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Application of the HPT-GWS for Hydrostratigraphy and Water Quality Investigations

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Background/Objectives. Many years of work in the environmental characterization and remediation industry have clearly shown that high resolution information about site hydrostratigraphy and contaminant distribution are critical to the development of an accurate conceptual site model and achieving remediation objectives in a timely manner. Over the past few years the hydraulic profiling tool (HPT) with its injection pressure logs and tandem electrical conductivity (EC) logs has proven to be a valuable technology for detailed characterization of site hydrostratigraphy in unconsolidated formations. A new HPT probe has been designed with multiple injection ports that also may function as sampling ports. This new probe is called the Hydraulic Profiling Tool-Ground Water Sampler. Preliminary testing of the HPT-GWS was conducted in an alluvial aquifer system in central Kansas at depths approaching 100 ft to evaluate performance of the new tool for defining hydrostratigraphy and groundwater profiling for water quality.

Approach/Activities. While testing the HPT-GWS at the field site the injection pressure logs were monitored to determine permeable zones in the formation where groundwater could be successfully sampled. At the selected depths probe advancement was halted and a small down-hole pump was operated to purge groundwater from the aquifer. A water quality meter was placed in-line to monitor water quality parameters to stability prior to sampling for analytes of interest. Changes in water quality parameters were used to guide locations and depth intervals for sampling major element cations/anions as well as the natural occurring elements arsenic and uranium that may impact use of the aquifer as a local drinking water supply.

Results/Lessons Learned. During field activities a strong relation was observed between groundwater specific conductance and bulk formation EC in the coarse grained aquifer facies. This relationship was then used to further guide the placement of log locations but more specifically the selection of depth intervals for groundwater profiling. We learned that the bulk formation EC could be used to define zones in the local aquifer facies where fresh water recharge was occurring below local storm water retention basins and were brine from the shale bedrock was impacting the water at the base of the aquifer. Results for arsenic and uranium were all below action levels indicating that neither the fresh water recharge nor the brine impact were mobilizing these naturally occurring, hazardous elements, in the aquifer. However, the elevated levels of sodium, chloride and sulfate due to the brine impact in the lower zone of the aquifer limit its use for a municipal water supply in this area. The results here demonstrate that the HPT-GWS can be used to define formation hydrostratigraphy at the inch-scale and may be used to accurately sample for contaminants at multiple depth intervals (profiling) at the part-per-billion level in formations with sufficient permeability.