

Paper # 00-995

Innovative Methods for Treatment of Nitrate-Contaminated Groundwater: The Apache Wetland

Leo S. Leonhart, Hargis + Associates, Inc.
Eric M. Roudebush, Hargis + Associates, Inc.
Chris J. Courtney, Hargis + Associates, Inc.
Erik J. Nelson, Hargis + Associates, Inc

The Apache Wetland is a constructed treatment wetland designed to remediate nitrate-contaminated groundwater and return it via recharge or runoff to the San Pedro River. The wetland is a media component of the Apache Powder Superfund Site in Cochise County, Arizona, addressing the treatment of a portion of the nitrate plume in the San Pedro River alluvial aquifer. The groundwater contamination originated from wastewater discharge into unlined ponds operated by a nearby

nitrate product manufacturing plant. The wetland remediation system was constructed in 1997 and consists of a ~100-ft deep extraction well, a ~5000-ft long delivery pipeline, 5 ponds in series with a total surface area of ~5 acres, and a ~3000-ft long return pipeline. The maximum treatment rate through the system is ~250 gal/min. The system is designed to reduce nitrate-nitrogen in the influent groundwater from concentrations greater than 300 mg/l to less than 10 mg/l (the federal drinking water "Maximum Contaminant Level"). This is accomplished primarily via anaerobic microbiological denitrification as well as macrophytic uptake of nitrogen nutrients. An intermediate treatment cell removed ammoniacal residuals via aerobic nitrification. Based on bench scale tests performed at Humboldt State University an average wetland residence of 7 to 10 days is required to achieve this level of treatment. Unique design features and operational capabilities of the system include: Using natural strata to facilitate subsurface treatment processes; Constructing cutoff walls from on-site clay strata to prevent underflow of pond berms; Installing a discharge bypass valve to route poor quality water to locations where groundwater recharge will not occur while adjusting system upsets; Routing treated discharges to a location where either groundwater recharge or streamflow augmentation can occur; and Providing transported water to nearby residents for irrigation usage.