

Waskada Unit No. 18

Waterflood Progress Report 2019

January 1st through December 31st 2019

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

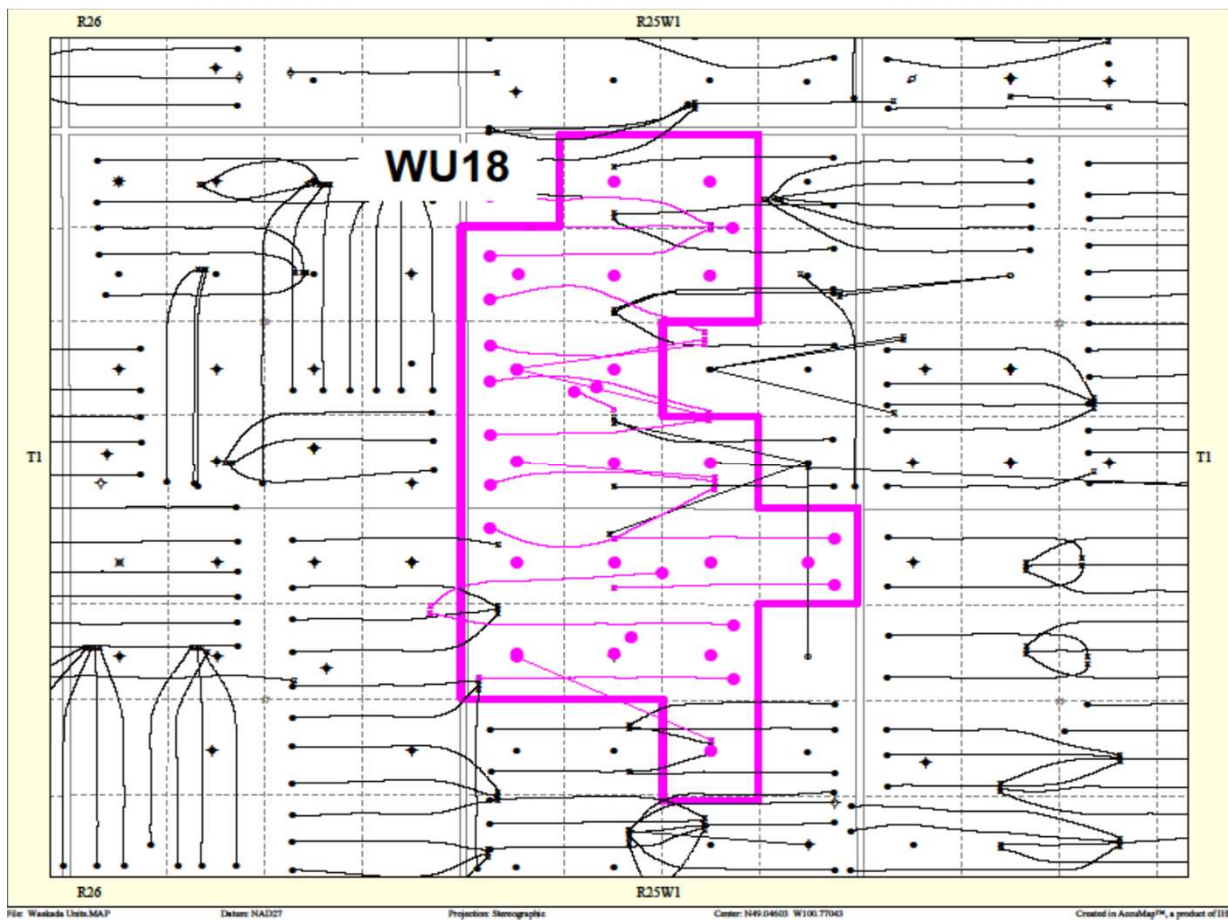
Tundra Oil and Gas

March 20, 2020

INTRODUCTION

The Waskada Unit No. 18 pressure maintenance project commenced water injection into the Lower Amaranth A pool in accordance with Manitoba Energy and Mines Order No. PM 68, dated October 1, 1991. Waskada Unit No. 18 was acquired from EOG Resources Canada Inc. effective October 1, 2014 (closing date December 1, 2014) with Tundra Oil and Gas (Tundra) as the new operator. The EOR project area, outlined in pink in Figure 1, contains 34 wells (13 abandoned/suspended, 18 producing and 3 injectors) over 18 LSDs in Township 1, Range 25W1.

Figure 1: Waskada Unit No. 18 Area Outline



Waskada Unit No. 18

Tundra Oil and Gas (Tundra), as the operator of the Waskada Unit No. 18 Enhanced Oil Recovery (EOR) project hereby submits the 2019 EOR report as per section 73 of the Drilling and Production Regulations.

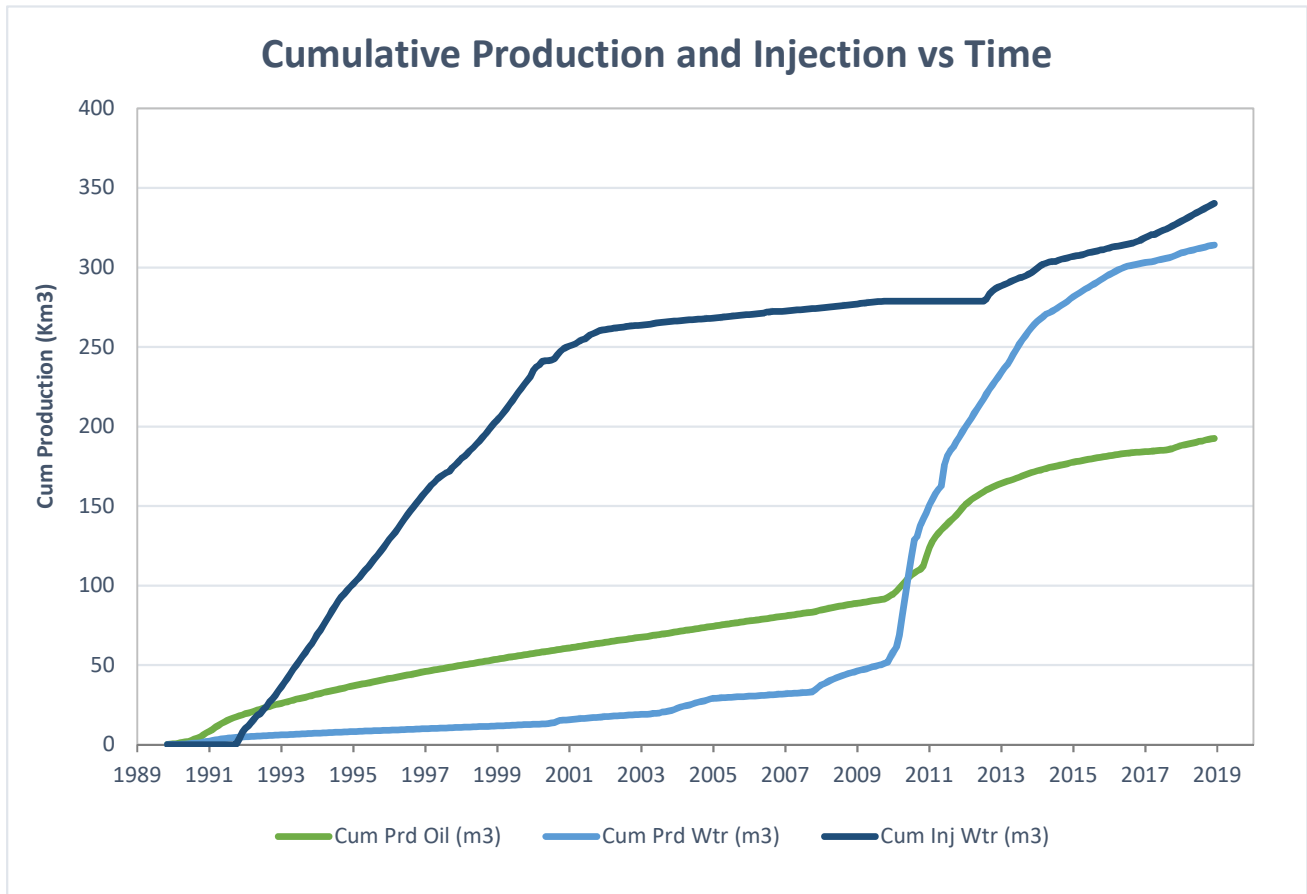
a) Monthly oil and water production rates, injection rate, GOR and WOR

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-2019	10.01	13.43	65.81	1.34	38.66
Feb-2019	9.88	11.60	65.91	1.18	43.4
Mar-2019	10.17	12.05	56.54	1.19	38.07
Apr-2019	9.50	10.84	35.33	1.14	37.89
May-2019	9.47	11.62	13.15	1.23	0
Jun-2019	9.95	15.85	12.90	1.59	0
Jul-2019	10.34	8.75	12.67	0.85	0
Aug-2019	10.71	8.03	12.56	0.75	0
Sep-2019	8.29	6.78	12.46	0.82	0
Oct-2019	6.91	6.08	12.25	0.88	0
Nov-2019	8.44	9.12	12.27	1.08	0
Dec-2019	8.11	8.45	12.16	1.04	0

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

2019 PRODUCTION	
Produced Oil (m ³)	3,399
Produced Gas (m ³)	47
Produced Water (m ³)	3,724
Fluid Injected (m ³)	6,425
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	195,943
Produced Water (m ³)	317,882

Waskada Unit No. 18



c) Monthly wellhead injection pressure for each injection well

	00/14-21 Inj		00/15-21 Inj		02/12-21 Inj		WU18	
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)
Jan-2019	119.4	4975	602.5	2446	298.1	4974	1020.0	4132
Feb-2019	107.6	4986	548.0	2464	267.2	4979	922.8	4143
Mar-2019	106.8	4804	499.3	2396	270.3	4977	876.4	4059
Apr-2019	114.9	4943	133.4	2452	281.6	4968	529.9	4121
May-2019	119.9	4972	0.0	2462	287.7	4975	407.6	4136
Jun-2019	114.6	4990	0.0	2462	272.4	4971	387.0	4141
Jul-2019	117.4	4973	0.0	2462	275.5	4971	392.9	4135
Aug-2019	116.9	4978	0.0	2462	272.6	4972	389.5	4137
Sep-2019	112.7	4977	0.0	2462	261.1	4969	373.8	4136
Oct-2019	114.7	4977	0.0	2462	265.2	4970	379.9	4136
Nov-2019	111.1	4961	0.0	2462	257.0	4968	368.1	4131
Dec-2019	114.5	4978	0.0	2462	262.5	4974	377.0	4138
Total	1370.5		1783.2		3271.2		6424.9	
Avg Inj P		4959		2454		4972		4129

MONTH	Jan-2019	Feb-2019	Mar-2019	Apr-2019	May-2019	Jun-2019	Jul-2019	Aug-2019	Sep-2019	Oct-2019	Nov-2019	Dec-2019
Total m3	1020.0	922.8	876.4	529.9	407.6	387.0	392.9	389.5	373.8	379.9	368.1	377.0
Daily (m³/d)	32.90	32.96	28.27	17.66	13.15	12.90	12.67	12.57	12.46	12.26	12.27	12.16

2019 AVG. ANNUAL DAILY INJECTION = 17.69 m3/d

CUMULATIVE INJECTION TO Dec 31, 2018 = 340,370 m3

TOTAL 2019 ANNUAL INJECTION = 6,425 m3

CUMULATIVE INJECTION TO Dec 31, 2019 = 346,795 m3

d) Summary of the result of any survey of reservoir pressure conducted in 2019. N/A

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

Well	Service Description	Date
100.16-16-001-25W1.00	Pump Change	11/21/2019
103.12-21-001-25W1.00	Pump Change	6/3/2019

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-2019	310.4	192.85	416.4	314.57	1020.0	341.39	1.308	0.632
Feb-2019	276.5	193.13	324.9	314.90	922.8	342.31	1.423	0.633
Mar-2019	315.2	193.45	373.6	315.27	876.4	343.19	1.180	0.634
Apr-2019	285.0	193.73	325.2	315.60	529.9	343.72	0.804	0.634
May-2019	293.6	194.02	360.3	315.96	407.6	344.13	0.579	0.634
Jun-2019	298.5	194.32	475.5	316.43	387.0	344.51	0.469	0.634
Jul-2019	320.5	194.64	271.1	316.71	392.9	344.91	0.608	0.634
Aug-2019	332.0	194.98	249.0	316.95	389.5	345.30	0.611	0.633
Sep-2019	248.6	195.22	203.5	317.16	373.8	345.67	0.756	0.634
Oct-2019	214.2	195.44	188.5	317.35	379.9	346.05	0.865	0.634
Nov-2019	253.3	195.69	273.6	317.62	368.1	346.42	0.646	0.634
Dec-2019	251.3	195.94	262.0	317.88	377.0	346.79	0.678	0.634

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>
100/07-16-001-25W1/0	Vertical	Abandoned Zone	-
100/10-16-001-25W1/0	Vertical	Abandoned Zone	-
102/10-16-001-25W1/0	Horizontal	Producing	-
103/10-16-001-25W1/0	Horizontal	Producing	-
102/11-16-001-25W1/0	Vertical	Abandoned	-
103/11-16-001-25W1/0	Vertical	Abandoned	-
100/12-16-001-25W1/0	Vertical	Producing	-
100/13-16-001-25W1/0	Vertical	Producing	-
102/13-16-001-25W1/0	Horizontal	Potential	-
100/14-16-001-25W1/0	Vertical	Pumping	-
102/14-16-001-25W1/0	Horizontal	Producing	-
100/15-16-001-25W1/0	Vertical	Abandoned	-
100/16-16-001-25W1/0	Vertical	Pumping	-
102/16-16-001-25W1/0	Horizontal	Suspended	-
103/16-16-001-25W1/0	Horizontal	Suspended	-
100/02-21-001-25W1/0	Vertical	Pumping	-
100/03-21-001-25W1/0	Vertical	Producing	-
100/04-21-001-25W1/0	Vertical	Abandoned	-
102/04-21-001-25W1/0	Horizontal	Producing	-
103/04-21-001-25W1/0	Horizontal	Producing	-
100/05-21-001-25W1/0	Vertical	Producing	-
102/05-21-001-25W1/0	Horizontal	Producing	-
103/05-21-001-25W1/0	Horizontal	Producing	-
100/06-21-001-25W1/0	Vertical	Abandoned	-
102/06-21-001-25W1/0	Vertical	Abandoned	-
100/10-21-001-25W1/0	Vertical	Abandoned	-
100/11-21-001-25W1/0	Vertical	Abandoned Zone	-
100/12-21-001-25W1/0	Vertical	Pumping	-
102/12-21-001-25W1/0	Horizontal	Injection	-
103/12-21-001-25W1/0	Horizontal	Producing	-
102/13-21-001-25W1/2	Horizontal	Producing	-
100/14-21-001-25W1/0	Vertical	Injection	-
100/15-21-001-25W1/0	Vertical	Injection	-
102/15-21-001-25W1/0	Horizontal	Suspended	-

k) Discussion

Water injection commenced with 4 injector wells on October 1991. Two more injectors were added in March 2001. **In 2011, EOG received permission to convert 3 Spearfish injection wells into Mississippian SWD wells. The wells converted were 00/10-21, 00/15-16 and 03/11-16-001-25W1.**