Aquifer Name: West Creston Bedrock Aquifer

Aquifer Number: 1280

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A. AQUIFER DESCRIPTION FOR AQUIFER 1280

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

This bedrock aquifer is located on the west side of the Kootenay River near Creston (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 northern, southern, and western boundaries are a combination of inferred groundwater divides (ridges) and the U.S. border. Aquifer extents were drawn using the surface licensing watershed boundaries and are a representation of topography (extent of the drainage basin) in the area. The aquifer is expected to be continuous toward the south across the U.S. border. The eastern boundary was delineated by the Kootenay River (major geographical feature).

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

Fulton et al. (1984) described the area of the aquifer to be overlain by sandy loam and loamy till, sandy till, glaciolacustrine silt, clay, and sand, alluvium, and glaciofluvial sand and gravel. Sections of the till are described to be thin and discontinuous with thickness up to 2 m in some regions. Aquifer 1280 may be locally overlain by the sediments of overburden aquifer 0487. Depth to bedrock ranges from 0.9 to 68.0 m. The average depth to bedrock is 10.5 m. Bedrock outcrops at higher elevations.

A.1.3 GEOLOGIC FORMATION (AQUIFER) – SUBTYPE: 5A – FRACTURED SEDIMENTARY ROCK

The aquifer is comprised primarily of fractured sedimentary rock of the Proterozoic Eon. The formation is composed mainly of argillite, greywacke, wacke, and conglomerate turbidites with some dolomitic carbonates and quartzite/quartz arenites. A small section of the aquifer is comprised of metamorphic rock of the Proterozoic (greenstone/greenschist; towards the west of the aquifer), and igneous intrusive rock of the Mesozoic Era (granodioritic; in the north and south; Cui et al. 2017).

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 composed of fractured rock. Depth to groundwater varies from shallow to deep. The average depth to water is 14.5 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 at higher elevations where the aquifer outcrops). Depth to bedrock ranges from 0.9 to 68.0 m, with an average depth of 10.5 m. There are artesian groundwater wells within the aquifer. Vulnerability across the aquifer ranges from moderate 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 topographically elevated areas where the overlying material is thin or absent and the bedrock outcrops). The overall vulnerability of the aquifer to surface contamination has been qualitatively assessed to be moderate.

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 artesian to deep (78.6 m). There are 26 wells with artesian groundwater conditions within the aquifer, located along the Kootenay River. 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 elevations in the west toward the Kootenay River floodplain in the east (i.e., from locations of high head to locations of low head).

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

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 fine-grained overburden is thinner and in topographically elevated areas 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 Kootenay River where the intervening overburden is thin. Aquifer 1280 may recharge overlying overburden aquifer 0487; however, spatial, and temporal understanding of this recharge mechanism is uncertain and further investigation is required to confirm these hydraulic connections.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Hydraulic connection to various surface water bodies (primarily the Kootenay River, which forms the eastern boundary of the aquifer, and its 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 0487) is inferred; however, the extent of the fracture network and its continuity requires further studies. Hydraulic connection with overburden aquifers 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 104 out of 110 wells (excluding six wells that were dry or had no reported well yield) within the aquifer range between 0.03 L/s and 6.3 L/s, with a geometric mean of 0.4 L/s, indicating an aquifer with generally moderate productivity with localized zones of low and high productivity. No water quality or quantity concerns were noted in the water quality comments of the GWELLS database.

There is a mix of domestic and commercial wells in the area 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.

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.