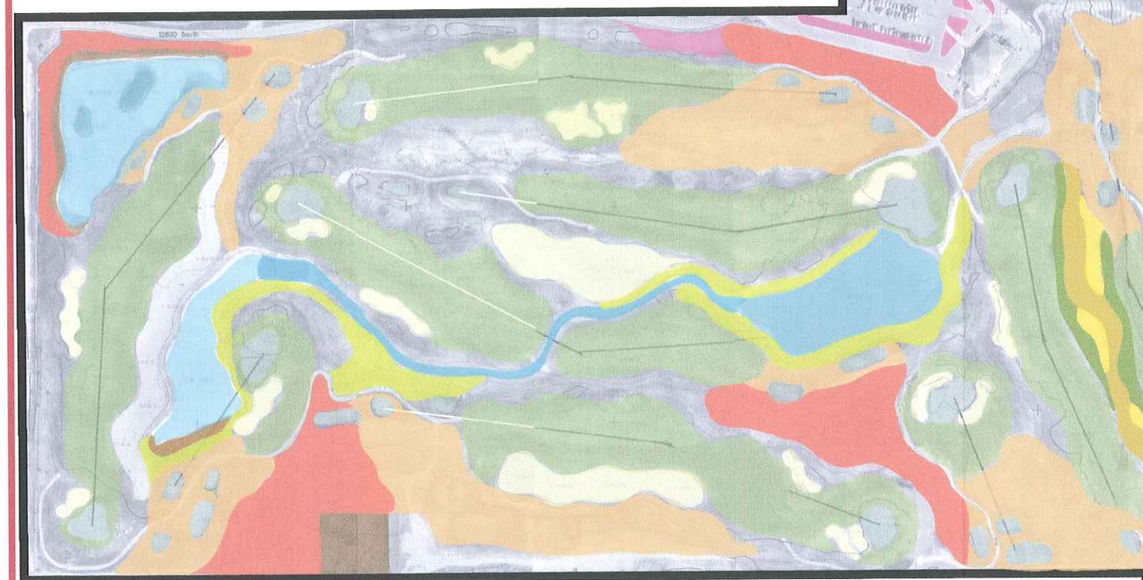
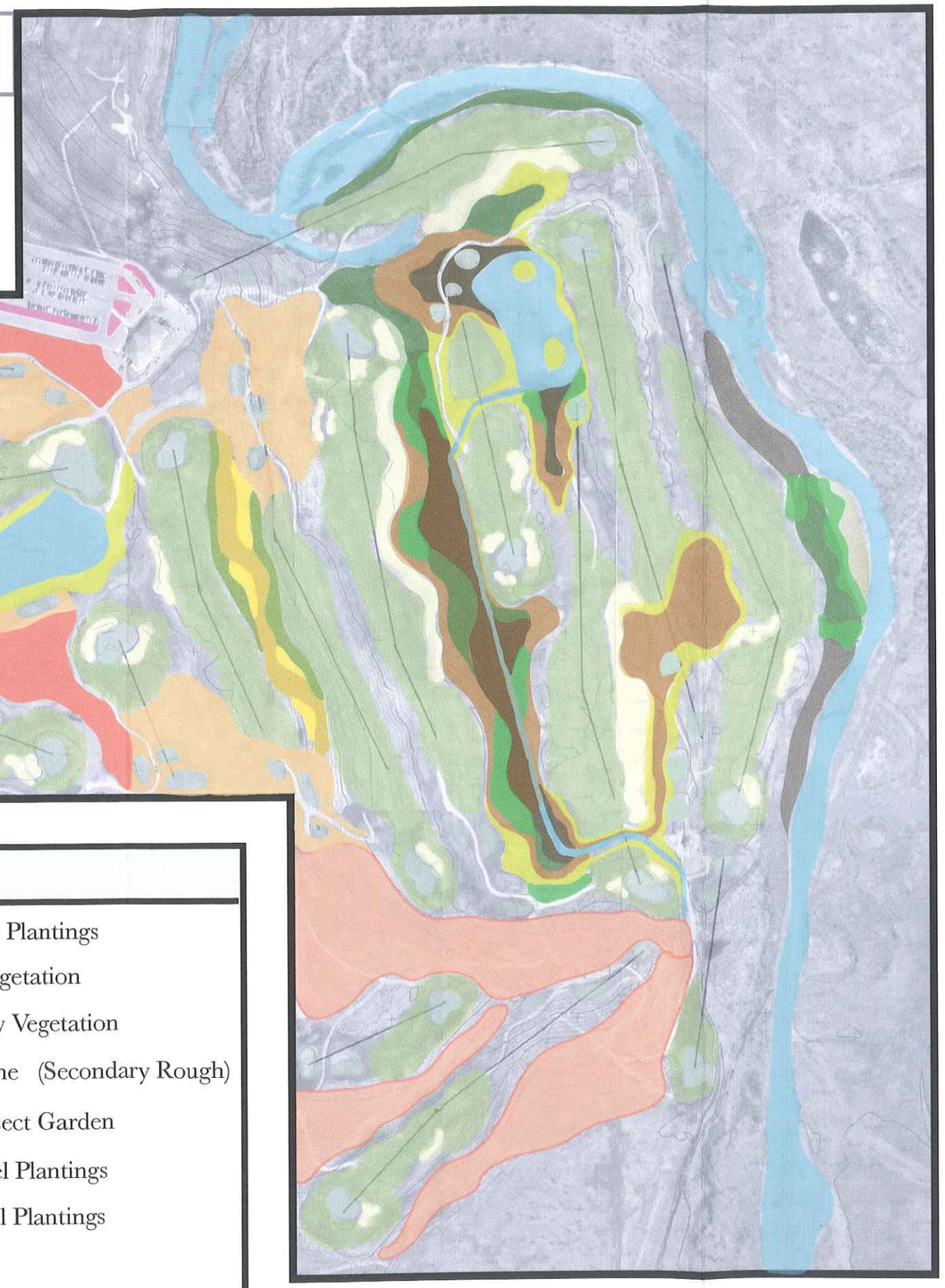
Minimum Conservation Alternative





LEGEND

- Grassland Naturalization
- Shrub Steppe Existing
- Shrub Steppe Naturalization
- Cottonwood Pole Plantings
- River Buffer (Existing Exotics)
- Riparian Shrub Plantings
- Gravel bar
- Sub Canopy Plantings
- Emergent vegetation
- Wet Meadow Vegetation
- No Mow Zone (Secondary Rough)
- Butterfly/Insect Garden
- Ground Level Plantings
- Canopy Level Plantings

Minimum Conservation Alternative

"Wildlife Habitat Enhancement Alternatives for Golf Courses Along the Jordan RIver"

Drawing Min1

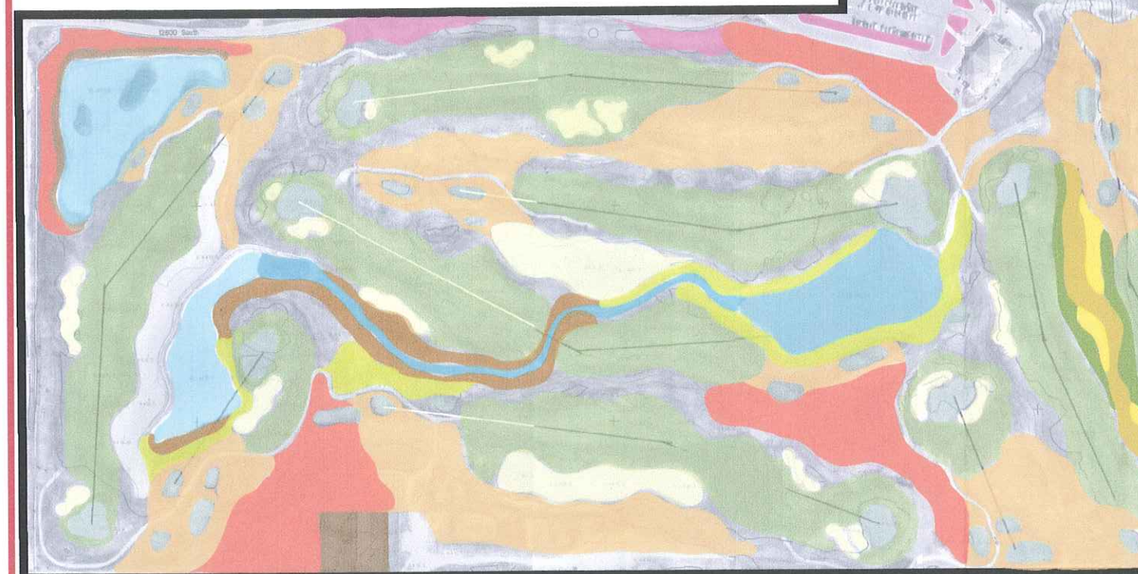
Riverbend Golf Course

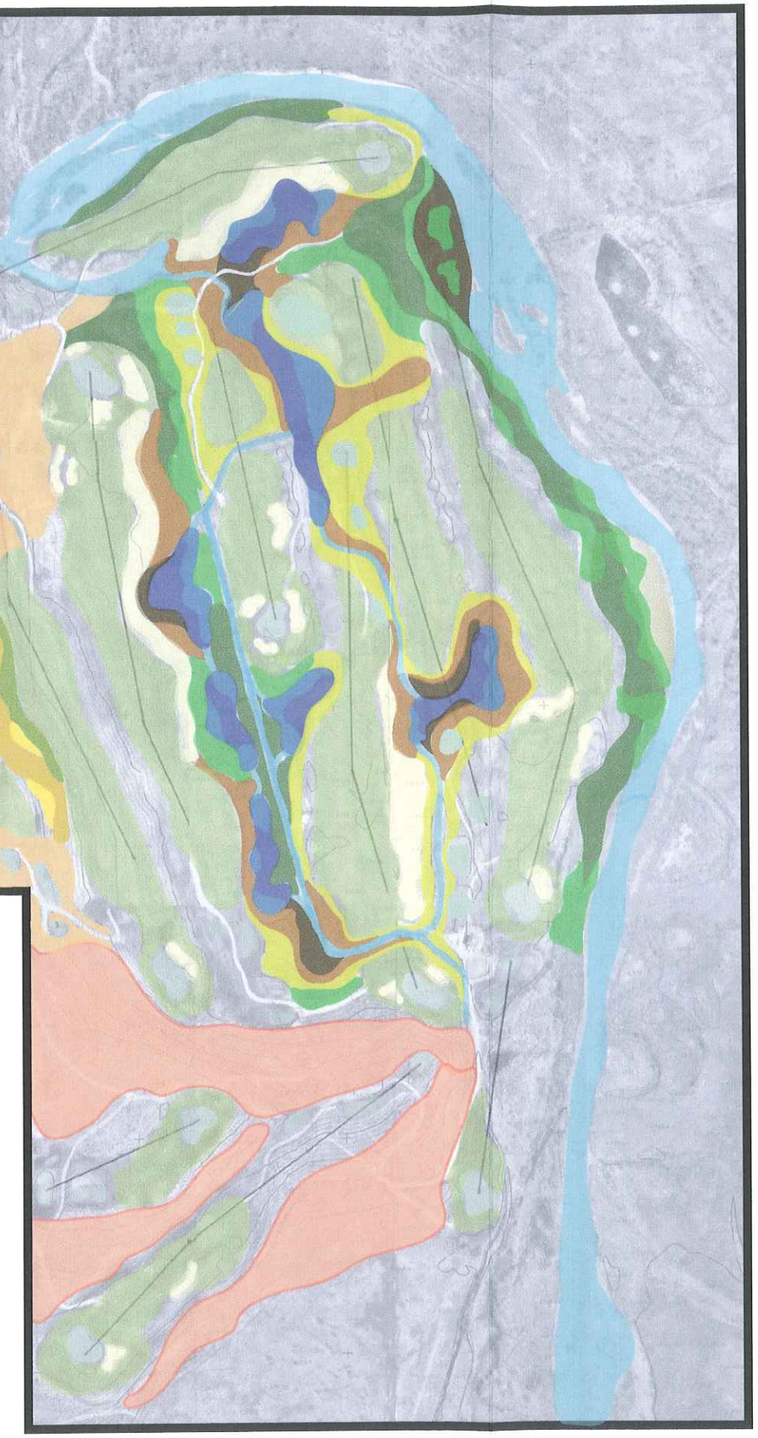
A case study of Riverbend Golf Course, Riverton, Utah

Utah State University Logan, Utah

Landscape Architecture and Environmental Planning

Maximum Conservation Alternative





LEGEND

- Grassland Naturalization
- Shrub Steppe Existing
- Shrub Steppe Naturalization
- Cottonwood Pole Plantings
- Canopy Level Plantings
- Riparian Shrub Plantings
- Gravel bar
- Sub Canopy Plantings
- Emergent vegetation
- Wet Meadow Vegetation
- No Mow Zone (Secondary Rough)
- Butterfly/Insect Garden
- Ground Cover Plantings

Maximum Conservation Alternative

"Wildlife Habitat Enhancement Alternatives for Golf Courses Along the Jordan RIver"

Riverbend Golf Course

Utah State University Logan, Utah

Landscape Architecture and Environmental Planning

Drawing Min2

A case study of Riverbend Golf Course, Riverton, Utah

MANAGEMENT AND MONITORING OF ENHANCEMENT FEATURES

Proper management of the enhancement features is essential in assuring success of the project. Without management, the enhancements will revert to what is present on site today. This is because the site is very controlled and natural disturbances are not allowed on site. These disturbances are such things as fire, drought, flooding, ungulate grazing, and natural succession. Without these disturbances the ecosystem can not renew itself and therefore is not sustainable. The goal of any management plan then is to mimic these disturbances and allow the system to work itself out. On our site, each of these disturbances historically had an effect, so presently they must once again be used.

On our site the problems we will have to manage for are: plant establishment for new projects, weed and exotic vegetation invasion, and water level management in the ponds and wetlands. Also important will be managing for geese populations and such birds as brown headed cowbird. The management of these can be a problem so this section will detail some design principles that can lessen the effect of these species.

Plant establishment

With any new planting, the new plants need a period to adjust and take root. Within this period, extensive maintenance will be needed. The success of the new plants will depend on supplemental water and minimal competition from weeds for nutrients. Weed invasion will be detailed in the next section, so this one will focus on irrigation.

With proper grading and a reliable water level, the wetland plants should need no supplemental irrigation. The Cottonwood pole plantings (Appendix B) will be at or near the water table and are self sufficient. Supplemental irrigation will be necessary for the

upland naturalized area, the slope plantings, and the riparian shrub plantings. Irrigation already exists on all parts of the site. With naturalization, this irrigation will become unused. For the moment though, it will need to be reconfigured. Zones will need to be split to treat the turf and the new plantings with differing amounts of water. Since the plan for the irrigation was not available, it will be the responsibility of the irrigation system designer to map the zones and make the required changes. The changes may include removing heads, readjusting heads, readjusting times, or adding aboveground temporary irrigation.

For the establishment of the new plantings, the time interval will be set at a year. Supplemental water and frequent weed eradication will need to take place in this time.

Weed and Exotic Plant Invasion

As with any new planting that exposes bare ground, weed invasion will follow. There exists two methods for weed eradication. These are mechanical and chemical with mechanical being the preferred method. During the period of establishment, the project should be weeded by hand once every month. If this is not feasible, chemical means should be employed. The same chemicals used to rid of turf explained earlier can be used. As before, the chemicals are non selective and should be used as a spot treatment method. A backpack sprayer should be used by a trained employee.

The second use of weed eradication is for existing invasive plants that exist on site. The primary example is Russian Olive. For our purposes, Russian Olive should be phased out as new plants grow to take their place. In very few instances will the Russian Olives be cut down, except on the river. They need to be killed but left to serve as snags

for cavity nesters. The trees can be topped, girdled, treated with chemicals, or a combination of these treatments.

Water Level Management

"Water-level management is the most important technique to manage wetland plant communities." (Payne, 1992, p.175) Water level fluctuation is an effective way to control plant species composition and gain the desirable plants. For the purpose of this project, the following objectives will warrant a draw down or flood. A draw down is a voluntary reduction in water level to expose the substrate and to dry out the vegetation and soils. The objectives are taken from Payne 1992.

1. Provide mudflat areas for moist-soil plants produced by natural or artificial seeding of food plants after summer drawdown.
2. Kill undesirable plants by summer drydown.
3. Increase production of invertebrates for laying ducks, ducklings and goslings, and shorebirds by flooding to increase aquatic and emergent vegetation.
4. Mosquito production in wetlands is a major concern right now and may warrant a drawdown during high activity times.

Canadian Geese Management

Canadian geese have a negative effect on golf course turf. They leave fecal mater on the turf and also graze which creates thin spots. The control of these is beneficial to the golf course. It will also benefit other wildlife in freeing up nesting sites. The following is a list of methods used to control geese in urban areas. Any can be used on the Riverbend Golf Course.

The primary non lethal methods are: exclusion, landscape modification, removal/relocation, hazing, and frightening devices. (Gosser, 1997.) Non lethal projects for Riverbend may include adding vegetation along the pond shores (which has been proposed), adding fencing (which may have an adverse affect on other wildlife), and hazing them when they first arrive at the site and until they leave. The most beneficial to Riverbend will be a mix of fencing and planting the pond shorelines with dense vegetation or adding rock to inhibit the movement from water to land The lethal methods generally require a permit and should be a second plan unless the population is out of control. This is a common problem on many golf courses and may require extensive amounts of time.

Brown Headed Cowbird

To date, it has not been determined if brown headed cowbirds are evident on site. With the site being disturbed from its natural state and the fact that a horse pasture borders the site, the course is susceptible to this species. This section will discuss ways to decrease the parasitism by this species through planting techniques. If it is found in the future to be detrimentally affecting the site, more intense management will need to be done preferably by a specialty agency. For the purpose of this project, design principles will be implemented. The following principles were adapted from Martin, 1989. and should be considered when plantings a specific enhancement or routing new golf courses.

1. Nest concealment from dense foliage may decrease predation and parasitism.
2. Complex patch habitat around the nest will limit searching by predators.
3. High levels of edge habitat on a site benefit predators

4. Diverse types of habitat will lessen the predator from locating nests by associating certain plants with certain species. This means planting several different species with the approximately same structure to offer various nesting sites.

Monitoring Program

Monitoring the enhancement projects is vital to the future success of these projects and others like them. It is important to record the successes and failures to improve the conditions of the projects and to avoid them on other projects. On the Riverbend Golf Course, the monitoring can be quite extensive and help may be needed through volunteers. The items needing to be monitored include: nest boxes, wildlife sightings and monitoring of breeding pairs, vegetation composition of new plantings, water quality in the wetlands, and piezometer readings. The following list will be objectives that need to be met in a monitoring program.

First Year:

1. Monitor plant growth by ensuring adequate water needs, elimination of competing weeds, and any evident diseases on the plant. Determine if herbivory is happening and if is, implement exclosure procedures such as fencing.
2. Document any wildlife visitors to the site.
3. Continue with piezometer readings to watch water levels.
4. Check nest boxes during breeding season and look for use

After One Year

1. When avian species take up residence document place and vegetation type of nest location
2. Monitor water quality in onsite water features

3. Monitor plant community dynamics of new plantings. Are certain species becoming dominant? Are certain species having a high mortality rate? Sample forms can be found in Appendix C.

Conclusions

The three alternatives shown above are a conceptual start to habitat enhancements on Riverbend Golf Course. The final say will be made with the input from the golfing public. The survey outlined in appendix A will be very important in keeping the golf course a fun yet challenging course. If the golf course suffers from lack of players, this plan will not be a success. The economics of the course will play a big part in how far this plan goes. Although economics play a large part in any restoration plan, as outlined in the no action plan, something must be done in order to avoid further degradation of the river corridor. With this in mind, and the minimum conservation plan acting as a long range master plan, the following discussion will center on short term phases to start the goal of wildlife habitat enhancement.

Phasing

For the first year after acceptance to implement this plan, the golf course itself, along with the JRNAF group, has several necessary steps to complete. The golf course has three primary objectives. The first is to start a program of piezometer monitoring and existing wildlife species documentation. The piezometer monitoring is essential to ensure success of future wetland construction. As this is the fifth year of drought, the seasonal low reading should be a reliable gauge as to how the ground water acts. With the seasonal highs and lows recorded for two years if possible, work can begin on finalizing grading plans for wetlands and biofilters.

The second part of objective one for the golf course is to monitor and record what wildlife species are present on site and determine what species are breeding on site. This will create a baseline to gauge the future success of the enhancements plans. Help with this can be gained through the many birding groups in the valley. Sample forms for the piezometer wells and wildlife documentation are found in Appendix C.

Objective two for the golf course pertains to determining the golfing skills of the golf course constituents. This can be done with monitoring of a hole by a volunteer to see where the highest percentage of errant shots land. With data from all eighteen holes , it can be decided upon where to naturalize. Another method is to display the conservation plans and ask golfers to place a dot where the highest percentage of their errant shots end up. As was stated earlier, the golfing public will have the final say in how extensive the enhancement plans are. Fulfilling this objective will have a certain percentage of error on public courses that see higher levels of weekend warrior players than does a private course. The data will still be beneficial and should be considered in the final plan.

The third objective for the Riverbend Golf Course staff is to enroll in the Audubon Cooperative Sanctuary Program and start dialogue pertaining to the enhancement plans. Any input from this agency will be beneficial to gaining certification.

The objectives for the JRNAF group deal with regulatory agencies and funding. Riverbend Golf Course is a public course owned by Salt lake County. This agency however is not the only source of funding. Many avenues exist such as WHIP grants

that the golf course can qualify for. Because of the expertise on the JRNAF committee, funding for projects should be a priority. JRNAF should also include the enhancement principles in their educational presentations.

With these steps in place, work can begin on implementing the projects set forth by this thesis project. The outcomes from the first initial steps will dictate the phasing and success of the enhancements.

CHAPTER 5

DESIGN AND CONSTRUCTION GUIDELINES FOR NEW GOLF COURSES PERTAINING TO WILDLIFE HABITAT

In 1996, several leading organizations in various field pertaining to golf courses and environmental issues came together with the USGA to craft a set of guidelines for new golf courses. The principles encompass items such as siting, design, construction, maintenance, and facilities. The full set of principles can be seen in appendix F or, www.usga.org/green/download/current_issues/print/environmental principles.html . For this project's purpose, the discussion will focus on the most relevant guidelines for the Jordan and Provo rivers.

The text will be split into four categories: site selection, routing, plan refinement, and construction. Principles from the USGA text, ecological principles from Johnson et al, and lessons learned from the Riverbend project will be incorporated. A brief summary of the principle will be followed by direct recommendations for the region.

SITE SELECTION

Developers and designers should work with local agencies and community groups to identify and address environmental issues relevant to the project. (USGA, 1996)

Agencies such as the Utah Division of Wildlife Resources, U.S. Fish and Wildlife Service, Natural Resources Conservation Service, Army Corps of Engineers, the Nature Conservancy, Audubon Society, and the Jordan River Natural Areas Forum should be involved in addressing local environmental issues related to golf courses along the Jordan and Provo rivers.

Recommendations

1. Coordinate with city comprehensive plans to locate areas designated for open space or recreational development.

2. Coordinate with local agencies to identify degraded lands suitable for restoration.

3. Coordinate with local conservation groups to aid in local environmental issues.

Site selection and analysis have a direct bearing on the environmental suitability of a golf course and should be considered in planning phases with outside agencies. (USGA, 1996)

Site selection is very important in providing a golf course that will be beneficial to wildlife and humans. In this region it is very critical when siting next to a river or creek since riparian areas are crucial to many species.

Recommendations

1. Consideration should be given to already degraded sites. Examples include: historically grazed areas that are invaded by exotic vegetation and have erosional problems, landfills, mines, gravel pits, abandoned industrial sites, or under-productive agricultural land.

2. In areas known to have beneficial wildlife habitat, care should be taken to not bisect historic drainage's that act as corridors for wildlife movement between ecosystem types such as upland shrub steppe and riparian corridors.

3. Avoid areas where natural disturbances (i.e. flooding, fire) are functioning properly. This is most important in riparian settings where rivers scour and erode banks or where wetland complexes are still connected to a viable floodplain.

4. Identify sensitive fish and wildlife species of the area and associated habitat. These areas should not be considered for new golf courses.

5. Consider critical plant community location in site selection. Specifically, do not site new golf courses in remnant patches such as cottonwood gallery forests or willow stands.

GOLF COURSE ROUTING

Once a site is selected, analysis prior to routing of the golf holes is crucial to protect existing habitat features and corridors. Overall, the primary objective in routing the course will be to preserve and enhance the landscape mosaic. Landscapes consist of a series of patches, corridors, and matrices. The function and structure of this mosaic, along with human intervention, determines the level of wildlife and fish habitat viability. An ideal situation is uninterrupted large patches of vegetation with corridors connecting migration and dispersal routes with access to food sources. This is a rare occurrence in today's urban environment. Development consumes more and more habitat; what is left are remnant patches of habitat that are often unsuitable for sustaining viable populations of most species and general biodiversity. To combat this, land managers must identify and preserve valuable patches and core reserves. "Planning and designing wildlife reserves and corridors at a watershed scale should be centered around preserving, linking, and buffering high value nodes." (Johnson et al). The following are ecological principles that should be considered when routing a golf course.

Large reserves/patches are better than small reserves patches. (Johnson, et al, 1999)

A large expanse of vegetation will tend to support a larger diversity of the regional native vegetation and also can support larger populations of wildlife species. This larger species base has a better chance of surviving local extinction's if that should happen. It has been shown that interior species are more subject to local extinction's, if subjected to a loss of habitat and an increase in edge area. (Johnson et al, 1999)

Since a golf course has a large amount of edge habitat, it should be a priority to consider routing choices in new construction to maximize large patches. If this is not possible due to limited acreage, another avenue would be to exploit surrounding land uses and create a mutual relationship with the golf course. Riverbend Golf Course has the benefit of being across the river from 300+ acres of undeveloped land designated as habitat for wildlife. In this situation, the golf course could act as a foraging area for avian species that nest across the river. It also has the potential of increasing the total area of riparian habitat adding to that which exists on the east side of the river.

Recommendations

1. During routing, consider plant communities identified as conservation areas, and route around them. Communities include: Cottonwood stands, willow stands, patches with good vegetative layering, and large forest or grassland/shrub areas.

2. Always protect riparian areas, and never route a course through them. Playing across the Jordan or Provo river should never be considered, nor should these rivers or a tributary run through the course and be in play acting as a hazard.

3. Identify patches on course with a diversity of native vegetation and route around them. As was seen in the case studies, Giants Ridge Golf Course routed the holes 100' away from sensitive plants.

Connected reserves/patches are better than separated reserves/patches.
(Johnson et al, 1999)

The benefits of connectivity are numerous: providing more habitat, allowing safe passage among patches, and serving as a source for recolonizing. The golf course environment, by design, acts as a corridor, providing movement to humans. This in turn may fragment habitat patches and corridors. It is critically important in course layout to minimize fragmentation of patches and severing of corridors. "Researchers found

corridors that connected drainageways to ridges supported greater species richness and abundance than corridors limited to a single topographic setting."

Recommendations

1. Consider differing plant communities and topographies on site and plan for native vegetation connections. Do not route course to dissect these. In a river setting, do not route holes to parallel river for the entire properties river front.

2. Golfer traffic and maintenance should not continually dissect a corridor. Small openings for both should be used and multiple holes can share the same cart path.

Unified reserves/patches are better than fragmented reserves/patches. (Johnson et al, 1999.)

In many urban areas, there are still some remnant native plant communities that are reserved for wildlife. However, they are often dissected by roads, trails, utilities, or other man made intrusions. "Of two reserves or patches having exactly the same area, one fragmented and one unified, the unified reserve/patch will be of far greater value." (Johnson et al.). On a golf course, the fragmentation happens in two ways. Either a cart or maintenance path bisects it or a golf hole bisects it. Both should be minimized.

Recommendations

1. In routing plans, keep golf holes out of conservable patches and keep cart paths within hole boundaries.

2. When connecting golf holes, or front nine to back nine, utilize common cart paths to keep intrusions to a minimum. This may require a longer cart ride or walk, but this is a compromise for wildlife habitat viability.

3. For maintenance traffic, utilize common cart paths and discourage entrance into out of play areas.

4. Discourage storage or intrusions into out of pay areas by golfers and maintenance.

Several reserves/patches (redundancy) are better than one reserve/patch

Several species of wildlife require more than one plant community to fulfill their life requirements. For instance, some avian species nest and brood in riparian area, yet forage in grasslands. Only one patch of riparian are would not fulfill this species life requirement. Another positive aspect of several patches is the concept of local extinction. If only one patch were present on the site and recolonizing patches were to far away, many factors could cause local extinction. With redundancy, there is opportunity for recolonization on site. When routing a golf course it should be considered where valuable connections are between differing plant community types. These should then be preserved and routed away from.

Recommendations

1. This is important in the Jordan River basin because of the relatively narrow riparian corridor and quick transition into the uplands. This can be seen on the Riverbend site. For new golf courses, along with large patches should be patches of grassland, shrub steppe, and riparian shrub thickets, or other types identified on site.

2. This concept is very important in wetland complexes. Several wetlands and ponds with appropriate plant communities are more beneficial than one pond or one wetland.

Wider corridors are better than narrow corridors

This is most important on rivers when describing the riparian buffer. On Riverbend, the width has been compromised and many other golf courses have no buffer.

Recommendations

1. A recommended buffer width is 100 yards. This will allow for stream meander and proper vegetation communities. Siting a golf course outside of the 100 year flood mark is preferable.

Natural connectivity should be maintained or restored

Existing corridor connections such as: wetland complexes, wet meadows, shrub steppe and grasslands, and natural drainage's should be preserved in their entirety and should not be bisected by the golf course. These are important avenues in the watershed and should be preserved. The most important being connections from the uplands to the riparian areas.

Structurally diverse patches and corridors are better than simple structure

The vegetative structure should have as many layers as possible and consist of diverse plant types.

Recommendations

1. Wetlands should consist of floating, emergent, wet meadow, and riparian shrub plantings. Refer to figure B.2 in Appendix B.

2. Upland plantings should consist of canopy, subcanopy, large shrub, small shrub, forbs, and groundcovers.

Emphasis should be placed upon the design of irrigation, drainage, and retention systems that provide for efficient use of water and protection of water quality.

For new golf courses, irrigation systems should be computerized. Central computers can be hooked up to a weather station and irrigating times can be adjusted pertaining to the days ET rate. This type of watering system minimizes water applications and runoff.

Drainage is very important on golf courses. Greens can contain as much as 500' of 4" drainage tile. Bunkers and tees are often subdrained as well. A problem arises in deciding where to daylight the drain tile. Many times tile is run directly into a stream or pond.

Recommendations

1. Never daylight a tile into the river or natural waterway.

2. Runoff should be directed to stay on site, and empty into a vegetative swale or or biofilter.

3. Retention basins should be created to collect runoff or rain from large storm events.

Buffer zones or other protective measures should be maintained or created to protect water resources.

This is important to consider when designing water features into the strategy of a golf hole. To ensure habitat for wildlife, room must be left around the pond or wetland to provide for the vegetative structure seen in Appendix B, figure B.2

Recommendations

1. All ponds and wetlands should include a vegetative buffer.

2. Out of play areas should include: riparian shrub, tall emergent, and a transition into upland vegetation. All in play areas should include a now mow zone consisting of grasses, wet meadow vegetation, and short emergent vegetation.

CONSTRUCTION

Recommendations

1. Silt fencing should be placed around all water features during construction. Other approved methods include bales of straw if secured properly, and sod strips around feature.

2. Protect wildlife habitat features appropriate to the area. Never remove during construction and keep access roads away from. These include: standing deadwood, complex woody debris, large rock fields, areas with complex vertical and horizontal structure, protected areas, undeveloped riparian zones, slopes and cliffs, high native plant diversity areas, and berry, nut, or nectar producing plants.

3. When constructing ponds or wetlands on site, consider the following traits beneficial to both.

a. Ponds and wetlands should have an irregular shoreline to provide diversity in habitat.

b. Open water should be no less than 1/2 a ha.

c. Grade banks as to provide a shelf of shallow water for emergent vegetation and grade shore as to promote areas for wet meadows

d. Create berms on south facing banks to protect ponds from cold winter winds.

e. When excavating, save rocks on dead timber and replace to act as special habitat features.

f. If native vegetation is growing in vicinity of pond, leave as is to act as a buffer

g. Plan for drainage to stay on site and direct it to vegetative swales. This refers to surface and subsurface drainage.

h. Never destroy natural connections to remnant patches on site. Direct construction traffic and activities away from.

CONCLUSIONS

The primary benefit for wildlife will come from the site analysis and design phases. If wildlife habitat is considered, the critters and the golf course can coexist beneficially. It will be important for a wildlife representative to be on site during design and construction to identify the critical areas and to direct construction traffic around. Overall, if sound ecological principles are employed, a golf course can benefit wildlife in many situations.

BIBLIOGRAPHY

Balogh, James C., William J. Walker. 1992. Golf Course Management and Construction, Environmental Issues. Lewis Publishers.

Bergsman, Steve. 2001. "Seeking Sanctuary" Urban Land, January 2001. p. 80, 4p.

Berry, Darlene. 1999. "Nature's Parable" Golf Course Management. May 1999. p. 171. 5p.

Biowest, Inc. 1998. "State Prison Property. Wetlands Inventory and Mitigation Feasibility Study". December 1998. Prepared for UDOT Region 2.

Carothers, Steven W., G. Scott Mills, R. Roy Johnson. "The Creation and Restoration of Riparian Habitat in Southwest Arid and Semi-Arid Regions"

Dodson, Ronald G. 2000. Managing Wildlife Habitat on Golf Courses. Ann Arbor Press. Chelsea, MI.

Dotti, Paul. 2002. "Is Your Course Certified?" USGA Green Section Record January-February 2002. pp. 17-20.

Du Feu, Chris. 1993. Nestboxes. British Trust for Ornithology. Thetford, Norfolk

Friedman, Jonathan M., Michael L. Scott, William M. Lewis, Jr. 1995. "Restoration of Riparian Forest Using Irrigation, Artificial Disturbance, and Natural Seedfall" Environmental Management, Vol. 19 No. 4, pp. 547-557.

Foy, John. 2002. "Course Presentation: Playability vs. Aesthetics" USGA Green Section Record. March-April 2002. pp. 23-24.

Gardener, Paul A., Richard Stevens, Frank Howe. 1999. "A Handbook of Riparian restoration and Revegetation for the Conservation of Land Birds in Utah With Emphasis on Habitat Types in Middle and Lower Elevations" Utah Division of Wildlife Resources Publication Number 99-38.

George, T. Luke, Steve Zack. 2001. "Spatial and Temporal Considerations in Restoring Habitat for Wildlife. Restoration Ecology, Vol. 9 No. 3, pp. 272-279.

Gillihan, Scott W. 2000. Bird Conservation on Golf Courses. Ann Arbor Press. Chelsea, MI.

Golf Media Group. 2002. "2002 Guidebook to Golfing Utah"

Gosser, A.L., M.R. Conover, T.A. Messmer. 1997. "Managing problems caused by

urban Canada geese. Berryman Institute Publication 13, Utah State University, Logan, Utah, 8pp.

Graham, D. Douglas. 1998. "Tiny Titans for the Environment" Golf Course Management, August 1998. p. 100. 5 p.

Henderson, Carrol L. 1987. Landscaping for Wildlife. Minnesota Department of Natural Resources.

Jimenez, J.E., M.R. Conover, T.A. Messmer. 2001. "Exclusionary methods to reduce predation on ground-nesting birds and their nests" Berryman Institute Publication No. 20, Utah State University, Logan. 12pp.

Johnson, Craig W. 1987. "Planning for Avian Wildlife in Urbanizing Areas in American Desert/ Mountain Valley Environments" Landscape and Urban Planning. 16 (1988), 245-252.

Johnson, Craig W. 1994. "Planning and designing for the multiple use role of habitats in urban/suburban landscapes in the Great Basin" Landscape and Urban Planning 32 (1995) 219-225.

Johnson, Craig W. 1999. "Conservation Corridor Planning at the Landscape Level" USDA Part 614.4

"Jordan River Natural Conservation Corridor Report" 2000. Prepared by the National Audubon Society for the Mitigation Commission and the U.S. Fish and Wildlife Service.

Lipsey, Rick, Kevin Cook, Mark Mravic. 1999. "Rare Birdies" Sports Illustrated, 6/14/99, Vol. 90 Issue 24, p.28.

Leslie, Mark. 2001. Urban Land April 2001. p. 63-65.

MacKay, Jean. 2002. "Getting Golfers in the Swing of Things" USGA Green Section Record. January-February 2002. pp. 24-25.

MacKay, Jean, Peter Bronski. 2002. "Looking Back, Looking Forward" USGA Green Section Record. March-April 2002. pp. 21-22.

Martin, Thomas E. 1989. "Breeding productivity considerations: What are the appropriate habitat features for management?" Manomet Symposium 1989.

Marzluff, John M., Kern Ewing. 2001. "Restoration of Fragmented Landscapes for the Conservation of Birds: A General Framework and Specific recommendations for Urbanizing Landscapes" Restoration Ecology Vol.9 No.3, pp. 280-292.

Mee, Wendy, J. 2002, "Wetland Community Types of the Intermountain West: Pond, Marsh, Meadow, and Playa Communities. Ogden Nature Center Habitat Restoration Plan Utah State University, Department of Landscape Architecture and Environmental Planning.

Middleton, Beth. 1999. Wetland Restoration, Flood Pulsing and Disturbance Dynamics. John Wiley and Sons, Inc. New York, New York.

Milius, Susan. 1991-1992. "Can Anyone Build this Bird a Home?" National Wildlife. Dec91/Jan92, Vol. 31 Issue 1, p12, 4p.

Mitsch, William J., Wu, Xinyuan, et al. 1998. "Creating and Restoring Wetlands" Bioscience, Dec. 98, Vol. 48 Issue 12, p1019, 12p.

Morrison, Michael L. 2001. "Introduction: Concepts of Wildlife and Wildlife Habitat for Ecological Restoration" Restoration Ecology Vol.9 No.3, pp. 251-252.

Morrison, Michael L, Bruce G. Marcot, R. William Mannan. 1998. Wildlife Habitat Relationships. The University of Wisconsin Press.

Paige, C., S.A. Ritter. 1999. "Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Flight Western Working Group, Boise, ID.

Page, Douglas. 1998. "Cleaning Up It's Act" Golf Course Management, June 1998. p. 72. 5 p.

Payne, Neil F. 1992. Wildlife Habitat Management of Wetlands. Krieger Publishing Comapny, Malabar, Florida.

Payne, Neil F., Fred C. Bryant. 1994. Techniques for Wildlife Habitat Management of Uplands. McGraw-Hill Inc, New York, New York.

Petrovic, A. Martin. 1990. "The Fate of Nitrogenous Fertilizers Applied to Turfgrass" Journal of Environmental Quality. Vol. 19 Jan-Mar. 1990 No.1.

Reiger, John. 1992. "Western Riparian and Wetland Ecosystems" Restoration and Management Notes. 10:1 Summer, 1992.

Ricciardi, Anthony. 1998. "The Exotic Species Problem and Freshwater Conservation" Wild Earth, Spring 1998. pp. 44-49.

Rich, Terrell D. 2002. "Using breeding land birds in the assessment of western riparian systems" Wildlife Society Bulletin 2002, 30 (4): 1128-1139.

Slavesen, David. 1996. "Greening up the Greens" Planning, Aug. 1996, Vol. 62 Issue 8, p.4.

Schumann, Gail L., Patricia J. Vittum, Monica L. Elliot, Patricia P. Cobb. IPM Handbook for Golf Courses. Ann Arbor Press, Inc. Chelsea, MI

Shapard, Rod. 1997. "Environment at the Fore Front: Keys for Greener Municipal Golf Courses" American City and County, April 1997, Vol. 112 Issue 4, p.52.

Smallwood, K. Shawn. 2001. "Linking Habitat Restoration to Meaningful Units of Animal Demography" Restoration Ecology, Vol. 9 No.3, pp. 253-261.

Stauffer, Dean F., Louis B. Best. 1980. "Habitat Selection by Birds of Riparian Communities: Evaluating effects of Habitat Alterations" Journal of Wildlife Management. 44 (1): 1980.

Stuller, Jay. 1997. "Golf Gets Back to Nature, Inviting Everyone to Play" Smithsonian, April 1997, Vol. 28 Issue 1, p. 56.

Terman, Max R. 1997. "Natural links: naturalistic golf courses as wildlife habitat" Landscape and Urban Planning 38 (1997) 183-197.

Toth, Richard E. 1974. "A Planning and Design Methodology" Department of Landscape Architecture and Environmental Planning, Utah State University.

USGA Environmental Principles for Golf Courses in the United States" www.usga.org/green/dpwnload/current_issues/print/environmental-principles.html

White, Kevin D., Amy L. Meyers. 1997. "Above Par Storm-Water Management" Civil Engineering, July 1997, Vol. 67 Issue 7, p.50.

Winward, Alma H. 2000. "Monitoring the Vegetation resources in Riparian Areas" Gen, Tech. Rep. RMRS-GTR-47. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain research Station. 49p.

Witteveen, Gordon, Michael Bavier. 1998. Practical Golf Course Maintenance. Sleeping Bear Press.

APPENDIX A

SAMPLE SURVEY

While the goal of the project is to enhance wildlife habitat on the golf course, it must be taken into account that the playability of the golf course must not be interfered with as this is the primary use of the area. With this in mind, a survey was developed to determine the view, objectives, and playing level of golfers. The survey will be most beneficial to courses that have a certain level of repeat players such as private clubs. This adds a level of commitment to the course as the golfers are very familiar with the layout. On public courses, leagues would be a great way to implement the survey. The survey consisted of six areas of inquiry with various questions each.

-Existing course condition
-Course maintenance
-Wildlife values
-Conservation participation
-Jordan River programs
-Course aesthetics

For future golf courses to adapt and use this survey, each area will be detailed as to indicate the desired outcome from the questions. New questions can be proposed as long as they work towards the desired outcome. As can be seen from the survey, it was written with Riverbend golf course in mind.

1. Existing course condition

The goal of this section was to determine the views associated with Riverbend golf course held by the players. The results will help determine areas that people feel are under maintained and can be referred to in a management plan. Although the management of these areas may not be increased, in fact they may be decreased, a mangement plan can identify and describe how these areas are beneficial to wildlife and therefore justify the level of maintenance. This section will also help with budget

problems. If the golfers feel the course is under-maintained, explain how much it will cost to meet expectations and ask for more money.

2. Course maintenance

The goal of this section is to determine the level of maintenance that golfers feel is the minimum level they would be willing to play on and also what they understand is standard maintenance. The misconception that everyday maintenance should be tournament quality needs to be broken.

3. Wildlife values

The goal of this section is to determine if golfers attribute wildlife in a positive way to golf courses. Also to be determined by this section are any negative aspects golfers feel wildlife bring to the golfing experience.

4. Conservation participation

This section has two goals. One is to determine the level of knowledge people had of conservation efforts in the local area. Two was to determine the level of participation people would have for volunteer efforts on the golf course and on the river. This will be more beneficial to golf courses that have a high level of repeat golfers with a vested interest in the course such as private clubs.

5. Jordan River programs

With this section, questions were asked about the Jordan River parkway, and also the Jordan River Natural Areas Forum. The primary benefit is to determine the level of use of the trails by golfers and associate the golf course with the parkway and the JRNAF groups projects. This can help gain support and even funding for golf course projects.

6. Course aesthetics

This section is concerned with how golfers perceive a golf course and their ideal view of what a golf course should be. Golfers perceptions of what a golf course is supposed to look like, many times stems from what they see on television. The PGA Tour has courses that are highly manicured and do not resemble courses with habitat conservation programs. The goal is to determine if local golfers feel this way. This was done with a set of questions that were linked to pictures and a choice of A or B. One picture was usually a highly manicured course with little or no habitat and a great deal of turf. The other pictures showed golf courses with less turf and more native vegetation.

The survey results can be very beneficial in validating design decisions based on peoples recommendations and views. They can also be beneficial in educational materials, to target the areas that are not viewed correctly or are not beneficial to the project at hand.

The following pages are the sample survey created for this project and the accompanying pictures.

Riverbend Golf Course and Jordan River Enhancement Project

Questionnaire

A thousand years ago the Jordan River was a dynamic river system that was home to some 10,000 birds. Today with growth encroaching we are losing this dynamic biodiversity

The Utah Golf Association, Envision Utah, Utah Reclamation Mitigation and Conservation Commission, Jordan River Natural Areas Forum, and The Governors Office of Planning and Budget, and Utah State University are interested in improving wildlife habitat that is associated with golf courses along the Jordan River.

Riverbend golf course has been chosen as a case study. The study will explore opportunities to enhance wildlife habitat on the course and also to integrate the course with habitat improvements along the Jordan River.

We need your help! It's critical to receive opinions from those who golf at Riverbend about their perceptions of habitat and wildlife. Your responses will help determine the balance between the requirements for the game and wildlife needs. We will be looking for responses in the following categories:

-Existing course condition
-Course maintenance
-Wildlife values
-Conservation participation
-Jordan River programs
-Course aesthetics

Please take a few minutes to fill out this survey. The responses are confidential. Thank you for your time and enjoy Riverbend.

Sponsors
Utah Golf Association
Utah Reclamation Mitigation and Conservation Commission
Envision Utah
Governors Office of Planning and Budget
Utah State University

Part I.

1. Are you male or female?

2. What is your age?

3. What is your USGA Handicap?

4. How many rounds of golf do you play per year? (circle one)
   0-5
   5-15
   15-50
   50+

5. How many of these rounds are played at Riverbend golf course?

6. How close do you live to Riverbend golf course? (circle one)
   0-1 mile
   1-5 miles
   5-10 miles
   10+ miles

Part II.

7. Do you play Riverbend, or other golf courses along the Jordan River, because of the proximity to the river and distant views of the mountains?

8. Are you satisfied with the playing conditions of the course? Y/N If No, what can be changed?

9. Would a golf courses environmental record, (such as water quality, wildlife diversity, and pest management), contribute to selection of a course to play? Y/N

10. Would you pick a course with a good environmental record to play over a golf course that has unsound management practices? Y/N

11. Do you believe golf courses use too much water? Y/N

12. Do you believe golf courses use too many chemicals? Y/N

13. Are you in favor of using less water on golf courses? Y/N

14. Are you in favor of using less chemicals on golf courses? Y/N

15. Which of the changes noted below would you be willing to accept as a way to reduce water and chemical use?

-Less turf (Like many target golf courses in Arizona) Y/N
-Turf that is less green Y/N
-Brown Patches Y/N

16. If yes to any of above, what percentage decrease would you allow?

-Less turf	(10-25%)	(25-35%)	(35%+)
-Turf that is less green	(10-25%)	(25-35%)	(35%+)
-Brown Patches	(10-25%)	(25-35%)	(35%+)

17. Put a check mark by each task that you feel should be standard maintenance and adds to the playability of the golf course.

-Mowing out of play areas
-Mowing around water ways
-Planting exotic plants for seasonal color
-Keeping rough in tournament quality condition
-Keeping greens in tournament quality condition
-Keeping fairways and tees in tournament quality condition

Part III.

18. Do you value the visual quality of the existing natural wildlife habitat along the Jordan River adjacent to the Riverbend golf course? Y/N

19. Do wildlife sightings and sounds make a valuable contribution to an outdoor activity? Y/N

20. Do wildlife sightings and sounds make a valuable contribution to a round of golf? Y/N

21. Do you believe a golf course can play a valuable role in providing wildlife habitat? Y/N

22. How much value do you place in the sighting of wildlife while playing golf?

MUCH VALUE SOME VALUE LITTLE VALUE NO VALUE

23. Do you believe that wildlife can be a hinderance to your play on a golf course? Y/N

24. If answer is yes, which of the general categories of species do you consider a hinderance?

REPTILES/AMPHIBIANS	ex (snakes, frogs)
SMALL BIRDS	ex (robins, doves)
SMALL MAMMALS	ex (rabbits, beaver)
WATERFOWL	ex (geese, ducks)
LARGE MAMMALS	ex (deer, moose)
OTHER (please list)	

Part IV.

25. Are you a member of a conservation organization such as: Great Salt Lake Audubon Society, Tree Utah, or the many others? Y/N

26. Would you participate in a field trip to see conservation efforts of the golf course?

27. Would you volunteer to assist with: Planting programs
Educational tours
Wildlife monitoring

Part V

28. Do you, or have you in the past, used the Jordan River Parkway Trail or other non golf related facilities or activities along the river? Y/N

29. Are you aware of city, county, state, or federal conservation efforts along the river? Y/N

30. Are you familiar with the Jordan River Natural Areas Forum? Y/N

Part VI

The following questions will refer to the diagrams on the poster.

31. Of the three drawings 1,2, and 3; which do you feel is:

-Easiest to play? (circle one)	**1**	**2**	**3**
-Most challenging? (circle one)	**1**	**2**	**3**
-Most interesting visually? (circle one)	**1**	**2**	**3**
-Which hole would you rather play? (circle one)	**1**	**2**	**3**

32. Do you prefer the manicured look of wild areas such as course A, or the natural look as in course B? **A or B**

33. Do you prefer the look of manicured turf around a water feature like course A, or a more natural appearance like course B? **A or B**

34. Would you rather play a round of golf on an open golf course like course A, or a narrow golf course with defined hole boundaries like course B? **A or B**

35. Circle each course that you believe provides sufficient habitat for wildlife.
A **B** **C**

36. Do you prefer open courses that are predominately turf grass like course A, or do you prefer courses with diverse vegetation like course B? **A or B**

37. Which area do you believe is more visually appealling? **A or B**
Which area do you believe provides more wildlife habitat? **A or B**

38. Which golf course do you believe is more visually appealing? **A or B**

39. Does hitting over dense vegetation as in course A, have the same feeling as hitting over water as in course B? **A or B**

Thank you for showing interest in the Jordan River and the wonderful Riverbend golf course. If you would like more information or would like to become involved in the conservation efforts along the Jordan River, please visit these organizations web sites.

Jordan River Environmental education Program
www.jordanriver-utah.org

Northern Utah Wetlands Partnership
www.utahwetlands.org

U.S. Fish and Wildlife Service
www.r6.fws.gov/jordan

Tree Utah
www.treelink.org/treeutah

Great Salt Lake Audubon Jordan River Environmental Education Program
485-2550