

2019



VERMILION
E N E R G Y



Sinclair Unit No.9 Waterflood Project 2019 Performance Report

Prepared for: Vermilion Energy Inc.
Prepared By: VZFOX Canada Engineering
June 25, 2020

[2019 WATERFLOOD PERFORMANCE REPORT]

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



TABLE OF CONTENTS

TABLE OF CONTENTS.....	2
1.0 ANNUAL REPORT.....	3
1.1 Oil Production Rate, Injection Rate, GOR, & WOR (Annual and Cumulative)	4
1.2 Monthly Wellhead Injection Pressure.....	5
1.3 Survey of Reservoir Pressure.....	5
1.4 Well Servicing	5
1.5 Method of Quality Control and Treatment	5
2.0 ATTACHMENTS	5



1.0 ANNUAL REPORT

The Sinclair Unit No. 9 is a one section waterflood located in Section 30-007-29W1 (referred to as the “project area” or “scheme area”). The waterflood is operated by Vermilion Energy and utilizes one injection pattern in the Bakken Three Forks formation. The waterflood pattern consists of seven (7) horizontal wellbores oriented north-south and spaced 185 – 300m apart. The waterflood has three (3) horizontal injectors and four (4) horizontal producers. There is also one (1) vertical abandoned well located at 100/11-30-007-29W1. Please see below for the wells associated with the waterflood:

Injection wells:

- 100/13-30-007-29W1/03 HZ
- 100/14-30-007-29W1/00 HZ
- 100/15-30-007-29W1/00 HZ

Production wells:

- 102/04-30-007-29W1/00 HZ
- 102/15-30-007-29W1/00 HZ
- 100/16-30-007-29W1/00 HZ
- 102/16-30-007-29W1/00 HZ

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

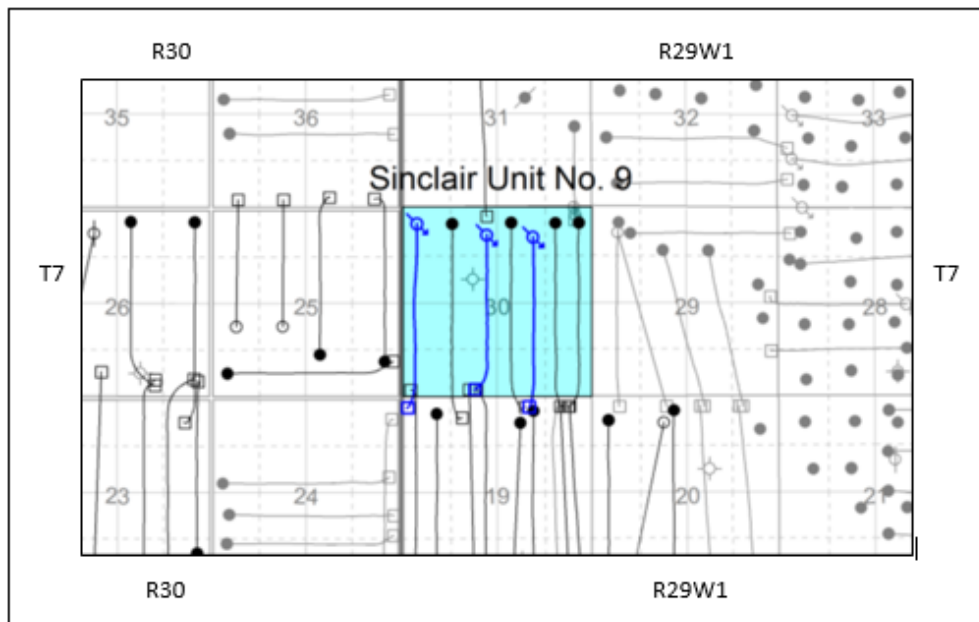


Figure 1: Sinclair Unit No. 9 Map



The main productive zones within the Three Forks in section 30-007-29W1 are the Upper Devonian Lyleton A Dolomitic Siltstone member and the overlying Mississippian Middle Bakken Siltstone member. Horizontal wells in section 30 have undulated through both the Three Forks Lyleton A Member and the Bakken Siltstones over the length of the laterals.

The original oil in place (OOIP) for the Sinclair Unit No 9 is estimated to be approximately 1.2 e6m3 (7,629 mstb), of which approximately 5.5% is recoverable under primary production. Production within the scheme area commenced in 2009, and to date approximately 33.5 e3m3 of oil, which accounts to approximately 2.8% of OOIP. Injection started in 2013 and to date the scheme has injected approximately 105.9 e3m3 of water back into pool.

Vermilion anticipates an incremental recovery of ~10-15% with secondary recovery, for a total recovery factor of 15-20%.

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

Detailed production and injection data for the whole project 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 #9 Produced Fluids for 2019

Sinclair Unit #9 Produced Fluids															
2019 Oil Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2019	CTD
Oil Total Production	32027.4	136.0	121.8	136.7	126.3	130.5	124.7	112.3	115.4	128.4	134.5	129.2	127.7	1523.5	33550.9
2019 Water Production m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2019	CTD
Water Total Production	122787.2	786.9	701.5	773.4	707.1	795.9	707.0	791.1	549.0	648.6	704.0	602.2	549.3	8316.0	131103.2
WOR	3.83	5.79	5.76	5.66	5.60	6.10	5.67	7.04	4.76	5.05	5.23	4.66	4.30	5.46	3.91
2019 Water Injection m3/month	Prior CTD	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2019	CTD
Water Injection	99906.0	861.4	736.9	773.3	739.8	452.6	770.2	421.5	381.0	206.7	250.7	215.9	266.0	6076.0	105982.0
VRR	0.65	0.93	0.90	0.85	0.89	0.49	0.93	0.47	0.57	0.27	0.30	0.30	0.39	0.62	0.64

Waterflood performance results in the Sinclair Unit No. 9 flood have been positive to date. The pattern has observed relatively stable total fluid production with no significant change in oil-cuts throughout the year. Water Injection volumes have fluctuated over the year with higher volumes in the first six (6) months, and lower volumes in the last six months.

Overall water-to-oil ratios (WOR) for the unit averaged 5.46 for 2019, which brings the cumulative WOR for the unit to 3.91 at the end of 2019. Instantaneous VRR for the year averaged 0.62, which has decreased the



cumulative VRR for the unit at 0.64. Overall performance for the unit is represented in both tabular and graphical formats on a monthly and cumulative basis for 2019 (Attachment 1).

1.2 MONTHLY WELLHEAD INJECTION PRESSURE

Please refer to Attachment 2 for production plots showing injection rate vs pressure for each injection well for 2019, and Attachment 3 for the monthly average rate and pressure data.

1.3 SURVEY OF RESERVOIR PRESSURE

There were no pressure surveys executed in Unit No. 9 in 2019.

1.4 WELL SERVICING

The only well servicing that occurred in 2019 resulted from routine pump changes. No other servicing operations were completed within Unit in 2019.

1.5 METHOD OF QUALITY CONTROL AND TREATMENT

Injection fluid for Sinclair Unit No. 9 is sourced from the Mannville formation in the 100/15-18-007-29W1 water source well. The 15-18 well is on the same lease as the 15-18 injection facility and is pipeline connected. At the 15-18 facility the water is pumped through a filtration skid where it completes three stages of filtration. The primary filter stage is a 1-micron nominal bag filter, secondary is a 1-micron absolute bag filter and a tertiary 0.5-micron polisher cartridge filter. After the water is filtered it enters the injection pipeline system via a positive displacement pump. All water is treated with scale and biocide inhibitors prior to being injected into Unit No. 9.

2.0 ATTACHMENTS

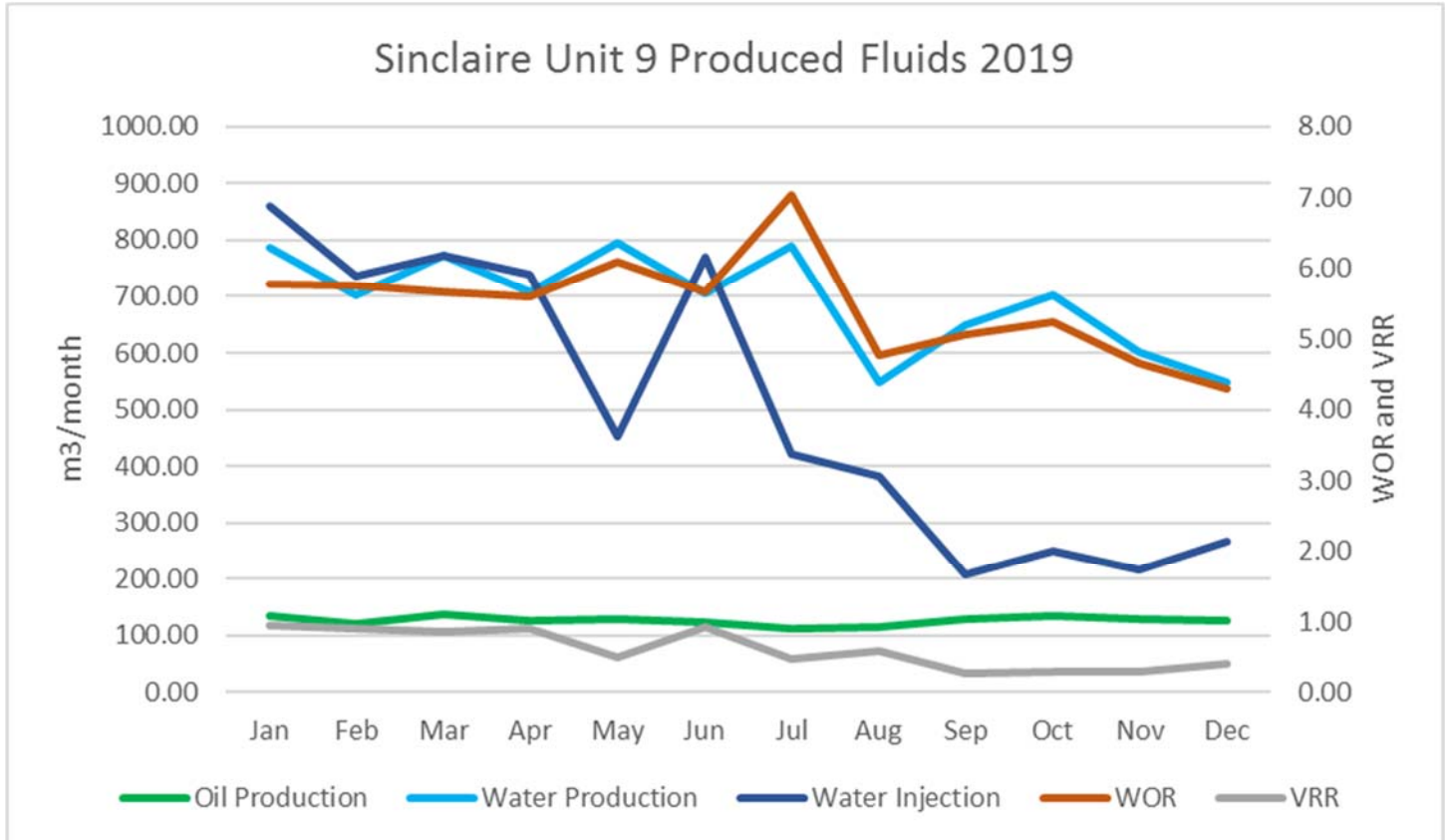
Attachment 1: Produced Fluids for Whole Waterflood Project (Tabular and Graphical)

Attachment 2: Injection Rate Vs Pressure for Injection Wells

Attachment 3: Monthly Average Rate and Pressure Data



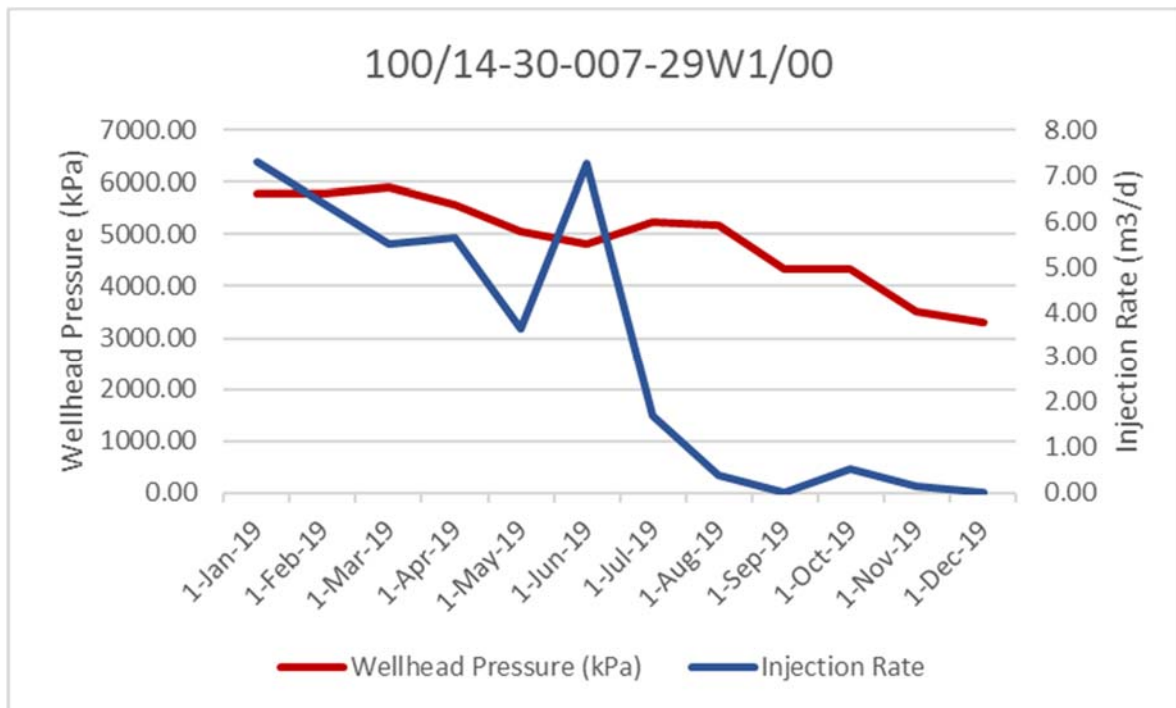
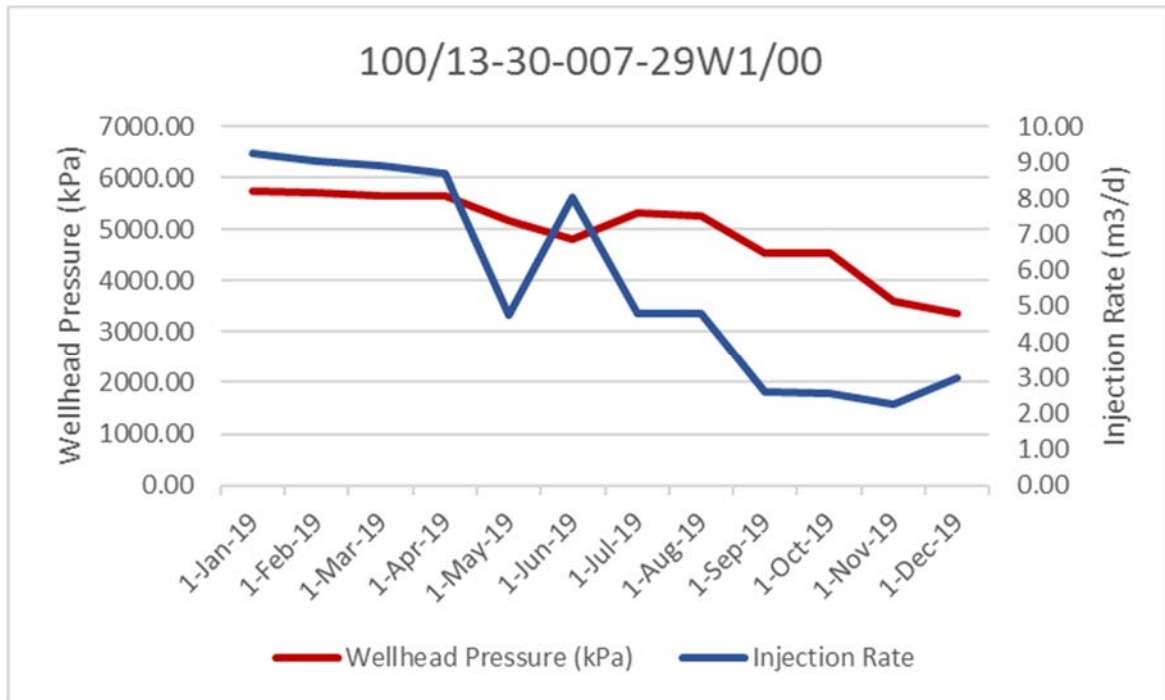
ATTACHMENT 1: PRODUCED FLUIDS FOR WHOLE WATERFLOOD PROJECT (TABULAR AND GRAPHICAL)

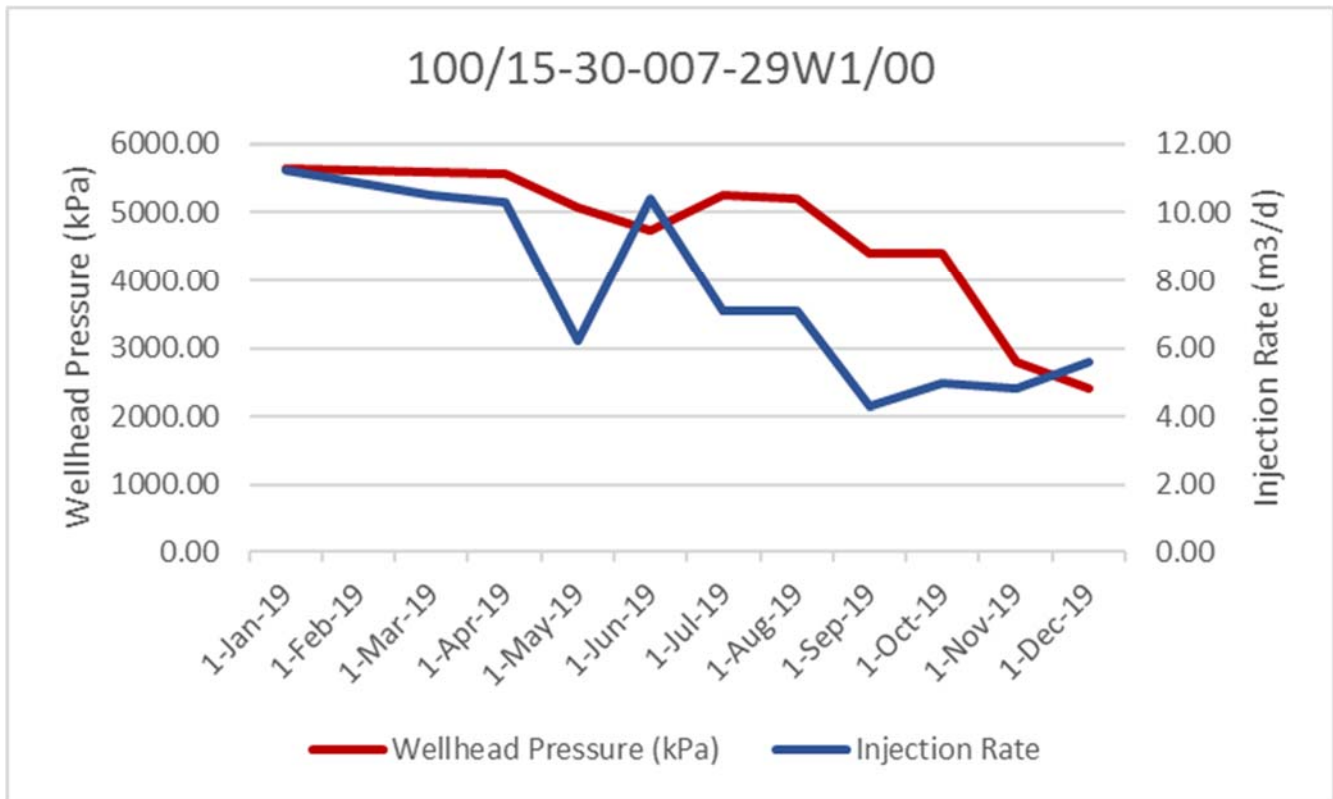


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oil Production	136.00	121.80	136.70	126.30	130.50	124.70	112.30	115.40	128.40	134.50	129.20	127.70
Water Production	786.90	701.50	773.40	707.10	795.90	707.00	791.10	549.00	648.60	704.00	602.20	549.30
Water Injection	861.40	736.90	773.30	739.80	452.60	770.20	421.50	381.00	206.70	250.70	215.90	266.00
WOR	5.79	5.76	5.66	5.60	6.10	5.67	7.04	4.76	5.05	5.23	4.66	4.30
VRR	0.93	0.90	0.85	0.89	0.49	0.93	0.47	0.57	0.27	0.30	0.30	0.39



ATTACHMENT 2: INJECTION RATE VS PRESSURE FOR INJECTION WELLS





ATTACHMENT 3: MONTHLY AVERAGE RATE AND PRESSURE DATA

Monthly Averages	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00/13-30 Injection Rate (m3/d)	9.27	9.03	8.91	8.67	4.75	8.02	4.81	4.79	2.59	2.56	2.26	3.01
00/13-30 Injection Pressure (kPa)	5740.03	5729.96	5669.97	5652.67	5161.90	4815.99	5320.00	5270.29	4549.99	4549.99	3597.96	3360.02
00/14-30 Injection Rate (m3/d)	7.29	6.39	5.52	5.66	3.65	7.25	1.71	0.39	0.01	0.54	0.13	0.01
00/14-30 Injection Pressure (kPa)	5774.98	5794.98	5915.01	5568.69	5068.48	4808.96	5250.02	5191.27	4339.98	4339.98	3499.99	3289.97
00/15-30 Injection Rate (m3/d)	11.23	10.90	10.52	10.33	6.21	10.40	7.07	7.11	4.29	4.99	4.81	5.56
00/15-30 Injection Pressure (kPa)	5635.02	5629.99	5599.37	5574.83	5076.54	4746.01	5250.02	5195.75	4410.03	4410.03	2801.96	2400.00

