

Buried tunnel valley aquifers in the Fort McMurray region, northeast Alberta

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Three dimensional modelling of geophysical and lithological data has improved the understanding of the bedrock topography and the distribution, morphology and sedimentary architecture of buried tunnel valleys in the surface-mineable and in situ–recoverable oil sands area north of Fort McMurray.

Valley fills comprise a range of glaciogenic lithofacies, including stacked sequences of diamict, glaciofluvial sands and gravels and glaciolacustrine silts and clays. Such materials may constitute targets for the supply of potable water for municipal and industrial use.

Unlike the more continuous aquifers located in large, preglacial bedrock valleys south of the study area, these buried glacial aquifers are largely confined to the tunnel valleys, which have high depth to width ratios, with undulating, low gradient longitudinal profiles. Many valleys start and end abruptly, and occur as solitary, straight to slightly sinuous incisions, or form widespread anastomosing networks. Typically, these valleys are between 0.5 and 3 km wide and 10 and 30 m deep, although in some cases the depth of incision exceeds 100 m. Several valleys extend for up to 60 km, but most are between 10 and 30 km long. Although most valleys do not form a continuous, well-connected networks across the region, they may still function as natural pathways for the subsurface movement of water or other fluids at the local scale.