

North Pierson Unit No. 1

Waterflood Progress Report 2017

January 1st through December 31st 2017

Prepared for:

Manitoba Industry, Economic Development and Mines

Petroleum Branch

Prepared by:

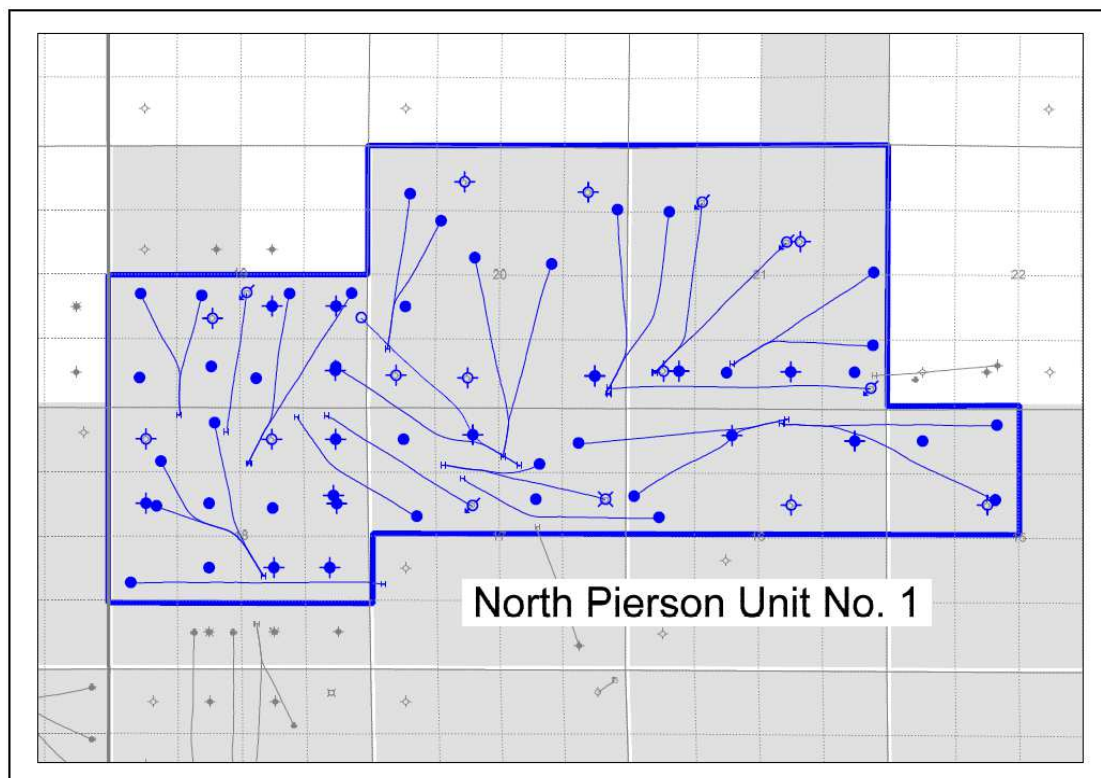
Tundra Oil and Gas

August 13, 2018

INTRODUCTION

North Pierson Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 31, effective January 1st, 2014 with Tundra Oil and Gas as Operator. The EOR project area, outlined in blue in Figure 1, contains 26 abandoned wells, 12 producing vertical wells, 26 producing horizontal wells and 5 injection wells in 72 LSDs in Township 3, Range 28W1.

Figure 1: North Pierson Unit No. 1 Area Outline



North Pierson Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the North Pierson Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2017 EOR report as per section 73 of the Drilling and Production Regulations.

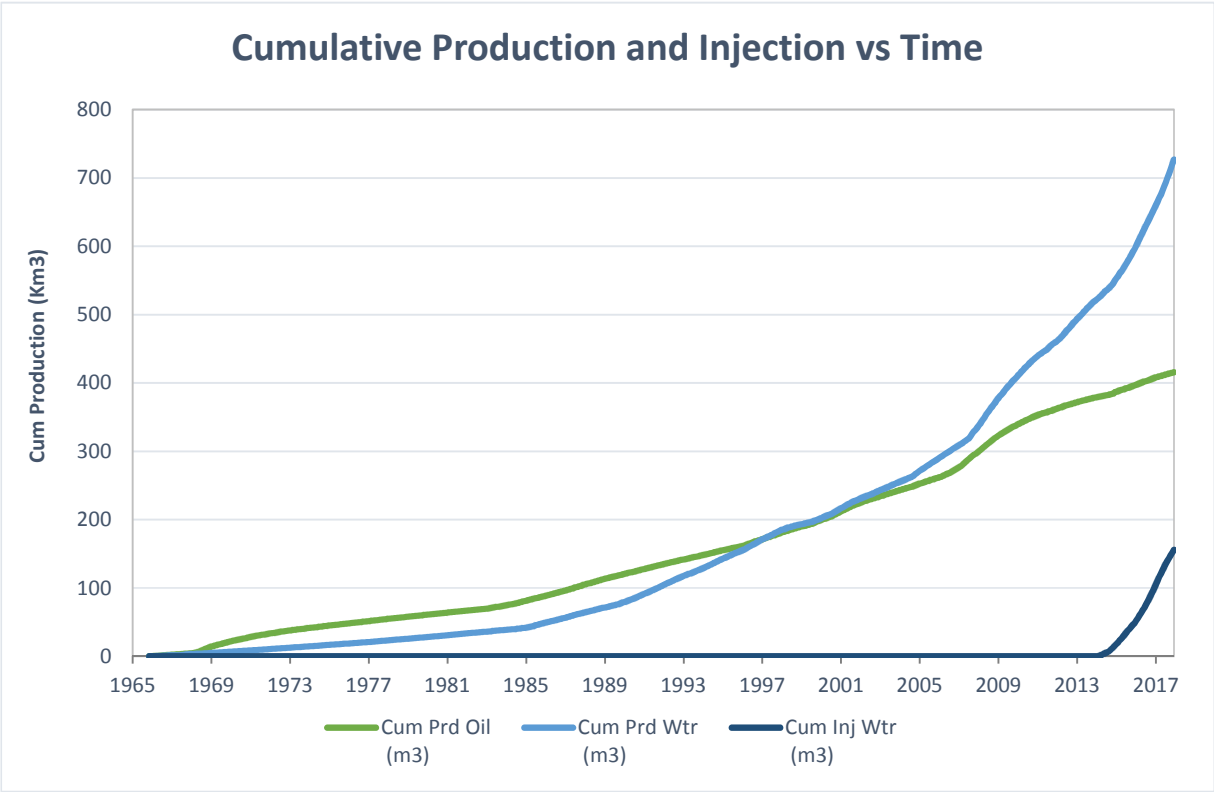
a) Monthly oil and water production rates, injection rate, GOR and WOR

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-2017	27.60	156.68	175.39	5.68	0
Feb-2017	26.16	158.77	176.93	6.07	0
Mar-2017	24.47	176.96	176.77	7.23	0
Apr-2017	23.87	186.08	175.93	7.80	0
May-2017	22.98	182.98	159.61	7.96	0
Jun-2017	25.66	202.37	159.93	7.89	0
Jul-2017	20.69	192.44	158.52	9.30	16.21
Aug-2017	23.58	222.97	129.29	9.46	12.86
Sep-2017	19.20	192.98	129.13	10.05	14.93
Oct-2017	19.34	206.04	128.74	10.66	14.35
Nov-2017	24.73	247.71	130.33	10.02	12.94
Dec-2017	21.98	213.21	137.74	9.70	12.62

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

2017 PRODUCTION	
Produced Oil (m ³)	8,516
Produced Gas (m ³)	55
Produced Water (m ³)	71,210
Fluid Injected (m ³)	55,862
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	415,498
Produced Water (m ³)	726,506

North Pierson Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/11-17 Inj		02/07-19 Inj		03/01-21 Inj		02/10-21 Inj		NPU1	
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)
Jan-2017	1846.0	3063	1798.0	3242	874.0	2985	919.0	-85	5437.0	2301
Feb-2017	1679.0	3278	1642.0	3316	797.0	2974	836.0	-84	4954.0	2371
Mar-2017	1848.0	3368	1817.0	3304	892.0	2975	923.0	-85	5480.0	2390
Apr-2017	1797.0	3405	1770.0	3313	817.0	2996	894.0	-85	5278.0	2407
May-2017	1606.0	3039	1563.0	2905	856.0	2986	923.0	-85	4948.0	2211
Jun-2017	1514.0	2594	1473.0	2564	920.0	3016	891.0	-83	4798.0	2023
Jul-2017	1534.0	2355	1499.0	2518	977.0	2982	904.0	-83	4914.0	1943
Aug-2017	1536.0	2283	1460.0	2574	96.0	578	916.0	-83	4008.0	1338
Sep-2017	1514.0	2162	1469.0	2401	0.0	-90	891.0	-83	3874.0	1097
Oct-2017	1559.0	2290	1510.0	2478	0.0	-90	922.0	-84	3991.0	1149
Nov-2017	1496.0	2164	1456.0	2469	0.0	-90	958.0	-84	3910.0	1115
Dec-2017	1547.0	2312	1498.0	2366	0.0	-90	1225.0	-85	4270.0	1126
Total	19476.0		18955.0		6229.0		11202.0		55862.0	
Avg Inj P		2693		2787		1761		-84		1789

MONTH	Jan-2017	Feb-2017	Mar-2017	Apr-2017	May-2017	Jun-2017	Jul-2017	Aug-2017	Sep-2017	Oct-2017	Nov-2017	Dec-2017
Total m3	5437.0	4954.0	5480.0	5278.0	4948.0	4798.0	4914.0	4008.0	3874.0	3991.0	3910.0	4270.0
Daily (m³/d)	175.39	176.93	176.77	175.93	159.61	159.93	158.52	129.29	129.13	128.74	130.33	137.74

2017 AVG. ANNUAL DAILY INJECTION =	153.19 m3/d
CUMULATIVE INJECTION TO Dec 31, 2016 =	99,858 m3
TOTAL 2017 ANNUAL INJECTION =	55,862 m3
CUMULATIVE INJECTION TO Dec 31, 2017 =	155,720 m3

d) Summary of the result of any survey of reservoir pressure conducted in 2017. N/A

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

Well	Service Description	Date
100.05-18-003-28W1.00	Pump Change	7/14/2017
102.01-21-003-28W1.00	Pump Change	7/20/2017
102.01-21-003-28W1.00	Pump Change	8/30/2017

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

VOIDAGE CALCULATIONS

OIL FORMATION VOLUME FACTOR (Rm3/Sm3) = 1.24

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-2017	855.6	407.84	4857.2	660.15	5437.0	105.30	0.919	0.090
Feb-2017	732.5	408.57	4445.5	664.60	4954.0	110.25	0.925	0.094
Mar-2017	758.6	409.33	5485.8	670.08	5480.0	115.73	0.853	0.098
Apr-2017	716.0	410.04	5582.5	675.67	5278.0	121.01	0.816	0.102
May-2017	712.3	410.76	5672.5	681.34	4948.0	125.96	0.755	0.106
Jun-2017	769.7	411.53	6071.1	687.41	4798.0	130.75	0.683	0.109
Jul-2017	641.4	412.17	5965.5	693.38	4914.0	135.67	0.727	0.113
Aug-2017	731.0	412.90	6912.2	700.29	4008.0	139.68	0.513	0.115
Sep-2017	576.1	413.48	5789.4	706.08	3874.0	143.55	0.596	0.118
Oct-2017	599.4	414.07	6387.2	712.46	3991.0	147.54	0.560	0.120
Nov-2017	741.8	414.82	7431.2	719.90	3910.0	151.45	0.468	0.123
Dec-2017	681.5	415.50	6609.5	726.51	4270.0	155.72	0.573	0.125

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

Injection water for NPU1 is supplied from the Mannville formation in the 100/03-18-03-28W1 well. Mannville water is pumped from the 100/03-18 source well to the Pierson 01-18-03-28W1 battery, where it is filtered and then pumped up to injection system pressure.

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>
100/11-15-003-28W1/0	Vertical	Abandoned	-
102/11-15-003-28W1/2	Horizontal	Producing	-
100/13-15-003-28W1/0	Vertical	Producing	-
100/14-15-003-28W1/0	Horizontal	Producing	-
100/12-16-003-28W1/0	Horizontal	Pumping	-
102/12-16-003-28W1/0	Horizontal	Producing	-
100/14-16-003-28W1/0	Vertical	Abandoned	-
100/16-16-003-28W1/0	Vertical	Abandoned	-
100/09-17-003-28W1/2	Horizontal	Drain	-
100/10-17-003-28W1/0	Vertical	Pumping	-
100/11-17-003-28W1/0	Horizontal	Injection	-
100/12-17-003-28W1/0	Horizontal	Producing	-
100/13-17-003-28W1/0	Vertical	Producing	-
100/14-17-003-28W1/0	Vertical	Abandoned	-
100/15-17-003-28W1/0	Horizontal	Pumping	-
100/16-17-003-28W1/2	Horizontal	Producing	-
100/05-18-003-28W1/0	Horizontal	Producing	-
100/06-18-003-28W1/0	Vertical	Producing	-
100/07-18-003-28W1/0	Vertical	Abandoned	-
100/08-18-003-28W1/0	Vertical	Abandoned	-
100/09-18-003-28W1/0	Vertical	Abandoned	-
102/09-18-003-28W1/0	Vertical	Abandoned	-
100/10-18-003-28W1/0	Vertical	Producing	-
100/11-18-003-28W1/0	Vertical	Producing	-
100/12-18-003-28W1/0	Vertical	Abandoned	-
102/12-18-003-28W1/2	Horizontal	Producing	-
100/13-18-003-28W1/0	Vertical	Abandoned	-
102/13-18-003-28W1/3	Horizontal	Producing	-
100/14-18-003-28W1/0	Horizontal	Producing	-
100/15-18-003-28W1/0	Vertical	Abandoned	-
100/16-18-003-28W1/0	Vertical	Abandoned	-
100/01-19-003-28W1/0	Dir/Dev	Abandoned Zone	-
102/01-19-003-28W1/0	Horizontal	Producing	-
100/02-19-003-28W1/0	Vertical	Producing	-
100/03-19-003-28W1/0	Vertical	Producing	-
100/04-19-003-28W1/0	Vertical	Producing	-
102/05-19-003-28W1/0	Horizontal	Producing	-
100/06-19-003-28W1/0	Vertical	Abandoned	-
100/06-19-003-28W1/2	Horizontal	Producing	-
100/07-19-003-28W1/0	Vertical	Abandoned	-
102/07-19-003-28W1/0	Horizontal	Injection	-
102/07-19-003-28W1/2	Horizontal	Producing	-
100/08-19-003-28W1/0	Vertical	Abandoned	-
102/08-19-003-28W1/0	Horizontal	Producing	-
103/08-19-003-28W1/2	Horizontal	Potential	-

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/01-20-003-28W1/0	Vertical	Abandoned	-
100/01-20-003-28W1/2	Vertical	Abandoned	-
100/03-20-003-28W1/0	Vertical	Abandoned	-
100/04-20-003-28W1/0	Vertical	Abandoned	-
100/05-20-003-28W1/0	Vertical	Producing	-
100/07-20-003-28W1/2	Horizontal	Producing	-
100/11-20-003-28W1/0	Horizontal	Producing	-
102/11-20-003-28W1/2	Horizontal	Producing	-
100/13-20-003-28W1/0	Horizontal	Producing	-
100/14-20-003-28W1/0	Vertical	Abandoned	-
100/16-20-003-28W1/0	Vertical	Abandoned	-
100/16-20-003-28W1/2	Horizontal	Producing	-
100/01-21-003-28W1/0	Vertical	Producing	-
102/01-21-003-28W1/0	Horizontal	Producing	-
103/01-21-003-28W1/0	Horizontal	Injection	-
100/02-21-003-28W1/0	Vertical	Abandoned	-
100/03-21-003-28W1/0	Vertical	Producing	-
100/04-21-003-28W1/0	Vertical	Abandoned	-
102/04-21-003-28W1/0	Vertical	Abandoned	-
100/09-21-003-28W1/2	Horizontal	Producing	-
100/10-21-003-28W1/0	Vertical	Abandoned	-
102/10-21-003-28W1/0	Horizontal	Injection	-
100/12-21-003-28W1/0	Horizontal	Producing	-
100/14-21-003-28W1/2	Horizontal	Injection	-