

**SINCLAIR UNIT NO. 7**  
**WATERFLOOD EOR PROJECT**  
**ANNUAL REPORT FOR 2014**

**March 30, 2015**

**Tundra Oil and Gas Partnership**

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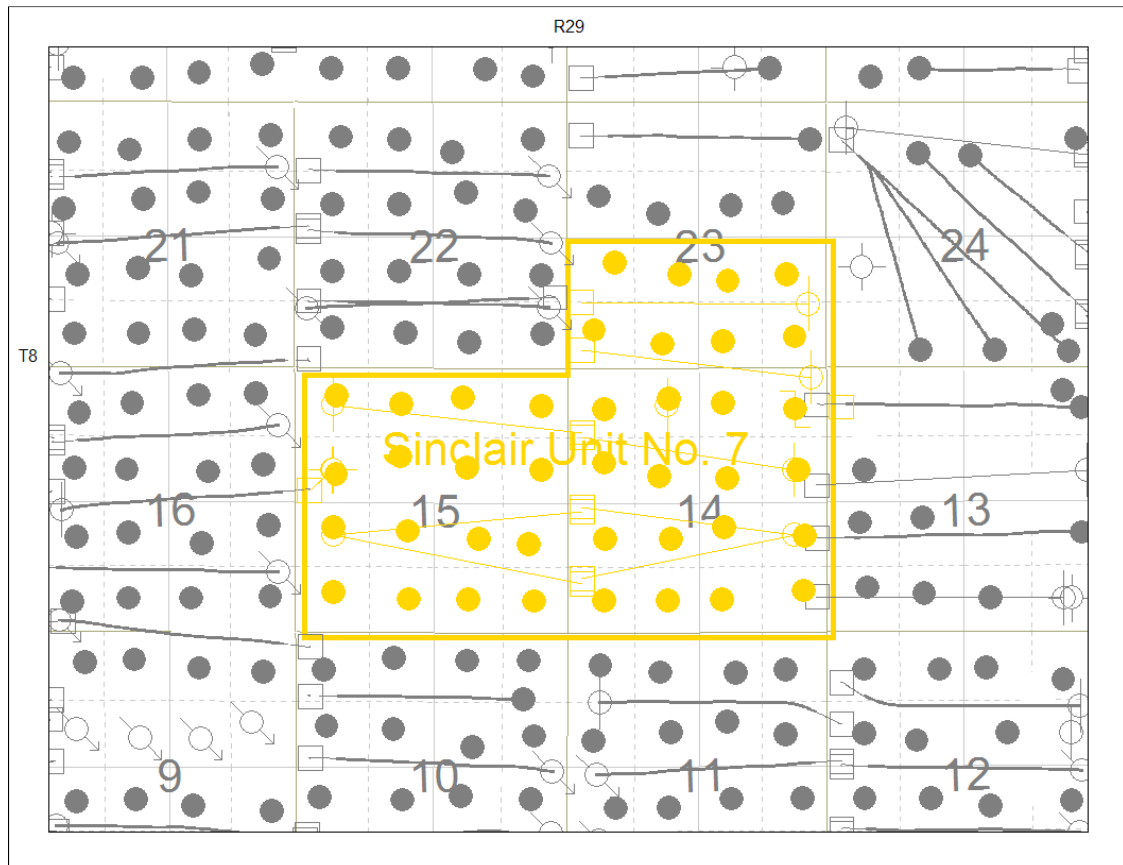
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02/08-14-008-29W1  
03/08-14-008-29W1  
02/09-14-008-29W1  
02/16-14-008-29W1  
02/04-15-008-29W1 (Inter-Unit Injector)  
02/05-15-008-29W1  
03/05-15-008-29W1  
04/12-15-008-29W1  
02/01-23-008-29W1

## **INTRODUCTION**

Sinclair Unit No. 7 Enhanced Oil Recovery (EOR) Waterflood was approved under Waterflood Order No. 26 effective July 1, 2013 with Tundra Oil and Gas (Tundra) as operator. The Unit area contains 41 producing wells in 2½ sections in Township 8 Range 29 W1 as shown in the figure below.

**Figure 1: Sinclair Unit 7 Area Outline**



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra hereby submits the following 2014 Annual Progress Report for Sinclair Unit No. 7.

## **DISCUSSION**

### **Production History**

For the wells included in Sinclair Unit No. 7, production started in March 2005 with 00/13-14-008-29W1 and 00/13-15-008-29W1. Average oil production peaked at 5.3 m³/d per well in March of 2006. This production was coming from 27 wells and totaled 142.7

m<sup>3</sup>/d for the whole Unit. In December 2014, the Unit was producing 51.70 m<sup>3</sup>/d of oil and 21.21 m<sup>3</sup>/d of water. Water injection commenced in Sinclair Unit No. 7 in August 2013. The rates and WOR are presented in Figure 2.

**Figure 2: Sinclair Unit 7 Production/Injection Rates and WOR vs Time**

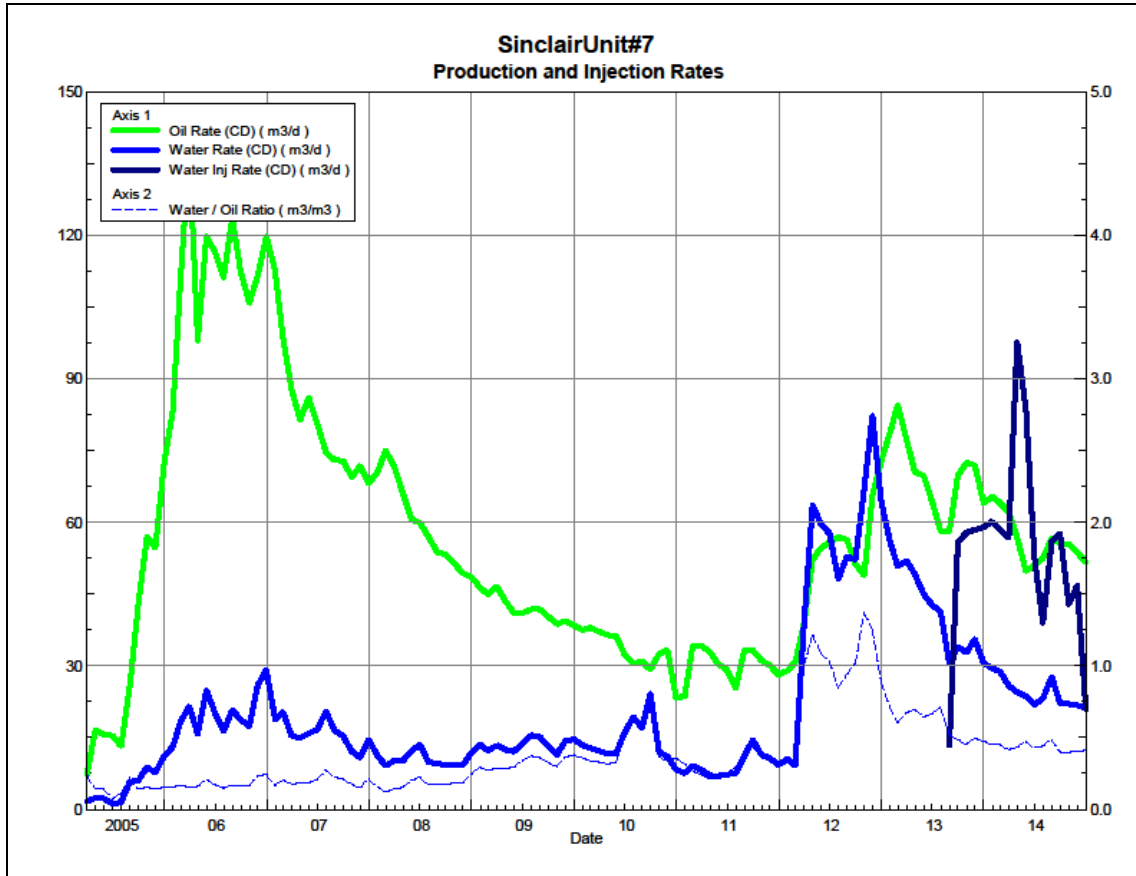
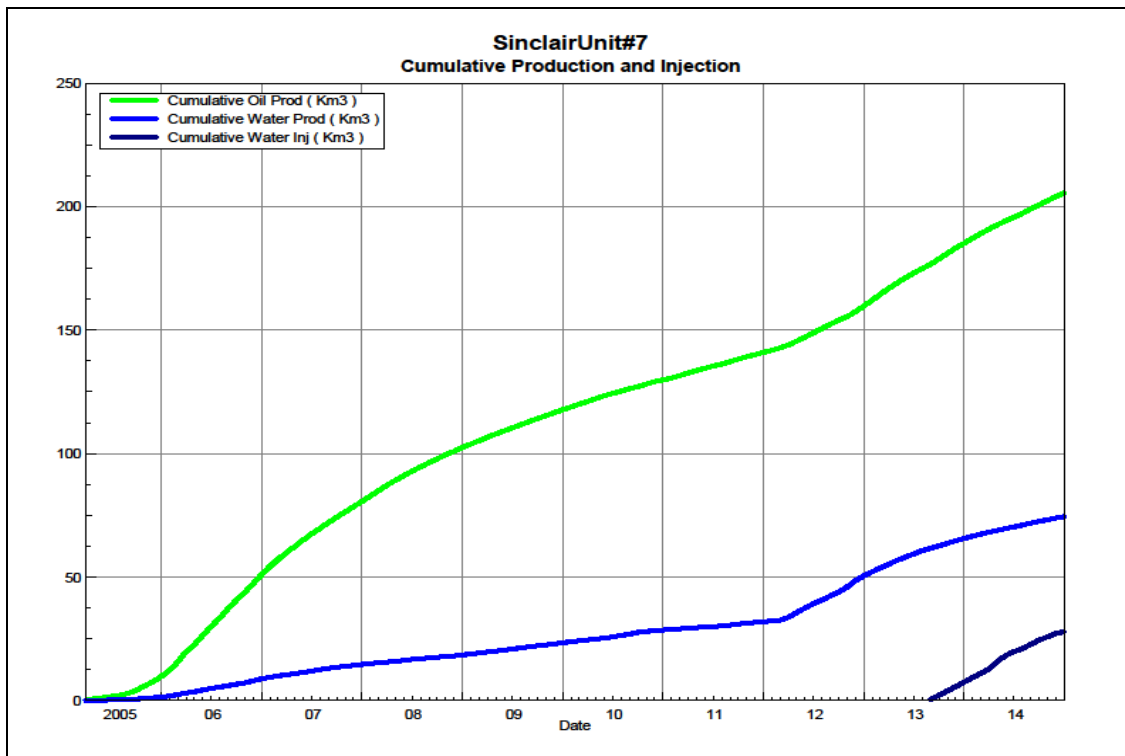


Figure 3 shows the cumulative production for Sinclair Unit 7 to the end of December 2014 as 205.7 E<sup>3</sup>m<sup>3</sup> of oil, and 74.6 E<sup>3</sup>m<sup>3</sup> of water, representing a 10.8% recovery factor of the OOIP.

**Figure 3: Sinclair Unit 7 Cumulative Oil, Water and Water Injected vs Time**



## **Waterflood Development Plan**

### **Sinclair Unit No 7 Waterflood (WF) Development Plan**

Sinclair Unit No. 7 is still in the development phase at the end of 2014. In 2011, 2 of the 8 proposed horizontal injectors were drilled and the remaining 6 horizontal injection wells were drilled in 2012. In 2013, 2 inter-unit horizontal wells were drilled at 03/01-14 and 02/04-15-008-29W1/0. All of the horizontal wells are fracture stimulated to improve the injection rates. In order to maximize recovery from this Unit, Tundra plans the produce all of the injectors for a short period of time to clean-up the reservoir near the wellbores prior to being converted into water injectors. Water injection commenced in Sinclair Unit No. 7 in August 2013. As of December 2014, Sinclair Unit No. 7 had 4 injection patterns in place, including the inter-unit injector at 03/01-14.

Production performance by injector pattern are summarized in Appendix A.

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 Sinclair Unit No. 7 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 August 2013. The 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 wells. For Sinclair Unit No. 7, pressure data taken in 2012 and 2013 from 6 locations is available. A summary table is presented in Appendix B. Pressures are corrected to a common datum of -450 m SS for comparison with other units in the area.

### **Well Servicing**

The following table summarizes the maintenance that was required in Sinclair Unit No. 7 during 2014:

**Table 1: Sinclair Unit #7 Well Servicing**

100/05-23-008-29W1/00	Pump Change	3/19/2014
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## **Waterflood Performance Discussion**

At the end of 2014, Sinclair Unit No. 7 had 4 injection patterns in place, including the inter-unit injector at 03/01-14. The patterns consist of an east-west horizontal injector placed between 8 vertical producers (line drive pattern), 4 to the north and 4 to the south. The 02/14-14-008-29W1 short horizontal location will remain a producer in this unit. It was drilled to improve oil recovery in this portion of the unit. Conversion of the remaining 5 future injection wells is anticipated to take place in Q4 2015.

In 2013, the 03/01-14-008-29W1/0 and 02/04-15-008-29W1/0 horizontal locations were drilled as future inter-unit injectors. In August 2014, the 03/01-14 horizontal location was converted to an injector. It is Tundra's plan to produce the 02/04-15 location until mid-2015 and then convert it to an injector.

Plots of the production and injection data along with the VRR information for each injection pattern is presented in Appendix D.

## List of Appendices

Appendix A: Sinclair Unit No. 7 Injection Pattern Summary

Appendix B: Sinclair Unit No. 7 Reservoir Pressure Summary

Appendix C: Sinclair Unit No. 7 Monthly Injection Pressure Table

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

03/01-14-008-29W1 (Inter-Unit Injector)

02/08-14-008-29W1

03/08-14-008-29W1

02/09-14-008-29W1

02/16-14-008-29W1

02/04-15-008-29W1 (Inter-Unit Injector)

02/05-15-008-29W1

03/05-15-008-29W1

04/12-15-008-29W1

02/01-23-008-29W1



## Sinclair Unit No. 7 Injection Pattern Summary as of December 2014

[illegible]

## APPENDIX B

### Sinclair Unit #7 - Pressure Summary

Location	Test Date	Final Pressure (kPaa)	MPP (mTVD)	KB	Datum Depth	Gradient	Pressure @ -450 masl
102/08-14-008-29W1/00	July 15 - Aug 31, 2012	2528.46	952.74	520.08	-450	8.25	2672
103/08-14-008-29W1/00	June 18 - Sept 6, 2012	2202.77	952.47	520.01	-450	8.25	2347
102/09-14-008-29W1/00	January 20 - 30, 2012	4088.56	951.37	519.87	-450	8.25	4241
102/04-15-008-29W1/00	June 26 - July 23, 2013	2429.12	956.10	519.35	-450	8.25	2429
103/05-15-008-29W1/00	June 28 - Aug 18, 2012	2107.99	956.86	519.77	-450	8.25	2214
102/13-15-008-29W1/00	Jan 28 - Feb 5, 2012	2792.92	957.82	519.87	-450	8.25	2892

## Appendix C

### Average Monthly Injection Pressure (kPag)

Month	Injection Pressure			
	102/09-14	102/16-14	102/01-23	103/01-14
Jan-13	-	-	-	-
Feb-13	-	-	-	-
Mar-13	-	-	-	-
Apr-13	-	-	-	-
May-13	-	-	-	-
Jun-13	-	-	-	-
Jul-13	0	0	0	0
Aug-13	0	0	0	0
Sep-13	0	0	0	0
Oct-13	0	0	0	0
Nov-13	0	197	583	0
Dec-13	0	1075	1637	0
Jan-14	0	1768	2526	0
Feb-14	109	2423	3190	0
Mar-14	784	2444	2919	0
Apr-14	3102	4335	4190	0
May-14	3136	4851	4806	0
Jun-14	2291	4781	4987	0
Jul-14	862	4366	4700	0
Aug-14	1523	5198	5283	0
Sep-14	2662	4614	6197	0
Oct-14	2275	4976	6276	0
Nov-14	2785	4955	6169	-57
Dec-14	2919	3634	4872	-82

## **Appendix D**

### **Rates and VRR Plots**

# Pattern: 02/08-14-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.50 m3/m3

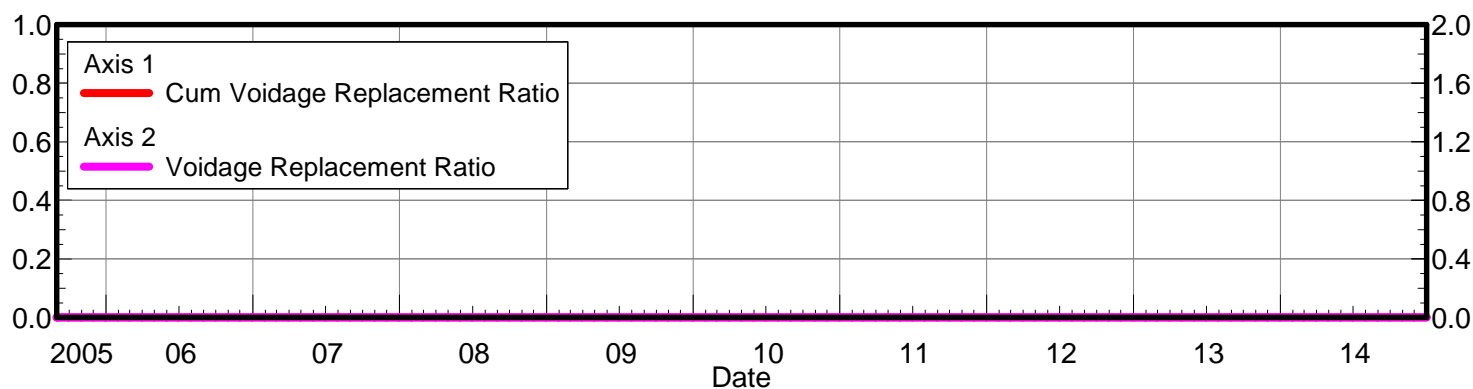
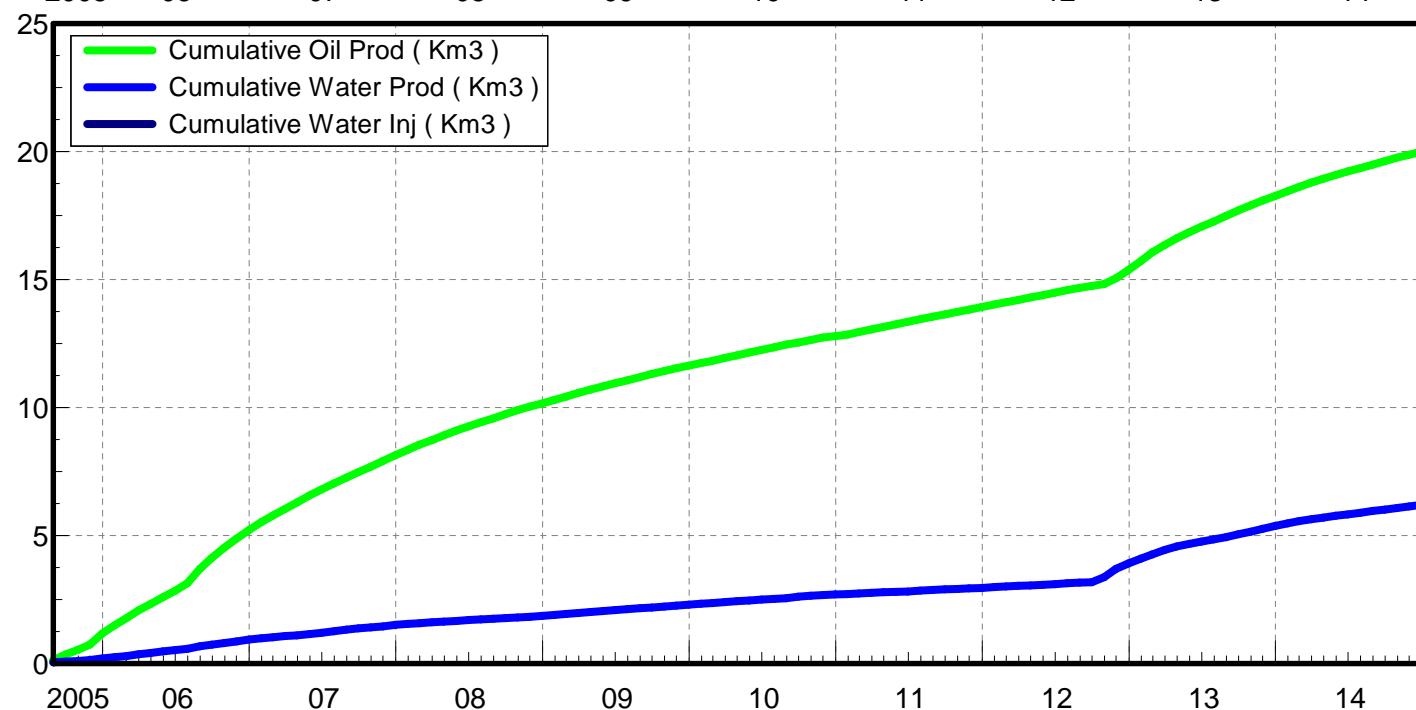
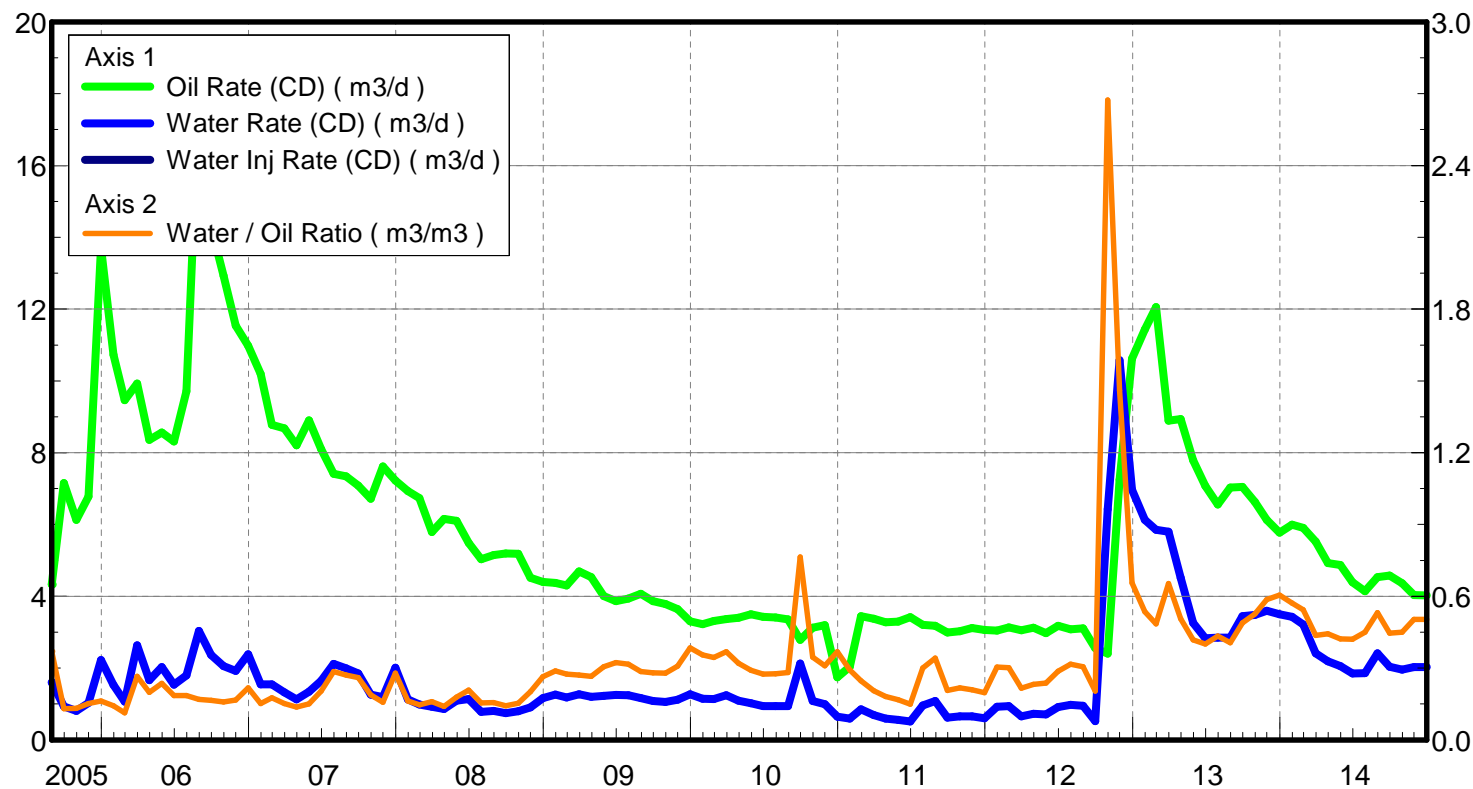
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 4.02 m3/d

Water Rate (CD) : 2.03 m3/d

Water Inj Rate (CD) : \* m3/d



# Pattern: 03/08-14-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.39 m3/m3

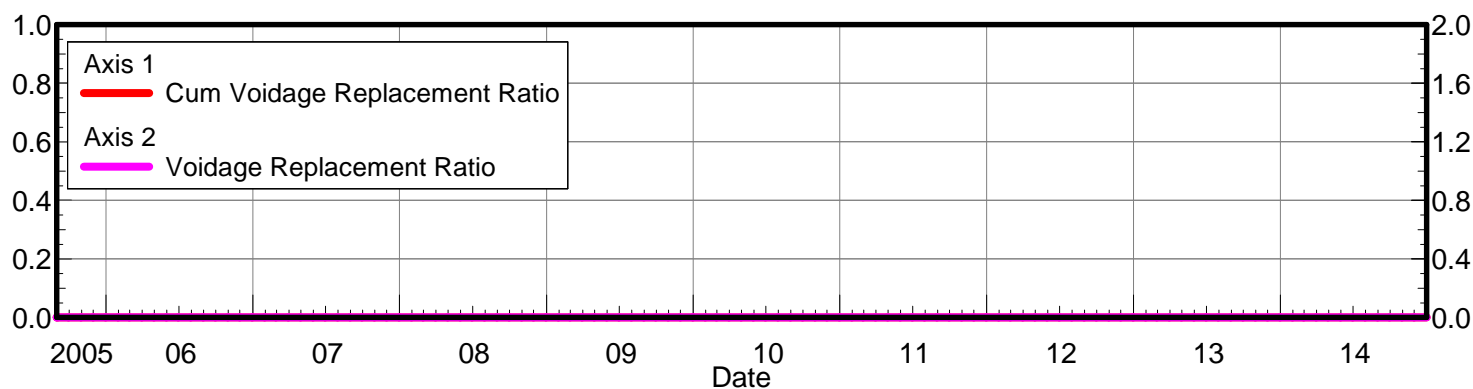
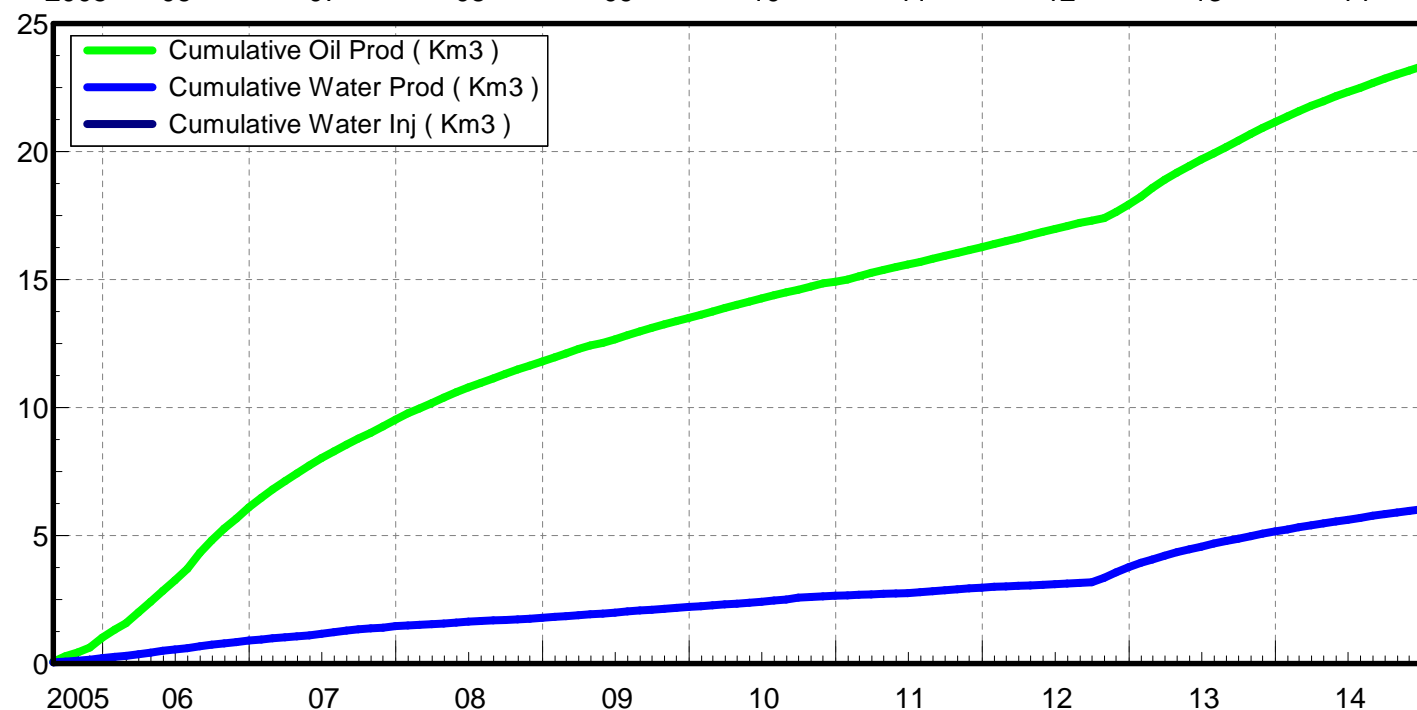
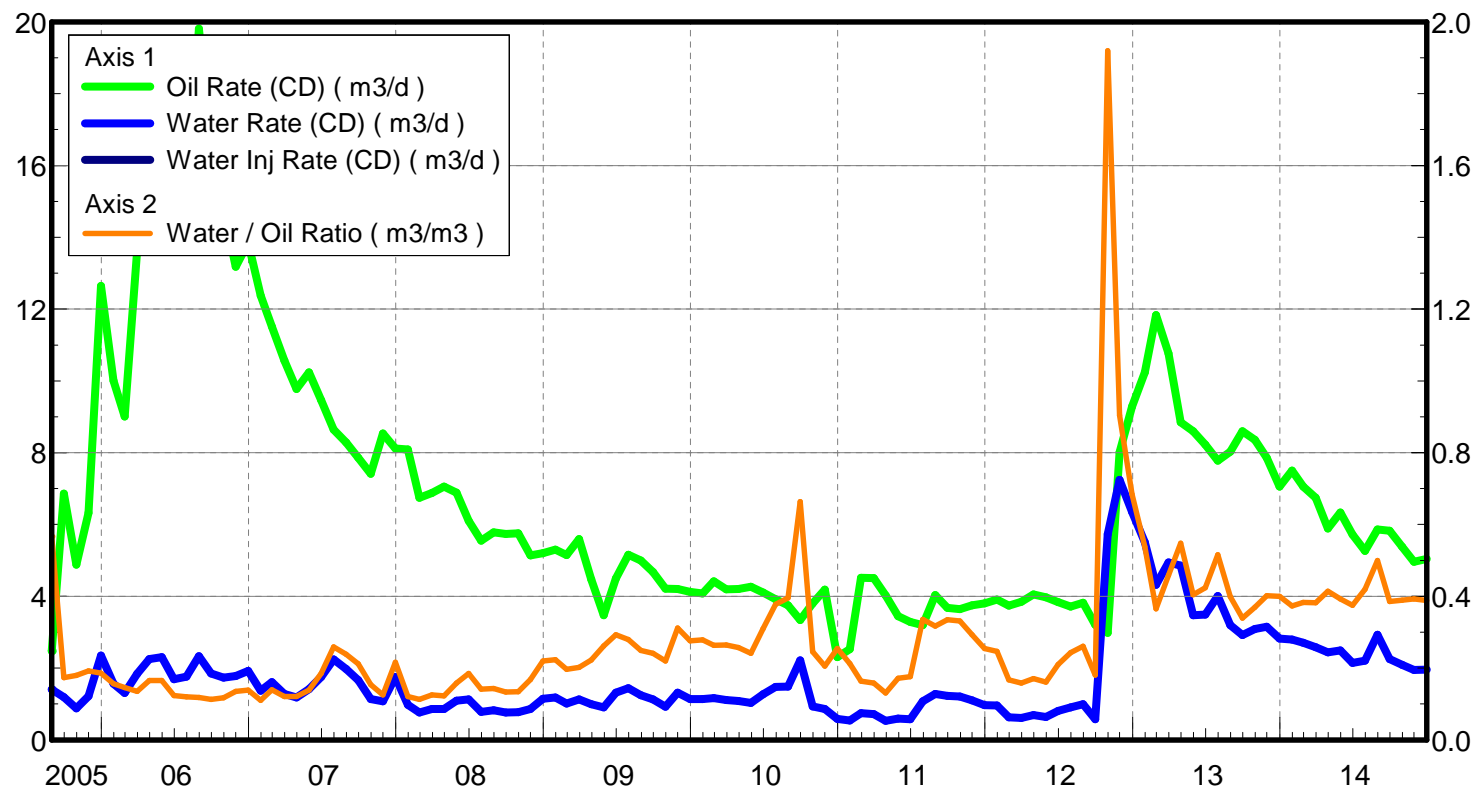
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 5.04 m3/d

Water Rate (CD) : 1.95 m3/d

Water Inj Rate (CD) : \* m3/d



# Pattern: 02/09-14-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.67 m3/m3

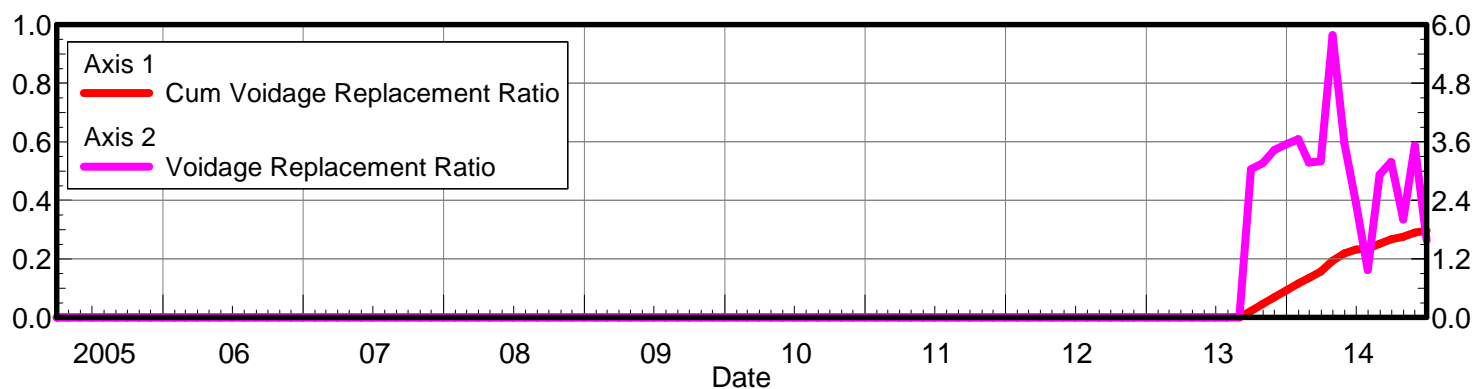
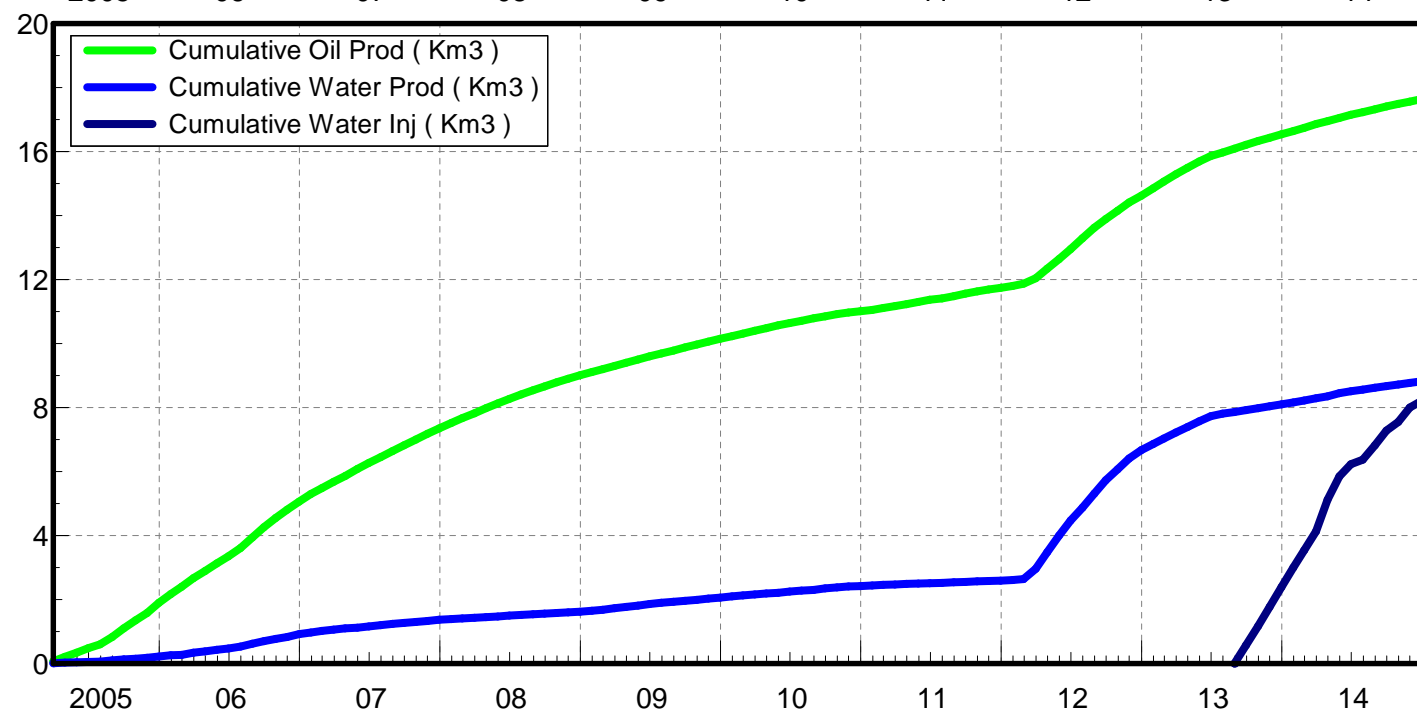
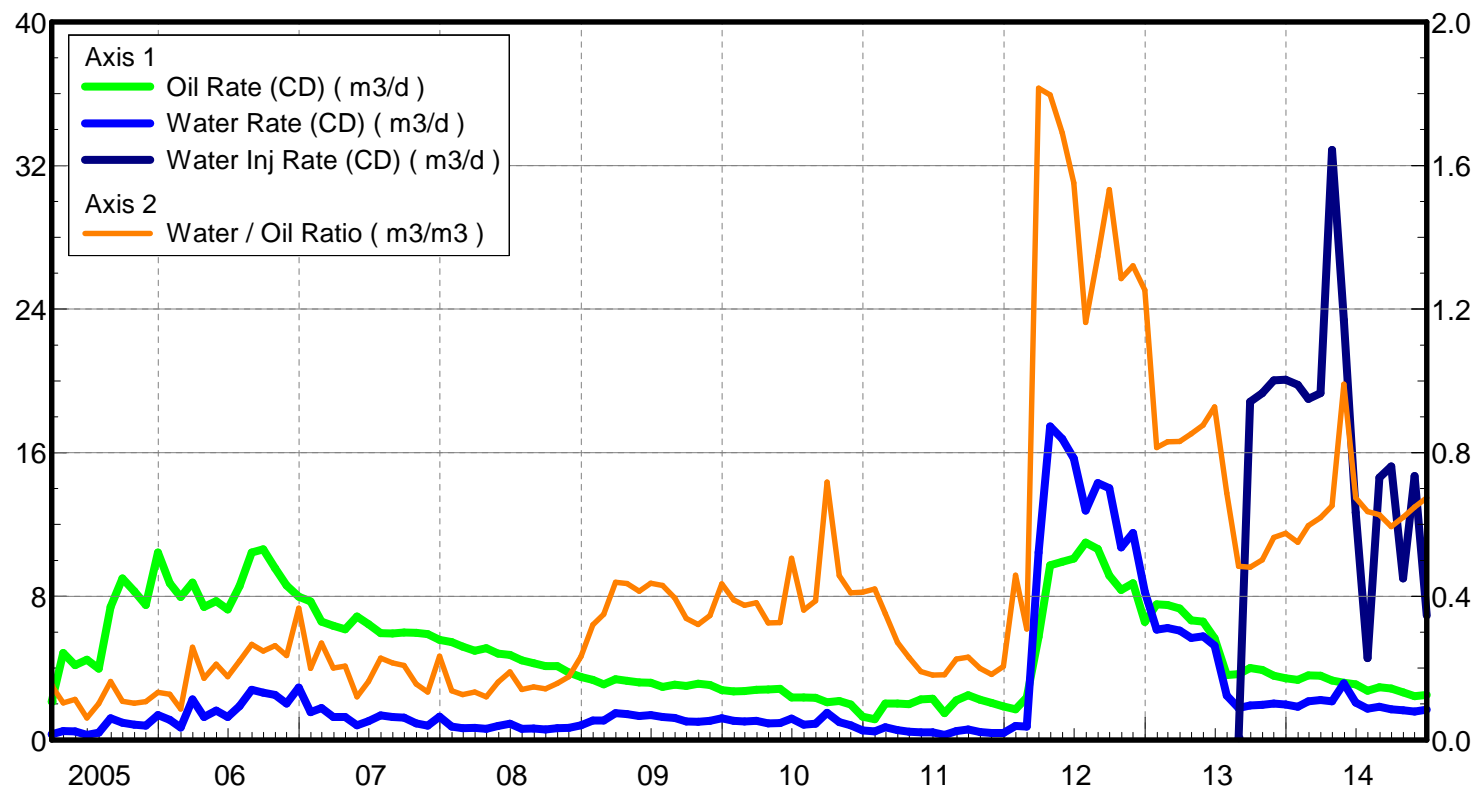
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 2.51 m3/d

Water Rate (CD) : 1.69 m3/d

Water Inj Rate (CD) : 6.94 m3/d



# Pattern: 02/16-14-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.43 m3/m3

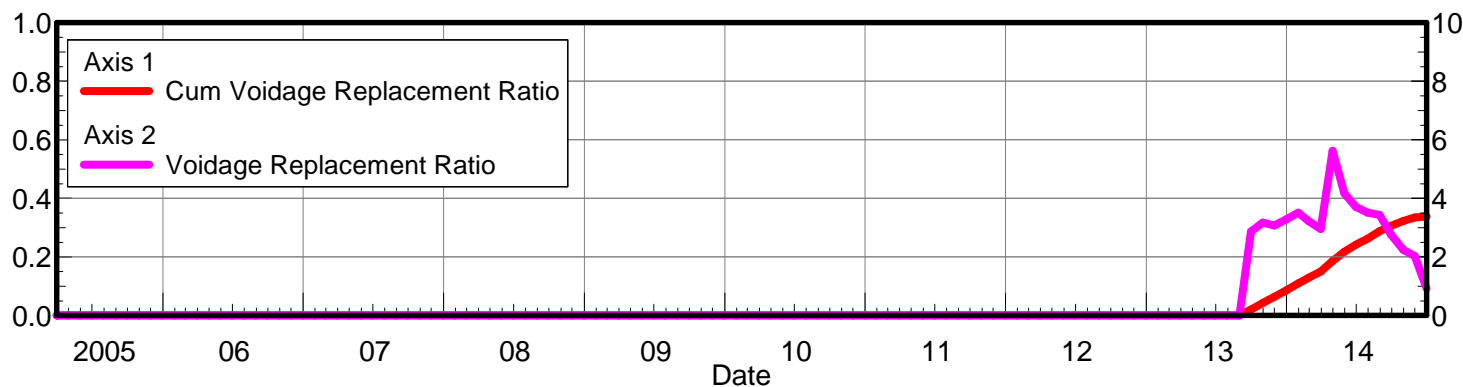
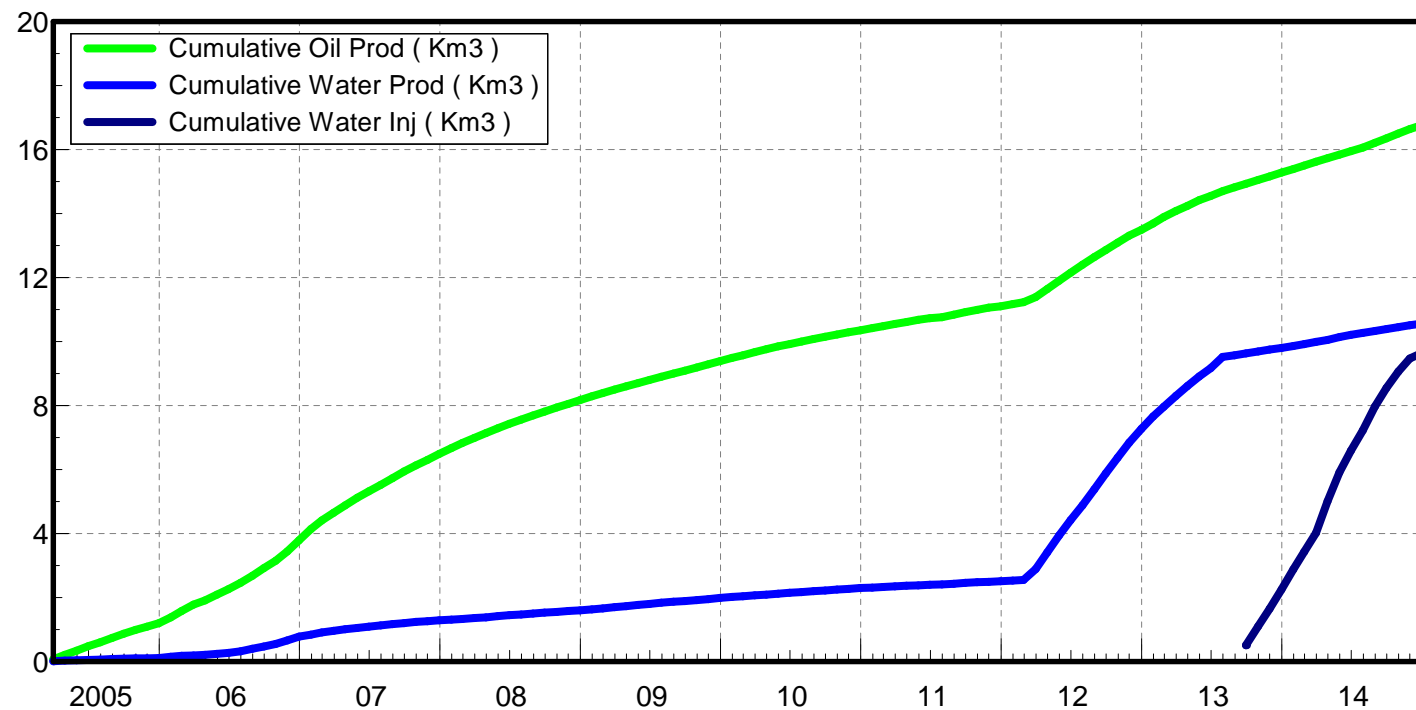
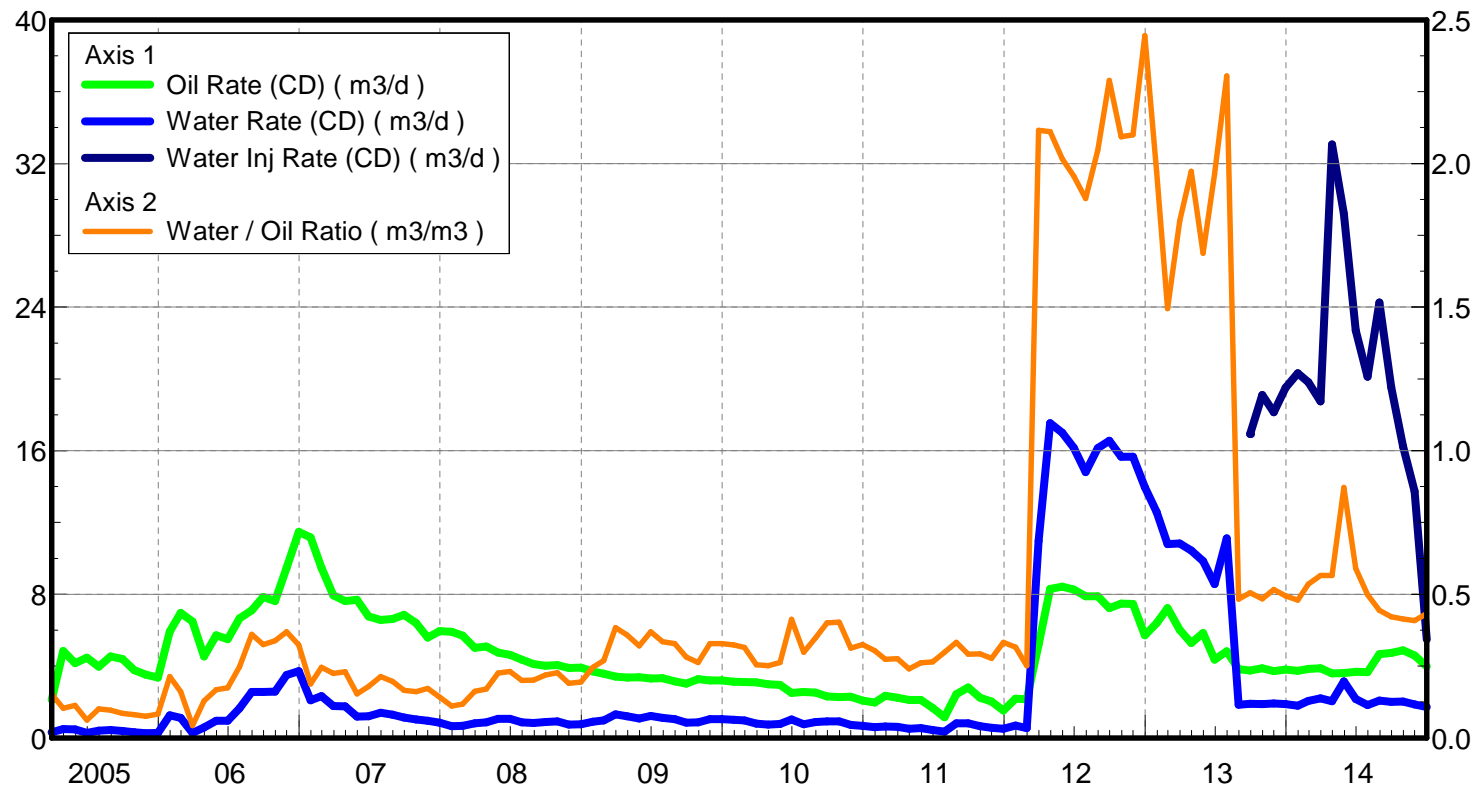
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 3.99 m3/d

Water Rate (CD) : 1.72 m3/d

Water Inj Rate (CD) : 5.48 m3/d





# Pattern: 02/05-15-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.51 m3/m3

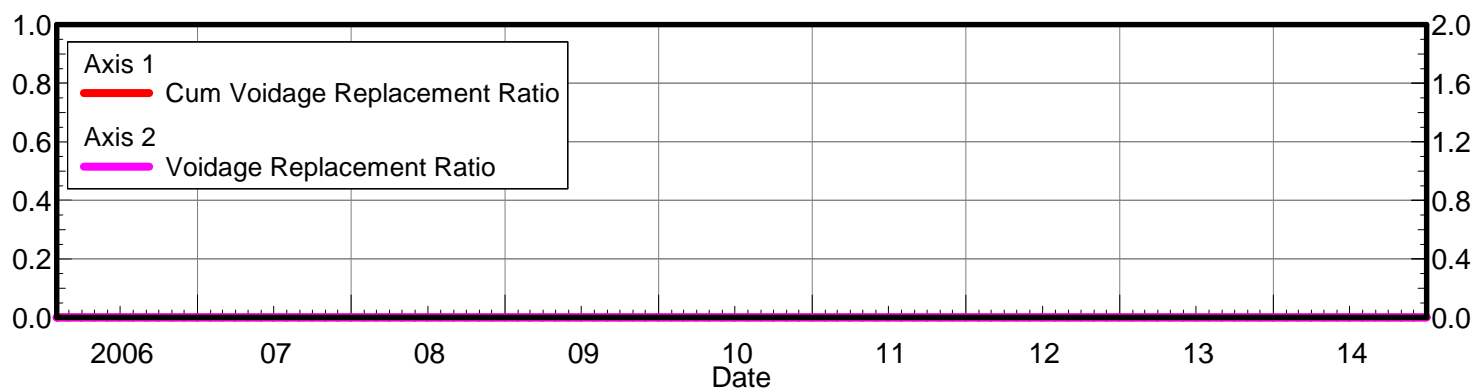
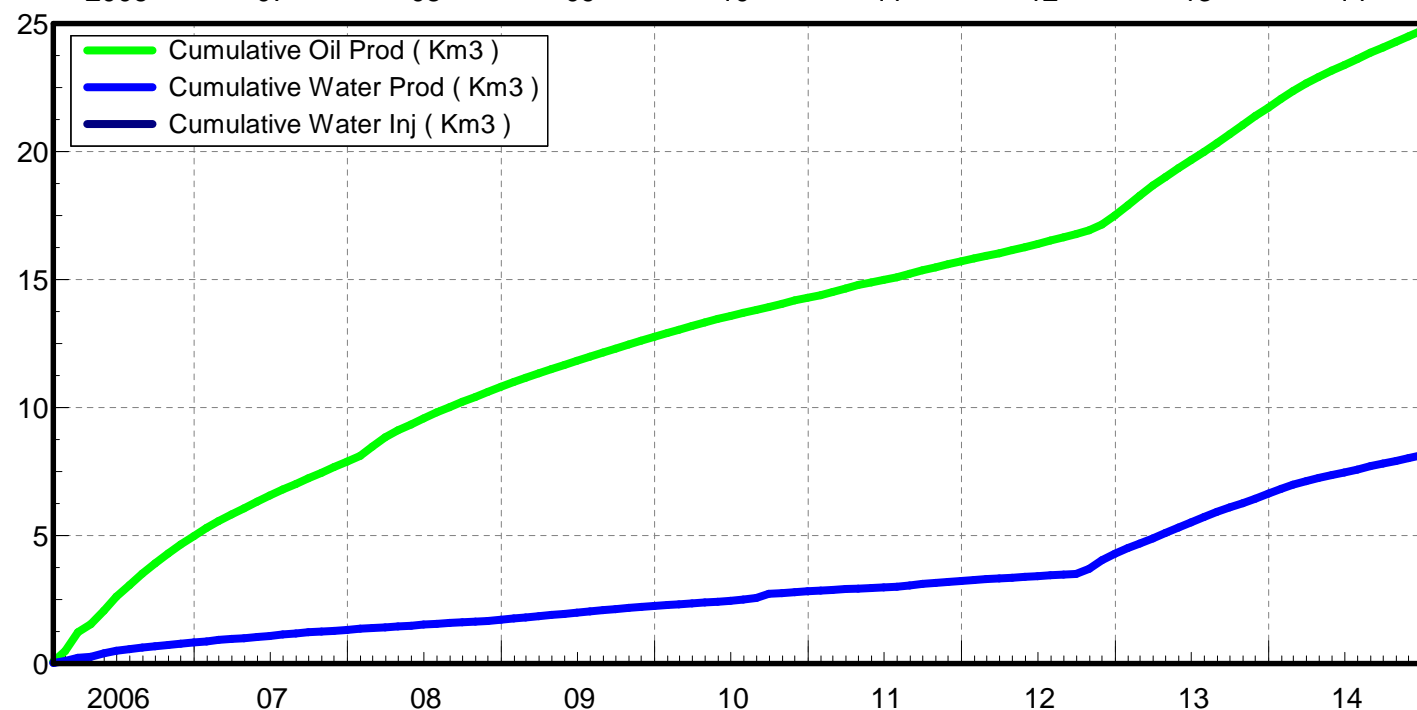
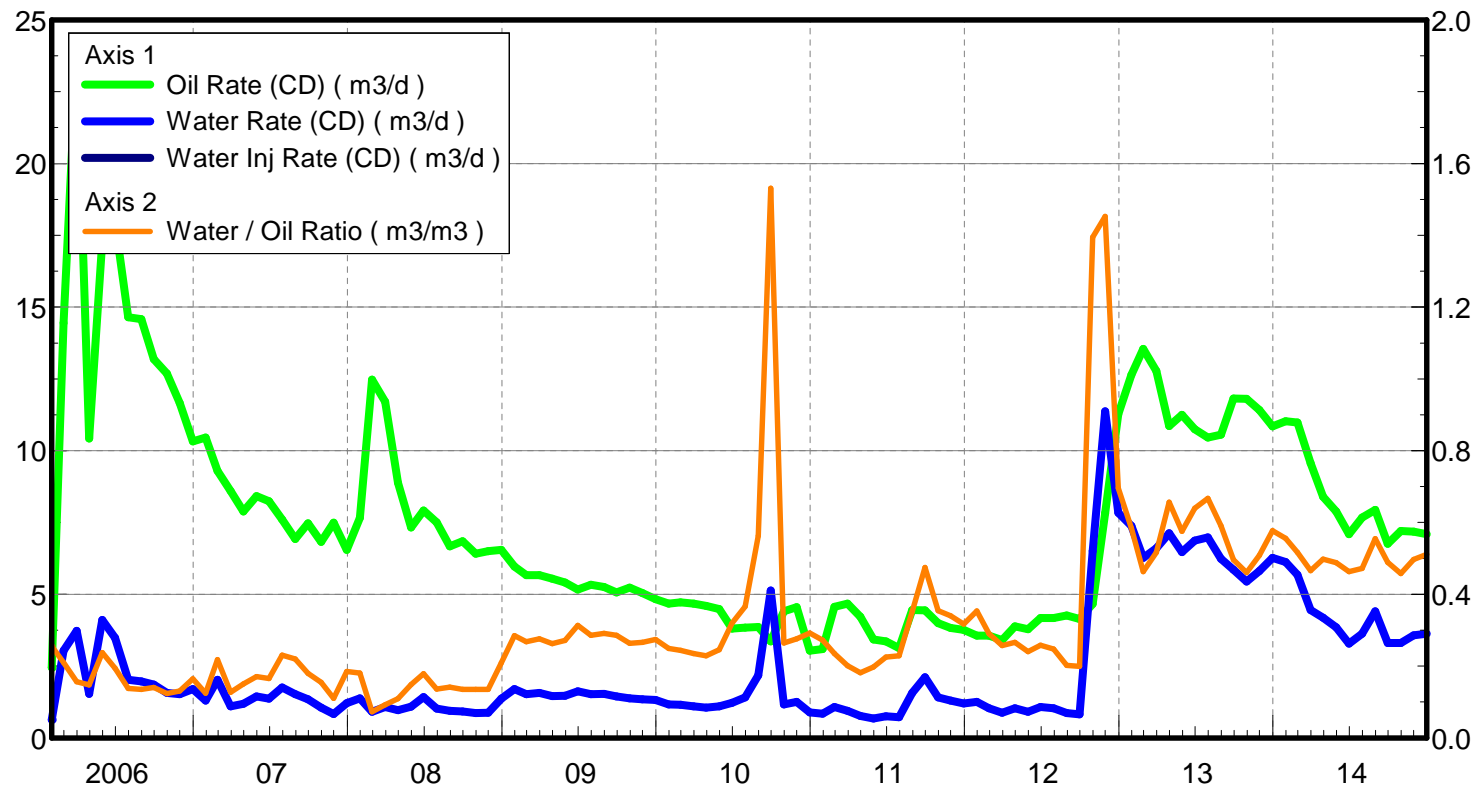
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 7.10 m3/d

Water Rate (CD) : 3.63 m3/d

Water Inj Rate (CD) : \* m3/d



# Pattern: 03/05-15-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.38 m3/m3

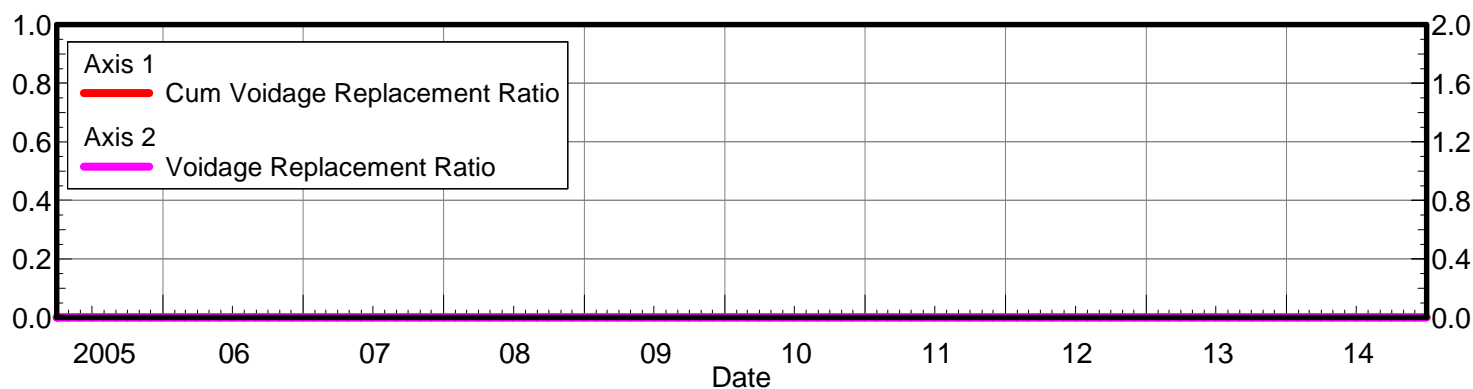
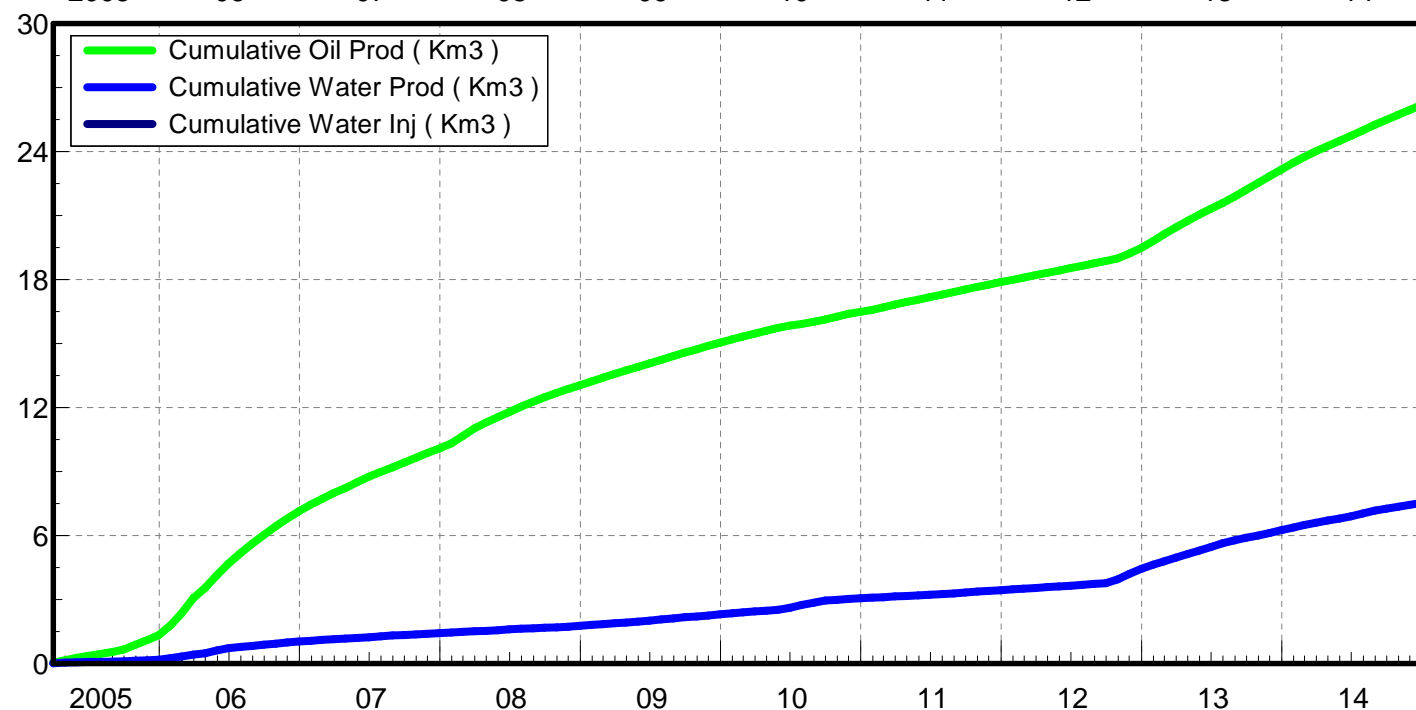
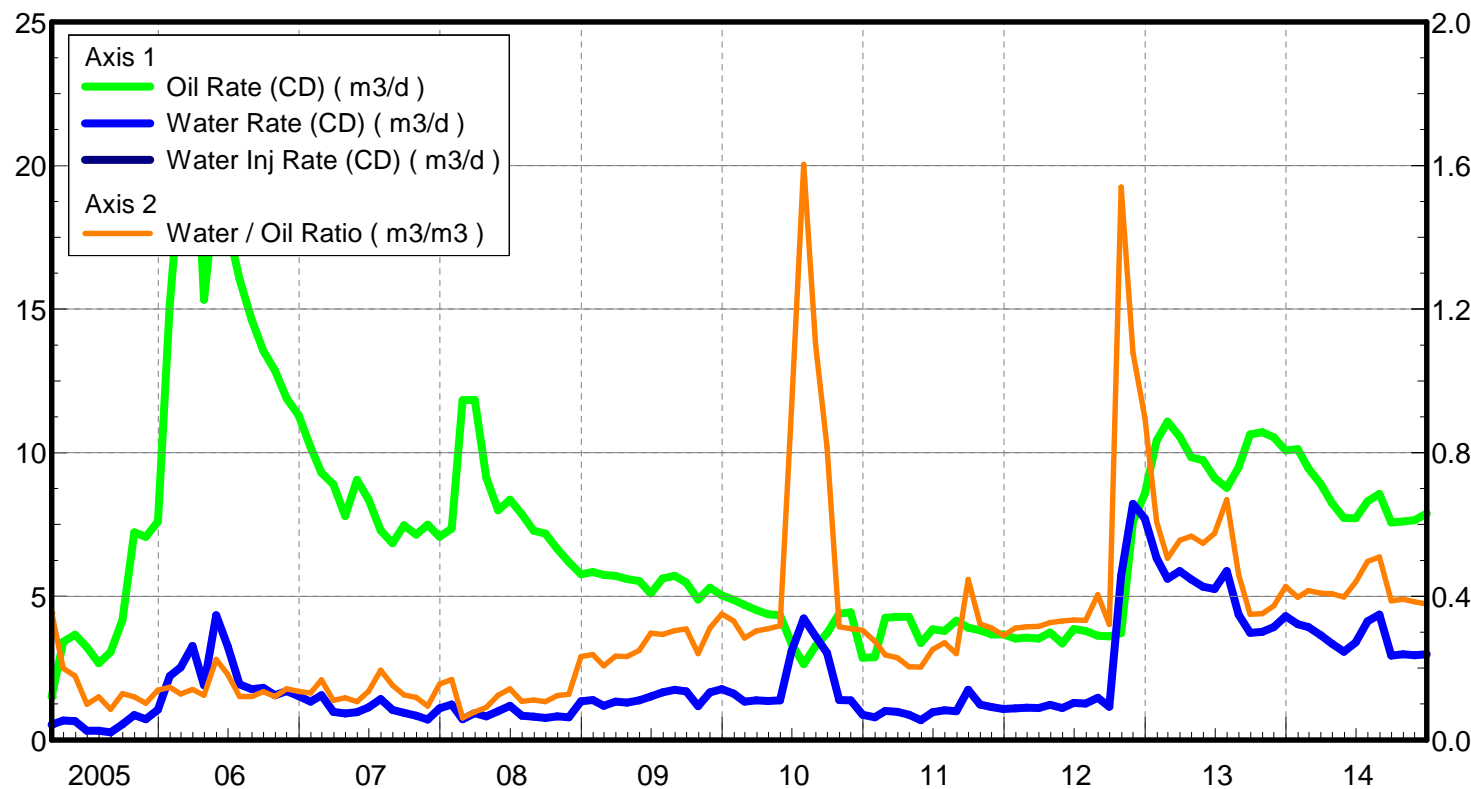
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 7.89 m3/d

Water Rate (CD) : 2.98 m3/d

Water Inj Rate (CD) : \* m3/d



# Pattern: 04/12-15-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.36 m3/m3

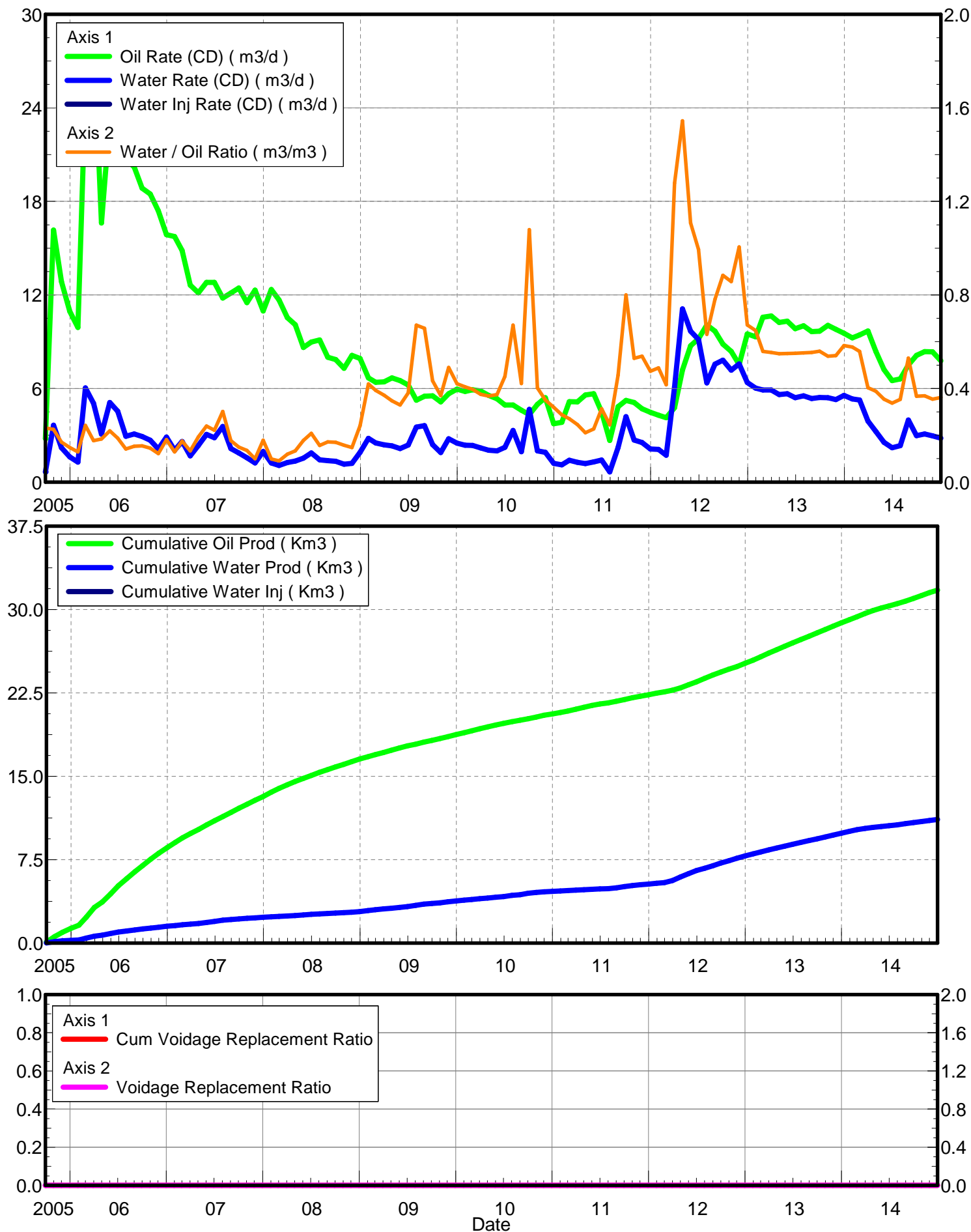
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 7.78 m3/d

Water Rate (CD) : 2.82 m3/d

Water Inj Rate (CD) : \* m3/d



# Pattern: 02/01-23-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.25 m3/m3

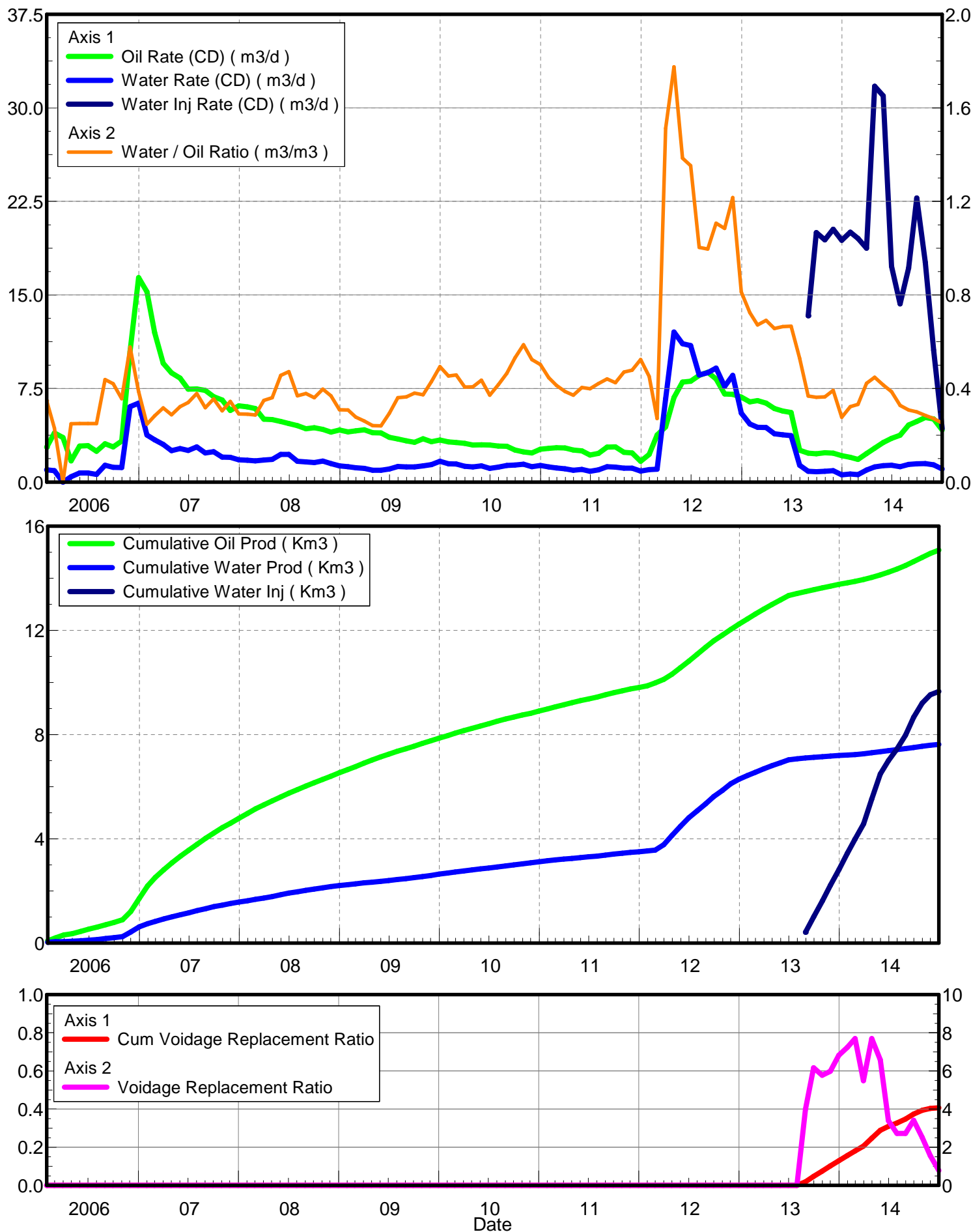
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 4.17 m3/d

Water Rate (CD) : 1.05 m3/d

Water Inj Rate (CD) : 4.29 m3/d



# Pattern: 03/01-14-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.19 m3/m3

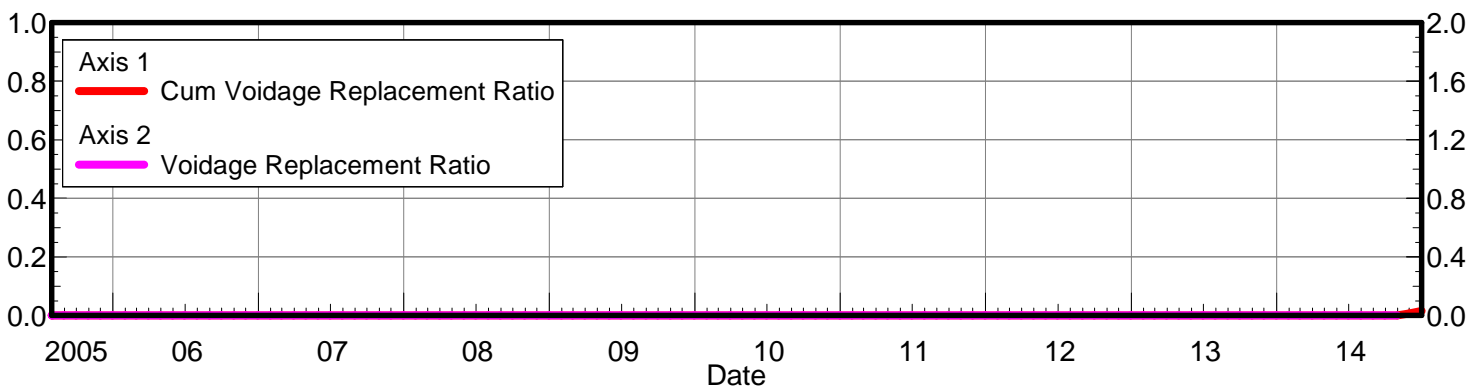
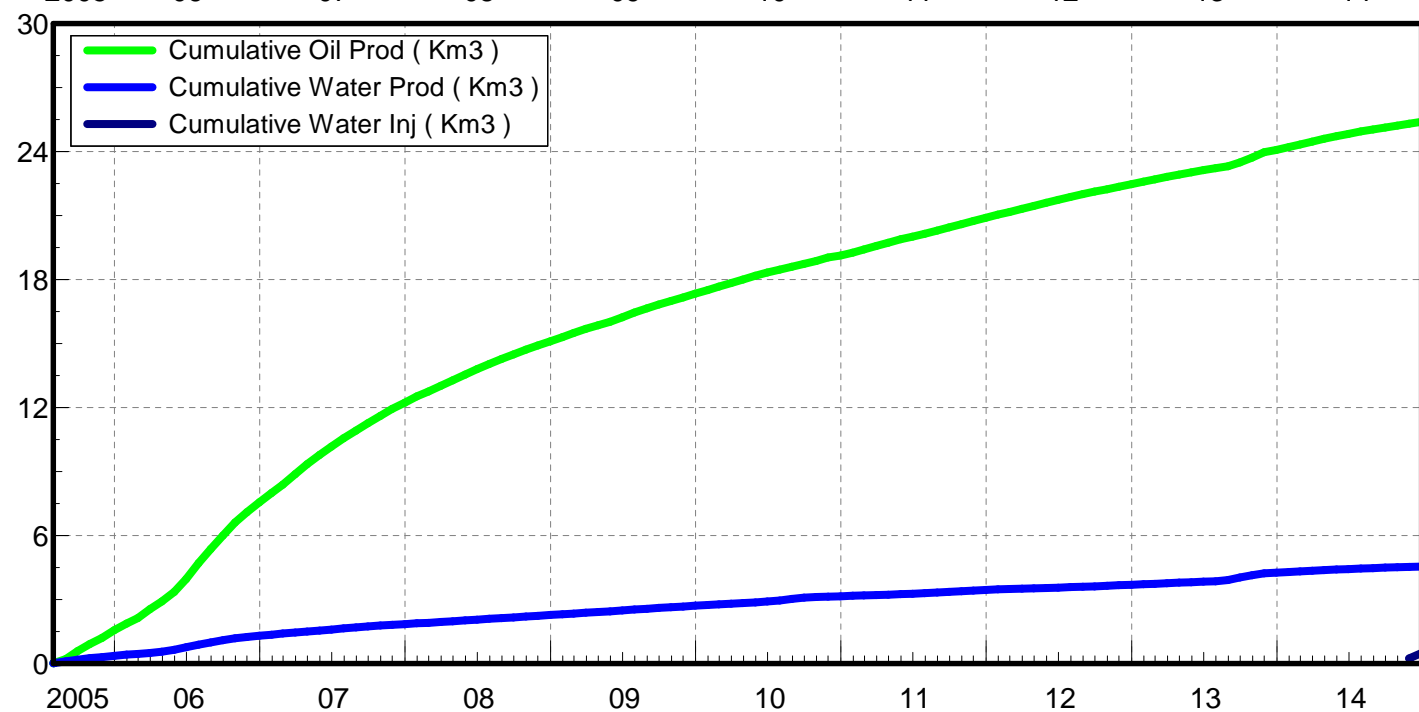
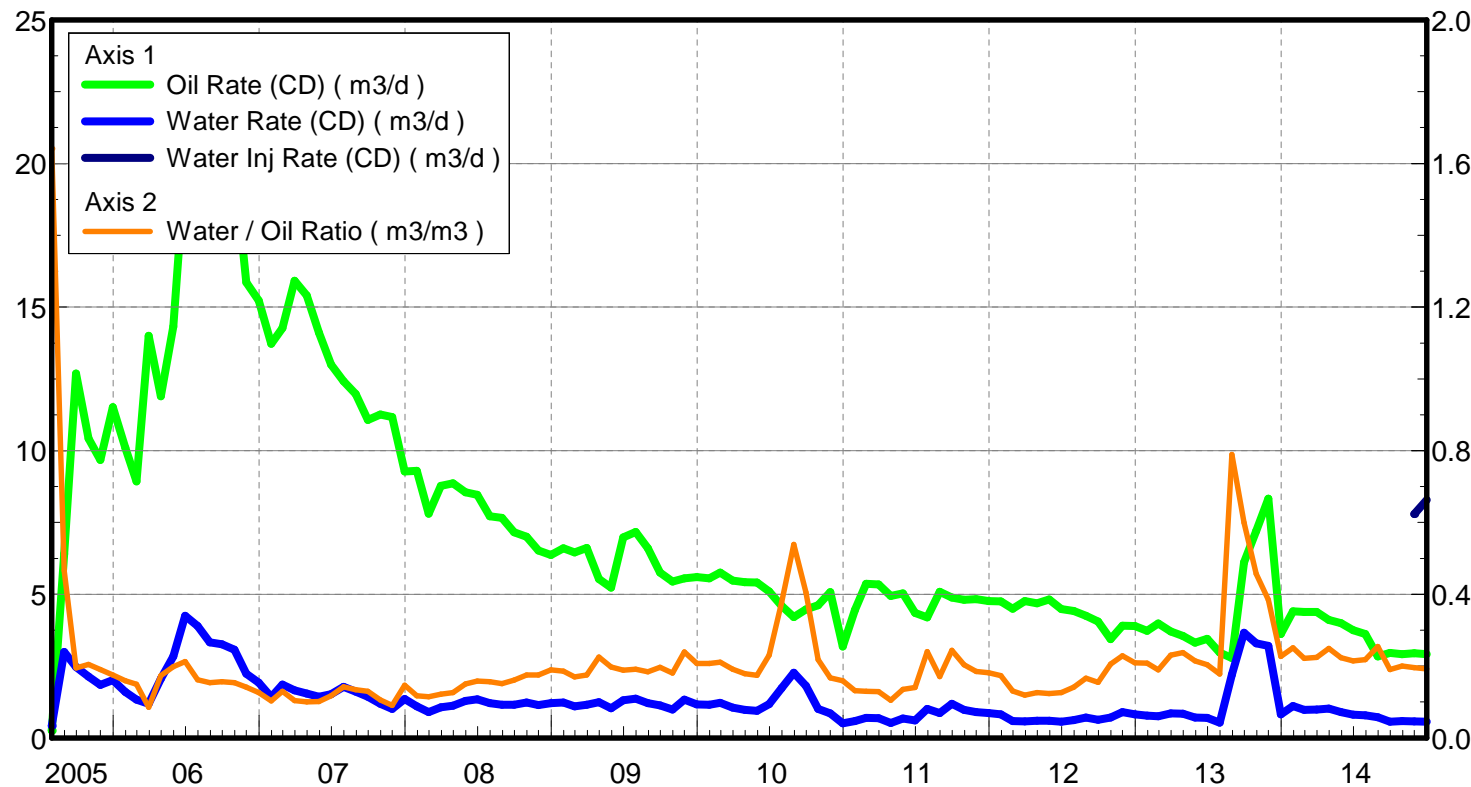
March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 2.91 m3/d

Water Rate (CD) : 0.56 m3/d

Water Inj Rate (CD) : 8.29 m3/d



# Pattern: 02/04-15-008-29Inj Set: SinclairUnit#7

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 0.30 m3/m3

March 24, 2015

Operator: Tundra\_O&G\_Prtshp

Oil Rate (CD) : 10.32 m3/d

Water Rate (CD) : 3.13 m3/d

Water Inj Rate (CD) : \* m3/d

