WEST ELLS SAGD

Scheme No. 11764G
AER In Situ Performance Presentation
May 25, 2020
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Introduction
West Ells SAGD Project
Located in the NW part of the Athabasca Oilsands Deposit, Alberta, Canada
West Ells SAGD

- Covering 9,856 contiguous gross hectares in the Athabasca Oil Sands Region
- Two phases of 5,000bbl/d
  - Phase 1 currently in Operation since September 2015 is supplied by Pad 2
  - Phase 2 will commence in the future and is supplied by Pad 3 which has already been drilled
  - MSL 112941 and MSL 112933 were cleared of vegetation with no soil disturbance, anticipated to serve as make-up pads as the project advances
Subsurface
Annotation of Major Events

West Ells Fluid Rates

- Steam (m3/d)
- Bitumen (m3/d)
- Water (m3/d)
- iSOR

- Lower Sales Nominations (Market conditions)
- Water Imbalance
- Evap Cleaning
- ESP Performance Decline
- ESP Repair
- ESP Trip

West Ells SAGD 2019 Performance
### Development and Project Area

<table>
<thead>
<tr>
<th>Area</th>
<th>Land Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development Area</td>
<td>T94 R17W4;</td>
</tr>
<tr>
<td>(4 sections)</td>
<td>Sec 30, 31</td>
</tr>
<tr>
<td></td>
<td>T94 R18W4;</td>
</tr>
<tr>
<td></td>
<td>Sec 25, 36</td>
</tr>
<tr>
<td>Project Area</td>
<td>T94 R17W4;</td>
</tr>
<tr>
<td>(6 sections)</td>
<td>Sec 30, 31, 32, 33</td>
</tr>
<tr>
<td></td>
<td>T94 R18W4;</td>
</tr>
<tr>
<td></td>
<td>Sec 25, 36</td>
</tr>
</tbody>
</table>

First Steam – September 2015  
First Production – December 2015
West Ells SAGD 2019 Performance

West Ells Pad & Well Locations

CPF

Pad 2 (Phase 1)  Pad 3 (Phase 2)

- SAGD Well Pair – Drilled & Completed
- SAGD Well Pair – Drilled, liners installed, pump and instrumentation install not complete.
- Source Water Well – Drilled & Completed
Typical SAGD Well Placement (e.g. Pair 8)

Wells are placed at the base of the Wabiskaw D unit. The producer well was positioned above the underlying mud unit by using a deep resistivity geosteering tool that detected the proximity of the bed boundary while drilling.

Top 261.6 m
So = 78.6%
Porosity = 35.1%

Injector

kh = 3860 md
kv = 2960 md

Bottom 268.75 m
So = 83.0%
Porosity = 34.9%

Producer
The SAGD wells are located at the base of the Wabiskaw D sand unit.
The elevation varies from 290 to 297 m asl
The elevation varies from 270 to 280 m asl
The top gas ranges in thickness from 1.0 to 6.4 m and the average is 3.1 m.
The lean zone varies in thickness from 0 to 3.6 m and the average is 1.3 m.
Geomechanical Anomalies--Cap Rock Integrity

• No geomechanical anomalies reported in 2019 as the injection pressure was below MOP*. The injection pressure was between 2000-2450 kPa throughout the year

• Mini-frac tests were performed at:
  - 1AA/14-31-094-17W4/0
  - 1AA/07-36-094-18W4/0

• Caprock average minimum stress gradient = 22 kPa/m (Wabiskaw Shale Member)

* The maximum operating pressure (MOP) of 4400 kPag was granted on March 10, 2016
Geomechanics -- Caprock and Oil Sand from 14-31-94-17W4 Location

Caprock - Wabiskaw Shale Member

1AA/14-31-094-17W4/0 Well Log

Oil sand - Wabiskaw Sand
3D Seismic Survey and Acquisition Parameters

- No new seismic data acquired in this reporting period

### Survey Layout

### Acquisition Parameters

<table>
<thead>
<tr>
<th>Source Information</th>
<th>Receiver Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source interval (m)</td>
<td>20</td>
</tr>
<tr>
<td>Source line interval (m)</td>
<td>80</td>
</tr>
<tr>
<td>Line orientation</td>
<td>N-S</td>
</tr>
<tr>
<td>Total km of line</td>
<td>167.1</td>
</tr>
<tr>
<td>Number of source points</td>
<td>7078</td>
</tr>
<tr>
<td>Source depth (m)</td>
<td>6</td>
</tr>
<tr>
<td>Source type</td>
<td>Dynamite</td>
</tr>
</tbody>
</table>

**Area** 10.7 (km²)

**Source Information**

- Source interval (m): 20
- Source line interval (m): 80
- Line orientation: N-S
- Total km of line: 167.1
- Number of source points: 7078
- Source depth (m): 6
- Source type: Dynamite

**Receiver Information**

- Receiver interval (m): 20
- Receiver line interval (m): 60
- Line orientation: W-E
- Total km of line: 194.9
- Number of receiver points: 9681
4-D Seismic

• As measured on the observation wells, the width of the steam chamber is narrow and less than 10 m from the SAGD well pair. Therefore, Sunshine did not plan a 4D seismic acquisition survey in 2019 because it is difficult to image a small steam chamber in the seismic data.

• While there are no plans in 2020 to conduct a 4D seismic survey, Sunshine will consider a 4D seismic survey when it is appropriate and provides an advantage for resource recovery.
Cross-Section A-A’ of the Active Development Area

West Ellis SAGD 2019 Performance

Location of Section A-A’
**OBIP for Pads 2 & 3 and Development Area**

<table>
<thead>
<tr>
<th>Number of SAGD Well Pairs</th>
<th>Drainage Area 50m Boundary (10^3 m³)</th>
<th>Average Net Pay above producer (m)</th>
<th>Total OBIP (10^6 m³)</th>
<th>Cumulative Bitumen Produced* (m³)</th>
<th>Current Recovery Factor (%)</th>
<th>Estimated Recovery Factor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pad 2</td>
<td>8</td>
<td>504</td>
<td>16.2</td>
<td>1.87</td>
<td>301,141</td>
<td>16.1</td>
</tr>
<tr>
<td>Pad 3</td>
<td>8</td>
<td>504</td>
<td>15.4</td>
<td>1.86</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Production to December 31, 2019

<table>
<thead>
<tr>
<th>Development Area</th>
<th>Area (10^3 m³)</th>
<th>Average Net Pay (m)</th>
<th>Total OBIP (10^6 m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10,511</td>
<td>15.2</td>
<td>37.2</td>
</tr>
</tbody>
</table>

OBIP = Area x Net Pay x Porosity x Bitumen Saturation / FVF

FVF = Formation Volume Factor = 1.005

**Wabiskaw Net Pay Map**

*Production to December 31, 2019

**West Ells SAGD 2019 Performance**
### Average Reservoir Properties for Development Area

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitumen saturation (%)</td>
<td>71</td>
</tr>
<tr>
<td>Porosity (%)</td>
<td>33</td>
</tr>
<tr>
<td>Grain size</td>
<td>Fine to medium</td>
</tr>
<tr>
<td>Net pay (m)</td>
<td>15.2</td>
</tr>
<tr>
<td>Horizontal perm. (D)</td>
<td>2.4</td>
</tr>
<tr>
<td>Vertical perm. (D)</td>
<td>1.7</td>
</tr>
<tr>
<td>Reservoir pressure (kpa)</td>
<td>600</td>
</tr>
<tr>
<td>Reservoir temperature (°C)</td>
<td>9</td>
</tr>
<tr>
<td>Reservoir depth (m TVD)</td>
<td>265</td>
</tr>
<tr>
<td>Bitumen viscosity (cp)</td>
<td>&gt; 1 million</td>
</tr>
<tr>
<td>Well length (m)</td>
<td>800</td>
</tr>
<tr>
<td>Well spacing (m)</td>
<td>70</td>
</tr>
</tbody>
</table>
Surface
CPF Plot Plan

- No major facility modifications during this reporting period
CPF Process Flow Simplified
CPF Process flow

- No modifications during this reporting period
2019 Bitumen Production

Bitumen Production (m³/d)
Steam Injection

2019 Steam Injection

Steam injected m3
Project Steam m3/month
MARP

Measurement, Accounting and Reporting Plan (MARP)

- Reporting codes associated with West Ells
  - ABBT0123666
  - ABIF0123667
  - ABWS0139258, ABWS0139259, ABWS0139260

- MARP approved August 2012
- MARP updated in 2015
- MARP Meter list revised in 2018
- No further changes or alterations made during the 2019 reporting period
Metering Schematic – Injection Facility
Measurement Methodology

- No changes or alteration made to measurement methodology in reporting period
- Daily oil rate of each well is calculated by multiplying the most current well emulsion rate with the manual oil cut
  - Emulsion rate is the test flow rate from the test separator and oil cut is measured manually by taking a sample of the flow
  - Due to the slugging nature of the wells and high water flow during initial production, the test separator is not fully commissioned
  - There is only one separator on the well pad and well tests generally last for 8 to 15 hours depending on the fluid rate from the well (includes time to purge the test pipeline and test vessel)
  - To properly conduct a well test, with 8 wells on a pad, only one well can be tested every 4 - 5 days
  - With the total production from the pad, individual well volumes are prorated against the overall production volume
  - The same philosophy and process is applied to produced water and gas
  - Currently, the meters on the test separator are being verified every time by comparing the results with the manual oil cut and water
Proration of Oil and Water

2019 Proration Factors

- Oil
- Water
Water Disposal

• There are no approved disposal facilities or wells associated with the West Ells Project

• All water is trucked off site to approved waste management facilities in the form of Evaporator Blowdown water

• The Directive 81 disposal limit for 2019 was 7.75%
  • \[((\text{Fresh In} \times D_f + \text{Produced In} \times D_p)/(\text{Fresh In} + \text{Produced In}))\] \times 100

• West Ells has had an average disposal rate of 2.36% for 2019
  • \[((\text{Total Disposal})/ (\text{Fresh In} + \text{Produced In}))\] \times 100

• West Ells was compliant with disposal limits for the entirety of 2019
## Water Disposal And Recycle Rates

### Directive 081 Monthly Balances

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Water In (m3)</td>
<td>25,977.40</td>
<td>25,812.10</td>
<td>20,631.00</td>
<td>11,034.50</td>
<td>8,152.90</td>
<td>8,513.60</td>
</tr>
<tr>
<td>Produced Water In (m3)</td>
<td>16,690.90</td>
<td>18,296.10</td>
<td>23,139.40</td>
<td>53,516.10</td>
<td>58,831.50</td>
<td>53,554.00</td>
</tr>
<tr>
<td>Disposal Total (m3)</td>
<td>835.50</td>
<td>980.50</td>
<td>910.10</td>
<td>1,445.20</td>
<td>1,472.00</td>
<td>1,267.80</td>
</tr>
<tr>
<td>Disposal Factor, Fresh Water</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Disposal Factor, Produced Water</td>
<td>0.10</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Disposal Limit %</td>
<td>5.74</td>
<td>5.90</td>
<td>6.70</td>
<td>8.80</td>
<td>9.15</td>
<td>9.04</td>
</tr>
<tr>
<td>Disposal Rate %</td>
<td>1.96</td>
<td>2.22</td>
<td>2.08</td>
<td>2.24</td>
<td>2.20</td>
<td>2.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh Water In (m3)</td>
<td>12,729.10</td>
<td>15,308.00</td>
<td>11,835.00</td>
<td>16,354.30</td>
<td>14,692.80</td>
<td>14,479.50</td>
</tr>
<tr>
<td>Produced Water In (m3)</td>
<td>45,927.40</td>
<td>37,803.70</td>
<td>36,955.50</td>
<td>32,931.70</td>
<td>28,155.80</td>
<td>27,616.50</td>
</tr>
<tr>
<td>Disposal Total (m3)</td>
<td>1,116.00</td>
<td>1,186.20</td>
<td>1,164.00</td>
<td>1,432.50</td>
<td>1,389.00</td>
<td>1,212.40</td>
</tr>
<tr>
<td>Disposal Factor, Fresh Water</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Disposal Factor, Produced Water</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Disposal Limit %</td>
<td>8.48</td>
<td>7.98</td>
<td>8.30</td>
<td>7.68</td>
<td>7.60</td>
<td>7.59</td>
</tr>
<tr>
<td>Disposal Rate %</td>
<td>1.90</td>
<td>2.23</td>
<td>2.39</td>
<td>2.91</td>
<td>3.24</td>
<td>2.88</td>
</tr>
</tbody>
</table>
Water Disposal Rate

2019 Water Disposal Actual Rate Versus Limit

- Red line: Disposal Limit %
- Blue line: Disposal Rate %

Waste Water Disposal

2019 Evaporator Blowdown Water Disposal Volumes (m$^3$)
Flaring & Venting

- There were no reportable flaring events in 2019
- There was no venting in 2019
Sulphur Production

- There are no sulphur recovery facilities at West Ells

Total Plant $SO_2 = $Flared $SO_2 +$ Steam Generator $SO_2 +$ Co-Generation Units $SO_2$
Compliance – Monitoring Programs

Ambient Air Quality Monitoring

- There are four (4) passive monitoring stations that monitor SO₂ and H₂S

<table>
<thead>
<tr>
<th>Month</th>
<th>Peak SO₂ (ppbv)</th>
<th>Peak H₂S (ppbv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.5</td>
<td>0.59</td>
</tr>
<tr>
<td>February</td>
<td>0.6</td>
<td>0.35</td>
</tr>
<tr>
<td>March</td>
<td>0.7</td>
<td>0.39</td>
</tr>
<tr>
<td>April</td>
<td>1.0</td>
<td>0.45</td>
</tr>
<tr>
<td>May</td>
<td>1.0</td>
<td>0.17</td>
</tr>
<tr>
<td>June</td>
<td>1.0</td>
<td>0.48</td>
</tr>
<tr>
<td>July</td>
<td>0.6</td>
<td>0.42</td>
</tr>
<tr>
<td>August</td>
<td>0.6</td>
<td>1.08</td>
</tr>
<tr>
<td>September</td>
<td>4.6</td>
<td>0.87</td>
</tr>
<tr>
<td>October</td>
<td>0.5</td>
<td>1.58</td>
</tr>
<tr>
<td>November</td>
<td>0.7</td>
<td>1.40</td>
</tr>
<tr>
<td>December</td>
<td>0.9</td>
<td>1.33</td>
</tr>
</tbody>
</table>
Compliance – Monitoring Programs

2019 Comparison of 85 MW Power Boiler hourly mass NO\textsubscript{x} emissions to performance targets and Approval limits
Compliance – Monitoring Programs

2019 Comparison of Co-generation Units hourly mass NO\textsubscript{x} emissions to performance targets and Approval limits
Industrial Runoff Monitoring

- Industrial runoff is monitored and tested prior to release and reported annually
- Releases from the Central Processing Facility (CPF) Storm Pond are analyzed by accredited lab
- Industrial runoff parameters meet the limits established in EPEA Approval Schedule V, Section 5

<table>
<thead>
<tr>
<th>Discharge Point</th>
<th>Average pH</th>
<th>Average Cl</th>
<th>Volume (m^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm Pond</td>
<td>7.7</td>
<td>8.5</td>
<td>10,650.0</td>
</tr>
<tr>
<td>Pad Ditch</td>
<td>7.4</td>
<td>18.4</td>
<td>2,250.0</td>
</tr>
</tbody>
</table>
Historical & Upcoming Activity
On May 1, 2019, Producer and Injector wells, P11/I11 (Pad 2), were suspended

- P11 online March 12, 2018 after completion of ESP repair
- P11 ESP trip May 17, 2018 after a trial of speeding up the pump
  - Unable to turn on pump and backflush the pump through tubing
- Production ceased May 18, 2018
- Suspension is temporary as it is not economic to fix the well at this time
- The suspension impacts production from well pairs 10 and 12
- 226,723 m³ remaining reserves
Regulatory and Operational Changes

In this reporting year there were:

• No material regulatory or operational changes

• No events that materially affected scheme performance, energy or material balances

• No technological innovations or pilots conducted
Lessons, Success and Failures

- In 2019, West Ells achieved the most stable operation for steam injection and production
- There were no major failures/incidents reported at site
- Emulsion flow reduction could cause process upset which could be solved by following:
  - Reduce the frequency of well testing
  - Adjust water dump rate at FWKO
  - Conduct more bottle tests to ensure that OIW in the de-oiled system is within spec
- Diluent injection rate should be monitored/adjusted carefully based on the trending of oil cut
- Maintaining clear communication was key between Calgary and Site teams. *A simple request can be answered in different ways*
Compliance History – Approval Contraventions

- The following list summarizes non-compliance events and one reportable spill in this reporting period

<table>
<thead>
<tr>
<th>Date</th>
<th>CIC #</th>
<th>Description</th>
<th>Remediation</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-Mar</td>
<td>0351380</td>
<td>Failed to submit January CEMS data and February passive air monitoring data</td>
<td>Data has been submitted.</td>
</tr>
<tr>
<td>29-Mar</td>
<td>0351382</td>
<td>Water level no longer monitored in Observation Wells</td>
<td>Manual water level reading occur weekly</td>
</tr>
<tr>
<td>1-May</td>
<td>0352681</td>
<td>Failed to submit March passive air monitoring data</td>
<td>Data has been submitted</td>
</tr>
<tr>
<td>30-Jun</td>
<td>0356947</td>
<td>Failed to submit June passive air monitoring data</td>
<td>Data has been submitted</td>
</tr>
<tr>
<td>2-Jul</td>
<td>0355501</td>
<td>Failed to submit May passive air monitoring and CEMS data</td>
<td>Data has been submitted</td>
</tr>
<tr>
<td>16-Oct</td>
<td>0360099</td>
<td>Failure to submit August passive air monitoring data</td>
<td>Data has been submitted</td>
</tr>
<tr>
<td>18-Oct</td>
<td>0360178</td>
<td>Did not provide a minimum of two weeks notice prior to Relative Accuracy Test Audit (RATA)</td>
<td>Internal process has been updated</td>
</tr>
<tr>
<td>31-Oct</td>
<td>0360643</td>
<td>Failure to submit September passive air monitoring data</td>
<td>Data has been submitted</td>
</tr>
<tr>
<td>11-Dec</td>
<td>0361936</td>
<td>After a successful chemical cleaning of the evaporator, the chemical reaction during the chemical cleaning process caused the evaporator to trip on high pressure and the water seal on the suction side of the evaporator compressor failed, releasing approximately 4.0 m3 of evaporator fluid</td>
<td>Final soil scraping and confirmatory samples to be taken once the area thaws</td>
</tr>
</tbody>
</table>
Future Plans

- The current COVID – 19 pandemic and extreme low oil price has forced the temporary suspension of production at West Ells. This will have significant impacts on scheme performance for the remainder of the year.

- No new initiatives planned
  - Continue to fully demonstrate the reservoir productivity before advancing to Phase II (10,000 bpd production)
Contact

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