

**Waskada Unit No. 6**

**Waterflood Progress Report 2018**

**January 1<sup>st</sup> through December 31<sup>st</sup> 2018**

**Prepared for:**

**Manitoba Industry, Economic Development and Mines**

**Petroleum Branch**

**Prepared by:**

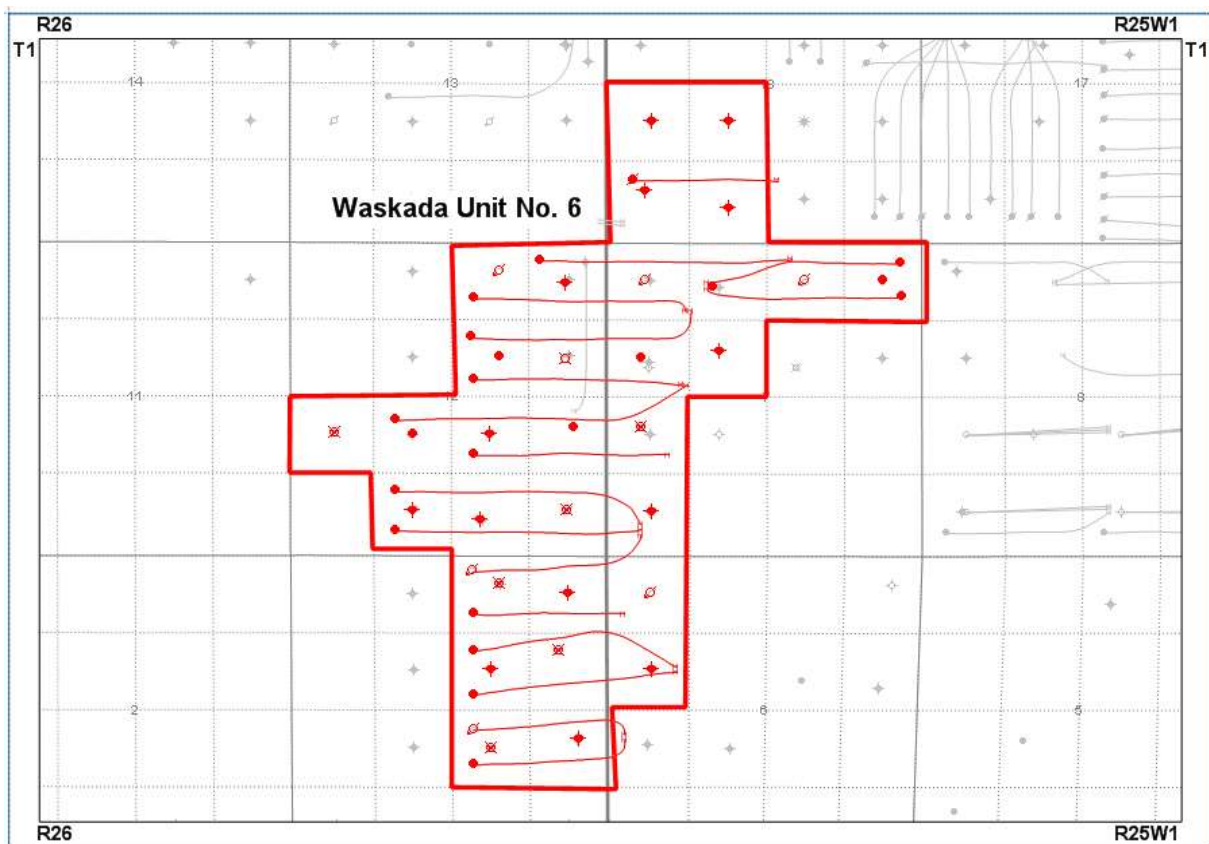
**Tundra Oil and Gas**

**June 26, 2019**

## INTRODUCTION

Waskada Unit No. 6 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 44 effective May 1985 and then amended into WF Order No. 1 in May 1995. Waskada Unit No. 6 area contains 32 abandoned/suspended wells, including 13 inactive/abandoned injectors, and 16 producing/injection wells in 31 LSDs in Township 1, Range 26 W1 as shown in the figure below.

**Figure 1: Waskada Unit No. 6 Area Outline**



## Waskada Unit No. 6

Tundra Oil and Gas (Tundra), as the operator of the Waskada Unit No. 6 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

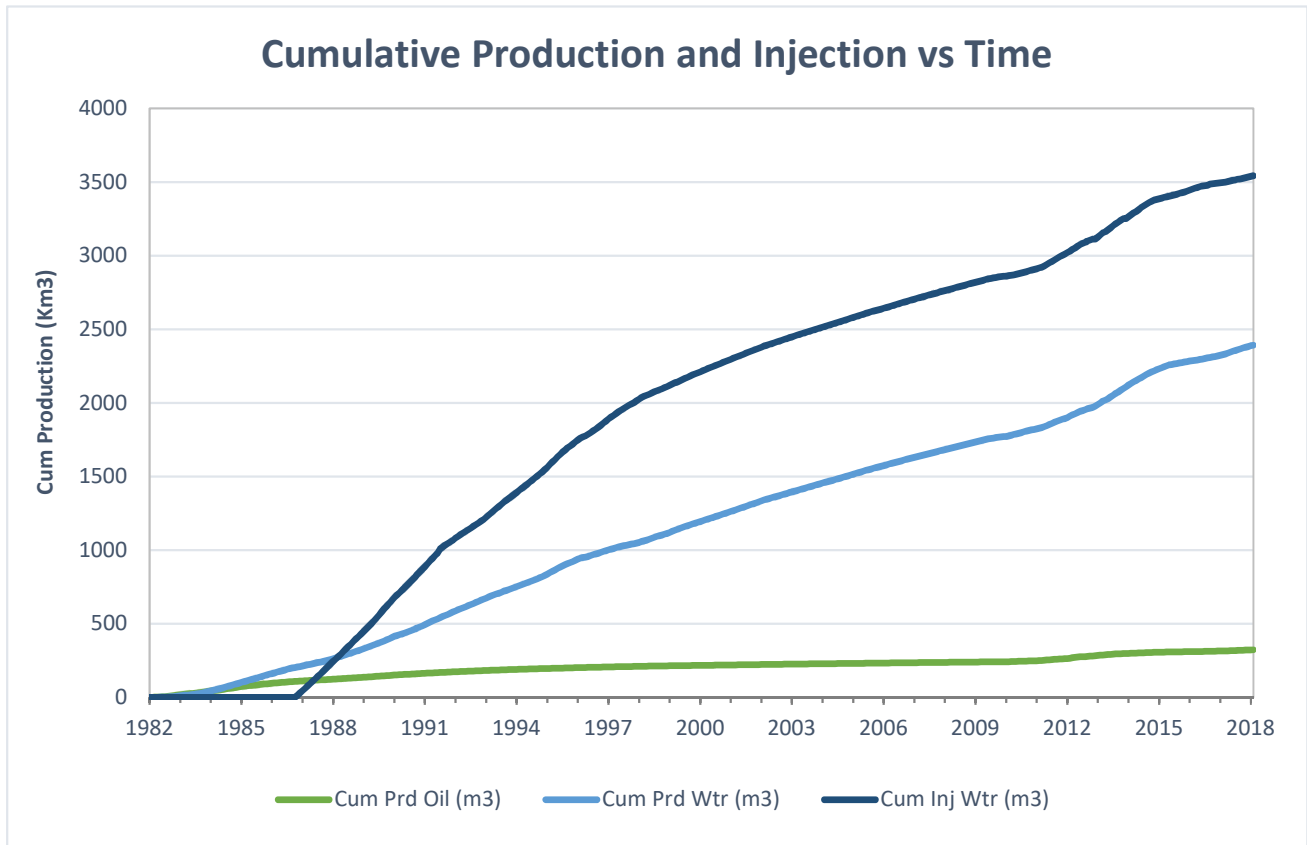
**a) Monthly oil and water production rates, injection rate, GOR and WOR**

MONTH	Cal Dly Oil m <sup>3</sup> /day	Cal Dly Wtr m <sup>3</sup> /day	Cal Inj Wtr m <sup>3</sup> /day	WOR m <sup>3</sup> /m <sup>3</sup>	GOR m <sup>3</sup> /m <sup>3</sup>
Jan-2018	13.35	145.13	117.68	10.87	37.69
Feb-2018	11.20	180.72	125.71	16.14	44.32
Mar-2018	19.45	201.43	125.71	10.36	23.05
Apr-2018	24.52	231.63	128.47	9.45	18.9
May-2018	21.50	160.75	119.52	7.48	15.6
Jun-2018	20.92	154.55	110.07	7.39	15.77
Jul-2018	21.39	171.08	93.35	8.00	19.3
Aug-2018	29.13	197.09	131.19	6.77	15.39
Sep-2018	19.33	172.19	135.50	8.91	23.97
Oct-2018	18.98	169.67	138.65	8.94	24.48
Nov-2018	17.74	165.19	146.63	9.31	24.81
Dec-2018	19.05	135.76	140.49	7.12	22.35

**b) Cumulative volume of oil, gas and water produced and fluid injected**

<b>2018 PRODUCTION</b>	
Produced Oil (m <sup>3</sup> )	7,217
Produced Gas (m <sup>3</sup> )	159
Produced Water (m <sup>3</sup> )	63,375
Fluid Injected (m <sup>3</sup> )	46,004
<b>CUMULATIVE PRODUCTION</b>	
Produced Oil (m <sup>3</sup> )	322,593
Produced Water (m <sup>3</sup> )	2,392,376

## Waskada Unit No. 6



c) Monthly wellhead injection pressure for each injection well

	00/15-12 Inj		00/15-07 Inj		03/15-01 Inj		02/07-01 Inj		03/10-01 Inj		03/03-12 Inj	
MONTH	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)
Jan-2018	0.0	0	0.0	0	1208.0	2449	1208.0	2094	617.0	-93	615.0	-85
Feb-2018	0.0	0	0.0	0	1099.0	2773	1100.0	2293	661.0	-93	660.0	-83
Mar-2018	0.0	0	0.0	0	1216.0	2669	1182.0	3035	765.0	-93	734.0	-90
Apr-2018	0.0	0	0.0	0	1179.0	2772	1182.0	2260	750.0	-93	743.0	-91
May-2018	0.0	0	0.0	0	1130.0	2570	1146.0	2339	714.0	-93	715.0	-90
Jun-2018	0.0	0	0.0	0	1150.0	2973	996.0	2549	625.0	-93	531.0	-63
Jul-2018	0.0	0	0.0	0	1098.0	2794	506.0	2164	400.0	-34	890.0	-91
Aug-2018	0.0	0	0.0	0	1151.0	2964	1079.0	1978	920.0	456	917.0	-91
Sep-2018	0.0	0	0.0	0	1092.0	2993	1180.0	2588	898.0	947	895.0	-90
Oct-2018	0.0	0	0.0	0	1095.0	2920	1200.0	2735	1017.0	1600	986.0	-90
Nov-2018	0.0	0	0.0	0	1163.4	3531	1164.2	2659	1036.3	1919	1034.9	-15
Dec-2018	0.0	0	0.0	0	1157.6	3299	1174.8	2458	975.7	1906	1047.1	129
<b>Total</b>	0.0		0.0		13739.0		13118.0		9379.0		9768.0	
<b>Avg Inj P</b>		0		0		2892		2429		520		-63

	WU6	
MONTH	Inj Water (m <sup>3</sup> )	Avg Inj P (kPa)
Jan-2018	3648.0	728
Feb-2018	3520.0	815
Mar-2018	3897.0	920
Apr-2018	3854.0	808
May-2018	3705.0	788
Jun-2018	3302.0	894
Jul-2018	2894.0	805
Aug-2018	4067.0	885
Sep-2018	4065.0	1073
Oct-2018	4298.0	1194
Nov-2018	4398.8	1349
Dec-2018	4355.2	1299
<b>Total</b>	46004.0	
<b>Avg Inj P</b>		963

**c) Monthly wellhead injection pressure for each injection well**

MONTH	Jan-2018	Feb-2018	Mar-2018	Apr-2018	May-2018	Jun-2018	Jul-2018	Aug-2018	Sep-2018	Oct-2018	Nov-2018	Dec-2018
<b>Total m3</b>	3648.0	3520.0	3897.0	3854.0	3705.0	3302.0	2894.0	4067.0	4065.0	4298.0	4398.8	4355.2
<b>Daily (m<sup>3</sup>/d)</b>	117.68	125.71	125.71	128.47	119.52	110.07	93.35	131.19	135.50	138.65	146.63	140.49

2018 AVG. ANNUAL DAILY INJECTION = 126.08 m3/d
--

CUMULATIVE INJECTION TO Dec 31, 2017 = 3,496,884 m3
---

TOTAL 2018 ANNUAL INJECTION = 46,004 m3
---

CUMULATIVE INJECTION TO Dec 31, 2018 = 3,542,888 m3
---

**d) Summary of the result of any survey of reservoir pressure conducted in 2018. N/A**

e) **Date and type of any well servicing.**

Well	Service Description	Date
102.03-12-001-26W1.00	Pump Change	12/7/2018
102.03-12-001-26W1.00	Cemented Liner Clean Out	2/28/2018
102.06-12-001-26W1.00	Pump Change	9/13/2018
102.07-12-001-26W1.00	Cemented Liner Clean Out	6/18/2018
102.10-01-001-26W1.00	Cemented Liner Clean Out	3/9/2018
102.10-12-001-26W1.00	Cleanout	3/1/2018
102.15-01-001-26W1.00	Pump Change	9/28/2018
102.15-12-001-26W1.00	Pump Change	10/17/2018
103.07-01-001-26W1.00	Cemented Liner Clean Out	8/15/2018
103.10-12-001-26W1.00	Pump Change	1/28/2018
103.10-12-001-26W1.00	Pump Change	7/11/2018
103.10-12-001-26W1.00	Pump Change	8/31/2018

f) **Calculations of voidage replacement ratio on a monthly and cumulative basis**

**VOIDAGE CALCULATIONS**

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.17

MONTH	Mth Oil Prod (m3)	Cum Oil Prod (Km3)	Mth Water Prod (m3)	Cum Water Prod (Km3)	Mth Water Inj (m3)	Cum Water Inj (Km3)	VRR	Cum VRR
Jan-2018	413.9	315.79	4499	2333.50	3648.0	3500.53	0.732	1.295
Feb-2018	313.6	316.10	5060.2	2338.56	3520.0	3504.05	0.649	1.294
Mar-2018	603.0	316.71	6244.3	2344.80	3897.0	3507.95	0.561	1.292
Apr-2018	735.5	317.44	6949	2351.75	3854.0	3511.80	0.493	1.290
May-2018	666.5	318.11	4983.2	2356.74	3705.0	3515.51	0.643	1.288
Jun-2018	627.6	318.74	4636.5	2361.37	3302.0	3518.81	0.615	1.287
Jul-2018	663.1	319.40	5303.5	2366.68	2894.0	3521.70	0.476	1.285
Aug-2018	902.9	320.30	6109.7	2372.79	4067.0	3525.77	0.568	1.283
Sep-2018	579.9	320.88	5165.7	2377.95	4065.0	3529.84	0.696	1.282
Oct-2018	588.3	321.47	5259.7	2383.21	4298.0	3534.13	0.723	1.281
Nov-2018	532.1	322.00	4955.7	2388.17	4398.8	3538.53	0.789	1.280
Dec-2018	590.7	322.59	4208.7	2392.38	4355.2	3542.89	0.889	1.279

g) **An outline of the method used for quality control and treatment of the injected fluid**

The injected fluid is treated by filtration.

h) **A report of any unusual performance problems and remedial measures taken or being considered. N/A**

i) **Any other information necessary to evaluate the project**

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/12-06-001-25W1/0	Vertical	Abandoned	-
100/13-06-001-25W1/0	Vertical	Injection	-
100/04-07-001-25W1/2	Vertical	Abandoned	-
102/05-07-001-25W1/0	Vertical	Abandoned	-
100/11-07-001-25W1/0	Vertical	Abandoned	-
103/12-07-001-25W1/0	Vertical	Producing	-
102/13-07-001-25W1/0	Vertical	Injection	-
102/14-07-001-25W1/0	Vertical	Producing	-
100/15-07-001-25W1/0	Vertical	Injection	-
100/16-07-001-25W1/0	Vertical	Producing	-
102/16-07-001-25W1/0	Horizontal	Producing	-
103/16-07-001-25W1/0	Horizontal	Producing	-
100/03-18-001-25W1/0	Vertical	Abandoned Zone	-
100/04-18-001-25W1/0	Vertical	Abandoned	-
102/04-18-001-25W1/0	Horizontal	Suspended	-
100/05-18-001-25W1/0	Vertical	Abandoned	-
100/06-18-001-25W1/0	Vertical	Abandoned	-
100/07-01-001-26W1/0	Vertical	Abandoned	-
102/07-01-001-26W1/0	Horizontal	Injection	-
103/07-01-001-26W1/0	Horizontal	Producing	-
100/08-01-001-26W1/2	Vertical	Abandoned Zone	-
100/09-01-001-26W1/0	Vertical	Abandoned	-
100/10-01-001-26W1/2	Vertical	Abandoned Zone	-
102/10-01-001-26W1/0	Horizontal	Producing	-
103/10-01-001-26W1/0	Horizontal	Injection	-
100/15-01-001-26W1/2	Vertical	Abandoned	-
102/15-01-001-26W1/0	Horizontal	Producing	-
103/15-01-001-26W1/0	Horizontal	Injection	-
100/16-01-001-26W1/2	Vertical	Abandoned Zone	-
100/01-12-001-26W1/0	Vertical	Abandoned	-
100/02-12-001-26W1/2	Vertical	Abandoned	-
100/03-12-001-26W1/2	Vertical	Abandoned	-
102/03-12-001-26W1/0	Horizontal	Producing	-
103/03-12-001-26W1/0	Horizontal	Injection	-
100/05-12-001-26W1/0	Vertical	Abandoned	-
100/06-12-001-26W1/2	Vertical	Producing	-
102/06-12-001-26W1/0	Horizontal	Producing	-
100/07-12-001-26W1/0	Vertical	Abandoned	-
102/07-12-001-26W1/0	Horizontal	Producing	-
100/08-12-001-26W1/0	Vertical	Producing	-
102/09-12-001-26W1/0	Vertical	Source	-
100/10-12-001-26W1/0	Vertical	Producing	-
102/10-12-001-26W1/0	Horizontal	Producing	-
103/10-12-001-26W1/0	Horizontal	Producing	-
100/15-12-001-26W1/0	Vertical	Injection	-



**j) Well List****Waskada Unit No. 6 Well List**

<i><b>UWI</b></i>	<i><b>Type</b></i>	<i><b>Status</b></i>	<i><b>Future Plans</b></i>
102/15-12-001-26W1/0	Horizontal	Producing	-
102/16-12-001-26W1/0	Vertical	Abandoned Zone	-
104/16-12-001-26W1/0	Horizontal	Producing	-