

Groundwater Monitoring Plan

Summit Pit Project

Mountain Ash Limited Partnership

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Table of Contents

1.0	Introduction.....	1
2.0	Site Description.....	1
2.1	Land Uses.....	1
2.2	Proposed Site Activities	2
2.3	Potential Sources of Groundwater Contamination.....	2
2.3.1	Historical.....	2
2.3.2	Current and Future	2
3.0	Geology	3
3.1	Surficial Geology.....	3
3.2	Bedrock Geology	3
4.0	Hydrogeology.....	4
4.1	Aquifer Properties	4
4.1.1	Surficial Unconsolidated Deposits	4
4.1.2	Paskapoo Formation Bedrock	5
4.2	Groundwater Levels and Flow	5
4.2.1	Groundwater/Surface Water Interactions	7
4.3	Baseline Water Quality Assessment.....	8
4.3.1	Surficial Deposits.....	8
4.3.2	Paskapoo Formation Bedrock	8
4.3.3	Big Hill Springs.....	10
4.4	Regional and Local Water Users.....	12
5.0	Regulatory Framework.....	14
6.0	Proposed Groundwater Monitoring Well Network.....	15
6.1	Groundwater Monitoring Objectives.....	15
6.2	Groundwater Monitoring Approach	15
6.3	Groundwater Monitoring Network Description.....	15
7.0	Groundwater Monitoring Program	16
7.1	Methodology	16
7.1.1	Groundwater Monitoring.....	16

7.1.2	Monitoring Wells	17
7.1.3	Residential Wells.....	17
7.1.4	Groundwater and Surface Water Sampling	17
7.1.5	Groundwater and Surface Water Analytical Program	18
7.2	Quality Assurance and Quality Control (QA/QC)	18
7.3	Proposed Monitoring Schedule.....	19
8.0	Groundwater Response Plan	21
8.1	Baseline Groundwater Sampling	21
8.2	Establish Control Limits.....	21
8.3	Annual Groundwater Monitoring.....	22
8.4	Annual Groundwater Monitoring Report	22
8.5	Identification of a Problem.....	22
8.6	Source Investigation.....	22
8.7	Risk Management Plan	22
9.0	Summary	23
10.0	Statement of Limitations	23
11.0	References.....	25

Tables in Text

Table 1:	Summary of Big Hill Spring Flow Data	7
Table 2:	Groundwater Quality Summary, Expressed as Historic Ranges.....	9
Table 3:	Historical Summary of Bighill Spring Water Quality	11
Table 4:	Water Wells within 800 Metres.....	13
Table 5:	Proposed Phase 1 Monitoring Schedule	20
Table 6:	Control Limits for Parameters Not Covered by Provincial Guidelines.....	21

Appended Tables

Table A1: Sand and Gravel Monitoring Well Groundwater Quality Results

Table A2: Paskapoo Formation Residential Well Groundwater Quality Results

Table A3: Big Hill Springs Water Quality Results

Appended Figures

Figure 1: Site Location and Study Area

Figure 2: Current and Historical Potential Sources of Groundwater Contamination

Figure 3: Monitoring Well and Water Well Location Plan

Figure 4: Schematic Geological Section A-A'

Figure 5: Groundwater Elevations (July 3, 2019)

Figure 6: Phase 1 Monitoring Location Plan

Figure 7: Groundwater Response Plan

Appendices

Appendix A Monitoring Well Construction Logs

Appendix B Groundwater Hydrographs

Appendix C Alberta Water Well Records

Appendix D Residential Well Assessment Questionnaires

1.0 Introduction

Mountain Ash Limited Partnership (MALP) is planning to develop the Summit Pit (the Project) along Highway 567 within NW and SW 31-026-03 W5M, northeast of the Town of Cochrane, in Rocky View County (RVC), Alberta (Figure 1). The Project will encompass approximately 208 acres (84 ha) excluding existing road rights-of-way. This land is currently owned by 1410266 Alberta Ltd. (a general partner of MALP). The Project received land use and a master site development plan (MSDP) approval on March 2, 2021 (Land Use Bylaw C-8051-2020).

A hydrogeological assessment was undertaken as part of the MSDP application to assess the potential for groundwater impacts from Project operations in relation to nearby groundwater users. The assessment concluded that Project activities are not expected to effect adjacent groundwater well users because aggregate extraction occurs above the water table, and the nearest off-site residential wells are located more than 490 metres (m) away from the closest point of Project operations. As a requirement for the Code of Practice (COP) for Pits and Development Permit (DP) applications, and in response to supplementary information requests (SIRs) from Alberta Environment and Protected Areas (AEPA) dated August and December 2022, and April 2023, this report details the revised and updated Groundwater Monitoring Plan (GWMP) in relation to the operation of the Project. The objective of this GWMP is to monitor potential effects of Project operations on groundwater resources in the vicinity of the site, and to mitigate adverse effects wherever possible. This is also consistent with a condition required as part of the land re-designation and MSDP. Ongoing monitoring and assessment of groundwater levels and quality will be determined for effective monitoring of the lack of effect of operations on groundwater, and to plan and manage mitigation should un-anticipated impact occur.

Several residential water wells and groundwater springs exist near the proposed Project area. The Hydrogeological Assessment (SLR 2020c) concluded these receptors are not expected to be adversely affected by Project activities. This GWMP provides a description of:

- Local geology and hydrogeology
- Potential historical and future sources of contamination
- The proposed groundwater monitoring program including monitoring locations and parameters
- Groundwater response plan

2.0 Site Description

2.1 Land Uses

The site is currently being used for agricultural purposes, previously referred to as Ranch/Farm. There are two large wetlands in the northwest corner which have been classified as Temporary Graminoid Marshes (M-G-II) and a number of other, smaller water bodies which are mainly ephemeral water bodies that have been farmed through. A detailed description of water bodies, including wetlands, on site is provided in the Wetland Assessment and Impact Report (SLR 2022). The site location and surrounding land use is shown on Figure 1.

2.2 Proposed Site Activities

The property will be operated in six phases of similar size excluding Phase 4 and Phase 6 which are smaller than Phases 1 to 3 and Phase 5, with operations commencing initially in the southwest parcel. Phase 1 comprises about 14.4 ha (35.5 acres) and is expected to take 5 to 7 years to deplete, depending on market demand. Each of the subsequent phases is anticipated to take approximately 5 to 7 years to deplete, depending on market demand. The proposed phasing is shown on Figure 2.

Based on drilling investigations at the site, there is 3 m to 6 m of glacial till overburden overlying approximately 20 m of sand and gravel, on average (Appendix A). The till and organic topsoil will be stripped and stockpiled for future use during post-development restoration. It is anticipated that stripping will commence in the southwest corner of Phase 1 and move eastwards. Sand and gravel are the target deposit for extraction/processing and lies immediately above the underlying bedrock. Groundwater in assessment boreholes was noted at between 20 m and 24 m below ground surface (m bgs) and above the bedrock in most wells. The site will be excavated to a depth, not exceeding 1.0 m above the highest recorded groundwater level, within the targeted gravel deposit, and will therefore be a dry excavation. Dry excavations do not require operational or permanent dewatering. Actual depths will be determined with progressive investigation of water levels as the aggregate resource is developed (see Section 7.1.1).

2.3 Potential Sources of Groundwater Contamination

An assessment of potential sources for contamination was undertaken by SLR. Potential sources, which could affect groundwater at the site, are identified and described below, and are shown on Figure 2.

2.3.1 Historical

A search of historical records for potential sources of contamination using the Alberta Environment and Parks (AEP) Environmental Site Assessment Repository (ESAR) indicated that no investigations on the public record had been carried out within the boundaries of the site. This is common for rural settings.

A review of historical air photos from Google Earth dating back as far as May 2002 indicates that the site was undeveloped and consisted of rough grazing land as is the current situation. No evidence of previous contaminating land uses was found.

2.3.2 Current and Future

The following current and future operations at and adjacent to the site have been identified from a review of air photos, site visits, recent development applications and the MSDP which have the potential to impact soil and groundwater quality onsite:

- Oil and gas infrastructure is currently located in close proximity to the site and is likely the biggest contamination risk to groundwater in the area. This infrastructure includes several operational oil wells with associated pump jacks located along Highway 567 north of the site, and a pipeline which runs north/south along the western boundary of the site.
- Septic systems are present at the three residences on site and could be a potential hazard to groundwater quality if not functioning correctly.
- Volker Stevin Highways Maintenance Facility (10 acre) is located adjacent to SW31-26-3-W5M, to the west.

- Diesel fuel, equipment refueling, equipment and lubricants will be stored on-site adjacent to the scale building. Fuels and lubricants will be stored in accordance with current regulations and, as per the recommendations in the Hydrogeological Assessment (SLR 2020c), be located in an area where thick clay overburden is still present. The location of the proposed storage, refueling and maintenance area is shown on Figure 2.

There are no significant quantities of chemicals stored or used at the site. Future operations will ship incidental hazardous and non-hazardous wastes off site for disposal at an approved waste facility. This is common with other rural land uses.

3.0 Geology

The geology and hydrogeology in the vicinity of the site has been compiled from site specific drilling data, available published documents, and the AEP water well database. Figure 3 shows the line of a vertical cross-section (Figure 4) that runs northwest to southeast along the direction of groundwater flow towards the springs (A-A'). It has been prepared to illustrate the relationship between the various geological units at the site and is referred to in the following subsections.

3.1 Surficial Geology

Surficial geology in the vicinity of the Project has been determined from published geology maps (Shetsen 1987). Two primary layers are found, as can be seen in the cross-section in Figure 4. The upper strata are predominantly comprised of Pleistocene-age moraine draped over underlying sand and gravel. This moraine consists of an unsorted mixture of clay, silt, sand, and gravel with local water-sorted material; this is called a glacial till. The till in the vicinity of the site, is of a relatively consistent thickness with a flat to undulating topography. The till topography reflects the topography of underlying deposits, which in turn reflect the shape of the bedrock surface below. Underlying the draped moraine at the site is sand and gravel of glaciofluvial origin, which formed on the slopes and base of meltwater channels draining melting ice sheets (Shetsen 1981).

Borehole logs for 31 test holes from the site indicate that surficial deposits over the majority of the site include approximately 3 m to 6 m of silty, sandy or gravelly clay till and approximately 0.5 m of organic topsoil (this overburden and topsoil will have to be removed to expose the underlying aggregate deposit). Beneath the clay till is the sand and gravel deposit of interest, which is generally a well graded mixture of sand and gravel containing occasional beds of pure sand or pure gravel up to 2 m thick. The sand and gravel unit varies in thickness, with an average thickness of approximately 20 m.

3.2 Bedrock Geology

Consolidated bedrock underlies the unconsolidated sand and gravel layer as indicated on Figure 4. The bedrock represents the basement to site operations where the sand and gravel is not saturated. Structurally, the site is located several kilometres (km) east of the furthest extent of the main Cordilleran Deformation. As such, the bedrock is relatively flat lying with little folding or faulting compared to older bedrock further west in the Disturbed Belt. The bedrock beneath the sand and gravel at the site consists of Tertiary, Paleocene age (55 to 65 million years old) sedimentary rocks of the Upper Paskapoo Formation. The Paskapoo Formation comprises grey to greenish grey, thickly bedded, calcareous sandstone interbedded with siltstone or mudstone and minor conglomerate or thin limestone beds (Alberta Geological Survey 1999). Drilling at this site has found grey sandstones and siltstones directly underlying the sand and gravel. The bedrock was derived from sediments eroded from the Rocky

Mountains during a period of uplift and erosion and carried east by river systems which drained melting ice from the mountains west of the site. The sandstones within the Paskapoo are a complex series of stacked river channel deposits separated by floodplain siltstone and mudstone deposits (Hamblin 2004).

Outcrops of the Paskapoo Formation sandstone can be seen in the steep slopes at the Big Hill Springs Provincial Park southeast of the site. A number of domestic well records from the immediate vicinity identify sandstone and shale¹ beneath and surrounding the site.

4.0 Hydrogeology

The hydrogeological regime at the application site and the surrounding area is described in the following sub sections:

- Aquifer properties
- Groundwater levels and flow
- Baseline water quality assessment
- Regional and local water users

The hydrogeological data is drawn from the Hydrogeological Assessment (SLR 2020c). This data has been used to develop a conceptual site model that has in turn been used to develop the monitoring system installed to assess potential impacts associated with the proposed development.

4.1 Aquifer Properties

A number of different geological units with different hydraulic properties are present in the study area. The distinct units are discussed here progressively with depth from surface (and increasing geological age). The testing of two monitoring wells and two residential wells was undertaken and a summary of the work is provided below. Hydraulic conductivity testing methodology and analysis are provided in the Hydrogeological Assessment (SLR 2020c) and are not reproduced here.

4.1.1 Surficial Unconsolidated Deposits

Surficial deposits of unconsolidated soils consist of till overlying sand and gravel deposits as described in Section 3.1 above. Groundwater flows in the intergranular pores in these soils, and the rate of flow is proportional to the hydraulic conductivity of the soil. For example, the hydraulic conductivity is low where clay rich material infills these pores but is significantly higher where clean sand and gravel is present.

Since the upper glacial till that caps the site is not saturated, no groundwater monitoring wells were installed and therefore no field testing for hydraulic conductivity was undertaken. These soils are not typically aquifers, as their hydraulic conductivity is in the range of 10^{-8} to 10^{-7} m/s (Freeze and Cherry 1979), but they do act as a protective layer for underlying deposits.

¹ It is common for drillers to use the term “shale” to describe mudstones and siltstones, as the differences are subtle, and they all share a common fine-grained appearance to the untrained eye.

As detailed in the Hydrogeological Assessment (SLR 2020c) a number of slug and pumping/recovery tests were undertaken on monitoring wells MW14-101 and MW14-103 which are screened in the sand and gravel. The testing determined hydraulic conductivities of approximately 1×10^{-4} m/s to 3×10^{-4} m/s. These values fall in a narrow range and are typical of sand and gravel aquifers.

4.1.2 Paskapoo Formation Bedrock

The Paskapoo Formation is the most significant aquifer formation in western Alberta and potentially the Prairie region, and although of regional importance as a whole, the isolated nature of the main sandstone units can provide variable success for residential wells. Only the sandstone facies of the Paskapoo Formation demonstrate any significant intergranular porosity; however, the pore spaces may be filled with calcareous cement in some areas. Bedding planes, joints and structural fractures contribute to a secondary permeability of the bedrock as well. Based on water well records in the area and the drilling at this site, much of the formation in this area is primarily comprised of fine-grained bedrock such as siltstone, mudstone and shale which demonstrate low intergranular porosity. Secondary fracture porosity is likely to be responsible for the yields obtained from residential wells in the vicinity of the site. Lower yields are recorded from wells completed within mudstone and siltstone than from the sandstone (Geological Survey of Canada, 2007; Ozaray and Barnes 1977). The majority of residential wells in the area are drilled into the Paskapoo Formation indicating that the aquifer is locally important for groundwater supplies.

A short-term pumping and recovery test was undertaken on WW2 as described in the Hydrogeological Assessment (SLR 2020c). The test results showed that the Paskapoo Formation sandstone and shale penetrated by WW2 has an approximate hydraulic conductivity of 2×10^{-7} m/s. The hydraulic conductivity value obtained reflects this fractured bedrock. When purging the wells, WW2 had drawdown of >7 m at a flow rate of approximately 12 Litres per minute (L/min) and WW4 had drawdown of just 0.09 m at a flow rate of approximately 39 L/min. The contrast between the performances of the two wells demonstrates the variability of the hydraulic properties of the bedrock in the Paskapoo Formation.

4.2 Groundwater Levels and Flow

A total of ten groundwater monitoring wells have been installed at various times in the sand and gravel at the site since 2014. The wells are variably screened from the bedrock up into the base of the sand and gravel.

The locations of these monitoring wells and their groundwater elevations (on July 3, 2019) are presented on Figure 5. The well construction details are found in Appendix A. The information from these wells have historically been supplemented with groundwater level information from residential wells WW2 and WW4 also presented in Figure 5.

The groundwater monitoring points completed at the site have been subject to periodic groundwater elevation monitoring between October 2014 and April 2023. Sand and gravel monitoring wells MW14-101 and MW14-103 and bedrock residential wells WW2 and WW4 have been equipped with dataloggers recording continuous groundwater levels on a daily basis since October 2014. Groundwater hydrographs of monitoring data to April 2023 are presented in Appendix B, a review of which shows:

- A downward vertical gradient between the sand and gravel deposits and the underlying Paskapoo Formation was demonstrated in SLR 2020c. Therefore, there is a component of downward vertical groundwater flow from the sand and gravel to the bedrock. The amount of downward groundwater flow is probably limited due to the relatively lower hydraulic conductivity of the underlying bedrock, inhibiting drainage to depth; however, the recharge is enough to locally sustain single wells drilled into the bedrock.
- Minimal short-term (daily/weekly) fluctuation in the groundwater levels within the sand and gravel (Appendices B1 and B2). This indicates negligible or no influence from pumping within residential wells in the area.
- Groundwater levels within the sand and gravel gradually fell over the initial years of monitoring between 2014 and 2019, with a drop of approximately 0.9 to 1.3 m during the period (Appendices B1 and B2). This is due to a series of dry years with <400 millimetres (mm) of precipitation each year, based on Environment and Climate Change Canada data for the meteorological station at Calgary International Airport. Even an above average precipitation year (2016) with 520 mm of precipitation did not increase water levels, likely due to a high soil moisture deficit absorbing much of the surplus. Levels rebounded somewhat (0.2 m) in the months between July and September 2019 due to the higher-than-average rainfall totals (526 mm) in the area in spring and summer 2019. This had followed an average precipitation year (424 mm) in 2020 which allowed soil moisture deficits to be reduced. The levels then gradually declined back to the pre-2019 recharge levels in March 2020 before again rising approximately 0.3 to 0.4 m in the 2020 spring recharge event (see Appendices B1 and B2). Groundwater levels continued to slowly rise through 2020 and into the spring of 2021 due to the high precipitation in 2020 (554 mm) before they started to decline again to the end of the monitoring record. Comparison of the groundwater elevations to rainfall therefore indicates that it takes a minimum of two consecutive years of above average precipitation to create a sustained rise of groundwater levels in the sand and gravel under natural conditions.
- A variable response to the pumping from normal use in residential bedrock wells, with the wells recovering within a few hours of extended pumping (Appendices B3 to B5). The degree of response between wells is indicative of the differing performance of the wells due to variability of the hydraulic conductivity within the Paskapoo Formation.

Using site groundwater observation data, Figure 5 shows the inferred potentiometric groundwater surface (drawn in blue) in the sand and gravel at site as recorded on 3 July 2019. Figure 5 shows that the horizontal flow direction in the sand and gravel is towards the south-southeast and the Big Hill Springs valley.

The potentiometric surface within the Paskapoo Formation cannot be drawn based on just two far apart data points (WW2 and WW4). Examination of historical water levels at other wells based on the water well records show that the elevation of the potentiometric surface is between about 1,266 and 1,268 metres above sea level (masl) in the area of the site, which is near the bedrock surface. If one assumes the bedrock potentiometric surface is near ground level at the Big Hill Springs, which is about 1,240 masl, then there is strong lateral gradient southeast towards the springs at which point groundwater is observed discharging to the surface.

4.2.1 Groundwater/Surface Water Interactions

Two large wetlands (Water bodies 19 and 20) located in the northwestern corner of the site have a surface elevation of approximately 1,290 masl and are perched on 6 m of low permeability fine grained till. The presence of freestanding water is temporary based on observations made at the site, with water being present for only a temporary period of about four weeks after snow melt. Monitoring well MW14-101 located close to one of the wetlands (Water body 20) has a groundwater elevation in the sand and gravel of approximately 1,274 masl, which is well below the base of the till (at about 1,284 masl). This demonstrates that the wetlands are not fed by groundwater from the sand and gravel. Thus, it is inferred that the wetlands are fed by rainfall and snowmelt from the local catchment and from the catchment across Highway 567 transported by the culvert located beneath the highway. These wetlands will be retained on the landscape.

Since groundwater from beneath this site flows southeasterly towards the Big Hill Springs, it represents an offsite interaction of groundwater with surface water in the area. Bedrock outcrops can be seen on the valley walls surrounding the stream and springs and thus it is inferred that the host valley is incised into the bedrock. Stream flow downstream of Big Hill Springs has been manually measured in several studies at the Provincial Park over the years, the results of which are presented in Table 1. The collected data indicates that this flow ranges from 40 litres per second (L/s) to 400 L/s, with an average flow in the vicinity of 70 to 100 L/s. Flows from October to February (fall/winter) are generally in the range of 50 to 100 L/s, while flows from March to September (spring/summer) are more variable. The variability in flow rates speaks to the seasonality of inputs to the discharge. There is lower stream flow in late summer and over winter when groundwater flow is the primary input. The highest and more variable flows are found during spring and summer when spring freshet and snowmelt periods occur, and during summer storms when high runoff occurs.

Table 1: Summary of Big Hill Spring Flow Data

Source	Measurement Point	Date	Number of Measurements	Lowest Flow (L/s)	Highest Flow (L/s)	Average Flow (L/s)
Ozaray and Barnes (1977)	Unknown	Unknown	Unknown	--	40.0*	--
Borneuf (1983)	Unknown	Unknown	Unknown	--	11.3**	--
Caron (2004)	Source	2003 - 2004	9	45.3	89.4	73.0
	Culvert downstream of Park	2003 - 2004	9	54.6	76.7	70.0
Poschmann (2007)	Source	2003 - 2006	20	50.0	240.0	100.0
Fouli (2018)	Main Spring	June 2017	1	--	184.0*	--
Fouli (2020)	Main Spring	July 2019	1	--	227.0*	--
Fennell (2021)	Unknown	Unknown	Unknown	100.0	400.0	--
<p>*Where only one figure for the spring has been quoted in the published source it has been added in the Highest Flow column. Those results posted for Fouli (2018, 2020) are the highest flows measured in the reports, other results for the main springs were only presented in charts with no specific values attached.</p> <p>**This figure is considered an outlier when compared with the other flows measured at the Project area and so is not included in the summary statistics.</p>						

4.3 Baseline Water Quality Assessment

Groundwater samples have been collected from the accessible residential wells in the Paskapoo Formation bedrock, the onsite sand and gravel monitoring wells and the furthest publicly accessible upstream discharge point at Big Hill Springs as part of the baseline water quality assessment. A detailed comparison of the water quality in the Hydrogeological Assessment (SLR 2020c) concluded that this is the same water type for the sand and gravel, the Paskapoo bedrock, and the discharge from Big Hill Springs. The groundwater and spring water chemistry supports the conclusion that groundwater within the saturated sand and gravel recharges the Paskapoo Formation bedrock and provides baseflow to Big Hill Springs. A summary of historical water quality is provided in Table 2 with details provided in appended Tables A1, A2 and A3. In general, more recent results reflect historically measured ranges, as would be expected, since operations have not yet begun.

4.3.1 Surficial Deposits

Table A1 (appended) indicates that groundwater in the sand and gravel deposit is of marginally poor quality for drinking. The Alberta Tier 1 Groundwater Remediation Guidelines (2023) set guidelines protective of all water users which have been applied for agricultural land use in coarse-grained soils.

Generally, natural groundwater has a moderately alkaline pH (7.2 to 8.2), low sodium (5 to 10 milligrams per litre {mg/L}), low chloride (7 to 29 mg/L) and high hardness (280 to 350 mg/L). A number of total metals exceeded Tier 1 guidelines. These included trace metals such as arsenic, barium, cadmium, chromium, lead, manganese, and mercury. In addition, microbiological parameters (total coliforms and E.Coli) were exceeded. Total metals exceeded guidelines likely due to high turbidity during sampling in the monitoring wells. Turbidity is an artifact of some sampling methodologies, like the one used for this Project. The method inadvertently stirs up sediment within the monitoring well during sampling. A comparison of dissolved (filtered) metals versus total metals was completed for the onsite sand and gravel groundwater samples collected on July 4, 2019, with concentrations of both presented in Table A1. Table A1 shows that in almost all cases where an exceedance of the total metal guideline concentration occurs, the dissolved concentration for the same sample is significantly reduced and falls below the relevant guideline. This is due to the total metal sample being preserved using acid, which dissolves sediments stirred up during sampling. This leads to higher metals concentrations than the filtered dissolved metal sample. The dissolved metal concentrations in groundwater are, therefore, more representative of natural conditions and indicate that groundwater is generally of good quality with low dissolved metals.

It is recommended that a program of well development occurs in the existing monitoring wells in an attempt to remove sediment remaining from drilling within the wells and reduce the turbidity sampling issues as much as possible.

4.3.2 Paskapoo Formation Bedrock

Table A2 (appended) indicates that groundwater in the Paskapoo Formation is of relatively good quality for drinking, with all parameters meeting the Canadian Drinking Water Quality (CDWQ) guidelines except a single exceedance of total coliforms in WW4 and a single turbidity exceedance in WW2. E.Coli was not detected in WW4 which indicates that the coliforms were not related to fecal contamination; however, they do indicate that the well could be vulnerable to bacterial contamination. pH values were moderately high (7.6 to 8.1) in all samples, indicating slightly more alkaline conditions within the bedrock as compared to the sand and gravel.

Table 2: Groundwater Quality Summary, Expressed as Historic Ranges

Parameter	Units	Groundwater					
		Guideline (Alberta Tier 1) ¹	Sand and Gravel ²		Guideline (CDWQ)	Paskapoo Formation ³	
			min	max		min	max
Aluminum	mg/L	0.05 ⁴	<0.0030	0.44	0.1 (OG)	0.0041	0.011
Antimony	mg/L	0.006	<0.00060	0.0013	0.006 (MAC)	<0.00050	0.00088
Arsenic	mg/L	0.005	<0.00020	0.00061	0.01 (MAC)	0.000121	0.00032
Barium	mg/L	2	0.22	0.48	1 (MAC)	0.11	0.41
Bicarbonate (as HCO ₃)	mg/L	NV	310	400	NV	340	391.6
Boron	mg/L	1	<0.020	0.032	5 (MAC)	<0.020	0.039
Cadmium	mg/L	0.00037 ⁴	<0.000020	0.000063	0.005 (MAC)	<0.000005	0.00004
Dissolved Calcium	mg/L	NV	61	79	NV	55	80
Chloride	mg/L	100	7.83	29	<250 (AO)	1.38	17
Chromium	mg/L	0.001	<0.0010	0.0013	0.05 (MAC)	<0.0010	0.0012
Copper	mg/L	0.007	<0.0002	0.0074	2 (MAC) / 1 (AO)	0.0016	0.125
Hardness	mg/L	NV	280	350	NV	-	-
Iron	mg/L	0.3	<0.060	1.2	<0.3 (AO)	<0.010	0.3
Lead	mg/L	0.005 ⁴	<0.00020	0.0023	0.005 (MAC)	<0.00020	0.011
Mercury	mg/L	0.000005	<0.0000019	0.0000048	0.001 (MAC)	<0.0000020	<0.00020
Dissolved Magnesium	mg/L	NV	30	37	NV	30	39.9
Manganese	mg/L	0.02	<0.0040	0.11	0.12 (MAC) / 0.02 (AO)	<0.0010	0.015
Molybdenum	mg/L	NV	0.00051	0.012	NV	0.00063	0.00222
Nickel	mg/L	0.12 ⁴	<0.00050	0.0035	NV	<0.00050	0.00174
Nitrate-N	mg/L	3	0.97	5.22	10 (MAC)	0.37	3.4
Nitrite-N	mg/L	0.1 ⁴	<0.010	0.098	1 (MAC)	<0.005	0.012
Dissolved Potassium	mg/L	NV	2.4	6.3	NV	2	3.3

Parameter	Units	Groundwater					
		Guideline (Alberta Tier 1) ¹	Sand and Gravel ²		Guideline (CDWQ)	Paskapoo Formation ³	
			min	max		min	max
pH		6.5 - 8.5	7.2	8.2	7.0 -10.5	7.6	8.1
Selenium	mg/L	0.002	0.00037	0.0022	0.05 (MAC)	0.00037	0.0018
Silver	mg/L	NV	<0.0001	<0.0001	NV	<0.00007	0.00012
Dissolved Sodium	mg/L	200	5.2	18	<200 (AO)	6.4	22
Sulphate	mg/L	500 ⁴	4.8	77	<500 (AO)	5.9	21
Thallium	mg/L	NV	<0.00020	<0.00020	NV	<0.00020	<0.00020
Total Dissolved Solids (calculated)	mg/L	500	280	380	<500 (AO)	300	349
Turbidity	NTU	NV	0.54	>4000	1 (OG)	0.2	1.23
Uranium	mg/L	0.01	0.0014	0.0027	0.02 (MAC)	0.00064	0.0021
Zinc	mg/L	0.03	<0.003	0.01	<5 (AO)	0.0046	0.99
Total Coliforms	MPN/100 mL	<1 (MAC)	<1	120000	<1 (MAC)	<1	11
E.Coli	MPN/100 mL	<1 (MAC)	<1	100	<1 (MAC)	<1	<1

Notes:

1. Table 2, Alberta Tier 1 Groundwater Remediation Guidelines (2023) applied for Agricultural land use in coarse grained soils
2. Metal concentrations are dissolved unless stated otherwise.
3. Metal concentrations are total unless stated otherwise.
4. Tier 1 guideline is the lowest of the aquatic life guideline and all other guidelines. Lead is based on the potable water pathway, as is sulphate in the absence of an assessment for the very high natural groundwater hardness. Cadmium and nickel guidelines are hardness dependent and nitrite as N guideline is chloride dependent for the aquatic life pathway. Guidelines quoted are based on the lowest chronic guideline applied for the range of hardness or chloride observed.

4.3.3 Big Hill Springs

Table A3 (appended) summarizes water quality results of water samples taken from the creek downstream from the springs (BHS1) at Big Hill Springs Provincial Park on October 30, 2014, August 4, 2015, July 10, 2019, December 15, 2022, and April 19, 2023, by SLR. Data collected by SLR for general water quality parameters was combined with a number of published sources to provide the baseline water quality summary included in Table 3 below.

Table 3: Historical Summary of Bighill Spring Water Quality

Parameter	Units	Number of Measurements	Lowest Value	Mean Value	Highest Value	Standard Deviation
Temp	C°	36	3	5	7.9	0.9
Electrical Conductivity (EC) (field)	uS/cm	19	260	365	580	78.0
Electrical Conductivity (EC) (lab)	uS/cm	26	403	536	610	56.6
pH	---	10	7.94	8.20	8.37	0.1
Dissolved Oxygen	mg/L	1	10.92	N/A	10.92	N/A
Turbidity	NTU	5	0.8	2	5.1	N/A
Calcium	mg/L	37	43	70	77.1	6.8
Magnesium	mg/L	37	18	34	39	4.2
Sodium	mg/L	37	5	7	13.4	1.3
Potassium	mg/L	37	1.9	3	6.7	0.8
Chloride	mg/L	36	1.8	7	16.8	3.2
Nitrate-N	mg/L	36	1	3	7.2	1.4
Sulphate	mg/L	37	4.7	9	13.5	1.8
Bicarbonate	mg/L	37	200	364	390	36.6
Total Dissolved Solids (TDS)	mg/L	36	190	457	526	95.6
Summary includes data from: Caron, 2004; Poschmann, 2007; Fouli, 2020; Koning, 2022 and this report.						

Groundwater emerging at Bighill Springs is generally cold (approximately 3 to 8°C), with an alkaline pH (>8), low sodium, low chloride, and saturated with respect to calcium (Turner and Jones, 2005). Of some interest, both calcium (Ca) and bicarbonate (HCO₃) have the highest concentrations in the spring water. Tufa is primarily composed of CaCO₃, which is consistent with these groundwater concentrations and the formation of tufa within the Provincial Park. It should be noted that data from July 10, 2019, showed uncharacteristically low bicarbonate, calcium, and TDS concentrations (200 mg/L, 43 mg/L and 190 mg/L respectively) and which, on first review, appears could be anomalously low. Further review reveals that two studies; SLR (2020) and Fouli (2020), sampled the springs on the same day (July 10, 2019), and while the concentrations were not identical, they were of the same order of magnitude. Flow measured on the sampling date by Fouli (2020) and listed in Table 1 indicates a high flow condition (227 L/s) on that day. This would indicate that a high proportion of the flow sampled may have been comprised of stormwater runoff (Environment Canada reported thundershowers in the area during previous days) which would have had a much lower dissolved mineral content and diluted the spring flow, thus lowering key parameter concentrations, therefore accounting for the uncharacteristically low values mentioned above.

Since this groundwater discharge is the source for a surface water stream, and the point of sampling is within that stream, it is compared to the Environmental Quality Guidelines (EQG) for Alberta Surface Waters (March 2018). The EQG has guidelines for 22 parameters of the sampling suite. The samples met 18 of the guidelines for these parameters indicating that water discharging from the spring is generally of good quality. It is noted that total coliforms and E.Coli concentrations exceed the CDWQ drinking water guidelines; however, there is no CWQG bacteria guideline for the protection of aquatic life. High concentrations of E.Coli are consistent with the presence of livestock in the stream catchment and of which evidence was abundant adjacent to the property line at the sampling location. Only aluminum, selenium and nitrate as nitrogen exceeded the EQG guideline in these natural waters. Of minor note, the laboratory detection limit for mercury (0.001 mg/L) in 2014 and 2015 exceeded the guideline (0.000005 mg/L) and thus the “non-detect” reported in Table A3 may or may not meet the lower guideline. Mercury sources in this geologic setting are not common, nor will the proposed aggregate operation be a source of mercury. Mercury concentrations measured in 2019 fell below the guideline. Since this water is the source for the stream, the downstream biota will be acclimatized to this form of the natural water quality.

4.4 Regional and Local Water Users

As part of the original hydrogeologic study (SLR 2020c), a field verified water well survey was conducted to establish residential well use, baseline water quality conditions and to provide an assessment of the hydraulic parameters within the aquifers used by local residences adjacent to the site. Initially, a water well record search was undertaken by obtaining records from the Alberta Water Wells database which are presented in Appendix C (updated in 2019). This was followed by a door-to-door survey (October to December 2014) of residences within a 500 m radius of the site with visits on a number of occasions to those houses where no resident was at home. Where possible, the formal well records were correlated with the actual wells in the field. It was considered that the 1,600 m radius required for a *Water Act* application is not appropriate as no groundwater body is to be disturbed by the Project which will be worked dry, and much of that greater area is not in the same groundwater flow field. A number of properties were surveyed and sampled and/or yield tested in order to further assess the relevant aquifer units. At each residential well, a questionnaire was completed to determine the type of well, well completion details, water levels and whether the well user has any issues with water quality or quantity. The questionnaires completed at the residential wells are provided in Appendix D.

The majority of local wells (for which there are records) are used for domestic or commercial purposes. The Alberta records indicated a total of 17 wells within 500 m of the Project with two of those decommissioned (391599 and 391600) and one with very little available detail (395793). Figure 3 presents the locations of the wells identified from the records search and the door-to-door survey for which Table 4 summarizes the information collected. The majority of drilled wells are drilled to between 30 m and 75 m bgs and are screened within the Paskapoo Formation.

Two drilled wells (WW1 and WW4) are on the site at the residences of the current tenants; however, all of the other drilled wells recorded are greater than 100 m from the site boundary. With respect to the WW1 property, there is a well listed in the records for this property (494800); however, the geology recorded in this record is completely different than the rest of the area. It had been concluded that the available log is for a different well and has been misfiled in the digital records kept by AEPA. Therefore, the log has not been used in the analysis.

Dug wells identified at location WW5 (four wells in total) are between 6.1 m and 7.6 m deep according to details provided by the householder. This location is in the bottom of the valley at the southeast end of Section 31. No lithological logs are available for the dug wells; however, based on their estimated depth and the lithological details provided in nearby drilled wells to the east, it is inferred that they are completed in the sand and gravel deposits. The well owners reported that the static water level is 3 m bgs. Although this was unconfirmed by direct measurement, it is a reasonable estimate, given the shallow nature of the wells.

Table 4: Water Wells within 800 Metres

Water Well Number	Alberta Water Well Record Number	No. of Wells	Well Owner	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
WW1	Unknown	1	Waterman	680559 ¹	5682875	Unknown	Drilled	On Site
WW2	1475699	1	Rawn	680988 ¹	5682770	50.9	Drilled	200 E
WW3	1475698	1	Rawn	681173 ¹	5682907	36.0	Drilled	400 E
WW4	350194	1	Nugter	680257 ¹	5682091	35.1	Drilled	On Site
WW5	N/A	4	Burnco	681547 ¹	5681568	6.1 – 7.6	Dug	800 SE
WW6	Unknown	1	Unknown	See Note ²	SW Quarter, S32-T26-R3	Unknown	Drilled	900 E
WW7	Unknown	1	Unknown	See Note ²	SW Quarter, S32-T26-R3	Unknown	Drilled	900 E
WW8	395786	1	Hodgson	See Note ²	NE Quarter, S31-T26-R3	62.5	Drilled	690 E
WW9	360164	1	Carroll	680744 ¹	5683480	67.1	Drilled	350 N
WW10	Unknown	1	Unknown	See Note ²	SE Quarter, S6-T27-R3	Unknown	Unknown	800 N
WW11	391000	1	Unknown	679932 ³	5683339	39.6	Drilled	350 N
WW12	Unknown	1	Unknown	See Note ²	NE Quarter, S36-T26-R4	Unknown	Unknown	270 W
WW13	Unknown	1	Big Hill Estates	See Note ²	SW Quarter, S30-T26-R3	Unknown	Drilled	1,800 S
N/A	1022436	1	Lafarge Canada Inc.	679682 ³	5682526	30.5	Drilled	
N/A	387449	1	Lafarge Canada Inc.	See Note ⁴	NE Quarter, S36-T26-R4	33.8	Drilled	
N/A	494773	1	Lafarge Canada Inc.	See Note ⁴	NE Quarter, S36-T26-R4	30.5	Drilled	

Water Well Number	Alberta Water Well Record Number	No. of Wells	Well Owner	Easting (UTM)	Northing (UTM)	Well Depth (m)	Drilled / Dug	Distance (m) and Direction from Site
N/A	2095665	1	Unknown	See Note ⁴	SW Quarter, S6-T27-R3	25.6	Drilled	
N/A	390998	1	Unknown	See Note ⁴	SE Quarter, S6-T27-R3	65.5	Drilled	
N/A	390999	1	Unknown	See Note ⁴	SE Quarter, S6-T27-R3	73.2	Drilled	
N/A	391598	1	Unknown	See Note ⁴	NW Quarter, S3-T26-R3	39.6	Drilled	
N/A	395786	1	Unknown	See Note ⁴	NE Quarter, S31-T26-R3	62.5	Drilled	
<p>1. Location based on GPS measurement in the field.</p> <p>2. Plotted by AEP at quarter centre centroid, adjusted to likely location, subject to field confirmation.</p> <p>3. Location based on Abacus Datagraphics database.</p> <p>4. Wells plotted at quarter-section centroid in Abacus Datagraphics database. Not likely actual location.</p>								

5.0 Regulatory Framework

The site will operate under a Development Permit issued by RVC and an Approval under the COP for Pits. A requirement of the Development Permit is to prepare a groundwater monitoring program for assessing whether site operations are impacting groundwater quality and levels. This document is intended to meet this latter requirement.

It is proposed that for the first year, groundwater quality at the onsite monitoring wells be assessed initially by comparing groundwater monitoring results with the Alberta Tier 1 and/or 2 Soil and Groundwater Remediation Guidelines (updated August 2022) and herein referred to as the Tier 1 or Tier 2 Guidelines. The Tier 1 Guidelines contain guidelines which are protective of all receptors and potential exposure pathways, whereas the Tier 2 Guidelines can be modified to exclude those pathways or receptors which don't apply. Monitoring results will be compared to guidelines for Agricultural land use based on the current site and surrounding land uses. The site is coarse-grained with respect to contaminant migration in the surficial deposits.

Water quality results obtained from residential wells which opted to join the monitoring program, will be assessed against the Guidelines for CDWQ and equivalent Alberta potable groundwater guidelines.

Water quality results obtained from the Bighill Springs (BHS1) will be compared against the Environmental Quality Guidelines (EQG) for Alberta Surface Waters as updated. Additional water quality guidelines were developed by SLR from baseline sampling by SLR and others for the protection of tufa formation (section 8.2).

Background groundwater chemistry will be established using historical groundwater monitoring data and additional data collected during April 2023 after spring freshet and prior to development of the site. Control limits setting upper and lower acceptable bounds for parameters have been derived for each sampling point using the pre-operational data, and subsequent data will be compared to these control limits.

6.0 Proposed Groundwater Monitoring Well Network

6.1 Groundwater Monitoring Objectives

The objectives of the groundwater monitoring program are twofold:

- To enable understanding of the groundwater flow regime at the site and adapt the basal elevation of the pit in response to observed groundwater levels.
- To confirm the site is having only the effects predicted, but also to enable the gathering of sufficient information to identify and provide solutions to any unanticipated groundwater problems should they arise through the life of the site.

6.2 Groundwater Monitoring Approach

The site monitoring program is designed to provide data to enable the assessment of potential impacts to groundwater quality in the vicinity of the site. By extrapolation it can be inferred what the likely effects of any observed changes will be at potential receptors such as private residential wells. In addition, potential receptors will also be monitored directly as a precaution to assess potential changes. All monitoring wells installed within the boundaries of the site will receive the earliest warning possible of any changes in the groundwater system.

Background monitoring provides a key benchmark for the assessment of change within the groundwater system, both temporally, before development commences, and spatially, in up-gradient locations. Down-gradient wells provide information on what changes, if any, may be occurring as the groundwater passes beneath the site. By this method, early warning is attained on site, long before any problem could manifest itself in the more distant private wells.

6.3 Groundwater Monitoring Network Description

The groundwater monitoring network for the site will comprise three main elements:

- Existing onsite sentinel monitoring wells to monitor groundwater flowing directly beneath the site in upgradient, downgradient and cross-gradient locations from the actively working areas.
- Monitoring of adjacent residential wells as part of a precautionary water well protection program which protects both the operator and the local residents.
- Sampling of water quality within Big Hill Springs to confirm no negative effects are being seen.

The locations of the proposed groundwater monitoring points for the baseline monitoring are presented in Figure 3 and the monitoring wells for Phase 1 monitoring are presented in Figure 6.

Ten monitoring wells have been installed onsite. The monitoring wells are screened either at the base of the sand and gravel unit or across the upper bedrock / sand and gravel interface to ensure the water table could be measured. The wells are constructed of 50 mm diameter polyvinyl chloride (PVC) pipe with a hydrated bentonite chip seal placed around the annulus of the solid section of standpipe above the screened section. An above ground steel protective cover with a lockable lid was concreted in place above the top of the wells. Borehole geological information and monitoring well construction details are provided in the SLR well logs in Appendix A.

As indicated in Section 4.4 and Table 4, several residential wells are located within or close to an 800 m radius of the site (WW1 to WW12), and MALP has offered to include them in the monitoring program as a precautionary measure to confirm the quality and quantity of water available in these wells is unimpacted by the Project. WW13 (Big Hill Creek Estates Water Coop) is approximately 1.8 km to the south of the site, and unlikely to be affected by the Project because it falls on the other side of a groundwater divide; however, a commitment was made during the Public Hearing to review data from this well as part of the monitoring program. It is our understanding that this well is monitored by others and Mountain Ash proposed to enter into a data sharing agreement, however the Co-Op has not yet agreed.

Confirmatory sampling from the furthest publicly accessible upstream point of the stream flowing from Big Hill Springs will be sampled within the Big Hill Springs Provincial Park (BHS1).

7.0 Groundwater Monitoring Program

7.1 Methodology

7.1.1 Groundwater Monitoring

Each onsite groundwater monitoring well will be measured for depth to groundwater using an electronic water level tape on a monthly basis during operating months (April to November). Prior to the day's monitoring, the water level probe will be inspected and tested for proper operation. The depth to the nearest millimetre from the highest point of the well pipe (which has been surveyed for geodetic elevation) will be observed and recorded. The depth to the bottom of each well will also be measured and noted if any soil particles are present. The water level probe will be cleaned with an Alconox and water solution, rinsed with clean tap water, neutralized with isopropyl alcohol, and then rinsed with distilled water between each well to minimize the potential for cross contamination between wells.

Additional simple piezometers will be installed within the pit once the base of extraction reaches within approximately 3 m of the proposed extraction depth to confirm that no extraction takes place within 1 m of the groundwater table. These will be installed approximately every 200 m as the excavation moves laterally and will be removed as the area is worked out and prepared for restoration.

Groundwater levels will only be measured within residential wells where safe access to the wellhead can be provided. Water levels will be measured using the same methodology outlined above for the onsite monitoring wells. Pressure transducers with built in data loggers will also be installed in available residential wells to establish the normal range of water level fluctuation due to daily use. Twelve private wells have been identified (WW1 to WW12) within or near the 800 m limit as described above.

Each owner has been approached to see if they wish to be included. Some decline as they do not wish to be disturbed by monitoring staff or due to their great distance from the operation. Participation will be based on owner's willingness. All owners within 800 m have been approached, and the monitoring details will be provided to them upon issuance and approval of the development permit. Owners initially were given an overview of the program's intentions, process, procedures, and pending approval by the development authority. Monitoring of wells within an 800 m radius of the active area of the pit will commence once DP approval has been obtained and will continue for a period of 5 years or until the Phase 1 DP expires.

7.1.2 Monitoring Wells

Prior to groundwater sampling, each monitoring well will be purged using the parameter stabilization method. While purging, the following geochemical parameters will be monitored and recorded periodically with a minimum of three minutes between readings: temperature, pH, electrical conductivity (EC). The time, flow rate and cumulative volume purged will also be recorded with qualitative observations such as colour, odour and sheen, if any.

Stabilization will be considered achieved after all parameters have stabilized for three successive readings. The following stabilization criteria will be used:

- pH: +/- 0.2 units
- Temperature: +/- 0.2°C
- EC: +/- 5%

Each well will be purged until field parameters have stabilized.

7.1.3 Residential Wells

Residential well samples will be collected from a point within the household system before any water quality treatment. The sample will be taken after a purge of 15 minutes or until field parameters are deemed to have stabilized. Attention will be paid to ensure that static water from the pressure tank is not inadvertently sampled.

7.1.4 Groundwater and Surface Water Sampling

Samples will be collected from the dedicated sampling equipment (for monitoring wells and surface water) or the sampling tap (for residential wells) and transferred directly to clean, laboratory prepared sample containers that will be labelled prior to sample collection. A clean pair of disposable nitrile gloves will be worn during sample collection and a new pair of gloves used at each sample location.

Upon collection, the sample containers will be placed immediately into sealed coolers with ice packs and delivered directly under Chain-of-Custody (COC) to the laboratory the same day.

7.1.5 Groundwater and Surface Water Analytical Program

The proposed Phase 1 monitoring and sampling schedule is provided in Table 5 and the monitoring point locations presented in Drawing 6. The parameters included in the suites in Table 5 are defined as follows:

- **Field Parameters:** Temperature, pH, specific conductance, turbidity
- **Routine Potability:** alkalinity, bicarbonate (HCO_3), electrical conductivity (EC), ion balance, dissolved calcium (Ca), iron (Fe), potassium (K), manganese (Mn), magnesium (Mg), sodium (Na), chloride (Cl), sulphate (SO_4), nitrite (NO_2), nitrate (NO_3), pH, hardness, total dissolved solids
- **Tier 1 metals:** Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, U, V, Zn
- **Petroleum Hydrocarbons:** Benzene, toluene, ethylbenzene, xylenes, petroleum hydrocarbon fractions F1 & F2 Turbidity.

These parameters take into account all those likely indicator parameters which would indicate unanticipated impacts to the groundwater from the operations. Full details of the parameters to be tested are provided in Table 5, below.

7.2 Quality Assurance and Quality Control (QA/QC)

Field procedures will be implemented to minimize the potential of cross contamination between sampling locations. Sample handling protocols will be established to track and maintain the integrity of the samples. Disposable Nitrile gloves will be used at all times and will be changed between sampling locations. Sampling will progress from up-gradient locations to down-gradient locations, reducing the potential for cross contamination from potentially impacted areas to un-impacted or background locations.

Field duplicates will be submitted at a rate of 1 per every 10 samples collected or a minimum of one per sampling event. A field or equipment blank will be run through the sampling equipment and then submitted to the laboratory for analysis to assist in assessing the effect of field sampling and sample shipping methodologies on the accuracy and precision of the analytical results. For volatile parameters, a travel or trip blank prepared by the laboratory will accompany the sample bottles and be submitted for analysis.

For each duplicate, a relative percent difference (RPD) is calculated for each parameter analysed for comparison to SLR's standard QA/QC acceptance limits. RPD will be calculated as follows:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100$$

Where: C1 is the concentration in the original sample; and

C2 is the concentration in the duplicate.

Analytical error increases near the reported detection limit (RDL); therefore, the RPD is not normally calculated unless the concentrations of both the original and duplicate samples are greater than five times the RDL. If the RPD for a sample and its duplicate do not meet SLR's RPD standards (60% for organic parameters or 40% for inorganic parameters) for the parameters analysed, an explanation is required to qualify the difference in values.

Chain-of-custody forms will be completed for all samples submitted to the laboratory and will accompany each sample shipment. Sample temperatures will be maintained between 0°C and 10°C at all times by being kept in sealed coolers on ice. Samples will be shipped for analyses within the recommended time requirements.

All samples will be submitted to a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory that uses AEP recognized methods to conduct laboratory analyses. Laboratories accredited by CALA are required to be ISO17025 compliant. Method blanks, control standards samples, certified reference material standards, method spikes, replicates, duplicates and instrument blanks are routinely analysed as part of the analytical laboratory's QA/QC programs.

7.3 Proposed Monitoring Schedule

Historical water quality from the residential wells shows that the water is of consistent quality between the residential wells collected at different times and at various depths within the bedrock. Water quality within the sand and gravel is likewise consistent between the monitoring wells and at different times of year (excluding the outliers due to high turbidity within the samples). This historical data (excluding outliers) is used to form the baseline groundwater quality with the completion of baseline sampling during the spring 2023 freshet and prior to the commencement of stripping and excavation. Results of the baseline sampling to date is provided in Tables A1 to A3, with the monitoring point locations presented in Figure 3.

Now baseline water quality has been established for all sampling points, the program will be reduced to sampling of only those monitoring wells surrounding the working areas (i.e., those stripped areas, those extracting sand and gravel, or those being actively restored) and for wells which will act as baseline for later phases, plus those residential wells within 800 m of the working areas. Monthly water level monitoring will continue at onsite monitoring wells during operating months. The Phase 1 monitoring and sampling schedule is provided in Table 5 and the monitoring point locations presented in Figure 6.

Table 5: Proposed Phase 1 Monitoring Schedule

Parameter / Parameter Suite	Monitoring Point	Frequency
Water Level	Onsite Monitoring Wells MW14-101, MW14-102*, MW14-103, MW18-104, MW18-105, MW18-106, MW18-107, MW19-108, MW19-109, MW19-110, PIZ21-001	Monthly during Operating Months (April -November)
	Residential Wells WW1, WW2, WW3, WW4, WW5**, WW6**, WW7**, WW8**, WW9**, WW10**, WW11**, WW12**, WW13**	Manual readings twice annually (April and November). Data loggers installed and recording daily fluctuations.
Field Parameters Routine Potability Tier 1 dissolved metals	Onsite Monitoring Wells MW14-102*, MW19-108, MW19-109, MW19-110	Biannually (twice per year)
	MW18-106, MW18-107	Every 2 years
Petroleum Hydrocarbons	Onsite Monitoring Wells MW14-102*, MW19-108, MW19-109, MW19-110	Annually
Field Parameters Routine Potability Tier 1 dissolved and total metals	Residential Wells WW1, WW2, WW3, WW4, WW5**, WW6**, WW7**, WW8**, WW13**	Annually until Phase 1 DP expires
	Surface Water BHS1	Annually
Turbidity: Field measurement	Surface Water	Quarterly
Stream Flow Rate	BHS1	Monthly
<p>* - MW14-102 has been dry since it was drilled, it will be monitored as per the schedule and only sampled should groundwater levels rise into the monitoring well.</p> <p>** - Pending well owner agreement for inclusion in the monitoring program</p>		

8.0 Groundwater Response Plan

The groundwater response plan is presented schematically in Figure 7. The following sections describe the components of the plan.

8.1 Baseline Groundwater Sampling

Groundwater sampling has been conducted previously at the site to establish existing conditions and perform an impact assessment. To establish the baseline, historical data has been aggregated for the onsite monitoring wells and residential wells to define the baseline groundwater quality in the sand and gravel and the bedrock, respectively. This allows the natural seasonal and annual variability of the groundwater quality to be established. Routine sampling frequencies will be undertaken on the proposed schedule in Table 5 going forwards. All water quality taken from private wells will be shared with homeowners.

8.2 Establish Control Limits

The initial baseline groundwater monitoring has been used to develop “control limits” (described in Section 5) that can be used to identify groundwater quality issues at the site. Control limits are provided in Table 6 below for those parameters not included in the Alberta Tier 1 or EQG guidelines using all available data to April 2023. These control limits are applied to ensure all groundwater quality parameters remain stable to protect water dependent features not covered by the guidelines, and which includes the tufa formations in the Provincial Park. The control limits are dependent on the parameter considered for each aquifer and incorporate statistically significant deviation from background groundwater quality if natural concentrations are above applicable guideline values. Consideration of natural seasonal variability in measured concentrations will be made so that it can be determined if observed results reflect naturally occurring concentrations or if results are potentially being driven by impacts from operations.

Table 6: Control Limits for Parameters Not Covered by Provincial Guidelines

Parameter	Units	Groundwater Quality in Monitoring Wells at the Project Site		Spring Water Quality at BHS1 (Downstream of the Spring)	
		Lower Control Limit	Upper Control Limit	Lower Control Limit	Upper Control Limit
Temp	C°	3.0	7.9	3.0	7.9
pH	---	7.2	8.4	7.9	8.4
HCO ₃	mg/L	310	400	200	390
Ca	mg/L	61	79	43	77
TDS	mg/L	280	380	190	526
Turbidity	NTU	0	100*	0	7.1**
<p>* While turbidity can be measured reasonably accurately in surface water, representative groundwater values are difficult to obtain from monitoring wells, as they are highly method dependent and subject to large fluctuations depending on how much disturbance occurs within the well. Efforts will be made to use best practice in obtaining representative turbidity samples, however historical results in some of the monitoring wells indicate turbidities much higher than the proposed upper control limit can be obtained on occasion.</p> <p>** From Environmental Quality Guidelines for Alberta Surface Waters - Maximum average increase of 2 NTU from background for longer term exposures used. Maximum increase of 8 NTU from background can be used for short term exceedances (i.e., high runoff events).</p>					

In addition to the control limits developed above, annual monitoring data will be reviewed to determine the presence of increasing or decreasing trends in groundwater quality and elevations using Mann-Kendall analysis or equivalent statistical method once a sufficient data set has been established. Increasing trends in parameters of concern will initiate source identification and flag a given well for follow up during subsequent monitoring events.

8.3 Annual Groundwater Monitoring

Annual groundwater monitoring and sampling for Excavation Phase 1 will occur as described in Table 5 after the baseline sampling period. Groundwater monitoring data will be entered and stored in a format suitable for identifying control limit exceedances and trends. Please be aware that this program will be extended in breadth for each successive Phase; however, those steps are subject to renewed approvals at that time.

8.4 Annual Groundwater Monitoring Report

An annual groundwater monitoring report will be prepared and submitted to RVC by April 30 of the year following the year in which the information on which the report is based was collected. It will include data summaries and an interpretation of the results with respect to the environmental performance of the site.

The report will also highlight any recommended changes to the monitoring program to make it more effective or recommendations for any risk management measures to be undertaken in the subsequent year. This is a key component of any adaptive monitoring plan, whereby groundwater is managed based on progressive results, and risk management is undertaken based on real risk.

Individual well owners will receive a summary of the data for their well privately each year.

8.5 Identification of a Problem

If an exceedance of a control limit or increasing trend is detected at a given well, the well will be re-sampled for the full suite of parameters. If the re-sampling confirms the initial result, AEPA will be notified of the result. If the source can be easily identified and managed, details will be provided to APEA with the notification. If not, a Source Investigation Plan will be provided.

8.6 Source Investigation

Once a control limit exceedance or increasing trend is confirmed by re-sampling, attempts will be made to identify potential sources and remove or manage them if feasible. Source removal might include such activities as removal of surficial soil impact, repair of leaks, etc., however, the operator will be doing daily inspections of equipment, routine maintenance and monitoring at the site which will likely flag issues before impacts show up at the sentinel wells. Depending upon the situation, a detailed investigation of the source zone may be necessary and will be included as part of the Risk Management Plan (Section 8.7).

8.7 Risk Management Plan

As indicated on the flow chart in Figure 7, a risk management plan will only be developed if an issue and its source are identified as being related to the operation. This plan will be developed if exceedances or increasing trends are confirmed and source removal is not feasible.

The first step in any risk management plan will be a preliminary risk assessment to identify any potential receptors and applicable pathways. The preliminary risk assessment will determine if there are any immediate risks to receptors.

After the preliminary risk assessment is completed, a specific risk management and mitigation process will be developed and implemented to reduce the potential risk to any receptors to levels acceptable to AEPA. Such activities will be commensurate with the problem at hand. For example, a spill of hydrocarbons would entail containment with soaker pads and the subsequent removal of impacted soils as appropriate depending on the nature of the impact. The actions required could include but not be limited to additional sampling, installation of monitoring wells, residential well investigation and rehabilitation, changes to operational practices or reporting. If risks cannot be managed or mitigated to the satisfaction of the Director, this may result in the cessation of operations and/or cancellation of the Registration.

9.0 Summary

The foregoing groundwater monitoring plan has been developed using both industry standard techniques and enhancements based on the unique setting of this site. Monitoring of both groundwater levels (as they might conceptually affect private well performance) and groundwater quality (given the local use of the underlying aquifer by others as a potable water source) will be undertaken. It is expected that the monitoring program will confirm and refine the interpretation of the site found in the supporting hydrogeological report (SLR 2020c). It will also serve to identify unanticipated problems, first and foremost at the site by way of the sentry monitoring well network. Private wells are a much greater distance from the excavation and given that the pit development is above the water table, there is little likelihood of impacts there. The monitoring program is intended to periodically confirm this and provide that data to the pit operator and private well owners alike. A groundwater response plan has been presented that outlines the steps that will be taken should unanticipated conditions develop.

10.0 Statement of Limitations

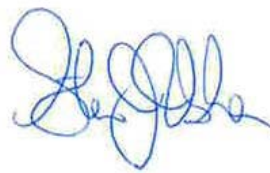
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Sincerely,

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Tables

Groundwater Monitoring Plan

Summit Pit Project

Mountain Ash Limited Partnership

SLR Project No. 212.06650.00007

May 11, 2023



Table A1
Sand and Gravel Monitoring Well Groundwater Quality Results

Parameter	Guideline (Alberta Tier 1)*	Units	MW14-101				MW14-103					MW18-104				
			20-Nov-14	16-Aug-22	15-Dec-22	19-Apr-23	20-Nov-14	4-Aug-15	16-Aug-22	14-Dec-22	19-Apr-23	4-Jul-19		16-Aug-22	14-Dec-22	19-Apr-23
Aluminum	0.05 ¹	mg/L	0.164	0.0072	<0.0030	0.034	5.57	0.109	<0.0030	<0.0030	0.23	3.7	0.0051	<0.0030	<0.0030	<0.003
Antimony	0.006	mg/L	<0.00050	<0.00060	<0.00060	<0.00060	<0.00050	<0.00050	<0.00060	<0.00060	<0.00060	0.0049	0.0013	<0.00060	<0.00060	<0.00060
Arsenic	0.005	mg/L	0.00035	<0.00020	<0.00020	<0.00020	0.007858	0.000336	<0.00020	<0.00020	0.0003	0.0044	0.00080	0.00025	0.00027	0.00023
Barium	2	mg/L	0.424	0.43	0.4	0.39	0.7	0.332	0.38	0.37	0.39	0.61		0.48	0.43	0.41
Bicarbonate (as HCO3)	NV	mg/L	382	340	330	370	380	375	380	360	400	310		330	360	370
Boron	1	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.031	0.025	0.031	<0.020	<0.020	<0.020
Cadmium	0.00037 ¹	mg/L	0.000016	<0.000020	<0.000020	<0.000020	0.00029	<0.000005	<0.000020	<0.000020	0.000031	0.00036	0.000039	<0.020	<0.000020	<0.000020
Calcium	NV	mg/L	76	73	73	70	75	73	76	78	79	63		69	70	63
Chloride	100	mg/L	10.5	13.0	13	12	7.8	8.8	17.0	20	22	29.0		17	18	15
Chromium	0.001 ²	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0076	0.0016	<0.0010	<0.0010	<0.0010	0.018	<0.001	<0.0010	<0.0010	<0.0010
Copper	0.007	mg/L	<0.0010	<0.0010	0.002	0.0032	0.0093	0.0013	0.001	<0.0010	0.0035	0.064	0.0025	0.0063	0.0027	0.0026
Hardness	NV	mg/L	329	310	320	300	324	317	340	350	340	280		320	330	290
Iron	0.3	mg/L	0.28	<0.060	<0.060	<0.060	12	0.22	<0.060	<0.060	0.21	7.6	0.18	<0.060	<0.060	<0.060
Lead	0.005 ¹	mg/L	0.00031	<0.00020	<0.00020	<0.00020	0.00464	<0.00030	<0.00020	<0.00020	0.00032	0.0049	<0.0002	<0.00020	<0.00020	<0.00020
Mercury	0.000005	mg/L	<0.00010	-	<0.0000019	0.0000028	<0.00010	<0.00020	-	<0.0000019	0.0000041	0.00003		-	<0.0000019	<0.0000019
Magnesium	NV	mg/L	33.7	31	33	31	33.4	32.6	36	37	35	30		36	37	33
Manganese	0.02	mg/L	0.02	<0.0040	<0.0040	0.012	0.93	0.01	<0.0040	<0.0040	0.048	0.62		0.017	<0.0040	<0.0040
Molybdenum	NV	mg/L	0.0008	0.00063	0.00061	0.001	0.00184	0.00086	0.00064	0.00069	0.00051	0.015	0.012	0.0034	0.0035	0.0023
Nickel	0.12 ¹	mg/L	<0.00050	0.0027	<0.00050	<0.00050	0.01196	0.00051	<0.00050	<0.00050	<0.00050	0.02	0.0024	0.00089	<0.00050	<0.00050
Nitrate-N	3	mg/L	1.19	1.5	1.5	1.7	5.22	1.801	1.7	1.5	1.6	0.97		1.6	1.7	1.6
Nitrite-N	0.1 ¹	mg/L	<0.05	<0.010	<0.010	<0.010	<0.05	<0.005	<0.010	<0.010	<0.010	0.098		<0.010	<0.010	<0.010
Potassium	NV	mg/L	4.8	4.4	4	3.8	4.3	3.9	3.5	3.6	3.6	4.1		3.3	3.3	2.9
pH	6.5 - 8.5		7.9	7.58	7.87	7.87	7.8	8	7.63	7.86	7.75	7.91		7.24	8.19	7.57
Selenium	0.002	mg/L	<0.00060	0.00038	0.00052	0.00048	0.00112	0.00087	0.00098	0.0012	0.00089	0.00049	0.00024	0.00079	0.00064	0.0005
Silver	NV	mg/L	<0.000070	<0.00010	<0.00010	<0.00010	<0.000070	<0.000070	<0.00010	<0.00010	<0.00010	0.00044	<0.0001	<0.00010	<0.00010	<0.00010
Sodium	200	mg/L	6	5.5	5.8	5.9	8.8	7.9	9.6	9.6	9.4	13		7.8	8.2	7.1
Sulphate	500 ¹	mg/L	8.88	7.3	7.8	7.1	11.9	10.56	13	13	11	9.2		77	7.3	6.8
Thallium	NV	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Dissolved Solids (calculated)	500	mg/L	337	310	300	320	354	333	350	350	370	310		380	330	320
Turbidity	NV	NTU	9.6	-	0.54	580	680	8	-	29	81	130		-	1.2	36
Uranium	0.01	mg/L	0.001697	0.0016	0.0014	0.0015	0.002014	0.001563	0.0017	0.0016	0.0017	0.0019	0.0015	0.0019	0.0018	0.0018
Zinc	0.03	mg/L	<0.020	<0.0030	<0.0030	<0.0030	0.033	<0.020	<0.0030	<0.0030	<0.0030	0.072	<0.003	<0.0030	<0.0030	<0.0030
Total Coliforms	<1 (MAC) ³	MPN/100 mL	-	-	-	-	-	<1	-	-	-	>24000		-	-	-
E.Coli	<1 (MAC) ³	MPN/100 mL	-	-	-	-	-	<1	-	-	-	10		-	-	-

Notes:

* - Table 2, Alberta Tier 1 Groundwater Remediation Guidelines (2023) applied for Agricultural land use in coarse grained soils

NV = no value

1. Tier 1 guideline is the lowest of the aquatic life guideline and all other guidelines. Lead is based on the potable water pathway, as is sulphate in the absence of an assessment for the very high natural groundwater hardness. Cadmium and nickel guidelines are hardness dependent, aluminum is pH dependent and nitrite as N guideline is chloride dependent for the aquatic life pathway. Guidelines quoted are based on the lowest chronic guideline applied for the range of hardness, pH or chloride observed.

2. Guideline is for chromium (hexavalent) and used for screening purposes when not analyzed

3. No guideline value is provided in Alberta Tier 1 guidelines, so Canadian Drinking Water Guideline value has been included for comparison purposes. (MAC = Maximum Allowable Concentration)

Metal concentrations in groundwater are provided as dissolved metals unless otherwise indicated or by total metal concentrations being indicated in *italics*. A comparison between total and dissolved metals was undertaken on 4 July 2019 and therefore two columns of metal concentrations are shown.

BOLD RED – Exceeds guideline

Table A1
Sand and Gravel Monitoring Well Groundwater Quality Results

Parameter	Guideline (Alberta Tier 1)*	Units	MW18-105					MW18-106					MW18-107				
			4-Jul-19		16-Aug-22	14-Dec-22	19-Apr-23	4-Jul-19		16-Aug-22	15-Dec-22	19-Apr-23	4-Jul-19		16-Aug-22	15-Dec-22	19-Apr-23
Aluminum	0.05 ¹	mg/L	5.4	<0.003	0.0051	<0.0030	0.017	13	0.0034	<0.0030	<0.0030	0.0059	7	0.0033	<0.0030	<0.0030	0.02
Antimony	0.006	mg/L	0.006	<0.00060	<0.00060	<0.00060	<0.00060	0.0048	<0.00060	<0.00060	<0.00060	<0.00060	0.00079	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	0.005	mg/L	0.0056	<0.0002	<0.00020	<0.00020	<0.00020	0.017	<0.0002	<0.00020	<0.00020	<0.00020	0.0076	0.00023	<0.00020	<0.00020	<0.00020
Barium	2	mg/L	2.8		0.36	0.34	0.34	1.1		0.35	0.31	0.31	0.79		0.35	0.32	0.32
Bicarbonate (as HCO3)	NV	mg/L	320		340	320	320	360		350	330	360	370		360	330	360
Boron	1	mg/L	0.021	<0.02	<0.020	<0.020	<0.020	<0.020	<0.02	<0.020	0.032	<0.020	<0.020	0.029	<0.020	<0.020	<0.020
Cadmium	0.00037 ¹	mg/L	0.0055	<0.00002	<0.000020	<0.000020	<0.000020	0.00095	<0.00002	<0.000020	<0.000020	<0.000020	0.00033	<0.00002	<0.000020	<0.000020	0.000033
Calcium	NV	mg/L	69		64	65	61	73		70	72	67	71		71	70	68
Chloride	100	mg/L	13.0		10	10	9.5	9.3		11	11	9.7	10.0		15	16	15
Chromium	0.001 ²	mg/L	0.0046	<0.0010	<0.0010	<0.0010	<0.0010	0.081	<0.001	<0.0010	<0.0010	<0.0010	0.025	<0.001	<0.0010	<0.0010	<0.0010
Copper	0.007	mg/L	0.11	0.0003	0.0054	0.0013	<0.0010	0.11	0.00072	0.0015	<0.0010	0.0033	0.018	<0.0002	0.0074	0.001	0.0038
Hardness	NV	mg/L	300		290	300	280	310		310	320	300	310		320	320	300
Iron	0.3	mg/L	49	0.16	<0.060	<0.060	<0.060	37	0.16	<0.060	<0.060	<0.060	17	0.15	<0.060	<0.060	<0.060
Lead	0.005 ¹	mg/L	0.025	<0.0002	0.0015	<0.00020	<0.00020	0.019	<0.0002	<0.00020	<0.00020	<0.00020	0.0075	<0.0002	<0.00020	<0.00020	<0.00020
Total Mercury	0.000005	mg/L	0.0013		-	<0.0000019	<0.0000019	0.00032		-	<0.0000019	<0.0000019	0.000048		-	<0.0000019	<0.0000019
Magnesium	NV	mg/L	32		31	33	30	31		33	34	32	32		34	34	32
Manganese	0.02	mg/L	2.90		<0.0040	<0.0040	<0.0040	1.90		<0.0040	0.0058	<0.0040	0.60		<0.0040	<0.0040	<0.0040
Molybdenum	NV	mg/L	0.0014	0.00096	0.00062	0.00071	0.00061	0.005	0.0012	0.0006	0.00088	0.00073	0.0021	0.00095	0.00069	0.0007	0.00074
Nickel	0.12 ¹	mg/L	0.015	<0.0005	<0.00050	<0.00050	<0.00050	0.036	<0.0005	<0.00050	<0.00050	<0.00050	0.014	<0.0005	<0.00050	<0.00050	<0.00050
Nitrate-N	3	mg/L	2.6		2.3	2.1	2.3	2.3		2.6	2.4	2.7	2		2.6	2.3	2.6
Nitrite-N	0.1 ¹	mg/L	<0.010		<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.010	0.034		<0.010	<0.010	<0.010
Potassium	NV	mg/L	2.9		2.4	2.4	2.4	3.3		3.3	3.2	3.2	3		3.2	3.1	3
pH	6.5 - 8.5		8.05		7.56	8.01	8.08	7.87		7.71	7.95	7.86	7.8		7.53	7.79	7.64
Selenium	0.002	mg/L	0.00093	0.00043	0.00037	0.00052	0.0004	0.0011	0.00067	0.00048	0.00085	0.00058	0.00094	0.00081	0.00055	0.00088	0.00065
Silver	NV	mg/L	<0.00010	<0.0001	<0.00010	<0.00010	<0.00010	0.0017	<0.0001	<0.00010	<0.00010	<0.00010	0.0001	<0.0001	<0.00010	<0.00010	<0.00010
Sodium	200	mg/L	5.7		5.2	5.3	5	9		6.2	7.1	6.3	6.6		6.2	6.7	7.1
Sulphate	500 ¹	mg/L	5.8		4.8	5.6	5.2	7.6		6.3	7.2	7	6.6		6	6.7	5.8
Thallium	NV	mg/L	0.00023	<0.00020	<0.00020	<0.00020	<0.00020	0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Dissolved Solids (calculated)	500	mg/L	300		290	290	280	320		310	310	320	320		320	310	320
Turbidity	NV	NTU	>4000		-	86	>4000	3100		-	6.7	>4000	53		-	19	160
Uranium	0.01	mg/L	0.012	0.0018	0.0016	0.0014	0.0016	0.003	0.002	0.0015	0.0016	0.0016	0.0027	0.0017	0.0015	0.0014	0.0016
Zinc	0.03	mg/L	0.19	<0.003	0.0048	<0.0030	<0.0030	0.13	<0.003	0.0031	<0.0030	<0.0030	0.037	<0.003	<0.0030	<0.0030	<0.0030
Total Coliforms	<1 (MAC) ³	MPN/100mL	<100		-	-	-	1100		-	-	-	>2400		-	-	-
E.Coli	<1 (MAC) ³	MPN/100mL	<100		-	-	-	<10		-	-	-	<1		-	-	-

Notes:

* - Table 2, Alberta Tier 1 Groundwater Remediation Guidelines (2023) applied for Agricultural land use in coarse grained soils

NV = no value

1. Tier 1 guideline is the lowest of the aquatic life guideline and all other guidelines. Lead is based on the potable water pathway, as is sulphate in the absence of an assessment for the very high natural groundwater hardness. Cadmium and nickel guidelines are hardness dependent, aluminum is pH dependent and nitrite as N guideline is chloride dependent for the aquatic life pathway. Guidelines quoted are based on the lowest chronic guideline applied for the range of hardness, pH or chloride observed.

2. Guideline is for chromium (hexavalent) and used for screening purposes when not analyzed

3. No guideline value is provided in Alberta Tier 1 guidelines, so Canadian Drinking Water Guideline value has been included for comparison purposes. (MAC = Maximum Allowable Concentration)

Metal concentrations in groundwater are provided as dissolved metals unless otherwise indicated or by total metal concentrations being indicated in *italics*. A comparison between total and dissolved metals was undertaken on 4 July 2019 and therefore two columns of metal concentrations are shown.

BOLD RED – Exceeds guideline

Table A1
Sand and Gravel Monitoring Well Groundwater Quality Results

Parameter	Guideline (Alberta Tier 1)*	Units	MW19-108					MW19-109				MW19-110		
			4-Jul-19		16-Aug-22	14-Dec-22	19-Apr-23	5-Jul-19	16-Aug-22	14-Dec-22	19-Apr-23	10-Jul-19	14-Dec-22	19-Apr-23
Aluminum	0.05 ¹	mg/L	15	0.0051	0.39	<0.0030	0.44	95	0.029	0.0035	0.32	10	<0.0030	<0.003
Antimony	0.006	mg/L	0.0022	<0.00060	<0.00060	<0.00060	<0.00060	0.0034	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	0.005	mg/L	0.0086	0.00022	0.00061	<0.00020	0.00039	0.071	0.00023	<0.00020	0.0003	0.0084	<0.00020	<0.00020
Barium	2	mg/L	1.1		0.39	0.33	0.37	7.2	0.24	0.22	0.25	2.2	0.33	0.32
Bicarbonate (as HCO3)	NV	mg/L	390		340	350	370	350	370	370	370	330	320	360
Boron	1	mg/L	0.029	<0.02	<0.020	<0.020	<0.020	0.087	<0.020	<0.020	0.031	<0.020	<0.020	<0.020
Cadmium	0.00037 ¹	mg/L	0.00095	<0.00002	0.000063	<0.000020	0.00005	0.01	<0.000020	0.000024	0.000054	0.0042	<0.000020	<0.000020
Calcium	NV	mg/L	74		79	68	70	77	73	77	72	62	68	62
Chloride	100	mg/L	14.0		10	12	12	18	17	17	16	8.4	9.1	8
Chromium	0.001 ²	mg/L	0.038	<0.001	0.0011	<0.0010	0.0013	0.19	<0.0010	<0.0010	<0.0010	0.019	<0.0010	<0.0010
Copper	0.007	mg/L	0.038	<0.0002	0.005	<0.0010	0.0036	0.29	0.0013	<0.0010	0.003	0.032	<0.0010	0.0015
Hardness	NV	mg/L	320		340	310	310	350	320	340	310	280	310	280
Iron	0.3	mg/L	29	0.16	1.2	<0.060	0.59	190	<0.060	<0.060	0.32	10	<0.060	<0.060
Lead	0.005 ¹	mg/L	0.024	<0.0002	0.0023	<0.00020	0.00089	0.15	<0.00020	<0.00020	0.0006	0.019	<0.00020	<0.00020
Total Mercury	0.000005	mg/L	0.000067		-	<0.0000019	0.0000046	0.00208	-	<0.0000019	0.0000048	0.000002	<0.0000019	<0.0000019
Magnesium	NV	mg/L	32		34	34	33	37	33	36	31	30	33	31
Manganese	0.02	mg/L	0.74		0.11	0.0055	0.054	8.9	0.0054	0.0068	0.030	7.3	<0.0040	<0.0040
Molybdenum	NV	mg/L	0.0065	0.0029	0.0012	0.0012	0.0034	0.023	0.0022	0.0019	0.0017	0.0015	0.00075	0.00084
Nickel	0.12 ¹	mg/L	0.047	0.0023	0.0035	0.00071	0.0021	0.41	0.00084	0.00065	0.0015	0.065	<0.00050	<0.00050
Nitrate-N	3	mg/L	2.4		2	2	2.1	1.7	3.2	2.9	3.1	1.9	1.6	1.7
Nitrite-N	0.1 ¹	mg/L	0.048		<0.010	<0.010	<0.010	0.065	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Potassium	NV	mg/L	3.4		3.3	3.1	3.1	6.3	2.9	3	2.8	2.7	2.9	2.9
pH	6.5 - 8.5		7.91		8	8.01	7.88	8.19	7.48	8.07	7.97	7.82	7.96	7.98
Selenium	0.002	mg/L	0.0013	0.00074	0.00079	0.00076	0.00061	0.00059	0.0022	0.002	0.0019	0.00096	0.0006	0.00052
Silver	NV	mg/L	0.0003	<0.0001	<0.00010	<0.00010	<0.00010	0.0025	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	200	mg/L	12		8.8	7.4	6.7	18	7.2	7.7	6.8	6	6.2	5.7
Sulphate	500 ¹	mg/L	17		8.7	8.3	6.9	26	10	10	10	8.1	6.7	6.1
Thallium	NV	mg/L	0.00028	<0.00020	<0.00020	<0.00020	<0.00020	0.0026	<0.00020	<0.00020	<0.00020	0.00024	<0.00020	<0.00020
Total Dissolved Solids (calculated)	500	mg/L	350		320	310	320	360	340	340	340	290	290	300
Turbidity	NV	NTU	670		-	48	30	>4000	-	1.5	330	<0.10	3	46
Uranium	0.01	mg/L	0.0047	0.0027	0.0023	0.0018	0.0017	0.016	0.0025	0.0022	0.0025	0.006	0.0015	0.0016
Zinc	0.03	mg/L	0.15	<0.003	0.01	<0.0030	0.0039	1.2	<0.0030	<0.0030	<0.0030	0.14	<0.0030	<0.0030
Total Coliforms	<1 (MAC) ³	MPN/100mL	<10		-	-	-	120000	-	-	-	180	-	-
E.Coli	<1 (MAC) ³	MPN/100mL	<10		-	-	-	100	-	-	-	63	-	-

Notes:

* - Table 2, Alberta Tier 1 Groundwater Remediation Guidelines (2023) applied for Agricultural land use in coarse grained soils

NV = no value

1. Tier 1 guideline is the lowest of the aquatic life guideline and all other guidelines. Lead is based on the potable water pathway, as is sulphate in the absence of an assessment for the very high natural groundwater hardness. Cadmium and nickel guidelines are hardness dependent, aluminum is pH dependent and nitrite as N guideline is chloride dependent for the aquatic life pathway. Guidelines quoted are based on the lowest chronic guideline applied for the range of hardness, pH or chloride observed.

2. Guideline is for chromium (hexavalent) and used for screening purposes when not analyzed

3. No guideline value is provided in Alberta Tier 1 guidelines, so Canadian Drinking Water Guideline value has been included for comparison purposes. (MAC = Maximum Allowable Concentration)

Metal concentrations in groundwater are provided as dissolved metals unless otherwise indicated or by total metal concentrations being indicated in *italics*. A comparison between total and dissolved metals was undertaken on 4 July 2019 and therefore two columns of metal concentrations are shown.

BOLD RED – Exceeds guideline

Table A2
Paskapoo Formation Residential Well Groundwater Quality Results

Parameter	Guideline (CDWQ)	Units	WW1		WW2				WW3			WW4			
			29-Oct-14	4-Aug-15	29-Oct-14	4-Aug-15	10-Jul-19	16-Aug-22	29-Oct-14	4-Aug-15	16-Aug-22	30-Oct-14	4-Aug-15	5-Jul-19	16-Aug-22
Total Aluminum	2.9 (MAC) / 0.1 (OG)	mg/L	0.0068	0.011	<0.0050	<0.0050	0.006	<0.0030	0.0061	<0.0050	<0.0030	<0.0050	<0.0050	0.0041	<0.0030
Total Antimony	0.006 (MAC)	mg/L	0.00088	<0.00050	0.00059	<0.00050	<0.00060	<0.00060	<0.00050	<0.00050	<0.00060	<0.00050	<0.00050	<0.00060	<0.00060
Total Arsenic	0.01 (MAC)	mg/L	0.000126	0.000132	0.000165	0.000205	<0.00020	<0.00020	0.000143	0.000121	<0.00020	0.000192	0.000194	0.00032	<0.00020
Total Barium	2 (MAC)	mg/L	0.282	0.284	0.128	0.142	0.11	0.12	0.221	0.225	0.24	0.385	0.391	0.36	0.41
Bicarbonate (as HCO3)	NV	mg/L	366.6	359.6	380.6	375.1	350	370	391.6	377.7	380	371.8	365.2	340	360
Total Boron	5 (MAC)	mg/L	0.022	<0.020	0.032	<0.020	0.023	0.039	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total Cadmium	0.007 (MAC)	mg/L	0.000013	<0.000005	0.000016	0.000024	0.000029	<0.000020	0.00004	0.000024	<0.000020	0.000008	<0.000005	<0.000020	<0.000020
Dissolved Calcium	NV	mg/L	70.3	68.2	63.6	63.4	55	59	73.2	69.7	72	75.3	72	80	75
Chloride	<250 (AO)	mg/L	4.29	4.49	1.38	1.93	2	1.7	10.31	5.88	15	10.86	10.95	12	17
Total Chromium	0.05 (MAC)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010
Total Copper	2 (MAC) / 1 (AO)	mg/L	0.0317	0.013	0.0022	0.0016	0.0045	0.012	0.125	0.0057	0.0035	0.0017	0.0018	0.034	0.0035
Total Iron	<0.3 (AO)	mg/L	0.015	0.014	0.018	0.04	<0.060	<0.060	<0.010	<0.010	<0.060	0.017	0.044	0.3	<0.060
Total Lead	0.005 (MAC)	mg/L	0.00127	0.00048	<0.00030	<0.00030	0.00054	0.0012	0.00302	<0.00030	<0.00020	<0.00030	<0.00030	0.011	0.00025
Total Mercury	0.001 (MAC)	mg/L	<0.00010	<0.00020	<0.00010	<0.00020	<0.000020	-	<0.00010	<0.00020	-	<0.00010	<0.00020	<0.000020	-
Dissolved Magnesium	NV	mg/L	35.1	31.8	37.3	35	30	32	39.9	35.5	37	35.2	31.5	35	33
Total Manganese	0.12 (MAC) / 0.02 (AO)	mg/L	<0.0010	<0.0010	0.004	0.0042	0.012	0.015	0.0014	<0.0010	<0.0040	<0.0010	<0.0010	<0.0040	<0.0040
Total Molybdenum	NV	mg/L	0.00148	0.00147	0.00222	0.00193	0.0014	0.0015	0.00113	0.00104	0.00081	0.00076	0.00066	0.00065	0.00063
Total Nickel	NV	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	<0.00050	0.00174	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Nitrate-N	10 (MAC)	mg/L	1.67	1.658	0.78	1.054	0.37	0.54	1.87	1.889	1.9	3.02	3.314	3.2	3.4
Nitrite-N	1 (MAC)	mg/L	<0.05	<0.005	<0.05	<0.005	<0.010	0.012	<0.05	<0.005	<0.010	<0.05	<0.005	<0.010	<0.010
Dissolved Potassium	NV	mg/L	3.3	3.2	2.8	2.6	2	2.3	3.1	3	2.9	3.1	2.9	3	2.8
pH ²	7.0 -10.5		8.1	8	8	8.1	7.95	7.58	7.9	8	7.64	8	8	8.13	7.62
Total Selenium	0.05 (MAC)	mg/L	0.00084	<0.00060	0.00112	0.00105	0.00052	0.00037	0.0007	0.00085	0.00068	0.0018	0.00096	0.00093	0.00086
Total Silver	NV	mg/L	<0.000070	<0.00007	<0.00007	<0.00007	<0.00010	<0.00010	<0.00007	<0.00007	<0.00010	<0.00007	<0.00007	0.00012	<0.00010
Dissolved Sodium	<200 (AO)	mg/L	7.2	7	13.8	9.3	17	22	7.8	7.6	7	7.1	6.5	7.7	6.4
Sulphate	<500 (AO)	mg/L	6.95	7.51	15.82	12.85	20	21	10.33	11.09	9.7	7.66	6.77	5.9	5.9
Total Thallium	NV	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Total Dissolved Solids (calculated) ³	<500 (AO)	mg/L	318	310	328	317	300	320	349	330	340	339	328	330	330
Turbidity	1 (OG)	NTU	0.2	0.31	0.2	1.23	0.31	-	0.2	0.25	-	0.6	0.23	0.66	-
Total Uranium	0.02 (MAC)	mg/L	0.001299	0.001241	0.001023	0.001214	0.00091	0.00064	0.001744	0.001688	0.0016	0.001785	0.001672	0.0021	0.0017
Total Zinc	<5 (AO)	mg/L	<0.020	<0.020	0.024	<0.020	0.046	0.013	0.205	<0.020	0.0046	0.029	0.031	0.99	0.028
Total Coliforms	<1 (MAC)	MPN/100 mL	-	<1	-	<1	1	-	-	<1	-	-	<1	11	-
E.Coli	<1 (MAC)	MPN/100 mL	-	<1	-	<1	<1	-	-	<1	-	-	<1	<1	-

Notes:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: September 2019

2. pH Objective (CDWQ): 7.0 - 10.5

3. Calculated result only includes measured parameters. Actual TDS may be higher.

BOLD RED – Exceeds guideline

Table A3
Big Hill Springs Water Quality Results

Parameter	Guideline (Alberta EQG for Surface Water)	Units	BHS1				
			30-Oct-14	4-Aug-15	10-Jul-19	15-Dec-22	19-Apr-23
Hardness (as CaCO3)	NV	mg/L	336	317	200	330	310
Total Aluminum ¹	0.05	mg/L	0.0182	0.0144	0.3	-	-
Total Antimony	NV	mg/L	<0.00050	<0.00050	<0.00060	-	-
Total Arsenic	0.005	mg/L	0.000153	0.000146	0.00061	-	-
Total Barium	NV	mg/L	0.304	0.313	0.21	-	-
Bicarbonate (as HCO3)	NV	mg/L	376.1	371	240	360	390
Total Boron ²	1.5	mg/L	0.024	<0.020	<0.020	-	-
Total Cadmium ³	0.00037	mg/L	0.000032	0.000008	0.000034	-	-
Dissolved Calcium	NV	mg/L	74.1	72	48	75	70
Chloride ⁴	120	mg/L	9.6	10.12	8.2	16	13
Total Chromium ⁵	0.001	mg/L	<0.0010	<0.0010	0.001	-	-
Total Copper ⁶	0.007	mg/L	<0.0010	0.001	0.0013	-	-
Total Iron	0.3	mg/L	0.027	0.019	0.25	-	-
Total Lead ⁷	0.007	mg/L	<0.00030	<0.00030	<0.00020	-	-
Total Mercury	0.000005	mg/L	<0.00010	<0.00020	0.0000025	-	-
Dissolved Magnesium	NV	mg/L	36.7	33.3	20	36	33
Total Manganese	NV	mg/L	0.0019	0.0012	<0.0040	-	-
Total Molybdenum	0.073	mg/L	0.00141	0.00089	0.00038	-	-
Total Nickel ⁸	0.13	mg/L	<0.00050	<0.00050	0.00088	-	-
Nitrate-N ⁹	3	mg/L	2.83	3.037	1.4	2.7	2.9
Nitrite-N ¹⁰	0.1	mg/L	<0.05	<0.005	<0.010	<0.010	<0.010
Dissolved Potassium	NV	mg/L	3.4	3.3	4.8	3.0	2.8
pH	6.5-9		8.2	8.2	8.07	8.37	8.21
Total Selenium ¹¹	0.001	mg/L	0.00218	0.0013	0.00068	-	-
Total Silver	0.00025	mg/L	<0.000070	<0.000070	<0.00010	-	-
Dissolved Sodium	NV	mg/L	7.8	7.5	5	7.6	7.4
Sulphate ¹²	500	mg/L	9.36	8.36	4.7	8.8	7.2
Total Thallium	0.0008	mg/L	<0.00020	<0.00020	<0.00020	-	-
Total Dissolved Solids (calculated) ¹³	NV	mg/L	342	334	210	340	340
Turbidity ¹⁴	7.1	NTU	0.8	1.07	5.1	1.7	0.19
Total Uranium ¹⁵	0.015	mg/L	0.001953	0.001875	0.0013	-	-
Total Zinc	0.03	mg/L	<0.020	<0.020	<0.0030	-	-
Total Coliforms	NV	MPN	-	2420	>2400	-	-
E.Coli	NV	MPN	-	1733	1600	-	-

Notes:

NV = no value

Environmental Quality Guidelines for Alberta Surface Waters, March 2018

- Aluminum Guideline value is for long term exposure. (Protection of Freshwater Aquatic Life): if pH >= 6.5 then 0.05 mg/L, else if pH < 6.5 then use equation
- Boron Guideline value is for long term exposure. Short term exposure value is 29 mg/L
- Cadmium Guideline value varies with hardness. Based on a typical hardness of 300 to 340 mg/L
- Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L
- Chromium Guideline value is for hexavalent chromium as conservative value. Trivalent chromium guideline is 0.0089 mg/L.
- Copper Guideline is for long term exposure and only applies to waters of hardness >= 50mg/L as CaCO₃
- Lead Guideline varies with hardness. Based on a typical hardness of 300 to 340 mg/L
- Nickel Guideline varies with hardness. Based on a typical hardness of 300 to 340 mg/L
- Nitrate Guideline value is for long term exposure.. Short Term exposure value is 124 for Freshwater
- Nitrite as N guideline varies with chloride. Based on a typical chloride concentration of 8 to 10 mg/L
- Alert concentration for sensitive environments = 0.001 mg/L. Guideline value = 0.002 mg/L
- Sulphate Guideline value varies with hardness. Based on a typical hardness of 300 to 340 mg/L
- Calculated result only includes measured parameters. Actual TDS may be higher.
- Maximum increase of 8 NTU from background for short term. Maximum average increase of 2 NTU from background for longer term exposures.
- Uranium Guideline value is for long term exposure. Short term exposure value is 0.033 mg/L

BOLD RED – Indicates Exceeds guideline

Figures

Groundwater Monitoring Plan

Summit Pit Project

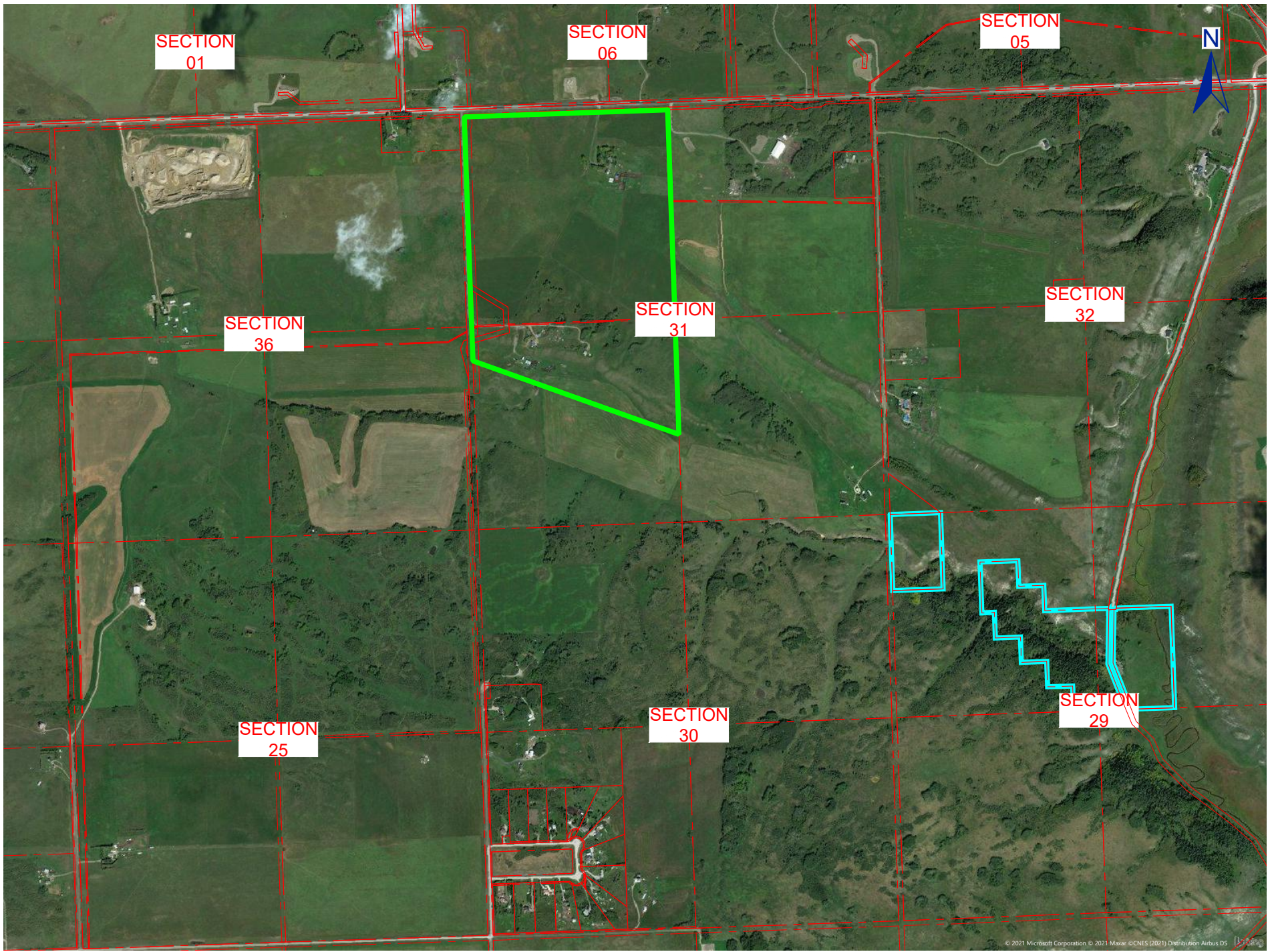
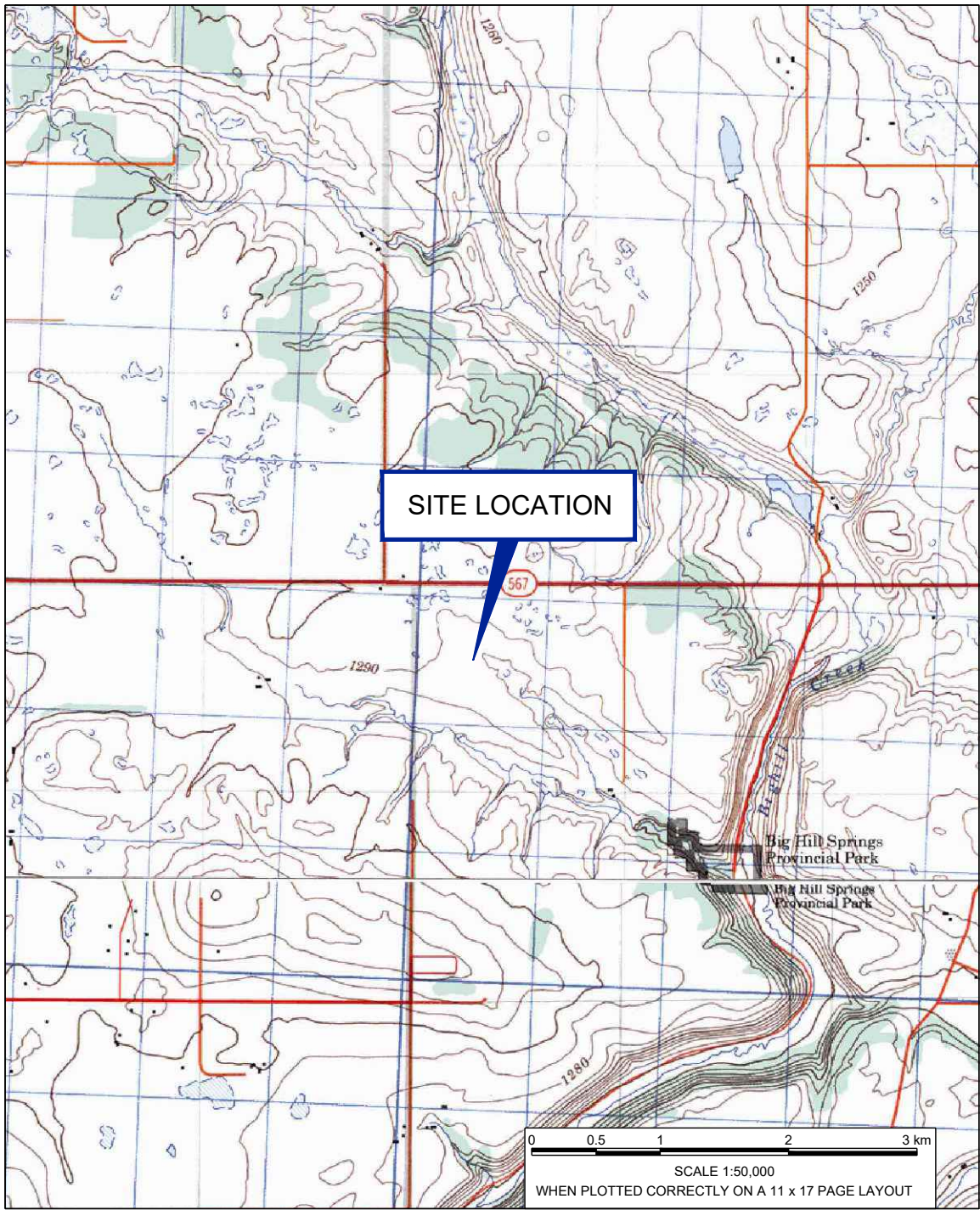
Mountain Ash Limited Partnership

SLR Project No. 212.06650.00007

May 11, 2023



Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

IMAGERY SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY. IMAGERY DATE: SEPTEMBER 9, 2016.

LEGEND:
- - - PROPERTY BOUNDARY
[Green Outline] SUBJECT BOUNDARY
[Blue Outline] BIG HILL SPRINGS PROVINCIAL PARK

0 0.2 0.4 0.8 1.2 km
SCALE 1:20,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM ZONE 11N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA

GROUNDWATER MONITORING PLAN

SITE LOCATION &
STUDY AREA

Date: January 10, 2023

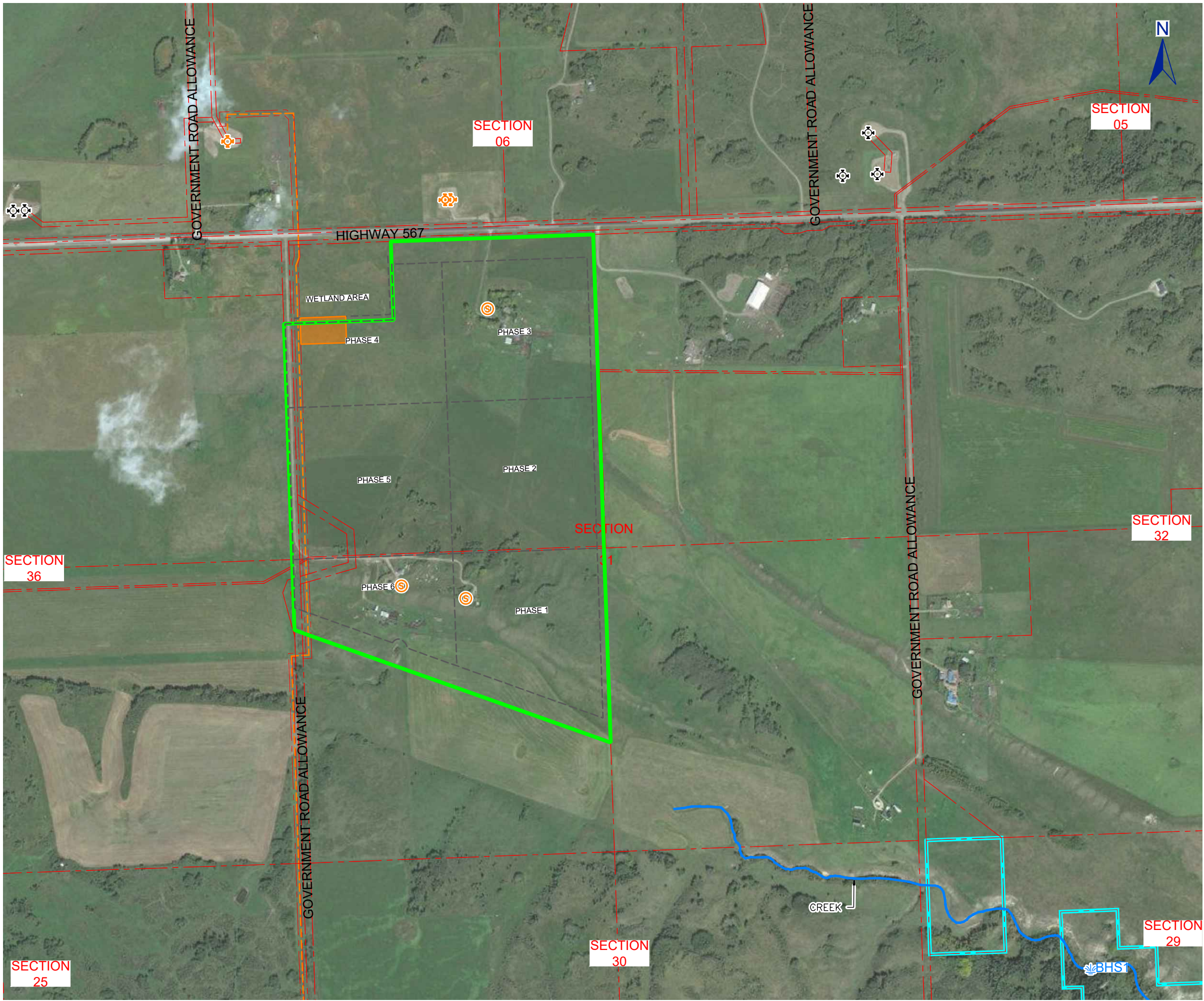
Project No. 212.06650.00007

Drawing No.

1



Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

IMAGERY SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY. IMAGERY DATE: SEPTEMBER 9, 2016.

LEGEND:

- PROPERTY BOUNDARY
- SITE LOCATION
- BIG HILL SPRINGS PROVINCIAL PARK BOUNDARY
- EXTRACTION PHASE BOUNDARIES
- SURFACE WATER MONITORING POINT
- WELL CENTRE
- POTENTIAL SOURCES OF GROUNDWATER CONTAMINATION
- EXISTING SEPTIC TANK
- OIL PIPELINE
- WELL CENTRE
- PROPOSED REFUELLING, EQUIPMENT MAINTENANCE AND STORAGE LOCATION

0 100 200 400 600 m

SCALE 1:10,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM ZONE 11N

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MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA

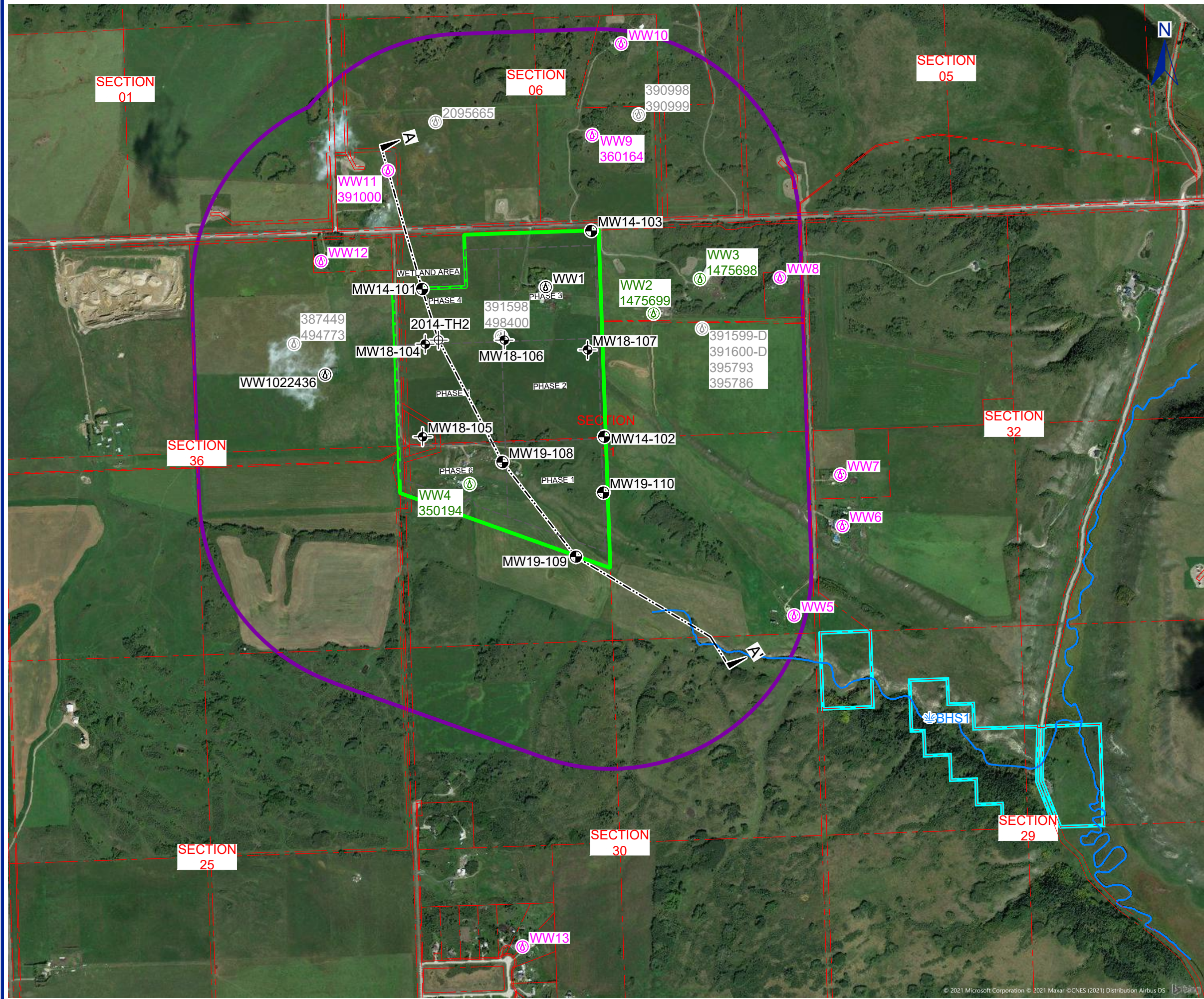
GROUNDWATER MONITORING PLAN

CURRENT AND HISTORICAL POTENTIAL
SOURCES OF GROUNDWATER CONTAMINATION

Date: January 10, 2023	Drawing No. 2
Project No. 212.06650.00007	



Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

IMAGERY SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY. **IMAGERY DATE:** SEPTEMBER 9, 2016.

LEGEND:

- PROPERTY BOUNDARY
- PROJECT BOUNDARY
- BIG HILL SPRINGS PROVINCIAL PARK BOUNDARY
- EXTRACTION (PIT) PHASE BOUNDARIES
- 800 m RADIUS FROM SITE
- BOREHOLE (OTHERS)
- BOREHOLE COMPLETED AS A MONITORING WELL
- BOREHOLE COMPLETED AS A MONITORING WELL (OTHERS)
- WATER WELL
- WATER WELL (WELL PLOTTED AT QUATER SECTION CENTROID BASED ON DATABASE. EXACT LOCATION WITHIN QUATER SECTION IS UNKNOWN)
- WATER WELL (DECOMMISSIONED)
- PREVIOUSLY SAMPLED WATER WELL TO BE INCLUDED IN MONITORING PROGRAM
- WATER WELL TO BE ADDED TO MONITORING PROGRAM
- SURFACE WATER MONITORING POINT
- STRATIGRAPHIC CROSS SECTION LINE

STATION ID	NORTHING	EASTING
MW14-101	5682867.5	680067.9
MW14-102	5682278.7	680793.2
MW14-103	5683099.2	680740.6
MW18-104	5682648.9	680080.8
MW18-105	5682280.0	680070.2
MW18-106	5682664.2	680394.2
MW18-107	5682625.1	680726.1
MW19-108	5682179.2	680387.3
MW19-109	5681802.5	680679.1
MW19-110	5682057.8	680788.1
WW2/1475699	5682770.4	680988.2
WW4/350194	5682091.3	680256.7

0 0.25 0.5 1.0 km
SCALE 1:15,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM ZONE 11N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

**MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA**

GROUNDWATER MONITORING PLAN

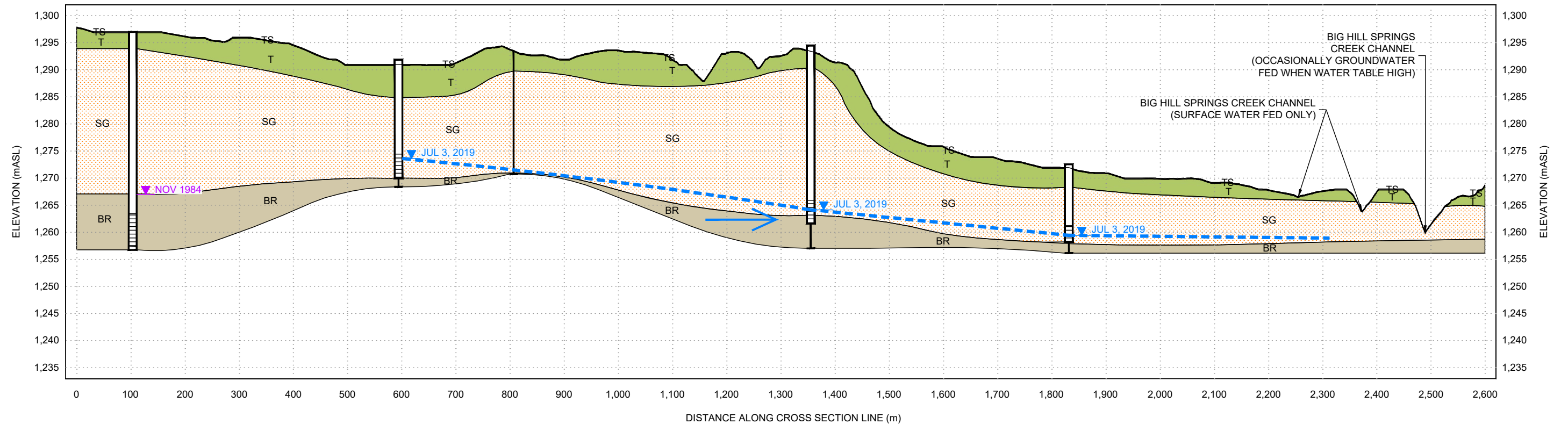
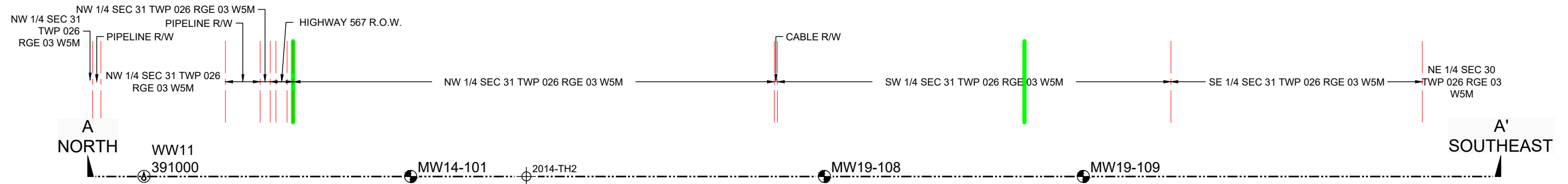
**MONITORING WELL AND WATER WELL
LOCATION PLAN**

Date: January 10, 2023
Project No. 212.06650.00007

Drawing No. 3

SLR

Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

- LEGEND:
- PROPERTY BOUNDARY
 - SITE LOCATION
 - BOREHOLE (OTHERS)
 - BOREHOLE COMPLETED AS A MONITORING WELL
 - WATER WELL
 - GROUNDWATER ELEVATION IN SAND AND GRAVEL
 - GROUNDWATER POTENTIOMETRIC ELEVATION IN PASKAPOO FORMATION BEDROCK
 - INFERRED GROUNDWATER LEVEL
 - INFERRED GROUNDWATER FLOW DIRECTION

- LEGEND:
- A A'
- STRATIGRAPHIC CROSS SECTION A - A'
- TS TOPSOIL
 - T TILL
 - SG SAND AND GRAVEL
 - BR BEDROCK
 - WELL
 - SCREENED INTERVAL
 - BOREHOLE OR TESTPIT
 - END OF HOLE

MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA

GROUNDWATER MONITORING PLAN

SCHEMATIC GEOLOGICAL SECTION A - A'

Date: January 10, 2023

Project No. 212.06650.00007

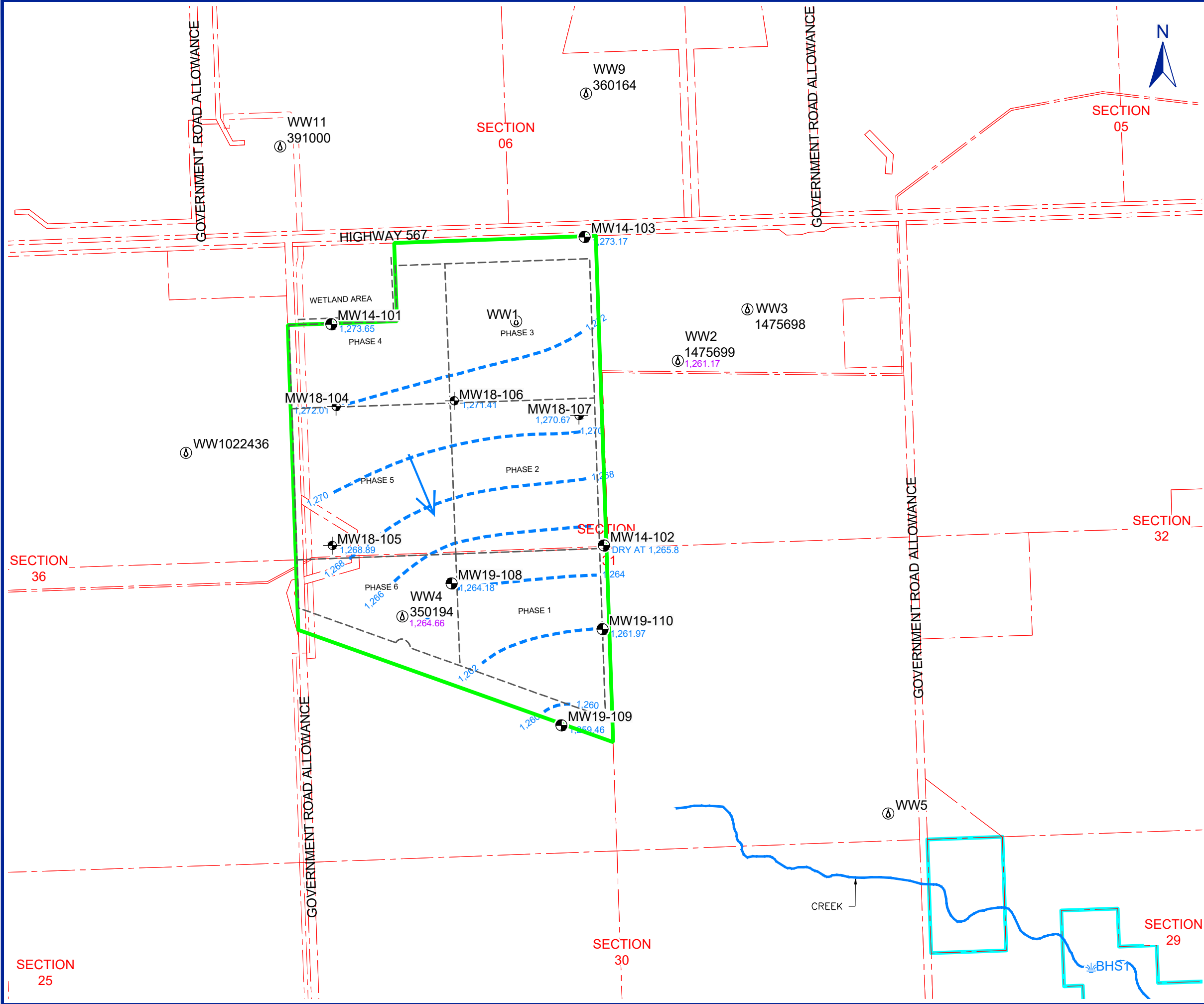
Drawing No.

4



THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

LEGEND:

- PROPERTY BOUNDARY
- SITE LOCATION
- BIG HILL SPRINGS PROVINCIAL PARK BOUNDARY
- EXTRACTION PHASE BOUNDARIES
- BOREHOLE (OTHERS)
- BOREHOLE COMPLETED AS A MONITORING WELL (OTHERS)
- BOREHOLE COMPLETED AS A MONITORING WELL (OTHERS)
- WATER WELL
- SURFACE WATER MONITORING POINT
- GROUNDWATER MONITORING RESULTS**
GROUNDWATER ELEVATION IN SAND AND GRAVEL (mASL)
1,260.73
1,260
1,260.73
INFERRED GROUNDWATER ELEVATION CONTOUR IN SAND AND GRAVEL (INTERVAL 2.0 m)
INFERRED GROUNDWATER FLOW DIRECTION IN SAND AND GRAVEL
GROUNDWATER POTENTIOMETRIC ELEVATION IN PASKAPOO FORMATION BEDROCK (mASL)

WATER WELLS WITH EXACT LOCATIONS UNKNOWN ARE LISTED BELOW WITH THE LOCATIONS AVAILABLE FROM ALBERTA WELL RECORDS WHICH INDICATE LOCATIONS AT THE CENTROID OF THE 1/4 SECTIONS. THESE WATER WELLS ARE NOT SHOWN ON THE DRAWINGS.

ALBERTA WATER WELL RECORD NUMBER	LEGAL LAND LOCATION
2095665	SW 6-27-3 W5M
390998	SE 6-27-3 W5M
390999	SE 6-27-3 W5M
387449	NE 36-26-4 W5M
494773	NE 36-26-4 W5M
391598	NW 31-26-3 W5M
395786	NE 31-26-3 W5M

0 100 200 400 600 m
SCALE 1:10,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM ZONE 11N
THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

**MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA**

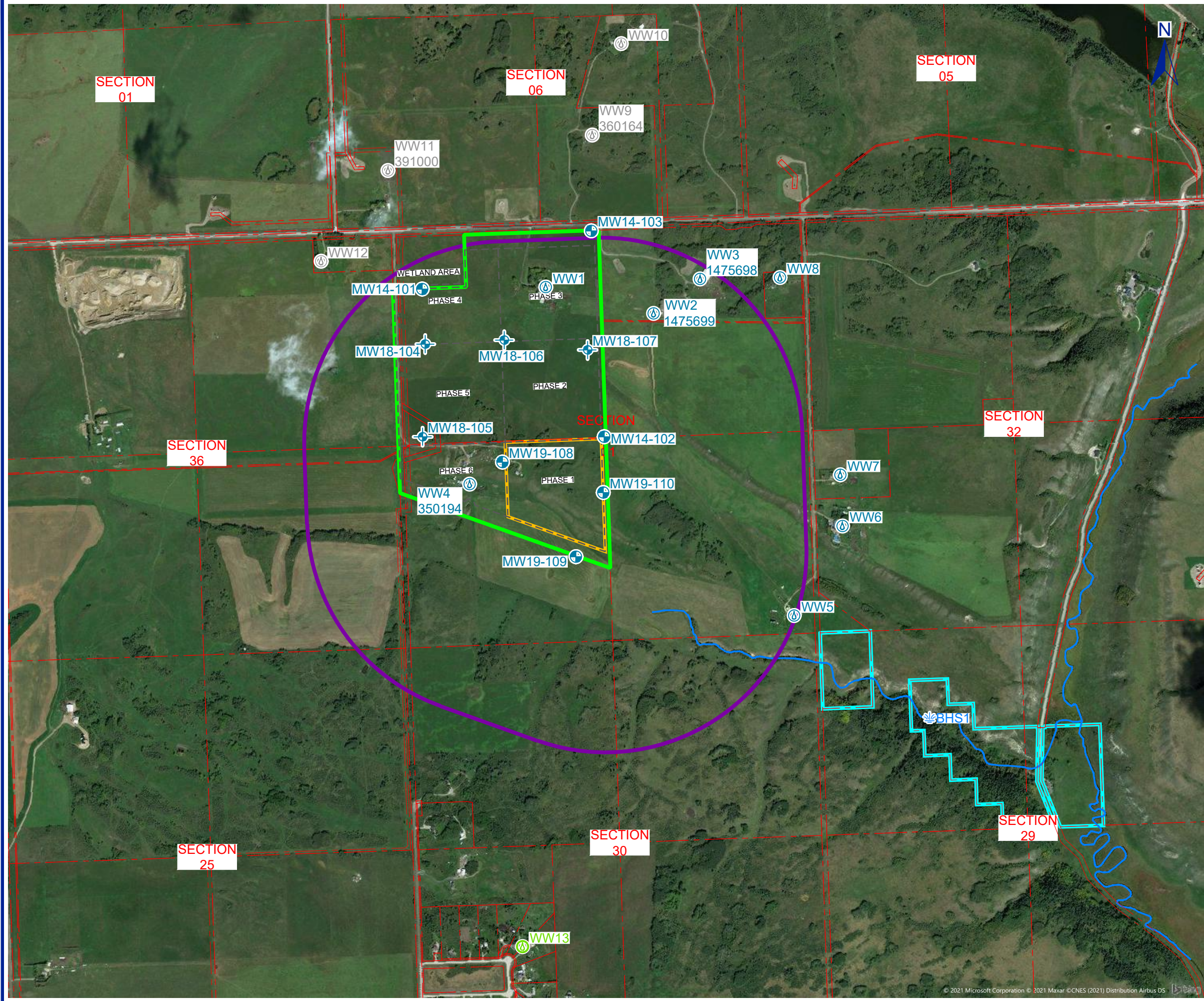
GROUNDWATER MONITORING PLAN

GROUNDWATER ELEVATIONS (JULY 3, 2019)

Date: January 10, 2023	Drawing No. 5
Project No. 212.06650.00007	

SLR

Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY" AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

IMAGERY SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY. **IMAGERY DATE:** SEPTEMBER 9, 2016.

LEGEND:

	PROPERTY BOUNDARY
	PROJECT BOUNDARY
	BIG HILL SPRINGS PROVINCIAL PARK BOUNDARY
	EXTRACTION (PIT) PHASE BOUNDARIES
	PHASE I EXTRACTION (PIT) BOUNDARY
	800 m RADIUS FROM PHASE I
	BOREHOLE COMPLETED AS A MONITORING WELL TO BE INCLUDED IN PHASE I ROUTINE MONITORING
	BOREHOLE COMPLETED AS A MONITORING WELL (OTHERS) TO BE INCLUDED IN PHASE I ROUTINE MONITORING
	RESIDENTIAL WATER WELL TO BE INCLUDED IN PHASE I ROUTINE MONITORING
	RESIDENTIAL WATER WELL NOT INCLUDED IN PHASE I ROUTINE MONITORING
	ANNUAL REVIEW OF DATA COLLECTED BY OTHERS
	SURFACE WATER MONITORING POINT

0 0.25 0.5 1.0 km
SCALE 1:15,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM ZONE 11N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

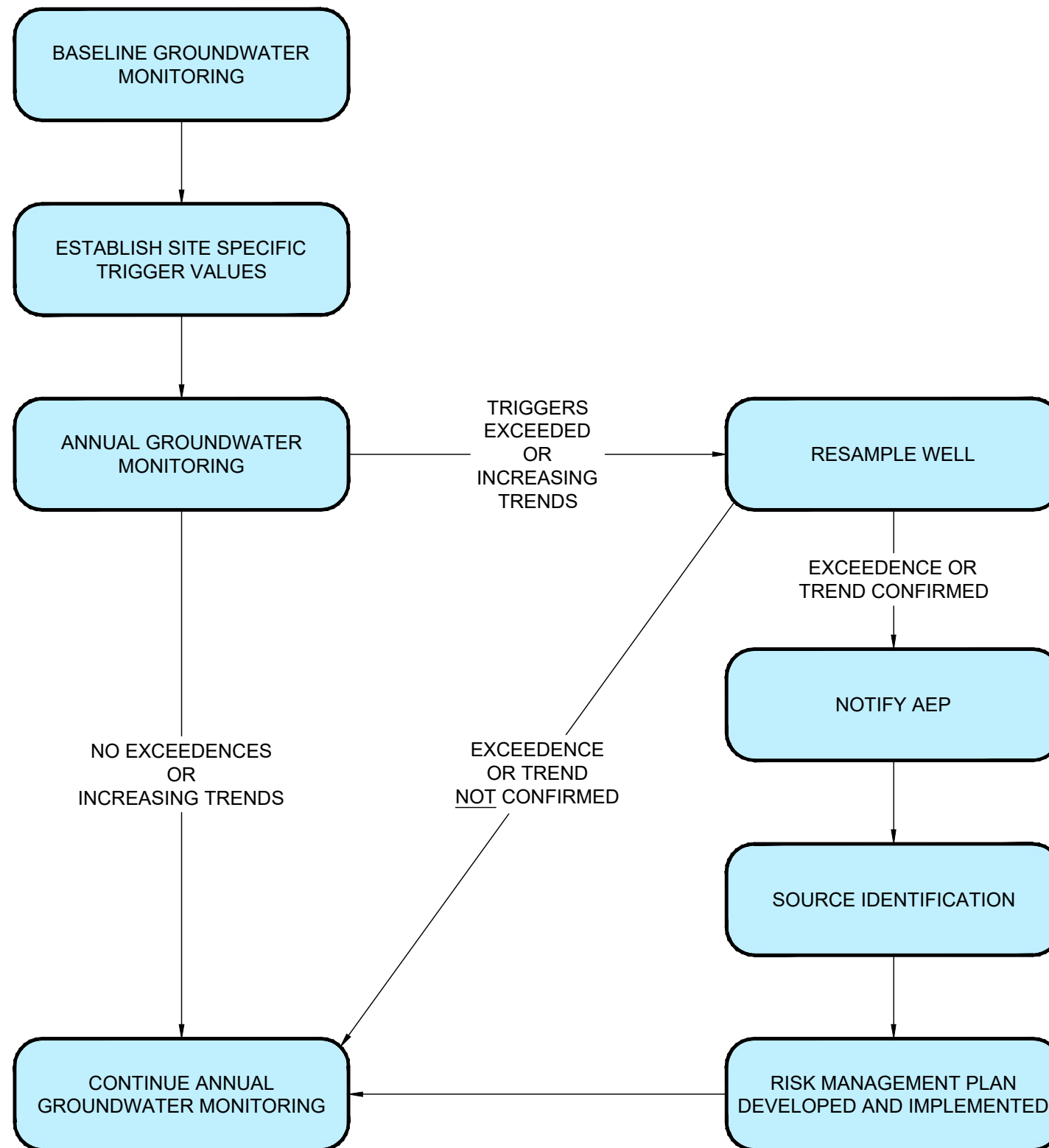
**MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA**

GROUNDWATER MONITORING PLAN

PHASE I MONITORING LOCATION PLAN

Date: January 10, 2023	Drawing No. 6
Project No. 212.06650.00007	

Cadfile name: S_212-06650-00007-A5.dwg



NOTES:
DRAWING COMPILED FROM LIDAR DATA, PROPERTY LINE DATA AND AIR
PHOTOS AS PROVIDED BY THE CLIENT, NTS MAP 82 O/01 TITLED "CALGARY"
AND 82 O/08 TITLED "CROSSFIELD" AND SITE RECONNAISSANCE INFORMATION.

LEGAL DESCRIPTION:
W 1/2 SEC 31 TWP 026 RGE 03 W5M
ROCKY VIEW COUNTY, ALBERTA

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL
LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

MOUNTAIN ASH LIMITED PARTNERSHIP
SUMMIT PIT
NW & SW 31-26-03-W5M
ROCKY VIEW COUNTY, ALBERTA

GROUNDWATER MONITORING PLAN

GROUNDWATER RESPONSE PLAN

Date: January 10, 2023

Project No. 212.06650.00007

Drawing No.

7



Appendix A Monitoring Well Construction Logs

Groundwater Monitoring Plan

Summit Pit Project

Mountain Ash Limited Partnership

SLR Project No. 212.06650.00007

May 11, 2023





CLIENT: **Summit Aggregates Resource**
PROJECT: **Hydrogeological Assessment**
NW 31-026-3 W5M Alberta
PROJECT No. **203.50065.00001**

BOREHOLE LOG

BOREHOLE NO: **MW14-101** UTM COORDINATES
SURFACE ELEVATION: **1293.53 m** **5682869 N**
680066.4 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
-1										
0					Ground Surface				stickup, above ground steel protector	1294
0.3					TOPSOIL Clay, some silt, occasional gravel, rootlets, brown, moist, soft to firm					1293
1		WP1			CLAY TILL Sandy, gravelly (fine to coarse grained) clay, light brown, dry, very hard				backfilled with drill cuttings	1292
2										1291
3										1290
4										1289
5										1288
6										1287
6.1		WP2			SAND AND GRAVEL Fine to medium grained sand, fine to coarse grained gravel, well graded, light brown to orangey brown, dry, compact with occasional hard, calcified bands					1286
7										1285
8										1284
9									hydrated bentonite chips	1283
10										1282
11										1281
12										

DRILLING METHOD: Becker Hammer


Notes: ■ GRAB SAMPLE

DRILL DATE: 30 September 2014 LOGGED BY: RT

Sheet 1 of 2




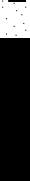


SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR_CAN V5.2 MOISTURE.GDT 21/1/15

SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR_CAN V5.2 MOISTURE.GDT 21/1/15

<div> SLR CONSULTING (CANADA) LTD.</div>					CLIENT: Summit Aggregates Resource		BOREHOLE LOG					
					PROJECT: Hydrogeological Assessment		BOREHOLE NO: MW14-101		UTM COORDINATES			
					PROJECT No. 203.50065.00001		SURFACE ELEVATION: 1293.53 m		5682869 N 680066.4 E			
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION		TEST DATA		WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
							■ SPT Count ◆ % Moisture					
13												1280
14												1279
15						GRAVEL 14.63 Medium to coarse grained, sandy, light brown, moist, compact with occasional hard bands Below 15.2 m: Occasional cobbles					50 mm solid PVC pipe	1278
16	WP3											1277
17						Below 16.8 m: Wet					GW = 16.40 mbg (2Oct2014)	1276
18												1275
19											50 mm 010 slot PVC pipe	1274
20	WP4					SAND 19.5 Medium to coarse grained, grey brown, wet, very loose						1273
21	WP5					SANDSTONE 21.03 Fine grained, brown, grey, wet, weak Below 21.6 m: Weathered, clayey, silty, soft					bentonite chips	1272
22	WP6											
					End of borehole at 22.3 m	22.3						
					Well Completion Details: Screened interval from 16.5 m to 21.0 m below surface Elevation at top of pipe (TOP) = 1294.240 m Groundwater Information: Depth to groundwater from TOP = 17.11 m (2Oct2014)							
DRILLING METHOD: Becker Hammer					Notes: ■ GRAB SAMPLE							
DRILL DATE: 30 September 2014 LOGGED BY: RT									Sheet 2 of 2			

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
-1										1284
0					Ground Surface				stickup, above ground steel protector	1283
0.3					TOPSOIL Sandy, occasional gravel, dark brown, rootlets, moist CLAY TILL Silty, sandy clay, some gravel, brown, moist, very hard				silica sand	1282
1										1282
2		WP7								1281
3									hydrated bentonite chips	1280
4		WP8			SAND Medium to coarse grained, well graded, gravelly (fine to coarse, rounded), occasional cobble, brown, moist	3.96				1279
5		WP9			GRAVEL AND SAND Well graded, fine to coarse gravel and well graded, fine to coarse sand, occasional cobble, rounded, moist	4.57				1278
6										1277
7		WP10			SAND AND GRAVEL Fine grained, trace medium, trace coarse sand. Fine to coarse, rounded gravel, red, moist	6.4			backfilled with drill cuttings	1276
8					From 7.6 to 7.9 m: Rounded, medium to coarse gravel, sandy, dry					1275
9										1274
10									hydrated bentonite chips	1273
11		WP11			GRAVEL Poorly graded, medium, rounded, sandy, trace silt, trace clay coating on gravel, black and dark brown staining Below 11.3 m: Fine to coarse grained gravel, rounded, sandy, fine, dark brown, moist	10.7			50 mm solid PVC pipe	1272
12		WP12							50 mm Ø10 slot PVC pipe	1271

SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR_CAN V5.2 MOISTURE.GDT 21/1/15

<div><div><div>SLR</div><div>SLR CONSULTING (CANADA) LTD.</div></div><div>CLIENT: Summit Aggregates Resource PROJECT: Hydrogeological Assessment NW 31-026-3 W5M Alberta PROJECT No. 203.50065.00001</div></div>					<div>BOREHOLE LOG</div> <div>UTM COORDINATES</div> <div>BOREHOLE NO: MW14-102</div> <div>SURFACE ELEVATION: 1283.26 m</div> <div>5682280 N</div> <div>680791.6 E</div>							
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA		WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)	
						■ SPT Count ◆ % Moisture						
13	WP13				GRAVEL AND SAND 12.8 Fine to medium, trace coarse, rounded gravel. Fine, trace medium, trace coarse sand, occasional cobble, dry Below 13.7 m: Increasing cobble						1270	
14												
15	WP14				SANDSTONE 14.93 Weak, fine grained, silty, dry From 15.5 to 15.8 m: Higher clay and silt					silica sand	1268	
16	WP15				Becoming more competent below 15.8 m					bentonite chips	1267	
					End of borehole at 16.5 m 16.5 Well Completion Details: Screened interval from 10.4 m to 14.9 m below surface Elevation at top of pipe (TOP) = 1284.060 m							
DRILLING METHOD: Becker Hammer					Notes:  GRAB SAMPLE					Sheet 2 of 2		
DRILL DATE: 1 October 2014 LOGGED BY: MH												

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
-1										
0					Ground Surface				stickup, above ground steel protector	-1300
0					TOPSOIL Silty and clay, trace sand, rootlets, dark brown, moist				silica sand	-1299
0.61					CLAY TILL Silty, sandy clay, trace rounded gravel, grey, moist, very hard, softer below 2.4 m					-1298
1										-1297
2										-1296
2.4										-1295
2.7										-1294
3		WP16							hydrated bentonite chips	-1293
4										-1292
5										-1291
6										-1290
6.4					Below 6.4 m: Brown					-1289
7					SAND AND GRAVEL Very fine, trace coarse sand. Medium to coarse grained, rounded gravel. Some silt, red/brown, dry					-1288
7.01										-1287
8										-1286
8.53					GRAVEL AND SAND Fine to medium, (trace coarse) gravel. Poorly graded, very fine sand, brown, moist					-1285
9										-1284
10										-1283
10.7					Below 10.7 m: Increasing gravel					-1282
11		WP17								-1281
12										-1280

SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR_CAN V5.2 MOISTURE.GDT 21/1/15

DRILLING METHOD: Becker Hammer


Notes: GRAB SAMPLE

DRILL DATE: 1 October 2014 LOGGED BY: MH

Sheet 1 of 3

<div>SLR</div> <div>SLR CONSULTING (CANADA) LTD.</div>				CLIENT: Summit Aggregates Resource PROJECT: Hydrogeological Assessment NW 31-026-3 W5M Alberta PROJECT No. 203.50065.00001		BOREHOLE LOG MW14-103 BOREHOLE NO: 5683100 N SURFACE ELEVATION: 1299.81 m 680739 E					
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA ■ SPT Count ◆ % Moisture		WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
13					Below 12.8 m: Increasing gravel, some cobble					50 mm solid PVC pipe	
14					Below 14.0 m: Decreasing gravel, no cobble						
15											
16											
17					Below 16.8 m: Decreasing gravel						
18					SAND AND GRAVEL 19.2 Poorly graded, very fine sand. Medium with trace fine and trace coarse gravel. Occasional cobble, red/brown, moist						
19	WP18										
20											
21											
22						Below 21.3 m: Increasing gravel					
23											
24						Below 23.2 m: 0.08 m clay lens					
25											
26	WP19					Below 25.3 m: Wet gravel, very angular					
DRILLING METHOD: Becker Hammer					Notes: GRAB SAMPLE						
DRILL DATE: 1 October 2014 LOGGED BY: MH					Sheet 2 of 3						

SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR_CAN V5.2 MOISTURE.GDT 21/1/15

					BOREHOLE LOG					
CLIENT: Summit Aggregates Resource PROJECT: Hydrogeological Assessment NW 31-026-3 W5M Alberta PROJECT No. 203.50065.00001					BOREHOLE NO: MW14-103 SURFACE ELEVATION: 1299.81 m UTM COORDINATES: 5683100 N 680739 E					
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
27										
		WP20		×	WEATHERED SILTSTONE					
		WP21		×	Clay and silt, some sand, grey with red striations, moist				silica sand	
					Below 27.7 m: Siltstone, grey, dry				hydrated bentonite chips	
					End of borehole at 27.7 m					
					Well Completion Details:					
					Screened interval from 22.6 m to 27.1 m below surface					
					Elevation at top of pipe (TOP) = 1300.720 m					
					Groundwater Information:					
					Depth to groundwater from TOP = 24.40 m (2Oct2014)					

DRILLING METHOD:	Becker Hammer	Notes:	GRAB SAMPLE
DRILL DATE:	1 October 2014	LOGGED BY:	MH

Sheet 3 of 3

MW18-104

1 OF 3

SAND & GRAVEL EXPLORATION LOG

PROPERTY:
BORING ID: MA-18-06
PLANT: CALGARY
 COORD. SYS: WGS84 - UTM ZONE 11N
 DRILL METHOD: SONIC
COUNTY: ROCKY VIEW
 RIG: B.L. - Track Mounted
 DATE STARTED: 06-26-18
PROVINCE: ALBERTA
 NORTHING: 5,682,650.0
 DATE COMPLETED: 06-26-18
LOCATION: MOUNTAIN ASH
 EASTING: 680,079.0
 TYPE SAMPLE: 4.0" CORE
LOGGED BY: D.B.
 ELEVATION: 1,294.0
 CASED TO: 27.4
TOTAL DEPTH: 27.4m
 EST. WL (m): 21.9m

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
0		0.3	topsoil					0
		0.9	silty till			1	1	
		1.8	clay till, stiff			2	2	
		3.0	sandy gravel, medium to fine sand thin clayey seam @ 5.6m	28.5	16.9	3	3	
5						4	4	5
		1.8	sandy gravel, medium to fine sand	31.6	22	5	5	
		0.3	clay seam, moist	25.5	18.4			
		0.9	silty gravel, fine sand, dry	31.9	12.5	6	6	
		1.2	gravel, clay, fine sand, moist	28.1	24.7	7	7	
10		0.3	clay seam					10
		2.1	gravel, fine to medium sand, silty, poorly graded consolidated thin silt seams.	30.6	19.1	8	8	

2 OF 3

PROPERTY:

PLANT: CALGARY

COUNTY: ROCKY VIEW

PROVINCE: ALBERTA

LOCATION: MOUNTAIN ASH

LOGGED BY: *D.B.*

BORING ID: *MA-18-06*

COORD. SYS: WGS84 - UTM ZONE 11N

RIG: B.L. - Track Mounted

NORTHING: 5 682 650.0

EASTING: 680.079.0

ELEVATION: 1,294.0

TOTAL DEPTH: 27.4m

DRILL METHOD: SONIC

DATE STARTED: 06-26-18

DATE COMPLETED: 06-26-18

TYPE SAMPLE: 4.0" CORE


CASED TO: 27.4

EST. WL (m): 21.9m

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
15		1.8	gravel, fine to medium sand, silty, poorly graded consolidated thin silt seams. 	29.7	17.5	9	9	15
		0.6	gravel, clay, fine sand, moist	33.7	11.4	10	10	
	0.9	lost core, wet, likely saturated			11	11		
	0.6	clay, gravel	21.7	11.7				
	1.5	gravel, silt, fine sand, cobbles, poorly graded dry	24.3	19.8	12	12		
	1.2	gravel, silt/clay, fine sand, wet	22.4	19.5	13	13		
20		1.8	gravel, silt, fine sand, cobbles, poorly graded dry	18.5	25.8	14	14	20
		3.7	clay with sand and gravel, wet	25.8	17.6	15	15	
						16	16	

3 OF 3

<u>PROPERTY:</u>		<u>BORING ID:</u>	MA-18-06	
<u>PLANT:</u>	CALGARY	<u>COORD SYS:</u>	WGS84 - UTM ZONE 11N	<u>DRILL METHOD:</u> SONIC
<u>COUNTY:</u>	ROCKY VIEW	<u>RIG:</u>	B.L. - Track Mounted	<u>DATE STARTED:</u> 06-26-18
<u>PROVINCE:</u>	ALBERTA	<u>NORTHING:</u>	5,682,650.0	<u>DATE COMPLETED:</u> 06-26-18
<u>LOCATION:</u>	MOUNTAIN ASH	<u>EASTING:</u>	680,079.0	<u>TYPE SAMPLE:</u> 4.0" CORE
<u>LOGGED BY:</u>	D.B.	<u>ELEVATION:</u>	1,294.0	<u>CASED TO:</u> 27.4
		<u>TOTAL DEPTH:</u>	27.4m	<u>EST. WVL (m):</u> 21.9m

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
25		2.4	siltstone	---	---	17	17	25
				---	---	18	18	

MW18-105

1 OF 3

SAND & GRAVEL EXPLORATION LOG

PROPERTY:
BORING ID: MA-18-11
PLANT: CALGARY
 COORD. SYS: WGS84 - UTM ZONE 11N
 DRILL METHOD: SONIC
COUNTY: ROCKY VIEW
 RIG: B.L. - Track Mounted
 DATE STARTED: 06-25-18
PROVINCE: ALBERTA
 NORTHING: 5,682,281.0
 DATE COMPLETED: 06-25-18
LOCATION: MOUNTAIN ASH
 EASTING: 680,070.0
 TYPE SAMPLE: 4.0" CORE
LOGGED BY: D.B.
 ELEVATION: 1,294.0
 CASED TO: 27.4m
TOTAL DEPTH: 27.4m
 EST. WL (m): 24.4m










Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
0			dry silt, becoming hard and consolidated					0
		1.5				1	1	
		2.4	clay till, hard, stiff			2	2	
		2.1	sandy gravel, moderately to poorly graded sand / silt dry	34.1	23.2	3	3	
5		1.5	gravel, fine sand and silt, cobbles saturated from 6.7m to 7.6m, thin (<100mm) clay lense at bottom	28.2	24.9	4	4	5
		2.4	sandy gravel, moderately graded, some coarse sand dry	27.6	14.2	5	5	
		0.6	sand, fine to medium, with silt, trace gravel consolidated, dry	1	0	6	6	
		0.9	gravel, silt, clay seam at 11.6m saturated	42.6	20	7	7	10
		0.6	sandy gravel, moderately graded, some coarse sand damp, use 25-33' as reference sample			8	8	
			clay, with sand and gravel. sticky	35.2	15.1			

MW18-105

2 OF 3

SAND & GRAVEL EXPLORATION LOG

PROPERTY:
BORING ID: MA-18-11
PLANT: CALGARY
 COORD. SYS: WGS84 - UTM ZONE 11N
 DRILL METHOD: SONIC
COUNTY: ROCKY VIEW
 RIG: B.L. - Track Mounted
 DATE STARTED: 06-25-18
PROVINCE: ALBERTA
 NORTHING: 5,682,281.0
 DATE COMPLETED: 06-25-18
LOCATION: MOUNTAIN ASH
 EASTING: 680,070.0
 TYPE SAMPLE: 4.0" CORE
LOGGED BY: D.B.
 ELEVATION: 1,294.0
 CASED TO: 27.4m
TOTAL DEPTH: 27.4m
 EST. WL (m): 24.4m



Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
		1.5	clay, with sand and gravel, sticky			9	9	
		1.5	gravel, silty to sandy, damp at bottom	34.4	18	10	10	
15		1.8	gravel, higher clay content, damp	27.6	17.6	11	11	15
		3.0	gravel, sand, silt consolidated	23.3	24.4	12	12	
						13	13	
20		1.2	gravel, silt, sand, clay seams (<100mm thick)	25.2	17.6	14	14	20
		3.0	coarse gravel, some sand, silt, poorly graded consolidated, dry	20.3	22.3	15	15	
						16	16	
			gravel, clay, sand	28.6	26.5			

MW18-105

3 OF 3

SAND & GRAVEL EXPLORATION LOG

PROPERTY:	<input type="text"/>	BORING ID:	MA-18-11	DRILL METHOD:	SONIC
PLANT:	CALGARY	COORD. SYS:	WGS84 - UTM ZONE 11N	DATE STARTED:	06-25-18
COUNTY:	ROCKY VIEW	RIG:	B.L. - Track Mounted	DATE COMPLETED:	06-25-18
PROVINCE:	ALBERTA	NORTHING:	5,682,281.0	TYPE SAMPLE:	4.0" CORE
LOCATION:	MOUNTAIN ASH	EASTING:	680,070.0	CASED TO:	27.4m
LOGGED BY:	D.B.	ELEVATION:	1,294.0	EST. WL (m):	24.4m
		TOTAL DEPTH:	27.4m		

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
25		1.2	wet			17	17	25
		1.8	siltstone			18	18	

MW18-106

1 OF 2

SAND & GRAVEL EXPLORATION LOG

PROPERTY:		BORING ID:	MA-18-07	DRILL METHOD:	SONIC
PLANT:	CALGARY	COORD. SYS:	WGS84 - UTM ZONE 11N	DATE STARTED:	06-26-18
COUNTY:	ROCKY VIEW	RIG:	B.L. - Track Mounted	DATE COMPLETED:	06-26-18
PROVINCE:	ALBERTA	NORTHING:	5,682,664.0	TYPE SAMPLE:	4.0" CORE
LOCATION:	MOUNTAIN ASH	EASTING:	680,393.0	CASED TO:	19.8m
LOGGED BY:	D.B.	ELEVATION:	1,287.8	EST. WL (m):	15.2m
		TOTAL DEPTH:	19.8m		

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
0			silty till, unconsolidated, tan			1	1	0
		2.1				2	2	
		4.0	clay till, very stiff, hard, brown			3	3	
5						4	4	5
		3.0	gravel, silty, poorly graded fine sand, some cobble, tan consolidated thin silt seams	37.2	19.3	5	5	
						6	6	
10		1.8	gravel, clay, fine sand, brown, wet	21.2	23.2	7	7	10
		1.2	gravel, silty, poorly graded fine sand, some cobble, tan dry	21.9	24.6	8	8	
			gravel, silt and clay, clay-rich seams	25.2	15.1			

MW18-106

2 OF 2

SAND & GRAVEL EXPLORATION LOG

PROPERTY:		BORING ID:	MA-18-07	DRILL METHOD:	SONIC
PLANT:	CALGARY	COORD. SYS:	WGS84 - UTM ZONE 11N	DATE STARTED:	06-26-18
COUNTY:	ROCKY VIEW	RIG:	B.L. - Track Mounted	DATE COMPLETED:	06-26-18
PROVINCE:	ALBERTA	NORTHING:	5,682,664.0	TYPE SAMPLE:	4.0" CORE
LOCATION:	MOUNTAIN ASH	EASTING:	680,393.0	CASED TO:	19.8m
LOGGED BY:	D.B.	ELEVATION:	1,287.8	EST. WL (m):	15.2m
		TOTAL DEPTH:	19.8m		




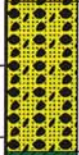





Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
		1.5	gravel, silt and clay, clay-rich seams wet			9	9	
		1.5	gravel, silty, poorly graded fine sand, some cobble - increasing with depth, tan dry, getting wet near the bottom of run	30.3	24.1	10	10	
15		3.0	gravel, silt and clay, fine sand, medium sand seam (>150mm) @ 16.5m wet	11.7	47.3	11	11	15
		0.6	siltstone			12	12	
		0.6	sand and gravel, wet			13	13	
		0.3	siltstone / claystone					

MW18-107

1 OF 3


SAND & GRAVEL EXPLORATION LOG

PROPERTY:
BORING ID: MA-18-08
PLANT: CALGARY
 COORD. SYS: WGS84 - UTM ZONE 11N
 DRILL METHOD: SONIC
COUNTY: ROCKY VIEW
 RIG: B.L. - Track Mounted
 DATE STARTED: 06-28-18
PROVINCE: ALBERTA
 NORTHING: 5,682,628.0
 DATE COMPLETED: 06-28-18
LOCATION: MOUNTAIN ASH
 EASTING: 680,724.0
 TYPE SAMPLE: 4.0" CORE
LOGGED BY: D.B.
 ELEVATION: 1,292.1
 CASED TO: 27.4m
TOTAL DEPTH: 27.4m
 EST. WL (m): 21.3m

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
0			silty till			1	1	0
		3.0				2	2	
			clay till, stiff, hard			3	3	
		1.8						
5			sandy gravel, fine to medium sand, moderately graded, brown	44.9	16	4	4	5
		1.2						
			gravel, fine sand, brown, wet	28.1	35.1	5	5	
		2.1						
			clay, some gravel	25.9	7.7	6	6	
		0.6						
			gravel, silt, fine sand, poorly graded, tan to brown dry,	37.9	14.7			
		0.9						
10			gravel, clay/silt, cobbles, brown wet	30.6	25.5	7	7	10
		0.9						
			sandy gravel, fine to medium sand, moderately graded, brown dry	48.8	12.3	8	8	
		1.5						
			gravel, clay/silt, cobbles, brown	36.8	21.2			

2 OF 3

PROPERTY:		BORING ID:	MA-18-08	
PLANT:	CALGARY	COORD. SYS:	WGS84 - UTM ZONE 11N	DRILL METHOD: SONIC
COUNTY:	ROCKY VIEW	RIG:	B.L. - Track Mounted	DATE STARTED: 06-28-18
PROVINCE:	ALBERTA	NORTHING:	5,682,628.0	DATE COMPLETED: 06-28-18
LOCATION:	MOUNTAIN ASH	EASTING:	680,724.0	TYPE SAMPLE: 4.0" CORE
LOGGED BY:	D.B.	ELEVATION:	1,292.1	CASED TO: 27.4m
		TOTAL DEPTH:	27.4m	EST. WL (m): 21.3m


Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
		1.2	gravel, clay/silt, cobbles, brown wet			9	9	
		1.8	gravel, silt, fine sand, consolidated, dry	31	15.5	10	10	
15		1.8	gravel, fine sand, clay, some cobble wet to saturated	27.7	24.6	11	11	15
		1.2	gravel, silt, fine sand, poorly graded dry	31.6	19.6	12	12	
		1.2	clayey sand and gravel, cobbles, wet	20.8	23.2	13	13	
20		1.8	gravel, silt, fine sand, some cobble, consolidated, damp	35	23.8	14	14	20
		3.4	gravel, silty, fine sand, saturated	26.4	39.9	15	15	
						16	16	

MW18-107

3 OF 3

SAND & GRAVEL EXPLORATION LOG

<u>PROPERTY:</u>		<u>BORING ID:</u>	MA-18-08	
<u>PLANT:</u>	CALGARY	<u>COORD SYS:</u>	WGS84 - UTM ZONE 11N	<u>DRILL METHOD:</u> SONIC
<u>COUNTY:</u>	ROCKY VIEW	<u>RIG:</u>	B.L. - Track Mounted	<u>DATE STARTED:</u> 06-28-18
<u>PROVINCE:</u>	ALBERTA	<u>NORTHING:</u>	5,682,628.0	<u>DATE COMPLETED:</u> 06-28-18
<u>LOCATION:</u>	MOUNTAIN ASH	<u>EASTING:</u>	680,724.0	<u>TYPE SAMPLE:</u> 4.0" CORE
<u>LOGGED BY:</u>	D.B.	<u>ELEVATION:</u>	1,292.1	<u>CASED TO:</u> 27.4m
		<u>TOTAL DEPTH:</u>	27.4m	<u>EST. WVL (m):</u> 21.3m

Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
25		2.7	claystone			17	17	25
						18	18	



CLIENT: **Mountain Ash Limited Partnership**
PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-108** UTM COORDINATES
SURFACE ELEVATION: **1293.64 m** 680386 N
5682182 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
0					Ground Surface				above ground steel protector	1294
0					CLAY TILL Fine trace gravel, dark grey brown, minor sample recovery, dry					1293
1										1292
2					@ 1.5 m: Some fine to coarse gravel				hydrated bentonite chips	1291
3										1290
4					SAND AND GRAVEL Fine to coarse sand and gravel, brown, dry	3.35				1289
5					SANDY GRAVEL Medium to coarse gravel, coarse sand, brown, dry	4.57				1288
6										1287
7										1286
8										1285
9										

DRILLING METHOD: Sonic/Odex

Notes: ■ GRAB SAMPLE

DRILL DATE: June 3, 2019

LOGGED BY: NY

Sheet 1 of 4

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003 -100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19



CLIENT: **Mountain Ash Limited Partnership**
PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-108** UTM COORDINATES
SURFACE ELEVATION: **1293.64 m** 680386 N
5682182 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
9.14					GRAVELLY SAND Fine to coarse sand and gravel, yellow brown, dry					1284
10										1283
11										1282
12										1281
13										1280
14										1279
15										1278
16									slough and backfill	1277
17										1276
18										1275
19										

DRILLING METHOD: Sonic/Odex

Notes: ■ GRAB SAMPLE

DRILL DATE: June 3, 2019

LOGGED BY: NY

Sheet 2 of 4

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19



CLIENT: **Mountain Ash Limited Partnership**
PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-108** UTM COORDINATES
SURFACE ELEVATION: **1293.64 m** 680386 N
5682182 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
20					@ 19.2 m: Trace silt present to 20.7 m					1274
21										1273
22										1272
23										1271
24										1270
25										1269
26										1268
27					SAND Some gravel, brown, fine to coarse sand and gravel, dry					1267
28										1266
29										1265

DRILLING METHOD: Sonic/Odex

Notes: ■ GRAB SAMPLE

DRILL DATE: June 3, 2019

LOGGED BY: NY

Sheet 3 of 4

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19

SLR CONSULTING (CANADA) LTD.

PROJECT No. **212.06650.00003**

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
30										1264
31										1263
32										1262
33										1261
34										1260
35										1259
36										1258
					End of borehole at 36.6 m	36.6				

DRILLING METHOD: Sonic/Odex

Notes: XXXXXXXXXX GRAB SAMPLE

DRILL DATE: June 3, 2019

LOGGED BY: NY

Sheet 4 of 4



CLIENT: **Mountain Ash Limited Partnership**
 PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
 PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-109** UTM COORDINATES
 SURFACE ELEVATION: **1271.68 m** 5681803 N
 680679 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
0					Ground Surface				above ground steel protector	1272
0					CLAY TILL Trace fine gravel, dark brown, moist					1271
1										1270
2					@ 1.5 m: Some fine gravel				hydrated bentonite chips	1269
3										1268
4					SAND AND GRAVEL Coarse sand, fine to coarse gravel, grey brown, dry	3.66				1267
5										1266
6					GRAVELLY SAND Fine to coarse gravel and sand, grey brown, dry	5.49				1265
7									slough and backfill	1264
8										1263
9										

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19

DRILLING METHOD: ODEX Air Rotary Drilling

Notes:

DRILL DATE: June 4, 2019

LOGGED BY: NY

Sheet 1 of 2



CLIENT: **Mountain Ash Limited Partnership**
 PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
 PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-109** UTM COORDINATES
 SURFACE ELEVATION: **1271.68 m** 5681803 N
 680679 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
10										1262
11										1261
12					SANDY GRAVEL Fine to coarse gravel and sand, grey brown, dry	11.58				1260
13										1259
14					BEDROCK Could not determine lithology with minimal returns	14.02				1258
15										1257
					End of borehole at 15.8 m	15.8				1256
					Groundwater Information: Depth to groundwater from TOP = 12.32 m (5June2019)					

filter pack sand
 GW = 1259.36 m
 (5June2019)

bentonite pellets

DRILLING METHOD: ODEX Air Rotary Drilling

Notes:

DRILL DATE: June 4, 2019

LOGGED BY: NY

Sheet 2 of 2

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19



CLIENT: **Mountain Ash Limited Partnership**
 PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
 PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-110** UTM COORDINATES
 SURFACE ELEVATION: **1291.14 m** 5682058 N
 680788 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
0					Ground Surface				above ground steel protector	1291
0					CLAY TILL Trace gravel, dark brown, moist					1291
1										1290
2										1289
3										1288
3.35					SAND AND GRAVEL Fine to coarse sand and gravel, yellow brown, dry					1287
4										1287
4.57					GRAVELLY SAND Fine to coarse sand and gravel, reddish brown, dry					1286
5										1286
5.5					@ 5.5 m: Yellow brown to 11.6 m				hydrated bentonite chips	1285
6										1285
7										1284
8										1283
9										1283

DRILLING METHOD: ODEX Air Rotary Drilling

Notes: ■ GRAB SAMPLE

DRILL DATE: June 4, 2019

LOGGED BY: NY

Sheet 1 of 4

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003 -100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19

<div><div>SLR<div><div></div><div></div></div></div><div>SLR CONSULTING (CANADA) LTD.</div></div>					CLIENT: Mountain Ash Limited Partnership PROJECT: Proposed Summit Pit NW 31-026-03 W5M Cochrane, AB PROJECT No. 212.06650.00003		<div><div>BOREHOLE LOG</div><div>BOREHOLE NO: MW19-110 SURFACE ELEVATION: 1291.14 m</div><div>UTM COORDINATES 5682058 N 680788 E</div></div>				
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)	
						■ SPT Count ◆ % Moisture					
					@ 9.1 m: Clay layer, dark brown, moist to 10.1 m						
10										1281	
11										1280	
12					GRAVEL AND SAND Fine to coarse sand and gravel, yellow brown, dry	11.58				1279	
13										1278	
14										1277	
15										1276	
16										1275	
17										1274	
18										1273	
19											
DRILLING METHOD: ODEX Air Rotary Drilling					Notes: ■ GRAB SAMPLE						
DRILL DATE: June 4, 2019 LOGGED BY: NY					Sheet 2 of 4						



CLIENT: **Mountain Ash Limited Partnership**
PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-110** UTM COORDINATES
SURFACE ELEVATION: **1291.14 m** 5682058 N
680788 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
20									slough and backfill	1271
21					@ 20.7 m: Grey - brown to 29.3 m					1270
22										1269
23										1268
24										1267
25										1266
26										1265
27										1264
28										1263
29									GW = 1262.29 m (5June2019)	

DRILLING METHOD: ODEX Air Rotary Drilling

Notes: ■ GRAB SAMPLE

DRILL DATE: June 4, 2019

LOGGED BY: NY

Sheet 3 of 4

SLR BOREHOLE LOG (MOISTURE) 212.06650.00003_100 SERIES_3-5JUNE2019.GPJ SLR_CAN V5.2 MOISTURE.GDT 12/6/19



CLIENT: **Mountain Ash Limited Partnership**
PROJECT: **Proposed Summit Pit**
NW 31-026-03 W5M Cochrane, AB
PROJECT No. **212.06650.00003**

BOREHOLE LOG

BOREHOLE NO: **MW19-110** UTM COORDINATES
SURFACE ELEVATION: **1291.14 m** 5682058 N
680788 E

SLR CONSULTING (CANADA) LTD.

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture				
30					BEDROCK Siltstone, grey, dry					
31										
32										
33										
					End of borehole at 33.2 m					
					Groundwater Information: Depth to groundwater from TOP = 28.85 m (5June2019)					

DRILLING METHOD: ODEX Air Rotary Drilling

Notes: ■ GRAB SAMPLE

DRILL DATE: June 4, 2019 LOGGED BY: NY

Sheet 4 of 4

Appendix B Groundwater Hydrographs

Groundwater Monitoring Plan

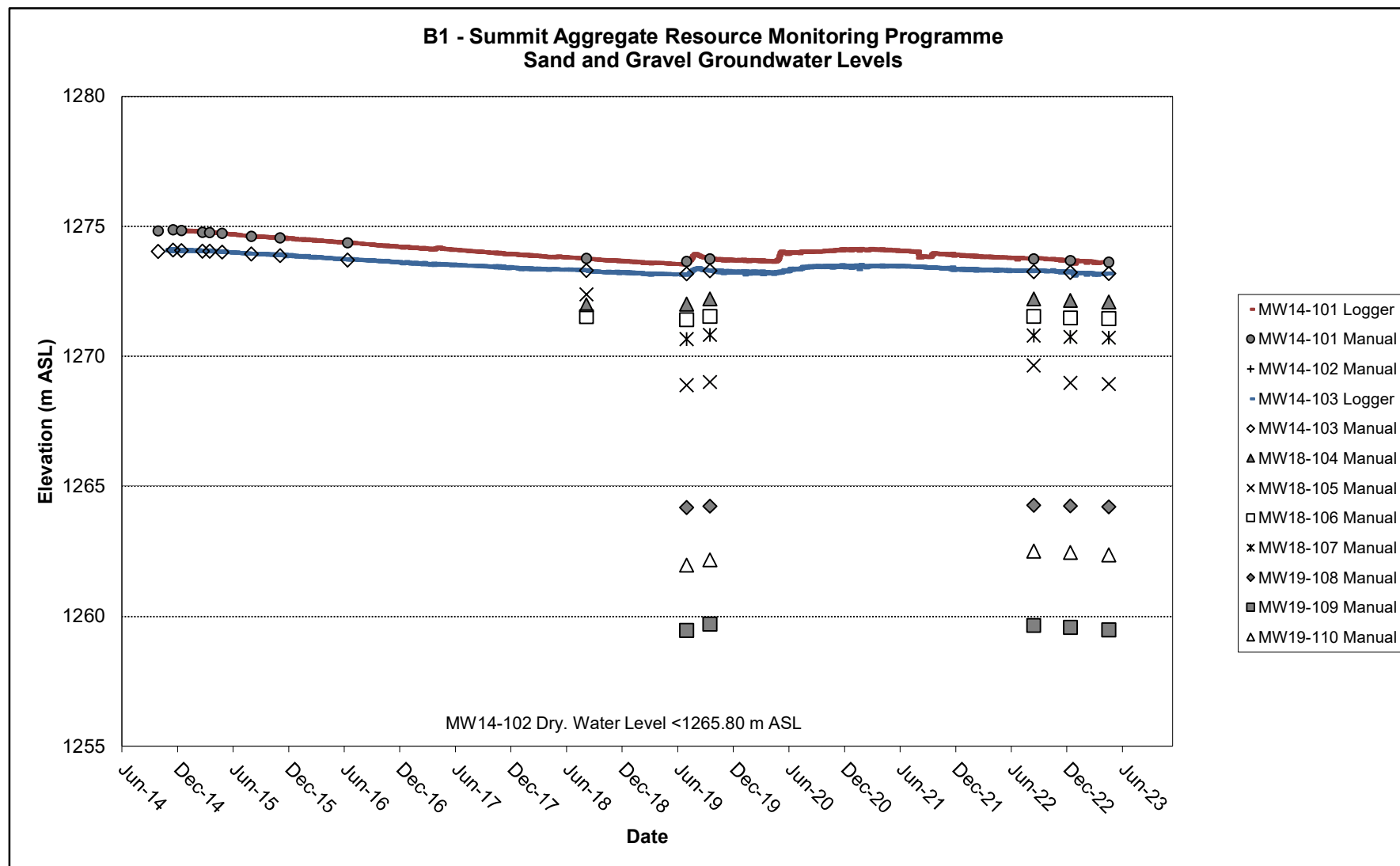
Summit Pit Project

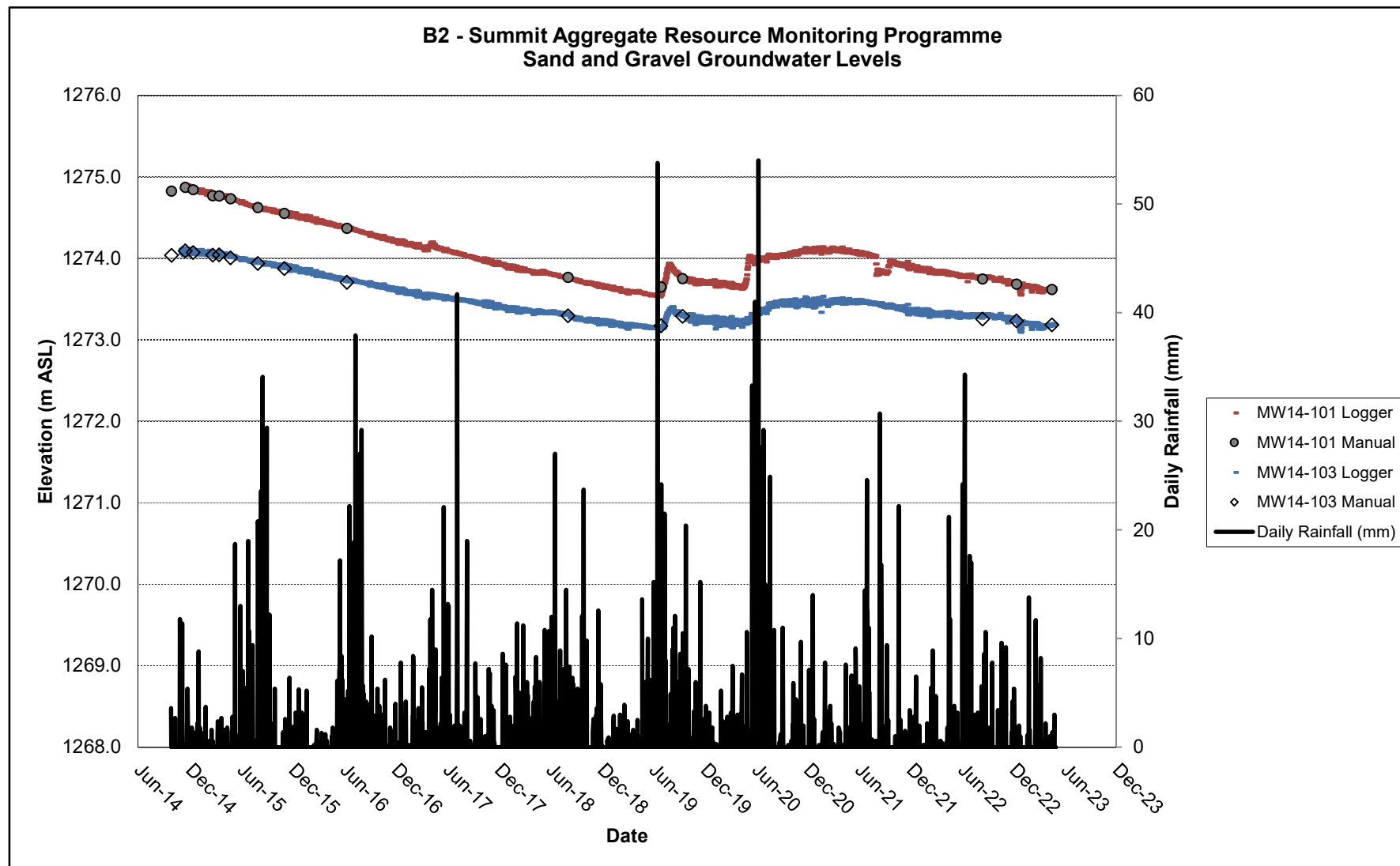
Mountain Ash Limited Partnership

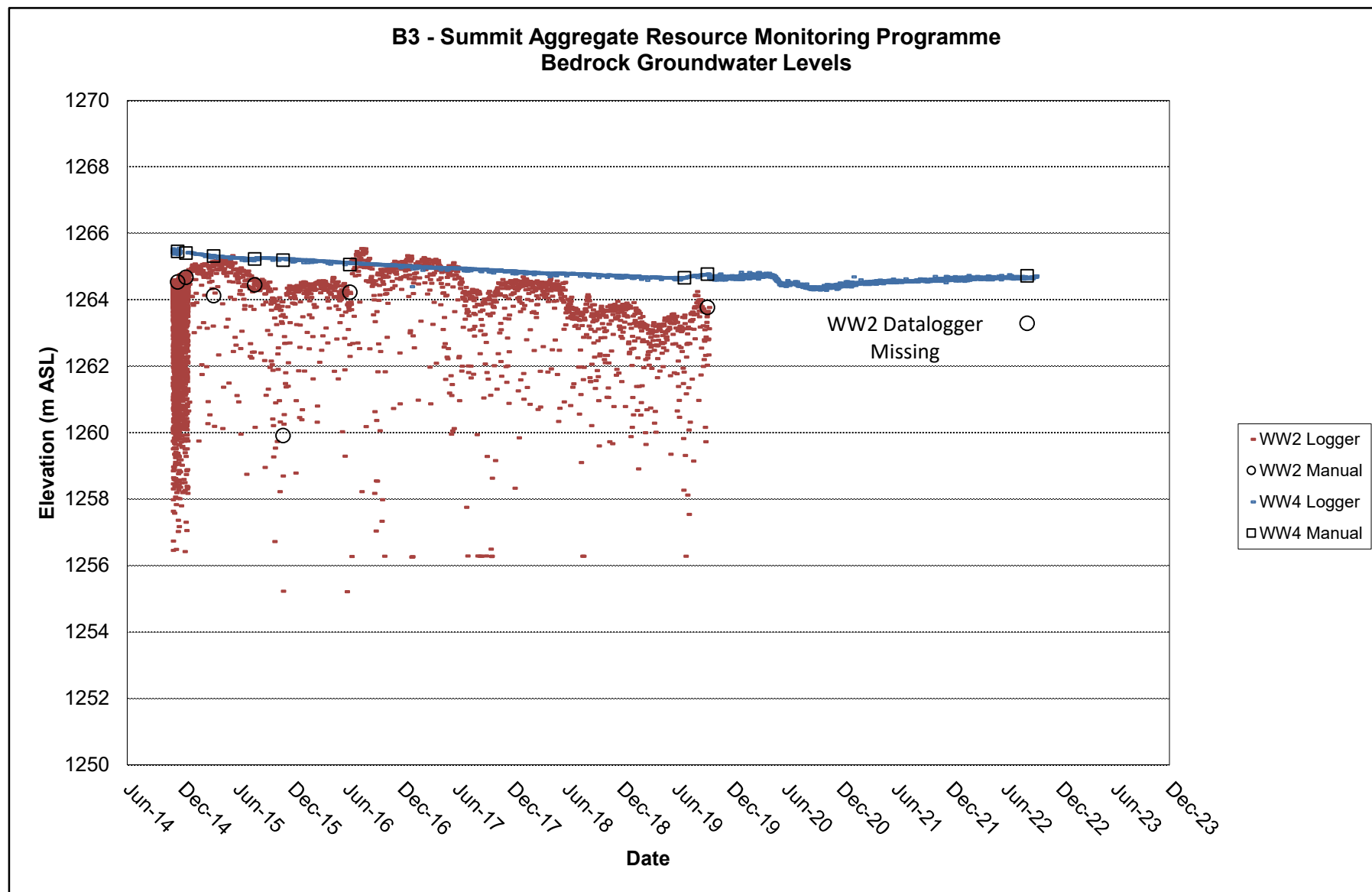
SLR Project No. 212.06650.00007

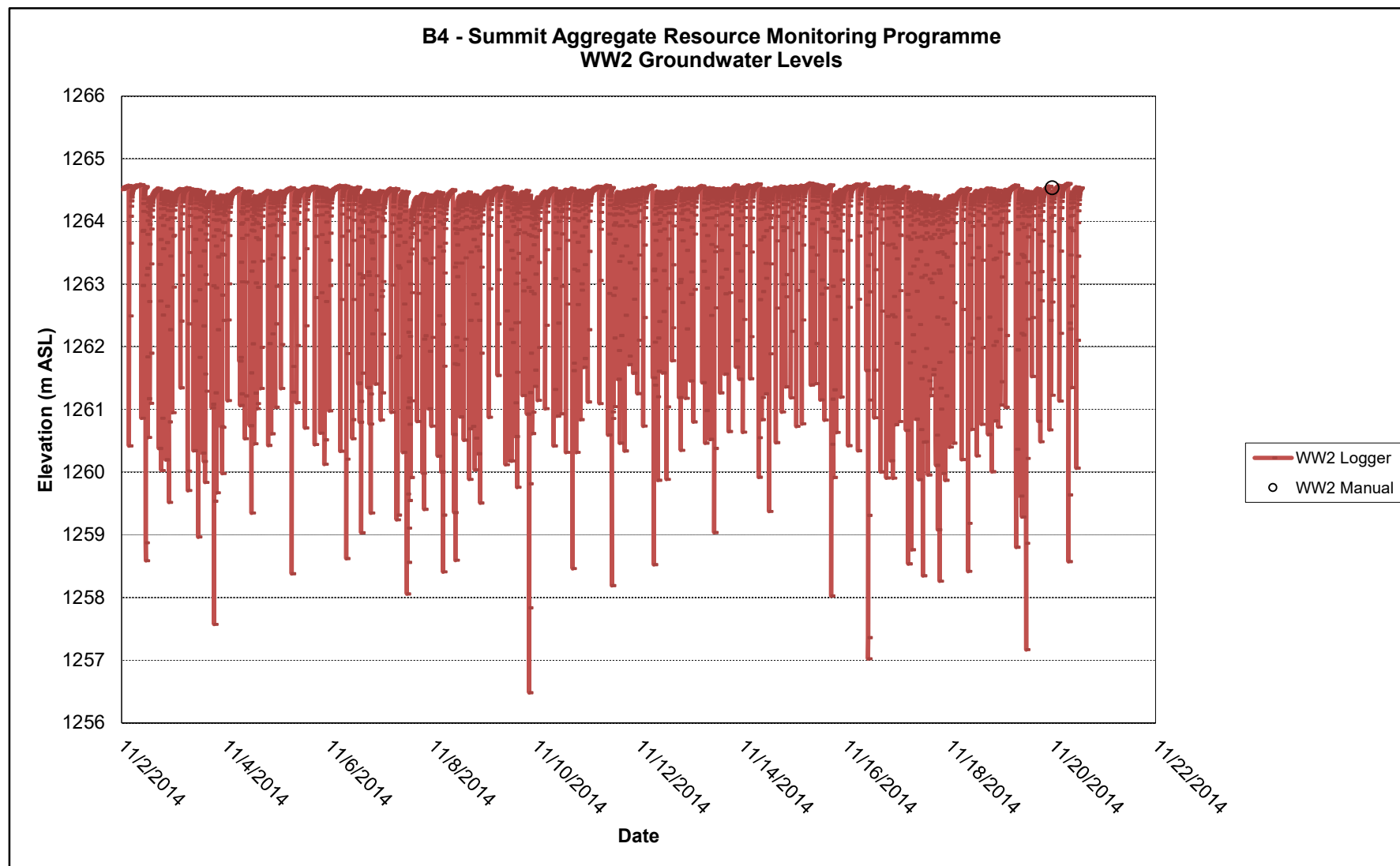
May 11, 2023

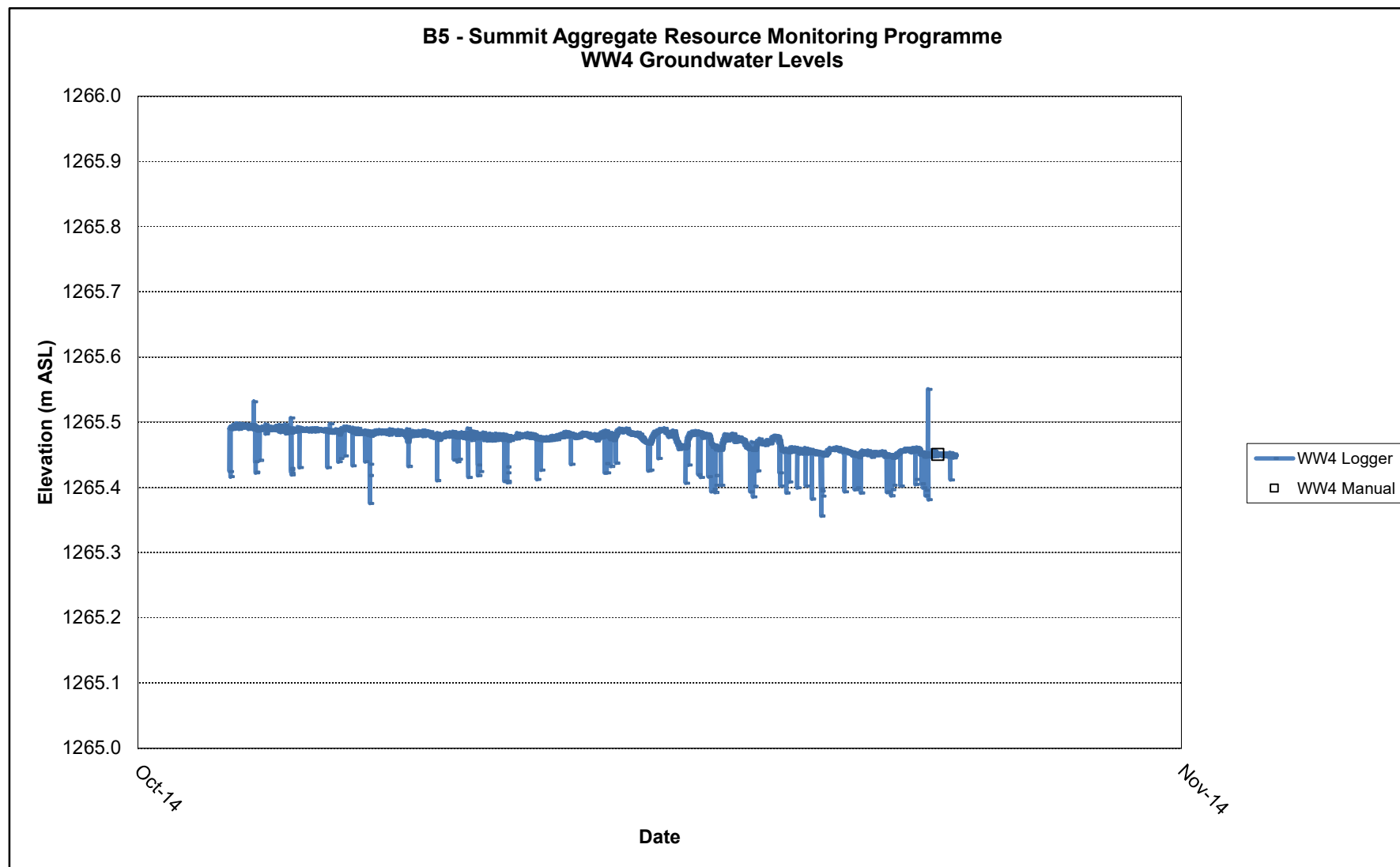












Appendix C Alberta Water Well Records

Groundwater Monitoring Plan

Summit Pit Project

Mountain Ash Limited Partnership

SLR Project No. 212.06650.00007

May 11, 2023





Reconnaissance Report

[View in Imperial](#)

[Export to Excel](#)

Groundwater Wells

Please click the water Well ID to generate the Water Well Drilling Report.

GIC Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIA (cm)
350194	SW	31	26	3	5	LOU'S WATER WELL DRILLING	1990-03-09	35.05	New Well	Domestic		9		DAVIDSON, D.W.	15.24	54.55	14.12
360164	SE	6	27	3	5	AERO DRILLING & CONSULTING LTD.	1991-10-08	73.15	New Well	Domestic		10		BARGETZI, ERNIE	33.53	136.38	14.12
387449	NE	36	26	4	5	PARSONS DRLG	1962-08-10	33.83	New Well	Unknown		9		BRISTOW, C.R.	21.95	72.74	0.00
390998	SE	6	27	3	5	ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	1987-02-11	65.53	New Well	Domestic & Stock		11		STRANGE, R.	45.72	36.37	16.84
390999	SE	6	27	3	5	ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	1987-11-19	73.15	New Well	Stock		15		STRANGE, R.	39.62	45.46	16.84
391000	4	6	27	3	5	DIVERSIFIED DRILLING & EXPLORATION CO.	1984-11-07	40.23	New Well	Domestic & Stock	1	7		CIRCLE J RANCHES	28.96	68.19	13.97
391598	NW	31	26	3	5	PARSONS DRILLING		39.62	New Well	Domestic & Stock				MURRAY, R.J.			17.78
391599	NE	31	26	3	5	KRIEGER DRILLING LTD.		49.38	New Well- Decommissioned	Investigation		14		PARKER, G.L.	0.00		0.00
391600	NE	31	26	3	5	KRIEGER DRILLING LTD.	1981-10-14	27.43	New Well- Decommissioned	Domestic		9		PARKER, G.L.			0.00
395786	NE	31	26	3	5	PARSONS DRILLING	1981-11-19	62.48	New Well	Domestic & Stock		21		PARKER, G.L.	48.77	68.19	17.78
395793	NE	31	26	3	5	UNKNOWN DRILLER		62.48	Chemistry	Domestic				KIRK, S.			0.00
494773	NE	36	26	4	5	ALKEN BASIN DRILLING LTD.	1999-11-16	30.48	New Well	Stock		4	9	GOETJEN, MORRIE	22.25	63.65	13.97
498400	NW	31	26	3	5	MEDICINE VALLEY WATER WELLS	2001-05-14	74.68	New Well	Domestic		14	24	GIBBS, DAVE	10.82	9.09	13.97
1022436	9	36	26	4	5	AARON DRILLING INC.	2014-05-05	30.48	New Well	Investigation		6		LAFARGE CANADA INC			16.81
1475698	16	31	26	3	5	M&M DRILLING CO. LTD.	2003-01-14	39.62	New Well	Domestic		10	24	QUICK WAY FARMS LTD	32.00	45.46	14.13
1475699	15	31	26	3	5	M&M DRILLING CO. LTD.	2003-01-17	53.95	New Well	Domestic		10	24	QUICK WAY FARMS LTD	32.64	24.55	14.13
2095665	SW	6	27	3	5	UNKNOWNDRILLINGCOMP11		25.60	Well Inventory	Domestic & Stock		1		CIRCLE J RANCHES LTD			

Well Identification and Location										Measurement in Metric
Owner Name DAVIDSON, D.W.		Address P.O. BOX 970 COCHRANE		Town		Province		Country	Postal Code T0L 0W0	
Location	1/4 or LSD SW	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.259801</u> Longitude <u>-114.414277</u> How Location Obtained Not Verified			Elevation _____ m How Elevation Obtained Not Obtained		

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
6.10		Boulders	
10.67		Sand & Gravel	
12.19		Sand	
15.24		Gravel	
18.29		Gray Shale	
22.86		Light Green Shale	
28.96		Green Shale	
32.00		Green Shale	
35.05		Green Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate _____ 0.00 L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
1990/03/09	54.55	15.24	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
35.05 m		1990/03/02	1990/03/09	
Borehole				
Diameter (cm)	From (m)	To (m)		
0.00	0.00	35.05		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Steel		
Size OD : <u>14.12 cm</u>		Size OD : <u>11.43 cm</u>		
Wall Thickness : <u>0.478 cm</u>		Wall Thickness : <u>0.318 cm</u>		
Bottom at : <u>15.24 m</u>		Top at : <u>13.72 m</u>		
		Bottom at : <u>35.05 m</u>		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
22.86	35.05	0.318		25.40
Perforated by Torch				
Annular Seal Driven				
Placed from <u>0.00 m</u> to <u>15.24 m</u>				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : <u>0.00 cm</u>				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type _____		Grain Size _____		
Amount <u>0.00</u>				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name LOU'S WATER WELL DRILLING	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country		Postal Code
DAVIDSON, D.W.		P.O. BOX 970 COCHRANE									TOL 0W0
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	SW	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.259801 Longitude -114.414277					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm											
Is Artesian Flow _____											
Rate _____ L/min											
Is Flow Control Installed _____											
Describe _____											
Recommended Pump Rate				0.00 L/min				Pump Installed _____		Depth _____ m	
Recommended Pump Intake Depth (From TOC)				0.00 m				Type _____		Make _____ H.P. _____	
Model (Output Rating) _____											
Did you Encounter Saline Water (>4000 ppm TDS)				Depth _____ m				Well Disinfected Upon Completion _____			
Gas _____				Depth _____ m				Geophysical Log Taken _____			
Submitted to ESRD _____											
Sample Collected for Potability _____ Submitted to ESRD _____											
Additional Comments on Well _____											

Yield Test			Taken From Ground Level		Measurement in Metric	
			Depth to water level			
Test Date	Start Time	Static Water Level				
1990/03/09	12:00 AM	15.24 m				
Method of Water Removal			Drawdown (m)		Elapsed Time	
					Minutes:Sec	
Type Bailer			Recovery (m)			
Removal Rate 54.55 L/min						
Depth Withdrawn From 0.00 m						
If water removal period was < 2 hours, explain why						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner Date approval holder signed
LOU'S WATER WELL DRILLING	

Well Identification and Location										Measurement in Metric	
Owner Name BARGETZI, ERNIE		Address 233 RATCLIFF PLACE SE, CALGARY			Town		Province		Country	Postal Code	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
SE		06	027	03	5		2	9110979			
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.274744</u> Longitude <u>-114.405998</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
9.45		Till & Clay		
21.64		Gravel		
25.30		Brown Shale		
34.75		Gray Shale		
39.62		Gray Sandstone		
44.20		Gray Shale		
51.82		Gray Sandstone		
59.74		Gray Shale		
66.75		Gray Sandstone		
73.15		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate		<u>136.38 L/min</u>		
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1991/10/08	136.38	33.53		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
73.15 m		1991/10/08	1991/10/08		
Borehole					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	73.15			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Steel		
Size OD :		<u>14.12 cm</u>	Size OD :		<u>11.43 cm</u>
Wall Thickness :		<u>0.620 cm</u>	Wall Thickness :		<u>0.396 cm</u>
Bottom at :		<u>24.99 m</u>	Top at :		<u>18.29 m</u>
			Bottom at :		<u>73.15 m</u>
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
36.58	67.06	0.157		15.24	
Perforated by Torch					
Annular Seal Drive Shoe					
Placed from		<u>0.00 m</u>	to		<u>24.99 m</u>
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD :		<u>0.00 cm</u>			
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings		Bottom Fittings			
Pack					
Type		Grain Size			
Amount		<u>0.00</u>			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name AERO DRILLING & CONSULTING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code	
BARGETZI, ERNIE		233 RATCLIFF PLACE SE, CALGARY										
Location		1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
		SE	06	027	03	5		2	9110979			
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from					Latitude 51.274744 Longitude -114.405998					Elevation _____ m		
_____ m from					How Location Obtained					How Elevation Obtained		
					Not Verified					Not Obtained		

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm											
Is Artesian Flow _____											
Rate _____ L/min											
Is Flow Control Installed _____											
Describe _____											
Recommended Pump Rate				136.38 L/min				Pump Installed _____		Depth _____ m	
Recommended Pump Intake Depth (From TOC)				0.00 m				Type _____		Make _____ H.P. _____	
Model (Output Rating) _____											
Did you Encounter Saline Water (>4000 ppm TDS)				Depth _____ m				Well Disinfected Upon Completion _____			
Gas _____				Depth _____ m				Geophysical Log Taken _____			
Submitted to ESRD _____											
Sample Collected for Potability _____ Submitted to ESRD _____											
Additional Comments on Well _____											

Yield Test			Taken From Ground Level		Measurement in Metric									
			Depth to water level											
Test Date		Start Time		Static Water Level										
1991/10/08		12:00 AM		33.53 m										
<table><tr><td>Drawdown (m)</td><td>Elapsed Time</td><td>Recovery (m)</td></tr><tr><td></td><td>Minutes:Sec</td><td></td></tr><tr><td></td><td></td><td></td></tr></table>						Drawdown (m)	Elapsed Time	Recovery (m)		Minutes:Sec				
Drawdown (m)	Elapsed Time	Recovery (m)												
	Minutes:Sec													
Method of Water Removal														
Type Air														
Removal Rate		136.38 L/min												
Depth Withdrawn From		39.62 m												
If water removal period was < 2 hours, explain why														

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
AERO DRILLING & CONSULTING LTD.	Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name BRISTOW, C.R.		Address COCHRANE		Town		Province		Country	Postal Code		
Location	1/4 or LSD NE	SEC 36	TWP 026	RGE 04	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.267032</u> Longitude <u>-114.426119</u>					Elevation <u>1292.35</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Map					Estimated	

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Unknown	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
4.88		Yellow Clay	
21.03		Gravel	
23.77		Fine Grained Sand	
25.91		Yellow Clay	
26.82		Blue Clay	
27.13		Hard Shale	
28.04		Sand	
32.00		Blue Shale & Sandstone Ledges	
33.83		Gray Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate <u>0.00</u> L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
1962/08/10	72.74	21.95	

Well Completion			Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date
33.83 m			1962/08/10
Borehole			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	33.83	
Surface Casing (if applicable)		Well Casing/Liner	
Size OD :	<u>0.00</u> cm	Size OD :	<u>0.00</u> cm
Wall Thickness :	<u>0.000</u> cm	Wall Thickness :	<u>0.000</u> cm
Bottom at :	<u>0.00</u> m	Top at :	<u>0.00</u> m
		Bottom at :	<u>0.00</u> m
Perforations			
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)
Perforated by _____			
Annular Seal			
Placed from <u>0.00</u> m to <u>0.00</u> m			
Amount _____			
Other Seals			
Type		At (m)	
Screen Type			
Size OD : <u>0.00</u> cm			
From (m)	To (m)	Slot Size (cm)	
Attachment _____			
Top Fittings _____		Bottom Fittings _____	
Pack			
Type _____		Grain Size _____	
Amount _____			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name PARSONS DRLG	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric
Owner Name		Address			Town		Province		Country	Postal Code
BRISTOW, C.R.		COCHRANE								
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description	
	NE	36	026	04	5					
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					
_____ m from					Latitude 51.267032		Longitude -114.426119		Elevation 1292.35 m	
_____ m from					How Location Obtained		How Elevation Obtained			
					Map		Estimated			

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate					0.00 L/min		Pump Installed _____		Depth _____ m	
Recommended Pump Intake Depth (From TOC)					0.00 m		Type _____		Make _____ H.P. _____	
										Model (Output Rating) _____
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m		Well Disinfected Upon Completion _____			
Gas _____					Depth _____ m		Geophysical Log Taken _____			
										Submitted to ESRD _____
Additional Comments on Well _____										
										Sample Collected for Potability _____ Submitted to ESRD _____

Yield Test			Taken From Ground Level	Measurement in Metric
			Depth to water level	
Test Date	Start Time	Static Water Level	Drawdown (m)	Elapsed Time
1962/08/10	12:00 AM	21.95 m		Minutes:Sec
Method of Water Removal				
Type Bailer				
Removal Rate 72.74 L/min				
Depth Withdrawn From 0.00 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
PARSONS DRLG	Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name STRANGE, R.		Address P.O. BOX 981 COCHRANE		Town		Province		Country		Postal Code T0L 0W0	
Location	1/4 or LSD SE	SEC 06	TWP 027	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.274744</u> Longitude <u>-114.405998</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Domestic & Stock	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
7.62		Till	
10.36		Gravel	
11.58		Silty Clay	
17.68		Weathered Shale	
27.43		Shale	
39.62		Sandstone	
48.77		Shale	
60.96		Sandstone	
62.48		Shale	
63.70		Sandstone	
65.53		Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate <u>27.28 L/min</u>			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
1987/02/11	36.37	45.72	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
65.53 m		1987/02/10	1987/02/11	
Borehole				
Diameter (cm)	From (m)	To (m)		
0.00	0.00	65.53		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Plastic		
Size OD : <u>16.84 cm</u>		Size OD : <u>12.70 cm</u>		
Wall Thickness : <u>0.478 cm</u>		Wall Thickness : <u>0.630 cm</u>		
Bottom at : <u>18.29 m</u>		Top at : <u>16.76 m</u>		
		Bottom at : <u>65.53 m</u>		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
47.24	59.44	0.000		0.10
Perforated by Machine				
Annular Seal Driven				
Placed from <u>0.00 m</u> to <u>11.58 m</u>				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : <u>0.00 cm</u>				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type _____		Grain Size _____		
Amount _____				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric			
Owner Name		Address			Town		Province		Country		Postal Code		
STRANGE, R.		P.O. BOX 981 COCHRANE									TOL 0W0		
Location		1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
		SE	06	027	03	5							
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)								
_____m from					Latitude 51.274744					Longitude -114.405998		Elevation _____m	
_____m from					How Location Obtained					How Elevation Obtained			
					Not Verified					Not Obtained			

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____cm											
Is Artesian Flow _____											
Rate _____L/min											
Is Flow Control Installed _____											
Describe _____											
Recommended Pump Rate				27.28 L/min				Pump Installed _____		Depth _____m	
Recommended Pump Intake Depth (From TOC)				62.48 m				Type _____		Make _____H.P. _____	
Model (Output Rating) _____											
Did you Encounter Saline Water (>4000 ppm TDS)				Depth _____m				Well Disinfected Upon Completion _____			
Gas _____				Depth _____m				Geophysical Log Taken _____			
Submitted to ESRD _____											
Sample Collected for Potability _____Submitted to ESRD _____											
Additional Comments on Well _____											

Yield Test			Taken From Ground Level		Measurement in Metric									
			Depth to water level											
Test Date		Start Time		Static Water Level										
1987/02/11		12:00 AM		45.72 m										
<table><tr><td>Drawdown (m)</td><td>Elapsed Time</td><td>Recovery (m)</td></tr><tr><td></td><td>Minutes:Sec</td><td></td></tr><tr><td></td><td></td><td></td></tr></table>						Drawdown (m)	Elapsed Time	Recovery (m)		Minutes:Sec				
Drawdown (m)	Elapsed Time	Recovery (m)												
	Minutes:Sec													
Method of Water Removal														
Type Air														
Removal Rate		36.37 L/min												
Depth Withdrawn From		0.00 m												
If water removal period was < 2 hours, explain why														

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name STRANGE, R.		Address P.O. BOX 981 COCHRANE			Town		Province		Country	Postal Code T0L 0W0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	SE	06	027	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.274744</u> Longitude <u>-114.405998</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
5.79		Till		
8.84		Gravel		
9.75		Till		
16.76		Yellow Sandstone		
20.12		Gray Sandstone		
30.48		Shale		
36.88		Sandstone		
39.62		Shale		
40.23		Moist Sandstone		
50.29		Shale		
51.82		Sandstone		
58.22		Shale		
64.01		Shale		
71.32	Yes	Water Bearing Sandstone		
73.15		Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate		<u>31.82 L/min</u>		
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1987/11/19	45.46	39.62		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
73.15 m		1987/11/18	1987/11/19		
Borehole					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	73.15			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Plastic		
Size OD :		<u>16.84 cm</u>	Size OD :		<u>12.70 cm</u>
Wall Thickness :		<u>0.478 cm</u>	Wall Thickness :		<u>0.630 cm</u>
Bottom at :		<u>11.89 m</u>	Top at :		<u>9.14 m</u>
			Bottom at :		<u>73.15 m</u>
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
39.62	73.15	0.157		15.24	
Perforated by Other					
Annular Seal Driven					
Placed from		<u>0.00 m</u>	to		<u>9.75 m</u>
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD :		<u>0.00 cm</u>			
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings		Bottom Fittings			
Pack					
Type		Grain Size			
Amount					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric
Owner Name STRANGE, R.		Address P.O. BOX 981 COCHRANE		Town		Province		Country	Postal Code T0L 0W0	
Location	1/4 or LSD SE	SEC 06	TWP 027	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.274744</u> Longitude <u>-114.405998</u> How Location Obtained Not Verified			Elevation _____ m How Elevation Obtained Not Obtained		

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm					Is Flow Control Installed _____					
Is Artesian Flow _____ Rate _____ L/min					Describe _____					
Recommended Pump Rate _____ 31.82 L/min					Pump Installed _____		Depth _____ m			
Recommended Pump Intake Depth (From TOC) _____ 60.96 m					Type _____		Make _____ H.P. _____		Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m		Well Disinfected Upon Completion _____			
Gas _____					Depth _____ m		Geophysical Log Taken _____ Submitted to ESRD _____			
Additional Comments on Well WATER OCCURES AT 130-132' @ 1 GPM, 210-234' @ 8-10 GPM.					Sample Collected for Potability _____ Submitted to ESRD _____					

Yield Test			Taken From Ground Level Depth to water level	Measurement in Metric
Test Date 1987/11/19	Start Time 12:00 AM	Static Water Level 39.62 m		
Method of Water Removal Type Air			Drawdown (m)	Elapsed Time Minutes:Sec
Removal Rate _____ 45.46 L/min				Recovery (m)
Depth Withdrawn From _____ 0.00 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken L	Diversion Date & Time

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name ALBERTA SOUTHERN EXPLORATION DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name CIRCLE J RANCHES		Address RR2, COCHRANE		Town		Province		Country		Postal Code	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	04	06	027	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.272936</u> Longitude <u>-114.420414</u>					Elevation _____ m	
_____ m from _____					How Location Obtained _____					How Elevation Obtained _____	
					Map _____					Not Obtained	

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic & Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
3.05		Yellow Clay		
7.32		Cemented Gravel		
19.51		Gravel		
20.12		Cemented Gravel		
29.87		Gravel & Boulders		
32.92		Brown Shale & Sandstone		
40.23	Yes	Brown Water Bearing Sandstone		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____			0.00 L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1984/11/07	68.19	28.96		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
40.23 m		1984/10/15	1984/11/07		
Borehole					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	40.23			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Steel		
Size OD : _____			Size OD : _____		
13.97 cm			11.43 cm		
Wall Thickness : _____			Wall Thickness : _____		
0.620 cm			0.318 cm		
Bottom at : _____			Top at : _____		
31.09 m			0.00 m		
			Bottom at : _____		
			40.23 m		
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
33.53	39.62	0.396		25.40	
Perforated by _____					
Torch					
Annular Seal Driven					
Placed from _____ 0.00 m to _____ 1.22 m					
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD : _____ 0.00 cm					
From (m)		To (m)		Slot Size (cm)	
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
Pack					
Type _____			Grain Size _____		
Amount _____					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name DIVERSIFIED DRILLING & EXPLORATION CO.	Copy of Well report provided to owner _____ Date approval holder signed _____

GIC Well ID 391000
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1984/12/05

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
CIRCLE J RANCHES		RR2, COCHRANE									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	04	06	027	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.272936 Longitude -114.420414					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate _____ 0.00 L/min										
Pump Installed _____										
Depth _____ m										
Recommended Pump Intake Depth (From TOC) _____ 0.00 m										
Type _____										
Make _____										
H.P. _____										
Model (Output Rating) _____										
Did you Encounter Saline Water (>4000 ppm TDS) _____										
Depth _____ m										
Well Disinfected Upon Completion _____										
Gas _____										
Depth _____ m										
Geophysical Log Taken _____										
Submitted to ESRD _____										
Sample Collected for Potability _____										
Submitted to ESRD <u>Yes</u>										
Additional Comments on Well _____										

Yield Test			Taken From Ground Level	Measurement in Metric
			Depth to water level	
Test Date	Start Time	Static Water Level	Drawdown (m)	Elapsed Time
1984/11/07	12:00 AM	28.96 m		Minutes:Sec
				Recovery (m)
Method of Water Removal				
Type Bailer				
Removal Rate 68.19 L/min				
Depth Withdrawn From 32.00 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
DIVERSIFIED DRILLING & EXPLORATION CO.	Date approval holder signed

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Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
MURRAY, R.J.		511 19ST NW, CALGARY									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NW	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.267033		Longitude -114.414280		Elevation 1290.83 m		
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Estimated	

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic & Stock	

Formation Log		Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description	

Yield Test Summary		Measurement in Metric	
Recommended Pump Rate _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	

Well Completion		Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date
39.62 m			
Borehole			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	39.62	
Surface Casing (if applicable)		Well Casing/Liner	
Steel		Steel	
Size OD : _____	17.78 cm	Size OD : _____	
Wall Thickness : _____	0.000 cm	Wall Thickness : _____	
Bottom at : _____	26.82 m	Top at : _____	
		Bottom at : _____	
Perforations			
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)
31.09	38.10	0.000	
Hole or Slot Interval(cm)			
0.00			
Perforated by _____			
Annular Seal Drive Shoe			
Placed from _____ 0.00 m to _____ 0.00 m			
Amount _____			
Other Seals			
Type		At (m)	
Screen Type			
Size OD : _____ 0.00 cm			
From (m)	To (m)	Slot Size (cm)	
Attachment _____			
Top Fittings _____		Bottom Fittings _____	
Pack			
Type _____		Grain Size _____	
Amount _____			

Contractor Certification <i>Name of Journeyman responsible for drilling/construction of well</i> UNKNOWN NA DRILLER <i>Company Name</i> PARSONS DRILLING		<i>Certification No</i> 1 <i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>
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Well Identification and Location										Measurement in Metric
Owner Name MURRAY, R.J.		Address 511 19ST NW, CALGARY			Town		Province		Country	Postal Code
Location	1/4 or LSD NW	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.267033</u> Longitude <u>-114.414280</u> How Location Obtained _____ Map _____			Elevation <u>1290.83</u> m How Elevation Obtained _____ Estimated		

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____					Is Flow Control Installed _____					
Rate _____ L/min					Describe _____					
Recommended Pump Rate _____ L/min					Pump Installed _____			Depth _____ m		
Recommended Pump Intake Depth (From TOC) _____ m					Type _____		Make _____		H.P. _____	
Model (Output Rating) _____										
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m		Well Disinfected Upon Completion _____			
Gas _____					Depth _____ m		Geophysical Log Taken _____			
Submitted to ESRD _____										
Additional Comments on Well _____					Sample Collected for Potability _____			Submitted to ESRD _____		

Yield Test			Taken From Ground Level	Measurement in Metric
Test Date	Start Time	Static Water Level		
		m		
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name PARSONS DRILLING	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name PARKER, G.L.		Address P.O. BOX 123 COCHRANE		Town		Province		Country	Postal Code T0L 0W0		
Location	1/4 or LSD NE	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of _____ m from _____ m from					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.267033</u> Longitude <u>-114.402748</u> How Location Obtained Map				Elevation <u>1295.40</u> m How Elevation Obtained Estimated		

Drilling Information	
Method of Drilling Rotary	Type of Work New Well-Abandoned
Proposed Well Use Investigation	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
0.30		Topsoil		
1.22		Gray Clay		
4.27		Brown Clay		
6.71		Brown Sandy Clay		
11.89		Sandy Gravel		
17.07		Medium Grained Gravel		
18.90		Fine Grained Gravel		
19.20		Sandstone		
24.69		Fine Grained Sand		
32.92		Fine Grained Gravel		
36.27		Shale		
36.58		Dark Shale		
43.59		Clay & Shale		
49.38		Unknown		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate <u>0.00</u> L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1981/10/10		0.00		

Well Completion			Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
49.38 m				
Borehole				
Diameter (cm)	From (m)	To (m)		
0.00	0.00	49.38		
Surface Casing (if applicable)		Well Casing/Liner		
Size OD :	<u>0.00</u> cm	Size OD :	<u>0.00</u> cm	
Wall Thickness :	<u>0.000</u> cm	Wall Thickness :	<u>0.000</u> cm	
Bottom at :	<u>0.00</u> m	Top at :	<u>0.00</u> m	
		Bottom at :	<u>0.00</u> m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
Perforated by				
Annular Seal Driven				
Placed from <u>0.00</u> m to <u>0.00</u> m				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : <u>0.00</u> cm				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type _____		Grain Size _____		
Amount _____				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name KRIEGER DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country		Postal Code
PARKER, G.L.		P.O. BOX 123 COCHRANE									T0L 0W0
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.267033 Longitude -114.402748					Elevation 1295.40 m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Estimated	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm											
Is Artesian Flow _____						Is Flow Control Installed _____					
Rate _____ L/min						Describe _____					
Recommended Pump Rate				0.00 L/min		Pump Installed _____				Depth _____ m	
Recommended Pump Intake Depth (From TOC)				0.00 m		Type _____		Make _____		H.P. _____	
										Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion _____					
Gas _____				Depth _____ m		Geophysical Log Taken _____					
										Submitted to ESRD _____	
Additional Comments on Well										Sample Collected for Potability _____ Submitted to ESRD _____	
DRILLER REPORTS MED HARD WATER, NO SPECS FOR SURFACE CASING											

Yield Test			Taken From Ground Level		Measurement in Metric	
			Depth to water level			
Test Date	Start Time	Static Water Level				
1981/10/10	12:00 AM	0.00 m				
Method of Water Removal			Drawdown (m)		Elapsed Time	
					Minutes:Sec	
Type Air			Recovery (m)			
Removal Rate _____ L/min						
Depth Withdrawn From _____ 0.00 m						
If water removal period was < 2 hours, explain why						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner Date approval holder signed
KRIEGER DRILLING LTD.	

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Well Identification and Location											Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code		
PARKER, G.L.		P.O. BOX 123 COCHRANE									T0L 0W0		
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description				
	NE	31	026	03	5								
Measured from Boundary of						GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from						Latitude		51.267033		Longitude		-114.402748	
_____ m from						How Location Obtained				How Elevation Obtained			
						Map				Estimated			

Drilling Information			
Method of Drilling	Type of Work	Plugged	1981/10/14
Rotary	New Well-Abandoned	Plugged with	Unknown
Proposed Well Use		Amount	
Domestic			

Formation Log		Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description	
0.30		Topsoil	
10.06		Sandy Till	
17.68		Clay & Shale	
20.12		Clay & Gravel	
21.03		Shale	
22.86		Clay & Silt	
24.08		Gray Clay	
26.82		Clay & Gravel	
27.43		Lost Circulation	

Yield Test Summary		Measurement in Metric	
<i>Recommended Pump Rate</i> _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	

Well Completion		Measurement in Metric	
<i>Total Depth Drilled</i>	<i>Finished Well Depth</i>	<i>Start Date</i>	<i>End Date</i>
27.43 m		1981/10/11	1981/10/14

Borehole

Diameter (cm)	From (m)	To (m)
0.00	0.00	27.43

Surface Casing (if applicable) **Well Casing/Liner**

Size OD : _____ 0.00 cm

Wall Thickness : _____ 0.000 cm

Bottom at : _____ 0.00 m

Size OD : _____ 0.00 cm

Wall Thickness : _____ 0.000 cm

Top at : _____ 0.00 m

Bottom at : _____ 0.00 m

Perforations

From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)

Perforated by _____

Annular Seal

Placed from _____ 0.00 m *to* _____ 0.00 m

Amount _____

Other Seals

Type	At (m)

Screen Type

Size OD : _____ 0.00 cm

From (m)	To (m)	Slot Size (cm)

Attachment _____

Top Fittings _____ *Bottom Fittings* _____

Pack

Type _____ *Grain Size* _____

Amount _____

Contractor Certification <i>Name of Journeyman responsible for drilling/construction of well</i> UNKNOWN NA DRILLER <i>Company Name</i> KRIEGER DRILLING LTD.		<i>Certification No</i> 1 <i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>
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Well Identification and Location										Measurement in Metric
Owner Name PARKER, G.L.		Address P.O. BOX 123 COCHRANE		Town		Province		Country	Postal Code T0L 0W0	
Location	1/4 or LSD NE	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.267033</u> Longitude <u>-114.402748</u> How Location Obtained Map			Elevation <u>1295.40 m</u> How Elevation Obtained Estimated		

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____					Is Flow Control Installed _____					
Rate _____ L/min					Describe _____					
Recommended Pump Rate _____ L/min					Pump Installed _____		Depth _____ m			
Recommended Pump Intake Depth (From TOC) _____ m					Type _____	Make _____	H.P. _____	Model (Output Rating) _____		
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m	Well Disinfected Upon Completion _____				
Gas _____					Depth _____ m	Geophysical Log Taken _____				
					Submitted to ESRD _____					
Additional Comments on Well _____					Sample Collected for Potability _____		Submitted to ESRD _____			

Yield Test			Taken From Ground Level	Measurement in Metric
Test Date	Start Time	Static Water Level		
		m		
Method of Water Removal				
Type _____				
Removal Rate _____ L/min				
Depth Withdrawn From _____ m				
If water removal period was < 2 hours, explain why _____				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name KRIEGER DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name PARKER, G.L.		Address P.O. BOX 123 COCHRANE		Town		Province		Country		Postal Code	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.267033</u> Longitude <u>-114.402748</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic & Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
1.83		Brown Clay & Boulders		
3.35		Gray Clay & Boulders		
3.96		Boulders		
10.97		Brown Clay & Gravel		
13.72		Gravel		
15.54		Brown Shale		
21.64		Gray Hard Shale		
23.16		Gray Hard Sandstone		
25.30		Gray Shale		
26.82		Gray Sandstone		
27.74		Gray Shale		
28.65		Gray Sandstone		
29.26		Gray Soft Sandstone		
30.78		Gray Hard Sandstone		
34.75		Gray Firm Shale		
36.88		Gray Hard Sandstone		
43.89		Gray Firm Shale		
45.11		Gray Hard Sandstone		
54.86		Gray Shale		
56.39	Yes	Gray Water Bearing Sandstone		
62.48		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate			0.00 L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1981/11/19	68.19	48.77		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
62.48 m		1981/11/05	1981/11/19		
Borehole					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	62.48			
Surface Casing (if applicable)			Well Casing/Liner		
Steel			Steel		
Size OD :		17.78 cm	Size OD :		12.70 cm
Wall Thickness :		0.587 cm	Wall Thickness :		0.556 cm
Bottom at :		13.72 m	Top at :		0.00 m
			Bottom at :		62.48 m
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
48.16	61.87	0.953		40.64	
Perforated by Torch					
Annular Seal Drive Shoe					
Placed from		0.00 m	to		13.72 m
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD :		0.00 cm			
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings		Bottom Fittings			
Pack					
Type		Grain Size			
Amount		0.00			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name PARSONS DRILLING	Copy of Well report provided to owner Date approval holder signed

GIC Well ID 395786
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1982/02/02

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
PARKER, G.L.		P.O. BOX 123 COCHRANE									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.267033 Longitude -114.402748					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate					0.00 L/min					
Recommended Pump Intake Depth (From TOC)					60.96 m					
Pump Installed					Depth _____ m					
Type _____					Make _____ H.P. _____					
					Model (Output Rating) _____					
Did you Encounter Saline Water (>4000 ppm TDS) _____					Depth _____ m					
Gas _____					Depth _____ m					
Well Disinfected Upon Completion _____										
Geophysical Log Taken _____										
Submitted to ESRD _____										
Sample Collected for Potability _____					Submitted to ESRD _____					
Additional Comments on Well										
DRILLER REPORTS WATER QUALITY AS TURBID										

Yield Test			Taken From Ground Level	Measurement in Metric
			Depth to water level	
Test Date	Start Time	Static Water Level	Drawdown (m)	Elapsed Time
1981/11/19	12:00 AM	48.77 m		Minutes:Sec
				Recovery (m)
Method of Water Removal				
Type Bailer				
Removal Rate 68.19 L/min				
Depth Withdrawn From 48.77 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
PARSONS DRILLING	Date approval holder signed

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Well Identification and Location											Measurement in Metric	
Owner Name		Address			Town		Province		Country		Postal Code	
KIRK, S.		P.O. BOX 1295 COCHRANE									TOL 0W0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
NE	31	026	03	5								
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)							
m from					Latitude 51.267033		Longitude -114.402748			Elevation m		
m from					How Location Obtained					How Elevation Obtained		
					Not Verified					Not Obtained		

Drilling Information	
Method of Drilling Unknown	Type of Work Chemistry
Proposed Well Use Domestic	

Formation Log		Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description	

Yield Test Summary		Measurement in Metric	
Recommended Pump Rate _____ L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	

Well Completion		Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date
62.48 m			
Borehole			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	62.48	
Surface Casing (if applicable)		Well Casing/Liner	
Size OD : _____	0.00 cm	Size OD : _____	0.00 cm
Wall Thickness : _____	0.000 cm	Wall Thickness : _____	0.000 cm
Bottom at : _____	0.00 m	Top at : _____	0.00 m
		Bottom at : _____	0.00 m
Perforations			
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)
Perforated by _____			
Annular Seal			
Placed from _____ 0.00 m to _____ 0.00 m			
Amount _____			
Other Seals			
Type		At (m)	
Screen Type			
Size OD : _____ 0.00 cm			
From (m)	To (m)	Slot Size (cm)	
Attachment _____			
Top Fittings _____		Bottom Fittings _____	
Pack			
Type _____		Grain Size _____	
Amount _____			

Contractor Certification <i>Name of Journeyman responsible for drilling/construction of well</i> UNKNOWN NA DRILLER <i>Company Name</i> UNKNOWN DRILLER		<i>Certification No</i> 1 <i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>
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GIC Well ID 395793
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country		Postal Code
KIRK, S.		P.O. BOX 1295 COCHRANE									T0L 0W0
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.267033 Longitude -114.402748					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm											
Is Artesian Flow _____											
Rate _____ L/min											
Is Flow Control Installed _____											
Describe _____											
Recommended Pump Rate				L/min				Pump Installed		Depth _____ m	
Recommended Pump Intake Depth (From TOC)				m				Type		Make _____ H.P. _____	
Model (Output Rating) _____											
Did you Encounter Saline Water (>4000 ppm TDS)				Depth _____ m				Well Disinfected Upon Completion _____			
Gas _____				Depth _____ m				Geophysical Log Taken _____			
Submitted to ESRD _____											
Sample Collected for Potability _____ Submitted to ESRD _____											
Additional Comments on Well _____											

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			

Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						

If water removal period was < 2 hours, explain why _____						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner Date approval holder signed
UNKNOWN DRILLER	

Well Identification and Location										Measurement in Metric	
Owner Name GOETJEN, MORRIE		Address RR1, AIRDRIE		Town		Province		Country CANADA	Postal Code T4B 2A3		
Location	1/4 or LSD NE	SEC 36	TWP 26	RGE 4	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.267032</u> Longitude <u>-114.426119</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
3.05		Brown Clay		
23.16		Coarse Grained Gravel		
29.26	Yes	Water Bearing Gravel		
30.48		Brown Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate <u>36.37 L/min</u>				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1999/11/16	63.65	22.25		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
30.48 m		1999/11/15	1999/11/16		
Borehole					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	30.48			
Surface Casing (if applicable)			Well Casing/Liner		
Steel					
Size OD :		<u>13.97 cm</u>	Size OD :		<u>0.00 cm</u>
Wall Thickness :		<u>0.620 cm</u>	Wall Thickness :		<u>0.000 cm</u>
Bottom at :		<u>28.04 m</u>	Top at :		<u>0.00 m</u>
			Bottom at :		<u>0.00 m</u>
Perforations					
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)	
Perforated by					
Annular Seal Driven & Bentonite					
Placed from		<u>0.00 m</u>	to		<u>28.04 m</u>
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD :		<u>0.00 cm</u>			
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings		Bottom Fittings			
Pack					
Type		Grain Size			
Amount					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name ALKEN BASIN DRILLING LTD.	Copy of Well report provided to owner Date approval holder signed

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Well Identification and Location											Measurement in Metric	
<i>Owner Name</i>		<i>Address</i>			<i>Town</i>		<i>Province</i>		<i>Country</i>		<i>Postal Code</i>	
GOETJEN, MORRIE		RR1, AIRDRIE							CANADA		T4B 2A3	
<i>Location</i>	<i>1/4 or LSD</i>	<i>SEC</i>	<i>TWP</i>	<i>RGE</i>	<i>W of MER</i>	<i>Lot</i>	<i>Block</i>	<i>Plan</i>	<i>Additional Description</i>			
NE		36	26	4	5							
<i>Measured from Boundary of</i>						<i>GPS Coordinates in Decimal Degrees (NAD 83)</i>						
<u> m from</u>						<i>Latitude</i>		<u>51.267032</u>	<i>Longitude</i>		<u>-114.426119</u>	<i>Elevation</i> <u> </u> m
<u> m from</u>						<i>How Location Obtained</i>				<i>How Elevation Obtained</i>		
						Not Verified				Not Obtained		

Additional Information		Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm	Is Artesian Flow _____	Is Flow Control Installed _____	
Rate _____ L/min		Describe _____	
Recommended Pump Rate _____ 36.37 L/min	Pump Installed _____	Depth _____ m	
Recommended Pump Intake Depth (From TOC) _____ 27.43 m	Type _____	Make _____ H.P. _____	
		Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____	Depth _____ m	Well Disinfected Upon Completion _____	
Gas Yes _____	Depth _____ m	Geophysical Log Taken _____	
		Submitted to ESRD _____	
	Sample Collected for Potability _____	Submitted to ESRD _____	
Additional Comments on Well _____			
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 2'.			

Yield Test			Taken From Ground Level		Measurement in Metric
Test Date	Start Time	Static Water Level	Depth to water level		
1999/11/16	12:00 AM	22.25 m			
Method of Water Removal					
Type	Air		Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
Removal Rate	63.65 L/min			1:00	26.82
Depth Withdrawn From	30.48 m			2:00	24.38
				3:00	23.16
				4:00	22.71
				5:00	22.56
				6:00	22.40
				7:00	22.25
				8:00	22.25
				10:00	22.25
If water removal period was < 2 hours, explain why					

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification <i>Name of Journeyman responsible for drilling/construction of well</i> UNKNOWN NA DRILLER <i>Company Name</i> ALKEN BASIN DRILLING LTD.		<i>Certification No</i> 1 <i>Copy of Well report provided to owner</i> <i>Date approval holder signed</i>
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Well Identification and Location										Measurement in Metric
Owner Name GIBBS, DAVE		Address P.O. BOX 1773 SPRUCE VIEW			Town		Province		Country	Postal Code T0M 1V0
Location	1/4 or LSD NW	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.267033</u> Longitude <u>-114.414280</u> How Location Obtained Not Verified			Elevation _____ m How Elevation Obtained Not Obtained		

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
4.57		Brown Clay & Rocks	
8.23		Gray Sandstone	
13.72		Gray Shale	
19.51		Gray Sandy Shale	
22.86		Gray Shale	
24.08		Gray Sandstone	
29.87		Gray Shale	
30.78		Blue Shale	
34.14		Gray Silty Shale	
54.56		Gray Shale	
57.30		Gray Sandstone	
67.67		Gray Shale	
71.63		Gray Sandy Shale	
74.68		Gray Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate <u>9.09</u> L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2001/05/14	9.09	10.82	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
74.68 m		2001/05/07	2001/05/14	
Borehole				
Diameter (cm)	From (m)	To (m)		
0.00	0.00	74.68		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Plastic		
Size OD : <u>13.97</u> cm		Size OD : <u>11.43</u> cm		
Wall Thickness : <u>0.620</u> cm		Wall Thickness : <u>0.602</u> cm		
Bottom at : <u>24.69</u> m		Top at : <u>19.81</u> m		
		Bottom at : <u>74.68</u> m		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
24.69	74.68	0.635		20.32
Perforated by Saw				
Annular Seal Driven				
Placed from <u>0.00</u> m to <u>24.69</u> m				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : <u>0.00</u> cm				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type _____		Grain Size _____		
Amount _____				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name MEDICINE VALLEY WATER WELLS	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
GIBBS, DAVE		P.O. BOX 1773 SPRUCE VIEW								T0M 1V0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NW	31	026	03	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.267033 Longitude -114.414280					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Not Verified					Not Obtained	

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate					9.09 L/min					
Recommended Pump Intake Depth (From TOC)					71.63 m					
Pump Installed					Type _____					
Depth					_____ m					
Make					_____ H.P.					
Model (Output Rating)					_____					
Did you Encounter Saline Water (>4000 ppm TDS)					Depth _____ m					
Gas _____					Depth _____ m					
Well Disinfected Upon Completion					_____					
Geophysical Log Taken					Submitted to ESRD					
Sample Collected for Potability					Submitted to ESRD					
Additional Comments on Well										
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 1'.										

Yield Test			Taken From Ground Level	Measurement in Metric	
			Depth to water level		
Test Date	Start Time	Static Water Level	Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
2001/05/14	12:00 AM	10.82 m		1:00	54.32
				2:00	53.77
				3:00	53.28
				4:00	52.88
				5:00	52.40
				6:00	52.09
				7:00	51.82
				8:00	51.58
				9:00	51.19
				10:00	50.81
				12:00	50.38
				14:00	50.05
				16:00	49.50
				20:00	48.05
				25:00	46.09
				30:00	44.84
				35:00	43.08
				40:00	41.53
				50:00	39.01
				60:00	36.32
				75:00	33.19
				90:00	30.57
				105:00	28.79
				120:00	26.93

Method of Water Removal
Type Bailer
Removal Rate 9.09 L/min
Depth Withdrawn From 0.00 m
If water removal period was < 2 hours, explain why

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
MEDICINE VALLEY WATER WELLS	Date approval holder signed

GIC Well ID 1022436
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/09/24

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name LAFARGE CANADA INC		Address 115 QUARRY PARK BLVD			Town CALGARY		Province ALBERTA		Country CANADA	Postal Code T2C 5G9	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	9	36	26	4	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.265686</u> Longitude <u>-114.424418</u>					Elevation _____ m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Hand held autonomous GPS 20-30m					Hand held autonomous GPS 20-30m	

Drilling Information	
Method of Drilling Rotary - Air	Type of Work New Well
Proposed Well Use Investigation	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
0.30		Topsoil		
4.27		Brown Moist Clay		
25.30		Gravel		
28.35		Moist Gravel		
29.26		Sandstone		
30.48		Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
30.48 m	28.35 m	2014/05/01	2014/05/05		
Borehole					
Diameter (cm)	From (m)	To (m)			
20.02	0.00	25.60			
15.56	25.60	30.48			
Surface Casing (if applicable)			Well Casing/Liner		
Steel					
Size OD : <u>16.81 cm</u>		Size OD : _____ cm			
Wall Thickness : <u>0.478 cm</u>		Wall Thickness : _____ cm			
Bottom at : <u>25.60 m</u>		Top at : _____ m			
		Bottom at : _____ m			
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
Annular Seal Cement/Grout					
Placed from <u>0.00 m</u> to <u>25.60 m</u>					
Amount <u>150.00</u> Gallons					
Other Seals					
Type		At (m)			
Driven		25.60			
Screen Type Stainless Steel					
Size OD : <u>14.12 cm</u>					
From (m)	To (m)	Slot Size (cm)			
26.21	27.43	0.025			
Attachment <u>Telescoped</u>					
Top Fittings <u>Packer</u>		Bottom Fittings <u>Tail Pipe</u>			
Pack					
Type <u>Natural</u>		Grain Size _____			
Amount _____					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well CHRIS QUINLAN	Certification No 48135A
Company Name AARON DRILLING INC.	Copy of Well report provided to owner Yes
	Date approval holder signed 2014/09/24

Well Identification and Location										Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code	
LAFARGE CANADA INC		115 QUARRY PARK BLVD			CALGARY		ALBERTA		CANADA		T2C 5G9	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
	9	36	26	4	5							
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from					Latitude 51.265686 Longitude -114.424418					Elevation _____ m		
_____ m from					How Location Obtained					How Elevation Obtained		
					Hand held autonomous GPS 20-30m					Hand held autonomous GPS 20-30m		

Additional Information										Measurement in Metric			
Distance From Top of Casing to Ground Level										91.44 cm			
Is Artesian Flow										Is Flow Control Installed			
Rate _____ L/min										Describe _____			
Recommended Pump Rate					L/min		Pump Installed		Depth _____ m				
Recommended Pump Intake Depth (From TOC)					m		Type _____		Make _____		H.P. _____		
										Model (Output Rating) _____			
Did you Encounter Saline Water (>4000 ppm TDS)					Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>						
Gas _____					Depth _____ m		Geophysical Log Taken _____						
										Submitted to ESRD _____			
Additional Comments on Well										Sample Collected for Potability _____		Submitted to ESRD _____	
PUMP TEST PERFORMED BY WATERLINE RESOURCES													

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			

Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						

If water removal period was < 2 hours, explain why						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
CITY OF CALGARY	9092.18 L	2014/04/29 8:00 AM

Contractor Certification		
Name of Journeyman responsible for drilling/construction of well		Certification No
CHRIS QUINLAN		48135A
Company Name	Copy of Well report provided to owner	Date approval holder signed
AARON DRILLING INC.	Yes	2014/09/24

Well Identification and Location										Measurement in Metric	
Owner Name QUICK WAY FARMS LTD		Address P.O. BOX 1719		Town BROOKS		Province AB		Country CA	Postal Code T1R 1C5		
Location	1/4 or LSD 16	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.267444</u> Longitude <u>-114.400639</u>					Elevation _____ m	
_____ m from _____					How Location Obtained Hand held autonomous GPS 20-30m					How Elevation Obtained Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
2.13		Clay	
21.03		Clay & Gravel	
23.16		Clay	
26.82		Gray Shale	
28.65		Gray Sandy Shale	
31.39		Gray Shale	
31.70		Sandstone	
33.53		Shale	
35.97		Sandstone	
39.62		Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate <u>36.37</u> L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2003/01/15	45.46	32.00	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
39.62 m		2003/01/10	2003/01/14	
Borehole				
Diameter (cm)	From (m)	To (m)		
22.23	0.00	39.62		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Unknown		
Size OD : <u>14.13</u> cm		Size OD : _____ cm		
Wall Thickness : <u>0.478</u> cm		Wall Thickness : _____ cm		
Bottom at : <u>35.97</u> m		Top at : _____ m		
		Bottom at : _____ m		
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
32.00	35.97	0.318		25.40
Perforated by Torch				
Annular Seal Driven & Bentonite				
Placed from <u>0.00</u> m to <u>31.39</u> m				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : _____ cm				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type <u>Unknown</u>		Grain Size _____		
Amount _____		Unknown		

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well WILLIAM PENROD	Certification No A000187
Company Name M&M DRILLING CO. LTD.	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric
Owner Name		Address			Town		Province		Country	Postal Code
QUICK WAY FARMS LTD		P.O. BOX 1719			BROOKS		AB		CA	T1R 1C5
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description	
	16	31	026	03	5					
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					
_____ m from					Latitude 51.267444 Longitude -114.400639					Elevation _____ m
_____ m from					How Location Obtained					How Elevation Obtained
					Hand held autonomous GPS 20-30m					Not Obtained

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level										60.96 cm
Is Artesian Flow										
Rate _____ L/min										Is Flow Control Installed _____
										Describe _____
Recommended Pump Rate										36.37 L/min
Recommended Pump Intake Depth (From TOC)										35.05 m
Pump Installed _____										Depth _____ m
Type _____										Make _____ H.P. _____
										Model (Output Rating) _____
Did you Encounter Saline Water (>4000 ppm TDS)										
Gas _____										Depth _____ m
										Well Disinfected Upon Completion _____
										Geophysical Log Taken _____
										Submitted to ESRD _____
Additional Comments on Well										
Sample Collected for Potability _____										Submitted to ESRD _____
FIELD TEST HARD WATER TDS 250, GPS # 51.2671333, N-51-16.0-2.8, W-114-24-2.3, -114.40038333, BOREHOLE DIAMETER 8.75" TO 103' & 6.25" TO 130'										

Yield Test			Taken From Ground Level	Measurement in Metric	
			Depth to water level		
Test Date	Start Time	Static Water Level	Drawdown (m)	Elapsed Time	Recovery (m)
2003/01/15	12:00 AM	32.00 m		Minutes:Sec	
Method of Water Removal					
Type Pump					
Removal Rate			45.46 L/min		
Depth Withdrawn From			35.05 m		
If water removal period was < 2 hours, explain why					
			32.39	1:00	32.81
			32.59	2:00	32.69
			32.69	3:00	32.65
			32.75	4:00	32.61
			32.83	5:00	32.60
			32.85	6:00	32.56
			32.89	7:00	32.51
			32.90	8:00	32.49
			32.92	9:00	32.47
			32.94	10:00	32.45
			32.99	12:00	32.40
			33.02	14:00	32.37
			33.05	16:00	32.34
			33.08	20:00	32.32
			33.13	25:00	32.28
			33.06	30:00	32.26
			33.19	35:00	32.23
			33.24	40:00	32.21
			33.27	50:00	32.20
			33.28	60:00	32.16
			33.31	75:00	32.12
			33.32	90:00	32.10
			33.34	105:00	32.09
			33.35	120:00	32.06

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
WILLIAM PENROD	A000187
Company Name	Copy of Well report provided to owner
M&M DRILLING CO. LTD.	Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name QUICK WAY FARMS LTD		Address P.O. BOX 1719			Town BROOKS		Province AB	Country CA	Postal Code T1R 1C5		
Location	1/4 or LSD 15	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description STOCK WELL		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.267556</u> Longitude <u>-114.405667</u>					Elevation _____ m	
_____ m from _____					How Location Obtained Hand held autonomous GPS 20-30m					How Elevation Obtained Not Obtained	

Drilling Information	
Method of Drilling Rotary	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric
Depth from ground level (m)	Water Bearing	Lithology Description	
2.44		Clay & Rocks	
27.43		Lost Circulation Gravel	
28.96		Shattered Shale	
32.92		Brown Sandstone	
34.75		Gray Sandstone	
45.72		Shale & Sandstone Ledges	
47.24	Yes	Water Bearing Sandstone	
50.29	Yes	Water Bearing Shale	
50.90	Yes	Water Bearing Sandstone	
53.95		Shale	

Yield Test Summary			Measurement in Metric
Recommended Pump Rate <u>27.28</u> L/min			
Test Date	Water Removal Rate (L/min)	Static Water Level (m)	
2003/01/20	24.55	32.64	

Well Completion				Measurement in Metric
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
53.95 m		2003/01/15	2003/01/17	
Borehole				
Diameter (cm)	From (m)	To (m)		
22.23	0.00	53.95		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Plastic		
Size OD :	<u>14.13</u> cm	Size OD :	<u>11.43</u> cm	
Wall Thickness :	<u>0.478</u> cm	Wall Thickness :	<u>0.544</u> cm	
Bottom at :	<u>30.18</u> m	Top at :	<u>23.47</u> m	
		Bottom at :	<u>53.95</u> m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
43.28	50.90	0.635		25.40
Perforated by Saw				
Annular Seal Driven & Bentonite				
Placed from <u>0.00</u> m to <u>30.18</u> m				
Amount _____				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : _____ cm				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
Pack				
Type	<u>Unknown</u>	Grain Size	_____	
Amount	<u>Unknown</u>			

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well WILLIAM PENROD	Certification No A000187
Company Name M&M DRILLING CO. LTD.	Copy of Well report provided to owner Date approval holder signed

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
QUICK WAY FARMS LTD		P.O. BOX 1719			BROOKS		AB		CA	T1R 1C5	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	15	31	026	03	5				STOCK WELL		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude 51.267556		Longitude -114.405667		Elevation _____ m		
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Hand held autonomous GPS 20-30m					Not Obtained	

Additional Information			Measurement in Metric		
Distance From Top of Casing to Ground Level	_____	60.96 cm	Is Flow Control Installed	_____	
Is Artesian Flow	_____		Describe	_____	
Rate	_____	L/min			
Recommended Pump Rate	_____	27.28 L/min	Pump Installed	_____	Depth _____ m
Recommended Pump Intake Depth (From TOC)	_____	42.67 m	Type _____	Make _____	H.P. _____
					Model (Output Rating) _____
Did you Encounter Saline Water (>4000 ppm TDS)	_____	Depth _____ m	Well Disinfected Upon Completion	_____	
Gas	_____	Depth _____ m	Geophysical Log Taken	_____	
			Submitted to ESRD	_____	
			Sample Collected for Potability	_____	Submitted to ESRD _____
Additional Comments on Well					
FIELD TEST 300 TDS MOD HARD BAILED @ 7 IGM, GPS # 51-16-03.2, W-114-24-20.4, -114.4034, BOREHOLE DIAMETER 8.75" TO 99' & 5.125" 177', 90' - 95' SHATTERED SHALE (LOSS CIRCULATION).					

Yield Test			Taken From Ground Level		Measurement in Metric
Test Date	Start Time	Static Water Level	Depth to water level		
2003/01/20	12:00 AM	32.64 m			
Method of Water Removal					
Type	Pump				
Removal Rate	24.55 L/min				
Depth Withdrawn From	53.34 m				
If water removal period was < 2 hours, explain why					
			Drawdown (m)	Elapsed Time Minutes:Sec	Recovery (m)
			35.07	1:00	36.99
			35.73	2:00	36.20
			35.83	3:00	36.12
			36.01	4:00	36.02
			36.22	5:00	35.91
			36.37	6:00	35.79
			36.49	7:00	35.72
			36.62	8:00	35.61
			31.24	9:00	35.45
			36.86	10:00	35.41
			36.96	12:00	35.29
			37.11	14:00	35.16
			36.91	16:00	35.05
			37.40	20:00	34.88
			37.58	25:00	34.75
			37.76	30:00	34.59
			37.90	35:00	34.50
			38.01	40:00	34.40
			38.28	50:00	34.27
			38.43	60:00	34.14
			38.71	75:00	34.03
			38.91	90:00	33.91
			39.09	105:00	33.83
			39.24	120:00	33.74

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> WILLIAM PENROD	<i>Certification No</i> A000187
<i>Company Name</i> M&M DRILLING CO. LTD.	<i>Copy of Well report provided to owner Date approval holder signed</i>

GIC Well ID 1556533
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/06/04

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name SOUTH ROCK LTD		Address P.O. BOX 460		Town MEDICINE HAT		Province ALBERTA		Country CANADA	Postal Code T1A 7G2		
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description OBSERVATION HOLE #5		
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.258118</u> Longitude <u>-114.396505</u> How Location Obtained Differential corrected handheld GPS 5-10m					Elevation <u>1270.00</u> m How Elevation Obtained Differential corrected handheld GPS 5-10m	

Drilling Information	
Method of Drilling Rotary - Mud Proposed Well Use Monitoring	Type of Work Other

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
0.30		Black Topsoil		
6.40		Brown Clay		
11.89		Gray Gravel		
13.72		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
13.72 m	13.72 m	2014/05/08	2014/05/08		
Borehole					
Diameter (cm)	From (m)	To (m)			
14.29	0.00	13.72			
Surface Casing (if applicable)			Well Casing/Liner		
Size OD : _____ cm			Plastic		
Wall Thickness : _____ cm			Size OD : <u>6.35</u> cm		
Bottom at : _____ m			Wall Thickness : <u>0.516</u> cm		
			Top at : <u>-0.91</u> m		
			Bottom at : <u>13.72</u> m		
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
Annular Seal Bentonite Chips/Tablets					
Placed from <u>0.91</u> m to <u>9.75</u> m					
Amount <u>300.00</u> Pounds					
Other Seals					
Type				At (m)	
Screen Type Slotted PVC					
Size OD : <u>6.35</u> cm					
From (m)	To (m)	Slot Size (cm)			
10.67	13.72	0.254			
Attachment <u>Attached To Casing</u>					
Top Fittings <u>Riser Pipe</u>		Bottom Fittings <u>Plug</u>			
Pack					
Type <u>Sand</u>		Grain Size <u>10-20</u>			
Amount <u>200.00</u> Pounds					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well CHAD NIEMANS Company Name NIEMANS DRILLING (1980) LTD.	Certification No 46340A Copy of Well report provided to owner Yes Date approval holder signed 2014/06/04

Well Identification and Location										Measurement in Metric	
Owner Name SOUTH ROCK LTD		Address P.O. BOX 460		Town MEDICINE HAT		Province ALBERTA		Country CANADA	Postal Code T1A 7G2		
Location	1/4 or LSD 4	SEC 32	TWP 26	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description OBSERVATION HOLE #5		
Measured from Boundary of _____ m from _____ _____ m from _____					GPS Coordinates in Decimal Degrees (NAD 83) Latitude <u>51.258118</u> Longitude <u>-114.396505</u> How Location Obtained Differential corrected handheld GPS 5-10m				Elevation <u>1270.00</u> m How Elevation Obtained Differential corrected handheld GPS 5-10m		

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>91.44</u> cm										Is Flow Control Installed _____	
Is Artesian Flow _____ Rate _____ L/min										Describe _____	
Recommended Pump Rate _____ L/min				Pump Installed _____		Depth _____ m		Recommended Pump Intake Depth (From TOC) _____ m			
Type _____				Make _____		H.P. _____		Model (Output Rating) _____			
Did you Encounter Saline Water (>4000 ppm TDS) _____				Depth _____ m		Well Disinfected Upon Completion <u>Yes</u>		Geophysical Log Taken _____			
Gas _____				Depth _____ m		Submitted to ESRD _____		Sample Collected for Potability _____ Submitted to ESRD _____			
Additional Comments on Well LOCKABLE PROTECTOR PIPE INSTALLED AND CONCRETED INTO THE GROUND.											

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			
Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						
If water removal period was < 2 hours, explain why _____						

Water Diverted for Drilling		
Water Source TOWN OF OKOTOKS	Amount Taken 1818.44 L	Diversion Date & Time 2014/05/08 7:00 AM

Contractor Certification			
Name of Journeyman responsible for drilling/construction of well CHAD NIEMANS		Certification No 46340A	
Company Name NIEMANS DRILLING (1980) LTD.		Copy of Well report provided to owner Yes	Date approval holder signed 2014/06/04

GIC Well ID 1556534
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/06/04

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name SOUTH ROCK LTD		Address P.O. BOX 460		Town MEDICINE HAT		Province ALBERTA		Country CANADA	Postal Code T1A 7G2		
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description OBSERVATION WELL #6		
4		32	26	3	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.257155</u> Longitude <u>-114.394328</u>					Elevation <u>1277.00</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work Other
Proposed Well Use Monitoring	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
5.79		Brown Sandy Clay & Rocks		
8.84		Gray Gravel		
10.97		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
10.97 m	10.97 m	2014/05/12	2014/05/12		
Borehole					
Diameter (cm)	From (m)	To (m)			
14.29	0.00	10.97			
Surface Casing (if applicable)			Well Casing/Liner		
			Plastic		
Size OD :	_____ cm	Size OD :	6.35 cm		
Wall Thickness :	_____ cm	Wall Thickness :	0.518 cm		
Bottom at :	_____ m	Top at :	-0.91 m		
			Bottom at : 10.97 m		
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
Annular Seal Bentonite Chips/Tablets					
Placed from <u>0.91</u> m to <u>7.01</u> m					
Amount <u>200.00</u> Pounds					
Other Seals					
Type			At (m)		
Screen Type Slotted PVC					
Size OD : <u>6.35</u> cm					
From (m)	To (m)	Slot Size (cm)			
Attachment <u>Attached To Casing</u>					
Top Fittings <u>Riser Pipe</u>		Bottom Fittings <u>Plug</u>			
Pack					
Type <u>Sand</u>		Grain Size <u>10-20</u>			
Amount <u>200.00</u> Pounds					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well CHAD NIEMANS	Certification No 46340A
Company Name NIEMANS DRILLING (1980) LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2014/06/04

GIC Well ID 1556534
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/06/04

Well Identification and Location										Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code	
SOUTH ROCK LTD		P.O. BOX 460			MEDICINE HAT		ALBERTA		CANADA		T1A 7G2	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
4		32	26	3	5				OBSERVATION WELL #6			
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from					Latitude 51.257155 Longitude -114.394328					Elevation 1277.00 m		
_____ m from					How Location Obtained					How Elevation Obtained		
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m		

Additional Information										Measurement in Metric		
Distance From Top of Casing to Ground Level										91.44 cm		
Is Artesian Flow										Is Flow Control Installed		
Rate _____ L/min										Describe _____		
Recommended Pump Rate					L/min		Pump Installed		Depth		m	
Recommended Pump Intake Depth (From TOC)					m		Type		Make		H.P.	
									Model (Output Rating)			
Did you Encounter Saline Water (>4000 ppm TDS)					Depth		m		Well Disinfected Upon Completion Yes			
Gas					Depth		m		Geophysical Log Taken			
									Submitted to ESRD			
Additional Comments on Well					Sample Collected for Potability				Submitted to ESRD			
INSTALLED LOCKABLE PROTECTOR CASING AND CONCRETED INTO THE GROUND.												

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			

Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						

If water removal period was < 2 hours, explain why						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
TOWN OF OKOTOKS	2727.66 L	2014/05/12 7:00 AM

Contractor Certification			
Name of Journeyman responsible for drilling/construction of well		Certification No	
CHAD NIEMANS		46340A	
Company Name		Copy of Well report provided to owner	Date approval holder signed
NIEMANS DRILLING (1980) LTD.		Yes	2014/06/04

GIC Well ID 1556535
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2014/06/04

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name SOUTH ROCK LTD		Address P.O. BOX 460		Town MEDICINE HAT		Province ALBERTA		Country CANADA	Postal Code T1A 7G2		
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description OBSERVATION WELL #7		
	4	32	26	3	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.255906</u> Longitude <u>-114.392635</u>					Elevation <u>1273.00</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m	

Drilling Information	
Method of Drilling Rotary - Mud	Type of Work Other
Proposed Well Use Monitoring	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
3.66		Brown Clay & Rocks		
11.28		Gray Gravel		
12.19		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
12.19 m	12.19 m	2014/05/13	2014/05/13		
Borehole					
Diameter (cm)	From (m)	To (m)			
Surface Casing (if applicable)			Well Casing/Liner		
Size OD :	_____ cm	Size OD :	_____ 6.35 cm		
Wall Thickness :	_____ cm	Wall Thickness :	_____ 0.518 cm		
Bottom at :	_____ m	Top at :	_____ -0.91 m		
		Bottom at :	_____ 12.19 m		
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
Annular Seal Bentonite Chips/Tablets					
Placed from <u>0.91</u> m to <u>8.23</u> m					
Amount <u>250.00</u> Pounds					
Other Seals					
Type			At (m)		
Screen Type Plastic					
Size OD : <u>6.35</u> cm					
From (m)	To (m)	Slot Size (cm)			
9.14	12.19	0.000			
Attachment <u>Attached To Casing</u>					
Top Fittings <u>Riser Pipe</u>		Bottom Fittings <u>Plug</u>			
Pack					
Type <u>Sand</u>		Grain Size <u>10-20</u>			
Amount <u>200.00</u> Pounds					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well CHAD NIEMANS	Certification No 46340A
Company Name NIEMANS DRILLING (1980) LTD.	Copy of Well report provided to owner Yes
	Date approval holder signed 2014/06/04

Well Identification and Location										Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code	
SOUTH ROCK LTD		P.O. BOX 460			MEDICINE HAT		ALBERTA		CANADA		T1A 7G2	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
4		32	26	3	5				OBSERVATION WELL #7			
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					Elevation		
_____ m from					Latitude 51.255906 Longitude -114.392635					1273.00 m		
_____ m from					How Location Obtained					How Elevation Obtained		
					Differential corrected handheld GPS 5-10m					Differential corrected handheld GPS 5-10m		

Additional Information										Measurement in Metric		
Distance From Top of Casing to Ground Level										91.44 cm		
Is Artesian Flow										Is Flow Control Installed		
Rate _____ L/min										Describe _____		
Recommended Pump Rate					L/min		Pump Installed		Depth		m	
Recommended Pump Intake Depth (From TOC)					m		Type		Make		H.P.	
									Model (Output Rating)			
Did you Encounter Saline Water (>4000 ppm TDS)					Depth		m		Well Disinfected Upon Completion		Yes	
Gas					Depth		m		Geophysical Log Taken			
									Submitted to ESRD			
Additional Comments on Well					Sample Collected for Potability				Submitted to ESRD			
INSTALLED LOCKABLE PROTECTOR CASING AND CONCRETED INTO THE GROUND.												

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level			m	

Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						

If water removal period was < 2 hours, explain why						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
TOWN OF OKOTOKS	1818.44 L	2014/05/12 7:00 AM

Contractor Certification			
Name of Journeyman responsible for drilling/construction of well		Certification No	
CHAD NIEMANS		46340A	
Company Name		Copy of Well report provided to owner	Date approval holder signed
NIEMANS DRILLING (1980) LTD.		Yes	2014/06/04

Well Identification and Location										Measurement in Metric	
Owner Name CIRCLE J RANCHES LTD		Address RR 2		Town COCHRANE		Province ALBERTA		Country CANADA	Postal Code T0L 0W0		
Location	1/4 or LSD SW	SEC 6	TWP 27	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description M. GILES		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.274608</u> Longitude <u>-114.417737</u>					Elevation _____ m	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Not Obtained	

Drilling Information	
Method of Drilling Unknown	Type of Work Well Inventory
Proposed Well Use Domestic & Stock	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
25.60		Old Well		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
25.60 m		1934/06/30			
Borehole					
Diameter (cm)	From (m)	To (m)			
Surface Casing (if applicable)			Well Casing/Liner		
Size OD : _____ cm			Size OD : _____ cm		
Wall Thickness : _____ cm			Wall Thickness : _____ cm		
Bottom at : _____ m			Top at : _____ m		
			Bottom at : _____ m		
Perforations					
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)	
Perforated by _____					
Annular Seal					
Placed from _____ m to _____ m					
Amount _____					
Other Seals					
Type			At (m)		
Screen Type					
Size OD : _____ cm					
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
Pack					
Type _____			Grain Size _____		
Amount _____					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN DRILLER11	Certification No 11
Company Name UNKNOWNDRILLINGCOMP11	Copy of Well report provided to owner Date approval holder signed

Well Identification and Location										Measurement in Metric	
Owner Name CIRCLE J RANCHES LTD		Address RR 2		Town COCHRANE		Province ALBERTA		Country CANADA	Postal Code T0L 0W0		
Location	1/4 or LSD SW	SEC 6	TWP 27	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description M. GILES		
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.274608</u> Longitude <u>-114.417737</u>					Elevation _____ m	
_____ m from _____					How Location Obtained Not Verified					How Elevation Obtained Not Obtained	

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level _____ cm											
Is Artesian Flow _____										Is Flow Control Installed _____	
Rate _____ L/min										Describe _____	
Recommended Pump Rate _____ L/min										Pump Installed _____	
Recommended Pump Intake Depth (From TOC) _____ m										Depth _____ m	
Type _____										Make _____ H.P. _____	
										Model (Output Rating) _____	
Did you Encounter Saline Water (>4000 ppm TDS) _____										Depth _____ m	
Gas _____										Depth _____ m	
										Well Disinfected Upon Completion _____	
										Geophysical Log Taken _____	
										Submitted to ESRD _____	
										Sample Collected for Potability _____	
										Submitted to ESRD _____	
Additional Comments on Well											
ORIGINAL WELL REPORT NOT IN GIC. THE FOLLOWING INFORMATION WAS TAKEN FROM DROUGHT EMERGENCY GROUNDWATER TESTING PROGRAM APPLICATION RECEIVED ON DECEMBER 04, 1984. OWNER REPORTS THIS WELL WAS BAILED OUT TO 4 FEET OF WATER, TOOK 1 DAY TO RECOVER, WERE GETTING 1 GPM CONSISTENTLY. OWNER REPORTS THAT WELL WAS CONSTRUCTED IN APPROXIMATELY 1934 AND IS APPROXIMATELY 84 FEET DEEP. ALREADY DRILLED ANOTHER WELL 391000.											

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			
Method of Water Removal						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						
If water removal period was < 2 hours, explain why _____						

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN DRILLER11	Certification No 11
Company Name UNKNOWNDRILLINGCOMP11	Copy of Well report provided to owner Date approval holder signed

Appendix D Residential Well Assessment Questionnaires

Groundwater Monitoring Plan

Summit Pit Project

Mountain Ash Limited Partnership

SLR Project No. 212.06650.00007

May 11, 2023



Water Well Reconnaissance Survey



SITE RECONNAISSANCE CHECKLIST

Project Name: WATERMAN AGGREGATE RESOURCE
 Project Number: 203-80065.00001 SLR Staff: R. TIL
 Street Address: ~~35181~~ - NW 31-26-3 WSM - 35181 BIG HILL SPRINGS ROAD
 Property Type: Private Residence ☒ Commerical/Industrial ☐ Other ☐
 Person/Resident Interviewed: JULIE THORESON, BRUCE WATERMAN
 Date of Visit: 29 OCT 2014 Time: 10:15

1. Well Owner Information

Name: BRUCE WATERMAN
 Street Address: _____
 Contact Number: Home: _____ Business: _____ Cell: _____
 Email Address: _____

2. Well User/Occupant of the Residence Using the Well

Same as Well Owner ☐

If different from well owner please fill out details below:

Name: JULIE THORESON
 Street Address: _____
 Contact Number: Home: _____ Business: _____ Cell: _____
 Email Address: _____

3. Well Details

Well Location Lot: NW 31-26-3 WSM Concession: _____ Township: _____

3A. Well Use

Water Use: NO DRINKING, Domestic: ☒
 USES BOTTLED WATER
 Livestock: ☒
 Lawn Watering: ☐
 Irrigation: ☐
 No. of people using water from the well: 1
 No. of livestock using water from the well: 7 HORSES + SHEEP + GOAT
 Acres/area covered: _____ Approximate Amount: _____
 Acres/area covered: _____ Approximate Amount: _____

3A. Well Use Continued

Additional Equipment:

Pool: ☐

Jacuzzi/Hot Tub: ☐

Landscape water feature/fountain: ☐

Other: _____

Private waste and water disposal:

Type (ex. Septic tank): SEPTIC TANK

System description:

1000 GAL TANK

Distance to Well

75ft

Direction from well (N, S, E, or W)

W

Well is

Uphill ☐

Downhill ☐

Same Grade ☒

as the waste water system

3B. Well Construction Details

Construction/Installation Date:

UNKNOWN PRE-1960

Contractor: _____

Type of Installation:

Drilled ☒

Dug ☐

Other: _____

Diameter:

6/8 inch

Well Depth (m):

8 ~ 400ft

Screen?

UNKNOWN

YES ☐

NO ☐

Screen length (m) _____

Depth to top of screen (m) _____

Is the well accessible for sampling?

YES ☐

NO ☒

MOE Record Number:

Confirmed ☐

Inferred ☐

If no provide details:

WELL HEAD APPROXIMATELY 2m BELOW GROUND LEVEL IN A PIT

Location of measurement (top of pipe (TOP), ground surface): _____

SLR staff member collecting the measurement: _____

Date of original measurement: _____

Original/initial water level depth (m)

Subsequent water level measurements

Date						
Depth (m)						
Staff						

3C. Pumping Equipment

Pump Type:

Suction-lift ☐

Pumping Capacity _____

Positive-submergence ☐

Age _____

How is the pump lubricated? _____

Depth of intake setting:

Original (m) _____

Present (m) _____

100+ft Pumping Rate (L/s) _____

Storage Tank:

Type:

CISTERN

Capacity:

1000 GAL

Additional Features:

Chlorinator ☐

Water softener ☐

Water filter ☐

Filter type: _____

NO TREATMENT

4. Well History

How long have you owned, operated or lived on this property?

7 YEARS

Have you ever experienced any previous problems with your well?

SAND IN WELL

If so, when? ONGOING

What was the cause of the previous problem:

Drought

Pump Failure

Plugging

Increased usage

Interference

Contamination

✓

If the problem was contamination, what water quality changes were apparent? (Note any differences in taste, odour, colour or clarity)

SAND IN CISTERN, PIPES ETC

What action was taken to overcome this problem? FLUSHING + CHLORINATED

What were the effects of this action?

CLEARED PROBLEM BUT PROBLEM CAME BACK

Did you ever have your well?

deepend,

YES

☐

NO

☒

cleaned,

YES

☒

NO

☐

SHOCKED

or a new

well

YES

☐

NO

☒

If so why?

Outline briefly any previous repairs or changes in pumping equipment, and dates

5. Sample Details - TAKEN FROM KITCHEN TAP - (NO TREATMENT ON SITE)

Date:

29/10/14

Sample Collected? YES

☒

NO

☐

Sample Name/Number:

WW1

Number of Bottles:

2

Field Analysis

Harness

Iron

Conductivity

pH

Temperature

Other

6. Contact Details

Permission for future monitoring?

YES

☒

NO

☐

Well Aware Booklet:

Preferred contact time/method:

call/contact ahead

☒

site visit

☐

Contact by:

email

☐

phone

☒

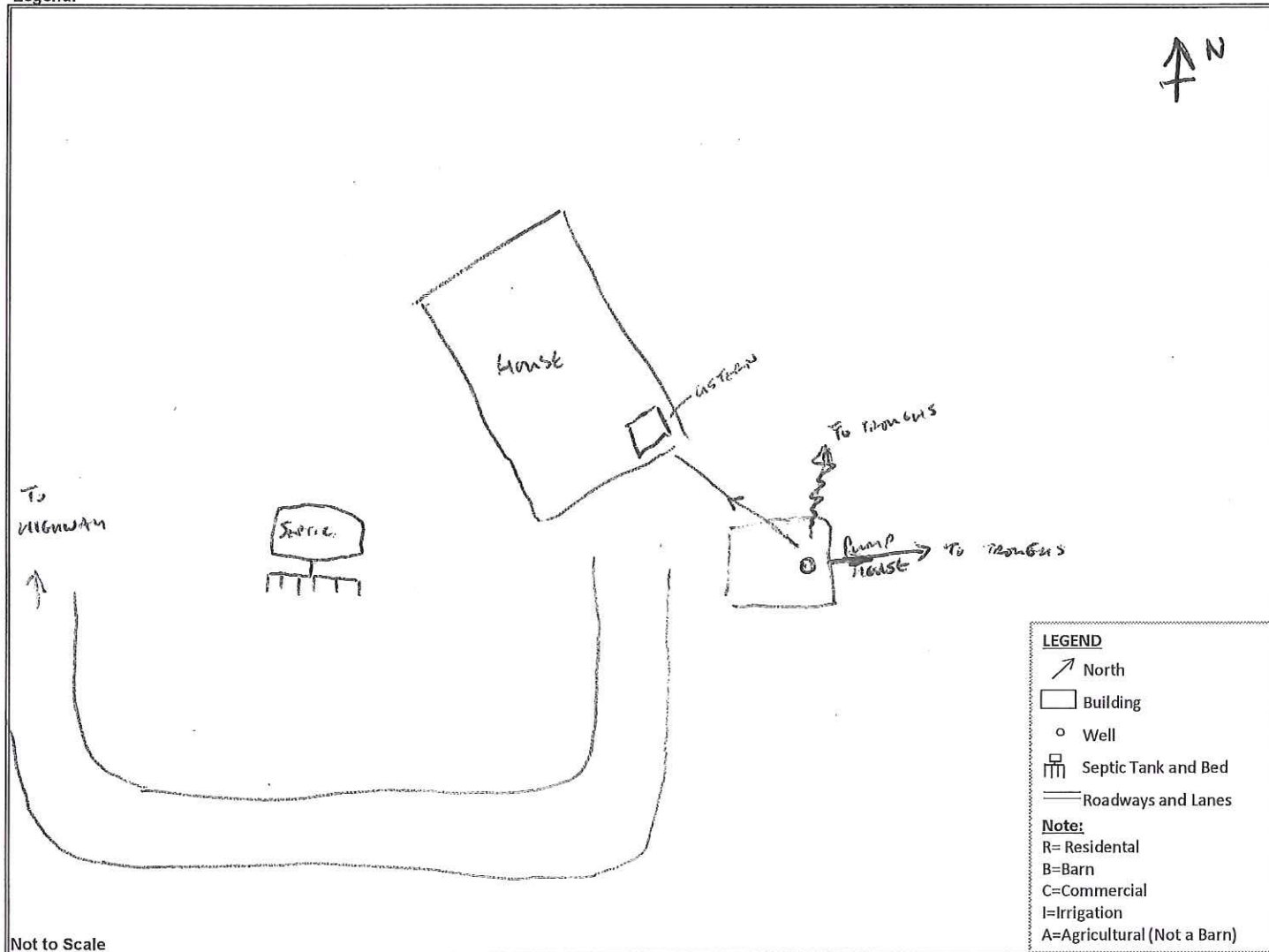
preferred contact number:

preferred contact time (evening, weekday, morning, etc.):

ANY TIME DURING DAY

7. Well Location Sketch

Notes: shown location of water well(s), septic tanks and beds, laneways/roads, fences, site buildings, north arrow, and any distinguishing site features. Include Legend.



Well GPS _____

8. Site Photograph Log

Number of Photos Taken: _____

<u>Photograph Number/Name</u>	<u>Description</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Water Well Reconnaissance Survey



SITE RECONNAISSANCE CHECKLIST

Project Name: WATERMAN AGGREGATE RESOURCE

Project Number: 203-50065-00001 SLR Staff: R. TILL

Street Address: SE 31-26-3 WSM

Property Type: Private Residence ☒ Commerical/Industrial ☐ Other ☐

Person/Resident Interviewed: MRS PARKER

Date of Visit: PHONE CALL 10 DEC 2014 Time: 16:30

1. Well Owner Information

Name: MRS PARKER

Street Address: Box 123 SE 31 26 3 WSM

Contact Number: Home: Business: Cell:

Email Address:

2. Well User/Occupant of the Residence Using the Well

Same as Well Owner ☒

If different from well owner please fill out details below:

Name:

Street Address:

Contact Number: Home: Business: Cell:

Email Address:

3. Well Details

Well Location Lot: IN HOUSE SE 31-26-3 WSM Concession: Township:

3A. Well Use

4 WELLS

Water Use: Domestic: ☒ No. of people using water from the well: 2

Livestock: ☒ No. of livestock using water from the well: 100 HEAD CATTLE

Lawn Watering: ☐ Acres/area covered: Approximate Amount:

Irrigation: ☐ Acres/area covered: Approximate Amount:

3 ARTESIAN WELLS

3A. Well Use Continued

Additional Equipment: /Pool: ☐Jacuzzi/Hot Tub: ☐Landscape water feature/fountain: ☐

Other: _____

Private waste and water disposal:

Type (ex. Sptic tank): SEPTIC TANK

System description: _____

Distance to Well

100 ft

Direction from well (N, S, E, or W)

DEPENDS ON WELL

Well is

Uphill ☒Downhill ☐Same Grade ☐

as the waste water system

3B. Well Construction Details

Construction/Installation Date: 1920'sContractor: OWNER

Type of Installation:

Drilled ☐Dug ☒

Other: _____

Diameter:

6" or 8"Well Depth (m): 20-25 feet

Screen?

YES ☒NO ☐

Screen length (m) _____

Depth to top of screen (m) _____

Is the well accesible for sampling?

YES ☐NO ☒

MOE Record Number:

Confirmed ☐Inferred ☐

If no provide details:

IN THE HOUSE

Location of measurement (top of pipe (TOP), ground surface): _____

SLR staff member collecting the measurement: _____

Date of original measurement: _____

Original/initial water level depth (m)

3 ARTESIAN - 10 ft Below Ground

Subsequent water level measurements

Date						
Depth (m)						
Staff						

3C. Pumping Equipment

Pump Type:

Suction-lift ☐SUBMERSIBLE

Pumping Capacity _____

Positive-submergence ☐

Age _____

How is the pump lubricated? _____

Depth of intake setting:

Original (m) _____

Present (m) _____

Pumping Rate (L/s) _____

Storage Tank: NO

Type: _____

Capacity: _____

Additional Features: NOChlorinator ☐Water softener ☐Water filter ☐

Filter type: _____

TREATMENT

4. Well HistoryHow long have you owned, operated or lived on this property? 1955Have you ever experienced any previous problems with your well? NO

If so, when? _____

What was the cause of the previous problem:

Drought	<u>/</u>	Pump Failure	<u>/</u>
Plugging	<u>/</u>	Increased usage	<u>/</u>
Interference	<u>/</u>	Contamination	<u>/</u>

If the problem was contamination, what water quality changes were apparent? (Note any differences in taste, odour, colour or clarity)

What action was taken to overcome this problem? _____

What were the effects of this action? _____

Did you ever have your well?

deepend,	YES	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>
cleaned,	YES	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>
or a new well	YES	<input type="checkbox"/>	NO	<input checked="" type="checkbox"/>

If so why? _____

Outline briefly any previous repairs or changes in pumping equipment, and dates 1966/67 Pumps**5. Sample Details**

Date: _____

Sample Collected? YES ☐ NO ☐

Sample Name/Number: _____

Number of Bottles: _____

Field Analysis

Harness _____

Iron _____

Conductivity _____

pH _____

Temperature _____

Other _____

6. Contact DetailsPermission for future monitoring? YES ☐ NO ☒ - NOT UNTIL AFTER XMAS

Well Aware Booklet: _____

Preferred contact time/method: call/contact ahead ☐ site visit ☐Contact by: email ☐ phone ☐ preferred contact number: _____

preferred contact time (evening, weekday, morning, etc.): _____

7. Well Location Sketch

Notes: shown location of water well(s), septic tanks and beds, laneways/roads, fences, site buildings, north arrow, and any distinguishing site features. Include Legend.

Not to Scale

LEGEND

↗ North

□ Building

○ Well

▢ Septic Tank and Bed

— Roadways and Lanes

Note:

R= Residential

B= Barn

C= Commercial

I= Irrigation

A= Agricultural (Not a Barn)

Well GPS _____

8. Site Photograph Log

Number of Photos Taken: _____

<u>Photograph Number/Name</u>	<u>Description</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Water Well Reconnaissance Survey



SITE RECONNAISSANCE CHECKLIST

Project Name: WATERMAN & AGGREGATE RESOURCE

Project Number: 203-50065-00001 SLR Staff: R. Tiu

Street Address: NE 31-26-3 WSM

Property Type: Private Residence ☒ Commercial/Industrial ☐ Other ☐

Person/Resident Interviewed: CALVIN & RAWN

Date of Visit: 29 OCT 2014 Time: 12:00

1. Well Owner Information

Name: CALVIN RAWN

Street Address: AS ABOVE

Contact Number: Home: _____ Business: _____ Cell: _____

Email Address: _____

2. Well User/Occupant of the Residence Using the Well

Same as Well Owner ☒

If different from well owner please fill out details below:

Name: _____

Street Address: _____

Contact Number: Home: _____ Business: _____ Cell: _____

Email Address: _____

3. Well Details

Well Location Lot: NE 31-26-3 WSM Concession: _____ Township: _____

3A. Well Use

2 wells

Water Use:	Domestic: <input checked="" type="checkbox"/>	No. of people using water from the well: <u>5</u> (ww2)
	Livestock: <input checked="" type="checkbox"/>	No. of livestock using water from the well: <u>40 HORSES</u> (ww3)
	Lawn Watering: <input type="checkbox"/>	Acres/area covered: _____ Approximate Amount: _____
	Irrigation: <input type="checkbox"/>	Acres/area covered: _____ Approximate Amount: _____

3A. Well Use Continued

Additional Equipment: Pool: ☐ Jacuzzi/Hot Tub: ☐ Landscape water feature/fountain: ☐
 Other: _____

Private waste and water disposal: Type (ex. Sptic tank): SEPTIC TANK

System description: _____

Distance to Well 2-300 ft Direction from well (N, S, E, or W) EAST

Well is Uphill ☐ Downhill ☐ Same Grade ☒ as the waste water system

3B. Well Construction Details

Construction/Installation Date: _____ Contractor: _____

Type of Installation: Drilled ☒ Dug ☐ Other: _____

Diameter: 6 INCH Well Depth (m): HOUSE 177 + BARN 135 ft

Screen? YES ☐ NO ☐

Screen length (m) _____

Depth to top of screen (m) _____

Is the well accessible for sampling? YES ☒ (WW2) NO ☒ (WW3)

MOE Record Number:

Confirmed ☐ Inferred ☐

If no provide details: WW3 BLOCKED @ 27.5m TOP

Location of measurement (top of pipe (TOP), ground surface): TOP

SLR staff member collecting the measurement: ROBERT TILL

Date of original measurement: 29/OCT/2014 Original/initial water level depth (m) 29.65m TOP (WW2)

Subsequent water level measurements - WW2 - LOGGER INSTALLED

Date						
Depth (m)						
Staff						

3C. Pumping Equipment

Pump Type: Suction-lift ☐ SUBMERSIBLE Pumping Capacity ✓

Positive-submergence ☐ Age 10 YRS + 5 YRS

How is the pump lubricated? _____

Depth of intake setting: Original (m) _____ Present (m) 16ft + 12ft Pumping Rate (L/s) _____

Storage Tank: Type: CISTERN Capacity: 400 GAL (HOUSE) + 750 GAL (BARN)

Additional Features: Chlorinator ☐ Water softener ☒ Water filter ☒ Filter type: PARTICULATE

HOUSE HOUSE

4. Well History

How long have you owned, operated or lived on this property?

10 yrs

Have you ever experienced any previous problems with your well?

No

If so, when?

What was the cause of the previous problem:

Drought

Pump Failure

Plugging

Increased usage

Interference

Contamination

If the problem was contamination, what water quality changes were apparent? (Note any differences in taste, odour, colour or clarity)

N/A

What action was taken to overcome this problem? N/A

What were the effects of this action?

N/A

Did you ever have your well?

deepend,

YES

☐

NO

☒

cleaned,

YES

☐

NO

☒or a new
well

YES

☐

NO

☒

If so why?

Outline briefly any previous repairs or changes in pumping equipment, and dates

REPLACED HOUSE PUMP

5. Sample Details WW2 - STANDPIPE AT BACK OF PUMP HOUSE, WW3 - HOSE IN STABLES (NO TREATMENT)

Date:

29 OCT 2014

Sample Collected?

YES

☒

NO

☐

Sample Name/Number:

WW2 + WW3

Number of Bottles:

2 EACH

Field Analysis

Harness

Iron

Conductivity 577 $\mu\text{S}/\text{cm}$

pH 7.62

Temperature 6.4°C

Other

6. Contact Details

Permission for future monitoring?

YES

☒

NO

☐

Well Aware Booklet:

Preferred contact time/method:

call/contact ahead

☒

site visit

☐

Contact by:

email

☐

phone

☐

preferred contact number:

preferred contact time (evening, weekday, morning, etc.):

DURING DAY - ANY REASONABLE
HOURS

7. Well Location Sketch

Notes: shown location of water well(s), septic tanks and beds, laneways/roads, fences, site buildings, north arrow, and any distinguishing site features. Include Legend.

The sketch shows a property layout with the following features:

- Buildings:** A large rectangle labeled "house", a smaller rectangle labeled "house (TRAILER)", and a large oval labeled "OUTDOOR RIDING AREA". To the right is a structure labeled "INDOOR RIDING AREA" with "STABLES" below it.
- Wells:**
 - Well WW2: Located near a "house" and a "BUNK SHED". It is marked with a circle and labeled "HOUSE WELL WW2" and "STANDPIPE SAMPLED".
 - Well WW3: Located near the "INDOOR RIDING AREA". It is marked with a circle and labeled "WISHING WELL WW3".
 - Well WW3 HOSE: Located near the "INDOOR RIDING AREA", marked with an arrow and labeled "WW3 HOSE SAMPLED".
- Roads:** A line labeled "MAIN ROAD" with an arrow pointing upwards.
- Legend:**
 - North arrow pointing up-right.
 - Building: represented by a rectangle.
 - Well: represented by a circle.
 - Septic Tank and Bed: represented by a rectangle with internal lines.
 - Roadways and Lanes: represented by a double line.
- Note:**
 - R= Residential
 - B=Barn
 - C=Commercial
 - I=Irrigation
 - A=Agricultural (Not a Barn)

Not to Scale

Well GPS WW2 - 0680992m , 5682772m WW3 - 0681169m , 5682906m

8. Site Photograph Log

Number of Photos Taken: _____

Photograph Number/Name	Description
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Water Well Reconnaissance Survey



SITE RECONNAISSANCE CHECKLIST

Project Name: WATERMAN AGGREGATE RESOURCE

Project Number: 203.50065.00001 SLR Staff: R. TILLY

Street Address: SW 31-26-03 WSM

Property Type: Private Residence ☒ Commerical/Industrial ☐ Other _____

Person/Resident Interviewed: JOHN NUGTER

Date of Visit: 30 OCTOBER 2014 Time: 11:20

1. Well Owner Information

Name: JOHN NUGTER

Street Address: AS ABOVE

Contact Number: Home: _____ Business: _____ Cell: _____

Email Address: _____

2. Well User/Occupant of the Residence Using the Well

Same as Well Owner ☒

If different from well owner please fill out details below:

Name: _____

Street Address: _____

Contact Number: Home: _____ Business: _____ Cell: _____

Email Address: _____

3. Well Details

Well Location Lot: SW-31-26-03 WSM Concession: _____ Township: _____

3A. Well Use

Water Use: Domestic: ☒ No. of people using water from the well: 3

Livestock: ☒ No. of livestock using water from the well: 25 CATTLE, 5 HORSES

Lawn Watering: ☐ Acres/area covered: _____ Approximate Amount: _____

Irrigation: ☐ Acres/area covered: _____ Approximate Amount: _____

3A. Well Use Continued

Additional Equipment:

Pool: ☐Jacuzzi/Hot Tub: ☐Landscape water feature/fountain: ☐

Other: _____

Private waste and water disposal:

Type (ex. Specific tank): SEPTIC TANKS (2 TANKS)

System description:

1 TANK FOR HOUSE + 1 FOR RENTAL HOUSE

Distance to Well _____

Direction from well (N, S, E, or W) _____

Well is

Uphill ☐Downhill ☐Same Grade ☐

as the waste water system

3B. Well Construction Details

Construction/Installation Date:

1990

Contractor:

LOW'S WATER WELL DRILLING

Type of Installation:

Drilled ☒Dug ☐

Other: _____

Diameter: _____

Well Depth (ft):

115 ft

Screen?

YES ☒NO ☐

Screen length (m) _____

Depth to top of screen (m) _____

Is the well accessible for sampling?

YES ☒NO ☐

MOE Record Number:

350194Confirmed ☒Inferred ☐

If no provide details: _____

Location of measurement (top of pipe (TOP), ground surface):

TOP

SLR staff member collecting the measurement:

ROBERT TILL

Date of original measurement:

30 OCTOBER 2014

Original/initial water level depth (m)

11.734 mb TOC

Subsequent water level measurements

Date						
Depth (m)						
Staff						

3C. Pumping Equipment

Pump Type:

Suction-lift ☐Positive-submergence ☐SUBMERSIBLE

Pumping Capacity

30 GPM/MIN

Age

2006

How is the pump lubricated? _____

Depth of intake setting:

Original (m) _____

Present (m)

100 ft ?

Pumping Rate (L/s) _____

Storage Tank:

Type:

N/A

Capacity: _____

Additional Features:

Chlorinator ☐Water softener ☐Water filter ☐

Filter type: _____

NO TREATMENT

4. Well History

How long have you owned, operated or lived on this property?

17 YEARSHave you ever experienced any previous problems with your well?NO

If so, when?

What was the cause of the previous problem:

Drought

Pump Failure

Plugging

Increased usage

Interference

Contamination

If the problem was contamination, what water quality changes were apparent? (Note any differences in taste, odour, colour or clarity)

What action was taken to overcome this problem?

What were the effects of this action?

Did you ever have your well?

deepend,

YES

☐

NO

☒cleaned,
or a new
well

YES

☐

NO

☒

YES

☐

NO

☒

If so why?

Outline briefly any previous repairs or changes in pumping equipment, and dates

CHANGED pump 2006

5. Sample Details

Date:

30 OCT 2014

Sample Collected?

YES

☒

NO

☐

Sample Name/Number:

WW4

Number of Bottles:

2

Field Analysis

Harness

Iron

Conductivity

606 μ S/cmpH 5.44 ?

Temperature

5.1°C

Other

6. Contact Details

Permission for future monitoring?

YES

☒

NO

☐

Well Aware Booklet:

Preferred contact time/method:

call/contact ahead

☒

site visit

☐

Contact by:

email

☐

phone

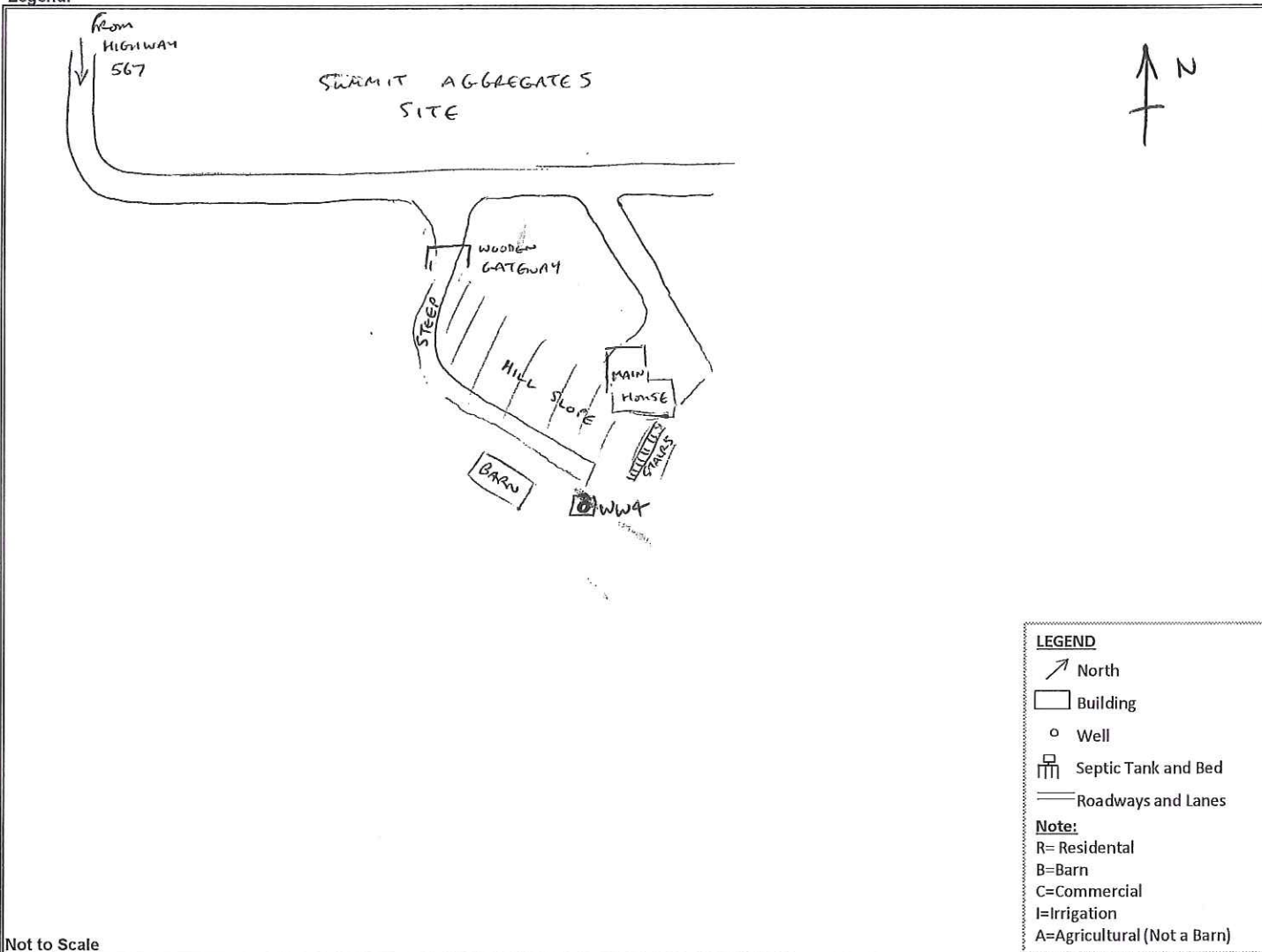
☒

preferred contact number:

preferred contact time (evening, weekday, morning, etc.):

7. Well Location Sketch

Notes: shown location of water well(s), septic tanks and beds, laneways/roads, fences, site buildings, north arrow, and any distinguishing site features. Include Legend.



Not to Scale

Well GPS 0680258 , 5682090

8. Site Photograph Log

Number of Photos Taken: _____

Photograph Number/Name	Description
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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