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Domestic Well No 3
T.W. No 6

GROUNDWATER DEVELOPMENT
HATCH POINT, B.C.
FOR
CRC CANADIAN RETIREMENT CORPORATION
AND
APLIN & MARTIN ENGINEERING LTD.

HATCH POINT DOMESTIC WELL NO. 3

By

W.L. Brown, P. Eng.

August, 1988

1.0 INTRODUCTION

1.1 Location - Hatch Point Domestic Well No. 3 is located 60 m west of Ratcliff Road and 180 m north of Hutchinson Road. Please see well location map, Fig. 1.

1.2 Drilling and Testing - The construction of Domestic Well No. 3 started on June 30 and finished on July 19, 1988. A constant rate pump test was conducted on August 10 and 11, 1988.

2.0 HYDROGEOLOGY (Please see Isometric Diagram, Fig. 2 attached)

2.1 Bedrock - Domestic Well No. 3 was drilled to granitic bedrock at a depth of 53.95 m. Granitic bedrock was also encountered in Domestic Wells No. 1 and 2 and sandstone was encountered in Irrigation Well No. 1. Thus the fault that forms the contact between the granitic and sandstone rocks trends in a northwesterly direction which is most probably coincident with the topographic grain of the country.

2.2 Unconsolidated Sediments - Sands and sand and gravel with one thin silt bed were drilled to a depth of 43.28 metres where a clay was encountered.

3.0 WELL CONSTRUCTION

Domestic Well No. 3 was drilled by a cable tool rig.

Reference to the well log attached will show that the well is cased with 305 mm diameter casing to a depth of 37.80 m. A screen assembly consisting of a 178 mm diameter riser 1.52 m long, a 4.57 m length of stainless steel, 10 slot, 203 telescopic diameter well screen and a 3.05 m long, 178 mm diameter sump is set between depths of 37.19 and 46.33 m. The screen was developed by bailing.

4.0 PUMP TESTING

A constant rate pump test was conducted on Domestic Well No. 3 during August 10/12, 1988 at a discharge rate of 164 m^3/day (25 I gpm). Drawdown water level readings were taken and recorded during a 2,900 minute (slightly over two day) period of pumping and recovery water level measurements were recorded for 60 minutes after pumping stopped. The water levels in Irrigation Wells No. 1 and No. 2 were measured and recorded during the pumping of Domestic Well

No. 3. Reference to the pump test data well shows that the water levels in these two wells rose 2.830 and 0.175 metres respectively during the test. Unfortunately, these two wells could only be shut-off just before the test started. However, these readings indicate that interference between Domestic Well No. 3 and these irrigation wells is insignificant. Reference to Fig. 2 will show that interference between Irrigation Well No. 1 and Domestic Well No. 3 would not be expected. Minor interference between Domestic Well No. 3 and Irrigation Well No. 2 could be expected.

Please see the details of the pump test, the log of the well and the semi-log plots of the drawdown and recovery readings. The transmissivity of the last leg of the drawdown plot at 53 m^2/day (4,200 U.S. gpd/ft) is considered realistic. This figure is lower than the 76 to 100 m^2/day (6,000 to 8,000 U.S. gpd/ft) transmissivity figures calculated from the pump tests run on Domestic Wells No. 1 and No. 2.

The water level in Domestic Well No. 3 reached near stabilization at a depth of 32.70 meters between 900 and 1,300 minutes of pumping. This is 6.01 metres above the top of the well screen at a depth of 38.71 metres. The discharge rate fluctuated and was increased at 1400 minutes. This increase with a probable interference from a neighbouring well caused a water level drop of approximately 0.458 m. The well was again trending towards stabilization when the pump test was stopped.

Based upon available information we judge that Domestic Well No. 3 has a safe productive capacity of 260 m^3/day (40 I gpm).

The production pump should be "shrouded" and set in the sump below the screen to allow the water level to be drawndown to the top of the screen. The pump should be capable of discharging at a rate of 260 m^3/day (40 I gpm) from a water level depth of 38 m with the pump suction at a depth of 44 m. The total dynamic head of the pump should be 38 m plus the system pressure.

5.0 WATER QUALITY

A sample of water was collected prior to the end of the pump test and was sent to a commercial laboratory for

chemical analysis. Please see chemist's report attached. This water should have been similar to the waters from the other wells.

Reference to the chemist's reports will show the following:

Domestic Well Number	Total (mg/l)		Dissolved (mg/l)	
	Iron	Manganese	Iron	Manganese
1	0.30	0.05	less than 0.03	0.050
2	0.30	0.05	less than 0.03	0.011
3	1.63	0.23	less than 0.03	0.210

The chemist's report on the water from Domestic Well No. 3 indicates that the iron is contained in the suspended solids which have a concentration of 2.0 mg/l. The filtered sample has a concentration of dissolved iron of less than 0.03. Further pumping which should decrease the suspended solid concentration should also decrease the total iron content to less than 0.30. The chemist's report notes that the limits for iron and manganese are set in the drinking water guidelines for aesthetic reasons and not physiological reasons.

6.0 RECOMMENDATIONS AND CONCLUSIONS

6.1 Based upon presently available information the safe productive capacity of Domestic Well No. 3 is 260 m^3/day (40 I gpm).

6.2 This well should **NOT** be

overpumped
vibrated
raw-hided

6.3 The new concrete cribbings that will be constructed around Domestic Well No. 3 will change the datum of the measuring point from that used on the well logs and pump tests attached to this report. The relationship between the original ground surface and the new top of cribbings should be established and recorded.

6.7 Water level measurements should be made and recorded in all wells during the first five years of operation. These records should be reviewed by the writer once a year.

CHEMICAL ANALYSIS REPORT

Date: August 26, 1988

File No. 6120A

Report On: Water Sample From Arbutus Ridge

Report To: Brown Erdman & Turner Ltd.
1409 Bewicke Avenue
North Vancouver, B. C.
V7M 2W0

DATE OF SUBMISSION:

August 16, 1988

SAMPLE IDENTIFICATION

Labelled as shown in RESULTS section.

METHODOLOGY

Analysed in accordance with "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, 1985.

RESULTS OF ANALYSIS

Results are presented in the table(s) attached.

analytical service laboratories ltd.
CONSULTING CHEMISTS & ANALYSTS
1650 Pandora Street
Vancouver, B.C. • V5L 1L6
Fax (604) 253-6700 • Tel. (604) 253-4188

REMARKS

The water as represented by the sample submitted can be characterized as moderate with respect to dissolved mineralization.

The water sample met drinking water guidelines for all parameters analysed with the exception of iron and manganese. These parameter are limited for aesthetic purposes (i.e., appearance, taste, etc.) rather than health considerations. Their presence would likely cause a "metallic" taste.

ASL ANALYTICAL SERVICE LABORATORIES LTD.

A. W. Maynard, M.Sc.
Senior Partner

Barbara Szczachor, B.Sc.

BS/AWM/mm

ASL

RESULTS OF ANALYSIS

File No. 6120A
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	Arbutus Ridge	Drinking*1 Water Guidelines
Physical Tests		
pH	7.51	6.5-8.5
Conductivity	46.	-
Colour	5.	15.
Turbidity NTU	3.7	5.
Suspended Solids	2.0	-
Dissolved Solids	124	-
Hardness CaCO3	78.6	-*2
Anions and Nutrients		
Alkalinity CaCO3	87.0	-
Sulphate SO4	<1.0	500.
Chloride Cl	3.6	250.
Fluoride F	0.11	1.5
NO3/NO2 N	0.022	10.0
Total Metals		
Iron T Fe	1.63	0.30
Manganese T Mn	0.23	0.05
Dissolved Metals		
Arsenic D As	0.0022	0.05
Barium D Ba	<0.010	1.0
Cadmium D Cd	<0.0002	0.005
Chromium D Cr	<0.015	0.05
Copper D Cu	<0.010	1.0
Iron D Fe	<0.03	-
Lead D Pb	<0.00005	0.05
Manganese D Mn	0.21	-
Zinc D Zn	0.010	5.0
Calcium D Ca	17.8	-
Magnesium D Mg	8.12	-
Potassium D K	0.83	-
Sodium D Na	6.16	- *3

< = Less than
Results expressed as milligrams per litre except for pH, Conductivity (µmhos/cm), Colour (CU), Turbidity (NTU)
*1 "Maximum acceptable concentration" as published by Health & Welfare Canada, 1985
*2 Maximum level not established - water supplies with a hardness exceeding 200 mg/L are considered poor but will be tolerated. Not a health consideration
#3 Maximum level not established - of concern to consumers with sodium restricted diet. Levels exceeding 20 mg/L may be of concern in this circumstance.

HATCH POINT

DOMESTIC WELL NO. 3

Depth (Below Ground Surface)		Description
Metres	Feet	
0.00 - 1.52	0 - 5	Sandy, loam
1.52 - 24.69	5 - 81	Sand and gravel, silty
24.69 - 26.52	81 - 87	Silt, tight
26.52 - 28.00	87 - 92	Sand, with pebbles, silty
28.04 - 30.48	92 - 100	Sand and gravel, silty
30.48 - 43.28	100 - 142	Sand, fine to medium grained water-bearing
43.28 - 48.77	142 - 161	Clay, silty
48.77 - 53.95	161 - 177	Clay with cobbles (till-like)
53.95 -	177 -	Bedrock, granite

Construction Details - below ground surface

	Metres	Feet
305 mm (12-inch) diameter casing	00.00 - 37.80	00.00 - 124
178 mm (7-inch) diameter riser	37.19 - 38.71	122 - 127
203 mm (8-inch) telescopic diameter screens	38.71 - 43.28	127 - 142
178 mm (7-inch) diameter sump	43.28 - 46.33	142 - 152

Screens - stainless steel, 10 slot

HATCH POINT DOMESTIC WELL NO. 3

CONSTANT RATE PUMP TEST

DRAWDOWN

Date: August 10/12, 1988

Discharge Rate: 30 U.S. gpm, 25 I gpm or 164 m^3/day

Time of Day	Elapsed Time Minutes	Depth to Water Metres	Drawdown Metres	Comments
Aug. 10				Measuring Point-top of casing
1100	0.0	24.857	0.000	0.56 m above existing ground
	0.5	25.780	0.923	Discharge - 152 m from well
	1.0	27.180	2.323	Flow rate checked by watch
	1.5	29.000	4.143	and container
	2.0	29.777	4.920	
	2.5	30.465	5.608	
	3.0	30.122	5.265	42 US gpm or 234 m^3/day
	3.5	30.614	5.757	
	4.0	31.071	6.214	Decreasing discharge
	4.5	31.852	6.995	
	5.0	32.635	7.778	
	6.0	33.182	8.325	
	7.0	33.609	8.752	
	8.0	33.969	9.112	
	9.0	34.200	9.343	
	10	34.381	9.524	
	12	34.466	9.609	
	14	34.433	9.576	
	16	34.309	9.452	
	18	-	-	
	20	34.221	9.364	30 US gpm or 164m^3/day
	25	34.187	9.330	
	30	34.179	9.322	
	35	33.628	8.771	
	40	33.178	8.321	
	45	33.002	8.145	29.7 US gpm or 162 m^3/day

HATCH POINT DOMESTIC WELL NO. 3

CONSTANT RATE PUMP TEST

DRAWDOWN

Time of Day	Elapsed Time Minutes	Depth to Water Metres	Drawdown Metres	Comments
	50	32.732	7.875	
1200	60	32.632	7.775	29.7 US gpm or 162m^3/day
	70	32.633	7.776	
	80	32.552	7.695	29.7 US gpm or 162m^3/day
	90	32.532	7.675	
	100	32.533	7.676	29.7 US gpm or 162m^3/day
	125	32.544	7.687	
	150	32.554	7.697	
1420	200	32.560	7.703	
	250	32.574	7.717	
	300	32.580	7.723	
	350	32.596	7.739	
	400	32.600	7.743	
	450	32.608	7.751	
	500	32.617	7.760	29.7 US gpm or 162m^3/day
	550	32.620	7.763	
	600	32.631	7.774	
	650	32.647	7.790	
	700	32.665	7.808	
	750	32.675	7.818	
Aug. 11	800	32.685	7.828	
0110	850	32.695	7.838	
	900	32.700	7.843	
	950	32.700	7.843	
	1000	32.695	7.838	29.7 US gpm or 162m^3/day
	1050	32.695	7.838	
	1100	32.700	7.843	
	1150	32.705	7.848	
0700	1200	32.700	7.843	
	1250	32.710	7.853	
	1300	32.700	7.843	
	1350	32.685	7.828	28 US gpm or 153m^3/day
	1400	32.658	7.801	
	1450	33.158	8.301	30 US gpm or 164m^3/day
	1500	33.158	8.301	
1250	1550	33.158	8.301	
	1600	33.159	8.302	30 US gpm or 164m^3/day
	1650	33.160	8.303	

HATCH POINT DOMESTIC WELL NO. 3

CONSTANT RATE PUMP TEST

DRAWDOWN

Time of Day	Elapsed Time Minutes	Depth to Water Metres	Drawdown Metres	Comments
	1700	33.164	8.307	30 US gpm or 164m^3/day
	1750	33.164	8.307	
	1800	33.166	8.309	30 US gpm or 164m^3/day
	1850	33.167	8.310	
	1900	33.175	8.318	30 US gpm or 164m^3/day
	1950	33.179	8.322	
2020	2000	33.181	8.324	30 US gpm or 164m^3/day
	2050	33.189	8.332	
	2100	33.209	8.352	30 US gpm or 164m^3/day
	2150	33.220	8.363	
Aug 12	2200	33.225	8.368	
0030	2250	33.235	8.378	30 US gpm or 164m^3/day
	2300	33.245	8.388	
	2350	33.250	8.393	
0300	2400	33.260	8.403	
	2450	33.265	8.408	30 US gpm or 164m^3/day
	2500	33.270	8.413	
	2550	33.280	8.423	30 US gpm or 164m^3/day
	2600	33.280	8.423	
	2650	33.280	8.423	
0800	2700	33.275	8.418	
	2750	33.285	8.428	
	2800	33.285	8.423	30 US gpm or 164m^3/day
	2850	33.285	8.428	
1120	2900	33.280	8.423	Water Sample Collected
1200	2940	33.280	8.423	Pump off

HATCH POINT DOMESTIC WELL NO. 3

CONSTANT RATE PUMP TEST

RECOVERY

Time of Day	Elapsed Time Minutes	Depth to Water Metres	Drawdown Metres	Time Since Pumping Started Divided by Time Since Pumping Stopped
Aug 12				
1200	0.0	33.280	8.423	
	0.5	32.334	7.477	5881
	1.0	31.745	6.888	2941
	1.5	31.071	6.214	1961
	2.0	30.537	5.680	1471
	2.5	30.029	5.172	1177
	3.0	29.582	4.725	981
	3.5	28.170	3.313	841
	4.0	27.825	2.968	736
	4.5	27.481	2.624	654
	5.0	27.189	2.332	589
	6.0	26.710	1.853	491
	7.0	26.330	1.473	421
	8.0	26.020	1.163	368
	9.0	25.770	0.913	328
	10	25.584	0.727	295
	12	25.300	0.443	246
	14	25.129	0.272	211
	16	25.029	0.172	185
	18	24.956	0.099	164
	20	24.910	0.053	148
	25	24.861	0.004	119
	30	24.844	-0.013	99
	35	24.831	-0.026	85
	40	24.829	-0.028	75
	45	24.824	-0.033	66
	50	24.823	-0.034	60
1300	60	24.820	-0.037	50

HATCH POINT DOMESTIC WELL NO. 3

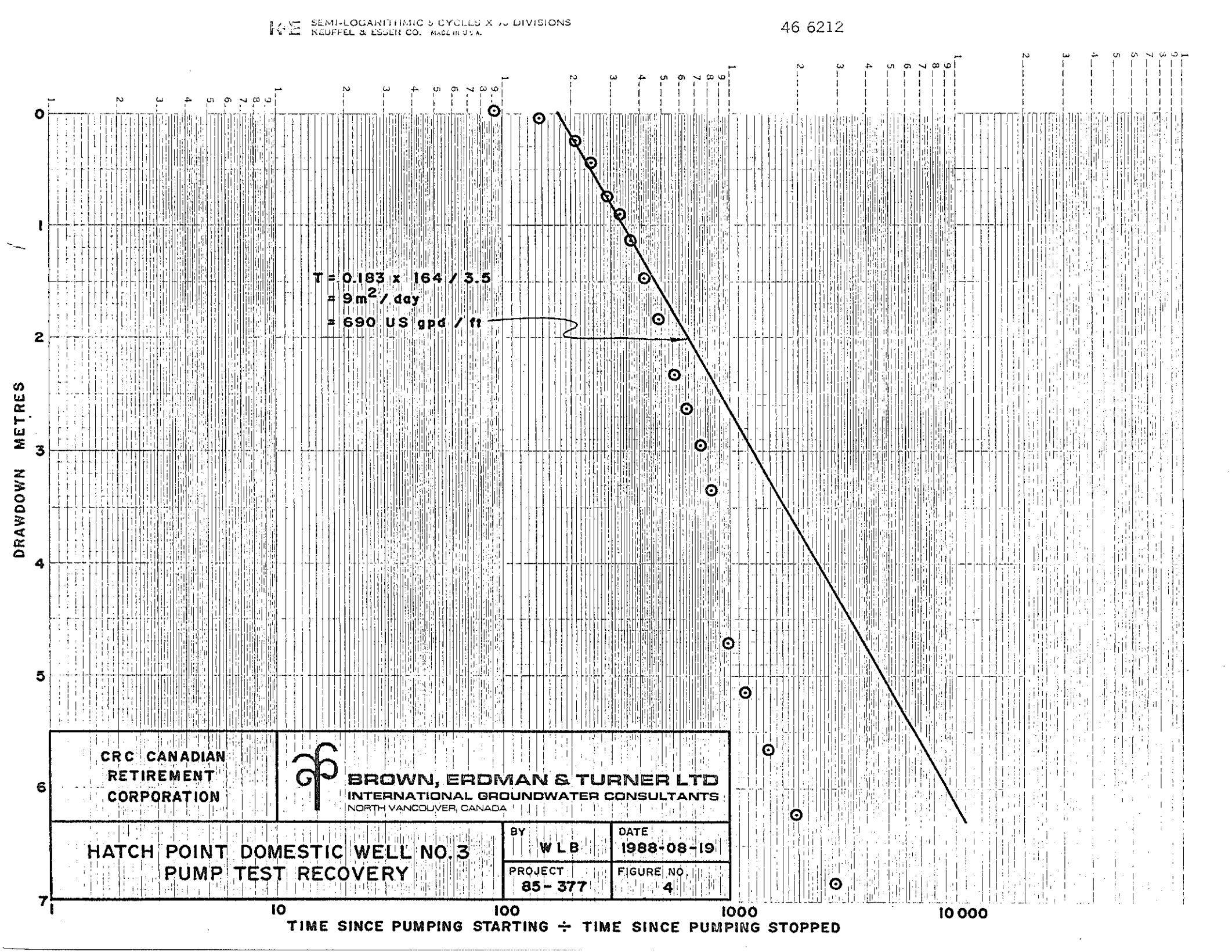
CONSTANT RATE PUMP TEST

IRRIGATION WELLS NO. 1 & 2 USED AS OBSERVATION WELLS

DRAWDOWN

Date: August 10/12, 1988

Time of Day	Elapsed Time Minutes	Depth to Water M Irr Well No. 1	Depth to Water M Irr Well No. 2
Aug 10/88			
1100	0.0	Shut-off	Shut-off
1210	70	36.735	27.435
1305	125	36.410	27.420
	150	35.852	27.370
	200	35.578	27.231
	250	35.334	27.321
1650	350	35.057	27.310
	550	34.600	27.310
	750	34.155	27.285
Aug 11/88	950	34.500	27.285
0610	1150	34.000	27.275
	1400	34.010	27.275
	1600	34.010	27.275
	1850	34.010	27.270
	2050	34.010	27.270
	2250	34.010	27.265
	2450	34.015	27.265
	2650	33.905	27.260
	2940		Shut down test



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BROWN, ERDMAN & TURNER LTD
INTERNATIONAL GROUNDWATER CONSULTANTS
NORTH VANCOUVER, CANADA

HATCH POINT DOMESTIC WELL NO. 3
PUMP TEST RECOVERY

BY	DATE
W L B	1988-08-19
PROJECT	FIGURE NO.
85-377	4