

Kola 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:

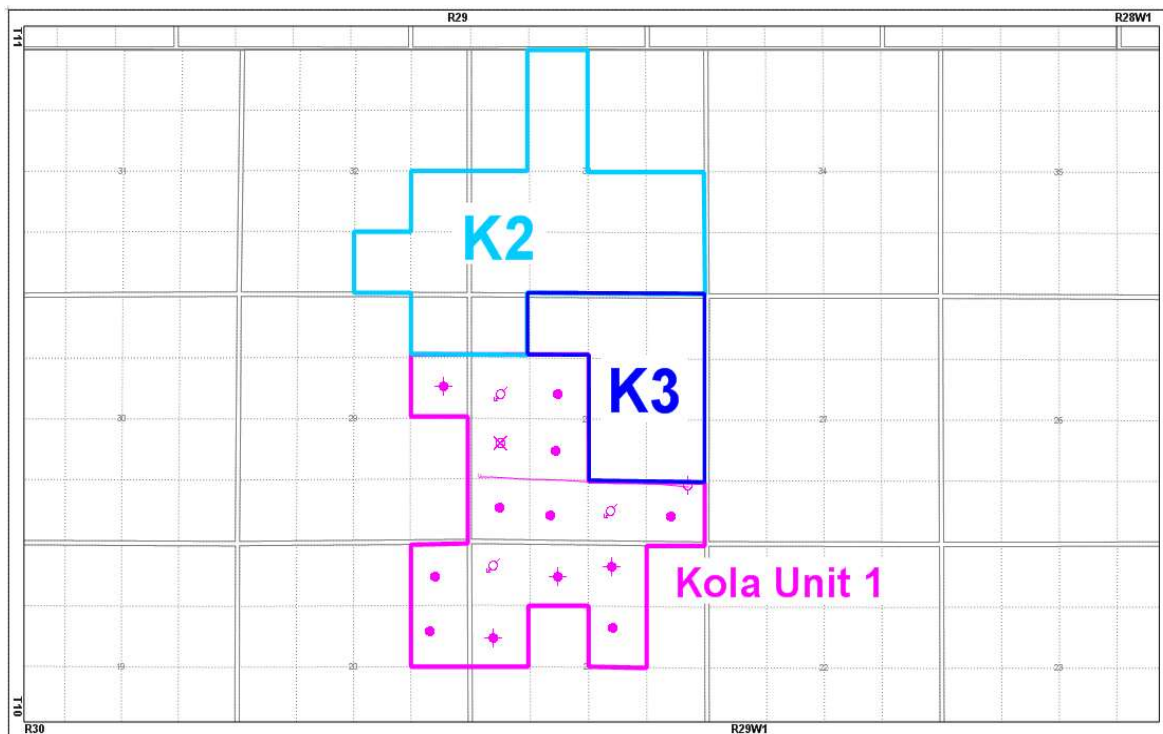
Tundra Oil and Gas

July 9, 2019

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 17 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 2018 EOR report as per section 73 of the Drilling and Production Regulations.

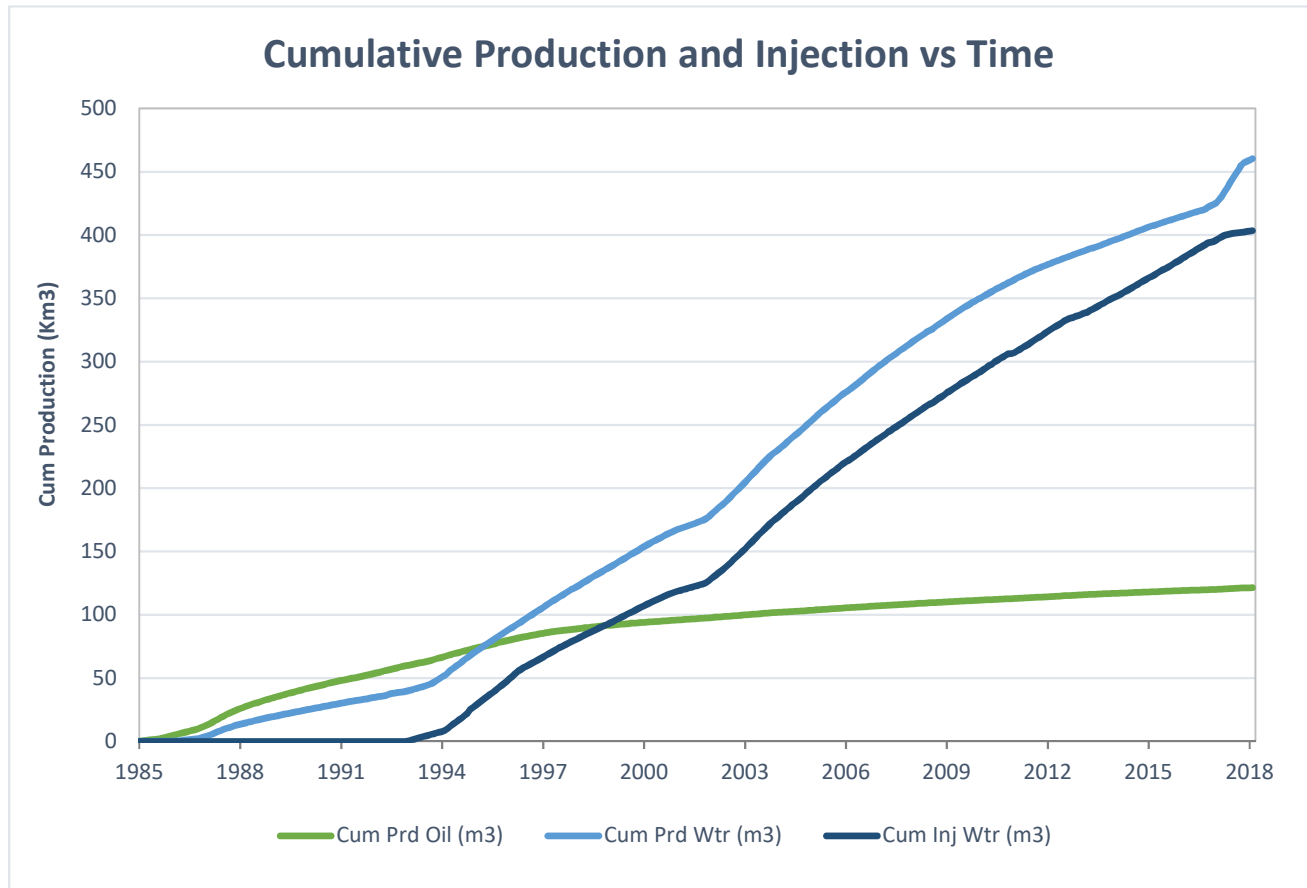
a) Monthly oil and water production rates, injection rate, GOR and WOR

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	4.83	119.97	41.10	24.83	0
Feb-2018	4.79	116.15	23.39	24.25	0
Mar-2018	5.07	122.07	15.26	24.06	0
Apr-2018	4.15	119.75	11.17	28.88	0
May-2018	3.90	118.09	10.81	30.25	0
Jun-2018	4.21	106.40	9.20	25.27	0
Jul-2018	3.44	115.07	10.90	33.46	0
Aug-2018	2.50	63.34	7.19	25.30	0
Sep-2018	2.11	35.60	11.20	16.87	0
Oct-2018	2.09	35.15	11.19	16.84	0
Nov-2018	2.19	34.24	11.00	15.61	0
Dec-2018	2.00	35.33	11.06	17.69	0

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

2018 PRODUCTION	
Produced Oil (m ³)	1,253
Produced Gas (m ³)	0
Produced Water (m ³)	31,012
Fluid Injected (m ³)	5,265
CUMULATIVE PRODUCTION	
Produced Oil (m ³)	121,480
Produced Water (m ³)	461,511

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 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	177.0	6287	925.0	4605	172.0	6648	1274.0	5847
Feb-2018	163.0	6343	338.0	341	154.0	6666	655.0	4450
Mar-2018	181.0	6481	124.0	392	168.0	6668	473.0	4514
Apr-2018	174.0	6497	0.0	-15	161.0	6654	335.0	4379
May-2018	175.0	6507	0.0	-7	160.0	6595	335.0	4365
Jun-2018	154.0	5966	0.0	-8	122.0	4575	276.0	3511
Jul-2018	180.0	6373	0.0	-9	158.0	6516	338.0	4293
Aug-2018	129.0	4406	0.0	-9	94.0	3835	223.0	2744
Sep-2018	177.0	6136	0.0	-9	159.0	6645	336.0	4257
Oct-2018	181.0	6198	0.0	-9	166.0	6619	347.0	4269
Nov-2018	170.0	6002	0.0	-79	160.0	6439	330.0	4121
Dec-2018	164.0	5671	0.0	-82	179.0	6655	343.0	4081
Total	2025.0		1387.0		1853.0		5265.0	
Avg Inj P		6072		426		6210		4236

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	1274.0	655.0	473.0	335.0	335.0	276.0	338.0	223.0	336.0	347.0	330.0	343.0
Daily (m³/d)	41.10	23.39	15.26	11.17	10.81	9.20	10.90	7.19	11.20	11.19	11.00	11.06

2018 AVG. ANNUAL DAILY INJECTION = 14.46 m3/d

CUMULATIVE INJECTION TO Dec 31, 2017 = 398,549 m3

TOTAL 2018 ANNUAL INJECTION = 5,265 m3
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CUMULATIVE INJECTION TO Dec 31, 2018 = 403,814 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
100.04-28-010-29W1.00	Polish Rod Repair	2/5/2018

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	149.8	120.38	3719.2	434.22	1274.0	399.82	0.328	0.710
Feb-2018	134.1	120.51	3252.1	437.47	655.0	400.48	0.193	0.707
Mar-2018	157.3	120.67	3784.1	441.26	473.0	400.95	0.120	0.703
Apr-2018	124.4	120.79	3592.4	444.85	335.0	401.29	0.090	0.699
May-2018	121.0	120.91	3660.7	448.51	335.0	401.62	0.088	0.695
Jun-2018	126.3	121.04	3192.1	451.70	276.0	401.90	0.083	0.691
Jul-2018	106.6	121.15	3567.2	455.27	338.0	402.23	0.092	0.688
Aug-2018	77.6	121.22	1963.4	457.23	223.0	402.46	0.109	0.686
Sep-2018	63.3	121.29	1068.1	458.30	336.0	402.79	0.296	0.685
Oct-2018	64.7	121.35	1089.6	459.39	347.0	403.14	0.299	0.684
Nov-2018	65.8	121.42	1027.3	460.42	330.0	403.47	0.301	0.683
Dec-2018	61.9	121.48	1095.3	461.51	343.0	403.81	0.295	0.683

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	WIW Conversion
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	-