

The Economics of Irrigation

How the University of Chicago is tackling water's higher costs

By Mike Ingles

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Photos courtesy the University of Chicago.

The University of Chicago has two water-supply problems - they are both economic problems. The first problem is that the city of Chicago can no longer afford to give nonprofits free water services, so the university is now saddled with a \$1 million annual expense. The second problem is that Chicago Water Management has just announced a 50 percent increase in water rates.

The university is located virtually within walking distance of Lake Michigan's shoreline. The Great Lakes form the largest freshwater system on the Earth and contain 84 percent of North America's surface fresh water and about 20 percent of the world's supply of surface fresh water. How then can fresh water be an issue for the University?

Again, the supply problem is as much about economics as anything else, which presents yet another irony. The University is known worldwide for its School of Economics. Milton Friedman (1912-2006), the late Nobel Prize of Economics winner, chaired the school during his 30 years at the university.

However, the challenge of finding solutions to the university's water supply issues, and especially as they pertain to maintaining its greenery and its botanical garden, does not fall to an economist; it falls to Richard Bumstead, associate director for campus environment and registered landscape architect who has been with the university for over 30 years. Bumstead, who started young as the caretaker of his family's perennial garden

beds in Montana, is a graduate of both the Illinois Institute of Technology and the University of Illinois Champaign-Urbana. He was also one of 15 founding members of the Higher Education Facilities Management Association.

When presented with the problem, the university contacted Conservation Design Forum, Elmhurst, Ill., an ecological design firm, and collaborated with them to produce a study "The Wise Water Guidelines." Bumstead and his staff are using that as a template for future development



The University of Chicago is a private research university with about 15,000 students and is consistently ranked among the 10 best in the world.

Sitting on sand

"Our first priority was to perform a sprinkler audit of several of the systems we knew were good candidates for upgrade," says Bumstead. "We took simple readings of the amount of water the system was distributing over the course of its cycle, and then looked at filtration rates. We found that in most instances we were wasting about 70 percent of the water we were distributing because the campus sits on 35 feet of old Lake Michigan sand. Once the top 6 inches of soil - where the root structures for plants are located - were sufficiently watered, in about five to seven minutes, anything after that was draining right back into the water table."

The crews then reprogrammed the irrigation clocks, adjusted sprinkler heads (which gave them better control over the spray) and added soil probes to determine if the systems needed to run at all. Bumstead calls this their "smart irrigation system." The system is tied into a desktop computer at the landscape services shop. To date the school is saving about 500,000 gallons of water a year with these upgrades.

The Treatment Link

Two and a half miles north from Lakeshore Drive in Lake Michigan, fresh water falls into cribs, large concrete catches, and flows through huge tunnels south to the James W. Jardine Water Plant on the Chicago shoreline. It is here that a billion gallons a day are treated and readied for distribution to more than 5 million people. Built in 1964 and often called a marvel in engineering, the freshwater supply runs through miles of a tunnel system built deep inside the bedrock.

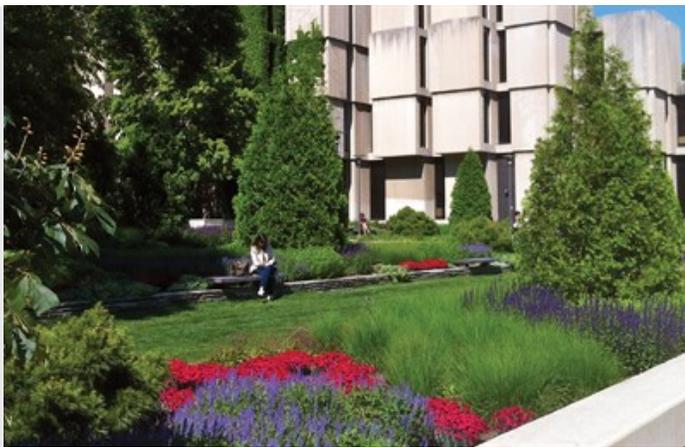
Residents' access to water for drinking and other daily uses wasn't so reliable or safe prior to 1890 when the city's sewage floated just offshore in Lake Michigan, where the city got most of its water. Cholera and other diseases periodically swept through the city. In 1900, the city completed the 28-mile-long Chicago Sanitary and Ship Canal (aka the Chicago Drainage Canal). The Canal turned the flow of the Chicago River away from the

lake, eventually linking it to the Mississippi River. Today, the Canal collects the city's waste (1.3 billion gallons of sewage and runoff daily) where it is treated at seven reclamation plants to be returned into the Des Plaines River and, eventually, down the Mississippi to the Gulf of Mexico.

Bumstead says the university installed these irrigation systems over the past two years at 10 locations. Original calculations showed the University recouping the cost in 10 years, but because of the water rate increase, the upgrade will probably amortize much more quickly.

"Our campus is a botanic garden," explains Bumstead, "and we have been working over the past 15 years developing and supporting this initiative, which is supported at the highest levels of the university administration."

Their investment also carries the inherent responsibility that the campus look presentable at all times. So maintaining water and irrigation are paramount in sustaining a well-manicured campus, especially in August and September when the Illinois prairie, historically a dry tallgrass prairie and ecological system set in sandy soil, goes dormant and yet thousands of students are returning to school increasing foot-traffic.



The south-facing perennial beds in front of the University of Chicago's Regenstein Library showcase a variety of evergreens and drought-tolerant ornamentals. It's a favorite place for students to relax.

"As we live on pure sand, it's hard to build any campus landscape without a sprinkler system, so we do what we can to utilize the water resource as best we can," says Bumstead. And part of that is finding new and improved ways to capture water for irrigation purposes. New buildings are being designed to capture water runoff from rooftops, for example.

In their new William Eckhardt Research Center, the university is harvesting water from the building's air-conditioning compressors. Not a new idea, but one that will provide all the irrigation for not only that facility, but for their new North Sciences Quadrangle. The city of Chicago finally approved this effort as a pilot program, and Bumstead hopes to use it as a model for future buildings on campus.

Bumstead adds, "One of my new initiatives over the next couple of years is to work with the city of Chicago to install some pilot parkway projects where we can develop stormwater infiltration systems and get much of this water directly back into the soil; we have the perfect setting with all that sand. These systems typically are found in locations without much winter weather and snow accumulation. The city has a few pilot programs installed now so we can learn from their experiences, especially after the winter we're having."

Bumstead says that the university has been trying since 2000 to utilize stormwater, which they are required to capture under building code enforcement. The college was going through a major construction boom at the time and wanted to better utilize stormwater, mostly roof overflow, for irrigation. Instead, city code allowed for the water to be collected and stored in huge underground cisterns and filtered through the Metropolitan Water Reclamation District, wasting resources, time and money.



When the University's irrigation system was finally audited it was discovered that it contained a hodge podge of heads, valves and timers.

Another paradox, says Bumstead, is that at the time Mayor Richard Daley, who was so attuned to green buildings and gardens, had no directives about developing a system in which to reuse this water. Each time the University started the conversation, it would run into code issues and was unable to make any progress.

Chicago provides more than 1 billion gallons of water a day to the 5.5 million citizens in its metro area. And the city has just undertaken a new program to place water meters in every home in the city, on a voluntary basis, hoping to give the public an idea of the amounts of water they use. The new billing system issued every two months instead of every six months, along with better controls on water usage, should save the residents on water and is guaranteed not to cost more for at least seven years.

Following the plan

The University's Wise Water Guidelines were completed in October 2012, and with them the University has discovered better methods to be good stewards of the water resources and have developed irrigations plans as well as action plans and strategies to remove code barriers well into the future.

A key design partner in the Wise Water Guidelines was Jeffery Bruce of Jeffery L. Bruce & Co., North Kansas City, Mo. The firm is actively engaged with projects in the campus area. Bruce says that the initial audit brought out some of the troubling issues.

"We found over 30 various irrigation systems or components in nozzles, sprinkler heads, valves and timers," he says. "A few systems were not even metered. To meet the high goals of the guidelines of 'net zero water use' we have to figure out how to repurpose and harvest water and distribute through integrated irrigations systems."

According to Bruce, the University will endeavor to build more environmentally friendly buildings with new construction design, as mentioned above, and establish better-engineered irrigation hardware and software to facilitate these improvements.

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Bumstead adds, "The city of Chicago still does not recognize the beauty of grey water systems (discarded water used in dishwashers, washing machines, etc.) whereas parts of the desert southwest, where I grew up, have been mandating these types of systems for decades. It's a very simple approach, and has not been the cause of any public health issues. I am a huge advocate and hope that we can continue to work with the city to explore these topics."

Like many American cities, Chicago is reeling from debt, in the form of increased city services and unfunded pension obligations, about \$33 billion. And, like many great American cities, it is so top-heavy with bureaucracy that incorporating modern architectural design and green building codes along with the much advancement in grounds management techniques might be a bridge too far. And yet, as the University of Chicago has demonstrated, these technologies can more than pay for themselves in sustaining their natural resources.

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