

Progress Energy Ltd.

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October 21, 1998

Manitoba Energy and Mines
Petroleum and Energy Branch
360 – 1395 Ellice Avenue
Winnipeg, Manitoba
R3G 3P2

ATTENTION: MR. JOHN FOX

Dear Sir:

**RE: APPLICATION FOR APPROVAL TO WATERFLOOD
THE BAKKEN A POOL- BIRDTAIL FIELD**

Progress Energy Ltd., as the working interest owner in the Birdtail Bakken A Pool located in sections 4, 5, 8 and 9-16-27W1M requests approval of a plan to repressurize by water injection the Bakken sands for enhanced oil recovery. An outline of the subject lands is attached as Figure 1. The above noted lands are currently subject to unitization proceedings to address freehold mineral lessor considerations.

The following discussions are set out in accordance with the guidelines for "Application for Approval of Enhanced Oil Recovery" issued by Manitoba Energy and Mines, Petroleum and Energy Branch.

1. (a) **The Results of Reservoir Studies**

- (i) Original oil-in-place underlying the subject lands is estimated at 326.8 10^3m^3 (2056.3 MSTB) based on the reservoir parameters and reserve calculations shown in Table 1.

- (ii) Ultimate oil recovery under continued primary production is expected to be $28.1 \times 10^3 \text{ m}^3$ (176.9 MSTB) representing 8.6% of the original oil-in-place.
- (iii) Repressurization by water injection is expected to result in an incremental recovery of $53.6 \times 10^3 \text{ m}^3$ (337.2 MSTB), 16.4% of OOIP, yielding an ultimate primary plus waterflood recovery of $81.7 \times 10^3 \text{ m}^3$ (514.1 MSTB), 25.0% of OOIP.
- (iv) Performance predictions under primary and waterflood recovery mechanisms have been prepared based upon analogous Bakken waterflood patterns offsetting the area of application. The waterfloods implemented in the nearby Rocanville, Saskatchewan Bakken pools as well as the Kola Bakken A pool and the Daly Bakken D pool provide analogous support for the implementation of a successful waterflood in the application area given similar geology and reservoir parameters.
- (v) The primary reserves and production forecasts were generated from offset reservoir simulation studies, decline analysis and volumetric calculations of the individual wells on the subject lands. Appendix 1 shows the production history of the subject lands. An economic limit of $.5 \text{ m}^3$ (3 BOPD) per well was used. The consolidated primary production forecast is shown in Table 2.
- (vi) The waterflood production forecast was generated based upon analogous waterflood projects and projections of calculated waterflood recovery factors. Oil production under waterflood was forecast to attain a maximum peak production rate of $23 \text{ m}^3/\text{d}$ (144 BOPD). Decline rates during the early stages of the waterflood may be slightly higher than the current base production case, with declines moderating and approaching the base case declines through the mid to late stages of the waterflood forecast (ie 2010 to 2021). It was assumed that water injection would commence by

December, 1998 (subject to waterflood approval) and the economic limit for the project would be 1.8 m³/d (11 BOPD). The primary plus waterflood production forecast is shown in Table 2.

- (vii) The original reservoir fluid in the subject reservoir consisted of undersaturated crude oil with a relative density of 867.1 kg/m³ (32.5° API) based upon an oil analysis conducted on the well 14-04-16-27W1 attached in Appendix 2. A complete reservoir fluid study on fluid recovered from the offset Rocanville well 08-35-15-31 W1M is attached in Appendix 2, and indicates a solution GOR of 0.9 m³ / m³ (5.1 SCF/STB) at a bubble point pressure of 834 kPa (121 psi) and temperature of 32° C (89.6° F).

(viii) **Geology**

The Bakken formation lies at the base of the Mississippian system. It is overlain by the Mississippian Lodgepole formation of the Lower Madison Group, which in this area is a finely crystalline limestone. The Bakken is underlain by the very silty argillaceous dolomites of the Devonian Torquay formation. Both upper and lower contacts represent disconformities with the Bakken formation.

The Bakken is commonly divided into three members: the upper member, a black highly radioactive shale; middle member, a sandstone-siltstone sequence in which the hydrocarbons are trapped and; the lower member, another highly radioactive shale. The lower shale member is generally present except where it was truncated by uplift of the shale underlying Devonian. This is the case in the Birdbear area where the lower Bakken shale is not usually present.

The Bakken sand-siltstone facies represents a series of offshore bars deposited in a shallow marine environment. These were influenced by tidal currents and by adjacent fluvial systems. These tidal channels are fairly sinuous and generally follow a fairly broad flow pattern. The over and underlying shales were deposited in a deeper, quiet water environment.

The best reservoirs are found in high-energy current type of sediment. The reservoir is composed of a very fine-grained sand, which can be laminated with clay layers. Core analysis shows that the Bakken reservoir contains alternating bands of high and low porosity and permeability sands. In the Birdtail area Bakken sands have porosities and permeabilities ranging from 16-24% and 80-250 md respectively. Net pay for the sand is typically less than 2.5 meters. The silty tidal flat sediments have lower porosities and permeabilities and are not of reservoir quality.

Geological Maps and Cross Sections are included as Appendix 4.

(ix) **Water Sources**

Make-up water is expected to come from the Lodgepole formation in the 00/02-19-16-27 W1M well, subject to testing and fluid compatibility. Additional makeup source water will come from produced Bakken water from the existing wells in the pool.

The peak demand for Lodgepole water for the proposed Progress Birdtail waterflood is estimated to be approximately 45 m³/d (283 BWPD).

Water analyses available at this time consist of geochemical modeling conducted by Core Laboratories on formation waters from the Bakken, Lodgepole and Birdbear formations in the adjacent Rocanville,

Saskatchewan area. All three formation waters were subjected to geochemical modeling to predict the scaling tendencies of the water mixtures. Per results outlined in Appendix 5, it appears that the various combinations of Bakken, Lodgepole and Birdbear formation waters are compatible. However, further physical analyses will be obtained and the water's compatibility with the Bakken sand will be determined prior to injection.

(b)(i) **Development and Production History**

The Birdtail Bakken pools are located in southwestern Manitoba, in Township 16, Range 27 W1M. Within the Bakken formation in this area, there appears to be two distinct pools: the Bakken C Pool in sections 18, 19 and 20 as well as the Bakken A Pool in sections 4, 5, 8 and 9.

Development drilling began in the Birdtail Bakken A Pool in 1996 with the first production commencing in September, 1996. Additional wells were drilled and placed on production through 1996 and 1997. The analogous Progress Rocanville waterflood project commenced operation in 1997 and encouraging results has prompted initiation of this waterflood application.

Wells in the subject area lands are currently produced under a primary drive mechanism. Currently there are 7 producing wells on the subject lands with a total producing rate of 12.2 m³/d (77 BOPD). One additional producer is anticipated to be drilled at 06-06-16-27 W1M. To the end of July, 1998, the pool has produced 8441.1 m³ (53,179 STB) of oil, and 15,707.7 m³ (98,959 STB) of water. The majority of the wells are producing with relatively high water cuts of 85% while two wells are producing at a low 5% water cut. Current water cut for the overall pool is 74%. Gas production has been so small as to be immeasurable.

Production history data and plots for the subject wells are attached in Appendix 1.

There is no initial reservoir pressure data for this pool. Pressure data is limited during the producing life of the wells in the proposed waterflood area, given the recent development drilling activity within the pool primarily during 1996 and 1997. Also, given the low permeability of the Bakken formation, fully built up reservoir pressures have been difficult to obtain. However, primary production in the Bakken is typically characterized by a rapid decline in reservoir pressure. This is evidenced by a static reservoir pressure measurement taken at 07-05-16-27W1 on September 11, 1998 of 3716 kPag (539 psig). The available pressure shown in Table 3 indicate that this reservoir is an undersaturated reservoir which requires pressure maintenance through waterflood to maintain an effective drive mechanism for optimal oil recovery.

Offset pressure data for a waterflood project located in the Saskatchewan Rocanville field in sections 04 and 05-16-31W1 indicates initial reservoir pressures of 6200 kPa in 1957 with pressures dropping substantially to 1700 kPa by 1984 during the course of infill drilling. The substantial drop in reservoir pressure in this offset pool provides further support for the requirement for pressure maintenance via waterflood.

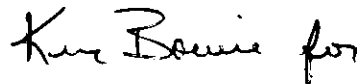
- (ii) The wells 07-05 and 14-04-16-27 W1M are expected to be converted to water injection. An additional injector will be drilled at 03-06-16-27 W1M. It is expected that the maximum injection requirement will be 45 m³/d (283 BWPD). The proposed injection wells will have a sandface injection pressure of approximately 14 mPa (2030 psi). The maximum wellhead injection pressures are expected to be approximately 9 mPa (1305 psi). The surface land impact of this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M.

- (c)(i) Figure 1 is a map identifying the wells and showing the outline of the proposed injection patterns.
- (ii) The lessors and lessees within the subject area are tabulated in Figure 4.
- (d) The proposed completions for the injection wells are illustrated in Figure 2.
- (e) A schematic of the proposed surface facilities is shown in Figure 3.
- (f) Corrosion protection will be achieved through:
- i) fibreglass water injection pipelines of sufficient pressure rating to transport high pressure injection water
 - ii) all water storage tanks are of fibreglass construction
 - iii) water injection pump internals are constructed of corrosion resistant brass and stainless steel
 - iv) wellhead master valve internals are brass
 - v) water injection well tubulars are internally TK-99 coated
 - vi) water injection well packers will be impreglon coated
 - vii) Inhibited fluid will be placed in annulus of injectors for protection of casing and tubing.
- (g) The lands involved in this waterflood application are currently subject to unitization proceedings to address freehold mineral lessor considerations. The existing pool has been well delineated and no offset mineral owners should be negatively impacted by this waterflood scheme. Given extent of the pool, placement of injectors and resultant sweep patterns there should be no adverse effects on lessees or lessors adjacent to the proposed waterflood scheme.
- (h) An information package regarding this proposed enhanced recovery scheme has been submitted to area landowners. Copies of the covering letters for these related submissions are included in Appendix 6.

- (i) The project will be built using CSA Z662-96 for pipelining, B51 for pressure vessels and B31.3 for plant piping.

If further information is required or you have any questions, please contact the undersigned at (403) 216-2510 (extension 105).

Yours truly,
PROGRESS ENERGY LTD.

A handwritten signature in black ink, appearing to read "Jeff Screen for".

Jeff Screen, P.Eng.
Manager, Production - Operations

TABLE OF CONTENTS

LETTER OF APPLICATION

TABLES

1. Calculation of Original Oil in Place
2. Primary and Primary Plus Waterflood Production Forecasts
3. Pressure History

FIGURES

1. Application Area
2. Waterflood Injection Well Schematic
3. Water Injection Facilities Schematic
4. Mineral Owners
5. Surface Landowners

APPENDICES

1. Birdtail Production Summary
2. Reservoir Fluid Analysis
3. Core Studies
4. Geological Maps and Cross Sections
5. Water Compatibility Geochemical Modeling Results
6. Surface Landowner Information Letters

TABLES

TABLES

- 1. Calculation of Original Oil in Place**
- 2. Primary and Primary Plus Waterflood Production Forecast**
- 3. Pressure History**

TABLE 1

Calculation of Original Oil in Place

**BIRDTAIL FIELD
BAKKEN A POOL
PRIMARY AND SECONDARY RESERVES CALCULATION**

	<u>10³m³</u>	<u>mbbls</u>
Original Oil in Place	326.8	2056.3
Primary Recovery Factor	8.6%	8.6%
Recoverable Oil in Place - Primary	28.1	176.9
Secondary Recovery Factor	16.4%	16%
Recoverable Oil in Place - Secondary	53.6	337.2
Total Recovery Factor	25.0%	25.0%
Total Recoverable Oil in Place with EOR	81.7	514.1

Progress Energy Ltd.

Reserves

Birdtail South Bakken Pool, Manitoba

Well	Well Status	Reserve Class	Net Pay x Por. Fr.	OOIP m3	Rec. Fr.	ROIP m3	Cum. to date m3	W.I. Fr.	Volume. Reserves m3	Decline Reserves m3	Prod. Rate m3/d
03-04-16-27w1	no well		0.050	5,090							
04-04-16-27w1	no well	Prob	0.150	15,269				1.00			
05-04-16-27w1	Producing	PDP	0.325	33,083 ✓	0.14	4,632	975	1.00	3,657	3950	4.40
06-04-16-27w1	no well		0.120	12,215							
11-04-16-27w1			0.025	2,545							
12-04-16-27w1	Producing	PDP	0.230	23,412 ✓	0.14	3,278	1335	1.00	1,943	2160	2.70
13-04-16-27w1	Producing	PDP	0.270	27,484 ✓	0.10	2,748	1050	1.00	1,698	1532	2.00
14-04-16-27w1	Producing	PDP	0.070	7,126 ✓	0.04	285	175	1.00		0	0.20
01-05-16-27w1			0.110	11,197							
07-05-16-27w1	Producing	PDP	0.190	19,341 ✓	0.04	774	95	1.00		0	0.20
08-05-16-27w1	Producing	PDP	0.325	33,083 ✓	0.14	4,632	0	1.00	4,632	3919	
09-05-16-27w1	Producing	PDP	0.370	37,663 ✓	0.10	3,766	1275	1.00	2,491	2225	2.80
10-05-16-27w1	no well	Prob	0.250	25,448				1.00			
15-05-16-27w1	Producing	PDP	0.200	20,359 ✓	0.14	2,850	335	1.00	2,515	1890	1.80
16-05-16-27w1	Producing	PDP	0.225	22,903 ✓	0.10	2,290	1200	1.00	1,090	1100	1.70
01-08-16-27w1			0.060	6,108							
03-09-16-27w1			0.040	4,072							
04-09-16-27w1	Producing	PDP	0.200	20,359 ✓	0.14	2,850	550	1.00	2,300	1200	1.25
Totals			3.210	326,756		28,105	6,990		20,326	17,976	17.05
Totals barrels				2,056,232		176,862	43,987		127,912	113,121	107
Assumptions	Well spacing, ha	16.4									
	Water Saturation	0.37									
	Boi	1.02									

Waterflood Recovery will be 25% of OOIP.

**PROGRESS BIRDTAIL BAKKEN A POOL
PRIMARY AND PRIMARY PLUS WATERFLOOD
PRODUCTION FORECASTS**

YEAR	PRIMARY		PRIMARY PLUS WATERFLOOD	
	OIL RATE (M3/D)	CUM PROD (M3)	OIL RATE (M3/D)	CUM PROD (M3)
1996	4.2	500	4.2	500
1997	13.5	5425	13.5	5425
1998	13.2	10232	13.2	10232
1999	9.0	13532	23.0	18627
2000	6.7	15994	20.5	26104
2001	5.4	17958	18.2	32765
2002	4.5	19593	16.3	38697
2003	3.8	20993	14.5	43981
2004	3.4	22218	12.9	48687
2005	3.0	23305	11.5	52879
2006	2.7	24284	10.2	56612
2007	2.4	25173	9.1	59938
2008	2.2	25988	8.1	62900
2009	2.1	26741	7.2	65539
2010	1.9	27439	6.4	67889
2011	1.8	28095	5.7	69982
2012			5.1	71846
2013			4.5	73507
2014			4.1	74986
2015			3.6	76303
2016			3.2	77477
2017			2.9	78522
2018			2.6	79453
2019			2.3	80282
2020			2.0	81020
2021			1.8	81678
Total		<u>28095</u>		<u>81678</u>

TABLE 2

Primary and Primary Plus Waterflood Production Forecast

TABLE 3
Pressure History

Testing

Progress et al Birdtail 07-05

07-05-016-27W1

Bakken Zone

Wireline

Static Gradient Test

Sep 11, 98



SUBSURFACE PRESSURE MEASUREMENTS

1. BASIC DATA JOB 6057

PAGE 1 OF 1

COMPANY Progress Energy Inc.		WELL NAME Progress et al Birdtail 07-05	
ADDRESS 520, 520 - 5 Ave. S.W.		UNIQUE WELL ID 07-05-016-27W1	
FIELD Birdtail	STATUS Oil	SUBSURFACE LOCATION	
POOL and FORMATION Bakken			
PRODUCING THROUGH	mm TUBING <input checked="" type="checkbox"/>	mm CASING <input type="checkbox"/>	
PERFS INTERVAL (CF) 510.4-513.1		m PERF <input checked="" type="checkbox"/>	OH <input type="checkbox"/>
MID POINT OF PRODUCING (MPP) INTERVAL (CF)	511.75 m	TUBING DEPTH	m CF CASING DEPTH
POOL DATUM (SUBSEA)		m DATUM DEPTH OF WELL (FROM CF)	m
ELEVATION (CF)	471.20 m (KB)	474.80 m (KB) to (CF)	3.60 m

2. SUBSURFACE TEST

PRESSURE (GAUGE) TUBING	N/A kPa	GAUGE <input type="checkbox"/>	DWG <input type="checkbox"/>	SHUT IN DATE	98/06/08	DURATION @	2275:7000	h
CASING	0 kPa	GAUGE <input type="checkbox"/>	DWG <input checked="" type="checkbox"/>	SHUT IN TIME	18:00	h		
SECONDARY (GAUGE) TUBING PRESSURE:				kPa	DATE ON BOTTOM	98/09/11 @	13:32	h
RUN DEPTH (FROM CF)	521.00 m	DATE OFF BOTTOM	98/09/11 @	13:42	h			
B.H. TEMP.	20.00 °C	SURFACE TEMP.	°C	MPP PRESSURE (GAUGE)	3,716.29	kPa		
RUN DEPTH PRESSURE (GAUGE)	3,809.90	kPa	DATUM DEPTH PRESSURE (GAUGE)		kPa			
RUN DEPTH GRADIENT:	10.120	kPa/m	LIQUID LEVEL:	134.00	m			
RUN DEPTH GRADIENT ASSUMED?	No	ELEMENT SERIAL NO.	1032					
RECORDER TYPE	Sunada Electronic Recorders	RANGE (GAUGE)	17,237.00	kPa				
TEST TYPE:	Static Gradient	CLOCK RANGE	h	LAST CALIBRATION				

3. TEST COMMENTS

Estimated liquid level @ 134 m, CF.

4. OTHER OPERATIONS

COMMENTS:

Remarks:

SURVEY COMPANY Opsco '92 Industries Ltd.

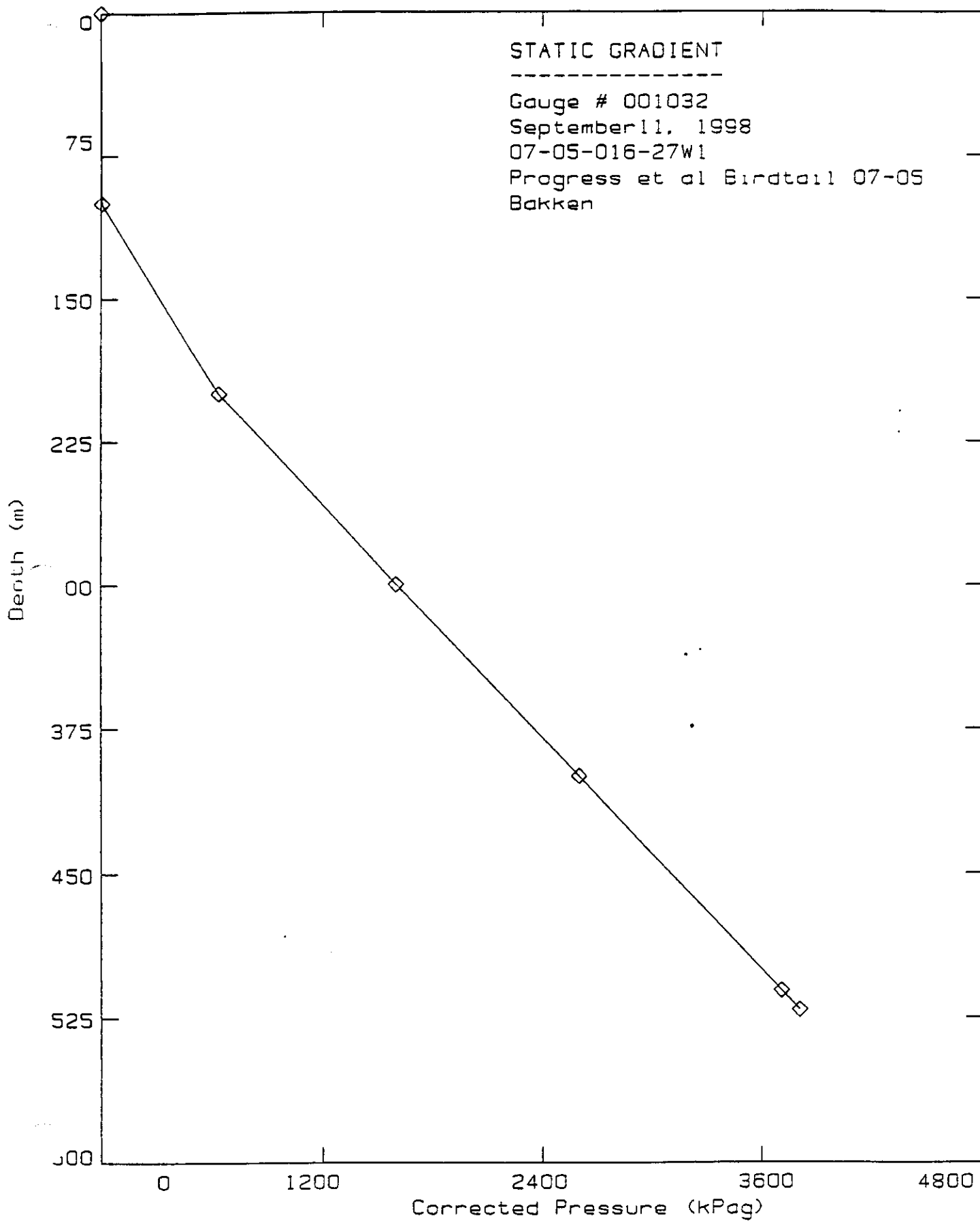
TEST BY Murray B

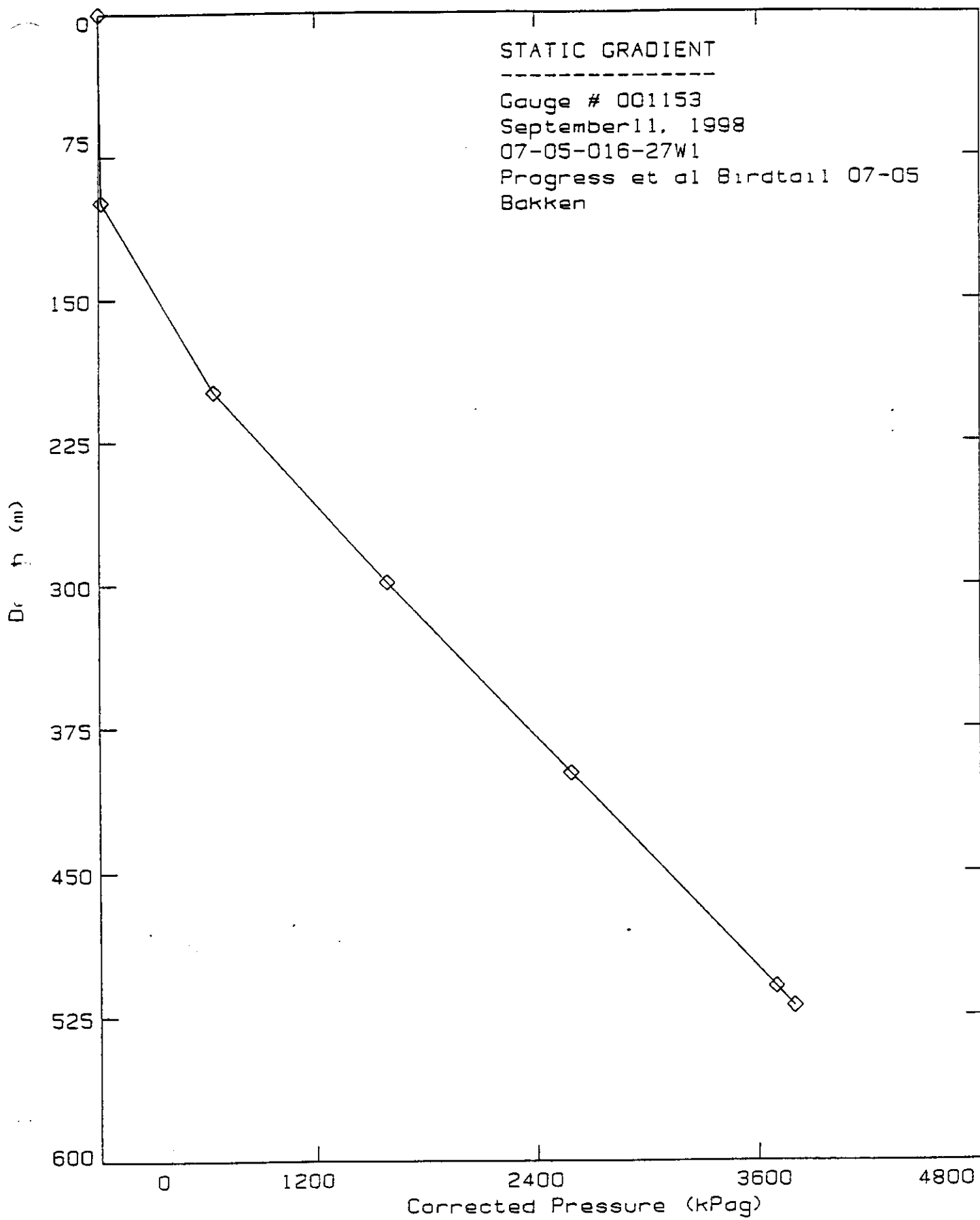
COMPUTED BY Keith A

CHECKED BY Robert H

O-12-81-08

Opsco '92





Reporting Date: Sep 14, 1998,

Page

WellName: Progress et al Birdtail 07-05 Location : 07-05-016-27W1
 Pool : Bakken Date Of Test: September 11, 1998

----- Upper Gauge -----

Serial # 001153 Range 17237

----- Lower Gauge -----

Serial # 001032 Range 17237

Start Time	End Time	Depth	Deflect	Corrected Pressure	Grad.	Depth	Deflect	Corrected Pressure	Grad.
hh:mm	hh:mm	CF (m)	(mm)	(kPag)	(kPa/m)	CF (m)	(mm)	(kPag)	(kPa/m)
12:10	12:15	SURF		0.0		SURF		0.0	
12:17	12:27	99.0		12.4	0.125	100.0		4.1	0.041
12:28	12:38	199.0		633.8	6.214	200.0		640.8	6.367
12:39	12:49	299.0		1592.8	9.590	300.0		1599.9	9.591
12:50	13:00	399.0		2589.6	9.968	400.0		2603.6	10.037
13:01	13:31	510.0		3697.7	9.983	511.0		3708.7	9.956
13:32	13:42	520.0		3797.3	9.960	521.0		3809.9	10.120
13:48	13:53	SURF		0.0		SURF		0.0	

Comments:

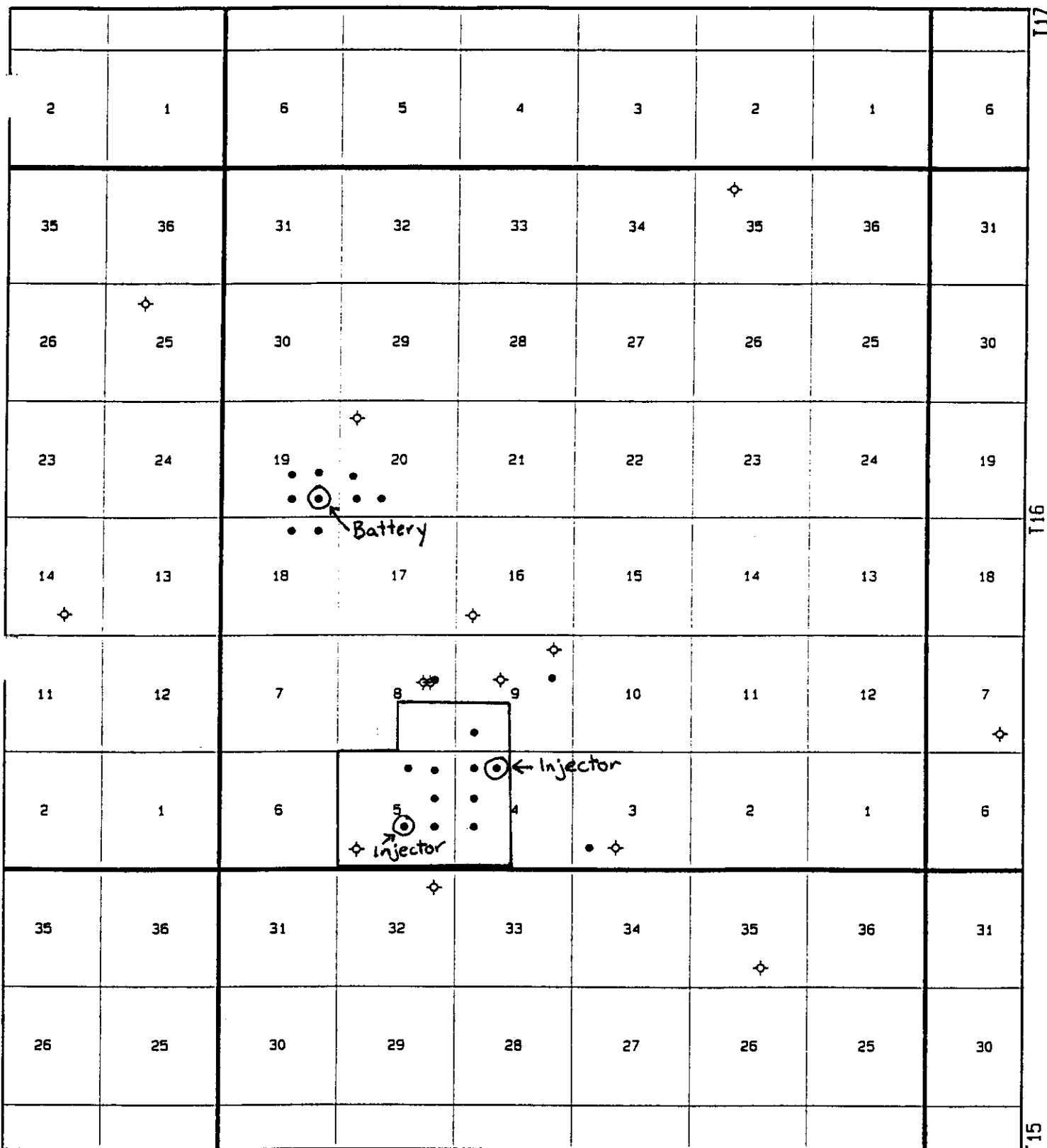
TBG pressure by DWG = N/A
 CSG pressure by DWG = 0 kPag
 Temperature at run depth = 20 C
 Estimated liquid level @ 134 m, CF

FIGURES

FIGURES

1. Application Area
2. Waterflood Injection Well Schematic
3. Water Injection Facilities Schematic
4. Mineral Owners
5. Surface Landowners

FIGURE 1
Application Area



Well Symbols Location Oil Gas Susp Oil Susp Gas Abnd Oil Abnd Gas Susp H Oil Susp H Gas Abnd H Oil Abnd H Gas Susp Undes D & A Service Abnd Service Injection Gas Injection No Well Postings Specified		Drilling Gas Oil&Gas Susp Gas Abnd Gas Susp Oil&Gas Susp H Gas Abnd Oil&Gas D & A Abnd Service Gas Injection	Progress Energy Ltd. APPLICATION AREA Author: Date: September 23, 1998
Scale 1:75000 0 4 Kilometers 0 2 Miles		Produced by: AccuMap EnerData Corp. Map File: WATER.MAP Licence Data to: July 31, 1998 / Production Data to: June 30, 1998	

FIGURE 2

Waterflood Injection Well Schematic

**Progress Birdtail
Typical Water Injection
Wellbore Diagram**

UWI: 100/07-05-016-27W1/0

Licence No.: 4684

Date: 22-Sep-98

Drawn by: Jeff Screen

KB: 474.8 m

GL: 471.2 m

spudded: 97/03/10

rig release: 97/03/12

Current Well Status: Proposed Water Injector

Wellhead: Kvaerner, 229 x 177.8 x 14 MPa

Surface Casing:

177.8 mm, 25.3 kg/m, H-40, ST&C

Landed at 108.0 mKB

Cement:

9 t, 0:1:0 "G" + 3% CaCl₂

2.0 m³ cement returns

Production Casing:

114.3 mm, 14.1 kg/m, J-55, ST&C

Landed at 542.0 mKB

Cement:

6 t, 1:1:4 "G" + 0.5% FRC-3 + 0.1% DEF-3

Tailed in W/

5.5 t, Telmaster + 0.1% CA-2 + 0.15% DEF-3

2.0 m³ cement returns

Annulus:

Filled with inhibited fresh water

Topped off w/ diesel

Tubing Detail:

60.3 mm TK-99 internally coated tubing

Double Grip, internally coated packer

Nipple w/ No-Go

Perforations:

Bakken

514.0 - 516.7 mKB

Float Collar: 534.4 mKB

TD: 542.0 mKB

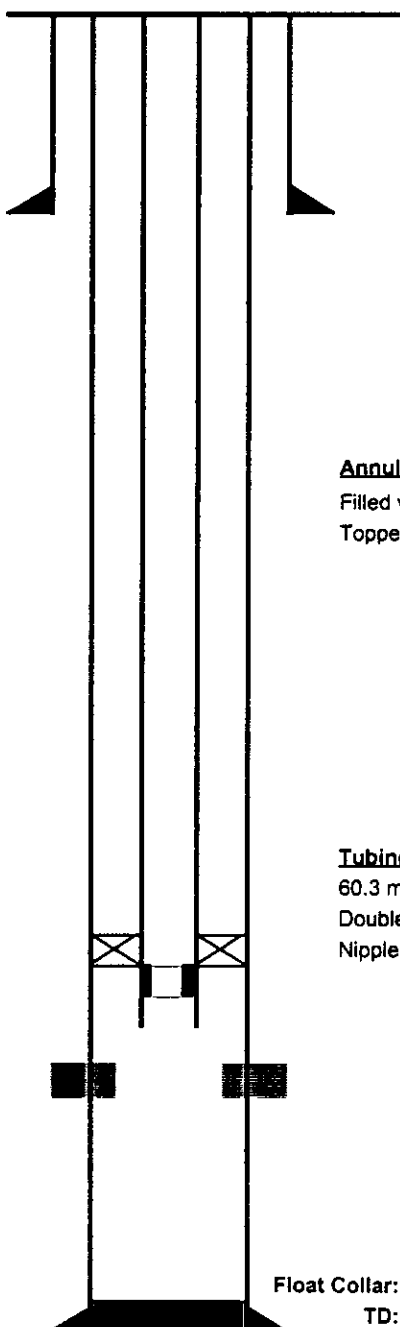


FIGURE 3
Water Injection Facilities Schematic

Birdtail Battery PFD

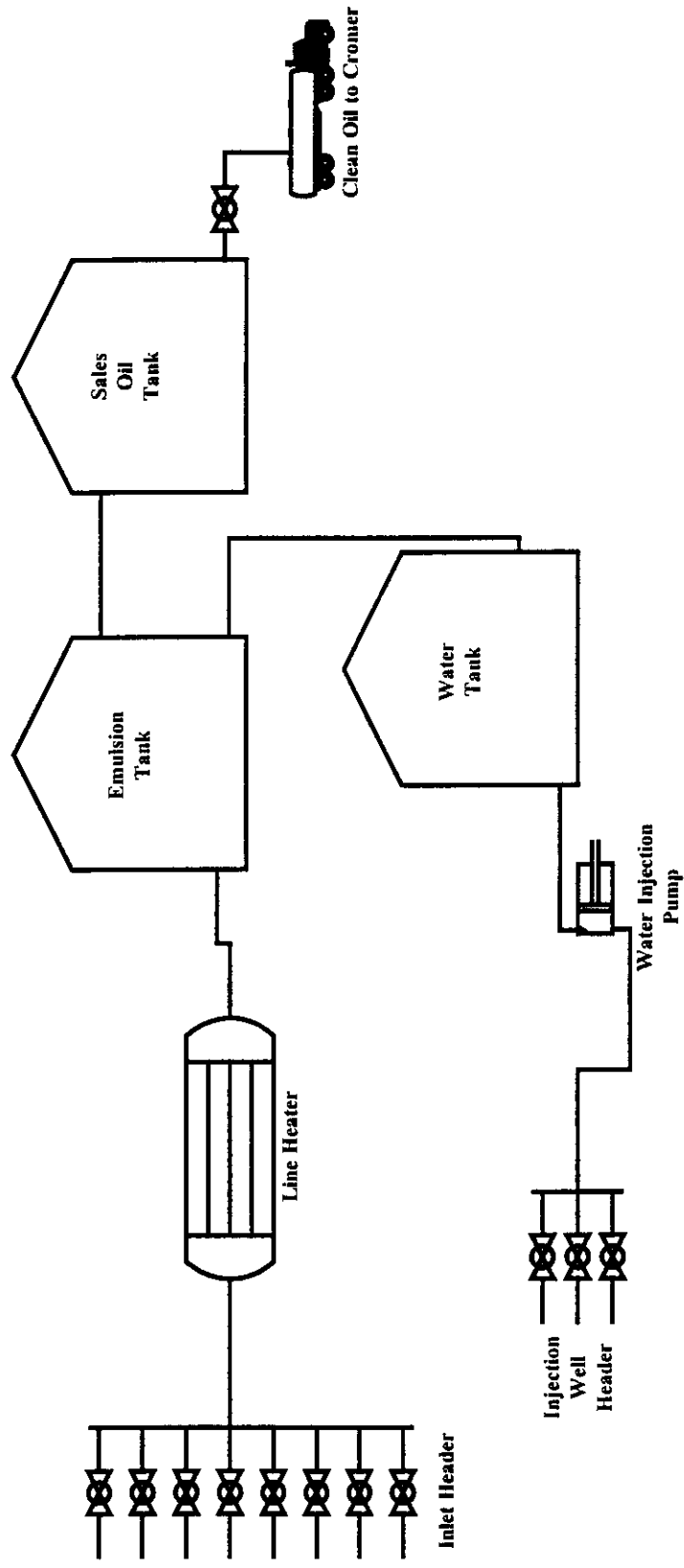


FIGURE 4
Mineral Owners

**BIRDTAIL FIELD
MINERAL LESSEES FOR THE FOLLOWING LANDS
OCTOBER, 1998**



15-27W1	31	All	Progress Energy Ltd.	100.000
15-27W1	32	All	Progress Energy Ltd.	100.000
15-27W1	32	All	Progress Energy Ltd.	100.000
15-27W1	34	All	Progress Energy Ltd.	100.000
16-27W1	3	All	Progress Energy Ltd.	100.000
16-27W1	4	All	Progress Energy Ltd.	100.000
16-27W1	5	All	Progress Energy Ltd.	100.000
16-27W1	6	All	Progress Energy Ltd.	100.000
16-27W1	7	All	Progress Energy Ltd.	100.000
16-27W1	8	All	Progress Energy Ltd.	100.000
16-27W1	9	All	Progress Energy Ltd.	100.000
16-27W1	10	All	Progress Energy Ltd.	100.000
16-27W1	15	All	Progress Energy Ltd.	100.000
16-27W1	16	All	Progress Energy Ltd.	100.000
16-27W1	17	S/2,NE/4	Progress Energy Ltd.	100.000
16-27W1	17	NW/4	Renaissance Energy Ltd.	100.000
16-27W1	18	All	Progress Energy Ltd.	100.000

PROGRESS ENERGY LTD.
MANITOBA WATERFLOOD PROJECT
 Mineral
 Our File #120
 LINE LIST

September 25, 1998

PROGRESS FILE NO.	LAND DESCRIPTION	OWNER/OCCUPANT	ADDRESS	TELEPHONE NUMBER	REMARKS
120	20 $\frac{1}{2}$ N $\frac{1}{2}$ 31-15-27-W1M	Edward Alexander Stoughton	Box Oakville, MB R0H 0Y0	204-767-2064	
	20 $\frac{1}{2}$ N $\frac{1}{2}$ 31-15-27-W1M	Gerrine Bohn			
	20 $\frac{1}{2}$ N $\frac{1}{2}$ 31-15-27-W1M	James Stanley Stoughton			
	20 $\frac{1}{2}$ N $\frac{1}{2}$ 31-15-27-W1M	Cheryl Wilson			
	20 $\frac{1}{2}$ N $\frac{1}{2}$ 31-15-27-W1M	Allan Stoughton	Box Oakville, MB R0H 0Y0		
	75 $\frac{1}{2}$ Ptn. S $\frac{1}{2}$ 31-15-27-W1M	Gladys Marie Edwards (Life Estate), Nelsia Courtney Edwards, Paula Frances Verley (Estate in Remainder Expectant)			
	12 $\frac{1}{2}$ Ptn. S $\frac{1}{2}$ 31-15-27-W1M	Jacynthe Marie Fouillard	Box 28 St. Lazare, MB R0M 1Y0		
	12 $\frac{1}{2}$ Ptn. S $\frac{1}{2}$ 31-15-27-W1M	Aline Gabrielle Fouillard	Box 118 St. Lazare, MB R0M 1Y0		
	100 $\frac{1}{2}$ NE 32-15-27-W1M	Crown Minerals		204-945-6577	
	100 $\frac{1}{2}$ NW 32-15-27-W1M	R.M. of Miniota	Box 70 Miniota, MB R0M 1M0	204-567-3683	
	100 $\frac{1}{2}$ SE 32-15-27-W1M	Crown Minerals		204-945-6577	

100% SW 32-15-27-W1M	R.M. of Miniota	Box 70 Miniota, MB R0M 1M0	204-567-3683	
100% NW 33-15-27-W1M	R.M. of Miniota	Box 70 Miniota, MB R0M 1M0	204-567-3683	
100% SE 33-15-27-W1M	The Soldier Settlement Board of Canada	National Resources Canada-Public Land ResourceMgmt.Division 10th Floor, 580 Booth St. Ottawa, ON K1A 0E4	613-943-2910	
100% SW 33-15-27-W1M	R.M. of Miniota	Box 70 Miniota, MB R0M 1M0	204-567-3683	
75% NE 34-15-27-W1M	Joseph Stech			
12% NE 34-15-27-W1M	Arthur Douglas Radalinsky			
12% NE 34-15-27-W1M	Tony Derlago			
50% W 34-15-27-W1M	Canada Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
50% W 34-15-27-W1M	Donald Glen Darker	Box 89 Miniota, MB R0M 1M0	204-567-3711	
100% SE 34-15-27-W1M	Crown Minerals		204-945-6577	
100% NE 3-16-27-W1M	Adolph Bezo			
100% SE 3-16-27-W1M	Linda Helen Butcher	1175 Lake Placid Dr. SE Calgary, AB T2J 5J2		
100% W 3-16-27-W1M	R.M. of Birtle	Box 70 Birtle, MB R0M 0C0	204-842-3403	
100% NW 4-16-27-W1M	R.M. of Birtle	Box 70 Birtle, MB R0M 0C0	204-842-3403	

	100% E½ 4-16-27-W1M 100% SW 4-16-27-W1M	Crown Minerals		204-945-6577	
	100% N½ 5-16-27-W1M 100% SW 5-16-27-W1M	R.M. of Birtle	Box 70 Birtle, MB ROM OCO	204-842-3403	
	50% SE 5-16-27-W1M	George Barteaux	Box Birtle, MB ROM OCO	204-842-3346	
	50% SE 5-16-27-W1M	John Barteaux	Box Birtle, MB ROM OCO	204-842-5222	
	50% N½ 6-16-27-W1M 50% N½ 6-16-27-W1M	Andrew Bertram Joan Bertram			
	16.66% Ptn. S½ 6-16-27-W1M	Marjorie Marie Butterworth			
	16.66% Ptn. S½ 6-16-27-W1M	Arthur Harrison Doig			
	16.66% Ptn. S½ 6-16-27-W1M	Harrison Doig			
	16.66% Ptn. S½ 6-16-27-W1M	John Andrew Doig			
	33.33% Ptn. S½ 6-16-27-W1M	Douglas Scantlebury	Box 465 Birtle, MB ROM OCO	204-842-5187	
	50% NE 7-16-27-W1M 37½% NE 7-16-27-W1M 12½% NE 7-16-27-W1M	Carrol Langford Clifford Barteaux John Edgar Barteaux Estate			
	50% NW 7-16-27-W1M 50% NW 7-16-27-W1M	Alberta Barteaux Estate Prudential Trust Company	Box 398 Birtle, MB ROM OCO	204-842-3721	
		Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8		403-267-6887	

100% S½ 7-16-27-W1M	Joan Bertram	Box 106 Birtle, MB ROM OCO		
100% N½ 8-16-27-W1M	Robert Corr	Box Birtle, MB ROM OCO	204-842-3806	
50% S½ 8-16-27-W1M	Prudential Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
50% S½ 8-16-27-W1M	Kenton Salmon	Box 518 Birtle, MB ROM OCO	204-842-3664	
100% SEC 9-16-27-W1M	R.M. of Birtle	Box 70 Birtle, MB ROM OCO	204-842-3403	
100% NE 10-16-27-W1M	Crown Minerals		204-945-6577	
100% NW 10-16-27-W1M	2992770 Manitoba Ltd.	Box 310 Birtle, MB ROM OCO		
50% SE 10-16-27-W1M	Douglas Scantlebury	Box 465 Birtle, MB ROM OCO	204-842-5187	
50% SW 10-16-27-W1M	William Zapuchlak			
50% S½ 10-16-27-W1M	Prudential Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
100% SEC 16-16-27-W1M	Douglas Foster Wilson "et al"	Box 315 Birtle, MB ROM OCO		
25% E½ 17-16-27-W1M	George Thomas Wady			
25% E½ 17-16-27-W1M	George B. Wady			
50% E½ 17-16-27-W1M	Cynthia Slevin	314-167 Bannatyne Ave. Winnipeg, MB R3B 0R4		

	100% NW 17-16-27-W1M	David Henry Nettle "et al"	Box 398 Birtle, MB ROM OC0		
	25% SW 17-16-27-W1M	George B. Wady			
	25% SW 17-16-27-W1M	Thomas George Wady			
	50% SW 17-16-27-W1M	Cynthia Slevin	314-167 Bannatyne Ave. Winnipeg, MB R3B 0R4		
	100% E4 18-16-27-W1M	Crown Minerals		204-945-6577	
	100% NW 18-16-27-W1M	William Kuch	Box 268 Birtle, MB ROM OC0		
	50% SW 18-16-27-W1M	Carrol Wallace Langford			
	37% SW 18-16-27-W1M	Clifford Smith Bartheaux			
	12% SW 18-16-27-W1M	John Edgar Bartheaux Estate	Box 398 Birtle, MB ROM OC0	204-842-3721	
	100% Ptn.NE 19-16-27-W1M	David Pittendreigh "et al"	94 Lisner Crescent Winnipeg, MB R3R 1N6		
	100% Ptn.NE 19-16-27-W1M	Lella Gwendolyn Whitmore	460-2251 Cadbord Bay Victoria, BC V8R 5H3		
	50% NW 19-16-27-W1M	Crown Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
	50% NW 19-16-27-W1M	Linda Helen Butcher	1175 Lake Placid Dr. SE Calgary, AB T2J 5J2		
	100% SW 19-16-27-W1M	Noah Bartley			
	100% SE 19-16-27-W1M	Crown Minerals		204-945-6577	
	100% NE 20-16-27-W1M	George Harrison Bartheaux			
	100% SE 20-16-27-W1M	Phillip Tillson Bartheaux			

	50% WA 20-16-27-WIM	Wattview Resources Ltd.	Box 2504 The Pas, MB R9A 1M3		
	50% WA 20-16-27-WIM	Cynthia Slevin	404-15 Cornish Ave. Winnipeg, MB R3C 0Z7		
	50% NW 21-16-27-WIM 50% SW 21-16-27-WIM	Cynthia Slevin	404-15 Cornish Ave. Winnipeg, MB R3C 0Z7		
	25% NW 21-16-27-WIM 25% SW 21-16-27-WIM	George B. Wady			
	25% NW 21-16-27-WIM 25% SW 21-16-27-WIM	George Thomas Wady			
	100% SE 21-16-27-WIM	Douglas Scantlebury	Box 465 Birtle, MB ROM 0C0		
	100% SEC 28-16-27-WIM	Francis William Crew			
	100% SEC 29-16-27-WIM	Crown Minerals		204-945-6577	
	100% NW 30-16-27-WIM	Allan Barteaux "et al"	Box 52 Birtle, MB ROM 0C0		
	50% SW 30-16-27-WIM	Crown Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
	50% SW 30-16-27-WIM	Linda Helen Butcher	1175 Lake Placid Dr. SE Calgary, AB T2J 5J2		
	50% NE 13-16-28-WIM 50% NE 13-16-28-WIM	Henry Melville Doig Estate William Kuch			
	100% SE 13-16-28-WIM 100% Ptn. WA 13-16-28-WIM	Crown Minerals Robert Corr	Box 268 Birtle, MB ROM 0C0	204-945-6577	

	100% E½ 24-16-28-W1M	Frances Marie Lundeen	1371-17th Ave. SE Salmon Arm, BC V1E 2G2		
	50% NW 24-16-28-W1M	George Richard Leaming			
	50% NW 24-16-28-W1M	Prudential Trust Company	Montreal Trust Co. of Canada 530-8th Ave. S.W. Calgary, AB T2P 3S8	403-267-6887	
	100% SW 24-16-28-W1M	Crown Minerals		204-945-6577	
	100% NE 25-16-28-W1M	Robert Andrew Dupont	Box 73 St. Lazare, MB R0M 1Y0		
	100% NW 25-16-28-W1M	Georgette Sharon Dupont	Box 1317 Russell, MB R0J 1W0		
	100% E½ of SE 25-16-28-W1M	Orville David Dandridge			
	100% W½ of SE 25-16-28-W1M	Linda Helen Butcher	1175 Lake Placid Dr. SE Calgary, AB T2J 5J2		
	100% SW 25-16-28-W1M	Kenneth Raymond Dupont	Box St. Lazare, MB R0M 1Y0		

FIGURE 5
Surface Landowners

PROGRESS ENERGY LTD.
MANITOBA WATERFLOOD PROJECT
 Surface
 Our File #120
 LINE LIST

September 25, 1998

PROGRESS FILE NO.	LAND DESCRIPTION	OWNER/OCCUPANT	ADDRESS	TELEPHONE NUMBER	REMARKS
120	100% NW 32-15-27-W1M NE 31-15-27-W1M Ptn. NW 31-15-27-W1M	John "Harvey" Fulton	Box 171 Birtle, MB ROM OCO	204-842-3260	
	Ptn. NW 31-15-27-W1M	Grand Truck Pacific Railway Co.	Pan Canadian		
	SW 31-15-27-W1M	Louise Irene Marie Fouillard "et al"	Box 28 St. Lazare, MB ROM 1Y0		
	NE 32-15-27-W1M	Allan Dale Barteaux	Box 52 Birtle, MB ROM OCO	204-842-3428	
	NE 33-15-27-W1M	David Robert Lane and James Wilfred Lane	Birtle, MB	204-842-3692 - Dave 204-842-3658 - Jim	
	NW 33-15-27-W1M	Ruby Isabel Lindsey	Winnipeg, MB		
	SE 33-15-27-W1M	Elsie May Gies	Miniota, MB		
	SW 33-15-27-W1M	Allan "Dale" Gies	Birtle, MB	204-842-3378	
	SE 34-15-27-W1M NE 34-15-27-W1M SE 3-16-27-W1M	Scantlebury Farms Ltd.	Box 95 Birtle, MB ROM OCO	204-842-3606	
	W/2 34-15-27-W1M	Donald Glen Darker and Leila Ethel Darker	Box 89 Miniota, MB ROM 1M0	204-567-3716	

	NE 3-16-27-W1M	Michael Radlinsky	General Delivery Birtle, MB ROM OCO	204-842-3282	
	W½ 3-16-27-W1M	Robert Bruce Still and Brenda Marie Still	Box 16 Isabella, MB ROM OYO	204-586-4574	
	E½ 4-16-27-W1M	George Argyle Salmon	Box 45 Birtle, MB ROM OCO	204-842-3766	
	W½ 4-16-27-W1M	George Argyle Salmon and Vera Merelene Salmon	Box 45 Birtle, MB ROM OCO	204-842-3766	
	NE 5-16-27-W1M	Murray Ephraim Salmon	Box 518 Birtle, MB ROM OCO	204-842-3680	
	W½ 5-16-27-W1M	Fassie Fern Farm Ltd.	Box 261 Birtle, MB ROM OCO	204-842-5112 Francis Crew	
	SE 5-16-27-W1M	Philip Tillson Barteaux	Birtle, MB	204-842-3761	
	N½ 6-16-27-W1M	Douglas Glen Scantlebury	Box 465 Birtle, MB ROM OCO	204-842-5187	
	S½ 6-16-27-W1M	The Manitoba Agricultural Credit Corporation	Unit 100, 1525-1st St S Brandon, MB R7A 7A1	204-726-6850	
	NE 7-16-27-W1M	Glen Tillson Barteaux	Box 88 Birtle, MB ROM OCO	204-842-3646	
	SW 32-15-27-W1M NW 7-16-27-W1M SE 7-16-27-W1M	Ronald Bruce Barteaux	Box 425 Birtle, MB ROM OCO	204-842-3613	
	SW 7-16-27-W1M (2 Titles)	Albert Bruce Bartram	Box 116 Birtle, MB ROM OCO	204-842-3848	
	N½ 8-16-27-W1M	Robert Allen Corr		204-842-3806	

	SX 8-16-27-W1M	Clifford Kenton Clarence Salmon	Box 518 Birtle, MB ROM OCO	204-842-3664	
	NX 9-16-27-W1M	Janice Pauline Meseyton	Box 1581 Portage La Prairie, MB R1N 3P1		
	SE 9-16-27-W1M SW 9-16-27-W1M	William Roger Wilson	Box 315 Birtle, MB ROM OCO	204-842-3861	
	NX 10-16-27-W1M SW 10-16-27-W1M	2992770 Manitoba Ltd.	Box 310 Birtle, MB ROM OCO		
	SE 10-16-27-W1M	John Radlinsky	346 Kilbride Winnipeg, MB	204-339-2943	
	NE 16-16-27-W1M SE 16-16-27-W1M	Douglas Foster Wilson, Edith Lillian Wilson and William Roger Douglas Wilson	Box 315 Birtle, MB ROM OCO	204-842-3861	
	WX 16-16-27-W1M	William Roger Wilson	Box 315 Birtle, MB ROM OCO	204-842-3861	
	NE 17-16-27-W1M	Robert John Barteaux and Marjorie Lynne Barteaux	Box 355 Birtle, MB ROM OCO	204-842-3779	
	NW 17-16-27-W1M	David Henry Nettle and Aynsley Celeste Nettle	Box 398 Birtle, MB ROM OCO	204-842-3721	
	SE 17-16-27-W1M SW 17-16-27-W1M	Bruce Henry Bertram and Louise Hilda Bertram		204-842-5189	
	NX 18-16-27-W1M	William Kuch	Box 268 Birtle, MB ROM OCO	204-842-5106	
	SX 18-16-27-W1M	Ronald Bruce Barteaux		204-842-3613	
	Ptn. NE 19-16-27-W1M	Glen Tilson Barteaux		204-842-3646	
	Ptn. NE 19-16-27-W1M	David William Pittendreigh and Sandra Grace Pittendreigh	94 Wismer Crescent Winnipeg, MB R3R 1N6	204-895-7901	

	NW 19-16-27-W1M	David Robert Paul Barteaux	Box 81 Birtle, MB ROM OCO	204-842-3654	
	Ptn. SE 19-16-27-W1M SW 19-16-27-W1M	Frederick George Barteaux and Shirley Diane Barteaux	Box 444 Birtle, MB ROM OCO	204-842-3655	
	Ptn. SE 19-16-27-W1M (2 Titles)	Bruce Henry Bertram	✓	204-842-5189	
	Ex 20-16-27-W1M	Philip Tillson Barteaux	✓	204-842-3761	
	Ptn. SW 20-16-27-W1M NW 20-16-27-W1M	Kelvin Bruce Gooda and Nona Marie Ada Gooda	Box 125 Birtle, MB ROM OCO	204-842-3604	
	Ptn. SW 20-16-27-W1M	Neil Owen Bertram	Box 613 Birtle, MB ROM OCO	204-842-3716	
	NW 21-16-27-W1M	Glen Tilson Barteaux		204-842-3646	
	SE 21-16-27-W1M	Douglas Glen Scantlebury	Box 465 Birtle, MB ROM OCO	204-842-5187	
	SW 21-16-27-W1M	Charles Harold Bertram	Box 106 Birtle, MB ROM OCO	204-842-3758	
	SEC. 28-16-27-W1M	Francis William Crew		204-842-5112	
	NW 29-16-27-W1M	Crown			
	NE 29-16-27-W1M				
	SE 29-16-27-W1M				
	SW 29-16-27-W1M	Glen Tilson Barteaux		204-842-3646	
	NW 30-16-27-W1M	Allan Dale Barteaux and Evelyn Marie Barteaux	Box 52 Birtle, MB ROM OCO	204-842-3428	
	SE 30-16-27-W1M	Murray Walter Barteaux	Box 106 Birtle, MB ROM OCO		
	SW 30-16-27-W1M	Charles Harold Bertram	Box 106 Birtle, MB ROM OCO	204-842-3758	

	NE 13-16-28-W1M	William Kuch	Box 268 Birtle, MB ROM 0C0	204-842-5106	
	NW 13-16-28-W1M SW 13-16-28-W1M	Robert Allen Corr		204-842-3806	
	SE 13-16-28-W1M	Bruce Henry Bertram and Hilda Louise Bertram	Box 172 Birtle, MB ROM 0C0	204-842-5189	
	E/ 24-16-28-W1M SW 24-16-28-W1M	David Robert Paul Barteaux	Box 81 Birtle, MB ROM 0C0	204-842-3654	
	NW 24-16-28-W1M	Thomas Farms Ltd.	Box 73 Birtle, MB ROM 0C0		
	NE 25-16-28-W1M	Robert Andrew George Dupont	Box 73 St. Lazare, MB ROM 1Y0		
	NW 25-16-28-W1M	Georgette Sharon Margaret Dupont	Box 1317 Russell, MB R0J 1W0		
	SE 25-16-28-W1M SW 25-16-28-W1M	Orville David Dandridge Kenneth Raymond John Dupont	General Delivery St. Lazare, MB ROM 1Y0	204-842-3437 204-683-2364	

APPENDICES

APPENDICES

1. **Birdtail Production Summary**
2. **Reservoir Fluid Analysis**
3. **Core Studies**
4. **Geological Maps and Cross Sections**
5. **Water Compatibility Geochemical Modeling Results**
6. **Surface Landowner Information Letters**

APPENDIX 1
Birdtail Production Summary

South Birdtail Summary W. Data 09/96-07/98

Operator:

Field:

Zone:

Type: Other

Group: South Birdtail

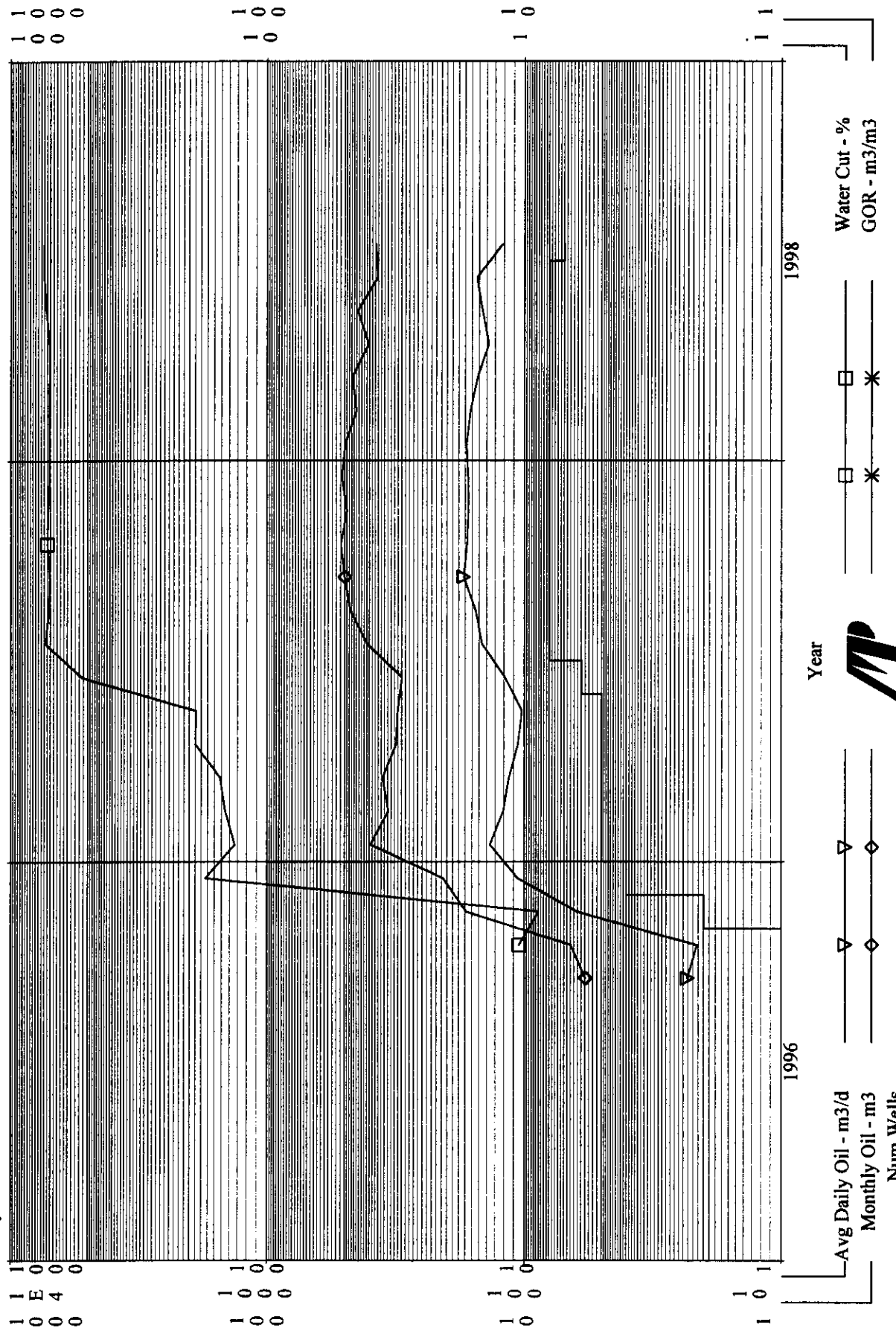
Production Cumis

Oil: 8441.1 m3

Gas: 0 E6m3

Water: 15707.7 m3

Cond: 0 m3



Avg Daily Oil - m3/d
Monthly Oil - m3
Num Wells

Year

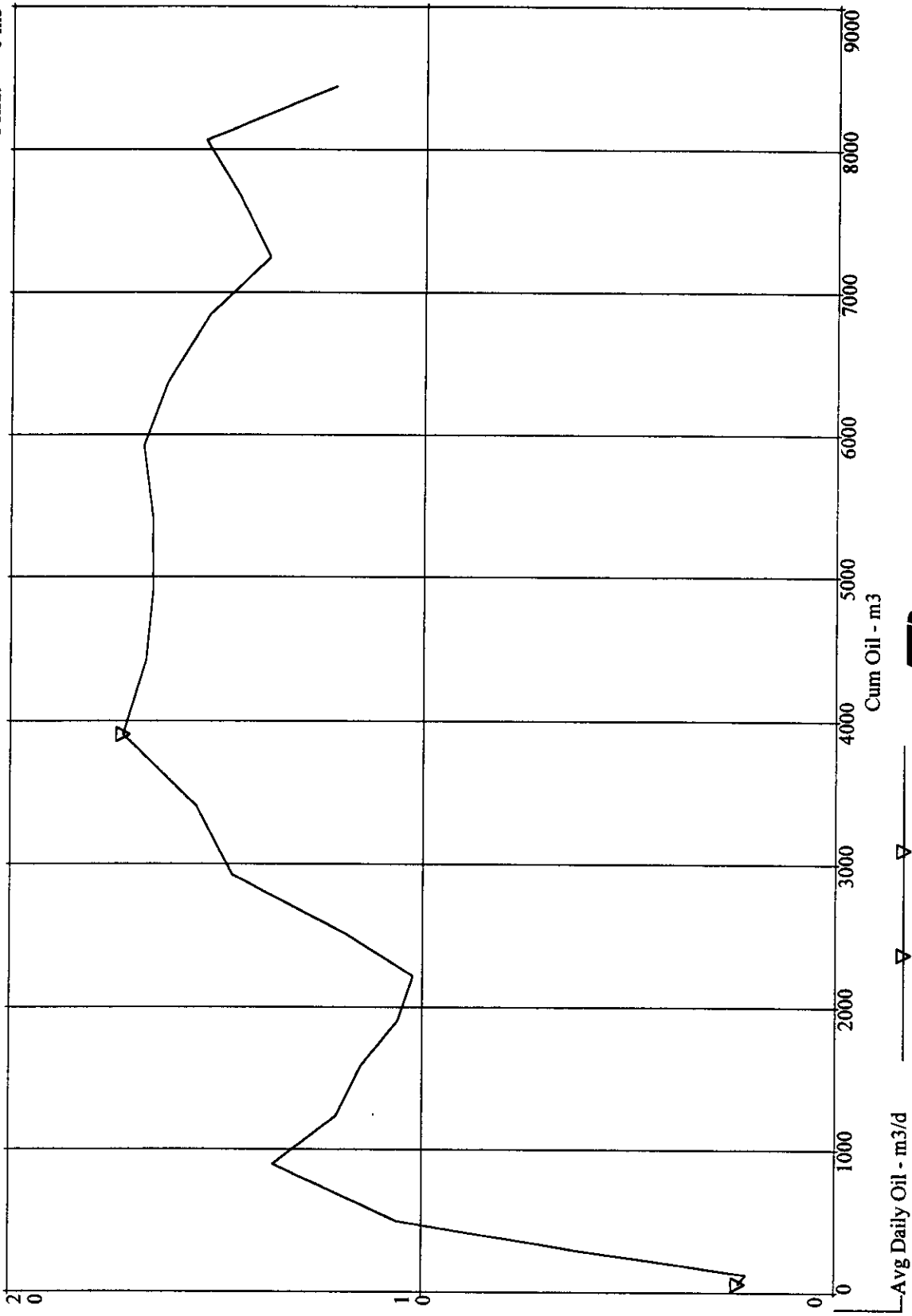


Water Cut - %
GOR - m3/m3

South Birdtail Summary Well Data 09/96-07/98

Operator:
Field:
Zone:
Type: Other
Group: South Birdtail

Production Cums
Oil: 8441.1 m3
Gas: 0 E6m3
Water: 15707.7 m3
Cond: 0 m3



MP

00/05-04-016-27W1/0 (Northrock Birdtail Prov. 05D-04-16-27W1) Data 07/97-07/98

Operator:

Field: 15

Zone: 60A

Type: Other

Group: South Birdtail

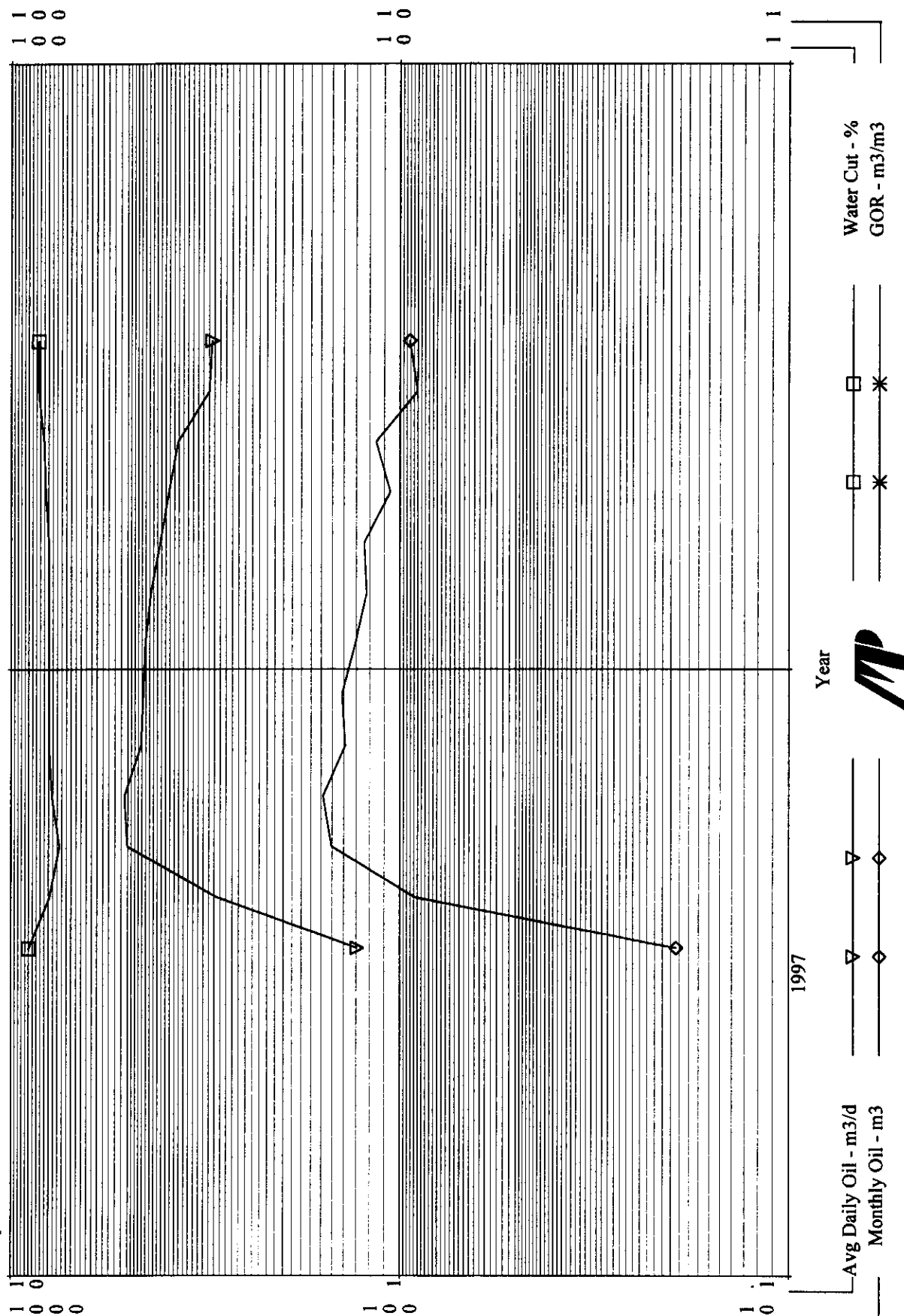
Production Cums

Oil: 1484.1 m3

Gas: 0 E6m3

Water: 6234.9 m3

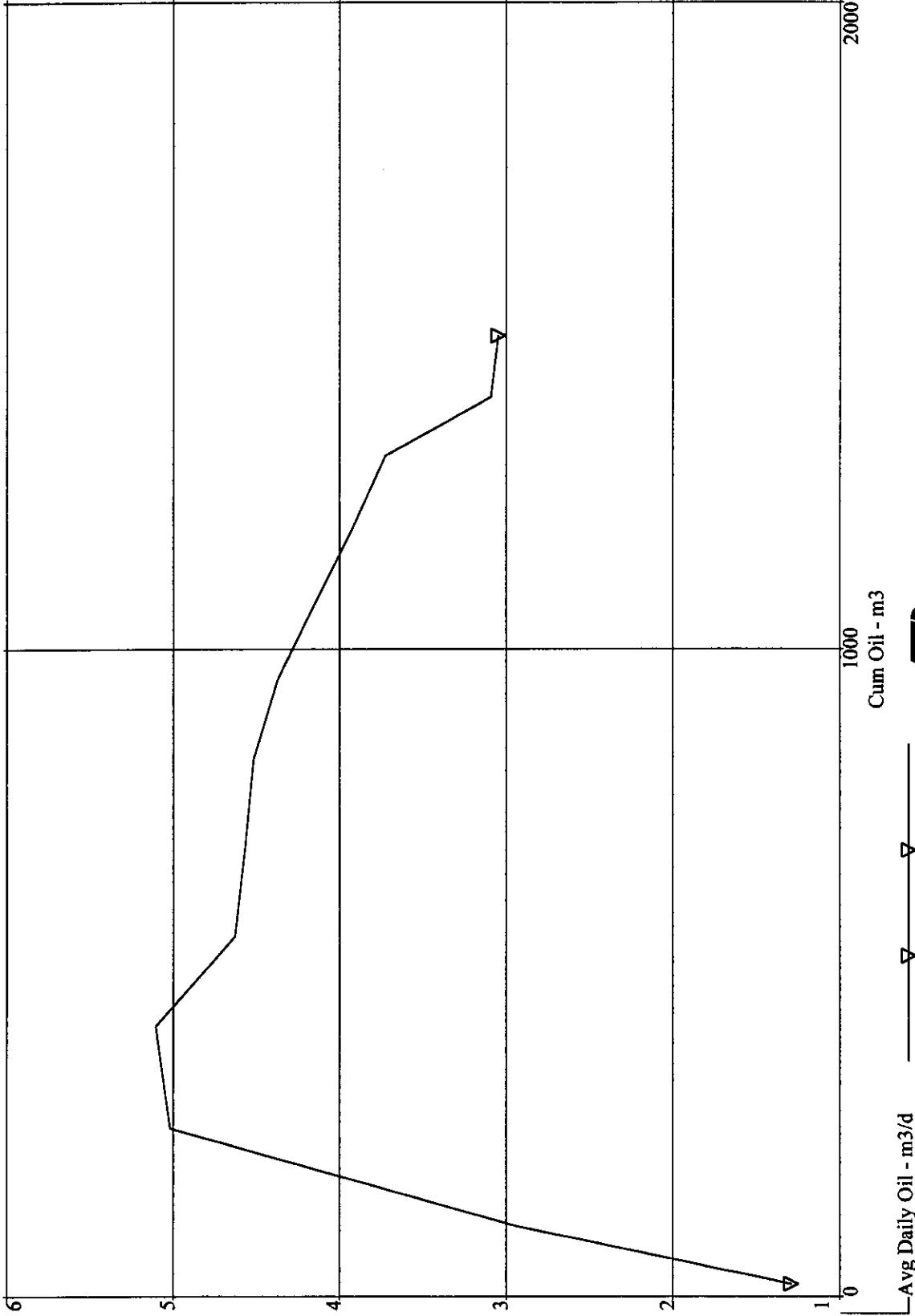
Cond: 0 m3



00/05-04-016-27W1/0 (Northrock Birdtail Pro... 5D-04-16-27W1) Data 07/97-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

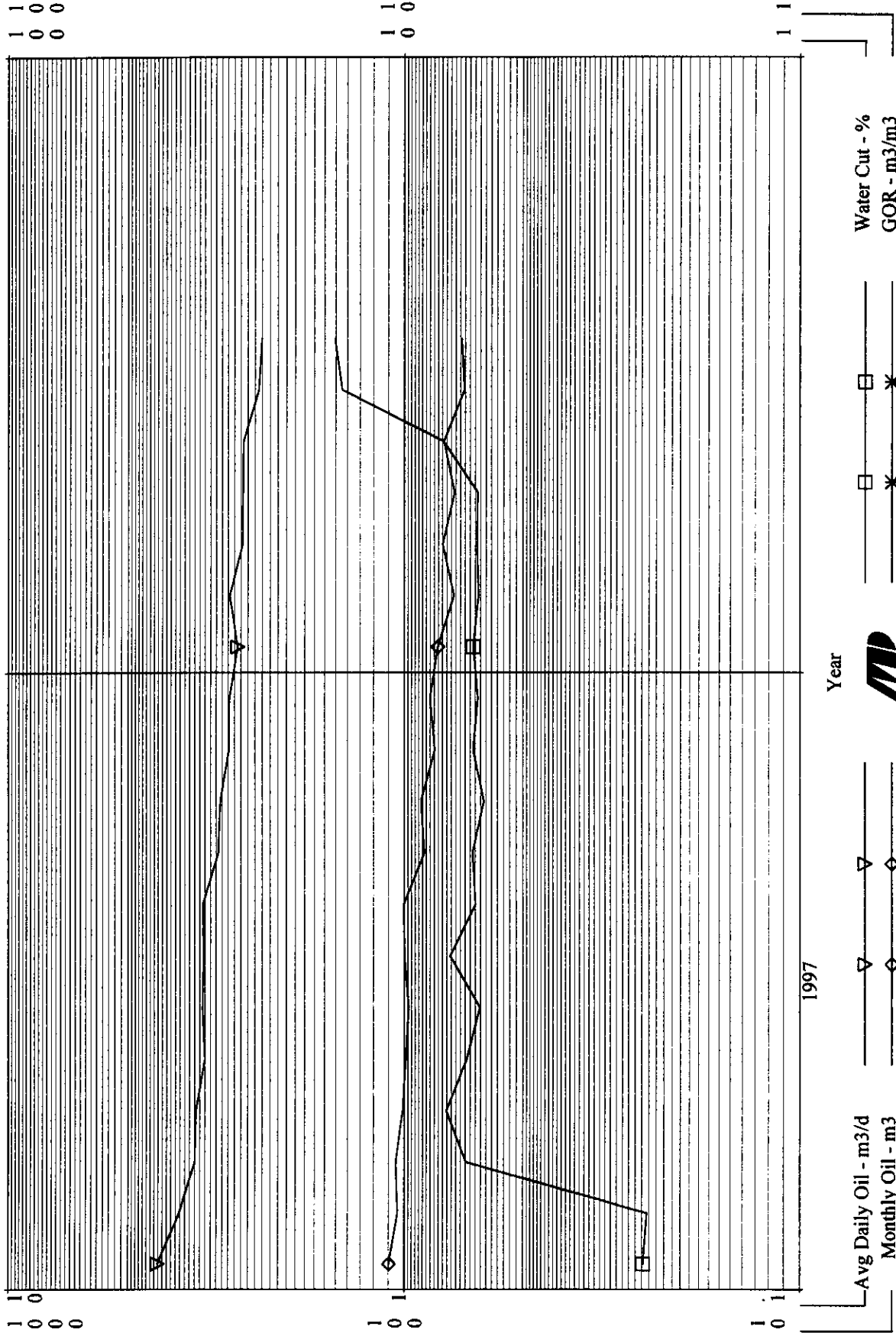
Production Cums
Oil: 1484.1 m3
Gas: 0 E6m3
Water: 6234.9 m3
Cond: 0 m3



00/12-04-016-27W1/0 (Northrock Birdtail -04-16-27W1) Data 01/97-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 1700.9 m3
Gas: 0 E6m3
Water: 129.3 m3
Cond: 0 m3



00/12-04-016-27W1/0 (Northrock Birdtail ...04-16-27W1) Data 01/97-07/98

Operator:

Field: 15

Zone: 60A

Type: Other

Group: South Birdtail

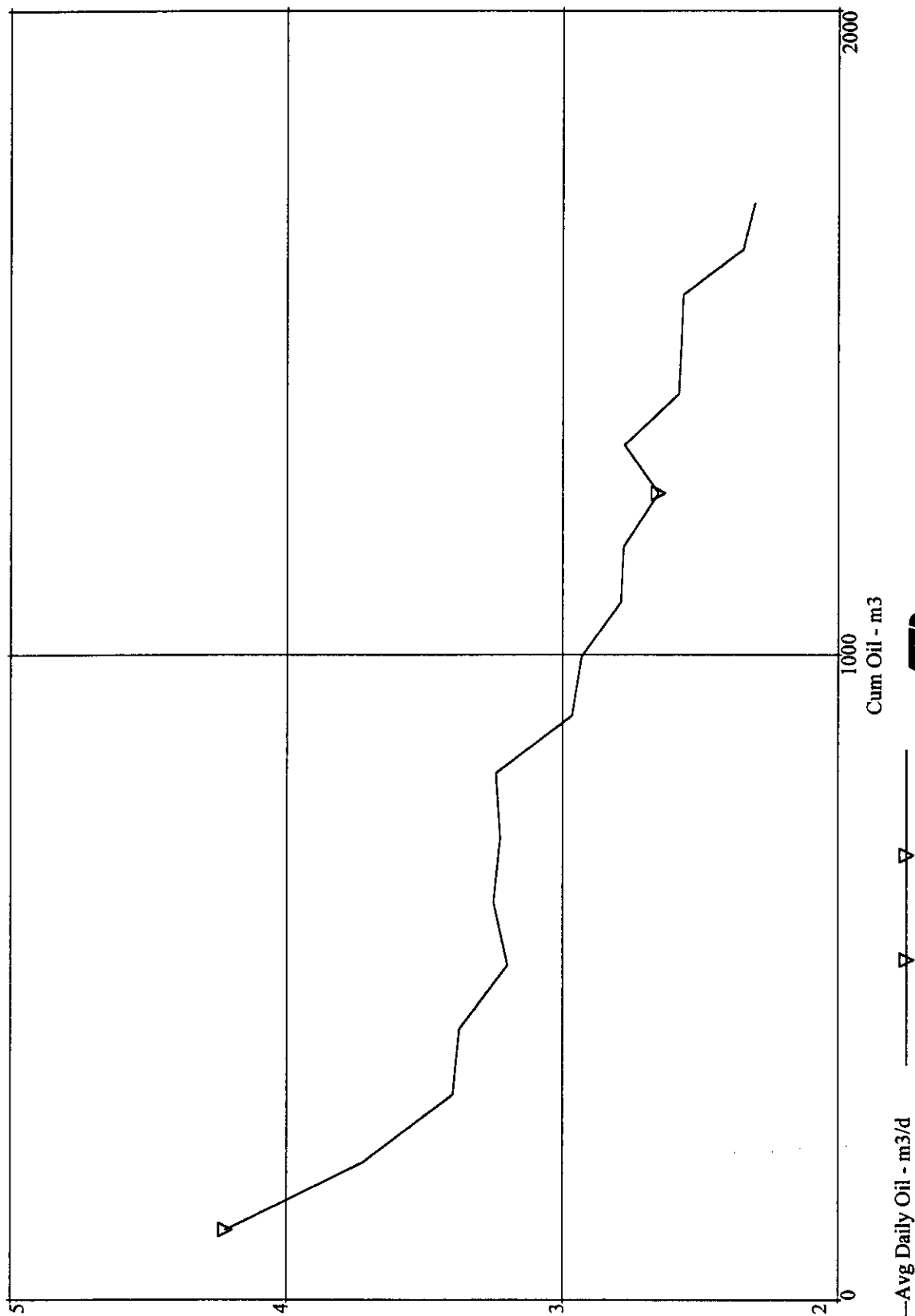
Production Cums

Oil: 1700.9 m3

Gas: 0 E6m3

Water: 129.3 m3

Cond: 0 m3



MP

00/13-04-016-27W1/0 (Northrock Birdtail -04-16-27W1) Data 11/96-07/98

Operator:

Field: 15

Zone: 60A

Type: Other

Group: South Birdtail

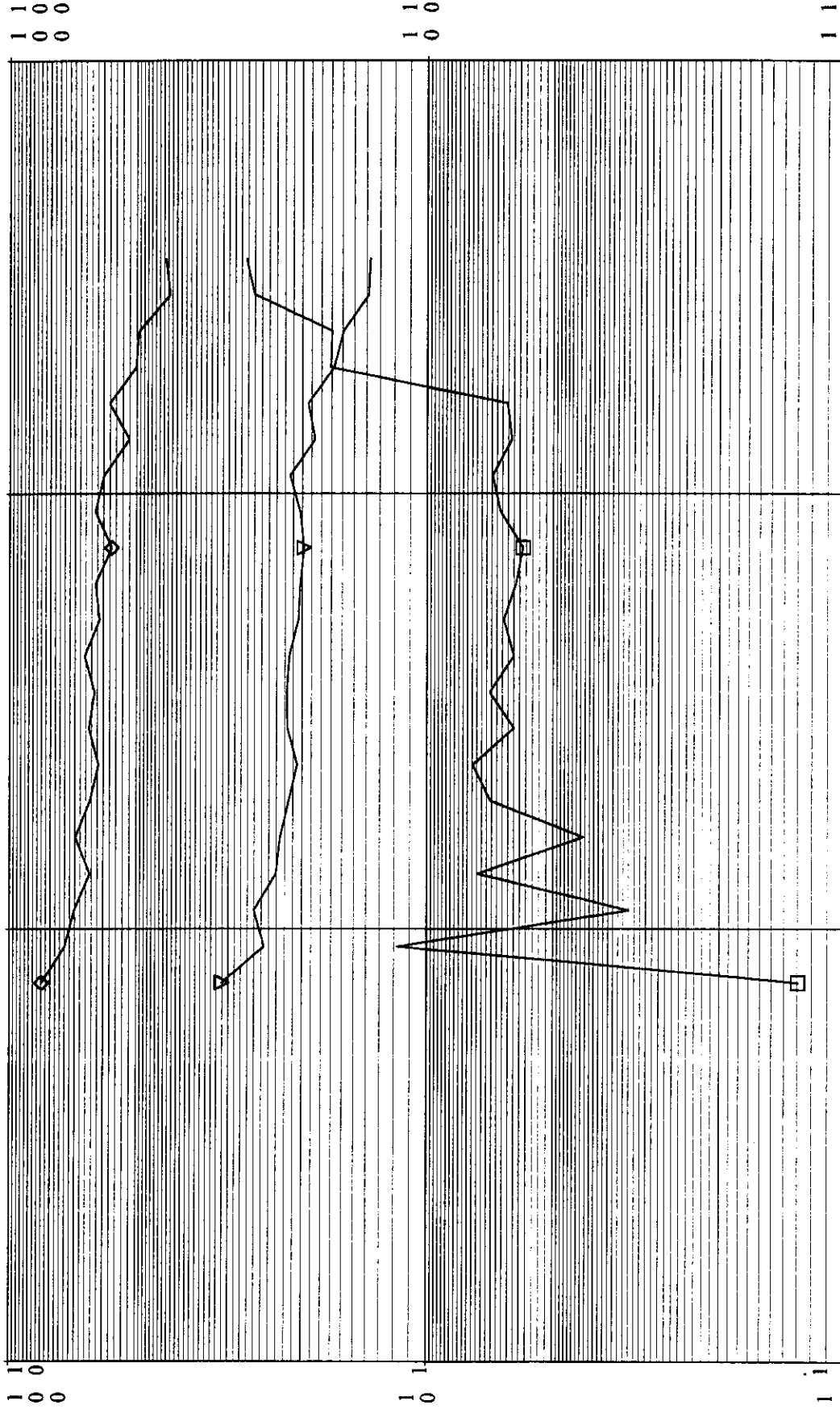
Production Cums

Oil: 1281.6 m3

Gas: 0 E6m3

Water: 125.1 m3

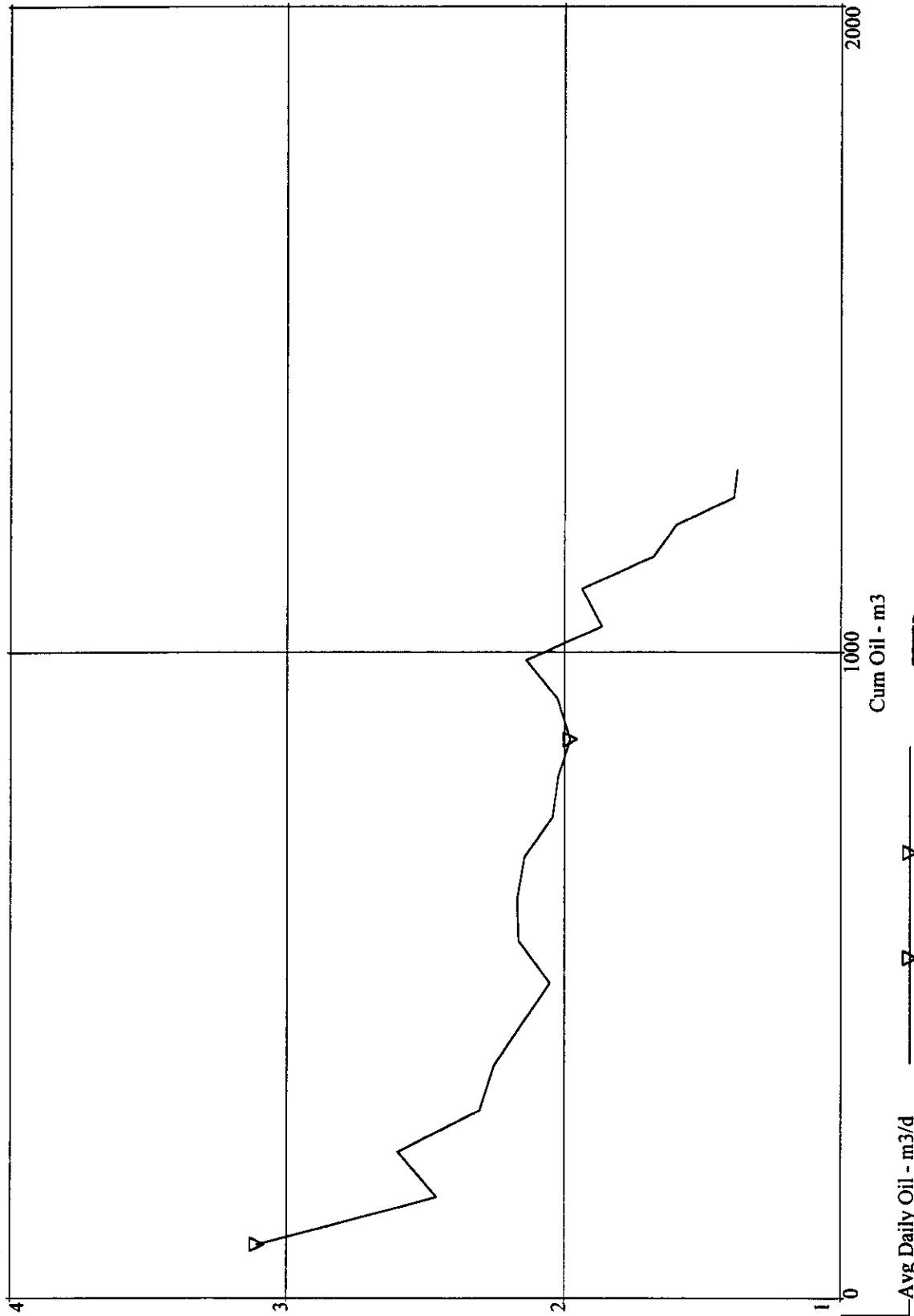
Cond: 0 m3



00/13-04-016-27W1/0 (Northrock Birdtail 13-04-16-27W1) Data 11/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 1281.6 m3
Gas: 0 E6m3
Water: 125.1 m3
Cond: 0 m3

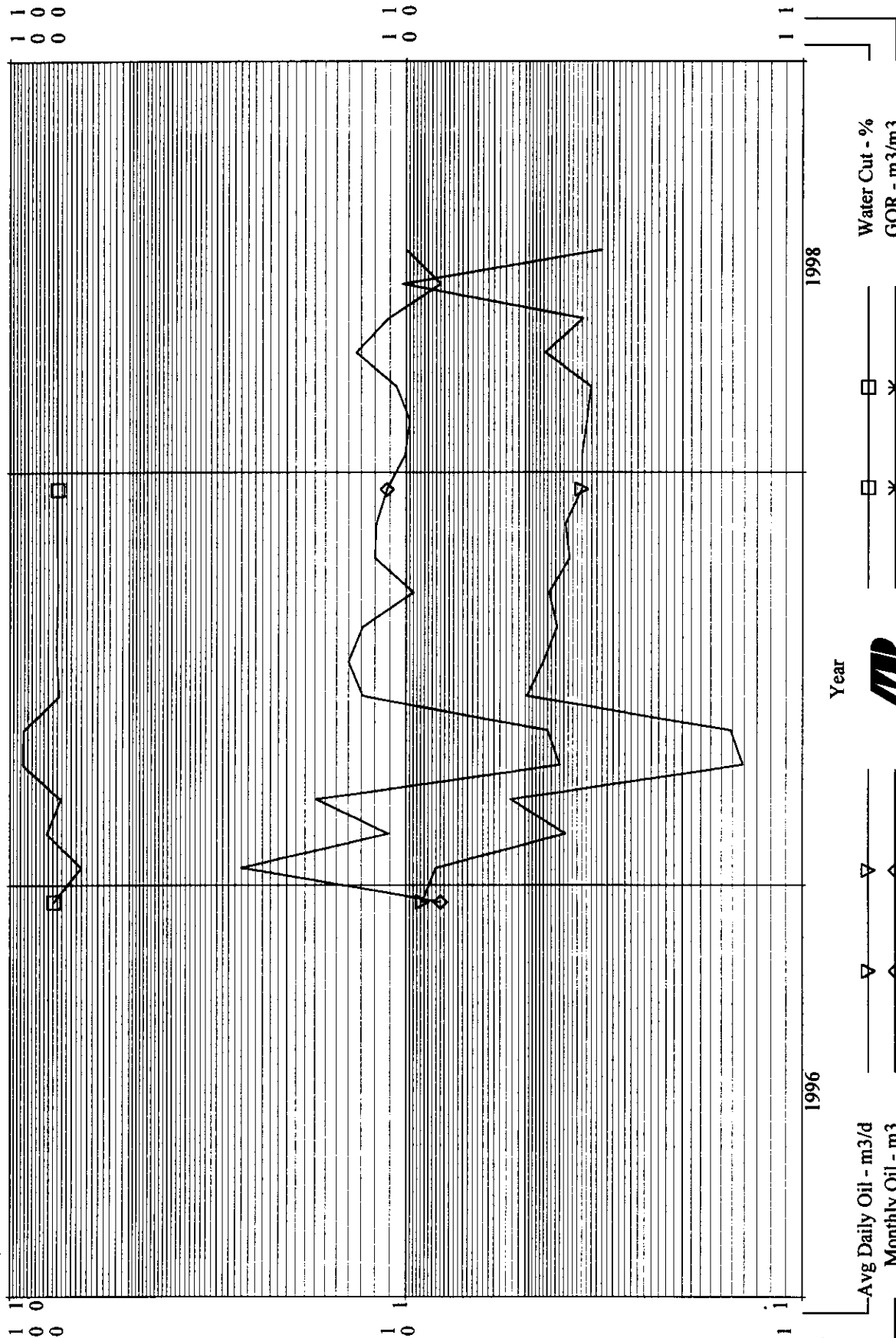


MP

00/14-04-016-27W1/0 (Northrock Birdtail) 04-16-27W1) Data 01/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

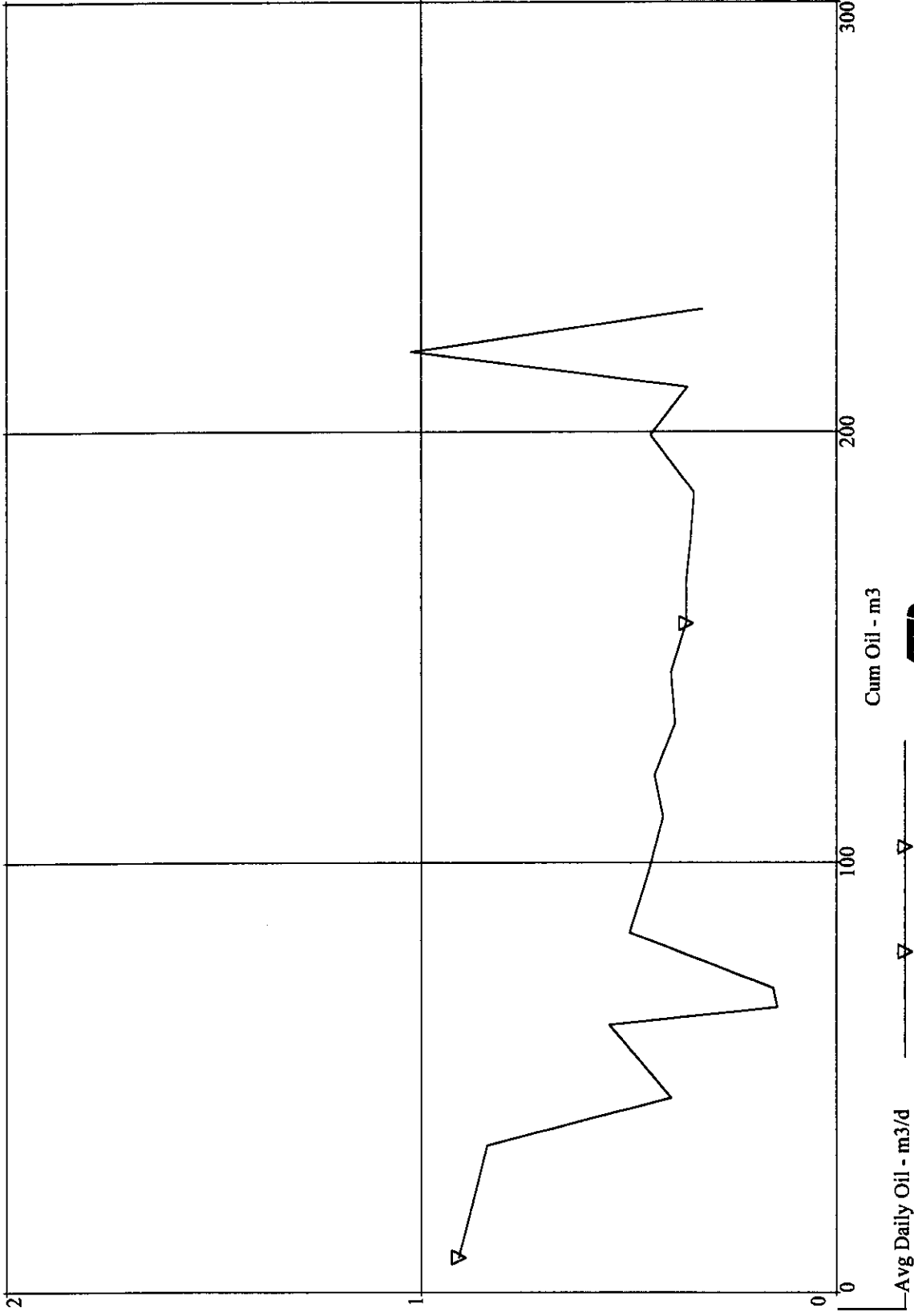
Production Cums
Oil: 228.5 m3
Gas: 0 E6m3
Water: 782.2 m3
Cond: 0 m3



00/14-04-016-27W1/0 (Northrock Birdta. 04-16-27W1) Data 01/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 228.5 m3
Gas: 0 E6m3
Water: 782.2 m3
Cond: 0 m3

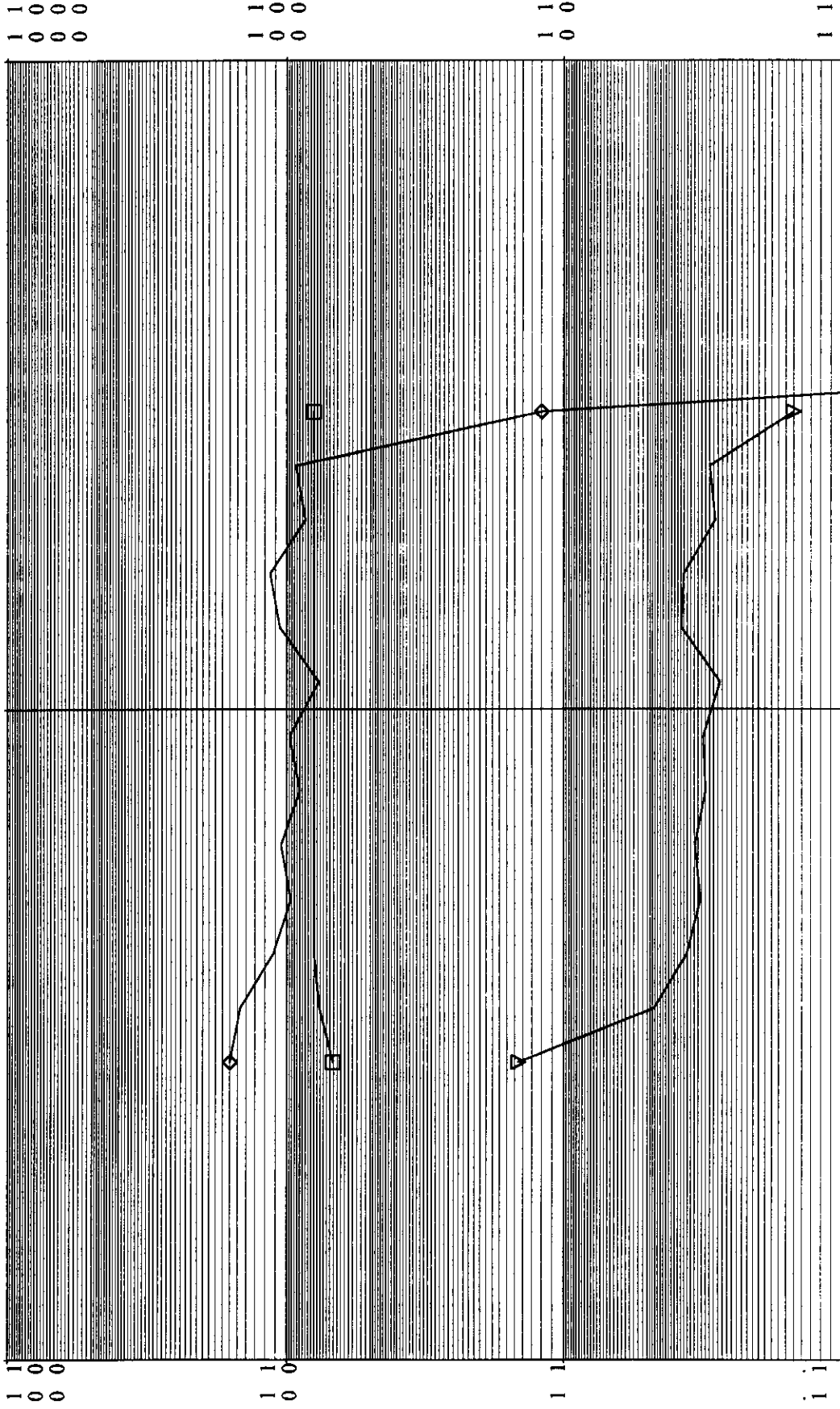


MP

00/07-05-016-27W1/0 (Northrock Birdtail) -05-16-27W1) Data 06/97-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 129.8 m3
Gas: 0 E6m3
Water: 479.7 m3
Cond: 0 m3



Avg Daily Oil - m3/d
Monthly Oil - m3
Year
Water Cut - %
GOR - m3/m3

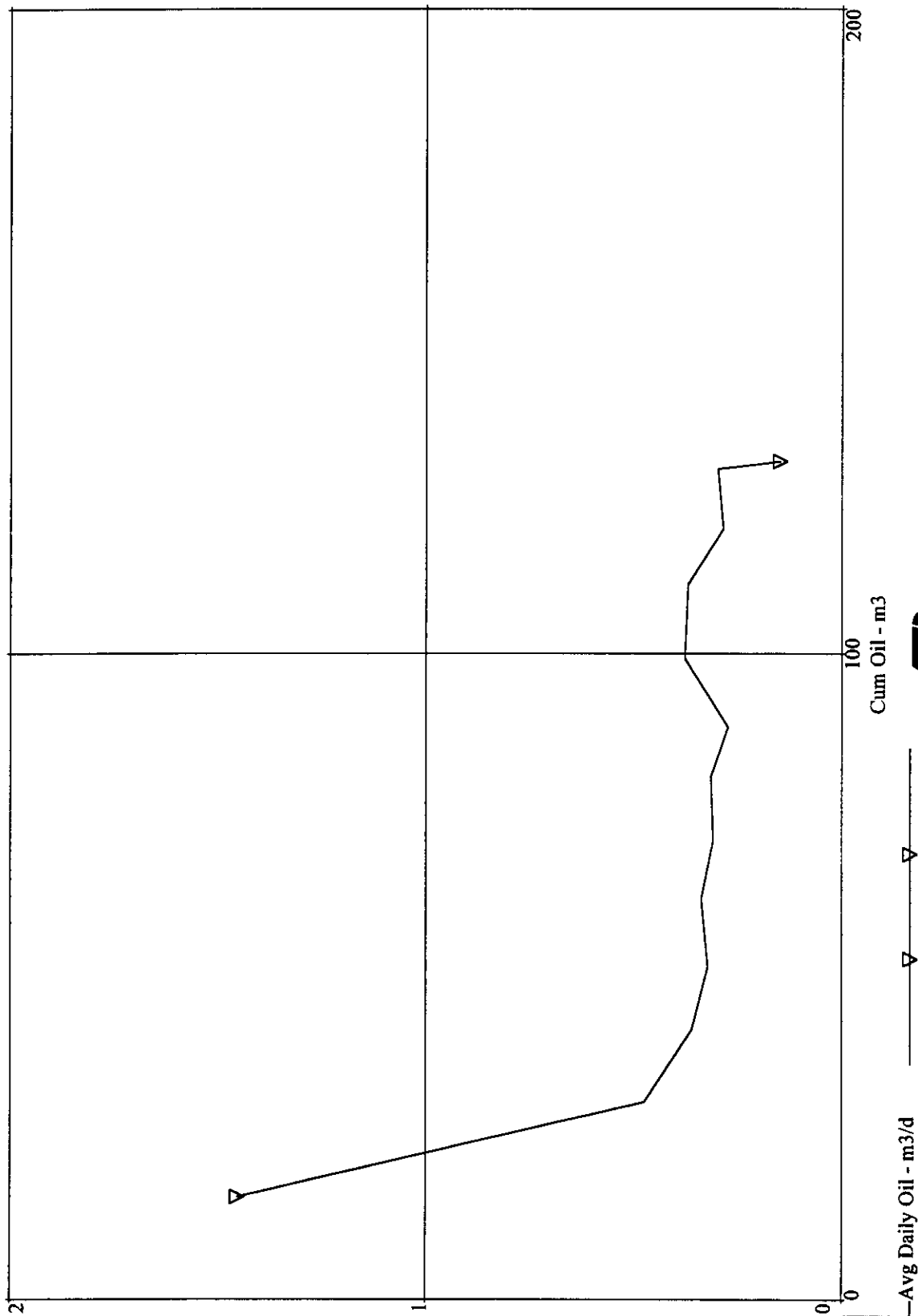
1997

MP

00/07-05-016-27W1/0 (Northrock Birdtail) -05-16-27W1) Data 06/97-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

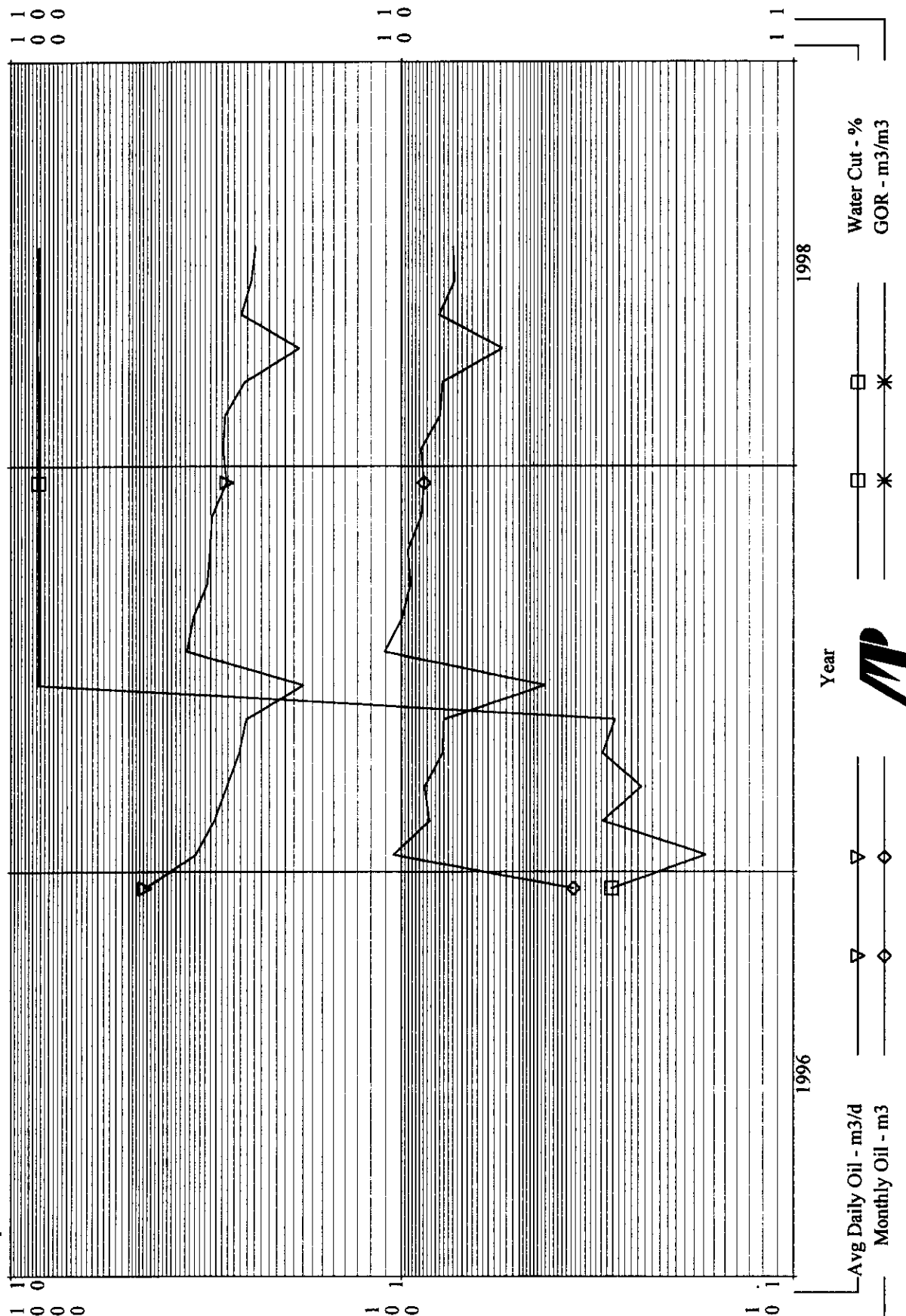
Production Cums
Oil: 129.8 m3
Gas: 0 E6m3
Water: 479.7 m3
Cond: 0 m3



MP

Production Cums
Oil: 1622.9 m3
Gas: 0 E6m3
Water: 6554.1 m3
Cond: 0 m3

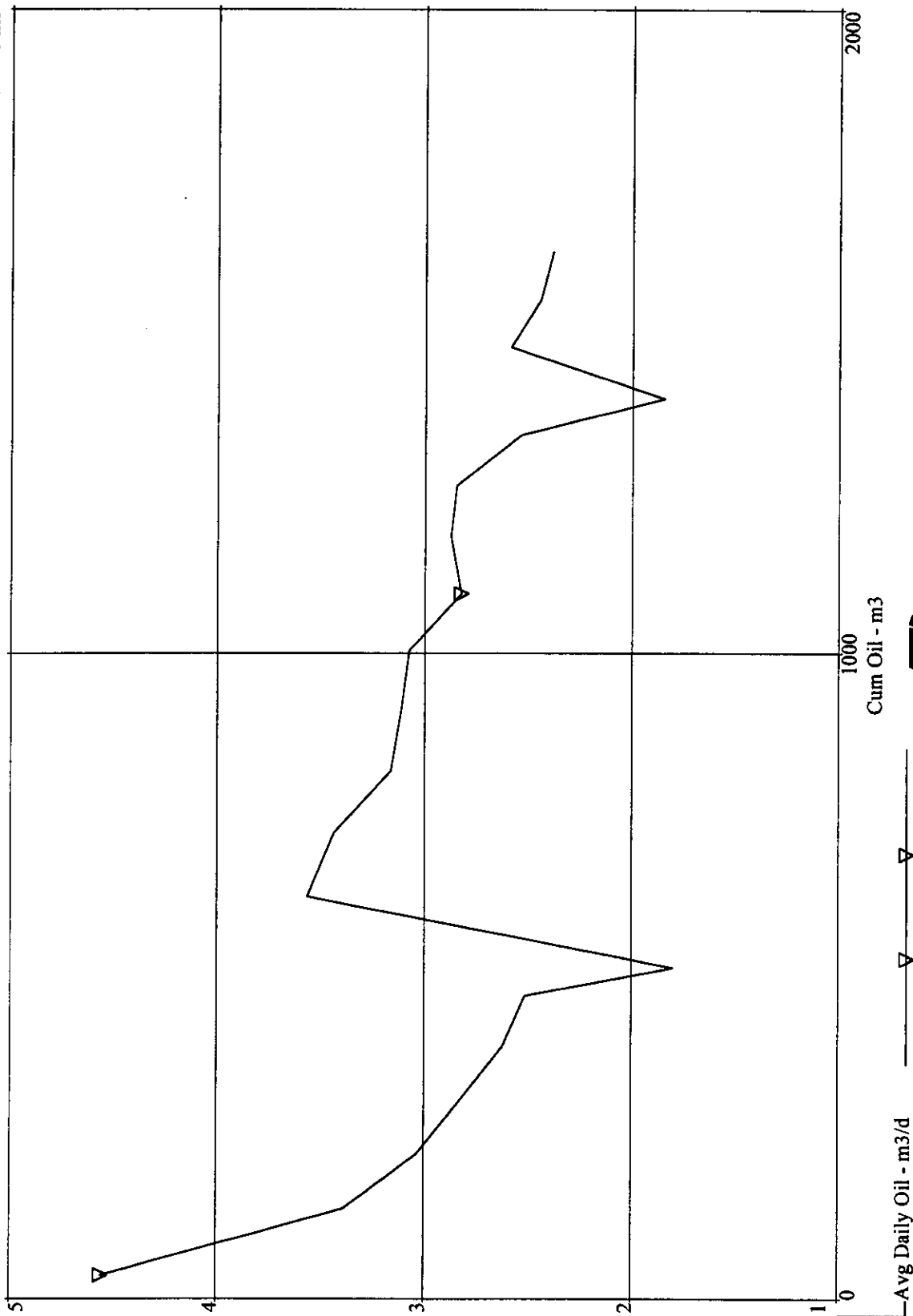
Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail



00/09-05-016-27W1/0 (Northrock Birdia. -05-16-27W1) Data 01/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 1622.9 m3
Gas: 0 E6m3
Water: 6554.1 m3
Cond: 0 m3



MP

00/15-05-016-27W1/0 (Northrock Birdtail ,5-05-16-27W1) Data 07/97-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 561.6 m3
Gas: 0 E6m3
Water: 1346.3 m3
Cond: 0 m3



1997

Avg Daily Oil - m3/d
Monthly Oil - m3

Year

Water Cut - %
GOR - m3/m3

1 1

00/15-05-016-27W1/0 (Northrock Birdtail) 05-16-27W1) Data 07/97-07/98

Operator:

Field: 15

Zone: 60A

Type: Other

Group: South Birdtail

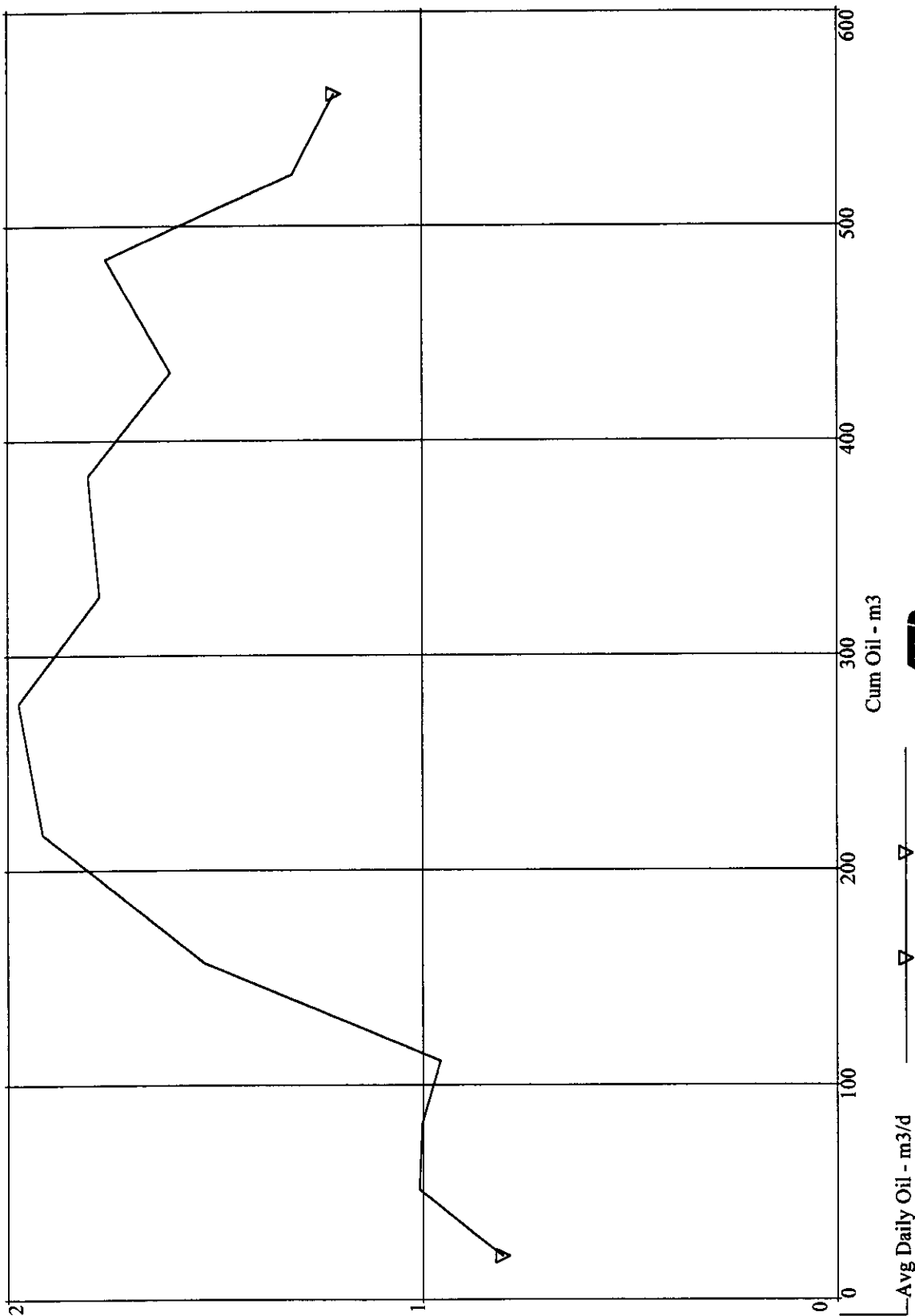
Production Cums

Oil: 561.6 m3

Gas: 0 E6m3

Water: 1346.3 m3

Cond: 0 m3

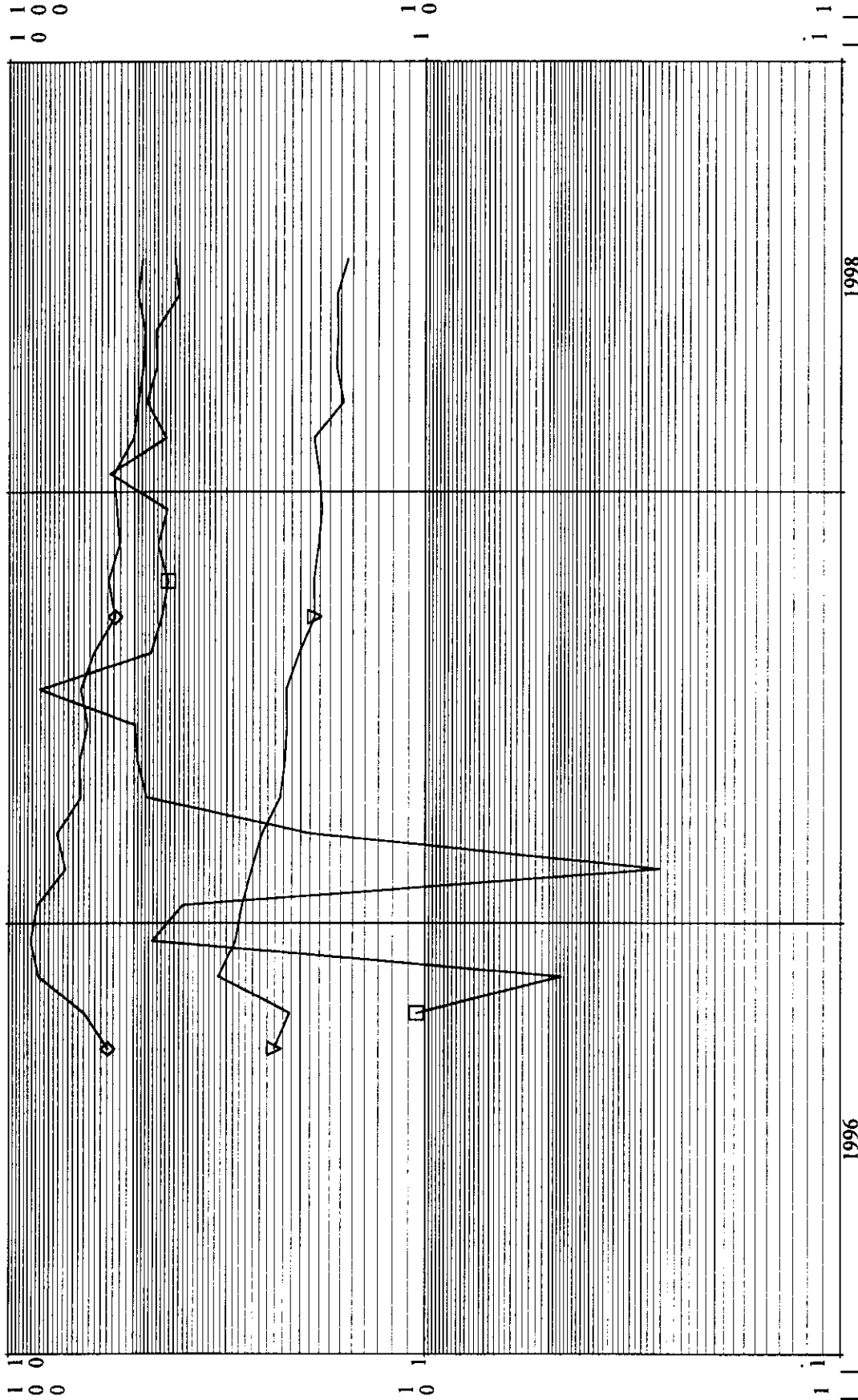


MP

00/16-05-016-27W1/0 (Northrock Birdtail 16-05-16-27W1) Data 09/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 1431.7 m3
Gas: 0 E6m3
Water: 56.1 m3
Cond: 0 m3



Year **M**

Avg Daily Oil - m3/d ▽ ◇ ▽ ◇

Monthly Oil - m3 ◇ ◇ ◇ ◇

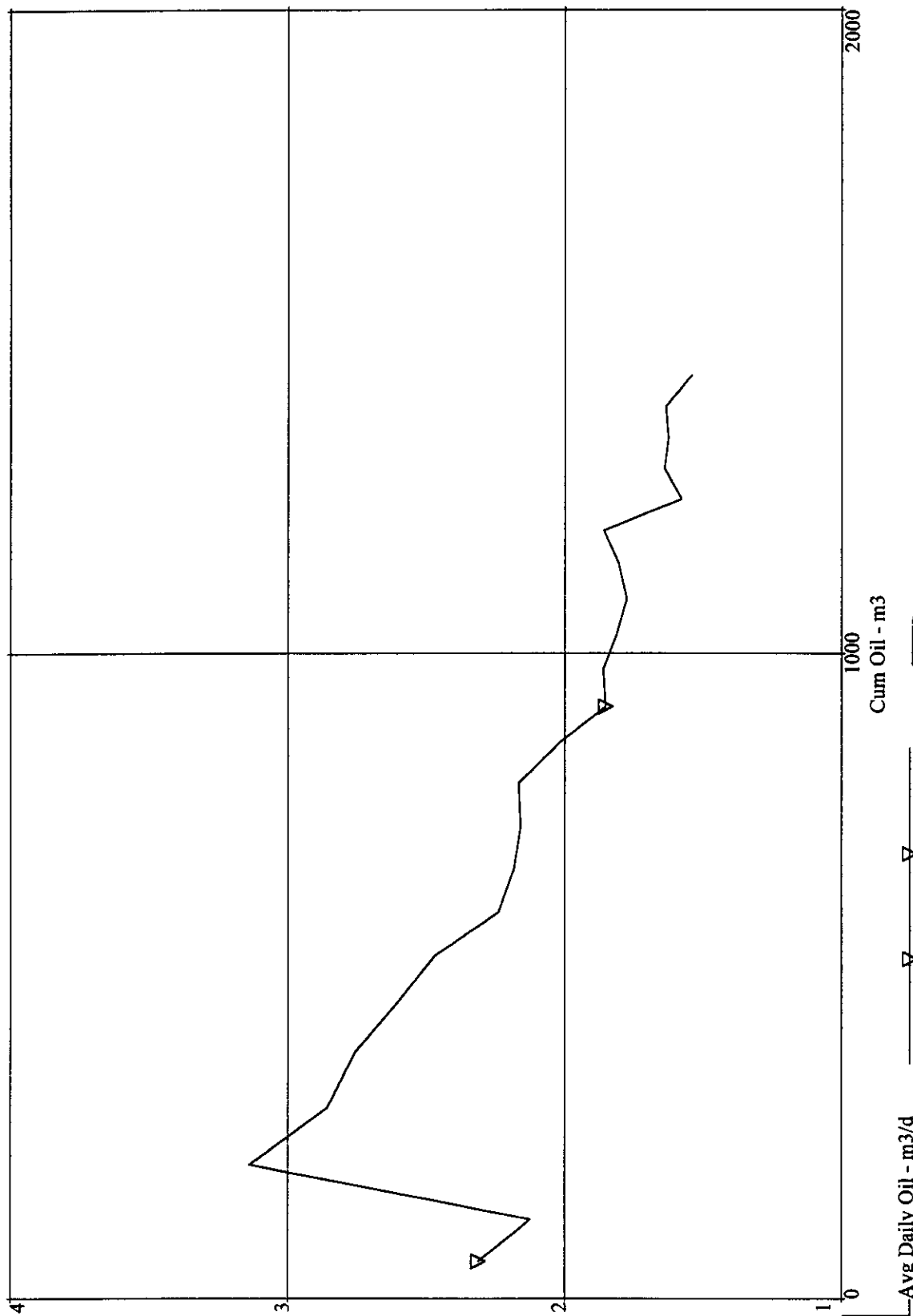
Water Cut - % □ □ □ □

GOR - m3/m3 * * * *

00/16-05-016-27W1/0 (Northrock Birdtai. 05-16-27W1) Data 09/96-07/98

Operator:
Field: 15
Zone: 60A
Type: Other
Group: South Birdtail

Production Cums
Oil: 1431.7 m3
Gas: 0 E6m3
Water: 56.1 m3
Cond: 0 m3



Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:54:05 am
Well	: South Birdtail Summary Well	User	: dale
	: 000000002		
Hist.Data	: 09/96-07/98	On Prod	: 02/09
Operator	:	Status	: Other
Field	:	Zone	:

Production Data from September, 1996 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Num Wells	Water Cut %	GOR m3/m3
Sep., 1996	2.312	57.8	1		
Oct., 1996	2.12581	65.9	1	1.05059	
Nov., 1996	6.24815	168.7	2	0.880932	
Dec., 1996	10.6256	207.2	4	17.378	
Jan., 1997	13.6011	396.7	5	13.3603	
Feb., 1997	12.0786	338.2	5	14.5473	
Mar., 1997	11.4871	356.1	5	15.2288	
Apr., 1997	10.6003	315.8	5	18.9981	
May., 1997	10.2354	310.9	5	18.8819	
Jun., 1997	11.8967	299.4	6	52.668	
Jul., 1997	14.6071	409	8	73.0994	
Aug., 1997	15.4829	476.1	8	71.0364	
Sep., 1997	17.269	500.8	8	70.4085	
Oct., 1997	16.7194	518.3	8	72.0203	
Nov., 1997	16.5502	490.3	8	71.586	
Dec., 1997	16.571	513.7	8	70.6198	
Jan., 1998	16.7899	497.4	8	70.689	
Feb., 1998	16.209	449.8	8	70.9209	
Mar., 1998	15.2195	468	8	70.3912	
Apr., 1998	13.76	404.2	8	70.6201	
May., 1998	14.5371	445.2	8	72.6179	
Jun., 1998	15.3231	373.5	8	74.1313	
Jul., 1998	12.1968	378.1	7	74.1774	

Production Report

Group : South Birdtail	Date : October 15, 1998 11:54:20 am
Well : Northrock Birdtail Prov. 05D-04-16-27W1	User : dale
: 00/05-04-016-27W1/0	
Hist.Data : 07/97-07/98	On Prod : 06/98
Operator :	Status : Other
Field : 15	Zone : 60A

Production Data from July, 1997 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Jul., 1997	1.29333	19.4	6.22931	89.9494	
Aug., 1997	2.95161	91.5	14.4852	79.6142	
Sep., 1997	5.02	150.6	20.1322	75.0538	
Oct., 1997	5.10645	158.3	23.7442	78.4844	
Nov., 1997	4.63	138.9	23.0187	79.8771	
Dec., 1997	4.56774	141.6	22.6956	79.865	
Jan., 1998	4.51724	131	21.1309	79.993	
Feb., 1998	4.37143	122.4	21.8591	79.993	
Mar., 1998	4.13667	124.1	20.0179	79.993	
Apr., 1998	3.92963	106.1	19.0516	81.4282	
May., 1998	3.72581	115.5	21.0823	82.3195	
Jun., 1998	3.09257	90.2	20.018	84.9736	
Jul., 1998	3.04839	94.5	20.3239	84.9944	

Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:54:29 am
Vell	: Northrock Birdtail 12-04-16-27W1	User	: dale
	: 00/12-04-016-27W1/0		
Hist.Data	: 01/97-07/98	On Prod	: 06/98
Operator	:	Status	: Other
Field	: 15	Zone	: 60A

Production Data from January, 1997 to July, 1998

Year	Avg Daily Oil	Monthly Oil	Cal Day Fluid	Water Cut	GOR
	m3/d	m3	m3/d	%	m3/m3
Jan., 1997	4.22308	109.8	3.63382	2.48561	
Feb., 1997	3.725	104.3	3.8195	2.43113	
Mar., 1997	3.39677	105.3	3.65311	6.97594	
Apr., 1997	3.37333	101.2	3.66149	7.82924	
May., 1997	3.2	99.2	3.44012	6.93899	
Jun., 1997	3.25	97.5	3.47476	6.42729	
Jul., 1997	3.22581	100	3.49497	7.66078	
Aug., 1997	3.24194	100.5	3.4724	6.5958	
Sep., 1997	2.96667	89	3.18131	6.70584	
Oct., 1997	2.93226	90.9	3.13032	6.28606	
Nov., 1997	2.79	83.7	2.99123	6.68622	
Dec., 1997	2.78065	86.2	2.97542	6.50491	
Jan., 1998	2.65484	82.3	2.84633	6.68659	
Feb., 1998	2.77778	75	2.86547	6.48112	
Mar., 1998	2.58065	80	2.76243	6.53936	
Apr., 1998	2.57241	74.6	2.6611	6.51361	
May., 1998	2.56452	79.5	2.78823	7.98288	
Jun., 1998	2.34667	70.4	2.74437	14.4538	
Jul., 1998	2.30645	71.5	2.71714	15.0775	

Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:54:39 am
Well	: Northrock Birdtail 13-04-16-27W1	User	: dale
	: 00/13-04-016-27W1/0		
Hist.Data	: 11/96-07/98	On Prod	: 06/98
Operator	:	Status	: Other
Field	: 15	Zone	: 60A

Production Data from November, 1996 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Nov., 1996	3.10741	83.9	2.83457	1.29356	
Dec., 1996	2.46333	73.9	2.70428	11.8093	
Jan., 1997	2.6037	70.3	2.34616	3.29983	
Feb., 1997	2.30714	64.6	2.49744	7.57918	
Mar., 1997	2.25484	69.9	2.35583	4.24478	
Apr., 1997	2.15333	64.6	2.31762	7.04747	
May., 1997	2.05333	61.6	2.15571	7.78127	
Jun., 1997	2.16667	65	2.31095	6.20234	
Jul., 1997	2.17241	63	2.18799	7.07675	
Aug., 1997	2.14516	66.5	2.28804	6.20336	
Sep., 1997	2.04333	61.3	2.18757	6.55218	
Oct., 1997	2.02258	62.7	2.15573	6.13519	
Nov., 1997	1.97931	57.4	2.03418	5.89919	
Dec., 1997	2.02581	62.8	2.17186	6.68373	
Jan., 1998	2.13929	59.9	2.07827	6.98472	
Feb., 1998	1.86429	52.2	1.99011	6.28107	
Mar., 1998	1.93667	58.1	2.00405	6.43857	
Apr., 1998	1.67667	50.3	2.02407	17.1272	
May., 1998	1.59355	49.4	1.92006	16.9686	
Jun., 1998	1.38667	41.6	1.87728	26.1016	
Jul., 1998	1.37419	42.6	1.89093	27.295	

Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:54:48 am
Well	: Northrock Birdtail 14-04-16-27W1	User	: dale
	: 00/14-04-016-27W1/0		
Hist.Data	: 01/96-07/98	On Prod	: 06/98
Operator	:	Status	: Other
Field	: 15	Zone	: 60A

Production Data from January, 1996 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Jan., 1996					
Feb., 1996					
Mar., 1996					
Apr., 1996					
May., 1996					
Jun., 1996					
Jul., 1996					
Aug., 1996					
Sep., 1996					
Oct., 1996					
Nov., 1996					
Dec., 1996	0.911111	8.2	1.18076	77.588	
Jan., 1997	0.841936	26.1	2.48102	66.0499	
Feb., 1997	0.396429	11.1	2.06803	80.8222	
Mar., 1997	0.545161	16.9	2.13572	74.4629	
Apr., 1997	0.141379	4.1	1.96339	93.0362	
May., 1997	0.151724	4.4	1.88393	92.4627	
Jun., 1997	0.496154	12.9	1.73686	75.2317	
Jul., 1997	0.451613	14	1.89375	76.1419	
Aug., 1997	0.416129	12.9	1.74534	76.1473	
Sep., 1997	0.436364	9.6	1.32347	75.8106	
Oct., 1997	0.387097	12	1.61307	75.992	
Nov., 1997	0.396667	11.9	1.66684	76.192	
Dec., 1997	0.36129	11.2	1.50016	75.9059	
Jan., 1998	0.360714	10.1	1.35498	75.9443	
Feb., 1998	0.35	9.8	1.46444	76.0896	
Mar., 1998	0.341935	10.6	1.41951	75.901	
Apr., 1998	0.446667	13.4	1.86686	76.0634	
May., 1998	0.358065	11.1	1.48403	75.8615	
Jun., 1998	1.025	8.2	1.14012	76.0154	
Jul., 1998	0.322581	10	1.33885	75.8956	

Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:54:58 am
Well	: Northrock Birdtail 07-05-16-27W1	User	: dale
	: 00/07-05-016-27W1/0		
Hist.Data	: 06/97-07/98	On Prod	: 06/98
Operator	:	Status	: Other
Field	: 15	Zone	: 60A

Production Data from June, 1997 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Jun., 1997	1.45455	16	1.6869	68.3699	
Jul., 1997	0.474194	14.7	2.03247	76.6588	
Aug., 1997	0.36129	11.2	1.81629	80.0996	
Sep., 1997	0.323333	9.7	1.61681	79.993	
Oct., 1997	0.33871	10.5	1.6937	79.993	
Nov., 1997	0.310345	9	1.50013	79.993	
Dec., 1997	0.316129	9.8	1.58078	79.993	
Jan., 1998	0.275	7.7	1.24204	79.993	
Feb., 1998	0.378571	10.6	1.89302	79.993	
Mar., 1998	0.370968	11.5	1.855	79.993	
Apr., 1998	0.286667	8.6	1.43346	79.993	
May., 1998	0.3	9.3	1.50013	79.993	
Jun., 1998	0.15	1.2	0.203351	80.3209	
Jul., 1998		0	0		

Production Report

Group	: South Birdtail	Date	: October 15, 1998 11:55:12 am
Well	: Northrock Birdtail 09-05-16-27W1	User	: dale
	: 00/09-05-016-27W1/0		
Hist.Data	: 01/96-07/98	On Prod	: 06/98
Operator	:	Status	: Other
Field	: 15	Zone	: 60A

Production Data from January, 1996 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Jan., 1996					
Feb., 1996					
Mar., 1996					
Apr., 1996					
May., 1996					
Jun., 1996					
Jul., 1996					
Aug., 1996					
Sep., 1996					
Oct., 1996					
Nov., 1996					
Dec., 1996	4.5625	36.5	1.21342	2.92428	
Jan., 1997	3.3871	105	3.44665	1.68466	
Feb., 1997	3.03571	85	3.13348	3.07736	
Mar., 1997	2.81935	87.4	2.89156	2.4543	
Apr., 1997	2.62333	78.7	2.70782	3.0775	
May., 1997	2.51613	78	2.59143	2.86303	
Jun., 1997	1.8	43.2	9.61063	85.01	
Jul., 1997	3.56452	110.5	23.708	84.9583	
Aug., 1997	3.43448	99.6	21.3917	84.974	
Sep., 1997	3.16333	94.9	21.0314	84.9524	
Oct., 1997	3.1129	96.5	20.711	84.9632	
Nov., 1997	3.07586	89.2	19.668	84.8757	
Dec., 1997	2.82581	87.6	18.8561	85.0072	
Jan., 1998	2.87742	89.2	19.2593	85.053	
Feb., 1998	2.85	79.8	18.8763	84.895	
Mar., 1998	2.53871	78.7	16.7753	84.8597	
Apr., 1998	1.84667	55.4	12.9475	85.731	
May., 1998	2.59032	80.3	17.2269	84.9569	
Jun., 1998	2.44667	73.4	16.6411	85.2909	
Jul., 1998	2.3871	74	15.9043	84.9842	

Production Report

Group : South Birdtail	Date : October 15, 1998 11:55:21 am
Well : Northrock Birdtail 15-05-16-27W1	User : dale
: 00/15-05-016-27W1/0	
Hist.Data : 07/97-07/98	On Prod : 06/98
Operator :	Status : Other
Field : 15	Zone : 60A

Production Data from July, 1997 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Jul., 1997	0.808	20.2	7.1519	90.8849	
Aug., 1997	1.00968	31.3	5.7327	82.3797	
Sep., 1997	1.00333	30.1	5.02711	80.0328	
Oct., 1997	0.958065	29.7	4.79074	79.993	
Nov., 1997	1.52667	45.8	4.76734	67.9624	
Dec., 1997	1.91613	59.4	4.79117	59.9894	
Jan., 1998	1.97419	61.2	4.93635	59.9894	
Feb., 1998	1.77857	49.8	4.44721	59.9894	
Mar., 1998	1.80645	56	4.51692	59.9894	
Apr., 1998	1.60667	48.2	4.23404	62.0369	
May., 1998	1.76333	52.9	4.87495	64.98	
Jun., 1998	1.31333	39.4	3.82058	65.6096	
Jul., 1998	1.2129	37.6	3.46828	65.0132	

Production Report

Group : South Birdtail	Date : October 15, 1998 11:55:33 am
Well : Northrock Birdtail 16-05-16-27W1	User : dale
: 00/16-05-016-27W1/0	
Hist.Data : 09/96-07/98	On Prod : 06/98
Operator :	Status : Other
Field : 15	Zone : 60A

Production Data from September, 1996 to July, 1998

Year	Avg Daily Oil m3/d	Monthly Oil m3	Cal Day Fluid m3/d	Water Cut %	GOR m3/m3
Sep., 1996	2.312	57.8	1.92752		
Oct., 1996	2.12581	65.9	2.14932	1.05059	
Nov., 1996	3.14074	84.8	2.84124	0.469278	
Dec., 1996	2.85806	88.6	2.99481	4.52396	
Jan., 1997	2.75806	85.5	2.86896	3.8229	
Feb., 1997	2.61429	73.2	2.62258	0.27236	
Mar., 1997	2.47097	76.6	2.52044	1.91979	
Apr., 1997	2.24	67.2	2.35099	4.67889	
May., 1997	2.18387	67.7	2.29774	4.91367	
Jun., 1997	2.16	64.8	2.27428	4.98325	
Jul., 1997	2.16774	67.2	2.3687	8.44346	
Aug., 1997	2.01935	62.6	2.11702	4.57125	
Sep., 1997	1.85333	55.6	1.93748	4.30111	
Oct., 1997	1.86129	57.7	1.94276	4.15107	
Nov., 1997	1.81333	54.4	1.89747	4.39182	
Dec., 1997	1.77742	55.1	1.85562	4.17215	
Jan., 1998	1.80645	56	1.91692	5.72153	
Feb., 1998	1.85926	50.2	1.87222	4.1967	
Mar., 1998	1.58065	49	1.65876	4.6673	
Apr., 1998	1.64138	47.6	1.6607	4.41581	
May., 1998	1.62759	47.2	1.59422	4.45157	
Jun., 1998	1.63667	49.1	1.70405	3.91224	
Jul., 1998	1.54516	47.9	1.61036	4.00632	

APPENDIX 2
Reservoir Fluid Analysis

LABORATORY TEST RESULTS

JOB NUMBER: 52138-98-5431

CUSTOMER: Progress Energy Inc.

ATTN: Mr. Wayne Wyatt

WELL NAME: Progress Birdtail

PAGE 2 of 8

LSD: 14-4-16-27 W1M

LABORATORY I.D: 52138

FIELD OR AREA: Birdtail

DATE RECEIVED: 1998 06 30

DATE SAMPLED:

DATE ANALYZED: 1998 07 02

SAMPLING POINT:

ANALYZED BY: AC

SAMPLED BY: Operator

REMARKS:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECH
API Gravity @ 15.6 °C	32.5	0.1	Units	ASTM D-4052	98 07 02	AC
Absolute Density @ 15.0 °C	867.1	0.1	kg/m ³	ASTM D-4052	98 07 02	AC
Total Sulphur	3.26	0.01	g/kg	ASTM D-4294	98 07 02	AC

CORE LABORATORIES

463 Devonian Street

Estevan, Saskatchewan S4A 2K9

HYDROCARBON LIQUID ANALYSIS

Operator: Northrock Resources Ltd.
Well: Northrock et al Rocanville 8-35-15-31
Sample Point: Wellhead

Page: 2
File: 52134-97-0711
Date: 97 04 23

Analysis of C₆₊ Fraction

Boiling Point: Range (°C)	Component	Carbon Number	Mole Fraction	Mass Fraction	Liq. Vol. Fraction
36.1- 68.9	Hexanes	C ₆	0.0284	0.0106	0.0124
68.9- 98.3	Heptanes	C ₇	0.0620	0.0268	0.0303
98.3-125.6	Octanes	C ₈	0.0921	0.0454	0.0500
125.6-150.6	Nonanes	C ₉	0.0654	0.0362	0.0391
150.6-173.9	Decanes	C ₁₀	0.0677	0.0416	0.0442
173.9-196.1	Undecanes	C ₁₁	0.0614	0.0414	0.0433
196.1-215.0	Dodecanes	C ₁₂	0.0659	0.0485	0.0501
215.0-235.0	Tridecanes	C ₁₃	0.0531	0.0423	0.0433
235.0-252.2	Tetradecanes	C ₁₄	0.0490	0.0419	0.0426
252.2-270.6	Pentadecanes	C ₁₅	0.0418	0.0384	0.0387
270.6-287.8	Hexadecanes	C ₁₆	0.0415	0.0405	0.0407
287.8-302.8	Heptadecanes	C ₁₇	0.0329	0.0341	0.0340
302.8-317.2	Octadecanes	C ₁₈	0.0279	0.0307	0.0304
317.2-330.0	Nonadecanes	C ₁₉	0.0261	0.0302	0.0298
330.0-344.4	Eicosanes	C ₂₀	0.0230	0.0280	0.0276
344.4-357.2	Heneicosanes	C ₂₁	0.0197	0.0252	0.0247
357.2-369.4	Docosanes	C ₂₂	0.0162	0.0217	0.0212
369.4-380.0	Tricosanes	C ₂₃	0.0147	0.0206	0.0200
380.0-391.1	Tetracosanes	C ₂₄	0.0125	0.0184	0.0177
391.1-401.7	Pentacosanes	C ₂₅	0.0115	0.0177	0.0169
401.7-412.2	Hexacosanes	C ₂₆	0.0097	0.0153	0.0148
412.2-422.2	Heptacosanes	C ₂₇	0.0089	0.0147	0.0140
422.2-431.7	Octacosanes	C ₂₈	0.0073	0.0125	0.0119
431.7-441.1	Nonacosanes	C ₂₉	0.0072	0.0128	0.0122
441.1 PLUS	triacontanes Plus	C ₃₀₊	0.1117	0.2892	0.2749
80.0	Benzene	C ₆ H ₆	0.0003	0.0001	0.0001
110.6	Toluene	C ₇ H ₈	0.0013	0.0005	0.0005
136.1-138.9	Ethylbenzene, p + m-Xylene	C ₈ H ₁₀	0.0063	0.0029	0.0026
144.4	o-Xylene	C ₈ H ₁₀	0.0052	0.0024	0.0021
168.9	1,2,4 Trimethylbenzene	C ₉ H ₁₂	0.0018	0.0009	0.0008
48.9	Cyclopentane	C ₅ H ₁₀	0.0010	0.0003	0.0003
72.2	Methylcyclopentane	C ₆ H ₁₂	0.0017	0.0006	0.0006
81.1	Cyclohexane	C ₆ H ₁₂	0.0014	0.0005	0.0005
101.1	Methylcyclohexane	C ₇ H ₁₄	0.0104	0.0044	0.0044
	TOTAL		0.9870	0.9973	0.9967
	Mole Fraction of C7+				0.9576
	Mass Fraction of C7+				0.9864
	Liquid Volume Fraction of C7+				0.9840
	Calculated Relative Molecular Mass of C7+				239
	Calculated Relative Density of C7+				0.8584
	Calculated Density of C7+ (kg/m3)				857.6

Northrock Resources Ltd.
Northrock et al Rocanville 8-35-15-31 (W1M)
52134-97-0711

VOLUMETRIC DATA
(at 32.0 °C)

Saturation Pressure (P _{sat})	834 kPa(g)
Thermal Exp. @ 12 411 kPa(g)	1.01482 V at 32.0 °C / V at 15.0 °C

AVERAGE SINGLE-PHASE COMPRESSIBILITIES

Pressure Range kPa(g)			Single-Phase Compressibility v/v/kPa
12 411	to	10 342	7.42 E -7
10 342	to	6 895	7.63 E -7
6 895	to	3 447	8.03 E -7
3 447	to	2 758	8.42 E -7
2 758	to	2 068	8.64 E -7
2 068	to	1 379	8.95 E -7
1 379	to	834	9.37 E -7

Northrock Resources Ltd.
Northrock et al Rocanville 8-35-15-31 (W1M)
 52134-97-0711
PRESSURE-VOLUME RELATIONS
 (at 32.0 °C)

Pressure kPa(g)	Relative Volume (A)
12 411	0.9908
10 342	0.9923
8 895	0.9949
3 447	0.9977
2 758	0.9983
2 068	0.9989
1 379	0.9995
0.834	1.0000

(A) Relative Volume: V/V_{sat} or volume at indicated pressure per volume at saturation pressure.

Northrock Resources Ltd.
Northrock et al Rocanville 8-35-15-31 (W1M)
52134-97-0711

RESERVOIR FLUID VISCOSITY
(at 32.0 °C)

Pressure kPa(g)	Oil Viscosity mPa·s
12 411	4.54
10 342	4.39
6 895	4.14
3 447	3.89
2 758	3.84
2 068	3.79
1 379	3.74
0 834	3.70

Northrock Resources Ltd.
Northrock et al Rocanville 8-35-15-31 (W1M)
 52134-97-0711

SEPARATOR TEST OF RESERVOIR FLUID

Flash Conditions		Gas/Oil Ratio (m ³ /m ³) (A)	Gas/Oil Ratio (m ³ /STm ³) (B)	Stock Tank Oil Gravity at 15.6 °C (°API)	Formation Volume Factor Bofb (C)	Separator Volume Factor (D)	Specific Gravity of Flashed Gas (Air=1.000)	Oil Phase Density (kg/m ³)
kPa(g)	°C							

834	32.0							842.0 *
0	20.0	0.9	0.9	34.1	1.015	1.004	1.072	850.3

Rsfb = 0.9

* Calculated by material balance of separator test volumetrics.

- (A) Cubic metres of gas at 101.325 kPa(a) and 15.0 °C per cubic metre of oil at indicated pressure and temperature.
- (B) Cubic metres of gas at 101.325 kPa(a) and 15.0 °C per cubic metre of stock tank oil at 15.0 °C.
- (C) Cubic metres of saturated oil at 834 kPa(g) and 32.0 °C per cubic metre of stock tank oil at 15.0 °C.
- (D) Cubic metres of oil at indicated pressure and temperature per cubic metre of stock tank oil at 15.0 °C.

APPENDIX 3

Core Studies

PROGRESS BAKKEN A AND C POOL
RESERVOIR PARAMETERS
(>2.0 mD. CUT-OFF)

<u>Location</u>	<u>Interval</u>		<u>Avg ϕ</u> (%)	<u>Avg Perm (k)</u> (mD)	<u>Net Pay (h)</u> (m)
	<u>Top</u> (m)	<u>Bottom</u> (m)			
08-19-16-27W1M	523.0	525.2	19.9%	79.22	2.2
16-05-16-27W1M	516.1	518.0	24.1%	152.01	0.9

PROGRESS BAKKEN POOL
CORE ANALYSIS RESULTS

<u>Location</u>	<u>Interval</u>		<u>Residual Oil Saturation</u> (%)	<u>Amount of Net Pay >20 mD Permeability</u> (%)
	<u>Top</u> (m)	<u>Bottom</u> (m)		
08-19-16-27W1M	523.0	525.2	32%	70%
16-05-16-27W1M	516.1	518.0	36%	100%
Average			<u>34%</u>	<u>85%</u>

Recovery Factor - Birdtail Bakken C Pool

$$R.F. = EA \times EV \frac{(1 - SW - SOR)}{(1 - SW)}$$

EA 0.63
EV 0.70
SW 0.37
SOR 0.34

$$R.F. = 0.20$$

Recovery Factor - Birdtail Bakken A Pool

$$R.F. = EA \times EV \frac{(1 - SW - SOR)}{(1 - SW)}$$

EA 0.63
EV 0.85
SW 0.37
SOR 0.34

$$R.F. = 0.25$$

NORTHROCK BIRDTAIL **08-19-18-27W1M**

Totals	2.21	175,088	175,088
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NORTHROCK BIRDTAIL
16-05-16-27W1M

1.87 1.87 88.025

CORE LABORATORIES

Company : PROGRESS ENERGY INC.
Well : NORTHROCK BIRDTAIL 8-19-16-27
Location : LSD 00/08-19-016-27 W2/O
Province : MANITOBA, CANADA

Field : BIRDTAIL
Formation : BAKKEN SAND
Coring Equip.: DIAMOND
Coring Fluid : WATER BASE MUD

File No.: 52138-98-5008
Date : 1998 01 25
Analysts: RJH/JP
Core Dia: 75 mm

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH m	INTVL REP m	SATURATION		DESCRIPTION
			(PORE VOLUME) OIL frac	WATER frac	
CORE NO. 1 520.00 - 529.00m (CORE RECEIVED 8.65m)(6 BOXES)					
-	520.00- 20.84	0.84			sh
-	520.84- 21.75	0.91			sh ssdy pyr
-	521.75- 22.07	0.32	0.180	0.671	ss
	522.07- 22.99	0.92			ss shy pyr
2	522.99- 23.24	0.25	0.306	0.496	ss
3	523.24- 23.44	0.20	0.233	0.609	ss
4	523.44- 23.63	0.19	0.225	0.604	ss
5	523.63- 23.89	0.26	0.275	0.589	ss
6	523.89- 24.15	0.26	0.351	0.464	ss
7	524.15- 24.37	0.22	0.319	0.559	ss
8	524.37- 24.62	0.25	0.347	0.545	ss
9	524.62- 24.77	0.15	0.188	0.693	ss
10	524.77- 24.98	0.21	0.422	0.433	ss
11	524.98- 25.20	0.22	0.458	0.402	ss
-	525.20- 26.11	0.91			do1 sdy shbks pyr
-	526.11- 28.65	2.54			sh ssdy pyr
-	528.65- 29.00	0.35			Lost core

Slightly sand

Slightly sand

CORE LABORATORIES

Company : PROGRESS ENERGY INC.
 Well : NORTHROCK BIRDTAIL PROV. 8-19-16-27
 Location : LSD 00/08-19-016-27 W1/O
 Province : MANITOBA, CANADA

Field : BIRDTAIL
 Formation : BAKKEN SAND
 Coring Equip.: DIAMOND
 Coring Fluid : WATER BASE MUD

File No.: 52138-98-5008
 Date : 1998 01 25
 Analysts: RJH/JP
 Core Dia: 75 mm

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH m	INTVL REP m	SAMPLE LENGTH m	PERMEABILITY			CAPACITY (MAXIMUM) Kair mD-m	POROSITY (MELIUM) fraction	CAPACITY (MELIUM) φ-m	BULK DENSITY kg/m3	GRAIN DENSITY kg/m3	SATURATION		DESCRIPTION
				(MAXIMUM) Kair mD	(90 DEG) Kair mD	(VERTICAL) Kair mD						(PORE VOLUME) DIL frac	WATER frac	
CORE NO. 1 520.00 - 529.00m (CORE RECEIVED 8.85m)(6 BORES)														
-	520.00- 20.84	0.84												sh
-	520.84- 21.75	0.91												sh ssdy pyr
1	521.75- 22.07	0.32	0.11	6.11	3.65	0.01	1.955	0.127	0.042	2450.	2810.	0.180	0.671	ss vf f shy pyr
-	522.07- 22.99	0.92												ss shy pyr
2	522.99- 23.24	0.25	0.10	15.5	13.8	0.32	3.875	0.169	0.040	2270.	2700.	0.306	0.496	ss vf f sh-lam pyr
3	523.24- 23.44	0.20	0.08	18.4	16.7	0.14	3.680	0.185	0.034	2280.	2730.	0.233	0.609	ss vf f sh-lam pyr
4	523.44- 23.63	0.19	0.06	81.0	79.6	1.14	15.390	0.216	0.042	2150.	2740.	0.225	0.604	ss vf f sh-lam pyr
5	523.63- 23.89	0.26	0.08	74.6	74.1	0.80	19.396	0.226	0.057	2120.	2730.	0.275	0.589	ss vf f sh-lam pyr
6	523.89- 24.15	0.26	0.07	91.6	85.8	1.92	23.816	0.207	0.055	2160.	2730.	0.351	0.484	ss vf f sh-lam pyr
7	524.15- 24.37	0.22	0.08	17.8	16.1	0.27	3.916	0.165	0.037	2290.	2740.	0.319	0.559	ss vf f lam pyr
8	524.37- 24.62	0.25	0.08	136.	129.	1.89	33.750	0.231	0.058	2100.	2730.	0.347	0.545	ss vf f lam pyr
9	524.62- 24.77	0.15	0.09	248.	185.	1.14	37.200	0.209	0.032	2140.	2710.	0.188	0.693	ss vf f lam pyr
10	524.77- 24.98	0.21	0.09	60.9	59.3	4.74	12.789	0.217	0.046	2120.	2710.	0.422	0.433	ss vf f pyr
11	524.98- 25.20	0.22	0.06	96.7	93.3	0.48	21.274	0.191	0.042	2190.	2710.	0.458	0.402	ss vf f lam pyr
12	525.20- 26.11	0.91	0.19	4.22	3.10	0.21	3.840	0.164	0.146	2390.	2860.	-	-	do! i ppv shy pyr frac
13	526.11- 26.60	0.48	0.16	1.52	0.34	0.01	0.745	0.108	0.054	2540.	2840.	-	-	do! i ppv shy pyr vfrac
-	526.60- 26.65	2.05												sh ssdy pyr
-	528.65- 29.00	0.35												Lost core

PROGRESS ENERGY INC.

NORTHROCK BIRDTAIL PROV

8-19-16-27 W1M

BIRDTAIL, MANITOBA

FILE NO. 52138-98-5008

FORMATION: BAKKEN SAND

(520.00 - 528.65m)

Core Laboratories Canada Ltd.

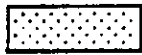
Vertical Scale

10.00 cm = 24.0 meter

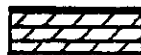
- Lithology Legend -



Shale



Sandstone



Dolomite

**Core Gamma
API**

150

**Depth
Meter
500**

510

520

530

540

CORE ANALYSIS REPORT

FOR

NORTHROCK RESOURCES LTD.

**NORTHROCK BIRDTAIL 16-5-16-27
LSD XX/16-005-016-27 WIM/X
BIRDTAIL, MANITOBA**

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom; and for whose exclusive and confidential use; this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories (all errors and omissions excepted); but Core Laboratories and its officers and employees, assume no responsibility and make no warranty or representations, as to the productivity, proper operations, or profitability of any oil, gas or mineral well or formation in connection with which such report is used or relied upon.

CORE LABORATORIES

Company : NORTHROCK RESOURCES LTD.
Well : NORTHROCK BIRDTAIL 16-5-16-27
Location : LSD XX/16-005-016-27 W1M/X
Province : MANITOBA, CANADA

Field : BIRDTAIL
Formation : BAKKEN SAND
Coring Equip.: DIAMOND
Coring Fluid : WATER BASE MUD

File No.: 52138-96-5044
Date : 1996 08 19
Analysts: RJH
Core Dia: 76 mm

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH m	INTVL REP m	PERMEABILITY (MAXIMUM) Kair mD	CAPACITY (MAXIMUM) Kair mD-m	POROSITY (HELIUM) fraction	CAPACITY (HELIUM) φ-m	BULK DENSITY kg/m3	GRAIN DENSITY kg/m3	SATURATION		DESCRIPTION
									(PORE VOLUME) OIL frac	WATER frac	
CORE NO. 1 514.00 - 523.00m (Core Received 9.00m) (7 Boxes)											
-	514.00- 14.51	0.51									sh
-	514.51- 15.23	0.72									sh sdy
NA	515.23- 16.13	0.90									ss shy
1	516.13- 16.30	0.17	279.	47.430	0.265	0.044	1980.	2690.	0.473	0.396	ss f vf pyr 37.5 API
NA	516.30- 16.62	0.32									ss shy
2	516.62- 16.71	0.09	387.	34.830	0.269	0.024	1950.	2670.	0.416	0.394	ss f vf
3	516.71- 16.89	0.18	0.10	0.018	0.072	0.013	2470.	2670.	0.327	0.541	ss vf f sschy lam
4	516.89- 17.09	0.20	108.	21.600	0.236	0.048	2050.	2690.	0.283	0.589	ss f vf sschy lam 37.0 API
5	517.09- 17.31	0.22	76.5	16.830	0.226	0.051	2080.	2690.	0.328	0.568	ss vf f sschy lam
6	517.31- 17.52	0.21	69.5	14.595	0.231	0.048	2070.	2690.	0.364	0.519	ss vf f sschy lam
7	517.52- 17.73	0.21	0.13	0.027	0.076	0.017	2450.	2650.	0.444	0.435	ss vf f sschy lam
8	517.73- 18.00	0.27	0.46	0.124	0.092	0.024	2410.	2650.	0.324	0.522	ss vf f sschy lam 36.5 API
-	518.00- 20.65	2.65									sh ssdy
-	520.65- 23.00	2.35									sh

CORE LABORATORIES

Company : NORTHROCK RESOURCES LTD.
Well : NORTHROCK BIRDTAIL 16-5-16-27

Field : BIROTAIL
Formation : BAKKEN SAND

File No.: 52138-96-5044
Date : 1996 08 19

TABLE I
SUMMARY OF CORE DATA

ZONE AND CUTOFF DATA

ZONE:
Identification ----- BAKKEN SAND
Top Depth ----- 514.00 m
Bottom Depth ----- 523.00 m
Number of Samples ----- 8

DATA TYPE:
Porosity ----- (HELIUM)
Permeability ----- (MAXIMUM) Kair

CUTOFFS:
Porosity (Minimum) ----- 0.000 frac
Porosity (Maximum) ----- 1.000 frac
Permeability (Minimum) ----- 0.0000 mD
Permeability (Maximum) ----- 100000. mD
Water Saturation (Maximum) ----- 1.000 frac
Oil Saturation (Minimum) ----- 0.000 frac
Grain Density (Minimum) ----- 2000. kg/m3
Grain Density (Maximum) ----- 3000. kg/m3
Lithology Excluded ----- NONE

CHARACTERISTICS REMAINING AFTER CUTOFFS

ZONE:
Number of Samples ----- 8
Thickness Represented ----- 1.55 m

POROSITY:
Storage Capacity ----- 0.268 ϕ -m
Arithmetic Average ----- 0.173 frac
Minimum ----- 0.072 frac
Maximum ----- 0.269 frac
Median ----- 0.229 frac
Standard Deviation ----- ± 0.088 frac

PERMEABILITY:
Flow Capacity ----- 135.46 mD-m
Arithmetic Average ----- 87.4 mD
Geometric Average ----- 8.00 mD
Harmonic Average ----- 0.39 mD
Minimum ----- 0.10 mD
Maximum ----- 387. mD
Median ----- 73.0 mD
Standard Dev. (Geom) ----- $K \cdot 10^{\pm 1.545}$ mD

HETEROGENEITY (Permeability):
Dykstra-Parsons Var. ----- 0.987
Lorenz Coefficient ----- 0.498

GRAIN DENSITY:
Arithmetic Average ----- 2674. kg/m3
Minimum ----- 2650. kg/m3
Maximum ----- 2690. kg/m3
Median ----- 2680. kg/m3
Standard Deviation ----- $\pm 18.$ kg/m3

AVERAGE SATURATIONS (Pore Volume):
Oil ----- 0.365 frac
Water ----- 0.505 frac

CORE LABORATORIES

Company : NORTHROCK RESOURCES LTD.
Well : NORTHROCK BIRDTAIL 16-5-16-27

Field : BIRDTAIL
Formation : BAKKEN SAND

File No.: 52138-96-5044
Date : 1996 08 19

ANALYTICAL PROCEDURES AND QUALITY ASSURANCE

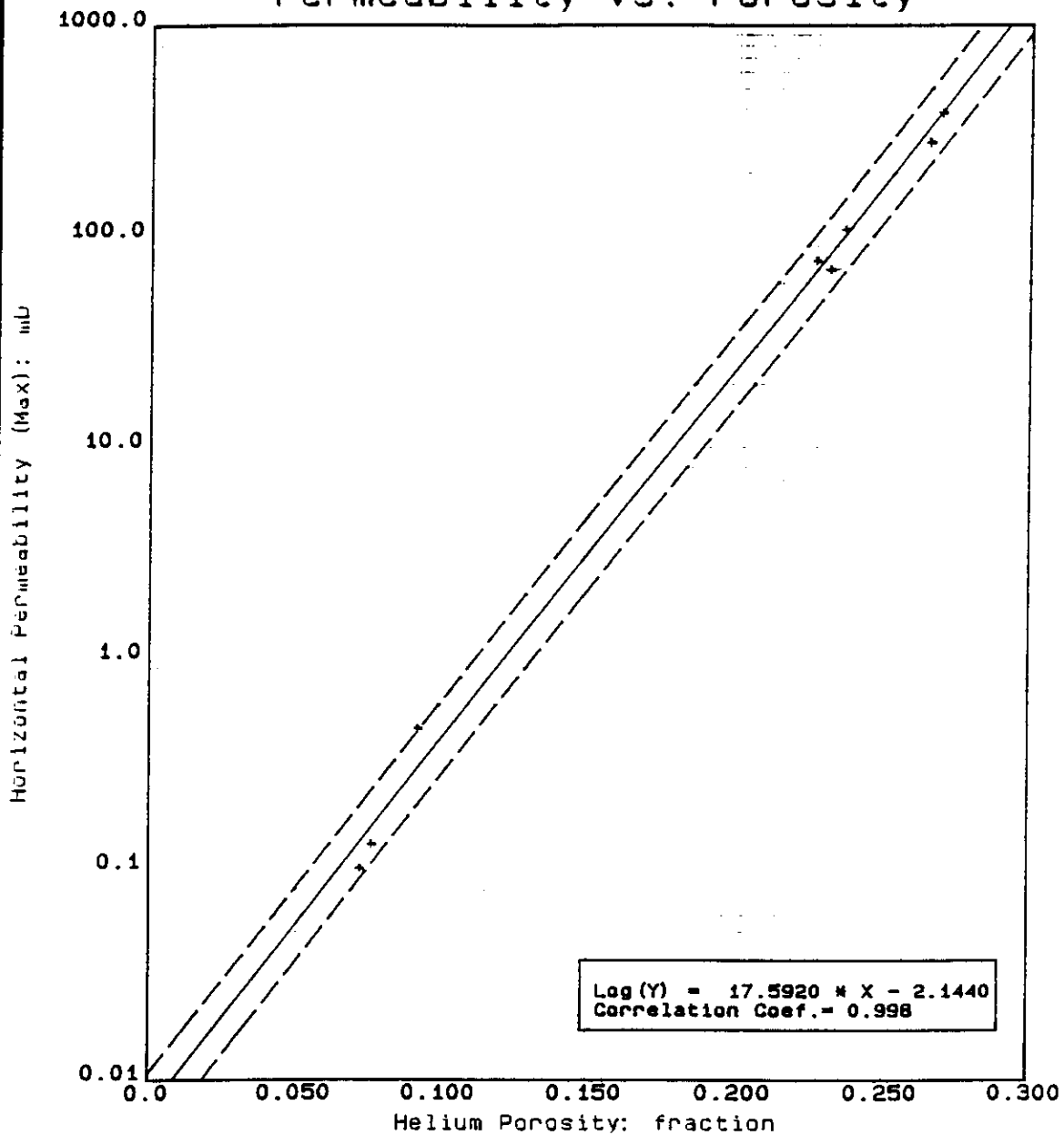
HANDLING & CLEANING	ANALYSIS
<p>Core Transportation : A & A CORING</p> <p>Solvent : TOLUENE</p> <p>Extraction Equipment : CENTRIFUGE</p> <p>Extraction Time : 7.5 HOURS</p> <p>Drying Equipment : GRAVITY OVEN</p> <p>Drying Time : 1 HOUR</p> <p>Drying Temperature : 100 DEG. C.</p>	<p>Grain volume measured by Boyle's Law in a matrix cup using He</p> <p>Bulk volume by Archimedes Principle</p> <p>Fluid saturations by reflow</p> <p>Permeabilities measured on 25.4 mm diameter drilled plugs</p> <p>Core Gamma Composite</p>
<p>REMARKS</p> <p>THE PERMEABILITY AND HELIUM POROSITY VALUES REPRESENT MEASUREMENTS ON PARTIALLY EXTRACTED SAMPLES ONLY.</p>	

CORELAB

CODE KEY - DESCRIPTIONS

A	= (Prefix A) Horizontal matrix permeability measured by pressure decay profile permeametry through a probe tip due to induced fractures	incl	= Inclusions	shy	= Moderately shaly (20% - 40%)
		lam	= Laminar (laminated)	sid	= Siderite
		lmy	= Limy	sltst	= Siltstone
		ls	= Limestone	slty	= Silty
ACA	= Removed for advanced core analysis	lv	= Large vug	SP	= Small plug (sample drilled from core in maximum horizontal direction and parallel to bedding plane where possible) permeability, porosity and grain density are measured
ah	= Anhydrite	m	= Medium		
AST	= Appears similar to	mi	= Mud invaded		
bit	= Bitumen	mic	= Micaceous		
bk	= Break	mv	= Medium vug		
bldr	= Boulder	NA	= Not analyzed by request	ss	= Sandstone
c	= Coarse	NP	= No permeability measurement possible due to poor sample quality	ssh	= Slightly shaly (<20%)
calc	= Calcite (calcareous)	NR	= Not received	sty	= Stylolite (ic)
carb	= Carbonaceous	ool	= Oolitic	sulf	= Sulphur
cbl	= Cobble	OB	= Overburden sample (permeability and porosity measured at net overburden stress)	sv	= Small vug
CEC	= Cation exchange capacity			TEC	= Thermal Extraction Chromatography to determine oil richness
cem	= Cemented			TS	= Thin section
cgl	= Conglomerate	P	= Preserved for future studies	uncon	= Unconsolidated
cht	= Chert	pbl	= Pebble	vc	= Very coarse
coal	= Coal/coal inclusion	PET	= Removed for petrographic analysis	vfrac	= Vertical fracture
dol	= Dolomite	ppv	= Pinpoint vug	vf	= very fine
f	= Fine	PSA	= Particle size analysis	VIS	= Viscosity of oil measured
	= Full diameter analysis including three directional permeabilities, porosity and densities	pyr	= Pyrite (pyritic)	VOB	= Vertical overburden sample (vertical permeability measured at net overburden stress)
foss	= Fossil (fossiliferous)	pyrbit	= Pyrobitumen		
frac	= Fracture (undifferentiated)	ru	= Rubble	vshy	= Very shaly (>40%)
fri	= Friable	SA	= Sieve analysis	VSP	= Vertical small plug drilled from whole core to measure vertical permeability and occasionally porosity
glau	= Glauconite (glauconitic)	sdv	= Sandy		
grnl	= Granule	SEM	= Scanning electron microscope analysis	vug	= Vuggy (vuggy)
gyp	= Gypsum	sh	= Shale	ws	= Water sand
hfrac	= Horizontal fracture	SPH	= Humidity analysis of small plug sample at 60 degrees Celsius and 50 percent relative humidity	XRD	= X-ray diffraction
hal	= Halite (salt)				
i	= Intercrystalline	SPT	= Small Plug used for tracer analysis		= Perm unavailable due to broken core

Permeability vs. Porosity



NORTHROCK RESOURCES LTD.

NORTHROCK BIRDTAIL

16-5-16-27 W1M

BIRDTAIL, SASKATCHEWAN

FILE NO. 52138-96-5044

FORMATION: BAKKEN SAND

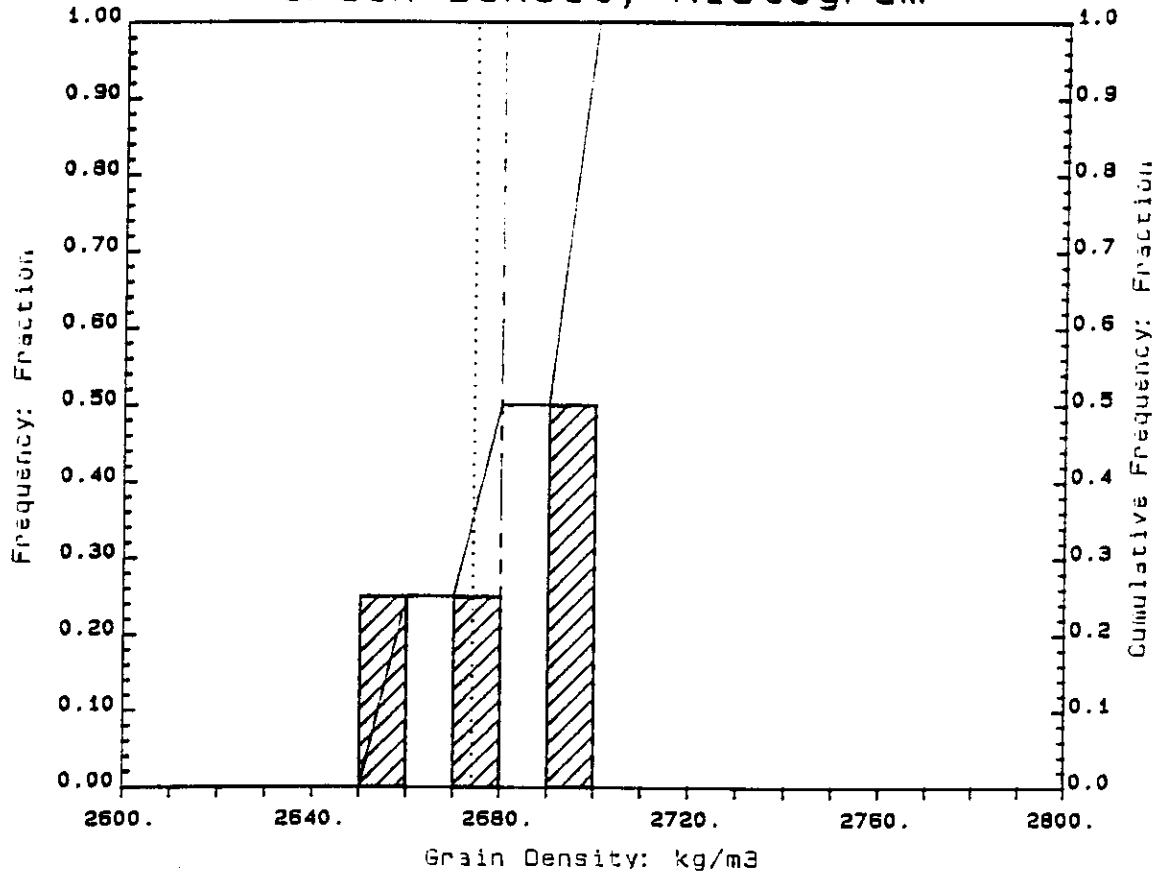
(514.00 - 523.00m)

Core Laboratories Canada Ltd.

- LEGEND -

BAKKEN SAND

Grain Density Histogram



NORTHROCK RESOURCES LTD.

NORTHROCK BIRDTAIL

16-5-16-27 W1M

BIRDTAIL, SASKATCHEWAN

FILE NO. 52138-96-5044

FORMATION: BAKKEN SAND

(514.00 - 523.00m)

Core Laboratories Canada Ltd.

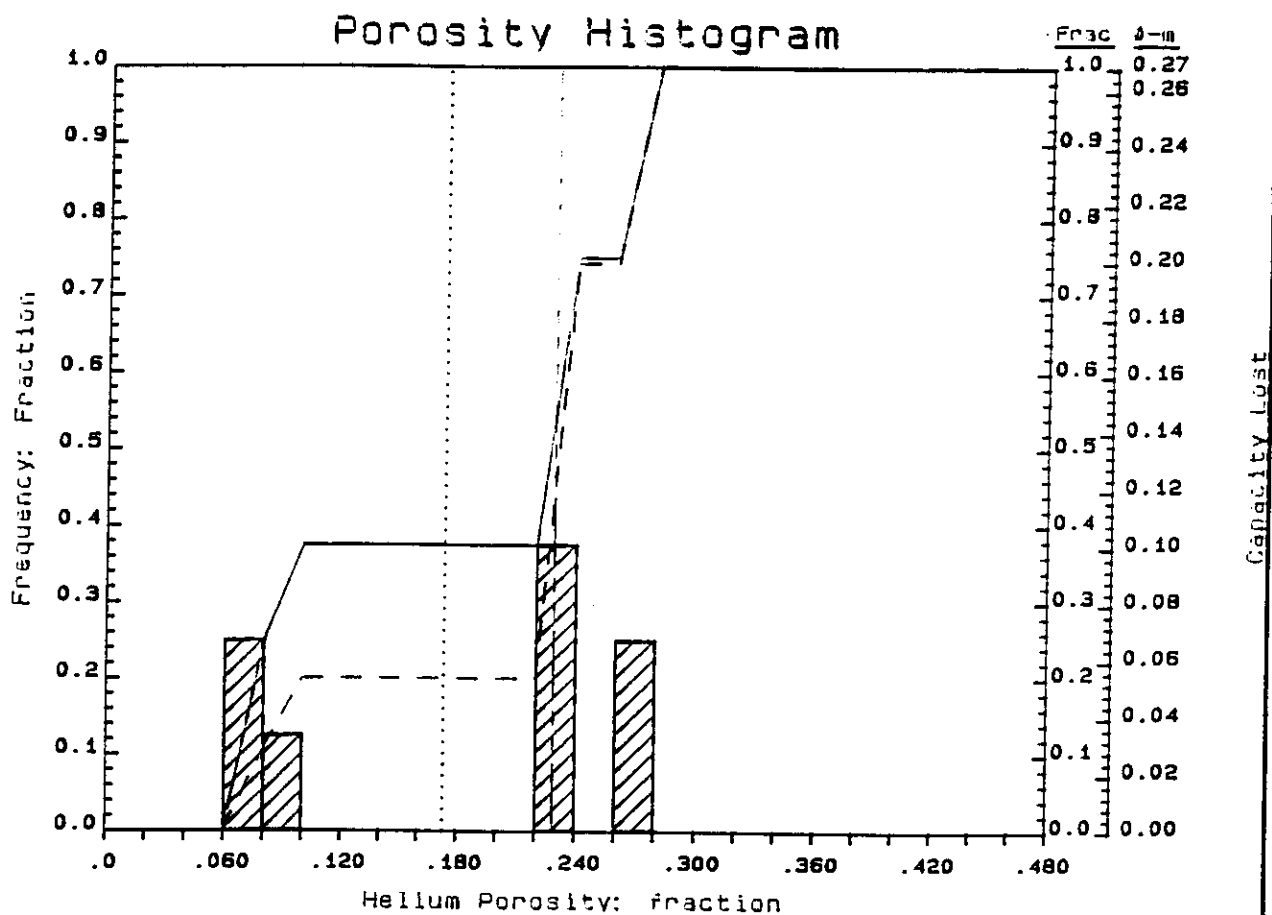
- LEGEND -

— Median Value (2680)

..... Arith. Average (2674)

— Cumulative Frequency

8 Samples



NORTHROCK RESOURCES LTD.

NORTHROCK BIRDTAIL

16-5-16-27 W1M

BIRDTAIL, SASKATCHEWAN

FILE NO. 52138-96-5044

FORMATION: BAKKEN SAND

(514.00 - 523.00m)

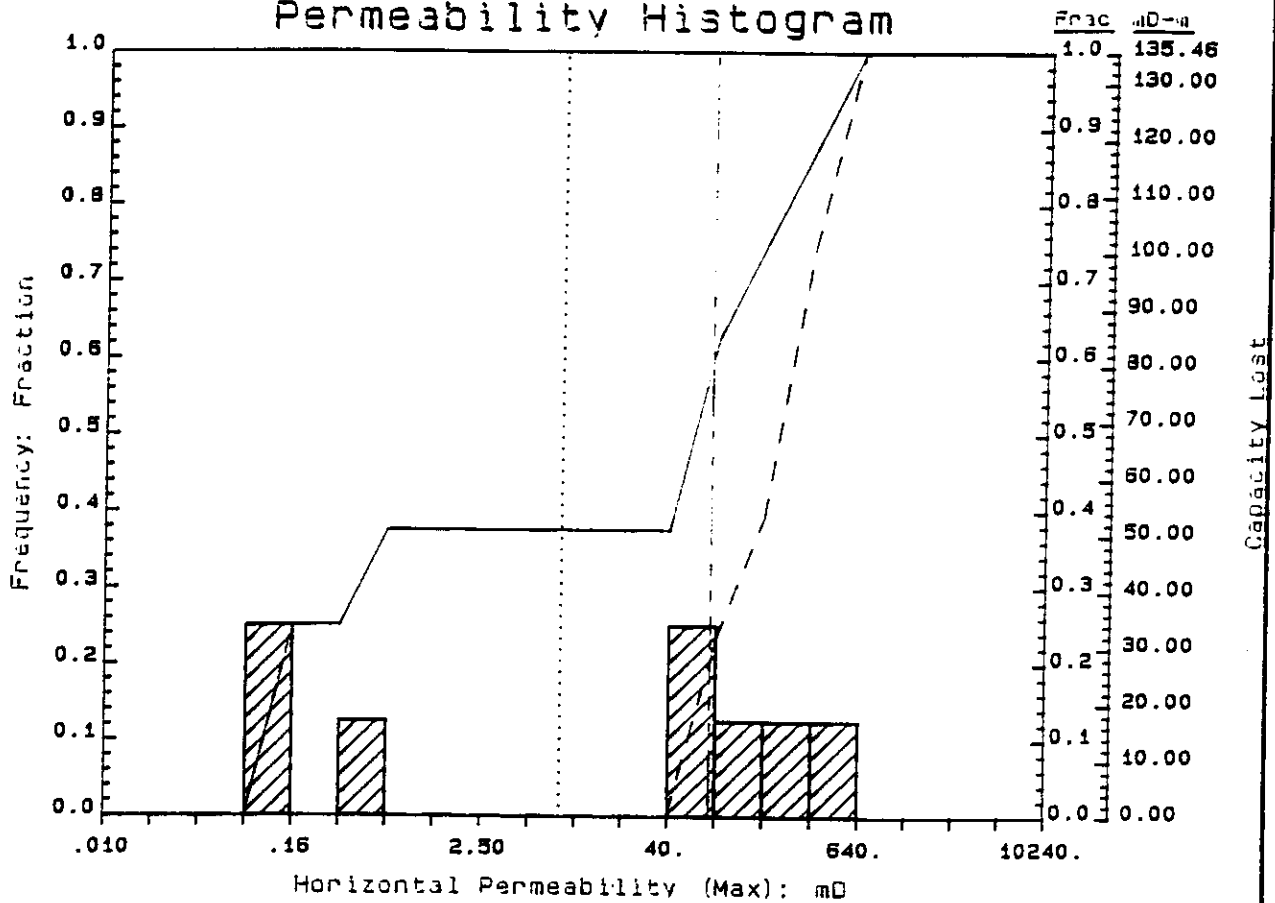
Core Laboratories Canada Ltd.

- LEGEND -

- Median Value (0.229)
- Arith. Average (0.173)
- Cumulative Frequency
- - - Cumulative Capacity Lost

8 Samples

Permeability Histogram



NORTHROCK RESOURCES LTD.

NORTHROCK BIRDTAIL

16-5-16-27 W1M

BIRDTAIL, SASKATCHEWAN

FILE NO. 52138-96-5044

FORMATION: BAKKEN SAND

(514.00 - 523.00m)

Core Laboratories Canada Ltd.

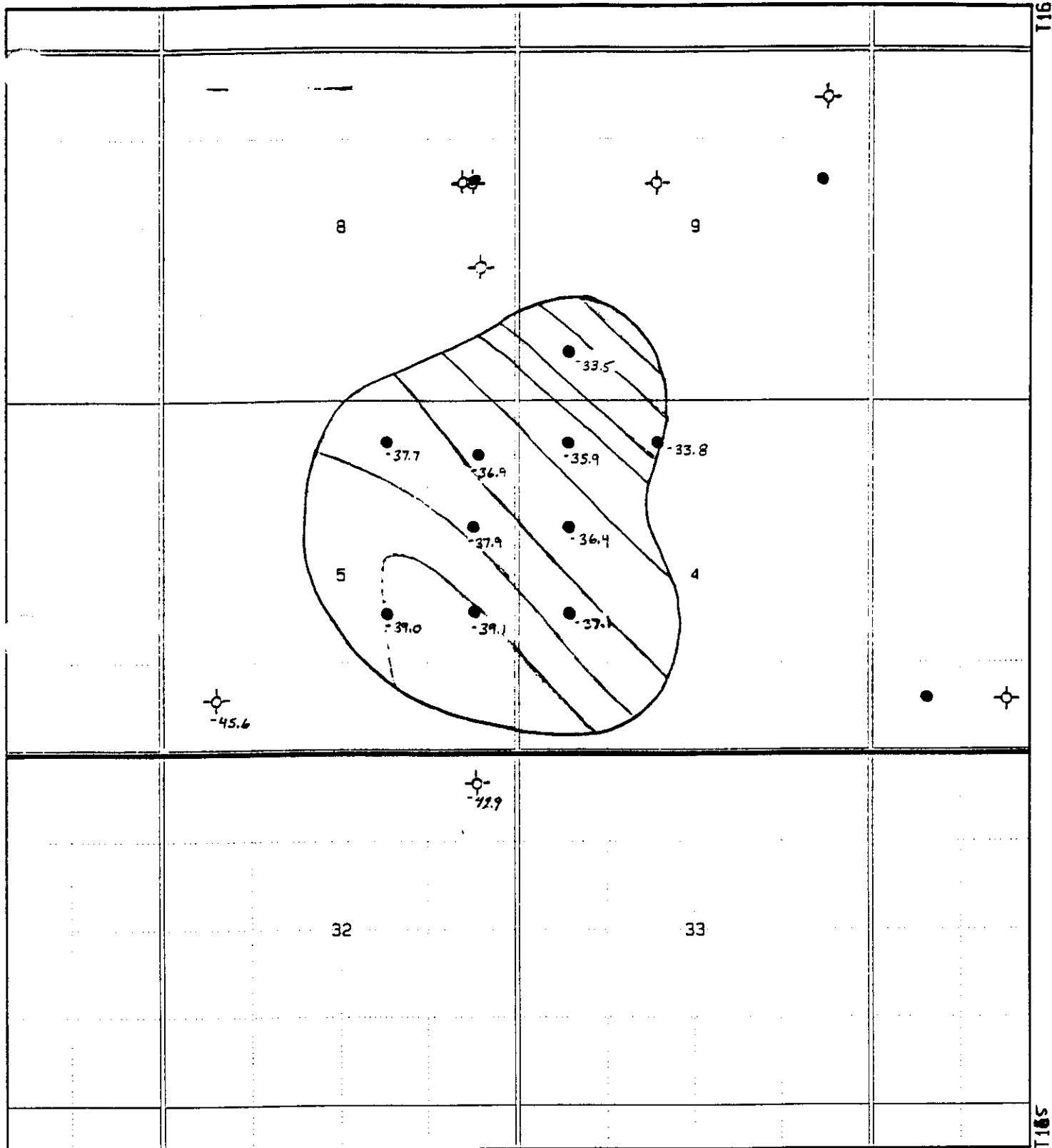
- LEGEND -


- Median Value (73.0)
- Geom. Average (8.00)
- Cumulative Frequency
- - - Cumulative Capacity Lost

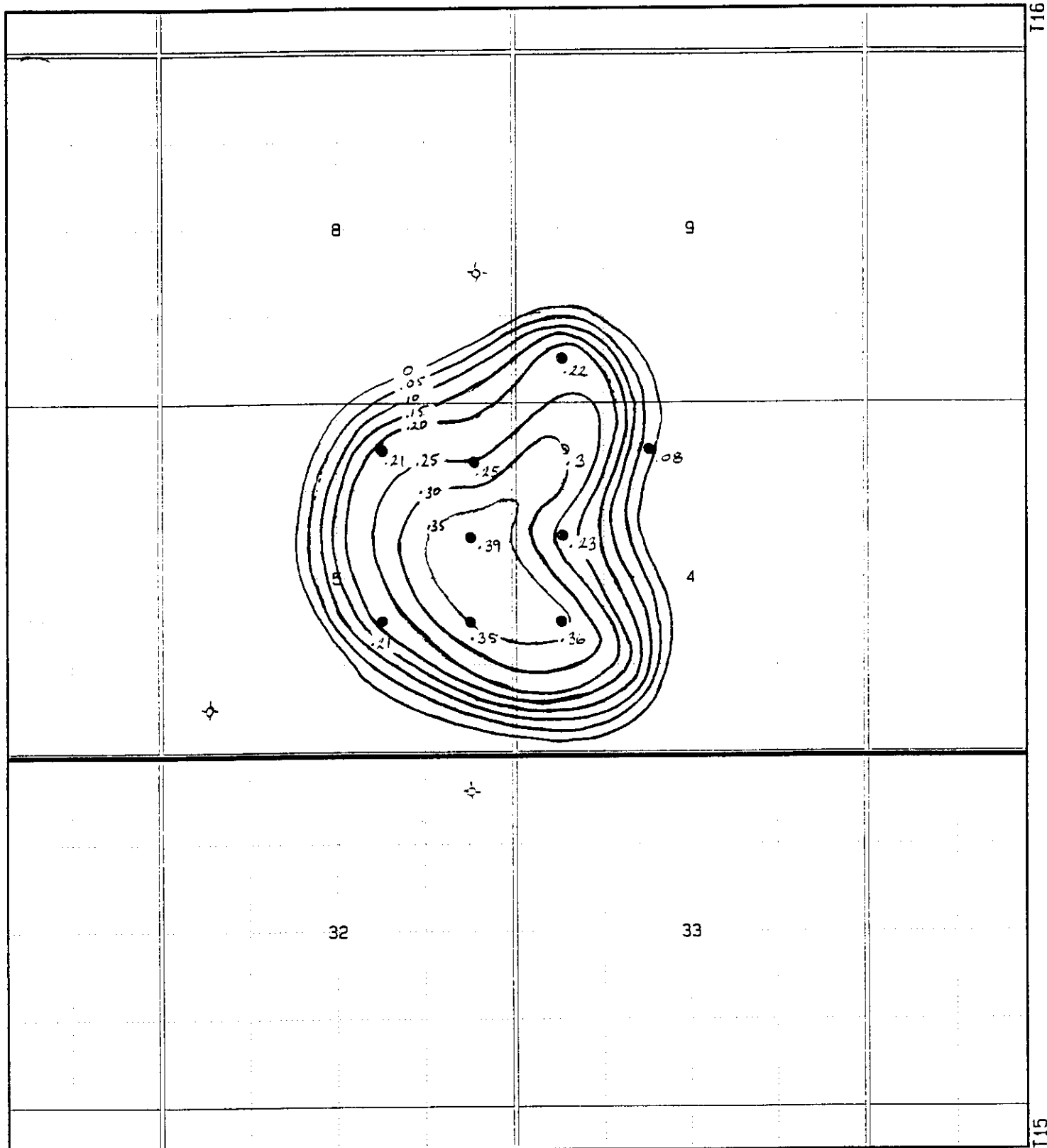
8 Samples

APPENDIX 4

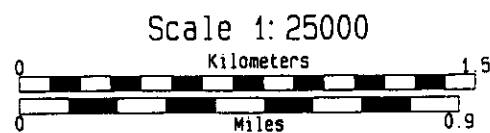
Geological Maps and Cross Sections



Well Symbols		Progress Energy Ltd.	
Location	□ Drilling	STRUCTURE TOP BAKKEN SAND (m)	
	* Gas		
Oil	* Oil&Gas	Birdtail South	
* Susp Oil	* Susp Gas		
* Abnd Oil	* Abnd Gas	Author: Date: September 9, 1998	
* Susp H Oil	* Susp Oil&Gas		
* Abnd H Oil	* Abnd Oil&Gas	Scale 1: 25000	
○ Susp Undes	◇ O & A		
□ Service	□ Abnd Service		
□ Injection	* Gas Injection		
No Well Postings Specified *			



Well Symbols	
Location	Drilling
Oil	Gas
Susp Oil	Oil&Gas
Abnd Oil	Susp Gas
Susp H Oil	Abnd Gas
Abnd H Oil	Susp Oil&Gas
Susp Undes	Abnd Oil&Gas
Service	D & A
Injection	Abnd Service
	Gas Injection
No Well Postings Specified	
*	



Progress Energy Ltd.	
Bakken Sand (Øm)	
Birdtail South	
Author:	
Date:	August 28, 1998

TYPE LOG

NORT ROCK BIRDTAIL

9-5-16-27 U1

K.B. 481.7

MISS / LOGGERS POLE

BAKKEN SHALE

BAKKEN SAND

DEVONIAN / TORQUAY

PR Y Collar

PR Gauge Ray

PR X Collar

PR 20K Deep

PR 7" idulum

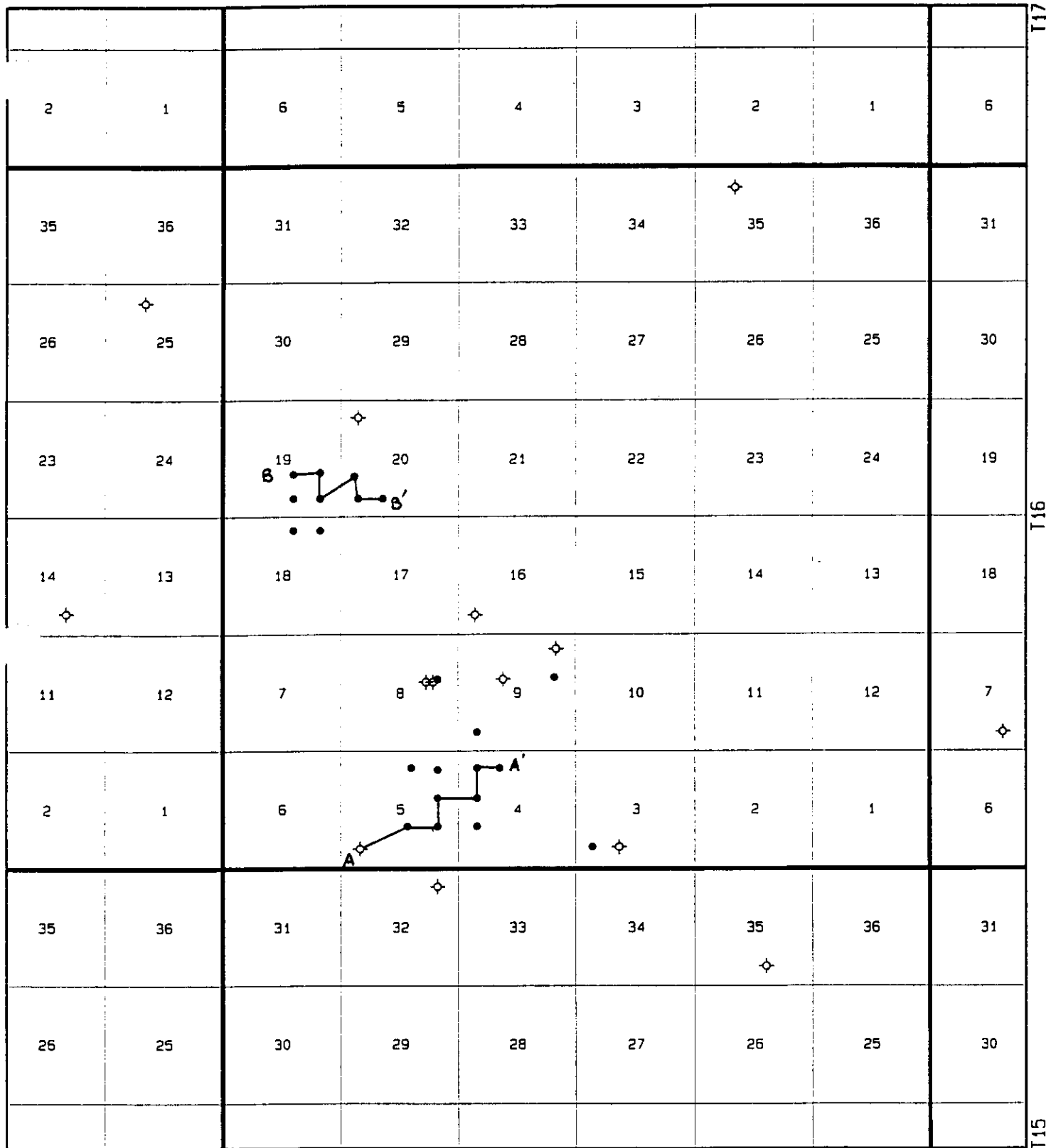
PR SPL Resistivity

TENSION

BIT SIZE

NO DST

NO CORES



<p>Well Symbols</p> <table border="0"> <tr> <td>Location</td> <td>Drilling</td> </tr> <tr> <td>Oil</td> <td>Gas</td> </tr> <tr> <td>Oil</td> <td>Oil&Gas</td> </tr> <tr> <td>Susp Oil</td> <td>Susp Gas</td> </tr> <tr> <td>Abnd Oil</td> <td>Abnd Gas</td> </tr> <tr> <td>Susp H Oil</td> <td>Susp Oil&Gas</td> </tr> <tr> <td>Abnd H Oil</td> <td>Abnd Oil&Gas</td> </tr> <tr> <td>Susp Undes</td> <td>O & A</td> </tr> <tr> <td>Service</td> <td>Abnd Service</td> </tr> <tr> <td>Injection</td> <td>Gas Injection</td> </tr> <tr> <td colspan="2">No Well Postings Specified</td> </tr> </table>		Location	Drilling	Oil	Gas	Oil	Oil&Gas	Susp Oil	Susp Gas	Abnd Oil	Abnd Gas	Susp H Oil	Susp Oil&Gas	Abnd H Oil	Abnd Oil&Gas	Susp Undes	O & A	Service	Abnd Service	Injection	Gas Injection	No Well Postings Specified		<p>Scale 1: 75000</p> <p>Kilometers 0 4</p> <p>Miles 0 2</p>	<p>Progress Energy Ltd.</p> <p>BIROTAIL</p> <p>X-SECTIONS</p> <p>Author:</p> <p>Date: September 28, 1998</p>
Location	Drilling																								
Oil	Gas																								
Oil	Oil&Gas																								
Susp Oil	Susp Gas																								
Abnd Oil	Abnd Gas																								
Susp H Oil	Susp Oil&Gas																								
Abnd H Oil	Abnd Oil&Gas																								
Susp Undes	O & A																								
Service	Abnd Service																								
Injection	Gas Injection																								
No Well Postings Specified																									

Produced by: Accumap EnerData Corp. Map File: WATER.MAP Licence Data to: July 31, 1998 / Production Data to: June 30, 1998

X-SECTION A-A'

NOT SCANNED
(Oversized)

FOR AVAILABILITY
CONTACT THE
PETROLEUM BRANCH
(Engineering Section)

APPENDIX 5

Water Compatibility Geochemical Modeling Results



CORE LABORATORIES

CORE Laboratories Reservoir Fluids Report - Calgary
Geochemical Modeling
for
Northrock Resources Ltd.
Various Locations

File Number: 52137-97-1348

Date: May 27, 1997

Report Distribution: Jeff Shaw, Northrock (Calgary) - 2 copies and invoice

APPROVED BY: *M. Mills*

Marcia Mills
Technical Specialist
Phone # 250-4059

Please contact the above person should there be any questions concerning the contents of this report.

The analysis, opinions or interpretations contained in this report are based upon observations and material supplied by the client for whose exclusive and confidential use this report has been made. The interpretations or opinions expressed represent the best judgement of CORE Laboratories. CORE Laboratories assumes no responsibility and makes no warranty or representations, expressed or implied, as to the productivity, proper operations, or profitability however of any oil, gas, coal or other mineral, proper well or sand in connection with which such report is used or relied upon for any reason whatsoever.

COMPANY Northrock Resources Ltd.
WELL Various Locations
PROJECT Geochemical Modeling

PAGE 1 of 5
FILE 52137-97-1348
DATE 97-05-27

Introduction

Three ionic compositions were received at Core Laboratories (see Page 5). All three waters were subjected to geochemical modeling which will predict the scaling tendencies of the water mixtures.

Compositions Received

Water #1:	100/02-29-015-30W1/00	Depth:	659.5 - 662.0 m
Formation:	Bakken		
Water #2:	100/10-28-015-27W1/00	Depth:	463.3 - 474.0 m
Formation:	Lodgepole		
Water #3:	100/14-17-015-31W1/00	Depth:	778.5 - 790.7 m
Formation:	Birdbear		

Discussion

The analytical data of the composition of the three fluids were entered into a Geochemical Modeling program and mathematically mixed. The scaling indices for the most common scaling compounds were calculated for each of the mixes (see Table 1-4).

The scaling tendency can be inferred from the scaling indices as well as the concentration of the ionic species involved in that compound. The scaling indices can be viewed as follows:

- If the index is negative, the water is not saturated with the component and scale formation is unlikely.
- If the index is positive, the water is supersaturated with the component and scale formation is possible.
- If the index is zero, the component is in equilibrium with the saturation point, and precipitation may or may not occur.

The larger the variance from zero, the greater the variance from a saturated solution.

Whether or not scale formation is indicated by the calculation, it does not mean that the outcome is a certainty. These calculations provide an insight to what may happen in a system. Relating these values to the analyses and historical data is necessary to make proper inferences.

COMPANY Northrock Resources Ltd.
 WELL Various Locations
 PROJECT Geochemical Modeling

PAGE 2 of 5
 FILE 52137-97-1348
 DATE 97-05-27

Modeling Data and Interpretation

The following pages contain the charts of the data calculated from the provided water analyses.

Table 1 - Bakken & Lodgepole @ 31°C and 3300 kPa

Bakken	0%	10%	20%	50%	80%	90%	100%
Lodgepole	100%	90%	80%	50%	20%	10%	0%
Calcium Carbonate CaCO ₃ (Calcite)	1.332	1.306	1.276	1.154	0.998	0.942	0.885
Calcium Sulphate CaSO ₄ (Gypsum)	-0.536	-0.470	-0.410	-0.256	-0.131	-0.094	-0.060

Table 2 - Bakken & Lodgepole @ 31°C and 10 mPa

Bakken	0%	10%	20%	50%	80%	90%	100%
Lodgepole	100%	90%	80%	50%	20%	10%	0%
Calcium Carbonate CaCO ₃ (Calcite)	1.275	1.250	1.219	1.097	0.940	0.883	0.827
Calcium Sulphate CaSO ₄ (Gypsum)	-0.571	-0.504	-0.444	-0.290	-0.166	-0.129	-0.094

Table 3 - Bakken & Birdbear @ 31°C and 3300 kPa

Bakken	0%	10%	20%	50%	80%	90%	100%
Birdbear	100%	90%	80%	50%	20%	10%	0%
Calcium Carbonate CaCO ₃ (Calcite)	0.463	0.489	0.517	0.616	0.751	0.811	0.885
Calcium Sulphate CaSO ₄ (Gypsum)	-0.437	-0.424	-0.409	-0.346	-0.225	-0.156	-0.060

Table 4 - Bakken & Birdbear @ 31°C and 10 mPa

Bakken	0%	10%	20%	50%	80%	90%	100%
Birdbear	100%	90%	80%	50%	20%	10%	0%
Calcium Carbonate CaCO ₃ (Calcite)	0.413	0.439	0.466	0.564	0.695	0.754	0.827
Calcium Sulphate CaSO ₄ (Gypsum)	-0.466	-0.453	-0.439	-0.376	-0.257	-0.189	-0.094

* -gray shading denotes mixes with a significant increase in scaling tendency

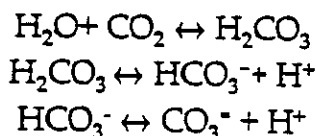
COMPANY Northrock Resources Ltd.
WELL Various Locations
PROJECT Geochemical Modeling

PAGE 3 of 5
FILE 52137-97-1348
DATE 97-05-27

Calcium Carbonate

The Calcium Carbonate values for the end-members and all the mixes are above zero, which is not unusual for most formation waters. This indicates that some scaling may occur. The main concern is whether the tendency increases for any of the mixes. In this case, all scaling indices are less than the highest end member, which indicates that the waters are compatible.

An increase in pressure actually reduces the likelihood of precipitating calcium carbonate by increasing the partial pressure of carbon dioxide. The partial pressure of carbon dioxide increases CaCO_3 solubility in water. When CO_2 dissolves in water, it forms carbonic acid, which ionizes according to the following equations:



Bakken-Lodgepole Blend

As the amount of Bakken increases the scaling tendency of calcite decreases; conversely, as Lodgepole concentration increases the scaling tendency increases. This means that adding Lodgepole to Bakken would decrease the water quality but adding Bakken to Lodgepole would improve the quality of the water.

Bakken-Birdbear Blend

As the amount of Birdbear increases the scaling tendency of calcite decreases; conversely, as Bakken concentration increases the scaling tendency increases. This means that adding Bakken to Birdbear would decrease the water quality but adding Birdbear to Bakken would improve the quality of the water.

Calcium Sulphate

The Calcium Sulphate values remain well below zero during the entire series, for all the blends indicating that precipitation will likely not occur.

COMPANY Northrock Resources Ltd.
WELL Various Locations
PROJECT Geochemical Modeling

PAGE 4 of 5
FILE 52137-97-1348
DATE 97-05-27

Summary

If there has been no significant scaling historically occurring on these wells then there may be little, if any, scaling of the noted species likely to occur in the future. If there has been significant scaling of the noted species, then caution needs to be exercised.

These difficulties could be mitigated by using chemical treatment programs.

Further testing could also include physical tests to determine if the predicted tendencies actually support what occurs when the two waters are combined.

Caution should be exercised when assessing whether the waters will scale. Barite and Strontianite scale were not included in this analysis. These are very common types of oilfield scales and all the waters have elevated levels of sulphate ions. However, waters with high sulphate concentration generally have low amounts of barium.

COMPANY Northrock Resources Ltd.
 WELL Various Locations
 PROJECT Geochemical Modeling

PAGE 5 of 5
 FILE 52137-97-1348
 DATE 97-05-27

Constituent and/or Property	Bakken 100/02-29-015-30W100	Lodgepole 100/10-28-015-27W100	Birdbear 100/14-17-015-31W100
	mg/L		
Sodium, Na + K	13118	10879	73218
Calcium, Ca	1395	814	1922
Magnesium, Mg	561	463	778
Chloride, Cl	20843	17395	114000
Sulphate, SO ₄	5123	2500	6071
Bicarbonate, HCO ₃	437	566	230
pH	7.3	7.9	7.1
Density (g/cm ³)	1.031	1.030	1.130
Total Solids	41477	32617	196219

APPENDIX 6

Surface Landowner Information Letters

Progress Energy Ltd.

Suite 520, 520 – 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 518
Birtle, MB
R0M 0C0

Attention: Clifford Kenton Clarence Salmon

Dear Mr. Salmon:

**Re: Application for Approval to Waterflood
the Bakken A Pool – Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 – 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 219
Birtle, MB
R0M 0C0

Attention: Robert Allen Corr

Dear Mr. Corr:

**Re: Application for Approval to Waterflood
the Bakken A Pool – Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 - 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 215
Birtle, Manitoba
R0M 0C0

Attention: William Roger Wilson

Dear Mr. Wilson:

**Re: Application for Approval to Waterflood
the Bakken A Pool - Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 – 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 1581
Portage La Prairie, Manitoba
R1N 3P1

Attention: Janice Pauline Meseyton

Dear Ms. Meseyton:

**Re: Application for Approval to Waterflood
the Bakken A Pool – Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 - 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 341
Birtle, MB
R0M 0C0

Attention: Phillip Tillson Barteaux

Dear Mr. Barteaux:

**Re: Application for Approval to Waterflood
the Bakken A Pool - Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 – 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 261
Birtle, Manitoba
R0M 0C0

Attention: Fassie Fern Farm Ltd.

To Whom It May Concern:

**Re: Application for Approval to Waterflood
the Bakken A Pool – Birdtail Field**

As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.



Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 - 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 518
Birtle, Manitoba
R0M 0C0

Attention: Murray Ephraim Salmon

Dear Mr. Salmon:

**Re: Application for Approval to Waterflood
the Bakken A Pool - Birdtail Field**


As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.


Jeff Screen, P.Eng.
Manager, Production - Operations

Progress Energy Ltd.

Suite 520, 520 – 5th Ave. SW
Calgary, AB
T2P 3R7
Phone: 403-216-2510
FAX: 403-216-2514

October 21, 1998

Box 45
Birtle, Manitoba
R0M 0C0

Attention: George Argyle Salmon and Vera Merelene Salmon

**Re: Application for Approval to Waterflood
the Bakken A Pool – Birdtail Field**

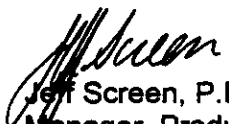
As part of the application procedure Progress Energy Ltd. wishes to notify surface land owners in the area of the Bakken A pool, that we have made application to the Manitoba Energy and Mines for approval of enhanced oil recovery from this pool. The Bakken A Pool is located within Sections 4, 5, 8 & 09-16-27 W1M. An outline of the lands involved in this application is attached.

This enhanced oil recovery project will involve waterflooding the Bakken A Pool by re-injecting produced formation water. This will result in the increase of total recoverable oil from this pool.

The surface land impact from this project will be minor as all wells will be pipelined to a central battery location at 01-19-16-27 W1M, and all pumpjack engines will be converted to electric motors. A Progress Energy Ltd. representative will discuss any surface land issues arising from this development with the directly affected landowners.

Should you have any questions or concerns in this matter please feel free to contact me at 216-2510 (ext. 105).

Yours truly,
PROGRESS ENERGY LTD.


Jeff Screen, P.Eng.
Manager, Production - Operations