Aquifer Name: East Creston Bedrock Aquifer

Aquifer Number: 0488

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A. AQUIFER DESCRIPTION FOR AQUIFER 0488

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

Aquifer 0488 has been consolidated with former bedrock aquifers 0499, 0982, and 0983. The aquifer is located on the east side of the Kootenay Lake and Kootenay River near Creston (see Figure 1; Lengyel et al. 2024). It is a bedrock aquifer delineated based on water licensing watershed boundaries and surface water bodies within a regionally extensive geological/hydrostratigraphic unit. The eastern and northern boundaries are inferred groundwater divides (ridges) drawn using the surface licensing watershed boundaries. The boundaries are a representation of topography (extent of the drainage basin) in the area. The western boundary is the Kootenay River (major geographical feature). Aquifer 1280, adjacent to aquifer 0488, is also part of the same geological/hydrostratigraphical unit. In the south, the aquifer is bound by the U.S. border; however, the aquifer is expected to be continuous in this direction.

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, sandy loam and loamy till, alluvium, and glaciolacustrine silt, clay, and sand. Sections of the till are described to be thin and discontinuous with thickness up to 2 m in some regions. Aquifer 0488 may be locally overlain by the sediments of overburden aquifers 0487, 0489, 0984, and 1279 where intervening materials are absent or permeable. Depth to bedrock ranges from 0.3 to 112.8 m. The average depth to bedrock is 20.5 m. Bedrock outcrops at higher elevations.

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

Aquifer 0488 is comprised of fractured sedimentary rock of the Proterozoic Era. The formation is composed mainly of argillite, greywacke, wacke, and conglomerate turbidites with some dolomitic carbonates and quartzite/quartz arenites. A small section (northwest portion) of the aquifer is comprised of igneous intrusive rock (granodioritic) of the Mesozoic Era (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; 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. The average depth to water is 20.7 m.

The bedrock aquifer is confined, although 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). Depth to bedrock ranges from 0.3 to 112.8 m, with an average depth of 20.5 m. There are artesian wells within the aquifer. Vulnerability across the aquifer ranges from moderate (where the aquifer is confined by overlying sediments [and where most of the development is expected to occur] and the risk of contamination from land use is expected to be higher) to high (in areas of topographical high where bedrock outcrops and overlying material is thin). 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 (85.3 m). There are 10 wells with artesian groundwater conditions 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 from the east toward the Kootenay River floodplain on the west.

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 primary 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 likely varies depending on thickness and material texture of overlying unconsolidated sediment. 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, 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. Recharge may occur through the overlying overburden aquifers 0487, 0489, 0984, and 1279. The aquifer may also be recharged by overlying tributaries of the Kootenay River where the intervening overburden is thin. Aquifer 0488 may regionally discharge in the Kootenay River, potentially recharging aquifers 0487 and 0489. Spatial and temporal understanding of the recharge mechanism, however, 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 western boundary of aquifer 0488, and tributaries) is expected.

Hydraulic connection to other aquifers (including the overlying overburden aquifers 0487, 0489, 0984, and 1279) may be possible should the fractures in the aquifer be continuous on a regional scale and the intervening sediments be thin and/or permeable; however, the extent of the fracture network and its continuity requires further studies.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Based on the water quality comments in the GWELLS database, two wells reported elevated water hardness as a water quality concern. Well yields for 364 out of 384 wells (excluding 20 wells that were dry or had no reported well yield) within the aquifer range between 0.0001 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.

There is a mix of domestic, irrigation, and observation wells within aquifer 0488 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.

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

Lengyel, T., Verma, V., 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
20020301	1	Major	Initial mapping of aquifer	N/A
20230202	2	Major	Remapping and consolidation of aquifers	Tibor Lengyel, M.Sc., P.Geo., Simrat Verma, M.Sc., and Andrew Hinnell, PhD, P.Geo.

Note: Author of first mapping not available