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Groundwater Monitoring Systems

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February 22, 2010

WSA Engineering Ltd.
2248 Columbia Avenue
Castlegar, BC
V1N 2X1

Attention: Ralf Waters, P. Eng.
Project Engineer

Dear Sirs:

Re: VILLAGE OF SIVERTON – WATER WELL NO. 2 (WELL TAG 27023) AQUIFER TESTING PROGRAM AND APPLICATION FOR IHA NEW WATER SOURCE APPROVAL

1.0 INTRODUCTION

The present aquifer testing and water quality sampling program has been carried out by Aquilog Groundwater Monitoring Systems at the request of WSA Engineering Ltd. of Castlegar, BC on behalf of the Village of Silverton. The testing program was conducted with the Village of Silverton, Water Well No. 2, which was drilled in May, 2009. The new water well is constructed with 254 mm diameter casing, whereas the original well (Well No. 1) is constructed with 203 mm diameter casing. The new well is constructed with larger diameter casing and is designed to provide a higher well yield capacity with the purpose of meeting the greater water demands required during the summer months. A Construction Permit application was not filed at the time of construction of Water Well No. 2.

The main objective of the present testing program and accompanying report is two-fold as follows:

1. To evaluate the sustainable yield and water quality of the new groundwater source; and,
2. To file application for an IHA new water source approval.

The following report outlines the nature of the present program, provides a discussion of the findings along with a discussion of wellhead protection considerations. Report figures, field data including pumping test information and water quality data are attached to Appendices A, B and C. The Application for Construction Permit information is included in Appendix D.

2.0 BACKGROUND

The Village of Silverton is located on the east side of Slocan Lake, approximately 3.5 kms south of New Denver. The community of Silverton is situated on an alluvial fan/delta complex, which was built out into Slocan Lake as Silverton Creek downcut its present day course into the bedrock upland area.

In general terms, the alluvial fan is comprised of granular material ranging from cobbles and boulders to sand and gravel, mixed with varying proportions of silt and clay. The quantity and extent of silt and clay material, depends on the amount of fines carried by Silverton Creek during deposition and also, on the lake level when these sediments were laid down. During periods when the lake level was relatively high and flows within the creek were not excessively turbid, clean deposits of sand and gravel were deposited. These sand and gravel formations, because of their water transmitting capacity, form the major aquifers in this type of geologic setting.

Silverton's Well No. 1 was completed in May, 1988 under the supervision of Kala Groundwater Consulting Ltd. of Vernon, BC. It is a 203 mm diameter by 47.9 m deep well drilled by Owen's Drilling Ltd. of Cranbrook, BC. The total screen assembly is 6.4 m in length and this is comprised of four sections of Johnson's stainless steel well screen each 1.6 m in length (from top to bottom, a #30 slot, #40 slot, #15 slot and #40 slot). A 0.61 m riser pipe and Figure K packer is attached to the top of the screen assembly, bringing the top of the screen assembly to 40.8 m below ground level. A 24-hour aquifer test was conducted with the well pumping at a constant rate of 390 USgpm (24.6 L/s). Based on the test results, the well has a theoretical safe yield of approximately 1000 USgpm. However, the screens in Well No. 1 are designed to transmit 450 USgpm (28.4 L/s) at an entrance velocity of 0.1 feet per second and this was the recommended sustainable yield for the well. A copy of the driller's log and well completion diagram are attached to Appendix A of this report.

Well No. 2, the subject of this report, was completed in May, 2009 under the supervision of WSA Engineering Ltd. of Castlegar, BC. It is a 254 mm diameter by 47.5 deep well drilled by JR Drilling Ltd. of Cranbrook, BC. The new well is located 7.6 m downstream from Well No. 1. The total screen assembly in Well No. 2 is 6.1 m in length and is comprised of 3.3 m of #100 slot screen, 1.2 m of #40 slot and 1.8 m of #80 slot, 254 mm telescopic, stainless steel well screen. The well was developed by the air lift method for a period of approximately 10 hours. An evaluation of sustainable yield for Well No. 2 was one of the purposes of the present investigation and is discussed in Section 4 of this report.

3.0 FIELD PROGRAM

The field program was conducted during the period February 1 to February 3, 2010. All pump testing services were provided by Monashee Aquifer Testing of Lumby, BC, under the supervision of Larry C. Topp, P. Geo. with Aquilog Groundwater Monitoring Services.

The testing crew arrived on-site around mid morning, February 1, 2010 and met with Leonard Caisley, the contact person with the Village of Silverton. After becoming familiar with the well site conditions and proposed water discharge location for the pumping test, the crew started the program by conducting a down-the-hole camera inspection of Well No. 2. This was carried out to establish initial well depth soundings and water well completion details, including well screen settings. Following the camera work, a 30 HP test pump was set into the well to a depth of 38.1 m by the testing crew and the well was chlorinated. This was the end of day one.

On day two, Mr. Topp arrived on site at 8:00 AM with the water sample bottles obtained from Caro Analytical Services of Kelowna, BC on the previous day. The pump in Well No. 1 had been shut-down at around 12:00 midnight the previous night. After final preparation of the pumping test equipment, which included the laying of discharge line, installation of an orifice meter and a data logger in Well No. 2 the test was initiated. To start with a step-drawdown test was conducted involving three consecutive steps pumping at 153 USgpm (9.7 L/s), 302 USgpm (19.1 L/s) and finally 545 USgpm (34.4 L/s). After allowing the well to recovery for a 30 minute interval, the constant rate test was started at 10:30 AM, February 2, 2010. During the constant rate test the well was pumped at a continuous rate of 550 USgpm (34.7 L/s). Drawdown measurements were obtained manually from the production well (Well No. 2) and also drawdown interference was measured in Well No. 1 with an acoustic well sounder. In addition, water level drawdown was measured on a continuous basis in the production with the data logger.

At 8:00 AM on day three, the test crew was informed by Leonard that the reservoir level was starting to run low and asked if the test could be shut down a little earlier than the planned 24 hour pumping interval. Mr. Topp reviewed the test data and noted that the pumping level had stabilized during the night and in fact had recovered a small amount. Based on this, Mr. Topp recommended that the test could be shut down after all the water samples were obtained and following a short period of recovery measurements in the production well, the pump in Well No. 1 could be re-started. The test pump in Well No. 2 was shut-down at 8:30, which allowed a 22 hour pumping interval for the test and the pump in Well No. 1 was re-started at 8:45 AM.

It should be noted that during the pumping test with Well No. 2 a water quality profiling program between Silverton Creek and Well No. 2 was carried out on two separate occasions using a

Oakton Multi-Parameter Tester 35 field kit. The parameters included pH, temperature and conductivity.

4.0 PROGRAM FINDINGS

4.1 Aquifer Testing

A review of the DVD made during the down-the-hole camera inspection shows that after almost one year of the well sitting idle, some form of chemical precipitate has accumulated in the well screens. Judging by the color of the water (red) upon test start-up it would appear that this precipitate is iron oxide. A copy of the DVD can be obtained from Mr. L.C. Topp on request.

Results of the step-drawdown test are summarized in Table 1 following.

Table 1 – Specific Capacity Determinations

Pumping Rate	*Specific Capacity after 30 mins pumping*
153 USgpm	83.11 USgpm/m of dd
302 USgpm	84.04 USgpm/m of dd
545 USgpm	79.29 USgpm/m of dd

With the exception of the final step the specific capacity remains fairly consistent throughout the step-drawdown test indicating that the well is efficient. The small decrease in specific capacity noted during the final step is not unusual and can be explained by the fact that the steps where run consecutively without a period of recovery between.

During the constant rate yield test, the pumping level showed a small decline (approximately 0.6 feet) for the first 540 minutes of pumping, which was followed by a stabilized pumping level between the 540 and 840 minute pumping interval and then the pumping showed a small rate of recovery during the final minutes of the pumping test.

The maximum amount of drawdown experienced during the 22 hour pumping test was 25.24 feet (7.69 m) which represents 39.4 % of the total available drawdown (TAD) in the well. TAD is defined as the distance between the static water level and the top of the well screen assembly, which in this case is 63.98 feet (19.5 m).

The sustainable yield for a water well is generally determined by extrapolating the rate of drawdown over an extended period of time (for example 5 or 20 years) and then projecting a pumping rate that will not exceed 70 percent of the total available drawdown. Applying this method, a sustainable yield projection for the subject water well would be in excess of 900

USgpm. We do not however recommend that the design production rate exceed the pumping test rate of 550 USgpm (34.7 L/s)

A second important factor to consider is that during the pumping test, the subject well produced sand. Even though the sand production was not excessive, it was noted on a continuous basis throughout the test. Sand production can present problems with pumping equipment, distribution lines and household fixtures. We would suggest that a program of further development be undertaken with this well. The general rule is that one hour of development is required for every foot of well screen in a large diameter water well. Well No. 2 has 20 feet of screen and has only been developed for 10 hours. An additional 10 hours of development may be required.

Two final observations relating to the pumping test phase of the program are; (a) the total drawdown interference measured in Well No. 1 (Observation Well) at the end of the pumping interval was 4.0 feet (1.22 m) and; (b) the water level in Well No. 2 (Pumping Well) recovered a full 99 % after only 15 minutes of shutting down the test pump.

4.2 Water Quality

At 8:30 AM on February 3.2010, near the end of the pumping test, water samples were obtained from Well No. 2 in properly prepared sampling bottles and transported immediately to Caro Analytical Services in Kelowna, BC for an extended potability analysis as per "HPF10160 Parameter List For New Drinking Water Sources". Certificates of analysis are provided in Appendix C of this report. A brief characterization of the raw water quality from Well No. 2 is as follows:

Microbiological Parameters – Based on the water samples obtained on February 3, 2010, Total Coliforms, Background Colonies and E. Coli were all below the detection limits. Iron related bacteria and Sulfate reducing Bacteria were <2 and <8.0 respectively, both below the detection limits.

General Parameters – All parameters for which an analyses was performed fall within the Guidelines for Canadian Drinking Water Quality (GCDWQ).

Total Recoverable Metals by ICPMS - All parameters for which an analyses was performed fall within the Guidelines for Canadian Drinking Water Quality (GCDWQ).

UV Transmittance – The UV Transmittance @ 254mm was 97.5.

In general terms the water may be characterized as moderately soft and of excellent quality.

5.0 WELLHEAD PROTECTION CONSIDERATIONS

The Village of Silverton's production wells (Well No. 1 – Well Tag 66073 and Well No. 2 – Well Tag 27023) are located approximately 25 m southeast of Silverton Creek and are separated by a distance of approximately 7.9 m. A site plan and ortho-mosaic photo is shown in Figure 1 and 2 respectively (see Appendix A).

There are no MOE website Aquifer Vulnerability Maps available for this area at this particular time and therefore aquifer vulnerability cannot be defined in this manner. We did however consider some other factors including lithology, water levels and water quality profiling between the creek and the wells. A review of the lithologic profile for Water Well No. 1 indicates that the silty to clayey sand and gravel encountered between 12 and 136 feet (3.7 and 41.5 m) below ground surface will provide and excellent filtering media and protective zone above the aquifer. The top of the aquifer was encountered at 136 feet (41.5 m) below ground surface. Secondly the static water level in Well No. 2 is 66.52 feet (20.27m), whereas the water level in the creek is approximately 15 feet (4.5 m) below ground surface, indicating that there is no direct hydraulic connection between Silverton Creek and the well field. Finally results of the water quality profiling taken between the creek and Well No. 2 is summarized in Table 2 following.

Table 2 - Water Quality Profiling Summary

Feb. 2, 2010 @ 1445 hrs		*Feb. 3, 2010 @ 0810 hrs*	
Well No. 2	**Creek**	**Well No. 2**	**Creek**
pH: 7.8	pH: 8.0	pH: 7.4	pH: 8.1
Cond: 158	Cond: 155	Cond: 179	Cond: 155
Temp: 6.7 C	Temp: 3.3 C	Temp: 6.9 C	Temp: 3.0 C

Even though the profile differences are not significant, the findings do provide evidence that there is not a direct hydraulic connection between the Creek and Well No. 2. Also the minor changes that did occur between the two sets of readings, were in opposite directions. Taking all factors into consideration, including water quality, there is more evidence to support a NON-GWUDI source of water supply as opposed to a GWUDI source.

Generally the Capture Zone for an aquifer of this nature will be relatively narrow (probably less than 20 m in width), will not extend too far downstream (less than 5 m), but may extend a fair distance upstream, depending on the extent and nature of the sand and gravel deposit. This would suggest that all future wellhead protection efforts be concentrated in an upstream direction.

The nearest sewage disposal system located upstream of the well field is situated approximately 45 m away, which is outside of the 30 m criteria. We would recommend that the Village place restrictions on the number and location of any future septic systems.

There is one light industrial complex located further upstream of the well field and we would suggest that the Village insist that any fuel storage tanks associated with this complex have proper containment structures. For example they should be placed on a cement pad, constructed with raised berms around the perimeter.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the present aquifer testing and water sampling program, the following conclusions and recommendations are provided for Client/Approving Authority considerations.

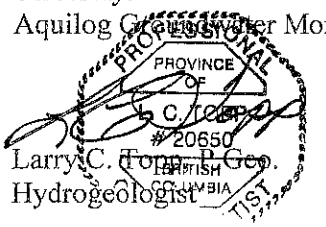
- The testing program was conducted with the Village of Silverton, Water Well No. 2, (Well Tag 27023), which was drilled in May, 2009. The water source is a 254 mm diameter by 47.7 m deep drilled water well located approximately 7.9 m southwest of the original Water Well No. 1.
- The main objective of the present testing program and accompanying report is two-fold as follows:
    - To evaluate the sustainable yield and water quality of Well No. 2, and;
    - To file application for an IHA new water source approval.
- The Village of Silverton is located on the east side of Slocan Lake, approximately 3.5 kms south of New Denver. The community at Silverton is situated on an alluvial fan/delta complex, which was build out into Slocan Lake as Silverton Creek downcut its present day course into the bedrock upland area.
- The field program, carried during the period February 1 to February 3, 2010, involved a down-the-hole camera inspection of Well No. 2, a step-drawdown test followed by a 22 hour constant rate pumping test, the collection of water samples as per HPF10160 parameter list, and water quality profiling between Silverton Creek and Water Well No. 2.
- The specific capacity of Well No. 2 based on the results of the step-drawdown test ranged from 83.11 USgpm/m of drawdown while pumping at 153 USgpm, declining to 79.29 USgpm/m of drawdown while pumping at 545 USgpm.
- The maximum amount of drawdown experienced during the 22 hour pumping test was 25.24 feet (7.69 m) which represents 39.4 % of the total available drawdown (TAD) in the well.
- A sustainable yield projection for the subject water well would be in excess of 900 USgpm. We do not however recommend that the design production rate exceed the pumping test rate of 550 USgpm (34.7 L/s).
- With respect to water quality all parameters for which an analyses was performed meet the Guidelines for Canadian Drinking Water Quality and overall the quality could be characterized as excellent.
- During the pumping test, Water Well No. 2 produced a small amount of sand, but on a continuous basis. We are recommending additional development of the well.
- Taking all factors into consideration, including water quality, there is more evidence to support a NON-GWUDI source of water supply as opposed to a GWUDI source.

7.0 CLOSURE

This report was prepared in accordance with generally accepted hydrological evaluation practices. The applicability of this report is only valid to the extent that there has been no material alteration from any of the said descriptions provided to ***Aquilog Groundwater Monitoring Systems (AGMS)***, unless ***AGMS*** is specifically requested by the client to review and revise this report in light of such alterations. This report must be used in its entirety. Statements of professional opinion are those of ***AGMS***. If additional information or assessment findings arise which may alter the conclusions and/or recommendations of this report ***AGMS*** would be pleased to review and append our report where required.

We trust this meets your present requirements and if there are any questions or concerns regarding the investigation, please do not hesitate to contact the undersigned at (250) 549-0704

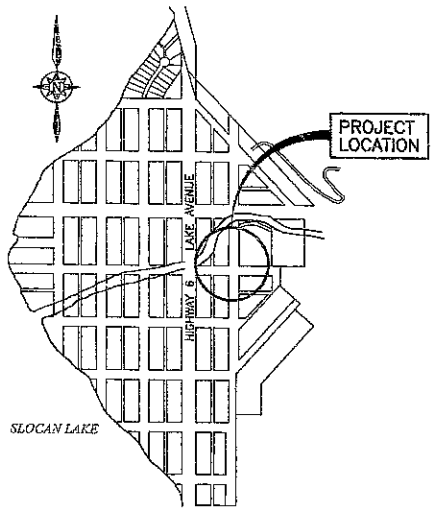
Sincerely:
Aquilog Groundwater Monitoring Systems



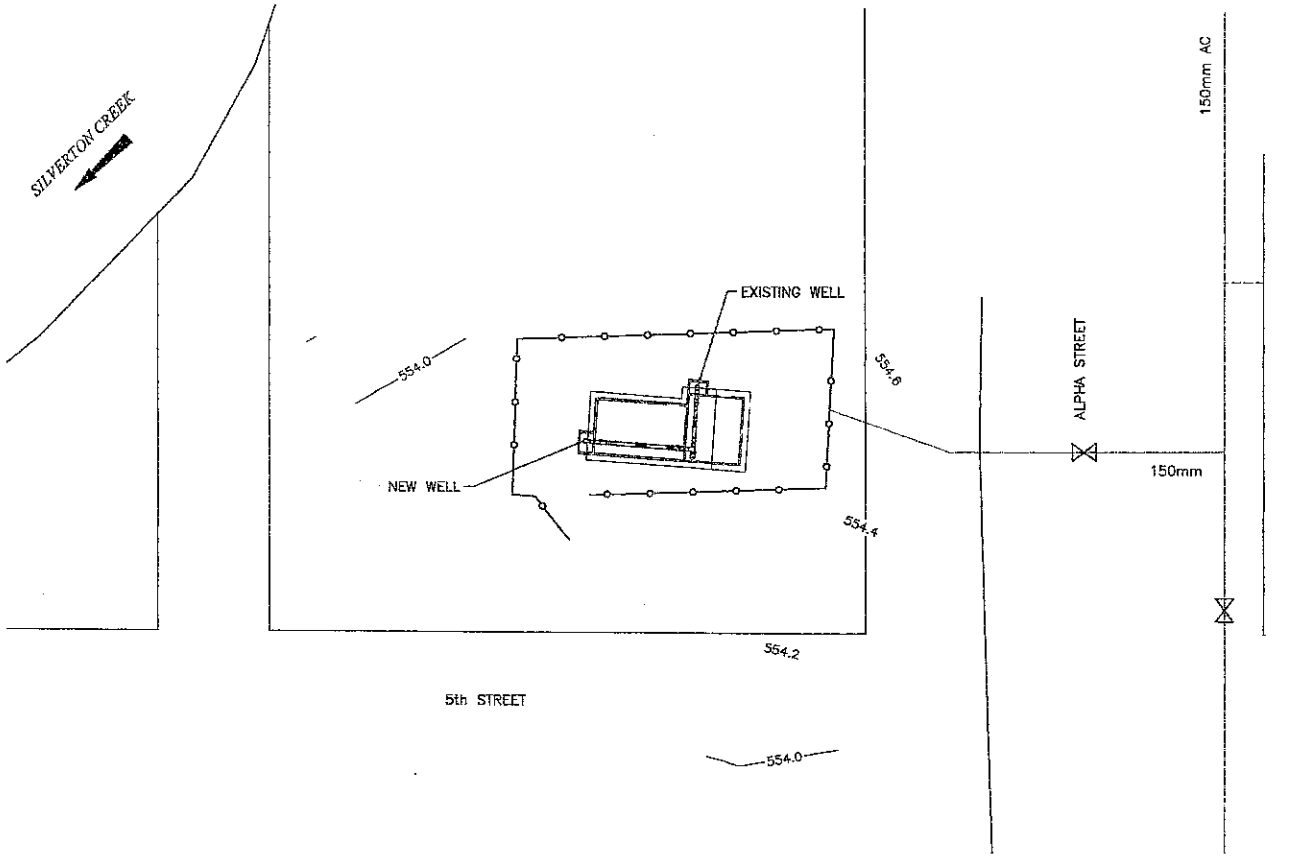
Larry C. Tomy, P.Geo.
Hydrogeologist

APPENDIX A

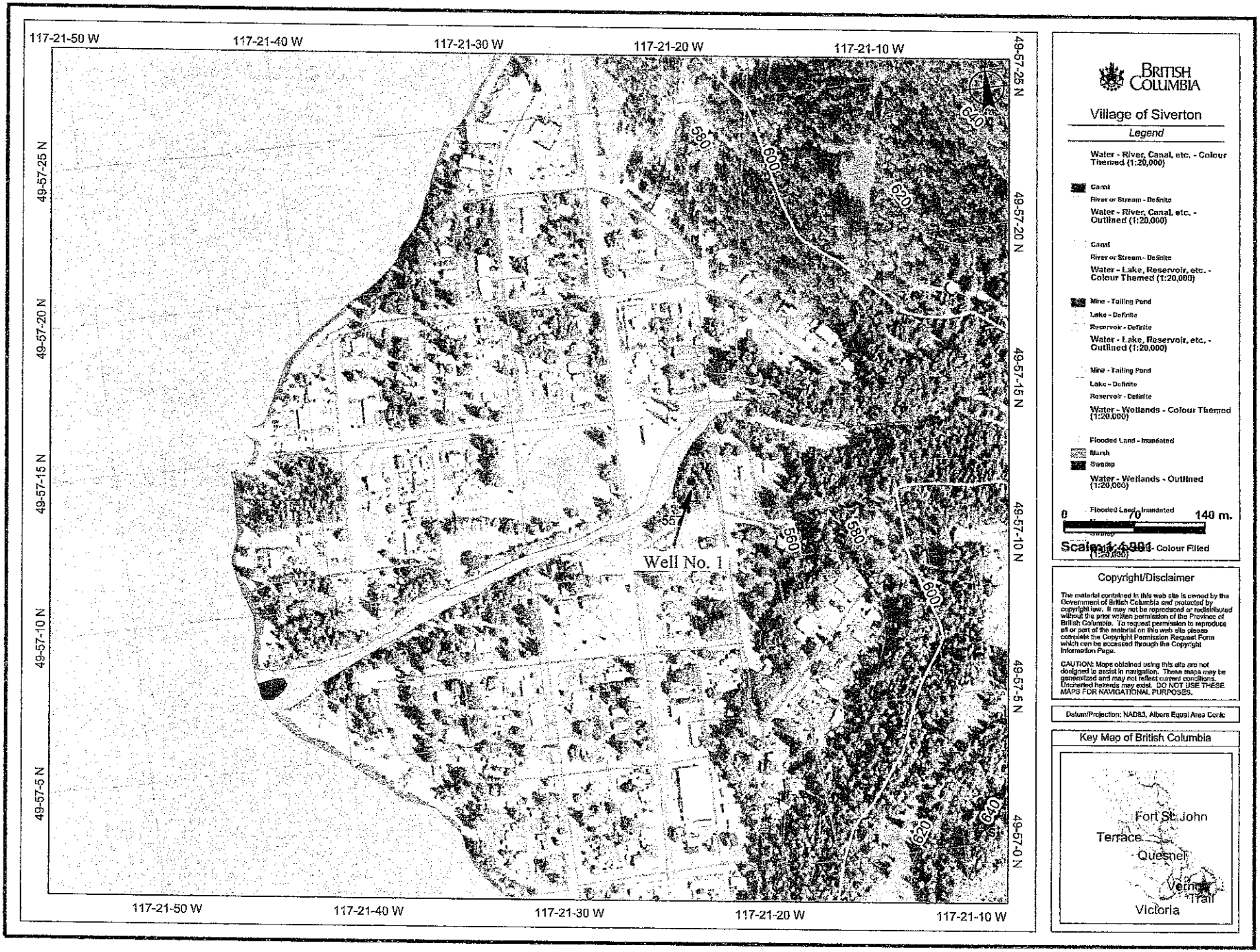
- Report Figures
- Lithology and Well Completion (Wells 1 and 2)
- Site Photos



VILLAGE OF SILVERTON



WSA ENGINEERING LTD. WOODS SAHLSTROM ASSOCIATES Geotechnical • Civil • Structural • Materials Testing 2248 Columbia Ave. Castlegar, B.C. V1N 2X1 Ph: (250) 365-3696	VILLAGE OF SILVERTON NEW WELL SITE PLAN	SCALE: 1:250 JOB: C09147--006 DATE: 10/02/2010 Figure 1


117-21-50 W
117-21-40 W
117-21-30 W
117-21-20 W
117-21-10 W
49-57-25 N
49-57-20 N
49-57-15 N
49-57-10 N
49-57-5 N
49-57-0 N
Well No. 1
BRITISH COLUMBIA
Village of Siverton
Legend
Water - River, Canal, etc. - Colour Themed (1:20,000)
Canal
River or Stream - Definite
Water - River, Canal, etc. - Outlined (1:20,000)
Canal
River or Stream - Definite
Water - Lake, Reservoir, etc. - Colour Themed (1:20,000)
Mine - Tailing Pond
Lake - Definite
Reservoir - Definite
Water - Lake, Reservoir, etc. - Outlined (1:20,000)
Mine - Tailing Pond
Lake - Definite
Reservoir - Definite
Water - Wetlands - Colour Themed (1:20,000)
Flooded Land - Inundated
Marsh
Swamp
Water - Wetlands - Outlined (1:20,000)
Flooded Land - Inundated
Swamp
(1:20,000)
- Colour Filled
0
70
140 m.
Scale: 1:991
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Datum/Projection: NAD83, Albers Equal Area Conic
Key Map of British Columbia
Fort St. John
Terrace
Quesnel
Vernon
Trail
Victoria

Figure 2

VILLAGE OF SILVERTON

TEST/PRODUCTION WELL

DRILLER'S LITHOLOG

Depth Interval in feet	Lithologic Description
0 - 4	Silty sand and gravel with cobbles
4 - 12	Boulders, up to 3 feet diameter
12 - 16	Silty sand and gravel with cobbles and boulders
16 - 33	Silty sand with gravelly zones
33 - 57	Silty gravel, grey, moist
57 - 80	Silty gravel with lenses of silty sand
80 - 95	Gravel with silt and silty clay, wet
95 - 98	Silty sand with gravel, moist
98 - 117	Silty gravel, loose intervals, wet
117 - 119	Silty clay, grey
119 - 136	Clayey silt with gravel, wet
136 - 148	Sand and gravel, water-bearing, material grading from fine sand to med. gravel
148 - 151	Sand with some gravel
151 - 158	Sand and gravel

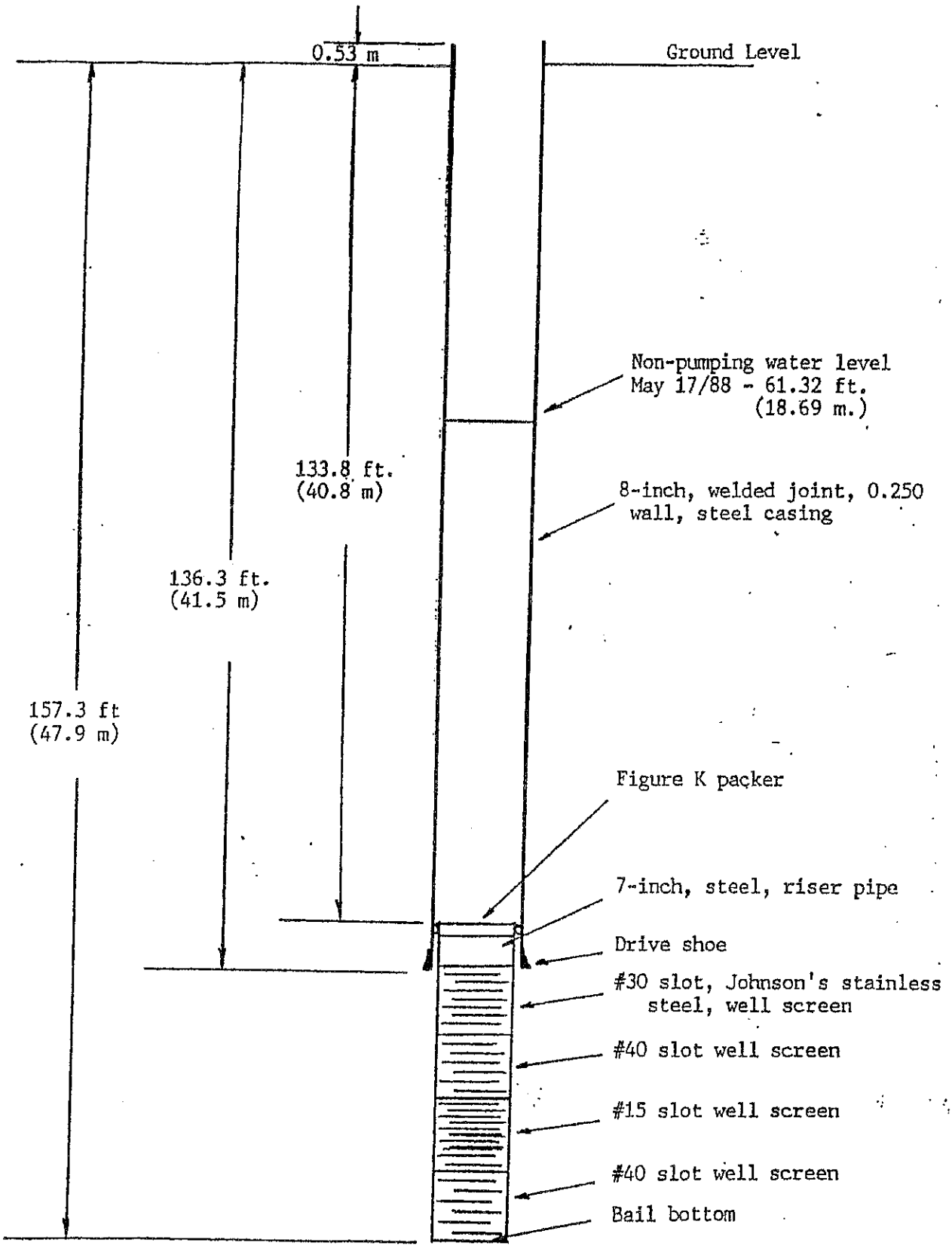


FIGURE 2 WELL COMPLETION DIAGRAM

Identify Results

Coordinate Position
BC Albers: 1618832, 586446
Geographic: 49° 57' 12.8" N, 117° 21' 21.3" W
UTM 11N: 474466, 5533528

Well Lithologies

Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285580
Well ID:	66722
Lithology Sequence Number:	0
Lithology From:	0
Lithology To:	15
Lithology Raw Data:	GRAVEL CLAY & BOULDERS
AREA:	0
LEN:	0
Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285581
Well ID:	66722
Lithology Sequence Number:	0
Lithology From:	15
Lithology To:	130
Lithology Raw Data:	HARDPAN SAND & GRAVEL
AREA:	0
LEN:	0
Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285582
Well ID:	66722
Lithology Sequence Number:	0
Lithology From:	130
Lithology To:	136
Lithology Raw Data:	WET SANDY CLAY
AREA:	0
LEN:	0
Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285583
Well ID:	66722
Lithology Sequence Number:	0
Lithology From:	136
Lithology To:	146
Lithology Raw Data:	SAND & GRAVEL
AREA:	0
LEN:	0
Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285584
Well ID:	66722

Lithology Sequence Number:	0
Lithology From:	146
Lithology To:	154
Lithology Raw Data:	COURSE AND FINE SAND
AREA:	0
LEN:	0
Well Tag No.:	000000066073
Source Accuracy:	G
Feature Code:	WA12100190
Lithology Description ID:	285585
Well ID:	66722
Lithology Sequence Number:	0
Lithology From:	154
Lithology To:	159
Lithology Raw Data:	SAN & GRAVEL
AREA:	0
LEN:	0

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: 27023
Ministry Well Tag Number: _____
☐ Confirmation/alternative specs. attached
☐ Original well construction report attached

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

Owner name: VILLAGE OF SILVERTON

Mailing address: _____ Town SILVERTON Prov. BC Postal Code _____

Well Location (see note 2): Address: Street no. _____ Street name _____ Town SILVERTON

or Legal description: Lot _____ Plan _____ D.L. _____ Block _____ Sec. _____ Twp. _____ Rg. _____ Land District _____

or PID: _____ and Description of well location (attach sketch, if nec.): _____

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

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

Orientation of well: ☑ vertical ☐ horizontal Ground elevation: _____ 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+clay gravel	Bedrock Material: Siltstone/shale	Sandstone	Conglomerate	Limestone	Basalt	Volcanic	Crystalline	Other (specify)	Bedrock: Soft	Colour: Red	Orange	Brown	Tan	Light Grey	Blue	Green	Dark Grey	Hardness: Very Hard	Hard	Medium	Loose/Soft	Soft	Water Content: Dry	Moist	Wet	Flowing/Artesian	Lost circulation	Not Available	Observations (e.g. other geological materials (e.g. boulders), est. water bearing flow (USgpm), or closure details)
0	19																																			BOULDERS
19	54																																			
54	148																																			
148	156																																			

Casing details

From ft (bgl)	To ft (bgl)	Dia in	Casing Material/Open Hole (see note 17)	Wall Thickness in	Drive Shoe
0	136	10"	STEEL	SCH. 40	BOTTOM

Surface seal: Type: BENTONITE Depth: 18 ft

Method of installation: ☐ Poured ☐ Pumped Thickness: 1 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 16)	Slot Size

Intake: ☑ Screen ☐ Open bottom ☐ Unscreened hole

Screen type: ☑ Telescope ☐ Pipe size

Screen material: ☑ Stainless steel ☐ Plastic ☐ Other (specify): _____

Screen opening: ☑ Continuous slot ☐ Slotted ☐ Perforated pipe

Screen bottom: ☑ Ball ☐ 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: 12 hrs

Notes: _____

Well yield estimated by:

☐ Pumping ☑ Air lifting ☐ Bailing ☐ Other (specify): _____

Rate: 200 - 300 USgpm Duration: 12 hrs

SWL before test: 70 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): DARREN PARNELL

Registration no. (see note 20): WD 079901

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 of 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.

Final well completion data:

Total depth drilled: 156 ft Finished well depth: 156 ft (bgl)

Final stick up: 12 in Depth to bedrock: _____ ft (bgl)

SWL: 70 ft (btoc) Estimated well yield: 200-300 USgpm

Artesian flow: _____ USgpm, or Artesian pressure: _____ ft

Type of well cap: STEEL Well disinfected: ☐ Yes ☑ No

Where well ID plate is attached: SIDE

Well closure information:

Reason for closure: _____

Method of closure: ☐ Poured ☐ Pumped

Sealant material: _____ Backfill material: _____

Details of closure (see note 18): _____

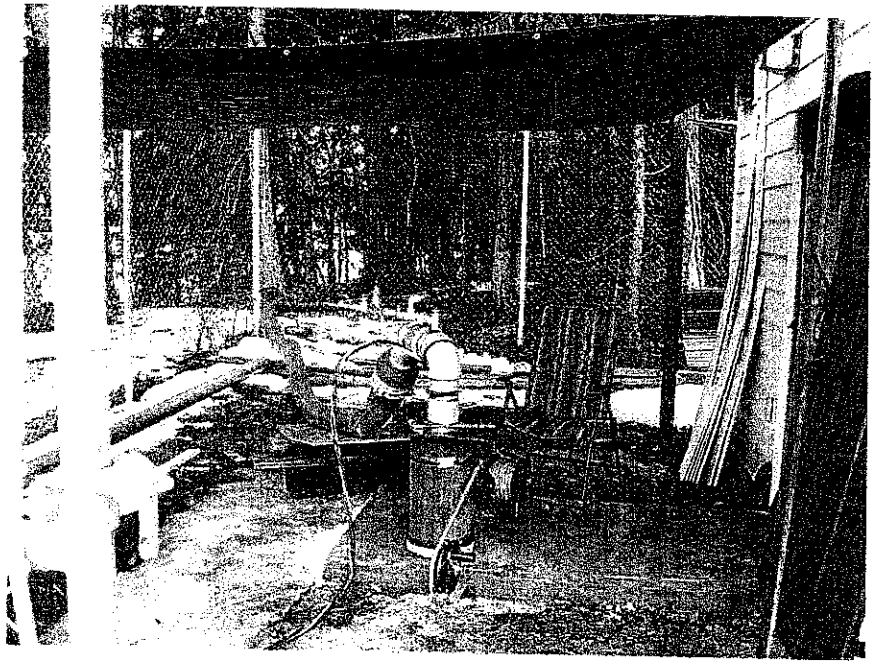
Date of work (YYYY/MM/DD):

Started: 2009/11/04 Completed: 2009/05/06

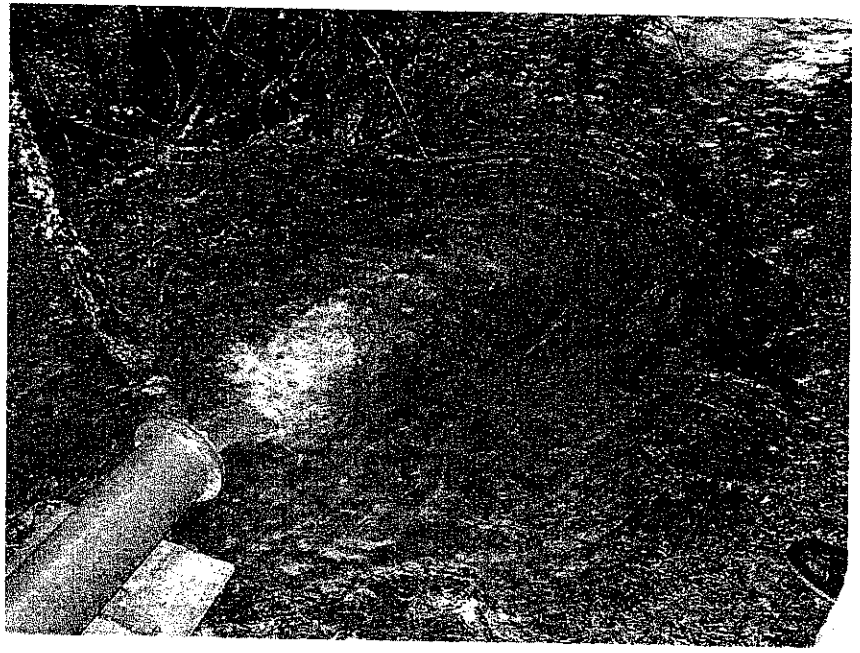
Comments: WATER QUALITY + QUANTITY NOT GUARANTEED BY CONTRACTOR

White: Customer copy
Canary: Driller copy
Pink: Ministry copy

Sheet ___ of ___

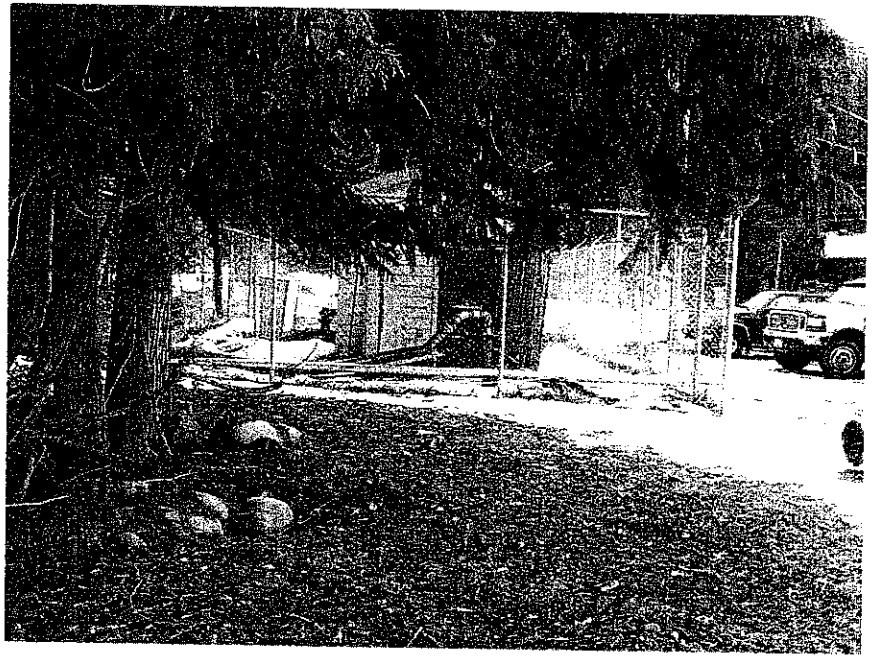


Pumping Test Set-up With Silverton Water Well No. 2

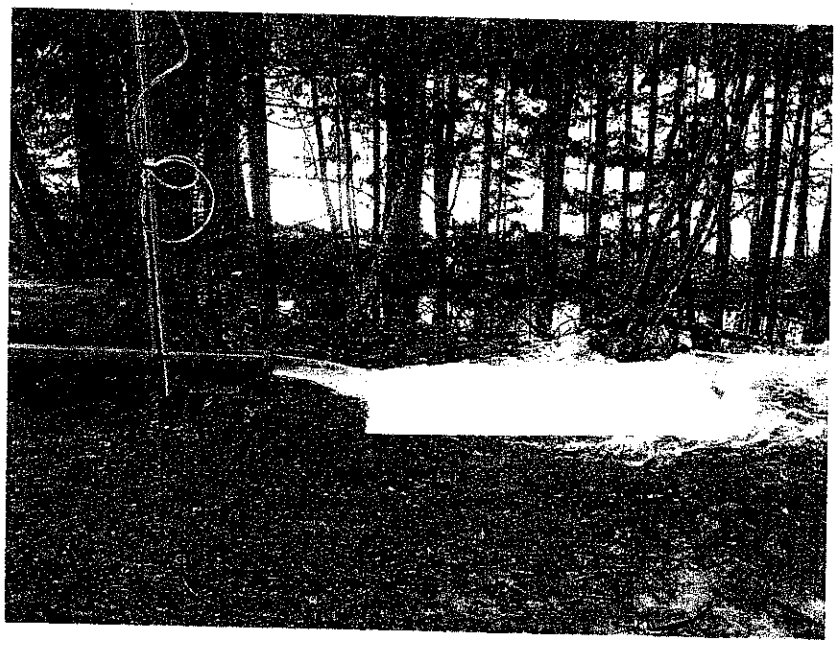


Water Discharge at Test Start-up – Note reddish colour

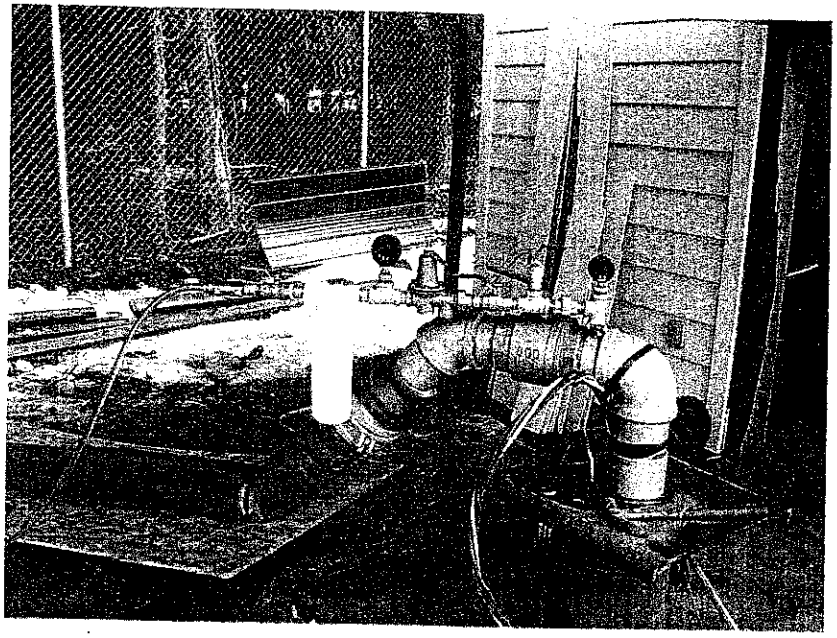
Measuring Water Level Drawdown During Pumping Test



Well Field Compound Showing Water Well No. 1 and 2

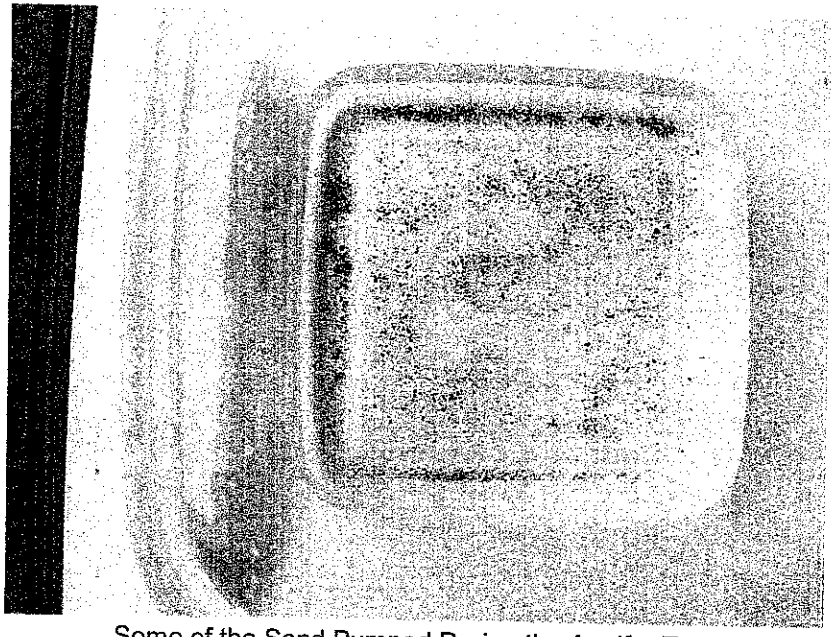


Water Discharge After 5 hours of Pumping (Water Clear)



Wellhead Configuration During Pumping Test

Looking Upstream of Well Field Complex



Some of the Sand Pumped During the Aquifer Test

APPENDIX B

- Pumping Test Data

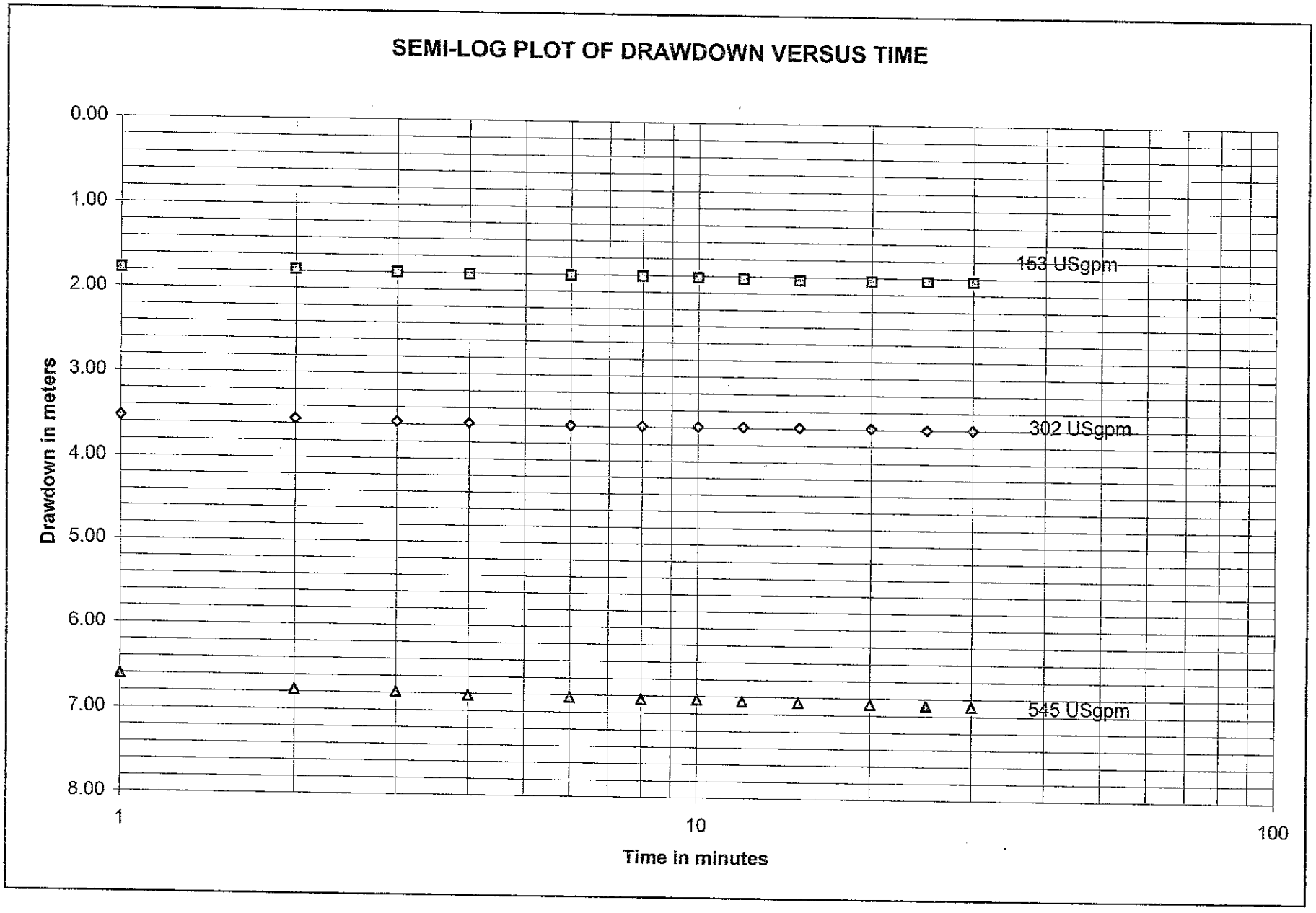
PUMPTEST (Drawdown)

Village of Silverton
Water Well No. 2 (Well Tag 27023) - Step Drawdown Test

Date test started: Feb. 2, 2010
Time test started: 8:30 AM
Ave. pumping rate: See Comments
Pre-test water level: 20.88 meters

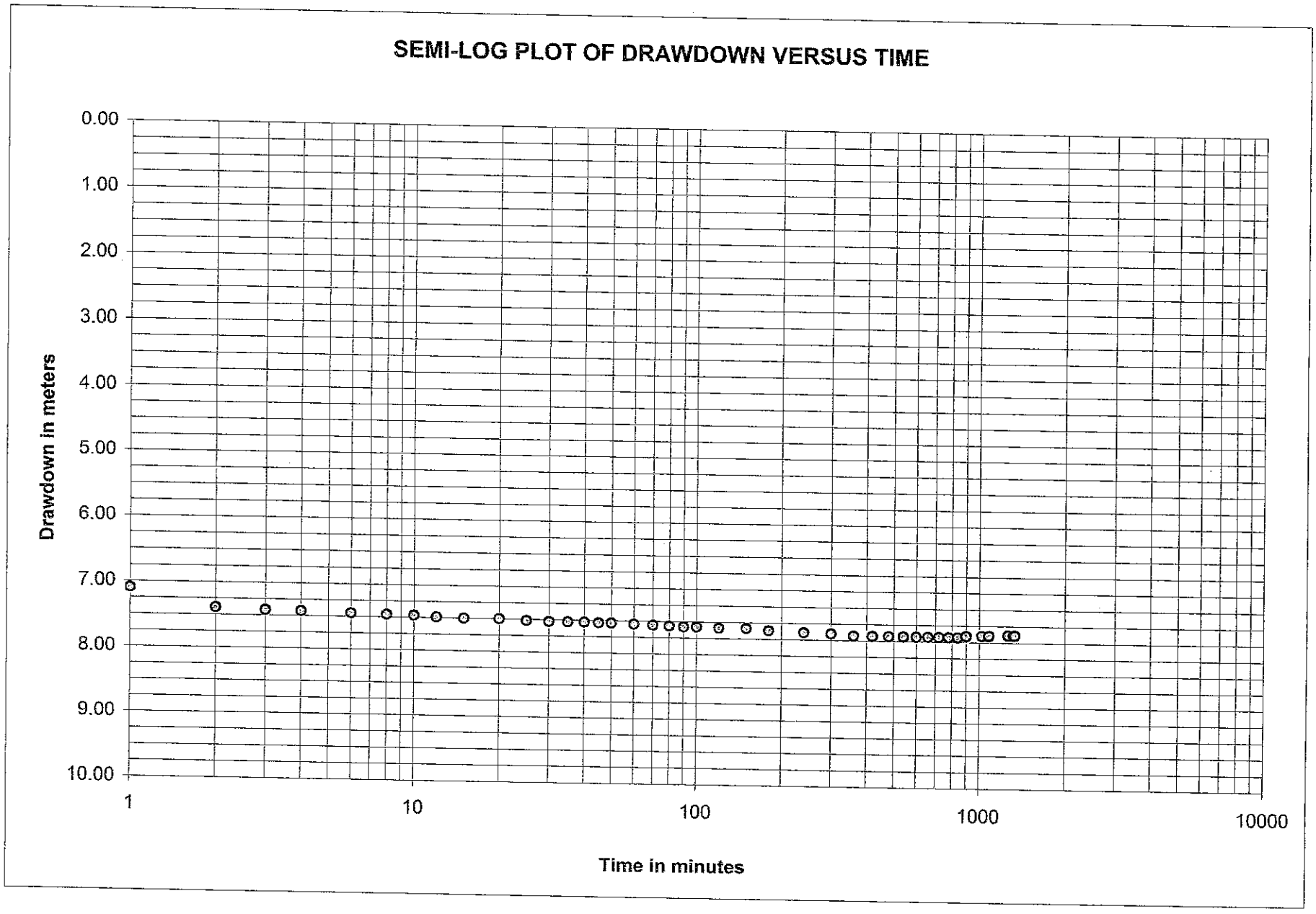
Reference Point: Top of Casing
Height of ref. point: 0.61 m above ground
Depth of well: 47.7 m
Top of screen: 39.8 m

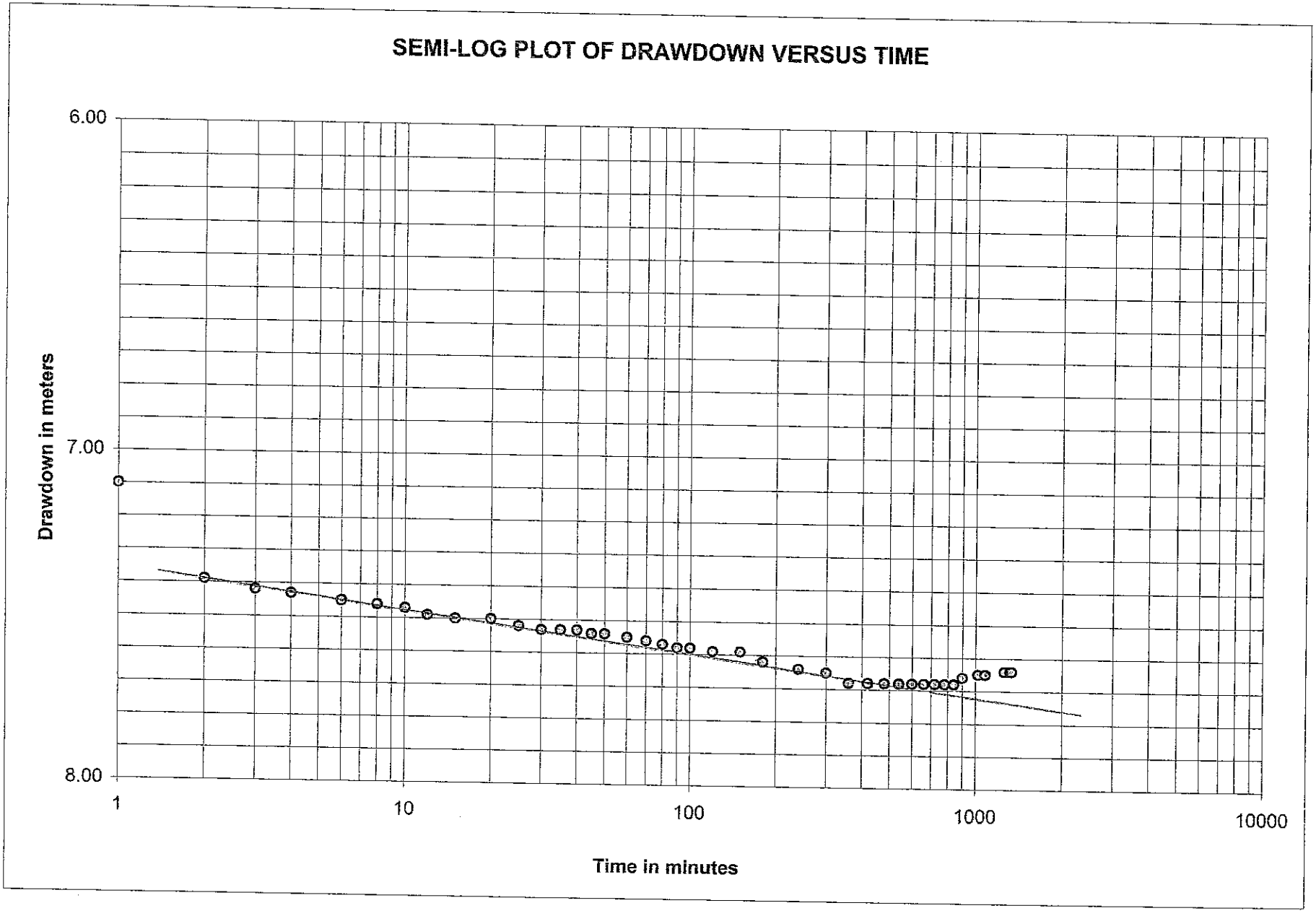
Time (t) since pumping started in minutes	Depth to water in feet	Drawdown in feet	Comments
Step No. 1 - 153 USgpm			
1	22.66	1.78	Pumping rate: 153 USgpm
2	22.66	1.78	5.5-inches on 4-inch orifice plate
3	22.68	1.80	
4	22.69	1.81	
6	22.69	1.81	
8	22.69	1.81	
10	22.70	1.82	
12	22.71	1.83	
15	22.72	1.84	
20	22.72	1.84	
25	22.72	1.84	
30	22.72	1.84	
Step No. 2 - 302 USgpm			
1	24.41		
2	24.43	3.55	Pumping rate: 302 USgpm
3	24.45	3.57	21.5-inches on 4-inch orifice place
4	24.46	3.58	
6	24.47	3.59	
8	24.47	3.59	
10	24.47	3.59	
12	24.47	3.59	
15	24.47	3.59	
20	24.47	3.59	
25	24.48	3.60	
30	24.48	3.60	
Step No. 3 - 545 USgpm			
1	27.49	6.61	Pumping rate: 545 USgpm
2	27.65	6.77	70 inches on 4-inch orifice plate
3	27.67	6.79	
4	27.70	6.82	
6	27.71	6.83	
8	27.72	6.84	
10	27.72	6.84	
12	27.73	6.85	
15	27.74	6.86	
20	27.75	6.87	
25	27.76	6.88	
30	27.77	6.89	


SEMI-LOG PLOT OF DRAWDOWN VERSUS TIME
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Drawdown in meters
153 USgpm
302 USgpm
545 USgpm
1
10
100
Time in minutes

PUMPTEST (Drawdown)	Village of Silverton Water Well No. 2 - Well Tag 27023	
Date test started: Feb. 2, 2010 Time test started: 10:30 AM Ave. pumping rate: 550 USgpm Pre-test water level: 20.88 meters		Reference Point: Top of casing Height of ref. point: 0.61 m above ground Depth of well: 47.7 m Top of screen: 39.8 m

Time (t) since pumping started in minutes	Depth to water in feet	Drawdown in feet	Comments
0	20.88	0.00	
1	27.98	7.10	Pumping rate: 550 USgpm (34.7 L/s)
2	28.27	7.39	19.5 inches on 5-inch orifice plate
3	28.30	7.42	
4	28.31	7.43	
6	28.33	7.45	
8	28.34	7.46	
10	28.35	7.47	
12	28.37	7.49	
15	28.38	7.50	
20	28.38	7.50	
25	28.40	7.52	
30	28.41	7.53	
35	28.41	7.53	
40	28.41	7.53	
45	28.42	7.54	
50	28.42	7.54	
60	28.43	7.55	
70	28.44	7.56	
80	28.45	7.57	
90	28.46	7.58	
100	28.46	7.58	
120	28.47	7.59	
150	28.47	7.59	
180	28.50	7.62	
240	28.52	7.64	
300	28.53	7.65	
360	28.56	7.68	
420	28.56	7.68	
480	28.56	7.68	
540	28.56	7.68	
600	28.56	7.68	
660	28.56	7.68	
720	28.56	7.68	Pumping rate remained constant at 550 USgpm throughout test
780	28.56	7.68	
840	28.56	7.68	
900	28.54	7.66	
1020	28.53	7.65	
1080	28.53	7.65	
1260	28.52	7.64	
1320	28.52	7.64	
1335	28.52	7.64	Water samples obtained at 8:45 AM on Feb. 3, 2010


SEMI-LOG PLOT OF DRAWDOWN VERSUS TIME
Drawdown in meters
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
1
10
100
1000
10000
Time in minutes


SEMI-LOG PLOT OF DRAWDOWN VERSUS TIME
6.00
7.00
8.00
Drawdown in meters
1
10
100
1000
10000
Time in minutes

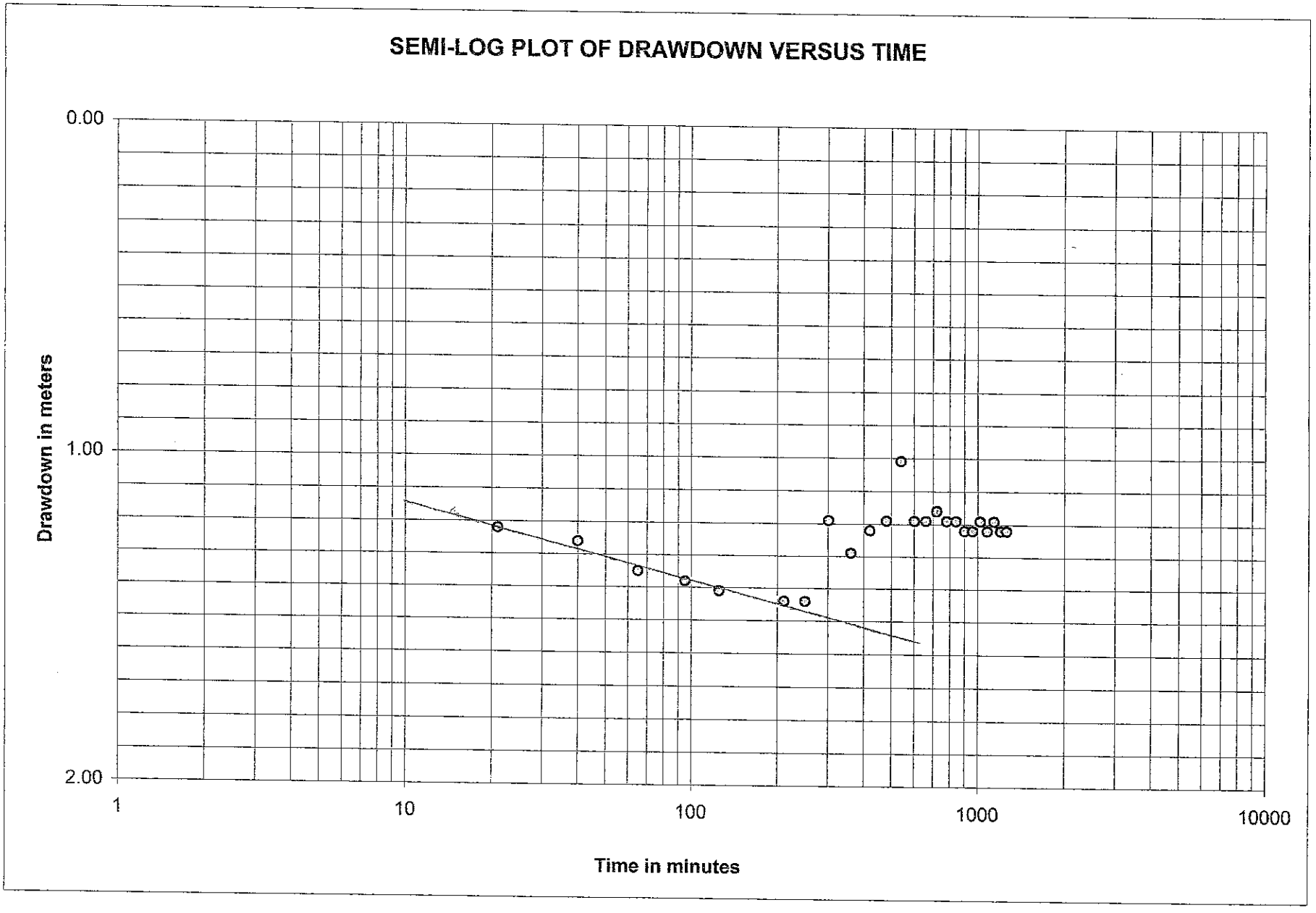
PUMPTEST (Drawdown)	Village of Silverton - Well No. 1 (Obs. Well) *Used as Observation Well during Pumping Test with Well No. 2*	
Date test started: Feb. 2, 2010 Time test started: 10:30 AM Ave. pumping rate: 550 USgpm Pre-test water level: 21.36 meters		Reference Point: Top of casing Height of ref. point: 0.61 m above ground Depth of well: 47.9 m Top of screen: 40.8 m

Time (t) since pumping started in minutes	Depth to water in feet	Drawdown in feet	Comments
0	21.36	0.00	
21	22.58	1.22	Pumping rate: 550 USgpm (34.7 L/s) in Well No. 2
40	22.62	1.26	19.5 inches on 5-inch orifice plate
65	22.71	1.35	
95	22.74	1.38	
125	22.77	1.41	
211	22.80	1.44	
250	22.80	1.44	
302	22.55	1.19	
361	22.65	1.29	
421	22.58	1.22	
481	22.55	1.19	
541	22.37	1.01	
602	22.55	1.19	
661	22.55	1.19	
721	22.52	1.16	
781	22.55	1.19	
841	22.55	1.19	
901	22.58	1.22	
961	22.58	1.22	
1021	22.55	1.19	
1081	22.58	1.22	
1141	22.55	1.19	
1201	22.58	1.22	
1261	22.58	1.22	

Village of Silverton

Water Well No. 1

Observation Well



Aquilog Groundwater Monitoring Systems

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0
250-547-6845

PUMP TEST – DRAWDOWN DATA
STEP TEST

DAY	MONTH	YEAR
02	02	2010

PROJECT Village of Silverton

Well [illegible] No 2

Datum Point [illegible]

Elevation of Datum Point 2' from Ground Level

Static Water Level [illegible]

Total Drawdown 22.59' TAD 64.03'

Pre Test level 68.52' Well No 1 [illegible] Pump intake @ 125' Safe TAD [illegible]

TIME HR.	TIME MIN.	ELAPSED TIME SINCE PUMPING STARTED t (min.)	ELAPSED TIME SINCE PUMPING STOPPED t' (min.)	RATIO (t/t')	DISTANCE TO WATER	~~RESIDUAL~~ DRAWDOWN	Flow	REMARKS
08	30	00			68.52'			Well Chlorinated @ 1630 Feb 01
	31	01			74.36	5.84	153 USGPM	1 L of extra strength [illegible]
	32	02			74.35	5.83	5.5" of head	diluted in 15 L of water
	33	03			74.42	5.90		
	34	04			74.43	5.91		6" orifice weir
	35	05			74.45	5.93		4" orifice plate
	36	06			74.46	5.94		5.5" of head
	37	07			74.46	5.94		
	38	08			74.46	5.94		
	39	09			74.49	5.97		
	40	10			74.49	5.97		
	42	12			74.51	5.99		
08	45	15			74.53	6.01		
	50	20			74.53	6.01		
	55	25			74.55	6.03		
09	00	30			74.56	6.04	25.33	Spec. Capacity
	01	31			80.11	11.59		302 USGPM
	02	32			80.16	11.64		21.5" of head
	03	33			80.22	11.70		
	04	34			80.24	11.72		
	05	35			80.26	11.74		
	06	36			80.27	11.75		
	07	37			[illegible]	11.75		
	08	38			80.28	11.76		
	09	39			80.28	11.76		
	10	40			80.29	11.77		
	12	42			80.29	11.77		Checked [illegible]
09	15	45			80.30	11.78		
	20	50			80.30	11.78		
	25	55			80.31	11.79		

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0
250-547-6845

PUMP TEST – DRAWDOWN DATA

STEP TEST

PAGE 6 OF 11

08	08	2010
DAY	MONTH	YEAR

PROJECT Village of Silverton

Well Tay No. 370283 NO 2

Datum Point TOC

Elevation of Datum Point 2' From Ground Level

Static Water Level 70.78' TAD 64.03'

Total Drawdown 22.59'

Pre Test Level 68.52' Monitoring Well Pump off @ Midnight

TIME		ELAPSED TIME SINCE PUMPING STARTED	ELAPSED TIME SINCE PUMPING STOPPED	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN		REMARKS
HR.	MIN.	t (min.)	t' (min.)					
09	30	60			90 31'	11.79'		545 USGPM 70% of head
	31	61			90 60	21.68		
	32	62			90 79	22.19		
	33	63			90 78	22.26		
	34	64			90 85	22.33		
	35	65			90 87	22.35		
	36	66			90 92	22.40		
	37	67			90 92	22.40		
	38	68			90 94	22.42		
	39	69			90 95	22.43		
	40	70			90 96	22.44'		
	46	76			90 98	22.46		
09	45	75			91 05	22.51		
	50	80			91 06	22.54		
	55	85			91 08	22.56		
10	00	90			91 10	22.59		

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0

PUMP TEST – RECOVERY DATA
STEP TEST

08	08	2000
DAY	MONTH	YEAR

PROJECT Village of Silverton

Well Tag No 27023 No 2

Datum Point TOC Elevation of Datum Point 2' From Ground level

Static Water Level 70.72' Total Drawdown 22.59' TRD 69.03'

Pre Test Level 68.32' Pump intake @ 125' Sic TRD 69.4

TIME		ELAPSED TIME SINCE PUMPING STARTED	ELAPSED TIME SINCE PUMPING STOPPED	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN		REMARKS
HR.	MIN.	t (min.)	t' (min.)					
10	00	90	00		[illegible]	22.59'		
	30 sec				67.47	.95		
	01	91	01		68.75	.33		
	01 30sec				68.58	.16		
	02	92	02		68.66	.14		
	02 30sec				68.65	.13		
	03	93	03		68.65	.13		
	03 30sec				68.65	.13		
	04	94	04		[illegible]	.12		
	04 30sec				[illegible]	.12		
	05	95	05		[illegible]	.11		
	06	96	06		68.63	.11		
	07	97	07		68.62	.10		
	08	98	08		69.62	.10		
	09	99	09		68.62	.10		
	10	100	10		68.62	.10		
	12	102	12		68.61	.09		
10	15	105	15		68.61	.09		
	20	110	20		68.60	.08		
	25	115	25		68.59	.07		
10	30	120	30		68.58	.06		

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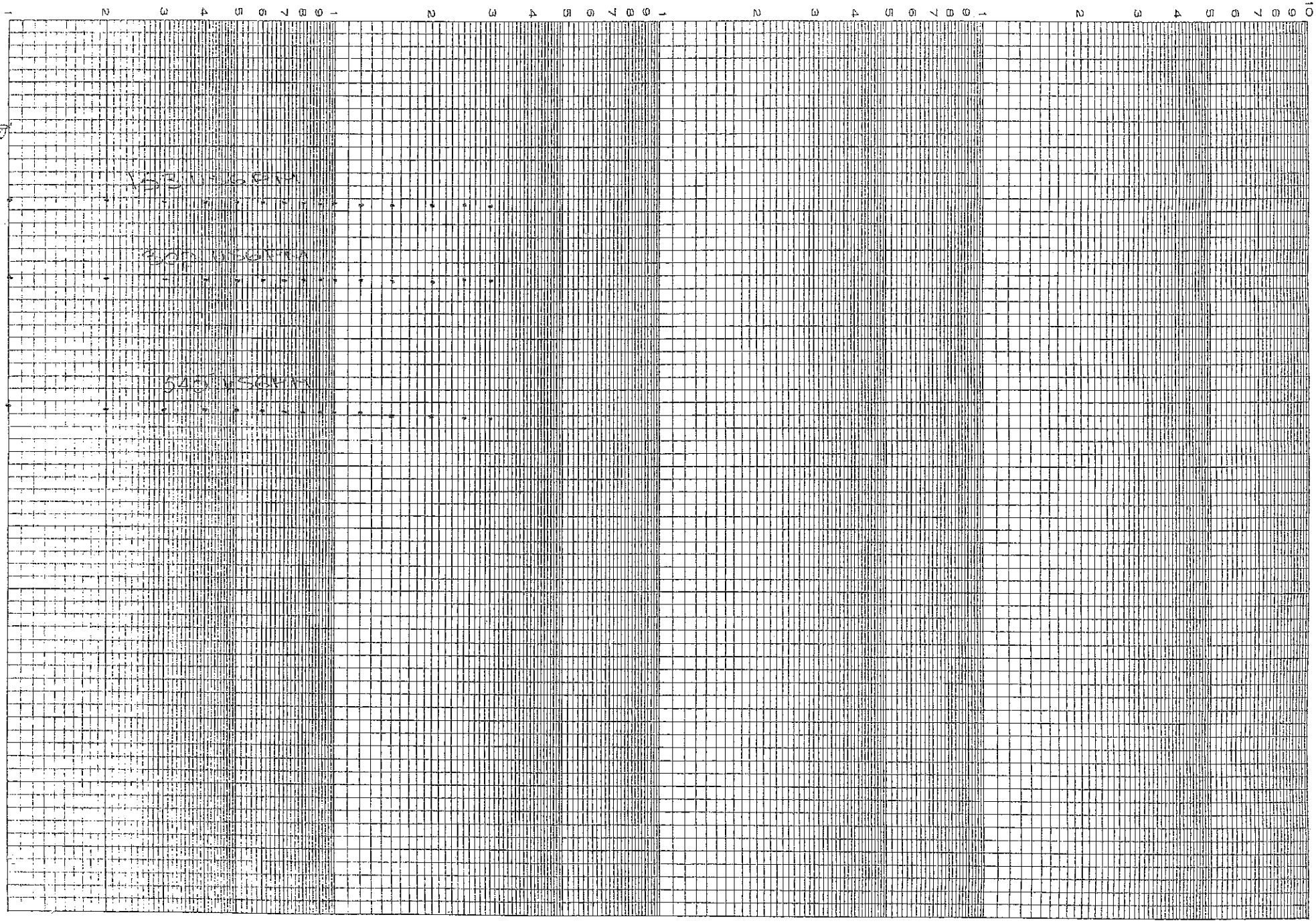

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BOX 752, LUMBY, B.C. V0E 2G0
250-547-6845

PUMP TEST – DRAWDOWN DATA
24 HR

08	09	2010
DAY	MONTH	YEAR

PROJECT Village of Silverton

Well Jay S7023 No #2

Datum Point TOC Elevation of Datum Point 2' from Ground Level

Static Water Level 70.72' Total Drawdown 25.05' TWD 64.03'

Pre Test Level 68.52' (well no pumping for 1 day) Pump Intake @ 125' Safe TWD 60.40

TIME HR.	TIME MIN.	ELAPSED TIME SINCE PUMPING STARTED t (min.)	ELAPSED TIME SINCE PUMPING STOPPED t' (min.)	RATIO (t/t')	DISTANCE TO WATER	DRAWDOWN		REMARKS
10	30	00			68.52'			Pump on Rate @ 550 USGPM
	31	01			91.80	23.28'		6" orifice weir
	32	02			92.75	24.23		5" plate
	33	03			92.86	24.34		19.5' of beam
	34	04			92.88	24.36		
	35	05			92.94	24.42		
	36	06			92.95	24.43		
	37	07			92.98	24.46		
	38	08			92.98	24.46		
	39	09			92.98	24.46		
	40	10			93.00	24.48		
	42	12			93.07	24.55		
10	45	15			93.10	24.58		
	50	20			93.13	24.61		
	55	25			93.17	24.65		Checked Level
11	00	30			93.21	24.69		
	05	35			93.21	24.69		
	10	40			93.22	24.70		
11	15	45			93.25	24.73		
	20	50			93.26	24.74		
11	30	60			93.28	24.76		
	40	70			93.30	24.78		
	50	80			93.33	24.81		
12	00	90			93.38	24.86		
	10	100			93.38	24.86		
	20	110			93.39	24.87		
12	30	120			93.40	24.88		
13	00	150			93.42	24.90		
13	30	180			93.50	24.98		Checked Level
14	00	210			93.54	25.02		

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0
250-547-6845

PUMP TEST – DRAWDOWN DATA

24 HR

DAY	MONTH	YEAR
02	00	[illegible]

PROJECT Village of [illegible]

Well [illegible]

Datum Point TOC

Elevation of Datum Point 2' from [illegible]

Static Water Level 70.72'

Total Drawdown 25.05' TAG 64.03'

Pre [illegible] level 68.52'

Pump intake @ 125' [illegible] 60.40'

TIME HR.	TIME MIN.	ELAPSED TIME SINCE PUMPING STARTED t (min.)	ELAPSED TIME SINCE PUMPING STOPPED t' (min.)	RATIO (t/t')	DISTANCE TO WATER	~~RESIDUAL~~ DRAWDOWN		REMARKS
14	30	240			93.58'	25.06'		Checked [illegible]
15	30	300			93.62	25.10		
16	30	360			93.69	25.17		
17	30	420			93.71	25.19		
18	30	480			93.72	25.20		Checked Field
[illegible]	[illegible]	540			93.70	25.22		
20	30	600			93.72	25.24		Checked Field
21	30	660			93.70	25.22		
22	30	720			93.70	25.22		Checked Field
23	30	780			93.70	25.22		
[illegible]	30	[illegible]			93.70	25.22		
[illegible]	[illegible]	[illegible]			93.65	[illegible] 13		Checked Field
[illegible]	[illegible]	960			[illegible]	[illegible]		Checked Field
[illegible]	[illegible]	1020			93.60	25.08		Checked Field
[illegible]	[illegible]	1080			[illegible]	[illegible] 08		Checked Field
[illegible]	[illegible]	1140			[illegible]	[illegible] 08		Checked Field
[illegible]	[illegible]	1200			[illegible]	[illegible]		Checked Field
[illegible]	[illegible]	[illegible]60			93.58	[illegible].08		Checked Field
[illegible]	[illegible]	[illegible]20			93.57	[illegible] 05		Checked Field
08	45	1335			93.57	25.05	Early [illegible]	[illegible]
							in Reservoir	
Feb		2 2010	@ 1445 HRS			Feb. 3	2010	0810 HRS
Well		No 2		Creek		Well	No 2.	Creek
PH		7.8	PH 8.0			PH	7.4	PH 8.1
Cond.		158	Cond. 155			Cond.	179	Cond 155
Temp		6.7°C	Temp. 3.3°C			Temp	6.9°C	Temp. 3.0°C

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0

PUMP TEST – RECOVERY DATA
24 HR

DAY	MONTH	YEAR
03	02	2010

PROJECT [illegible]

Well [illegible]

Datum Point TOC

Elevation of Datum Point 2' from Ground Level

Static Water Level 70.72'

Pre Test Level [illegible]

Total Drawdown 25.05'   TAD 64.03

Pump intake @ 125'   Safe TAD 50.40

TIME HR.	TIME MIN.	ELAPSED TIME SINCE PUMPING STARTED t (min.)	ELAPSED TIME SINCE PUMPING STOPPED t' (min.)	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN		REMARKS
08	[illegible]	1335	00		93.57'	25.05'		
	[illegible]	1336	01		68.55	.33		
	[illegible]	1337	02		68.72	.26		
	[illegible]	1338	03		68.71	.19		
	49	[illegible]	04		68.71	.19		
	50	[illegible]	05		68.69	.17		
	51	[illegible]	06		68.68	[illegible]		
	52	1342	07		68.68	[illegible]		
	53	1343	[illegible]		68.68	.16		
	54	[illegible]	09		68.67	.15		
	55	[illegible]	[illegible]		68.67	.15		
	57	[illegible]	[illegible]		68.66	[illegible]		
09	00	350	[illegible]		68.[illegible]	[illegible]		
Reading on the		100 2	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	03				70.80'			
09	05				70.89			
09	08				70.89			
								[illegible]
								[illegible]
								[illegible]
								[illegible] water @
								1030 hrs Feb. 3, 2010
								Inspection of pump
								intake + riser pipe
								Sand particles throughout.
								See sample provided

Village of Silver Lake
well tag No 27023
well No #2
12"
Static level 70.72'

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4 of 4
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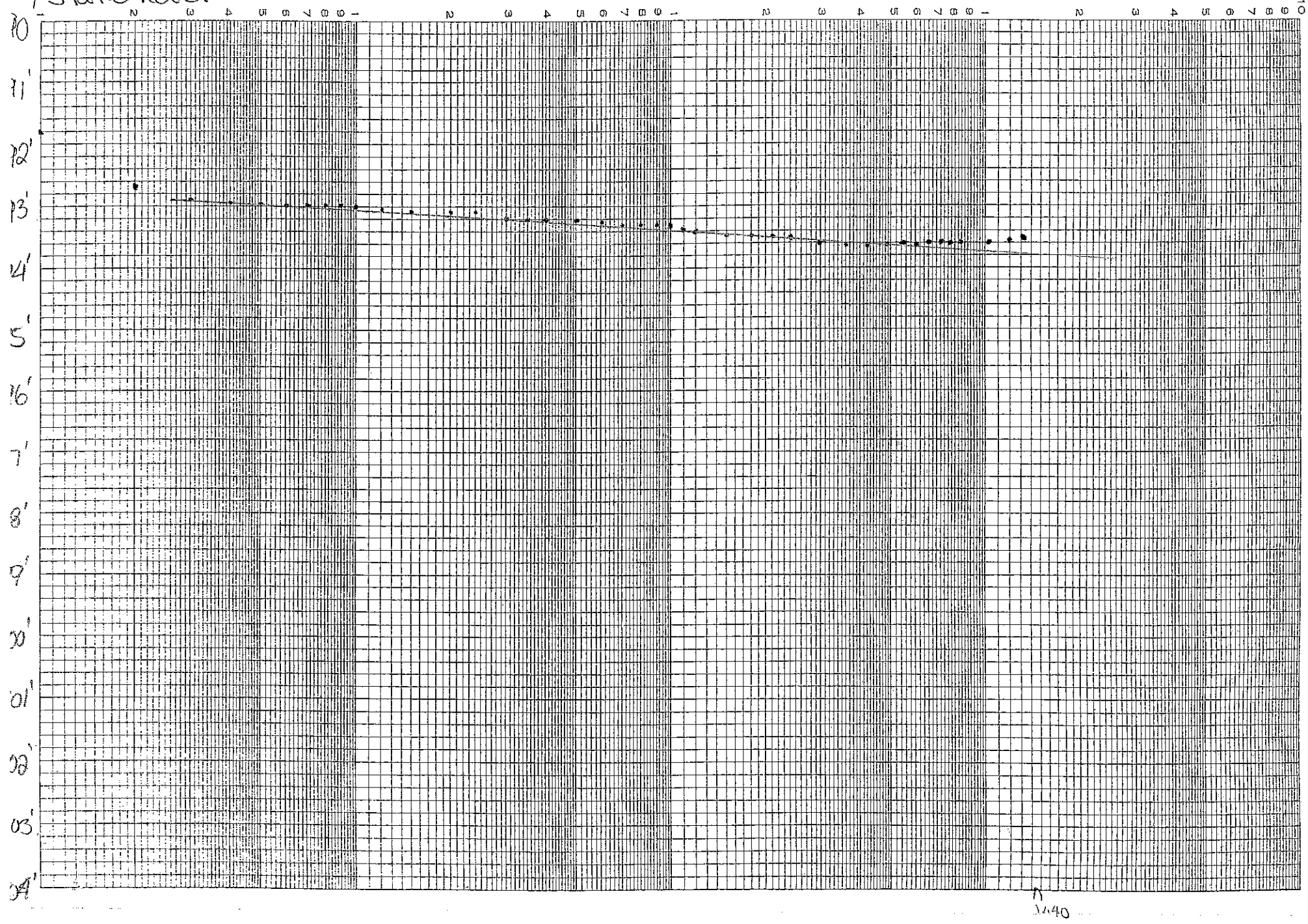


MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0
250-547-6845

Monitoring Well

PUMP TEST – DRAWDOWN DATA

08	09	2010
DAY	MONTH	YEAR

PROJECT Village of Silverton

Well No 1 Monitoring Well

Datum Point TOC Elevation of Datum Point

Static Water Level 70.1' Acoustic Sounder Total Drawdown

TIME		ELAPSED TIME SINCE PUMPING STARTED	ELAPSED TIME SINCE PUMPING STOPPED	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN		REMARKS
HR.	MIN.	t (min.)	t' (min.)					
08	30				70.1'			
08	39				71.6			
08	47				71.9			
08	50				71.9			
08	58				71.6			
09	04				71.8			
09	11				71.6			
09	21				71.6			
09	29				71.6			
09	35				74.5			
09	46				73.8			
09	57				73.9			
					70.5			RECOVERY
10	40				74.7			Pump ON
10	51				74.1			
11	10				74.2			
11	35				74.5			
12	05				74.6			
12	35				74.7			
13	23				73.9			
14	01				74.8			
14	40				74.8			
15	32				74.0			Nov 18 2010
16	31				74.3			
17	31				74.1			
18	31				74.0			
19	31				73.4			
20	32				74.0			
21	31				74.0			

MONASHEE AQUIFER TESTING
BOX 752, LUMBY, B.C. V0E 2G0

Monitoring Well

PUMP TEST – RECOVERY DATA

02	02	10
DAY	MONTH	YEAR

PROJECT Village of Silverton

Well MW1 Monitoring Well

Datum Point T.O.C. Elevation of Datum Point

Static Water Level 70.1' Acoustic Sounder Total Drawdown

TIME		ELAPSED TIME SINCE PUMPING STARTED	ELAPSED TIME SINCE PUMPING STOPPED	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN		REMARKS
HR.	MIN.	t (min.)	t' (min.)					
22	31	720			73.9			
23	31	780			74.0			
00	31	840			74.0			
01	31	900			74.1			
02	31	960			74.1			
03	31	1020			74.0			
04	31	1080			74.1			
05	31	1140			74.0			
06	31	1200			74.1			
07	31	1260			74.1			
09	00				76.4	Pump off		

APPENDIX C

- Water Qulaity Data

CERTIFICATE OF ANALYSIS

CARO

CLIENT	**Topp, Larry**		
	114 - 6688 Tronson Road		
	Vernon BC	TEL	1-250-549-0704
	V1H 1R9	FAX	-
ATTENTION	**Larry Topp**		

RECEIVED / TEMP	Feb-03-10 14:55 / 2.0 °C	**WORK ORDER**	K0B0153
REPORTED	Feb-15-10	**PROJECT**	Silverton Well #2
COC #(s)	26688	**PROJECT INFO**	Well #2, Tag 27023

General Comments:

CARO Analytical Services employs methods which are based on those found in "Standard Methods for the Examination of Water and Wastewater", 21st Edition, 2005, published by the American Public Health Association (APHA); US EPA protocols found in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW846", 3rd Edition; and protocols published by the British Columbia Ministry of Environment (BCMOE).

Methods not described in these publications are conducted according to procedures accepted by appropriate regulatory agencies, and/or are done in accordance with recognized professional standards using accepted testing methodologies and quality control efforts except where otherwise agreed to by the client.

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 entirity. 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.

- All solids results are reported on a dry weight basis unless otherwise noted

- Units: mg/kg = milligrams per kilogram, equivalent to parts per million (ppm)
  mg/L = milligrams per litre, equivalent to parts per million (ppm)
  ug/L = micrograms per litre, equivalent to parts per billion (ppb)
  ug/g = micrograms per gram, equivalent to parts per million (ppm)
  ug/m3 = micrograms per cubic meter of air

- "RDL" Reported detection limit
- "<" Less than reported detection limit
- "AO" Aesthetic objective
- "MAC" Maximum acceptable concentration (health-related guideline)
- "LAB" RMD = CARO - Richmond location, KEL = CARO - Kelowna location, SUB = Subcontracted

Please contact CARO if more information is needed.

CARO Analytical Services

Final Review Per: **Ed Hoppe, B.Sc, P.Chem**
Laboratory Manager

SAMPLE DATA

CARO

CLIENT	Topp, Larry	**WORK ORDER #**	K0B0153
PROJECT FILE	Silverton Well #2	**REPORTED**	Feb-15-10

Analyte	Result	Canadian DW Guidelines (May 08)	RDL	Units	Analyzed	Method	Lab	Notes
General Parameters								
Silverton Well# 2, (Well Tag 27023) (K0B0153-01) Matrix: Water Sampled: Feb-03-10 08:30								
Aggresiveness Index	**11.4**			-	Feb-12-10	Reference	KEL	
Alkalinity, Total as CaCO3	**70.4**		1.0	mg/L	Feb-04-10	APHA 2320 B	KEL	
Carbon, Total Organic	**0.8**		0.5	mg/L	Feb-05-10	APHA 5310 B	KEL	
Chloride	**0.51**	AO ≤ 250	0.10	mg/L	Feb-04-10	APHA 4110 B	KEL	
Colour, True	<5	AO ≤ 15	5	Color Unit	Feb-05-10	APHA 2120 B	KEL	
Conductivity (EC)	**172**		5	uS/cm	Feb-04-10	APHA 2510 B	KEL	
Cyanide (total)	<0.01	MAC = 0.2	0.01	mg/L	Feb-10-10	APHA 4500-CN	KEL	
Fluoride	**0.11**	MAC = 1.5	0.10	mg/L	Feb-04-10	APHA 4110 B	KEL	
Hardness, Total (Total as CaCO3)	**81.3**		2.91	mg/L	Feb-09-10	APHA 2340 B	RMD	
Langelier Index	**-0.73**		-5.0	-	Feb-12-10	Reference	KEL	
Nitrogen, Ammonia as N	<0.02		0.02	mg/L	Feb-03-10	APHA 4500-NH3 G	KEL	
Nitrogen, Nitrate as N	**0.30**	MAC = 10	0.01	mg/L	Feb-04-10	APHA 4110 B	KEL	
Nitrogen, Nitrite as N	<0.01	MAC = 3.2	0.01	mg/L	Feb-04-10	APHA 4110 B	KEL	
Nitrogen, Total Kjeldahl	**0.13**		0.05	mg/L	Feb-05-10	APHA 4500-N D	KEL	
Nitrogen, Organic	**0.13**		0.05	mg/L	Feb-05-10	CALC	KEL	
pH	**7.61**	AO = 6.5 - 8.5	0.10	pH Units	Feb-04-10	APHA 4500-H+	KEL	
Phosphorus, Total	<0.01		0.01	mg/L	Feb-05-10	APHA 4500P:B.5/E	KEL	
Solids, Total Dissolved	**97**	AO ≤ 500	5	mg/L	Feb-08-10	APHA 2540 C	KEL	
Sulfate	**16.2**	AO ≤ 500	1.0	mg/L	Feb-04-10	APHA 4110 B	KEL	
Sulfide	<0.050	AO ≤ 0.05	0.050	mg/L	Feb-05-10	APHA 4500-S D	KEL	
Temperature	**2.4**	AO ≤ 15		C	Feb-10-10	N/A	KEL	
Turbidity	<0.1	Varies, See Guidelines	0.1	NTU	Feb-04-10	APHA 2130 B	KEL	
UV Transmittance @ 254nm	**97.5**		0.1	%	Feb-08-10	APHA 5910B	KEL	
Total Recoverable Metals by ICPMS								
Silverton Well# 2, (Well Tag 27023) (K0B0153-01) Matrix: Water Sampled: Feb-03-10 08:30								
Aluminum	<0.050	AO ≤ 0.1	0.050	mg/L	Feb-09-10	EPA 6020A	RMD	
Antimony	<0.0010	MAC = 0.006	0.0010	mg/L	Feb-09-10	EPA 6020A	RMD	
Arsenic	<0.0050	MAC = 0.01	0.0050	mg/L	Feb-09-10	EPA 6020A	RMD	
Barium	**0.0219**	MAC = 1	0.0050	mg/L	Feb-09-10	EPA 6020A	RMD	
Beryllium	<0.0010		0.0010	mg/L	Feb-09-10	EPA 6020A	RMD	
Boron	**0.026**	MAC = 5	0.020	mg/L	Feb-09-10	EPA 6020A	RMD	
Cadmium	<0.00010	MAC = 0.005	0.00010	mg/L	Feb-09-10	EPA 6020A	RMD	
Calcium	**27.4**		1.0	mg/L	Feb-09-10	EPA 6020A	RMD	
Chromium	<0.0050	MAC = 0.05	0.0050	mg/L	Feb-09-10	EPA 6020A	RMD	
Cobalt	<0.00050		0.00050	mg/L	Feb-09-10	EPA 6020A	RMD	
Copper	<0.0010	AO ≤ 1	0.0010	mg/L	Feb-09-10	EPA 6020A	RMD	
Iron	<0.10	AO ≤ 0.3	0.10	mg/L	Feb-09-10	EPA 6020A	RMD	
Lead	<0.0010	MAC = 0.01	0.0010	mg/L	Feb-09-10	EPA 6020A	RMD	
Magnesium	**3.15**		0.10	mg/L	Feb-09-10	EPA 6020A	RMD	
Manganese	<0.0020	AO ≤ 0.05	0.0020	mg/L	Feb-09-10	EPA 6020A	RMD	
Mercury	<0.00050	MAC = 0.001	0.00050	mg/L	Feb-09-10	EPA 6020A	RMD	
Molybdenum	**0.0019**		0.0010	mg/L	Feb-09-10	EPA 6020A	RMD	
Nickel	<0.0020		0.0020	mg/L	Feb-09-10	EPA 6020A	RMD	
Phosphorus	<0.20		0.20	mg/L	Feb-09-10	EPA 6020A	RMD	

SAMPLE DATA

CARO

CLIENT	Topp, Larry	**WORK ORDER #**	K0B0153
PROJECT FILE	Silverton Well #2	**REPORTED**	Feb-15-10

Analyte	Result	Canadian DW Guidelines (May 08)	RDL	Units	Analyzed	Method	Lab	Notes
Total Recoverable Metals by ICPMS, Continued								
Silverton Well# 2, (Well Tag 27023) (K0B0153-01) Matrix: Water Sampled: Feb-03-10 08:30, Continued								
Potassium	**1.38**		0.10	mg/L	Feb-09-10	EPA 6020A	RMD	
Selenium	<0.0030	MAC = 0.01	0.0030	mg/L	Feb-09-10	EPA 6020A	RMD	
Silicon	**2.6**		2.0	mg/L	Feb-09-10	EPA 6020A	RMD	
Silver	<0.00050		0.00050	mg/L	Feb-09-10	EPA 6020A	RMD	
Sodium	**1.60**	AO ≤ 200	0.10	mg/L	Feb-09-10	EPA 6020A	RMD	
Uranium	**0.00188**	MAC = 0.02	0.00020	mg/L	Feb-09-10	EPA 6020A	RMD	
Vanadium	<0.010		0.010	mg/L	Feb-09-10	EPA 6020A	RMD	
Zinc	**0.036**	AO ≤ 5	0.010	mg/L	Feb-09-10	EPA 6020A	RMD	
Microbiological Parameters								
Silverton Well# 2, (Well Tag 27023) (K0B0153-01) Matrix: Water Sampled: Feb-03-10 08:30								
Iron Related Bacteria	<2		2	CFU/mL	Feb-03-10	DBISOP-06	KEL	
Sulphate Reducing Bacteria	<8.0		8.0	CFU/mL	Feb-03-10	DBHSOP-05	KEL	
Coliforms, Total	<1	MAC < 1	1	CFU/100mL	Feb-03-10	APHA 9222	KEL	
Background Colonies	<1		1	CFU/100mL	Feb-03-10	APHA 9222	KEL	
E. coli	<1	MAC < 1	1	CFU/100mL	Feb-03-10	APHA 9223	KEL	

Interior Health

Health Protection

Drinking Water Program

PARAMETER LIST FOR NEW DRINKING WATER SOURCES

Evaluating proposed water sources for the presence and concentrations of hazardous organisms/substances and identifying trends in water quality is crucial for the health assessment, source protection planning, and water system design processes. The data required, sampling locations, and frequency of sampling to characterize a proposed source should be established by the design team, but will typically include the following:

BACTERIOLOGICAL:

E. coli	Background growth
Total Coliform	Protozoa

CHEMICAL AND PHYSICAL:

Alkalinity	Corrosivity (Calcium	Phosphorous
Aluminum	Carbonate	Potassium
Ammonia	saturation/Langelier's	Selenium
Antimony	index)	Sodium
Arsenic	Cyanide	Sulphate
Barium	Fluoride	Sulphide (ground water
Boron	Hardness	sources only)
Cadmium	Iron	Temperature
Calcium	Lead	Total Dissolved Solids
Chlorides	Magnesium	Total Organic Carbon
Chromium	Manganese	Turbidity
Colour	Molybdenum	Uranium
Conductivity	Mercury	UV transmittance
(Conductance/Specific	Nitrates	Zinc
Conductance)	Organic Nitrogen	
Copper	pH	

**Testing should be done by an approved laboratory with samples collected using appropriate methods.*

ADDITIONAL TESTING FOR SPECIFIC CONTAMINANTS

Additional analysis may be required based on the results of the initial analysis and on potential impact by nearby sources of contamination. For example, if industrial, agricultural or forestry contamination (e.g. pesticides) is suspected, identify what chemicals have been used and analyze for the most likely indicator parameters. If petroleum contamination is suspected analyze for BTEX (benzene, toluene, ethyl benzene and xylene) and conduct a hydrocarbon scan.

SEASONABLE VARIABILITY

To provide a reasonable account of seasonal variability source monitoring should typically be carried out over a two year period. The monitoring, including frequency and extent necessary to characterize the source should be made a condition of approval, if acceptance of the source and/or construction permit by Interior Health is granted before the end of the two year period.

APPENDIX D

- IHA Application for New Drinking Water Source

Interior Health

Health Protection

Drinking Water Program

Application for New Drinking Water Source

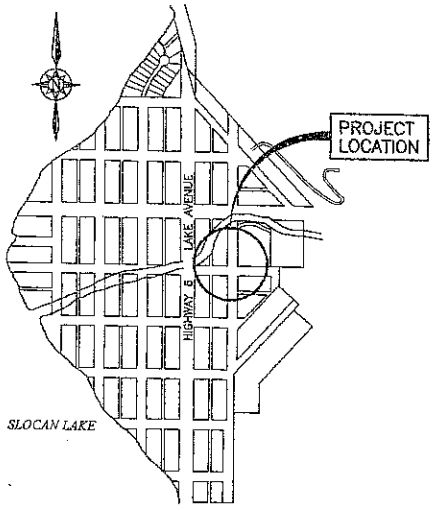
Name of Water System (or proposed name)	Date
Village of Silverton Water System	Feb 22/10
Street Address	
PO Box 14, 421 Lake Ave.	
Community	**Postal Code**
Village of Silverton	
Applicant Name	
Village of Silverton	
Applicant Address	
PO Box 14, Silverton, BC, V0G 2B0	
Phone(s)	**Email**
(250) 358-2404	works@silverton.ca

Please provide the following information with the application:

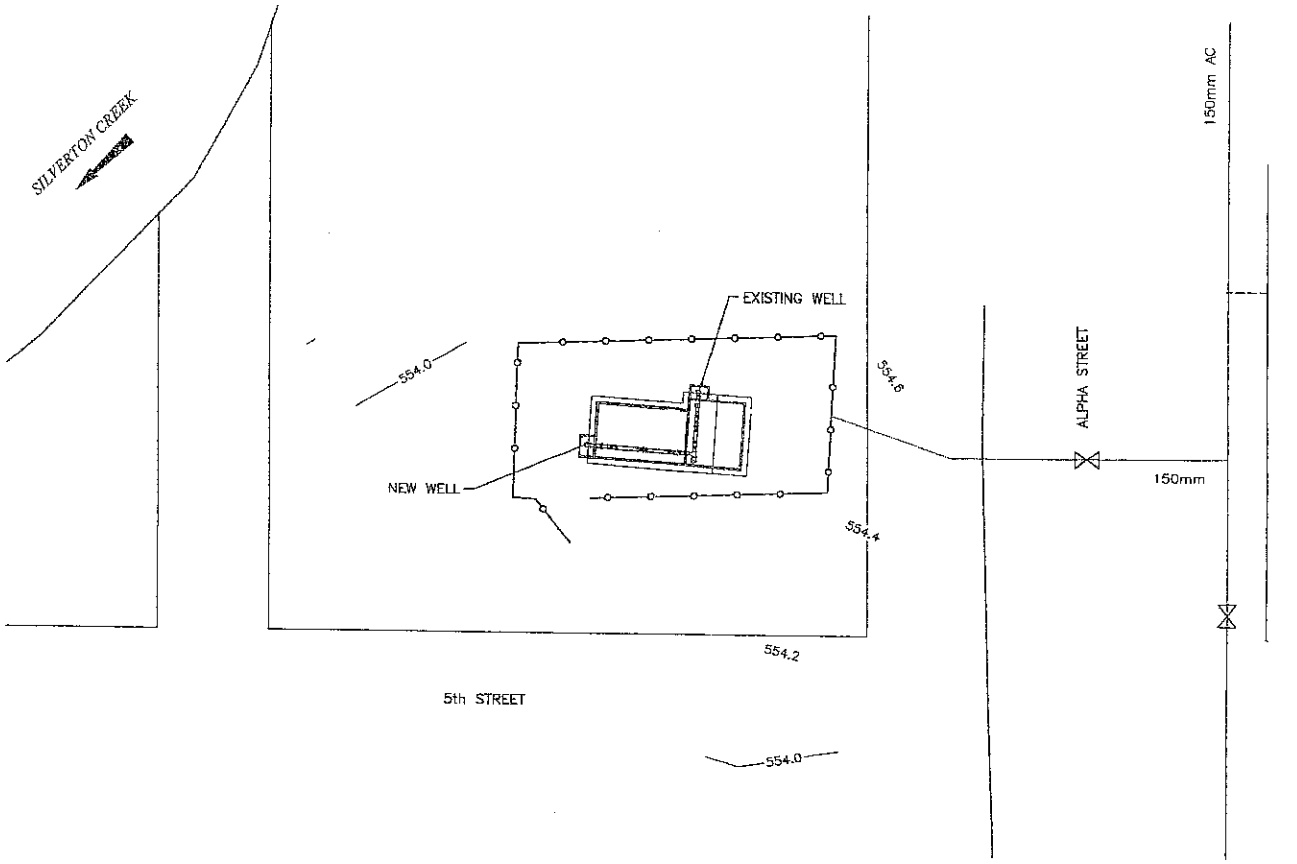
1. A site assessment/contaminant survey including a site location map to scale showing the proposed source location and distance to buildings, roads, storm sewers, sanitary sewers, water mains, septic tanks, septic fields, water courses such as lakes, rivers, streams, and other potential sources of contamination. Please attach map and site survey to this application form.
2. A water quality analyses results per HPF10160 "Parameter List for New Drinking Water Sources.
3. Is the proposed water source(s) Surface water ☐ Ground water ☒ Combined ☐
4. For Surface Water: What is the expected depth of the intake? _____
5. For Ground Water:
6. What is the expected depth to the well screen? 136 ft (41.5 m)
7. Is it expected that there will be a clay layer or impervious layer above the above the well screen or intake? ☒ Yes ☐ No
8. Is it expected that the aquifer will be artesian? ☐ Yes ☒ No

Submitted by: Larry C. Topp, P. Geo.

Signature Topp Feb 22, 2010 *Date*



VILLAGE OF SILVERTON



WSA ENGINEERING LTD.
WOODS SAHLSTROM ASSOCIATES
Geotechnical • Civil • Structural • Materials Testing
2248 Columbia Ave. Castlegar, B.C. V1N 2X1 Ph: (250) 365-3696

VILLAGE OF SILVERTON

NEW WELL SITE PLAN

SCALE:	1:250
JOB:	C09147-006
DATE:	10/02/2010
FIGURE:	3

Interior Health

November 3, 2009

32900-20/ Village of Silverton - Log 619

Ralf Waters, P.Eng.
WSA Engineering Ltd.
2248 Columbia Avenue
Castlegar, BC V1N 2X1

Dear Mr. Waters:

Re: Application for Construction Permit – Village of Silverton – Pump House Piping Upgrade to Connect New Well Source

Thank you for the Construction Permit application and drawings received October 20, 2009 for the construction of waterworks for the above mentioned project. At this time we are unable to issue a construction permit as no approval or acceptance have been issued by Interior Health for a new well source for the Village of Silverton.

Please find enclosed the applications and information for obtaining a new source. This approval/ acceptance is not only for the source water quality but acceptance of the proposed well site, i.e. in an acceptable location. In discussion with the Environmental Health Officer, Paul Geisler, he advised that there were some preliminary discussions regarding a proposed new well source, but at the time a site was not selected. This process is conducted prior to the drilling of a new well.

Please ensure your client, the Village of Silverton, completes the new source acceptance/ approval process. Once the source site and the source quality have been accepted by the Environmental Health Officer we will be able to consider the application for the works to connect the new well source to the existing water system. From the drawing submitted, some preliminary items noted for the proposed well source which should be addressed are proximity to the existing well source and building and proximity to a surface source. Other items are provision for flushing the well as may be required from time to time and ability to sample raw water quality.

Please re-apply when the new source acceptance/ approval process has been satisfied. Please refer to our Waterworks Construction Permit Guidelines for the documentation required when submitting an application for a new well source being connected to a water system.

Please contact the undersigned if you have any questions.

Yours truly,

Marianne Crowe, P. Eng.
Public Health Engineer
Kootenay Region

c.c. Paul Geisler, EHO, IHA, 2nd Floor, 333 Victoria Street, Nelson, BC, V1L 4K3
Village of Silverton, PO Box 14, 421 Lake Ave, Silverton, BC, V0G B0
Ministry of Community Services, Municipal Engineering Services Branch, PO Box 9838 Stn Prov Govt, Victoria, BC, V8W 9T1
File

NEW DRINKING WATER SOURCE GUIDELINE

1.0 INTRODUCTION

Health Protection staff engage in assessing and evaluating proposed new sources of drinking water to ensure they are properly located and verify possible sources of contamination or drinking water health hazards.

The guideline outlines evaluation information necessary to assess health risks, support source protection efforts, and facilitate proper system design. Surface and ground water source components include:

1.1 Surface Water Sources

a) Watershed characterization (e.g. hydrology, water quality, trends).

b) Contaminant survey results that identify hazards in a watershed and have the potential to impact water quality.

c) Risk characterization including consequences to drinking water.

d) Source protection measures to be considered or implemented.

1.2 Ground Water Sources

a) Aquifer characterization (e.g. well site selection, aquifer vulnerability)

b) Contaminant survey results that identify hazards that may impact well water quality.

c) Risk characterization including consequences to drinking water.

d) Identification of wellhead protection measures to be considered or implemented.

2.0 PROCESS

***Note: An Application for New Drinking Water Source must be submitted to the local Environmental Health Officer prior to submitting an Application for Waterworks Construction Permit to Public Health Engineering.**

2.1 The applicant on behalf of a water supply system proposing a new drinking water source provides the following to the local Environmental Health Officer (EHO):

a) A completed HPL0940 Application for New Drinking Water Source including:

- Water system name, legal owner, address, phone number
- location, nature and type of proposed source
- water quality analyses results

b) Results from a site inspection and contaminant survey. For guidance regarding the evaluation of proposed surface or groundwater sources please refer to HPF10140 Evaluation Criteria for Surface Water or HPF10150 Evaluation Criteria for Ground Water respectively.

2.2 The Environmental Health Officer is responsible for the following:

a) When a completed HPL0940 Application for New Drinking Water Source is received the EHO initiates the review and evaluation process.

b) Originals of the application and supporting information are kept by the Environmental Health Officer. Copies of information are provided to appropriate staff as required. Examples are the Drinking Water Specialist, Team Leader, and Source Protection Officer.

c) As part of the source assessment process, evaluate the appropriateness of the proposed water source by :

- Carrying out a site inspection of the proposed source prior to the construction of any works (i.e. intake or well).
- Reviewing a water quality analyses with reference to the *Drinking Water Protection Act* (DWPA), Guidelines for Canadian Drinking Water Quality (GCDWQ), and Ministry of Environment Source Water Quality Guidelines.
- Consulting with members of the Drinking Water Team (e.g. Public Health Engineer, Medical Health Officer, Drinking Water Specialist, and Source Protection Officer) as required.

d) Upon completion of the evaluation process the Environmental Health Officer will forward site inspection results and water quality evaluation to the water system applicant (a copy is provided to the Public Health Engineer). They will indicate whether the proposed source is appropriate to be considered for use as a drinking water source (i.e. can or can not be used), whether treatment is required, and identify any other concerns they may have regarding the proposed drinking water source.

EVALUATION CRITERIA FOR NEW DRINKING WATER GROUND WATER SOURCES

1.0 INTRODUCTION

The intent of the source assessment process is to provide the information necessary to evaluate potential health risks, support source protection planning, and facilitate proper system design. The information provided should include the following elements:

1. Source assessment (e.g. well site selection)
2. Identification of potential sources of contamination that may impact water quality
3. Identification of wellhead protection measures to be considered or implemented.

2.0 INVESTIGATION CRITERIA

The depth of investigation and amount of information required to support system design will vary for each situation.

a) Water systems proposing to service >500 persons should typically be expected to complete an assessment equivalent to that described in modules 1, 2, & 7 of the BC *Comprehensive Source-to-Tap Assessment Guideline* (see references).

b) Small water systems (i.e. those serving <500 persons) should at a minimum provide an assessment equivalent to that described in the BC Drinking Water Source-to-Tap Screening Tool (see references)

c) Considerations:

The following items may be considered during the site assessment of a proposed surface drinking water source. This list is not exhaustive, but is intended to stimulate thought:

Does the water supplier own the land that the proposed well will be located on?				☐ Yes	☐ No
Is the aquifer in the general area considered confined or is it vulnerable? (MOE website-Wells, Aquifer Vulnerability maps)				☐ Yes	☐ No
Does the proposed well location have the potential to be GUDI/GWUDI?				☐ Yes	☐ No
Are there any contaminated sites in proximity to the proposed well location? (MOE contaminated sites registry)				☐ Yes	☐ No
Is any of the following occurring within the capture zone or within 100m of the proposed well?					
Cattle Grazing	☐ Yes	☐ No	Agriculture	☐ Yes	☐ No
Fertilizer Use	☐ Yes	☐ No	Industrial	☐ Yes	☐ No
Fuel storage	☐ Yes	☐ No	Landfills	☐ Yes	☐ No
Manure Stockpiles	☐ Yes	☐ No	Transportation	☐ Yes	☐ No
Salt storage	☐ Yes	☐ No			

Are there any sewerage disposal systems within 30 metres?	☐ Yes	☐ No
Are there any Municipal Sewage Regulation disposal systems within 90 metres?	☐ Yes	☐ No
Are there any cemeteries within 120 metres?	☐ Yes	☐ No
Is the area low lying or potentially subject to flooding (i.e. within the 20 year flood level)?	☐ Yes	☐ No

3.0 REFERENCE DOCUMENTS

No one process for assessing ground water will be appropriate for all systems. However, the following provincial documents provide some guidance regarding the collection of information to support water system design:

a) BC *Drinking Water Source-to-Tap Screening Tool* (Section B1) (www.health.gov.bc.ca/protect/source.html#water2)

b) BC *Comprehensive Source-to-Tap Assessment Guideline* (Modules 1, 2, & 7) (www.bcwwa.org/source-to-tap/index.php)

c) BC *Well Protection Toolkit* (www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/well protect.html)

More extensive lists of hazards and elements to be considered can be found in the:

d) BC *Well Protection Toolkit (Appendix 3.1)*,

e) *Guidance Document for Determining Ground Water at Risk of Pathogens and Ground Water Under Direct Influence of Surface Water* (Province of BC Draft Document),

f) CCME's *From Source to Tap: Guidance on the Multi-barrier Approach to Safe Drinking Water* (www.ccme.ca/publications/list_publications.html),

g) USEPA Source Water Protection website (http://cfpub.epa.gov/safewater/sourcewater/):