

## Fractured Bedrock Characterization in the Foothills of Alberta – Old Sites, New Ideas

Tim Van Dijk and Amit Sharma, Matrix Solutions Inc.

The structural geology of the foothills can create complex hydrogeological environments to manage where contaminants are present in fractured bedrock aquifers with connectivity to surface water bodies. The foothills were an area of extensive oil and gas developments in the 1960's through 1980's, and have been undergoing assessment as contaminated sites for decades. Over this time, technology and conceptual understanding of contaminant fate and transport in fractured rock has advanced significantly. Recently, Matrix has been revisiting these sites and applying modern approaches for fractured rock characterization to: 1) gain a better understanding of the conceptual site model (CSM), and 2) develop long term remedial action or risk management plans. The key parameters required to develop a quantitative model for a fractured rock site include 1) fracture orientation, 2) fracture frequency, 3) fracture aperture, 4) fracture porosity, and 5) hydraulic conductivity. The field investigative methods for this work included bedrock coring, geophysical logging, packer testing, pump testing, transmissivity and reverse-head profiling and multi-port well installations using FLUTe (Flexible Liner Underground Technologies), and discreet interval groundwater monitoring and sampling. The field data collected allowed for an analysis of aquifer parameters such as bulk and discreet interval hydraulic conductivity, anisotropy, vertical hydraulic gradients, and fracture network orientations, density, frequency, and mechanical and hydraulic aperture. The laboratory investigative methods included core testing to determine permeability, porosity, and fracture porosity. With this spectrum of data, quantitative predictions on plume transport, attenuation and risk to receptors will be investigated with increased confidence.

### Tim Van Dijk

Tim Van Dijk has been with Matrix Solutions since 2005. His experience has included groundwater monitoring programs, contaminated sites assessments, aquifer characterization, water supply and disposal, groundwater remediation, and integrated groundwater-surface water monitoring programs.

### Amit Sharma

Amit Sharma has over 8 years of hydrogeology and remediation experience. His work experience includes leading hydrogeological assessments, contaminant investigations, spill response, and project supervision for environmental impact assessments, groundwater supply investigations for in situ oil sands, and groundwater monitoring for oil and gas, coal mining, and conventional oil and gas projects.