Aquifer Name: Brilliant Bedrock Aquifer

Aquifer Number: 1283

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A. AQUIFER DESCRIPTION FOR AQUIFER 1283

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

Bedrock Aquifer 1283 is located southeast of the confluence of the Kootenay and Columbia rivers in the vicinity of the Brilliant Power station and Dam (see Figure 1; Lengyel et al. 2024). Bedrock forms a regionally extensive geological/hydrostratigraphic unit. The extent of the aquifer is defined based on topography, major surface water features, and water licensing watershed boundaries. The Columbia River forms the western boundary while the Kootenay River forms the northern boundary (major geographical features). The rest of the aquifer is mapped using inferred groundwater divides (ridges) drawn using the surface licensing watershed boundaries and are a representation of topography (extent of the drainage basin) in the area.

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

Fulton et al. (1984) described the area of the aquifer to be overlain by glaciofluvial sand and gravel along the Columbia River floodplain. The bedrock outcrops in the rest of the area. Aquifer 1283 may be locally overlain by the sediments of overburden aquifer 0501. Depth to bedrock ranges from 13.4 to 137.2 m along the Columbia River. The average depth to bedrock is 52.6 m.

A.1.3 GEOLOGIC FORMATION (AQUIFER) – SUBTYPE: 6B – FRACTURED CRYSTALLINE ROCK

The aquifer is composed primarily of fractured igneous intrusive rock (granodioritic; Cui et al., 2017). A small portion is volcanic rock (basaltic). Bedrock forming the aquifer is of the Mesozoic Era.

As the bedrock has been faulted and fractured throughout the area of the aquifer and surrounding region and well yields change over short distances and do not appear to be correlated with bedrock type, secondary permeability is expected to be dominant in all types of bedrock; and as such, all these rocks may act as aquifers. Accordingly, bedrock aquifers are expected to extend across lithological boundaries.

A.1.4 VULNERABILITY - MODERATE

The bedrock aquifer is comprised of fractured rock. Depth to groundwater varies from shallow to deep, with an average depth of 41.3 m. The bedrock aquifer is confined, however, some areas throughout the aquifer show higher vulnerability (i.e., where permeable deposits are overlying the aquifer, overlying material is thin, and in higher elevations where the aquifer outcrops).

The average depth to bedrock is 52.6 m in the Columbia River floodplain. Vulnerability across the aquifer ranges from low along the floodplain of the Columbia River (where the aquifer is confined by overlying sediments [and where most of the development is expected to occur] and where the risk of contamination from land use is expected to be higher) to high further away from the river (in areas of topographical high where there is bedrock outcrops and thin overlying material). The overall vulnerability of the aquifer to surface contamination has been qualitatively assessed to be low.

A.2 CONCEPTUAL UNDERSTANDING OF FLOW DYNAMICS

A.2.1 GROUNDWATER LEVELS AND FLOW DIRECTION

Static water levels recorded in the provincial groundwater wells database (GWELLS) range from shallow (12.2 m) to deep (91.4 m). There are no wells with artesian groundwater conditions within the aquifer. There are no provincial observation wells within the aquifer.

The groundwater surface is interpreted to be a subdued representation of the topography based on regional interpolation of groundwater surface elevations. Groundwater is interpreted to flow from higher elevation in the southeast toward the Columbia River floodplain in the west.

No information has been identified on the primary porosity and permeability of the bedrock unit. Based on the type of material (primarily igneous intrusive rocks) and the large variation of reported well yields over short distances, flow is expected to occur primarily through fractures.

No information is available on how faults impact groundwater flow in the area. Fracturing associated with the faults is interpreted to enhance permeability.

A.2.2 RECHARGE

Recharge to the aquifer varies depending on depth to bedrock. In areas where the overburden is thick, surficial recharge to the aquifer is likely limited. The infiltration of precipitation and snowmelt is expected to focus on areas where overburden is thinner and away from the Columbia River in areas of higher topographic elevations where overburden is absent, and the bedrock outcrops at surface (Fulton et al. 1984). Much of the recharge is expected to occur in the spring associated with snowmelt. The aquifer may also be recharged by overlying tributaries of the Columbia River away from the river where the intervening overburden is absent. Aquifer 1283 may recharge the overlying overburden aquifer 0501; however, the spatial and temporal understanding of this recharge mechanism is uncertain and further investigation is required to confirm hydraulic connections.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Hydraulic connection to various surface water bodies (primarily the Columbia River which forms the western boundary and the Kootenay River which forms the northern boundary of the aquifer, and its minor tributaries) is expected. As the bedrock has been faulted and fractured throughout the Study Area, hydraulic connection to other aquifers (including the overlying overburden aquifer 0501) is inferred; however, the extent of the fracture network and its continuity requires further study. Hydraulic connection with the overburden aquifer may be limited should low permeability layers separate them.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Reported well yields for 27 out of 33 wells (excluding six wells that were dry or had no reported well yield) within the aquifer range between 0.03 L/s and 32.2 L/s[1], with a geometric mean of 0.7 L/s, indicating an aquifer with moderate productivity with localized zones of both low and high productivity. No other water quality or quantity concerns were reported in the water quality comments of the GWELLS database.

The wells within the aquifer are primarily used for domestic use and water supply based on well purpose recorded in GWELLS.

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

No water availability or water budget studies have been completed in the area.

A.4 AQUIFER REFERENCES

Berardinucci J. and K. Ronneseth, 2002. Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Cui, Y., Miller, D., Schiarizza, P., and Diakow, L.J. 2017. British Columbia Digital Geology. BC Ministry of Energy Mines and Petroleum Resources, BC Geological Survey Open File 2017-8, 9p. Data Version 2019-12-19.

Fulton, R.J., Shetsen, I., and Rutter, N.W., 1984. Surficial geology, Kootenay Lake, British Columbia-Alberta. Geological Survey of Canada, Open File 1084, 1:1,000,000 scale.

Geographic datasets from the BC Data Catalogue, accessed December 2022 https://data.gov.bc.ca/.

Lengyel, T., Verma, S., Deri-Takacs, J., and Hinnell, A. 2024. Aquifer Mapping in the Kootenay/Boundary Region of British Columbia: Creston, Rossland, Castlegar, and Salmo. Water Science Series, WSS2024-05. Prov. B.C., Victoria B.C.

[1] Groundwater well with highest well yield of 99.1 L/s (Well Tag Number 31358) was excluded as it was suspected to be an erroneous measurement.

A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
20230202	1	Major	Initial Mapping of Aquifer	Tibor Lengyel, M.Sc., P.Geo., Simrat Verma, M.Sc., and Andrew Hinnell, PhD, P.Geo.