

Long Beach Water Signs Agreement with U.S. Bureau of Reclamation to Fund Seawater Desalination Research and Development

On Sept. 9, the Long Beach Water Department signed a Cooperative agreement with the U.S. Bureau of Reclamation to begin design and construction of a \$5.3 million prototype desalination plant in Long Beach, California. The Long Beach Water Department has developed a process for desalting seawater using membrane technology and, for nearly one year, it has been testing this patent-pending process on a small scale. The department is now ready to begin the next phase, which involves exhaustive research into every aspect of desalting seawater with an eye towards identifying the optimum sites and processes for desalination in Long Beach. This phase will include the fabrication of a 100,000- to 200,000-gallon per day desalination plant at the Los Angeles Department of Water and Power Haynes power generation station. The desalted water from this test facility will be recombined with the salt water; it will not be placed into the city's drinking water system.

The desalination plant will be used to demonstrate the viability of the process, identify the optimum pretreatment process, optimize power consumption, and address brine disposal issues, among other

things. In addition, thorough environmental studies will be conducted in order to comply with strict state and federal environmental quality regulations. Design of the plant was scheduled to begin in October. It will be located at the Haynes generation station in southeastern Long Beach. The subsequent and final phase of the project will be to bring this optimized facility on-line, targeted for 2009, producing about 9 million gallons of drinking water per day for the city, or enough water for approximately 20,000 Long Beach families.

For more information visit www.ci.long-beach.ca.us/water/

EPA Releases Demonstration Bulletin on Ecomat, Inc.'s Biological Denitrification Process

EcoMat, Inc., of Hayward, CA, has developed a two-stage, ex-situ, anoxic biofilter biodenitrification process. The fixed-film bioremediation system employs biocarriers and specific bacteria to treat nitrate-contaminated water. The patented, mixed-bed reactor retains the biocarrier within the system, thus minimizing solids carryover. Fixed-film treatment allows rapid and compact removal of nitrate with minimal byproducts. Methanol is added as a source of carbon for cell growth and for metabolic processes that remove free oxygen. The resulting oxygen-deficient environment encourages the bacteria to consume nitrate. Methanol also is important to assure that conversion of nitrate proceeds to the production of nitrogen gas rather than to a more toxic nitrite intermediate.

A demonstration of the EcoMat biodenitrification system was conducted in 1999 at the location of a former public water supply well in Bendena, Kansas, in cooperation with the Kansas Department of Health and Environment. The primary contaminant in the water is nitrate from uncertain sources ranging from 20 to 130 mg/L, with low concentrations of volatile organic contaminants, particularly carbon tetrachloride, posing a secondary problem.

During the study, EcoMat's main goal was to demonstrate that its system could reduce incoming nitrate-N in excess of 20 mg/L to a combined nitrate plus nitrite concentration below 10 mg/L. A second goal of the study was to demonstrate that the post-treatment system would produce treated water that would meet applicable drinking water standards with respect to nitrate-N and nitrite-N. The final effluent would also have a pH between 6.5 and 8.5, and it would not contain turbidity of greater than 1 NTU, detectable levels of methanol (1 mg/L), increased levels of biological material or suspended solids. Results from the EcoMat biodenitrification process were encouraging when the entire system was operating at optimal performance. In those instances where the final combined nitrate-nitrite effluent concentration was above the regulatory limit, operational problems (mostly mechanical) were suspected as the primary cause.

For more information, visit www.epa.gov/ORD/SITE/reports/540mr01501.htm

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Colorado State Researchers Create Drought Lab

Researchers at Colorado State University (CSU) have established DroughtLab, a joint initiative of CSU's Water Center and the Climate Center. This research facility brings together the knowledge of more than 100 researchers from 22 academic departments at CSU, as well as labs and departments at the University of Colorado at Boulder. Disciplines contributing to DroughtLab's efforts include atmospheric science, civil engineering, watershed sciences, soil and crop sciences, rangeland science, forest science, ecology, sociology, political science, and agricultural and resource economics.

DroughtLab will serve as a framework for researchers to collaborate and develop encompassing information that helps water managers reduce Colorado's vulnerability to drought. Outreach education, statewide Cooperative Extension efforts, technology transfer and the communication of drought knowledge to state and local officials and the general public will compliment the lab's research efforts. Research will be conducted on campus and across the state at the university's Agricultural Experiment Station research centers located in communities throughout Colorado.

DroughtLab researchers will initially focus on three key areas: drought analysis and characterization, drought impacts and consequences, and drought response and management.

Visit cwrii.colostate.edu for more information.

Plant May Provide Key to Metal Distribution in Stream

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University of Arizona and U.S. Geological Survey scientists are studying manganese accumulation in an aquatic plant to gain insight into metal distribution in a mining-impacted stream in central Arizona. Pinal Creek, in Globe, Arizona, received elevated concentrations of dissolved manganese and other metals due to seepage of contaminated groundwater

from copper mining operations. The contaminated groundwater has been intercepted, but metals, including manganese, cobalt, nickel, and zinc, persist in the stream. Manganese is of particular interest because manganese oxides combine with other, more harmful heavy metals and thus may aid in their removal from the system.

Veronica anagallis aquatica, commonly known as water speedwell, is a common emergent and submergent plant in the stream channel of Pinal Creek. Roots and shoots of the plant were found to have much higher concentrations of manganese and other metals in them than the surrounding stream water or sediment. The researchers set out to answer the following questions:

- Where does water speedwell accumulate most of the metals?
- Can the metal uptake account for temporal and spatial variations in metals concentrations in the stream?
- What is the rate of metal removal by water speedwell from metal-spiked water?

Water speedwell was collected approximately monthly from Pinal Creek for one year, 2001-2002. Roots and shoots were separated, and the external metal concentrations were measured. Water speedwell was found to accumulate substantial manganese in its root and shoot tissues. Submerged shoots and leaves tend to have slightly higher concentrations of manganese oxide on their external surfaces, but overall, more metals were associated with the roots than the shoots. Median values of manganese concentrations were 22,000 mg/kg dry root

and 1,700 mg/kg dry shoot, respectively, compared to 7,000 mg/kg dry sediment and 1 mg/L in surface water.

The root to shoot ratios of manganese and nickel were found to be highly correlated across different plant samples. However, zinc did not show the same trend; it was nearly always found evenly distributed between roots and shoots, indicating a different uptake mechanism. Metal concentrations in sediment and water speedwell did not correlate with surface water concentrations, thus, water speedwell and other local factors may control both the release and reprecipitation of manganese oxides in the stream.

To determine metal uptake rates, a known mass of plants was placed in a container with artificial surface water spiked with known metal concentrations. The change in metal concentration from solution was monitored over time. Manganese, nickel, and cobalt followed similar trends of an initial rapid decrease in metal from solution followed by a slower uptake rate. As much as 50 percent of the manganese and nickel were removed from solution over a five-day period.

Overall, the results suggest that the primary mechanism that water speedwell provides for enhanced metal removal is to provide surfaces conducive for precipitation of metal oxyhydroxides. In that capacity, water speedwell may play a significant role in removing metals from solution, accumulating metals at levels well above sediment concentrations.

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Isotope Analysis

²H ¹³C ¹⁴C ¹⁵N ¹⁸O ³⁴S ³⁷Cl

¹⁵N of NO₃⁻, Inorganic ³⁷Cl, ²H + ¹⁸O in Groundwater
²H, ¹³C, ¹⁴C, ³⁴S of crude, Petroleum Fuels & Gases

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