HYDROGEOLOGIC CHARACTERIZATION OF TWO SALT CONTAMINATION SITES IN MAINE

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Sand and salt storage piles are operated by state and town governments for use in winter highway maintenance. Many of these piles have been stored unprotected on open ground and have contaminated nearby groundwater. Salt contamination sites provide a unique opportunity to study sediment-fractured bedrock aquifer systems. Salt contamination sites in Washington and Glenburn, Maine, were studied through the use of surficial and borehole geophysical methods and numerical modeling.

Seismic refraction analyses were used to constrain the depth to bedrock. Electromagnetic methods enabled the extent of the contaminant plume to be mapped. Borehole fluid conductivity logging was performed in an attempt to locate hydraulically conductive fractures and to determine fracture inflow parameters. Two borehole methods were utilized: down-hole fluid conductivity logging (Tsang *et al.*, 1990, *Water Resources Research* **26**, p.561) and borehole diffusion/dilution, which was developed for this project.

Tsang's method involves exchanging contaminated well water with purified water. After exchange, the well is pumped and an electrical conductivity profile is logged as the formation water returns to the well. Individual peaks in the profile indicate the location of conductive fractures. A finite-element model, BABORE, was written to interpret field data. The Theis equation was used to determine the transmissivity of discrete fracture zones.

Borehole diffusion/dilution is a single-hole tracer test that is performed without the use of packers. A tracer is introduced to a well. As diffusion occurs, an electrical conductivity profile is logged for the well. Once the solute front reaches a hydraulically

conductive fracture, dilution of the diffusing front occurs within the borehole in the vicinity of each fracture as fresher water enters the well bore. A finite-element model, F2BD2, was written to simulate the borehole diffusion/dilution method. By fitting curves to the field data, groundwater velocities at discrete fractures were inferred.

Using the field studies to constrain model parameters, the USGS program SUTRA was used to model the study sites. Hydraulically conductive fractures at the Washington site control contaminant transport, but the hydraulic conductivity of the overlying sediment controls the rate of natural groundwater quality restoration. The saturated till at the Glenburn site controls contaminant transport.