

A. AQUIFER DESCRIPTION FOR AQUIFER 216

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

Aquifer area is approximately 32.1 km². The aquifer boundary was delineated using 3D interpolation of water well information (i.e., area of well development and geology), surficial geology maps and geomorphic features. The aquifer is located between the Englishman River and French Creek, including Parksville/Coombs industrial area and extending north to Parksville Bay. Aquifer 216 pinches out against upland bedrock in the Coombs area south of the Alberni Highway, and against the bedrock high near Morningstar Creek/Parksville.

Number of wells = 218.

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

Aquifer 216 is typically overlain by Vashon Drift sediments, comprising a dense, low permeability till (Figure 1). Where the Vashon till has been eroded, the aquifer may be exposed at ground surface or is overlain by a complex of glaciomarine (Vashon) and marine (Capilano) deposits of stoney clay, silty sand and gravel.

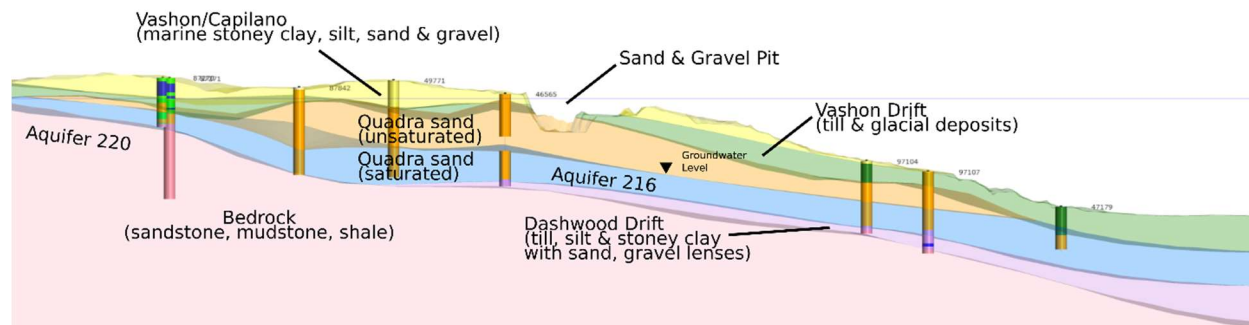


Figure 1. Slice through the French Creek 3D model showing the vertical arrangements of hydrogeological units. Quadra sand Aquifer 216 is represented in blue.

A.1.3 GEOLOGIC FORMATION (AQUIFER)

Aquifer 216 is associated with the Quadra Sand, a proglacial outwash deposit that is extensive throughout the Georgia Basin. The unit consists mainly of well sorted, fine to coarse grained sand and is described in outcrop and boreholes as grey, white and occasionally brownish in colour (likely resulting from mineral staining). Clay, silt, and gravel represent less than 10% of the sediment over the entire basin, but are locally common (Clague 1976). Average well depth is 36 m.

A.1.4 VULNERABILITY

Moderate. Aquifer 216 is partly confined (i.e., with windows) and groundwater levels are low within the unit. Exceptions include lower elevation areas between the Inland Island Highway/Despard Avenue West to the coast. Unconfined portions are evident in the southern (upland) part of aquifer, along the Parksville Bypass/Alberni Highway. Several sand and gravel pits in this area have exposed the aquifer at surface (Figure 1).

Confined areas are capped by the low-permeability Vashon till, which offers protection from surface contamination. The confining layers of clay and/or till overlying the aquifer varies in thickness ranging from 0 to 30 m.

A.1.5 PRODUCTIVITY AND HYDRAULIC PROPERTIES

Moderate. The median yield is 25 USgpm. The 75 percentile is 114 USgpm and the 25 percentile is 8 USgpm. Transmissivities of 1.6 to 106 m²/day have been determined from pump test data.

Saturated thickness of Aquifer 216: Mean =16 m; Maximum = 75 m; Standard Deviation = 12 m.

A.2 CONCEPTUAL UNDERSTANDING OF FLOW DYNAMICS

A.2.1 GROUNDWATER LEVELS AND FLOW DIRECTION

Water levels range from flowing to 41 metres below ground, the average depth to water is 16 m and the median depth to water is 14 metres. Areas of flowing artesian conditions exist at the base of slope at 50 metres to 60 metres elevation, extending from Church Road east to the City of Parksville springs/wells. Groundwater daylights as springs to French Creek, Morningstar Creek and Romney Creek.

There are five observation wells, OW424, OW314, OW304, OW398 and RDN VOW01 located in this aquifer. The annual amplitude of water level fluctuation is between 20 to 90 cm. High water levels usually occur in April and the lowest occur in September. Water level patterns vary depending on the location: Where water is relatively shallow (about 6 m as in OW314), the water levels usually correlate with patterns of precipitation, whereas water levels at the deeper end (about 20 m) show a mountain recharge - snowmelt pattern (OW424 and VOW01).

Statistics on water levels in Aquifer 216 are outlined in the table below.

Number of wells	Average water depth (m)	Minimum water depth (m)	Max water depth (m)	Max water elevation (masl)	Min water elevation (masl)
172	15.3	0	44.2	107	14

Flow direction is generally towards the Ocean and along and towards major French Creek. Water levels are deeper inland at higher elevation.

A.2.2 RECHARGE

Evidence of snowmelt and mountain block recharge, as shown on water level fluctuation pattern in OW424 and VOW01. Infiltration of precipitation in areas without confining layers.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Likely connected to French Creek from approximately 1 to 3 km upstream from the mouth and between the Inland Island Hwy and Coombs (creek gaining from aquifer). Groundwater may be contributing to French Creek via small springs or seepage along banks from north of the Inland Island Hwy to about 3 km before the mouth.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Groundwater used for multiple purposes including domestic, agricultural, industrial and municipal water supply. Demand is high. OW314, installed in Aquifer 216, records groundwater level data from 1992 to 2020. High water levels usually occur in April and the lowest levels occur in September. Groundwater levels drastically declined between 1992 and 2003 and have increased slightly up to present (GW Solutions 2020).

The aquifer supplies several community water systems including: City of Parksville (Springwood and Railway well fields); Epcor-French Creek (Church Road well field).

Local reports of elevated manganese and iron. Isolated report of elevated turbidity level.

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

GW Solutions 2020. Water Quality and Quantity Risk Assessment in Support of RDN Area F OCP Update. Prepared for the Regional District of Nanaimo.

Waterline Resources Inc., 2013. Water budget project: RDN Phase One (VANCOUVER ISLAND). Nanaimo, BC: Regional District of Nanaimo.

A.4 AQUIFER REFERENCES

Arengi, J.T., 1995. Construction and Testing of Test Wells R-7 and R-7A for French Creek Estates in the French Creek Area of Vancouver Island. Report prepared for Moore Planning Associates Ltd. by Pacific Hydrology Consultants Ltd.

Barroso, A., Richard, S., Vardal, M., and Barroso, S. 2025. French Creek Area Hydraulic Connectivity and Aquifer Mapping Study. Water Science Series, WSS2025-01. Prov. B.C., Victoria B.C.

Clague, J. J. (1976). Quadra Sand and its relation to the late Wisconsin glaciation of southwest British Columbia. *Canadian Journal of Earth Science*, 13, 803–815.

Fyles, J.G., 1963. GSC Memoir 318. Surficial Geology of Horne Lake and Parksville Map Areas, Vancouver Island, British Columbia. NTS 92F/7 and 92F/8. Geological Survey of Canada, Department of Mines and Technical Surveys.

Hodge, W.S., 1995. Breakwater Enterprises Ltd. - French Creek Estates. Memorandum to M. Wei, Sr. Groundwater Hydrologist, Groundwater Section, Hydrology Branch, Water Management Division, Ministry of Environment Lands and Parks.

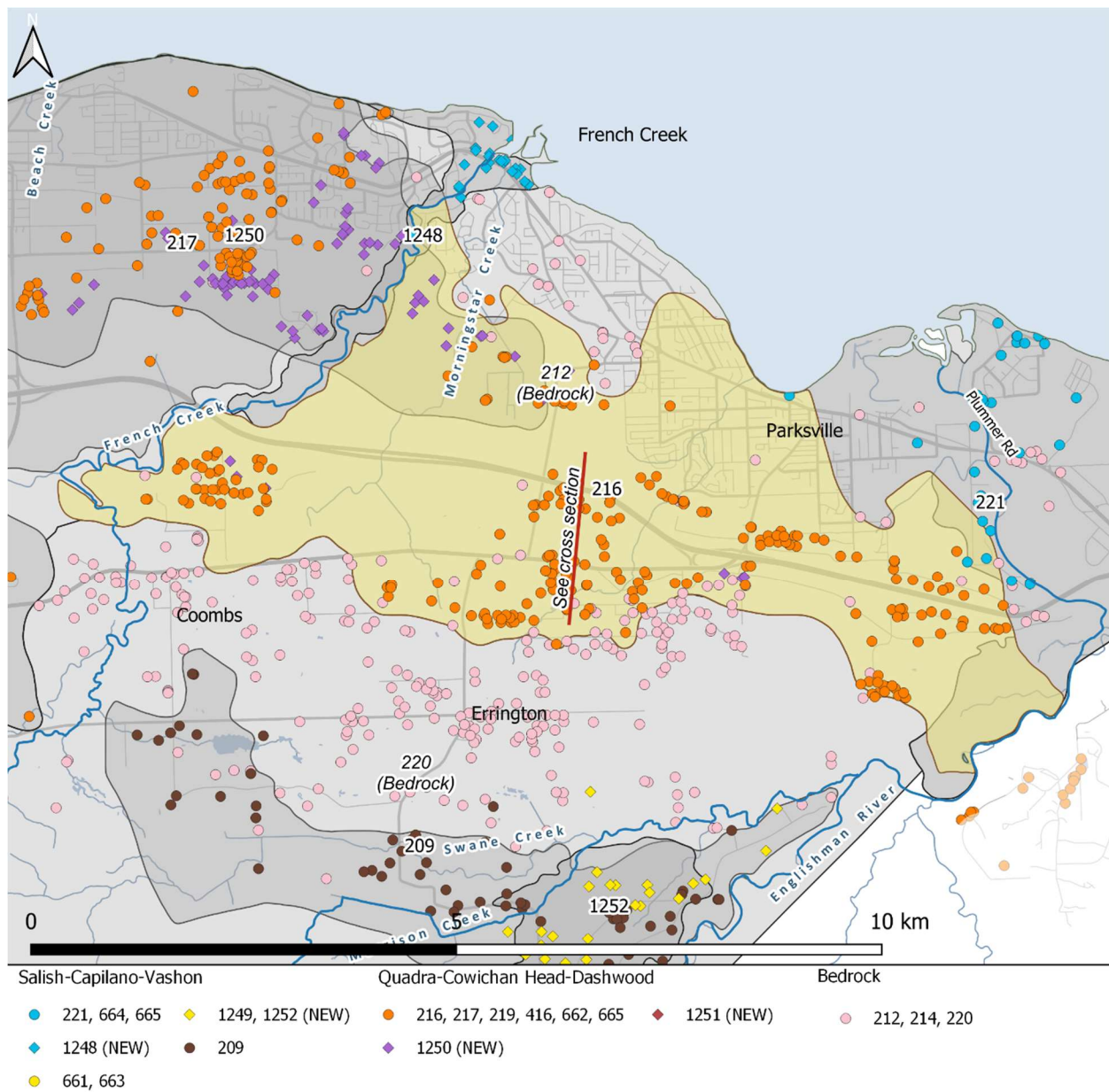
Russell, H. A. J. & Benoit, N., 2016. Nanoose Bay - Deep Bay Area, Nanaimo Lowlands Groundwater Study Atlas, Regional District of Nanaimo, British Columbia: Geological Survey of Canada, OPEN FILE 7877.

Wei, M., 1992. Groundwater Conditions near Breakwater for Waste Disposal Applications PR-111015 and PR-10901. Memorandum to A.P. Kohut, Manager, Groundwater Section, Hydrology Branch, Water Management Division, Ministry of Environment Lands and Parks. File 0317588.

Wei, M., 1995. Breakwater Enterprises Ltd. - Well HC11-94 and Re-Evaluation of HC9-91 and MacGillivray wells. Memorandum to A.P. Kohut, Manager, Groundwater Section, Hydrology Branch, Water Management Division, Ministry of Environment Lands and Parks. File 0317588.

A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
19960215	1	Major	Initial mapping of aquifer	Unknown
20200331	2	Major	Updates to boundaries, description, and statistics	GW Solutions Inc.
20230519	3	Major	Updates to boundaries and statistics	D. van Everdingen



Aquifer 216: Representative Cross Section

