926-2-138

E. LIVINGSTON, P. Eng.
A. BADRY

PACIFIC HYDROLOGY CONSULTANTS LTD.

CONSULTING GROUNDWATER GEOLOGISTS

204 - 1929 WEST BROADWAY
VANCOUVER, B.C. V6J 1Z3
TELEPHONE: (604) 738-9232

August 28, 1991

West and Associates
20609 Logan Avenue
LANGLEY, B.C. V3A 7A3

Attention: Mr. Tony West,
President

Subject: **Pumping Tests of Two Wells at the Faulkner Property at 1517 - 224th Street in Langley**

Dear Sirs:

This letter is in reply to a facsimile message from West and Associates and is further to a telephone discussion on August 27 between Tony West of West and Associates and Ed Livingston, P. Eng., of Pacific Hydrology, about analysis of data from pump tests carried out on two wells by Aquarius Drilling in July and August of this year.

The test of the drilled well, which the data show was started at an initial rate of 34 L/min for 10 minutes, continued at a rate of 31 L/min for the last 50 minutes of the 60 minute test; the drawdown at the end of the test was 18.30 ft. Recovery of the water level following the termination of pumping was very rapid; residual drawdown after two minutes was 6.90 ft and, after 10 minutes, it was 2.65 ft. Since this well is screened in a granular aquifer, since the test was carried out at a rate more than three times the required rate, since the drawdown was constant at the end of the test, and since the drawdown was only 52% of total available drawdown we have no hesitation in stating that the well capacity meets the Langley Subdivision Bylaw requirements.

.../2

The required Forms for the drilled well are included with this letter; for the well capacity calculation, we have assumed a pump setting of 36.3 m, which is about 0.3 m above the top of the well screen. This gives a "minimum available drawdown" of 6.95 metres, based on the assumption of a minimum required daily yield of 1.74 L/min. Obviously there is likely to be an higher capacity pump installed in the well but this does not affect the Form F-7 calculation, which is based on the minimum capacity required under the Langley Bylaw.

The data for the dug well have been calculated and are included with this letter. In examining these data, it must be kept in mind that the well was in use supplying the Faulkner home during the pumping and particularly during the recovery period. For the first four hours, the well was pumped at a rate 30% greater than the Langley Bylaw requirement; the constant rate was much higher than the required 24 hour capacity. The well was still drawing down at the end of the test and had used up 60% of the total available drawdown, assuming a static level of 2.74 m and allowing 0.5 m of water in the well at maximum drawdown. The fact that the well has been in use for many years without problems and was in use up to the time of the test and during the test, is an important indicator of the adequate capacity of the well.

The Langely Certification Forms are clearly not applicable to a dug well so we have not used them to analyze and/or record the data for the dug well. Plots of drawdown and recovery on appropriate semi-logarithmic graph paper are included, although they are also not strictly applicable in the case of large diameter dug wells.

In conclusion, the pump test data and other historical information on the experience with the use of the well show that the dug well on the Faulkner Property has sufficient capacity to meet the Langley Bylaw requirements.

.../3

We trust that this is the information you require. Please call if we can be of further assistance with this matter.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.

E. Livingston

E. Livingston, P. Eng.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
E. LIVINGSTON

Enclosures

The Corporation of the Township of Langley

SCHEDULE "A"

PRIVATE WELL CERTIFICATION

PURSUANT TO SCHEDULE "A" of the Subdivision and Development Control Bylaw, which requires that each lot to be created and/or each existing lot forming part of the proposed development can be serviced with potable water in accordance with the requirements of the Bylaw for the development of:

LEGAL DESCRIPTION: Lot 10, Sec. 7, Tp. 10, Plan 33459, N.W.D.

PROJECT NO.: _____

I certify that a quantity of not less than 2,500 litres per day has been proven for each existing or proposed lot in the development.

I certify that each well within the subdivision has been tested and is capable of continuously providing water at a rate of 9 litres/min. for a four hour period.

I certify that water quality tests have been conducted and that the "B.C. Drinking Water Standards, 1982" can be met for each existing or proposed lot in the development.

EDMUND LIVINGSTON, P. ENG.
Certified By (Name of Professional Engineer)

E Livingston

PACIFIC HYDROLOGY CONSULTANTS LTD.
Address

204 - 1929 West Broadway, VANCOUVER, B.C. V6J 1Z3

PROFESSIONAL SEAL

See attachments as required pursuant to clause 2.2.18 of Schedule "A".

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The Corporation of the Township of Langley

SCHEDULE "A"

WELL PUMP TEST - FIELD TEST

OWNER'S NAME: Dave Faulkner

WELL NO. 1 (Drilled)

APPLICATION NO.:

DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley

SHEET 1 OF 7

TEST NO. 1

☒ Drawdown ☐ Recovery

Rdg #	Time From Start	Depth To Water	Draw Down	Flow Measurement Data			Comments
	(Min)	(M)	(M)	(MIN)	(L)	Lpm	
19:00	0	26.00					Static level; start pump.
	½	26.73	0.73	0.33	11.35	34	Discharge water brown.
	1	27.46	1.46				
	1½	27.99	1.99				
	2	28.38	2.38				
	2½	28.72	2.72				
	3½	29.35	3.35				
	4	29.515	3.515				
	4½	29.69	3.69				
	6	30.05	4.05				
	8	30.66	4.66				
	9	30.765	4.765				
	10	30.835	4.835				
	12	30.94	4.94	0.37	11.35	30.7	
	14	31.05	5.05				
	16	31.11	5.11				Discharge water clear; no odour.
	18	31.16	5.16				
	20	31.20	5.20				
	25	31.29	5.29	0.37	11.35	30.7	
	30	31.35	5.35				

The Corporation of the Township of Langley

SCHEDULE "A"

WELL PUMP TEST - FIELD TEST

OWNER'S NAME: Dave Faulkner

WELL NO. 1 (Drilled)

APPLICATION NO.: _____

DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley

SHEET 2 OF 7

TEST NO. 1

☒ Drawdown ☐ Recovery

Rdg #	Time From Start	Depth To Water	Draw Down	Flow Measurement Data			Comments
	(Min)	(M)	(M)	(MIN)	(L)	Lpm	
19:35	35	31.43	5.43				
	40	31.47	5.47				
	45	31.49	5.49				
	50	31.49	5.49	0.38	11.35	29.9	
	55	31.49	5.49				
	60	31.49	5.49				Stop pump.

The Corporation of the Township of Langley

SCHEDULE "A"

WELL PUMP TEST - FIELD TEST

OWNER'S NAME: Dave Faulkner

WELL NO. 1 (Drilled)

APPLICATION NO.: _____

DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley

SHEET 3 OF 7

TEST NO. 1

☐ Drawdown ☒ Recovery

Rdg #	Time From Start	Depth To Water	Draw Down	Flow Measurement Data			Time From Stop	t/t	Comments
	(Min)	(M)	(M)	(MIN)	(L)	Lpm	(Min)		
20:00	60	31.49	5.49						Stop pump.
	60½	30.06	4.06				½	121	
	61	29.45	3.45				1	61	
	61½	28.41	2.41				1½	41	
	62	28.02	2.02				2	31	
	62½	27.80	1.80				2½	25	
	63	27.70	1.70				3	21	
	63½	27.56	1.56				3½	18.1	
	64	27.45	1.45				4	16.0	
	64½	27.35	1.35				4½	14.3	
	65	27.26	1.26				5	13.0	
	66	27.11	1.11				6	11.0	
	67	26.98	0.98				7	9.6	
	68	26.88	0.88				8	8.5	
	69	26.80	0.80				9	7.7	
	70	26.72	0.72				10	7.0	
	72	26.63	0.63				12	6.0	
	74	26.56	0.56				14	5.3	
	76	26.48	0.48				16	4.75	
	78	26.44	0.44				18	4.3	

F-6
(modified)

The Corporation of the Township of Langley

SCHEDULE "A"

WELL PUMP TEST - FIELD TEST

OWNER'S NAME: Dave Faulkner

WELL NO. 1 (Drilled)

APPLICATION NO.: _____

DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley

SHEET 4 OF 7

TEST NO. 1

☐ Drawdown ☒ Recovery

Rdg #	Time From Start	Depth To Water	Draw Down	Flow Measurement Data			Time From Stop	t/t	Comments
	(Min)	(M)	(M)	(MIN)	(L)	Lpm	(Min)		
20:20	80	26.42	0.42				20	4.0	
	85	26.33	0.33				25	3.4	
	90	26.28	0.28				30	3.0	
	95	26.24	0.24				35	2.7	
	100	26.20	0.20				40	2.5	
	105	26.18	0.18				45	2.3	
	110	26.16	0.16				50	2.2	
	115	26.14	0.14				55	2.1	
	120	26.13	0.13				60	2.0	

F-6
(modified)

The Corporation of the Township of Langley

SCHEDULE "A"

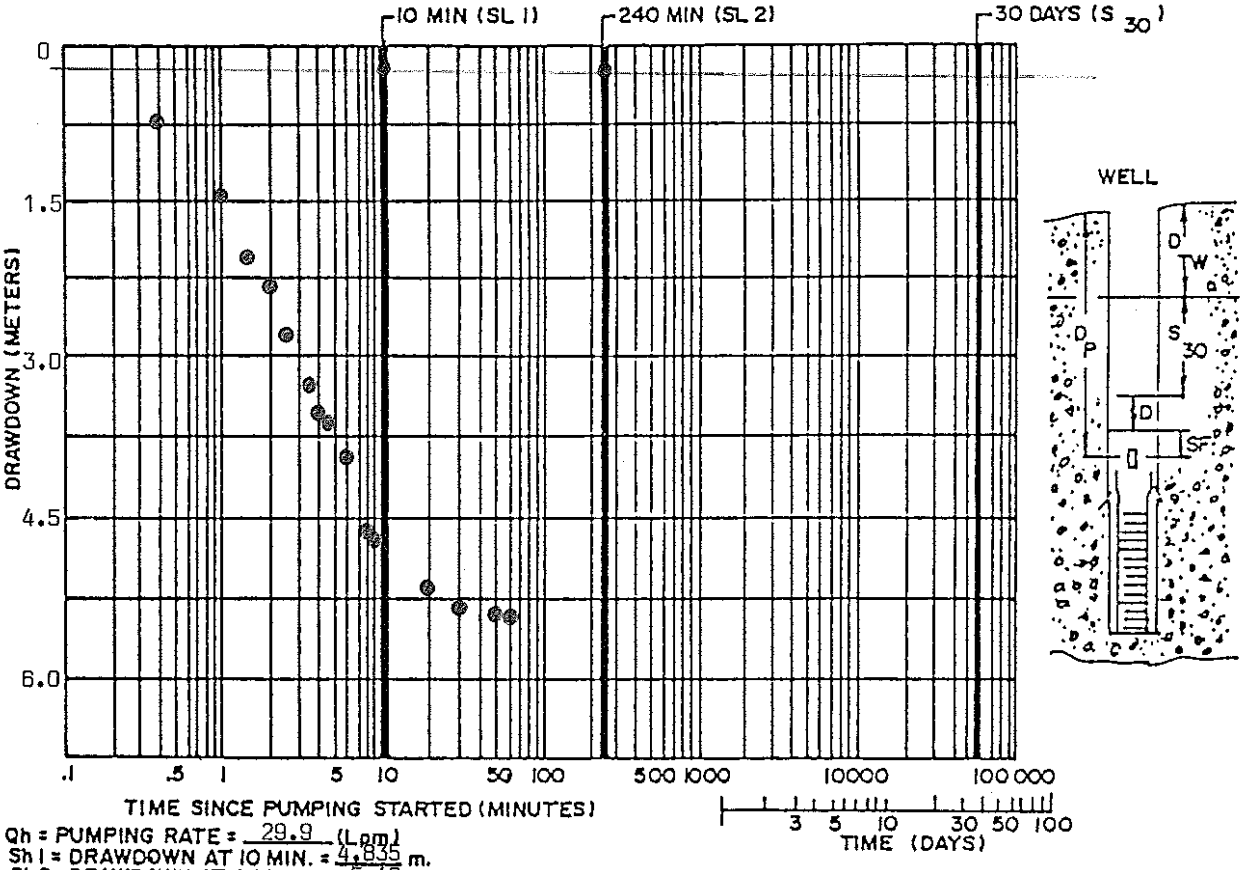
TIME-DRAWDOWN GRAPH FOR PUMP TEST

OWNER'S NAME: Dave Faulkner WELL No. 1 (Drilled)

APPLICATION No: _____ DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley SHEET 5 OF 7

DEPTH TO STATIC WATER LEVEL: 26.00 m (m) TEST No. 1



Qh = PUMPING RATE = 29.9 (Lpm)

Sh1 = DRAWDOWN AT 10 MIN. = 4.835 m.

Sh2 = DRAWDOWN AT 240 MIN.= 5.49 m.

CALCULATED DRAWDOWN VALUES: $SL1 = \frac{Qi}{Qh} \times Sh1 = 0.274$ m

$SL2 = \frac{Qi}{Qh} \times Sh2 = 0.319$ m

DRAWDOWN AT 30 DAYS (S_{30}) = 0.35 m

ESTIMATED MINIMUM ADJUSTMENT FOR SEASONAL DECLINE (D): USE FOLLOWING FIGURES IF OTHER LOCAL DATA OR HYDROGEOLOGIST'S OPINION IS NOT AVAILABLE.

TESTS RUN IN AUG., SEPT. & OCT.:	2 m
TESTS RUN IN NOV., DEC., JAN., MAY, JUNE & JULY:	4 m
TESTS RUN IN FEB, MAR. & APRIL:	6 m

SAFETY FACTOR = SF = 1m

DEPTH TO PROPOSED PUMP SUCTION (D_P) 36.3 m

CALCULATE MINIMUM AVAILABLE DRAWDOWN: $D_P - (D_{TW} + S_{30} + D + SF) =$

36.3 - (26.0 + 0.35 + 2.0 + 1.0) = 6.95 m

IF ANSWER TO ABOVE CALCULATION IS NEGATIVE, THEN EITHER THE PUMP HAS TO BE SET LOWER OR THE WELL IS NOT CAPABLE OF SUPPLYING WATER FOR A HOUSE.

The Corporation of the Township of Langley

SCHEDULE "A"

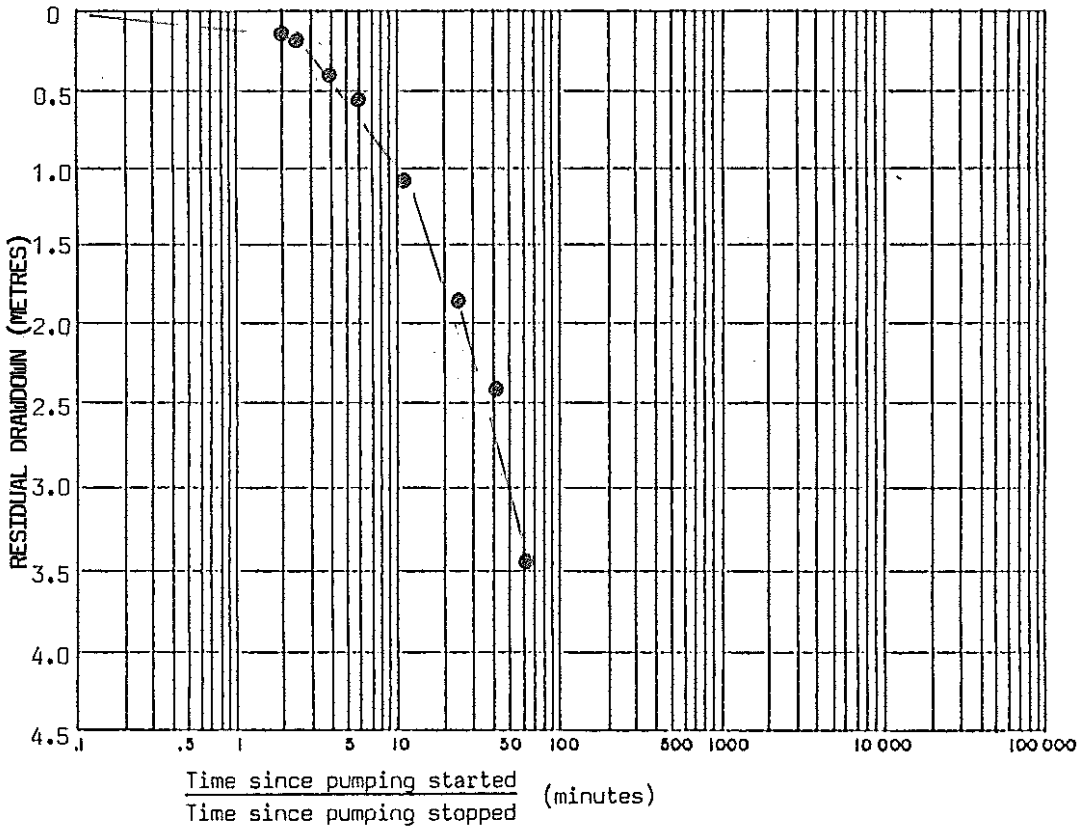
RECOVERY GRAPH FOR PUMP TEST

OWNER'S NAME: Dave Faulkner WELL NO. 1 (Drilled)

APPLICATION NO.: DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley SHEET 6 OF 7

DEPTH TO STATIC WATER LEVEL: 26.00 (m) TEST NO. 1



F-7
(modified)

The Corporation of the Township of Langley

SCHEDULE "A"

PUMP TEST SUMMARY

OWNER'S NAME: Dave Faulkner WELL NO. 1 (Drilled)

APPLICATION NO.: _____ DATE: 30 July 1991

LOCATION: 1517 - 224 Street, Langley SHEET 7 OF 7

_____ TEST NO. 1

WELL COMPLETION DATA

Depth 38.1 (m)

Diameter 150 (mm)

Static Water Level 26.0 (m)

SCREEN DESIGN (mark one)

☐ Open Hole ☐ Slotted Casing

☒ Screen ☐ Gravel Pack

☐ Other _____

Screen interval 36.6 m to 38.1 m

DESCRIPTION OF AQUIFER

sand with minor gravel between 34.4 and 38.1 m

PUMP TEST

Start: Date 30/07/91 (d/mo/yr) Time 7:00 p.m. (hr/min)

Pump Type: ☒ Electric submersible ☐ Jet ☐ Air Lift

Other? Describe _____

Test Pump Set at 32.9 m below ground

Water level sounded by: ☒ Electric tape ☐ Air bubbler ☐ Steel tape

☐ Other? Describe _____

Flow measured by: ☒ Container & watch ☐ Flow meter

☐ Orifice & tube ☐ Other? Describe _____

TEST

Constant rate of yield final = 29.9 Lpm Test duration one hours

Initial non-pumping level 26.0 m

Drawdown in well at end of test 5.49 m

Recommended pumping rate 30 Lpm

WATER SAMPLES TAKEN DURING TEST

Chemical Analysis ☒ Yes ☐ No

Bacterial Analysis ☒ Yes ☐ No

Water Temperature - °C

Any particular gas smells noted none

Comments on clarity of water Discharge water was clear after 16 minutes of pumping

Other _____

PUMP TEST – DRAWDOWN DATA

10	August	1991
DAY	MONTH	YEAR

CONTRACTOR Aquarius Drilling

PROJECT DAVE FAULKNER

Location 1517 - 224 Street in Langley

Well Dug well

Pumping Rate (Q) Constant at 12 L/min.

Datum Point Edge of concrete

Elevation of Datum Point -

Static Water Level Assume 274 cm

Screen Location n/a - Dug well with depth of 5.2 m

TIME		ELAPSED TIME	DISTANCE TO WATER	DRAWDOWN (cm)			PUMPING RATE	REMARKS
HR.	MIN.	t (MIN.)						
10	00	0	274.3	0.3			(L/min)	Start pump.
		1	275.8	1.8				
		2	277.1	3.1			12	
		3	278.0	4.0				
		4	278.5	4.5				Discharge water clear;
								no odour.
		5	279.3	5.3				
		6	280.5	6.5				
		7	281.0	7.0				
		8	281.6	7.6				
		9	282.3	8.3				
		15	286.3	12.3				
		20	287.5	13.5				
		25	290.0	16.0				
10	30	30	292.5	18.5				
		35	295.0	21.0				
		40	297.5	23.5				
		45	300.7	26.7				
		50	303.1	29.1				
		55	305.7	31.7				
11	00	60	308.0	34.0				
		75	316.5	42.5				
		90	324.0	50.0				
		105	331.0	57.0				
12	00	120	338.0	64.0				
		135	346.0	72.0				
12	30	150	352.3	78.3				
		165	359.0	85.0				

PUMP TEST – DRAWDOWN DATA

DAY	MONTH	YEAR
10	August	1991

PROJECT DAVE FAULKNER

Well Dug well Static Water Level Assume 274 cm

TIME HR.	MIN.	ELAPSED TIME t (MIN.)	DISTANCE TO WATER	DRAWDOWN (cm)			PUMPING RATE	REMARKS
13	00	180	367.0	93.0			(L/min)	
13	15	195	373.5	99.5			12	
13	30	210	379.0	105.0				
13	45	225	385.0	111.0				
14	00	240	391.1	117.1				Stop pump.

UMP TEST – RECOVERY DATA

10/11	August	1991
DAY	MONTH	YEAR

PROJECT DAVE FAULKNER

Well Dug Well

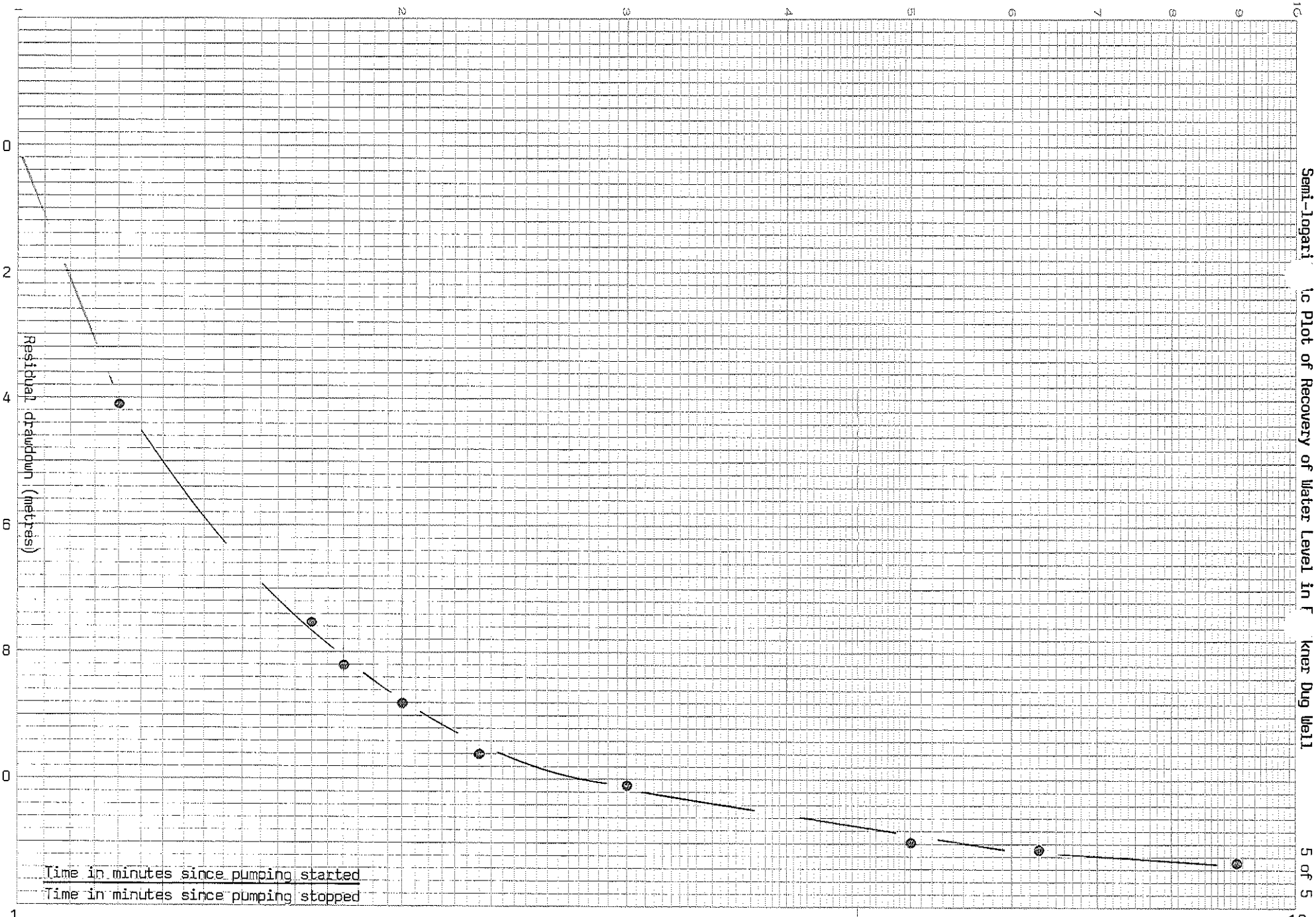
Datum Point Edge of concrete Elevation of Datum Point –

Static Water Level Assume 274 cm Total Drawdown 117.1 cm

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.)			(cm)		
14	00	240	0		391.1	117.1		Stop pump.
14	15	255	15	17.0	389.2	115.2		
14	30	270	30	9.0	387.0	113.0		
14	45	285	45	6.3	385.3	111.3		
15	00	300	60	5.0	383.8	109.8		
16	00	360	120	3.0	375.1	101.1		
17	00	420	180	2.3	368.0	96.0		
18	00	480	240	2.0	362.1	88.1		
19	00	540	300	1.8	356.2	82.2		
20	00	600	360	1.7	349.4	75.4		
11/11	00	1500	1260	1.2	315.0	41.0		

NO. 340R-L110 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
1 CYCLES X 10 DIVISIONS PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.



Semi-logari ic Plot of Recovery of Water Level in F kner Dug Well

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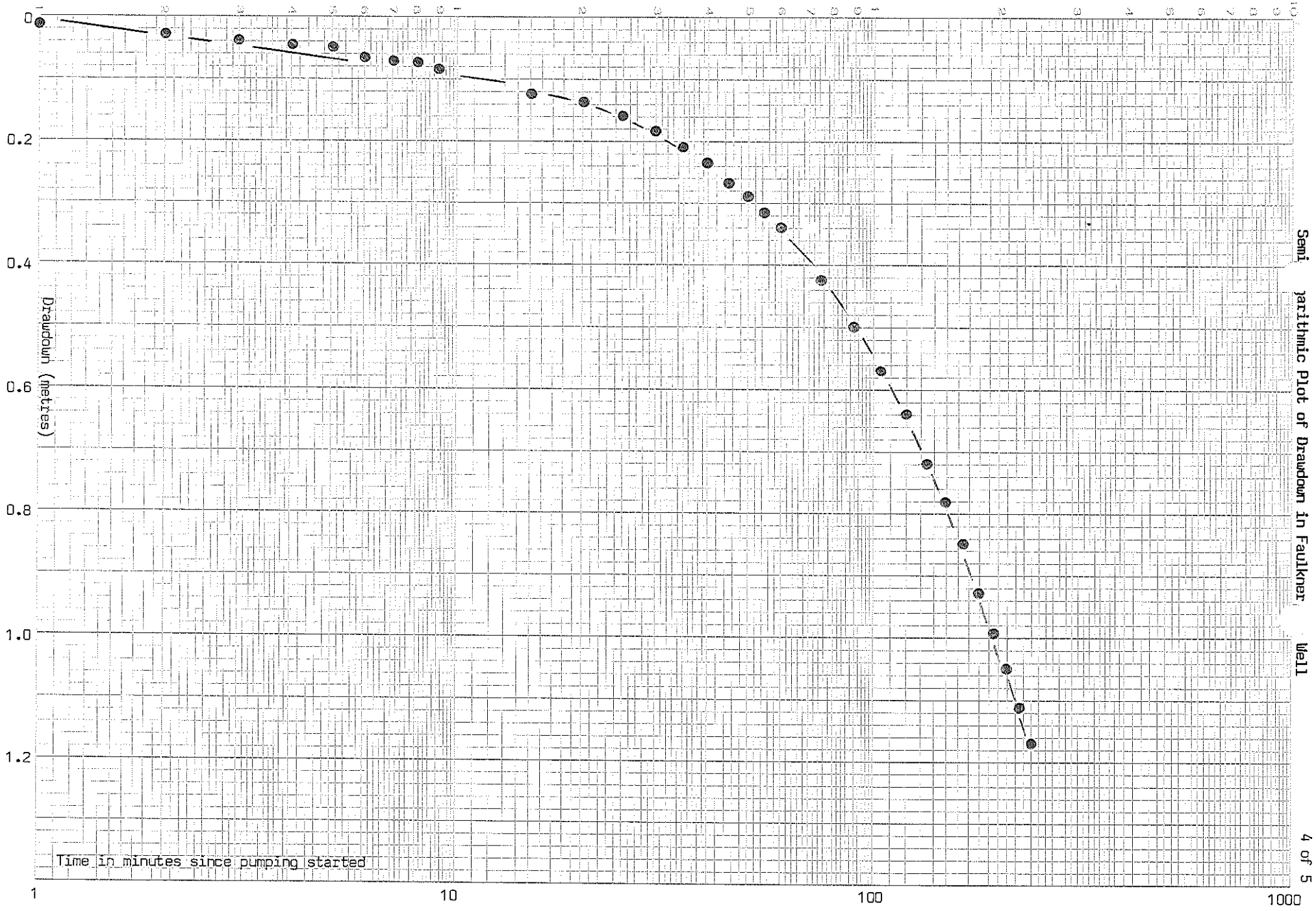

Semi-logarithmic Plot of Drawdown in Faulkner Well