Water Efficiency/Conservation BMP Plan

Birdie Golf Course

72 Golf Course Drive
Birdie, TX 01234
(Updated: January 1, 2014)

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The purpose of a Water Efficiency/Conservation BMP (Best Management Practices) Plan is to foster the efficient use of water and to conserve water. Water use efficiency supports the policy of this facility to manage natural resources in a conservative and sustainable manner.

The approach used by Birdie Golf Course to enhance greater water-use efficiency and conserve water resources is a holistic, site specific, science-based BMP plan. This allows for more rigid controls to be incorporated during a local water crisis, but in a science-based manner using relevant triggers for each level of restriction.

Property Information:

A. Property Description - Site Assessment, Area, Plants, General Factors

1. Location – Consists of approximately 130 acres in central Birdie County.
2. Greens – 100,000 square feet, Ultra-dwarf Bermudagrass, Soil - USGA specifications, 10+ cupping areas (no more than 1.5% slope), Some traffic funnels, low cutting height (.110 – .130 inch)
3. Tees – 150,000 square feet, Tifway-419 Bermudagrass (high drought tolerance), Soil –USGA mix with drainage and, good traffic control, good water holding capacity and less water use, low cutting height (.45 inch).
4. Fairways – 25.4 acres, Tifway-419 Bermudagrass (high drought tolerance), Soil – native clay mixes, good drainage (water flow is generally back to central lakes), High traffic on course, good water holding capacity, low cutting height (.55 inch)
5. Rough – 70.5 acres, Tifway-419 Bermudagrass (high drought tolerance), Soil – native clay mixes, good drainage (water flow is generally back to central lakes), high traffic, good water holding capacity, high cutting height (2 inches)
6. Landscape – 10 acres, mostly cactus beds and native grasses, mature plants and use less water, Soil – native clay mixes
7. Clubhouse Grounds – 3 acres (include grass, nursery stock and annuals), Soils – native clay mixes except in annual beds (amended with potting mix-good moisture holding capacity), Tifway-419 Bermudagrass (High drought tolerance), Cutting height 2 inches

B. Overall Water Needs:

1. Metering – Each water source is metered and water use is compared to computerized flow management irrigation control system used to calculate a water use estimate.
2. Recordkeeping – Daily flows are recorded for each water source.
3. Water Testing – As needed, but usually every year for water quality (attach most recent tests)

4. Source – 7 acre surface impoundment. Also receive 375,000 gallons/day effluent water from the City of Birdie waste water treatment plant. An additional 30 acre-feet of water is available to supplement needs in the summer through a permit to pump from Birdie Creek.
5. Future Needs – No new areas requiring water are planned. The treatment plant has a planned expansion that will increase our effluent supply.
6. Alternative Water Sources – Currently we are utilizing the best possible sources.
7. Irrigation Method is a Combination of:
    a. Plant Based Science
    b. Soil Based Science
    c. Atmospheric Data
    d. Budget Approach.

C. Irrigation System Analysis:
1. Pump Station – Aqua-pump Variable Frequency Drive (VFD) 2000 gpm, Low Pressure shut down, High Flow shut down, vertical turbine pumps, Wye strainer with auto wash, flow meters, hour meters, weekly visual, maintenance as per manual, good condition
2. Controls –19 satellite controllers with grounding, central computer control, good condition
3. Irrigation line layout – Loop for greens, part circle heads on course perimeters, Aqua-pour 500 series sprinkler heads on course, pop-ups and stream rotors in landscape areas and clubhouse grounds.

D. Irrigation Demand Baseline: Refer to Attachments
1. The irrigation demand baselines are calculated from historical and manufacturer specification data to determine the amount of supplemental water required for irrigation.
2. The calculations take into consideration evapotranspiration (ET), average rainfall (50%), irrigation system efficiency (60-80%), crop coefficient (65%), pond evaporation, effluent use and irrigated acreage.

BMP Strategies for Water-Use Efficiency and Conservation:

A. Current Measures Already Implemented:
1. Current Irrigation Controls and Costs – Pump Station with Low pressure and High flow shut down, VFD technology to keep loss down from High pressure relief and leaks. Aqua-pour Software for efficient night watering.
2. Staffing – Fulltime irrigation technician to handle repairs, inventory, etc. Supervisor time is also used heavily on irrigation.
3. Scouting – Daily scouting for wet spots, dry spots through out the property. This includes drainage issues as well as dry issues
4. Hand Watering – Hand watering of new installations, annuals, dry spots on greens, dry spots on fairways. Greatly reduces need due to only watering exactly where needed.
5. Night Water – Irrigation scheduled at night to reduce loss and to keep from extending the natural free moisture range (disease pressure reduced).
6. Rain, Leak, etc. Loss Controls – See Scouting, Pump Controls, Irrigation controls.

7. Traffic Controls – Move and reduce traffic by utilizing signs, ropes, hole closed to traffic, and change directions mowing. These efforts reduce compaction and stress increasing drought tolerance and efficient water use
8. Keep standard mowing heights (do not go lower than needed) to reduce stress.
9. Soil Cultivation – Aerate and top dress to promote good root depth enhancing water efficiency of the plant – Greens 2x plus times per year, tees 1x per year, drive on and heavily trafficked areas as needed.
10. Evapotranspiration – Utilize weather station data to help schedule irrigation cycles based on evapotranspiration values.
11. Landscape Material Selection – Install only strong plant material adapted to the climate for water use efficiency. Use mulch to hold moisture.
12. Natural Areas – Remove areas from maintenance.
13. Fertilization – Do not over feed turf to keep from using too much water – Low Nitrogen.
14. Pest Management – Scout for indicators, use precise applications, apply early morning (when irrigating product in) to reduce water loss.
15. Wetting agents – Utilize wetting agents to enhance water applications to hydrophobic areas reducing water runoff and loss.

B. Measures Identified for a Short-Term Improvement Plan

1. Modify the hydraulic program in the control software to more accurately match each sprinkler/zone flow with the performance specifications of the sprinkler and piping system. This will allow for the various flow zones and sprinklers to perform more closely with the design specifications.
2. Replace full-circle (FC) sprinklers in the green complexes with two sets of part-circle (PC) sprinklers to provide independent control of the putting surfaces and green surrounds that have very diverse irrigation requirements.
3. Irrigation at the hotel can be converted from potable water to raw water or effluent water if made available to that site.
4. Continue to replace poor functioning sprinklers with new sprinklers.
5. When aeration fountains need to be replaced, replace with air diffusers to reduce evaporation loss.

C. Measures Identified for a Long-Term Improvement Plan

1. Modify the existing block sprinkler configuration to better match the site specific spacing, nozzle sizing, trajectory and pipe size of each sprinkler and irrigation zone. This will help improve the sprinkler performance more closely to the manufacturer specifications.
2. There are opportunities to reduce the existing irrigated acreage over time. Out of play irrigated areas should be evaluated for conversion to native vegetation that can be taken out of regular irrigation once established.
3. Audubon certification is a goal worth consideration.
4. In time as the development grows, we expect to increase our use of effluent water for irrigation and as a result, decrease our dependence on raw water for irrigation.
5. Consider further diversifying water sources by including groundwater options.
6. Another consideration for future water savings could be closed loop equipment washing systems at the maintenance facilities.
7. Opportunities to improve our environmental stewardship will continue to grow as technology continues to advance.
8. Replace all aeration fountains with air diffusers to reduce evaporation loss.

Investment Cost and Benefits Review: (Includes cost of the improvements and net savings or benefit resulting from the investments)

A. VFD Pump Station Conversions - $90,900
   1. VFDs Save electricity and the water to produce the electricity.
   2. They also save water by reducing pipe and fitting failures that result in leaks and runoff, enabling our staff to make timelier repair of leaks.
B. Site Programs – Allow for site prioritization allowing for rough and perimeter irrigation to be either reduced or eliminated during periods of drought.
C. Kept filling of ponds and streams to a minimum during periods of drought.
D. More efficient irrigation due to a combination of approximately $100,000 of sprinkler replacements and improved agronomic practices since 2008.
E. On Site Weather Station – Installed and became operational in 2012. – (approximately $30,000 for hardware, software and installation)
F. Soil Moisture Sensors – Purchased 6 soil sensors to date for $950 each plus repeaters. The goal is to monitor our full range of variable environmental conditions throughout the property.
G. Moisture Meters – Purchased 3 hand-held meters at $1,200 each. Helps manage our soil moisture throughout the day.
H. Our Effluent water use increased 126% in 2013 since 2009 and is up from 20% of our total irrigation use in 2009 to 36% in 2013.
I. A combination of all these initiatives has reduced our raw water use by approximately 39% compared to 2008.

Reasons for Water Conservation:

A. Proper water management dictates that OVERWATERING is unacceptable.
B. Playability dictates that dry is better therefore over watering is bad for the game.
C. Over watering will break down the environment and micro environments that are essential for the success of the turf and landscape plant.
D. Economics – watering and water management costs money.
E. Economics – players reject wet golf courses.
F. Depleted water supplies and reduced water quality.

Counter Measures to Reduce the Effects of Drought:

A. Raise mowing heights where possible
B. Stop mowing in areas that are cut off
C. Increase hand watering
D. Reduce traffic
E. Reduce fertility
F. Keep mowers sharp
G. Education of patrons

Other Water Conservation Related Plans:

A. Drought Conservation Plan

   Level One
   - Reduce Driving Range by 10%
   - Reduce Rough by 10%

   Level Two
   - Reduce Fairways by 10%
   - Reduce Tees by 5%

- Reduce Rough by 20% total
- Reduce Driving Range by 25% total

Level Three

- Reduce Fairways by 20% total
- Reduce Tees by 15% total
- Reduce Rough by 30% total
- Reduce Driving Range by 35% total

Level Four

- Reduce Fairways by 30% total
- Reduce Tees by 20% total
- Reduce Rough by 50% total
- Reduce Driving range by 50% total

B. Education Program:

1. *Benefits of Golf course and Turf*
   - Economic contributor
   - Carbon dioxide exchange for oxygen
   - Temperature moderation
   - Erosion control
   - Water filter for improved water quality
   - Wildlife sanctuary
   - Recreational benefits of reduced stress and increased health
   - Community outreach (First Tee Programs)
2. *During drought have papers on water conservation in the pro shop and locker rooms for members and patrons to use at home*
   - Increase awareness of water conservation
   - Spread the word

<u>Attachments:</u>

- Most Recent Water Quality Test Results
- Copies of Publications
- Irrigation Demand Baseline