Alberta Research Council
Open File Report 1968-8

CHEVRON STANDARD 13-1

Ld. 13, Sec. 1, Tp. 35, R. 10, W. 4th Mer.

OIL-FIELD INJECTION SOURCEWELL

December 1963
1968

D. V. Currie

Alberta
RESEARCH COUNCIL

INTRODUCTION

The subject well was drilled as a source of water to be injected into oil wells presently producing from the Hamilton Lake sand of the Cretaceous Viking Formation.

The Research Council of Alberta was invited by Chevron Standard and Doering Drilling to attend a proposed five-day pump test of the Bulwark Sandstone, a member of the Cretaceous Bearpaw Formation.

The duration of the pump test was cut to 24 hours. It is believed that data obtained from the well will be of use in construction of the Groundwater Division's hydrogeological map series.

METHODS

a) Preliminary

Prior to visiting the drilling operations, a study of topographic maps at the scales of 1:250 000 and 1:50 000 was made (Figs. 1 and 2). This provided an exact location of the well and its relation to neighboring topographic highs such as Nose Hill and the Neutral Hills.

The Research Council of Alberta Preliminary Report 62-3, "A reconnaissance groundwater survey of the Oyen map-area," (Kunkle, 1962) yielded the information that groundwater conditions are generally poor in the area (Figs. 3 and 4). A bedrock topography map included in the same report (Fig. 5) shows the drift thickness to be 40 feet.

Air photographs at the scale of 1:2640 were purchased and an interpretative airphoto map constructed (Fig. 6). This map shows the present status of oil field development, the location of the subject well, identification of surficial

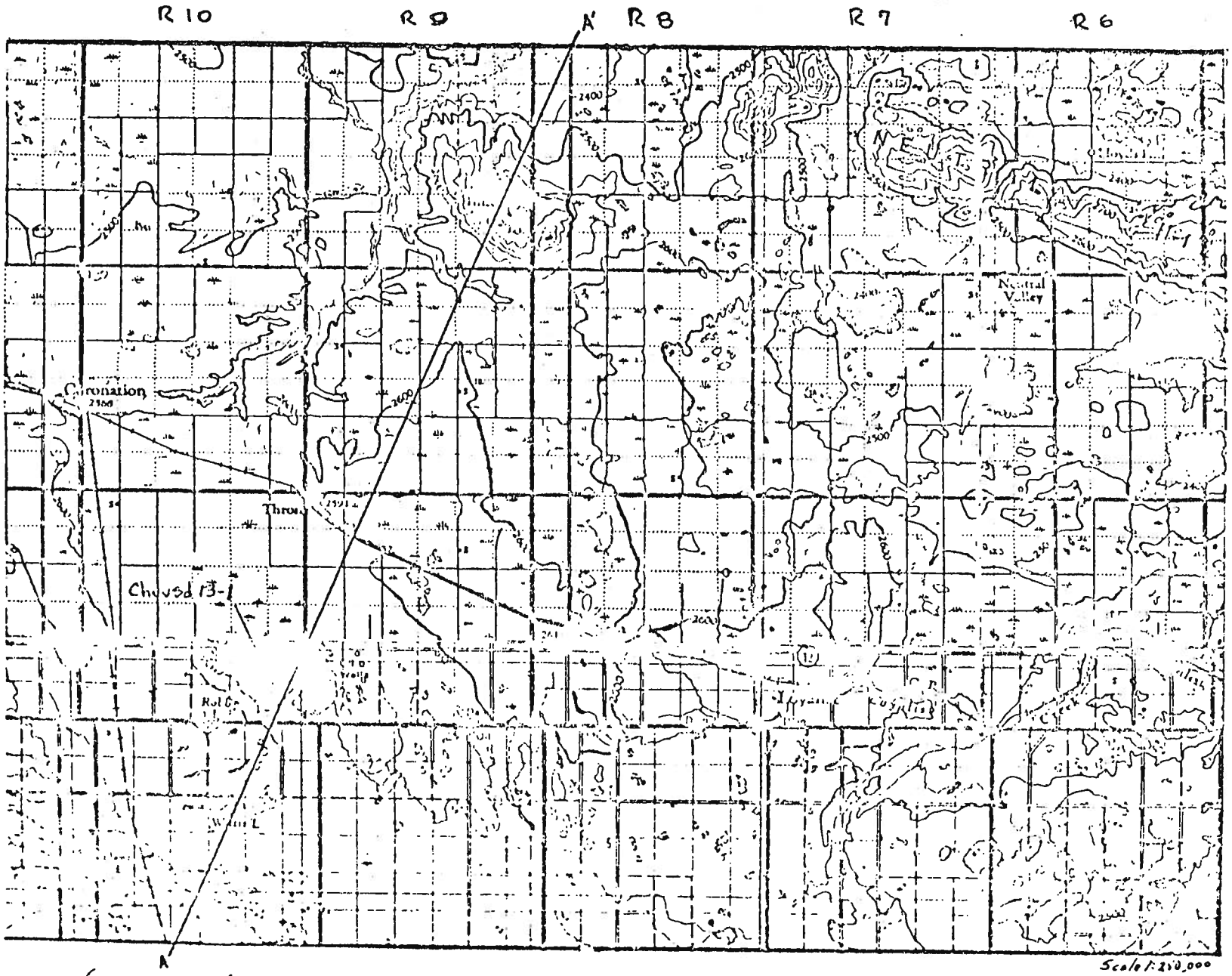


Fig 1 National Topographic Series Map 1:250,000 Line of Cross section A-A'

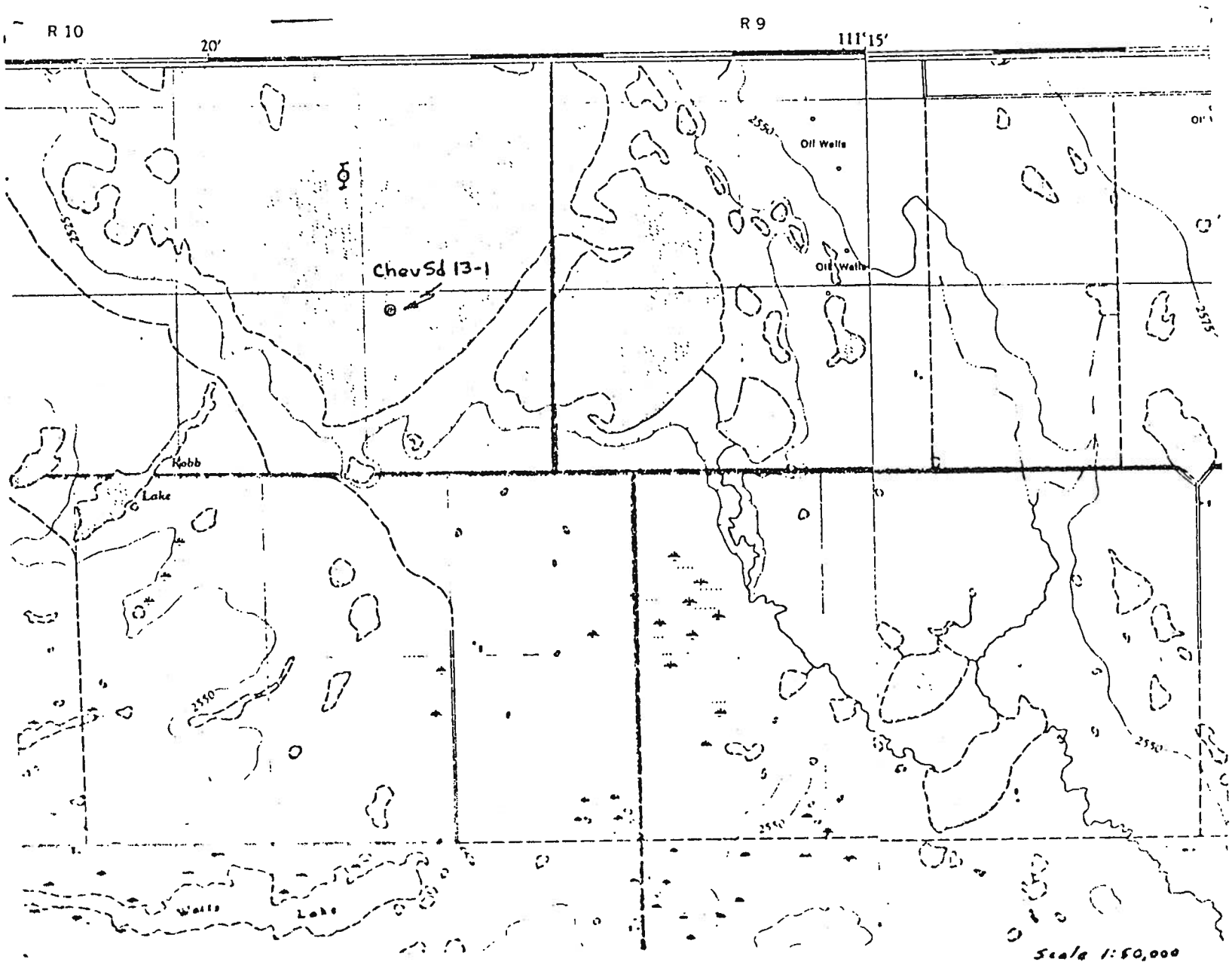


Fig 2 National Topographic Series Map 1:50,000

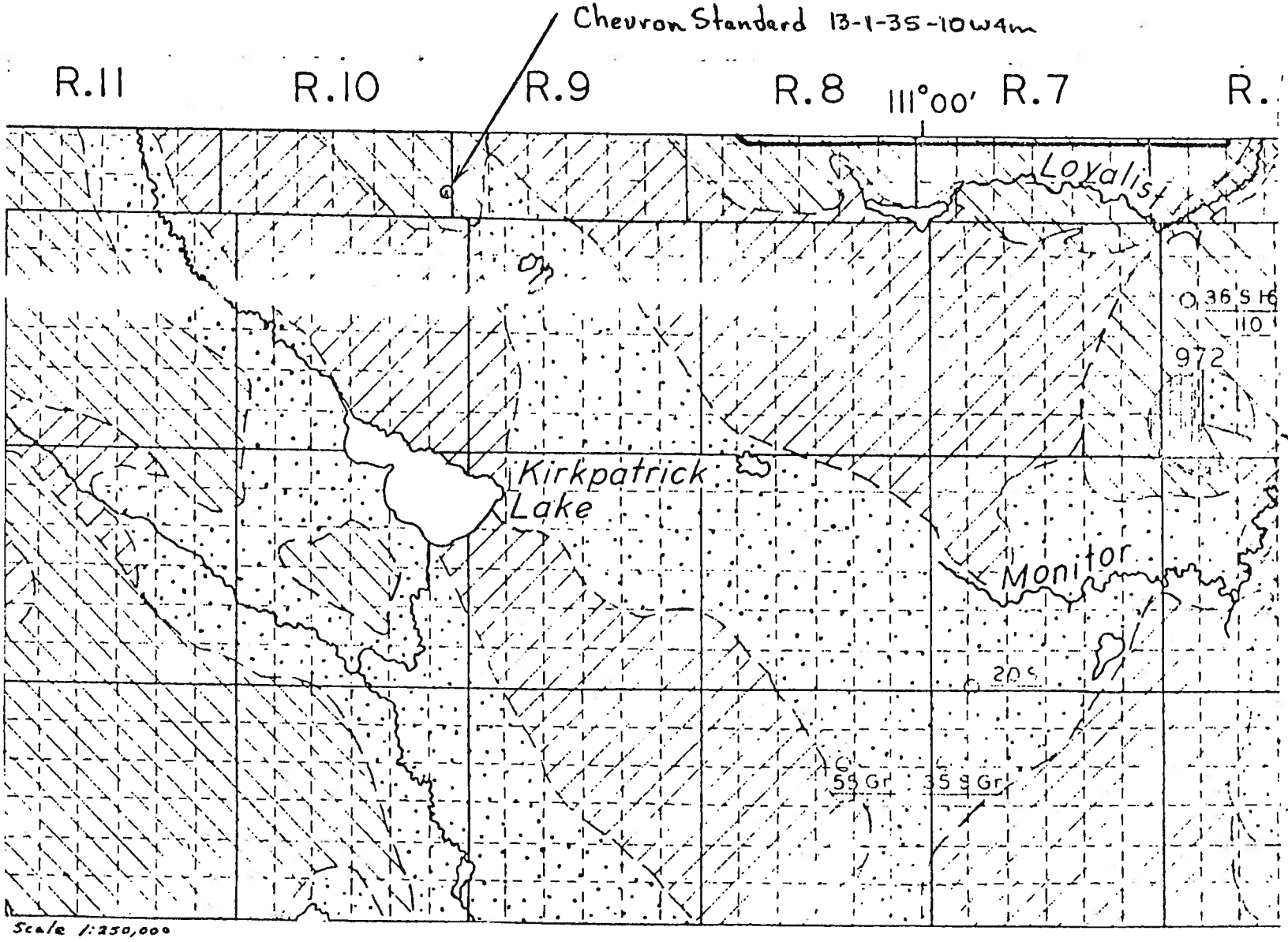


fig 3 Groundwater probability map of the drift OYEN MAP AREA - Kunkle (1962)

Good probability of obtaining 5-10 gpm from shallow sands and gravels [Max yield 75gpm]

Fair probability of obtaining 5-10 gpm from pockets of sand and gravel [Max yield 60gpm]

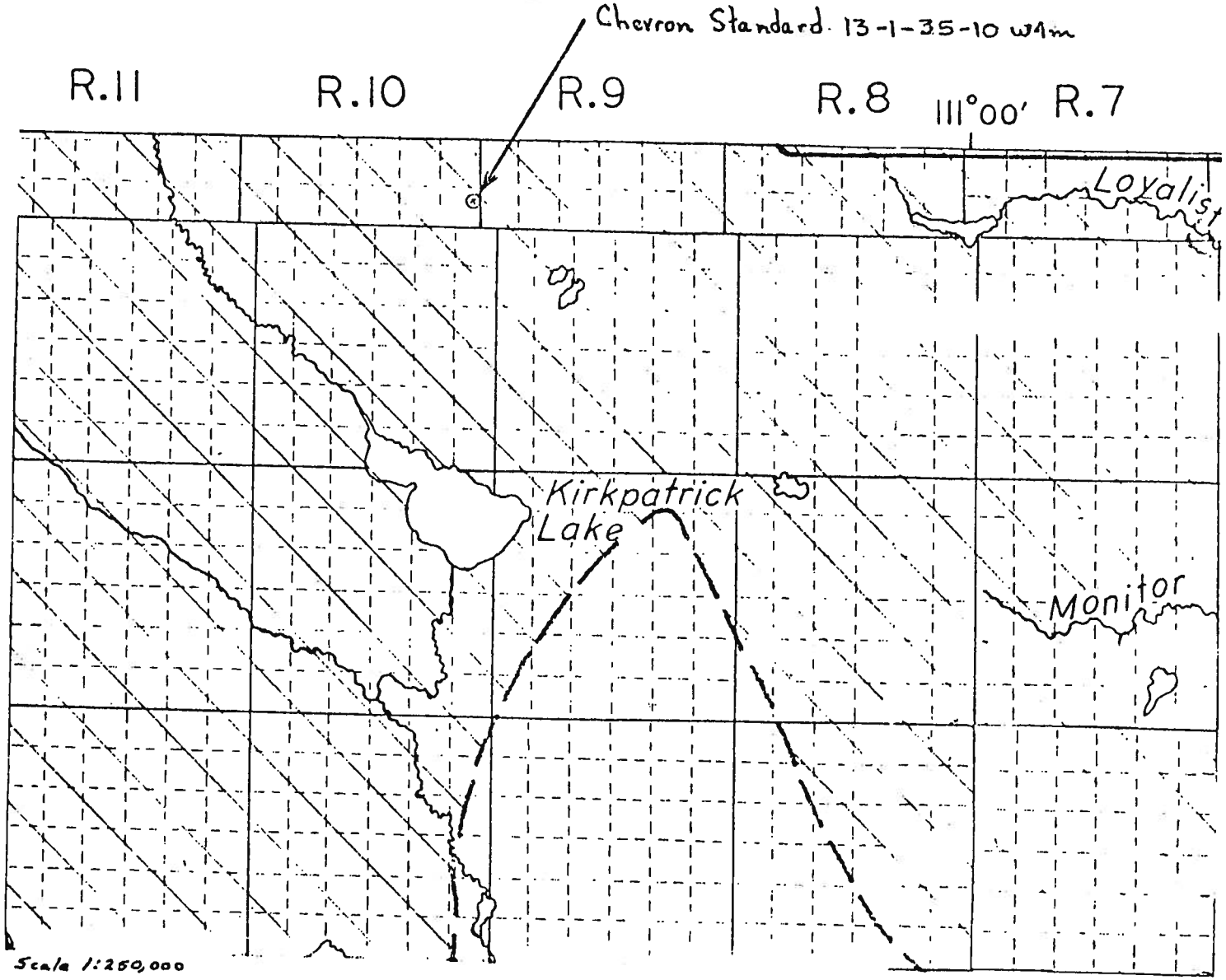


fig 4 Groundwater probability of the bedrock. OYEN MAP AREA (Kunkle (1962)

Fair to Good probability of obtaining 5-10 gpm. Areas underlain by Bulwark Ss and/or Edmonton Fm.

Poor to fair probability of obtaining 5-10 gpm. Areas underlain by Bearpaw shale only.

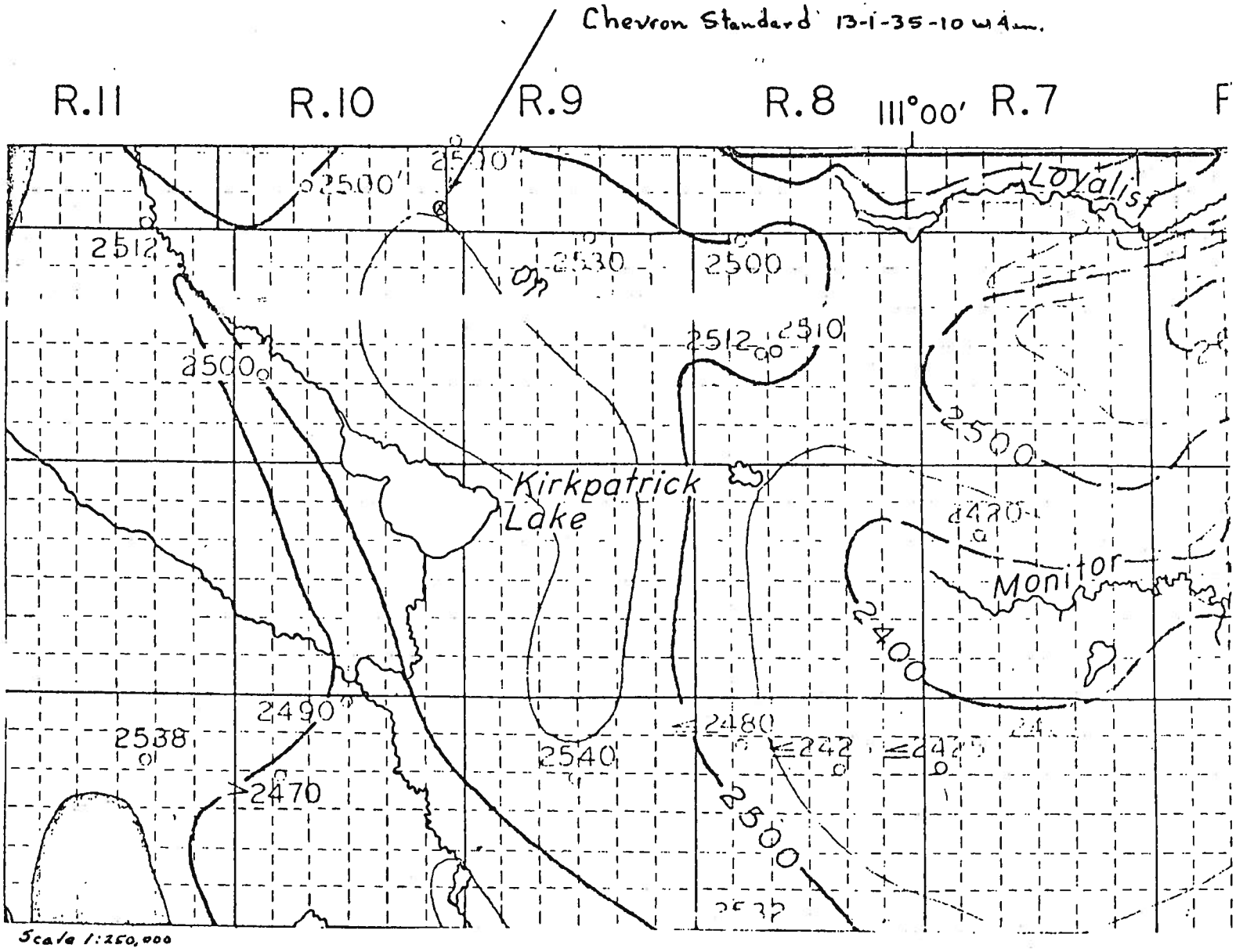


fig 5 Preliminary map of bedrock topography OYEN MAP AREA (Kunkle 1962)

Edmonton Formation.

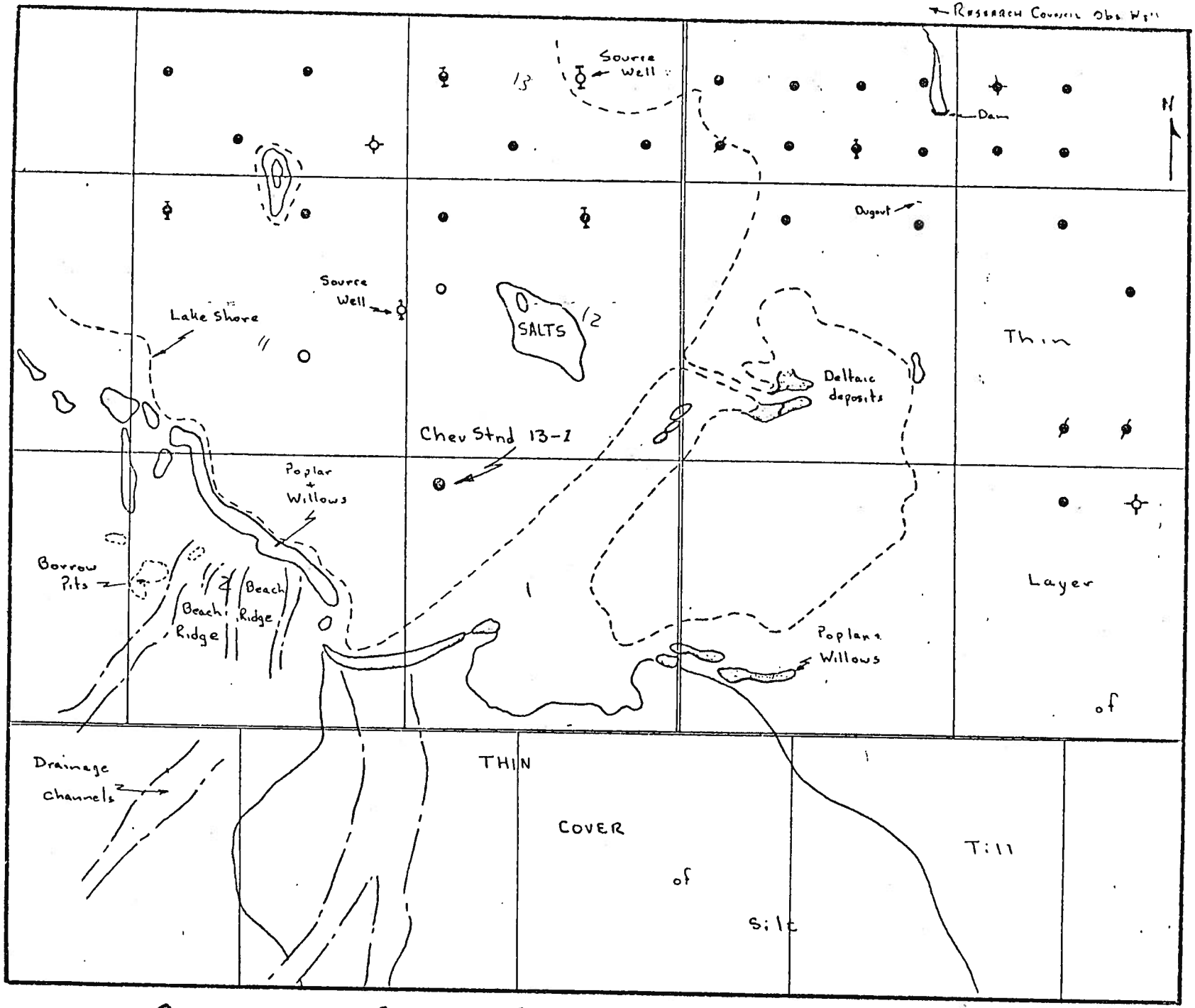


Fig 6. Surficial map from Airphotos scale 1:2640

materials, land forms, and the distribution of poplar and willow in the area.

A depth to bedrock estimate of 90 feet was made from the air photographs. The location of beach ridges and borrow pits could have provided an economical, close at hand source for well completion materials.

The salts identified on the dry bottom of Hamilton Lake may be derived from upward flowing groundwater, during dry periods, from a regional flow system originating in the Nose-Hill, Neutral-Hill areas to the north. This is a speculative suggestion (Fig. 7).

b) Drilling operations

The well was drilled by Doering Drilling of Olds, Alberta with a 72 Speed Star cable tool rig. Samples of the drilled material were caught at 2 1/2 foot intervals, washed, dried, and described at the well site (strip log, page 12). A sieve analysis of selected samples is included (pages 13 and 14).

The chronology of the drilling operations outlines the number of drilling days and activities at the well site. A short summary of the completion details is included.

c) Calculations

A two-hour bail test and a 24-hour pump test were conducted on the well. The results follow:

BAIL TEST: Rate 82 Igpm

Bailed Well

Drawdown test
T = 3,566 Igpd/ft
Q_{20} = 83 Igpm

Recovery test
T = 1,519 Igpd/ft
Q_{20} = [illegible] Igpm

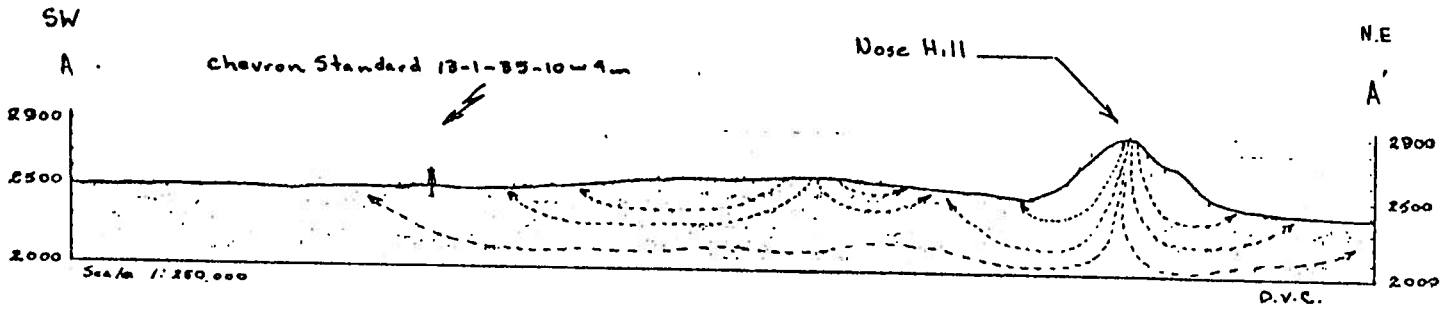


Fig 7 Hypothetical groundwater flow pattern Throne area Alberta.

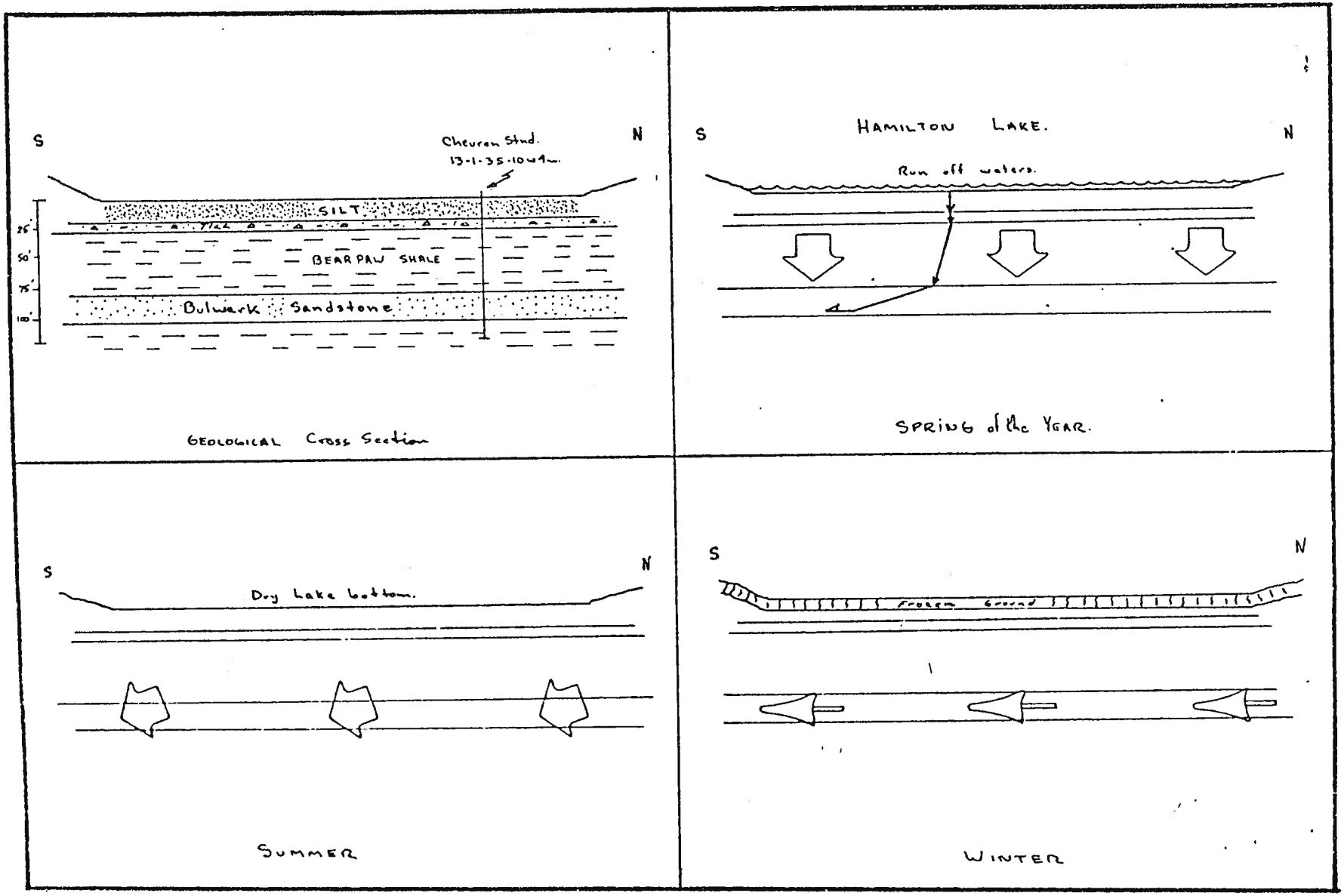


Diagram to illustrate local seasonal recharge to the Bulwark Ss.

Observation Well

Drawdown test
T = 4,[illegible] gpd/ft
Q_{20} = [illegible] gpm
Recovery test
T = 4,092 gpd/ft
Q_{20} = 97 gpm
Storage Coefficient = .000113

PUMP TEST: Rate 83 gpm

Pumped Well

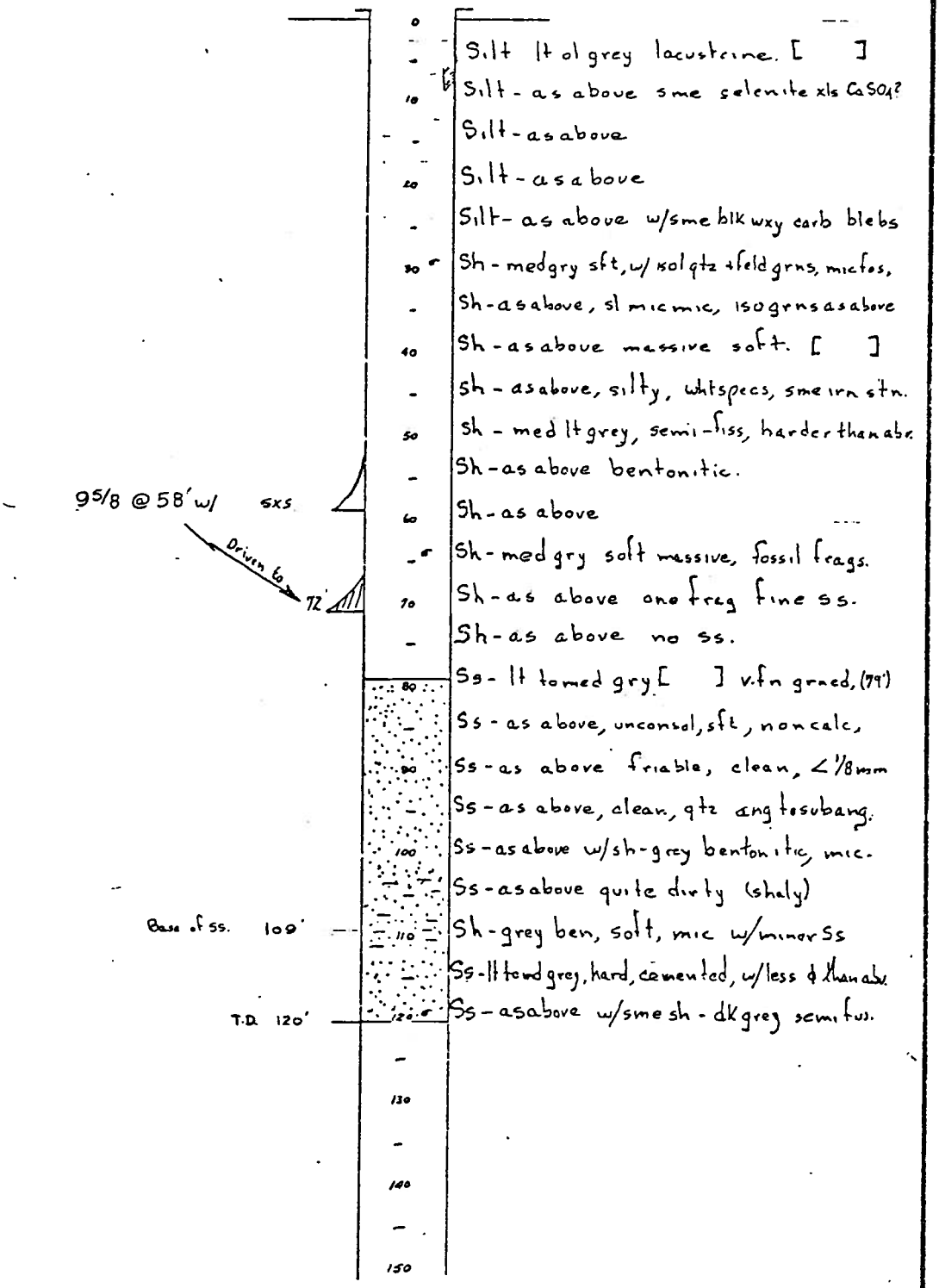
Drawdown test
T = 549 gpd/ft
Q_{20} = 12 gpm
Recovery test
T = 486 gpd/ft
Q_{20} = 10 gpm
Storage Coefficient = .000117

Observation Well

Drawdown test
T = 5,513 gpd/ft
Q_{20} = 123 gpm
Storage Coefficient = .0000448
Recovery test
T = [illegible] gpd/ft
Q_{20} = 195 gpm

From these results it can be concluded that the Dulwark Sandstone in this area is capable of producing a safe yield for 20 years of between 64 and 195 gpm. A plot of the drawdown within the well screen (page) gives a Q_{20} of 17 gpm.

Chevron Standard 13-1-35-10 w 4m.

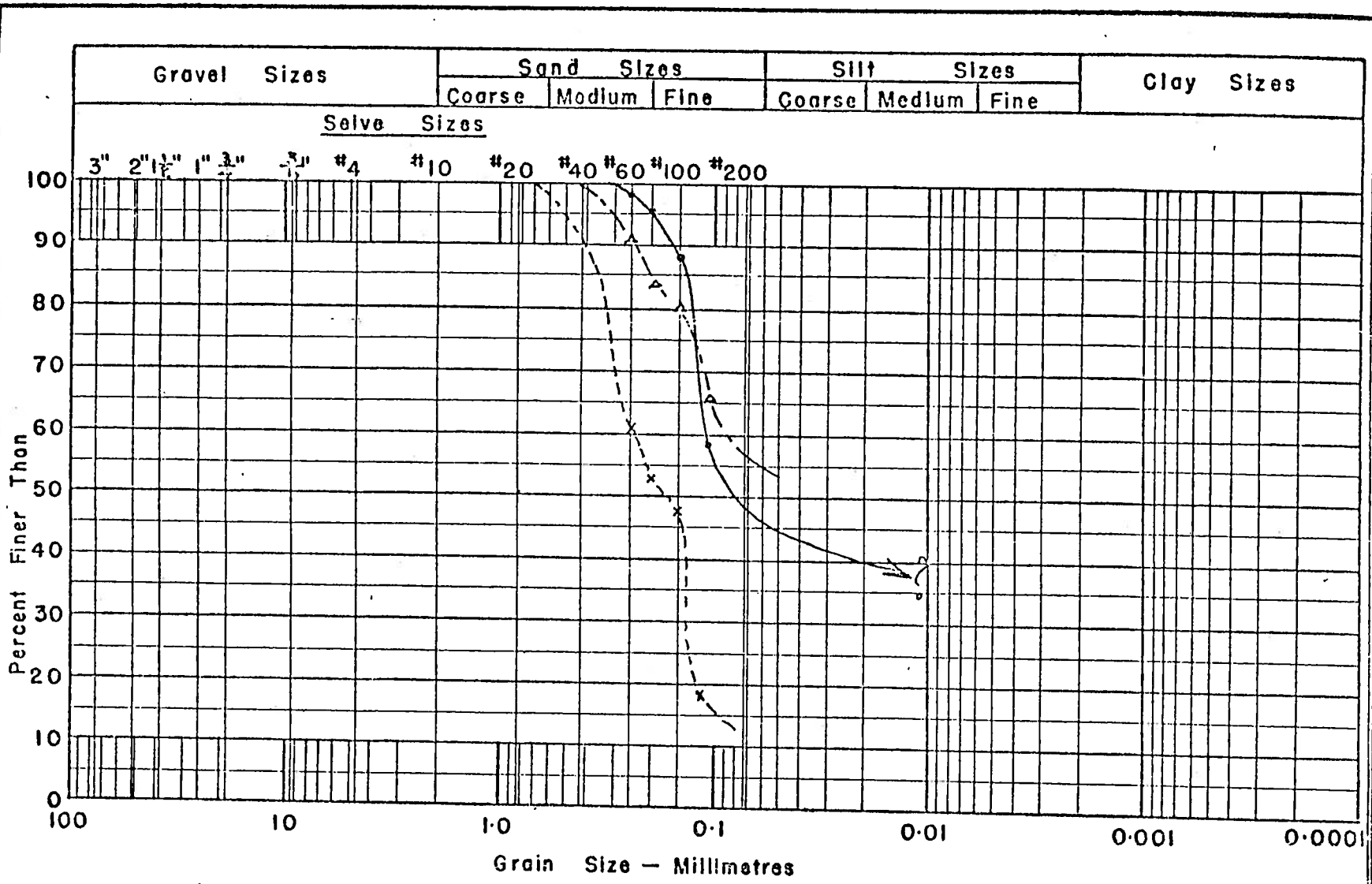


Sieve Analysis of Selected Samples

13-1-35-10 w4m.

Sample Depth.	Screen Size and % Retained.				
	#60	#80	#100	#120	Pan
78-80′	39.4 (60.6)*	7.4 (53.2)	6.0 (47.2)	20 (17.2)	25.8
88-90′	1 (99)	3.7 (95.3)	7 (88.3)	30 (58.3)	59
96-98′	8 (92)	8 (84)	13.6 (80.4)	15.1 (65.3)	55.3

* percent passing (see plot)



UNIVERSITY of ALBERTA
DEPT. of CIVIL ENGINEERING
SOIL MECHANICS LABORATORY

GRAIN SIZE CURVE

PROJECT Lower Sousa Standard
SITE Water Source well
SAMPLE 78-80 88-90 96-98
LOCATION 13-1-25-20 W4m.
HOLE DEPTH 125'
TECHNICIAN O.K.C DATE Dec 9/68

Remarks: --- 78-80 — — 88-90 —— 96-98
The coarsest sand is near the top of the producing interval. #12 Screen should be set at 79 to 85.

D_{10} = ____ mm.
D_{60} = ____ mm.
C_u ____

Note: M.I.T. Grain Size Scale

COMPLETION DETAILS

The Bulwark Sandstone of the Cretaceous Bearpaw Formation was encountered at a drilling depth of 79 feet. The sandstone is extremely fine grained (60 per cent passing #120 sieve).

Chevron decided to run number 10 and 12 screen with an artificial 40/60 sand pack. They installed a total of 25 feet of screen over the interval 80 to 105 feet.

This completion failed to produce enough water and the screens were pulled and re-installed with a coarser sand pack of 10-20 and 20-30 sand.

A decision to recomplete the well was made January 2, 1969.

CHRONOLOGY

November 21	Moved on and ringed up - broke dog clutch.
November 22	SCA - D.V. Currie visited drilling site and checked airphoto interpretation.
December 2	Repair to rig completed. Doering rig #2 moved on to drill the observation well. Located 100' east.
December 3	Both rigs spudded at 1.30 p.m. Pump test hole drilled to 45'. Observation hole - 31.
December 4	At rig 8.15 a.m. Rig #1 would not start. Rig #2 made to 60' and ran 8" casing to 60' w/24 sks of cement. Rig #1 made to 53 and set 53' of casing - not cemented. Rigs shut down 8.00 p.m.
December 5	At rig 8.05 a.m. Both rigs drilled to 120'. Bulwark Sandstone encountered at 79'. Rigs shut down 6.30 p.m.
December 6	Observation well deepened to 135', Pump test well casing lowered 15'.
December 9	Observation well completed. Pump test well reamed to 11".
December 10	Observation well drilled near existing source well at Lsd. 9, Sec. 11. Began installing screen and sand pack.
December 11	Observation well completed at 9-11. Continued installing screen and pack at pump test well.
December 12	Installed #10 and #12 screen over 25' of hole and artificially sand packed the hole with 40-60 sand.
December 13	Surged well
December 16	Surged well and attempted to run pump test. 40-60 sand too fine. Pulled pump at 4.30 p.m. Static water level in observation well 29.21'.
December 17	Pulled well screens, pumped and bailed out artificial sand pack. Conducted two hour bail test.
December 18	Re-installed well screen with an artificial sand pack of 10-20 and 20-30 graded sand.

December 19	Surged well
December 20	Trouble starting generator, established a pump rate of 28 igpm. Waited on recovery, began pump test at 4.30 pm.
December 21	Pump failed at 4.25 p.m.; began recovery portion of test.
December 22	Well recovered. Test terminated at 10.00 a.m.

DRILLER'S LOG FROM CHEVRON

Standard 9-11-35-10-W 4M

Depth (feet)	
0- 30	drift and sand
30- 67	shale
67- 83	sand
83- 95	sandy shale
95-105	sand
105-114	sandy shale
114-120	shale
120-135	sandy shale
135-163	hard shale
163-200	sandy shale

At 94 feet bailed 1/2 hour, 20 igpm, static 13 feet; bailed 1 hour, 25 igpm, fluid level 60 feet.

$$T = \frac{264C}{25} = \text{about } 350 \text{ igpd/ft}$$

At 114 feet bailed 1 hour, 30 igpm, water level 13 feet from surface after bailing stopped. Completion 26 feet of screen - developed 2 weeks.

BAIL TEST

Project: Cheuron Standard 13-1 Date Dec 17/68 Time: _____
Test hole No. BAILED WELL Location: 13-1-35-10 W4
Depth of hole at the time of test: 120 ft.
Length of casing at the time of test: 58 ft.
Depth(s) to top of major aquifer(s): 79 ft. _____ ft. _____ ft.
Depth to nonpumping water level: 29.73 ft.
Length of bailing: 120 minutes
Length of measured period of recovery: 130 minutes
Rate of bailing: 32 gpm

Period of Bailing		
Time after bailing started, (t) (min.)	Depth to water (feet)	Drawdown s (feet)
-10		
- 5	29.73.	
0		
1	31.9	2.17
2	32.9	3.17
3	33.35	3.62
4	33.7	3.97
5	33.8	4.07
6	34.4	4.67
8	34.4	4.67
10	34.8	5.07
12	34.7	4.97
15	34.7	4.97
20	35.9	5.88
25	35.8	5.78
30	35.4	5.38
40	36.4	6.38
50	36.6	6.58
60	36.65	6.63
70	36.4	6.38
80	36.1	6.08
90	37.0	6.98
100	36.5	6.48
110	36.6	6.58
120	37.3	7.28

Period of Recovery				
Time after bailing started, (t) (min.)	Time after bailing stopped, (t') (min.)	t/t'	Depth to water (feet)	Residual drawdown (s') (feet)
	30"	241	34.7	4.97
121	1	121	34.0	4.27
122	2	61	33.3	3.57
123	3	41	32.85	3.12
124	4	31	32.5	2.77
125	5	25	32.25	2.52
126	6	21	32.05	2.32
128	8	16	31.9	2.17
130	10	13	31.55	1.82
132	12	11	31.4	1.67
135	15	9.5	31.2	1.47
140	20	7.0	30.97	1.24
145	25	5.8	30.8	1.07
150	30	5.0	30.72	0.99
160	40	4.0	30.51	0.78
170	50	3.4	30.46	0.73
180	60	3.0	30.25	0.52
190	70	2.72	30.22	0.49
200	80	2.50	30.10	0.37
210	90	2.34	30.05	0.32
220	100	2.20	30.05	0.32
230	110	2.09	29.89	0.16
240	120	2.00	29.87	0.14

Remarks:

Drawdown

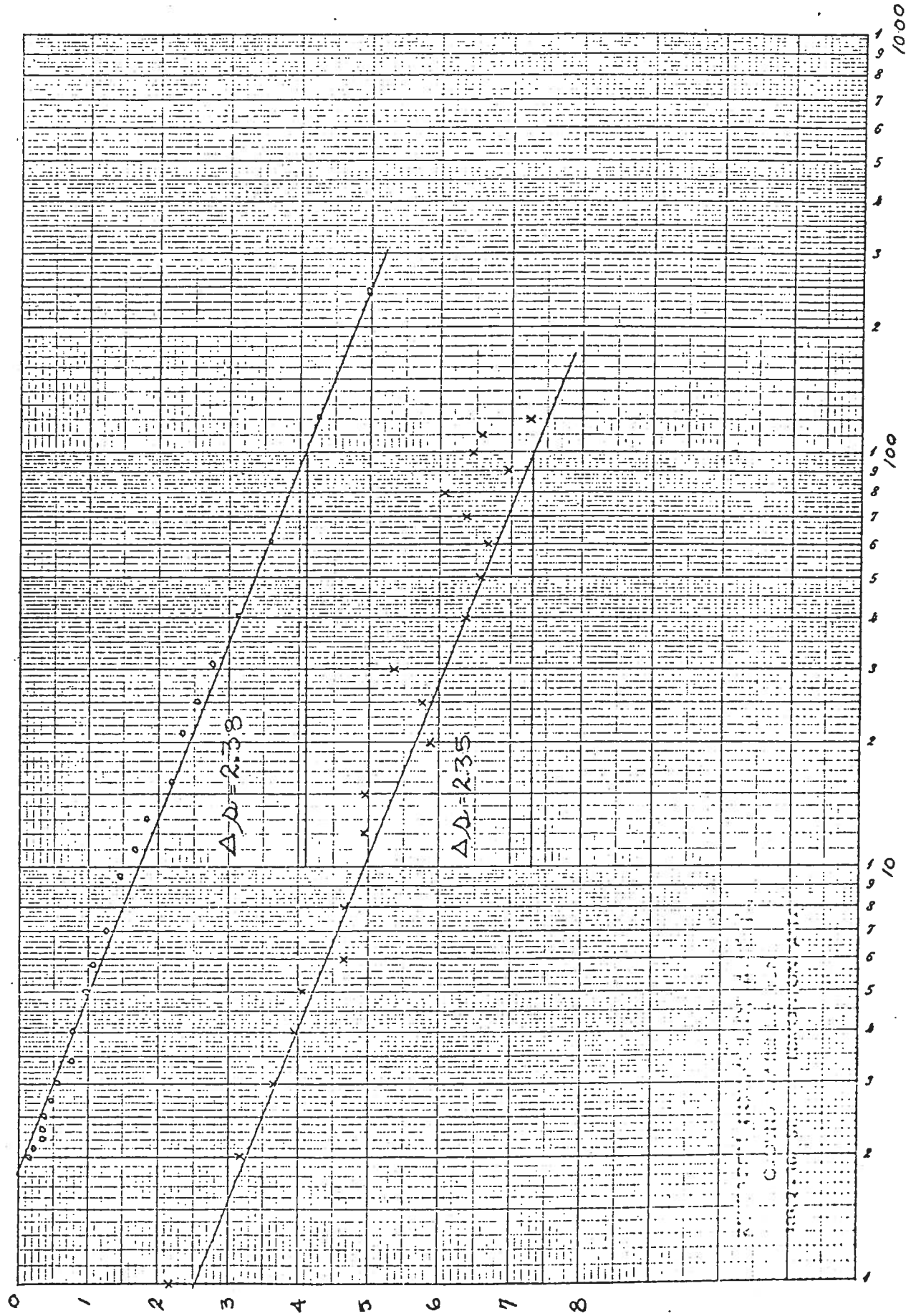
$T = \frac{264Q}{\Delta s} = 3595$ igpd/ft

$Q_{20} = \frac{TH}{2110} = 85$ igpm

Recovery

$T = 3549$

$Q_{20} = 84$


ΔD=2.38
ΔD=2.35
0
1
2
3
4
5
6
7
8
1000
100
10
ε and ε'

BAIL TEST

Project: Chevron Std 13-1 Date Dec 17 1968 Time: 2:30 Pm
Test hole No. Observation Well Location: 13-1-35-10 W4m
Depth of hole at the time of test: 120 ft.
Length of casing at the time of test: 58 ft.
Depth(s) to top of major aquifer(s): 79 ft. _____ ft. _____ ft.
Depth to nonpumping water level: 29.73 ft.
Length of bailing: 120 minutes
Length of measured period of recovery: 120 minutes
Rate of bailing: 32 gpm

Period of Bailing		
Time after bailing started, (t) (min.)	Depth to water (feet)	Drawdown s (feet)
-10		
- 5	29.73	
0		
1	30.88	1.15
2	31.45	1.72
3	31.81	2.08
4	32.12	2.39
5	32.32	2.59
6	32.48	2.75
8	32.74	3.01
10	33.00	3.27
12	33.18	3.45
15	33.37	3.64
20	33.60	3.87
25	33.78	4.05
30	33.93	4.20
40	34.17	4.44
50	34.36	4.63
60	34.51	4.78
70	34.59	4.86
80	34.63	4.90
90	34.70	4.97
100	34.83	5.00
110	34.92	5.09
120	35.01	5.18

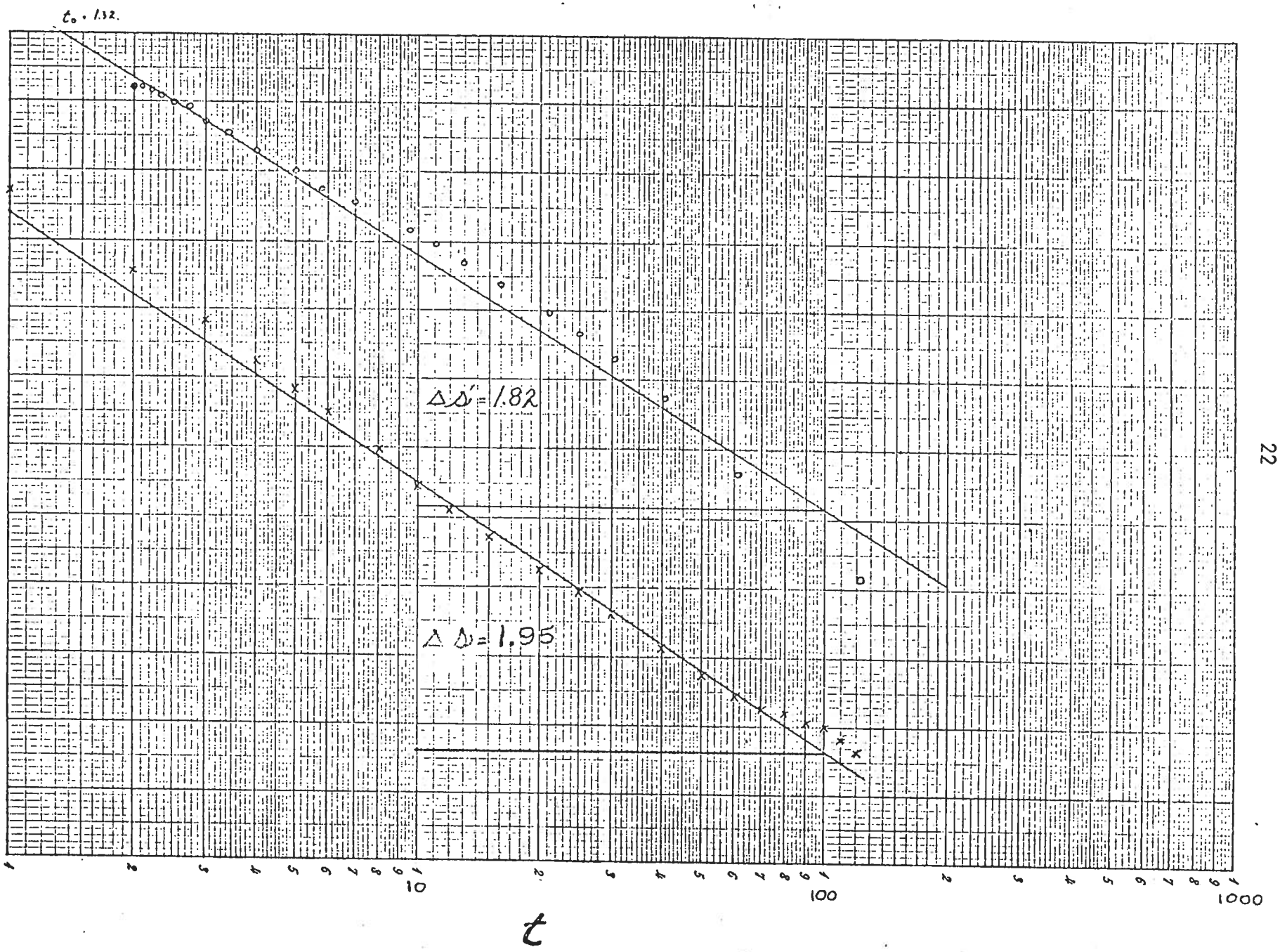
Period of Recovery				
Time after bailing started, (t) (min.)	Time after bailing stopped, (t') (min.)	t/t'	Depth to water (feet)	Residual drawdown (s') (feet)
121	1	121	33.65	3.92
122	2	61	32.92	3.19
123	3	41	32.36	2.63
124	4	31	32.08	2.35
125	5	25	31.89	2.16
126	6	21	31.73	2.01
128	8	16	31.53	1.81
130	10	13	31.37	1.65
132	12	11	31.24	1.52
135	15	9.5	31.13	1.41
140	20	7.0	30.95	1.23
145	25	5.8	30.83	1.11
150	30	5.0	30.72	1.00
160	40	4.0	30.59	.86
170	50	3.4	30.45	.73
180	60	3.0	30.37	.65
190	70	2.72	30.30	.58
200	80	2.50	30.24	.52
210	90	2.34	30.19	.46
220	100	2.20	30.14	.42
230	110	2.09	30.11	.39
240	120	2.00	30.04	.32

Remarks: Drawdown Recovery

(transmissibility) $T = \frac{264\,Q}{\Delta s}$, 4332 igpd/ft. T: 4092

(safe yield 90 m) $Q_{90} = \frac{TH}{2110}$ = 102 igpm Q_{90}: 97

(storage coeff) $S = \frac{Tt}{\quad}$, .00011 for recovery


t_0 = 1.32.
0
1
2
3
4
5
$\Delta\Delta' = 1.82$
$\Delta\Delta = 1.95$
1
10
100
1000
t

PUMP TEST

Project: Chevron Std 13-1-35-10Wt Date Dec 20/66 Time 4:30 PM.

Depth of hole 120' Length of pumping 24 hrs

length of Csg 58' Length of recovery 24 hrs

Depth to Aquifer 79' Pump rate 24-28 igpm.

Depth to non-pumping water level 29.55' Pumped Well Drawdown.

Period of		
Time after Pumping Started	Depth to Water (feet)	Drawdown s (feet)
-10	31.35	
- 5		
0	31.90	
1	-	
2	33.00	1.10
3	33.21	1.31
4	33.61	1.71
5	33.80	1.90
6	34.25	2.35
7	34.43	2.53
8	34.82	2.92
9	35.38	3.48
10	35 95	3.65
12	35.90	4.00
15	36.10	4.20
20	38.29	6.39
25	39.30	7.40
30	40.47	8.57
40	42.37	10.47
50	43 14	11.24
60	44.78	12.88
80	46.32	14.42
100	47.50	15.60
120	48 50	16.40
150	4904	17.14
30 sec	32.74	.84
1.5 min	32.85	.95

Period of		
Time after Pumping Started	Depth to Water (feet)	Drawdown s (feet)
180	49.36	17.46
210	49 60	17.70
240	49.76	17.86
300	49 79	17.89
360	49.38	17.48
420	48.99	17.09
480	48.86	16.96
540	48.84	16.94
600	48.60	16.70
660	48.30	16.40
720	47.55	15.65
840	46.50	14.60
960	46 16	14.26
1080	50.85	18.95
1200	50.22	18.32
1320	49.46	17.56
1440	51.87	19.97

Remarks:

a) Specific Conductance @ 42°F = 1500 mmhos.

b) Pump rate fluctuated ± 1 igpm.

c) Pump quit operation 5 min before end of test.

d) Probe off end of E-tape lost down hole at some unknown time.

Period of Recovery				
Time after Pumping started (t) (min.)	Time after pumping stopped (t') (min.)	t/t'	Depth to water (feet)	Residual drawdown (s') (ft)
1440	0		51.87	19.97
1440.5	30 secs.	2880	+7 88	15.98
1441	1	1441	47.64	15.74
1441.5	1.5	967	47.41	15.51
1442	2	720	47.40	15.50
1443	3	480	46.93	15.03
1444	4	360	46.57	14.67
1445	5	288	46.21	14.31
1446	6	240	45.87	13.97
1447	7	206	45.53	13.63
1448	8	180	45.21	13.31
1449	9	160	44.85	12.95
1450	10	144	44.52	12.62
1452	12	120	44.05	12.15
1455	15	97	43.05	11.15
1460	20	72	41.38	9.48
1465	25	58	40.31	8.41
1470	30	48	39.17	7.27
1480	40	36	37.30	5.40
1490	50	29	35.34	3.44
1500	60	24	3480	2.90
1520	80	18	33.52	1.62
1540	100	14	32.16	.56
1560	120	12	30.80	
1590	150	9.7	31.29	
1620	180	8	31.00	
1650	210	6.7	30.70	
1680	240	6	30.64	
1740	300	4.8	30.55	
1800	360	4	30.41	
1860	420	3.4	30.34	
1920	480	3	30.30	
1980	540	2.7	30.32	
2040	600	2.4	30.27	
2100	660	2.2	30.23	
2160	720	2.0	30.26	

Pumped well recovery.

Period of Recovery				
Time after Pumping started (t) (min)	Time after pumping stopped (t') (min)	t/t'	Depth to Water (ft)	Residual drawdown (s') (ft)
2280	840	1.7	30.16	
2400	960	1.5	30.16	
2520	1080	1.3	30.16	
2640	1200	1.2		
2760	1320	1.1		
2880.	1440	1		

Pumped well recovery.

From fig 8 $T = \frac{264Q}{\Delta s}$ $Q_{20} = \frac{TH}{2110}$

drawdown

1. Δs = 4'/log cycle T = 1716 igpd/ft

Q_{20} = 39 igpm.

2. Δs = 12.5'/log cycle T = 549 igpd/ft.

Q_{20} = 12 igpm.

recovery.

3. Δs = 15.75'/log cycle T = 436 igpd/ft

Q_{20} = 10 igpm.

4 Δs = 2'/log cycle T = 3432 igpd/ft

Q_{20} = 77 igpm.

5. $S = \frac{T t_o}{4790 r^2}$ = .000117

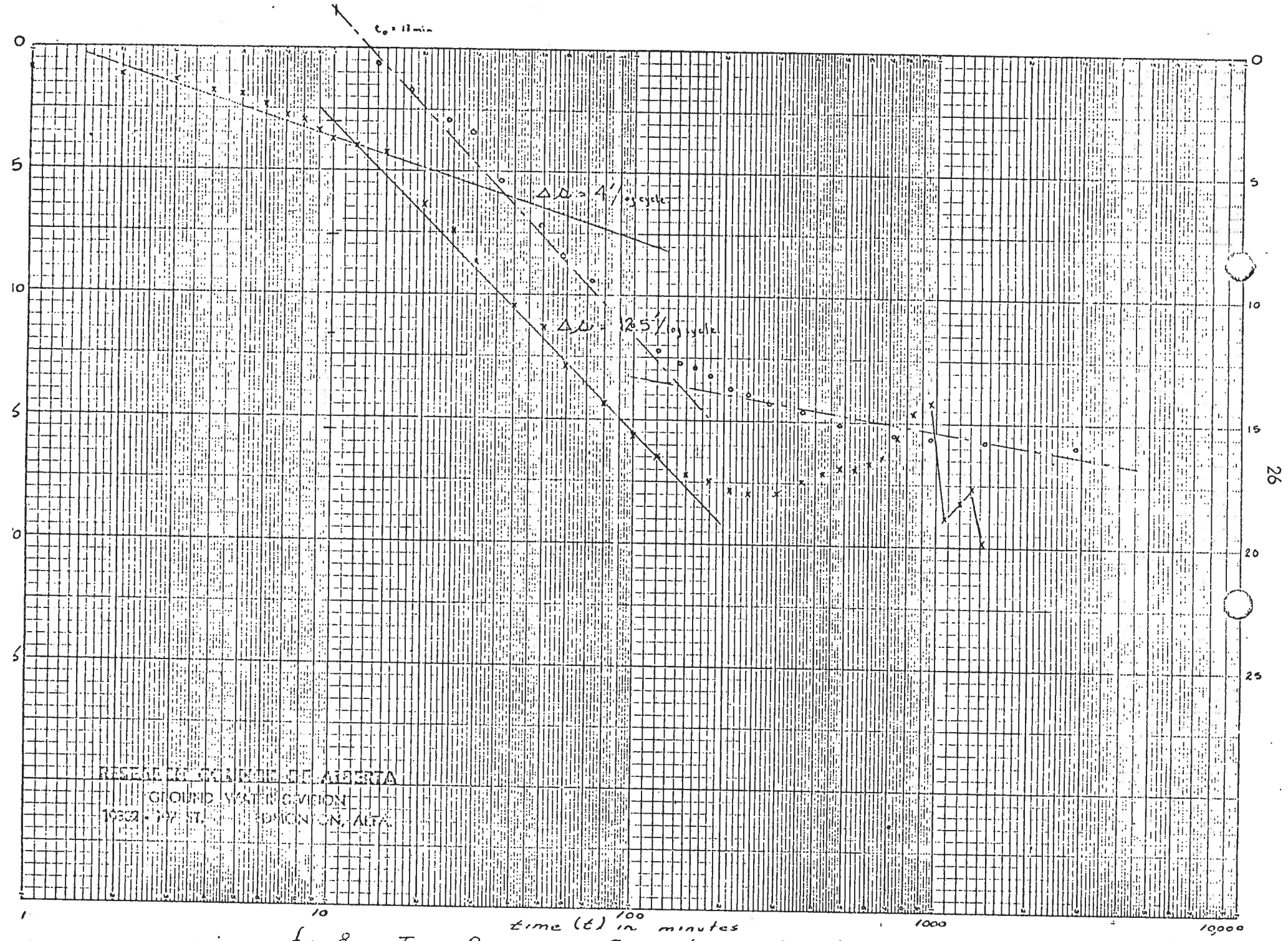


Fig 8 Time Drawdown Curve (pumped well) Chauvin Standard 13-1

Drawdown within well screen and sand pack.

Period of Pumping		
Time after Pumping started (min)	Depth to Water (feet)	Drawdown s (feet)
-10	30.84	
30 sec.	41.90	11.06
1	48.35	17.51
1.5	51.30	20.46
2	52.30	21.46
3	54.68	23.84
4	55.72	24.88
5	56.20	25.36
6	56.50	25.66
7	56.75	25.91
8	57.05	26.21
9	57.20	26.36
10	57.35	26.51
15	57.57	26.73
30	58.00	27.16
50	58.40	27.56
80	58.50	27.66
120	58.58	27.74
150	58.63	27.79
180	58.66	27.82
720	56.23	25.39
1080	60.02	29.18
1200	58.84	28.00

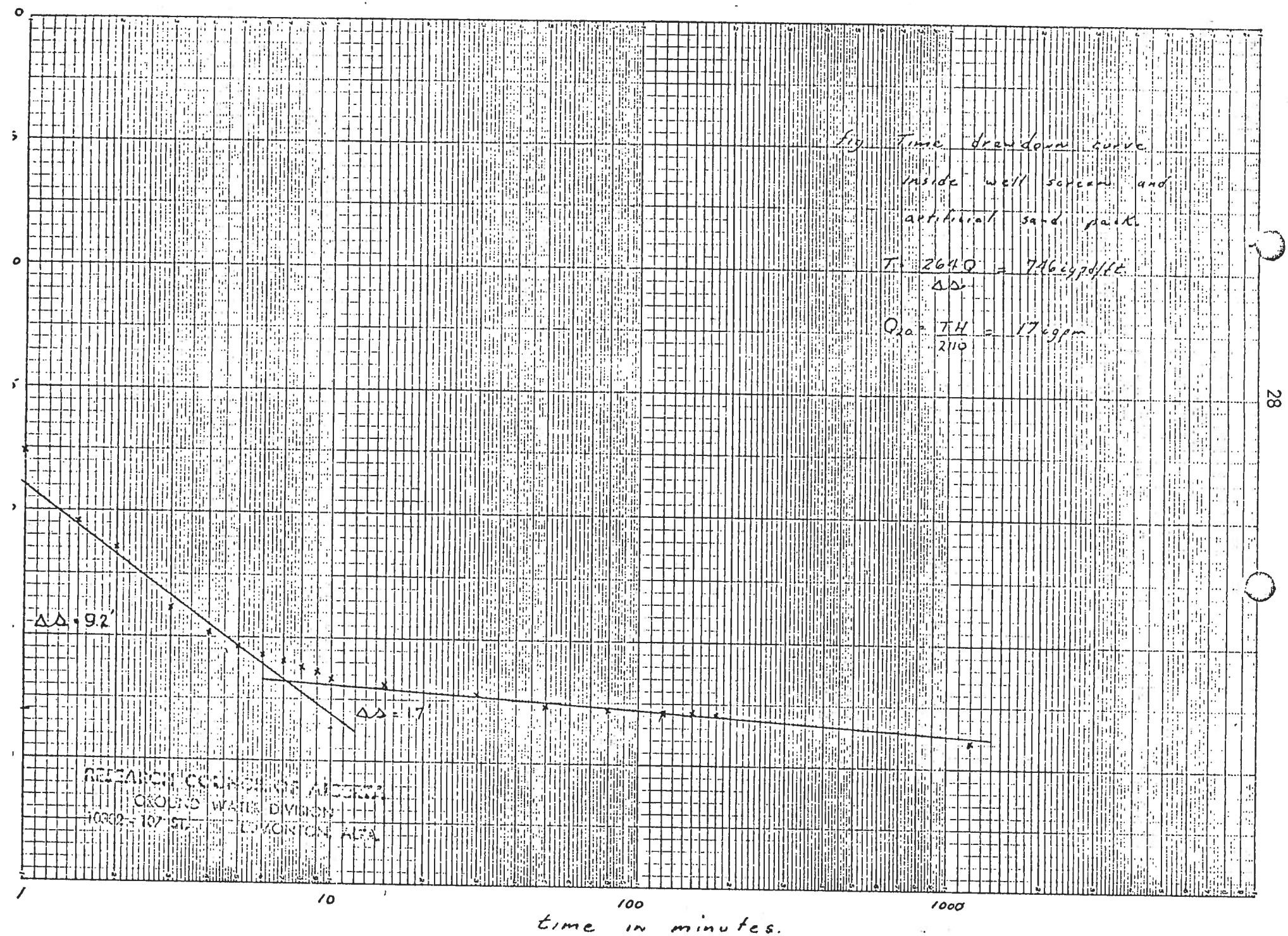


Fig. Time drawdown curve inside well screen and artificial sand pack.

$$T = \frac{264Q}{\Delta\Delta'} = 746 \text{ gpd/ft.}$$

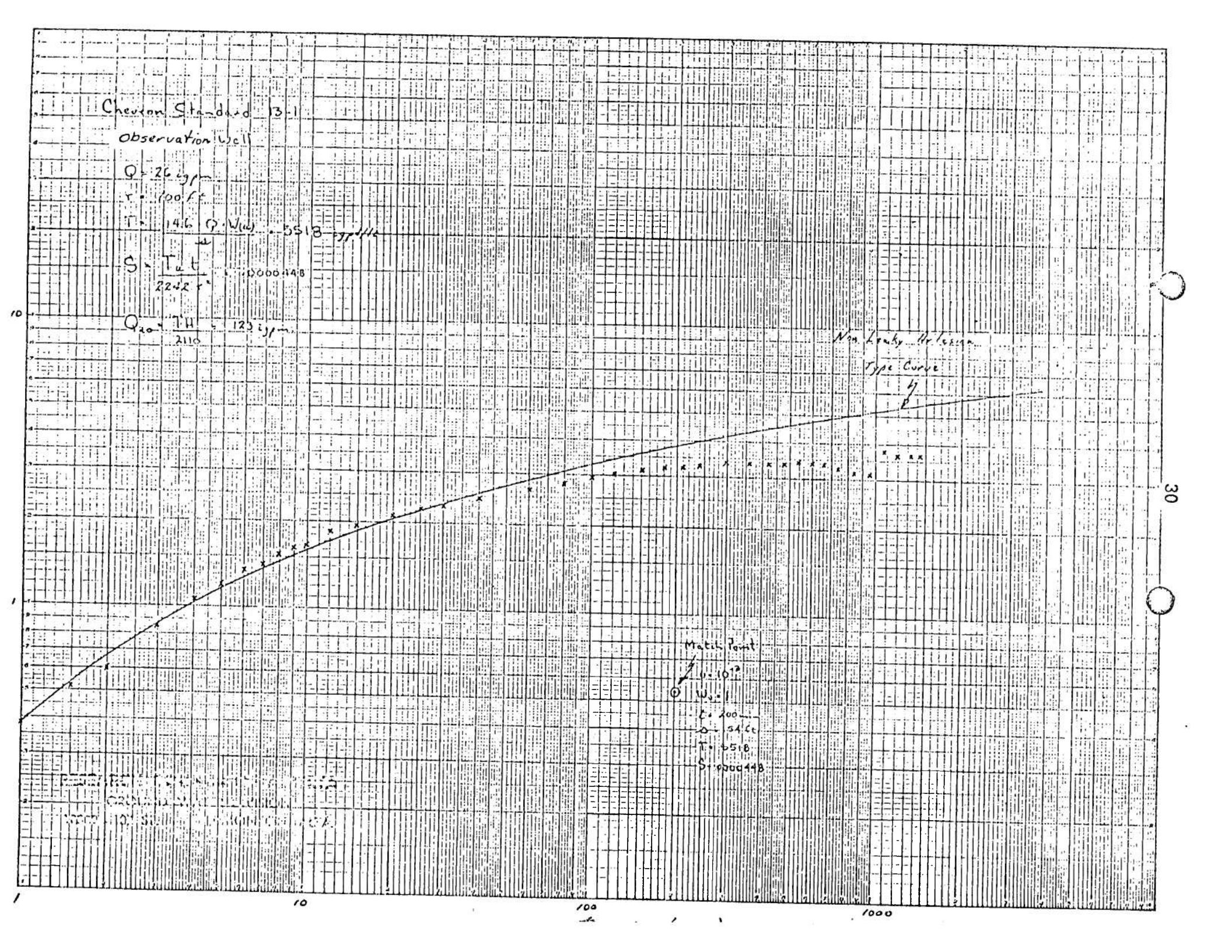
$$Q_{2a} = \frac{TH}{2110} = 17 \text{ gpm}$$

Pump Test - observation well drawdown

Period of Pumping		
Time after Pumping started (min)	Depth to Water (ft)	Drawdown s (ft)
-10		
-5		
0	29.60	
30 sec	29.70	.10
1	29.98	.38
1.5	30.11	.51
2	30.20	.60
3	30.45	.85
4	30.65	1.05
5	30.80	1.20
6	30.93	1.33
7	31.00	1.40
8	31.12	1.52
9	31.22	1.62
10	31.27	1.67
12	31.43	1.83
15	31.57	1.97
20	31.72	2.12
25	31.83	2.23
30	31.90	2.30
40	32.05	2.45
60	32.25	2.65
80	32.40	2.80
100	32.55	2.95
120	32.65	3.05

Period of Pumping		
Time after Pumping started	Depth to Water (feet)	Drawdown s (feet)
150	32.73	3.13
180	32.80	3.20
210	32.84	3.24
240	32.90	3.30
300	33.00	3.40
360	32.96	3.36
420	32.98	3.38
480	32.97	3.37
540	33.00	3.40
600	32.98	3.38
660	32.97	3.37
720	32.88	3.28
840	32.74	3.14
960	32.74	3.14
1080	33.34	3.74
1200	33.24	3.64
1320	33.24	3.64
1440	33.24	3.64

OBSERVATION WELL DRAWDOWN.


Chevron Standard 13-1
Observation Well
Q = 26 gpm
r = 100 ft
T = 146 Q·W(u) = 5518 gpd/ft
S = Tut/2242r² = .0000448
Q20 = TH/2110 = 123 gpm
Non Leaky Artesian
Type Curve
Match Point
W = 10¹²
u = 1
t = 200
s = 54.6
T = 5518
S = .0000448
10
1
30
1
10
100
1000

Period of Recovery				
Time after Pumping Started (t) (min)	Time after Pumping stopped (t') (min)	t/t'	Depth to water (feet)	Residual drawdown s' (Feet)
1440	0		33.24	3.64
1440.5	30 secs	2880	33.17	3.57
1441	1	1441	33.04	3.44
1441.5	1.5	967	32.94	3.34
1442	2	720	32.85	3.25
1443	3	480	32.75	3.15
1444	4	360	32.65	3.05
1445	5	288	32.51	2.91
1446	6	240	32.41	2.81
1447	7	206	32.37	2.77
1448	8	180	32.30	2.70
1449	9	160	32.26	2.66
1450	10	144	32.15	2.55
1452	12	120	32.07	2.47
1455	15	97	31.97	2.37
1460	20	72	31.83	2.23
1465	25	58	31.72	2.12
1470	30	48	31.65	2.05
1480	40	36	31.52	1.92
1490	50	29	31.43	1.83
1500	60	24	31.34	1.74
1520	80	18	31.20	1.60
1540	100	14	31.09	1.49
1560	120	12	31.02	1.42
1590	150	9.7	30.93	1.33
1620	180	8	30.86	1.26
1650	210	6.7	30.80	1.20
1680	240	6	30.75	1.15
1740	300	4.8	30.68	1.07
1800	360	4	30.62	1.01
1860	420	3.4	30.59	.98
1920	480	3	30.53	.92
1980	540	2.7	30.50	.89
2040	600	2.4	30.45	.84
2100	660	2.2	30.42	.81
2160	720	2.0	30.39	.78

observation well recovery

Period of Recovery				
Time after Pumping Started (t) (min)	Time after Pumping Stopped (t') (min)	t/t'	Depth to Water (feet)	Residual Drawdown (s') (feet)
2280	840	1.7	30.35	.74
2400	960	1.5	30.31	.70
2520	1080	1.3	30.27	.66
2640	1200	1.2	30.25	.64
2760	1320	1.1	30.22	.61
2880	1440	1	30.20	.59

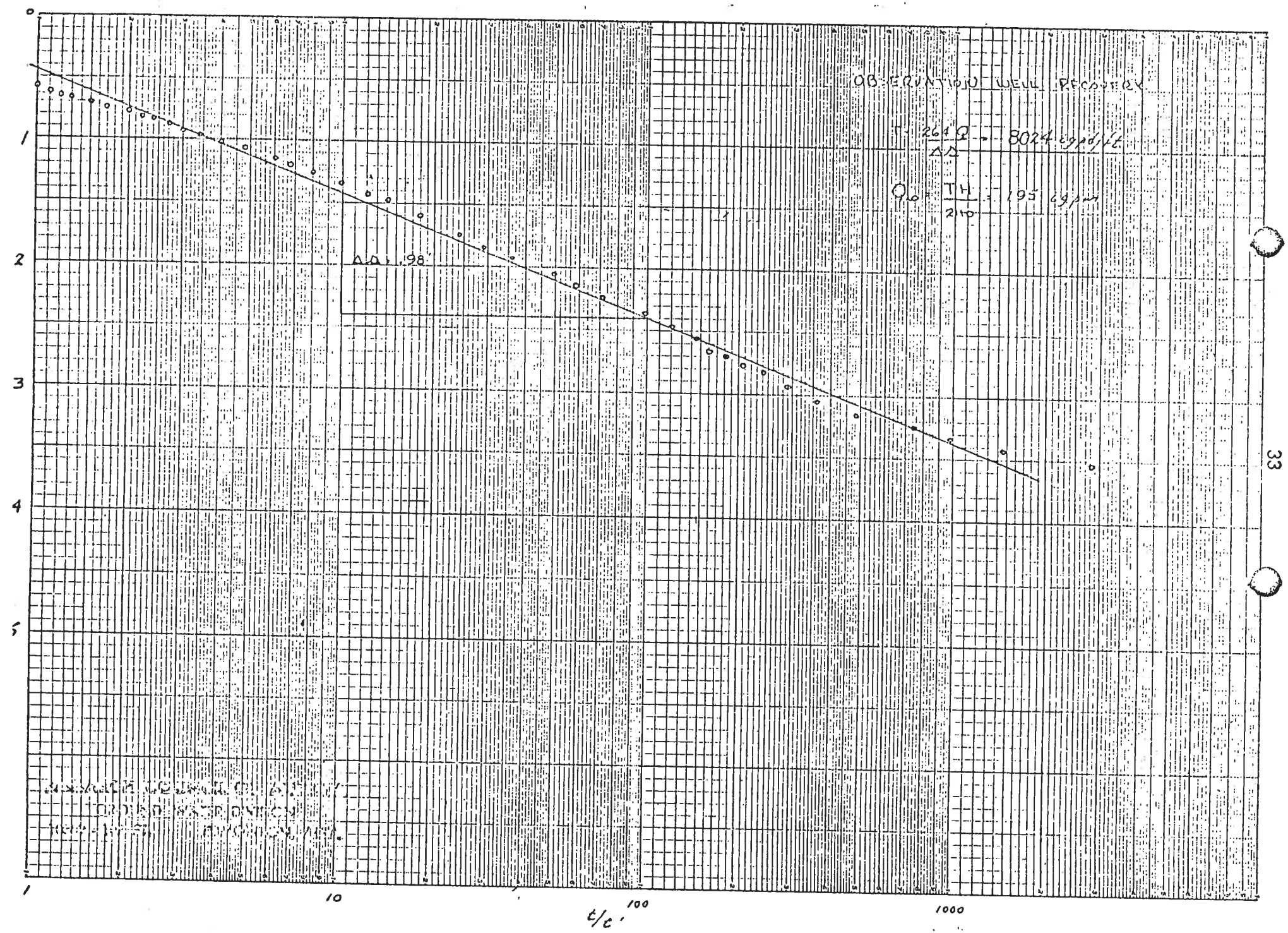
Observation well recovery.

Calculations from recovery curve:

$\Delta s = .98'$

$T = 8024$ igpd/ft.

$Q_{20} = 195$ igpm.


OBSERVATION WELL RECOVERY
$\frac{264Q}{\Delta\Delta}$ = 8024 gpd/ft
Q_0 = TH = 195 gpm
2h
ΔΔ = 1.98
0
1
2
3
4
5
1
10
100
1000
t/t'
33

COMPLETION AND TESTING REPORT FOR WELLS DRILLED
TO SUPPLY WATER FOR INJECTION PURPOSES

NOTE:

To be completed by the operator and submitted, within two weeks of the completion or abandonment date of the well, in duplicate to the appropriate Field Engineer of the Oil and Gas Conservation Board and singly to the Groundwater Geologist, Research Council of Alberta, 87th Ave. and 114th St., Edmonton. This form does not replace, but is to be completed in addition to the Water Well Drillers Report required by the Water Resources Branch of the Department of Agriculture.

Pump test particulars and on production data may be sent in at a later date but within two weeks of the on production date.

SAMPLE LOG

From	To	Description
0	8	Man Made Fill
8	28	Till and Sandy Clay
28	45	Sandy Shale
45	54	Sandy Shale
54	66	Shale
66	79	Sandy Shale
79	104	Soft Bentonite S.S. w/Sh. Stringers
104	105.5	Hard S.S.
105.5	113	Bentonitic S.S w/Sh. Stringers
113	118	Shale
118	120	Bentonitic S.S.

Well Name: Chevron et al Hamil W.W. 13-1

Location: L.S. 13 Sec 1 Twp 35 Rge 10 W 4 Mer.

Approximate Co-ordinates: 940' East & 540' South of N.W. corner or LSD 13, Sec. 1, Twp. 35, Rge. 10 W4

Elevation: 2524 + 8' fill Licence No.: 3[illegible]49

Date Spudded: Dec. 3, 1968 Completed: May 23, 1969

Total Depth: 120' Hole Size: 12¼

Size Casing: 9-5/8" 7" Landed At: 72'

Amount of Cement and Interval: 27 sks. from 72' to surface

Slotted or Perforated Interval of Casing: 25 ft. of screens

Size Tubing: 2½ Set At: 65 ft.

Size and Make of Pump: JACUZZI Model 7SS6J5-T4 Submersible Turbine

Pump Landed At: 69.12 ft.

BAILER TESTING

Date of Test: Jan. 9, 1969

Depth of Hole when Test was Made: 120 Ft.

Static Fluid Level: 26.6 Ft. Length of Test: 2 Hrs.

Estimated Rate: 26 - 27 G.P.M. Gals/Min.

Final Fluid Level: 30' 3½" Ft.

PUMP TEST

Date of Test: May 23 to May 27

Static Fluid Level: 23 Ft. Length of Test: 87½ Hrs.

Volume: 6423 Bbls.

Stabilized Pumping Fluid Level: 34 Ft.

Date Well Went On Production: May 23, 1969

ABANDONMENT PLUGS

Date	No.	Interval	Cement	Felt At

If Abandoned Give Reason:

Signature of Operator's Agent: [signature]

Title: Date: June 2, 1969

Observation Well 13-1
Static Fluid Level: 30 ft.
Stabilized Pumping Fluid Level: 36 ft.

ED-40-6-63

15-1-34-10 (W4)

SUMP FLUID

& Forests File No. _____ Chem. Analysis N

Analysis Date

by _____ of _____

Sec. ___ Twp. ___ Rge. ___ West ___

collected by _____ Company _____

Field Examination:

of sump: depth ..... ft. x length ..... ft. x width ..... ft. = ... cu

of sump: diesel __, gasoline __, H_2S __, sour __, sweet __, acid __, pu

of sump: blue __, grey __, yellow __, brown __, red __, green __, black __

ance of sump: clear __, colorless __, cloudy __, murky __, muddy __

ter of area: hilly __, flat __, bush __, forest __, open __

ce from water: > 2000 ft. __, < 2000 ft. __, < 1000 ft. __, < 500 ft. __, < 100

of water: river __, stream __, lake __, muskeg __, slough __, periodic __, permanent __

of oil: thickness < 1/2" __, > 1/2" __, scum __, rainbow __

Type: ...rown clear solution with a reddish sediment on the bottom.

Laboratory Examination:

Fluorescence: yellow __, green __, blue __, dark __, light __, pink __

metals, Hg & Cr present: yes __, no __, untested __

much __, some __, trace __, none __

Analysis (mg/l) Done by _____

Cl	....12..	SO_4	..170...	T.S. (calc.)	.....[illegible].	NH_3	...
OH	.....0.	Ca	....14...	T.S. (by evap)	.....0.	HydroCarbs	
HCO_3	.....	Mg	.....2..	PO_4	.....	State Method fo	
				H_2S	..trace.	H.C. determn. ___	
CO_3	...[illegible].	Na(calc)	....[illegible]...	NO_2 or NO_3	....		

Metals (ppb): Cr ___, Pb __, Hg __, Cd __, Mn __

Metals done by _____

Check before treatment: i.d. __, d < 24 __, d < 48 __

Check done by _____

Treatment:

Required because: trout OK __; disposal __; Special

Used:

	yes	no			
(1) to remove oil	___	___	(4)		
(2) to flocculate gel	___	___	(5)		
(3) to separate solids	___	___	(6)		

Check after treatment: i.d. __, d < 24 __, d < 48 __, d

Check done by _____

Responsible for Treatment _____

_____

175
533
18 m
179
0
35000
10,600
0.776
5.32
0.600 < 10
18.398
19.0320
57.9662
2.7601
20.2457
0.0000
14
0
675
0
33 S 0.6986
690 S 0.0000
14 S 29.3625
545 S 0.0000
0 S
20.54480 Ag 30.0611
27.70480 Ag 2.3240
0.76000 Ag 0.0000
17.25000 Ag 97.6796
0.32450 Ag 0.0000
10.90000 Ag
0.00000 Ag
OK __
97.34024 Ag
2.66255 Ag
60.43301 Ag

MRS. KATHLEEN I. STRAUSZ
PROVINCIAL ANALYST
~~ACTING~~ DIRECTOR INDUSTRIAL LABORATORY

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA

WATER ANALYSIS REPORT
CHEMICAL

Submitted by	Research Council of Alberta	Date received	January 14, 1969
Address	Groundwater Division	Date reported	January 24, 1969
	Attn: Mr. D. V. Currie	Source of Sample	D.V. Currie, Chevron Stnd 13-1, 13-1-35-10-W4M
Container No.		Serial No.	Dec 22/68 at conclusion of pump test
		Lab No.	69 - 620

PARTS PER MILLION

Total Solids	1744	Carbonate	30.0 parts per million
Ignition Loss	198	Bicarbonate	597.8 parts per million
Hardness	45	Calcium	9.2 parts per million
Sulphates	660	Magnesium	5.4 parts
Chlorides	14	Sodium	
Alkalinity	540	Potassium	
Nature of Alkalinity	Bicarbonate of soda, lime and magnesium		
Nitrite Nitrogen	Trace		
Nitrate Nitrogen	2.5		
Iron	1.34		
Fluoride	0.51		
pH	8.48		

REMARKS:

K.I. Strausz
Kathleen I. Strausz
Director, Provinc

KIS:ps

MRS. KATHLEEN I. STRAUSZ
PROVINCIAL ANALYST
ACTING DIRECTOR INDUSTRIAL LABORATORY

THE UNIVERSITY OF ALBERTA
EDMONTON, CANADA

WATER ANALYSIS REPORT
CHEMICAL

Submitted by	Research Council of Alberta	Date received	January 14, 1969
Address	Groundwater Division	Date reported	January 24, 1969
	Attn: Mr. D. V. Currie	Source of Sample	Chevron Stnd 13-1 13-1-35-10 W4M, Dec 16/68
Container No.		Serial No.	Start of Pump test -
		Lab No.	69 - 619

PARTS PER MILLION

Total Solids	1782	Carbonate	36.0 parts per million
Ignition Loss	182	Bicarbonate	591.7 parts per million
Hardness	38	Calcium	7.3 parts per million
Sulphates	690	Magnesium	4.8 parts per million
Chlorides	14	Sodium	
Alkalinity	545	Potassium	
Nature of Alkalinity	Bicarbonate of soda, lime and magnesium		
Nitrite Nitrogen	nil		
Nitrate Nitrogen	nil		
Iron	0.35		
Fluoride	0.51		
pH	8.45		

REMARKS:

K. I. Strausz
Kathleen I. Strausz (Mrs.)
Director, Provincial Analyst

KIS:ps

MEMORANDUM

FROM:

OUR FILE

YOUR FILE

13-1-35-10 W4M WATER SOURCE WELL

For information concerning this water well, refer to the report written by D. V. CURRIE, P. GEOL. HYDROGEOLOGIST OF THE GROUND WATER DIVISION, RESEARCH COUNCIL OF ALBERTA.

The recovery tests on this well indicate the well is capable of producing a safe yield for 20 years of between 84 and 195 IGPM. The actual production rate is approximately 26 GPM due to completion of the well.

RESEARCH COUNCIL OF ALBERTA - Groundwater Division

Water Level Measurements (field)

Test conducted by: _____ Measured by: _____

Location of project Chevron Std. Well location: Lsd. or 1/4 13 Sec. 1 Tp. 35 R. 10 Mer. 4

Status Pumping (pumping or observation well) R = _____ (distance from pumping well in feet and direction)

Date Dec 20/68 Page 2

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min.		Remarks (i.e. pump adjustments, water temp., static level, etc.)
	7:36	240					49.76	17.86	
	7:30	300					49.79	17.90	
	10:30	360					49.36	17.46	10:00 Pumping about same
	11:30	420					48.99	17.09	
	12:31	480					48.86	16.96	(32-7.74)
	1:30 AM	540					48.84	16.94	
	2:30 AM	600					48.60	16.60	
	3:30	660			56.23		48.30	16.40	-1.7
	4:30	720					47.55	15.65	-2.45
	5:30	840					46.50	14.60	
	8:30	960					46.16	14.26	-3.84
	10:30	1060			60.02		50.85		
	12:30	1200			61.84		50.22		
	2:30	1320					49.46		Pumping rate seems diminishing (@ 25 i.p.m.).
	4:30	1440							

Time 12.50
Level 33.31

RESEARCH COUNCIL OF ALBERTA - Groundwater Division

Water Level Measurements (field)

Test conducted by: _____ Measured by: _____

Location of project _____ Well location: Lsd. or 1/4 ____ Sec. ____ Tp. ____ R. ____ Mer. ____

Status _____ R = _____ Date _____ Page _____

(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min.		Remarks (i.e. pump adjustments, water temp., static level, etc.)
	9:30	300		30.55					
	10:30	360		30.41					
	11:30	420		30.34					
	12:30	480		30.30					
	1:30	540		30.32					
	2:30	600		30.27					
	3:30	660		30.23					
	4:30	720		30.26					
	6:30	840		30.6					
	8:30	960			6:50	= 30.16			
	10:30	1080			9:45	= 30.16			
	12:30	1200							
	2:30	1320							
	4:30	1440							

10590

RESEARCH COUNCIL OF ALBERTA - Groundwater Division

Water Level Measurements (field)

Test conducted by: _____ Measured by: _____

Location of project 13-1-35-10W4. Well location: Lsd. or 1/4 13 Sec. 1 Tp. 35 R. 10 Mer. 4

Status Pumping (pumping or observation well) R = _____ (distance from pumping well in feet and direction)

Date Dec 20/68 Page 1

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min.			Remarks (i.e. pump adjustments, water temp., static level, etc.)
		-10		31.35	30.84		32	7 3/4	31.81	42° 1600 in hose
	4:30 PM	0			31.35		32	9 3/4	31.9	41° 1600 in Barrel
		30 sec			41.90		32	8 5/8	31.74	
		1 min			48.35		~~35~~	~~10 5/8~~		
		1.30 min			51.3		32	10 5/8	32.85	Chart Chang
		2 min			52.30		33	0	33.00	8:30
		3			54.68		33	2 1/2	33.21	12:30
		4			55.72		33	6 1/4	33.61	4:30
		5			56.20		33	9 3/8	33.80	8:30
		6			56.50		34	1 1/2	34.25	
		7			56.75		34	5 1/8	34.43	
		8			57.05		34	8 7/8	34.82	
		9			57.20		35	3/8	35.38	
		10			57.35		35	4 7/8	35.55	
		15					35	8 3/4	36.10	
		20					38	3 1/2	38.29	
		25		32 min			39	.30	39.30	
		30			58.0		40	.47		8.57
		40					42	.37		10.47
		50		22 min	58.40		43	.14		11.24
	5:30	60					44	.78		12.88
	5:50	80			58.50		46	.32		14.42
	6:10	100					47	.50		15.60
	6:30	120			~~58.58~~	58.58	48	.30		16.40
	~~7:00~~	150			58.63		49	.04		17.14
	7:30	180			58.66		49	.36		17.46
	8:00	210					49	.60		17.70
		12			57.57		35	10 1/8	35.90	

RESEARCH COUNCIL OF ALBERTA - Groundwater Division

RECOVERY

Water Level Measurements (field)

Test conducted by: _____ Measured by: _____

Location of project _____ Well location: Lsd. or 1/4 ___ Sec. ___ Tp. ___ R. ___ Mer. ___

Status _____ R = _____ Date _____ Page ___

(pumping or observation well) (distance from pumping well in feet and direction)

Date	Time hrs. & mins.	Elapsed time in mins.	Tape Reading at Meas. Point	Tape Reading at Water level	Depth to water in feet	Draw-down in feet	Q = discharge gals/min.		Remarks (i.e. pump adjustments, water temp., static level, etc.)
	4:30	0		50-1.37	4:27 PM				
		30 sec		47.88					
		1		-2.4					
		1½		-2.47					
		2		47.4					
		3		46.93					
		4		46.57					
	4:35	5		46.205					
		6		45.87					
		7		45.53					
		8		45.21					
		9		44.85					
	4:40 4:37	10		44.52					
	4:45	15		43.05					
	4:50	20		41.38					
	4:55	25		40.31					
	5:00	30		39.17					
	5:10	40		37.30					
	5:20	~~50~~ 55		35.34					
	5:30	60		34.80					
	5:50	80		33.52	← pump out here				
	6:10	100		32.46					
	6:30	120		30.80					
	7:00	150		31.29					
	7:30	180		31.00					
	8:00	210		30.70					
	8:30	240		30.64					
				44.05					