Aquifer Name: Salmo River Bedrock Aquifer

Aquifer Number: 0493

Date of Mapping: February 2nd, 2023

Authors: Tibor Lengyel, M.Sc., P.Geo., Simrat Verma, M.Sc., and Andrew Hinnell, PhD, P.Geo.

A. AQUIFER DESCRIPTION FOR AQUIFER 0493

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

The aquifer underlies the town of Salmo and the surrounding area (see Figure 1; Lengyel et al. 2024). In the southwest, the aquifer is separated from aquifer 0486 by a fault line (along Beaver Creek) where multiple dry (no yield) bedrock groundwater wells indicate the absence of active groundwater flow. The extents of the rest of the aquifer are defined based on topography, major surface water features, and water licensing watershed boundaries within a regionally extensive geological/hydrostratigraphic unit.

Aquifer 0493 has been consolidated with former bedrock aquifers 0494 and 0495.

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, 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 0493 may be locally overlain by the sediments of overburden aquifers 0496 and 1284. Depth to bedrock ranges from 0.3 to 51.8 m. The average depth to bedrock is 10.9 m. Bedrock outcrops at higher elevations.

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

Aquifer 0493 is comprised of fractured sedimentary rock (mudstone, siltstone, shale, fine clastic and limestone, slate, argillite), igneous intrusive rock (granodioritic), and fractured volcanics (basalts) of Mesozoic Era. There is a portion of sedimentary rock (mudstone, siltstone, shale, fine clastic) along the eastern boundary of the aquifer that is of the Paleozoic 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; and as such, all these rocks may act as aquifers. Accordingly, bedrock aquifers are expected to extend across lithological boundaries.

The aquifer was mapped outside the extent of well development; thus, uncertainty exists with aquifer properties.

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 13.6 m and average depth to bedrock is 10.9 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). Some sections of the overlying geology are described as thin and discontinuous. 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 where the risk of contamination from land use is expected to be higher) to high (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 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 (61.0 m). There are five well 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 locally to flow from mountain tops to valley bottoms discharging in the Salmo River, and the Erie and Beaver creeks, while regionally from higher elevations in the north/northeast (inland) to lower elevations in the south/southwest towards the Columbia River.

No information has been identified on the primary porosity and permeability of the bedrock unit, however, based on the type of material (basaltic volcanic rocks at some places), they may be high. Based on the large variation of reported well yields over short distances, groundwater flow is expected to occur primarily through fractures.

No information is available on how faults impact groundwater flow in the area. While fracturing associated with the faults is assumed to enhance permeability, based on the spatial association between dry wells and the fault delimiting the aquifer in the southwest, this regional fault is interpreted to act as a barrier to groundwater flow.

A.2.2 RECHARGE

Recharge to the aquifer 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 and 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 0496 and 1284. Mountain block recharge from the neighboring mountain ranges may be a source of recharge to this aquifer. The aquifer may also be recharged by overlying tributaries of the Salmo River where the intervening overburden is thin; 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

Bedrock wells located adjacent to Beaver Creek may be hydraulically connected to Beaver Creek. Most bedrock wells are located on the Beaver Creek floodplain. Hydraulic connection to various surface water bodies (rivers, creeks, and lakes) in the area 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.

The aquifer may also be hydraulically continuous with the overlying overburden aquifers (0496 and 1284) where the intervening sediments allow for it. Hydraulic connection across aquifer boundaries defined by inferred groundwater divides may also be possible contingent on the presence of fractures. Thus, aquifer 0493 may be hydraulically continuous with aquifer 0486, 0511, and 1282. Aquifers 0486, 0493, 0511, and 1282 are defined within a regionally continuous hydrostratigraphic unit.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Reported well yields for 123 out of 134 wells (excluding 11 wells that were dry or had no reported well yield) within the aquifer range between 0.006 L/s and 9.5 L/s, with a geometric mean of 0.5 L/s indicating an aquifer with generally moderate productivity with localized zones of low and high productivity. No water quality of quantity concerns were noted in the water quality comments of the GWELLS database.

There is a mix of domestic and commercial wells within aquifer 0493 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
20020303	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