

COMPLETION REPORT  
CONSTRUCTION AND TESTING OF MARSHALL ROAD WELL NO. 4  
FOR DEWDNEY-ALOUETTE REGIONAL DISTRICT

Prepared for

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OCTOBER 31, 1990

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October 31, 1990

Dayton & Knight Ltd.  
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Attention: Mr. A. Berzins, P. Eng.

Subject: Completion Report  
Construction and Testing of Marshall Road Well No. 4  
for Dewdney-Alouette Regional District

Dear Sirs:

Enclosed herewith is our completion report concerning the construction and testing of the new production well for Dewdney-Alouette Regional District which is to replace the existing Well No. 3 at Marshall Road.

We trust that the report meets with your approval.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.



E. Livingston, P. Eng.

COMPLETION REPORT  
CONSTRUCTION AND TESTING OF MARSHALL ROAD WELL NO. 4  
FOR DEWDNEY-ALOUETTE REGIONAL DISTRICT

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## 1.0 SUMMARY AND CONCLUSIONS

The recent construction and testing of Well No. 4 in Dewdney-Alouette Regional District's Marshall Road Well Field may be summarized as follows:

1. The new Well No. 4, located about 7.6 m (25 ft) south of Well No. 3 which it replaces, encountered similar conditions as reported at Well No. 3. The sand and gravel aquifer in the new Well No. 4 extended from 33.8 to 42.4 m (111 to 139 ft), while that in Well No. 3 was reported to be somewhat thicker with the top of the aquifer at 30.2 m (99 ft) and the bottom at a similar depth at 42.2 m (138½ ft).
2. The new Well No. 4 was drilled by the pull-down technique using a cable tool drill rig; this method of drilling results in the least disturbance to the aquifer during drilling and increases the accuracy of the samples.
3. An 8.52 m (27.96 ft) long screen assembly of 0.61 m (24") nominal diameter Johnson stainless steel screen, with slot size ranging from 2.54 to 4.57 mm (0.100 to 0.180"), was installed between 33.6 and 42.1 m (110 and 138 ft).
4. The well screen was installed by the standard pull-back method and development was carried out using standard techniques of bailing, surging in the casing above the screen, pumping and surging in the screen. Development was continued until only small amounts of sediment could be brought into the screen and no further improvement in well performance occurred.
5. Following development, Marshall Road Well No. 4 was pump tested for 10 hours at a maximum rate of 117.56 L/sec (1863 USgpm) for the last 9 hours. This was the maximum rate possible due to problems of water disposal.
6. Analysis of the pumping test data shows that the aquifer at Marshall Road Well No. 4 has a moderate water-yielding capability with a transmissivity about 1490 m<sup>2</sup>/day (1.2 x 10<sup>5</sup> USgal/day/ft).

7. At use of 70, 80 and 96% of the available drawdown during the time of a seasonal low static water level, the capacity of Marshall Road Well No. 4 for simultaneous pumping with Wells No. 1 and No. 2 at a combined capacity of 88.34 L/sec (1400 USgpm), is projected to be 118.6, 134.4 and 151.3 L/sec (1880, 2130 and 2400 USgpm; 1565, 1775 and 2000 igpm); in contrast, at similar use of 70, 80 and 96% of the available drawdown, the capacity of the Well for individual pumping at the time of maximum groundwater conditions is projected to be 151.3, 167.2 and 189.3 L/sec (2400, 2650 and 3000 USgpm; 2000, 2200 and 2500 igpm), respectively.

## 2.0 RECOMMENDATIONS

The following recommendations are made in regard to the equipping and use of Marshall Road Well No. 4:

1. Install the permanent pump just above the packer at the top of the screen assembly, at 33.6 m (110 ft) below ground; equip the pump with a tail pipe to best utilize the well capacity.
2. Provide for measuring both pumping and non-pumping water levels, by installing a small diameter PVC tube through which an electric water level indicator can be lowered; include a totalizing water meter to measure consumption.
3. Protect the well from possible backwashing due to check-valve failure by considering carefully the location and type of check valve.
4. Provide for access to the well head for a drilling rig in the event that rehabilitation of the well is required in future.
5. Provide a means of directly measuring the water level in Well No. 2, by installing a small diameter PVC tube for lowering an electric water level indicator, and evaluate the present performances of Marshall Road Wells No. 1 and No. 2.
6. At such time as the permanent pump is in place in Well No. 4, carry out step-drawdown testing to confirm well performance at rates exceeding the pumping test rate of 117.56 L/sec (1863 USgpm). From the results of such testing, decide on an operating schedule for the three Marshall Road Wells that will achieve maximum yield, and provide Dewdney-Alouette Regional District with an operating manual for use of the Wells in the Marshall Road Well Field.
7. During operation of Well No. 4, monitor production and water levels on a regular basis to assist in determining whether there is any decline in well performance; in this way, declines in well performance can be dealt with before the problem becomes serious.

### 3.0 INTRODUCTION

#### 3.1 Purpose, Scope and Authorization

The purpose of this report is to describe the recent construction and testing of Marshall Road Well No. 4, located in Dewdney-Alouette Regional District's Well Field, southwest of the intersection of Marshall Road and 328th Street (Gladwin Road) in the District of Matsqui. The new 600 mm (24") diameter well was constructed to replace existing Well No. 3, whose performance had declined and could not be restored. Because of the lack of success of a rehabilitation program carried out in 1986 and because of the gravel-pack type well construction, it was agreed by all concerned that it was not advisable to expend more effort on attempting to rehabilitate the existing Well No. 3 and that the preferred course of action was to replace the well.

Following a meeting among Mr. David Swanson, Water Supply Coordinator of Dewdney-Alouette Regional District, Mr. Agris Berzins, P. Eng., of Dayton & Knight Ltd., and Mr. Ed Livingston, P. Eng., of Pacific Hydrology Consultants Ltd. on April 4, Pacific Hydrology presented a course of action and estimated costs for such a well, in a letter to Dayton & Knight dated April 10, 1990. Authorization for Pacific Hydrology to proceed was given by Dayton & Knight in a letter dated April 18, 1990.

#### 3.2 Background

In previous correspondence between Pacific Hydrology Consultants Ltd. and Dayton & Knight Ltd. concerning Marshall Road Well No. 3, some uncertainty had been expressed about the depth to the bottom of the aquifer. The recent construction of Well No. 4 at a distance of only 7.6 m (25 ft) from Well No. 3, confirms the bottom of the aquifer as shown on Dayton & Knight Ltd.'s Drawing No. 60.8.2, "Matsqui District Marshall Road Production Well". However, at this time, the contractor that drilled and constructed the well is still unknown. While the bottom of the aquifer in Wells No. 3 and



No. 4 is almost the same, the litholog for Well No. 3 shows 3.7 m (12 ft) more of aquifer, with the sediment in the same interval in the new Well No. 4 described as interbedded water-bearing sand and gravel and less permeable sediment designated by the driller to be "till". As previously discussed, the driller's log for Well No. 2, at a distance about 2.7 m (9 ft) from Well No. 3, shows that Well No. 2 was only drilled to a depth of 36.9 m (121 ft), after encountering 0.9 m (3 ft) of material described as "fine sand and gravel, very high clay content". Similarly, Well No. 1 was only drilled to a depth of 38.1 m (125 ft), after drilling 0.3 m (1 ft) into "gravel and sand". Thus, both Well No. 1 and Well No. 2 may not have been drilled to the bottom of the aquifer zone; alternatively, they both may have reached the bottom of the zone since, in an area underlain by ice contact deposits, rapid changes in lithology and permeability often occur in very short distances.

The locations of the Marshall Road Wells with respect to each other are shown on Figure 1 in Appendix A. For easy reference, details about all of the Marshall Road Wells are included in Appendix B.

#### 4.0 DRILLING AND WELL CONSTRUCTION

The drilling and construction of Marshall Road Well No. 4 were carried out by Field Drilling Contractors Ltd. of Aldergrove, using a cable tool drilling rig equipped with pull-down jacks. In this method, an hydraulic cylinder is anchored below ground surface on each side of the well casing. The jacks pull down on the casing by means of a ring that fits over the top of the casing and which is attached to the jack rams by means of chains. Thus the casing is pushed into the ground by steady hydraulic pressure rather than being driven into the ground by pounding of the drill stem. The advantages are:

1. longer lengths of pipe can be used;
2. drilling and bailing can go on continuously;
3. it is not necessary to place and remove drive clamps;
4. the casing has less tendency to stick to the surrounding ground.

The main disadvantage of the pull-down technique is that setup and removal take longer, because of placing and removing the anchors for the jacks.

The litholog of the materials encountered during the drilling of Well No. 4 is included in Appendix B; it is similar to the logs of the other nearby Wells. There was some question as to whether the bottom of the aquifer extended below 42.1 m (138 ft) which is the depth of the large diameter production Well No. 3. The bottom of the aquifer in the new Well No. 4 is at 42.4 m (139 ft); this is approximately the same as the bottom of the existing Well No. 3 in the pump house which it replaces. Drilling was continued open hole to 44.5 m (146 ft) beyond the apparent bottom of the aquifer to ensure that the bottom of the aquifer had been reached. In preliminary discussions about constructing a new well in the Marshall Road Well Field, the possibility of changing to 200 mm (8") diameter casing at the bottom of the aquifer and exploring for a deeper aquifer had been considered. However, because conditions looked good in the aquifer to obtain the desired amount of water, the deeper exploratory drilling was not carried out.

During drilling, samples of aquifer sand and gravel were collected by a suction bailer and sieve analyses of these samples were carried out to design the well screen. Copies of these analyses are included in Appendix B. Based on the sieve analyses, a 8.52 m (27.96 ft) long screen assembly was installed in the Well between 33.5 and 42.1 m (110 and 138 ft). Attention is drawn to the fact that the screen installed in the new well varies in slot opening from 2.54 to 4.57 mm (0.100 to 0.180") with most of the screen greater than 2.54 mm (0.100"); in contrast, the screen in existing Well No. 3 consists entirely of 2.54 mm (0.100") slot screen with an artificial gravel pack.

The screen was installed in Well No. 4 by the standard pull-back method and development was carried out by bailing, surging and pumping, until very little sediment could be brought into the well and until no further increase in well performance could be achieved. As required by the contract for the work, Field Drilling continuously checked the performance of the well by mini pumping tests at a rate of 6.31 to 12.62 L/sec (100 to 200 USgpm) during the development to prevent over-development.

## 5.0 PUMPING TEST

### 5.1 Test Procedure

The pumping test of Marshall Road Well No. 4 was carried out by Aqua-Flo Testing and Equipment Ltd. using a deep well turbine test pump driven by a diesel engine. Electric water well indicators were used to measure water levels in the pumped well and Well No. 3, the old production well in the pump house. Water was discharged to the storm sewer through lay-flat pipe. A standard orifice, which was set up at the end of the lay-flat pipe, was used to measure the pumping rate. In order to convey the water into the manhole of the storm sewer, a modified sheet metal stock-watering trough was placed over the manhole. The pumping rate during the test was limited to 117.5 L/sec (1863 USgpm) because the storm sewer would not accept a larger amount.

On the day before the pump test, the Well was pumped for 35 minutes through a smaller orifice in three 10-minute steps to obtain a preliminary evaluation of well performance and to complete the development of the Well.

Final pumping began at a rate about 77.0 L/sec (1220 USgpm); the rate was increased at 30 minutes to 94.3 L/sec (1494 USgpm) and, at 60 minutes, to a final rate of 117.5 L/sec (1863 USgpm) for the duration of the 600 minute test period. Following the termination of pumping, the recovery of the water levels in the pumped Well No. 4 and nearby Well No. 3 were observed for 610 minutes.

### 5.2 Test Results

The purpose of the pumping test of Marshall Road Well No. 4 was to determine the capacity of the new well. The performance of the aquifer and its ability to sustain prolonged pumping have been tested by many years of pumping from the existing production wells.

### 5.3 Analysis of Results

Table 1 on the previous page shows that Marshall Road Well No. 4 performs as expected, with a decrease in specific capacity for an increased rate and duration of pumping. Even during the preliminary pumping, only a small amount of sediment was pumped for a few minutes at startup. No sand was pumped during the final test, even as a result of each rate increase; a small amount of sand can usually be observed in new wells but this was not the case for Marshall Road Well No. 4.

As a matter of interest, we have calculated the transmissivity (T) of the aquifer at Well No. 4 by the curve-matching method, using interference drawdown data from Well No. 3 for the first step of the final pump test (Figure 5, Page C - 12). The transmissivity so obtained is 1490 m<sup>2</sup>/day ( $1.2 \times 10^5$  USgal/day/ft); this is a moderately high T, confirming good water-yielding capability for the aquifer. The storage coefficient of 0.017 calculated from the curve-matching is somewhat less than the usual range of 0.05 to 0.30 expected for a water table aquifer. Theoretical tables which compare well performance (specific capacity) and aquifer transmissivity show that Well No. 4 is fairly efficient and is probably obtaining about as much water as the aquifer is capable of yielding at that location.

## 6.0 WELL CAPACITY

The capacity of Marshall Road Well No. 4 is calculated from the following parameters:

1. Top of screen assembly below ground - 33.5 m (110 ft).
2. Static water level below ground - 19.8 m (65 ft) in October 1990. The static water level at the time of pump testing in October was close to the expected seasonal low water level in the aquifer; at the time of high water, the level is expected to be about 17.7 m (58 ft).
3. Specific capacity of well - 14.65 L/sec/m of drawdown (70.76 USgpm/ft), at a final pumping rate of 117.56 L/sec (1863 USgpm), after 10 hours of pumping; projections for higher rates of pumping are shown on Figure 7 in Appendix C (Page C - 14).
4. Total available drawdown at end of summer drought - 13.7 m (44.9 ft); total available drawdown at the time of high water in the aquifer - 15.8 m (51.9 ft).
6. 70% of total available drawdown - 9.6 m (31.5 ft); this represents a pumping water level of  $19.8 + 9.6 = 29.5$  m (97 ft) when groundwater conditions in the aquifer are close to minimum; such a level would be the usual basis for rating the capacity of a production well for long-term continual use.

As stated above, the specific capacity of Marshall Road Well No. 4 at a pumping rate of 117.56 L/sec (1863 USgpm) is 14.65 L/sec/m (70.76 USgpm/ft). Since the specific capacity decreases as the pumping rate increases, it will obviously be less at pumping rates greater than the maximum test rate of 117.56 L/sec. The capacity of Marshall Road Well No. 4 will also be affected by interference from the pumping of Wells No. 1 and No. 2; at respective capacities of 63.1 and 25.2 L/sec (1000 and 400 USgpm), the available drawdown in Well No. 4 will be reduced by about 2.1 m (7 ft).

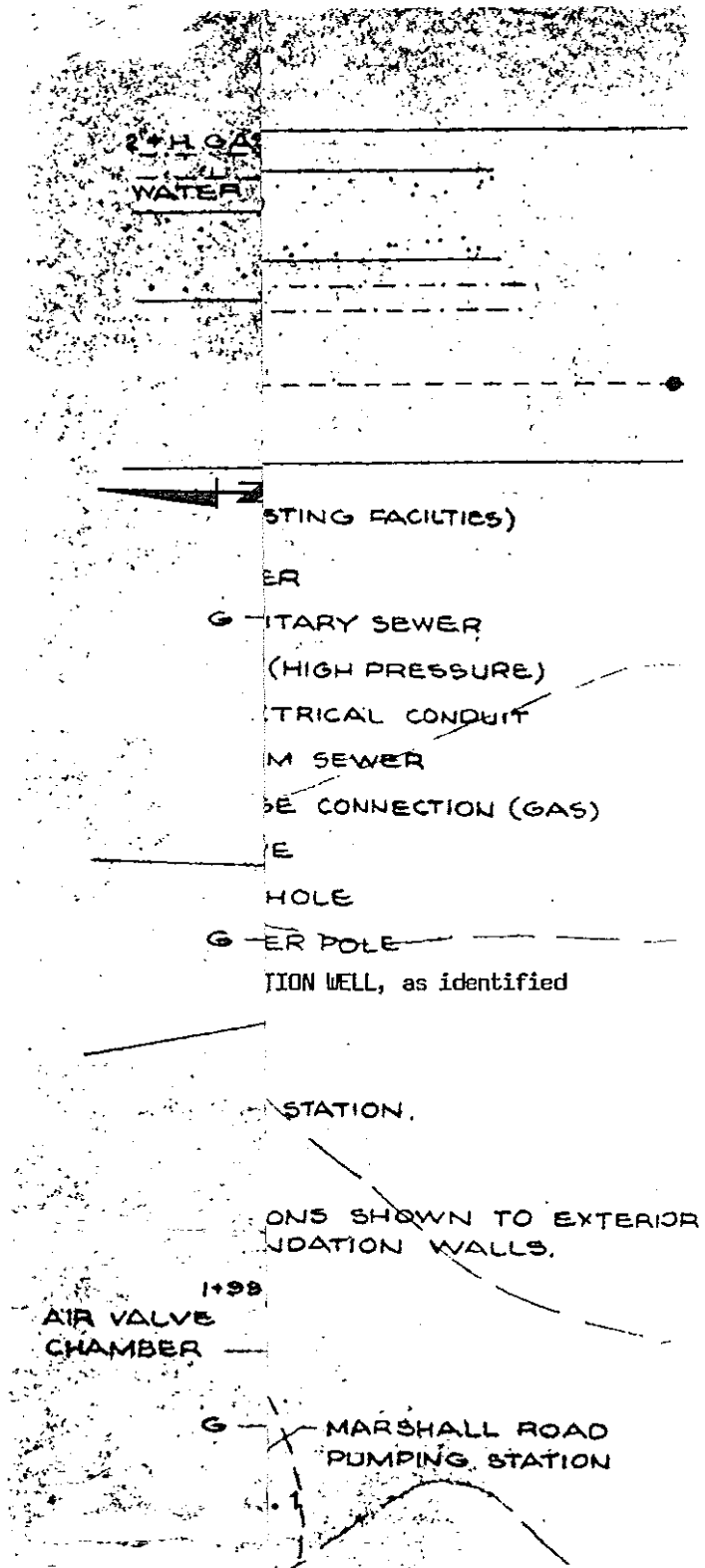
Taking the various factors into account, the capacity of Marshall Road Well No. 4 will vary at certain times and under certain conditions as shown in the table on the following page. To utilize most of the available drawdown, the pump intake should include a short tail pipe extending into the screen.

**APPENDIX A**

**SITE PLAN**

FIGURE 1

ht Ltd. Drawing No. 60.8.5 reduced to a scale of  
rawing.



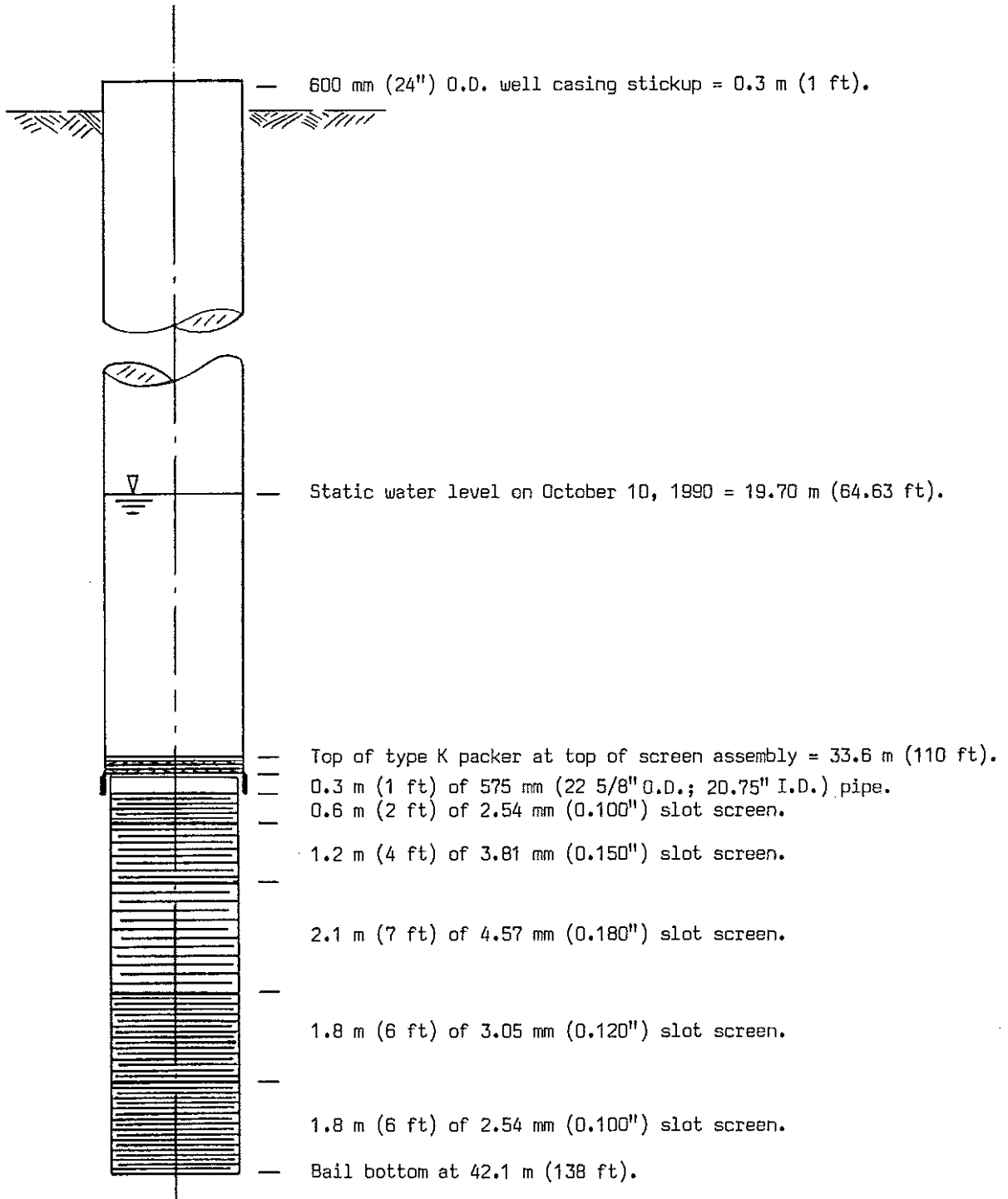


APPENDIX B

LITHOLOGS, WELL CONSTRUCTION DETAILS AND SIEVE ANALYSES

FIGURE 2

MARSHALL ROAD WELL NO. 4 CONSTRUCTION DETAILS



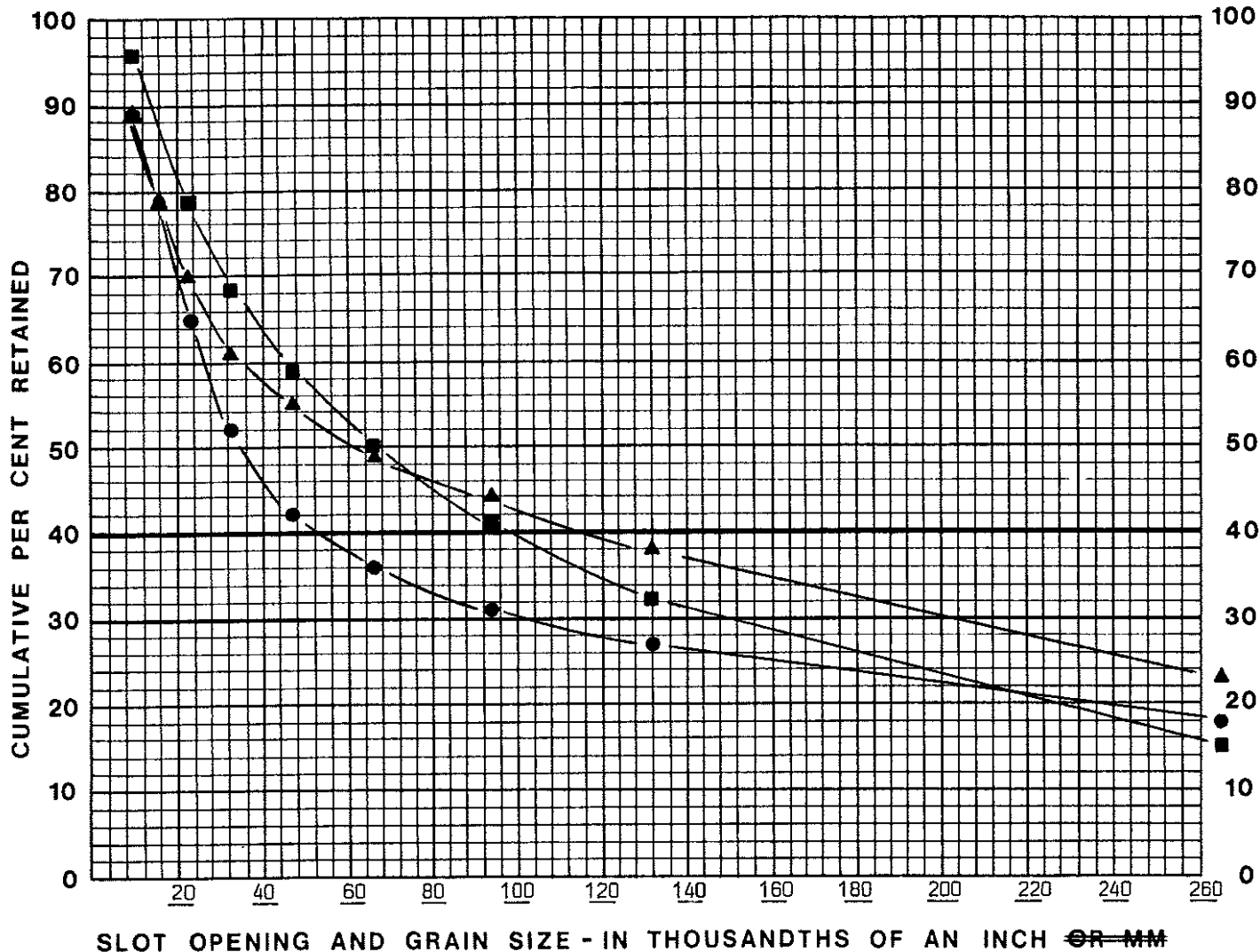
Notes:

1. All measurements are below ground level unless otherwise indicated.
2. The well screen is Johnson 600 mm (24") nominal diameter (20.75" I.D.) stainless steel.
3. The sketch is not to scale.

# SIEVE ANALYSIS

21	JULY	1990
Day	Month	Year

**PROJECT** DEWONEY-ALOUETTE REGIONAL DISTRICT  
**REMARKS** Production Well No. 4 on Marshall Road

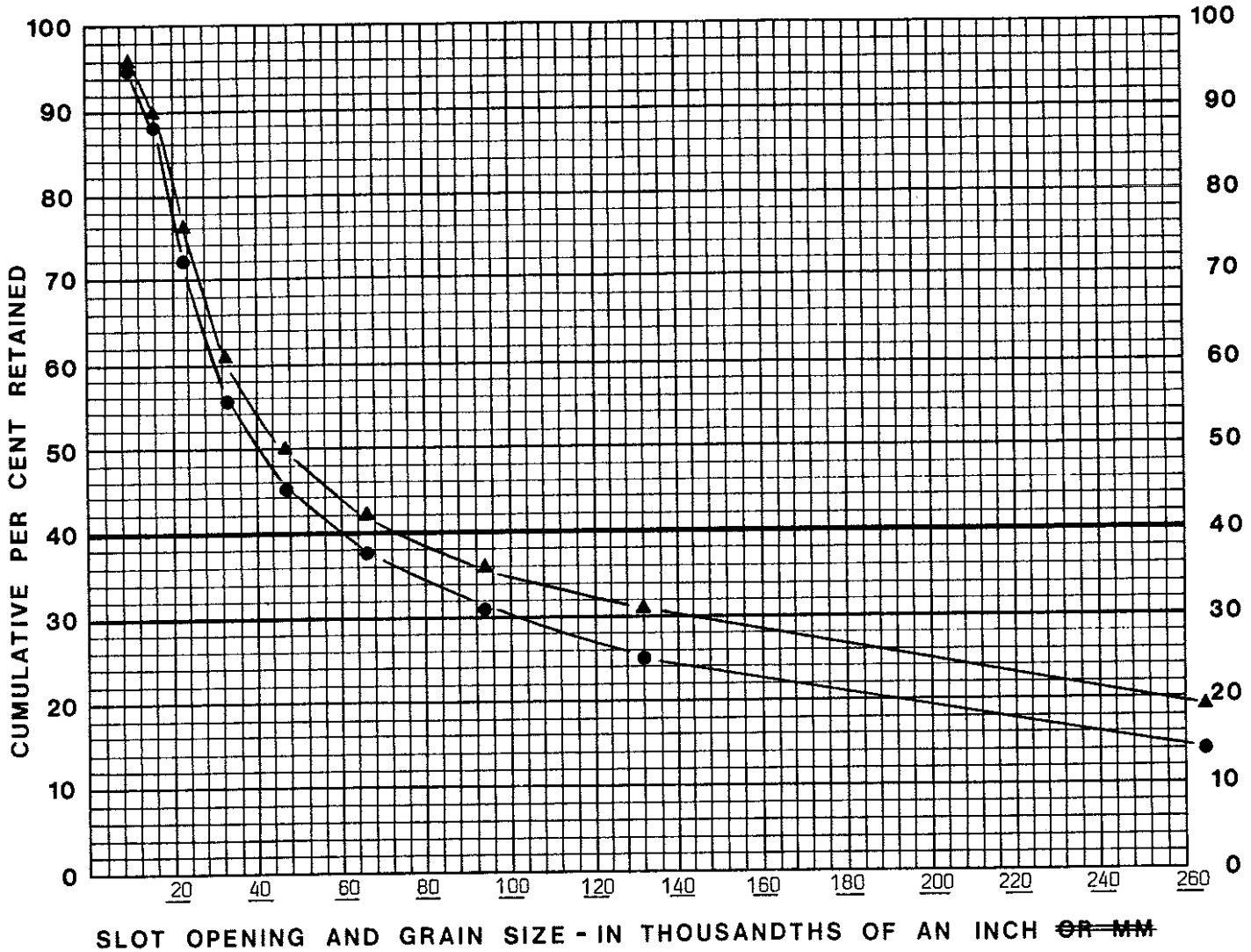


U.S. SIEVE NO	SIEVE OPENING		CUMULATIVE % RETAINED				REMARKS	
	INCHES	MM	GRAMS	%	GRAMS	%		
ESTIMATED OVERSIZE				30		30		
3	.265	6.73	164	18	157	23	139	15
6	.132	3.36	240	27	257	38	303	32½
8	.094	2.38	277	31	298	44	385	41
12	.066	1.68	319	36	330	49	467	50
16	.047	1.19	375	42	367	55	550	59
20	.033	0.84	463	52	411	61	639	68½
30	.023	0.60	579	65	467	70	735	79
40	.016	0.42	707	79	532	79	836	90
50	.012	0.30	-	-	-	-	-	-
60	.010	0.25	800	89	598	89	897	96
100	.006	0.15						
200	.003	0.08						
TOTAL			891		670		932	

# SIEVE ANALYSIS

21	JULY	1990
Day	Month	Year

**PROJECT** DEWDNEY-ALOUETTE REGIONAL DISTRICT  
**REMARKS** Production Well No. 4 on Marshall Road



U.S SIEVE NO	SIEVE OPENING		CUMULATIVE % RETAINED				REMARKS
	INCHES	MM	GRAMS	%	GRAMS	%	
ESTIMATED OVERSIZE				15		20	
3	.265	6.73	155	14	212	19	
6	.132	3.36	278	25	342	31	
8	.094	2.38	345	31	404	36	
12	.066	1.68	413	37½	468	42	
16	.047	1.19	496	45	551	50	
20	.033	0.84	611	55½	671	61	
30	.023	0.60	791	72	843	76	
40	.016	0.42	967	88	996	90	
50	.012	0.30	-		-		
60	.010	0.25	1047	95	1065	96	
100	.006	0.15					
200	.003	0.08					
TOTAL			1100		1107		

APPENDIX C

PUMPING TEST DATA AND PLOTS

The data collected during the pumping test of Marshall Road Well No. 4 are included in Appendix C along with drawdown and recovery plots of the data. The data have been plotted according to standard straight line methods of analyzing pumping test data, with drawdown versus log of time in minutes since pumping started and, in the case of the recovery data, residual drawdown versus log of the ratio, time in minutes since pumping started. The curve-matching time in minutes since pumping stopped technique was also used to analyze the interference drawdown in Well No. 3.

The plot of the drawdown data for Well No. 4 (Figure 3, Page C - 10), shows that the water level drew down rapidly at each increase in rate during the test, following which the rate of drawdown became very small. At the final pumping rate of 117.56 L/sec (1863 USgpm), drawdown continued at a slow but steady rate for the duration of the test, with a total drawdown of 0.045 m (0.15 ft) in the last 200 minutes of pumping. Drawdown within the aquifer had become nearly stable by the end of the 10 hour pump test. This is shown by the fact that the rate of drawdown in the aquifer for the last 500 minutes of the test, as shown by the observation well data (Figure 4, Page C - 11), was about 0.290 m (0.95 ft) per log cycle.

The following table summarizes the performance of Well No. 4 at the various rates of the preliminary and final pumping test.

Table 1. Performance of Marshall Road Well No. 4

Pumping Rate		Minutes Since Pumping Started	Drawdown		Specific Capacity	
L/sec	(USgpm)		m	(ft)	L/sec/m	(USgpm/ft)
31.99	(507)	10	1.76	(5.77)	18.19	(87.87)
44.36	(703)	20	2.45	(8.05)	18.08	(87.33)
55.47	(879)	30	3.08	(10.11)	17.99	(86.94)
76.99	(1220)	10	4.73	(15.51)	16.28	(78.66)
76.99	(1220)	30	4.87	(15.97)	15.81	(76.39)
94.34	(1495)	60	6.02	(19.74)	15.67	(75.73)
117.56	(1863)	90	7.63	(25.02)	15.41	(74.46)
117.56	(1863)	600	8.03	(26.33)	14.65	(70.76)

Table 2. Capacity of Marshall Road Well No. 4

% of Available Drawdown	Pumping Water Level		Projected Specific Capacity		Well Capacity		
	m	(ft)	L/sec/m	(USgpm/ft)	L/sec	(USgpm)	(igpm)
<b>Individual Pumping at Minimum Conditions</b>							
70	29.5	(97)	14.0	(67.6)	134.4	(2130)	(1775)
80	31.0	(101)	13.7	(66.0)	151.3	(2400)	(2000)
96	33.0	(108)	13.0	(63.0)	170.4	(2700)	(2250)
<b>Individual Pumping at Maximum Conditions</b>							
70	29.0	(94)	13.7	(66.0)	151.3	(2400)	(2000)
80	30.3	(99.5)	13.2	(64.0)	167.2	(2650)	(2200)
96	33.0	(108)	12.4	(60.0)	189.3	(3000)	(2500)
<b>Simultaneous Pumping at Minimum Conditions</b>							
70	30.0	(98.5)	14.65	(70.8)	118.6	(1880)	(1565)
80	31.0	(101)	14.0	(67.6)	134.4	(2130)	(1775)
96	33.0	(108.5)	13.7	(66.0)	151.3	(2400)	(2000)
<b>Simultaneous Pumping at Maximum Conditions</b>							
70	29.5	(97)	14.0	(67.6)	134.4	(2130)	(1775)
80	31.0	(101)	13.7	(66.0)	151.3	(2400)	(2000)
96	33.0	(108)	13.0	(63.0)	170.4	(2700)	(2250)

Under the prevailing geologic conditions, where aquifer boundaries are known to be present, a note of caution is urged in projecting well performance by such a large factor, from the maximum pump testing rate of 117.56 L/sec (1863 USgpm) to 189.3 L/sec (3000 USgpm). In such circumstances, final assignment of well capacity is best done by adjusting the rate in response to actual performance. At such time as the permanent pump is in place, a performance check can be carried out and, as a result of such testing, an operations manual prepared.

DEWDNEY-ALOUETTE REGIONAL DISTRICT MARSHALL ROAD WELL NO. 4

Location: In Dewdney-Alouette Regional District's Marshall Road Well Field, southwest of the intersection of Marshall and Gladwin Roads in Matsqui, at a site 7.6 m (25 ft) south of Well No. 3.

Contractor: Field Drilling Contractors Ltd.

Litholog:

0 - 7.6 m ( 0 - 25 ft)	sand and gravel with small boulders at the bottom
7.6 - 18.0 m ( 25 - 59 ft)	till, soft at the top, compact below 7.6 m (48 ft), with a lense of compact cobbly gravel between 6.8 and 7.6 m (43 and 48 ft).
18.0 - 22.0 m ( 59 - 72 ft)	very silty sand and gravel; water-bearing
22.0 - 26.5 m ( 72 - 87 ft)	grey clay with stones
26.5 - 33.8 m ( 87 - 111 ft)	till with a lense of water-bearing sand and gravel between 31.1 and 33.2 m (102 and 109 ft)
33.8 - 42.4 m (111 - 139 ft)	sand and gravel with water
42.4 - 44.5 m (139 - 146 ft)	grey clay and stones.

Diameter: 0.61 m (24") O.D. casing.

Completed depth of well: 42.1 m (138 ft).

Static water level: 19.7 m (64.63 ft) below ground on October 10, 1990.



DEWDNEY-ALOUETTE REGIONAL DISTRICT MARSHALL ROAD WELL NO. 4

(cont'd)

Completion:

Well No. 5 is completed with an assembly of 0.61 m (24") nominal diameter Johnson stainless steel screen, 8.52 m (27.96 ft) in length, as follows:

at top of 33.6 m (110 ft)	type K packer
0.3 m (1 ft) of	575 mm (22 5/8 ") O.D. pipe
0.6 m (2 ft) of	2.54 mm (0.100") slot screen
1.2 m (4 ft) of	3.81 mm (0.150") slot screen
2.1 m (7 ft) of	4.57 mm (0.180") slot screen
1.8 m (6 ft) of	3.05 mm (0.120") slot screen
1.8 m (6 ft) of	2.54 mm (0.100") slot screen
at bottom at 42.1 m (138 ft)	bail bottom.

Well performance and capacity:

Following construction, Marshall Road No. 4 was pump tested for 10 hours at a final rate of 117.56 L/sec (1863 USgpm) between 60 and 600 minutes; this caused a total drawdown of 8.03 m (26.33 ft), for a specific capacity of 14.65 L/sec/m (70.76 USgpm/ft). Allowing for a decrease in specific capacity at an higher rate of pumping and based on use of 70 to 80% of total available drawdown, the capacity of Well No. 4 is 134.4 to 151.3 L/sec (2130 to 2400 USgpm; 1775 to 2000 igpm), for individual pumping at the time of minimum groundwater conditions.

DEWDNEY-ALOUETTE REGIONAL DISTRICT MARSHALL ROAD WELL NO. 1

Date of construction: November 1967.

Contractor: G & G Well Drilling.

Log:

0	-	0.9 m	(	0	-	3 ft)	topsoil
0.9	-	2.4 m	(	3	-	8 ft)	gravel
2.4	-	9.5 m	(	8	-	31 ft)	coarse gravel
9.5	-	10.1 m	(	31	-	33 ft)	clay and gravel
10.1	-	11.6 m	(	33	-	38 ft)	clay
11.6	-	17.4 m	(	38	-	57 ft)	coarse gravel
17.4	-	22.0 m	(	57	-	72 ft)	coarse gravel; very tight
22.0	-	32.6 m	(	72	-	107 ft)	clay
32.6	-	37.8 m	(	107	-	124 ft)	coarse gravel; water-bearing
37.8	-	38.1 m	(	124	-	125 ft)	gravel and clay.

Diameter: 350 mm (14").

Completed depth of well: 37.8 m (124 ft).

Static water level: 19.2 m (63 ft) in November 1967.

Completion: Marshall Road Well No. 1 is completed with a 4.78 m (15'8") long Johnson stainless steel screen assembly consisting of 2.032 mm (0.080") slot screen set with the bottom at 37.8 m (124 ft).

Well performance and capacity: Following construction, Marshall Road Well No. 1 was pumped at 63.1 L/sec (1000 US(?)gpm) with 11.0 m (36 ft) of drawdown.

DEWDNEY-ALOUETTE REGIONAL DISTRICT MARSHALL ROAD WELL NO. 2

Date of construction: June, 1958.

Contractor: G & G Well Drilling.

Log:

0	-	0.6 m	(	0	-	2	ft)	topsoil
0.6	-	2.7 m	(	2	-	9	ft)	gravel
2.7	-	3.4 m	(	9	-	11	ft)	fine angular gravel
3.4	-	4.6 m	(	11	-	15	ft)	very coarse gravel
4.6	-	13.0 m	(	15	-	42 $\frac{1}{2}$	ft)	glacial till
13.0	-	15.5 m	(	42 $\frac{1}{2}$	-	51	ft)	coarse gravel
15.5	-	22.0 m	(	51	-	72	ft)	fine gravel, sand, some clay
22.0	-	27.7 m	(	72	-	91	ft)	very hard clay
27.7	-	31.7 m	(	91	-	104	ft)	coarse gravel and sand; water-bearing
31.7	-	34.0 m	(	104	-	118	ft)	coarse gravel
34.0	-	36.9 m	(	118	-	121	ft)	fine sand and gravel, very high clay content.

Diameter: 300 mm (12").

Completed depth of well: 34.0 m (118 ft).

Static water level: 18.0 m (59 ft) in June 1958.

Completion: Marshall Road Well No. 2 is completed with 6.1 m (20 ft) of 1.016 mm (0.040") slot Cook screen set between 29.9 m and 36.0 m (98 and 118 ft).

Well performance and capacity: Following construction, Marshall Road Well No. 2 was pumped at 25.2 L/sec (400 US(?)gpm) with drawdown of 1.2 metres (3.92 ft).

DEWDNEY-ALOUETTE REGIONAL DISTRICT MARSHALL ROAD WELL NO. 3

Date of construction: February - March 1971.

Contractor: unknown.

Log:

0 - 1.2 m	( 0 - 4 ft)	sandy topsoil
1.2 - 8.8 m	( 4 - 29 ft)	coarse sand and gravel
8.8 - 19.8 m	( 29 - 65 ft)	till
19.8 - 23.2 m	( 65 - 76 ft)	coarse sand and silt
23.2 - 30.2 m	( 76 - 99 ft)	till
30.2 - 42.2 m	( 99 - 138 $\frac{1}{2}$ ft)	gravel and sand
42.2 - 43.3 m	(138 $\frac{1}{2}$ - 142 ft)	till.

Diameter: 600 mm (24").

Completed depth of well: 42.1 m (138 ft).

Static water level: 17.6 m (57.83 ft) in March 1971.

Completion: Marshall Road Well No. 3 is completed with 8.2 m (27 ft) of 450 mm (18") diameter stainless steel screen with 2.54 mm (0.100") slots set between 33.8 and 42.1 m (111 and 138 ft); at the top of the screen is 1.5 m (5 ft) of stainless steel riser pipe and at the top of the assembly, at 32.3 m (106 ft,) is a lead packer. The screen is gravel packed.

Well performance and capacity: Following construction, Marshall Road Well No. 3 was pump tested in March 1971 at a maximum rate of 150 L/sec (2380 US(?)gpm) with 10.1 m (33 ft) of drawdown.

# PUMP TEST – DRAWDOWN DATA

CONTRACTOR Aqua-Flo Testing & Equipment Ltd.

9	OCTOBER	1990
DAY	MONTH	YEAR

PROJECT DEWDNEY-ALOUETTE REGIONAL DISTRICT - MARSHALL ROAD

Location Southwest of the Intersection of Dewdney and Gladwin Roads

Well No. 4 Pumping Rate (Q) See below (6" orifice on 10" pipe)

Datum Point Top of measuring tube Elevation of Datum Point 0.3 m (1 ft) above well casing

Static Water Level 66.63 ft (20.314 m) Screen Location 33.6 to 42.1 m (110 to 138 ft)

TIME		ELAPSED TIME	DISTANCE TO WATER	DRAWDOWN (ft)	DISTANCE TO WATER	DRIFICE PRESSURE (in)	PUMPING RATE (USgpm)	REMARKS
HR.	MIN.	t (MIN.)						
18	25				65.14			
18	27		66.63					
18	30							Start pump.
18	31	1	71.42	4.79				
18	31½	1½	71.60	4.97				Discharge water cloudy.
18	32	2	71.95	5.32				
18	32½	2½	71.96	5.33				Adjust flow up slightly.
18	33	3	72.09	5.46		13	507	
18	33½	3½	72.17	5.54				Discharge water cloudy.
18	34	4	72.23	5.60				
18	35	5	72.29	5.66				
18	36	6	72.33	5.70				Discharge water clearing.
18	37	7	72.38	5.75				
18	38	8	72.40	5.77		13	507	
18	40	10	72.40	5.77				Increase rate.
18	41	11	74.40	7.77				
18	42	12	74.48	7.85		25	703	
18	43	13	74.61	7.98				
18	44	14	74.63	8.00				
18	45	15	74.65	8.02				Discharge water clear.
18	47	17	74.68	8.05				
18	50	20	74.68	8.05				Increase rate.
18	51	21	76.64	10.01		39	879	
18	52	22	76.66	10.03				
18	53	23	76.68	10.05				
18	54	24	76.69	10.06				



# PUMP TEST – DRAWDOWN DATA

CONTRACTOR Aqua-Flo Testing & Equipment Ltd.

10	OCTOBER	1990
DAY	MONTH	YEAR

PROJECT DEWDNEY-ALOUETTE REGIONAL DISTRICT – MARSHALL ROAD

Location Southwest of the Intersection of Marshall and Gladwin Roads

Well No. 4 Pumping Rate (Q) See below (10" orifice on 12" pipe)

Datum Point Top of measuring tube Elevation of Datum Point 0.6 m (2 ft) above ground

Static Water Level 66.83 ft (20.314 m) Screen Location 33.6 to 42.1 m (110 to 138 ft)

TIME		ELAPSED TIME	DISTANCE TO WATER	DRAWDOWN (ft)		ORIFICE PRESSURE (in)	PUMPING RATE (USgpm)	REMARKS
HR.	MIN.	t (MIN.)						
10	15		66.63					Static level; start.
10	20	1	81.15	14.52				
		1½						Discharge water cloudy.
		2	81.27	14.64				
		2½	81.36	14.23		5½	1168	
		3	81.45	14.82				
		3½	81.64	15.01				
		4	81.68	15.05				
		4½	81.77	15.14				Discharge water cloudy.
		5	81.79	15.16		6	1220	
		6	81.89	15.26				
		7	81.99	15.36				
		8	82.02	15.39				
		9	82.06	15.43		6	1220	
10	30	10	82.14	15.51				
		12	82.24	15.61				
		14	82.37	15.74				
		20	82.48	15.85				
		25	82.57	15.94				
10	50	30	82.60	15.97				Increase rate.
		31	85.71	19.08				
		32	85.75	19.12				
		33	85.94	19.31				
		34	85.97	19.34				
		36	85.98	19.35		9	1494	
		38	86.01	19.38				
11	00	40	86.05	19.42				
		45	86.11	19.48				

# PUMP TEST – DRAWDOWN DATA

PROJECT DEWDNEY-ALOUETTE REGIONAL DISTRICT – MARSHALL ROAD

10	OCTOBER	1990
DAY	MONTH	YEAR

Well No. 4 Static Water Level 66.83 ft (20.314 m)

TIME		ELAPSED TIME	DISTANCE TO WATER	DRAWDOWN (ft)		DRIFICE PRESSURE (in)	PUMPING RATE (USgpm)	REMARKS
HR.	MIN.	t (MIN.)						
11	10	50	86.23	19.60				
11	15	55	86.31	19.68				
11	20	60	86.37	19.74		9	1494	Increase rate.
11	21	61	90.40	23.77				
11	22	62	90.61	23.98		14	1863	
11	23	63	90.95	24.32				
11	24	64	91.15	24.52				
11	26	66	91.19	24.56				
11	28	68	91.23	24.60		14	1863	
11	30	70	91.31	24.68				
11	35	75	91.46	24.83				
11	40	80	91.54	24.91				
11	45	85	91.60	24.97		14	1863	
11	50	90	91.65	25.02				
12	00	100	91.75	25.12				
12	10	110	91.86	25.23		14	1863	
12	20	130	91.93	25.30				
12	50	150	92.05	25.42		14	1863	
13	15	175	92.18	25.55				
13	40	200	92.23	25.60		14	1863	
14	05	225	92.30	25.67				
14	55	275	92.48	25.85		14	1863	
15	20	300	92.51	25.88				
15	45	325	92.56	25.93		14	1863	
16	10	350	92.63	26.00				
16	35	375	92.73	26.10		14	1863	
17	00	400	92.76	26.13				
17	25	425	92.81	26.18		14	1863	
17	50	450	92.84	26.21				
18	15	475	92.86	26.23		14	1863	
18	40	500	92.90	26.27				
19	05	525	92.92	26.29				





PUMP TEST – DRAWDOWN DATA

PROJECT DEWDNEY-ALOUETTE REGIONAL DISTRICT - MARSHALL ROAD

10	OCTOBER	1990
DAY	MONTH	YEAR

Well No. 3 (Observation) Static Water Level 65.17 ft (19.869 m)

TIME		ELAPSED TIME	DISTANCE TO WATER	DRAWDOWN (ft)		PUMPING RATE	REMARKS
HR.	MIN.	t (MIN.)					
10	10		65.17				Static level; start.
10	20	1	67.88	2.71			
		2	69.20	4.03			
		2½					Rate of flow in No. 4 = 1168 USgpm.
		3	69.65	4.48			
		4	69.87	4.70			
10	25	5	70.02	4.85			Rate of flow in No. 4 = 1220 USgpm.
		6	70.13	4.96			
		7	70.20	5.03			
		9	70.35	5.18			
10	30	10	70.39	5.22			
10	33	13	70.50	5.33			
10	41	21	70.75	5.58			
10	46	26	70.86	5.69			
10	50	30					Increase rate of flow in No. 4 to 1494 USgpm.
10	54	34	71.81	6.64			
10	57	37	71.95	6.78			
11	01	41	72.05	6.88			
11	06	46	72.11	6.94			
11	11	51	72.17	7.00			
11	19½	59½	72.26	7.09			
11	20	60					Increase rate of flow in No. 4 to 1863 USgpm.
11	25	65	73.65	8.48			
11	29	69	73.81	8.64			
11	33	73	73.86	8.69			
11	39	79	73.95	8.78			
11	41	81	74.06	8.89			
12	01	101	74.23	9.06			



PUMP TEST – RECOVERY DATA

PROJECT DEUDNEY-ALOUETTE REGIONAL DISTRICT – MARSHALL ROAD

10	OCTOBER	1990
DAY	MONTH	YEAR

Well No. 4 and No. 3 (Observation)

Datum Point Top of measuring tube Elevation of Datum Point 0.6 m (2 ft) above ground

Static Water Level 66.83 ft (20.314 m) Total Drawdown 26.33 ft (8.03 m)

WELL NO. 4

WELL NO. 3

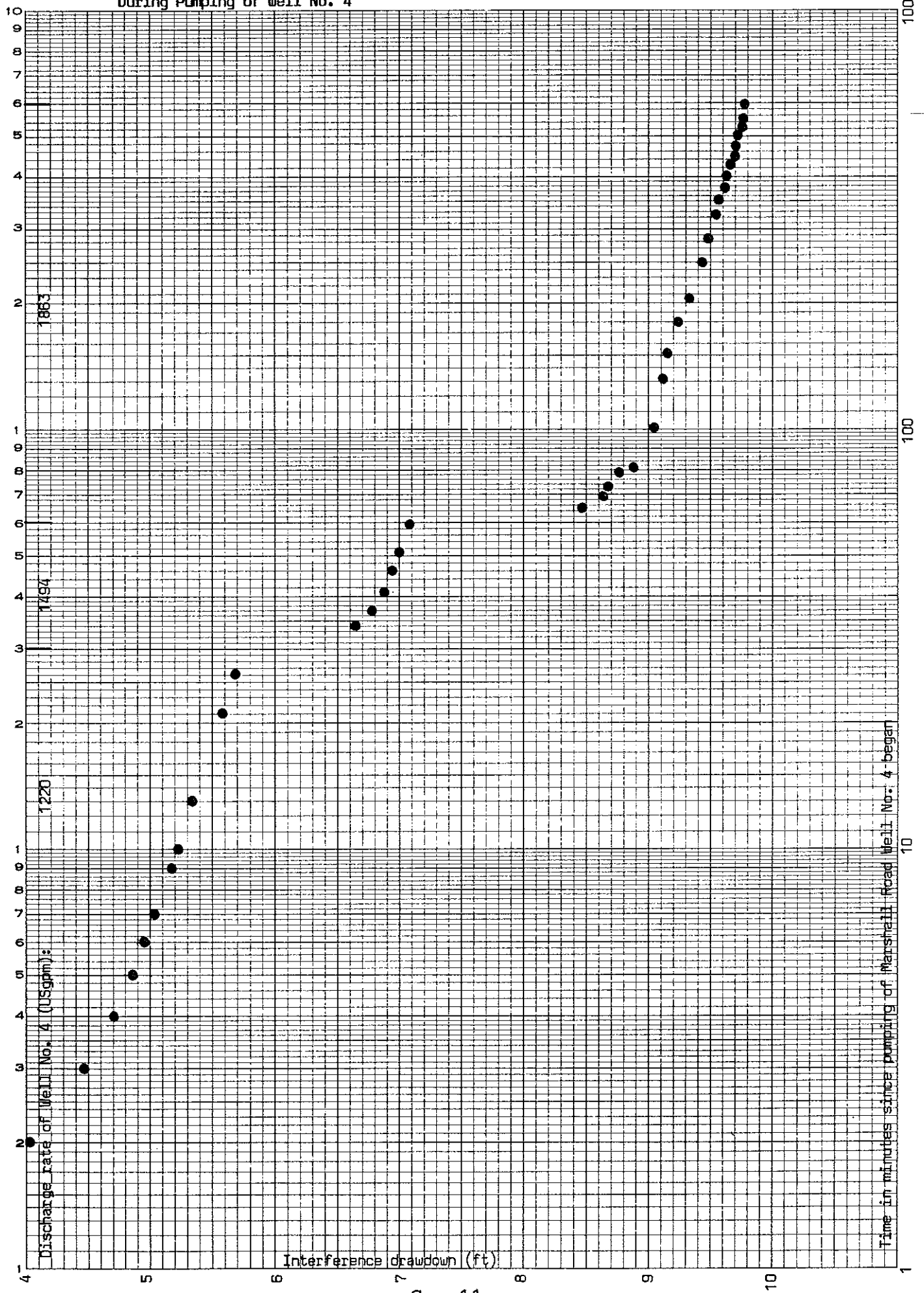
TIME		ELAPSED TIME SINCE PUMPING STARTED	ELAPSED TIME SINCE PUMPING STOPPED	RATIO (t/t')	DISTANCE TO WATER	RESIDUAL DRAWDOWN (ft)	DISTANCE TO WATER	RESIDUAL DRAWDOWN (ft)	REMARKS
HR.	MIN.	t (min.)	t' (min.)						
20	20	600			92.96	26.33			Stop pump in Well No. 4.
			½		71.11	4.48			
			1		70.42	3.79			
			1½		69.95	3.32			
			2		69.65	3.02			
			2½		69.50	2.87			
			3				68.22	3.05	
			3½		69.35	2.72			
			4		69.33	2.70			
			4½		69.23	2.60			
20	25	605	5	121	69.14	2.51			
		605½	5½	110.1			67.50	2.33	
20	26	606	6	101	69.04	2.41			
		607	7	86.7	68.95	2.32			
		608	8	76	68.83	2.20			
		609	9	67.7			67.19	2.02	
20	30	610	10	61	68.67	2.04			
20	32	612	12	51	68.55	1.92			
20	33	613	13	47.15			67.03	1.86	
20	35	615	15	41	68.42	1.79			
20	36	616	16	38.5			66.84	1.67	
20	40	620	20	31	68.18	1.55			
20	41	621	21	29.6			66.71	1.54	
20	45	625	25	25	68.09	1.46			
20	46	626	26	24.1			66.59	1.42	
20	50	630	30	21	67.97	1.34			
20	51	631	31	20.35			66.47	1.30	
20	55	635	35	18.1	67.85	1.22			
20	56	636	36	17.7			66.35	1.18	





Figure 4. Semi-logarithmic Plot of Interference Drawdown in Marshall Road Well No. 3 (Observation) During Pumping of Well No. 4

NO. 3000 L31C...TZBE...GRAPH...R  
 DIET...J CO...RATIL...  
 MADE IN U.S.A.  
 3 CYCLES X 10 DIVISIONS PER INCH



NO. 340-L35 DIEZEL GEN. UNAPH. PAPER  
 LOGARITHMIC  
 3 CYCLES X 5 CYCLES  
 DIEZEL GEN. CORPORATION  
 MADE IN U.S.A.

Figure 5. Log-log Plot of Interference Drawdown in Marshall Road Well No. 3 (Observation) During Pumping of Well No. 4

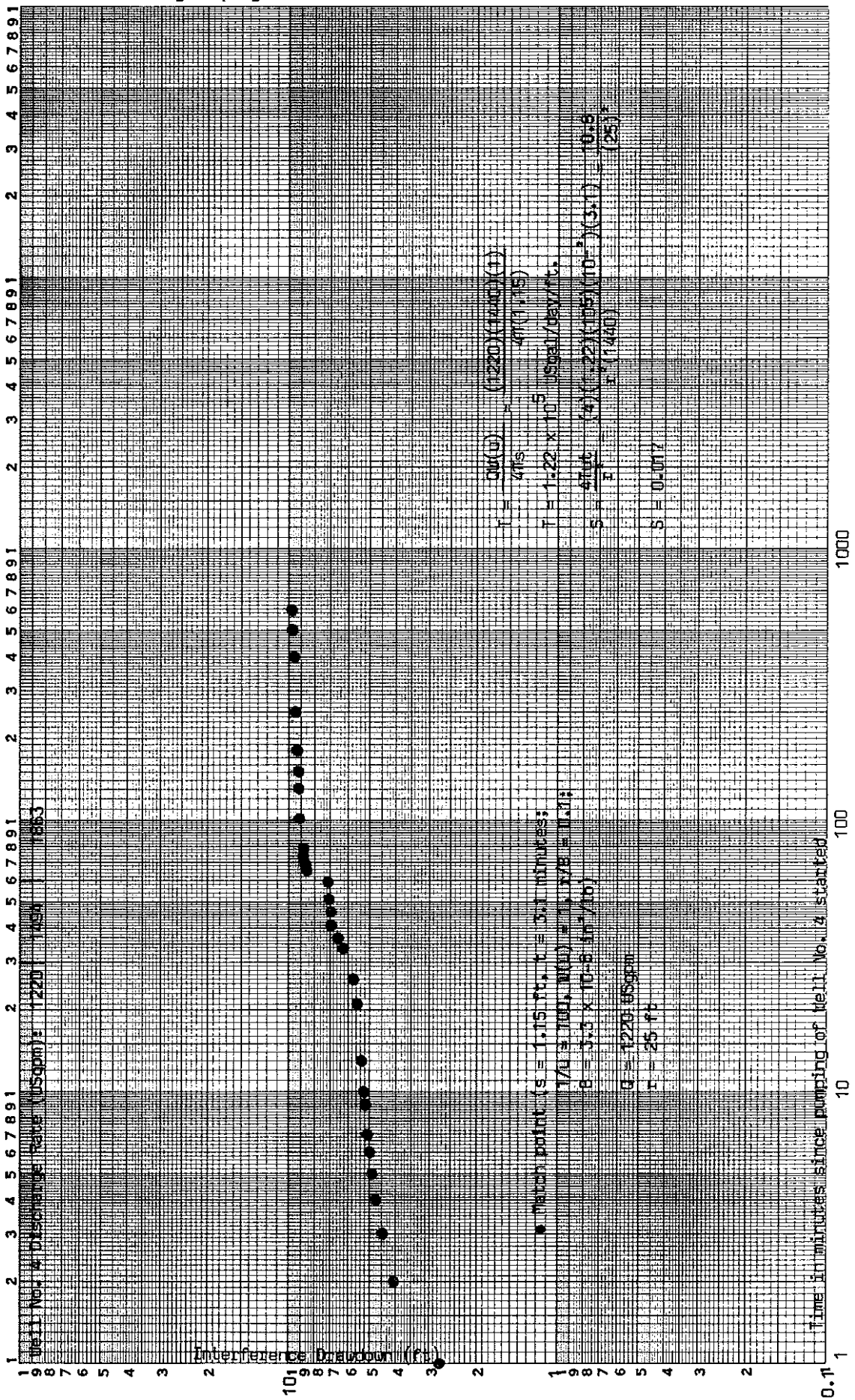




Figure 6. Semi-logarithmic Plot of Recovery of Water Levels in Marshall Road Well No. 4 (Pumping) and Well No. 3 (Observation)

ND, JTB-L22C, MOLTZEN GRAPH PAPER  
 SEMI-LOGARITHMIC  
 2 CYCLES X 20 DIVISIONS PER INCH  
 DIEZGEN CORPORATION  
 MADE IN U. S. A.

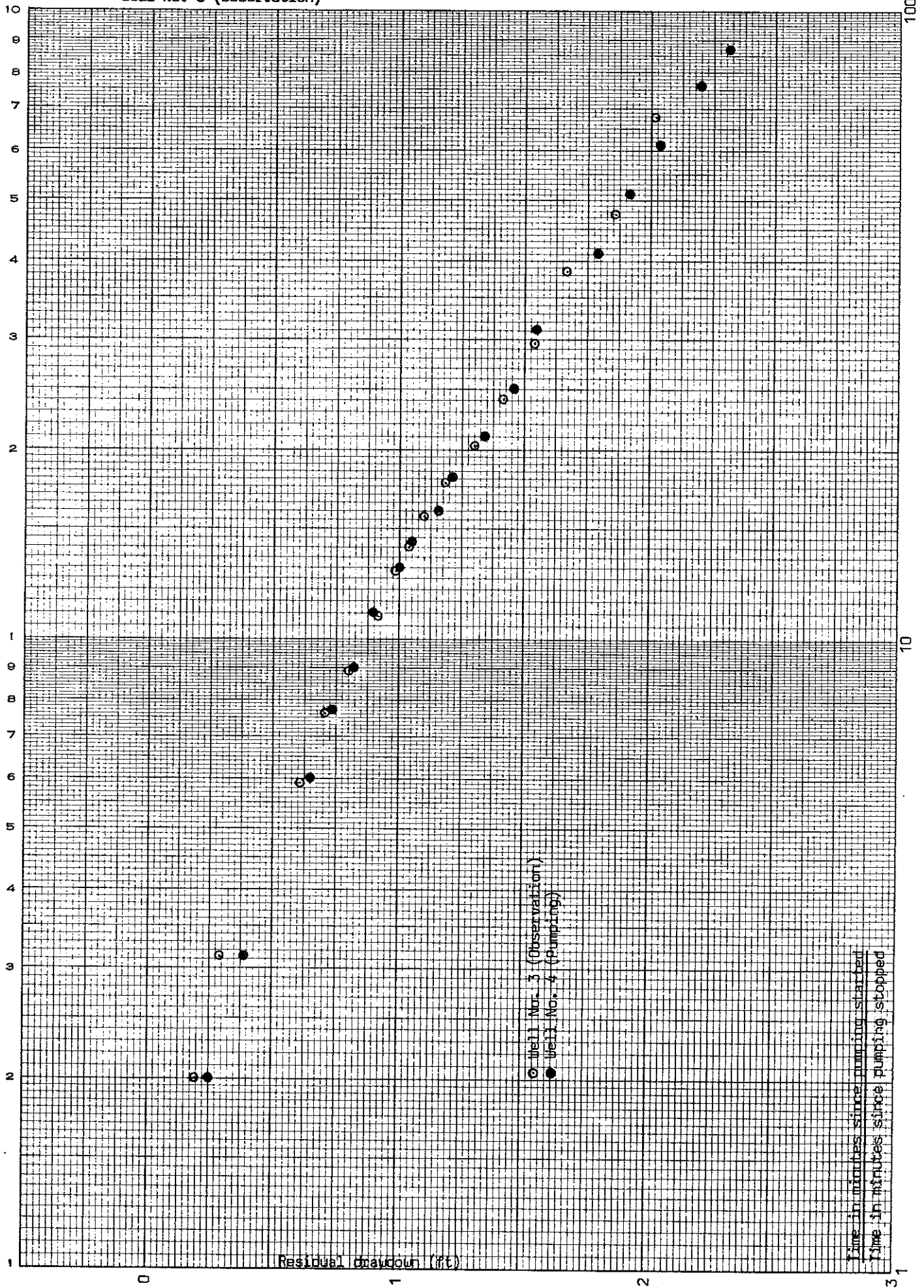


Figure 7. Comparison of Well Yield and Performance (Specific Capacity) for Marshall Road Well No. 4

