HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF A RE-ZONING APPLICATION FOR 1900 STALKER ROAD GABRIOLA ISLAND, BC

Submitted To:

Seward Development Inc.
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Submitted By:

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Nanaimo, British Columbia
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1.0 INTRODUCTION

1.1 Background and Objective

Seward Developments Inc. (Seward) is seeking re-zoning approval to subdivide a land parcel, Lot 1, Section 4 Gabriola Island, Nanaimo Region, Plan 16590, located at 1900 Stalker Road Gabriola Island, BC (the Site; Figure 1). The proposed subdivision will comprise three lots, each being serviced by its own dedicated water supply well. Two lots (Lot A and Lot B) at the Site both have a water supply well in place and, therefore, only one additional water supply well is required to service the third lot (Lot C). A survey plan of the Site is provided in Appendix A (Turner and Associates Land Surveying, 2023).

Seward retained Waterline Resources Inc. (Waterline) to conduct a hydrogeological assessment to evaluate the potential of using groundwater to service Lot C. The goal of this assessment is to also characterize potential impacts from groundwater diversion on mapped aquifers, hydraulically-connected streams and/or local registered groundwater users, as stipulated under the servicing policy (Section 7.0) listed in the Islands Trust, Gabriola Island Official Community Plan (OCP) Bylaw No. 166, 1997 (Islands Trust, 2022).

1.2 Scope of Work

To meet the objective of the hydrogeological assessment, Waterline conducted the following scope of work:

- Reviewed publicly available hydrogeological information for the area of the proposed re-zoning, including nearby registered groundwater users (water wells), well construction details, aquifer conditions, surface water features and terrain mapping;
- Reviewed available groundwater chemistry data collected from the existing water supply well located on Lot A, to provide context of the source water quality; and,
- Completed this technical report summarizing the results of the preliminary hydrogeological assessment, including potential hydrogeological impacts from the groundwater development activities for a rezoning application to facilitate subdivision approval.

1.3 Regulatory Considerations for Groundwater Development

1.3.1 Groundwater Development

There are no groundwater supply requirements listed in the OCP (Island Trust, 2022) for proposed subdivisions on Gabriola Island. However, the Ministry of Transportation and Infrastructure (MOTI) requires proof of 2.5 cubic metres per day (m^3/d) of water supply per dwelling unit (single lot) as a condition of subdivision (MOTI, 2018), which is the current standard stipulated by the Islands Trust local planning services team (personal communication, Margot T. [Islands Trust], December 12, 2024).

Groundwater development must be carried out in a way that protects the water source. Regulatory standards listed in the Water Sustainability Act (WSA) *Groundwater Protection Regulation* (GWPR; BC Government, 2022) set out several offset distances and conformance requirements for development of new groundwater wells.

1.3.2 Saltwater Intrusion

According to the *Best Practice for Prevention of Saltwater Intrusion* published by the former BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD, 2016), wells completed in aquifers adjacent to the coast containing groundwater with chloride concentration greater than 150 milligram per liter (mg/L), specific conductivity (EC) greater then 1,000 microsiemens per centimeter (µS/cm), or a total dissolved solids (TDS) concentration greater than 700 mg/L, are considered to be affected by saltwater intrusion.

For coastal BC, these thresholds have been established as operational objectives, and a groundwater well should only be pumped if it can produce a water quality that does not exceed these threshold values (FLNRORD, 2016). Under Section 58 or the WSA (BC Government, 2024), it is prohibited to operate a well in a manner that causes intrusion of saline water into an aquifer. Mitigative measures include completing a new groundwater well in a location that is greater than 50 metres (m) from the coastline and minimizing drawdown below sea level during operation of the water source well (FLNRORD, 2016).

2.0 METHODS

2.1 Desktop Review

Waterline used its proprietary Environmental Web Services (EWS) geodatabase system to obtain local data to support the preliminary hydrogeological assessment. EWS integrates publicly available data including geological, hydrogeological, and hydrological information, among additional datasets, using a Geographic Information Systems (GIS) platform. EWS provides a visual presentation of the searched data relative to the Site and surrounding areas. This allowed for the rapid characterization of the hydrogeological setting and determination of the potential risk of the proposed subdivision on adjacent environmental receptors.

Datasets accessed using EWS included:

- Government of BC - Freshwater Atlas Lakes/Manmade Waterbodies/Rivers (FLNRORD, 2022a);
- Government of BC - Freshwater Atlas Named Watersheds (FLNRORD, 2022b);
- Government of BC - Freshwater Atlas Stream Network (FLNRORD, 2019);
- Ministry of Environment (ENV) - Ground Water Wells and Aquifer Databases (GWELLS, ENV, 2024a);
- Government of BC - Terrain Inventory Mapping (ENV, 2013a); and
- British Columbia Geological Survey – Bedrock Geology Mapping (Cui et al, 2017).

Seward provided Waterline a copy of the Archaeological Impact Assessment of 1900 Stalker Road Gabriola Island, BC, completed by Baseline Archaeological Services Inc. (Baseline, 2023) to help provide context of the site setting and current land use designation.

2.2 Site Visit

Waterline completed a site visit on November 9, 2023, to assess the Lot A and Lot B water supply wells, with Well Tag Numbers (WTN) 26181 and 26180, respectively. The work performed onsite included:

- Photographing and documenting the Site and the wells (Photograph B1 to B4; Appendix B), including verifying the lack of surface water features and riparian areas;
- Measuring the stickup and manual water level for WTN 26181. Waterline was unable to open the wellhead for WTN 26180 without risk of damaging the installed pump (Photograph B5; Appendix B);
- Purging the water from WTN 26181 for 20 minutes using the dedicated pump, while continuously measuring water chemistry parameters. The water was passed through the pressure tank and filter;
- Collecting a water quality sample from WTN 26181 for routine chemistry parameters, total metals and some dissolved metal parameters, in accordance with the *BC Field Sampling Manual* (ENV, 2013b). Waterline was unable to collect a water sample from WTN 26180 as the well was unpowered and the lines were winterized; and
- Submitting the groundwater chemistry samples from WTN 26181 to CARO Analytical Services (CARO) on November 10, 2023, located in Burnaby, BC.

3.0 SETTING

3.1 Current and Planned Land Use

The Site is zoned as Resource land (R) as per Schedule B of Bylaw No. 166, 1997 (Island Trust, 2022), with a total land area of 3.6 hectares (ha). Access to the Site is from Stalker Road (Figure 2). The land parcel to the south of the Site is designated as Park land (P; Drumbeg Provincial Park), with Agricultural land (AG) to the north.

The Client is proposing to subdivide the property into three lots (Lot A, B and C) having an average parcel size greater than 0.5 ha, consisting of 47% of the total land use area (1.7 ha). The remaining space is proposed to be communal land (49%), with some area designated as Park land (4%).

Each lot has an existing dwelling (Photograph B6 to B8, Appendix B). Only Lot C does not have a designated water supply well and currently stores trucked water in a large cistern, located next to the dwelling. If rezoning is approved, the current Resource land designation would be re-designated as Small Rural Residential (SSR).

3.2 Physiography

The Site is situated on the southeast coast of Gabriola Island, approximately 18 km east of downtown Nanaimo, BC (Figure 1). Topography across the Site slopes west to east, ranging from 39 above sea level (masl) to seal level, respectively. Surface water runoff follows topography (Figure 2).

There are no mapped watersheds on Gabriola Island, and very few surface water features (Figure 2). Surface water features are intermittent and tend to dry up during the summer months, making groundwater one of the few sources of reliable freshwater (Agriculture Canada, 1990). The closest freshwater water surface feature to the Site is Belevedere Farm Creek (located 1.3 km to the west), a seasonal stream flowing into Degnen Bay (Figure 2).

Historical climate data, representative of climate conditions near the Site, was obtained from the Nanaimo Airport climate station, having Climate Station ID 1025370 from 1981 to 2016 and replaced with Climate Station ID 1025369 after 2016 (Environment Canada, 2024), located approximately 15.5 km southwest of the Site (Figure 1) at an elevation of 28 masl. Average monthly temperature and total precipitation data is available from 1981 to 2010 (climate normals), and yearly total precipitation data is available from 2011 to 2022; this data is summarized in Table 1.

Table 1: Climate Normals and Recent Climate Data from Airport Climate Station

Climate Normal Data (1981-2010)													
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Avg Yr.**
Avg Temp (°C)	3.5	4.3	6.3	9.0	12.5	15.6	18.1	18.2	14.9	9.9	5.6	3.1	10.1
Total Precip (mm)	188	126	113	67	54	43	25	28	36	102	197	184	1165
Precipitation Data (2011-2021)													
Parameter	**2011**	**2012**	**2013**	**2014**	**2015**	**2016[a]**	**2017**	**2018**	**2019**	**2020**	**2021**	**Avg Yr.**	
Total Precip (mm)	1025	1279	756	1156	984	1356	1178	1213	775	1155	1232	1101	

Notes: Avg Temp means average temperature; **Precip** means precipitation; **°C** means degrees Celsius; **mm** means millimetres; **Avg Yr.** means average yearly. **a)** In June 2016, Climate Station No 1025370 was changed to 1025369. **b)** Precipitation data is only to April 19, 2022.

There are two distinct seasonal patterns, including a warmer dried period from April to September (spring to early fall) and a cooler wetter period from October through March (late fall through winter). Recent climate data from 2011 to 2021 (11-years) suggest the average annual precipitation (1101 millimetres) has slightly decreased in comparison to the climate normals, with the lowest recorded precipitation measured in 2013.

3.3 Surficial and Bedrock Geology

Regional mapping indicates the Site is underlain by a veneer or blanket of glaciomarine material, consisting of gravels, sands, silt and clay (ENV, 2013a), which extends across the entire island. Glaciomarine materials are deposited by a combination of glacier and marine-related processes during previous deglaciation events.

The surficial sediments are underlain by Upper Cretaceous sedimentary bedrock of the Nanaimo Group, which consists of interbedded conglomerate, sandstone, siltstone, shale, and occasionally coal (Cui et. al., 2017; Muller and Jeletzky, 1970), extending throughout the Nanaimo area. Sandstone outcrops on the Site are seen along the shoreline and in occasional outcrops through the area where surficial sediments have been eroded. There are no mapped bedrock faults intersecting the Site, but regional scale faulting does exist northwest and southeast of the Site, where faults cut through the islands orthogonally in northeast-southwest trends (Cui et. al., 2017; Figure 1). In these areas of faulting, the frequency of bedrock fractures generally increases, however, fracture patterns are known to be heterogeneous.

While the mapped soil and bedrock boundaries are approximate, in general they agree with the lithology data provided by the available well logs near the Site and observations made by Waterline during the site visit.

3.4 Hydrogeology

3.4.1 Mapped Bedrock Aquifer 709

A provincially mapped fractured bedrock aquifer (Aquifer 709; Figure 1) reportedly underlies the Site. The aquifer extent and description are based on data collected from the driller's logs for registered groundwater wells in the area, referenced from the ENV GWELLS database (ENV, 2024a). Details of Aquifer 709 are summarized in Table 2.

Table 2: Description of Aquifer 709

Aquifer Name	Aquifer 709
Aquifer Type/Material	Fractured Bedrock – Sandstone with minor shale and conglomerate
Aquifer Area (km^2)	46.8
Aquifer Productivity	Low
Aquifer Demand	Moderate
Aquifer Vulnerability	High
Median Depth to Groundwater (mbgl)	6.1
Median Well Completion Depth (mbgl)	33.4
Median Well Yield Estimate (m^3/d)	24
Aquifer Use	Domestic, commercial, industrial, agricultural
Comments	1042 wells are associated with the aquifer, including 6 artesian wells

Notes: mbgl is metres below ground level; m^3/d is cubic metres per day

General observations include:

- The groundwater flow direction within the aquifer is anticipated to be from higher to lower elevations, generally towards the ocean in all areas of the aquifer, however directional permeability of the fractured bedrock is generally unknown.
- Recharge to the aquifer is expected to come from infiltration of precipitation and direct connection with surface water features where bedrock fractures are near surface.
- The vulnerability of Aquifer 709 to surface contamination is classified as 'high' as the permeability of the overburden is moderate to high and discontinuous with bedrock outcropping near surface. Aquifer 709 is also noted to be at risk of sea water intrusion.

3.4.2 Aquifer 709 Groundwater Level Trends

Groundwater levels in Aquifer 709 are monitored at four Provincial Groundwater Observation Wells (OW). OW 316, located 5.4 km west of the Site is most representative of groundwater conditions in the southeastern portion of Gabriola Island (Figure 1). The Groundwater level data from OW 316, compiled by ENV (ENV, 2024b) suggests:

- Groundwater levels fluctuate seasonally, correlating to seasonal precipitation patterns. There is a 3.1 m median annual fluctuation between January and September; and
- Historical groundwater levels for the period of 1992 to 2022 indicate the groundwater has a stable trend, suggesting that water input to the system for recharge matches groundwater output from the system from water use and other environmental factors (evaporation, discharge to the ocean, etc.).

3.4.3 Groundwater Well Records Within a 1 Km Radius of the Site

Waterline searched the provincial Groundwater Wells and Aquifer database (ENV, 2024a) to determine the number of registered water wells within a 1 km radius of the Site. The search results indicated records for 42 water wells including the Lot A (WTN 26181) and Lot B (WTN 26180) wells, as shown on Figure 2 and summarized in Table C1; Appendix C.

Table 3 presents a statistical summary of the groundwater well construction details and well yields for both the unconsolidated and bedrock aquifers within the searched area. It should be noted that the reported well yields are from driller's logs, taken from short duration airlift tests at the time of well drilling. Although they are not considered year-round sustainable well yields, they do provide good insight into the expected water supply potential.

Table 3: Summary of Registered Groundwater Wells within a 1 km Radius of the Site

Water Well Records Statistics	Finished Well Depth (mbgl)	Bedrock Depth (mbgl)	Well Yield (m^3/d)
Minimum	18.3	0.0	0
Maximum	109.7	6.4	109
Average	53.0	1.7	30

Notes: mbgl means metres below ground level; m^3/d means cubic metres per day.

Of the 42 registered water wells:

- None of the wells within the search area are licensed (Table C1);
- All 42 wells are completed in Aquifer 709 and are registered for domestic or unknown use (Table C1);
- The closest bedrock wells to the Site are registered with WTN 13744 and WTN 123454, located 510 m southwest and 440 m west of the Site boundaries, respectively (Figure 2). As there are very few registered groundwater wells near the Site, the aquifer development (balance of water supply vs. water demand) is considered low, thus reducing aquifer vulnerability. It should be noted that:
    - WTN 13744 is completed in sandstone and shale to a depth of 18.3 mbgl and has an estimated yield of 13.6 m^3/d; while,
    - WTN 123454 is also completed in sandstone, to a depth of 51.8 mbgl and has an estimated yield of 27.3 m^3/d.
- Three wells (WTNs 13746, 13913, and 35556) are registered as completed in the surficial unconsolidated sediments above Aquifer 709, but in reviewing the driller's reports, it was confirmed that they are in fact completed in the fractured bedrock of Aquifer 709. As such, there are no known wells in the search area that are completed in an unconsolidated aquifer, and none are expected due to the thin veneer of surficial sediment.

3.5 Existing Site Water Supply Wells

The two existing groundwater wells on the Site, WTN 26181 and WTN 26180, are proposed as the main water supply for Lot A and Lot B, respectively (Appendix A). These wells are both registered and were drilled and completed in Aquifer 709. A summary of the wells' construction details is included in Table 4, borehole logs are included in Appendix D. Three water-bearing fractures were identified in each well. The fractures are near, or below, sea level; however, the wells are over 100 m from the shoreline.

Table 4: Well Construction Details

Well Name	Lot A Water Supply Well	Lot B Water Supply Well
Well Tag Number (WTN)	WTN 26181	WTN 26180
Well Identification Number (WIN)	-	-
Well Construction Date (YYYY-MM-DD)	1972-05-01	
Well Driller	Windecker Water Wells	
Easting (UTM Zone 10)[a]	449396	449400
Northing (UTM Zone 10)[a]	5442806	5442776
Ground Surface Elevation (masl)	18.1	16.1
Casing Inside Diameter (mm)	154	
Casing Stick-up (m)	0.36	0.30
Surface Casing Depth (m)	2.1	1.5
Depth to Water (mbgl)	0.39 (Nov 9, 2024)	-
Screen Interval	Open hole	
Depth to Water Bearing Fracture Zones (mbgl)	• 3.0 • 24.1 • 27.4	• 15.2 • 25.9 • 29.0
Elevation of Water Bearing Fractures (masl)	• 15.1 • -6.0 • -9.3	• 0.9 • -9.8 • -12.9
Well Depth (mbgl)	27.4	29.0
Well Depth Elevation (masl)	-9.3	-12.9
Well Capacity (m^3/d)*	98	11
Aquifer Formation	Nanaimo Group (Fractured Sandstone and Shale)	
Distance to Ocean (m)	103	101

Notes: **a)** UTM Coordinates are based on Waterline's site visit; **masl** means metres above sea level; **mbgl** means metres below ground level; **m^3/d** means cubic metres per day; * The reported well capacity is from short-term airlift testing at the time of drilling

The well completion details for WTN 26180 and WTN 26181 were compared with regulatory standards listed in the GWPR (BC Government, 2022). Using the site plan, Waterline confirmed relevant offset distances to potential sources of contamination as listed in the GWPR and detailed in the BC Ministry of Health (BC MoH), Health Hazards Regulation (2020) and Island Health Subdivision Standards (IH, 2020). The results of the assessment are summarized below in Table 5.

Table 5: Overview of WTN 26180 and WTN 26181 Conformance with Regulatory Standards

Requirement	Meets Requirement?	
	WTN 26180	WTN 26181
Groundwater Protection Regulation		
The well casing extends greater than 0.3 m above ground level	Yes	Yes
The ground around is properly sloped to avoid pooling around the well casing	Yes	Yes
The well has a well identification number	No	No
The well is capped and locked	Yes	Yes
There is a well seal installed around the well casing.	No	No
Health Hazard Regulation		
Setback distance to private dwellings (>6 m)	Yes	Yes
Setback distance to known cemeteries, dumping grounds or contaminated sites (>120 m)	Yes	Yes
Island Health Subdivision Standards		
Setback distance from planned septic fields (>30 m)	Yes	Yes

WTN 26180 and WTN 26181 do not have Well Identification Numbers (WINs) as they were drilled prior to first enforcement of the GWPR in 2005. Furthermore, the minimum requirements for well surface seal as per Section 22 of the GWPR (BC Government, 2022) have not been met for both wells, again, as guidelines had not been defined at the time of well construction.

However, both WTN 26180 and 26181 are constructed with surface casing extending through the surficial material, driven into bedrock, limiting movement of surface water along the casing which could cause cross-contamination of the groundwater source. Also, both wells are located inside pumphouses and have concrete floors (Photograph B2 and B4, Appendix B) that help reduce pooling of water around the well casing, preventing the infiltration of water downward into the underlying surficial material near the well.

3.6 Groundwater Quality

A water quality sample was collected from WTN 26181 during the Site visit. In combination with water chemistry from OW 316, Waterline characterized the water quality for the southeastern portion of Aquifer 709. The data associated with OW 316 was retrieved from the ENV Environmental Monitoring System (ENV, 2024c) database, using the most recent sample entry, from October 8, 2014.

A summary table (Table E1) comparing the general chemistry, major ions and total/dissolved metals concentrations from WTN 26181 and OW 316 is included in Appendix E. The laboratory report for WTN 26181 is included in Appendix E.

The water quality results were compared with the groundwater quality guidelines listed in the *Best Practices for Prevention of Saltwater Intrusion* (FLNRORD; 2016) and with the *Guidelines for Canadian Drinking Water Quality* (GCDWQ; Health Canada, 2024). The GCDWQ set standards based on aesthetic objectives (AO) and on maximum acceptable concentrations (MAC). Some notable observations for the groundwater source include:

- The groundwater hardness for WTN 26181 was 57.8 milligram per liter (mg/L), indicating the groundwater is soft (Hanna et al., 2016);
- WTN 26181 has a TDS of 96.4 mg/L and an EC of 184 µS/cm, both of which are below the respective limits outlined in the Best Practices for Prevention of Saltwater Intrusion (TDS: 700 mg/L; EC: 1,000 µS/cm; FLNRORD; 2016). TDS is below the Canadian Drinking Water Quality AO guideline concentration of 500 mg/L (Health Canada, 2024);
- Despite being only 103 m from the ocean, dissolved chloride values at WTN 26181 are 22.5 mg/L, below the Best Practices for Prevention of Saltwater Intrusion value of 150 mg/L (FLNRORD; 2016);
- Based on the major ion chemistry, the water type for Aquifer 709 varies. The dominant anion for the groundwater sources is bicarbonate, indicating groundwater is recharged primarily from recent precipitation and not likely to be affected by saltwater intrusion. The dominant cation at OW 316 is calcium, whereas WTN 26181 has a mixed (no dominant) cation composition (Figure 3);
- OW 316 has dissolved iron that exceeds the AO and dissolved manganese that exceeds the MAC, while WTN 26181 concentrations are below the guidelines for both metals;
- Turbidity in OW 316 exceeds the AO for untreated water, while turbidity was not measured at WTN 26181;
- No microbiological samples have been collected from OW 316 or WTN 26181; and
- The only measured parameter exceeding the AO for WTN 26181 is aluminum, while pH was below the AO.

4.0 ASSESSMENT RESULTS

4.1 Adequacy of Groundwater Supply for New Use Water Supply Well on Lot C

Aquifer 709 is the only known groundwater source on Gabriola Island for development of a new well on Lot C. The Lot A and Lot B wells, both completed in Aquifer 709, have very different reported capacities, ranging from 11 to 98 m^3/d, despite being drilled only 30 m apart and having similar completion depths (Table 4).

Wells completed in Aquifer 709, within 1-km of the Site, have a reported average well yield of 30 m^3/d (Table 3), which is higher than the onsite well capacity. This is comparable to the median well yield (24 m^3/d; Table 2) reported for all wells across Aquifer 709. Considering the minimum reported well yield within 1 km of the Site (2.7 m^3/d; Table 3), it is reasonable to infer that new groundwater development onsite could meet the MOTI requirement of 2.5 m^3/d, to provide adequate supply for a single residential lot.

4.2 Impacts of Additional Groundwater Diversion on Existing Groundwater Users

If groundwater development on Lot C is successful, there could be impacts to groundwater users on the Site (Lot B and Lot A), given the proximity of WTN 26180 and WTN 26181 and potential connectivity of the groundwater fracture system. The next closest registered groundwater user

(WTN 123454) is 440 m northwest of the Site boundary, and negative impacts from groundwater development are not expected.

Groundwater availability during the summer, the period of lowest groundwater recharge, has not been a concern for the current owner (personal communication, David G. [Owner] December 20, 2024). Groundwater level trends for Aquifer 709, measured from OW 316, are stable, suggesting additional groundwater extraction for the southeastern portion of Gabriola Island is sustainable. Nevertheless, local impacts from additional groundwater diversion should be verified through aquifer pumping tests and groundwater monitoring.

4.3 Impacts of Additional Groundwater Diversion on the Receiving Environment

The proposed groundwater extraction for Lot C should not impact surface water features, including Belevedere Farm Creek, the nearest surface water feature. Given the distance (1.3 km) between the surface water source and the groundwater source on the Site, a direct hydraulic connection is unlikely. Furthermore, Belevedere Farm Creek flows intermittently, suggesting creek flow is predominantly from precipitation and surface water runoff (quick flow component), with lesser influence from groundwater discharge (baseflow component).

The groundwater quality reported from WTN 26181 suggests groundwater at the Site is fresh, despite the groundwater fractures encountered during well drilling being documented near or below sea level. Therefore, minimizing groundwater development on Lot C to 2.5 m^3/d and ensuring any new groundwater diversion (e.g., well drilling) is located more than 100 m from the shoreline should mitigate the risk of saltwater intrusion impacts on Aquifer 709.

5.0 CONCLUSION

In conclusion, based on the desktop review completed as part of the preliminary hydrogeological assessment, it is Waterline's opinion that the water requirements (2.5 m^3/d) for Lot C can be met by a new water well completed in Aquifer 709. The proposed water demand is not expected to adversely impact adjacent groundwater users or hydraulically connected streams and freshwater bodies.

Currently, the groundwater quality is fresh; however, Aquifer 709 is vulnerable to surface contamination. To mitigate the potential risk of saltwater intrusion, groundwater development on Lot C should be limited to household use, ensuring any new groundwater diversion (e.g., well drilling) is located more than 100 m from the shoreline.

6.0 RECOMMENDATIONS

The following recommendations are provided for consideration by the Client after re-zoning is complete and as part of potable water supply development:

- Contract a registered well driller to install a new well on Lot C. The well construction and sitting (including setbacks) should meet the regulatory guidelines listed in the GWPR and be greater than 100 m from the shoreline;
- Complete a constant rate pumping test in the new well after drilling. As Islands Trust and MOTI do not provide any guidelines or requirements for well testing, it is Waterline's professional opinion that RDN Policy B1.21 (RDN, 2019) be followed at a minimum to confirming a sustainable well yield of 2.5 m^3/d. Indicator parameters for saltwater intrusion should be monitored during testing to ensure groundwater extraction does not induce saline intrusion or compromise water quality; and
- The water from the new well should be tested for bacteriological and routine chemical parameters as stipulated by IH. A qualified pump installer in the province of British Columbia should be consulted at the time of well commissioning to review the raw water quality results to ensure proper filtration and treatment are provided.

7.0 CERTIFICATION

This document was prepared under the direction of a professional geoscientist registered in the Province of British Columbia.

Waterline Resources Inc. trusts that the information provided in this document is sufficient for your requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,

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FIGURES

Climate Station
MOE Observation Well
River/Stream - Definite
River/Stream - Indefinite
River/Stream - Intermittent
Canal/Ditch
Fault
Aquifer 709
Site Boundary

N

Coordinate System: NAD83 / UTM zone 10N

References:

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Hydrogeological Assessment in Support of a Re-zoning Application for 1900 Stalker Road Gabriola Island, BC

LOCATION MAP

Waterline

Prepared By:	Waterline Resources Inc.
Project Number:	3330-24-001
Compiled By:	mwine
Date Issued:	2025-Jan-15
Date Revised:	--

FIGURE 1

G:\Projects\Seward Developments\2024_figs.qgz

References:

Esri World Topo, Contains information licensed under the Open Government Licence – British Columbia and the Open Government Licence – Canada.

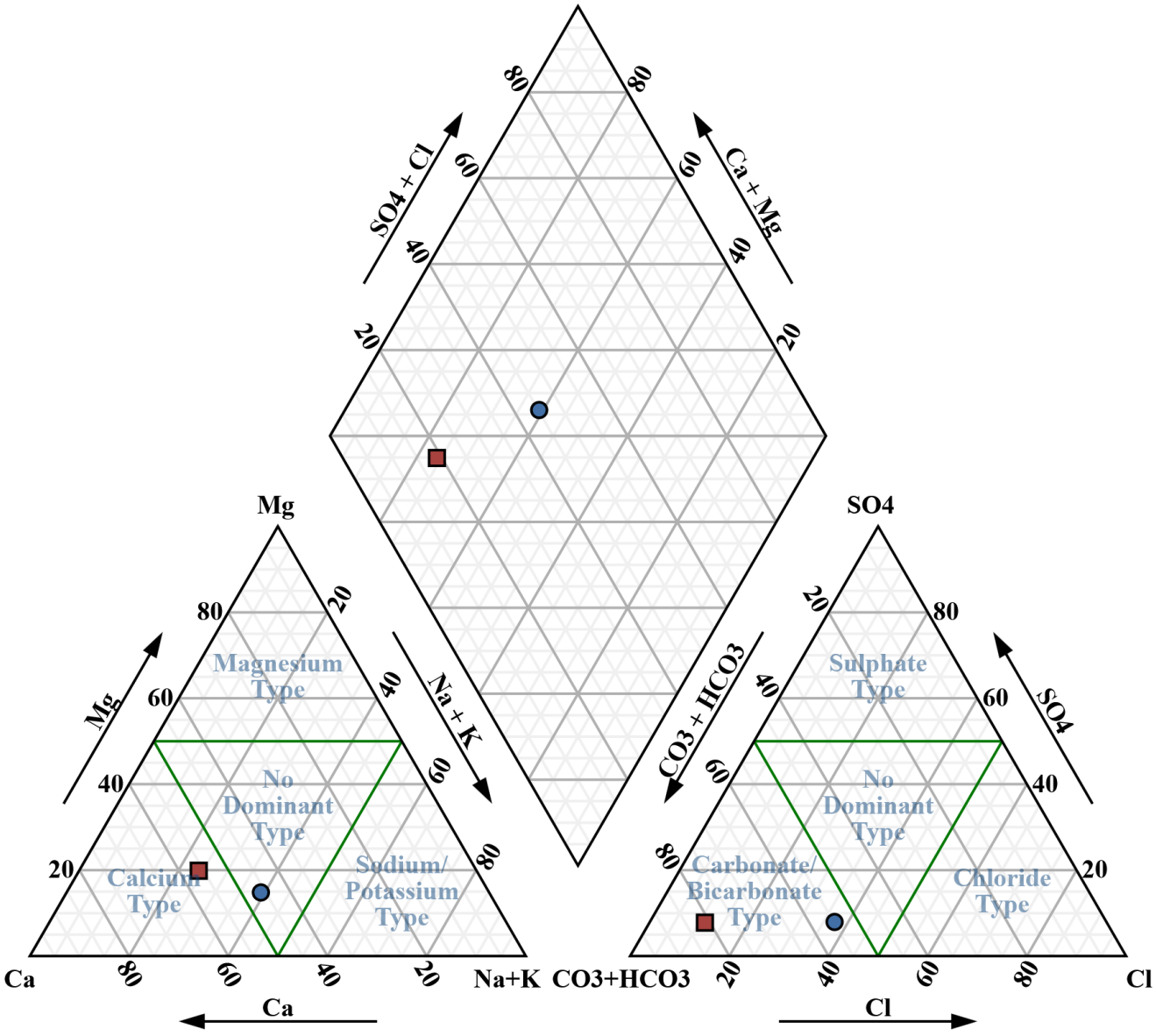
Hydrogeological Assessment in Support of a Re-zoning Application for 1900 Stalker Road Gabriola Island, BC

SITE MAP

Prepared By:	Waterline Resources Inc.
Project Number:	3330-24-001
Compiled By:	mwine
Date Issued:	2025-Jan-15
Date Revised:	--

FIGURE 2

G:\Projects\Seward Developments\2024_figs.qgz



Lot A (WTN 26181)
OW 316

Hydrogeological Assessment in Support of Re-Zoning for Subdivision Approval
1900 Stalker Road, Gabriola Island, British Columbia
Submitted to Toby Seward

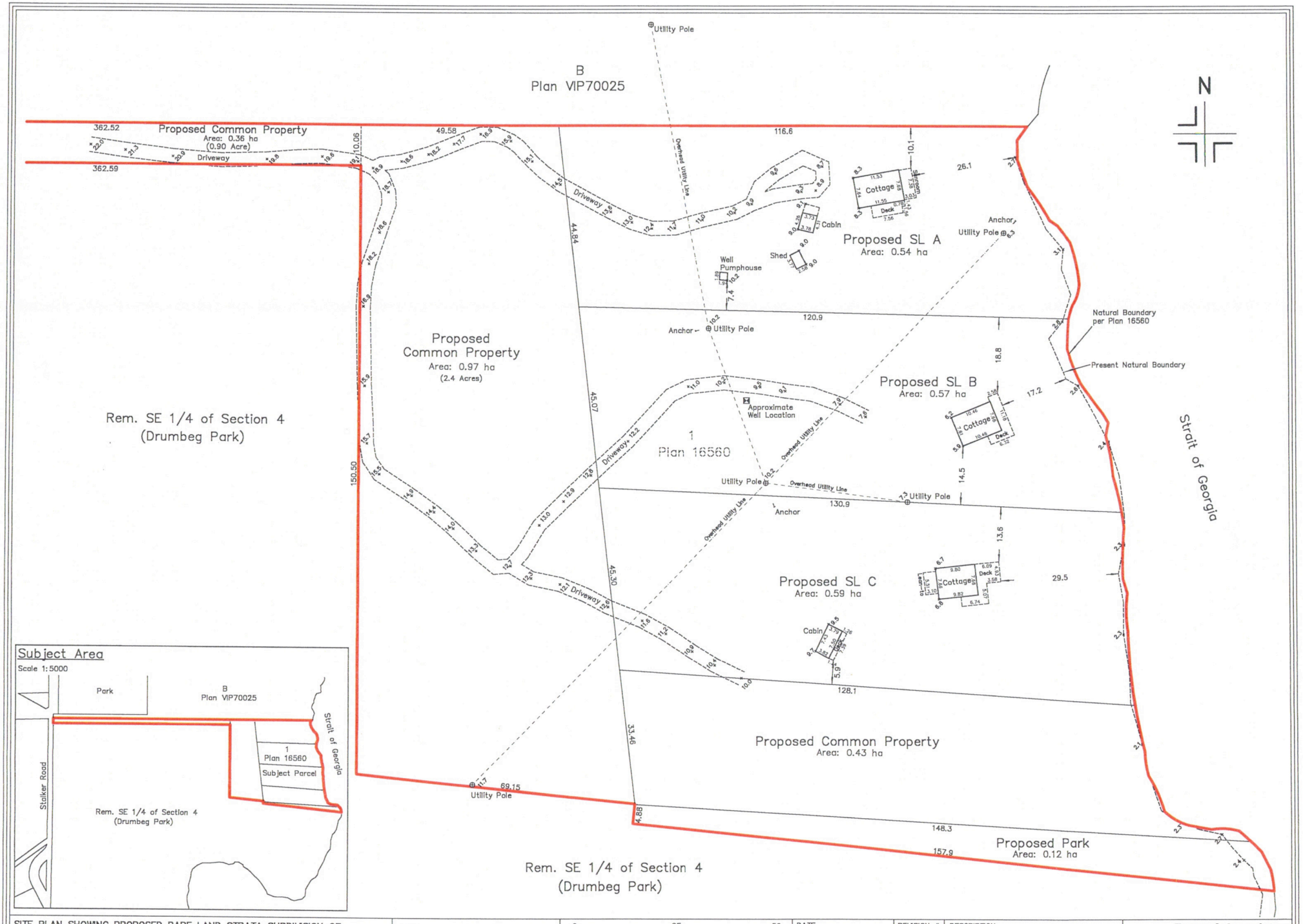
PIPER PLOT

PREPARED BY:	Waterline Resources Inc.
PROJECT:	3330-24-001
COMPILED BY:	Hydrachem
DATE ISSUED:	2025-Jan-16
REVISED:	-

FIGURE 3

Appendix A

Proposed Site Plan



SITE PLAN SHOWING PROPOSED BARE LAND STRATA SUBDIVISION OF:
LOT 1, SECTION 4, GABRIOLA ISLAND,
NANAIMO DISTRICT, PLAN 16560.

Client: GEOFFREY LITHERLAND			Civic Address: 1900 STALKER ROAD	
File: 18-045	Scale: 1:600	Drawn by: DRW	Date: October 12, 2023	Existing Zoning: Resource (R)

NOTE:
THIS PROPERTY IS AFFECTED BY THE FOLLOWING REGISTERED DOCUMENTS:
UNDERSURFACE RIGHTS M76301,
SRW ES25205 & ES25206.

0 25 50
SCALE 1:600
DISTANCES AND ELEVATIONS SHOWN ARE IN METRES.
GEODETIC ELEVATIONS ARE DERIVED FROM GNSS OBSERVATIONS (CVD28BC DATUM).

DATE	REVISION #	DESCRIPTION
March 12, 2020	First Issue	
October 12, 2023	1	REVISE LOT LAYOUT

Turner & Associates
land surveying™
250.753.9778
435 Terminal Avenue North
Nanaimo, BC V9S 4J8
www.turnersurveys.ca

Appendix B

Site Photographs

Photograph B1 (LEFT): Looking north towards the pumphouse on Lot A. **Photograph B2 (RIGHT):** Looking down and inside the pumphouse on Lot A at WTN 26181. The pressure tank, in-line filter and wellhead are shown.

Photograph B3 (LEFT): Looking north towards the pumphouse on Lot B. **Photograph B4 (RIGHT):** Looking down and inside the pumphouse on Lot B at WTN 26180. The pressure tank and wellhead are shown

Photograph B5: Close up of the WTN 26180 wellhead. The wellhead cap could not be lifted without removing the pump, which would require assistance from a pump installer.

Photograph B6: Looking east at Lot A cabin and the coastline. Topography is sloping from west to east towards the ocean.

Photograph B7: Looking east towards the Lot B cabin and the coastline. Topography is sloping from west to east towards the ocean.

Photograph B8: Looking east towards the Lot C cabin and the coastline. Topography is sloping from west to east towards the ocean. There is no groundwater supply well located on Lot C and currently water is trucked to site and stored in a large cistern next to the dwelling.

Appendix C

Summary of Groundwater Well Records Within 1 Km of the Site

Table C1: Water Well Records Within a 1 km Radius of the Site

Well Tag #	Well Owner	UTM Zone	Northing	Easting	Status	Construction Date	Finished Well Depth (m)	Well Yield (m^3/d)	Depth to Bedrock (m)	Intended Water Use	Aquifer ID#
13744	N MCLEARAN	10	5442344	449090	UNLICENSED	1952-01-01	18.3	13.6	2.4	Unknown Well Use	709
13746	DR J S THYHURST	10	5443611	449524	UNLICENSED	1952-01-01	30.5	13.6	0.0	Private Domestic	709
13913	N P MCLEARN	10	5442389	448919	UNLICENSED	1953-01-01	18.3	16.4	-	Private Domestic	709
16090	DR F M BRUNTON	10	5442353	448894	UNLICENSED	1959-08-01	18.3	10.9	1.2	Unknown Well Use	709
19843	LABELL	10	5442524	448890	UNLICENSED	1966-02-09	27.4	54.5	0.9	Unknown Well Use	709
26180[a]	DR B A COOKSON	10	5442720	449379	UNLICENSED	1972-05-01	29.0	10.9	0.9	Unknown Well Use	709
26181[a]	DR G C WINCH	10	5442771	449378	UNLICENSED	1972-05-01	27.4	98.1	1.8	Unknown Well Use	709
28542	G F HICKS	10	5442359	448995	UNLICENSED	1973-08-01	27.4	24.5	1.8	Unknown Well Use	709
30403	HUGH SCHAEFERE	10	5443141	448697	UNLICENSED	1974-05-29	48.8	109.0	0.9	Unknown Well Use	709
33905	ERIC KENNY	10	5442141	448851	UNLICENSED	1975-12-01	45.7	16.4	1.8	Unknown Well Use	709
34949	ERIC KENNY	10	5442280	448673	UNLICENSED	1976-06-01	63.1	5.5	2.1	Not Applicable	709
35556	R J PARKINSON	10	5442392	448864	UNLICENSED	1976-09-01	18.3	81.8	1.5	Unknown Well Use	709
35557	DR BRUNTON	10	5442344	448925	UNLICENSED	1976-09-01	41.1	16.4	2.4	Unknown Well Use	709
47898	R DICKINSON	10	5442379	448623	UNLICENSED	1981-05-08	67.7	2.7	0.3	Private Domestic	709
50634	R DICKINSON	10	5442456	448645	UNLICENSED	1982-07-11	54.9	32.7	1.8	Unknown Well Use	709
56005	P SCHMITT	10	5443091	448442	UNLICENSED	1986-05-16	50.3	43.6	1.2	Unknown Well Use	709
64376	DAVE BAXTER	10	5443148	448478	UNLICENSED	1995-05-26	45.7	10.9	3.7	Unknown Well Use	709
64377	RAY MORFORD	10	5443084	448481	UNLICENSED	1990-05-30	50.3	16.4	2.4	Unknown Well Use	709
65132	PALMER DAVE	10	5442953	448439	UNLICENSED	1987-06-26	97.5	10.9	1.2	Private Domestic	709
65134	PALMER DAVE	10	5442951	448437	UNLICENSED	1987-07-08	30.5	109.0	1.5	Private Domestic	709
65138	PALMER DAVE	10	5442957	448443	UNLICENSED	1987-08-19	80.8	76.3	0.5	Private Domestic	709
68810	WEEKS BRIAN	10	5443354	448697	UNLICENSED	1991-04-23	45.7	32.7	3.7	Unknown Well Use	709
68934	MALCOLM BOS	10	5442251	448577	UNLICENSED	1991-10-23	39.6	27.3	5.5	Not Applicable	709
73042	LEES YETTA	10	5442929	448888	UNLICENSED	1994-11-01	57.9	21.8	0.3	Not Applicable	709
73113	KELIN MRS	10	5443041	448897	UNLICENSED	1994-04-21	48.8	21.8	1.2	Unknown Well Use	709
73219	RICK ANTAL	10	5442299	448498	UNLICENSED	1996-08-01	73.2	5.5	2.1	Unknown Well Use	709
85047	DEREK LYNCH	10	5442505	448436	UNLICENSED	2004-07-01	45.7	54.5	6.4	Private Domestic	709
89853	DAVID BOUVIER	10	5443134	448801	UNLICENSED	1992-12-15	80.5	8.2	2.4	Private Domestic	709
96337	JAMES STEWART TYHURST	10	5443661	449365	UNLICENSED	2008-02-29	109.7	2.7	2.4	Private Domestic	709
106450	DAN & DEBBIE FOLEY	10	5443000	448849	UNLICENSED	2001-10-13	76.2	32.7	2.1	Private Domestic	709
106454	DAN & DEBBIE FOLEY	10	5443006	448829	UNLICENSED	2001-10-06	76.2	21.8	1.5	Private Domestic	709
106464	DAVID MORGAN	10	5443193	448897	UNLICENSED	2001-12-06	54.9	38.2	1.8	Private Domestic	709
106466	DAN & DEB FOLEY	10	5443008	448852	UNLICENSED	2001-10-31	70.1	27.3	0.9	Private Domestic	709
106497	ALICE RICH	10	5442963	448681	UNLICENSED	2003-11-25	76.2	27.3	0.6	Private Domestic	709
106512	THOR SIMROSE	10	5443473	448824	UNLICENSED	2004-06-15	42.7	43.6	1.2	Private Domestic	709
106556	JOHN BISHOP	10	5443240	448712	UNLICENSED	1999-07-20	45.7	16.4	0.9	Private Domestic	709
106606	KEN & JEAN MITCHELL	10	5442277	448780	UNLICENSED	2000-04-01	61.0	5.5	0.0	Private Domestic	709
119418	Potlatch Properties Ltd	10	5442839	448414	UNLICENSED	2019-05-02	80.8	8.2	0.9	Private Domestic	709
123454	LIZ & DILLON WALLINGER	10	5442969	448995	UNLICENSED	2021-04-15	51.8	27.3	0.9	Private Domestic	709
125230	Michael Riedijk	10	5443162	449022	UNLICENSED	2022-03-04	91.4	8.2	0.9	Private Domestic	709

Notes: mbgl means metres below ground level; **m^3/d** means cubic meters per day; **"-"** indicates that no data was available. **a)** Blue highlighted wells are located on Site.

Appendix D

Driller's Logs for WTN 26180 and WTN 26181

092G.012.2.3.1

WTN 26180

GROUND — WATER DIVISION, WATER INVESTIGATIONS BRANCH, DEPT. OF LANDS, FORESTS, and WATER RESOURCES, VICTORIA, B.C.

RANGE (TENS / UNITS) | SECTION (TENS / UNITS) | QUARTER (NE SE SW NW) | LAND DISTRICT (TENS / UNITS) | MUNICIPALITY (TENS / UNITS)

6

LOCATION LOT 1 PL 16560 SEC 4 NANAIMO
(COMPLETE LEGAL DESCRIPTION)

#20

OWNER'S NAME DR. B.A. COOKSON ADDRESS 607 BARNHAM ROAD, W. VAN.

DRILLER'S NAME WINDECKER (146) ADDRESS GABRIOLA IS. DATE OF COMPLETION MAY/72

DEPTH 95' ELEVATION OF COLLAR ____ CASING DIAM. 6" LENGTH 5' TYPE 1' stick-up

METHOD OF DIGGING CABLE-TOOL SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

LOCATION OF SCREEN ____ DEVELOPED ☐ DESCRIBE ____

PERFORATED CASING ☐ LENGTH ____ LOCATION OF PERFORATIONS ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

PUMP ☐ TYPE ____ POWER ____

CAPACITY ____ OTHER DATA PUMPING LEVEL : 85'

COSTS WELL ____ PUMP ____ PUMP HOUSE, ETC. ____

MAINTENANCE ____

DISTANCE TO WATER FROM TOP OF CASING 20' ☐ ESTIMATED ☒ MEASURED ELEVATION ____ FLUCTUATION ____

HIGH WATER ____ MONTH ____ LOW WATER ____ MONTH ____ OBSERVATION DATA ☐ FILE No. ____

WATER USE ____

MAX. RATE WITHDRAWAL ☐ ESTIMATED ☐ MEASURED ____

TEMPERATURE ____ PUMPS SAND ☐ ____

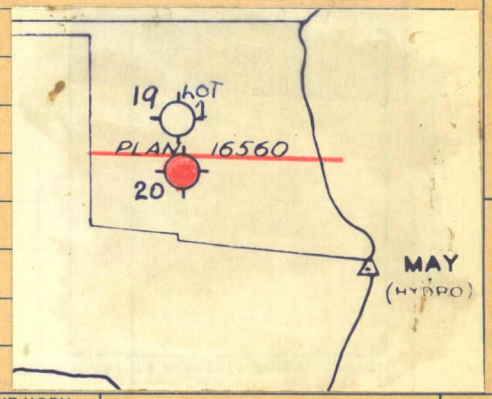
CLOGS SCREEN ☐ TYPE DEPOSIT ____ AQUIFER DATA ____

LICENSE No. ____ DATE LICENSE ____ AMOUNT ____

DATE APPLICATION ____ USE ____

LOCATION: STALKER PT., GABRIOLA IS.

13788



WATER QUALITY: ANALYSIS; SOFT; HARD; HIGH IRON; HIGH SULPHUR; SALTY; ALKALINE; SALINE; POLLUTED; INADEQUATE QUALITY

CAPACITY GPD.: DRY HOLE; INADEQUATE QUANTITY; PUMPING TEST; $0 - 10^3$; $10^3 - 10^4$; $10^4 - 10^5$; $10^5 - 10^6$; 10^6

METHOD: DUG; DRIVEN; DRILLED; JETTED; BORED

DEPTH: 0 — 25; 25 — 30; 50 — 100; 100 — 200; 200 — 400; >400

OBSERVATION; ABANDONED; DEVELOPED; SCREEN; PERF. CASING; GRAVEL ENV.; PUMP

TYPE WELL: FLOWING; NON-FLOW ARTESIAN; WATER TABLE; PART CONFINED

SUPPLY AQUIFER (TENS / UNITS) | OTHER AQUIFER PRESENT (TENS / UNITS) | OTHER AQUIFER PRESENT (TENS / UNITS)

CHARACTER OF SUPPLY AQUIFER: SAND; GRAVEL; TILL

WATER USE: DOMESTIC; GARDEN; STOCK; COOLING; IRRIGATION; INDUSTRIAL; WATERWORKS

RELIABILITY OF DATA: GOOD; FAIR; POOR

ROCK; SPRING

VISIrecord® 12708

LOG

FROM	TO	DESCRIPTION	NAME
0	3	OVERBURDEN	
3	45	SANDSTONE	
45	60	BLUE SHALE	
60	75	BLUE CLAY	
75	90	BLUE SHALE	
90	95	SANDSTONE	

(B)

0.5 gpm @ 50'
0.5 gpm @ 85
1 gpm @ 95'

SAMPLE No. _____ DATE _____

LAB. _____

COLIFORM ORGANISMS _____

TOTAL BACTERIA _____

COLOUR _____ ODOUR _____

TASTE _____

PUMPING TEST SUMMARY

TEST BY _____

DATE _____ FILE No. _____

SPECIFIC CAPACITY _____ PERMIABILITY _____

STORAGE COEFF _____ TRANSMISSIBILITY _____

REMARKS _____

ANALYSIS

	PPM
Total Hardness	
Carbonate Hard	
Magnesium Hard	
Fe	
SO_2	
Ca	
Mg	
Na	
K	
HCO_3	
CO_3	
Cl	
SO_4	
NO_3	
B	
E	
Total Dis-solids	
Total Alkalinity	
Suspended Solids	
Ph	

OTHER DATA

SIZE ANALYSIS. ETC. _____

EST. YIELD: 2 gpm

CARD BY Bruce D. Bell DATE AUG/72

SOURCES INFORMATION DRILL LOG

092G.012.2.3.1

WTN 26181

GROUND — WATER DIVISION, WATER INVESTIGATIONS BRANCH, DEPT. OF LANDS, FORESTS, and WATER RESOURCES, VICTORIA, B.C.

RANGE | SECTION | QUARTER | LAND DISTRICT: 5

LOCATION LOT 1 PL 16560 SEC 4 (9 acres) (COMPLETE LEGAL DESCRIPTION) N/NAIMO

OWNER'S NAME DR. G.C. WINCH ADDRESS 504 EASTOOT, W. VAN.

#19

DRILLER'S NAME WINDECKER (146) ADDRESS GABRIOLA IS. DATE OF COMPLETION MAY/72

DEPTH 90' ELEVATION OF COLLAR ____ CASING DIAM. 6" LENGTH 8' TYPE 1 'stick-up

METHOD OF DIGGING CABLE-TOOL SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

LOCATION OF SCREEN ____ DEVELOPED ☐ DESCRIBE ____

PERFORATED CASING ☐ LENGTH ____ LOCATION OF PERFORATIONS ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

PUMP ☐ TYPE ____ POWER ____

CAPACITY ____ OTHER DATA PUMPING LEVEL : 80'

COSTS WELL ____ PUMP ____ PUMP HOUSE, ETC. ____

MAINTENANCE ____

DISTANCE TO WATER FROM TOP OF CASING 7' ☐ ESTIMATED ☒ MEASURED ELEVATION ____ FLUCTUATION ____

HIGH WATER ____ MONTH ____ LOW WATER ____ MONTH ____ OBSERVATION DATA ☐ FILE No. ____

WATER USE ____

MAX. RATE WITHDRAWAL ☐ ESTIMATED ☐ MEASURED ____

TEMPERATURE ____ PUMPS SAND ☐ ____

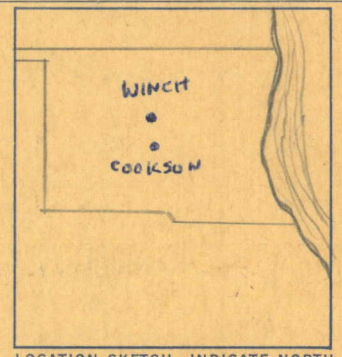
CLOGS SCREEN ☐ TYPE DEPOSIT ____ AQUIFER DATA ____

LICENSE No. ____ DATE LICENSE ____ AMOUNT ____

DATE APPLICATION ____ USE ____

LOCATION: STALKER PT., GABRIOLA IS.

12788 LITHERLAND



LOCATION SKETCH—INDICATE NORTH

METHOD: DUG, DRIVEN, DRILLED, JETTED, BORED

DEPTH: 0 — 25, 25 — 30, 50 — 100, 100 — 200, 200 — 400, >400

OBSERVATION, ABANDONED, DEVELOPED, SCREEN, PERF. CASING, GRAVEL ENV., PUMP

TYPE WELL: FLOWING, NON-FLOW ARTESIAN, WATER TABLE, PART CONFINED

WATER QUALITY: ANALYSIS, SOFT, HARD, HIGH IRON, HIGH SULPHUR, SALTY, ALKALINE, SALINE, POLLUTED, INADEQUATE QUALITY

CAPACITY GPD.: DRY HOLE, INADEQUATE QUANTITY, PUMPING TEST; 0 — 10^3, 10^3 — 10^4, 10^4 — 10^5, 10^5 — 10^6, 10^6

CHARACTER OF SUPPLY AQUIFER: SAND, GRAVEL, TILL

WATER USE: DOMESTIC, GARDEN, STOCK, COOLING, IRRIGATION, INDUSTRIAL, WATERWORKS

RELIABILITY OF DATA: GOOD, FAIR, POOR

ROCK, SPRING

OTHER AQUIFER PRESENT: TENS, UNITS

OTHER AQUIFER PRESENT: TENS, UNITS

SUPPLY AQUIFER: TENS, UNITS

VISIrecord® 12708

LOG

FROM	TO	DESCRIPTION	NAME
0	6'	OVERBURDEN	
6'	30	SANDSTONE	
30	60	BLUE CLAY	
60	85	BLUE SHALE	
85	90	SANDSTONE	
		5 gpm @ 10'	
		8 gpm @ 79'	
		5 gpm @ 90'	

SAMPLE No. _____ DATE _____

LAB. _____

COLIFORM ORGANISMS _____

TOTAL BACTERIA _____

COLOUR _____ ODOUR _____

TASTE _____

PUMPING TEST SUMMARY

TEST BY _____

DATE _____ FILE No. _____

SPECIFIC CAPACITY _____ PERMIABILITY _____

STORAGE COEFF _____ TRANSMISSIBILITY _____

REMARKS _____

ANALYSIS

	PPM
Total Hardness	
Carbonate Hard	
Magnesium Hard	
Fe	
SO_2	
Ca	
Mg	
Na	
K	
HCO_3	
CO_3	
Cl	
SO_4	
NO_3	
B	
E	
Total Dis-solids	
Total Alkalinity	
Suspended Solids	
Ph	

OTHER DATA

SIZE ANALYSIS. ETC. _____

EST. YIELD: 18 gpm

CARD BY Bruce Brad DATE AUG/72

SOURCES INFORMATION DRILL LOG

Appendix E

Groundwater Quality Results and Laboratory Report

Table E1: Summary of Water Quality Results from WTN 26181 (Lot A) and OW 316

Sample Location	Units	Guidelines			WTN 26181 (Lot A)	OW 316
Sample Date		Best Practices for Prevention of Saltwater Intrusion	AO	MAC	2023-Nov-09	2014-Oct-08
Lab ID					23K1368-01	-
General Chemistry						
Alkalinity, Total (as $CaCO_3$)	mg/L	-	-	-	46.7	92.8
Alkalinity, pp (as $CaCO_3$)	mg/L	-	-	-	-	0.5
Conductivity (EC)	µS/cm	**1000**	-	-	184	-
Hardness (as $CaCO_3$)	mg/L	-	-	-	57.8	89
Total Dissolved Solids-Calculated	mg/L	**700**	500	-	96.4	-
Turbidity	NTU	-	0.1	-	-	74.1
pH	-	-	7-10.5	-	6.47	7.46
Major Ions						
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	-	-	-	46.7	112
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	-	-	-	<1.0	0.5
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	-	-	-	<1.0	0.5
Ammonia (N)-Dissolved	mg/L	-	-	-	-	0.005
Ammonia-Total (as N)	mg/L	-	-	-	-	-
Bicarbonate (HCO_3)	mg/L	-	-	-	57	136.6
Calcium (Ca)-Dissolved	mg/L	-	-	-	17.5	26.3
Carbonate (CO_3)	mg/L	-	-	-	<0.600	0.3
Chloride (Cl)	mg/L	**150**	250	-	22.5	11
Dissolved Kjeldahl Nitrogen	mg/L	-	-	-	-	0.034
Fluoride (F)	mg/L	-	-	1.5	<0.10	0.065
Hydroxide (OH)	mg/L	-	-	-	<0.340	-
Ion Balance	%	-	-	-	110	-
Iron (Fe)-Dissolved	mg/L	-	0.3	-	0.069	0.566
Magnesium (Mg)-Dissolved	mg/L	-	-	-	3.42	5.66
Manganese (Mn)-Dissolved	mg/L	-	0.02	0.12	0.0037	0.249
Nitrate (NO_3)	mg/L	-	-	45	-	0.0696
Nitrate+Nitrite-N	mg/L	-	-	-	0.213	-
Nitrate-N	mg/L	-	-	10	0.213	-
Nitrite (NO_2)	mg/L	-	-	3	-	0.0072
Nitrite-N	mg/L	-	-	1	<0.010	-
Nitrogen-Total (as N)	mg/L	-	-	-	-	-
Organic Nitrogen-Total (as N)	mg/L	-	-	-	-	0.034
Phenolphthalein	mg/L	-	-	-	<1.0	-
Potassium (K)-Dissolved	mg/L	-	-	-	0.14	0.642
Sodium (Na)-Dissolved	mg/L	-	200	-	17	12.6
Sulphate (SO_4)	mg/L	-	500	-	6.5	10.4
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-
Dissolved Metals						
Aluminum (Al)-Dissolved	mg/L	-	0.1	2.9	-	0.00054
Antimony (Sb)-Dissolved	mg/L	-	-	0.006	-	0.000072
Arsenic (As)-Dissolved	mg/L	-	-	0.01	-	0.000126
Barium (Ba)-Dissolved	mg/L	-	-	2	-	0.0684
Beryllium (Be)-Dissolved	mg/L	-	-	-	-	0.00001
Bismuth (Bi)-Dissolved	mg/L	-	-	-	-	0.000005
Boron (B)-Dissolved	mg/L	-	-	5	-	0.031
Cadmium (Cd)-Dissolved	mg/L	-	-	0.007	-	0.000005
Chromium (Cr)-Dissolved	mg/L	-	-	0.05	-	0.0001
Cobalt (Co)-Dissolved	mg/L	-	-	-	-	0.000176
Copper (Cu)-Dissolved	mg/L	-	1	2	-	0.000373
Lead (Pb)-Dissolved	mg/L	-	-	0.005	-	0.000006
Lithium (Li)-Dissolved	mg/L	-	-	-	-	0.00503
Molybdenum (Mo)-Dissolved	mg/L	-	-	-	-	0.000367
Nickel (Ni)-Dissolved	mg/L	-	-	-	-	0.00129
Selenium (Se)-Dissolved	mg/L	-	-	0.05	-	0.000147
Silicon (Si)-Dissolved	mg/L	-	-	-	-	9.6
Silver (Ag)-Dissolved	mg/L	-	-	-	-	0.000005
Strontium (Sr)-Dissolved	mg/L	-	-	7	-	0.193
Sulphur (S)-Dissolved	mg/L	-	-	-	-	3.7
Thallium (Tl)-Dissolved	mg/L	-	-	-	-	0.0
Tin (Sn)-Dissolved	mg/L	-	-	-	-	0.0
Titanium (Ti)-Dissolved	mg/L	-	-	-	-	0.0005
Uranium (U)-Dissolved	mg/L	-	-	0.02	-	0.000008
Vanadium (V)-Dissolved	mg/L	-	-	-	-	0.0002
Zinc (Zn)-Dissolved	mg/L	-	5	-	-	0.00274
Zirconium (Zr)-Dissolved	mg/L	-	-	-	-	0.0001

Table E1: Summary of Water Quality Results from WTN 26181 (Lot A) and OW 316

Sample Location	Units	Guidelines			WTN 26181 (Lot A)	OW 316
Sample Date		**Best Practices for Prevention of Saltwater Intrusion**	AO	MAC	2023-Nov-09	2014-Oct-08
Lab ID					23K1368-01	-
Total Metals						
Aluminum (Al)-Total	mg/L	-	0.1	2.9	0.353	-
Antimony (Sb)-Total	mg/L	-	-	0.006	<0.00020	-
Arsenic (As)-Total	mg/L	-	-	0.01	<0.00050	-
Barium (Ba)-Total	mg/L	-	-	2	<0.0050	-
Beryllium (Be)-Total	mg/L	-	-	-	<0.00010	-
Bismuth (Bi)-Total	mg/L	-	-	-	<0.00010	-
Boron (B)-Total	mg/L	-	-	5	<0.0500	-
Cadmium (Cd)-Total	mg/L	-	-	0.007	<0.000010	-
Calcium (Ca)-Total	mg/L	-	-	-	16.7	-
Chromium (Cr)-Total	mg/L	-	-	0.05	<0.00050	-
Cobalt (Co)-Total	mg/L	-	-	-	<0.00010	-
Copper (Cu)-Total	mg/L	-	1	2	0.00692	-
Iron (Fe)-Total	mg/L	-	0.3	-	0.11	-
Lead (Pb)-Total	mg/L	-	-	0.005	0.00139	-
Lithium (Li)-Total	mg/L	-	-	-	0.00044	-
Magnesium (Mg)-Total	mg/L	-	-	-	3.12	-
Manganese (Mn)-Total	mg/L	-	0.02	0.12	0.00569	-
Molybdenum (Mo)-Total	mg/L	-	-	-	<0.00010	-
Nickel (Ni)-Total	mg/L	-	-	-	<0.00040	-
Phosphorus (P)-Total	mg/L	-	-	-	<0.050	-
Potassium (K)-Total	mg/L	-	-	-	0.12	-
Selenium (Se)-Total	mg/L	-	-	0.05	<0.00050	-
Silicon (Si)-Total	mg/L	-	-	-	8.6	-
Silver (Ag)-Total	mg/L	-	-	-	<0.000050	-
Sodium (Na)-Total	mg/L	-	200	-	16.5	-
Strontium (Sr)-Total	mg/L	-	-	7	0.0442	-
Sulphur (S)-Total	mg/L	-	-	-	<3.0	-
Tellurium (Te)-Total	mg/L	-	-	-	<0.00050	-
Thallium (Tl)-Total	mg/L	-	-	-	<0.000020	-
Thorium (Th)-Total	mg/L	-	-	-	<0.00010	-
Tin (Sn)-Total	mg/L	-	-	-	<0.00020	-
Titanium (Ti)-Total	mg/L	-	-	-	<0.0050	-
Tungsten (W)-Total	mg/L	-	-	-	<0.0010	-
Uranium (U)-Total	mg/L	-	-	0.02	0.000183	-
Vanadium (V)-Total	mg/L	-	-	-	<0.0050	-
Zinc (Zn)-Total	mg/L	-	5	-	0.0146	-
Zirconium (Zr)-Total	mg/L	-	-	-	0.00062	-
Phosphorus (P) - Total Dissolved	mg/L	-	-	-	-	0.0028

Notes:

mg/L means milligrams per litre; **µS/cm** means micro Siemens per centimetre; **NTU** means Nephelometric Turbidity Units

MAC and AO guidelines represents the Guidelines for Canadian Drinking Water Quality, Summary Table (Health Canada, October 2024). Guidelines are health based and listed as maximum acceptable concentrations (MAC), or based on aesthetic considerations and listed as aesthetic objectives (AO).

Bold - Value exceeds the Best Practices for Prevention of Saltwater Intrusion

Underline - Value exceeds the Aesthetic Objectives (AO).

Orange highlight - Value exceeds the Maximum Acceptable Concentration (MAC).

CERTIFICATE OF ANALYSIS

REPORTED TO	Waterline Resources Inc. - Nanaimo 2430 Jingle Pot Road Nanaimo, BC V9R 6W2		
ATTENTION	Colin McKenzie	**WORK ORDER**	23K1368
PO NUMBER		**RECEIVED / TEMP**	2023-11-10 08:50 / 8.1°C
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38
PROJECT INFO			

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

If you have any questions or concerns, please contact me at bwhitehead@caro.ca

Authorized By:

Brent Whitehead
Account Manager

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Analyzed	Qualifier
Lot A (23K1368-01) | Matrix: Water | Sampled: 2023-11-09 13:00					
Anions					
Chloride	**22.5**	0.10	mg/L	2023-11-13	
Fluoride	< 0.10	0.10	mg/L	2023-11-13	
Nitrate (as N)	**0.213**	0.010	mg/L	2023-11-13	HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2023-11-13	HT1
Sulfate	**6.5**	1.0	mg/L	2023-11-13	
Calculated Parameters					
Hardness, Total (as CaCO3)	**57.8**	0.500	mg/L	N/A	
Ion Balance	**110**		%	N/A	
Nitrate+Nitrite (as N)	**0.213**	0.0100	mg/L	N/A	
Solids, Total Dissolved	**96.4**	1.00	mg/L	N/A	
Dissolved Metals					
Calcium, dissolved	**17.5**	0.20	mg/L	2023-11-12	
Iron, dissolved	**0.069**	0.010	mg/L	2023-11-12	
Magnesium, dissolved	**3.42**	0.010	mg/L	2023-11-12	
Manganese, dissolved	**0.00370**	0.00020	mg/L	2023-11-12	
Potassium, dissolved	**0.14**	0.10	mg/L	2023-11-12	
Sodium, dissolved	**17.0**	0.10	mg/L	2023-11-12	
General Parameters					
Alkalinity, Total (as CaCO3)	**46.7**	1.0	mg/L	2023-11-16	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2023-11-16	
Alkalinity, Bicarbonate (as CaCO3)	**46.7**	1.0	mg/L	2023-11-16	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2023-11-16	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2023-11-16	
Bicarbonate (HCO3)	**57.0**	1.22	mg/L	N/A	
Carbonate (CO3)	< 0.600	0.600	mg/L	N/A	
Hydroxide (OH)	< 0.340	0.340	mg/L	N/A	
Conductivity (EC)	**184**	2.0	µS/cm	2023-11-16	
pH	**6.47**	0.10	pH units	2023-11-16	HT2
Total Metals					
Aluminum, total	**0.353**	0.0050	mg/L	2023-11-11	
Antimony, total	< 0.00020	0.00020	mg/L	2023-11-11	
Arsenic, total	< 0.00050	0.00050	mg/L	2023-11-11	
Barium, total	< 0.0050	0.0050	mg/L	2023-11-11	
Beryllium, total	< 0.00010	0.00010	mg/L	2023-11-11	
Bismuth, total	< 0.00010	0.00010	mg/L	2023-11-11	
Boron, total	< 0.0500	0.0500	mg/L	2023-11-11	
Cadmium, total	< 0.000010	0.000010	mg/L	2023-11-11	
Calcium, total	**16.7**	0.20	mg/L	2023-11-11	
Chromium, total	< 0.00050	0.00050	mg/L	2023-11-11	
Cobalt, total	< 0.00010	0.00010	mg/L	2023-11-11	

TEST RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Analyzed	Qualifier
Lot A (23K1368-01) | Matrix: Water | Sampled: 2023-11-09 13:00, Continued					
Total Metals, Continued					
Copper, total	**0.00692**	0.00040	mg/L	2023-11-11	
Iron, total	**0.110**	0.010	mg/L	2023-11-11	
Lead, total	**0.00139**	0.00020	mg/L	2023-11-11	
Lithium, total	**0.00044**	0.00010	mg/L	2023-11-11	
Magnesium, total	**3.12**	0.010	mg/L	2023-11-11	
Manganese, total	**0.00569**	0.00020	mg/L	2023-11-11	
Molybdenum, total	< 0.00010	0.00010	mg/L	2023-11-11	
Nickel, total	< 0.00040	0.00040	mg/L	2023-11-11	
Phosphorus, total	< 0.050	0.050	mg/L	2023-11-11	
Potassium, total	**0.12**	0.10	mg/L	2023-11-11	
Selenium, total	< 0.00050	0.00050	mg/L	2023-11-11	
Silicon, total	**8.6**	1.0	mg/L	2023-11-11	
Silver, total	< 0.000050	0.000050	mg/L	2023-11-11	
Sodium, total	**16.5**	0.10	mg/L	2023-11-11	
Strontium, total	**0.0442**	0.0010	mg/L	2023-11-11	
Sulfur, total	< 3.0	3.0	mg/L	2023-11-11	
Tellurium, total	< 0.00050	0.00050	mg/L	2023-11-11	
Thallium, total	< 0.000020	0.000020	mg/L	2023-11-11	
Thorium, total	< 0.00010	0.00010	mg/L	2023-11-11	
Tin, total	< 0.00020	0.00020	mg/L	2023-11-11	
Titanium, total	< 0.0050	0.0050	mg/L	2023-11-11	
Tungsten, total	< 0.0010	0.0010	mg/L	2023-11-11	
Uranium, total	**0.000183**	0.000020	mg/L	2023-11-11	
Vanadium, total	< 0.0050	0.0050	mg/L	2023-11-11	
Zinc, total	**0.0146**	0.0040	mg/L	2023-11-11	
Zirconium, total	**0.00062**	0.00010	mg/L	2023-11-11	

Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Bicarbonate in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]		N/A
Carbonate in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]		N/A
Conductivity in Water	SM 2510 B (2021)	Conductivity Meter	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Hydroxide in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]		N/A
Ion Balance in Water	SM 1030 E (2021)	SM 1030 E		N/A
pH in Water	SM 4500-H+ B (2021)	Electrometry	✓	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2021)	SM 1030 E		N/A
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
%	Percent
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the received samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:bwhitehead@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3K1285										
Blank (B3K1285-BLK1)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B3K1285-BLK2)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B3K1285-BLK3)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B3K1285-BS1)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	16.1	0.10	mg/L	16.0		100	90-110			
Fluoride	4.18	0.10	mg/L	4.00		104	88-108			
Nitrate (as N)	4.01	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	2.00	0.010	mg/L	2.00		100	85-115			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
LCS (B3K1285-BS2)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	4.07	0.10	mg/L	4.00		102	88-108			
Nitrate (as N)	4.01	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	2.03	0.010	mg/L	2.00		101	85-115			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
LCS (B3K1285-BS3)				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	4.11	0.10	mg/L	4.00		103	88-108			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B3K1285, Continued										
LCS (B3K1285-BS3), Continued				Prepared: 2023-11-13, Analyzed: 2023-11-13						
Nitrate (as N)	4.01	0.010	mg/L	4.00		100	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
Dissolved Metals, Batch B3K1267										
Blank (B3K1267-BLK1)				Prepared: 2023-11-12, Analyzed: 2023-11-12						
Calcium, dissolved	< 0.20	0.20	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
LCS (B3K1267-BS1)				Prepared: 2023-11-12, Analyzed: 2023-11-12						
Calcium, dissolved	4.11	0.20	mg/L	4.00		103	80-120			
Iron, dissolved	4.17	0.010	mg/L	4.00		104	80-120			
Magnesium, dissolved	4.26	0.010	mg/L	4.00		107	80-120			
Manganese, dissolved	0.0420	0.00020	mg/L	0.0400		105	80-120			
Potassium, dissolved	4.14	0.10	mg/L	4.00		103	80-120			
Sodium, dissolved	4.09	0.10	mg/L	4.00		102	80-120			
General Parameters, Batch B3K1664										
Blank (B3K1664-BLK1)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B3K1664-BLK2)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B3K1664-BLK3)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B3K1664-BS1)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	108	1.0	mg/L	100		108	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	31.4	1.0	mg/L	50.0		63	0-200			
LCS (B3K1664-BS2)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	108	1.0	mg/L	100		108	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	32.8	1.0	mg/L	50.0		66	0-200			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3K1664, Continued										
LCS (B3K1664-BS3)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Alkalinity, Total (as CaCO3)	90.8	1.0	mg/L	100		91	80-120			
Alkalinity, Phenolphthalein (as CaCO3)	4.7	1.0	mg/L	50.0		9	0-200			
LCS (B3K1664-BS4)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Conductivity (EC)	1360	2.0	µS/cm	1410		96	95-105			
LCS (B3K1664-BS5)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
LCS (B3K1664-BS6)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-105			
Reference (B3K1664-SRM1)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
pH	7.03	0.10	pH units	7.01		100	98-102			
Reference (B3K1664-SRM2)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
pH	7.03	0.10	pH units	7.01		100	98-102			
Reference (B3K1664-SRM3)				Prepared: 2023-11-16, Analyzed: 2023-11-16						
pH	7.02	0.10	pH units	7.01		100	98-102			
Total Metals, Batch B3K1230										
Blank (B3K1230-BLK1)				Prepared: 2023-11-10, Analyzed: 2023-11-11						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3K1230, Continued										
Blank (B3K1230-BLK1), Continued				Prepared: 2023-11-10, Analyzed: 2023-11-11						
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B3K1230-BS1)				Prepared: 2023-11-10, Analyzed: 2023-11-11						
Aluminum, total	3.88	0.0050	mg/L	4.00		97	80-120			
Antimony, total	0.0386	0.00020	mg/L	0.0400		96	80-120			
Arsenic, total	0.388	0.00050	mg/L	0.400		97	80-120			
Barium, total	0.0389	0.0050	mg/L	0.0400		97	80-120			
Beryllium, total	0.0404	0.00010	mg/L	0.0400		101	80-120			
Bismuth, total	0.0390	0.00010	mg/L	0.0400		97	80-120			
Boron, total	0.416	0.0500	mg/L	0.400		104	80-120			
Cadmium, total	0.0399	0.000010	mg/L	0.0400		100	80-120			
Calcium, total	4.04	0.20	mg/L	4.00		101	80-120			
Chromium, total	0.0388	0.00050	mg/L	0.0400		97	80-120			
Cobalt, total	0.0392	0.00010	mg/L	0.0400		98	80-120			
Copper, total	0.0390	0.00040	mg/L	0.0400		98	80-120			
Iron, total	4.03	0.010	mg/L	4.00		101	80-120			
Lead, total	0.0393	0.00020	mg/L	0.0400		98	80-120			
Lithium, total	0.0400	0.00010	mg/L	0.0400		100	80-120			
Magnesium, total	3.75	0.010	mg/L	4.00		94	80-120			
Manganese, total	0.0392	0.00020	mg/L	0.0400		98	80-120			
Molybdenum, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Nickel, total	0.0390	0.00040	mg/L	0.0400		98	80-120			
Phosphorus, total	3.87	0.050	mg/L	4.00		97	80-120			
Potassium, total	3.88	0.10	mg/L	4.00		97	80-120			
Selenium, total	0.390	0.00050	mg/L	0.400		97	80-120			
Silicon, total	4.0	1.0	mg/L	4.00		99	80-120			
Silver, total	0.0400	0.000050	mg/L	0.0400		100	80-120			
Sodium, total	4.05	0.10	mg/L	4.00		101	80-120			
Strontium, total	0.0385	0.0010	mg/L	0.0400		96	80-120			
Sulfur, total	39.5	3.0	mg/L	40.0		99	80-120			
Tellurium, total	0.0383	0.00050	mg/L	0.0400		96	80-120			
Thallium, total	0.0391	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0403	0.00010	mg/L	0.0400		101	80-120			
Tin, total	0.0391	0.00020	mg/L	0.0400		98	80-120			
Titanium, total	0.0389	0.0050	mg/L	0.0400		97	80-120			
Tungsten, total	0.0398	0.0010	mg/L	0.0400		99	80-120			
Uranium, total	0.0404	0.000020	mg/L	0.0400		101	80-120			
Vanadium, total	0.0393	0.0050	mg/L	0.0400		98	80-120			
Zinc, total	0.384	0.0040	mg/L	0.400		96	80-120			
Zirconium, total	0.0398	0.00010	mg/L	0.0400		100	80-120			
Matrix Spike (B3K1230-MS1)	**Source: 23K1368-01**			Prepared: 2023-11-10, Analyzed: 2023-11-11						
Aluminum, total	4.83	0.0050	mg/L	4.00	0.353	112	70-130			
Antimony, total	0.0438	0.00020	mg/L	0.0400	< 0.00020	109	70-130			
Arsenic, total	0.455	0.00050	mg/L	0.400	< 0.00050	114	70-130			
Barium, total	0.0475	0.0050	mg/L	0.0400	< 0.0050	114	70-130			
Beryllium, total	0.0477	0.00010	mg/L	0.0400	< 0.00010	119	70-130			
Bismuth, total	0.0447	0.00010	mg/L	0.0400	< 0.00010	112	70-130			
Boron, total	0.495	0.0500	mg/L	0.400	< 0.0500	117	70-130			
Cadmium, total	0.0463	0.000010	mg/L	0.0400	< 0.000010	116	70-130			
Calcium, total	21.4	0.20	mg/L	4.00	16.7	117	70-130			
Chromium, total	0.0445	0.00050	mg/L	0.0400	< 0.00050	110	70-130			
Cobalt, total	0.0452	0.00010	mg/L	0.0400	< 0.00010	113	70-130			
Copper, total	0.0524	0.00040	mg/L	0.0400	0.00692	114	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Waterline Resources Inc. - Nanaimo	**WORK ORDER**	23K1368
PROJECT	3330-23-001	**REPORTED**	2023-11-17 13:38

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B3K1230, Continued										
Matrix Spike (B3K1230-MS1), Continued		**Source: 23K1368-01**		Prepared: 2023-11-10, Analyzed: 2023-11-11						
Iron, total	4.67	0.010	mg/L	4.00	0.110	114	70-130			
Lead, total	0.0466	0.00020	mg/L	0.0400	0.00139	113	70-130			
Lithium, total	0.0473	0.00010	mg/L	0.0400	0.00044	117	70-130			
Magnesium, total	7.28	0.010	mg/L	4.00	3.12	104	70-130			
Manganese, total	0.0510	0.00020	mg/L	0.0400	0.00569	113	70-130			
Molybdenum, total	0.0460	0.00010	mg/L	0.0400	< 0.00010	115	70-130			
Nickel, total	0.0455	0.00040	mg/L	0.0400	< 0.00040	113	70-130			
Phosphorus, total	4.51	0.050	mg/L	4.00	< 0.050	113	70-130			
Potassium, total	4.58	0.10	mg/L	4.00	0.12	111	70-130			
Selenium, total	0.447	0.00050	mg/L	0.400	< 0.00050	112	70-130			
Silicon, total	12.7	1.0	mg/L	4.00	8.6	104	70-130			
Silver, total	0.0455	0.000050	mg/L	0.0400	< 0.000050	114	70-130			
Sodium, total	20.2	0.10	mg/L	4.00	16.5	94	70-130			
Strontium, total	0.0882	0.0010	mg/L	0.0400	0.0442	110	70-130			
Sulfur, total	47.7	3.0	mg/L	40.0	< 3.0	114	70-130			
Tellurium, total	0.0452	0.00050	mg/L	0.0400	< 0.00050	113	70-130			
Thallium, total	0.0453	0.000020	mg/L	0.0400	< 0.000020	113	70-130			
Thorium, total	0.0476	0.00010	mg/L	0.0400	< 0.00010	119	70-130			
Tin, total	0.0466	0.00020	mg/L	0.0400	< 0.00020	116	70-130			
Titanium, total	0.0484	0.0050	mg/L	0.0400	< 0.0050	115	70-130			
Tungsten, total	0.0472	0.0010	mg/L	0.0400	< 0.0010	118	70-130			
Uranium, total	0.0467	0.000020	mg/L	0.0400	0.000183	116	70-130			
Vanadium, total	0.0458	0.0050	mg/L	0.0400	< 0.0050	112	70-130			
Zinc, total	0.457	0.0040	mg/L	0.400	0.0146	111	70-130			
Zirconium, total	0.0486	0.00010	mg/L	0.0400	0.00062	120	70-130			