

October 15, 1991

The Oil and Natural Gas
Conservation Board

- Ian Haugh, Chairman
- H. Clare Moster, Deputy Chairman
- Wm. McDonald, Member

John N. Fox
Chief Petroleum Engineer
Petroleum Branch

RE: Daly Unit No. 4
Conversion to Water Injection
Res Jorex Daly 7-35-9-28 (WPM)

Chevron Canada Resources, operator of Daly Unit No. 4 has made application to convert the well, Res Jorex Daly 7-35-9-28 (WPM) to water injection.

RECOMMENDATION:

It is recommended that the Board approve Chevron's application. A copy of the proposed Board letter of approval is attached. The letter requests Chevron advise the Petroleum Branch of its plans for the 1C-35-9-28 (WPM) well.

DISCUSSION:

Board Order No. PM 53 (January 22, 1987) approved a pilot waterflood in Daly Unit No. 4 (Figure 1). Subsection 1(1) of the order approved the conversion of two wells to water injection, 15D-27-9-28 (WPM) and 1C-35-9-28 (WPM) and provides for the approval of additional injection wells.

The 15D-27 well was converted to water injection December 7, 1988 and Chevron attempted to convert the 1C-35 well to injection in October, 1989.

The 1C-35 disposal well was completed uphole from 732-33 m and 737-40 m for water injection (Figure 2). An injection test indicated 80% of the injected fluid was entering the injection zone 732-740 m and 20% was channelling behind casing to a zone at 750 m. The Branch shares Chevron's concern that communication between the disposal zone and proposed injection zone will reduce the effectiveness of 1C-35 as an injection well. It is requested that Chevron advise the Branch of its plans for the 1C-35 well.

Chevron has applied to convert the 7-35-9-28 (WPM) well to injection. The well is presently suspended and has been shut-in since September, 1988. The final producing rate for the 7-35 well was 0.1 m³ OPD at a 99% water-cut.

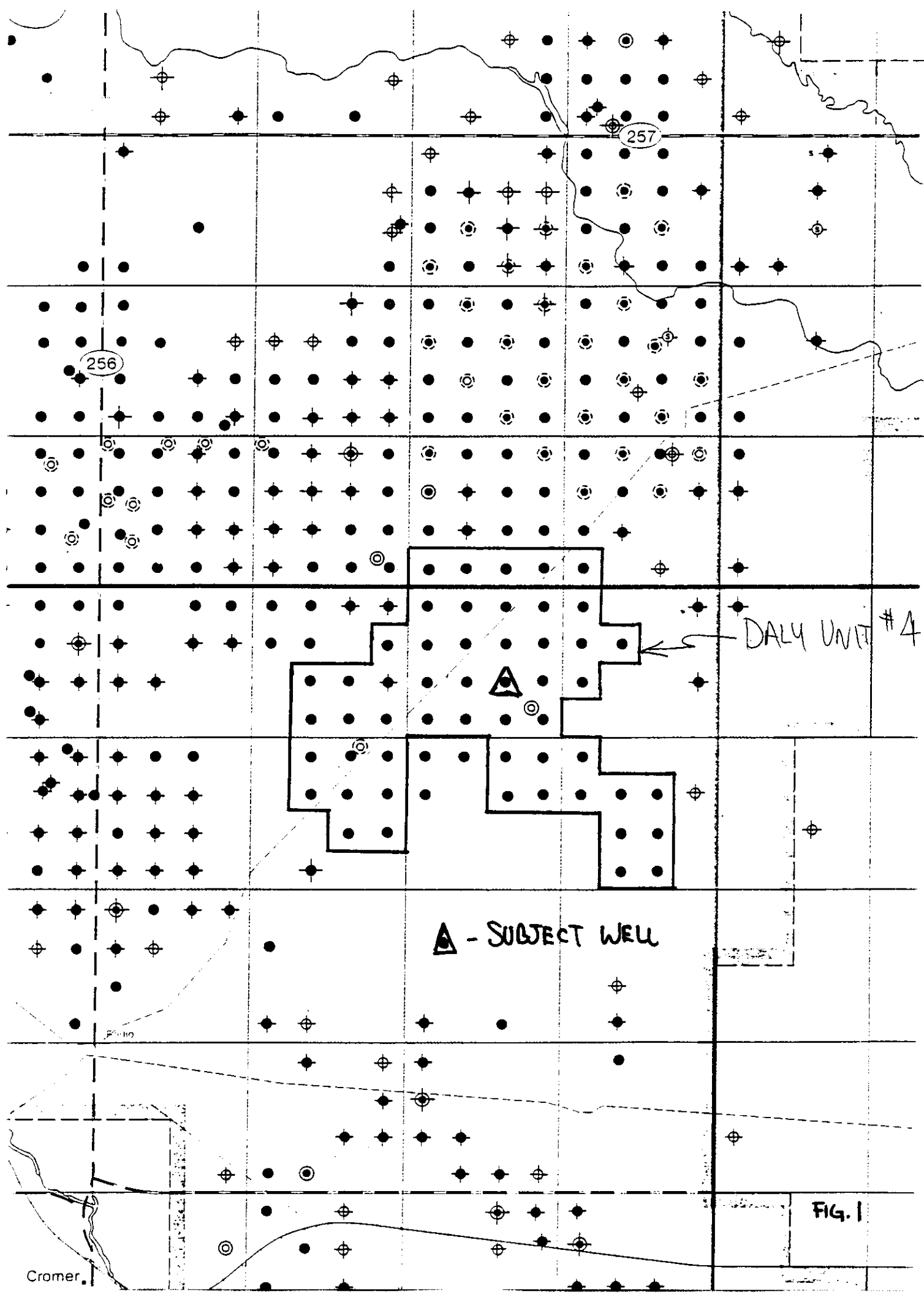
A review of the 15D-27 injection pattern indicates pressure support has resulted in an increase in production from the 4 offset wells from 5 m³/d (December, 1988) to 9 m³/d (August, 1989) (Figure 3). Estimated incremental recoverable reserves for the 15D-27 injection pattern are 7324 m³.

Production from the 8 wells offsetting 7-35-9-28 has declined constantly from 19 m³/d in 1984 to less than 4 m³/d in 1991 (Figure 4). Conversion of the 7-35 well should result in an increase in recovery from the offset producers.

ORIGINAL SIGNED BY
JOHN N. FOX

John N. Fox

Approved: _____
L.R. Dubreuil, Director



COMPLETION
SCHEMATIC

RES JOH. ET AL
DALY SWD
IC-35-A-28

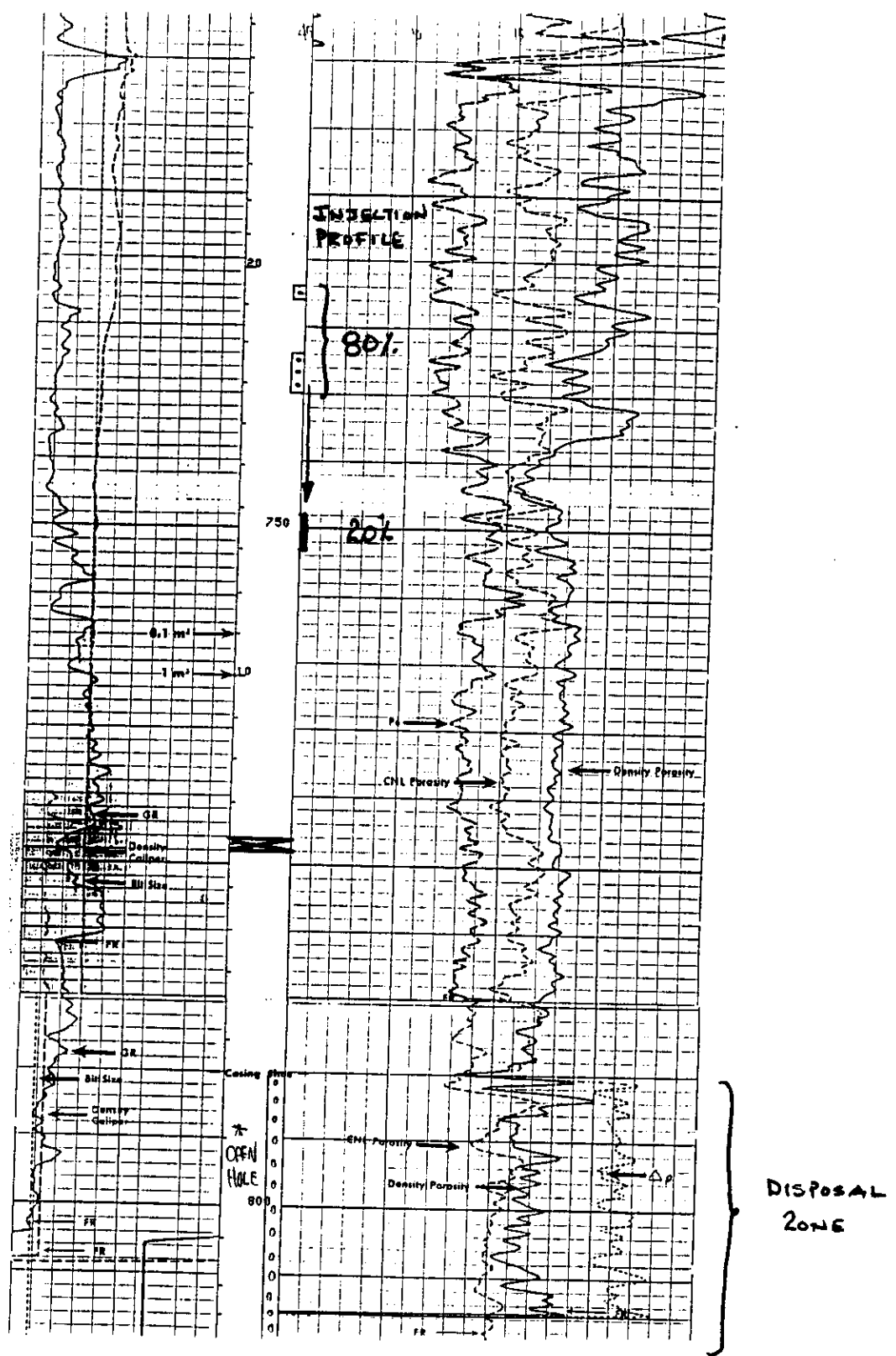
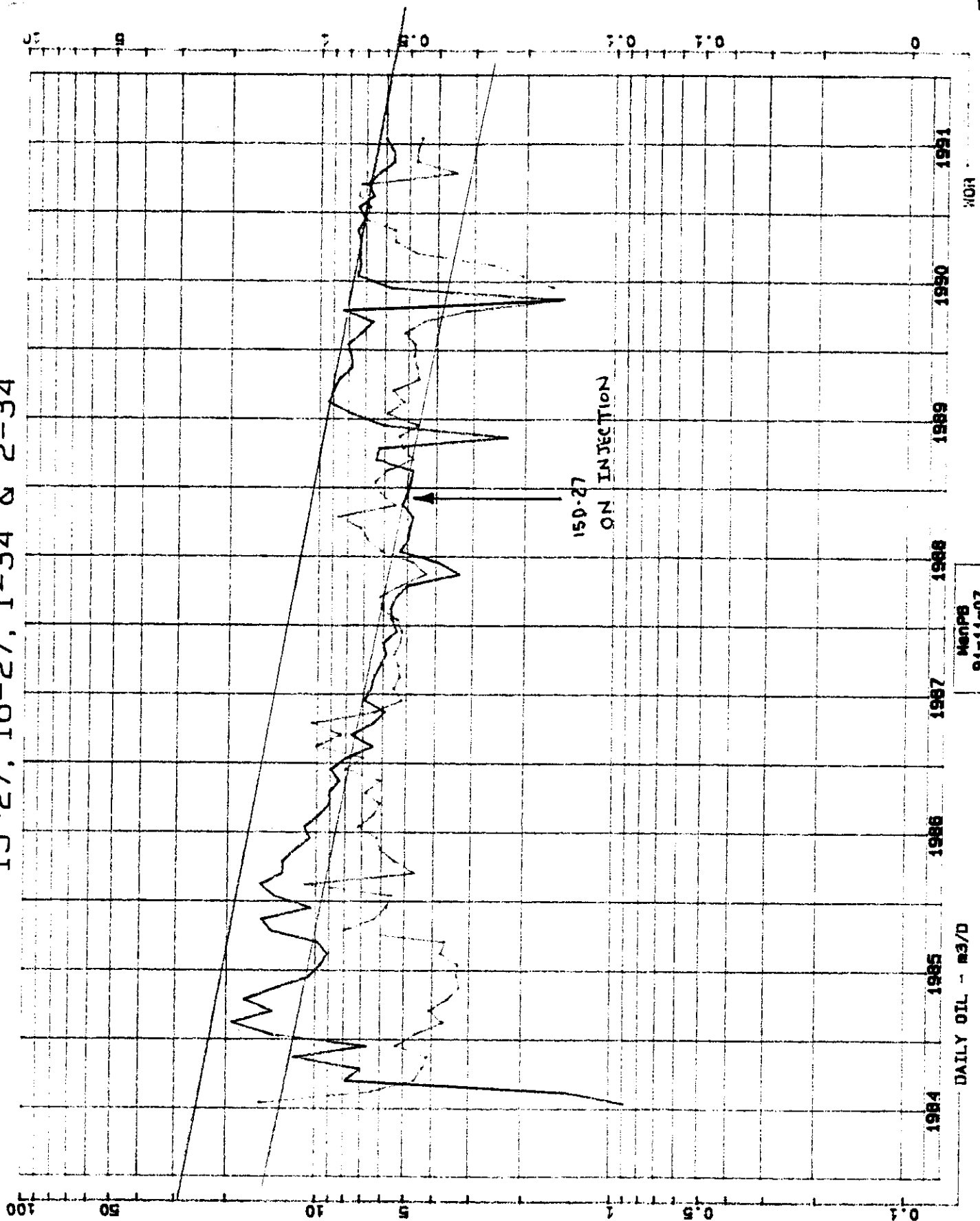


FIGURE 2

15-27, 16-27, 1-34 & 2-34



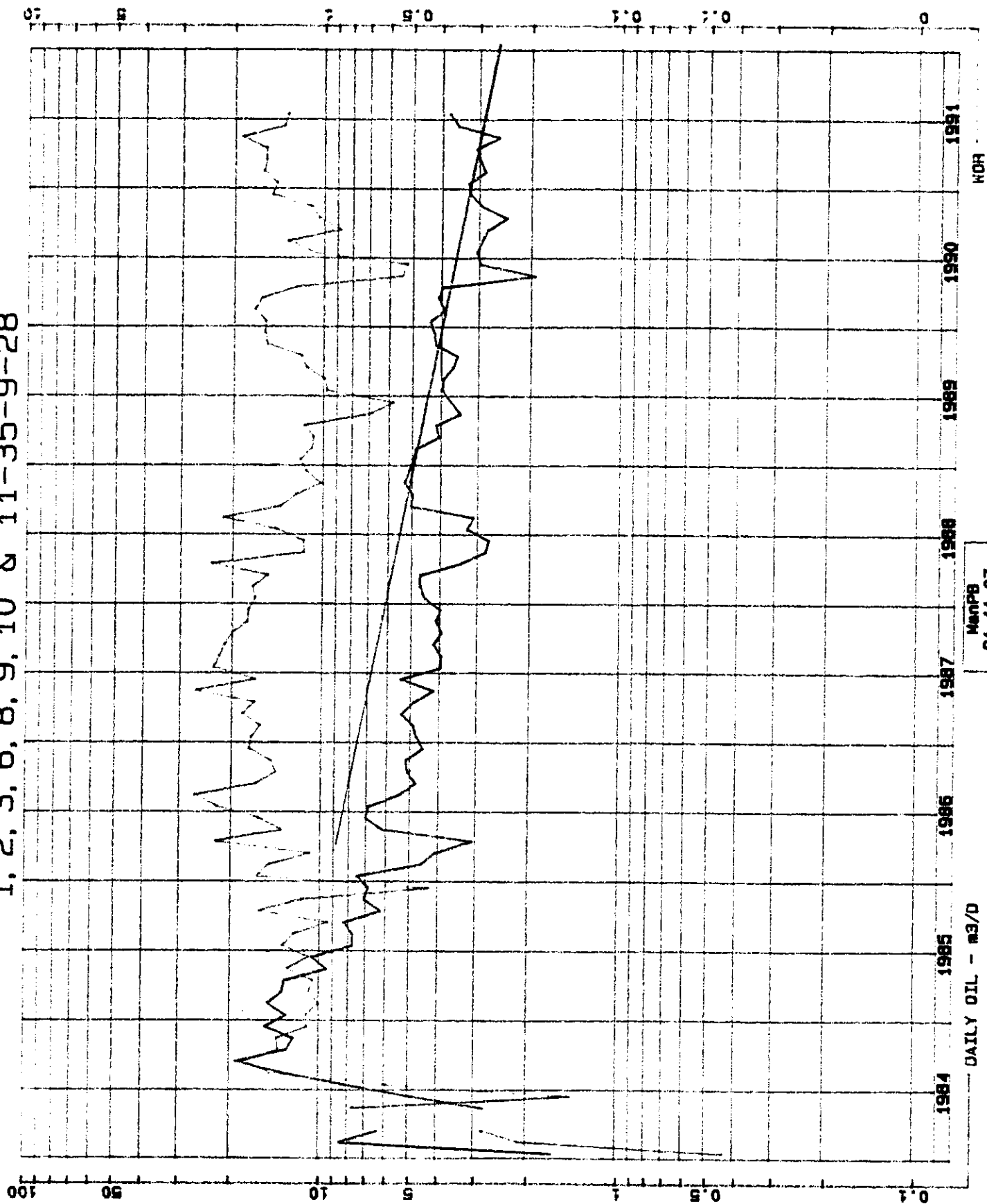
Memorandum
91-11-07

DAILY OIL - M3/D

NOV

Fig. 2

1, 2, 3, 6, 8, 9, 10 & 11-35-9-28



DAILY OIL - m3/d

ManPB
91-11-07
m3-d-50

WCR

Fig. 4

October 17, 1991

Mr. J.E. Causgrove, P. Eng.
Area Superintendent
Chevron Canada Resources
P.O. Box 100
Virden, Manitoba
ROM 2C0

Dear Mr. Causgrove:

RE: Application for Conversion to Water Injection
Daly Unit No. 4 WIW 7-35-9-28 (WPM)

Attached is a copy of the approved application to convert the subject well to water injection.

Chevron is requested to advise the Branch before November 4, 1991 of its plans to suspend or abandon the well, Res Jorex et al Daly SWD 1C-35-9-28 (WPM).

If you have any questions in respect of this matter, please contact John N. Fox, Chief Petroleum Engineer at 945-6574.

Yours respectfully,

ORIGINAL SIGNED BY
H. CLARE MOSTER

H. Clare Moster
Deputy Chairman

Encl.



APPLICATION TO

~~SUSPEND PRODUCTION~~
~~ABANDON~~
~~RECOMPLETE~~
CONVERT TO SWD; WIW, or
~~SUSPEND DRILLING~~
~~RESUME DRILLING~~
~~OTHER~~

A WELL

(Stroke Out Operations Which Do Not Apply)

In compliance with the Petroleum Drilling and Production Regulations, 1984 and amendments thereto, approval is hereby applied for the following operations to be commenced on or about the30...., day of September... 19 91...., on the well known as

located on Lsd....7..... Sec....35..... Twp....9..... Rge....2B..... W of First Meridian,

Well Licence No. ...3143..... Field or UnitDaly Unit #4.....

CASING RECORD

	Size O.D. (mm)	Weight (Kg/m)	Amount (m)	Set (m)	Cement (tonnes)	Method
First String	..219..1...	....35..7..	.....	..132..5...	..11..5....	..Pumped..
Second String	..139..7...	....23..1..	.....	..820..0...	..31..5....	..Pumped..
Third String	.....	.....	.....	.....	.....	.....

CONDITION OF WELL

Present StatusSuspended.....
Total Depth of Well ...828.0 mKB..... Plug Back Total Depth800.0 mKB.....
Perforations (K.B.): From 732.0.. to 734.0.; From 738.0 to 741.0.; From 744.0. to 749.5;
Open Hole (K.B.): To
Name of Producing ZoneLodgepole 'A' Pool.....
Date of Last Production1989-03.....
Date of Last Production Test ..1988-02..... Daily Production ..0.1m³.OPD..7.4m³.....
W.O.R.74..... W.C.%99..... G.O.R.
Reason for Operations Proposed: ...Convert. to WIW. to provide bottom hole pressure support
...to offset wells.....

Program of Operations Proposed:

1). Rig in service rig and equipment. 2). Install BOP's and perform a 4.2m³ 15% HCl acid stimulation. 3). POOH plain 60.3mm tubing and RIH 60.3mm plastic lined tubing and coat packer. 4) Strip off BOP's and circulate annulus to inhibited fresh water. 6) Set pack and pressure test casing to 3.5 MPa. 7) Rig out equipment. 8) Install injection line and place well on injection.

Operations to be carried out by: Address
Responsible agent in field: J.E. Causgrove... Address ...Virden, MB.. Phone No. 748-1334
Responsible agent, Co. office: K.E. Godard.. Address ..Calgary, AB.. Phone No. 234-5000
Signed by ...*Jerry Holbert*... Title ...Area Superintendent
Company ...Chevron Canada Resources... at Virden, this 13..... day of ...August..... 19 91.....

FOR DEPARTMENT USE ONLY

APPROVAL

This application has been examined and program of operations approved, subject to the following conditions:

1. Please advise our Virden/Waskada office before approved operations are commenced.
2. This approval expires May 1, 1992.

Date ...*Oct 7*... 19 91...
.....
Petroleum Engineering Section

Approved: ...*[Signature]*...
.....
Director, Petroleum Branch



Chevron Canada Resources Limited

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7
1986-06-26

K.E. Godard
Chief Engineer

Daly Lodgepole "A" Pool
Proposed Daly Unit No.4
Application For Enhanced Oil Recovery
By Water Injection

The Oil and Natural Gas Conservation Board
Room 309, Legislative Building
Winnipeg, Manitoba
R3C 0V8

Attention: C. S. Kang, Chairman

Gentlemen:


1. On 1986-03-31, Chevron Canada Resources Limited, as Operator of the proposed Daly Unit No. 4, applied for approval of a scheme to enhance oil recovery from the Daly Lodgepole "A" Pool by water injection.
2. Because of the current economic conditions in the petroleum industry, the original Section 27 proposal will not be implemented.
3. Chevron submits the following amendment to the subject Application:
 - a) The Stage I Waterflood Development in the Section 27 area will consist of one 5 spot pattern with 8 ha well spacing, instead of four patterns. The injector would be drilled in the vicinity of location 16C-27-9-28.
4. The proposal to convert Well 1C-35-9-28 from a water disposal well to a water injection water remains unchanged. An amended Stage I Development scenario is shown on Figure 1.
5. The production history for the 16C-27 pattern wells are shown on Figure 2. Primary and waterflood recoveries from this pattern will be similar to the Section 27 recoveries noted in the original Application.

6. The injection pipeline to 16C-27 will be designed to allow for future expansion of the waterflood in the Section 27 area.
7. The water source for both injectors will be Daly Unit No. 4 produced water. Current water production is about 100 m³/d, which is sufficient for voidage replacement at both patterns.
8. In a related matter, the Board questioned the desirability of injecting above fracture pressure in the proposed Daly Unit No. 4 waterflood, before a water bank is established around the water injectors. Field experience indicates that the proposed Daly Unit No. 4 area has a fracture pressure of 9 500 to 10 000 kPa (wellhead pressure with produced water in the wellbore). Daly Unit No. 3 has a maximum wellhead injection pressure limitation of 10 000 kPa, while the current wellhead pressures are about 8 500 kPa.

Chevron concurs with the Board concerns and will maintain injection pressures below the fracture pressure until a water bank has been established. Wellhead injection pressures in the proposed Unit No. 4 will be similar to the Daly Unit No. 3 wellhead pressures.

Any questions regarding this matter should be directed to Kevin Matieshin at (204) 748-1334 or Doug Schierman at (403) 234-5150.

Sincerely,



for C. G. FOLDEN, P.Eng.
Supervising Engineer
Reservoir Engineering

DS/ds

R.28WPM

R.27WPM

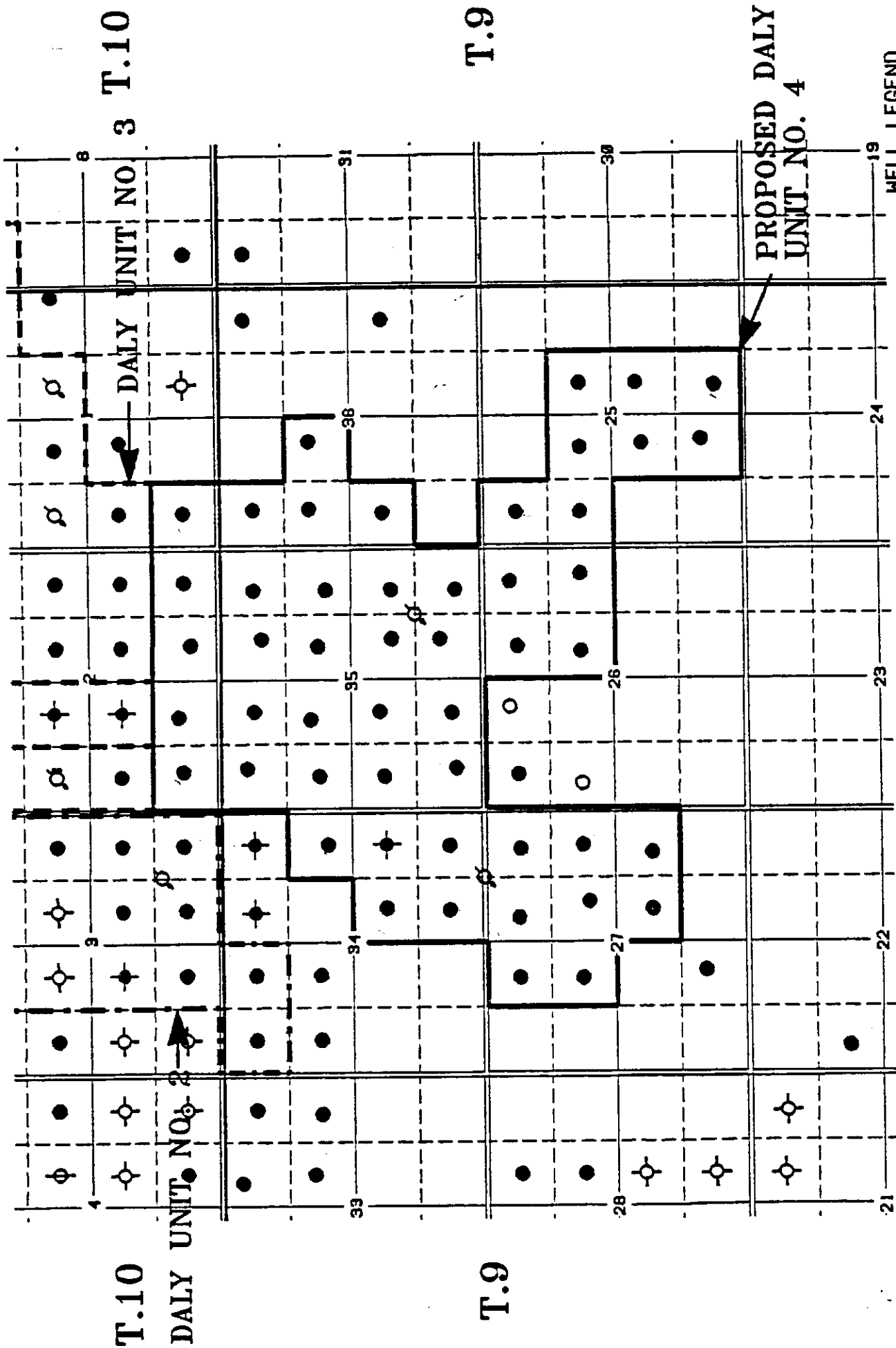


FIGURE NO.1

PROPOSED DALY UNIT NO. 4 Amended Stage I Waterflood Development

DALY UNIT NO.4 PRODUCTION PLOT SUMMARY

FIGURE 2

.1E05
.1E05
.1E05

.1E04
.1E04
.1E04

.1E03
.1E03
.1E03

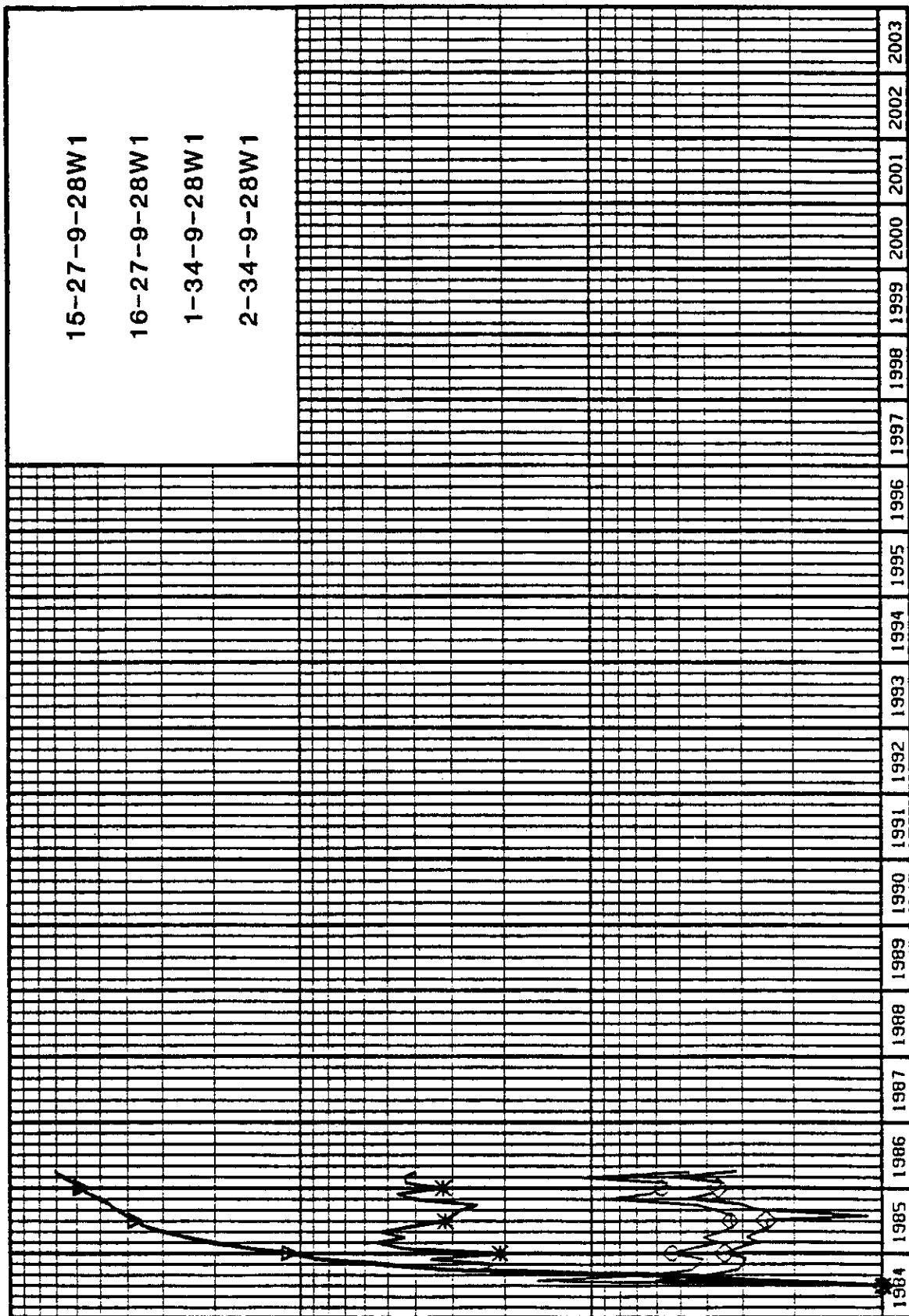
.1E02
.1E02
.1E02

.1E03

.1E02

.1E01

.1E00



WCR (M³/M³)

DATE

OIL/MONTH (M³)
CUMULATIVE OIL (M³)
% WATER CUT



Chevron Canada Resources Limited

500 - Fifth Avenue S.W., Calgary, Alberta T2P 0L7

K.E. Godard
Chief Engineer

1986-03-31

Daly Lodgepole "A" Pool
Proposed Daly Unit No. 4
Application For Enhanced Oil Recovery
By Water Injection

The Oil and Natural Gas Conservation Board
309 Legislative Building
Winnipeg, Manitoba
R3C 0N8

Attention: Mr. C. Kang, Chairman

Gentlemen:

Pursuant to Section 64 of the Manitoba Oil and Gas Regulations, Chevron Canada Resources Limited as Operator of the proposed Daly Unit No. 4, requests approval of a scheme to enhance oil recovery from the Daly Lodgepole "A" Pool by water injection.

1. The proposed Daly Unit No. 4 area is shown on Figure 1 and will include the following lands:

Lsd's 2, 3, 6, 7, 11, 12, & 13-25-9-28 WPM

NE-1/4-26-9-28 WPM

Lsd. 7, 8, 11 & 14-27 WPM

NE-1/4-27-9-28 WPM

SE-1/4-34-9-28 WPM

Lsd. 9-34-9-28 WPM

Sec. 35-9-28 WPM

Lsd's 6, 11, 12 & 13-36-9-28 WPM

Lsd. 4-1-10-28 WPM

Lsd's 1, 2, 3, & 4-2-10-28 WPM

2. The status of each well within and adjoining the proposed Unit is shown on Figure 1.
3. The mineral rights' owners, lessees and surface owners within and adjoining the proposed Unit are shown on Tables I and II.
4. A Daly Lodgepole "A" Pool net pay map for the subject area is shown on Figure 2.
5. A pore volume map for the subject area of the Daly Pool is attached as Figure 3. A permeability capacity map could not be generated because of insufficient core data.
6. The OOIP in the proposed Daly Unit No. 4 area is estimated at $5\,084\,10^3\text{ m}^3$ from volumetric calculations. Cumulative oil production to 1985-12-31 is $38.8\,10^3\text{ m}^3$ which is 1% of OOIP. Cumulative water production to 1985-12-31 is $56.3\,10^3\text{ m}^3$. Figure 4 shows the production history of the proposed Unit.
7. No reservoir pressure surveys have been done. A pressure survey will be done before water injection commences.
8. The reservoir fluids from the Daly Unit No. 4 area are expected to have PVT properties similar to fluids from other portions of the Daly Lodgepole "A" Pool. A PVT analysis from the Well Daly Prov 6-10-10-28 is attached in Appendix B.
9. Because developing a waterflood over the entire Unit is uneconomic at this time, Chevron plans to develop the Daly Unit No. 4 waterflood in stages. Stage I will serve as a pilot waterflood to confirm that waterflooding the subject area of the Daly Lodgepole "A" Pool will be technically successful. Waterflood expansion in Unit No. 4 would proceed in stages, if the waterflood process is proven technically and economically feasible.

10. The first waterflood stage would include the following:

- a) Drill four injectors in Section 27-9-28 to develop four 5-spot patterns with 8 ha well spacing. This area was chosen for Stage I because it has the highest net pay in the Unit. A fifth injector would be drilled if Wells 12 and 13-26 are included in the proposed Unit. The Operator of these wells has indicated an interest in joining Unit No. 4.
- b) Convert Well 1C-35-9-28 from a water disposal well to a water injection well to develop a 5 spot pattern. This area was chosen because the wellbore and necessary surface equipment are in place.


This development scenario is shown on Figure 5.

11. The OOIP in the subject Section 27 area is $1\,821\,10^3\text{ m}^3$. Cumulative oil production from this area is $7.5\,10^3\text{ m}^3$ or less than 1% of OOIP (see production history on Figure 6). Ultimate primary recovery is estimated at 2% of OOIP. Secondary recovery from waterflooding is estimated at 11% of OOIP. Figure 7 contains the production forecasts. Appendix A contains a description of the method used to calculate primary and secondary recovery.
12. The four producers around the proposed Injector 1C-35 exhibit rapid production decline (see production history on Figure 8). Current production rates are close to the economic cut off, so water injection is required to restore productivity. Waterflood performance at 1C-35 is expected to be slightly poorer than the expected performance in Section 27. This pattern will provide data on waterflood performance in areas of lower net pay.
13. The average expected injection rate is $2\,500\text{ m}^3/\text{mo}/\text{well}$. The method used to estimate the expected injection rate is described in Appendix A.
14. Maximum wellhead injection pressure will be 10 MPa. Figure 9 shows a schematic for a typical injection well.

15. A schematic of the surface production and injection facilities is contained in Figure 5. A comprehensive schematic showing pipe sizes, working pressures, etc., will be developed when the facility design has been finalized.
16. The injection water source will be produced water from Unit No. 4 and the Daly West Field. The injection rate at disposal well 5-29-9-28 is 570 m³/d so sufficient make up water will be available. Produced water will be treated and filtered before being injected. Chemicals will be added to prevent scale formation. No water compatibility problems are anticipated as the injection water will be the same as used in Unit No. 3. Measurement of injected water will be done by individual well positive displacement meters.
17. Corrosion control methods will be as follows:
 - a) For the wellbores, the production casing has been cemented from total depth to surface.
 - b) The casing/tubing annulus of the injection wells will be filled with inhibited fresh water and isolated by a packer.
 - c) Injection well tubing will be cement lined.
 - d) Fiberglass pipe will be used for the production pipelines
 - e) Cement lined pipe will be used for the injection pipelines. These pipelines will also have cathodic protection.
 - f) Corrosion inhibitor will be added to the injected water.
18. Water injection is planned to commence during 1986-10. Injection rates will be adjusted to maximize oil recovery from the Lodgepole reservoir while replacing voidage and maintaining reservoir pressure.

Any questions regarding this application should be directed to Kevin Matieshin at (204) 748-1334 or Doug Schierman at (403) 234-5150.

Sincerely,



C. G. FOLDEN, P.Eng.
Supervising Engineer
Reservoir Engineering

DS/ds
Attach.

TABLE I

Mineral Rights Owners, Lessees and Surface Owners within
The Proposed Daly Unit #4

<u>Legal Description</u>	<u>Surface/ Mineral</u>	<u>Owner (Fractional Interest If Any)</u>	<u>Lessee</u>
Leds. 2, 7 & 10	25-9-28 WPM	Minerals	
		Alva M. Williams (3/16)	Chevron Canada Res.
		Stewart H. Lowdon (3/16)	Chevron Canada Res.
		Clifford Lowden (3/16)	Chevron Canada Res.
		Georgina M. Lowden (3/16)	Chevron Canada Res.
		Trilogy Resources (1/4)	Resman Oil & Gas and C&T Resources
Leds. 3, 5 & 6	25-9-28 WPM	Minerals	
		Alva M. Williams (1/16)	Chevron Canada Res.
		Stewart H. Lowdon (1/16)	Chevron Canada Res.
		Clifford Lowden (1/16)	Chevron Canada Res.
		Georgina M. Lowden (1/16)	Chevron Canada Res.
		Canada Permanent Trust (1/2)	Chevron Canada Res.
		Trilogy Resources (1/4)	Resman Oil & Gas and C&T Resources
Leds. 11, 12 & 13	25-9-28 WPM	Minerals	
		Alva M. Williams (1/8)	Chevron Canada Res.
		Stewart H. Lowdon (1/8)	Chevron Canada Res.
		Clifford Lowdon (1/8)	Chevron Canada Res.
		Georgina M. Lowdon (1/8)	Chevron Canada Res.
		Canada Permanent Trust (1/4)	Chevron Canada Res.
		Trilogy Resources (1/4)	Resman Oil & Gas and C&T Resources
Led. 5	36-9-28 WPM	Minerals	
		Harold H. Shoemaker (1/4)	Chevron Canada Res.
		John W. Clarke (1/2)	Chevron Canada Res.
		Canada Permanent Trust (1/4)	Chevron Canada Res.
Leds. 11, 12 & 13	36-9-28 WPM	Minerals	
		Gov't. of Manitoba	Chevron Canada Res.
Led. 4	1-10-28 WPM	Minerals	
		Cecil J. Williams	Chevron Canada Res.
Leds. 1 & 2	2-10-28 WPM	Minerals	
		Cecil J. Williams	Chevron Canada Res.
Leds. 3 & 4	2-10-28 WPM	Minerals	
		Gerald B. Haskett	Chevron Canada Res.

<u>Legal Description</u>	<u>Surface/ Mineral</u>	<u>Owner (Fractional Interest If Any)</u>	<u>Lessee</u>
Lsd. 9	34-9-28 WPM	Orma J. Gray (3/4) Canada Permanent Trust (1/4)	Resman Oil & Gas Trilogy Resources
SE-1/4	34-9-28 WPM	University of Manitoba	Resman Oil & Gas Jorex or C&T Resources
Lsds. 7 & 8	27-9-28 WPM	66529 Manitoba Ltd.	Chevron Canada Res.
Lsds. 11 & 14	27-9-28 WPM	David G. Gerrand (1/4) Clifford Lowdon) Stewart H. Lowdon)(3/4) Lowdon Resources Ltd.)	Chevron Canada Res. Chevron Canada Res.
NE-1/4	27-9-28 WPM	Clifford Lowdon) Stewart H. Lowdon)(In Lowdon Resources Ltd.) Common)	Chevron Canada Res.
NE-1/4	26-9-28 WPM	Marion D. Wilson (1/4) Henry G. Kilford (3/4)	Chevron Canada Res. Chevron Canada Res.
N-1/2 & SE-1/4	35-9-28 WPM	Stewart H. Lowdon (1/8) Richard T. Perry (1/4) Glen R. Lowdon (1/8) Alva M. Williams (1/8) Clifford Lowdon (1/8) Trilogy Resources (1/4)	Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Resman Oil & Gas C&T Resources
SW-1/4	35-9-28 WPM	Canada Permanent Trust (1/2) Clifford Lowdon (1/16) Alva M. Williams (1/16) Glen R. Lowdon (1/16) Stewart H. Lowdon (1/16) Trilogy Resources (1/4)	Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Chevron Canada Res. Resman Oil & Gas C&T Resources

<u>Legal Description</u>	<u>Surface/ Mineral</u>	<u>Owner (Fractional Interest If Any)</u>	<u>Lessee</u>
Lds. 5, 11, 12 & 13	Surface	William S. Grant	
Lsd. 4	Surface	Lloyd R. Williams	
Lds. 3 & 4	Surface	William B. Haskett	
Lds. 1 & 2	Surface	Lloyd R. Williams	
Lsd. 9	Surface	Orma Jean Gray	
SE-1/4	Surface	Robert C. Scharff (1/2) David C. Scharff (1/2)	
NE-1/4 and Lds. 11 & 14	Surface	Walter A. Kool Helen Kool	
Lds. 7 & 8	Surface	David M. Hogg	
NE-1/4	Surface	Ivan A. Williams Terry L. Williams	
Lds. 2, 3, 5, 6, 7, 10, 11, 12 & 13	Surface	Gordon F. Hayhurst	
Sec.	Surface	Howard T. Hayhurst	

TABLE II

1986-03-05

Mineral Rights Owners, Lessees and Surface Owners Adjacent to
The Proposed Daly Unit #4

<u>Legal Description</u>	<u>Rights Held</u>	<u>Owner/Lessor</u>	<u>Fractional Interest (If Any)</u>	<u>Lessee/ Working Int. Owner</u>
<u>9-27 WPM</u>				
W-1/2 Sec. 30	Surface	William S. Grant		
SW-1/4 Sec. 30	Minerals	Manitoba Crown		Westmead and Brosco Fund
NW-1/4 Sec. 30	Minerals	Alva M. Williams	(1/4)	Chevron Canada Res.
		Stewart H. Lowden	(1/4)	Chevron Canada Res.
		Georgina M. Lowden	(1/4)	Chevron Canada Res.
		Buffalo Rose Holdings Ltd.	(1/4)	Chevron Canada Res.
<u>9-28 WPM</u>				
NE-1/4 Sec. 22	Surface			
NE-1/4 Sec. 22	Minerals	Canada Permanent Trust	(3/4)	Chevron Canada Res.
NE-1/4 Sec. 22	Minerals	Rosa E. Bentley	(1/4)	Trilogy Resources
N-1/2 Sec. 24	Surface	Robert C. Scharff		
N-1/2 Sec. 24	Minerals	Manitoba Crown		Chevron Canada Res.
Sec. 25	Surface	Gordon F. Hayhurst		
E-1/2 Sec. 25	Minerals	Alva M. Williams	(3/16)	Chevron Canada Res.
		Stewart H. Lowden	(3/16)	Chevron Canada Res.
		Clifford Lowden	(3/16)	Chevron Canada Res.
		Georgina M. Lowden	(3/16)	Chevron Canada Res.
SW-1/4 Sec. 25	Minerals	Alva M. Williams	(1/16)	Chevron Canada Res.
		Stewart H. Lowden	(1/16)	Chevron Canada Res.
		Clifford Lowden	(1/16)	Chevron Canada Res.
		Georgina M. Lowden	(1/16)	Chevron Canada Res.
SW-1/4 Sec. 25	Minerals	Canada Permanent Trust	(1/2)	Chevron Canada Res.
NW-1/4 Sec. 25	Minerals	Alva M. Williams	(1/8)	Chevron Canada Res.
		Stewart H. Lowden	(1/8)	Chevron Canada Res.
		Clifford Lowden	(1/8)	Chevron Canada Res.
		Georgina M. Lowden	(1/8)	Chevron Canada Res.
NW-1/4 Sec. 25	Minerals	Canada Permanent Trust	(1/4)	Chevron Canada Res.
Sec. 25	Minerals	Trilogy Resources	(1/4)	Chevron Canada Res.

<u>Legal Description</u>	<u>Rights Held</u>	<u>Owner/Lessor</u>	<u>Fractional Interest (If Any)</u>	<u>Lessee/Working Int. Owner</u>
9-28 WPM				
NW-1/4 Sec. 26	Surface	Ivan and Terry Williams as joint tenants		
NW-1/4 Sec. 26	Minerals	Dome Petroleum		
S-1/2 Sec. 26	Surface	Reginald D. Kellsey		
S-1/2 Sec. 26	Minerals	Dome Petroleum		
NW-1/4 Sec. 27	Surface	Walter and Helen Kool		
NW-1/4 Sec. 27	Minerals	Buffalo Rose Holdings	(1/4)	Chevron Canada Res.
		Stewart H. Lowdon	(1/4)	Chevron Canada Res.
		Lowden Resources Ltd.	(1/4)	Chevron Canada Res.
		David G. Gerrand	(1/4)	Chevron Canada Res.
S-1/2 Sec. 27	Surface	David M. Hogg		
S-1/2 Sec. 27	Minerals	66529 Manitoba Ltd.		Chevron Canada Res.
NE-1/4 Sec. 28	Surface	Norman E. Glinz	(2/3)	
NE-1/4 Sec. 28	Surface	Willis C. Glinz	(1/3)	
NE-1/4 Sec. 28	Minerals	Manitoba Crown		Tri-Star Resources Beaverhead Resources
SW-1/4 Sec. 34	Surface	Lorne and Lynne Heaman as joint tenants		
SW-1/4 Sec. 34	Minerals	Richard T. Perry	(1/4)	Chevron Canada Res.
		Lynne M. Heaman	(1/4)	Chevron Canada Res.
		Colleen L. Effler	(1/4)	Chevron Canada Res.
		Murray D. Gray	(1/4)	Chevron Canada Res.
NW-1/4 Sec. 34	Surface	Clifford and Margaret Horn as joint tenants Murray and Elizabeth Gray as joint tenants Olee and Evelyn Jorgensen as joint tenants		
NW-1/4 Sec. 34	Minerals	Canada Permanent Trust	(1/4)	Beaverhead Resources
NW-1/4 Sec. 34	Minerals	Richard T. Perry	(1/4)	Beaverhead Resources
NW-1/4 Sec. 34	Minerals	Lynne M. Heaman	(1/6)	Beaverhead Resources
		Colleen L. Effler	(1/6)	Beaverhead Resources
		Murray D. Gray	(1/6)	Beaverhead Resources

<u>Legal Description</u>	<u>Rights Held</u>	<u>Owner/Lessor</u>	<u>Fractional Interest (If Any)</u>	<u>Lessee/ Working Int. Owner</u>
<u>9-28 WPM</u>				
NE-1/4 Sec. 34	Surface	Orma J. Gray Clifford and Margaret Horn as joint tenants		
NE-1/4 Sec. 34	Minerals	Orma J. Gray	(3/4)	Resman Oil & Gas
NE-1/4 Sec. 34	Minerals	Canada Permanent Trust	(1/4)	Trilogy Resources
E-1/2 &				
NW-1/4 Sec. 36	Surface	William S. Grant		
E-1/2 Sec. 36	Minerals	Lillian A. Gray	(1/4)	Chevron Canada Res.
E-1/2 Sec. 36	Minerals	Canada Permanent Trust	(1/4)	Chevron Canada Res.
SE-1/4 Sec. 36	Minerals	Elizabeth A. Forsyth	(1/8)	Chevron Canada Res.
SE-1/4 Sec. 36	Minerals	Jacqueline S. Brayfield	(1/8)	Chevron Canada Res.
SE-1/4 Sec. 36	Minerals	William J. Perkins	(1/12)	Chevron Canada Res.
SE-1/4 Sec. 36	Minerals	John W. M. Thompson	(1/6)	Niagara Petroleum
NE-1/4 Sec. 36	Minerals	John W. Clarke	(1/2)	Chevron Canada Res.
NW-1/4 Sec. 36	Minerals	Manitoba Crown		Chevron Canada Res.
SW-1/4 Sec. 36	Surface	William S. Grant		
SW-1/4 Sec. 36	Minerals	Canada Permanent Trust	(1/4)	Chevron Canada Res.
SW-1/4 Sec. 36	Minerals	John W. Clarke	(1/2)	Chevron Canada Res.
SW-1/4 Sec. 36	Minerals	Harold H. Shoemaker	(1/4)	Chevron Canada Res.
<u>10-28 WPM</u>				
NW-1/4 Sec. 1	Surface	Lloyd R. Williams, Federal Crown		
NW-1/4 Sec. 1	Minerals	Lloyd R. Williams	(1/2)	Chevron Canada Res.
NW-1/4 Sec. 1	Minerals	Richard T. Perry	(1/4)	Chevron Canada Res.
NW-1/4 Sec. 1	Minerals	*John W. CLarke	(1/4)	Chevron Canada Res.
S-1/2 Sec. 1	Surface	Lloyd R. Williams		
SW-1/4 Sec. 1	Minerals	Cecil J. Williams	(47/100)	Chevron Canada Res.
SW-1/4 Sec. 1	Minerals	Charles R. Williams	(7/25)	Chevron Canada Res.
SW-1/4 Sec. 1	Minerals	Norman E., Willis C. and Arvel H. Glinz	(1/4)	Chevron Canada Res.
SE-1/4 Sec. 1	Minerals	Manitoba Crown		Chevron Canada Res.

<u>Legal Description</u>	<u>Rights Held</u>	<u>Owner/Lessor</u>	<u>Fractional Interest (If Any)</u>	<u>Lessee/ Working Int. Owner</u>
<u>10-28 WPM</u>				
NE-1/4 Sec. 2	Surface	William B. Haskett Chevron Canada Resources		
NE-1/4 Sec. 2	Minerals	Bessie M. Haskett	(1/4)	Chevron Canada Res. (as to Lds. 15 & 16)
NE-1/4 Sec. 2	Minerals	Canada Permanent Trust	(1/2)	Chevron Canada Res. (as to Lds. 15 & 16)
NE-1/4 Sec. 2	Minerals	*John W. Clarke	(1/4)	Chevron Canada Res. (as to Lds. 15 & 16)
W-1/2 Sec. 2	Surface	William B. Haskett		
W-1/2 Sec. 2	Minerals	Marion D. Wilson	(1/4)	Chevron Canada Res.
W-1/2 Sec. 2	Minerals	Canada Permanent Trust	(1/2)	Chevron Canada Res.
W-1/2 Sec. 2	Minerals	*Gerald B. Haskett	(1/4)	Chevron Canada Res.
SE-1/2 Sec. 2	Surface	Lloyd R. Williams		
SE-1/4 Sec. 2	Minerals	E. Norman, C. Willis and Arvel H. Glinz	(1/4)	Chevron Canada Res.
SE-1/4 Sec. 2	Minerals	Cecil J. Williams	(47/100)	Chevron Canada Res.
SE-1/4 Sec. 2	Minerals	Marion D. Wilson	(7/25)	Chevron Canada Res.
SE-1/4 Sec. 3	Surface	James and Agnes Mathieson joint tenants		
SE-1/4 Sec. 3	Minerals	Dorothy M. Manser	(1/2)	Beaverhead Resources
SE-1/4 Sec. 3	Minerals	Lillian M. Donaldson	(1/2)	Beaverhead Resources

*Indicates a royalty trust agreement may be in effect.

R.28WPM

R.27WPM

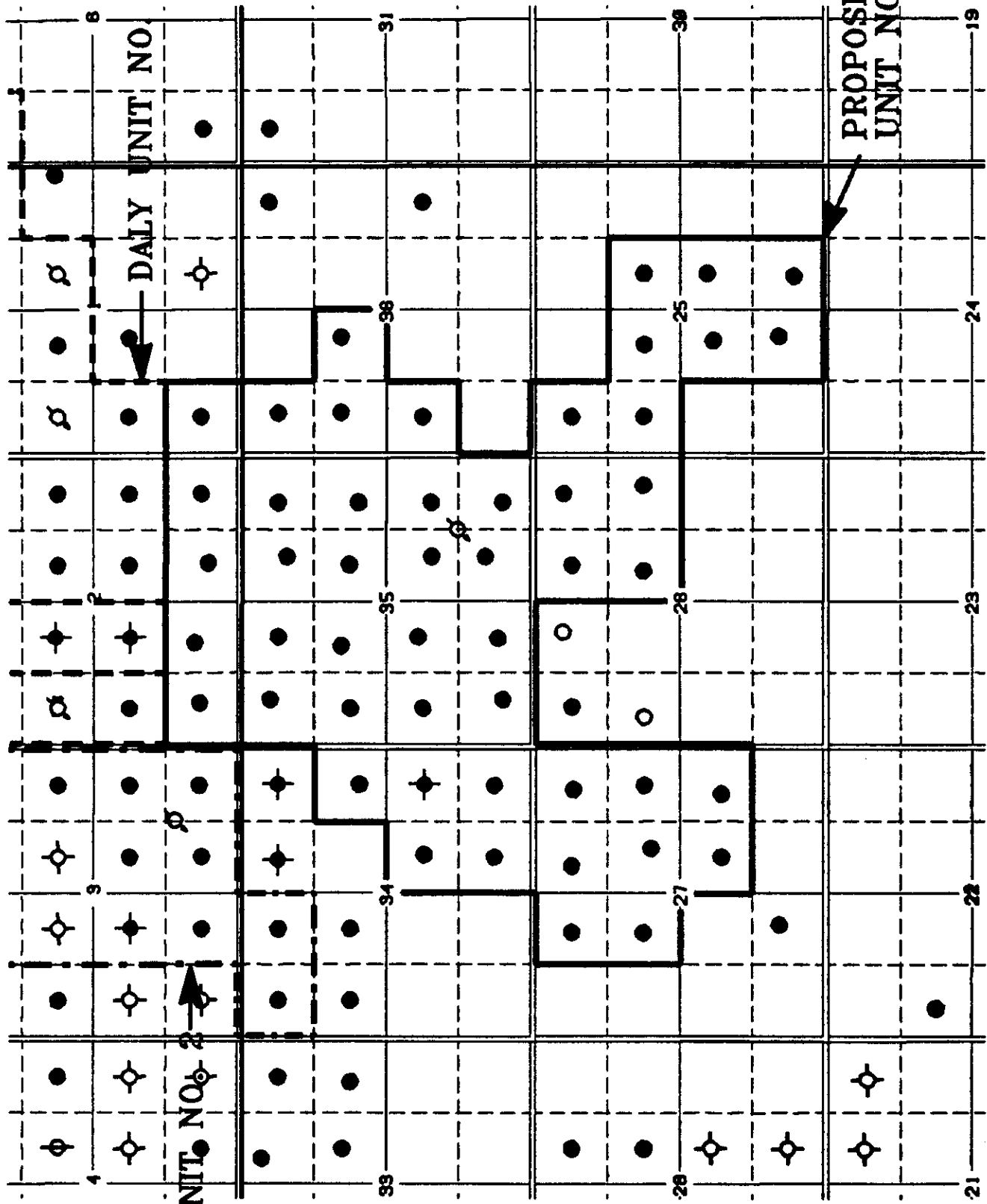


FIGURE NO.1

PROPOSED DALY UNIT NO. 4

Unit Boundary and Status of Wells

- WELL LEGEND
- OIL
 - DRILLING
 - ⊕ WATER INJECTOR
 - ⊙ SUSPENDED OIL
 - ⊕ ABANDONED OIL
 - ⊕ ABANDONED

R.28W1M

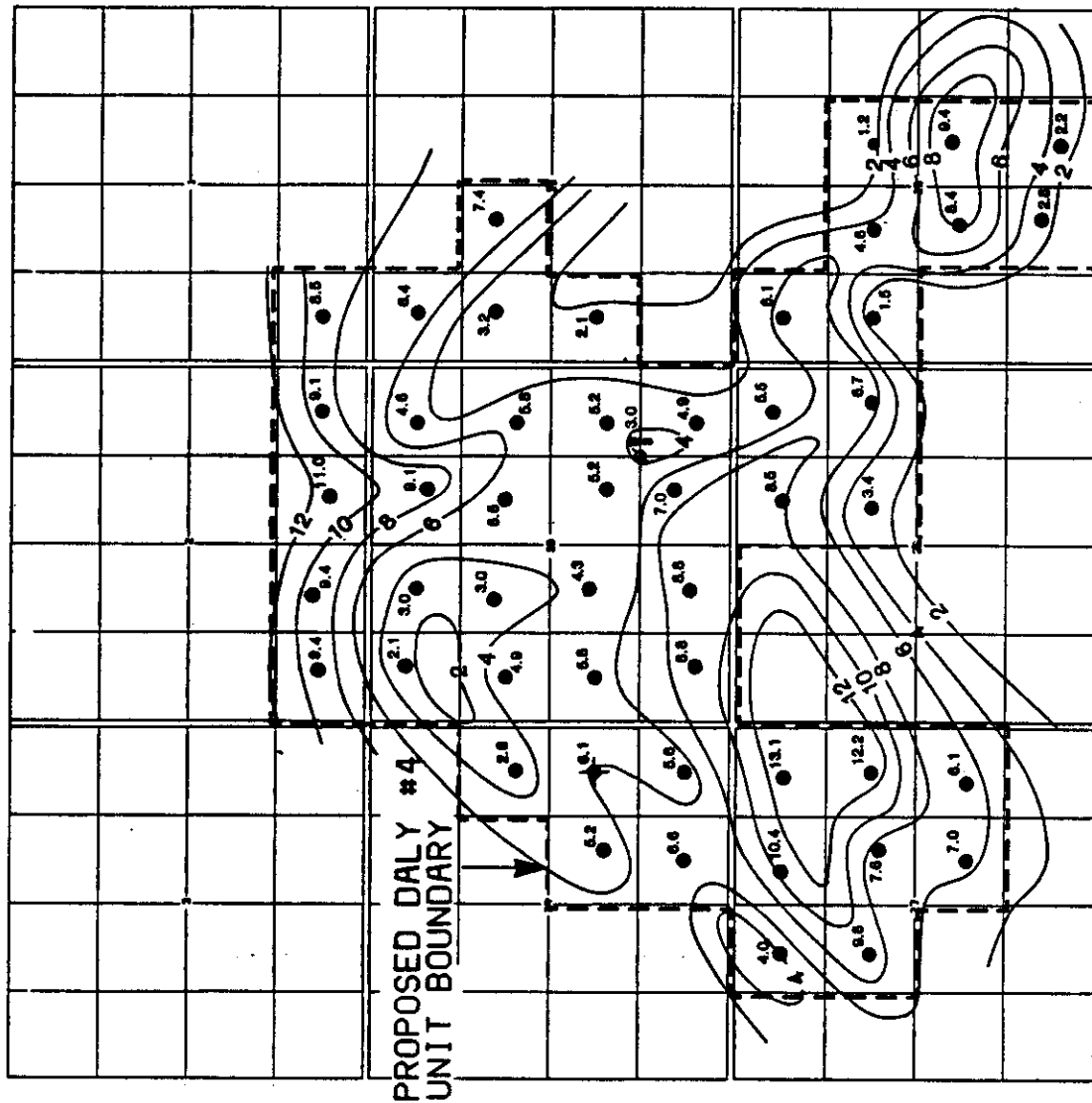


FIGURE 2

PROPOSED DAILY UNIT #4

LODGEPOLE
'A' POOL

NET PAY MAP
Ø CUTOFF 0.13

SW CUTOFF 0.60
SCALE 4" = 1 MILE

CJL 2 M
88-03 JKKER



R.28W1M

T.10

T.9

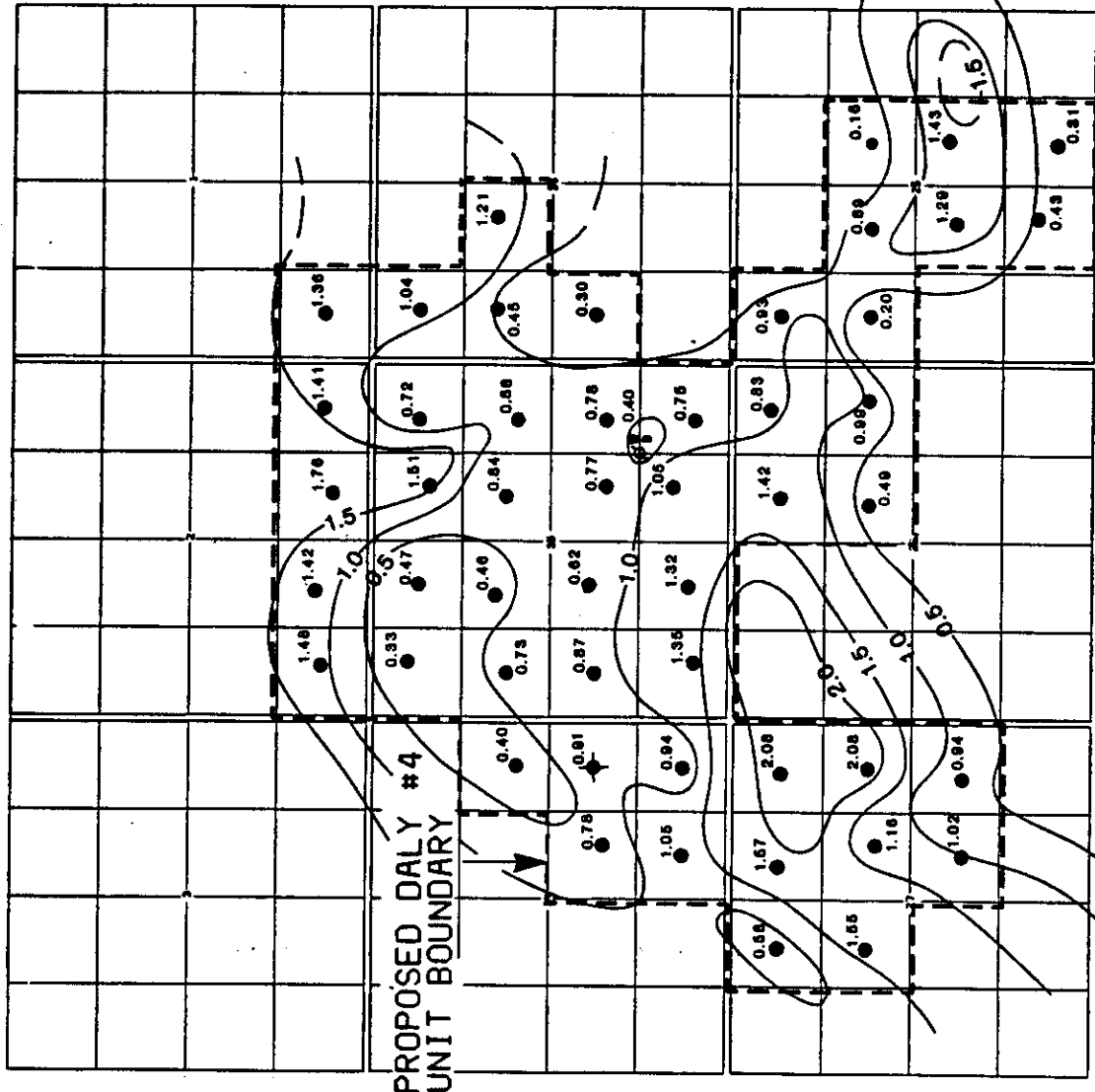


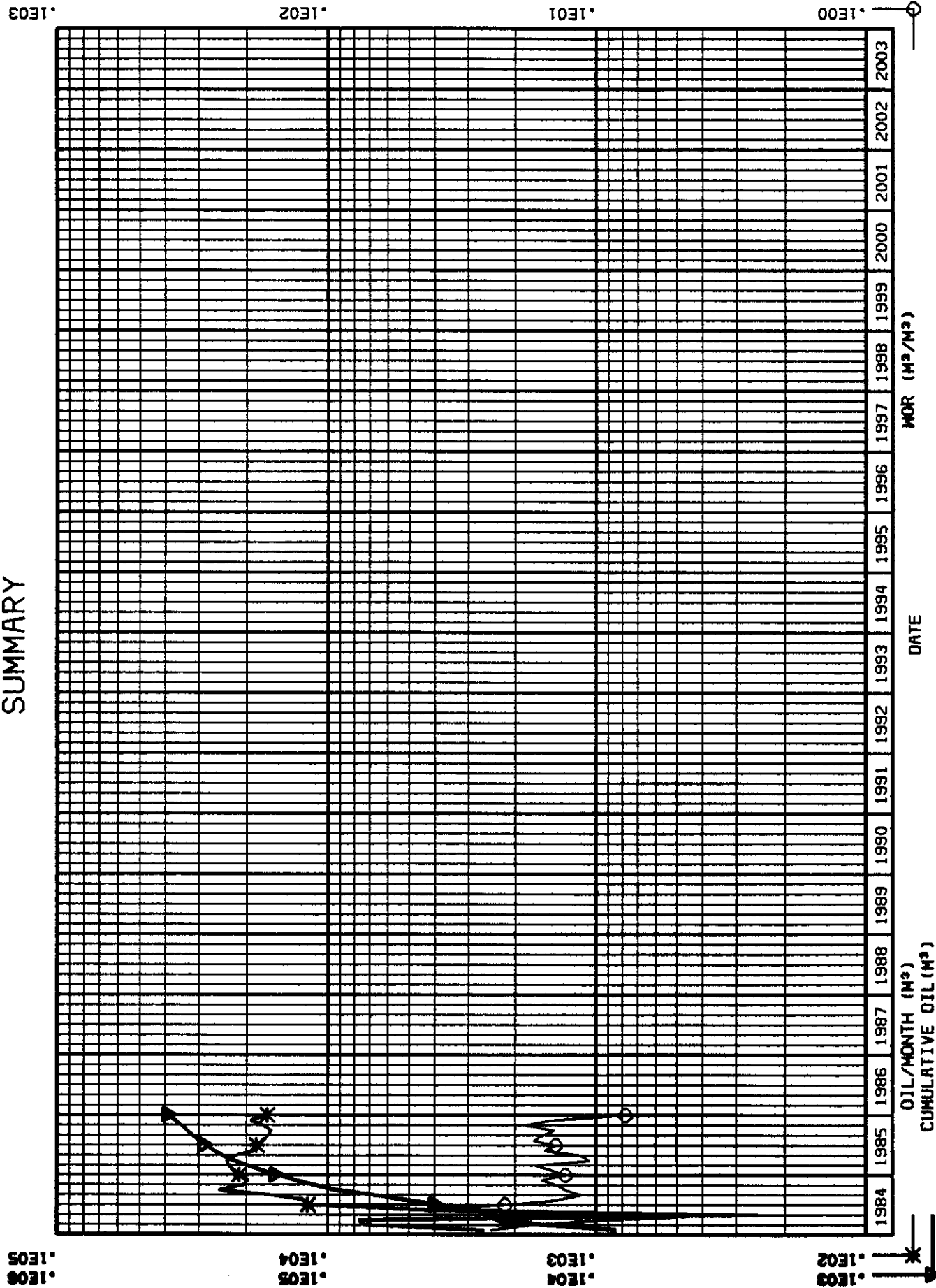
FIGURE 3
 PROPOSED DALY UNIT #4
 LODGEPOLE
 'A' POOL
 0h (m) MAP
 0' CUTOFF 0.13
 SW CUTOFF 0.50
 SCALE 4" = 1 MILE

G.I. 0.5
 86-03 JMKRER



DALY UNIT NO. 4 PRODUCTION PLOT SUMMARY

FIGURE 4



R.28W1M

T.10

PROPOSED DAILY UNIT #4
UNIT BOUNDARY

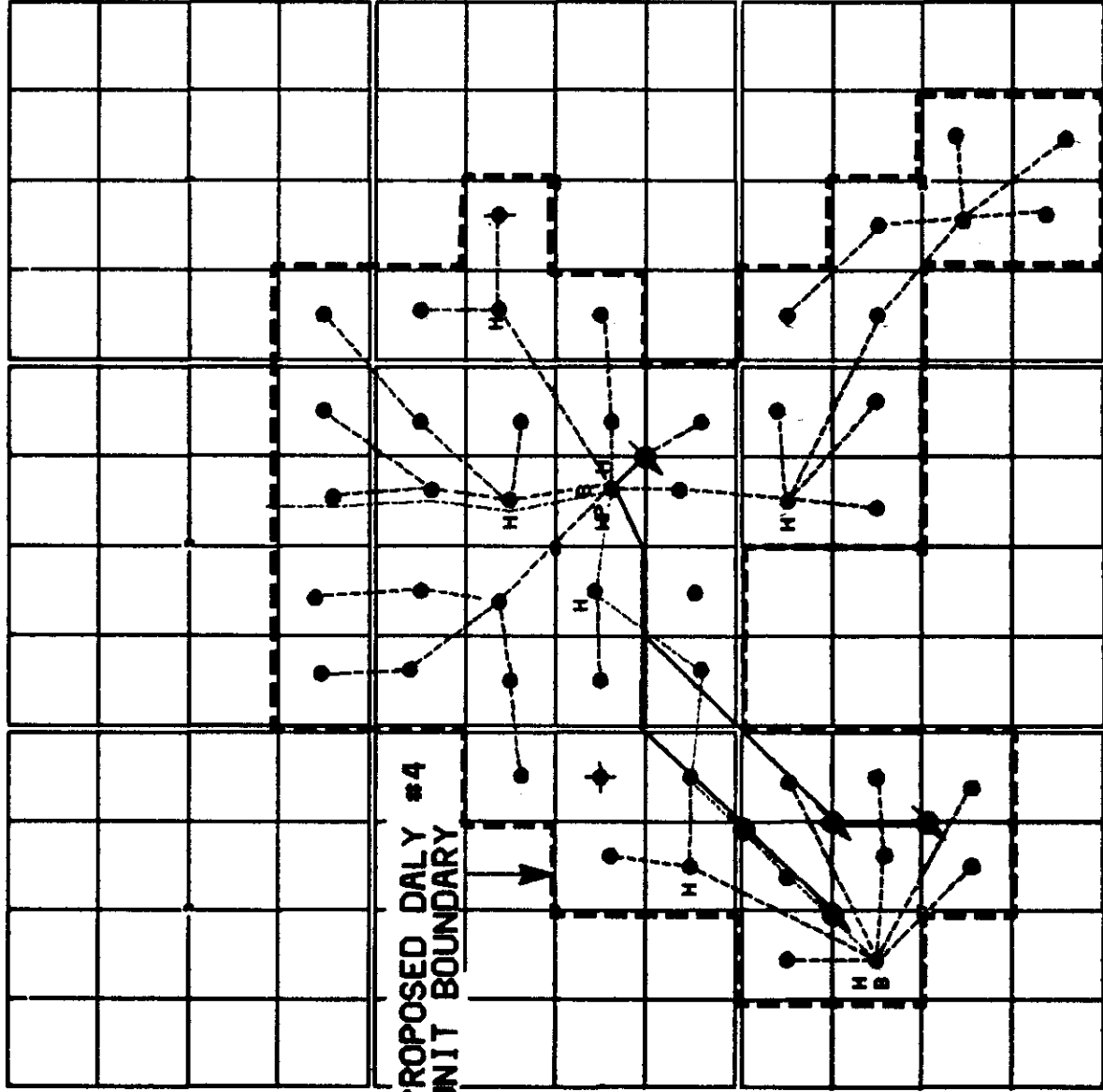


FIGURE 5

LEGEND

- PROPOSED INJECTOR
- WATER INJECTION PIPELINES
- PRODUCTION PIPELINES
- BATTERY
- HEADER
- WATER PLANT
- PRODUCED WATER GATHERING PIPELINE
- WATER SOURCE PIPELINE

PROPOSED DAILY UNIT #4
WATERFLOOD
SURFACE FACILITIES

T.9

R.28W1M

FIGURE 6 DALY UNIT NO. 4

PRODUCTION PLOT
SUMMARY

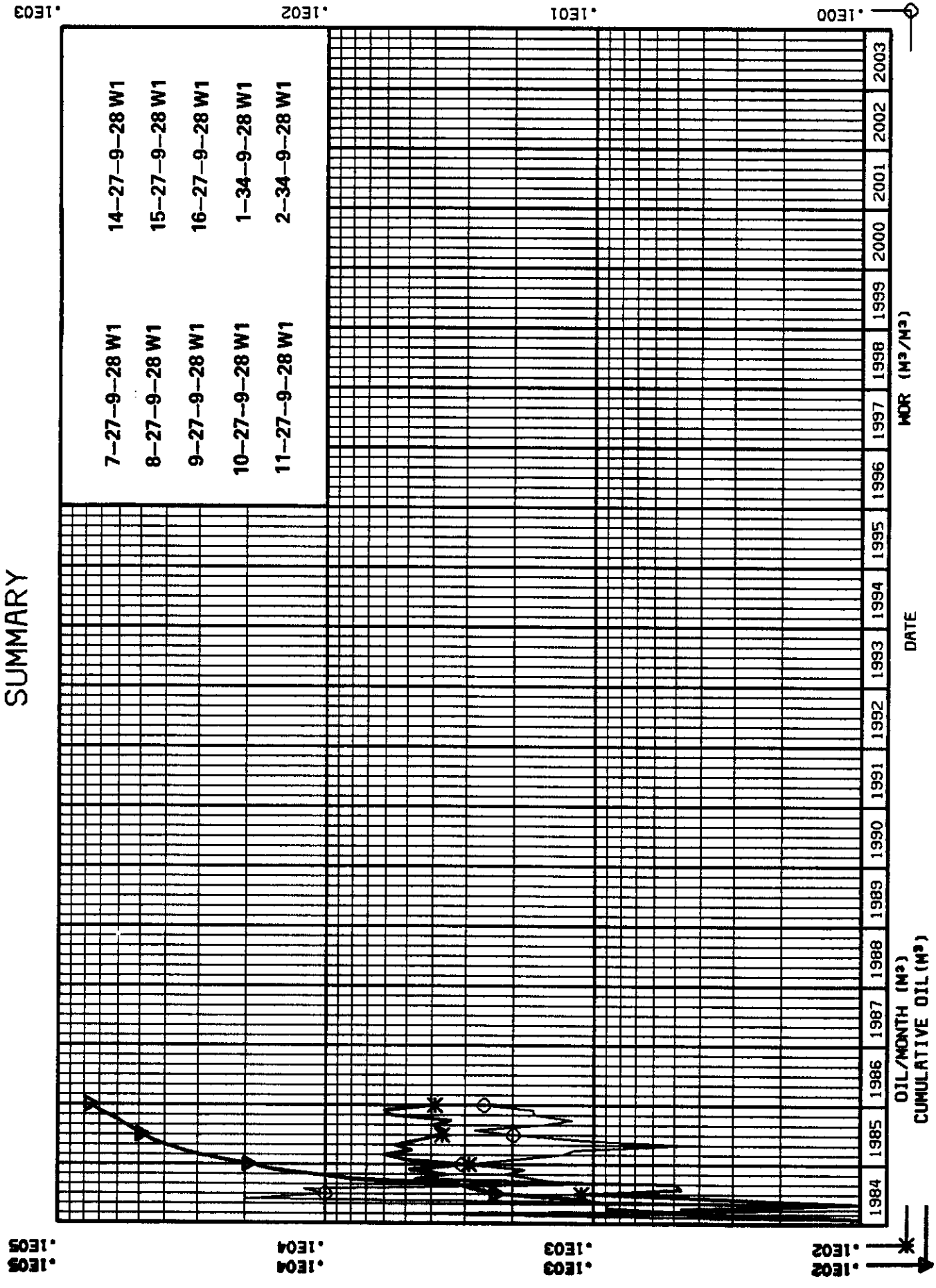


FIGURE 7

DAILY UNIT NO. 4 - SECTION 27 AREA
PRIMARY AND WATERFLOOD PRODUCTION HISTORY AND FORECAST

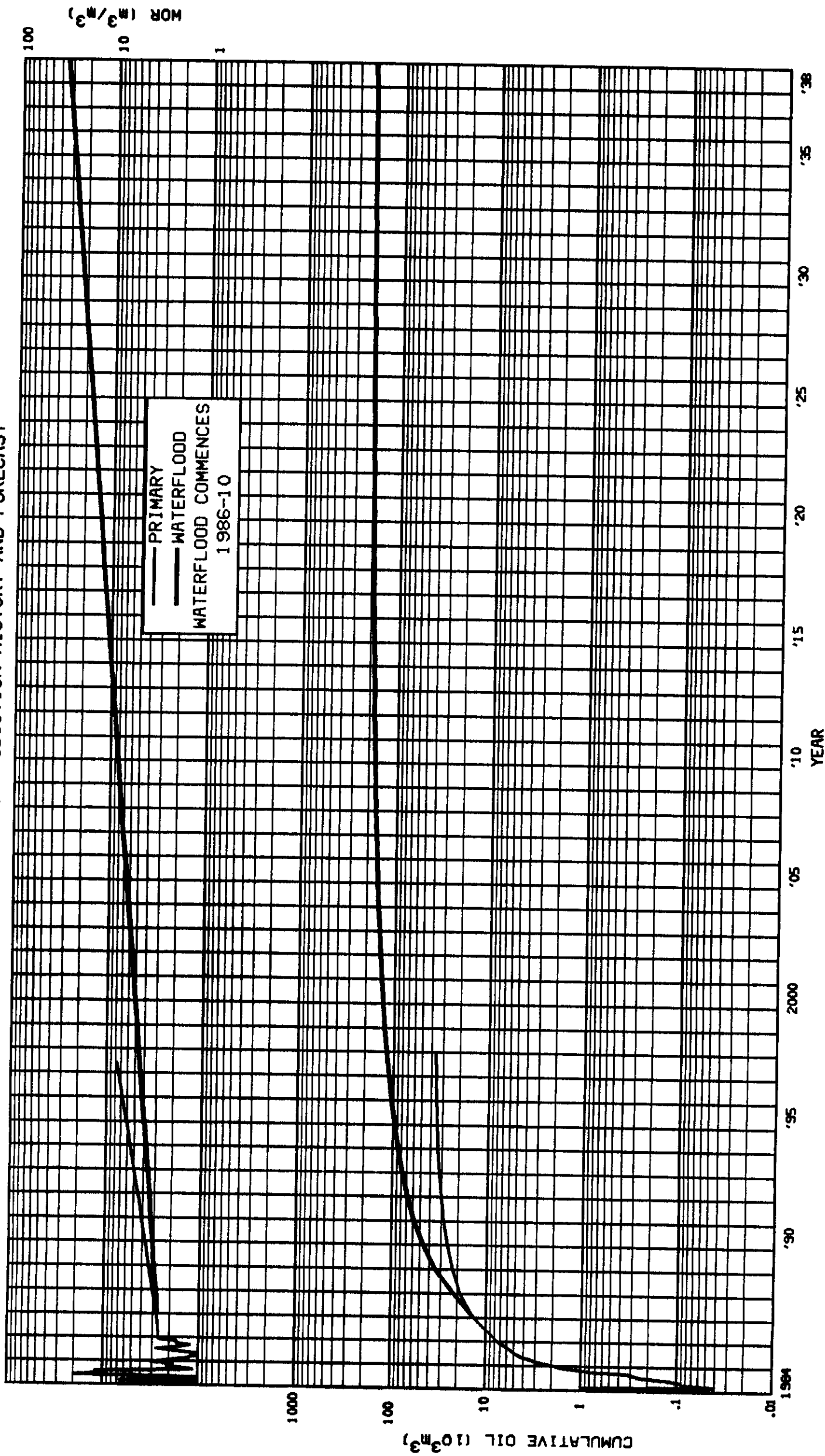


FIGURE 8 DAILY UNIT NO. 4 PRODUCTION PLOT SUMMARY

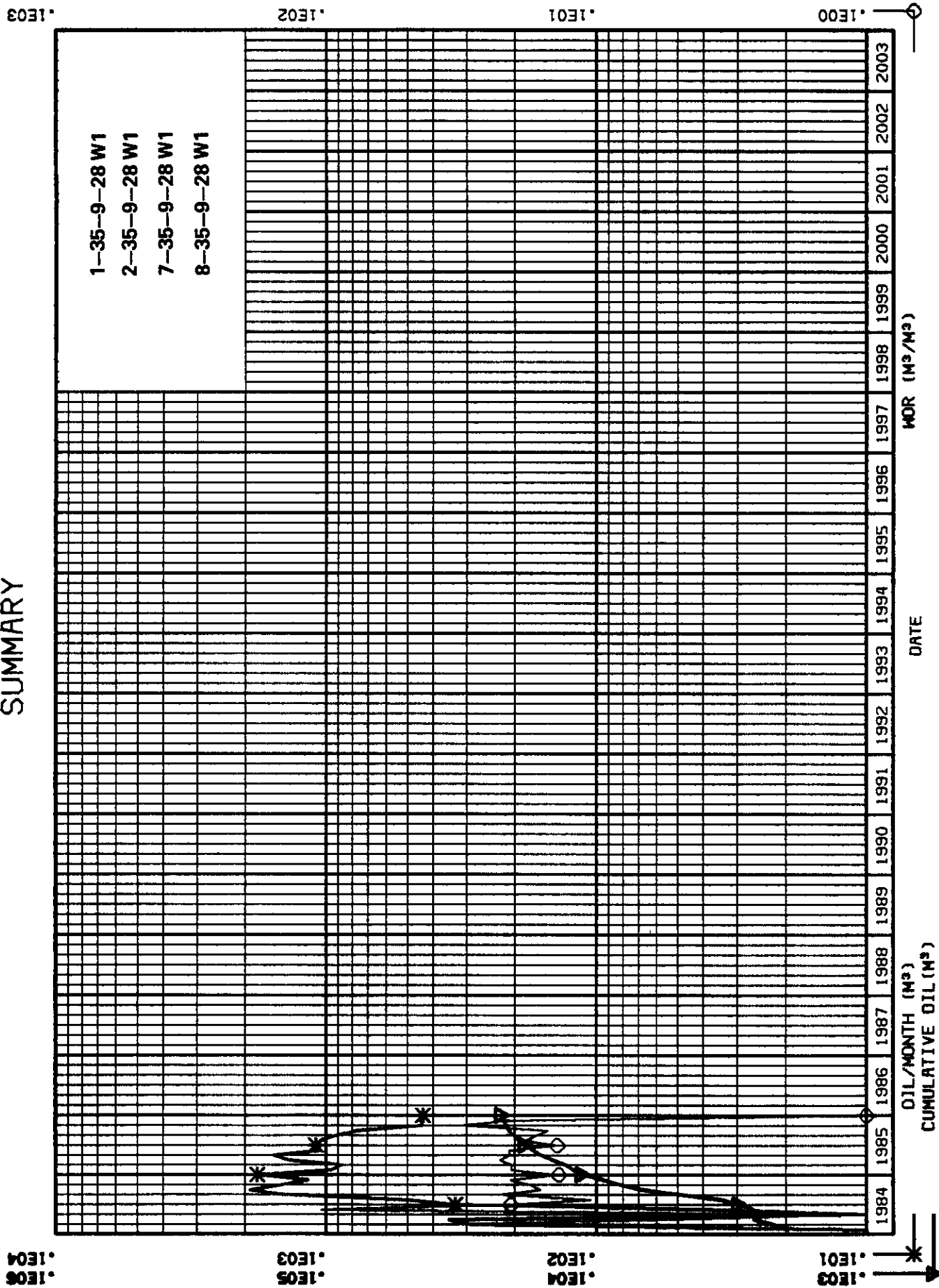
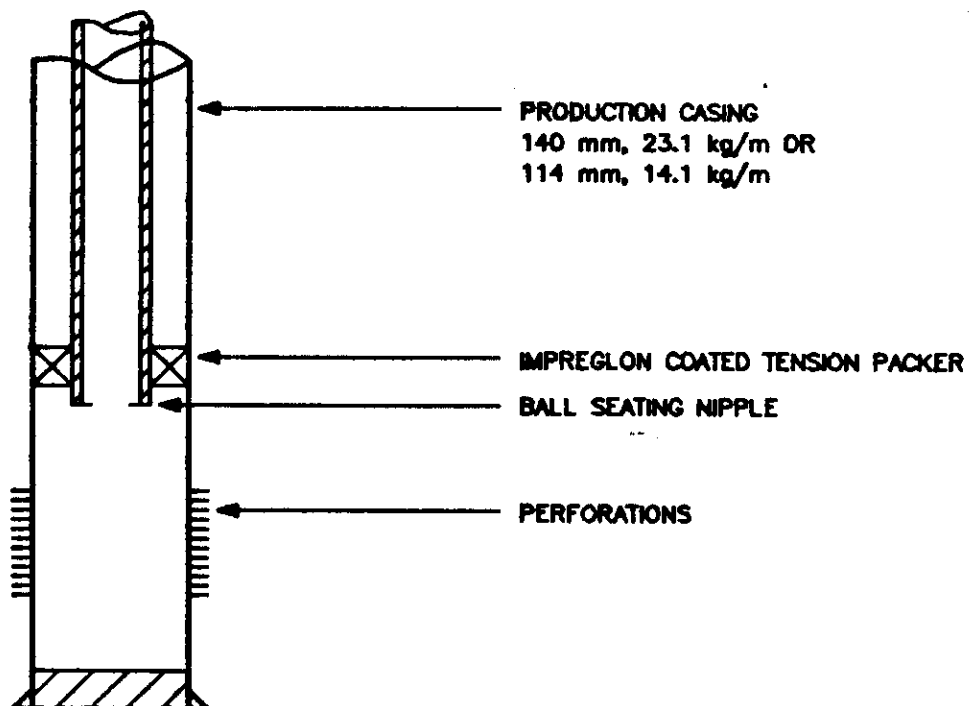
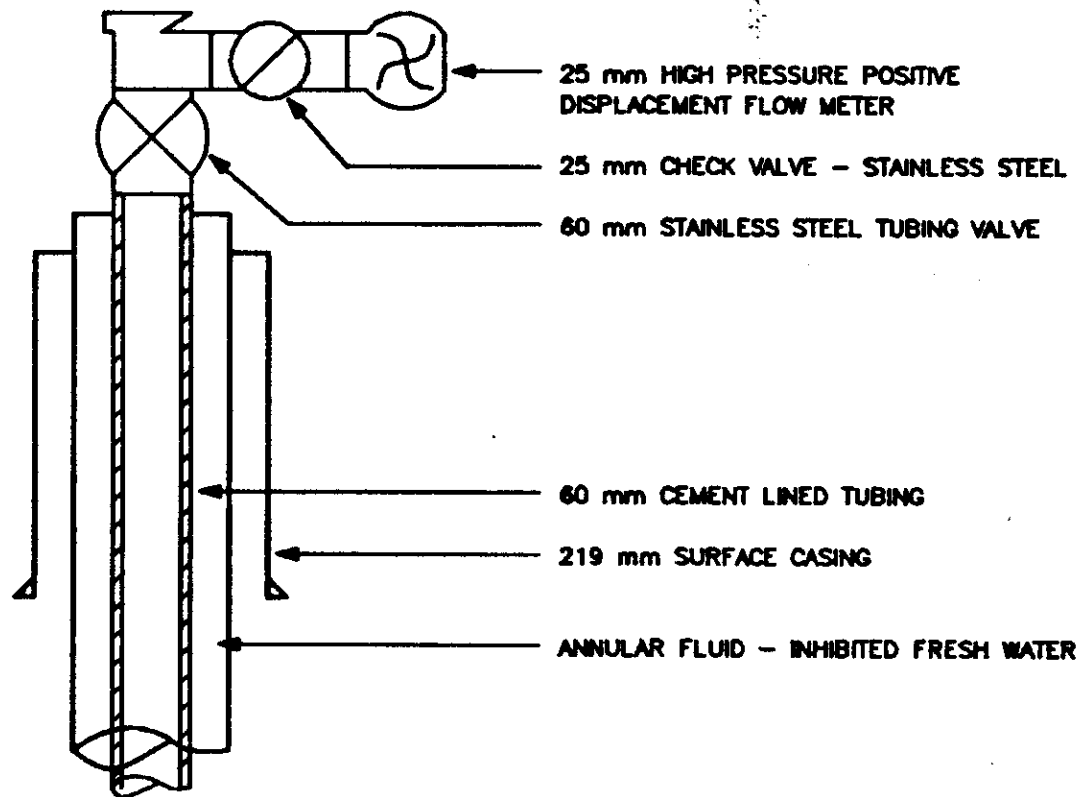


FIGURE 9
PROPOSED DALY UNIT NO.4
SCHEMATIC OF A TYPICAL INJECTION WELL

1986-02-18



APPENDIX A

PRODUCTION AND INJECTION FORECASTING METHODS

A. Reservoir Properties

The reservoir properties for Daly Unit Nos. 1, 2, 3, and 4 were reviewed and are shown on Table A1. A problem arises in comparing the Unit No. 4 well data with the data from other Units. Unit No. 4 well log and core data was obtained in the last two or three years, while the data from the other Units was obtained 30 years ago. In order to be consistent, only core data was used, which results in a small sample size. A permeability cutoff of 1 md was used to determine net pay.

Given the available data, the following observations were made:

1. Permeabilities are similar in all Units with the average permeability ranging from 3 to 6 md.
2. Porosities from Unit Nos. 1, 2, and 3 are similar with the average porosity ranging from 8.6 to 10.0%. The porosity in Unit No. 4 is higher with an average of 13.4%.
3. Total net pay is similar in Unit Nos. 1 and 3 (16 m). Unit No. 4 has about half the net pay of these Units (8.3 m), while Unit No. 2 net pay is in between Unit Nos. 1 and 3 and Unit No. 4 (10.7 m).

B. Initial Productivity Data

Initial Productivity Data for Daly Unit Nos. 1, 2, 3, and 4 were reviewed. Tables A2 and A3 contain the initial oil rate and WOR data for selected wells in these Units. The initial oil rate varies

considerably with a range of 2 to 13 m³/d. Unit Nos. 2 and 4 are at the lower end with average initial oil rates of 1.6 and 3.2 m³/d, respectively. The WOR also varies considerably with a range of .08 to 1.5, with Unit No. 4 having the highest initial WOR. The high WOR could be due to communication with the aquifer via natural or induced fractures.

C. Primary Production Forecast

A primary production forecast was generated as follows:

1. Production data from Daly Unit Nos. 1 and 2 were reviewed to determine the primary decline rates. In Unit No. 1, the average primary decline rate was 5 - 14% per year with some wells showing rapid decline in the early years of production. In Unit No. 2, the primary decline rate was 14% per year for the first seven years and then 5% per year. See Figure A1.
2. Production data from the Well Consolidated Daly 8-34-9-28 W1 was also reviewed to determine its primary decline rate. This well is currently abandoned, but it produced from the Lodgepole "A" Pool in the 1960s. See Figure A2 for the production history. The decline rate at 8-34 was 33% per year, and the well had a six-year life.
3. Daly Unit No. 4 wells exhibit very high primary decline rates; 50-60% per year in the first year is not unusual. The high decline rates could be due to natural fractures. Once the fracture volume has been depleted, well productivity would be controlled by the matrix permeability.

4. The Section 27 primary production forecast shown on Figure 7 was generated using a 20% per year production decline. Some wells in the Section 27 area have more pay than Well 8-34, so the average decline rate for all the wells should not be as severe. (See the net pay map on Figure 2 for a comparison of net pay.) Ultimate primary recovery from this forecast is 2% of OOIP. The entire Unit No. 4 area will have a similar ultimate primary recovery.

D. Waterflood Production Forecast

The waterflood production forecast was generated as follows:

1. Production data from Daly Unit Nos. 1 and 2 were reviewed to determine waterflood response and production rate decline. Both Units use 5 spot patterns with injectors drilled on 8 ha well spacing. In Unit No. 1, production rates increased an average of four times the production rate before water injection. The maximum productivity was obtained in one year. After the maximum response, the average decline rate is about 16% per year. In Unit No. 2, the productivity at the 1C-3 five-spot pattern increased 2.2 times. The maximum productivity was realized about 2 years after water injection started. After the maximum response, the production decline rate is about 7% per year. See Figures A1 and A3 for the production and injection data. Current recovery in the Unit No. 2 five-spot is 7% of OOIP.
2. The Section 27 waterflood production forecast was generated by increasing the production rate over 1.5 years to the initial capabilities of all the affected wells. This productivity increase is within the limits of the Unit No. 1 and 2 waterflood performance. The production rate was declined at 7% per year to determine the ultimate waterflood recovery.

3. Ultimate waterflood recovery from this production forecast for Section 27 is 11% of OOIP. Recovery from the entire Unit No. 4 area would be similar. This recovery is much lower than the ultimate recoveries of greater than 30% of OOIP expected in Daly Unit Nos. 1 and 3. (See Daly Unit No. 3 Application for Reduced Well Spacing dated 1986-02-04.) Waterflood recovery in the Unit No. 4 area will be lower because Unit No. 4 wells have higher initial water cuts and lower oil productivity than Unit Nos. 1 and 3 wells.

E. Expected Injection Rate

The expected injection rate for the Daly Unit No. 4 area injectors was based on the injection rate at Daly Unit Nos. 1 and 2 injectors. See Table A4. An injection rate of 2 500 m³/mo/well is expected at the Unit No. 4 injectors.

TABLE A1
Daly Lodgepole "A" Pool
Summary of Reservoir Parameters¹

<u>Area</u>	<u>\bar{k}</u> md	<u>$\bar{\phi}$</u> %	<u>\bar{h}^2</u> m
Unit 1	6	9.7	16.1
Unit 2	4	8.6	10.7 ³
Unit 3	6	10.0	16.0
Unit 4	3	13.4	8.3

¹This summary includes only those wells with core analysis. The wells used in each Unit are listed below:

<u>Unit #1</u>	<u>Unit #2</u>	<u>Unit #3</u>	<u>Unit #4</u>
4- 4-10-28	1C- 3-10-28	14- 1-10-28	11-25- 9-28
6- 4-10-28	16- 3-10-28	2-12-10-28	11-27- 9-28
11- 4-10-28		7-12-10-28	16-27- 9-28
12- 4-10-28		10-12-10-28	3-35- 9-28
7- 5-10-28			7-35- 9-28
15- 5-10-28			11-35- 9-28
			16-35- 9-28
			5-36- 9-28

²Net pay is calculated using a 1 md permeability cut-off.

³As there was only two wells with core data in Unit 2, the average net pay was estimated from core and log information.

1985-12-20

TABLE A2

Daly Lodgepole A Pool
Initial Productivity and WOR
After One Year

Daly Unit No. 1			Daly Unit No. 2			Daly Unit No. 3		
Well	Oil Rate m ³ /d	WOR	Well	Oil Rate m ³ /d	WOR	Well	Oil Rate m ³ /d	WOR
13- 3-10-28	8	.03	1-3-10-28	.8	no	15- 1-10-28	7	.002
3- 4	10	.10	2-3	2.0	data	1-11	10	.04
4- 4	10	.18	7-3	2.5		2-11	3	.30
5- 4	27	.10	8-3	1.0		3-11	7	.04
6- 4	15	.10				4-11	7	.05
11- 4-	8	.14				5-11	7	-
12- 4	17	.09				7-11	7	.04
13- 4	17	.04				8-11	7	.10
14- 4	13	.01				9-11	5	.06
16- 4	13	.14				11-11	3	3
1- 5	20	.10				13-11	13	.10
2- 5	13	0				15-11	7	.50
7- 5	13	.10				1-12	10	.07
8- 5	20	0				2-12	10	.03
9- 5	17	.20				3-12	18	.04
10- 5	13	.10				4-12	20	.02
16- 5	7	.10				5-12	10	.02
1- 8	7	3				6-12	7	.02
1- 9	6	.07				7-12	7	.06
2- 9	13	.04				9-12	5	.03
3- 9	10	.2				10-12	3	.04
4- 9	3	0				11-12	7	.04
4-10	8	.07				12-12	5	.03
						13-12	7	.03
						15-12	7	.2
Average	13	.09		1.6			8	.08

1986-03-27

TABLE A3
DALY LODGEPOLE 'A' POOL
UNIT #4 INITIAL OIL RATE

TRACT	ON PRODUCTION DATE	CONSECUTIVE PRODUCING PERIOD	TIME ON DAYS	OIL PROD m3	OIL RATE m3/d
02-25-09-28-W1	1985-12	01-01 TO 01-31	31	59.0	1.9
03-25-09-28-W1	1985-09	09-13 TO 09-30	18	37.3	2.1
06-25-09-28-W1	1984-12	02-01 TO 02-29	27	201.4	7.5
07-25-09-28-W1	1985-10	10-11 TO 10-31	21	47.4	2.3
10-25-09-28-W1	1986-02	02-13 TO 02-28	14	67.6	4.8
11-25-09-28-W1	1984-06	07-01 TO 06-31	30	19.5	0.7
12-25-09-28-W1	1985-12	12-03 TO 12-31	28	36.6	1.3
13-25-09-28-W1	1984-06	08-12 TO 08-31	20	32.2	1.6
09-26-09-28-W1	1984-09	10-01 TO 10-30	30	100.1	3.3
10-26-09-28-W1	1985-10	12-01 TO 12-31	30	20.3	0.7
15-26-09-28-W1	1984-08	09-01 TO 09-30	30	179.9	6.0
16-26-09-28-W1	1984-01	02-01 TO 02-29	28	95.8	3.4
07-27-09-28-W1	1985-12	12-19 TO 01-11	24	5.0	0.2
08-27-09-28-W1	1984-08	11-01 TO 11-27	27	33.6	1.2
09-27-09-28-W1	1984-09	11-01 TO 11-30	30	92.7	3.1
10-27-09-28-W1	1985-05	07-02 TO 07-31	29	13.5	0.5
11-27-09-28-W1	1984-02	05-03 TO 05-31	26	28.4	1.1
14-27-09-28-W1	1985-08	10-07 TO 10-31	24	35.6	1.5
15-27-09-28-W1	1984-10	02-01 TO 02-28	25	267.7	10.7
16-27-09-28-W1	1984-07	10-01 TO 10-31	31	206.7	6.7
01-34-09-28-W1	1985-10	11-06 TO 11-30	25	56.5	2.3
02-34-09-28-W1	1985-10	10-03 TO 10-31	28	142.8	5.1
07-34-09-28-W1	1985-02	02-04 TO 02-28	21	144.7	6.9
08-34-09-28-W1	1963	1963			2.6
09-34-09-28-W1	1985-08	10-05 TO 10-31	25	59.4	2.4
01-35-09-28-W1	1984-08	09-04 TO 09-30	27	50.1	1.9
02-35-09-28-W1	1984-08	09-01 TO 09-30	30	58.7	2.0
03-35-09-28-W1	1984-08	09-01 TO 09-30	30	92.7	3.1
04-35-09-28-W1	1984-08	09-01 TO 09-30	29	68.4	2.4
05-35-09-28-W1	1985-01	02-01 TO 02-28	27	58.4	2.2
06-35-09-28-W1	1984-01	03-01 TO 03-25	25	196.8	7.9
07-35-09-28-W1	1983-11	02-01 TO 02-29	29	29.3	1.0
08-35-09-28-W1	1984-08	09-01 TO 09-30	30	58.3	1.9
09-35-09-28-W1	1984-09	10-01 TO 10-31	30	55.4	1.8
10-35-09-28-W1	1984-07	09-02 TO 09-30	28	86.3	3.1
11-35-09-28-W1	1984-08	09-01 TO 09-30	30	30.1	1.0
12-35-09-28-W1	1985-03	05-01 TO 05-31	29	5.1	0.2
13-35-09-28-W1	1984-06	09-01 TO 09-30	29	84.1	2.9
14-35-09-28-W1	1984-01	05-04 TO 05-31	28	134.5	4.8
15-35-09-28-W1	1984-06	09-02 TO 09-30	29	109.3	3.8
16-35-09-28-W1	1983-11	01-02 TO 01-31	30	131.1	4.4
05-36-09-28-W1	1983-12	02-01 TO 02-29	29	30.3	1.0
11-36-09-29-W1	1984-05	06-01 TO 06-30	30	27.4	0.9
12-36-09-28-W1	1986-02	02-09 TO 02-28	17	75.2	4.4
13-36-09-28-W1	1984-01	02-01 TO 02-29	29	32.6	1.1
04-01-10-28-W1	1984-12	03-01 TO 03-31	31	78.9	2.5
01-02-10-28-W1	1984-06	07-01 TO 07-31	29	251.3	8.7
02-02-10-28-W1	1984-07	09-01 TO 09-30	30	302.0	10.1
03-02-10-28-W1	1984-05	06-01 TO 06-27	26	102.2	3.9
04-02-10-28-W1	1984-09	10-01 TO 10-31	31	43.7	1.4

AVERAGE

3.2

Table A4

1986-03-11

DALY LODGEPOLE "A" POOL INJECTIVITYUnit No. 1 Injectors

<u>Injector</u>	<u>Injection Rate</u> <u>m³/mon</u>	<u>Net Pay</u> <u>m</u>
13-3	4 500	6
13-4	2 500	10
14-4	3 500	10
15-4	4 000	10
Average	3 600	

Unit No. 2 Injectors

1C-3	2 500	10
------	-------	----

Unit No. 3 Injectors

10-11	2 000	7
14-11	1 000	>10

FIGURE A 1

DALY UNIT NO. 2 WATERFLOOD
SUMMARY 2-3-10-28WI, 7-3, 8-3

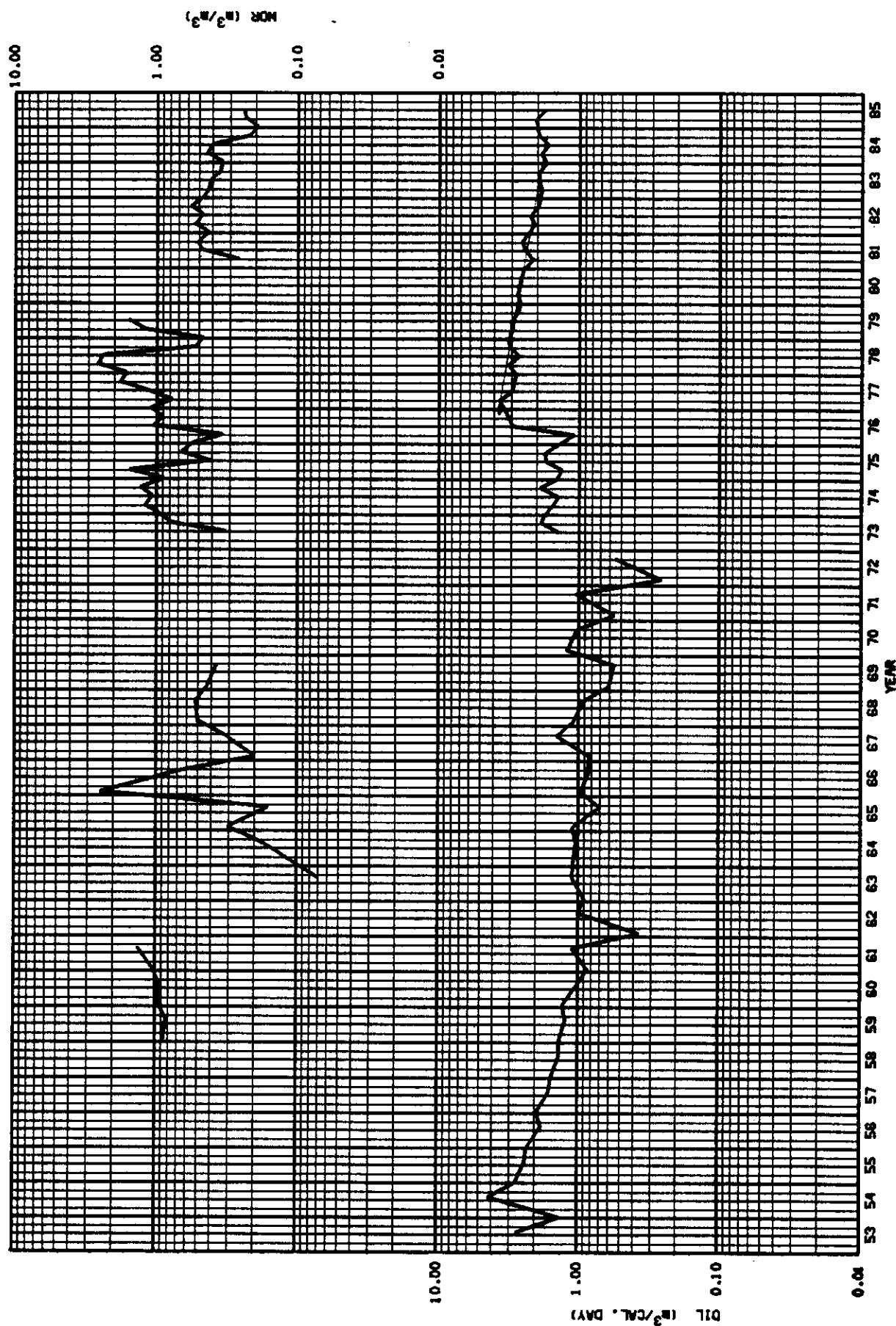


FIGURE A2

CONSOLIDATED DALY 8-34-9-28 W1

PRODUCTION HISTORY

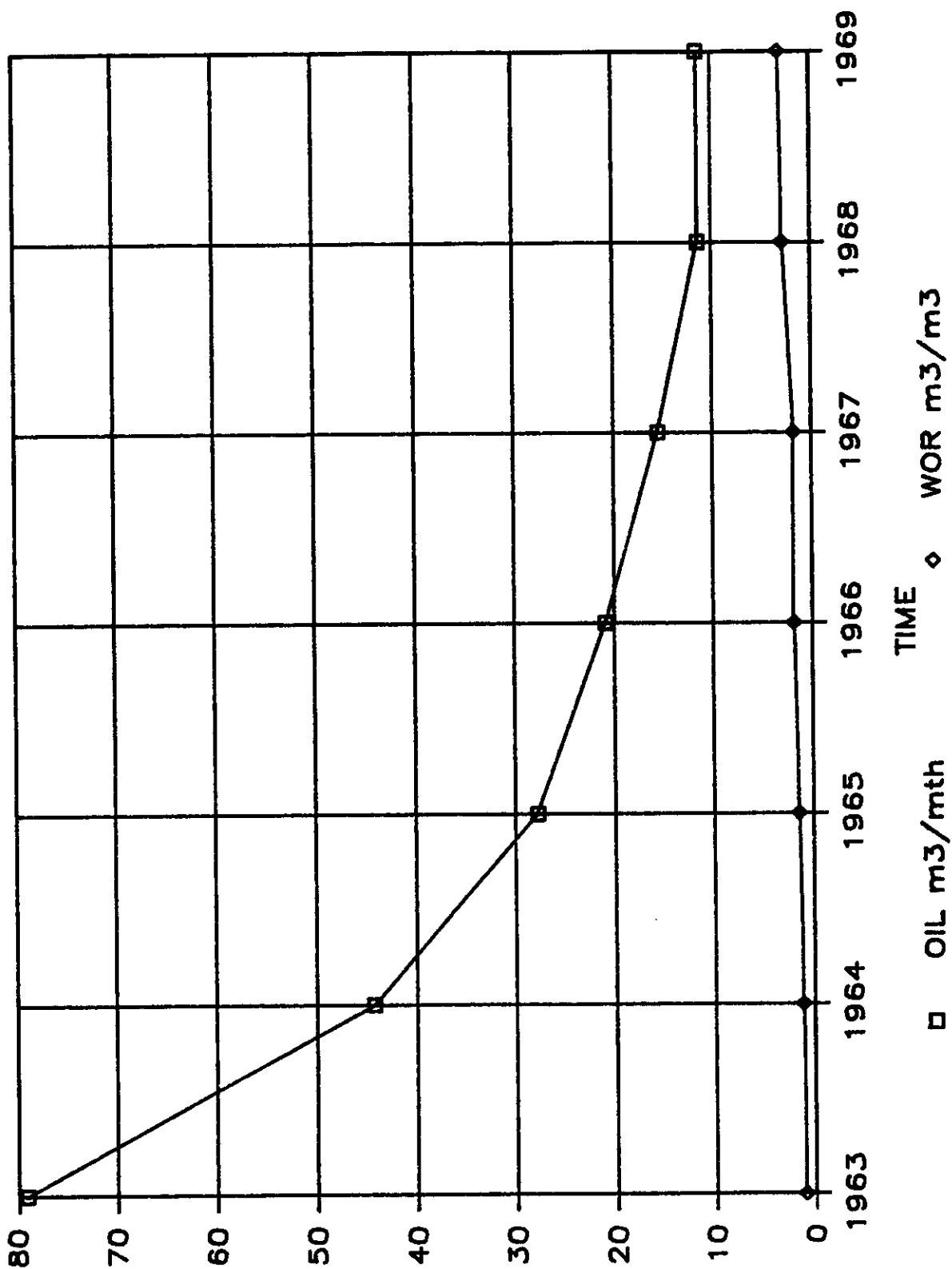
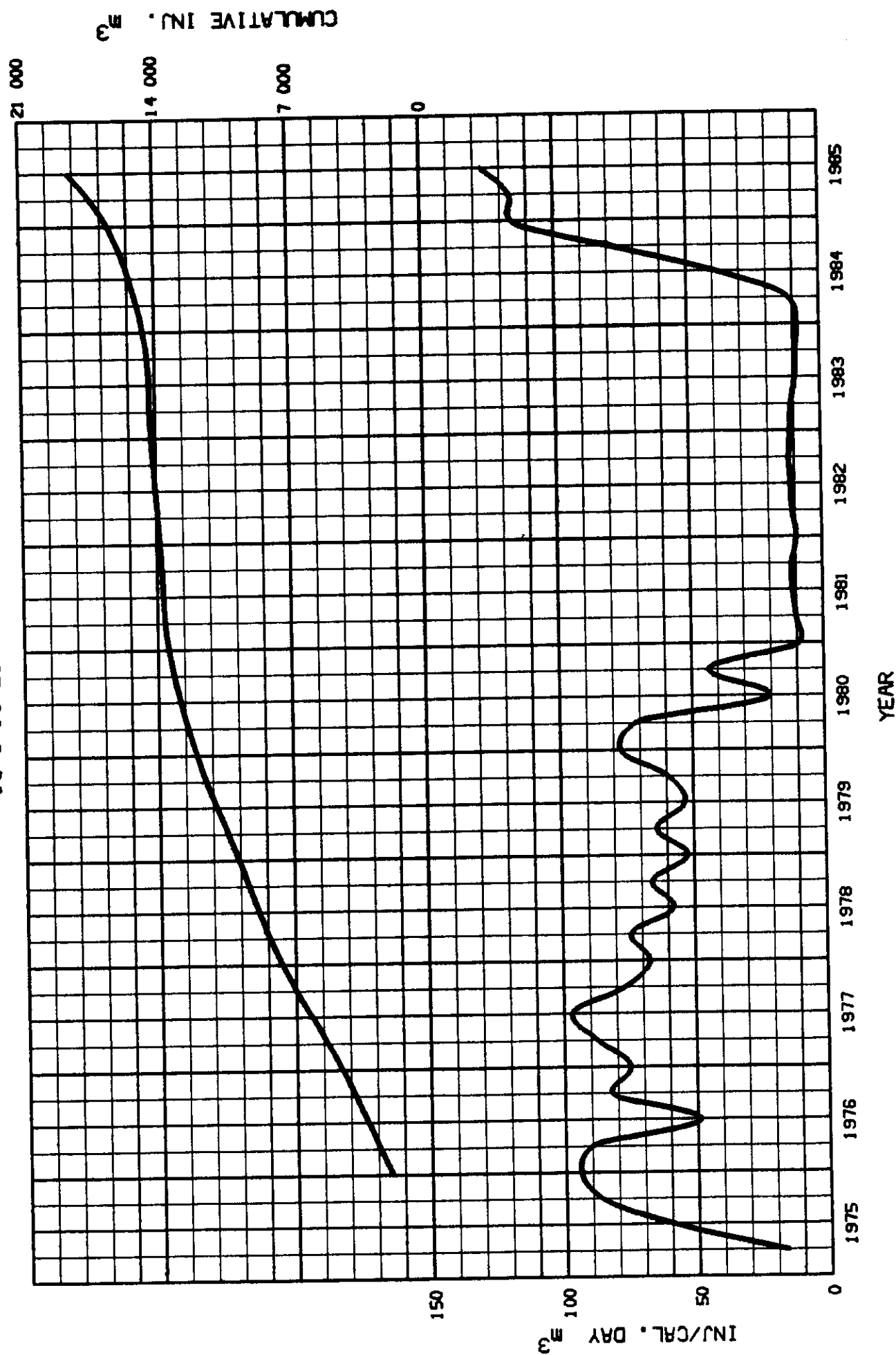


FIGURE A3

DAILY UNIT 2 WATERFLOOD

1C-3-10-28 W1



APPENDIX B

ACC. NO. SC 090650/00
FILE ADDR: PROD CD
00201 DALY
TECHNICAL INFORMATION SERVICES

CALIFORNIA RESEARCH CORPORATION
La Habra, California

RESERVOIR FLUID STUDY
DALY WELL 6-10

PROJECT 8211

RECORDS CENTRE
FILE COPY

H. S. Yaplee
September 11, 1953

CALIFORNIA RESEARCH CORPORATION
La Habra, California

RESERVOIR FLUID STUDY
DALY WELL 6-10

File 568.22
Project 8211
September 11, 1953

This report presents the results of a reservoir fluid study made on a bottom-hole fluid sample from Daly Well 6-10. The study was requested in Mr. C. D. Mims' letter of June 11, 1953, to Mr. E. G. Gaylord.

Data were determined for the following information:

1. Pressure-volume relations at a reservoir temperature of 79°F
2. Differential gas liberation data at 79°F
3. Single-stage flash vaporization data at separator conditions of 0 psig and 45°F
4. Viscosity of liquid phase at reservoir temperature.

These data are presented in the attached tables and figures.

A considerable quantity of wax or asphalt precipitation with a melting point of approximately 115°F was found in the samples. Because of this, it was necessary to measure the liquid phase viscosities at 120°F and 150°F and then obtain the liquid viscosities at reservoir temperature by extrapolating the data to 79°F. Only undersaturated liquid viscosities could be obtained. These are given in Table 7.

H. S. YAPLEE

Tables 1 through 7
Figures 1 through 3 (LE-6517-19)



RESERVOIR FLUID STUDY

DALY WELL 6-10

TABLE 1

SUMMARY OF GENERAL DATA

Bubble Point Pressure: 436 psia at 79°F

Coefficient of compressibility at reservoir
temperature of 79°F, $-\frac{1}{V} \left[\frac{\partial V}{\partial P} \right]_T$:

<u>Pressure, psia</u>	<u>Coefficient, vol per vol per psi</u>
Bubble point	6.3 (10 ⁻⁶)
1600	6.3

RESERVOIR FLUID STUDY

DALY WELL 6-10

TABLE 2

PRESSURE-VOLUME RELATIONSHIP AT 79°F - EXPERIMENTAL DATA

Bubble Point Pressure: 436 psia

Pressure psia	Relative Volume Factor Bubble Point Volume = 1.0 Gas + Liquid	$\left[\frac{P_s - P}{P} \right]^Y$	$\left[\frac{1}{\frac{V}{V_s} - 1} \right]$	Per Cent Liquid
2008	0.9907			
1652	0.9919			
1308	0.9944			
961	0.9970			
604	0.9991			
420	1.0060	6.3420		
413	1.0075	7.3958		
369	1.0207	8.7729		
323	1.0486	7.2020		
298	1.0672	6.8903		
233	1.1288	6.7640		88.07
149	1.3692	5.2172		72.26
100	1.7960	4.2211		54.89
78	2.3379	3.4305		41.93
55	3.2666	3.0562		29.89

RESERVOIR FLUID STUDY

DALY WELL 6-10

TABLE 3

PRESSURE-VOLUME RELATIONSHIP AT 79°F - SMOOTHED DATA*

Bubble Point Pressure: 436 psia

<u>Pressure</u> <u>psia</u>	Relative Volume Factor, Bubble Point Volume = 1.0	
	<u>Gas + Liquid</u>	<u>Liquid</u>
1600		0.9926
1400		0.9939
1200		0.9952
1000		0.9964
800		0.9977
600		0.9989
400	1.0122	0.999
350	1.0338	0.998
300	1.0636	0.997
250	1.1080	0.995
200	1.1858	0.993
150	1.3636	0.990
100	1.8215	0.984
50	3.6294	0.975

*By application of "Y" curve:
$$Y = \left[\frac{P_s - P}{P} \right] \left[\frac{1}{\frac{V}{V_s} - 1} \right]$$

RESERVOIR FLUID STUDY

DALY WELL 6-10

TABLE 4

DIFFERENTIAL GAS LIBERATION AT 79°F - EXPERIMENTAL DATA

Bubble Point Pressure: 436 psia at 79°F

Relative Volume: 1.0746 bbl per bbl*

Pressure Range psia	Volume cfb*	Liberated Gas		Relative Volume of Saturated Oil at Lower Pressure bbl per bbl*
		Specific Gravity (Air=1.0)	Compressibility Factor at Lower Pressure $Z = PV/NRT$	
436-334	6	0.966	0.892	1.0737
334-248	7	0.982	0.910	1.0727
248-123	17	1.025	0.945	1.0650
123-63	20	1.130	0.969	1.0511
63-14.7	<u>72</u>	1.475	-	1.0083

*Basis: Residual oil volume at 14.7 psia and 60°F = 1.0

RESERVOIR FLUID STUDY

DALY WELL 6-10

TABLE 5

SUMMARY OF DIFFERENTIAL GAS LIBERATION TEST AT 79°F

Bubble point pressure, psia	436
Volume of gas liberated between saturation and atmospheric pressure, cu ft per bbl residual oil at 14.7 psia and 60°F	122
Relative volume of residual oil at 60°F, bbl per bbl saturated oil at 436 psia and 79°F	0.9306
Gravity of residual oil, °API	30.5
Density of saturated oil at 436 psia and 79°F, gm per cc	0.845
Average specific gravity of all gas liberated (Air = 1.0)	1.300

RESERVOIR FLUID ANALYSIS

DALY WELL 6-10

TABLE 6

SINGLE-STAGE SEPARATOR TEST AT 45°F

Tank Pressure: 0 psig

Total Gas-Tank Oil Ratio, cfb	137
Gas Gravity (Air = 1.0)	1.315
Tank Oil Gravity, °API	27.5
Formation Volume Factor bbl reservoir oil per bbl tank oil at 14.7 psia and 60°F	1.100

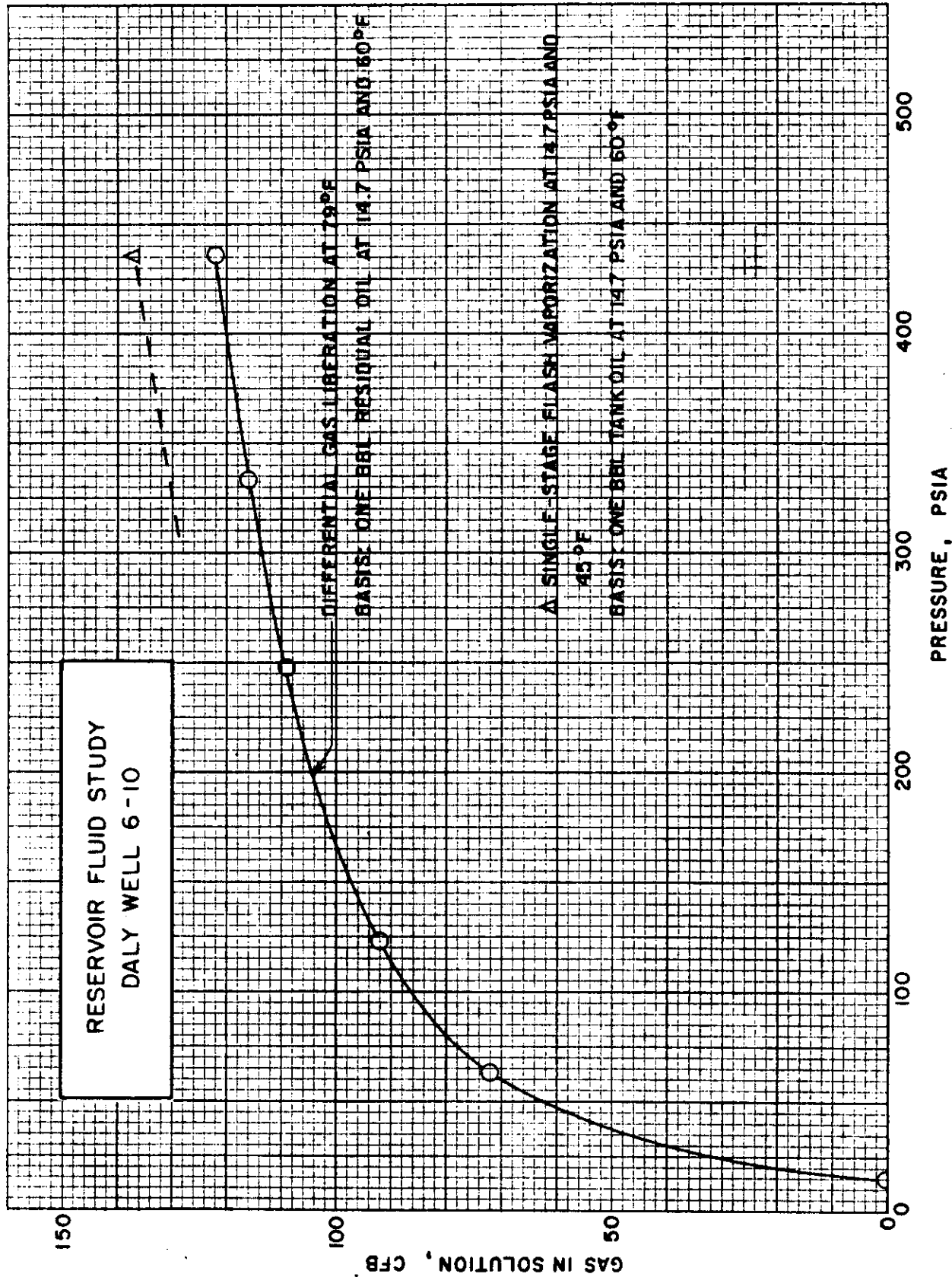
RESERVOIR FLUID STUDY
DALY WELL 6-10

TABLE 7

VISCOSITY OF LIQUID PHASE AS FUNCTION OF PRESSURE

Temperature: 79°F

<u>Pressure</u> <u>psia</u>	<u>Viscosity</u> <u>cp</u>
1600	3.75
1400	3.68
1200	3.61
1000	3.54
800	3.47
600	3.40
500	3.36
Bubble Point Pressure	3.34



CALIFORNIA RESEARCH CORPORATION	
OIL FIELD RESEARCH DIVISION	
LA HABRA LABORATORY	
DRAWN BY	DATE 9-9-53
ENG'R: <i>[Signature]</i>	PROJ. 6211
LE 6517	

FIGURE 1
GAS IN SOLUTION VS PRESSURE

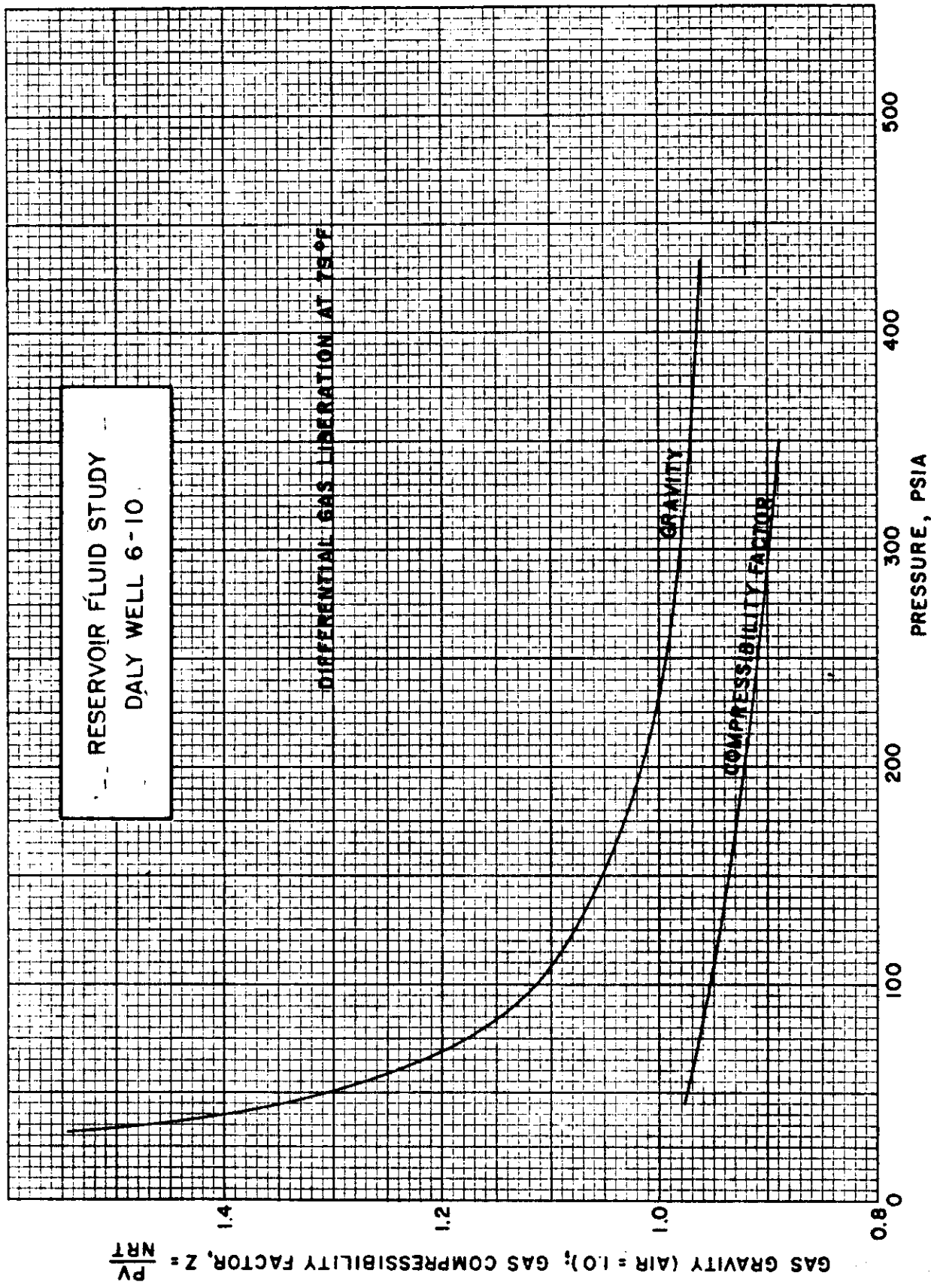


FIGURE 3
GAS GRAVITY AND COMPRESSIBILITY FACTOR
VS PRESSURE

CALIFORNIA RESEARCH CORPORATION OIL FIELD RESEARCH DIVISION LA HABRA LABORATORY	
DRAWN BY: 85 ENG. R. 1/54	DATE: 9-9-63 PROJ. 8211
LE 6519	



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

NOTICE

UNDER THE MINES ACT

Chevron Canada Resources Limited, Operator of the proposed Daly Unit No. 4, has made application for approval to conduct pressure maintenance by waterflooding operations in the proposed Unit area.

It is proposed to drill four injection wells and to convert one well from a salt water disposal well to a water injection well. The area of the proposed Unit and the location of the proposed water injection wells is shown on the following map. The proposal is a pilot project and if it is technically successful, development of the entire proposed Unit area on a similar basis could result.

If no intervention or objection in writing is received by the Board at Room 309, Legislative Building, Winnipeg, Manitoba, R3C 0V8, within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application can be obtained from Chevron Canada Resources Limited - Information Centre, 500 - 5th Avenue S.W., Calgary, Alberta T2P 0L7 (phone (403) 234-5000) or can be viewed at the offices of the Petroleum Branch, 555 - 330 Graham Avenue, Winnipeg, Manitoba R3C 4E3 (phone (204) 945-6577).

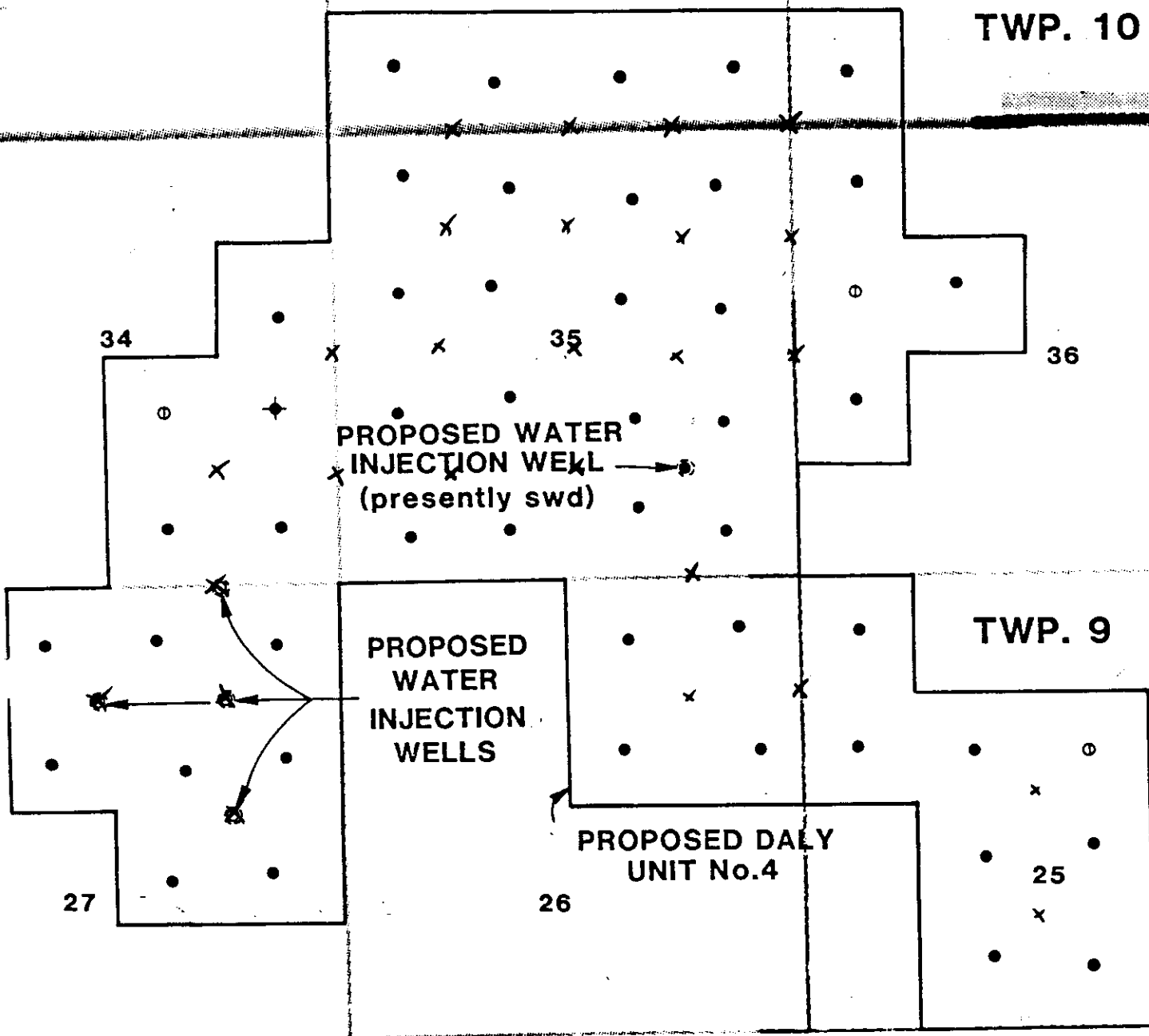
DATED at Winnipeg this 21st day of April, 1986.

A handwritten signature in black ink, appearing to read "Charles S. Kang".

Charles S. Kang
Chairman

R28 WPM

TWP. 10



LEGEND

- ⊙ Standing
- Producer
- ⊕ Abandoned Producer

Devo's Shell Service, Walker's TV and Audio, and the Manitoba Government Employees' Association.

NOTICE OF HEARING

A Public Hearing will be held in the Virden Elks Hall, 227 - 3rd Avenue South, Virden, Manitoba on August 7, 1986 commencing at 9:00 a.m. official time for the purpose of hearing representations with respect to:

1. An application by Chevron Canada Resources Limited, as Unit Operator of Daly Unit No. 3, to decrease the size of drilling spacing units within the Unit area from 16 hectares (40 acres) to 8 hectares (20 acres).
2. An application by Chevron Canada Resources Limited, as Operator of the proposed Daly Unit No. 4, for approval of a pressure maintenance by waterflooding project in the said proposed Unit.

Copies of the above applications may be obtained from Chevron Canada Resources Limited - Information Centre, 500 - 5th Avenue S.W., Calgary, Alberta, T2P 0L7 (Phone: (403) 234-5000) or may be viewed at the offices of the Petroleum Branch of the Department of Energy and Mines at 247 Wellington Street West, Virden, Manitoba or 555 - 330 Graham Avenue, Winnipeg, Manitoba.

Anyone wishing to make a submission shall, prior to July 31, 1986 advise the Board that they plan to attend to make a submission, and provide to the Board, at its address set out below, six copies of the submission or an outline of the points to be presented in its submission at the hearing. Submissions or outlines may be viewed after July 31, 1986 at the offices of the Petroleum Branch, Department of Energy and Mines at 247 Wellington Street West, Virden, Manitoba.

Every person who makes a submission to the Board shall be present at the hearing or shall be represented by a person at the hearing with the knowledge and authority to speak on the matter and to explain the contents of the submission and answer questions.

Submissions or outlines should be sent to:

The Oil and Natural Gas Conservation Board
Room 309, Legislative Building
Winnipeg, Manitoba
R3C 0V8

CHARLES S. KANG
Chairman

Dated at Winnipeg, Manitoba
this 6th day of June, 1986.



Kent's,
10 kg

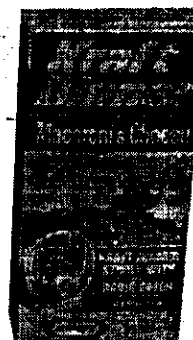
Prairie Dawn Flour

439

Macaroni & Cheese Dinner

Kraft,
225 g

55¢



Apple Juice

Sun-Rype,

White Label, 1 L

89¢

Sifto,
1 kg.

MEAT COUNTER

"Bulk" Smokies

179 394

Maple Leaf Lb.

kg

Bacon

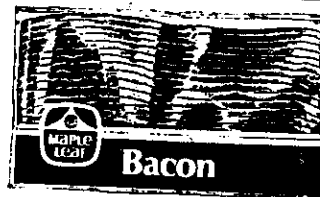
Maple Leaf, Reg.,

Thick Slice or

Hint of Maple,

500 g

259



MAPLE LEAF ... TODAY'S WISE CHOICE!

Cooked Ham

Maple Leaf, 175 g

169

Salami

Maple Leaf, For Slicing

179 394

Bung Bologna

Maple Leaf

169

Bologna

Maple Leaf, Regular, All Beef or Thick Slice, 500 g

219

Peaches

Fresh,
U.S. Grown,
80s

White Potatoes

New, Canada No. 1, U.S. G

Green Onions

California Grown, Canada

Cello Radishes

U.S. Grown, Canada No. 1

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- Parties
- Fishing
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- Socials
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Virden Empire Advance June 18/86



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

NOTICE OF HEARING

(204) 945-3130

A Public Hearing will be held in the Virden Elks Hall, 227 - 3rd Avenue South, Virden, Manitoba on August 7th, 1986 commencing at 9:00 A.M. official time for the purpose of hearing representations with respect to:

1. An application by Chevron Canada Resources Limited, as Unit Operator of Daly Unit No. 3, to decrease the size of drilling spacing units within the Unit area from 16 hectares (40 acres) to 8 hectares (20 acres).
2. An application by Chevron Canada Resources Limited, as Operator of the proposed Daly Unit No. 4, for approval of a pressure maintenance by waterflooding project in the said proposed Unit.

Copies of the above applications may be obtained from Chevron Canada Resources Limited - Information Centre, 500 - 5th Avenue S.W., Calgary, Alberta, T2P 0L7 (Ph.: (403) 234-5000) or may be viewed at the offices of the Petroleum Branch of the Department of Energy and Mines at 247 Wellington Street West, Virden, Manitoba or 555 - 330 Graham Avenue, Winnipeg, Manitoba.

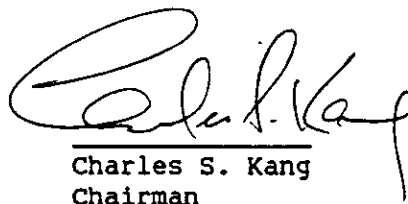
Anyone wishing to make a submission shall, prior to July 31, 1986 advise the Board that they plan to attend to make a submission, and provide to the Board, at its address set out below, six copies of the submission or an outline of the points to be presented in its submission at the hearing. Submissions or outlines may be viewed after July 31, 1986 at the offices of the Petroleum Branch, Department of Energy and Mines at 247 Wellington Street West, Virden, Manitoba.

Every person who makes a submission to the Board shall be present at the hearing or shall be represented by a person at the hearing with the knowledge and authority to speak on the matter and to explain the contents of the submission and answer questions.

Submissions or outlines should be sent to:

The Oil and Natural Gas Conservation Board
Rm. 309 Legislative Building
Winnipeg, Manitoba
R3C 0V8

Dated at Winnipeg, Manitoba
this 6th day of June, 1986



Charles S. Kang
Chairman



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

July 9, 1986

Don Heritage
Box 1047
Virden, Manitoba
R0M 2C0

Dear Mr. Heritage:

Re: Enhanced Recovery by Waterflood
Proposed Daly Unit No. 4

Enclosed for your information is an amendment to Chevron's application dated March 31, 1986 for approval of pressure maintenance operations in the proposed Daly Unit No. 4. The amended application will be considered at The Oil and Natural Gas Conservation Board public hearing on August 7, 1986.

Yours sincerely,

[Signature]
JUL 10 1986

Charles S. Kang
Chairman

LBD/1k

b.c. Wm. McDonald
B. Ball
Petroleum Branch



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

July 9, 1986

I. A. Williams
Box 192
Virden, Manitoba
R0M 2C0

Dear Mr. Williams:

Re: Enhanced Recovery by Waterflood
Proposed Daly Unit No. 4

Enclosed for your information is an amendment to Chevron's application dated March 31, 1986 for approval of pressure maintenance operations in the proposed Daly Unit No. 4. The amended application will be considered at The Oil and Natural Gas Conservation Board public hearing on August 7, 1986.

Yours sincerely,

[Handwritten signature]
JUL 11 1986 P 1003

Charles S. Kang
Chairman

LRD/lk

b.c. Wm. McDonald
B. Ball
Petroleum Branch



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

July 9, 1986

Mrs. K. A. Angell
Box 430
Virden, Manitoba
R0M 2C0

Dear Mrs. Angell:

Re: Enhanced Recovery by Waterflood
Proposed Daly Unit No. 4

Enclosed for your information is an amendment to Chevron's application dated March 31, 1986 for approval of pressure maintenance operations in the proposed Daly Unit No. 4. The amended application will be considered at The Oil and Natural Gas Conservation Board public hearing on August 7, 1986.

Yours sincerely,

[Handwritten signature]
W. S. Kang

Charles S. Kang
Chairman

LRD/lk

b.c. Wm. McDonald
B. Ball
Petroleum Branch



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

July 9, 1986

Manitoba Surface Rights Association
Box 182
Waskada, Manitoba
R0M 2E0

Dear Sirs:

Re: Enhanced Recovery by Waterflood
Proposed Daly Unit No. 4

Enclosed for your information is an amendment to Chevron's application dated March 31, 1986 for approval of pressure maintenance operations in the proposed Daly Unit No. 4. The amended application will be considered at The Oil and Natural Gas Conservation Board public hearing on August 7, 1986.

Yours sincerely,

A handwritten signature in dark ink, appearing to read "Charles S. Kang".

Charles S. Kang
Chairman

LRD/lk

b.c. Wm. McDonald
B. Ball
Petroleum Branch



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

July 9, 1986

Chevron Canada Resources Limited
500 - 5th Avenue S.W.
Calgary, Alberta
T2P 0L7

Attention: Mr. D. Schierman

Dear Sirs:

Re: Enhanced Recovery by Waterflood
Proposed Daly Unit No. 4

Your letter of June 26, 1986 regarding the subject application is acknowledged and noted. As scheduled, the revised application will be considered at a hearing of The Oil and Natural Gas Conservation Board on August 7, 1986.

Yours sincerely,

ORIGINAL SIGNED BY
WM. M. McDONALD, P. ENG.

Charles S. Kang
Chairman

LRD/lk

b.c. Wm. McDonald
B. Ball
Petroleum Branch

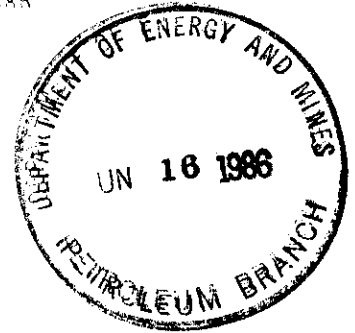


The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

JUN 16 1986



Mr. I.A. Williams
Box 192
VIRDEN, MB ROM 2C0

Re: Daly Unit No. 4 - Pressure Maintenance Project

Dear Mr. Williams:

Your letter of May 2, 1986 regarding the subject application is acknowledged.

The application will be considered at a public hearing to be held August 7, 1986 at the Elk's Hall in Virden. A copy of the Notice of Hearing is enclosed for your information.

The Board has requested that Chevron critically examine alternatives to conventional drilling as a means of developing the Unit area on 8 hectare (20 acre) spacing and that it be prepared to review its findings at the hearing.

Sincerely yours,

ORIGINAL SIGNED BY
CHARLES S. KANG

Charles S. Kang
Chairman

LRD/HCM:dah

bc: Wm. McDonald
B. Ball
Petroleum

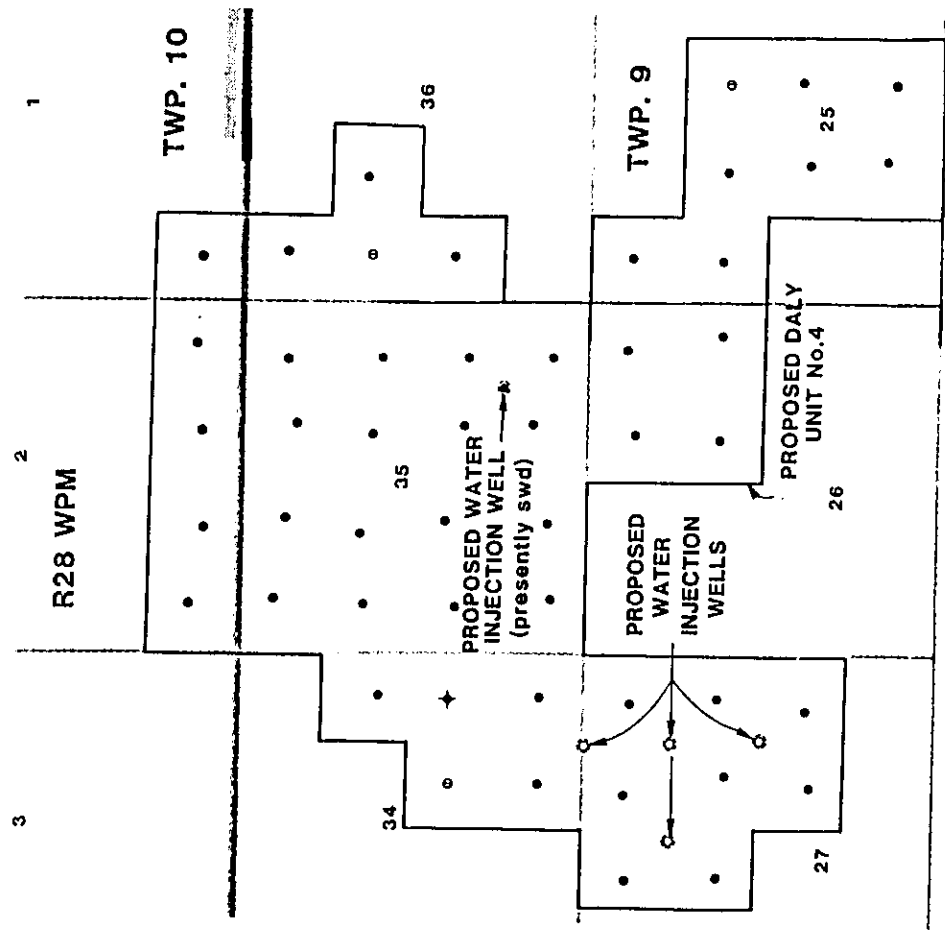
LM - 25794081

shown on the following map. The proposal is a pilot project and if it is technically successful, development of the entire proposed Unit area on a similar basis could result. If no intervention or objection in writing is received by the Board at Room 309, Legislative Building, Winnipeg, Manitoba, R3C 0V8, within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application can be obtained —18

CHARLES S. KANG,
Chairman.

—18



LEGEND

- Standing
- Producer
- ⊙ Abandoned Producer

Strip 25, Range 19 West of the Principal Meridian in the R.M. of Dauphin.

L.A. 129-86 — 1000 Foot Control Circle — P.T.H. Nos. 5, 5A and 10 — R.M. of Dauphin

Consideration to be given to the establishment of a 1000 foot control circle at the intersection of Provincial Trunk Highway Nos. 5, 5A and 10 on the south end of the Town of Dauphin situated in the West Half of Section 34, Township 24, Range 19 West of the Principal Meridian and the East Half of Section 33, Township 24, Range 19 West of the Principal Meridian in the R.M. of Dauphin.

L.A. 130-86 — Removal — 1000 Foot Control Circle and 250 Foot Control Line — P.T.H. No. 5A and Government Road Allowance — R.M. of Dauphin and Town of Dauphin

Consideration to be given for the removal of the 1000 foot control circle situated at the intersection of Provincial Trunk Highway No. 5A and the Government Road Allowance in the N.E. 1/4 of Section 33, Township 24, Range 19 West of the Principal Meridian, the N.W. 1/4 of Section 34, Township 24, Range 19 West of the Principal Meridian, the S.E. 1/4 of Section 4, Township 25, Range 19 West of the Principal Meridian and the S.W. 1/4 of Section 3, Township 25, Range 19 West of the Principal Meridian and the 250 foot control line situated adjacent to a portion of the Government Road Allowance in the South Half of Section 4, Township 25, Range 19, West of the Principal Meridian and the North Half of Section 33, Township 24, Range 19 West of the Principal Meridian in the R.M. of Dauphin and the Town of Dauphin.

The Highway Traffic Board will be prepared to consider any submissions regarding the above applications at this hearing. Any persons wishing to make a submission should either contact the Secretary at the hearing or forward their written submission in advance to: A. Poltaruk, Secretary, The Highway Traffic Board, Room 206-301 Weston Street, Winnipeg, Manitoba, R3E 3H4.

Phone: 945-8912

A. POLTARUK, MMM CD
Secretary,
—18 THE HIGHWAY TRAFFIC BOARD.

04-86 — Minitonas Chamber of Commerce — P.T.H. No. 10 — R.M. of Minitonas

Application by the Minitonas Chamber of Commerce for a permit for a Sign adjacent to P.T.H. No. 10, N.E. 1/4, Section 13-36-26 West, R.M. of Minitonas.

06-86 — Bartley's Department Store — H.H. No. 1 — R.M. of Wallace

Application by Bartley's Department Store for a permit for a Sign adjacent to H.H. No. 1, N.W. 1/4, Section 4-12-28 West, M. of Wallace.

08-86 — Bartley's Department Store — H.H. No. 1 — R.M. of Wallace

Application by Bartley's Department Store for a permit for a Sign adjacent to H.H. No. 1, N.E. 1/4, Section 26-12-28 West, M. of Wallace.

The Highway Traffic Board will be prepared to consider any submissions regarding the above applications at this hearing. Any persons wishing to make a submission should either contact the Secretary at the hearing or forward their written submission in advance to: A. Poltaruk, Secretary, Highway Traffic Board, Room 206-301 Weston Street, Winnipeg, Manitoba, R3E 3H4.

Phone: 945-8912

A. POLTARUK, MMM CD
Secretary,
THE HIGHWAY TRAFFIC BOARD.

THE HIGHWAY TRAFFIC BOARD

Notice is hereby given that a hearing of Highway Traffic Board will be held on Tuesday, June 5, 1986 at 10:00 A.M. in the 4th Floor Board Room, Dauphin Provincial Building, 27-2nd Avenue S.W., Dauphin, Manitoba.

Control Areas — Part III — Section 15

A. 128-86 — 250 Foot Control Area — Dauphin By-Pass — P.T.H. No. 5 and 10 — R.M. of Dauphin

Consideration to be given to the establishment of a 250 foot control line adjacent to Provincial Trunk Highway No. 5 and 10 commonly known as the Dauphin By-Pass portion situated in Section 33, Township 24, Range 19 West of the Principal

UNDER THE MINES ACT

It is proposed to drill four injection wells and to convert one well from a salt water disposal well to a water injection well. The area of the proposed Unit and the location of the proposed water injection wells is

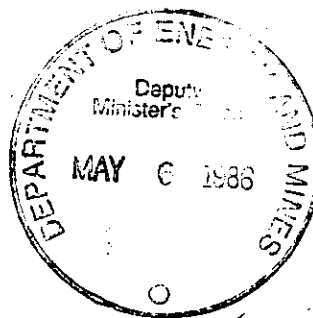
MANITOBA GAZETTE
MAY 3, 1986

Under Man
May 2/86

Oil & Natural Gas
Conservation Board
c/o Charles Kory.

Re Notice for reduced spacing in
Daly Unit #4
& Object to this proposal.

Luan R Williams
Box 192
Under Man



bad weather.

On April 18, we had a lovely chicken supper, and the members would like to extend appreciation to those who arranged it, as well as those who served and donated the lovely desserts.

Our Friday evening sessions will terminate at the end of April, but our usual Monday, Wednesday and Friday afternoon sessions will go on as usual, and every senior citizen is welcome.

Arthritis is anybody's illness.

THE ARTHRITIS SOCIETY If it hurts, see your doctor. He can help.

NOTICE

UNDER THE MINES ACT

Chevron Canada Resources Limited, Operator of the proposed Daly Unit No. 4, has made application for approval to conduct pressure maintenance by waterflooding operations in the proposed Unit area.

It is proposed to drill four injection wells and to convert one well from a salt water disposal well to a water injection well. The area of the proposed Unit and the location of the proposed water injection wells is shown on the following map. The proposal is a pilot project and if it is technically successful, development of the entire proposed Unit area on a similar basis could result.

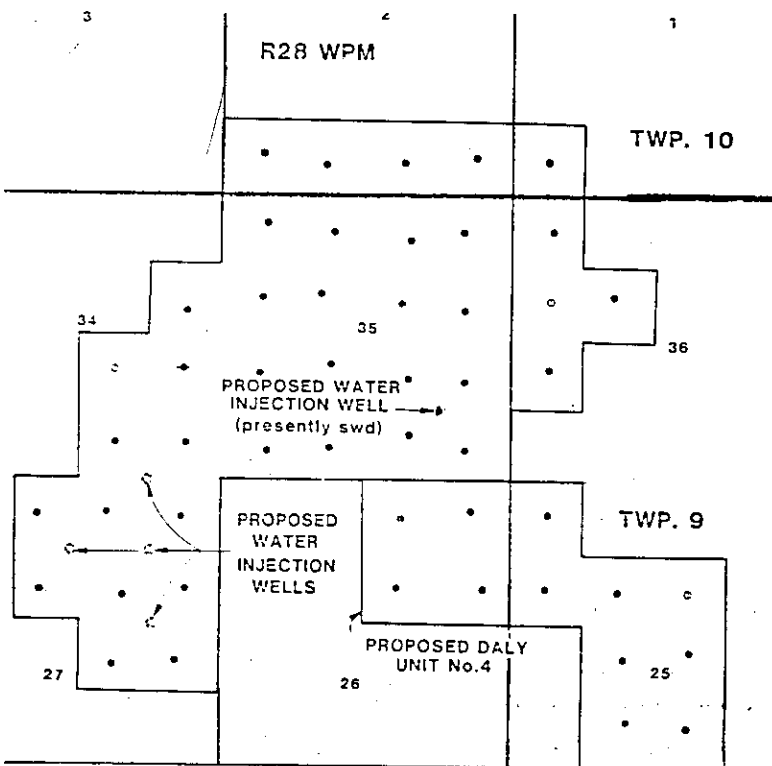
If no intervention or objection in writing is received by the Board at

Room 309, Legislative Building, Winnipeg, Manitoba, R3C 0V8, within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application can be obtained from Chevron Canada Resources Limited - Information Centre, 500 - 5th Avenue S.W., Calgary, Alberta, T2P 0L7 (phone (403) 234-5000) or can be viewed at the offices of the Petroleum Branch, 555 - 330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3 (phone (204) 945-6577).

DATED at Winnipeg this 21st day of April, 1986.

Charles S. Kang
Chairman



LEGEND

- Standing
- Producer
- ⊗ Abandoned Producer

VIRIDEN EMPIRE ADVANCE
APR. 30, 1986

APRIL 16 - May 10



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For rugged
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from \$

Constructive
punctures and
tread groove
multi-ply pro
reduce road
Radial cons
pound pro
tread life ov
aggressive
tion in mud
pavement.

SIZE	PRICE
LT195/75R14	\$105.44
LT215/75R15	107.88
LT235/75R15	109.88

SIZE	P
31x10.50R15 LT	\$1
750 R16 LT	1
LT235/75R16	1

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low as each P155/80R13

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SIZE	PRICE
P155/80R13	\$52.44
P165/80R13	53.44
P175/80R13	56.44
P185/80R13	57.44

SIZE	P
P185/75R14	\$6
P195/75R14	65
P205/75R14	67
P215/75R14	69

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April 23, 1986

Queen's Printer
Statutory Publications
200 Vaughan Street

L. R. Dubreuil
Chief Petroleum Engineer
Petroleum Branch
555 - 330 Graham Avenue

MANITOBA GAZETTE

Please have the attached Notice appear in the next issue of the Manitoba Gazette under The Mines Act.

L. R. Dubreuil

LRD/ch

Attachment



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

APR 21 1986

Chevron Canada Resources Limited
500 - 5th Avenue S.W.
CALGARY, Alberta T2P 0L7

Attention: Mr. D. Schierman

Dear Sir:

Re: Proposed Daly Unit No. 4
Pressure Maintenance

Your application dated March 31, 1986 for approval to conduct pressure maintenance by waterflooding in the subject proposed Unit is acknowledged. Processing of the application has been commenced.

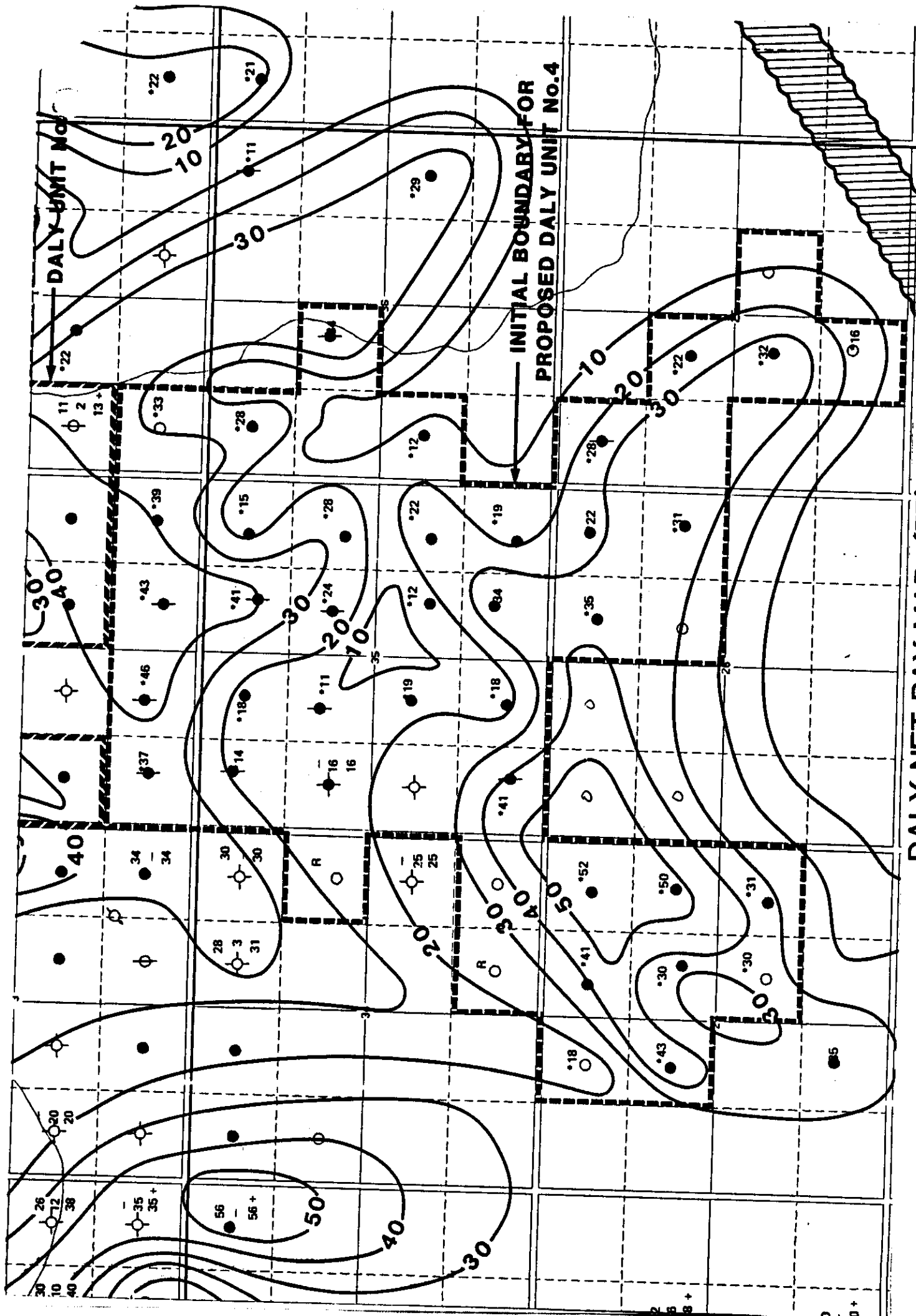
Upon review of your application, we note that the proposed maximum wellhead injection pressure is 10 000 kPa which is in excess of the estimated fracture pressure. We request your comments on the need for and the desirability of injecting above the fracture pressure prior to the establishment of a water bank around each injection.

Sincerely yours,

ORIGINAL SIGNED BY
CHARLES S. KANG

Charles S. Kang
Chairman

LRD:HCM:dah



DALY NET PAY MAP (FT)



Memorandum

Date April 16, 1986

To The Oil and Natural
Gas Conservation Board
C.S. Kang - Chairman
Wm. McDonald - Deputy Chairman
J.F. Redgwell - Member

From H. Clare Moster
Director
Petroleum Branch

Telephone

Subject

Re: Proposed Daly Unit No. 4
Pressure Maintenance by Waterflooding

Chevron Canada Resources Limited, as operator of the proposed Daly Unit No. 4, has applied for approval to conduct pressure maintenance operations by waterflooding in the subject proposed Unit. It is proposed to drill four injection wells on 8 hectare spacing and convert an existing salt water disposal well to a water injection well (see Fig. No. 1).

Recommendation

It is recommended that the attached letter acknowledging receipt of the application and questioning the desirability of injecting water at pressures in excess of the fracture pressure be sent to Chevron. It is also recommended that notice of the application be published in the Manitoba Gazette and the Virden Empire Advance and sent to surface owners in the area of the proposed Unit (see Table No. 1) and to working interest owners offsetting the area of the proposed Unit (see Table No. 2).

Discussion

A substantial development drilling program has been carried out by Resman Oil and Gas Ltd. under the terms of a Farmout agreement with Chevron Canada Resources Limited. This development has resulted in the drilling of approximately sixty wells which in December 1985, had a combined production of more than 1 700 m³.

Figure No. 2 shows each well's initial oil rate (for the first month in which the well produced more than 20 days), its current oil rate (for December 1985) and its production decline rate expressed in percent per year, for wells having more than 12 months production life. The average decline rate for these wells is about 48% per year. In addition, note that 21 of the 46 wells, or 46% of the completed oil wells in the proposed Unit area were either shut in or produced at rates of less than 1.0 m³ day.

Based on the above, it is quite apparent that remaining primary reserves in this area will be quite limited. In its application, Chevron estimates an ultimate primary recovery of 2% of the original oil-in-place (OOIP) (compared with a current recovery of 0.7% of OOIP). In estimating primary reserves, Chevron has used a decline rate of 20% per year. The Branch feels that Chevron's estimate is reasonable although maybe somewhat optimistic.

Enhanced recovery by waterflooding has proven effective elsewhere in the Daly Lodgepole A Pool. In Daly Unit No. 3, waterflooding based on a 5-spot 16 hectare spacing pattern has been in operation for over 30 years. While production response has been favourable in areas of good reservoir quality, the areas of poorer reservoir quality have responded only marginally. A recent application to the Board postulates that it may be necessary to convert that Unit to 8 hectare spacing to maximize recovery.

In Daly Unit No. 1, in the West part of the Pool, a water injection project involving drilling of infill water injectors on 8 hectare spacing was initiated in 1971. That project, which is similar to the current proposal, has resulted in positive production response in most areas.

A one injector pilot waterflood in the proposed Daly Unit No. 2 was initiated in February 1975 and presently is operated as a salt water disposal facility. Although an increase in production in the pilot area was noted approximately one year after injection commenced, this appears to be primarily the result of deepening of two wells and acidizing a third. A review of the pilot in 1981 concluded that incremental reserves due to waterflooding were minimal.

Based on performance of other Daly Lodgepole A waterfloods, it is concluded that development on 8 hectare spacing is probably necessary to maximize the chances of success. However, as illustrated by the previous pilot in the proposed Daly Unit No. 2, even injection on this spacing does not ensure success. Consequently, Chevron's proposal to initiate a pilot project is a reasonable and prudent approach. Chevron's waterflood recovery estimates also appear reasonable.

Chevron proposes to limit injection wellhead pressures to 10 000 kPa. Based on fracture calculations and performance at Daly Unit No. 3, this pressure would likely result in fracturing of the formation and could result in bypassing of oil by injected water. It is consequently suggested that Chevron be requested to comment on the need and desirability of injecting above the fracture pressure. A proposed draft letter to Chevron is attached.

Development of the proposed Unit area on 8 hectare spacing would involve the drilling of some 26 injection wells of which

15 would be located away from the road allowances. Because of this, complete development of the area may be quite disruptive to agricultural operations. For this reason, it is proposed to send a notice to all surface owners in the proposed Unit area (see Table No. 1). It is also proposed to send a copy of the notice to all offsetting working interest owners (see Table No. 2) as well as publish the notice in the Manitoba Gazette and the Virden Empire Advance.

Original Signed by H. C. Moster

H. C. Moster

Table No. 1
Proposed Daly Unit No. 4
Surface Ownership

<u>Lands</u>	<u>Surface Owner</u>
Lsd. 5, 11, 12 & 13-36-9-28 (WPM)	✓ W.S. Grant
Lsd. 4-1-10-28 (WPM)	✓ L.R. Williams
Lsd. 1 & 2-2-10-28 (WPM)	
Lsd. 3 & 4-2-10-28 (WPM)	✓ W.B. Haskett
Lsd. 9-34-8-28 (WPM)	✓ O.J. Gray
SE1/4 34-9-28 (WPM)	✓ R.C. Scharff ✓ D.C. Scharff
NE1/4 & Lsd 11 & 14-27-9-28 (WPM)	✓ W.A. Kool ✓ H. Kool
Lsd. 7 & 8-27-9-28 (WPM)	✓ D.M. Hogg
NE1/4 26-9-28 (WPM)	✓ I.A. Williams ✓ T.L. Williams
Lsd. 2, 3, 5, 6, 7, 10, 11, 12, 13-25-9-28 (WPM)	✓ G.F. Hayhurst
Sec. 35-9-28 (WPM)	✓ H.T. Hayhurst

Table No. 2
Proposed Daly Unit No. 4
Offsetting Working Interest Owners

<u>Lands</u>	<u>Working Interest Owners</u>
NW1/4 34-9-28 (WPM) SE1/4 3-10-28 (WPM)	↓ Beaverhead Resources Ltd.
NW1/4 26-9-28 (WPM)	↓ Home Oil Co. Limited
Lsd. 10, 15 & 16-34-9-28 (WPM)	↓ Resman Oil and Gas Ltd. Trilogy Resource Corporation
All other offsetting Lands	√ Chevron Canada Resources Limited



The Oil and Natural Gas
Conservation Board

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

NOTICE

UNDER THE MINES ACT

Chevron Canada Resources Limited, Operator of the proposed Daly Unit No. 4, has made application for approval to conduct pressure maintenance by waterflooding operations in the proposed Unit area.

It is proposed to drill four injection wells and to convert one well from a salt water disposal well to a water injection well. The area of the proposed Unit and the location of the proposed water injection wells is shown on the following map. The proposal is a pilot project and if it is technically successful, development of the entire proposed Unit area on a similar basis could result.

If no intervention or objection in writing is received by the Board at Room 309, Legislative Building, Winnipeg, Manitoba, R3C 0V8, within 14 days of the publication of this notice, the Board may approve the application.

Copies of the application can be obtained from Chevron Canada Resources Limited - Information Centre, 500 - 5th Avenue S.W., Calgary, Alberta T2P 0L7 (phone (403) 234-5000) or can be viewed at the offices of the Petroleum Branch, 555 - 330 Graham Avenue, Winnipeg, Manitoba R3C 4E3 (phone (204) 945-6577).

DATED at Winnipeg this 21st day of April, 1986.

A handwritten signature in dark ink, appearing to read "Charles S. Kang".

Charles S. Kang
Chairman

3

2

1

R28 WPM**TWP. 10**

34

35

36

**PROPOSED WATER
INJECTION WELL
(presently swd)**

**PROPOSED
WATER
INJECTION
WELLS**

TWP. 9

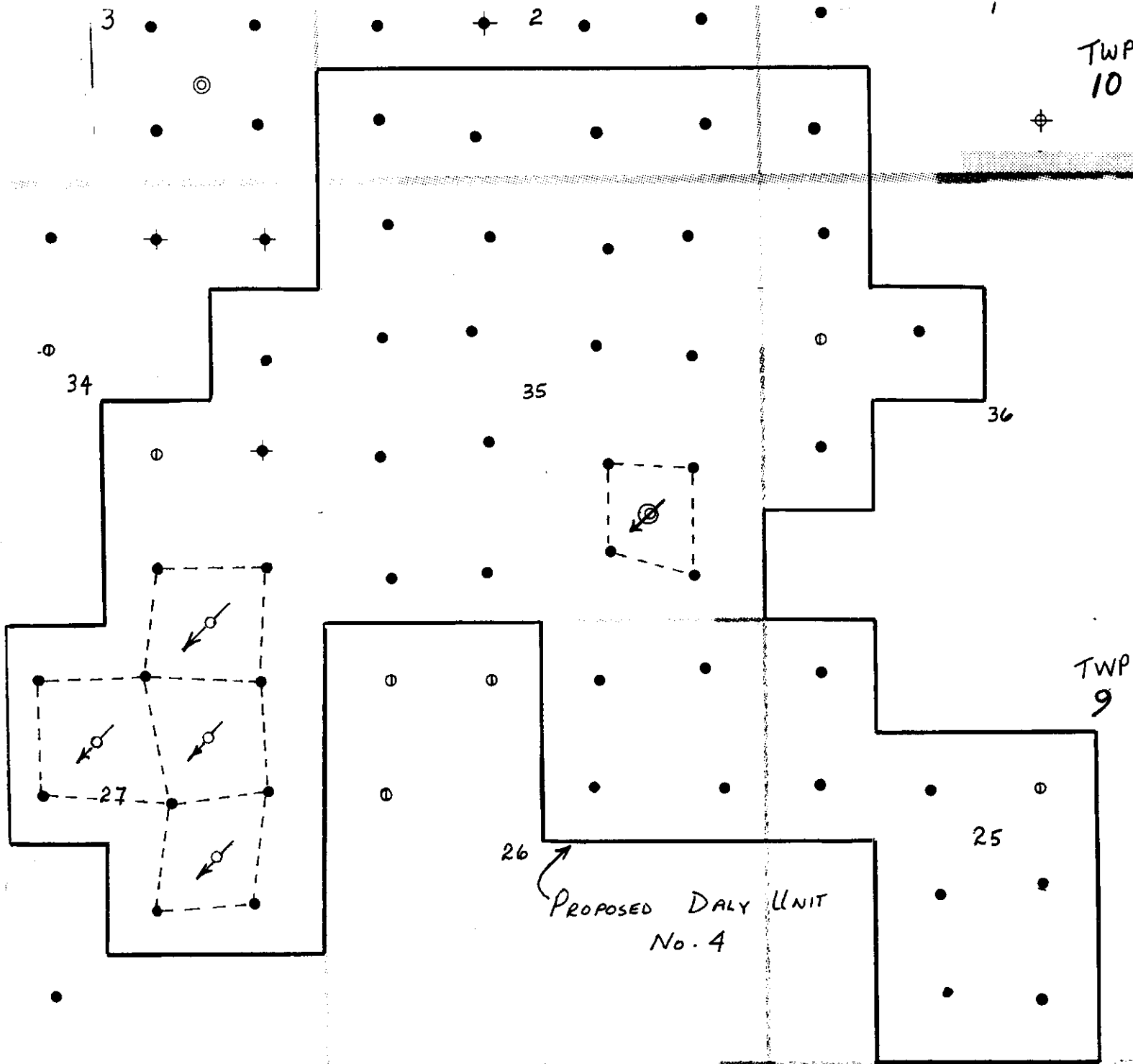
**PROPOSED DALY
UNIT No.4**

27

26

25

LEGEND⊙ **Standing**● **Producer**⊙ **Abandoned Producer**

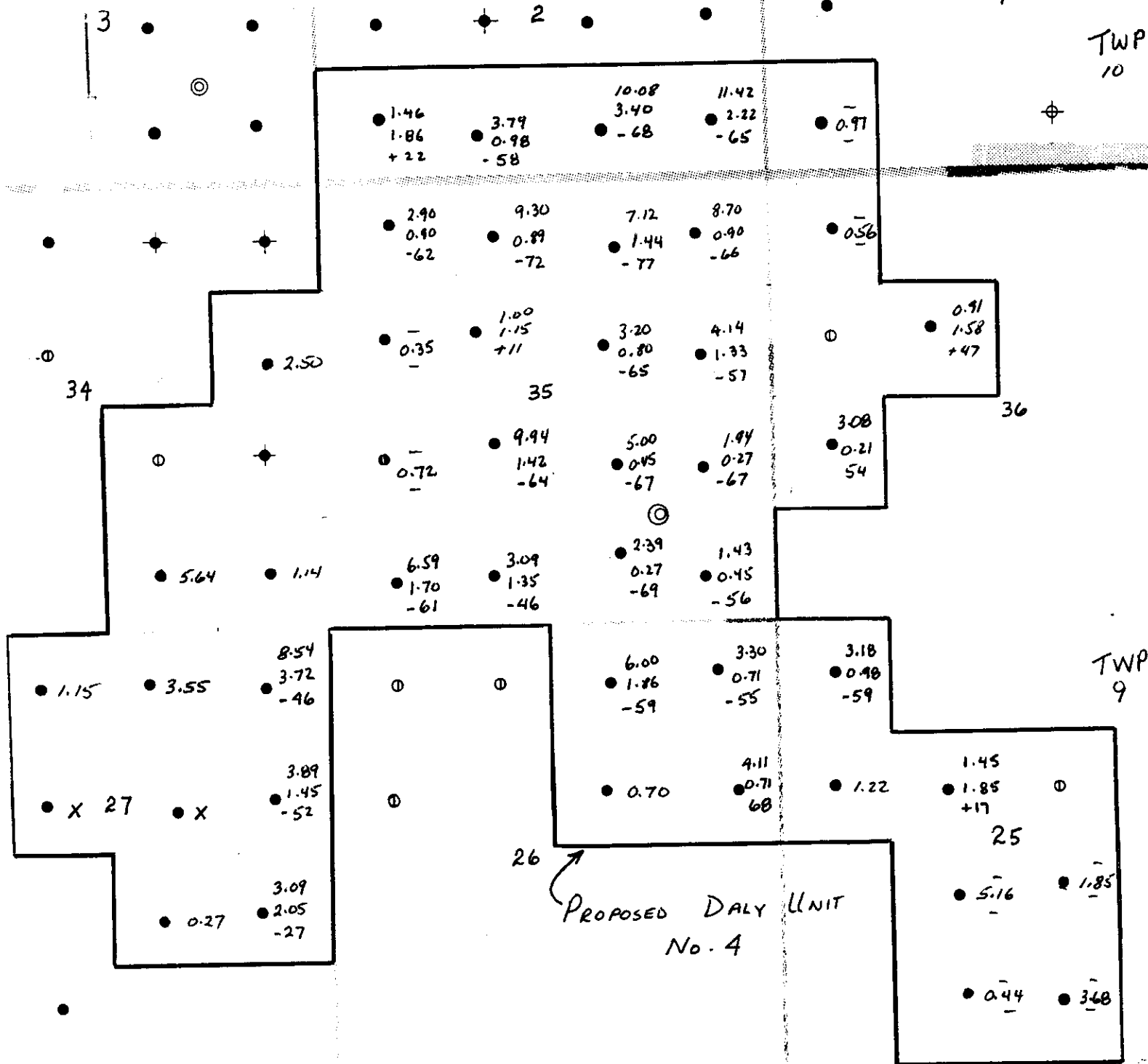


LEGEND

- ⊙ Standing
- Producer
- ⊙ Abandoned producer
- ⊙ Dry and abandoned
- ⊙ Salt water disposal
- ➔ Proposed Water Injection Wells

Figure No. 1

R 28 WPM



LEGEND

- ⊙ Standing
- Producer
- ⊕ Abandoned producer
- ⊗ Dry and abandoned
- ⊙ Salt water disposal

FIG No 2

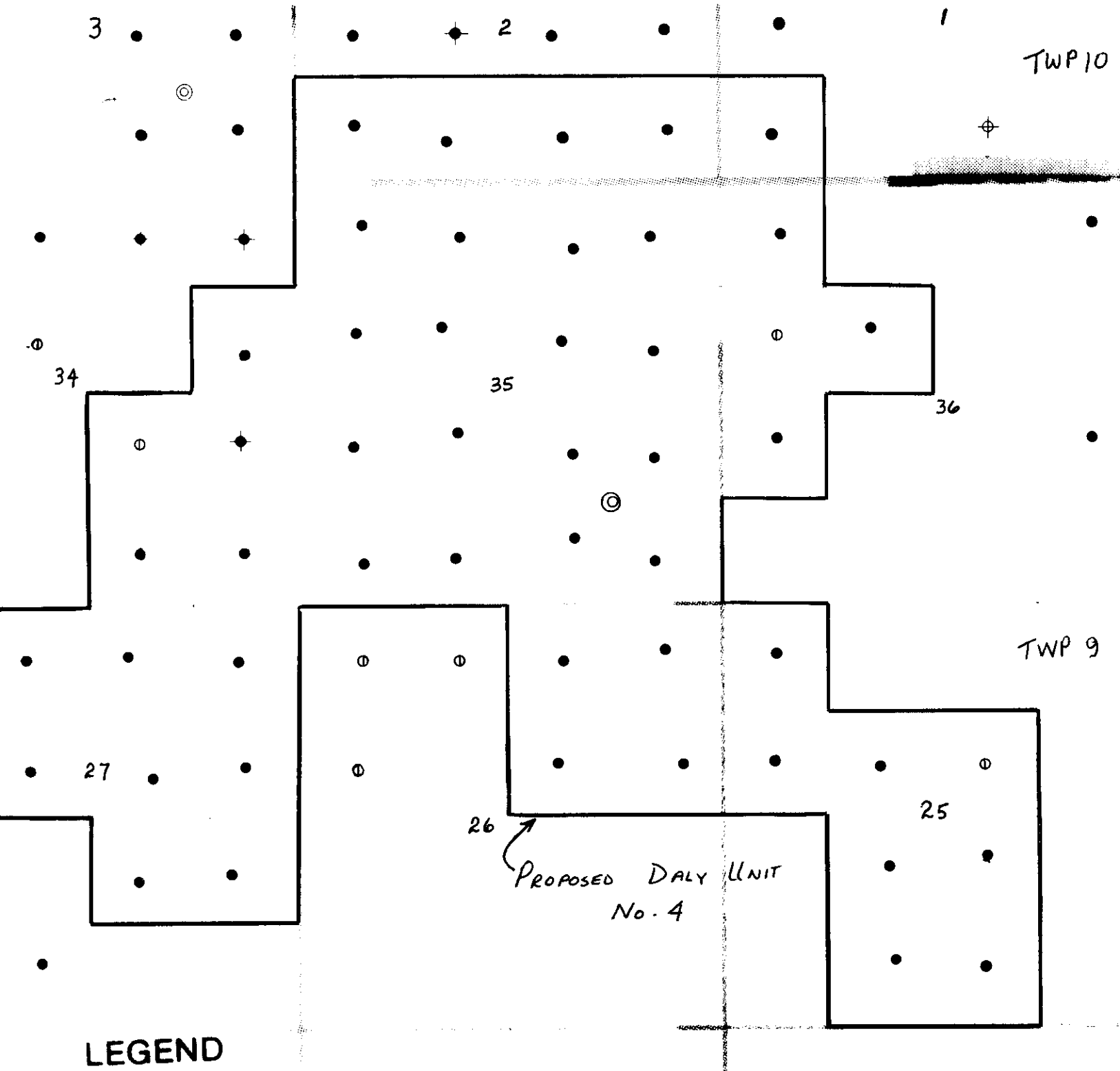
OIL RATE DECLINE

- 3.09 - Initial Oil Rate (m^3/d) (FIRST 20 DAY¹ MONTH¹)
- 2.05 - CURRENT OIL RATE (m^3/d) (Dec 85)
- 27 - Annual decline rate %/year.

R 28 WPM

<u>Well</u>	<u>FIRST 20 DAY MONTH</u>	<u>RATE</u>	<u>DEC 1985 RATE</u>	<u>Years</u>	<u>Decline rate ft 10/yr</u>
11-25 June 84	June 84	1.45	1.85 1.583	1.583	1.85 +17%
13-25	Sept 84	3.18	0.98	1.33	59
9-26	Oct 84	4.11	0.71	1.25	68
15-26	Sept 84	6.00	1.86	1.33	59
16-26	Feb 84	3.30	0.71	1.92	55
8-27	Sept 84	2.19		1.33	
8-27	Sept 84	3.09	2.05	1.33	47 27
9-27	Sept 84	3.89	1.45	1.33	52
11-27	May 84	1.14	51	1.67	-
15-27 ¹⁶⁻²⁷	Sept 84	8.54	3.72	1.33	46
16-27					
1-35	Aug 84	1.43	0.45	1.42	56
2-35	Aug 84	2.39	0.27	1.42	69
3-35	Sept 84	3.09	1.35	1.33	46
4-35	Aug 84	6.59	1.70	1.42	61
6-35	Feb 84	9.94	1.42	1.92	64
7-35	Nov 83	5.00	0.45	2.17	67
8-35	Sept 84	1.94	0.27	1.33	67
9-35	" 84	4.14	1.33	1.33	57
10-35	" 84	3.20	0.80	1.33	65
11-35	" 84	1.00	1.15	1.33	+ 11
13-35	" 84	2.90	0.09	1.33	62
14-35	Mar 84	9.30	0.89	1.83	72
15-35	Aug 84	7.12	1.44	1.42	77
16-35	Dec 83	8.70	0.90	2.08	66
5-36	Dec 83	3.08	0.21	2.08	54
11-36	June 84	0.91	1.68	1.58	+47
13-36	Feb 84	1.12	0.56	1.92	30

1-2 - xxxxxx	June 84	11.42	2.22	1.58	65
2-2	Sept 84	10.08	3.40	1.33	68
3-2	June 84	3.79	0.98	1.58	58
4-2	Oct 84	1.46	1.86	1.25	+22



LEGEND

- Standing
- Producer
- ◆ Abandoned producer
- ⊕ Dry and abandoned
- ⊙ Salt water disposal

PROPOSED DALY UNIT NO. 4 - PRESSURE MAINTENANCE

1. Chevron Canada Resources Limited made application dated March 31, 1986 for approval to conduct pressure maintenance operations in the proposed Daly Unit No. 4. The initial phase of the proposal would involve drilling of four injectors on 8 ha. spacing.
2. The Board issued a Notice of the application on April 21, 1986. The Notice was published in the Manitoba Gazette on May 3, 1986 and in the Virden Empire Advance on April 30, 1986. Copies of the Notice were also sent to all surface owners in the area of the proposed Unit and to offsetting working interest owners.
3. One objection from a surface owner has been received. Note, however, that many of the objections received for Daly Unit No. 3 implicitly included Daly Unit No. 4.
4. The Board issued a Notice of Hearing on June 6, 1986. The hearing is scheduled for August 7, 1986 at the Virden Elks Hall. Copies of the Notice of Hearing were sent to Chevron as well as the objector.

**TRI-R PRODUCTION
SERVICES LTD.**

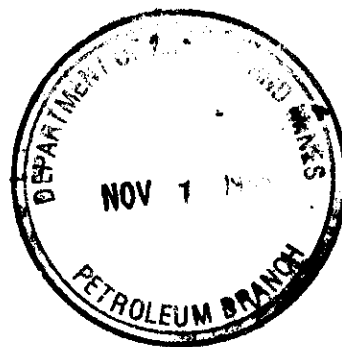
Box 2018 Virden, Manitoba
Oilfield Construction & Maintenance

Bob

*Daly Unit #4 area
as per your request.*

ATTACHMENT NO. 2

PROPOSED DALY UNIT NO. 4
AREA & WELL COUNT

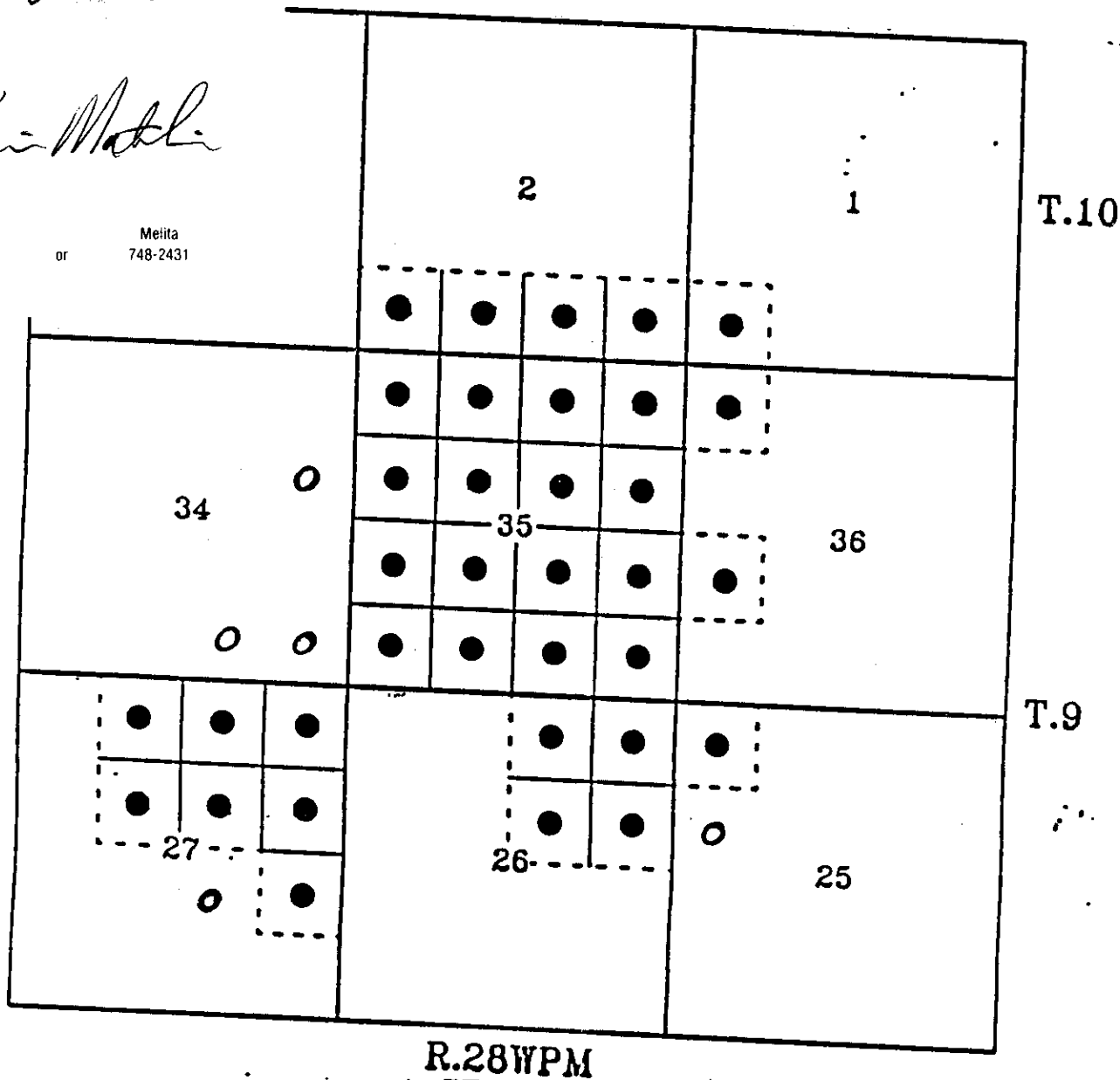


Keri Mathli

Virden
748-3345

or

Meiita
748-2431



--- Pre-unit boundary

o Other wells also being considered for Unit.

11-61-52-1

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