A Pure Solution to Orange County’s Water Needs

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The Groundwater Replenishment System (GWRS) in Orange County, California, is an indirect potable reuse project that will initially produce 70 million gallons per day (mgd) of water from treated effluent, with an ultimate capacity of 130 mgd. The water will be used for groundwater recharge and to protect the groundwater basin from seawater intrusion. Sponsored by the Orange County Water District (OCWD) and the Orange County Sanitation District (OCSD), the GWRS has three major components: 1) an Advanced Water Purification Facility (AWPF) and pumping stations; 2) a major pipeline connecting treatment facilities to existing recharge basins; and 3) an extension of the existing seawater intrusion barrier.

Using microfiltration, reverse osmosis, and advanced oxidation, the AWPF will treat clarified secondary effluent that is currently discharged into the ocean. The product water will be pumped to injection wells and recharge basins, where the water will pass through the ground naturally and mix with groundwater.

Treatment processes for the GWRS source water will be jointly managed by OCSD and OCWD. OCSD normally treats wastewater using primary and secondary treatment technologies and releases the treated effluent to the ocean. With the GWRS, however, OCSD provides clarified secondary effluent to OCWD, which treats the effluent using a three-step advanced treatment process.

The first step is microfiltration (MF) using a low-pressure membrane process that pretreats the source water. MF removes suspended particles, bacteria, protozoa, and some viruses, and promotes efficiency in the subsequent treatment processes.

The second step in the treatment is reverse osmosis (RO), a high-pressure process that forces water through a thin membrane that filters out minerals and contaminants. This step removes salt and organic contaminants to produce nearly distilled-quality water. Newer and advanced membranes have allowed lower operating pressures, higher fluxes, and increased contaminant rejection, improving efficiency by reducing cost and improving water quality. RO is used by many bottled water companies and has been used by OCWD for over 25 years.

The final step is advanced oxidation (AO), which consists of applying ultraviolet light and hydrogen peroxide. AO not only disinfects the water, but also uses oxidation to destroy low-molecular-weight organic compounds that pass the RO membrane. The entire MF-RO-AO process is a multiple-barrier approach to water treatment that ensures that high-quality water is introduced into the drinking water basin. The treated water will be either delivered to one of 36 injection wells along the coast to prevent seawater intrusion or piped 13 miles north to OCWD’s recharge basins. The GWRS is designed to also treat 100 mgd of wastewater in peak-flow events, reducing the volume OCSD needs to release through their ocean outfall.
The GWRS will provide numerous benefits not only to Orange County, but to the rest of California. It makes available a new, reliable, high-quality source of water to recharge the basin and protect it from further degradation from seawater intrusion. It will enhance groundwater storage and conjunctive use of the basin while utilizing about half the energy of imported water supplies. The project will also relieve peak wastewater flows by increasing water reclamation, postponing construction of a new ocean outfall while providing an alternative water supply to replenish groundwater stores.

Construction of the GWRS will rely on seven major construction contracts totaling $410.3 million and a total program budget of $486.9 million. The project has received federal, state, and local support totaling $92.5 million and a $3.7 million annual operational subsidy from the Metropolitan Water District of Southern California. Low-interest state loans, debt proceeds, and water rates will fund the remainder.

An important component in the success of the GWRS has been its proactive public outreach and education program. This program includes project presentations to groups throughout the OCWD/OCSD service area, neighborhood meetings near construction areas, and minority outreach and school programs. The GWRS has been endorsed by numerous elected officials, environmental organizations, chambers of commerce, and medical and health officials.

For more information, visit the GWRS website at www.gwrsystem.com.
Two municipal entities within the Española Basin, Santa Fe County and the City of Santa Fe, are seeking to improve their understanding of potential water-supply options by developing a regional groundwater model.

The Española Basin (shown at right) is a tectonic basin in northern New Mexico filled with several thousand feet of alluvial fan and slope wash sedimentary deposits, with some interbedded basalt and ash beds. It is an area of rapid growth and competing demands for the available water supply.

The county and city each hired consultants to develop numerical groundwater flow models to help them evaluate the regional groundwater supply. INTERA was retained by the county and the city retained CDM. The city developed a preliminary model in 2002 and has been working for the past few years to update and enhance it. In 2005, the county embarked on a similar course of
model development, albeit with somewhat different objectives and areas of interest.

To maximize scientific and economic resources and develop a model of the highest possible quality, the two governments entered into a process of collaborative model development. They invited other regional water experts to participate, including representatives from the New Mexico Office of the State Engineer (OSE), the U.S. Geological Survey (USGS), the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), and Los Alamos National Laboratory (LANL). The OSE administers all groundwater in New Mexico, while USGS, NMBGMR, and LANL are performing a variety of research studies within the basin. To have this mix of technical experts engaged in the process is unique in New Mexico, as the agencies they represent do not typically work closely together and the collaboration involves stakeholders that historically have often been at odds on water resources issues.

With the objective of focusing resources, INTERA and CDM will divide their efforts such that each will take primary responsibility for model development in a particular area or topic of interest. Both contractors are working closely to coordinate development of the geologic model, develop parameters, conceptualize boundary conditions, and identify appropriate calibration targets, among other tasks. This process is being facilitated by the development of a series of internal white papers on model layering and faulting, hydraulic parameters, pumping, surface water, boundary conditions, and recharge.

The collaborative process is ongoing, with weekly technical meetings that focus on exchanging data, developing the geologic model and parameters, and updating progress on a variety of technical milestones. CDM and INTERA have designed a dynamic and interactive approach to the model development that includes checking both the conceptual and technical development of modeling input datasets.

The process also includes a procedure for resolving technical differences collaboratively. The group’s goal is to reach consensus on all technical matters. However, if disagreements arise, the OSE and USGS will be consulted to help achieve a resolution. In cases where there is a reasonable range for a parameter but a difference of opinion on what value to use, the group agrees to pick a value but use the sensitivity analysis process to identify the effect of using other values. All parties have agreed that the calibrated model developed by the end of the project will be based on a common set of inputs. The hope is that this collaborative process will reduce conflicts traditionally caused by differences in the tools and techniques applied to evaluate water management strategies, resulting in a model that is both technically sound and readily used by all regional stakeholders.

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