

Waskada Lower Amaranth Unit No. 1

Waterflood Progress Report 2018

January 1st through December 31st 2018

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

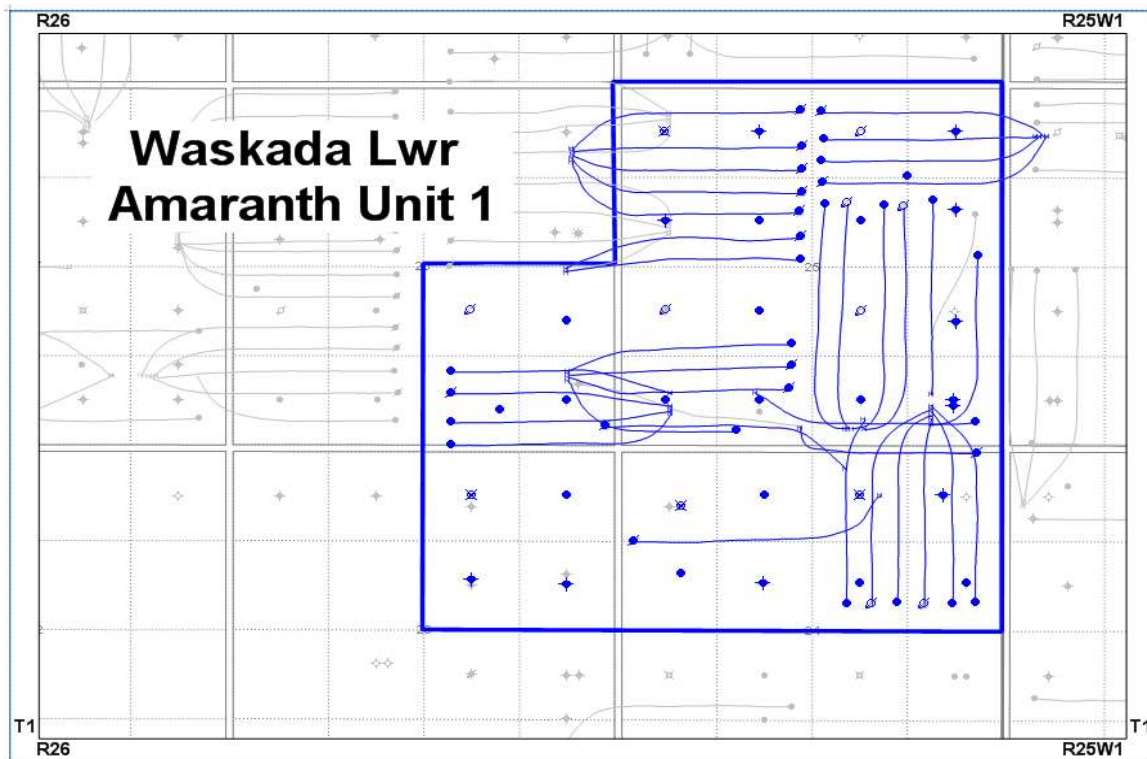
Tundra Oil and Gas

June 26, 2019

INTRODUCTION

Waskada Lower Amaranth Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 58 effective February 1983. The Unit area contains 30 abandoned/suspended/inactive wells, including 8 suspended/inactive injectors, and 39 producing/inactive wells in 32 LSDs in Township 1, Range 26 W1 as shown in the figure below.

Figure 1: Waskada Lower Amaranth Unit No. 1 Area Outline



Waskada Lower Amaranth Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the Waskada Lower Amaranth Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2018 EOR report as per section 73 of the Drilling and Production Regulations.

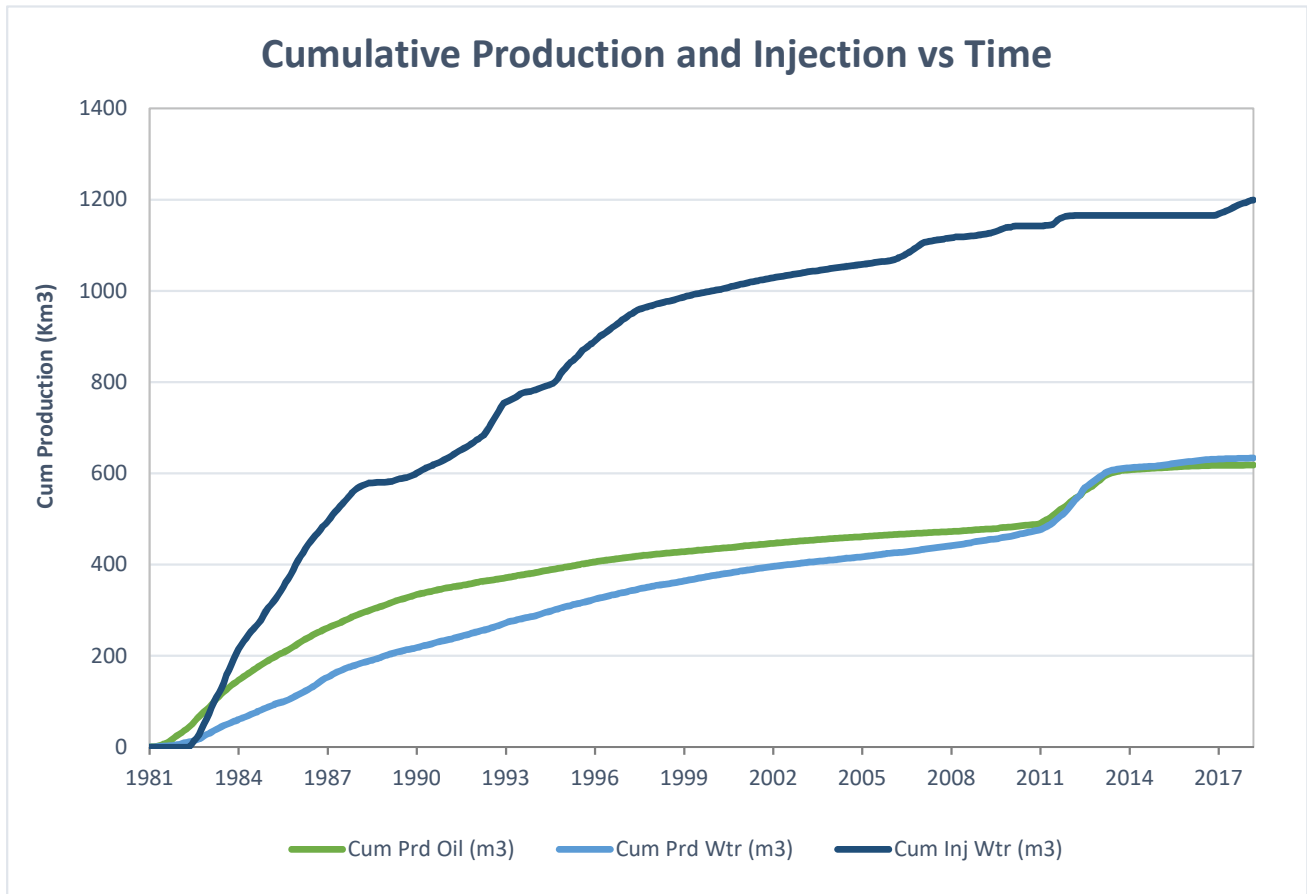
a) Monthly oil and water production rates, injection rate, GOR and WOR

MONTH	Cal Dly Oil m ³ /day	Cal Dly Wtr m ³ /day	Cal Inj Wtr m ³ /day	WOR m ³ /m ³	GOR m ³ /m ³
Jan-2018	1.28	4.82	78.40	3.75	0
Feb-2018	0.84	4.11	88.92	4.91	0
Mar-2018	1.03	5.10	89.95	4.94	0
Apr-2018	0.97	4.70	83.42	4.83	0
May-2018	0.72	3.66	91.12	5.06	0
Jun-2018	0.56	3.48	89.41	6.21	0
Jul-2018	0.62	3.29	72.06	5.29	0
Aug-2018	0.50	3.34	37.48	6.68	0
Sep-2018	3.87	6.14	47.21	1.59	0
Oct-2018	4.79	8.15	105.48	1.70	0
Nov-2018	4.25	4.61	64.40	1.08	0
Dec-2018	3.53	5.48	26.90	1.55	0

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

2018 PRODUCTION	
Produced Oil (m ³)	700
Produced Gas (m ³)	0
Produced Water (m ³)	1,732
Fluid Injected (m ³)	26,566
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	618,509
Produced Water (m ³)	633,770

Waskada Lower Amaranth Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/07-25 Inj		00/15-25 Inj		00/07-26 Inj		00/05-25 Inj		03/10-25 Inj		03/09-24 Inj	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2018	0.0	0	0.0	0	0.0	0	0.0	0	612.3	-56	612.1	-50
Feb-2018	0.0	0	0.0	0	0.0	0	0.0	0	645.7	-87	645.8	-89
Mar-2018	0.0	0	0.0	0	0.0	0	0.0	0	737.5	-89	737.4	-91
Apr-2018	0.0	0	0.0	0	0.0	0	0.0	0	666.3	-83	666.8	-90
May-2018	0.0	0	0.0	0	0.0	0	0.0	0	765.4	-71	765.4	-90
Jun-2018	0.0	0	0.0	0	0.0	0	0.0	0	736.6	-73	735.6	-84
Jul-2018	0.0	0	0.0	0	0.0	0	0.0	0	620.5	-81	619.9	-89
Aug-2018	0.0	0	0.0	0	0.0	0	0.0	0	284.0	-63	452.5	-86
Sep-2018	0.0	0	0.0	0	0.0	0	0.0	0	412.0	-45	689.5	-83
Oct-2018	0.0	0	0.0	1	0.0	0	0.0	0	889.0	-70	821.0	-89
Nov-2018	0.0	0	0.0	1	0.0	0	0.0	0	587.0	-48	379.0	-64
Dec-2018	0.0	0	0.0	1	0.0	0	0.0	0	222.0	-56	187.0	-77
Total	0.0		0.0		0.0		0.0		7178.4		7312.0	
Avg Inj P		0		0		0		0		-68		-82

	06/10-25 Inj		02/10-24 Inj		WLAMU1	
MONTH	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)	Inj Water (m ³)	Avg Inj P (kPa)
Jan-2018	607.4	1475	598.7	-54	2430.6	164
Feb-2018	552.3	1835	645.9	-85	2489.7	197
Mar-2018	576.2	1716	737.3	-88	2788.4	181
Apr-2018	502.8	1985	666.7	-88	2502.6	215
May-2018	528.6	1989	765.4	-87	2824.7	218
Jun-2018	478.7	1997	731.3	-73	2682.2	221
Jul-2018	372.6	1828	620.9	-86	2234.0	197
Aug-2018	181.3	1795	244.0	-77	1161.8	196
Sep-2018	134.7	-62	180.0	-67	1416.2	-32
Oct-2018	803.0	-19	757.0	-72	3270.0	-31
Nov-2018	587.0	-37	379.0	-61	1932.0	-26
Dec-2018	231.0	-37	194.0	-57	834.0	-28
Total	5555.6		6520.1		26566.2	
Avg Inj P		1205		-75		123

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
Total m3	2430.6	2489.7	2788.4	2502.6	2824.7	2682.2	2234.0	1161.8	1416.2	3270.0	1932.0	834.0
Daily (m³/d)	78.41	88.92	89.95	83.42	91.12	89.41	72.06	37.48	47.21	105.48	64.40	26.90

2018 AVG. ANNUAL DAILY INJECTION = 72.90 m3/d

CUMULATIVE INJECTION TO Dec 31, 2017 = 1,172,840 m3

TOTAL 2018 ANNUAL INJECTION = 26,566 m3

CUMULATIVE INJECTION TO Dec 31, 2018 = 1,199,406 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
102.10-24-001-26W1.00	WIW Cemented Liner Cleanout	9/10/2018
103.01-25-001-26W1.00	Pump Change	9/27/2018
103.10-25-001-26W1.00	Cemented Liner Clean Out	8/30/2018
106.10-25-001-26W1.00	Cemented Liner Clean Out	8/22/2018

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	39.8	617.85	149.3	632.19	2430.5	1175.27	12.409	0.867
Feb-2018	23.4	617.87	115	632.30	2489.7	1177.76	17.487	0.869
Mar-2018	32.0	617.90	158	632.46	2788.4	1180.55	14.267	0.871
Apr-2018	29.2	617.93	141	632.60	2502.6	1183.05	14.287	0.873
May-2018	22.4	617.96	113.4	632.71	2824.8	1185.88	20.234	0.875
Jun-2018	16.8	617.97	104.3	632.82	2682.2	1188.56	21.638	0.877
Jul-2018	19.3	617.99	102.1	632.92	2233.9	1190.79	17.917	0.878
Aug-2018	15.5	618.01	103.6	633.02	1161.8	1191.95	9.544	0.879
Sep-2018	116.0	618.12	184.1	633.21	1416.2	1193.37	4.428	0.880
Oct-2018	148.4	618.27	252.5	633.46	3270.0	1196.64	7.674	0.882
Nov-2018	127.6	618.40	138.3	633.60	1932.0	1198.57	6.718	0.883
Dec-2018	109.4	618.51	170	633.77	834.0	1199.41	2.799	0.884

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>
100/09-23-001-26W1/0	Vertical	Abandoned	-
102/10-23-001-26W1/0	Vertical	Abandoned	-
103/10-23-001-26W1/0	Horizontal	Drilled & Cased	-
100/15-23-001-26W1/0	Vertical	Abandoned	-
100/16-23-001-26W1/0	Vertical	Producing	-
100/09-24-001-26W1/2	Vertical	Producing	-
102/09-24-001-26W1/0	Horizontal	Producing	-
103/09-24-001-26W1/0	Horizontal	Injection	-
104/09-24-001-26W1/0	Horizontal	Producing	-
100/10-24-001-26W1/0	Vertical	Producing	-
102/10-24-001-26W1/0	Horizontal	Injection	-
103/10-24-001-26W1/0	Horizontal	Producing	-
104/10-24-001-26W1/0	Horizontal	Producing	-
100/11-24-001-26W1/0	Vertical	Abandoned	-
100/12-24-001-26W1/2	Vertical	Commingle	-
102/12-24-001-26W1/0	Horizontal	Suspended	-
102/13-24-001-26W1/0	Vertical	Abandoned	-
103/13-24-001-26W1/0	Horizontal	Suspended	-
100/14-24-001-26W1/0	Vertical	Producing	-
100/15-24-001-26W1/0	Vertical	Abandoned	-
102/16-24-001-26W1/0	Vertical	Abandoned	-
103/16-24-001-26W1/2	Horizontal	Suspended	-
100/01-25-001-26W1/2	Vertical	Abandoned	-
102/01-25-001-26W1/0	Vertical	Abandoned	-
103/01-25-001-26W1/0	Horizontal	Producing	-
100/02-25-001-26W1/2	Vertical	Producing	-
100/03-25-001-26W1/2	Vertical	Abandoned Zone	-
103/03-25-001-26W1/0	Horizontal	Suspended	-
104/03-25-001-26W1/0	Horizontal	Suspended	-
105/03-25-001-26W1/0	Horizontal	Producing	-
100/04-25-001-26W1/2	Vertical	Abandoned Zone	-
100/05-25-001-26W1/2	Vertical	Suspended	-
100/06-25-001-26W1/0	Vertical	Producing	-
102/06-25-001-26W1/0	Horizontal	Producing	-
100/07-25-001-26W1/0	Vertical	Injection	-
102/08-25-001-26W1/0	Vertical	Abandoned	-
100/09-25-001-26W1/0	Vertical	Abandoned Zone	-
102/09-25-001-26W1/0	Horizontal	Pumping	-
103/09-25-001-26W1/0	Horizontal	Producing	-
100/10-25-001-26W1/0	Vertical	Producing	-
102/10-25-001-26W1/0	Horizontal	Suspended	-
103/10-25-001-26W1/0	Horizontal	Injection	-
104/10-25-001-26W1/0	Horizontal	Producing	-
105/10-25-001-26W1/0	Horizontal	Producing	-
106/10-25-001-26W1/0	Horizontal	Injection	-

j) Well List

Waskada Lower Amaranth Unit No. 1 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/11-25-001-26W1/0	Vertical	Producing	-
102/11-25-001-26W1/0	Horizontal	Suspended	-
103/11-25-001-26W1/0	Horizontal	Suspended	-
104/11-25-001-26W1/0	Horizontal	Producing	-
105/11-25-001-26W1/0	Horizontal	Suspended	-
100/12-25-001-26W1/0	Vertical	Abandoned	-
100/13-25-001-26W1/0	Vertical	Abandoned	-
100/14-25-001-26W1/0	Vertical	Abandoned	-
102/14-25-001-26W1/0	Horizontal	Suspended	-
103/14-25-001-26W1/0	Horizontal	Suspended	-
104/14-25-001-26W1/0	Horizontal	Suspended	-
100/15-25-001-26W1/0	Vertical	Injection	-
102/15-25-001-26W1/0	Horizontal	Suspended	-
103/15-25-001-26W1/0	Horizontal	Producing	-
104/15-25-001-26W1/0	Horizontal	Producing	-
100/16-25-001-26W1/0	Vertical	Abandoned Zone	-
1B0/16-25-001-26W1/0	Vertical	Producing	-
100/01-26-001-26W1/2	Vertical	Commingled	-
100/02-26-001-26W1/0	Vertical	Abandoned Zone	-
102/02-26-001-26W1/0	Horizontal	Producing	-
103/02-26-001-26W1/0	Horizontal	Producing	-
104/02-26-001-26W1/0	Horizontal	Producing	-
105/02-26-001-26W1/0	Horizontal	Suspended	-
100/07-26-001-26W1/0	Vertical	Injection	-
100/08-26-001-26W1/0	Vertical	Producing	-