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# Detection of Preferential Flow Paths at Coal Mine Sites Using Integration of Soil Fas Mapping and Vertical Flow Meter Borehole Logging

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**Abstract** Mining impacts on the adjacent river and groundwater systems are likely to be controlled predominately by preferential flow zones provided by faults, fracture and coal seam cleats. Identification of open active faults and fracture zones is a part of exploration study prior to mining operation. However, detailed mapping of geological continuities in a low permeable overburden is rarely carried out in the mining area. The goal of the study is to quantify the hydraulic connectivity between coal mines and adjacent river and groundwater systems in the Hunter River Valley region, Australia. Field investigation is attempted to integrate non-invasive high-density soil gas concentration mapping and high precision vertical flow meter logging to delineate the subsurface extension of faults and permeable fracture zones in the study area. The integration of these techniques for localizing decimeter scale permeable structures is unique to our best knowledge. Such a combination is innovative and likely to produce new insights into the heterogeneity of the fractured rock system over a range of scales. Field results are demonstrated in a successful application in decimeter scale. Geophysical model and soil gas mapping are conducted independently, but both two methods indicate the very same geological structure crossing the sampling region.
**Keywords** hydraulic conductivity, groundwater system, field inverstigation