

Implementing Water Reuse

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On the south side of Denver, a rapidly growing suburb consisting of commercial development and multi-family residential properties has historically depended on a deep-aquifer groundwater supply for indoor water use and outdoor irrigation. Reliance on this nonsustainable supply has sparked questions and concerns about a future water shortage, the need for new source supplies, and water conservation. A solution: water reuse!

In summer 2009, Arapahoe County Water and Wastewater Authority (ACWWA) expanded its wastewater effluent reuse irrigation program from one authorized user—a golf course—to 49 users, paying the same for reuse water as for potable water. Users represent and irrigate commercial properties, public schools, large multi-family complexes, street medians, and golf courses, primarily through spray irrigation of turf grass and drip irrigation of shrubs. This expansion of users propelled ACWWA to become the wastewater treatment entity with the second greatest number of individual users in Colorado. The explosive growth was achieved only with the foresight of decades of diligent planning and infrastructure development.

ACWWA, a political subdivision of Arapahoe County, Colorado, provides municipal water and wastewater service to its 10-square-mile service area, with a population of approximately 30,000. Development of renewable water resources is seen as a critical need in this south Denver metropolitan area that relies heavily on deep bedrock aquifers.

Dual Systems in Place

Master planning for ACWWA nonpotable development began in the early 1990s and called for an extensive nonpotable water system to supplement irrigation needs and reduce the burden on peak summer daytime demand. This led to the



development of a dual, parallel pipe system consisting of a potable waterline and a purple nonpotable irrigation waterline. Currently, ACWWA has over 28 miles of nonpotable distribution piping in place that provides irrigation for nearly 30 percent of the service area. Ultimately, over 59 miles of purple nonpotable piping is proposed. This water conservation effort comprises a significant proportion of the agency's overall water portfolio.

A sequence of events facilitated the conversion of the existing irrigation-water system and supply (which was using potable water) to a reuse water supply. First was the commissioning of the Lone Tree Creek Water Reuse Facility (LTCWRF), a new 3.6 million-gallon-per-day, state-of-the-art advanced wastewater treatment plant. Next, wastewater treatment and

return flow for irrigation was consolidated with a neighboring wastewater district. Most recently, a reverse-osmosis potable-water treatment plant will soon be unveiled. A key component of the design flow for the reverse-osmosis plant was eliminating the need to meet irrigation-related high peak demands, thereby allowing the plant to operate more efficiently.

Starting the Conversion

ACWWA retained Wright Water Engineers Inc. (WWE) as its consultant to implement the conversion to reclaimed water for irrigation. Very few physical retrofits were required as the onsite irrigation network and separate irrigation water meters were already in place. Only a small amount of pipe needed removal

to achieve the separation between potable and nonpotable water pipes required for safety. However, customer education, public awareness, and regulatory compliance issues were significant challenges to making this reuse program a success.

The Colorado Department of Public Health and Environment (CDPHE) regulates reclaimed water in the state. Regulation No. 84, adopted in October 2000, established requirements, prohibitions, standards, and concentration limits for the use of reclaimed water to protect public health and the environment. Further, each reclaimed water user is required to have a "user plan to comply for the use of reclaimed water," and be granted a notice of authorization by the state. Training, inspections, and annual reporting are all mandated.

Finding and Educating Customers

Armed with only business names, addresses, and water-bill contact information, WVE began attempting to contact potential future users. Although local business managers often could be reached, the trail frequently turned cold when only out-of-state corporate post-office-box information was available. As a result, an intensive phone campaign coupled with personal meetings with key contacts for each prospective user was executed. Contacts included legal and site contacts (often irrigation

the potential health hazards involved with contact or ingestion of reclaimed water. The user plan detailing compliance with these requirements must be submitted to CDPHE for approval. Open dialogue with regulators was invaluable throughout the approval process.

Public reception was generally positive. A key message of the introductions, personal meetings, inspections, and training was the need for and importance of water conservation and the development of sustainable renewable water supplies. Some businesses latched onto this concept and incorporated the reuse-conservation

units (NTU) as a monthly average and 5 NTU in more than 5 percent of the monthly analytical results. ACWWA easily achieves these “swim beach” water-quality standards. Typical data reported by ACWWA, following secondary biological nutrient removal and advanced treatment with coagulant addition and adsorption clarification and sand filtration, are *E. coli* of 3.95 per 100 ml and turbidity of 0.45 NTU.

An important component of the implementation strategy was complete organizational transparency and staff availability. Personal relationships were established with most new users, facilitating information exchange and providing an outlet for the rare complaint. On a handful of occasions water was unavailable or only available during limited time periods. The open communication channels with ACWWA’s field staff and consultant helped facilitate solutions which, in one case, involved hauling in water for irrigation.

The reuse program at ACWWA has been well received by the community and has become a valuable component of its water resources portfolio. The state’s environmental protection specialist commented that “ACWWA has done a remarkable job with their reuse program and that no one has ever added this magnitude of users in such a short time period.” As of this writing, Colorado has 23 authorized treaters and 230 users, up from 150 just one year ago. ■

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contractors) for properties, home-owner-association officials, management-company representatives, and other interested individuals who regularly attended the informational meetings.

Meetings for future users consisted of detailed explanations of Regulation No. 84 and user obligations necessary to remain compliant. For example, the user must ensure that direct and windblown spray and other means of human exposure from irrigation systems will be confined to designated areas; ensure that application rates are controlled to strictly minimize ponding and runoff; post signs notifying the public that reclaimed water is being used and is not safe for drinking; and inform workers who operate and maintain the reclaimed water system of

aspect into their own green building plans. Other users expressed concerns with irrigation water quality, salt content, and potential landscape damage (particularly pine tree sensitivity to elevated dissolved solids). Representative water-quality data and plant susceptibility information were available to help alleviate these concerns.

Meeting Standards

ACWWA’s effluent water quality is well within allowable levels for unrestricted irrigation reuse. Regulation No. 84 allows *E. coli* concentrations of 126 per 100 milliliters (ml) monthly geometric mean and a single sample maximum of 235 per 100 ml. Turbidity, the other regulated effluent standard, is not to exceed 3 nephelometric turbidity

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