Aquifer Name: East Pine - Groundbirch Bedrock Aquifer

Aquifer Number: 0591

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A. AQUIFER DESCRIPTION FOR AQUIFER 0591

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

The aquifer is between the Pine and Kiskatinaw rivers near the community of Groundbirch. It is a bedrock aquifer delineated based on water licensing watershed boundaries and surface water bodies within a regionally extensive geological/hydrostratigraphic unit. The aquifer is bound by watershed boundaries in the northwest, west, and east, and by the Murray River, the Coldstream Creek, and an unnamed tributary in the south and southwest (Lengyel et al. 2023, Figure 1). The aquifer boundary is uncertain in the south where it follows the Coldstream Creek and its unnamed tributary. To the north and west the aquifer abuts aquifers (0589 and 0595) that are part of the same geological/hydrostratigraphical unit.

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

The aquifer is overlain by glaciolacustrine, alluvial, eolian, and glaciofluvial deposits. Thirty out of the 38 wells associated with the aquifer reported fine-grained material (clay, silt, till) overlying the aquifer. Of the other wells, two reported sand and fines (silty sand), and two reported coarser grained (medium sand) sediments on the surface. The thickness of the overlying material ranges from less than 3 to more than 70 meters.

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

The bedrock aquifer comprises sediments of the Kaskapau Formation. The Kaskapau Formation mostly consists of shale, siltstone, and sandstone. Permeability is interpreted to be associated with secondary porosity (through fractures and erosion). The Kaskapau Formation is described in further detail by Lengyel et al. (2023). The aquifer is interpreted to be confined based on the overlying materials.

A.1.4 VULNERABILITY

Depth to groundwater varies from shallow to moderately deep. While the permeability of the aquifer has not been tested, it is expected to be low to medium based on the type of aquifer material (shale and sandstone), and high where fractures are present. Surficial mapping by Reimchen (1980) and borehole logs indicate that the bedrock aquifer is covered by fine- to coarse-grained materials of variable thickness. The overall vulnerability of the aquifer to surface contamination has been interpreted 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 shallow (3.0 m) to moderately deep (50.7 m). No active provincial monitoring wells and no wells with artesian conditions exist within the aquifer extent. There is an inactive provincial monitoring well (OW-421) within the extents of 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 primarily towards the Kiskatinaw and Pine rivers and their tributaries.

A.2.2 RECHARGE

Recharge to the aquifer could occur via distributed infiltration of precipitation and snowmelt through the thin overburden (Baye et al. 2016). Much of the recharge is expected to occur in the spring associated with snowmelt. The aquifer may also be recharged by the overlying minor tributaries of the Pine and Murray rivers and/or regional groundwater flow in the bedrock units. However, the spatial and temporal understanding of these recharge pathways as well as vertical flow potential within the bedrock are uncertain and further investigation is required to be evaluated.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Groundwater in the aquifer is in direct hydraulic connection with the groundwater in the neighbouring bedrock aquifers 0589 and 0595. Aquifer boundaries are defined based on inferred groundwater flow paths within the Dunvegan and Kaskapau formations rather than by structural boundaries. Hydraulic connection may also exist between aquifer 0591 and overlying buried channel aquifer (Goetz 2021, i.e., aquifer 0590).

Groundwater in the aquifer may also be in direct hydraulic connection with the minor tributaries of the Pine and Murray rivers and wetlands in the northwest due the limited thickness and locally coarse-grained texture of the overburden separating them.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Two wells reported a water quality concern (WTN 39099 and 47816), representing isolated water quality concerns. Well 17365 noted poor quantity. Baye et al. (2016) reported exceedances for arsenic, iron, manganese, and hardness in some of the bedrock wells within the extent of aquifer 0591. Stated yields in the well records range from 0.06 to 1.5 L/s, with geometric mean of 0.42 L/s indicating moderate productivity. Groundwater is used primarily for domestic purposes (20 of 37 wells).

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

The regional groundwater flow model developed for the Sunset paleo-valley area (Goetz 2021) concluded that the weathered bedrock aquifer, underlying the Sunset buried channel, is the main source of groundwater recharge to the buried channel aquifer. Similarly, aquifer 0591 may recharge the overlying buried channel aquifer (i.e., 0590) which may guide management actions.

Aquifer 0591 is part of the Kaskapau Formation. Bedrock aquifers in the weathered and fractured Dunvegan and Kaskapau formations in the Study Area (0589, 0591, 0593, 0595, 0633, and 1275) are inferred to be part of the same hydrostratigraphic unit and are interpreted to be continuous on a regional scale (see Lengyel et al. 2023). The aquifer is differentiated from adjacent aquifers (0589 and 0595) based on regional groundwater flow paths. Water management decisions for the aquifer may require assessment of adjacent aquifers, especially where development is near the aquifer boundaries.

A.4 AQUIFER REFERENCES

Baye, A., Rathfelder, K., Wei, M., and Yin, J., 2016. Hydrostratigraphic, hydraulic and hydrogeochemical descriptions of Dawson Creek-Groundbirch areas, Northeast BC. Victoria, Prov of B.C. Water Science Series 2016-04.

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Goetz, A. M., 2021. Regional groundwater conditions in northeast BC: Results from a monitoring well network in an area of historical and ongoing unconventional natural gas development. M.Sc. Thesis, University of British Columbia, Vancouver, B.C.

Lengyel, T., Deri-Takacs, J., Hinnell, A. C, & Clague, J. J. 2023. Kiskatinaw-Peace Aquifer Mapping and Hydrostratigraphic Characterization. Victoria, B.C.

Reimchen, T.H.F, 1980. Surficial Geology Dawson Creek; Geological Survey of Canada, Map 1467A, 1:250000 scale map.

A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
2011	1	Major	Initial mapping of aquifer	Lowen Hydrogeology Consulting Ltd. 2011.
02/10/2023	2	Major	Aquifer boundaries updated to include hydraulically connected geologic formations (merged with Aquifer 0589)	Tibor Lengyel, M.Sc., P.Geo., Judit Deri-Takacs, Ph.D., Andrew Hinnell, Ph.D., P.Geo.