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Orion is an in situ oil sands steam-assisted gravity drainage (SAGD) project consisting of a central processing facility (CPF) and five well pads situated in 13-16-064-03 W4M, approximately 30 km north-west of Cold Lake, Alberta.
From inception to December 31, 2019: Provincial production curtailment impact in 2018 and 2019
Drilled and Approved Drainage Patterns
Geoscience

Orion In Situ Oil Sands
2019 Annual Performance Report
Project Area and Well Data
Seismic Data

3D, 2D & Swath Datasets:

- Hilda 3D – 2005, 1.8 km²
- 2D – 2005, 3 lines
- Swath – 2007, 1522 records
- Orion 3D – 2009, 6.6 km²
- Swath – 2009, 1705 records
- Swath – 2011, 1074 records
- Swath – 2014, 1708 records
- 2D – 2014, 1 lines
- Orion 3D & Hilda 3D Merged - 2015
- Swath – 2016, 1688 records

No Seismic Data Gathered Since 2016
Clearwater SAGD Reservoir Isopach
Clearwater Gas Cap Isopach
Clearwater Reservoir Basal Water Isopach
Caprock Isopach
Structural Cross-Section

Northwest

A

Hilda Pilot Obs-1
102/15-17-064-03W4

Clearwater Shale
Clearwater Sand
TOP PAY
SAGD Interval
Base Pay
Basal Water
Wabiskaw

1233 m

Pad 106
1F2/11-16-064-03W4

100/07-16-064-03W4

562 m

1AA/01-16-064-03W4

424 m

1AA/03-12-064-03W4

1440 m

Southeast

A'

Clearwater Shale
TOP PAY
SAGD Interval
Base Pay
Basal Water
Wabiskaw

Facies from Core:
- Very fine- to medium-grained sand
- Very fine- to medium-grained sand to muddy sand or sand with interbedded mud
- Mud with interbedded sand
- Carbonate concretion
# Reservoir Properties and Producible Bitumen in Place (PBIP)

## PBIP and Recovery to Date (1)

<table>
<thead>
<tr>
<th>Pad</th>
<th>Start Date</th>
<th>Operating Well Pairs</th>
<th>Well Length</th>
<th>Well Pair Spacing (2)</th>
<th>Total PBIP (3)</th>
<th>Current Recovery (4)</th>
<th>Estimated Ultimate Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Date</td>
<td>#</td>
<td>m</td>
<td>m</td>
<td>10^5 m³</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Pilot</td>
<td>Sep 1997</td>
<td>2</td>
<td>950</td>
<td>100</td>
<td>1.14</td>
<td>66</td>
<td>&gt;70</td>
</tr>
<tr>
<td>Pad 103</td>
<td>Oct 2009</td>
<td>4</td>
<td>670</td>
<td>100</td>
<td>1.53</td>
<td>57</td>
<td>&gt;60</td>
</tr>
<tr>
<td>Pad 104</td>
<td>Oct 2007</td>
<td>4</td>
<td>695</td>
<td>100</td>
<td>1.79</td>
<td>27</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 105</td>
<td>May 2008</td>
<td>4</td>
<td>675</td>
<td>100</td>
<td>1.46</td>
<td>61</td>
<td>&gt;60</td>
</tr>
<tr>
<td>Pad 106</td>
<td>Sep 2007</td>
<td>4</td>
<td>730</td>
<td>100</td>
<td>1.76</td>
<td>29</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 107</td>
<td>Sep 2007</td>
<td>4</td>
<td>700</td>
<td>100</td>
<td>1.67</td>
<td>45</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 108</td>
<td>Jun 2017</td>
<td>2</td>
<td>1,000</td>
<td>70</td>
<td>0.88</td>
<td>16</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 109</td>
<td>Sep 2018</td>
<td>5</td>
<td>1,000</td>
<td>80</td>
<td>1.74</td>
<td>7</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 204</td>
<td>Jun 2017</td>
<td>7</td>
<td>1,000</td>
<td>80</td>
<td>2.76</td>
<td>13</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 205</td>
<td>Jul 2018</td>
<td>3</td>
<td>1,000</td>
<td>80</td>
<td>1.00</td>
<td>10</td>
<td>50-60</td>
</tr>
<tr>
<td>Pad 206</td>
<td>Sep 2018</td>
<td>4</td>
<td>800</td>
<td>80</td>
<td>1.21</td>
<td>8</td>
<td>50-60</td>
</tr>
</tbody>
</table>

(1) As of December 2019  
(2) Approximate Well Pair Spacing, m  
(3) PBIP = Area x Thickness Above Producer x Porosity x Oil Saturation  
(4) Recovery as of December 2019, on PBIP basis

## SAGD Reservoir Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth</td>
<td>425 m</td>
</tr>
<tr>
<td>Pay Thickness</td>
<td>16-25 m</td>
</tr>
<tr>
<td>Average Porosity</td>
<td>%</td>
</tr>
<tr>
<td>Average Oil Saturation</td>
<td>%</td>
</tr>
<tr>
<td>Average Bitumen Weight</td>
<td>%</td>
</tr>
<tr>
<td>Horizontal Permeability</td>
<td>Darcies</td>
</tr>
<tr>
<td>Kv:Kh</td>
<td>X</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C</td>
</tr>
<tr>
<td>Pressure</td>
<td>MPa</td>
</tr>
<tr>
<td>Oil Gravity</td>
<td>°API</td>
</tr>
<tr>
<td>Viscosity at 16°C</td>
<td>cP</td>
</tr>
</tbody>
</table>

Osum Production Corp.
Surface Operations

Orion In Situ Oil Sands

2019 Annual Performance Report
Facility Highlights

No major modifications were done to the CPF requiring AER approval for 2019; facility highlights are associated with operation optimization activities such as:

• 16-17 dual purpose brackish well was utilized as produced water disposal or source water well depending on water balance needs. (Approval No. 8175F).

• Crystallizer unit (commissioned in 2018) processes additional distillate for boiler feed and decreases evaporator blowdown waste disposal (avg. 207 m$^3$/d blow down waste reduction).

• Conversion of produced water coolers to inlet emulsion coolers significantly reduced cooler fouling and required cleanings.

• Multiple chemical trials/pilots (Reverse Emulsion Breaker (REB), Emulsion Breaker (EB), Phosphonate, Organic dispersant and silica dispersant) were executed resulting in optimization of chemical consumption and reduced fouling in evaporators.
Orion Bitumen/Steam Performance

Annual Bitumen Rates against Design Throughput

Annual Steam Production against Design Throughput
## 2019 Compliance Summary

<table>
<thead>
<tr>
<th>Approval Number</th>
<th>Compliance Reporting</th>
<th>Corrective Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPEA 00141258</td>
<td>Compliant with all conditions of approval.</td>
<td></td>
</tr>
<tr>
<td>Water Act License 00242090</td>
<td>Compliant with all conditions of approval.</td>
<td></td>
</tr>
<tr>
<td>Directive 13/IWCP Program</td>
<td>Year 5 compliant.</td>
<td>Completed all required suspensions and abandonments</td>
</tr>
<tr>
<td>Voluntary Self-Disclosure No. 27793</td>
<td>Failure to amend Sulphur inlet rates on facility license prior to exceedance.</td>
<td>Amended Sulphur inlet rates on facility license.</td>
</tr>
</tbody>
</table>
Wellbore Integrity

- Two wellbore integrity failures have occurred since the last annual presentation on 102/16-17-64-03/W4. The failures were reported to the AER and fixed.
- There were no wellhead or Surface Casing Vent Flow failures that have occurred since the last annual presentation.
Wellbore Integrity

102/16-17-64-03/W4 Disposal Well Casing Failure – March 2, 2019

• Failure Description:
  • On March 2, 2019, after having installed a serviced slick joint and expansion joint in the hole, the pressure test against the casing failed. The leak occurred at the casing connection at 256mMD;
  • 210 liters of cement was squeezed into the casing breach;
  • Casing pressure test good on March 16, 2019 and the well was put into service.

• Causes
  • Causes of the failure are considered to be age of the well and the type of the connection (non-premium casing connection)

• Mitigation
  • Closely monitor the casing pressure

• Negative Impacts
  • No negative impact on ground water (base of groundwater protection is 116.17 mMD);
  • No concerns of crossflow to other formations based on cement bond log;
  • No negative impact on the environment at surface
Wellbore Integrity

102/16-17-64-03/W4 Disposal Well Casing Failure – Sept. 28, 2019

- Failure Description:
  - There was noticeable pressure build up at casing side, rig was moved on the well, Sept. 28, 2019; casing was confirmed leaking again at 256m
  - Perforated 1 meter interval across the connection;
  - 239 liters of cement was squeezed into the perforation;
  - Casing pressure test good on Oct. 4, 2019 and the well was put into service.

- Causes
  - Not enough cement was squeezed into the casing breach during the last repair
  - Again, age of the well and the type of the connection (non-premium casing connection) are still the main contributions to the failure

- Mitigations
  - Continue closely monitoring the casing pressure;
  - Drill a new replacement well in case the well fails again (the new well was drilled in March 2020).

- Negative Impacts
  - No negative impact on ground water (base of groundwater protection is 116.17 mMD);
  - No concerns of crossflow to the other formations based on cement bond log;
  - No negative impact on the environment at surface
## 2019 Scheme Amendments

<table>
<thead>
<tr>
<th>Approval Number</th>
<th>Description</th>
<th>Approval/ Submission Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>10103W</td>
<td>Requested a variance of OSCA Commercial Scheme Approval 10103, Condition 8 associated with the requirement to implement sulphur recovery when sulphur inlet rates are in excess of 1 tonne per day on a calendar-quarter-year basis.</td>
<td>Submitted May 29th, 2019 Approved June 27th, 2019 Temporary exemption approved from meeting the recovery requirements as set out in Table 1 of AER ID 2001-03. This clause will expire on Dec. 31st, 2019.</td>
</tr>
<tr>
<td>10103X</td>
<td>Requested a variance of OSCA Commercial Scheme Approval 10103, Condition 8 associated with the requirements to implement sulphur recovery when sulphur inlet rates are in excess of 1 tonne per day on a calendar-quarter-year basis.</td>
<td>Submitted Oct. 24th, 2019 Approved Nov. 7th, 2019 Temporary exemption approved from meeting the recovery requirements as set out in Table 1 of AER ID 2001-03. Expiry Dec. 31st, 2020.</td>
</tr>
<tr>
<td>10103Y</td>
<td>Request to install Purlucid Replaceable Skin Layer™ Ultra Filtration waste water treatment technology. Not currently pursuing.</td>
<td>Submitted Nov. 20th, 2019 Approved Feb. 3rd, 2020</td>
</tr>
</tbody>
</table>
## 2020 Scheme Amendments

<table>
<thead>
<tr>
<th>Scheme 10103 Amendments</th>
<th>Description</th>
<th>Submission Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butane Blending</td>
<td>Request to install and utilize butane blending to meet pipeline shipping specifications in addition to diluent currently utilized for this purpose.</td>
<td>Submitted May 19&lt;sup&gt;th&lt;/sup&gt;, 2020, Issued June 16&lt;sup&gt;th&lt;/sup&gt;, 2020</td>
</tr>
<tr>
<td>Upper Grand Rapids-Reservoir Addition</td>
<td>Request to add the Upper Grand Rapids Formation to the approved scheme for commercial production within the approved development area.</td>
<td>Pending - Q3 2020</td>
</tr>
<tr>
<td>Organic Rankine Cycle</td>
<td>Request to incorporate organic rankine cycle infrastructure to meet power requirements for Orion by utilizing waste heat within the existing plot plan.</td>
<td>Pending - Q3 2020</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amendment 8175</th>
<th>Description</th>
<th>Submission Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-16-17-064-03W4</td>
<td>Request to utilize Granite Wash well as Class II Disposal Well</td>
<td>Submitted April 29, 2020, Issued June 1, 2020</td>
</tr>
</tbody>
</table>
Osum Production Corp.

2020 Scheme Amendments
Upper Grand Rapids (UGR) Formation

- Osum executed a four-well delineation program in 2020 to further understand the extent and quality of a UGR channel-fill bitumen reservoir that overlies the Clearwater Formation.
  - The Upper Grand Rapids at Orion was deposited in a fluvial to estuarine environment and is a reservoir suited for SAGD development.
    - Up to 23 m thick
    - Porosity 36%, Oil Saturation 71%, Viscosity at 16°C 65,000cp.
- Project amendment will include the addition of 23 UGR well pairs to be added to existing and approved Orion surface well pads.
2020 Scheme Amendments
Upper Grand Rapids (UGR) Formation

Upper Grand Rapids Isopach
2020 Scheme Amendments
Upper Grand Rapids (UGR) Formation

Planned Development
2020 Scheme Amendments
Organic Rankine Cycle

- Organic Rankine Cycle (ORC) infrastructure utilizes waste heat to generate electricity.
- Closed-loop thermodynamic cycle will convert low-grade glycol and produced gas heat at Orion that is currently dissipated to atmosphere via aerial coolers, to generate approximately 80% of Orion’s power requirements.
- The ORC implementation will improve Orion’s energy efficiency, reduce the operations’ overall greenhouse gas impact with no incremental emissions.
5 Year Development Plan - Summary

• Central Processing Facility (CPF): Add remaining components for completion of approved Phase 2 development extent and potential addition of ORC infrastructure.

• Development Wells (map on next slide): Continue project operations and resource recovery subject to available CPF capacities by adding production from a subset combination of (timing and number will depend on performance and declines of currently operating well pairs):
  • Approved 6 remaining Clearwater SAGD well pairs from existing surface pads; (Commercial Scheme Approval 10103Q)
  • Approved 9 Clearwater SAGD well pairs from existing surface pads; (Commercial Scheme Approval 10103U)
  • Approved 8 Clearwater Lower Drainage Wells (LDWs) from existing surface pads; (Commercial Scheme Approval 10103U)
  • Approved 20 Clearwater SAGD well pairs from new surface pads A and B; and (Commercial Scheme Approval 10103V);
  • Proposed 16 Upper Grand Rapids SAGD well pairs from existing surface pad extensions. (Scheme amendment to be submitted)

• Proposed initiation of Non-Condensable Gas (NCG) Co-injection (with steam) in mature Pilot and Phase 1 well pairs for pressure maintenance and SOR reduction.
5 Year Development Plan – Plot Plan
5 Year Development Plan - Surface
Osum Production Corp.

Subsidiary of Osum Oil Sands Corp.

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