Geophysical and Water Quality Sampling with Depth in a Public Supply Well in Temple Terrace, Florida and Implications for Water Supply Managers

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Flow, water-quality, core, and geophysical data from a 174-foot public-supply well in Temple Terrace, Florida, were compared to provide resource managers with decision-making tools. Previously collected water quality samples from the well contained low concentrations of nitrate, atrazine, chloroform, trichloroethylene, arsenic, uranium, and radon. A steady-state ground-water flow model, calibrated to identify the potential contributing area to this well, does not adequately represent local characteristics of flow. To improve model calibration and identify potential zones of higher contaminant concentrations, depth sampling was undertaken. To perform geophysical logging and obtain water quality samples the turbine and bowls were removed and a small temporary submersible pump was installed in the well in October 2004. Gamma, resistance, caliper, spinmeter, Electromagnetic (EM) flowmeter, temperature, and conductance logs were then run under pumping and ambient conditions throughout the open interval of the well. The results of the caliper log and a previously recorded video log showed multiple small caverns in the open interval between 134 to 152 feet below land surface and a large conduit (approximately 4 by 3 feet aperature, length of conduit undeterminable) at a depth of approximately 164 feet below land surface. The karst features at these depths provided most all of the flow to this well based on results of the EM flowmeter, spinmeter, temperature, and conductance results. The large conduit at 164 feet provided about 70 to 90 percent of the total flow of water under pumping conditions. This information was used to select water quality sampling intervals at 3 depths under pumping conditions and at 2 depths under ambient conditions to study how contaminants enter the well. Preliminary water quality results indicate that water entering the well is on average less than 2 years old. Chloroform and trichloroethylene (TCE), at concentrations less than 1 microgram per liter (ug/L), were detected in all samples. Nitrate (3.6 milligrams per liter (mg/L)) and dissolved oxygen (1.0 mg/L) concentrations peaked in a sample collected from 160 feet below land surface (corresponding to the largest conduit) under non-pumping conditions. Arsenic (18.9 ug/L) and uranium (5.3 ug/L) concentrations were highest in samples from the depth interval 140 to 160 feet under pumping conditions. High arsenic concentrations have been previously found in core samples collected from the Hawthorn Group.

Water quality and flow information collected with depth in public supply wells may be used by water managers to make decisions about specific zones that may be avoided to improve the quality of water from the well. In this particular well, concentrations of contaminants were relatively low and well below USEPA maximum contaminant levels (MCLs)[1], but were present in the highest production zone (at 140 to 164 feet below land surface). Production would most likely be compromised if this zone was closed off to improve water quality.

[1]U.S. Environmental Protection Agency maximum contaminant level for drinking water.