A. AQUIFER DESCRIPTION FOR AQUIFER 662

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

Aquifer area is approximately 56.5 km^2. The aquifer boundary was delineated using water well record information (area of well development), surficial geology mapping (Fyles 1963, Russell & Benoit, 2016), and topography. The aquifer is encountered between the Little Qualicum and Qualicum rivers and extends from the mountain front to the coast. Number of wells = 242.

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

Aquifer 662 is locally exposed at surface or is overlain by Vashon Drift (dense till and silty gravel and clay), a low permeability aquitard that protects the aquifer from direct surface infiltration. The saturated thickness layer varies in thickness from approximately 2 to over 70 m. The aquifer is overlain by Aquifer 661 at Spider Lake, and the two aquifers are separated by a till layer (Figure 1).

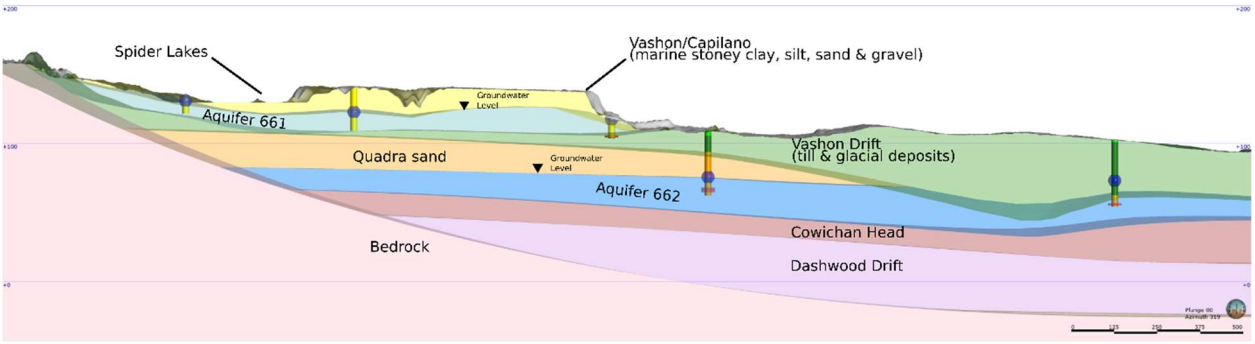

Figure 1. Vertical arrangement of hydrogeological units in the Spider Lakes area. Aquifer 662 is the saturated portion of the Quadra sand unit.

A.1.3 GEOLOGIC FORMATION (AQUIFER)

Aquifer 662 is the saturated portion of an extensive Quadra sand deposit underlying coastal lowlands from Qualicum River to Bowser. The Quadra sand consists of:

- Sand, well sorted, fine to medium grained that is extremely consistent in texture, white or grey in colour, although may appear brown (likely resulting from mineral staining).
- Rare gravel, clay, and silt lenses.

The aquifer is generally underlain by non-glacial Cowichan Head sediments of interbedded silt, clay, sand and gravel or the Dashwood Drift (primarily till and glaciomarine silts and stoney clay). Aquifer 662 becomes confined and pressurized towards the coast (Figure 2).

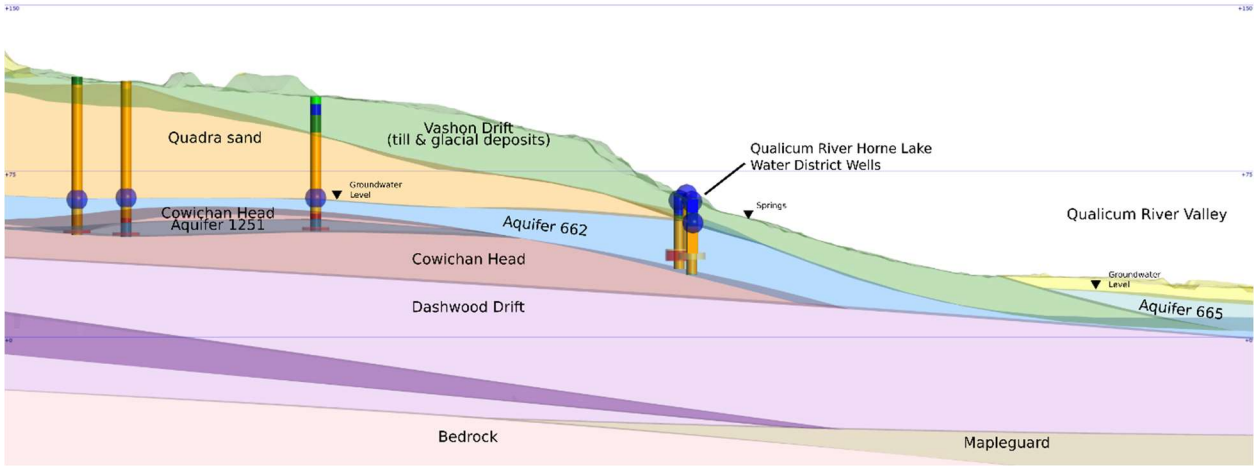

Figure 2. Vertical arrangement of hydrogeological units in the vicinity of the Qualicum River/Horne Lake Water District supply wells.

Average well depth is 51 m.

A.1.4 VULNERABILITY

Low overall vulnerability due to overlying Vashon Drift (dense till and silty gravel and clay). Many well records report no confining layer, and these are mostly located in the northwest area near the Qualicum River.

A.1.5 PRODUCTIVITY

Moderate. The median estimated well yield is 8 USgpm. Statistics for estimated well yield reported in well logs are included in the table below.

Correlated wells	242
Wells with reported yield greater than 0	
N=	221
Minimum (USgpm)	1
Median	8
Average	17
Maximum (USgpm)	480
25th percentile	5
75th percentile	10

A.2 CONCEPTUAL UNDERSTANDING OF FLOW DYNAMICS

A.2.1 GROUNDWATER LEVELS AND FLOW DIRECTION

Statistics on water levels in Aquifer 662 are outlined in the table below.

Number of wells	Average water depth (m)	Minimum water depth (m)	Maximum water depth (m)	Maximum water elevation (masl)	Min water elevation (masl)
199	31.1	0.3	78.6	124	-11

Flowing artesian conditions and springs are reported from the area around the Qualicum River/Horne Lake Water District supply wells, at Horne Lake Road, north of the Inland Island highway.

There are two observation wells, OW426 in the northern portion and OW391 between Kinkade Creek and Little Qualicum River. Groundwater levels fluctuate less than 0.5 m over a year.

Groundwater flow is generally towards the ocean. Locally, groundwater flow is directed around streams that have down-cut through the Quadra sand (e.g., toward Kinkade Creek and Little Qualicum River).

A.2.2 RECHARGE

Infiltration from precipitation in areas not covered by till and possibly from bedrock where the two formations are in contact.

Possible contribution from new Dashwood-Mapleguard aquifer below (upward flow). Further studies need to be conducted to determine sources of recharge to the aquifer.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Likely connected with Kinkade and Little Qualicum River, as these two streams have cut down through the Quadra sand. The aquifer likely forms seepage faces along the Qualicum River valley sides.

Some portions of the aquifer seem disconnected and losing i.e., stream is “perched” above the aquifer in the upper Kinkade Creek watershed.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Groundwater from Aquifer 662 is used mostly for domestic and commercial/industrial purposes. Aquifer provides water for the Qualicum Bay Horne Lake Waterworks District from three wells (WTN’s 110569, 96521, and 96893). This water service has 617 connections, including residential, Qualicum First Nation and commercial/industrial users. Considering the physical size of the aquifer and sparse population, demand is considered low. Water quality is typical of Quadra sand in the area, with average TDS of 91 mg/L (based on data from OW391 and OW426).

- No conflicts between users documented.
- No quantity concerns documented.
- Isolated cases of elevated iron levels.

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

- RDN Phase 1 Water budget project, (Waterline, 2013). Provides groundwater recharge areas and quantity, defines the level of stress of aquifers.
- Groundwater flow model of the Nanaimo Lowlands, (Benoit et al, 2016).
- Well Protection Plan for the Qualicum Bay Horne Lake Waterworks (Waterline, 2017)

A.4 AQUIFER REFERENCES

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Benoit, N., Paradis, D., Bednarski, J.M., Hamblin, T., and Russell, H.A.J., 2015. Three-dimensional hydrostratigraphic model of the Nanoose-Deep Bay area, Nanaimo Lowland, British Columbia; Geological Survey of Canada, Open File 7796.

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A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
20040329	1	Major	Initial mapping of aquifer	Unknown
20200331	2	Major	Updates to report, parameters, correlation and spatial files	GW Solutions Inc.
20230519	3	Minor	Updated statistics	D. van Everdingen
20241129	4	Minor	Updated statistics and description	GW Solutions Inc.