# Characterization of Rapid, Localized Groundwater Transport in the Crater Flat Tuffs, Yucca Mountain, Nevada

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We recently conducted a study to characterize the spatial distribution and magnitude of groundwater flux through the Crater Flat Group of volcanic tuffs, approximately 15 km south of the proposed high-level nuclear waste repository at Yucca Mountain, Nevada. In borehole NC-EWDP-24PB (24PB), an extensive logging program, which included flowing fluid electrical conductivity (FEC) and distributed thermal perturbation sensor (DTPS) logging, indicated that fluid flux was spatially concentrated within sections of the Bullfrog tuff and Tram tuff subunits of the Crater Flat Group. While the FEC logs have identified transmissive zones, quantitative interpretation of the FEC results was difficult because differences in hydraulic heads in different flowing intervals created significant intraborehole fluid flow. The well was subsequently backfilled and completed with a distributed thermal perturbation sensor (DTPS), a novel instrument that introduces a thermal pulse to the wellbore and uses the thermal transient to estimate groundwater flux. The DTPS has identified two flowing intervals within the Bullfrog tuff that are each approximately 20 m thick and exhibit an average specific discharge of 50 m/yr, corroborating the FEC observations. Given that the kinematic fracture porosity is generally thought to be less than 1% for these fractured tuffs, groundwater velocities are estimated to be on the order of 5 to 10 km/yr. Since 24PB is located along predicted groundwater transport pathways for radionuclides that may potentially escape the repository and enter the saturated zone, additional data will be needed to determine the lateral extent of these fast flowing intervals.

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