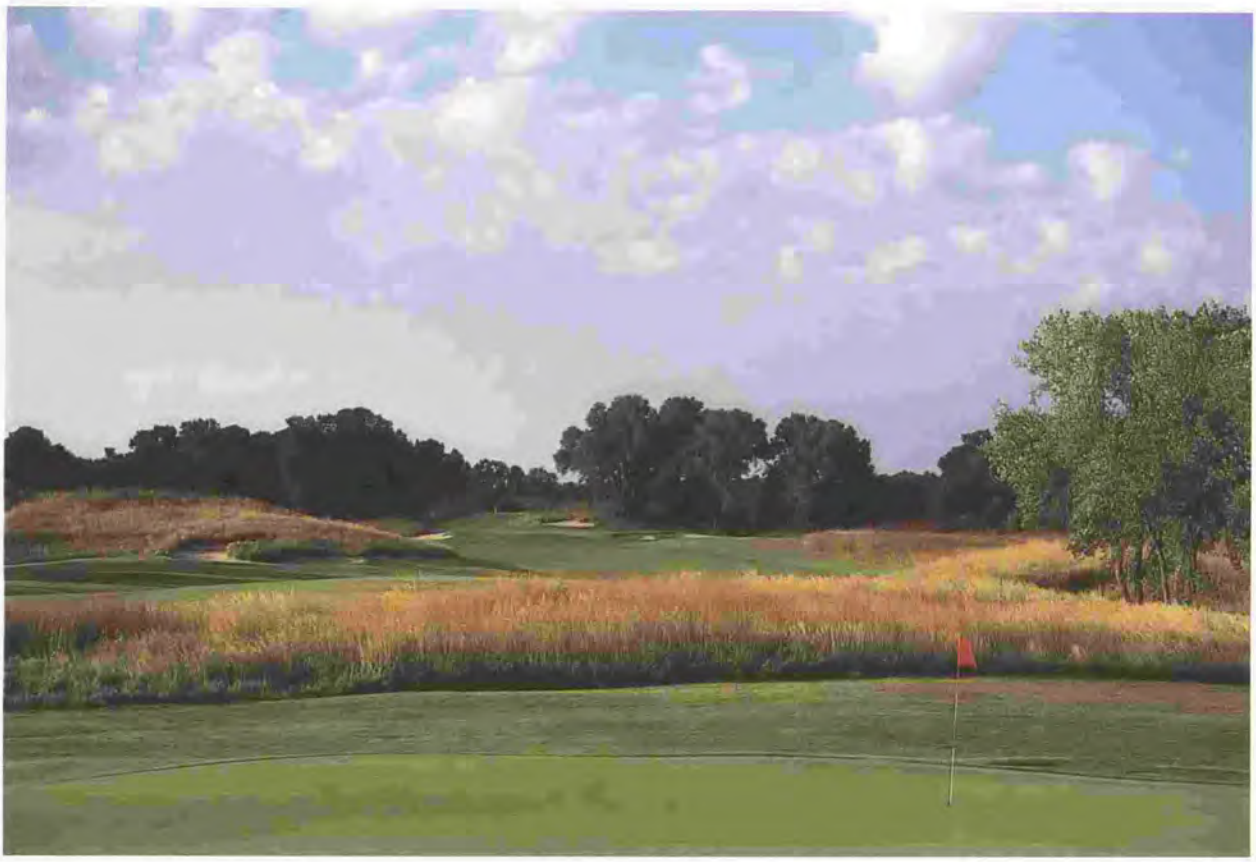

An Environmental Approach to Golf Course Development

Forward

By Paul Thomas

United States Environmental Protection Agency/Water Division, Region 5

As someone who loves both golf and the environment, I am very pleased by the increasing emphasis placed on the relationship between our nation's golf courses and our environment, especially during this time of increasing interest in the game.

The American Society of Golf Course Architects (ASGCA) has been playing a key role in some of these efforts. For example, the first edition of ***An Environmental Approach to Golf Course Development*** was published in 1992 and has since been instrumental in educating permitting boards, town councils, developers and many others of the process of developing a golf course in concert with the environment. Other environmental efforts, such as the creation of the "Environmental Principles for Golf Courses in the United States," which was endorsed by 23 environmental and golf organizations, are also occurring within the game.

This edition of ***An Environmental Approach to Golf Course Development*** provides a great service by detailing some of these efforts. Personally, I find the case studies particularly useful, as they provide real-life examples of the integration of golf and environmental stewardship. The Society should be lauded for producing this second edition, as dialogue and education are the keys to furthering environmental stewardship within the golf community.

It is important to remember that golf course architects are only one of the groups who play a part in golf's environmental efforts. It is up to everyone connected with the game to do their part in protecting human health and safety and to conserve and enhance our environment. In fact, golfers themselves are probably the most important group, for they provide the demand in golf's economic equation.

The golf community should be commended for its recent efforts in the environmental arena. However, it must not rest on its laurels; in fact, it should continue to challenge itself and the rest of society to do more. Golf is a game of honor, and it is simply proper that it do everything possible to remain in harmony with our planet, for the sake of our children and future generations.

Table of Contents

Cover: Prairie Dunes Country Club, Hutchinson, Kansas
Title Page: Kananaskis Golf Course, Alberta, Canada

An Environmental Approach to Golf Course Development

by Bill Love, ASGCA

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American Society of Golf Course Architects

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American Society of Golf Course Architects©

Introduction

Environmental awareness in this country has grown significantly over the past few decades. Some of the most important concerns of government officials at all levels, as well as the general public, include air and water quality, the availability of natural resources and minimizing the impact of land development. Population growth is also a concern both here and in other parts of the world because it requires the development of new housing, services and recreational opportunities. We now recognize that such development must be accomplished in a responsible manner that protects our environment, improves our existing conditions and ensures a higher quality of life for future generations.

At the same time, there has been much more emphasis on physical fitness and recreational activities within our society, and because of this the game of golf has grown and today is enjoying unprecedented popularity. With more leisure time available and a desire for affordable recreation, the number of people playing golf in the United States has increased at a tremendous rate. This trend is expected to continue and the development of new golf courses needs to keep pace with the growing golf population. The result is a significant pent-up demand for new facilities.

Pinehurst No. 2, Pinehurst, North Carolina

Golf is unlike most other sports in that it does not involve a standard playing field or arena. Instead, golf utilizes the landscape and for that reason maintains an intimate relationship with the environment. This relationship between golf courses and the environment has become a priority within the golf industry. Organizations such as American Society of Golf Course Architects, Golf Course Superintendents Association of America, Golf Course Builders Association of America, United States Golf Association and others representing management, construction, ownership and professional golf tours formed The Allied Associations of Golf to address important issues facing the industry and the game. Through research, education and application, members of the Allied Associations are striving to find the most environmentally responsible approach to the development of new golf courses and the management of existing facilities.

The development of a golf course has become a complex process. To deal with it, qualified professionals provide the expertise necessary to create design solutions for golf courses that are compatible with the environment. A golf course presents the opportunity to meet a need for recreational amenities, while preserving green space that

Cypress Point Club, Monterey, California

will provide benefits for the future development of an area. Often the green space of a golf course can serve as a protective buffer between sensitive environmental areas and development. This buffer, which contains extensive turfed areas and vegetation, will also protect water quality by providing stabilization against erosion and storm water management. Efficient and responsible maintenance practices for the golf course will promote the proper use and conservation of water resources. A golf course can provide enhancement to the environment by incorporating areas for conservation and the promotion of wildlife habitat. Where land has been degraded over time by intensive use or mismanagement, golf courses can provide much needed land improvement. These are benefits that can result when an environmental approach is used for the design, construction and maintenance of a golf course.

The Environmental Committee of the American Society of Golf Course Architects has produced this publication in an effort to provide the reader with information and an understanding about the golf course development process and how it is approached in an environmental manner.

As background, an overview has been included on the history of the game and the development of golf courses. Various aspects of golf course development are discussed to show how environmental issues can be identified and addressed in each stage of the process. Case studies have been included to illustrate how golf courses have provided successful solutions to environmental issues. The major steps involved in the process have been outlined in a checklist for the development of a golf course. Suggested references and the organizations belonging to The Allied Associations of Golf are also included to give the reader a source for further information.

The Growth of Golf

St. Andrews, The Old Course, Scotland

The game of golf as we know it today originated in the British Isles hundreds of years ago. Along the coast of Scotland, where rivers like the Forth and Eden empty into the sea, the land referred to as "linksland" was formed by the forces of nature into very particular features and often stretched across long distances. Nearby towns utilized the linksland mainly for agricultural purposes and grazing livestock, but because of its unique characteristics and the fact that it was mostly under public ownership, linksland also afforded the townspeople a natural setting in which to create courses and play golf.

Early courses simply evolved from the linksland and became known by the names of the towns nearby, such as Prestwick, Guillane and Leith. The most notable of the earliest courses was St. Andrews, considered by many to be the "home" of golf. There are records that indicate a golf course existed in some form at St. Andrews as early as 1414. It was eventually designated "The Royal and Ancient Golf Club of St. Andrews." The rules of the game were first administered out of St. Andrews, and its course became the standard by which other courses were compared.[1]

Portstewart G.C., Portstewart, N. Ireland

As the interest in golf increased, early courses were expanded or new ones "discovered" in linksland. These golf courses served as a focal point around which the towns grew, providing recreational activity and open space for the townspeople. For many of these small towns, golf became a part of everyday life; even people who did not play the game would stroll through the linksland and watch their neighbors pursue the sport.

By the mid-1800s, golf had spread throughout the British Isles along the coasts and inland, as well as in parts of Europe. By the late 1800s, there were only 150 courses scattered throughout Britain. This situation changed dramatically during the next few decades as a great number of new golf courses were put into play, due to the growth in the game. Golf has remained a popular sport throughout Britain and many countries in Europe.

Golf was introduced to the United States in the late 1700s, but it did not really become established until the late 1800s. Many Americans visited the British Isles and were captivated by the game. Upon returning to the U.S., these golfers set about creating the first simple courses in order to continue playing the game they had enjoyed overseas. Often it was arranged for people who were involved with golf in Britain to come to the U.S. and assist in the development of golf courses. Many golf clubs had formed before the turn of the century, and the United State Golf Association was established to administer the game. By the early 1900s, there were almost 1,000 golf

[1] Cornish, Geoffrey S. and Whitten, Ronald E. The Golf Course, New York: Rutledge Press. Rev. 1987

courses in this country, more than the number in Britain. Since then, golf has experienced periods of tremendous growth. The first was the late 1920s, often referred to as the "Golden Age of Golf." Popular golfers, such as Bobby Jones, competed for championships both at home and abroad, bringing national attention to the sport and generating public interest. As a result, there was a growing demand for new golf courses.

It is estimated that approximately 500 new courses were being developed annually toward the end of the 1920s. Even at this rate, the need for more courses continued as the number of people playing golf increased steadily. During the Depression and World War II, the attention of the country was directed toward other more pressing matters, and this slowed the growth of golf. At the beginning of the 1950s, there were an estimated 3,000,000 golfers in the U.S. playing on 5,000 facilities. The popularity of major golf tournaments, professional golf tours and the increased exposure from television coverage during the decade heightened interest in the game and refueled the growth of golf. By the 1960s, there were more than 4,000,000 people playing on almost 6,000 facilities. Golf was entering into another "boom" period. Heading into 1970, there were over 9,000,000 golfers, and the demand for new courses accelerated, but the number of new facilities still had not kept pace, having reached only 10,000.

Merion G.C., Ardmore, Pennsylvania

The 1970s and 1980s experienced periods of economic slowdown. In spite of this, golf continued to grow by offering a local, affordable recreational activity. The demand for new golf courses was stronger than ever in the 70s, and the number of golfers exceeded 17,000,000 by the mid-80s. These golfers played more than 400,000,000 rounds of golf on 13,000 facilities. In the late 1990s, golf experienced another resurgence, with the number of annual rounds exceeding 540 million, but the number of courses reaching only 16,000.[2] The next decade will present a need for more golf facilities as we are likely to witness more than 30,000,000 golfers playing more than 650 million rounds annually.

The growth of golf has not been limited to the United States. In Europe and Asia, there has been a great increase in golf activity, and the game has found its way to all parts of the world. New golf courses have been opened in Russia and China.

Cape Breton Highlands Links, Ingonish Beach, Nova Scotia

Based on the current and projected participation rates, the demand for the development of new golf courses to meet the needs of our growing golf population is expected to remain well into the future. Although golf may have had its beginnings in the U.S. among small select groups, now people of all ages and backgrounds are experiencing the pleasure and recreational benefits of the game.

[2] Golf Participation in the United States, Ed. 1998; and Golf Facilities in the United States, Ed. 1998; Jupiter, Fla.: National Golf Foundation

The Development of Golf Courses

The first golf courses of the British Isles came about in linksland areas because the land was ideally suited to the game. Linksland is characterized by distinct features such as dunes or small hills and numerous hollows, covered with native grasses and few, if any, trees. The soil is typically sand-based with excellent drainage and provides ideal conditions for growing grass. Recognizing these inherent characteristics, it was easy for the early golfers to walk among the dunes and select certain grassy hollows as the first golf holes. There were no standards to follow for laying out a golf course at this time, so a series of holes was simply selected with a routing that often ran along the coast and returned near to the starting point. The number of holes varied from course to course, and when it became desirable to enlarge the golf course, the players would simply venture farther into the linksland and discover more holes.

Ballybunion Golf Club, Ireland

There was very little construction involved in these initial courses because of their advantageous settings and natural features. Even when the first man-made modifications occurred, they were done in concert with the existing land. As golf moved out of the linksland, new courses had to be constructed on sites that were not as well suited to golf as the seaside locations. Construction techniques were primitive at that time, relying on hand labor and equipment drawn by mules or oxen. The early architects were limited in what could be done to alter the landscape in building a new course. They worked carefully with the topography and existing features to avoid excessive disturbance as well as expense in construction.

Early courses in the U.S. often followed this tradition. Sites were selected for their inherent character and the ability to produce an outstanding test of golf. Some of the golf courses built in this country years ago, such as Pebble Beach and Cypress Point with their magnificent oceanside holes, Augusta National with tall Georgia pines lining holes that play over and around Rae's Creek, and Shinnecock Hills winding its way through the wind-blown landscape of Long Island, are all still acknowledged as among the best in the game. These courses were carefully designed in response to their sites, and have since functioned compatibly as an integral part of their environments. The appeal of these golf courses can be attributed to the feeling that each course belongs in its setting.

Pebble Beach Golf Links, Pebble Beach, California

Augusta National G.C., Augusta, Georgia

Not all golf course development since the early years has been based solely on site selection. The growth of the game required that new facilities be more accessible to the public. During the "boom" periods, new golf courses tended to be located where the demand was greatest. Since the 1950s, trends have been established in this country, producing golf courses in roles other than as private clubs. New residential developments contain golf as an amenity for enhancement, and vacation destinations include it as an added attraction. Perhaps the most significant trend, however, has been the increase in public golf courses which provide an affordable recreational activity for local communities. Prior to 1950, private golf facilities outnumbered public. In 1990, the number of daily fee and municipal courses for public use was almost double that of private facilities.

Today, sites are being selected for demographic and economic purposes, as well as for their suitability as golf courses. Modern construction methods have made it possible to build golf courses in locations where there is a demand for new facilities. Not all locations offer sites with an outstanding natural character. Often they contain no significant land forms, water features, trees or scenery. In some cases, golf courses have been specifically developed to enhance the visual quality of featureless sites and provide an attractive green, open space. Other sites that have been mismanaged or abandoned after extensive use as agricultural fields, stone quarries, gravel pits, landfills, sludge disposal sites or other operations that degrade the land can be reclaimed, improved and beautified through use as a golf course.

Troon Golf & Country Club, Scottsdale, Arizona

Environmental Issues Most Often Encountered in the Development of a Golf Course

A project of any type that is being proposed for a particular location, whether a shopping center, residential development, office complex, school or golf course, will undergo a review and approval process by local and, at times, state and federal officials. When a golf course is being proposed as a separate facility or part of a larger project, it must be thoroughly reviewed and then evaluated to determine its impact and benefit to area residents. Typically, during the review process, hearings are held to allow the public an opportunity to comment and to express any opinions. Many of the comments often are about environmental issues. The size of the sites and land use involved in a golf course require that these issues be raised and addressed.

Balsams Resort, Dixville Notch, New Hampshire

Over the last few decades, the environmental movement has focused attention on issues involved in land development, and it has also led to a much more sensitive, responsive approach to how golf courses are planned, designed, built and managed. Because of the intimate relationship a golf course shares with the land, and the special nature of its development, the environmental issues must be considered during the review and evaluation process. If a proposed golf course development is reviewed in the same light as any other project (a shopping center for example), benefits to the community, future development and environmental issues might be overlooked.

Every proposed golf course presents a unique case because existing conditions vary and no two sites are ever exactly the same. There will be specific issues based on location, site characteristics, climate and local regulations. However, as with most golf courses, there are questions concerning certain environmental issues that must be addressed during the planning, review and construction process.

- Does a golf course constitute the elimination of open or green space by making use of a site which is currently undeveloped?
- Will the proposed golf course alter or eliminate wetland and other sensitive environmental areas that may exist on the site?
- Are there significant historical or archaeological areas on the site that will be affected by the golf course?
- What impact will the golf course have on the ecological systems of the site, such as plant life and wildlife habitat?
- How will the golf course affect the existing character of a site through alteration of the topography and vegetative cover?
- Is there any potential for water pollution from earth disturbance and erosion during the construction of the golf course?
- Will the irrigation requirements of the golf course lead to the reduction or depletion of water supplies, especially in areas experiencing conditions which limit water resources?
- Will the long-term application of chemicals for turfgrass management on a golf course cause water pollution from surface run-off or infiltration into the ground?

It is essential that these issues be identified and addressed in the initial stages of planning and design for the project. A responsive approach to the issues will avoid impacts as well as costly delays in the development process and will result in the successful completion of a golf course that is environmentally compatible with its site.

Addressing the Environmental Issues in the Golf Course Development Process

With existing economic and environmental conditions, the development of a golf course has become a complex process involving a substantial investment of time and money. The objective of any golf course is to provide an enjoyable recreational facility that is environmentally sound and successfully operated. To achieve this goal, the golf course must be carefully designed, properly constructed and responsibly managed.

Even before the planning and design phase begins, it is necessary to understand the existing conditions of a general area and the specific site that will affect the development process and determine the best approach to the project. A feasibility study is used to analyze the demographics and economy of an area, to assess the need for a facility and to determine whether or not it can be properly supported. The study will provide population information, the golf participation rate and potential growth, the number of existing golf facilities, as well as those being planned, a general assessment of the site for its suitability, estimated costs of development and projected revenues. This information will verify the need for a new facility, determine the type of golf course best suited to meet that need and establish the initial goals of the project.

Once the feasibility of the project has been confirmed, whether the golf course is intended to be a stand-alone facility or part of a larger project, the next steps are to refine the goals, gain a clear understanding of the site on which the course is to be built and formulate an approach to the development process. To accomplish this, a team of experienced professionals may be assembled. A qualified golf course architect, such as those within the membership of the American Society of Golf Course Architects, may be joined by engineers, land planners, landscape architects, environmental specialists and other consultants to form a team for the planning and design of the golf course.

The architect will work closely with the client to evaluate and refine the goals of the project, based in part on the information provided by the feasibility study. At this point in the process, it can be determined or confirmed what type of golf course will best meet the objectives set for the project. While demographic and economic factors may have established the need for a golf course and set the initial goals, the proposed site will be the most important factor in determining how the development of the course is approached.

Maidstone Club, East Hampton, New York

There is no typical site for a golf course, especially from a topographical standpoint. Many consider land with gently rolling hills and partially covered with trees to be an ideal site. However, some of the country's best golf courses have been located on sites that differ significantly in relief, amount of tree cover and

Cascades G.C., Hot Springs, Virginia

other features. The visual quality of a golf course is not based on any standard. It is up to the golf course architect and other consultants to work with a site to produce a course that affords an attractive, pleasant, even exciting setting in which to play the game.

The architect will explore the characteristics and environmental aspects of the site by compiling all available information, performing field reconnaissance to confirm and supplement this information and then completing a thorough site analysis. A series of maps is typically used to delineate the results of the analysis and will illustrate the potential and limitations offered by the site. Information and mapping critical to the consultants for planning and design purposes should include:

Survey of property boundaries – Location of boundary lines to show what land is available for use.

Map of coordinates or grid system – Reference points to supplement the survey and locate features on site.

Climatic conditions – Determine the orientation of the sun, prevailing winds, annual rainfall and other pertinent data.

Topography – The configuration or relief of the land and the location of natural features.

Areas of sensitive, steep slopes – The location of steep slopes that are regulated.

Water bodies and drainage patterns – The location and characteristics of water bodies such as lakes and streams, as well as drainage patterns and required setbacks or buffer areas.

Wetlands and required buffer areas – The location and characteristics of sensitive wetland areas and required setbacks or buffer areas.

Location of the floodplain – The location, extent and frequency of inundation from storm water run-off.

Water availability – The study of both surface and underground sources of water for irrigation.

Soils survey – The soil types, characteristics, and in some cases, the geology of the site.

Locations and identification of vegetative cover – The types of plant material and sensitive or high-quality areas.

Location and identification of wildlife habitat – The areas of sensitive or protected habitat.

Existing roads – The existing road system, both on-site and off, showing points of access to the site.

Existing structures – Structures located on-site and their present use.

Location of historical or archaeological sites – The sites, structures or ruins that may be historically or archaeologically significant and may require relocation or preservation.

Location of all right-of-ways or easements – Identification of all utility lines, right-of-ways and other easements that must be maintained.

Location of utilities – Identification of the nearest sources for power, water and sewer.

Scenic views – The location of scenic views, both on-site and off.

Adjacent land uses – Location and identification of adjacent land uses that may have a visual or olfactory impact on the site.

To complete the analysis of the site information and identify the environmental issues that will be involved in the project, all applicable land use and environmental and construction regulations must be reviewed. A thorough understanding of the regulatory process at each level, from federal to local, will allow the design team to assess the feasibility of the initial goals set for the project and the best approach to accomplishing them. Informal meetings with regulatory agencies and local environmental groups will provide identification and input on the prevalent environmental issues in the area where the site is located. There can be instances when the environmental issues involved in the site will require reconsideration of the location or a modification of the project goals. The team must determine if environmentally sensitive areas can be incorporated compatibly as a part of design features on the golf course, or avoided to prevent potential impacts.

Basing an evaluation on site information, the team can find creative and responsible design solutions that are sensitive to the environment and meet the goals of the project. This is especially important to achieve a golf course that will be challenging, enjoyable, attractive and compatible with its site. A thorough understanding of the regulations and their application to the site will also establish realistic goals and produce the most efficient planning and design, thereby avoiding costly revisions and delays during the review, permitting and construction process.

After the site information has been studied, the design criteria for the golf course must be confirmed. The basic criteria will be determined by the feasibility study and the initial goals concerning the use and operation of the golf course and its role in the project.

A golf course can have a number of uses as a stand-alone facility or as part of a larger project:

- A community can provide a golf course as a public recreational amenity. It will also provide preserved open space as the development and population of an area grows.
- Planned residential developments may include golf as a recreational amenity. Integrating the course with housing will create enhancement value for home sites and an attractive setting to serve as a marketing tool for promoting sales.
- Hotels and resorts can include golf, often with more than one course, to increase the activities offered to guests and also to create a beautiful setting.
- A group of golf enthusiasts may build a golf course in order to have a place to play the game or as a business venture. Sometimes a landowner will simply want to fulfill a life-long dream of building and owning a golf course.

Black Butte Ranch G.C., Sisters, Oregon

The operation of the facility will be one of three basic categories:

- A private golf course with play restricted to members and their guests.
- Semi-private or daily-fee facilities that provide a combination of public play and some restricted play for a limited membership.
- Municipal or privately owned golf courses with unrestricted play, open on a pay-as-you-play basis.

There must also be specific additional criteria established for the golf course based on its intended use and operation. The type of course, number of holes and configuration will be determined in the initial stages of planning and design. There are many variations to these aspects of a golf course, and the golf course architect will work closely with the client and other consultants to finalize the criteria for a golf course that will best meet the goals for the project.

The additional design criteria will include:

Number of holes – The accepted number of holes for a typical or regulation golf course is 18. A hole consists of a tee complex, fairway and rough areas, and a green complex. There are a number of courses with only nine holes and others with as many as 27, 36, 45 or 54. More than 27 holes constitutes multiple golf courses. A practice area or driving range and practice green may be included as a part of most courses.

Configuration – The configuration or layout of the course will depend upon the intended use and the site. There are no standards, only basic configurations. A golf course with a core design has all its holes located in one area, adjacent to one another. Single fairway golf courses have the holes laid out in loops, either as a continuous 18 or two loops of nine each which start and finish in the same location. Double fairway layouts which incorporate parallel golf holes can also be continuous or have two separate nines. The configurations that tend to spread out the golf holes across a site are typically used in conjunction with residential development. Within these basic configurations there will be an infinite number of variations.

Length – Regulation golf courses are usually played to a length of between 6,000 to over 7,200 yards for men and 4,500 to 5,800 yards for women. There are many courses with lengths above and below these yardages.

Par – Par is a measurement of the strokes or shots intended for a golf course. Par is indicative of the number of shots an expert player would take for a particular course. A particular par is assigned to each hole depending upon length, difficulty and other factors. The regulation 18-hole golf course will typically have a total par of between 70 and 72.

Acreage – Acreage requirements for the golf course will vary according to the proposed type, configuration and characteristics of the site. An 18-hole regulation course will generally utilize between 140 and 200 acres. Of the basic configuration, core layouts require the least acreage and single fairway layouts require the most.

In addition to regulation golf courses, there are also executive and par-3 types. These courses are shorter in length and consequently have a lower par. Executive golf courses usually consist of par 3 and par 4 holes only. The par for this type of course will typically range between 58 and 64, with a length between 3,500 and 5,000 yards. Because of their shorter lengths, these layouts require less land, usually between 50 and 100 acres. All par 3 courses are the shortest layouts and sometimes require as little as 25 to 30 acres if the length of the holes has been kept to a minimum.

The key factors of use, operation, configuration, length and par are carefully studied in the initial stages of planning and design to determine the golf course best studied to meet the goals of the project. However, the environmental issues presented by the site information must also be studied and evaluated with the design criteria for the golf course.

The environmental issue of golf courses eliminating open space is addressed prior to the planning and design process. The development of a golf course will not eliminate open space. The course will preserve its site as open space, serve as a buffer to sensitive environmental areas and provide the opportunity for additional use. In many instances, a golf course will preserve an open space land that might be otherwise developed.

It is in the planning and design phases that responsible solutions are found for the environmental issues. This is very important to the successful development of the golf course. Impacts during construction and management of the course can best be avoided by identifying and addressing the environmental issues beforehand. This will produce a satisfactory plan that can be approved and permitted.

After reviewing and evaluating the site information, regulations and design criteria, the golf course architect begins the conceptual design for the golf course. There will be many considerations during the design process which address both the environmental issues and the criteria for the golf course. To illustrate this, case studies have been included to show how golf courses can provide responsible solutions to the environmental issues most often encountered during the development process.

Amelia Island Plantation, Amelia Island, Florida

Typically, the main considerations during the design process will be:

Sensitive environmental areas – A careful study of areas such as wetlands, fragile vegetation and protected wildlife habitat will determine their effect on the design of the golf course. Sensitive areas will often provide some of the most distinctive features and scenery on a site when incorporated as a part of the golf course in a positive, compatible manner.

At this point, early in the process, the issue of altering or eliminating wetlands and other sensitive areas can be addressed. Through field reconnaissance, environmentally sensitive areas are identified and delineated. By using this information during design, the golf course architect will route the golf course so that play will be adjacent to or over the sensitive areas, incorporating them as a part of the strategy and aesthetics. To prevent impacts to these areas during construction, responsible management practices are implemented and then continued as part of the maintenance for the golf course. The most sensitive areas on a site will often be wetlands. Depending upon the location, coastal or inland, there can be a difference in the characteristics and quality of wetlands. In some instances, the best overall design solution may require that there be some minor encroachment into low quality wetland areas. To offset the impact of encroachment, mitigated or new wetland areas will be included as part of the golf course. This provides the opportunity to improve the quality and function of the wetlands while creating an attractive feature for the enhancement of conservation and wildlife habitat. For the most part, mitigation is used on a very limited basis due to the time and cost involved.

Topography – The topography and natural features of the site are carefully reviewed to locate the golf course in the most advantageous areas. By properly utilizing the topography, the golf course can be constructed efficiently and can establish the proper relationship with other land uses.

Drainage patterns and water features – The drainage patterns and existing water features such as streams and ponds, etc., are reviewed in conjunction with the topography. The golf course must be designed with respect to the existing drainage patterns to provide good playability and efficient maintenance. Existing water features can be utilized in the strategy of the golf course and can provide some of the most dramatic golf holes. Water features are often designed into the golf course for playability and aesthetics, but also to provide erosion control and storm water management. Drainage patterns will determine the best locations for these controls to prevent pollution from surface run-off.

Historic or archaeological sites – Land for a golf course must be researched to determine if there are ruins or archaeological sites which are historically important.

The same approach is taken with the issue of significant historical or archaeological areas. Old buildings, cemeteries and ruins with aesthetic qualities can contribute to the character of a golf course. These areas can be preserved by being located within the golf course, lending interest and a sense of history. Should a site of significance be discovered during construction, it may require modifications to the golf course if relocation proves to be unfeasible.

Vegetation and wildlife habitat – The tree and other on-site vegetative cover is assessed to determine the extent of clearing necessary for the golf course and areas for potential revegetation. Existing vegetation, especially trees, can

Banff Springs G.C., Alberta, Canada

be an integral part of the strategy and can provide the most natural appearance of the golf course. Specific areas on the site are also studied for preservation or conservation and the potential to improve wildlife habitat.

The issue of ecological impacts to plant life and wildlife habitat is also addressed during the routing of the golf course. Natural areas, made up of specific types of vegetation indigenous to the region, can be designed as features to provide a natural setting, as well as conservation and protection for existing wildlife habitat. These areas can also be designed as habitat to stimulate endangered species. Impacts to sensitive areas of habitat are avoided by carefully clearing the site and providing responsible management practices during the construction of the golf course. Golf holes that are located through stands of trees provide the opportunity to create more diverse habitat and promote wildlife through revegetation at the edges of the cleared areas. Tree-lined holes are often the most exciting and attractive on the golf course. The conservation areas and wildlife habitat are protected through the management of the golf course after its completion.

Climatic conditions – The orientation of the sun, prevailing winds and annual rainfall must be considered for the playability and maintenance of the golf course. Golf holes are strategically located to take advantage of wind direction and are not adversely affected by the rising or setting sun. The amount of rainfall is directly related to the irrigation requirements of the golf course, design of the irrigation system and determination of water supply.

Access to the site – The existing road system is studied to determine points of access to provide the most efficient circulation patterns and location for operation of the golf course.

Design of the golf course routing – The routing or layout of the golf holes is based on the proposed use for the golf course and characteristics of the site. Routing should take advantage of the topography and existing characteristics of the site to create a unique but natural character. By respecting the lay of the land, the golf course can be integrated into its setting. The routing must also take into consideration environmentally sensitive areas, drainage patterns, climatic conditions and other factors which will affect the playability, construction and maintenance of the golf course.

Arrowhead G.C., Littleton, Colorado

Cape Cod National, Brewster, Massachusetts

The issue of altering the existing character of a site is addressed during the routing process for the golf course. If a site has an inherent character with distinctive natural features, the golf course architect will carefully design the routing of the golf course so that it lays lightly on the land. One of the most appealing aspects of a golf course is its ability to provide a sense of place, which gives an appreciation for the region in which it is located. If the routing has been carefully integrated into the landscape, the golfer will experience the unique qualities indigenous to the region that have been incorporated into the design of the golf course. The golf course architect will also consider construction when routing the golf course. By locating the golf holes with respect to the existing topography, the amount of earthwork and disturbance can be controlled and allow for the most efficient construction. However, many sites may be virtually featureless and lacking in character. This is often true of land that has been abandoned after intensive use as quarries, landfills, or agricultural fields. The golf course will be used to improve the land and provide visual quality to enhance value. The routing can be designed to utilize areas of the site that were severely disturbed and would otherwise remain unproductive. This will often involve a large amount of earthwork to recreate a natural quality and appearance for the golf course. Land improvement and adaptive reuse can be one of the most beneficial aspects of a golf course.

The routing of the course must also achieve the length, par and variety of holes established by the design criteria. Circulation, speed-of-play and safety must be given attention when the individual golf holes are being laid out. This is especially important in the case of a development-oriented facility. The golf course will be required to make the best use of the site and provide recreation and enhancement value, but must also maintain the proper relationship to any adjacent land uses such as housing and roadways.

Design of golf course features – In addition to the natural features of a site, the golf course will incorporate teeing areas, green complexes, sand and grass bunkers, mounds and ponds to define the strategy of each hole and produce the desired visual quality. For sites that lack character, these features are used in conjunction with the routing of the golf course to create playability and aesthetics.

To provide the proper environmental protection during construction, the location of erosion and storm water management controls must be included as a part of the initial design. Ponds and other detention areas used for storm water management purposes can be incorporated as features to create strategy and to provide a dramatic appearance. These features can also take the form of bunkers, grass hollows or swales. Most of these features will be installed during construction to prevent adverse impacts to sensitive areas and will remain on a permanent basis as controls for environmental protection.

The design of features can affect the cost and methods of maintenance for the golf course. Whether the features are severe or subtle in nature, they should be designed for efficient maintenance. Often golf course features will be designed to blend into the existing landscape and, as a consequence, will reduce the amount of required maintenance.

Black Diamond Ranch, Lecanto, Florida

Shinnecock Hills G.C., Southampton, New York

The issue of potential water pollution from earth disturbance during construction can be addressed with the proper design and location of erosion and storm water management control features. These features, when installed prior to and during construction, will contain the movement of sediment caused by storm water run-off and the erosion of disturbed areas, thereby protecting existing streams, ponds, and sensitive areas from contamination. Once the grading of the site has been completed and turfgrass or other vegetation has been established to stabilize the disturbed areas, some of these features will be removed. However, if properly designed, the major erosion and storm water management control features will often remain on a permanent basis and continue to provide protection for sensitive areas as a part of the responsible management practices involved in the maintenance of the golf course. These features will be used to filter storm water run-off from the golf course, and to prevent fertilizer, herbicides and pesticides from entering adjacent sensitive areas. When a golf course is part of a residential development, storm water management ponds on the course can be used to collect drainage from streets and homesites. This water can then be filtered to remove contaminants before being released into existing streams, ponds, or other water bodies. In many cases, storm water management features are used to collect and recycle water for irrigation purposes, providing a valuable alternative or supplement to groundwater as a source of supply.

Natural areas will often be included as features to reduce maintenance, but also for the promotion of wildlife habitat and environmental enhancement. Existing vegetation which is preserved during construction and incorporated as a part of the golf course, as well as areas designed for revegetation after construction, can promote a more diverse habitat and attract a wider range of wildlife. Many golf courses use natural areas to establish a particular appearance and additional quality.

Irrigation requirement, supply and application – The availability of water, irrigation requirements of the golf course and methods of application will influence the design of the golf course. In some areas where water supply is strictly controlled, the design of the golf course will allow for reduced irrigation requirements through the use of natural areas, smaller turfed areas, and drought-tolerant grasses. Ponds included in the design of the golf course can serve as reservoirs to supply water for irrigation. Alternative sources for irrigation, such as recycled water or effluent, have been used on golf courses to lessen the demand for potable water in areas where there are limitations on supply.

The issue of irrigation requirements and potential depletion of existing water supplies are addressed during the design of the golf course. Research can be done to determine how the withdrawal of groundwater for irrigation will affect the water supply of an area. Based on this research, irrigation requirements can be altered, if necessary, to prevent any impact or depletion to a water supply. Alternatives to groundwater, such as the collection of storm water and the use of effluent, should be investigated as a source of supply for golf course irrigation. Recycled water for irrigation can lessen the demand on potable water supplies in areas that have little rainfall or have experienced drought conditions.

Development of an Integrated Management Program (IMP) – The Integrated Management Program, or IMP, addresses the environmental issues and existing conditions on-site in the initial stages of design. This will provide the responsible management practices that will be required for the construction and maintenance of the golf course. Such items as soil erosion control and storm water management during construction, as well as the control of fertilizer and pesticide applications during daily maintenance, are included as part of the IMP. The application of chemicals for turfgrass management is part of a specific program called Integrated Pest Management (IPM). There will be a program for each particular golf course which incorporates a variety of cultural, biological and chemical methods to prevent turfgrass damage while respecting the environment.

The issue of groundwater contamination from chemical application for turfgrass can be addressed through the development of an IPM program. Through research, the consultant team can determine a program and management practices that will avoid impacts to groundwater from application of chemicals during the maintenance of the golf course. Numerous studies have supported the use of an IPM program and have promoted the benefits of quality turfgrass in avoiding impacts to the environment. The Golf Course Superintendents Association of America is one of the leaders in the development of comprehensive IPM for golf courses. Often an experienced golf course superintendent, who is a licensed chemical applicator, will be involved in the design process to provide input in the development of an IMP which addresses the site-specific practices that will be required for a proposed golf course. The responsible management practices contained within an IMP are necessary to address the environmental issues and prevent impacts from maintenance practices.

The aforementioned considerations are those most often encountered and are general in nature. There may be other specific considerations during the design process for each project depending on the specific objectives and the unique characteristics of a proposed site.

Maggie Valley Resort, Maggie Valley, North Carolina

Based on the knowledge gained from careful evaluation of the information and their own expertise, the golf course architect and design team will create a preliminary plan for the golf course that satisfies the initial goals and addresses the environmental issues. An important step is to then arrange for a pre-submittal meeting with representatives of the regulatory agencies responsible for reviewing and approving the project and interested local citizen or environmental groups. The concept for the golf course can be discussed and evaluated along with innovative design solutions being proposed for any environmental issues. These meetings are important as they provide the opportunity to present concepts that have been carefully designed not only to protect the environment, but to produce the most mutually beneficial results. Discussion of the input received from the various agencies will determine whether or not the solutions have merit and a good chance of being approved. This approach will

confirm the environmental issues involved in the project and provide the best method to avoid the substantial costs and loss of time that may occur if a plan does not receive approval after going through a lengthy formal review process.

Once the planning and design process has been completed and a satisfactory plan has been approved, the construction phase of the development process begins. The environmental issues concerning construction will have been addressed during the design phase and development of the Integrated Management Program. Detailed plans and specifications are produced for use by a qualified golf course builder to construct the facility. The plans and specifications, together with proper construction methods and management, are used to prevent environmental impacts to the site, implement the intended design and ensure the quality of the golf course.

The Links at Spanish Bay, Pebble Beach, California

The construction documents will vary depending upon the architect and local regulations, but typically include:

Staking Plan – Locates the key points of the golf course (tees, landing areas and greens) in the field for review and construction.

Erosion Control and Storm Water Management Plan – Shows the location of features and methods of controlling storm water and erosion on disturbed areas of the site during construction.

Clearing Plan – Indicates the limits of clearing necessary for construction of the golf course. Specimen trees to be saved or areas of vegetation to be preserved will be shown on this plan or designated in the field.

Grading and Drainage Plan – Shows the overall plan for construction of the golf course and the earth work necessary to create features and produce the proper drainage.

Green Plans – Provides details for the construction of each green complex.

Construction Details and Sections – Shows how the features (tees, bunkers, mounding, ponds, etc.) are to be constructed in conjunction with the Grading and Drainage Plan.

Irrigation Plans and Details – Provides the information for the type of irrigation system and pump station to be installed.

Grassing Plan – Indicates the areas where specific turfgrasses and in some cases, native or ornamental grasses, are to be planted.

Landscape Plan – Serves as a guideline to show where plant material is to be installed to enhance the design of the golf course. As a part of this plan, conservation or natural areas can be established throughout the golf course.

Specifications and Bid Documents – Outlines the methods and details of construction.

Prior to the start of construction, the golf course superintendent should be hired. The superintendent will serve as an on-site representative for the owner and architect and will inspect the progress of the construction on a daily basis. This will allow the most responsible management practices to be implemented during construction and continued for the grow-in and maintenance of the golf course.

Chaparral Pines, Payson, Arizona

During the construction process, site visits are made by the golf course architect, accompanied at times by other members of the consultant team, to inspect the work and see that the intended level of design and quality in the golf course is being accomplished. These visits are important to give the golf course architect an opportunity to work closely with the land and its distinctive features and to create the character for the golf course. Inspections are also made to monitor the controls and management techniques that are in place for environmental protection.

The construction process starts with the stakeout of the golf course. After the key points and centerlines of each golf hole have been staked in the field, the golf course architect reviews the relationship of their location to the site. Minor field adjustments are often made at that time to improve the golf course by responding to the existing terrain, integrating natural features and providing further protection for sensitive areas and the preservation of specific natural features (such as trees, rock outcroppings, etc.) in the design.

The soil erosion control features are installed and checked to ensure proper placement and installation prior to the clearing and grading of the site. Various methods are used to contain soil erosion and sediment movement during grading activities. All sensitive areas and features on the site are protected by these controls, which will remain in place throughout construction and until all disturbed areas on-site have been stabilized.

Clearing then begins, and for sites with tree cover, it is critical that this facet of the construction is completed properly. The clearing or tree removal on the site is done in phases to prevent the unnecessary loss of natural features that can contribute to the character of the golf course. After the initial phase of clearing, all specimen quality trees and other unique areas of vegetation that are to be preserved are identified and protected from disturbance. Trees represent one of the best ways to create compatibility between the golf course and the site, providing a natural setting and creating an integral part of the strategy.

Storm water management controls and the use of responsible management practices are installed during the initial phase of construction to control the drainage of the site and avoid impacts to sensitive areas. Storm water management controls are often incorporated into the design of the golf course as ponds and grass swales and can be utilized to control run-off from adjacent development. They also contribute to the water supply for irrigation.

The golf course is then graded to avoid excessive disturbance, produce the necessary drainage and provide the features required by the design. The site will first be rough graded to accomplish the major earthwork necessary for the construction of features such as tees, greens, mounding and bunkers. The features are then graded or shaped to provide the desired strategy and character for the golf course. As a part of this operation, topsoil is removed from all work areas and then replaced upon completion of grading. Details and specifications are provided to ensure that the features are built properly for both design and maintenance purposes. During site visits, the golf course architect will sometimes require adjustments of the features to adapt to the existing conditions of the site and achieve a natural appearance in the golf course.

An irrigation system is installed after grading has been completed. The system must be complete and operational to support the planting of the golf course.

After the irrigation system has been installed, all disturbed areas are prepared and planted with the specific types of turf grass or ornamental grass required by the design. Areas susceptible to erosion often will be sodded or mulched for protection.

In conjunction with the planting of turfgrasses, the golf course will be landscaped with trees, shrubs and other plant material to enhance the design of the golf course and provide the desired visual quality. As a part of this landscaping, conservation areas can be developed using native plant material to establish and promote wildlife habitat.

Conservation organizations such as Audubon International and various environmental regulatory agencies have been participating actively with the golf industry concerning its relationship with the environment. One example is the Audubon Cooperative Sanctuary Program for Golf Courses established by Audubon International and the United States Golf Association. The members of the American Society of Golf Course Architects often work with the guidelines established by the sanctuary program as they design new golf courses. The program has been initiated to enhance wildlife habitat on new and existing golf courses as to encourage active participation in conservation programs...recognize golf courses as important open spaces...and educate the public and golfing community on the benefits of golf courses and the role they play relative to the environment.

Prior to the completion of construction, the maintenance and management of the golf course will start. During the grow-in period, responsible management practices are established and the golf course is prepared for opening. Controls for environmental protection are monitored during the grow-in period. After all disturbed areas have been stabilized with vegetative cover, some of the environmental controls will be removed and others will remain as permanent features of the golf course.

Colliers Reserve, Naples, Florida

Once the turfgrasses have been established and the maintenance has achieved a desired level, the golf course will open for play. The environmental issues concerning the maintenance of the golf course are addressed by the Integrated Management Program. The program will provide environmentally sensitive practices for the maintenance of the golf couse, such as:

- Integated Pest Management (IPM) for the controlled application of chemicals and other practices to reduce pests and disease with the least impact to the environment.
- Management practices to produce high-quality playing conditions and reduce maintenance requirements.
- Irrigation practices to promote conservation and, when possible, use alternative sources of supply.
- Monitoring of groundwater to detect and eliminate infiltration of chemicals.

- Monitoring of water sources to detect and eliminate pollution from surface run-off.
- Management of natural or conservation areas to promote wildlife habitat.

These responsible maintenance practices will remain in place as long as the golf course is in operation, ensuring environmental compatibility, high-quality conditioning and efficient management of resources.

Golf courses, like any landscape, grow and experience subtle changes with time. As a course ages, minor adjustments may become necessary to maintain the desired level of maintenance and playability. This is often the case with golf courses that have been in play for a number of years. Improvements to the technology and equipment of the game, a substantial increase in the amount of play, maturation of the trees and other landscaping and advanced maintenance practices can all have a significant impact on a golf course that was designed based on criteria of 50, 40, even 20 years ago.

Golf course superintendents will work with consultants such as golf course architects, U.S.G.A. Turf Advisory Service and the Audubon Cooperative Sanctuary Program when adjustments become necessary. The consultants work together to create and implement environmentally compatible solutions that address the needs of the golf course.

SUMMARY – A golf course offers an excellent opportunity to provide a recreational activity, maintain open space and preserve the visual quality of the landscape. The development of a golf course which produces these benefits is a complex process that involves proper planning and design, construction and management. A team of qualified professionals will provide the necessary expertise to accomplish the process and create an outstanding and environmentally sound golf course.

Environmental issues have become a priority for the golf industry. Members of the Allied Associations of Golf, such as the American Society of Golf Course Architects, Golf Course Superintendents Association of America and the United States Golf Association are dedicated to continuing education and research to provide the most up-to-date and beneficial methods for the development and management of golf courses.

Whistler Resort, Whistler, B.C., Canada

Taking a Team Approach

John F. Harbottle, III, ASGCA
John Harbottle Design

GENOA, NEVADA

Experience shows it is never too early to start communicating with permitting agencies to develop an understanding of their needs. This information is necessary to formulate a design which will develop into a quality project.

When a variety of sensitive elements are associated with a project, such as the Golf Club at Genoa Lakes, a team of consultants is needed to assess the various elements and determine what impact the golf course will have on those areas. A team may consist of experts in the field of biology, archeology, geology and hydrology. These experts should conduct field reconnaissance and map the sensitive areas for use in planning the golf course layout. Such a team was assembled for the planning of the Golf Club at Genoa Lakes.

The Genoa Lakes project is located on a sensitive site just outside South Lake Tahoe. The town of Genoa is the oldest settlement in the state. Situated near the Carson River, the site was a natural for early settlement. It served as the gateway to San Francisco for the old wagon train trail. The land on which the golf course was built is a mixture of high desert savannah, wetland and riparian woodland habitat.

Genoa Lakes mapping showed that wetlands and wildlife habitat on the site were significant. Meetings were held with permitting agencies such as the Army Corps of Engineers and the State Department of Fish and Wildlife to verify the exact location of sensitive areas. The meetings proved beneficial in helping to arrive at design solutions that would neither adversely impact the sensitive areas of the site nor decrease the quality of the golf course.

Initially, golf course drainage was not allowed to flow directly into any wetland or wildlife habitat area. However, it was determined that the golf course drainage could pass through a small, natural grass buffer zone and then into the sensitive areas.

The buffer zone served to filter fertilizer and pesticides contained in the golf course runoff. This was of great benefit as the wetlands became natural hazards for the course and could be incorporated into the design.

In addition, the buffer areas helped to preserve the natural wildlife habitat, creating a fringe that developed refuge and food sources for many birds and small animals. The dense vegetative edge also served to speed play as balls hit into the hazard were irretrievable. Thus, what was once a design obstacle had become a feature that enhanced the course's character, developing a mature look consistent with the natural vegetation.

Of the 200 acres allocated to the golf course at Genoa Lakes, **only 120 acres are irrigated and only about 100 acres are maintained.** All wetlands and wildlife habitat were preserved and integrated to create natural amenities and hazards for the course.

To ensure that sensitive areas were linked to maintain circulation corridors for the wildlife, several new wetland and habitat areas were created. They made aesthetic, natural hazards for the course, creating diagonal carries from the tee.

All this brought the natural areas closer to the golfers, once again adding appreciably to the quality of the playing experience. It is not uncommon for golfers to observe deer, fish and waterfowl while enjoying a round of golf.

SUMMARY – Genoa Lakes is a fine example of the team approach taken today to design and build golf courses that are in concert with the environment. By consulting environmental groups, state and federal agencies, consultants with special expertise, and others, golf courses can preserve and protect the environment.

Designing for Sensitive Habitat

Jeffrey D. Brauer, ASGCA, and Eric Nelson, ASGCA
GolfScapes, Inc.

BIWABIK, MINNESOTA

Construction of Giant's Ridge Golf Course started in November 1994 and was completed in August 1996, with opening in June 1997. Construction began after 18 months of review by environmental groups and the Minnesota Environmental Protection Agency.

The objective of the project was to create a state-owned resort golf course to broaden the tourist base of the Iron Range area in northern Minnesota, utilizing funds of the IRRRB, a state agency that taxes mining revenues for economic redevelopment. The 18-hole, 6,900 yard championship golf course has helped to fill hotels in the summer, stabilize small surrounding towns by providing tourist revenue, and brought positive publicity to a region known more for its industrial heritage. As a testimony to golf's ability to draw tourists, more than 80 percent of the course's 275 average daily rounds come from players who have journeyed 100 miles or more.

The project was confronted with a number of environmental issues. To begin with, the IRRRB owned a parcel of land adjacent to an existing ski hill, but it consisted of only 100 acres. Site selection immediately became an issue because it was necessary to acquire surrounding public or private land. Eventually, private land was purchased for the golf course. At the same time, the IRRRB initiated a unique land swap with the United States Forest Service, trading some of the land it owned with high-quality eagle habitat for land adjacent to the ski hill. This land has been leased by the IRRRB for cross-country ski trails, U.S. Olympic biathlon training, and other winter recreational uses.

The assembled parcel exhibited the best qualities of the northern Minnesota landscape – extensive lake frontage on Wynne Lake and the Wynne Creek channel and wetlands; dense woods of ancient pines, oak and birch; and wildlife including moose and bear, which are often seen on the golf course.

Some potentially endangered species such as Marsh Marigold and Barren Strawberry were found on portions of the site. A historic Indian portage route existed on the property and prime examples of northern wetlands also were present. All were avoided in the final design. **The final design of the golf course required over 30 routings, ensuring all concerned citizens that the plan was the best possible one.**

Portions of the site were situated in glacier drumlins – a mixture of rocky and silty soil deposited at the end of a glacial flow. This raised concerns about surface runoff and sub-soil leeching from the golf course into Wynne Lake. Resolving these issues required careful design and the retention of several outside environmental and turf experts to provide an integrated golf course management plan. Following these recommendations, **the golf course architects sensitively graded the entire golf course to provide drainage catchments that controlled golf course runoff to surrounding properties.**

Out of concern for surface runoff, all golf holes were held back to a minimum 100 feet from the shores of Wynne Creek, the Wynne Creek wetlands and the historic Indian portage. The par 3 No. 17 hole was placed on the shore of the lake with special grading and drainage to prevent runoff into the lake.

SUMMARY – The design process addressed other public concerns. Local golf course owners, cross-country ski and snowmobile enthusiasts were consulted. The golf cart path system was carefully designed to serve as a cross-country ski trail in the winter, giving the land a multi-purpose use.

Giant's Ridge Golf Club serves as an excellent example of how golf course architects and developers are working with environmental groups, state agencies and others to create golf courses that are economically and environmental success stories.

Preserving a Sensitive Environment

Ed Seay, ASGCA
Palmer Course Design Company

THE OLD TABBY LINKS AT SPRING ISLAND

SPRING ISLAND, SOUTH CAROLINA

Spring Island is an uncommonly beautiful, nearly untouched sea island of 3,000 acres off the coast of South Carolina. The oldest island on the Southeast coast as well as the highest in elevation, Spring Island enjoys beautiful panoramic views of the surrounding rivers and marshes. Along with a varied and rich history, its landscape includes marshes, creeks, ponds, open fields and the largest contiguous forest of giant live Oak trees remaining in eastern North America. As one of the last large undeveloped islands on the Atlantic coast and remarkable in its natural beauty, Spring Island provided a unique challenge for architect and developer. The goal was to create a golf course development that would fit naturally and sensitively into this pristine environment.

Through the early planning process the design team of golf course architects coordinated the routing and construction design with a carefully selected team that included the developer, building contractor, archeologist, biologist/botanist, coastal research manager, woodland & wildlife consultant, landscape architects, civil engineer and golf course contractor. The planning team first identified those areas that would require careful land management and/or extensive regulatory review and permitting:

- Important archeological sites
- Coastal sensitivity
- Protection of natural rookeries and wildlife habitats

Once these areas were inventoried, the team worked to comply with and address all issues presented by the attendant regulatory agencies. A comprehensive study of the rich heritage of Spring Island revealed the presence of important archeological data. Artifacts were discovered and catalogued from three separate historical periods on the island. By working with the South Carolina Institute of Archeology and Anthropology, the South Carolina State Historical Preservation Society and the South Carolina Institute of Archives and History, all sites of historical significance were identified for research and a detailed archeological assessment was prepared for the entire island.

Key to the evaluation was the corridor through which the golf course would pass. A major concern was the preservation, recovery, and documentation of all pertinent historical data. **Understanding that the recovery of this data could necessitate a shifting of the golf features, the course was designed with extra wide corridors to accommodate this possibility.** The master land use plan and golf course routing were finalized. Avoidance of historically sensitive areas was a top priority. The few areas of historical significance remaining within the golf course corridor were researched, managed and cataloged by one of three investigative methods.

- **Method #1 or "green space" required a total avoidance of an archeological area.** Hole No. 9, a reachable par 5, was carefully routed to return to the clubhouse and marsh setting through a narrow gap between two sensitive "green space" areas. Survey crews staked and corded the narrow corridor for the containment of construction. Adjacent to No. 9 green and facing the coastal marsh is the 200-year old tabby ruins of a cotton plantation mansion, the most preserved and visible of the archeological settings. These historical ruins lend interest and a sense of history to the course yet remain untouched in a "green space" natural setting.
- **Method #2 or "data recovery" was used when the area contained artifacts or information determined important enough for immediate research.** The green for the par 3, No. 17 hole, a spectacular point overlooking the marsh is an excellent example of this recovery method. This point is believed to be the site of an ancient Indian encampment. In this instance a comprehensive dig was initiated to recover the data prior to grading. Only after a full retrieval and cataloging of artifacts did the golf course construction begin.
- **Method #3 or "preservation-in-place" was selected for those archeologically significant areas where possible future investigation might be employed.** Working with the South Carolina Institute of Archives and History, a careful layering of fill with photo documentation "preserved-in-place" the remnants of 19th century slave quarters located between the tees and fairway on No. 18. The construction crews carefully corded these areas and made no cuts to existing grade to ensure that no damage to artifacts occurred. Elsewhere on the course, the green complex of No. 6 was shifted to avoid disturbance and to allow future research of this important archeological area. The necessary realigning of the golf course features was made easier due to the wide corridors, a flexible master plan and a commitment by architect and developer.

Close coordination with the regulatory agencies was essential in routing the golf course through the archeological sites and was equally important for those areas along the Chechessee Marsh. The South Carolina Coastal Council was the primary agency involved in the coastal preservation and storm water management during construction.

A primary concern of the design team and the Coastal Council was the quality of water discharged to the marshes. After thorough research and analysis, two methods of protection were initiated along the four golf holes that played to or paralleled the marsh. First, an undisturbed buffer zone of twenty feet from a predetermined "critical line" of elevation set by the Coastal Council was maintained throughout construction. Secondly, large expanses of native grass plantings and/or large sandy waste areas were incorporated into the golf course design. **These areas detained any runoff for a period of time, allowing the grasses and sand to act as filtering agents.**

In addition, the golf course superintendent established an ongoing program of hand fertilizing these sensitive areas with slow-release fertilizers that move slowly through the soil, and allow the native grasses and sandy buffers to cleanse any storm water or irrigation runoff. With a careful coordination of efforts with the regulatory agencies and a commitment to "protection and preservation" the golf course dovetailed well into the sensitive coastal environment.

The third area of concern for the team was the protection of the rookeries and wildlife habitats native to the island. The golf course design incorporated several features that created additional habitats for wildlife to flourish. One such feature was a naturalized "dune" designed and constructed throughout several key areas on the golf course. **These dunes, planted with native plants and grasses, present a beautiful and natural hazard for the golfer, yet provide a continuation of wildlife habitat within the golf course corridor. More than one-fourth of the golf course acreage (more than 25 acres) was naturalized with indigenous plants.**

The vegetation selected for ornamental cover of these areas was propagated from native seed on the island and collected by hand. These natural dune areas, while requiring more hand labor to maintain, have little need for fertilizer or irrigation. Wild Mustard, Toad Flax and other native species provide changing colors and textures throughout the seasons and are a striking counterpoint to the maintained green turf of the fairways. Feeders have been located under trees and along the perimeter of the golf course to attract birds and attendant wildlife.

This careful blending of nature and golf was a hallmark of the original design concept and required an attention to detail to detail by the entire team. Old Tabby Links became a registered member of the Audubon Cooperative Sanctuary in 1993. This joint program sponsored by Audubon International recognizes a golf course for environmental awareness in respect to course management.

Some existing ponds were natural rookeries for a variety of species including the endangered Wood Stork. It was imperative that these nesting grounds remain as undisturbed as possible throughout construction. Working with the U.S. Fish and Wildlife Agency the habitat requirements were carefully researched and precautionary measures taken. Staff members are encouraged to check areas known to support wildlife and report all injured, deceased or orphaned animals to the resident naturalist who monitors and assists in providing a healthy natural environment for the island wildlife.

New ponds constructed within the golf course were designed to incorporate littoral shelves, another feature that provides shelter for the native waterfowl and wildlife. Bands of wetland plants and grasses planted on these shelves support an abundance of wildlife and fish by providing both food and habitat. These areas are maintained by hand to avoid chemical treatment. These grasses are not only an enhancement of the area but serve as a filtering system for runoff from the golf course. Grass Carp were introduced into the ponds to reduce the unwanted algae that choke out the oxygen in the water. This has reduced the need for chemical control of this unhealthy vegetation. Very quickly these ponds have become a natural part of the island ecosystem.

SUMMARY – The South Carolina Association of Naturalists visited Spring Island and the Old Tabby Links in its first year of operation. Their enthusiastic commendation for the sensitivity to wildlife acknowledged that a golf course could ecologically "fit into the environment within a short period of time." *In addition, the Spring Island Development Company was recognized by* the South Carolina Wildlife Federation in January 1994, for establishing the Spring Island Trust, a nonprofit organization dedicated to preserving the environment and history of the island.

More than one-third of the island (1,200 acres) has been dedicated as a permanent Nature Preserve. Close coordination with the EPA and state regulatory agencies in conjunction with a careful plan for recreating natural wildlife habitats have enabled the golf course and development to meld unobtrusively into this pristine environment.

The Old Tabby Links demonstrates that excellence in golf design can be environmentally sensitive. With sensitive conservation and environmentally compatible development, the natural resources of Spring Island have been preserved for future generations.

Integrating a Conservation Plan

Bob Lohmann, ASGCA
Lohmann Golf Designs, Inc.

DANVILLE, INDIANA

Twin Bridges began in 1994 as a golf course project located on an 832 acre parcel owned by Waste Management of Indiana. The project is part of a large recreational land use plan that, along with the golf course, includes soccer and ball fields, archery, a forest preserve and many wildlife conservation habitats including Prairie Meadows, Wildflower Meadows and a Picnic Meadow. The project will serve the City of Danville and the surrounding Greater Indianapolis area.

Twin Bridges Golf Club is a daily fee 18 hole golf course and practice facility. It plays from 5,470 to 7,058 yards at a par of 72. Construction of the golf course began in 1995. It opened for play in July, 1997.

Although the golf course site is part of a larger Waste Management Landfill site, the golf course does not enter into any of the landfill. White Lick Creek is a major creek that runs through the golf course. **Along with the surrounding riparian corridor and its wildlife habitat, the site also includes some small wetlands, several ravines, and the Indian Brown Bat, an endangered species that proved to be the highlight of the conservation plan.**

With all these issues in mind, the golf course architect worked closely with the management company to invite Audubon International to coordinate the plan and help Twin Bridges work toward becoming one of the first certified Audubon signature courses in the state. The project was coordinated through various environmental consultants and the Indiana Department of Environmental Management and the Department of Natural Resources.

During the early design process, the site was walked numerous times to identify areas of concern, and to locate golf features away from these sensitive areas. Initial routings were submitted to the agencies for their review.

As these plans became available, it became apparent that the greatest concern was with the Indian Bats that thrived along the riparian corridor. Because of the layout of the property, and the acreage available, this corridor must be crossed for the golf routing to work. Through the reviewing process, tees began to be moved to eliminate as much clearing as possible. As the permit was being issued, a major concern was the timetable given for construction to take place along the riparian corridor. Because the roosting habits of the Indian Bats are very sensitive, the time frame for clearing the affected areas, which included two golf holes, was granted for the month of September only. To facilitate this timetable the golf course routing and the construction schedule began to take shape to avoid the areas as much as possible and complete the work in the time allowed.

Clearing and earthmoving began in April on the west side of the property, away from the creek. Work progressed smoothly through the summer and schedules were managed to accomplish the work along the creek corridor when September arrived.

As work began moving toward the creek, silt basins and silt fences were built and installed to protect against runoff into the creek. Ponds and detention basins were constructed in the floodplain to compensate for fill being placed, as features were being constructed on the course. Clearing started on schedule in September along the creek corridor. Twenty-foot buffer strips of native vegetation were left undisturbed along the creek banks. **This buffer strip was left to protect against erosion on the banks and keep the natural look of the creek intact**

SUMMARY – The Twin Bridges project has been a tremendous success, not only from the golf course point of view but for the community as well. Community groups were formed to help name golf holes and Boy Scout and Girl Scout units helped build birdhouses on the course.

The golf course superintendent has continued maintenance practices set up initially as part of the course's long-term plan. These practices include the planting of native aquatic plants back into the floodplain ponds, incorporating bat houses and wood duck houses into these areas, and stocking the ponds with fish. The habitats of these areas have improved and are marked by an increase in ducks, frogs, turtles, deer and the Indian Brown Bat

Reclaiming Degraded Property

Keith Foster, ASGCA, and Art Schaupeter
Keith Foster Golf Course Design

SAN ANTONIO, TEXAS

The development of the Quarry Golf Club serves as a wonderful example of reclaiming a degraded property that had no alternative uses. The Quarry Golf Club sits on ground that comprised a portion of the Alamo Cement Company, which operated in San Antonio from the 1920s until 1981. Over the course of the next 10 years of inactivity the site became an environmentally blighted, unusable eyesore.

In 1992, planning was begun on the development of the site. Approximately 170 acres, including a 90 acre, 125-foot deep limestone quarry, were to be used for a golf course. Besides the degraded condition in which the site was left, the additional impact of 10 years of illegal dumping had to be confronted.

There were two main issues that had to be addressed from an environmental standpoint. About 500,000 cubic yards of kiln dust, a by-product of the cement company operations, had been left on site in large stockpiles. The second issue concerned the existing lake in the bottom of the quarry pit. It was directly tied to the Edwards Aquifer, which supplies the drinking water for the San Antonio metropolitan area. The site left in an untended condition had the potential to create serious environmental problems. These problems would have to be corrected so that they would not recur in the future.

The kiln dust presented the most hazardous situation. It was extremely acidic, and would have caused serious problems if it had invaded the water supply. In order to receive final approval for the golf course plans, a Landfill Closure Plan had to be filed with the Texas Natural Resource Conservation Commission. The final design and routing of the golf course as well as the irrigation system had to respond to the need to bury the kiln dust in clay lined vaults that could not be disturbed or punctured. This was done under portions of what was to become the front nine. The golf holes on the front nine acquired something of a links feel as they were built up from the kiln dust vaults, creating rolling fairways that lifted in the areas over the buried vaults.

In contrast, the back nine holes are sunk entirely within the confines of the old limestone quarry. Drainage and irrigation water had to be monitored in the quarry to ensure that there was no contamination of the aquifer through the existing lake in the quarry bottom. **Drainage of the holes from storms and irrigation is allowed to surface through adjacent native areas, which helps to filter out nitrates and other impurities before the water enters the lake.** The quarry holes were creatively routed on the various rock shelves to reduce the amount of blasting needed to adjust the existing grades.

As part of the ongoing maintenance of the golf course, both the quarry lake and the irrigation lake are tested quarterly and after every one-inch rainstorm to ensure that nitrate levels are within an acceptable range. In addition, monitoring wells are present around each kiln dust vault to monitor any seepage or leaks. These are inspected each month.

After four years the lakes have consistently met all requirements. The kiln vault monitoring wells have also shown no signs of seepage. The maintenance program covers both the golf course turf and the out of play areas. These areas were planted with a variety of native grass species which have attracted many birds and animals. The Quarry Golf Club is home to many species of native and migratory birds and waterfowl. Red foxes, skunks, raccoons, squirrels and snakes also call the golf course home. The Quarry works closely with the Audubon Cooperative Sanctuary Program to enhance the golf course and its surrounding environment.

SUMMARY – The Quarry Golf Club has proven to be a successful business venture. Tee times are continually in short supply and the golf course has received regional and national recognition. Just as importantly though, The Quarry has been successful in demonstrating how degraded land that has "no alternative use" and the potential to create severe environmental problems if left unmonitored, has been reclaimed as a recreational amenity for the area with a flourishing wildlife community and native grasses. The development of the golf course has resulted in the site going from an ignored, forgotten piece of ground to an active, closely maintained area that continues to become more environmentally vibrant as it matures.

Environmental Stewardship on Historic Property

Dick Phelps, ASGCA, and Rick Phelps
Richard M. Phelps, Ltd.

LINCOLN, CALIFORNIA

Twelve Bridges Golf Club is located approximately 20 miles northeast of Sacramento at the toe of the Sierra foothills. The history of the property is part of what made Twelve Bridges an extremely unique and interesting project.

In the 1870s, J. Parker Whitney, one of the early pioneers in this region of north central California, owned nearly 22,000 acres, including the land where Twelve Bridges Golf Club was planned. To provide access and to allow distinguished guests to tour his estate, Whitney had constructed an eight mile loop road that included 12 hand-hewn granite bridges crossing the site's creeks and drainageways. Many of the bridges are still standing and, in fact, two were used in the final routing of the golf course.

The Whitney ranch was used primarily as a sheep and cattle ranching operation. However, Whitney also allowed a number of Maidu Indian families to spend the winter months on his property where the small game was plentiful and the native vegetation provided nuts, seeds, berries and other food sources. Interestingly enough, Whitney also created a nine-hole golf course on his property. It was one of the first golf courses in California, but had long since been abandoned.

In the late 1980s, nearly 5,000 acres of what remained of the Whitney estate was purchased and the design/entitlement process for Twelve Bridges began. While most of the property was open, rolling grassland, the golf course was set to be designed in a 335-acre oasis in the northeast corner of the property. The site for the Twelve Bridges Golf Club was tucked in a secluded bowl covered with California live oaks, valley oaks and blue oaks with scattered digger pines and miscellaneous other trees.

The geological history of the area includes the major volcanic activity of the late Paleozoic era, some 30 million years ago, which resulted in granite boulder outcroppings throughout the site, varying in size from basketballs to two-car garages. The site was bisected by two perennial streams, which created areas of seasonal wetlands and a large riparian corridor. **The golf site presented practically every situation that could possibly be encountered in a typical permitting process today. These included wetlands, archeological sites, hazardous materials and endangered species.**

With this type of site as the given canvas, the golf course architects carefully placed a golf course in this environment with the least amount of impact possible, while still allowing for a tournament quality golf course. The final design was a par 72 course that plays from 5,300 to nearly 7,200 yards. Construction began in the fall of 1994 and the facility was completed and opened for play in April 1996 as the host for an LPGA tour event.

The bulk of the project planning and engineering for the golf course site occurred in 1992 and 1993. A team of consultants including the golf course architects, a land planner, wetland consultant, landscape ecologist, civil engineer and an irrigation consultant all took part in the planning and permitting for the golf course.

While the golf site was a small part of the 5,000-acre planned community, the permitting was completed separately but simultaneously due to the distinctly different environments of the two land areas. Also, the Williamson Act in California prevented the owner from building any homes until 1998, so the golf course took a front seat in terms of getting permitted and approved. An Environmental Impact Report (EIR) was required by Placer County as part of the permitting process. The county at that time was the main governing body for approval of the golf course plans.

As part of the EIR process, the consultant team members worked closely with the owner, Placer County, U.S. Army Corps of Engineers and the California Fish and Wildlife Division to help create a project that could be permitted and approved. The first area of concern was the copper sulfate pit. The area of copper sulfate contamination was excavated and approximately 50 cubic yards of material was hauled to an approved hazardous waste disposal site in Placer County.

The EIR included a "Resource Analysis and Protection" report prepared by the landscape ecologist. The highly detailed report included all aspects of the site's flora and fauna and showed where and how the golf course might impact as well as improve the existing conditions.

At least 59 species of birds were observed on the site during the analysis.

Two small elderberry shrubs had survived the cattle and sheep grazing and were necessarily preserved as habitat for the endangered elderberry beetle. A small area of vernal pools, which include habitat for the endangered tadpole shrimp and ferry shrimp, was identified on the golf site. The ecologist's report resulted in the preservation of approximately 70 acres of vernal pools on the 5,000-acre project.

A preliminary archeological study was required by the U.S. Army Corps of Engineers' Individual 404 permit process and it concluded that there were some significant sites included in the project area. The Maidu Indian presence at the end of the 19th century had contributed numerous house pits, grinding mortars and one burial site. Also, after a more detailed study required by the Corps, two older sites (circa 1000 A.D.) were identified, excavated and capped.

The approved plans included setting aside an area of approximately 25 acres where the house pits, grinding stones and other archeological information could be preserved. The burial site was relocated and capped under the watchful eye of a Maidu Tribal representative. All told, the archeological elements of the site added approximately $500,000 to the cost of the project.

The wetland study, which was also part of the 404 permit process, concluded that there were 11.19 acres of jurisdictional wetlands on the golf course property. With avoidance as the main priority in the golf course routing, only 1.81 acres of relatively low quality, seasonal wetland were impacted. Two important results of the wetland permitting process were:

- Negotiation of an average setback from the seasonal wetland areas as opposed to a fixed setback. This allowed the flexibility to cross the wetland areas with golf in select locations and prevented long "forced carries" for higher handicap golfers.
- Mitigation for the lost seasonal wetlands by the creation of three acres of high quality emergent marsh and wet-meadow wetlands. The net result was a greatly improved biodiversity among the wetland species on the site.

All elements were required as part of the 404 permitting process and/or the entitlement process through Placer County. The other major concern among the Placer County officials was the protection and preservation of the oak trees, particularly the Valley Oaks and Blue Oaks. The owner was required to erect construction fencing around all oaks that were to remain. The contractor was responsible for maintaining the integrity of the construction fencing throughout the project.

The only other design concept that was incorporated to protect the golf course and its surrounding environment was the use of fine fescue swales where any hardscape areas drained into the golf course. Both the parking lot and the maintenance area had relatively flat swales that were at least 50 feet long and planted with fine fescue grasses that act as filters before the runoff proceeds onto the golf course property. The management of the swales is kept to a bare minimum to increase their ability to slow the runoff and drop out contaminants in the storm water.

SUMMARY – The Twelve Bridges project is an outstanding example of environmental stewardship.

The created wetlands are thriving as the introduction of water to some of the intermittent streams has provided a broader range of plant materials and thus an increased diversity within the wetlands. The wetland areas are required to be reviewed two times per year for a period of five years by an independent wetland consultant as part of the 404 permit agreement. Also, the absence of cattle/sheep grazing has caused an increase in the quantity and quality of under-story vegetation, which, in turn, has increased the habitat area for birds, small mammals and reptiles. The water-quality monitoring program, which tests both groundwater and surface water twice per year, has shown no negative impact over the three years of testing. The golf course superintendent has implemented an Integrated Pest Management program that uses only organic products within 50 feet of the waterways and wetlands.

The golf course itself has been quite successful as well. The golf course has played more than 60,000 rounds in each of its first two full years of operation. Twelve Bridges Golf Club continues to host an annual LPGA Tour competition.

Sensitive Design and Shoreline Protection

Pete Dye, ASGCA, and Mike O'Connor
Pete Dye, Inc.

WHISTLING STRAITS GOLF COURSE

HAVEN, WISCONSIN

Whistling Straits Golf Course is the vision of Herbert V. Kohler, CEO of Kohler Company. Kohler wanted as true a links style golf course as possible in the United States. The Kohler Company already owned and operated 36 holes in the Village of Kohler (Blackwolf Run's River and Meadow Courses). The new 36 holes at the property beside Lake Michigan would complement the existing resort.

Whistling Straits is located in the town of Haven, 12 miles north of Kohler. Kohler Company purchased a total of 560 acres along a two-mile stretch of the Lake Michigan shoreline. A small creek divides the site into two one-mile stretches along the lake, one to the north and one to the south.

The team consisted of engineers and environmentalists, the Army Corps of Engineers, Department of Natural Resources, local county and town officials, the golf course contractor and the golf course architect and his team. Prior to construction, meetings were held to review environmental issues and how they were to be approached. The four major tasks at hand: **Clean up an abandoned military base; protect the wetlands, creek and lake during construction; stop bluff erosion caused by Lake Michigan; and improve the condition of the affected wetland ecosystem.**

The first task was to locate and dispose of the old fuel tanks and any stray ammunition that had been buried in the site for years and to demolish two large underground concrete bunkers that served as ammunition storage. The clean up operation was a very sensitive one which involved environmental engineers carefully scanning the site before they allowed construction of the golf course to begin.

The second task was to identify all existing wetland systems and to protect them during construction. Silt fencing was installed along the entire lake shoreline within the property, the creek edges and around all the existing wetland areas before construction to prevent sedimentation or impacting any of the adjacent water bodies during construction.

The third task was to find a way to stabilize the bluffs along the Lake Michigan shoreline which were eroding at a rate of two to five feet per year, causing sedimentation problems and disrupting the adjacent wetland on the south side of the property enough to eventually destroy the entire wetland. The construction team identified critical points along the shoreline where revetment walls would be placed to help control the erosion of the bluffs and complement the design of the golf course as well. The revetment walls were built by placing large boulders four feet below the waterline and up to six feet above the waterline. This would prevent further erosion that may occur during storms.

The fourth task was to stabilize the wetland that had been affected by erosion and to restore it to a thriving wetland environment. This was done by creating a 22 acre wetland area adjacent to the affected wetland. Clay barriers were placed at four to eight feet below the natural grade to ensure that water would not leak out of the system. The irrigation system for the golf course was connected to the 22 acres of wetland to feed water into the wetland in case of a drought. Several 18-inch drain lines were installed in the wetland to control flooding during heavy rains.

The design of the golf course takes advantage of the natural topography and the beautiful vistas of Lake Michigan. Eight holes play alongside the shoreline at a lower level than the inland holes, thus allowing the golfer a view of Lake Michigan at every hole. **To ensure a natural-looking course, the grasses planted consisted of a native fescue variety.** Bentgrass was used only on the greens and tees. Approximately 150,000 cubic yards of native sand was brought in to create the "true links" look that had been envisioned. The course plays 7,645 yards from the back tees and 5,440 yards from the forward tees with various tees in between to satisfy golfers at all levels of play. It is a high end daily fee public golf course. Since no carts are allowed on the course and there are plenty of dunes to climb, caddies are required when playing. Whistling Straits opened in July of 1998.

SUMMARY – Kohler Company and the Department of Environmental Regulation plan to maintain Whistling Straits with the same sensitivity to the environment that was used as the course was built. The wetlands will be monitored carefully by environmental engineers and the DER. The 22 acre wetland creation is, to date, the largest thriving wetland created in the state. The revetment walls at the lake's shoreline have withstood the Wisconsin climate and the forces of Lake Michigan.

An Environmental Demonstration Project

Dr. Michael Hurdzan, ASGCA
Hurdzan-Fry Golf Course Design

SCITUATE, MASSACHUSETTS

Widow's Walk Golf Course was the first "Environmental Demonstration Project Golf Course" in the United States. The golf course was planned, built and operated with the cooperation and advice of various environmental representatives, who dealt with wetlands, habitat, land reclamation, town water supply protection, affordability and accessibility for public golf.

The 120 acre site had been a sand and gravel quarry. After it was mined out it became an illegal dumping ground for everything unwanted and a very impoverished habitat for wildlife. On the positive side, it had a collection of high ridges and mining spoil piles that offered great off-site views of the Atlantic Ocean, Cape Cod Bay and the tidal North River. While built with a modest budget, it received the abundant assistance and support of environmentalists.

The first step in the project was to assemble a team of environmental experts to assess and map the site for environmental resource areas such as endangered plants or animals, regulated lands, and serious environmental threats. Then, the golf course architects routed a golf course on the site that tried to avoid all of the identified resource areas. Since these areas of special concern took up over 50 percent of the site, avoidance was impossible. A rational approach to compromise and mitigation had to be devised. Resource areas were prioritized as were areas for mitigation to produce the best total land use for the environment and golf.

The overall objective was to produce a corridor of mixed habitats to support the greatest variety of plants and animals as possible. This included open water ponds, wetlands, vegetated streams, woods, open grassy areas, vernal pools, and many lesser habitats.

A town well for drinking water was located in the center of this very sandy site, so groundwater protection was paramount. **Zones of contribution or influence were established around the town well, which allowed varying degrees of impact and activity.** Zone I allowed absolutely no fertilization or pesticide of any kind, and monitoring wells were established to ensure this protection. Zone II allowed reduced levels of fertilizers and pesticides but with appropriate water quality monitoring. Zone III, outside the well recharge areas, was unregulated.

Water for irrigating the golf course came from reopened and previously abandoned drinking wells that no longer met EPA purity standards. The water quality was fine for golf course turf grass use, and when applied to the turf, it became sufficiently filtered to become an acceptable contributor to the town well. **In essence, the golf course became a bio-filter to improve the unpotable water to a suitable drinking water standard.**

One stated goal of the development team was to use only 50 percent of the water, fertilizer, pesticide and fossil fuel required for maintenance at other golf courses in the area. This required selecting drought and disease resistant grasses that require little fertilizer. The golf course has met those reduced input goals, but only with the understanding and support of golfers who don't demand lush green turf grass all year long. The golf course turns more brown than green during drought years, but not at the expense of an exciting round of golf.

During the construction of the golf course efforts were made to recycle everything possible. Wood chips and sawdust were made into compost to substitute for a lack of topsoil, ground up asphalt debris was used for cart paths, and even carpet scraps were used to make bunker faces. Experiments on various types of green construction for cost effectiveness were installed, as were meters for measuring water use, soil moisture and temperature.

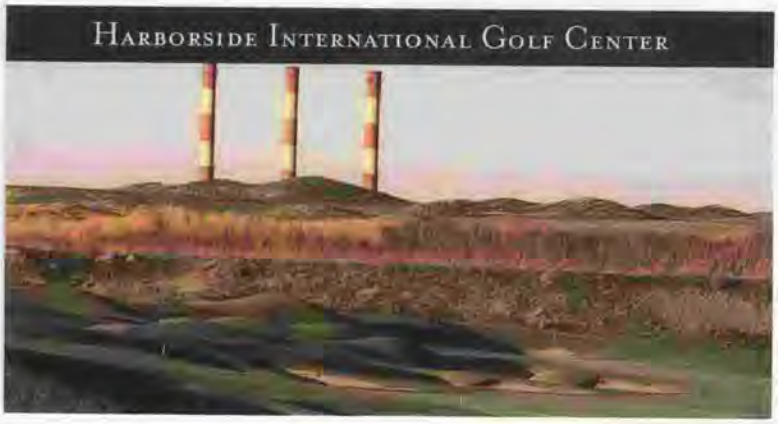
After the course was opened the management team initiated efforts to work closely with universities to encourage research on the facility, and with the Massachusetts Audubon Society to better manage habitat areas. Both activities are continuing with great success. Several research projects have been started, many habitat areas have been given appropriate nesting supplies, and **more than 75 species of birds have been sighted on the golf course.**

A golfer guidebook was written that provides information about the wildlife value of each hole and details specific management practices employed. The sale of each book produces $1 income to the golf course and $1 for the Massachusetts Audubon Society.

SUMMARY – Widow's Walk – designed, built and maintained under the watchful eyes of experts in golf and environmentalism – exemplifies the cooperative approach to golf course development.

Reuse of Problem-Laden Landfill

Dick Nugent, ASGCA, and Tim Nugent
Nugent Golf Associates



CHICAGO, ILLINOIS

In 1991, the Illinois International Port District was faced with a requirement calling for the closing of a solid waste landfill that could not be used for industrial, commercial or residential development. The Environmental Protection Agency required that the site be encapsulated with a seal of impervious clay, planted and maintained with a covering of vegetation. The Port District elected to take the closure to the next level to achieve the site's highest and best use by developing a golf facility. This was the only use that would pay for its own maintenance and return an operating profit. However, due to the project's location in the industrial south side of Chicago, the local demographics could not support the expense of converting this brown field into a golf course. It would be necessary to tap the greater metropolitan area to "make the numbers work."

To achieve this goal, it was determined that the end product would have to be a "world-class" facility if it were to draw high-end golfers. Fortunately, the site nears I-94, I-57, and I-80, approximately 300,000 cars pass daily. It was deemed that access to the site outweighed the surrounding area and therefore, "build it and they will come" became the operative phrase.

The Harborside International Golf Center features a matched pair of 7,150 yard, 18 hole championship golf courses and a 58 acre practice facility, including a Golf Academy situated on 450 acres of sanitary and construction debris landfills. Provisions are present for a three-hole practice course. The golf course operates as a daily fee facility and was constructed from 1992 through 1995. Although the final cost approached $30 million, the Port District does not have any taxing or bonding abilities and had to finance the project conventionally.

The site was originally used for the disposal of the City of Chicago's municipal solid waste. Later it was used to dispose of incinerator ash and wastewater sludge. The greatest challenge in the designing of Harborside was that the land consisted of a 200 acre partially closed sanitary landfill and an ongoing construction debris landfill located on the remaining 250 acres. Further complicating the task was that the site was devoid of any topsoil. The treated sludge, which was the only available cover material would have to be brought to the site for a three-year period at 250,000 cubic yards per year until an alternate disposal site was found. The design had to incorporate the deliveries into the construction schedule.

The remaining 250 acres was about 30 feet lower and wrapped around the northern and western sides of Lake Calumet, an 800 acre lake which connects to Lake Michigan via the Calumet river. Non-organic, non-hazardous material (i.e. broken concrete, demolished buildings, bridges and roads, and general mixed dirt from excavation sites) covered this portion of the site. Therefore, an impervious cap was not required for this section. However, no sludge could be placed within a 300-foot buffer zone around the Lake Calumet shoreline. Three low grade wetlands had been formed in depressions of old fill operations. It was decided to relocate these to the upper section of Lake Calumet and upgrade them.

Harborside's fairways, greens and contoured bunkers were crafted in a pioneering use of wastewater biosolids carefully blended with other locally available materials. The solids were installed in a complex layering process to form a golf course out of the previously flat topography. The result is a sweeping links-style facility reminiscent of Scottish seaside courses with no trees whose roots might permeate the underlying clay cap. To obtain clay for the cap from the closest available source, and clear the way for a future marina, sections of the shallow north end of Lake Calumet were sealed off, drained and fish were seined and returned to the open water. Over 550,000 cubic yards of stiff blue clay was excavated with backhoes and large off-road trucks. This was placed in three compacted 8" lifts over the shaped sludge to form the 2-foot landfill cap.

The golf course irrigation system is extensive yet miserly in the use of water. The irrigation water is drawn from Lake Michigan and amounts are regulated by a multi-state commission. Drainage and irrigation systems were carefully designed to protect the integrity of the clay cap, with sensors and controls to manage storm water runoff and a special pump station to draw irrigation water from Lake Calumet while protecting against Zebra Mussel infestation.

Due to the close proximity of Lake Calumet, the project team worked closely with the Illinois Department of Fish and Wildlife, the Illinois Environmental Protection Agency and the Army Corps of Engineers. Since these agencies each have their own mandates, the solution to one edict sometimes was in conflict with one of the other agencies. By conducting joint meetings where all parties could put their issues on the table, a "big picture" was developed and through the interaction of the public and private professionals, solutions were developed which satisfied all parties.

First and foremost was protection and enhancement for wildlife. Chicago and Cook County have set aside vast tracts of land for parks and forest preserves. Being part of the northern flyway, work on the excavation of the Lake was not allowed during migration periods. Staff members of Fish & Wildlife culled the desirable game fish from the undesirable rough fish when the sections were drained. Wetland mitigation was planned which would add to and enhance the overall ecosystem of the area.

Water quality was also a driving design parameter and the site drainage system became a critical element in the sculpturing of the golf course. Because the 200 acre landfill was to have a two foot layer of sludge placed over the clay cap, it was required that all storm water runoff be contained within the site. However, since this water had to be taken to one of two sanitary inlets, only amounts less than a 5-year storm event could be discharged into the Metropolitan Wastewater Reclamation District's sewer system. The golf course architect and the engineer collaborated in the design of an elaborate drainage system where all site drainage is collected and stored at seven dry detention locations within the site and routed back to a sewage treatment plant for processing.

The wetland issues were twofold. First was the "two for one" relocation and upgrading of the three small, low-grade wetlands in the construction debris fill. While this was not a necessity for the golf course, it was determined that incorporating the mitigation into the shallow end of Lake Calumet would allow for a synergistic upgrade of the entire ecosystem. This was achieved by creating an 8-1/2 acre peninsula in the lake. To offset the filling of one section of the lake, an equal amount was excavated in another section that was deep enough for fish to over-winter.

The second wetland issue was the protection of the existing wetland sections of the lake. These were located in the northern most reach of the lake and adjacent to No. 16, 17 and 18 on the Port course. Being old fill sites, these wetland areas are emergent in nature. A buffer was created to protect them. However, due to the expanse of the shoreline affected, several different solutions were incorporated to create an aesthetic system, which emulates what is found in nature. In the area adjacent to No. 16, deep water was excavated between the golf course and shoreline wetland No. 17 is a sharp dogleg left and has an additional 40-foot wide beach, which begins at the tees and wraps around the entire left edge of the fairway. The sand transition buffer then continues along the No. 18 tees, up to the first landing area of the par 5 hole. At this point, the wetlands end and the fairway was filled 8 to 10 feet, so drain basins could be incorporated to prevent any storm water from flowing into the lake.

Perhaps the biggest dilemma from the outset was "how do you grow not just grass – but turf – on a 450 acre site that is completely devoid of topsoil or any other acceptable growing medium." The solution was found in the very item that was being disposed of on the site. Every year the Metropolitan Wastewater Reclamation District trucked 250,000 cubic yards of sludge to the site. Sludge is the end product of the sewage treatment process. As such, it is very organic in nature but has high levels of fats and salts. The result is a medium that, due to its high salt content, draws water out of plants and will not readily saturate. To help remedy this, a 6 to 8 inch layer of sand was placed over the fairway. This tapered to 4 inches in the roughs and 2 inches on the mounds in the outer roughs. **The trenching of the extensive under network of a wall-to-wall irrigation system and drain tiles brought up enough sludge that, when final raking operations took place, an acceptable amount of organic material was present in the sand layer.** In fact, virtually no fertilizer was needed and the grass grew so fast that it was hard to keep it cut.

SUMMARY – The development of the whole site was an environmental undertaking from its very inception. The site itself was the prodigy of the old practice of filling water bodies with by-products of urban civilization. Not only did this project have to finish what others had started decades ago; it had to do so in a manner that would:

- **Right some of the environmental wrongs perpetuated on the site.**
- **Enhance the overall ecosystem of the area.**
- **Create a self-sustaining, world-class golf facility without the use of any public monies.**
- **Together with the Historic Pullman Preservation District, provide the nucleus for urban renewal and neighborhood upgrading.**
- **Establish the cornerstone for revitalizing an economically depressed area.**
- **Develop a solution to utilize urban sewage sludge to remediate the brown field site that contained no viable soil-growing medium.**

Irrigating With Effluent Water

Bobby Weed, ASGCA, and Scot Sherman
Weed Design

JACKSONVILLE, FLORIDA

In 1996 Timuquana Country Club, a tree-lined 1923 Donald Ross design on the banks of the St. Johns River south of Jacksonville, was mandated by the St. Johns River Management District to make a change from well water to treated waste water for irrigating the golf course. Local agencies were not going to re-issue necessary water permits to the club unless treated water was used as the primary source to irrigate the golf course. Because of these water issues, Timuquana Country Club was faced with vacating its entire irrigation system. Coincidentally, the U.S. Naval Air Station, which borders the course, had been looking for a way to discharge less treated water into the St. Johns River.

The golf course at Timuquana Country Club is situated on about 200 acres of the approximate 450 acres owned by the private club. The par 72, 6,859 yard layout has holes that are framed by native pines, oaks and palmettos. It has only slight elevation changes.

In addition to seeking a way to respond to regulatory issues, the club was also seeking a solution to the drainage difficulties that caused the course to be closed after the heavy rains that are frequent in north Florida. Also, many club members wanted to bring the historic Donald Ross course back to the original strategic layout of the 1923 design, which had been changed several times since it was originally built.

Through negotiations between Timuquana Country Club and the Delaney Naval Air Station it was decided that the Navy would send treated water to Timuquana Country Club and the club would complete a golf course renovation along with its new irrigation system to accommodate the Navy's waste water. The mission of the golf course architect was to interface with all parties in the environmental regulatory agencies to find the best way to meet irrigation regulations and renovate the system while upgrading green surfaces, drainage and turf grass and restoring the Ross design as closely as possible. **The solution also created a way for the golf club to reduce the amount of water taken from the Florida aquifer and assist the Navy in its goal of releasing less treated water into the St. Johns River.** Timuquana Country Club received permission to take as much effluent water as it could use.

The NAS Jacksonville wastewater treatment plant treats, on average, 300 million gallons of water per year. The Navy now sends more than 100 million gallons per year of treated water from its wastewater treatment plant to the Timuquana Country Club for use in irrigating the golf course. The Navy completed the water treatment system and installed a pipeline to a pump house at the east side of the golf course property line. From there, the club routes the water to a large collection pond which it uses to irrigate the course. The soil removed to form the collection pond was used by the Navy on the base, which benefited both parties.

St. Johns River Waste Management District Governing Board hailed the agreement as a "victory for common sense." It pointed out that the continued growth in Jacksonville is draining the Florida aquifer and that community water reuse systems had to be established to reduce consumption of valuable ground water, improve the quality of drinking water and aid in the clean-up of the St. Johns River.

In restoring the Ross features to the golf course, the architects referred to old aerial photos of the course taken before any modifications had been made. The shots were taken in the 1940s and showed clearly the routing, bunkering, trees and greens of the original Ross layout. The routing was kept intact. Approximately 800 trees that had overgrown the fairways, changing the original Ross strategy, were removed. The old-growth oaks that are characteristic of the area were kept, but many of the new pines were eliminated. The greens were rebuilt with a modified USGA greens profile. The entire golf course was renovated and regrassed. Cart paths were added for playability. Some areas of turf were converted to pine straw. Aquatics were planted in all of the on-site ponds for habitat.

SUMMARY – This project is one more example of how golf can help solve some of today's environmental challenges. In this case, the conversion to reclaimed water for irrigating the golf course, and the resulting environmental benefits, was simply the catalyst for the entire renovation project. The result was a long-awaited restoration of the strategy and flavor of the revered Ross design.

Permitting a 10-Mile Coastal Site

Damian Pascuzzo, ASGCA, and Neal Meagher
Graves & Pascuzzo, Ltd.

SEA RANCH, CALIFORNIA

The Sea Ranch on the Sonoma Coast of northern California is a development initially conceived in the mid-1960's with the goal of preserving the existing dramatic environment. The award-winning development occupies a 10-mile stretch of coastline at the far northern end of which lies the golf course. The first nine holes opened in 1974 and were laid out on a coastal bluff between Highway One, which bisects the entire development, and the Pacific Ocean. The golf course architect was directed by the owners to create a golf course that took advantage of the site characteristics but not touch one square foot of land if it was not absolutely required.

The envelope for the entire 18 hole golf course was included in the original Sea Ranch master plan. Market forces dictated that only nine holes be constructed initially. But by the late 1980's, with the growing demand for golf, the time was right to construct the second nine. This should have been a straightforward process, but the flood of environmental regulations that were passed in the late 1970's and 1980's placed a burden on planning and design that was never anticipated.

The first step was to begin working with a firm that specializes in land restoration and environmental permitting. The firm prepared the now required wetland delineation and endangered species surveys while also consulting on native plant design. The analysis identified significant challenges to course development under current regulations. Under current rules of the Army Corps of Engineers, a site with 154 days of continuous soil saturation at the surface in California's mild climate can, and often will, be considered a wetland. These conditions are often met by sites that were not recognized as wetlands in 1974. Not surprisingly, many new wetlands appeared on the land for the proposed second nine holes. These and other factors contributed to the protracted time period required to obtain the necessary permits.

The Sea Ranch is also within the jurisdiction of the California Coastal Commission. Under the Commission's rules, only a limited number of uses are allowed in wetlands and golf courses are not among them. Although the original nine holes sailed through the approval process, the second nine required significant redesign to conform to new conditions of approval. This was further complicated by the fact that much of the adjacent real estate had already been subdivided into residential lots. Opportunities to alter the routing of the golf course were limited. As a result, many of the wetlands and native grass areas replaced traditional golf course hazards as challenges to the golfers. For example, several dead trees were incorporated into the fairway of the 13th hole. These old snags provide habitat to various raptors that circle the site looking for prey.

The par three 17th hole crosses a preserved creek and wetland and the green is directly adjacent to the location of a sensitive plant, the flexible knotweed (Erigeron supplex). This meant that the back tee had to be eliminated. The carry over the preserved creek became much longer as the condition of approval stipulated that no wetland be filled in. Also, the presence of the sensitive plant dictated that no construction could be performed while it is in bloom, and its close relation to the left front of the green presents an additional hazard since this area cannot be maintained.

By 1995, the State Department of Fish and Game determined that California's native grasses (which dominate significant portions of the course) had been depleted and that new development should work to restore or enhance these habitats. **A plan was developed to preservate nine acres of native grass species and convert 19 acres of non-native species. These native grasslands were used as secondary roughs along some of the fairways and as buffers between the wetlands and golf course turf. This work resulted in long-term cost savings, native habitat enhancement and the creation of a visually stunning course that weaves the fairways through contrasting fields of native shrubs, wetlands and grasses.**

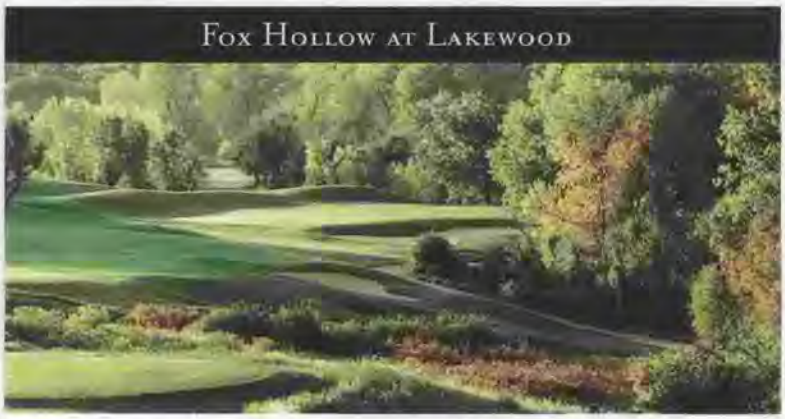
Grading and drainage were carefully monitored to minimize their impacts. An underground drainage system was installed to collect stormwater and move it to areas that are out of play.

The golf course is irrigated with reclaimed water generated by a local treatment plant. Since water is at a premium it was important to have a state-of-the-art irrigation system. Using a valve-in-head design coupled with a central computer monitoring weather data and application rates, the golf course is very efficient with water resources. In times of low water availability, only the most critical areas are irrigated regularly.

SUMMARY – The Sea Ranch Golf Links is ever changing. Each season presents a different look as the colors and the textures of the golf course and surrounding landscape respond to the varying environmental conditions. For golfers, the course harkens back to the origins of the game in Scotland. It provides the chance to enjoy the great game of golf in a setting of magnificent natural beauty.

Working With Regulatory Agencies

Denis Griffiths, ASGCA
Denis Griffiths & Associates, Inc.



LAKEWOOD, COLORADO

The City of Lakewood began planning in the fall of 1989 for the new Fox Hollow Golf Course. The leased 450 acres set on the eastern end of Bear Creek Lake Park owned by the Army Corps of Engineers is the site of the upscale daily-fee 27 hole facility. With this location in the park came the mandate for a course that would be environmentally sensitive, with minimal impact while enhancing its surroundings. The planning, permitting and environmental positioning was completed by January of 1992. Construction began immediately thereafter and was completed in 10 months.

The site contains three individual types of topographic and vegetative characters including meadow and riparian; upland native grassland; and previously disturbed upland revegetated with bromegrass. Bear Creek and its riparian corridors bisect the land, with mature tree corridors paralleling the water course. **Approximately 13 acres of jurisdictional wetlands were delineated mainly related to Bear Creek and its tributaries. The park is a haven for wildlife.**

The Corps of Engineers was very active throughout the development of the course and continues to monitor the operations on a daily basis. **The following departments of the Corps were part of the planning process: environmental, wildlife, archeology, real estate, dam engineering, dam safety, legal and storm water. Each had its own specific agenda with wildlife and habitat protection being paramount, wetland and riparian area disturbance to be absolutely minimized, and a strict set of dam and storm drainage requirements to be followed.**

During the early stages of planning, the city had an environmental assessment prepared which included wetland determination; vegetation, wildlife and habitat inventories; and guidelines for future fertilizer and pesticide management. The golf course was routed so as to have no impact on any sensitive element or area. The city's plan called for 36 holes to be located on the property, but after testing the site with various routings, 27 holes was determined to be the best solution to maintain the integrity and current identity of this portion of Bear Creek Park.

The holes were laid out to leave ample area between fairways to maintain natural vegetative buffers. **Every effort was taken to place the golf course in the meadows and open grasslands – working in and around trees and other wildlife habitat, taking advantage of the vegetation for framing and play strategy, while minimizing removal.** Minor impacts to several lower quality wetland areas were proposed on tributaries to Bear Creek. The 240 feet of elevation change within the site dictated the orientation of many holes to minimize earthwork and avoid steep slopes.

Periodic meetings were held on site and in the Omaha Corps of Engineer offices from the onset through approval of the plans to discuss limitations, approaches and solutions. The goal was to develop a golf course consistent with the Corps' wishes and those of other concerned parties. **By minimizing wetland impact, wetlands work could be done under a Nationwide 26 permit.**

Extensive silt protection was installed prior to the start of construction. Wide areas of existing grasses were left between fairways and as perimeter buffers to protect from lateral silt movement. **A complex drainage system, including ponds, wetlands, ditches, subsurface pipe and redirected surface drainage, was installed to capture the majority of the surface drainage from the course.** The drainage was routed into lakes for treatment prior to discharging into Bear Creek and the associated riparian corridors. This same system would later be used for surface drainage treatment of nutrients and chemicals.

The few major trees that were removed were placed in remote areas of the course for additional bird and wildlife habitat. Two clearspan bridges were placed across Bear Creek causing no disturbance to the creek, aquatic vegetation or wildlife.

The irrigation system was installed to maximize water application efficiency. In out-of-play areas and some strategic locations, native grass mix using indigenous drought tolerant species were used to add color, texture and wildlife habitat. These areas were located to minimize the total amount of irrigated turf and reduce the irrigation water needs of the course.

Throughout construction, wildlife was monitored and protected. Numerous nesting areas were located and cordoned off until eggs hatched and the young left. **Wildlife of specific concern included two coyotes, pairs of red tail hawks, blue herons and great horned owls. All remained after construction.**

SUMMARY – Within one year of opening, the Fox Hollow at Lakewood Golf Course received the National Environmental Steward Award for demonstrated conservation efforts and stewardship. The course plays nearly 70,000 rounds of golf as the wildlife population thrives with the expanding habitat. The Corps of Engineers and Environmental Protection Agency have recognized Fox Hollow as an outstanding demonstration of how golf can enhance the surroundings with minimal impact to the environment.

Solving Storm Water Challenges

Jerry Matthews, ASGCA, and Denny Spencer
Jerry Matthews Natural Course Design

GROESBECK MUNICIPAL GOLF COURSE

LANSING, MICHIGAN

Amendments to the Clean Water Act in 1987 included a mandate that states must reduce the amount of pollution and sewage being released into rivers. The City of Lansing installed two pipes in the ground, one for storm water discharge into the Grand River and the other for sewer water headed for the treatment plant. After the construction, the city would no longer take the storm water from Lansing Township, a nearby suburb, but it would continue to accept Lansing Township's sewage since it would be financially impossible for a town of only 9,000 residents to build its own treatment plant.

The Ingham County Drain Commission was faced with the traditional solution of piping Lansing Township's storm water to one of three nearby rivers. But this solution would cost in excess of $20 million and bankrupt the community. So the commission became very creative and assembled a team of professionals to design a 30-acre urban wetland system to handle all of the storm water discharge. Using an innovative method, the Tollgate Drainage District of Lansing Township diverts storm water to the lowland area of Fairview Park, where it is naturally cleansed. During heavy storms, excess water flows into seven acres of storage ponds located on the nearby Groesbeck Municipal Golf Course.

The City of Lansing became a willing partner in the project. There had long been talk of remodeling the golf course and the Mayor of Lansing and the Director of Parks and Recreation seized upon the opportunity represented by the Drain Commission. The plan included building a large system of interconnecting deep water ponds on the golf course. Since nine holes of the golf course would be closed during construction, the Mayor encouraged the city to go forward with its desire to remodel this part of the course. In doing so, the project became a cooperative effort with the goals of the city and the golf course designed into the plan.

The challenge presented to the golf course architects was to redesign the new golf holes to include the ponds and wetlands required by the Drain Commission without requiring any additional land. The design goal was also to maintain the playability and safety that is required of municipal golf. The new water features affected six of the nine holes. At No. 8, a 185 yard par 3, a new perched wetland was created that borders the entire left side of the hole.

In addition to beautiful and strategic water features, the pond construction provided nearly 90,000 cubic yards of soil for building new tee and green complexes and a large amount of fairway elevation and mounding. The fairways on No. 1 and No. 9 were raised four feet to provide additional storm water storage during an unusually heavy storm.

The ponds themselves provide a number of environmental advantages in addition to storm water storage. **A combination of wetlands, waterfalls, underwater aerification and select deep water areas all contribute to sedimentation control and pollution reduction.** The ponding system also relies on evaporation to reduce its volume and provide a source of irrigation water for all 18-holes. Along with new double row irrigation, the golf course architect worked with the irrigation consultant to design an underground recirculating system which exchanges the water in the ponds every 24 hours.

The HDPE pipe, installed along the bottom of the ponds, recirculates the water throughout the entire water system and pushes water from the lower depths to the surface.

SUMMARY – The total 30 acre urban wetland system, including the golf course, can handle 10 million gallons of water per day, or two 25 year storms back-to-back. More importantly, the water is naturally filtered and cleansed so that no pollutants are being discharged into the river, solving a complex environmental problem. The entire project was done for $6.2 million, less than one-third of the cost of the traditional solution, with the golf course renovation representing less than $2.5 million of the project total.

Groesbeck Municipal Golf Course, which previously had no water features, can now boast about its new nine with six beautiful and challenging water holes. Its new environment is also teaming with numerous species of fish, waterfowl, shore birds and other forms of amphibian wildlife.

Routing Course to Natural Topography

Bruce Charlton, ASGCA
Robert Trent Jones II Golf Course Designers

SABINO SPRINGS, ARIZONA

In 1994 the City of Tucson and Pima County began developing plans for a new 18-hole golf course as part of an existing residential development. The golf course and residential community were nestled within the natural characteristics of the Sonoran Desert, with scenic backdrops of the Catalina Mountains and Colorado National Forest.

The site for the new course encompassed nearly 200 acres of rugged terrain and native riparian corridors. The natural desert runoff channels and the associated vegetation provided more than adequate cover, water and natural pathways for all types of wildlife to traverse the site unencumbered.

The sharp desert contrast and the nine natural springs presented a breathtaking location for a golf course, as well as great challenges to maintain harmony with the unique environment. **The springs, extremely rare in an arid environment, were identified and mapped. Prior to construction, buffer zones of 50 feet were established with fencing to protect the integrity of each spring.**

The site was surveyed by an archeologist before planning and construction, and a foundation of a former adobe building was found within 150 feet of an on-site seasonal wetland pond. The pond was used more than 1,000 years ago by the Hahokam Indians. **All clearing and nearby grading did not occur until a complete archeological dig and site-specific survey was completed.**

Many artifacts were found and removed, and the foundation remained intact near the 12th green. To protect the site permanently, the entire adobe foundation was capped. The green was shifted slightly and had to be raised three feet to protect the foundation from the trenching of drain lines.

Before construction began, the Pima County Board of Supervisors created and approved an extensive desert preservation plan. The course was designed to meet the requirements of the plan, which included:

- **Minimizing runoff and soil erosion due to the alteration of the terrain.**
- **Constructing rough and fairways to maximize use of existing cacti and vegetation.**
- **Utilizing desert hardy trees, shrubs and groundcovers that are low pollen disbursing.**
- **Building advanced irrigation systems and on-site storage ponds.**
- **Routing course to natural topography, slope conditions and vegetation massing and corridors.**

Two biologists and a horticulturist directed the vegetation removal during construction, tagging specific desert vegetation for salvage and transplanting. More than 85 percent of the Saguaro Cactus on site were removed and salvaged; they were either moved to a six-acre nursery or transplanted on the perimeter of the golf course in non-irrigated zones.

Native trees (Mesquite, Ironwood and Palo Verde) were also transplanted to a nursery. Native plant species were revegetated as "bufferyards" to existing neighborhoods and newly constructed roadways through the project.

Managing stormwater on the site proved to be as complicated as the vegetation procedures. Before the golf course was built, Sabino High School, the neighbor at the southwest corner of the property, regularly flooded during heavy rainfall. **Working with Pima County Flood Control, the golf course was designed to channel the would-be floodwater away from the school and into a meandering man-made dry wash**. The dry wash also serves as an integral hazard and element of shot value strategy on the par 5 second hole and the par 4 first hole.

The practice range was sited east of the high school near the mouth of the dry wash at an elevation considerably lower than all portions of the high school property. **The range was contoured like a giant bathtub to contain rapid runoff and release water at a low rate into an existing drainageway**.

Several rocky drop structures were introduced to dissipate the energy of the water during runoff. Rock rip-rap was placed adjacent to road crossings and the entrance to the practice range to minimize erosion and siltation.

SUMMARY – Raven Golf Club was planned, adjusted and constructed with consultation of several outside experts and the results were very positive. Ancient artifacts were recovered. Almost all the vegetation was preserved and the future environmental impact was enhanced rather than corrupted.

Protecting Water Quality

Thomas A. Marzolf, ASGCA
Fazio Golf Course Designers, Inc.

VIRGINIA BEACH, VIRGINIA

Bayville Golf Club represents a combined effort of the Norfolk area business community to create a world-class golf experience, in a private club setting, with an open, non-discriminating membership policy. Several options for finding a site were reviewed. The Virginia Beach land selected for the course was a dairy cattle and row crop farm, adjacent to the Lynnhaven Sound and the Chesapeake Bay area. The land is roughly 250 acres, has sandy soil with gentle grades, and is ideally suited for an 18-hole golf course and extensive practice area. The perimeter edges of the site are tree lined, with the center sections open for farming. A portion of Bayville Farms borders directly on the Lynnhaven Sound, with dramatic, long-range marsh and open water views. This windswept setting is similar to Scottish and British links land and allowed for the course to be created with a natural feel that seamlessly blends into the existing environment.

To begin the design efforts and obtain required permits, a local environmental consultant and engineering firm were hired. The design team met with local, state and federal agencies to outline a logical approach. The owners of the land set the tone by instructing the team to ensure environmental sensitivity. This goal quickly evolved into a process that allowed Bayville Golf Club to become a model project that enhanced, protected and preserved the shoreline habitat.

The major permit issues for this project were:

- Surface water quality – containment of runoff
- Chesapeake Bay preservation guidelines
- Reclamation of existing farm waste
- Wetland preservation
- Shoreline edge protection
- Archeological preservation

The golf course was routed to ensure that all the permit issues could be addressed. Mandatory buffer areas were set aside along the coastal shoreline holes. Additional space was designed into these holes to allow for native revegetation that would further buffer and protect the shoreline. Linear sand bunkers were placed along the shoreline edges of holes No. 1, 2, 15, 16 and 18 to act as further separation of maintained turf from the sensitive Chesapeake Bay.

Storm water runoff was a key concern. **The goal here was to ensure that all surface water runoff from the course would be collected and directed away from the wetlands and marsh.** This was accomplished with a series of interconnected lakes that act as a contained collection system. These lakes also serve as the irrigation source for the course.

Each hole was shaped to create water catchment areas. These catch basins were piped back to the lake system. All direct runoff from the course was captured and piped to the lakes. Also, during the construction of holes No. 17 and 18, several cattle waste ponds were drained, excavated and moved away from the shoreline. This improved the environment in this area and ensured that no remnants from the land's previous use would impact the marsh.

The project archeologists identified Indian artifacts on the 15th hole. These important artifact areas were mapped and reviewed with the state. It was decided to leave these areas intact, fill the ground over these sites and preserve them for future restoration.

To complete the construction and grass the course, extensive sodding was installed along the buffer edges to reduce the grow-in period and stabilize the soil. **Native grasses were planted throughout the course to create habitat areas for nesting birds and further protect the marsh.**

SUMMARY – Once the grow-in was underway, the golf course superintendent established an extensive integrated pest management program to ensure protective alternative methods to maintain the course.

The golf course greens are seeded with the new A-4 Bentgrass, which requires far less chemical use than older varieties and helps protect the environment.

The course, opened for play in the fall of 1995, has hosted several regional golf events and is highly regarded among area players. A local environmental group, Friends of the Chesapeake, has identified this project as a model and has conducted tours of the site to show potential developers how to pursue projects of this kind.

Bayville Golf Club is an excellent example of the innovative design processes that are employed by ASGCA members to protect and preserve the environment, while meeting the client's objectives of quality golf.

Transforming a Superfund Site

Bruce Borland, ASGCA
Nicklaus Design

ANACONDA, MONTANA

Years of mining and smelting activity left behind hundreds of acres of waste. Mine tailings, slag piles and rubble piles from the long abandoned Old Work buildings lay scattered around the site. In 1977, the Atlantic Richfield Company (ARCO) purchased the Anaconda Company with intentions of continuing mining operations. Operations, however, quickly closed down and ARCO inherited the responsibility of cleaning up more than 100 years of pollution. In 1983, the property was designated a Superfund site.

ARCO faced the choice of either removing tons of waste materials from the property or taking remedial actions. ARCO conducted studies and interacted with the community to determine the best solution. **The decision was to transform the Superfund site into a top-notch golfing facility for the town of Anaconda and Deer Lodge County.**

Construction began in 1994 and the Old Works Golf Course opened in 1997. The altitude-adjusted par 72 course plays through 250 acres and can be stretched to 7,581 yards. The complete practice facility includes a range and three practice holes.

Designers of the course were confronted by a number of environmental issues related to the site. **As a result of the mining operations, the soil contained concentrations of arsenic, lead and copper. Scattered throughout the site were piles of rubble and garbage. One of the major concerns was the erosion of contaminated soils into the nearby Warm Springs Creek during storm runoff. Related to the erosion was the potential problem of ground water contamination. There was also a concern that the small particulate matter from the contaminated soils could become airborne and create problems.**

The agencies involved with this project included:

- Environmental Protection Agency (State and Federal)
- Montana Department of Health and Environmental Sciences
- U.S. Department of Justice
- U.S. Fish and Wildlife
- Anaconda/Deer Lodge Golf Course Authority
- Department of Natural Resources

The golf course routing took advantage of natural and man-made features. Several holes on the front nine play along stone smelting ovens, flues and brick walls. Four holes are routed to take strategic advantage of Warm Springs Creek.

Other areas of the site dictated that fairways be routed over contaminated soils. **The agencies determined that these areas be covered with two inches of lime rock and capped with 16 inches of clay soil. The cap was then covered with six to eight inches of topsoil and grassed.**

EPA standards required that these capped areas be irrigated and drained. The irrigation system was designed to provide water and keep the clay cap moist so that it would not dry out and crack. A complex drainage system was designed to prevent contamination of ground water. **The system captures the excess irrigation and storm water and returns it to one of two irrigation ponds lined with a protective neoprene material.**

The course's bunkers are unique. **Tons of inert piles of black slag material left by the copper smelting process were used in the bottoms of the bunkers. The slag met all requirements for drainage and playability and provided visually stunning effects.**

Initially, Old Works was to be a desert links-style course with green ribbons of grass flowing through badlands. However, the EPA believed that more of the property needed to be capped and grassed. Approximately 70 acres are grassed with native materials.

A key element in the successful remediation of the property is the prevention of storm and irrigation water from making contact with the capped waste materials. To achieve this separation, the complex subsurface drainage system is connected to all the irrigation mainline drains and blow-offs. This solution, protects the clay cap in the event of an irrigation pipeline break.

The four holes that border Warm Springs Creek had to be protected from potential irrigation failures that would bring excessive water flows into the creek. Flow sensors and shut off valves on all lateral lines along these holes trigger automatic valve shut-off in the event of a break.

The mining operations had virtually decimated all natural vegetation and wildlife. Native areas and tree plantings were used to create an enhanced environment in what had been a virtual moonscape for nearly 100 years. In addition to the 400 trees planted during construction, the course adds new plant materials on an annual basis.

SUMMARY – Construction of the Old Works Golf Course has transformed a once toxic, barren scrap of land into a safe and clean recreational environment. Anaconda is the proud owner of a fine golf course that provides both locals and tourists with an excellent value.

Checklist for the Development of a Golf Course

The design, construction and maintenance of a golf course has evolved into a complex process. Today's environmental issues, the economic climate, and the many demands established by the project objectives all require careful consideration for the development of a golf course.

Each proposed site and golf course has its own unique characteristics that require specific solutions for its design, construction and maintenance. However, there are certain major steps that are common in the development of almost every golf course. These steps, as discussed in the preceding text, have been listed below to serve as a checklist for an environmentally responsible approach to the development of a golf course.

- Conduct a feasibility study to verify the need for a golf course. Assess the suitability of the site and establish basic goals for the project.
- Assemble a team of qualified professionals led by a Golf Course Architect to address the complex issues involved in the planning, design and construction of the golf course. Perform a thorough site analysis with current and accurate data.
- Determine the environmental issues that may be involved. Review all applicable land use, environmental and construction regulations.
- Confirm site suitability and goals for the project with the client. Establish the design criteria for the golf course.
- Develop a conceptual plan that addresses all environmental issues and design criteria. Include responsible management practices for the construction and maintenance of the golf course.
- Arrange a pre-submittal meeting with the regulatory agencies and interested local citizen or environmental groups to review and receive input on the conceptual plan.
- Refine the concept based on the input received and develop a final master plan.
- Submit the master plan for required approvals.
- Stake out the golf course. Make minor adjustments, if necessary, to take advantage of natural features and adapt compatibly to the site.
- Develop a thorough set of construction plans and specifications for the golf course. Finalize the responsible management practices.
- Submit construction documents for regulatory review and permitting.
- Hire a qualified golf course superintendent prior to the commencement of construction to provide management and administration for the project.
- Undergo a bidding or negotiation process for the construction of the golf course. Consider the retention of a qualified golf course builder who is experienced and specializes in the unique construction techniques required for the development of a golf course.
- Start construction.
- Perform site inspection visits to ensure that the course is being constructed in accordance with the plans and intent of the design. Monitor controls for environmental protection.
- Implement responsible management practices for maintenance prior to the completion of construction.
- Complete construction of the golf course. Maintain environmental controls until all disturbed areas are stabilized.
- Prepare the golf course for opening. Monitor remaining environmental controls during the grow-in period.
- Open for play. Tee it up and enjoy both the game and the environment. Continue responsible management practices during maintenance of the golf course.

Goals Within the Golf Industry to Improve the Golf Course Development Process

1. To educate and participate with legislative bodies and regulatory agencies to bring about more consistent regulations from those respective agencies at the federal, state and local level. The goal is to provide better parameters for design and allow the best possible solutions without costly delays.

2. To work with the regulatory agencies to promote innovative design solutions for today's complex issues. Encourage the agencies to consider solutions that are not limited by the strict application of regulations, but those that produce the best results with the most environmentally responsible approach. Stress the need for only the most qualified individuals from each agency to be involved in the review process to improve cooperation and promote effective design solutions. Request periodic review and revision to regulations which are impractical when implemented and inhibit the most beneficial results. Foster progress in the relationship of golf course development to issues of environmental protection, conservation and the promotion of wildlife habitat.

3. To promote further cooperation within the golf industry for continuing education and research to improve methods of design, construction and management.

4. To provide the related development industries with continued education and information on the benefits of golf courses.

5. To increase the effort within the golf industry to educate the general public, golfers and non-golfers alike, as to the importance of environmental issues with respect to golf courses.

Dataw Island Club, Dataw Island, South Carolina

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