

EWART UNIT NO. 4
WATERFLOOD EOR PROJECT
ANNUAL REPORT FOR 2016

April 21, 2017

Tundra Oil and Gas Partnership

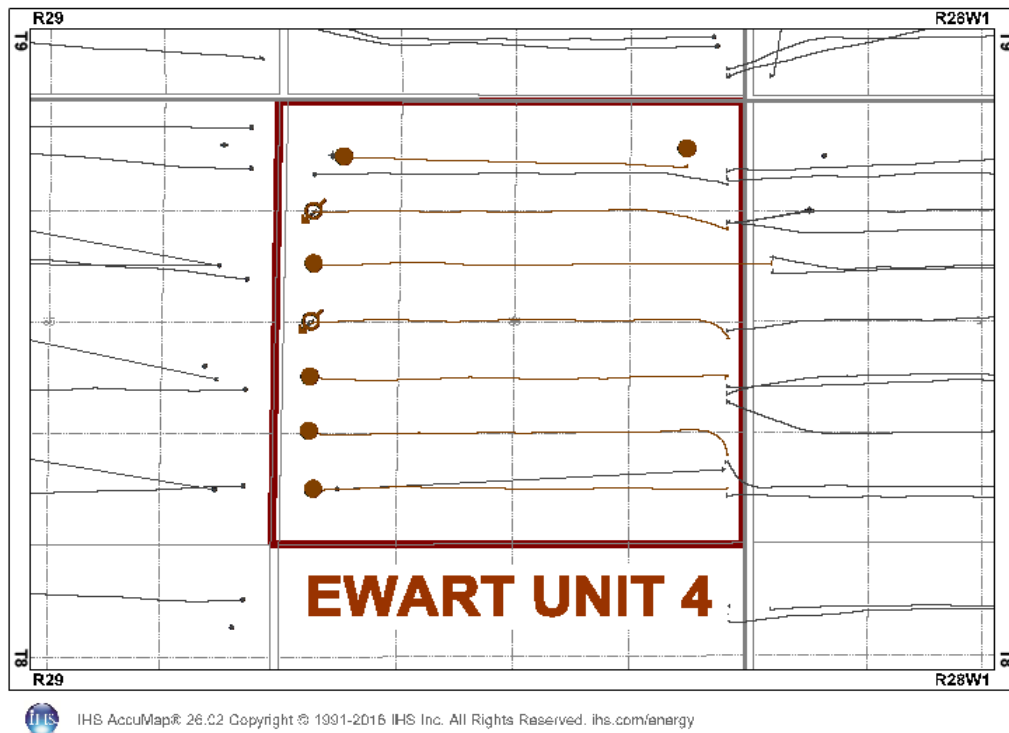
Table of Contents

Introduction	3.
Discussion	3.
Production History	3.
Waterflood Development Plan	5.
Waterflood EOR Operating Strategy and Performance	6.
Water Source and Quality	6.
Injection Wellhead Pressures	6.
Reservoir Pressure	6.
Well Servicing	6.
Waterflood Performance Discussion	6.
List of Appendices	7.
Appendix A: Well Name and Status Table	
Appendix B: Injection Pattern Summary	
Appendix C: Average Monthly Injection Pressure Summary	
Appendix D: Injector Pattern Production/Injection Rates, Cumulative and VRR Plots for the following injectors:	
102/05-36-008-29W1	
102/12-36-008-29W1	
103/12-36-008-29W1	

INTRODUCTION

Ewart Unit No. 4 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Waterflood Order No. 43, effective February 1, 2015 with Tundra Oil and Gas (Tundra) as Operator. The Unit area contains 1 abandoned vertical well and 5 horizontal producing wells and 2 horizontal injectors in 16 LSDs in Township 8 Range 29 W1 as shown in the figure below.

Figure 1: Ewart Unit No. 4 Area Outline



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the following 2016 Annual Progress Report for Ewart Unit No. 4.

DISCUSSION

Production History

For the wells included in Ewart Unit No. 4, production started in October 2006 with the 00/16-36-008-29W1 well. Average oil production peaked at 3.08 m³/d per well in January 2012. This production was coming from 3 wells and totaled 24.64 m³/d for the whole Unit. In December 2016, the Unit was producing 6.19 m³/d of oil and 22.22 m³/d of

water. Water injection commenced in Ewart Unit No. 4 in November 2015. The rates and WOR are presented in Figure 2.

Figure 2: Ewart Unit No. 4 Production/Injection Rates and WOR vs Time

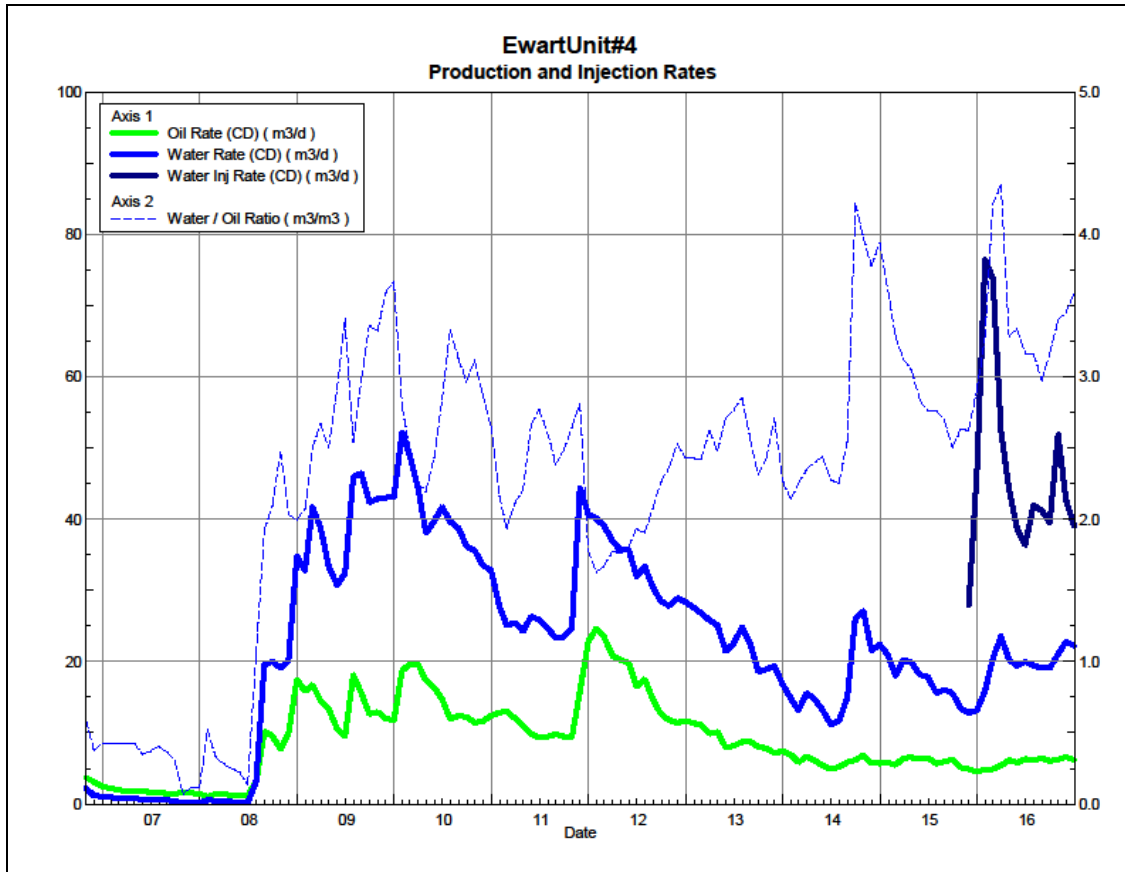
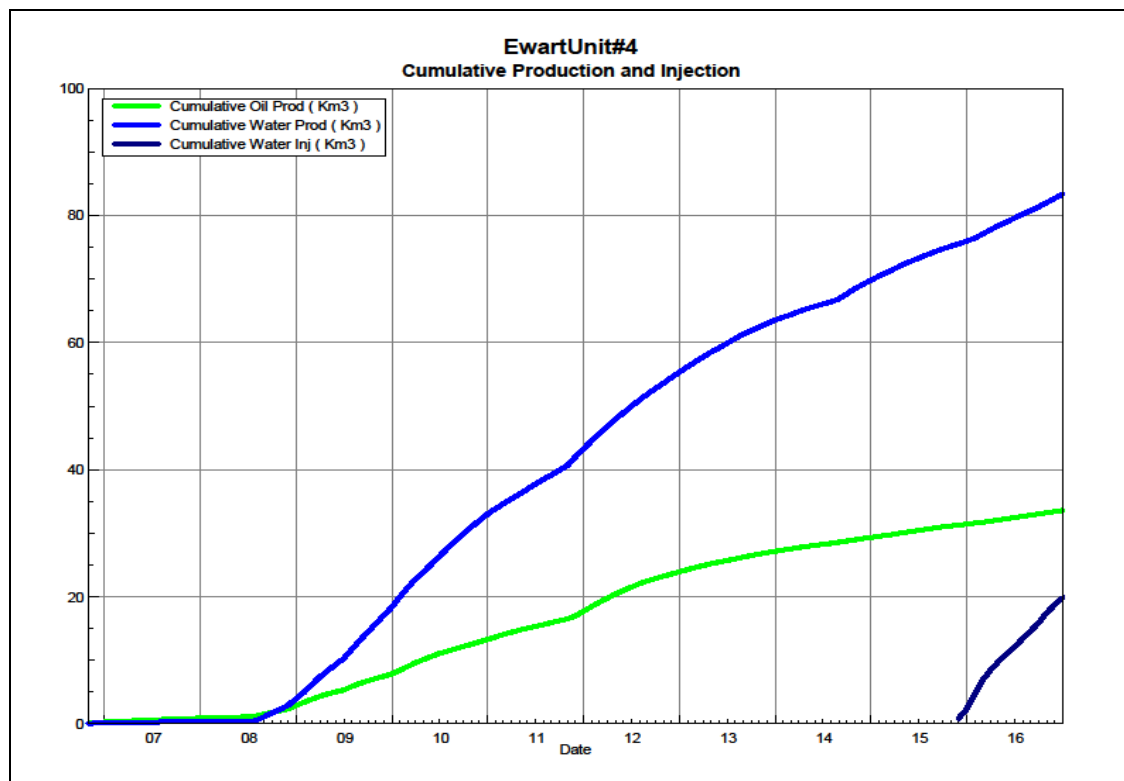


Figure 3 shows the cumulative production for Ewart Unit No. 4 to the end of December 2016 as 33.60 e³m³ of oil, and 83.36 e³m³ of water, representing a 6.3% recovery factor of the OOIP. The cumulative water injected was 19.89 e³m³.

Figure 3: Ewart Unit No. 4 Cumulative Oil, Water and Water Injected vs Time



Waterflood Development Plan

Ewart Unit No. 4 Waterflood (WF) Development Plan

Ewart Unit No. 4 is still in the development phase at the end of 2016. The three (3) proposed horizontal injection wells were drilled in 2011 between the existing horizontal producing wells, completing an effective 20 acre line drive waterflood pattern. In order to maximize recovery, new injection wells are placed on injection after a pre-production period to clean-up the reservoir near the wellbore. In November 2011, the proposed injectors were put on production. In 2015, Tundra converted the 02/12-36 and 03/12-36-008-29W1 producers to injectors. All horizontal wells are fracture stimulated to improve the injection rates. In December 2016, Tundra converted the 02/05-36 producer to an injector. Production performance by injector pattern is summarized in Appendix B.

Any future revisions to the waterflood development or surveillance plan would be based on new production or performance response data, technical studies, or observed reservoir behavior and reserves recovery interpretations.

Waterflood EOR Operating Strategy and Performance

Water Source and Quality

The injection water for Ewart Unit No. 4 will be sourced from the 16-32-007-29W1 well (Lodgepole formation). The water is treated at the 03-04-008-29W1 battery where it is filtered to 0.5 microns and has scale inhibitor added. The injection water is then distributed to the injectors through the dedicated infrastructure system.

Injection Wellhead Pressures

Injection started in this Unit in November 2015. The average monthly wellhead injection pressure for each injector is summarized in Appendix C. Since injection in this Unit is still in the early stages, the injectors are still building up to a target injection pressure of 6300 kPaa.

Reservoir Pressure

Where practical, Tundra is committed to collecting pressure data from newly drilled injection wells. For Ewart Unit No. 4, pressure data is currently available for the 02/05-36, 02/12-36 and 03/12-36-008-29W1 locations. The reservoir pressures are 7314, 7517 and 6437 kPa(a), respectively. Pressures are corrected to a common datum of -450 m SS for comparison with other units in the area.

Well Servicing

Table 1 lists the maintenance that was required in Ewart Unit No. 4 in 2016.

Table 1: Service and Maintenance in Ewart Unit No. 4

102.05-36-008-29W1.00	WIW Conversion	12/11/2016
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Waterflood Performance Discussion

At the end of 2016, Ewart Unit No. 4 waterflood area had 3 injection patterns in place. The waterflood area had three (3) proposed horizontal injection wells drilled and put on production in 2011. Water injection began in November 2015, after the conversion of the 02/12-36 and 03/12-36 producers to injectors. In December 2016, Tundra converted the 02/05-36 producer to an injector.

A summary table of the injector pattern(s) is presented in Appendix B. Plots of the production are presented in Appendix D for each of the injection pattern(s).

List of Appendices

Appendix A: Well Name and Status Table

Appendix B: Injection Pattern Summary

Appendix C: Average Monthly Injection Pressure Summary

Appendix D: Injector Pattern Production/Injection Rates, Cumulative and VRR Plots
for the following injectors:

102/05-36-008-29W1

102/12-36-008-29W1

103/12-36-008-29W1

Appendix A

UWI	Surface Location	Well Status
00/04-36-008-29W1/0	01-36-008-29W1	Capable of OIL Prod
00/05-36-008-29W1/0	08-36-008-29W1	Capable of OIL Prod
02/05-36-008-29W1/0	02/01-36-008-29W1	Water Injection
00/12-36-008-29W1/0	12-31-008-28W1	Capable of OIL Prod
02/12-36-008-29W1/0	02/08-36-008-29W1	Water Injection
03/12-36-008-29W1/0	03/09-36-008-29W1	Water Injection
02/13-36-008-29W1/0	16-36-008-29W1	Capable of OIL Prod
00/16-36-008-29W1/0	16-36-008-29W1	Abandoned Zone

Appendix B

Ewart Unit No. 4 Injection Pattern Summary as of December 2016

Pattern Name	Injector BH Location (008-29W1)	Injector Surf. Location (008-29W1)	Status	No. of Supported Wells	Supported Wells (008-29W1)	Allocation Factor	Pattern Prod Start Month	Inj Start Month	Oil Rate (m³/d)	Water Rate (m³/d)	WOR (m³/m³)	Water Injection (m³/d)	Cum Oil (E³m³)	Cum Water (E³m³)	Cum Inj Water (E³m³)	Monthly VRR	Cum VRR
02/05-36-008-29W1 Injector	02/05-36	02/01-36	Capable of Oil Production	2	04-36, 05-36	0.5	Nov 2008	-	1.5	5.0	3.32	-	8.6	25.3	0.0	0.000	0.000
02/12-36-008-29W1 Injector	02/12-36	02/08-36	WTR Injection	2	05-36, 12-36	0.5	Jun 2009	Nov 2015	1.8	8.2	4.5	15.4	8.0	21.1	9.5	1.514	0.320
03/12-36-008-29W1 Injector	03/12-36	03/09-36	WTR Injection	3	12-36, 02/13-36, 16-36	0.5	Oct 2006	Nov 2015	1.7	6.5	3.9	23.7	10.2	17.7	10.4	2.840	0.363

Appendix C

Average Monthly Injection Pressure (kPag)

Month	102/12-36	103/12-36
Nov-15	-75	-68
Dec-15	138	55
Jan-16	2117	1904
Feb-16	2892	2863
Mar-16	2867	2882
Apr-16	2986	2985
May-16	2988	2983
Jun-16	3090	2953
Jul-16	4161	3033
Aug-16	4460	2961
Sep-16	4572	2984
Oct-16	4891	4684
Nov-16	4711	4719
Dec-16	4956	4956

Appendix D

Rates and VRR Plots

Oil Formation Vol. Factor : 1.0015 m3/m3
Pattern: 02/05-36-008-29Inj Set: EwartUnit#4

Water Formation Vol Factor : 1.0015 m3/m3

Water / Oil Ratio : 3.70 m3/m3

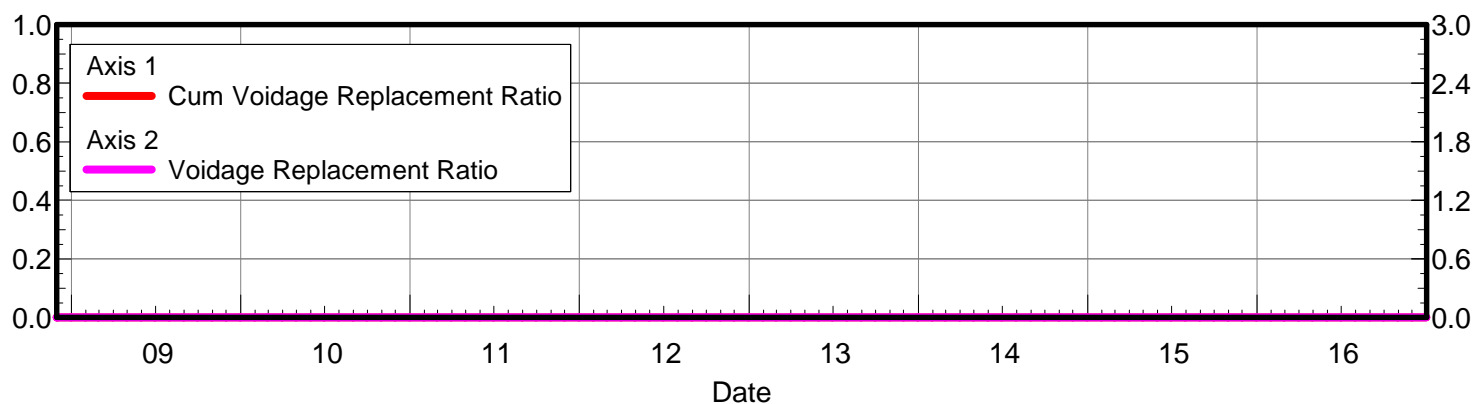
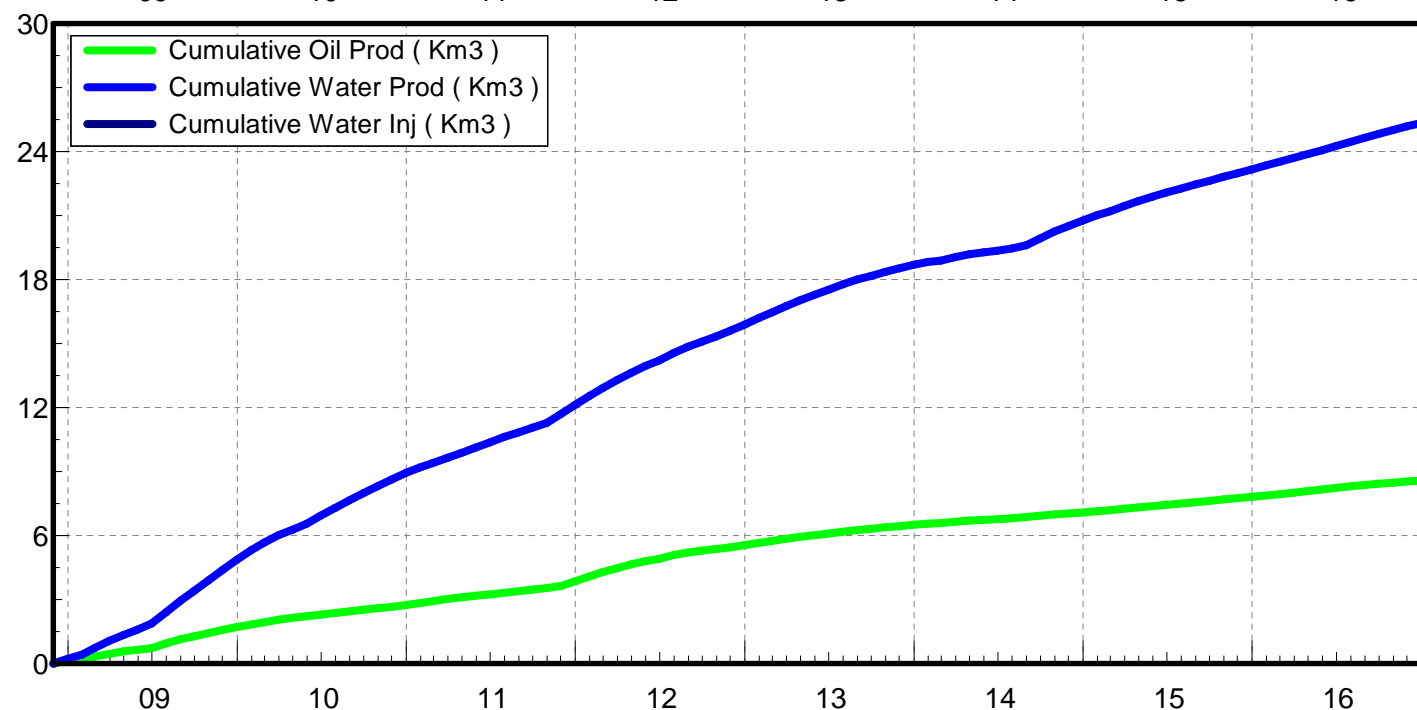
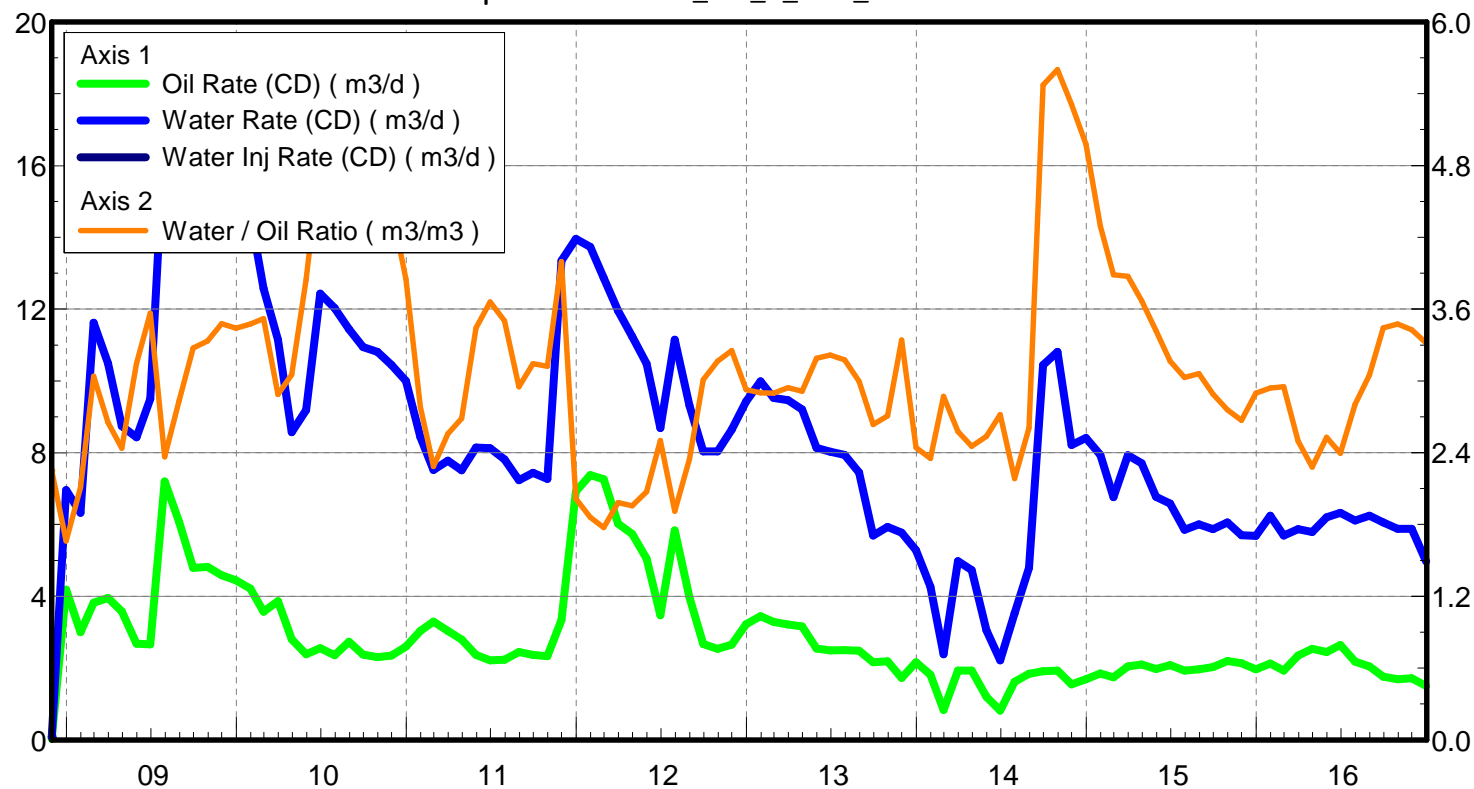
Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 0.82 m3/d

Water Rate (CD) : 3.02 m3/d

Water Inj Rate (CD) : 3.16 m3/d

April 21, 2017

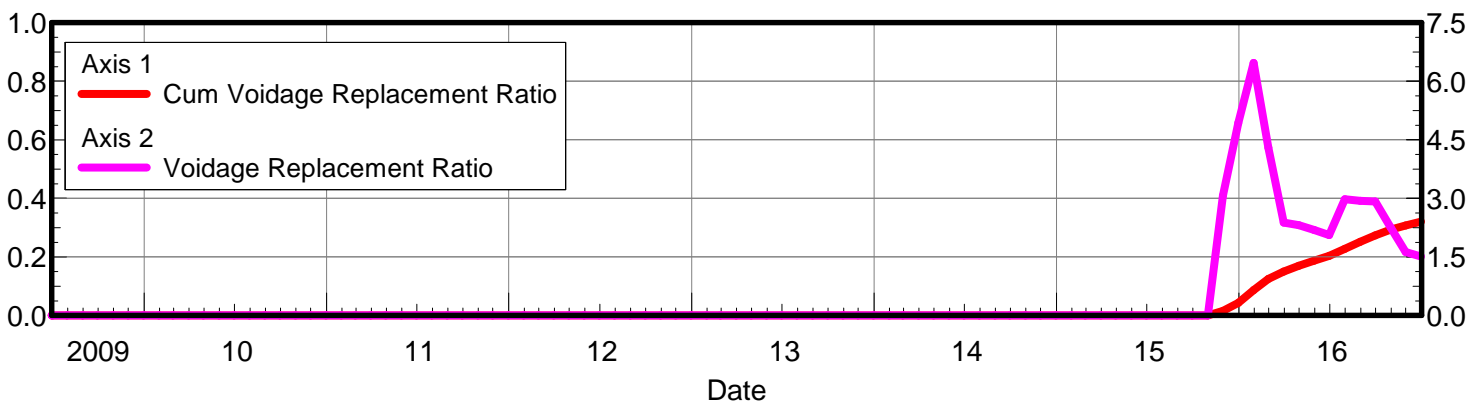
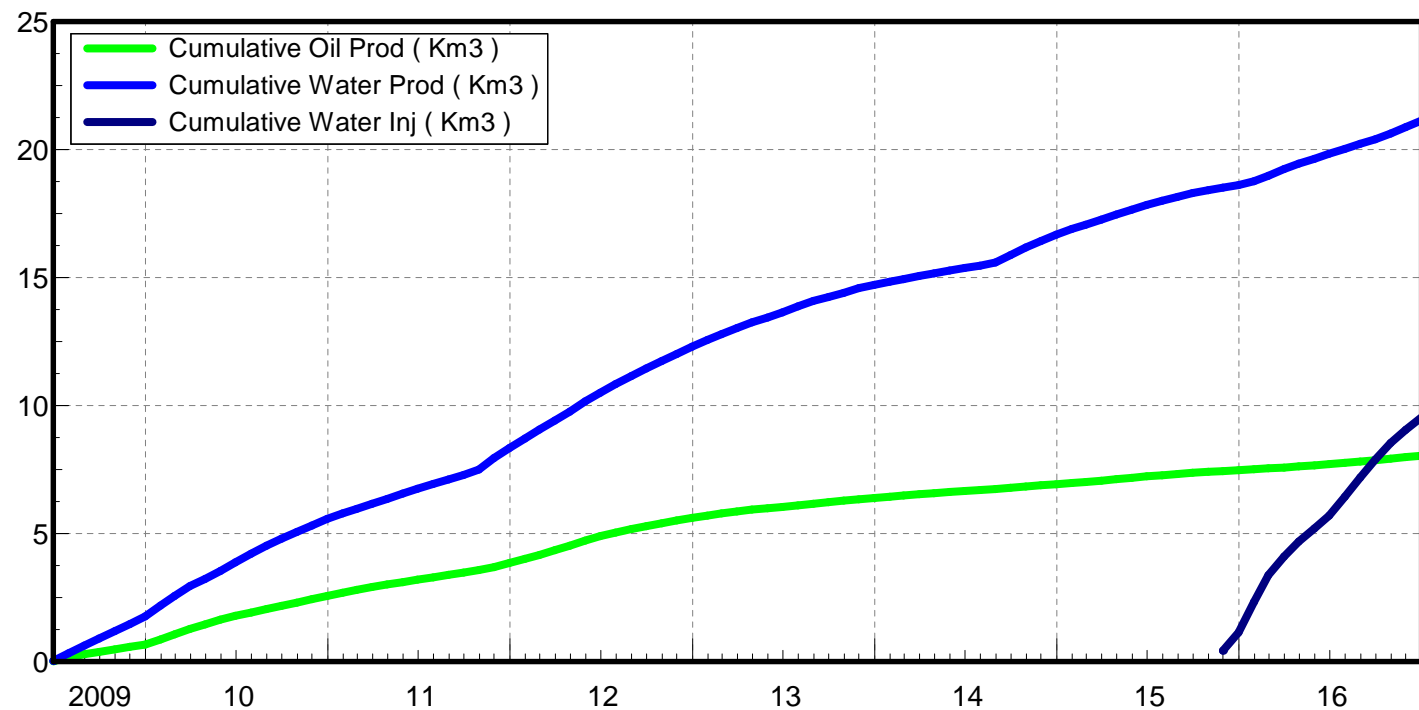
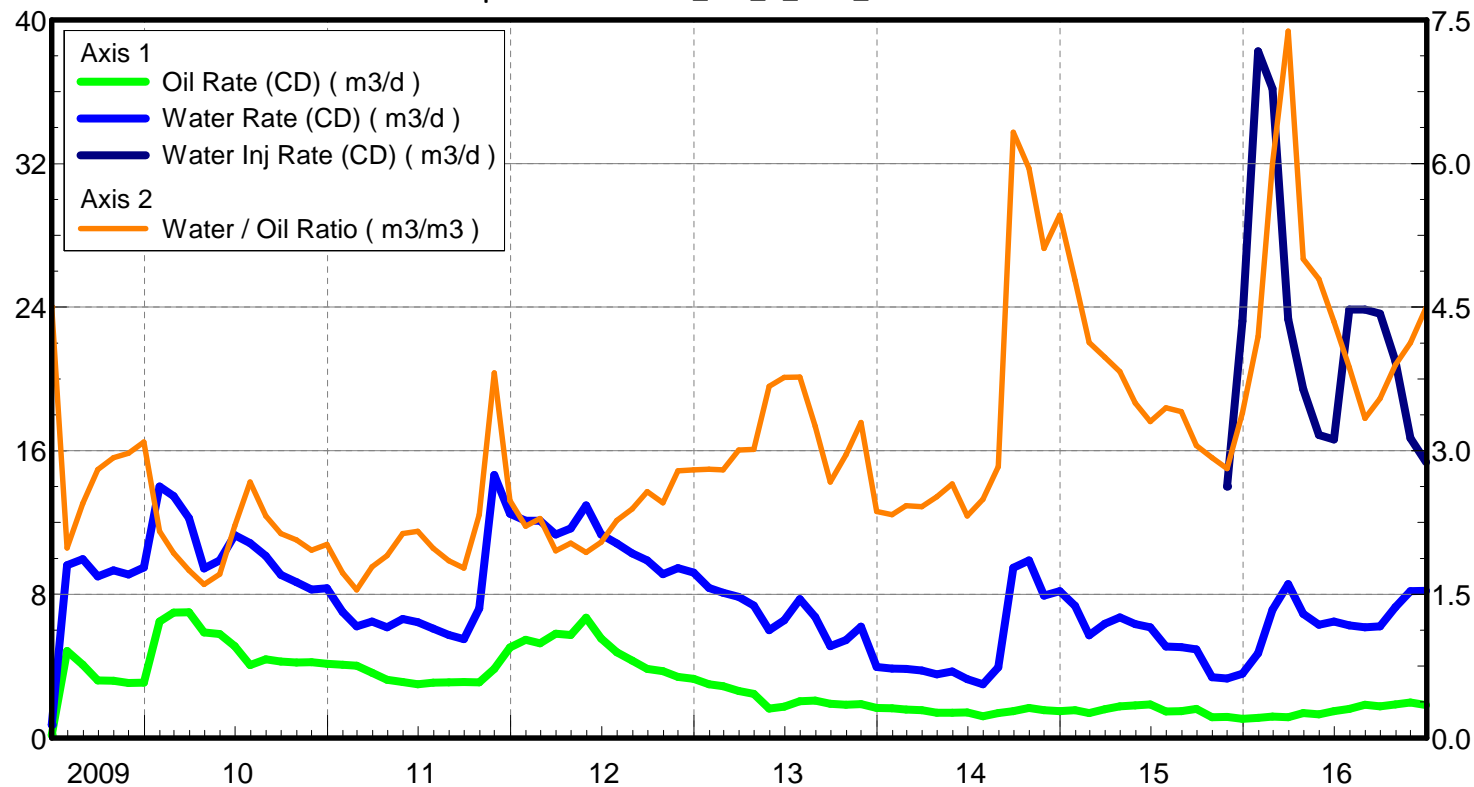


Oil Formation Vol. Factor : 1.0015 m3/m3
Water Formation Vol Factor : 1.0015 m3/m3
Water / Oil Ratio : 4.64 m3/m3
Operator: TUNDRA_OIL_&_GAS_LIMITED

Pattern: 02/12-36-008-29Inj Set: EwartUnit#4

Oil Rate (CD) : 1.62 m3/d
Water Rate (CD) : 7.50 m3/d
Water Inj Rate (CD) : 17.87 m3/d

April 21, 2017



Oil Formation Vol. Factor : 1.0015 m3/m3
Pattern: 03/12-36-008-29Inj Set: EwartUnit#4

Water Formation Vol Factor : 1.0015 m3/m3

Water / Oil Ratio : 4.05 m3/m3

Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 1.47 m3/d

Water Rate (CD) : 5.95 m3/d

Water Inj Rate (CD) : 21.29 m3/d

April 21, 2017

