

Daly Unit #13
2018 Annual EOR Report

Executive Summary

In 2018 oil production from the Daly Unit #13 was 23.2 m³/d (146 bbl/d), totaling 8.5 10³m³ (53.3 mmbbl). Annual production declined 26% from 2017 to 2018, this calculation is using the average production year over year and is a sharp reduction in the decline from previous years due to the initiation of the waterflood. Using the production of December 2017 and December 2018 there would be an annual incline in production of 13%. Cumulative oil production from the Daly Unit #13 was 199.4 10³m³ (1.25 mmbbl) at the end of 2018.

In December 2018, there were 14 active oil producers, 5 horizontal injection wells, and one disposal well which is suspended.

Discussion

Historically, the unit produced through vertical wells completed in the Lodgepole formation. The first well was drilled in 1964, then in 1965 another two wells were drilled. Further development did not occur until 1984, and between 1984 and 1986, 14 additional vertical wells had been drilled. In 1986 a disposal well was implemented to handle the water production in the unit. Over time, some of the wells were deepened to the Bakken formation, some of the Lodgepole zones being abandoned, others commingled with the Bakken. In 2013 and 2014, Corex continued to develop the unit through horizontal multistage fractured wells. Currently, the unit has twelve horizontal wells placed in the Lodgepole formation. After several years of primary production and pressure depletion it was deemed beneficial to implement a waterflood. In 2017, three wells were converted to injection. 103/13-25-009-29W1/00 and 103/01-36-009-29W1/00 were converted in March 2017, with some mechanical difficulties with 103/01-36-009-29W1/00, where it did not inject for some time. In November 2017, 103/12-25-009-29W1/00 was converted to injection. In March 2018, an additional two wells were converted to injection, 103/04-25-009-29W1/00 and 103/05-25-009-29W1/00.

With the conversion of water injection wells Corex suspended the 100/08-36-009-29W1/00 water disposal well and all water is disposed outside of the unit. Water injection in 2018 in Daly Unit #13 was $110.8 \text{ m}^3/\text{d}$ (697 bbl/d), totaling $40.4 \times 10^3 \text{ m}^3$ (254 mbbl). The producing WOR of the unit is $27 \text{ m}^3/\text{m}^3$. This is an increase compared to last year with a pump upsize on one of the wells that has attributed out of zone water production.

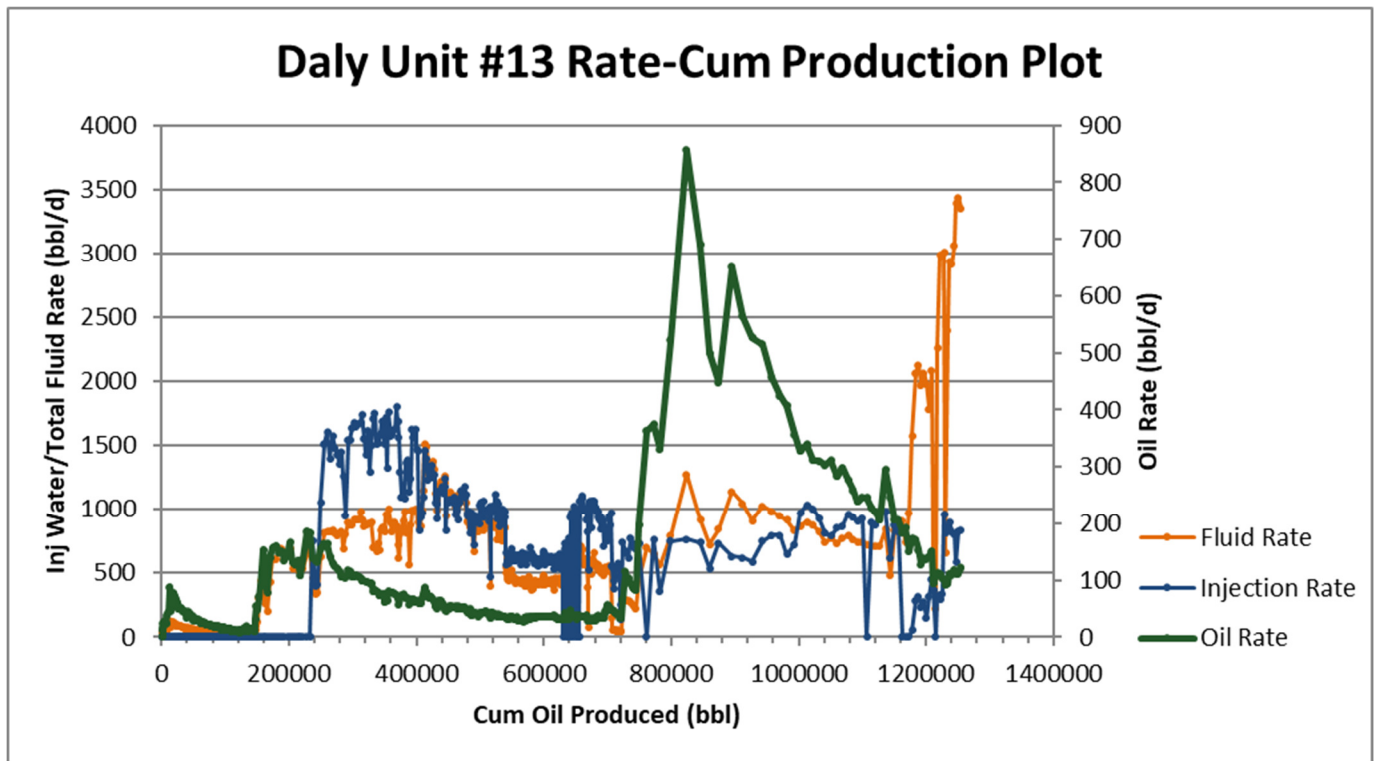
Significant activity in 2018 is as follows:

- March 2018, convert the 103/04-25-009-29W1/00 horizontal well to injection.
- March 2018, convert the 103/05-25-009-29W1/00 horizontal well to injection.

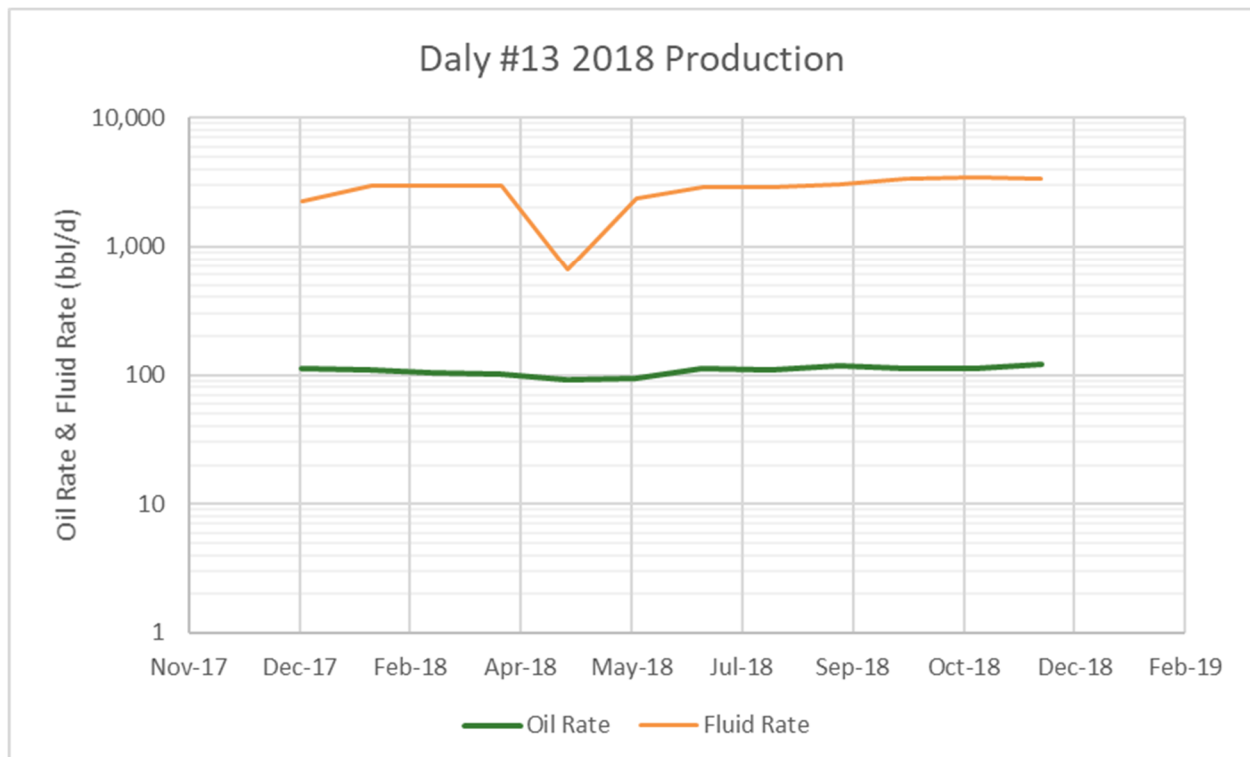
2018 is the first year of the full implementation of the waterflood. Early results are encouraging. Oil production has remained flat throughout the year and even increased, despite further losses in oil production due to the conversion of an additional two wells. The waterflood clearly has arrested the decline in the unit and increased production. For a tight oil waterflood the results are very promising. Corex will continue to operate the waterflood and further incremental reserves to be gained through secondary recovery.

It is important to note that publicly available production data does not include contribution from the newly drilled wells. Volumes quoted, and unit graphs presented are based on public production data augmented with proprietary data, and consequently should accurately reflect all wells. The pattern data within the tables below is based solely on publicly available production data and therefore missing some production volumes. These tables will be updated in subsequent progress reports.

Daly #13 – Rate vs Cum Oil Production



Daly #13 – Rate vs Time



2018 Reservoir Pressure Surveys

In 2018, no pressure surveys were conducted in Daly Unit #13. Recent pressures taken within the unit are below:

Unit	UWI	License	Test Type	Date of Pressure	Duration of SI (days)	Datum BHP (kPaa)
Daly Unit #13	103/04-25-009-29W1/00	9660	BH BU	3/3/2014	27	7,575
Daly Unit #13	100/08-36-009-29W1/00	3616	Surface Recorder	8/23/2014	1	8,396

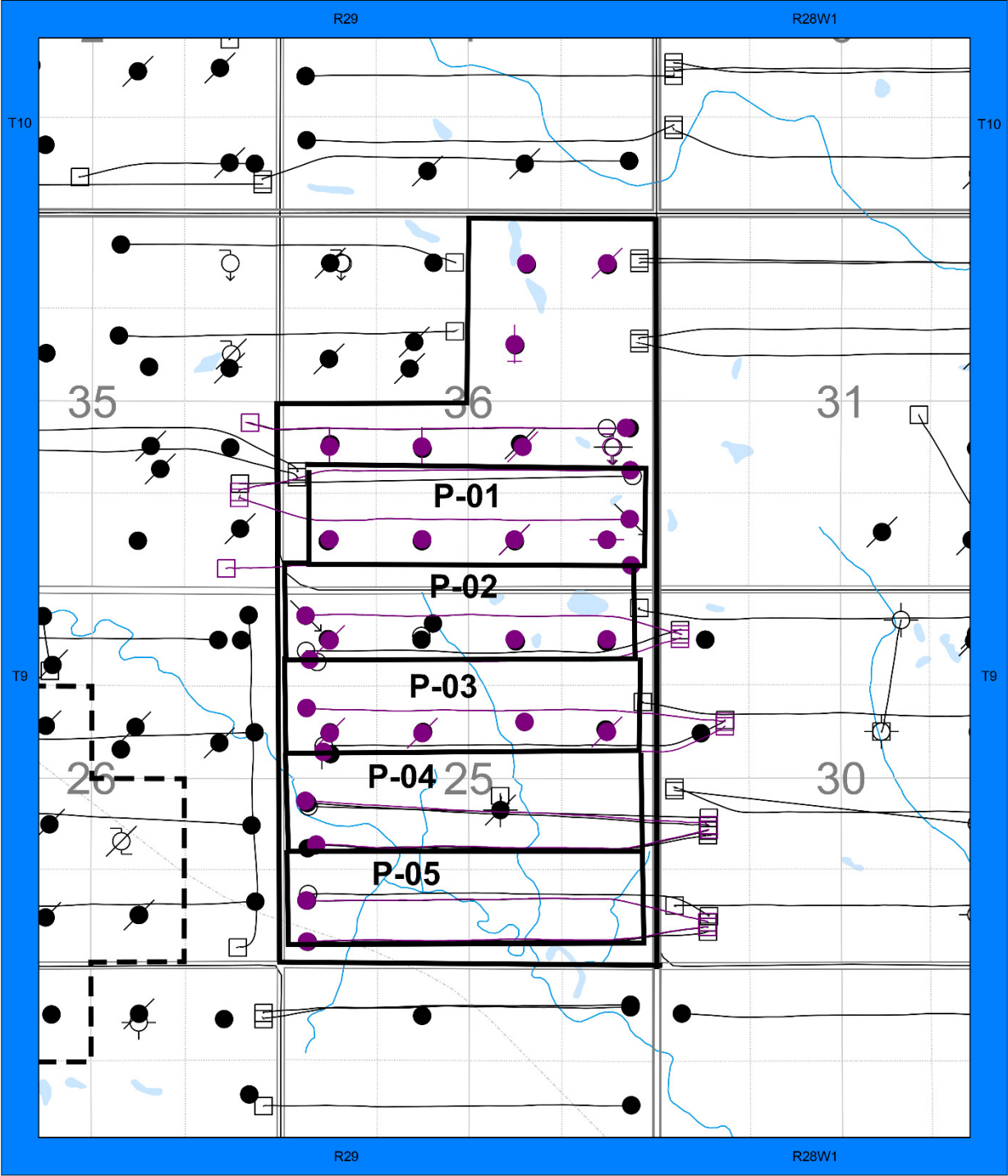
The estimated initial reservoir pressure for the Lodgepole is 8,200 kPaa, which is slightly over pressure. As the Lodgepole formation is quite large, with multiple oil bearing zones the pressures could vary with depth within the Lodgepole. However, the majority of the production from this unit out of the Lodgepole is from only one member, as are the pressures that were taken. The pressures taken in 2014 are close to the estimated initial reservoir pressure. Due to the inter well spacing and the length of the production period it is likely that the current reservoir pressure has been depleted and is lower than the initial reservoir pressure. However, with the initiation of injection in the unit, the pressure may be increasing. Due to the low permeability of the reservoir rock, obtaining representative buildup pressures is quite challenging and unlikely to be accurate in any way.

The VRR in December 2018 was 0.27, this would say that enough injection volumes are not going into the zone. However, this is including one well that likely has a large portion of out of zone water production, that does not need to be replaced. When looking at the individual patten instantaneous VRR's most of them are over 1, and the ones that aren't include the out of zone water production. The cumulative VRR at year end was 0.05, indicating that there is a long way until voidage is reached. An oil formation volume factor of $1.06 \text{ rm}^3/\text{sm}^3$ and a water formation volume factor of $1.04 \text{ rm}^3/\text{sm}^3$ were used in the VRR calculations.

2018 Well Servicing

UWI	Unit	Licence	Operation	Date	Objective
103/05-25-009-29W1/00	DU#13	9716	Injection Conversion	2018-02-05	
103/04-25-009-29W1/00	DU#13	9660	Injection Conversion	2018-02-21	
100/15-25-009-29W1/02	DALY UNIT 13 & 14	3271	Pump Repair	2018-03-07	
103/13-25-009-29W1/00	DU#13	9712	Acid Treatment	2018-03-19	
103/12-25-009-29W1/00	DU#13	9715	Acid Treatment	2018-03-19	
103/01-36-009-29W1/00	DU#13	9438	Acid Treatment	2018-03-19	
102/12-25-009-29W1/00	DU#13	9714	Upsize Pump	2018-06-04	
100/04-36-009-29W1/00	DALY UNIT 13 & 14	3302	Pump Repair	2018-06-19	
PIPELINE REPLACEMENT	DU#13	F18DAL006	Pipeline / Flowline Replacement	2018-11-05	
100/10-36-009-29W1/02	DALY UNIT 13 & 14	3707	Pump Repair	2018-12-05	

Waterflood Pattern Map

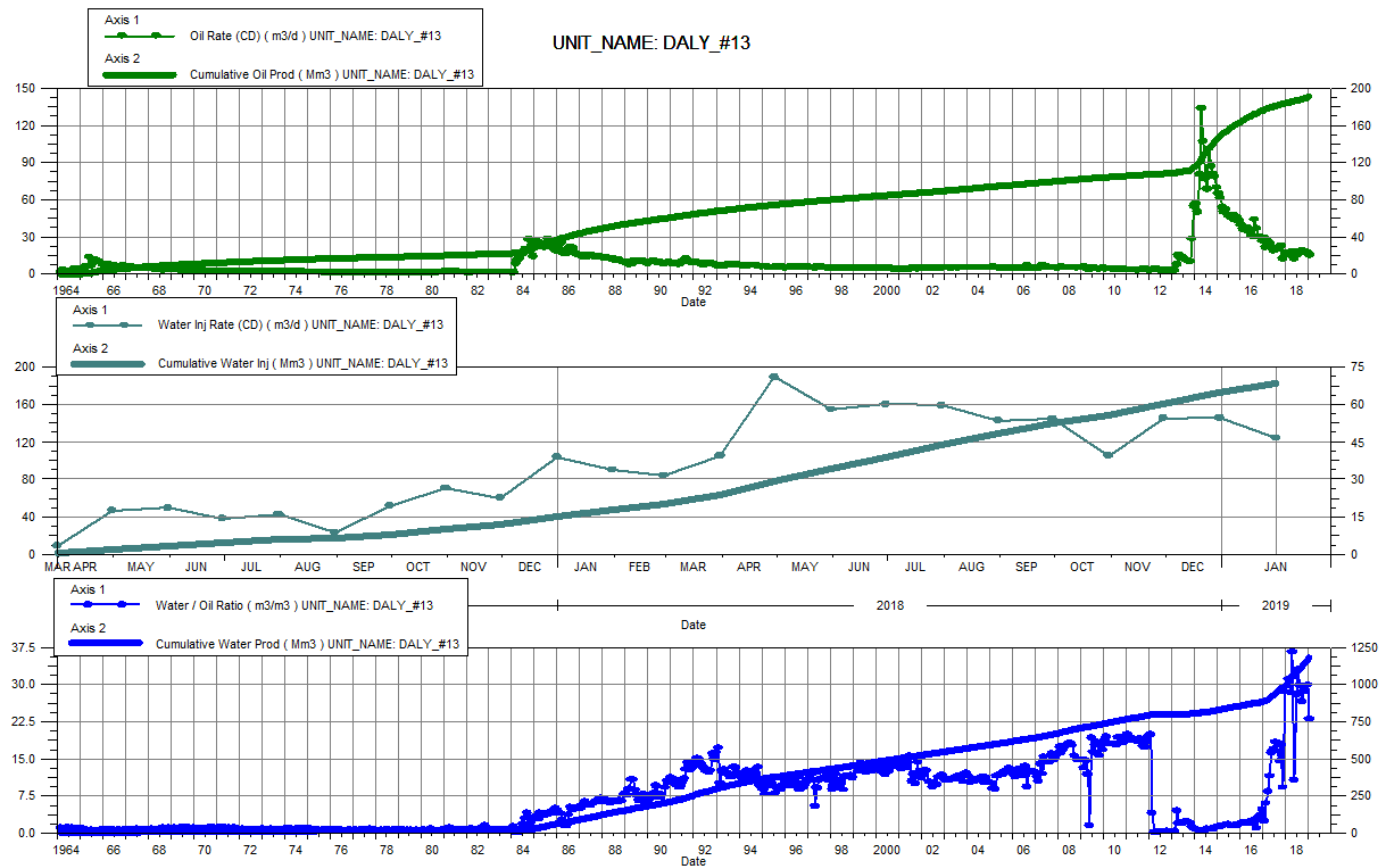


Waterflood Patterns and Corresponding Injectors

Pattern	Well
P-01	103/01-36-009-29W1/00
P-02	103/13-25-009-29W1/00
P-03	103/12-25-009-29W1/00
P-04	103/05-25-009-29W1/00
P-05	103/04-25-009-29W1/00

Total for Daly Unit No. 13

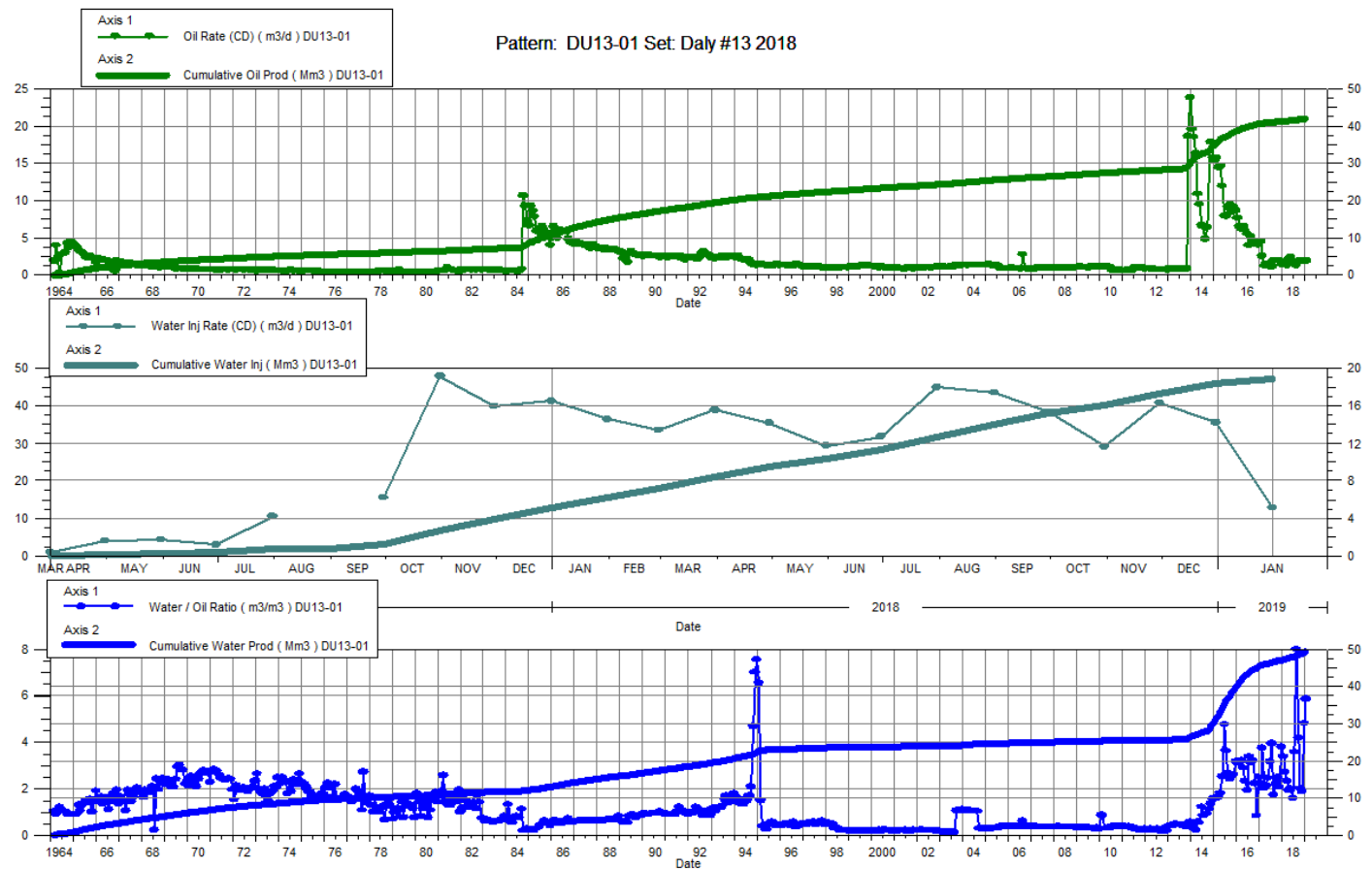
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacemt Ratio	Water Inj Pressure kPa
1-31-2018	17.32	184.54	512.38	1002.74	90.39	17.95	29.58	0.17	0.02	6,973.06
2-28-2018	17.33	185.03	537.13	1017.78	84.14	20.31	30.99	0.15	0.02	8,030.17
3-31-2018	16.76	185.55	473.64	1032.46	105.45	23.57	28.25	0.22	0.02	8,060.10
4-30-2018	18.13	186.09	662.04	1052.32	190.00	29.27	36.52	0.28	0.02	6,097.16
5-31-2018	12.60	186.48	135.44	1056.52	154.81	34.07	10.75	1.04	0.03	6,919.01
6-30-2018	14.92	186.93	415.63	1068.99	160.67	38.89	27.85	0.37	0.03	7,844.35
7-31-2018	18.17	187.49	597.80	1087.52	159.58	43.84	32.90	0.26	0.03	8,392.50
8-31-2018	16.73	188.01	496.98	1102.93	143.10	48.28	29.70	0.28	0.04	8,425.69
9-30-2018	19.25	188.59	510.16	1118.23	144.93	52.63	26.50	0.27	0.04	7,054.58
10-31-2018	18.15	189.15	517.22	1134.27	105.42	55.89	28.49	0.20	0.04	4,791.55
11-30-2018	18.50	189.71	531.30	1150.21	145.73	60.27	28.72	0.27	0.05	8,223.28
12-31-2018	17.80	190.26	531.04	1166.67	145.87	64.79	29.83	0.27	0.05	8,256.82



Daly Unit No. 13

Pattern P-01 - 03/01-36-009-29W1/0

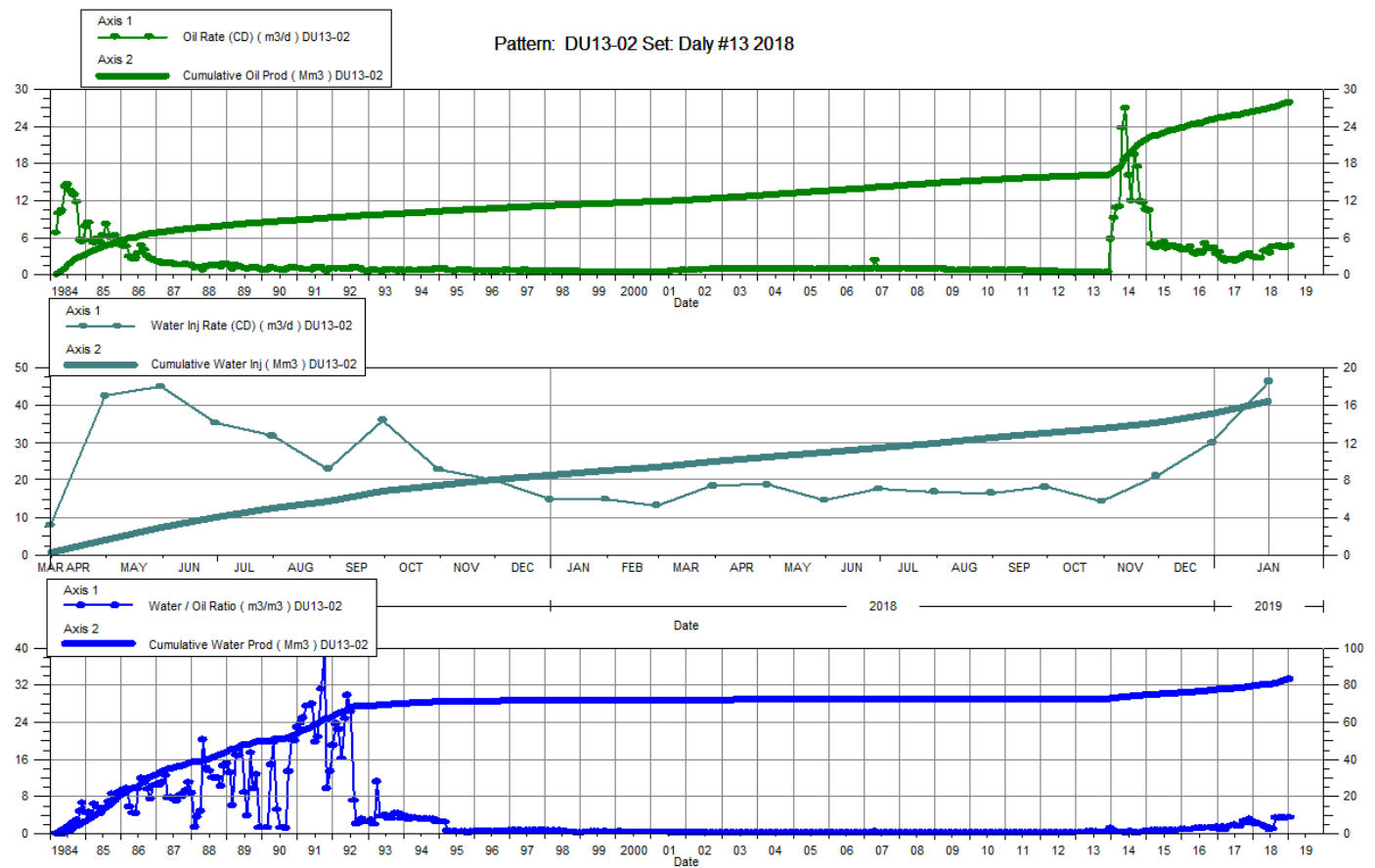
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	1.61	41.39	5.45	47.14	36.50	6.25	3.39	5.14	0.07	6,655.67
2-28-2018	1.48	41.43	4.04	47.25	33.62	7.20	2.72	6.06	0.08	7,876.12
3-31-2018	1.37	41.47	3.19	47.35	38.98	8.40	2.32	8.49	0.09	7,769.58
4-30-2018	2.10	41.53	4.06	47.47	35.51	9.47	1.93	5.72	0.11	7,927.00
5-31-2018	2.40	41.61	4.83	47.62	29.35	10.38	2.01	4.03	0.12	7,884.30
6-30-2018	1.92	41.67	3.07	47.71	31.80	11.33	1.60	6.33	0.13	8,140.28
7-31-2018	1.61	41.72	5.76	47.89	45.06	12.73	3.57	6.09	0.14	8,390.49
8-31-2018	1.36	41.76	10.85	48.23	43.61	14.08	7.97	3.56	0.16	-
9-30-2018	1.80	41.81	7.54	48.45	38.50	15.24	4.19	4.11	0.17	1,374.98
10-31-2018	1.98	41.87	4.00	48.58	29.19	16.14	2.01	4.85	0.18	66.14
11-30-2018	1.92	41.93	3.60	48.68	40.87	17.37	1.87	7.36	0.19	8,155.75
12-31-2018	2.03	41.99	9.74	48.99	35.58	18.47	4.81	3.01	0.20	8,160.39



Daly Unit No. 13

Pattern P-02 - 03/13-25-009-29W1/0

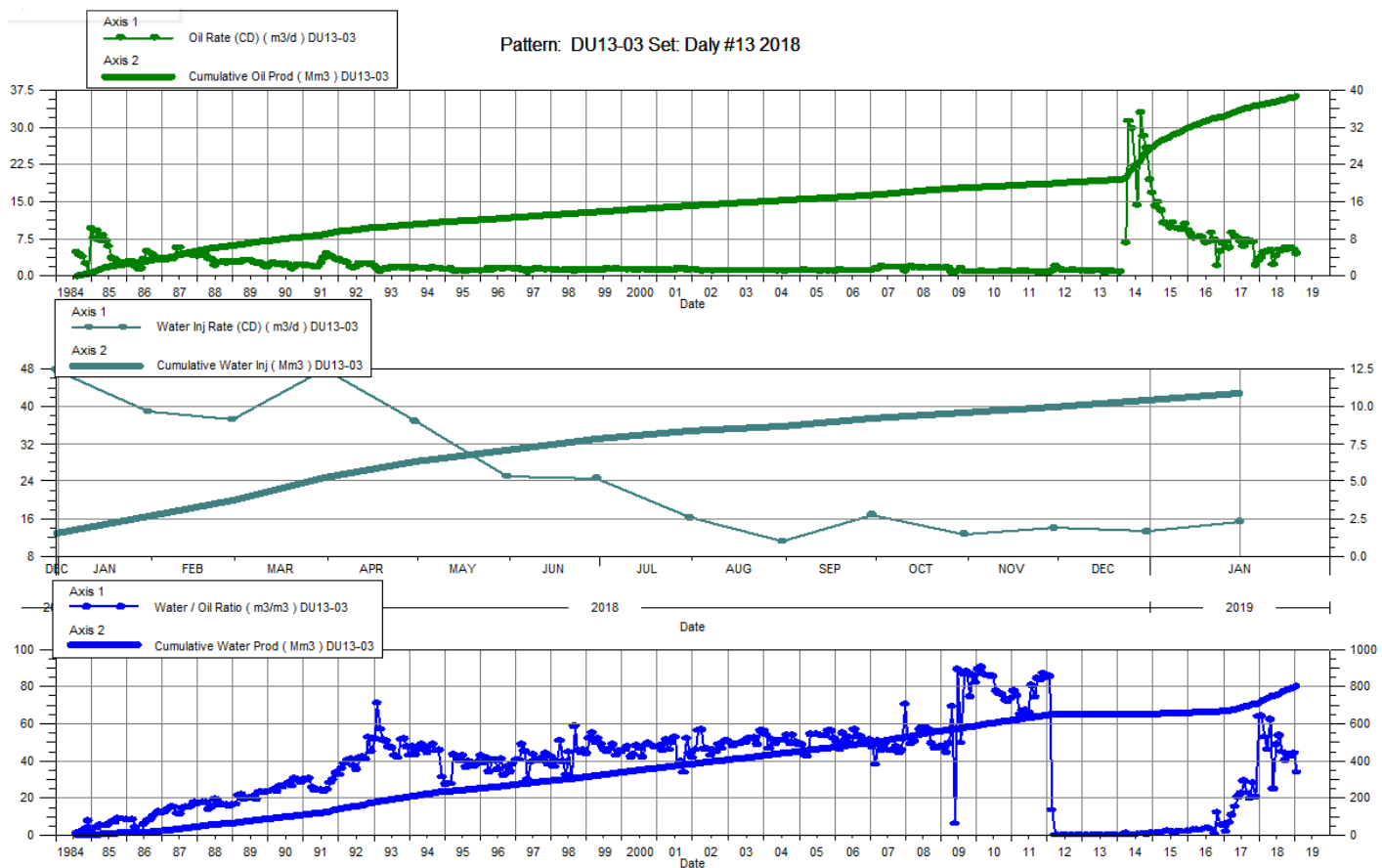
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	2.91	26.50	6.14	79.61	14.92	9.00	2.11	1.64	0.08	7,529.35
2-28-2018	2.78	26.57	6.16	79.78	13.20	9.37	2.21	1.47	0.09	8,238.90
3-31-2018	2.79	26.66	5.45	79.95	18.49	9.95	1.96	2.23	0.09	8,465.53
4-30-2018	3.91	26.78	6.55	80.15	18.74	10.51	1.68	1.78	0.10	2,986.61
5-31-2018	4.12	26.91	5.57	80.32	14.58	10.96	1.35	1.49	0.10	2,094.19
6-30-2018	3.61	27.01	2.90	80.41	17.67	11.49	0.80	2.68	0.11	6,172.37
7-31-2018	4.68	27.16	4.56	80.55	16.84	12.01	0.97	1.81	0.11	8,226.36
8-31-2018	4.64	27.30	16.39	81.06	16.58	12.53	3.53	0.79	0.12	8,264.86
9-30-2018	4.86	27.45	16.31	81.55	18.20	13.07	3.36	0.86	0.12	8,340.46
10-31-2018	4.50	27.59	15.55	82.03	14.35	13.52	3.45	0.71	0.12	5,964.36
11-30-2018	4.59	27.73	15.62	82.50	21.10	14.15	3.40	1.04	0.13	8,001.86
12-31-2018	4.60	27.87	16.22	83.00	30.10	15.08	3.52	1.44	0.14	7,988.22



Daly Unit No. 13

Pattern P-03 - 03/12-25-009-29W1/0

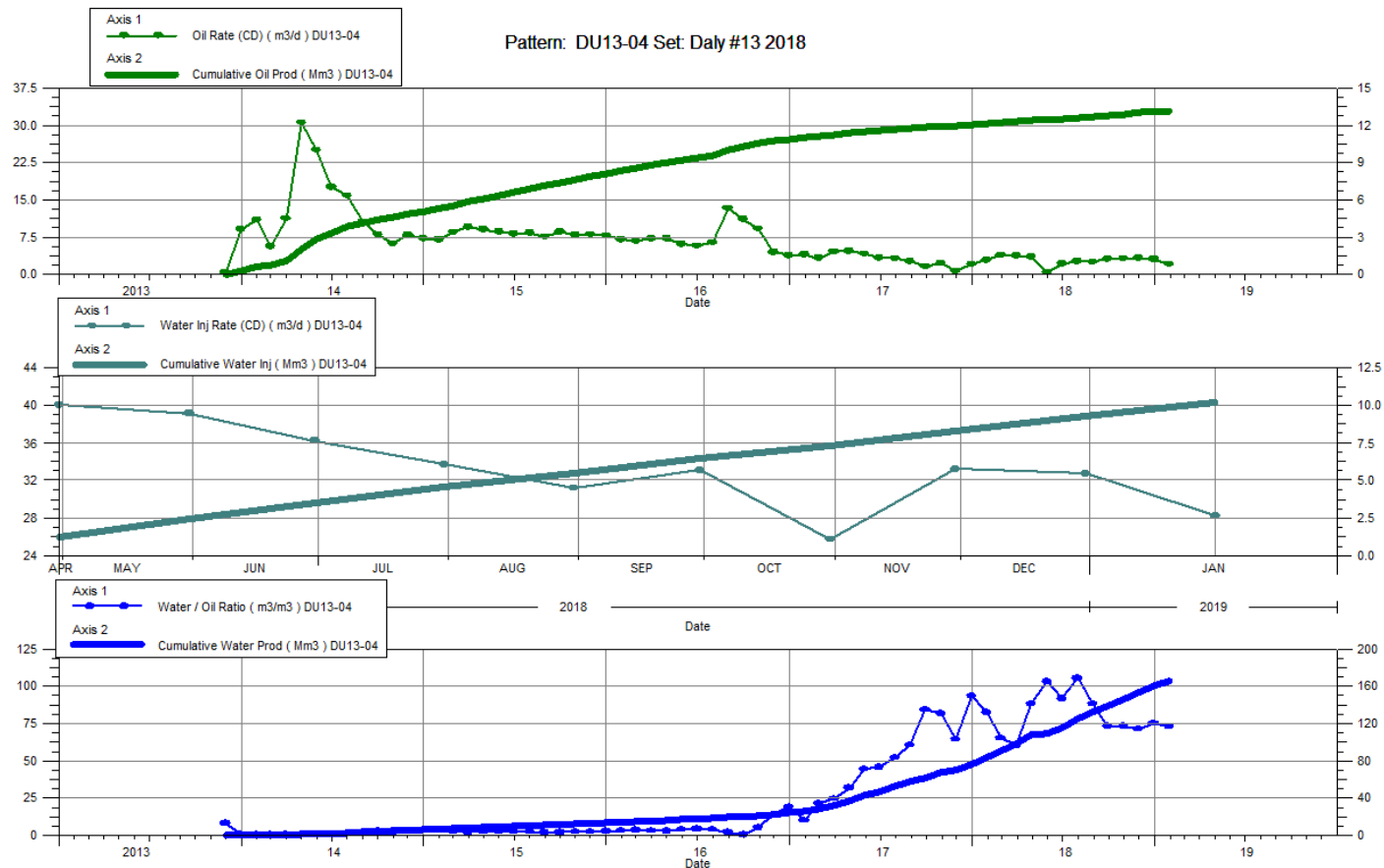
Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	3.86	36.91	247.09	720.56	38.96	2.69	64.07	0.16	0.00	6,734.16
2-28-2018	4.95	37.04	261.06	727.87	37.33	3.74	52.78	0.14	0.01	7,975.49
3-31-2018	5.01	37.20	230.58	735.02	47.98	5.23	45.98	0.20	0.01	7,945.19
4-30-2018	5.19	37.36	323.03	744.71	36.95	6.33	62.24	0.11	0.01	8,303.60
5-31-2018	2.42	37.43	60.14	746.57	25.06	7.11	24.87	0.40	0.01	8,293.65
6-30-2018	4.14	37.55	202.18	752.64	24.67	7.85	48.86	0.12	0.01	8,376.68
7-31-2018	5.39	37.72	288.90	761.59	16.19	8.35	53.61	0.06	0.01	8,434.32
8-31-2018	5.17	37.88	230.73	768.75	11.13	8.70	44.65	0.05	0.01	8,483.39
9-30-2018	5.86	38.06	235.19	775.80	16.83	9.20	40.17	0.07	0.01	8,548.06
10-31-2018	5.53	38.23	238.47	783.19	12.68	9.60	43.12	0.05	0.01	6,161.97
11-30-2018	5.70	38.40	241.64	790.44	14.00	10.02	42.43	0.06	0.01	8,196.39
12-31-2018	5.41	38.57	238.20	797.83	13.26	10.43	44.01	0.05	0.01	8,204.22



Daly Unit No. 13

Pattern P-04 - 03/05-25-009-29W1/0

Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	3.01	12.12	247.96	83.41		0.00	82.39		0.00	-
2-28-2018	4.03	12.23	261.75	90.73		0.00	64.97		0.00	-
3-31-2018	3.83	12.35	230.84	97.89		0.00	60.21		0.00	-
4-30-2018	3.69	12.46	323.86	107.61	40.07	1.20	87.88	0.12	0.01	6,057.69
5-31-2018	0.59	12.48	60.54	109.48	39.19	2.42	103.12	0.64	0.02	8,204.48
6-30-2018	2.22	12.54	203.12	115.58	36.23	3.50	91.57	0.18	0.03	8,226.99
7-31-2018	2.75	12.63	289.83	124.56	33.71	4.55	105.39	0.12	0.03	8,335.28
8-31-2018	2.64	12.71	231.55	131.74	31.16	5.51	87.86	0.13	0.04	8,339.59
9-30-2018	3.24	12.81	236.15	138.82	33.10	6.51	72.96	0.14	0.04	8,348.33
10-31-2018	3.27	12.91	239.15	146.24	25.71	7.30	73.04	0.11	0.05	5,867.00
11-30-2018	3.40	13.01	242.69	153.52	33.23	8.30	71.28	0.14	0.05	8,250.00
12-31-2018	3.19	13.11	239.20	160.93	32.74	9.32	75.09	0.14	0.05	8,284.62



Daly Unit No. 13

Pattern P-05 - 03/04-25-009-29W1/0

Date	Oil Rate (CD) m3/d	Cum Oil Prod Mm3	Water Rate (CD) m3/d	Cum Water Prod Mm3	Water Inj Rate (CD) m3/d	Cum Water Inj Mm3	Water Oil Ratio m3/m3	Voidage Replacement Ratio	Cum Voidage Replacement Ratio	Water Inj Pressure kPg
1-31-2018	4.00	15.18	1.72	4.81		0.00	0.43		0.00	-
2-28-2018	2.30	15.24	1.13	4.84		0.00	0.49		0.00	-
3-31-2018	1.87	15.30	0.72	4.87		0.00	0.38		0.00	-
4-30-2018	1.78	15.35	1.28	4.90	58.74	1.76	0.72	18.96	0.09	5,210.88
5-31-2018	1.53	15.40	0.88	4.93	46.61	3.21	0.58	19.07	0.16	8,118.46
6-30-2018	1.44	15.44	1.37	4.97	50.30	4.72	0.95	17.73	0.23	8,305.44
7-31-2018	1.47	15.49	1.58	5.02	47.77	6.20	1.08	15.50	0.30	8,576.04
8-31-2018	1.31	15.53	1.33	5.06	40.61	7.46	1.01	15.20	0.36	8,614.90
9-30-2018	1.78	15.58	9.93	5.36	38.30	8.61	5.57	3.26	0.41	8,661.05
10-31-2018	1.82	15.64	17.30	5.90	23.48	9.33	9.49	1.23	0.43	5,898.31
11-30-2018	1.85	15.69	23.43	6.60	36.53	10.43	12.70	1.44	0.46	8,512.42
12-31-2018	1.59	15.74	23.19	7.32	34.19	11.49	14.61	1.38	0.49	8,646.67

