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Report: Westwold Flowing Well Decommissioning Project

Contract 10005-40/GS19932-001

Prepared for:

Drillwell Enterprises Ltd.
Attn: Colin Slade, Partner
B.C. Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Attn: Mr. David Thomson, M.Sc., P.Geo., Regional Hydrogeologist

May 2019
Project: 19-002-01VR

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May 31, 2019

Mr. Colin Slade, Partner
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Re: Completion Report, Phase 6 Deliverable: Decommissioning of Flowing Artesian Well, Westwold, B.C. WTN 112429

Western Water Associates Ltd. provided hydrogeological support to Drillwell Enterprises Ltd. during the drilling of a pressure relief well and the decommissioning of Well Tag. Number 112429 located at 4686 Highway 97 in Westwold, B.C. This report provides the deliverable for Phase 6 of the Contract between Drillwell and B.C. Ministry of Forests Lands Natural Resources Operations and Rural Development. The report also documents installation of the relief well, Well ID Plate # 54907.

This report summarizes all works completed under the Contract. We trust that the information in this document is sufficient for your current requirements. Should you have any questions, or if we can be of further assistance in this matter, please do not hesitate to contact Doug Geller at 250-541-1030.

WESTERN WATER ASSOCIATES LTD.

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Notes on units of measurement, abbreviations, and acronyms	
Flow	Typically given in U.S. imperial units (US gpm), sometimes with metric equivalent in L/s
Distance, depth	The typical convention is to use metric (m, cm, mm), with U.S. imperial equivalents (ft, in) in parentheses, though for brevity the driller's common usage of U.S. imperial is used.
Pressure	Given as pounds-per-square inch (PSI) and occasional reference to the equivalent pressure in kilo-pascals (kPA).
Volume	Typically given in m^3 or US gallons
Well or borehole diameter	These are given as **nominal** dimensions in metric (mm) and US imperial equivalent (in)
Weight	Typically given as kilograms (kg) or pounds
asl	Above sea level
AO	Aesthetic Objectives
bgs	below ground surface
btoc	below top of casing
cm	centimetres
EM	Environmental monitor
ENV	Ministry of Environment and Climate Change Strategy
ft	Feet (1 ft = 0.3 m)
GCDWQ	Guidelines for Canadian Drinking Water Quality
GSC	Geological Survey of Canada
in	inches
K	Hydraulic Conductivity (length/time)
kPa	kilopascal
L/s	Litres per second
m	metres 1 m = 3.3 ft
mm	millimetres
MAC	Maximum Acceptable Concentrations
m-asl	metres above sea level
MFLNRORD	Ministry of Forests, Lands, Natural Resource Operations & Rural Development
MOTI	Ministry of Transportation and Infrastructure
PSI	Pounds Per Square Inch 1.0 PSI = 6.9 kPa
T	Transmissivity ($length^2$/time)
US gpm	United States gallons per minute; 100 US gpm = 12.6 L/s
USGS	United States Geological Survey
WPID	Well Plate ID Number (affixed to well)
WTN	Well Tag Number (database ID)
WWAL	Western Water Associates Ltd.

1. INTRODUCTION

This report summarizes work and analysis completed to date on the Drillwell-Western Water Associates project to permanently decommission Well Tag Number (WTN) 112429, located at 4686 Highway 97 in Westwold, B.C. This project was funded by the B.C. Ministry of Forests Lands Natural Resource Operations and Rural Development ("Ministry") and undertaken pursuant to Contract No. 10005-40/GS19932-001 between Drillwell and the Ministry. The decommissioned well was drilled in March 2016 at 4686 Highway 97, Westwold BC (subject property). The uncontrolled artesian flow from the well created a significant nuisance to surrounding landowners, to the property where the well was located, as well as the Ministry of Transportation and Infrastructure (the well was drilled about 10 metres from Highway 97).

The objective of this project was to permanently decommission the subject well and to construct a relief well that will comply with regulations. The applicable sections of the *Groundwater Protection Regulation* (GWPR) and *Water Sustainability Act* (WSA) govern the work done for this project, including but not limited to the following:

GWPR: Part 2 (15) Qualifications for activities in relation to artesian flow – well drillers

> Part 8 – ARTESIAN FLOW, Sections (66) and (67). Additional requirements – stopping or controlling artesian flow, and report on artesian flow management.
>
> Part 10 – WELL REPORTS, Section (80) – decommission reports for flowing artesian wells (see also Schedule 1 of Regulation).

WSA: Section 52 Controlling artesian flow during construction

1.1 Project Location and Site Conditions in early 2019

The subject property, 4686 Highway (Hwy) 97, is the site of the existing artesian well to be decommissioned (**Figure** 1). The property is a relatively small (~ 0.15 ha) triangular-shaped parcel of land with an existing unoccupied one-story residential dwelling located near the south end of the property. The subject well and the relief well (WPID 54907) are located between the house and Highway 97.

At the time work on this project began, the subject well had two discharge lines attached and twin 150 mm (6 inch) diameter pipes ran along the west side of the highway for about 200 m before discharging through a grate on the west side of the highway, below which water flowed in a 400 mm diameter culvert emptying into a small swale that connects to a branch of Pringle Creek located about 100 m north of the highway. The branch of the creek flows east passing several private properties and one regional district park, crossing to the south side of the highway before it reaches Douglas Lake Road and passes from the west to east side of the road through a culvert. The flow here slows and then widens on the east side of Douglas Lake Road into a less distinct drainage course. A wetland area exists in the centre of an adjacent field as the tributary continues east through agricultural properties. The creek branch then terminates at Buff Lumber (accessed from Douglas Lake Rd) in a grassy, shallow wetland along the west side of Service Road. Buff Lumber reportedly uses water in the wetland for irrigation.

Discharge from WTN 112429 was monitored using a calibrated ultrasonic flow meter provided by Max Schibli of Monashee Aquifer Testing. Recorded artesian flow ranged from approximately 200 to 250 US gpm throughout the period spanning late January to late March. A brief (10 minute) shut-in test of WTN 112429 was done during the planning stages of the project in late January, with the pressure reading 3.9 PSI at the gauge or approximately 5 PSI at the ground surface. The well had reportedly flowed at higher rates in 2016-2017 and it is likely that the artesian pressure was higher in 2016-17 than we observed in early 2019. Later in this report, (mainly Sections 5, 9 and 11) we provide further discussion of post-closure relief well shut-in pressures and recommended ongoing pressure monitoring.

1.2 Pre-Drilling Tasks and Decommissioning Plan Summary

The Decommissioning Plan (Volume II of final report) provides further details on the assessment of the well prior to drilling the relief well. This Plan provides documentation on all the pre-drilling tasks completed for the project and included the proposed pressure relief well design, the approach to testing the relief well, and the materials and methods to be used to permanently decommission WTN 112429. Some of the key tasks completed by Drillwell and/or WWAL in January and February 2019 included:

- Determined site requirements for drilling and decommissioning operations. Completed a site access agreement with neighbouring property owner (Buff).
- Made a series of initial site visits to assist with planning and permitting. On January 24, 2019, a camera survey was conducted on WTN 112429 as well as a reverse step test, documented in Volume II Decommissioning Plan.
- Applied to Ministry of Transportation and Infrastructure (MOTI) to temporarily modify the property boundary with Highway 97 right-of-way that involved re-grading to facilitate site access. Also filed traffic control plans as needed to facilitate site mobilization.
- Applied via FrontCounterBC for a short-term use approval to allow the relief well to be used for well decommissioning. Also submitted a *Water Sustainability Act* (WSA) Section 11 Notification for works in and about a stream for the discharge of water to the branch of Pringle Creek during drilling, development and testing.
- Identified licence holders on Pringle Creek branch and attempted to contact licence holders.
- Compiled information on other wells possibly completed in the deep, confined aquifer (i.e. well log, well location).
- Completed site preparation, and set up of support equipment (office trailer, etc).
- Installed a temporary fish screen in the branch of Pringle Creek upstream of where well discharge enters the branch.
- Collected a water sample from the discharge of WTN 112429 and submitted for analysis of drinking water parameters to Caro Analytical in Kelowna.
- Prepared for and attended a series of bi-weekly update meetings held by teleconference with Ministry staff.
- Prepared a first draft of the Decommissioning Plan, submitted on 31 January 2019.

- Prepared a second draft of the Decommissioning Plan, based on Ministry comments, on 28 February 2019. This version is attached as "Volume II" of this report.

The Decommissioning Plan outlined the approach to drilling, installing, developing and testing the relief well, and decommissioning the subject well and included relevant supporting plans such as the Environmental Management Plan, plan for management of drilling water generated on-site, and supportive documentation such as kickoff meeting minutes, and permit applications and approvals. Calculations and estimates of well interference were provided to help determine an appropriate setback distance between the relief well and the subject well. Details of grouting including grout density calculations sufficient to hold back artesian pressure at depth were also included.

1.3 Physiography, Climate and Surrounding Land Use

Westwold occupies a large valley bottomland comprised of approximately 2,500 hectares (ha) of land, most of which is used for growing forage crop and turf production (Bennett 2012). Located about midway between Kamloops and Vernon, Westwold is a largely rural area and is surrounded by low mountains. With a valley elevation of about 600 metres above sea level (m asl) and highlands reaching approximately 1,100 m, local topographic relief is on the order of 500 m. Most of the valley is bordered by relatively steeply sloping bedrock to the north, south and west.

Important local surface water features include the Salmon River, which originates to the south in the Douglas Lake highlands and drains to the Salmon Arm of Shuswap Lake, and nearby Pringle Creek. The latter watercourse drains Monte Lake, flows west to east, and joins the Salmon River approximately 1.5 km from the project site (**Figure 1**). A southerly branch of Pringle Creek flows west to east closer to the subject property and does not rejoin the main branch and appears to end on private lands as further described in Appendix D. Climate Normals (1981 – 2010) from Environment Canada (2019) indicate an average annual precipitation from a combination of rain and snowfall of about 409 mm, for the station located in Westwold. Precipitation is relatively consistent throughout the year, with February and March being the driest months on average. The daily average air temperature is 6.6 degrees, with July and August typically the warmest months and December and January the coldest. Climate Normal Data from Westwold (Station ID 1168880) are summarized in **Table 1.1**. This station is approximately 2 km east of the project site at an elevation of 609 m.

Table 1.1 Climate Normal Data 1981-2010 for Westwold Station, ID 1168880

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rainfall (mm)	7.4	8.3	14.4	26.1	44.4	52.4	44.3	30.7	36.4	35.4	19.1	6.8	325.6
Snowfall (cm)	20.8	8.8	4.9	0.9	0.2	0.0	0.0	0.0	0.0	1.3	17.1	29.3	83.3
Precipitation (mm)	28.3	17.1	19.3	27.0	44.5	52.4	44.3	30.7	36.4	36.7	36.2	36.0	408.9
Daily Average (°C)	-4.0	-1.6	2.7	7.0	11.5	15.3	18.0	17.5	12.3	6.1	-0.2	-5.1	6.6

Land use in the immediate vicinity of the project site is rural residential and agricultural. Primary agricultural activities include growing hay and other forage crops, and cattle grazing. Other uses include

a small park to the east and the Legion Hall / post office property to the west. The project site is relatively small (less than ½ acre) and is bordered by larger parcels on all sides except the frontage along Highway 97.

1.4 Hydrogeologic Setting

Local geology and hydrogeology information can be found in recent reports by Bennett (2012) and Stewart and Allard (2018). Both reports were prepared for and by the Ministry of Environment and Climate Change Strategy (ENV) and/or MFLNRORD.

Provincial mapping indicates two stacked aquifers are present beneath the project site, select details of which are provided below in **Table 1.2**. **Figure 2** illustrates a portion of the mapped aquifer boundaries in relation to the site. **Figures 3 and 4** depict a cross section of the generalized hydrogeology of the area derived through the interpretation of selected well driller's reports.

Table 1.2 Provincially Mapped Aquifers in the Westwold Area

Aquifer Reference Number	Geologic Formation	Overlying Materials	Aquifer Type	Demand	Productivity	Vulnerability
289 IIA	Alluvial and glacially reworked sand and gravel	Non-homogenous clay and diamicton/till	Mostly unconfined	Moderate	Moderate	High
98 IIB	Interglacial sand, some gravel and boulders	Glacial till, glaciolacustrine deposits	Mostly confined	Moderate	Moderate	Moderate

1.4.1 Aquifer 289 IIA (Westwold Aquifer)

The shallowest aquifer mapped near the project site is Aquifer 289 IIA. The aquifer extends from just west of Westwold to approximately 3 km west of Falkland and is bounded in the north-south direction by the mountains of the local valley. Aquifer 289 is mostly unconfined and is composed of sand and gravel, with portions that are covered by a relatively thin (average of 9 m), discontinuous layer of alluvial, colluvial and/or glacial deposits. In the Westwold area, a much thicker, clay-rich till, confining unit is present to the north and south, in proximity to the valley walls (Stewart & Allard, 2018) Groundwater levels are typically at or near surface, with deeper levels reported along the margins of the valley where ground elevation is higher. This aquifer, where present, corresponds to what we term Unit I (see Section 3.2 and **Table 3.1** below).

Recharge to Aquifer 289 is assumed to originate from a combination of sources including upland and local infiltration of precipitation and snowmelt, bedrock discharge, infiltration from the Salmon River and potentially through hydraulic connection to underlying Aquifer 98. Bennett's 2012 water budget study of the Westwold Aquifer indicated river loss comprises upwards of 70% of the total annual recharge entering into the system. Groundwater flow on a local scale is assumed to be topographically driven, with regional flow assumed to follow the direction of the Salmon River: south to north through Westwold, then east toward Falkland. The general area of the project site could be a zone of converging groundwater flow, with a component of flow originating in the Pringle Creek catchment (from Monte Lake) and the other component being the Salmon River flow system.

1.4.2 Aquifer 98 IIA (Lower Salmon River Confined Aquifer)

Covering approximately 10 km^2, Aquifer 98 follows the Salmon River from an area south and west of Westwold, east through Falkland and north toward Salmon Arm and Shuswap Lake. The aquifer is mostly

confined, except potentially in areas where modelling suggests hydraulic connection with the overlying aquifer exists, east of Westwold (Bennett, 2012; Stewart & Allard, 2018). The confining unit above is typically described as grey-blue clay, silt and silty sand which may be compacted/cemented in certain areas. Aquifer 98 is typically comprised of fine to coarse sand, with varying amounts of gravel and/or boulders that were deposited during the Pleistocene and/or older interglacial periods (e.g. Bessette type sediments). Many, but not all the driller's logs report the presence of a black sand with interbedded fines within this unit. The upper boundary of Aquifer 98 has an average depth of 50 m below ground surface (bgs) but can reach up to 100 m-bgs in certain areas. Groundwater levels are typically found at or near surface, with an average depth of 10 m-bgs. The flowing artesian aquifer found at the project site, which we termed Unit III in Section 3.2 is probably part of Aquifer 98. As the base of this aquifer has not been penetrated in area wells, there could be as yet unexplored deeper water-bearing zones above bedrock, and the groundwater flow and hydraulic head gradients within this fairly thick sequence of sediments could be quite complex. At the project site, relief well drilling revealed two distinct higher water-bearing zones, which were separated by several metres of low-yielding materials (see **Figure 5** and Appendix A).

Sources of potential recharge for Aquifer 98 include leakage from overlying Aquifer 289, as well as mountain block recharge and infiltration from upland areas. Similar to Aquifer 289, groundwater flow is assumed to be topographically driven on a local scale, while regionally following the direction of the Salmon River. Like many deeper aquifers in the B.C. Interior, less is known about this aquifer because fewer wells penetrate it. Examination of **Figure 2** shows that there are several wells believed to be completed in this confined aquifer, three of which had reported or confirmed artesian flow (project site wells WTN 112429, WPID 54907 and off-site well WTN 84367). Other reportedly non-flowing wells penetrating the aquifer, for example WTN 110528 presumably do not flow due to the higher ground surface elevation. Interestingly, a well penetrating the deeper aquifer about 1 km southeast of the project site (WTN 39689) had a reported static water level of 13.1 m (43 ft) below ground when drilled in 1978, and situated at a lower ground surface elevation than the project site. The completion depth of this well at 108.5m (356 ft) and its reported lower water level suggests that piezometric head decreases considerably from west to east through the area. The mechanisms that govern these relationships remain poorly understood.

1.4.3 Review of Reported Groundwater Wells in the Area

The BC Water Resource Atlas indicates an additional 23 groundwater wells are present within 500 m of WTN 11249, all of which are inferred to be installed the shallower Aquifer 289. Of importance to this project is the presence of the relatively deep, confined, sand and gravel Aquifer 98, as well as known flowing artesian conditions in and around Westwold. At present, there are reported records for five wells indicated to be flowing artesian (Government of B.C. 2018, Flowing Artesian Well Advisory for Westwold). Of these, one is a relatively shallow well (less than 12 m deep) and two are less than 23 m deep and in the eastern part of the valley several km from the project site.

The subject well and WTN 84367 (Miller Well) are completed in what we term the deep aquifer (No. 98) that develops flowing artesian conditions in the valley bottom. Three additional wells (WTN 110528, 39689 and 112210) are interpreted as completed in this aquifer but are assumed to be topographically positioned so as not to flow. All five of these deeper wells are more than 80 m (262.4 ft) deep and located in the western part of the Westwold Valley. All wells penetrating the confining unit into the deep aquifer that do not have a deep well seal create the potential for vertical movement of water between aquifers,

depending on the vertical gradient at the well's location. This fact is relevant to the requirement that the well decommissioning ensure that there is no movement of water between aquifers. In all likelihood, such movement could be occurring, either via wellbores, or through leakage across the confining unit. Fully grouted casings sealed into confining units are unlikely to permit such leakage to occur.

Table 1.3 below summarizes pertinent information for wells within 500 m of the site and reported flowing artesian/deep wells in the area.

Table 1.3 Wells in proximity to the Site

Well Tag Number	Date Drilled	Reported Yield (US gpm)	Total Depth (ft)	Static Water Level (ft)	Inferred Aquifer Unit	Intended Water Use
Wells Northwest of the Site (within 500 m)						
67895	1995	4	58	41	289	Private Domestic
51579	1983	8	130	-	289	Unknown
9030	1950	-	38	-	289	Private Domestic
15550	1958	-	24	18	289	Private Domestic
9025	-	-	-	-	289	Unknown
18840	1964	15	50	16	289	Irrigation
57296	1987	15	156	48	289	Unknown
Wells Southeast of the Site (within 500 m)						
14668	1956	-	22	-	289	Unknown
701	1992	10	26	16	289	Private Domestic
15557	1958	-	26	24	289	Private Domestic
15921	1959	-	8	-	289	Unknown
2345	1944	-	35	33	289	Private Domestic
9205	1950	-	12	3	289	Irrigation
103396	2010	5	43	31	289	Private Domestic
9290	1950	-	30	29	289	Private Domestic
9196	1950	-	18	-	289	Private Domestic
61639	1994	12	34	12	289	Private Domestic
51583	1983	15	117	70	289	Unknown
9285	1950	-	25	-	289	Unknown
9122	1950	-	40	-	289	Private Domestic
14007	1953	-	12	-	289	Private Domestic
14234	1954	-	22	-	289	Private Domestic
49697	1981	15	30	15	289	Private Domestic
Deep and/or Flowing Artesian Wells in proximity to the Site						
112429 (Site well)	2016	250+	280	Flowing (200+ US gpm)	98	Private Domestic
84367 (900 m N of site)	2000	100	332	Flowing (est. 3 US gpm)	98	Private Domestic
39689 (1.2 km SE of site)	1978	200	370	43	98	Unknown
2752 (1.4 km SW of site)	1947	-	38	Flowing	289	Private Domestic
110528 (2 km NE of site)	2014	80	416	65	98	Private Domestic, but reportedly used for stock watering
112210 2.4 km SW of site)	-	200	284	31	98	Irrigation

2. SITE PREPARATION AND PERMITTING

Drillwell and WWAL completed a series of tasks in January-February 2019 to prepare for relief well drilling, testing and subject well decommissioning. Site preparation entailed creating improved access to the site from Highway 97, made possible by an agreement with the adjoining landowner, re-grading the site to create a suitable work area for the drill rig and support vehicles, and removing fencing and trees to provide easy access for vehicle parking and required facilities such as a heated work trailer, outhouse, and emergency transport vehicle. Permitting consisted of filing a *Water Sustainability Act* Section 11 Notification ("for works in and about a stream") in connection with the discharge of water from the relief well to the branch of Pringle Creek; and applying for a short-term use approval to allow the relief well to be pumped for the purpose of decommissioning the subject well. The use approval was received in early March 2019 during the early stages of relief well construction (see Section 3). The Section 11 notification was also approved in March 2019. Appendix H provides copies of relevant permit applications and approvals.

3. RELIEF WELL CONSTRUCTION

Drillwell installed and developed the relief well between 28 February and 21 March 2019 in a near continuous effort that involved brief breaks for crew changes and waiting on well screen delivery. Three main phases of work were undertaken: 1) Temporary 400 mm (16-in) drill and case and telescoping a 300 mm (12-in) control casing inside the 16-inch hole and grouting in place; 2) 250 mm (10 inch) drill and case below the control casing to total depth; and 3) installation of a long-string screen assembly using the pull-back method, followed by development of the screen interval. A series of modifications to the casing headworks were also undertaken during this period to facilitate control of artesian flow and decommissioning operations. The following sections describe the completed works in more detail.

3.1 Equipment and Methods

Drillwell used a Foremost heavy duty DR24 rig for relief well drilling and development. In anticipation of flowing artesian conditions at the site, a multistage approach was taken during borehole advancement. Drilling commenced by installing a 400 mm (16-in) diameter temporary surface casing to a depth of 66 m (215ft) bgs into the confining unit above the flowing artesian aquifer. A nominal 300 mm (12-in) casing was then installed in the temporary casing to a depth of 66 m (215 ft) and grouted in place using a cement grout. The grout was installed under pressure using a tremie pipe through a drillable grout shoe. The seal was placed from the bottom of the 12-in casing back to surface while the temporary 16-in casing was retracted. The temporary casing was then extracted, the grout was permitted to set, and a bolted steel well flange was welded to the top of the 12-in casing. A 250 mm (10-inch) production casing was then telescoped inside the 12-inch casing, and then advanced to a depth of 108.5 m (356 ft) within the target aquifer. Saturated, water-bearing material of the flowing artesian aquifer was first noted at 84 m (275 ft).

Drillwell provided information on the gross weight of drilling and support equipment present on-site during relief well drilling and decommissioning operations. The following loads were placed on-site in close proximity to the wells during the contract, not including the fill placed on site during site preparation:

- DR-24HD Drill Rig: 37,000 kg, plus up to an additional 50,000 kg of pullback extracting 16-inch well casing
- Water containment tank: 10,000 to 70,000 kg depending on stored water volumes
- Rod truck: 10,000 to 20,000 kg
- Other equipment: 8,000 to 50,000 kg intermittently (e.g. vacuum truck, compressor, tooling, pumps, parked vehicles, etc).
- TOTAL: Approx. 65,000 kg, up to 200,000+ kg

Throughout drilling and decommissioning, the surface of the prepared drill site remained stable with no visible signs of settlement or subsidence resulting from the heavy equipment, and we also note that spring thaw began during the latter part of field operations in March 2019.

3.2 Hydrostratigraphic Units

Stratigraphy observed during drilling is summarized in **Table 3.1,** and the complete driller's lithologic description is provided in Appendix A. An as-built sketch of the completed well is provided as Figure 2. For descriptive ease, we subdivided the subsurface sediments encountered into three main hydrostratigraphic units: Unit I comprises the near-surface granular sands and gravels, mostly brown in colour and low or non-water bearing forming, what we interpret as part of Aquifer 289. Unit II is the principal aquitard overlying Unit III, the flowing artesian aquifer interval, composed largely of interbedded grey silt, clay and lenses of sand and gravel. Unit III is a dark grey to black sand and gravel unit with beds of silty fine sand, featuring at least two main zones of water production, forming part of Aquifer 98. The upper productive interval was found just below the base of Unit II and the lower zone was about 15 m (50 ft) into the aquifer.

Within each unit, there is considerable heterogeneity vertically. It is likely that the sediments also vary in texture and thickness laterally, over relatively short distances. The gross lithology indicated on the relief well log and the WTN 112429 well log is very similar, however, with both wells encountering these three main hydrostratigraphic units.

Table 3.1 Lithology Log Relief Well WPID 54907

Depth (m-bgs)	Depth (ft-bgs)	Lithology / Comments
Unit I – surficial sediments		
0 to 1.2	0 to 4	Brown Silt and Gravel
1.2 to 11.6	4 to 38	Brown Sand and Gravel; Water-bearing at base of unit
Unit II – aquitard package		
11.6 to 17.4	38 to 57	Grey Silt and Clay
17.4 to 19.5	57 to 64	Grey Sand and Gravel
19.5 to 29.6	64 to 97	Grey Gravelly Till
29.6 to 32.3	97 to 106	Grey Sand and Gravel; Water-bearing
32.3 to 34.1	106 to 112	Grey Till
34.1 to 34.7	112 to 114	Grey Sand and Gravel; Water-bearing
34.7 to 39.9	114 to 131	Grey Gravelly Till
39.9 to 44.5	131 to 146	Grey Silt and Clay
44.5 to 47.5	146 to 156	Grey Silt, Sand and Gravel; Water-bearing
47.5 to 52.1	156 to 171	Grey Silt and Clay

Depth (m-bgs)	Depth (ft-bgs)	Lithology / Comments
52.1 to 54.9	171 to 180	Grey Silty Sand and Gravel; Water-bearing
54.9 to 56.7	180 to 186	Grey Silt and Clay
56.7 to 59.4	186 to 195	Grey Silt and Sand; Water-bearing
59.4 to 62.5	195 to 205	Grey Silty Sand
62.5 to 83.8	205 to 275	Grey Silt and Clay *(note: control casing sealed into this unit)*
Unit III – flowing artesian package		
83.8 to 91.4	275 to 300	Black Sand and Gravel *(note: screened in relief well)*
91.4 to 92.7	300 to 304	Very Dark Grey to Black Sand
92.7 to 94.5	304 to 310	Black/Grey Silty Sand
94.5 to 101.8	310 to 334	Black Sand and Gravel *(note: screened in relief well)*
101.8 to 108.5	334 to 356	Dark Grey/Black Sand

Note that there may be minor differences between WWAL's interpretation of drill cuttings and the Drillwell well driller's log (Appendix A). During advancement of the upper portion of the borehole through Units I and II, samples were collected by the drillers at 1.5 m (5 ft) intervals and stored onsite in sample bags for hydrogeologist examination and classification. Once the aquifer was encountered, Unit III formation samples were collected every 0.6 m (2 ft) and placed in labeled bags for further classification and for screen design purposes. In total, thirteen samples from a depth range of 86.0 to 106.7 m (282 to 348 ft) were selected for field sieve analysis (Appendix B).

3.3 Well Screen Design

Based on the results of the field analysis, sieve results, and discussions with the well driller, a 26.2 m (86 ft), 200 mm (8-in) diameter, stainless-steel well screen assembly was designed and ordered from Variperm. After installation, the screen was exposed to the formation by pulling back the 250 mm (10-in) casing and the well was sounded to confirm the depth of the screen assembly. Details on the well screen design are summarized in **Table 3.2** and depicted on attached **Figure 5** and in the Drillwell well driller's report in Appendix A.

Table 3.2 Well Screen Assembly Design

Depth (m-bgs)	Depth (ft-bgs)	Well Screen Component
80.8 to 85.3	265 to 280	K-Packer and Riser (blank)
85.3 to 91.4	280 to 300	40 slot (1.0 mm/0.04 in)
91.4 to 96.0	300 to 315	Blank
96.0 to 97.5	315 to 320	55 slot (1.4 mm/0.055 in)
97.5 to 99.1	320 to 325	30 slot (0.8 mm/0.03 in)
99.1 to 107.0	325 to 351	Blank/Sump

Note: bottom of 10-inch casing at 280 ft / 85 m below ground.

Subsurface lithology in the confining unit varied from what was indicated on the JR Drilling log for WTN 112429. This well log showed what appeared to be a continuous fine-grained unit from a depth of 12.2 m (40 ft) to 82.3 m (270 ft) before the aquifer was encountered. Relief well drilling and formation sampling revealed considerable variability in the texture, grain size and competency of the confining unit. The interval was characterized by relatively thin beds of low-yielding water-bearing sand, with sparse gravel

interspersed with thicker intervals of non water-bearing silt and clayey silt. Consolidated gravel-sand silt layers (till-like) were also encountered. The 300 mm (12 inch) control casing was sealed into a non-water bearing silt at 65.5 m (215 ft) and there was one additional competent silt layer found deeper in the section, between the bottom of the control casing and the top of the flowing artesian aquifer, which was found at 83.8 m (275 ft).

The aquifer also exhibited considerable heterogeneity and was less productive overall than anticipated. The bottom of the aquifer was not encountered, so the unit is at least 22.8 m (75 ft) thick at the project location. As shown in Table 3.1, the two main water-bearing zones encountered were near the top of the aquifer (approximately the upper 6 m/20 ft) and a more productive, but thinner interval between 96.9 and 98.7 m (318 to 324 ft).

3.4 Surface Conductor Casing Installation

The initial drilling for the conductor (or "control") casing phase (Phase 2) of the project started on February 27 and was completed by March 7, 2019. The hole was advanced with a temporary 16-inch (400 mm) diameter casing from surface to a depth of 65.5 m (215 ft). The original plan called for a target depth of 59.4 m (195 ft), but the formation materials encountered at that depth were not ideally suited for casing installation, as there were beds of water-bearing sands found in between the silty units that characterize much of the aquitard interval above the confined flowing artesian aquifer. Below approximately 61 m (200 ft), the water production cut off once more compact silt and clayey silts were encountered. Throughout this section of the hole, Drillwell used a downhole hammer and carbide tipped drill bit and used direct air circulation to remove cuttings from the hole and to advance the well casing. At times, drilling required the addition of water, which Drillwell obtained from the adjacent flowing well.

The 300 mm (12-in) conductor casing was telescoped inside the temporary 400 mm (16-in) casing to the target depth of 65.5 m (215 ft) and then grouted under pressure using a tremie pipe and a drillable cement float shoe. The grout was pumped through the bottom of the casing and back to surface, with good return. The 16-inch casing was then retracted while the grout was topped up. Several zones in subsurface created grout loss to the formation, which was expected and normal in unconsolidated formations. Approximately 12m^3 of grout was required to complete the installation. The uppermost 1m of annulus was topped up with a bentonite chip seal to surface. The top of the neat cement grout was approximately 1 m below ground surface. The grout mix used was 1256 kg Portland cement to 625 kg water for each 1 m^3 of slurry (equivalent to 5.6 US gal/94 lb of cement), providing a density of approximately 15.3 lb/US gallon. All grout had a retarder applied by the cement supplier, with the trade name Sikatard 930. A ratio of 8 L/m^3 was used in cementing the control casing for the relief well. See the Section 6 Decommissioning WTN 112429 discussion for information on grout used in that operation.

The grouted casing was allowed to set over a three-day period while Drillwell completed a crew change and made preparations for switch-over to 10-inch diameter drilling using a tri-cone bit and threaded steel casing. The switch to 10-inch drilling also involved installation of a drill-through cone seal that allowed for a water-tight fit between the drill rods and the top of the production casing so that artesian flow, when encountered, could be controlled when the rig was not in operation (e.g. while waiting for the well screen or at other times such as when casing was being added to the drill string).

3.5 10-inch Lower Hole Drilling and Well Screen Assembly Installation

Drillwell advanced a cased borehole from 66m to 107 m (215 ft to 356 ft) using 10-inch casing and a tri-cone drilling bit. The rate of drill penetration was relatively rapid and most of this interval was drilled out in a single day, on 11 March, 2019. WWAL hydrogeologists Ryan Rhodes, P.Geo. and Paul Williamson, M.Sc., GIT were on-site throughout this phase of drilling. The cased hole remained at the 108.5 m (356 ft) depth while the screen assembly was ordered and shipped for pick up in Kamloops on 19 March, 2019. The lower 1.5 m (5 ft) of borehole was abandoned with granular backfill to a depth of 107 m (351 ft) prior to screen installation. Drillwell lowered the completed screen in sections while retracting the 10-inch well casing. The final depth of the 10-inch (250 mm) well casing was 85.4 m (280 ft), with a 26.2 m (86 ft) long screen assembly as depicted on **Figure 5** and in the well driller's report for WPID 54907.

3.6 Well Screen Development

Drillwell used a variety of methods to develop the well screen. Initially, the screen was surged and bailed with a dart bailer. This was followed by air surge development, with pulses of compressed air to draw fine grained formation material into the screen for airlift pumping to the surface. Drillwell crews regularly sounded the depth to formation material in the well screen and bailed as necessary. Starting on the second day of development, Drillwell began to use a suction pump to further develop the well. This phase of development included several short-term specific capacity tests to gauge the progress of well development. After approximately three days of well development, further improvement in the well's performance was minimal. The well produced clear, sand-free water and pumping up to approximately 460 US gpm using two suction pumps in tandem indicated a specific capacity on the order of 20 US gpm/ft. At this point, the Drillwell-WWAL team discussed the merits of further well development and decided that the well's performance was ready to be test-pumped, and likely sufficient to meet the intended purposes of temporarily depressurizing the aquifer during decommissioning.

The brief pumping tests during well development showed the strong connection between WTN 112429 and the relief well, and this connection appeared to improve as development proceeded. During air surging, water was seen surging through the wellhead of WTN 112429, and Drillwell captured fine formation material (fine silty sand) in the discharge from the well following the surging. The initial pump development drawdown test on 20 March slowed the artesian flow from WTN 112429 to 67 US gpm. The next day, additional relief well development and pumping tests slowed the well flow in stages, first to less than 30 US gpm (from relief well pumping at about 400 US gpm), and then flow was stopped completely, with the water level in WTN 112429 drawn down close to existing ground level. A table in Appendix A provides a summary of estimated well development flow rates, durations and volumes.

The performance of the relief well was more than adequate for the secondary purpose of being converted to a domestic well. Some of the additional details on well development between 19 and 21 March 2019 can be found in the Drillwell daily reports that appear in Appendix G of this report.

3.7 Relief Well – Completed Well Head Assembly

Upon completion and prior to rig demobilization, Drillwell equipped the relief well with a well head assembly with the following main components:

- A 300x150mm (12 x 6-in) tee bolted to the top flange of the 12-inch control casing;

- A flanged and bolted well top plate.
- Penetrations through the top plate for a sampling tap, transducer port, and future domestic connection.
- A butterfly valve on the 6-inch side discharge line.
- Locking mechanism for the valve (locked as of May 2019).

A photo of the completed well head appears in Appendix F (Photo 15). Note that this completion is intended to facilitate future conversion of the well for a private domestic water source. Due to the cold climate around Westwold, the well head will require freeze protection. Recommendations included herein in Section 10 provide further information and guidance on this, and will also include a summary of the property owner responsibilities with regard to flowing artesian wells.

4. RELIEF WELL TESTING METHODS

Upon completion of well screen development, the relief well was briefly pumped with two surface "trash" pumps that were available on site. A 4" surface pump was first inserted and pumped at an approximate rate of 400 US gpm for 30 minutes. During this time, the flow in WTN 112429 was reduced to approximately 10 US gpm, as measured with a stop watch and bucket. When a second 2" surface pump was added to the relief well, the overall relief well pumping rate was increased to approximately 460 US gpm. At this increased rate, the flow from WTN 112429 was successfully terminated. As result, the decision was made that a 6" surface pump in combination with a casing extension would be sufficient to terminate the artesian flow of WTN 112429 during the grouting process and a submersible test pump was deemed not necessary.

Under the oversight of WWAL Senior Hydrogeologist, Douglas Geller, P.Geo., a testing program on the relief well was conducted on 24 March, 2019. To prevent flow from WTN 112429, a 2.1 m (7 ft) section of 6" pipe was welded onto the top of the well casing. The intake of the 6" surface pump was inserted to an approximate depth bgs of 9 m (30 ft) in the relief well and a submerged pressure transducer was installed at an approximate depth of 9 m (30 ft) in the relief well. Water level measurements in both the relief well and WTN 112429 were also collected with an electric well sounder to the nearest millimetre, referenced to the top of the well casings. Flows were controlled using the throttle on the 6" surface pump and measured with an inline digital flow meter.

The assessment involved a three-tiered (including free artesian flow from the relief well), variable-rate, step test. Artesian flow from the relief well was conveyed through the side discharge of the wellhead tee, through the unmetered second pipeline, discharging to the Highway 97 MOTI culvert. Pumped flow from the relief well ran through a totalizing flow meter and then through the pipeline and flexible hose, discharging to the field on the far side of Highway 97 (see photo in Appendix F).

After the WTN 112429 casing extension was installed by Drillwell, the water level in WTN 112429 was 0.46 m-btoc (1.5 ft) or 2.29 m (7.5 ft) above ground surface while artesian flow occurred in the adjacent relief well. Artesian flow in the relief well was estimated by Doug Geller, P.Geo. of WWAL on 24/25 March 2019 at approximately 225 US gpm and the height of water at the well head discharge point was 0.45 m-btoc (1.48 ft-btoc) or 0.61 m (2 ft) above ground surface. Pumping rates of 345 US gpm, and 430

US gpm were used for each 30-minute step with drawdown levels approaching stabilization at each step rate. Following pump shutoff, water level recovery was monitored manually for an additional 10 minutes.

After the completion of the step test, the relief well was pumped two additional times. The first was during the setup at the wellhead of WTN 112429 on March 24, 2019, when the well was pumped at approximately 430 US gpm for 8 hours. The second was on March 25, 2019 during the grouting (decommissioning, see Section 6) of WTN 112429, when the well was pumped at a rate of 345 US gpm for approximately 6.5 hours. Throughout these two events, water levels were recorded in the relief well by the pressure transducer. These pumping events combined formed a series of tests and the total volume of water pumped, based on the totalizing flow meter used by Drillwell was 419,554 US gallons (1,586 m^3). A larger, though unmetered, volume of water was discharged from the relief well as artesian flow, estimated to be approximately 1,171,000 US gpm (4433 $m^{3)}$. The majority of this discharge occurred after flow WTN 112429 had ceased during decommissioning operations 24-25 March, 2019. The relief well flowed for about 3 days following closure of WTN 112429 (from the afternoon of 25 March until the afternoon of 28 March), after which time it was shut-in. See Section 5.4 below for a discussion of post-closure shut-in pressure monitoring and analysis.

5. RELIEF WELL TESTING RESULTS

Raw pumping test data were processed and plotted into a series of graphs (Appendix C), the results of which are summarized in the following sections. The preliminary drawdown tests during well development are described in Section 3.5. These initial tests demonstrated the strong connection between the two wells and gave a good indication of the probable pumping rate needed to kill flow in WTN 112429. It was also determined that a deep well submersible test pump was not likely needed due to the ability of the relief well to kill flow with less than 7.6 m (25 ft) of drawdown, attainable with a suction lift pump.

5.1 Step Test and Extended Relief Pumping Results

During the active pumping stages of the test, water levels declined rapidly and reached near stability within the first few minutes. During the second step (430 US gpm), the water level was observed to recover approximately 0.3 m (1 ft), possibly due to a slight decrease in the flow rate or the result of additional well development occurring during the step test. Discharge water was visually clear, and only a negligible amount of sand was observed throughout the test

Specific capacity (defined as pumping rate divided by drawdown) was calculated as 8.5 L/s/m (40.8 US gpm/ft), 3.5 L/s/m (17.0 US gpm/ft) and 3.3 L/s/m (16.0 US gpm/ft) for the three test flow rates, respectively. Following pump shutoff, the relief well returned to a state of free-flowing discharge within 8 minutes and the static water level in WTN 112429 recovered to 91% of pre-test value (which was also influenced by the relief well artesian flow) within 10 minutes. Summary step test data are provided in Table 5.1. Pumping data are provided in Appendix C - Table C1 and hydrographs of the step test are provided in Appendix C - Figure C1 through C4.

Similar to the step test, the water level in the relief well dropped rapidly in the first few minutes of extended pumping before settling to a more stable, slow rate of decline. After pump shutoff, the well returned to flowing conditions within a few minutes. Summary data for the extended periods of pumping are provided in Table 5.1 above and Figure C4 provides a hydrograph of the pumping data.

Table 5.1 Specific Capacity Summary

Flow Rate		Step/Test Duration	Drawdown		Specific Capacity	
L/sec	US gpm	minutes	metres	feet	L/s/m	US gpm/ft
Step Test – March 24, 2019						
14.2	225	(flowing)	1.68	5.51	8.5	40.8
21.8	345	30	6.19	20.31	3.5	17.0
27.1	430	30	8.21	26.94	3.3	16.0
Extended Relief Pumping – March 24 & 25, 2019						
27.1	430	470	8.27	27.13	3.3	15.8
21.8	345	400	6.45	21.16	3.4	16.3

5.2 Killing Flow of WTN 112429

Drillwell prepared WTN 112429 for decommissioning on 23-24 March, 2019. First, they removed the well head assembly installed by others in 2016, and then welded on an approximate 0.9 m (9 ft) casing extension. This allowed the water to rise under artesian pressure above ground surface, but not high enough to discharge, killing flow on an interim basis prior to grouting operations. A 6-inch diameter relief well pump was installed at this time, with the 4 inch pump used in development retained as a backup. Once the casing extension was in place, there was no more flow from the well.

Next, Drillwell extracted approximately 6 m (20 ft) of 150 mm (6 in) well casing and backfilled the void present at the bottom of the casing with a combination of pea gravel and bentonite chips. During this time, the relief well was pumped as needed to maintain the water level below top of casing. The top of this initial borehole plug was at depth of 247 ft. By the end of the day on 24 March, 2019, the well was ready for permanent decommissioning (Section 6 below).

On March 28, 2019, WWAL shut-in the relief well. This was done about 72 hours after WTN 112429 was decommissioned. A transducer set to record at 1-minute intervals recorded pressure build-up (recovery) data for approximately one-week, after which the data were downloaded and the instrument was re-set to record levels at 10-minute intervals. Monitoring of the wellhead pressure continued for several more weeks, with the last reading used in this report taken on 23 May, 2019 (see Section 5.4 and **Figure 5.1** below).

5.3 Hydraulic Response Calculations and Results

Data collected from the step test, extended periods of pumping and post well shut-in recovery were assessed visually by reviewing the hydrographs and interpreted using AQTESOLV, a software designed for the analysis of in-situ hydraulic testing of aquifer properties. The base of the aquifer was not encountered during the drilling of the relief well, therefore the actual thickness of the aquifer at the site is unknown. Only 9 m (30 ft) of the aquifer was deemed adequate to screen in the relief well, but the transmissive thickness is likely more than 9 m and could be much thicker. The well log for WTN 39689 (approximately

1 km east of the site) indicates an aquifer thickness of 31.1 m (102 ft), which seems reasonable and so was used in our analysis. The results of the AQTESOLV analysis are shown in Figures C5 and C6. Note that we did not estimate aquifer storage coefficient due to lack of observation well drawdown data.

During the step test, a slight recovery of relief well water level was observed during pumping at 345 US gpm (See Figure C2), possibly due to variations in the flow rate. As a result, the analysis of the step test data was focused on best matching the data recorded during the step at 430 US gpm, when the pumping rate was confirmed to be held constant. The Theis (1935) step-test solution was applied based on its ability to produce a representative value of Transmissivity (T) and Hydraulic Conductivity (K) for a partially penetrating monitoring well that is screened in a confined aquifer. In this case, a T value of 1,098 m^2/day and a K value of 35.3 m/day was estimated for the aquifer.

For the extended pumping data, several fluctuations in water levels were observed during the second period of pumping, which were likely due to slight changes in the pumping rate. As a result, the focus of analysis was placed on the first period of pumping. In this case, the Theis (1935) solution was again selected as best matching the data and generated an estimated T value of 1,010 m^2/day and a K value of 32.5 m/day.

The values of K calculated from the pumping test data (**Table 5.2**) are both in line with typical values for sand and gravel (Freeze and Cherry, 1979). These results also correspond well with field observations of the aquifer samples made during drilling.

Table 5.2 Summary of Calculated Aquifer Properties

Phase of Testing	Method of Analysis	T (m^2/day)	K (m/day)
Step Test	Theis (1935)	1098	35.3
Extended Pumping	Theis (1935)	1010	32.5

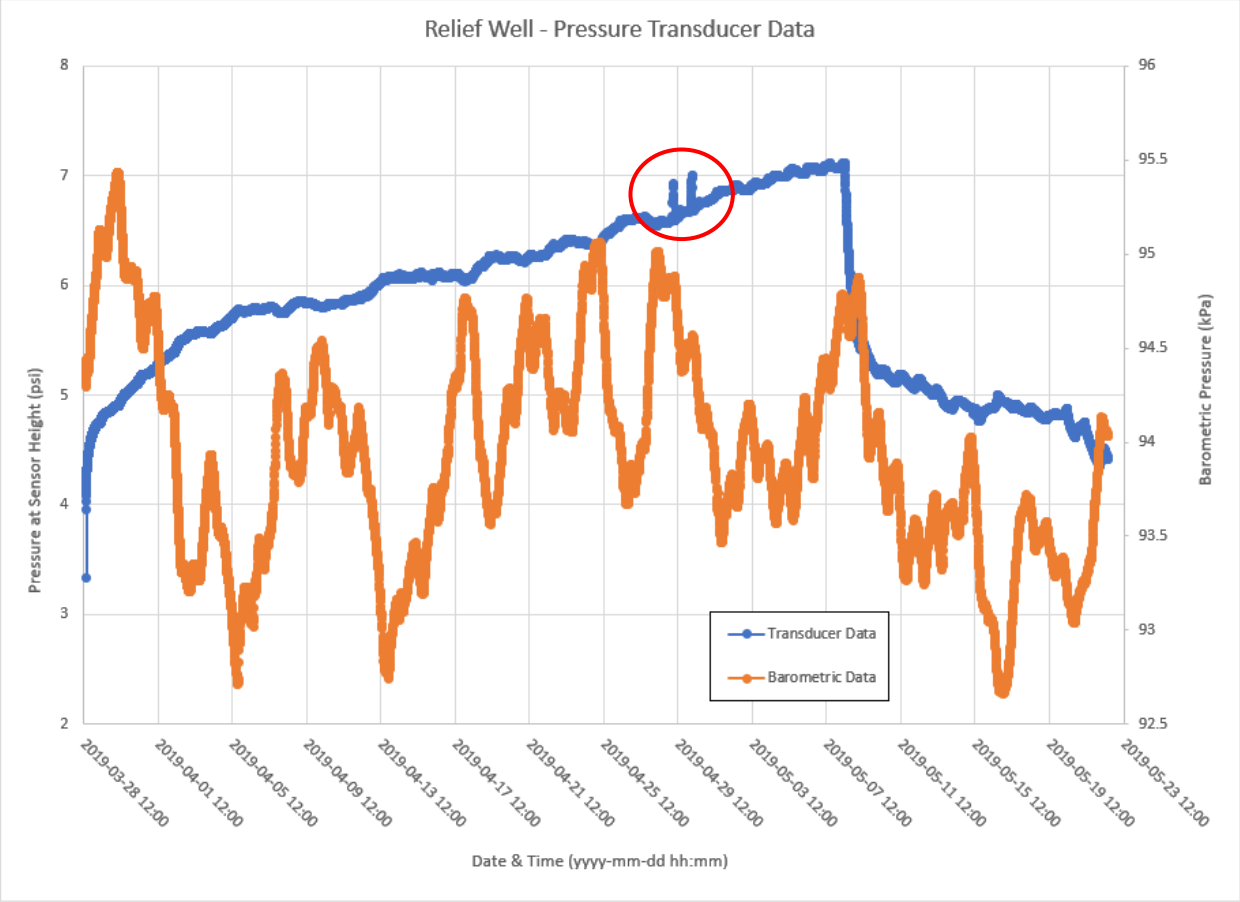
5.4 Post-Closure Recovery Monitoring and Analysis

About eight weeks of post-closure relief well pressure monitoring data from 28 March to 23 May 2019 are shown in **Figure 5.1** below. The data show that well head pressure steadily increased from an initial shut-in pressure of about 3.5 PSI to a maximum pressure of 7 PSI on May 8, after which sensor pressure abruptly dropped about 2 PSI by 10 May, and then gradually declined to approximately 4.4 PSI on 23 May 2019.

The data shown are given as an absolute head value in PSI at sensor level, which is approximately 0.6 m (0.9 PSI) above ground surface. The recovery curve over the first several weeks is not entirely smooth; we interpret that there are external influences on the piezometric head in the aquifer at this location, likely attributable to barometric effects on the confined aquifer, and possibly, pumping from other wells completed in the Lower Salmon River Aquifer No. 98. Additionally, two anomalous pressure spikes (circled red in Figure 5.1) amounting to approximately 0.3 PSI, were recorded by the transducer: the first on the morning of 29 April and the second on the morning of 30 April, 2019. In both cases, a gradual build-up of pressure occurred over 90 to 120 minutes with a rapid decline over approximately 30 minutes. Insufficient data exist to explain the cause of these two apparent small pressure spikes. The abrupt drop in pressure starting the morning of 8 May, 2019 we attribute to the probable start of irrigation pumping

in Westwold during approximately the second week of May. We do not have any data to indicate if this apparent hydraulic response is due to pumping of a well or wells completed in deep aquifer (No. 98), shallow aquifer (No. 289) or both.

Figure 5.1 – Post Closure Relief Well Pressure



We attempted to conduct a series of recovery analyses with the collected pressure buildup data from the post shut-in period using the Theis (1935) recovery solution for confined aquifers. However, field conditions and several unknowns made for a problematic analysis, as the analysis requires the user to input an accurate initial head condition, and a constant flow rate, which is an assumption of the recovery analysis method. Below we summarize how field conditions influenced the ability to conduct the recovery analysis:

a) WTN 112429 had flowed for approximately three years continuously.
b) The initial flow rate in 2016 is not known but could have been anywhere between 500 and 750 US gpm.
c) The initial shut-in pressure (the true "static" water level) is also not known and not readily estimated as there are few wells nearby with reliable static water level data and the hydraulic gradient in the aquifer is also not known.

d) The average flow rate over the three-year period is not known.
e) The flow rate during a three-day period leading up to WTN 112429 closure is more accurately known to be in the order of 225 US gpm from the relief well, and the shut-in pressure in early 2019 is documented to be on the order of 5 PSI at ground surface.
f) The aquifer appears to have been progressively depressurized between 2016 and 2019.

Given the above, it proved difficult to assign a suitable "pumping rate" and a water level that is considered full recovery (i.e. "static") that is required for the Theis analysis. Additionally, there remains uncertainty about the pressure in the aquifer prior to the installation of WTN 112429, which made selecting a pressure value to which the aquifer is currently recovering speculative at best. Several attempts were made to interpret the recovery data but all of these yielded somewhat low values of aquifer transmissivity that are not consistent with a moderately to the relatively thick and productive aquifer encountered. The results of these analysis are provided in Appendix C, indicated transmissivity values in the 150 to 500 m^2/day range. At this time, it appears that the drawdown data discussed above yield a more realistic and that a transmissivity on the order of 1,000 m^2/day is reasonable.

Figure 5.1 shows the barometric pressure measured at the site during the initial post-closure monitoring period (in kPa as shown on the right-hand vertical scale). What can be visually discerned from these data is that periods of increased atmospheric pressure seem to correspond to brief, but temporary dampening (flattening) of the relief well recovery curve. Barometric efficiency is defined as the ratio of water level change to the change in barometric pressure and describes how effectively a confined aquifer responds to barometric pressure changes at the surface. Under normal conditions, the barometric efficiency can be determined by comparing the incremental changes in barometric pressure to the changes in water levels over the same increment, but this is preferably done during a period of stability in the monitored aquifer. WWAL assessed the dataset from the recovery of the relief well in an attempt to generate a value for barometric efficiency. With the aquifer in an apparent state of recovery, pressure readings from the relief well steadily increased throughout the measurement period. We found no means to correct or compensate for the field conditions and therefore do not have a reliable barometric efficiency value for the aquifer at this time.

6. WTN 112429 DECOMMISSIONING OPERATIONS

On 25 March, 2019 Drillwell started pumping the relief well at a flow rate of approximately 340-350 US gpm at 9:30am at which time the cement truck arrived with the neat cement grout used in decommissioning. Doug Geller, P.Geo. of WWAL was on-site throughout to observe the decommissioning process. The well casing was extracted about 3 m (10 ft) and then cut-off, leaving a short length of casing and the drive shoe in place near the bottom of the hole as shown on **Figure 6**. The bottom of the hole was backfilled with alternating layers of pea gravel and bentonite to a depth of 75 m (247 ft). Above that depth, the hole was grouted with a neat cement grout to surface. The initial grouting was done under pressure with a 50 mm (2-in) diameter tremie pipe placed at the bottom of the well casing. A grout pump transferred the grout from the cement truck via a mixer tank laid on the ground between the truck and the well. Once grout return to surface was confirmed (see photo 12 in Appendix F), Drillwell removed the tremie pipe and began to gradually extract the 6 in well casing in approximate 6 m (20 ft) lengths, and then periodically topped up the grout as casing extraction continued.

The only interval that appeared to take more than the usual amount of grout was at approximately 49 m (160 ft.), as grout return to surface was confirmed throughout the process of cementing and casing extraction. Some grout invasion (grout loss) is expected and typical in unconsolidated formations, and is not a concern. All the casing was out of the ground and the grout at surface by about 1:30 pm on 25 March 2019. The following approximate volumes of backfill and grout material were placed during closure:

- 0.6 m^3 of pea gravel at bottom of hole, from 81 to 84 m (268 to 278 ft). This was tamped down as there was some void space at the bottom of the hole.
- Alternating 0.9 m (3 ft) layers of bentonite and pea gravel from 75 m to 81 m (247 to 268 ft), total of about 0.1 m^3.
- Approximately 5 m^3 of neat cement grout was used to decommission the hole from 75 m (247 ft) to surface. This volume is approximately equal to the cylindrical volume of the 6-inch diameter borehole from depth 75 m (247 ft) to surface.

7. SUMMARY OF ENVIRONMENTAL AND WATER QUALITY MONITORING

WWAL biologists with assistance from Drillwell and WWAL hydrogeologists prepared and implemented an Environmental Monitoring Plan (EMP) for the project. Many site visits were made during the planning phase of the project to inform the monitoring plan. During drilling, biologists made regular visits to the site to observe on and off-site water management and to record observations of flow, and to measure turbidity both upstream and downstream of the well discharge, and to inspect the off-site water management features (e.g haybale system, silt fence, upstream fish screen). A summary Environmental Monitoring Memo is attached to this report as Appendix D.

WWAL collected one water quality sample from the discharge of WTN 112429, on 27 February 2019. The results are attached in Appendix E. Field parameters were measured at this time. A series of other turbidity measurements were made of discharged water and creek water, reported on in the final EM memo attached.

Conditions were frozen in the branch of Pringle Creek until approximately March 19, at which time flow occurred late in the day, following by freezing at night. By about March 23, flow was continuous through the day. Discharge from the subject well and/or the relief well remained within the same general range as had occurred for three years, with only brief periods of higher rate pumping during relief well testing and WTN 112429 closure.

A final site visit for the EMP occurred on 29 March 2019 summarized in attached Appendix D memo, along with observations made on previous site visits. At the 29 March visit the fish screen was removed from the branch of Pringle Creek and recommendations developed to restore the off-site areas to pre-construction conditions or in accordance with the wishes of the property owner. The hay bales have since been removed.

In summary, there were no incidents or spills, or identified environmental impacts from the water discharged during the project. Recommendations mentioned in the Appendix D memo were addressed.

8. SUMMARY AND GENERAL CHRONOLOGY

The drilling of the relief well and the permanent decommissioning of WTN 112429 were completed over a period of approximately four weeks in March 2019, following an approximate six-week planning, permitting and site preparation phase. The project was completed ahead of schedule despite difficult winter conditions during the first half of March that featured snowfall events, and morning low temperatures of minus 20 C for several days consecutively. The schedule attained by the project team is attributed to several factors: 1) the team prepared extensively for the drilling and decommissioning work with excellent communication throughout, 2) aquifer pressure and artesian flow were lower than anticipated, and 3) equipment remained in good working order and experienced personnel conducted and supervised the work.

Below in **Table 8.1** is a chronology of work completed under the Contract for this project.

Table 8.1. Project Chronology

Date	Activity	Comments
January 22, 2019	Kickoff meeting	Teleconference. Notes from meeting circulated by FLNRORD
January 24, 2019	Reverse step test of WTN 112429. Camera survey. Well briefly shut-in.	Flow reduced from 250 US gpm to zero in steps. 10-min shut-in pressure approximately 4 PSI. No large void apparent at bottom of 6" shoe
February 1, 2019	MOTI permit for temporary road shoulder/ditch re-grading approved	
February 4, 2019	Section 11 notification filed with FrontCounter	
January 31, 2019	First Draft of Decommissioning Plan submitted	
February 12, 2019	Application for Short-Term Water Use submitted to FrontCounter. Site preparation underway.	
February 13, 2019	Site visit – posted one page info sheet at post office and community hall	
February 14, 2019	Received FLNRORD comments on draft Decommissioning Plan	
February 24, 2019	Site preparation largely complete including re-grading and site access improvements	
February 27, 2019	Equipment mobilized and drill rig (DR-24HD) brought to site	
February 27, 2019	Sample of WTN 112429 discharge collected and sent to lab for analysis	Results circulated March 11
February 27, 2019	Drilled and cased 16-inch to 75 ft.	
February 28, 2019	Submitted Revised Decommissioning Plan	Milestone Phase 1 complete.
February 28, 2019	Drilled and cased 16-inch 75 to 135 ft	
March 1, 2019	Drilled and cased 16-inch 135 to 215 ft.	

Date	Activity	Comments
March 2, 2019	Prepared to cut 16-inch casing shoe	
March 3, 2019	Cut 16-inch shoe, prepare to install 12-inch control casing	
March 4, 2019	Install 12-inch control casing	
March 5, 2019	Install 12-inch control casing	WTN 112429 flow 223 US gpm
March 6, 2019	Prepare for grouting of 12-inch control casing	225 gpm; 251 gpm
March 6, 2019	Received Short-Term Use Approval for Relief Well operations	
March 7, 2019	Control casing grouted in place	228 gpm. Milestone Phase 2 complete.
March 8, 2019	Top up grout, initiate prep to 10-inch drilling	247 gpm
March 9, 2019	Prepare for 10-inch drill and case	247 gpm
March 10, 2019	Finish preparation for drilling	224 gpm
March 11, 2019	Drill and case 10-inch from 215 to 356 ft	215 – 245 gpm WTN 112429 flow EM on site
March 11, 2019	Sieve analysis in field of approximately 12 formation samples	
March 12, 2019	Additional sieve analysis of 3 more samples, screen design discussions between Drillwell and WWAL	
March 12, 2019	Secure site for temporary halt to activities during screen fabrication	
March 13, 2019	Screen assembly ordered	
March 14, 2019	Wait on screen	EM site visit
March 15, 2019	Wait on screen	244 gpm
March 18, 2019	Screen delivered	Sounded total depth of WTN 112429. Formation settled approximately 5 cm (2 in) at bottom of casing
March 18, 2019	Received Section 11 Notification approval letter	
March 19, 2019	Screen installed to 351 ft, top of riser at 265 ft, begin relief well development	243 gpm
March 20, 2019	Continue well development with dart bailer, air surging. Pump test relief well 200 gpm, reduces flow in WTN 112419 to 70 gpm	255 gpm EM on site
March 21, 2019	Site visit / tour with Ministry officials	Surging affects discharge of WTN 112429. Fine material occasionally discharged as determined by samples collected at wellhead. EM on site, WWAL PM on site
March 21, 2019	Continue with development, performance of relief well improving.	250 gpm

Date	Activity	Comments
	Pump test relief well up to 460 gpm kills flow in WTN 112429	
March 22, 2019	Remove discharge well head from WTN 112429 and add casing extension.	Milestone Phase 3 complete (install relief well production casing and screen). EM on site
March 23, 2019	Re-position drill rig over WTN 112429, set up for step test of relief well. Brief test with 6 inch pump in relief well confirms flow is killed on WTN 112429.	
March 24, 2019	Relief well step test, prepare WTN 112429 for cement grout. Place bentonite chips and pea gravel to form base for grout, pull approximately 20 ft of 6 inch pipe	Well effectively stopped flowing after placement of bentonite chips and gravel above aquifer
March 25, 2019	WTN 112429 decommissioned. Grouting from 247 ft to surface with cement	Completion of Milestone 5.
March 26, 2019	Start of demobilization, installation of relief well head assembly	
M:arch 28, 2019	Installation of well head transducer and shut-in of relief well	Initial shut-in about 4 PSI. EM on site.
March 29, 2019	Final EM site visit by R.P. Bio.	Fish screen removed.
March 31, 2019	Interim Draft Report submitted by WWAL	Completion of Milestone 4A
April 2019	Periodic field visits to download transducer data and observe site conditions	
May 6, 2019	Final site visit before final draft reporting	Shut-in pressure 7 PSI; about 8 PSI at ground surface
May 10, 2019	Final Draft Report submitted	
May 23, 2019	Site visit, transducer download to update Figure 5.1 for final report	
May 31, 2019	Final Report submitted (this document)	Completion of Milestone 6.

9. FINDINGS AND CONCLUSIONS

The following provides the principal findings of this project and the hydrogeological assessment conducted in support of it.

1. WTN 112429 was a 150 mm (6-in) diameter water supply well installed by JR Drilling Central LLP of Kamloops B.C. in March 2016. Drilling penetrated a flowing artesian aquifer at an approximate depth of 82.3m (270 ft) in this well. The well flowed through a temporary well head and diversion pipeline for slightly more than three years, and was then permanently decommissioned (closed) by Drillwell Enterprises on 25 March 2019.
2. There are several unknowns regarding WTN 112429. These include:
    a. The original (March 2016) shut-in artesian pressure.

b. The initial and ongoing rate of flow during the three-year period of temporarily diverted flow.
c. Initial (2016) flow estimates reportedly ranged from 60 US gpm to 750 US gpm but documentation provided to us is insufficient to gauge the accuracy of these prior figures.
d. Anecdotal evidence suggests the rate of artesian flow had decreased by the time our team measured the flow with a flow meter in January 2019 (about 250 US gpm). The cause(s) of this flow rate reduction are not known, but are suspected to be due to the gradual depressurization of the aquifer.
e. Depressurization is likely the result of the three-years of flow and could also be due to other wells pumping from the same aquifer system.
f. The well driller's report for WTN 112429 indicated much of the section from surface to the depth of the flowing artesian aquifer was non-water bearing. Drilling of the adjacent relief well revealed the presence of several discrete and relatively thin water-bearing zones.

3. Flow from WTN 112429 had discharged to a hay field on the far side of Highway 97. This had been done with the property owner's permission. Drillwell and the Ministry were assured by the property owner that this practice would continue to be allowed to facilitate the decommissioning of the subject well.
4. Drillwell and WWAL prepared a detailed Decommissioning Plan that was submitted to the Ministry (two drafts) as one of the key contract deliverables. This plan guided the work subsequently completed. The plan included details on the relief well drilling, background information, safety plans, and other permits needed to accomplish the work. To help manage both on-site and off-site control of discharged water from drilling and testing operations, WWAL prepared an Environmental Monitoring Plan (EMP). A WSA notification approval was granted by the Ministry for this operation. This plan guided how discharge water would be handled and monitoring to be done in the receiving water, which was identified as a branch of Pringle Creek. The results of monitoring indicated Drillwell complied with the approval.
5. WWAL also applied on Drillwell's behalf for a temporary water use authorization, which allowed the relief well to be used for the purpose of decommissioning WTN 112429. The Ministry approved this use in March 2019. Drillwell complied with the terms of the temporary use authorization, which expires July 2019.
6. Drillwell decommissioned the subject well by removing the steel well casing and grouting the borehole with a neat cement grout. The lowermost part of the hole was backfilled with pea gravel and bentonite grout within and above the aquifer zone. The Well Closure Log (Appendix A) and Figure 6 documents this decommissioning work.
7. Periodic WWAL site visits over the ensuing weeks (between 25 March and 6 May 2019) confirmed no flow at the surface or in any proximity to the project site. There is no evidence to suggest potential for groundwater leakage to surface or other aquifers exists now that the decommissioning work has been completed at the site.
8. To facilitate decommissioning Drillwell with the assistance of WWAL drilled, design, installed and tested a nominal 300 mm (12-in) diameter pressure relief well. This well was drilled approximately 3.3 m from WTN 112429.

9. The Relief Well (WPID 54907) is 108.5 m (356 ft) deep and has a 26.2 m (86 ft) long well screen assembly, of which 30 feet are exposed to the flowing artesian aquifer. The aquifer is interpreted to be a highly confined portion of Province of B.C. Aquifer No. 98, which flows under artesian pressure in part of, but apparently not all of the Westwold area. The aquifer is composed chiefly of a dark grey to black sand, with minor gravel, with interbedded silty fine sand beds. We consider the aquifer to be moderately transmissive and productive. The relief well has a cement grout seal from surface to a depth of 66 m (215 ft.) This well as completed fully complies with the *Groundwater Protection Regulation*. Other wells completed in this aquifer appear to exist around Westwold. They do not have deep well seals placed into the confining unit. Not all such wells have reported artesian flow.
10. Free artesian flow from the relief well was similar to WTN 112429, or about 225 to 250 US gpm. The fact that the artesian flow from the two wells having very different designs was the same suggests that aquifer pressure is the limiting factor in artesian flow, as opposed to well design.
11. While the maximum yield of the well was not tested as this was not necessary to accomplish well decommissioning, we conservatively estimate that the relief well could provide a pumped yield on the order of 750 US gpm. The maximum flow rate during testing was approximately 460 US gpm so more testing is required to confirm the well's long-term capacity.
12. Both WTN 112429 and the relief well were drilled into what we interpret to be the Lower Salmon River Aquifer (confined) No. 98IIA (Stewart and Allard, 2018). As mentioned in the report, locally, in the northwestern part of the Westwold Valley, this aquifer has the potential to cause wells to flow under artesian pressure, depending on the elevation of the wellhead. The transmissive thickness of the confined aquifer is at least 25 m, and its transmissivity is on the order of 1,000 m^2/day, based on interpretation of hydraulic response data. While we do not have a good estimate of aquifer storativity; it is likely fairly low due to the well-confined conditions.
13. Following decommissioning of WTN 112429 on 25 March, 2019, the relief well was shut-in on 28 March 2019. The well head is equipped with a control valve and a water tight top flange. The well head assembly also includes: a sampling tap, a pressure gauge and a dedicated pressure transducer port. All of these well head penetrations are water-tight, and easy to maintain. The shut-in well is currently exposed to potential freezing and requires protection by next winter (see Recommendations below). As a deterrent to potential tampering, the control valve is currently locked and keys will be provided to the Ministry and property owner.
14. Maximum (early May 2019) shut-in pressure of the confined aquifer at ground surface at the project site was on the order of 7.5 to 8 PSI (or about 18 ft / 5.5 m above ground). Higher and lower pressures can be expected in future, as can be seen from the May data from 8 May 2019 onward showing a decline in pressure (see also, #16 below). The shut-in pressure at the time of drilling WTN 112429 is not known, as already stated, but in our opinion must have been at least 10 PSI in order to generate the reported higher initial artesian flows from the well of 500+ US gpm. At this time, we estimate a probable upper-bound shut-in pressure estimate of 12 PSI at ground surface. Future monitoring is needed to determine the range of aquifer pressures.
15. Aquifer test analysis conducted on data collected during relief well testing indicates an aquifer transmissivity on the order of 1,000 m^2/day. The most reasonable estimates were derived from the drawdown test data. Analysis of the recovery data collected following the shut-in of the relief well resulted in unreasonably low transmissivity estimates. We attribute this to the unknowns

discussed in (2) above, specifically, the initial head prior to artesian flow and the actual artesian flow rate from the aquifer prior to shut-in.

16. Shut-in pressure monitoring from 28 March to 6 May 2019 showed a gradual increase in shut-in pressure. The initial shut-in pressure was initially about 3.5 PSI and had increased to about 7.5 PSI, relative to ground surface by 6 May. On or about 8 May, shut-in pressure declined and continued to decline until the last reading taken for this report on 23 May. This drop in pressure is interpreted to be due to pumping of other wells in the area. For the purposes of this report, the May 23 site visit represents the last data point of initial post-closure pressure monitoring. The next section discusses recommended ongoing monitoring. WWAL will maintain the monitoring of the well until the Drillwell-Ministry contract is deemed complete, after which the Ministry will assume responsibility for this monitoring.
17. The contract called for monitoring to ensure there is no leakage to surface from the decommissioned well or leakage to other aquifers. Regarding leakage to other aquifers, there is no cost effective way to monitor for such leakage. As we discussed in Section 1.4.3, there is already potential for leakage via other wells that likely do not have deep casing seals across the confining unit. Such leakage would occur if there was a vertical hydraulic gradient and a continuous void outside the well casings providing the pathway for leakage. The fully grouted WTN 112429 borehole and the fully grouted and controlled relief well prevent such leakage from occurring at the project site.
18. WWAL and the Ministry met with the property owner 15 April 2019 to discuss the landowner responsibilities with regard to maintaining and/or using the relief well. The Ministry intends to follow up with a communication to the property owner about well owner responsibilities. WWAL provided a copy of the well driller's reports for the relief well and the closed well, along with result of water quality samples taken from WTN 112429 that indicated acceptable water quality except for elevated hardness and manganese.
19. Overall, the project successfully achieved all the principal objectives with minimal disruption to the property and surrounding areas and highway corridor. The project was completed ahead of schedule. WTN 112429 is permanently decommissioned, and routine post-closure monitoring can proceed as provided for in our recommendations below.

10. RECOMMENDATIONS

Based on the findings of this report and information collected during the performance of the Drillwell – WWAL contract, we offer the following recommendations:

R.1 Maintain the integrity of the relief well head by protecting it from physical damage by surrounding well casing with concrete barriers, and also protect the well from freezing. Ideally, this would involve installing a small, heated pump house or similar enclosed structure over the well head. If possible, we recommend leaving the twin 150 mm (6 in) steel pipelines in place for the two year monitoring period, in the event they are needed for any reason.

R.2 If the relief well is used for domestic purposes, such use must be in accordance with the *Groundwater Protection Regulation* including suitable backflow prevention. Because the relief well flows under

artesian pressure, it is possible (and recommended) to use the well without a submersible pump. Instead, the existing 5 cm (2 in) capped pipe on the well head can be tapped into, creating a service line to the residence from which a domestic pump can draw suction from the pressurized well to pressure-up a conventional in-home water tank and treatment system.

R.3 Regarding domestic well usage, we recommend consideration be given to water softening and manganese reduction to meet applicable Guidelines. Any and all works on the well should be completed by qualified persons holding the appropriate tickets and registrations to perform the required works.

R.4 Avoid excavating in and around the area of the now-decommissioned well as this could disturb the cement grout placed from the lower part of the confining unit back to surface. This can be facilitated by permanently locating the well with a stake or survey point. For information, the closed well was located 3.3 m from the relief well, on a compass bearing of 320◦ NW.

R.5 If any other use other than private domestic is considered for the relief well, it should be tested under the direction of a qualified hydrogeologist in order to determine its long term yield and the effect of pumping on the aquifer and other wells in the area. Following this, a licence for such non-domestic use must be applied for prior to such use. Well hydraulic testing should include a step-rate pumping test and a 72 hour pumping test followed by two to four weeks of post-pumping recovery monitoring. We recommend that the owners of other domestic wells inferred to be completed in the aquifer as well as the owners of any licensed wells completed in the aquifer be contacted for possible monitoring during any such testing program. The maximum recommended flow rate from the relief well during a testing program is on the order of 750 US gpm (about 47 L/s) based on the approximate well screen transmitting capacity and our estimation of the aquifer productivity inferred by the transmissivity value.

R.6. As sufficient quantities of groundwater appear to be present between ground surface and the base of the confining layer, well drillers should be advised to avoid drilling into the deep aquifer in this area unless adequate provisions have been made to protect against artesian flow. The existing flowing well advisory for Westwold and other online water-related tools comprise effective means to achieve this recommendation. We also recommend updating the Westwold advisory to inform driller's that adequate domestic use quantities are usually available from the shallower water bearing zones.

R.7 Monitoring for inter-aquifer leakage and potential ground subsidence (other than visual inspections) are not considered necessary at the project site as the potential for these to occur is very low. Monitoring the pressure and use of the relief well is considered a good way to determine the degree to which the flowing artesian pressure varies through the year and to gain insight into how the pressure varies and the possible causes of such variation (e.g. area well pumping, annual recharge etc). We recommend the Ministry implement Items 1-3 of the proposed monitoring program as described below in Section 11.

11. PROPOSED MONITORING PROGRAM

The Ministry has requested we develop a recommended two-year post-closure monitoring program for the project and a suggested budget for this future monitoring. The following outlines our recommended post-closure monitoring program. Note that the contract required a monitoring plan to ensure no leakage to surface or between aquifers. We discussed inter-aquifer leakage in Section 1.4.3 of the report and in the conclusions, noting that such leakage is not likely to occur via grouted boreholes but there is potential for such leakage to occur naturally or via ungrouted boreholes (i.e. any well completed in the deep aquifer with a casing that penetrates the confining unit without a deep grout seal). We specifically do not recommend drilling monitoring wells into the confining unit due to the high cost and to avoid unnecessary disturbance of the confining unit. Ground settlement monitoring is not considered necessary due to the low likelihood of settlement occurring.

11.1 Monitoring Criteria

The Contract calls for specific monitoring criteria to ensure no groundwater leakage to surface or to another aquifer. In our opinion, and as noted above, we do not recommend monitoring for inter-aquifer leakage, and in our opinion, such leakage is likely to occur naturally or via unsealed other boreholes, but unlikely to occur at the project site via the now-grouted borehole and fully controlled relief well. As noted in the main report text, it is likely that such leakage already has the potential to occur, either through natural processes (leakage across confining layer) or via unsealed boreholes of deeper wells that may penetrate the confining unit. The criteria for no leakage of groundwater to surface are that there is no visible groundwater surfacing at the project site in the area around the closed well or relief well. To date, no such leakage has occurred and is not likely to occur, and can continue to be verified through ongoing site visits during the remainder of the two year period.

To verify that the relief well maintains its integrity (i.e. allows full control of artesian flow to comply with regulation), continued wellhead pressure monitoring is recommended. In addition to verifying compliance, this monitoring will provide the Ministry with useful information on the variation in aquifer pressure through the year, and possible insights into the processes that may affect this pressure (we have already seen the possible influence of area wells pumping on aquifer pressure). Given that most groundwater use in the Westwold area is either smaller-scale private domestic or for irrigation, we would expect that the monitoring of the relief well would show the effects on the aquifer during the irrigation season (summer drawdown, followed by recovery in fall), and a relatively stable period through the late fall, winter and early spring.

11.2 Duration of Monitoring and Monitoring Details

The total duration of monitoring is <u>two years</u> from closure (i.e. until 25 March 2021), which coincides with the two-year warranty period of the Drillwell major works contract. The recommended frequency of various individual monitoring activities is described below. The monitoring should be overseen and reported on by a Qualified Professional.

1. <u>Site observation monitoring</u>
    a. We recommend approximate <u>monthly</u> site visits to look for any evidence of surfacing groundwater at or near the property. These visits should commence at Contract

completion (i.e. in June 2019) and continue for the two year monitoring period until after two years of closure (after 25 March 2021). MFLNRORD has access to the well for a third year and may wish to continue the monitoring beyond the Contract's two year warranty period.

b. During the site visits, download the wellhead pressure transducer data (see water level monitoring, below).
c. Observe the ground surface near the well and the stretch of highway adjoining the property for any signs of cracks, sags in the pavement, or other features that are inconsistent with other nearby parts of the highway and photo document any irregularities, reporting same to appropriate Ministries.
d. Site visits made during winter season cold weather periods to verify that freeze protection measures are in place for the relief well.

2. Water level monitoring
    a. Recommend continuous wellhead pressure monitoring using the dedicated transducer and baro-logger installed at the site. At this time, the recorder is set to collect data every 10 minutes but this can be reduced to hourly. Specifications on the instrument will be forwarded to the Ministry under separate cover.
    b. Produce an annual hydrograph of well head pressure and piezometric head, updating the hydrograph depicted in Figure 5.1 of this report. Attach this to an annual monitoring report. Any unusual or large fluctuations (+/- 2 PSI) in well head pressure should be reported to Ministry at time of occurrence.
3. Flow (well use) monitoring
    a. If relief well is converted to domestic well, notification should be provided as to when the well is intended to be used and the approximate daily flow rate (if for domestic use, a usage amount of 2,000 L/day may be assumed).
    b. If relief well is used for any other purpose than domestic, this use must be licenced or approved by the Ministry. Such use should be reported in accordance with any use or approval conditions and incorporated into the annual monitoring report.

11.3 Estimated Costs

The estimated cost per year for two-years of monitoring including reporting is $27,000 plus applicable taxes, broken down approximately to $15,000 for year 1 and $12,000 for year 2. This assumes the existing relief well transducer and baro-logger set up continues to be used for the two-year period and that WWAL or a similarly qualified hydrogeological consultant performs this work.

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Storm & Wastewater Disposal to Ground

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Geothermal / Geoexchange Systems

Policy and Guideline Development

Applied Research

Rural Subdivision Services

Environmental Assessment & Permitting

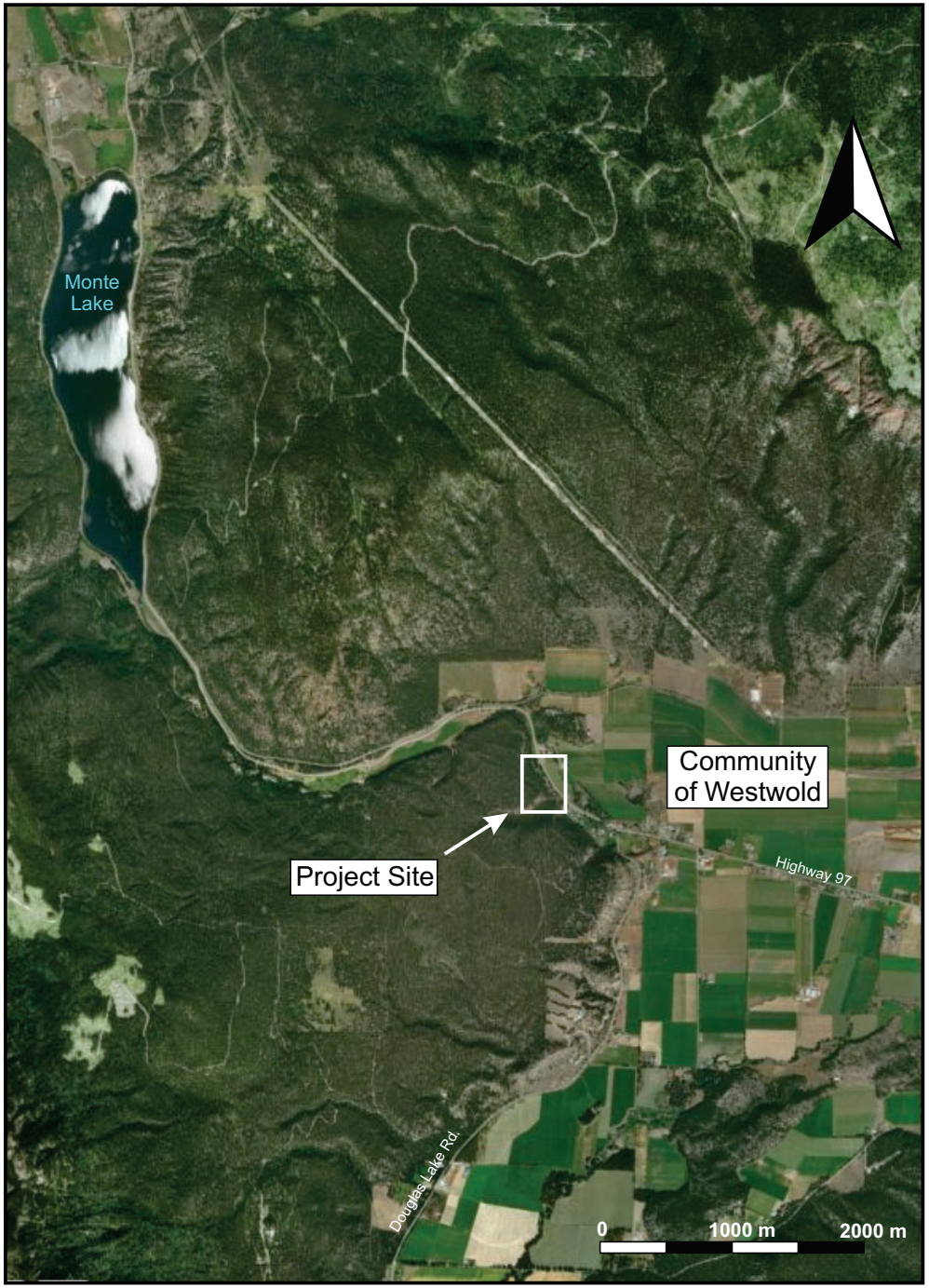

Figure 1 - Site Plan

Date: May 2019	Image Source: BC Water Resources Atlas (2019)		WWAL Project #: 19-002-01VR
Drawn by: PW	Checked by: DG	Client: MFLNRORD	Project: Westwold Flowing Well Decommissioning

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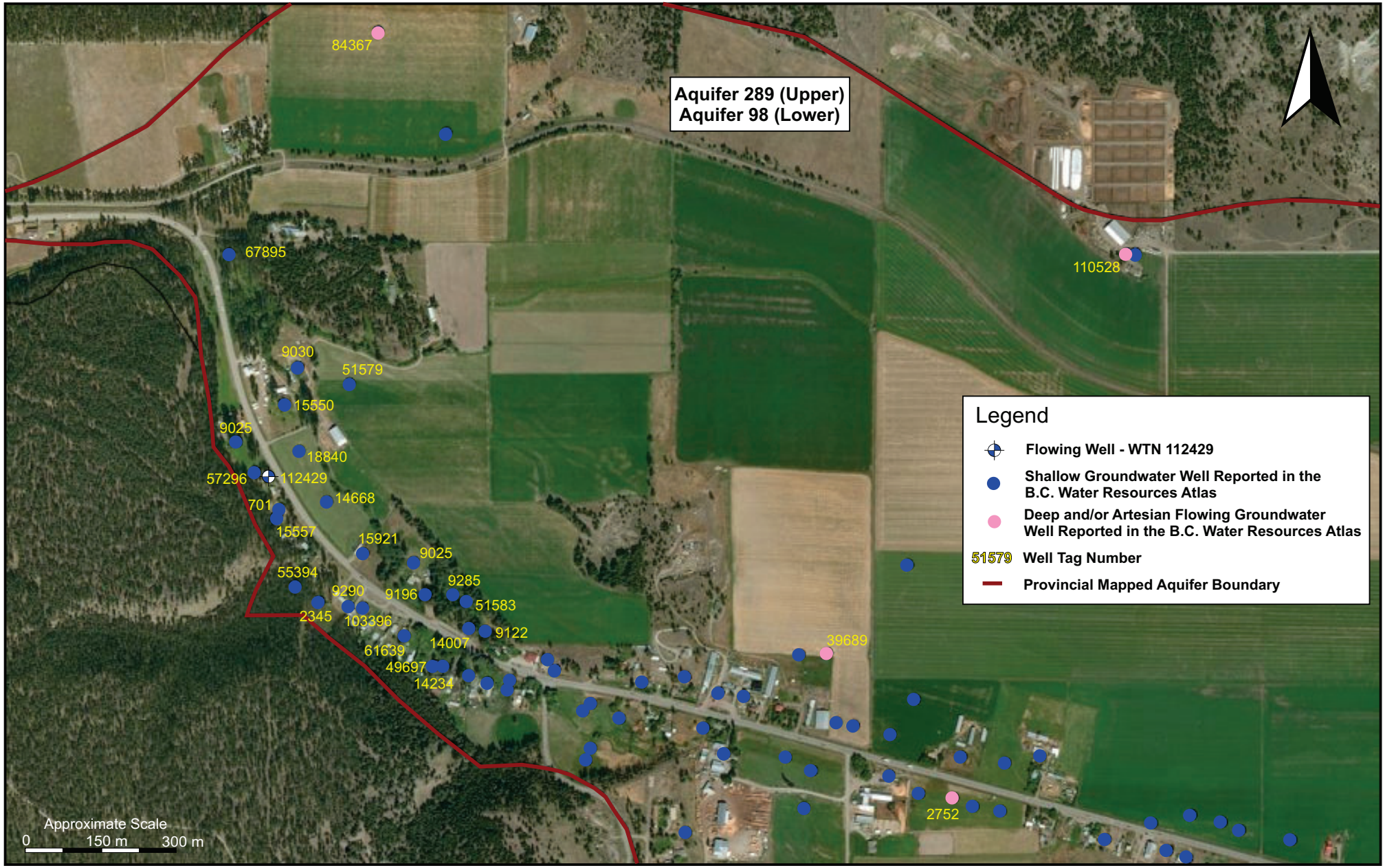

Figure 2 - Mapped Aquifers and Reported Wells of Interest in the Area

Date: May 2019	Image Source: BC Water Resources Atlas		WWAL Project: 19-002-01VR
Drawn by: PW	Checked by: DG	Client: MFLNRORD	Project: Westwold Flowing Well Decommissioning

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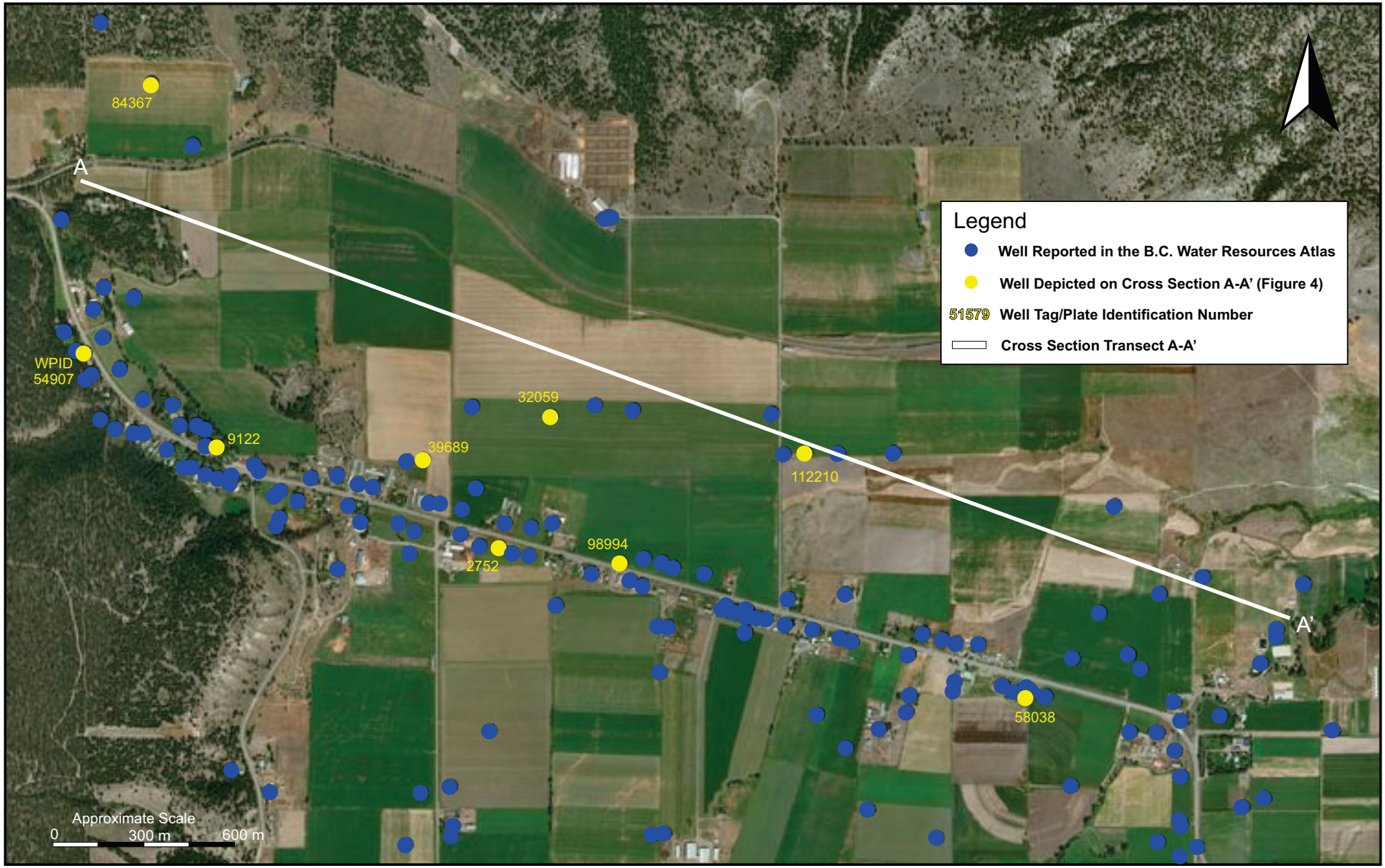

Figure 3 - Cross Section A-A' Transect

Date: May 2019	Image Source: BC Water Resources Atlas		WWAL Project: 19-002-01VR
Drawn by: PW	Checked by: DG	Client: MFLNRORD	Project: Westwold Flowing Well Decommissioning

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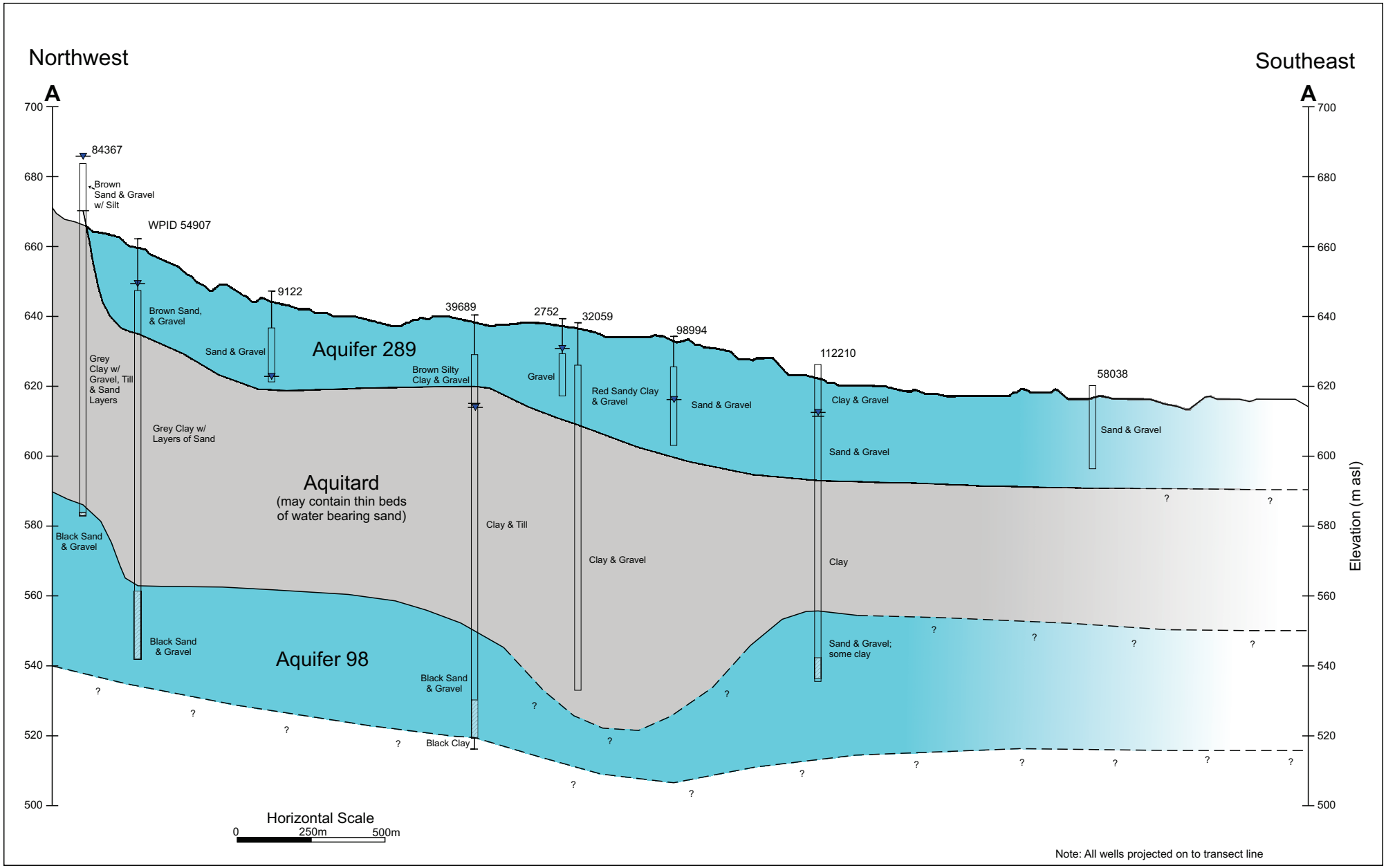

Figure 4 - Cross-section A - A' (See Figure 3)

Date: May 2019	Cross-Section Transect from Figure 3		WWAL Project: 19-002-01VR
Drawn by: PW	Checked by: DG	Client: MFLNRORD	Project: Westwold Flowing Well Decommissioning

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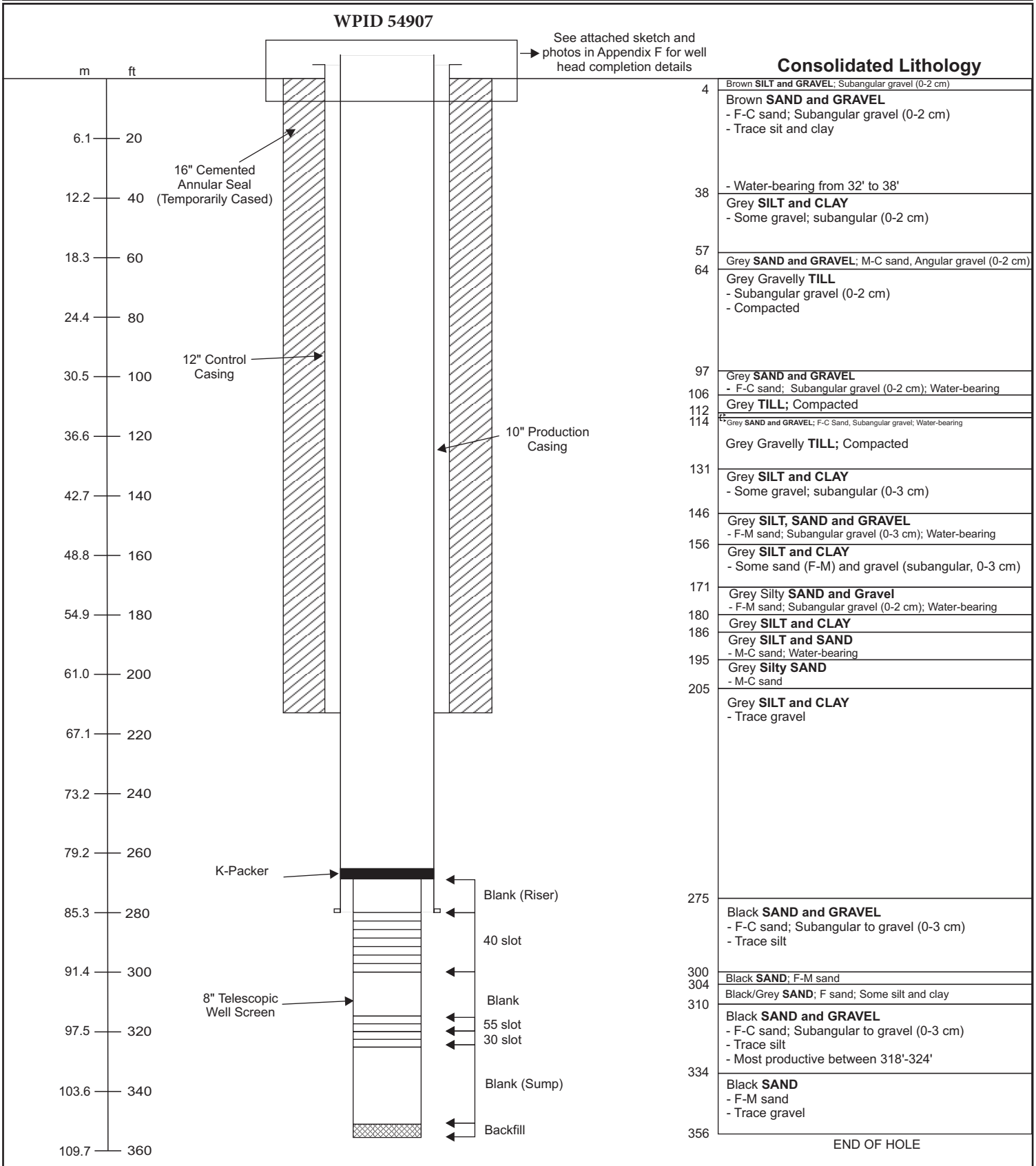
Figure 5: Relief Well Design

Project: Westwold Flowing Well Decommissioning

Client: Ministry of Forest, Lands, Natural Resource Operations, and Rural Development



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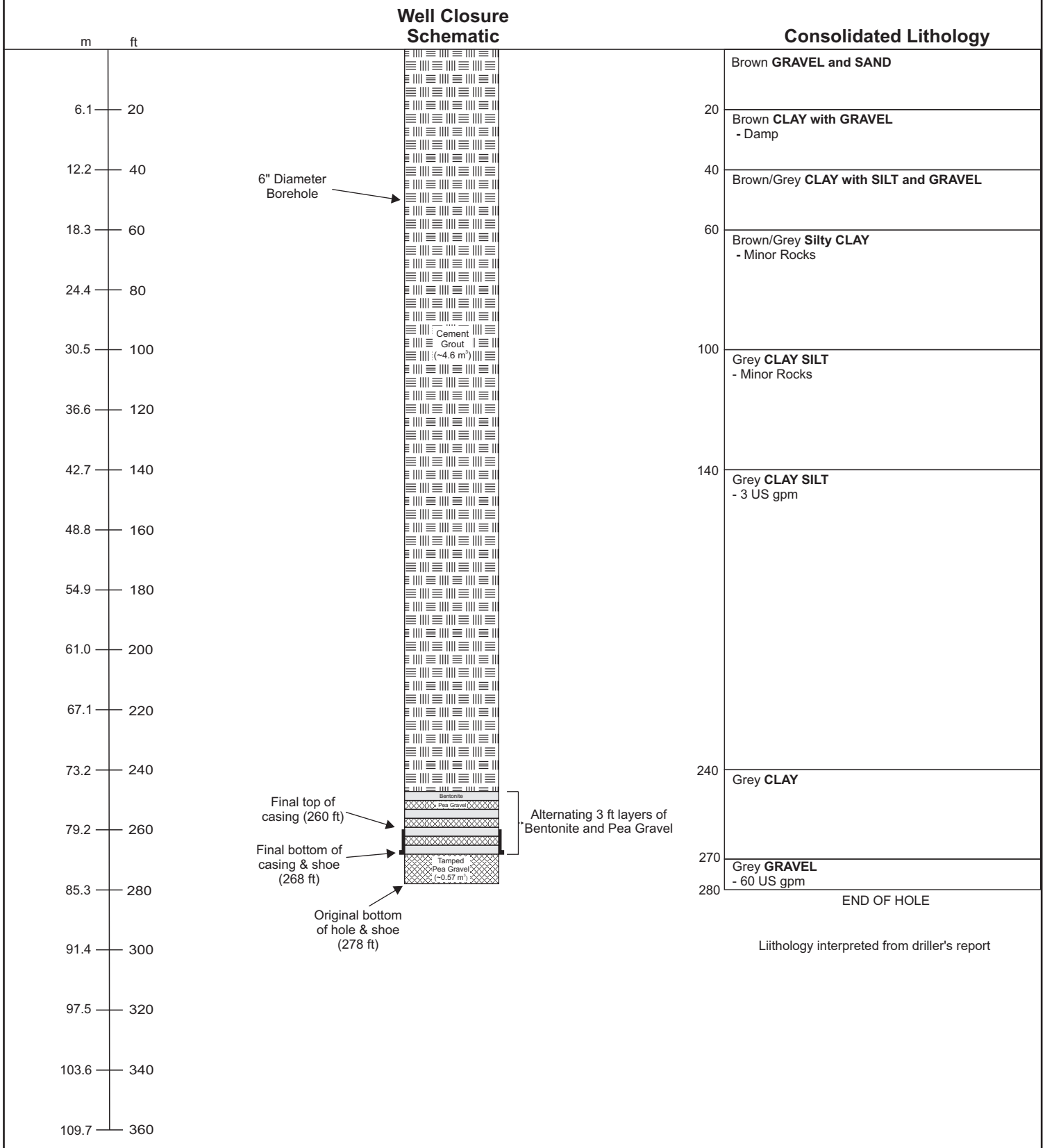
WWAL Project #: 19-002-01VR

Figure 6: WTN 112429 Well Closure Schematic

Project: Westwold Flowing Well Decommissioning

Client: Ministry of Forest, Lands, Natural Resource Operations, and Rural Development



Appendix A
Well Drillers Logs: Relief Well, WTN 112429 (Closure Log, Drillwell and Drillers Log JR Drilling)

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

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Ministry of Environment

☒ **Well Construction Report**
☐ **Well Closure Report**
☐ **Well Alteration Report**

Stamp company name/address/ phone/fax/e-mail here, if desired.

Ministry Well ID Plate Number: 54907
Ministry Well Tag Number: _____
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

Red lettering indicates minimum mandatory information. **See reverse for notes & definitions of abbreviations.**

Owner name: BRANDON UNDERWOOD
Mailing address: 17142 COMMONAGE RD Town LAKE COUNTRY Prov. BC Postal Code V0V 1B5
Well Location: Address: Street no. 4686 Street name HWY 97 NORTH Town WESTWOLD
(or) **Legal description:** Lot 1 Plan KAP9141 D.L. _____ Block _____ Sec. 31 Twp. 17 Rg. 13 Land District 25
(or) **PID:** 009-735-909 (and) **Description of well location (attach sketch, if nec.):** _____

NAD 83: Zone: 11 (see note 2) (and) **UTM Easting:** 0302050 m **UTM Northing:** 5595414 m (or) **Latitude (see note 3):** _____ **Longitude:** _____

Method of drilling: ☐ air rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ excavating ☒ other (specify): DVAL ROTARY
Orientation of well: ☒ vertical ☐ horizontal Ground elevation: 2085 ft (asl) Method (see note 4): GPS
Class of well (see note 5): WATER SUPPLY **Sub-class of well:** DOMESTIC
Water supply wells: indicate intended water use: ☒ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify): _____

Lithologic description (see notes 7-14) or closure description (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details
0	38		BROWN	SAND & GRAVEL W.B. @ 32'		WATER BEARING @ 32-38'
38	57			CLAY W GRAVEL		
57	64			SAND & GRAVEL		
64	97			GRAVELY TILL		
97	106			SAND & GRAVEL W.B.		LOTS OF WATER
106	112			TILL		
112	114			SAND & GRAVEL W.B.		
114	131			TILL		
131	146		GREY	CLAY W GRAVEL		
146	195			SILT, CLAY & SAND LAYER. SOME NARROW ZONES MAKING UP TO 10 GPM.		

Casing details

CONT...

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe
0	215	16"	STEEL - REMOVED	-	-
0	215	12"	STEEL	0.375	-
0	276	10"	STEEL - THREADED	0.365	D.R.
			★ 9.75" ID @ JOINTS		

Screen details

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size
265	280	8	K-PACK & RISER	-
280	300	8	PIPE SIZE SS	0.040"
300	315	8	PIPE BLANK	-
315	320	8	PIPE SIZE SS	0.055"

Surface seal: Type: NEAT CEMENT Depth: 215 ft
Method of installation: ☐ Poured ☒ Pumped Thickness: 2 in
Backfill: Type: BENTONITE CHIPS Depth: 3 ft
Liner: ☐ PVC ☐ Other (specify): _____
Diameter: _____ in Thickness: _____ in
From: ____ ft (bgl) To: ____ ft (bgl) Perforated: From: ____ ft (bgl) To: ____ ft (bgl)

Intake: ☒ Screen ☐ Open bottom ☐ Uncased hole
Screen type: ☐ Telescope ☒ Pipe size
Screen material: ☒ Stainless steel ☐ Plastic ☐ Other (specify): _____
Screen opening: ☒ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☐ Bail ☐ Plug ☒ Plate ☐ Other (specify): _____
Filter pack: From: ____ ft To: ____ ft Thickness: _____ in
Type and size of material: _____

Developed by:

☒ Air lifting ☐ Surging ☐ Jetting ☐ Pumping ☒ Bailing
☐ Other (specify): _____ Total duration: _____ hrs
Notes: _____

Well yield estimated by:

☒ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify): _____
Rate: _____ USgpm Duration: _____ hrs
SWL before test: _____ ft (btoc) Pumping water level: _____ ft (btoc)

Obvious water quality characteristics:

☒ Fresh ☐ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: _____ Water sample collected: ☐

Final well completion data:

Total depth drilled: 356 ft Finished well depth: 351 ft (bgl)
Final stick up: 24 in Depth to bedrock: - ft (bgl)
SWL: flowing ft (btoc) Estimated well yield: 500+ USgpm
Artesian flow: 200+ USgpm, or Artesian pressure: 8+ ft
Type of well cap: WATER TIGHT Well disinfected: ☐ Yes ☐ No
Where well ID plate is attached: CASING

Well closure information:

Reason for closure: _____
Method of closure: ☐ Poured ☐ Pumped
Sealant material: _____ Backfill material: _____
Details of closure (see note 17): _____

Well driller (print clearly):

Name (first, last) (see note 19): DAVID SLADE
Registration no. (see note 20): WD 04121404
Consultant (if applicable; name and company): DOUG GELLER @ WW

Date of work (YYYY/MM/DD):
Started: 2019/02/26 **Completed:** 2019/03/27
Comments: _____

DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the *Water Act* and the Ground Water Protection Regulation.
Signature of Driller Responsible [signature]

PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.

white: Customer copy
canary: Driller copy
pink: Ministry copy

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

☒ Well Construction Report
☐ Well Closure Report
☐ Well Alteration Report

Stamp company name/address/ phone/fax/e-mail here, if desired.

Ministry Well ID Plate Number: 54907
Ministry Well Tag Number:
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

Red lettering indicates minimum mandatory information. **See reverse for notes & definitions of abbreviations.**

Owner name: BRANDON UNDERWOOD
Mailing address: 17142 COMMONAGE RD Town LAKE COUNTRY Prov. BC Postal Code V0V 1B5
Well Location: Address: Street no. 4686 Street name HWY 97 NORTH Town WESTWOLD
(or) **Legal description:** Lot 1 Plan KAP 9141 D.L. Block Sec. 31 Twp. 17 Rg. 13 Land District 25
(or) **PID:** 009 735 909 (and) **Description of well location (attach sketch, if nec.):**

NAD 83: Zone: (see note 2) (and) **UTM Easting:** 0302050 m **UTM Northing:** 5595414 m (or) **Latitude (see note 3):** **Longitude:**

Method of drilling: ☐ air rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ excavating ☒ other (specify): DUAL ROTARY
Orientation of well: ☒ vertical ☐ horizontal Ground elevation: 2085 ft (asl) Method (see note 4): GPS
Class of well (see note 5): WATER SUPPLY **Sub-class of well:** DOMESTIC
Water supply wells: indicate intended water use: ☒ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify):

Lithologic description (see notes 7-14) or closure description (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details
195	205			VERY SILTY SAND & DENSE SILT		LITTLE WATER
205	215			DENSE SILT	0	NO WATER
215	226			SILT & VERY SILTY SAND		LITTLE WATER
226	275			DENSE CLAY/SILT	0	NO WATER
275	302			COARSE SAND & GRAVEL, SILTY	100+	VERY PRODUCTIVE
302	310			VERY FINE SAND		LITTLE WATER
310	315			SAND & GRAVEL, SILTY		
315	324			COARSE SAND & GRAVEL	100+	VERY PRODUCTIVE
324	356			SAND, MEDIUM/FINE		

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe
0	215	16"	STEEL - REMOVED	–	–
0	215	12"	STEEL	0.375	–
0	276	10"	STEEL - THREADED	0.365	D.R.
		* 9.75" ID COUPLING JOINTS.			

Screen details

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size
320	325	8	PIPE SIZE SS	0.030"
325	351	8	PIPE BLANK	–

Surface seal: Type: NEAT CEMENT Depth: 215 ft
Method of installation: ☐ Poured ☒ Pumped Thickness: 2 in
Backfill: Type: BENTONITE CHIPS Depth: 3 ft
Liner: ☐ PVC ☐ Other (specify):
Diameter: in Thickness: in
From: ft (bgl) To: ft (bgl) Perforated: From: ft (bgl) To: ft (bgl)

Intake: ☒ Screen ☐ Open bottom ☐ Uncased hole
Screen type: ☐ Telescope ☒ Pipe size
Screen material: ☒ Stainless steel ☐ Plastic ☐ Other (specify):
Screen opening: ☒ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☐ Bail ☐ Plug ☒ Plate ☐ Other (specify):
Filter pack: From: ft To: ft Thickness: in
Type and size of material:

Developed by:

☒ Air lifting ☐ Surging ☐ Jetting ☐ Pumping ☒ Bailing
☐ Other (specify): Total duration: hrs
Notes:

Well yield estimated by:

☒ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify):
Rate: USgpm Duration: hrs
SWL before test: ft (btoc) Pumping water level: ft (btoc)

Obvious water quality characteristics:

☒ Fresh ☐ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: Water sample collected: ☐

Final well completion data:

Total depth drilled: 356 ft Finished well depth: 351 ft (bgl)
Final stick up: 24 in Depth to bedrock: – ft (bgl)
SWL: flowing ft (btoc) Estimated well yield: 500+ USgpm
Artesian flow: 200+ USgpm, or Artesian pressure: 8+ ft
Type of well cap: WATER TIGHT Well disinfected: ☐ Yes ☐ No
Where well ID plate is attached: CASING

Well closure information:

Reason for closure:
Method of closure: ☐ Poured ☐ Pumped
Sealant material: Backfill material:
Details of closure (see note 17):

Well driller (print clearly):

Name (first, last) (see note 19): DAVID SLADE
Registration no. (see note 20): WD 04121404
Consultant (if applicable; name and company): DOUG GELLER @ WWS

Date of work (YYYY/MM/DD): **Started:** 2019/02/26 **Completed:** 2019/03/27
Comments:

DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the *Water Act* and the Ground Water Protection Regulation.
Signature of Driller Responsible

PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.

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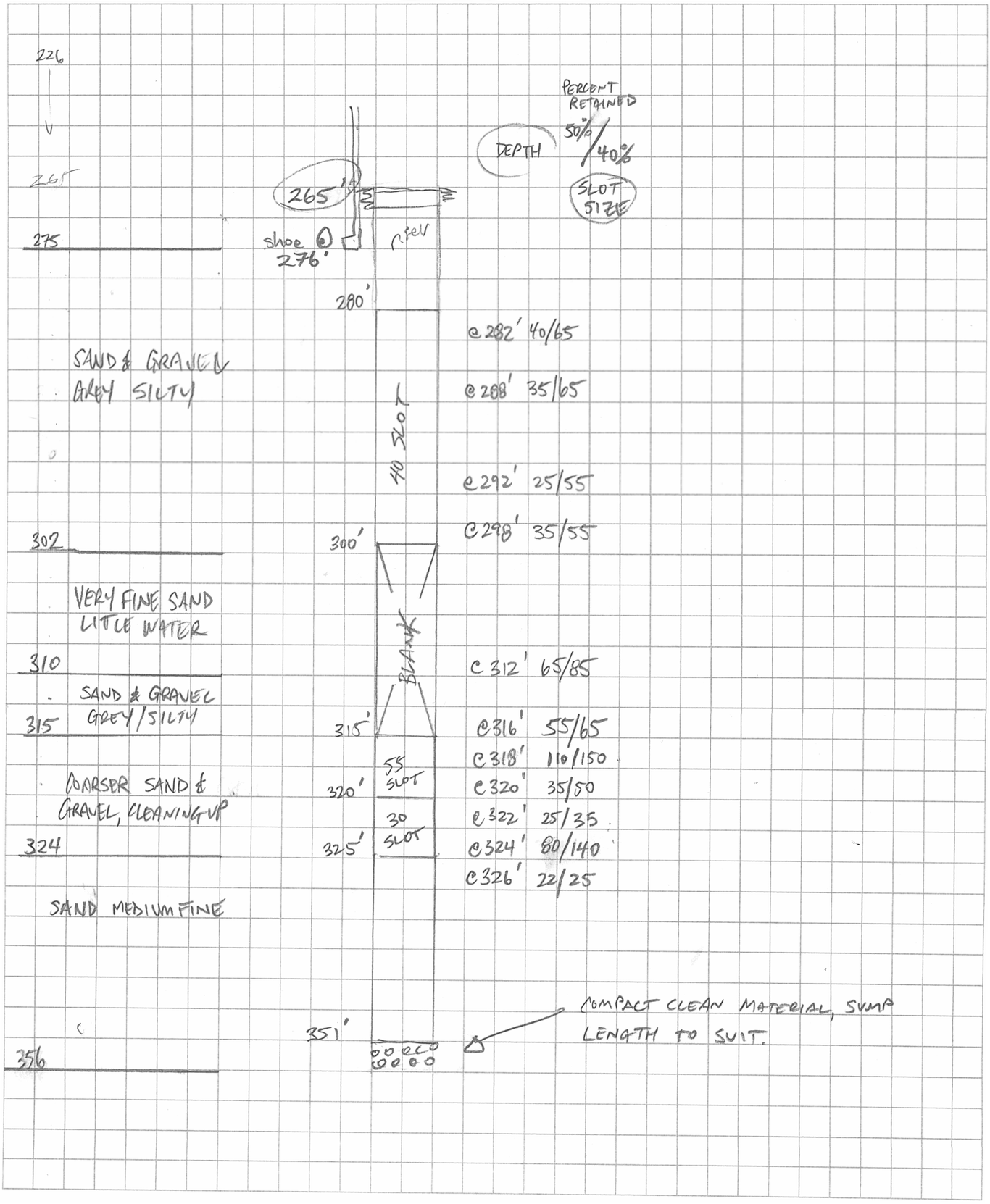
pink: Ministry copy

Drillwell Enterprises
4994 Polkey Road
Duncan, BC, V9L 6W3

Phone: (250) 746-5268
Fax: (250) 746-8404
Email: drill@drillwell.com



BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

☐ **Well Construction Report**
☒ **Well Closure Report**
☐ **Well Alteration Report**

Stamp company name/address/ phone/fax/email here, if desired.

Ministry Well ID Plate Number: 41736
Ministry Well Tag Number: 112429
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

Red lettering indicates minimum mandatory information. See reverse for notes & definitions of abbreviations.

Owner name: BRANDON UNDERWOOD

Mailing address: 17142 COMMONAGE RD, Town LAKE COUNTRY Prov. B.C. Postal Code V0V 1B5

Well Location (see note 2): Address: Street no. 4686 Street name HWY 97 NORTH Town WESTWOLD

(or) **Legal description:** Lot 1 Plan KAP9141 D.L. _____ Block _____ Sec. 31 Twp. 17 Rg. 13 Land District 25

(or) **PID:** 009-735-709 (and) **Description of well location (attach sketch, if nec.):** _____

NAD 83: Zone: 11 (and) **UTM Easting:** 0302050 m (or) **Latitude (see note 4):** _____
(see note 3) **UTM Northing:** 5595412 m **Longitude:** _____

Method of drilling: ☐ air rotary ☐ dual rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ other (specify): _____

Orientation of well: ☐ vertical ☐ horizontal Ground elevation: 2085 ft (asl) Method (see note 5): _____

Class of well (see note 6): _____ **Sub-class of well:** _____

Water supply wells: indicate intended water use: ☐ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify): _____

Lithologic description (see notes 8-13) or closure description (see notes 14 and 15)

From ft (bgl)	To ft (bgl)	Surficial Material: Clay	Silt	Till	Sand with clay/silt	Sand, fine-med	Sand, med-coarse	Sand with gravel	Bedrock Material: Siltstone/shale	Sandstone	Conglomerate	Limestone	Basalt	Volcanic	Cyrstalline	Other Surficial/ Bedrock	Colour: Red	Orange	Brown	Tan	Light Grey	Blue	Green	Dark Grey	Hardness: Very Hard	Hard	Dense/Stiff	Loose	Water Content: Dry	Moist	Wet	High Production	Lost circulation	Not Available	Observations (e.g. other geological materials (e.g. boulders), est. water bearing flow (USgpm), or closure details)
		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
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		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
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		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material/Open Hole (see note 17)	Wall Thickness in	Drive Shoe

Surface seal: Type: _____ Depth: _____ ft
Method of installation: ☐ Poured ☐ Pumped Thickness: _____ in
Backfill: Type: _____ Depth: _____ ft
Liner: ☐ PVC ☐ Other (specify): _____
Diameter: _____ in Thickness: _____ in
From: ___ ft (bgl) To: ___ ft (bgl) Perforated: From: ___ ft (bgl) To: ___ ft (bgl)

Screen details

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size

Intake: ☐ Screen ☐ Open bottom ☐ Uncased hole
Screen type: ☐ Telescope ☐ Pipe size
Screen material: ☐ Stainless steel ☐ Plastic ☐ Other (specify): _____
Screen opening: ☐ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☐ Bail ☐ Plug ☐ Plate ☐ Other (specify): _____
Filter pack: From: _____ ft To: _____ ft Thickness: _____ in
Type and size of material: _____

Developed by:
☐ Air lifting ☐ Surging ☐ Jetting ☐ Pumping ☐ Bailing
Other (specify): _____ Total duration: _____ hrs
Notes: _____

Well yield estimated by:
☐ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify): _____
Rate: _____ USgpm Duration: _____ hrs
SWL before test: _____ ft (btoc) Pumping water level: _____ ft (btoc)

Obvious water quality characteristics:
☐ Fresh ☒ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: _____ Water sample collected: ☐

Well driller (print clearly):
Name (first, last) (see note 19): DAVID SLADE
Registration no. (see note 20): WD 04121404
Consultant (if applicable; name and company): DOUG GELLER @ WESTERN WATER ASSOCIATES

DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the Water Act and the Ground Water Protection Regulation.

Signature of Driller Responsible

Final well completion data:
Total depth drilled: _____ ft Finished well depth: _____ ft (bgl)
Final stick up: _____ in Depth to bedrock: _____ ft (bgl)
SWL: _____ ft (btoc) Estimated well yield: _____ USgpm
Artesian flow: _____ USgpm, or Artesian pressure: _____ ft
Type of well cap: _____ Well disinfected: ☐ Yes ☐ No
Where well ID plate is attached: _____

Well closure information:
Reason for closure: WILDCAT FLOWING ARTESIAN
Method of closure: ☐ Poured ☒ Pumped
Sealant material: CEMENT Backfill material: BENTONITE & GRAVEL
Details of closure (see note 16): VOID BACKFILLED WITH GRAVEL, BENTONITE, CHIP PLUG, NEAT CEMENT FROM 247' TO SURFACE, ALL CASING PULLED.

Date of work (YYYY/MM/DD):
Started: 2019/03/23 **Completed:** 2019/03/25

Comments: PERFORMED AS REQUESTED BY FLNRO

PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.

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pink: Ministry copy

Sheet 1 of 1

M-1073 ✓
41736

BRITISH COLUMBIA
Ministry of Environment

☐ **Well Construction Report**
☐ **Well Closure Report**
☐ **Well Alteration Report**

Stamp company name/address/ phone/fax/e-mail here, if desired.

Ministry Well ID Plate Number: 41736
Ministry Well Tag Number: _____
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

Red lettering indicates minimum mandatory information. **See reverse for notes & definitions of abbreviations.**

Owner name: Brandon Underwood
Mailing address: 17142 Commonage Town Lumpfield Prov. BC Postal Code V4V 1B5
Well Location: Address: Street no. 4683 Street name Hwy 97 North Town Westwold
(or) **Legal description:** Lot 1 Plan 9141 D.L. _____ Block _____ Sec. 31 Twp. 17 Rg. 3 Land District KDD
(or) **PID:** _____ (and) **Description of well location (attach sketch, if nec.):** _____

NAD 83: Zone: 11V (see note 2) (and) **UTM Northing:** 5300202 7 m **UTM Easting:** 559542 7 m (or) **Latitude (see note 3):** _____ **Longitude:** _____

Method of drilling: ☑ air rotary ☐ cable tool ☐ mud rotary ☐ auger ☐ driving ☐ jetting ☐ excavating ☐ other (specify): _____

Orientation of well: ☑ vertical ☐ horizontal Ground elevation: _____ ft (asl) Method (see note 4): _____

Class of well (see note 5): Water Supply **Sub-class of well:** Domestic

Water supply wells: indicate intended water use: ☑ private domestic ☐ water supply system ☐ irrigation ☐ commercial or industrial ☐ other (specify): _____

Lithologic description (see notes 7-14) or closure description (see notes 15 and 16)

From ft (bgl)	To ft (bgl)	Relative Hardness	Colour	Material Description (Use recommended terms on reverse. List in order of decreasing amount, if applicable)	Water-bearing Estimated Flow (USgpm)	Observations (e.g., fractured, weathered, well sorted, silty wash), closure details
0	20	S/m	Br	Gravel & Sand		
20	40	S/m	Br	Gravel with Clay Damp		
40	60	S	Br/Grey	Clay with silt & Gravel		
60	100	S	Br/Grey	Silty Clay minor rocks		
100	140	S/m	Grey	Clay/Silt minor rocks		
140	240	S	Grey	Clay/Silt. Sandy		
240	260	S	Grey	Clay.		
260	270	M	Grey	Clay		
270	280	M	Grey	Gravel	60	

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material / Open Hole	Wall Thickness in	Drive Shoe
0	20	8	Steel Ramset		
0	280	6	Steel	.219	DS

Surface seal: Type: Bentonite Chips Depth: 20 ft
Method of installation: ☐ Poured ☐ Pumped Thickness: _____ in
Backfill: Type: _____ Depth: _____ ft
Liner: ☐ PVC ☐ Other (specify): _____
Diameter: _____ in Thickness: _____ in
From: ____ ft (bgl) To: ____ ft (bgl) Perforated: From: ____ ft (bgl) To: ____ ft (bgl)

Screen details

From ft (bgl)	To ft (bgl)	Dia in	Type (see note 18)	Slot Size

Intake: ☐ Screen ☑ Open bottom ☐ Uncased hole
Screen type: ☐ Telescope ☐ Pipe size
Screen material: ☐ Stainless steel ☐ Plastic ☐ Other (specify): _____
Screen opening: ☐ Continuous slot ☐ Slotted ☐ Perforated pipe
Screen bottom: ☐ Bail ☐ Plug ☐ Plate ☐ Other (specify): _____
Filter pack: From: ____ ft To: ____ ft Thickness: _____ in
Type and size of material: _____

Developed by:

☐ Air lifting ☐ Surging ☐ Jetting ☐ Pumping ☐ Bailing
☑ Other (specify): Flowing Total duration: 2 hrs
Notes: _____

Well yield estimated by:

☐ Pumping ☐ Air lifting ☐ Bailing ☐ Other (specify): _____
Rate: _____ USgpm Duration: _____ hrs
SWL before test: _____ ft (btoc) Pumping water level: _____ ft (btoc)

Obvious water quality characteristics:

☐ Fresh ☐ Salty ☐ Clear ☐ Cloudy ☐ Sediment ☐ Gas
Colour/odour: _____ Water sample collected: ☐

Well driller (print clearly):

Name (first, last) (see note 19): Kelly Kellerhals
Registration no. (see note 20): WD0705170
Consultant (if applicable; name and company): _____

DECLARATION: Well construction, well alteration or well closure, as the case may be, has been done in accordance with the requirements in the *Water Act* and the Ground Water Protection Regulation.

Signature of Driller Responsible _____

Final well completion data:

Total depth drilled: 280 ft Finished well depth: 280 ft (bgl)
Final stick up: 12 in Depth to bedrock: 6 ft (bgl)
SWL: Surface ft (btoc) Estimated well yield: _____ USgpm
Artesian flow: 60 USgpm, or Artesian pressure: _____ ft
Type of well cap: Lockable Well disinfected: ☐ Yes ☐ No
Where well ID plate is attached: Casing

Well closure information:

Reason for closure: _____
Method of closure: ☐ Poured ☐ Pumped
Sealant material: _____ Backfill material: _____
Details of closure (see note 17): _____

Date of work (YYYY/MM/DD):

Started: March 10, 2016 **Completed:** March 11, 2016

Comments: _____

PLEASE NOTE: The information recorded in this well report describes the works and hydrogeologic conditions at the time of construction, alteration or closure, as the case may be. Well yield, well performance and water quality are not guaranteed as they are influenced by a number of factors, including natural variability, human activities and condition of the works, which may change over time.

white: Customer copy
canary: Driller copy
pink: Ministry copy

Sheet ____ of ____

Appendix B
Grain Size Sieve Analysis

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

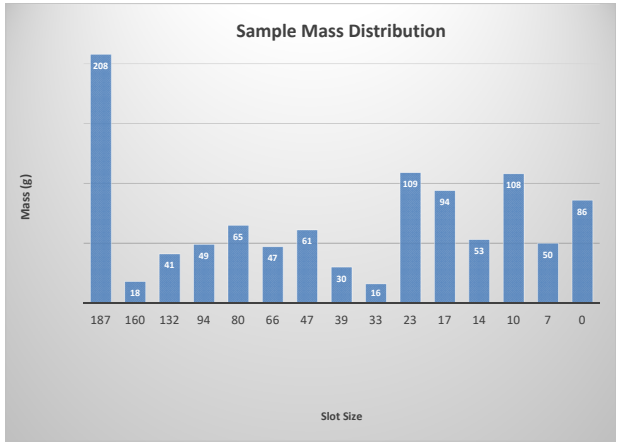
Sample depth (bgs) ft 282

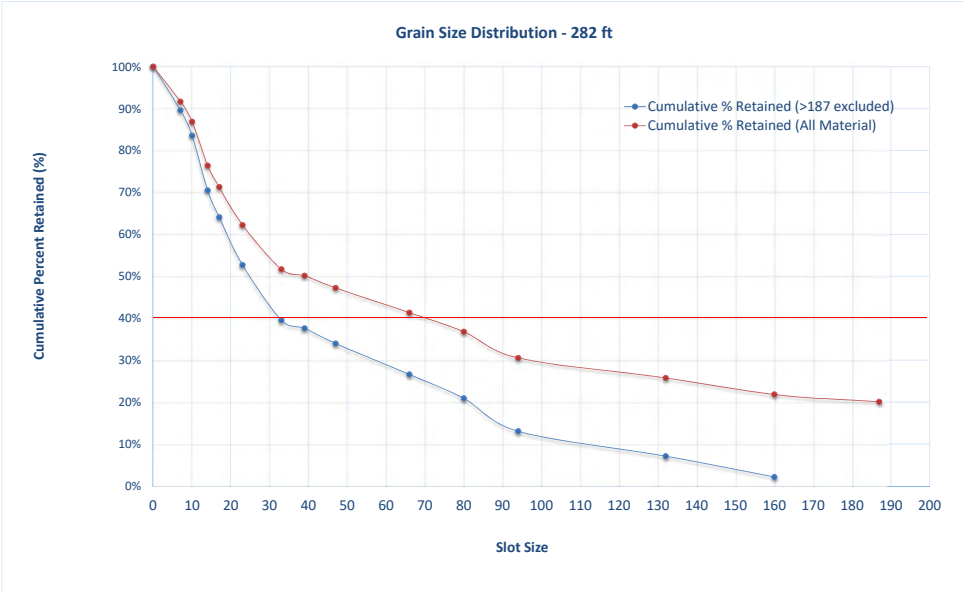
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	208		20%		20%
Gravel	3.35	5	160	18	2%	2%	2%	22%
Fine Gravel		6	132	41	5%	4%	7%	26%
Coarse Sand	2	8	94	49	6%	5%	13%	31%
Medium Sand	1.7	10	80	65	8%	6%	21%	37%
Medium Sand	1.4	12	66	47	6%	5%	27%	41%
Medium Sand	1	16	47	61	7%	6%	34%	47%
Medium Sand		18	39	30	4%	3%	38%	50%
Medium Sand	0.841	20	33	16	2%	2%	40%	52%
Fine Sand	0.595	30	23	109	13%	11%	53%	62%
Fine Sand	0.42	40	17	94	11%	9%	64%	71%
Fine Sand		45	14	53	6%	5%	70%	76%
Fine Sand	0.25	60	10	108	13%	10%	84%	87%
Fine Sand		80	7	50	6%	5%	90%	92%
			0	86	10%	8%	100%	100%
Total (All)				1035	100%	100%		
Total (exclude >187)				827				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

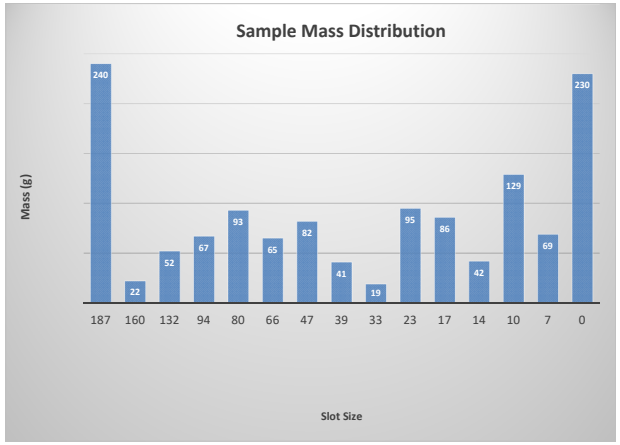
Sample depth (bgs) ft 288

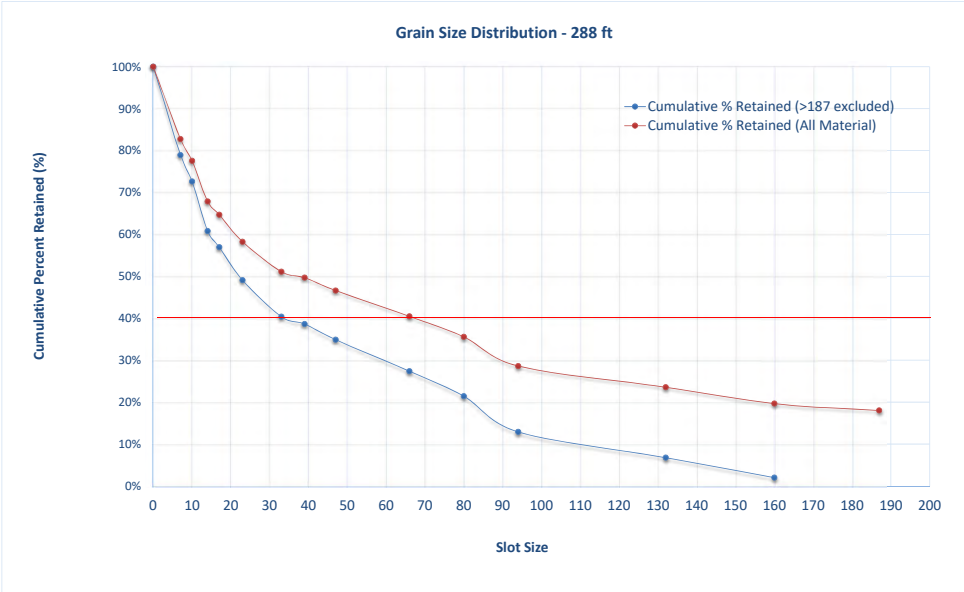
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	240		18%		18%
Gravel	3.35	5	160	22	2%	2%	2%	20%
Fine Gravel		6	132	52	5%	4%	7%	24%
Coarse Sand	2	8	94	67	6%	5%	13%	29%
Medium Sand	1.7	10	80	93	9%	7%	21%	36%
Medium Sand	1.4	12	66	65	6%	5%	27%	40%
Medium Sand	1	16	47	82	8%	6%	35%	47%
Medium Sand		18	39	41	4%	3%	39%	50%
Medium Sand	0.841	20	33	19	2%	1%	40%	51%
Fine Sand	0.595	30	23	95	9%	7%	49%	58%
Fine Sand	0.42	40	17	86	8%	6%	57%	65%
Fine Sand		45	14	42	4%	3%	61%	68%
Fine Sand	0.25	60	10	129	12%	10%	73%	78%
Fine Sand		80	7	69	6%	5%	79%	83%
			0	230	21%	17%	100%	100%
Total (All)				1332	100%	100%		
Total (exclude >187)				1092				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

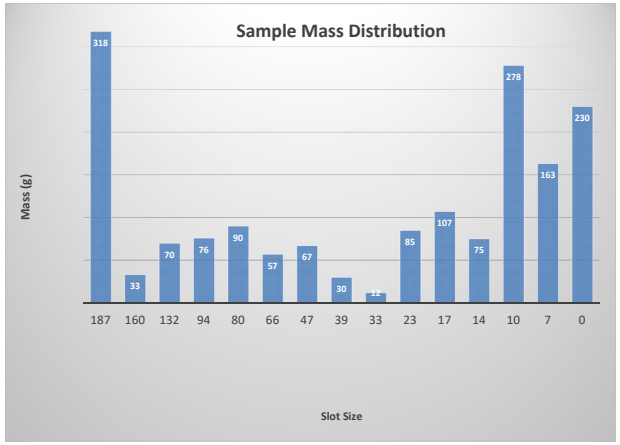
Sample depth (bgs) ft 292

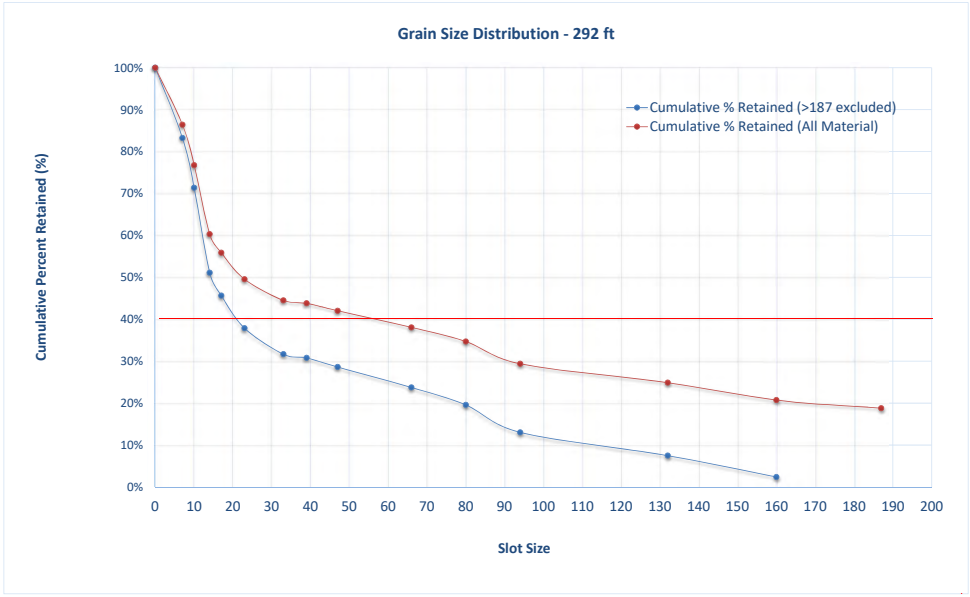
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	318		19%		19%
Gravel	3.35	5	160	33	2%	2%	2%	21%
Fine Gravel		6	132	70	5%	4%	8%	25%
Coarse Sand	2	8	94	76	6%	4%	13%	29%
Medium Sand	1.7	10	80	90	7%	5%	20%	35%
Medium Sand	1.4	12	66	57	4%	3%	24%	38%
Medium Sand	1	16	47	67	5%	4%	29%	42%
Medium Sand		18	39	30	2%	2%	31%	44%
Medium Sand	0.841	20	33	12	1%	1%	32%	45%
Fine Sand	0.595	30	23	85	6%	5%	38%	50%
Fine Sand	0.42	40	17	107	8%	6%	46%	56%
Fine Sand		45	14	75	5%	4%	51%	60%
Fine Sand	0.25	60	10	278	20%	16%	71%	77%
Fine Sand		80	7	163	12%	10%	83%	86%
			0	230	17%	14%	100%	100%
Total (All)				1691	100%	100%		
Total (exclude >187)				1373				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

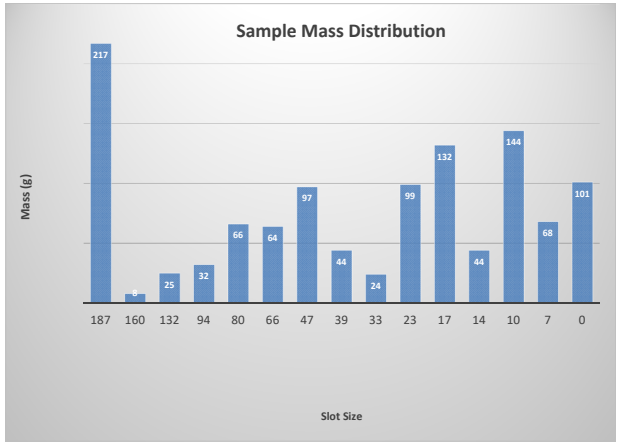
Sample depth (bgs) ft 298

Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	217		19%		19%
Gravel	3.35	5	160	8	1%	1%	1%	19%
Fine Gravel		6	132	25	3%	2%	3%	21%
Coarse Sand	2	8	94	32	3%	3%	7%	24%
Medium Sand	1.7	10	80	66	7%	6%	14%	30%
Medium Sand	1.4	12	66	64	7%	5%	21%	35%
Medium Sand	1	16	47	97	10%	8%	31%	44%
Medium Sand		18	39	44	5%	4%	35%	47%
Medium Sand	0.841	20	33	24	3%	2%	38%	50%
Fine Sand	0.595	30	23	99	10%	8%	48%	58%
Fine Sand	0.42	40	17	132	14%	11%	62%	69%
Fine Sand		45	14	44	5%	4%	67%	73%
Fine Sand	0.25	60	10	144	15%	12%	82%	85%
Fine Sand		80	7	68	7%	6%	89%	91%
			0	101	11%	9%	100%	100%
Total (All)				1165	100%	100%		
Total (exclude >187)				948				



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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

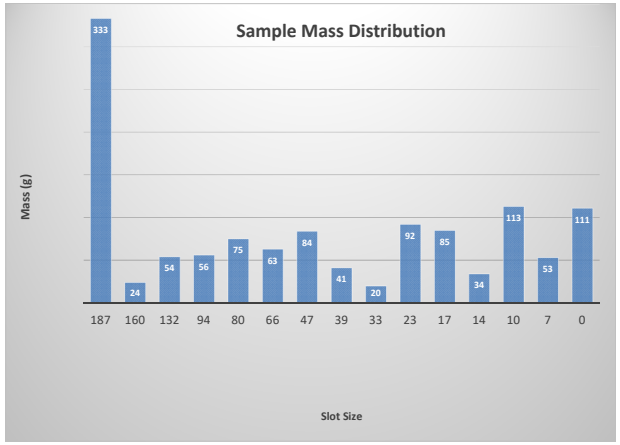
Sample depth (bgs) ft 312

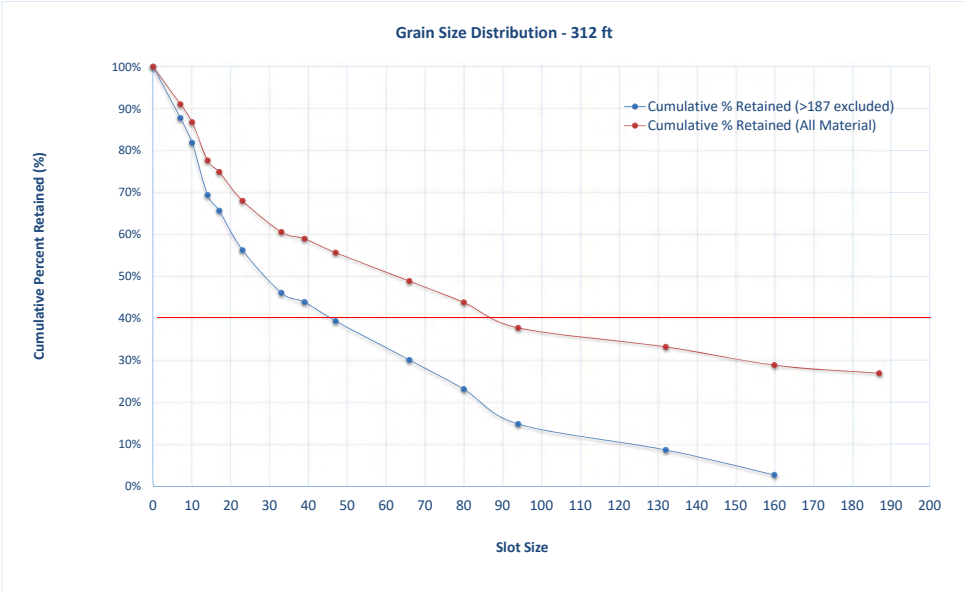
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	333		27%		27%
Gravel	3.35	5	160	24	3%	2%	3%	29%
Fine Gravel		6	132	54	6%	4%	9%	33%
Coarse Sand	2	8	94	56	6%	5%	15%	38%
Medium Sand	1.7	10	80	75	8%	6%	23%	44%
Medium Sand	1.4	12	66	63	7%	5%	30%	49%
Medium Sand	1	16	47	84	9%	7%	39%	56%
Medium Sand		18	39	41	5%	3%	44%	59%
Medium Sand	0.841	20	33	20	2%	2%	46%	61%
Fine Sand	0.595	30	23	92	10%	7%	56%	68%
Fine Sand	0.42	40	17	85	9%	7%	66%	75%
Fine Sand		45	14	34	4%	3%	69%	78%
Fine Sand	0.25	60	10	113	12%	9%	82%	87%
Fine Sand		80	7	53	6%	4%	88%	91%
			0	111	12%	9%	100%	100%
Total (All)				1238	100%	100%		
Total (exclude >187)				905				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

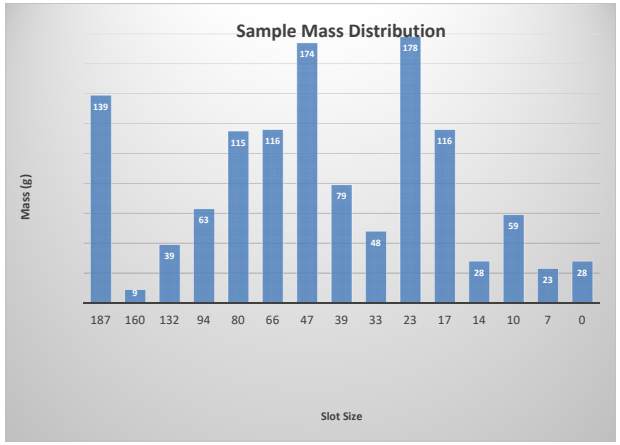
Sample depth (bgs) ft 316

Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	139		11%		11%
Gravel	3.35	5	160	9	1%	1%	1%	12%
Fine Gravel		6	132	39	4%	3%	4%	15%
Coarse Sand	2	8	94	63	6%	5%	10%	21%
Medium Sand	1.7	10	80	115	11%	9%	21%	30%
Medium Sand	1.4	12	66	116	11%	10%	32%	40%
Medium Sand	1	16	47	174	16%	14%	48%	54%
Medium Sand		18	39	79	7%	7%	55%	60%
Medium Sand	0.841	20	33	48	4%	4%	60%	64%
Fine Sand	0.595	30	23	178	17%	15%	76%	79%
Fine Sand	0.42	40	17	116	11%	10%	87%	89%
Fine Sand		45	14	28	3%	2%	90%	91%
Fine Sand	0.25	60	10	59	5%	5%	95%	96%
Fine Sand		80	7	23	2%	2%	97%	98%
			0	28	3%	2%	100%	100%
Total (All)				1214	100%	100%		
Total (exclude >187)				1075				



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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

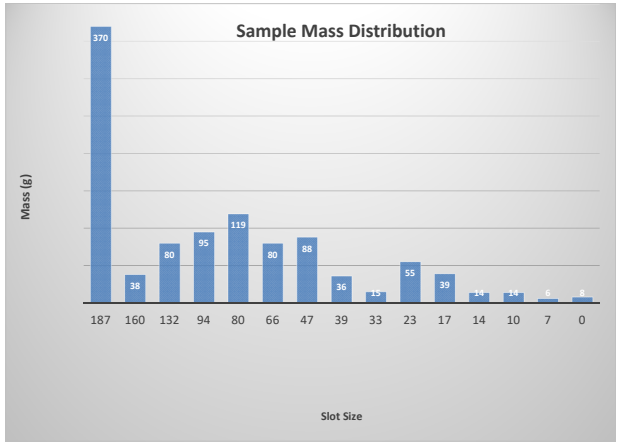
Sample depth (bgs) ft 318

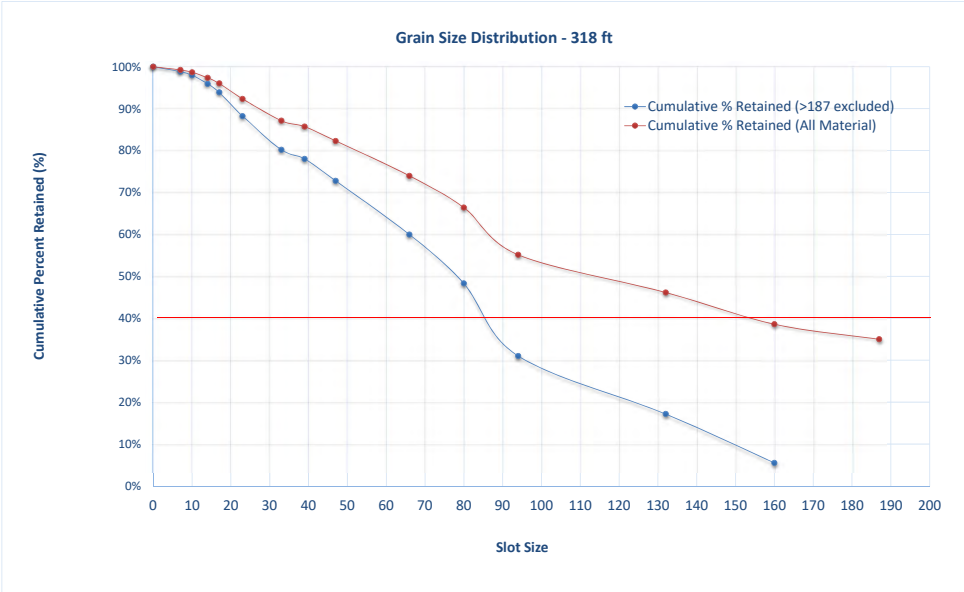
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	370		35%		35%
Gravel	3.35	5	160	38	6%	4%	6%	39%
Fine Gravel		6	132	80	12%	8%	17%	46%
Coarse Sand	2	8	94	95	14%	9%	31%	55%
Medium Sand	1.7	10	80	119	17%	11%	48%	66%
Medium Sand	1.4	12	66	80	12%	8%	60%	74%
Medium Sand	1	16	47	88	13%	8%	73%	82%
Medium Sand		18	39	36	5%	3%	78%	86%
Medium Sand	0.841	20	33	15	2%	1%	80%	87%
Fine Sand	0.595	30	23	55	8%	5%	88%	92%
Fine Sand	0.42	40	17	39	6%	4%	94%	96%
Fine Sand		45	14	14	2%	1%	96%	97%
Fine Sand	0.25	60	10	14	2%	1%	98%	99%
Fine Sand		80	7	6	1%	1%	99%	99%
			0	8	1%	1%	100%	100%
Total (All)				1057	100%	100%		
Total (exclude >187)				687				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

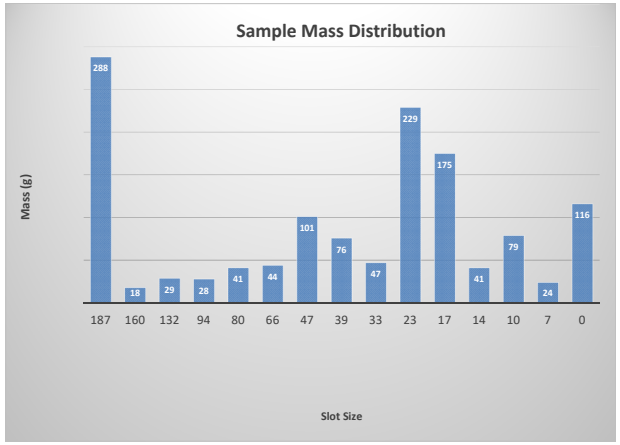
Sample depth (bgs) ft 320

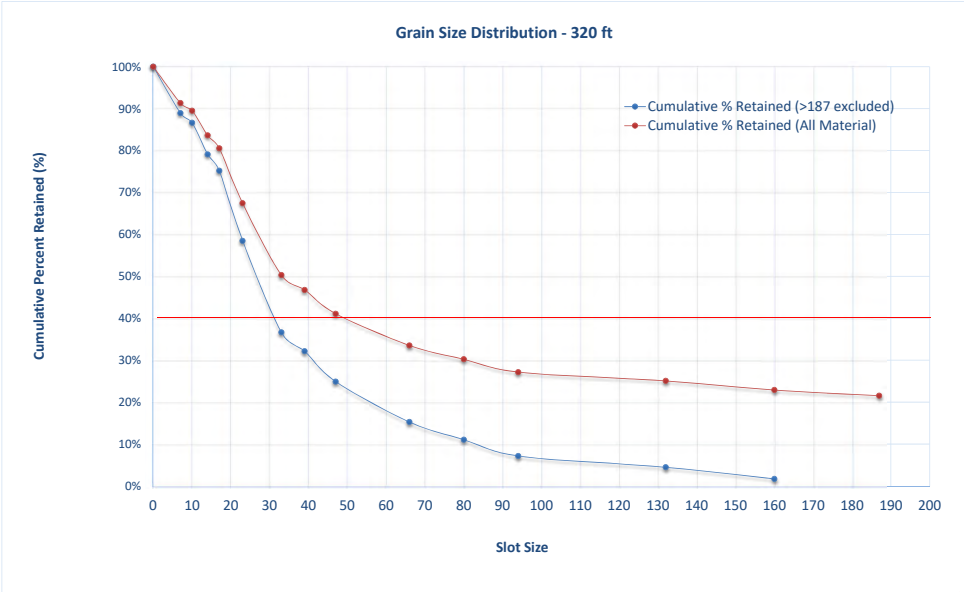
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	288		22%		22%
Gravel	3.35	5	160	18	2%	1%	2%	23%
Fine Gravel		6	132	29	3%	2%	4%	25%
Coarse Sand	2	8	94	28	3%	2%	7%	27%
Medium Sand	1.7	10	80	41	4%	3%	11%	30%
Medium Sand	1.4	12	66	44	4%	3%	15%	34%
Medium Sand	1	16	47	101	10%	8%	25%	41%
Medium Sand		18	39	76	7%	6%	32%	47%
Medium Sand	0.841	20	33	47	4%	4%	37%	50%
Fine Sand	0.595	30	23	229	22%	17%	58%	67%
Fine Sand	0.42	40	17	175	17%	13%	75%	81%
Fine Sand		45	14	41	4%	3%	79%	84%
Fine Sand	0.25	60	10	79	8%	6%	87%	90%
Fine Sand		80	7	24	2%	2%	89%	91%
			0	116	11%	9%	100%	100%
Total (All)				1336	100%	100%		
Total (exclude >187)				1048				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

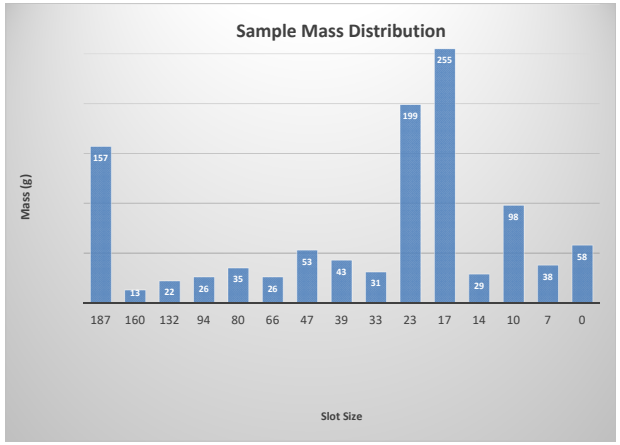
Sample depth (bgs) ft 322

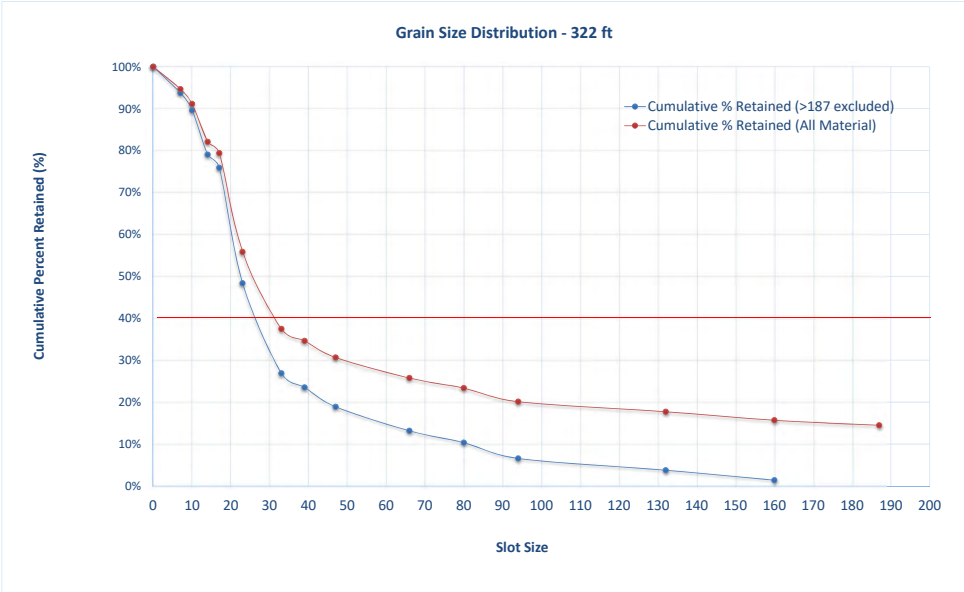
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	157		14%		14%
Gravel	3.35	5	160	13	1%	1%	1%	16%
Fine Gravel		6	132	22	2%	2%	4%	18%
Coarse Sand	2	8	94	26	3%	2%	7%	20%
Medium Sand	1.7	10	80	35	4%	3%	10%	23%
Medium Sand	1.4	12	66	26	3%	2%	13%	26%
Medium Sand	1	16	47	53	6%	5%	19%	31%
Medium Sand		18	39	43	5%	4%	24%	35%
Medium Sand	0.841	20	33	31	3%	3%	27%	37%
Fine Sand	0.595	30	23	199	21%	18%	48%	56%
Fine Sand	0.42	40	17	255	28%	24%	76%	79%
Fine Sand		45	14	29	3%	3%	79%	82%
Fine Sand	0.25	60	10	98	11%	9%	90%	91%
Fine Sand		80	7	38	4%	4%	94%	95%
			0	58	6%	5%	100%	100%
Total (All)				1083	100%	100%		
Total (exclude >187)				926				





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Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

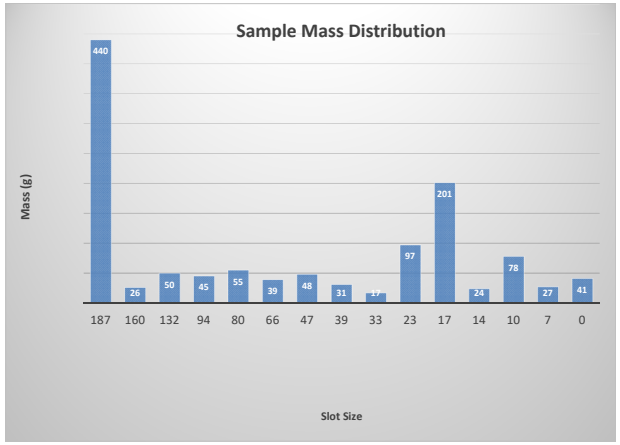
Sample depth (bgs) ft 324

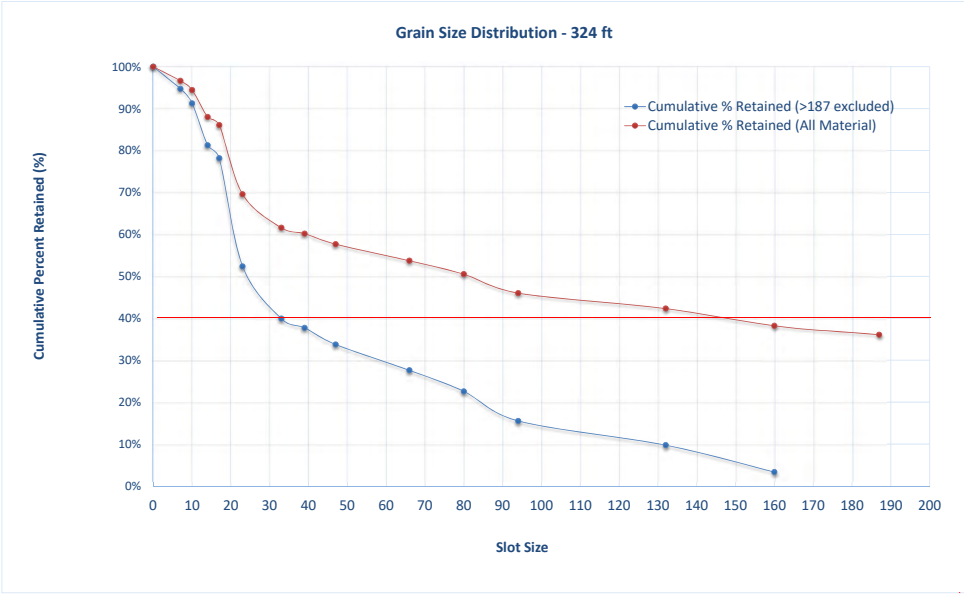
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	440		36%		36%
Gravel	3.35	5	160	26	3%	2%	3%	38%
Fine Gravel		6	132	50	6%	4%	10%	42%
Coarse Sand	2	8	94	45	6%	4%	16%	46%
Medium Sand	1.7	10	80	55	7%	5%	23%	51%
Medium Sand	1.4	12	66	39	5%	3%	28%	54%
Medium Sand	1	16	47	48	6%	4%	34%	58%
Medium Sand		18	39	31	4%	3%	38%	60%
Medium Sand	0.841	20	33	17	2%	1%	40%	62%
Fine Sand	0.595	30	23	97	12%	8%	52%	70%
Fine Sand	0.42	40	17	201	26%	16%	78%	86%
Fine Sand		45	14	24	3%	2%	81%	88%
Fine Sand	0.25	60	10	78	10%	6%	91%	94%
Fine Sand		80	7	27	3%	2%	95%	97%
			0	41	5%	3%	100%	100%
Total (All)				1219	100%	100%		
Total (exclude >187)				779				





western water ASSOCIATES LTD
Consultants in Hydrogeology and Water Resources Management

Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

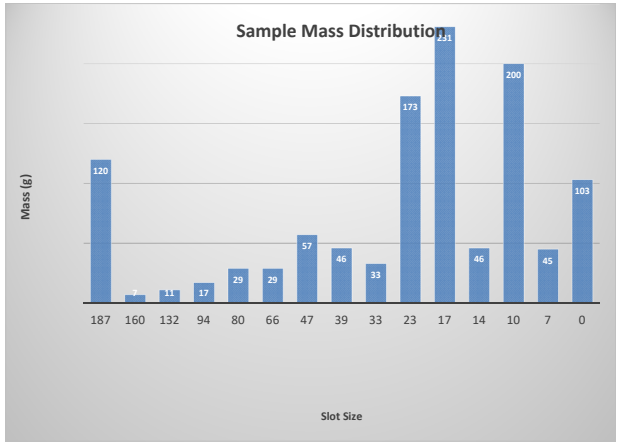
Sample depth (bgs) ft 326

Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	120		10%		10%
Gravel	3.35	5	160	7	1%	1%	1%	11%
Fine Gravel		6	132	11	1%	1%	2%	12%
Coarse Sand	2	8	94	17	2%	1%	3%	14%
Medium Sand	1.7	10	80	29	3%	3%	6%	16%
Medium Sand	1.4	12	66	29	3%	3%	9%	19%
Medium Sand	1	16	47	57	6%	5%	15%	24%
Medium Sand		18	39	46	4%	4%	19%	28%
Medium Sand	0.841	20	33	33	3%	3%	22%	30%
Fine Sand	0.595	30	23	173	17%	15%	39%	46%
Fine Sand	0.42	40	17	231	22%	20%	62%	66%
Fine Sand		45	14	46	4%	4%	66%	70%
Fine Sand	0.25	60	10	200	19%	17%	86%	87%
Fine Sand		80	7	45	4%	4%	90%	91%
			0	103	10%	9%	100%	100%
Total (All)				1147	100%	100%		
Total (exclude >187)				1027				



western water ASSOCIATES LTD
Consultants in Hydrogeology and Water Resources Management

Field Particle Size Analysis

Project No. 19-002-01VR

Westwold Flowing Well Decommissioning

Client: MFLNRORD

Location: Westwold, BC

Location On Site:

Well Tag # Relief Well

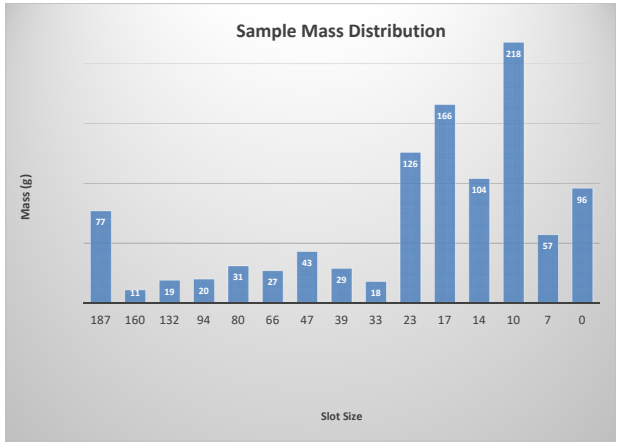
Sample depth (bgs) ft 332

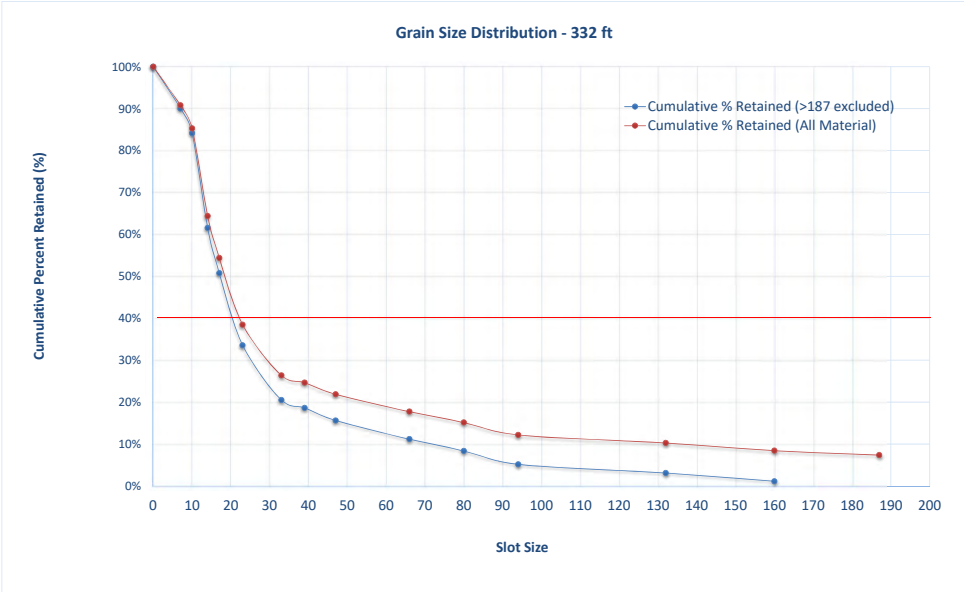
Date/ Time: 11-Mar-19

Field soil description/notes:

Fill in yellow cells with weight of eac htray

Sediment Type	Nominal aperture size (mm)	Mesh Size	Slot Size Range	Sieve Fraction Retained	> 187 excluded	All Material	Cumulative % Retained (>187 Excluded)	Cumulative % Retained (All Material)
				Weight (g)		% Wt.		%
Coarse Gravel		4	187	77		7%		7%
Gravel	3.35	5	160	11	1%	1%	1%	8%
Fine Gravel		6	132	19	2%	2%	3%	10%
Coarse Sand	2	8	94	20	2%	2%	5%	12%
Medium Sand	1.7	10	80	31	3%	3%	8%	15%
Medium Sand	1.4	12	66	27	3%	3%	11%	18%
Medium Sand	1	16	47	43	4%	4%	16%	22%
Medium Sand		18	39	29	3%	3%	19%	25%
Medium Sand	0.841	20	33	18	2%	2%	21%	26%
Fine Sand	0.595	30	23	126	13%	12%	34%	38%
Fine Sand	0.42	40	17	166	17%	16%	51%	54%
Fine Sand		45	14	104	11%	10%	62%	64%
Fine Sand	0.25	60	10	218	23%	21%	84%	85%
Fine Sand		80	7	57	6%	5%	90%	91%
			0	96	10%	9%	100%	100%
Total (All)				1042	100%	100%		
Total (exclude >187)				965				





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Consultants in Hydrogeology and Water Resources Management

Appendix C
Pumping Test Data and Graphs

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 08:00:00	0.46	-0.60	1.68
24-03-2019 08:01:00	0.46	-0.60	1.68
24-03-2019 08:02:00	0.45	-0.61	1.68
24-03-2019 08:03:00	0.45	-0.61	1.68
24-03-2019 08:04:00	0.45	-0.61	1.68
24-03-2019 08:05:00	0.45	-0.61	1.68
24-03-2019 08:06:00	0.45	-0.61	1.67
24-03-2019 08:07:00	0.45	-0.61	1.68
24-03-2019 08:08:00	0.45	-0.61	1.67
24-03-2019 08:09:00	0.45	-0.61	1.68
24-03-2019 08:10:00	0.45	-0.61	1.67
24-03-2019 08:11:00	0.45	-0.61	1.67
24-03-2019 08:12:00	0.45	-0.61	1.68
24-03-2019 08:13:00	0.45	-0.61	1.68
24-03-2019 08:14:00	4.22	3.17	5.45
24-03-2019 08:15:00	4.75	3.69	5.97
24-03-2019 08:16:00	5.09	4.03	6.31
24-03-2019 08:17:00	5.11	4.05	6.33
24-03-2019 08:18:00	5.21	4.15	6.44
24-03-2019 08:19:00	5.27	4.21	6.49
24-03-2019 08:20:00	5.28	4.22	6.51
24-03-2019 08:21:00	5.31	4.25	6.54
24-03-2019 08:22:00	5.30	4.24	6.53
24-03-2019 08:23:00	5.28	4.22	6.51
24-03-2019 08:24:00	5.30	4.24	6.52
24-03-2019 08:25:00	5.31	4.25	6.54
24-03-2019 08:26:00	5.13	4.07	6.36
24-03-2019 08:27:00	5.18	4.12	6.40
24-03-2019 08:28:00	5.10	4.04	6.33
24-03-2019 08:29:00	5.08	4.02	6.31
24-03-2019 08:30:00	5.06	4.00	6.29
24-03-2019 08:31:00	5.05	3.99	6.28
24-03-2019 08:32:00	5.05	3.99	6.28
24-03-2019 08:33:00	5.04	3.98	6.27
24-03-2019 08:34:00	4.98	3.92	6.21
24-03-2019 08:35:00	4.98	3.92	6.20
24-03-2019 08:36:00	4.97	3.91	6.20
24-03-2019 08:37:00	4.98	3.92	6.20
24-03-2019 08:38:00	4.95	3.89	6.18
24-03-2019 08:39:00	4.93	3.87	6.15
24-03-2019 08:40:00	4.91	3.85	6.13
24-03-2019 08:41:00	4.91	3.85	6.14
24-03-2019 08:42:00	4.95	3.89	6.18
24-03-2019 08:43:00	4.97	3.92	6.20
24-03-2019 08:44:00	6.88	5.82	8.11
24-03-2019 08:45:00	6.90	5.84	8.12

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 08:46:00	6.93	5.87	8.16
24-03-2019 08:47:00	6.95	5.89	8.18
24-03-2019 08:48:00	6.93	5.87	8.15
24-03-2019 08:49:00	6.95	5.89	8.18
24-03-2019 08:50:00	6.97	5.91	8.19
24-03-2019 08:51:00	6.96	5.90	8.18
24-03-2019 08:52:00	6.96	5.90	8.19
24-03-2019 08:53:00	6.95	5.89	8.18
24-03-2019 08:54:00	6.96	5.90	8.19
24-03-2019 08:55:00	6.94	5.88	8.17
24-03-2019 08:56:00	6.96	5.91	8.19
24-03-2019 08:57:00	6.98	5.92	8.21
24-03-2019 08:58:00	7.00	5.94	8.22
24-03-2019 08:59:00	6.96	5.90	8.18
24-03-2019 09:00:00	6.97	5.91	8.19
24-03-2019 09:01:00	6.98	5.92	8.21
24-03-2019 09:02:00	6.97	5.91	8.20
24-03-2019 09:03:00	6.98	5.92	8.20
24-03-2019 09:04:00	6.99	5.93	8.22
24-03-2019 09:05:00	6.96	5.90	8.19
24-03-2019 09:06:00	6.97	5.91	8.20
24-03-2019 09:07:00	6.98	5.92	8.20
24-03-2019 09:08:00	6.99	5.93	8.21
24-03-2019 09:09:00	6.97	5.91	8.20
24-03-2019 09:10:00	7.00	5.94	8.22
24-03-2019 09:11:00	6.98	5.92	8.21
24-03-2019 09:12:00	7.00	5.94	8.23
24-03-2019 09:13:00	6.98	5.92	8.20
24-03-2019 09:14:00	1.70	0.64	2.93
24-03-2019 09:15:00	1.49	0.43	2.72
24-03-2019 09:16:00	1.23	0.17	2.46
24-03-2019 09:17:00	1.06	0.00	2.29
24-03-2019 09:18:00	0.87	-0.19	2.10
24-03-2019 09:19:00	0.76	-0.30	1.99
24-03-2019 09:20:00	0.66	-0.40	1.89
24-03-2019 09:21:00	0.45	-0.61	1.68
24-03-2019 09:22:00	0.49	-0.57	1.72
24-03-2019 09:23:00	0.49	-0.57	1.71
24-03-2019 09:24:00	0.45	-0.61	1.67
24-03-2019 09:25:00	0.46	-0.60	1.69
24-03-2019 09:26:00	0.47	-0.59	1.69
24-03-2019 09:27:00	0.46	-0.60	1.69
24-03-2019 09:28:00	0.46	-0.60	1.69
24-03-2019 09:29:00	0.46	-0.60	1.69
24-03-2019 09:30:00	0.46	-0.60	1.69
24-03-2019 09:31:00	0.46	-0.60	1.69

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 09:32:00	0.46	-0.60	1.69
24-03-2019 09:33:00	0.46	-0.60	1.69
24-03-2019 09:34:00	0.46	-0.60	1.69
24-03-2019 10:00:00	1.43	0.37	2.66
24-03-2019 10:05:00	0.61	-0.45	1.83
24-03-2019 10:10:00	6.61	5.55	7.84
24-03-2019 10:15:00	6.71	5.65	7.93
24-03-2019 10:20:00	6.68	5.62	7.91
24-03-2019 10:25:00	6.69	5.63	7.92
24-03-2019 10:30:00	6.73	5.67	7.95
24-03-2019 10:35:00	6.73	5.67	7.96
24-03-2019 10:40:00	6.70	5.64	7.93
24-03-2019 10:45:00	6.71	5.65	7.93
24-03-2019 10:50:00	6.71	5.65	7.94
24-03-2019 10:55:00	6.73	5.67	7.96
24-03-2019 11:00:00	6.72	5.66	7.94
24-03-2019 11:05:00	6.71	5.65	7.94
24-03-2019 11:10:00	6.76	5.70	7.98
24-03-2019 11:15:00	6.72	5.66	7.94
24-03-2019 11:20:00	6.75	5.70	7.98
24-03-2019 11:25:00	6.75	5.69	7.97
24-03-2019 11:30:00	6.75	5.69	7.98
24-03-2019 11:35:00	6.75	5.69	7.97
24-03-2019 11:40:00	6.76	5.70	7.98
24-03-2019 11:45:00	6.73	5.68	7.96
24-03-2019 11:50:00	6.75	5.69	7.98
24-03-2019 11:55:00	6.81	5.75	8.04
24-03-2019 12:00:00	6.78	5.72	8.01
24-03-2019 12:05:00	6.80	5.74	8.02
24-03-2019 12:10:00	6.80	5.74	8.02
24-03-2019 12:15:00	6.78	5.72	8.01
24-03-2019 12:20:00	6.82	5.76	8.05
24-03-2019 12:25:00	6.78	5.72	8.01
24-03-2019 12:30:00	6.80	5.74	8.03
24-03-2019 12:35:00	6.80	5.74	8.02
24-03-2019 12:40:00	6.80	5.74	8.03
24-03-2019 12:45:00	6.81	5.75	8.04
24-03-2019 12:50:00	6.83	5.77	8.05
24-03-2019 12:55:00	6.86	5.80	8.08
24-03-2019 13:00:00	6.83	5.77	8.06
24-03-2019 13:05:00	6.85	5.79	8.08
24-03-2019 13:10:00	6.86	5.80	8.09
24-03-2019 13:15:00	6.82	5.76	8.05
24-03-2019 13:20:00	6.83	5.77	8.06
24-03-2019 13:25:00	6.85	5.79	8.08
24-03-2019 13:30:00	6.84	5.78	8.07

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 13:35:00	6.86	5.80	8.09
24-03-2019 13:40:00	6.86	5.80	8.08
24-03-2019 13:45:00	6.84	5.78	8.07
24-03-2019 13:50:00	6.87	5.81	8.10
24-03-2019 13:55:00	6.93	5.87	8.16
24-03-2019 14:00:00	6.91	5.85	8.13
24-03-2019 14:05:00	6.89	5.83	8.11
24-03-2019 14:10:00	6.90	5.85	8.13
24-03-2019 14:15:00	6.90	5.85	8.13
24-03-2019 14:20:00	6.90	5.85	8.13
24-03-2019 14:25:00	6.93	5.87	8.16
24-03-2019 14:30:00	6.90	5.84	8.12
24-03-2019 14:35:00	6.91	5.85	8.14
24-03-2019 14:40:00	6.92	5.86	8.15
24-03-2019 14:45:00	6.97	5.91	8.20
24-03-2019 14:50:00	6.96	5.90	8.19
24-03-2019 14:55:00	6.93	5.87	8.16
24-03-2019 15:00:00	7.00	5.94	8.22
24-03-2019 15:05:00	6.97	5.91	8.20
24-03-2019 15:10:00	6.94	5.88	8.17
24-03-2019 15:15:00	7.00	5.94	8.23
24-03-2019 15:20:00	6.97	5.91	8.20
24-03-2019 15:30:00	7.03	5.97	8.26
24-03-2019 15:35:00	7.04	5.98	8.27
24-03-2019 15:40:00	6.99	5.93	8.21
24-03-2019 15:45:00	7.02	5.96	8.25
24-03-2019 15:50:00	7.08	6.02	8.30
24-03-2019 15:55:00	7.05	5.99	8.28
24-03-2019 16:00:00	7.10	6.04	8.33
24-03-2019 16:05:00	7.08	6.02	8.31
24-03-2019 16:10:00	7.02	5.96	8.25
24-03-2019 16:15:00	7.07	6.01	8.30
24-03-2019 16:20:00	7.04	5.98	8.27
24-03-2019 16:25:00	7.01	5.95	8.24
24-03-2019 16:30:00	7.07	6.01	8.30
24-03-2019 16:35:00	7.04	5.98	8.27
24-03-2019 16:40:00	7.05	5.99	8.27
24-03-2019 16:45:00	7.01	5.95	8.24
24-03-2019 16:50:00	7.01	5.95	8.23
24-03-2019 16:55:00	6.99	5.93	8.22
24-03-2019 17:00:00	7.05	5.99	8.28
24-03-2019 17:05:00	7.06	6.00	8.28
24-03-2019 17:10:00	7.06	6.00	8.28
24-03-2019 17:15:00	7.03	5.97	8.26
24-03-2019 17:20:00	7.03	5.97	8.25
24-03-2019 17:25:00	7.03	5.97	8.25

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 17:30:00	7.06	6.00	8.28
24-03-2019 17:35:00	7.04	5.98	8.27
24-03-2019 17:40:00	7.04	5.98	8.27
24-03-2019 17:45:00	7.02	5.96	8.25
24-03-2019 17:50:00	1.31	0.25	2.54
24-03-2019 17:55:00	0.61	-0.45	1.84
24-03-2019 18:00:00	0.54	-0.51	1.77
24-03-2019 18:05:00	0.52	-0.54	1.75
24-03-2019 18:10:00	0.52	-0.54	1.75
24-03-2019 18:15:00	0.52	-0.54	1.75
24-03-2019 18:20:00	0.52	-0.54	1.75
24-03-2019 18:25:00	0.52	-0.54	1.74
24-03-2019 18:30:00	0.51	-0.55	1.74
24-03-2019 18:35:00	0.51	-0.55	1.74
24-03-2019 18:40:00	0.51	-0.55	1.74
24-03-2019 18:45:00	0.51	-0.55	1.73
24-03-2019 18:50:00	0.50	-0.55	1.73
24-03-2019 18:55:00	0.51	-0.55	1.73
24-03-2019 19:00:00	0.51	-0.55	1.73
24-03-2019 19:05:00	0.51	-0.55	1.73
24-03-2019 19:10:00	0.51	-0.55	1.73
24-03-2019 19:15:00	0.50	-0.56	1.73
24-03-2019 19:20:00	0.50	-0.56	1.72
24-03-2019 19:25:00	0.50	-0.56	1.73
24-03-2019 19:30:00	0.50	-0.56	1.72
24-03-2019 19:35:00	0.50	-0.56	1.72
24-03-2019 19:40:00	0.50	-0.56	1.72
24-03-2019 19:45:00	0.49	-0.57	1.72
24-03-2019 19:50:00	0.49	-0.57	1.72
24-03-2019 19:55:00	0.49	-0.57	1.71
24-03-2019 20:00:00	0.49	-0.57	1.72
24-03-2019 20:05:00	0.49	-0.57	1.72
24-03-2019 20:10:00	0.49	-0.56	1.72
24-03-2019 20:15:00	0.53	-0.53	1.76
24-03-2019 20:20:00	0.47	-0.59	1.70
24-03-2019 20:25:00	0.51	-0.55	1.74
24-03-2019 20:30:00	0.48	-0.58	1.71
24-03-2019 20:35:00	0.48	-0.58	1.71
24-03-2019 20:40:00	0.48	-0.58	1.70
24-03-2019 20:45:00	0.48	-0.58	1.70
24-03-2019 20:50:00	0.47	-0.59	1.70
24-03-2019 20:55:00	0.47	-0.59	1.70
24-03-2019 21:00:00	0.47	-0.59	1.70
24-03-2019 21:05:00	0.47	-0.59	1.70
24-03-2019 21:10:00	0.47	-0.59	1.70
24-03-2019 21:15:00	0.47	-0.59	1.70

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
24-03-2019 21:20:00	0.47	-0.59	1.69
24-03-2019 21:25:00	0.47	-0.59	1.69
24-03-2019 21:30:00	0.47	-0.59	1.70
24-03-2019 21:35:00	0.47	-0.59	1.70
24-03-2019 21:40:00	0.47	-0.59	1.70
24-03-2019 21:45:00	0.46	-0.60	1.69
24-03-2019 21:50:00	0.46	-0.60	1.69
24-03-2019 21:55:00	0.46	-0.60	1.69
24-03-2019 22:00:00	0.46	-0.60	1.69
24-03-2019 22:05:00	0.46	-0.60	1.69
24-03-2019 22:10:00	0.46	-0.60	1.69
24-03-2019 22:15:00	0.46	-0.60	1.68
24-03-2019 22:20:00	0.46	-0.60	1.69
24-03-2019 22:25:00	0.46	-0.60	1.68
24-03-2019 22:30:00	0.46	-0.60	1.68
24-03-2019 22:35:00	0.46	-0.60	1.68
24-03-2019 22:40:00	0.45	-0.61	1.68
24-03-2019 22:45:00	0.46	-0.60	1.68
24-03-2019 22:50:00	0.46	-0.60	1.68
24-03-2019 22:55:00	0.45	-0.61	1.68
24-03-2019 23:00:00	0.46	-0.60	1.68
24-03-2019 23:05:00	0.46	-0.60	1.68
24-03-2019 23:10:00	0.45	-0.61	1.68
24-03-2019 23:15:00	0.46	-0.60	1.68
24-03-2019 23:20:00	0.45	-0.61	1.68
24-03-2019 23:25:00	0.45	-0.61	1.68
24-03-2019 23:30:00	0.45	-0.61	1.68
24-03-2019 23:35:00	0.45	-0.61	1.68
24-03-2019 23:40:00	0.45	-0.61	1.68
24-03-2019 23:45:00	0.45	-0.61	1.68
24-03-2019 23:50:00	0.45	-0.61	1.68
24-03-2019 23:55:00	0.45	-0.61	1.68
25-03-2019 00:00:00	0.45	-0.61	1.68
25-03-2019 00:05:00	0.45	-0.61	1.68
25-03-2019 00:10:00	0.45	-0.61	1.68
25-03-2019 00:15:00	0.45	-0.61	1.68
25-03-2019 00:20:00	0.45	-0.61	1.68
25-03-2019 00:25:00	0.45	-0.61	1.68
25-03-2019 00:30:00	0.45	-0.61	1.68
25-03-2019 00:35:00	0.45	-0.61	1.68
25-03-2019 00:40:00	0.45	-0.61	1.67
25-03-2019 00:45:00	0.45	-0.61	1.68
25-03-2019 00:50:00	0.45	-0.61	1.67
25-03-2019 00:55:00	0.45	-0.61	1.67
25-03-2019 01:00:00	0.45	-0.61	1.68
25-03-2019 01:05:00	0.45	-0.61	1.67

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 01:10:00	0.45	-0.61	1.68
25-03-2019 01:15:00	0.45	-0.61	1.67
25-03-2019 01:20:00	0.45	-0.61	1.67
25-03-2019 01:25:00	0.45	-0.61	1.68
25-03-2019 01:30:00	0.45	-0.61	1.68
25-03-2019 01:35:00	0.45	-0.61	1.67
25-03-2019 01:40:00	0.45	-0.61	1.67
25-03-2019 01:45:00	0.45	-0.61	1.68
25-03-2019 01:50:00	0.45	-0.61	1.67
25-03-2019 01:55:00	0.45	-0.61	1.68
25-03-2019 02:00:00	0.45	-0.61	1.68
25-03-2019 02:05:00	0.45	-0.61	1.68
25-03-2019 02:10:00	0.45	-0.61	1.67
25-03-2019 02:15:00	0.45	-0.61	1.67
25-03-2019 02:20:00	0.44	-0.62	1.67
25-03-2019 02:25:00	0.45	-0.61	1.67
25-03-2019 02:30:00	0.45	-0.61	1.67
25-03-2019 02:35:00	0.45	-0.61	1.67
25-03-2019 02:40:00	0.45	-0.61	1.67
25-03-2019 02:45:00	0.45	-0.61	1.67
25-03-2019 02:50:00	0.45	-0.61	1.67
25-03-2019 02:55:00	0.44	-0.62	1.67
25-03-2019 03:00:00	0.45	-0.61	1.67
25-03-2019 03:05:00	0.45	-0.61	1.68
25-03-2019 03:10:00	0.44	-0.62	1.67
25-03-2019 03:15:00	0.45	-0.61	1.67
25-03-2019 03:20:00	0.44	-0.62	1.67
25-03-2019 03:25:00	0.44	-0.62	1.67
25-03-2019 03:30:00	0.45	-0.61	1.67
25-03-2019 03:35:00	0.44	-0.62	1.67
25-03-2019 03:40:00	0.45	-0.61	1.67
25-03-2019 03:45:00	0.45	-0.61	1.67
25-03-2019 03:50:00	0.45	-0.61	1.68
25-03-2019 03:55:00	0.45	-0.61	1.67
25-03-2019 04:00:00	0.45	-0.61	1.67
25-03-2019 04:05:00	0.45	-0.61	1.68
25-03-2019 04:10:00	0.45	-0.61	1.67
25-03-2019 04:15:00	0.44	-0.62	1.67
25-03-2019 04:20:00	0.44	-0.62	1.67
25-03-2019 04:25:00	0.45	-0.61	1.67
25-03-2019 04:30:00	0.45	-0.61	1.68
25-03-2019 04:35:00	0.45	-0.61	1.68
25-03-2019 04:40:00	0.45	-0.61	1.68
25-03-2019 04:45:00	0.45	-0.61	1.67
25-03-2019 04:50:00	0.45	-0.61	1.67
25-03-2019 04:55:00	0.45	-0.61	1.68

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 05:00:00	0.45	-0.61	1.68
25-03-2019 05:05:00	0.45	-0.61	1.68
25-03-2019 05:10:00	0.45	-0.61	1.68
25-03-2019 05:15:00	0.45	-0.61	1.68
25-03-2019 05:20:00	0.45	-0.61	1.68
25-03-2019 05:25:00	0.45	-0.61	1.68
25-03-2019 05:30:00	0.45	-0.61	1.68
25-03-2019 05:35:00	0.45	-0.61	1.67
25-03-2019 05:40:00	0.45	-0.61	1.68
25-03-2019 05:45:00	0.44	-0.61	1.67
25-03-2019 05:50:00	0.45	-0.61	1.68
25-03-2019 05:55:00	0.45	-0.61	1.68
25-03-2019 06:00:00	0.45	-0.61	1.68
25-03-2019 06:05:00	0.44	-0.61	1.67
25-03-2019 06:10:00	0.45	-0.61	1.68
25-03-2019 06:15:00	0.44	-0.62	1.67
25-03-2019 06:20:00	0.45	-0.61	1.68
25-03-2019 06:25:00	0.45	-0.61	1.67
25-03-2019 06:30:00	0.45	-0.61	1.68
25-03-2019 06:35:00	0.45	-0.61	1.67
25-03-2019 06:40:00	0.45	-0.61	1.68
25-03-2019 06:45:00	0.44	-0.62	1.67
25-03-2019 06:50:00	0.45	-0.61	1.67
25-03-2019 06:55:00	0.44	-0.62	1.67
25-03-2019 07:00:00	0.45	-0.61	1.67
25-03-2019 07:05:00	0.45	-0.61	1.67
25-03-2019 07:10:00	0.45	-0.61	1.68
25-03-2019 07:15:00	0.45	-0.61	1.68
25-03-2019 07:20:00	0.44	-0.61	1.67
25-03-2019 07:25:00	0.45	-0.61	1.67
25-03-2019 07:30:00	0.44	-0.62	1.67
25-03-2019 07:35:00	0.45	-0.61	1.67
25-03-2019 07:40:00	0.44	-0.61	1.67
25-03-2019 07:45:00	0.45	-0.61	1.67
25-03-2019 07:50:00	0.45	-0.61	1.68
25-03-2019 07:55:00	0.45	-0.61	1.68
25-03-2019 08:00:00	0.45	-0.61	1.68
25-03-2019 08:05:00	0.45	-0.61	1.68
25-03-2019 08:10:00	0.45	-0.61	1.68
25-03-2019 08:15:00	0.45	-0.61	1.68
25-03-2019 08:20:00	0.45	-0.61	1.68
25-03-2019 08:25:00	0.45	-0.61	1.67
25-03-2019 08:30:00	0.45	-0.61	1.67
25-03-2019 08:35:00	0.45	-0.61	1.68
25-03-2019 08:40:00	0.45	-0.61	1.68
25-03-2019 08:45:00	0.46	-0.60	1.68

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 08:50:00	0.45	-0.61	1.68
25-03-2019 08:55:00	0.45	-0.61	1.68
25-03-2019 09:00:00	0.45	-0.60	1.68
25-03-2019 09:05:00	0.46	-0.60	1.68
25-03-2019 09:10:00	0.46	-0.60	1.68
25-03-2019 09:15:00	0.53	-0.53	1.76
25-03-2019 09:20:00	0.46	-0.60	1.68
25-03-2019 09:25:00	0.46	-0.60	1.68
25-03-2019 09:30:00	0.46	-0.60	1.69
25-03-2019 09:35:00	0.53	-0.53	1.75
25-03-2019 09:40:00	5.34	4.28	6.57
25-03-2019 09:45:00	5.30	4.24	6.53
25-03-2019 09:50:00	5.00	3.94	6.23
25-03-2019 09:55:00	5.03	3.97	6.25
25-03-2019 10:00:00	4.99	3.93	6.22
25-03-2019 10:05:00	4.99	3.93	6.21
25-03-2019 10:10:00	4.92	3.86	6.14
25-03-2019 10:15:00	4.95	3.89	6.17
25-03-2019 10:20:00	5.01	3.95	6.23
25-03-2019 10:25:00	4.83	3.77	6.06
25-03-2019 10:30:00	4.83	3.77	6.06
25-03-2019 10:35:00	4.85	3.79	6.08
25-03-2019 10:40:00	4.84	3.78	6.07
25-03-2019 10:45:00	4.90	3.84	6.13
25-03-2019 10:50:00	4.88	3.82	6.11
25-03-2019 10:55:00	4.81	3.75	6.03
25-03-2019 11:00:00	4.87	3.81	6.09
25-03-2019 11:05:00	4.83	3.77	6.05
25-03-2019 11:10:00	4.85	3.79	6.07
25-03-2019 11:15:00	4.81	3.75	6.04
25-03-2019 11:20:00	4.78	3.72	6.00
25-03-2019 11:25:00	5.02	3.96	6.25
25-03-2019 11:30:00	5.02	3.96	6.25
25-03-2019 11:35:00	5.04	3.98	6.27
25-03-2019 11:40:00	5.10	4.04	6.32
25-03-2019 11:45:00	5.06	4.00	6.28
25-03-2019 11:50:00	5.12	4.06	6.34
25-03-2019 11:55:00	5.10	4.04	6.32
25-03-2019 12:00:00	5.07	4.01	6.29
25-03-2019 12:05:00	5.05	3.99	6.28
25-03-2019 12:10:00	5.13	4.07	6.36
25-03-2019 12:15:00	5.05	3.99	6.28
25-03-2019 12:20:00	5.08	4.02	6.31
25-03-2019 12:25:00	5.09	4.03	6.31
25-03-2019 12:30:00	5.12	4.06	6.35
25-03-2019 12:35:00	5.14	4.08	6.36

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 12:40:00	5.12	4.06	6.35
25-03-2019 12:45:00	5.15	4.09	6.38
25-03-2019 12:50:00	5.15	4.09	6.37
25-03-2019 12:55:00	5.21	4.15	6.43
25-03-2019 13:00:00	5.17	4.11	6.39
25-03-2019 13:05:00	5.10	4.04	6.33
25-03-2019 13:10:00	5.15	4.09	6.38
25-03-2019 13:15:00	5.17	4.11	6.39
25-03-2019 13:20:00	5.21	4.15	6.44
25-03-2019 13:25:00	5.20	4.14	6.42
25-03-2019 13:30:00	5.14	4.08	6.36
25-03-2019 13:35:00	5.15	4.09	6.38
25-03-2019 13:40:00	5.14	4.08	6.37
25-03-2019 13:45:00	5.15	4.09	6.38
25-03-2019 13:50:00	5.17	4.11	6.40
25-03-2019 13:55:00	5.20	4.14	6.42
25-03-2019 14:00:00	5.19	4.13	6.42
25-03-2019 14:05:00	5.17	4.11	6.40
25-03-2019 14:10:00	5.17	4.11	6.40
25-03-2019 14:15:00	5.19	4.13	6.42
25-03-2019 14:20:00	5.17	4.11	6.40
25-03-2019 14:25:00	5.16	4.10	6.39
25-03-2019 14:30:00	5.17	4.12	6.40
25-03-2019 14:35:00	5.15	4.09	6.37
25-03-2019 14:40:00	5.14	4.08	6.37
25-03-2019 14:45:00	5.18	4.12	6.41
25-03-2019 14:50:00	5.22	4.16	6.44
25-03-2019 14:55:00	5.17	4.11	6.40
25-03-2019 15:00:00	5.23	4.17	6.45
25-03-2019 15:05:00	5.15	4.09	6.37
25-03-2019 15:10:00	4.78	3.72	6.01
25-03-2019 15:15:00	4.79	3.73	6.02
25-03-2019 15:20:00	4.61	3.55	5.83
25-03-2019 15:25:00	4.90	3.84	6.12
25-03-2019 15:30:00	4.82	3.76	6.05
25-03-2019 15:35:00	4.51	3.45	5.73
25-03-2019 15:40:00	4.44	3.38	5.67
25-03-2019 15:45:00	4.49	3.43	5.72
25-03-2019 15:50:00	4.50	3.44	5.72
25-03-2019 15:55:00	4.47	3.41	5.70
25-03-2019 16:00:00	4.53	3.47	5.76
25-03-2019 16:05:00	4.51	3.45	5.74
25-03-2019 16:10:00	4.47	3.42	5.70
25-03-2019 16:15:00	4.77	3.71	6.00
25-03-2019 16:20:00	0.64	-0.42	1.86
25-03-2019 16:25:00	0.60	-0.46	1.82

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 16:30:00	0.57	-0.49	1.80
25-03-2019 16:35:00	0.57	-0.49	1.80
25-03-2019 16:40:00	0.57	-0.49	1.80
25-03-2019 16:45:00	0.57	-0.49	1.79
25-03-2019 16:50:00	0.57	-0.49	1.79
25-03-2019 16:55:00	0.56	-0.50	1.79
25-03-2019 17:00:00	0.57	-0.49	1.79
25-03-2019 17:05:00	0.57	-0.49	1.79
25-03-2019 17:10:00	0.57	-0.49	1.80
25-03-2019 17:15:00	0.57	-0.49	1.79
25-03-2019 17:20:00	0.56	-0.50	1.79
25-03-2019 17:25:00	0.56	-0.49	1.79
25-03-2019 17:30:00	0.56	-0.50	1.79
25-03-2019 17:35:00	0.56	-0.50	1.79
25-03-2019 17:40:00	0.56	-0.50	1.79
25-03-2019 17:45:00	0.56	-0.50	1.79
25-03-2019 17:50:00	0.56	-0.50	1.78
25-03-2019 17:55:00	0.55	-0.51	1.78
25-03-2019 18:00:00	0.56	-0.50	1.78
25-03-2019 18:05:00	0.56	-0.50	1.78
25-03-2019 18:10:00	0.56	-0.50	1.78
25-03-2019 18:15:00	0.55	-0.51	1.78
25-03-2019 18:20:00	0.55	-0.50	1.78
25-03-2019 18:25:00	0.55	-0.51	1.78
25-03-2019 18:30:00	0.55	-0.51	1.78
25-03-2019 18:35:00	0.55	-0.51	1.77
25-03-2019 18:40:00	0.55	-0.51	1.77
25-03-2019 18:45:00	0.54	-0.52	1.77
25-03-2019 18:50:00	0.54	-0.52	1.77
25-03-2019 18:55:00	0.55	-0.51	1.77
25-03-2019 19:00:00	0.55	-0.51	1.77
25-03-2019 19:05:00	0.55	-0.51	1.77
25-03-2019 19:10:00	0.55	-0.51	1.77
25-03-2019 19:15:00	0.56	-0.50	1.78
25-03-2019 19:20:00	0.56	-0.50	1.79
25-03-2019 19:25:00	0.54	-0.52	1.77
25-03-2019 19:30:00	0.56	-0.50	1.79
25-03-2019 19:35:00	0.55	-0.51	1.77
25-03-2019 19:40:00	0.59	-0.47	1.81
25-03-2019 19:45:00	0.54	-0.51	1.77
25-03-2019 19:50:00	0.55	-0.51	1.78
25-03-2019 19:55:00	0.55	-0.51	1.78
25-03-2019 20:00:00	0.55	-0.51	1.78
25-03-2019 20:05:00	0.55	-0.51	1.78
25-03-2019 20:10:00	0.55	-0.51	1.78
25-03-2019 20:15:00	0.55	-0.51	1.78

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
25-03-2019 20:20:00	0.55	-0.51	1.78
25-03-2019 20:25:00	0.55	-0.51	1.78
25-03-2019 20:30:00	0.55	-0.51	1.78
25-03-2019 20:35:00	0.56	-0.50	1.78
25-03-2019 20:40:00	0.55	-0.51	1.78
25-03-2019 20:45:00	0.55	-0.51	1.78
25-03-2019 20:50:00	0.55	-0.51	1.78
25-03-2019 20:55:00	0.55	-0.51	1.77
25-03-2019 21:00:00	0.55	-0.51	1.77
25-03-2019 21:05:00	0.55	-0.51	1.78
25-03-2019 21:10:00	0.55	-0.51	1.78
25-03-2019 21:15:00	0.55	-0.51	1.78
25-03-2019 21:20:00	0.55	-0.51	1.77
25-03-2019 21:25:00	0.55	-0.51	1.77
25-03-2019 21:30:00	0.55	-0.51	1.77
25-03-2019 21:35:00	0.55	-0.51	1.78
25-03-2019 21:40:00	0.55	-0.51	1.77
25-03-2019 21:45:00	0.55	-0.51	1.77
25-03-2019 21:50:00	0.54	-0.51	1.77
25-03-2019 21:55:00	0.55	-0.51	1.77
25-03-2019 22:00:00	0.55	-0.51	1.77
25-03-2019 22:05:00	0.55	-0.51	1.78
25-03-2019 22:10:00	0.55	-0.51	1.77
25-03-2019 22:15:00	0.55	-0.51	1.78
25-03-2019 22:20:00	0.55	-0.51	1.78
25-03-2019 22:25:00	0.55	-0.51	1.78
25-03-2019 22:30:00	0.55	-0.51	1.78
25-03-2019 22:35:00	0.55	-0.51	1.78
25-03-2019 22:40:00	0.55	-0.51	1.78
25-03-2019 22:45:00	0.55	-0.51	1.78
25-03-2019 22:50:00	0.55	-0.51	1.77
25-03-2019 22:55:00	0.55	-0.51	1.77
25-03-2019 23:00:00	0.55	-0.51	1.77
25-03-2019 23:05:00	0.55	-0.51	1.77
25-03-2019 23:10:00	0.55	-0.51	1.77
25-03-2019 23:15:00	0.55	-0.51	1.78
25-03-2019 23:20:00	0.55	-0.51	1.78
25-03-2019 23:25:00	0.55	-0.51	1.77
25-03-2019 23:30:00	0.55	-0.51	1.77
25-03-2019 23:35:00	0.55	-0.51	1.77
25-03-2019 23:40:00	0.54	-0.52	1.77
25-03-2019 23:45:00	0.55	-0.51	1.77
25-03-2019 23:50:00	0.55	-0.51	1.78
25-03-2019 23:55:00	0.55	-0.51	1.77
26-03-2019 00:00:00	0.55	-0.51	1.78
26-03-2019 00:05:00	0.55	-0.51	1.78

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
26-03-2019 00:10:00	0.54	-0.52	1.77
26-03-2019 00:15:00	0.55	-0.51	1.78
26-03-2019 00:20:00	0.55	-0.51	1.77
26-03-2019 00:25:00	0.55	-0.51	1.77
26-03-2019 00:30:00	0.55	-0.51	1.77
26-03-2019 00:35:00	0.55	-0.51	1.77
26-03-2019 00:40:00	0.55	-0.51	1.77
26-03-2019 00:45:00	0.55	-0.51	1.77
26-03-2019 00:50:00	0.55	-0.51	1.78
26-03-2019 00:55:00	0.55	-0.51	1.78
26-03-2019 01:00:00	0.55	-0.51	1.77
26-03-2019 01:05:00	0.55	-0.51	1.77
26-03-2019 01:10:00	0.55	-0.51	1.77
26-03-2019 01:15:00	0.55	-0.51	1.77
26-03-2019 01:20:00	0.55	-0.51	1.78
26-03-2019 01:25:00	0.55	-0.51	1.78
26-03-2019 01:30:00	0.55	-0.51	1.77
26-03-2019 01:35:00	0.55	-0.51	1.78
26-03-2019 01:40:00	0.55	-0.51	1.78
26-03-2019 01:45:00	0.55	-0.51	1.78
26-03-2019 01:50:00	0.55	-0.51	1.78
26-03-2019 01:55:00	0.55	-0.51	1.77
26-03-2019 02:00:00	0.55	-0.51	1.77
26-03-2019 02:05:00	0.56	-0.50	1.78
26-03-2019 02:10:00	0.55	-0.51	1.78
26-03-2019 02:15:00	0.55	-0.51	1.78
26-03-2019 02:20:00	0.55	-0.51	1.78
26-03-2019 02:25:00	0.55	-0.51	1.78
26-03-2019 02:30:00	0.55	-0.51	1.78
26-03-2019 02:35:00	0.55	-0.51	1.78
26-03-2019 02:40:00	0.55	-0.51	1.78
26-03-2019 02:45:00	0.55	-0.51	1.78
26-03-2019 02:50:00	0.55	-0.51	1.78
26-03-2019 02:55:00	0.56	-0.50	1.78
26-03-2019 03:00:00	0.55	-0.51	1.78
26-03-2019 03:05:00	0.55	-0.51	1.78
26-03-2019 03:10:00	0.55	-0.51	1.78
26-03-2019 03:15:00	0.55	-0.51	1.78
26-03-2019 03:20:00	0.55	-0.51	1.78
26-03-2019 03:25:00	0.56	-0.50	1.78
26-03-2019 03:30:00	0.55	-0.51	1.78
26-03-2019 03:35:00	0.55	-0.51	1.78
26-03-2019 03:40:00	0.55	-0.51	1.78
26-03-2019 03:45:00	0.55	-0.51	1.78
26-03-2019 03:50:00	0.55	-0.51	1.77
26-03-2019 03:55:00	0.55	-0.51	1.77

Table C1 - Westwold Well Decommissioning - Pumping Data

Transducer Data	Transducer (m-btoc)	Transducer (m-bgs)	Drawdown (m)
26-03-2019 04:00:00	0.55	-0.51	1.78
26-03-2019 04:05:00	0.55	-0.51	1.78
26-03-2019 04:10:00	0.55	-0.51	1.77
26-03-2019 04:15:00	0.55	-0.51	1.77
26-03-2019 04:20:00	0.55	-0.51	1.78
26-03-2019 04:25:00	0.55	-0.51	1.78
26-03-2019 04:30:00	0.55	-0.51	1.78
26-03-2019 04:35:00	0.55	-0.51	1.78
26-03-2019 04:40:00	0.56	-0.50	1.78
26-03-2019 04:45:00	0.55	-0.51	1.78
26-03-2019 04:50:00	0.55	-0.51	1.78
26-03-2019 04:55:00	0.55	-0.51	1.78
26-03-2019 05:00:00	0.55	-0.51	1.77
26-03-2019 05:05:00	0.55	-0.51	1.78
26-03-2019 05:10:00	0.55	-0.51	1.77
26-03-2019 05:15:00	0.55	-0.51	1.77
26-03-2019 05:20:00	0.55	-0.51	1.78
26-03-2019 05:25:00	0.55	-0.51	1.77
26-03-2019 05:30:00	0.55	-0.51	1.78
26-03-2019 05:35:00	0.55	-0.51	1.78
26-03-2019 05:40:00	0.55	-0.51	1.78
26-03-2019 05:45:00	0.55	-0.51	1.78
26-03-2019 05:50:00	0.54	-0.52	1.77
26-03-2019 05:55:00	0.55	-0.51	1.77
26-03-2019 06:00:00	0.55	-0.51	1.77
26-03-2019 06:05:00	0.55	-0.51	1.77
26-03-2019 06:10:00	0.55	-0.51	1.78
26-03-2019 06:15:00	0.55	-0.51	1.77
26-03-2019 06:20:00	0.55	-0.51	1.78
26-03-2019 06:25:00	0.55	-0.51	1.77
26-03-2019 06:30:00	0.55	-0.51	1.78
26-03-2019 06:35:00	0.55	-0.51	1.77

Table C1 - Westwold Well Decommissioning - Pumping Data

Manual Data - Step Test	6" Well (m-btoc)	6" Well (m-bgs)	6" Well Drawdown (m)
24-03-2019 08:13:00	0.46	-2.28	0.00
24-03-2019 08:14:00	1.22	-1.52	0.76
24-03-2019 08:15:00	1.42	-1.32	0.96
24-03-2019 08:16:00	1.49	-1.24	1.04
24-03-2019 08:17:00	1.57	-1.17	1.11
24-03-2019 08:18:00	1.60	-1.14	1.14
24-03-2019 08:19:00	1.62	-1.11	1.16
24-03-2019 08:20:00	1.65	-1.09	1.19
24-03-2019 08:21:00	1.66	-1.08	1.20
24-03-2019 08:22:00	1.66	-1.07	1.20
24-03-2019 08:23:00	1.67	-1.07	1.21
24-03-2019 08:28:00	1.66	-1.07	1.20
24-03-2019 08:33:00	1.65	-1.08	1.20
24-03-2019 08:38:00	1.65	-1.08	1.19
24-03-2019 08:43:00	1.66	-1.07	1.20
24-03-2019 08:44:00	2.04	-0.69	1.58
24-03-2019 08:45:00	2.09	-0.65	1.63
24-03-2019 08:46:00	2.11	-0.63	1.65
24-03-2019 08:47:00	2.12	-0.61	1.67
24-03-2019 08:48:00	2.15	-0.59	1.69
24-03-2019 08:49:00	2.15	-0.59	1.69
24-03-2019 08:50:00	2.16	-0.57	1.71
24-03-2019 08:51:00	2.16	-0.57	1.71
24-03-2019 08:52:00	2.17	-0.57	1.71
24-03-2019 08:53:00	2.18	-0.56	1.72
24-03-2019 08:58:00	2.20	-0.54	1.74
24-03-2019 09:03:00	2.21	-0.52	1.76
24-03-2019 09:08:00	2.23	-0.50	1.77
24-03-2019 09:13:00	2.25	-0.49	1.79
24-03-2019 09:14:00	1.20	-1.54	0.74
24-03-2019 09:15:00	1.04	-1.70	0.58
24-03-2019 09:16:00	0.94	-1.79	0.49
24-03-2019 09:17:00	0.87	-1.87	0.41
24-03-2019 09:18:00	0.80	-1.94	0.34
24-03-2019 09:19:00	0.74	-2.00	0.28
24-03-2019 09:21:00	0.66	-2.07	0.20
24-03-2019 09:22:00	0.65	-2.09	0.19
24-03-2019 09:23:00	0.63	-2.11	0.17

Table C1 - Westwold Well Decommissioning - Pumping Data

Manual Data - Step Test	Relief Well (m-btoc)	Relief Well (m-bgs)	Relief Well Drawdown (m)
24-03-2019 08:13:00	0.45	-0.610	1.676
24-03-2019 08:14:00	4.72	3.660	5.946
24-03-2019 08:15:00	4.96	3.900	6.186
24-03-2019 08:16:00	5.09	4.025	6.311
24-03-2019 08:17:00	5.18	4.120	6.406
24-03-2019 08:18:00	5.23	4.170	6.456
24-03-2019 08:19:00	5.29	4.230	6.516
24-03-2019 08:20:00	5.32	4.255	6.541
24-03-2019 08:21:00	5.32	4.255	6.541
24-03-2019 08:22:00	5.31	4.250	6.536
24-03-2019 08:23:00	5.32	4.255	6.541
24-03-2019 08:28:00	5.08	4.020	6.306
24-03-2019 08:33:00	5.00	3.940	6.226
24-03-2019 08:38:00	4.97	3.905	6.191
24-03-2019 08:43:00	4.96	3.900	6.186
24-03-2019 08:44:00	6.91	5.850	8.136
24-03-2019 08:45:00	6.92	5.860	8.146
24-03-2019 08:46:00	6.94	5.875	8.161
24-03-2019 08:47:00	6.95	5.885	8.171
24-03-2019 08:48:00	6.95	5.890	8.176
24-03-2019 08:49:00	6.95	5.885	8.171
24-03-2019 08:50:00	6.96	5.895	8.181
24-03-2019 08:51:00	6.97	5.910	8.196
24-03-2019 08:52:00	6.96	5.900	8.186
24-03-2019 08:53:00	6.96	5.900	8.186
24-03-2019 08:58:00	6.97	5.910	8.196
24-03-2019 09:03:00	6.97	5.910	8.196
24-03-2019 09:08:00	6.97	5.910	8.196
24-03-2019 09:13:00	6.98	5.920	8.206
24-03-2019 09:14:00	1.62	0.560	2.846
24-03-2019 09:15:00	1.32	0.260	2.546
24-03-2019 09:16:00	1.13	0.070	2.356
24-03-2019 09:17:00	0.95	-0.115	2.171
24-03-2019 09:18:00	0.80	-0.265	2.021
24-03-2019 09:19:00	0.69	-0.370	1.916
24-03-2019 09:21:00	0.45	-0.610	1.676
24-03-2019 09:22:00	0.45	-0.610	1.676
24-03-2019 09:23:00	0.45	-0.610	1.676

Figure C1 - Westwold Flowing Well Decommissioning - Hydrograph

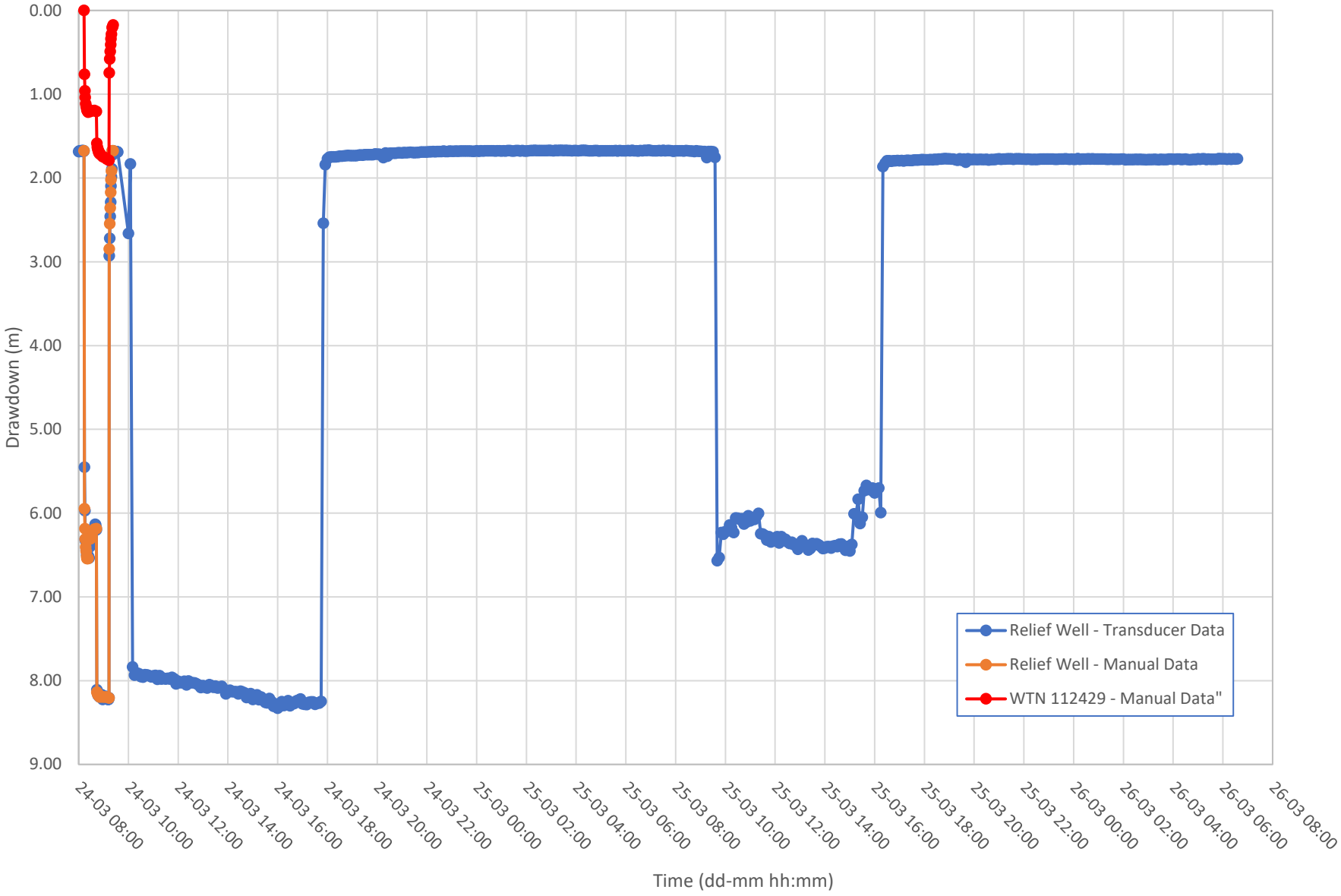


Figure C2 - Westwold Flowing Well Decommissioning - Step Test Hydrograph

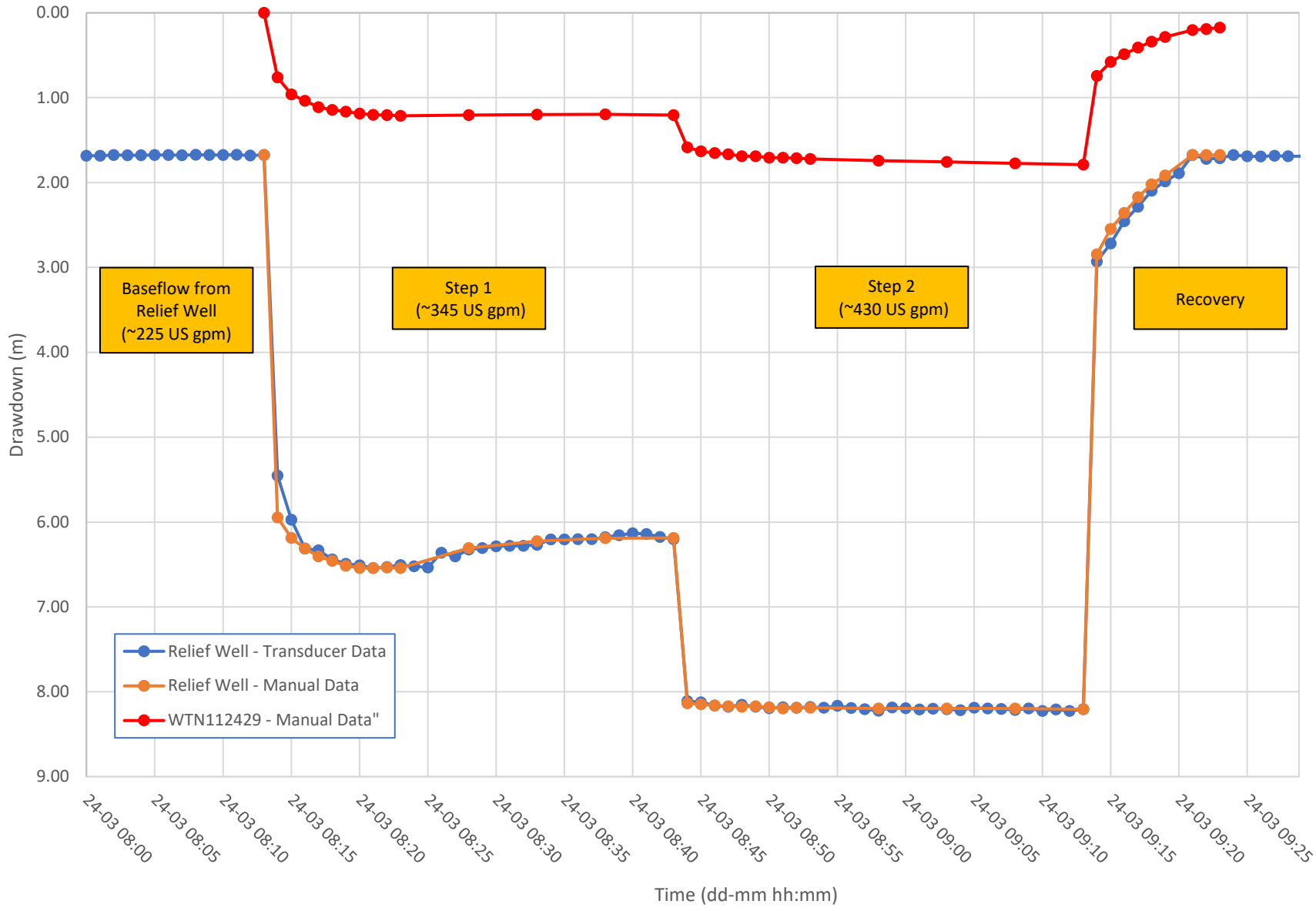


Figure C3 - Westwold Flowing Well Decommissioning - Step Test Drawdown vs Discharge

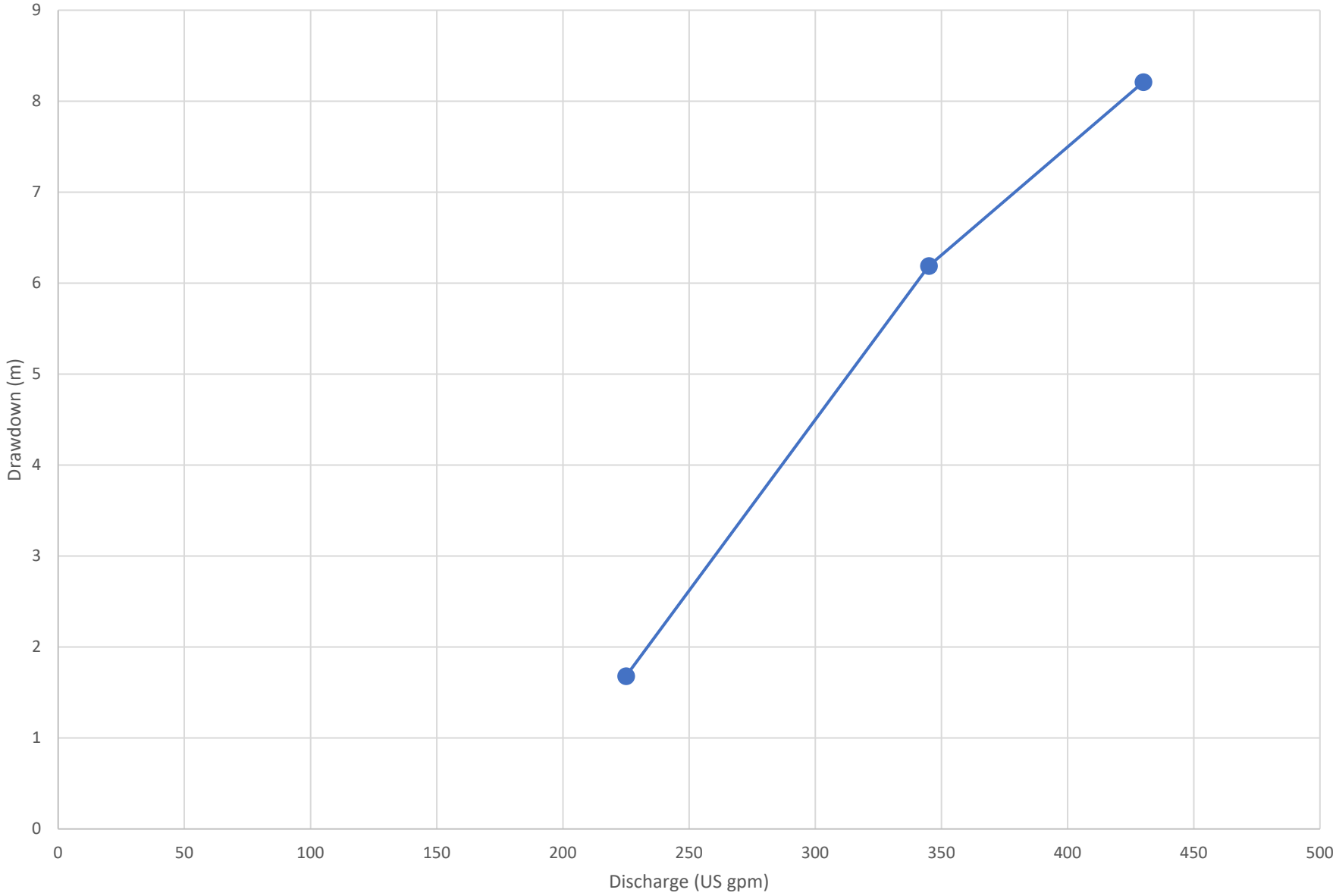
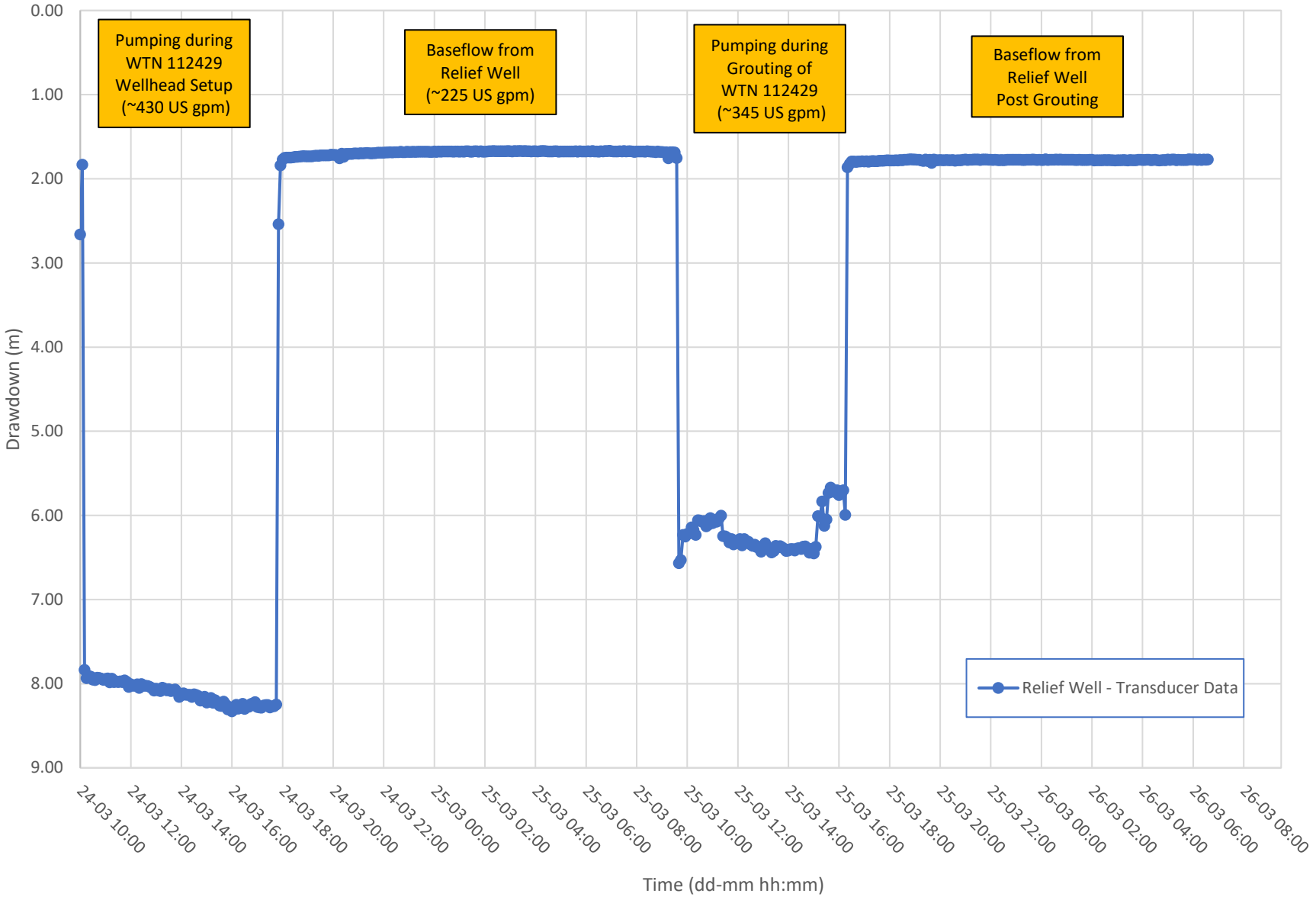


Figure C4 - Westwold Flowing Well Decommissioning - Extended Relief Well Pumping



Governing Equations of Pumping Test Solutions

Theis (1935) Solution for a Pumping Test in a Confined Aquifer

$$s = \frac{Q}{4\pi T}\int_{u}^{\infty}\frac{e^{-y}}{y}dy$$

$$u = \frac{r^2 S}{4Tt}$$

$$s_D = \frac{4\pi T}{Q}s$$

$$t_D = \frac{Tt}{r^2 S}$$

where

- Q is pumping rate [L^3/T]
- r is radial distance [L]
- s is drawdown [L]
- S is storativity [dimensionless]
- t is time [T]
- T is transmissivity [L^2/T]

Theis (1935) Solution for a Recovery Test in a Confined Aquifer

$$s' = \frac{Q}{4\pi T}\left[\ln(t/t') - \ln(S/S')\right]$$

where

- Q is pumping rate [L^3/T]
- s' is residual drawdown [L]
- S is storativity during pumping [dimensionless]
- S' is storativity during recovery [dimensionless]
- t is time since pumping began [T]
- t' is time since pumping stopped [T]
- T is transmissivity[L^2/T]

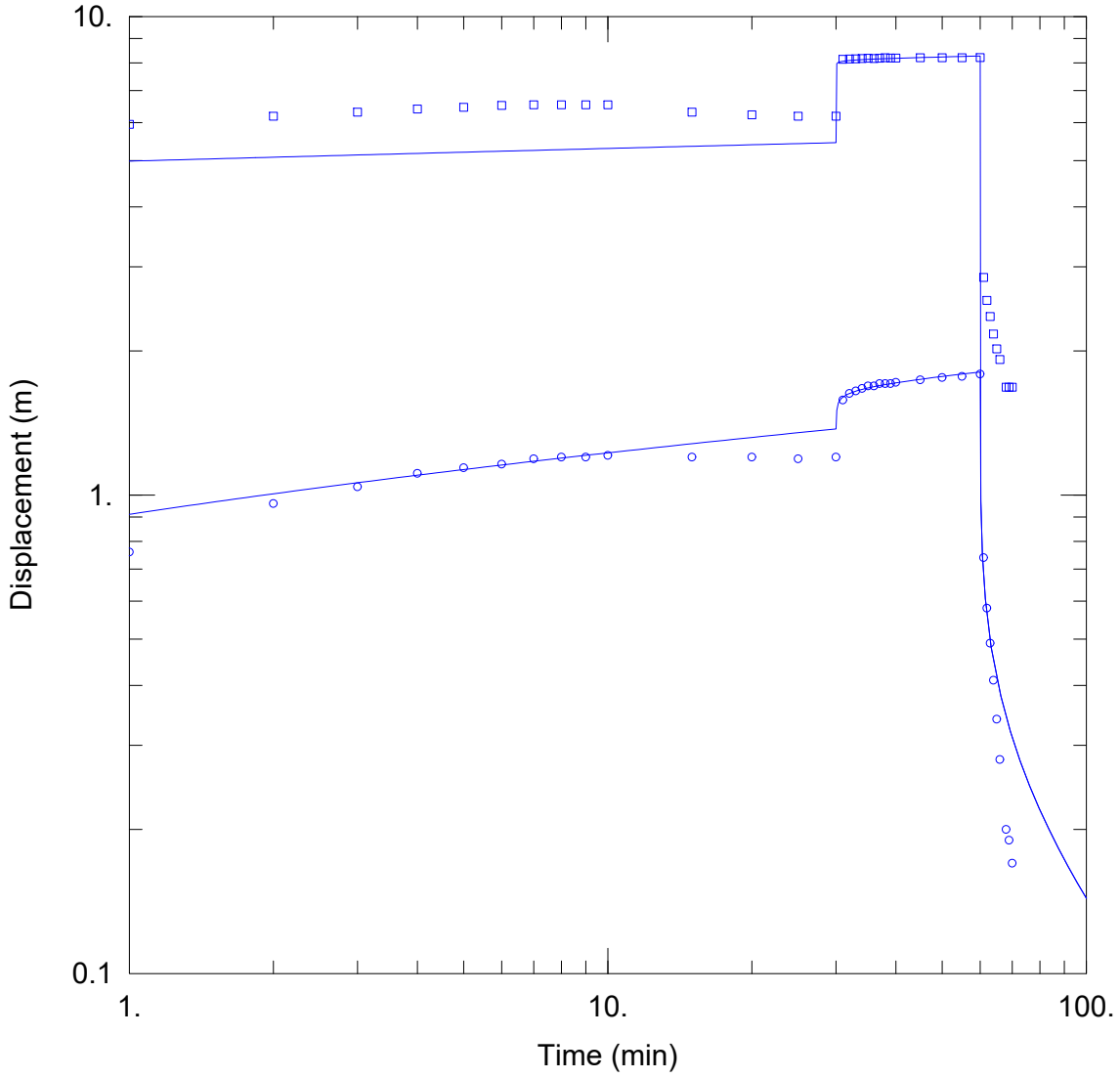


FIGURE C5 - STEP TEST ANALYSIS

Data Set: D:\...\Step Test Data.aqt
Date: 04/29/19 Time: 09:26:14

PROJECT INFORMATION

Company: Western Water Associates Ltd.
Client: MFLNRORD
Project: 19-002-01VR
Location: Westwold
Test Well: Relief Well
Test Date: March 24, 2019

AQUIFER DATA

Saturated Thickness: 31.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

Observation Wells

Well Name	X (m)	Y (m)
□ Relief Well	0	0
○ WPN 41736	3.3	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Step Test)

T = 1098. m^2/day
Sw = 0.075
P = 3.

S = 0.00178
C = 0.9 min^2/m^5

Step Test Model: Jacob-Rorabaugh
Time (t) = 1. min Rate (Q) in cu. m/min

$s(t) = 2.283Q + 0.9Q^{3.}$
W.E. = 48.58% (Q from last step)

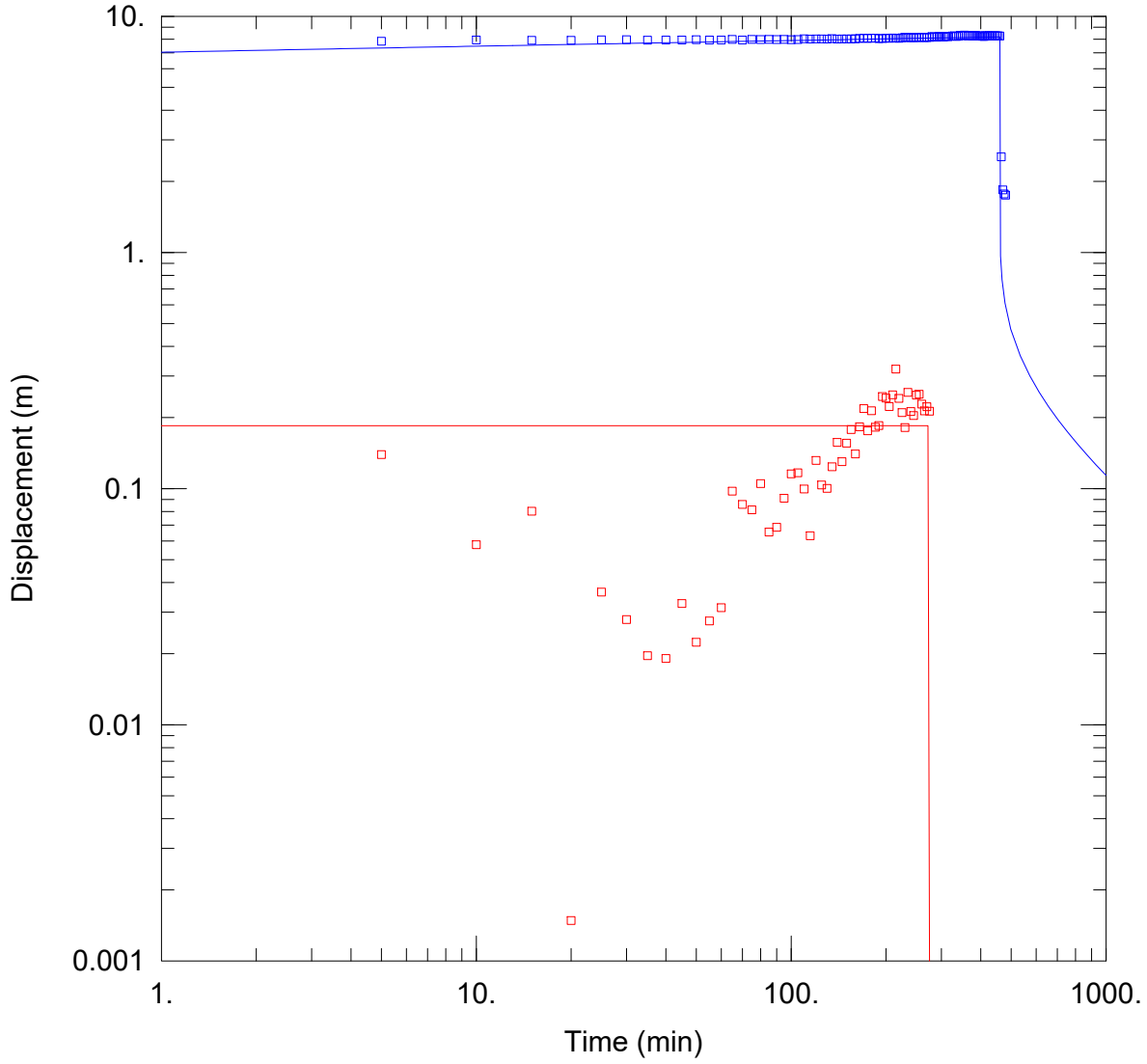


FIGURE C6 - EXTENDED PUMPING ANALYSIS

Data Set: D:\...\Constant Rate Data.aqt
Date: 04/29/19 Time: 16:29:39

PROJECT INFORMATION

Company: Western Water Associates Ltd.
Client: MFLNRORD
Project: 19-014-01VR
Location: Westwold
Test Well: Relief Well
Test Date: March 24, 2019

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

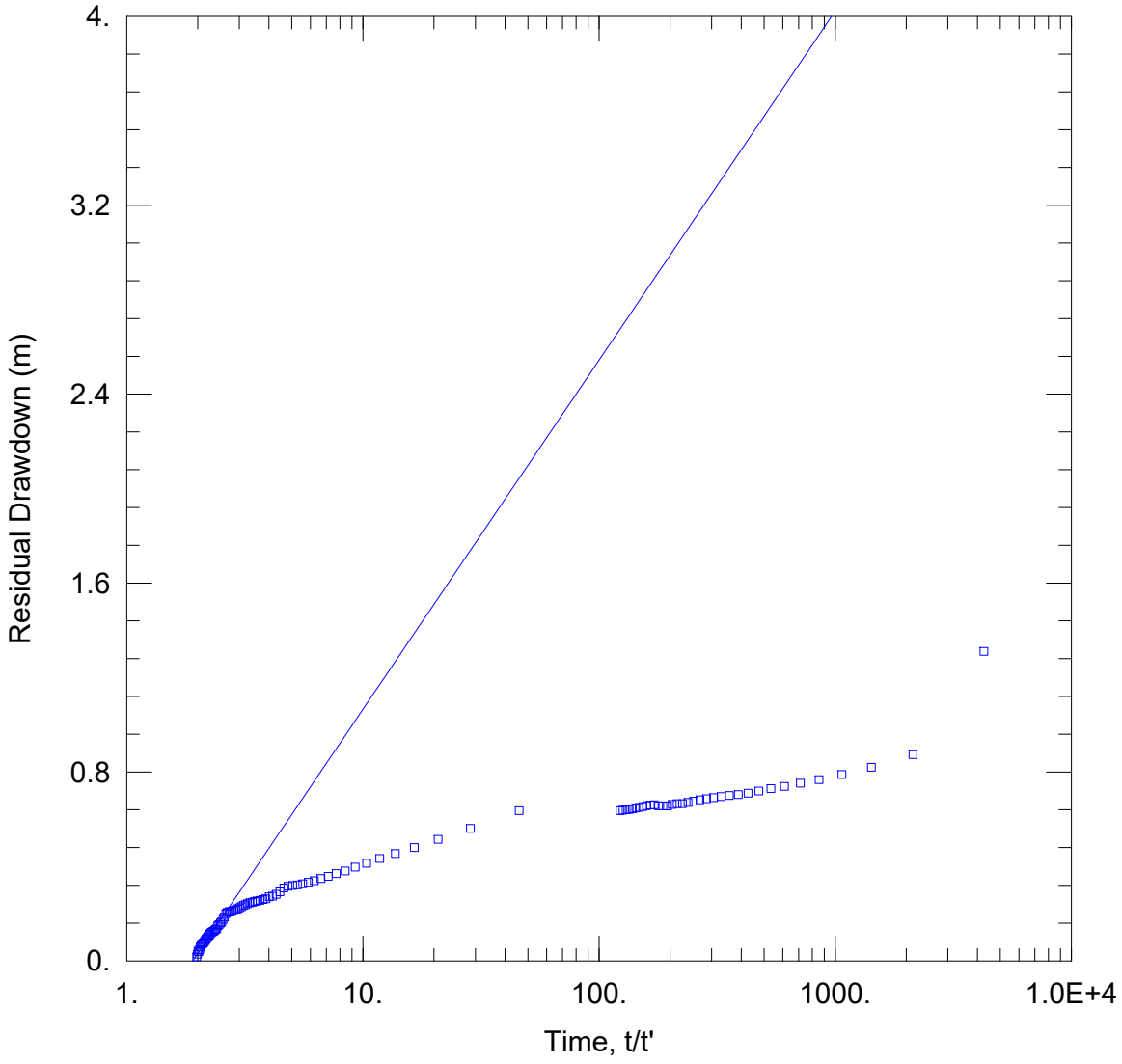
Observation Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 1010. m^2/day
Kz/Kr = 1.
S = 1.0E-10
b = 31.1 m



STEP TEST

Data Set: D:\...\Recovery - 3 days - 225 US gpm.aqt
Date: 05/02/19 Time: 16:15:49

PROJECT INFORMATION

Company: Western Water Associates Ltd.
Client: MFLNRORD
Project: 19-014-01VR
Location: Westwold
Test Well: Relief Well
Test Date: March 24, 2019

AQUIFER DATA

Saturated Thickness: 31.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

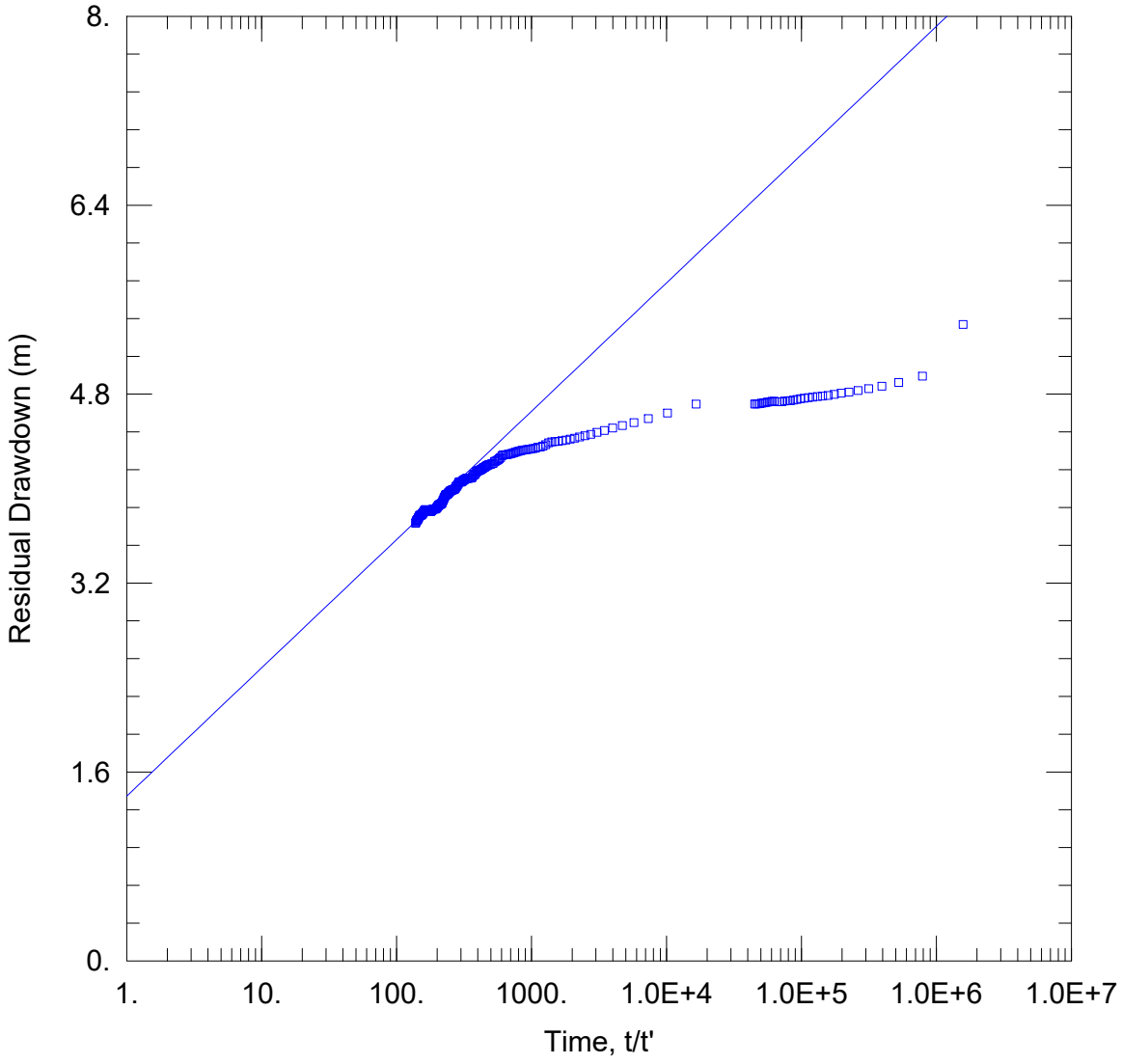
Observation Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 152. m^2/day S/S' = 1.904



STEP TEST

Data Set: D:\...\recovery.aqt
Date: 05/02/19 Time: 15:14:19

PROJECT INFORMATION

Company: Western Water Associates Ltd.
Client: MFLNRORD
Project: 19-014-01VR
Location: Westwold
Test Well: Relief Well
Test Date: March 24, 2019

AQUIFER DATA

Saturated Thickness: 31.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

Observation Wells

Well Name	X (m)	Y (m)
Relief Well	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 459.6 m^2/day S/S' = 0.05203

Appendix D
Environmental Monitoring Memo

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

western water ASSOCIATES LTD
Consultants in Hydrogeology and Environmental Science

Environmental Monitoring Memo

Environmental Monitoring for Westwold Well Decommissioning

TO: Colin Slade, Partner, Drillwell
Via Email: drill@drillwell.ca
Date: April 29, 2019
FROM: Trina Koch, Senior Biologist, R.P.Bio. **WWAL Project No.:** 19-002-01VR

1.0 Introduction and Background:

Western Water Associates Ltd. (WWAL) is providing this Environmental Monitoring Memo to Drillwell regarding environmental monitoring during decommissioning of an uncontrolled artesian well (WTN 112429 - the "subject well") located at 4686 Highway 97 in Westwold, BC (Figure 1).

A Section 11 *Water Sustainability Act* Change Approval #3006447 issued on March 18, 2019 by the Ministry of Forest, Lands, Natural Resource Operations and Rural Development allowed for temporary discharge of water from a relief well drilled to facilitate decommissioning of the subject well. This discharge used the same topographic feature as the existing discharge from the uncontrolled well, which was to ground on private lands and then eventually draining to a branch of Pringle Creek.

WWAL provided onsite environmental monitoring during pump testing, well drilling, well development and well decommissioning occurring between February 27, 2019 and March 28, 2019. In addition to monitoring for compliance with WWAL's Environmental Management Plan (EMP) (WWAL 2019) and Change Approval #3006447, we routinely monitored turbidity for compliance with BC Ministry of Environment specifications which state that turbidity not increase more than 8 NTU from background readings within 24 hours (Singleton 2001).

Environmental monitoring also included collecting field parameters and a water quality sample from the subject well discharge water on February 27, 2019. Samples were analyzed for comprehensive potability and sent to Caro Analytical Laboratory (Caro) in Kelowna, BC. Analytical results were compared with BC Drinking Water Quality Guidelines (BCDWQG) and BC Water Quality Guidelines for the protection of freshwater aquatic life (BCWQGAL).

This Memo describes environmentally significant site features, reports on field and analytical water quality and provides observations and photographs of each environmental monitoring site inspection. Figures are attached as Appendix A, Photographs as Appendix B, Field Turbidity as Appendix C and Caro's analytical water quality results of artesian well flow as Appendix D.

2.0 Environmentally Significant Site Features

Environmentally significant site features include the branch of Pringle Creek, off-site well discharge channel, on-site water and drill cuttings settling tank, well decommissioning site and mitigation features as shown in Figure 2.

Since the existing well (WTN 112429) was drilled in March of 2016, artesian discharge was conveyed for about 175 m south of the subject property in two 150 mm (6 in) diameter steel pipes along the ditch west of Highway 97 and then into a culvert that directs flow east then south through a grassy field into a

branch of Pringle Creek (Photograph 1). The branch has the potential to support fish outside of winter months when it is not frozen and receives unimpeded flow from the main stem of Pringle Creek, which is known to provide fish habitat. The branch eventually terminates within a wetland on property owned by Buff Lumber located 1.2 km southeast of the well discharge entry location (Figure 1 and Photograph 2).

During works, artesian flow continued to enter the field and move through the incised channel into the branch of Pringle Creek (Photograph 3). Water generated during relief well test pumping, well drilling and development was directed into the on-site container (Photograph 4) and allowed to settle before it was discharged near the bin onto ground, removed by vacuum truck, and/or pumped in a hose downstream of the subject site and through the Highway 97 culvert (Photographs 5 and 7). The most turbid water was typically pumped by vacuum truck and not discharged to the off-site works.

Mitigation features installed during the project to control sedimentation entering the branch of Pringle Creek included three hay bale rows (H1-H3) (Photograph 6), a silt curtain (Photograph 6) and fish exclusion net (Photograph 12).

3.0 Observations

WWAL's Senior Biologist, Trina Koch, B.Sc., R.P.Bio., acted as the Environmental Monitor (EM) and Qualified Environmental Professional (QEP), with assistance provided by Paul Williamson, M.Sc., GIT of WWAL (field hydrogeologist).Ms. Koch collected field water quality parameters and a water sample from the existing well (WTN 112429) on February 27, 2019. She measured turbidity, noted observations, took photographs and searched for leaks and spills on March 11, 14, 20, 21, 22 and 28, 2019. Field turbidity was monitored at the locations shown in Figure 2. Site #6 was only measured on March 20, 2019 when the branch had thawed and was flowing. Leaks and spills were not detected during any of the nine environmental monitoring site inspections. Other observations recorded during each site visit are summarized below. Field turbidity measurements are provided in Appendix C.

February 27, 2018:

The EM arrived onsite at 9:30 am. Weather conditions were cold and clear (-15°C). The well drilling site was clear of debris, leaks and spills and the settling bin was in place (Photograph 4).

The Pringle Creek branch was frozen and subject well discharge was flowing across the field. Flow continued from where it entered the branch to patches of wetland at Buff Lumber.

The EM collected field water quality parameters and a water sample at 10:00 am from uncontrolled well discharge (WTN 112429) immediately downstream of the Highway 97 culvert at the location shown in Figure 2 and Photograph 5. Samples were collected into laboratory preserved containers with gloved hands, following provincial protocol (BC Ministry of Water, Land and Air Protection. 2003).

Samples were placed in a cooler with ice and sent to Caro for analysis within 24 hours. Field parameters included temperature (air and water), pH, electrical conductivity (EC), salinity, total dissolved solids (TDS) and oxidation reduction potential (ORP). A summary of field measurements is provided in Table 2. Caro's analytical water quality results are included as Appendix D.

Table 2. Field Water Quality Measurements for WTN 112429 27 Feb 2019

Air Temp. (°C)	H_2O Temp (°C)	pH	EC (µS/cm)	Sal (mg/L)	TDS (mg/L)	ORP (mV)
-19	11.5-12.1	8.58	564	0.3	393	169

Field and analytical water quality results indicated that groundwater from the uncontrolled artesian well (WTN 112429) did not exceed BCDWQG or BCWQGAL.

Drilling of the relief well between the end of February and March 10 did not generate water discharged to the environment. The formation water produced while drilling the upper portion of the relief well borehole was contained in the on-site water tank and removed by vacuum truck or infiltrated to ground on the project site. Drilling through the flowing artesian aquifer triggered the next environmental monitoring event described below.

March 11, 2019:

- The EM arrived onsite at 13:30. Air temperature was about 0°C; it was sunny and cold.
- Three rows of hay bales (H1-H3) were in place in the off-site discharge location downstream of the culvert (Photograph 6).
- Discharge from well drilling was flowing into the channel through a hose fed through the culvert (Photograph 7).
- Background turbidity measurements of 3.13 NTU and 3.75 NTU were measured from Site 1 and Site 2, respectively.
- The EM placed a fish exclusion net in the frozen branch channel about 50 m upstream of the well discharge entry location (Figure 2). The net was secured with wooden stakes to each bank and pushed through the ice into the bottom of the channel (Photograph 8).
- By 13:40 turbidity had increased to 26.7 NTU at Site 1 but gradually reduced to 3.96 NTU at Site #5 after moving through haybales H1-H3.
- By14:00 turbidity had further increased to 37.7 NTU but was only 2.5 NTU at Site 5. These initial readings suggested that H1-H3 were performing as intended in managing the release of sediment before flow entered the branch.
- At 14:30 turbidity had reduced to 18.2 NTU at Site 1 and was 12.83 at Site 5. Pulses of turbidity continued to be effectively managed by the hay bales until 15:00..
- At 15:15, the Drillwell crew released bin water into the discharge hose causing turbidity to spike beyond instrument limits at Site 1 (Photograph 9). Although turbidity remained very high as discharge moved through the haybales, it was reduced to within readable limits at Site 5 (1962 NTU).
- The EM requested that Drillwell add more hay bales to H1 and H2 to increase their width and filtering ability. She explained that because the branch was still frozen upstream of the discharge entry point resulting in no fish passage, effects of turbidity on fish were not a concern.
- The EM left the site at 16:00. On the drive out, she noted that turbidity in the branch at the Douglas Lake Road crossing appeared clear, suggesting that sediment from the well discharge had settled out before the crossing.

March 14, 2019:

- Weather conditions were clear and cool (10°C).
- The EM was assisted by WWAL's Junior Biologist, Gina Le Bel B.I.T.
- Work was not occurring at the drill site.
- Hay bales had been added to H1 and H2. A large shallow settling pool had developed between H1 and H2 (Photograph 10).
- The subject artesian well discharge was entering the channel from the culvert. No discharge was flowing from the relief well discharge hose.
- Turbidity at Site 1 was 1.38 NTU and gradually increased downstream to where it was 7.1 NTU at Site 5. The increase in turbidity appeared to be caused by the presence of fine algae growing along the top of the water surface in the slow moving water upstream and downstream of each hay bale.

March 20, 2019:

- Conditions were sunny and warmer (12°C- 16°C). The EM arrived onsite at 9:45. Drillwell explained that work that day would involve developing the new relief well and that some turbidity from the discharge hose should be expected.
- Twelve mallard duck (*Anas platyrhynchos*) where in the channel between H1 and H2 upon the EM's arrival, but flew away shortly after. Duck droppings were abundant along the tops of the haybales.
- With the increase in temperature, mats of floating algae had established along the top of ponded water upstream of H1 and H2.
- Wooden stakes had been added to the downstream side of H1 and H2 to keep the hay bales in place.
- Haybales were placed on either side of the fence for safer access to the well discharge channel, prior to a planned Ministry staff site visit.
- The branch was frozen or dry upstream of its confluence with the well discharge channel and the fish exclusion net was surrounded by ice but in good repair and position (Photograph 11).
- At 10:05, before well development had begun, turbidity ranged from 2.04 NTU at Site 1 to 8.17 NTU at Site 5.
- After well development had begun at 10:43, turbidity in the well discharge channel was reduced from 18.6 at Site 1 to 14.7 NTU at Site 5 before moving through the haybales and entering the branch.
- At 11:19, the EM secured a silt curtain across the fence downstream of Site 5 to further manage silt in the well discharge, immediately before it entered the branch (Photograph 12).
- The silt curtain appeared to be effective in reducing turbidity downstream of Site 5.
- Work stopped during lunch break from 12:00 to 13:00.
- Water was being directly released from the settling bin into nearby gravels.
- At 13:07, turbidity in the channel appeared clear and was variable throughout the channel, ranging between 2.87 and 12.2 NTU. Variations in turbidity appeared to be influenced by the EM walking across the tops of the hay bales to access the sites.
- A surge of turbid water from the discharge hose occurred at 14:30. Turbidity stabilized by 14:30 with values between 4.5 NTU and 6.0 NTU at all sites.

- By 14:40 air temperature had risen to 16°C and ice in the branch had melted and was flowing slowly at a depth of about 8 cm. The fish exclusion net remained in place. Fish were not observed upstream of the net. Turbidity in the branch was 8.24 NTU at Site 6, located about 10 m upstream of the well discharge confluence.
- By 14:45 a relief well pumping test had begun. There was no flow coming from the discharge hose but turbid water was entering the well discharge channel from the culvert.
- At 15:00, a green plume of water entered the well discharge channel from the culvert that smelled of motor oil that had a turbidity reading of 41.7 NTU. (Photograph 13). It quickly dissipated and was replaced by a consistent plume of grey, turbid water.
- Turbidity at H1-H4 were measured between 15:04 and 15:10. Turbidity reduced from 56.6 NTU at Site 1 to 5.75 NTU at Site 4. Turbidity at Site 5 was not read because the EM noticed an increase of flow entering the well discharge channel from the discharge hose.
- A second start of the pumping test began at 15:15. Turbidity was visibly better with initial readings at Site 1 of 8.05 NTU that slightly increased to 6.11 NTU by the time flows reached Site 5.
- Surges of clear water continued to flow from the discharge hose during the pumping test that seemed to smell of of sulphur and hydrocarbons (though the presence of the latter are unlikely). Around 15:30, turbidity immediately upstream of the fish exclusion net was 15.1 NTU and at Site 6 was 9.17 NTU (Photograph 14).
- The EM left the site at 16:00.

March 21, 2019:

- Weather conditions were sunny and seasonally warm. Air temperature was 14°C at 11:00 when the EM arrived onsite.
- The EM spoke with Drillwell and Doug Geller from WWAL before monitoring the well discharge channel. Work included hosting a visit by MFLNRORD staff.
- Water was being purged from the settling bin into gravel and sand immediately next to the bin (Photograph 15). The discharge rate was relatively low (about 25 gpm). This water infiltrated into ground.
- No leaks and spills were seen by the EM at the drill site.
- At the well discharge channel, the silt curtain was in good repair and there were icy and dry patches in the branch upstream of the well discharge confluence. Because it was not flowing, no turbidity measurements were collected in the branch at Site 6.
- About sixteen MFLNRORD staff entered the drill site around 11:30.
- Turbidity at Site 1 was 5.39 NTU at 11:00 and 12:00. Although, there were slight variances in turbidity, values remained relatively stable throughout the channel before flow passed through the silt curtain and entered the branch.
- The EM led the Ministry staff through a tour of the monitoring sites along the well discharge channel and branch. They were shown the hay bales, silt curtain and fish exclusion fence. The EM answered questions and explained how the haybales were effective in filtering sediment from the well discharge. The tour ended at 12:33 and the EM left the site at 12:40.

March 22, 2019:

- The EM arrived on site at 10:37. Weather conditions were sunny and warm (16°C). Another MFLNRORD tour was scheduled to occur at 11:30 am.
- The well discharge channel appeared clear. More stakes had been placed downstream of the hay bales at H1 and H2 and another hay bale was added to the north end of H3.
- The branch upstream of the well discharge confluence was either frozen or dry and not flowing.
- Avian feathers and droppings littered the tops of the hay bales.
- New grass growth was observed at the base of the hay bales where they were immersed in water (Photograph 16).
- At 10:45 turbidity at Sites 1-4 ranged between 2.4 NTU and 5.03 NTU. At Site 5, turbidity was relatively elevated at18.3 NTU. This was likely due to the EM disturbing bottom sediments in the very shallow water column (less than 2 cm deep), while collecting the sample.
- At 11:07 a plume of turbid watered entered the well discharge channel from culvert.
- Water strider (*Aquarius remigis*) and scud (*Gammarus spp.*) were found in the well discharge channel between H1 and H2. The striders were swimming on top of the water and the scuds were breading near the bottom sediments.
- Strands of green, filamentous algae had established into large mats along the surface of the well discharge channel between H1 and H2 and H2 and H3 (Photograph 17).
- At 11:33 well discharge was arriving in pulses from the culvert into the channel but no water was moving through the hose. The pulses of water were slightly turbid but cleared immediately.
- At 11:40 the MFLNRORD tour began at the well site. Turbidity was 11.1 NTU at Site 1 but gradually reduced to 4.06 NTU by the time flow moved downstream to Site 5.
- From 11:50 to 12:30 flow entering the well discharge channel from the hose had turbidity readings ranging between 2.4 and 4.58 NTU (Site 1).
- The MFLNRORD group of about twelve people arrived at the well discharge channel at 12:30. Some of the same people that attending the tour from the day before were there again. The EM directed them to use the hay bales to cross the fence and assisted them into the field.
- The EM conducted the tour and answered a few questions from attendees.
- The tour ended at 12:50 and the MFLNRORD staff left the site. The EM left the site at 13:00.

March 29, 2019: Final site visit, post-decommissioning.

- The EM arrived on the site at 15:00. Conditions were sunny and warm (17°C).
- The well discharge channel was no longer flowing and the hay bales had been pushed to the side of the channel and were drying out (Photograph 18).
- The Pringle Creek branch was flowing at about ½ bank full (Photograph 19). Turbidity at Site 6 was 5.2 NTU.
- The EM removed the fish exclusion net and silt curtain (Photographs 20a and 20b).

4.0 COMPLIANCE

Spills and leaks were not observed at the drill site.

Fish movement was restricted effectively by ice cover and the fish exclusion net placed upstream of the well discharge confluence.

Haybales H1-H3 and silt curtain were effective at keeping turbidity within 8 NTU of background readings within a 24 hour period. Although occasional spikes of highly turbid well discharge entered the Pringle Creek channel, these events occurred when there was no possibility of fish entering the Pringle Creek channel from the main stem.

Wildlife was minimally impacted by the decommissioning of the well. Aquatic insect life observed utilizing the former well discharge channel (scud and water striders) are-well equipped to either survive in the damp soils or move into the Pringle Creek channel. Mallard ducks that were utilizing the former well discharge channel have many other suitable habitats nearby in which to re-establish including the main stem and branch of Pringle Creek, wetland ponds and the Salmon River.

5.0 RECOMMENDATIONS:

- Allow the hay bales to dry out and remove them if the land owner does not want to keep them.
- Remove all construction waste and discharge infrastructure from the site.
- Seed the former well discharge channel with a native seed mix or agricultural seed of the land owner's choose to restrict invasive plant growth.

5.0 CONCLUSIONS

Drillwell successfully drilled a new relief well and decommissioned the uncontrolled artesian well and its flow through the well discharge channel into the branch of Pringle Creek.

Water quality, collected from a sample of the decommissioned well discharge on February 27, 2019, was within BC Drinking Water Quality Guidelines and BC Water Quality Guidelines for the Protection of Aquatic Life.

WWAL provided direction on environmental mitigation, routine environmental monitoring during project works and hosting two MFLNRO tours of well discharge mitigation features on March 21 and 22, 2019.

Drillwell was diligent in following the EM's guidance and the environmental mitigation found in Section 11 *Water Sustainability Act* Notification Approval #R8004032.

Attachments:

- Appendix A: Figures
- Appendix B: Photographs
- Appendix C: Table of Field Turbidity Measurements
- Appendix D: Caro Analytical Water Quality Results.

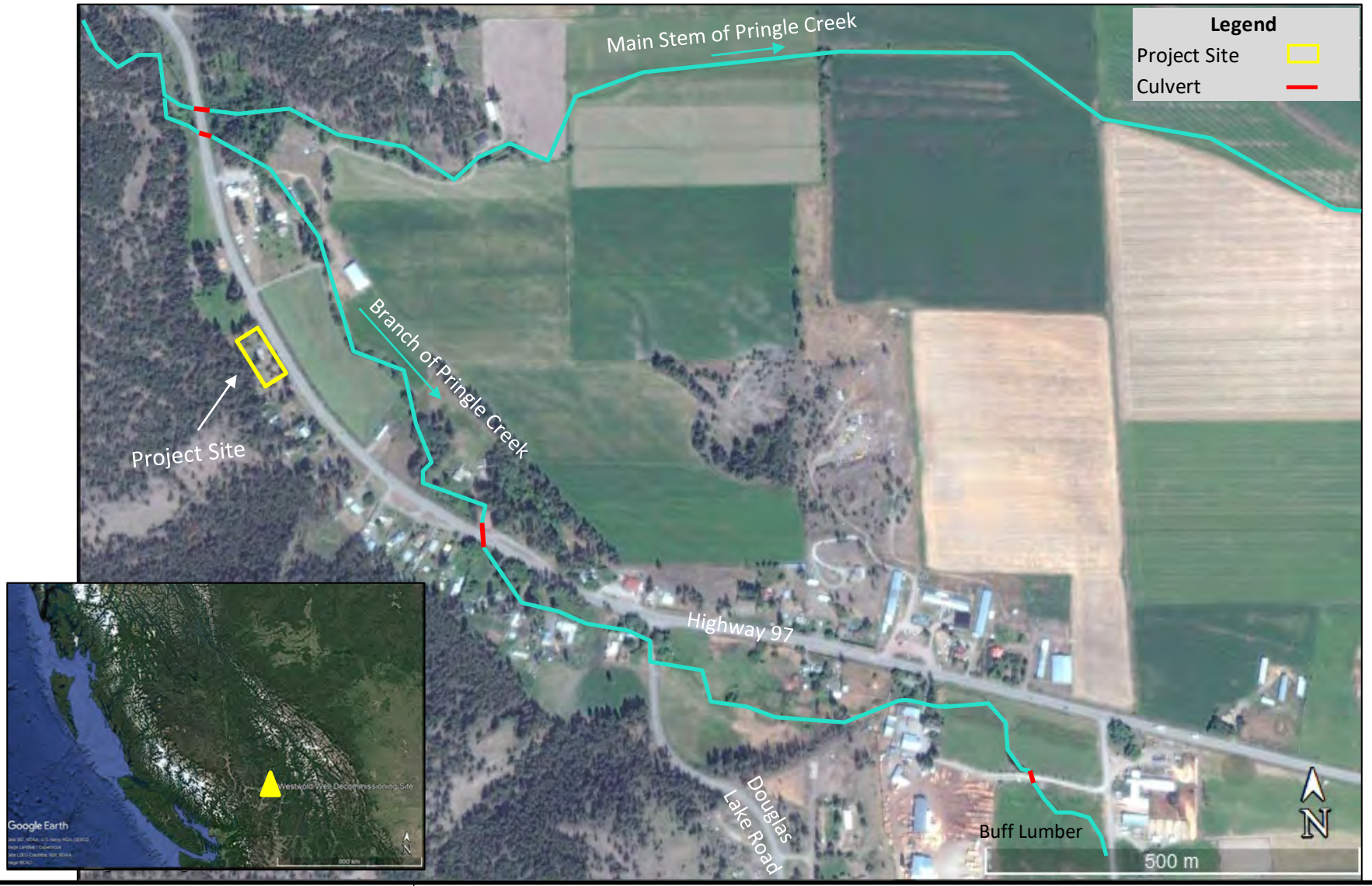
REFERENCES

BC Ministry of Water, Land and Air Protection. 2003. BC Field Sampling Manual. Part E: Water and Wastewater Sampling Ambient Freshwater and Effluent Sampling Part E. Version 1. Prepared by Ministry of Water, Land and Air Protection Water, Air and Climate Change Branch Published by the Resources Information Standards Committee. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/part_e_water_and_wastewater_sampling_ambient_freshwater_and_effluent_sampling_simulate_template.pdf

H, Singleton, 2001. Water Quality Ambient Water Quality Guidelines (Criteria) for Turbidity, Suspended and Benthic Sediments Overview Report . Prepared for the Water Management Branch of the Environment and Resource Division Ministry of Environment http://www.env.gov.bc.ca/wat/wq/BCguidelines/turbidity/turbidity.html

Western Water Associates Ltd (WWAL) 2019. Westwold Flowing Well Decommissioning Work Plan Environmental Management Plan. Appendix C. Prepared for Drillwell.

APPENDIX A: FIGURES



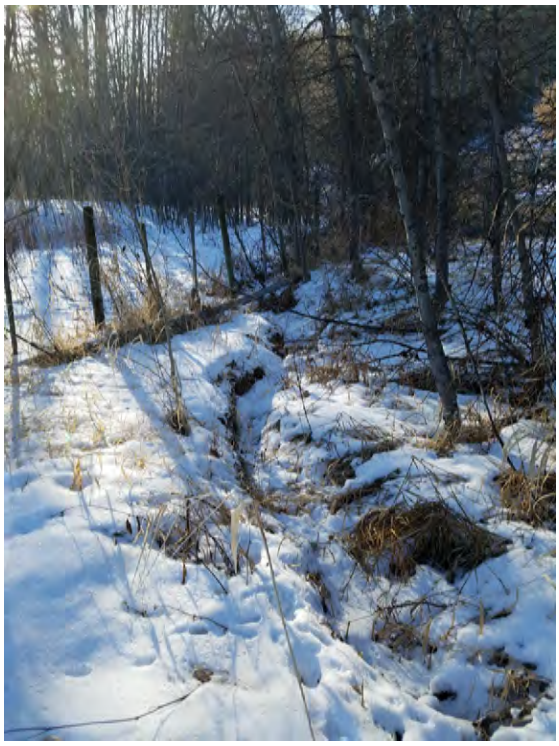
Westwold Well Decommissioning	TITLE **Figure 1:** Project Location			
western water ASSOCIATES LTD	DRAWN GL	DATE April 2019	PROJECT NO. 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	

Westwold Well Decommissioning	TITLE **Figure 2:** Turbidity Monitoring Sites and Mitigation Features			
western water ASSOCIATES LTD	DRAWN GL	DATE April 2019	PROJECT NO. 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	

APPENDIX B: PHOTOGRAPHS

Attachment: Photos

Photograph 1: Branch of Pringle Creek upstream of well discharge confluence (January 19, 2019)



Photograph 2: Termination of Pringle Creek branch on Buff Lumber property (January 19, 2019)

Photograph 3: Well Discharge Channel (January 19, 2019)

Photograph 4: Drill Site with Discharge Collection Bin (February 27, 2019)

Photograph 5: Well Discharge Sampling Location Site 1 (February 27, 2019)

Photograph 6: H1 placed across the Well Discharge Channel (March 11, 2019)

Photograph 7: Flow generated by drilling entering the well discharge channel from a hose fed through the culvert (March 11, 2019)

Photograph 8: Fish exclusion net placed in the frozen branch of Pringle Creek upstream of the well discharge confluence (March 11, 2019)

Photograph 9: A pulse of highly turbid well discharge (March 11, 2019 at 15:15)

Photograph 10:The EM measuring turbidity at Site 2 upstream of the shallow pool created by H1 and H2 (March 14, 2019)

Photograph 11: Fish Exclusion Net surrounded by ice (March 20, 2019).

Photograph 12: Silt curtain placed along the base of the fence (March 20, 2019).

Photograph 13: Green plume of water from discharge hose smelling of hydrocarbons with turbidity of 41.7 NTU (March 20, 2019).

Photograph 14: Melted water in the branch of Pringle Creek at Site 6 with turbidity of 9.17 NTU (March 20, 2019).

Photograph 15: Water being purged from the settling bin (March 21, 2019).

Photograph 16: Grass growling along the base of H2 (March 22, 2019).

Photograph 17: Mats of green filamentous algae in pooled sections between the hay bale rows (March 22, 2019).

Photograph 18: No flow in the well discharge channel (March 29, 2019).

Photograph 19: The branch of Pringle Creek was flowing near ½ bank full (March 29, 2019).

Photographs 20a and 20b: The silt curtain and the fish exclusion net were removed (March 29, 2019).

20a. Silt curtain removed

20b. Fish exclusion net removed

APPENDIX C: FIELD TURBIDITY

Appendix C: Field Turbidity
Westwold Well Decommissioning
WWAL 19-002-01VR

11-Mar-19		
Time	Site	Turbidity (NTU)
13:30	1	3.13
13:32	2	3.75
13:40	1	26.7
13:44	2	15.9
13:46	3	11.8
13:50	4	3.63
13:55	5	3.96
14:05	1	27.1
14:08	2	27.1
14:10	3	10.18
14:12	4	8.78
14:15	5	2.5
14:30	1	18.2
14:33	2	20.1
14:35	3	23.6
14:38	4	26.7
14:40	5	12.83
14:45	1	52.7
14:51	2	22.8
14:57	3	12.58
15:00	4	18.7
15:03	5	9.72
15:23	1	NR
15:25	2	NR
15:27	3	NR
15:29	4	NR
15:31	5	1962 AU
14-Mar-19		
13:50	1	1.38
13:52	2	4.9
13:55	3	3.55
13:44	4	6.17
13:46	5	7.1

NR: Too turbid to read

20-Mar-19		
Time	Site	Turbidity (NTU)
10:05	1	2.04
10:06	2	2.51
10:08	3	6.03
10:10	4	8.13
10:15	5	8.17
10:43	1	18.6
10:45	2	11.1
11:20	2	13.4
11:22	3	9.34
11:25	4	14.7
11:34	5	16.1
11:51	1	17.2
11:53	2	16.4
11:55	3	9.56
11:57	4	11.07
12:00	5	10.08
13:17	1	3.67
13:20	2	2.87
13:22	3	7.38
13:24	4	6.68
13:52	5	12.2
14:05	1	5.65
14:08	2	3.28
14:12	3	4.12
14:15	4	13
14:17	5	19.6
14:30	1	6.5
14:32	2	6.19
14:34	3	4.63
14:36	4	4.55
14:38	5	4.84
14:40	6	8.24
14:55	1	41.7
15:04	1	56.6
15:06	2	18
15:08	3	4.48
15:10	4	5.75
15:15	1	8.05
15:04	2	11.5
15:04	3	5.56
15:06	4	14
15:08	5	6.11
15:10	6	9.17

21-Mar-19		
Time	Site	Turbidity (NTU)
10:59	1	5.39
11:02	2	27.7
12:01	1	5.39
12:03	2	12.5
12:05	3	6.65
12:07	4	4.46
12:08	5	6.86
22-Mar-19		
10:45	1	2.4
10:47	2	4.46
10:50	3	4.7
10:51	4	5.03
10:55	5	18.3
11:40	1	11.1
11:42	2	5.94
11:45	3	4.84
11:48	4	7.05
11:50	5	4.06
12:08	1	3.19
12:12	1	2.79
12:30	1	2.4
12:40	1	3.07

APPENDIX D: LABORATORY WATER QUALITY ANALYSIS

CERTIFICATE OF ANALYSIS

REPORTED TO	Western Water Associates Ltd 106 - 5145 26th Street Vernon, BC V1T 8G4		
ATTENTION	Doug Geller	**WORK ORDER**	9021853
PO NUMBER		**RECEIVED / TEMP**	2019-02-27 14:10 / 4°C
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32
PROJECT INFO		**COC NUMBER**	B11568

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

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

We've Got Chemistry

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

Ahead of the Curve

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

Work Order Comments:

This is a revised report; please refer to Appendix 3 for details.

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

Authorized By:

Eilish St.Clair, B.Sc., C.I.T.
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW 112429 (9021853-01) | Matrix: Water | Sampled: 2019-02-27 11:00						
Anions						
Chloride	**1.97**	AO ≤ 250	0.10	mg/L	2019-02-27	
Fluoride	**0.28**	MAC = 1.5	0.10	mg/L	2019-02-27	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2019-02-27	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2019-02-27	
Sulfate	**4.2**	AO ≤ 500	1.0	mg/L	2019-02-27	
Calculated Parameters						
Hardness, Total (as CaCO3)	**149**	None Required	0.500	mg/L	N/A	
Langelier Index	**0.8**	N/A	-5.0		2019-03-06	
Solids, Total Dissolved	**304**	AO ≤ 500	1.00	mg/L	N/A	
Field Parameters						
Conductivity (EC)	**564**	N/A	2	µS/cm	2019-02-27	
Oxidation/Reduction Potential	**169**	N/A	-200	millivolts	2019-02-27	
Temperature, field	**11.5-12.1**	N/A		°C	2019-02-27	
General Parameters						
Alkalinity, Total (as CaCO3)	**300**	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Bicarbonate (as CaCO3)	**300**	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Colour, True	< 5.0	AO ≤ 15	5.0	CU	2019-02-28	
Conductivity (EC)	**520**	N/A	2.0	µS/cm	2019-02-27	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2019-02-28	
pH	**8.29**	7.0-10.5	0.10	pH units	2019-02-27	HT2
Temperature, at pH	**21.2**	N/A		°C	2019-02-27	HT2
Turbidity	**0.36**	VARIES	0.10	NTU	2019-02-28	
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2019-02-27	
E. coli	< 1	MAC = 10	1	CFU/100 mL	2019-02-27	
Total Metals						
Aluminum, total	< 0.0050	OG < 9.5	0.0050	mg/L	2019-03-04	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2019-03-04	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2019-03-04	
Barium, total	**0.0116**	MAC = 1	0.0050	mg/L	2019-03-04	
Boron, total	**0.0883**	MAC = 5	0.0050	mg/L	2019-03-04	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2019-03-04	
Calcium, total	**30.1**	None Required	0.20	mg/L	2019-03-04	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2019-03-04	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2019-03-04	
Copper, total	< 0.00040	AO ≤ 1	0.00040	mg/L	2019-03-04	

TEST RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW 112429 (9021853-01) | Matrix: Water | Sampled: 2019-02-27 11:00, Continued						
Total Metals, Continued						
Iron, total	**0.103**	AO ≤ 0.3	0.010	mg/L	2019-03-04	
Lead, total	< 0.00020	MAC = 0.01	0.00020	mg/L	2019-03-04	
Lithium, total	**0.00075**	N/A	0.00010	mg/L	2019-03-04	
Magnesium, total	**18.0**	None Required	0.010	mg/L	2019-03-04	
Manganese, total	**0.108**	AO ≤ 0.05	0.00020	mg/L	2019-03-04	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2019-03-05	
Molybdenum, total	**0.00183**	MAC = 0.25	0.00010	mg/L	2019-03-04	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2019-03-04	
Potassium, total	**7.54**	N/A	0.10	mg/L	2019-03-04	
Selenium, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2019-03-04	
Sodium, total	**59.5**	AO ≤ 200	0.10	mg/L	2019-03-04	
Strontium, total	**0.278**	N/A	0.0010	mg/L	2019-03-04	
Uranium, total	< 0.000020	MAC = 0.02	0.000020	mg/L	2019-03-04	
Zinc, total	**0.0079**	AO ≤ 5	0.0040	mg/L	2019-03-04	

Sample Qualifiers:

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

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Coliforms, Total in Water	SM 9222 B (2006)	Membrane Filtration / m-Endo Agar	Kelowna
Colour, True in Water	SM 2120 C (2011)	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	Kelowna
E. coli in Water	SM 9222 G (2006)	Membrane Filtration / Nutrient Agar with MUG	Kelowna
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
Langelier Index in Water	SM 2330 B (2010)	Calculation	N/A
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2011)	Calculation: 100 x ([Cations]-[Anions])/([Cations]+[Anions])	N/A
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
Turbidity in Water	SM 2130 B (2011)	Nephelometry	Kelowna

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

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
VARIES	
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

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

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

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

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

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B9B1772										
Blank (B9B1772-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B9B1772-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Chloride	16.1	0.10	mg/L	16.0		100	90-110			
Fluoride	3.99	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	4.06	0.010	mg/L	4.00		101	93-108			
Nitrite (as N)	2.01	0.010	mg/L	2.00		101	85-114			
Sulfate	16.1	1.0	mg/L	16.0		100	91-109			
General Parameters, Batch B9B1801										
Blank (B9B1801-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B9B1801-BS1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Alkalinity, Total (as CaCO3)	104	1.0	mg/L	100		104	92-106			
LCS (B9B1801-BS2)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-104			
Reference (B9B1801-SRM1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
pH	7.00	0.10	pH units	7.01		100	98-102			
General Parameters, Batch B9B1833										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
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Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B9B1833, Continued										
Blank (B9B1833-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B9B1833-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	0.0198	0.0020	mg/L	0.0200		99	82-120			
LCS Dup (B9B1833-BSD1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	0.0202	0.0020	mg/L	0.0200		101	82-120	2	10	
General Parameters, Batch B9B1837										
Blank (B9B1837-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Colour, True	< 5.0	5.0	CU							
LCS (B9B1837-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Colour, True	19	5.0	CU	20.0		96	85-115			
General Parameters, Batch B9B1850										
Blank (B9B1850-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Turbidity	< 0.10	0.10	NTU							
LCS (B9B1850-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Turbidity	40.2	0.10	NTU	40.0		100	90-110			
Microbiological Parameters, Batch B9B1736										
Blank (B9B1736-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B9B1736-BLK2)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B9B1736-BLK3)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B9C0158										
Blank (B9C0158-BLK1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0050	0.0050	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B9C0158, Continued										
Blank (B9C0158-BLK1), Continued				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B9C0158-BS1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	0.0231	0.0050	mg/L	0.0200		115	80-120			
Antimony, total	0.0230	0.00020	mg/L	0.0200		115	80-120			
Arsenic, total	0.0203	0.00050	mg/L	0.0200		102	80-120			
Barium, total	0.0209	0.0050	mg/L	0.0200		105	80-120			
Boron, total	0.0214	0.0050	mg/L	0.0200		107	80-120			
Cadmium, total	0.0213	0.000010	mg/L	0.0200		106	80-120			
Calcium, total	1.98	0.20	mg/L	2.00		99	80-120			
Chromium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Cobalt, total	0.0199	0.00010	mg/L	0.0200		100	80-120			
Copper, total	0.0207	0.00040	mg/L	0.0200		103	80-120			
Iron, total	1.95	0.010	mg/L	2.00		97	80-120			
Lead, total	0.0212	0.00020	mg/L	0.0200		106	80-120			
Lithium, total	0.0208	0.00010	mg/L	0.0200		104	80-120			
Magnesium, total	2.01	0.010	mg/L	2.00		100	80-120			
Manganese, total	0.0199	0.00020	mg/L	0.0200		100	80-120			
Molybdenum, total	0.0209	0.00010	mg/L	0.0200		105	80-120			
Nickel, total	0.0201	0.00040	mg/L	0.0200		100	80-120			
Potassium, total	1.91	0.10	mg/L	2.00		96	80-120			
Selenium, total	0.0212	0.00050	mg/L	0.0200		106	80-120			
Sodium, total	2.01	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0201	0.0010	mg/L	0.0200		101	80-120			
Uranium, total	0.0212	0.000020	mg/L	0.0200		106	80-120			
Zinc, total	0.0200	0.0040	mg/L	0.0200		100	80-120			
Reference (B9C0158-SRM1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	0.275	0.0050	mg/L	0.303		91	82-114			
Antimony, total	0.0554	0.00020	mg/L	0.0511		108	88-115			
Arsenic, total	0.120	0.00050	mg/L	0.118		102	88-111			
Barium, total	0.816	0.0050	mg/L	0.823		99	83-110			
Boron, total	3.47	0.0050	mg/L	3.45		101	80-118			
Cadmium, total	0.0511	0.000010	mg/L	0.0495		103	90-110			
Calcium, total	10.8	0.20	mg/L	11.6		93	85-113			
Chromium, total	0.249	0.00050	mg/L	0.250		100	88-111			
Cobalt, total	0.0378	0.00010	mg/L	0.0377		100	90-114			
Copper, total	0.509	0.00040	mg/L	0.486		105	90-117			
Iron, total	0.476	0.010	mg/L	0.488		97	90-116			
Lead, total	0.211	0.00020	mg/L	0.204		103	90-110			
Lithium, total	0.402	0.00010	mg/L	0.403		100	79-118			
Magnesium, total	3.78	0.010	mg/L	3.79		100	88-116			
Manganese, total	0.102	0.00020	mg/L	0.109		94	88-108			
Molybdenum, total	0.207	0.00010	mg/L	0.198		105	88-110			
Nickel, total	0.243	0.00040	mg/L	0.249		98	90-112			
Potassium, total	7.14	0.10	mg/L	7.21		99	87-116			
Selenium, total	0.127	0.00050	mg/L	0.121		105	90-122			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B9C0158, Continued										
Reference (B9C0158-SRM1), Continued				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Sodium, total	7.42	0.10	mg/L	7.54		98	86-118			
Strontium, total	0.383	0.0010	mg/L	0.375		102	86-110			
Uranium, total	0.0305	0.000020	mg/L	0.0306		100	88-112			
Zinc, total	2.60	0.0040	mg/L	2.49		104	90-113			
Total Metals, Batch B9C0271										
Blank (B9C0271-BLK1)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B9C0271-BLK2)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B9C0271-SRM1)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	0.00465	0.000010	mg/L	0.00489		95	80-120			
Reference (B9C0271-SRM2)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	0.00478	0.000010	mg/L	0.00489		98	80-120			

APPENDIX 3: REVISION HISTORY

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Sample ID	Changed	Change	Analysis	Analyte(s)
9021853-01	2019-03-07	Added	Conductivity (Field)	
9021853-01	2019-03-07	Added	Oxidation-Reduction Potential (Field)	
9021853-01	2019-03-07	Added	Temperature (Field)	

Appendix E
Water Quality Report – Caro Analytical (February 27, 2019)

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

CERTIFICATE OF ANALYSIS

REPORTED TO	Western Water Associates Ltd 106 - 5145 26th Street Vernon, BC V1T 8G4		
ATTENTION	Doug Geller	**WORK ORDER**	9021853
PO NUMBER		**RECEIVED / TEMP**	2019-02-27 14:10 / 4°C
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32
PROJECT INFO		**COC NUMBER**	B11568

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

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

We've Got Chemistry

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

Ahead of the Curve

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

Work Order Comments:

This is a revised report; please refer to Appendix 3 for details.

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

Authorized By:

Eilish St.Clair, B.Sc., C.I.T.
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW 112429 (9021853-01) | Matrix: Water | Sampled: 2019-02-27 11:00						
Anions						
Chloride	**1.97**	AO ≤ 250	0.10	mg/L	2019-02-27	
Fluoride	**0.28**	MAC = 1.5	0.10	mg/L	2019-02-27	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2019-02-27	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2019-02-27	
Sulfate	**4.2**	AO ≤ 500	1.0	mg/L	2019-02-27	
Calculated Parameters						
Hardness, Total (as CaCO3)	**149**	None Required	0.500	mg/L	N/A	
Langelier Index	**0.8**	N/A	-5.0		2019-03-06	
Solids, Total Dissolved	**304**	AO ≤ 500	1.00	mg/L	N/A	
Field Parameters						
Conductivity (EC)	**564**	N/A	2	µS/cm	2019-02-27	
Oxidation/Reduction Potential	**169**	N/A	-200	millivolts	2019-02-27	
Temperature, field	**11.5-12.1**	N/A		°C	2019-02-27	
General Parameters						
Alkalinity, Total (as CaCO3)	**300**	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Bicarbonate (as CaCO3)	**300**	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2019-02-27	
Colour, True	< 5.0	AO ≤ 15	5.0	CU	2019-02-28	
Conductivity (EC)	**520**	N/A	2.0	µS/cm	2019-02-27	
Cyanide, Total	< 0.0020	MAC = 0.2	0.0020	mg/L	2019-02-28	
pH	**8.29**	7.0-10.5	0.10	pH units	2019-02-27	HT2
Temperature, at pH	**21.2**	N/A		°C	2019-02-27	HT2
Turbidity	**0.36**	VARIES	0.10	NTU	2019-02-28	
Microbiological Parameters						
Coliforms, Total	< 1	MAC = 0	1	CFU/100 mL	2019-02-27	
E. coli	< 1	MAC = 10	1	CFU/100 mL	2019-02-27	
Total Metals						
Aluminum, total	< 0.0050	OG < 9.5	0.0050	mg/L	2019-03-04	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2019-03-04	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2019-03-04	
Barium, total	**0.0116**	MAC = 1	0.0050	mg/L	2019-03-04	
Boron, total	**0.0883**	MAC = 5	0.0050	mg/L	2019-03-04	
Cadmium, total	< 0.000010	MAC = 0.005	0.000010	mg/L	2019-03-04	
Calcium, total	**30.1**	None Required	0.20	mg/L	2019-03-04	
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2019-03-04	
Cobalt, total	< 0.00010	N/A	0.00010	mg/L	2019-03-04	
Copper, total	< 0.00040	AO ≤ 1	0.00040	mg/L	2019-03-04	

TEST RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW 112429 (9021853-01) | Matrix: Water | Sampled: 2019-02-27 11:00, Continued						
Total Metals, Continued						
Iron, total	**0.103**	AO ≤ 0.3	0.010	mg/L	2019-03-04	
Lead, total	< 0.00020	MAC = 0.01	0.00020	mg/L	2019-03-04	
Lithium, total	**0.00075**	N/A	0.00010	mg/L	2019-03-04	
Magnesium, total	**18.0**	None Required	0.010	mg/L	2019-03-04	
Manganese, total	**0.108**	AO ≤ 0.05	0.00020	mg/L	2019-03-04	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2019-03-05	
Molybdenum, total	**0.00183**	MAC = 0.25	0.00010	mg/L	2019-03-04	
Nickel, total	< 0.00040	N/A	0.00040	mg/L	2019-03-04	
Potassium, total	**7.54**	N/A	0.10	mg/L	2019-03-04	
Selenium, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2019-03-04	
Sodium, total	**59.5**	AO ≤ 200	0.10	mg/L	2019-03-04	
Strontium, total	**0.278**	N/A	0.0010	mg/L	2019-03-04	
Uranium, total	< 0.000020	MAC = 0.02	0.000020	mg/L	2019-03-04	
Zinc, total	**0.0079**	AO ≤ 5	0.0040	mg/L	2019-03-04	

Sample Qualifiers:

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

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Coliforms, Total in Water	SM 9222 B (2006)	Membrane Filtration / m-Endo Agar	Kelowna
Colour, True in Water	SM 2120 C (2011)	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
Cyanide, SAD in Water	ASTM D7511-12	Flow Injection with In-Line UV Digestion and Amperometry	Kelowna
E. coli in Water	SM 9222 G (2006)	Membrane Filtration / Nutrient Agar with MUG	Kelowna
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
Langelier Index in Water	SM 2330 B (2010)	Calculation	N/A
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	Richmond
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Solids, Total Dissolved in Water	SM 1030 E (2011)	Calculation: 100 x ([Cations]-[Anions])/([Cations]+[Anions])	N/A
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
Turbidity in Water	SM 2130 B (2011)	Nephelometry	Kelowna

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

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
AO	Aesthetic Objective
CFU/100 mL	Colony Forming Units per 100 millilitres
CU	Colour Units (referenced against a platinum cobalt standard)
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
OG	Operational Guideline (treated water)
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
VARIES	
ASTM	ASTM International Test Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

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

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

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

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

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

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B9B1772										
Blank (B9B1772-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B9B1772-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Chloride	16.1	0.10	mg/L	16.0		100	90-110			
Fluoride	3.99	0.10	mg/L	4.00		100	88-108			
Nitrate (as N)	4.06	0.010	mg/L	4.00		101	93-108			
Nitrite (as N)	2.01	0.010	mg/L	2.00		101	85-114			
Sulfate	16.1	1.0	mg/L	16.0		100	91-109			
General Parameters, Batch B9B1801										
Blank (B9B1801-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B9B1801-BS1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Alkalinity, Total (as CaCO3)	104	1.0	mg/L	100		104	92-106			
LCS (B9B1801-BS2)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-104			
Reference (B9B1801-SRM1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
pH	7.00	0.10	pH units	7.01		100	98-102			
General Parameters, Batch B9B1833										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B9B1833, Continued										
Blank (B9B1833-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	< 0.0020	0.0020	mg/L							
LCS (B9B1833-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	0.0198	0.0020	mg/L	0.0200		99	82-120			
LCS Dup (B9B1833-BSD1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Cyanide, Total	0.0202	0.0020	mg/L	0.0200		101	82-120	2	10	
General Parameters, Batch B9B1837										
Blank (B9B1837-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Colour, True	< 5.0	5.0	CU							
LCS (B9B1837-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Colour, True	19	5.0	CU	20.0		96	85-115			
General Parameters, Batch B9B1850										
Blank (B9B1850-BLK1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Turbidity	< 0.10	0.10	NTU							
LCS (B9B1850-BS1)				Prepared: 2019-02-28, Analyzed: 2019-02-28						
Turbidity	40.2	0.10	NTU	40.0		100	90-110			
Microbiological Parameters, Batch B9B1736										
Blank (B9B1736-BLK1)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B9B1736-BLK2)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Blank (B9B1736-BLK3)				Prepared: 2019-02-27, Analyzed: 2019-02-27						
Coliforms, Total	< 1	1	CFU/100 mL							
E. coli	< 1	1	CFU/100 mL							
Total Metals, Batch B9C0158										
Blank (B9C0158-BLK1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Boron, total	< 0.0050	0.0050	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B9C0158, Continued										
Blank (B9C0158-BLK1), Continued				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
LCS (B9C0158-BS1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	0.0231	0.0050	mg/L	0.0200		115	80-120			
Antimony, total	0.0230	0.00020	mg/L	0.0200		115	80-120			
Arsenic, total	0.0203	0.00050	mg/L	0.0200		102	80-120			
Barium, total	0.0209	0.0050	mg/L	0.0200		105	80-120			
Boron, total	0.0214	0.0050	mg/L	0.0200		107	80-120			
Cadmium, total	0.0213	0.000010	mg/L	0.0200		106	80-120			
Calcium, total	1.98	0.20	mg/L	2.00		99	80-120			
Chromium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Cobalt, total	0.0199	0.00010	mg/L	0.0200		100	80-120			
Copper, total	0.0207	0.00040	mg/L	0.0200		103	80-120			
Iron, total	1.95	0.010	mg/L	2.00		97	80-120			
Lead, total	0.0212	0.00020	mg/L	0.0200		106	80-120			
Lithium, total	0.0208	0.00010	mg/L	0.0200		104	80-120			
Magnesium, total	2.01	0.010	mg/L	2.00		100	80-120			
Manganese, total	0.0199	0.00020	mg/L	0.0200		100	80-120			
Molybdenum, total	0.0209	0.00010	mg/L	0.0200		105	80-120			
Nickel, total	0.0201	0.00040	mg/L	0.0200		100	80-120			
Potassium, total	1.91	0.10	mg/L	2.00		96	80-120			
Selenium, total	0.0212	0.00050	mg/L	0.0200		106	80-120			
Sodium, total	2.01	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0201	0.0010	mg/L	0.0200		101	80-120			
Uranium, total	0.0212	0.000020	mg/L	0.0200		106	80-120			
Zinc, total	0.0200	0.0040	mg/L	0.0200		100	80-120			
Reference (B9C0158-SRM1)				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Aluminum, total	0.275	0.0050	mg/L	0.303		91	82-114			
Antimony, total	0.0554	0.00020	mg/L	0.0511		108	88-115			
Arsenic, total	0.120	0.00050	mg/L	0.118		102	88-111			
Barium, total	0.816	0.0050	mg/L	0.823		99	83-110			
Boron, total	3.47	0.0050	mg/L	3.45		101	80-118			
Cadmium, total	0.0511	0.000010	mg/L	0.0495		103	90-110			
Calcium, total	10.8	0.20	mg/L	11.6		93	85-113			
Chromium, total	0.249	0.00050	mg/L	0.250		100	88-111			
Cobalt, total	0.0378	0.00010	mg/L	0.0377		100	90-114			
Copper, total	0.509	0.00040	mg/L	0.486		105	90-117			
Iron, total	0.476	0.010	mg/L	0.488		97	90-116			
Lead, total	0.211	0.00020	mg/L	0.204		103	90-110			
Lithium, total	0.402	0.00010	mg/L	0.403		100	79-118			
Magnesium, total	3.78	0.010	mg/L	3.79		100	88-116			
Manganese, total	0.102	0.00020	mg/L	0.109		94	88-108			
Molybdenum, total	0.207	0.00010	mg/L	0.198		105	88-110			
Nickel, total	0.243	0.00040	mg/L	0.249		98	90-112			
Potassium, total	7.14	0.10	mg/L	7.21		99	87-116			
Selenium, total	0.127	0.00050	mg/L	0.121		105	90-122			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B9C0158, Continued										
Reference (B9C0158-SRM1), Continued				Prepared: 2019-03-04, Analyzed: 2019-03-04						
Sodium, total	7.42	0.10	mg/L	7.54		98	86-118			
Strontium, total	0.383	0.0010	mg/L	0.375		102	86-110			
Uranium, total	0.0305	0.000020	mg/L	0.0306		100	88-112			
Zinc, total	2.60	0.0040	mg/L	2.49		104	90-113			
Total Metals, Batch B9C0271										
Blank (B9C0271-BLK1)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B9C0271-BLK2)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B9C0271-SRM1)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	0.00465	0.000010	mg/L	0.00489		95	80-120			
Reference (B9C0271-SRM2)				Prepared: 2019-03-05, Analyzed: 2019-03-05						
Mercury, total	0.00478	0.000010	mg/L	0.00489		98	80-120			

APPENDIX 3: REVISION HISTORY

REPORTED TO	Western Water Associates Ltd	**WORK ORDER**	9021853
PROJECT	19-002-01 VR	**REPORTED**	2019-03-07 13:32

Sample ID	Changed	Change	Analysis	Analyte(s)
9021853-01	2019-03-07	Added	Conductivity (Field)	
9021853-01	2019-03-07	Added	Oxidation-Reduction Potential (Field)	
9021853-01	2019-03-07	Added	Temperature (Field)	

Appendix F
Selected Project Photographs

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Photos

Photograph 1. WTN 112429 Well head prior to work commencing on decommissioning, January 21 2019

Photograph 2. Looking north during final stages of pre-drilling site preparation (February 14 2019)

Photograph 3. DR24HD rig used to install relief well, March 11, 2019

Photograph 4. Formation sample of gravel from top of flowing artesian aquifer, depth 278 ft. Most of the aquifer composed of finer-grained sand (see next photo), March 11, 2019

Photograph 5. Formation sample from depth 320 ft, the lower of the two productive zones screened in the relief well. March 11, 2019

Photograph 6. Relief well screen assembly installation, March 19, 2019

Photograph 7. Off-site water discharge swale on Miller property, during drilling of relief well control casing, March 1, 2019.

Photograph 8. Artesian flow (200-250 gpm) discharge from relief well (no flow from WTN 112429), March 24, 2019 just prior to start of decommissioning operations

Photograph 9. Pumped discharge from relief well, March 24, 2019

Photograph 10. Relief wellhead during pumping test March 24, 2019

Photograph 11. View looking back toward project site of off-site water discharge area, March 25, 2019 during well decommissioning operations.

Photograph 12. Drillwell personnel confirming return of grout to surface during initial cementing of WTN 112429, March 25, 2019

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Photograph 13. Decommissioned WTN 112429, grouted from bottom of confining unit to surface March 25, 2019.

Photograph 14. Oblique aerial view of project site taken by drone, March 26, 2019

Photograph 15. Relief well head assembly, with water sampling port, pressure gauges, connection for future domestic supply, and wellhead pressure transducer (arrow), April 9, 2019

Appendix G
Drillwell Daily Field Reports

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

From:	Drillwell Enterprises
To:	"Thomson, David A FLNR:EX"; Doug Geller
Cc:	"Wade, Melissa FLNR:EX"; "Pogson, John W FLNR:EX"; "Thomson, Skye FLNR:EX"; Ryan Rhodes
Subject:	RE: Friday Weekly Planning Update
Date:	February 22, 2019 6:10:44 PM

Update for week ending Feb 22

- Flow meter installed on 6" well
- Temporary Electrical permit pulled
- Loaded rig and rod trucks for mobilization (Mon thru Wednesday Feb 25-27th)
- All other required materials and equipment re-scheduled for earlier mob
- Will be starting daily evening updates beginning Monday (Feb 25th).

Have a good weekend,

Colin

DRILLWELL ENTERPRISES LTD.

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T: (250) 746-5268 | F: (250) 746-8404 | T: (800) 746-7444

drill@drillwell.com | www.drillwell.com

From: Drillwell Enterprises [mailto:drill@drillwell.com]
Sent: Friday, February 15, 2019 6:44 PM
To: 'Thomson, David A FLNR:EX'; 'Doug Geller'
Cc: 'Wade, Melissa FLNR:EX'; 'Pogson, John W FLNR:EX'; 'Thomson, Skye FLNR:EX'; 'Ryan Rhodes'
Subject: RE: Friday Weekly Planning Update

Update for week ending Feb 15th.

1. Feb 12: Short Term Use Application submitted by WWAL. Copies provided to D. Thomson, R. Reilly.
2. Feb 13: Project Info "one pagers" posted in Westwold: at Community Hall (no bulletin board, may not last…), and at the Post office (there is a kiosk there). Info on community hall rental passed on to Ministry. No one was at legion hall or post office when I was there this morning around 9:30.
3. Feb 13: The note to the property owner (Hutchings) at 4644 Hwy 97 was pinned to the closed gate to the property along with a copy of the one pager. We will let the team know if Trina hears back from the property owner.
4. Feb 13: asked earthworks contractor to place the concrete barriers around WTN 112429 when re-grading works are finished today. Also to arrange the orange barrier cones along the road frontage, using 2 of these to mark the location of the flexible discharge piping from the well to the Victualic lines.
5. Feb 14: excavator de-mobed off site.

6. Electrician is putting together plan and pulling permits for temporary power service for blockheaters and heat/lighting to site trailer.
7. Forwarded info on community hall rental to team.
8. Max Schibli of Monashee Aquifer testing will plan on weekly site visits to measure artesian flow starting soon. Once we have equipment on site we will be taking daily readings.
9. The branch of Pringle Creek appeared totally frozen downstream of the discharge when viewed where it passes through the community park south of the project site. Not surprising as temps were minus 14 when I was there and the temperature has probably not been above minus 10 for at least 10 days straight.
10. Received and reviewed de-commissioning plan comments. Will start to incorporate changes into next document revision.

Have a good weekend,

Colin Slade

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drill@drillwell.com | www.drillwell.com

From: Drillwell Enterprises [mailto:drill@drillwell.com]
Sent: Friday, February 08, 2019 2:01 PM
To: 'Thomson, David A FLNR:EX'; 'Doug Geller'
Cc: 'Wade, Melissa FLNR:EX'; 'Pogson, John W FLNR:EX'; 'Thomson, Skye FLNR:EX'; 'Garnett, Kaylee ENV:EX'; 'Ryan Rhodes'
Subject: RE: Friday Weekly Planning Update

Update for week ending Feb 8th.

- Trees were removed Friday last week, grubbing & leveling of site scheduled for Monday.
- 10" threaded casing on order and other required tooling and fittings being fabricated.
- Water Sust. Act Sec 11 notification submitted FrontCounter by Trina Koch of WWAL and copied to team. Lacking property owner contact information. There has been communication (email) with Ministry about this.
- Temporary use permit - relief well diversion. Application is ready to submit; awaiting direction on lack of property owner sign-off on co applicant form (email Drillwell to D. Thomson 7 February).
- WWAL will be onsite Monday 11 Feb to assist as needed with coordination of subcontractors to conduct site preparation (traffic control to be in place). Paul Williamson

of WWAL is the lead for this day. We will also check the well discharge at WTN 112429. Doug Geller may check in later in the day (afternoon).

- Weather conditions have been on the cold side for nearly a week (overnight lows in the minus 15 to minus 20 range, daytime highs of minus 10 at best). Ground conditions are frozen. Forecast is for continued below-normal temperatures for next 5-7 days with no significant snowfall.

- WWAL is available to help circulate / post the one-pager that MFLNRORD was to prepare (e.g. at legion hall, post office, community hall); if copies are provided (hard copy or email).

- WWAL plans to attend next week's update meeting on Tuesday at 10:30 and can come to Ministry Vernon office if a room is available; otherwise will call in.

Cheers,

Colin

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T: (250) 746-5268 | F: (250) 746-8404 | T: (800) 746-7444
drill@drillwell.com | www.drillwell.com

From: Drillwell Enterprises [mailto:drill@drillwell.com]
Sent: Friday, February 01, 2019 3:52 PM
To: 'Thomson, David A FLNR:EX'; 'Doug Geller'
Cc: 'Wade, Melissa FLNR:EX'; 'Pogson, John W FLNR:EX'; 'Thomson, Skye FLNR:EX'; 'Garnett, Kaylee ENV:EX'; 'Ryan Rhodes'
Subject: RE: Friday Weekly Planning Update

Hey Dave,

Here is the update for week ending Friday 1 February:

Bi-weekly telephone meetings started, summaries being circulated by MFLNRO with action items. Note: final version of kick-off meeting notes / minutes still pending?

Tree removal performed today (Feb 1) and fence removal scheduled for next week.

Traffic and work within road allowance permits have been filed and approved for initial site prep and mobilization phase. Excavation contractor and traffic control booked for Feb 11th.

Draft decommissioning work plan submitted for Ministry review on 31 January.

WWAL working on permit applications, should be done week of 4 Feb.

WWAL may make site visits, about once per week through February to check on flow and pressure of WTN 112429 to see if it changes.

WWAL coordinating with Drillwell on acquisition and planning for off-site water management materials (e.g. haybales, silt fencing).

Have a great weekend everyone,

Colin

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drill@drillwell.com | www.drillwell.com

From: Drillwell Enterprises [mailto:drill@drillwell.com]
Sent: Friday, January 25, 2019 4:15 PM
To: 'Thomson, David A FLNR:EX'; 'Doug Geller'
Cc: 'Wade, Melissa FLNR:EX'; 'Pogson, John W FLNR:EX'; 'Thomson, Skye FLNR:EX'; 'Garnett, Kaylee ENV:EX'; 'Ryan Rhodes'
Subject: Friday Weekly Planning Update

Hi Dave

Here is a brief summary of this past week's activities on the contract put together by WWAL and edited by myself.

Meetings. Project kickoff meeting held on 22 January in Vernon and via teleconference. MFLNRORD has circulated draft meeting minutes.
Project contact list being developed by MFLNRO. First Monday update meeting scheduled by Dave T.

Drillwell and WWAL personnel attended the site on Wed and Thur Jan 23-24. MFLNRORD (Dave) was also there on 24 Jan. Excavation subcontractor has been contacted about site re-grading.

Camera survey. Drillwell performed a camera survey of WTN 112429, finding no evidence of formation heave inside the casing and no large void below bottom of casing. Action item: Drillwell to circulate a copy of the video when it is ready (to Dave T and Doug G).

Flow measurement. Flowmeters were installed on the twin 6-inch discharge pipelines, and a new pressure gauge was installed at the wellhead.

Reverse flow test. Drillwell and WWAL staff performed a "reverse" step flow test on WTN 112429. The free-flow rate was about 200 US gpm (12.6 L/s). Using the valve assembly, flow was gradually reduced in steps while pressure buildup at the gauge was observed. It quickly became apparent that both flow and pressure were lower than previously thought. The well was fully shut-in for a period of

10 minutes at which time there was 4 PSI at the gauge, equal to about 5 PSI at ground surface. The team will proceed on the assumption that pressure could increase in March-April, to perhaps 8 to 10 PSI.

Relief well notes. If screened/completed near bottom of aquifer, relief well could have a higher shut-in pressure but its design will adequately hold back this relatively moderate artesian pressure. Because there were apparently no previous attempts by investigators to measure flow or pressure response to changes in flow, we do not know how the January 2019 shut in pressure compares to 2016 or 2017 conditions. Once decommissioned, pressure in the aquifer could build up. The design of the relief well and decommissioning plan for WTN 112429 will be based on this conservative assumption.

Well deviation survey. A future task will be to perform a deviation survey on the WTN 112429 well casing. This bears on how close the relief well can be drilled to the existing well, as discussed in the kickoff meeting.

Site visits, discussions with neighbours and investigation of water courses. WWAL, Drillwell and MFLNRORD all reportedly had discussions with area property owners this past week. Regarding off-site drilling and pump test water management, and the surface water courses associated with Pringle Creek. At this time, it appears that flows from the relief well during drilling and during test pumping and active pumping could possibly be less than previously anticipated. However, this water will still need to be managed both on and off-site. We will refer to the "mainstem" Pringle Creek as the northerly branch that connects to Salmon River downstream after passing through a wetland area and the "south branch) being the ditch-like creek that passes closer to the project site, and ending up at the Buff Lumber property in Westwold (maps provided at kickoff). WWAL staff also conducted a field assessment of Pringle Creek and the branch of Pringle Creek that passes through the Miller property where the discharge from WTN 112429 is currently routed to. It was found that the branch originates at a point west of Highway 97 (i.e. on same side of highway as project site). We are investigating this structure as a possible point of discharge.

Permits and plans. WWAL staff are working on the traffic management and site re-grading paperwork to be submitted week of 28 Jan to Ministry of Transportation (attn Ken Namislo). WWAL/Drillwell await further direction from MFLNRORD on whether a short-term use approval will be required to operate the relief well during WTN 112429 decommissioning. Work continues on the overall decommissioning plan and its supporting (e.g. H&S) plans. The goal being to submit a working draft of the plan by 31 January. As the pre-work proceeds through February, the idea will be to revisit and refine the plan as more information becomes available, thus making it a living document.

Drillwell continues to assess and refine its site layout and management plan. With the strong likelihood only a single relief well will be needed for decommissioning, Drillwell is assessing whether it would be possible to proceed without moving the existing dwelling.

Have a great weekend,

Colin

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From:	Doug Geller
To:	Amanda Ross
Subject:	FW: FW: Westwold Update
Date:	March 26, 2019 3:55:26 PM

Douglas Geller, M.Sc., P.Geo.
Principal Hydrogeologist / President

western water ASSOCIATES LTD
#106-5145 26 Street, Vernon, BC V1T 8G4
W: westernwater.ca | P: 250-541-1030 | C: 250-306-2843
Vernon | Victoria | Prince George

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From: Colin Slade <colin.slade@gmail.com>
Sent: March 3, 2019 7:57 PM
To: David.Thomson@gov.bc.ca; Melissa.Wade@gov.bc.ca; Doug Geller <doug@westernwater.ca>
Cc: David Slade <dslade@telus.net>; Drillwell Enterprises <drill@drillwell.com>
Subject: Re: FW: Westwold Update

Update for Sunday, March 3rd

- Very cold onsite, -24C
- Sounded hole, bailed out 5' of slime
- Tripped in cutter, attempted cut, tripped out cutter. Cut doesn't appear successful, blade flattened and ball bearings worn out. Replaced cutter wheel but bearings not available on Sunday.
- Fixed fuel transfer pump on tidy tank, repair cycloned, re-organized size for next stage of work.
- Bailed hole clean, secured site.

Tomorrow: Source replacement bearings, finish rebuilding cutter and attempt 2nd cut.

Have a good evening,

Colin

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Date SUNDAY SEP 24 Client _____ Shift _____

Consultant _____ Driller _____ Helper _____

Hole No. _____ Rig _____ Location WESTWOLD

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:00	3:00	TRAVEL TO AIRPORT FLY TO KELOWNA, PICK UP
		MEDICAL VEHICLE DRIVE TO WESTWOLD, CHECK
		SITE, TRAVEL TO KAMLOOPS

Consumables:

Hourly Charges Description:

Remarks:

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13051

Signature _____

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Date MON FEB 25 Client _____ Shift _____

Consultant _____ Driller REG Helper NICK, RAY, BRAD

Hole No. _____ Rig IR 24 1410 Location WESTWOLD

Total Drilled _____ From _____ To _____ Diameter 16" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
~~3:00~~	3:00	TRAVEL TO SITE
3:00	5:00	CHECK HOLE ALIGNMENT, HAVE SITE PLOWED
		OF SNOW.
5:00	5:45	TRAVEL TO KAMLOOPS

Consumables:

Hourly Charges Description:

Remarks:
HOLE IS QUITE STRAIGHT

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Date TUES FEB 26 Client PROVINCE OF B.C. Shift D

Consultant _____ Driller RED / S.S Helper B.A. N.S, B.P

Hole No. _____ Rig DR 24 HD # 10 Location WESTWOLD

Total Drilled _____ From _____ To _____ Diameter 16" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
7:00	7:45	TRAVEL TO SITE
7:45	1:30	RELIEVE TANK, LIGHT PLANTS, VARIOUS EQUIPMENT + SET UP SITE
1:30	2:00	LUNCH
2:00	6:00	SET UP ON HOLE, MAKE UP BIT STUFF CASING (WELDER ACTIVE UP - TRIM/PREP CASING WHILE TROUBLESHOOTING WELDER) STAND UP 1ST LENGTH + WELD SHOE

Consumables: 16" XXHD DRIVE SHOE

Hourly Charges Description:

Remarks:

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Signature _____

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Date WED FEB 27 Client PROVINCE OF B.C. Shift

Consultant Driller RED S.S. Helper D.P. B.A D.S

Hole No. Rig DR 24 HD #10 Location WESTWOLD

Total Drilled 75' From 0 To 75' Diameter 16" Cased ✓

Hours Worked Hours Chargeable P.O. No.

Depth / Time From	Depth / Time To	DESCRIPTION / DETAILS
6:45	7:30	Travel to site
7:30	9:00	Safety meeting / rig inspections & warm up
9:00	5:30	Drilling & Casing 16"
5:30	6:00	Clean up / Pack up
6:00	6:45	Travel to Hotel
12:45	1:45	Lunch

0-4 Brown silts & Gravel
4-32 Sands & Gravel
32-38 " " water bearing
38-57 - Clay with Some Gravel & gravel
57-64 - Sands & gravel
64-75 - very gravely TiN (mixed)

Consumables: 16" DRILL BIT (HAMMER)
1-16" HD Shoe
75' 16" Casing

Hourly Charges Description: on site - Rig - Rod Truck X2 - Service Truck - Aux Compressor - Frost Fighter heater - Containment bin - office - outhouse & ETI

Remarks: PLACED HAY BALES (STRAW) IN FIELD

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Date Feb 28/18 Client Province of B.C. Shift D

Consultant Western Water Driller RED Dave Helper Braydon/Brandon

Hole No. _____ Rig DR24 # 10 Location Westwold

Total Drilled 60' From 75' To 135 Diameter 16" Cased ✓

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS	
6^{40}	8^{00}	Dropped Brandon off @ IRL - #19 to Logan Lake for materials Fuel stop & drive to site	
8^{00}	8^{45}	Safety meeting - Equip inspections - warm up	75-97' Till
8^{45}	10^{30}	unloading Casing from delivery Truck	97-106 Sands & Gravel Lots of water
10^{30}	12^{15}	Drilling 16"	
12^{15}	12^{45}	Lunch	106-112 Till
12^{45}	5^{20}	Drilling 16"	112-114 WB/Sands & Gravel
5^{20}	6^{15}	welding on 160' and packing up site	114-131 Till lots of Gravel imbedded
6^{15}	7^{00}	Travel to hotel	131-135 Clay with some Gravel

Consumables: 60' 16" Casing

Hourly Charges Description: Equip on site = Rig, Rod Truck X3, Service Truck, Aux Compressor, Frost fighter heater, Containment bin, shed/office, outhouse 3 ETV

Remarks: CHECK FLOW with MAX's meter - 240 gpm.

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Date Mar. 1/2019 Client Province of BC Shift D

Consultant Western Water Driller Red. D.S Helper Brandon/Brayden

Hole No. _____ Rig DR24 #10 Location Westwold BC

Total Drilled ~~215~~ 80' From 135 To 215 Diameter 16 Cased ✓

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
135	146	Dense silt / clay some Gravel Grey
146	154	Silty Gravel & Silt Some Water Grey
154	156	Very silty Sand & Gravel WB 10gpm
156	160	Silt / clay dense w sand & Gravel - Till like
160	168	Soft silt with sand
168	171	Silt / clay Grey
171	180	Very silty Gravel & sand WB 10 gpm
180	186	Clay & silt Dense grey
186	195	Silt & Sand Dense layers WB 10 gpm in 1-5ST open hole

Consumables: 195 - 205 Very silty Sand & Dense Silt in 1-5T Layers

205 - 215 Dense silt - No Water !!

Hourly Charges Description:

Brandon to Logan LK for more pipe - waiting 2 hrs for more pipe

Remarks: 6:45 - 7:20 Travel to site 1:00 - 6:30 Drill 16".
7:20 - 12:30 Drill 16"
12:30 - 1:00 Lunch

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Signature _____

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Date Mar. 2, 2014 Client Province of BC Shift D

Consultant Western Water Driller Red - David Helper Brandon Braydon

Hole No. _____ Rig DR24 #10 Location Westwold.

Total Drilled 0 From _____ To _____ Diameter 16 Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:45	7:30	Travel to Site
7:30	12:30	Pull 10¾ Drill rods & Hammer & bailing from @190ft.
12:30	1:00	Lunch
1:00	5:00	Finish bailing to bottom (approx 219'3") remove 10"
		stinger / Install 4" - Bail settled material to
		bottom. Setup & test fire 16" Casing Cutter
5:00	5:30	Pack up & Secure site
5:30	6:15	Travel to hotel
		& Cutter at surface - ready to trip in morning

Consumables:

Hourly Charges Description:

Remarks:
Max's Meter Flow 215 gpm

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Date Mar. 3/19 Client Province of BC. Shift D.

Consultant Western Water Driller Red. David Helper Brandon Braydon

Hole No. _____ Rig DR-24 #10 Location West wold.

Total Drilled 0 From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS Minus 24c Sunny
6:45	7:20	AM - Commute to site
7:20		check Bottom - 5' material - boiling - Tripping in cutter.
9:40	10:20	Cutting. @ 214' Below Top of Casing
		Cut Not successful - Need to Rebuild Cutter - Need parts
10:20	1:00	Clearing up site - fixing fuel pump & cyclone
1:00	1:30	Lunch
1:30	6:00	Picked & re-arranged site (Rods/casing) replaced wheel
		on Cutter, Bailed hole clean
6:00	6:45	Travel to hotel

Consumables:

Hourly Charges Description:

Remarks: Max Meter Flow = 234 GPM

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Date March 4/19 Client Province of BC Shift D

Consultant Western Water Driller D. Slade/Red. Helper Brandon/Braydon

Hole No. _____ Rig _____ Location Westwold.

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:45	7:30	Travel to Site
7:30	10:30	Warm up equip. / Safety / prep for shoe Cut
10:30	12:45	Trip in cut shoe - Trip out - Cut. Good.!
12:45	1:15	Lunch.
1:15	6:00	Running 12" overlap Casing to 100 ft.

Consumables: Float Shoe - 12" 2 trips for Hydro-Vac. Clean Tank.
100 ft 12" Casing.

Hourly Charges Description: Cut 16" Casing Shoe @ 208 ft Below Ground.
Bottom of 16" Casing is 214 Below Ground.

Remarks: Max Flow Meter 245 GPM.
Casing Cut in 6 minutes - Spun for 20 min.

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Date Mar 5/2019 Client Province of B.C. Shift D

Consultant _____ Driller RED DAVID Helper Brandon/Brayden

Hole No. _____ Rig DR21 #10 Location Westwold B.C.

Total Drilled _____ From _____ To _____ Diameter 16/12 Cased —

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
~~7:30~~ 6:15	~~8:30~~ 7:20	Trave to site
7:20	8:00	Safety / Inspections - warm up
8:00	12:30	running in 12"
12:30	1:00	Lunch
1:00	6:00	Finish running in 12" - Trip in 2" Tremmie, Weld on victaulic Connection, Clean up & prep site to grout
6:00	6:45	Travel to hotel

Consumables: 126' 12"

Hourly Charges Description:

Remarks: Flow meter 223 GPM (max's)

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13062

Signature _____

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Date Mar. 6/14 Client Province of B.C Shift D

Consultant Western Water Driller S. Davidson/D. Slade Helper B. Picard/B. Auman

Hole No. _____ Rig DR-24 #10 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 16 Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS — 3°C in morning
6:45	7:20	~~Safe~~ Travel to Site
7:20	8:00	Safety / Inspections / warm up
8:00	1:00	Set up all grout pumps & systems. Test run pumps.
		Big mud pump performing poorly - Using Wilden & morno
1:00	1:30	lunch.
1:30	4:30	Refine system & plumbing - Fuel & oil all equip.
		Drain & Anti-freeze pumps & hose - Rearrange trucks
		& rods/pipe.
4:30	6:00	Travel to Kamloops - Stop for fuel - Shopping at Princess Auto.

Consumables:

Hourly Charges Description: 4 men. 3 Cranes DR-24, Aux. Comp.
3 mud pumps.

Remarks: Flow check 251 GPM

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13063

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Date Mar. 7/19 Client Province of BC Shift D.

Consultant Western Water Driller S. Davidson / D. Yade Helper B. Aman B. Pickard

Hole No. _____ Rig DR-24 #10 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 16" & 12" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS -2°C Snowing
6:45	7:20	Travel to site
7:20	8:00	Safety Inspections & Warmup.
8:00	9:00	Set up & prime pumping equipment
9.00	10:00	Pumping cement down tremie through float shoe to surface
		Pulled 2" Tremie line - RIG DIED.
10:00	Noon	Broke down - Cummings Mechanic From Kamloops Hotwired Rig.
Noon	1:30	Pulled 100 ft of 16" & sent for more cement.
1:30	2:00	Lunch
2:00	3:30	Finished pulling 16" & Topped hole with cement.

Consumables: 12 Yards Neat Cement.

3:30 - 5:30 Wash down & Packup.

5:30 - 6:15 Commute Back To Town.

Hourly Charges Description: Scott, Cody & Sterling arrived in Afternoon.

Remarks: Flow Check. Max's meter. 228 GPM

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Date March 8/19 Client Province of BC Shift D

Consultant Western Water Driller S. Burrows - D. Slade Helper C. Armen / S. Tabler

Hole No. _____ Rig #10 DR-24 Location Westwold.

Total Drilled 0 From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS -11 Cloudy
6:45	7:45	Fuel up & Travel to site to 17ft.
7:45	8:30	Safety - Warm up - Cement settled to 3 ft. Topped with Bentonite
8:30	12:45	Prepping to install BOP. Change Jaws
12:45	1:15	Lunch.
1:15	6:00	Grinding back bevel on 1st. piece Heavy Wall 10" welding overlap casing. 10' to 120 ft. 120 ft.
6:00	6:45	Commute to Hotel.

Consumables: 4 Bags Bentonite. 100 ft 10" casing 0.375" 20 ft 10" casing 0.500" One HD 10" DK Shoe

Hourly Charges Description:

Sounded 12" Hole - 9 ft material - cement goo.

Remarks: Bottom of cemented 12" @ 213' Below Ground.
Cement samples still soft in office shed.
Flow @ 9:30 AM 249 GPM. 247 @ 6:PM

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Date March 9/19 Client Province of BC. Shift D

Consultant Western Water Driller S. Burrows · D. Slade Helper C. Avram. S. Tabler

Hole No. _____ Rig #10 DR-24 Location Westwall.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS -6°C cloudy.
6:45	7:30	Travel to Site.
7:30	8:00	Warm up & Safety
8:00	12:30	Continue tripping 10" overlap.
12:30	1:00	Lunch.
1:00	5:00	welding last length w threaded Pipe
		fishing 6" layflat under road thru Culvert.
		rigging up cyclone & BOP
5:00	5:30	Fix Hyd leak on Rig Plumb in 6" layflat connection

Consumables: 95 ft. 6" Lay flat 80 ft 10" with thread connection on Top.

Hourly Charges Description:

Remarks: Sound Bottom in AM. - 201 ft from grnd. - 12 ft. ass Bot. of 12"

Flow Reading @ 10:30 AM 247 gpm

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13066

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Date Mar. 10/19 Client Province of BC Shift Day

Consultant Western Water Driller S. Burrows - D. Slade Helper C. Avman/S. Tablor

Hole No. _____ Rig #10 DR-24 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS — 15°C Clear
7:15	8:00	Travel from Kamloops - Leasurley start.
8:00	1:00	Complete BOP Install
1:00	1:30	Lunch
1:30	4:30	Rig up all pumping & drilling equipment. Install swivel & cyclone. Ready to drill!

Consumables:

Hourly Charges Description:

Remarks: Cement Samples are all rock hard.

Flow check @ Noon: 224 gpm

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Date Mar. 11/19 Client Province of BC Shift D

Consultant Western Water Driller D. Slade S. Burrows Helper C. Hunter S. Tabler

Hole No. _____ Rig #10 DR-24 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS 0°C overcast
215	226	silt & very silty sand. - not much water
226	275	Dense silt / clay no water
275	302	Aquifer Sand & Gravel grey silty W.B
302	310	Very silty fine Sand little water
310	315	Sand & Gravel grey silty. 6:40 - 7:20 Travel to Site
315	324	Coarser S & G W.B 100gpm cleaning up. 7:20 - 8:00 Safety / warm up.
324	356	Sand. med to fine grey silty W.B. 8:00 - 9:00 Prep to Drill
356	-	End Hole. Still in Aquifer 9:00 - 9:25 drill out Float Shoe
		9:25 - 12:30 drill to 255'

Consumables:

12:30 - 1:00 Lunch

1:00 - 4:00 Drill to 356'

4:00 - 6:00 Triprods

Hourly Charges Description: Water from 6" well cloudy after 280ft.

6:00 - 6:45 Commute.

Remarks: Start Drilling cement plug @ 201

Flow check @ 10 AM - 245 GPM @ 2:50PM 215 gpm

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 12/19 Client Province of BC Shift Day

Consultant Western Water Driller S. Burrows / D. Slade Helper S. Tabler / C. Ayres

Hole No. _____ Rig DR-24 # 10 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:50	7:30	Travel to Site
7:30	8:00	Warm up & Safety.
8:00	12:45	Finish tripping Rods. Sounded hole: 60ft of material. Bailing
12:45	1:15	Lunch
1.15	5:30	Continue bailing & load trucks
		Pack up site
		Bailed to 360 from Top of casing
		Total 10" To Top shoulder 361 ft.

Consumables:

Hourly Charges Description:

Remarks: Flow check @ Noon 240 GPM.
Discharge From 6" well to creek is Clear.

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 18/19 Client Province of BC Shift D

Consultant Western Water Driller S. Burrows / D. Slade Helper S. Tabler

Hole No. _____ Rig DR-24 #10 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS Clear & warm
6:00 AM	4:PM.	Travel to Site from Duncan. Pickup Screens in Kamloops
4:00	5:30	Unload Trucks, measure hole - 3 ft of material
		Bail hole clean. - Coarse Gravel & Silt Chunks & Bottom
		Water level 6 ft above ground.
		before bailing.

Consumables:

Hourly Charges Description:

Remarks: Flow check @ 5:00 PM. 244 GPM

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Email: drill@drillwell.com Website: www.drillwell.com

Date March 19/19 Client Province BC Shift _____

Consultant Western Water Driller S. Burrows / D. Slade Helper S. Tobler

Hole No. _____ Rig #10-DR-24 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS Clear -3°C
6:30	7:20	Commute from Kamloops
7:20	8:00	Safety & Warm up.
8:30	11:30	Establish & compact Bottom. Flowing @ 1/4 gpm 6' AGL
11:30	12:00	Lunch.
12:00	3:30	weld screen Assembly - Target Bottom @ 351' BGL
3:30	7:00	set screen assembly & pull casing to Expose.
		Bottom @ 351 BGL ±
		Top of riser 264'6" ±
7:00	7:40	Commute To Kamloops

Consumables: 26ft 8" pipe Sump. 10 of 8" pipe size screen 5' of 55 over 5' of 30
15ft 8" pipe Blank. 20ft 40 slot 8" pipe size screen.
15ft 6" of 8" pipe riser & K-packer.

Hourly Charges Description:

Remarks: Flow check @ 8:30 AM. 243 GPM

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13071

Signature _____

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date Mar. 20/18 Client Province of BC Shift D

Consultant Western Water Driller S. Burrows / D. Slade Helper S. Tabler

Hole No. _____ Rig #10 DR-24 Location Westwold

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS Clear -2
7:00	7:45	Fuel up & commute to Site.
7:45	8:00	Safety & Warm up.
8:00	12:15	Sound hole. Top of Screen Assembly 264'-6" BGL
		- 6' ft of material in bottom of Sump.
		Developing w dart bailer 6" x 30 gal Water Clearing
12:15	12:45	Lunch. Some turbidity in 6" well
12:45	2:00	Developing w 8" x 60 gal. bailer --
2:00	4:00	Rigged up & pump tested w 4" Trash pump:
4:00	5:30	Air lift Surging to 20 ft Below Grnd. moving

Consumables: lots of colour & Sand from both wells

5:30 : 6:15 Commute To Kamloops

Pumping w 4" Trash pump. D.D. 20 ft. ± 400 gpm: 6" well Slow @ 70 gpm

Hourly Charges Description: Vac Truck on site @ 8:45 AM. for 1st load.

Vac Truck Hauled 3 loads.

Remarks: Flow Check @ 9:AM. 255 GPM

Initial pre-development pump test 3.5 ft DD for 200gpm

After 3 hrs bailing pumptes 3.7 ft DD for 200gpm.

Reduced Slow in 6" well by 70 GPM

Signature _____

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date Mar 21/19 Client Province of BC Shift D

Consultant Western Water Driller S. Burrows / D. Slate Helper S. Tobler

Hole No. _____ Rig #10-DR-24 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:45	7:30	Fuel up & Commute.
7:30	8:00	on site Warm up & Safety.
8:00	10:00	All 2 rods & swivel. Sound bottom - 2 ft in sump. Set up 4"
		Pump for flowtesting. 20 ft DD for ± 400 gpm.
		flow in 6" well reduced to 30 gpm from 250 gpm
10:00	12:30	Air surging & Air lifting @ 35 ft. Moving Sand in both wells
12:30	1:00	Lunch
1:00	3:00	Air Surging & Air lifting
3:00	4:00	Test pumping relief well at approx 400 gpm reduced 6"

Consumables: well flow to 12 gpm - added 2" Trash pump @ 60 gpm

Killed flow in 6" well & drew down 2" below top T.

Total DD in reliefwell 19' (13' bgl)

Hourly Charges Description: Visit by 10 Client Reps. for job/site tour

4:00	5:00	Pack up site. Prepare to remove BOP.
5:00	5:40	Commute To Kamloops.

Remarks: ~~Flow check 255 gpm @ 9:00 AM.~~

Flow check 250 gpm @ 8:00 AM

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 22/19 Client Province of BC. Shift D

Consultant _____ Driller S. Burrows / D. Slade Helper S. Tobler

Hole No. _____ Rig #10 DR-24 Location Westwold.

Total Drilled _____ From _____ To _____ Diameter 10" Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS 0°C. Clear
6:40	7:15	Commute to Site
7:15	7:45	Safety & Warm up.
7:45	12:30	Remove BOP Prepare to Cut down
		10" & Attach well Head.
12:30	1:00	Lunch
1:00	6:15	Cut down 10" - weld Cleats & ring
		between 10 & 12" - 10" is 6" above lower flange.
		ATTach well head. Fold Rig over.
6:15	6:50	Commute to Kamloops.

Consumables:

Hourly Charges Description:

Remarks: 12 Visitors from FINRDD.

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 23/19 Client Province of BC Shift D

Consultant Western Water Driller S. Burrows/D. Slade Helper S. Tobler

Hole No. _____ Rig #10 DR-24 Location Westwold

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:40	7:15	Travel To site
7:15	7:45	Safety & Warm up
7:45	12:30	Move Rig & setup / Test 6" pump.
		6" Pump Pulling 10" water level down 23 ft - 6" well ~~down~~ @ ground level
		Preparing flow meter for installation & 6" well
		for extension
12:30	1:00	Lunch
1:00	3:30	Moved Rig onto 6" hole - Installed & tested flowmeter
		welded extension on 6" pulled casing 1 ft.

Consumables: 3:30 - 6:00 Pulling Back filling & tamping 6" Bottom.
Pulled 6" Casing 4 ft.
6:00 - 6:40 Commute to Kamloops

Hourly Charges Description:

Remarks: Test cut in 6" - Broke Blade - Repairing cutter.

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 24/19 Client Province of BC Shift ____

Consultant Western Water Driller S. Burroughs / D. Slade Helper S. Tabler

Hole No. ____ Rig #10 DR-24 Location Westwold.

Total Drilled ____ From ____ To ____ Diameter 6" Cased ____

Hours Worked ____ Hours Chargeable ____ P.O. No. ____

Depth / Time From	To	DESCRIPTION / DETAILS
6:30	7:20	Commute & Get Fuel
7:20	7:35	Warm up & Safety
7:35	10:00	Set up with Doug & Paul from W.W. & do 1hr step test & Recovery
10:00	12:30	Test casing cutter. OK. Continue backfilling & Tamping
		Pulled 6" casing back to 272. - Solid Bottom
12:30	1:00	Lunch
1:00	4:30	Ran cutter in to cut - Fired up & Voided hole.
		Pulled cutter back out. Ran Backup
		Cut casing shoe of. @ 260ft BGL · Bottom of shoe 268 BGL

Consumables: 4:30 - 6:00 Pulled 6" Casing to 245 ft installed
4 by 3 ft Bentonite plugs w 3 ft gravel spacers.
Ready for cement.

Hourly Charges Description: # Doug & Paul here from 7:30 To 10:AM
4 Bags Bentonite chips.
6:00 - 6:40 Travel to Kamloops

Remarks: Approx 40 pails of Gravel to fill 8 ft. of hole.
Ready for cement!

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13001

Signature ____

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date March 25/19 Client Province of BC Shift D

Consultant Western Water Driller S. Burbows/D. Slade Helper S. Tobler

Hole No. _____ Rig #10 DR-24 Location Westwold.

Total ~~Drilled~~ Pulled 250 From 250 To 0 Diameter 6 Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:30	7:20	Commute from Kamloops.
7:20	7:40	Safety + Warm up
7:40	9:45	Install Tremmie + prepare for grouting
		Cement Grout bottom @ 247 Grouting at 12: 9:45
9:45	12:30	Pumping grout + pulling 6' pipe
12:30	1:30	~~Rig~~. Wash down + clean cement
~~1:30~~	2:00	Lunch.
2:00	5:00	Load Trucks - pack up site
5:00	5:40	Commute To Kamloops

Consumables: 6 metres concrete.

Hourly Charges Description:

Remarks: 6" well "Killed"!

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13002

Signature _____

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date Mar. 26/11 Client Province of BC Shift D

Consultant Western Water Driller S. Brows/D. Yade Helper S. Teller

Hole No. _____ Rig #10 DR-24 Location West wold.

Total Drilled _____ From _____ To _____ Diameter 6 Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:40	7:20	Drive to Site
7:20	7:40	Safety & Warm up.
7:40	12:30	Pack up site Load Trucks
12:30	1:00	Lunch
1:00	4:30	Finish loading Truck & pack up Rig.
		Load out pumps & Rental Bin
4:30	5:10	Drive to Kamloops

Consumables: Well Head Fittings & guage.

Hourly Charges Description: VacTruck cleaning Bin - 2 loads.

Remarks:

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date APRIL 2/2019 Client PROVINCE OF B.C. Shift _____

Consultant WWAL Driller COLIN Helper TERRY

Hole No. _____ Rig #10 Location WESTWOLD.

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
6:00	1:00	MOB FROM KELAND, PICKUP ROD TRUCK IN KAMLOOPS
1:00	6:15	LOAD EQUIPMENT & TOOLING, MOVE SCRAP 6" OFF
		SITE, MOVE LOCK BLOCKS TO PROTECT HOSE HEAD.
		PACK UP DR24 HD.
6:15	7:00	DELIVER DR24HD TO KENWORTH KAMLOOPS.

Consumables:

Hourly Charges Description:

Remarks:

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13004

Signature _____

DRILLWELL ENTERPRISES LTD.

4994 Polkey Rd., Duncan, B.C. V9L 6W3 Phone: (250) 746-5268 Fax: (250) 746-8404
Email: drill@drillwell.com Website: www.drillwell.com

Date APRIL 2/2019 Client PROVINCE OF B.C. Shift _____

Consultant WWAL Driller COLIN Helper TERRY

Hole No. _____ Rig _____ Location WESTWOLD.

Total Drilled _____ From _____ To _____ Diameter _____ Cased _____

Hours Worked _____ Hours Chargeable _____ P.O. No. _____

Depth / Time From	To	DESCRIPTION / DETAILS
7:15	8:00	DRIVE TO SITE
8:00	12:00	CONTINUE PACKING UP SITE. MOVE CLIENTS EQUIPMENT INTO HOUSE. REMOVE & COMPOST HAY BALES FROM MILLAR'S FIELD. HYDROVAC OUT DITCH.
12:00	9:00	DE-MOB. CRANE TRUCK TO KAMLOOPS, DRIVE BACK TO ISLAND.

Consumables:

Hourly Charges Description:

Remarks:

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13005

Signature _____

Appendix H
Permits: MOTI, WSA short-term use and Section 11

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Westwold Flowing Well Decommissioning
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

GS19932-001 File: 100045-40/WESTWOLD

January 29, 2019

To: Colin Slade, Drillwell Enterprises Ltd., and
Douglas Geller, Western Water Associates Ltd.,
Via email to Drill@drillwell.com and Doug@Westernwater.com

From: David Thomson, P.Geo., Regional Hydrogeologist

Re: Works carried out by Drillwell Enterprises Ltd. and Western Water Associates for the purposes of decommissioning the Westwold Flowing Artesian Well under Contract GS19932-001

Under Major Works Contract GS19932-001, Drillwell Enterprises Ltd. (Drillwell) is undertaking works on behalf of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) to decommission a flowing artesian well at Westwold BC. Western Water Associates Limited (WWAL) is an approved subcontractor under GS19932-001. As such they will be conducting a short term pumping test for the purpose of decommissioning a flowing artesian well (WTN 112429). WWAL has the permission of the Ministry of Forests, Lands and Natural Resources Operations and Rural Development (FLNRORD) to apply for and obtain required permits/approvals in order to complete and carry out works that are relevant to the contract. Drillwell and WWAL will notify FLNRORD, in writing, when applications are made to FrontCounterBC. If you have any questions please contact the undersigned at 250 260-4641.

David Thomson, M.Sc., P.Geo., Regional Hydrogeologist
Ministry of Forests, Lands, Natural Resource Operations & Rural Development
South Area Groundwater Science, Vernon, British Columbia.

CC: Skye Thomson, P.Geo., Section Head, South Area Groundwater Science
Ray Reilly, Senior Authorizations Specialist
Melissa Wade, P.Geo., Regional Hydrogeologist
John Pogson, P.Geo., Groundwater Protection Officer

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Application Summary
eDAS File Number: 2019-00493

Permit Application:

Permit Type: Structure: Encroachment
Selected Office: Thompson Nicola District
Applicant File Number:
Project Description: 4686 Highway 97: grading shoulder/ temporary pressure line

Location:

Order	Location
	Map: 1439999,626193

Permit Application Details:

Local Government: Thompson Nicola Regional District
Size and Type of Structure: materials to grade side of highway for access to property

Sketch Plan

BCLS Name:
Drawing #:
Prepared Date:

Attachments:

Filename	File Description	Classification
Ditch.jpg	grading location	Photograph
site plan.pdf	site	Plan
Works on Highway App Sign Permit		Application

Permit Application Parties:

Type	Name/Company	Address	Role	Permit Holder
Applicant	Le Bel , Gina - Western Water Associates Ltd.			☐
Contact	Geller, Doug - Western Water Associates Ltd.	106 5145 26 Street , Vernon, British Columbia V1T 8G4	On-site	☑
Contact	Slade, Colin - Drillwell Enterprises Ltd.	4994 Polkey Road , Duncan, British Columbia V9L 6W3	Other	☐

Use Approval (Short Term Use of Water)

Tracking Number: 100275812

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization?	Company/Organization
What is your relationship to the company/organization?	Agent

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit / Tenure / Licence will be issued, if approved.

Name:	Drillwell Enterprises Ltd
Doing Business As:	
Phone:	250-746-5268
Fax:	
Email:	
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Colin Slade
Mailing Address:	4994 Polkey Road Duncan BC V9L 6W3

AGENT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name:	Douglas Geller
Phone:	250-541-1030
Daytime Phone:	
Fax:	
Email:	doug@westernwater.ca
Mailing Address:	106-5145 26th Street Street Vernon BC V1T 8G4
Letter(s) Attached:	Yes (auth_30_jan_signed.pdf)

ELIGIBILITY

Please answer the following questions related to whether you qualify to apply for a short term use of water.

Question	Answer	Warning
Will the water be diverted and used to support oil and gas activity that is being authorized by the Oil and Gas Commission?	No	
Do you want to divert and use the water for more than two years?	No	

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you: Yes

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

Are you an existing exempt client?	No
Fee Exemption Category:	Acting on behalf of a BC provincial ministry with a letter of permission from that ministry
Letter Uploaded:	Yes
Please enter any supporting information that will assist in determining your eligibility for a fee exemption. Please refer to help for details on fee exemption criteria and requirements.	This work is being done under Contract No. GS19932-001. The Ministry representatives are Skye Thomson, P.Geo. and Dave Thomson, P.Geo.

We require some more technical information from you. Please add sites where you need to divert and use water.

Term Start Date:	Mar 1, 2019
Term End Date:	Jul 15, 2019

SITES WHERE YOU WANT TO DIVERT THE WATER

Please provide us with information about all sites where you want to take the water from, how much water you will need and what the water will be used for.

SITES

Location ID:	4686 Highway 97, Westold BC
Name of the Stream:	Aquifer
Source of Water:	Groundwater
Is the water you are applying for coming from a well?	Yes
Well Status:	Not Constructed
Well Geographic Coordinates:	50.4771760, -119.7899300
Location of Intake:	
Purpose of Use:	Misc Indust
Rental Fee:	$1,000.00
Application Fee:	$200.00
Total Daily Quantity	
Quantity:	5,987.50000 m3/day
Maximum Rate of Diversion:	6,400.00000 m3/d
Term Start Date:	Mar 1, 2019
Term End Date:	Jul 15, 2019
Date of Use Start:	March 1
Date of Use End:	July 15
Works to be Used:	One well, drilled as a pressure relief well to aid in decommissioning an out-of-control flowing artesian well located on the project site, Well Tag. No. 112429.
Land Ownership:	☐ Applicant owns land ☐ Land is Crown Land but applicant has tenure ☐ Land is Crown Land but tenured to Ministry of Transportation ☐ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land **Name of Land Owner that owns the land where your works are proposed:** Brandon Underwood ☐ Land is Crown Land but the applicant does not have a tenure You require a written consent from the landowners to do the work. You can upload the consent on Documents upload step later in the application
Provide the legal description/location	Lot 1, Sec 31, Tp 17, R 13, W6M, KDYD, Plan 9141.

description of land(s) where works are proposed:	
Legal Description of land where the water is to be used:	Lot 1, Sec 31, Tp 17, R 13, W6M, KDYD, Plan 9141
Coordinates of Use:	50.4771760, -119.7899300

If you have more than one site you can make a copy of a site by clicking the 'Copy' link besides the site entry above. All the information will be copied from that entry and you can then edit that copied entry and change the values as required.

ENVIRONMENTAL ASSESSMENT

The Environmental Assessment Act requires that certain large groundwater extraction projects undergo an environmental assessment, and obtain an environmental assessment certificate, or obtain a formal determination that an environmental assessment certificate is not required.

Criteria for determining whether a groundwater extraction project may require an Environmental Assessment certificate:

1. Constructed on or after the year 1995 where one or more works, operated intermittently or continually for 1 year, divert 75 Litres per second (1189 US GPM) or greater.

2. Modifications to projects constructed prior to 1995 that result in diversion reaching or exceeding 75 Litres per second (1189 US GPM).

3. Project built prior to 1995 that divert 75 Litres per second (1189 US GPM) or greater that have been modified on or after 1995 such that there is an increase of 35% or more over the previous rate of diversion.

Projects that meet the criteria above may require either an Environmental Assessment Certificate or a letter of exemption from the Environmental Assessment Office (EAO). Visit the EAO website or see the Environmental Assessment Certificate Requirements for Groundwater Users Guidelines for more information.

According to the requirements above, does your application require an Environmental Assessment certificate, or do you have a letter of exemption?	No

LOCATION INFORMATION

LAND DETAILS

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☑ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description	Filename
location map google earth	location map.pdf

ATTACHED DOCUMENTS

Document Type	Description	Filename
Other	landowner access agreement with Ministry	Underwood Agreement October...

PRIVACY DECLARATION

☑ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company / Organization: Drillwell Enterprises Ltd
Contact Name: Colin Slade
Contact Address: 4994 Polkey Road
Duncan BC V9L 6W3
Contact Phone: 250-746-5268
Contact Email: drill@drillwell.com

☑ **I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.**

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this Short Term Use of Water Approval does not provide authority under the Water Sustainability Act to divert, use or store water from a stream or to construct works. I also understand that my application must first be investigated and a decision made on the application as to whether a approval may be granted and, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) for information on how to ensure your project complies with the Fisheries Act.
- Once you click 'Next' the application will be locked down and you will NOT be able to edit it any more.

DECLARATION

☑ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know? The MFLNRORD project manager is Dave Thomson, P.Geo. of the Vernon regional office. He has requested that a copy of this application be sent to him and to Ray Reilly in water authorizations. Western Water Associates Ltd. is sending the completed application to these two individuals who plan to facilitate the application process.

OFFICE

Office to submit application to: Vernon

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource No

authorization from the Province of BC?

APPLICANT SIGNATURE	
Applicant Signature	**Date**

OFFICE USE ONLY		
Office Vernon	**File Number**	**Project Number**
	Disposition ID	**Client Number**

Ministry of
Forests, Lands and
Natural Resource Operations

March 6, 2019 File: 3006443

Okanagan Shuswap Natural Resource District
Ministry of Forests, Lands & Natural Resource Operations
102 Industrial Pl, Penticton
V2A 7C8

Attention: Drillwell Enterprises Ltd.
Re: Section 10 Short Term Use Approval to decommission artesian well WTN 112429

Approval for the above has been granted and the approval document verifying this is attached. This approval or a copy of it should be kept at the work site so that it may be shown to a Ministry official upon request.

If you have any questions regarding this approval, please contact Bernard McDonell at (250) 490-8247 or by email at Bernard.McDonell@gov.bc.ca.

Yours truly,

Assistant Water Manager

Enclosures: Section 10 Use Approval and Schedule A

Ministry of
Forests, Lands and
Natural Resource Operations

USE APPROVAL

SHORT TERM USE OF WATER

SECTION 10

Drillwell Enterprises Ltd. on behalf of Ministry of Forests, Lands and Natural Resources Operations and Rural Development, 102 Industrial Pl, Penticton V2A 7C8 is hereby authorized to divert and use water as follows:

a) The source of water supply is listed in the attached Schedule A.
b) The points of diversion are located as described in the attached Schedule A.
c) The purpose use for which the water is to be used is Miscellaneous Industrial, to relieve pressure to decommission an artesian well.
d) The maximum quantities of water which may be diverted are as described in Schedule A.
e) The period during which the water may be used is as described in Schedule A.
f) The land upon which the water is to be used and to which this approval is appurtenant is owned by Branden Jerry Underwood with legal description LOT 1 SECTION 31 TOWNSHIP 17 RANGE 13 WEST OF THE 6TH MERIDIAN KAMLOOPS DIVISION YALE DISTRICT PLAN 9141, PID 009-735-909
g) This approval is valid only while it is held by the applicant and is not transferable to any other persons.
h) This approval is valid and fee exempt for the time period stated on an authorization letter that must be obtained from the Ministry of Forests, Lands, Natural Resources Operations and Rural Development.
i) The authorized works include a new well.
j) All authorized works shall be inspected for invasive species and cleaned prior to use. (www.bcinvasives.ca).
k) The existing well with tag #112429 must be decommissioned prior to the end date of this use approval.
l) A record of the total litres of water diverted shall be kept for inspection upon request by an officer under the Water Sustainability Act, or any other government official.
m) This approval does not authorize entry onto privately held land aside from that mentioned in clause (f) above.
n) The diversion of water authorized under this approval may be restricted or prohibited at any time by an Order in writing under the Water Sustainability Act, during periods of low flow to protect the rights of prior licensees or to maintain a minimum flow in nearby streams for the preservation of aquatic life.
o) This use approval is issued under the Water Sustainability Act (the Act). The exercise of rights under the approval is subject to the Act and its regulations, the terms and conditions of the approval, orders under the Act and the rights of the licensees whose rights have precedence on the stream or on an aquifer. The approval holder must comply with all such requirements, as well as the provisions of all other applicable enactments. In exercising rights under the approval, the approval holder must exercise reasonable care to avoid damaging land, works, trees or other property, and must make full compensation to the owners for damage or loss resulting from construction, maintenance, use, operation or failure of the works.
p) The registered well driller must be competent or be supervised by a registered well driller who is competent to stop or control artesian flow as a result of training, experience, knowledge or skills.
q) The decommissioning of this artesian well must satisfy the requirements as set out in the Groundwater Protection Regulation (GWPR), under the Water Sustainability Act (the Act).

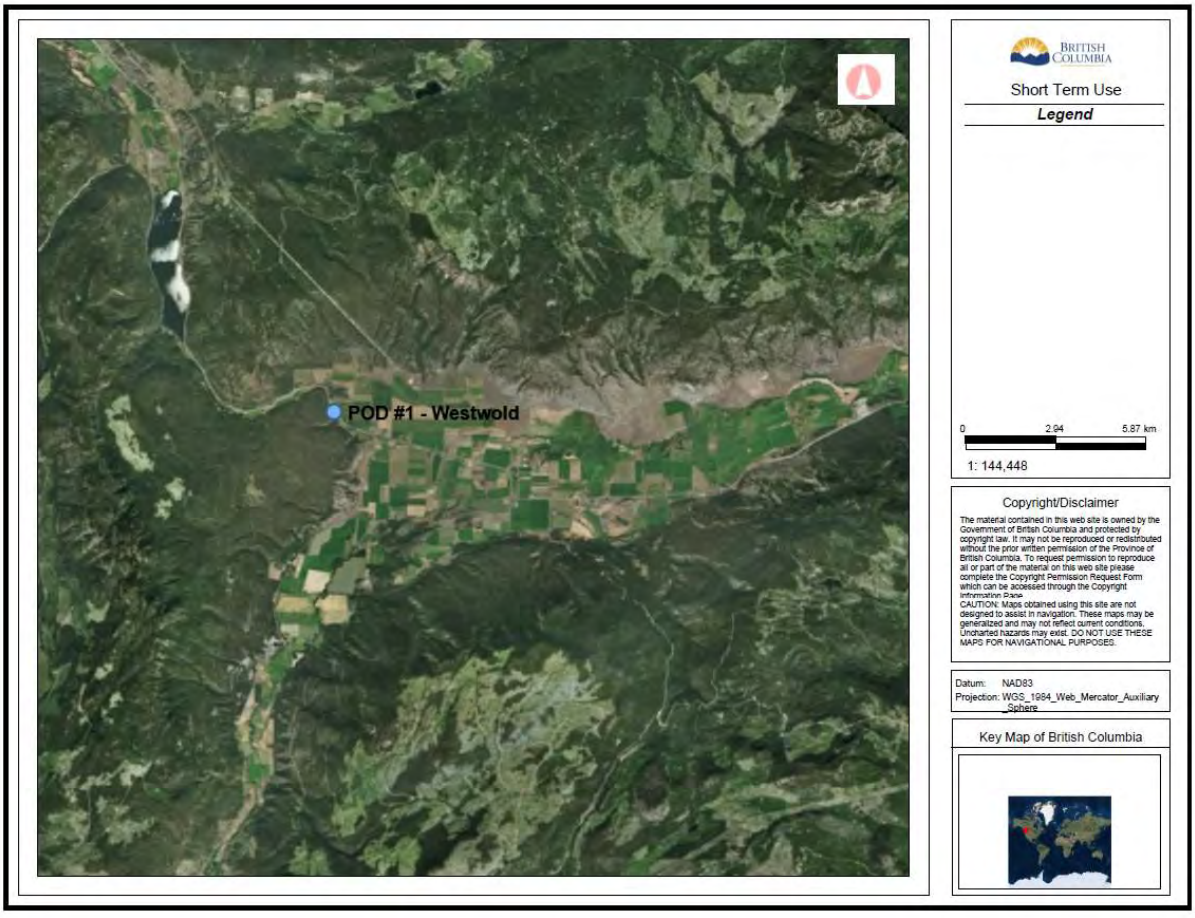
Assistant Water Manager

Ministry of Forests, Lands and Natural Resource Operations

Schedule A – Approved Points of Diversion File: 3006443

Site Name	Source	Location Description	Precinct	Latitude in Decimal Degrees	Longitude in Decimal Degrees	Approved Withdrawal (m^3/day)	Work period
Highway 97	Aquifer 98	4686 Highway 97, Adjacent to WTN #112429	Grand Prairie	50.4772805	119.7901444	6400	March 1 2019 to July 15 2019

Schedule A – Area Location Maps File: 3006443



Note: The tracking number assigned to your Notification Form is: 100275842 , Date Received on : Feb 7, 2019 3:18:48 PM

Please maintain a record of this tracking number for reference in any future correspondence about your proposal and any related follow-up.

Re: Notice to Habitat Officer / Changes in and about a Stream under Part 3 Water Sustainability Regulation

Your Notification to a Habitat Officer Ministry of Forests, Lands, Natural Resource Operations and Rural Development under the Water Regulation (Part 3 of the regulation) regarding your proposal to make changes in and about a stream of the kind described in section 39 of the regulation, has been received.

Please Note: Only changes in and about a stream of the kind listed in the Water Sustainability Regulation (Part 3 "Changes in and About a Stream") can proceed on notification and in accordance with requirements of the regulation including any terms and conditions specified by a Habitat Officer. An approval under the Water Sustainability Act for the change is otherwise required if the change proposed is not of the kind listed in section 39 of the regulation.

Under the provisions of the regulation, the Habitat Officer has 45 days following receipt by the Ministry of this notification to request additional information from you and to specify additional terms and conditions specific to your proposal, if warranted. A person making a change in and about a stream under this regulation, other than under section 39(1)(o) to (s) or 39(2) or 39(5), must then make that change in accordance with the regulation and any terms and conditions specified by the Habitat Officer *(including those further described in #1-17 below or as specified subsequently within 45 days of Habitat Officer receipt of this notice).*

Therefore, if you have *not* heard back from the Habitat Officer *within 45 days* of our receipt of your notice providing you with a statement of any additional terms and conditions specified by the Habitat Officer with respect to your proposal, you may proceed with the proposed changes in and about a stream but must satisfy the requirements of Part 3 of the regulation and also comply with the following terms and conditions in making those changes:

1. Any work associated with the proposed changes in and about a stream must not cause stream channel instability or increase the risk of sedimentation into the stream.

2. During work onsite, erosion and sediment control materials must be available onsite at all times and must be installed if sedimentation is likely to occur into the stream. A contingency plan must be developed outlining the measures to be taken by workers when carrying out any work to control erosion and sediment.

3. Soil disturbance must not occur in heavy rain conditions and any soil removed must be placed in a location that ensures that sediment or debris does not enter the stream.

4. Within a work area, water that contains sediment must be pumped to a vegetated area away from the stream where it can seep into the ground, or to a settling pond that is sufficiently far from the stream to allow sediment to settle out before the water returns to the stream.

5. The disturbance of stream bank vegetation must not occur or be minimized as much as possible.

6. Any areas that are disturbed during the work (such as exposed soil) must be promptly restored at a minimum to the pre-disturbance condition.
Note: Guidance is provided in the Enhancement Section of the Best Management Practices Instream Works

7. If possible, work must be conducted on, and equipment located and operated from, dry land (no water present) and the worksite must be isolated from flowing water.

8. Any equipment used in conducting work must be in good mechanical condition and, when operating in close proximity to the wetted perimeter of a stream, the operator must prevent entry of any substance, sediment, debris or material (e.g., hydrocarbons, silt) into the stream so as to prevent harm to fish, wildlife or the aquatic ecosystem of a stream. Note that Section 46 of the Water Sustainability Act prohibits the introduction of foreign matter into a stream. Failure to comply may result in a remediation order and it is also an offence to do so.

9. The original rate of water flow in the stream (existing prior to commencing work) must be maintained upstream and downstream of the worksite during all phases of instream activity associated with the work.

10. When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC : ***http://www.frontcounterbc.gov.bc.ca/****. Any salvage must be carried out by a qualified environmental professional (such as an R.P.Bio.).*

11. Following de-watering or isolation of the worksite, stream flow must be returned gradually to the de-watered or isolated area within the stream and not in a single sudden rush so as to avoid erosion of the stream channel and sediment delivery to the stream.

12. The stream channel width must not change as a result of the work.

13. Any materials, such as riprap or gabion rock, placed within the stream must be clean and not contain substances that could be harmful to fish, wildlife or the aquatic ecosystem of the stream.

14. Any areas disturbed as part of the work must be restored as close as possible to their pre-disturbance condition. Any soil exposed at the worksite must be promptly re-vegetated.

15. Subject to section 16 and 17 below, the work must be completed during the timing window for the stream in respect of which the changes are proposed. The applicable timing window (by region and/or by stream) are specified in the following links (see below) and are designed to protect fish, wildlife or the aquatic ecosystem of a stream. To determine the timing window, please select the relevant region from the map:
http://www.frontcounterbc.ca/pdf/RegionMap.pdf
*and then determine the applicable timing window:*Regional Timing Windows:*
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows<
<for that region and for the stream where the proposed changes will be made.
For projects proposed to take place outside these timing windows, please see section 16 and 17 below

16. In addition to the timing windows specified in section 15 above, work may be carried out during the following times provided these requirements are met when the changes are carried out:

i. If the stream channel is naturally dry (no flow) or frozen to the bottom at the worksite and the instream work / activity associated with the proposed change will not adversely impact fish, wildlife or the aquatic ecosystem of the stream (e.g. not result in any substance, sediment, debris or other material entering or leaching into the stream that would adversely affect fish, wildlife or the aquatic ecosystem),

ii. In the construction of a winter crossing, the stream channel is frozen to the bottom at the worksite and related work does not adversely impact the stream channel (including stream bed and banks), or fish, wildlife or the aquatic ecosystem of the stream, or impede their passage (in both directions) in the stream.

17. If your work is proposed outside of the timing window (as described in section 15 above), you must retain a qualified environmental professional (such as an R.P. Bio.). The professional will be responsible for providing a written technical rational that assesses and addresses the risks of the proposed changes in and about a stream, including proposing site specific mitigation (e.g. an Erosion Control Plan that identifies contingency measures and emergency procedures related to the proposal) and onsite monitoring of their implementation. This document must be submitted to the Habitat Officer via Front Counter B.C. with reference to your file number (shown on top of this document).
In proceeding outside the timing window in accordance with recommendations by your qualified environmental professional, you must comply with any measures specified by that professional to prevent impacts on the stream channel (including stream bed and banks) or fish, wildlife or the aquatic ecosystem of the stream, as well as any Habitat Officer terms and conditions specified in the confirmation of receipt of your original Notice.

In summary, you must meet the terms and conditions described above, as well as any additional terms and conditions specified by the Habitat Officer in respect of your proposal within 45 days of the Ministry's receipt of your notice, if any were specified. In addition, you must also meet any other requirements of the regulation, as are described in Part 3 of the Water Sustainability Regulation found at ***http://www.bclaws.ca/***

Also, for assistance to the public, the Province has developed clear guidance/practices, also referred to as best management practices, for working around water and for designing and implementing different types of changes in and about a stream, particularly in respect of instream works. This information in combination with the terms and conditions described above, including any additional Habitat Officer terms and conditions specified, if all followed, will help ensure that your changes in and about a stream will be compliant with the regulation and related legislation, as well as minimizing impacts on the environment (including related fish, wildlife and the aquatic ecosystem) in the stream and stream channel.

Follow the links and website directions (see below) to review the provincial guidance/practices provided for your proposed works. Please be advised that these documents may contain information which may be the subject of change due to amendments to the federal Fisheries Act and/or to related processes by Fisheries and Oceans Canada (DFO). Current up-to-date information on DFO process and legislation can be found at : ***http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html***

Province of BC Guidance / Practices:

Best Management Practices (BMP's) for Instream Works. When using this guide go to the list of "Guidebook Chapters" and select the appropriated chapters to match the specific activities relevant to your proposal for changes in and about a stream.

*Region specific BMP's for Instream Works links directly to other specific BMP pages for particular streams and regions (e.g. Shuswap and Mara foreshore guidelines): ***http://www.env.gov.bc.ca/wld/instreamworks/index.htm#**** Standards and Best Management Practices for Instream Works:***http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/standards_bp_instream_work.pdf**
Instream works: http://www.env.gov.bc.ca/wld/instreamworks/index.htm

*User's Guide to Working In and Around Water : ***http://www.env.gov.bc.ca/wsd/water_rights/cabinet/working_around_water.pdf***

* Water Licences and Approvals:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water<<* Apply for a Change Approval or Submit Notification of Instream work:

http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals/apply-for-a-change-approval-or-submit-notification-of-instream-work<<*Exemption from approval or notification: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/exemptions-from-approval-or-notification

Final Note: It is the responsibility of persons intending to carry out changes in and about a stream, as described under Part 3 of the Water Sustainability Regulation:

* To ensure that all sections of the Notice form are properly completed;

* To comply with federal, provincial and municipal enactments, including but not limited to the Water Sustainability Act (and its regulations), *Fisheries Act* (Canada), *Wildlife Act* (BC) or the *Navigation Protection Act* (Canada), as well as local government bylaws and regulations, as may be applicable to proposed changes and related works or activities; and

* To obtain the approval of the landowner for proposed changes and related works or activities intended to take place on private land or premises or to use any privately owner works, before proceeding.

Please be advised that, in the event of non-compliance with the requirements of the regulation (including habitat officer terms and conditions), it is the responsibility of persons carrying out changes in and about a stream:

* To report non-compliance with the regulation within 72 hours and then to take measures to remedy the non-compliance, as may be specified by a Water Sustainability Act Engineer, as well as to comply with any additional terms and conditions specified by the Habitat Officer; and

* To report damage to an aquatic ecosystem within 72 hours to a Habitat Officer and then to restore and repair the habitat to the state that existed before the damage was caused or as directed by the Habitat Officer.

For information, the Ministry may undertake review and inspection of specific changes in and about a stream and related works and activities to confirm compliance with:

* The requirements of the regulation

* Habitat Officer terms and conditions, including those listed in this document or any later specified by the Habitat Officer,

* Any site specific measures and mitigations specified by a qualified environmental professional for in-stream projects carried out outside accepted timing windows, and

* Any other applicable enactments

In cases of demonstrated non-compliance with legal requirements, compliance and enforcement actions may subsequently be undertaken by the Ministry where circumstances warrant.

For further information, please consult the Ministry websites listed above, as well as:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water

Please contact FrontCounter B.C. with any questions regarding these requirements

Protection of Privacy: The collection, use and disclosure of personal information by the provincial government is governed by the Freedom of Information an Protection of Privacy Act<. Additional authorities are provided in the Water Sustainability Act<. Note that, in providing this Notice to the Ministry, you are consenting to the collection, use and disclosure of any personal information provided by you in the Notice. See Sections 12 and 38 (3) of the Water Sustainability Regulation. Note: Under Section 44(1) of the regulation, “timing window”, in relation to a stream,

means a period of the calendar year, specified by a habitat officer, during
which changes in and about a stream can be made without causing a significant
harm to fish, wildlife or the aquatic ecosystem of the stream. These were previously know as “least risk”
timing windows. As noted above, please
select the relevant region from this map (first link below) and then determine
the applicable timing window for that region using the second link for Regional
Timing Windows:***http://www.frontcounterbc.ca/pdf/RegionMap.pdf***
*Regional Timing Window:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows<<

Thank You

Ron Diederichs, Habitat Officer West Coast Region

Kristina Robbins, Habitat Officer South Coast Region

Lora Nield, Habitat Officer Thompson Okanagan Region

Mike Knapik, Habitat Officer Kootenay Boundary Region

Robbin Hoffos, Habitat Officer Cariboo Region
Jocelyn Campbell, Habitat Officer Skeena Region

James Jacklin, Habitat Officer Omineca Region

Joelle Scheck, Habitat Officer North East Region

Change Approval and Notification (Changes In and About a Stream)

Tracking Number: 100275842

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization?	Company/Organization
What is your relationship to the company/organization?	Consultant

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit / Tenure / Licence will be issued, if approved.

Name:	Drillwell Enterprises Ltd.
Doing Business As:	
Phone:	250-746-5268
Fax:	
Email:	drill@drillwell.com
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Colin Slade
Mailing Address:	4994 Polkey Road Duncan BC V9L 6W3

CONSULTANT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name:	Western Water Associates Ltd.
Doing Business As:	Western Water Associates Ltd
Phone:	250-541-1030
Fax:	
Email:	ryan@westernwater.ca
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Gina Joyce Le Bel
Mailing Address:	106-5145 26th Street Vernon BC V1T 8G4
Letter(s) Attached:	Yes (Letter of Agency Signed CS.pdf)

CORRESPONDENCE E-MAIL ADDRESS

If you would like to receive correspondence at a different email address than shown above, please provide the correspondence email address here. If left blank, all correspondence will be sent to the above given email address.

Email:	trina@westernwater.ca
Contact Name:	Trina Koch

ELIGIBILITY

Please answer the following questions related to your Change Approval/Notification.

Question	Answer	Warning
Is this application to support oil and gas activity that is being authorized by the Oil and Gas Commission?	No	

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you:

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

No

APPLICATION BY GOVERNMENT

Please indicate if you are someone who works in the government OR you are working on behalf of the government.

Are you, or are you applying on behalf of, a government entity? No

TYPE OF WORKS

Please select the type of Notifications/Approvals you want to apply for as part of this application.

Please select the type of works to be undertaken:

Notification

- ☑ Road Crossing Culvert - Construction / Maintenance / Removal
- ☐ Clear Span Bridge - Construction / Maintenance / Removal
- ☐ Pipeline Crossing – Construction / Maintenance
- ☐ Dry Hydrant – Construction / Maintenance
- ☐ Pier, Wharf, (including docks) – Construction / Maintenance / Removal
- ☐ Cutting of annual vegetation in a stream channel
- ☐ Dike or Erosion Protection Works - Repair / Maintenance
- ☐ Storm Sewer Outfalls – Construction / Maintenance
- ☐ Control of Eurasian Watermilfoil or other invasive aquatic vegetation
- ☐ Ice Bridge / Winter Ford or Snowfill - Construction / Maintenance
- ☐ Maintenance of minor and routine nature by a public utility
- ☐ Removal of a beaver dam (as authorized under the Wildlife Act)
- ☐ Construction of a temporary ford
- ☐ Construction of a temporary diversion around a worksite

Approval:

- ☐ Bank Erosion Protection
- ☐ Bridge (other than clear span) - Construction / Maintenance / Removal
- ☐ Stream Diversion
- ☐ Large Debris Removal by machine - Plan required
- ☐ Gravel removal
- ☐ Other

Please note that the ultimate decision whether this constitutes a Notification or a Change Approval lies with the Province of British Columbia

SITES

Click on the Add Sites button to add one or more sites.

SITE

Location ID: A Branch of Pringle Creek

STREAM

Name of the Stream: Pringle Creek Branch
Source Flows Into: wetland/field on Buff Lumber Property

PROPOSED WORKS

Detailed Description of Works:

The project involves controlling artesian well flow that is currently entering a branch of Pringle Creek. A new well is proposed to be drilled and the current well is planned to be decommissioned. Ideally, before works commence, a fish screen would be placed across the face of the culvert accepting flow from the main stem of Pringle Creek into the branch.

The branch of Pringle Creek splits from the main stem of Pringle Creek on the west side of Highway 97 at the approximate coordinates (50.481088, -119.792326). A culvert allows water into the branch from the upper column of the main stem.

Currently conditions in the branch are frozen or dry, which are ideal conditions for placing a fish screen. It would also be ideal to block flow into the channel by placing sand bags in the culvert. That way, if water begins melting, there will not be extra flow added to the branch.

Adding the sand bags and a fish screen results in approximately 1m2 of work within the culvert.

Michael Hutchings owns the property on which the branch culvert is located but we have not been able to contact him. We would need his permission to access the culvert to place the fish screen and sand bags. Additionally, we have some information about active and inactive water license holders along the channel and have been unable to contact them.

Although we can proceed without placing the fish screen or blocking flow to the branch by implementation mitigation efforts, doing these two things would greatly alleviate impacts to fish and reduce the risk of flooding to properties downstream of well discharge.

Footprint of Project: 1 m2

PROPOSED TIMING FOR WORKS

Start Date: Feb 20, 2019
End Date: Jul 31, 2019
Is the proposed timing within the approved regional timing window? Yes

LOCATION OF WORKS

Provide a legal description of the land(s) where works are proposed: E1/2 LS 8 SEC 36 TP 17 R 14 W6M EXC PT LYING E OF PL H8
Geographic Coords of Works: 50.4810880, -119.7923260
Photo of Works Location: A Branch of Pringle Creek - Well discharge flowing over field and into a shallow pond before entering the branch of Pringle Creek

LAND OWNERSHIP AT THE WORKS

Land Ownership:

☑ Applicant owns land
☐ Land is Crown Land but applicant has tenure
☐ Land is Crown Land but tenured to Ministry of Transportation
☐ A third Party owns the land but the applicant has lease or tenure
☐ A third Party owns the land but applicant has written consent
☐ Land is Crown Land but the applicant does not have a tenure

LOCATION INFORMATION

LAND DETAILS

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☑ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description	Filename
branch culvert	branch culvert.kmz
where well discharge enters branch of Pringle Creek	where well discharge enters...

ATTACHED DOCUMENTS

Document Type	Description	Filename
Other	EMP	Appendix C Draft EMP.pdf
Other	Project Initiation Documents	APPENDIX E - Permits and Ot...

PRIVACY DECLARATION

PRIVACY NOTE FOR THE COLLECTION, USE AND DISCLOSURE OF PERSONAL INFORMATION
Personal information is collected by FrontCounter BC under the legal authority of section 26 (c) and 27 (1)(a)(i) of the Freedom of Information and Protection of Privacy Act (the Act).
The collection, use, and disclosure of personal information is subject to the provisions of the Act. The personal information collected by FrontCounter BC will be used to process your inquiry or application(s). It may also be shared when strictly necessary with partner agencies that are also subject to the provisions of the Act. The personal information supplied in the application package may be used for referrals or notifications as required. Personal information may be used by FrontCounter BC for survey purposes.For more information regarding the collection, use, and/or disclosure of your personal information by FrontCounter BC, please contact FrontCounter BC at 1-877-855-3222 or at:
FrontCounter BC Program Director
FrontCounter BC, Provincial Operation
441 Columbia Street
Kamloops, BC V2C 2T3
☑ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company / Organization:	Drillwell Enterprises Ltd.
Contact Name:	Colin Slade
Contact Address:	4994 Polkey Road Duncan BC V9L 6W3
Contact Phone:	250-746-5268
Contact Email:	drill@drillwell.com

☑ **I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.**

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this application does not provide authority under the Water Sustainability Act to construct works in and about a stream. I also understand that my application must first be investigated and a decision made on the application as to whether an approval may be granted and, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) for information on how to ensure your project complies with the Fisheries Act.

DECLARATION

☑ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know?	This project is part of a larger well decommissioning plan undertaken by Western Water and Drillwell and supported by the provincial government. It is our hope that the province can help us gain property access to the branch culvert by contacting the property owner. We also require assistance in contacting individuals who hold the active and inactive water license on the branch of Pringle Creek. A public open house may help to get the word out to the various individuals.

OFFICE

Office to submit application to:	Kamloops

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource authorization from the Province of BC?	No

APPLICANT SIGNATURE

Applicant Signature	**Date**

File: R3-3006447

March 18, 2019

Via Email: drill@drillwell.com

Drillwell Enterprises Ltd.
4994 Polkey Road
Duncan, BC V9L 6W3

Re: Section 11 *Water Sustainability Act* Application "Changes In and About a Stream" –Road Crossing Culvert - Construction / Maintenance / Removal – Location: E1/2 LS 8 SEC 36 TP 17 R 14 W6M EXC PT LYING E OF PL H8– A branch of Pringle Creek

Staff with the Ecosystems Section of the Ministry of Forests, Lands and Natural Resource Operations and Rural Development have reviewed the above mentioned authorized change application. A Section 11 *Water Sustainability Act* Change Approval is not required for the proposed work as long as the work is done in accordance with BC Regulation 36/2016 – Part 3.

As per section *38 (1) A person proposing to make an authorized change, other than an authorized change described in Section 39 (1) (o) to (s), (2) and (5), must*

(a) Provide a notice, signed by the person or the person's agent, to a habitat officer of the particulars of the proposal at least 45 days before beginning the authorized change, and

(b) Obtain from a habitat officer a statement of the Terms and Conditions described in section 44 (2) [protection of aquatic ecosystems] on which the authorized change can proceed.

Your authorized change can proceed as long as the terms and conditions for your works outlined here are followed:

http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/terms_and_conditions_for_cias_th_ok_2016.pdf

It is the proponent's responsibility to ensure their activities are in compliance with all legislation, including the *Fisheries Act*, as well as with local government bylaws and regulations.

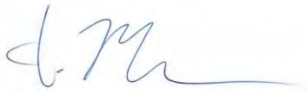
Ministry of Forests, Lands and Natural Resource Operations and Rural Development

Resource Management
Thompson Okanagan Region
1259 Dalhousie Drive
Kamloops, BC V2C 5Z5

Telephone: (250) 371-6200
Facsimile: (250) 828-4000

If you have further questions please contact the undersigned at 250-371-6252.

Yours truly,



Justine Densmore-McCulloch, MSc, R.P. Bio
Ecosystems Biologist

JDM/ls

Cc: Western Water Associates Ltd., trina@westernwater.ca and David Thomson, David.Thomson@gov.bc.ca

February 11, 2019

File: 10005-40/GS19932-001

Notification of Westwold Flowing Artesian Well Decommissioning Project, Westwold BC

To whom it may concern,

On behalf of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), we are providing this notification that Drillwell Enterprises Ltd. (Drillwell) has been retained to close a flowing artesian well located at 4686 Highway 97, Westwold BC. The well is being closed to comply with regulatory requirements and to reduce any long-term risks to infrastructure, property and aquifer management.

Drillwell will be on the subject property undertaking works to decommission a flowing artesian well, including site preparation, construction of a drill pad, drilling of a relief well, installation of water conveyance pipes, pump testing and monitoring, and staging of equipment and machinery. The purpose of the relief well drilling program is to complete a relief well into a confined sand and gravel aquifer to be used to aid in the future closure of the flowing artesian well.

Works on the site will commence immediately and will be conducted through the end of March 2019.

Should you have any questions or concerns, please feel free to contact the following:

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)

Project Coordinator: David Thomson, Regional Hydrogeologist Tel: 250-260-4641

Media Inquiries

Government Communications and Public Engagement Tel: 250-356-7506

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Regional Water Management
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Mailing/Location Address:
2501 14th Avenue
Vernon BC V1T 8Z1
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western water
ASSOCIATES
Consultants in Hydrogeology and Water Resources Management

Final Report: Volume II
Well Decommissioning Plan
Flowing Well Tag # 112429, Westwold, B.C.

Prepared for:

Ministry of Forests, Lands, and Natural Resource Operations (MFLNRORD) and Drillwell Enterprises Ltd.

Prepared by:

Western Water Associates Ltd.
106 – 5145 26th St
Vernon, BC
V1T-8G4

With assistance from Drillwell

May, 2019. Version 2. WWAL

Project 19-002-01VR

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- Environmental Management Plan (Appendix C)
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Figure 2 Relief well conceptual design

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1. INTRODUCTION AND OBJECTIVE

This work plan provides details on proposed work undertaken to permanently decommission Well Tag Number (WTN) 112429, located at 4686 Highway 97 in Westwold, B.C. This version revises and updates the first version submitted 31 January 2019. The Work Plan includes the following components:

- Project Roles and Responsibilities
- Pre-Drilling and Site Preparation Operations
- Relief Well Drilling and Testing, Materials and Methods (including on-and off-site drilling water management)
- WTN 112429 Decommissioning Materials and Methods
- Approach to Analysis and Reporting
- Attachments with information on supporting plans, permits and other documents

The objective of this project is to permanently decommission the subject well and to construct a relief well that will comply with regulations. The applicable sections of the Groundwater Protection Regulation (GWPR) and *Water Sustainability Act* (WSA) govern the work done for this project, including but not limited to the following:

GWPR: Part 2 (15) Qualifications for activities in relation to artesian flow – well drillers

Part 8 – ARTESIAN FLOW, Sections (66) and (67). Additional requirements – stopping or controlling artesian flow, and report on artesian flow management.

Part 10 – WELL REPORTS, Section (80) – decommission reports for flowing artesian wells (see also Schedule 1 of Regulation). (Please see Section 8 of this Work Plan for reporting).

WSA: Section 52 Controlling artesian flow during construction

This Plan is prepared in partial fulfillment of Drillwell's Major Works Contract with the Ministry, intended to satisfy the documentation of pre-drilling planning and site preparation tasks. The concordance table below highlights where the planning tasks identified in the Schedule C item 1 are provided in this plan. The tasks requested by the Ministry are a, b, d, e, g, k, m, q, r and s. Note that Schedule C Item 1 (s) refers to a two-year warranty period as specified in the Major Works Contract. This is not a planning task and is implicit in the contract and addressed at and following substantial completion.

Table 1 Planning Tasks Concordance Table

Planning task item and name	How addressed and if in this Plan, where to find information	Comments
(a) Decommissioning plan	This document and its attachments	
(b) Environmental, Health and Safety and Traffic Control Plans	Appendix C, B, and E respectively	
(d) Drill pad construction, site layout	See Appendix A Figure 3 for concept site layout (updated in February 2019)	Appendix E contains permit for temporary road ditch regrading. This work complete as of 25 Feb 2019
(e) Calculations on relief well design	Section 4 of Decommissioning plan	See discussions on grout pressures and distance drawdown calculations, pages 8-10
(g) Management of erosion and water discharge	See Appendix A, Figure 5 and Appendix C Environmental Management Plan	
(k) Traffic Control Plan	Appendix D	Traffic control used in site preparation and site access improvements.
(m) Prepare plan to address needed work areas if existing dwelling to be moved or demolished	Addressed in planning tasks outside of decommissioning plan	See (r) below. Access agreement with neighbour negates need to demolish or move the residence
(q) Apply for necessary permits	Permits applied for as a planning task. Copies of permit documents in Appendix D and Appendix E.	Traffic control, Section 11 and temporary road ditch regrading were the permits identified as necessary.
(r) Negotiate site access with neighbouring property owners as needed	Addressed in planning tasks completed in January 2019	Site access agreement in place between Drillwell and Buff (property owner)

2. ROLES AND RESPONSIBILITIES AND KEY CONTACTS

The roles and responsibilities for this project were reviewed during the 22 January 2019 kickoff meeting attended by MFLNRORD, MOTI, Drillwell and Western Water Associates Ltd. These are summarized in the table below, which also provides key contact information. This second revision of the Plan was prepared by Drillwell and Western Water Associates Ltd. and will be updated if needed. The final version of this Plan will be included in the completion report submitted to the Ministry at the end of the Contract.

Drillwell is the prime contractor and responsible for overall contract management and performance on the contract. Western Water Associates is the environmental and hydrogeologist subcontractor supporting Drillwell. **Table 2** lists the key contacts for the project team, as provided by MFLNRORD. The contract between Drillwell and the Province of B.C. identifies several key completion milestone dates. These are summarized in **Table 3** and are subject to change per mutual agreement between Drillwell and the Province. Work on this contract began in mid-January 2019 following contract award.

TABLE 2 PROJECT KEY CONTACTS

Highlighting – preferred after-hours contact

Name	Office	Cell	Notes
David Thomson (FLNRORD)	250-260-4641	250-540-9641 (24/7)	
Skye Thomson (FLNRORD)	250-490-8276	250-809-7972	
Melissa Wade (FLNRORD)	250-371-6206	See notes	Please email
John Pogson (FLNRORD)	250-490-8220	See notes	Please email
Ken T. Namislo (MOTI)	250-833-3378	250-253-1857	
Danny Morris (MOTI)	250 503-3632	250 308-8600	
Doug Geller (WWAL)	250-541-1030	250-306-2843	
Ryan Rhodes (WWAL)	250-541-1030	250-308-6160	
Paul Williamson (WWAL)	250-541-1030	250-540-6899	
Trina Koch (WWAL)	250-541-1030	250-309-2806	
Gina Le Bel (WWAL)	250-541-1030	250-540-0108	
Colin Slade – Partner Drillwell	(250) 746-5268	(250) 381-1990	Office phone number provides option for forwarding to person on call

All WWAL staff emails are (first name)@westernwater.ca example: ryan@westernwater.ca
Drillwell email: drill@drillwell.com
Ministry emails: lastname.firstname@gov.bc.ca

TABLE 3 CONTRACT MILESTONES AND DATES

Task 1	Site Preparation, Drill Pad Construction, Written Decommissioning Plan and Permitting	28 February 2019
Task 2	Drill and Install Relief Well Surface Casing	10 March 2019
Task 3	Drill and Install Relief Well Casing and Screen	25 March 2019
Task 4A	Test Relief Well and Preliminary Report	31 March 2019
Task4B	Drill, Install and Test RW#2 if necessary	30 April 2019
Task 5	Decommission WTN 112429 (includes site cleanup and de-mobe)	20 May 2019
Task 6	Draft and Final Post-Closure Report with Recommendations for Monitoring for minimum two year period	14 June 2019

Achieving the permanent decommissioning of WTN 112429 as soon as soon as possible within all known safety and operational constraints is the shared goal of the project team. The extent to which the aquifer pressure varies through the seasons is not known but based on experience elsewhere, it is likely that aquifer pressures will increase following the onset of spring freshet and the annual cycle of groundwater recharge in the B.C. Interior. Typically, observation wells in confined aquifers located in valley settings in this region show seasonal lows in February or March that rise to seasonal highs by June in most years (late April or early May in locations where there is significant irrigation pumping). There are no representative observation wells nearby (the Westwold observation well is shallow, and shows about 2-3 m of annual water level fluctuation). If WTN 112429 is decommissioned as planned prior to April or May then the effects of rising head in the confined aquifer should be manageable. See **Section 3** for a discussion of existing pressure conditions as determined on January 24, 2019.

3. PHASE 1 PRE-DRILLING AND SITE PREPARATION

A kick-off meeting was held 22 January 2019 (notes in Appendix F), which included key individuals identified by the Ministry and Drillwell. The objective of our efforts under this pre-drilling and pre-closure task will be to help ensure the project team and the project site are fully prepared for well drilling, testing and decommissioning operations; and any site modifications and permits are in place by the end of February 2019s. **Appendix A Figure 1** shows the site location and general plan, and **Figure 2** is the preliminary Relief Well design. The proposed general layout of drilling equipment and staging areas at the site is sketched by Drillwell as attached in **Appendix A, Figure 3**. A few of the key tasks completed in the planning stage are listed below.

- Confirm access and egress details for vehicles, equipment and personnel entering and occupying the project site. Regrading of site to be done with Ministry of Transportation (MOTI) approval and concurrence.

- Confirm details (dimensions, lengths, materials capacities) of existing WTN 112429 discharge header and pipeline works. Modify well head and pipeline works to allow optimum use of site during project operations.

- Prepare Site Management, Traffic, Parking and Safety Plans to guide each phase of the work. Complete any necessary permitting. At this time, permits with Highways have been filed and a pending task is to prepare and submit an application through FrontCounter for a temporary use authorization for use of the relief well for miscellaneous industrial purposes. This application is planned to be filed the week of 4 February 2019. A traffic control plan covering initial site activities has also been filed (copies in Appendix D and Appendix E).

- Confirm the proposed location of Relief Well 1 (RW1). It is recommended that RW1 be drilled as close as possible to WTN 112429, but not less than 3 metres or 10 ft from the wellhead. This distance is considered to sufficiently balance the need to maximize drawdown at WTN 112429 during RW1 operation while lessening the chances of grout invasion to the RW1 screen during decommissioning. See the table in Section 3 below for a series of estimates of relief well drawdown at WTN 112429 based on assumed values of pumping rate, aquifer thickness and hydraulic conductivity. In summary, the preferred setback distance is approximately 3-4 metres. The exact set back will be known once the rig is mobilized and set up to drill.

Completed preliminary field visit tasks

- In late January 2019, one of the initial tasks completed involved installing flow meters on the two 6" discharge lines currently connected to WTN 112429. Following this, "reverse" step flow testing was completed by Drillwell staff with assistance from WWAL. MFLNRORD staff were on site for portions of this. Summary results of the camera survey and step testing are provided here.

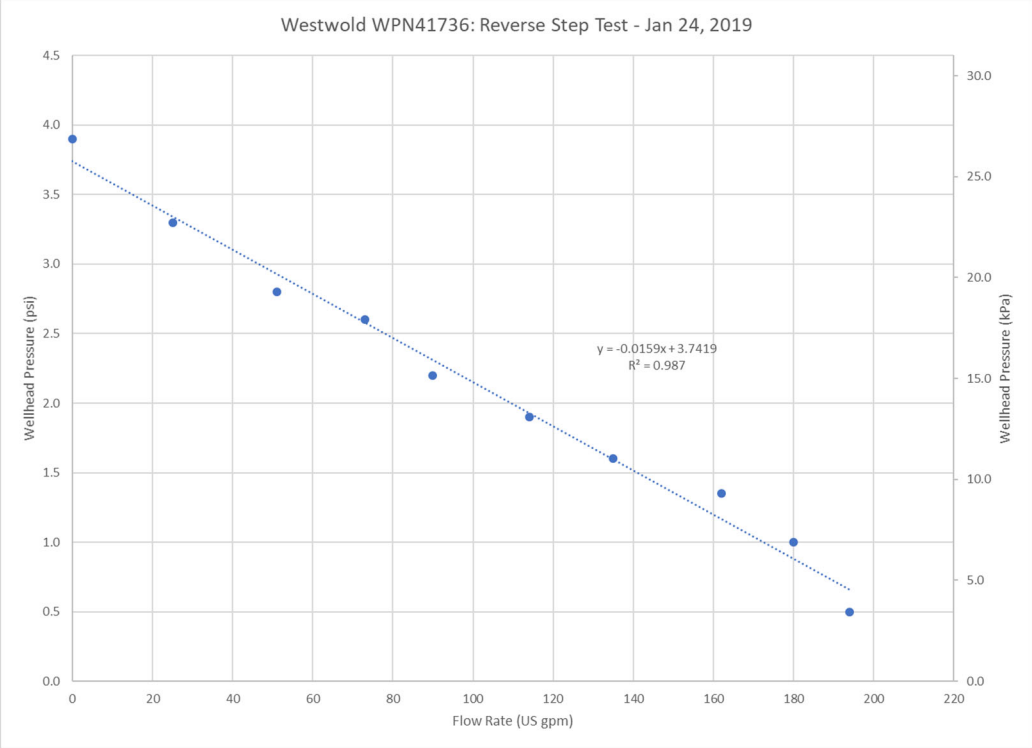
  Camera survey: the camera survey found that the bottom of the well casing of WTN 112429 was at the depth reported on the well drillers report and that no apparent formation heave or

voids/cavities below the casing. The bottom of the casing appears to comprise a "developed" zone of relatively coarse gravel (to cobble size) fragments.

Step testing: the free-flow rate of WTN 112429 was measured at approximately 200 US gpm (12.6 L/s) with minimal backpressure at the well head pressure gauge. A series of step-downs were done using the valve on the discharge header. We refer to this as a "reverse" step test in that reductions in flow rates were achieved by slowly closing the valve in steps, while observing the pressure buildup (recovery) at the pressure gauge. The resulting data (flow versus head buildup) typically plot on a straight line on a linear graph much like a conventional step-drawdown test. It quickly became apparent during the testing that the artesian pressure was relatively low (about 2 PSI of backpressure with the flow reduced by 50% to 100 US gpm). Therefore, after several small step flow reductions, the well was briefly shut in and a pressure at the gauge of 3.9 PSI (about 28 kPa) was recorded after 10 minutes of no flow with little change noted in the last 5 minutes of shut-in. The gauge is about 2 ft above ground, so this equates to an artesian head above ground of approximately 10 ft or 3 m. This is a relatively low-pressure situation, at present. The graph below shows the step-flow test data.

The apparent specific capacity of the well based on the free flow rate of 200 US gpm and the shut-in pressure is on the order of 25 US gpm/ft of drawdown.

Step Flow Test Data WTN 112429



Potential changes in artesian pressure: It is the consensus of the team that the artesian pressure could increase as we move toward spring, but it seems unlikely that there would be a dramatic

increase in pressure in the near term. More likely is a gradual increase (perhaps 1-3 m, or up to 4 PSI) during and following freshet, and given the confined aquifer setting, there could be a lag time between freshet and when the aquifer responds to recharge. The lack of formation heave or void formation at the bottom of the well casing is suggestive of a relatively low artesian pressure. It is possible that after nearly 3 years of unrestricted flow, that the confined aquifer has been partially depressurized and that pressures could have been higher in 2016-17. Therefore, over the longer term (post closure), aquifer pressure could continue to increase. Because of the uncertainty in the overall pattern of artesian pressure (we have only one spot measurement from January 2019), the team still intends to complete the decommissioning using active depressurization with a relief well. Due to the lower pressure observed, the chances of success using one relief well have increased considerably. The team will plan on a potential SIP of up to 10 PSI (~ 69 kPa) during decommissioning operations if done in March/April 2019. The completed relief well and the decommissioning of the subject well will withstand shut-in pressures greater than 10 PSI should they develop. The signed Major Works Contract specifies a two-year warranty period, during which monitoring will confirm this performance specification is met following decommissioning.

Discussion on relief well design

- Preliminary calculations on the 6 inch discharge lines and the measured flow from WTN 112429 confirm that one of the 6-inch lines can be used to carry the flow from the relief well. As discussed in the kickoff meeting, a solid pipe would be pulled through the Highway 97 culvert to allow for pumping under pressure to the discharge point.

- Preliminary Relief Well Design and Drawdown calculations for RW1: The Relief well is proposed to be completed with a 12 inch (300 mm) conductor casing that is grouted-in-place inside a temporarily cased nominal 16 inch (400 mm) diameter borehole (see **Figure 2** diagram, attached).

- A brief discussion on the shape of the drawdown curve is summarized here in a very generalized manner. In lower to moderately transmissive aquifers, the drawdown "cone" is relatively steep with a relatively small area of influence (drawdown) compared to a high transmissivity formation. In high T situations, the drawdown cone is relatively flat and drawdown extends further from the pumped well. Therefore, it follows that the radial distance between relief well and the well to be killed is an important consideration in low to moderately transmissive aquifers, to the extent that 1 or 2 metres of extra offset might make a difference in the outcome. In high T formations, drawdown as a function of distance does not vary as much over the span of a few metres. Our team has determined that a spacing of about 4 metres is a good balance between minimizing destabilization of WTN 112429 and maximizing the opportunities for drawdown.

- If possible, the relief well will be screened through the full thickness of the flowing artesian aquifer (some blank pipe and riser will also form parts of the screen assembly). We assume the production casing will be set at a depth of approximately 60 metres and therefore, the approximate drawdown limit in the relief well will be to a depth of about 58 metres below ground. Assuming a shut-in pressure of up to 10 PSI at the time of drilling, this is a very conservative well

design, but keep in mind that after the wildcat well is decommissioned, and the relief well is shut-in or only used for domestic, the aquifer pressure could begin to recover and could eventually exceed 10 PSI, which will be addressed in the monitoring plan. As noted, the relief well will be placed approximately 3-4 m (10-13 ft) from WTN 112429. A series of distance drawdown calculations based on the Theis (1935) equation suggested the flow can possibly be killed with a single relief well pumping at approximately 500 US gpm (32 L/s) if transmissivity is moderate (approx. 1000 m^2/day). However, the summary below provides for a worst-case condition that would involve pumping the relief well at 1,100 US gpm (about 70 L/s). The key variable governing effectiveness of pressure relief is hydraulic conductivity, thickness and hence transmissivity of the formation. The very high K scenario presents some potential challenge, but given the relatively low shut-in pressure, it appears feasible to kill flow with one relief well. In practice, a higher T formation would typically yield more water to a well, whereas a lower or moderate T aquifer might limit relief well capacity; depending on well efficiency. Note also the relative insensitivity to predicted drawdown as a function of radial distance in the high T scenario, as discussed above.

- We have run the drawdown calculations for a range of hydraulic conductivities (K values) using a simple Theis analysis spreadsheet tool, and assumed aquifer transmissivity based on K varying aquifer thickness remaining constant, varying well setback distances, and a 70 L/s flow rate, the practical maximum from a 10/12 inch well. Based on observed head in late January 2019, pressure-relief drawdown at WTN 112429 of about 5 psi (11.5 ft) would draw down the well to ground surface, killing flow. Based on these preliminary calculations this is theoretically possible (green shaded cells) except in the case of a very high K and high T (>2000 m2/day) situation (orange shaded cells). **Table 4** below summarizes the distance drawdown calculations at 1,100 US gpm / 70 L/s, considered a worst-case scenario in terms of water discharge management, and the probable upper limit for a 10 inch well. There is considerable uncertainty in these preliminary calculations, which are intended to show the probability of success is good with one 10 inch relief well. The actual formation conditions and design of the relief well will govern the outcome. As noted above, it is possible that a relief well flow as low as 500 US gpm could be enough to kill flow.

TABLE 4 SUMMARY DISTANCE DRAWDOWN ESTIMATES – WORST CASE (1100 us GPM)

Assumed radial distance between Relief Well and WTN 112429	"Low" K value predicted 24 hr drawdown	"Medium" K value predicted 24 hr drawdown	"High" K value predicted 24 hr drawdown
10 ft (3 m)	42.3 ft (12.9 m)	17.1 ft (5.2 m)	9.6 ft (2.9 m)
15 ft (4.6 m)	39.6 ft (12.1 m)	16.1 ft (4.9 m)	9.0 ft (2.7 m)
20 ft (6.1 m)	37.6 ft (11.5 m)	15.4 ft (4.7 m)	8.6 ft (2.6 m)

Notes: Low: K = 5.3 X 10^{-4} m/s; T = 418 m^2/day
Med: K = 1.4 X 10^{-3} m/s; T = 1115 m^2/day
High: K = 2.7 X 10^{-3} m/s; T = 2090 m^2/day
Drawdown values shown are at WTN 112429 based on Theis (1935) radial flow to well theory
Constant assumed values: flow rate 1,100 US gpm and aquifer thickness 9 m (30 ft)

4. PHASE 2 DRILL AND INSTALL RELIEF WELL SURFACE (CONDUCTOR) CASING

On mobilization, a deviation survey of WTN 112429 will be conducted by Drillwell to confirm the planned 3 to 4 m setback for the relief well is appropriate. If there is deviation noted in WTN 112429, its extent and compass direction will also help Drillwell determine where to place the relief well so that relief well drilling does not intercept the adjacent wellbore.

A critical step in construction of any well in a flowing artesian aquifer is the placement of the conductor or surface casing, and grouting this casing in place back to the surface prior to telescoping a smaller size casing inside the conductor casing to complete the hole. In some situations (e.g. deep aquifers, multiple stacked flowing artesian zones, damaged formations, etc), more than one "step down" from conductor to production casing may be required. At Westwold, the subsurface stratigraphy, formation conditions, and aquifer depth are such that only a single conductor casing and step down to production casing are needed. The key nominal cased hole diameters involved are: temporary 16 inch (400 mm), permanent 12 inch (300 mm) and 10-inch production (250 mm). Mobilization of equipment will start approximately end of February 2019. Site access improvements are complete as of February 25 2019 with the start of mobilization of drill rig and support equipment and facilities.

Drill Rig Description and Capabilities and Site Layout

Drillwell plans to use a Foremost Dual-Rotary (DR) 24 or DR24HD rig for relief well construction. Specifications and capabilities of this rig are provided in **Appendix E.** In summary, both the upgraded DR24s or DR24HD (heavy duty) rigs are capable of drilling to depths of more than 300 m at starting diameters up to 24-inch. The anticipated formation conditions for this project are well within the capabilities of the drilling machine to handle. The rig and crew require a number of support vehicles, trucks and laydown areas that are organized on site to promote safe and efficient operations. The updated site layout is attached (**Appendix A, Figure 3**) and this will be discussed and modified as needed once more is known about the final location of the relief well and any other site constraints are better understood. This site layout was updated to reflect the decision to leave the existing dwelling in place and is based on the access agreement Drillwell signed with the neighbouring property owner.

Figure 2 shows the conceptual relief well design in cross section along with a summarized log of the lithology based on the well drillers report for WTN 112429, also shown in the diagram. Also shown in the diagram is the concept of depressurization whereupon pumping the relief well will reduce the piezometric head in the aquifer, inducing drawdown at WTN 112429. At this time, the shape of the drawdown curve and hence the flow rate required to kill flow at WTN 112429 are not known, so the plan has some built-in adaptations to deal with this uncertainty, as explained further below. At this point, the team assumes a relief well flow of 500-700 US gpm (i.e 2.5 to 3.5 times the free flow rate) would likely kill the flow at WTN 112429.

In constructing a well in a flowing aquifer situation, a design factor is to determine a grout that is heavy enough to withstand the anticipated upward pressure at the shoe of the conductor casing. Calculations demonstrating this are provided below. The simple equations used here can be found in many publications, for example the Province of Ontario Document titled "Water Supply Wells – Requirements

and Best Management Practices" (Ontario Ministry of Environment and Climate Change, 2015). Qualified well drillers with Drillwell who are knowledgeable in the fundamentals of drilling fluid management, grouting and sealing use these relationships on a regular basis in order to maintain borehole stability and to ensure that grout seals are adequate to withstand expected formation pressures.

The grout density of the cement grout proposed by Drillwell (basically, a neat cement grout) is 16.8 pounds/US gallon. The following equation is used to determine the **Downhole Grout Pressure (DGP**) in PSI (pounds-per-square-inch).

DGP = grout density (lbs/US gal) x 0.052 x (depth to top of aquifer in ft)…….Equation 1

Here we will modify the DGP based on an assumed total grouted depth of 195 ft (not 270 ft). Using a depth of 195 ft to the bottom of the sealed conductor casing (12 inch), the DGP for RW1 is approximately 170 psi. DHP should be greater than the upward pressure at the shoe of the conductor casing, given by the following relationship, known as the **Downhole Hydrostatic Pressure (DHHP),** which is the sum of the estimated SIP and depth to top of aquifer.

DHHP = SIP + depth to aquifer……..Equation 2

Assuming 10 psi SIP and aquifer depth of 270 ft (~ 117 psi), DHHP is approximately 126 psi.

Based on the estimated DGP of 170 psi at the shoe of the 12 inch casing, the proposed design for the RW conductor casing grout is sufficient, and has a margin of safety of about 45 psi, and will likely prevent any flow from occurring outside the casing, and since the well is intended for long-term use, this conservative design is favourable from the standpoint of reducing the likelihood of issues occurring in future. The relief well design is based on an assumed maximum shut-in pressure (SIP) at construction of 10 PSI, future SIPs greater than 10 PSI, and the reasonable assumption that the confining unit above the aquifer has adequate formation strength to contain aquifer pressures. Once cured, the grout used in constructing the relief well and decommissioning the subject well will provide total control of artesian pressure.

Grout placement details – relief well

The 16" casing shoe will be cut to minimize difficulties extracting the 16" casing. 12" steel casing will be installed with a drillable float shoe (check valve) bottom and suspended off bottom while cement pumped thru the bottom of this float shoe and back up between 12" X 16" annulus. After all water has been displaced and grout is returning to surface the 12" will be lowered to the bottom of hole. 16" casing will be extracted and 16"X12" annulus will be topped up as necessary with a 1" tremmie pipe. Once the grout is in place and casing has been extracted it will be left for a minimum of 24hrs. During this time the rig can be swapped over to 10" drilling and the 10" overlap casing string can be run to bottom.

During drilling of the upper borehole (16 inch), WWAL hydrogeologists will visit the project site to log formation materials. The WTN 112429 well log suggests the possible presence of a small amount of groundwater found within sandy lenses in the confining unit. We will work with Drillwell to verify the depths of any minor water bearing zones between the surface and the bottom of the confining unit. All these zones will be effectively sealed off once the relief well conductor casing is grouted in place and the

subject well is decommissioned. At the conclusion of this task, Drillwell will have installed a 12-inch diameter steel casing that is grouted-in-place to an approximate depth of 59-60 m / 195 ft (the lower part of the confining unit), and the 12-inch well head will be ready for the attachment of temporary flow control fittings and eventual connection to the discharge line. The completion of the installation of the 12 inch conductor casing and the grout seal from surface to the shoe of this casing marks completion of one of the key project milestones. At this time, we will confirm with Drillwell and the rest of the project team the plans and schedule for the upcoming, critical stages of work to complete Relief Well 1 installation, development and testing, followed by WTN 112429 decommissioning

5. PHASE 3 DRILL AND INSTALL RELIEF WELL PRODUCTION CASING AND SCREEN

The proposed RW1 drilling plan calls for a nominal 10-inch (250 mm) diameter production casing to be telescoped inside the grouted in place 12-inch casing (see **Figure 2**). Recall that the top of the 12-inch well casing will be fitted with a drilled well flange to which any number of well head fittings can be attached to facilitate temporary control of artesian flow during constructionm; and also facilitate permanent completion of the well head following completion of decommissioning. Further details follow below.

Temporary well head works and lower hole drilling

During this phase of work, Drillwell will attach a temporary drill-through cone seal (**Appendix A**, Figure 4) to the 12" casing headworks. This will allow the well driller to seal off the wellhead when the rig is not operating with minimal leakage to surface, which would easily be handled with the on-site water storage container and discharge works. This will be important in achieving water management while drilling out the flowing artesian zone. Once the 10-inch drilling starts, WWAL hydrogeologists will attend the site full-time during the completion of the borehole to total depth. Drill cuttings moved to surface will drop out of the cyclone placed above the on-site temporary water storage container system, which will be captured as grab samples with buckets and/or shovels as needed. See Drillwell sketches of the temporary and completed relief well head assemblies in **Appendix A**.

The thickness of the flowing artesian aquifer is not known, but based on the apparent productivity of WTN 112429 (e.g. 200 US gpm with 4 PSI shut-in, high specific capacity for an unscreened 6 inch well), we expect that it will be at least 6m (20 ft) thick, and Drillwell's materials on-site and drilling plans will allow for an even thicker unit drilled out to the bottom (up to 30 m / 100ft thick aquifer). Drillwell intends to use threaded well casing for the lower part of the borehole to make this part of the drilling go as fast as possible and reduce issues making welded connections under heavy flowing conditions. WWAL will field-log and classify aquifer formation samples in the aquifer zone, collected approximately every 60 cm (2 ft) until the well reaches total depth. The plan would be, if possible, to drill out the full thickness of the aquifer until flow cuts off or fine-grained materials or bedrock are encountered.

Well screen design, fabrication and delivery and well development

Once the target aquifer has been drilled and temporarily cased, WWAL will either field-sieve the samples or submit them to Fletcher Paine in Vernon, and based on observations made during drilling and gradation analysis, work with Drillwell to develop a well screen design. Based on a conceptual design calling for a potential relief well capacity of at least 47 L/s (750 US gpm) and possibly more, depending on how coarse the formation is, we assume that the screen assembly for the relief well will be in the range of 3-5 m (10 to 16.5 ft) in length including slotted stainless steel screen and riser pipe. A sump may be included in the screen design depending on lower aquifer conditions. A sump will also allow for the accumulation of some material during development and subsequent pumping without impacting well efficiency. Development will consist of mechanical bailing and airlifting. Screen design (length and percent retained) may be influenced by the point of discharge's ability to accept the water during the drilling process. Challenges managing water may require a more conservative screen design (less development time), which would be acceptable given the intended domestic use of the well and the need to pump the well at high rates likely only once, and for a fairly short time, in its entire design life. See Appendix C for the plan to manage discharge water. The contingency plan here is to place a fish screen at the upstream end of the branch of Pringle Creek receiving discharge water and if needed, temporarily cut off flow to the branch to provide adequate capacity to receive discharge water without causing flooding of the creek branch.

Well head assembly

After screen installation and development Drillwell plans to cut the 10" casing to recover the threaded casing and provide a full 12" pumping chamber. If initial testing on well during the development process indicate this isn't necessary or there are any challenges with cutting and recovering the 10" it could be left in place. Should initial testing indicate flows of less than about 500 US gpm are adequate, a local pump installer (Monashee Aquifer testing) might be used for pump services. Should larger flow rates be required Ingram pump can supply solutions capable of 750GPM+ Crews will install a pre-made 12-inch by 6-inch tee to the top of the 12-inch casing, with a standard gate valve placed on the 6-inch portion capped with blind flanges, a pressure gauge access port, a secondary threaded port for a pressure transducer, and also a sampling port actuated with a small ball valve. This detail will make it far easier for others to work on the well in the future and will also facilitate monitoring. See the sketch shown in **Appendix A, Figure 4**.

Other tasks that Western Water staff, with assistance from Drillwell, will perform during this phase include the following:

- Periodically monitoring the flow rate from WTN 112429 to see if flow is reduced during drilling of the relief well;
- Monitoring field parameters of water discharged from the relief well and WTN 112429 in accordance with the environmental monitoring plan;
- Once relief well drilling is complete, WWAL will confirm shut-in pressure once Drillwell temporarily shuts-in the well either while waiting on screen delivery or after screen installation and before well development; (note that if the relief well drills out the full thickness of the aquifer,

the shut-in pressure at the relief well could be somewhat higher than that recently measured at WTN 112429, due to possible presence of upward vertical hydraulic gradient).

- Observe well screen development process, and continue to monitor flow from WTN 112429;
- Work with Drillwell and Pump contractor to develop and then finalize a relief well testing program (to be implemented in the next task);
- Environmental monitoring of discharged water per the environmental monitoring plan (EMP);
- Prepare a draft relief well completion diagram to be share with members of the project team and stakeholders.
- Prepare written progress reports as needed to inform project team of progress, issues, and solutions. Normally, there will be weekly emailed reports summarizing progress on Fridays, and also daily reports from the driller to the Ministry and team as needed, providing each day's details.

6. PHASE 4A TEST RELIEF WELL / PRELIMINARY REPORT

Once the relief well is drilled, Drillwell's team will complete the works necessary to enable the full flow of the well to be discharged in parallel with the existing discharge from WTN 112429 to the Miller field. Downstream from this point of discharge, environmental management plan recommendations will be implemented under WWAL's oversight along with monitoring of the Pringle Creek branch (see EMP in Appendix C). The design of this water discharge system will be able to take advantage of a diminished rate of flow from WTN 112429 once the relief well is flowing and/or pumping. At this stage, we see the need for several tests to be performed on the relief well, as follows:

- The actual flow rates for the testing will be determined upon completion of screen installation and development.
- Testing would start with an approximate half-day, 4 -hour free-flowing well test to confirm the natural artesian flow rate of the relief well and the effect free-flow from the relief well has on flow from WTN 112429; (also: it has been our experience that the maximum rate at which a flowing well can be pumped varies, but is rarely more than 2 times the artesian flow rate; the natural flow rate will help bracket the flow rates for the pumping test to follow);
- Following test pump installation, a four-hour step test (with flow rates to be determined) on the relief well, followed by a recovery (shut-in) period; during this test, flow will continue to be measured from WTN 112429 for indications of flow reduction or flow cessation;
- Based on the results of the free-flow and step pumping tests, a constant rate pumping test will be performed on the relief well if deemed necessary to confirm for decommissioning. The duration of this test may range from approximately 1 to 3 days or about 1.5 times the time estimated to grout WTN 112429 and to allow that grout to cure. During pumping, flow, pressure and drawdown at WTN 112429 will be recorded, and once flow ceases, depth to water measurements

in WTN 112429 will be made (referenced to pressure gauge height), until the end of the pumping test, after which recovery measurements will be made (both manually and with a pressure transducer) in both wells.

- Depending on results of initial pump testing and point of discharge's ability to receive water there may be an opportunity to curtail the pumping tests, as the primary objective is to determine the relief well flow required to kill flow in WTN 112429. Opportunities to derive relevant scientific information on the aquifer through testing and monitoring will be sought, but not at the expense of the project schedule or efficacy of closure operations.

Following completion of the testing program, WWAL will process data collected during relief well installation and testing for later inclusion in the project completion report. A preliminary report will be provided by the 31 March 2019 Milestone date per the Contract. We will confer with Drillwell on the appropriate rate for relief well operations during the upcoming decommissioning phase of the project and will update monitoring and data acquisition plans based on this. At this time an updated detailed schedule of works will be discussed and agreed on by the team for the upcoming decommissioning operation.

7. PHASE 5 DECOMMISSION WTN 112429

Drillwell will permanently decommission WTN 112429 using the materials and techniques described below. Rig will be repositioned on 6" well and casing shoe cut to minimize any difficulties extracting casing. Casing will be extracted to top of aquifer and void backfilled with granular material; granular material is preferred to minimize grout migration and fouling of nearby relief well. A bentonite plug will be placed at the top of confining layer to minimize grout flow into the relief well. A tremmie pipe will be lowered to the bottom of the well and cement grout will be placed using grout pumps to displace all water. Once grout returns to surface, the casing will be extracted and the grout level topped up as necessary, with the grout being placed across the entire thickness of the confining unit, thus re-establishing the seal across the confining unit. The relief well(s) will be operational throughout and following grout placement in WTN 112429 until the grout has fully set up and it is safe to cease aquifer depressurization. The relatively low artesian pressure indicated in the January 2019 assessment creates favourable conditions to complete the decommissioning. Once the grout is set up in the decommissioned hole, and the relief well is shut-in, full artesian control as defined in the Groundwater Protection Regulation will be achieved. This will then be verified during the two-year warranty period.

WWAL will visit the site during the decommissioning operation and continue to record flow and drawdown data on both wells until grouting begins. Once the grout has cured, we will be onsite to implement the gradual reduction in flow from the relief well to the flow level below which previous testing showed that WTN 112429 would flow. Once it is confirmed that flow from the now-sealed borehole does not occur, relief well pumping will cease and the relief well(s) will be shut-in. For planning purposes, the relief well would need to operate an additional two days beyond that done for the pumping test program to maintain pressure control at WTN 112429.

The final report (see below) will provide details on the recommended post-decommissioning monitoring plan. In the immediate aftermath of decommissioning, the Drillwell/WWAL team will visually monitor for evidence of water surfacing for several days following cessation of relief well pumping, and pumping equipment and operations will then proceed toward demobilization if there are no issues. Tasks performed during this phase of the work by WWAL include:

- Observing grouting operations and relief well pumping;
- Recording flow rate and drawdown data;
- Informing area landowners on completion of operations in accordance with project communications plan;
- Site visits to observe conditions following WTN 112429 closure;
- Conducting ongoing environmental monitoring in accordance with the EMP;
- Measuring discharge water quality and collecting water samples in accordance with the sampling plan;
- Discussing short and long term monitoring needs with the Ministry to help inform post-closure monitoring plans prior to reporting; and
- Downloading and processing field data collected by pressure transducers and dataloggers.
- Documenting demobilization of on-site and off-site materials and providing photos of same for project file.

Contingency Plans for Decommissioning

Although the Drillwell team is confident that WTN 112429 can be decommissioned per the procedures in this plan using one relief well, in the event it does not appear possible to decommission the subject well per the above described tasks, the contingency plans are as follows:

a) Install a second relief well to depressurize aquifer if needed and as authorized (i.e. Task 4B of Contract); then proceed to decommissioning after flow is killed with two relief wells.
b) As a last resort and only if necessary, decommissioning would be done by achieving control with two relief wells plus the installation of a relief port in WTN 112429. Cement would then be placed between the relief port and 6 inch casing while the casing is being pulled, and then the relief port would be pressure grouted.
c) Although unlikely, we note that WTN 112429 was installed by another driller and if the 6 inch casing fails on extraction (i.e. a weld breaks), a solution would be devised in the field for this. Drillwell will have the tooling needed to deal with casing failure, should it occur.

8. PHASE 6 PREPARE POST-CLOSURE REPORT FOR WTN 112429 WITH MONITORING PLAN

Following completion of all on-site works, WWAL will prepare draft and final hydrogeological completion report for Ministry review. Using the March 31 document as a starting point, this report will describe the works performed by the Drillwell team under this contract, summarizing the

preliminary planning, decommissioning plan, installation of relief well(s), test methods, interpretations and results; and full documentation of the decommissioning program. A recommended post-closure monitoring plan will be developed with input from the project team and Ministry, with a recommended budget for any instruments needed. For budgeting purposes, we have allowed for purchase of a dedicated pressure transducer and datalogger installed at the surface on the shut-in relief well. These instruments may be used during an interim period until the monitoring plan is finalized.

A draft report will be provided in PDF form for review and comment. We assume (and request) that the Ministry team will provide us with a single, coordinated set of comments back on the draft to facilitate efficient revision and finalization of the report. One draft and one final revision is budgeted for (see detailed budget estimate and assumptions in Appendix G). This Decommissioning Plan will form an appendix to the report.

The contents of the Post-Closure Report will be intended to fulfill the requirements of the Groundwater Protection Regulation (GWPR) as it pertains to the construction and decommissioning of flowing artesian wells. See GWPR Part 10, Section (80) and Schedule 1 for the details on the topics to be covered in the report.

At completion of the decommissioning project Contract, Drillwell will transition responsibility for the relief well to the property owner and will work with the Ministry on advising the property owner of the well owner's responsibilities under the GWPR (i.e. Part 8, Section (68) for maintaining the relief well (assuming that it will remain in place) and converted for use as a domestic well. WWAL and Drillwell will work with the Ministry and property owner to facilitate this transition.

APPENDIX A

Figures, Maps, Graphs and Sketches

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

Figure 1: Site Plan (Location)
Figure 2: Relief Well Schematic
Figure 3: Drillwell Site Layout Sketch
Figure 4: Drillwell Well Head Detail Sketch
Figure 5 Off-Site Water Management Features
Figure 6 Drillwell On-Site Water Management Sketch

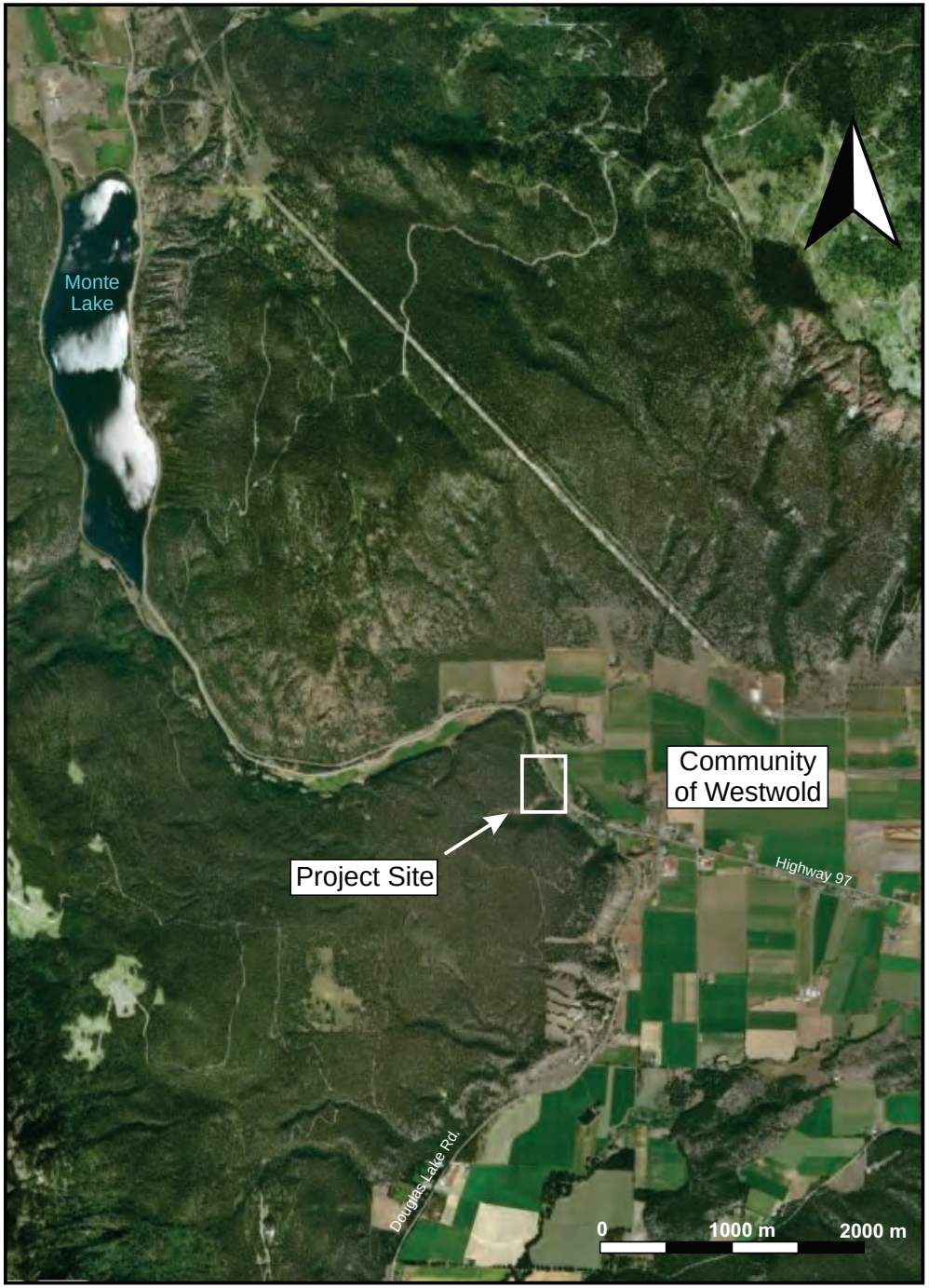


Figure 1 - Site Plan

Date: January 2019	Image Source: BC Water Resources Atlas (2019)		WWAL Project #: 19-002-01VR
Drawn by: PW	Checked by: DG	Client: MFLNRORD	Project: Westwold Flowing Well Decommissioning

western water ASSOCIATES LTD
Consultants in Hydrogeology and Water Resources Management

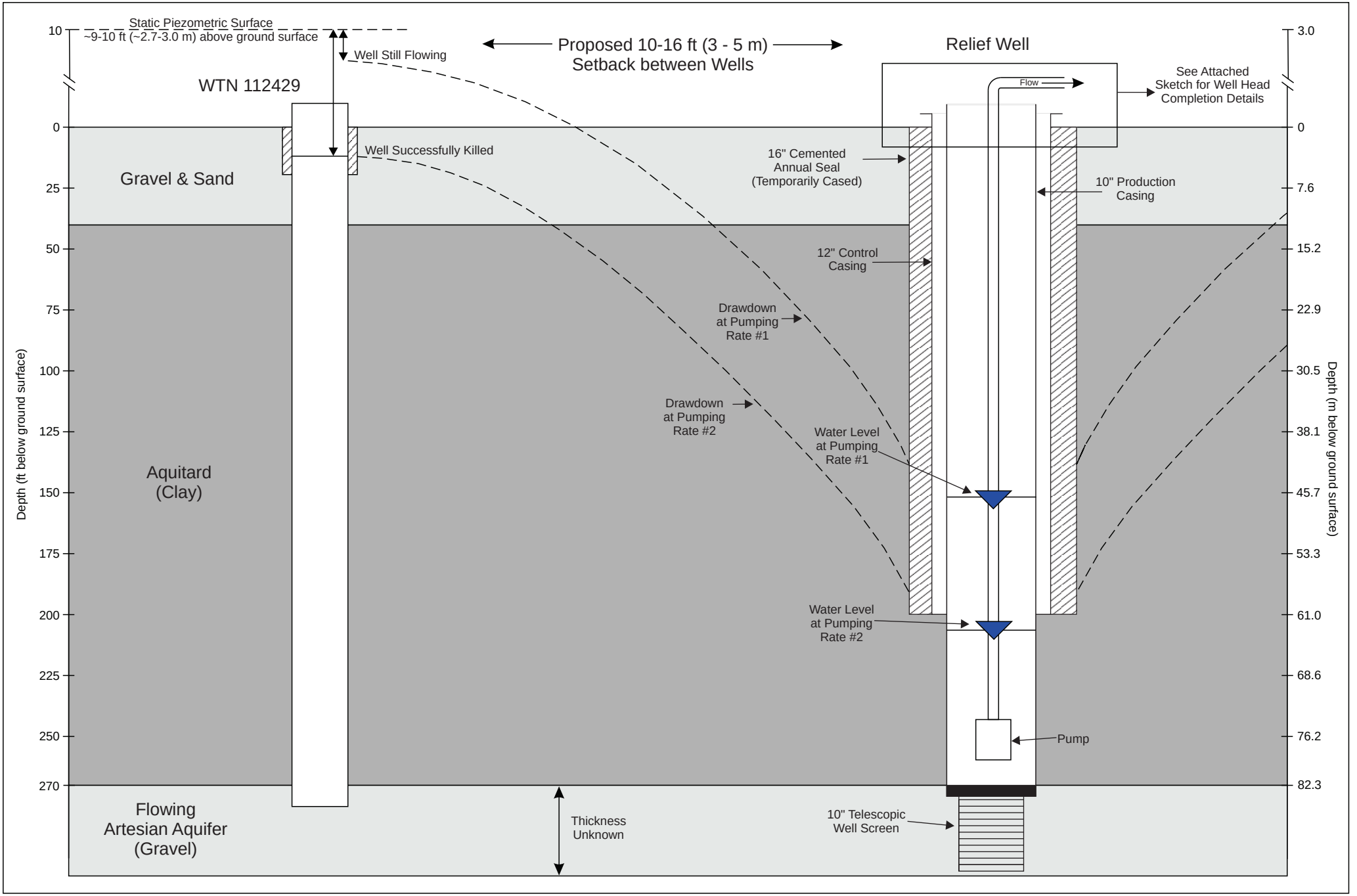


Figure 2 - Proposed Relief Well Design & Function

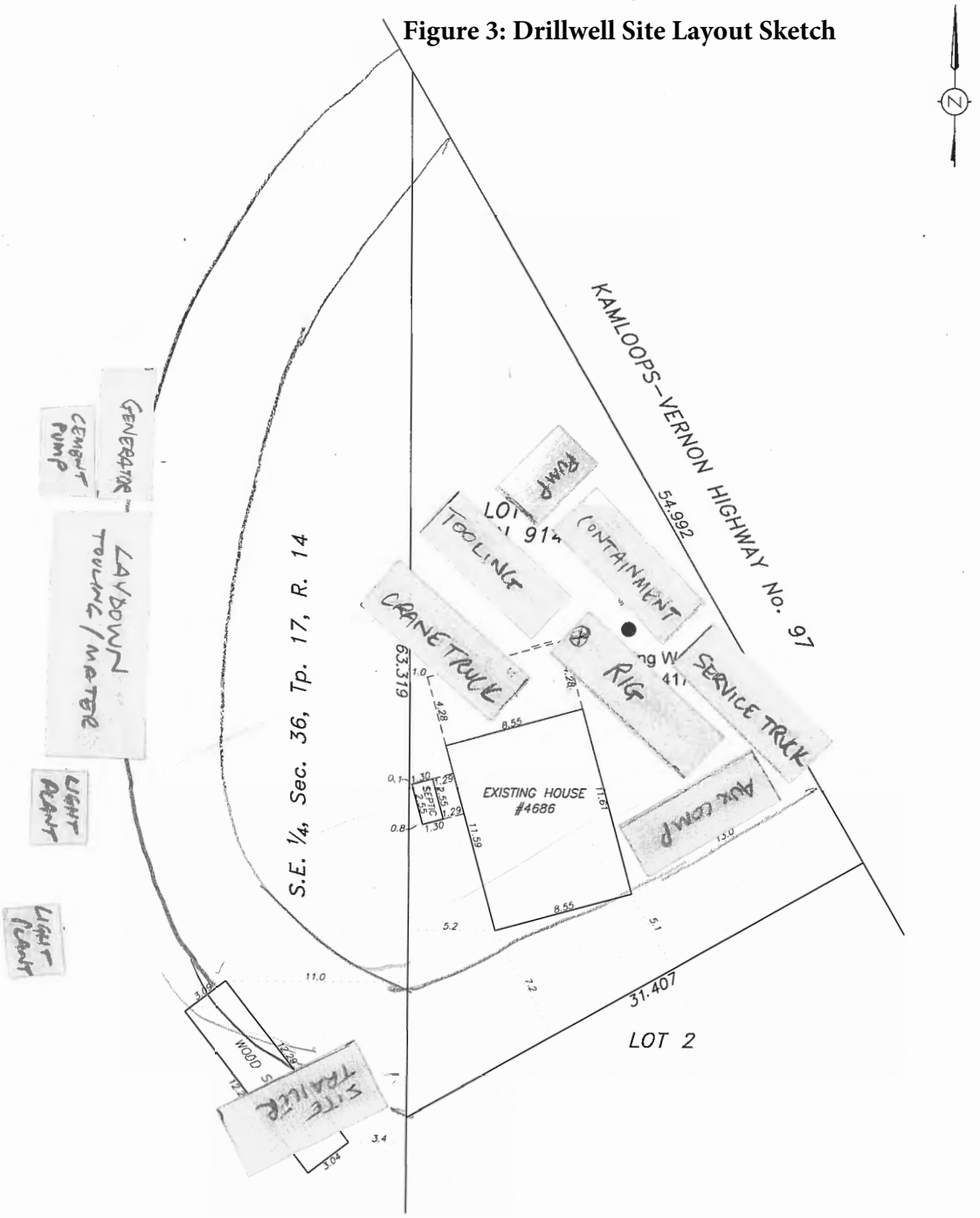
Drawn by: PW	Project: Westwold Flowing Well Decommissioning	WWAL Project #: 19-002-01VR
Checked by: DG	Client: MFLNRORD	Date: January 2019

western water ASSOCIATES LTD
Consultants in Hydrogeology and Water Resources Management

BRITISH COLUMBIA LAND SURVEYORS
CERTIFICATE OF LOCATION
LOT 1,
Sec 31, Tp 17, R 13, W6M,
KDYD, PLAN 9141

FILE No. VERANOVA PROPERTIES LTD.

Figure 3: Drillwell Site Layout Sketch



JOB NO. 14LS0586 SCALE 1 : 250

NOTE:
REFERENCE PLAN TO RE–ESTABLISH BOUNDARIES WOULD BE REQUIRED FOR AN ACCURATE DETERMINATION OF BUILDING OFFSETS.

Allnorth
Land Surveyors
#301–7 St. Paul St. W,
Kamloops, B.C. V2C 1E9
Phone (250)374–5331 Fax (250)374–5332
WALT SINGER BCLS – SCOTT RHODES BCLS, CLS
MARISSA MOORE, BCLS
ALLNORTH CONSULTANTS LIMITED,
W. SINGER LAND SURVEYING (2010) INC.,
S. RHODES LAND SURVEYING (2012) INC.,
M. MOORE LAND SURVEYING (2012) INC.,

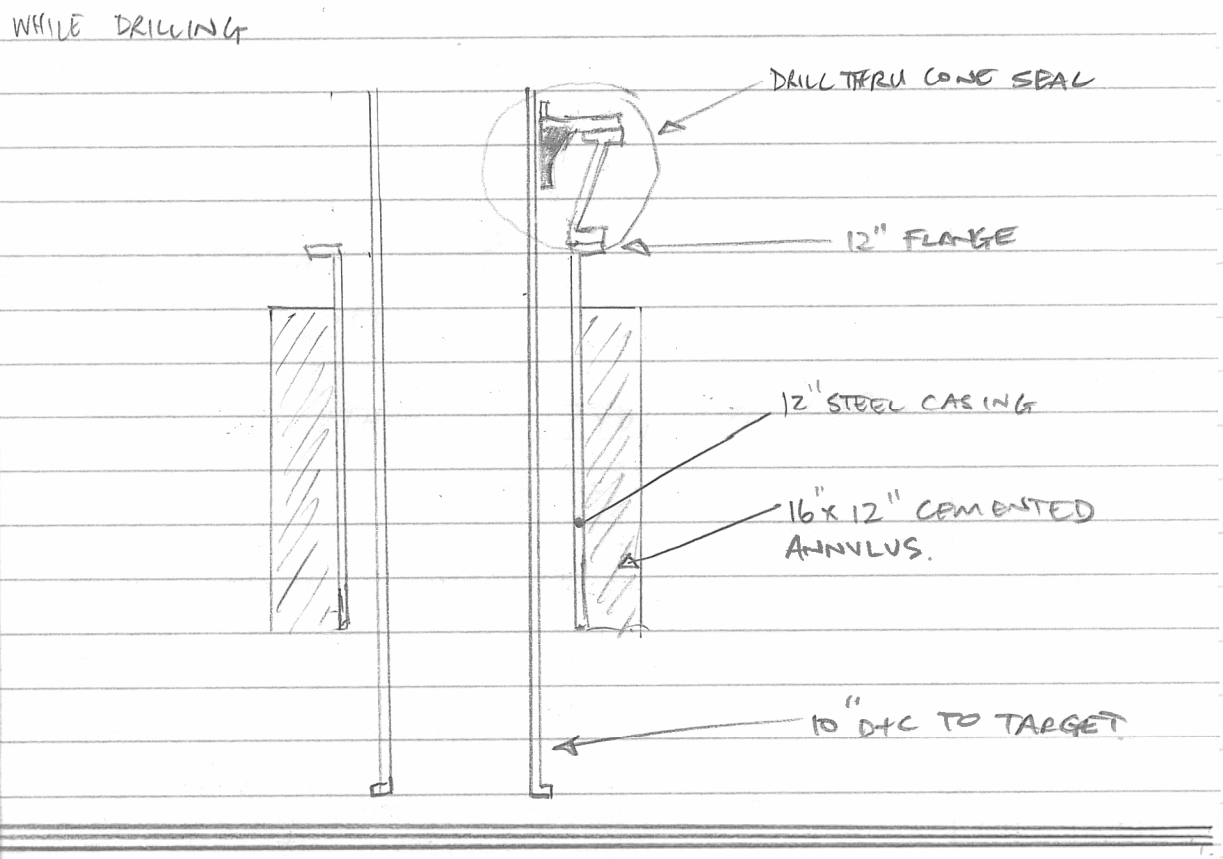
NOTE:
BOUNDARY DISTANCES ARE COPIED FROM PLANS ON RECORD AT THE LAND TITLE OFFICE. THIS PLAN IS FOR MUNICIPAL AND MORTGAGE PURPOSES AND SHOULD NOT BE USED FOR RE–ESTABLISHMENT OF PROPERTY LINES. THE SURVEYOR SHALL NOT BE RESPONSIBLE FOR ANY UNAUTHORIZED DISTRIBUTION OR REPRODUCTION OF THIS CERTIFICATE. THIS CERTIFICATE IS VERIFIED ONLY IF SIGNATURE IS ORIGINAL AND SEALED.

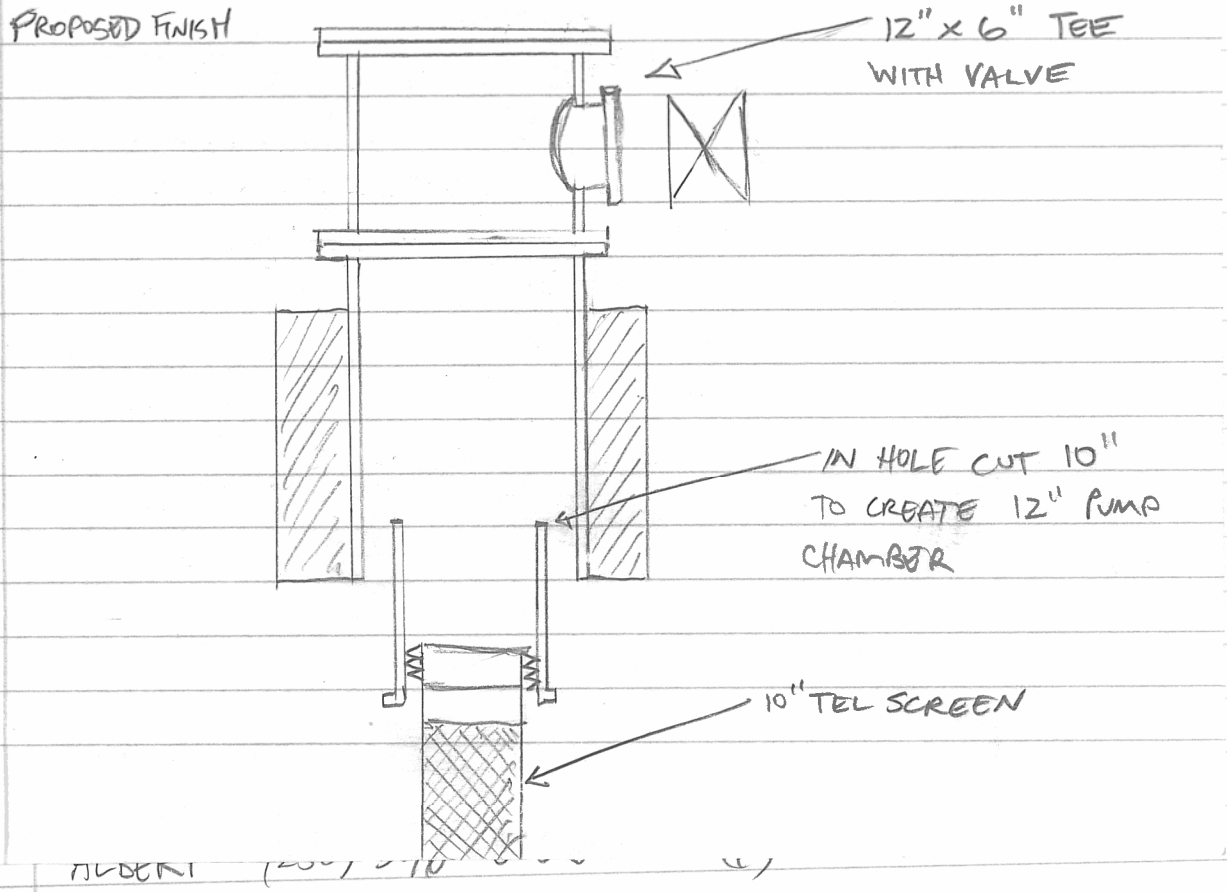
CERTIFIED THIS 6th DAY OF NOVEMBER, 2014.

B.C.L.S.

© KB

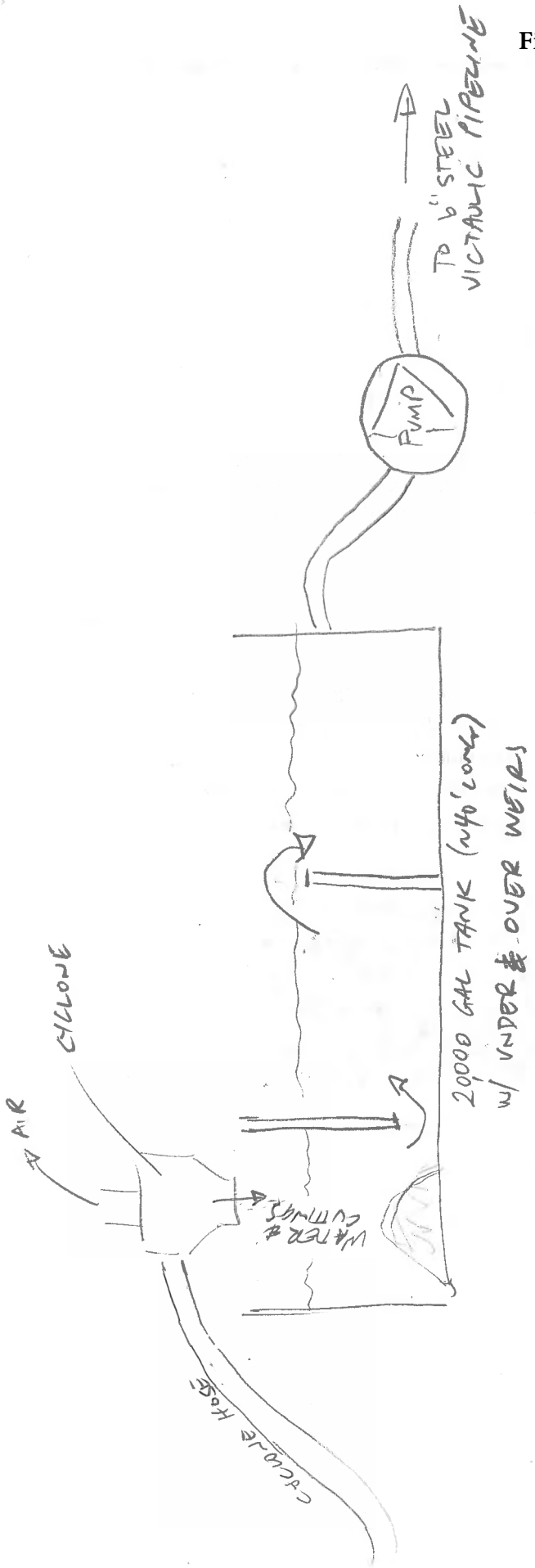
Figure 4 Drillwell Well Head Detail Sketches





Westwold Well Decommissioning	TITLE **Figure 5:** Off-Site Water Management Features			
western water ASSOCIATES LTD	DRAWN GL	DATE January 2019	PROJECT NO 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	

Figure 6: Drillwell On-site Water Management Sketch



APPENDIX B

Site Management, Parking and Safety Plans

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Drillwell Enterprises
4994 Polkey Road
Duncan, V9L 6W3, B.C.

Phone: (800) 746-7444
Fax: (250) 746-8404
Email: drill@drillwell.com

WESTWOLD FLOWING ARTESIAN CONTROL

PROJECT: Relief Well Construction and closure of flowing well

Equipment:

- Foremost DR-24 or 24HD Dual Rotary Drill Rig
- 27,000 GVW Flatbed truck(s) with Folding Boom Crane
- 14,500GVW Service truck(s)
- ETV, pickups, tow behind lightplants, compressors, pumps, ect.
- Misc. Tooling for DR-24

Safety:

- Drillwell employees shall have Level 1 First Aid training with Transport Endorsements.
- If 6 or more employees are on site there will be an ETV (emergency transport vehicle) available.
- Workers (and all visitors) will sign in and out at office.
- Daily toolbox meeting and Pre-job hazard assessments are performed every morning before commencing work.
- Job board to be posted at office with Emergency Response Plan, Routes to Hospitals, Monthly Safety Meeting Minutes, Daily JSAs, Site Inspections, Permits, Site Map, ect.
- Appropriate PPE to be worn by all including High-vis clothing, side impact hard hats, safety glasses, steel toed boots and hearing protection.
- Fire extinguisher to be maintained at all cutting and welding work areas.
- Maintain communication with drill and crane operators at all times when in working radius of equipment.
- **Adherence to Drillwell H&S policy**.

Mobilization:

- Site improvements to be performed prior to mobilization to allow safe, easy access for large commercial vehicles.
- DR-24 rig is on a truck frame and will arrive under its own power
- Drill rods, hammer, bits, cyclone and casing, cyclones, ect will arrive on Flatbed truck(s) and be offloaded.
- Once the project is completed the reverse procedure will be used to demobilize the equipment and tooling.

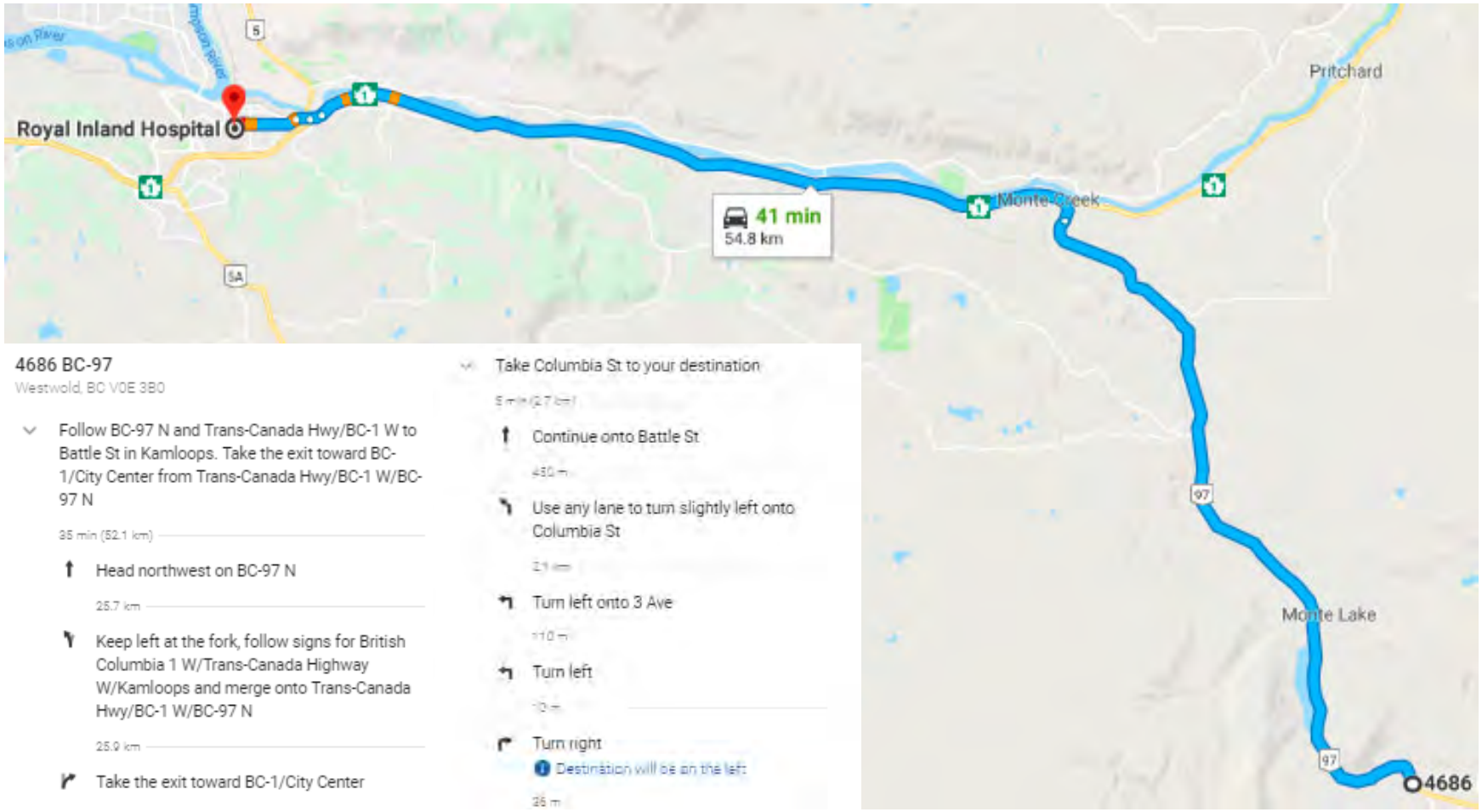
PRIME CONTRACTOR	
ADDRESS:	4994 Polkey Rd, Duncan BC, V9L 6W3
OFFICE #:	(250) 746-5268
AFTERHOURS#:	(250) 381-1990
SITE INFORMATION	
ADDRESS:	4686 Highway 97 (Kamloops Vernon HWY), Westwold
POLICE, FIRE, POISON AMBULANCE:	911

Clearly state to the emergency service the following information:

Your name and the company site name.
The exact address of the site & the location of the injured person (if applicable).
A brief description of the incident that occurred or relevant information.
A brief description of the suspected injuries [if you know] and the number of injured persons.
DO NOT HANG UP until operator advises they have all necessary information.
After any emergency service is called, phone the site supervisor as soon as possible.

MEDICAL FACILITY #1:	Royal Inland Hospital – Open 24hrs
ADDRESS:	311 Columbia Street, Kamloops
CONTACT #:	(250) 374-5111
MEDICAL FACILITY #2:	Vernon Jubilee Hospital – Open 24hrs
ADDRESS:	2101 32 St, Vernon
CONTACT #:	(250) 545-2211
SITE SUPERINTENDENT	
WCB CONTACT INFO	

Additional documents to be available at job board include Emergency Response Plan, Routes to hospitals, Monthly Safety Meeting Minutes, Daily JSAs, Site Inspections, Permits, Site Map, Notice of Project, ect.



4686 BC-97
Westwold, BC V0E 3B0

Follow BC-97 N and Trans-Canada Hwy/BC-1 W to Battle St in Kamloops. Take the exit toward BC-1/City Center from Trans-Canada Hwy/BC-1 W/BC-97 N

35 min (52.1 km)

Head northwest on BC-97 N

25.7 km

Keep left at the fork, follow signs for British Columbia 1 W/Trans-Canada Highway W/Kamloops and merge onto Trans-Canada Hwy/BC-1 W/BC-97 N

25.9 km

Take the exit toward BC-1/City Center

Take Columbia St to your destination

5 min (2.7 km)

Continue onto Battle St

450 m

Use any lane to turn slightly left onto Columbia St

2.1 km

Turn left onto 3 Ave

110 m

Turn left

70 m

Turn right

Destination will be on the left

26 m

Royal Inland Hospital – Open 24hrs
311 Columbia Street, Kamloops
(250) 374-5111

DRILLWELL

HEALTH & SAFETY POLICY & PROCEDURES

REVISED JANUARY 2018

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Health and Safety Policy

Drillwell Enterprises is committed to providing a safe and healthy work environment in all of our day-to-day operations. A safe and healthy work environment is a right of all workers and this policy extends to our sub-trades, clients, other site personnel and members of the general public. All new employees of Drillwell Enterprises Ltd. will receive a new worker safety orientation detailing their health and safety requirements and responsibilities as well as those of the management and supervisors of the company. Employees will receive a copy of the company safety program and all updates as they become available.

Worksafe BC Occupational Health and Safety Regulations will be considered the minimum standards for work procedures in the shop and in the field. All available employees are required to participate in minimum monthly safety meetings as well as any added safety training that the management of Drillwell Enterprises Ltd. deems necessary for the safe performance of duties.

All employees are required to correct and/or report all unsafe conditions and work procedures without delay. The supervisors and management of Drillwell Enterprises Ltd. will address all workers' concerns, investigate and act without delay to prevent incidents, industrial injury and disease. Documentation of all concerns and incidents will be kept as required by the OH&S Regulations.

It is our objective to eliminate workplace injuries by having well trained, safe and conscientious company employees. A safe and healthy workplace is a basic right of all workers. We will work in the spirit of consultation and cooperation with workers to meet this objective. Drillwell Enterprises Ltd. expects its employees to present a professional and safety first attitude to other trades, clients and the public.

Jan 31, 2018

Colin Slade - Partner

Date

Management and Supervisors Responsibility

The management and supervisors of Drillwell Enterprises Ltd. will enforce the Worksafe BC OH&S Regulations at all times, and on every project, with all workers and sub-trades under our responsibility. Every effort will be made during the planning of work to eliminate potential safety hazards, reduce all hazards to the lowest level of danger, and to utilize specialty equipment and procedures as necessary.

The management of Drillwell Enterprises Ltd. will view the safety of workers as their foremost responsibility and will provide, by means of direction to supervisors, general safety training and specific safety procedures, and all the tools necessary to maintain a safe work place. Regular documented safety inspections, at intervals frequent enough to prevent any hazardous conditions from developing will be conducted. Informal and documented discussions with supervisors and workers will take place whenever and wherever required to ensure the ongoing safety of all. In addition, specialized safety training will be provided to any workers the management or supervisors of Drillwell Enterprises Ltd. identifies as requiring added training to safely perform any specialized task.

Supervisors must ensure that workers are never placed at an undue hazard, and that all tasks will be monitored to ensure that the safest procedures possible are being utilized. Supervisors are responsible for the safety and supervision of the workers in their charge. All supervisors will effectively reduce and control hazards, and will report to management any problematic procedures.

Safety violation forms, new worker safety orientations, investigations, first aid treatment records, injury statistics and other documentation will be kept on file. The recording and documentation of information may be delegated to supervisors or others. Safety warnings that have been issued to workers, sub-trades or others will be enforced without prejudice by the management of Drillwell Enterprises ltd., and appropriate corrective measures will be implemented, including the consultation and involvement of Worksafe BC, as necessary.

Workers Responsibility

All workers employed by Drillwell Enterprises Ltd., either directly, or as a sub-contractor to Drillwell Enterprises Ltd. must abide by the Drillwell Enterprises Ltd. Safety Program while performing all work and duties related to any Drillwell Enterprises ltd. jobsite or contract. Any infraction of Worksafe BC's OH&S Regulations is subject to disciplinary action on behalf of Drillwell Enterprises Ltd. Details are included in Drillwell Enterprises Ltd.'s Worker Disciplinary Policy.

It is a responsibility of every worker to recognize workplace hazards. This includes conditions that may arise from the work processes being performed. Not only to protect themselves from harm, but fellow workers and the public as well. If there is a possibility that the public or an un-authorized worker may enter the work area, these work areas must be effectively cordoned off to prevent incidents and injuries.

Every worker is responsible to correct and/or report to a supervisor all unsafe conditions, acts and procedures. Failure to report unsafe acts and conditions may result in disciplinary action. All workers are reminded of their right to refuse unsafe work. All injuries must be reported to a supervisor, and treatment obtained by a first aid attendant. A record of every injury will be kept on file.

When a site is under the jurisdiction of a prime contractor, all site safety rules and procedures must be followed. In the event that an unsafe act or condition is the result of another contractor's work, the prime contractor's office or safety representative must be notified immediately, and all Drillwell Enterprises Ltd. Employees will stay back a safe distance until the condition or act has been rectified.

Subcontractor Responsibilities

In addition the requirements and responsibilities listed above all subcontractors must have a valid WCB account and be in good standing with WCB.

Violence, Harassment or Abuse in the Workplace

Drillwell is committed to providing a workplace free of verbal or physical abuse or harassment.

Every employee of Drillwell is entitled to be treated with dignity and respect regardless of their age, seniority, race, religion and sexual orientation. The management of Drillwell will not tolerate workers who engage in harassment, or physical or verbal abuse. All persons are expected to treat their fellow employees, their supervisors, and others on the job site with good manners and restrained behavior.

Any incidence of work place violence will result in the immediate suspension of the person or persons engaged in the acts of violence. The minimum suspension will be one week without pay, and the maximum will be termination of employment subject to the discretion of the management.

Any confirmed reports of verbal abuse or harassment will result in a verbal and a written warning, with a permanent entry into the personnel file. Any subsequent instances of verbal

harassment or abuse will result in the suspension or dismissal of the offending employee at the discretion of the management.

Drug and Alcohol

Policy

Drillwell Enterprises acknowledges that the use of illicit drugs and the inappropriate use of alcohol, prescription and over the counter medicine can have serious adverse effects on the safety and well-being of workers, contractors and the public. Drillwell Enterprises is committed to maintaining a safe work environment for all employees and those in the public who may be affected. As such, this commitment includes reasonable cause drug and alcohol testing of all employees.

Requirements

The use, possession, concealment, transportation, promotion or sale of illegal substances or items, by any employee, contractor, subcontractor, their employees and invitees is strictly prohibited. Employees will report for work fit for duty; safely able to perform their required duties without any limitations including those that are due to the use (or after effects) of alcohol, drugs or other substances.

Enforcement

As a condition of employment or continued employment, all employees shall be deemed to have and agreed to cooperate with the implementation of this policy and abide by its terms. In addition, as a condition of employment or continued employment, all employees shall be deemed to have agreed to the following enforcement procedures.

Searches and Inspections - An individual’s entry into, or presence at, company property, or project work sites, is conditional upon such persons consent to the right of the company, its authorized representative, or appropriate law enforcement personnel to search the person, his vehicle and personal effects for the presence of unauthorized, prohibited, illegal, or controlled drugs, chemicals or substances, alcohol, explosives, contraband, or firearms.

Drug and Alcohol Testing - A Pre-employment drug and alcohol screen will be required of all persons, prior to being approved for work on the premises of a customer where required. A Post-accident drug and alcohol screen will be required of any employee involved in an on-the-job accident when the incident could be attributed to substance abuse. A "Reasonable Cause" drug and alcohol screen will be required of all persons who show signs of possible intoxication or using or being under the influence of drugs or alcohol, or when such other circumstances exist that would lead a prudent supervisor to be concerned about the employee's safety and the safety of others.

Testing Procedures

Drillwell Enterprises will designate a testing company (CannAmm or similar) to perform pre-access screening service using provincially recognized standards and detection levels. This pre-access screening includes testing for the following substances: cannabinoid, cocaine, phencyclidine, opiates, amphetamines, ecstasy and alcohol.

Disciplinary Action for Non-Compliance

- No search, inspection or drug test will be conducted without consent. However, any employee who refuses to provide such consent and fully cooperate with this policy will be subject to disciplinary action up to and including discharge from employment.
- Under certain circumstances, disciplinary action may include a mandatory referral to and enrollment in an approved rehabilitation program at the employee's expense. This action may also require an indefinite suspension of regular employment.
- An employee's job is not in jeopardy by reason of his voluntary admission to having a substance problem and request for help and referral to an approved rehabilitation program, provided there has been no prior violation of this policy, and the employee has not previously been through rehabilitation while employed with the company. Employees participating in this rehabilitation program will be subject to follow-up or "maintenance" testing.
- If the final result of a "reasonable cause", "post-accident" or "maintenance" drug screening is positive, the employee will be terminated. No terminated employee can be reconsidered for reemployment sooner than six (6) months following termination.
- Any terminated employee who is subsequently rehired and later fails another drug screen will no longer be eligible to be reconsidered for employment.

Administrative Guidelines:

All employees will be informed regarding this policy at the time of employment. Additionally it will be discussed periodically at "tail gate" safety meetings.

In the event an employee or terminated employee requests a review be conducted regarding his/her positive test result, the laboratory will conduct a retest and will make the results of the retest available to the employee or terminated employee provided the request is made within 12 months following the initial test. In the event that the retest is also positive, the employee or terminated employee will be required to pay for the cost of such retest.

An employee who has a substance problem is encouraged to seek immediate assistance. Drillwell Enterprises will provide the employee with the name and address of local agencies or facilities that are equipped to provide the rehabilitation assistance needed by the employee.

The employee may be eligible for a one-time leave of absence from work for a period of up to 30 days, for the purpose of enrolling in an approved rehabilitation program. As a condition of employment such employee must test negative on a substance test in order to return to work. Such request must be made well in advance of any request by the company to submit reasonable cause substance screen.

Client Requirements

In the event that a client has an Alcohol and Drug Testing Guideline that is more stringent than those outlined above, the client's guidelines will be followed for all work done with that client.

General Rules

- All accidents must be reported immediately to your supervisor/foreman, and prior to leaving the workplace.
- All workers must have proof of training indicating that they are trained in WHMIS.
- Workers must wear appropriate PPE when and where required.
- Workers must perform all work following safe work practices and safe job procedures.
- Workers must maintain good housekeeping.
- No fighting or horseplay is permitted at the workplace.
- No theft or vandalism will be tolerated at the workplace.
- No possession or consumption of alcohol or illegal drugs is permitted while at the workplace.
- You are not permitted to arrive or remain at work if your ability to perform the job safely is impaired.

Worker Disciplinary "Zero Tolerance" Safety Policy

All personnel employed with Drillwell Enterprises Ltd., or sub-trades hired to perform work by Drillwell Enterprises Ltd. must follow established safety protocols, where and when required.

Failure to follow or implement company safety program procedure will result in immediate disciplinary action and possible termination of employment. Only one written warning may be removed from any employee file per calendar year, at the discretion of Drillwell Enterprises Ltd. management.

Safety is everybody's business. Safety is our greatest concern!

In the event of a worker contravening a WorksafeBC regulation or a company safety program policy, the following guidelines shall be implemented:

1. Immediately remove the worker(s) from the hazard in question. Contact the Drillwell Enterprises Ltd. site supervisor and office with the worker's name. Sub-trade personnel may be permanently removed from any or all Drillwell Enterprises Ltd. sites for non-compliance of safety regulations.

2. After review of the facts, the company representative will initiate appropriate disciplinary action. Guidelines for discipline are as follows:

- FIRST OFFENCE: The worker and/or supervisor will receive a written Safety Violation notice, and it will remain in their personal file for the duration of employment, including future employment with Drillwell Enterprises Ltd.
- SECOND OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for one (1) working day. Worker and supervisor will sign document.
- THIRD OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for five (5) working days. Worker and supervisor will sign document.
- FOURTH OFFENCE: employment will be terminated, effective immediately.

There will be no exceptions to this zero tolerance policy!

Hazard Assessment

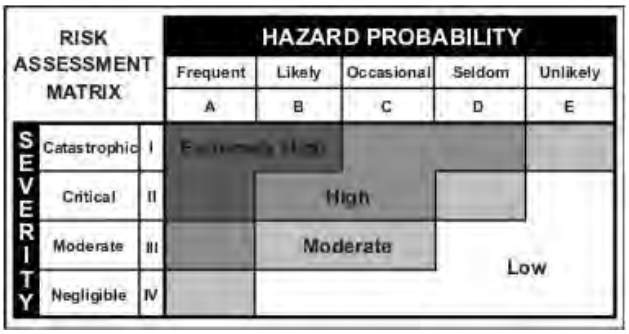
JSA

Written pre-job safety assessments (JSA) shall be performed to determine if hazards are present, or are likely to be present, which necessitate the use of PPE. These exercises are done during morning tailgate meetings and updated during the day as the work or site conditions

change. Drillwell will provide the JSA form unless the client or consultant's shared written JSA meeting includes the following:

- the job to be analyzed
- break down of the job into a sequence of steps
- identification of potential hazards prioritized
- list of identified critical tasks
- determination of preventive measures to overcome these hazards

Assessment of risks will use the following matrix.



LMRA

Last minute risk assessments (LMRA's) are informal, individual, mental hazard assessment of a task. It is intended to focus a worker's attention on the task and is performed before and during the work. It helps identify any unsafe behaviours and hazardous conditions that may have been missed in preparation for the work or which may have developed during the job. This process helps guard against rushing, frustration, fatigue, and complacency by forcing an individual to stop and consider the following:

- Understand the task and hazards
- Assess the risks
- Mitigate the risks

PPE and General Safety

Personal protective equipment (PPE) is the last means of protecting workers from injury. PPE is employed when administrative and engineering controls are ineffective or insufficient. Hazards should be minimized by ensuring that all jobs are well planned, workers are properly trained, and safe work practices and safe job procedures are followed. PPE provides an additional degree of protection from injury. All PPE is to be selected in accordance with standards outlined in OHS regulation.

All workers must equip themselves with Basic PPE including suitable clothing, shirts, and long pants for protection against both weather and workplace hazards. Unless otherwise agreed upon workers are also responsible for providing their own gloves and safety footwear.

Drillwell will provide specialized PPE including hardhats, eye, hearing, fall and respiratory protection along with any other specialized protective equipment required by the Occupational Health and Safety Regulations.

Minimum Health & Safety Requirements for all Drillwell Sites

1. Safety of Drillwell staff and of others in proximity to work site is of utmost importance.
2. Cell phone, land line phone, or radio access to emergency services must be verified.
3. Contact information for onsite first aid facilities, and route to hospital to be verified.
4. Normal precautions for pinch points, and rotating equipment.
5. Normal precautions for overhead and underground hazards.
6. Direction of discharge cuttings and water to be positioned to try and minimize detrimental impact to property and/or water courses.
7. Standard PPE (personal protective equipment); Steel toes, Hard hats, Safety glasses, Hearing protection, High vis.
8. At least one WCB Level 1 first aid attendant on drill site.
9. Adherence to all relevant WCB regulations.
10. Adherence to all relevant client and site specific safety standards and regulations.
11. Adherence to all Drillwell Safety Plans, Policies, and Procedures.
12. Do not use cell phones or other wireless hand held devices (excluding radios) while driving.

Basic PPE

Workers requiring PPE will be trained in the following:

- Exposures and how to identify them;
- Types of PPE to wear as protection from each exposure;
- When to wear them and their limitations;
- How to wear PPE properly; and
- How to care for, clean and properly store PPE.

Clothing

- Shirts required
- No excessively loose clothing.

- No large rips or tears.
- No short pants.
- Dress appropriate for the season.

CSA Grade 1 Footware (Green Tag)

- Wear appropriate protective footware at all times.
- Boots are to be CSA Grade 1 approved with toe protection and puncture resistant sole.
- Lace up boots fully. Laces should be appropriate length to avoid catching on things
- Make allowance for extra socks or insoles
- Boots should fit snugly around heel and ankle when laced
- Walk in new footwear to ensure it is comfortable
- Inspect footware regularly for damage
- Replace or repair damaged or defective footware
- Use a protective coating to make footware water-resistant
- C.S.A. runners only when traveling or very light duty work

Specialized PPE

Hard hats:

- Hard hats are to be worn if there is a risk of head injury or the site requires it.
- On some sites a chin strap may be required.
- Hard hats to be replaced every 5 years.
- Suspension should be adjusted so that hardhat fits snugly without causing any discomfort.
- Inspect and replace hard hats that show signs of wear, scratches, cracks or gouges.
- Hard hat that have been struck should be replaced even if no damage is visible
- Suspension should be kept clean and replaced if there are signs of torn adjustment straps or frayed or broken.

Hi-Vis coveralls

- Coveralls are to be worn on all worksites.
- Coveralls are to be hi-vis and fire retardant.
- Fit should allow for extra clothes underneath but not so loose as to cause risk of entanglement
- Legs and sleeves can be hemmed as required
- Coveralls are to be dropped off for washing as required.
- Broken zippers, ripped seams and tears to be tagged before being dropped off.

- Mandatory for all workers in close proximity to moving equipment, in an excavation, during excavation, during traffic control, or during hoisting operations
- Good practice for all workers to wear at all times.

Eye Protection

- CSA certified safety glasses to be worn whenever there is a risk to eyes or as required by site.
- Frames should be adjusted so that the arms fit comfortably over the ears and the frame is close to the face and supported by the bridge of the nose.
- Glasses to be kept clean following manufactures instructions
- Avoid rough handling or storage that can scratch lenses. Scratched lenses impair visibility and can reduce impact resistance.
- Damaged glasses should be replaced as necessary
- Mandatory for all tasks involving flying debris
- Mandatory when working near equipment & rigs
- Mandatory for all workers near torching operations
- No excuses for failure to comply

Face Protection

- Face shields are NOT protective eyewear; they should be worn in conjunction with safety glasses or goggles.
- To be worn when there is a risk of flying projectiles
- Avoid rough handling or storage that can scratch lens. Scratched lens will impair visibility and can reduce impact resistance.
- Damaged face shield should be replaced as necessary

Hearing protection

- Mandatory for all loud tasks
- Annual test mandatory must carry card
- Disposable Foam ear plugs or ear pods are of universal size.
- If neither foam nor pod fit comfortably another form of hearing protection should be considered.
- Disposable plugs should be kept clean and dry.
- Cardboard containers they come in can be used for short term storage
- Should they become dirty or damaged they should be replaced.

Respiratory protection:

- Mandatory for tasks involving moderate to high levels of dust/fumes/vapours/mists. Check OH&S regs for exposure limits.
- Control contaminants at the source whenever possible
- When controls aren't sufficient or during emergency situations with high exposure respiratory protection will be used.
- If in doubt respiratory protection should be employed
- Respiratory protection employed will be suitable for the task and environment.
- Where gas is expected forced ventilation and gas detectors shall be employed.
- Documented Fit testing, proper use and maintenance is required only if respirator is required.
- Fit testing to be performed by 3rd party.
- Respiratory equipment and training to be provided by employer

Fall protection:

- MANDATORY FOR WORK AT 10 FT. OR ABOVE
- Documented training required
- Daily inspection of equipment.
- Proper fit and use
- Work positioning system for derrick work at all times
- Zero tolerance for non-compliance.

General Orientation Topics

W.H.M.I.S. program

- Proof of training (federal law)
- Location of MSDS sheets
- MSDS sheets for all controlled products.
- Transport sheets & Controlled products together
- No decanting of products without proper labels.

Safety Meetings:

- Mandatory for all workers at site
- JSA at the beginning of each job
- Covers current issues, upcoming hazards etc.
- Reviews recent incident and near miss investigations.
- Covers recent safety inspections and written incident or safety violations issued.

Safety inspections:

- Safety checklists must be completed daily, and prior to starting each job.
- Workers are responsible to ensure their machines and the work areas are safe each day.
- Safety coordinator conducts safety inspections on surprise basis.
- Surprise inspections could include WorksafeBC

Personal medical conditions:

- First Aid attendants need to be aware of conditions like heart disease, epilepsy, diabetes, high blood pressure, etc.
- Medical alert bracelet
- Strict confidentiality of information.

Fire Hazards:

- Smoking is prohibited while handling/during refueling operations
- All flammable liquids must be properly stored
- All petroleum must be stored in approved containers
- Sources of ignition must be controlled during re-fueling
- All equipment gas equipment must be shut off during refueling
- Fire extinguishers must be kept clean & in good condition.
- Ensure careful, proper disposal of cigarette & cigar butts.
- Extreme hazard requires 1/2hr fire watch
- Wet ground after hot work

Pointed Hazards:

- Be aware of falling on any vertical point hazards around the rig
- Cover grade stakes with pails or off-set to a safe distance
- Rebar and other points must be bent over or effectively guarded.
- Do not lean or stand shovels, pry-bars etc. near rigs.

Rebar protection:

- Bend rebar to horizontal whenever possible
- Vertical rebars are guarded if unable to bend over.
- Mushroom caps are for horizontal rebar only.

Hole coverings:

- All openings larger than 6 inches must be securely covered with plywood or steel & marked with a circle, with an “X” through the center.
- Guard rails if the opening is too large to cover.

Electrical protection:

- All power cords to be medium or heavy gauge and in good condition.
- All power cords must be grounded. (3 prong plugs)
- All power cords are to be in good repair, or exchanged in shop ASAP and marked as needing repair.
- Power tools are to be double insulated or grounded plugs.
- Electricians or Drillwell Enterprises ltd. designated tool repair technician only to affect any electrical repair to any tools or equipment.

Power tools (including Pneumatic):

- Must be in good operating condition with no alterations.
- Always use the right tool for the task.
- Wear the appropriate PPE
- Guards are not to be removed.
- All manufacturers’ instructions are to be followed.

Transport of personnel & equipment:

- Seatbelt and all M.O.T. laws must be adhered to
- Only authorized personnel may operate vehicles & equipment.
- No workers allowed to ride on equipment except in a proper seat

Power lines:

- Location (underground, overhead).
- Clearances required.
- Locations of temporary power panels.
- Caution for temporary power lines, cords etc.
- Drillwell Policy is 20 ft. from unshielded power lines until voltage is verified

Housekeeping:

- Daily ritual
- Single worker or crew clean-ups.
- Nails and other sharp hazards bent over or removed.

- Awareness of fire hazard associated with the accumulation of debris.

Cranes and rigging:

- Current inspection sticker on crane.
- Qualified operator. (obtain copy of certificate) if required.
- Proper hand signals or dedicated radio frequency.
- Inspected rigging equipment with WLL tags.
- No loads over workers.
- Point/intended loading; be certain landing area can support the load.

Torching Operations:

- No debris or combustibles nearby.
- No petroleum products or batteries nearby.
- Fire extinguishers in close proximity.
- Personal protective equipment utilized.
- Proper signage to protect other workers/public
- Tanks secured, capped and not hoisted without proper cage.
- All components in good condition.
- Flash arrestor required

Forklifts/Bobcats/Manlifts:

- Only properly trained, authorized workers may operate forklifts and bobcats. In addition to training and authorization certification required for manlift operation.

Name of Supervisor:

- Know the name and contact # of supervisor

Instruction & Demonstration:

- Provide instruction and demonstrate the skills for the tasks the worker will be required to perform.
- Document competency of worker's skills after observation.

Health & Safety Representative:

- Provide contact info for the H&S representative

Safety Orientation Signoff

The safety orientation is mandatory for all workers. Each person is required to sign and date the orientation document to show they have received and understood the information. A copy of the orientation document may be provided to the worker.

Inspection & Preventative Maintenance

All tools, equipment, rigs and vehicles will be well maintained in order to minimize down time and prevent damage to person or property. Operators of equipment will be familiar with inspection and maintenance schedule of their equipment and will be responsible for ensuring the recommended maintenance schedule is adhered to.

Pre-trip and post inspections are a requirement of all commercial vehicle drivers. All rigs and cranes will have equipment inspection forms completed before daily operation. All maintenance (scheduled and otherwise) on vehicles and equipment will be recorded and submitted to the office and filed under the unit number.

Lockout Tagout Policy

Maintenance of equipment can be a hazard in itself. Any equipment that is taken out of service must be tagged and or locked out.

This policy applies to equipment such as rigs, cranes, trucks and hoists while greasing, maintenance or other work is being performed whereby individuals could be injured by the unexpected starting, or engaging of engines, clutches or shafts.

Lockout and tagout procedures also apply to power tools, extension cords, fall arrest equipment, hoisting and lifting equipment including slings, hooks, chains and other rigging.

Any equipment that has been taken out of service must be tagged with the date, the reason for tagging, and the name of the person who initiated the tagging.

Tags when used on rigs and large equipment are to be removed only by the equipment operator or with the equipment operators' authorization. Tags when used on power tools, extension cords, fall arrest or rigging and hoisting equipment are to be removed only by the site foreman, or by authorization from the site foreman.

Training and Communication

Safety Orientation

It is critical that all workers and visitors new to a construction site are properly informed of the safety rules and plans for that site. Prior to commencing work, the new worker must be made

aware of any and all hazards, emergency plans and procedures. A site-specific safety orientation should be received from the site Safety Coordinator (Driller or Foreman). This will be the Safety Coordinator's opportunity to explain the rules, how those rules will be enforced, and to collect/request documentation that will be required.

All new workers will be given a safety orientation, which includes, but is not limited to, the following subject matter:

Company policy:

- Workers must comply with all site rules and procedures.
- Review Company Health & Safety Policy
- Review Management & Worker's responsibilities
- Workers must be trained by Drillwell Enterprises ltd. and/or provide documented proof of training.
- Adhere to the minimum WorksafeBC regulations and standards.

General rules:

- Read any posted site rules, site hour's etc. as applicable
- Read any site safety plans as applicable.
- Designated smoking area
- No violence, practical jokes or horseplay.

Employee Responsibilities:

- Adhere to company policy and procedures.
- Take no risks.
- Assist fellow workers.
- Set a good example.
- Do not work in isolation.
- Possible criminal prosecution/ fines for non-compliance

Employee Rights:

- The right to refuse unsafe work (federal and provincial)
- The right to know the hazards
- The right to participate in the safety program

Reporting unsafe acts or conditions:

- Report hazards immediately

- Correct unsafe conditions whenever possible
- Do not expect others to report/correct.

Reporting incidents and injuries:

- Report immediately to supervisor or First Aid Attendant.
- Get treatment from first aid for assessment and to prevent infection.
- Abide by the decision of first aid when advised to seek medical attention.

Location of first aid (as applicable):

- Note the location of first aid trailer/room and equipment.
- Access and treatment with first aid attendant only.
- Locations of air horns, fire extinguishers and eye wash stations.
- Note personnel with O.F.A. qualifications.

Evacuation procedures:

- In regards to fire, gas leak, explosion or bomb threat, etc.
- Explain why an accurate head count is important to eliminate searches

Location of marshaling area:

- Front gate at shop, or as directed on site.
- In the absence of other directions or when in doubt, workers are to return to the company vehicle, if safe to do so. They should not leave the immediate jobsite area, greater than a reasonable safe distance from hazards.

How to contact first aid:

- Company policy
- Site procedures if applicable

Training

Safe work practices are developed through a combination of training and experience. A safe workforce requires a safe attitude. This attitude is developed with proper training, education, and the understanding that all incidents are preventable. Taking unnecessary risks significantly increases the chances of an incident occurring.

Drillwell Enterprises Ltd. will provide the appropriate safety education, training and equipment to their workers. Documents proving that workers have received specific training should be obtained and kept on file. Commencement of project safety meetings are a way of continuing

the safety training and education of the workers, and documented proof of these meetings must be kept on file.

WHMIS training is mandatory for all workers in Canada that may come in contact with any controlled substance. Proof of WHMIS training is required for all workers.

Short Service Worker (SSW) Program

Workers new to a job or task are at greater risk of injury to themselves and others than more knowledgeable and skilled workers. Our SSW program provides a structured approach to training orienting and mentoring new workers.

SSW Requirements

Drillwell will enroll new workers in our SSW program, they will be identified by wearing a green hard hat and remain enrolled until they:

- Have the basic skills and knowledge to perform their tasks safely
- Fully understand and participates in our safety culture
- Have accumulated a minimum of 2 weeks steady work

Trainers

Drillwell trainers will:

- Provide a positive safety attitude and complete understanding of our safety culture
- Demonstrate training skills and a solid understanding of the material they are teaching
- Will be responsible for the safety of SSW while under their supervision
- Not request a SSW to do new tasks they have not been trained for

Monthly Safety Meetings – JOHSC

The goal of regular safety meetings is to provide a consistent method to convey safety related information throughout the workforce. It also provides documented proof that the information is reaching the workers in the field, and that the workers have the opportunity to provide their feedback to management on the issues discussed. This forum also satisfies Joint Occupation Health & Safety Committee (JOHSC) requirements. Both management and workers are required to attend these meetings.

Identifying trends in incidents and injuries is an important step in the process of developing safe work procedures to lower the frequency of incidents that may result in injury. Workers are required to participate in the health and safety program developed by the company. Input from workers is part of a positive safety culture within an organization, and this input is essential to creating an effective and evolving safety program. The safety meeting is the forum where

workers can comment on issues brought forward by the company management, discuss the issues that are affecting their health and safety, and collectively explore ideas to improve conditions and reduce workplace incidents.

Topics for discussion brought forward by the company should be pertinent to the safety issues identified by trends from incidents and injuries. The findings from all incidents and incident investigations are topics for safety meetings, as they directly represent the safety culture and practices of the company. It is important that the workers hear directly from the company what the investigations revealed, and all recommendations that will be implemented. Workers are encouraged to participate in discussions and bring their ideas forward.

Injury statistics reveal trends specific to the workplace. These trends can identify areas that require an increased focus on safety, in order to reduce and eventually eliminate each type of injury.

Topics presented by workers at previous safety meetings are very important. These issues must be carefully thought through, and solutions developed. The front line workers may mention an issue that upon careful consideration may have the potential for serious injury and/or property damage. Workers will expect these issues to be addressed, and a pro-active safety culture begins with leadership from the top of the organization. Employees at all levels are encouraged to participate in the development of solutions including safe work procedures.

These meetings will be held at least monthly and every effort should be made by employees, management and JOHSC committee members alike to attend. At a minimum at least one JOHSC committee member will be present for quorum.

Each member of a joint committee is entitled to an annual educational leave totalling 8 hours, or a longer period if prescribed by regulation, for the purposes of attending occupational health and safety training courses conducted by or with the approval of the Board.

JOHSC duties and functions:

Drillwell will establish and maintain a Joint Occupational health and safety committee (JOHSC). We will take an active role in ensuring the joint committee functions as required. If a situation is identified where the committee is not meeting its obligations Drillwell will take appropriate action to rectify the problem.

As per WCB regulation the joint committee has the following duties and functions:

- to identify situations that may be unhealthy or unsafe for workers and advise on effective systems for responding to those situations;

- to consider and expeditiously deal with complaints relating to the health and safety of workers;
- to consult with workers and the employer on issues related to occupational health and safety and occupational environment;
- to make recommendations to the employer and the workers for the improvement of the occupational health and safety and occupational environment of workers;
- to make recommendations to the employer on educational programs promoting the health and safety of workers and compliance with this part and the regulations and to monitor their effectiveness;
- to advise the employer on programs and policies required under the regulations for the workplace and to monitor their effectiveness;
- to advise the employer on proposed changes to the workplace, including significant proposed changes to equipment and machinery, or the work processes that may affect the health or safety of workers;
- to ensure that accident investigations and regular inspections are carried out as required by this Part and the regulations;
- to participate in inspections, investigations and inquiries as provided in this Part and the regulations;
- to carry out any other duties and functions prescribed by regulation.

Joint Occupational H&S Membership

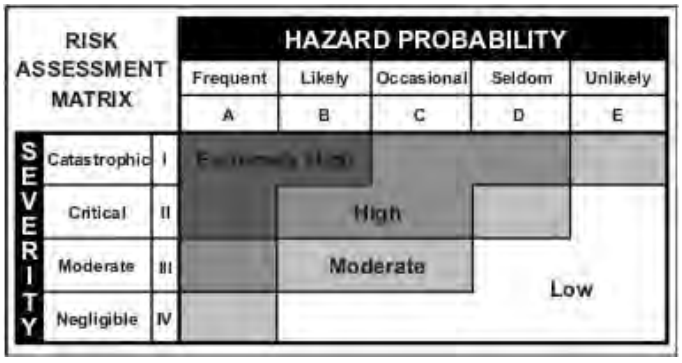
Membership will consist of a minimum of two representatives from both management and employees. Representatives will be roughly split between HVC and Vancouver Island locations. Should employees feel uncomfortable bringing their questions or concerns to the larger safety meeting they can seek out members of the JOHSC to make comments in private.

Management Representation:	Colin Slade (Duncan) 250-381-1990
	Shawn Slade (Duncan) 250-510-9253
	Tiger McGarry (HVC) 778-220-6780
Employee Representation:	Cass Currie (Duncan) 250-858-1253
	Adam Bush (Duncan) 250-709-5811

Inspections

Policy

It is the policy of Drillwell Enterprises Ltd. that regular, effective safety inspections will be performed. All inspections will be performed as frequent as necessary to prevent any hazardous conditions from developing. As determined by the management and supervisors of Drillwell Enterprises Ltd., different requirements may be placed on the inspection of equipment and work processes. Every inspection performed will be documented, and any hazards found will be rated according to the risk assessment matrix below. At any time, if the severity of a hazard is in question, it shall always be considered the more serious of the hazard ratings.



Inspections will be performed on a regular basis, as well as on a surprise basis by the management of Drillwell Enterprises Ltd. or their representative. At a minimum the shops will be inspected semi-annually and every month a worksite inspection will take place. To knowingly operate equipment or perform work related duties with a Class “I” and class “II” hazard present (not eliminated or controlled) will be considered a violation of the company safety policy and will warrant disciplinary action.

The management of Drillwell Enterprises Ltd. will review inspection documents on a regular basis, for the purpose of identifying trends or to identify the need for the development of specific safe work procedures. All Class “I” and class “II” hazards documented will be included as topics for general safety meetings.

Investigation and Reporting

Serious Injury Incidents

All incidents designated as “serious injury incidents” or an incident having the potential of causing serious injury shall be reported immediately to the WorksafeBC’s Incident Prevention Branch. The supervisor will immediately inform the project superintendent and Drillwell Enterprise’s office. The project Superintendent or Drillwell Enterprise’s office shall call the Worker’s Compensation Board office by telephone to report a serious injury incident.

Reportable incidents having the potential of causing serious injury for the purposes of the Industrial Health and Safety Regulations (IHSR) are:

- Incidents resulting in serious injury to, or the death of a worker, or involve a major structural failure or collapse of a building, bridge, tower, crane, hoist, temporary construction support system or excavation, or involve the major release of a toxic or hazardous substance, or
- Involved in a fire or explosion that had a potential for causing serious injury to a worker or was an incident required by Regulation to be reported.

Incident Reporting Procedures

The following is a summary of reporting requirements if an incident occurs.

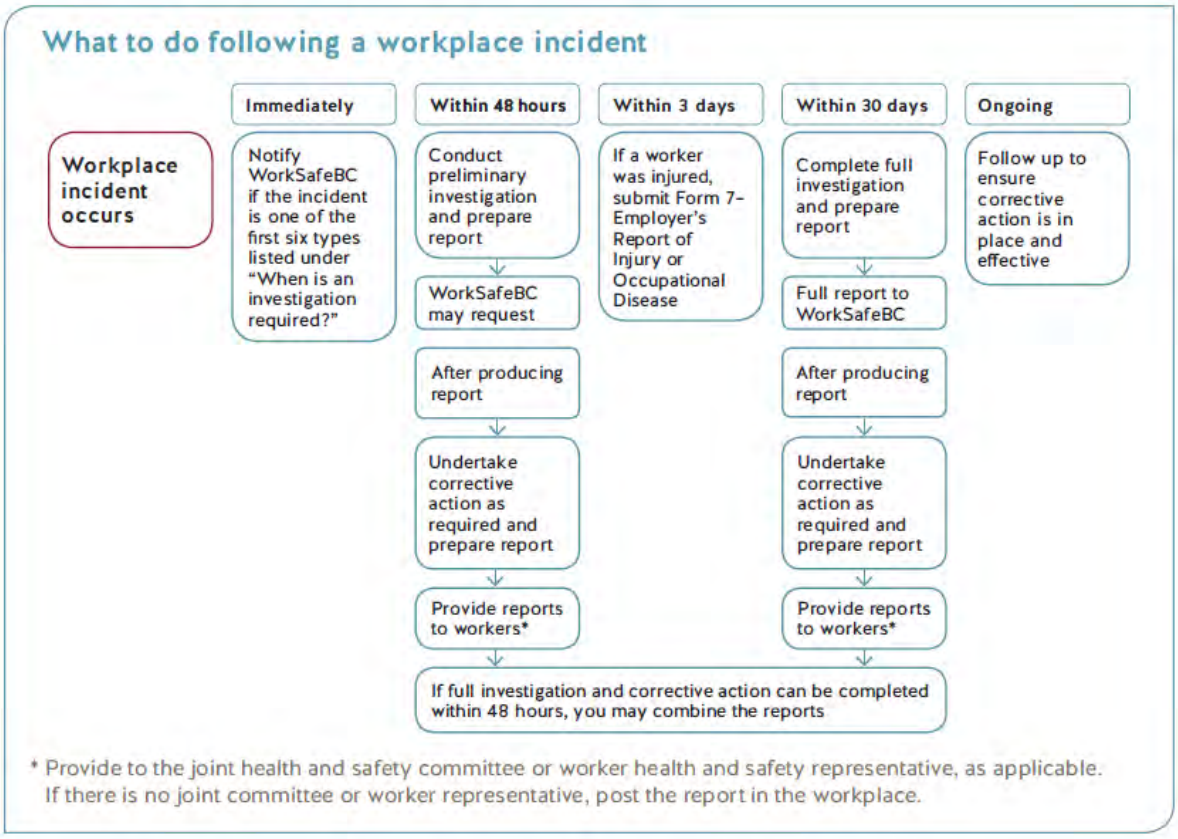


Figure 1 - What to do following a Workplace Incident

Non- Disabling Injury – First Aid Only

The injured worker will:

- Report to immediate Supervisor or First Aid Attendant
- Obtain first aid treatment

- Record incident details in first aid book and return to work

The supervisor or First Aid Attendant will:

- Complete first aid report and advise Drillwell Enterprise's office

Non- Disabling Injury – Medical Aid Required

The injured worker will:

- Report to immediate Supervisor or First Aid Attendant
- Obtain necessary first aid before going to physician
- Advise his immediate Supervisor if any time loss will be involved

The Supervisor or First Aid Attendant will:

- Provide first aid services and treatment recommendations
- Report the incident to Drillwell Enterprise's office
- Complete Workers' Compensation "Form 7A First Aid Report" if advised by the office to do so.
- Maintain contact with employee (and physician if necessary regarding treatment) ensuring the worker gets home after medical aid.
- Follow up to ensure an investigation is conducted. If directed by the office, complete an incident investigation report, send a copy to the Drillwell Enterprise's office.

Drillwell Enterprise's office will:

- Complete Form 7 "Employers Report of Injury or Industrial Disease". Copies of the report are to be given to WorksafeBC Prevention Division.
- Ensure an Employer Incident Investigation Report (EIIR) completed and submitted to WCB within 30 days of the occurrence of the incident.

Disabling Injury

- If able, the worker should report orally to his immediate Supervisor, First Aid Attendant or any other supervisor who is available.
- If unable to report, a fellow worker should report for him.
- Obtain any necessary first aid before going to a physician.

The Supervisor or First Aid Attendant will:

- Provide first aid services and treatment recommendations
- Report the incident to Drillwell Enterprise's office
- Complete Workers' Compensation "Form 7A First Aid Report"

- Maintain contact with employee (and physician if necessary regarding treatment)
- Follow up to ensure an investigation is conducted. If directed by the office, complete an incident investigation report, send a copy to the Drillwell Enterprise's office.

Drillwell Enterprise's office will:

- Complete Form 7 "Employers Report of Injury or Industrial Disease". Copies of the report are to be given to WorksafeBC Prevention Division.
- Ensure an Employer Incident Investigation Report (EIIR) completed and submitted to WCB within 30 days of the occurrence of the incident.

Motor Vehicle Accident (M.V.A)

The driver of a Company vehicle at the scene of an incident shall:

- Render necessary aid to the injured to the extent of training they have.
- Take safety precautions necessary to keep incident from creating a hazard to others.
- Report to immediate supervisor and Drillwell Enterprise's office as soon as possible.
- Contact police/ambulance if damage is extensive or personal injury is involved.
- Obtain all necessary information required for incident reports, such as names and addresses of other vehicle drivers involved, names and addresses of witnesses, etc.

Property Damage Incident – No Injury

Supervisor, workers or person at scene will:

- Report incident to supervisor or Drillwell Enterprise's office.

Near Miss Incident

All incidents which have a potential for serious injury or property damage must be investigated immediately by Drillwell Enterprise's office or delegated supervisor.

Pertinent information is to be gathered and a "near-miss" investigation report must be completed. Any information to be submitted by a subcontractor must be gathered in a timely manner with the report being submitted to Drillwell Enterprise's office no more than two (2) working days following the incident. Near misses of a serious nature are to be submitted to WorkSafe BC within 30 days of the occurrence. Near misses are to be discussed at subsequent safety meetings as a learning opportunity to all.

Absence Investigation and Follow-up

An integral part of good safety management is minimizing the number of lost workdays following an incident by facilitating a worker's return to work as soon as he is physically capable of doing so.

When a worker is absent from work for an extended period of time due to an incident, the Supervisor or Drillwell Enterprise's office will contact the worker to ascertain his physical condition, medical attention received, projected return to work date and offer any reasonable assistance that may be required. A worker is to be encouraged to return to his job as soon as he is physically fit to do so.

Should there be reasonable cause to believe a worker is physically fit to return to work on a job other than his own, Drillwell Enterprise's office will determine whether an alternative meaningful job can be offered to the worker.

First Aid Procedure

Any worker sustaining an injury or illness that is, or may be, job related shall report to the First Aid Attendant for treatment as soon as possible.

The designated First Aid Attendant shall ensure that a record of every injury or illness which requires first aid treatment is kept in a Treatment Record Book. Each record must be duly signed and dated by the designated First Aid Attendant.

A First Aid Treatment book shall be kept for at least ten (10) years following the completion of the project.

The management, in order to determine trends and recommend corrective action, shall review First Aid statistics on a regular basis.

Note: Workers are reminded that all work related injuries are to be reported to the supervisor and/or first aid attendant as soon as possible.

Exposure Control Procedure

Blood-Borne Pathogens

Definition – pathogenic micro organisms that are present in human blood and can cause disease in humans, e.g. Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immuno-deficiency Virus (HIV), etc.

1. Injured Worker

- Inform designated First Aid Attendant (O.F.A.A.) that there is an injured worker.

- O.F.A.A. MUST ENSURE ALL HAZARDS HAVE BEEN ELIMINATED OR EFFECTIVELY CONTROLLED PRIOR TO RENDERING AID.
- The O.F.A.A. has complete authority with respect to injured workers, initial treatment, and preservation of the incident scene and treatment recommendations. All workers, supervisors and management personnel will assist the O.F.A.A. in the performance of duties, and all requests made for assistance.
- No worker, O.F.A.A. or other personnel should touch injured workers unless they are wearing Personnel Protective Equipment (PPE). For first aid emergencies, the minimum P.P.E. is medical protective gloves. Face shield or protective eyewear may be necessary if there is a risk of spraying or splashing of bodily fluids.
- Proper glove-up and removal procedures must be adhered to. Gloves and gowns are to be worn for anticipated contact with blood and body fluids (e.g. feces, urine, sputum, saliva, wound drainage and non-intact skin.

Hands are to be washed before and immediately after gloves are removed. Antiseptic or alcohol wipes are to be utilized when proper hand washing is not practicable. Disposal of contaminated gloves, gowns, blankets, dressings or other objects is to be done in a manner, which eliminates future exposure to workers (immediately bagged & sealed).

2. Incidental Exposure:

Any employee who may have been exposed to blood or other potentially infectious materials must report it to the First Aid Attendant.

- Vigorous washing or cleaning must be performed utilizing an anti-bacterial solution, soap or antiseptic/alcohol wipes.
- Then report the incident to the immediate supervisor to obtain medical attention as soon as possible (within 2 hours of the exposure).
- Incidental exposure to possible blood borne pathogens is to be considered an event involving a moderate risk to life and health.

3. Supervisors and Drillwell Enterprises Ltd. management must ensure that all records such as exposure and exposure control training records are maintained. Records of incidental exposure will be kept as part of the first aid record book.

4. Supervisor will complete documentation to include conducting an incident/accident investigation.

Fall Protection Policy

Drillwell Enterprises Ltd. recognizes that falls from heights are a significant hazard to workers. This policy is to outline exactly what workers can expect from management and what will be expected from supervisors and workers with regards to the hazard of working at heights.

It is every employee's responsibility, from junior worker to senior management personnel to recognize and effectively control fall hazards. Every effort will be made in the planning stages of all work to reduce and if possible eliminate all fall hazards wherever they may present. WorksafeBC minimum regulatory standards must be adhered to at all times. Specific Safe Work Procedures will be developed to eliminate or reduce fall hazards. All worker's concerns raised will be addressed by management without delay, and any recommendations made will be transmitted to all company employees either immediately or through the regular safety meeting process.

Field supervisors are responsible to ensure that Fall Protection Procedures and equipment are inspected and utilized whenever required. Unusual hazards such as vertical grade stakes, shovels, pry-bars etc. are to be removed from the perimeter of the drilling rig. Installation of retractable lanyards and all other Fall Protection Equipment must be inspected prior to use and a record kept on the rig safety checklist.

Only trained and authorized workers will be permitted to perform any type of task that involves work being done at a height of 10 feet or greater above safe grade. Any work performed at heights over 10 feet (or some lesser height if required by client or site) will require restraint/arrest equipment to be employed. Any work at or above 25 feet will require a site specific fall protection form. Drillwell Enterprises Ltd. will provide workers with training as required advancing into positions requiring work from heights.

The Hierarchy of fall protection is as follows:

- Hazard elimination – Remove the hazard
- Fall Prevention – Prevent access to the hazard
- Fall Restraint – Restrain user from access the fall hazard
- Fall arrest – Catch the worker in event of fall.

Workers are aware that surprise safety inspections will be conducted by Drillwell Enterprises Ltd. management or designated parties, including the possibility of officers from the Prevention Division of WorksafeBC. Drillwell Enterprises ltd. has a zero tolerance policy with regards to Fall Protection regulatory violations, and all violations will result in disciplinary action.

Fire Prevention

This guideline is intended to provide compliance with all related regulation and standard safe work practice. The goal of these guidelines is to prevent fires and to provide general direction for action in the event that a fire does occur. Drillwell Enterprises employees shall be informed of the proper actions to take in the event of a fire. This includes, but is not limited to; notification and evacuation procedures. It is STRESSED that at no time does the task of fighting fire supersede an employee's primary duties of:

- Ensuring their own personal safety and the safety of others.
- Reporting the incident to the proper authority and ensuring personnel accountability for yourself and all subordinates at the jobsite, in accordance with company and client policy.

Procedure

- All Drillwell Enterprises employees are responsible for good housekeeping practices to enhance fire prevention methods. Supervisors will be held accountable for the housekeeping of their job sites.
- Only approved containers will be used during fueling operations.
- Flammable material shall be kept and stored in compliance with applicable provincial and client regulations. The quantity of flammable/combustible material shall be kept to a minimum on the job site.
- Welding, cutting and grinding sparks shall be regarded as potential sources of ignition.
- Hot work areas shall have a fire extinguisher and hose maintained on each jobsite and where dry conditions present a hazard work area will be kept wetted down.
- Hot Work Permits shall be used where required by client or site.
- Maintain the conditions of the hot work permit at all times
- Know the location of firefighting equipment in the immediate area
- Where dry conditions exist continuously monitor the work area during and for 30 minutes after hot work has finished to ensure no smoldering embers or slag exist
- Report all spills or suspicious odors immediately.
- Fire extinguishers are to be kept in areas easily accessible to employees. Only approved fire extinguishers are to be used. They must have an inspection tag attached. Extinguishers are to be maintained in a fully charged, ready to operate state. Extinguishers are to be inspected monthly and documented annually. Training is provided to all employees who use or may use fire extinguishers.
- NEVER put yourself or others a risk while attempting to extinguish a fire.
- NEVER attempt to extinguish a pressurized-fuel fed fire, including LPG fires

- DO NOT APPLY water to any acid or caustic release as it can cause a violent reaction. Additionally, low concentration acids or caustics become extremely corrosive, causing an increasing leak condition.

In the Event of a Fire

- Remain calm
- Only extinguish a fire when it is clearly within your abilities and the equipment available
- Know the location of the nearest alarm and how to activate the emergency system
- Know the evacuation routes and collection points
- If the fire cannot be extinguished, leave the area immediately and report to your evacuation area
- Await further instructions from the supervisor, or designated responsible personnel

Classes of Fire

- Class A - Ordinary combustibles (wood/paper/textiles)
- Class B - Flammable liquids (gasoline/oils/grease)
- Class C - Live electric (wiring/generators/motors)
- Class D - Combustible metals (finely divided form/chips, turnings)

Types of Fire Extinguishers

- Water - extinguisher for ordinary combustible fires
- Dry Chemical or CO2 - extinguisher for electrical equipment fires and for flammable liquid fires
- Multipurpose Dry Chemical - extinguisher for ordinary combustible fires, liquid fires, and electrical equipment fires
- Foam - extinguishing agent for hydrocarbon fire

Workplace Hazardous Materials Information System (WHMIS)

Policy

It is the policy of Drillwell Enterprises Ltd. to promote and sustain the efficient application of a program for WHMIS to ensure that workers receive the fullest knowledge and protection in the handling of products, which could be harmful to their health as per WCB H&S Regulations Section 5.l - 5.8.

Pursuant to the attainment of this goal, responsibilities for administration of the WHMIS program shall include, but not be limited to, the following:

The Site Supervisors will ensure that all controlled products entering the jobsite will have proper labels and identifying symbols attached to each container and that Safety Data Sheets

(SDS) are available and circulated to the proper personnel. The management of Drillwell Enterprises ltd. will also ensure that adequate information and training is provided for all personnel.

The management of Drillwell Enterprises Ltd. or their designate will coordinate the activities of WHMIS for the company. Duties will include the compiling of a list of hazardous products; requesting SDS sheets and labels for controlled products; keeping SDS sheets current and available at the site; and ensuring that adequate training is given to all workers.

The Site Supervisors will ensure that workers who handle, store or use controlled products are properly trained to identify labels. They must be properly trained to understand risk terminology; to be able to understand applicable sections of SDS`s; to implement emergency procedures should they be necessary and understand problems associated with the handling of controlled products. Supervisors will also ensure that all controlled products received on the jobsite are correctly labeled and that current SDS`s are readily available for these products.

Workers will follow all the established procedures for the use, storage, handling of and disposal of controlled products including, when required, the wearing of proper Personal Protective Equipment.

Cooperation is needed among all levels of the workforce to ensure that our workers receive the necessary information and equipment required for fulfilling our goal of reduced work place injuries. Strict compliance with the WHMIS regulations will ensure that workers have the fullest protection when handling products which could endanger their health now or at a later time in their lives.

Management Responsibilities

Safety Data Sheet

- Obtain up to date supplier Safety Data Sheet before the product is used or handled.
- Ensure that the SDS is less than three years old.
- Update the SDS within 90 days of receiving new information or at least every three years.
- Make sure that the SDS is available to all workers that will come in contact with the substance
- Ensure the workers are informed regarding the content of SDS and the purpose and importance of the information.

Supervisor Responsibilities

WHMIS Labels / SDS

- Ensure that all workers who work with or in proximity to controlled products are instructed in the content, purpose, and significance of supplier and workplace labels and other identifiers. (WCB Section 5.8)
- Ensure that a controlled product or the container of a controlled product has the proper label applied at the time of entry into the workplace.
- Ensure that no controlled product is used or handled in the workplace without the proper label.
- Take measures to ensure that supplier labels are not removed, defaced or altered in the workplace.
- Develop and apply workplace labels to containers of controlled products, when an existing supplier label becomes illegible, or is incidentally removed and a replacement supplier label is not available, or when a controlled product is decanted (transferred from its original container to any other container).
- Provide and apply others means of identification, which need not be workplace labels, but which clearly identify contents for any hazardous product.
- Ensure that SDS are readily available for reference, and that workers have read and understood the information contained within.
- Ensure that all workers who may be exposed to a controlled product are trained in the use of PPE relevant to the use of a controlled product and necessary procedures to be followed.
- Ensure workers are trained in emergency procedures with regard to the controlled products that they handle.

Worker Responsibilities

WHMIS Labels/SDS

It is the Workers responsibility to know and understand:

- The content information which should appear on supplier labels and workplace labels, including the requirements for information on the availability of SDS (Safety Data Sheets).
- The significance for worker health and safety information on labels and other written or symbolic means of identification.

- Procedures for the safe use, storage and handling of controlled products; procedures to be followed when fugitive emissions are present, or in an emergency which involves controlled products.
- How to handle controlled products in accordance with label and identifier alerts.
- How to follow employer directives to avoid removing, defacing or altering labels.
- When to inform employers of the presence of labels and other identifiers which are illegible or have been incidentally removed.
- How to wear and use the appropriate personal protective equipment.
- Know what to do in the event of an unintentional release of a controlled product.
- Understand the proper procedures for disposal of controlled products, obeying all provincial and regional regulations.

Emergency Procedures

For the purposes of worker health and safety and compliance with WorksafeBC OH&S Regulations, Drillwell Enterprises Ltd. has assessed the operations and working conditions, and have deemed all of our field operations as a “High” hazard. This is based upon the general rating for drilling operations, and the fact that our work does not differ greatly from general drilling operations.

This places the requirements for a Level 1 O.F.A. and a LV1 First Aid Kit to be present at all times when there is work being performed by 2 to 15 workers, within 20 minutes surface travel time of medical aid. Medical aid is considered a trauma unit or other medical facility capable of adequately attending to an injured worker. The number of workers is restricted to a maximum of 5 if the surface travel time to medical aid exceeds 20 minutes, or 6 to 10 workers if the level 1 O.F.A. has a transport endorsement and there is an Emergency Transport Vehicle on site at all times work is being performed. Surface travel time to medical aid, the route, and the facility’s ability to deal with an injured worker must be verified and documented prior to work commencing at any location.

Drillwell Enterprises Ltd. shop location will also be rated “High” for the purpose of assessment under the WorksafeBC OH&S Regulations. A Level 1 O.F.A. and LV1 Kit will be maintained whenever work of a hazardous nature may take place at the shop. Every effort will be made to provide this level of first aid support whenever clerical support staff and management staff are working in the building.

All Drillwell Enterprises ltd. workers are encouraged to obtain a minimum Level 1 O.F.A. certification at company expense and to renew this certification every 3 years as required by WorksafeBC OH&S Regulations.

Evacuation

All workers and employees of Drillwell Enterprises Ltd. must make themselves familiar with all exit locations from the office and shop area. As well, all workers will be familiar with the location of all fire extinguishing equipment in and around the building.

In the Event of a Fire or Evacuation:

1. Sound the fire alarm. This may include yelling “fire” loudly. All workers hearing “fire” being announced will themselves yell “fire” to alert all workers to the hazard.

2. All workers must exit the building via the nearest exit, as quickly as possible, closing all doors and windows as they go.

3. Fire extinguishing equipment may be utilized to put a fire out if:

- The fire is small or contained enough to allow the equipment a good chance of being effective.
- The worker has training in the effective use of the equipment.
- There is a clear escape route for the worker from the fire location.
- There are no additional hazards endangering workers (i.e. compressed gas cylinders, petroleum accelerants, explosives, exposed electrical cables etc)
- Other workers are already contacting the fire department.

4. All vehicles must be cleared from around the perimeter of the building.

5. All workers will marshal outside near the front gate or other designated marshal area, and remain a safe distance from the building. A head count should determine any staff that may be trapped in the building and reported to the first responder on scene. Workers will remain outside until fire department officials give clearance to re-enter the building.

APPENDIX 1 – SAFE WORK PRACTICES

Electrical Safety SWP

Drillwell Enterprises ltd. requires all employees to take every precaution to eliminate or reduce any electrical shock hazard. All cords will be 3 prong grounded and must be without any splices or tape. All cords in use must be in good condition, of medium or heavy gauge and inspected prior to use. Damaged cords will be exchanged at the shop ASAP when any damage is found.

Cords will be repaired and tested prior to being returned to service. All problems should be recorded on the safety checklist, and inspections and repairs made by the designated personnel without delay. Only designated personnel may make electrical repairs of any kind. Drillwell Enterprises Ltd. expects all employees to follow B.C. Hydro's 7 steps to electrical safety.

Body Positioning SWP

Conscious evaluation of body positioning is important to guard against injuries resulting from putting oneself in the line of fire, poor lifting techniques, repetitive motion tasks, fatigue and sub-optimal working surfaces.

- Stretch before, during and after work day
- Adjust working position as necessary to avoid strain
- Take turns or breaks when performing repetitive tasks
- Periodically adjust body when holding a position for extended periods of time
- Practice good posture
- Practice good lifting techniques
- Avoid sudden or unexpected movements
- Address poor working surfaces with appropriate measures

Angle Grinders SWP

- Angle grinders must have factory guards in place.
- Factory guards must have 120 degrees of protection.
- Grinding discs must be rated for the speed of the grinder; this includes, but is not limited to abrasive discs, wire wheels and wire cups.
- Adequate eye and face protection must be worn.
- Dispose of damaged disks.

Minimum Requirements:

Safety goggles, or goggle style safety glasses and or safety glasses with face shield.

OR

Safety glasses and welding helmet with flip up tinted lens.

Ground Disturbance SWP

- All ground disturbances must comply with relevant codes and standards.
- Remember to “Dial Before you Dig”.
- If the plans are not adequate to identify the location of underground buried services then appropriate steps to mitigate the potential hazards must be taken. (Locates or daylighting)
- No persons are to enter any excavation over 1.2 meters (4 feet) in depth unless
    - The sides are sloped to a safe angle, not exceeding the ratio of 3 horizontal units to 4 vertical units, or
    - The sides are supported with at least the minimum requirements of the Mine Code, or
- Sloped or supported with the written instructions of a professional engineer.
- You must keep a ladder in the immediate area of the people working in any excavation over 1.2 meters (4feet).
- Excavated material must be kept back at least 1.2meters (4 feet) or at least 0.6m (2 feet) of any trench less than 3.6m wide (12feet).
- Where there is a danger of a person falling into an excavation, standard guardrails or barriers must be placed along the exposed sides or be covered with appropriate material.
- Before an excavation or ground disturbance starts you and your Contract Administrator must review a current plan showing known buried services in the area.

Cement, Concrete, and Masonry Safe Work Practice SWP

Health effects

Cement can cause ill health by skin contact, eye contact, or inhalation. Risk of injury depends on duration and level of exposure and individual sensitivity. Hazardous materials in wet concrete and mortar include:

- alkaline compounds such as lime (calcium oxide) that are corrosive to human tissue
- trace amounts of crystalline silica which is abrasive to the skin and can damage lungs
- trace amounts of chromium that can cause allergic reactions.

Skin contact

The hazards of wet cement are due to its caustic, abrasive, and drying properties. Wet concrete contacting the skin for a short period and then thoroughly washed off causes little irritation. But continuous contact between skin and wet concrete allows alkaline compounds to penetrate and burn the skin.

When wet concrete or mortar is trapped against the skin—for instance, by falling inside a worker's boots or gloves or by soaking through protective clothing—the result may be first, second, or third degree burns or skin ulcers. These injuries can take several months to heal and may involve hospitalization and skin grafts.

Cement dust released during bag dumping or concrete cutting can also irritate the skin. Moisture from sweat or wet clothing reacts with the cement dust to form a caustic solution.

Eye contact

Exposure to airborne dust may cause immediate or delayed irritation of the eyes. Depending on the level of exposure, effects may range from redness to chemical burns and blindness.

Inhalation

Inhaling high levels of dust may occur when workers empty bags of cement. In the short term, such exposure irritates the nose and throat and causes choking and difficult breathing. Sanding, grinding, or cutting concrete can also release large amounts of dust containing high levels of crystalline silica. Prolonged or repeated exposure can lead to a disabling and often fatal lung disease called silicosis.

Personal Protection

To protect skin from cement and cement mixtures, workers should wear:

- Coveralls with long sleeves and full-length trousers
- Suitable respiratory protective equipment when cement dust can't be avoided
- Suitable eye protection where mixing, pouring, or other activities may endanger eyes (minimum—safety glasses with sideshields or goggles, under extremely dusty conditions, tight-fitting unvented or indirectly vented goggles.
- Don't wear contact lenses when handling cement or cement products).

Work Practices

- Work in ways that minimize the amount of cement dust released.
- Mix dry cement in well-ventilated areas.
- Make sure to work upwind from dust sources.
- When kneeling on fresh concrete, use a dry board or waterproof kneepads to protect knees from water that can soak through fabric.
- Remove jewelry such as rings and watches because wet cement can collect under them.

Hearing Loss Prevention SWP

A major long-term problem in the construction industry is hearing loss.

In order to exceed the minimum requirements of the WorksafeBC Industrial Health and Safety Regulations, Drillwell Enterprises Ltd. requires management and supervisors to ensure that:

All employees are provided with appropriate hearing protection whether occasionally or routinely exposed to excessive noise levels.

All employees receive instruction and understand the importance of hearing conservation and utilize hearing protection whenever necessary.

Hearing tests are conducted for all employees as required by WorksafeBC OH&S Regulations at least once per year.

Prolonged exposure to 85 decibels (db) of sound has been proven to cause permanent hearing loss. Examples of noise levels associated with the construction industry are:

Crane Operator	82 – 99 db
Drilling	99 – 103 db
Welding	84 – 97 db
Air Arc Cutting	120 db
Pneumatic Drill	100 db

Hearing Conservation Program

Drillwell Enterprises Ltd. recognizes that noise is a serious problem in the construction industry and is committed to providing a safe work environment for our employees, other trades people and the public.

Noise exposure can vary greatly on a construction site. Therefore, Drillwell Enterprises Ltd. will have an effective noise control and hearing conservation program, which will include:

- Education and training
- Noise control
- Hearing protection
- Hearing tests

Heat and Cold Stress SWP

Heat and cold stress are concerns when working in outdoor environments. These stresses can cause serious injury and need to be guarded against. The following information will help to identify onset of these stresses and mitigation.

Heat Stress

Heat stress takes place when your body's cooling system is overwhelmed. Heat stress can lead to illness or even death. It can happen when heat combines with other factors such as:

- hard physical work;
- fatigue (not enough sleep);
- dehydration (loss of fluids); and
- certain medical conditions.

Precautions when working in hot, humid conditions:

- Increase the frequency and length of rest breaks.
- Drink a cup of water every 1/2 hour.
- Recognize the signs and symptoms of heat stress. Start a "buddy system" because it's unlikely people will notice their own symptoms.
- Wear light summer clothing to allow air to move freely and sweat to evaporate. Always wear shirts for protection from direct sunlight.

Cold Stress

When you're cold, blood vessels in your skin, arms, and legs constrict, decreasing the blood flow to your extremities. This helps your critical organs stay warm, but your extremities are at risk for frostbite. Wind chill accelerates heat loss.

When your core temperature drops, you're at risk for hypothermia. Early signs of hypothermia are shivering, blue lips and fingers, and poor coordination. Soon your breathing and heart rate slow down, and you become disoriented and confused. Hypothermia requires medical help.

Precautions to prevent cold stress:

- Wear several layers of clothing rather than one thick layer.
- Wear gloves if the temperature is below 16°C for non-physical work, below 4°C for light work, and below –7°C for moderate work.
- Take warm, high-calorie drinks and food.
- When clothing gets wet at 2°C or less, change into dry clothes
- If you feel hot, open your jacket but keep your hat and gloves on.

- Take warm-up and rest breaks in a heated shelter. Ensure work is conducted within allowable exposure limits, as per provincial OHS Regulations.

Welding, Cutting and Burning SWP

- Workers not required to be directly involved with welding or cutting operations must remain at a safe distance and must not watch without appropriate PPE.
- Workers must never look down a section of pipe being cut or welded, or position themselves as to have that section of pipe "aiming" at them.
- Whenever possible, screen welding operations to protect other workers from welding flashes.
- Welders must wear gloves, protective clothing, goggles and/or face shields. Always wear goggles or glasses when cleaning off slag.
- Deposit electrode stubs in a waste container. If they are thrown around they may become a sharp, a tripping/slipping hazard or cause damage to tires.
- Always give a warning before striking an arc where others are working.
- Never look at an arc flash, even for an instant. Be sure to turn your head completely away from the arc, and also be careful of reflections especially in water as they may be dangerous.
- Oxygen under high pressure may react violently with grease or oil. Take every precaution to keep oxygen away from grease or oil, and never handle oxygen bottles, valves, regulators, hoses or other fittings with oily hands or gloves. Hoses and regulators should be hung up off the ground to avoid contamination by form oil, etc.
- Oxygen or compressed flammable gas cylinders found to have leaky valves or fittings which cannot be stopped by closing or tightening the valve or fitting, shall be taken to an open area away from sources of ignition and slowly ventilated.
- Compressed gas cylinders must always be stored and used in an upright position. Cylinders must always be secured to prevent tipping or falling.
- Always consider cylinders as full, and handle them carefully. Never move cylinders without the valve protector cap secured unless cylinders are being moved in an approved cart with a retaining chain.
- When cylinders are emptied, replace the protective cap and mark the cylinders "MT."
- Cylinders should never be used for any other purpose than to store gas.
- Cylinders must not be lifted by crane unless they are in a lifting cage specifically designed for hoisting.
- Fumes produced by the cutting or welding of some metals covered with paint/primer/coatings are very dangerous. Ensure that paints or coatings are removed

prior to cutting or welding and means are provided so workers avoid inhaling such fumes. Organic vapour cartridge respirators must be utilized whenever in doubt.

- Never open acetylene cylinder valves more than one (1) full turn and always leave the wrench or handle on the valve in case of emergency.
- Always check the hose lines for signs of wear or splits. Replace defective hoses.
- Never cut or weld on any container that has previously contained any petroleum products unless it has been properly steamed out and inspected by supervisory personnel.
- Always attach electric welding ground cables to the piece being welded and not to some distant part.
- Use only standard fittings on hoses.
- Do not use torches, grinders, or welders near batteries, as batteries may explode when exposed to sparks or flame.
- Flash back protectors are required on all regulators.

Aerial Lifts SWP

Aerial personnel lifts shall be operated, maintained, and controlled in a safe manner. These guidelines define the procedures and standards that apply to the care, control, maintenance, inspection, and operation of aerial personnel lifts. The following applies to all work sites, i.e., Drillwell yards, client job sites, etc., requiring the use of aerial personnel lifts.

General

- Only trained personnel who have been deemed competent and designated by their supervisor are authorized to operate aerial personnel lifts.
- Lift controls shall be tested prior to use to determine that such controls are in safe working condition.
- Personnel shall not be permitted to stand on the rails of aerial devices. A body harness shall be worn and a lanyard appropriately attached.
- Large or excessive amounts of material shall not be transported in an aerial personnel lift. Other material lifts would be necessary for such activities. Load limits specified by the manufacturer shall not be exceeded.
- Aerial personnel lifts that can operate horizontally shall set brakes and outriggers, when used, be positioned on pads or a solid surface, and chock wheels before using on an incline.

Boom Lift Units

Articulating boom and extendible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

Forklift SWP

Forklifts shall be operated, maintained, and controlled in a safe manner. The following procedures and standards apply to the care, control, maintenance, inspection, and operation of forklifts (powered industrial trucks) on Drillwell property and work sites.

Only trained, competent and authorized persons are permitted to operate a forklift. No employees are allowed to operate a forklift without the proper training. The Company Safety Officer or designee will administer the forklift operator certification program and maintain training records.

Training shall occur prior to employee operation of any Drillwell Enterprises forklift, with subsequent training if the observed performance by the operator dictates the need. The following requirements shall be met to become a "Qualified Forklift Operator":

- Completion of Training Course
- Instruction and evaluation of competence

Inspection and Maintenance

Prior to placing a forklift truck into service, the truck operator shall inspect their vehicle. This inspection is not necessary on days when the forklift will not be placed into service.

Forklifts that are defective, in need of repair or are unsafe shall be tagged "Danger – Do Not Operate." and taken out of service until restored to safe operating condition.

A maintenance log shall be maintained for each forklift to determine when required maintenance is due. Only qualified personnel shall perform maintenance and repair.

Maintenance records for each forklift shall be kept on file.

General Safe Operating Rules

- The following safe operating rules apply to employees who operate a forklift. Violations of safe operating rules can, and will result in retraining and/or disciplinary action.

- Only employees trained as per the requirements of this manual section and authorized by a supervisor shall be allowed to operate forklifts
- Stunt driving and horseplay shall not be permitted.
- Personnel are not permitted to ride on forklifts except in designated seats that are part of the equipment design.
- Forklifts shall be equipped with a portable fire extinguisher.
- Under travel conditions, the forklift shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Traffic regulations shall be observed, including authorized work site speed limits. A safe distance shall be maintained approximately three forklift lengths from the forklift truck ahead.
- The driver shall be required to look in the direction of, and keep a clear view of the path of travel.
- Copies of the manufacturer's operating instructions for each type of forklift shall be readily available for review by operators and supervisory personnel.
- Lift trucks, stackers, etc., shall have the rated capacity clearly posted on the vehicle so as to be clearly visible to the operator. When the manufacturer provides auxiliary removable counterweights, corresponding alternate rated capacities also shall be clearly shown on the vehicle. These ratings shall not be exceeded.
- No modifications or additions, which affect the capacity or safe operation of the equipment, shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
- Forklifts shall have the manufacturer's nameplate showing its weight with attachments, lifting capacity, lift height maximum and other pertinent data. Nameplates or markings shall be maintained in a legible condition and remain in place.
- Grades shall be ascended or descended slowly.
- When ascending or descending grades in excess of 10 percent, loaded forklifts shall be driven with the load upgrade.
- When travelling forklifts should be operated on all grades with the load engaging means raised only as far as necessary to clear the road surface.
- No person shall pass under the elevated portion of any forklift, whether loaded or empty.
- There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

- Arms or legs are prohibited from being placed between the uprights of the mast or outside the running lines of the forklift.
- When a forklift is left unattended load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set.
- Wheels shall be blocked if parked on an incline.
- An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material. etc. representative of the job application, but not to withstand the impact of a falling capacity load.
- Additional counter weighting of forklifts shall not be allowed unless approved by the manufacturer.
- Forklift operators shall yield to pedestrians.

Ladder Safety SWP

The Ladder Safety guideline is intended to provide employees with safe guidelines for the use of portable ladders, while complying with applicable provincial regulation and client standards.

- Under no circumstances are portable ladders to be used unless conditions are considered safe, secure and in compliance with company procedures and safe work practices.
- The use of ladders with broken or missing rungs or steps, broken or split side rails, or other faulty or defective construction is prohibited. All ladders will be inspected prior to use and when ladders with such defects are discovered they must be immediately removed from service and tagged as such.
- Employees will face the ladder while ascending or descending.
- Ladders will not be loaded beyond the maximum intended load for which they were built or beyond the manufacturer's rated capacity.
- All ladders shall be placed on secure footing, and the area around the top and bottom will be kept clear of work materials, tools and debris.
- Planks will not be used on the top step of stepladders.
- Portable ladders will be placed and used at a pitch that places the horizontal distance, from the top support to the foot of the ladder, at approx. one-quarter of the working length of the ladder. Ladders will not be used in a horizontal position as a platform, runway or scaffold.
- Ladders shall not be spliced together.
- Employees will not stand on the topcap.

- There shall be ample clearance and clear access at the top and bottom of portable ladders.
- Portable metal ladders will not be used for electrical work or where they may contact electrical conductors.
- Ladders shall be maintained in good condition.
- Only one employee is to work on or climb a ladder at the same time.
- All work done from a ladder shall be within an individual's normal reach and with no overextending allowed.

All work done from a ladder that exposes a worker to a fall potential of 10 feet or more requires the worker to wear a harness and be tied off per the Fall Protection Policy. Some clients and sites may require fall protection at less than 10 feet.

Working Alone SWP

There may be situations where personnel sometimes work alone. Examples include;

- Staying late to complete a job that must be done before the next day's work
- Completing a task where there is only room for one worker
- Servicing equipment in a remote area
- Cleaning up scrap and debris when work is done for the day.

A person is "working alone", when he or she is on their own at work; when they cannot be seen or heard by another person; and when emergency assistance is not readily available. The greatest risk in working alone is that no one is available to help a worker who may be injured, trapped, or unconscious. Even if co-workers realize that someone is missing, it may be difficult to locate an injured worker.

Planning

Inspect the jobsite for real and potential hazards and take whatever steps are required to safeguard workers.

If any personal protective equipment or clothing is required in addition to hard hat and safety boots, it should be provided, along with instruction in its proper use.

All safety and work-related procedures should be reviewed with workers to ensure that each procedure is clearly understood. The procedures should also be spelled out in the company's health and safety policy.

In some situations like confined spaces, regulations under the Occupational Health and Safety Act prohibit entry or work without another person standing by outside the area.

Communication

Communication is crucial in accounting for personnel working alone. A system must be established where, at regular intervals, someone checks on the worker or the worker reports to a designated person.

Where hazard exposure is high, intervals should be kept short.

Means of communicating between worker and outside contact must be predetermined and understood by both parties.

Cellular phones, Satellite phones, or two-way radios can provide effective communication. Test the units on-site to ensure that reception is reliable.

Responsibilities

The supervisor shall ensure that any worker working alone is aware of real and potential hazards in the area. The worker should be trained in hazard recognition and in the procedures and equipment required to do the job safely. The supervisor must also ensure that:

- a method of checking in with the worker has been established
- check-in intervals are clearly understood
- the designated contact person is aware of the work schedule
- any communication equipment used is in good working order
- no obstructions or interference may block phone or radio communications.

House Keeping SWP

Hazards in onsite work are everywhere. When natural hazards onsite are compounded with clutter of debris and tools, the hazard level increases, making the likelihood of an incident increase. A worksite with poor housekeeping procedure creates an environment that is unsafe to yourself and your co-workers.

Maintaining good housekeeping onsite can reduce the likelihood of accidents and/or incidents from occurring. The positive effect of good housekeeping practice far outweighs the extra effort. Everyone onsite must do their part to ensure that the jobsite is clean, orderly, and free of potential hazards.

The most common injuries that occur on a jobsite, from poor housekeeping, are Slips, Trips, and falls. Workers may slip, trip, or fall because of;

- Trash and/or debris
- Misplaced tools or equipment
- Hazards that are not properly coned, barricaded, or caution taped

- As a result, workers could suffer cuts, sprains, broken bones, and severe head injuries.

Employees shall take the following steps to maintain safe onsite work environment;

- Remove debris and trash to create a safe work environment.
- Clean as you work to prevent overload of debris, tools, and equipment.
- Place generated waste into containers, in a designated area.
- Keep pathways clear from obstruction.
- Keep worksite neat and orderly.
- Store tools and equipment out of the way.
- Place protective cones, barricades, and caution tape across areas where workers could slip, trip, or fall.
- Use sand or drying agent in wet or slippery areas.
- Only work in areas that have proper lighting.

If everyone does their part and works together to ensure that a worksite is clean and orderly, everyone can feel safer at the workplace. Make good housekeeping practices a habit to protect yourself and others from potential injuries.

Hydrogen Sulfide Awareness Guideline SWP

Hydrogen Sulfide H2S is a very toxic gas. It has no color, but it smells like rotten eggs. In larger amounts, H2S quickly blocks the sense of smell. The gas can irritate the eyes, nose, throat, and lungs.

Employees working on sites where H2S is likely to be encountered during drilling need to have appropriate training, detection equipment and PPE.

TRAINING

Training will be provided prior to working in any job with potential exposure to H2S gas. The purpose of hydrogen sulfide training is to familiarize employees with the provincial OHS regulations affecting H2S operations. Employees will learn the necessary skills to recognize, detect, and use the proper safety equipment in the event of an H2S incident.

Vertical Hoisting, Holding and Lowering of Steel Pipe and Casing SWP

AT NO TIME SHALL A WORKER OR ANY PART OF A WORKERS BODY INCLUDING HANDS AND FEET BE UNDER ANY STATIONARY VERTICAL SUSPENDED LOAD WITHOUT STABLE SECONDARY RESTRAINT OR SUPPORT.

This policy applies to pipe and casing that is not otherwise secured by drill rods or other specialized equipment for lifting and hoisting pipe, rods and casing. I.e.: Casing jacks, lower drives, clamshells, casing grabbers.

- When lifting, lowering, pulling, holding or hoisting steel pipe or casing in vertical or near vertical configuration a positive restraint should be employed at the upper end of the pipe or casing. This could be in the form of a bolted casing runner or other bolted device, threaded lifting bail, elevator or a shackle through a hole in the casing.
- When using a steel choker, strap, or sling, the sling shall be double wrapped and restrained from sliding up the steel pipe by a clamped or welded restraining device.
- A clamp style restraint could be in the form of a split ring of 2" by ¼" steel flat bar, or heavier material, bolted on opposing sides and protruding not less than 1.5 inches past the outside diameter of the pipe.
- A welded restraint (cleat or tab) should be of not less than 3 inch by 3 inch steel of ¼ inch or greater thickness.
- When a choker, strap or sling is attached to the pipe or casing it should be located so that it is in contact with the restraining device in order to prevent the choker from sliding up the pipe.
- If work must be done under a suspended load or structure, a secondary support capable of holding stable and carrying 100% of the weight of the load must be employed. A secondary support could be in the form of a second hoisting line, a strap or chain with a hook secured into the bottom of the pipe, or a metal or wooden block or frame on which the load can rest while still being held from above for the duration required to complete the work.
- Whenever possible work under or around suspended loads should be avoided. In some cases, this could be accomplished by using hand tools or handles, pushing or pulling the load to one side while work is being done, or lowering the load below the point where work must be done.

Tool use and Inspection SWP

How to use and inspect hand tools:

- Ensure that you have been properly trained to use the tool safely.
- Select the right tool for the job. Substitutes increase the chance of having an accident
- Keep tools in good condition at all times.
- Inspect tools for defects before use. Do not put away a defective tool.
- If a tool is defective, remove it from service, and tag it clearly " out of service do not use" and write the date, the defect and your name.

- Replace damaged or defective tools immediately. Do not use even temporarily.
- Replace cracked, splintered, or broken handles on files, hammers, screwdrivers, or sledges.
- Ensure that the handles of tools like hammers and axes fit tightly into the head of the tool.
- Replace worn jaws on wrenches, pipe tools and pliers.
- Redress burred or mushroomed heads of striking tools.
- Inspect pry bars, winch bars or other leverage tools for cracking, or other signs of wear that may cause the tool to break.
- Maintain tools carefully. Keep them clean and dry, and store them properly after each use.
- Wear all PPE, safety glasses or goggles, or face shield, and well-fitting gloves appropriate for the hazards to which you may be exposed when doing various tasks.
- Keep the work environment clean and tidy to avoid clutter which may cause accidents.
- During cold weather ensure tools\tool handles are kept free of snow and ice, defrosted when required, Do not leave unattended while defrosting.

How to use and inspect powered hand tools.

- Wear or use personal protective equipment (PPE) or clothing that is appropriate for the work you are doing; this may include items such as safety glasses or goggles, hearing protection, dust mask, gloves, safety boots or shoes, or rubber boots.
- Ensure that you have been properly trained to use the tool safely.
- Inspect tools for any damage prior to each use. Do not put away a defective tool.
- If a tool is defective, remove it from service, and tag it clearly " out of service do not use" and write the date, the defect and your name.
- Check the handle and body casing of the tool for cracks or other damage.
- If the tool has auxiliary or double handles, check to see that they're installed securely.
- Inspect cords for defects: check the power cord for cracking, fraying, and other signs of wear or faults in the cord insulation.
- Check for damaged switches and ones with faulty trigger locks.
- Inspect the plug for cracks and for missing, loose or faulty prongs. Ensure that the power tool has the correct guard, shield or other attachment that the manufacturer recommends. Prevent shocks. Ensure that the tools are properly grounded.

Inspection and use of cylindrical break out bars and forks SWP

When employing cylindrical style forks and breakout bars, inspect breakout bars and forks carefully before each use, ensure they are clean and can be gripped firmly and safely.

In cold weather defrost as required, ensure they are defrosted and can be gripped firmly and safely. **Do not over heat. Do not leave unattended while defrosting**, bars may become hot and create a burn hazard. **Defrost only**

Before employing cylindrical style forks and breakout bars into the holes on the drill rods, **ensure the receiving holes are clear of mud and debris**, clean as required to prevent cylindrical forks and break out bars from becoming slippery and difficult to grip and control safely. Pay careful attention to hand position and watch for/control pinch points.

***Caution heavy items**

APPENDIX 2 – SAFE JOB PROCEDURES

SJP - Air Brake Adjustment

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Other works and/or equipment Machine malfunction	Steel toe boots Safety glasses Gloves Chocks/Blocks

Safe Job Procedure:

1. Wear appropriate PPE
2. Park and apply parking brake on level ground
3. Build air to full system pressure
4. Block/ chock wheels
5. Release brakes and shutoff vehicle
6. Ensure pushrod travel is correct for brake type
7. Adjust slack adjuster if out of spec. If brake is automatic type and out of spec notify supervisor as soon as possible and note condition on pre-trip form.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Air Pressure Buildup in Casing Swivel and Discharge

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Explosive release of air Flying projectiles Hearing damage	Hard Hat Steel toe boots Eye protection Hearing protection

Safe Job Procedure:

Dangerous amounts of air pressure and volume can build up in casing if long discharge hose becomes plugged with cuttings or frozen mud, water and cuttings. Buildup and sudden release of air pressure can cause swivel and/or discharge hose to move violently and unexpectedly with potential for serious injury and property damage.

1. Prior to use and/or at the end of each shift, discharge hose to be drained to eliminate blockages. In subzero conditions this should be done during any significant work stoppage. Easiest method involves lifting hose vertically to drain.
2. At all times circulation of air through discharge hose must be verified prior to engagement of auxiliary air compressors.
3. If discharge air pressure is building above expected levels shut down compressor input and verify there is no blockage in the swivel or hose.
4. If dangerous buildup of pressure in casing or discharge is suspect ted shut down air, bleed off pressure where possible, remove all persons from immediate “danger area” until pressure has vented prior to finding and removing blockage.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Augers

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Rotating equipment Burrs Heavy lifting	Steel toed boots Safety glasses Hearing protection Gloves Coveralls

Safe Job Procedure:

1. Only qualified personnel shall work in proximity of drill rig
2. All loose clothing, boot laces, hair, jewelry shall be tied up or otherwise contained
3. Emergency stops shall be tested for functionality on a regular basis
4. If required by site or client auger guard is to be installed
5. All personal will keep clear of rotating augers at all times.
6. Auger will be stopped before any hand, glove, boot or part of person and or clothing makes contact with auger.
7. Two people per auger for lifting and moving augers when required (large diameter, heavily soiled, ect.)

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - BC Hydro's 7 Steps to Electrical Safety

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Shock Burn	Steel toed boots Safety glasses Hearing protection Gloves Coveralls

Safe Job Procedure:

1. Don't Become a Victim – Always call local emergency personnel when contact is made with an energized line
2. 10 Meters to Safety – Stay back at least 10 meters (33 feet) from any fallen power line or exposed underground cable
3. Look Up and Live – Look up, check and keep equipment clear of overhead power lines
4. Know Your Limits – When using equipment in the vicinity of power lines always maintain the limits of approach: from 3-7 meters (10-20 feet for unshielded lines) depending on the voltage

   DRILLWELL POLICY IS MIN 20 FEET UNLESS CLEARED BY CHECKING WITH BC HYDRO
5. Don't Hang Around Operating Equipment – Stay at least 10 meters (33 feet) from operating equipment, in case it contacts an energized line
6. Shuffle or Hop, Don't Step – If your vehicle makes contact with an energized line remain inside until help arrives. If you must get out due to fire jump with your feet together. Then shuffle or hop away keeping both feet close together. Never contact the ground and your vehicle at the same time.
7. Call Before You Dig – To avoid contacting underground power lines before you dig call B.C. One Call at 1-800-474=6886 or cell *6886.

   BE SURE SERVICE LOCATES HAVE BEEN DONE IN URBAN SETTINGS

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Casing Jacks, Yoke and Slips

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Airborne objects Failure of fittings or hoses Heavy items Crush/pinch points	Steel toe boots Safety glasses Hearing protection Gloves

Safe Job Procedure:

1. Wear appropriate PPE
2. Ensure hoses and fittings are in good repair
3. Foundation for jacks, stands and ladders must be firm and level
4. Setup Jacks and tie or chain to each other and the casing
5. Install yoke keeping hands out of potential pinch points
6. Install slips with all slips at roughly the same insertion depth
7. Stroke out jacks to extract casing
8. Monitoring jacks, jack pads, yolk and slips regularly and continuously for sinking twisting or deviation that may cause a hazard
9. Slightly retract jacks, stop if yolk and slips are stuck
10. If yolk and slips are stuck loosen by striking yolk downward with sledge hammer
11. Sledge hammers must be in good repair and inspected throughout process
12. Keep people out of the line of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Cranes on Flatdeck Trucks

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Suspended loads Failure of fittings or hoses Heavy items Crush/pinch points	Steel toe boots Safety glasses Hearing protection Gloves

Safe Job Procedure:

1. Only qualified operators with certification permitted to use folding cranes
2. All rigging to be inspected, in good condition and sized
3. Outriggers to be set to their maximum practical extension for loads over 500kg
4. Place jack pads or blocking under jacks ensuring ground will support load applied
5. Extend jacks ensuring that both sides begin to take truck load
6. Following specific crane model instructions un-package crane. Ensure knuckle is fully retracted before un-packaging
7. Keep out from under suspended loads at all times
8. Whenever a heavy load is moved away from the truck the load should be keep at close to the ground as practical so that in the case of equipment failure or operator error the load will contact ground limiting damage to load and/or equipment.
9. Keep an adequate distance away from boom and only approach boom after communication with the operator
10. When approaching the boom (i.e. attaching or unhooking a load) the operator will remove hands from controls to prevent accidental movement of crane.
11. In order to avoid accidental engagement of remote control remote unit should be turned around or turned off before bending over to attend rigging or climbing up and down from truck deck
12. Contact supervisor if unfamiliar with considerations for a specific load or rigging

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Compressed Air (150psi+)

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Airborne particles Failure of fittings or hoses	Steel toe boots Safety glasses Hearing protection Gloves Whip-checks

Safe Job Procedure:

1. Wear appropriate PPE
2. Ensure hoses and fittings are in good repair
3. Ensure whip checks are used at the end of hose fittings
4. Check fluid as per compressor recommendations (cold or warm)
5. Keep people out of the line of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Cutting Torch

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Burns Eye Injuries	Eye protection Gloves Coveralls, fire retardant Fire Extinguisher

Safe Job Procedure:

1. Ensure bottles are secure in the upright position
2. Open valves at bottles (1 full turn acetylene, fully open oxygen)
3. Adjust regulator (5-7psi acetylene, 35-45psi oxygen) with torch valves open
4. Close both torch valves. Open acetylene ½ turn at torch and light (oxygen closed when lighting)
5. Turn on and increase oxygen at torch until desired flame is achieved (sharp short blue tip)
6. Cut as required
7. Shutoff oxygen first followed by acetylene at torch
8. Shutoff bottles

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Equipment Daily Maintenance

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Equipment failure Collisions Pinch points	Steel toe boots Eye protection Hand protection Hearing protection

Safe Job Procedure:

1. Check over machine (damage, loose parts, ect) using equipment log checklist if applicable
2. Ensure equipment is within its service interval
3. Check engine for fluid levels, belt condition, leaks, loose hardware
4. Check other fluid levels if applicable (hydraulic, power steering, coolant ect.)
5. Ensure everyone is clear and start engine
6. Check gauges for normal oil pressure, temperature, hydraulic functions
7. Walk around equipment before moving

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Fall Protection on Drilling Rigs

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Falls from more than 10’ Trips Slips	Hard Hat Steel Toed Boots Safety Glasses Fall Arrest Harness Lanyard Self-retracting lifeline (optional)

Safe Job Procedure:

1. Remove any un-necessary objects from worksite that could be hazards in a fall (shovels, pry bars, ect.)
2. Inspect fall arrest harness system which can include (but is not limited to) harness, lanyards, karabiners, retractable lifeline, and tie-off points.
3. Complete fall arrest inspection sheet
4. Complete fall protection plan if work will be performed above 25’.
5. Don fall arrest harness and adjust to fit
6. Climb mast ensuring at least one lanyard (or retractable lifeline) is connected to an anchor point at all times.
7. At working position attach lanyard such that free fall distance will be limited.
8. Descend mast ensuring at least one lanyard (or retractable lifeline) is connected to an anchor point at all times.
9. Remove and inspect fall arrest equipment and put away

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Fueling Equipment

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Eye Injury Fire/Burn Spill	Steel toed boots Eye protection Fire Extinguisher

Safe Job Procedure:

1. All gas equipment must be shut off prior to re-fueling. Diesel equipment to be shut off if practical.
2. All sources of ignition must be controlled prior to re-fueling
3. Ensure adequate ventilation
4. Remove fill cap
5. Fuel equipment allowing some space in tank (do not overfill)
6. Fill nozzles with auto shutoff still need to be attended
7. Securely store fuel source after re-fueling

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Jump Starting Batteries

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Acid Explosive gas Awkward positioning Rotating equipment	Steel toe boots Eye protection

Safe Job Procedure:

1. Check cables for wear, damage to insulation, loose connections
2. Check booster cables for wear, damage to insulation, damaged clamps
3. Connect dead battery positive connection
4. Connect healthy battery positive connection
5. Connect healthy battery negative connection
6. Last connection should be dead battery negative connection but this connection should be made to a good ground (bare metal) away from the battery.
7. Remove cables once uncharged vehicle is started

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Hoisting Loads with DR Winch

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Eye Injury Pinch points Suspended loads	Steel toed boots Eye protection Gloves

Safe Job Procedure:

1. Whenever possible the weak point in a hoisting configuration should be the winch
2. Winch capacity on Dual Rotary rigs are 3000 - 6000lbs; straps and cables with a capacity greater than 6000lbs should be used for all but very small objects.
3. When using chockers or straps on casing double wraps are required. If casing is not restrained by drill rods or other restraints and is longer than 6' a secondary securing device such as a clamp or a cleat is required to prevent strap from slipping.
4. Cloth or rope slings used for hoisting should be in good repair and have rating exceeding the weight of the hoisted object
5. Do not attempt to "finish" cut with winch. If casing is not fully cut, release tension on winch and complete cut with torch/cutting disc.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Lifting

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves

Safe Job Procedure:

1. Assess if object is too heavy by trying to pick up one end. If it is too heavy get additional manpower or equipment to assist.
2. Keep back straight; bend at the hips and knees.
3. Obtain a firm grip
4. Keeping the load close to your body lift with leg muscles in smooth motion
5. Avoid quick or twisting motions
6. Keep hands and feet clear of pinch points when setting down the load

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Moving Vehicles and Equipment at sites

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Collisions with people Collisions with objects	Method of communication Hi-vis clothing

Safe Job Procedure:

1. Walk around vehicle prior to operation
2. Check clearances (left/right, front/back and above/below)
3. Avoid backing up when possible
4. Use spotter if possible
5. If backing up use horn
6. Maneuver at a safe speed
7. If exiting vehicle set brake and leave transmission in appropriate gear

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Securing Equipment on Decks or Trailers

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves Eye protection

Safe Job Procedure:

1. Ensure the machine is balanced properly on the trailer and all functions are parked and if equipped blades are resting on deck.
2. Secure the machine with chains and load binders from designated tie down locations
3. Ensure any tooling is secure
4. Any additional chain or strapping is to be secured
5. Double check all chains and tiedowns are tight
6. Check load periodically during trip

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Securing Tooling or Materials on Decks

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves Eye protection

Safe Job Procedure:

1. Use load stakes where appropriate
2. Use pallet corner protection where appropriate
3. Inspect straps and chains to ensure in good repair
4. Items longer than 5’ should have two straps
5. Dunnage should be used if required to achieve secure load
6. Tighten straps and/or chains and inspect load to ensure it is secure
7. Secure extra slack in straps and/or chain
8. Periodically check load during trip

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Welding

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Flash Burns Inhalation of gases Shock	Welding helmet Steel toed boots Leather Gloves Eye protection Fire Extinguisher

Safe Job Procedure:

8. Only qualified personnel shall perform welding activities
9. Area is to be well ventilated and clear of combustible materials
10. If extremely dry conditions exist wet down work area
11. Keep area clear of material that will be damaged by slag, heat and sparks
12. Keep area clear of trip and slip hazards
13. Attach ground lead to item to be welded
14. Perform welding activities
15. Be observant of surrounding worksite for ½ hour after welding in case of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Setting and Removal of Deepwell Pumps

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points Repetitive strain	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

1. Ensure adequate site access and preparation prior to setup. Site must be solid, reasonably level and large enough to ensure safe working conditions.
2. Equipment must be able to safely handle weight of pump column, wire, pump and water column. If in doubt request weight calculation from engineering.
3. Consider equipment failure or human error. Emergency escape routes should be discussed at each site. Electrical cable snaking or whipping is can be a major risk if pump is dropped down the hole.
4. Workers are to keep clear of loops and coils of electrical cable
5. Safety of workers is at all times to take precedence over potential damage to electrical cable and/or pump components.
6. Operator and helpers are to ensure all body parts are clear prior to lowering column, especially when lowering column onto fork.
7. Cable banding on last piece of pump column is not to be cut until pump AND motor are secure at surface.
8. During pump installation the same considerations (pinch points, cable loops and coils) must be considered.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Lightning

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Burns Electrocution	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

Every year in North America hundreds of people are struck by lightning and dozens of people are killed by it. When thunderstorms threaten get to a safe place.

1. Cease activities leaving equipment in safe state and alert nearby workers of the danger
2. Relocate to a safe location away from tall metal objects. Safe locations can include inside a vehicle or inside a building complete with plumbing and/or electrical wiring.
3. Wait until at least 20min pass since the most recent thunder or lightening event before returning to work.
4. A worker who is struck by lightning (directly or indirectly) doesn't hold an electrical charge and poses no threat to other workers. CPR may be required. Provide medical aid immediately and call for help. In an isolated situation package patient and provide transport to nearest medical aid.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Setup and Teardown of Cable Tool Rigs

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points Repetitive strain Fall from heights	Hardhat Steel toe boots Safety Glasses Hearing protection Fall protection

Safe Job Procedure:

1. Ensure adequate site access and preparation prior to setup. Site must be solid, reasonably level and large enough to ensure safe working conditions
2. Blocking (wood or steel) is to be used. Do not depend on hydraulic outriggers. Blocking must provide support and stability in both side-to-side and front to back directions
3. Mast hoist line to be inspected prior to every use. Must be replaced at first sign of damage or fatigue. Care must be taken to ensure mast hoist line spools neatly on drum
4. Mast hoist clutch must NEVER be left in gear when operator is off stand
5. Stand must be secure and well supported. Safety harness is required when rigging guys
6. Mast is not to be raised or lowered while anyone is on the mast or rig frame
7. When half-masting rig adequate wood or steel blocking must be installed in mast. Do not depend on mast hoist cable to support mast while working
8. Only persons authorized by foreman or management may set up or tear down ANY rig or equipment. No person shall setup or tear down any rig or equipment until they have received instruction, and been supervised by an experienced operator
9. Drill stem to be set in open hole whenever possible
10. Hoist line traveling block must not be secured by ANY means when mast is being raised
11. If mainline is to be secured while raising mast nothing stronger than ½" nylon rope may be used. CABLE CHAIN OR SLINGS ARE NOT TO BE USED
12. Mast hoist clutch will be setup so that it automatically disengages when released

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Rigging

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

1. Prior to each daily use all lifting equipment and rigging will be inspected
2. Chains, slings, chockers, straps, hooks and shackles must be in good condition with no jaggers, burns, cracks, tears, pitting or stretching present.
3. Any lifting equipment showing signs of damage above will be removed from service and tagged, destroyed or disposed of to ensure it isn't reused without being repaired.
4. Crane truck is to be inspected using Equipment inspection form with note indicating the condition of rigging.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

APPENDIX 3 – DRILLWELL SAFETY CARRIER MANUAL

Drillwell Carrier Safety

Rules and Regulations

OBJECTIVES: To have zero accidents, zero tickets, and zero notice and orders; to promote safety throughout the company, particularly in regard to vehicle operations and to ensure compliance with the requirements of the national safety code.

PROFESSIONAL DRIVERS: All employees are professional drivers when operating company vehicles. As professionals, they are required to drive in a safe and courteous fashion, to ensure that their vehicle is safe, secure, and legal, and to comply with "hours of service", inspection, and reporting requirements.

All employees who drive company vehicles must have a valid drivers' license, with the required endorsements, and a good driving record. Also drivers must obey all laws including seat belt, and speed limit, and display good judgment in regards to following distances and speed, especially during poor weather or on bad roads.

Employees must ask for instruction or guidance if unsure about vehicle inspections, hours of service, maintenance, brake adjustments, or load security.

Pre-trip and post-trip inspections are to be turned in daily, or weekly, as it is a finable offence for them to be in the vehicle after 20 days.

Drivers are responsible to do service and maintenance, and/or ensure that maintenance gets done. i.e. Notation in daily inspection report, AND written on shop white board.

Annual drivers' abstracts will be retained on file for all employees for at least 4 years.

Employees are required to report ALL accidents, tickets, and notices, regardless if they are issued while on or off duty, or in company or private vehicles. Copies of all tickets, fines, notices, suspensions, and accident reports are to be turned into the office within 5 days of being received.

Any employee who does not follow the requirements of this policy, and the National Safety Code, will be subject to warnings, fines, and possible suspension or termination.

Each driver is responsible to ensure that the vehicle being operated is equipped with all necessary safety equipment and documentation. This includes operational fire extinguisher charged and checked within the past year, first aid kit, road flares (triangles), and valid insurance, license, and inspection certificates.

Each driller/equipment operator is responsible to make sure that ALL units in his care and control receive all scheduled, and routine maintenance as per operators manuals, and that all units receive at least weekly lubrication, and inspection, and that all minor service gets done in the field. i.e. lights, reflectors, mirrors, wipers etc.

Repairs of ALL known defects are to be done PRIOR to vehicle inspections. Failed inspections go on our safety record. Inspections are NOT for maintenance, they are to verify that all maintenance is being done.

CELL PHONE OR OTHER HANDHELD WIRELESS USE IS FORBIDDEN WHILE DRIVING!

Discipline

Any disciplinary measure whether verbal or written will be recorded in employee file.

Disciplinary action could result from failure to meet the requirements of these policies, from abuse or neglect of equipment, from reports of poor driving, or negative feedback from clients, or from harassing, abusive, or disrespectful treatment of fellow employees.

Discipline would normally start with a verbal warning, followed by a written warning for repeated offences, followed by suspension or termination.

Immediate termination may result from: Theft, willful or deliberate damage to equipment or materials, unauthorized use of equipment, criminal convictions, drivers license suspensions, serious motor vehicle accidents or offences.

The company reserves the right to modify disciplinary action when it deems appropriate.

Use of alcohol or other intoxicating drugs is forbidden while on duty. No one shall work or report for work while under the influence of any intoxicating substance. Use or possession of open alcohol, or other intoxicating substances is forbidden in any Drillwell vehicle.

Regulations and Requirements (70 Hour 7 Day cycle)

1. A pre-trip, AND post-trip inspection are required daily for all vehicles over 14,600 kg GVW when driven on public roads. Drillwell policy is to complete these pre and post-trip inspections on all commercial vehicles other than pickups. Inspection MUST be done, signed, and dated with the time of pre, and post trip. A statement is required, stating defects as noted, or “no defects noted”. Inspection reports must be turned in promptly, as it is a fineable offence to have them in the vehicle for more than 20 days.

2. Drivers hours of service logs are required for all vehicles over 11,795kg if traveling more than 160 km from base, (North of Courtenay, West of Port Alberni, East of Chilliwack from Duncan), or if staying away overnight. Driver's hours of service logs must contain the previous 14 days of on duty time, and days off. They must be fully completed, totaled, signed, dated, and turned in promptly to the office. It is a fineable offence to not have log up to date, or to have log in vehicle for more than 20 days.
3. Inspection and service: Drivers are responsible to know when the vehicle that they are driving is due for CVI (Commercial Vehicle Inspection) or scheduled service, and to help ensure that Inspections and service are done. I.e. Note in daily inspections, and/or note on white board in shop. Lack of a dashboard sticker or illegible dashboard sticker is not an excuse. If you are unsure it is your responsibility to find out.
4. Driver is responsible for all aspects of load security and safety i.e. Brake adjustment, tires, tie down requirements, (number and condition), load security, (including doors, cinch handles, and debris on jack pads, and stands), lights, flags, fire extinguishers, flares, first aid kits.
5. All laws of the road must be followed, including safe passing, speed limits, construction and school zones, seat belts, and safe distances to follow.
6. Do not respond with aggression to the poor or dangerous driving of others. There is no excuse for road rage.
7. Hours of Service:
    - No one shall drive a Commercial Vehicle (over 11,795kg) after 14 hours of on duty time working and driving time combined in one 24 hr. period.
    - No one shall continue to drive a CV after 13 hours of continual driving in one 24 hr. period.
    - No driver shall drive a CV after 16 hours has elapsed from the start of that driver's day, including all off and on duty hours until at least 8 consecutive hours of off duty time has been taken.
    - No one shall drive a commercial vehicle after more than 70 hours of on duty time in 7 consecutive days until taking 36 consecutive hours of off duty time.
    - 24 consecutive off duty hours required in each 14 days to continue cycle.
      Seven day cycle is reset to zero by taking 36 hours off. (a night, a day and a night)

Calculating On-Duty and Off-Duty Hours of Service

Riding as a passenger in a pick-up, plane, etc., to drive a Commercial Vehicle over 11,759kg counts as On Duty hours unless 8 consecutive hours of off duty are taken just prior to driving. You could then deduct those hours spent as a passenger from your total hours in the 7 day cycle.

Waiting for ferries counts as on duty hours.

Time on a ferry is considered off duty hours, (though still chargeable time on your calendar). Show the hours riding the ferry in Remarks and as “Off Duty” on your Hours of Service log sheet.

Drillwell works using the 70 Hour, 7 Day Cycle, (Cycle 1).

DRILLWELL CARRIER SAFETY SIGNOFF

AFTER READING ALL OF THE PRECEDING INFORMATION PLEASE SIGN AND DATE BELOW TO AKNOWLEDGE THAT YOU UNDERSTAND ALL OF THE REQUIRMENTS OF THESE POLICIES, AND THAT YOU AGREE TO ABIDE BY ALL RULES AND REGULATIONS AS SET OUT HEREIN, AND REQUIRED BY THE NATIONAL SAFETY CODE.

A COPY OF THIS AKNOWLEDGEMENT MUST BE RETAINED AT THE OFFICE.

Name:_____

Driver License #_____

Date of expiry_____

Signature:_____

Date Signed:_____

APPENDIX 4 – FORMS

Drillwell Carrier Safety Signoff (Signed Form)

AFTER READING ALL OF THE PRECEDING INFORMATION PLEASE SIGN AND DATE BELOW TO AKNOWLEDGE THAT YOU UNDERSTAND ALL OF THE REQUIRMENTS OF THESE POLICIES, AND THAT YOU AGREE TO ABIDE BY ALL RULES AND REGULATIONS AS SET OUT HEREIN, AND REQUIRED BY THE NATIONAL SAFETY CODE.

A COPY OF THIS AKNOWLEDGEMENT MUST BE RETAINED AT THE OFFICE.

Name:_____

Driver License #_____

Date of expiry_____

Signature:_____

Date Signed:_____

New Worker Safety Orientation (Signed Form)

NAME: _____ DATE: _____

LOCATION: _____ _ POSITION: _____

Emergency contact name and tel. # _____

Topics Covered		Rigging, Slings & Straps	
Company Safety Policy & general rules		Fire Hazards	
Employee safety responsibility		Pointed Hazards	
Reporting unsafe conditions & acts		Rebar protection	
Reporting incidents & injuries		Fall protection	
First aid location & Evacuation procedures		Hole coverings	
Location of marshalling areas		Electrical protection	
How to contact first aid/signal emergency		Power tools	
Personal protective equipment		Transport of Personnel & Equip.	
WHMIS training? (copy) MSDS sheets		Power lines/locates	
Clothing requirements		High visibility vests/Clothing	
Safety meetings & inspections		Housekeeping	
Safety inspections		Lighting requirements	
Workers right to refuse unsafe work		Cranes and rigging	
Personal medical conditions		Torching	
Professional conduct/aggressive behaviour		Forklift	
First aid ticket? (copy)		Issued copy of Safety Program	
Harassment and Abuse		Name & contact info of supervisor	
Hearing test card?		Dual Rotary Hoisting with winch	
Folding Crane Use certification (copy)		Company H&S Representative	
Cable tool Rig Set up and Tear Down		Casing Jack Use	
Summary of Minimum Safety Requirements		Carrier Safety Policy	
Deep Well Pump Sets		Lockout Tagout requirements	
JOHSC Names and contact information		Hoisting Steel Pipe or Casing	

You must **initial each safety topic** discussed and provide copies of documents as indicated above. Your signature indicates that you have understood and agree to follow the procedures as explained.

SAFTEY COORDINATOR: _____ DATE: _____

WORKER'S SIGNATURE: _____

Worker Disciplinary "Zero Tolerance" Policy (Signed Form)

All personnel employed with Drillwell Enterprises Ltd., or sub-trades hired to perform work by Drillwell Enterprises Ltd. must follow established safety protocols, where and when required.

Failure to follow or implement company safety program procedure will result in immediate disciplinary action and possible termination of employment. Only one written warning may be removed from any employee file per calendar year, at the discretion of Drillwell Enterprises Ltd. management.

Safety is everybody's business. Safety is our greatest concern!

In the event of a worker contravening a WorksafeBC regulation or a company safety program policy, the following guidelines shall be implemented:

1. Immediately remove the worker(s) from the hazard in question. Contact the Drillwell Enterprises Ltd. site supervisor and office with the worker's name. Sub-trade personnel may be permanently removed from any or all Drillwell Enterprises Ltd. sites for non-compliance of safety regulations.

2. After review of the facts, the company representative will initiate appropriate disciplinary action. Guidelines for discipline are as follows:

- FIRST OFFENCE: The worker and/or supervisor will receive a written Safety Violation notice, and it will remain in their personal file for the duration of employment, including future employment with Drillwell Enterprises Ltd.
- SECOND OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for one (1) working day. Worker and supervisor will sign document.
- THIRD OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for five (5) working days. Worker and supervisor will sign document.
- FOURTH OFFENCE: employment will be terminated, effective immediately.

There will be no exceptions to this zero tolerance policy!

I acknowledge, understand and will comply with the company safety program & policy.

NAME: _____ DATE: _____

WORKER'S SIGNATURE: _____

Folding Cranes on Flatdeck Trucks (Signed Form)

- No employee is to use any folding crane without first reading these procedures, AND receiving instruction in crane operation from a senior employee.
- No person shall ever be under a suspended load for any reason.
- No one is to be standing, moving, or working near a boom or in immediate swing radius while crane is being operated. Do not approach boom until operator gives okay signal.
- If a person must be near the boom, i.e.: to attach or unhook a load, the operator will remove hands from controls to prevent accidental pinching or striking of worker by unintended movement of crane.
- Outriggers are to be set to their maximum practical extension any time heavy items (over 500kg.) are loaded or unloaded.
- Jack pads or ground pads are to be used at all times.
- When handling heavy items, the operator must be very aware that as the load moves away from the truck bed, or the boom is extended, the load and leverage acting on the crane and truck increases rapidly.
- Whenever a heavy load is moved away from the truck by swinging or extending the boom, the load should be as close to the ground as possible so that in case of equipment failure or error the load will contact the ground, before it overbalances the truck.
- When handling heavy items use extra caution and time. i.e.: for 16" and 20" casing in lengths 20ft. or over, lift only 2 pieces at one time, for 10" and 12" casing lift only 3 pieces at one time.
- Contact supervisor if unfamiliar with a specific load, or handling.
- All rigging is to be inspected, in good condition and sized appropriately for the intended lift

In order to avoid accidental engagement of remote control, remote unit must be turned off before operator bends over to attend rigging, or climbs up or down from truck deck

All employees who will be operating crane are to sign a copy of these procedures ONLY after they have read them, and received instruction on crane operation from a senior Drillwell Employee. **CERTIFICATION REQUIRED!**

NAME: _____ DATE: _____

WORKER'S SIGNATURE: _____

Crane Inspection (Form)

DRILLWELL

DAILY CRANE TRUCK INSPECTION REPORT

TRUCK: _____ UNIT #: _____ Crane Inspection Expiry: _____

Month: _____ Year: _____ Vehicle Inspection Expiry: _____

Last Service: _____ Fire Extinguisher Expiry: _____

Next Service Due: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Stakes & Load Secure	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Outriggers & Pads	Hyd. Oil	Boom & Frame	Greased Equip. Today	All Guages Working	Site Condition Good	Fluid Leaks	Fuel Level	Remote Checked	Operator init.	Problems / Issues / Hazards Service / Comments
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Additional Comments:

White Copy - submit to office monthly Yellow - retain in vehicle 38617 PrintCraft 1-800-240-7899

Rig/Equipment Inspection (Form)

DRILLWELL

DAILY RIG / EQUIPMENT INSPECTION REPORT

RIG: _____ UNIT #: _____

Month: _____ Year: _____

Last Service: _____

Next Service Due: _____

Vehicle Inspection Expiry: _____

Fire Extinguisher Expiry: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Comp. Oil	Hyd. Oil	Mast & Frame	Greased Equip. Today	All Guages Working	Site Condition Good	Fluid Leaks	Fuel Level	Driller init.	Helper init.	Problems / Issues / Hazards Service / Comments
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Additional Comments:

44198 PrintCraft 1-800-240-7899

Sonic Inspection (Form)

DRILLWELL

SONIC INSPECTION REPORT

Month: _____ Year: _____

	SERVICED (HRS)	DUE (HRS)
ENGINE		
HEAD		
ROTATION		

Fire Extinguisher Expiry: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Head Lube Oil	Hyd. Oil	Mast & Frame	Greased Equip. Today	Head / Spindle Bolts	Coolers	Fluid Leaks	Fuel Level	Driller initial	Problems / Issues / Hazards Service / Comments
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Additional Comments:

Pre-trip Inspection (Form)

DRILLWELL TRIP INSPECTION REPORT
as required by the National Safety Code

DATE: _____

UNIT # _____ Odometer Start _____

❑ In pre-trip inspection I have detected no defect or deficiency in this motor vehicle as would be likely to affect the safety of its operation or result in its mechanical breakdown.

TIME: _____ AM/PM SIGNATURE: _____

NAME: _____

TRUCK:

❑ Defect(s) found: (as marked)

❑ Brakes / Brake Adjustment	❑ Steering	❑ Windshield / Wipers
❑ Oil & Fluids	❑ Lights	❑ Horn
❑ Emergency Equipment	❑ Load Security	❑ Mirrors
❑ Tires-Wheels / Nuts / Studs	❑ Parking Brakes	❑ Mud Flaps

❑ TRAILER: (If Applicable) # _____

❑ Defect(s) found: (as marked)

❑ Brake Connections	❑ Lights	❑ Tires
❑ Brakes	❑ Mud Flaps	❑ Wheels
❑ Coupling	❑ Tie Downs	❑ Load Security

❑ In post-trip inspection I have detected no defect or deficiency in this motor vehicle as would be likely to affect the safety of its operation or result in its mechanical breakdown.

TIME: _____ AM/PM SIGNATURE: _____

REMARKS / REPAIRS - COMMENT REQUIRED! _____

_____

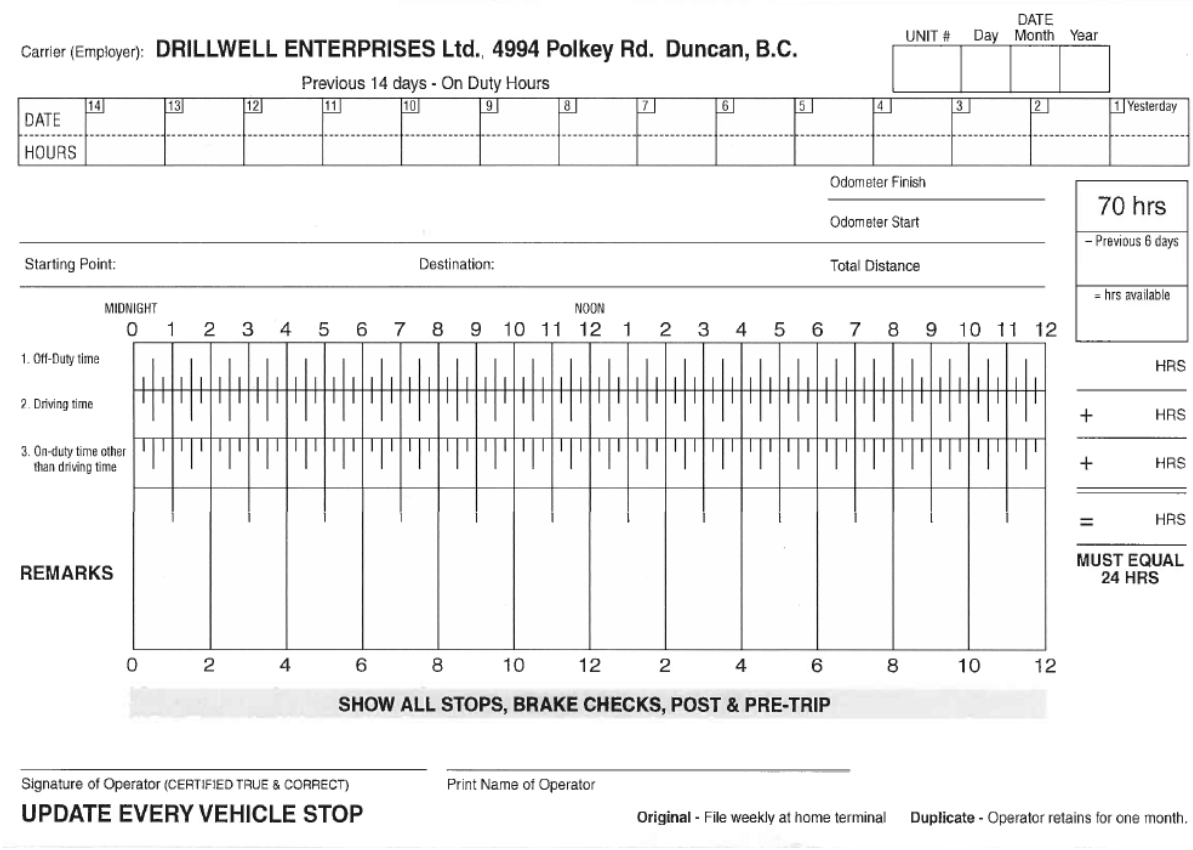
❑ Above defects corrected

❑ Above defects need not be corrected for safe operation

OFFICE REPORT

SIGNATURE: _____ DATE: _____

Driver's Hours of Service (Form)



Carrier (Employer): **DRILLWELL ENTERPRISES Ltd., 4994 Polkey Rd. Duncan, B.C.**

UNIT # | DATE Day Month Year

Previous 14 days - On Duty Hours

	14	13	12	11	10	9	8	7	6	5	4	3	2	1 Yesterday
DATE														
HOURS														

Odometer Finish

Odometer Start

Starting Point: Destination: Total Distance

70 hrs
– Previous 6 days
= hrs available

MIDNIGHT 0 1 2 3 4 5 6 7 8 9 10 11 12 NOON 1 2 3 4 5 6 7 8 9 10 11 12

1. Off-Duty time
2. Driving time
3. On-duty time other than driving time

REMARKS

0 2 4 6 8 10 12 2 4 6 8 10 12

HRS
+ HRS
+ HRS
= HRS

MUST EQUAL 24 HRS

SHOW ALL STOPS, BRAKE CHECKS, POST & PRE-TRIP

Signature of Operator (CERTIFIED TRUE & CORRECT)

Print Name of Operator

UPDATE EVERY VEHICLE STOP

Original - File weekly at home terminal **Duplicate** - Operator retains for one month.

Enviro/Geotech Safety Checklist (Form)

SAFETY CHECK LIST
DRILLWELL ENTERPRISES LTD.

4994 Polkey Road, Duncan, BC V9L 6W3
Email: drill@drillwell.com
Tel: (250) 746-5268 Fax: (250) 746-8404

Rig _____ Date _____

Driller _____

Helper _____

Location _____

Engineering Firm _____

Eng./Tech.Name _____

Cell Number _____

Owner/Client _____

Service Locates By _____

Job Type ☐ Enviro ☐ Geotech

DRILLWELL IS NOT Responsible for damage to underground services

DRILLER SIGNATURE _____

TECH./ENG. SIGNATURE _____

SITE CONDITION

Daylighting	☐ Yes	☐ No
Overhead Hazards	☐ Yes	☐ No
Traffic Hazards	☐ Yes	☐ No
Traffic Control	☐ Yes	☐ No
Environmental Hazards	☐ Yes	☐ No
Site Safety Plan	☐ Yes	☐ No
Drill sites clearly and precisely marked	☐ Yes	☐ No

Other Site Hazards _____

EQUIPMENT

☐ Fire Extinguishers	☐ First Aid Kit	☐ Fuel
☐ Eye Wash Stn.	☐ Hard Hats	☐ Gloves
☐ Safety Glasses	☐ High Vis Vest	☐ Lights
☐ Hydraulic System, leaks/hoses	☐ Lines & Cables	☐ Fluid Levels

Emergency contact #: **911** and/ or _____ Nearest Medical Facility _____

Route to medical facility: _____

Pre-Job Hazard Assessment (Form)

DRILLWELL ENTERPRISES LTD.

Pre-Job Hazard Assessment

Job Site: _____ Planned Activity: _____

Supervisor: _____ Weather Condition: _____

Approved by: _____ Unit # _____ Date: _____

STEPS: Identify the tasks related to the planned activity, identify and determine the Hazards involved to complete the tasks, evaluate the risk and provide the plan to eliminate or control the identified hazards.

NOTE: "High Risk" tasks require a written Safe Job Procedure or Safe Work Practice (refer to Drillwell Safety Manual).

Tasks	Hazards	Risk Rating	Plans to Eliminate / Control Hazards

Potential Hazards Checklist

Ergonomic Hazards
- ☐ Repetitive motion
- ☐ Heavy lifting
- ☐ Awkward positions
- ☐ Over exertion
- ☐ Pinch points
- ☐ Body in line of fire
- ☐ Working above your head

Access/Egress Hazards
- ☐ Aerial lift/man basket (inspected)
- ☐ Scaffold (Inspected)
- ☐ Ladders (tied off)
- ☐ Slips/trips
- ☐ Hoisting (tools/equipment)
- ☐ Excavation/trenching
- ☐ Confined space

Activity Hazards
- ☐ Welding/grinding
- ☐ Burn/heat sources
- ☐ Compressed gases
- ☐ Hoisting/lifting
- ☐ Noise (extreme)
- ☐ Dust/mist/fumes
- ☐ Mobile equipment
- ☐ Traffic and the public
- ☐ Rotating Equipment

Environmental
- ☐ Spill potential
- ☐ Weather conditions
- ☐ MSDS reviewed
- ☐ Ventilation
- ☐ Heat stress/cold exposure
- ☐ Lighting levels
- ☐ Housekeeping
- ☐ Fire Hazard

Procedures Required
- ☐ Lockout
- ☐ Confined Space
- ☐ Fall Protection
- ☐ Craning & Rigging
- ☐ Guarding
- ☐ Excavation
- ☐ Traffic Control
- ☐ Service Locates

Work at Height Hazards
- ☐ Barricading, flagging signs
- ☐ Hole (coverings in place)
- ☐ Falling items
- ☐ Powered platforms
- ☐ Others working overhead/below
- ☐ Fall (100% tie-off)
- ☐ Anchor points identified
- ☐ Ladders

Personal Hazards
- ☐ Working alone
- ☐ Violence
- ☐ First-time performing task
- ☐ Confusing instructions
- ☐ Modified work limitations
- ☐ Teamwork required

Electrical Hazards
- ☐ Shock hazard/GFCIs
- ☐ Working on/near energized eq.
- ☐ Hot work/electrical permit
- ☐ Electrical tools/cords inspected
- ☐ Overhead electrical
- ☐ Explosive hazard

PPE Requirements
- ☐ Safety footwear
- ☐ Safety eyewear
- ☐ Hardhat
- ☐ Hearing protection
- ☐ Respiratory protection
- ☐ Hand/limb/body protection
- ☐ Hi-visiblitiy apparel

Reviewed at Tailboard
- ☐ Fire extinguisher location
- ☐ First Aid room
- ☐ Route to Hospital
- ☐ Muster point
- ☐ Emergency response plan
- ☐ Incident reporting
- ☐ Nearest phone

Initials	Employee Review (print name)	Initials	Employee Review (print name)

Employer Incident Investigation Report – EIIR (Form)

1. Employer's information

Employer's name (legal name and trade name)		
WorkSafeBC account number	Operating location number	
Employer's head office address		
City	Province	Postal code
Employer's representative's name		Phone number (include area code)
Email address		

2. Injured persons

Last name	First name	Job title
a)		
b)		
c)		
d)		

3. Place, date, and time of incident

Location where incident occurred (street address or GPS coordinates)		
City (nearest)	Province	Postal code
Date of incident (yyyy-mm-dd)	Time of incident	☐ a.m. ☐ p.m.

4. Type of occurrence (select all that apply)

- ☐ Death of a worker
- ☐ Serious injury to a worker
- ☐ Major structural failure or collapse
- ☐ Major release of hazardous substance
- ☐ Blasting accident causing personal injury
- ☐ Dangerous incident involving explosives other than blasting incident
- ☐ Diving incident, as defined by regulation
- ☐ Incident of fire or explosion with potential for serious injury
- ☐ Minor injury or no injury but had potential for causing serious injury
- ☐ Injury requiring medical treatment beyond first aid

An incident investigation report is NOT required under the *Workers Compensation Act* if none of the above applies or if this incident is a vehicle accident occurring on a public street or highway.

5. Report type (select all that apply)

If this is a **revised version of a previous report**, please check here ☐

☐ Preliminary Investigation Report	☐ Interim Corrective Action Report	☐ **Full Investigation Report**	☐ Full Corrective Action Report
Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)
Only provide to a WorkSafeBC officer **if requested**		**Must be provided to WorkSafeBC within 30 days* Fax 1.866.240.1434**	
Officer's name		Date sent (yyyy-mm-dd)	

Employer Incident Investigation Report (EIIR)

6. Witnesses

Last name	First name	Job title
a)		
b)		
c)		

7. Other persons whose presence might be necessary for proper investigation

Last name	First name	Job title
a)		
b)		

8. Sequence of events that preceded the incident

Required in Preliminary Report. Update in Full Report if necessary. Describe events earlier that day or even in previous years that led up to the incident. Examples may include events such as training given or changes in equipment, procedures, or company management.

9. Unsafe conditions, acts, or procedures that significantly contributed to the incident

Required in all reports. Describe anything, or the absence of anything, that contributed to the hazard such as poor housekeeping or poor visibility, using equipment without guards, or the lack of safe work procedures.

10. Nature of the serious injury (optional — complete only if there has been an injury)

- ☐ Life threatening or resulting in loss of consciousness
- ☐ Major broken bones in head, spine, pelvis, arms, or legs
- ☐ Major crush injuries
- ☐ Major cut with severe bleeding
- ☐ Amputation of arm, leg, or large part of hand or foot
- ☐ Major penetrating injuries to eye, head, or body
- ☐ Severe (third-degree) burns
- ☐ Punctured lung or other serious respiratory condition
- ☐ Injury to internal organ or internal bleeding
- ☐ Injury likely to result in loss of sight, hearing, or touch
- ☐ Injury requiring CPR or other critical intervention
- ☐ Diving illness such as decompression sickness or near drowning
- ☐ Serious chemical or heat/cold stress exposure
- ☐ Other (specify)

Employer Incident Investigation Report (EIIR)

11. Brief description of the incident

Required in Preliminary Report. Briefly, summarize the sequence of events, the unsafe factors, and the resulting injury, if any.

12. Corrective actions identified and taken to prevent recurrence of similar incidents

Action (Required in Preliminary Report and Interim Corrective Action Report. Update in Full Report, if necessary.)	**Action assigned to** (name and job title)	**Expected completion date** (yyyy-mm-dd)	**Completed date** (yyyy-mm-dd)
a)			
b)			
c)			
d)			
e)			

13. Explanation of blank areas on this Preliminary Report, if any

If there are blank areas, describe the circumstances beyond your control that explain this lack of information.

14. Persons who carried out or participated in the preliminary investigation

Representative	**Name**	**Job title**	**Signature** (optional)	**Date signed** (yyyy-mm-dd)
Employer representative (required)				
Worker representative (required)				
Other				
Other				

End of report

Completing all the sections above satisfies the requirements for a Preliminary Investigation Report and an Interim Corrective Action Report.

Note: If this was a simple investigation and **all needed corrective actions have been completed within 48 hours**, the Preliminary and Full Investigation portions of the report can be completed at the same time. If so, you can check both the Preliminary Investigation Report and the Full Investigation Report boxes in section 5 on page 1.

As of January 1, 2016, copies of **all** reports must also be provided to the joint occupational health and safety committee or worker representative, as applicable.

Employer Incident Investigation Report (EIIR)

15. Determination of causes of incident

Required in Full Report. Analyze the facts and circumstances of the incident to identify underlying factors that led to the incident. Underlying factors include factors that made the unsafe conditions, acts, or procedures in the Preliminary Report possible. Update items from section 9, if needed.

16. Full description of the incident

Required in Full Report. Use the brief description from the Preliminary Report and update it, if necessary.

17. Additional corrective actions necessary to prevent recurrence of similar incidents

Additional corrective action (Required in Full Report and Full Corrective Action Report.)	**Action assigned to** (name and job title)	**Expected completion date** (yyyy-mm-dd)	**Completed date** (yyyy-mm-dd)
a)			
b)			
c)			
d)			

18. Persons who carried out or participated in the full investigation

Representative	**Name**	**Job title**	**Signature** (optional)	**Date signed** (yyyy-mm-dd)
Employer representative (required)				
Worker representative (required)				
Other				

19. Other relevant workplace parties

Company name	**Contact person**	**Contact number or email address**
a)		

End of report

Completing all the sections above satisfies the requirements for a Full Investigation Report and a Full Corrective Action Report.

Employers are required to submit **full** investigation reports to WorkSafeBC **within 30 days* of the incident.** Reports may be submitted by fax to 604.276.3247 (Greater Vancouver), toll-free fax 1.866.240.1434, or by mail to PO Box 5350, Stn Terminal, Vancouver BC V6B 5L5. Do **NOT** submit a preliminary report unless you have been so directed by a WorkSafeBC officer.

* Employers can request an extension from a WorkSafeBC officer, **if the full investigation cannot be completed within 30 days.**

As of January 1, 2016, copies of **all** reports must also be provided to the joint occupational health and safety committee or worker representative, as applicable.

Monthly Safety Meeting (Form)

Joint Health and Safety Meeting Minutes

Date:	

Last Evaluation:	24-May-17
Next Evaluation:	24-May-18

JHS members present:

All others present:

Addressed from Last meeting:

Recent Concerns, Observations, Comments:

Recent Near Misses:

Recent Incidents:

	Number of Time loss Injuries	Days Since last time lost Injury
Year to Date		

Topics For Next Safety Meeting:

Safety Violation – Employee or Subcontractor (Form)

Project name and address: _____

Issued To: _____

Sub-contractor: _____ Trade: _____

Date: _____ Time: _____

Violation:

_____
_____
_____
_____

Workers in violation:

_____

Worker's response:

_____
_____
_____

Action Taken:

_____
_____
_____

Recommendations:

_____
_____
_____

The sub-contractor named above must provide written verification to the site superintendent and safety supervisor within 5 working days of the date of this notice. Verification must address the violations identified and the recommendations set forth.

In the event of a failure to comply a copy of this notice will be forwarded to the WCB prevention division.

_____ _____

Signature of Safety Supervisor Signature of Site Supervisor

Fall Protection Equipment - Inspection Record (Form)

Date: _____ Location: _____ Unit # _____

Date of	Inspected	Equipment	I.D.#	Condition	Replace	Replacement

All equipment listed above has been deemed acceptable for continued service **unless otherwise noted.**

Additional Remarks:

_____

_____

Fall Protection – Site Specific Plan (Form)

Work Site:

Address or Location:

Work to be Performed:

Fall protection system to be used (i.e. guard rails, lanyards, self-retracting lifeline):

Rescue plan (i.e. ladder truck, man basket, high angle rescue team)

Training and Notification:

Have all workers been trained in the safe use of the fall protection equipment? YES NO

Have all affected workers been made aware of this plan? YES NO

Supervisor's Signature:	Date:

Inspection Record (Form)

Inspection Report

Use this report to record the results of your regular workplace inspections.

Company name:_____

Date: _____

Inspectors' Names: _____

_____

Type of hazard *Critical, Urgent, or Important*	Describe hazard and precise location	Recommended corrective action	Person responsible for corrective action	Due Date	Completed *Yes/No*

First Aid Record (Form)

This record must be kept by the employer for three (3) years. This form must be kept at the employer's workplace. Do **NOT** submit to WorkSafeBC.

Sequence number

Name	Occupation
Date of injury or illness (yyyy-mm-dd)	Time of injury or illness (hh:mm) ☐ a.m. ☐ p.m.
Initial reporting date and time (yyyy-mm-dd) (hh:mm) ☐ a.m. ☐ p.m.	Follow-up report date and time (yyyy-mm-dd) (hh:mm) ☐ a.m. ☐ p.m.
Initial report sequence number	Subsequent report sequence number(s)

Description of how the injury, exposure, or illness occurred (What happened?)

Description of the nature of the injury, exposure, or illness (What you see — signs and symptoms)

Description of the treatment given (What did you do?)

Name of witnesses

1.	2.

Arrangement made relating to the worker (return to work/medical aid/ambulance/follow-up)

Provided worker handout ☐ Yes ☐ No Alternate duty options were discussed ☐ Yes ☐ No	A form to assist in return to work and follow-up was sent with the worker to medical aid ☐ Yes ☐ No
First aid attendant's name (please print)	First aid attendant's signature
Patient's signature	

Project Name: Westwold Flowing Well Decommissioning
Project number: 19-002-01VR

Date(s) in field: **January to May 2019** **(dd/mm/yy)** **Current Date:** **16/01/2019** **(dd/mm/yyyy)**

Project Details

Field Crew Leader: Trina Koch; Ryan Rhodes **Field Assistant(s): Gina LeBel; Paul Williamson**

Project Manager: Doug Geller **Contractor Name(s): Drillwell Enterprises Ltd.**

Work Site Location:
Municipal Address: 4686 Highway 97, Westwold, BC *Lat/Long or UTM coordinates*: **302038; 5595428**

Area/Watershed: Salmon River Field Vehicle: *(make, colour, license number)*: Company Truck

Location of base (road name and km, creek crossing, etc.): Same as Municipal Address

Work Plan

Summary of Work Plan:	**Estimated Time to Completion:**
• **Pre-Drilling Site Preparation**	**2-4 Weeks**
• **Observation & Monitoring of Relief Well Installation**	**2-4 Weeks**
• **Observation & Monitoring Relief Well Testing**	**1-2 Week**
• **Observation & Monitoring Well 112429 Decommissioning**	**2-3 Weeks**
• **Post-Closure Monitoring**	**2-4 Weeks**

Training Requirements: All persons on the Work Site must have adequate training to safely carry out the tasks that they are assigned including applicable regulatory certifications and familiarity with applicable safe work procedures. List applicable certifications and SOPs require for field work below:

Personal Protective Equipment: All persons on the Work Site must wear basic and specialized personal protective equipment (PPE) as defined by the Hazard Assessment and Mitigative Measures. This PPE must be properly maintained and meet applicable safety certification standards.

Required Work Site PPE:

Safety Communication: All persons on the Work Site must have easy access to project safety documents including the Job Safety Plan, associated Tailgate Meeting forms, Workday Register and applicable Safe Work Practices and Job Procedures. If a single location does not provide such access to all persons on the Work Site an adequate number of copies must be made.

All persons must complete a review of projects safety documents, meeting all requirements therein before beginning any work on the Work Site or entering any restricted areas. Any persons entering or leaving the Work Site must be recorded on the Work Site Register. Workers re-entering the Work Site must review the Changing Condition Register prior to resuming work.

All WWAL personal on a work site must identify a “check-in” person and have a “check-in” procedure in place with a minimum check-in of twice daily (once when on site and once when leaving site).

Location of Project Safety Documentation: Project File Folder

Check-In : Check-in protocols are required for Work Sites at remote locations or those involving significant highway travel.

Check-in Person(s):	**Ryan Rhodes**	**Contact #: 250-308-6160**
	Trina Koch	**Contact #: 250-309-2923**
Primary Responsible Person:	**Doug Geller**	**Contact #: 250-306-2843**
Secondary Contact(s):	**Gina LeBel**	**Contact #: 250-307-8127**
	Paul Williamson	**Contact #: 250-540-6899**

First Aid and Emergency Information + KEY PHONE NUMBERS

WCB minimum requirements for first aid attendants and equipment must be met or exceeded on the Work Site.

First Aid Attendant(s): All WWAL Staff **Location of First Aid Kits: Field Vehicle**

Nearest Hospital or First Aid Station: (See Attached – Nearest Hospital and First Aid Station)

Emergency Services: **911** Gas Line Leaks or Breaks: **1-800 474-6886** Electrical Emergencies: **1-888 769-3766**

Wild Fires: 1-800-663-5555 (*5555 on the cellular phones)

Client Contact #: See Master Contact List **Client Work #:**

WWAL Office – 250-541-1030

Local Radio Frequencies: **Emergency Radio Frequencies:**

Safety Representative: WWAL Staff onsite

Other Contacts:

Emergency Fire Response Plan:

1. Assess any hazards at the scene to ensure the safety of both yourself and others.
2. Notify the supervisor and appropriate fire response center (i.e. Wild fire and/or emergency services center)
3. If it is safe, begin suppression of fire procedure and assist emergency personnel as requested.
4. If in imminent danger, evacuate the area immediately to a safe distance.

Injury and Fatality Response Plan:

1. Ensure the site is safe and assess any potential risks before entering incident location.
2. Contact first aid person, 911 or appropriate emergency response number (See first aid and emergency information).
3. Assist first response personnel as requested.
4. Call the supervisor to report incident.
5. In the event of fatality, do not disturb the site, cover the body or block access to site if needed.

Natural Disaster Response Plan:

1. Ensure you are prepared and informed on site locations (topography, upcoming weather conditions).
2. Where applicable, evacuate to a safe location, take shelter or lock down area.
3. Ensure the site is safe and assess hazards at the scene.
4. Attempt to stabilize the incident and minimize potential damage (i.e. Utilize first aid training, follow spill containment procedures)
5. Notify appropriate emergency personnel and supervisor of the disaster

Hazard Assessment

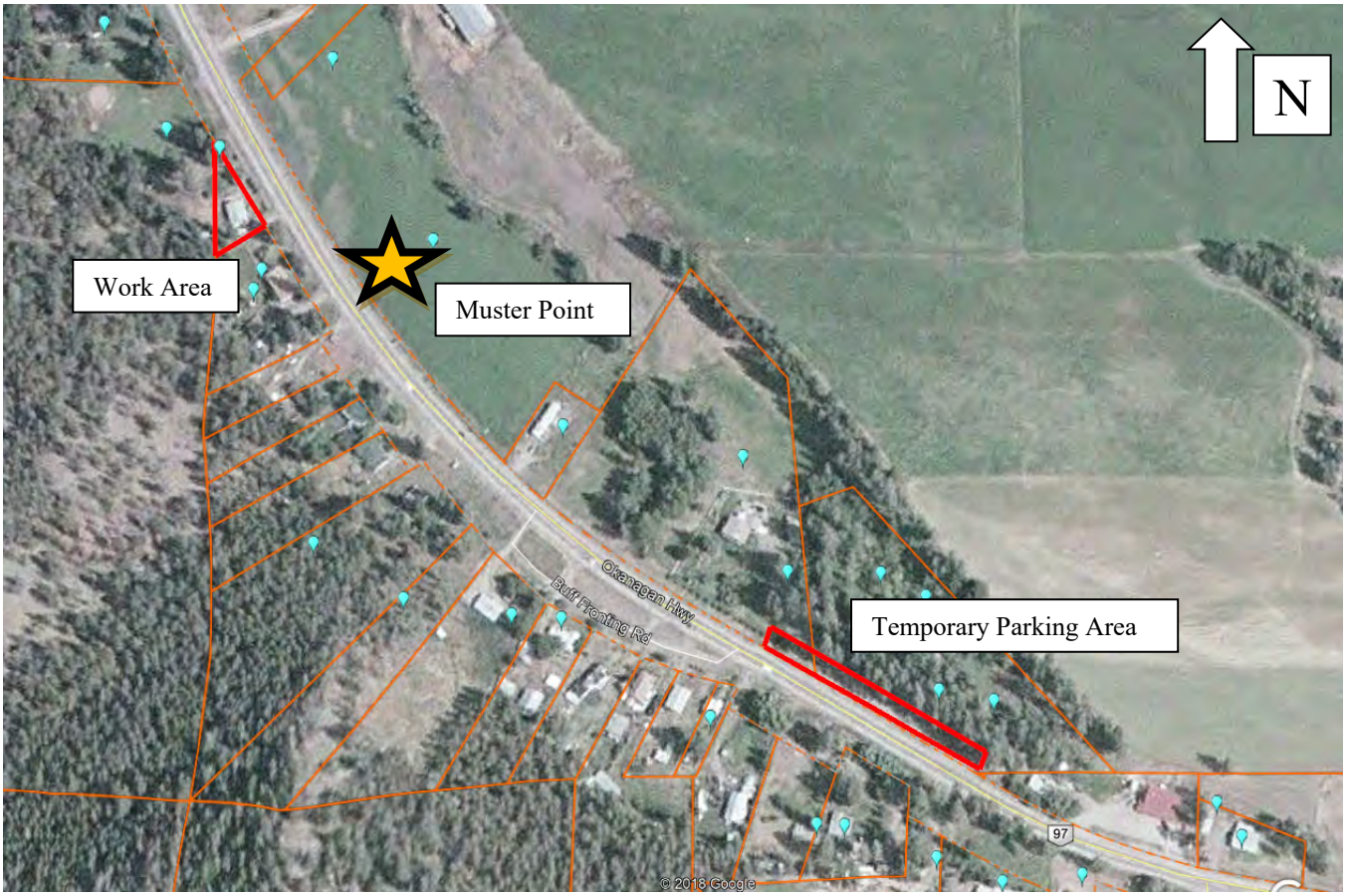
A hazard assessment must be completed prior to beginning any of the tasks involved in the work plan. If Work Site conditions change significantly or if amendments to the work plan are proposed, any new hazards must be assessed, recorded and communicated to all applicable workers before work continues.

ITEM #	HAZARD	RISK (1 - 5)	MITIGATION MEASURES
1	Slips and Trips	3	Watch footing; Good housekeeping; Avoid icy areas
2	Traffic	3	Attention when crossing Highway 97; Traffic control (if required)
3	Heavy Equipment	4	Proper training; Communication; PPE
4	Underground Work	2	BC One Call made
5	Confined Space	N/A	
6	Chemical Exposure (Attach MSDS)	N/A	
7	Fire / Explosive	N/A	
8	Overhead Hazards	4	PPE; Communication; Spotters
9	Noise	4	Ear protection
10	Working at Height	N/A	
11	Cold/Heat Stress	3	Appropriate clothing; Take breaks when required
12	Vehicle Use	2	Defensive driving; Monitor weather conditions; Park in designated area
14	Work Over Water	N/A	
15	Energized Systems	N/A	
16	Pinch Points	4	PPE; Communication; Safety discussions prior to work
17	Hand Tools	3	PPE; Communication; Safety discussions prior to work
18	Working Alone	2	Inform others of plans; Check in at predetermined points
20	Manual Lifting	3	Use machine lift where possible; Proper technique
21	Pressurized Gases		
22	Other: Drilling Debris	3	Safety Eyewear; Maintain distance
23	Other: Flowing Water	3	Safety gear; Maintain safe distances
24	Other:		
Additional Details:			

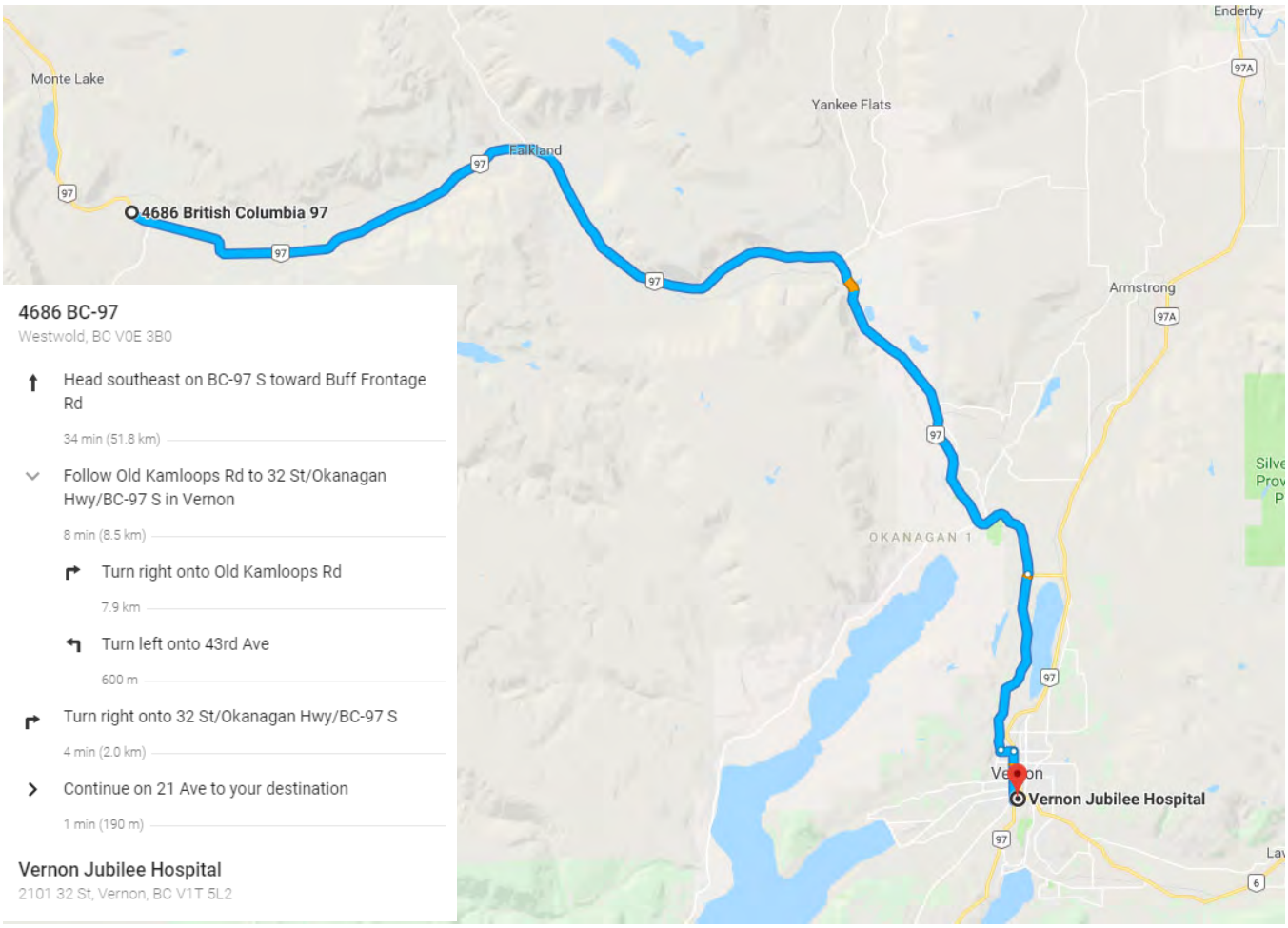
Changing Conditions and Mitigative Measures: Mitigative measures must be implemented for all identified hazards. If Work Site conditions change significantly or if amendments to the work plan are proposed, new mitigative measures must be, recorded, implemented and communicated to all applicable workers before work continues.

AMENDMENTS / CHANGING CONDITIONS		
Applicable Task	**Hazard**	**Mitigative Measure(s)**

Work Site Plan (Identify muster point(s) and ensure directional arrows are on map i.e. North)



Nearest Hospital and First Aid Station (See Drillwell H&S plan for info on Kamloops Royal Inland Hosp)



Daily Tailgate Safety Meeting: Review and Update JSSA and Mitigative Measures

By signing this meeting record, I acknowledge that I have reviewed the Job Specific Safety Plan.

Signature	Company	Time on-site /off-site	Date
Day 1			
Day 2			
Day 3			
Day 4			

Signature	Company	Time on-site /off-site	Date
Day __			
Day __			
Day __			
Day __			
Day __			

FIRST AID

Circle **more** or **less** for time from hospital

First Aid Assessment – for LOW risk injury and that is more / less than 20 min from hospital				
Check Appropriate Box	**Workers Per shift**	**Supplies, Equipment & Facility**	**First Aid Certificate Required**	**Transportation**
	1	Personal first aid kit	N/A	N/A
	2 -5	Level 1 first aid kit	Level 1 certificate	N/A
	6 - 30	Level 1 first aid kit ETV Equipment	Level 1 certificate w/ Transportation Endorsement	N/A

First Aid Assessment - for MODERATE risk injury and that is more / less than 20 min from hospital				
Check Appropriate Box	**Workers Per shift**	**Supplies, Equipment & Facility**	**First Aid Certificate Required**	**Transportation**
	1	Personal first aid kit	N/A	N/A
	2 - 5	Level 1 first aid kit	Level 1 certificate	N/A
	6 - 15	Level 1 first aid kit, ETV Equipment	Level 1 certificate w/ Transportation Endorsement	N/A
	16 - 50	Level 3 first aid kit, Dressing station, ETV Equipment	Level 3 Certificate	ETV

First Aid Assessment - for HIGH risk injury and that is more / less than 20 min from hospital				
Check Appropriate Box	**Workers Per shift**	**Supplies, Equipment & Facility**	**First Aid Certificate Required**	**Transportation**
	1	Personal first aid kit	N/A	N/A
	2 - 5	Level 1 first aid kit	Level 1 certificate	N/A
	6 - 10	Level 1 first aid kit, ETV Equipment	Level 1 certificate w/ Transportation Endorsement	ETV
	11 - 30	Level 3 first aid kit, Dressing station	Level 3 Certificate	ETV
	31 - 50	Level 3 first aid kit, First Aid room, ETV Equipment	Level 3 Certificate	ETV

Hazard Rating (L/M/H): _____ List types of injuries that can occur based on job site and type of work:

APPENDIX C

Environmental Management Plan

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

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1. BACKGROUND

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) and Drillwell Enterprises Ltd. (Drillwell) have retained Western Water Associates Ltd (WWAL), to complete an Environmental Management Plan (EMP) to support the decommissioning of an artesian well (WTN 112429) and the drilling of a relief well in Westwold, BC. We understand that prior environmental work has been done in regard to this discharge by a previous QP, in 2016 of 2017. WWAL completed an in-depth assessment of the area, specific to the proposed dewatering management plan and current site conditions.

The well to be decommissioned was drilled in 2016 and is located at 4686 Highway 97, Westwold BC (subject property). The uncontrolled artesian flow from the well has been a significant disturbance to surrounding land owners. We understand that once the relief well has been installed and the current artesian well decommissioned, the uncontrolled well discharge will cease. This EMP provides a summary of biophysical conditions, proposed impacts of the project and environmental mitigation to address those impacts. Figures are attached as Appendix A, Photographs as Appendix B, Silt Fence and Silt Curtain Detail as Appendix C, and Species at Risk with the Potential to Inhabit the Project Area as Appendix D.

2. REGULATORY REQUIREMENTS

The following regulatory requirements have been considered in the development of this EMP:

- *B.C. Environmental Management Act*
- *Spill Reporting Regulation*
- *B.C. Fish Protection Act*
- *B.C. Water Sustainability Act*
- *B.C. Wildlife Act*
- *Canada Fisheries Act*
- *Canada Migratory Birds Convention Act*
- *Canada Species at Risk Act*
- *Canada Wildlife Act*

3. PROPOSED PROJECT

The project is a collaborative effort between Drillwell, WWAL and MFLNRO. It involves as series of tasks involving desktop planning, site preparation, relief well drilling, well decommissioning, permitting and reporting. The proposed work schedule is provided in Table 1.

Table 1. Proposed Work Schedule

Date	Task
January 31, 2019	Desktop planning tasks due
February 28, 2019	Site preparation completed
March 10, 2019	Drill and cement surface casing
March 25, 2019	Drill and install relief well
March 31, 2019	Conduct and report on relief well testing
April 30, 2019	Drill, develop and test 2nd relief well if needed
May 20, 2019	Decommission subject well
June 14, 2019	Post closure report including monitoring plan

3.1 Roles and Responsibilities

This project includes the following agencies and individuals responsible for delivering services towards the completion of the proposed project:

3.2 Hydrogeological Services

Western Water Associates Ltd.
Douglas Geller
ph: 250 306 2843
e: doug@westernwater.ca

3.3 Well Decommissioning and Relief Well Installation

Drillwell Enterprises Ltd.
Colin Slade
ph: 250 746 5268
e: drill@drillwell.com

3.4 Environmental Permitting and Monitoring

Western Water Associates Ltd.
Trina Koch R.P.Bio., Senior Biologist, Qualified Environmental Professional (QEP)
ph: 250-309-2806
e: trina@westernwater.ca

Western Water Associates Ltd.
Gina Le Bel B.I.T., Junior Biologist
Ph. 250-540-0108
e. gina@westernwater.ca

4. BIOPHYSICAL ASSESSMENT

On January 18, 2019 and January 24, 2019 WWAL's Biologists completed field assessments of the subject property and surrounding area, including where the well discharge enters the branch of Pringle Creek, where it flows out of the main stem of Pringle Creek and where it terminates. We provide a summary of our results using information from the field assessment, provincial databases, historical reporting and online mapping applications.

4.1 Existing Infrastructure

Existing infrastructure at the subject property consists of a driveway, one-story house, and well and discharge lines. The well is located in the front yard and is about 20 m from Highway 97. The discharge line carries well discharge south from the well to a grate on the west side of Highway 97 and then east through a 45cm diameter culvert under Highway 97. At the time of the site visits, the culvert was approximately 1/3 full of water. Well discharge continues east from the culvert across a hayfield into the branch of Pringle Creek. Well discharge has incised a channel in the field that was approximately 2.5 m wide and about 5 cm deep at the time of the site visit. Flow meters on the discharge line indicated a flow rate of approximately 12.6 L/s (200 US gpm) during site visits in late January 2019.

4.2 Branch of Pringle Creek

The branch of Pringle Creek flows from the main stem of Pringle Creek about 400 m north of the subject property at a culvert / control structure. The main stem of Pringle Creek and the branch of Pringle Creek flow in separate culverts below Hwy 97. The main stem of Pringle Creek flows east, and the branch of Pringle Creek flows east and then south through the edge of agricultural property for about 1 km before well discharge enters it from the right bank. At the time of the site visits, the branch of Pringle Creek was 0.3 and 1 m wide, contained about 5 cm of ice and was not flowing upstream of well discharge.

Well discharge continues southward from where it enters the branch of Pringle Creek to a small wetland area before crossing Highway 97. Flow in the branch of Pringle Creek appeared to become reduced after it moved through a shallow wetland. From the east side of Highway 97, the branch of Pringle Creek narrows to about 0.3 m wide and carries flow across a series of residential front and back yards channel before moving through the culvert below Douglas Lake Road. Flows in the residential area reached about half bank in the narrow channel. The branch of Pringle Creek then slows and widens on the east side of Douglas Lake Road and moves through a series of wetlands in agricultural fields. It then terminates at Buff Lumber in a grassy, shallow wetland along the west side of Service Road.

4.2.1 Fish and Fish Habitat

Pringle Creek is a large creek draining Monte Lake. Fish presence in the branch of Pringle Creek is likely as there are no barrier to fish passage between the main stem of Pringle Creek and Monte Lake and there is no fish screen limiting fish access into the branch of Pringle Creek. Fish can also enter the main stem of Pringle Creek from the Salmon River when flows are higher. Fish species listed in Table 2 have been documented in Monte Lake and/ or in the Salmon River (MOE 2018b).

Table 2. Fish Species Present in Monte Lake and/ or the Salmon River

Common Name	Scientific Name	Waterbody
Burbot	*Lota lota*	Salmon River
Chinook Salmon	*Oncorhynchus tshawytscha*	Salmon River
Chum Salmon	*Oncorhynchus keta*	Salmon River
Coho Salmon	*Oncorhynchus kisutch*	Salmon River
Dace (General)	*Leuciscus spp.*	Salmon River
Dolly Varden*	*Salvelinus malma*	Salmon River
Kokanee (Sockeye)	*Oncoryhynchus nerka*	Salmon River & Monte Lake
Largescale Sucker	*Catostomus macrocheilus*	Salmon River & Monte Lake
Mountain Whitefish	*Prosopium williamsoni*	Salmon River
Northern Pikeminnow	*Ptychocheilus oregonensis*	Salmon River & Monte Lake
Pink Salmon	*Oncorhynchus gorbuscha*	Salmon River
Prickly Sculpin	*Cottus asper*	Monte Lake
Rainbow (Steelhead) Trout	*Oncorhynchus mykiss*	Salmon River & Monte Lake
Redside Shiner	*Richardsonius balteatus*	Salmon River & Monte Lake
Sculpin (General)	*Cottoidea spp.*	Salmon River
Sucker (General)	*Cottus spp.*	Monte Lake

* Provincially blue-listed

WWAL assessed fish habitat in the branch of Pringle Creek using RIC protocol (RIC 1998). Substrate, leaf litter, woody debris, cover and salmonid spawning potential were considered. In the northern vegetated portion of the works area where the main stem of Pringle Creek and the branch of Pringle Creek fork, fish habitat is good. The gravel and cobble substrate support spawning, the dense riparian cover prove leaf litter and insect drop and undercut banks provide cover for small fish.

The fish habitat is of moderate quality as the branch of Pringle Creek continues south from the through the agricultural field where there is far less riparian cover. However, where the tributary reaches the well discharge, large cottonwoods and pacific willow are abundant. Where it flows through the small wetland, the branch of Pringle Creek's channel fills with cattail and reeds and fish habitat worsens.

After water flows through the residential lots west of Highway 97, fish habitat becomes very poor. The channel is narrow and straightened, substrate is comprised of fines and riparian habitat is limited to lawn grass and the occasional cluster of pacific willow (*Salix lucida*) or ornamental shrubs. Movement through the series of wetlands in the agricultural land further degrades fish habitat as the channel widens and fills again with cattail. Additionally, because the branch of Pringle Creek terminates in a wetland without no outflow, there is a high potential for fish to become annually stranded during periods of low water.

4.3 Vegetation

The subject property is located within the Interior Douglas Fir (IDF) biogeoclimatic zone, very hot and dry (IDF xh2) sub variant (BC Government 2017). This zone is characterized by long, hot summers and forests of Douglas fir (*Pseudotsuga menziesii*) and Ponderosa pine (*Pinus ponderosa*) with dry, relatively open understories. Natural riparian areas within this zone support black cottonwood *(Populus trichocarpa*), balsam poplar (*Populus balsamifera*), pacific willow (*Salix lucida*), water birch (*Betula occidentalis*) and a variety of native shrubs.

The branch of Pringle Creek is bordered by a variety of vegetation types. Vegetation providing higher quality wildlife habitat include pacific willow and black cottonwood. Areas along the channel with lower quality habitat are dominated by reed canary grass (*Phalaris arundinacea*) and other invasive species.

Vegetation species observed along the branch of Pringle Creek are listed in Table 3. A total of 18 plant species were identified, including four invasive species and 14 native species.

Table 3. Vegetation Species Present in Assessed Areas

Common Name	Scientific Name	Invasive or Native
Black Cottonwood	*Populus trichocarpa*	Native
Common Cattail	*Typha latifolia*	Native
Common Burdock	*Arctium minus*	Invasive
Diffuse Knapweed	*Centaurea diffusa*	Invasive
Douglas Fir	*Pseudotsuga menziesii*	Native
Duckweed	*Lemnoideae spp.*	Native
Lupine	*Lupinus spp.*	Native
Orchard Grass	*Cdactylis glomerata*	Invasive
Oregon Grape	*Mahonia aquifolium*	Native
Pacific Willow	*Salix lucida*	Native
Paper Birch	*Betula papyrifera*	Native

Common Name	Scientific Name	Invasive or Native
Ponderosa Pine	*Pinus ponderosa*	Native
Red Alder	*Alnus rubra*	Native
Reed Canary Grass	*Phalaris arundinacea*	Invasive
Saskatoon Berry	*Amelanchier alnifolia*	Native
Scrub Birch	*Betula nana*	Native
Trembling Aspen	*Populus tremuloides*	Native
Woolly Muellin	*Verbascum thapsus*	Invasive

4.4 Species at Risk

Dolly varden (*Salvelinus malma*) are blue-listed[1] species known to inhabit the Salmon River, that may inhabit the main stem of Pringle Creek and the branch of Pringle Creek during high flows.

Although the BC Conservation Data Centre (CDC) did not identify any animal or plant species at risk inhabiting the project area, the blue-listed North American racer (*Coluber constrictor*) is mapped within ten km of the subject property (MOE 2018a). These snakes, as adults, prey mostly on small rodents, frogs, toads, lizards and other snakes (Amphibians and Reptiles of South Dakota 2018). The North American racer is often found near water and in grassland type habitat as they can use their good vision and speed to hunt. Mating generally takes place in spring from April to June and a month later females lay eggs. This project occurs outside of the mating and laying season of these snakes so it is unlikely that this species will be impacted by project works.

Species at risk known to inhabit areas similar to those along the branch of Pringle Creek are listed in Appendix D. These include fourteen red-listed[2] species and forty-six blue-listed species (MOE 2018c). Red-listed species with the highest potential to inhabit the assessed area include the American badger (*Taxidea taxus*), burrowing owl (*Athene cunicularia*), Mexican mosquito fern (*Azolla mexicana*), Peregrine Falcon (*Falco peregrinus anatum*), Prairie falcon (*Falco mexicanus*), prairie wedgegrass (*Sphenopholis obtusata*), and Swainson's hawk (*Buteo swainsoni)*. Because works do not involve excavation or vegetation removal within the riparian corridor, impacts to these species as a result project works highly unlikely.

4.1 Existing Surface Water Licenses and Permitting

There is one active existing surface license (#C127892) for private irrigation on the branch of Pringle Creek on the west side of Highway 97 and two water licenses on the branch of Pringle Creek (#C032274 domestic, and #500726 private irrigation) further downstream (Figure 1). Because licenses #C127892 and #C032274 are irrigation use, and relief well project works are planned in March, which is outside of licenced irrigation timing, there is no impact to holders of Licenses #C127892 and #C032274 if the flow

[1] Blue-listed, includes any indigenous species or subspecies considered to be of Special Concern. Schedule 1 The Species at Risk Act (SARA) establishes Schedule 1, as the official list of wildlife species at risk. It classifies those species as being either extirpated, endangered, threatened, or a special concern.

[2] Red-listed: Includes any indigenous species or subspecies that have, or are candidates for, Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction.

is blocked to the branch of Pringle Creek. However, blocking flow to the branch would require permission from the holder of domestic License #C032274 but because flow in the branch is currently frozen solid, permission may be easy to obtain. If blocking flow into the branch is not permitted, placing a fish screen across the upstream end of the culvert that carries flow into the branch of Pringle Creek would require a Section 11 *Water Sustainability Act* Approval.

4.2 Artesian Well Discharge Quality

We understand previous QPs tested artesian well discharge for bacterial parameters (*E.,coli,, total coliform and fecal coliform),* dissolved metals, total metals, turbidity and total dissolved and suspended solids in 2016 as part of the initial assessment, and that water discharge from the well met the *Canadian Guidelines for Drinking Water Quality* and provincial *Aquatic Life Criteria.* An additional sample will be collected by WWAL during the month of February 2019 and analyzed to confirm guidelines continue to be met.

5. RELIEF WELL AND WELL DECOMMISSIONING PLAN

The main text of the Decommissioning Plan describes the overall project in detail. The project involves managing existing artesian well flow and new well discharge created during relief well drilling, development and testing and decommissioning of the existing well. During relief well drilling there will be periodic discharge of water on-site, into large container to allow sediment in the water to settle out before it is pumped off-site. During relief well development, more water, and over a longer period of time, including some turbid water will managed in the same manner as water produced while drilling. During relief well testing, well discharge may flow up to 1,150 US gpm for 1-3 days. By this time, the discharge water should be clear and 100% "tight piped" to field and from there to creek/ditch. During decommissioning of the existing well, crews will cement grout the well hole and the cement will displace the water in the hole to surface. The pH might be elevated in this water due to contact with cement but the volume will be relatively small and of short duration.

To manage well discharge during this project, we propose two discharge plans (Plan A and Plan B). Plan A and Plan B are shown in Figure 2 with Figure 3 providing a detailed explanation of Plan A.

Plan A, the most desirable option, involves leaving the existing pipes in place to new well discharge across Highway 97 where it will be pumped onto the field north of the incised artesian well discharge channel. The new well discharge will flow across the field through a series of hay bales to filter water as it flows down gradient towards the small wetland at the south end of the artesian well discharge channel (Figure 3). A silt curtain will be installed along the existing fence located between the wetland and branch of Pringle Creek to filter out any remaining sediments in the new well discharge before it enters the branch.

Plan B is shown in Figure 2 and involves pumping new well discharge approximately 400 m north (uphill) directly into Pringle Creek through the west side of the Highway 97 culvert crossing.

For both Plan A and Plan B, to mitigate impacts to fish and land owners during this project, WWAL suggests blocking the branch of Pringle Creek culvert from receiving water from the main stem of Pringle Creek, while water in the branch of Pringle Creek is still frozen. This could be done easily by filling the culvert with sandbags, which would be removed once the works have been completed (May 2019). In this way, there would be no chance for fish or meltwater to enter the irrigation channel during project works. The absence of fish and extra water in the irrigation channel would greatly simplify managing

artesian flows during project works. Since water would continue to enter Buff Lumber's fields during all stages of the project, water supply to their wetland would not be terminated during the project. We understand that Larry Buff, owner of Buff Lumber supports temporarily blocking flow into the branch of Pringle Creek from the main stem during project works. There are no other licence holders on the branch of Pringle Creek downstream of the well discharge area.

6. EXISTING SURFACE WATER LICENSES AND PERMITTING

We have confirmed licence status using online data as well as in correspondence with MFLNRORD. There is one active existing surface license (#C127892) for private irrigation on the branch of Pringle Creek on the west side of Highway 97 and two water licenses on the branch of Pringle Creek (#C032274 domestic, and #500726 private irrigation) further downstream (Figure 1). Because licenses #C127892 and #C032274 are for irrigation use, and relief well / decommissioning works are planned in March/April, which is outside of licenced irrigation timing, there is no impact to holders of Licenses #C127892 and #C032274 if the flow is blocked to the branch of Pringle Creek. However, blocking flow to the branch would require permission from the holder of domestic License #C032274 but because flow in the branch is currently frozen solid, permission may be easy to obtain. If blocking flow into the branch is not permitted, placing a fish screen across the upstream end of the culvert that carries flow into the branch of Pringle Creek would require a Section 11 *Water Sustainability Act* Approval. WWAL would apply for this approval, and it would need to be expedited by MFLNRORD staff for this project to remain on track.

7. POTENTIAL ENVIRONMENTAL IMPACTS

Due to the nature of the work, birds and fish are most at risk of being impacted by the proposed development. Potential environmental impacts include the following:

- Destruction of habitat or damage to wildlife, nests or plant species at risk;
- Destruction of habitat used by raptors and migratory birds;
- Sediment, entering the branch of Pringle Creek and resulting in reduced fish habitat quality;
- Fuel or other toxic substances from heavy machinery entering the soil or water.

8. ENVIRONMENTAL MITIGATION

Our environmental mitigation strategies follow *Standards and Best Practices for Instream Works* (MOE 2004) and *Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia* (MOE 2013).

8.1 Timing and Wildlife Management

Onsite works are proposed between early March and the end of May 2018.

Works involving discharge of diverted well water into the branch of Pringle Creek or Pringle Creek will be completed outside of the fish timing window and partially completed during low water conditions. If flow to the branch of Pringle Creek is blocked while conditions are still frozen / dry in the irrigation channel, risks to all fish species will be entirely mitigated for.

Although works will be partially completed during the migratory bird window of August 1 – March 31, the threat of impacts to migratory birds is low as no vegetation removal is proposed. Proposed work is outside of the raptor window of August 15 – January 30.

8.2 Air Quality

All equipment should be in excellent working order and engine air filters should be clean and functioning well.

8.1 Environmental Monitoring

A copy of this document and all appropriate plans, drawings and permits will be forwarded to all contractors.

The environmental monitor (EM) will be provided with written authority to modify and/or halt any construction activity if deemed necessary for the protection of fish and wildlife populations or their habitats. A pre-construction meeting will be held between the EM and the contractor undertaking the work on the site to ensure an understanding of the mitigative strategies for the project.

The EM will provide guidance on well discharge procedure and best practices during works occasionally during the works to monitor the turbidity and Pringle Creek branch conditions.

Within 60 days of completion of the project, the environmental monitor will complete and submit a copy of a monitoring report to Drillwell and FLNRO.

8.2 Sediment Control

As the water might be turbid during the works a settling basin is being used to allow the sediments time to settle out prior to being pumped into the unnamed tributary. The main part of the Decommissioning Plan has more information on this. Additionally, hay bales and a silt curtain will be set up to filter any remaining sediments from the water as shown in Figure 3.

If natural flow is occurring in the discharge channel, the EM will collect a background turbidity measurement immediately upstream of where well discharge enters the irrigation. The EM will routinely check the turbidity of the water entering the ditch and compare it back ground levels during well drilling and decommissioning. If turbidity in the branch of Pringle Creek increases downstream of well discharge by more than 8NTU, the EM will have sediment and irrigation control structures adjust to improve filtering.

8.3 Spill Response

Contractors must ensure that equipment and machinery are in good operating condition (power washed), free of leaks, excess oil, and grease. No equipment re-fueling, or servicing should be undertaken within 30m of any watercourse or surface water drainage.

A spill containment kit must be onsite in the event of a release of any deleterious substance to the environment and all contractors must be trained on its use. Spill of a substance that is toxic, polluting, or deleterious to aquatic life of quantities larger than what the spill containment kit can contain, must be reported to the Provincial Emergency Program at **1-800-663-3456**.

8.4 Revegetation and Site Restoration

Any areas disturbed by equipment or excavation should be reseeded with a native seed mix. Equipment, supplies, debris and all construction materials should be removed from the work site(s) once work is complete.

REFERENCES

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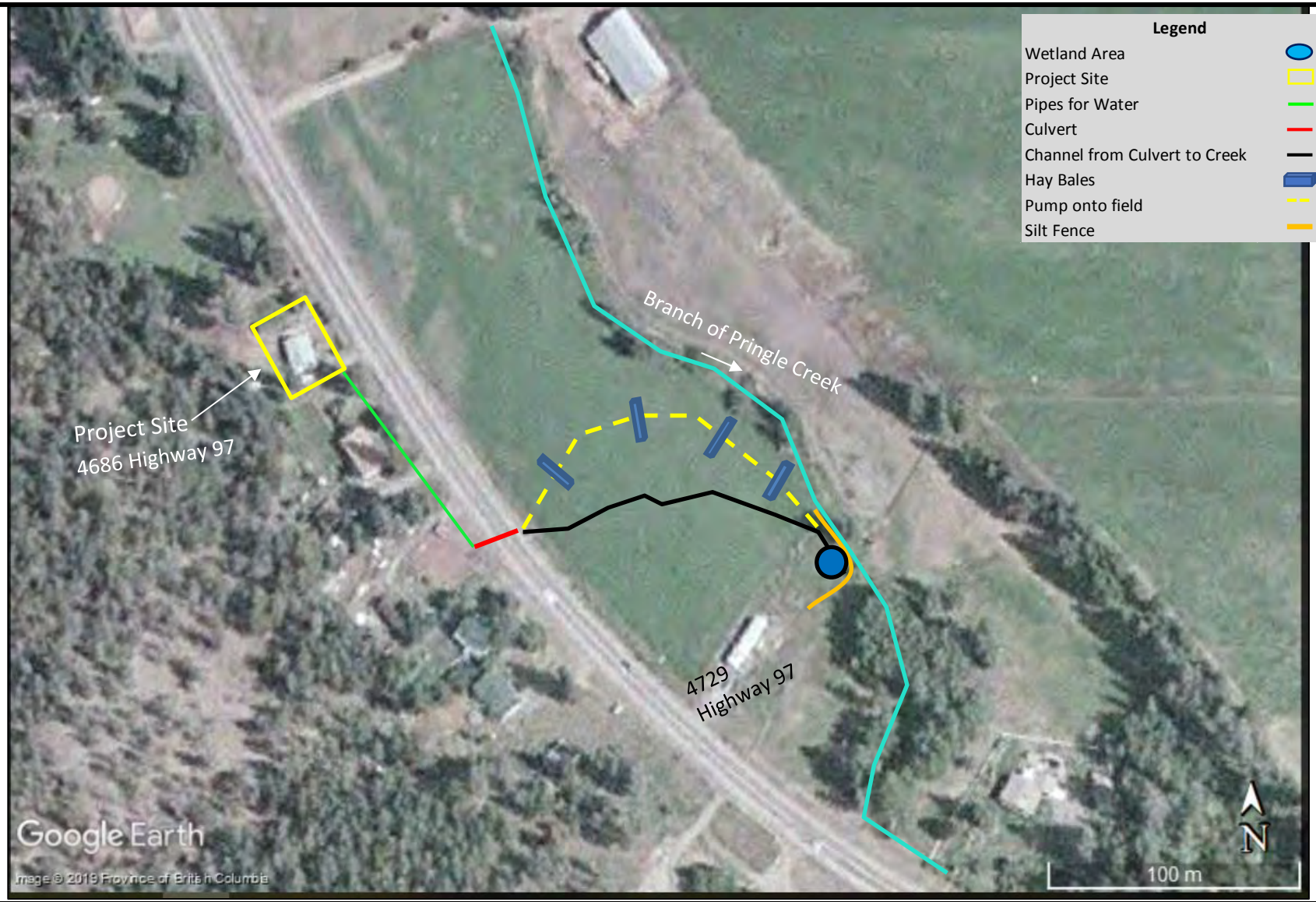
APPENDIX A

Figures

TK1

Westwold Well Decommissioning	TITLE **Figure 1:** Project Location			
western water ASSOCIATES LTD	DRAWN GL	DATE January 2019	PROJECT NO 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	

Westwold Well Decommissioning	TITLE **Figure 2:** Site Layout for Well Decommissioning			
western water ASSOCIATES LTD	DRAWN GL	DATE January 2019	PROJECT NO 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	



Westwold Well Decommissioning	TITLE **Figure 3:** Discharge Plan Detail: Plan A			
western water ASSOCIATES LTD	DRAWN GL	DATE January 2019	PROJECT NO. 19-002-01VR	
	CHECKED DG	Westwold, BC	TOPOGRAPGY	
	REVIEWED DG		SOURCE. Google Earth	

APPENDIX B
Photographs

Photograph 1. Well to be decommissioned with uncontrolled artesian discharge flowing into pipes (January 18, 2019)

Photograph 2. South facing view of well discharge pipes (January 18, 2019)

Photograph 3. Pipes pouring well discharge into grated culvert on the east side of Highway 97 (January 18, 2019)

Photograph 4. Incised channel on a hayfield established from well discharge flowing east from Highway 97 (January 18, 2019)

Photograph 5. Well discharge flows into a shallow wetland before draining into the branch of Pringle Creek (January 24, 2019)

Photograph 6. View of the incised channel from the shallow wetland (January 24, 2019)

Photograph 7A and B. Fence line south of the shallow wetland where silt fence installation is proposed to remove sediment before well discharge fans out into the branch of Pringle Creek (January 24, 2019)

Photograph 8. Branch of Pringle Creek east of Highway 97 carrying well discharge across residential properties (January 18, 2019)

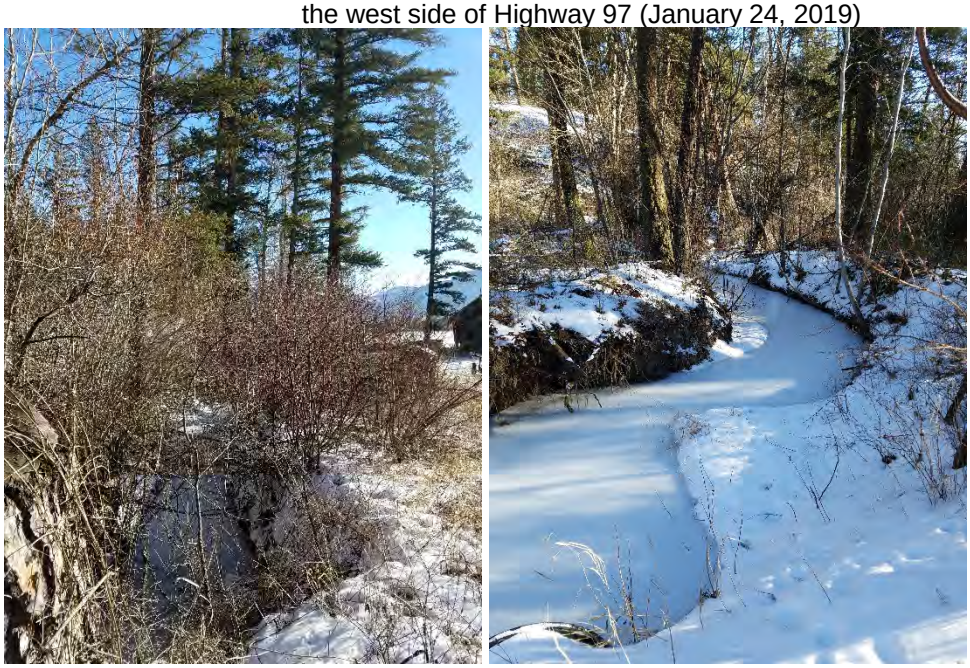
Photograph 9.Pacifical willow growing along the branch of Pringle Creek as it flows through private property (January 18, 2019)

Photograph 10. The branch of Pringle Creek flowing into a series wetlands though agricultural lands (January 18, 2019)

Photograph 11. The branch of Pringle Creek flowing east of Douglas Lake Road (January 18, 2019)

Photograph 12. The branch of Pringle Creek on the east side of Highway 97 upstream of well discharge, frozen solid (January 18, 2019)

Photograph 12. The wider and deeper main stem of Pringle Creek's frozen surface with flows below the ice, on the west side of Highway 97 (January 24, 2019)



Photograph 13. The culvert / control structure that carries flow from the main stem of Pringle Creek into the branch of Pringle Creek, about 1/8 filled with solid ice (January 24, 2019)

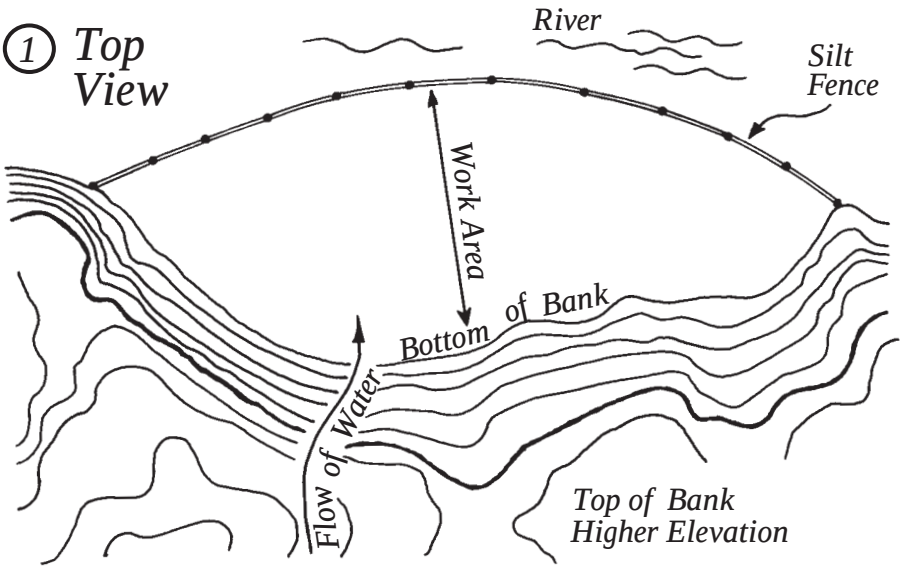
Photograph 14. North view of the branch of Pringle Creek at Buff Lumber (January 24, 2019)

APPENDIX C

Silt Fence Detail

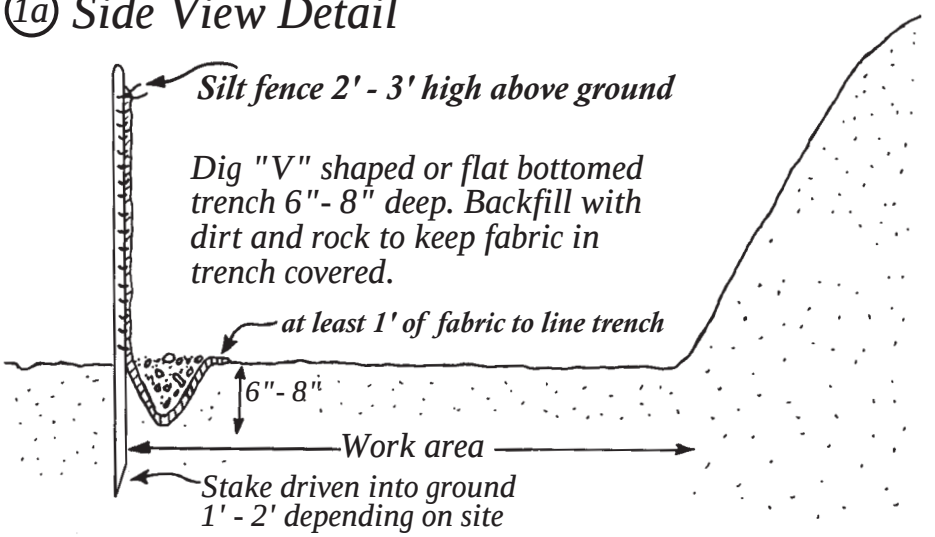
Silt Fence Installation *Step-by-Step*

① Top View



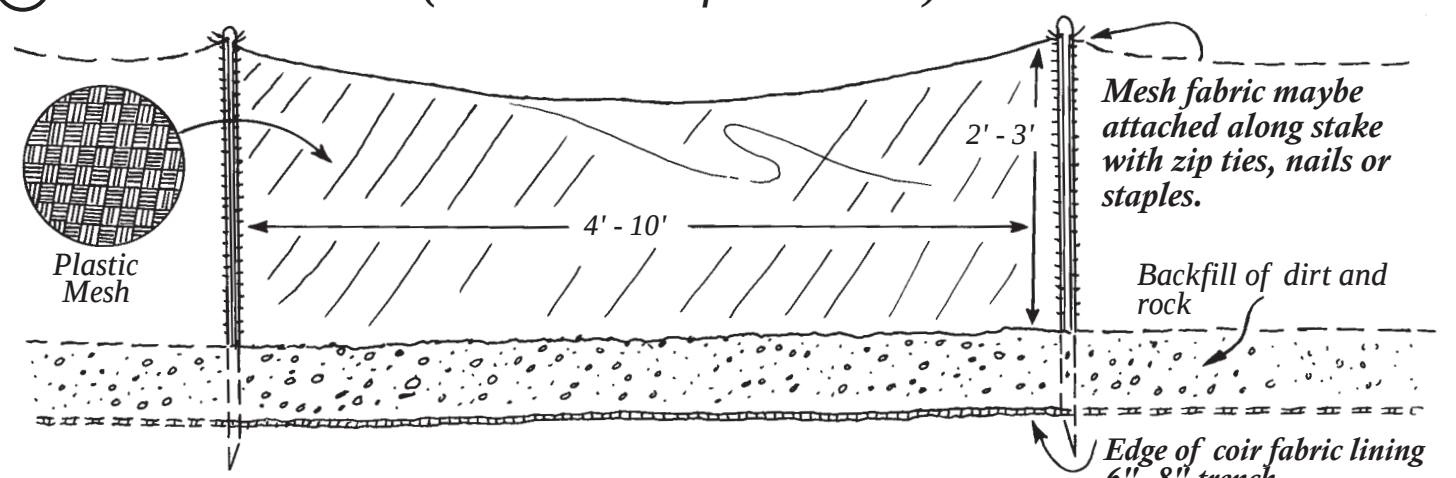
Prepare a stormwater pollution prevention plan. Set up silt fences according to terrain, soil and run-off consideration. Prevent soil migration by decreasing soil exposure, steep unvegetated slopes and construction time. Revegetate as soon as possible in the SAME SEASON.

①a Side View Detail



Moniter integrity of installed silt fence and remove sediment before it reaches 1/3 the height of the silt fence. It is especially important to moniter during and after rain and break-up events.

①b Front View Detail (One Section of Silt Fence)



Leave silt fence in place until vegetation is established and sediment is stabilized.

Silt (Sediment) Fence Installation

When installing a silt fence, first choose the appropriate place to set up a silt fence by considering site terrain and slope, water flow and projected soil disturbance during construction.

Set the silt fence perpendicular to the slope of the land, curving the fence inward towards slope.

Place the silt fence spaced away from the toe-of-slope, leaving enough room to accumulate sediment and to perform work.

Dig a six to eight-inch trench (either V shaped or flat-bottomed) directly up-slope or upstream of the silt fence. On the downstream edge, drive in wood stakes, rebar or steel stakes at least 1 foot down into the sediment. The stakes or rebar should be long enough to accommodate the trench depth and height of the silt fence fabric.

Run a continuous length of fabric along the inside of the stakes and secure with nails,
staples or zip ties allowing at least 1 foot to line the trench. Extend termination points uphill one full panel length.

Use continuous fabric piece for the silt fence. If one is unavailable and a joint is necessary, overlap the fabric at least the width of one stake spacing and secure in place using a wooden lath, staples, zip ties or nails.

Cover the trench with backfilled and compacted soil, gravel or rock.

Maintain the fence by checking the fabric for damage, failure of fence to withhold sediment, and damage to posts. Install additional back-up silt fence if needed.

APPENDIX D

Species at Risk with the Poential to Inhabit the Project Area

Appendix D: Species at Risk with the Potential to Inhabit the Project Area

Westwold Well Decommissioning
19-002-01VR

English Name	Scientific Name	COSEWIC	SARA	BC List	Class (English)
American Bittern	*Botaurus lentiginosus*			Blue	birds
Barn Swallow	*Hirundo rustica*	T (May 2011)	1-T (Nov 2017)	Blue	birds
Bighorn Sheep	*Ovis canadensis*			Blue	mammals
Bobolink	*Dolichonyx oryzivorus*	T (Apr 2010)	1-T (Nov 2017)	Blue	birds
bushy cinquefoil	*Potentilla supina* ssp. *paradoxa*			Blue	dicots
California Hairstreak	*Satyrium californica*			Blue	insects
Canyon Wren	*Catherpes mexicanus*	NAR (May 1992)		Blue	birds
Columbia Plateau Pocket Mouse	*Perognathus parvus*			Blue	mammals
Common Sootywing	*Pholisora catullus*			Blue	insects
cut-leaved water-parsnip	*Berula erecta*			Blue	dicots
dark lamb's-quarters	*Chenopodium atrovirens*			Blue	dicots
Fisher	*Pekania pennanti*			Blue	mammals
Fringed Myotis	*Myotis thysanodes*	DD (May 2004)	3 (Mar 2005)	Blue	mammals
Gopher Snake, *deserticola* subspecies	*Pituophis catenifer deserticola*	T (Apr 2013)	1-T (Jan 2005)	Blue	reptiles
Great Basin Spadefoot	*Spea intermontana*	T (Apr 2007)	1-T (Jun 2003)	Blue	amphibians
Great Blue Heron, *herodias* subspecies	*Ardea herodias herodias*			Blue	birds
Grizzly Bear	*Ursus arctos*	SC (May 2002)	1-SC (Jun 2018)	Blue	mammals
Horned Lark, *merrilli* subspecies	*Eremophila alpestris merrilli*			Blue	birds
Immaculate Green Hairstreak	*Callophrys affinis*			Blue	insects
Lark Sparrow	*Chondestes grammacus*			Blue	birds
Lewis's Woodpecker	*Melanerpes lewis*	T (Apr 2010)	1-T (Jul 2012)	Blue	birds
Long-billed Curlew	*Numenius americanus*	SC (May 2011)	1-SC (Jan 2005)	Blue	birds
Monarch	*Danaus plexippus*	E (Nov 2016)	1-SC (Jun 2003)	Blue	insects
Montana larkspur	*Delphinium bicolor* ssp. *bicolor*			Blue	dicots
Mountain Goat	*Oreamnos americanus*			Blue	mammals
Nevada Skipper	*Hesperia nevada*			Blue	insects

North American Racer	*Coluber constrictor*	T (Nov 2015)	1-SC (Aug 2006)	Blue	reptiles
Northern Bog Lemming, *artemisiae* subspecies	*Synaptomys borealis artemisiae*			Blue	mammals
Olive-sided Flycatcher	*Contopus cooperi*	SC (May 2018)	1-T (Feb 2010)	Blue	birds
Oregon willowherb	*Epilobium oregonense*			Blue	dicots
Painted Turtle - Intermountain - Rocky Mountain Population	*Chrysemys picta* pop. 2	SC (Nov 2016)	1-SC (Dec 2007)	Blue	turtles
peach-leaf willow	*Salix amygdaloides*			Blue	dicots
porcupine sedge	*Carex hystericina*			Blue	monocots
rough dropseed	*Sporobolus compositus* var. *compositus*			Blue	monocots
Short-eared Owl	*Asio flammeus*	SC (Mar 2008)	1-SC (Jul 2012)	Blue	birds
Spotted Bat	*Euderma maculatum*	SC (Nov 2014)	1-SC (Jul 2005)	Blue	mammals
Suksdorf's lupine	*Lupinus bingenensis* var. *subsaccatus*			Blue	dicots
sulphur lupine	*Lupinus sulphureus*			Blue	dicots
Townsend's Big-eared Bat	*Corynorhinus townsendii*			Blue	mammals
Tweedy's willow	*Salix tweedyi*			Blue	dicots
upswept moonwort	*Botrychium ascendens*			Blue	
Western Rattlesnake	*Crotalus oreganus*	T (May 2015)	1-T (Jul 2005)	Blue	reptiles
Western Screech-Owl, *macfarlanei* subspecies	*Megascops kennicottii macfarlanei*	T (May 2012)	1-T	Blue	birds
Western Skink	*Plestiodon skiltonianus*	SC (Nov 2014)	1-SC (Jan 2005)	Blue	reptiles
Western Small-footed Myotis	*Myotis ciliolabrum*			Blue	mammals
Wolverine, *luscus* subspecies	*Gulo gulo luscus*	SC (May 2014)	1-SC (Jun 2018)	Blue	mammals

APPENDIX D
Traffic Control

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Application Summary
eDAS File Number: 2019-00493

Permit Application:

Permit Type: Structure: Encroachment
Selected Office: Thompson Nicola District
Applicant File Number:
Project Description: 4686 Highway 97: grading shoulder/ temporary pressure line

Location:

Order	Location
	Map: 1439999,626193

Permit Application Details:

Local Government: Thompson Nicola Regional District
Size and Type of Structure: materials to grade side of highway for access to property

Sketch Plan

BCLS Name:
Drawing #:
Prepared Date:

Attachments:

Filename	File Description	Classification
Ditch.jpg	grading location	Photograph
site plan.pdf	site	Plan
Works on Highway App Sign Permit		Application

Permit Application Parties:

Type	Name/Company	Address	Role	Permit Holder
Applicant	Le Bel , Gina - Western Water Associates Ltd.			☐
Contact	Geller, Doug - Western Water Associates Ltd.	106 5145 26 Street , Vernon, British Columbia V1T 8G4	On-site	☑
Contact	Slade, Colin - Drillwell Enterprises Ltd.	4994 Polkey Road , Duncan, British Columbia V9L 6W3	Other	☐

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

File Number _____
Permit Number _____
Date (yyyy/mm/dd) 20 / /

WORK NOTIFICATION/LANE CLOSURE REQUEST AND APPROVAL

NOTE: This form is to be submitted ten (10) working days prior to start of work or closure.

If you have a DriveBC account, you can enter this data directly into DriveBC through the Web Input Utility (WIU). Otherwise, please submit prior to 6:30 a.m. or 24 hours in advance to: Ministry of Transportation District Office, and cc the Regional Transportation Management Centre (RTMC) at RTMC@gov.bc.ca. The RTMC requires 24/7 emergency phone numbers for all projects.

To KEN NAMISLO (District Manager Transportation) SALMON ARM (District Office) Telephone 250-833-3378 Fax _____

From DRILLWELL ENTERPRISES (Organization) COLIN (Contact Person) Telephone 250-746-5268 Fax _____

☒ I request approval to **work** within the Ministry right-of-way (check as many boxes below as required):
☐ North Bound ☒ South Bound ☐ East Bound ☐ West Bound

☒ I request approval to **close** the Ministry right-of-way indicated below (check as many boxes below as required):
☐ North Bound ☒ South Bound ☐ East Bound ☐ West Bound

Indicate all lanes affected: ☐ Right Turn Lane ☐ Middle Lane ☐ Left Turn Lane ☐ Work on Shoulder
☒ Curb/Outside Lane ☐ Centre/Inside Lane ☐ All Lanes ☐ No Lane Closure

on Highway 97 (Number) ~~between~~ At WESTWOLD (Landmark) and _____ (Landmark)

from 8:00 ☒ a.m./☐ p.m. to 4:00 ☐ a.m./☒ p.m. on the following dates (yyyy/mm/dd) 2019/02/04

to 2019/02/04 ; for the purpose of constructing the following works: _____

UNLOADING AN EXCAVATOR AND FILLING IN A DITCH AT 46816 HWY 97.

In the above noted directions, the highway is ☐ one (1) / ☒ two (2) / ☐ three (3) or more lanes wide and ☐ zero (0) / ☒ one (1) / ☐ two (2) lanes of traffic will be maintained in the same directions as the closure.

PLEASE ATTACH THE FOLLOWING:

a) Traffic control diagram figure number 7.8 as per "Traffic Management Manual for Work on Roadways (Interim)";
b) A detailed Traffic Management Plan (format available at the Highways District Office)

APPROVAL SECTION

☐ Request denied ☐ Request approved as submitted ☒ Request approved with the following changes:

Approval not valid during periods of reduced visibility, slippery conditions or inclement weather

All Signage and Traffic Control to meet MoTI Standards.

☒ This approval is granted subject to traffic queues being monitored continuously by the Ministry or Project Representative while lane closures or traffic diversions are under way. Delays are not to exceed 5 minutes over the normal travel time.

☒ This approval is granted subject to traffic queues being monitored continuously by the Ministry or Project Representative while lane closures or traffic diversions are under way. Standards will be set as to what delays are acceptable to the public in the Traffic Management Plan and then work will commence until these standards are not met, at which time the Traffic Management Plan will be adjusted and re-approved accordingly.

The Ministry's Regional Transportation Management Centre 1-866-707-7862, must be contacted as follows:

- **At the installation of the lane closure,**
- **Upon removal of the lane closure.**

This approval must be kept on-hand at the work site.

Traffic Data Program can be accessed from here

Ken T. Namislo (District Manager Transportation (or Designate)) 2019-01-25 (Date (yyyy/mm/dd))

H1080 (2016/07) **Distribution:** Original - District Manager Transportation Copy - Highways Maintenance Contractor
Copy – Regional Transportation Management Centre (RTMC)

BRITISH COLUMBIA | Ministry of Transportation

PROVINCIAL PUBLIC HIGHWAY PERMIT APPLICATION

District File Number

Your File Number 19-002-01VR

The personal information on this form is collected under the authority of the Transportation Act. The information collected will be used to process your application. If you have any questions about the collection, use and disclosure of this information, contact the local Ministry of Transportation District Development Technician.

Submit this application to the Ministry of Transportation Office or a Front Counter BC Office in your area.

I (We) hereby propose the following use or occupation requiring authorization under the *Transportation Act*, in accordance with the attached plans and specifications submitted. It is understood that this application is not complete until a covering permit has been issued.

(Please check the category below which best describes your proposal)

WORKS ON THE RIGHT OF WAY

- ☐ Bus Stops, Shelters and Benches
- ☐ Cattle Guards and Gates
- ☐ Digital Communications
- ☐ Exploratory Survey
- ☐ Fencing
- ☐ Luminaries and Signals
- ☐ Mailboxes and Newsletter Boxes
- ☐ Pipelines
- ☐ Polelines
- ☐ Roadworks
- ☐ Sidewalks and Landscaping
- ☐ Signs
- ☐ Underground Cable, Telephone and Power

ACCESS

- ☐ Ordinary Access
- ☐ Controlled Access
- ☐ Industrial Transportation Certificate

SPECIAL EVENTS

- ☐ Filming
- ☐ Special Events
- ☐ Cattle Drive

STRUCTURES

- ☐ Encroachment
- ☐ setback

☒ Miscellaneous (describe) grading shoulder/temporary pressure line

LOCATION *(include civic address)*

4686 Highway 97

The proposal consists of and is described as follows:

DESCRIPTION

Preparation for drilling and well discharge during testing will occur in Feb. of 2019. A relief well will be drilled on the subject property and tested prior to decommissioning of well WTN 112429. The Hwy works will include adjusting the grade at the road shoulder along the subject property line and pulling of a pressure line through the nearby culvert. These modifications will be temporary and everything will be returned to its current state after approximately 3 months.

Dates (proposed): February 1 - April 1, 2019.

Times: From: 6 a.m./p.m. To: 8 a.m./p.m.

THE FULL LEGAL DESCRIPTION OF THE PROPERTY TO BE SERVED

L 1PL 9141 SEC TP 17 R 13 W6M

HIGHWAY NAME(S)
N./S./E./W. side of the highway?
E.and W. of Highway 97

Between Royal Canadian Legion (landmark) and Pearse Park (landmark).

ATTACHED DRAWING OR SKETCH ☒ Drawing Number _____.

Have the necessary applications for approval been filled with the proper authorities? (i.e. RCMP, Municipality, road and bridge maintenance contractor or as documented in the notes below)

Other Authorities	Submitted/Approved

I(We) wish to have the permit issued in the name of:

NAME/ORGANIZATION (include affiliated agency were applicable)

Drillwell Enterprises Ltd.

Is this company registered with the Registrar of Companies of British Columbia?
yes ☒ no ☐ Certificate of Incorporation No. 1014896 31.

MAILING ADDRESS

#106 5145 26th Street, Vernon BC, V1T 8G6
4 4994 POLKEY RD, DUNCAN, BC, V9L 6W3

Telephone	2507465268	Cellular/Pager	
Fax		Email Address	drill@drillwell.com

CONTACTS *(if not as above)*

Project/Location Manager Name	Colin Slade		
Telephone	2507465268	Cellular/Pager	(250) 381 1990
Fax		Email Address	drill@drillwell.com
Director Name	SAME AS ABOVE		
Telephone			
Site Contact Person	SAME AS ABOVE		
Telephone		Cellular/Pager	
Fax		Email Address	
Traffic Control Company Name	DOMCOR		
Telephone		Cellular/Pager	250 859 0326

Signature (Applicant)	Print Name	Date (yyyy/mm/dd)
	COLIN SLADE	2019-01-25

NOTES FOR WORKS PERMITS

The plans submitted may be blueprints, and shall consist of key-map, general plan, profile, and where necessary, detail plan on the following scales: **Key-map**, according to size of undertaking; **general plan**, 1:5000; **profile**, horizontal 1:5000, vertical 1:250; **details**, on suitable scales. For minor undertakings, such as small water-pipes or culverts, etc., under a road, sketches will be accepted and sections and details as to dimensions, depth of cover, etc.

The plans shall supply at least the following information:

(a) The boundaries of highway right-of-way affected;

(b) The position of all existing public works within such boundaries and relative thereto and the name of the authority in control of same;

(c) The position of all private works (with the names of owners) within such boundaries and relative thereto. (N.B. – Where the proposed works are upon or above the ground only such private works as are upon or above the ground, or as may be interfered with under the ground, need be shown);

(d) The proposed position within such boundaries and relative thereto which would be occupied by the works;

(e) The details of all tanks, manholes, lamp-poles, surface boxes, bridges, culverts, retaining-walls, or other structures to be constructed and used for the support of traffic, and details showing the method to be employed in supporting any proposed work, where any public works are affected;

(f) Full information showing exactly in what manner and to what extent it is proposed to use any land or works under the control of the Minister of Transportation.

Specifications for the carrying-out of the work within the boundaries of all highway right-of-way shall also be submitted.

When application is made in respect of the following works, the requisite particulars, plans, and specifications must be submitted to the proper authorities before the approval of the application by the Minister of Transportation.

WORKS	AUTHORITY TO WHOM PARTICULARS, ETC., MUST BE SUBMITTED	
1. Electrical Undertakings		
(a) Telegraph and telephone lines	Inspector of Electrical Energy	453 West 12th Ave., Vancouver BC V5Y 1V4
(b) Energy generated otherwise than by water-power	Inspector of Electrical Energy	
(c) Energy generated by water-power	Inspector of Electrical Energy	
	Comptroller of Water Rights	Parliament Bldgs., Victoria BC
(d) Electrical railways	Inspector of Electrical Energy	453 West 12th Ave., Vancouver BC V5Y 1V4
	Deputy Minister of Transportation	Parliament Bldgs., Victoria BC
2. Steam – railways	Deputy Minister of Transportation	Parliament Bldgs., Victoria BC
3. Logging – railways		
4. Skid – roads	Deputy Minister of Transportation and also Chief Forester	Parliament Bldgs., Victoria BC
5. Sewerage and sewerage – disposal	Environmental Protection Division	
(a) Large systems	Water, Land & Air Protection	Regional Office
(b) Small systems	Regional Health Authority	Regional Office
6. Water – supply for domestic purposes	Local Water Management Office or	Regional Office
7. Waterworks undertakings other than for domestic supply	Comptroller of Water Rights	Parliament Bldgs., Victoria BC
8. Works to be constructed within any municipality	Municipal Office	

NOTES FOR STRUCTURES PERMITS

1. Plans shall be metric, scaleable, and shall show:
   - the exact offsets of the foundation and overhand of proposed or existing structure from the right-of-way boundary and the nearest internal property line.
   - any feature or structure which limits the placement of the subject structure from being constructed at the required setback distance.
   - any other structure on the subject property within the setback requirement area.

     an inset or additional plan showing the profile of the structure and terrain to the travelled road edge.
   - the nearest edge of shoulder of the physical road.
   - the road name, legal description, any property pins evident and a north arrow.

   Submit three copies of the plan if larger than 11" x 17".
2. In cases where setback is to legalize and/or add to an existing structure, the plans are to be prepared by a qualified licensed professional surveyor.
3. It is the responsibility of the applicant to assure that design and construction of the structure conforms to all applicable legislation, bylaws, and codes, and; that all other necessary permits are applied for.
4. A certificate of title and a letter of authorization from the registered owner(s) is to be provided where the applicant is not the owner.
5. In addition you may be required to have the property lines and extremities of the footings of the proposed structure clearly flagged on site prior to Ministry inspection.

NOTES FOR HIGHWAY ACCESS PERMITS

1. Property described must have highway frontage.
2. Insert number of accesses requested.
3. Insert specific land use proposed (for example, single-family dwelling, farm, motel and restaurant, service-station, furniture factory, etc.).

3a. Indicate the permitted uses for the existing zoning on the property. This can be obtained from your local government.

4. Insert figures indicating number of dwelling units, square metres of floor area of buildings, sleeping units, employees, seats in restaurant, etc.
   (a) Insert the word "indefinitely" if required for long-term use; or
   (b) Insert the specific number of months or years if required for temporary period

5. (a) Insert "myself" or "ourselves" if required by owner or lessee; or
   (b) Insert name and address of person or company who will actually develop the property and construct, use and maintain the access works, if required by other party (for example, property is under option and owner proposes to sell or lease same); or
   (c) If access required for land beyond, give name of owner(s) and legal description of parcel involved.

NOTES FOR FILMING PERMITS

1. For location, please specify the highway name, and landmarks that indicate the outer boundaries of where you are filming.
2. Your description should include:
   - the dates and times of filming
   - the nature of what you are filming
   - whether you will be using special effects or stunts

   Please give a more detailed schedule and description of any special effects and/or stunts.
3. Specify the production company name and phone number, and its Certificate of Incorporation number, if applicable.
4. Authorities you will need to notify include:
   - the police
   - the municipality

   Include here the name and phone number of the traffic control company you will be using.
5. Please give the names and phone numbers for:
   - the location manager
   - the on-site contact person
   - the producer and/or director
6. Provide appropriate Certificate of Insurance (H0111)

NOTES FOR EVENTS AND CATTLE DRIVE PERMITS

1. For location, please specify the highway name, and specific locations on the highway between which you are holding your event.
2. Under Description, provide the following information:
   - dates and times of event
   - time of event, from starting hour to finishing hour (including set up and tear down).

   Provide a letter indicating the scope and nature of the event, including the type and number of participants (cyclists, pedestrians, runners, youth group, etc.)

   Include a traffic management plan.

   Specify any animals you propose to have involved and their experience in traffic, if relevant.

   Give the number of escort vehicles and how you propose to use them.

   Specify if it is a fundraising event.

   Provide an appropriate Certificate of Insurance.

   Specify your parking requirements, such as the number of vehicles requiring parking.
3. Specify the person(s) or organization legally responsible for the event.
4. Check with the municipality or regional district, if applicable that you have their authority for the event.

APPENDIX E

Permits and Other Key Documents

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Permit/File Number: 2019-00493
Office: Vernon Area Office

PERMIT TO CONSTRUCT, USE, AND MAINTAIN WORKS WITHIN THE RIGHT-OF-WAY OF A PROVINCIAL PUBLIC HIGHWAY

PURSUANT TO TRANSPORTATION ACT AND/OR THE INDUSTRIAL ROADS ACT AND/OR THE MOTOR VEHICLE ACT AND/OR AS DEFINED IN THE NISGA'A FINAL AGREEMENT AND THE NISGA'A FINAL AGREEMENT ACT.

BETWEEN:

The Minister of Transportation and Infrastructure

Vernon Area Office
4791 23rd Street
Vernon, BC V1T 4K9
Canada

("The Minister")

AND:

Drillwell Enterprises Ltd.
4994 Polkey Road
Duncan, British Columbia V9L 6W3
Canada

("The Permittee")

WHEREAS:

A. The Minister has the authority to grant permits for the auxiliary use of highway right of way, which authority is pursuant to both the Transportation Act and the Industrial Roads Act, the Motor Vehicle Act, as defined in the Nisga'a Final Agreement and the Nisga'a Final Agreement Act;

B. The Permittee has requested the Minister to issue a permit pursuant to this authority for the following purpose:

The installation, operation, and maintenance of:

- **Temporary widened shoulder area to provide access and parking for drilling vehicles and equipment**
- **Temporary pressure line running adjacent to the highway and through a cross culvert**

located adjacent to 4686 Highway 97 and as shown in Schedule A

C. The Minister is prepared to issue a permit on certain terms and conditions;

ACCORDINGLY, the Minister hereby grants to the Permittee a permit for the Use (as hereinafter defined) of highway right of way on the following terms and conditions:

1. That the construction and maintenance of the said works is carried out to the satisfaction of the Regional Director, Transportation.
2. That, before opening up any highway or interfering with any public work, intimation in writing of the intention to do so must be given to the District Official at least seven days before the work is begun.
3. That any person appointed by the Regional Director, Transportation, for the purpose shall have free access to all parts of the works for the purpose of inspecting the same.

4. That the construction of the said works may be commenced on **February 1, 2019** and shall be prosecuted with due diligence and to the satisfaction of the Regional Director, Transportation, and shall be completed on or before **May 31, 2019.**

5. All excavation work must be carried out in accordance with the BC Occupational Health and Safety Regulation. Care shall be taken to protect adjacent property.

6. That where the work for which permission is hereby granted comes in contact with any bridge, culvert, ditch, or other existing work, such existing work must be properly maintained and supported in such manner as not to interfere with its proper function during the construction of the new work, and on the completion of the new work the bridge, culvert, ditch, or other existing work interfered with shall be completely restored to its original good condition.

7. That when necessary all excavations, materials, or other obstructions are to be efficiently fenced, lit, and watched, and at all times every possible precaution is to be taken to ensure the safety of the public.

8. The Permittee shall indemnify and save harmless the Ministry, its agents and employees, from and against all claims, liabilities, demands, losses, damages, costs and expenses, fines, penalties, assessments and levies made against or incurred, suffered or sustained by the Ministry, its agents and employees, or any of them at any time or times, whether before or after the expiration or termination of this permit, where the same or any of them are based upon or arise out of or from anything done or omitted to be done by the Permittee, its employees, agents or Subcontractors, in connection with the permit.

9. That the permission herein granted to use and maintain the works is only granted for such times as the land or public work in, upon, or over which the said works are constructed is under the jurisdiction of the Minister of Transportation and Infrastructure. This permission is not to be construed as being granted for all time, and shall not be deemed to vest in the permittee any right, title or interest whatsoever in or to the lands upon which the works are constructed. Should the lands affected at any time be included within that of an incorporated municipality or city, this permission shall become void, unless the works are on a highway duly classified as an arterial highway pursuant to Section 45 of the Transportation Act.

10. That after receiving notice in writing of the intention on the part of the Provincial Government to construct, extend, alter, or improve any public work, the person or persons responsible for the maintenance of the works for which permission is hereby granted shall within six weeks move or alter such work at his or their own expense to such new positions or in such manner as may be necessitated by the construction, extension, alteration, or improvement proposed to be carried out by the Provincial Government.

11. That while reasonable care will be taken on the part of the Provincial Government to do as little damage as possible to any private work in the carrying-out of the construction, extension, alterations, improvement, repair, or maintenance of any public work adjacent thereto, the Provincial Government can accept no responsibility for any kind of such damage.

12. That the permission hereby granted to construct, use, and maintain work is granted without prejudice to the provisions of the Transportation Act, or other Acts governing Crown lands and public works or their use by the public.

13. That this permission shall be in force only during such time as the said works are operated and maintained by the applicants, to the entire satisfaction of the Regional Director, Transportation.

14. That the Ministry will not be responsible for grade changes on accesses caused by reconstruction of any Provincial highway.

15. This permit is valid only for the specific works stated herein. Any alterations or additions must be covered by a separate permit.

16. This permit may be canceled, at the discretion of the Minister, without recourse, should the permittee fail to comply with all the terms of the permit. Thirty days' notice will be given before cancellation.

17. When the requirements of the Ministry necessitate use of the said lands for Provincial purposes, at the discretion of the Minister, this permit may be canceled.

18. That these works shall be identified with this permit number in a manner satisfactory to the District Official of the Ministry of Transportation and Infrastructure.

19. As a condition of this permit, the permittee unconditionally agrees with the Ministry of Transportation and Infrastructure that the permittee is the prime contractor or will appoint a qualified prime contractor, as described in Section 118 of the Workers Compensation Act, for the purposes of the work described by this permit, at the work location described in this permit, and that the permittee or designated prime contractor will observe and perform all of the duties and obligations which fall to be discharged by the prime contractor pursuant to the Workers Compensation Act and the Occupational Health and Safety Regulation.

20. The permittee is advised and acknowledges that the following hazards may be present at the work location and need to be considered in co-ordinating site safety: overhead hazards, particularly electrical or telecommunications lines; buried utilities, particularly electrical, telecommunication, and gas lines; traffic, danger trees, falling rocks, and sharp or infectious litter.

21. Any works within the Ministry right-of-way that fall within the scope of "engineering" under the Engineers and Geoscientists Act will be performed by a Professional Engineer, and shall comply with this Ministry's "Engineer of Record and Field Review Guidelines". The Guidelines can be viewed on the Ministry's website at http://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-circulars/2009/t06-09.pdf

22. The permittee is responsible for preventing the introduction and spread of noxious weeds on the highway right-of-way as defined by the British Columbia Weed Control Act and Weed Control Regulation.

23. Protection of Survey Monuments

The Permittee shall be responsible for the preservation during construction of all geodetic benchmarks, survey monuments and property markers on the right-of-way. The Permittee shall use, at no expense to the Ministry, a British Columbia Land Surveyor to replace any survey monuments destroyed or damaged as a result of the Permittee's negligence. At locations where construction work will cover or destroy such markers, the Permittee shall not move or remove them until written direction is received from the Ministry Representative.

24. Protection of Roads

The Permittee shall ensure all equipment working on or hauling material on to and from the Site does not damage or deposit material onto any part of an existing roadway. Materials spilled onto the public roadways or driveways opened to public traffic shall be cleaned up immediately. The Permittee has the full responsibility to repair any damage to existing highways, local roads and driveways caused by its construction equipment and/or operations.

25. Accommodation of Traffic

The Permittee shall, at his cost, supply, erect, and maintain standard traffic control devices in accordance with the Ministry of Transportation and Infrastructure Traffic Control Manual for Works on Roadways and Occupational Health and Safety Regulation.

26. Clean Up

All unsuitable material and inorganic debris shall be removed from the project area. All surplus or unsuitable organic waste and debris shall be removed from the site unless its complete burning is approved by the Designated Ministry Official in compliance with the B.C. Open Burning Smoke Control regulation.

27. **The widened shoulder, which will provide access and parking for equipment, is located within a drainage corridor (roadside ditch).**

This fill material must be removed as soon as the works are complete. The ditch, shoulder and foreslope must be restored to their previous condition, or better.

If there are any drainage issues, that may impact the road prism, the Permittee will be required to remove the material and restore the area immediately.

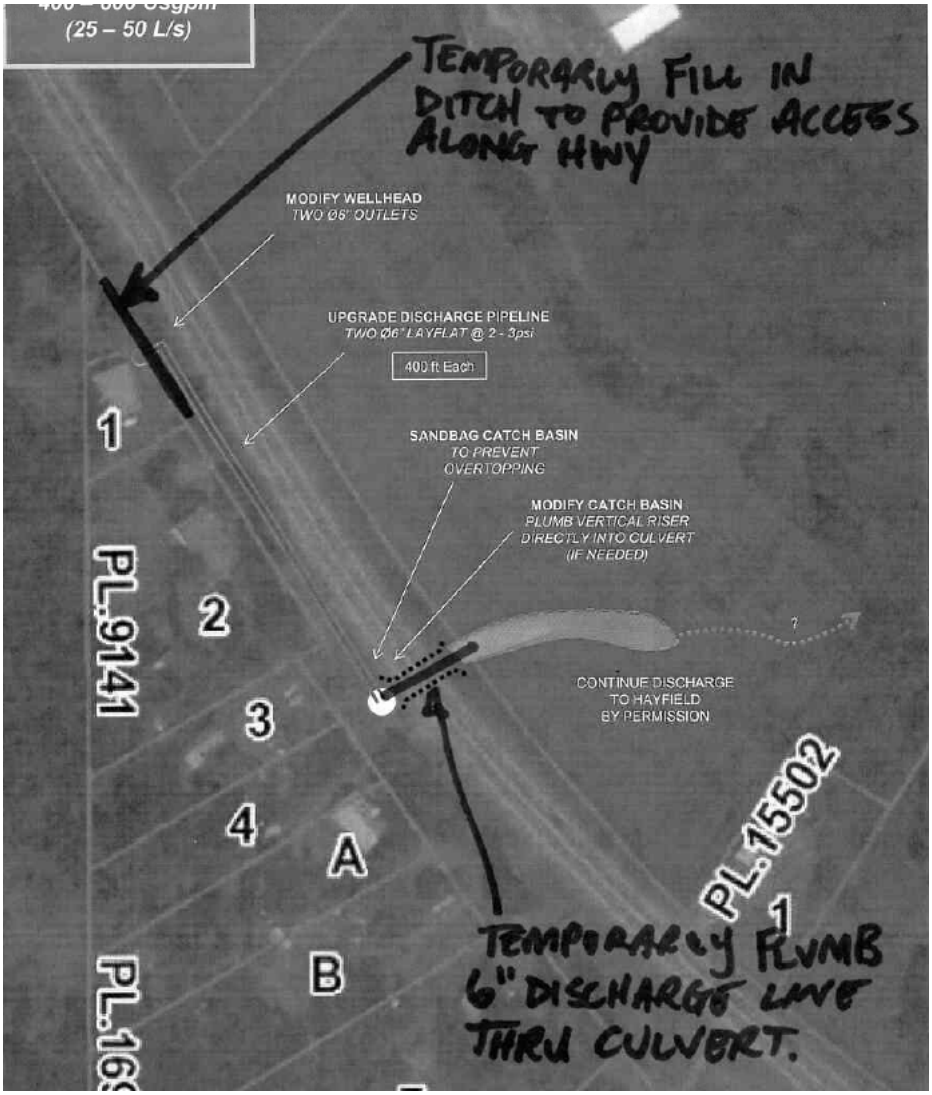
28. **The widened shoulder area must not be used by the travelling public as there would be safety risks involved. The Permittee is to delineate the area, along the original edge of the shoulder, to prevent other vehicles from using it.**

The rights granted to the Permittee in this permit are to be exercised only for the purpose as defined in Recital B on page 1.

Dated at Vernon, British Columbia, this 1 day of February, 2019

On Behalf of the Minister

Schedule A:



Shoulder widening location:

GS19932-001 File: 100045-40/WESTWOLD

January 29, 2019

To: Colin Slade, Drillwell Enterprises Ltd., and
Douglas Geller, Western Water Associates Ltd.,
Via email to Drill@drillwell.com and Doug@Westernwater.com

From: David Thomson, P.Geo., Regional Hydrogeologist

Re: Works carried out by Drillwell Enterprises Ltd. and Western Water Associates for the purposes of decommissioning the Westwold Flowing Artesian Well under Contract GS19932-001

Under Major Works Contract GS19932-001, Drillwell Enterprises Ltd. (Drillwell) is undertaking works on behalf of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) to decommission a flowing artesian well at Westwold BC. Western Water Associates Limited (WWAL) is an approved subcontractor under GS19932-001. As such they will be conducting a short term pumping test for the purpose of decommissioning a flowing artesian well (WTN 112429). WWAL has the permission of the Ministry of Forests, Lands and Natural Resources Operations and Rural Development (FLNRORD) to apply for and obtain required permits/approvals in order to complete and carry out works that are relevant to the contract. Drillwell and WWAL will notify FLNRORD, in writing, when applications are made to FrontCounterBC. If you have any questions please contact the undersigned at 250 260-4641.

David Thomson, M.Sc., P.Geo., Regional Hydrogeologist
Ministry of Forests, Lands, Natural Resource Operations & Rural Development
South Area Groundwater Science, Vernon, British Columbia.

CC: Skye Thomson, P.Geo., Section Head, South Area Groundwater Science
Ray Reilly, Senior Authorizations Specialist
Melissa Wade, P.Geo., Regional Hydrogeologist
John Pogson, P.Geo., Groundwater Protection Officer

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Application Summary
eDAS File Number: 2019-00493

Permit Application:

Permit Type: Structure: Encroachment
Selected Office: Thompson Nicola District
Applicant File Number:
Project Description: 4686 Highway 97: grading shoulder/ temporary pressure line

Location:

Order	Location
	Map: 1439999,626193

Permit Application Details:

Local Government: Thompson Nicola Regional District
Size and Type of Structure: materials to grade side of highway for access to property

Sketch Plan

BCLS Name:
Drawing #:
Prepared Date:

Attachments:

Filename	File Description	Classification
Ditch.jpg	grading location	Photograph
site plan.pdf	site	Plan
Works on Highway App Sign Permit		Application

Permit Application Parties:

Type	Name/Company	Address	Role	Permit Holder
Applicant	Le Bel , Gina - Western Water Associates Ltd.			☐
Contact	Geller, Doug - Western Water Associates Ltd.	106 5145 26 Street , Vernon, British Columbia V1T 8G4	On-site	☑
Contact	Slade, Colin - Drillwell Enterprises Ltd.	4994 Polkey Road , Duncan, British Columbia V9L 6W3	Other	☐

Use Approval (Short Term Use of Water)

Tracking Number: 100275812

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization?	Company/Organization
What is your relationship to the company/organization?	Agent

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit / Tenure / Licence will be issued, if approved.

Name:	Drillwell Enterprises Ltd
Doing Business As:	
Phone:	250-746-5268
Fax:	
Email:	
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Colin Slade
Mailing Address:	4994 Polkey Road Duncan BC V9L 6W3

AGENT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name:	Douglas Geller
Phone:	250-541-1030
Daytime Phone:	
Fax:	
Email:	doug@westernwater.ca
Mailing Address:	106-5145 26th Street Street Vernon BC V1T 8G4
Letter(s) Attached:	Yes (auth_30_jan_signed.pdf)

ELIGIBILITY

Please answer the following questions related to whether you qualify to apply for a short term use of water.

Question	Answer	Warning
Will the water be diverted and used to support oil and gas activity that is being authorized by the Oil and Gas Commission?	No	
Do you want to divert and use the water for more than two years?	No	

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you: Yes

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

Are you an existing exempt client?	No
Fee Exemption Category:	Acting on behalf of a BC provincial ministry with a letter of permission from that ministry
Letter Uploaded:	Yes
Please enter any supporting information that will assist in determining your eligibility for a fee exemption. Please refer to help for details on fee exemption criteria and requirements.	This work is being done under Contract No. GS19932-001. The Ministry representatives are Skye Thomson, P.Geo. and Dave Thomson, P.Geo.

We require some more technical information from you. Please add sites where you need to divert and use water.

Term Start Date:	Mar 1, 2019
Term End Date:	Jul 15, 2019

SITES WHERE YOU WANT TO DIVERT THE WATER

Please provide us with information about all sites where you want to take the water from, how much water you will need and what the water will be used for.

SITES

Location ID:	4686 Highway 97, Westold BC
Name of the Stream:	Aquifer
Source of Water:	Groundwater
Is the water you are applying for coming from a well?	Yes
Well Status:	Not Constructed
Well Geographic Coordinates:	50.4771760, -119.7899300
Location of Intake:	
Purpose of Use:	Misc Indust
Rental Fee:	$1,000.00
Application Fee:	$200.00
Total Daily Quantity	
Quantity:	5,987.50000 m3/day
Maximum Rate of Diversion:	6,400.00000 m3/d
Term Start Date:	Mar 1, 2019
Term End Date:	Jul 15, 2019
Date of Use Start:	March 1
Date of Use End:	July 15
Works to be Used:	One well, drilled as a pressure relief well to aid in decommissioning an out-of-control flowing artesian well located on the project site, Well Tag. No. 112429.
Land Ownership:	☐ Applicant owns land ☐ Land is Crown Land but applicant has tenure ☐ Land is Crown Land but tenured to Ministry of Transportation ☐ A third Party owns the land but the applicant has lease or tenure ☑ A third Party owns the land **Name of Land Owner that owns the land where your works are proposed:** Brandon Underwood ☐ Land is Crown Land but the applicant does not have a tenure You require a written consent from the landowners to do the work. You can upload the consent on Documents upload step later in the application
Provide the legal description/location	Lot 1, Sec 31, Tp 17, R 13, W6M, KDYD, Plan 9141.

description of land(s) where works are proposed:	
Legal Description of land where the water is to be used:	Lot 1, Sec 31, Tp 17, R 13, W6M, KDYD, Plan 9141
Coordinates of Use:	50.4771760, -119.7899300

If you have more than one site you can make a copy of a site by clicking the 'Copy' link besides the site entry above. All the information will be copied from that entry and you can then edit that copied entry and change the values as required.

ENVIRONMENTAL ASSESSMENT

The Environmental Assessment Act requires that certain large groundwater extraction projects undergo an environmental assessment, and obtain an environmental assessment certificate, or obtain a formal determination that an environmental assessment certificate is not required.

Criteria for determining whether a groundwater extraction project may require an Environmental Assessment certificate:

1. Constructed on or after the year 1995 where one or more works, operated intermittently or continually for 1 year, divert 75 Litres per second (1189 US GPM) or greater.

2. Modifications to projects constructed prior to 1995 that result in diversion reaching or exceeding 75 Litres per second (1189 US GPM).

3. Project built prior to 1995 that divert 75 Litres per second (1189 US GPM) or greater that have been modified on or after 1995 such that there is an increase of 35% or more over the previous rate of diversion.

Projects that meet the criteria above may require either an Environmental Assessment Certificate or a letter of exemption from the Environmental Assessment Office (EAO). Visit the EAO website or see the Environmental Assessment Certificate Requirements for Groundwater Users Guidelines for more information.

According to the requirements above, does your application require an Environmental Assessment certificate, or do you have a letter of exemption?	No

LOCATION INFORMATION

LAND DETAILS

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☑ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description	Filename
location map google earth	location map.pdf

ATTACHED DOCUMENTS

Document Type	Description	Filename
Other	landowner access agreement with Ministry	Underwood Agreement October...

PRIVACY DECLARATION

☑ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company / Organization: Drillwell Enterprises Ltd
Contact Name: Colin Slade
Contact Address: 4994 Polkey Road
Duncan BC V9L 6W3
Contact Phone: 250-746-5268
Contact Email: drill@drillwell.com

☑ **I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.**

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this Short Term Use of Water Approval does not provide authority under the Water Sustainability Act to divert, use or store water from a stream or to construct works. I also understand that my application must first be investigated and a decision made on the application as to whether a approval may be granted and, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) for information on how to ensure your project complies with the Fisheries Act.
- Once you click 'Next' the application will be locked down and you will NOT be able to edit it any more.

DECLARATION

☑ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know? The MFLNRORD project manager is Dave Thomson, P.Geo. of the Vernon regional office. He has requested that a copy of this application be sent to him and to Ray Reilly in water authorizations. Western Water Associates Ltd. is sending the completed application to these two individuals who plan to facilitate the application process.

OFFICE

Office to submit application to: Vernon

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource No

authorization from the Province of BC?

APPLICANT SIGNATURE	
Applicant Signature	**Date**

OFFICE USE ONLY		
Office Vernon	**File Number**	**Project Number**
	Disposition ID	**Client Number**

Note: The tracking number assigned to your Notification Form is: 100275842 , Date Received on : Feb 7, 2019 3:18:48 PM

Please maintain a record of this tracking number for reference in any future correspondence about your proposal and any related follow-up.

Re: Notice to Habitat Officer / Changes in and about a Stream under Part 3 Water Sustainability Regulation

Your Notification to a Habitat Officer Ministry of Forests, Lands, Natural Resource Operations and Rural Development under the Water Regulation (Part 3 of the regulation) regarding your proposal to make changes in and about a stream of the kind described in section 39 of the regulation, has been received.

Please Note: Only changes in and about a stream of the kind listed in the Water Sustainability Regulation (Part 3 "Changes in and About a Stream") can proceed on notification and in accordance with requirements of the regulation including any terms and conditions specified by a Habitat Officer. An approval under the Water Sustainability Act for the change is otherwise required if the change proposed is not of the kind listed in section 39 of the regulation.

Under the provisions of the regulation, the Habitat Officer has 45 days following receipt by the Ministry of this notification to request additional information from you and to specify additional terms and conditions specific to your proposal, if warranted. A person making a change in and about a stream under this regulation, other than under section 39(1)(o) to (s) or 39(2) or 39(5), must then make that change in accordance with the regulation and any terms and conditions specified by the Habitat Officer *(including those further described in #1-17 below or as specified subsequently within 45 days of Habitat Officer receipt of this notice).*

Therefore, if you have *not* heard back from the Habitat Officer *within 45 days* of our receipt of your notice providing you with a statement of any additional terms and conditions specified by the Habitat Officer with respect to your proposal, you may proceed with the proposed changes in and about a stream but must satisfy the requirements of Part 3 of the regulation and also comply with the following terms and conditions in making those changes:

1. Any work associated with the proposed changes in and about a stream must not cause stream channel instability or increase the risk of sedimentation into the stream.

2. During work onsite, erosion and sediment control materials must be available onsite at all times and must be installed if sedimentation is likely to occur into the stream. A contingency plan must be developed outlining the measures to be taken by workers when carrying out any work to control erosion and sediment.

3. Soil disturbance must not occur in heavy rain conditions and any soil removed must be placed in a location that ensures that sediment or debris does not enter the stream.

4. Within a work area, water that contains sediment must be pumped to a vegetated area away from the stream where it can seep into the ground, or to a settling pond that is sufficiently far from the stream to allow sediment to settle out before the water returns to the stream.

5. The disturbance of stream bank vegetation must not occur or be minimized as much as possible.

6. Any areas that are disturbed during the work (such as exposed soil) must be promptly restored at a minimum to the pre-disturbance condition.
Note: Guidance is provided in the Enhancement Section of the Best Management Practices Instream Works

7. If possible, work must be conducted on, and equipment located and operated from, dry land (no water present) and the worksite must be isolated from flowing water.

8. Any equipment used in conducting work must be in good mechanical condition and, when operating in close proximity to the wetted perimeter of a stream, the operator must prevent entry of any substance, sediment, debris or material (e.g., hydrocarbons, silt) into the stream so as to prevent harm to fish, wildlife or the aquatic ecosystem of a stream. Note that Section 46 of the Water Sustainability Act prohibits the introduction of foreign matter into a stream. Failure to comply may result in a remediation order and it is also an offence to do so.

9. The original rate of water flow in the stream (existing prior to commencing work) must be maintained upstream and downstream of the worksite during all phases of instream activity associated with the work.

10. When work requires de-watering or isolation of the worksite in the stream, a permit for the salvage of fish and wildlife must be obtained prior to commencing work. All required salvage permits must be obtained from FrontCounter BC : ***http://www.frontcounterbc.gov.bc.ca/****. Any salvage must be carried out by a qualified environmental professional (such as an R.P.Bio.).*

11. Following de-watering or isolation of the worksite, stream flow must be returned gradually to the de-watered or isolated area within the stream and not in a single sudden rush so as to avoid erosion of the stream channel and sediment delivery to the stream.

12. The stream channel width must not change as a result of the work.

13. Any materials, such as riprap or gabion rock, placed within the stream must be clean and not contain substances that could be harmful to fish, wildlife or the aquatic ecosystem of the stream.

14. Any areas disturbed as part of the work must be restored as close as possible to their pre-disturbance condition. Any soil exposed at the worksite must be promptly re-vegetated.

15. Subject to section 16 and 17 below, the work must be completed during the timing window for the stream in respect of which the changes are proposed. The applicable timing window (by region and/or by stream) are specified in the following links (see below) and are designed to protect fish, wildlife or the aquatic ecosystem of a stream. To determine the timing window, please select the relevant region from the map:
http://www.frontcounterbc.ca/pdf/RegionMap.pdf
*and then determine the applicable timing window:*Regional Timing Windows:*
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows<
<for that region and for the stream where the proposed changes will be made.
For projects proposed to take place outside these timing windows, please see section 16 and 17 below

16. In addition to the timing windows specified in section 15 above, work may be carried out during the following times provided these requirements are met when the changes are carried out:

i. If the stream channel is naturally dry (no flow) or frozen to the bottom at the worksite and the instream work / activity associated with the proposed change will not adversely impact fish, wildlife or the aquatic ecosystem of the stream (e.g. not result in any substance, sediment, debris or other material entering or leaching into the stream that would adversely affect fish, wildlife or the aquatic ecosystem),

ii. In the construction of a winter crossing, the stream channel is frozen to the bottom at the worksite and related work does not adversely impact the stream channel (including stream bed and banks), or fish, wildlife or the aquatic ecosystem of the stream, or impede their passage (in both directions) in the stream.

17. If your work is proposed outside of the timing window (as described in section 15 above), you must retain a qualified environmental professional (such as an R.P. Bio.). The professional will be responsible for providing a written technical rational that assesses and addresses the risks of the proposed changes in and about a stream, including proposing site specific mitigation (e.g. an Erosion Control Plan that identifies contingency measures and emergency procedures related to the proposal) and onsite monitoring of their implementation. This document must be submitted to the Habitat Officer via Front Counter B.C. with reference to your file number (shown on top of this document).
In proceeding outside the timing window in accordance with recommendations by your qualified environmental professional, you must comply with any measures specified by that professional to prevent impacts on the stream channel (including stream bed and banks) or fish, wildlife or the aquatic ecosystem of the stream, as well as any Habitat Officer terms and conditions specified in the confirmation of receipt of your original Notice.

In summary, you must meet the terms and conditions described above, as well as any additional terms and conditions specified by the Habitat Officer in respect of your proposal within 45 days of the Ministry's receipt of your notice, if any were specified. In addition, you must also meet any other requirements of the regulation, as are described in Part 3 of the Water Sustainability Regulation found at ***http://www.bclaws.ca/***

Also, for assistance to the public, the Province has developed clear guidance/practices, also referred to as best management practices, for working around water and for designing and implementing different types of changes in and about a stream, particularly in respect of instream works. This information in combination with the terms and conditions described above, including any additional Habitat Officer terms and conditions specified, if all followed, will help ensure that your changes in and about a stream will be compliant with the regulation and related legislation, as well as minimizing impacts on the environment (including related fish, wildlife and the aquatic ecosystem) in the stream and stream channel.

Follow the links and website directions (see below) to review the provincial guidance/practices provided for your proposed works. Please be advised that these documents may contain information which may be the subject of change due to amendments to the federal Fisheries Act and/or to related processes by Fisheries and Oceans Canada (DFO). Current up-to-date information on DFO process and legislation can be found at : ***http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html***

Province of BC Guidance / Practices:

Best Management Practices (BMP's) for Instream Works. When using this guide go to the list of "Guidebook Chapters" and select the appropriated chapters to match the specific activities relevant to your proposal for changes in and about a stream.

*Region specific BMP's for Instream Works links directly to other specific BMP pages for particular streams and regions (e.g. Shuswap and Mara foreshore guidelines): ***http://www.env.gov.bc.ca/wld/instreamworks/index.htm#**** Standards and Best Management Practices for Instream Works:***http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-rights/standards_bp_instream_work.pdf**
Instream works: http://www.env.gov.bc.ca/wld/instreamworks/index.htm

*User's Guide to Working In and Around Water : ***http://www.env.gov.bc.ca/wsd/water_rights/cabinet/working_around_water.pdf***

* Water Licences and Approvals:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water<<* Apply for a Change Approval or Submit Notification of Instream work:

http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/water-licences-approvals/apply-for-a-change-approval-or-submit-notification-of-instream-work<<*Exemption from approval or notification: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/exemptions-from-approval-or-notification

Final Note: It is the responsibility of persons intending to carry out changes in and about a stream, as described under Part 3 of the Water Sustainability Regulation:

* To ensure that all sections of the Notice form are properly completed;

* To comply with federal, provincial and municipal enactments, including but not limited to the Water Sustainability Act (and its regulations), *Fisheries Act* (Canada), *Wildlife Act* (BC) or the *Navigation Protection Act* (Canada), as well as local government bylaws and regulations, as may be applicable to proposed changes and related works or activities; and

* To obtain the approval of the landowner for proposed changes and related works or activities intended to take place on private land or premises or to use any privately owner works, before proceeding.

Please be advised that, in the event of non-compliance with the requirements of the regulation (including habitat officer terms and conditions), it is the responsibility of persons carrying out changes in and about a stream:

* To report non-compliance with the regulation within 72 hours and then to take measures to remedy the non-compliance, as may be specified by a Water Sustainability Act Engineer, as well as to comply with any additional terms and conditions specified by the Habitat Officer; and

* To report damage to an aquatic ecosystem within 72 hours to a Habitat Officer and then to restore and repair the habitat to the state that existed before the damage was caused or as directed by the Habitat Officer.

For information, the Ministry may undertake review and inspection of specific changes in and about a stream and related works and activities to confirm compliance with:

* The requirements of the regulation

* Habitat Officer terms and conditions, including those listed in this document or any later specified by the Habitat Officer,

* Any site specific measures and mitigations specified by a qualified environmental professional for in-stream projects carried out outside accepted timing windows, and

* Any other applicable enactments

In cases of demonstrated non-compliance with legal requirements, compliance and enforcement actions may subsequently be undertaken by the Ministry where circumstances warrant.

For further information, please consult the Ministry websites listed above, as well as:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water

Please contact FrontCounter B.C. with any questions regarding these requirements

Protection of Privacy: The collection, use and disclosure of personal information by the provincial government is governed by the Freedom of Information an Protection of Privacy Act<. Additional authorities are provided in the Water Sustainability Act<. Note that, in providing this Notice to the Ministry, you are consenting to the collection, use and disclosure of any personal information provided by you in the Notice. See Sections 12 and 38 (3) of the Water Sustainability Regulation. Note: Under Section 44(1) of the regulation, “timing window”, in relation to a stream,

means a period of the calendar year, specified by a habitat officer, during
which changes in and about a stream can be made without causing a significant
harm to fish, wildlife or the aquatic ecosystem of the stream. These were previously know as “least risk”
timing windows. As noted above, please
select the relevant region from this map (first link below) and then determine
the applicable timing window for that region using the second link for Regional
Timing Windows:***http://www.frontcounterbc.ca/pdf/RegionMap.pdf***
*Regional Timing Window:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows<<

Thank You

Ron Diederichs, Habitat Officer West Coast Region

Kristina Robbins, Habitat Officer South Coast Region

Lora Nield, Habitat Officer Thompson Okanagan Region

Mike Knapik, Habitat Officer Kootenay Boundary Region

Robbin Hoffos, Habitat Officer Cariboo Region
Jocelyn Campbell, Habitat Officer Skeena Region

James Jacklin, Habitat Officer Omineca Region

Joelle Scheck, Habitat Officer North East Region

Change Approval and Notification (Changes In and About a Stream)

Tracking Number: 100275842

Applicant Information

If approved, will the authorization be issued to an Individual or Company/Organization?	Company/Organization
What is your relationship to the company/organization?	Consultant

APPLICANT COMPANY/ORGANIZATION CONTACT INFORMATION

Applicant is an Individual or an Organization to whom this authorization Permit / Tenure / Licence will be issued, if approved.

Name:	Drillwell Enterprises Ltd.
Doing Business As:	
Phone:	250-746-5268
Fax:	
Email:	drill@drillwell.com
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Colin Slade
Mailing Address:	4994 Polkey Road Duncan BC V9L 6W3

CONSULTANT INFORMATION

Please enter the contact information of the Individual/Organization who is acting on behalf of the applicant.

Name:	Western Water Associates Ltd.
Doing Business As:	Western Water Associates Ltd
Phone:	250-541-1030
Fax:	
Email:	ryan@westernwater.ca
BC Incorporation Number:	
Extra Provincial Inc. No:	
Society Number:	
GST Registration Number:	
Contact Name:	Gina Joyce Le Bel
Mailing Address:	106-5145 26th Street Vernon BC V1T 8G4
Letter(s) Attached:	Yes (Letter of Agency Signed CS.pdf)

CORRESPONDENCE E-MAIL ADDRESS

If you would like to receive correspondence at a different email address than shown above, please provide the correspondence email address here. If left blank, all correspondence will be sent to the above given email address.

Email:	trina@westernwater.ca
Contact Name:	Trina Koch

ELIGIBILITY

Please answer the following questions related to your Change Approval/Notification.

Question	Answer	Warning
Is this application to support oil and gas activity that is being authorized by the Oil and Gas Commission?	No	

TECHNICAL INFORMATION

GOVERNMENT AND FIRST NATION FEE EXEMPTION REQUEST

Do you belong to, are you applying on behalf of, or are you:

- A provincial government ministry
- The Government of Canada
- A First Nation for water use on reserve land
- A person applying to use water on Treaty Lands
- A Nisga'a citizen
- An entity applying to use water from the Nisga'a Water Reservation?

No

APPLICATION BY GOVERNMENT

Please indicate if you are someone who works in the government OR you are working on behalf of the government.

Are you, or are you applying on behalf of, a government entity? No

TYPE OF WORKS

Please select the type of Notifications/Approvals you want to apply for as part of this application.

Please select the type of works to be undertaken:

Notification

- ☑ Road Crossing Culvert - Construction / Maintenance / Removal
- ☐ Clear Span Bridge - Construction / Maintenance / Removal
- ☐ Pipeline Crossing – Construction / Maintenance
- ☐ Dry Hydrant – Construction / Maintenance
- ☐ Pier, Wharf, (including docks) – Construction / Maintenance / Removal
- ☐ Cutting of annual vegetation in a stream channel
- ☐ Dike or Erosion Protection Works - Repair / Maintenance
- ☐ Storm Sewer Outfalls – Construction / Maintenance
- ☐ Control of Eurasian Watermilfoil or other invasive aquatic vegetation
- ☐ Ice Bridge / Winter Ford or Snowfill - Construction / Maintenance
- ☐ Maintenance of minor and routine nature by a public utility
- ☐ Removal of a beaver dam (as authorized under the Wildlife Act)
- ☐ Construction of a temporary ford
- ☐ Construction of a temporary diversion around a worksite

Approval:

- ☐ Bank Erosion Protection
- ☐ Bridge (other than clear span) - Construction / Maintenance / Removal
- ☐ Stream Diversion
- ☐ Large Debris Removal by machine - Plan required
- ☐ Gravel removal
- ☐ Other

Please note that the ultimate decision whether this constitutes a Notification or a Change Approval lies with the Province of British Columbia

SITES

Click on the Add Sites button to add one or more sites.

SITE

Location ID: A Branch of Pringle Creek

STREAM

Name of the Stream: Pringle Creek Branch
Source Flows Into: wetland/field on Buff Lumber Property

PROPOSED WORKS

Detailed Description of Works:

The project involves controlling artesian well flow that is currently entering a branch of Pringle Creek. A new well is proposed to be drilled and the current well is planned to be decommissioned. Ideally, before works commence, a fish screen would be placed across the face of the culvert accepting flow from the main stem of Pringle Creek into the branch.

The branch of Pringle Creek splits from the main stem of Pringle Creek on the west side of Highway 97 at the approximate coordinates (50.481088, -119.792326). A culvert allows water into the branch from the upper column of the main stem.

Currently conditions in the branch are frozen or dry, which are ideal conditions for placing a fish screen. It would also be ideal to block flow into the channel by placing sand bags in the culvert. That way, if water begins melting, there will not be extra flow added to the branch.

Adding the sand bags and a fish screen results in approximately 1m2 of work within the culvert.

Michael Hutchings owns the property on which the branch culvert is located but we have not been able to contact him. We would need his permission to access the culvert to place the fish screen and sand bags. Additionally, we have some information about active and inactive water license holders along the channel and have been unable to contact them.

Although we can proceed without placing the fish screen or blocking flow to the branch by implementation mitigation efforts, doing these two things would greatly alleviate impacts to fish and reduce the risk of flooding to properties downstream of well discharge.

Footprint of Project: 1 m2

PROPOSED TIMING FOR WORKS

Start Date: Feb 20, 2019
End Date: Jul 31, 2019
Is the proposed timing within the approved regional timing window? Yes

LOCATION OF WORKS

Provide a legal description of the land(s) where works are proposed: E1/2 LS 8 SEC 36 TP 17 R 14 W6M EXC PT LYING E OF PL H8
Geographic Coords of Works: 50.4810880, -119.7923260
Photo of Works Location: A Branch of Pringle Creek - Well discharge flowing over field and into a shallow pond before entering the branch of Pringle Creek

LAND OWNERSHIP AT THE WORKS

Land Ownership:

☑ Applicant owns land
☐ Land is Crown Land but applicant has tenure
☐ Land is Crown Land but tenured to Ministry of Transportation
☐ A third Party owns the land but the applicant has lease or tenure
☐ A third Party owns the land but applicant has written consent
☐ Land is Crown Land but the applicant does not have a tenure

LOCATION INFORMATION

LAND DETAILS

DRAWINGS

A Drawing to Scale is required that meets the Application Drawing Standards. Choose one of the options below to submit the required map/drawing.

Additionally, it is recommended that you provide a topographical map showing the general location of the property where the water is proposed to be used and the works constructed in relation to nearby communities, highways, railways and other water sources.

(this additional map will not be necessary if your Drawing to Scale is provided using the Geomark Service or a spatial file such as .KML or .KMZ)

☑ I have map(s) saved to my computer and wish to provide these with my application

MAP FILES

Do you have a PDF or image file of a drawn map? You can upload it here.

Description	Filename
branch culvert	branch culvert.kmz
where well discharge enters branch of Pringle Creek	where well discharge enters...

ATTACHED DOCUMENTS

Document Type	Description	Filename
Other	EMP	Appendix C Draft EMP.pdf
Other	Project Initiation Documents	APPENDIX E - Permits and Ot...

PRIVACY DECLARATION

PRIVACY NOTE FOR THE COLLECTION, USE AND DISCLOSURE OF PERSONAL INFORMATION
Personal information is collected by FrontCounter BC under the legal authority of section 26 (c) and 27 (1)(a)(i) of the Freedom of Information and Protection of Privacy Act (the Act).
The collection, use, and disclosure of personal information is subject to the provisions of the Act. The personal information collected by FrontCounter BC will be used to process your inquiry or application(s). It may also be shared when strictly necessary with partner agencies that are also subject to the provisions of the Act. The personal information supplied in the application package may be used for referrals or notifications as required. Personal information may be used by FrontCounter BC for survey purposes.For more information regarding the collection, use, and/or disclosure of your personal information by FrontCounter BC, please contact FrontCounter BC at 1-877-855-3222 or at:
FrontCounter BC Program Director
FrontCounter BC, Provincial Operation
441 Columbia Street
Kamloops, BC V2C 2T3
☑ Check here to indicate that you have read and agree to the privacy declaration stated above.

REFERRAL INFORMATION

Some applications may also be passed on to other agencies, ministries or other affected parties for referral or consultation purposes. A referral or notification is necessary when the approval of your application might affect someone else's rights or resources or those of the citizens of BC. An example of someone who could receive your application for referral purposes is a habitat officer who looks after the fish and wildlife in the area of your application. This does not apply to all applications and is done only when required.

Please enter contact information below for the person who would best answer questions about your application that may arise from anyone who received a referral or notification.

Company / Organization:	Drillwell Enterprises Ltd.
Contact Name:	Colin Slade
Contact Address:	4994 Polkey Road Duncan BC V9L 6W3
Contact Phone:	250-746-5268
Contact Email:	drill@drillwell.com

☑ **I hereby consent to the disclosure of the information contained in this application to other agencies, government ministries or other affected parties for referral or First Nation consultation purposes.**

IMPORTANT NOTICES

Please review the "Important Notices" below and then check the declaration at the bottom confirming that everything in this application is complete and accurate.

- I understand that the submission of this application does not provide authority under the Water Sustainability Act to construct works in and about a stream. I also understand that my application must first be investigated and a decision made on the application as to whether an approval may be granted and, as part of that review, additional information may be requested of me.
- The application may be subject to further requirements under the federal Fisheries Act. Please refer to Fisheries and Oceans Canada Projects Near Water webpage (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) for information on how to ensure your project complies with the Fisheries Act.

DECLARATION

☑ By submitting this application form, I, declare that the information contained on this form is complete and accurate.

OTHER INFORMATION

Is there any other information you would like us to know?	This project is part of a larger well decommissioning plan undertaken by Western Water and Drillwell and supported by the provincial government. It is our hope that the province can help us gain property access to the branch culvert by contacting the property owner. We also require assistance in contacting individuals who hold the active and inactive water license on the branch of Pringle Creek. A public open house may help to get the word out to the various individuals.

OFFICE

Office to submit application to:	Kamloops

PROJECT INFORMATION

Is this application for an activity or project which requires more than one natural resource authorization from the Province of BC?	No

APPLICANT SIGNATURE

Applicant Signature	**Date**

OFFICE USE ONLY		
Office Kamloops	**File Number**	**Project Number**
	Disposition ID	**Client Number**

February 11, 2019

File: 10005-40/GS19932-001

Notification of Westwold Flowing Artesian Well Decommissioning Project, Westwold BC

To whom it may concern,

On behalf of the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), we are providing this notification that Drillwell Enterprises Ltd. (Drillwell) has been retained to close a flowing artesian well located at 4686 Highway 97, Westwold BC. The well is being closed to comply with regulatory requirements and to reduce any long-term risks to infrastructure, property and aquifer management.

Drillwell will be on the subject property undertaking works to decommission a flowing artesian well, including site preparation, construction of a drill pad, drilling of a relief well, installation of water conveyance pipes, pump testing and monitoring, and staging of equipment and machinery. The purpose of the relief well drilling program is to complete a relief well into a confined sand and gravel aquifer to be used to aid in the future closure of the flowing artesian well.

Works on the site will commence immediately and will be conducted through the end of March 2019.

Should you have any questions or concerns, please feel free to contact the following:

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)

Project Coordinator: David Thomson, Regional Hydrogeologist Tel: 250-260-4641

Media Inquiries

Government Communications and Public Engagement Tel: 250-356-7506

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Regional Water Management
South Area Groundwater Science
Mailing/Location Address:
2501 14th Avenue
Vernon BC V1T 8Z1
Telephone: 250-558-1700
Website: www.gov.bc.ca/env

DRILLWELL RIG SPECIFICATIONS

		DR-12	DR-24 (hi torque)	DR-24HD
TOP DRIVE				
Stroke	Up	25 ft (7.62 m)	26 ft (7.92 m)	26 ft (7.92 m)
Hoist Speed	Pullback	177 ft/min (54 m/min)	122 ft/min (37 m/min)	78 ft/min (24 m/min)
Hoist Capacity	Pulldown	40,000 lbs (18140 kg)	60,000 lbs (27200 kg)	84,000 lbs (38100 kg)
Torque (stall)		12,000lbs (5400 kg)	20,000 lbs (9000 kg)	25,900 lbs (11800 kg)
Rotation Speed		10,000 ft-Ibs (13,500 Nm)	10,000 ft-Ibs (13,500 Nm)	14,500 ft-Ibs (19,600 Nm)
		0 - 122 rpm	0 - 122 rpm	0 - 86 rpm
LOWER DRIVE				
Stroke	Pullback	12 ft (3.66 m)	12 ft (3.66 m)	12 ft (3.66 m)
Hoist Capacity	Pulldown	42,400 lbs (19200 kg)	75,400 lbs (34200 kg)	117,000 lbs (53000 kg)
Torque		18,500 lbs (8400 kg)	33,000 lbs (15000 kg)	42,400 lbs (19200 kg)
Rotation Speed		500,000 in-lbs (56500 Nm)	1,500,000 in-lbs (112000 Nm)	2,500,000 in-lbs (282000 Nm)
Max. Casing		0 - 13 rpm	0 - 21 rpm	0 - 6 rpm
Diameter		12” (305 mm)	24” (609.6 mm)	24” (609.6 mm)
COMPRESSOR				
Air Flow		900 cfm (25.5 m3/min)	900-1150 cfm (25.5 m3/min)	SAME AS DR 24
Pressure		350 psi (24.1 bar)	350 psi (24.1 bar)	
Engine Power		525 hp (391 kW)	525 hp (391 kW)	
DIMENSIONS				
Length		37 ft (11.28 m)	38 ft 9 in (11.81 m)	SAME AS DR 24
Height		13 ft (3.96 m)	13 ft 6 in (4.11 m)	
Width		8 ft (2.44 m)	8 ft (2.44 m)	
Weight		51,600 lbs (23500 kg)	56,000 - 72,000 lbs (25400 - 32650 kg)	

APPENDIX F

Kick-off Meeting Notes

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Meeting Minutes

Westwold Flowing Artesian Well Decommission Project

Project Kickoff Meeting

January 22, 2019 13:00-15:00

Attendees

Dave Thomson, Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)
John Pogson, FLNRORD
Melissa Wade, FLNRORD
Skye Thomson, FLNRORD
Colin Slade, Drillwell Enterprises Ltd.
Doug Geller, Western Water Associates Ltd. (WWAL)
Ryan Rhodes, WWAL
Trina Koch, WWAL
Ken Namislo, Ministry of Transportation and Infrastructure (MOTI)

1. Introductions and Review of agenda – Colin requested to add to the agenda further discussion on the existing onsite pipelines and ownership

2. Phases of contract (reviewed by Dave)

Review contract phases as per major works contract
Key dates:

- Jan 31 - desktop planning tasks due
- Feb 28 – site preparation done
- March 10 - drill and cement surface casing
- March 25 - drill and install relief well
- Mar 31 – conduct and report on relief well testing
- Apr 30 - drill develop and test 2nd relief well if necessary
- May 20 – decommission subject well
- June 14 – post closure report including monitoring plan

3. Roles and responsibilities-

- Dave is main point of contact and is acting as the FLNRORD project coordinator to manage the field program and acting as the Ministry's qualified receiver. All future communications to be routed through him; Melissa to act as back up if Dave is not available.
- Skye is acting as the contract manager and is responsible for managing the budget, expenditures, outcomes and deliverables of the project
- John is providing technical assistance and support to Dave as needed.
- Melissa is providing technical assistance and support to Dave as needed.

Note - Best way to communicate with FLNRORD staff after work hours is via text messaging or direct call to notify an email has been sent, as staff are unable to receive emails on the work phones.

- Ken – primary contact for MOTI permitting, he is concerned with protecting highway infrastructure and traffic management when equipment entering/leaving work site
- Colin – primary point of contact for Drillwell, same contact info to reach Shawn Slade or David Slade who will be acting as alternates. Drillwell is the prime contractor, but if anyone has any questions for WWAL they go straight to WWAL if that makes sense, and cc others on project when it makes sense in effort to try not to overload too many email inboxes.
- Doug – providing hydrogeological support for Drillwell during the project. Acting as the EGBC professional on the project to sign off on reports and fulfill EGBC requirements. Provide local support to drillwell, can meet people on site, provide input to relief well design, prepare decommissioning plan, water discharge plan, etc.
- Trina – environmental support, dewatering plan, already been out on site, she has an assistant who will also be on site with her.
- Ryan – EGBC professional hydrogeologist acting to back up Doug on this project, will be onsite along with other hydrogeologists at key times.
- Team effort from WWAL on reporting

4. Invoicing

- The invoicing is tied to the milestones and timelines outlined in the contract
- All invoices to be sent to Dave. Dave is acting as the qualified receiver to make sure deliverables in contract are received. He will confirm work is substantially completed per phase. Dave will then raise invoices to Skye for payment.
- Ensure that the contract number is on all invoices.
- As per the 10% performance security outlined in the contract, there are also holdback provisions in 15.09 of the contract. Each invoice will be subject to holdback of:
    - 10% of the value of the work performed and materials supplied under the terms of the contract; and,
    - 5% of the value of the work and materials supplied in the case of a warranty claim
    - Holdback releases specified in 15.12 of the contract.
- Invoices should have full amount for each milestone, but with PST and GST listed as a separate line item
- Colin had no questions, all looks good. He asked if we want partial billing? For instance if works are completed earlier can we do partial billing to bill earlier? FLNRO preference is completion of a milestone before payment, but would consider partial payments on work completed as we near the March 31 deadline.
- No further questions

Colin is in the process of developing a more detailed timeline for second phase should be done in about a week. Would like to talk at end of meeting about some site prep items.

5. Communications

Dave reviewed suggested communications on the agenda:

a) regular meeting to touch base to go over progress, daily updates from Colin, maybe meetings more frequently than 1x/week during key times of project suggested by Colin. Drillwell/WWAL to send out weekly emailed project updates on Fridays.
b)*Action Item" - Dave to make a placeholder in our calendars to regularly communicate to all team members. Placeholder for Mondays around 10am, move to Tuesday if Monday is a stat holiday.
d) Notification to landowners, Colin and WWAL already been on site

- Skye mentioned important for landowners to know what's going on
- Suggestion to have someone go door to door and inform about the project to make sure they have a contact person, also notify adjacent landowners along water course about the water discharge plan.
    - Colin – has already reached out to landowners
    - Dave to speak with landowners in area

Colin - What is stance on passerby's who want to ask about project and what's going on?

- Be aware that there could be folks trying to stop in and ask questions. Redirect any inquiries to Dave so we can provide a coordinated response.
- *Action Item* FLNRORD to develop a one-pager plain language handout that can be available on site. Also, can be posted on notice board at the legion or at the post office to proactively inform neighbours.

- Doug –Summary of communication plan amongst contractor team:
    - Colin to do outreach to neighbours,
    - Direct all questions to Dave, but if you are on site (for example Trina or Doug) then can answer any simple questions on site. All agreed.

6. Landowner Access Agreements

Discussed the landowner agreement. Province has a voluntary agreement with the landowner (Underwood). Skye reviewed the background of the landowner agreement.

- Highlighted item "H" of the agreement - re: moving or demolishing the house – agreement discusses need to look at access from adjacent parcels first (Buff), then option to move the house second, and demolition as third option (in order of preference).

Reviewed all numbered items from the landowner access agreement.
Agreement dated Oct 26, 2018
Any questions about the landowner agreement?

- Trina – who owns parcel across the highway? That's not the landowner's (Underwood) property, that's the Miller property, it's a separate parcel
- Doug - Any update on the status of the house?
    - Colin – Initial Plan A was to demolish the house but now considering house move., Drillwell can access the landowner property from buff lumber property but need space closer to the well head. Colin has spent a lot of time of finding somewhere to move the house in Falkland, they should find out later this week if they can put in Falkland. New plan A is to move the house off the property.
    - John got a very rough estimate for $40,000 to move the house. Colin got about the same estimate between $35,000 - $50,000 for moving.

  - Colin – any chance for backup plan to temporarily move the house temporarily that province can provide? Ken – storage of house and pit would be in non-compliance of the Mines Act. Nothing comes to mind from MOT perspective. Skye – Ken can you look into any back up R/W or other property from MOTI? Yes, he will check with Steve Sirrett.
- *Action Item*- FLNR will look in to any crown land options.
- *Action Item*- Ken – will look into what MOTI has available (initial emails did not return anything – waiting to hear back from Steve Sirett on request).- Large land holdings by Buff lumber. Doug – someone should look into the School district property – Westwold school is closed, large parking lot, FLNR and MOTi to explore.

7. Plans

- Trina – everything is frozen to the north, the only flow to the south is the water that's discharging from the well.
  - Ryan- are we okay to start contacting landowners about going on their property to monitor discharge? So far people have been very happy and receptive to have the work done to fix this well.

  *Action Item*Dave will check in with neighbours and alert them that people may be in the area. Dave will talk to people and leave business cards. Ryan and Trina will probably go too on Thursday with Dave.
- *Action Item* - Site visit on Thursday, will try to make a backup of where to re-divert discharge if any flooding occurs.
- Discussion about pinch points with culverts and ensuring they're sized properly, need to re-visit
  - Colin – They will have a large tank with baffles for recirculation, will clean it out after drilling, so plan to have clean water at exit of containment.
  - Colin – Culvert is not designed to take more flow than current discharge amount, plan to run a 6-inch discharge line underneath the highway to pump through.
  - *Action Item* Ken – can help get quick turnaround on permitting to pull the 6-inch hard line throughthe culvert. Ken and Colin will talk after this call.
- Colin - wants to put some coarse material down in the 'ditch' beside the highway right next to the wellhead to bring it all up to even grade on the homeowner property. Ken – as long as right-of-way is returned to original condition he has no problem with that.
- Ryan – Will ministry provide a key contact for environmental permitting? Will go over in 8. b)
- Colin – working on safety plans, looks like we'll need a safety building on site for duration of project.
- Colin – couple of trees on property that need to be removed. Plan was to have tree removal service cut them down and remove them. Skye – article 10 speaks to subcontracting, but we can add others to approved sub contractors list. Prime contractor is responsible to ensure worksafe BC requirements are met as well as conditions outlined in Article 10 of the contract.
  - *Action Item* - FLNR to provide approval for Pine Valley as subcontractor. This is under Schedule D, Article 3 of contract. Plan to sub contract out some other smaller things, does FNLR need to approve every subcontractor? Dave – we don't need to know about every single one, there is a defn of subcontractor in agreement to help guide.

- Doug –decommissioning work plan. WWAL has been working on that and it will be sent out next week for review, approval and discussion. It will come from Drillwell.

8. Approvals

a) Traffic Control

Ken – pretty well touched base on everything. Email sent to Steve Sirett about storage of the house. Standard 20 m right-of-way highway. 2 additional potential storage options,

- by the legion.
- CSRD park by wide party of the highway. Frontage road on the north side of the highway. Not often used.
- Or Falkland rodeo grounds?

Concerns about traffic management – Ken will be main contact. Need to have traffic control even when not shutting down traffic. One flagger minimum even when you're off the road. "No Parking" signs, concerned about looky lou's parking on the side of the hwy. Wants to review the traffic management plan, ie) how vehicles will be entering and leaving the work site.

Action Item - Colin will talk to Ken afterward about traffic control and flaggers. All work will be done on the property, not on shoulders, or on road. Plan for no flaggers when not working on the roadway, only when moving house, and having machinery entering/exiting the project.

One other thing – have we considered a public meeting?

Action Item - FLNRO will look into a public meeting, include info on our one-pager.

Ken – during project someone should be the 24/7 contact? Colin will be the main contact available 24/7.

Dave – the Legion could be a parking spot for people to park and access the property, and possibly Buff lumber. Colin – we can put signage up so people won't be parking on the side of the highway

b) Water Discharge

Dave – no approval required to discharge water during aquifer testing, common courtesy to inform neighbours. To pump a well with the purpose of dewatering needs a short term use approval. Need to get the application together and submit it, then we can add the volume component later. These applications can get approved on a relatively quick timeline. Dave will put Colin and Doug in touch with the water officer . Skye – look at the total discharge volume so doesn't get stuck up in FrontCounter (i.e. <75L/s.)

Action Item - Dave to look into Short term Water Use Approval, and advise requirements to contractor for the discharge during aquifer/well testing.

9. Other Issues for Consideration

Colin – summary of short term plans:

- David Slade to head up tomorrow to meet with homeowners and will be on site Thursday to do camera inspection
- Set up flowmeters and get a rough idea of capacity of well and potential shut In pressures.
- Check for any deviation in the well
- Dave – keys to the locks are tucked in to the back door of the house. Colin will put his own locks on and clip off existing locks.
- Meet up with the house moving contractor, and excavation contractor, and maybe set up meeting with electrician for temporary connection.
- Skye – are you removing the foundation? Colin – yes, foundation, septic tank and field will be removed and replaced with structural fill.
- Skye – landowner had asked if we locate the relief well so it doesn't impede access to the property or building another house. Colin advised this will be considered.
- Dave – concrete blocks in place around the wellhead, who owns these? Ken – belong to MOTI, , he would like those blocks back, *Action Item* Ken can make arrangements to pick the cement blocks up.
- Colin – existing pipeline , what is the plan who do they belong to? He is planning on leaving it on site. Dave – no plan we are aware of. JR drilling probably owns the pipe. Skye – maybe have a conversation with JR drilling to discuss use of the pipeline. John – maybe there's an agreement with Brandon. *Action Item* - FLNR will commit to check in with JR drilling out of Kamloops and let Colin know status of discharge pipeline. Ensure will remain useable for duration of project, and Drillwell will do the work removing all the pipeline pieces at completion.
- Ken – current state of pipeline is fine, but at completion he wants them all removed. Just cut off the pipeline beneath the new paved driveway.
- Colin – follow up for work on the right-of-way and modification of the culvert.

Action Item - FLNR will put together contact list so everyone has phone numbers

Ken - Potential for vandalism on the house, put posts on community board about having someone store the house?

Colin – Brandon is very motivated to find somewhere to store his house but hasn't found anyone willing to keep it for him yet.

Meeting adjourned. Dave T to schedule next meeting.

APPENDIX G

Cost Estimate Details

Westwold Flowing Well Decommissioning
Decommissioning Work Plan
WWAL Ref: 19-002-01VR

western water ASSOCIATES LTD

Drillwell Enterprises
4994 Polkey Road
Duncan, V9L 6W3, B.C.

Phone: (800) 746-7444
Fax: (250) 746-8404
Email: drill@drillwell.com

Date: 2019-02-25

PHASE 1 - Planning and Site Prep

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
1	Replumb wellhead, Install flow meter and leave in place for up to 3 months	lump sum	1	$12,000.00	$12,000.00
2	Site Prep & restoration (tree falling, grubbing, grading, snow removal, traffic control, ect.)	lump sum	1	$54,000.00	$54,000.00
3	Buff Agreement at cost + 15%	lump sum	1.15	$20,000.00	$23,000.00
4	Temporary Electrical service including power to site trailer, reconnect, permits, ect.	lump sum	1	$7,500.00	$7,500.00
5	Site visits, camera inspection, permit applications, service disconnects, flow test, support time, ect.	lump sum	1	$20,000.00	$20,000.00
6	Site Trailer & Furniture	month	3	$1,200.00	$3,600.00
	Delivery/pickup	lump sum	1	$2,000.00	$2,000.00
7	Upgrade discharge piping as required	lump sum	1	$10,000.00	$10,000.00
8	Consultants Fees	cost + 15%	1.15	$28,094.00	$32,308.10
9	Engineering, office support, insurance premiums, bid security, and contingency	lump sum	1	$22,591.90	$22,591.90
		PHASE 1 TOTAL			$187,000.00

Drillwell Enterprises
4994 Polkey Road
Duncan, V9L 6W3, B.C.

Phone: (800) 746-7444
Fax: (250) 746-8404
Email: drill@drillwell.com

PHASE 2 - Mob Rig, Drill and Install Surface Casing

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
1	Mobilize and de-mobilize crew, Dual Rotary and equipment	lump sum	1	$65,000.00	$65,000.00
2	Additional Senior Site Supervisor	days	5	$1,450.00	$7,250.00
3	Dual Rotary Hourly (all non-drilling time)	hours	60	$600.00	$36,000.00
4	16" Drill and case with Dual Rotary	feet	195	$275.00	$53,625.00
	16" Dual Rotary drive shoe	each	1	$1,079.00	$1,079.00
	16" Hammer Bit	each	1	$16,000.00	$16,000.00
	16" Casing lost or destroyed	feet	195	$65.00	$12,675.00
5	Auxiliary Compressor	month	0.5	$15,000.00	$7,500.00
	Delivery / pickup	lump sum	1	$6,000.00	$6,000.00
6	Shipping of pipe, rods, tools, tank, ect.	lump sum	1	$30,000.00	$30,000.00
7	Crew changes (every 12 days)	lump sum	1	$7,500.00	$7,500.00
8	12"x 0.375" wall conduit casing	feet	220	$45.00	$9,900.00
	Stabilizers	lump sum	1	$750.00	$750.00
9	Portland Cement				
	light loads (road ban, steep hills)	4m^3	2	$7,500.00	$15,000.00
10	Gardner Denver Mud Pump, tanks, tremmie pipe	week	2	$4,500.00	$9,000.00
	4" Trash Pump + 2" Trash Pump	week	2	$2,500.00	$5,000.00
	Frost Fighter and Light Plant	week	2	$2,000.00	$4,000.00
	Jacks and power unit	week	2	$1,200.00	$2,400.00
	In hole cutters	week	2	$2,375.00	$4,750.00
11	Standby (delays by others, cement set, ect)	hours	10	$300.00	$3,000.00
12	Allowance for Vac Truck to remove solids	lump sum	1	$10,000.00	$10,000.00
13	Crew Subsistence	man day	33	$290.00	$9,570.00
14	Consultants Fees	cost + 15%	1.15	$8,660.00	$9,959.00
15	Engineering, office support and contingency	lump sum	1	$37,391.00	$37,391.00
		PHASE 2 TOTAL			$363,349.00

Drillwell Enterprises
4994 Polkey Road
Duncan, V9L 6W3, B.C.

Phone: (800) 746-7444
Fax: (250) 746-8404
Email: drill@drillwell.com

PHASE 3 - Drill and Install Production Casing and Screen; assume up to 350' deep, 40' of screen.

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
	Dual Rotary Hourly (set up, jaw changes, moves tripping, overlap, shoe cuts, extracting casing, cementing, developing, ect.)	hours	80	$600.00	$48,000.00
	Additional Senior Site Supervisor	days	12	$1,450.00	$17,400.00
	Auxiliary Compressor	month	0.5	$15,000.00	$7,500.00
	Delivery / pickup	lump sum	1	$6,000.00	$6,000.00
	Shipping of pipe, rod, ect. (estimate)	cost+15%	1.15	$21,000.00	$24,150.00
	Crew changes (every 12 days)	lump sum	1	$7,500.00	$7,500.00
	10" Drill and Case (tricone)	feet	155	$250.00	$38,750.00
	10" Dual Rotary drive shoe	each	1	$750.00	$750.00
	10" Tricone	each	1	$15,000.00	$15,000.00
	10" Welded casing	feet	200	$40.00	$8,000.00
	10" Threaded casing	lump sum	1	$65,000.00	$65,000.00
	10" tel SS screen - expedited	feet	40	$375.00	$15,000.00
	Bottom, k-packer and extended riser	each	1	$2,050.00	$2,050.00
	Expedited screen shipping	lump sum	1	$4,750.00	$4,750.00
	Gardner Denver Mud Pump, tanks, tremmie pipe	week	2	$4,500.00	$9,000.00
	4" Trash Pump + 2" Trash Pump	week	2	$2,500.00	$5,000.00
	Frost Fighter and Light Plants	week	2	$2,000.00	$4,000.00
	Jacks and power unit	week	2	$1,200.00	$2,400.00
	In hole cutter	week	2	$2,375.00	$4,750.00
	Standby without crew (screen order)	week	1	$30,000.00	$30,000.00
	Standby (delays caused by others)	hours	10	$300.00	$3,000.00
	Flanges, diverter, valves and wellhead fittings	lump sum	1	$15,000.00	$15,000.00
	Further upgrades to discharge lines	lump sum	1	$10,000.00	$10,000.00
	Crew Subsistence	man day	39	$290.00	$11,310.00
	Consultants Fees	cost +15%	1.15	$15,792.00	$18,160.80
	Engineering, office support and contingency	lump sum	1	$41,089.20	$41,089.20
		PHASE 3 TOTAL			$413,560.00

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PHASE 4A - Test Relief Well & Preliminary Report

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
	Mob/demob	lump sum	1	$7,500.00	$7,500.00
	Pull and set well pump	per well	1	$5,940.00	$5,940.00
	Pump rental	per well	1	$5,000.00	$5,000.00
	Supply discharge piping	per well	1	$2,500.00	$2,500.00
	Initial flow testing and pumping tests	per well	1	$4,900.00	$4,900.00
	Crew subsistence	per day	3	$1,200.00	$3,600.00
	Genset & Fuel	per hour	30	$250.00	$7,500.00
	Rig Standby	per week	1	$30,000.00	$30,000.00
	Consultants Fees	cost + 15%	1.15	$35,808.00	$41,179.20
	Engineering, office support and contingency	lump sum	1	$11,295.80	$11,295.80
		PHASE 4A TOTAL			$119,415.00

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PHASE 4B - Drill, develop and test 2nd Relief Well (IF REQ).

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
	SURFACE CASING				
	Dual Rotary Hourly (all non-drilling time)	hours	50	$600.00	$30,000.00
	16" Drill and case with Dual Rotary	feet	195	$275.00	$53,625.00
	16" Dual Rotary drive shoe	each	1	$1,079.00	$1,079.00
	Auxiliary Compressor	month	0.25	$15,000.00	$3,750.00
	Crew changes (every 12 days)	lump sum		$7,500.00	
	12"x 0.375" wall conduit casing	feet	220	$45.00	$9,900.00
	Stabilizers	lump sum	1	$750.00	$750.00
	Portland Cement light loads (road ban, steep hills)	4m^3	2	$7,500.00	$15,000.00
	Gardner Denver Mud Pump, tanks, tremmie pipe.	week	1	$4,500.00	$4,500.00
	6" Trash Pump	week	1	$2,500.00	$2,500.00
	Frost Fighter and Light Plants	week	1	$2,000.00	$2,000.00
	Jacks and power unit	week	1	$1,200.00	$1,200.00
	In hole cutter	week	1	$2,375.00	$2,375.00
	Standby (delays caused by others)	hours		$300.00	
	Crew Subsistence	man day	24	$290.00	$6,960.00
	PRODUCTION CASING AND DEV.				
	Dual Rotary Hourly (set up, jaw changes, moves tripping, overlap, shoe cuts, extracting casing, cementing, developing, ect.)	hours	70	$600.00	$42,000.00
	Additional Senior Site Supervisor	days	7	$1,450.00	$10,150.00
	Shipping of additional pipe, rod, ect. (estimate)	cost+15%	1.15	$5,000.00	$5,750.00
	Crew changes (every 12 days)	lump sum	1	$7,500.00	$7,500.00
	10" Drill and Case (tricone)	feet	155	$250.00	$38,750.00
	10" Dual Rotary drive shoe	each	1	$750.00	$750.00
	10" Welded casing	feet	200	$40.00	$8,000.00
	10" tel SS screen	feet	40	$375.00	$15,000.00
	Bottom, k-packer and extended riser	each	1	$2,050.00	$2,050.00
	screen shipping	lump sum	1	$1,500.00	$1,500.00
	Gardner Denver Mud Pump, tanks, tremmie pipe.	week	1	$4,500.00	$4,500.00
	6" Trash Pump + lines	week	1	$2,500.00	$2,500.00

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	Frost Fighter and Light Plants	week	1	$2,000.00	$2,000.00
	Jacks and power unit	week	1	$1,200.00	$1,200.00
	In hole cutter	week	1	$2,375.00	$2,375.00
	Crew Subsistence	man day	27	$290.00	$7,830.00
	PUMP TEST				
	Mob/demob (2nd set of gear)	lump sum	1	$5,287.00	$5,287.00
	Pull and set well	per well	1	$5,940.00	$5,940.00
	Pump rental	per well	1	$5,000.00	$5,000.00
	Supply discharge piping	per well	1	$2,500.00	$2,500.00
	8hr pump test	per well	1	$4,900.00	$4,900.00
	Pump Crew subsistence	per day	3	$1,200.00	$3,600.00
	Genset 160kw	per hour	30	$250.00	$7,500.00
	4B General				
	Consultants Fees	cost + 15%	1.15	$26,160.00	$30,084.00
	Engineering, office support and contingency	lump sum	1	$22,166.00	$22,166.00
		PHASE 4B TOTAL			$372,471.00

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PHASE 5 - Decommission existing well

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
	Mobilize additional equipment	lump sum	1	$8,575.00	$8,575.00
	Dual Rotary Hourly (set up, moves, jaw changes, tripping, overlap, shoe cuts, extracting casing, cementing, developing, ect.)	hours	35	$600.00	$21,000.00
	Additional Senior Site Supervisor	days	4	$1,450.00	$5,800.00
	Supply of 2" steel tremmie pipe	feet	250	$10.00	$2,500.00
	Supply of disposable packer	lump sum	1	$5,000.00	$5,000.00
	Supply of pea gravel	yard	10	$150.00	$1,500.00
	Crew changes (every 12 days)	lump sum		$7,500.00	
	Portland Cement light loads (road ban, steep hills)	4m^3	1	$7,500.00	$7,500.00
	Gardner Denver Mud Pump, tanks, tremmie pipe.	week	1	$4,500.00	$4,500.00
	6" Trash Pump	week	1	$2,500.00	$2,500.00
	Frost Fighter and Light Plants	week	1	$2,000.00	$2,000.00
	Jacks and power unit	week	1	$1,200.00	$1,200.00
	In hole cutter	week	1	$2,375.00	$2,375.00
	Standby (delays caused by others)	hours		$300.00	
	Flanges, diverter, valves and wellhead fittings	lump sum	1	$2,500.00	$2,500.00
	Crew Subsistence	man day	15	$290.00	$4,350.00
	Consultants Fees	cost +15%	1.15	$7,787.00	$8,955.05
	Engineering, office support and contingency	lump sum	1	$9,094.95	$9,094.95
		PHASE 5 TOTAL			$89,350.00

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PHASE 6 - Reporting

Item	Item Description	Units	Est. Qty	Price per Unit	Totals
	Consultants Fees	cost +15%	1.15	$21,918.00	$25,205.70
	Engineering, office support and contingency	lump sum	1	$2,019.30	$2,019.30
		PHASE 6 TOTAL			$27,225.00

Sum Total for All Phases	$1,572,370.00

Hydrogeological Services: Westwold Flowing Artesian Well Decommissioning (RFP#10005-50/GS19932-001)

25-Feb-19

Western Water Associates Ltd.			Task 1: Site Preparation, Drill Pad Construction, Temporary Fixtures. Written Decommissioning Plan and Permitting		Task 2: Drill and Install Relief Well Surface Casing		Task 3: Drill and Install Relief Well Production Casing and Screen		Task 4A: Test Relief Well 1 and Preliminary Report		Task 4B: Drill, Install, Test and Report on RW2 if necessary		Task 5: Decomission Subject Well		Task 6: Draft and Final Post-Closure Report including cost estimate for future monitoirng to achieve professional sign off		TOTAL	
Labour	unit	rate	units	cost	units	cost	units	cost	units	cost	units	cost	units	cost	units	cost	units	cost
Doug Geller, P.Geo (Senior Hydrogeologist)	hour	$ 190	54	$ 10,260	12	$ 2,280	20	$ 3,800	20	$ 3,800	24	$ 4,560	6	$ 1,140	12	$ 2,280	148	$28,120
Mike Wei, P.Eng (Senior Review of Report)	hour	$ 190							2	$ 380				$ -	16	$ 3,040	18	$3,420
Ryan Rhodes, P.Geo (Project Hydrogeologist)	hour	$ 140	38	$ 5,320	6	$ 840	6	$ 840	40	$ 5,600	8	$ 1,120	6	$ 840	22	$ 3,080	126	$17,640
Paul Williamson, M.Sc., GIT (Staff Hydrogeologist)	hour	$ 110	20	$ 2,200	20	$ 2,200	54	$ 5,940	64	$ 7,040	84	$ 9,240	22	$ 2,420	80	$ 8,800	344	$37,840
Trina Koch - Senior Biologist, permitting and plans	hour	$ 115	40	$ 4,600	4	$ 460	8	$ 920	8	$ 920	34	$ 3,910	4	$ 460	12	$ 1,380	110	$12,650
Junior Biologist, environmental monitoring	hour	$ 90	40	$ 3,600	16	$ 1,440	22	$ 1,980	24	$ 2,160	48	$ 4,320	16	$ 1,440	16	$ 1,440	182	$16,380
CAD / GIS	hour	$ 90	8	$ 720		$ -			5	$ 450				$ -	6	$ 540	19	$1,710
Total Labour			***200***	***$ 26,700***	***58***	***$ 7,220***	***110***	***$ 13,480***	***163***	***$ 20,350***	***198***	***$ 23,150***	***54***	***$ 6,300***	***164***	***$ 20,560***	***947***	***$117,760***
Expenses																		
site visit travel 120 km return (see Note 3)	each	$72.00	8	$ 576	4	$ 288	16	$ 1,152	9	$ 648	9	$ 648	5	$ 360	2	$ 144	53	$3,816
Field Sieve Set	day	$ 150		$ -		$ -	2	$ 300		$ -						$ -	2	$300
Water Quality Kit (pH, conductivity, temp, turbidity, DO)	day	$ 100		$ -	4	$ 400	4	$ 400	12	$ 1,200	8	$ 800	1	$ 100		$ -	29	$2,900
Transducer Rental	week	$ 400		$ -					2	$ 800	2	$ 800	2	$ 800		$ -	6	$2,400
Transducer Reader	day	$ 24		$ -											24	$ 576	24	$576
Laboratory Water quality analysis	sample	$ 500		$ -	1	$ 500		$ -		$ -						$ -	1	$500
Transducer and data logger purchase for post-closure	est	$ 4,000							1	$ 4,000							1	$4,000
				$ -												$ -		$0
Total Expenses				***$ 576***		***$ 1,188***		***$ 1,852***		***$ 6,648***		***$ 2,248***		***$ 1,260***		***$ 720***		***$14,492***
Geotech and Surveyor Subs (allowance - see Note 4)	***est***								*$ 1*	*$ 8,000*							1	$8,000
Administration and Minor Disbursements (3%)				***$ 818***		***$ 252***		***$ 460***		***$ 810***		***$ 762***		***$ 227***		***$ 638***		***$3,968***
TOTAL (excludes GST)				**$ 28,094**		**$ 8,660**		**$ 15,792**		**$ 35,808**		**$ 26,160**		**$ 7,787**		**$ 21,918**		**$ 144,220**
																		$ -
	Milestone Dates			**28-Feb-19**		**10-Mar-19**		**25-Mar-19**		**31-Mar-19**		**30-Apr-19**		**20-May-19**		**14-Jun-19**		**$ 118,060**

Notes:

Cost in red is without 4B

1) Tasks alligned with Major Contract Schedule "C" (a) Line Items i through vi. More Detail on WWAL scope of work under each task is provided in our proposal and in decommissioning plan.
2) Note that Task 4B (RW2) may not be needed.
3) Budget allows for 44 site visits (53 if RW2 is drilled). 8 site visits have been made as of Feb 25 2019.
4) We do not have quotes for these subs. If/when needed, we will obtain quotes and if not within allowance, request a change to cover the actual cost of subs
5) WWAL project management time is built in to the above tasks
6) Cost estimate for Task 1 reflects actual efforts from project inception to February 25 2019 now estimated to be complete