Murphy Oil Company LTD.

Seal Polymer Project
Scheme Approval No. 11320C
Annual AER Progress Presentation

May 4, 2015

SEAL EOR Facilities
Agenda

- Subsurface
- Surface
Subsurface

- Background
- Geology
- Drilling & Completions
- Flood Performance
- Injection Pressures
- Future Plans
Background

Geology

Drilling & Completions

Flood Performance

Injection Pressures

Future Plans
Background – Map of Seal Central

- Polymer injection located in Central Seal
- Range 15 – Townships 83 & 84
- Terminology
  - Area 1 – Approval 11320B (Blue)
  - Area 2 – Approval 11320C (Green)
Background – Map of Seal Central

- Pilot + 3 Phases of expansion
- **Pilot** operational Oct, 2010
- **Phase 1** operational Sept, 2012
- **Phase 2** operational Dec, 2012
- **Phase 3** on hold
- Background
- Geology
- Drilling & Completions
- Flood Performance
- Injection Pressures
- Future Plans
Geology - Reservoir Properties

- Bluesky Sand
  - Unconsolidated, quartz-rich sandstone
    - fine-medium grained
    - moderate sorting
  - Depth of ~625m TVD
  - Net Pay Range ~4 - 8m in Polymer area (up to 22 in main area)
  - Porosity 22 - 30%
  - Permeability 500 - 2000mD in Polymer area
  - Reservoir temperature 19 °C
  - Water Saturation < 25% (typically 15-20% in reservoir)
  - Oil Viscosity average ~28,000 cP
  - Initial Reservoir Pressure 4500 - 5000kPa
- Petrophysically derived cut-offs for net bitumen
  - VCL <40 (~75-80 API GR)
  - PHie >17
  - SWe <30 from Archie
Background

Geology

Drilling & Completions

Flood Performance

Injection Pressures

Future Plans
Pilot + Expansion Locations:
- Lowest viscosity compared to other locations
- <10 m net pay
- Murphy 100% working interest
- Flowline production

Well Placement Criteria:
- Well placement within the top 5 meters of the Bluesky due to low viscosity and high permeability
Original well spacing was 140 meters with infills drilled at 70 meters

Injector and producing wells are at 70 meter spacing
**D&C - Typical Completion Details**

- **Surface Casing**: 339.7mm, 81.1 kg/m, J-55, ST&C
- **Intermediate Casing (311mm Hole)**: 219.1mm, 35.72 kg/m, J-55
- **KOP**: Approximate 367m with Builds of 9°/30m
- **Slotted Production Liner (200mm Hole)**: 1600 m of 139.7mm, 20.83 kg/m, J-55, ST&C
- **88.9 mm Tubing**: J55 EUE
- Background
- Geology
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- Future Plans
First Polymer Injection in October 2010

- Hydrating polymer concentrations: 1000-1500 ppm = 40-60 cp
- Polymer trace in produced water: >900 ppm within pilot
- Live oil mobility ratio: 34-53
  - The polymer viscosity is the only variable available in achieving a target mobility ratio due to the uncertainty surrounding permeability and in-situ oil viscosity
- Pilot consists of 3 injectors and 4 producers.
- Approval No. 11320B to downspace on the East side of the pilot.
- 70 meter spacing
- Injection started Q4 2010, production response has been observed since Q3 2011
- Current RF: 10.07%
- Ultimate RF: 15.07%
Increased production >70 m3/day

Maintained “plateau” for 2.5 years

Observed that: Reduced injection pressure = Reduced production rates
Phase 1 consists of 2 injectors and 2 producers.

70 meter spacing

Injection started Q3 2012, response has been in Q4 2014

Current RF: 7.93%

Ultimate RF: 11.14%
- Conformance treatment reduced WC’s from 70% to 20%
- Increased production was noticed after the conformance treatment
Phase 2 consists of 9 injectors and 11 producers.

- 70 meter spacing

- Injection started Q4 2012 on the south pad & Q2 2013 on the north pad, water cuts increased Q3 2013 on the north pad

- Current RF: 5.41 %

- Ultimate RF: 6.59%
Positive results from 13-03 Pad: Low water cuts & increasing reservoir pressure
Conducted a conformance treatment on 2 injectors on the 4-10 pad, no results yet
No production response recorded
Pads with premature breakthrough:

- 13-10 Pad – completed on 1 injector and 2 offsetting producers
- 4-10 Pad – completed on 2 injectors and 3 offsetting producers

For now we just have results from the 13-10 Pad.
Breakthrough was recorded shortly after the start of polymer injection

Stopped injection to lower water cuts and to evaluate the problem

Preformed a conformance program in November of 2014

Results show a reduction of water cuts by 50%

Still no uplift in production, almost at fill-up
- Breakthrough was recorded shortly after the start of polymer injection.
- Stopped injection to lower water cuts and to evaluate the problem.
- Preformed a conformance program in November of 2014.
- Water cuts have been reduced by 75%.
- Production has increased by 2X.
Pilot has best production results within the project
Phase 1 is starting to show response
Phase 2 has mixed results
Maintaining reservoir voidage within the project area
- Volume of injected polymer to date 322.6 E3m3
Expected incremental recovery factor after polymer flood 8.8%
Produced solution gas from the pilot & expansion is captured and tied in to 4-33 battery.
Injectivity is a non-issue with wells on vacuum at the start of injection

Higher injection pressures yield better production

Start injection before or soon after infill producers are drilled

Conformance treatments can offer potential mitigation to early breakthrough, this will be key in already depleted zones such as Area 1 Phase 3
- Background
- Geology
- Drilling & Completions
- Flood Performance
- Injection Pressures
- Future Plans
Polymer Injection Approval Pressure (Approval # 11320C)
- MAWHIP  4,900 kPa
- MABHIP  11,500 kPa

Monitoring Injection Pressure
- Surface pressure recorded daily and monitored to ensure MAWHIP is not exceeded
Pressure drop when rates are slowed down to maintain 1-1 injection / production ratio.
Injection pressures continue to rise while maintaining water cuts.
Mixed results with build up occurring on the 13-03 pad and conformance issues on the 4-10 pad
Background

Geology

Drilling & Completions

Flood Performance

Injection Pressures

Future Plans
Future - Expansion Plans

- Murphy has commissioned 2 of 3 Phases of the commercial Area 1 expansion.
  - Phase 3 injection is currently on hold
- Murphy has plans within the 2016 budget to implement AREA 2
Future Plans - Expansion

- Located in Central Seal just North of existing pilot and expansion.
- Similar reservoir characteristics and viscosities

Area 2
Agenda

- Subsurface
- Surface
Facilities

Non-Saline Water Use and Conservation

Regulatory

Conclusion
- Facilities

- Non-Saline Water Use and Conservation

- Regulatory

- Conclusion
- Located in Central Seal
- All producing wells from the polymer pilot and Area 1 are flow lined to the 4-33 CPF
- All future Area 2 production will be processed at the 1-26 CPF
- All source water treatment facilities are equipped to remove iron, oxygen and bacteria from the water before hydration occurs.
Pilot – 14-10 Plot Plan
• Facilities

• Non-Saline Water Use and Conservation

• Regulatory

• Conclusion
Water Usage - Paddy Formation

- **UWI: 1F1/14-10-083-15W5/0**
  - Murphy currently has term license 00289082-00-00 with Alberta Environment for the diversion of up to 164,250 m³ of Paddy water for injection with an expiry date of 2018-03-05
  - 3,750 TDS
  - Fe was not detected

- **UWI: 1F1/15-03-083-15W5/0**
  - No TDL necessary with TDS testing >4000 ppm
  - 5,383 TDS
  - Fe was not detected
Water Usage - Notikewan Formation

- UWI: 1F1/4-10-083-15W5
- TDL’s are not needed for Notikewan wells with TDS >4000 ppm
  - 10,592 TDS
  - Fe was not detected
Murphy is currently developing a water management program for the entire Seal field.
Produced volumes are reported from test tanks located at the well site (tested weekly).

From the start of the polymer flood there has been a recorded 20,951 m³ of water produced from the producing wells.

Water volumes are calculated through BS&W tests conducted simultaneously with the well test.

Produced water is currently being injected into disposal wells 102/06-33-082-15W5/0, 100/10-04-083-14W5/3 and 100/11-28-082-15W5/2.

There is no sulfur production from the 4-33 battery.

Murphy is currently not recycling produced water from emulsion as per regulatory approval.

The 1-26 Facility currently is outside the current operating polymer flood and is considered out of scope for this update.
# Water & Gas Usage – Volumes

## Polymer Injection Volumes (m3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
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</thead>
<tbody>
<tr>
<td>2014</td>
<td>Fresh Water</td>
<td>5,371.30</td>
<td>5,645.00</td>
<td>6,516.70</td>
<td>6,251.00</td>
<td>6,327.30</td>
<td>5,999.90</td>
<td>5,928.30</td>
<td>4,010.20</td>
<td>5,019.30</td>
<td>4,237.50</td>
<td>4,602.40</td>
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<tr>
<td></td>
<td>Saline Water</td>
<td>2,763.50</td>
<td>3,254.90</td>
<td>3,713.10</td>
<td>3,737.70</td>
<td>3,682.10</td>
<td>3,979.80</td>
<td>3,398.30</td>
<td>2,714.40</td>
<td>3,405.60</td>
<td>2,852.30</td>
<td>4,755.90</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>8,134.80</td>
<td>8,899.90</td>
<td>10,229.80</td>
<td>10,099.40</td>
<td>10,981.40</td>
<td>9,979.70</td>
<td>9,326.60</td>
<td>6,724.60</td>
<td>8,424.90</td>
<td>7,089.80</td>
<td>9,358.30</td>
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</table>

## 4-33 Total Water Volumes (m3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Produced Water (Area 1)</td>
<td>1,274.00</td>
<td>886.40</td>
<td>527.90</td>
<td>673.00</td>
<td>945.00</td>
<td>449.70</td>
<td>382.50</td>
<td>342.80</td>
<td>493.90</td>
<td>618.00</td>
<td>1,007.50</td>
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<td></td>
<td>Produced Water (Field)</td>
<td>14,276.00</td>
<td>13,140.00</td>
<td>12,721.00</td>
<td>11,827.00</td>
<td>17,210.00</td>
<td>11,569.00</td>
<td>11,525.00</td>
<td>9,618.00</td>
<td>11,600.00</td>
<td>12,653.00</td>
<td>15,181.00</td>
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<tr>
<td></td>
<td>Fresh Water *Injected</td>
<td>5,371.30</td>
<td>5,945.00</td>
<td>6,516.70</td>
<td>6,251.00</td>
<td>6,327.30</td>
<td>5,999.90</td>
<td>5,928.30</td>
<td>4,010.20</td>
<td>5,019.30</td>
<td>4,237.50</td>
<td>4,802.40</td>
</tr>
<tr>
<td></td>
<td>Saline Water *Injected</td>
<td>2,763.50</td>
<td>3,254.90</td>
<td>3,713.10</td>
<td>3,737.70</td>
<td>3,682.10</td>
<td>3,979.80</td>
<td>3,398.30</td>
<td>2,714.40</td>
<td>3,405.60</td>
<td>2,852.30</td>
<td>4,755.90</td>
</tr>
<tr>
<td></td>
<td>Third Party Disposal (Field)</td>
<td>1,057.80</td>
<td>(58.60)</td>
<td>(118.10)</td>
<td>(1,701.80)</td>
<td>2,833.50</td>
<td>51.90</td>
<td>628.30</td>
<td>1,417.90</td>
<td>487.30</td>
<td>2,177.10</td>
<td>4,103.60</td>
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<td>Disposal Volumes (Field)</td>
<td>13,220.20</td>
<td>13,198.60</td>
<td>12,839.10</td>
<td>13,528.30</td>
<td>14,376.40</td>
<td>11,517.10</td>
<td>10,896.70</td>
<td>8,200.10</td>
<td>11,312.70</td>
<td>10,475.50</td>
<td>12,077.40</td>
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<td>Prorated Disposal Volumes (Area 1)</td>
<td>1,175.61</td>
<td>890.35</td>
<td>532.80</td>
<td>769.84</td>
<td>789.41</td>
<td>447.68</td>
<td>361.65</td>
<td>292.26</td>
<td>473.50</td>
<td>511.67</td>
<td>751.99</td>
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</table>

## 2014 Source Water (m3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>1F1/14-10-083-15W5/0</td>
<td>5,371.30</td>
<td>5,645.00</td>
<td>6,516.70</td>
<td>6,251.00</td>
<td>6,327.30</td>
<td>5,999.90</td>
<td>5,928.30</td>
<td>4,010.20</td>
<td>5,019.30</td>
<td>4,237.50</td>
<td>4,602.40</td>
<td>4,962.50</td>
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<tr>
<td>1F1/04-10-083-15W5/0</td>
<td>2,763.50</td>
<td>3,254.90</td>
<td>3,713.10</td>
<td>3,737.70</td>
<td>3,682.10</td>
<td>3,979.80</td>
<td>3,398.30</td>
<td>2,714.40</td>
<td>3,405.60</td>
<td>2,852.30</td>
<td>4,755.90</td>
<td>5,757.40</td>
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</table>

## 4-33 Total Gas Volumes (E3m3)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Produced Gas (Area 1)</td>
<td>170.40</td>
<td>343.70</td>
<td>373.20</td>
<td>314.10</td>
<td>288.50</td>
<td>274.00</td>
<td>262.50</td>
<td>195.20</td>
<td>225.10</td>
<td>191.80</td>
<td>161.30</td>
</tr>
<tr>
<td></td>
<td>Produced Gas (Field)</td>
<td>1,618.30</td>
<td>2,259.10</td>
<td>2,346.90</td>
<td>2,084.00</td>
<td>2,500.20</td>
<td>2,789.90</td>
<td>2,621.10</td>
<td>2,178.40</td>
<td>2,592.30</td>
<td>2,528.40</td>
<td>3,202.00</td>
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<td>Consumed</td>
<td>729.30</td>
<td>857.30</td>
<td>1,053.10</td>
<td>1,135.00</td>
<td>1,186.10</td>
<td>1,099.50</td>
<td>1,090.00</td>
<td>1,186.10</td>
<td>744.40</td>
<td>816.80</td>
<td>1,877.00</td>
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<td>Flared</td>
<td>83.70</td>
<td>265.70</td>
<td>101.60</td>
<td>25.02</td>
<td>31.40</td>
<td>28.60</td>
<td>28.20</td>
<td>116.60</td>
<td>42.50</td>
<td>43.70</td>
<td>101.00</td>
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<tr>
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<td>Blanket Gas</td>
<td>998.07</td>
<td>454.08</td>
<td>711.40</td>
<td>948.74</td>
<td>664.35</td>
<td>186.00</td>
<td>309.63</td>
<td>606.48</td>
<td>(95.71)</td>
<td>(42.39)</td>
<td>190.57</td>
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<td>Delivered</td>
<td>1,803.37</td>
<td>1,829.18</td>
<td>1,903.60</td>
<td>1,872.72</td>
<td>1,947.55</td>
<td>1,847.80</td>
<td>1,812.53</td>
<td>1,500.78</td>
<td>1,709.69</td>
<td>1,625.51</td>
<td>1,414.57</td>
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</tbody>
</table>

*(Field) represents all field production flowing to the 4-33 CPF*
Water Usage - WSW Locations

- 14-10 Paddy
- 4-10 Notikewan
- 15-3 Paddy
Water Usage - Paddy Well Location

105/14-10-83-15W5/0 Observation Well

1F1/14-10-83-15W5/0 Paddy Water Source Well
**Water Usage - Disposal Wells**

102/06-33-082-15W5/0

100/10-04-083-14W5/3

100/11-28-082-15W5/2

- **102/06-33-083-15W5 is on vacuum justifying the lack of injection pressure**

### Table: UWI, Approval Number, Formation

<table>
<thead>
<tr>
<th>UWI</th>
<th>Approval Number</th>
<th>Formation</th>
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<tbody>
<tr>
<td>102/06-33-082-15W5/0</td>
<td>11949</td>
<td>Debolt</td>
</tr>
<tr>
<td>100/10-04-083-14W5/3</td>
<td>11353C</td>
<td>Nisku</td>
</tr>
<tr>
<td>100/11-28-082-15W5/2</td>
<td>11949</td>
<td>Debolt</td>
</tr>
</tbody>
</table>
Proration factors for production volumes are calculated using standard accounting procedures

<table>
<thead>
<tr>
<th>4-33 CPF ABBT0094150</th>
<th>2014 Gas Proration</th>
<th>2014 Oil Proration</th>
<th>2014 Water Proration</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>0.75964</td>
<td>0.82550</td>
<td>0.90841</td>
</tr>
<tr>
<td>February</td>
<td>1.03769</td>
<td>0.76339</td>
<td>0.95133</td>
</tr>
<tr>
<td>March</td>
<td>1.05893</td>
<td>0.77343</td>
<td>0.79729</td>
</tr>
<tr>
<td>April</td>
<td>1.03276</td>
<td>0.77619</td>
<td>1.03697</td>
</tr>
<tr>
<td>May</td>
<td>1.15478</td>
<td>0.79624</td>
<td>0.87524</td>
</tr>
<tr>
<td>June</td>
<td>0.97690</td>
<td>0.76726</td>
<td>1.01250</td>
</tr>
<tr>
<td>July</td>
<td>1.23463</td>
<td>0.77707</td>
<td>0.87183</td>
</tr>
<tr>
<td>August</td>
<td>1.10351</td>
<td>0.72064</td>
<td>0.83578</td>
</tr>
<tr>
<td>September</td>
<td>1.14399</td>
<td>0.70065</td>
<td>1.28180</td>
</tr>
<tr>
<td>October</td>
<td>0.77458</td>
<td>0.77139</td>
<td>0.95143</td>
</tr>
<tr>
<td>November</td>
<td>0.74934</td>
<td>0.71372</td>
<td>1.04481</td>
</tr>
<tr>
<td>December</td>
<td>0.70742</td>
<td>0.72258</td>
<td>1.13995</td>
</tr>
</tbody>
</table>
Water Usage – Injected Volumes

**Pilot**
177,920 m³ injected

**Phase 1**
44,568 m³ injected

**Phase 2**
95,495 m³ injected

**Total** = 317,983 m³ injected
- Facilities
- Non-Saline Water Use and Conservation
- Regulatory
- Conclusion
Murphy is in compliance with other regulatory bodies (AER, SRD, AENV, DFO)
Facilities

Non-Saline Water Use and Conservation

Regulatory

Conclusion
Murphy is committed to maximizing the value of the resource for both itself and the province of Alberta through its royalty interest.

Observations made over the past year will be applied to future polymer project within Seal Lake.

Murphy’s top priority is ensuring compliance with AER and all regulatory bodies.