

WELL COMPLETION EVALUATION

Is construction according to spec – in new wells & applicability of evaluation in old wells

Evaluation of well construction in new wells is important to determine if specifications have been followed, or in old wells if there is concern well integrity has degraded over time. If completion is not according to specification and grout or other specified annular seal material is not continuous, there may be voids behind casing or other integrity problems that can provide an opportunity for vertical migration of contaminants or undesirable formation water into the well. In the example here, borehole geophysical and hydrophysical methods were applied in this large, high yield water supply well to verify well completion, both within and behind casing, and to evaluate the vertical distribution of flow and water quality.

This well was used as a municipal supply well for a large city in Utah. A chlorinated hydrocarbon plume in the upper, shallow saturated zone had migrated to the well location, potentially impacting the water quality in the deeper, open hole portion of the well. The well was taken offline after low-level detections of TCE were found.

Logging was conducted to help make the decision on whether to rehab the existing well, or to construct a new replacement well. Multiple geophysical methods (mechanical caliper, analog video, natural gamma, gamma-gamma density, and compensated neutron) were used to assess casing integrity, annular seal quality, and/or to confirm well construction details. Vertical distribution of flow and water quality was assessed using a combination of electromagnetic flowmeter and hydrophysical logging methods (under both ambient and pumping conditions), and additional water quality data were obtained via discrete point sampling under pumping conditions. The data were also used to provide detailed aquifer information for the site conceptual model (SCM).

Evaluation of the data collected, and integration of the geophysical data with the flow and water quality information from hydrophysical logging, was conducted. Based on the analysis of the data, it was determined that the existing well could be used, and no new replacement well was needed. The vertical evaluation of the distribution of flow, water quality and well conditions indicated that impact to water quality was sufficiently low, and well condition sufficiently intact, to allow continuing well operation. Replacement of this municipal production well would have been extremely expensive, so confirmation that this well could be utilized was good news.

The upper portion (A) of the figure on the reverse of this page presents the casing integrity, annular seal quality, and well construction details in the upper, cased portion of the supply well. Some intervals had lower quality seal, or voids behind the casing, than did others, which could compromise the overall viability of the well.

The lower portion (B) of the figure presents the results of the hydrophysical logging and geophysical logging below the water table, in the screened portion of the well. Multiple conductive features were identified and the interval-specific flow and water quality data are presented. Correlation of these data with respect to geophysical data added significant value in the understanding of the site hydrostratigraphic model. In this case, integrated evaluation of multiple geophysical logs was important in the effective and accurate analysis of this well.