

**Kola Unit No. 1**

**Waterflood Progress Report 2019**

**January 1<sup>st</sup> through December 31<sup>st</sup> 2019**

**Prepared for:**

**Manitoba Industry, Economic Development and Mines**

**Petroleum Branch**

**Prepared by:**

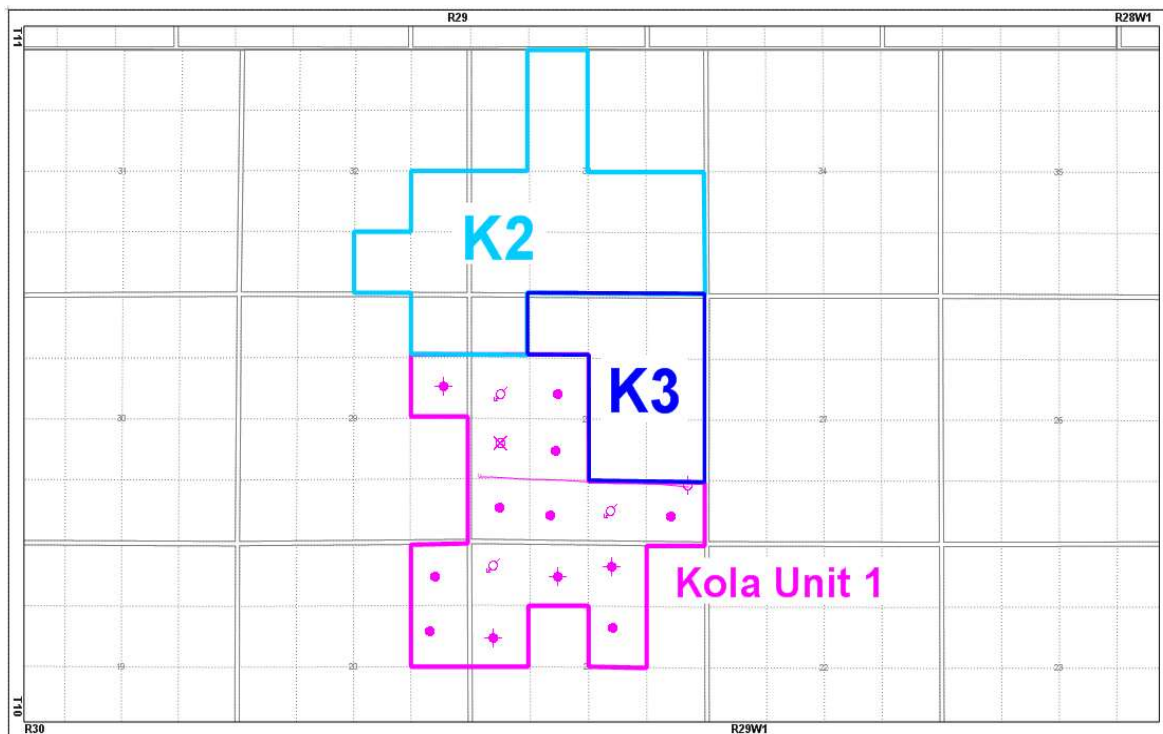
**Tundra Oil and Gas**

**April 28, 2020**

## INTRODUCTION

Kola Unit No. 1 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 71 effective October 1, 1993 with Tundra Oil and Gas as Operator. In May 1995, Board Order No. PM 71 was replaced by Waterflood Order No. 2. The EOR project area contains 18 wells in 16 LSDs in Township 10, Range 29 W1 as shown in the figure below.

**Figure 1: Kola Unit No. 1 Area Outline**



## Kola Unit No. 1

Tundra Oil and Gas (Tundra), as the operator of the Kola Unit No. 1 Enhanced Oil Recovery (EOR) project hereby submits the 2019 EOR report as per section 73 of the Drilling and Production Regulations.

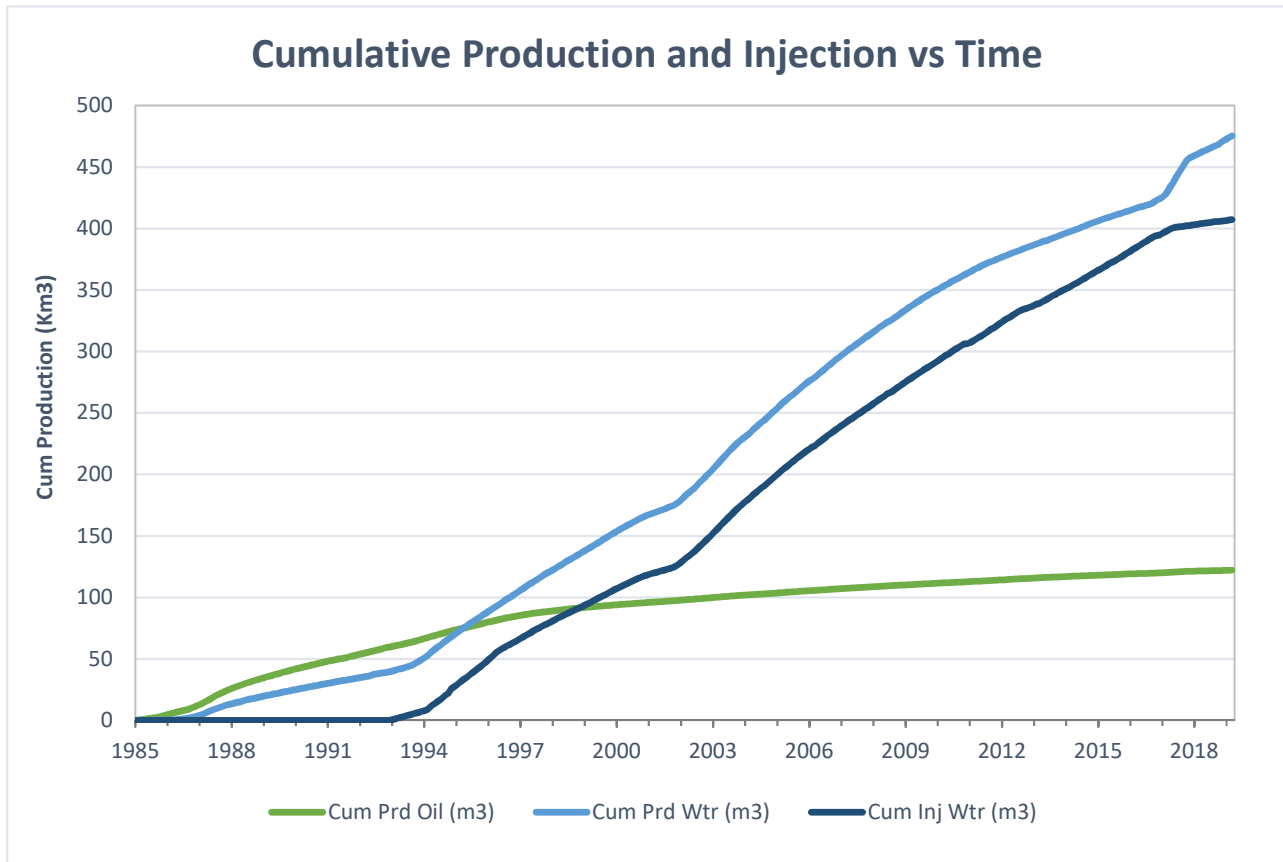
### a) Monthly oil and water production rates, injection rate, GOR and WOR

MONTH	Cal Dly Oil m <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-2019	1.76	36.05	10.77	20.50	0
Feb-2019	1.63	34.59	8.86	21.24	0
Mar-2019	1.80	32.90	10.00	18.31	0
Apr-2019	1.55	30.83	10.80	19.93	0
May-2019	1.51	32.49	10.77	21.52	0
Jun-2019	1.48	32.23	7.83	21.83	0
Jul-2019	1.28	27.86	2.61	21.76	0
Aug-2019	1.68	59.71	10.35	35.53	0
Sep-2019	2.35	46.03	11.00	19.61	0
Oct-2019	3.01	41.35	9.52	13.72	0
Nov-2019	2.42	43.92	11.00	18.13	0
Dec-2019	2.02	40.42	10.16	20.05	0

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

2019 PRODUCTION	
Produced Oil (m <sup>3</sup> )	684
Produced Gas (m <sup>3</sup> )	0
Produced Water (m <sup>3</sup> )	13,953
Fluid Injected (m <sup>3</sup> )	3,457
CUMULATIVE PRODUCTION	
Produced Oil (m <sup>3</sup> )	122,164
Produced Water (m <sup>3</sup> )	475,465

## Kola Unit No. 1



c) Monthly wellhead injection pressure for each injection well

	00/02-28 Inj		00/12-28 Inj		00/13-21 Inj		KU1	
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)
Jan-2019	173.0	5673	0.0	-52	161.0	6515	334.0	4045
Feb-2019	134.0	5201	0.0	-18	114.0	4681	248.0	3288
Mar-2019	183.0	6179	0.0	-6	127.0	5667	310.0	3946
Apr-2019	175.0	6371	0.0	-4	149.0	5935	324.0	4101
May-2019	181.0	6481	0.0	-8	153.0	5874	334.0	4116
Jun-2019	143.0	5816	0.0	-15	92.0	3759	235.0	3187
Jul-2019	75.0	3097	0.0	-12	6.0	94	81.0	1060
Aug-2019	169.0	5543	0.0	-8	152.0	5021	321.0	3518
Sep-2019	176.0	5971	0.0	-8	154.0	5781	330.0	3915
Oct-2019	173.0	5807	0.0	-8	122.0	5999	295.0	3933
Nov-2019	176.0	5947	0.0	-8	154.0	5960	330.0	3966
Dec-2019	181.0	5932	0.0	-8	134.0	5642	315.0	3855
<b>Total</b>	1939.0		0.0		1518.0		3457.0	
<b>Avg Inj P</b>		5668		-13		5077		3577

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
<b>Total m3</b>	334.0	248.0	310.0	324.0	334.0	235.0	81.0	321.0	330.0	295.0	330.0	315.0
<b>Daily (m<sup>3</sup>/d)</b>	10.77	8.86	10.00	10.80	10.77	7.83	2.61	10.35	11.00	9.52	11.00	10.16

2019 AVG. ANNUAL DAILY INJECTION = 9.47 m3/d
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CUMULATIVE INJECTION TO Dec 31, 2018 = 403,814 m3
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TOTAL 2019 ANNUAL INJECTION = 3,457 m3
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CUMULATIVE INJECTION TO Dec 31, 2019 = 407,271 m3
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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
100.04-28-010-29W1.00	Polish Rod Repair	7/22/2019

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-2019	54.5	121.53	1117.4	462.63	334.0	404.15	0.284	0.682
Feb-2019	45.6	121.58	968.6	463.60	248.0	404.40	0.244	0.681
Mar-2019	55.7	121.64	1020	464.62	310.0	404.71	0.287	0.680
Apr-2019	46.4	121.68	924.9	465.54	324.0	405.03	0.332	0.680
May-2019	46.8	121.73	1007.2	466.55	334.0	405.36	0.316	0.679
Jun-2019	44.3	121.77	967	467.52	235.0	405.60	0.232	0.678
Jul-2019	39.7	121.81	863.8	468.38	81.0	405.68	0.089	0.677
Aug-2019	52.1	121.86	1851.1	470.23	321.0	406.00	0.168	0.676
Sep-2019	70.4	121.94	1380.8	471.61	330.0	406.33	0.227	0.675
Oct-2019	93.4	122.03	1281.9	472.89	295.0	406.63	0.213	0.674
Nov-2019	72.7	122.10	1317.7	474.21	330.0	406.96	0.236	0.673
Dec-2019	62.5	122.16	1253	475.46	315.0	407.27	0.239	0.672

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

Injected fluid consisted of produced water from the Lodgepole formation, from the unit and surrounding area until November 2013. Injection water for Kola Unit No. 1 is now being provided from the Jurassic source water well at 100/02-25-010-29W1 (2-25). Tundra received approval from the Petroleum Branch in March 2013 to use the 2-25 well as a source water well for waterflood operations. Jurassic-sourced water is pumped from the 2-25 source well to the Daly 12-24-10-29 battery, where it is filtered to 50 microns 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**

## j) Well List

## Kola Unit No. 1 Well List

<i>UWI</i>	<i>Type</i>	<i>Status</i>	<i>Future Plans</i>
100/09-20-010-29W1/0	Vertical	Producing	-
100/16-20-010-29W1/0	Vertical	Producing	-
100/10-21-010-29W1/0	Vertical	Producing	-
100/12-21-010-29W1/0	Vertical	Abandoned	-
100/13-21-010-29W1/0	Vertical	Injection	-
100/14-21-010-29W1/0	Vertical	Abandoned	-
100/14-21-010-29W1/2	Vertical	Abandoned	-
100/15-21-010-29W1/0	Vertical	Abandoned	-
100/01-28-010-29W1/0	Vertical	Pumping	-
102/01-28-010-29W1/0	Horizontal	Producing	
100/02-28-010-29W1/0	Vertical	Injection	-
100/03-28-010-29W1/0	Vertical	Producing	-
100/04-28-010-29W1/0	Vertical	Producing	-
100/05-28-010-29W1/0	Vertical	Abandoned	-
100/06-28-010-29W1/0	Vertical	Producing	-
100/11-28-010-29W1/0	Vertical	Pumping	-
100/12-28-010-29W1/0	Vertical	Injection	-
100/09-29-010-29W1/0	Vertical	Abandoned Zone	-