

**WASKADA UNIT NO. 1  
WATERFLOOD EOR PROJECT**

**ANNUAL WATERFLOOD PROGRESS REPORT FOR 2016**

**May 8<sup>th</sup>, 2017**

**Tundra Oil and Gas Partnership**

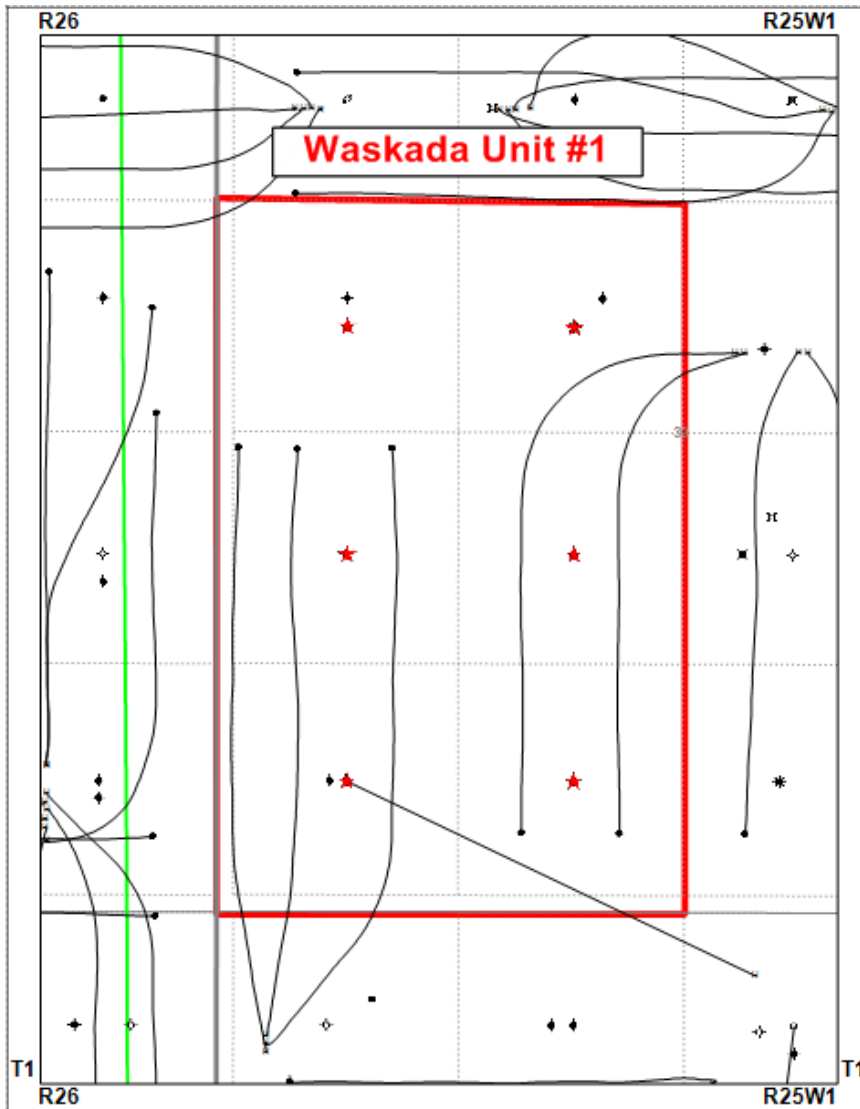
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## **INTRODUCTION**

Waskada Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM47 effective June 1976. The Unit area contains 6 abandoned wells in 6 LSDs in Township 1 Range 25 W1 as shown in the figure below.

**Figure 1: Waskada Unit 1 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the following 2016 Annual Progress Report for Waskada Unit No. 1.

## DISCUSSION

### Production History

For the wells included in Waskada Unit No. 1, production started in January 1967 with 00/11-30-001-25W1/0. Average oil production peaked at 6.2 m<sup>3</sup>/d per well in July 1968. This production was coming from 6 wells and totaled 37.3 m<sup>3</sup>/d for the whole Unit. None of these wells produced any fluid in 2016. Water injection commenced in Waskada Unit No. 1 in April 1976 until 1983, and ceased in until May 1991 when injection was restarted for 2 months. Injection reoccurred from January 1995 to March 1996. Gas injection was conducted from March 1986 to December 1994. The rates and WOR are presented in Figure 2.

**Figure 2: Waskada Unit 1 Production/Injection Rates and WOR vs Time**

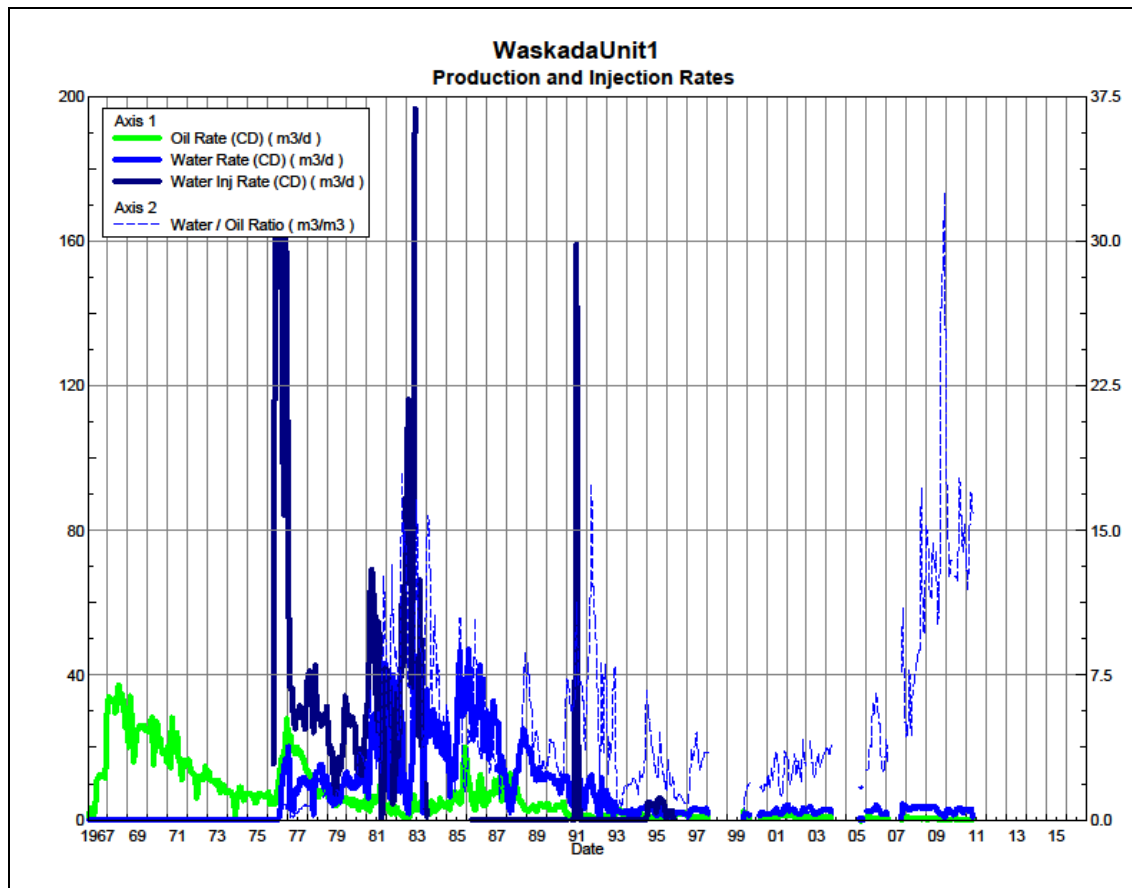
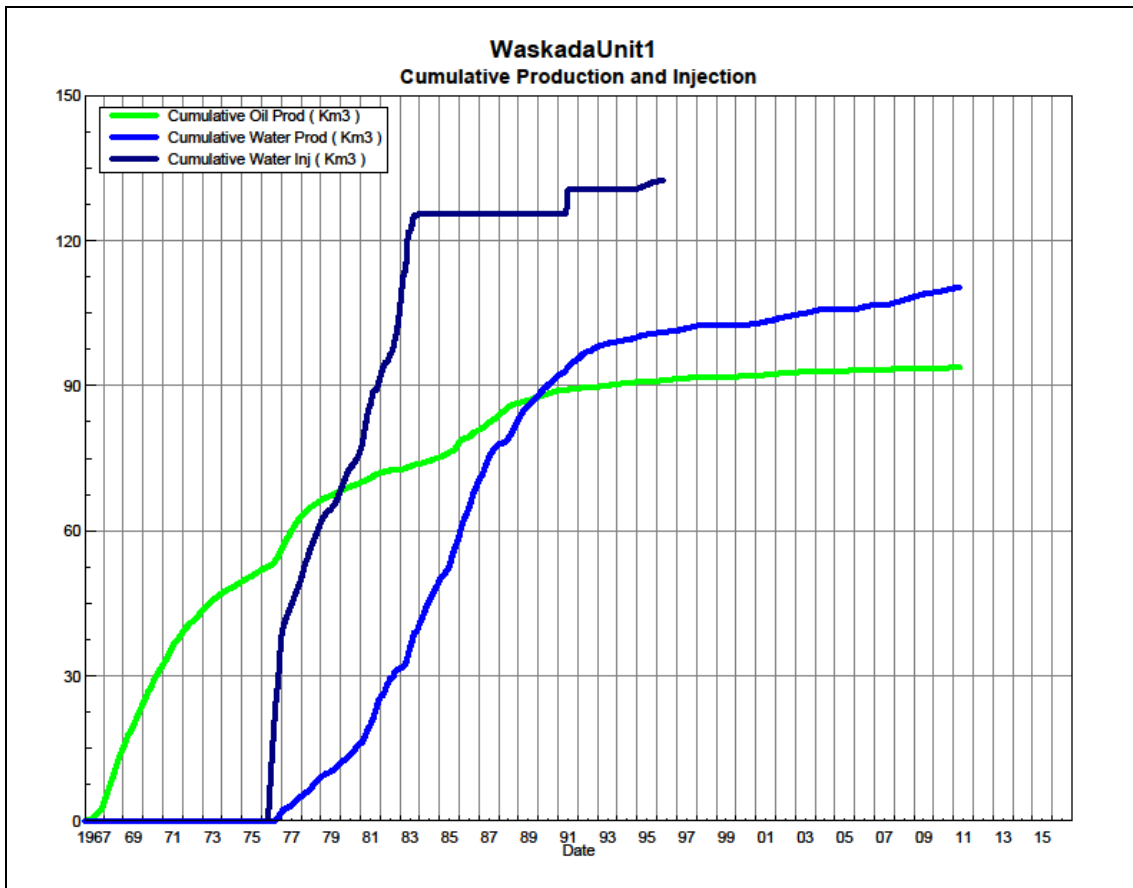


Figure 3 shows the cumulative production for Waskada Unit No. 1 to the end of December 2016 stayed as 93.7 e<sup>3</sup>m<sup>3</sup> of oil, and 110.4 e<sup>3</sup>m<sup>3</sup> of water.

**Figure 3: Waskada Unit 1 Cumulative Oil, Water and Water Injected vs Time**



## **Waterflood EOR Operating Strategy and Performance**

### **Corrosion and Scale Prevention**

The wells in Unit 1 are currently using cathodic protection against corrosion. The water gathering system for Unit 1 is made of fiberglass and such is not susceptible to corrosion.

### **Injection Wellhead Pressures**

No injection wellhead pressures were recorded in 2016.

### **Reservoir Pressure**

Where practical, Tundra is committed to collecting pressure data from newly drilled injection wells. Since no new wells were drilled in the Unit, therefore, no pressure surveys were conducted in 2016.

## Well Servicing

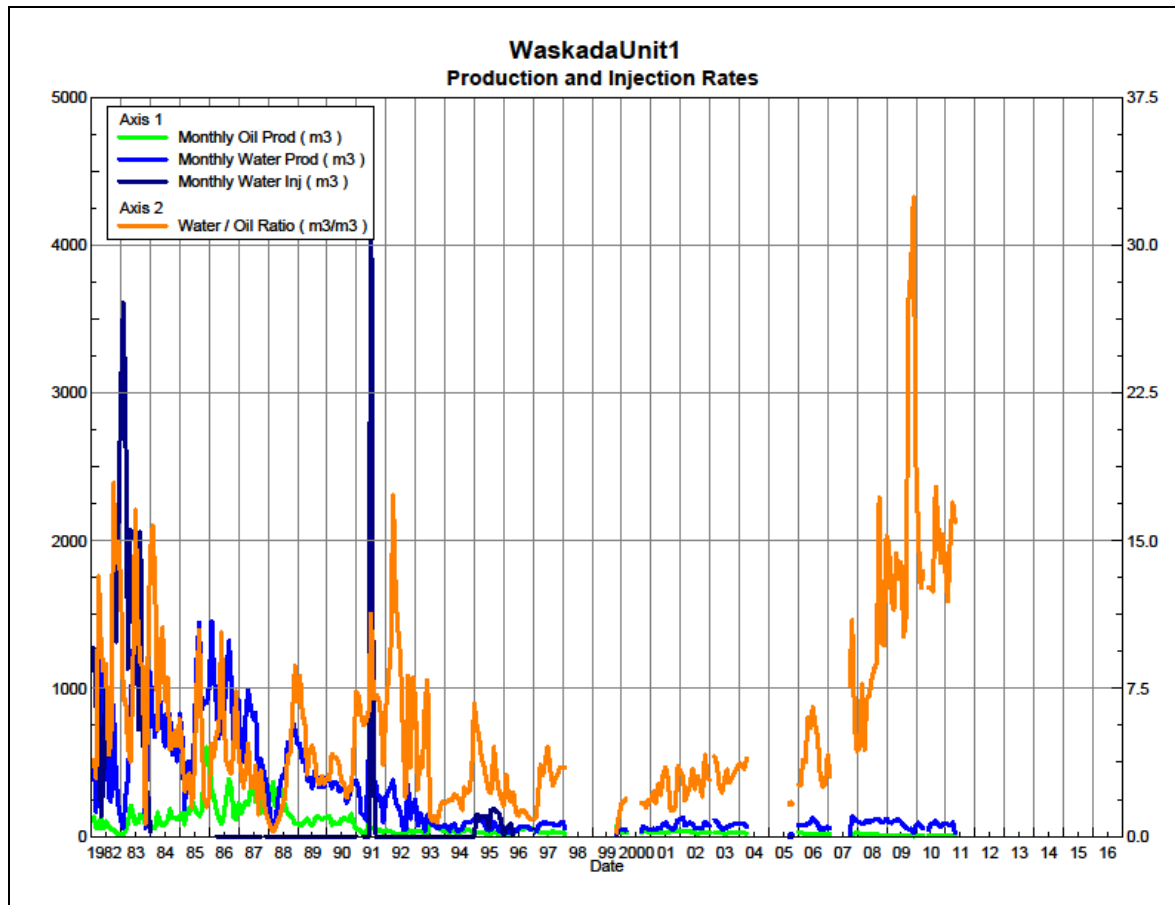
No well servicing was performed in 2016 for Waskada Unit No. 1.

## Waterflood Performance Discussion

From January 1 to December 31 in 2016, none of the 6 wells in the Unit produced or injected any fluid. There is no active injection in this Unit, and Tundra Oil and Gas has no plans to reactivate injection. The cumulative VRR stayed at a value of 1.857 at the end of 2016.

A plot of the Voidage Replacement Ratio for the Unit is presented in Appendix D. Plots of the production and injection data is presented in Appendix E for each of the injection patterns.

**Figure 4: Waskada Unit 1 Production and Injection Rates**



**TABLE NO. 1: WASKADA UNIT NO. 1 WELL SUMMARY**

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>On Prod Date</i>	<i>Cum Prd Oil (m3)</i>	<i>Cum Prd Water (m3)</i>	<i>Last Prod Date</i>	<i>Cum Inj Water (m3)</i>	<i>Last Inj Date</i>
100/03-30-001-25W1/0	Vertical	Producing	12/1/1967	22573.0	36916.4	4/30/2011	0.0	
100/04-30-001-25W1/0	Vertical	Abandoned	12/1/1967	23250.4	56278.5	9/30/1991	0.0	
100/05-30-001-25W1/0	Vertical	Abandoned	5/1/1967	15932.6	2775.8	6/30/1977	0.0	
100/06-30-001-25W1/0	Vertical	Abandoned	24807	10286.4	0.0	2/28/1975	132443.2	4/30/1996
100/11-30-001-25W1/0	Vertical	Abandoned	1/1/1967	6145.9	839.8	5/31/1980	0.0	
100/12-30-001-25W1/0	Vertical	Abandoned	12/1/1967	15552.0	13590.4	7/31/1993	0.0	
				93740.3	110400.9		132443.2	

TABLE NO. 2 - VRR Calculations

Date	Mth Oil Prod m3	Cum Oil Prod Km3	Mth Water Prod m3	Cum Water Prod Km3	Water Oil Ratio m3/m3	Mth Water Inj m3	Cum Water Inj Km3	VRR	Cum VRR
12/31/1967	3459	3.459	0	0.000	0.00		0.000	0.000	0.000
12/31/1968	11851	15.310	0	0.000	0.00		0.000	0.000	0.000
12/31/1969	8960	24.270	0	0.000	0.00		0.000	0.000	0.000
12/31/1970	7926	32.196	0	0.000	0.00		0.000	0.000	0.000
12/31/1971	6743	38.940	0	0.000	0.00		0.000	0.000	0.000
12/31/1972	4544	43.484	0	0.000	0.00		0.000	0.000	0.000
12/31/1973	3604	47.088	0	0.000	0.00		0.000	0.000	0.000
12/31/1974	2415	49.503	0	0.000	0.00		0.000	0.000	0.000
12/31/1975	2390	51.892	0	0.000	0.00		0.000	0.000	0.000
12/31/1976	4313	56.205	1797	1.797	0.42	38042	38.042	5.631	0.573
12/31/1977	6712	62.916	3317	5.114	0.49	12109	50.151	1.097	0.647
12/31/1978	3359	66.275	3969	9.083	1.18	11609	61.760	1.482	0.724
12/31/1979	1986	68.261	2883	11.966	1.45	6729	68.489	1.302	0.757
12/31/1980	1704	69.965	4146	16.112	2.43	8176	76.665	1.339	0.794
12/31/1981	2014	71.979	9351	25.463	4.64	15005	91.670	1.286	0.847
12/31/1982	742	72.720	6083	31.546	8.20	14360	106.030	2.070	0.921
12/31/1983	1190	73.911	9346	40.892	7.85	19474	125.505	1.817	0.997
12/31/1984	1308	75.219	8836	49.729	6.76		125.505	0.000	0.921
12/31/1985	3056	78.275	9208	58.937	3.01		125.505	0.000	0.843
12/31/1986	2549	80.824	11575	70.512	4.54	0	125.505	1.933	0.939
12/31/1987	3083	83.906	7413	77.925	2.40	0	125.505	2.640	1.046
12/31/1988	2537	86.443	5102	83.028	2.01	0	125.505	3.136	1.138
12/31/1989	1284	87.727	5026	88.053	3.91	0	125.505	5.391	1.284
12/31/1990	1226	88.953	3991	92.044	3.26	0	125.505	11.746	1.575
12/31/1991	499	89.452	3451	95.496	6.92	5194	130.699	7.386	1.693
12/31/1992	322	89.774	2626	98.121	8.16	0	130.699	11.515	1.839
12/31/1993	584	90.358	1016	99.137	1.74	0	130.699	9.600	1.904
12/31/1994	384	90.742	888	100.025	2.31	0	130.699	12.710	1.974
12/31/1995	252	90.994	872	100.897	3.46	1530	132.229	1.317	1.970
12/31/1996	421	91.415	539	101.436	1.28	215	132.443	0.210	1.962
12/31/1997	316	91.730	935	102.371	2.96		132.443	0.000	1.949
12/31/1998	15	91.745	53	102.424	3.48		132.443	0.000	1.949
12/31/1999	142	91.887	105	102.529	0.74		132.443	0.000	1.946
12/31/2000	191	92.079	330	102.859	1.72		132.443	0.000	1.941
12/31/2001	357	92.436	841	103.699	2.35		132.443	0.000	1.929
12/31/2002	347	92.783	934	104.633	2.69		132.443	0.000	1.917
12/31/2003	264	93.047	835	105.468	3.16		132.443	0.000	1.907
12/31/2004	66	93.113	238	105.706	3.63		132.443	0.000	1.904
12/31/2005	32	93.144	80	105.786	2.52		132.443	0.000	1.903
12/31/2006	222	93.366	920	106.706	4.15		132.443	0.000	1.893
12/31/2007	74	93.440	413	107.118	5.59		132.443	0.000	1.888
12/31/2008	154	93.595	1228	108.346	7.95		132.443	0.000	1.876
12/31/2009	67	93.661	934	109.280	14.00		132.443	0.000	1.867
12/31/2010	60	93.722	849	110.130	14.11		132.443	0.000	1.859
12/31/2011	19	93.740	271	110.401	14.50		132.443	0.000	1.857
12/31/2012		93.740		110.401			132.443		1.857
12/31/2013		93.740		110.401			132.443		1.857
12/31/2014		93.740		110.401			132.443		1.857
12/31/2015		93.740		110.401			132.443		1.857
12/31/2016		93.740		110.401			132.443		1.857

TABLE NO. 3

**Tundra Oil and Gas  
Waskada Unit No. 1  
2016 Injection Volumes**

Well Location	Date	Hours On	H <sub>2</sub> O Inj Cal-d avg (m <sup>3</sup> /d)	Gas Inj Cal-d avg (kscm)	Monthly Injected H <sub>2</sub> O (m <sup>3</sup> )
<b>Unit No. 16 Total:</b>					
	Jan-16	0	0.0	0.0	0.00
	Feb-16	0	0.0	0.0	0.00
	Mar-16	0	0.0	0.0	0.00
	Apr-16	0	0.0	0.0	0.00
	May-16	0	0.0	0.0	0.00
	Jun-16	0	0.0	0.0	0.00
	Jul-16	0	0.0	0.0	0.00
	Aug-16	0	0.0	0.0	0.00
	Sep-16	0	0.0	0.0	0.00
	Oct-16	0	0.0	0.0	0.00
	Nov-16	0	0.0	0.0	0.00
	Dec-16	0	0.0	0.0	0.00
<b>2016 Group Totals:</b>					<b>0.00</b>

Unit No. 16 Total:

1976	0	138.24		38,041.80
1977	0	33.15		12,109.10
1978	0	31.82		11,609.10
1979	0	18.43		6,729.30
1980	0	22.33		8,175.80
1981	0	41.18		15,005.30
1982	0	39.3		14,360.00
1983	0	64.12		19,474.20
1984	0	0		0.00
1985	0	0		0.00
1986	0	0		0.00
1987	0	0		0.00
1988	0	0		0.00
1989	0	0		0.00
1990	0	0		0.00
1991	0	17.27		5,194.10
1992	0	0.0		0.00
1993	0	0.0		0.00
1994	0	0.0		0.00
1995	0	4.2		1,530.00
1996	0	1.8		214.50
1997	0	0.0		0.00
1998	0	0.0		0.00
1999	0	0.0		0.00
2000	0	0.0		0.00
2001	0	0.0		0.00
2002	0	0.0		0.00
2003	0	0.0		0.00
2004	0	0.0		0.00
2005	0	0.0		0.00
2006	0	0.0		0.00
2007	0	0.0		0.00
2008	0	0.0		0.00
2009	0	0.0		0.00
2010	0	0.0		0.00
2011	0	0.0		0.00
2012	0	0.0		0.00
2013	0	0.0		0.00
2014	0	0.0		0.00
2015	0	0.0		0.00
2016	0	0.0		0.00
				132,443.20

TABLE NO. 4

**Tundra Oil and Gas  
Waskada Unit No. 1  
2016 Production Volumes**

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
Jan-16	0	0.00	0	0	0	0	0
Feb-16	0	0.00	0	0	0	0	0
Mar-16	0	0.00	0	0	0	0	0
Apr-16	0	0.00	0	0	0	0	0
May-16	0	0.00	0	0	0	0	0
Jun-16	0	0.00	0	0	0	0	0
Jul-16	0	0.00	0	0	0	0	0
Aug-16	0	0.00	0	0	0	0	0
Sep-16	0	0.00	0	0	0	0	0
Oct-16	0	0.00	0	0	0	0	0
Nov-16	0	0.00	0	0	0	0	0
Dec-16	0	0.00	0	0	0	0	0
	0		0		0		

Date	Hours On	Oil Rate (CD) m3/d	Monthly Oil Prod m3	Water Rate (CD) m3/d	Monthly Water Prod m3	Water Oil Ratio m3/m3	Well Count
1967	13440	9.42	3,459	0.00	0	0.00	4
1968	45600	32.37	11,851	0.00	0	0.00	6
1969	43152	24.61	8,960	0.00	0	0.00	6
1970	47880	21.73	7,926	0.00	0	0.00	6
1971	46728	18.43	6,743	0.00	0	0.00	6
1972	46656	12.41	4,544	0.00	0	0.00	6
1973	43968	9.88	3,604	0.00	0	0.00	6
1974	36792	6.62	2,415	0.00	0	0.00	6
1975	29880	6.55	2,390	0.00	0	0.00	5
1976	32976	11.75	4,313	4.90	1797	0.42	5
1977	36408	18.42	6,712	9.03	3317	0.49	4
1978	34440	9.22	3,359	10.85	3969	1.18	4
1979	34008	5.45	1,986	7.88	2883	1.45	4
1980	29256	4.66	1,704	11.31	4146	2.43	4
1981	23304	5.51	2,014	25.62	9351	4.64	3
1982	17952	2.04	742	16.69	6083	8.20	3
1983	19536	3.26	1,190	25.55	9346	7.85	3
1984	24552	3.56	1,308	24.11	8836	6.76	3
1985	20112	8.34	3,056	25.07	9208	3.01	2
1986	22176	6.99	2,549	31.74	11575	4.54	3
1987	23616	8.43	3,083	20.31	7413	2.40	3
1988	23808	6.96	2,537	13.91	5102	2.01	3
1989	25056	3.51	1,284	13.78	5026	3.91	3
1990	23784	3.35	1,226	10.94	3991	3.26	3
1991	19008	1.36	499	9.42	3451	6.92	2
1992	14,952	0.88	322	7.20	2626	8.16	2
1993	10,728	1.60	584	2.80	1016	1.74	1
1994	8,712	1.05	384	2.43	888	2.31	1
1995	8,760	0.69	252	2.40	872	3.46	1
1996	7,848	1.25	421	1.61	539	1.28	1
1997	8,640	0.87	316	2.56	935	2.96	1
1998	432	0.49	15	1.71	53	3.48	1
1999	2,112	1.54	142	1.14	105	0.74	1
2000	4,680	0.90	191	1.55	330	1.72	1
2001	8,688	0.98	357	2.30	841	2.35	1
2002	8,664	0.96	347	2.56	934	2.69	1
2003	7,944	0.79	264	2.51	835	3.16	1
2004	1,920	0.72	66	2.62	238	3.63	1
2005	792	0.51	32	1.29	80	2.52	1
2006	8,580	0.61	222	2.52	920	4.15	1
2007	2,880	0.48	74	2.69	413	5.59	1
2008	8,779	0.42	154	3.36	1228	7.95	1
2009	8,352	0.18	67	2.56	934	14.00	1
2010	7,183	0.18	60	2.54	849	14.11	1
2011	2,328	0.16	19	2.26	271	14.50	1
2012	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0
	897,062		93,740		110,401		