

GROUNDWATER

Study geographic boundaries: PDA, PEAA.

Study time boundaries: Construction, operations, and decommissioning.

Project works and activities considered in the study*:

- RoW and site preparation (grading, blasting)
- Temporary and permanent road development (grading, blasting)
- Pipeline construction (open trench, blasting, temporary dewatering)

- Tunneling and waste rock disposal, groundwater management (temporary dewatering)
- Camp operations (groundwater use)
- RoW maintenance (temporary dewatering)
- Operations at Bruderheim initiating pump station, pump stations, Kitimat Terminal (groundwater use)
- Site restoration

Study methods: The project crosses five physiographic regions, which are characterized by different geological, climatological and topographic conditions that influence groundwater flow within the region. Groundwater quantity includes the components of flow rates and direction. Groundwater quality describes the chemical quality of the groundwater and measured by determining the concentration of chemical parameter(s).

VEC	Key Issues	KIR	Baseline Results	Measurable Parameter	Potential Project Effects**	Proposed Mitigation	Residual Effects	Cumulative Effects
Hydrogeology	<p>Altered groundwater flows</p> <p>Diminished groundwater quality</p> <p>Acidic rock drainage</p> <p>Effects on groundwater use by local groundwater users</p> <p>Disruption to groundwater/surface water interactions</p>	n/a	<p>Only a few towns and settlements in British Columbia near the RoW use groundwater as potable water sources: Kitimat, Burns Lake, Fort St. James and Bear Lake. In contrast, groundwater use is more widespread in Alberta and intense use is noted between Whitecourt and Bruderheim. As a result of these usage patterns, a more detailed understanding of groundwater systems exists in the Southern Alberta Uplands and Eastern Alberta Plains regions than in the three other physiographic regions.</p> <p>The most productive and most often exploited groundwater aquifers are typically made up of surficial deposits. These are mainly glacial or recent alluvial deposits. In the Coast Mountains, large deposits are found within the Kitimat-Terrace valley with less extensive alluvial deposits found along other river valleys in this region. Broader distributions of glacial deposits are found in the Interior Plateau and, in particular, glacial lake deposits centred on Prince George have been reworked by the major rivers of the Fraser Basin to form productive aquifers. Related glacial deposits are found locally where the RoW traverses to the north of this basin. Volcanic flows in the Interior Plateau might also form aquifers; however, these have generally not been exploited. Within the Rocky Mountains, sandstone units of the Fort St. John Group and the Bullhead Group constitute the main aquifers.</p> <p>In general, low permeability glacial deposits cover much of the Southern Alberta Uplands region and Eastern Alberta Plains region with groundwater aquifers made up of granular surficial material found within recent alluvial and buried valley deposits. Productive bedrock aquifers are found in the Southern Alberta Uplands and Eastern Alberta Plains in sandstones from the Wapiti and Paskapoo formations.</p>	Groundwater quantity	<p>Grading and trenching may affect groundwater levels or direction of groundwater flow.</p> <p>Project activities may alter flow on local shallow groundwater use or groundwater/ surface water interactions.</p> <p>Blasting may affect bedrock well yields.</p> <p>Temporary dewatering during pipeline construction or groundwater management during tunnelling may affect groundwater levels.</p>	Currently being assessed.	No significant effects on groundwater quantity are expected as effects will likely be local, short term and reversible.	Currently being assessed.
				Groundwater quality	<p>Waste water releases from camps may affect water quality in shallow groundwater.</p> <p>There may be some effects from ripping and blasting activities, and the effects of acid rock drainage on groundwater quality.</p>	Currently being assessed.	No significant effects on groundwater quality are expected as effects will likely be local, short term and reversible.	Currently being assessed.

*Refer to Figure 3.1 in section 3, Project description, for the full list of physical works and activities. **The effects of spills and malfunctions will be included in the update for the supplemental filing.