Project Brief: Bedrock and Overburden Investigations at Massachusetts Industrial Site

STONE ENVIRONMENTAL

Services / Expertise
Site Characterization
Chlorinated VOCs
Membrane Interface Probe
Packer Sampling
Flute Liner Installation
Bedrock Core Analysis
3-D Visualization Modeling

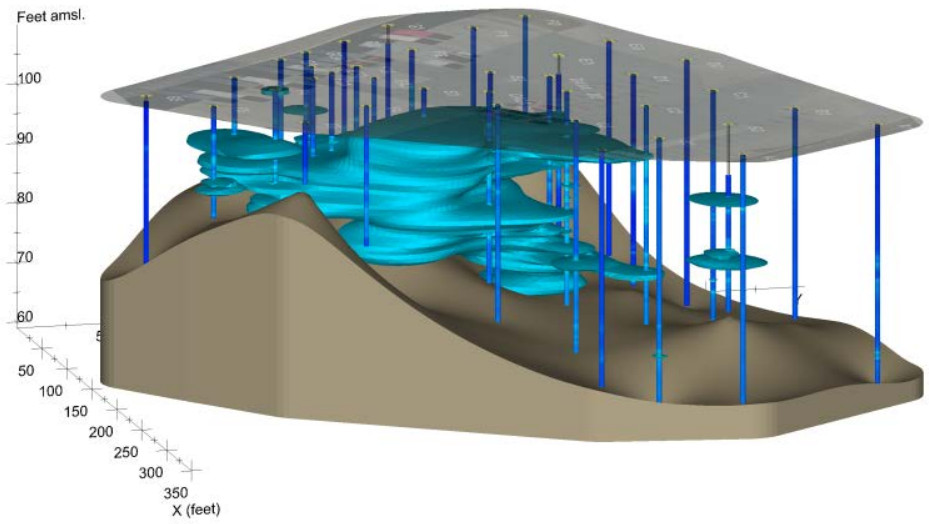
Markets
Industrial Client

Project Location
Needham, Massachusetts

Date Completed
2015

Project Owner
Private Industrial Client

Project ID#
15-074



EVS 3-D visualization of VOC distribution in the subsurface.

STONE Environmental (Stone) was retained to conduct Membrane Interface Probe (MIP) overburden investigations, generate 3-dimensional visualization figures, and support a program of rock core sampling and analysis, bedrock fracture hydraulic testing, and low-flow groundwater sampling at seven bedrock borehole locations at a site in Needham, MA.

The MIP investigations were conducted in the overburden and the data collected was used to generate three dimensional models of EC, PID, XSD, and FID results using the Earth Volumetric Studio (EVS) version 2015.3.0 (beta) computer software package from C TECH Development Corporation. EVS conducts three-dimensional kriging interpolations employing an expert system to compute variogram parameters used in the interpolation process.

The bedrock investigations were conducted to assess the distribution of chlorinated volatile organic compounds (VOCs) within the bedrock matrix and the bedrock fractures. Boreholes were drilled in June 2015 and Bedrock fracture hydraulic testing and low-flow groundwater sampling was conducted in July 2015.

Coring was conducted using HQ3 size tooling. The five foot long HQ size core barrels generate 63.5 mm (2.5-inch) diameter cores. A triple-tube core barrel (HQ3) was utilized to minimize disturbance to the core. This method limited the disturbance and mechanical breaks of the core samples, and provided cores that better reflected the in situ fracture distribution. A total of 80 rock core samples were collected for VOC extraction and analysis in accordance with the CORE Discrete Fracture Network™ (DFN™) procedure. Seven intact core samples were collected for physical property analyses (porosity, water content, bulk density, specific gravity, and total organic

carbon). VOC extraction and analysis of the rock core samples were conducted at the Stone laboratory in Barre, VT during June and July 2015.

Sample locations were selected for VOC analysis based on fracture distributions and lithology with a target frequency of approximately one sample every foot. Samples were collected both from fracture surfaces and from the intervening un-fractured rock matrix, where applicable. The outer portion of the sample was trimmed and the remaining subsample was then placed in a stainless steel cell and crushed using a hydraulic press under a pressure of approximately 6,000 pounds per square inch. The crushed subsample was immediately transferred to a pre-labeled 40mL VOA vial containing 15 mL of purge-and-trap grade methanol.

After completion of each borehole, Stone measured the static groundwater level, and then tested the full borehole hydraulic properties via rising and falling head tests utilizing a stainless-steel slug. Groundwater elevation changes were measured using In-Situ® Troll 700 pressure transducers, and data were extracted using WinSitu5 software.

Following each full borehole test, two to four discrete fracture intervals were measured using a packer assembly, lowered into the borehole using a GeoProbe® 6610 winch. Each interval was packed off and monitored for water level stabilization prior to hydraulic testing. Following the hydraulic testing, dedicated sample tubing was inserted into the packed interval, and low-flow groundwater sampling was performed, using a GeoTech® GeoPump peristaltic pump. The drawdown during the low-flow sampling was monitored by the pressure transducer. A total of 20 discrete bedrock intervals were hydraulically tested and sampled, in addition to the seven full boreholes that were hydraulically tested. Following testing, FLUTe liners were inserted in four of the boreholes where there was potential for flow to occur between fracture intervals within the borehole under open borehole conditions.

Cascade Laboratory Equipment