



# **Groundwater Monitoring Plan**

## **Mountain Ash Limited Partnership Summit Pit**

SLR Project No: 212.06650.00006

June 2021



Groundwater Monitoring Plan  
Mountain Ash Limited Partnership  
Rocky View County, Alberta  
SLR Project No: 212.06650.00006

Prepared by  
SLR Consulting (Canada) Ltd.  
6940 Roper Road  
Edmonton, AB T6B 3H9

for

Mountain Ash Limited Partnership  
1945 Briar Crescent NW  
Calgary, AB T2N 3V6

June 23, 2021

This document has been prepared by SLR Canada. The material and data in this report were prepared under the supervision and direction of the undersigned.

Prepared by:

Reviewed by:



**Robert Till, M.Sc., P.Geo.**  
Senior Hydrogeologist

**Steve Usher, M.Sc., P.Geo., FGC**  
Principal Hydrogeologist

Distribution: 1 copy – Mountain Ash Limited Partnership  
1 copy – SLR Consulting (Canada) Ltd.

# Table of Contents

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>2.0</b>	<b>SITE DESCRIPTION .....</b>	<b>1</b>
2.1	Land Uses .....	1
2.2	Proposed Site Activities .....	1
2.3	Potential Sources of Groundwater Contamination .....	2
2.3.1	<i>Historical</i> .....	2
2.3.2	<i>Current and Future</i> .....	2
<b>3.0</b>	<b>GEOLOGY .....</b>	<b>3</b>
3.1	Surficial Geology .....	3
3.2	Bedrock Geology .....	3
<b>4.0</b>	<b>HYDROGEOLOGY .....</b>	<b>4</b>
4.1	Aquifer Properties .....	4
4.1.1	<i>Surficial Unconsolidated Deposits</i> .....	4
4.1.2	<i>Paskapoo Formation Bedrock</i> .....	5
4.2	Groundwater Levels and Flow .....	5
4.2.1	<i>Groundwater / Surface Water Interactions</i> .....	6
4.3	Baseline Water Quality Assessment .....	6
4.3.1	<i>Surficial Deposits</i> .....	7
4.3.2	<i>Paskapoo Formation Bedrock</i> .....	7
4.3.3	<i>Big Hill Springs</i> .....	11
4.4	Regional and Local Water Users .....	11
<b>5.0</b>	<b>REGULATORY FRAMEWORK .....</b>	<b>15</b>
<b>6.0</b>	<b>PROPOSED GROUNDWATER MONITORING WELL NETWORK .....</b>	<b>15</b>
6.1	Groundwater Monitoring Objectives .....	15
6.2	Groundwater Monitoring Approach .....	15
6.3	Groundwater Monitoring Network Description .....	16
<b>7.0</b>	<b>GROUNDWATER MONITORING PROGRAM .....</b>	<b>16</b>
7.1	Methodology .....	16
7.1.1	<i>Groundwater Monitoring</i> .....	16
7.1.2	<i>Monitoring Wells</i> .....	17
7.1.3	<i>Residential Wells</i> .....	17
7.1.4	<i>Groundwater Sampling</i> .....	18
7.1.5	<i>Groundwater Analytical Program</i> .....	18
7.2	Quality Assurance and Quality Control (QA/QC) .....	18
7.3	Proposed Monitoring Schedule .....	19

<b>8.0</b>	<b>GROUNDWATER RESPONSE PLAN.....</b>	<b>22</b>
8.1	Baseline Groundwater Sampling .....	22
8.2	Establish Control Limits .....	22
8.3	Annual Groundwater Monitoring .....	22
8.4	Annual Groundwater Monitoring Report .....	22
8.5	Source Identification .....	23
8.6	Risk Management Plan .....	23
<b>9.0</b>	<b>SUMMARY.....</b>	<b>23</b>
<b>10.0</b>	<b>REFERENCES.....</b>	<b>24</b>
<b>11.0</b>	<b>STATEMENT OF LIMITATIONS .....</b>	<b>24</b>

## EMBEDDED TABLES

Table 1	Water Quality Summary.....	8
Table 2	Water Wells within 800 Metres .....	13
Table 3	Proposed Baseline Monitoring Schedule .....	20
Table 4	Proposed Phase 1 Monitoring Schedule .....	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

## DRAWINGS

Drawing 1:	Site Location and Study Area
Drawing 2:	Current and Historical Potential Sources of Groundwater Contamination
Drawing 3:	Monitoring Well and Water Well Location Plan
Drawing 4:	Schematic Geological Section A-A'
Drawing 5:	Groundwater Elevations (July 3, 2019)
Drawing 6:	Phase 1 Monitoring Location Plan
Drawing 7:	Groundwater Response Plan



## APPENDICES

Appendix A	Groundwater Hydrographs
Appendix B	Alberta Water Well Records
Appendix C	Residential Well Assessment Questionnaires
Appendix D	Monitoring Well Construction Logs

## 1.0 INTRODUCTION

Mountain Ash Limited Partnership (Mountain Ash) 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 (Drawing 1). The Project will encompass approximately 208 acres (84 ha) excluding existing road rights-of-way. Mountain Ash is applying for Phase 1 of a six-phase mining plan. This land is currently owned by 1410266 Alberta Ltd. (a general partner of Mountain Ash). Summit Pit 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 the Project operations in relation to nearby groundwater users. The report concluded that there is little risk of impact to adjacent well users because aggregate extraction occurs above the water table, and the nearest wells residential wells are located more than 490 metre (m) away when the operations are located at its nearest point to the off-site residential well. As a requirement for the Code of Practice (COP) for Pits and Development Permit (DP) applications, this report details the Groundwater Monitoring Plan (GMP) in relation to the operation of the Summit Pit. The objective of this GMP is to ensure the effects of site operations on groundwater resources in the vicinity of the site are monitored and negative impacts prevented 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 potential groundwater receptors including residential water wells and groundwater springs exist near the proposed Project area which the Hydrogeological Assessment (SLR 2020c) concluded would be unaffected by the Project. This GMP is designed to monitor Project effects to ensure this is the case. This GMP 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 Class II Gramminoid Marsh Wetlands and a number of other, smaller wetlands mainly classified as Class I Farmed through Wetlands. A detailed description of the wetlands on site is provided in SLR (2020a; 2020b), namely the Wetland Assessment and Impact Report and Biophysical Impact Report. The site location and surrounding land use is shown on Drawing 1.

### 2.2 Proposed Site Activities

The property will be operated and permitted in six phases of similar size excluding Phase 4 and Phase 6 which are smaller than Phases 1 through 5, with operations and permitting commencing initially for the

southeast parcel. This is called Phase 1 and 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 Drawing 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. The till and organic topsoil will be stripped and stockpiled for future use in the post-development restoration. The sand and gravel is 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. It is anticipated that 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 considered a dry excavation, with no requirement for 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 the potential sources for contamination was undertaken by SLR and several potential sources, which could impact groundwater at the site, have been identified as described below and are shown on Drawing 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 which is common for rural settings.

A review of historical air photos on Google Earth back as far as May 2002 indicates that the site was undeveloped and consisted of rough grazing land as is the current situation. There is no evidence of previous land uses which may have been contaminating.

### 2.3.2 Current and Future

The following current and future operations at and adjacent to the site have been identified 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.
- Future Highway Maintenance Facility (10 acre) located adjacent to SW31-26-3-W5M, to the west. The facility will be operated by Volker Stevin Highways.
- 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 storage, refueling and maintenance area is shown on Drawing 2.

There are no significant quantities of chemicals involved in the site operation and incidental hazardous and non-hazardous wastes will be shipped off site for disposal as 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. Drawing 3 shows the line of a vertical cross-section (Drawing 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 the published geology maps (Shetsen 1987). Two primary layers are found as can be seen in the cross-section in Drawing 4. The upper strata are predominantly comprised of Pleistocene-age moraine draped over the underlying sand and gravel. This moraine consists of an unsorted mixture of clay, silt, sand and gravel with local water-sorted material and 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 which 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 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 in those areas investigated by 31 test holes.

### 3.2 Bedrock Geology

Consolidated bedrock underlies the unconsolidated sand and gravel layer as indicated on Drawing 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). The test drilling at this site 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 of the Big Hill Springs Provincial Park southeast of the site. A number of domestic well records from the immediate vicinity identify sandstone and shale<sup>1</sup> 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 used 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.

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  $1 \times 10^{-4}$  m/s to  $3 \times 10^{-4}$  m/s. These values fall in a narrow range and are typical of sand and gravel aquifers.

---

<sup>1</sup> 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.

#### 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  $2 \times 10^{-7}$  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 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 Drawing 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 Drawing 5.

The groundwater monitoring points completed at the site have been subject to periodic groundwater elevation monitoring between October 2014 and September 2019. 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 September 2019 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 fluctuation in the groundwater levels within the sand and gravel indicates negligible or no influence from pumping within residential wells in the area. Groundwater levels within the sand and gravel have been gradually falling over the initial years of monitoring, with a drop of

approximately 0.9 to 1.3 m during the period. Levels rebounded somewhat (0.1 m) in the months between July and September 2019 due to the higher than average rainfall totals in the area in spring and summer 2019.

- A variable response to the pumping from normal use in residential wells, with the wells recovering within a few hours of extended pumping. 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, Drawing 5 shows the inferred potentiometric groundwater surface (drawn in blue) in the sand and gravel at site as recorded on 3 July 2019. Drawing 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 located in the northwestern corner of the site have a surface elevation of approximately 1,290 masl and are perched on the 6 m of low permeability fine grained till. The presence of freestanding water is seasonal based on observations made at the site, with water levels generally decreasing through summer and autumn. Monitoring well MW14-101 located close to one of the wetlands 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, and 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. Ozaray & Barnes (1977) reports that spring flow is in the order of 40 L/s and water temperature is typically less than 5°C.

### 4.3 Baseline Water Quality Assessment

Groundwater samples have been collected from the accessible residential wells in the Paskapoo Formation bedrock, the 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 the groundwater within the saturated sand and gravel recharges the Paskapoo Formation bedrock and also provides baseflow to the

Big Hill Springs. A summary of the water quality is provided in Table 1 with details provided in appended Tables A1, A2 and A3.

#### **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 Canadian Drinking Water Quality (CDWQ) standards set maximum allowable concentrations (MAC) for 16 parameters for drinking water purposes. A number of these were exceeded in several sand and gravel monitoring wells, including trace metals arsenic, barium, cadmium, chromium, lead, manganese and mercury, and microbiological parameters total coliforms and *E.Coli*. Other CDWQ guidelines that were exceeded were the aesthetic objective parameters aluminum and iron. The pH was moderately alkaline at 7.8 to 8.2, and groundwater from a number of the monitoring wells exceeded guidelines for turbidity, which is a parameter that is included because it shows when water is not clear, may contain sediment, and can also mask bacteria counts.

#### **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 CDWQ guidelines except a single exceedance of total coliforms in WW4. *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 (7.9 to 8.1) in all samples, indicating slightly more alkaline conditions within the bedrock as compared to the sand and gravel.



Table 1 Water Quality Summary

Parameter	Units	Groundwater					Surface Water		
		Guideline (CDWQ)	Sand and Gravel		Paskapoo Formation		Guideline (CWQG PAL Freshwater)	Big Hill Springs	
			min	max	min	max		min	max
Total Aluminum	mg/L	0.1 (OG)	0.109	95	0.0041	0.011	0.1	0.0144	0.3
Total Antimony	mg/L	0.006 (MAC)	<0.0006	0.006	<0.00050	0.00088	NV	<0.00050	<0.00060
Total Arsenic	mg/L	0.01 (MAC)	0.000336	0.071	0.000121	0.00032	0.005	0.000146	0.00061
Total Barium	mg/L	1 (MAC)	0.332	7.2	0.11	0.391	NV	0.21	0.313
Bicarbonate (as HCO <sub>3</sub> )	mg/L	NV	310	390	340	391.6	NV	240	376.1
Total Boron	mg/L	5 (MAC)	<0.020	0.087	<0.020	0.032	1.5	<0.020	0.024
Total Cadmium	mg/L	0.005 (MAC)	<0.000005	0.01	<0.000005	0.00004	0.00009	0.000008	0.000034
Dissolved Calcium	mg/L	NV	62	77	55	80	NV	48	74.1
Chloride	mg/L	<250 (AO)	7.83	29	1.38	12	120	8.2	10.12
Total Chromium	mg/L	0.05 (MAC)	<0.0010	0.19	<0.0010	0.0012	0.001	<0.0010	0.001
Total Copper	mg/L	2 (MAC) / 1 (AO)	<0.0010	0.29	0.0016	0.125	0.004	<0.0010	0.0013
Total Iron	mg/L	<0.3 (AO)	0.22	190	<0.010	0.3	0.3	0.019	0.25
Total Lead	mg/L	0.005 (MAC)	0.00031	0.15	<0.00030	0.011	0.007	<0.00020	<0.00030
Total Mercury	mg/L	0.001 (MAC)	<0.00010	0.00208	<0.0000020	<0.00020	0.000026	0.0000025	<0.00020

Parameter	Units	Groundwater					Surface Water		
		Guideline (CDWQ)	Sand and Gravel		Paskapoo Formation		Guideline (CWQG PAL Freshwater)	Big Hill Springs	
			min	max	min	max		min	max
Dissolved Magnesium	mg/L	NV	30	37	30	39.9	NV	20	36.7
Total Manganese	mg/L	0.12 (MAC) / 0.02 (AO)	0.0144	8.9	<0.0010	0.012	NV	0.0012	0.0019
Total Molybdenum	mg/L	NV	0.0008	0.023	0.00065	0.00222	0.073	0.00038	0.00141
Total Nickel	mg/L	NV	<0.00050	0.41	<0.00050	0.00174	0.15	<0.00050	0.00088
Nitrate-N	mg/L	10 (MAC)	0.97	5.22	0.37	3.314	2.9	1.4	3.037
Nitrite-N	mg/L	1 (MAC)	<0.005	0.098	<0.005	<0.05	0.06	<0.005	<0.05
Dissolved Potassium	mg/L	NV	2.7	6.3	2	3.3	NV	3.3	4.8
pH		7.0 -10.5	7.8	8.19	7.9	8.13	6.5-9	8.07	8.2
Total Selenium	mg/L	0.05 (MAC)	0.00049	0.0013	0.00052	0.0018	0.001	0.00068	0.00218
Total Silver	mg/L	NV	<0.000070	0.0025	<0.00007	0.00012	0.00025	<0.000070	<0.00010
Dissolved Sodium	mg/L	<200 (AO)	5.7	18	6.5	17	NV	5	7.8
Sulphate	mg/L	<500 (AO)	5.8	26	5.9	20	NV	4.7	9.36
Total Thallium	mg/L	NV	<0.00020	0.0026	<0.00020	<0.00020	0.0008	<0.00020	<0.00020
Total Dissolved Solids (calculated)	mg/L	<500 (AO)	290	360	300	349	NV	210	342

Parameter	Units	Groundwater					Surface Water		
		Guideline (CDWQ)	Sand and Gravel		Paskapoo Formation		Guideline (CWQG PAL Freshwater)	Big Hill Springs	
			min	max	min	max		min	max
Turbidity	NTU	1 (OG)	8	3100	0.2	1.23	NV	0.8	5.1
Total Uranium	mg/L	0.02 (MAC)	0.001563	0.016	0.00091	0.0021	0.015	0.0013	0.001953
Total Zinc	mg/L	<5 (AO)	<0.020	1.2	0.024	0.99	0.007	<0.0030	<0.020
Total Coliforms	MPN/100 mL	<1 (MAC)	<1	120000	<1	11	NV	>2400	2420
E.Coli	MPN/100 mL	<1 (MAC)	<1	100	<1	<1	NV	1600	1733

### 4.3.3 Big Hill Springs

Table A3 (appended) summarizes the water quality results of the water samples taken from the creek downstream from the springs at Big Hill Springs Provincial Park on October 30, 2014, August 4, 2015 and July 10, 2019. Since this groundwater discharge is the source for a surface water stream, and at the point of sampling is within that stream, it is compared to the CWQG Protection for Aquatic Life (PAL) guideline. The PAL has guidelines for 20 parameters of the sampling suite. The sample met 17 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. The high concentrations 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 and selenium exceeded the PAL 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 (0.000026 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). Drawing 3 presents the locations of the wells identified from the records search and the door-to-door survey for which Table 2 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 AEP. 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 2 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	6805591	5682875	Unknown	Drilled	On Site
WW2	1475699	1	Rawn	6809881	5682770	50.9	Drilled	200 E
WW3	1475698	1	Rawn	6811731	5682907	36.0	Drilled	400 E
WW4	350194	1	Nugter	6802571	5682091	35.1	Drilled	On Site
WW5	N/A	4	Burnco	6815471	5681568	6.1 – 7.6	Dug	800 SE
WW6	Unknown	1	Unknown	See Note2	SW Quarter, S32-T26-R3	Unknown	Drilled	900 E
WW7	Unknown	1	Unknown	See Note2	SW Quarter, S32-T26-R3	Unknown	Drilled	900 E
WW8	395786	1	Hodgson	See Note2	NE Quarter, S31-T26-R3	62.5	Drilled	690 E
WW9	360164	1	Carroll	6807441	5683480	67.1	Drilled	350 N
WW10	Unknown	1	Unknown	See Note2	SE Quarter, S6-T27-R3	Unknown	Unknown	800 N
WW11	391000	1	Unknown	6799323	5683339	39.6	Drilled	350 N
WW12	Unknown	1	Unknown	See Note2	NE Quarter, S36-T26-R4	Unknown	Unknown	270 W
WW13	Unknown	1	Big Hill Estates	See Note2	SW Quarter, S30-T26-R3	Unknown	Drilled	1,800 S
N/A	1022436	1	Lafarge Canada Inc.	6796823	5682526	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	387449	1	Lafarge Canada Inc.	See Note <sup>4</sup>	NE Quarter, S36-T26-R4	33.8	Drilled	
N/A	494773	1	Lafarge Canada Inc.	See Note <sup>4</sup>	NE Quarter, S36-T26-R4	30.5	Drilled	
N/A	2095665	1	Unknown	See Note <sup>4</sup>	SW Quarter, S6-T27-R3	25.6	Drilled	
N/A	390998	1	Unknown	See Note <sup>4</sup>	SE Quarter, S6-T27-R3	65.5	Drilled	
N/A	390999	1	Unknown	See Note <sup>4</sup>	SE Quarter, S6-T27-R3	73.2	Drilled	
N/A	391598	1	Unknown	See Note <sup>4</sup>	NW Quarter, S3-T26-R3	39.6	Drilled	
N/A	395786	1	Unknown	See Note <sup>4</sup>	NE Quarter, S31-T26-R3	62.5	Drilled	

1. Location based on GPS measurement in the field.

2. Plotted by AEP at quarter centre centroid, adjusted to likely location, subject to field confirmation.

3. Location based on Abacus Datagraphics database.

4. Wells plotted at quarter-section centroid in Abacus Datagraphics database. Not likely actual location.

## 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 January 2019) 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 the residential wells which opt to join the monitoring program will be assessed against the Guidelines for CDWQ and the equivalent Alberta potable groundwater guidelines.

Background groundwater chemistry would be established using historical groundwater monitoring data and additional data collected during a monitoring and sampling event prior to development of the site. In the first annual monitoring report, control limits setting upper and lower acceptable bounds for parameters will be derived for each sampling point 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 Drawing 3 and the monitoring wells for Phase 1 monitoring are presented in Drawing 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 2, several residential wells are located within or close to an 800 m radius of the site (WW1 to WW12), and it has been offered by the Developer that these wells be included 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 proposes to enter into a data sharing agreement.

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.

## 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 low-flow parameter stabilization method. As the groundwater within the monitoring wells is below the effective depth of a peristaltic pump (approximately 8 m), an electric submersible or bladder pump will be used to conduct the low-flow purge. 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 Sampling

Samples will be collected from the dedicated sample tubing (for monitoring wells) 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 Analytical Program

The proposed analytical program includes the following parameters as parameters of potential concern:

- Routine parameters: pH, Total Dissolved Solids (TDS), chloride, nitrate, alkalinity, electrical conductivity, hardness and major cations and anions
- Hydrocarbon parameters: benzene, toluene, ethylbenzene and xylenes (BTEX), petroleum hydrocarbon (PHC) fractions F1 and F2 (to be conducted in the onsite sentinel wells only)
- Tier 1 dissolved metal suite

These parameters take into account all those likely indicator parameters which would indicate impacts to the groundwater from the operations. Full details of the parameters to be tested are provided in Tables 3 and 4, 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 (excluding the outliers due to high turbidity within the samples). This historical data (excluding outliers) will be used to form the baseline groundwater quality with the addition of one more confirmatory sample prior to the commencement of stripping and excavation. This additional sample will be collected for all onsite monitoring wells, participating residential wells and the spring sampling point. This baseline data will then be used to establish control limits in the first annual monitoring report. Details of the baseline sampling is provided in Table 3, with the monitoring point locations presented in Drawing 3.

Once baseline water quality has been established for all sampling points the program will be reduced to annual 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), 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 4 and the monitoring point locations presented in Drawing 6.

**Table 3 Proposed Baseline Monitoring Schedule**

Parameter	Monitoring Point	Frequency
<b>Water Level</b>	<b>Onsite Monitoring Wells</b> MW14-101, MW14-102*, MW14-103, MW18-104, MW18-105, MW18-106, MW18-107, MW19-108, MW19-109, MW19-110	Monthly during Operating Months (April -November)
	<b>Residential Wells</b> WW1, WW2, WW3, WW4, WW5**, WW6**, WW7**, WW8**, WW9**, WW10**, WW11**, WW12**, WW13**	Manual readings twice in the baseline period (June and November). Data loggers installed and recording normal usage and seasonal trends.
<b>Field Parameters:</b> Temperature, pH, specific conductance	<b>Onsite Monitoring Wells</b> MW14-101, MW14-102*, MW14-103, MW18-104, MW18-105, MW18-106, MW18-107, MW19-108, MW19-109, MW19-110  <b>Residential Wells</b> WW1, WW2, WW3, WW4, WW5**, WW6**, WW7**, WW8**, WW9**, WW10**, WW11**, WW12**, WW13**  <b>Surface Water</b> BHS1	Once before excavation commences
<b>Routine Potability:</b> alkalinity, bicarbonate (HCO <sub>3</sub> ), electrical conductivity (EC), ion balance, dissolved calcium (Ca), iron (Fe), potassium (K), manganese (Mn), magnesium (Mg), sodium (Na), chloride (Cl), sulphate (SO <sub>4</sub> ), nitrite (NO <sub>2</sub> ), nitrate (NO <sub>3</sub> ), pH, hardness, total dissolved solids		
<b>Tier 1 dissolved metals:</b> 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		
<b>Petroleum Hydrocarbons:</b> Benzene, toluene, ethyl-benzene, xylenes, petroleum hydrocarbon fractions F1 & F2		

\* - MW14-102 has been dry since it was drilled, it will be monitored as per the schedule and only sampled should groundwater levels rise above the end of hole.

\*\* - Pending well owner agreement for inclusion in the monitoring program

**Table 4 Proposed Phase 1 Monitoring Schedule**

Parameter	Monitoring Point	Frequency
<b>Water Level</b>	<b>Onsite Monitoring Wells</b> MW14-101, MW14-102*, MW14-103, MW18-104, MW18-105, MW18-106, MW18-107, MW19-108, MW19-109, MW19-110	Monthly during Operating Months (April -November)
	<b>Residential Wells</b> 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 usage.
<b>Field Parameters:</b> Temperature, pH, specific conductance	<b>Onsite Monitoring Wells</b> MW14-102*, MW19-108, MW19-109, MW19-110	Annually
<b>Routine Potability:</b> alkalinity, bicarbonate (HCO <sub>3</sub> ), electrical conductivity (EC), ion balance, dissolved calcium (Ca), iron (Fe), potassium (K), manganese (Mn), magnesium (Mg), sodium (Na), chloride (Cl), sulphate (SO <sub>4</sub> ), nitrite (NO <sub>2</sub> ), nitrate (NO <sub>3</sub> ), pH, hardness, total dissolved solids		
<b>Tier 1 dissolved metals:</b> 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		
<b>As Above</b>	<b>Residential Wells</b> WW1, WW2, WW3, WW4, WW5**, WW6**, WW7**, WW8**, WW13**	Annually until Phase 1 DP expires
<b>As above with the exception of water level</b>	BHS1	Annually
<b>Petroleum Hydrocarbons:</b> Benzene, toluene, ethyl-benzene, xylenes, petroleum hydrocarbon fractions F1 & F2	<b>Onsite Monitoring Wells</b> MW14-102*, MW19-108, MW19-109, MW19-110	Annually

\* - MW14-102 has been dry since it was drilled, it will be monitored as per the schedule and only sampled should groundwater levels rise above the end of hole.

\*\* - Pending well owner agreement for inclusion in the monitoring program

## 8.0 GROUNDWATER RESPONSE PLAN

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

### 8.1 Baseline Groundwater Sampling

Groundwater sampling has been conducted previously at the site only to establish existing conditions and perform an impact assessment. Additional data is required to reliably establish a baseline and develop site-specific control limits. To establish the baseline, historical data plus data collected as per Table 3 above, will be 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 revert to the proposed schedule in Table 4 after the baseline is established. All water quality taken from private wells will be shared with homeowners.

### 8.2 Establish Control Limits

The initial baseline groundwater monitoring will be used to develop “control limits” (described in Section 5) that can be used to identify groundwater quality issues at the site. Exact upper and lower control limits will be provided after the baseline groundwater sampling in the first year. The control limits will be dependent on the parameter considered for each aquifer and will 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 observed results that are perfectly natural do not inadvertently trigger unnecessary remedial action.

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 4 after the baseline sampling period. Groundwater monitoring data will be entered and stored in a format suitable for identifying control limit exceedances and trends. 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, AEP will be notified of the result. 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. Once the baseline data collection has been completed, the control limits will be defined in the annual report for that year, and subsequent reports will examine the recent results in that context.

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

## 8.5 Source Identification

Once a control limit exceedance or increasing trend is confirmed, 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 8.6).

## 8.6 Risk Management Plan

A risk management plan will be developed for this site. This plan will be implemented 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 AEP. 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.

## 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 REFERENCES

- Alberta Geological Survey. 1999. *Geological Map of Alberta, 1:1,000,000 scale*.
- Geological Survey of Canada. 2007. *Paskapoo groundwater study. Part I: Hydrogeological properties of the Paskapoo Formation determined from six continuous cores*. Open File 5392.
- Hamblin, A.P. 2004. *Paskapoo-Porcupine Hills formations in western Alberta: synthesis of regional geology and resource potential*. Geological Survey of Canada, Open File 4679.
- Ozaray, G.F. and Barnes, R. 1977. *Hydrogeology of the Calgary-Golden Area*.
- Shetsen, I. 1981. *Sand and gravel resources of the Calgary area, Alberta*. Alberta Research Council, OFR 1981-08, 96 p.
- Shetsen, I. 1987. *Quaternary Geology, Southern Alberta*. 1:500,000 scale map. Alberta Research Council.
- SLR. 2020a. *Mountain Ash Limited Partnership Aggregate Operation – Biophysical Assessment Report*
- SLR. 2020b. *Mountain Ash Limited Partnership Aggregate Operation – Wetland Assessment and Impact Report*
- SLR. 2020c. *Mountain Ash Limited Partnership Aggregate Operation – Hydrogeological Assessment Report*

## 11.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Mountain Ash Limited Partnership, hereafter referred to as the “Client”. It is intended for the sole and exclusive use of Mountain Ash Limited Partnership. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope of Work and agreement between SLR and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLR is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLR does not warranty the accuracy of information provided by third party sources.



## **Groundwater Monitoring Plan**

Mountain Ash Limited Partnership

Summit Pit

SLR Project No.: 212.06650.00006

Table A1  
Sand and Gravel Monitoring Well Groundwater Quality Results

Parameter	Guideline (CDWQ)	Units	MW14-101	MW14-103		MW18-104	MW18-105	MW18-106	MW18-107	MW19-108	MW19-109	MW19-110
			20-Nov-14	20-Nov-14	4-Aug-15	4-Jul-19	4-Jul-19	4-Jul-19	4-Jul-19	4-Jul-19	5-Jul-19	10-Jul-19
Total Aluminum <sup>1</sup>	0.1 (OG)	mg/L	0.164	5.57	0.109	3.7	5.4	13	7	15	95	10
Total Antimony	0.006 (MAC)	mg/L	<0.00050	<0.00050	<0.00050	0.0049	0.006	0.0048	0.00079	0.0022	0.0034	<0.00060
Total Arsenic	0.01 (MAC)	mg/L	0.00035	0.007858	0.000336	0.0044	0.0056	0.017	0.0076	0.0086	0.071	0.0084
Total Barium	1 (MAC)	mg/L	0.424	0.7	0.332	0.61	2.8	1.1	0.79	1.1	7.2	2.2
Bicarbonate (as HCO <sub>3</sub> )	NV	mg/L	382	380	375	310	320	360	370	390	350	330
Total Boron	5 (MAC)	mg/L	<0.020	<0.020	<0.020	0.025	0.021	<0.020	<0.020	0.029	0.087	<0.020
Total Cadmium	0.005 (MAC)	mg/L	0.000016	0.00029	<0.000005	0.00036	0.0055	0.00095	0.00033	0.00095	0.01	0.0042
Dissolved Calcium	NV	mg/L	76	75	73	63	69	73	71	74	77	62
Chloride	<250 (AO)	mg/L	10.5	7.8	8.8	29.0	13.0	9.3	10.0	14.0	18	8.4
Total Chromium	0.05 (MAC)	mg/L	<0.0010	0.0076	0.0016	0.018	0.0046	0.081	0.025	0.038	0.19	0.019
Total Copper	2 (MAC) / 1 (AO)	mg/L	<0.0010	0.0093	0.0013	0.064	0.11	0.11	0.018	0.038	0.29	0.032
Total Iron	<0.3 (AO)	mg/L	0.28	12	0.22	7.6	49	37	17	29	190	10
Total Lead	0.005 (MAC)	mg/L	0.00031	0.00464	<0.00030	0.0049	0.025	0.019	0.0075	0.024	0.15	0.019
Total Mercury	0.001 (MAC)	mg/L	<0.00010	<0.00010	<0.00020	0.00003	0.0013	0.00032	0.000048	0.000067	0.00208	0.000002
Dissolved Magnesium	NV	mg/L	33.7	33.4	32.6	30	32	31	32	32	37	30
Total Manganese	0.12 (MAC) / 0.02 (AO)	mg/L	0.02	0.93	0.01	0.62	2.90	1.90	0.60	0.74	8.9	7.3
Total Molybdenum	NV	mg/L	0.0008	0.00184	0.00086	0.015	0.0014	0.005	0.0021	0.0065	0.023	0.0015
Total Nickel	NV	mg/L	<0.00050	0.01196	0.00051	0.02	0.015	0.036	0.014	0.047	0.41	0.065
Nitrate-N	10 (MAC)	mg/L	1.19	5.22	1.801	0.97	2.6	2.3	2	2.4	1.7	1.9
Nitrite-N	1 (MAC)	mg/L	<0.05	<0.05	<0.005	0.098	<0.010	<0.010	0.034	0.048	0.065	<0.010
Dissolved Potassium	NV	mg/L	4.8	4.3	3.9	4.1	2.9	3.3	3	3.4	6.3	2.7
pH <sup>2</sup>	7.0 -10.5		7.9	7.8	8	7.91	8.05	7.87	7.8	7.91	8.19	7.82
Total Selenium	0.05 (MAC)	mg/L	<0.00060	0.00112	0.00087	0.00049	0.00093	0.0011	0.00094	0.0013	0.00059	0.00096
Total Silver	NV	mg/L	<0.000070	<0.000070	<0.000070	0.00044	<0.00010	0.0017	0.0001	0.0003	0.0025	<0.00010
Dissolved Sodium	<200 (AO)	mg/L	6	8.8	7.9	13	5.7	9	6.6	12	18	6
Sulphate	<500 (AO)	mg/L	8.88	11.9	10.56	9.2	5.8	7.6	6.6	17	26	8.1
Total Thallium	NV	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	0.00023	0.0002	<0.00020	0.00028	0.0026	0.00024
Total Dissolved Solids (calculated) <sup>3</sup>	<500 (AO)	mg/L	337	354	333	310	300	320	320	350	360	290
Turbidity	1 (OG)	NTU	9.6	680	8	130	>4000	3100	53	670	>4000	<0.10
Total Uranium	0.02 (MAC)	mg/L	0.001697	0.002014	0.001563	0.0019	0.012	0.003	0.0027	0.0047	0.016	0.006
Total Zinc	<5 (AO)	mg/L	<0.020	0.033	<0.020	0.072	0.19	0.13	0.037	0.15	1.2	0.14
Total Coliforms	<1 (MAC)	MPN/100 mL	-	-	<1	>24000	<100	1100	>2400	<10	120000	180
E.Coli	<1 (MAC)	MPN/100 mL	-	-	<1	10	<100	<10	<1.0	<10	100	63

Notes:

NV = no value

OG = Operational Guidance

AO = Aesthetic Objective

MAC = Maximum Allowable Concentration

Canadian Drinking Water Quality CDWQ Guidelines: September 2019

1. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants <0.1 mg/L (100 ug/L), Other Treatment Systems <0.2 mg/L (200 ug/L)

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 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	29-Oct-14	4-Aug-15	30-Oct-14	4-Aug-15	5-Jul-19
Total Aluminum <sup>1</sup>	0.1 (OG)	mg/L	0.0068	0.011	<0.0050	<0.0050	0.006	0.0061	<0.0050	<0.0050	<0.0050	0.0041
Total Antimony	0.006 (MAC)	mg/L	0.00088	<0.00050	0.00059	<0.00050	<0.00060	<0.00050	<0.00050	<0.00050	<0.00050	<0.00060
Total Arsenic	0.01 (MAC)	mg/L	0.000126	0.000132	0.000165	0.000205	<0.00020	0.000143	0.000121	0.000192	0.000194	0.00032
Total Barium	1 (MAC)	mg/L	0.282	0.284	0.128	0.142	0.11	0.221	0.225	0.385	0.391	0.36
Bicarbonate (as HCO <sub>3</sub> )	NV	mg/L	366.6	359.6	380.6	375.1	350	391.6	377.7	371.8	365.2	340
Total Boron	5 (MAC)	mg/L	0.022	<0.020	0.032	<0.020	0.023	<0.020	<0.020	<0.020	<0.020	<0.020
Total Cadmium	0.005 (MAC)	mg/L	0.000013	<0.000005	0.000016	0.000024	0.000029	0.00004	0.000024	0.000008	<0.000005	<0.000020
Dissolved Calcium	NV	mg/L	70.3	68.2	63.6	63.4	55	73.2	69.7	75.3	72	80
Chloride	<250 (AO)	mg/L	4.29	4.49	1.38	1.93	2	10.31	5.88	10.86	10.95	12
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	0.0012
Total Copper	2 (MAC) / 1 (AO)	mg/L	0.0317	0.013	0.0022	0.0016	0.0045	0.125	0.0057	0.0017	0.0018	0.034
Total Iron	<0.3 (AO)	mg/L	0.015	0.014	0.018	0.04	<0.060	<0.010	<0.010	0.017	0.044	0.3
Total Lead	0.005 (MAC)	mg/L	0.00127	0.00048	<0.00030	<0.00030	0.00054	0.00302	<0.00030	<0.00030	<0.00030	0.011
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	39.9	35.5	35.2	31.5	35
Total Manganese	0.12 (MAC) / 0.02 (AO)	mg/L	<0.0010	<0.0010	0.004	0.0042	0.012	0.0014	<0.0010	<0.0010	<0.0010	<0.0040
Total Molybdenum	NV	mg/L	0.00148	0.00147	0.00222	0.00193	0.0014	0.00113	0.00104	0.00076	0.00066	0.00065
Total Nickel	NV	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	0.00174	<0.00050	<0.00050	<0.00050	<0.00050
Nitrate-N	10 (MAC)	mg/L	1.67	1.658	0.78	1.054	0.37	1.87	1.889	3.02	3.314	3.2
Nitrite-N	1 (MAC)	mg/L	<0.05	<0.005	<0.05	<0.005	<0.010	<0.05	<0.005	<0.05	<0.005	<0.010
Dissolved Potassium	NV	mg/L	3.3	3.2	2.8	2.6	2	3.1	3	3.1	2.9	3
pH <sup>2</sup>	7.0 -10.5		8.1	8	8	8.1	7.95	7.9	8	8	8	8.13
Total Selenium	0.05 (MAC)	mg/L	0.00084	<0.00060	0.00112	0.00105	0.00052	0.0007	0.00085	0.0018	0.00096	0.00093
Total Silver	NV	mg/L	<0.000070	<0.00007	<0.00007	<0.00007	<0.00010	<0.00007	<0.00007	<0.00007	<0.00007	0.00012
Dissolved Sodium	<200 (AO)	mg/L	7.2	7	13.8	9.3	17	7.8	7.6	7.1	6.5	7.7
Sulphate	<500 (AO)	mg/L	6.95	7.51	15.82	12.85	20	10.33	11.09	7.66	6.77	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
Total Dissolved Solids (calculated) <sup>3</sup>	<500 (AO)	mg/L	318	310	328	317	300	349	330	339	328	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	0.001744	0.001688	0.001785	0.001672	0.0021
Total Zinc	<5 (AO)	mg/L	<0.020	<0.020	0.024	<0.020	0.046	0.205	<0.020	0.029	0.031	0.99
Total Coliforms	<1 (MAC)	MPN/100 mL	-	<1	-	<1	1	-	<1	-	<1	<b>11</b>
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

1. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants <0.1 mg/L (100 ug/L), Other Treatment Systems <0.2 mg/L (200 ug/L)

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 (CWQG PAL Freshwater)	Units	BHS1		
			30-Oct-14	4-Aug-15	10-Jul-19
Hardness (as CaCO <sub>3</sub> )	NV	mg/L	336	317	200
Total Aluminum <sup>1</sup>	0.1	mg/L	0.0182	0.0144	<b>0.3</b>
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 HCO <sub>3</sub> )	NV	mg/L	376.1	371	240
Total Boron <sup>2</sup>	1.5	mg/L	0.024	<0.020	<0.020
Total Cadmium <sup>3</sup>	0.00009	mg/L	0.000032	0.000008	0.000034
Dissolved Calcium	NV	mg/L	74.1	72	48
Chloride <sup>4</sup>	120	mg/L	9.6	10.12	8.2
Total Chromium <sup>5</sup>	0.001	mg/L	<0.0010	<0.0010	0.001
Total Copper <sup>6</sup>	0.004	mg/L	<0.0010	0.001	0.0013
Total Iron	0.3	mg/L	0.027	0.019	0.25
Total Lead <sup>7</sup>	0.007	mg/L	<0.00030	<0.00030	<0.00020
Total Mercury	0.000026	mg/L	<b>&lt;0.00010</b>	<b>&lt;0.00020</b>	0.0000025
Dissolved Magnesium	NV	mg/L	36.7	33.3	20
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 <sup>8</sup>	0.15	mg/L	<0.00050	<0.00050	0.00088
Nitrate-N <sup>9</sup>	2.9	mg/L	2.83	<b>3.037</b>	1.4
Nitrite-N	0.06	mg/L	<0.05	<0.005	<0.010
Dissolved Potassium	NV	mg/L	3.4	3.3	4.8
pH	6.5-9		8.2	8.2	8.07
Total Selenium	0.001	mg/L	<b>0.00218</b>	<b>0.0013</b>	0.00068
Total Silver	0.00025	mg/L	<0.000070	<0.000070	<0.00010
Dissolved Sodium	NV	mg/L	7.8	7.5	5
Sulphate	NV	mg/L	9.36	8.36	4.7
Total Thallium	0.0008	mg/L	<0.00020	<0.00020	<0.00020
Total Dissolved Solids (calculated) <sup>10</sup>	NV	mg/L	342	334	210
Turbidity	NV	NTU	0.8	1.07	5.1
Total Uranium <sup>11</sup>	0.015	mg/L	0.001953	0.001875	0.0013
Total Zinc	0.007	mg/L	<b>&lt;0.020</b>	<b>&lt;0.020</b>	<0.0030
Total Coliforms	NV	MPN	-	2420	>2400
E.Coli	NV	MPN	-	1733	1600

**Notes:**

NV = no value

Canadian Water Quality Guidelines (CWQG) Protection for Aquatic Life (PAL) Freshwater Guidelines Updated to September 2019

1. Aluminum Guideline (CWQG Aquatic Life - Freshwater): if pH < 6.5 then 0.005 mg/L (5 ug/L), else if pH >= 6.5 then 0.1 mg/L (100 ug/L)

2. Boron Guideline value is for long term exposure. Short term exposure value is 29 mg/L

3. Cadmium Guideline value is for long term exposure. Short term exposure value is 0.001 mg/L

4. Chloride Guideline value is for long term exposure. Short term exposure value is 640 mg/L

5. Chromium Guideline value is for hexavalent chromium as conservative value. Trivalent chromium guideline is 0.0089 mg/L.

6. Copper Guideline (CWQG Aquatic Life - Freshwater): if hardness (as CaCO<sub>3</sub>) < 82 mg/L then 0.002 mg/L (2 ug/L), if CaCO<sub>3</sub> = 83-180 mg/L then is calculated using an equation, if CaCO<sub>3</sub> > 180 mg/L then 0.004 mg/L (4 ug/L),

7. Lead Guideline (CWQG Aquatic Life - Freshwater): if hardness (as CaCO<sub>3</sub>) < 60 mg/L then 0.001 mg/L (1 ug/L), if CaCO<sub>3</sub> = 60-180 mg/L then is calculated using an equation, if CaCO<sub>3</sub> > 180 mg/L then 0.007 mg/L (7 ug/L)

8. Nickel Guideline (CWQG Aquatic Life - Freshwater): if hardness (as CaCO<sub>3</sub>) < 60 mg/L then 0.025 mg/L (25 ug/L), if CaCO<sub>3</sub> = 60-180 mg/L then is calculated using an equation, if CaCO<sub>3</sub> > 180 mg/L then 0.150 mg/L (150 ug/L),

9. Nitrate Canadian Water Quality Guidelines (CWQG) for Aquatic Life represents lower value for "Long Term Exposure". Short Term exposure value is 124 for Freshwater

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

11. Uranium Guideline value is for long term exposure. Short term exposure value is 0.033 mg/L

**BOLD RED** – Indicates Exceeds guideline

---



# Drawings

## **Groundwater Monitoring Plan**

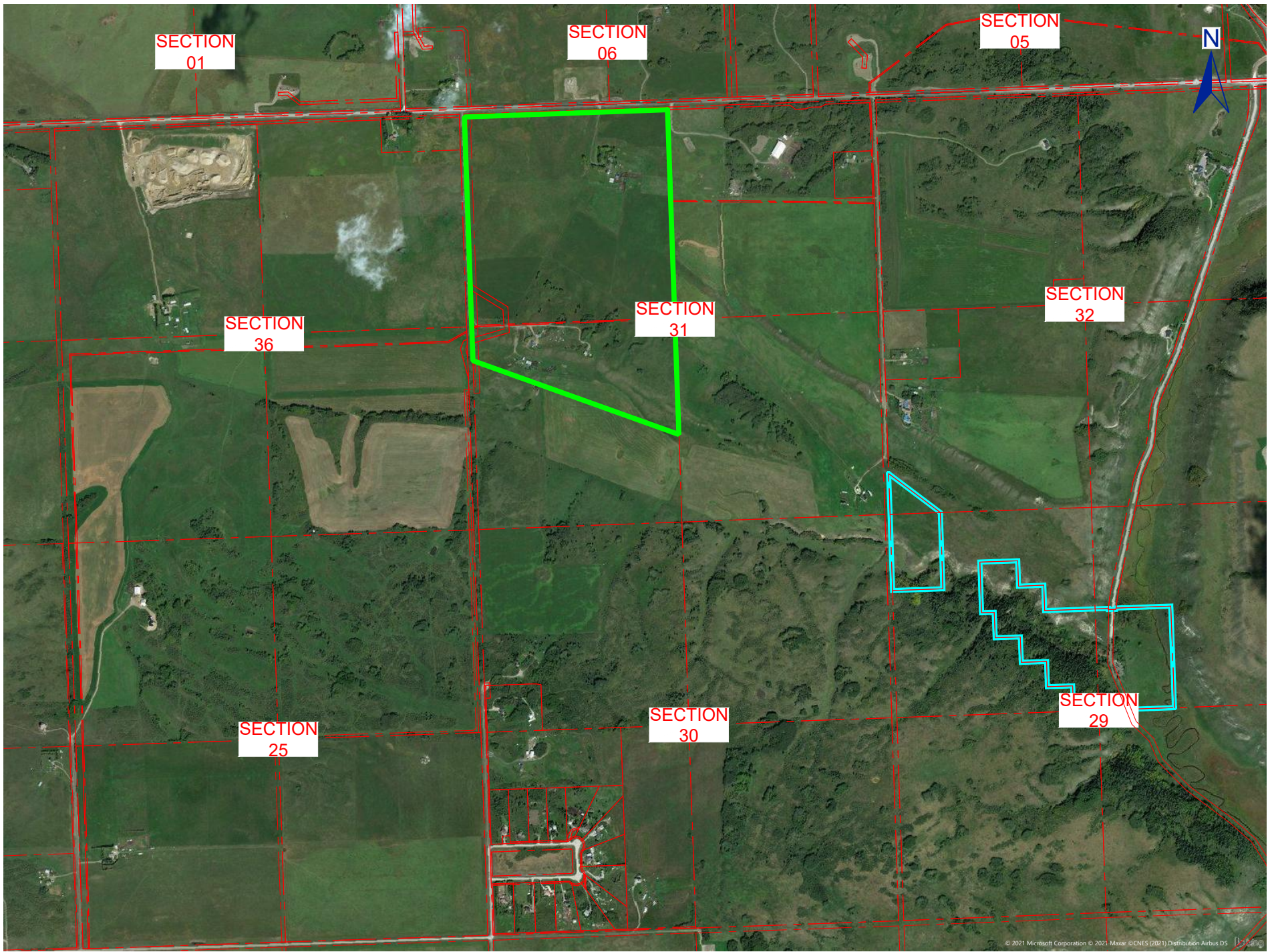
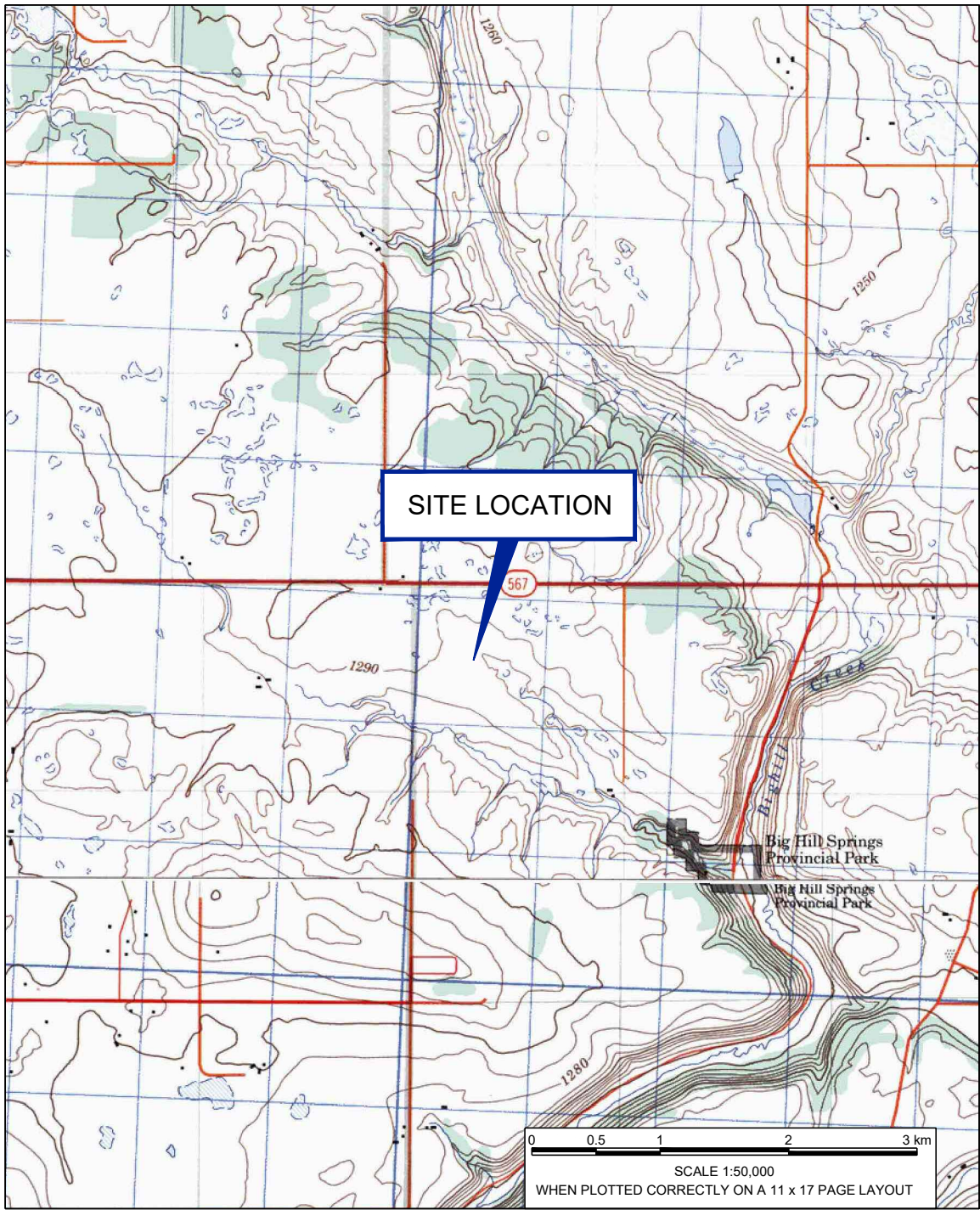
Mountain Ash Limited Partnership

Summit Pit

SLR Project No.: 212.06650.00006



Cadfile name: S\_212-06650-00006-A1.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
- SUBJECT BOUNDARY
- 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: April 16, 2021

Project No. 212.06650.00006

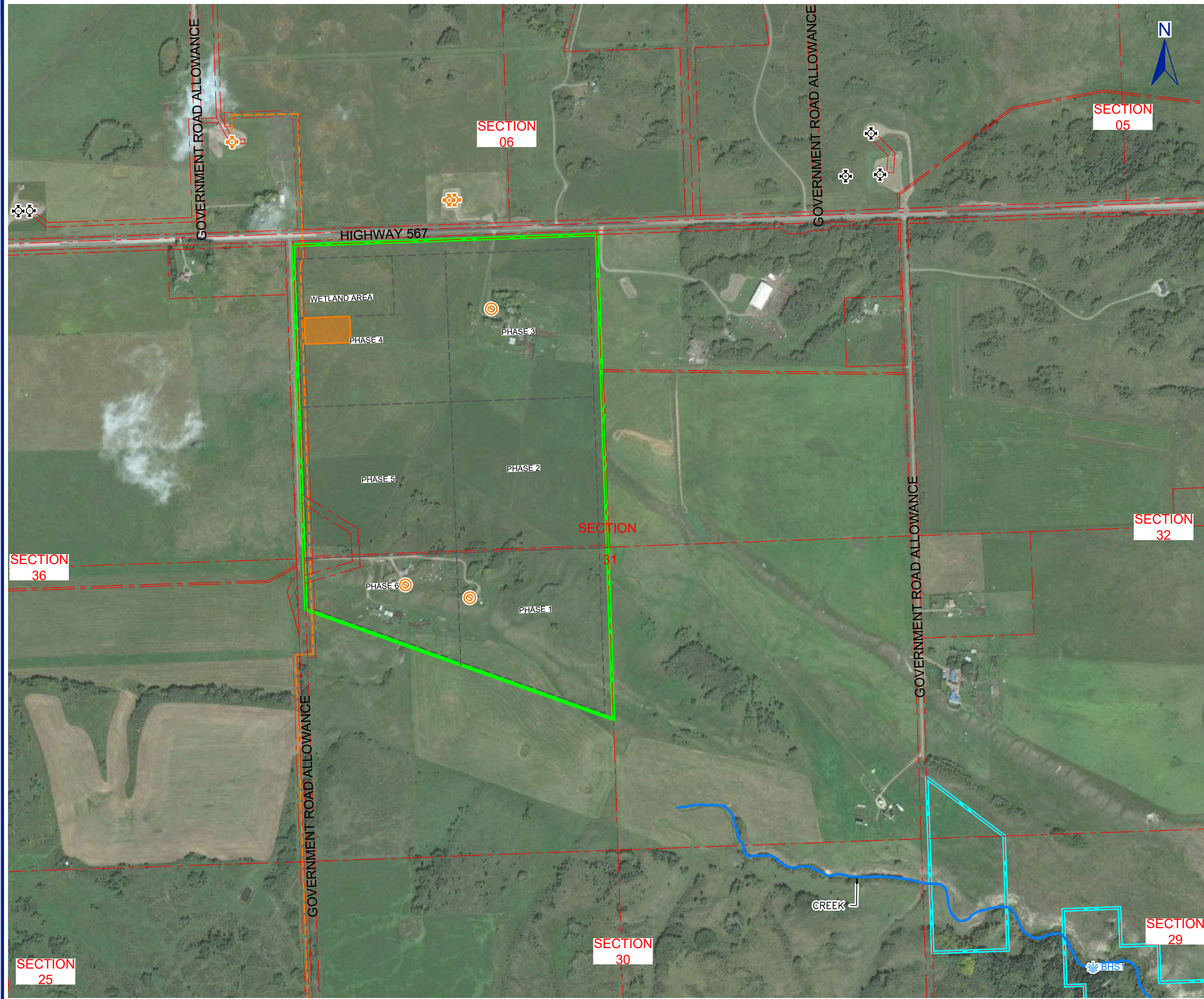
Drawing No.

1





Cadfile name: S\_212-06650-00006-A1.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

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**

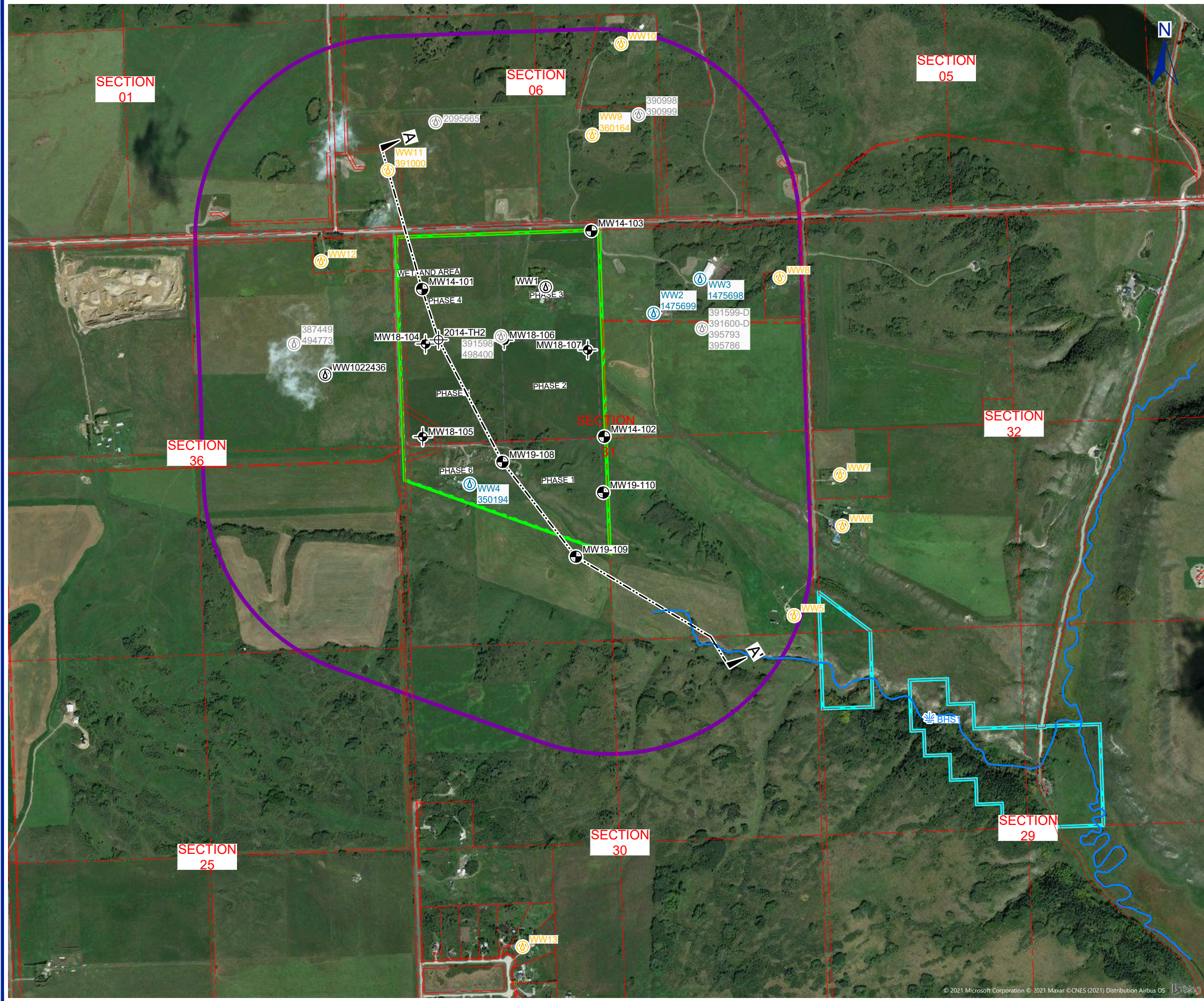
**CURRENT AND HISTORICAL POTENTIAL  
SOURCES OF GROUNDWATER CONTAMINATION**

Date: April 16, 2021	Drawing No. <b>2</b>
Project No. 212.06650.00006	

**SLR**



Cadfile name: S\_212-06650-00006-A1.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
- 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: April 16, 2021

Project No. 212.06650.00006

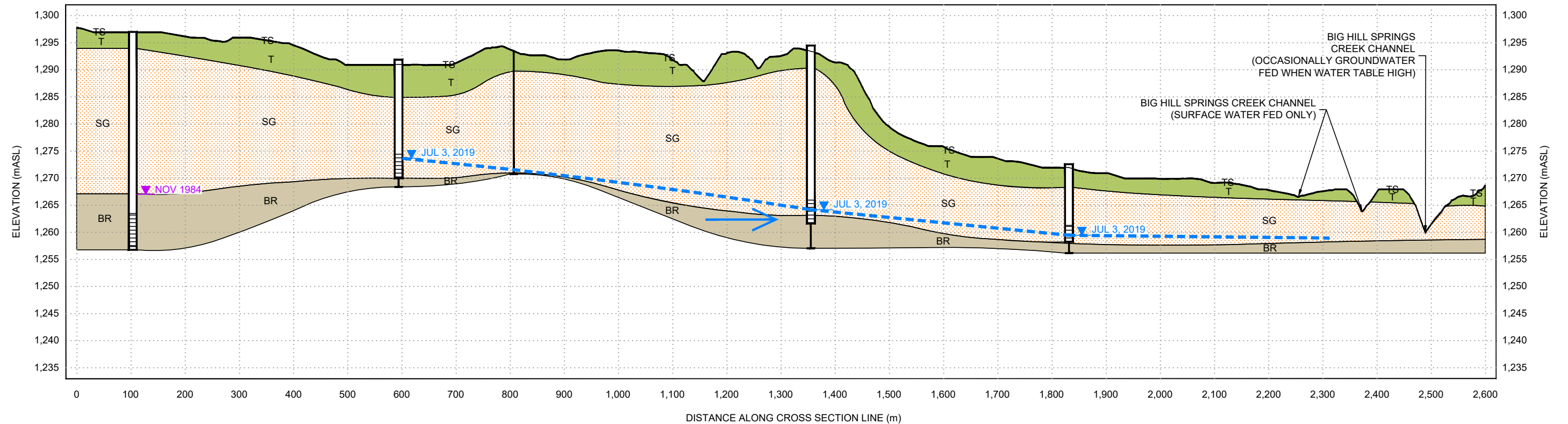
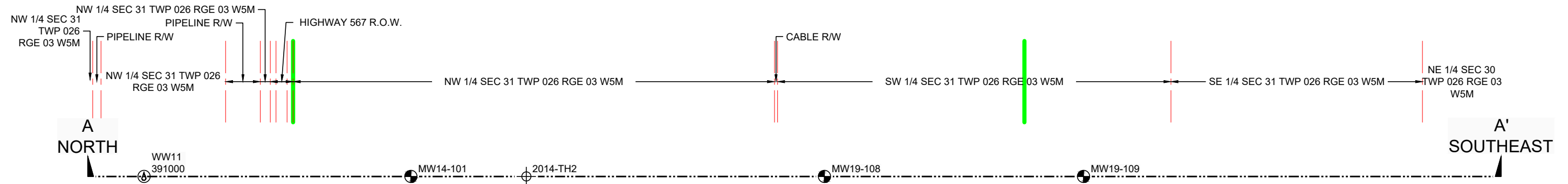
Drawing No.

3





Cadfile name: S\_212-06650-00006-A1.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: April 16, 2021

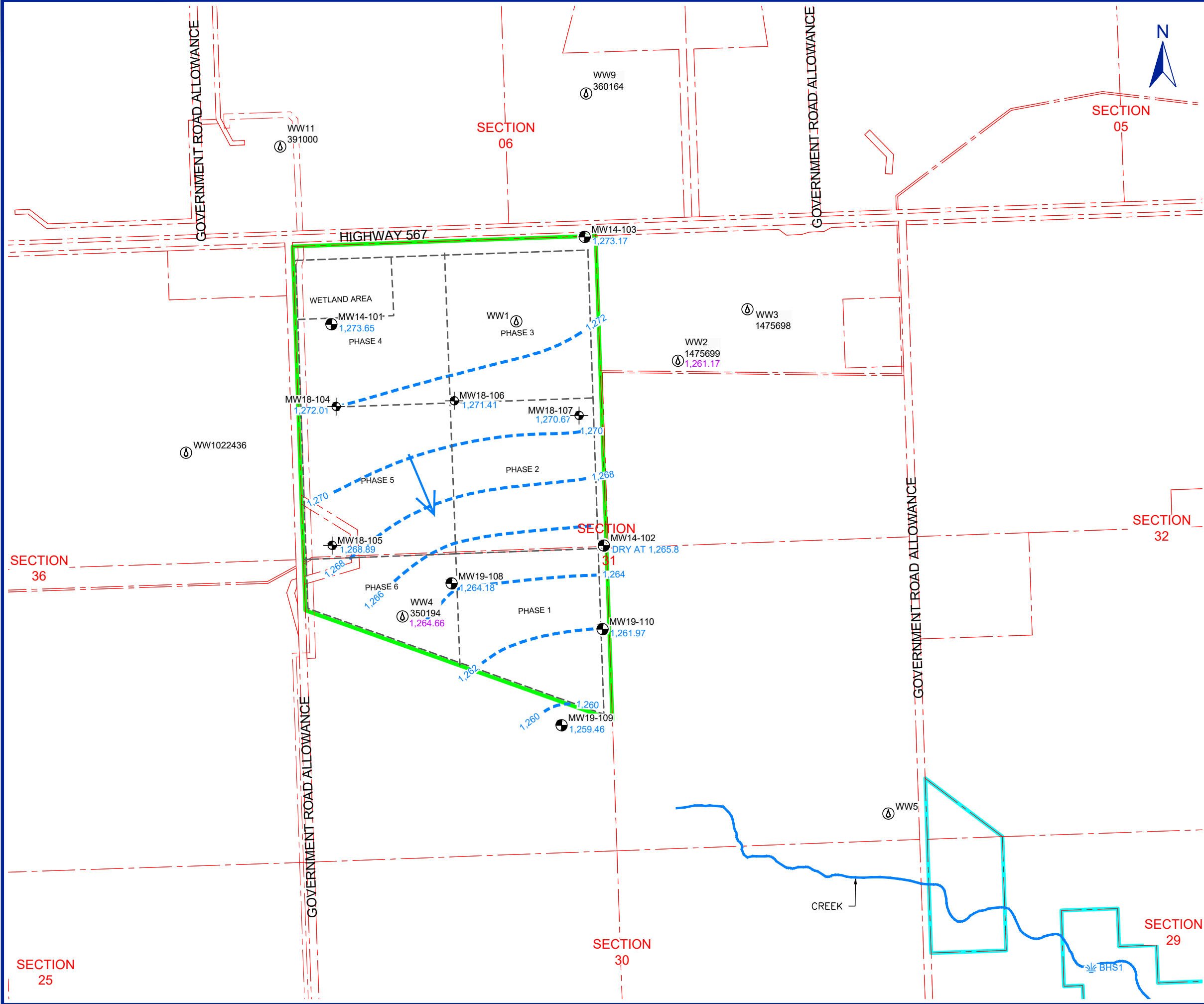
Project No. 212.06650.00006

Drawing No.

4

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





**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  
1,260.73  
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**

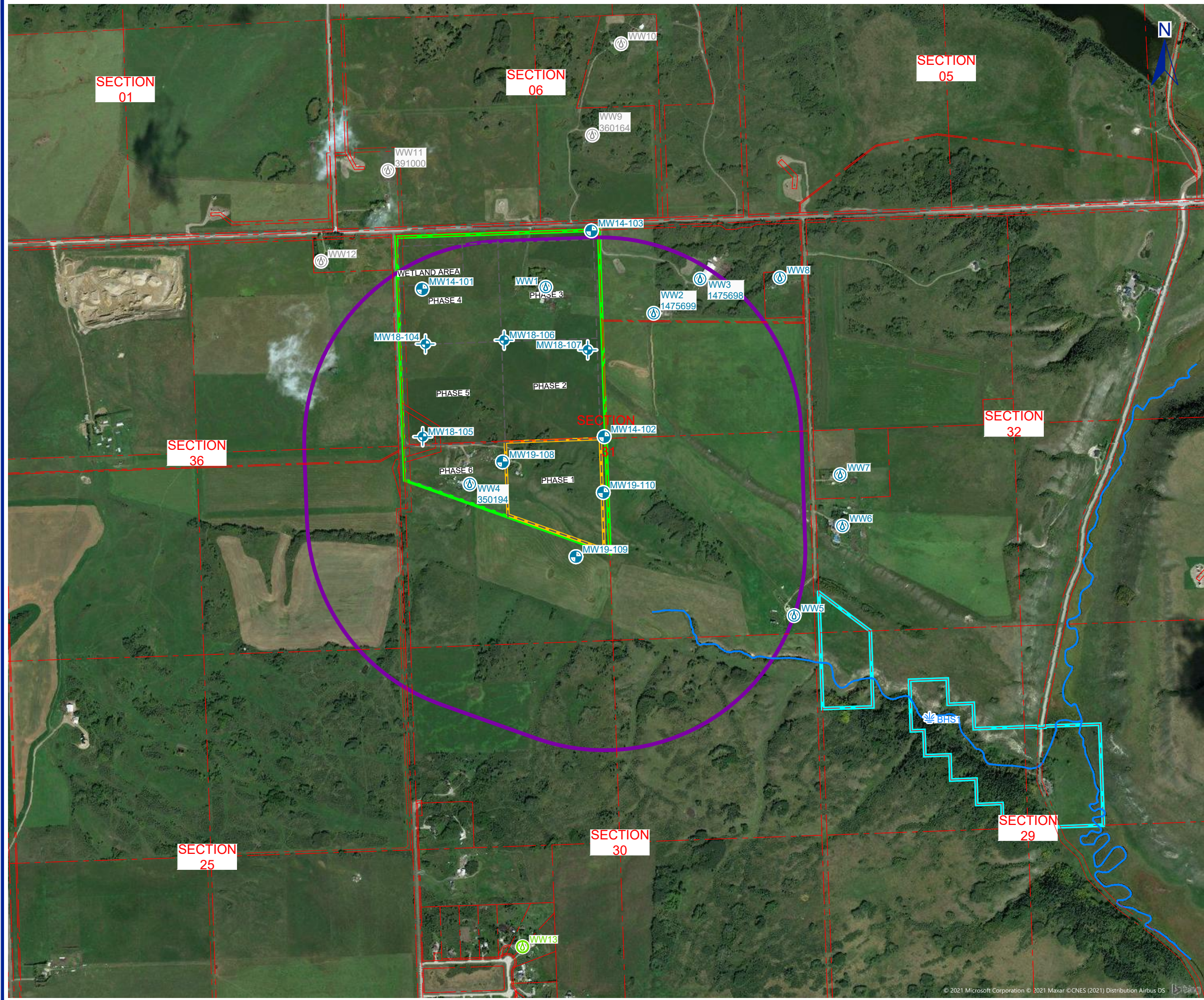
**GROUNDWATER ELEVATIONS (JULY 3, 2019)**

Date: April 16, 2021	Drawing No. 5
Project No. 212.06650.00006	

**SLR**



Cadfile name: S\_212-06650-00006-A1.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
- PHASE I EXTRACTION 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**

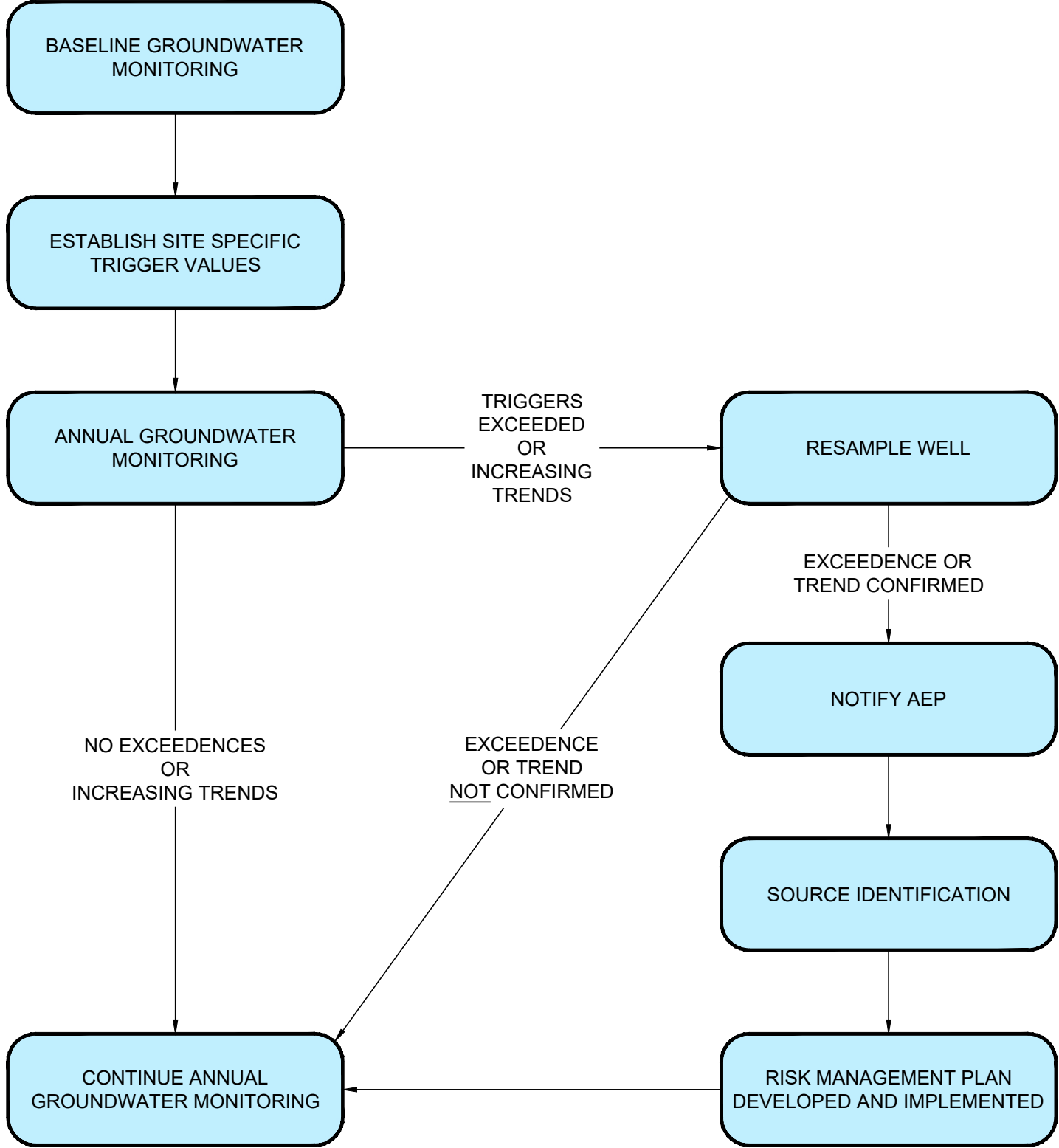
**PHASE I MONITORING LOCATION PLAN**

Date: April 16, 2021	Drawing No. <b>6</b>
Project No. 212.06650.00006	

**SLR**



Cadfile name: S\_212-06650-00006-A1.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: April 16, 2021

Project No. 212.06650.00006

Drawing No.

7





## Appendix A

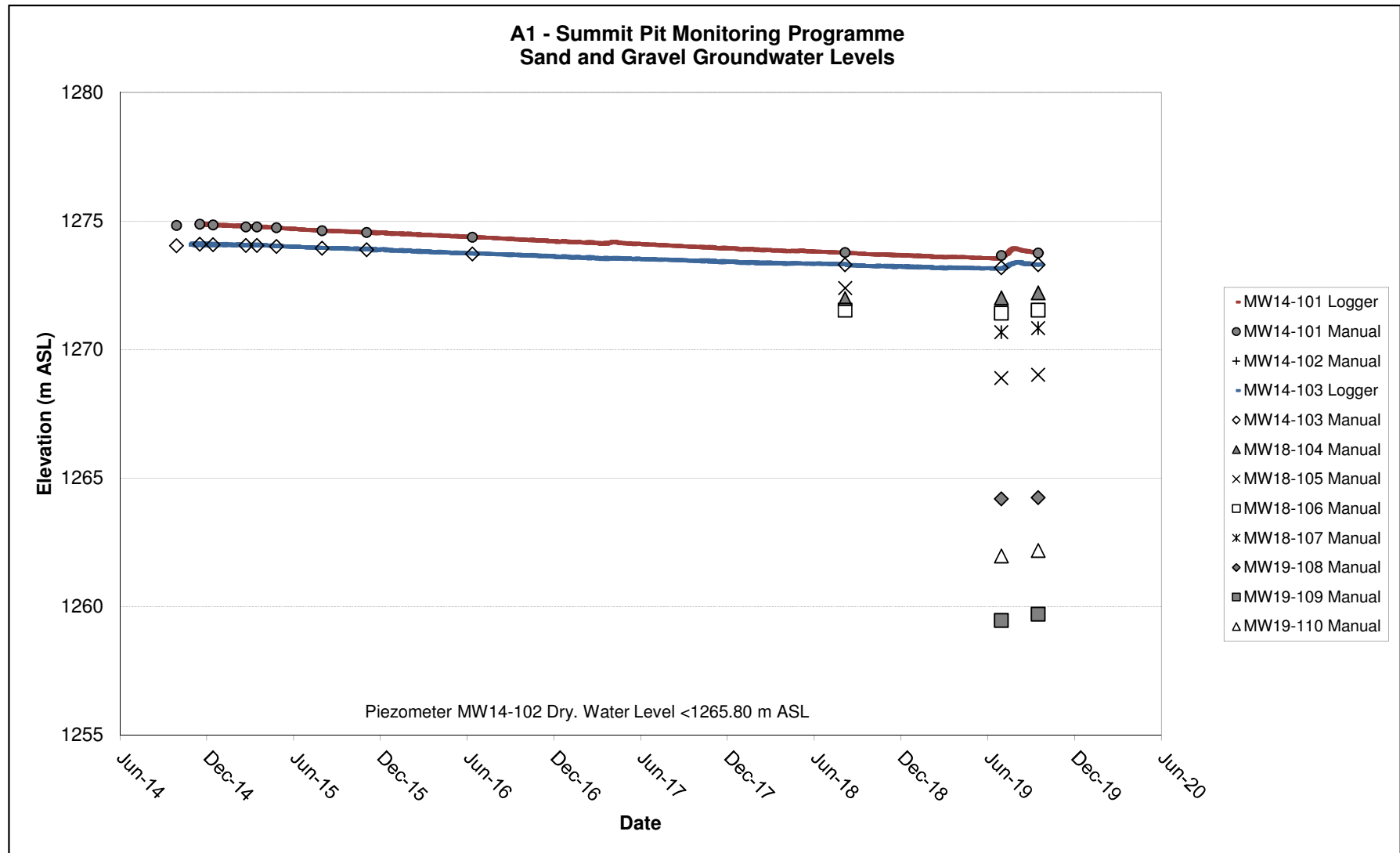
# Groundwater Hydrographs

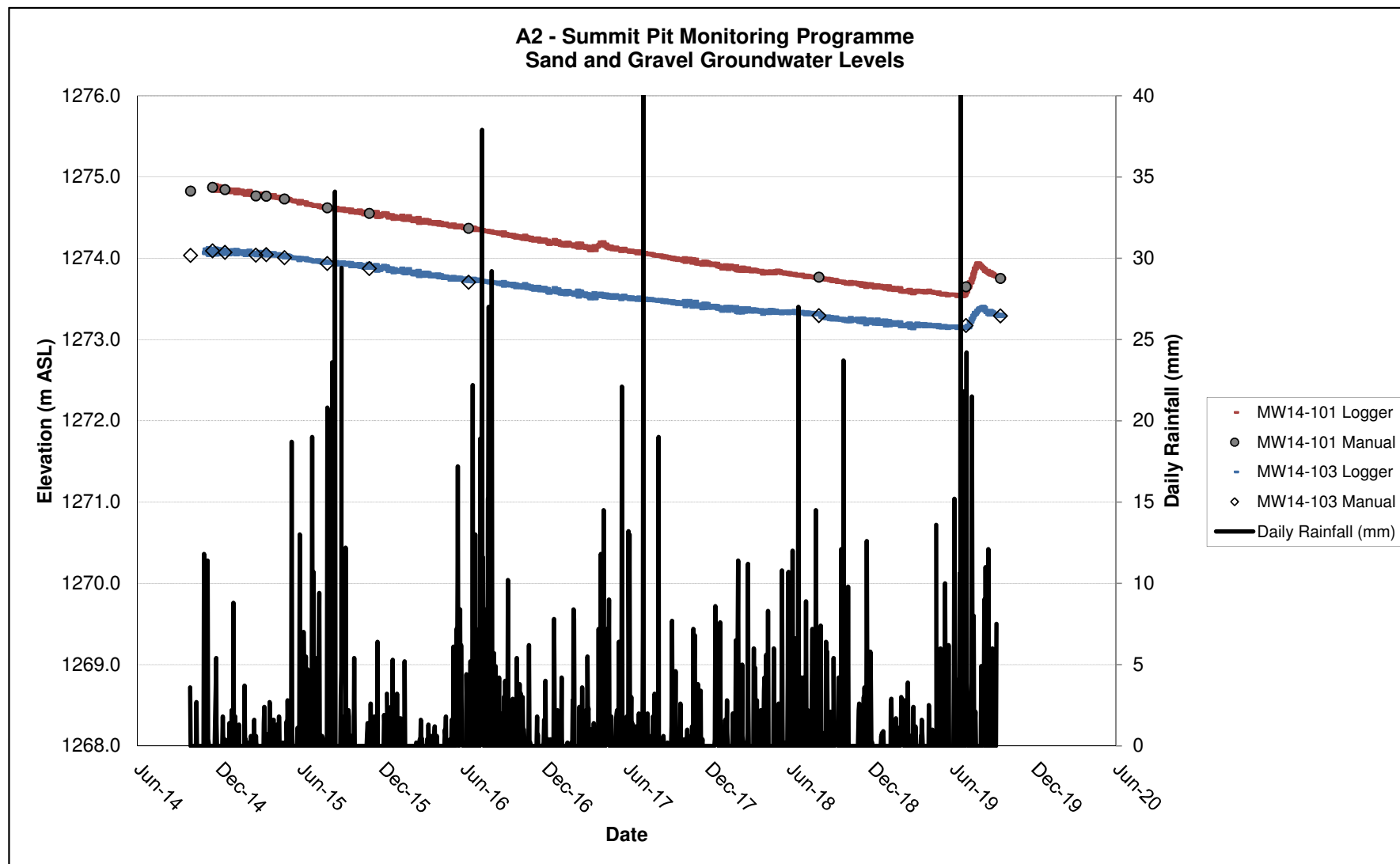
### **Groundwater Monitoring Plan**

Mountain Ash Limited Partnership

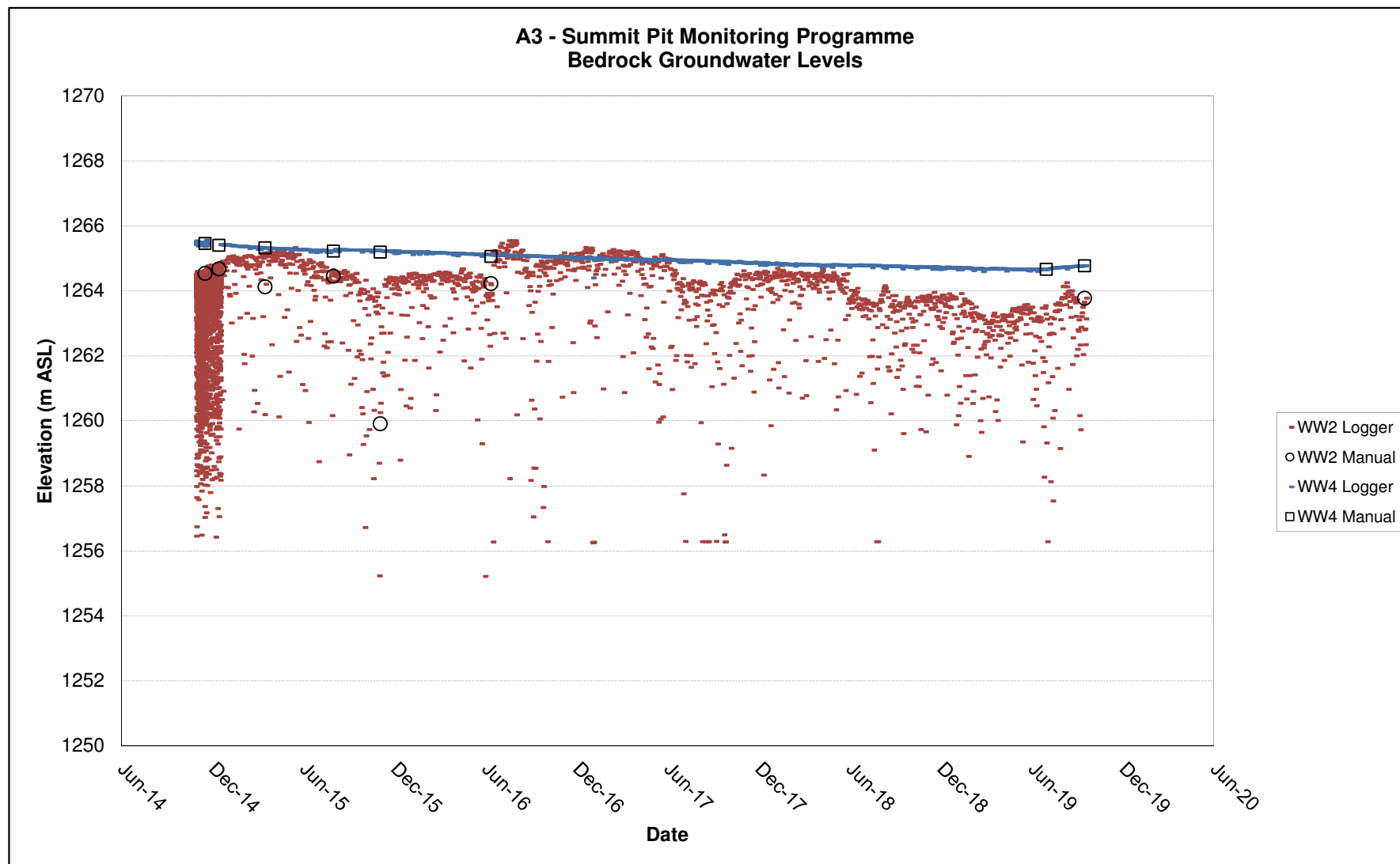
Summit Pit

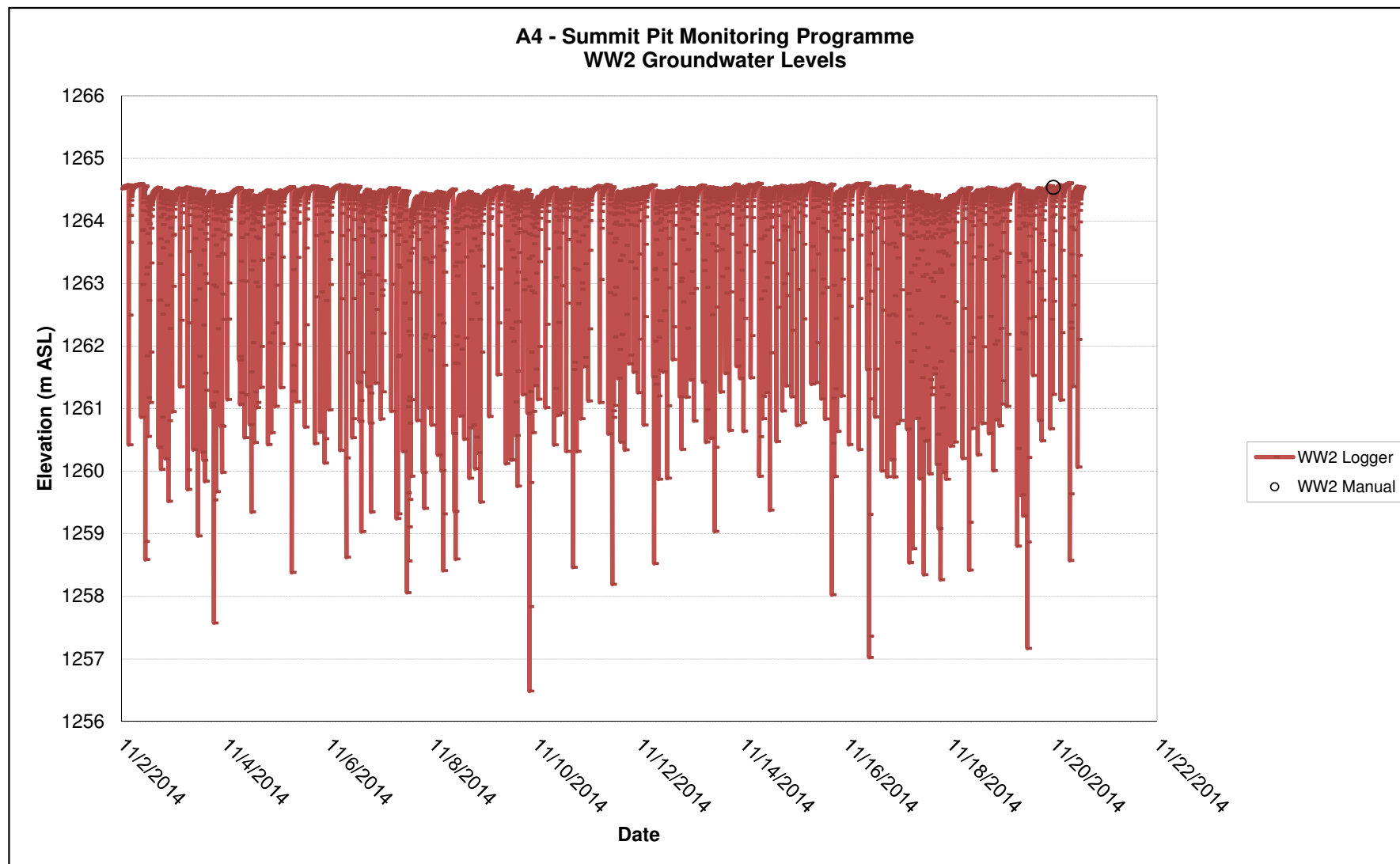
SLR Project No.: 212.06650.00006

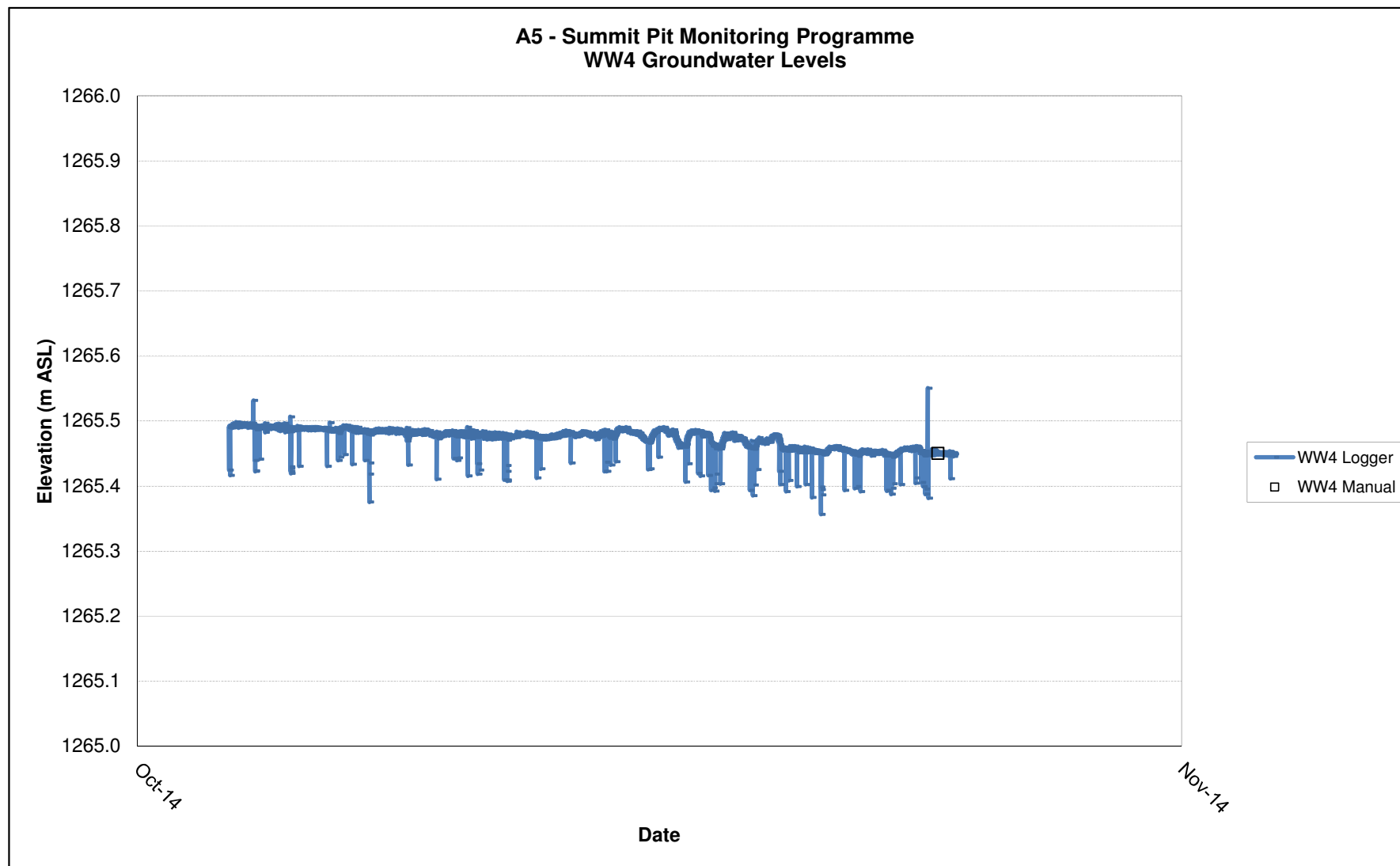














## Appendix B

# Alberta Water Well Records

### **Groundwater Monitoring Plan**

Mountain Ash Limited Partnership

Summit Pit

SLR Project No.: 212.06650.00006



# 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)
<a href="#">350194</a>	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
<a href="#">360164</a>	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
<a href="#">387449</a>	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
<a href="#">390998</a>	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
<a href="#">390999</a>	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
<a href="#">391000</a>	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
<a href="#">391598</a>	NW	31	26	3	5	PARSONS DRILLING		39.62	New Well	Domestic & Stock				MURRAY, R.J.			17.78
<a href="#">391599</a>	NE	31	26	3	5	KRIEGER DRILLING LTD.		49.38	New Well- Decommissioned	Investigation		14		PARKER, G.L.	0.00		0.00
<a href="#">391600</a>	NE	31	26	3	5	KRIEGER DRILLING LTD.	1981-10-14	27.43	New Well- Decommissioned	Domestic		9		PARKER, G.L.			0.00
<a href="#">395786</a>	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
<a href="#">395793</a>	NE	31	26	3	5	UNKNOWN DRILLER		62.48	Chemistry	Domestic				KIRK, S.			0.00
<a href="#">494773</a>	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
<a href="#">498400</a>	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
<a href="#">1022436</a>	9	36	26	4	5	AARON DRILLING INC.	2014-05-05	30.48	New Well	Investigation		6		LAFARGE CANADA INC			16.81
<a href="#">1475698</a>	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
<a href="#">1475699</a>	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
<a href="#">2095665</a>	SW	6	27	3	5	UNKNOWNDRILLINGCOMP11		25.60	Well Inventory	Domestic & Stock		1		CIRCLE J RANCHES LTD			

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

Drilling Information	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> 0.00 L/min				
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		
1990/03/09	54.55	15.24		

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

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

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	
<b>Owner Name</b> BARGETZI, ERNIE		<b>Address</b> 233 RATCLIFF PLACE SE, CALGARY			<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b>	
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
	SE	06	027	03	5		2	9110979			
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> <u>136.38 L/min</u>				
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		
1991/10/08	136.38	33.53		

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

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



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	
<b>Owner Name</b> BRISTOW, C.R.		<b>Address</b> COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b>		
<b>Location</b>	<b>1/4 or LSD</b> NE	<b>SEC</b> 36	<b>TWP</b> 026	<b>RGE</b> 04	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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
<b>Recommended Pump Rate</b> <u>0.00</u> L/min			
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>	
1962/08/10	72.74	21.95	

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

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

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 _____										
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	Drawdown (m)	Elapsed Time
1962/08/10	12:00 AM	21.95 m		Minutes:Sec
				Recovery (m)
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	
<b>Owner Name</b> STRANGE, R.		<b>Address</b> P.O. BOX 981 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>		<b>Postal Code</b> T0L 0W0	
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
	SE	06	027	03	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> <u>27.28 L/min</u>				
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		
1987/02/11	36.37	45.72		

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

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

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 _____					Is Flow Control Installed _____					
Rate _____ L/min					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 _____										
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	Recovery (m)
1987/02/11	12:00 AM	45.72 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	
<b>Owner Name</b> STRANGE, R.		<b>Address</b> P.O. BOX 981 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>		<b>Postal Code</b> T0L 0W0	
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
	SE	06	027	03	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b>		<u>31.82 L/min</u>		
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		
1987/11/19	45.46	39.62		

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

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

Well Identification and Location										Measurement in Metric
<b>Owner Name</b> STRANGE, R.		<b>Address</b> P.O. BOX 981 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b> T0L 0W0	
<b>Location</b>	<b>1/4 or LSD</b> SE	<b>SEC</b> 06	<b>TWP</b> 027	<b>RGE</b> 03	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>	
<b>Measured from Boundary of</b> _____ m from _____ m from					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> 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 Artesian Flow _____					Is Flow Control Installed _____					
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					Sample Collected for Potability _____ Submitted to ESRD _____					
WATER OCCURES AT 130-132' @ 1 GPM, 210-234' @ 8-10 GPM.										

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		
			Drawdown (m)	Elapsed Time Minutes:Sec
				Recovery (m)
<b>Method of Water Removal</b>				
Type Air _____				
Removal Rate _____ 45.46 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 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	
<b>Owner Name</b> CIRCLE J RANCHES		<b>Address</b> RR2, COCHRANE			<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b>	
<b>Location</b>	<b>1/4 or LSD</b> 04	<b>SEC</b> 06	<b>TWP</b> 027	<b>RGE</b> 03	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> _____ 0.00 L/min				
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		
1984/11/07	68.19	28.96		

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

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



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 _____					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 <u>Yes</u>			

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

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

Drilling Information	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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			
<b>Borehole</b>			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	39.62	
<b>Surface Casing (if applicable)</b>		<b>Well Casing/Liner</b>	
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 : _____	
<b>Perforations</b>			
From (m)	To (m)	Diameter or Slot Width(cm)	Hole or Slot Interval(cm)
31.09	38.10	0.000	0.00
Perforated by _____			
<b>Annular Seal</b> Drive Shoe			
Placed from _____ 0.00 m to _____ 0.00 m			
Amount _____			
Other Seals			
Type		At (m)	
<b>Screen Type</b>			
Size OD : _____ 0.00 cm			
From (m)	To (m)	Slot Size (cm)	
Attachment _____			
Top Fittings _____		Bottom Fittings _____	
<b>Pack</b>			
Type _____		Grain Size _____	
Amount _____			

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



Well Identification and Location										Measurement in Metric
<b>Owner Name</b> PARKER, G.L.		<b>Address</b> P.O. BOX 123 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b> T0L 0W0	
<b>Location</b>	<b>1/4 or LSD</b> NE	<b>SEC</b> 31	<b>TWP</b> 026	<b>RGE</b> 03	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>	
<b>Measured from Boundary of</b> _____ m from _____ m from					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well-Abandoned
<b>Proposed Well Use</b> 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			0.00 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			
<b>Borehole</b>			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	49.38	
<b>Surface Casing (if applicable)</b>		<b>Well Casing/Liner</b>	
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
<b>Perforations</b>			
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)
Perforated by			
<b>Annular Seal</b> Driven			
Placed from 0.00 m to 0.00 m			
Amount			
Other Seals			
Type		At (m)	
<b>Screen Type</b>			
Size OD : 0.00 cm			
From (m)	To (m)	Slot Size (cm)	
Attachment			
Top Fittings		Bottom Fittings	
<b>Pack</b>			
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 _____											
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											
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
KRIEGER DRILLING LTD.	Date approval holder signed

GIC Well ID 391600  
GoA Well Tag No.  
Drilling Company Well ID  
Date Report Received 1981/11/25

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

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

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	
<b>Recommended Pump Rate</b> _____ L/min				
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>		

Well Completion				Measurement in Metric	
<b>Total Depth Drilled</b>	<b>Finished Well Depth</b>	<b>Start Date</b>	<b>End Date</b>		
27.43 m		1981/10/11	1981/10/14		
<b>Borehole</b>					
<b>Diameter (cm)</b>	<b>From (m)</b>	<b>To (m)</b>			
0.00	0.00	27.43			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
<b>Size OD :</b> _____ 0.00 cm		<b>Size OD :</b> _____ 0.00 cm			
<b>Wall Thickness :</b> _____ 0.000 cm		<b>Wall Thickness :</b> _____ 0.000 cm			
<b>Bottom at :</b> _____ 0.00 m		<b>Top at :</b> _____ 0.00 m			
		<b>Bottom at :</b> _____ 0.00 m			
<b>Perforations</b>					
<b>From (m)</b>	<b>To (m)</b>	<b>Diameter or Slot Width (cm)</b>	<b>Slot Length (cm)</b>	<b>Hole or Slot Interval (cm)</b>	
Perforated by _____					
<b>Annular Seal</b>					
Placed from _____ 0.00 m to _____ 0.00 m					
Amount _____					
Other Seals					
Type			At (m)		
<b>Screen Type</b>					
Size OD : _____ 0.00 cm					
<b>From (m)</b>	<b>To (m)</b>	<b>Slot Size (cm)</b>			
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
<b>Pack</b>					
Type _____			Grain Size _____		
Amount _____					

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

Well Identification and Location										Measurement in Metric
<b>Owner Name</b> PARKER, G.L.		<b>Address</b> P.O. BOX 123 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>	<b>Postal Code</b> T0L 0W0	
<b>Location</b>	1/4 or LSD NE	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description	
<b>Measured from Boundary of</b> _____ m from _____ _____ m from _____					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> 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		
<b>Method of Water Removal</b>				
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	
<b>Owner Name</b> PARKER, G.L.		<b>Address</b> P.O. BOX 123 COCHRANE		<b>Town</b>		<b>Province</b>		<b>Country</b>		<b>Postal Code</b>	
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
	NE	31	026	03	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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		
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
0.00	0.00	62.48			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
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
<b>Perforations</b>					
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					
<b>Annular Seal</b> Drive Shoe					
Placed from		0.00 m	to		13.72 m
Amount _____					
Other Seals					
Type			At (m)		
<b>Screen Type</b>					
Size OD :		0.00 cm			
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings		Bottom Fittings			
<b>Pack</b>					
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										
Well Disinfected Upon Completion _____										
Gas _____										
Depth _____ m										
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
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

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									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	
<b>Method of Drilling</b> Unknown	<b>Type of Work</b> Chemistry
<b>Proposed Well Use</b> 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			
<b>Borehole</b>			
Diameter (cm)	From (m)	To (m)	
0.00	0.00	62.48	
<b>Surface Casing (if applicable)</b>		<b>Well Casing/Liner</b>	
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
<b>Perforations</b>			
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)
Perforated by _____			
<b>Annular Seal</b>			
Placed from _____ 0.00 m to _____ 0.00 m			
Amount _____			
Other Seals			
Type		At (m)	
<b>Screen Type</b>			
Size OD : _____ 0.00 cm			
From (m)	To (m)	Slot Size (cm)	
Attachment _____			
Top Fittings _____		Bottom Fittings _____	
<b>Pack</b>			
Type _____		Grain Size _____	
Amount _____			

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

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	
<b>Owner Name</b> GOETJEN, MORRIE		<b>Address</b> RR1, AIRDRIE		<b>Town</b>		<b>Province</b>		<b>Country</b> CANADA	<b>Postal Code</b> T4B 2A3		
<b>Location</b>	<b>1/4 or LSD</b> NE	<b>SEC</b> 36	<b>TWP</b> 26	<b>RGE</b> 4	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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
<b>Recommended Pump Rate</b> <u>36.37 L/min</u>			
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>	
1999/11/16	63.65	22.25	

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

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



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

Drilling Information	
<b>Method of Drilling</b> Cable Tool	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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
<b>Recommended Pump Rate</b> <u>9.09</u> L/min			
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>	
2001/05/14	9.09	10.82	

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

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



Well Identification and Location

Measurement in Metric

Owner Name

Address

Town

Province

Country

Postal Code

GIBBS, DAVE
P.O. BOX 1773 SPRUCE VIEW

TOM 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

Longitude

Elevation

m from

How Location Obtained

How Elevation Obtained

51.267033

-114.414280

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

Pump Installed

Depth

m

Recommended Pump Intake Depth (From TOC)

71.63 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

DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 1'.

Yield Test

Taken From Ground Level

Measurement in Metric

Test Date

Start Time

Static Water Level

2001/05/14
12:00 AM
10.82 m

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

Drawdown (m)

Elapsed Time

Minutes:Sec

Recovery (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

Water Diverted for Drilling

Water Source

Amount Taken

L

Diversion Date & Time

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

MEDICINE VALLEY WATER WELLS

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	
<b>Owner Name</b> LAFARGE CANADA INC		<b>Address</b> 115 QUARRY PARK BLVD			<b>Town</b> CALGARY		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T2C 5G9	
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
	9	36	26	4	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary - Air	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> _____ L/min				
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		

Well Completion				Measurement in Metric	
<b>Total Depth Drilled</b>	<b>Finished Well Depth</b>	<b>Start Date</b>	<b>End Date</b>		
30.48 m	28.35 m	2014/05/01	2014/05/05		
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
20.02	0.00	25.60			
15.56	25.60	30.48			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
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			
<b>Perforations</b>					
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)	
Perforated by					
<b>Annular Seal</b> 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			
<b>Screen Type</b> 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>			
<b>Pack</b>					
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	
<b>Owner Name</b> LAFARGE CANADA INC		<b>Address</b> 115 QUARRY PARK BLVD			<b>Town</b> CALGARY		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T2C 5G9	
<b>Location</b>	<b>1/4 or LSD</b> 9	<b>SEC</b> 36	<b>TWP</b> 26	<b>RGE</b> 4	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>		
<b>Measured from Boundary of</b> _____ m from _____ _____ m from _____					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> Latitude <u>51.265686</u> Longitude <u>-114.424418</u> How Location Obtained Hand held autonomous GPS 20-30m				Elevation _____ m How Elevation Obtained Hand held autonomous GPS 20-30m		

Additional Information										Measurement in Metric	
Distance From Top of Casing to Ground Level <u>91.44</u> 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			
<b>Method of Water Removal</b>						
Type _____						
Removal Rate _____ L/min						
Depth Withdrawn From _____ m						
If water removal period was < 2 hours, explain why						

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

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
<b>Owner Name</b> QUICK WAY FARMS LTD		<b>Address</b> P.O. BOX 1719		<b>Town</b> BROOKS		<b>Province</b> AB		<b>Country</b> CA	<b>Postal Code</b> T1R 1C5	
<b>Location</b>	<b>1/4 or LSD</b> 16	<b>SEC</b> 31	<b>TWP</b> 026	<b>RGE</b> 03	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b>	
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>					
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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
<b>Recommended Pump Rate</b> <u>36.37</u> L/min			
<b>Test Date</b>	<b>Water Removal Rate (L/min)</b>	<b>Static Water Level (m)</b>	
2003/01/15	45.46	32.00	

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

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

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										
Type										
Make										
Depth										m
Model (Output Rating)										
Did you Encounter Saline Water (>4000 ppm TDS)										
Gas										
Depth										m
Well Disinfected Upon Completion										
Geophysical Log Taken										
Submitted to ESRD										
Sample Collected for Potability										
Submitted to ESRD										
Additional Comments on Well										
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	
<b>Owner Name</b> QUICK WAY FARMS LTD		<b>Address</b> P.O. BOX 1719		<b>Town</b> BROOKS		<b>Province</b> AB		<b>Country</b> CA	<b>Postal Code</b> T1R 1C5		
<b>Location</b>	<b>1/4 or LSD</b> 15	<b>SEC</b> 31	<b>TWP</b> 026	<b>RGE</b> 03	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b> STOCK WELL		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary	<b>Type of Work</b> New Well
<b>Proposed Well Use</b> 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	
<b>Borehole</b>				
Diameter (cm)	From (m)	To (m)		
22.23	0.00	53.95		
<b>Surface Casing (if applicable)</b>		<b>Well Casing/Liner</b>		
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	
<b>Perforations</b>				
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				
<b>Annular Seal</b> Driven & Bentonite				
Placed from <u>0.00</u> m to <u>30.18</u> m				
Amount _____				
Other Seals				
Type		At (m)		
<b>Screen Type</b>				
Size OD : _____ cm				
From (m)	To (m)	Slot Size (cm)		
Attachment _____				
Top Fittings _____		Bottom Fittings _____		
<b>Pack</b>				
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

Well Identification and Location										Measurement in Metric
<b>Owner Name</b> QUICK WAY FARMS LTD		<b>Address</b> P.O. BOX 1719		<b>Town</b> BROOKS		<b>Province</b> AB		<b>Country</b> CA	<b>Postal Code</b> T1R 1C5	
<b>Location</b>	1/4 or LSD 15	SEC 31	TWP 026	RGE 03	W of MER 5	Lot	Block	Plan	Additional Description STOCK WELL	
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>					
_____ 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					

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ 60.96 cm										
Is Artesian Flow _____					Is Flow Control Installed _____					
Rate _____ L/min					Describe _____					
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
			Depth to water level	
Test Date 2003/01/20	Start Time 12:00 AM	Static Water Level 32.64 m		
<b>Method of Water Removal</b>				
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
			35.07	1:00
			35.73	2:00
			35.83	3:00
			36.01	4:00
			36.22	5:00
			36.37	6:00
			36.49	7:00
			36.62	8:00
			31.24	9:00
			36.86	10:00
			36.96	12:00
			37.11	14:00
			36.91	16:00
			37.40	20:00
			37.58	25:00
			37.76	30:00
			37.90	35:00
			38.01	40:00
			38.28	50:00
			38.43	60:00
			38.71	75:00
			38.91	90:00
			39.09	105:00
			39.24	120:00
				Recovery (m)
				36.99
				36.20
				36.12
				36.02
				35.91
				35.79
				35.72
				35.61
				35.45
				35.41
				35.29
				35.16
				35.05
				34.88
				34.75
				34.59
				34.50
				34.40
				34.27
				34.14
				34.03
				33.91
				33.83
				33.74

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

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



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

Drilling Information	
<b>Method of Drilling</b> Rotary - Mud	<b>Type of Work</b> Other
<b>Proposed Well Use</b> Monitoring	

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	
<b>Recommended Pump Rate</b> _____ 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		
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
14.29	0.00	13.72			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
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		
<b>Perforations</b>					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
<b>Annular Seal</b> 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)		
<b>Screen Type</b> 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>			
<b>Pack</b>					
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	
<b>Owner Name</b> SOUTH ROCK LTD		<b>Address</b> P.O. BOX 460		<b>Town</b> MEDICINE HAT		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T1A 7G2		
<b>Location</b>	1/4 or LSD 4	SEC 32	TWP 26	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description OBSERVATION HOLE #5		
<b>Measured from Boundary of</b> _____ m from _____ _____ m from _____					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> 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			
<b>Method of Water Removal</b>						
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	
<b>Owner Name</b> SOUTH ROCK LTD		<b>Address</b> P.O. BOX 460		<b>Town</b> MEDICINE HAT		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T1A 7G2		
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b> OBSERVATION WELL #6		
4		32	26	3	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary - Mud	<b>Type of Work</b> Other
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> _____ 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		
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
14.29	0.00	10.97			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
			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		
<b>Perforations</b>					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
<b>Annular Seal</b> 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)	
<b>Screen Type</b> 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>			
<b>Pack</b>					
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	
<b>Owner Name</b> SOUTH ROCK LTD		<b>Address</b> P.O. BOX 460		<b>Town</b> MEDICINE HAT		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T1A 7G2		
<b>Location</b>	1/4 or LSD 4	SEC 32	TWP 26	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description OBSERVATION WELL #6		
<b>Measured from Boundary of</b> _____ m from _____ _____ m from _____					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> Latitude <u>51.257155</u> Longitude <u>-114.394328</u> How Location Obtained Differential corrected handheld GPS 5-10m				Elevation <u>1277.00</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 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 <u>Yes</u>	
										Geophysical Log Taken _____	
										Submitted to ESRD _____	
Additional Comments on Well										Sample Collected for Potability _____	
INSTALLED LOCKABLE PROTECTOR CASING AND CONCRETED INTO THE GROUND.										Submitted to ESRD _____	

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			
<b>Method of Water Removal</b>						
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 2727.66 L	Diversion Date & Time 2014/05/12 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 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	
<b>Owner Name</b> SOUTH ROCK LTD		<b>Address</b> P.O. BOX 460		<b>Town</b> MEDICINE HAT		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T1A 7G2		
<b>Location</b>	<b>1/4 or LSD</b>	<b>SEC</b>	<b>TWP</b>	<b>RGE</b>	<b>W of MER</b>	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b> OBSERVATION WELL #7		
4		32	26	3	5						
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Rotary - Mud	<b>Type of Work</b> Other
<b>Proposed Well Use</b> 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	
<b>Recommended Pump Rate</b> _____ 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		
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
Size OD : _____ cm			Plastic		
Wall Thickness : _____ cm			Size OD : <u>6.35</u> cm		
Bottom at : _____ m			Wall Thickness : <u>0.518</u> cm		
			Top at : <u>-0.91</u> m		
			Bottom at : <u>12.19</u> m		
<b>Perforations</b>					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)	
Perforated by					
<b>Annular Seal</b> 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)	
<b>Screen Type</b> 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>			
<b>Pack</b>					
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	
<b>Owner Name</b> SOUTH ROCK LTD		<b>Address</b> P.O. BOX 460		<b>Town</b> MEDICINE HAT		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T1A 7G2		
<b>Location</b>	1/4 or LSD 4	SEC 32	TWP 26	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description OBSERVATION WELL #7		
<b>Measured from Boundary of</b> _____ m from _____ _____ m from _____					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b> Latitude <u>51.255906</u> Longitude <u>-114.392635</u> How Location Obtained Differential corrected handheld GPS 5-10m			Elevation <u>1273.00</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 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 INSTALLED LOCKABLE PROTECTOR CASING AND CONCRETED INTO THE GROUND.										Sample Collected for Potability _____ Submitted to ESRD _____	

Yield Test			Taken From Ground Level		Measurement in Metric	
Test Date	Start Time	Static Water Level	m			
<b>Method of Water Removal</b>						
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 2014/05/12 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 2095665  
GoA Well Tag No.  
Drilling Company Well ID  
Date Report Received 2014/12/04

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	
<b>Owner Name</b> CIRCLE J RANCHES LTD		<b>Address</b> RR 2		<b>Town</b> COCHRANE		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T0L 0W0		
<b>Location</b>	<b>1/4 or LSD</b> SW	<b>SEC</b> 6	<b>TWP</b> 27	<b>RGE</b> 3	<b>W of MER</b> 5	<b>Lot</b>	<b>Block</b>	<b>Plan</b>	<b>Additional Description</b> M. GILES		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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	
<b>Method of Drilling</b> Unknown	<b>Type of Work</b> Well Inventory
<b>Proposed Well Use</b> 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			
<b>Borehole</b>					
Diameter (cm)	From (m)	To (m)			
<b>Surface Casing (if applicable)</b>			<b>Well Casing/Liner</b>		
Size OD : _____ cm			Size OD : _____ cm		
Wall Thickness : _____ cm			Wall Thickness : _____ cm		
Bottom at : _____ m			Top at : _____ m		
			Bottom at : _____ m		
<b>Perforations</b>					
From (m)	To (m)	Diameter or Slot Width(cm)	Slot Length(cm)	Hole or Slot Interval(cm)	
Perforated by _____					
<b>Annular Seal</b>					
Placed from _____ m to _____ m					
Amount _____					
Other Seals					
Type			At (m)		
<b>Screen Type</b>					
Size OD : _____ cm					
From (m)	To (m)	Slot Size (cm)			
Attachment _____					
Top Fittings _____			Bottom Fittings _____		
<b>Pack</b>					
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	
<b>Owner Name</b> CIRCLE J RANCHES LTD		<b>Address</b> RR 2		<b>Town</b> COCHRANE		<b>Province</b> ALBERTA		<b>Country</b> CANADA	<b>Postal Code</b> T0L 0W0		
<b>Location</b>	1/4 or LSD SW	SEC 6	TWP 27	RGE 3	W of MER 5	Lot	Block	Plan	Additional Description M. GILES		
<b>Measured from Boundary of</b>					<b>GPS Coordinates in Decimal Degrees (NAD 83)</b>						
_____ 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			
<b>Method of Water Removal</b>						
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 C

# Residential Well Assessment Questionnaires

### **Groundwater Monitoring Plan**

Mountain Ash Limited Partnership

Summit Pit

SLR Project No.: 212.06650.00006

# 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:

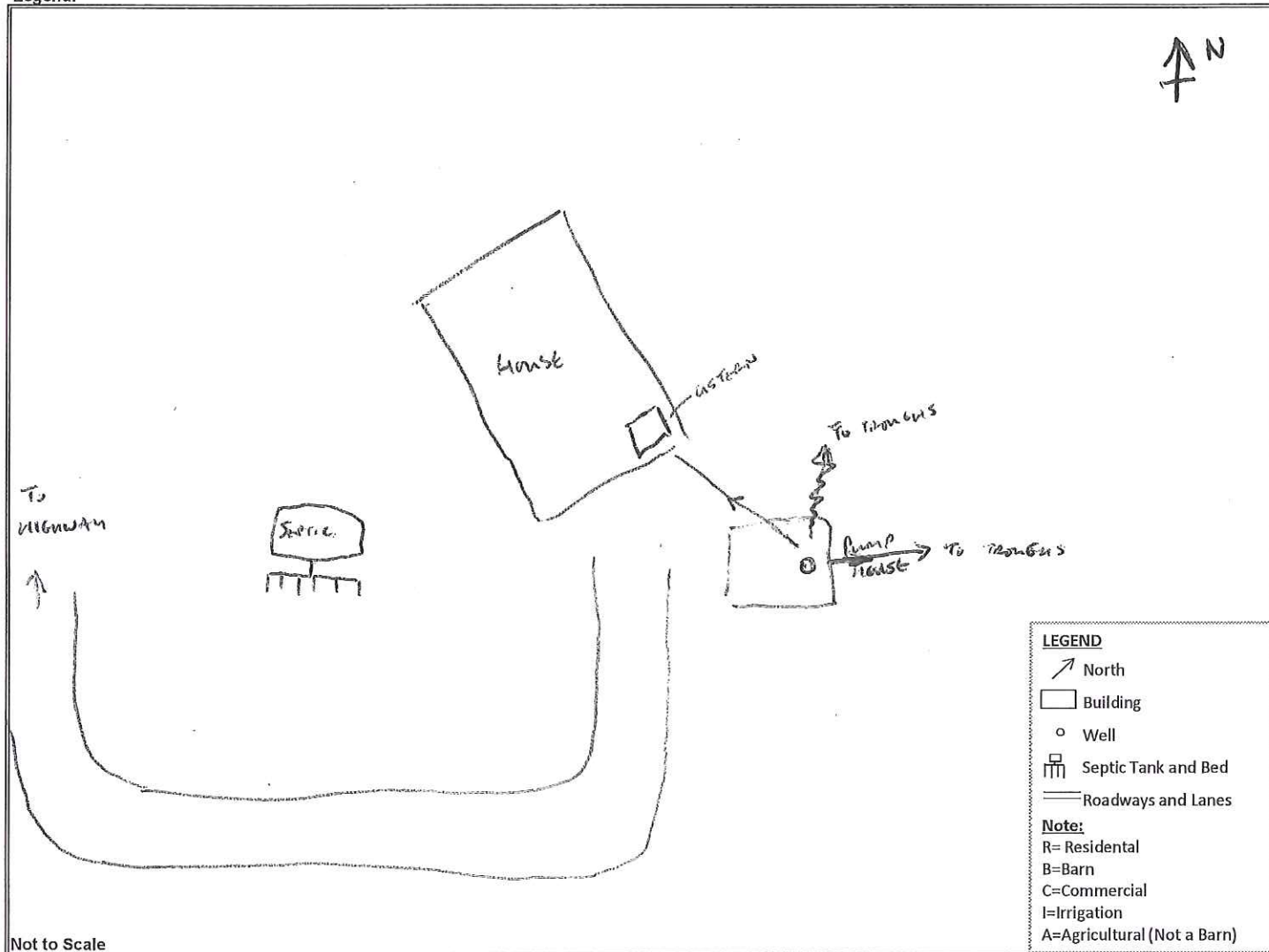
preferred contact time (evening, weekday, morning, etc.):

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: \_\_\_\_\_

Photograph Number/Name

Description




## 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) \_\_\_\_\_

MOE Record Number:

Confirmed ☐Inferred ☐

Is the well accesible for sampling?

YES ☐NO ☒

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 History**

How 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

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

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 Details**

Permission 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. TIL

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) \_\_\_\_\_

MOE Record Number:

Is the well accessible for sampling?

YES ☒ (WW2)NO ☒ (WW3)Confirmed ☐Inferred ☐

If no provide details:

WW3 BLOCKED @ 27.5m TOPLocation of measurement (top of pipe (TOP), ground surface): TOP

SLR staff member collecting the measurement:

ROBERT TILLDate of original measurement: 29/OCT/2014Original/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)

WW2 WW316ft + 12ft Pumping Rate (L/s)

Storage Tank:

Type:

CISTERN

Capacity:

WW2 400 GAL (HOUSE) + WW3 750 GAL

Additional Features:

Chlorinator ☐Water softener ☒Water filter ☒Filter type: PARTICULATEHOUSEHOUSE

**4. Well History**

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

10 yrsHave 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/AWhat 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  
wellYES ☐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  $\mu$ S/cmpH 7.62Temperature 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 rectangle on the right labeled "INDOOR RIDING AREA" which contains two sections labeled "STABLES".
- Riding Areas:** An oval labeled "OUTDOOR RIDING AREA" is located near the top right.
- Roads:** A vertical line labeled "MAIN ROAD" with an upward arrow is on the right side.
- Wells:**
  - Well WW2 is marked with a circle and labeled "HOUSE WELL WW2". Above it is a point labeled "STANDPIPE SAMPLED". Below it is a point labeled "BUNK SHED".
  - Well WW3 is marked with a circle and labeled "WASHING WELL WW3". Below it is a point labeled "W3 HOSE SAMPLED".
- Other Features:** A north arrow is in the top right corner. A legend box is in the bottom right corner.

**LEGEND**

- North arrow symbol
- Building symbol (rectangle)
- Well symbol (circle)
- Septic Tank and Bed symbol (rectangle with internal lines)
- Roadways and Lanes symbol (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 GAL/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  $\mu$ S/cmpH 5.44 ?

Temperature

5.1°C

Other

## 6. Contact Details

Permission for future monitoring?

YES

☒

NO

☐

Well Aware Booklet:

Perferred contact time/method:

call/contact ahead

☒

site visit

☐

Contact by:

email

☐

phone

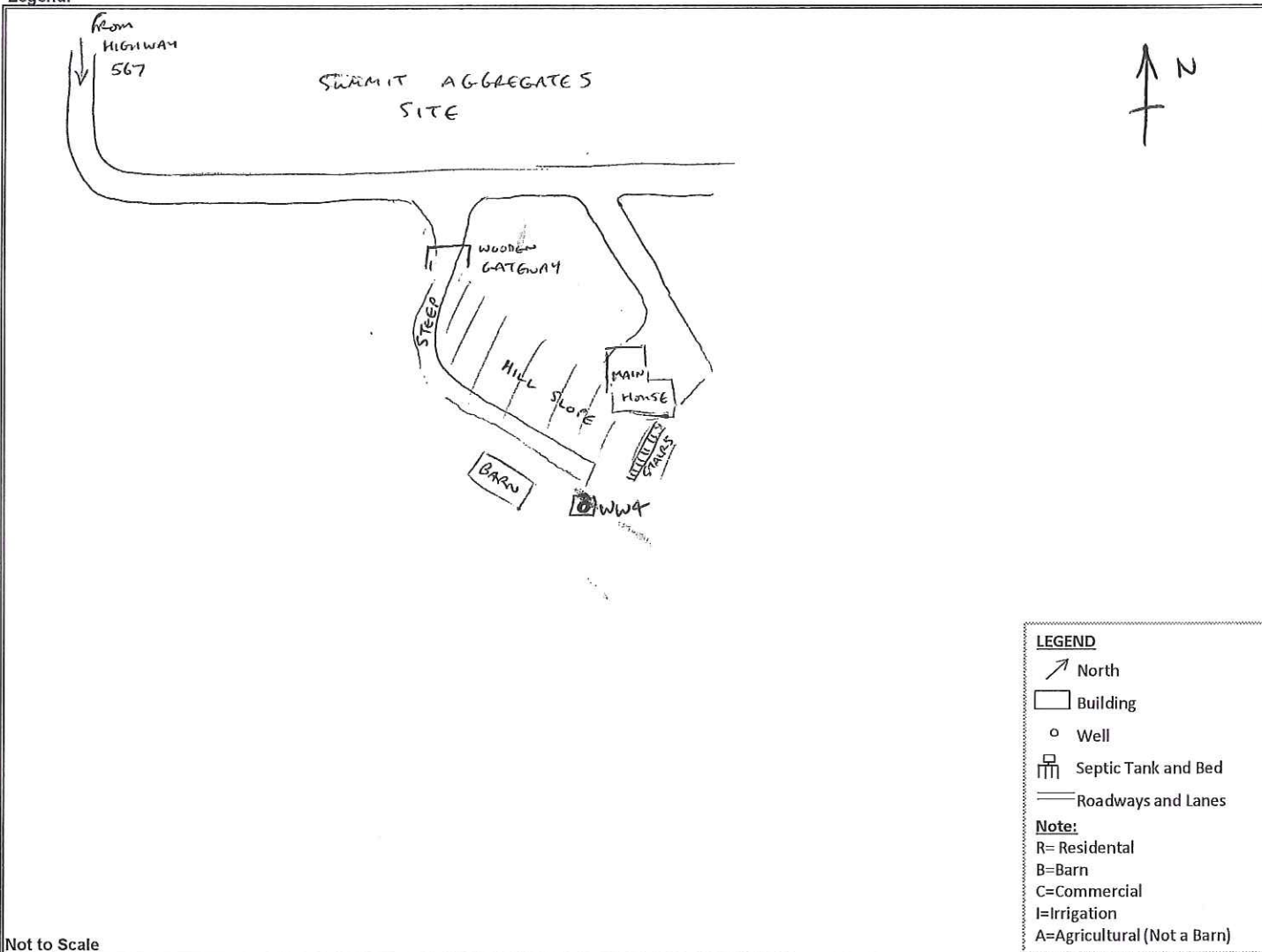
☒

perferred contact number:

perferred 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.



Summit Aggregates Site

From Highway 567

WOODEN GATEWAY

STEEP

HILL SLOPE

MAIN HOUSE

BARN

LITTLE CHANG

WWT

North

Building

Well

Septic Tank and Bed

Roadways and Lanes

Note:  
R= Residential  
B= Barn  
C= Commercial  
I= Irrigation  
A= Agricultural (Not a Barn)

Not to Scale

Well GPS 0680258 5682090

## 8. Site Photograph Log

Number of Photos Taken: \_\_\_\_\_

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




## Water Well Reconnaissance Survey



## SITE RECONNAISSANCE CHECKLIST

Project Name: SUMMIT AGGREGATES RESOURCE

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

Street Address: 265201 RANGE ROAD 35, ROCKY VIEW COUNTY

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

Person/Resident Interviewed: MR + MRS HODGSON

Date of Visit: 1 Feb 2016 Time: 19:00

## 1. Well Owner Information

Name: HARRY HODGSON

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: \_\_\_\_\_ Concession: \_\_\_\_\_ Township: \_\_\_\_\_

## 3A. Well Use

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

Livestock: ☒ No. of livestock using water from the well: 2 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. Septic tank): YES - SEPTIC FIELD

System description:

TANK LEADING SEPTIC FIELD

Distance to Well

100m

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

SW

Well is

Uphill ☐Downhill ☐Same Grade ☒

as the waste water system

**3B. Well Construction Details**Construction/Installation Date: NOVEMBER 1981Contractor: PARSONS DRILLING

Type of Installation:

Drilled ☒Dug ☐

Other: \_\_\_\_\_

Diameter:

5 INWell Depth (m): 62.5

Screen?

YES ☒NO ☐Screen length (m) 13.7

Depth to top of screen (m)

48.15

MOE Record Number:

395 786Confirmed ☒Inferred ☐

Is the well accessible for sampling?

YES ☐NO ☒

If no provide details:

WELL IN A BELOW GROUND PIT - CONFINED SPACE ENTRY

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

160ft To WATER - FROM CLIENT LOG

SLR staff member collecting the measurement: \_\_\_\_\_

Date of original measurement: 5/NOV/1981Original/initial water level depth (m) 48.72m (DRILLER)

Subsequent water level measurements

Date						
Depth (m)						
Staff						

**3C. Pumping Equipment**

Pump Type:

Suction-lift ☐

Pumping Capacity \_\_\_\_\_

Positive-submergence ☐

Age

<1yr

How is the pump lubricated? \_\_\_\_\_

Depth of intake setting:

Original (m)

170 ft

Present (m) \_\_\_\_\_

Pumping Rate (L/s) \_\_\_\_\_

Storage Tank:

Type: \_\_\_\_\_

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?

11 YEARS

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)

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

**5. Sample Details**

LAB TESTED

Date:

Sample Collected? YES

☐

NO

☐

Sample Name/Number:

Number of Bottles:

Field Analysis

Harness

Iron

Conductivity

pH

Temperature

Other

**6. Contact Details**

Permission for future monitoring?

YES

☒

NO

☐

Well Aware Booklet:

Perferred contact time/method:

call/contact ahead

☒

site visit

☐

Contact by:

email

☐

phone

☐

perferred contact number:

403-818-9741 (cell)

403-932-5664 (hm)

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 Drilling Report

[View in Metric](#) [Export to Excel](#)

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

GOWN ID

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 Imperial		
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)					Elevation		ft
					Latitude 51.267033 Longitude -114.402748							
					How Location Obtained					How Elevation Obtained		
					Map					Not Obtained		

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

Formation Log			Measurement in Imperial	
Depth from ground level (ft)	Water Bearing	Lithology Description		
6.00		Brown Clay & Boulders		
11.00		Gray Clay & Boulders		
13.00		Boulders		
36.00		Brown Clay & Gravel		
45.00		Gravel		
51.00		Brown Shale		
71.00		Gray Hard Shale		
76.00		Gray Hard Sandstone		
83.00		Gray Shale		
88.00		Gray Sandstone		
91.00		Gray Shale		
94.00		Gray Sandstone		
96.00		Gray Soft Sandstone		
101.00		Gray Hard Sandstone		
114.00		Gray Firm Shale		
121.00		Gray Hard Sandstone		
144.00		Gray Firm Shale		
148.00		Gray Hard Sandstone		
180.00		Gray Shale		
185.00	Yes	Gray Water Bearing Sandstone		
205.00		Gray Shale		

Yield Test Summary			Measurement in Imperial	
Recommended Pump Rate			0.00 igpm	
Test Date	Water Removal Rate (igpm)	Static Water Level (ft)		
1981/11/19	15.00	160.00		

Well Completion			Measurement in Imperial	
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
205.00 ft		1981/11/05	1981/11/19	

Borehole		
Diameter (in)	From (ft)	To (ft)
0.00	0.00	205.00

Surface Casing (if applicable)		Well Casing/Liner	
Steel		Steel	
Size OD :	7.00 in	Size OD :	5.00 in
Wall Thickness :	0.231 in	Wall Thickness :	0.219 in
Bottom at :	45.00 ft	Top at :	0.00 ft
		Bottom at :	205.00 ft

Perforations				
From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
158.00	203.00	0.375		16.00

Perforated by Torch

Annular Seal		Drive Shoe
Placed from	0.00 ft to	45.00 ft
Amount		

Other Seals

Type	At (ft)

Screen Type		
Size OD :	0.00 in	
From (ft)	To (ft)	Slot Size (in)
Attachment		
Top Fittings	Bottom Fittings	

Pack	
Type	Grain Size
Amount	0.00

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
PARSONS DRILLING	



# Water Well Drilling Report

[View in Metric](#) [Export to Excel](#)

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

GOWN ID

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 Imperial	
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)						
ft from					Latitude 51.267033 Longitude -114.402748					Elevation ft	
ft from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Additional Information										Measurement in Imperial
Distance From Top of Casing to Ground Level in										
Is Artesian Flow										Is Flow Control Installed
Rate igpm										Describe
Recommended Pump Rate 0.00 igpm										Pump Installed
Recommended Pump Intake Depth (From TOC) 200.00 ft										Depth ft
										Type
										Make
										Model (Output Rating)
Did you Encounter Saline Water (>4000 ppm TDS)										Depth ft
Gas										Well Disinfected Upon Completion
Depth ft										Geophysical Log Taken
										Submitted to ESRD
Additional Comments on Well										Sample Collected for Potability
DRILLER REPORTS WATER QUALITY AS TURBID										Submitted to ESRD

Yield Test			Taken From Ground Level	Measurement in Imperial
			Depth to water level	
Test Date	Start Time	Static Water Level	Drawdown (ft)	Elapsed Time
1981/11/19	12:00 AM	160.00 ft		Minutes:Sec
			Recovery (ft)	
Method of Water Removal				
Type Bailer				
Removal Rate 15.00 igpm				
Depth Withdrawn From 160.00 ft				
If water removal period was < 2 hours, explain why				

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

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

---

# **Appendix D**

## Monitoring Well Construction Logs

### **Groundwater Monitoring Plan**

Mountain Ash Limited Partnership

Summit Pit

SLR Project No.: 212.06650.00006



## Monitoring Well Summary

Monitoring Well Name	Drill Hole Name	Northing	Easting	Ground Elevation (masl)	Top of Screen (mbg)	Base of Screen (mbg)
MW14-101	MW14-101	5682868.6	680066.4	1291.08	16.5	21.0
MW14-102	MW14-102	5682279.8	680791.6	1280.92	10.4	14.9
MW14-103	MW14-103	5683100.4	680739.0	1297.44	22.6	27.1
MW18-104	MA-18-06	5682650.8	680079.8	1293.81	-	27.4
MW18-105	MA-18-11	5682281.0	680070.0	1294.21	-	27.4
MW18-106	MA-18-07	5682665.6	680392.4	1287.66	-	19.8
MW18-107	MA-18-08	5682628.0	680724.0	1292.03	-	27.4
MW19-108	MW19-108	5682182.0	680386.0	1293.64	29.0	32.0
MW19-109	MW19-109	5681803.0	680676.0	1271.68	10.7	13.7
MW19-110	MW19-110	5682059.0	680785.0	1291.14	27.7	32.3

mASL – metres above sea level

mbg – metres below ground


- Top of screen not recorded in 2018 wells

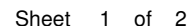


SLR BOREHOLE LOG (MOISTURE) 203.50065.00001.GPJ SLR\_CAN V5.2 MOISTURE.GDT 21/1/15




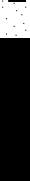
SLR CONSULTING (CANADA) LTD.				CLIENT: Summit Aggregates Resource PROJECT: Hydrogeological Assessment NW 31-026-3 W5M Alberta PROJECT No. 203.50065.00001		BOREHOLE LOG BOREHOLE NO: MW14-101 SURFACE ELEVATION: 1293.53 m UTM COORDINATES 5682869 N 680066.4 E					
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION	TEST DATA		WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count ◆ % Moisture					
-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											1280
DRILLING METHOD: Becker Hammer					Notes: ■ GRAB SAMPLE					Sheet 1 of 2	
DRILL DATE: 30 September 2014 LOGGED BY: RT											
















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




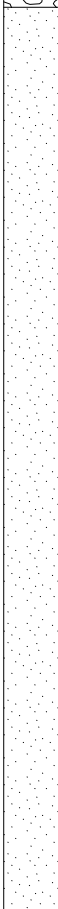


<div> SLR CONSULTING (CANADA) LTD.</div>					CLIENT: Summit Aggregates Resource		BOREHOLE LOG					
					PROJECT: Hydrogeological Assessment		BOREHOLE NO: MW14-101		UTM COORDINATES			
					PROJECT No. 203.50065.00001		SURFACE ELEVATION: 1293.53 m		5682869 N 680066.4 E			
DEPTH (m)	SAMPLE TYPE	SAMPLE ID	% Recovery	SOIL TYPE	SOIL DESCRIPTION		TEST DATA		WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
						■ SPT Count	◆ % Moisture					
13												1280
14												1279
15						<b>GRAVEL</b> 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					<b>SAND</b> 19.5 Medium to coarse grained, grey brown, wet, very loose						1273
21	WP5					<b>SANDSTONE</b> 21.03 Fine grained, brown, grey, wet, weak						1272
22	WP6					Below 21.6 m: Weathered, clayey, silty, soft					bentonite chips	
					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							



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				<b>GRAVEL AND SAND</b> 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				<b>SANDSTONE</b> 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	
					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						
DRILL DATE: 1 October 2014      LOGGED BY: MH								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										
0					Ground Surface				stickup, above ground steel protector	-1300
0					<b>TOPSOIL</b> Silty and clay, trace sand, rootlets, dark brown, moist				silica sand	-1299
0.61					<b>CLAY TILL</b> Silty, sandy clay, trace rounded gravel, grey, moist, very hard, softer below 2.4 m					-1298
1										-1297
2										-1296
2.4										-1295
3		WP16							hydrated bentonite chips	-1294
4										-1293
5										-1292
6										-1291
6.4										-1290
7										-1289
7.01					<b>SAND AND GRAVEL</b> Very fine, trace coarse sand. Medium to coarse grained, rounded gravel. Some silt, red/brown, dry					-1288
8										-1287
8.53					<b>GRAVEL AND SAND</b> Fine to medium, (trace coarse) gravel. Poorly graded, very fine sand, brown, moist					-1286
9										-1285
10		WP17								-1284
10.7										-1283
11										-1282
12										-1281

<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						1286			
15											1285			
16											1284			
17					Below 16.8 m: Decreasing gravel						1283			
18											1282			
19		WP18			<b>SAND AND GRAVEL</b> 19.2 Poorly graded, very fine sand. Medium with trace fine and trace coarse gravel. Occasional cobble, red/brown, moist						1281			
20											1280			
21					Below 21.3 m: Increasing gravel						1279			
22											1278			
23					Below 23.2 m: 0.08 m clay lens						1277			
24											1276			
25											1275			
26		WP19			Below 25.3 m: Wet gravel, very angular						1274			
											1273			
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



					<b>BOREHOLE LOG</b>					
CLIENT: <b>Summit Aggregates Resource</b> PROJECT: <b>Hydrogeological Assessment</b> <b>NW 31-026-3 W5M Alberta</b> PROJECT No. <b>203.50065.00001</b>					BOREHOLE NO: <b>MW14-103</b> SURFACE ELEVATION: <b>1299.81 m</b> UTM COORDINATES: <b>5683100 N 680739 E</b>					
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		×	<b>WEATHERED SILTSTONE</b>					
		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		1.8	sandy gravel, medium to fine sand	31.6	22	4	4	5
		0.3	clay seam, moist	25.5	18.4	5	5	
		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

<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. WL (m):</u> 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			1	1	0
		1.5						
			clay till, hard, stiff			2	2	
		2.4						
			sandy gravel, moderately to poorly graded sand / silt dry	34.1	23.2	3	3	
5		2.1				4	4	5
			gravel, fine sand and silt, cobbles saturated from 6.7m to 7.6m, thin (<100mm) clay lense at bottom	28.2	24.9	5	5	
		1.5						
			sandy gravel, moderately graded, some coarse sand dry	27.6	14.2	6	6	
		2.4						
10			sand, fine to medium, with silt, trace gravel consolidated, dry	1	0	7	7	10
		0.6						
			gravel, silt, clay seam at 11.6m saturated	42.6	20	8	8	
		0.9						
			sandy gravel, moderately graded, some coarse sand damp, use 25-33' as reference sample					
		0.6						
			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

<b>PROPERTY:</b>	<input type="text"/>	<b>BORING ID:</b>	MA-18-11	<b>DRILL METHOD:</b>	SONIC
<b>PLANT:</b>	CALGARY	<b>COORD. SYS:</b>	WGS84 - UTM ZONE 11N	<b>DATE STARTED:</b>	06-25-18
<b>COUNTY:</b>	ROCKY VIEW	<b>RIG:</b>	B.L. - Track Mounted	<b>DATE COMPLETED:</b>	06-25-18
<b>PROVINCE:</b>	ALBERTA	<b>NORTHING:</b>	5,682,281.0	<b>TYPE SAMPLE:</b>	4.0" CORE
<b>LOCATION:</b>	MOUNTAIN ASH	<b>EASTING:</b>	680,070.0	<b>CASED TO:</b>	27.4m
<b>LOGGED BY:</b>	D.B.	<b>ELEVATION:</b>	1,294.0	<b>EST. WL (m):</b>	24.4m
		<b>TOTAL DEPTH:</b>	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  
**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:** 5,682,664.0
 **DATE COMPLETED:** 06-26-18  
**LOCATION:** MOUNTAIN ASH
 **EASTING:** 680,393.0
 **TYPE SAMPLE:** 4.0" CORE  
**LOGGED BY:** D.B.
 **ELEVATION:** 1,287.8
 **CASED TO:** 19.8m  
**TOTAL DEPTH:** 19.8m
 **EST. WL (m):** 15.2m

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

# MW18-106

2 OF 2

## SAND & GRAVEL EXPLORATION LOG

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




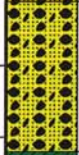





Depth (m)	Lithology	Thickness (m)	MATERIAL DESCRIPTION	Gravel %	Oversize	Sample Run	Picture #	Depth (m)
		1.5	gravel, silt and clay, clay-rich seams wet			9	9	
		1.5	gravel, silty, poorly graded fine sand, some cobble - increasing with depth, tan dry, getting wet near the bottom of run	30.3	24.1	10	10	
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

<b>PROPERTY:</b>		<b>BORING ID:</b>	MA-18-08	
<b>PLANT:</b>	CALGARY	<b>COORD. SYS:</b>	WGS84 - UTM ZONE 11N	<b>DRILL METHOD:</b> SONIC
<b>COUNTY:</b>	ROCKY VIEW	<b>RIG:</b>	B.L. - Track Mounted	<b>DATE STARTED:</b> 06-28-18
<b>PROVINCE:</b>	ALBERTA	<b>NORTHING:</b>	5,682,628.0	<b>DATE COMPLETED:</b> 06-28-18
<b>LOCATION:</b>	MOUNTAIN ASH	<b>EASTING:</b>	680,724.0	<b>TYPE SAMPLE:</b> 4.0" CORE
<b>LOGGED BY:</b>	D.B.	<b>ELEVATION:</b>	1,292.1	<b>CASED TO:</b> 27.4m
		<b>TOTAL DEPTH:</b>	27.4m	<b>EST. WL (m):</b> 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	
		1.8	gravel, silt, fine sand, some cobble, consolidated, damp	35	23.8	14	14	20
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					<b>CLAY TILL</b> 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					<b>SAND AND GRAVEL</b> Fine to coarse sand and gravel, brown, dry	3.35				1289
5					<b>SANDY GRAVEL</b> 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					<b>GRAVELLY SAND</b> 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					<b>SAND</b> 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



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				
30										1264
31										1263
32										1262
33										1261
34										1260
35										1259
36										1258
					<b>BEDROCK</b> Siltstone, grey, dry	30.48			GW = 1263.34 m (5 June 2019) filter pack sand	
					End of borehole at 36.6 m	36.6			bentonite pellets	

DRILLING METHOD: Sonic/Odex

Notes: ■ GRAB SAMPLE

DRILL DATE: June 3, 2019

LOGGED BY: NY

Sheet 4 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: **MW19-109** 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
					<b>CLAY TILL</b> Trace fine gravel, dark brown, moist					
1										
					@ 1.5 m: Some fine gravel					
2									hydrated bentonite chips	1270
3										1269
4					<b>SAND AND GRAVEL</b> Coarse sand, fine to coarse gravel, grey brown, dry	3.66				1268
5										1267
6					<b>GRAVELLY SAND</b> Fine to coarse gravel and sand, grey brown, dry	5.49				1266
7									slough and backfill	1265
8										1264
9										1263

DRILLING METHOD: ODEX Air Rotary Drilling

Notes:

DRILL DATE: June 4, 2019

LOGGED BY: NY

Sheet 1 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: **MW19-109** 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					<b>SANDY GRAVEL</b> Fine to coarse gravel and sand, grey brown, dry	11.58				1260
13										1259
14					<b>BEDROCK</b> Could not determine lithology with minimal returns	14.02				1258
15										1257
					End of borehole at 15.8 m  Groundwater Information: Depth to groundwater from TOP = 12.32 m (5June2019)	15.8				1256

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	
					<b>CLAY TILL</b> Trace gravel, dark brown, moist					1291
1										1290
2										1289
3										1288
					<b>SAND AND GRAVEL</b> Fine to coarse sand and gravel, yellow brown, dry	3.35				
4										1287
					<b>GRAVELLY SAND</b> Fine to coarse sand and gravel, reddish brown, dry	4.57				
5										1286
					@ 5.5 m: Yellow brown to 11.6 m				hydrated bentonite chips	
6										1285
7										1284
8										1283
9										

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>SLR CONSULTING (CANADA) LTD.</div></div>					CLIENT: <b>Mountain Ash Limited Partnership</b> PROJECT: <b>Proposed Summit Pit</b> <b>NW 31-026-03 W5M Cochrane, AB</b> PROJECT No. <b>212.06650.00003</b>		<div><b>BOREHOLE LOG</b></div> <div>BOREHOLE NO: <b>MW19-110</b>UTM COORDINATES 5682058 N 680788 E SURFACE ELEVATION: 1291.14 m</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					
10					@ 9.1 m: Clay layer, dark brown, moist to 10.1 m					1281	
11										1280	
12					<b>GRAVEL AND SAND</b> 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					Sheet 2 of 4	
DRILL DATE: June 4, 2019 LOGGED BY: NY											



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					<b>BEDROCK</b> 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

