APPENDIX 6

HYDROGEOLOGICAL AND GROUNDWATER REPORT

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July 29, 2025

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SLR Project No.: 243.024532.00000

RE: Technical Memorandum – Water Well Assessment
Safari Road, Hamilton, Ontario

1.0 Introduction

SLR is pleased to provide a Technical Memorandum detailing the results of the Water Well Assessment for the Safari Road improvement project in Hamilton, Ontario (the Project Site) (**Figure 1**). SLR understands the project proposes road and drainage improvements to Safari Road between Kirkwall Road and Valens Road. The purpose of this technical memorandum is to inventory existing water well records within 500 m of the site boundary and collect data on existing water users to create a baseline data set to mitigate/manage risk.

2.0 Water Well Assessment

2.1 MECP Water Well Records

SLR completed a review of the Ministry of Environment, Conservation and Parks (MECP) Water Well Records (WWRs) database within 500 m of the site boundary (**Figure 2**). Based on this review, 17 WWRs exist within 500 m of the site boundary (**Table 1**). Of these wells, ten (10) wells are for domestic use, three (3) are for livestock/domestic use, three (3) have unknown usage, and one (1) is for commercial use.

All of these wells are drilled wells completed in the limestone bedrock with a 6 m steel well casing isolating the upper overburden from the bedrock aquifer unit. The bedrock was generally found at or near surface in all of the wells, with a maximum depth to bedrock of 3 m. The well depths range from 7.9 to 48.8 meters below ground surface (mbgs) with an average depth of 23.0 mbgs. Water levels in the wells range from 1.2 to 20.4 mbgs, with an average of 5.7 mbgs. Recommended pumping rates range from 19 to 75 LPM with an average of 37 GPM. These are relatively high pumping rates, with a typical domestic single family home needing 7 to 11 LPM.

Three wells were identified in close proximity to Safari Road (#6800946, #6811570, and #6809445). These wells are all drilled wells that source potable groundwater from the bedrock, with two wells being used for domestic use, and one being used for livestock.

Table 1. MECP Water Well Records (500m Radius)

Well ID	Year Completed	Well Depth (mbgs)	Water Level (mbgs)	Pumping Rate (LPM)	Casing Diameter (m)	Well Use	Completed Geology
6800883	1965-05-11	22.6	4.6	37	0.10	Domestic	Limestone
6800942	1961-11-15	18.9	5.2	37	0.10	Livestock / Domestic	Limestone

Well ID	Year Completed	Well Depth (mbgs)	Water Level (mbgs)	Pumping Rate (LPM)	Casing Diameter (m)	Well Use	Completed Geology
6800946	1967-06-22	24.1	4.0	30	0.13	Domestic	Limestone
6808477	1973-06-12	7.9	3.0	19	0.15	Domestic	Limestone
6808798	1974-04-03	16.8	1.2	26	0.15	Domestic	Limestone
6809445	1976-06-15	12.2	4.6	37	0.15	Domestic	Limestone
6811093	1986-12-17	19.8	3.7	37	0.15	Livestock / Domestic	Limestone
6811570	1988-12-19	12.2	1.2	37	0.15	Livestock / Domestic	Limestone
6811990	1990-09-19	18.9	3.7	37	0.15	Domestic	Limestone
6811991	1990-10-01	-	-	-	-	Unknown	Limestone
6811992	1990-09-18	29.3	3.7	37	0.15	Domestic	Limestone
6811993	1990-10-01	16.8	-	-	-	Unknown	Limestone
6812328	1993-04-14	21.3	4.0	75	0.15	Commercial	Limestone
6812416	1993-11-25	37.8	20.4	30	0.15	Domestic	Limestone
6814566	2006-08-28	48.8	6.4	57	0.15	Domestic	Limestone
7035047	2006-08-29	37.2	13.4	19	0.15	Domestic	Limestone
7131753	2009-09-29	-	-	-	-	Unknown	Limestone

No data available is indicated by "-"

2.2 Door-to-Door Water Well Survey

The City of Hamilton obtained Permits to Enter (PTEs) from five (5) residences near the site boundary to be involved in the Water Well Survey (WWS) (**Table 2**). The locations of the residences are labelled on **Figure 1**. The purpose of the WWS is to determine the condition of wells within the site boundary, septic conditions, and obtain baseline groundwater levels and raw groundwater chemistry data. Based on a discussion with the homeowners involved in the WWS, each of the homes currently relies on a standard septic system, with a septic tank and a leaching field adjacent to each home.

On October 18th, 2024, SLR personnel visited each residence listed in **Table 2** to collect a groundwater level and raw groundwater chemistry sample. The majority of the wells were buried and inaccessible. The groundwater level from the MECP WWR was used for these wells. No resident was home at 1285 Kirkwall Road, and a water sample could not be collected. Groundwater chemistry data is provided in **Attachment A**. Groundwater samples were compared to Aesthetic and Microbiological/Chemical Ontario Drinking Water Standards (ODWS). The groundwater samples reflect raw groundwater and does not include any filtration systems the homes may have.

Exceedances in the Aesthetic ODWS were noted in color, hardness, iron, and manganese. Filtration methods such as activated carbon, sedimentation or water softeners can likely reduce the concentration of iron and manganese. Exceedances in the Microbiological/Chemical ODWS were noted in coliforms and e.coli. This is typical in raw groundwater and can be removed through UV light filters. 1781 Safari Road showed exceedances in fluoride and sodium, which can be reduced through reverse osmosis filters.

The groundwater chemistry for each well was generally good, and typical for raw groundwater.

Table 2. Water Well Survey Results

Residential Address	Associated MECP WWR	Depth (mbgs)	Groundwater Level (mbgs)	Water Sample Collected
1285 Kirkwall Road*	6808477	7.9	3.0	No
1359 Valens Road*	No nearby well record	-	-	Yes
1492 Kirkwall Road*	6800944	16.1	4.3	Yes
1618 Safari Road*	6809445	12.2	4.6	Yes
1781 Safari Road	No nearby well record	-	3.48	Yes

**Well buried and not accessible, groundwater level utilizes MECP WWR.*

3.0 Conclusion

Based on the MECP Water Well Records and the Door-to-Door Water Well Survey, all of the wells within 500 m of the site boundary are deep drilled wells. Four (4) wells were identified in close proximity to Safari Road, with three having associated MECP WWRs (#6800946, #6811570, and #6809445), and one being identified during the WWS located at 1781 Safari Road. These wells obtain potable groundwater from the bedrock aquifer, which typically relies on regional groundwater flow and offsite recharge. These wells are also isolated from the surface with a 6 m steel well casing and are not likely to be impacted by surface works. As the proposed works along Safari Road does not include significant groundwater dewatering or changes to permeability, no impact to nearby groundwater wells is anticipated.

Regards,

SLR Consulting (Canada) Ltd.

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Operations Lead, Hydrogeology East

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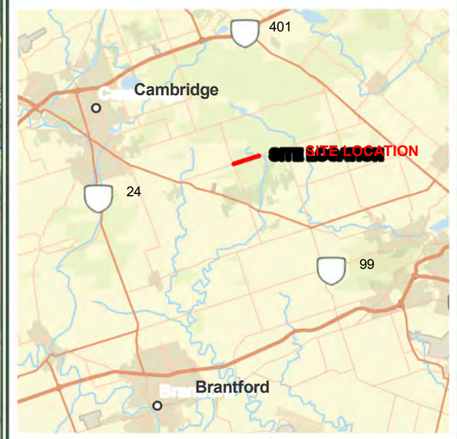
LEGEND:

- SUBJECT SITE
- PROPERTY BOUNDARY
- WATERCOURSE [1]



NOTES:
1. LIO/MNRF

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0 50 100 200 300 400 500 m

SCALE 1:10,000
PAGE SIZE 11 x 17
NAD 1983 UTM Zone 17N

THIS MAP IS FOR CONCEPTUAL PURPOSES ONLY AND SHOULD NOT BE USED FOR NAVIGATION

R.V. ANDERSON ASSOCIATES LTD.
SAFARI ROAD
HAMILTON, ON

HYDROGEOLOGICAL INVESTIGATION

SITE MAP

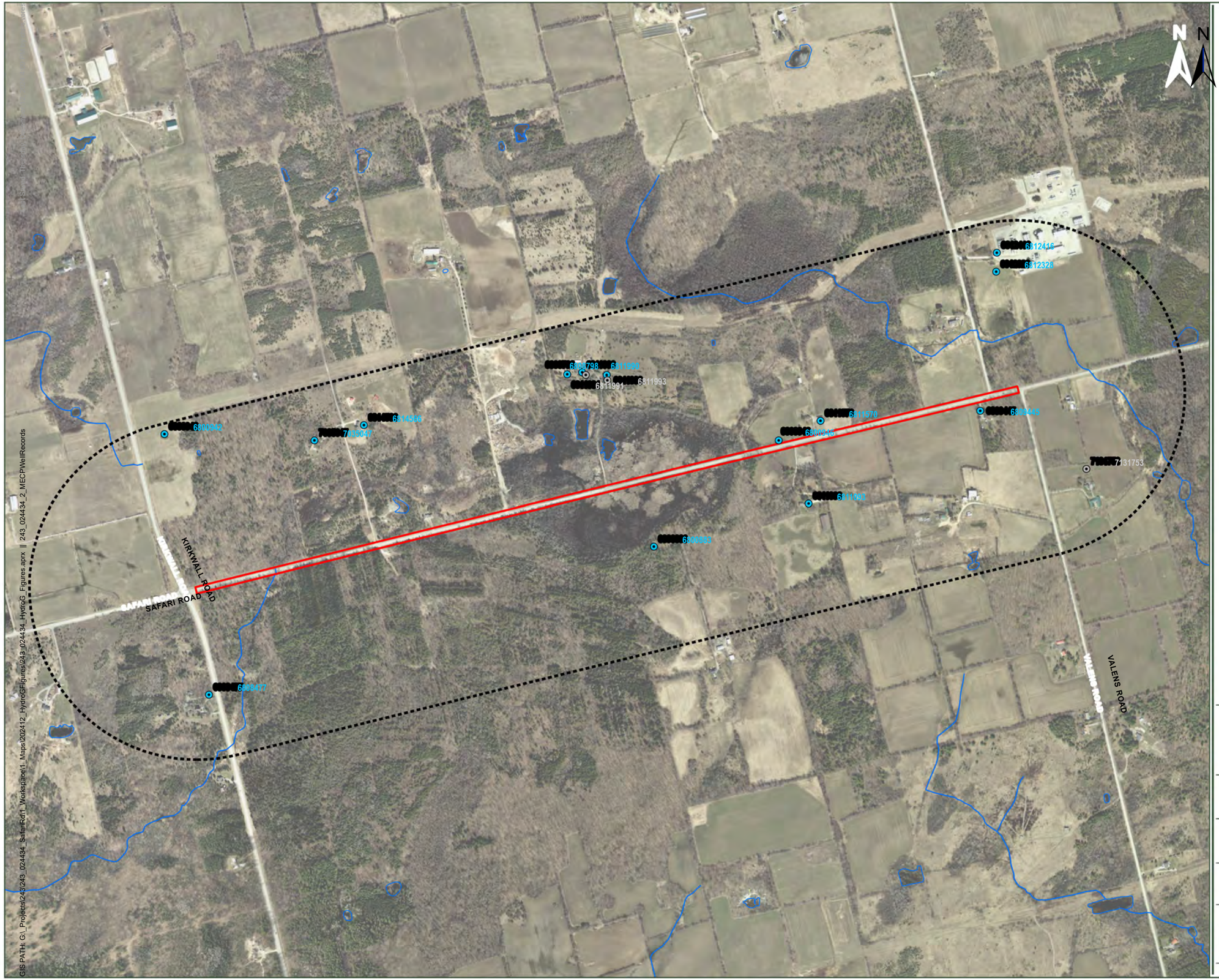
SLR

FIGURE NO:
1

DATE: December 12, 2024

PROJECT NO: 243.024434.00001

GIS PATH: G:_Projects\243\243_024434_SafariRd\1_Workspace\1_Maps\2024\12_HydroGFigures\243_024434_HydroG_Figures.aprx || 243_024434_1_SiteMap



LEGEND:

- SUBJECT SITE
- 500 M SITE BUFFER
- WATERCOURSE [1]

WATER WELL RECORD [2] WITHIN 500 M

BY WELL USE

- WATER SUPPLY
- N/A

NOTES:
1. LIO/MNRF
2. MECP

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0 50 100 200 300 400 500 m

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R.V. ANDERSON ASSOCIATES LTD.
SAFARI ROAD
HAMILTON, ON

HYDROGEOLOGICAL INVESTIGATION

MECP WATER WELL RECORDS WITHIN 500 M OF SITE

SLR

FIGURE NO:
2

DATE: December 12, 2024

PROJECT NO: 243.024434.00001

GIS PATH: G:_Projects\243\243_024434_SafariRd\1_Workspace\1_Maps\202412_HydroGFigures\243_024434_HydroG_Figures.aprx || 243_024434_2_MECPWellRecords

Attachment A – Groundwater Chemistry

Parameters	Units	ODWS Aesthetic Objective	ODWS Schedule 1 and 2	1359 Valens Road	1492 Kirkwall Road	1618 Safari Road	1781 Safari Road
Physical Tests (Matrix: Water)							
Conductivity	µS/cm	-	-	642	713	529	530
Alkalinity, bicarbonate (as HCO3)	mg/L	-	-	385	334	327	305
Alkalinity, carbonate (as CO3)	mg/L	-	-	13.3	5.8	5.9	6.3
Alkalinity, hydroxide (as OH)	mg/L	-	-	<1.0	<1.0	<1.0	<1.0
Alkalinity, total (as CaCO3)	mg/L	30 -> 500	-	338	283	278	260
Colour, apparent	CU	5	-	29.3	8.5	31.4	<2.0
Hardness (as CaCO3), from total Ca/Mg	mg/L	80 -> 100	-	332	378	291	0.65
Langelier index (@ 4°C)		-	-	0.640	1.13	1.06	-2.42
Solids, total dissolved [TDS]	mg/L	500	-	328	406	260	300
Solids, total dissolved [TDS], calculated	mg/L	-	-	417	463	344	344
Turbidity	NTU	5	-	0.48	1.50	4.07	<0.10
pH	pH units	6.5 -> 8.5	-	7.91	8.44	8.47	7.98
Langelier index (@ 20°C)	-	-	-	0.888	1.38	1.30	-2.17
pH, saturation (@ 4°C)	pH units	-	-	7.27	7.31	7.41	10.4
pH, saturation (@ 20°C)	pH units	-	-	7.02	7.06	7.16	10.2
Anions and Nutrients (Matrix: Water)							
Ammonia, total (as N)	mg/L	-	-	0.0613	0.0085	0.0821	<0.0050
Bromide	mg/L	-	-	<0.10	<0.10	<0.10	<0.10
Chloride	mg/L	250	-	7.88	22.7	2.40	7.86
Fluoride	mg/L	-	1.5	0.183	1.33	1.47	1.56
Nitrate (as N)	mg/L	-	10	<0.020	<0.020	<0.020	<0.020
Nitrate + Nitrite (as N)	mg/L	-	10	<0.0224	<0.0224	<0.0224	<0.0224
Nitrite (as N)	mg/L	-	1	<0.010	<0.010	<0.010	<0.010
Phosphate, ortho-, dissolved (as P)	mg/L	-	-	0.0113	<0.0010	<0.0010	0.0025
Sulfate (as SO4)	mg/L	500	-	19.7	83.5	12.4	8.50

Parameters	Units	ODWS Aesthetic Objective	ODWS Schedule 1 and 2	1359 Valens Road	1492 Kirkwall Road	1618 Safari Road	1781 Safari Road
Microbiological Tests (Matrix: Water)							
Coliforms, Escherichia coli [E. coli]	CFU/100mL	-	-	560	<1	<1	<1
Coliforms, total	CFU/100mL	-	1	1500	<10	<1	1
coliforms, total background	CFU/100mL	-	1	43	<10	11	180
Metals (Matrix: Water)							
Sodium adsorption ratio [SAR]	-	-	-	0.10	0.24	<0.10	70.5
Ion Balance (Matrix: Water)							
Anion sum	meq/L	-	-	7.40	8.10	5.96	5.68
Cation sum (total)	meq/L	-	-	6.90	8.09	5.92	5.71
Ion balance (cations/anions)	%	-	-	93.2	99.9	99.3	100
Ion balance (APHA)	%	-	-	-3.50	-0.062	-0.337	0.263
Total Metals (Matrix: Water)							
Aluminum, total	mg/L	0.1	-	0.0083	<0.0030	<0.0030	<0.0030
Antimony, total	mg/L	-	0.006	<0.00010	0.00013	<0.00010	<0.00010
Arsenic, total	mg/L	-	0.01	0.00093	0.00018	<0.00010	<0.00010
Barium, total	mg/L	-	1	0.0184	0.0285	0.0759	<0.00010
Beryllium, total	mg/L	-	-	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth, total	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Boron, total	mg/L	-	5	0.018	0.016	<0.010	<0.010
Cadmium, total	mg/L	-	0.005	0.0000496	0.0000076	<0.0000050	<0.0000050
Calcium, total	mg/L	-	-	76.1	88.7	65.0	0.072
Cesium, total	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Chromium, total	mg/L	-	0.05	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt, total	mg/L	-	-	0.00185	0.00056	<0.00010	<0.00010
Copper, total	mg/L	1	-	0.00235	0.00717	0.0139	0.00910
Iron, total	mg/L	0.3	-	0.712	1.01	0.180	<0.010
Lead, total	mg/L	-	0.01	0.00174	0.00449	0.00128	0.000322

Parameters	Units	ODWS Aesthetic Objective	ODWS Schedule 1 and 2	1359 Valens Road	1492 Kirkwall Road	1618 Safari Road	1781 Safari Road
Lithium, total	mg/L	-	-	<0.0010	0.0019	<0.0010	<0.0010
Magnesium, total	mg/L	-	-	34.4	37.9	31.3	0.115
Manganese, total	mg/L	0.05	-	0.373	0.00594	0.00613	0.00029
Molybdenum, total	mg/L	-	-	0.000158	0.00153	<0.000050	<0.000050
Nickel, total	mg/L	-	-	0.00334	0.00572	<0.00050	<0.00050
Phosphorus, total	mg/L	-	-	<0.050	<0.050	<0.050	<0.050
Potassium, total	mg/L	-	-	1.43	1.71	0.700	0.131
Rubidium, total	mg/L	-	-	0.00068	0.00102	0.00059	<0.00020
Selenium, total	mg/L	-	0.05	0.000138	<0.000050	<0.000050	<0.000050
Silicon (as SiO2), total	mg/L	-	-	6.44	7.23	6.54	6.67
Silicon, total	mg/L	-	-	3.01	3.38	3.06	3.12
Silver, total	mg/L	-	-	<0.000010	<0.000010	<0.000010	<0.000010
Sodium, total	mg/L	200	20	4.32	10.8	1.66	131
Strontium, total	mg/L	-	-	0.0706	0.704	0.0668	0.00022
Sulfur, total	mg/L	-	-	5.40	30.5	4.41	3.10
Tellurium, total	mg/L	-	-	<0.00020	<0.00020	<0.00020	<0.00020
Thallium, total	mg/L	-	-	0.000025	0.000043	<0.000010	<0.000010
Thorium, total	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Tin, total	mg/L	-	-	<0.00010	<0.00010	0.00079	<0.00010
Titanium, total	mg/L	-	-	0.00033	<0.00030	<0.00030	<0.00030
Tungsten, total	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Uranium, total	mg/L	-	0.02	0.000226	0.00187	0.000064	0.000016
Vanadium, total	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Zinc, total	mg/L	5	-	0.0298	0.0153	0.0054	0.0032
Zirconium, total	mg/L	-	-	0.00027	<0.00020	<0.00020	<0.00020

ODWS Aesthetic Exceedance highlighted in yellow

ODWS Schedule 1 and 2 Exceedance highlighted in orange