Geological and numerical flow models were developed to explore the hydraulic role of buried valley aquifers in regional groundwater flow and assess the potential groundwater resource. The study area was the central Peace Region in Northeast British Columbia. The reservoir software Petrel was used to construct the geological model of a buried valley network by integrating interpretations from an airborne electromagnetic survey (SkyTEM) and borehole gamma-ray and lithology logs. This detailed geological model and a simplified geological model were used to develop two numerical flow models in MODFLOW. The modelling results suggest that permeable deposits exist within the buried valleys, but are not regionally connected throughout the whole network, and thus do not play a significant role in the regional groundwater flow regime. However, extensive permeable deposits within the buried valleys appear to exist at smaller scales, and may offer a viable water source in the area.