

IRRIGATION BEST MANAGEMENT PRACTICES IN ARIZONA

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Introduction - Conscientious precision irrigation practices are essential in Arizona and throughout the arid southwest due to limited water resources. Public concern regarding golf course water use continues as Arizona suffers through its 5th severe drought year. A historical fact of life in the arid southwest is the cycle ranging from extreme drought years with reduced drought severity periods as a result of increased precipitation. These cycles coupled with continual population growth in the region require a planned water management approach if current life quality is to continue. Water regulators have begun collaborating with researchers and golf courses to attempt development of water conservation measures that ensure the minimum amount of irrigation water is used to maintain golf course turf quality.

Traditional regulatory water conservation measures have been based on restricting irrigated turf acreage and irrigation scheduling. A Best Management Practices (i.e. BMP) irrigation approach is being pursued in Arizona as a proactive alternative to traditional conservation methods. BMP procedures would provide regulators assurance of scientifically based turf requirements with documented water conservation by precision water use in a reference evapotranspiration (i.e. ETo) based water budget irrigation application. BMP for irrigation also provide irrigation practitioners with a factual basis for making irrigation application and management decisions for responsible irrigation water use.

Action taken - March 24, 2004 marked the first step in these new developments during the USGA Arizona Regional conference at Phoenix Country Club in Phoenix, Arizona. This conference brought together for the first time representatives from the water regulatory community and the golf industry irrigation water users. Speakers from the Tucson and Phoenix active management areas of the Arizona Department of Water Resources (ADWR), the Arizona Governor's Drought Task Force, the Cactus and Pine Golf Course Superintendent's Association, the University of Arizona, the Arizona Golf Association, the Professional Golfers Association (PGA), and the United States Golf Association (USGA) joined together to develop consensus and plans for ensuring responsible stewardship of the state water resources.

The conference showed that golf is big business in Arizona. Golf is a \$1.5 billion industry with the annual revenues at golf facilities exceeding receipts from dairy farms (\$173 million), cotton (\$233 million), and vegetable producers (\$258 million) in the state.

Government employees involved in public policy and water regulation voiced concerns about the public perception of golf courses as major water users even though golf course water use figures show golf to be a minority water user (e.g. Water use figures from Tucson ADWR: Municipal 48%, Agriculture 30%, Mining 12%, Golf 6%, other industrial 4%). Best Management Practices hold the key for bringing regulators and water users together to develop scientifically based

water conservation practices that are supportable and understandable by regulators, golf course water users, and the public.

Highlights of the current status in Arizona golf course irrigation BMP are listed below:

- Members of the Cactus and Pine Golf Course Superintendent's Association have supported the concept of BMP development in conjunction with ADWR, the USGA, and the University of Arizona. Two new research projects by David Kopec and Paul Brown were approved for funding by Cactus and Pine GCSA August 10, 2004 to answer questions needed for developing data that can be used in a fact based BMP document for Arizona. This research will try to define physiological differences between adequate irrigation and deficit irrigation, define the physiological requirements of salt affected golf course turf under water conservation irrigation limitations, define the influence of topography, soil types, area size and edge effects, and other factors essential for accurate physiological irrigation requirement models under drought affected golf course turf.

- Research by the University of Arizona will be used to identify factual irrigation water use data for healthy turf compared to deficit irrigation. A water budget based on ETo (i.e. Reference evapotranspiration (ETo) with appropriate crop coefficients) will be developed to specify different levels of irrigation ranging from optimal turf irrigation to deficit turf irrigation (i.e. water conservation in drought years). This research shows water conservation procedures must also account for salt affected turf irrigation adjustments, winter overseeded turf adjustments, and natural precipitation adjustments. (As an example BMP could assume a distribution uniformity (DU) of 80%, 100% of ETo for 10 days during spring transition, 110% ETo in October during overseeding, and site specific ETo replacement levels for optimal turf during each month through the year, no salt limitations, and 50% of rainfall precipitation being effective for turf use).

- Turf edges require more water compared to plants inside larger turf areas. Research examples found 7% to 11% additional water is needed to maintain turf quality in the afternoon while 6% to 8% additional water is needed to maintain turf quality in the morning. 5% to 10% more water is needed in small turf areas (i.e. less than 60 feet from edge) compared to turf in larger areas. Formal research results from this study are due for publication in 2005. These results show how golf course design can affect turf irrigation and impact water conservation.

- ADWR has established a 90 acre maximum irrigated turf area for golf courses with 4.6 to 4.9 acre feet of water applied per acre maximum in the current management plan. An additional water allocation is available (i.e. 5% to 15%) to golf courses with salt affected irrigation water to allow for regular leaching. Recently funded university research will try to determine the actual deficit irrigation specifics for golf course turf and the actual water supplements needed to maintain salt affected golf quality turf health.

- Water losses must be specified in a comprehensive BMP. Losses identified in golf course irrigation are estimated to be 1% to 10% due to leaks, 2% to 20% due to drift and evaporation. Other water losses not currently defined include: over-watering (i.e. mismanagement), and non-uniform irrigation (due to design, management, and maintenance inconsistencies). Additional research to define these losses is needed to determine the exact amount of irrigation water that is applied to turf compared to water delivered to the property for irrigation purposes.

- Site specific influences to be included in BMP include turf species, turf root depth, soil moisture and texture, infiltration rates, mowing height, cultivation procedures, and alternative irrigation water reuse (e.g. water runoff capture). The irrigation water source is another site specific aspect of the BMP (e.g. well, potable, effluent/reclaimed, irrigation district water, etc.)

- Discussions will continue through 2005 and 2006 while the fourth ADWR irrigation management plan for golf courses is developed. (i.e. 1st management plan: 1980-1990, 2nd management plan: 1990-2000, 3rd management plan: 2000-2010, 4th management plan: 2010-2020, 5th management plan: 2020-2025. 2005 and 2006 are crucial for discussions regarding any changes to be considered from the current program performance process between ADWR and water use stakeholders). It is hoped that BMP will be the basis for this new plan using a water budget criteria rather than strict water use or day restriction criteria.

Conclusion - Paul Brown and David Kopec from the University of Arizona and David Wienecke, of USGA Green Section, Southwest Region are developing the outline and content for the Arizona Golf Course Irrigation BMP document. The BMP document is viewed as an evolutionary document that will change as research and/or field experience dictate. It is hoped that the BMP document will be a boiler plate to be used by superintendents for developing site specific BMP documents for their golf course. The BMP approach provides a science based format on which collaborations between researchers, regulators, and water users assure conscientious stewardship of this most precious resource. ###