

2020



VERMILION
E N E R G Y



Sinclair Unit No.4 Waterflood Project 2020 Performance Report

Prepared for: Vermilion Energy Inc.
Prepared By: VZFOX Canada Ltd. - Engineering
December 17, 2021

[2020 WATERFLOOD PERFORMANCE REPORT]

Manitoba Mineral Resources requires the annual waterflood performance reports as per Manitoba Petroleum Guideline 11 – Enhanced Oil Recovery (EOR) Annual Report.



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1.0 ANNUAL REPORT

The Sinclair Unit No. 4 is a two section area located in Sections 11 and 14-007-29W1 (referred to as the “project area” or “scheme area”). The waterflood is operated by Vermilion Energy and utilizes two injection patterns in the Three Forks formation. The first waterflood pattern is located in Section 14-007-29W1 and consists of three (3) injectors, three (3) horizontal producers and two (2) vertical producers. Please see below for the wells associated with the first injection pattern:

Injection wells in Section 14-007-29W1:

- 100/13-14-007-29W1/03 HZ
- 100/15-14-007-29W1/00 HZ
- 100/16-14-007-29W1/00 HZ

Production wells in Section 14-007-29W1:

- 100/04-14-007-29W1/00 VT
- 100/09-14-007-29W1/00 HZ
- 100/11-14-007-29W1/00 VT
- 100/14-14-007-29W1/00 HZ
- 102/16-14-007-29W1/00 HZ

The second injection pattern encompasses Section 11-007-29W1 and consists of two (2) horizontal injectors, four (4) horizontal producers, two (2) vertical producers, and one (1) horizontal well which was downhole abandoned in 2016 (100/13-11-007-29W1/00). Please see below for the wells associated with the second injection pattern:

Injection wells in the Section 11-007-29W1:

- 102/02-11-007-29W1/00 HZ
- 100/03-11-007-29W1/00 HZ

Production wells in Section 11-007-29W1:

- 100/01-11-007-29W1/00 HZ
- 100/02-11-007-29W1/00 HZ
- 100/04-11-007-29W1/00 HZ
- 100/06-11-007-29W1/00 VT
- 102/13-11-007-29W1/00 HZ
- 100/14-11-007-29W1/00 VT



Please see Figure 1 below for the project area map displaying the wellbore layouts:

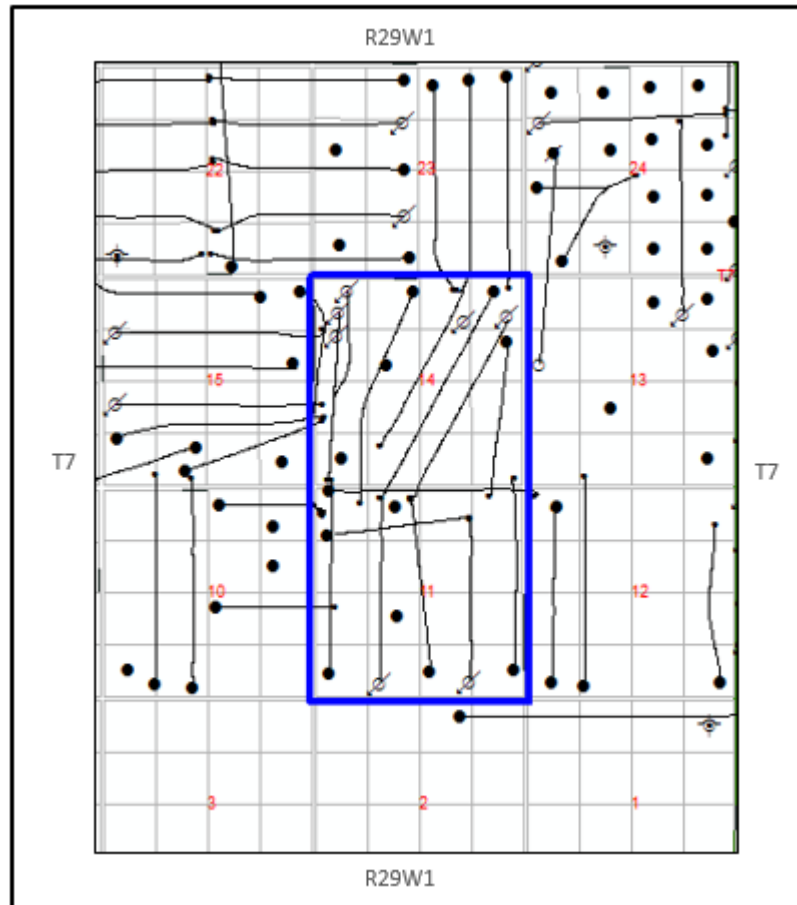


Figure 1: Sinclair Unit No. 4 Map

Unit No. 4 water flood continues to show positive response to water injection since optimization work was performed on the horizontal injection wells in 2017.

The original oil in place (OOIP) for the Sinclair Unit No 4 is estimated to be approximately 1.4 e6m3 (8,551 mstb), of which approximately 8% is recoverable under primary production. To date, the scheme area has produced approximately 73.6 e3m3 of oil, which accounts to approximately 5.3% of OOIP. To date the scheme has injected approximately 217.2 e3m3 of water back into pool.



1.1 OIL PRODUCTION RATE, INJECTION RATE, GOR, & WOR (ANNUAL AND CUMULATIVE)

Detailed production and injection data for the whole project area can be found in Table #1 below and in Attachment 1. The provided data outlines production and injection volumes, instantaneous and cumulative voidage replacement ratios (VRR) and water/oil ratios (WOR) on an annual and cumulative basis.

Table 1: Sinclair Unit #4 Produced Fluids for 2020

Sinclair Unit #4 Produced Fluids

2020 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Production	34902.55	85.40	77.30	69.40	62.30	66.80	44.20	70.00	64.80	52.90	66.60	55.50	57.20	969.90	35674.95
Pattern #2 Production	36828.26	112.30	107.90	99.40	97.40	102.00	66.30	112.30	108.90	79.80	85.00	75.00	88.30	1134.60	37962.86
Total Oil Production	71730.81	197.70	185.20	168.80	159.70	168.80	110.50	182.30	173.70	132.70	151.60	130.50	145.50	2104.50	73637.81

2020 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Production	75865.30	215.50	220.70	203.20	168.00	202.70	89.60	155.40	163.70	148.60	201.40	178.80	147.40	2850.90	78716.20
Pattern #2 Production	167729.31	749.50	721.10	773.00	752.90	884.80	503.10	817.10	655.40	626.80	719.40	685.90	650.10	8539.10	176268.41
Total Water Production	243594.61	965.00	941.80	976.20	920.90	1087.50	592.70	972.50	819.10	775.40	920.80	864.70	797.50	11390.00	254984.61

Scheme Area WOR	3.40	4.88	5.09	5.78	5.77	6.44	5.36	5.33	4.72	5.84	6.07	6.63	5.48	5.41	3.46
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2020 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Injection	86055.70	538.00	627.60	356.60	388.70	585.20	452.70	466.90	456.10	466.70	494.30	430.90	412.30	7541.20	93596.90
Pattern #2 Injection	115762.24	718.50	638.60	411.20	783.00	748.10	626.10	750.50	712.60	694.10	718.80	599.60	442.80	7843.90	123606.14
Total Water Injection	201817.94	1256.50	1266.20	767.80	1171.70	1333.30	1078.80	1217.40	1168.70	1160.80	1213.10	1030.50	855.10	15385.10	217203.04

Scheme Area VRR	0.64	1.08	1.12	0.67	1.08	1.06	1.53	1.05	1.18	1.28	1.13	1.04	0.91	1.14	0.66
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Overall water-to-oil ratios (WOR) for the unit averaged 5.62 for 2020, which brings the cumulative WOR for the unit to 3.46 at the end of 2020. Injected volumes have shown improvement overall for 2020. Instantaneous VRR for the year averaged 1.09, which has increased the cumulative VRR for the unit to 0.66 at year-end. Overall performance for the unit is represented in both tabular and graphical formats on a monthly and cumulative basis for 2020 (Attachment 1).

Pattern #1: Section 14-007-29W1

As mentioned above, Pattern #1 is found in Section 14. The section's WOR fluctuated throughout the year, ranging from 2.03 to 3.22. WOR for the year averaged 2.70, resulting in the cumulative WOR of 2.21 to date. VRR ranged from 1.31 to 2.32 throughout the year. Average VRR for 2020 is 2.04, resulting in the cumulative VRR to increase from 0.78 at the beginning of the year to 0.82 at the end of the year. Please refer to Table 2 below and Attachment 2 for the graphical data.



Table 2: Production Volumes for Pattern #1

Sinclair Unit #4 Produced Fluids: Pattern #1 Sec 14-7-29W1M

	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Oil Production m3/month	34902.55	85.40	77.30	69.40	62.30	66.80	44.20	70.00	64.80	52.90	66.60	55.50	57.20	969.90	35674.95
Water Production m3/month	75865.30	215.50	220.70	203.20	168.00	202.70	89.60	155.40	163.70	148.60	201.40	178.80	147.40	2850.90	78716.20
Water Injection m3/month	86055.70	538.00	627.60	356.60	388.70	585.20	452.70	466.90	456.10	466.70	494.30	430.90	412.30	7541.20	93596.90
Pattern #1 WOR	2.17	2.52	2.86	2.93	2.70	3.03	2.03	2.22	2.53	2.81	3.02	3.22	2.58	2.94	2.21
Pattern #1 VRR	0.78	1.79	2.11	1.31	1.69	2.17	3.38	2.07	2.00	2.32	1.84	1.84	2.02	1.97	0.82

Pattern #2: Section 11-007-29W1

The second waterflood pattern is found in Section 11-07-029W1. The section's WOR fluctuated throughout the year, ranging from 6.02 to 9.15. WOR for the year averaged 7.6, resulting in the cumulative WOR of 4.64 to date. VRR for the section ranged from 0.47 to 1.10 throughout the year. Average VRR for 2020 is 0.82, resulting in the cumulative VRR to increase from 0.57 at the beginning of the year to 0.58 at the end of the year. Please refer to Table 3 below and Attachment 3 for the graphical data.

Table 3: Production Volumes for Pattern #2

Sinclair Unit #4 Produced Fluids: Pattern #2 Sec 11-7-29W1M

	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
2020 Oil Production m3/month	36828.26	112.3	107.9	99.4	97.4	102.0	66.3	112.3	108.9	79.8	85.0	75.0	88.3	1134.6	37962.9
2020 Water Production m3/month	167729.31	749.5	721.1	773.0	752.9	884.8	503.1	817.1	655.4	626.8	719.4	685.9	650.1	8539.1	176268.4
2020 Water Injection m3/month	115762.24	718.5	638.6	411.2	783.0	748.1	626.1	750.5	712.6	694.1	718.8	599.6	442.8	7843.9	123606.1
Pattern #2 WOR	4.55	6.67	6.68	7.78	7.73	8.67	7.59	7.28	6.02	7.85	8.46	9.15	7.36	7.5261	4.64
Pattern #2 VRR	0.57	0.83	0.77	0.47	0.92	0.76	1.10	0.81	0.93	0.98	0.89	0.79	0.60	0.8108	0.58

1.2 MONTHLY WELLHEAD INJECTION PRESSURE

Please refer to Attachment 4 for production plots showing injection rate vs pressure for each injection well for 2020, and Attachment 5 for the monthly average rate and pressure data.

1.3 SURVEY OF RESERVOIR PRESSURE

There were no pressure surveys executed in Unit No. 4 in 2020.

1.4 WELL SERVICING

The only well servicing that occurred in 2020 resulted from routine pump changes. No other servicing operations were completed within Unit in 2020.



1.5 METHOD OF QUALITY CONTROL AND TREATMENT

Injection water for Sinclair Unit No. 04 is sourced from the Mannville formation via the 100/14-09-007-29W1 water source well. The 100/14-09 source well is pipeline connected to Vermilion's 08-16 facility. At 08-16, injection water is filtered to 1 micron nominal remaining particulate through two six-bag canister filters and injected down the 5 unit injection wells. All water is treated with scale inhibitor and biocide.

2.0 ATTACHMENTS

Attachment 1: Produced Fluids for Whole Waterflood Project (Tabular and Graphical)

Attachment 2: Produced Fluids for Pattern #1 of the Waterflood Project (Tabular and Graphical)

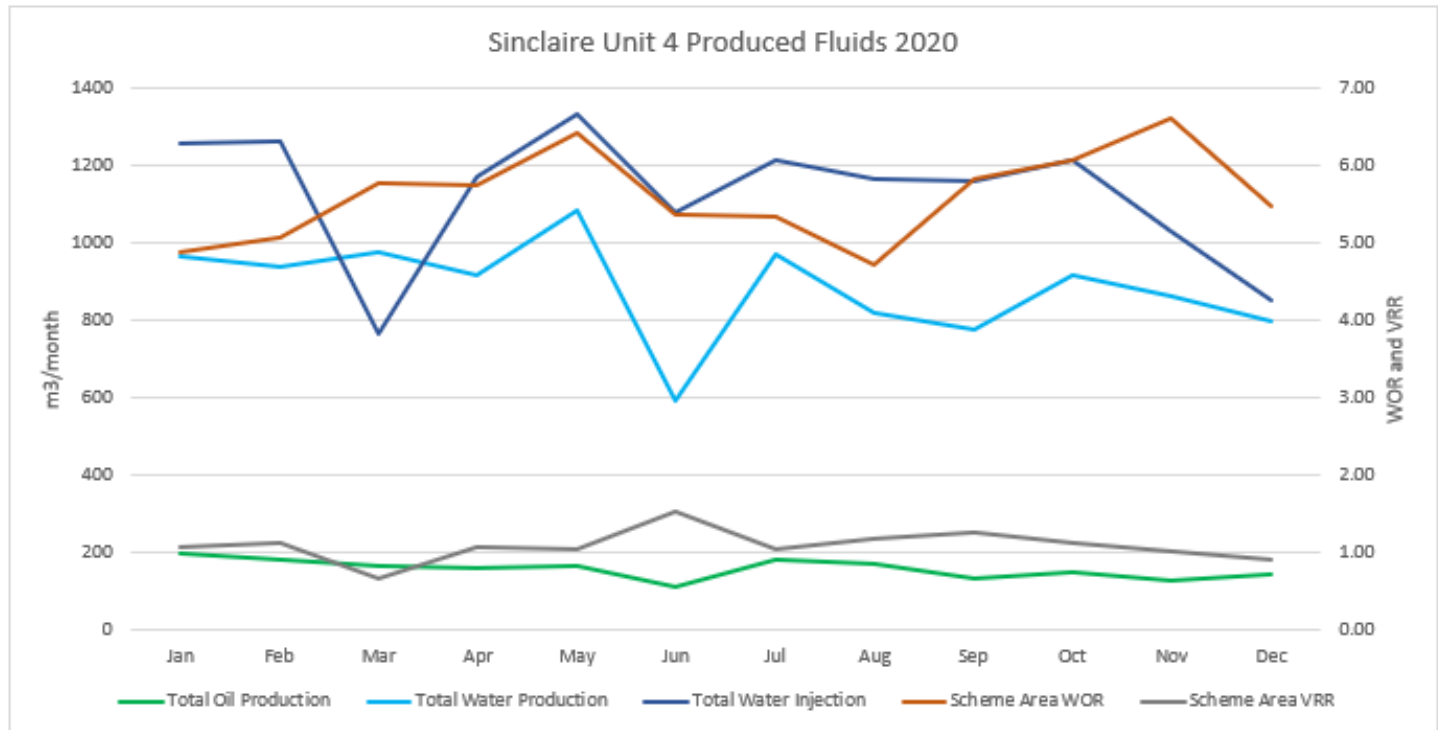
Attachment 3: Produced Fluids for Pattern #2 of the Waterflood Project (Tabular and Graphical)

Attachment 4: Injection Rate Vs Pressure for Injection Wells

Attachment 5: Monthly Average Rate and Pressure Data



ATTACHMENT 1: PRODUCED FLUIDS FOR WHOLE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)



Sinclair Unit #4 Produced Fluids

2020 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Production	34902.55	85.40	77.30	69.40	62.30	66.80	44.20	70.00	64.80	52.90	66.60	55.50	57.20	969.90	35674.95
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Total Oil Production	71730.81	197.70	185.20	168.80	159.70	168.80	110.50	182.30	173.70	132.70	151.60	130.50	145.50	2104.50	73637.81

2020 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Production	75865.30	215.50	220.70	203.20	168.00	202.70	89.60	155.40	163.70	148.60	201.40	178.80	147.40	2850.90	78716.20
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Total Water Production	243594.61	965.00	941.80	976.20	920.90	1087.50	592.70	972.50	819.10	775.40	920.80	864.70	797.50	11390.00	254984.61

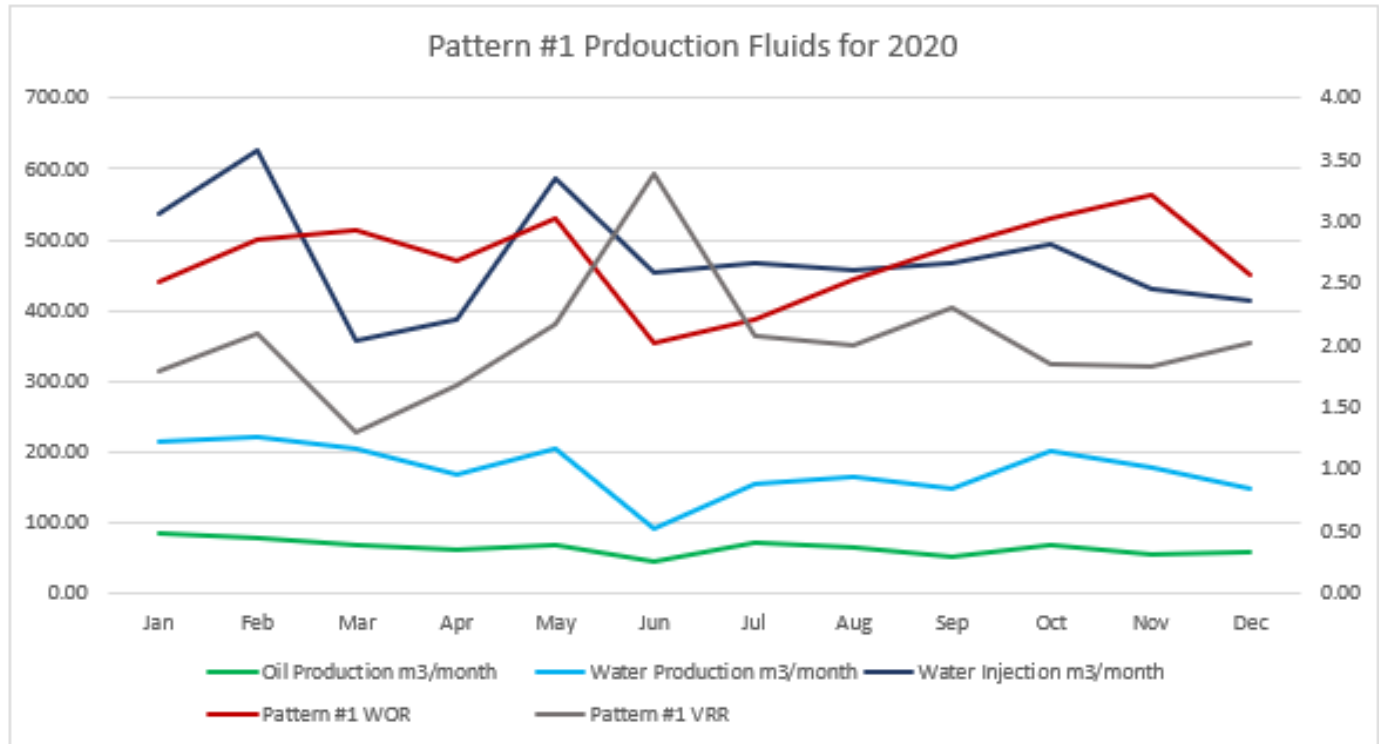
Scheme Area WOR	3.40	4.88	5.09	5.78	5.77	6.44	5.36	5.33	4.72	5.84	6.07	6.63	5.48	5.41	3.46
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2020 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
Pattern #1 Injection	86055.70	538.00	627.60	356.60	388.70	585.20	452.70	466.90	456.10	466.70	494.30	430.90	412.30	7541.20	93596.90
Pattern #2 Injection	115762.24	718.50	638.60	411.20	783.00	748.10	626.10	750.50	712.60	694.10	718.80	599.60	442.80	7843.90	123606.14
Total Water Injection	201817.94	1256.50	1266.20	767.80	1171.70	1333.30	1078.80	1217.40	1168.70	1160.80	1213.10	1030.50	855.10	15385.10	217203.04

Scheme Area VRR	0.64	1.08	1.12	0.67	1.08	1.06	1.53	1.05	1.18	1.28	1.13	1.04	0.91	1.14	0.66
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ATTACHMENT 2: PRODUCED FLUIDS FOR PATTERN #1 OF THE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)

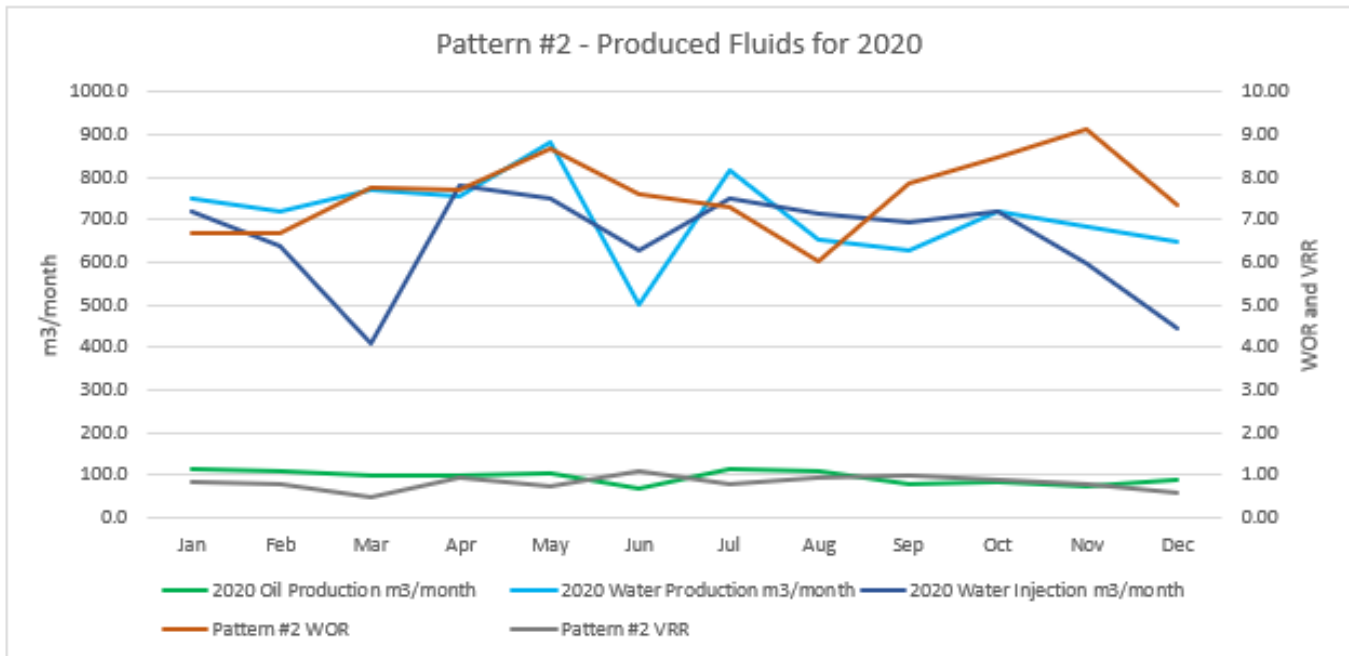


Sinclair Unit #4 Produced Fluids: Pattern #1 Sec 14-7-29W1M

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oil Production m3/month	85.40	77.30	69.40	62.30	66.80	44.20	70.00	64.80	52.90	66.60	55.50	57.20
Water Production m3/month	215.50	220.70	203.20	168.00	202.70	89.60	155.40	163.70	148.60	201.40	178.80	147.40
Water Injection m3/month	538.00	627.60	388.70	585.20	452.70	466.90	456.10	494.30	430.90	412.30		
Pattern #1 WOR	2.52	2.86	2.93	2.70	3.03	2.03	2.22	2.53	2.81	3.02	3.22	2.58
Pattern #1 VRR	1.79	2.11	1.31	1.69	2.17	3.38	2.07	2.00	2.32	1.84	1.84	2.02



ATTACHMENT 3: PRODUCED FLUIDS FOR PATTERN #2 OF THE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)

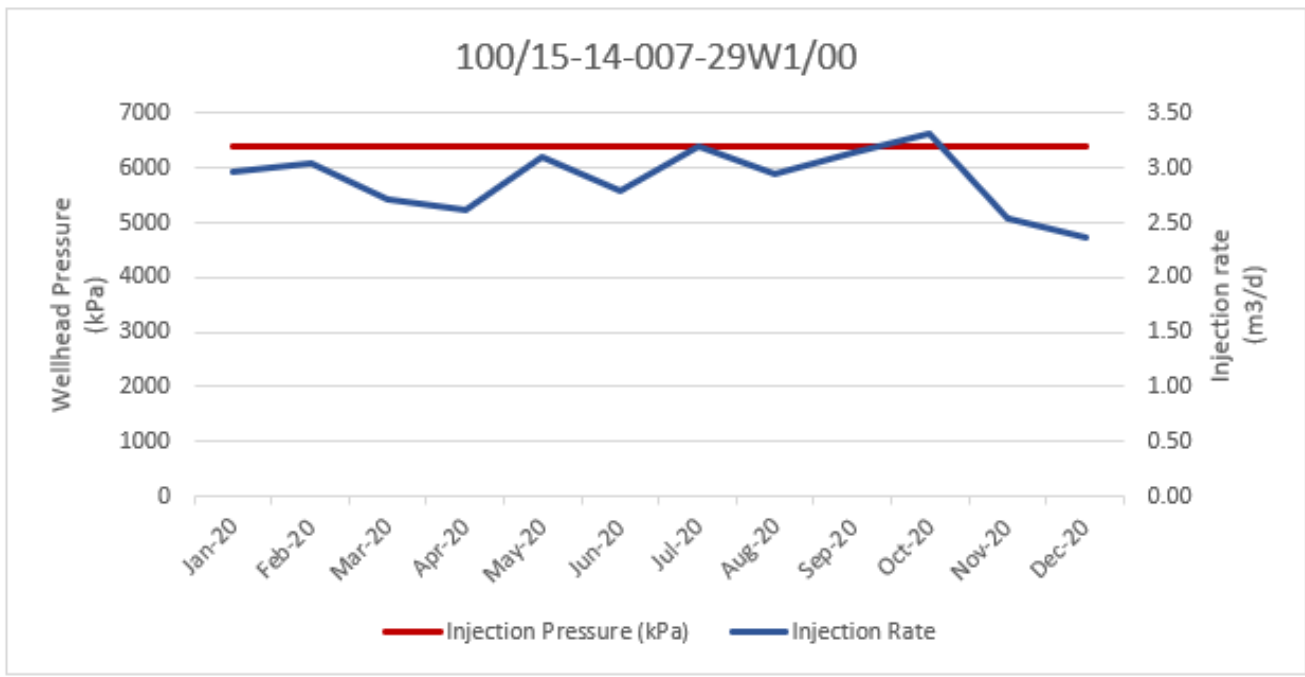
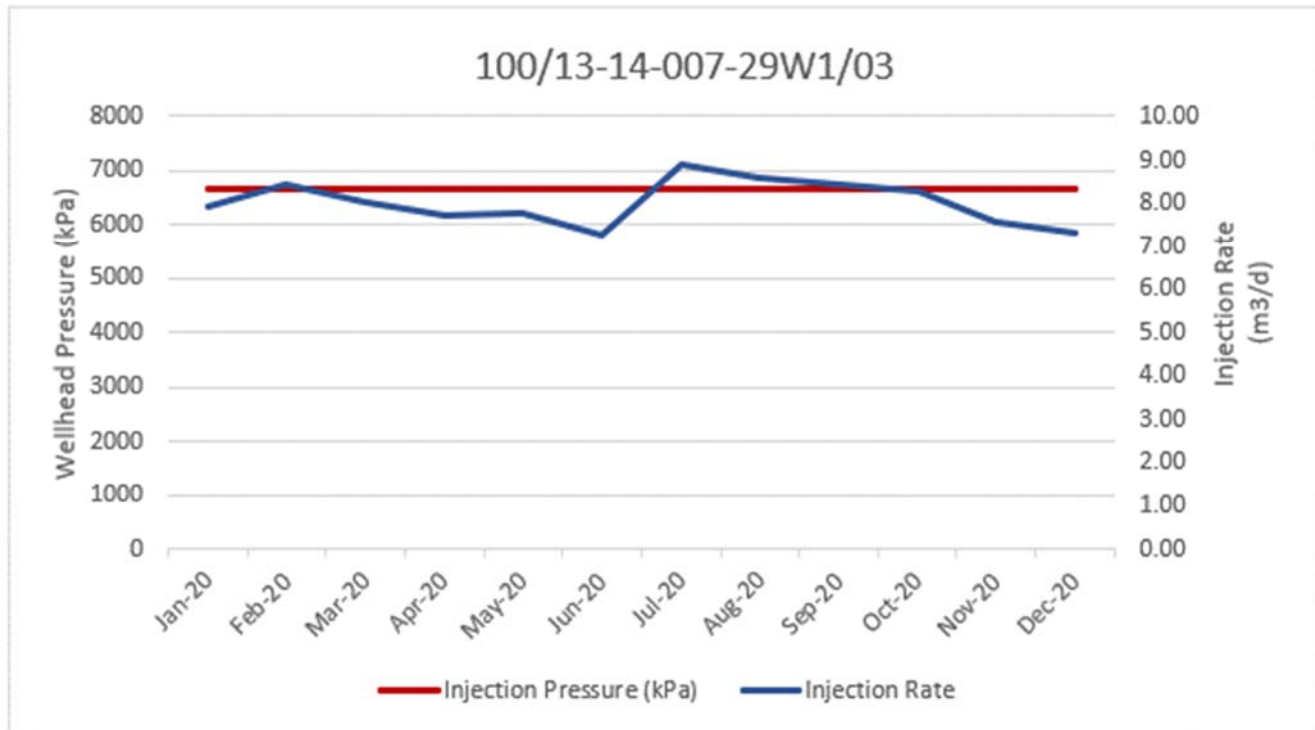


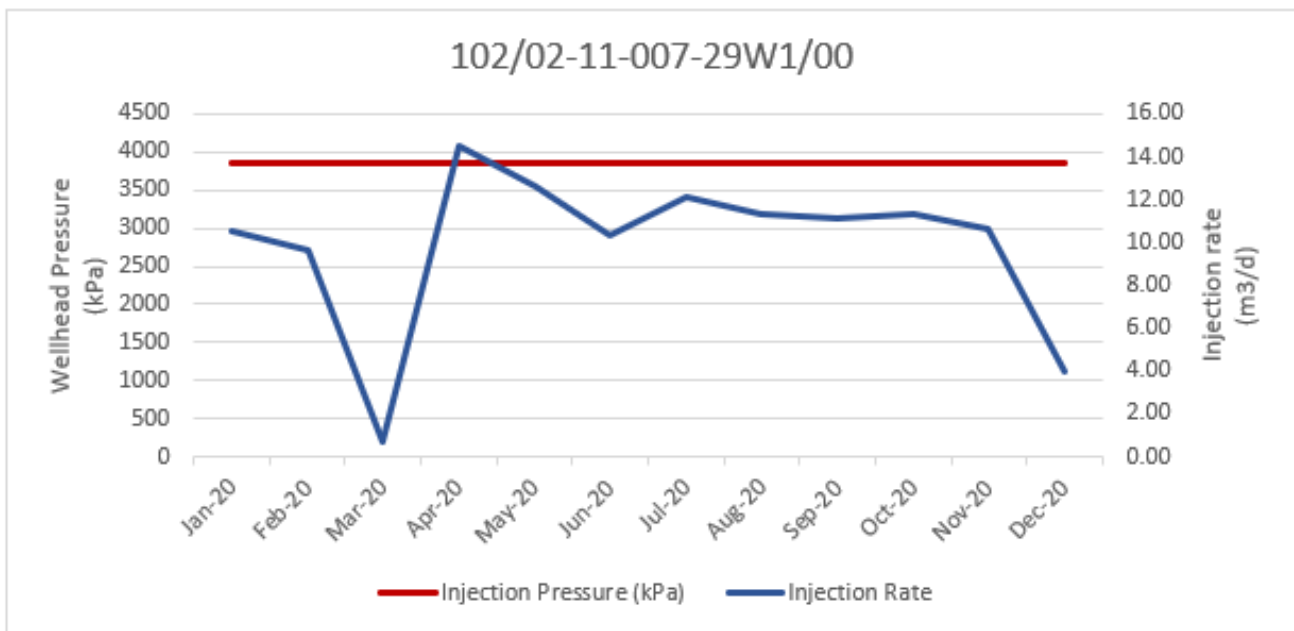
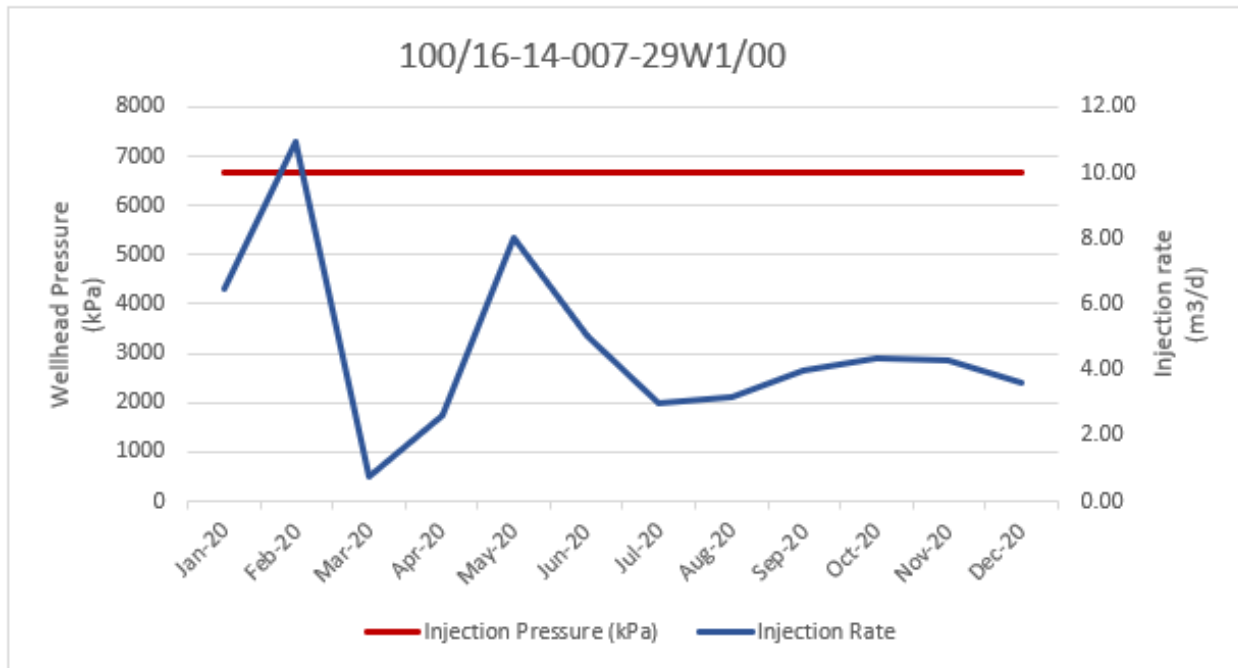
Sinclair Unit #4 Produced Fluids: Pattern #2 Sec 11-7-29W1M

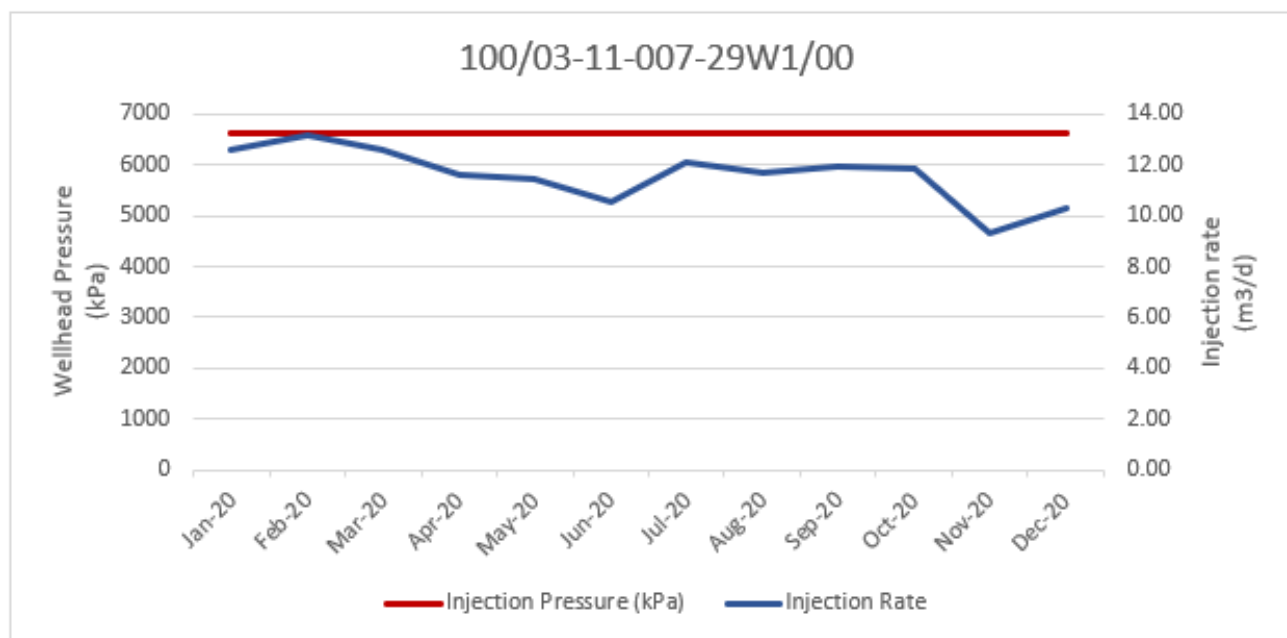
	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2020	CTD
2020 Oil Production m3/month	36828.26	112.3	107.9	99.4	97.4	102.0	66.3	112.3	108.9	79.8	85.0	75.0	88.3	1134.6	37962.9
2020 Water Production m3/month	167729.31	749.5	721.1	773.0	752.9	884.8	503.1	817.1	655.4	626.8	719.4	685.9	650.1	8539.1	176268.4
2020 Water Injection m3/month	115762.24	718.5	638.6	411.2	783.0	748.1	626.1	750.5	712.6	694.1	718.8	599.6	442.8	7843.9	123606.1
Pattern #2 WOR	4.55	6.67	6.68	7.78	7.73	8.67	7.59	7.28	6.02	7.85	8.46	9.15	7.36	7.5261	4.64
Pattern #2 VRR	0.57	0.83	0.77	0.47	0.92	0.76	1.10	0.81	0.93	0.98	0.89	0.79	0.60	0.8108	0.58



ATTACHMENT 4: INJECTION RATE VS PRESSURE FOR INJECTION WELLS







ATTACHMENT 5: MONTHLY AVERAGE RATE AND PRESSURE DATA

Sinclair Unit #4 Monthly Average Injection Data

Pattern #1 Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00/15-14 Injection Rate (m3/d)	2.97	3.04	2.72	2.62	3.09	2.80	3.21	2.95	3.14	3.32	2.53	2.36
00/15-14 Injection Pressure (kPa)	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00	6408.00
00/16-14 Injection Rate (m3/d)	6.45	10.93	0.76	2.61	8.02	5.05	2.97	3.18	3.98	4.34	4.27	3.62
00/16-14 Injection Pressure (kPa)	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00	6689.00
00/13-14 Injection Rate (m3/d)	7.94	8.44	8.02	7.73	7.76	7.24	8.89	8.58	8.44	8.28	7.56	7.32
00/13-14 Injection Pressure (kPa)	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00	6683.00

Pattern #2 Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
02/2-11 Injection Rate (m3/d)	10.55	9.67	0.70	14.47	12.66	10.33	12.11	11.29	11.17	11.36	10.67	3.97
02/2-11 Injection Pressure (kPa)	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00	3846.00
00/3-11 Injection Rate (m3/d)	12.63	13.14	12.56	11.63	11.47	10.54	12.10	11.70	11.97	11.83	9.31	10.32
00/3-11 Injection Pressure (kPa)	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00	6634.00

