MITCHELL DRILLING (1979) LTD.

GROUNDWATER GEOLOGY OF THE DINSMORE AREA SASKATCHEWAN

Report 0106-001 June 3, 1985

E. A. Christiansen Consulting Ltd.

CONSULTING GEOLOGIST

BOX 3087
SASKATOON, SASKATCHEWAN, CANADA
S7K 3S9

PHONE 374-6700

June 3, 1985

Mitchell Drilling (1979) Ltd.
001 CN Towers
Saskatoon, Saskatchewan
S7K 1J5

Attention: Mr. John Trytko:

Dear Mr. Trytko:

Enclosed are three copies of report 0106 -001 on the "Groundwater geology of the Anerley aquifer, Saskatchewan". If you have any queries, please contact me.

Sincerely yours,

E.A. Christiansen

E.A. Christiansen

SUMMARY

The Anerley aquifer is composed of 7 metres of gravel with an occasional till interbed. The aquifer is hydraulically connected to the Anerley valley alluvium from which it may receive most of its recharge.

The presence of 12 metres of silts and clays between the Anerley and Dinsmore aquifers, and the lack of response in piezometers in the Dinsmore aquifer when the Anerley aquifer was pump tested suggest that pumpage from this aquifer will not appreciably reduce the flow of springs from the Dinsmore aquifer.

Long term measuring of water levels and pumping rates will be required for an accurate assessment of the long term yield of the Anerley aquifer.

TABLE OF CONTENTS

1. INTRODUCTION AND OBJECTIVE

E.A. Christiansen Consulting Ltd. (EAC) was comissioned on April 3, 1985 by Mitchell Drilling (1979) Ltd.(MDL) to geologically interpret the testhole information from the Dinsmore groundwater supply study. On April 23, EAC collected samples and logs from testhole No. 06, and on April 26 a preliminary cross section from Dinsmore to the Anerley valley was submitted to MDL for a meeting with the Dinsmore village council that evening.

Between May 2 and 10, 1985, testholes Nos. 7-10 and the testhole for Dinsmore Well No. 1 were drilled by MDL and sampled by EAC. Samples from these testholes and No. 6 were selected for carbonate and mechanical analyses to aid the geological interpretation. From the testhole information provided by MDL, EAC constructed north-south (A-A') and east-west (B-B') cross sections to determine the location and extent of the "Anerley aquifer" and to determine the relationship between this aquifer and Harold Green's spring, herein called "Green Spring".

Geological interpretation is based on samples collected from the drilling fluid (Fig. 1). These samples were washed, dried, described, and the description compiled into logs (Appendix 1).

2. GEMORPHOLOGY

The geomorphology (surface form) is shown in Drawing 0106-001-01. The Anerley aquifer is best developed west of the confluence of the Dinsmore coulee and the Anerley valley in the vicinity of wells Nos. 1 and 2.

A

B

Figure 1. Test drilling and sampling at Site No. 7. (A) Driller catching samples from drilling fluid. (B) Cutting samples from well No. 1 showing gravel with a till interbed from the Anerley aquifer.

The Dinsmore spring which is the largest in the area and the Green spring occur along the Dinsmore coulee and the Anerley valley. These names have been coined to facilitate the writing of this report. The village of Dinsmore foreman Mr. R. Leavins was contacted to determine whether local names were in existence for these features.

The location of the area of investigation herein called the "Dinsmore area" is shown in Figures 2-5. Major features include the Anerley valley and associated lakes and the Dinsmore coulee and associated springs.

3. GEOLOGY

From oldest to youngest, the sediments are the preglacial Bearpaw Formation and the glacial and postglacial Sutherland and Saskatoon Groups (Christiansen, 1968) of deposits (Drawings 0106-001-02,03). The Bearpaw Formation is composed of marine, noncalcareous silt and clay, commonly referred to as bedrock or shale. In Drawings 0106-001-02 and 03, the Bearpaw Formation is overlain by tills of the Sutherland Group. These tills, which contain silt and sand interbeds, range in thickness from 14 to 36 metres.

The Sutherland Group is overlain by the Saskatoon Group of glacial and post-glacial deposits, including till and sands, tills, Anerley and Dinsmore aquifers, silt and clay, and the Anerley valley alluvium (Drawing 0106-001-02,03). Tills of the Sutherland Group are separated from tills of the Saskatoon Group by carbonate content,texture, and electrical resistance (Appendices 2-3). The tills of the Sutherland Group have a mean carbonate

A

B

Figure 2. Well Site No.1 (A) Regional setting of Well Site No. 1 northwest of confluence of Dinsmore coulee (from right) and Anerley valley, (upper left). (B) Test drilling at Well Site No. 1 with Anerley Lakes in background.

A

B

Figure 3. Anerley valley. (A) Milden Lake in background with old pumphouse in middle left and Dinsmore coulee in lower left. (B) Milden Lake in foreground and Anerley Lakes and Green farmstead in background.

A

B

Figure 4. Dinsmore spring. (A) Dinsmore spring in lower left, old pumphouse and Milden Lake in upper right, and Well Site Nos. 1 and 2 in between. (B) Dinsmore spring in Dinsmore coulee with Anerley Lakes in background.

A

B

Figure 5. Dinsmore spring. (A) Dinsmore spring looking east with testhole 7 on left horizon. (B) Dinsmore spring looking west.

content of 24 ± 2mL CO_2 , whereas the tills of the Saskatoon Group have a mean carbonate content of 32 ± 5mL CO_2/g. In addition the tills of the Sutherland Group have a higher clay content and a lower electrical resistance than tills in the Saskatoon Group.

The Anerley valley floor is covered with up to 16 metres of sands and diamictons (mixture of gravel, sand, and silt) herein called the "Anerley valley alluvium".

4. GROUNDWATER

The groundwater investigation conducted by EAC in the Dinsmore area included an investigation of the occurrence and potentials of groundwater only. This study does not include groundwater hydrological analyses.

Two aquifers prevalent in the Dinsmore area which are herein called the Anerley and Dinsmore aquifers (Drawings 0106-001-02,03). The Anerley aquifer, which is up to 7 metres thick, lies on an erosional surface in tills of the Sutherland Group and Saskatoon Groups and is overlain by glacial lake silts and clays. The aquifer is composed mainly of gravel with an occasional till interbed (Fig. 1B). The gravel is thought to represent an outwash deposit laid down on a glacially eroded surface. As the glacier retreated, the outwash gravel was covered by glacial lake silts and clays.

The Dinsmore aquifer, for the most part, overlies the glacial lake silts and clay (Drawing 0106-001-03). The aquifer accupies the lower 5 metres of a sand and till, 11 to 13 metres thick, lying between a silt and clay unit and till. The Dinsmore aquifer is highly interbedded.

The Anerley aquifer discharges into the Anerley valley alluvium (Drawing 0106-001-02), whereas the Dinsmore aquifer dishcarges into the Dinsmore coulee (Fig. 4,5) as well as the Anerley valley (Drawing 0106-001-03). The equivalent of the Dinsmore aquifer sand and till northwest of Dinsmore coulee is completely dry having been drained into the Anerley valley.

The springs in the Dinsmore coulee are restricted to the south side of the coulee because the north side is dry. If it is assumed that little retreat of the north side of the coulee has taken place since its formation about 13000 years ago (Christiansen, 1979), it can be concluded that the south side of the coulee has retreated 185 metres by spring sapping in about 13000 years or about 14 millimetres per year.

Cross section BB' (Drawing 0106-0010-03) shows clearly that the Anerley and Dinsmore aquifers are two distinctly different water bearing formations separated by 12 metres of silts and clays. The Anerley aquifer is deeper and drains into the Anerley valley alluvium, whereas the shallower Dinsmore aquifer drains onto the floors of the Anerley valley and Dinsmore coulee. The presence of 12 metres of silts and clays between the Anerley and

Dinsmore aquifers and the lack of response in piezometer 7 and 8 when the Anerley aquifer was pump tested at 75 IGPM for 24 hours suggest that pumpage of this aquifer will not appreciably affect the flow of springs from the Dinsmore aquifer.

EAC was informed by MDL that piezometer 2A recovered when the old well was shut off. This suggests a hydraulic connection between the Anerley aquifer and the Anerley valley alluvium. The Anerley valley alluvium may be the main source of recharge for the Anerley aquifer.

5. CONCLUSIONS

1. The Anerley aquifer is in a 7-metre outwash blanket deposit lying between tills of the Sutherland and Saskatoon Groups and glacial lake silts and clays.
2. The Anerley aquifer is hydraulically connected to the Anerley valley alluvium from which water can be induced to flow into the Anerley aquifer during pumping.
3. The Anerley and Dinsmore aquifers are separated stratigraphically by 12 metres of glacial lake silts and clays of relatively low permeability.
5. The long term yield of the Anerley aquifer will depend on the areal extend of the aquifer and the rate of recharge. Pump test analyses, not included in this report, will serve as a quide to estimating this yield, but long term measuring of water levels and pumping rates will be required for a more accurate estimate of the long term yeild.

6. LITERATURE CITED

Christiansen, E.A. 1968. Pleistocene stratigraphy of the Saskatoon area, Saskatchewan, Canada. Canadian Journal of Earth Sciences, v. 5, pp. 1167-1173.

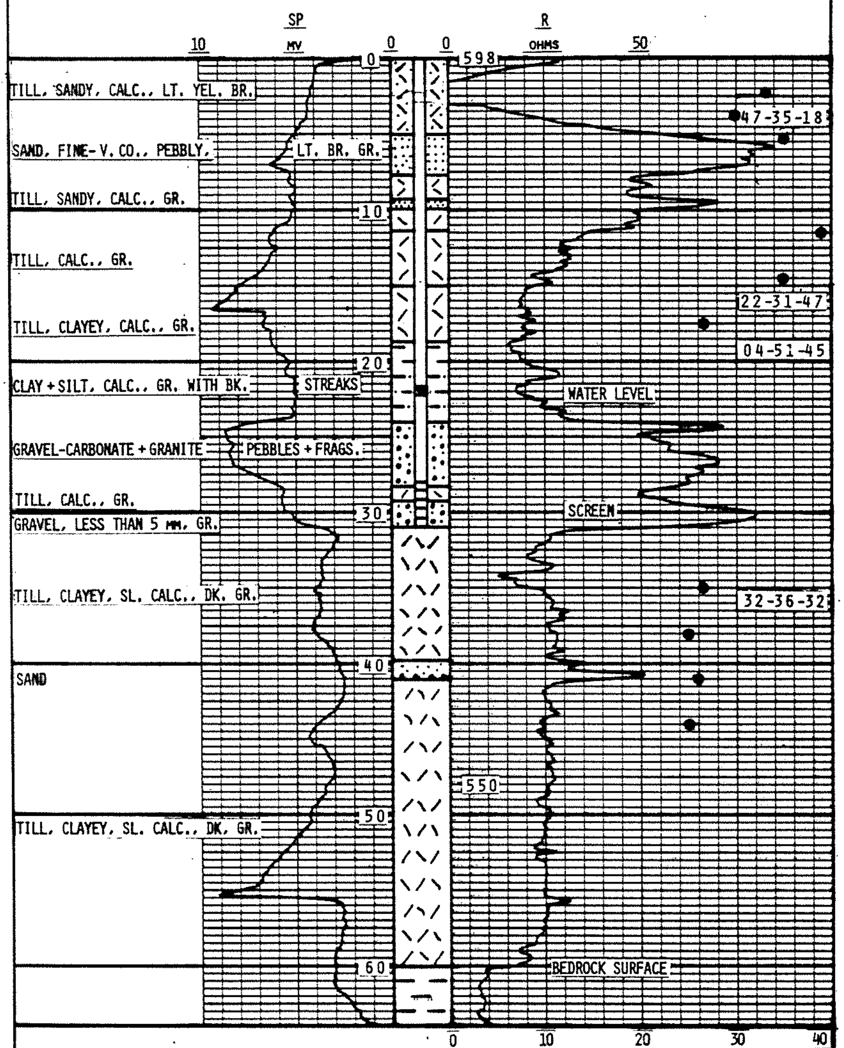
Christiansen, E.A. 1979. The Wisconsinan deglaciation of southern Saskatchewan and adjacent areas. Canadian Journal of Earth Sciences, v. 16, pp. 913-938

Appendix 1. Geological logs.

V

VOFD 720/06 1985
DINSMORE NO.01
SW-10-31-27-10-W3
2590'W,2330'S,NEC-S-31
WELL

ELEVATION 598 M
SURVEY
SP COND MUD 1600 MICROSIEMENS/CM AT 25° C
SP COND WATER 2000 MICROSIEMENS/CM AT 25° C
SP 10 MV. R 50 OHMS



CUTTING SAMPLE DESCRIPTION

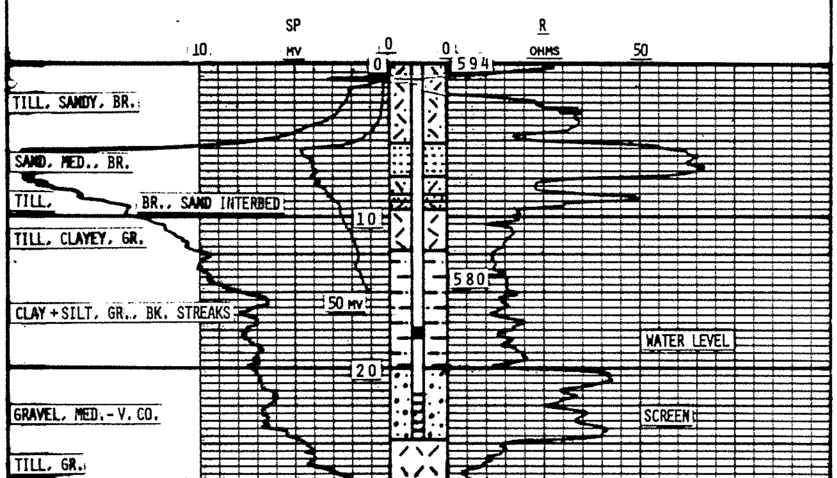
30-40-30=30% SAND, 40% SILT, 30% CLAY

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

VOFD 720/06 1985
DINSMORE NO.02
SW-10-31-27-10-W3
2590'W,2070'S,NEC-S-31
WELL

ELEVATION 594 M
SURVEY
SP COND MUD 700 MICROSIEMENS/CM AT 25° C
SP COND WATER 400 MICROSIEMENS/CM AT 25° C
SP 10 MV R 50 OHMS



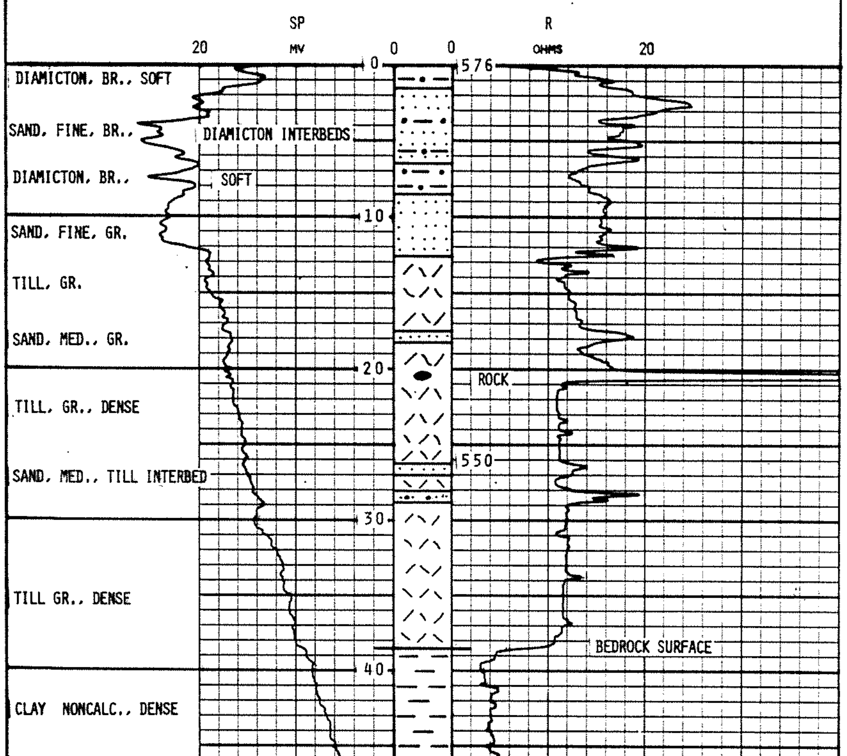
DRILLER'S LOG

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

LOG COMPILED FROM DRILLER'S
AND ELECTRIC LOGS BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

$V_{OF}D$ 720/06 1985
DINSMORE NO.02B
SW-16-31-27-10-W3
1320'W,1230'S,NEC-S-31
TESTHOLE

ELEVATION 575.55 M
SURVEY
SP COND MUD 2100 MICROSIEMENS/CM AT 25° C
SP COND WATER 1600 MICROSIEMENS/CM AT 25° C
SP 20 MV R 20 OHMS



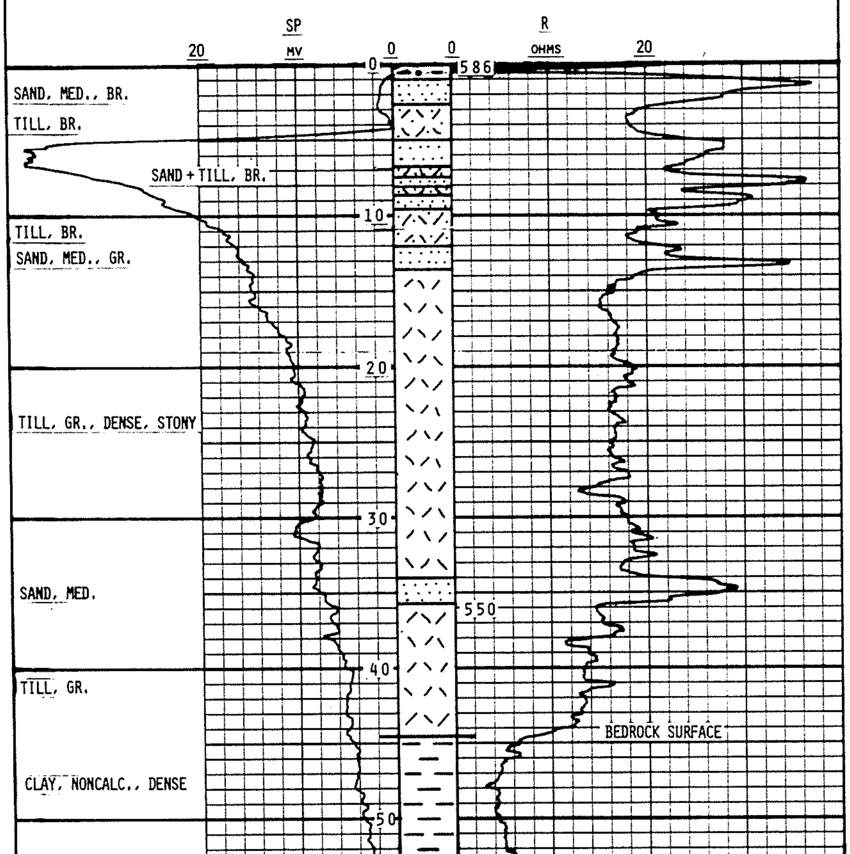
DRILLER'S LOG

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN. TRYTKO

LOG COMPILED FROM DRILLER'S
AND ELECTRIC LOGS BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

VOF D 720/06 1985
DINSMORE NO.03
NE-16-31-27-10-W3
700 'W, 260'S,NEC-S-31
TESTHOLE

ELEVATION 585.73 M
SURVEY
SP COND MUD 1800 MICROSIEMENS/CM AT 25° C
SP COND WATER 1600 MICROSIEMENS/CM AT 25° C
SP 20 MV R 20 OHMS



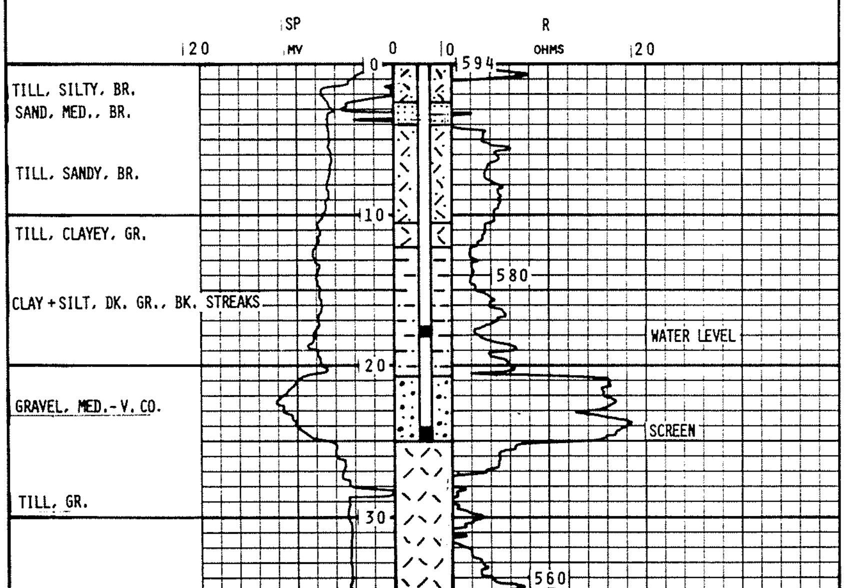
DRILLER'S LOG

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

LOG COMPILED FROM DRILLER'S
AND ELECTRIC LOGS BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

V OF D 720/06 1985
DINSMORE NO.04
SW-10-31-27-10-W3
2620'W,2070'S,NEC-S-31
PIEZOMETER

ELEVATION 593.58 M
SURVEY
SP COND MUD 2000 MICROSIEMENS/CM AT 25° C
SP COND WATER 1600 MICROSIEMENS/CM AT 25° C
SP 20 MV R 20 OHMS



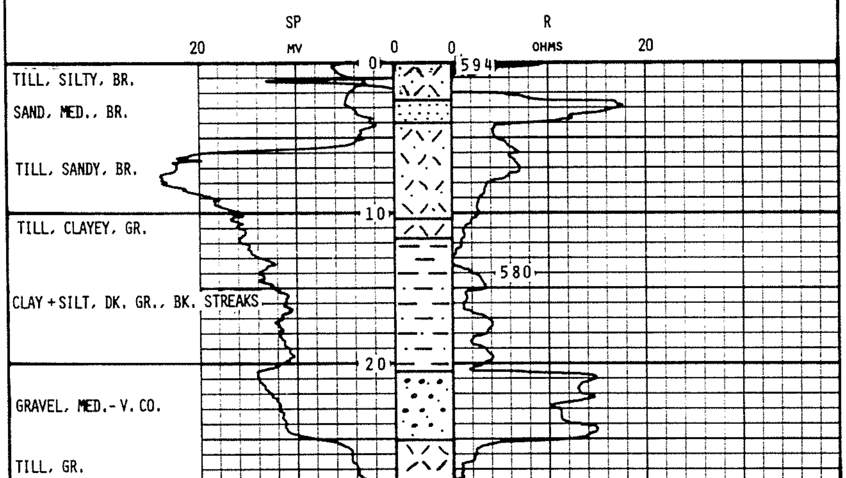
DRILLER'S LOG

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

LOG COMPILED FROM DRILLER'S
AND ELECTRIC LOGS BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

V$_{OF}$D 720/06 1985
DINSMORE NO.05
SW-10-31-27-10-W3
2620'W,2070'S,NEC-S-31
ABANDONED WELL

ELEVATION 593.65 M
SURVEY
SP COND MUD 2000 MICROSIEMENS/CM AT 25° C
SP COND WATER 1600 MICROSIEMENS/CM AT 25° C
SP 20 MV R 20 OHMS



DRILLER'S LOG

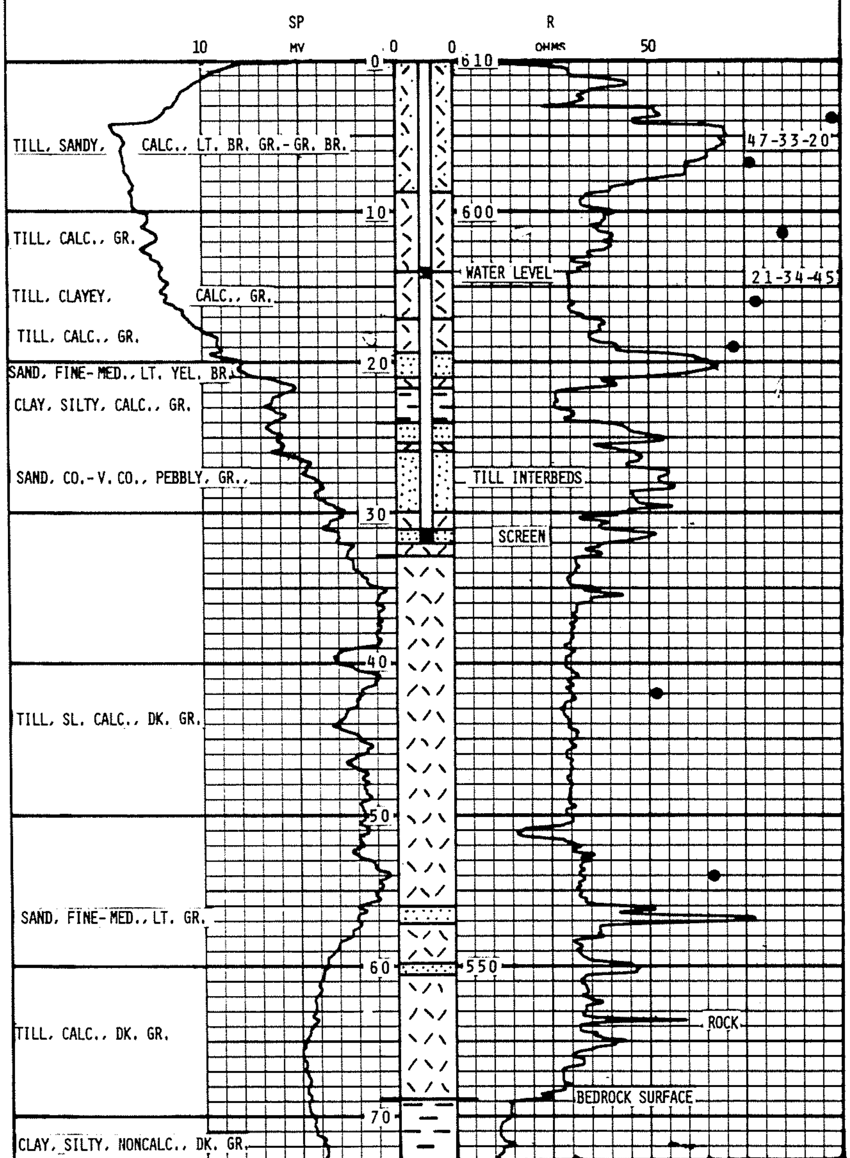
CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

LOG COMPILED FROM DRILLER'S
AND ELECTRIC LOGS BY
E.A.CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

V

$V_{OF}D$ 720/06 1985
DINSMORE NO.06
NW-01-36-27-11-W3
700 'W,4400'S,NEC-S-36
PIEZOMETER

ELEVATION 609.77 M
SURVEY
SP COND MUD 2000 MICROSIEMENS/CM AT 25° C
SP COND WATER 1600 MICROSIEMENS/CM AT 25° C
SP 10 MV R 50 OHMS



CUTTING SAMPLE DESCRIPTION

CO_2 ML/G

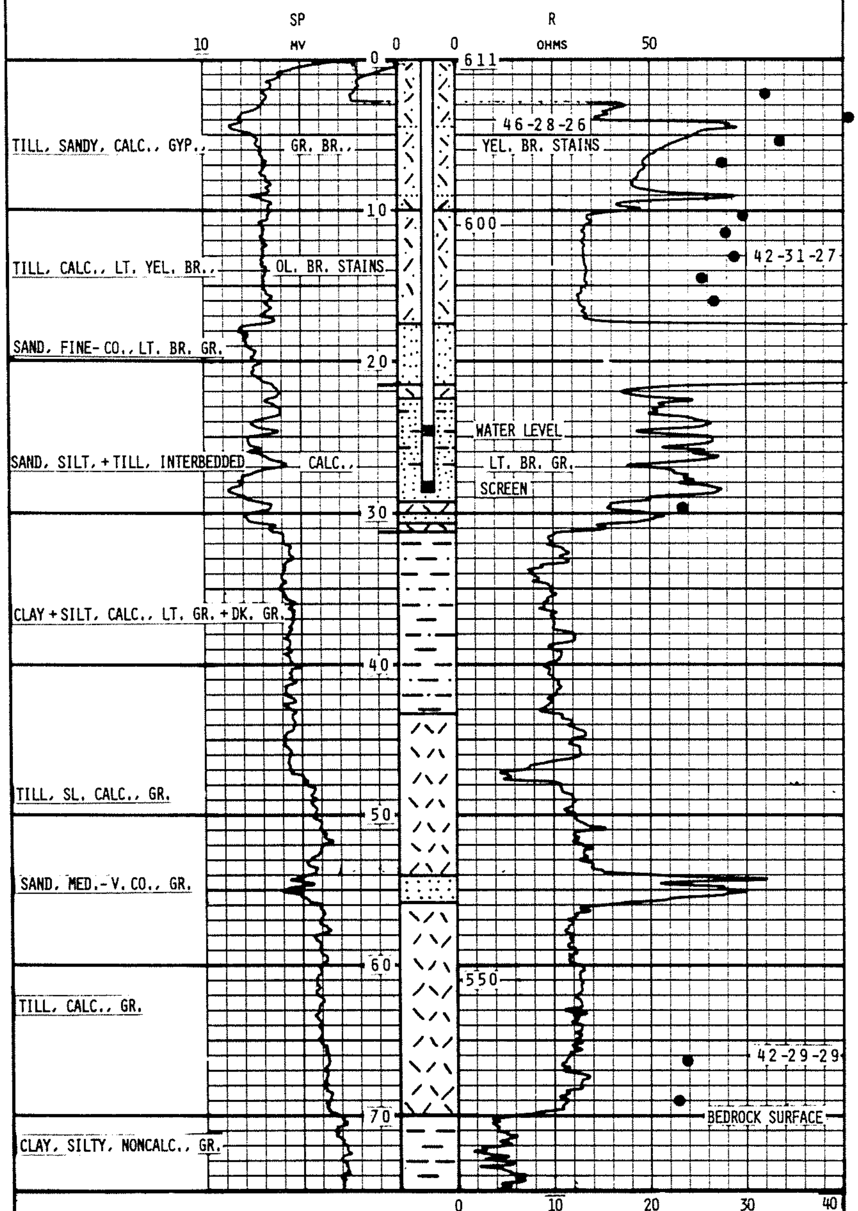
30-40-30 = 30% SAND, 40% SILT, 30% CLAY

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

$V_{OF}D$ 720/06 1985
DINSMORE NO.07
SE-07-31-27-10-W3
1630'W,3340'S,NEC-S-31
PIEZOMETER

ELEVATION 610.52 M
SURVEY
SP COND MUD 1000 MICROSIEMENS/CM AT 25° C
SP COND WATER 400 MICROSIEMENS/CM AT 25° C
SP 10 MV. R 50 OHMS



CUTTING SAMPLE DESCRIPTION

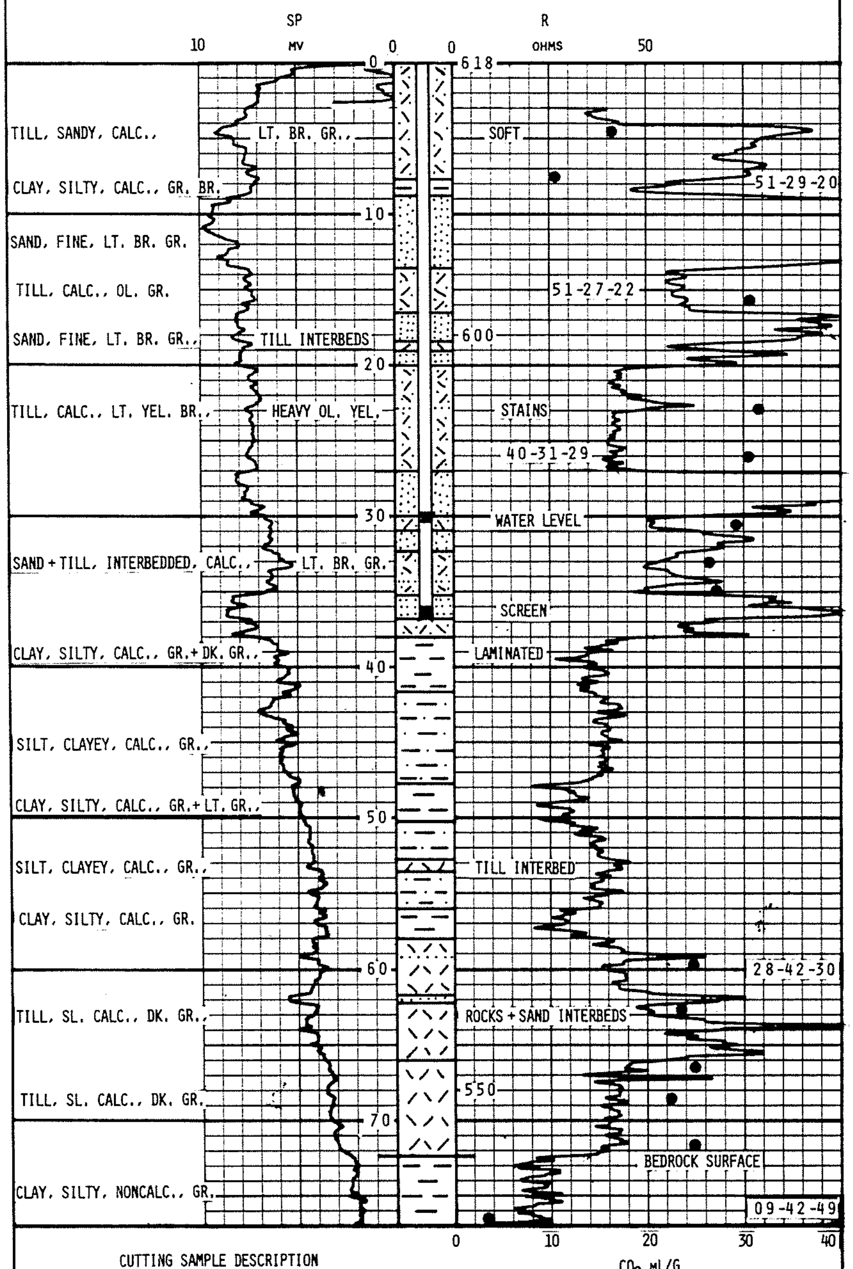
30-40-30 = 30 % SAND, 40 % SILT, 30 % CLAY

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

VofD 720/06 1985
DINSMORE NO.08
SW-05-32-27-10-W3
5150'W,3340'S,NEC-S-32
PIEZOMETER

ELEVATION 618.11 M
SURVEY
SP COND MUD 700 MICROSIEMENS/CM AT 25° C
SP COND WATER 300 MICROSIEMENS/CM AT 25° C
SP 10 MV R 50 OHMS



CUTTING SAMPLE DESCRIPTION

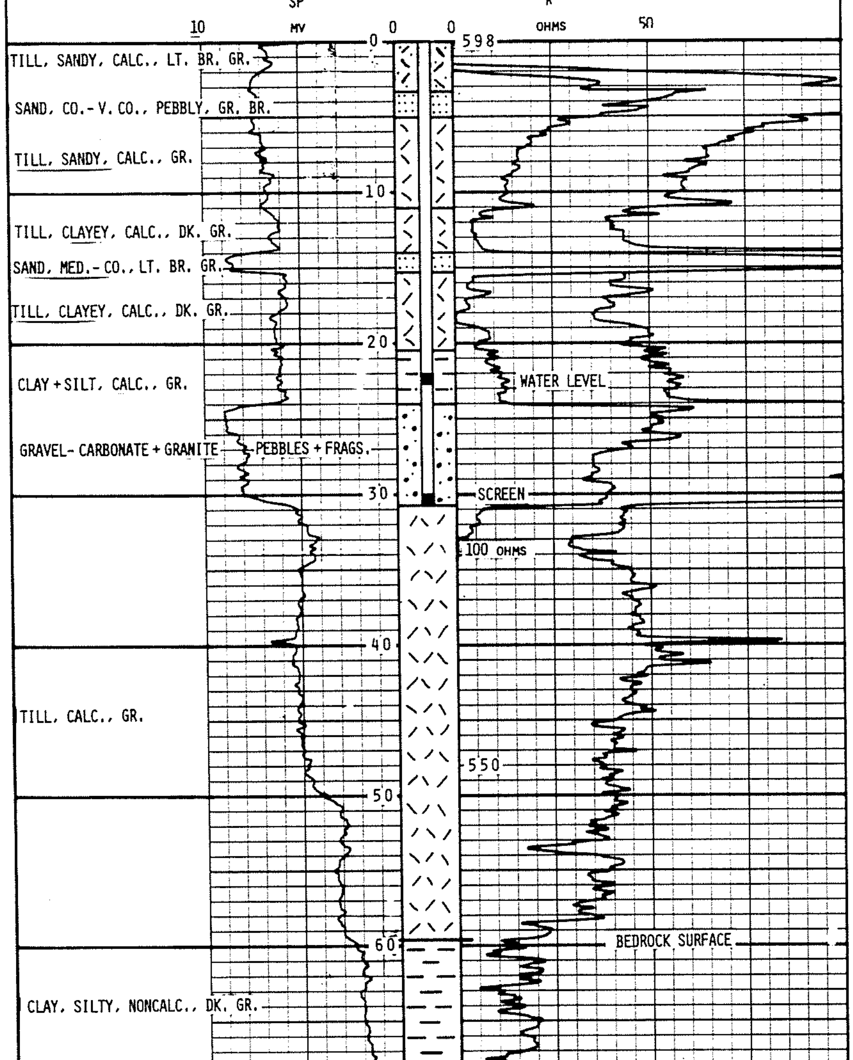
30-40-30 = 30% SAND, 40% SILT, 30% CLAY

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

V OF D 720/06 1985
DINSMORE NO.09
SW-10-31-27-10-W3
2420'W,2510'S,NEC-S-31
PIEZOMETER

ELEVATION 597.89 M
SURVEY
SP COND MUD 700 MICROSIEMENS/CM AT 25° C
SP COND WATER 300 MICROSIEMENS/CM AT 25° C
SP 10 MV R 50 OHMS



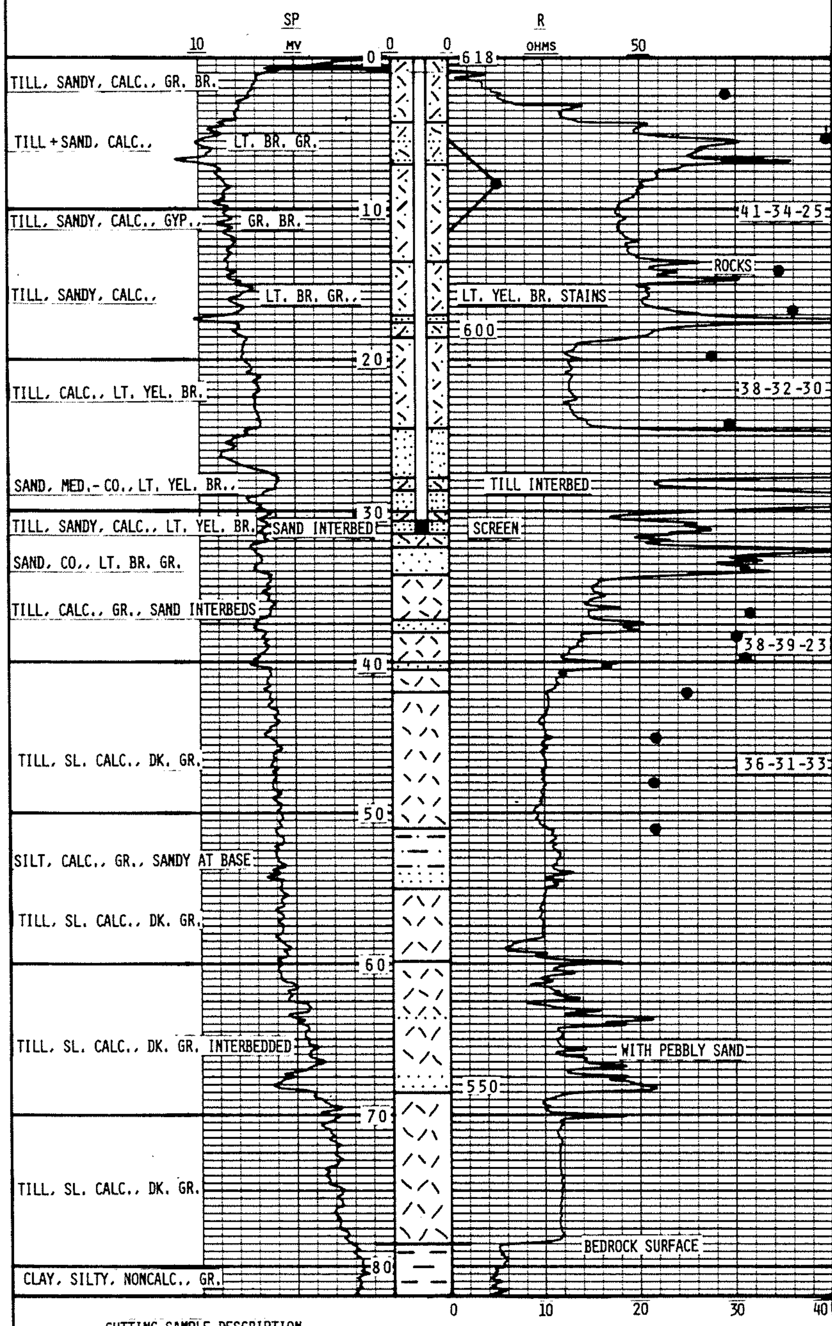
CUTTING SAMPLE DESCRIPTION

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

V$_{OF}$D 720/06 1985
DINSMORE NO.10
NE-12-31-27-10-W3
4090'W,1410'S,NEC-S-31
PIEZOMETER

ELEVATION 618 M
SURVEY
SP COND MUD 850 MICROSIEMENS/CM AT 25° C
SP COND WATER 300 MICROSIEMENS/CM AT 25° C
SP 10 MV R 50 OHMS



CUTTING SAMPLE DESCRIPTION

CO_2 ML/G

30-40-30 = 30% SAND, 40% SILT, 30% CLAY

CONTRACTOR
MITCHELL DRILLING (1979) LTD.
DRILLER
JOHN TRYTKO

GEOLOGY BY
E.A. CHRISTIANSEN CONSULTING LTD.
MAY 29, 1985

Appendix 2. Carbonate analyses.

SASKATCHEWAN SOIL TESTING LABORATORY

DATE:28/05/85 SPECIAL ANALYSIS

D*CHRSTNSN-E*CO3.I84-5612/5677 ***E.A. CHRISTIANSEN***

SAMPLE #	CLIENT SAMPLE NUMBER	CO2 Eqiv mls/gm
I84-5612	#1 10	33.0
I84-5613	#1 15	29.9
I84-5614	#1 20	35.4
I84-5615	#1 40	39.0
I84-5616	#1 50	34.7
I84-5618	#1 60	26.5
I84-5620	#1 110-120	26.5
I84-5621	#1 120-130	24.9
I84-5622	#1 130-140	25.8
I84-5623	#1 140-150	25.0
I84-5624	#6 10-15	39.3
I84-5626	#6 20-25	30.6
I84-5627	#6 35-40	33.9
I84-5629	#6 50-55	31.2
I84-5630	#6 60-65	28.8
I84-5631	#6 135-140	20.8
I84-5632	#6 175-180	26.7
I84-5633	#7 10	32.1
I84-5634	#7 15	40.6
I84-5635	#7 20	33.6
I84-5636	#7 25	27.6
I84-5637	#7 35	29.7
I84-5638	#7 40	27.8
I84-5639	#7 45	28.8
I84-5640	#7 50	25.4

COMMENT:

SASKATCHEWAN SOIL TESTING LABORATORY

SPECIAL ANALYSIS

DATE:28/05/85

D*CHRSTNSN-E*CO3.I84-5612/5677 ***E.A. CHRISTIANSEN***

SAMPLE #	CLIENT SAMPLE NUMBER	CO2 Eqiv mls/gm
I84-5641	#7 55	26.7
I84-5642	#7 100	23.7
I84-5643	#7 220	21.9
I84-5644	#7 230	23.0
I84-5645	#8 20	16.3
I84-5646	#8 30	10.6
I84-5647	#8 60	30.6
I84-5648	#8 80	31.7
I84-5649	#8 90	30.6
I84-5650	#8 100	29.3
I84-5651	#8 110	26.3
I84-5652	#8 120	27.3
I84-5653	#8 200	24.9
I84-5654	#8 210	23.7
I84-5655	#8 220	25.0
I84-5656	#8 230	22.3
I84-5657	#8 240	24.9
I84-5658	#8 260	3.7
I84-5659	#10 10	28.9
I84-5660	#10 20	39.5
I84-5661	#10 30	44.7
I84-5663	#10 40	41.2
I84-5664	#10 50	34.5
I84-5665	#10 60	36.0
I84-5666	#10 70	27.6

COMMENT:

SASKATCHEWAN SOIL TESTING LABORATORY

DATE:28/05/85 SPECIAL ANALYSIS

D*CHRSTNSN-E*CO3.I84-5612/5677 ***E.A. CHRISTIANSEN***

SAMPLE #	CLIENT SAMPLE NUMBER	CO_2 Eqiv mls/gm
I84-5668	#10 80	26.7
I84-5669	#10 90	29.5
I84-5670	#10 125	31.7
I84-5671	#10 130	30.2
I84-5672	#10 135	31.0
I84-5673	#10 140	25.2
I84-5674	#10 150	21.9
I84-5676	#10 160	21.7
I84-5677	#10 170	21.9

COMMENT:

Appendix 3. Mechanical analyses.

SASKATCHEWAN SOIL TESTING LABORATORY

DATE:21/05/85

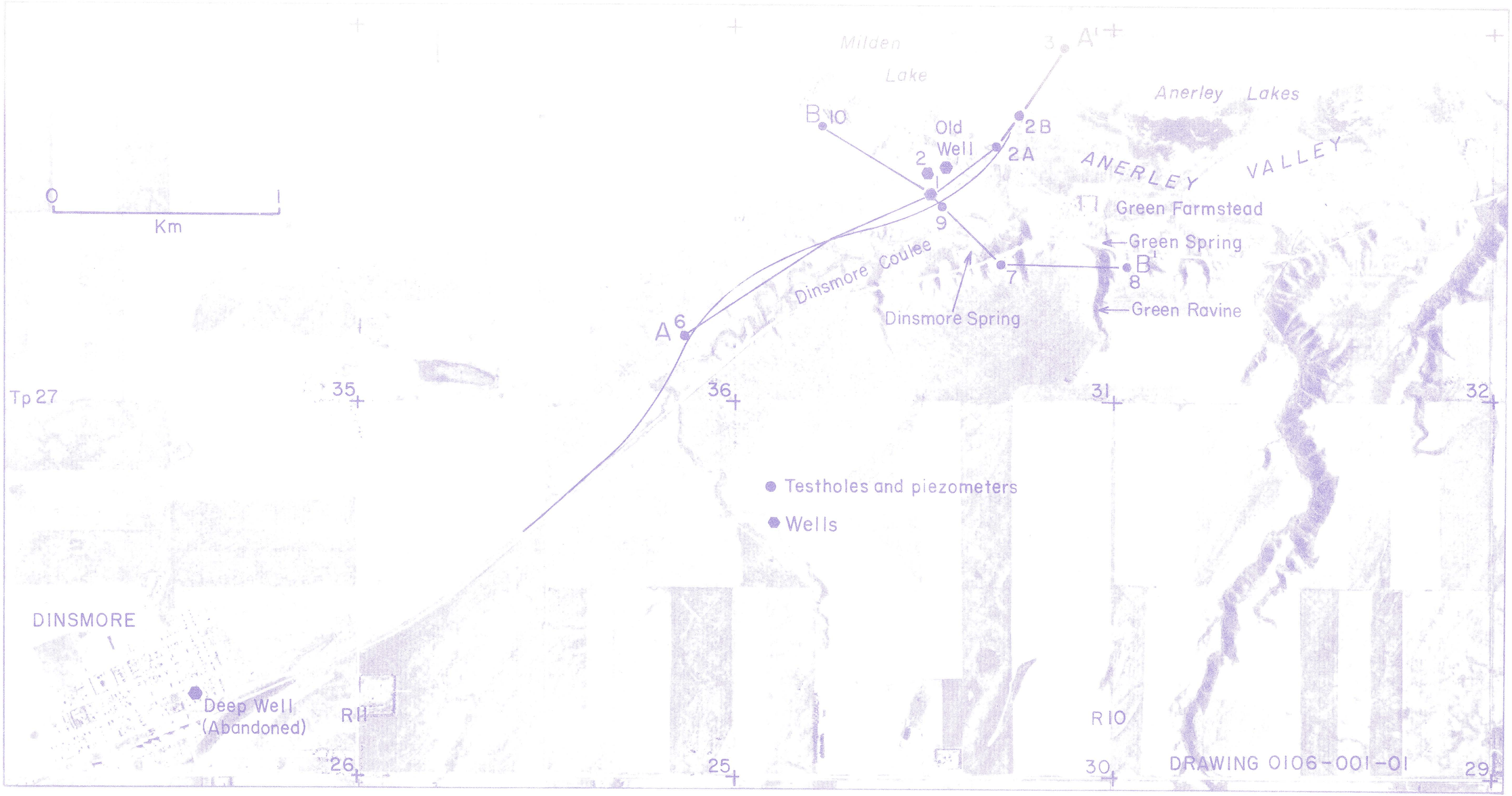
MECHANICAL ANALYSIS

D*CHRSTNSN-E*MEC.I84-5613/5675

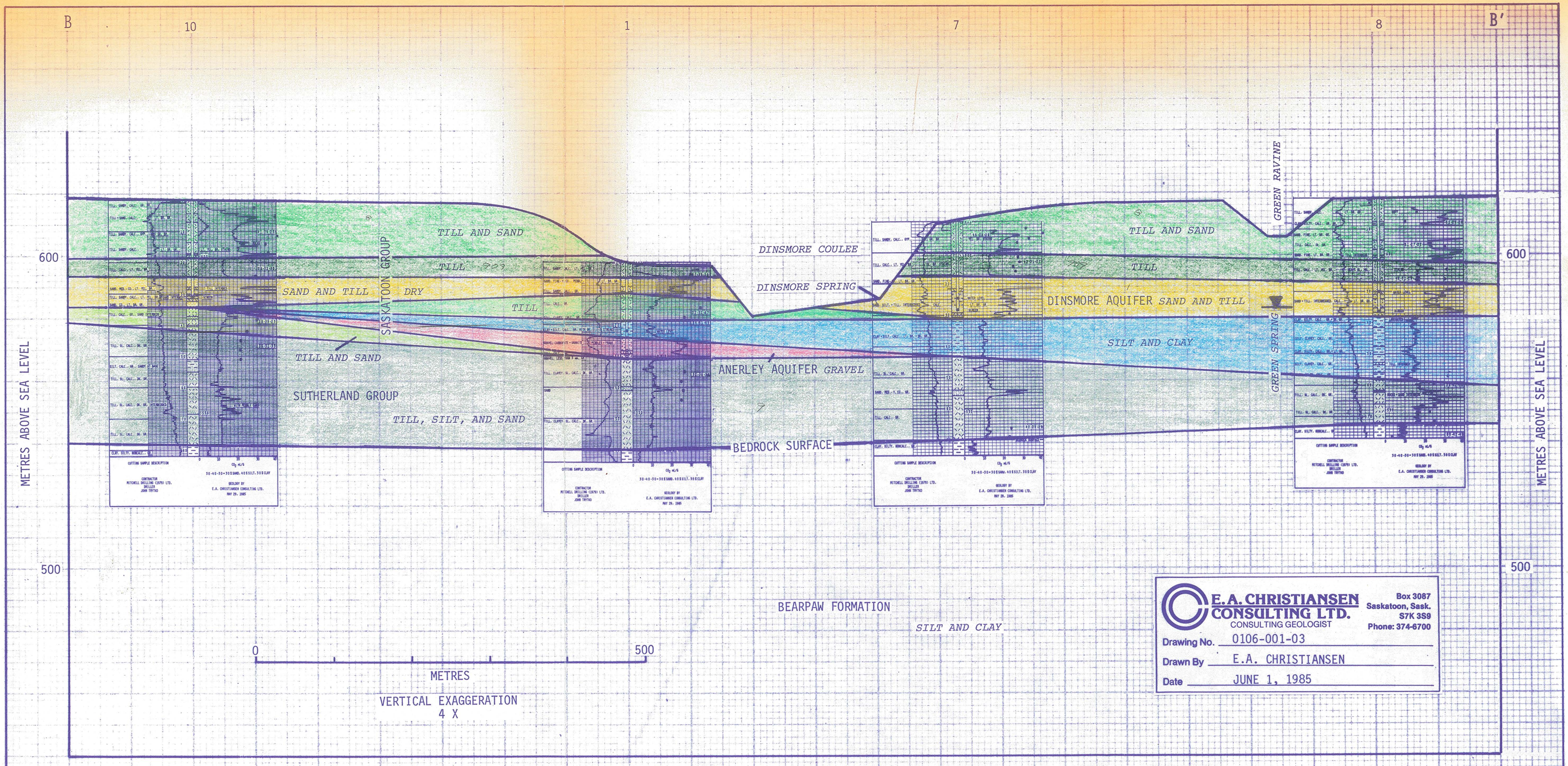
E.A. CHRISTIANSEN

SAMPLE #	CLIENT SAMPLE NUMBER	SAND percent	SILT percent	CLAY percent
I84-5613	#1 15	46.7	35.4	17.9
I84-5617	#1 55	21.7	31.3	47.0
I84-5619	#1 65-75	4.0	50.8	45.2
I84-5620	#1 110-120	32.3	35.6	32.1
I84-5625	#6 15-20	47.5	32.8	19.7
I84-5628	#6 45-50	20.7	34.3	45.0
I84-5635	#7 20	45.9	28.1	26.0
I84-5639	#7 45	41.5	31.0	27.5
I84-5643	#7 220	41.9	29.1	29.0
I84-5646	#8 30	51.2	29.2	19.5
I84-5647	#8 60	50.7	27.4	21.9
I84-5649	#8 90	39.6	30.9	29.5
I84-5653	#8 200	27.7	41.8	30.4
I84-5658	#8 260	8.5	42.4	49.2
I84-5662	#10 35	40.5	34.5	25.0
I84-5667	#10 75	38.1	31.5	30.5
I84-5671	#10 130	37.8	38.6	23.6
I84-5675	#10 155	35.5	31.5	33.0

COMMENT:



Milden
Lake
Anerley Lakes
3
A'
B
10
Old
Well
2B
2A
2
1
ANERLEY VALLEY
9
Green Farmstead
Green Spring
Dinsmore Coulee
B'
7
8
Dinsmore Spring
Green Ravine
A
6
0
1
Km
Tp 27
35
36
31
32
Testholes and piezometers
Wells
DINSMORE
Deep Well
(Abandoned)
R11
R10
26
25
30
29
DRAWING 0106-001-01



DRAWING 0106-001-03. CROSS SECTION B-B′. DINSMORE WATER SUPPLY.

DRAWING 0106-001-02. CROSS SECTION A-A', DINSMORE WATER SUPPLY.

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

Draft Report

to

MITCHELL DRILLING (1979) LTD.

ANALYSIS OF PUMPING TEST RESULTS
WATER SUPPLY WELLS
DINSMORE, SASKATCHEWAN

DRAFT COPY

Distribution:

1 copy - J. Trtyko
Mitchell Drilling Ltd.
Saskatoon, Saskatchewan

1 copy - Golder Associates
Saskatoon, Saskatchewan

August, 1985

852-6030

DRAFT COPY

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

August 13, 1985

Our ref: 852-6030

Mitchell Drilling Ltd.
45 Nicholson Place
Saskatoon, Saskatchewan
S7L 4G7

ATTENTION Mr. J. Trtyko

Dear John:

Enclosed is a copy of Golder Associates report on the results of the pumping tests undertaken for the Village of Dinsmore. As discussed by telephone on Friday, certain information is missing such as pumping test dates, depth of backfill and the like. Please review the report and make any changes you feel are required. We will then update the report for submission to the Water Corporation.

Yours truly,

GOLDER ASSOCIATES

J.T. Dance

J.T. Dance, P. Eng.

JTD/mjw

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

Golder Associates has been retained by Mitchell Drilling (1979) Limited (MDL) of Saskatoon to review and analyze the results of two pumping tests performed on two water supply wells installed for the Village of Dinsmore, Saskatchewan. The wells are located about four kilometres northeast of Dinsmore on the shore of Milden Lake (Figure 1).

We understand that these wells were required to replace a 'deep' water supply well located in the Village of Dinsmore completed in 1984 which in the spring of 1985 was found to yield insufficient water to meet the village's potable water requirements.

Geologic interpretation of the area has been conducted by E.A. Christiansen Consulting Ltd. based upon the results of a testhole program undertaken to identify a potable water aquifer in the area. This interpretation is presented in E.A. Christiansen's Report No. 0106-001 to MDL entitled "Groundwater Geology of the Dinsmore Area, Saskatchewan", dated June 3, 1985. Portions of the information presented by Christiansen will be referred to in this report.

Golder Associates services were retained verbally by Mr. J. Trytko of Mitchell Drilling (1979) Ltd. on July 12, 1985.

2.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

Ten testholes were drilled in the vicinity of the confluence of Dinsmore Coulee and Anerley Valley (Christiansen, 1985) about four kilometres northeast of the Village of Dinsmore. These testholes were drilled to investigate the possible occurrence and the distribution of an intertill aquifer in the area. The aquifer was suspected because of the proximity of two springs referred to by Christiansen as Dinsmore spring and Green's spring which discharge along the southern flank of Anerley Valley at the site. These springs are locally used as water supplies and have never been known to become dry.

The testholes were drilled by MDL between late March and early May, 1985. Rotary cuttings samples and geophysical logs of the testholes were used to provide subsurface information which has been interpreted by Christiansen. This interpretation is presented in the report listed in the introductory section. A brief summary is contained in the following.

From the testhole information, Christiansen defined three basic sedimentary units in the area consisting from ground surface to the depth penetrated by the testholes, of;

Saskatoon Group
Sutherland Group
Bearpaw Formation

The Bearpaw Formation is a pre-glacial deposit of marine, non-calcareous silt and clay and is the uppermost bedrock formation in the area.

The Sutherland Group, a glacial till formation is deposited directly on top of the eroded surface of the Bearpaw Formation. In the testholes drilled for this investigation the Sutherland Group ranges in thickness from 14 to 36 metres and consists of clayey silt and silty clay containing interbeds of silt and sand.

The Sutherland Group is overlain by glacial and post-glacial sediments which comprise the Saskatoon Group. In this area, the Saskatoon Group consists of till and sand, till, the Anerley and Dinsmore Aquifers, silt and clay and Anerley Valley alluvium.

The Dinsmore Aquifer occurs stratigraphically above the Anerley Aquifer. The Dinsmore Aquifer is about 11 to 13 metres thick and is composed of interbedded sand, silts and clays. The aquifer is overlain by till and is laid down on top of glacial lake silt and clay. The aquifer occurs on both sides of Dinsmore Coulee. To the north the aquifer is dry. To the south groundwater from the aquifer discharges to form Dinsmore and Green's springs.

The Anerley Aquifer occurs below the Dinsmore Aquifer and is separated from it by approximately 12 metres of glacial lake silts and clays. The Anerley Aquifer is laid down on an erosional surface formed by tills of the Saskatoon and Sutherland Groups. The aquifer is about 7 metres thick and is composed mostly of gravel with an occasional till interbed. Water from the aquifer drains into the Anerley Valley alluvium.

The Anerley Valley alluvium is a highly stratified deposit of sands, silts and clays. One well, known as the "old well" obtains water from the alluvium. We understand that when the village well became dry, this well was put into production to supply the village.

Based upon the results of the test drilling program MDL decided that the Anerley Aquifer was the best potential water supply aquifer in the area. The geologic information suggested that the aquifer was best developed west of the confluence of Dinsmore Coulee and Anerley Valley. Two wells, No. 1 and 2, were located in the aquifer at this site.

3.0 TESTING PROGRAM

3.1 Production Well Installation

Two pumping wells were installed by MDL in the Anerley Aquifer which underlies the area northeast of the Village of Dinsmore. The well locations relative to the village are shown on Figure 1.

Each well was constructed of 0.2 m OD PVC well casing. A 3 metre length of No. 30 slot Johnson stainless steel well screen was attached to the PVC and inserted in the aquifer. A one metre length of blank tubing was installed below the well screen as a sump to contain any fine-grained material washing through the screen during pumping.

The annular space around the well screen and casing was backfilled with 8.12 frac sand to a level above the top of the well screen. The remainder of the annular space from the top of the filter pack to the ground surface was backfilled with pea gravel. Details of the well construction are provided on Figures 2 and 3 for wells 1 and 2 respectively and are summarized in Table 1.

TABLE 1

Summary of Well Completions

	Well 1	Well 2
Total Drilled Depth (metres)	64.0	27.5
Depth of Well Screen (metres)	29 to 32	22 to 25
Depth of Aquifer (metres)	24 to 32	20 to 25
Static Water Level (metres)	22.3	18.2

3.2 Pumping Test Procedure

Pumping tests were carried out on Wells 1 and 2 on June __ and June __, 1985 respectively by MDL. During both tests, water levels in the aquifer were monitored both at the pumping well and at nearby observation wells. Observation well 1 was located 9.1 metres east of Well 1 and observation well 2 was located 12.8 metres north of Well 2. Both observation wells were completed in the aquifer. The relative position of the observation wells and pumping wells at the site is shown on Figure 4.

The pumping test on Well 1 was carried out for a period of 24 hours at a continuous pumping rate of 3.8 litres per second (approximately 50 IGPM). The test on Well 2 was continued for the same period but at a slighly greater rate of 5.7 litres per second (75 IGPM). The pumping rates were monitored during the test using an orifice weir.

Throughout the pumped period of the two test water levels were monitored at periodic intervals in both the pumped well and the observation well. Following the 24 hour pumping period pumping from each well was halted and the water levels were allowed to recover. The rate of recovery of both wells was monitored for a period of four hours.

A hydrograph of the water levels recorded during both the pumping and recovery portions of the two tests is presented on Figure 5A and B. All water level data reported for the pumping tests was obtained by personnel of MDL.

TABLE 2

Summary of Pumping Test Results

Observation Location	Static Water Level (metres)	Total Available Drawdown (metres)	Maximum Observed Drawdown (metres)	Pumping Rate (1/s)
Pumping Test 1 - Pumping Well 1				
Well 1	22.3	5.2	2.76	3.8
Observation Well 1	22.3	5.2	0.15	3.8
Pumping Test 2 - Pumping Well 2				
Well 2	18.2	4.3	0.18	5.8
Observation Well 2	18.2	4.3	0.11	5.8

4.0 RESULTS

4.1 Well Hydrographs

The hydrographs of the pumping wells and observation wells for both pumping tests presented in Figure 5 do not produce drawdown and recovery curves typical of the response expected during a pumping test. There are two reasons attributed for this departure from non-ideal behaviour. Firstly, the drawdown acheived in the observation wells was small, accounting to only 15 and 11 centimetres for observation wells 1 and 2 respectively. Measurements of drawdown of this small scale are prone to relative inaccuracies.

Secondly, we understand that because of the urgent requirement for water by the Village of Dinsmore, the "old well" was put into production during work on developing a new water supply well. The position of this old well relative to the location where the pumping tests were undertaken is shown on Figure 1. The magnitude of interference which might have been caused by pumping from this well is uncertain, but it may be the reason for the departure of the drawdown curve from its anticipated behaviour.

Other naturally occuring conditions such as aquifer boundaries may also induce a comparable response curve. However, because of the relatively low degree of impact observed in the observation wells due to pumping and because Christiansen has illustrated that the Anerley Aquifer is extensive, we anticipate that the radius of influence of the well did not intercept any aquifer boundaries. Thus the response curve observed cannot be produced by these means.

We also note that the drawdown in Well 1 was almost instantaneous. This suggests that considerable head losses were sustained in the well bore during the pumping test which produced the large drawdown.

4.2 Pumping Test Analyses

As indicated by the summary of pumping test results presented in Table 2, the total drawdown acheived on Wells 1 and 2 amounted to approximately 53 and 4 percent of the total drawdown available at the pumping well locations. As indicated in the preceeding section, a considerable portion of the drawdown acheived in Well 1 can be assumed to be caused by head losses within the well bore. Therefore the 53 percent drawdown acheived in Well 1 above can more reasonably be assumed to coincide with an actual drawdown in the aquifer of less than 10 percent of the available drawdown as acheived in Well 2.

These low percentages are indications that at pumping rates of 3.8 litres per second and 5.7 litres per second, the wells did not substatially impact the aquifer. Pumping rates in the order of a few ten's litres per second would likely be required to produce a significant impact on the aquifer suitable for a more reliable pumping test. However, we understand that the Village of Dinsmore peak requirements amount to only 3.8 litres per second and therefore a pumping test at a greater rate was not required.

Interference effects suspected during the pumping test and the relatively small drawdown obtained make conventional transient analyses of the pumping test results unreliable to obtain hydraulic parameters of transmissivity and storativity. Therefore, to obtain an estimate of the aquifers transmissivity a simpler analyses based upon the total drawdown, pumping rate and the distance between the observation well and pumping wells has been made. These estimates are presented below (TABLE 3) and indicate that the transmissivity of the aquifer is on the order of 5 x 10-2 centimetres per second. This estimate is based upon the analysis of test results from pumping Well 2. Results from pumping Well 1 are listed but have been assumed to be misleading because of the possibility of substantial well losses.

Unfortunately, the low degree of impact induced by the pumping tests make estimates of the long term yields from the aquifer unreliable. To improve these predictions it is suggested that continual records of the pumping rates and drawdown in observation wells be maintained. These records will enable the water availability to the village to be carefully monitored.

TABLE 3

Analysis of Pumping Test Results

	Effective Well Radius (m)	Pumping Well Drawdown (m)	Distance to Observation Well (m)	Observation Well Drawdown (m)	Pumping Rate (l/s)	Transmissivit (m2/sec)
Pumping Test 1	0.25	5.76	9.1	0.15	3.8	8.3 x 10-4
Pumping Test 2	0.25	0.18	12.8	0.11	5.7	5.1 x 10-2

5.0 CONCLUSIONS AND RECOMMENDATIONS

1. Pumping tests have been undertaken on two wells completed at a site about four kilometres northeast of the village of Dinsmore.

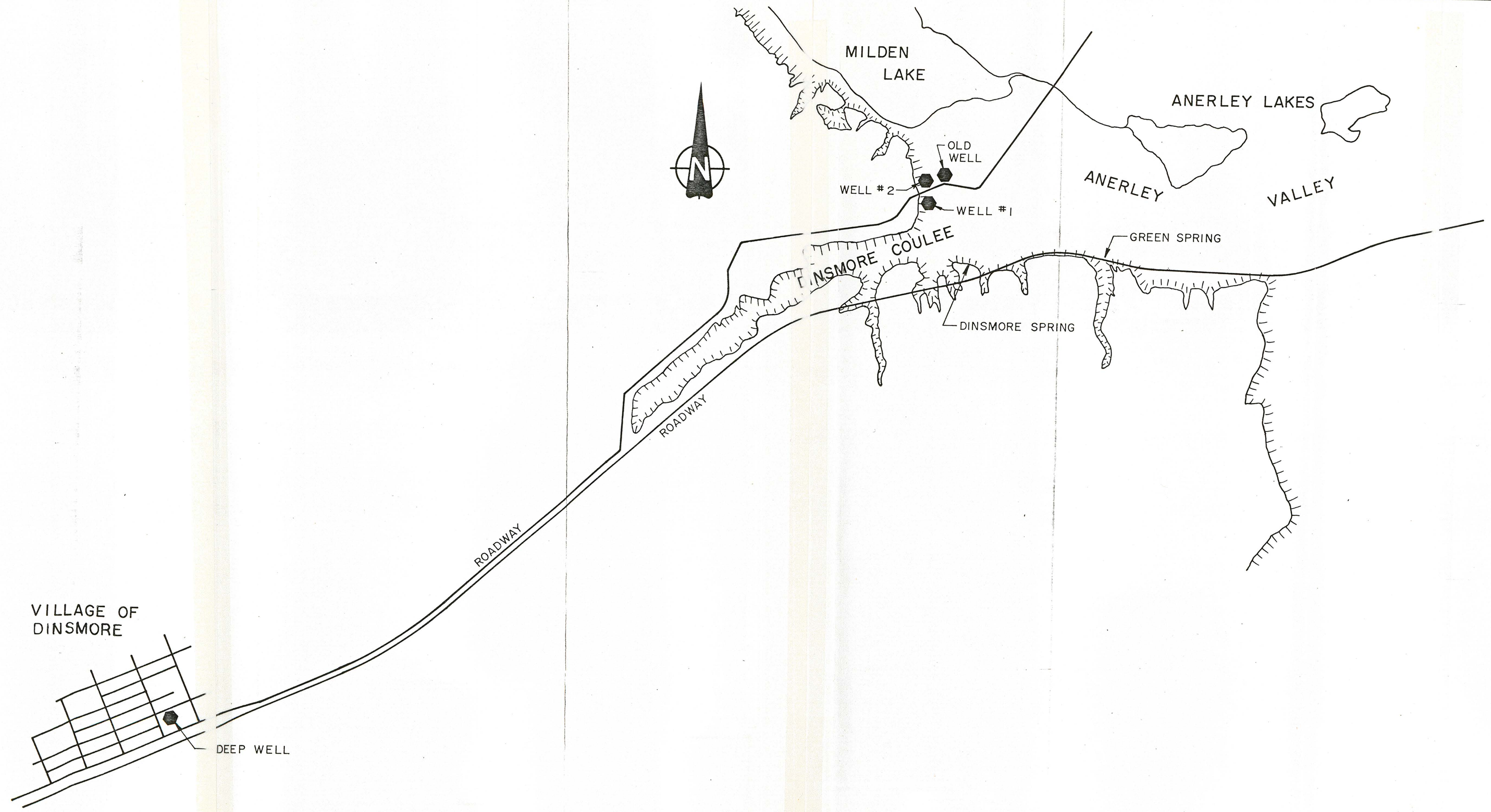
2. The tests were carried out at rates of 3.8 and 5.7 litres per second and produced drawdowns of approximately 2.76 and 0.18 metres in Wells 1 and 2. These drawdowns amount to about 53 and 4

percent of the total drawdown available. Because the drawdown in Well 1 occurred almost instantaneously it has been assumed that significant head losses within the well bore are responsible for much of the drawdown noted.

3. The pumping test did not signifiantly impact the aquifer and it can therefore be concluded that the aquifer can support much larger pumping rates on the order of a few tens of litres per second.

4. Analysis of the pumping test results has yielded our estimate for the aquifers transmissivity of 5 x 10-2 m2/sec. However, this estimate was based upon limited information concerning the aquifers behaviour and possible geologic boundaries.

5. Long term predictions concerning the reliability of the water supply from the aquifer based upon the aquifers parameters are unreliable. It is recommended that a record of the pumping rate and water levels in the monitoring wells be maintained in an attempt to improve these predictions and consequently review the reliability of the villages water supply.



SITE LOCATION PLAN

DRAFT COPY
FIGURE 1

LEGEND

⬢ WELL LOCATION

SCALE

0 Km 1

Date AUG./85
Project 852-6030

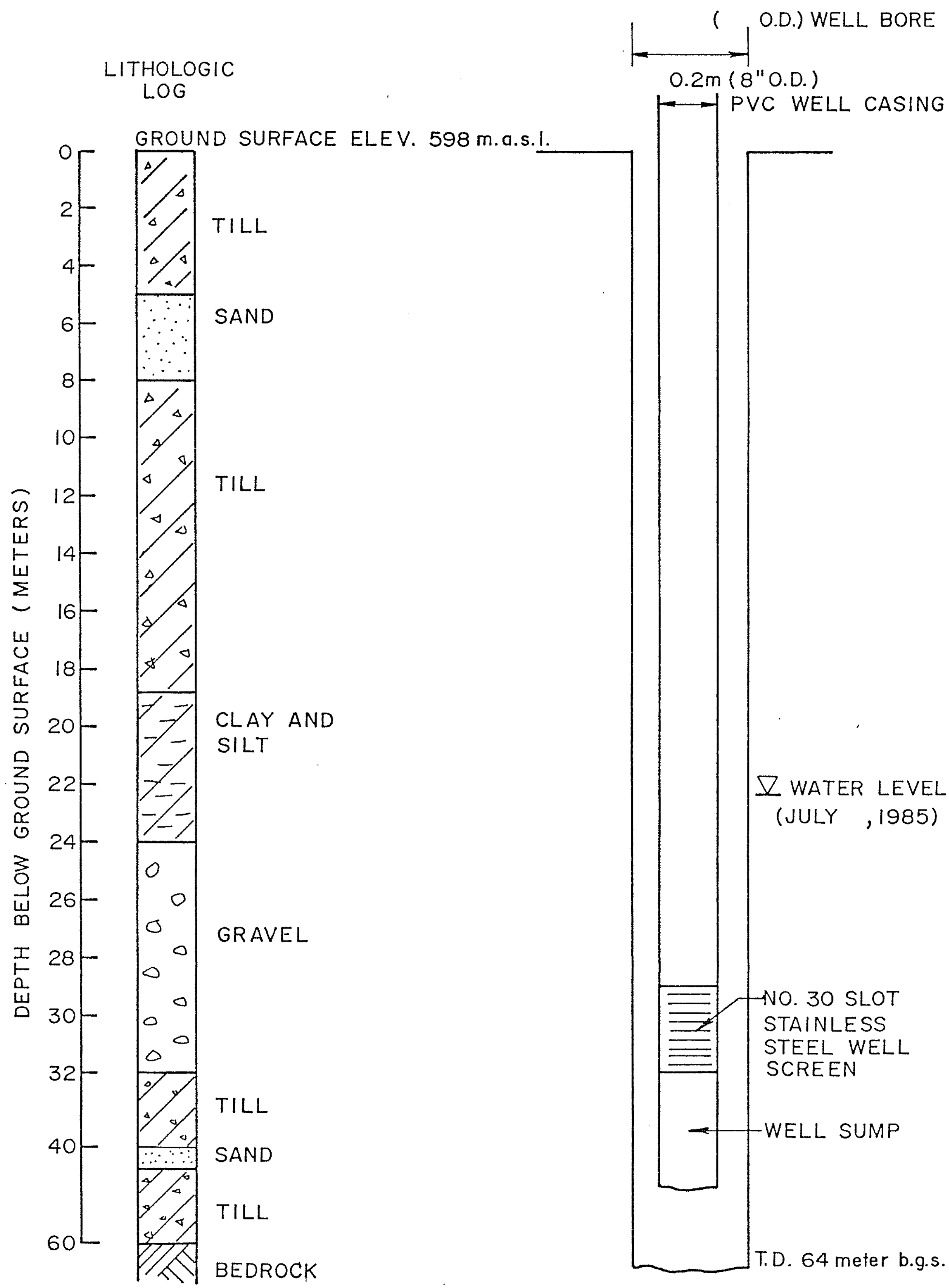
Golder Associates

Drawn J. BRIGGS
Chkd

INSTALLATION RECORD - WELL 1

DRAFT COPY

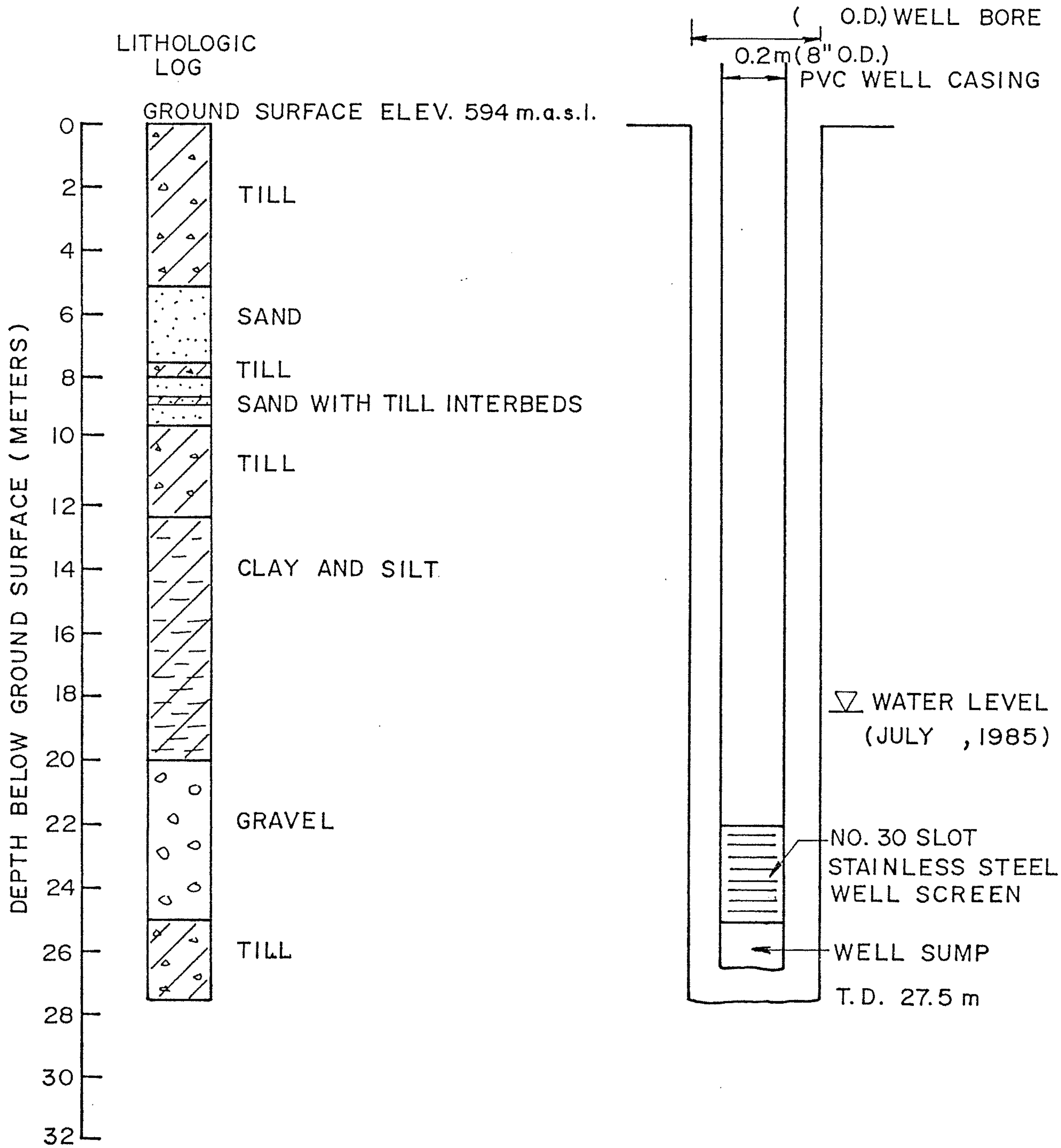
Figure 2



Project No 852-6030 Drawn JWB Reviewed ______ Date AUG/85

INSTALLATION RECORD - WELL 2

DRAFT COPY
Figure 3

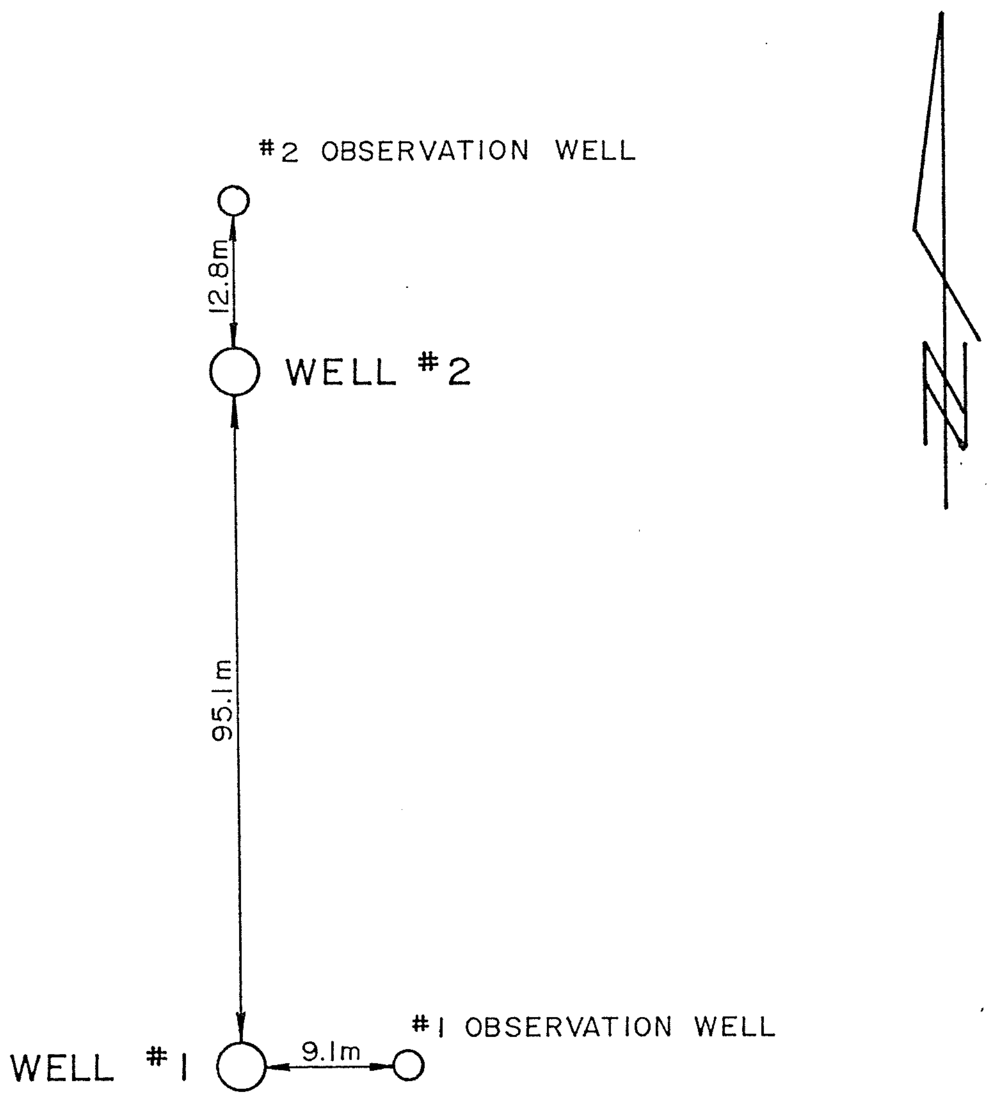


Project No ...2-6050 Drawn JWB Reviewed ______ Date AUG/85

DRAFT COPY

SCHEMATIC WELL LOCATION PLAN

Figure 4



NOTES

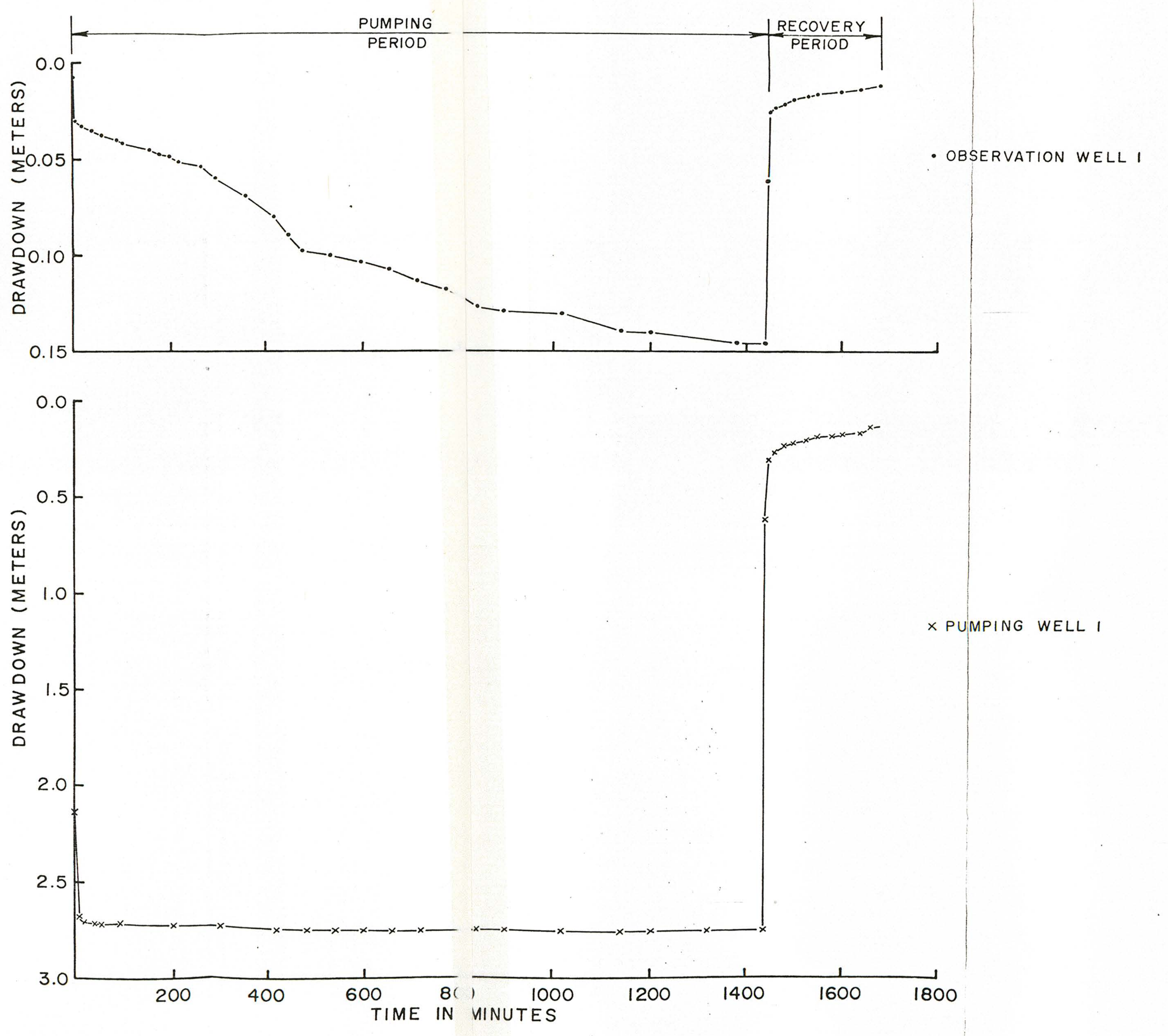
- NOT TO SCALE.
- DIMENSIONS APPROXIMATE ONLY.

Project No 852-6030 Drawn JWB Reviewed ______ Date AUG./85

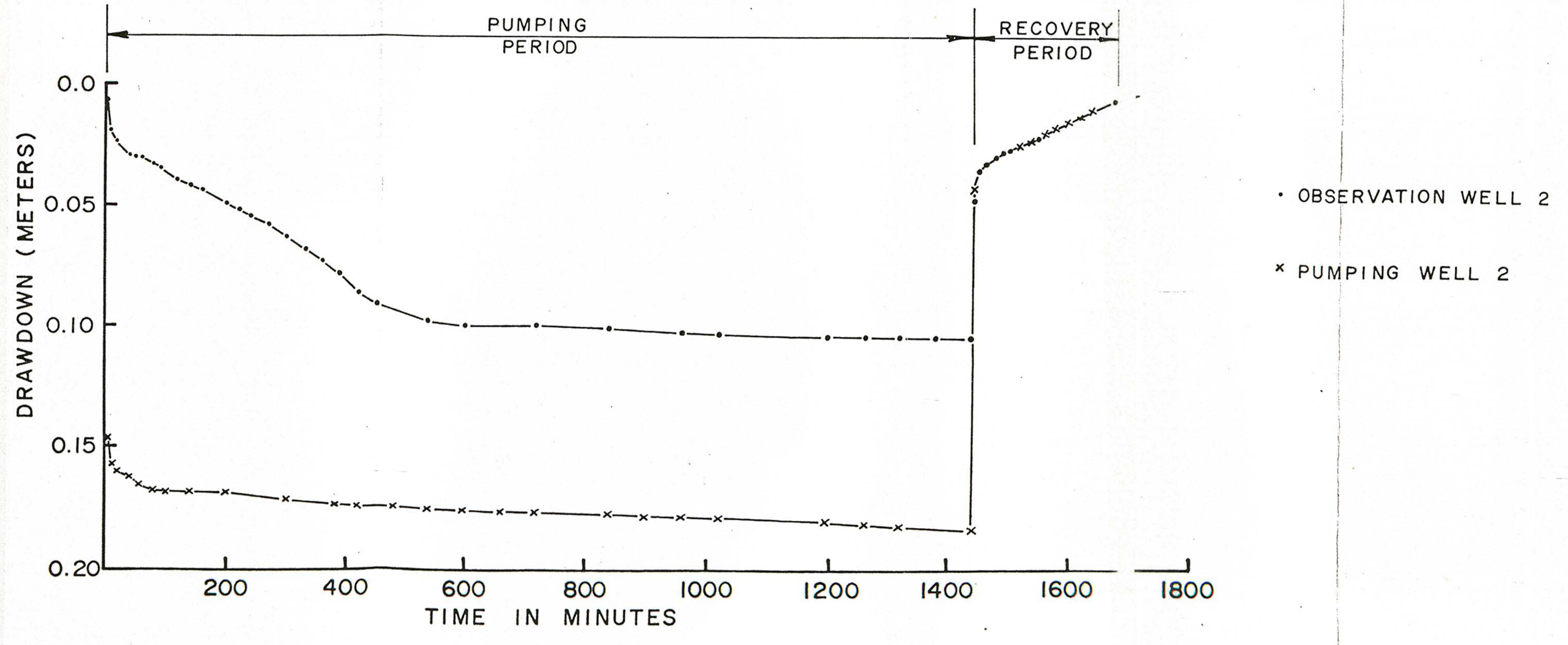
Golder Associates

HYDROGRAPHS OF WATER LEVELS RECORDED DURING PUMPING TEST

DRAFT COPY FIGURE 5



A) PUMPING TEST I



B) PUMPING TEST 2

Date AUG. / 85
Project 852-6030

Golder Associates

Drawn J.W. BRIGGS
Chkd

Summary situation at end of July 1986

Piez. well.	Decline since 17/03/86	water level end july 1986 below top aquifer	remaining saturated thickness aquifer	Remarks.
Piez. 1A	0.597	1.07	3.93	
Piez. 4	0.57	0.78	3.71	
Piez. 9	0.55	0.95	6.05	
Well No. 1	1.17	1.73	5.27	influenced by well losses.
Well No. 2	0.64	1.18	3.82	

Note: systematic weekly water level measurements started 17/03/86

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS1A	86	3	17	0	0	598.367	0.000	0.000	24.841	573.526
DINS1A	86	3	24	0	0	598.367	0.000	0.000	24.790	573.577
DINS1A	86	3	31	0	0	598.367	0.000	0.000	24.917	573.450
DINS1A	86	4	7	0	0	598.367	0.000	0.000	24.790	573.577
DINS1A	86	4	14	0	0	598.367	0.000	0.000	24.994	573.373
DINS1A	86	4	21	0	0	598.367	0.000	0.000	24.917	573.450
DINS1A	86	4	28	0	0	598.367	0.000	0.000	24.943	573.424
DINS1A	86	5	5	9	0	598.367	0.000	0.000	24.892	573.475
DINS1A	86	5	12	9	0	598.367	0.000	0.000	24.994	573.373
DINS1A	86	5	19	9	0	598.367	0.000	0.000	25.019	573.348
DINS1A	86	5	26	9	0	598.367	0.000	0.000	25.133	573.234
DINS1A	86	6	2	9	0	598.367	0.000	0.000	25.197	573.170
DINS1A	86	6	9	0	0	598.367	0.000	0.000	25.298	573.069
DINS1A	86	6	16	9	0	598.367	0.000	0.000	25.270	573.097
DINS1A	86	6	23	9	0	598.367	0.000	0.000	25.451	572.916
DINS1A	86	6	30	9	0	598.367	0.000	0.000	25.375	572.992
DINS1A	86	7	7	9	0	598.367	0.000	0.000	25.476	572.891
DINS1A	86	7	14	9	0	598.367	0.000	0.000	25.464	572.903
DINS1A	86	7	21	9	0	598.367	0.000	0.000	25.426	572.941
DINS1A	86	7	28	9	0	598.367	0.000	0.000	25.438	572.929

Water level decline since 17/03/86: 0.597 m (1.96 ft)

Top aquifer 574 m ASL: 28/07/86 water level 1.07 m below top aquifer

Bottom aquifer 569 m ASL: 28/07/86 572.929 - 569 = 3.93 m (12.9 ft). saturated.

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS2A	86	3	17	9	0	576.198	0.000	0.000	2.743	573.455
DINS2A	86	3	24	9	0	576.198	0.000	0.000	2.705	573.493
DINS2A	86	3	31	9	0	576.198	0.000	0.000	2.705	573.493
DINS2A	86	4	7	9	0	576.198	0.000	0.000	2.477	573.721
DINS2A	86	4	14	9	0	576.198	0.000	0.000	2.387	573.811
DINS2A	86	4	21	9	0	576.198	0.000	0.000	2.286	573.912
DINS2A	86	4	28	9	0	576.198	0.000	0.000	2.197	574.001
DINS2A	86	5	5	9	0	576.198	0.000	0.000	2.197	574.001
DINS2A	86	5	12	9	0	576.198	0.000	0.000	2.095	574.103
DINS2A	86	5	19	9	0	576.198	0.000	0.000	2.045	574.153
DINS2A	86	5	26	9	0	576.198	0.000	0.000	2.070	574.128
DINS2A	86	6	2	9	0	576.198	0.000	0.000	2.185	574.013
DINS2A	86	6	9	9	0	576.198	0.000	0.000	2.159	574.039
DINS2A	86	6	16	9	0	576.198	0.000	0.000	2.286	573.912
DINS2A	86	6	23	9	0	576.198	0.000	0.000	2.362	573.836
DINS2A	86	6	30	9	0	576.198	0.000	0.000	2.438	573.760
DINS2A	86	7	7	9	0	576.198	0.000	0.000	2.483	573.715
DINS2A	86	7	14	9	0	576.198	0.000	0.000	2.362	573.836
DINS2A	86	7	21	9	0	576.198	0.000	0.000	2.349	573.849
DINS2A	86	7	28	9	0	576.198	0.000	0.000	2.223	573.975

Water level declining since 17/03/86 ~ 0.57m (1.86ft)

Tbo

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS4	86	3	17	9	0	593.468	0.000	0.000	20.599	572.869
DINS4	86	3	24	9	0	593.468	0.000	0.000	20.574	572.894
DINS4	86	3	31	9	0	593.468	0.000	0.000	20.625	572.843
DINS4	86	4	7	9	0	593.468	0.000	0.000	20.675	572.793
DINS4	86	4	14	9	0	593.468	0.000	0.000	20.803	572.665
DINS4	86	4	21	9	0	593.468	0.000	0.000	20.625	572.843
DINS4	86	4	28	9	0	593.468	0.000	0.000	20.650	572.818
DINS4	86	5	5	9	0	593.468	0.000	0.000	20.625	572.843
DINS4	86	5	12	9	0	593.468	0.000	0.000	20.726	572.742
DINS4	86	5	19	9	0	593.468	0.000	0.000	20.790	572.678
DINS4	86	5	26	9	0	593.468	0.000	0.000	20.828	572.640
DINS4	86	6	2	9	0	593.468	0.000	0.000	20.904	572.564
DINS4	86	6	9	9	0	593.468	0.000	0.000	21.069	572.399
DINS4	86	6	16	9	0	593.468	0.000	0.000	21.031	572.437
DINS4	86	6	23	9	0	593.468	0.000	0.000	21.184	572.284
DINS4	86	6	30	9	0	593.468	0.000	0.000	21.107	572.361
DINS4	86	7	7	9	0	593.468	0.000	0.000	21.235	572.233
DINS4	86	7	14	9	0	593.468	0.000	0.000	21.184	572.284
DINS4	86	7	21	9	0	593.468	0.000	0.000	21.158	572.310
DINS4	86	7	28	9	0	593.468	0.000	0.000	21.165	572.303

Waterlevel decline since 17/03/86: 0.57 m (1.86 ft)

Top aquifer 573.08 m ASL : 28/07/86 waterlevel 0.78 m (2.55 ft) below top aquifer

Bottom aquifer 568.59 m ASL: 28/07/86 572.303 - 568.59 = 3.71 m (12.2 ft) saturated

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS6	85	5	30	0	0	610.290	0.000	0.000	14.364	595.926
DINS6	86	3	17	9	0	610.290	0.000	0.000	14.834	595.456
DINS6	86	3	24	9	0	610.290	0.000	0.000	14.859	595.431
DINS6	86	3	31	9	0	610.290	0.000	0.000	14.859	595.431
DINS6	86	4	7	9	0	610.290	0.000	0.000	14.935	595.355
DINS6	86	4	14	9	0	610.290	0.000	0.000	14.910	595.380
DINS6	86	4	21	9	0	610.290	0.000	0.000	14.872	595.418
DINS6	86	4	28	9	0	610.290	0.000	0.000	14.935	595.355
DINS6	86	5	5	9	0	610.290	0.000	0.000	14.821	595.469
DINS6	86	5	12	9	0	610.290	0.000	0.000	14.834	595.456
DINS6	86	5	19	9	0	610.290	0.000	0.000	14.872	595.418
DINS6	86	5	26	9	0	610.290	0.000	0.000	14.897	595.393
DINS6	86	6	2	9	0	610.290	0.000	0.000	14.834	595.456
DINS6	86	6	9	9	0	610.290	0.000	0.000	14.834	595.456
DINS6	86	6	16	9	0	610.290	0.000	0.000	14.884	595.406
DINS6	86	6	23	9	0	610.290	0.000	0.000	14.897	595.393
DINS6	86	6	30	9	0	610.290	0.000	0.000	14.846	595.444
DINS6	86	7	7	9	0	610.290	0.000	0.000	14.910	595.380
DINS6	86	7	14	9	0	610.290	0.000	0.000	14.884	595.406
DINS6	86	7	21	9	0	610.290	0.000	0.000	14.859	595.431
DINS6	86	7	28	9	0	610.290	0.000	0.000	14.808	595.482

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS7	85	5	30	0	0	611.130	0.000	0.000	24.866	586.264
DINS7	86	3	17	9	0	611.130	0.000	0.000	24.308	586.822
DINS7	86	4	14	9	0	611.130	0.000	0.000	24.435	586.695

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS8	85	5	30	0	0	618.540	0.000	0.000	30.379	588.161
DINS8	86	3	17	9	0	618.540	0.000	0.000	30.937	587.603
DINS8	86	4	14	9	0	618.540	0.000	0.000	31.039	587.501

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS9	85	5	30	0	0	598.400	0.000	0.000	22.619	575.781
DINS9	86	3	17	9	0	598.400	0.000	0.000	24.917	573.483
DINS9	86	3	24	9	0	598.400	0.000	0.000	24.917	573.483
DINS9	86	3	31	9	0	598.400	0.000	0.000	24.917	573.483
DINS9	86	4	7	9	0	598.400	0.000	0.000	24.968	573.432
DINS9	86	4	14	9	0	598.400	0.000	0.000	24.994	573.406
DINS9	86	4	21	9	0	598.400	0.000	0.000	24.917	573.483
DINS9	86	4	28	9	0	598.400	0.000	0.000	24.968	573.432
DINS9	86	5	5	9	0	598.400	0.000	0.000	24.968	573.432
DINS9	86	5	12	9	0	598.400	0.000	0.000	25.045	573.355
DINS9	86	5	19	9	0	598.400	0.000	0.000	25.083	573.317
DINS9	86	5	26	9	0	598.400	0.000	0.000	25.146	573.254
DINS9	86	6	2	9	0	598.400	0.000	0.000	25.197	573.203
DINS9	86	6	9	9	0	598.400	0.000	0.000	25.311	573.089
DINS9	86	6	16	9	0	598.400	0.000	0.000	25.337	573.063
DINS9	86	6	23	9	0	598.400	0.000	0.000	25.476	572.924
DINS9	86	6	30	9	0	598.400	0.000	0.000	25.406	572.994
DINS9	86	7	7	9	0	598.400	0.000	0.000	25.552	572.848
DINS9	86	7	14	9	0	598.400	0.000	0.000	25.489	572.911
DINS9	86	7	21	9	0	598.400	0.000	0.000	25.451	572.949
DINS9	86	7	28	9	0	598.400	0.000	0.000	25.464	572.936

Water level decline since 17/03/86 : 0.55 m (1.79 ft)

Top aquifer 573.89 m ASL (1882.84) : 28/07/86 water level 0.95 m (3.1 ft) below top aquifer

Bottom aquifer 566.89 m ASL : 28/07/86 572.936 - 566.89 = 6.05 m (19.8 ft) saturated.

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
DINS10	86	3	17	9	0	609.600	0.000	0.000	36.601	572.999
DINS10	86	3	24	9	0	609.600	0.000	0.000	36.652	572.948
DINS10	86	3	31	9	0	609.600	0.000	0.000	36.614	572.986
DINS10	86	4	7	9	0	609.600	0.000	0.000	36.601	572.999
DINS10	86	4	14	9	0	609.600	0.000	0.000	36.601	572.999
DINS10	86	4	21	9	0	609.600	0.000	0.000	36.627	572.973
DINS10	86	4	28	9	0	609.600	0.000	0.000	36.627	572.973
DINS10	86	5	5	9	0	609.600	0.000	0.000	36.754	572.846
DINS10	86	5	12	9	0	609.600	0.000	0.000	36.627	572.973
DINS10	86	5	19	9	0	609.600	0.000	0.000	36.627	572.973
DINS10	86	5	26	9	0	609.600	0.000	0.000	36.690	572.910
DINS10	86	6	2	9	0	609.600	0.000	0.000	36.703	572.897
DINS10	86	6	9	9	0	609.600	0.000	0.000	36.728	572.872
DINS10	86	6	16	9	0	609.600	0.000	0.000	36.703	572.897
DINS10	86	6	23	9	0	609.600	0.000	0.000	36.779	572.821
DINS10	86	6	30	9	0	609.600	0.000	0.000	36.767	572.833
DINS10	86	7	7	9	0	609.600	0.000	0.000	36.817	572.783
DINS10	86	7	14	9	0	609.600	0.000	0.000	36.792	572.808
DINS10	86	7	21	9	0	609.600	0.000	0.000	36.779	572.821
DINS10	86	7	28	9	0	609.600	0.000	0.000	36.805	572.795

08/14/86

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
WELL NO. 1	86	3	17	9	0	598.662	0.000	0.000	25.222	573.440
WELL NO. 1	86	3	24	9	0	598.662	0.000	0.000	25.146	573.516
WELL NO. 1	86	3	31	9	0	598.662	0.000	0.000	25.730	572.932
WELL NO. 1	86	4	7	9	0	598.662	0.000	0.000	25.781	572.881
WELL NO. 1	86	4	14	9	0	598.662	0.000	0.000	25.807	572.855
WELL NO. 1	86	4	21	9	0	598.662	0.000	0.000	25.197	573.465
WELL NO. 1	86	4	28	9	0	598.662	0.000	0.000	25.667	572.995
WELL NO. 1	86	5	5	9	0	598.662	0.000	0.000	25.756	572.906
WELL NO. 1	86	5	12	9	0	598.662	0.000	0.000	25.807	572.855
WELL NO. 1	86	5	19	9	0	598.662	0.000	0.000	25.832	572.830
WELL NO. 1	86	5	26	9	0	598.662	0.000	0.000	25.933	572.729
WELL NO. 1	86	6	2	0	0	598.662	0.000	0.000	25.933	572.729
WELL NO. 1	86	6	9	9	0	598.662	0.000	0.000	26.009	572.653
WELL NO. 1	86	6	16	9	0	598.662	0.000	0.000	26.086	572.576
WELL NO. 1	86	6	23	9	0	598.662	0.000	0.000	26.175	572.487
WELL NO. 1	86	6	30	9	0	598.662	0.000	0.000	26.111	572.551
WELL NO. 1	86	7	7	9	0	598.662	0.000	0.000	26.276	572.386
WELL NO. 1	86	7	14	9	0	598.662	0.000	0.000	26.390	572.272

water level decline since 17/03/86 : 1.17 m (3.8 ft)

Top aquifer 574 m ASL (1883.2 ft) : 14/07/86 water level 1.73 (5.67 ft) below top aquifer.

Bottom aquifer 567 m : 14/07/86 572.272 - 567 = 5.27 (17.3 ft) saturated.

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
WELL NO. 2	85	6	26	0	0	594.182	0.000	0.000	19.101	575.081
WELL NO. 2	85	6	27	0	0	594.182	0.000	0.000	19.177	575.005
WELL NO. 2	85	6	28	0	0	594.182	0.000	0.000	19.228	574.954
WELL NO. 2	85	6	29	0	0	594.182	0.000	0.000	19.279	574.903
WELL NO. 2	85	6	30	0	0	594.182	0.000	0.000	19.330	574.852
WELL NO. 2	85	7	2	0	0	594.182	0.000	0.000	19.330	574.852
WELL NO. 2	85	7	3	0	0	594.182	0.000	0.000	19.330	574.852
WELL NO. 2	85	7	4	0	0	594.182	0.000	0.000	19.330	574.852
WELL NO. 2	85	7	5	0	0	594.182	0.000	0.000	19.380	574.802
WELL NO. 2	85	7	6	0	0	594.182	0.000	0.000	19.406	574.776
WELL NO. 2	85	7	7	0	0	594.182	0.000	0.000	19.406	574.776
WELL NO. 2	85	7	8	0	0	594.182	0.000	0.000	19.431	574.751
WELL NO. 2	85	7	9	0	0	594.182	0.000	0.000	19.406	574.776
WELL NO. 2	85	7	10	0	0	594.182	0.000	0.000	19.698	574.484
WELL NO. 2	85	7	11	0	0	594.182	0.000	0.000	19.685	574.497
WELL NO. 2	85	7	12	0	0	594.182	0.000	0.000	19.685	574.497
WELL NO. 2	85	7	15	0	0	594.182	0.000	0.000	19.812	574.370
WELL NO. 2	85	7	16	0	0	594.182	0.000	0.000	19.685	574.497
WELL NO. 2	85	7	17	0	0	594.182	0.000	0.000	19.711	574.471
WELL NO. 2	85	7	18	0	0	594.182	0.000	0.000	19.609	574.573
WELL NO. 2	85	7	19	0	0	594.182	0.000	0.000	19.711	574.471
WELL NO. 2	85	7	20	0	0	594.182	0.000	0.000	19.711	574.471
WELL NO. 2	85	7	21	0	0	594.182	0.000	0.000	19.711	574.471
WELL NO. 2	85	7	22	0	0	594.182	0.000	0.000	19.812	574.370
WELL NO. 2	85	7	24	0	0	594.182	0.000	0.000	19.914	574.268
WELL NO. 2	85	7	26	0	0	594.182	0.000	0.000	19.812	574.370
WELL NO. 2	85	7	28	0	0	594.182	0.000	0.000	19.939	574.243
WELL NO. 2	85	8	15	0	0	594.182	0.000	0.000	20.117	574.065
WELL NO. 2	85	8	21	0	0	594.182	0.000	0.000	20.155	574.027
WELL NO. 2	85	8	23	0	0	594.182	0.000	0.000	20.219	573.963
WELL NO. 2	85	8	26	0	0	594.182	0.000	0.000	20.320	573.862
WELL NO. 2	85	8	27	0	0	594.182	0.000	0.000	20.269	573.913
WELL NO. 2	85	8	29	0	0	594.182	0.000	0.000	20.269	573.913
WELL NO. 2	85	8	30	0	0	594.182	0.000	0.000	20.142	574.040
WELL NO. 2	85	9	1	0	0	594.182	0.000	0.000	20.244	573.938
WELL NO. 2	85	9	3	0	0	594.182	0.000	0.000	20.168	574.014
WELL NO. 2	85	9	4	0	0	594.182	0.000	0.000	20.244	573.938
WELL NO. 2	85	9	8	0	0	594.182	0.000	0.000	20.345	573.837
WELL NO. 2	85	9	9	0	0	594.182	0.000	0.000	20.295	573.887
WELL NO. 2	85	9	10	0	0	594.182	0.000	0.000	20.295	573.887
WELL NO. 2	85	9	12	0	0	594.182	0.000	0.000	20.168	574.014
WELL NO. 2	85	9	15	0	0	594.182	0.000	0.000	20.193	573.989
WELL NO. 2	85	9	16	0	0	594.182	0.000	0.000	20.092	574.090

Piezometer Waterlevel Data - Dinsmore
(Metric)

Piezometer	YY	MM	DD	HR	MN	Elevation	Hold	Wet	WLDepth	Waterlvl
WELL NO. 2	85	9	18	0	0	594.182	0.000	0.000	20.345	573.837
WELL NO. 2	85	9	19	0	0	594.182	0.000	0.000	20.295	573.887
WELL NO. 2	85	9	20	0	0	594.182	0.000	0.000	20.320	573.862
WELL NO. 2	85	9	22	0	0	594.182	0.000	0.000	20.295	573.887
WELL NO. 2	86	3	17	9	0	594.182	0.000	0.000	20.726	573.456
WELL NO. 2	86	3	24	9	0	594.182	0.000	0.000	20.650	573.532
WELL NO. 2	86	3	31	9	0	594.182	0.000	0.000	20.879	573.303
WELL NO. 2	86	4	7	9	0	594.182	0.000	0.000	20.930	573.252
WELL NO. 2	86	4	14	9	0	594.182	0.000	0.000	20.955	573.227
WELL NO. 2	86	4	21	9	0	594.182	0.000	0.000	20.688	573.494
WELL NO. 2	86	4	28	9	0	594.182	0.000	0.000	20.955	573.227
WELL NO. 2	86	5	5	9	0	594.182	0.000	0.000	20.879	573.303
WELL NO. 2	86	5	12	9	0	594.182	0.000	0.000	20.980	573.202
WELL NO. 2	86	5	19	9	0	594.182	0.000	0.000	20.955	573.227
WELL NO. 2	86	5	26	9	0	594.182	0.000	0.000	21.031	573.151
WELL NO. 2	86	6	2	9	0	594.182	0.000	0.000	21.107	573.075
WELL NO. 2	86	6	9	9	0	594.182	0.000	0.000	21.184	572.998
WELL NO. 2	86	6	16	9	0	594.182	0.000	0.000	21.247	572.935
WELL NO. 2	86	6	23	9	0	594.182	0.000	0.000	21.361	572.821
WELL NO. 2	86	6	30	9	0	594.182	0.000	0.000	21.291	572.891
WELL NO. 2	86	7	7	9	0	594.182	0.000	0.000	21.443	572.739
WELL NO. 2	86	7	14	9	0	594.182	0.000	0.000	21.361	572.821
WELL NO. 2	86	7	21	9	0	594.182	0.000	0.000	21.361	572.821

Water level decline since 17/03/86 : 0.64 m (2.08 ft)

Top aquifer 574 m (1883.2 ft) : 21/07/86 water level 1.18 (3.87 ft) below top

Bottom aquifer 569 m : 21/07/86 572.821 - 569 = 3.82 m (12.54 ft) saturated.