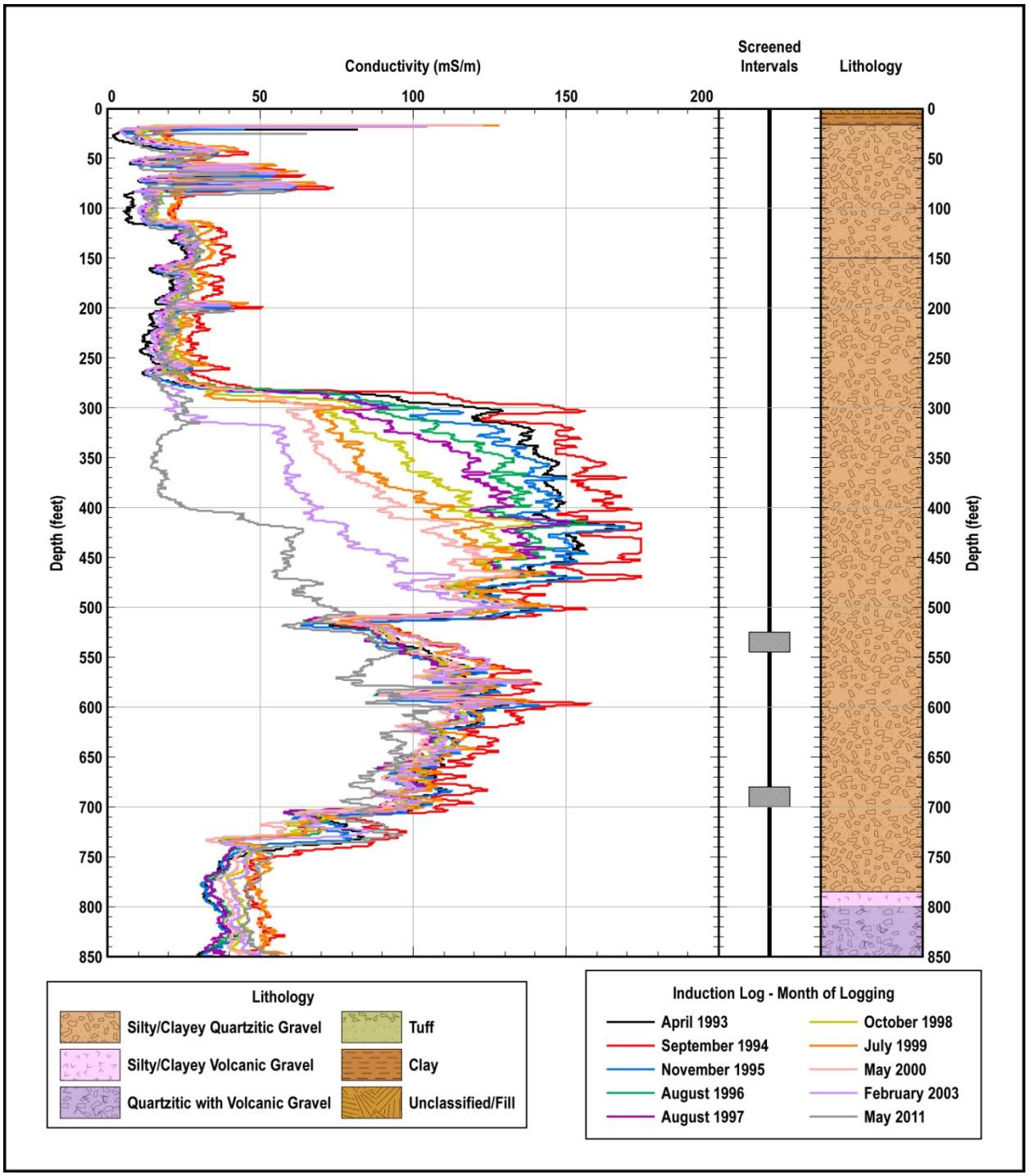
USING ELECTROMAGNETIC INDUCTION GEOPHYSICAL LOGGING TO MONITOR PLUME MIGRATION AND THE EFFECTIVENESS OF GROUNDWATER PUMP AND TREAT SYSTEMS

Accurately monitoring changes in a contaminant mass over time can be expensive and labor intensive. Unless plume monitoring wells are constructed with specific knowledge of the locations of water-bearing intervals, and properly screened to intercept these intervals (see RAS Case Study #1), changes in water quality of time are often missed. The Electromagnetic Induction method is useful in measuring formation water quality (fluid electrical conductivity) in open or PVC-cased holes. Although the method actually measures total formation conductivity (including both bulk and fluid conductivity), since the bulk properties of the formation will not change significantly over time, changes in formation conductivity are assigned to a reduction (or increase) in fluid conductivity.

In this actual case study, a plume of high TDS (high fluid conductivity) water was being remediated via a pump & treat system. Due to the large plume footprint and number of wells, the cost and time necessary to accurately monitor the effectiveness of the remediation system was significant. Further, in many locations within the plume footprint, wells were not screened in the intervals from which the pump & treat system was removing most of the water. As such, those wells could not monitor changes in TDS over time.

EM logging was used at this site to monitor changes in formation (fluid) conductivity over time. Time-series EM Induction logs were collected in wells over an 18 year period beginning in 1993. By noting significant changes in formation conductivity at specific depth intervals over time, the reduction in TDS could be monitored in intervals where no screen was present. In the example presented on the back, the interval most impacted by contamination was from 280 to 510 feet. In 1994, the conductivity in this zone averaged approximately 150 μS/cm. Conductivity in the un-impacted, upper portions of the same unit (110 to 280 feet in depth) were relatively unchanged over the 18-year monitoring period and averaged about 25 μS/cm. The change in formation conductivity in the impacted interval from 150 μS/cm in 1994, to between 20 and 60 μS/cm in 2011, is assigned to the significant reduction n TRDS of this water though long-term operation of the remedial system.



Time-series EM Induction logs were collected in this well over an 18 year period beginning in 1993. High TDS water was remediated via a pump & treat system. In this well, the interval most impacted by contamination was from 280 to 510 feet. Samples collected from within the screened intervals in this well do not reflect the change in fluid conductivity (from a reduction in TDS). However, EM Induction logging has been effective in monitoring the reduction in fluid conductivity. The most recent log indicates that significant clean-up has occurred in this part of the aquifer.