

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

April 18, 2017

Tundra Oil and Gas Partnership

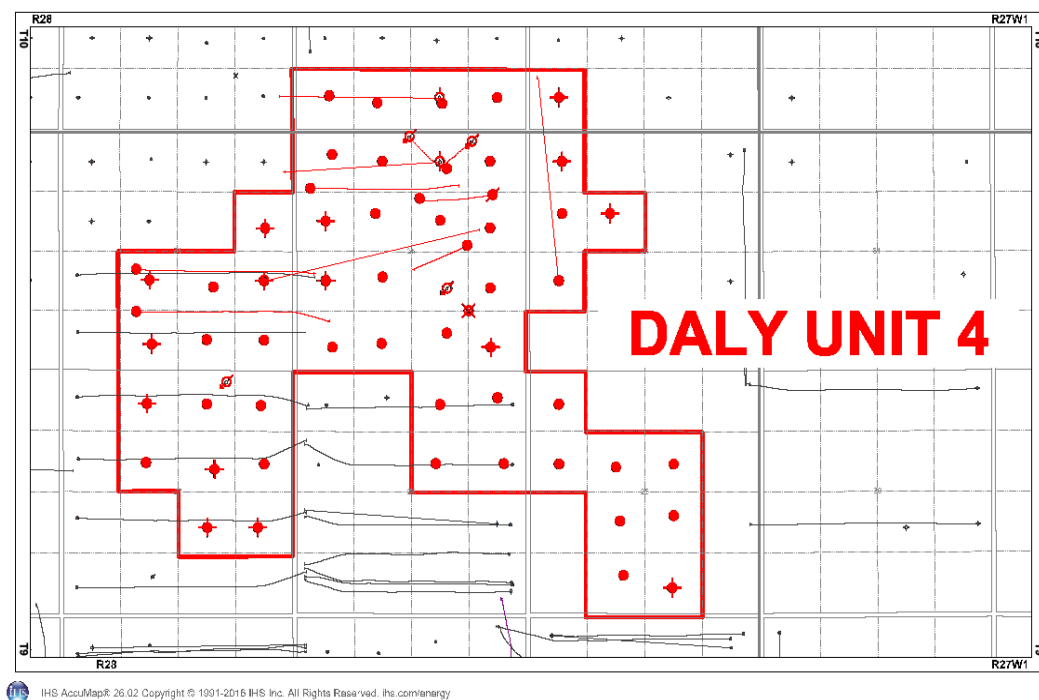
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INTRODUCTION

Daly Unit No.4 Enhanced Oil Recovery (EOR) Waterflood Project was approved under Board Order No. PM 65. Daly Unit No. 4 was acquired from Zargon Oil & Gas Ltd. on June 1, 2012 with Tundra Oil and Gas as the new Operator. The EOR project area, outlined in red in Figure 1, contains 66 wells over 52 LSDs in Township 9 and 10, Range 28W1. Well list and well status is available in Appendix A.

Figure 1. Daly Unit No. 4 Area Outline



In accordance with Section 73 of the Manitoba Drilling and Production Regulation, Tundra submits the following 2016 Annual Progress Report for Daly Unit No. 4 as required by Board Order No. PM 65.

Discussion

Production History

For the wells included in Daly Unit No.4, production started in September 1962 with the 00/05-35-009-28W1/00 well. From 1980 – 1983, 51 wells were drilled. Oil production peaked

at 84.37 m³/d in September of 1984. The average production for the unit was 57.5 m³/d of oil and 83.8 m³/d of water, and the average WOR was 1.46 m³/m³ in 2016. The oil production rate, injection rate and WOR during each month for each injection pattern is presented in Appendix B. The rates and WOR are presented in Figure 2.

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

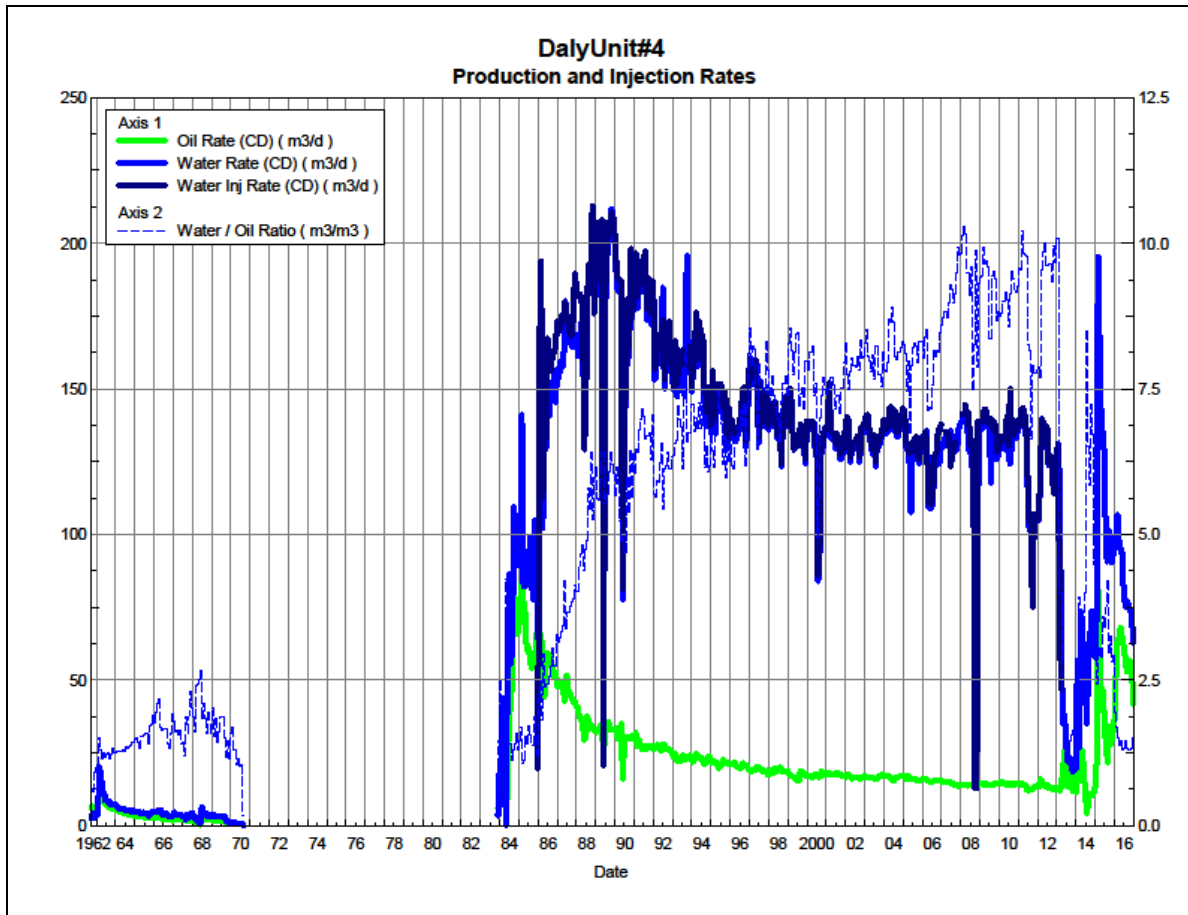
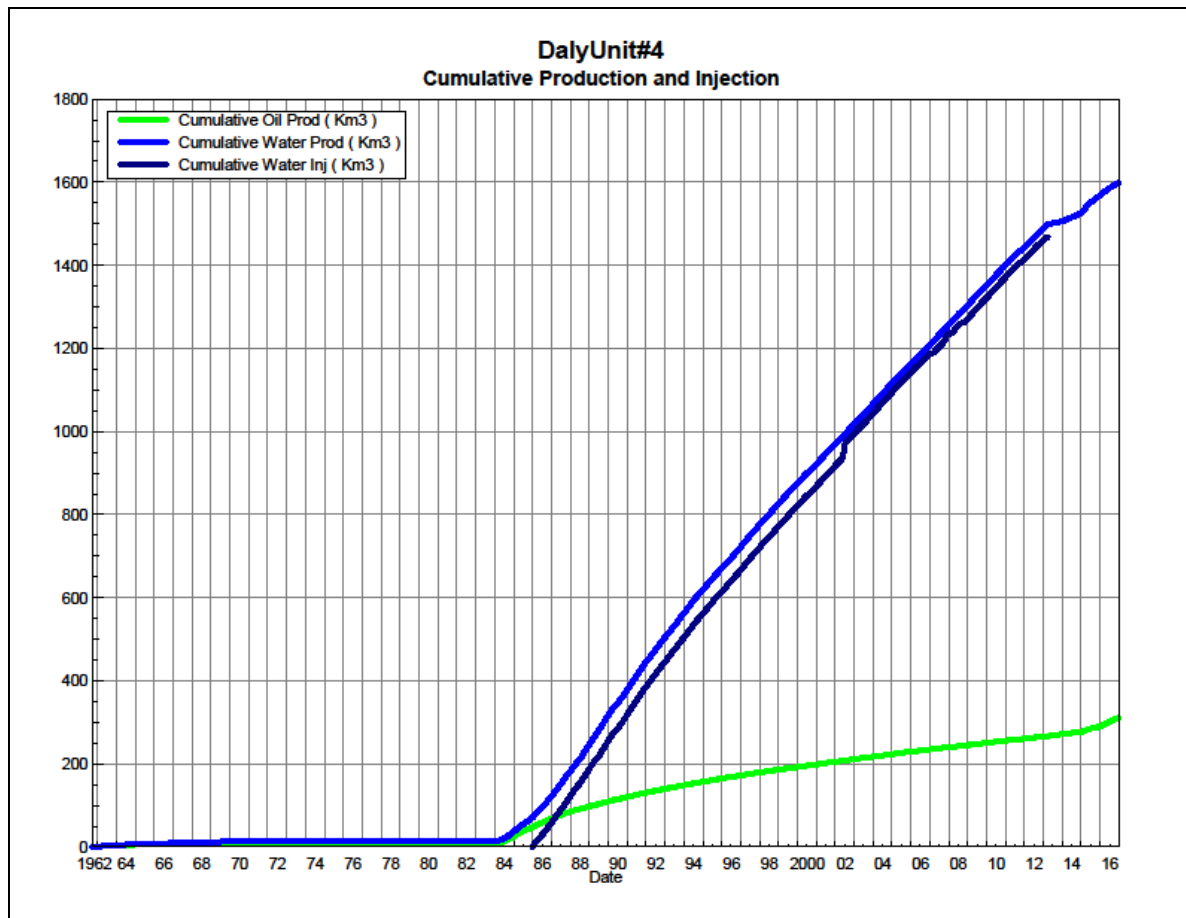


Figure 3 shows the cumulative production for Daly Unit No. 4 to the end of December 2016 as 311.1 e³m³ of oil, and 1599.4 e³m³ of water. The cumulative water injected is over 1468.5 e³m³. The cumulative volume of oil, and water produced and fluid injected for each injection pattern is presented in Appendix B.

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



Waterflood History

Daly Unit No. 4 area was discovered in 1962 when 3 wells were initially drilled. In 1970 the wells were abandoned due to poor productivity. The area was not further delineated until 1983 when an aggressive drilling program was initiated. From 1980 – 1983, 51 vertical wells were drilled. Prior to being unitized in April 1988, the area was developed on 40-acre spacing. Following unitization of the field in 1988, a pilot waterflood pattern was initiated in Section 27. The waterflood program in the unit currently has four patterns of which 3 are 40-acre inverted five-spot patterns and one 160-acre inverted nine-spot pattern.

Water injection started in January 1986. In March 2013, water injection was suspended in the Unit because of safety concerns associated with using old pipelines and injection infrastructure. Tundra no longer wants to use produced water for injection in this Unit, so they

are currently evaluating a new source of water prior to reinitiating the waterflood in this Unit. Tundra is also planning on reconfiguring pattern designs in this Unit in order to improve the ultimate recovery of reserves in this area. Since 2013, 7 horizontal infill wells have been drilled in Daly Unit No. 4 (6 producing, 1 suspended) to further evaluate reservoir strategies for future development and optimization in the Unit. An overall summary for each injector pattern is presented 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 injected water in the area is currently treated with corrosion inhibitor to ensure the integrity of the field equipment is maintained.

Injection Wellhead Pressures

The monthly injection wellhead pressures are shown in Appendix C for each injection well. The pressures from January to May 2012 are not in the database since Tundra acquired Daly Unit No. 4 in June of 2012.

Reservoir Pressure

No reservoir pressure measurements were taken at Daly Unit No. 4 in 2016.

Voidage Replacement

Cumulative voidage for Daly Unit No. 4 was 0.760 in December 2016. Plots of the VRR on a monthly and cumulative basis for each injection pattern are presented in Appendix D.

Well Servicing

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

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

Well Location	Objective	End Date
102.15-35-009-28W1.00	Pump Change	10/26/2016

Waterflood Performance Discussion

Given an OOIP of 7,949 e³m³ (50 MMstb), the current recovery factor is 3.9%. The overall performance of this waterflood has been extremely poor as indicated by the low recovery factor, and obvious lack of waterflood response in producers. This is likely due to significant reservoir discontinuity and the location of the injectors, resulting in poor areal sweep efficiency. The Unit will require additional water injection wells in addition to increased fluid handling throughput in order to make this an effective waterflood.

List of Appendices

Appendix A: Well List and Well Status

Appendix B: Injection Pattern Summary

Appendix C: Average Monthly Injection Pressures

Appendix D: Injector Pattern Production/Injection Rates, Cumulative and VRR

Plots for the following injectors:

02/15-27-009-28W1/0

00/07-35-009-28W1/0

02/14-35-009-28W1/0

02/16-35-009-28W1/0

Appendix A: Well List and Well Status

UWI		Well Status		UWI		Well Status
100/02-25-009-28W1/00	Vertical	ABD Producer		100/03-35-009-28W1/00	Vertical	Capable of Oil Prod
100/03-25-009-28W1/00	Vertical	ABD Producer		100/04-35-009-28W1/00	Vertical	Capable of Oil Prod
100/06-25-009-28W1/00	Vertical	Capable of Oil Prod		100/05-35-009-28W1/00	Vertical	ABD Producer
100/07-25-009-28W1/00	Vertical	Capable of Oil Prod		100/05-35-009-28W1/02	Vertical	Capable of Oil Prod
100/10-25-009-28W1/00	Vertical	ABD Producer		100/06-35-009-28W1/00	Vertical	Capable of Oil Prod
100/11-25-009-28W1/00	Vertical	Capable of Oil Prod		100/07-35-009-28W1/00	Vertical	WTR Injection
100/12-25-009-28W1/00	Vertical	ABD Producer		100/08-35-009-28W1/00	Vertical	Capable of Oil Prod
100/13-25-009-28W1/00	Vertical	Capable of Oil Prod		100/09-35-009-28W1/00	Vertical	Capable of Oil Prod
100/09-26-009-28W1/00	Vertical	Capable of Oil Prod		102/09-35-009-28W1/00	Horizontal	Susp OIL Prod
100/10-26-009-28W1/00	Vertical	Capable of Oil Prod		100/10-35-009-28W1/00	Vertical	Capable of Oil Prod
100/15-26-009-28W1/00	Vertical	Capable of Oil Prod		103/10-35-009-28W1/00	Horizontal	Capable of Oil Prod
100/16-26-009-28W1/00	Vertical	Capable of Oil Prod		100/11-35-009-28W1/00	Vertical	Capable of Oil Prod
100/07-27-009-28W1/00	Vertical	ABD Producer		100/12-35-009-28W1/00	Vertical	ABD Producer
100/08-27-009-28W1/00	Vertical	ABD Producer		100/12-35-009-28W1/02	Vertical	ABD Producer
100/09-27-009-28W1/00	Vertical	Capable of Oil Prod		100/13-35-009-28W1/00	Vertical	Capable of Oil Prod
100/10-27-009-28W1/00	Vertical	ABD Producer		102/13-35-009-28W1/00	Horizontal	Capable of Oil Prod
100/11-27-009-28W1/00	Vertical	Capable of Oil Prod		100/14-35-009-28W1/00	Vertical	Capable of Oil Prod
100/14-27-009-28W1/00	Vertical	ABD Producer		102/14-35-009-28W1/00	Dir/Dev	WTR Injection
100/15-27-009-28W1/00	Vertical	Capable of Oil Prod		100/15-35-009-28W1/00	Vertical	Capable of Oil Prod
102/15-27-009-28W1/00	Vertical	WTR Injection		102/15-35-009-28W1/00	Horizontal	Capable of Oil Prod
100/16-27-009-28W1/00	Vertical	Capable of Oil Prod		100/16-35-009-28W1/00	Vertical	Capable of Oil Prod
100/01-34-009-28W1/00	Vertical	Capable of Oil Prod		102/16-35-009-28W1/00	Dir/Dev	WTR Injection
100/02-34-009-28W1/00	Vertical	Capable of Oil Prod		100/05-36-009-28W1/00	Vertical	Capable of Oil Prod
100/03-34-009-28W1/00	Vertical	ABD Producer		102/05-36-009-28W1/00	Horizontal	Location
102/03-34-009-28W1/00	Horizontal	Capable of Oil Prod		100/11-36-009-28W1/00	Vertical	ABD Producer
100/06-34-009-28W1/00	Vertical	ABD Producer		100/12-36-009-28W1/00	Vertical	Capable of Oil Prod
102/06-34-009-28W1/00	Horizontal	Capable of Oil Prod		100/13-36-009-28W1/00	Vertical	ABD Producer
100/07-34-009-28W1/00	Vertical	Capable of Oil Prod		100/04-01-010-28W1/00	Vertical	ABD Producer
100/08-34-009-28W1/00	Vertical	ABD Producer		100/01-02-010-28W1/00	Vertical	Capable of Oil Prod
100/09-34-009-28W1/00	Vertical	ABD Producer		100/02-02-010-28W1/00	Vertical	Capable of Oil Prod
100/01-35-009-28W1/00	Vertical	ABD Producer		102/02-02-010-28W1/00	Horizontal	Capable of Oil Prod
102/01-35-009-28W1/00	Vertical	ABD SWD		100/03-02-010-28W1/00	Vertical	Capable of Oil Prod
100/02-35-009-28W1/00	Vertical	Capable of Oil Prod		100/04-02-010-28W1/00	Vertical	Capable of Oil Prod

Appendix B

Daly Unit No. 4 Pattern Summary as of December 31, 2016

Pattern Name	Injector Location (009-28W1)	Injector Surface Location	Status	No. of Supported Wells	Supported Wells	Allocation Factor	Pattern Prod Start Year	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
02/15-27-009-28W1/0	02/15-27	02/15-27	WTR Injection	4	00/01-34, 00/02-34, 00/15-27, 00/16-27	0.25	1984	Dec. 1988	0.35	0.57	1.65	0.00	12.65	16.75	834.80	0.000	27.572
00/07-35-009-28W1/0	00/07-35	00/07-35	WTR Injection	9	00/01-35, 00/03-35, 00/09-35, 00/11-35	0.25	1983	Dec. 1991	1.72	5.70	3.32	0.00	16.91	35.75	408.12	0.000	7.582
					00/02-35, 00/06-35, 00/08-35, 00/10-35, 03/10-35	0.5											
02/14-35-009-28W1/0	02/14-35	00/15-35	WTR Injection	4	00/02-02, 00/03-02, 00/14-35, 00/15-35	0.25	1984	Jun. 2000	0.14	0.16	1.11	0.00	7.16	6.71	9.46	0.000	0.659
02/16-35-009-28W1/0	02/16-35	00/15-35	WTR Injection	4	00/01-02, 00/02-02, 00/15-35, 00/16-35	0.25	1983	Jun. 2000	0.24	0.23	0.95	0.00	9.73	22.46	33.81	0.000	1.029

Appendix C

Average Monthly Injection Pressures (kPa) for Daly Unit No. 4

Month	Injection Well Pressures			
	102/15-27	00/07-35	102/14-35	102/16-35
Jan-12	-	-	-	-
Feb-12	-	-	-	-
Mar-12	-	-	-	-
Apr-12	-	-	-	-
May-12	-	-	-	-
Jun-12	7900	7900	7100	7100
Jul-12	7901	7901	7101	7101
Aug-12	7901	7901	7101	7101
Sep-12	7901	7901	7101	7101
Oct-12	7901	7901	7101	7101
Nov-12	7901	7901	7101	7101
Dec-12	7900	7900	7100	7100
Jan-13	7900	7900	7100	7100
Feb-13	7445	6346	2750	2836
Mar-13	6855	6837	1142	774
Apr-13	5860	6403	2342	1728
May-13	5400	6210	1810	1152
Jun-13	5300	6133	1540	962
Jul-13	5121	6010	1245	795
Aug-13	4668	5823	323	221
Sep-13	4551	5362	0	0
Oct-13	4052	4854	0	0
Nov-13	3498	4958	0	0
Dec-13	2689	6010	0	0
Jan-14	1994	6468	0	0
Feb-14	1398	5966	0	0
Mar-14	935	5835	0	0
Apr-14	697	5222	0	0
May-14	452	4881	0	0
Jun-14	275	4652	0	0
Jul-14	277	4589	0	0
Aug-14	216	4418	0	0
Sep-14	200	4380	0	0
Oct-14	200	4371	0	0
Nov-14	166	4201	0	0
Dec-14	181	4210	0	0

Month	Injection Well Pressures			
	102/15-27	00/07-35	102/14-35	102/16-35
Jan-15	170	4299	0	0
Feb-15	132	3019	0	0
Mar-15	156	1874	0	0
Apr-15	175	1600	0	0
May-15	175	1600	0	0
Jun-15	156	1600	0	0
Jul-15	139	1103	213	0
Aug-15	120	699	600	0
Sep-15	120	700	600	0
Oct-15	120	700	600	0
Nov-15	120	700	600	0
Dec-15	120	700	600	0
Jan-16	120	700	600	0
Feb-16	120	700	600	0
Mar-16	120	700	600	0
Apr-16	120	700	600	0
May-16	120	700	600	0
Jun-16	120	700	600	0
Jul-16	120	700	600	0
Aug-16	120	700	600	0
Sep-16	120	700	600	0
Oct-16	124	655	600	0
Nov-16	137	500	600	0
Dec-16	137	500	600	0

Appendix D

Rates and VRR Plots

Pattern: 02/15-27-009-28Inj Set: DalyUnit#4

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 1.40 m3/m3

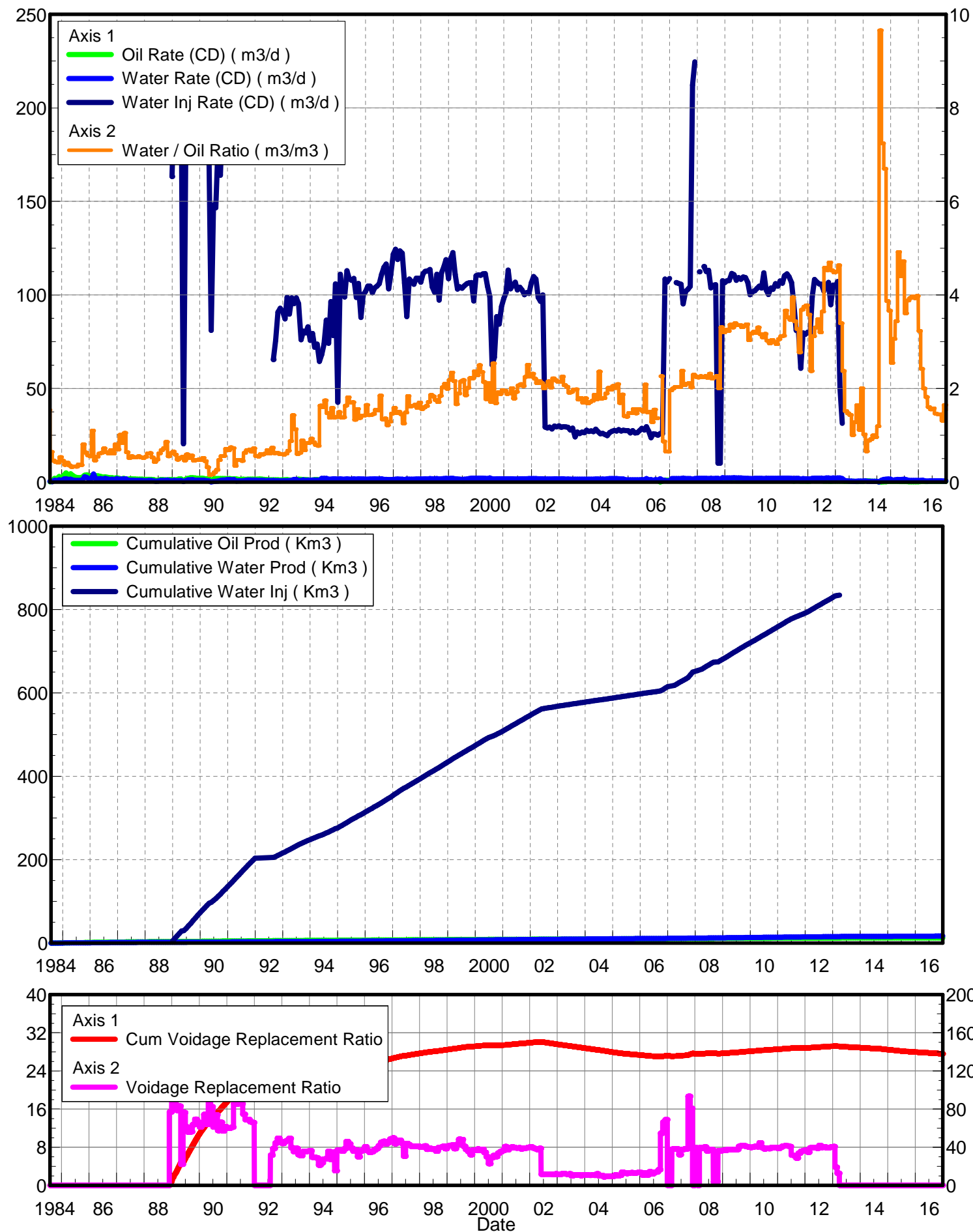
April 18, 2017

Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 0.38 m3/d

Water Rate (CD) : 0.58 m3/d

Water Inj Rate (CD) : 31.39 m3/d



Pattern: 00/07-35-009-28Inj Set: DalyUnit#4

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 4.65 m3/m3

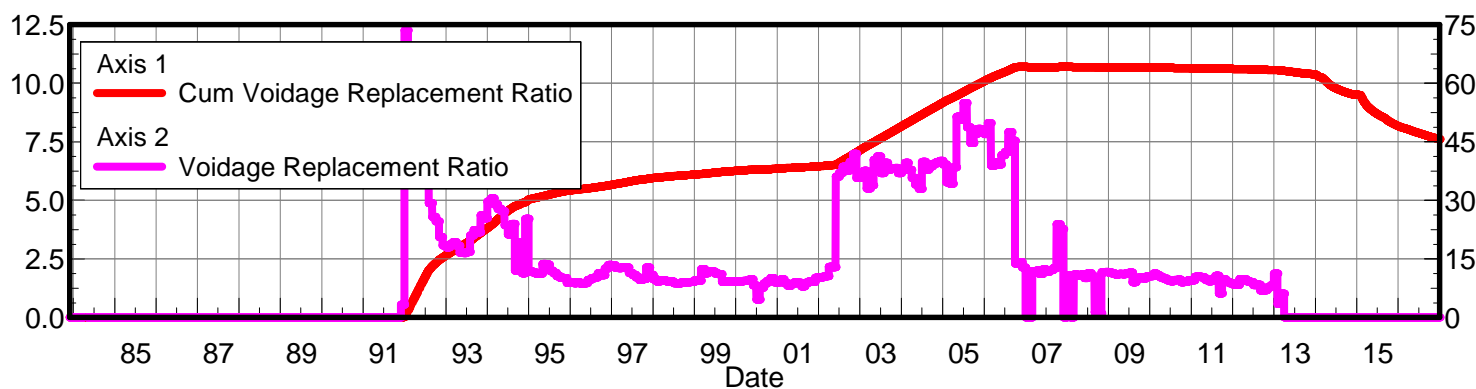
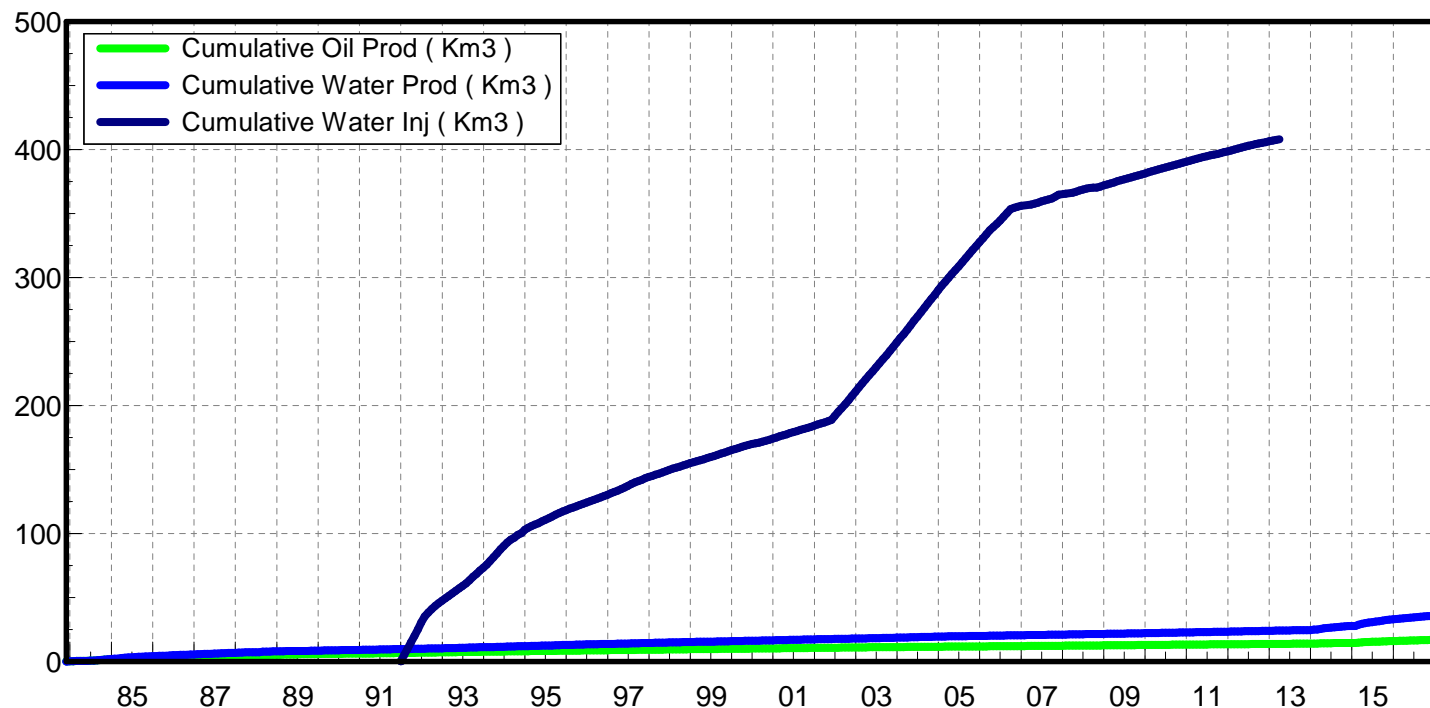
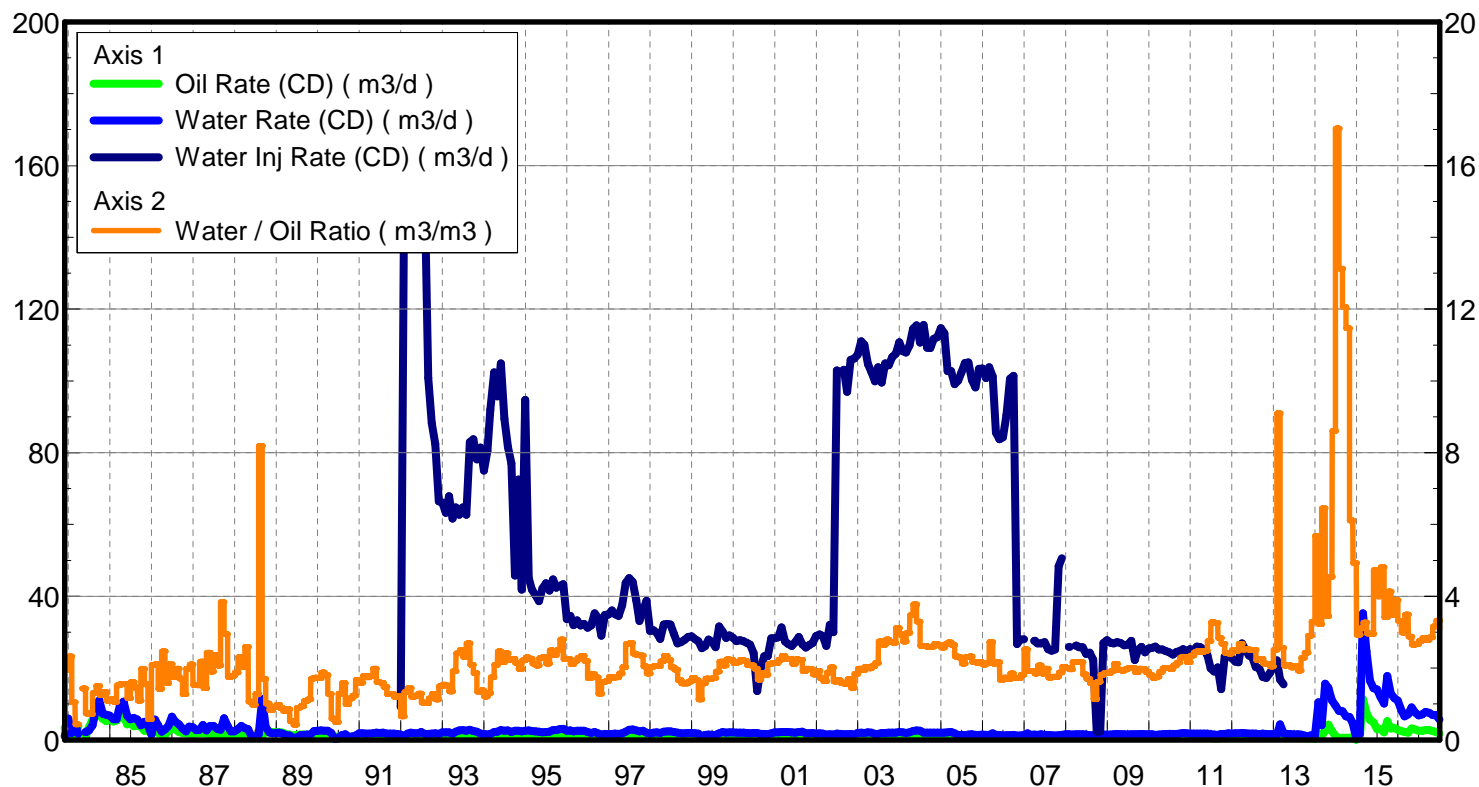
April 18, 2017

Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 2.09 m3/d

Water Rate (CD) : 6.44 m3/d

Water Inj Rate (CD) : 15.45 m3/d



Pattern: 02/14-35-009-28Inj Set: DalyUnit#4

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 6.56 m3/m3

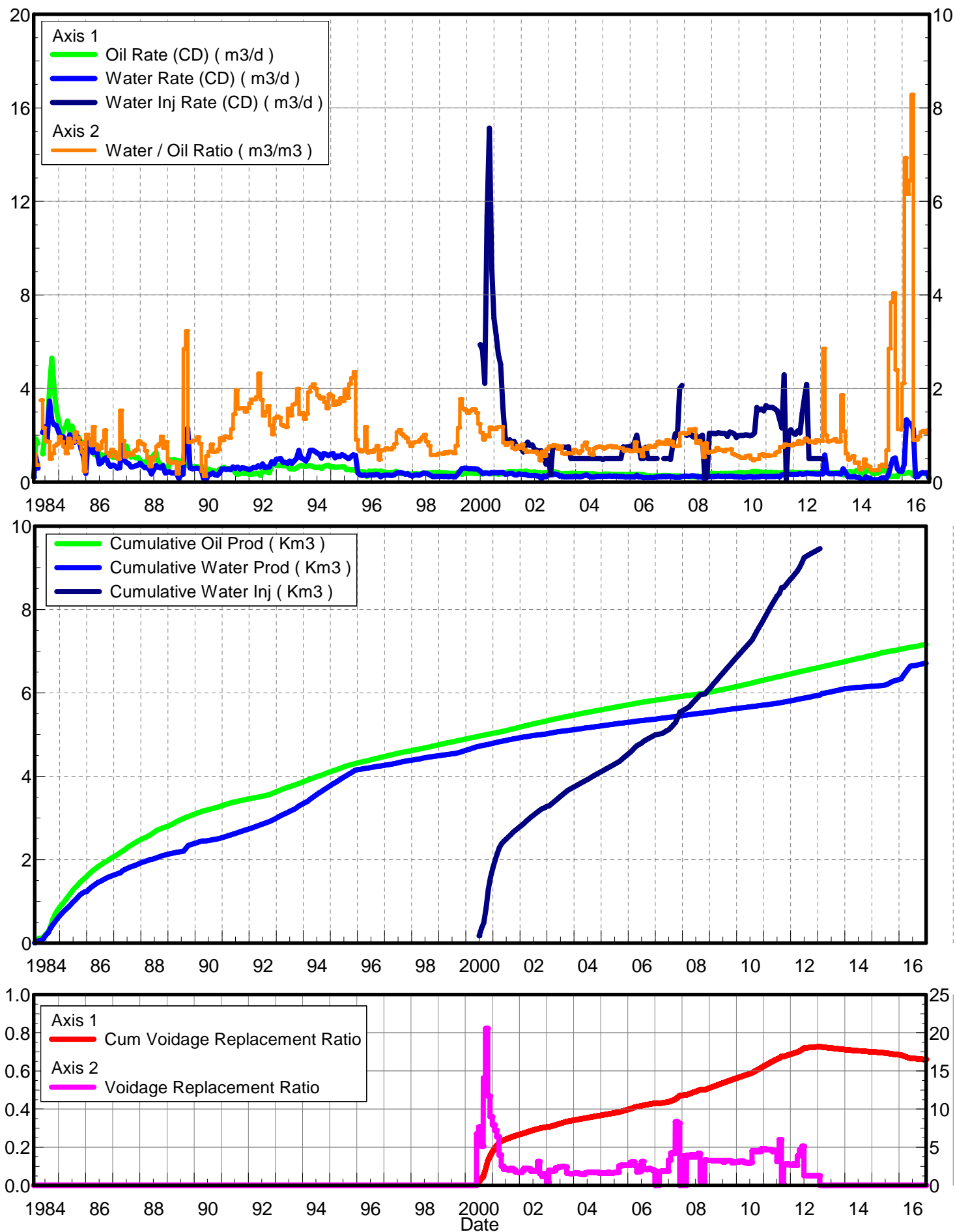
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Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 0.13 m3/d

Water Rate (CD) : 0.61 m3/d

Water Inj Rate (CD) : 0.97 m3/d



Pattern: 02/16-35-009-28Inj Set: DalyUnit#4

Oil Formation Vol Factor : 1.07100 m3/m3

Water Formation Vol Factor : 1.00150 m3/m3

Water / Oil Ratio : 1.06 m3/m3

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Operator: TUNDRA_OIL_&_GAS_LIMITED

Oil Rate (CD) : 0.28 m3/d

Water Rate (CD) : 0.35 m3/d

Water Inj Rate (CD) : 0.97 m3/d

