

**Province of British Columbia
Ministry of Environment
Water Management Division**

**Construction and Testing of Observation
Well No. 301 Matsqui, British Columbia
Contract No. 89**

**W. S. Hodge and M. Wei
Groundwater Section
Water Management Division**

**Victoria, British Columbia
April 1992**

ABSTRACT

One 152 mm (6 inch) diameter well has been completed to a depth of 26.0 m (85.3') in the Abbotsford Upland Aquifer along King Road to monitor water level fluctuation and water quality in the aquifer. The well is capable of 1.87 L/s (30 USgpm). All chemical constituents analyzed are within the drinking water limits. Elevated levels of nitrate-nitrogen from field analysis, does however, indicate that water quality degradation may be occurring as a result of agricultural activity in the local area. Total contract cost for well construction and testing is \$6243.01. The well has been incorporated into the Provincial Observation Well Network (Observation Well No. 301). Water level monitoring is recommended for a minimum period of 10 years. Yearly sampling for water quality analysis is also recommended.

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**Construction and Testing
of Observation Well No. 301
Matsqui, British Columbia**

Contract No. 89

1. Introduction

One 152 mm (6 inch) diameter observation well was completed to a depth of 26.0 metres (85.3 feet) on the King Road right-of-way west of Bradner Road, in Matsqui (Figures 1 and 2). The well was constructed by Perry's Well Drilling of Langley between March 6th and 9th, 1988 and tested by Aqua Flo Testing and Equipment Ltd. of Langley on March 11, 1988. Total contract costs for well construction and testing were \$6,243.03.

The Aldergrove area was recommended as part of the 1987/88 Groundwater Observation Well Network Expansion Program (Wei, 1987). This area was selected for groundwater monitoring because of the extensive groundwater use from this aquifer (Abbotsford Upland Aquifer). The Abbotsford aquifer underlies much of the area and supplies water for irrigation, industrial and residential use. The aquifer is also subject to non-point source pollution of nitrogen from fertilizer application and stockpiling of animal waste.

A field survey was conducted in September 1987 to locate a suitable observation well for use as an observation well. This attempt was unsuccessful, however, and a decision was made to construct an observation well at Matsqui.

2. Well Construction and Testing

The 152 mm (6 inch) observation well was initially drilled to a depth of 41.1 metres (135 feet) using an air rotary drill rig - TLT 342. A 254 mm (10 inch) surface casing was driven to a depth of 4.3 metres (14 feet).

Sand and gravel was encountered to (26.2) metres (86 feet). Till was encountered between 26.2 metres (86 feet) and 32 metres (105 feet). Sand and gravel was again encountered between 32.0 metres (105 feet) and 41.1 metres (135 feet). Well construction is shown in Figure 3 and the well record is shown in Appendix A.

Soil samples were routinely collected during drilling and more frequently where changes in lithology occurred or where water bearing zones were encountered. All samples were bagged and stored for future reference.

The water table or zone of saturation occurs at about 15.8 metres (52 feet). The hole was backfilled to 26 metres (85.3 feet) and the well was completed with a screen assembly consisting of a 0.67 metre (2.2 feet) length of riser pipe and packer and 1.2

metre (4 feet) length of 20-slot Johnson stainless steel screen. The screen was set between 24.7 metres (81.2 feet) and 26.0 metres (85.3 feet). The 152 mm (6 inch) casing was then pulled back to expose the screen. The screen was set above the confining till layer to monitor groundwater conditions in the unconfined portion of the aquifer which is most susceptible to impacts from local land-use. The screen was pre-selected and screen design was not based on sieve analysis results. Although the screen installed does not allow for optimum well efficiency under pumping conditions, it is adequate for monitoring.

The annular space between the 254 mm (10 inch) and the 152 mm (6 inch) casing was then grouted using 8 bags of Portland cement. The 254 mm surface casing was left in place.

The well was developed by air for a period of 2.5 hours at approximately 25 gpm. A pumping test was carried out by Aqua Flo Testing and Equipment Ltd. on March 11, 1988 for 480 minutes (8 hours). A 2 H.P. submersible pump was used and set at a depth of 23.8 metres (78 feet) below the top of the 152 mm casing.

The static water level at the time of testing was 15.7 metres (51.65 feet) below the top of the well casing. The pumping rate started at 1.5 litres/second (24.4 USgpm) and was stepped up to 1.9 litres/second (30 USgpm) after 200 minutes. The pumping rate was held constant over the last 280 minutes at 1.9 litres/second (30 USgpm). The pumping rate was measured with a container of known volume and the water was discharged through a 102 mm (4 inch) discharge line approximately 30 metres (100 feet) from the well head. A drawdown of 6.4 metres (21.03 feet) occurred over the test period representing 71 percent of the drawdown available. The available drawdown during testing was 9.0 metres (29.55 feet). Based on a pumping rate of 1.9 litres/second (30 USgpm), a specific capacity of 0.30 L/s/m (1.43 USgpm/ft) of drawdown is determined (Figure 3). Water level stabilization was reached during testing. Based on utilizing 70 percent of available drawdown, the well has a theoretical long-term capacity of 1.87 litres/second (29.6 USgpm).

Water level recovery was rapid. Recovery was measured for twenty minutes after pump shutdown. The water level recovered to 0.10 metres (0.33 feet) from the original static water level after twenty minutes.

An automatic water level recorder and protective steel housing were installed on the well head. The recorder will allow for continuous monitoring of water levels and is intended to remain in place for a minimum 10 year period. The well should be sampled for complete chemistry once per year during the late summer or early fall when water levels would be at their lowest level.

3. Hydrogeology

The observation well is completed in the Abbotsford Upland Aquifer, along the northern boundary of the aquifer (Johanson,1988). The aquifer consists of glacial outwash sands and gravels and exists under unconfined conditions; the extent of the surficial sands and gravels is shown in Figure 4. A hydrogeologic section across the aquifer is shown in Figure 5. The saturated thickness of the aquifer is generally less than 100' (30 m) thick in the area near the observation well and typically up to about 50' (15 m) thick. The aquifer is underlain by a thick sequence of till, fine sand, and silt-clay layers. The till and clay form an aquitard underlying the aquifer (Figure 5). Well log information suggest the aquitard may be up to several hundred feet thick (>100 m).

The observation well appears to be completed in the recharge area of the aquifer. Groundwater flow in the local area is to the south (Johanson, 1988). Source of recharge is primarily from precipitation. Howes Creek may also recharge the aquifer in the local area (Figures 4 and 5). Aquifer transmissivity could not be accurately determined from the 8-hour pump-test, but is expected to be in the neighbourhood of thousands to tens of thousands of gallons/day/ft of aquifer, indicative of a moderately productive aquifer capable of supplying domestic and small irrigation and industrial wells (Figure 5). Well records indicate that a few wells in the local area have reported capacities of 50 gpm (3 L/s) or more.

The fact that the aquifer is unconfined indicates that it is very susceptible to contamination from surface sources. Farms exist north and east of the observation well. A chicken farm was located in the immediate vicinity west of the well. Stockpiling of animal wastes and application of animal wastes, fertilizers and pesticides to the land could impact on the quality of the groundwater. In the area south and west of the observation well, the land has been excavated for gravel mining. This activity could alter recharge and local groundwater flow. Any improper disposal of construction wastes associated with the gravel mining operations could also introduce contaminants into the aquifer.

4. Water Quality

Water samples were collected for field and laboratory analysis during the pumping test on March 11, 1988. A Hach Kit and Beckman Conductivity meter were used for field analyses (Appendix B). Water samples were collected at 70 minutes and 420 minutes and submitted to the Environmental Laboratory for chemical analysis. Results are shown in Appendix B. Some major parameters such as pH, residue filterable, alkalinity, sulfate, chloride, and nitrate for example, were omitted in the laboratory analysis. All parameters tested however, were within the Guidelines for Canadian Drinking Water Quality (1989). Elevated levels of nitrate-

nitrogen (NO₃-N) were detected during field analysis. The NO₃-N level of about 5 mg/L, although within drinking water limit, does indicate possible water quality degradation from agricultural activity nearby. Field analysis also indicates that the water is low in mineralization (conductivity <200 µS/cm) and soft (hardness = 85 mg/L).

5. Conclusions and Recommendations

- (a) One 152 mm (6 inch) diameter observation well was drilled and tested for a period of 480 minutes (8 hours). The well was completed within the unconfined (Abbotsford) aquifer which consists of gravel and sand to a depth of 26 metres (85.3 feet) . Total contract costs for well construction and testing was \$6,243.03.
- (b) The aquifer is productive. A long-term pumping test is, however, necessary before the transmissive characteristics of this aquifer can be better known. Long-term pumping at a higher rate could reveal transmissivity and any hydraulic boundaries not evident from this short-term pumping test. A 20-slot screen was considered very conservative for this well.
- (c) All water chemistry parameters tested are within the maximum acceptable concentrations set out in "Guidelines for Canadian Drinking Water Quality 1978". The water can be described as a low mineralization, soft, calcium bicarbonate type.
- (d) Due to the aquifer's susceptibility to NO₃-N contamination, the observation well should be sampled for complete chemistry once every year (Hodge, 1992). Sampling should be carried out in the late summer-early fall when groundwater levels are expected to be lowest.
- (e) The water level recorder installation should remain in place for a minimum period of 10 years. The data obtained will make it possible to understand the short and long term recharge and withdrawal effects and impacts of land-use on this aquifer.

6. References

Armstrong, J. E., 1976. Surficial Geology, Mission, British Columbia. GSC Map No. 117.

Johanson, D., 1988. Fishtrap/Pepin/Bertrand Creeks Water Management Basin Plan. Unpublished Report, Groundwater Section, Ministry of Environment and Parks.

Wei, M., 1987. Groundwater Observation Well Network Expansion Program Proposal, 1987/88 Fiscal Year. Unpublished memorandum, Groundwater Section, Ministry of Environment, Victoria, B.C.

Hodge, W. S., 1992. Observation Well Network Sampling Frequency. Unpublished memorandum, Groundwater Section, Ministry of Environment, Lands and Parks. File: 0183616-B.

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LOCATION MAP



Province of British Columbia
 Ministry of Environment
 WATER MANAGEMENT BRANCH

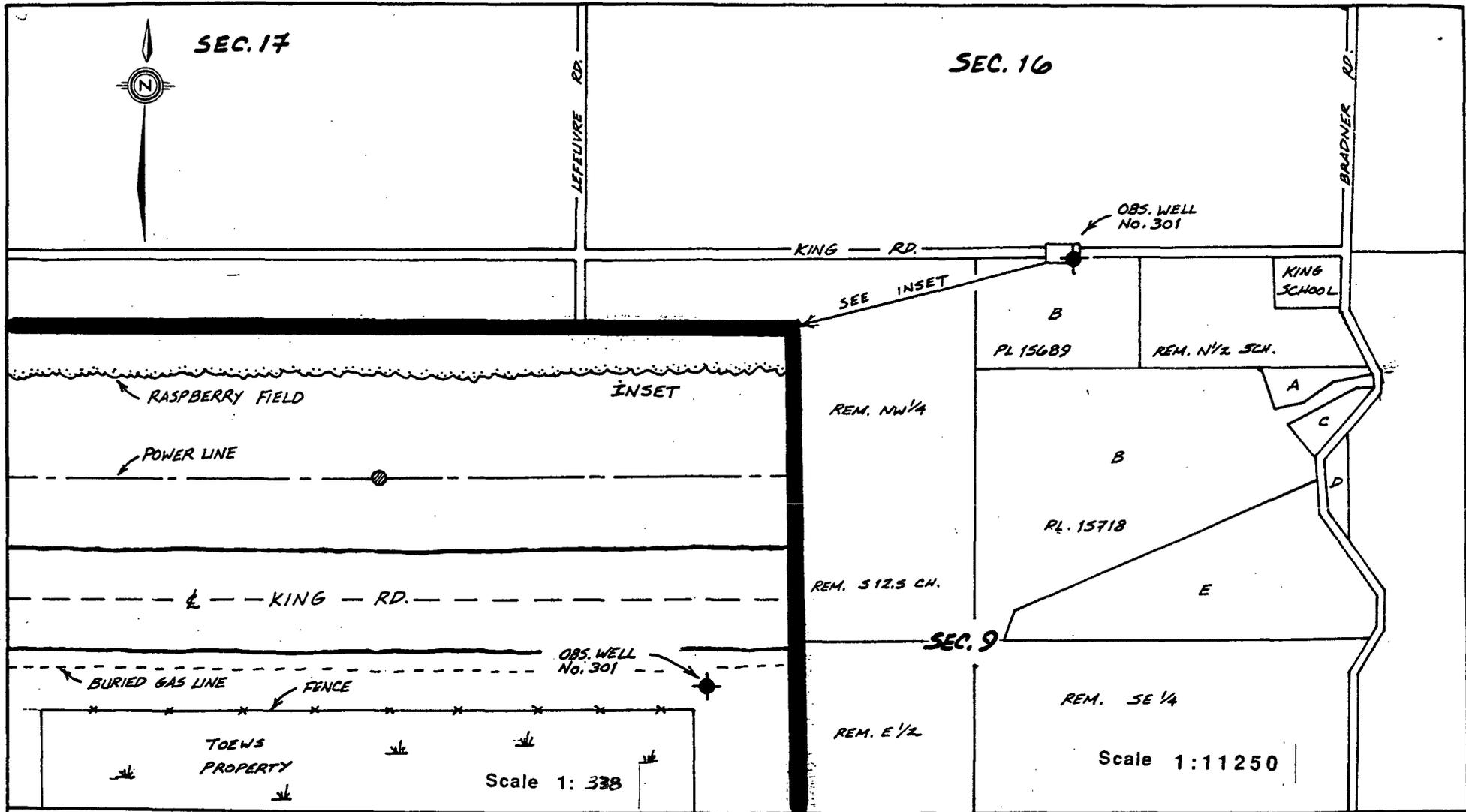
TO ACCOMPANY REPORT ON
 Construction and Testing of
 Observation Well No. 301,
 Matsqui, B.C.

SCALE: ~~VERT~~ 1:100,000

DATE
 Apr. 1992

ENGINEER
 FILE No. _____ DWG. No. Figure 1

VAN CAL 15712



VANICAL - 10263



Province of British Columbia
 Ministry of Environment
 WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

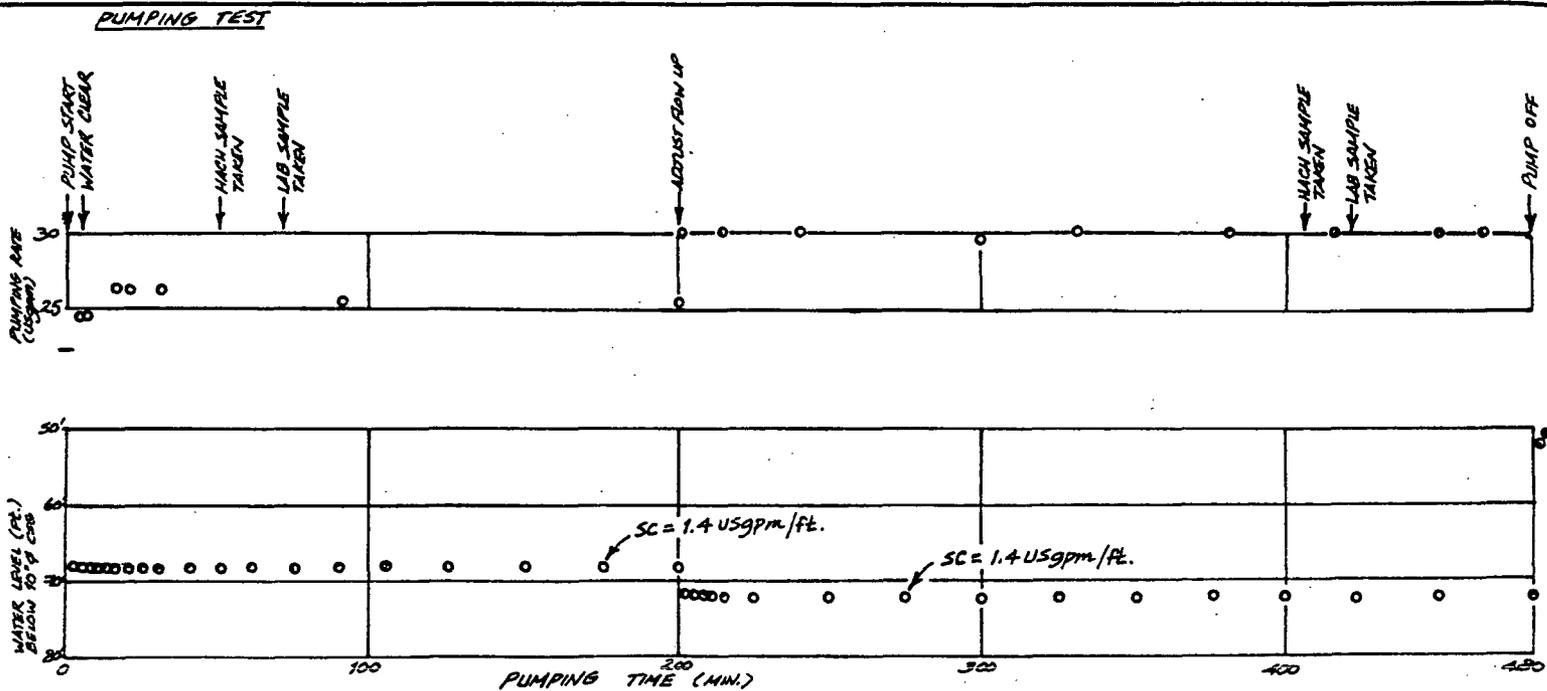
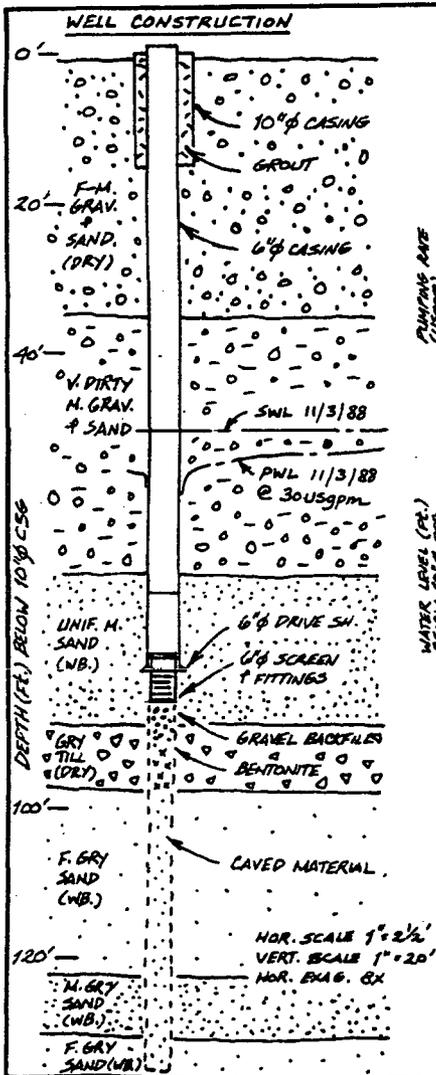
LOCATION PLAN, OBS. WELL No. 301, MATSQUI, B.C.

SCALE: VERT. N/A
 HOR. AS SHOWN

DATE
21/3/88

M. WEI ENGINEER

FILE No. 92611 #52 DWG No. FIGURE 2



CONTRACT No. 89

DRILLER: B. HALVORSEN + W. PERRY
PERRY'S WELL DRILLING

PUMPING TEST: AQUA-RO TESTING + EQUIP. LTD.

DATE OF WORK: MARCH 7-11, 1988

CONTRACT COST: \$6243.00

FIELD WATER QUALITY ANALYSES

SAMPLE	T(°C)	COND. (US/KM)	PH	PHEN. ALK. (MG/L)	M.O. AIR (MG/L)	NO. (MG/L)	NaCl (MG/L)	Fe (MG/L)	N (MG/L)
50 MIN. NACH	9	200	7.6	0	85	85	<12.5	≤0.5	6-7
405 MIN. NACH	9	185	7.6-7.7	0	85	85	<12.5	0.3	4-5



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

CONSTRUCTION + TESTING OF OBS. WELL No. 301, MATSQUI, B.C.

SCALE: VERT. AS SHOWN

HOR. AS SHOWN

DATE

17/3/88

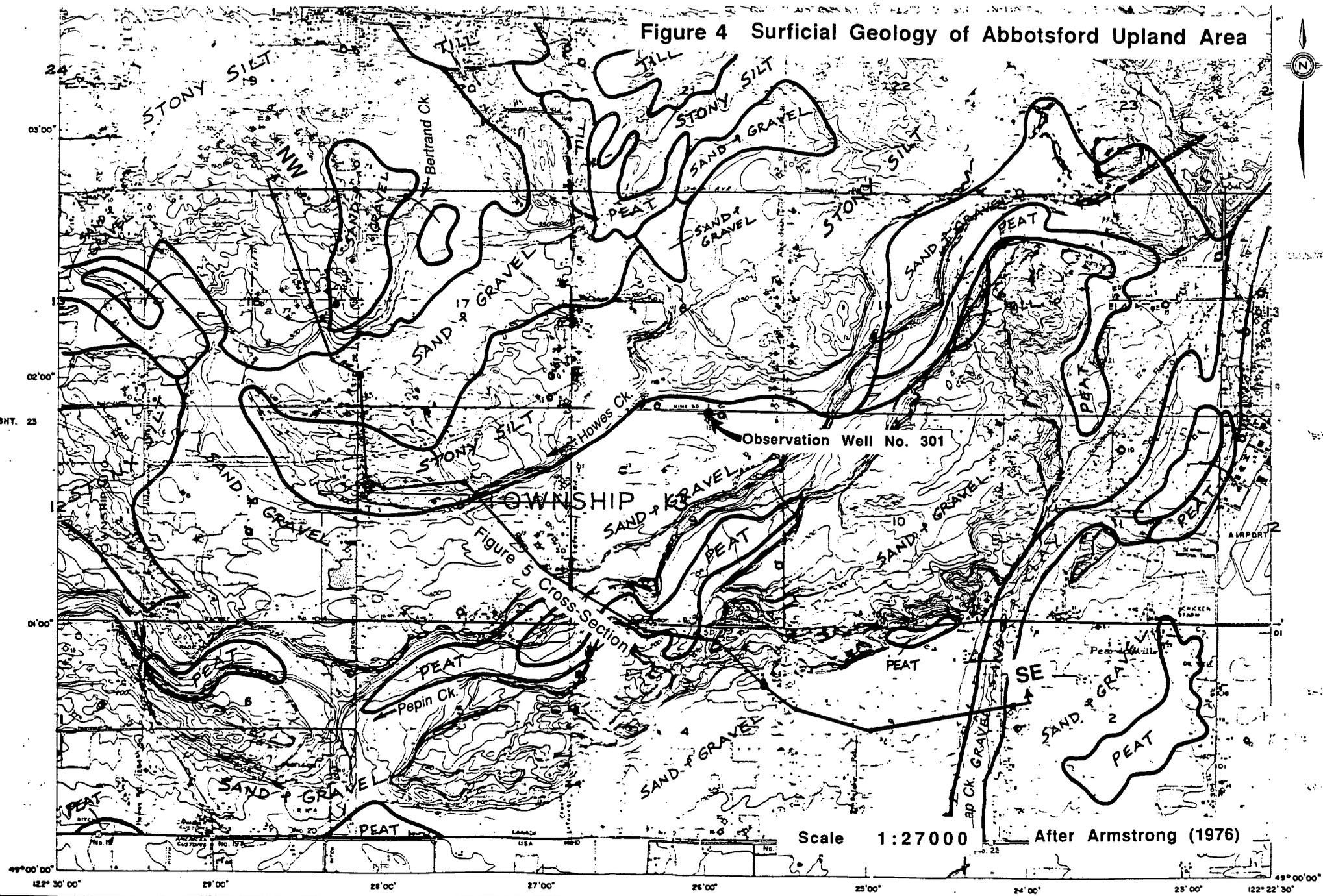
M. WEI

ENGINEER

FILE No. 920/1 #52

DWG No. FIGURE 3

Figure 4 Surficial Geology of Abbotsford Upland Area

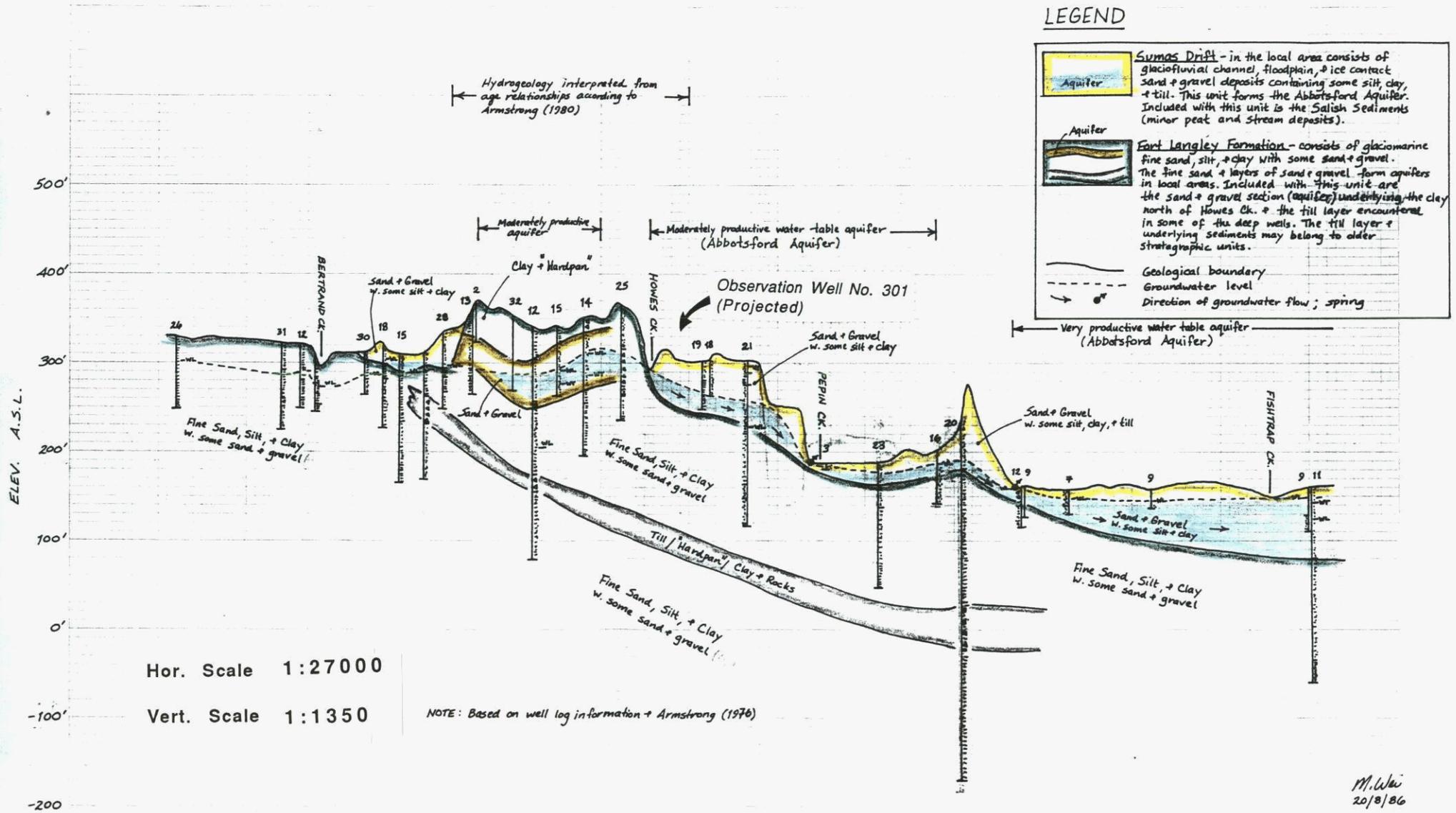


Interpretation of Hydrogeology Southeast of Aldergrove between Bertrand Ck. + Fishtrap Ck.

Figure 5

NW

SE

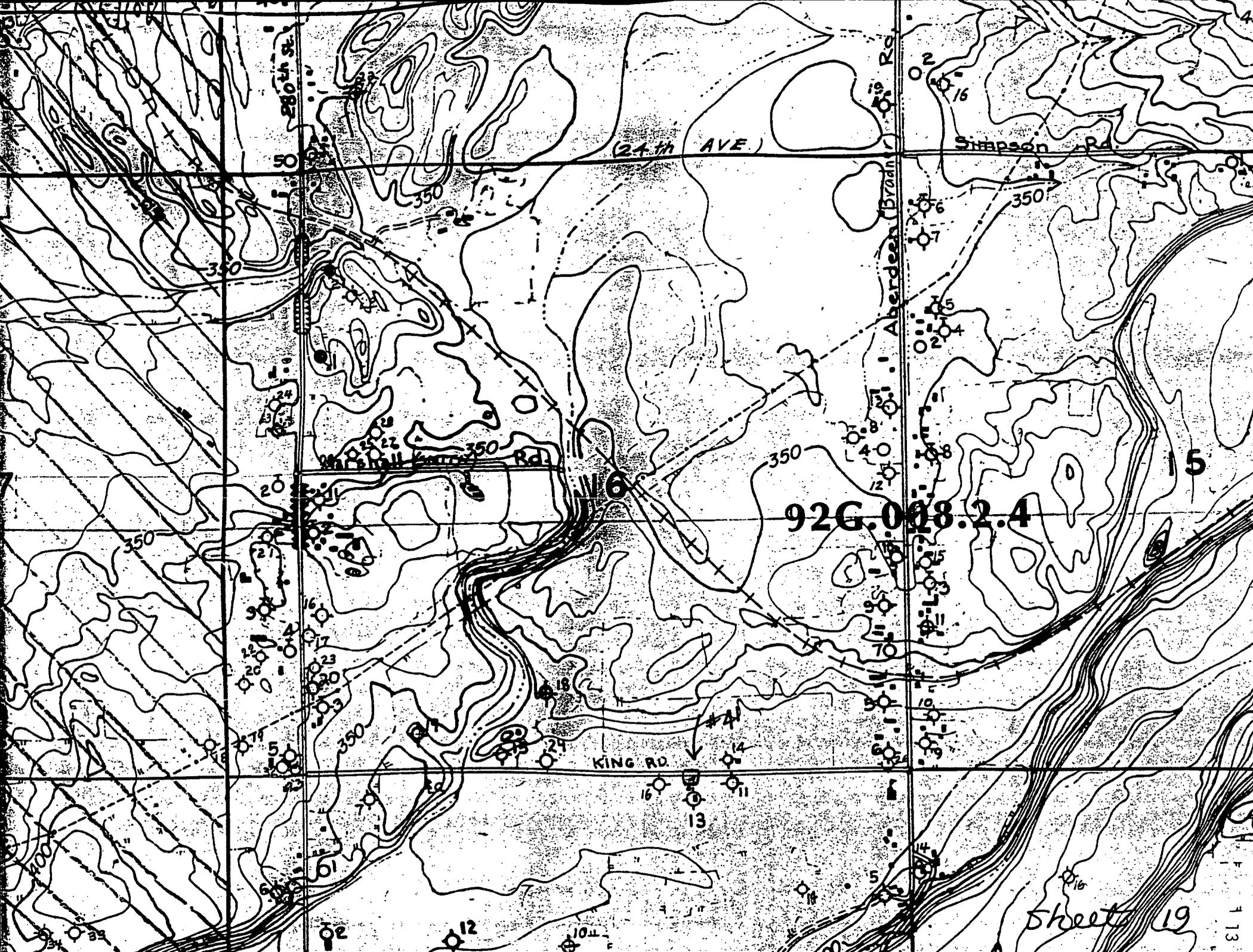


Appendix A

Well Record, Water level Recorder Installation Specifications,
Pumping Test data and plot, Recovery data and plot.

092G-008-2.4.1 #41

WATER WELL RECORD		WELL NO. <u>041</u>
MINISTRY OF ENVIRONMENT, WATER MANAGEMENT BRANCH		VICTORIA, BRITISH COLUMBIA
LEGAL DESCRIPTION: LOT <u>B</u> SEC. <u>9</u> TP. <u>13</u> R. _____ D.L. _____ LAND DISTRICT <u>NW</u> PLAN <u>15689</u>		E N
DESCRIPTIVE LOCATION <u>KING RD RR/WAY WEST OF BRAUER RD, MATSOUI B.C.</u> LICENCE NO. _____ DATE _____		Z X Y NO.
OWNER'S NAME <u>MINISTRY OF ENVIRONMENT</u> ADDRESS <u>VICTORIA B.C.</u>		NAT. TOPO. SHEET NO. _____
DRILLER'S NAME <u>Perry's Well Drilling</u> ADDRESS <u>Langley B.C.</u> DATE COMPLETED <u>Mar 988</u>		<u>SHEET NO. 19</u>
DEPTH <u>85.2</u> ELEVATION _____ OF _____ <input type="checkbox"/> ESTIMATED <input type="checkbox"/> SURVEYED CASING DIAM. <u>6"</u> LENGTH _____		PRODUCTION TEST SUMMARY
METHOD OF CONSTRUCTION <u>AIR ROTARY</u> CASING DIAM <u>10"</u> LENGTH <u>15'</u>		DATE <u>Mar 10/88</u>
SCREEN LOCATION <u>81.2-85.2</u> SCREEN <input checked="" type="checkbox"/> SIZE <u>20 SLOT</u> LENGTH <u>4'</u> TYPE <u>S.S.</u>		TEST BY <u>Agua 50</u>
SANITARY SEAL YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> SCREEN <input type="checkbox"/> SIZE _____ LENGTH _____ TYPE _____		BAIL TEST <input type="checkbox"/> PUMP TEST <input type="checkbox"/> DURATION OF TEST <u>8</u>
PERFORATED CASING <input type="checkbox"/> LENGTH _____ PERFORATIONS FROM _____ TO _____		RATE <u>30 USGPM</u> DRAWDOWN <u>21.0</u>
GRAVEL PACK <input type="checkbox"/> LENGTH _____ DIAM. _____ SIZE GRAVEL, ETC. _____		WATER LEVEL AT COMPLETION OF TEST <u>72.68</u>
DISTANCE TO WATER <u>51.65'</u> <input type="checkbox"/> ESTIMATED WATER LEVEL FROM <u>T.C.</u> <input type="checkbox"/> MEASURED ELEVATION _____ ARTESIAN PRESSURE _____		AVAILABLE DRAWDOWN _____ SPECIFIC CAPACITY _____
DATE OF WATER LEVEL MEASUREMENT <u>Mar 10</u> WATER USE <u>Observation Well</u>		PERMEABILITY _____ STORAGE COEFF. _____
CHEMISTRY		RECOMMENDED PUMPING RATE _____
TEST BY <u>Zenon Environmental Inc.</u> DATE _____		RECOMMENDED PUMP SETTING _____
TOTAL DISSOLVED SOLIDS _____ mg/l TEMPERATURE _____ °C PH _____ SILICA (SiO ₂) _____ mg/l		LITHOLOGY
CONDUCTANCE <u>µmhos/cm</u> AT 25°C TOTAL IRON (Fe) _____ mg/l TOTAL HARDNESS (CaCO ₃) _____ mg/l		FROM TO DESCRIPTION
TOTAL ALKALINITY (CaCO ₃) _____ mg/l PHEN. ALKALINITY (CaCO ₃) _____ mg/l MANGANESE (Mn) _____ mg/l		<u>0 6 SAND, BROWN</u>
COLOUR _____ ODOUR _____ TURBIDITY _____		<u>6 8 SAND GRAVEL</u>
ANIONS mg/l epm		<u>8 15 COARSE GRAVEL TO 4-INCH</u>
CATIONS mg/l epm		<u>15 29 COARSE GRAVEL</u>
CARBONATE (CO ₃) _____	CALCIUM (Ca) _____	<u>29 33 GRAVEL, SAND & SILT</u>
BICARBONATE (HCO ₃) _____	MAGNESIUM (Mg) _____	<u>33 42 GRAVEL SAND LESS SILT</u>
SULPHATE (SO ₄) _____	SODIUM (Na) _____	<u>42 45 GRAVEL COARSE</u>
CHLORIDE (Cl) _____	POTASSIUM (K) _____	<u>45 69 GRAVEL BROWN RINDER</u>
NO ₂ - NO ₃ (NITROGEN) _____	IRON (DISSOLVED) _____	<u>69 75 GRAVEL & SAND (W.B.)</u>
• TKN. (NITROGEN) _____		<u>75 86 GRAVEL & SAND (W.B.)</u>
PHOSPHORUS (P) _____		<u>86 105 SILT SAND GRAVEL CLAY LAYERS</u>
• TKN - TOTAL KJELDAHL NITROGEN	CHEMISTRY SITE NO. <u>E 207423</u>	<u>105 135 SAND GRAVEL (W.B.) GREY</u>
NO ₂ - NITRITE NO ₃ - NITRATE		
CHEMISTRY FIELD TESTS		
TEST BY _____ DATE _____ EQUIPMENT USED _____		
CONTENTS OF FOLDER		
<input type="checkbox"/> DRILL LOG	<input type="checkbox"/> PUMP TEST DATA	<input type="checkbox"/> CHEMICAL ANALYSIS
<input type="checkbox"/> SIEVE ANALYSIS	<input type="checkbox"/> GEOPHYSICAL LOGS	<input type="checkbox"/> REPORT
OTHER _____		
SOURCES OF INFORMATION _____		



(24th AVE.)

Simpson Rd.

Aberdeen Braemar Rd.

280th St.

Marshall Rd.

KING RD

926.008.2.4

Sheet 19

113

7

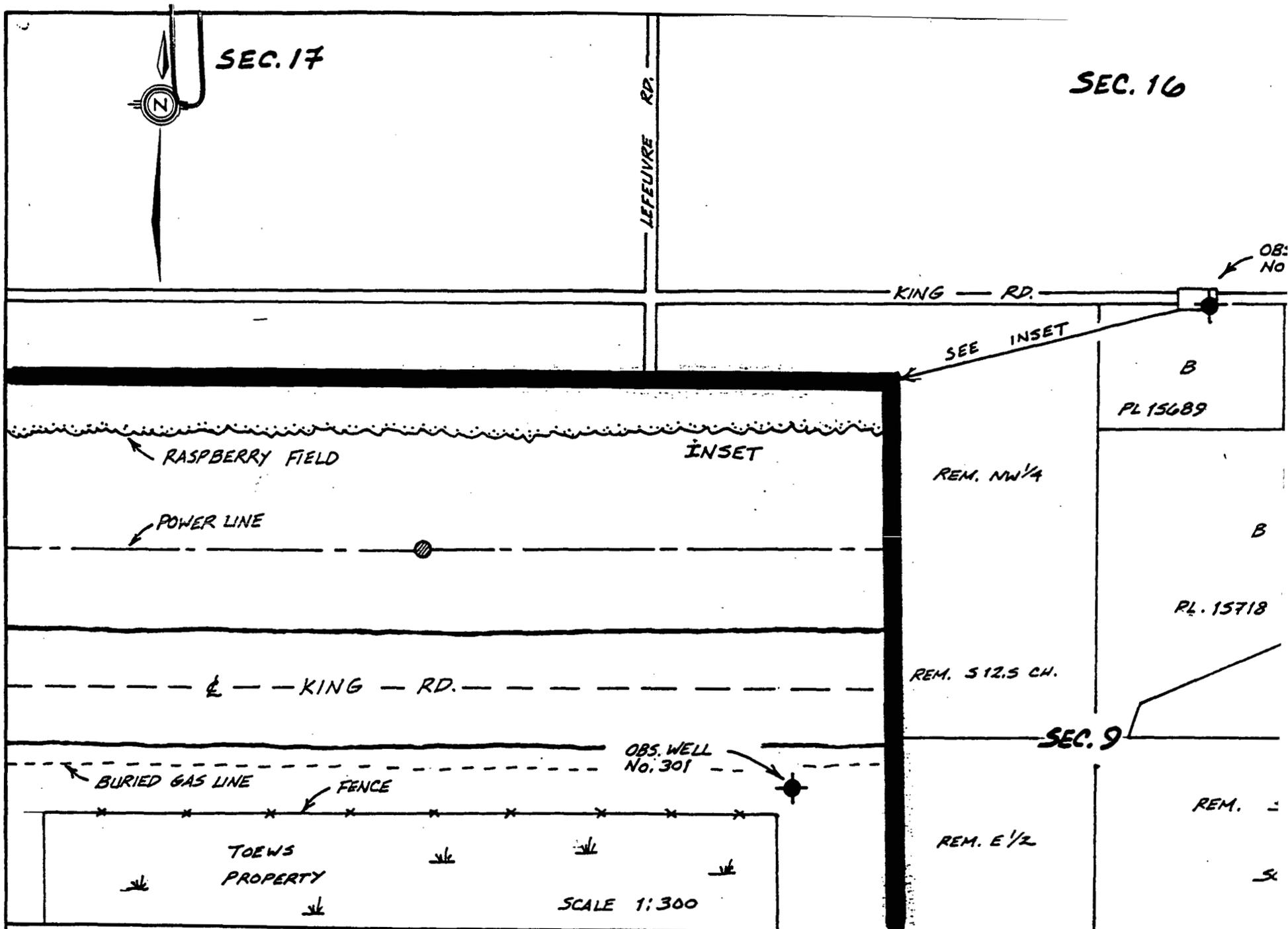
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Province of British Columbia
 Ministry of Environment
 WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

LOCATION PLAN, OBS. WELL No. 301, MATSQUI, B.C.

SCALE: VE
 HC
 FILE No..



Province of
British Columbia

Ministry of
Environment
and Parks
WATER MANAGEMENT
BRANCH

MEMORANDUM

To: W.S. Hodge
Senior Technician
Groundwater Section

Date: April 18, 1988

Our File: 0183613-B-301

Re: Establishment of Observation Well No. 301
MATSQUI, B.C.

On April 12, 1988, a Stevens water level recorder was installed on the recently drilled observation well in Matsqui. This well was drilled under government Contract No. 89 - "Drilling, Construction and Testing of One Groundwater Observation Well in Matsqui, British Columbia". This well is located on the King Road right of way west of Bradner Road in Matsqui (Figure 1). Permission to drill at this site was granted by the Corporation of the District of Matsqui.

The purpose of establishing this observation well is to monitor groundwater levels and water quality in this area. The level of nitrates in this area of the Fraser Valley is of particular interest.

Well Construction

Date Drilled	March 7 - 10, 1988
Well Depth	24.8m 26m
Well Diameter	152mm
Aquifer Description	Sand and Gravel
Static Water Level	15.7m
Drill Contractor	Perry's Well Drilling
Contract Cost	\$6,243.03

Recorder Installation Specifications

1	Aluminum Housing
1	Wood Recorder Stand with Pulley
1	Stevens Water Level Recorder with Quartz Clock
1	127mm Diameter Float
1	10m Length of Graduated Float Tape and Counterweight
1	Viro Lock
1	2:1 GAGE SCALE

W.S. Hodge
APR. 20/88

- 2 -

W.S. Hodge

April 18, 1988

Ground Level Datum Measurements (April 12, 1988)

Static Water Level to Pointer	16.506m
* Ground Level to Pointer	1.388m
Tape Reading	3.928m

* Ground level was established as the top of the 10 inch surface casing.

The correction factor to be applied to the tape reading is +11.190m.

Observer

Don Child of the Surrey Regional office will be changing recorder charts as part of the Lower Fraser Valley observation well network program.



Dave Kalyn
Technician
Groundwater Section
Water Management Branch

DK/sz
AES:W2612

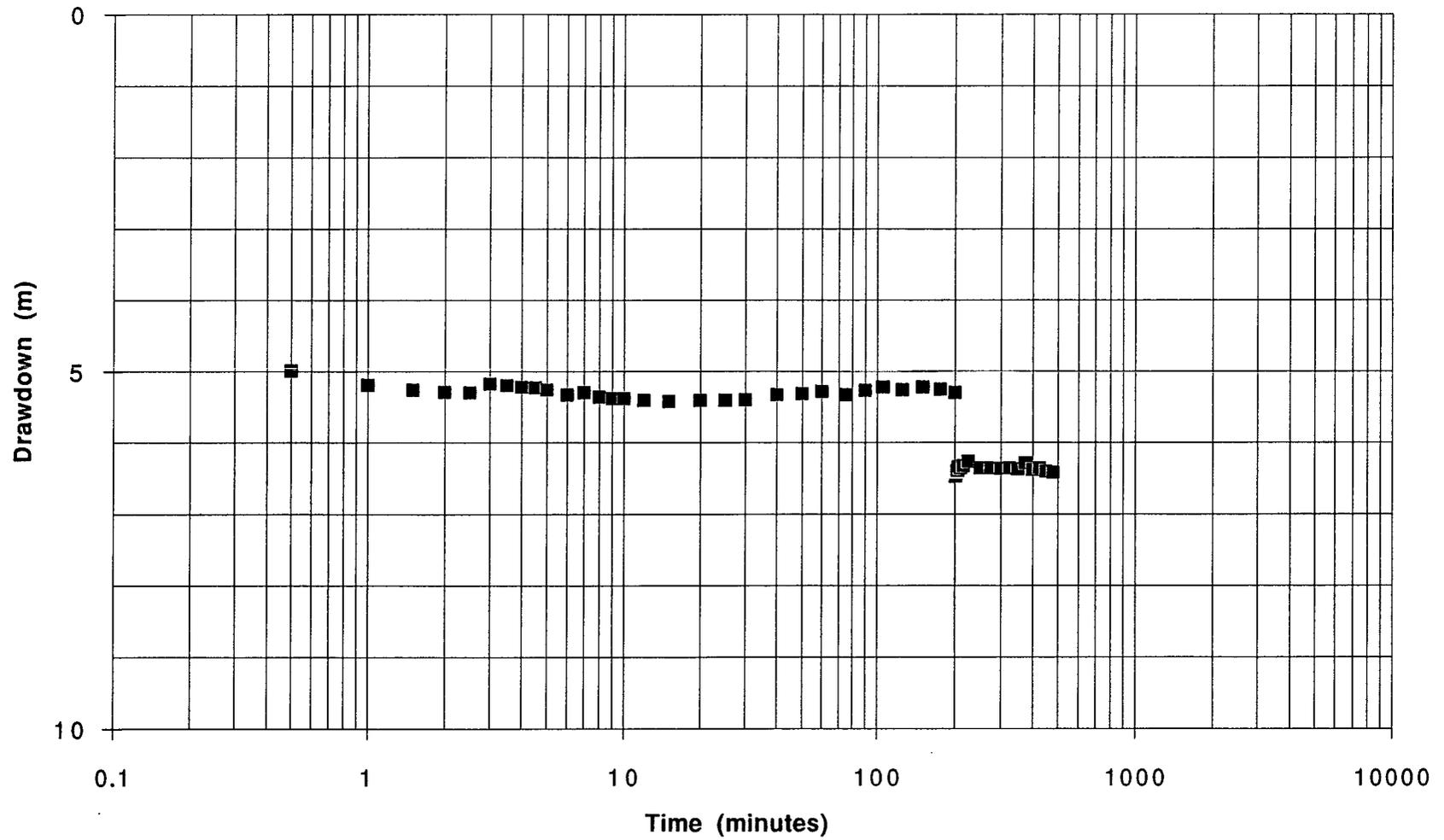
PUMPING TEST DATA

PROJECT: CONTRACT No. 89 WELL NO: OBS. WELL No. 301
 LOCATION: KING RD. - MATSQUI TEST: STEP-UP
 START OF TEST: 07:15 11/3/88 END: 15:15 11/3/88
 REFERENCE PT: 1.32 (ft) 0.402 (m) Above ~~Ground Level~~ 10"φ CASING
 PUMP SETTING: 78 (ft) 23.8 (m) Below Ref. Pt.
 STATIC WATER LEVEL: 51.65 (ft) 15.74 (m) Below Ref. Pt.

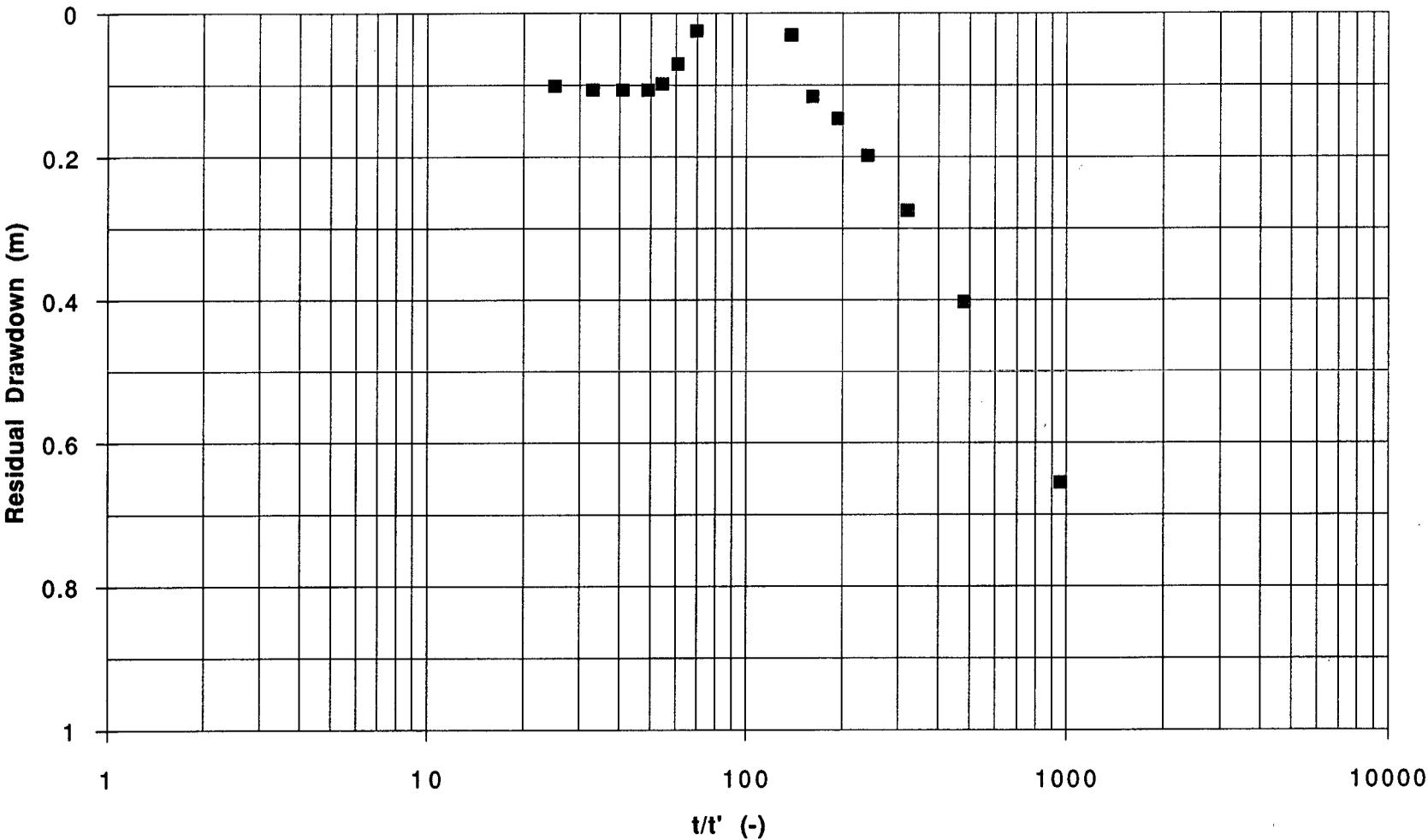
TIME	ELAPSED TIME (t) (min.)	WATER LEVEL (below Ref.Pt.)		DRAWDOWN		PUMPING RATE (USgpm)	ORIFICE HEAD (in.)	REMARKS
		(ft.)	(m)	(ft.)	(m)			
07:15 11/3/88	0	51.65	15.74	—		—	—	START PUMP
	1/2	68.00	20.73	16.35	4.98			
	1	68.65	20.92	17.00	5.18			
	1 1/2	68.88	20.99	17.23	5.25			
	2	68.98	21.03	17.33	5.28			
	2 1/2	69.00	21.04	17.35	5.29			
	3	68.60	20.91	16.95	5.17			
	3 1/2	68.68	20.93	17.03	5.19			
	4	68.75	20.96	17.10	5.21	24.4		
	4 1/2	68.78	20.97	17.13	5.22			
	5	68.89	20.99	17.24	5.25			WATER CLEAR
	6	69.11	21.06	17.46	5.32	25.4		
	7	69.02	21.04	17.37	5.29			PH=7.6 T=9°C
	8	69.22	21.10	17.57	5.36			
	9	69.28	21.11	17.63	5.37			
	10	69.28	21.11	17.63	5.37			
	12	69.35	21.13	17.70	5.39			
	15	69.42	21.16	17.77	5.42	26.4		
	20	69.37	21.14	17.72	5.40	26.4		PH=7.6 T=9°C
	25	69.37	21.14	17.72	5.40			

PUMPING TEST DATA - (CONT'D.)							PAGE <u>2</u> OF <u>4</u>	
TIME	ELAPSED TIME (t) (min.)	WATER LEVEL (below Ref.Pt.)		DRAWDOWN		PUMPING RATE (USgpm)	ORIFICE HEAD (in.)	REMARKS
		(ft.)	(m)	(ft.)	(m)			
	30	69.33	21.13	17.68	5.39	26.4		PH=7.6 T=9°C C=200µS/cm
	40	69.10	21.06	17.45	5.32			
	50	69.07	21.05	17.42	5.31			HACH SAMPLE TAKEN @ 50 MINS.
	60	68.95	21.02	17.30	5.27			
	75	69.10	21.06	17.45	5.32			LAB SAMPLE TAKEN @ 70 MINS.
	90	68.90	21.01	17.25	5.26	25.4		
	105	68.75	20.96	17.10	5.21			
	125	68.88	20.99	17.23	5.25			
	150	68.77	20.97	17.12	5.22			
	175	68.86	20.99	17.21	5.25			
	200	69.00	21.03	17.35	5.29	25.4		ADJUST FLOW UP
	201	72.97	22.21	21.22	6.47	30.0		
	202	72.73	22.17	21.08	6.43			
	203	72.68	22.15	21.03	6.41			
	204	72.63	22.14	20.98	6.39			
	205	72.61	22.14	20.96	6.39			
	207	72.43	22.08	20.78	6.33			
	210	72.50	22.10	20.85	6.36			
	215	72.40	22.07	20.75	6.32	30.0		
	225	72.20	22.01	20.55	6.26			
	250	72.50	22.10	20.85	6.36	30.0		PH=7.6-7.7 (240 MINS.) T=9°C C=200µS/cm
	275	72.48	22.09	20.83	6.35			
	300	72.52	22.10	20.87	6.36	29.0		
	325	72.50	22.10	20.85	6.35	30.0		PH=7.6-7.7 (330 MINS.) T=9°C C=180µS/cm
	350	72.54	22.12	20.89	6.37			
	375	72.26	22.02	20.61	6.28	30.0		PH=7.6-7.7 (380 MINS.) T=9°C C=185µS/cm
	400	72.57	22.12	20.92	6.38			HACH SAMPLE TAKEN @ 405 MINS.

. Drawdown Data-Obs. well No. 301



Recovery Data-Obs Well 301, March 11/88



Appendix B

Field Water Quality Analysis and Laboratory Water Quality Analysis

Field Water Quality Analysis

Well Obs. Well No. 301 Location Matoqui

Date and Time of Sampling 8:05am 11/3/88

Method of Sampling Collect from discharge after 50 mins of pumping 26 USgpm

Sampling Zone 85.25 - 81.1'

Notes _____

- * rinse all tubes and bottles 3 x w. sample or distilled water
- * dropper vert. when titrating and added drop x drop while swirling

Color X Turbid X Odor X

Evid. of any Gas X Taste ✓ good.

- * leave thermo. in for 1± min.

T°C 9 Cond. 200 $\mu\text{mhos/cm}$
@ 25°C

TDS \approx _____ x Cond = _____ mg/L

pH

- fill both glass tubes to mark
- 6 drops Wide Range pH Ind.
- Compare w. color disc.

pH = 7.6 probe.

Alkalinity

High Range

- fill plastic tube & pour in bottle
- 1 phenolphthalein
- if pink, titrate w. Sulfuric Acid 0.03N

Phen. Alk = 0 drops x 17.1 = 0 mg/L

- 1 Brom Cresol Green Methyl Red & swirl
- titrate w. Sulfuric Acid 0.03N

M.O. Alk = 5+ total drops x 17.1 = _____ mg/L

Low Range

- fill bottle to 15 ml
- 1 phenolphthalein
- if pink, titrate w. Sulfuric Acid 0.03N

Phen. Alk = _____ drops x 6.8 = _____ mg/L

- 1 Brom Cresol Green Methyl Red & swirl
- titrate w. Sulfuric Acid 0.03N

M.O. Alk = _____ total drops x 6.8 = _____ mg/L

$[HCO_3^-]$ = 1.22 x (M.O. Alk - (2 Phen Alk)) = _____ mg/L

$[CO_3^{2-}]$ = 1.20 x Phen. Alk = _____ mg/L

Hardness

- fill plastic tube & pour in bottle
- 3 drops Hardness 1 Solution
- 1 or 2 drops Hardness 2 Solution
- titrate w. Hardness 3 Solution

Hardness (CaCO₃) = 5 drops x 17.1 = _____ mg/L

Chloride

High Range

- fill plastic tube & pour in bottle
- 1 Chloride Indicator
- titrate w. Chloride Titrant

NaCl = _____ drops x 50 = _____ mg/L

Low Range

- fill bottle to 23 ml
- 1 Chloride Indicator
- titrate w. Chloride Titrant

NaCl = < 1 drops x 12.5 = _____ mg/L

$[Cl^-]$ = NaCl x 0.606 = _____ mg/L

Iron

- fill glass tubes to mark
- 1 Ferro Ver
- compare w. color disc

Fe = ≤ 0.15 _____ mg/L

- Fe diss. - color instant
- Fe part. - 1 → 2 min. for color
- minimize Fe part. - let water settle
- if Fe ≥ 5 mg/l, dilute sample & retest

Nitrate - 6-7 mg/L

MWA

Field Water Quality Analysis

Well Matoqui Obs Well #301 Location Matoqui

Date and Time of Sampling 2:00 pm 11/3/88

Method of Sampling Collect from disch. after 405 mins pumping at 25-30 USgpm

Sampling Zone 85.25 - 81'

Notes _____

- * rinse all tubes and bottles 3 x w. sample or distilled water
- * dropper vert. when titrating and added drop x drop while swirling

Color X Turbid X Odor X

Evid. of any Gas X Taste ✓ good

- leave thermo. in for 1± min.

T°C 9 Cond. 185 umhos/cm @ 25°C

TDS ≈ _____ x Cond = _____ mg/L

pH

- fill both glass tubes to mark
- 6 drops Wide Range pH Ind.
- Compare w. color disc.

pH = 7.6-7.7 ^{purple}

Alkalinity

High Range

- fill plastic tube & pour in bottle
- 1 phenolphthalein
- if pink, titrate w. Sulfuric Acid 0.03N

Phen. Alk = 0 drops x 17.1 = 0 mg/L

- 1 Brom Cresol Green Methyl Red & swirl
- titrate w. Sulfuric Acid 0.03N

M.O. Alk = 5 total drops x 17.1 = _____ mg/L

Low Range

- fill bottle to 15 ml
- 1 phenolphthalein
- if pink, titrate w. Sulfuric Acid 0.03N

$$\text{Phen. Alk} = \underline{\hspace{2cm}} \text{ drops} \times 6.8 = \underline{\hspace{2cm}} \text{ mg/L}$$

- 1 Brom Cresol Green Methyl Red & swirl
- titrate w. Sulfuric Acid 0.03N

$$\text{M.O. Alk} = \underline{\hspace{2cm}} \text{ total drops} \times 6.8 = \underline{\hspace{2cm}} \text{ mg/L}$$

$$[\text{HCO}_3^-] = 1.22 \times (\text{M.O. Alk} - (2 \text{ Phen Alk})) = \underline{\hspace{2cm}} \text{ mg/L}$$

$$[\text{CO}_3^{2-}] = 1.20 \times \text{Phen. Alk} = \underline{\hspace{2cm}} \text{ mg/L}$$

Hardness

- fill plastic tube & pour in bottle
- 3 drops Hardness 1 Solution
- 1 or 2 drops Hardness 2 Solution
- titrate w. Hardness 3 Solution

$$\text{Hardness (CaCO}_3) = \underline{5} \text{ drops} \times 17.1 = \underline{\hspace{2cm}} \text{ mg/L}$$

ChlorideHigh Range

- fill plastic tube & pour in bottle
- 1 Chloride Indicator
- titrate w. Chloride Titrant

$$\text{NaCl} = \underline{\hspace{2cm}} \text{ drops} \times 50 = \underline{\hspace{2cm}} \text{ mg/L}$$

Low Range

- fill bottle to 23 ml
- 1 Chloride Indicator
- titrate w. Chloride Titrant

$$\text{NaCl} = \underline{< 1} \text{ drops} \times 12.5 = \underline{\hspace{2cm}} \text{ mg/L}$$

$$[\text{Cl}^-] = \text{NaCl} \times 0.606 = \underline{\hspace{2cm}} \text{ mg/L}$$

Iron

- fill glass tubes to mark
- 1 Ferro Ver
- compare w. color disc

$$\text{Fe} = \underline{0.3} \text{ mg/L}$$

- Fe diss. - color instant
- Fe part. - 1 → 2 min. for color
- minimize Fe part. - let water settle
- if Fe ≥ 5 mg/l, dilute sample & retest

Nitrate = 4⁵ mg/L

30-Aug-88

MINISTRY OF ENVIRONMENT AND PARKS

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ENVIRONMENTAL LABORATORY

Report for form 00411656

SEP 28 1988

Groundwater (DL)-Water Program

ATTN: KALYN D J

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

Submitted by (44954) KALYN D J

Address (16) Water Management Branch
Groundwater Section
4th Floor, 765 Broughton Street
Victoria, BC V8V 1X5

Phone No. 387-1115

Audit Sample ()
Client study reference code ()
Sampling agency code (14)

SEAM Comments: START OF TEST
70 MINS

Site (E207423) FRASER VALLEY OBS. WELL NO. 301

Sample Adjective ()
Sample State (FW) Fresh Water
Sample Descriptor (GE) General

This form was processed to the computer on 15-MAR-1988 as REGULAR
The cost for analyzing samples for this form is

Routine analysis:	\$	118.80
Special analysis:	\$	0.00

Total	\$	118.80

ENVIRONMENTAL LABORATORY

Report for form 00411656

Groundwater (DL)-Water Program

ATTN: KALYN D J

Sample 87021235

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

From : 88/03/13:1310

To : 88/03/13:1310

Depth Range : 26.0 26.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Hardness Dissolved	90.3	mg/L	Calculated Result (1107CALC/--/--)
Arsenic	0.003	mg/L	HCl/K2S2O8, Hydride; ICP (As-T0181/05/02)
Calcium	22.7	mg/L	HNO3 Dig: ICP Analysis (Ca-T0040/05/02)
Cadmium	< 0.01	mg/L	HNO3 Dig: ICP Analysis (Cd-T0040/05/02)
Cobalt	< 0.1	mg/L	HNO3 Dig: ICP Analysis (Co-T0040/05/02)
Chromium	< 0.01	mg/L	HNO3 Dig: ICP Analysis (Cr-T0040/05/02)
Copper	< 0.01	mg/L	HNO3 Dig: ICP Analysis (Cu-T0040/05/02)
Iron	0.15	mg/L	HNO3 Dig: ICP Analysis (Fe-T0040/05/02)
Magnesium	8.30	mg/L	HNO3 Dig: ICP Analysis (Mg-T0040/05/02)
Manganese	0.02	mg/L	HNO3 Dig: ICP Analysis (Mn-T0040/05/02)
Molybdenum	< 0.01	mg/L	HNO3 Dig: ICP Analysis (Mo-T0040/05/02)
Nickel	< 0.05	mg/L	HNO3 Dig: ICP Analysis (Ni-T0040/05/02)
Lead	< 0.1	mg/L	HNO3 Dig: ICP Analysis (Pb-T0040/05/02)
Vanadium	< 0.01	mg/L	HNO3 Dig: ICP Analysis (V--T0040/05/02)

ENVIRONMENTAL LABORATORY

Report for form 00411656

Groundwater (DL)-Water Program

ATTN: KALYN D J

Sample 87021235

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

From : 88/03/13: 1310

To : 88/03/13: 1310

Depth Range : 26.0 26.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Zinc	0.01	mg/L	HNO3 Dig: ICP Analysis (Zn-T0040/05/02)
Arsenic Dissolved	0.003	mg/L	HCl/K2S2O8, Hydride; ICP (As-D0181/05/13)
Boron Dissolved	0.02	mg/L	ICP Analysis (B--D0030/05/13)
Barium Dissolved	0.06	mg/L	ICP Analysis (Ba-D0030/05/13)
Calcium Dissolved	22.6	mg/L	ICP Analysis (Ca-D0030/05/13)
Cadmium Dissolved	< 0.01	mg/L	ICP Analysis (Cd-D0030/05/13)
Cobalt Dissolved	< 0.1	mg/L	ICP Analysis (Co-D0030/05/13)
Chromium Dissolved	< 0.01	mg/L	ICP Analysis (Cr-D0030/05/13)
Copper Dissolved	< 0.01	mg/L	ICP Analysis (Cu-D0030/05/13)
Iron Dissolved	0.07	mg/L	ICP Analysis (Fe-D0030/05/13)
Magnesium Dissolved	8.22	mg/L	ICP Analysis (Mg-D0030/05/13)
Manganese Dissolved	0.02	mg/L	ICP Analysis (Mn-D0030/05/13)
Molybdenum Dissolved	< 0.01	mg/L	ICP Analysis (Mo-D0030/05/13)
Nickel Dissolved	< 0.05	mg/L	ICP Analysis (Ni-D0030/05/13)

30-Aug-88

MINISTRY OF ENVIRONMENT AND PARKS

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ENVIRONMENTAL LABORATORY

SEP 28 1988

Report for form 00411&56

Groundwater (DL)-Water Program

ATTN: KALYN D J

Sample 87021235

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

From : 88/03/13: 1310

To : 88/03/13: 1310

Depth Range: 26.0 26.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Lead Dissolved	< 0.1	mg/L	ICP Analysis (Pb-D0030/05/13)
Vanadium Dissolved	< 0.01	mg/L	ICP Analysis (V--D0030/05/13)
Zinc Dissolved	0.01	mg/L	ICP Analysis (Zn-D0030/05/13)

30-Aug-88

MINISTRY OF ENVIRONMENT AND PARKS

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ENVIRONMENTAL LABORATORY

Report for form 00411655

SEP 28 1988

Groundwater (DL)-Water Program

ATTN: KALYN D J

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

Submitted by (44954) KALYN D J

Address (16) Water Management Branch
Groundwater Section
4th Floor, 765 Broughton Street
Victoria, BC V8V 1X5

Phone No. 387-1115

Audit Sample ()
Client study reference code ()
Sampling agency code (14)

SEAM Comments: END OF TEST
420 MINS

Site (E207423) FRASER VALLEY OBS. WELL NO. 301

Sample Adjective ()
Sample State (FW) Fresh Water
Sample Descriptor (GE) General

This form was processed to the computer on 15-MAR-1988 as REGULAR
The cost for analyzing samples for this form is

Routine analysis:	\$	118.80
Special analysis:	\$	0.00

Total	\$	118.80

ENVIRONMENTAL LABORATORY

Report for form 00411655

Groundwater (DL)-Water Program

ATTN: KALYN D U

Sample 87021236

Site: E207423 FRASER VALLEY OBS. WELL NO. 201

From : 88/03/13:1310

To : 88/03/13:1310

Depth Range 26.0 26.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Hardness Dissolved	84.6	mg/L	Calculated Result (1107CALC/--/--)
Arsenic	0.002	mg/L	HCl/K2S2O8, Hydride; ICP (As-T0181/05/02)
Calcium	21.2	mg/L	HNO3 Dig; ICP Analysis (Ca-T0040/05/02)
Cadmium	< 0.01	mg/L	HNO3 Dig; ICP Analysis (Cd-T0040/05/02)
Cobalt	< 0.1	mg/L	HNO3 Dig; ICP Analysis (Co-T0040/05/02)
Chromium ()	< 0.01	mg/L	HNO3 Dig; ICP Analysis (Cr-T0040/05/02)
Copper	< 0.01	mg/L	HNO3 Dig; ICP Analysis (Cu-T0040/05/02)
Iron	0.09	mg/L	HNO3 Dig; ICP Analysis (Fe-T0040/05/02)
Magnesium	7.80	mg/L	HNO3 Dig; ICP Analysis (Mg-T0040/05/02)
Manganese	0.01	mg/L	HNO3 Dig; ICP Analysis (Mn-T0040/05/02)
Molybdenum	< 0.01	mg/L	HNO3 Dig; ICP Analysis (Mo-T0040/05/02)
Nickel	< 0.05	mg/L	HNO3 Dig; ICP Analysis (Ni-T0040/05/02)
Lead	< 0.1	mg/L	HNO3 Dig; ICP Analysis (Pb-T0040/05/02)
Vanadium	< 0.01	mg/L	HNO3 Dig; ICP Analysis (V--T0040/05/02)

ENVIRONMENTAL LABORATORY

Report for form CO411655

Groundwater (DL)-Water Program

ATTN: KALYN D U

Sample B7021235

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

From : 88/03/07:1310

To : 88/03/13:1310

Depth Range : 26.0 28.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Zinc	0.01	mg/L	HNO3 Dig: ICP Analysis (Zn-T0040/05/02)
Arsenic Dissolved	0.002	mg/L	HCl/K2S2O8, Hydride: ICP (As-D0181/05/13)
Boron Dissolved	< 0.01	mg/L	ICP Analysis (B--D0030/05/13)
Barium Dissolved	0.06	mg/L	ICP Analysis (Ba-D0030/05/13)
Calcium Dissolved	21.1	mg/L	ICP Analysis (Ca-D0030/05/13)
Cadmium Dissolved	< 0.01	mg/L	ICP Analysis (Cd-D0030/05/13)
Cobalt Dissolved	< 0.1	mg/L	ICP Analysis (Co-D0030/05/13)
Chromium Dissolved	< 0.01	mg/L	ICP Analysis (Cr-D0030/05/13)
Copper Dissolved	< 0.01	mg/L	ICP Analysis (Cu-D0030/05/13)
Iron Dissolved	0.05	mg/L	ICP Analysis (Fe-D0030/05/13)
Magnesium Dissolved	7.75	mg/L	ICP Analysis (Mg-D0030/05/13)
Manganese Dissolved	0.01	mg/L	ICP Analysis (Mn-D0030/05/13)
Molybdenum Dissolved	< 0.01	mg/L	ICP Analysis (Mo-D0030/05/13)
Nickel Dissolved	< 0.05	mg/L	ICP Analysis (Ni-D0030/05/13)

30 Aug 88

MINISTRY OF ENVIRONMENT AND PARKS

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ENVIRONMENTAL LABORATORY

Report for form 00411653

SEP 28 1988

Groundwater (DL)-Water Program

ATTN: KALYN D J

Sample 67021236

Site: E207423 FRASER VALLEY OBS. WELL NO. 301

From : 88/03/12:1310

To : 88/03/13:1310

Depth Range : 26.0 26.0

Tide :

Sample State: Fresh Water

Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
Lead Dissolved	< 0.1	mg/L	ICP Analysis (Pb-D0030/05/13)
Vanadium Dissolved	< 0.01	mg/L	ICP Analysis (V--D0030/05/13)
Zinc Dissolved	0.01	mg/L	ICP Analysis (Zn-D0030/05/13)