

the AQUIFER

Volume 25

Number 4

Spring 2011

©

A PUBLICATION OF THE GROUNDWATER FOUNDATION



Embracing Sustainability

Golf Industry Working to Change Practices, Perceptions

By William K. Bieck, CGCS, Golf Course Superintendent at Heritage Hills Golf Course in McCook, Nebr.

What does the future promise for the golf industry? Not only from a business standpoint, but from the ability to offer a gratifying recreation experience as well as the ability to properly manage and care for natural resources that the game and society relies upon.

All three of these components – economic, community, and the environment – are key elements of sustainability. Sustainability is becoming an important aspect or philosophy of many businesses, organizations, communities, and government entities throughout the world. Many of us might like to avoid the tough questions of achieving sustainability. But we

as an industry must be prepared, accountable and pro-active as we head into the future. There will be a need to closely monitor these aspects to ensure the growth of the game and protect the environment.

The Environmental Institute for Golf (EIFG), the philanthropic organization of Golf Course Superintendent's Association of America, is leading a collaborative industry-wide effort toward a sustainable approach to golf facility management. Their focus is on continual improvement by professionally managing and conserving resources and inputs, and reducing waste while providing playing conditions

that satisfy golfers of today and tomorrow. Water usage and protection are regarded as a primary focus in golf's drive toward sustainability.

Sustainability may be considered by some as a righteous cause or something that can be accomplished by a few changes in operations. But one thing is certain, it can't be achieved and then forgotten. Sustainability is an ever-changing, dynamic way of doing business. It isn't something to back away from, but to embrace. Sustainable business practices can have positive impacts on a facility's bottom line with both short-term

Sustainability, continued on page 7 ►

INSIDE

2

Common Sense

Means WaterSense

3

Ongoing Protection

4

Savings Multiplied

6

News from The

Foundation

8

Six Degrees of

Groundwater

9

Order Form



Mission of The Groundwater Foundation:

To educate people and inspire action to ensure sustainable, clean groundwater for future generations.

Common Sense Means WaterSense

Groundwater Foundation Partners with U.S. EPA to Promote Water Conservation

Americans take water for granted. We think our water is abundant, that it is constantly replenished and ever flowing. Unfortunately, it's not that simple.

While in some places the water supply might seem abundant, the facts tell a different story. Between 1950 and 2000, the U.S. population nearly doubled, while our use of water through public supplies more than tripled.

With demand outstripping supply, at least 36 states anticipate some degree of water shortage by 2013. The bottom line is that our supply of water is limited and demand is growing.

It is easier and less expensive to save water than it is to find new supplies. Communities face increasing challenges with maintaining and creating new water systems. Using water efficiently can help delay the need to create new supplies, saving communities money and resources.

The key to saving our water is thinking about our habits. Each

American uses an average of 100 gallons of water a day. We can cut that by as much as 30 percent, through a few simple steps.

First, we need to know how we use water. Most people don't know that leaving the tap open during a daily ritual like brushing our teeth can use up to 8 gallons of water—that's the same amount as the average person drinks in 16 days. By turning the tap off, you'll use just half a gallon.

Second, technology is making water efficiency easier than ever. New tools are available each day to help all of us use less water without sacrificing product quality or performance.

Efficient appliances and fixtures are a good place to start. They are cost-effective and can dramatically reduce your daily water use. Installing high-performance, high-efficiency toilets in your bathrooms can cut your indoor water use by about 16 percent. A new crop of dishwashers and washing machines are using considerably less water than conventional

models. Point-of-use water heaters prevent excess water use while waiting for the hot water to reach the faucet or shower.

We can change the way we use water outside our homes too. Many people don't realize that 30 percent of household water is used outdoors, typically for irrigation. A well-maintained irrigation system

can achieve excellent landscaping results while using much less water. Look for sprinklers that produce droplets, not mist, make sure your system is well maintained and that water is evenly distributed. Set timers properly, and install rain shut-off devices and moisture sensors to reduce excess watering and run-off.

Businesses play an essential role in water conservation as well. They account for 17 percent of all water used in public systems. Through upgrades to their equipment, many businesses can cut their water usage by 20 to 30 percent.

A U.S. Environmental Protection Agency (EPA) partnership program that seeks to help protect and preserve the nation's water supply is also a valuable tool in helping promote water efficiency. EPA's WaterSense program (www.epa.gov/watersense) offers a simple way to make product choices that use less water—just look for the WaterSense label. Toilets and faucets that meet EPA specifications are independently tested to perform as well as or better than conventional models with no sacrifice to quality or product performance.

The Groundwater Foundation has partnered with the WaterSense program to help citizens conserve water for future generations.

Using WaterSense labeled products will help save water and money while preserving limited water resources for the future. For example, the average home, retrofitted with water-efficient fixtures, can save 30,000 gallons per year. If one out of every



10 homes in the United States upgraded to water-efficient fixtures, it could save more than 300 billion gallons and nearly \$2 billion annually. If every home in the United States installed WaterSense labeled faucets or faucet aerators in the bathrooms, it would save 60 billion gallons of water annually—saving households more than \$350 million in water bills and about \$600 million in energy costs to heat their water.

“The goal of EPA's WaterSense program is to help Americans save water and money by offering simple ways to reduce water use through water-efficient product choices,” says Sheila Frace, Director of the EPA Office of Water's Municipal Support Division. “Using water more efficiently can help delay the need to create more supplies, saving communities money and resources, as well as ensuring that water will be available for future generations.”

If you look at the numbers they certainly add up. Saving water is a smart, cost-effective, win-win solution. When you look at the impact of water efficiency as a bigger picture, it is clear it's the only way we can go. It's about changing what we know and turning that knowledge into action.

Let's step up and save this vital resource from washing away.♦





Ongoing Protection

Wellhead Protection in Seward County, Nebraska

By David Lathrop, City of Seward, Nebraska

The aquifer that provides the City of Seward, Nebraska's drinking water has been contaminated by agricultural fertilizer applications from 25 to 35 years ago. Nitrate levels have risen from about eight parts per million (ppm) in 1985 to nearly 14 ppm in 2009.

The State and Federal limit for nitrates in drinking water is 10 milligrams per liter (mg/l), or ppm. Nitrates in drinking water can cause methemoglobinemia in infants and unborn babies. Nursing mothers must also avoid ingesting high levels of nitrates. Methemoglobinemia, also known as blue baby syndrome, occurs when nitrates compete for oxygen in a baby's blood.

Because of these rising levels of nitrates, Seward constructed a \$5 million reverse osmosis (RO) membrane water treatment plant. It went online in June 2004 and maintains nitrate levels of 7.5 to 8.5 mg/l in drinking water supplies.

Long before the RO plant was built, Seward was one of the eight charter communities of what became the Groundwater Guardian program in 1994. The group formed in the mid 1990s as many communities throughout the nation were experiencing groundwater contamination. The initial focus of the Seward group was to encourage agricultural best practices such as crop rotation, no till farming, fertilizer applications based on soil requirements, and minimal irrigation. These practices have undoubtedly reduced the amount of fertilizer contamination making its way into the aquifer. Unfortunately, Seward's drinking water wells draw from a portion of the aquifer that contains water with an age of 25 to 35 years. The net effect is that Seward's water supply has been contaminated by agricultural practices from 25 to 35 years ago.

In early 2000s, Seward's Groundwater Guardian team disbanded as efforts shifted toward building the RO treatment plant. The final justification for building the plant came from the Nebraska Department of Health and Human Services as they placed Seward under an Administrative Order (AO) not only for nitrate contamination, but also for corrosive water, which was causing copper plumbing pipes in homes to dissolve, ultimately ending up in the water used for drinking. The City did not complete the process of creating a wellhead protection (WHP) plan at the time, although, the boundaries of the area to eventually be protected were established. (See §3-153 of the Seward Municipal Code at <http://www.cityofsewardne.com/Building/plans/citycode/citycode.htm>.)

In 2007, Seward County passed zoning regulations for a WHP plan to be created and submitted to the state for approval. The county zoning ordinances mostly affect new or expanded use of already built chemical handling facilities in the WHP area; existing facilities are able to continue operation as they have been. The facilities include fertilizer storage, fuel tanks and livestock yards. (See section §3.20 and section §4.15 of Seward County zoning regulations at <http://connectseward.org/cgov/Zoning%20Plans%20&%20Regs/SewardCoZoning2007.pdf>)

On October 20, 2009 the Seward City Council approved the WHP plan. At the February 15, 2010 meeting the City approved an interlocal agreement with the County for the wells outside of the City's two-mile corporate jurisdiction, finally making the WHP plan official with the Nebraska Department of Environmental Quality (NDEQ) and the County.

A unique challenge for the City was the location of an oil pipeline through the WHP area. TransCanada's Keystone Pipeline is a 2,000 mile-long pipeline that carries roughly half a million barrels of crude oil a day from Canada to refineries in the U.S. As such, the City worked to include monitoring provisions within the WHP plan and in Groundwater Guardian activities.

In early 2009, a new Groundwater Guardian team formed and decided to implement three result-oriented activities (ROAs). These activities include:

- Modify county ordinances to include transport of hazardous chemicals such as petroleum in the TransCanada Keystone Pipeline.
- Monitor the construction of the Keystone pipeline in the area to ensure it meets construction specifications.
- Shepherd interlocal agreement with County and City of Seward.

In August 2009, the Groundwater Guardian team received funding from NDEQ, the Upper Big Blue Natural Resources District and Seward County Extension to help farmers irrigate optimally to prevent over pumping of water. This project used weather stations to determine evapotranspiration (ET) values and soil moisture probes to aid farmers on making decisions about when to irrigate. This system was up and running in 2010, with a few glitches that have been addressed for the 2011 growing season and beyond. If all area irrigators would use such a system, 25-50% of groundwater pumped for irrigation could be saved. For comparison, if the City implemented severe water conservation measures, the water-savings impact would be about 0.5%. Optimal irrigation improves



crop yields and reduces the amount of fertilizer leaching into the groundwater.

In February 2010, the Groundwater Guardian team began work on four new ROAs:

- Operation of weather stations to minimize irrigation.
- Registration of WHP plan with the Nebraska Department of Transportation (DOT) as a High Consequence Area.
- Creation of a City ordinance for the WHP plan inside corporate limits.
- Seek grants to monitor Keystone Pipeline for leaks.

On January 12, 2011 the City signed an agreement with the US Geological Survey to install an oil leak detection network near the Keystone Pipeline within the City's WHP area. The project includes a \$48,000 grant from DOT, a \$25,000 match from USGS, a City match of \$11,000.

For more information about the City's WHP efforts or Groundwater Guardian activities, please contact David Lathrop, at 402-643-3433 or david.lathrop@cityofsewardne.com.



Savings Multiplied

Conserve Water and Energy to Maximize Efficiency, Reduce Emissions

by Craig Hannah and Tricia Kruse, Johnson Controls

Water and energy are intertwined in a water-energy nexus: Conserving one inevitably conserves the other. And saving these resources goes hand in hand with sustainability.

The water now on Earth is all there ever was or ever will be, and 99 percent of that water is salty or locked up in ice and glaciers. People depend on the remaining amounts of water to produce energy and significant amounts of energy to distribute, purify, and heat water for various uses. That interconnectivity is called the water-energy nexus.

Societies are becoming increasingly adept at saving energy because pure economics demands it. Conserving water is even more critical because of water's unique ability to sustain life. Fortunately, many fundamentals of wise energy use can be applied to water. Smart water management can help make the most of water as it journeys from source to users and back to the environment. Each improvement along the way also saves energy.

A Resource Under Stress

The importance of freshwater becomes more apparent as growing populations around the world stretch supplies. By 2025, an estimated 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be under water stress conditions, according to a 2006 United Nations report.

In the United States, a country considered rich in water, the population is expected to grow by 70 million in the next 25 years, during which water and electricity use will rise by 50 percent. A 2008 US government study found that, by 2013, at least 36 states expect

to see water shortages. Water could quickly become a factor that limits economic growth.

Meanwhile, demand for energy is increasing pressure on water resources. Some 40 percent of all daily freshwater withdrawals are used for cooling at large-scale electric power plants. In many regions, because of the amount of water needed to produce electricity, people use daily as much water turning on lights and running appliances as they use in taking showers and watering lawns.

Conversely, in mid-size cities, 30-40 percent of the electricity is used by water utilities (mainly for pumping) and wastewater utilities (primarily for aeration). In the United States, transportation, distribution, and purification of water consume 4 percent of all electricity. In addition, an estimated 18 percent of water used in homes and businesses is heated, requiring still more energy. In high hot-water demand industries such as hospitality, 42 percent of energy use is to heat water. Commercial buildings with heavy hot-water demand include dormitories, public housing facilities, and facilities with commercial laundries or industrial processes.

For these and other reasons, sustainability initiatives increasingly focus on water. Virtually every corporate, municipal, and institutional sustainability policy emphasizes water efficiency. The US Green Building Council's Leadership in Energy and Environmental Design (LEED) certification program focuses on water efficiency with an emphasis on water-use reduction, water-efficient landscaping, and innovative wastewater technologies.

Rising Demand, Prices

For many years, water efficiency lagged behind energy efficiency, largely because users thought water inexpensive and abundant. However, the US Department of Energy reports that water rates have risen by 100-500 percent in the last decade and likely will keep rising at 10 percent/year average.

Prices will continue to increase if water utilities adopt full-cost pricing, as advocated by the US Environmental Protection Agency (USEPA). In many locations, water prices don't fully reflect the costs of producing, treating, and distributing water, according to USEPA. Part of this value includes an increasing financial obligation to maintain water and wastewater infrastructure. USEPA is encouraging utilities to charge for the full cost of service, adopt management practices that help them better manage assets, and implement measures to use water more efficiently.

Between 1950 and 2000, the US population nearly doubled, and public demand for water more than tripled. In many regions, scarcity alone, whether caused by drought or population growth, has brought water efficiency to the forefront.

In the face of increased demand, communities and water utilities find that water efficiency is the best and least expensive route to greater capacity. Building or expanding treatment plants is far more expensive.

Wasting Water

Although many communities are making progress with comprehensive water conservation initiatives, losses are still significant. Thousands of US water utilities together deliver more than 34 billion gallons

per day (bgd) of drinking water. The US Geological Survey has estimated that as much as 6 bgd are categorized as nonrevenue water attributable to leakage, poor accounting, and other unbilled consumption – enough to supply the nation's 10 largest cities.

AWWA's 2007 State of the Industry Report estimated losses at 10-20 percent in water distribution systems throughout the nation. In parts of the northeastern United States, more than 30 percent of treated water is lost through exfiltration. In extreme cases, a water utility may bill for only 50 percent (or less) of the water it treats and pumps to distribution.

The situation is no better at the end-user level, where buildings consume 20 percent of the world's available water. If businesses in California alone adopted proper water efficiency measures, they could save enough water to supply San Francisco, Los Angeles, and San Diego, according to a Natural Resources Defense Council paper.

Meanwhile, a US household can waste an average of 11,000 gallons per year from running toilets, dripping faucets, and other leaks. If all US households installed water-efficient appliances, the collective savings would total more than 3 trillion gallons of water and more than \$18 billion per year. Older, inefficient toilets waste the most water in American homes. Replacing these outdated models with toilets bearing the USEPA WaterSense label could save nearly 3 bgd across the country.

Similar or greater gains in water efficiency are possible from commercial and industrial facilities to hospitals, schools, universities, government office buildings, correctional facilities, and military bases.

Efficiency Pays

The good news is conserving water pays large dividends, even more than saving energy. On average, implementing water-efficient designs and products leads to about a 15 percent reduction in water use, about 10 percent reduction in energy use, and about a 12 percent reduction in operating costs.

Construction industry research shows that lower energy and operating costs are the two reasons owners incorporate water-efficiency projects. Water and energy savings incorporate the same basic disciplines:

- Identify and fix waste sources.
- Install more efficient equipment.
- Add automation and controls where possible.
- Improve maintenance and operating practices.
- Measure results and establish continuous improvement strategies.
- Educate users and change wasteful behaviors.

Optimization Strategies

Any effective efficiency program follows a continuous cycle: measure, manage, monitor, and report. Here are several basic ways in which water users and providers can reduce water consumption, increase efficiency in systems that distribute and use water, and employ sustainable practices.

Water-Efficient Green Building Solutions. Facilities of all kinds can benefit from efficiency enhancements, which can cut energy and water consumption by 10-50 percent through conservation and operational changes. Possible improvements include modernizing HVAC systems; improving processes in industrial buildings, hotels and hospitals; installing plumbing fixtures that curtail domestic water use (i.e.

faucets, toilets, showerheads); and promoting educational and awareness initiatives. Efficiency upgrades are available for many processes and equipment that use water, from hospital imaging equipment, cooling and process systems, to cooling towers.

Landscaping and Smart Irrigation. Landscape irrigation uses vast amounts of potable water. Simple conservation measures include choosing plants that need less water, harvesting rain for irrigation, and avoiding watering during the day when evaporation losses are high. More advanced measures include installing weather-based irrigation controllers, which automatically modify watering schedules based on weather, plant, and soil combinations.

Conservation Education. Building owners, cities, and water utilities can use education and communication tools to teach residents how to conserve water directly by cutting water use and indirectly by saving electricity. Building owners can install and pursue water-saving products. Cities can encourage residents to install water-efficient fixtures and appliances and provide incentives in the form of rebates or tax breaks.

Water-Loss Prevention. Although a main break often becomes big news and can waste water in tens of thousands of gallons, small leaks that fail to surface often cause much more water loss. Utilities can lose substantial water from major line breaks or from slow, persistent leaks. A good starting point for water loss optimization is to perform an AWWA water audit, and accounting of all water uses. AWWA's Water Loss Control Committee is actively updating tools to help water utilities compile annual water audits and to control water and revenue losses (see www.waterwiser.org). Water audit data can drive water

conservation, water reuse, and water-loss control initiatives. An optimization program can include ongoing leak detection and repair, pressure management, metering of usage with the correct meter types and sizes, advanced metering infrastructure (AMI), periodic meter testing, and a systemwide review of service and business operations.

Greening Treatment Plants. Many water and wastewater treatment plants waste substantial energy. Energy conservation and operational changes can cut energy consumption by 10-30 percent. In addition to traditional improvements to HVAC equipment and controls, lighting systems, building automation systems, and domestic water use improvements, water treatment plant operations can be improved with high-efficiency raw water pumps, backwash water pumps, and high-service pumps. Wastewater plants can benefit from high-efficiency lift pumps, aeration system improvements, and combined heat and power systems using digester gas. Both kinds of plants may also deploy wind and solar energy systems.

Metering Accuracy and Automation. One of the best ways to help fund efficiency and sustainability initiatives is to maximize billable revenue from water delivered to customers. To reduce apparent water loss, a utility should consider installing an automatic meter reading (AMR) or AMI system, replacing or repairing old water meters, and installing the correct size and type of meter for each application. AMR and AMI systems save labor and fuel, reduce vehicle emissions, and minimize operational expenditures while eliminating errors in the meter-reading process. Hourly data from AMI systems can be used to detect anomalies and potential issues faster while enhancing customer services.



Finding the Funds

Naturally, water efficiency requires an investment. Private and public entities can receive grants or low interest loans under state-sponsored efficiency initiatives. They can also take advantage of performance contracting, a financing method to fund projects by using the projects' guaranteed savings.

In a typical performance contract, an organization engages an energy service company (ESCO) to replace aging equipment and systems with modern, efficient technologies, including renewable energy. Some of the most rewarding performance contracts combine water and energy savings projects into a single package.

An ESCO guarantees customer savings over a contract period, such as 10-15 years, and those savings repay the capital investment in the improvements. Typically, the owner's operating costs go down immediately, even as the initial investment is repaid. At the end of the contract, when the project is paid in full, the owner has substantially lower costs than before the improvements were made, and those savings affect the bottom line.

Sense of Urgency

Sustainability initiative – and the motivation to conserve water and energy – will only increase in the future. Investments in water and energy efficiency can bring quick and substantial returns. Available funding mechanisms make those investments more attractive than ever. The time is right for all who use, distribute, and treat water to apply the latest knowledge and tools to drive out waste and maximize these resources. ♦

Reprinted from Opflow, Volume 36, Number 12, December 2010.

www.groundwater.org ♦ page 5



Awesome Aquifers Back in National Science Olympiad

The popular Awesome Aquifer for Science Olympiad event is back in the national lineup for the 2010/2011 and 2011/2012 seasons!

Science Olympiad is a nonprofit organization working to improve the quality of science education, increase student interest in science, create a technologically-literate workforce, and provide recognition for outstanding achievement in science education by students and teachers. This mission is met through classroom activities, educator workshops, and Science Olympiad competitions. Science Olympiad creates a passion for learning science and improves the quality of science education by emphasizing problem solving and hands-on, minds-on learning.

Science Olympiad tournaments at the regional, state, and national level allow individuals and teams of students to compete in various science disciplines including biology, Earth science, chemistry, physics, computers, and technology. Students test their science knowledge among their peers in a fun and engaging environment.

The Groundwater Foundation worked with Science Olympiad at the national level and in Nebraska in 2005 to develop the Awesome Aquifers event. It ran as an official event from 2005-2007 and will be back in the lineup for the 2011 and 2012 seasons. The 2011 national tournament will be held May 20-21 at the University of Wisconsin in Madison, Wisconsin. Over 100 of the top Science Olympiad teams from across the country will compete at the national tournament.

Awesome Aquifers is designed to increase middle

school students' understanding of groundwater. The event tests students' knowledge of groundwater through written tests and requires them to build a model aquifer to demonstrate various groundwater concepts.

Prior to the competition students spend hours working to increase their knowledge and perfect their aquifer models. Many students use The Groundwater Foundation's Awesome Aquifer Kit to kick start their learning and model building. The kit includes everything needed to construct a model aquifer from the container to house the model, sand and gravel, and tubes to demonstrate how groundwater is pumped through wells. The kit also comes with an activity guide with instructions on how to demonstrate the connection between surface water and groundwater, porosity and permeability, and contamination and remediation. The Awesome Aquifer Kit is available for purchase through the Groundwater Catalog, online at www.groundwater.org/shop/proddetail.asp?prod=1021.

To learn more about Awesome Aquifers, visit www.groundwater.org/pe/so_aa.html. Awesome Aquifers is supported through partnerships with Science Olympiad and the U.S. Geological Survey. Learn more about Science Olympiad at www.soinc.org.

Groundwater Foundation National Conference to Return in October

The Groundwater Foundation is excited to announce the return of its national conference in 2011. Mark your calendars and plan to attend the conference, October 4-6 in Omaha, Nebraska. The

theme for the conference is "Let's Keep It Clean: Exploring a Collaborative Approach to Groundwater Protection."

Groundwater is the water we drink, the water that grows the food we eat, the water that supplements the lakes and rivers for recreation. It's a vital resource, one we must all work to protect for today's uses and for those of future generations. Communities must prepare themselves to work as a whole towards groundwater protection, with each segment of the community doing its part to protect its groundwater resources.

The conference, through in-the-field tours, case studies, and a wide variety of presentations, will provide tools and knowledge to help build a far-reaching, all-inclusive groundwater protection strategy that truly makes a positive difference in protecting groundwater.

Join us and learn not only from conference presenters but from Groundwater Guardian teams who work tirelessly towards the protection of their local groundwater. Groundwater Guardians and Green Sites will be recognized for these efforts during a Designation Celebration and dinner. All conference participants are encouraged to attend this celebration and learn about local efforts that have educated communities and protected groundwater.

Watch for more information from The Groundwater Foundation about this important event. If you are interested in presenting at the conference, please send a 250 word abstract to Cindy Kreifels at ckreifels@groundwater.org.

The 2011 Groundwater Foundation National Conference is co-sponsored by Valmont, Nebraska Department of Environmental Quality, and Water Research Foundation.

Groundwater Foundation Partners with Rain Bird

The Groundwater Foundation is pleased to announce a partnership with Rain Bird Corporation as part of its Groundwater Guardian Green Site program.

Based in Azusa, California, Rain Bird Corporation is the leading manufacturer and provider of irrigation products and services. Since its beginnings in 1933, Rain Bird has offered a broad range of irrigation products for farms, golf courses, sports arenas, commercial developments and homes in more than 130 countries around the world.

The partnership will help the Foundation grow and expand the Green Site program.

"We're excited to be a partner with a company like Rain Bird," said Groundwater Foundation President Jane Griffin. "It's a great opportunity for us to continue to recognize sites for their groundwater stewardship and be able to offer additional tools and resources courtesy of Rain Bird."

Rain Bird has been awarded more than 130 patents, including the first in 1935 for the impact sprinkler. Rain Bird and the Intelligent Use of Water is about using water wisely. Its commitment extends beyond products to education, training and services for the industry and the community. Rain Bird maintains state-of-the-art manufacturing assembly facilities in the U.S., France, Sweden and Mexico, and is the sponsor of the Intelligent Use of Water Awards.

For more information about the Green Site program, visit www.groundwater.org/gg/greensites.html. For more information about Rain Bird, visit www.rainbird.com.

and long-term investments and returns. We can consider short-term savings through simple energy conservation practices like turning off the lights or saving water, but consider long-term returns from investing in technologies and even the improved image of the game or brand of a facility. Incorporating these key elements into a site's decision-making processes will only help the business, as well as society.

Environmental Stewardship

And of course it is about environmental stewardship as well. As we look ahead we can expect that golf throughout the U.S. will face increasing regulatory pressures pertaining to water use and water quality issues. In addition, resource restrictions and availability will affect business. Water, land use, labor issues, energy use, air quality, and pollution concerns will continue to be within the headlines. Environmental groups are demanding increasing regulatory action in lieu of voluntary compliance. Ultimately, the cost of doing business will continue to increase.

Across the United States, golf facilities are dealing with water management issues from use restrictions in California and Nevada to nutrient use restrictions in Florida and states adjacent to the Chesapeake Bay. This trend is expected to expand across the nation. Our message is that golf courses rely upon and professionally manage inputs, such as water, nutrients and pesticides, in order to deliver our product, which has many great benefits.

Sustainability will not only provide the means to improve our bottom line, but provides a great platform to deliver this message. It is important to communicate and promote the

many benefits the golf and other "green" industries can offer the environment. We want to see governmental agencies and environmental groups mitigating the loss of "green space" with the development of environmental friendly golf courses and parks. In addition, we want to see communities placing a greater value on turf and its effects on soil erosion and flood control. We would like to see golf courses and parks recognized for their ability to filter and clean contaminated water runoff and recharge groundwater supplies in urban areas. Golf facilities should be recognized as community greenspaces that provide not only recreational opportunities, but also offer important wildlife habitat. Proper turf and plant management can leave a positive "environmental footprint."

Looking Ahead

The truth is that we don't know all of the environmental challenges that lay ahead, but we can be equipped to defend our actions. Adopting a sustainable business philosophy through best management practices and advocating on behalf of our respective industries before regulations impact our business is a sound approach. Outreach communications and a willingness to discuss the difficult issues based on sound science will be critical.

The EIFG offers existing, established and recognized resources from throughout the nation. Resources include access to Best Management Practices that are recognized within states, such as Oregon, Florida, and Pennsylvania, as well as links to environmental programs, like the Groundwater Guardian Green Site Program, Audubon International and ePar Environmental Management Systems.

Key elements of these programs include the following suggestions to enhance facilities' environmental stewardship:

- Conduct an environmental assessment in order to develop an overall environmental policy and/or long-range plan.
- Maintain ongoing records to measure and document progress toward environmental standards (continual improvement).
- Adopt practices and technologies that conserve natural resources including water and energy.
- Develop and initiate comprehensive programs for recycling, reuse and waste reduction.
- Properly store and dispose of solvents, cleaning materials, paints and other hazardous substances.
- Participate in programs that help foster effective environmental management and policies.
- Take active steps to educate golfers, neighbors and the general public about their environmental policies and practices.

What will your legacy be? Will your industry be viewed as part of the problem or part of the solution? To legitimize the approach to environmental sustainability and stewardship we need to validate our actions through conservation and protection....even at a financial cost! The late President John F. Kennedy has been quoted as saying, "There are risks and costs to a program of action, but they are far less than the long-range risks and costs of comfortable inaction."♦

Editor's note: Heritage Hills Golf Course has been designated as a Groundwater Guardian Green Site since the program's pilot year of 2007.



Six Degrees of Groundwater

By Jamie Oltman, The Groundwater Foundation

Are you familiar with the concept of “six degrees of separation?”

It is the idea that we are all, on average, separated by only six other connections. This is a pretty neat concept to think about. For example, can I connect myself to President Barack Obama? My cousin and her daughter attended a dinner where they met Hillary Clinton, who was appointed as Secretary of State by President Barack Obama. That was pretty easy! Can you connect yourself to the Mayor of your hometown, the Governor of your state, or even the President? Without getting into the details or theories behind this concept, it's simply a fun and intriguing idea to think about. Some will say, “It's a small world after all,” and maybe they are right.

What about groundwater?

I have a new game for you, adding a twist on the six degrees of separation concept. Groundwater is the environmental bottom line, so let's see if you can connect these four items to groundwater: a hamburger, the garbage in your trash can, ski slopes, and yourself.

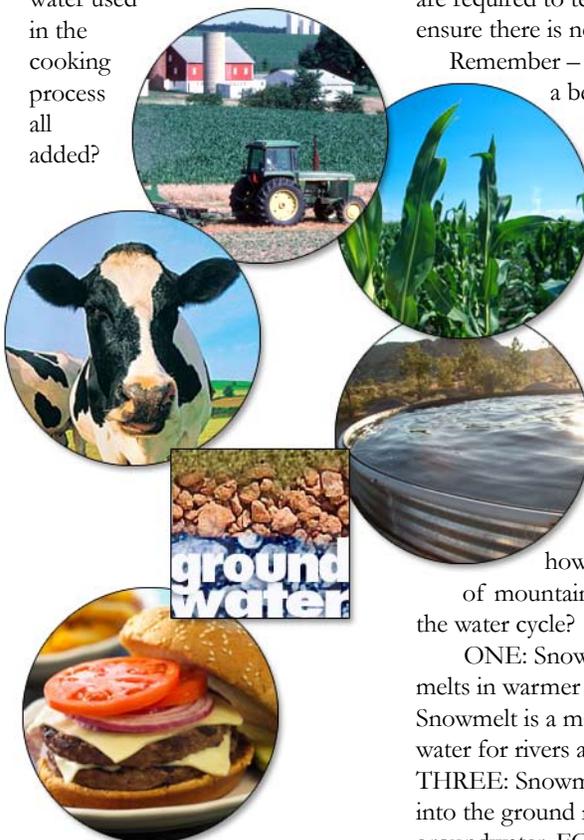
Were you able to make the connection? How did you get there? How many steps did it take you? Are your connections the same or different as what I came up with?

A hamburger – Have you ever thought about how much water it would take to make a hamburger?

ONE: The hamburger was once a cow. TWO: The cow may have been raised on a ranch. THREE: The cow's food was grown with water both from groundwater and precipitation. FOUR: Water for the cow to drink was pumped from a well.

I've seen estimates range from 100 gallons to 1,300 gallons

of water to make just one hamburger. It's hard to estimate how much water is actually involved in the process depending on what steps you include in the calculation. Was the water the cow drank, the water used in the processing of the meat, and the water used in the cooking process all added?



Regardless of exactly how much water, it's a good reminder that water is an important part in the production of the food we eat.

Garbage – Did you know in 2009 the United States alone produced an amazing 243 million tons of solid waste?

ONE: We throw away something we can't use. TWO: The trash is picked up from our house. THREE: Trash is added to the landfill. FOUR: Landfills, if improperly constructed and managed, can be a potential source of groundwater contamination.

Landfills today are highly engineered and managed to

ensure the materials it contains do not cause environmental harm. Landfills are required to be constructed with a base lining that prevents leachate that is released by the decomposing waste from entering the surrounding soils and groundwater. In addition, landfills are required to test groundwater to ensure there is no contamination.

Remember – recycling is much a better option

than simply throwing waste in the trash. Recycling conserves many natural resources, including water. Reduce, reuse, recycle!

Ski slopes – Do you ever think about

how snow on the top of mountains plays a part in the water cycle?

ONE: Snow on the mountain melts in warmer months. TWO: Snowmelt is a major source of water for rivers and streams. THREE: Snowmelt may also seep into the ground recharging the groundwater. FOUR: Rivers and streams provide water to farmers to irrigate crops. FIVE: Irrigation water seepage and from ditches can recharge groundwater. SIX: Some rivers and streams lose water to groundwater recharge.

Now that we have made the connection from ski slopes to groundwater, can you connect the groundwater back to the ski slopes? The water cycle has no beginning and no end. Water continues to cycle through the system changing from its liquid form to water vapor, a gas, and at times will be frozen in its solid form as ice. After water enters into groundwater it may eventually make its way to the surface, adding water to a river or lake, or even ocean. It may also be pumped up

to the surface and fill our empty glasses for a cool drink of water. This water will evaporate and end up in the atmosphere and at some point become precipitation and fall back to the earth... and around and around it goes.

Yourself – Do you know if the water you drink comes from groundwater or surface water supplies?

ONE: I drink groundwater! (that was pretty easy!)

If you drink water from a surface water source, such as a river or lake, do you think at some point the water you drink may have once been groundwater or after you use it will it one day become groundwater? Think about the water cycle mentioned in the ski slope example above. In addition, over 50% of the entire U.S. population relies on groundwater as their drinking water source, so if the water from your faucet isn't groundwater, odds are you know someone who does rely on groundwater for their drinking water. Also, think back to the hamburger – it's likely that some of the food you eat was grown with groundwater, too.

Play this game with your family and friends. Try to think of other items and see if you can stump anyone, or see who can make connections with the least amount of steps or the most detailed. Have fun with this game and remember we are all connected to the amazing resource, groundwater!♦

Editor's note: Want to share your connections? Visit our blog at <http://groundwaterfoundation.blogspot.com> or share them on The Groundwater Foundation's Facebook page at <http://www.facebook.com/groundwaterfoundation>.



The Aquifer
Spring 2011
Volume 25, Number 4

The Aquifer is published quarterly by:

The Groundwater Foundation
P.O. Box 22558
Lincoln, NE 68542-2558
Phone: 402-434-2740
E-mail: info@groundwater.org
Web: www.groundwater.org

Board of Directors:
Warren Arganbright
Chair

Tom Spears
Past Chair

Jay Beaumont
Vice Chair

Lori Davison
Secretary

James Burks
Treasurer

John Chapo
Catherine Chertudi
Jane Griffin
Rick Karlin
Don Kraus
Cindy Kreifels
Chandler Mazour
E. Robert Meaney
Steve Seglin
Dayle Williamson
Nancy Wright

Technical Advisory Committee:
Michael Allen
Angela Amack
Marge Cook
Hyder Houston
Bob Kuzelka
Pat Mangan
Mike Shulters

The Groundwater Foundation is a nonprofit educational foundation dedicated to educating the public about the conservation and protection of groundwater.

© 2011 The Groundwater Foundation. All rights reserved. Reproduction of material permitted with full attribution to copyright owner.

The Aquifer is a registered trademark of The Groundwater Foundation and is published quarterly. The views expressed in articles appearing in *The Aquifer* are those of the authors and do not necessarily represent the view of The Groundwater Foundation, individual members, or its Board of Directors.

Aquifer Staff:

Editor:
Jennifer Wemhoff
jwemhoff@groundwater.org

Design & Illustration:
Carla Otreodosky

Editorial Contributors:
Cindy Kreifels
Jane Griffin

♻️ Please consider the environment before printing.

Follow The Groundwater Foundation Online!

We're on Facebook, Twitter and YouTube



Membership, Materials and Publications Order Form

ITEM	PRICE	QTY	AMOUNT																
Groundwater Foundation Memberships																			
Ripple Creator	\$35-\$74																		
Big Splash Supporter.....	\$150-\$249																		
Groundwater Defender.....	\$500-\$999																		
<input type="checkbox"/> New Membership <input type="checkbox"/> Renewal Your contribution as a Groundwater Foundation member helps support the Foundation's educational programs. You will also receive <i>The Aquifer</i> , a 10% discount on all Foundation Catalog products, and reduced registration fees to all Groundwater Foundation events. Visit www.groundwater.org for more information.																			
Awesome Aquifer Kit	\$34.95																		
Build your own working aquifer model! Includes instructions for six advanced groundwater demonstrations.	10 or more at \$32.95																		
Water Facts CD-ROM	\$10.95																		
Over 150 ready-to-print fun facts, figures, and trivia about water to help enhance a water festival or community education event.																			
Making A Bigger Splash: A Collection of Water Education and Festival Ideas	\$16.45																		
Hands-on activities, games and science experiments.																			
Rainmakers: A Photographic Story of Center Pivots	\$24.95																		
Center pivots are used world-wide to bring food to our tables, over 100 intriguing photos enable readers to view the beauty and marvel of this unique technology. Great gift idea.																			
NAME _____ ORGANIZATION _____ ADDRESS _____ CITY _____ STATE _____ ZIP _____ DAYTIME PHONE _____ EMAIL ADDRESS _____			Subtotal: <i>Groundwater Foundation members, don't forget to subtract 10% from the subtotal for your member discount. Sorry, discount cannot be used on Foundation memberships (new or renewal).</i>																
PLEASE CHARGE MY: <input type="checkbox"/> VISA <input type="checkbox"/> MASTERCARD CARD # _____ EXPIRES _____ 3-DIGIT SECURITY CODE / SIGNATURE OF CARDHOLDER _____ ENCLOSED, PLEASE FIND: <input type="checkbox"/> CHECK <input type="checkbox"/> MONEY ORDER																			
Send completed order form and payment to: The Groundwater Foundation, P.O. Box 22558, Lincoln, NE 68542-2558 Shipping Charge Table*			Shipping Charge: <i>See table below at left. *Please call 402-434-2740 for orders totaling \$200 or more, for orders shipped outside of the United States, or for special rush options.</i>																
<table border="1"> <thead> <tr> <th>Total Price of Items</th> <th>Shipping Charge</th> </tr> </thead> <tbody> <tr><td>\$0.00 - 14.99</td><td>\$10.50</td></tr> <tr><td>15.00 - 29.99</td><td>13.35</td></tr> <tr><td>30.00 - 49.99</td><td>15.45</td></tr> <tr><td>50.00 - 74.99</td><td>17.85</td></tr> <tr><td>75.00 - 99.99</td><td>19.65</td></tr> <tr><td>100.00 - 149.99</td><td>21.75</td></tr> <tr><td>150.00 - 199.99</td><td>24.15</td></tr> </tbody> </table>			Total Price of Items	Shipping Charge	\$0.00 - 14.99	\$10.50	15.00 - 29.99	13.35	30.00 - 49.99	15.45	50.00 - 74.99	17.85	75.00 - 99.99	19.65	100.00 - 149.99	21.75	150.00 - 199.99	24.15	Sales Tax: <i>Nebraska residents only: please include appropriate sales tax for your area. Do not add sales tax to membership dues.</i>
Total Price of Items	Shipping Charge																		
\$0.00 - 14.99	\$10.50																		
15.00 - 29.99	13.35																		
30.00 - 49.99	15.45																		
50.00 - 74.99	17.85																		
75.00 - 99.99	19.65																		
100.00 - 149.99	21.75																		
150.00 - 199.99	24.15																		
			Total Amount Enclosed:																