

**BIRDTAIL UNIT NO. 2**  
**WATERFLOOD EOR PROJECT**  
**ANNUAL REPORT FOR 2014**

**April 27, 2015**

**Tundra Oil and Gas Partnership**

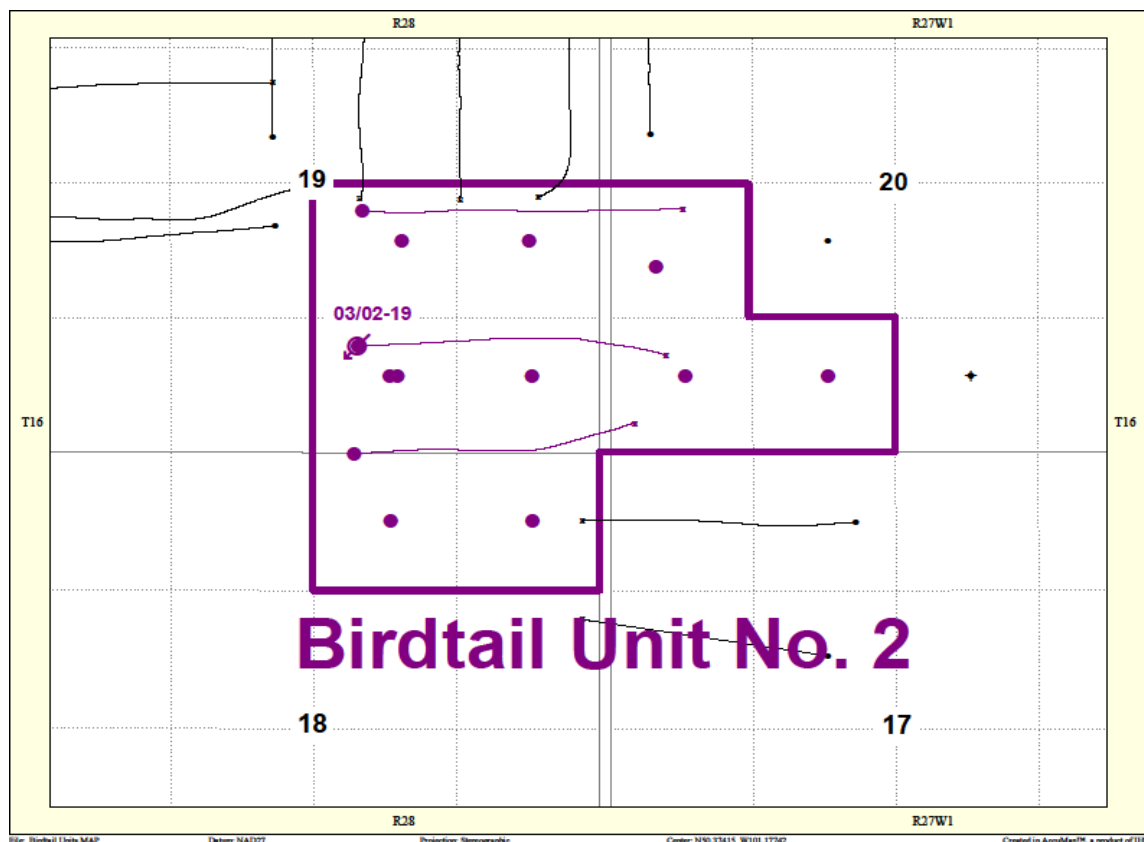
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## **INTRODUCTION**

Birdtail Unit No. 2 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 8 effective December 1, 2000 with Progress Energy Production Partnership as Operator. Tundra acquired the unit from Progress Energy Production Partnership and become operator in October 2003. The EOR project area contains 13 wells in 9 LSDs in Township 16, Range 27 W1 as shown in the figure below. Well list and well status is available in Appendix A.

**Figure 1: Birdtail Unit No. 2 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the 2014 Annual Progress Report for Birdtail Unit No. 2 as required by Waterflood Order No. 8.

## **DISCUSSION**

### **Production History**

For the wells included in Birdtail Unit No. 2, production started January 1997 with 00/05-20-016-27W1/0 well. Oil production peaked at 11.8 m<sup>3</sup>/d in July 1998. The Unit

was producing 6.02 m<sup>3</sup>/d of oil and 24.08 m<sup>3</sup>/d of water in December 2014 and had an average WOR of 3.77 m<sup>3</sup>/m<sup>3</sup> in 2014. The oil production rate, injection rate, and WOR during each month for each injection pattern and for whole project are presented in Appendix D. The rates and WOR are plotted in Figure 2.

**Figure 2: Birdtail Unit No. 2 Production/Injection Rates and WOR vs. Time**

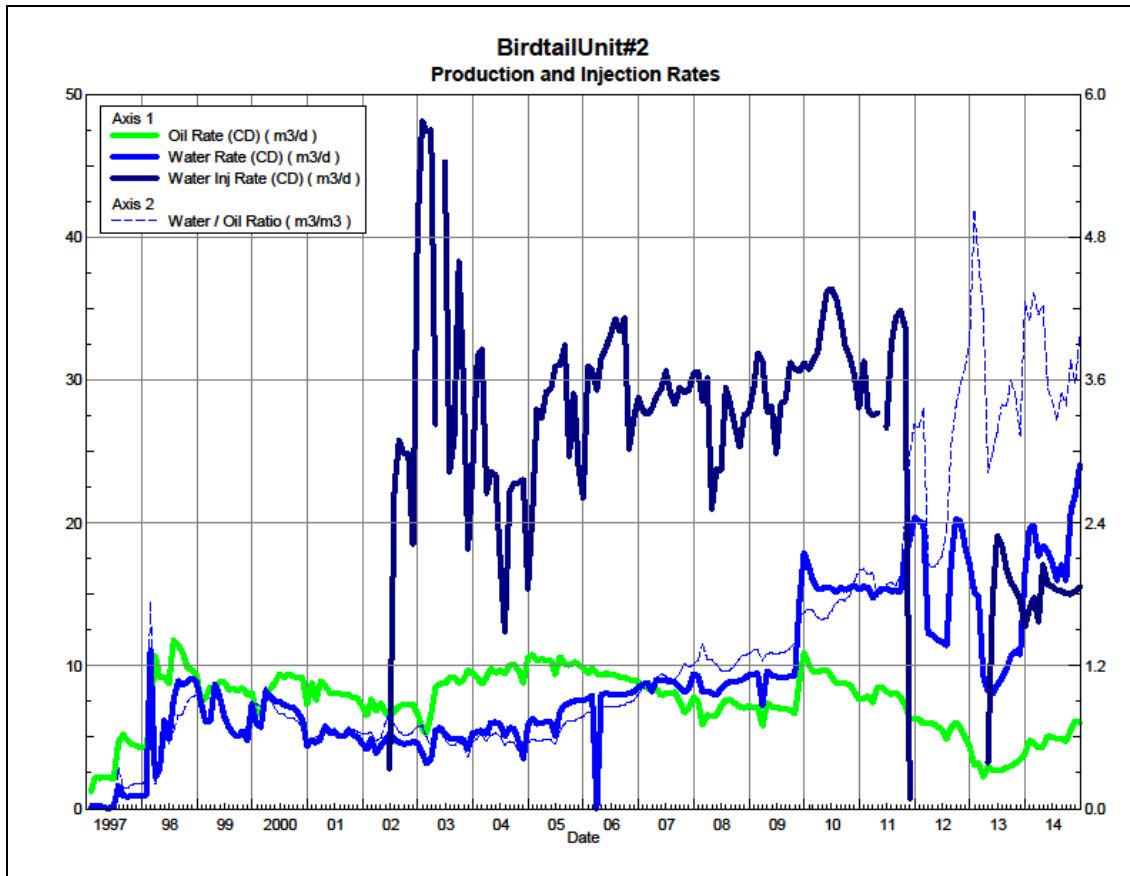
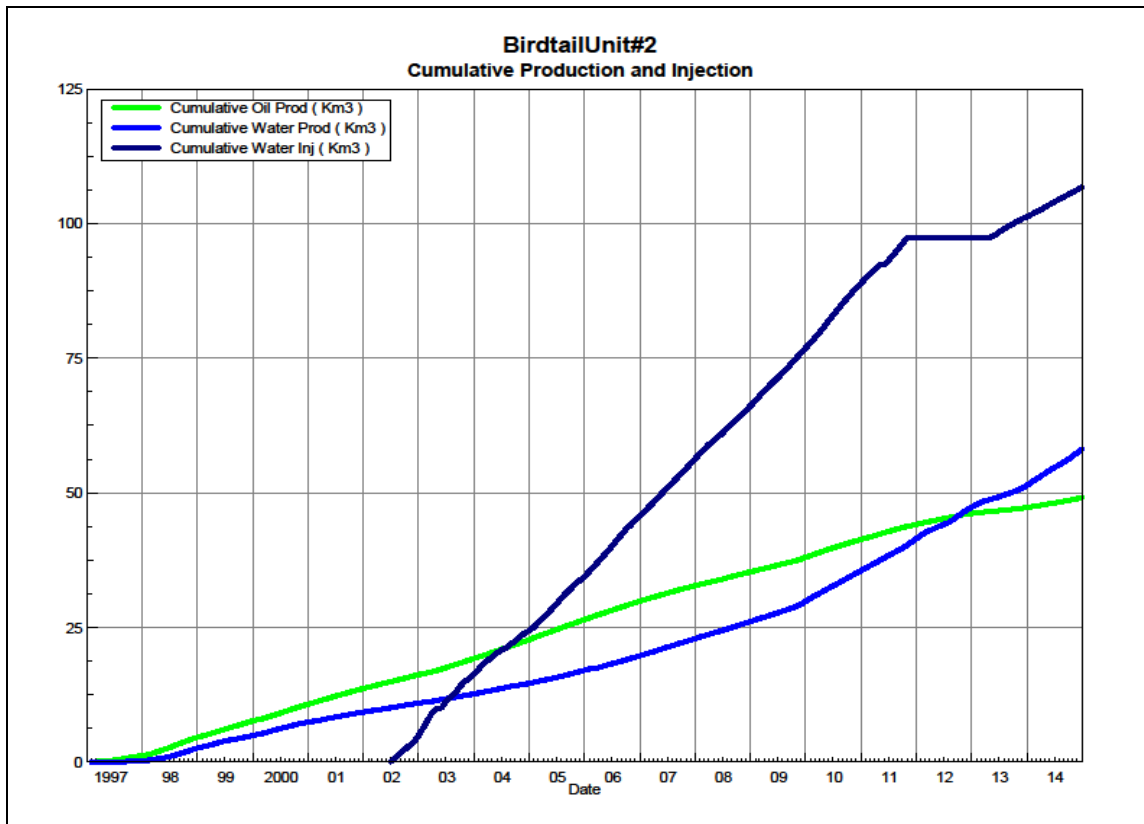


Figure 3 shows the cumulative production for Birdtail Unit No. 2 to the end of December 2014 as 49.1 e<sup>3</sup>m<sup>3</sup> of oil, and 58.2 e<sup>3</sup>m<sup>3</sup> of water. The cumulative water injected is 106.8 E<sup>3</sup>m<sup>3</sup>. The cumulative volume of oil, and water produced and fluid injected for each injection pattern and for the whole project for each injection well is presented in Appendix D.

**Figure 3: Birdtail Unit No. 2 Cumulative Oil, Water and Water Injected vs. Time**



### **Waterflood History**

As of December 2014 the Unit has 1 active horizontal injector at 03/02-19-016-27W1/0. The vertical injectors at 02/02-19-016-27W1/0 (02/02-19) and 00/04-20-016-27W1/0 (00/04-20) were suspended in October 2011. Water injection started in June 2002. An overall summary for each injector pattern is presented in Appendix C.

Any future revisions to the waterflood development or surveillance plan would be based on new production or performance response data, technical studies, or observed reservoir behavior and reserves recovery interpretations.

## **Waterflood EOR Operations**

### **Water Source and Quality**

The injection water for Birdtail Unit No. 2 is sourced from the 00/02-19-016-27W/2 well (Lodgepole formation). The water is treated at the 09-05-16-27W1 battery where it is filtered to 0.50 microns and has scale inhibitor added.

### **Injection Wellhead Pressures**

The monthly wellhead injection pressures for each injection well is summarized in Appendix B, and shows all injection pressure since 2003. In 2011, the average injection pressure for injector 00/04-20 was 7050 kPag and 7070 kPag for 02/02-19. The average injection pressure for the horizontal injector at 03/02-19-016-27W1/0 was 2970 kPag in 2014.

### **Reservoir Pressure**

Where practical, Tundra is committed to collecting pressure data from newly drilled wells. For Birdtail Unit No. 2, pressure data taken in 2012 and 2013 from 4 locations is available (02/02-19, 03/02-19, 04/02-19 and 00/04-20). The reservoir pressures are 5266, 3990, 4646 and 5745 kPa(a), respectively.

### **Well Servicing**

Table 1 lists the maintenance that was required in Birdtail Unit No. 2 in 2014.

**Table 1: Service and Maintenance in Birdtail Unit No. 2**

03/02-19-016-27W1/0	Packer Repair	3/28/2014
02/07-19-016-27W1/0	Pump Change	10/8/2014
00/01-19-016-27W1/0	Pump Change	10/10/2014

### **Voidage Replacement**

Cumulative voidage for Birdtail Unit No. 2 was 0.993 in December 2014. This is reasonable considering that the wells within the unit have been producing for almost fourteen years. From 2002 until 2011, monthly voidage was significantly greater than 1, which is why the Birdtail Unit No. 2 had a cumulative VRR greater than 1. Calculation, plots and tables of the Voidage Replacement Ratio on a monthly and cumulative basis for each injection pattern are presented in Appendix D.

In consideration of the cumulative VRR in excess of 1, water injection was suspended in October 2011 in the vertical injectors. Injection in the Unit resumed in April 2013 with the conversion of the horizontal producer at 03/02-19-016-27W1/0 to injection.

## **Waterflood Performance Discussion**

The original oil-in-place (OOIP) of 393 e<sup>3</sup>m<sup>3</sup> with cumulative oil recovered to date of 49.1 e<sup>3</sup>m<sup>3</sup> results in a recovery factor of 12.5%. The ultimate expected recoverable reserve based on decline analysis is 70.0 e<sup>3</sup>m<sup>3</sup> or an ultimate recovery factor of 17.8%. The overall performance of this waterflood has been good as indicated by an expected recovery factor of 17.8% and increased or flattened oil production since water injection began in 2002.

The 03/02-19-016-27W1/0 (03/02-19) horizontal well was converted to a water injector in April 2013 after a short production period. The injection rates have been reasonably steady between 14-17 m<sup>3</sup>/d and are starting to show some oil response on the offset vertical wells. Ultimately, it is expected that the 02/07-19-016-27W1/0 horizontal well will benefit the most from the new 03/02-19 water injector.

Trends in production since 2013 have seen a decline in inflow and oil cut in some of the vertical producers which is likely due to shutting in the vertical injectors. Even though total field voidage has been maintained well above unity, it may be that local withdrawals of fluid from the horizontal producing wells are resulting in lower pressures and drainage. Tundra will be evaluating the response of the reconfigured waterflood in this unit in 2014/2015 and will make any appropriate changes as required to the injection targets and wells.

## **List of Appendices**

Appendix A: Well Name and Well Status

Appendix B: Monthly Injection Wellhead Pressures Table and Plots

Appendix C: Birdtail Unit No. 2 Injection Pattern Summary

Appendix D: Injector Pattern Production/Injection Rates, Cumulative and VRRs

Plots and Tables for the following injector:

03/02-19-016-27W1/0



## Appendix A

UWI	Surface Location	Well Status
100/15-18-016-27W1/00		ABD Producer
100/16-18-016-27W1/00		Capable of OIL Prod
100/01-19-016-27W1/00		Capable of OIL Prod
100/02-19-016-27W1/00		ABD Producer
102/02-19-016-27W1/00		WTR Injection
103/02-19-016-27W1/00	103/04-20-016-27W1/00	WTR Injection
104/02-19-016-27W1/00	104/04-20-016-27W1/00	Capable of OIL Prod
100/07-19-016-27W1/00		Capable of OIL Prod
102/07-19-016-27W1/00	102/05-20-016-27W1/00	Capable of OIL Prod
100/08-19-016-27W1/00		Capable of OIL Prod
100/03-20-016-27W1/00		Capable of OIL Prod
100/04-20-016-27W1/00		WTR Injection
100/05-20-016-27W1/00		Capable of OIL Prod

Appendix B

Average Monthly Injection Pressure (kPag)

Month	Injection Pressure		Month	Injection Pressure		Month	Injection Pressure		Month	Injection Pressure	
	100/04-20	102/02-19		100/04-20	102/02-19		100/04-20	102/02-19		100/04-20	102/02-19
			Jan-06	8100	8200	Jan-09	8000	8100	Jan-12	-	-
			Feb-06	8100	8200	Feb-09	8000	8100	Feb-12	-	-
			Mar-06	8100	8200	Mar-09	8000	8100	Mar-12	-	-
			Apr-06	8100	8200	Apr-09	8000	8100	Apr-12	-	-
			May-06	8100	8200	May-09	8000	8100	May-12	-	-
			Jun-06	8100	8200	Jun-09	8000	8100	Jun-12	-	-
			Jul-06	8100	8200	Jul-09	8000	8100	Jul-12	-	-
			Aug-06	8100	8200	Aug-09	7774	8100	Aug-12	-	-
			Sep-06	8100	8200	Sep-09	8000	8100	Sep-12	-	-
Oct-03	8400	8600	Oct-06	8055	8155	Oct-09	8000	7747	Oct-12	-	-
Nov-03	8147	8220	Nov-06	7900	8050	Nov-09	8000	8100	Nov-12	-	-
Dec-03	8310	8410	Dec-06	8000	8100	Dec-09	8000	6974	Dec-12	-	-
Jan-04	8300	8400	Jan-07	8000	8100	Jan-10	8000	7084	Jan-13	-	-
Feb-04	8300	8400	Feb-07	8000	8100	Feb-10	8000	8100	Feb-13	-	-
Mar-04	8300	8400	Mar-07	8000	8100	Mar-10	8000	8100	Mar-13	-	-
Apr-04	8240	8340	Apr-07	8000	8100	Apr-10	8000	8100	Apr-13	-	35
May-04	8200	8300	May-07	8000	8100	May-10	8000	8100	May-13	-	736
Jun-04	7390	7363	Jun-07	8000	8100	Jun-10	8000	8100	Jun-13	-	2346
Jul-04	5732	5581	Jul-07	8000	8100	Jul-10	8000	8100	Jul-13	-	2938
Aug-04	8200	8297	Aug-07	8000	6984	Aug-10	8000	8100	Aug-13	-	3000
Sep-04	8200	8300	Sep-07	8000	8100	Sep-10	8000	8100	Sep-13	-	3000
Oct-04	8200	8300	Oct-07	8000	8100	Oct-10	8000	8100	Oct-13	-	3000
Nov-04	8200	8300	Nov-07	8000	8100	Nov-10	8020	7963	Nov-13	-	3040
Dec-04	6997	6774	Dec-07	8000	8100	Dec-10	8003	7968	Dec-13	-	2614
Jan-05	7013	7000	Jan-08	8000	8100	Jan-11	7900	7800	Jan-14	-	2998
Feb-05	8000	8200	Feb-08	8000	8100	Feb-11	7882	7818	Feb-14	-	3012
Mar-05	8000	8200	Mar-08	8000	8100	Mar-11	7594	7777	Mar-14	-	2610
Apr-05	8000	8200	Apr-08	8000	8100	Apr-11	7743	7943	Apr-14	-	2989
May-05	8035	8200	May-08	8000	8100	May-11	7761	7897	May-14	-	3000
Jun-05	8100	8200	Jun-08	8000	8100	Jun-11	7057	7207	Jun-14	-	3001
Jul-05	8100	8200	Jul-08	8000	8100	Jul-11	7800	7900	Jul-14	-	3019
Aug-05	8100	8200	Aug-08	8000	8100	Aug-11	7800	7900	Aug-14	-	2999
Sep-05	8203	8303	Sep-08	8000	8100	Sep-11	7800	7900	Sep-14	-	3001
Oct-05	8300	8400	Oct-08	8000	8100	Oct-11	7129	7974	Oct-14	-	3000
Nov-05	8300	8400	Nov-08	8000	8100	Nov-11	4347	4157	Nov-14	-	3000
Dec-05	8197	8297	Dec-08	8000	8100	Dec-11	3767	2583	Dec-14	-	2999

# Appendix C

## Birdtail Unit No.2 Pattern Summary as of December 2014

Pattern Name	Injector Location (016-27W1)	Injector Surf. Location (016-27W1)	Status	No. of Supported Wells	Supported Wells (016-27W1)	Allocation Factor	Pattern Prod Start Month	Injector Start Month	Injector End Month	Oil Rate (m³/d)	Water Rate (m³/d)	WOR (m³/m³)	Water Injection (m³/d)	Cum Oil (E³m³)	Cum Water (E³m³)	Cum Inj Water (E³m³)	Monthly VRR	Cum VRR
02/02-19-016-27W1 Injector	02/02-19	Vertical Well	WTR Injection	7	15-18, 02-19, 07-19	1	Jul 1997	Jun 2002	Oct 2011	-	-	-	-	-	-	-	-	-
					16-18, 01-19, 08-19, 02/07-19	0.5												
00/04-20-016-27W1 Injector	00/04-20	Vertical Well	WTR Injection	6	03-20, 05-20	1	Jan 1997	Jul 2002	Oct 2011	-	-	-	-	-	-	-	-	-
					16-18, 01-19, 08-19, 02/07-19	0.5												
03/02-19-016-27W1 Injector	03/02-19	03/04-20	WTR Injection	9	01-19, 02-19, 02/02-19, 07-19, 08-19, 04/02-19 (Surf Loc 04/04-20), 02/07-19 (Surf Loc 02/05-20), 04-20, 05-20	1	Jan 1997	Apr 2013	-	5.4	24.0	4.4	15.5	35.5	47.8	106.8	0.5	1.3

**Appendix D**  
**Rates and VRR**  
**Plots and Tables**

# Pattern: 03/02-19-16-27Inj Set: BirdtailUnit#2

Oil Formation Vol Factor : 1.00300 m3/m3

Water Formation Vol Factor : 1.00000 m3/m3

Water / Oil Ratio : 4.44 m3/m3

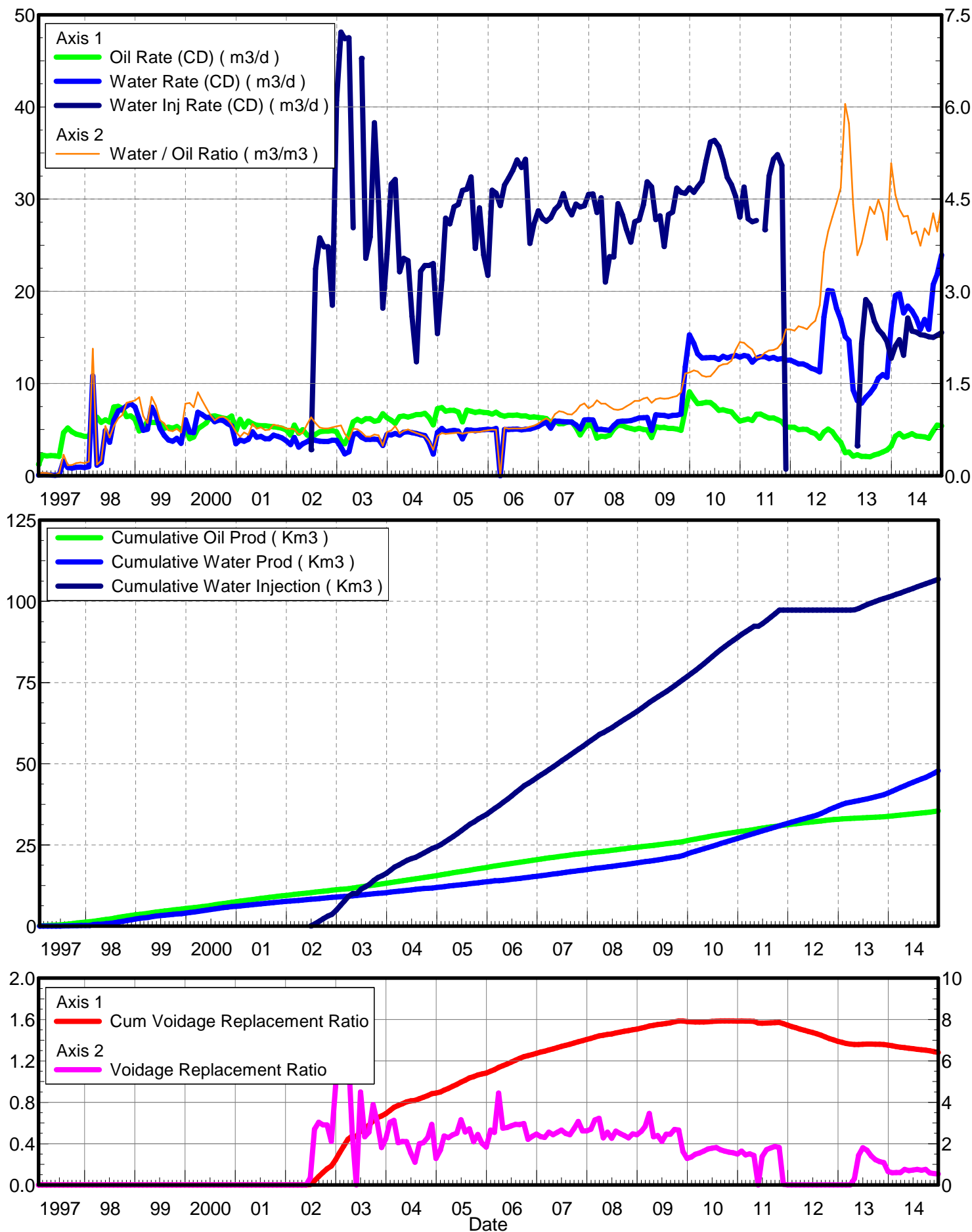
April 27, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 5.39 m3/d

Water Rate (CD) : 23.95 m3/d

Water Inj Rate (CD) : 15.52 m3/d



Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
1/31/1997	1.23	0.05	0.04		0.04	0.00	0.00	0.000	0.000
2/28/1997	2.22	0.10	0.05		0.10	0.00	0.00	0.000	0.000
3/31/1997	2.14	0.09	0.04		0.17	0.01	0.00	0.000	0.000
4/30/1997	2.19	0.06	0.03		0.23	0.01	0.00	0.000	0.000
5/31/1997	2.17	0.03	0.01		0.30	0.01	0.00	0.000	0.000
6/30/1997	2.09	0.09	0.04		0.36	0.01	0.00	0.000	0.000
7/31/1997	4.68	1.59	0.34		0.51	0.06	0.00	0.000	0.000
8/31/1997	5.18	0.89	0.17		0.67	0.09	0.00	0.000	0.000
9/30/1997	4.76	0.82	0.17		0.81	0.11	0.00	0.000	0.000
10/31/1997	4.50	0.91	0.20		0.95	0.14	0.00	0.000	0.000
11/30/1997	4.39	0.94	0.21		1.08	0.17	0.00	0.000	0.000
12/31/1997	4.26	0.87	0.20		1.21	0.20	0.00	0.000	0.000
1/31/1998	4.25	0.97	0.23		1.35	0.23	0.00	0.000	0.000
2/28/1998	5.24	10.81	2.07		1.49	0.53	0.00	0.000	0.000
3/31/1998	6.34	1.14	0.18		1.69	0.57	0.00	0.000	0.000
4/30/1998	5.78	1.42	0.25		1.86	0.61	0.00	0.000	0.000
5/31/1998	6.06	4.89	0.81		2.05	0.76	0.00	0.000	0.000
6/30/1998	5.81	3.61	0.62		2.22	0.87	0.00	0.000	0.000
7/31/1998	7.45	5.99	0.80		2.46	1.05	0.00	0.000	0.000
8/31/1998	7.53	7.03	0.93		2.69	1.27	0.00	0.000	0.000
9/30/1998	7.31	7.20	0.99		2.91	1.49	0.00	0.000	0.000
10/31/1998	6.39	7.57	1.19		3.11	1.72	0.00	0.000	0.000
11/30/1998	6.50	7.82	1.20		3.30	1.96	0.00	0.000	0.000
12/31/1998	6.10	7.45	1.22		3.49	2.19	0.00	0.000	0.000
1/31/1999	4.85	6.18	1.27		3.64	2.38	0.00	0.000	0.000
2/28/1999	5.06	4.91	0.97		3.78	2.52	0.00	0.000	0.000
3/31/1999	5.88	5.04	0.86		3.96	2.67	0.00	0.000	0.000
4/30/1999	5.78	7.42	1.28		4.14	2.90	0.00	0.000	0.000
5/31/1999	5.76	6.57	1.14		4.32	3.10	0.00	0.000	0.000
6/30/1999	5.67	5.12	0.90		4.49	3.25	0.00	0.000	0.000
7/31/1999	5.15	4.37	0.85		4.65	3.39	0.00	0.000	0.000
8/31/1999	5.25	3.87	0.74		4.81	3.51	0.00	0.000	0.000
9/30/1999	5.16	3.73	0.72		4.96	3.62	0.00	0.000	0.000
10/31/1999	5.32	4.05	0.76		5.13	3.75	0.00	0.000	0.000
11/30/1999	4.98	3.50	0.70		5.28	3.85	0.00	0.000	0.000
12/31/1999	5.16	6.06	1.17		5.44	4.04	0.00	0.000	0.000
1/31/2000	4.00	4.73	1.18		5.56	4.19	0.00	0.000	0.000
2/29/2000	4.18	4.66	1.11		5.68	4.32	0.00	0.000	0.000
3/31/2000	5.07	6.87	1.36		5.84	4.53	0.00	0.000	0.000
4/30/2000	5.40	6.63	1.23		6.00	4.73	0.00	0.000	0.000
5/31/2000	5.72	6.31	1.10		6.18	4.93	0.00	0.000	0.000
6/30/2000	6.42	6.34	0.99		6.37	5.12	0.00	0.000	0.000
7/31/2000	6.49	5.86	0.90		6.57	5.30	0.00	0.000	0.000
8/31/2000	6.36	6.05	0.95		6.77	5.49	0.00	0.000	0.000
9/30/2000	6.23	5.99	0.96		6.96	5.67	0.00	0.000	0.000
10/31/2000	6.18	5.65	0.91		7.15	5.84	0.00	0.000	0.000
11/30/2000	6.47	5.40	0.83		7.34	6.00	0.00	0.000	0.000
12/31/2000	4.85	3.46	0.71		7.49	6.11	0.00	0.000	0.000

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
1/31/2001	6.11	3.87	0.63		7.68	6.23	0.00	0.000	0.000
2/28/2001	5.29	3.73	0.70		7.83	6.34	0.00	0.000	0.000
3/31/2001	5.92	3.94	0.67		8.01	6.46	0.00	0.000	0.000
4/30/2001	5.65	4.76	0.84		8.18	6.60	0.00	0.000	0.000
5/31/2001	5.46	4.17	0.76		8.35	6.73	0.00	0.000	0.000
6/30/2001	5.43	4.26	0.78		8.52	6.86	0.00	0.000	0.000
7/31/2001	5.42	4.01	0.74		8.68	6.98	0.00	0.000	0.000
8/31/2001	5.36	4.00	0.75		8.85	7.11	0.00	0.000	0.000
9/30/2001	5.31	4.40	0.83		9.01	7.24	0.00	0.000	0.000
10/31/2001	5.24	4.26	0.81		9.17	7.37	0.00	0.000	0.000
11/30/2001	5.14	4.11	0.80		9.33	7.49	0.00	0.000	0.000
12/31/2001	4.94	3.77	0.76		9.48	7.61	0.00	0.000	0.000
1/31/2002	4.40	3.36	0.76		9.62	7.71	0.00	0.000	0.000
2/28/2002	5.50	4.14	0.75		9.77	7.83	0.00	0.000	0.000
3/31/2002	4.60	3.09	0.67		9.91	7.93	0.00	0.000	0.000
4/30/2002	4.99	3.46	0.69		10.06	8.03	0.00	0.000	0.000
5/31/2002	4.41	3.69	0.84		10.20	8.14	0.00	0.000	0.000
6/30/2002	4.19	3.99	0.95	2.82	10.32	8.26	0.08	0.344	0.005
7/31/2002	4.48	3.82	0.85	22.44	10.46	8.38	0.78	2.698	0.041
8/31/2002	4.77	3.74	0.78	25.79	10.61	8.50	1.58	3.028	0.083
9/30/2002	4.82	3.70	0.77	24.83	10.76	8.61	2.32	2.911	0.120
10/31/2002	4.83	3.72	0.77	24.84	10.91	8.72	3.09	2.900	0.157
11/30/2002	4.90	3.85	0.79	18.49	11.05	8.84	3.65	2.111	0.183
12/31/2002	4.75	3.82	0.80	40.70	11.20	8.96	4.91	4.737	0.243
1/31/2003	3.80	3.10	0.82	48.11	11.32	9.05	6.40	6.965	0.314
2/28/2003	3.46	2.37	0.68	47.41	11.41	9.12	7.73	8.115	0.376
3/31/2003	4.39	2.59	0.59	47.50	11.55	9.20	9.20	6.792	0.443
4/30/2003	5.83	4.46	0.76	26.89	11.73	9.33	10.01	2.608	0.474
5/31/2003	6.10	4.61	0.75		11.91	9.48	10.01	0.000	0.467
6/30/2003	5.88	4.16	0.71	45.26	12.09	9.60	11.37	4.499	0.523
7/31/2003	6.17	3.94	0.64	23.57	12.28	9.72	12.10	2.328	0.549
8/31/2003	6.18	3.93	0.64	25.91	12.47	9.85	12.90	2.559	0.577
9/30/2003	5.90	3.95	0.67	38.30	12.65	9.96	14.05	3.882	0.620
10/31/2003	5.98	3.92	0.65	29.71	12.84	10.09	14.97	2.997	0.652
11/30/2003	6.73	3.28	0.49	18.17	13.04	10.18	15.52	1.812	0.667
12/31/2003	6.28	4.47	0.71	24.03	13.23	10.32	16.26	2.231	0.689
1/31/2004	6.01	4.41	0.73	31.62	13.42	10.46	17.24	3.028	0.721
2/29/2004	5.68	4.58	0.81	32.13	13.58	10.59	18.17	3.128	0.750
3/31/2004	6.41	4.40	0.69	22.11	13.78	10.73	18.86	2.041	0.768
4/30/2004	6.47	4.70	0.73	23.59	13.98	10.87	19.57	2.107	0.786
5/31/2004	6.35	4.76	0.75	23.32	14.17	11.02	20.29	2.095	0.804
6/30/2004	6.47	4.67	0.72	17.28	14.37	11.16	20.81	1.549	0.814
7/31/2004	6.62	4.58	0.69	12.35	14.57	11.30	21.19	1.101	0.818
8/31/2004	6.64	4.45	0.67	22.18	14.78	11.44	21.88	1.998	0.833
9/30/2004	6.77	4.35	0.64	22.80	14.98	11.57	22.56	2.047	0.848
10/31/2004	6.31	3.56	0.56	22.79	15.18	11.68	23.27	2.304	0.865
11/30/2004	5.51	2.33	0.42	23.02	15.34	11.75	23.96	2.928	0.883
12/31/2004	7.26	4.69	0.65	15.41	15.57	11.89	24.44	1.288	0.888

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
1/31/2005	7.38	5.13	0.69	21.22	15.80	12.05	25.09	1.693	0.900
2/28/2005	7.00	4.76	0.68	27.94	15.99	12.19	25.88	2.372	0.917
3/31/2005	7.07	4.85	0.68	27.31	16.21	12.34	26.72	2.287	0.935
4/30/2005	7.09	4.91	0.69	29.16	16.42	12.48	27.60	2.425	0.953
5/31/2005	6.89	4.83	0.70	29.41	16.64	12.63	28.51	2.504	0.972
6/30/2005	5.83	3.98	0.68	30.95	16.81	12.75	29.44	3.149	0.994
7/31/2005	7.10	4.97	0.70	31.07	17.03	12.91	30.40	2.569	1.014
8/31/2005	6.99	4.93	0.71	32.41	17.25	13.06	31.41	2.713	1.034
9/30/2005	6.86	4.87	0.71	24.64	17.46	13.21	32.15	2.096	1.047
10/31/2005	6.95	4.94	0.71	29.05	17.67	13.36	33.05	2.438	1.063
11/30/2005	6.86	4.98	0.73	23.95	17.88	13.51	33.76	2.019	1.074
12/31/2005	6.83	5.03	0.74	21.72	18.09	13.66	34.44	1.828	1.083
1/31/2006	6.66	4.98	0.75	30.95	18.29	13.82	35.40	2.653	1.100
2/28/2006	6.88	5.13	0.75	30.65	18.49	13.96	36.26	2.549	1.115
3/31/2006	6.57	0.00	0.00	29.30	18.69	13.96	37.16	4.443	1.136
4/30/2006	6.45	5.01	0.78	31.52	18.88	14.11	38.11	2.746	1.153
5/31/2006	6.57	5.02	0.76	32.29	19.09	14.27	39.11	2.782	1.170
6/30/2006	6.54	5.03	0.77	33.14	19.28	14.42	40.10	2.859	1.188
7/31/2006	6.59	5.06	0.77	34.26	19.49	14.58	41.17	2.934	1.206
8/31/2006	6.46	4.95	0.77	33.44	19.69	14.73	42.20	2.925	1.224
9/30/2006	6.50	5.03	0.77	34.31	19.88	14.88	43.23	2.973	1.241
10/31/2006	6.34	5.05	0.80	25.20	20.08	15.04	44.01	2.210	1.251
11/30/2006	6.39	5.18	0.81	27.29	20.27	15.19	44.83	2.355	1.262
12/31/2006	6.31	5.35	0.85	28.73	20.47	15.36	45.72	2.462	1.274
1/31/2007	6.26	5.64	0.90	27.88	20.66	15.53	46.59	2.340	1.285
2/28/2007	6.20	5.78	0.93	27.58	20.84	15.69	47.36	2.298	1.294
3/31/2007	5.79	5.14	0.89	27.97	21.02	15.85	48.23	2.556	1.306
4/30/2007	5.93	5.93	1.00	28.88	21.19	16.03	49.09	2.431	1.317
5/31/2007	5.62	5.89	1.05	29.36	21.37	16.21	50.00	2.548	1.328
6/30/2007	5.65	5.86	1.04	30.61	21.54	16.39	50.92	2.656	1.340
7/31/2007	5.82	5.83	1.00	29.04	21.72	16.57	51.82	2.491	1.351
8/31/2007	5.83	5.80	1.00	28.30	21.90	16.75	52.70	2.429	1.361
9/30/2007	5.25	5.52	1.05	29.45	22.06	16.92	53.58	2.732	1.373
10/31/2007	4.43	5.05	1.14	29.15	22.19	17.07	54.49	3.071	1.385
11/30/2007	5.14	6.04	1.18	29.28	22.35	17.25	55.37	2.617	1.396
12/31/2007	5.56	6.09	1.10	30.50	22.52	17.44	56.31	2.615	1.407
1/31/2008	5.28	6.03	1.14	30.56	22.68	17.63	57.26	2.700	1.418
2/29/2008	4.08	5.00	1.23	28.56	22.80	17.77	58.09	3.141	1.429
3/31/2008	4.29	5.03	1.17	30.14	22.93	17.93	59.02	3.229	1.442
4/30/2008	4.23	4.96	1.17	21.00	23.06	18.08	59.65	2.282	1.448
5/31/2008	4.38	4.92	1.12	23.77	23.20	18.23	60.39	2.551	1.455
6/30/2008	5.04	5.44	1.08	23.70	23.35	18.40	61.10	2.258	1.461
7/31/2008	5.47	5.84	1.07	29.50	23.52	18.58	62.01	2.604	1.471
8/31/2008	5.45	5.92	1.09	28.28	23.69	18.76	62.89	2.484	1.479
9/30/2008	5.25	5.91	1.13	26.72	23.84	18.94	63.69	2.391	1.486
10/31/2008	5.12	5.97	1.17	25.34	24.00	19.12	64.48	2.282	1.493
11/30/2008	5.02	6.10	1.22	27.53	24.15	19.31	65.30	2.473	1.500
12/31/2008	5.15	6.25	1.21	27.75	24.31	19.50	66.16	2.430	1.508



Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
1/31/2009	5.02	6.29	1.25	29.39	24.47	19.69	67.07	2.596	1.516
2/28/2009	4.96	6.31	1.27	31.87	24.61	19.87	67.97	2.825	1.526
3/31/2009	4.14	4.91	1.19	31.33	24.74	20.02	68.94	3.456	1.538
4/30/2009	5.31	6.61	1.24	27.77	24.89	20.22	69.77	2.328	1.544
5/31/2009	5.20	6.56	1.26	28.19	25.06	20.42	70.64	2.394	1.551
6/30/2009	5.23	6.54	1.25	24.86	25.21	20.62	71.39	2.110	1.555
7/31/2009	5.12	6.43	1.26	28.33	25.37	20.82	72.27	2.449	1.562
8/31/2009	5.11	6.54	1.28	28.60	25.53	21.02	73.15	2.452	1.569
9/30/2009	5.06	6.56	1.30	31.20	25.68	21.22	74.09	2.683	1.577
10/31/2009	4.91	6.66	1.36	30.75	25.83	21.43	75.04	2.652	1.585
11/30/2009	7.09	11.78	1.66	30.62	26.05	21.78	75.96	1.621	1.586
12/31/2009	9.09	15.26	1.68	31.22	26.33	22.25	76.93	1.280	1.581
1/31/2010	8.37	14.35	1.71	30.74	26.59	22.70	77.88	1.352	1.578
2/28/2010	7.80	13.23	1.70	31.33	26.81	23.07	78.76	1.488	1.577
3/31/2010	7.85	12.77	1.63	31.94	27.05	23.46	79.75	1.547	1.576
4/30/2010	7.95	12.80	1.61	34.11	27.29	23.85	80.77	1.642	1.577
5/31/2010	7.93	12.82	1.62	36.19	27.53	24.25	81.90	1.742	1.579
6/30/2010	7.58	12.81	1.69	36.38	27.76	24.63	82.99	1.782	1.581
7/31/2010	7.07	12.61	1.78	35.72	27.98	25.02	84.09	1.813	1.584
8/31/2010	7.14	12.95	1.81	34.24	28.20	25.42	85.16	1.703	1.586
9/30/2010	7.01	12.76	1.82	32.36	28.41	25.80	86.13	1.635	1.586
10/31/2010	6.92	12.93	1.87	31.56	28.63	26.20	87.10	1.589	1.586
11/30/2010	6.37	13.04	2.05	30.29	28.82	26.60	88.01	1.559	1.586
12/31/2010	5.91	12.85	2.17	28.05	29.00	26.99	88.88	1.494	1.585
1/31/2011	6.03	13.03	2.16	31.31	29.19	27.40	89.85	1.641	1.585
2/28/2011	6.15	12.94	2.10	27.86	29.36	27.76	90.63	1.458	1.584
3/31/2011	5.99	12.30	2.05	27.54	29.55	28.14	91.49	1.504	1.583
4/30/2011	6.64	12.74	1.92	27.68	29.75	28.52	92.32	1.427	1.582
5/31/2011	6.67	12.90	1.93		29.95	28.92	92.32	0.000	1.566
6/30/2011	6.44	12.89	2.00	26.67	30.15	29.31	93.12	1.378	1.564
7/31/2011	6.24	12.70	2.04	32.50	30.34	29.70	94.13	1.714	1.565
8/31/2011	6.27	12.84	2.05	34.34	30.53	30.10	95.19	1.795	1.567
9/30/2011	6.08	12.62	2.08	34.83	30.72	30.48	96.23	1.860	1.570
10/31/2011	5.86	12.69	2.17	33.66	30.90	30.87	97.28	1.814	1.572
11/30/2011	5.26	12.52	2.38	0.69	31.06	31.25	97.30	0.039	1.559
12/31/2011	5.26	12.53	2.38		31.22	31.64	97.30	0.000	1.546
1/31/2012	5.23	12.32	2.36		31.38	32.02	97.30	0.000	1.532
2/29/2012	4.99	12.13	2.43		31.52	32.37	97.30	0.000	1.520
3/31/2012	5.03	12.13	2.41		31.68	32.75	97.30	0.000	1.508
4/30/2012	5.01	11.95	2.38		31.83	33.11	97.30	0.000	1.496
5/31/2012	4.72	11.64	2.47		31.98	33.47	97.30	0.000	1.485
6/30/2012	4.56	11.50	2.52		32.11	33.81	97.30	0.000	1.474
7/31/2012	4.05	11.25	2.77		32.24	34.16	97.30	0.000	1.463
8/31/2012	4.73	17.20	3.64		32.39	34.70	97.30	0.000	1.448
9/30/2012	5.06	20.09	3.97		32.54	35.30	97.30	0.000	1.432
10/31/2012	4.75	20.02	4.21		32.69	35.92	97.30	0.000	1.416
11/30/2012	4.10	18.16	4.43		32.81	36.46	97.30	0.000	1.403
12/31/2012	3.62	16.95	4.68		32.92	36.99	97.30	0.000	1.390

Date	Oil Rate (CD) m3/d	Water Rate (CD) m3/d	Water Oil Ratio m3/m3	Water Inj Rate (CD) m3/d	Cum Oil Prod Km3	Cum Water Prod Km3	Cum Water Inj Km3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio
1/31/2013	2.50	15.10	6.05		33.00	37.46	97.30	0.000	1.379
2/28/2013	2.56	14.66	5.73		33.07	37.87	97.30	0.000	1.370
3/31/2013	2.11	9.29	4.41		33.14	38.15	97.30	0.000	1.363
4/30/2013	2.27	8.13	3.59	3.23	33.20	38.40	97.40	0.311	1.358
5/31/2013	2.08	7.86	3.78	14.32	33.27	38.64	97.84	1.439	1.359
6/30/2013	2.08	8.50	4.08	19.10	33.33	38.90	98.41	1.804	1.361
7/31/2013	2.05	8.96	4.37	18.48	33.39	39.18	98.99	1.678	1.362
8/31/2013	2.26	9.62	4.26	16.74	33.46	39.47	99.50	1.409	1.362
9/30/2013	2.35	10.57	4.49	15.83	33.53	39.79	99.98	1.225	1.362
10/31/2013	2.56	10.95	4.28	15.32	33.61	40.13	100.46	1.133	1.360
11/30/2013	2.78	10.67	3.84	14.57	33.70	40.45	100.89	1.082	1.359
12/31/2013	3.21	16.30	5.08	12.74	33.80	40.96	101.29	0.653	1.353
1/31/2014	4.27	19.53	4.57	14.06	33.93	41.56	101.72	0.591	1.346
2/28/2014	4.56	19.80	4.34	14.75	34.06	42.12	102.14	0.605	1.339
3/31/2014	4.18	17.64	4.22	13.06	34.19	42.66	102.54	0.598	1.333
4/30/2014	4.35	18.40	4.23	17.10	34.32	43.21	103.05	0.751	1.327
5/31/2014	4.55	17.88	3.93	15.68	34.46	43.77	103.54	0.699	1.322
6/30/2014	4.30	17.08	3.97	15.57	34.59	44.28	104.01	0.728	1.317
7/31/2014	4.25	15.88	3.74	15.29	34.72	44.77	104.48	0.759	1.313
8/31/2014	4.21	16.95	4.02	15.23	34.85	45.30	104.95	0.719	1.308
9/30/2014	4.05	15.86	3.92	15.07	34.97	45.77	105.41	0.756	1.304
10/31/2014	4.86	20.74	4.27	15.00	35.12	46.42	105.87	0.586	1.297
11/30/2014	5.49	21.84	3.98	15.23	35.29	47.07	106.33	0.557	1.289
12/31/2014	5.39	23.95	4.44	15.52	35.45	47.81	106.81	0.529	1.281