Birdtail 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:

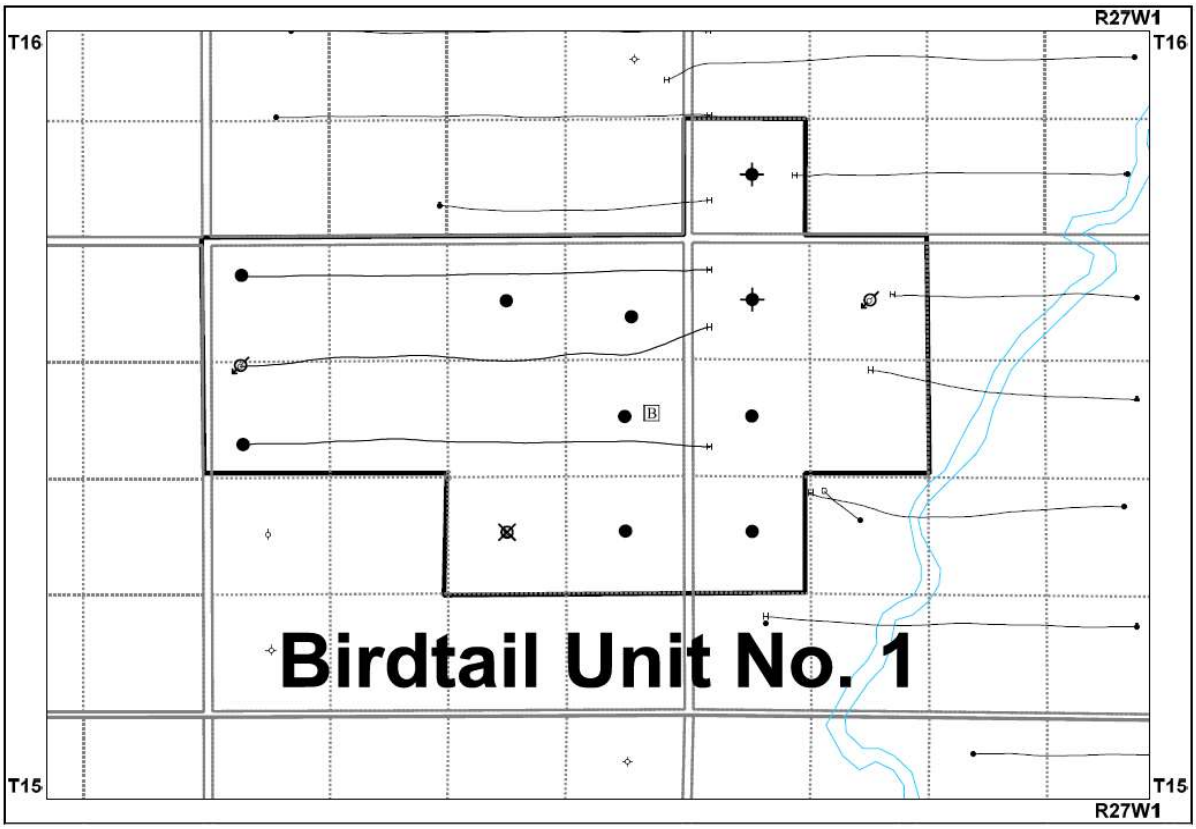
Tundra Oil and Gas

April 9, 2019

INTRODUCTION

Birdtail Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 7 effective August 1, 1999 with Progress Energy Production Partnership as Operator. Tundra acquired the unit from Progress Energy Production Partnership and became operator in October 2003. The EOR project area contains 13 wells (10 vertical, 3 horizontal) in 16 LSDs in Township 16, Range 27 W1 as shown in the figure below.

Figure 1: Birdtail Unit No. 1 Area Outline



Birdtail Unit No. 1

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

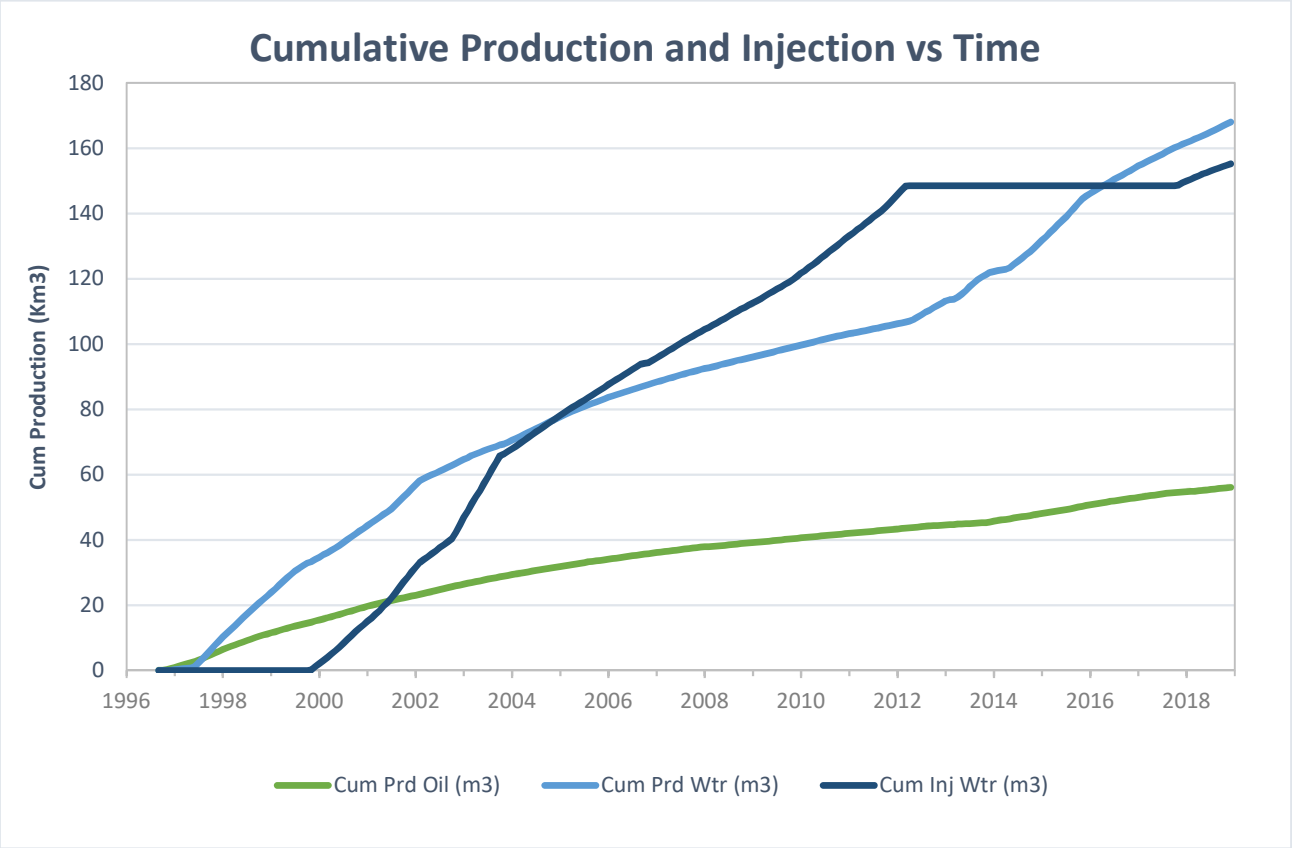
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	2.63	16.63	17.61	6.32	0
Feb-2018	2.55	17.84	18.75	7.01	0
Mar-2018	2.49	18.00	18.23	7.24	0
Apr-2018	3.77	17.16	17.07	4.55	0
May-2018	4.40	16.95	16.35	3.85	0
Jun-2018	4.04	17.66	15.47	4.38	0
Jul-2018	4.89	18.67	15.16	3.82	0
Aug-2018	4.69	19.89	14.81	4.24	0
Sep-2018	4.63	20.91	14.47	4.51	0
Oct-2018	4.79	21.11	14.23	4.41	0
Nov-2018	4.35	20.96	13.97	4.82	0
Dec-2018	2.88	18.08	13.74	6.28	0

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

2018 PRODUCTION	
Produced Oil (m^3)	1,405
Produced Gas (m^3)	0
Produced Water (m^3)	6,810
Fluid Injected (m^3)	5,768
CUMULATIVE PRODUCTION	
Produced Oil (m^3)	56,095
Produced Water (m^3)	168,029

Birdtail Unit No. 1



c) Monthly wellhead injection pressure for each injection well

MONTH	02/12-05 Inj		Birdtail Unit 1	
	Inj Water (m^3)	Avg Inj P (kPa)	Inj Water (m^3)	Avg Inj P (kPa)
Jan-2018	546.0	2986	546.0	2986
Feb-2018	525.0	3530	525.0	3530
Mar-2018	565.0	3884	565.0	3884
Apr-2018	512.0	3953	512.0	3953
May-2018	507.0	3978	507.0	3978
Jun-2018	464.0	3971	464.0	3971
Jul-2018	470.0	3979	470.0	3979
Aug-2018	459.0	3981	459.0	3981
Sep-2018	434.0	3979	434.0	3979
Oct-2018	441.0	3982	441.0	3982
Nov-2018	419.0	3961	419.0	3961
Dec-2018	426.0	3965	426.0	3965
Total	5768.0		5768.0	
Avg Inj P		3846		3846

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	546.0	525.0	565.0	512.0	507.0	464.0	470.0	459.0	434.0	441.0	419.0	426.0
Daily (m^3/d)	17.61	18.75	18.23	17.07	16.35	15.47	15.16	14.81	14.47	14.23	13.97	13.74

2018 AVG. ANNUAL DAILY INJECTION =	15.82 m3/d
CUMULATIVE INJECTION TO Dec 31, 2017 =	149,436 m3
TOTAL 2018 ANNUAL INJECTION =	5,768 m3
CUMULATIVE INJECTION TO Dec 31, 2018 =	155,204 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
100.12-04-016-27W1.00	Pump Change	6/16/2018
100.12-04-016-27W1.00	Pump Change	8/7/2018

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

VOIDAGE CALCULATIONS

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.071

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	81.6	54.77	515.5	161.73	546.0	149.98	0.906	0.681
Feb-2018	71.3	54.84	499.5	162.23	525.0	150.51	0.912	0.681
Mar-2018	77.1	54.92	558	162.79	565.0	151.07	0.882	0.682
Apr-2018	113.1	55.03	514.8	163.31	512.0	151.58	0.805	0.682
May-2018	136.4	55.17	525.6	163.83	507.0	152.09	0.755	0.682
Jun-2018	121.1	55.29	529.9	164.36	464.0	152.56	0.703	0.682
Jul-2018	151.5	55.44	578.7	164.94	470.0	153.03	0.634	0.682
Aug-2018	145.3	55.59	616.6	165.56	459.0	153.48	0.594	0.682
Sep-2018	139.0	55.73	627.4	166.19	434.0	153.92	0.559	0.681
Oct-2018	148.5	55.87	654.4	166.84	441.0	154.36	0.542	0.681
Nov-2018	130.5	56.01	628.7	167.47	419.0	154.78	0.545	0.680
Dec-2018	89.3	56.09	560.5	168.03	426.0	155.20	0.649	0.680

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

The injection water for Birdtail Unit No. 1 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.

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

j) Well List

Birdtail Unit No. 1 Well List

UWI	*Type*	*Status*	*Future Plans*
100/05-04-016-27W1/0	Vertical	Producing	-
100/12-04-016-27W1/0	Vertical	Pumping	-
100/13-04-016-27W1/0	Vertical	Abandoned	-
100/14-04-016-27W1/0	Vertical	Injection	-
100/07-05-016-27W1/0	Vertical	Abandoned	-
100/08-05-016-27W1/0	Vertical	Producing	-
100/09-05-016-27W1/0	Vertical	Pumping	-
100/12-05-016-27W1/0	Horizontal	Producing	-
102/12-05-016-27W1/0	Horizontal	Injection	-
100/13-05-016-27W1/0	Horizontal	Producing	-
100/15-05-016-27W1/0	Vertical	Producing	-
100/16-05-016-27W1/0	Vertical	Pumping	-
100/04-09-016-27W1/0	Vertical	Abandoned	-

k) Discussion

Water injection started in November 1999 in the two injectors at 00/14-04 and 00/07-05-016-27W1 (00/07-05). The 00/07-05 injector has been abandoned since July 2003. In April 2012, injection into the 00/14-04 well was suspended.

Tundra is in the process of redeveloping this unit. Tundra no longer wants to use produced water for injection in this Unit, so they currently have in place a new source of water at 00/02-32-016-27W1. As part of the redevelopment of this unit, Tundra drilled a horizontal producer at 00/13-05-016-27W1/0 in the north part of the unit in 2013 along with the construction of a new injection line coming from the Birdtail battery located at 09-05-016-27W1. This line will supply filtered source water to the unit.

In September 2014, Tundra drilled another horizontal producer at 00/12-05-016-27W1/0. Tundra also applied to expand the Unit to include the NE/4 of 05-016-27W1/0 in 2014. In July 2015, a produce first horizontal injector between the 00/12-05 and 00/13-05 producers was drilled at 02/12-05-016-27W1/0. Tundra also plans to convert a couple of vertical wells into injectors to improve the sweep efficiency of the waterflood.