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How to Map the GSI of a One-Mile Long, 10 PPM TCE Plume

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Background/Objectives. A one mile long, 10 PPM+ TCE plume was identified at a site in the Midwestern United States through the use of high-resolution, Smart Characterization. The plume, originally missed by the use of a conventional monitoring well network at the site, was found to be discharging to a stream, one mile north of the site. Groundwater samples upgradient of the stream still contained TCE concentrations above 10 PPM, but the actual discharging groundwater concentrations were not defined. The GSI at the site was mapped using multiple approaches, including vertical aquifer profile sampling from a boat-mounted direct push drilling rig, collection of soil cores, Henry Samplers, seep sampling, surface water sampling, and passive diffusion bags. The first stage of GSI characterization mapped the venting groundwater concentrations at a relatively coarse level (100-200 ft spacing) across the floodplain, which identified the local area where the majority of the plume is discharging. Next, the identified local area of plume discharge was mapped at a finer scale (25-50 ft spacing) to determine the concentrations in shallow discharging groundwater. Finally, the area of discharging groundwater was targeted with repeat porewater sampling to better evaluate the spatial and temporal variability of the discharging groundwater. All GSI data were integrated into the project 3D digital conceptual site model (CSM) which also integrated the plume mapping from the high-resolution site characterization to facilitate rapid decision making in the field.

Approach/Activities. The GSI at the site was mapped using multiple approaches, including vertical aquifer profile sampling from a boat-mounted direct push drilling rig, collection of soil cores, Henry Samplers, seep sampling, surface water sampling, and passive diffusion bags. The first stage of GSI characterization mapped the venting groundwater concentrations at a relatively coarse level (100-200 ft spacing) across the floodplain, which identified the local area where the majority of the plume is discharging. Next, the identified local area of plume discharge was mapped at a finer scale (25-50 ft spacing) to determine the concentrations in shallow discharging groundwater. Finally, the area of discharging groundwater was targeted with repeat porewater sampling to better evaluate the spatial and temporal variability of the discharging groundwater. All GSI data were integrated into the project 3-D digital conceptual site model (CSM) which also integrated the plume mapping from the high-resolution site characterization to facilitate rapid decision making in the field.

Results/Lessons Learned. The GSI characterization yielded several important results. Although groundwater seeps in the floodplain were numerous, it was found that the seeps were non-detect and not contributing contaminant mass. Soil cores completed across the floodplain identified a thick sequence of organic-rich sediments, which was enhancing TCE biodegradation in the upper 5 to 10 feet of aquifer. TCE degradation was supported by the trends observed in porewater sampling, with the disappearance of TCE and concurrent appearance of daughter products in shallow groundwater samples. Significantly, the presence of the organic sediments and the resulting degradation of TCE were not apparent from the monitoring well network and groundwater samples collected upgradient of the stream, highlighting the need for proper GSI characterization.