Section 3.1.1 – Subsurface Issues Related to Resource Evaluation and Recovery
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• Instrumentation in Wells – Micaela Streeter
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• Scheme Performance – Jennifer Smith
• Future Plans – Matt Beazer
Safety Moment – Operational Excellence

• One of Suncor’s value drivers is to continue to advance Suncor’s journey to operational excellence.

• Operational excellence is a disciplined way of running our business using consistent practices to continually improve our performance.

OEMS x Operational Discipline = Operational Excellence
The **OEMS** (Operational Excellence Management System) framework of controls includes consistent standards, processes and procedures. It enables Suncor to consistently and effectively:

- Manage risk
- Operate safely and reliably
- Mitigate environmental impacts
- Develop and share best practices
- Support continuous improvement.

**Operational discipline** means doing the right thing, the right way, every time. It’s foundational to Suncor achieving operational excellence. Five behaviors we strive to demonstrate:

- Seek knowledge and understanding
- Adhere to procedures
- Use a questioning attitude to surface problems
- Expect accountability
- Collaborate
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Firebag Project Overview

• The Firebag Project is a commercial Steam Assisted Gravity Drainage (SAGD) scheme

• Supplies bitumen to the Oil Sands Upgrader and sales to market

• Stage 4 wells (Pad 106 & 116) came on production in 2013

• Current production capacity of 180,000 bbl/d (28,617 m³/day) of bitumen with a Steam to Oil Ratio (SOR) of 3.2
AER Project & Approved Development Areas

Firebag Approval 8870
As of February 2014

- Change during report period due to AER approval of Pads
  - 114 (8870KK)
  - 111/112 (8870SS)
  - 118 (8870SS)
Composite Aerial Photo of Firebag
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Type Well Location Map

Type Wells
• 1AA/01-01-095-06W4
• 1AA/16-01-095-06W4

Type Horizontal Well
• Pad 101 Pair 7
Firebag Type Well  1AA/01-01-095-06W4/00

- McMurray Fm 83.9 m
- Shoreface 5.4 m
- Tidal Flat 15.6 m
- Channel Complex 48.9 m
  - Net Pay 47.8 m
  - NTG 0.977
  - Core Porosity 35.7%
  - Core Sw 21.9%
  - Kh 8-10 D
  - Kv 4-5 D
- Continental 14 m
- 45 m west of Pad 1 Pair 7
Continental Unit (Non Reservoir)
Channel Complex Oil Sands Reservoir

Estuarine Channel Sand

89% bitumen saturation

Kh 8400 md; Kv 7000 md

SUNCOR ENERGY INC.
SUNCOR FIREBAG 1AA/01-01-095-06W4/00
FEB., 1999
RC8113

TOP CORE: 30 305.05m

14
Channel Complex - Mud Clast Breccia
Tidal Flat / Channel Complex Contact

Sandy Tidal Flat

Channel Margin/I.H.S Sand

Steam Injector

Bitumen Producer

TD 352.10 m
Tidal Flat Unit
Pad 1 Pair 7 Structural Cross Section

Clearwater Formation (Shale)

Tidal Flat

Type Well 1AA/01-01-095-06W4/00

Shoreface

Channel Complex (Reservoir)

Continental
Firebag Type Well  1AA/16-01-095-06W4/00

- Middle McMurray Tidal Flat/Abandoned Channel
- Reservoir quality within McMurray varies and can present challenges
Structure Map of Base of Gross Bitumen Pay Interval
Structure Map of Top of Gross Bitumen Pay Interval

Top of McMurray Channel Complex
Isopach Map of Cumulative Net Bitumen Pay

- Cumulative Net Pay Cut-Offs: Gamma < 60API, Porosity > 22%, Sw < 50%
- Continuous Pay Cut-Offs being developed
### Original Bitumen in Place (OBIP) & Average Reservoir Properties

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>Gross Thickness (m)</th>
<th>Gross Rock Volume (e⁶ m³)</th>
<th>Net-to-Gross Ratio¹</th>
<th>Net Pay Thickness (m)</th>
<th>Porosity</th>
<th>Oil Saturation</th>
<th>Formation Volume Factor</th>
<th>OBIP² (e⁶ m³)</th>
<th>OBIP² (MMbbl)</th>
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### Firebag Approved Project Area

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>Gross Thickness (m)</th>
<th>Gross Rock Volume (e⁶ m³)</th>
<th>Net-to-Gross Ratio¹</th>
<th>Net Pay Thickness (m)</th>
<th>Porosity</th>
<th>Oil Saturation</th>
<th>Formation Volume Factor</th>
<th>OBIP² (e⁶ m³)</th>
<th>OBIP² (MMbbl)</th>
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<td>193,970,483</td>
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<td>0.84</td>
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<td>1,299.3</td>
<td>8172.6</td>
</tr>
</tbody>
</table>

1 Net-to-Gross Ratio: Net pay cutoffs applied are GR>60 API, Porosity < 0.22, and Sw > 0.50.
2 OBIP: Original Bitumen in Place
Average Reservoir Properties

- Average reservoir properties for the operating portion of the scheme (Pads 101-108 and Pad 116)
  - Initial reservoir pressure: 800kPa
  - Initial reservoir temperature: 8°C
  - Average gross pay = 46.4m
  - Average net pay = 39.7m
  - Average porosity = 0.322
  - Average oil saturation = 0.85
  - Effective horizontal permeability: 3 to 4 D
  - Effective vertical permeability: 2 to 3 D
  - Viscosity: ~ 11cp @ 215°C
2013 Winter Delineation Program and 3D Seismic Program

- Existing wells in grey
- New wells 2013-2014 Drilling Program (RR Mar 01, 2013 to Feb 28, 2014) in green
- New 3D Seismic survey (shot Jan 2014) in blue
- Wells typically obtained core across the McMurray Fm. (occasionally across portions of the Clearwater Fm.); followed by routine photography and analysis
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Pads 101, 102 & 108 Heave Contour Mar 2003 to Jan 2014

- Max heave +30.2 cm; average heave +15.9 cm; Min change last year 1.1 cm, Max change last year 9.0 cm

Heave is displayed in metres
Heave is displayed in mm

Max Heave is 2 cm
Caprock – Geological Activity

• 2013/14 Winter Drilling Program

New Observation Wells
– Five new observation wells with Piezometer pressure measurement
  • 3 of the 5 also have thermocouples
– OB 205 was drilled to retrieve caprock core, and pressure monitoring
  • Was mini-frac’d in the McMurray Channel, Tidal Flats and Clearwater Formations
  • Has pressure monitoring inside casing at McMurray and Clearwater Formations

New Fracture Characterization Wells
– Six full Clearwater / McMurray cores were recovered for caprock / reservoir characterization.
– Three slant caprock cores were recovered for fracture characterization.
– Mapping is updated as new data becomes available
5 New and 2 Recompleted Caprock Monitoring Wells

Temperature Instrumentation
Reservoir Thermocouple (TC) String:
• OB 182 has a Clearwater TC string and OB 40 has a Full Thermocouple string which may have been damaged when perforating the Tidal Flats
• OB 202, 203 & 204 have Thermocouples

Pressure Instrumentation
Piezometers
1. OB 182 has 2 piezometers inside casing at the Tidal Flats and Clearwater intervals
2. OB 40 has an inside casing piezometer in the Tidal Flats
3. OB 201, 202, 203 & 204 are piezometer equipped observation wells
4. OB 205 Mini-frac well has piezometers inside casing at the McMurray and Clearwater intervals
Caprock Integrity Assurance

• Mini-Fracs in 2014
  – OB205 tested via mini-frac in 2014
  – Data was analyzed in-house and is consistent with SPE Paper 157843 presented at the June 2012 SPE Heavy Oil Conference Canada

• Lab Testing in 2013/14
  – Geomechanical Rock Properties were tested by University and commercial Labs

• Suncor Geomechanical Modeling
  – Models are being updated as lab data comes in
  – Heave monitoring program and 4-D seismic useful for calibrating geomechanical models
  – New InSAR heave survey commissioned for Pads 106 and 116
  – Geomechanical modeling in 2013 matches Pad 101 heave

• All of these activities confirm that operating at the approved MOP does not impact Firebag Caprock Integrity
### Reservoir Fracture Closure Gradient 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Well Alias</th>
<th>Well Interval (mTVD)</th>
<th>Target</th>
<th>Minimum Stress (kPaa)</th>
<th>Fracture Gradient (kPaa/m)</th>
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<tbody>
<tr>
<td>15-Mar-12</td>
<td>OB134</td>
<td>297-298</td>
<td>McMurray Sandstone</td>
<td>5238.9</td>
<td>17.6</td>
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<td>17-Mar-12</td>
<td>OB135</td>
<td>263-264</td>
<td>McMurray Sandstone</td>
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</table>

- No change recommended to currently approved injection pressures:
- Startup MOP based on an 80% S.F. overburden based closure pressure (4040 kPag except for Pads 111 and 112 where thinner overburden thickness has reduced Startup MOP to 3980 kPag)
- 3570 kPag during production phase
Pressure Monitoring

• Casing injection pressure will be limited to approved overburden based MOP during start-up and 3570 kPag during the production phase
  – Friction losses will provide an extra margin of safety for protecting the reservoir

• All existing injection wells are set up to monitor downhole pressure
  – Some wells have thermocouple monitoring temperatures along the horizontal for start-up

• Production wells capable of periodically monitoring pressure via blanket gas during start-up period
  – Some wells have thermocouple or fibre monitoring temperature along the horizontal for start-up
  – During mechanical lift conversion, pressure and temperature monitoring at the ESP is installed on all wells (bubble tubes/pressure gauges, thermocouples)
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SAGD Well Layout
Typical SAGD Injector

- 18 5/8” Surface Casing typically landed at 80 m Thermally cemented
- 10 3/4” Slave String typically landed at 480 m (Premium Connections) with blanket gas behind
- 13 3/8” Intermediate Casing typically landed at 530 m (Premium Connections) Thermally cemented
- 3 1/2” Injection Tubing typically landed at 1510 m
  Or: 5½” crossed over to 4½”
- 13 3/8” x 10 3/4” Debris Seal
- 10 3/4” Slotted Liner for the first ~275 m
- 9 5/8” or 8 5/8” Slotted Liner for the final 750 m typically landed at 1530 m
Typical Concentric Producer ML-SAGD (includes infills)

- **18 5/8” Surface Casing** typically landed at 80 m Thermally cemented
- **13 3/8” Intermediate Casing** typically landed at 530 m (Premium Connections) Thermally cemented
- **5 1/2” Production Tubing with Pump** typically landed at 480 m
- **9 5/8” or 8 5/8” Slotted liner** typically landed at 1530 m
  - **13 3/8” x 10 3/4” liner hanger** Debris Seal
Typical Producer Circulation Setup

- **18 5/8” Surface Casing** typically landed at 80 m Thermally cemented
- **13 3/8” or 11 3/4” Intermediate Casing** typically landed at 530 m (Premium Connections) Thermally cemented
- **3 1/2” or 2 7/8” Production Tubing** typically landed at 500 m
- **5 1/2” or 4 1/2” Production Tubing** at 1500 m
- **9 5/8” or 8 5/8” Slotted liner** typically landed at 1530 m
  - **13 3/8” x 10 3/4” liner hanger Debris Seal**
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Artificial Lift Wells

- Labeled wells are operating on mechanical lift (138 wells) as of Feb 28, 2014
- Wells 3P3 and 3P4 abandoned due to wellbore issues
  - Wells 3P3B and 3P4B re-drilled to access reserves
- Pads 106 & 116 finished mechanical lift conversion in 2013
- P4N2 converted to mechanical lift, other 4 infills still warming as of Feb 28, 2014
Artificial Lift Performance

• Mechanical Lift
  – Electric submersible pumps (ESP)
  – 12 – 36 Stages depending on application
  – Total fluid lift capacity ranges from 100 to 3000 m³/d depending on pump size
  – Averaged 800 m³/d total fluid production per well over reporting time frame
  – Maximum operating temperatures ~ 250°C, as measured at the pump
    – Pumps generally run between 135°C and 220°C (UHT and SA-3)
  – Pump mean time to failure since day 1 is 603 days
  – Run-life is increasing as operational practices and pump technology improves
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## Instrumentation - SAGD Wells

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<th>Pad #</th>
<th>Temperature</th>
<th>Pressure</th>
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<tbody>
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<td>Pad 101</td>
<td>- 2-3 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- Fiber</td>
<td>- P1P6 – Piezometer</td>
</tr>
<tr>
<td></td>
<td>- Motor winding (infills)</td>
<td>- Intake gauge (infills)</td>
</tr>
<tr>
<td></td>
<td>- Intake gauge (infills)</td>
<td></td>
</tr>
<tr>
<td>Pad 102</td>
<td>- 2-3 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- Fiber</td>
<td>- P2P6 – Piezometer</td>
</tr>
<tr>
<td></td>
<td>- Motor winding (infills)</td>
<td>- 2P9 intake &amp; discharge</td>
</tr>
<tr>
<td>Pad 103/104</td>
<td>- 3 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- 3P9 internal motor TC</td>
<td>- P/T Intake gauges (infills)</td>
</tr>
<tr>
<td>(including 104</td>
<td>- 104 infills Fiber</td>
<td></td>
</tr>
<tr>
<td>infills)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pad 107/108</td>
<td>- 3 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- 7P5 Pain &amp; RTD sensor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 8P1/5/8 6 pt TCs to toe</td>
<td></td>
</tr>
<tr>
<td>Pad 105</td>
<td>- 3 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- 5P14/15 Fiber</td>
<td></td>
</tr>
<tr>
<td>Pad 106</td>
<td>- 2 pt. Thermocouple</td>
<td>- Bubble Tube</td>
</tr>
<tr>
<td></td>
<td>- 6 pt. Thermocouple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 6P2/4/6/8 Fiber</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 6P5 2 pt. Combo Line Thermocouple</td>
<td></td>
</tr>
<tr>
<td>Pad 116</td>
<td>- 2 pt. Thermocouple</td>
<td>- Bubble Tube</td>
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<tr>
<td></td>
<td>- A-tool with 6 pt. Thermocouple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 16P5/6/9/13/15/16/18 Fiber</td>
<td></td>
</tr>
<tr>
<td>All Injectors</td>
<td>- 106/116 6 pt. Thermocouple</td>
<td>- Blanket Gas</td>
</tr>
<tr>
<td></td>
<td>- 8S1/5/7 6 pt. Thermocouple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 5S14/15 Fiber</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 5S4/3/2 10 pt. Thermocouple</td>
<td></td>
</tr>
</tbody>
</table>

Items in red indicate temporary instrumentation used during startup.
Typical SAGD Producer Well – Instrumentation Locations

- Instrumentation is located at the heel of the well
  - Continuous monitoring in the horizontal being tested in select wells on Pad 2 North infills, Pad 105, and Pad 106/116
- Measures pump intake pressure and temperature
  - Additional thermocouples monitor the ESP motor
New Technology Testing Program in 2013

- Fiber optic and 6-pt thermocouples used for temperature monitoring – Pad 102 infills, Pad 105, Pad 106, and Pad 116
- Fibre Optic ESP instrumentation – Pad 104 infills
- Vacuum insulated tubing – 5S13
- NCG injection on Pad 101
- Vx meters – Pad 101/102 infills, Pad 105, Pad 106, and Pad 116
- New generation high temperature pumps rated to 250°C – Ultra High Temperature Pump (UHT) and Hotline 3 Pump (HL3)
Future SAGD Well Instrumentation Plans

• Suncor Firebag is currently reviewing the following downhole pressure and temperature measurement schemes against their technical and economic merit. These technologies will be given consideration against the current pressure and temperature monitoring requirements for both producers and injector wells.

• Integrated pressure and temperature sensors with the ESP
  – Pad 101 infills
  – Future testing on Pad 103 infills and Pad 104 infills
  – 2N7 discharge pressure gauge

• Instrumentation configuration with reduced liner sizes
## Instrumentation – SAGD Observation Wells

<table>
<thead>
<tr>
<th>Well</th>
<th>Temperature</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB111, OB113-114</td>
<td>1 Point Thermocouple</td>
<td>1 Piezometer</td>
</tr>
<tr>
<td>DW OB1, OB DW4</td>
<td>1 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB8, OB10-11, OB19, OB37-40, OB67-69, OB74-75, OB107, OB109-110</td>
<td>2 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>ETS1, PSS2-4 OB</td>
<td>10 Point Thermocouple</td>
<td>N/A</td>
</tr>
<tr>
<td>ETS OB1, ETS OB3, ETS OB4, OB6-7, OB9, OB12-14, OB17-18, OB20-23, OB27-36, OB42-45, OB47</td>
<td>24 Point Thermocouple</td>
<td>N/A</td>
</tr>
<tr>
<td>OB49, OB51, OB54, OB56, OB62</td>
<td>24 Point Thermocouple</td>
<td>1 Piezometer</td>
</tr>
<tr>
<td>OB48</td>
<td>24 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB63</td>
<td>24 Point Thermocouple</td>
<td>3 Piezometers</td>
</tr>
<tr>
<td>OB152</td>
<td>24 Point Thermocouple</td>
<td>5 Piezometers</td>
</tr>
<tr>
<td>OB122-127, OB129-130, OB132-133, OB143</td>
<td>40 Point Thermocouple</td>
<td>N/A</td>
</tr>
<tr>
<td>OB128, OB135-137</td>
<td>40 Point Thermocouple</td>
<td>1 Piezometer</td>
</tr>
<tr>
<td>OB118-119, OB131, OB134</td>
<td>40 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB153-4</td>
<td>40 Point Thermocouple</td>
<td>5 Piezometers</td>
</tr>
<tr>
<td>OB DS4</td>
<td>43 Point Thermocouple</td>
<td>6 Piezometers</td>
</tr>
<tr>
<td>OB57</td>
<td>46 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB3, OB5</td>
<td>54 Point Thermocouple</td>
<td>N/A</td>
</tr>
<tr>
<td>OB59, OB4</td>
<td>54 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB66, OB70-73, OB76-98, OB101-103, OB105-106</td>
<td>56 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
<tr>
<td>OB61</td>
<td>58 Point Thermocouple</td>
<td>1 Piezometer</td>
</tr>
<tr>
<td>OB60</td>
<td>58 Point Thermocouple</td>
<td>2 Piezometers</td>
</tr>
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</table>
# Instrumentation – SAGD Observation Wells

<table>
<thead>
<tr>
<th>Well</th>
<th>Temperature</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB DW12, OB138, OB147, QW1-2, QW4, OB147</td>
<td>N/A</td>
<td>1 Piezometer</td>
</tr>
<tr>
<td>PP7, OB167-168, OB170</td>
<td>N/A</td>
<td>2 Piezometers</td>
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<tr>
<td>OB DS2, DS5, OB166, OB169</td>
<td>N/A</td>
<td>3 Piezometers</td>
</tr>
<tr>
<td>OB DS1</td>
<td>N/A</td>
<td>4 Piezometers</td>
</tr>
<tr>
<td>DS6</td>
<td>N/A</td>
<td>5 Piezometers</td>
</tr>
<tr>
<td><em>Temporary</em> OB155 &amp; OB165</td>
<td>N/A</td>
<td>6 Piezometers</td>
</tr>
<tr>
<td><em>Temporary</em> OB158 &amp; OB164</td>
<td>N/A</td>
<td>1 Piezometer</td>
</tr>
</tbody>
</table>
Observation Well Location Map

- Includes 2013-2014 Observation Well Drilling Program

Legend:
- Abandoned or No Instrumentation
- Only Thermocouple(s)
- Fibre (Temperature Only)
- Piezometers and Thermocouples
- Only Piezometers
- Abandoned Core Hole
- Existing SAGD Well

SAGD Wells and Vertical Well Control
OBSERVATION WELLS
Typical SAGD Observation Wells

Pressure Instrumentation
Two Piezometers
Location:
1. Middle of Shoreface
2. 15 m above base of McMurray

Temperature Instrumentation
Standard Obs well:
• Base to top of McMurray
• 20-24 TC spaced every 3 to 4 m
Clearwater Obs well (2010):
• Base of Shoreface to top of Clearwater
• 26-34 TC spaced every 2 m
Instrumentation strapped to outside of casing string
ETS 1 (100/12-06-095-05 W4M)
Horizontal Observation Well Configuration

Instrumentation
Temperature Monitoring
- 10 thermocouples spaced every 130 m
- TC’s span from 330 mKB to 1500 mKB

Observation wells 5S2, 5S3 and 5S4 also have 10 point thermocouples placed in horizontal sections
1981 Inactive Wells

- Five wells were drilled as per regulatory standards in 1981
  - The wells were cemented with Oilwell G cement, not Thermal 40
  - Following a detailed risk assessment and discussion with the AER, the decision was made to monitor the wells for any noticeable changes along with yearly inspections
  - Field visits have been conducted at these locations and there have been no noticeable changes
## 1981 Inactive Wells Locations

<table>
<thead>
<tr>
<th>UWI</th>
<th>License #</th>
<th>Spud Date</th>
<th>Distance to Planned Steam Operations (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-02-095-06W4</td>
<td>A0088049C</td>
<td>2/4/1981</td>
<td>Approx. 4.3</td>
</tr>
<tr>
<td>11-03-095-06W4</td>
<td>A0088049D</td>
<td>1/27/1981</td>
<td>Approx. 22</td>
</tr>
<tr>
<td>10-11-095-06W4</td>
<td>A0088049E</td>
<td>2/14/1981</td>
<td>Approx. 365</td>
</tr>
<tr>
<td>11-32-094-06W4</td>
<td>A0088049B</td>
<td>1/18/1981</td>
<td>Approx. 965</td>
</tr>
<tr>
<td>11-33-094-06W4</td>
<td>A0088049E</td>
<td>1/28/1981</td>
<td>Approx. 1000</td>
</tr>
</tbody>
</table>
1981 Inactive Wells Locations Continued

- All 1981 Inactive Wells were inspected March 8th, 2014
1964 Vintage Wells

- Seven evaluation wells were drilled and abandoned in 1964 within the Firebag thermal recovery area.
- These wells could pose an environmental and safety risk because of the method and type of cement used to abandon them. (Standard in 1964 – No casing or cement)

<table>
<thead>
<tr>
<th>UWID</th>
<th>Licence #</th>
<th>Spud Date</th>
<th>Distance from steam operations</th>
<th>Re-Abandonment Approved by AER</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1AA/11-22-095-06W4/00</td>
<td>0025561D</td>
<td>3/24/1964</td>
<td>Approximately 3000m</td>
<td>Yes</td>
<td>Located &amp; Abandoned 2009</td>
</tr>
<tr>
<td>1AA/05-28-094-06W4/00</td>
<td>0026040A</td>
<td>3/9/1964</td>
<td>Approximately 3000m</td>
<td>Yes</td>
<td>Located &amp; Abandoned 2009</td>
</tr>
<tr>
<td>1AA/06-08-095-06W4/00</td>
<td>0026038A</td>
<td>3/15/1964</td>
<td>Approximately 4000m</td>
<td>Yes</td>
<td>Located &amp; Abandoned 2010</td>
</tr>
<tr>
<td>1AA/15-32-095-06W4/00</td>
<td>0025561E</td>
<td>3/28/1964</td>
<td>Approximately 6000m</td>
<td>Yes</td>
<td>Located &amp; Abandoned 2010</td>
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<tr>
<td>1AA/14-32-093-06W4/00</td>
<td>Y0002251</td>
<td>2/18/1964</td>
<td>Approximately 10000m</td>
<td>Yes</td>
<td>Located in 2011, Abandoned in 2012</td>
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<tr>
<td>1AA/08-22-093-06W4/00</td>
<td>0026039A</td>
<td>2/22/1964</td>
<td>Approximately 10000m</td>
<td>Yes</td>
<td>Located in 2011, Abandoned in 2012</td>
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<tr>
<td>1AA/16-15-096-06W4/00</td>
<td>0025561F</td>
<td>3/30/1964</td>
<td>Approximately 10000m</td>
<td>Yes</td>
<td>1 of 2 wells located in 2011, other to be located and both to be abandoned with indication of development in area</td>
</tr>
</tbody>
</table>

- 11-22, 6-8, 5-28, 15-32, 14-32, and 08-22 were abandoned with thermal cement and cut and capped according to current Directive 20 standards.
- Approval received from AER to re-enter the wellbores and bring them into compliance.
- 2 joints of casing were cemented in place to ensure future identification.
- 16-15 had two wellbores drilled originally.
  - Have located the shallower of the two, will be abandoned at a later date.
  - To be located and abandoned when development plans move north of current pads.
  - Access to location has been built.
Table of Contents

• Safety Moment – Matt Beazer
• Introduction – Doug Castellino
• Geoscience – Frank Sun
• Surface Heave and Cap Rock Integrity – Jin Wang
• Drilling and Completions – Micaela Streeter
• Artificial Lift – Micaela Streeter
• Instrumentation in Wells – Micaela Streeter
• 4-D Seismic – Frank Sun
• Scheme Performance – Jennifer Smith
• Future Plans – Matt Beazer
4D Seismic - Survey Outlines

- Suncor places a high value on 4D seismic
- Data was collected in the year indicated and interpretation reported the following year due to required process and interpretation time
2013 4D Seismic - Steam Chamber Thickness Map

- Steam chamber thickness ranges from 0 to 23 m (Pad102 N).
- Pad 105 and Pad 106 E first images of chamber development
- Pad 105 early days in the life of the pad, up to 18 m of steam chamber growth
- Variations due to mud baffles or barriers
Table of Contents

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Methodology for Predicting Performance

• At Firebag, future performance is predicted by leveraging multiple tools
  – Analytical Models:
    • Modified Butler’s Tandrain equations
    • Water balance to monitor well communication
  – Analytical models and flow simulations are history matched on a well pair, pattern and field level

• Constraints are applied to the forecast
  – Plant turnarounds
  – Well downtime
  – New plant expansion and development pad schedule / availability
Scheme Performance – Well Production History

Firebag Production Data
Full Field

Stein, Oil Rates (m3/cd)

Produced Gas (E3m3/Cd)

Oil (m3/Cd)

Water Injected (m3/Cd)

Water Produced (m3/Cd)

Produced Gas (E3m3/Cd)
Issues and Milestones

Daily Rates

- May: Plant Turnaround
- Oct: TCPL gas interruption #1
- Nov-Dec: TCPL gas curtailment
- Dec: Pad 104 Infills First Steam
- Jan: 2 Power Outage incidents

Graph showing daily rates from March 2013 to January 2014, with annotations for key events.
Firebag Production

• Highest monthly average bitumen production over reporting period was 169,611 bopd (26,799 m³/cd) and occurred in February 2014
  • Stages 1, 2, 3, and 4 currently on production
  • Producing well count up by 20% over reporting period

• SOR Discussion
  • As of Feb 28, 2014 cumulative SOR at Firebag is 3.36 m³/m³
  • SOR over the reporting period was 3.24 m³/m³
    • Pad 106 and 116 ramp up steaming negatively impacted SOR over the reporting period
    • Pad 101 and 102 infill wells positively impacted SOR
Steam Chamber Discussion – 8WP1 / 1WP2

- OB6 located near the toe of 8WP1
  - 16.5 m N of 8WP1
  - 165 m SE of 1WP2

- OB ETS1 is located at the midpoint, between 8WP1 and 8WP2
  - 69.5 m S of 8WP1
  - 32.6 m N of 8WP2
  - No temperature observed

- 8WP1 first steam in October 2011

- 1WP2 first steam in October 2003
Steam Chamber Discussion – 8WP1 / 1WP2

OB6 – Toe of 8WP1, and riser section of 1WP2

- 16.5 m north of 8WP1
- Mid way along 1WP2 build section, 165m SE of 1WP2
- Instrumented with 24 thermocouples covering the McMurray channel and into the Clearwater
- Temp began increasing Sept 2010, 8WP1 first steam Oct 2011
- Steam chamber expanding past the heel of 1WP2
- Steam chamber top interpreted at 295 mKB
Steam Chamber Discussion – 7WP4

- 7WP4 has three observation wells nearby

- OB133 is located off the toe of 7WP4
  - 88.7 m NE of 7WP3
  - 61.6 m NW of 7WP4

- OB88 is located close to the mid-point of 7WP4
  - 63.6 m E of 7WP3
  - 25.1 m W of 7WP4

- OB123 is located at the heel between 7WP3&4
  - 47.0 m E of 7WP3
  - 42.9 m W of 7WP4
  - No temperature observed
Steam Chamber Discussion – 7WP4

OB133 – Toe of P7WP4, 61.6 m North West

• Instrumented with 40 thermocouples covering the McMurray channel and into the Clearwater

• First reading Aug 2012 showed temperature (1st steam April 2011)

• Continued heating over the last year with larger change over past 3 months

• Indicates chamber expansion extends from toe of well
Steam Chamber Discussion – 7WP4

OB88 – Mid-Point of P7WP4, 25.1 m West

- Instrumented with 56 thermocouples covering the McMurray channel and into the Clearwater
- Temperature started increasing Apr 2012, 7S4 first steam Apr 2011
- Chamber continues to grow above facies at 302mKB.
Steam Chamber Discussion – 16WP15

- 16WP15 has one observation well
- OB42 is located at the mid-point of 16WP15
  - 27.5 m N of 16WP15
  - 60.5 m S of 16WP16
Steam Chamber Discussion – 16WP15

OB42 – Mid-point of 16WP15, 27.5 m North

- Instrumented with 24 thermocouples covering the McMurray channel and into the caprock
- First steam Oct 2012
- Heating from virgin reservoir temperature (10°C) to steam temperature over the last year
- Good chamber development through channel, chamber top at 272mKB
## Pad Recoveries

<table>
<thead>
<tr>
<th>Pad</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>Stage 1 &amp; 2 Totals</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Recovery to Date, e³m³</td>
<td>9,268</td>
<td>7,124</td>
<td>6,342</td>
<td>4,143</td>
<td>26,877</td>
</tr>
<tr>
<td>Recovery Factor to Date, %</td>
<td>40%</td>
<td>30%</td>
<td>32%</td>
<td>22%</td>
<td>32%</td>
</tr>
<tr>
<td>Expected Ultimate Recovery, e³m³</td>
<td>13,760</td>
<td>13,077</td>
<td>11,495</td>
<td>12,147</td>
<td>50,479</td>
</tr>
<tr>
<td>Expected Ultimate Recovery Factor, %</td>
<td>60%</td>
<td>56%</td>
<td>57%</td>
<td>66%</td>
<td>59%</td>
</tr>
<tr>
<td>OBIP, e³m³</td>
<td>23,100</td>
<td>23,400</td>
<td>20,000</td>
<td>18,500</td>
<td>85,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pad</th>
<th>105</th>
<th>106</th>
<th>107</th>
<th>108</th>
<th>116</th>
<th>Stage 3 &amp; 4 Totals</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery to Date, e³m³</td>
<td>1,709</td>
<td>810</td>
<td>2,094</td>
<td>832</td>
<td>991</td>
<td>6,437</td>
</tr>
<tr>
<td>Recovery Factor to Date, %</td>
<td>7%</td>
<td>4%</td>
<td>17%</td>
<td>5%</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Expected Ultimate Recovery, e³m³</td>
<td>13,482</td>
<td>8,522</td>
<td>7,457</td>
<td>8,204</td>
<td>10,430</td>
<td>48,094</td>
</tr>
<tr>
<td>Expected Ultimate Recovery Factor, %</td>
<td>58%</td>
<td>46%</td>
<td>59%</td>
<td>46%</td>
<td>60%</td>
<td>54%</td>
</tr>
<tr>
<td>OBIP, e³m³</td>
<td>23,300</td>
<td>18,500</td>
<td>12,600</td>
<td>17,700</td>
<td>17,300</td>
<td>89,400</td>
</tr>
</tbody>
</table>

- Infill wells are included
- P108 North wells are included
Pad 101 Performance – High Recovery

• Pad 101
  • Most mature pad
  • 19 wells are currently on production
    – 10 producers and 9 infills
  • Monthly steam chamber pressures:
    – Average: 2,222 kPag
    – Range: 2,174 kPag – 2,272 kPag
  • Performance as of Feb 28, 2014:
    – Cumulative steam injected is 26,222,579 m³
    – Cumulative oil produced is 9,267,925 m³
    – Recovery Factor of 40%
    – Non-Condensable Gas Trial started Aug 2013
      • 1WP6,7,8
        – Pressure communication and chamber coalescence with off-set patterns interpreted with LRST, seismic and observation wells
          – Has not significantly changed overall recovery factor
Firebag Pad 101 Production

Pad 101 Performance – High Recovery

3.1.1 7e) iii)
Pad 101 Performance – High Recovery

Firebag Pad 101 Production

May: Plant Turnaround
Aug: NCG Trial Start
Oct - Dec: Steam shortages due to TCPL gas curtailment

Rate, m³/d

NCG Rate, E₃m³/CD & SOR, m³/m³

Date


Oil Rate (m³/CD)  Steam Rate (m³/CD)  Water Rate (m³/Cd)  SOR (m³/m³)  CSOR (m³/m³)  NCG Rate (E₃m³/CD)
NCG Co-injection Pilot Data

• Average composition of injected fuel gas (2013):

<table>
<thead>
<tr>
<th></th>
<th>N2 (%)</th>
<th>CO2 (%)</th>
<th>C1 (%)</th>
<th>C2 (%)</th>
<th>C3 (%)</th>
<th>NC4 (%)</th>
<th>IC4 (%)</th>
<th>NC5 (%)</th>
<th>IC5 (%)</th>
<th>NC6 (%)</th>
<th>NC7 (%)</th>
<th>NC8 (%)</th>
<th>HE (%)</th>
<th>H2 (%)</th>
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<tr>
<td>Total</td>
<td>0.58</td>
<td>0.71</td>
<td>91.85</td>
<td>4.72</td>
<td>1.45</td>
<td>0.28</td>
<td>0.21</td>
<td>0.05</td>
<td>0.06</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.04</td>
<td>0.00</td>
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</tbody>
</table>

• Volume percentage of total injection that fuel gas represents: \( \text{sm}^3 \text{ NCG} / (\text{sm}^3 \text{ steam} + \text{sm}^3 \text{ NCG}) \)

<table>
<thead>
<tr>
<th></th>
<th>Total Pilot</th>
<th>1WP6</th>
<th>1WP7</th>
<th>1WP8</th>
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<tbody>
<tr>
<td>Volume</td>
<td>0.4%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>0.5%</td>
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</table>
NCG Co-injection Learnings

- No anticipated impact to resource recovery
  - Oil rate maintained as steam has been cut, leading to improved SORs
- Possible NCG accumulation at the top and edges of the steam chamber
  - Some of this NCG was likely present pre-pilot
- Sampling of mixture of non-condensable and condensable gases remains a challenge and safety issue
  - High subcool values depress vapor production
Pad 104 Performance – Medium Recovery

- Pad 104
  - 10 wells are currently on production
  - North Infill wells started steaming Q4 2013
  - Monthly steam chamber pressures:
    - Average: 2455 kPag
    - Range: 2373 kPag - 2608 kPag
  - Performance as of Feb 28, 2014:
    - Cumulative steam injected is 12,819,040 m³
    - Cumulative oil produced is 4,143,385 m³
    - Recovery Factor of 22%
  - Production rate decreased due to surface facility constraints.
  - Steam chamber thickness map from 2013 4D Seismic data shown
    - South steam chamber growth less than north
Pad 104 Performance – Medium Recovery

Firebag Pad 104 Production

May 13: Plant Turnaround

Oct - Dec 13: TCPL gas curtailment

Rate, m³/d

SOR, m³/m³

Oil Rate (m³/CD)  Water Rate (m³/CD)  Steam Rate (m³/CD)  SOR (m³/m³)  CSOR (m³/m³)

Date

Pad 104 Performance – Medium Recovery

Firebag Pad 104 Production

- Oct 08: First Steam
- Apr 09: NL SAGD conversions commenced
- Sep-Dec 09: Reduced steam availability due to plant upsets
- Sep 11: Plant Turnaround
- May 12: Plant Turnaround
- Jul 12: Plant Trip
- Oct-Dec 13: TCPL gas curtailment
- May 13: Plant Turnaround

Legend:
- Oil Rate (m3/CD)
- Steam Rate (m3/CD)
- Water Rate (m3/CD)
- SOR (m3/m3)
- CSOR (m3/m3)
Pad 4 WSR Discussion

- Communication with offset patterns evident during later start up through increasing WSR
- Off-set pads operate at higher chamber pressures than pad 4
- Expect continued WSR>1 due to infill contribution
Pad 108 Performance – Low Recovery

- Pad 108
  - 12 wells currently on production
  - 2 well pairs and one infill planned first steam in late 2014
  - Steam chamber pressures:
    - Average over period: 2630 kPag
    - Range over period: 2394 kPag - 2733 kPag
  - Performance as of Feb 28, 2014:
    - Cumulative steam injected is 5,118,485 m³
    - Cumulative oil produced is 832,275 m³
    - Recovery Factor of 5%
  - Production and steam injection ramping up as per expectations
Pad 108 Performance – Low Recovery

Firebag Pad 108 Production

May 13: Plant Turnaround
Oct - Dec 13: Steam shortage due to TCPL gas curtailment

Rate, m3/d

SOR, m3/m3

Date


Oil Rate (m3/CD) Water Rate (m3/CD) Steam Rate (m3/CD) SOR (m3/m3) CSOR (m3/m3)
Pad 108 Performance – Low Recovery

Firebag Pad 108 Production

Oct 11: First Steam
Jan 12: First Oil
Oct 12: 8WP11&12 First Steam
Mar 13: 8WP11&12 First Oil
May 13: Plant Turnaround
Oct - Dec 13: Steam shortage due to TCPL gas curtailment
Future Plans – Well and Pad Abandonments

• Do not anticipate abandonment of any SAGD pads within the next 5 years
Steam Injection Properties

• Approved MOP of currently producing pads:
  • 4040 kPag (251 °C) during circulation
  • 3570 kPag (243 °C) during SAGD

• Average monthly casing injection pressure during Feb 2014 (as measured by blanket gas) was 2423 kPag (225 °C)

• Steam quality decreases between the central plant and the pads
  • Steam quality leaving the plant is 100% at approximately 11 MPag
  • Steam quality at the wellhead is not measured, but has been modelled and estimated to be 95%

• These conditions are in line with those in the original design
Steam Injection Properties

• The transportation distance from the central plant to the pads in which steam can be delivered at reasonable qualities will vary depending upon:
  • Line size
  • Insulation thickness
  • Initial pressure
  • Desired steam rate

• Steam transport distance remains economic at approximately 10 km from Firebag facility
  • Current longest steam transport distance to an operating pad is approximately 5.5 km
Summary of Key Learnings

• Infill Performance
  • Bottom hole temperatures vary greatly well to well
  • Mobility and conformance greatly influence steam requirement
  • Tailored well completions based on preliminary temperature surveys
    • Equip well for bull heading, steam past ESP, no steam
    • Target hot / cold zones for production / injection
  • Select wells required multiple steaming cycles
  • Generally stable production once in SAGD mode
  • Optimizing infill & base well interaction
Summary of Key Learnings

Infill & Base Well Total Fluid Rate & SOR

- Pad 2 Base Well Total Fluid Rt
- Pad 1 Base Well Total Fluid Rt
- Pad 2 Infills Total Fluid Rt
- Pad 1 Infills Total Fluid Rt
- Pad 2 Combined SOR
- Pad 1 Combined SOR

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Pad 1 & 2 WSR Discussion

- WSR ratio increase due to infill contribution
- No change in chamber pressure or oil cut
- Pressure communication with Pad 8 evident in south pattern
- WSR may normalize as infill production progresses
Summary of Key Learnings

- Water Mobility
  - ESP tested in cold SAGD producer able to produce water at high rates and low drawdown
  - Utilize Bullheading during startup
  - New startups impact TFSR on adjacent pads
  - Observation wells show pressure transmission

OB39 320m NW of 16WP19 toe
Pressure response at OB39 correlates to steam injection rate
Summary of Key Learnings

• Bullheading Startup
  • Injecting steam into the reservoir without circulating a portion of the steam back to surface
  • Purpose is to heat the reservoir between injector and producer
  • Historically circulation startup wells at Firebag have leaked off a material portion of circulated steam
  • By not taking returns, bullheading:
    • Requires less cumulative steam
    • Achieves the same reservoir heating as circulation
    • Reduces CSOR and thus emissions / bbl produced
  • Operates within AER approved MOP
  • Pads with Bullheading Start Up: 105, 107, 108, 116, 104 Infills
  • Circulation considered when bullheading is unable to achieve target injection rate under MOP
Summary of Key Learnings

• Startup Strategy
  – Startup time frame is two to three months
  – Startup wells converted directly to mechanical lift
    • Natural lift phase is no longer employed, ESP operation allows for stable operation and strict subcool control
  – Startup steaming on Stage 3 Pads completed in 2012
    • All Stage 3 wells are now in SAGD mode
  – Startup steaming on Stage 4 Pads completed in 2012
    • All Stage 4 Pads are now in SAGD mode as of Feb 2013
  – Startup steaming on Pad 4 Infill wells occurred in Dec 2013
    • First oil is expected Q2 2014
Summary of Key Learnings

- Sub-cool Management
  - Operate SAGD well pairs with target of 20°C reservoir subcool
  - Temperature measured in all producers at the ESP intake
  - Low rate steam tests measure reservoir pressure monthly
  - Adjust pump speeds regularly to maintain subcool target
  - Manage reservoir fluid levels below injectors to avoid flooding
  - Reduces risk of steam coning
  - Improved pump reliability
Summary of Key Learnings

- **Artificial Lift**
  - Mechanical lift used in all Firebag production wells
  - Mechanical lift allows for quick adjustment to production rates in order to maintain subcool control
  - High temperature pumps now in operation which allow for operation at a range of steam chamber pressures
    - Enabled earlier use of mechanical lift
    - Enabled steaming past the pump
    - Higher pressure in early time promotes chamber growth and speeds ramp up
    - Lower pressure in later time may reduce water loss and decreases SOR
Steam Strategy

• Operating Pressure
  • Operating pressures ranged from 1900-3000 kPag chamber pressure in SAGD, depending on Pad
  • Plan to drop chamber pressures on mature wells over next few years

• Under normal operating conditions, steam is allocated to balance chamber pressures across patterns

• In periods of lower steam supply, priority generally given to younger wells
Table of Contents

• Safety Moment – Matt Beazer
• Introduction – Doug Castellino
• Geoscience – Frank Sun
• Surface Heave and Cap Rock Integrity – Jin Wang
• Drilling and Completions – Micaela Streeter
• Artificial Lift – Micaela Streeter
• Instrumentation in Wells – Micaela Streeter
• 4-D Seismic – Frank Sun
• Scheme Performance – Jennifer Smith
• Future Plans – Matt Beazer
Future Plans – Regulatory Applications

• Filed Applications
• Future Applications
  – Geoscience and Reservoir Development teams are continuing work to
determine optimum depletion plans for next sustaining pads
  – Anticipating the submission of three D23 applications in 2014

<table>
<thead>
<tr>
<th>Directive 23 Applications</th>
<th>Description</th>
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<th>Date Approved</th>
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<td>Thirty wellpairs</td>
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<td>Eighteen wellpairs</td>
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<td>Tie-In of Plant 91/92 PWTs to VRU</td>
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<td>Pad 110 &amp; 115</td>
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Future Plans - Drilling Activities

• Completed Drilling
  – Pad 110 finished drilling May 2013
  – Pad 103 Infills finished drilling April 2013
  – Pad 108 North finished drilling November 2013
  – Pad 117 finished drilling January 2014

• Drilling In Progress
  – Pad 109 commenced drilling July 2013, anticipate rig release Q2 2014
  – Pad 114 commenced drilling June 2013, shut down in Nov 2013, restart drilling in May 2014, anticipate rig release Q3 2014
  – Pad 112 commenced drilling in January 2014, anticipate rig release Q4 2014
2013 Drilling: Re-entered & Re-drilled Wells

The following wells were re-entered or re-drilled during the reporting period:

<table>
<thead>
<tr>
<th>Well</th>
<th>Re-entry/Re-drill</th>
<th>Reason</th>
</tr>
</thead>
</table>
| 8P13 | Re-entry (Sidetrack) | • Poor geology – large mud body between original wells  
• 8P13, was sidetracked as a new injector to create a viable well pair above the mud |
| 8P14 | Re-entry (Sidetrack) | • Poor geology – large mud body between original wells  
• 8P14, was sidetracked as a new injector to create a viable well pair above the mud |
| 9P7  | Re-entry (Sidetrack) | • Liner got stuck at approx. 1135mKB  
• Re-entered well, sidetracked and landed liner to toe (1570mKB) |
Future Plans – Drilling Activities

• Future Drilling
  – Pad 104 South Infills to commence drilling in Q3 2014
  
  – Pad 118 to commence drilling in Q4 2014

  – Coreholes/observation wells will be drilled as necessary to:
    • Adequately delineate the resource
    • Monitor SAGD operations
    • Further cap rock integrity analysis
    • Hydrogeology analysis
    • Water disposal analysis
Future Plans – Testing

• Pad 104 North Chemical Co-Injection Test
  – Application was approved in Mar 2013
  – Test planned for Q2 2014
  – Three injectors: 4S2, 4S3 and 4S4

• Pad 110 Chemical Co-Injection Test
  – Planned for Q4 2014
  – Planning for two well pairs: 10WP12 & 10WP13

• Chemical Soak – 15WP6 & 15WP7
  – Planned for Q2 2014

• Electrical Pre-heat – 10P7
  – Planned for Q2 2014
Future Plans – Pad 123

- Pad 123 D23 submitted September 2013
  - Proposing conventional SAGD with non-condensable gas co-injection

- 2014 regional water mobility testing program
  - Continuing analysis of test results
Section 3.1.2 – Surface Operations, Compliance and Issues Not Related to Resource Evaluation and Recovery
Table of Contents

- Introduction – Doug Castellino
- Safety Moment – Doug Castellino
- **Operations and Facility Performance** – Pat De Haas
- Measurement and Reporting – Leah Butler
- Water Production, Injection and Usage – Leah Butler, Micaela Streeter/Steve Hodges
- Sulphur Production – Steve Hodges
- Environmental Performance – Steve Hodges
- Future Plans – Pat De Haas
Firebag Project Site
Site Survey Plan
Firebag Simplified Process Block Diagram

1) a)
Stages 1, 2, 3 & 4

FWKO's

BFW Tank

Water Treatment

Process Water Tank

OTSG

Stage 3 & 4

Stage 1&2

DilBit

Process Water Tank

Water Treatment

BFW Tank

OTSG

PADS 105/106, 116

PADS 107/108

PAD 104

PADS 101/102/103

PADS 105/106, 116

PADS 107/108

PAD 104

PADS 101/102/103

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Oil Treatment Technologies

- All Plants
  - Free water knockout drums and treaters for bitumen separation
  - Inject diluent upstream of the free water knockout drum

- Plant 93/94 primary differences from Plant 91/92:
  - Produced gas separators at the pads
  - Electrostatic grids in the treaters
  - Spiral Produced Water Coolers versus conventional shell and tube
  - Oil Removal Filters (ORF’s)

- Skim Tanks in Plant 91/92 and Microbubble Flotation in Expansion, Plant 93/94

- Diluent Stripping Unit that produces Hotbit and recovers diluent from Dilbit
Oil Treatment Risks and Opportunities

• All Plants
  – Ongoing Chemical Usage Optimization
  – Handling solids accumulation in the vessels which is coming in with the emulsion
  – Produced water cooler fouling issues as well as Produced Water cooling capacity issues in all the Plants
  – Dilbit Cooling Capacity Issues during summer time
  – Cooling issues from Glycol System which is operating close to capacity
  – Ongoing operation improvement to reduce venting incidents
  – Increase Dilbit Density resulting in reduced diluent usage

• Plant 93/94/Expansion
  – Improvement in MBF operations

• Plant 93/94
  – DSU Overhead Pressure Relief Capacity Limitations
  – Handling of Recycle Skimmed Oil stream and reliability of Recycle Oil Stream Pumps
Water Treatment Technologies

- Water treatment technology used at Firebag:
  - Plant 91 - Warm Lime Softening (WLS), Filtration (Anthracite), Weak Acid Cation Exchange (WAC)
  - Plant 92 - Evaporators and Disposal Water Treatment (DWT) Technology
  - Plant 93 – WLS, Filtration (Walnut Shell), WAC
  - Plant 94 – WLS, Filtration (Walnut Shell), WAC
Water Treatment Risks and Opportunities

• 91 – WLS Performance
  – Chemical Optimization

• 92 – Evaporator Improvement Trials
  – Continue to trial and improve cleaning methods
  – Improved monitoring program
  – Testing internal mechanical changes

• 93/94 – WLS Performance
  – Improve chemical system reliability
  – Chemical reduction and optimization
  – Optimize sludge handling
  – Performance test for bottleneck identification and removal

• Canada’s Oil Sands Innovation Alliance (COSIA) – steam / water projects improvement group
Steam Generation Risks and Opportunities

- Continued optimization of control systems and safety interlocks
- Optimization of steam generation capacity during steam long situations
- Stage 3/4 cogenerator troubleshooting control systems and quality control increases/optimizations
- Trialing new tube temperature monitoring equipment to help understand impact of water quality excursions
- Improved pigging frequency and use to maximize steam generator usage
- Natural gas interruptions from Nova Pipeline
- Reliability of Steam Generator U-bends
Sulphur Recovery Technologies

- The Firebag Sulphur Recovery Complex (SRC) came online successfully in February 2011.

- It consists of both an Amine Stripping Unit (ASU) and a Sulphur Recovery Unit (SRU).

- The SRC is an integral part in the development and operation of Firebag.

- Amine includes Two Trains and use MDEA for sour gas sweetening.

- Sulphur Recovery complex (SRU) consist of two trains which each one includes a three stage Claus process. The capacity of each train is 13.5 T/day sulphur.

- The Amine unit sweetens the produced gas for steam generation.

- Since start-up, many constraints and challenges have been overcome to achieve high sulphur recovery level.
Sulphur Recovery Plant Risk and Opportunities

- To meet regulatory requirements of 95.9% per calendar quarter for production above 10 tonne/day
- Firebag Experienced the sulphur production of 10 tonne/day and above from fourth quarter of 2013
- All the produced gas in Firebag were routed to SRU by end of 2013
- The major Produced gas in Firebag includes:
  - Pads Produced Gas
  - Tank VRU Gas
  - Diluent Recovery Separator Gas
  - DSU Produced Gas
  - Blanket Gas
- Firebag produced high volume of produced gas (PG) in parallel with increasing Production in 2013. The goal is to minimize the amount of Firebag PG Gas
- Average SRC sulphur recovery was 96.4 and overall plant sulphur recovery was 95.3
- Firebag sulphur recovery improved by 2.6% from 2012 to 2013 (sulphur recovery in 2012 was 92.6%)
- SRU turnaround was implemented in Q3 of 2013
Pads/Gathering Technologies

• Firebag currently consists of 9 Pads and 140 Producing Wells

• The new Pads including Pad-115, Pad-104 & Pad-103 Infill, Pad-108

• North, Pad-109, 110, 111, 112, 114, 117 and 118 will be added by 2018 as Firebag development program

• The Produced emulsion from Pad-1 to 4 will be transferred to Plant-91/92 and Emulsion from Pad-105, 106, 107, 108, 116 are transferred to Plant-93/94. There are also booster pumps which transfer Produced emulsion from Pads-101-104 to Stage-93/94

• Produced Gas from Pads are transferred to SRU plant

• The MOP (Maximum Operating Pressure) for pads is set at 3570 Kpag for reservoir cap rock protection
Pads/Gathering Risk and Opportunities

• Improve pads energy intensity by handling excess condensate generation in MP steam header

• Optimize the group separator pressure to improve plant energy integrity and reduce GHG gas

• SOR and WOR in Firebag has been improved over 2013

• Average SOR was 3.30 in 2013 in compare with 3.43 in 2012

• Average WOR was 3.41 in 2013 in compare with 3.50 in 2012

• Technology Group started Implementing of pilot plant in 2013 to test
  – Injection of Fuel Gas into Reservoir in Pad-101
  – Injection of Chemical into Pad-104
## Produced Water (PW) Quality

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<thead>
<tr>
<th></th>
<th>Plant 91</th>
<th>Plant 92</th>
<th>Plant 93 &amp; 94</th>
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<tr>
<td>pH (pH units)</td>
<td>9.1</td>
<td>10.5</td>
<td>6.9</td>
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<tr>
<td>Turbidity (NTU)</td>
<td>54.5</td>
<td>90.5</td>
<td>176.4</td>
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<tr>
<td>Reactive Silica (mg/L)</td>
<td>243.4</td>
<td>269.3</td>
<td>264.4</td>
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<tr>
<td>Bitumen in Water (ppm)</td>
<td>0.7</td>
<td>1.4</td>
<td>2.8</td>
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<tr>
<td>Dissolved Ca (mg/L)</td>
<td>6.8</td>
<td>2.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Dissolved Mg (mg/L)</td>
<td>1.3</td>
<td>0.5</td>
<td>0.6</td>
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<tr>
<td>Dissolved Hardness CaCO3 (mg/L)</td>
<td>22.3</td>
<td>7.2</td>
<td>7.9</td>
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</table>
## Boiler Feed Water (BFW) Quality

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<th></th>
<th>Plant 91</th>
<th>Plant 92</th>
<th>Cogen (HRSG)</th>
<th>Plant 93/94</th>
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<tr>
<td><strong>Total Dissolved Solids (mg/L)</strong></td>
<td>1200</td>
<td>180</td>
<td>410</td>
<td>2900</td>
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<tr>
<td><strong>Reactive Silica (mg/L)</strong></td>
<td>45.0</td>
<td>4.0</td>
<td>12.0</td>
<td>42.0</td>
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<tr>
<td><strong>Dissolved Chloride (mg/L)</strong></td>
<td>180</td>
<td>18</td>
<td>48</td>
<td>570</td>
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<tr>
<td><strong>Dissolved Sodium (mg/L)</strong></td>
<td>478</td>
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<td><strong>Dissolved Potassium (mg/L)</strong></td>
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<td><strong>Alkalinity (mg/L)</strong></td>
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<td>113</td>
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<td><strong>pH (pH units)</strong></td>
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<td>9.9</td>
<td>9.6</td>
<td>9.9</td>
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Plant Improvements

- Optimized operation on the FWKO and Deoiling area ensuring onspec BS&W in Dilbit and Oil in Water

- Use of a new EB that improved handling of Recycle Skimmed Oil stream in Plant 93/94 for consistent production of on-spec Dilbit and Produced Water

- Improved MBF and Diluent Stripping Unit operations in Plant 93/94 through better operating knowledge and procedure

- Constructed line to treat 93/94 disposal water in evaporators

- Work done on Plant 91/92 Produced Water Tanks to prepare for tie-in to Vapour Recovery Unit as a continuous improvement opportunity

- Optimized steam generation capacity during steam long situations to maximize energy efficiency

- Upgraded peroxide dosing system to meet increasing H2S removal demand
Stage 3/4 Update

- Performance evaluation of the Diluent Stripping Unit and MBF to understand actual capacity and identify opportunities for debottleneck projects

- Several planned chemical trials to improve handling of Recycle Skimmed oil stream and increase run time of Produced Water Coolers

- Planning to trial to increase dilbit density which has the benefits of reduced diluent usage and improve DSU vapor handling capacity

- Performance evaluation for future water treatment debottlenecking projects

- Water disposal system review ongoing

- Ongoing preparation to transition Firebag to using Pond Effluent Water as utility water instead of RO Make Up
Steam Injected

From March 2013 to February 2014, Firebag injected on average 75,805 m³/day of steam into the wells.
### Steam Qualities

<table>
<thead>
<tr>
<th></th>
<th>Plant 91 OTSGs</th>
<th>Plant 92 OTSGs</th>
<th>Plant 91 Cogen</th>
<th>Plant 93 OTSGs</th>
<th>Plant 93 Cogens</th>
<th>Plant 94 OTSGs</th>
<th>Plant 94 Cogens</th>
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<td>Aug-13</td>
<td>77.0%</td>
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<td>78.7%</td>
<td>74.9%</td>
<td>75.2%</td>
<td>74.9%</td>
<td>74.8%</td>
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<td>73.7%</td>
<td>73.9%</td>
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<td>76.1%</td>
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<td>75.7%</td>
<td>75.3%</td>
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<tr>
<td>Nov-13</td>
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<td>76.8%</td>
<td>77.9%</td>
<td>75.3%</td>
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<td>75.8%</td>
<td>75.7%</td>
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<tr>
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<td>77.4%</td>
<td>74.1%</td>
<td>76.2%</td>
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<td>73.6%</td>
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<td>74.0%</td>
<td>74.6%</td>
<td>74.0%</td>
<td>74.9%</td>
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<tr>
<td>Feb-14</td>
<td>75.3%</td>
<td>75.4%</td>
<td>76.5%</td>
<td>74.1%</td>
<td>75.7%</td>
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<td>75.4%</td>
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<tr>
<td><strong>Average:</strong></td>
<td><strong>75.9%</strong></td>
<td><strong>76.9%</strong></td>
<td><strong>78.3%</strong></td>
<td><strong>74.8%</strong></td>
<td><strong>74.8%</strong></td>
<td><strong>74.9%</strong></td>
<td><strong>74.8%</strong></td>
</tr>
</tbody>
</table>
Notes of Steam Qualities

• For Plant 91, the quality can be run to a maximum of 80% on any individual pass, which means the average must be lower than 80% due to the spread of pass qualities. Plant 91 is specifically prone to particulate hardness excursions and the quality must be cut to 75% and then 70% to protect the boiler tubes on occasions. This happens frequently enough to account for the low quality below.

• For Plant 92, the quality can be run to a maximum of 80% on any individual pass, which means the average must be lower than 80% due to the spread of pass qualities.

• For the Plant 91 Cogeneration unit, the quality can be run to a maximum of 80% on any individual pass, which means the average must be lower than 80% due to the spread of pass qualities, however tighter pass control on this cogeneration unit allows a higher average quality than Plant 92.

• For all Plant 93 and 94, the design is for 75% average.
Electricity Generation/Consumption

From March 2013 to February 2014, Firebag generated 3,366 GW-hours of electricity, with 2,529 GW-hours being exported to Oilsands.
Energy Intensity

Firebag’s average energy intensity was 8.67 GJ per m³ of production, from March 2013 to February 2014.

Note: Energy Intensity includes all facility gas consumption and both electricity imported and exported.
Monthly Bitumen Production

Firebag averaged 23,452 m³/day (147,508 BPD) of production from March 2013 to February 2014.
Purchased Gas Usage

Firebag used on average 6,307 e³m³ of natural gas per day, from March 2013 to February 2014.
### Facility Environmental Performance

<table>
<thead>
<tr>
<th>Emissions Parameter</th>
<th>Mar 2013 - Feb 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution Gas Consumed (e³m³)</td>
<td>10,225.3</td>
</tr>
<tr>
<td>Solution Gas Flared (e³m³)</td>
<td>148.0</td>
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<tr>
<td>Solution Gas Vented¹ (e³m³)</td>
<td>30.0</td>
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<tr>
<td>Solution Gas Recovery</td>
<td>98.3%</td>
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<tr>
<td>Total Gas Flared (e³m³)</td>
<td>1,299.3</td>
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<tr>
<td>Total Gas Vented³ (e³m³)</td>
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<tr>
<td>H₂S Emissions² (kg)</td>
<td>7880.4</td>
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</tbody>
</table>

¹ Solution gas vented = gas vented from tanks upstream of produced gas separators (i.e. production tanks)

² H₂S emissions = H₂S gas vented at Firebag as communicated through the Digital Data Submission System (DDS)

³ Total Gas Vented = gas vented at Firebag as communicated through the Digital Data Submission System (DDS)

### GHG Emission Parameter

<table>
<thead>
<tr>
<th>GHG Emission Parameter</th>
<th>Jan 2013 – Dec 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>*2013 GHG Emissions (tonnes CO₂e) Calendar Year</td>
<td>3,312,124</td>
</tr>
<tr>
<td>*2013 GHG Emission Intensity (tonnes CO₂e/m³) Calendar Year</td>
<td>0.3974</td>
</tr>
</tbody>
</table>

*CO₂e is based on AENV SGER Reporting for the 2013 calendar year
Table of Contents

- Introduction – Doug Castellino
- Safety Moment – Doug Castellino
- Operations and Facility Performance – Pat De Haas
- **Measurement and Reporting** – Leah Butler
- Water Production, Injection and Usage – Leah Butler, Micaela Streeter/Steve Hodges
- Sulphur Production – Steve Hodges
- Environmental Performance – Steve Hodges
- Future Plans – Pat De Haas
Measurement, Accounting and Reporting Plan (MARP)

- Firebag MARP approved June 2010

- Fourth MARP update submitted to the AER in February 2014

- MARP details all the requirements in Directive 42

- Firebag formed an Enhanced Production Audit Program (EPAP) and MARP team in January 2013
  - Team made up of representatives from each discipline who have tasks associated with MARP and EPAP
  - Team meets monthly to ensure tasks are being completed to remediate the deficiencies from the EPAP audit, and other measurement deficiencies identified through the monthly meetings
Estimating Well Production & Steam Injection Volumes

- Fluid production tests are performed as per Directive 17 requirements

- BS&W metering and manual cuts are applied to emulsion to determine water and oil production

- Well test bitumen is prorated based on facility bitumen production

- Well test water production is prorated on facility produced water

- Steam volumes are metered at the wellheads and prorated against the plant steam
Testing Improvements

• Dec. 16, 2011 received approval for MPFM on Pad 105 and future developments

• Continue to make improvements to Well Production Test software (WPT)

• MPFM now present on Pads 101 infills, 102 infills, 105, 106, and 116

• Improving sample locations and methods on Pads 101, 102, 107 and 108
Water proration near the upper portion of the 0.85-1.15 target range is due to unaccounted steam condensate that is separated at pads and sent back to CPF with emulsion.
Steam Proration Values
Measurement During Circulation

<table>
<thead>
<tr>
<th>Pad 107</th>
<th>Pad 108</th>
<th>Pad 105</th>
<th>Pad 106</th>
<th>Pad 116</th>
</tr>
</thead>
</table>

• Production metering
  - Pads 107 & 108: AGAR & Coriolis meters (Test separator)
  - Pad 105, 106 & 116: Vx Meters (No test separator)

• Production accounting
  - All steam injection is metered on each well and reported to the Petrinex
  - Pads 107 & 108:
    - Assumed 100% water cut during circulation and a 90% water cut during Semi-SAGD/Steam Assist
    - As wells were converted to production, returns were metered using the AGAR meter for water cuts (referenced against manual samples, if >5% difference, manual sample values were used for that test) and the Coriolis meter for mass flow rate
    - AGAR meters are recalibrated quarterly
  - Pads 105, 106 & 116
    - Assumed 100% water cut during circulation
    - During circulation, the pad outflow meters were used to measure total flow from the pad, which was distributed evenly among the circulating wells to provide an estimate of returns
    - As wells are converted to production, Vx meters are used to measure flow rates and water cuts for each producing well (calibration currently ongoing)
Table of Contents

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- Environmental Performance – Steve Hodges
- Future Plans – Pat De Haas
Water Sources

• Primary makeup water source for process operations is two wastewater streams from Oil Sands Base Plant:
  
  - Reverse Osmosis (RO) Water
  - The total volume of RO water used from March 2013 to February 2014 was 869,990 m³ (2013 calendar year usage was 874,385 m³)

• Pond Effluent Water (PEW)
  - The total volume of PEW used from March 2013 to February 2014 was 384,320 m³ (2013 calendar year usage was 404,213 m³)
Water Usage

- Site runoff water (rainfall and snow melt) is routed to the site process ponds and reused in the process

- A total of 111,539 m³ of storm water runoff water was diverted for process use from March 2013 to February 2014 (for the 2013 calendar year, usage was 120,260 m³; 4,625 m³ for the Stages 1/2 area and 115,635 m³ for the Stages 3/4 area)

  - Water Act Approval 00310571-00-00 for ponds in NE 11-095-06-04-W4 (Stages 1/2 Area) for diversion of up to 95,000 m³ annually
  - Water Act Approval 00310571-00-00 for ponds in SW 13-095-06-W4, NW 12-092-06-W4 and NE 14-095-06-W4 (Stages 3/4 Area) for diversion of up to 250,000 m³ annually

- Water Act License 00233808 for Production Well 03-05 as back-up supply for up to 620,500 m³ annually. The well was not used in 2013 or 2014 year-to-date
## Overall Water Balance

<table>
<thead>
<tr>
<th></th>
<th>Fresh Water (m³)</th>
<th>Steam (m³)</th>
<th>Water (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>REC (FW1)</td>
<td>DISP (FW3)</td>
<td>PLTUSE (FW6)</td>
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<td>Jan-13</td>
<td>91,987.0</td>
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<td>50.6</td>
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<td>Feb-13</td>
<td>104,873.0</td>
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<td>17.2</td>
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<td>Mar-13</td>
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<tr>
<td>Apr-13</td>
<td>142,458.1</td>
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<td>Jun-13</td>
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<td>Jul-13</td>
<td>142,178.6</td>
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<td>Aug-13</td>
<td>126,954.0</td>
<td>63,347.9</td>
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<td>Sep-13</td>
<td>151,068.7</td>
<td>74,261.6</td>
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<td>Oct-13</td>
<td>82,329.7</td>
<td>27,844.9</td>
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<td>Nov-13</td>
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<td>26,176.1</td>
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<td>Dec-13</td>
<td>81,609.6</td>
<td>34,831.2</td>
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<td>Jan-14</td>
<td>85,958.9</td>
<td>28,691.2</td>
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<tr>
<td>Feb-14</td>
<td>77,891.4</td>
<td>24,177.2</td>
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</table>
Disposal Limits and Actual Disposal

* Calculated as per formulas stated in Directive 81: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes
Waste Management – Disposal

Disposal Well Locations

• Current disposal wells:

  – 100/10-03-095-06W4/00

  – 100/06-03-095-06W4/00

  – 100/02-10-095-06W4/00
    • Performance test completed on February 17, 2014, no other injection during reporting period

• All disposal wells approved for use as per Approval Class 1b Approval No. 9487F (March 27, 2013)
### Waste Management – Disposal

#### Disposal Information – 100/10-03-095-06W4
(data shown is averaged across the month)

<table>
<thead>
<tr>
<th>Month</th>
<th>Injection Rate (Sm³/day)</th>
<th>Wellhead Pressure (kPa-g)</th>
<th>Downhole Pressure (kPa-g)</th>
<th>Injection Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>March-2013</td>
<td>1302</td>
<td>970</td>
<td>Offline (reported data gap)</td>
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<td>4128</td>
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<td>May-2013</td>
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<td>705</td>
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<td>1592</td>
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<td>January-2014</td>
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<td>February-2014</td>
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## Waste Management – Disposal

### Disposal Information – 100/06-03-095-06W4
(data shown is averaged across the month)

<table>
<thead>
<tr>
<th>Month</th>
<th>Injection Rate (Sm3/day)</th>
<th>Wellhead Pressure (kPa-g)</th>
<th>Downhole Pressure (kPa-g)</th>
<th>Injection Temperature (°C)</th>
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</thead>
<tbody>
<tr>
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<td>July-2013</td>
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## Waste Management – Disposal

### Disposal Information – 100/02-10-095-06W4

(data shown is averaged across the month)

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<th>Injection Rate (Sm3/day)</th>
<th>Wellhead Pressure (kPa-g)</th>
<th>Downhole Pressure (kPa-g)</th>
<th>Injection Temperature (°C)</th>
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<tr>
<td>March-2013</td>
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<td>April-2013</td>
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<td>May-2013</td>
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<td>Offline</td>
</tr>
<tr>
<td>June-2013</td>
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<td>Offline</td>
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<tr>
<td>July-2013</td>
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<tr>
<td>August-2013</td>
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<td>September-2013</td>
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<td>October-2013</td>
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<tr>
<td>November-2013</td>
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<tr>
<td>December-2013</td>
<td>Offline</td>
<td>Offline</td>
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<td>Offline</td>
</tr>
<tr>
<td>January-2014</td>
<td>Offline</td>
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<td>Offline</td>
</tr>
<tr>
<td>February-2014</td>
<td>18</td>
<td>208</td>
<td>4633</td>
<td>49</td>
</tr>
</tbody>
</table>
Disposal Information – 100/10-03-095-06W4 (daily data)

Reported data gap in downhole pressure due to failed surface unit, and downhole gauges.
Waste Management – Disposal

Disposal Information – 100/06-03-095-06W4 (daily data)
Performance test completed on February 17, 2014
Waste Management – Disposal

Disposal Observation Well Locations

• Current Observation Wells:
  – 100/12-06-095-06W4/00 (DS1)
  – 102/12-06-095-06W4/00 (DS2)
  – 103/12-06-095-06W4/00 (DS3)
  – 100/13-34-094-06W4/00 (DS4)
  – 100/02-15-095-06W4/00 (DS5)
  – 100/11-28-094-06W4/00 (DS6)
  – 100/04-06-095-05W4/00 (DS7)
  – 109/13-03-095-06W4/00 (PP7/DW22)
  – 100/08-02-095-06W4/00 (DW OB1)
  – 100/16-03-095-06W4/00 (DW12)
  – 1AA/12-30-095-05W4/00 (DW4)
Waste Management – Disposal

• During the reporting period, the following was completed:
  – Drilled DS7 for future testing and monitoring programs
  – Completed, tested and sampled chemistry at DS4 and DS6
  – Re-sampled chemistry at DS1, DS2, DS3, DS4 and DS5
  – Monitoring of downhole pressures and temperatures continued at all disposal observation well locations
  – All results (chemistry, pressure and temperature) will be reported as part of the annual disposal well monitoring report, to be submitted October 31 of each year
  – Future drilling locations and testing programs will be based on learnings from the data acquired

• Numerical modeling, based on all data acquired to date, is ongoing
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- Introduction – Doug Castellino
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- Environmental Performance – Steve Hodges
- Future Plans – Pat De Haas
Firebag Performance Presentation
Sulphur Production
May 7th, 2014
## Sulphur Recovery

<table>
<thead>
<tr>
<th>Average Inlet Sulphur (tonnes/day)</th>
<th>Sulphur Recovery (%)</th>
<th>Sulphur Balance (%)</th>
<th>Acid Gas Flared (e3m3)</th>
<th>Sulphur Flared (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 2013</td>
<td>8.82</td>
<td>95.6%</td>
<td>3.8%</td>
<td>2.5</td>
</tr>
<tr>
<td>Q2 2013</td>
<td>7.52</td>
<td>96.4%</td>
<td>2.6%</td>
<td>3.4</td>
</tr>
<tr>
<td>Q3 2013</td>
<td>9.33</td>
<td>93.4%</td>
<td>4.7%</td>
<td>1.7</td>
</tr>
<tr>
<td>Q4 2013</td>
<td>9.03</td>
<td>95.3%</td>
<td>3.7%</td>
<td>5.4</td>
</tr>
<tr>
<td>Q1 2014</td>
<td>10.18</td>
<td>96.9%</td>
<td>1.8%</td>
<td>6.9</td>
</tr>
</tbody>
</table>

- Regulatory requirement of > 89.7% sulphur recovery per calendar quarter for inlet rates > 5-10 tonnes/day

- Regulatory requirement of > 95.9% sulphur recovery per calendar quarter for inlet rates > 10-50 tonnes/day

- Sulphur recovery rates in 2013 and 2014 year-to-date have consistently been above these requirements
SO$_2$ Emissions

- **SRU Outage**: 6.9 t/day 365 rolling day average limit
- **Emergency Plant Shutdown**

6.9 t/day 365 rolling day average limit

SO$_2$ Emissions, Actual Daily Calculated
SO$_2$ Limit, 365 Day Rolling Average
SO$_2$ Emissions, 365 Day Rolling Average
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Other Environmental Initiatives

• Suncor is an active member of:
  – Cumulative Environmental Management Association (CEMA)
  – Regional Aquatics Monitoring Program (RAMP)
  – Wood Buffalo Environmental Association (WBEA)
  – Oil Sands Leadership Initiative (OSLI)
  – Alberta Biodiversity Monitoring Institute (ABMI)
  – Alberta Water Council (Watershed Planning Advisory Council)
  – Oil Sands Developers Group (OSDG)

• Suncor is in ongoing consultation with:
  – Regional stakeholders
    • Aboriginal Communities and the local Municipality
## Regulatory – AER Compliance Items

<table>
<thead>
<tr>
<th></th>
<th>Number of Occurrences</th>
<th>Date of Occurrence</th>
<th>Details of Occurrence</th>
<th>Suncor Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Well Testing</td>
<td>2</td>
<td>February 7, 2013, September 26, 2013</td>
<td>The Y strainer on the group separator became clogged and prevented completion of the required tests as per Directive 17</td>
<td>Suncor has implemented a regular cleaning program to ensure compliance with Directive 17</td>
</tr>
<tr>
<td>Monitoring Disposal Well Equipment Failure</td>
<td>3</td>
<td>May 5 &amp; 30, 2013, January 28, 2014</td>
<td>Any failures of the monitoring wells and/or equipment must be submitted to the AER In Situ Surveillance Section within 30 days from the detection date of the failure with a plan for repair or replacement</td>
<td>Suncor has had on going meetings with the AER to implement solutions to the equipment failures</td>
</tr>
<tr>
<td>Disposal of Liquid Waste from Firebag to Tailings Pond</td>
<td>1</td>
<td>April 26, 2013</td>
<td>Suncor had one event related to disposal of liquid waste from Firebag during turnaround to Oil Sands base plant tailings ponds without approval</td>
<td>Suncor filed an application with the AER and received temporary approval to continue with disposal of liquid wastes to Base Plant tailings ponds for the 2013 plant turnaround</td>
</tr>
<tr>
<td>Venting</td>
<td>91</td>
<td></td>
<td>There have been 91 venting incidents reported to the AER during the reporting period using the DDS system as well as performance challenges with the Plant 91 and 92 Produced Water Tank scrubber systems</td>
<td>Suncor continues work on reducing venting incidents. The majority of the incidents were caused by factors external to Suncor like gas supply. Further, the approved plan to connect the Produced Water Tanks in Plant 91 and 92 to the VRU will address outstanding performance challenges.</td>
</tr>
<tr>
<td>Overpressure on Pad 104 Infill well</td>
<td>1</td>
<td>February 5, 2014</td>
<td>Temporarily exceeded the AER approved surface Maximum Operating Pressure during the steam injection phase</td>
<td>Suncor will work with the AER to amend approvals for start-up</td>
</tr>
</tbody>
</table>
Regulatory Compliance Summary

- Suncor Energy is in compliance with all regulatory approvals, decisions, regulations and conditions; except for compliance items identified in this presentation or otherwise disclosed.
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Future Plans

• Hot Bit operation on line 24 started July 2013
• DSU performance test targeted for May 2014

Key growth and sustaining project timelines
• BFW transfer line between 91/92 and 93/94 targeted Q3 2014
• Additional 93/94 PWC target Q1 2015
• PEW transition for make up source target Q1 2015
• Pad 115 (8 Wells) Q2 2014
• Pad 110 (15 Wells) Q1 2015
• Pad 109 (15 Wells) Q3 2015
• Pad 117 (14 Wells) Q1 2016
• FB debottleneck project 21KBPD expansion gate 1 target Q1 2019
Overall Water Balance

Below are a set of definitions of the terms used in the water balance table provided in this presentation

Freshwater
• REC (FW1): The sum of all freshwater streams received. Firebag receives water from the Suncor Oilsands site (AB OS 0077189) and from surface runoff (AB RO). Firebag also has a source water well (AB WI 100151109506W400), however it was not used in 2013.
• DISP (FW3): Freshwater transferred to the oil battery (AB BT 0078417), in the deoiling unit for cooling purposes. This water is received back into the injection facility along with the produced water from the wells.
• PLTUSE (FW6) = Freshwater vented from the evaporators. An evaporator vent collection system exists so under normal operation, no water is vented from the evaporators. It is determined by multiplying the ratio of freshwater to total feed water by the total evaporator vent.

Steam
• INJ (INT): The total steam injected at the wells. Steam is metered at each of the steam generators in Plants 91-94 OTSGs and Cogeneration units.

Water
• REC (PW1): The water received from the oil battery (AB BT 0078417). This includes produced water from the wells, plus the water/freshwater that was sent from the injection facility to the oil battery for utility and cooling purposes.
• DISP (PW8): Steam sent to the oil battery (AB BT 0078417), used for utilities. This water is received back into the injection facility along with the produced water from the wells.
• INVCL (PW5): Water tank closing inventory. This volume takes into consideration levels in water tanks.
• INVOP (PW4): Water tank opening inventory. This volume is carried forward from last months closing inventory.
• PLTUSE (PW6): The remaining water vented from the evaporators. An evaporator vent collection system exists so under normal operation, no water is vented from the evaporators. This is determined from the total vent minus the fresh vent volume.
• INJ (DIT): Water injected to the two disposal wells (AB WI 100060309506W400 and AB WI 100060309506W400).
Appendix
2014 Appendix to AER Subsurface Presentation

May 6, 2014
Reporting Period: March 1, 2013 to February 28, 2014
Pad Produced & Injected Fluids Plots

Firebag Pad 101 Monthly Production

[Graph showing monthly production of different fluids, including monthly oil, steam, water, NCG, and SOR, from September 2003 to January 2014.]
Pad Produced & Injected Fluids Plots

![Firebag Pad 102 Monthly Production Chart](image-url)
Pad Produced & Injected Fluids Plots

Firebag Pad 103 Monthly Production

- Monthly Cum, m³
- SOR, m³/m³
- Monthly Oil, m³
- Monthly Steam, m³
- Monthly Water, m³
- Monthly SOR, m³/m³
Pad Produced & Injected Fluids Plots
Pad Produced & Injected Fluids Plots

Firebag Pad 105 Monthly Production

- Monthly Oil, m3
- Monthly Steam, m3
- Monthly Water, m3
- Monthly SOR, m3/m3

Date:
Oct 11, Nov 11, Dec 11, Jan 12, Feb 12, Mar 12, Apr 12, May 12, Jun 12, Jul 12, Aug 12, Sep 12, Oct 12, Nov 12, Dec 12, Jan 13, Feb 13, Mar 13, Apr 13, May 13, Jun 13, Jul 13, Aug 13, Sep 13, Oct 13, Nov 13, Dec 13, Jan 14, Feb 14
Pad Produced & Injected Fluids Plots

![Firebag Pad 106 Monthly Production Graph](image-url)
Pad Produced & Injected Fluids Plots

Firebag Pad 107 Monthly Production

- Monthly Oil, m³
- Monthly Steam, m³
- Monthly Water, m³
- Monthly SOR, m³/m³
Pad Produced & Injected Fluids Plots

![Firebag Pad 108 Monthly Production](image)

- Monthly Cum, m³
- SOR, m³/m³

Legend:
- Monthly Oil, m³
- Monthly Steam, m³
- Monthly Water, m³
- Monthly SOR, m³/m³
Pad Produced & Injected Fluids Plots

Firebag Pad 116 Monthly Production

- Monthly Cum, m³
- SOR, m³/m³

Legend:
- Monthly Oil, m³
- Monthly Steam, m³
- Monthly Water, m³
- Monthly SOR, m³/m³
# SAGD Observation Well Positioning

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Well Location</th>
<th>Proximity Relative to</th>
<th>Lateral Proximity To</th>
<th>Vertical Proximity To</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETS OB1</td>
<td>102/10-01-095-06 W4/0</td>
<td>P8P1, P8P2</td>
<td>69.5 m S, 32.6 m N</td>
<td>311.5m MD, 315.9m MD</td>
</tr>
<tr>
<td>ETS OB3</td>
<td>100/01-11-095-06 W4/0</td>
<td>P7P6, P7P7</td>
<td>24.4 m E, 79.8 m W</td>
<td>321.0m MD, 313.8m MD</td>
</tr>
<tr>
<td>ETS OB4</td>
<td>102/01-11-095-06 W4/0</td>
<td>P2P1, P7P8</td>
<td>258.9 m W, 140.6 m E</td>
<td>328.1m MD, 315.8m MD</td>
</tr>
<tr>
<td>ETS 1</td>
<td>100/12-06-095-05 W4/0</td>
<td>P8P1 (ETS 1 heel), P8P1 (ETS 1 heel), P1N5 (ETS 1 toe), P8P1 (ETS 1 toe), P8P2 (ETS 1 toe)</td>
<td>27 m S, 52 m N, 235 m SW, 303 m SE, 297.5 m NE</td>
<td>313.8 m TVD, 318.3 m TVD, 318.1 m TVD, 312.68 m TVD, 323.5 m TVD</td>
</tr>
<tr>
<td>OB3</td>
<td>102/08-01-095-06 W4/0</td>
<td>P1S6, P1P6</td>
<td>2.7 m E, 1 m E</td>
<td>310.06 m MD, 316.58 m MD</td>
</tr>
<tr>
<td>OB4</td>
<td>1W2/01-01-095-06 W4/0</td>
<td>P1S6, P1P6</td>
<td>3.1 m E, 4 m E</td>
<td>310.33 m MD, 316.61 m MD</td>
</tr>
<tr>
<td>OB5</td>
<td>100/15-36-094-06 W4/0</td>
<td>P1S6, P1P6</td>
<td>1.5 m E, 0.6 m W</td>
<td>310.21 m MD, 316.71 m MD</td>
</tr>
<tr>
<td>OB6</td>
<td>105/09-01-095-06 W4/0</td>
<td>P1S2, P1P2, P8P1</td>
<td>165 m SE of heel, 165 m SE of heel, 16.5 m N</td>
<td>318.65 m MD, 324.2 m MD, 309.2m MD</td>
</tr>
<tr>
<td>OB7</td>
<td>102/09-01-095-06 W4/0</td>
<td>P1S8, P1P8, P8P3</td>
<td>138.5 m NE of heel, 138.5 m NE of heel, 60.6 m N</td>
<td>313.49 m MD, 320.94 m MD, 320.0m MD</td>
</tr>
<tr>
<td>OB8</td>
<td>100/15-12-095-06 W4/0</td>
<td>P3P9, P3P8</td>
<td>98.3 m S, 89 m N</td>
<td>N/A - between P3P8 and P3P9</td>
</tr>
<tr>
<td>OB9</td>
<td>102/16-12-095-06 W4/0</td>
<td>P3S9, P3P9</td>
<td>18.7 m N, 20 m N</td>
<td>303.67 m MD, 311.52 m MD</td>
</tr>
<tr>
<td>OB10</td>
<td>100/13-01-095-06 W4/0</td>
<td>P8N15_planned, P2S1, P2P1</td>
<td>38 m E, 91.5 m W</td>
<td>328 m MD, 319.55 m MD, 326.59 m MD</td>
</tr>
</tbody>
</table>
## SAGD Observation Well Positioning

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Well Location</th>
<th>Proximity Relative to</th>
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</tr>
</thead>
<tbody>
<tr>
<td>OB11</td>
<td>106/15-36-094-06 W4/0</td>
<td>P1S7, P1P7</td>
<td>76 m S of toe, 76 m S of toe</td>
<td>312.83 m MD, 318.61 m MD</td>
</tr>
<tr>
<td>OB12</td>
<td>102/15-12-095-06 W4/0</td>
<td>P3S9, P3P9</td>
<td>21.6 m N, 26 m N</td>
<td>302.05 m MD, 314.91 m MD</td>
</tr>
<tr>
<td>OB13</td>
<td>110/07-11-095-06 W4/0</td>
<td>P7S2, P7P2, P7P1</td>
<td>16.8 m W, 14.9 m W, 74.2 m E</td>
<td>322.66 m MD, 322.7 m MD, 318.5 m MD</td>
</tr>
<tr>
<td>OB14</td>
<td>103/08-02-095-06 W4/0</td>
<td>P8P6, P7P9</td>
<td>160.2 m W, 91.2 m E</td>
<td>312.4 m MD, 325.0 m MD</td>
</tr>
<tr>
<td>OB17</td>
<td>105/05-12-095-06 W4/0</td>
<td>P2P1, P7P9</td>
<td>199.7 m W, 202.3 m E</td>
<td>326.5 m MD, 313.5 m MD</td>
</tr>
<tr>
<td>OB18</td>
<td>100/09-10-095-06 W4/0</td>
<td>P5P6, P5P5</td>
<td>33.8 m W of horizontal, 100 m E of horizontal</td>
<td>319 m MD, 320 m MD</td>
</tr>
<tr>
<td>OB19</td>
<td>106/03-02-095-06 W4/0</td>
<td>P4S7, P4P7</td>
<td>83.5 m E of toe, 49.9 m S of toe</td>
<td>319.31 m MD, 326.4 m MD</td>
</tr>
<tr>
<td>OB20</td>
<td>100/05-02-095-06 W4/0</td>
<td>P4S9, P4P9</td>
<td>78.4 m E of horizontal, 74.9 m E of horizontal</td>
<td>317.28 m MD, 323.23 m MD</td>
</tr>
<tr>
<td>OB21</td>
<td>100/11-03-095-06 W4/0</td>
<td>P5P18, P5P17</td>
<td>21.3 m E of horizontal, 116.8 m W of horizontal</td>
<td>325 m MD, 326.6 m MD</td>
</tr>
<tr>
<td>OB22</td>
<td>100/13-02-095-06 W4/0</td>
<td>P5P11, P4P10, P5P12</td>
<td>80 m S, 90 m N, 200 m NE</td>
<td>313.33 m MD, 318.4 m MD, 319.1 m MD</td>
</tr>
<tr>
<td>OB23</td>
<td>100/05-11-095-06 W4/0</td>
<td>P4S3, P4P3</td>
<td>41.7 m W of horizontal, 42.7 m W of horizontal</td>
<td>311.87 m MD, 318.49 m MD</td>
</tr>
<tr>
<td>OB27</td>
<td>100/05-04-095-06 W4/0</td>
<td>P116P12</td>
<td>559 m S of horizontal</td>
<td>296.2 m MD</td>
</tr>
<tr>
<td>OB28</td>
<td>100/07-04-095-06 W4/0</td>
<td>P116P11</td>
<td>400 m SW of ICP</td>
<td>315.75 m MD</td>
</tr>
<tr>
<td>OB29</td>
<td>100/07-05-095-06 W4/0</td>
<td>P116P12</td>
<td>643.7 m SW of toe</td>
<td>293 m MD</td>
</tr>
<tr>
<td>OB30</td>
<td>100/15-05-095-06 W4/0</td>
<td>P116P14, P116P13</td>
<td>63.4 m SW of toe, 87.6 m NW of toe</td>
<td>288 m MD</td>
</tr>
</tbody>
</table>
## SAGD Observation Well Positioning

<table>
<thead>
<tr>
<th>Well Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>OB31</td>
<td>100/06-08-095-06 W4/0</td>
<td>P116P19, P115P1</td>
<td>750 m NW of toe</td>
<td>275.75m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>795 m SW of ICP_PLAN</td>
<td>275.5m MD</td>
</tr>
<tr>
<td>OB32</td>
<td>100/11-08-095-06 W4/0</td>
<td>P115P1</td>
<td>476 m W of horizontal</td>
<td>277m MD</td>
</tr>
<tr>
<td>OB33</td>
<td>100/13-08-095-06 W4/0</td>
<td>P115P1</td>
<td>868 m W of horizontal</td>
<td>270.5m MD</td>
</tr>
<tr>
<td>OB34</td>
<td>100/03-09-095-06 W4/0</td>
<td>P116P19, P116P18</td>
<td>90.4 m SE of ICP</td>
<td>285.75m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>97.6 m NE of ICP</td>
<td>286.2m MD</td>
</tr>
<tr>
<td>OB35</td>
<td>100/05-09-095-06 W4/0</td>
<td>P115P12, P115P11</td>
<td>92.6 m NW of ICP_PLAN</td>
<td>285m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>119 m SW of ICP_PLAN</td>
<td>285m MD</td>
</tr>
<tr>
<td>OB36</td>
<td>100/11-09-095-06 W4/0</td>
<td>P115P9</td>
<td>206.5 m N of horizontal</td>
<td>286.4m MD</td>
</tr>
<tr>
<td>OB37</td>
<td>100/11-04-095-06 W4/0</td>
<td>P116P12, P116P10</td>
<td>218 m SE of ICP</td>
<td>294.3m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>585 m SW of ICP</td>
<td>306.2m MD</td>
</tr>
<tr>
<td>OB38</td>
<td>100/11-05-095-06 W4/0</td>
<td>P116P12</td>
<td>557 m SW of toe</td>
<td>288m MD</td>
</tr>
<tr>
<td>OB39</td>
<td>100/07-08-095-06 W4/0</td>
<td>P116P19, P115P1</td>
<td>320 m NW of toe</td>
<td>281.2m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>539 m SW of ICP_PLAN</td>
<td>280.6m MD</td>
</tr>
<tr>
<td>OB40</td>
<td>100/09-09-095-06 W4/0</td>
<td>P6P1, P115P9</td>
<td>132.7 m W of horizontal</td>
<td>291m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>229 m N of horizontal</td>
<td>288.4m MD</td>
</tr>
<tr>
<td>OB42</td>
<td>100/13-04-095-06 W4/0</td>
<td>P116P15, P116P16</td>
<td>27.5 m N of horizontal</td>
<td>288.7m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60.5 m S of horizontal</td>
<td>288.3m MD</td>
</tr>
<tr>
<td>OB43</td>
<td>100/15-09-095-06 W4/0</td>
<td>P6P1, P115P9</td>
<td>383 m NW of toe</td>
<td>292.2m MD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>658 m N of horizontal</td>
<td>289.2m MD</td>
</tr>
<tr>
<td>OB44</td>
<td>100/01-05-095-06 W4/0</td>
<td>P116P12</td>
<td>1065 m S of horizontal</td>
<td>296.4m MD</td>
</tr>
<tr>
<td>OB45</td>
<td>100/03-05-095-06 W4/0</td>
<td>P116P12</td>
<td>1191 m SW of toe</td>
<td>285.6m MD</td>
</tr>
<tr>
<td>OB47</td>
<td>105/16-03-095-06 W4/0</td>
<td>P5P13, P5P14</td>
<td>16.2m W of ICP</td>
<td>329m TVD</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>121.5m E of ICP</td>
<td>574m MD</td>
</tr>
<tr>
<td>OB48</td>
<td>102/11-06-095-06 W4/0</td>
<td>P116P12</td>
<td>2229 m SW of toe</td>
<td>274.8m MD</td>
</tr>
<tr>
<td>OB49</td>
<td>100/13-06-095-06 W4/0</td>
<td>P116P14</td>
<td>2582 m W of toe</td>
<td>262.8m MD</td>
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<tr>
<td>OB51</td>
<td>100/03-18-095-05 W4/0</td>
<td>P3P10</td>
<td>725 m NE of ICP</td>
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<td>OB54</td>
<td>100/13-07-095-05 W4/0</td>
<td>P3S10</td>
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<td>302.91 m MD</td>
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<tr>
<td>OB56</td>
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<td>P3S1, P3P1</td>
<td>108.64 m E of horizontal, 110.92 m E of horizontal</td>
<td>306.67 m MD, 314.85 m MD</td>
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<td>OB57</td>
<td>100/01-12-095-06 W4/0</td>
<td>P1S4, P1P4</td>
<td>77.9 m W of horizontal, 78.6 m W of horizontal</td>
<td>316.76 m MD, 324.6 m MD</td>
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<td>OB59</td>
<td>100/03-07-095-05 W4/0</td>
<td>P3S2, P3P2, 3WP1</td>
<td>85.46 m E of horizontal, 85.0 m E of horizontal, 76m W of hz</td>
<td>304.39 m MD, 311.11 m MD, 303.5m MD (prod)</td>
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<td>OB60</td>
<td>100/04-01-095-06 W4/0</td>
<td>P2S9, P2P9, P8P12, P2N9</td>
<td>25.1 m W of horizontal, 22.5 m W of horizontal, 56.6 m E of horizontal, 101.9 m W of horizontal</td>
<td>305.27 m MD, 312.29 m MD, 333.5 m MD, 326.0 m MD</td>
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<td>OB61</td>
<td>100/04-11-095-06 W4/0</td>
<td>P4S4, P4P4</td>
<td>27.13 m E of heel, 3.32 m E of heel</td>
<td>211.76 m MD, 157.52 m MD</td>
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<td>OB62</td>
<td>100/06-02-095-06 W4/0</td>
<td>P4P6_ST1N, P7P14</td>
<td>51 m E of horizontal, 73 m W of horizontal</td>
<td>325m MD, 331.1m MD</td>
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<tr>
<td>OB63</td>
<td>107/08-11-095-06 W4/0</td>
<td>P7P6, P7P7</td>
<td>34 m E of horizontal, 55 m W of horizontal</td>
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<td>OB66</td>
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<td>P8S5, P8S4</td>
<td>31.2 m E of horizontal, 75.3 m W of horizontal</td>
<td>307.2m MD, 307.3m MD</td>
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<td>645.3 m E of Horizontal</td>
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<td>OB68</td>
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<td>P1S7</td>
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<td>OB69</td>
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<td>P7S9</td>
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<td>OB70</td>
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<td>OB71</td>
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<td>316.5m MD, 310.5m MD</td>
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<tr>
<td>OB73</td>
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<tr>
<td>OB74</td>
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<td>OB75</td>
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<td>OB76</td>
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<td>P8S8, P8S9</td>
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<td>OB77</td>
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<td>P3P9, P3P10</td>
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<td>OB78</td>
<td>107/03-11-095-6 W4/0</td>
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<td>94.7 m E, 61.2 m W</td>
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<td>OB79</td>
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<td>40.8 m E of horizontal, 48.2 m W of horizontal</td>
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<tr>
<td>OB80</td>
<td>102/05-11-095-6 W4/0</td>
<td>P4P3, P4S2</td>
<td>71.4 m W of horizontal, 92.7 m E of horizontal</td>
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<tr>
<td>OB81</td>
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<td>P4S3, P4S4</td>
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<td>OB82</td>
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<td>P4S4, P4P5</td>
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<td>OB83</td>
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<td>OB84</td>
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<td>OB86</td>
<td>100/12-11-095-6 W4/0</td>
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<td>OB87</td>
<td>104/14-02-095-6 W4/0</td>
<td>P4S6, P7S1</td>
<td>105 m NE of horizontal, 25.5 m W of horizontal</td>
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<td>OB88</td>
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<td>P7P3, P7S4</td>
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<tr>
<td>OB89</td>
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<td>OB90</td>
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<td>790 m NE of horizontal</td>
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<td>OB91</td>
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<tr>
<td>OB93</td>
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<tr>
<td>OB94</td>
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<td>P4S8, P4S7</td>
<td>44.4 m E of horizontal, 114.9 m W of horizontal</td>
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<tr>
<td>OB95</td>
<td>109/01-10-095-6 W4/0</td>
<td>P5P6, P5P7</td>
<td>59.2 m E of horizontal, 61.25 m W of horizontal</td>
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<tr>
<td>OB96</td>
<td>100/05-10-095-6 W4/0</td>
<td>P6S6, P6P7</td>
<td>65.1 m E of horizontal, 24.3 m W of horizontal</td>
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<tr>
<td>OB97</td>
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<td>P115P1, P6P1, P16P19</td>
<td>487.5 m N of horizontal, 1241 m W, 1203 m N</td>
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<td>OB98</td>
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<tr>
<td>OB101</td>
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<td>OB102</td>
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<td>OB103</td>
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<td>OB105</td>
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<td>P5S2, P5P3</td>
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<tr>
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<tr>
<td>OB107</td>
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<td>OB109</td>
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<td>OB110</td>
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<td>OB111</td>
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<td>P2N8, P2P8</td>
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<td>OB113</td>
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<td>OB114</td>
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<td>104 m SW 82 m NW</td>
<td>289.9 289.4</td>
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</table>
## SAGD Observation Well Positioning

<table>
<thead>
<tr>
<th>Well Name</th>
<th>Well Location</th>
<th>Proximity Relative to</th>
<th>Lateral Proximity To</th>
<th>Vertical Proximity To</th>
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<tbody>
<tr>
<td>OB166</td>
<td>100/05-32-094-05W4/0</td>
<td>P1P6</td>
<td>2448 m SE</td>
<td>308.71</td>
</tr>
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<td>OB167</td>
<td>100/01-32-094-05W4/0</td>
<td>P1P6</td>
<td>3635 m SE</td>
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<td>OB168</td>
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<td>P1P6</td>
<td>3923 m E</td>
<td>309.1</td>
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<td>OB169</td>
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<td>P1P6</td>
<td>2467 m E</td>
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<td>OB170</td>
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<td>P1P6</td>
<td>4058 m SE</td>
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<tr>
<td>QW1</td>
<td>111/13-10-095-06W4/0</td>
<td>P6P4 P6P3</td>
<td>19 m W</td>
<td>296.1</td>
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<td>71 m E</td>
<td>297.6</td>
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<td>QW2</td>
<td>100/12-10-095-06W4/0</td>
<td>P6P7 P6P6</td>
<td>58 m W</td>
<td>295.5</td>
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<td>33 m E</td>
<td>293.2</td>
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<tr>
<td>QW4</td>
<td>109/04-10-095-06W4/0</td>
<td>P16P2 P16P3</td>
<td>7.5 m S</td>
<td>303.6</td>
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<td>81 m N</td>
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<td>P112P12_planned</td>
<td>512 m SW</td>
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<td>P10P10</td>
<td>31 m S</td>
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<td>P110P10</td>
<td>2117 m SW</td>
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<td>P8P6</td>
<td>20 m W</td>
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<td>OB DW4</td>
<td>1AA/12-30-095-05W4/0</td>
<td>P9P15_planned</td>
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<td>OB DW12</td>
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<td>P5P12</td>
<td>14 m W</td>
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<td>PP7/DW22</td>
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<td>P5S2 OB</td>
<td>106/15-10-095-06W4/2</td>
<td>P5P2</td>
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<td>10.47 m MD</td>
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<td>P5S3 OB</td>
<td>105/15-10-095-06W4/0</td>
<td>P5P3</td>
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<td>17.16 m MD</td>
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<td>P5S4 OB</td>
<td>104/15-10-095-06W4/0</td>
<td>P5P4</td>
<td></td>
<td>13.45 m MD</td>
</tr>
</tbody>
</table>
Piezometer Plots & Temperature vs Depth Plots

ETS OB1

Temperature (°C) and Gamma Ray (API Units)

Depth (mKBB)

Legend:
- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
Piezometer Plots & Temperature vs Depth Plots

ETS OB3

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top, Continental Top, Channel Base, Channel Top, Tidal Flat Top, Shoreface Top, Clearwater Top, Gamma, 01-Feb-2014, 01-Jan-2014, 01-Dec-2013, 01-Nov-2013, 01-Oct-2013, 01-Sep-2013, 01-Aug-2013, 01-Jul-2013, 01-Jun-2013, 01-May-2013, 01-Apr-2013, 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

ETS OB4
Temperature (°C) and Gamma Ray (API Units)
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

1W2/01-01-095-06 W4/0

OB4

Pressure (kPag)

Date


OB4 Pressure @ 264 mKB  OB4 Pressure @ 286 mKB
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

Temperature (ºC) and Gamma Ray (API Units)

102/09-01-095-06 W4/0

OB7

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/15-12-095-06 W4/0

OB8

Date
- OB8 Pressure @ 309.97 mKB
- OB8 Pressure @ 309.97 mKB
- OB8 Temperature @ 271.38 mKB
- OB8 Temperature @ 309.97 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (ºC) and Gamma Ray (API Units)

102/16-12-095-06 W4/0

OB9

Depth (mKB)

Temperature data and Gamma Ray readings are plotted against depth. The graph shows various geological markers such as Devonian Top, Continental Top, Channel Base, Channel Top, Tidal Flat Top, Shoreface Top, and Clearwater Top. The data is dated from 01-Feb-2014 to 01-Mar-2013, with specific readings marked on the graph for different months and years.
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

OB11

106/15-36-094-06 W4/0

Date

- OB11 Pressure @ 316.89 mKB
- OB11 Pressure @ 316.89 mKB
- OB11 Temperature @ 294.65 mKB
- OB11 Temperature @ 316.89 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

OB12

102/15-12-095-06 W4/0

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots

110/07-11-095-06 W4/0

Temperature (°C) and Gamma Ray (API Units)

OB13

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-Apr-2013
Piezometer Plots & Temperature vs Depth Plots

103/08-02-095-06 W4/0

OB14

Temperature (°C) and Gamma Ray (API Units)

Depth (mKb)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Gamma
01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013  01-Aug-2013
01-Jul-2013  01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013  Series14
Piezometer Plots & Temperature vs Depth Plots

105/05-12-095-06 W4/0

OB17

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

- Gamma

- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013

- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

100/09-10-095-06 W4/0

OB18

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

106/03-02-095-06 W4/0

OB19

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

Pressure (kPag)

3,500
3,000
2,500
2,000
1,500
1,000
500
0

Temperature (ºC)

160
140
120
100
80
60
40
20
0

OB19 Pressure @ 319.94 mKB
OB19 Temperature @ 282.44 mKB
OB19 Temperature @ 319.94 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

OB20

100/05-02-095-06 W4/0

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top
Gamma  01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013
01-Aug-2013  01-Jul-2013  01-Jun-2013  01-May-2013  01-Apr-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/11-03-095-06 W4/0

OB21

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR

210
Piezometer Plots & Temperature vs Depth Plots

100/13-02-095-06 W4/0

OB22

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/05-04-095-06 W4/0

Temperature (°C) and Gamma Ray (API Units)

OB27

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/07-04-095-06 W4/0

OB28

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

**OB31**

Temperature (ºC) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/11-08-095-06 W4/0

OB32

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

100/13-08-095-06 W4/0

OB33

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB35

100/05-09-095-06 W4/0

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

100/11-09-095-06 W4/0

OB36

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/11-04-095-06 W4/0

OB37

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/11-04-095-06 W4/0

OB37

Date


Pressure (kPag)

0 500 1,000 1,500 2,000 2,500

OB37 Pressure @ 278.8 mKB  OB37 Pressure @ 310.47 mKB
Piezometer Plots & Temperature vs Depth Plots

100/11-05-095-06 W4/0

OB38

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Apr-2013
01-Mar-2013

225
Piezometer Plots & Temperature vs Depth Plots

100/11-05-095-06 W4/0

OB38

Pressure (kPa) vs Date

- OB38 Pressure @ 300.2 mKB
- OB38 Pressure @ 326.4 mKB
Piezometer Plots & Temperature vs Depth Plots

100/07-08-095-06 W4/0

OB39

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB39

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

100/07-08-095-06 W4/0

OB39 Pressure @ 283.5 mKB
OB39 Pressure @ 312.5 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/09-09-095-06 W4/0

OB40

Pressure (kPag)

Date


OB40 Pressure @ 296.5 mKB

OB40 Pressure @ 326.6 mKB
Piezometer Plots & Temperature vs Depth Plots

100/13-04-095-06 W4/0

OB42

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top, Continental Top, Channel Base, Channel Top, Tidal Flat Top, Shoreface Top, Clearwater Top

Gamma

01-Feb-2014, 01-Jan-2014, 01-Dec-2013, 01-Nov-2013, 01-Oct-2013, 01-Sep-2013, 01-Aug-2013, 01-Jul-2013, 01-Jun-2013, 01-May-2013, 01-Apr-2013, 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB43

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top
Gamma  01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013
01-Aug-2013  01-Jul-2013  01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma

Dates:
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
- 01-Aug-2013
- 01-Sep-2013
- 01-Oct-2013
- 01-Nov-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKb)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top
Gamma  01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013
01-Aug-2013  01-Jul-2013  01-Jun-2013  01-May-2013  01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

OB48

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Date:
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB48

102/11-06-095-06 W4/0

Pressure (kPa)

Date


OB48 Pressure @ 298 mKB
OB48 Pressure @ 327 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB49

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top
Gamma
01-Feb-2014  01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013

Depth (mKB)

100/13-06-095-06 W4/0
Piezometer Plots & Temperature vs Depth Plots

OB49 Pressure @ 274.6 mKB

Date


OB49

Pressure (kPag)

100/13-06-095-06 W4/0

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/03-18-095-05 W4/0

OB51

Temperature (°C) and Gamma Ray (API Units)

Devonian Top  | Continental Top  | Channel Base | Channel Top   | Tidal Flat Top | Shoreface Top | Clearwater Top
Gamma         | 01-Feb-2014      | 01-Jan-2014  | 01-Dec-2013   | 01-Nov-2013   | 01-Oct-2013   | 01-Sep-2013
01-Aug-2013   | 01-Jul-2013      | 01-Jun-2013  | 01-May-2013   | 01-Apr-2013   | 01-Mar-2013   |
Piezometer Plots & Temperature vs Depth Plots

100/13-07-095-05 W4/0

Temperature (°C) and Gamma Ray (API Units)

OB54

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top

Gamma  01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013

01-Aug-2013  01-Jul-2013  01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB54

Pressure (kPag)

Date

100/13-07-095-05 W4/0

OB54 Pressure @ 298.81 mKB
Piezometer Plots & Temperature vs Depth Plots

OB56

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

OB56

Pressure (kPag) vs Date

100/15-06-095-05 W4/0

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB56 Pressure @ 297 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (ºC) and Gamma Ray (API Units)

100/01-12-095-06 W4/0

OB57

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/01-12-095-06 W4/0

OB57

Pressure (kPag)

Date


OB57 Pressure @ 248.78 mKB
OB57 Pressure @ 310.28 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB59

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma
Piezometer Plots & Temperature vs Depth Plots

100/03-07-095-05 W4/0

OB59

Pressure (kPag)

Date


OB59 Pressure @ 237.8 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

100/04-01-095-06 W4/0

OB60

Pressure (kPag)

Date

OB60 Pressure @ 247.95 mKB
OB60 Pressure @ 326 mKB
Piezometer Plots & Temperature vs Depth Plots

100/04-11-095-06 W4/0

Temperature (°C) and Gamma Ray (API Units)

* Uphole temperature profile study indicates conductive heating is occurring between 4S3&4 injector riser sections and OB61 uphole thermocouples.*
Piezometer Plots & Temperature vs Depth Plots

OB61 Pressure @ 252.25 mKB
Piezometer Plots & Temperature vs Depth Plots

OB62

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

100/06-02-095-06 W4/0

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013

01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

107/08-11-095-06 W4/0

OB63

Pressure (kPag) vs Date

OB63 Pressure @ 256 mKB
OB63 Pressure @ 283 mKB
OB63 Pressure @ 326.8 mKB
Piezometer Plots & Temperature vs Depth Plots

111/15-35-094-6 W4/0

OB66

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

111/15-35-094-6 W4/0

OB66

Date


Pressure (kPag)

0 500 1000 1500 2000 2500 3000 3500

OB66 Pressure @ 256.3 mKB

OB66 Pressure @ 301.3 mKB
Piezometer Plots & Temperature vs Depth Plots

OB67

Pressure (kPa)

Date


OB67 Pressure @ 252 mKB
OB67 Pressure @ 297 mKB
Piezometer Plots & Temperature vs Depth Plots

OB68

100/07-36-094-6 W4/0

Pressure (kPag) vs Date

Temperature (ºC) vs Date

OB68 Pressure @ 271.75 mKB
OB68 Pressure @ 316.75 mKB
OB68 Temperature @ 271.75 mKB
OB68 Temperature @ 316.75 mKB
Piezometer Plots & Temperature vs Depth Plots

OB69

Date
- OB69 Pressure @ 263.6 mKB
- OB69 Pressure @ 308.6 mKB
- OB69 Temperature @ Shoreface mKB
- OB69 Temperature @ ECC mKB
Piezometer Plots & Temperature vs Depth Plots

105/13-35-094-6 W4/0

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

105/13-35-094-6 W4/0

OB70

Pressure (kPag)

Date


OB70 Pressure @ 262.6 mKB
OB70 Pressure @ 307.6 mKB

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots

107/03-02-095-6 W4/0

OB71

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

107/03-02-095-6 W4/0

OB71

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB71 Pressure @ 260 mKB
OB71 Pressure @ 305 mKB

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots

100/16-02-095-6 W4/0

OB72

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/16-02-095-6 W4/0

OB72

Pressure (kPag)

Date


OB72 Pressure @ 263 mKB

OB72 Pressure @ 308 mKB
Piezometer Plots & Temperature vs Depth Plots

100/05-31-094-5 W4/0

OB73

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

100/05-31-094-5 W4/0

OB73

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB73 Pressure @ 252 mKB
OB73 Pressure @ 297 mKB
Piezometer Plots & Temperature vs Depth Plots

OB74 Pressure @ 249 mKB
OB74 Pressure @ 294 mKB
OB74 Temperature @ 249 mKB
OB74 Temperature @ 294 mKB
Piezometer Plots & Temperature vs Depth Plots

100/11-31-094-5 W4/0

OB75

Pressure (kPag) vs Date

Temperature (ºC) vs Date

Date

- OB75 Pressure @ 236.65 mKB
- OB75 Temperature @ 236.65 mKB
- OB75 Pressure @ 281.65 mKB
- OB75 Temperature @ 281.65 mKB
Piezometer Plots & Temperature vs Depth Plots

OB76

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

109/11-02-095-6 W4/0

OB76

Pressure (kPag)

Date

OB76 Pressure @ 258 mKB
OB76 Pressure @ 303 mKB
Piezometer Plots & Temperature vs Depth Plots

100/13-12-095-6 W4/0

OB77

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/13-12-095-6 W4/0

OB77

Pressure (kPag)

Date

0 500 1,000 1,500 2,000 2,500


100/13-12-095-6 W4/0

OB77 Pressure @ 272 mKB

OB77 Pressure @ 317 mKB

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

107/03-11-095-6 W4/0

OB78

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

OB78
Piezometer Plots & Temperature vs Depth Plots

107/03-11-095-6 W4/0

OB78

Pressure (kPag)

Date

OB78 Pressure @ 259.7 mKB
OB78 Pressure @ 304.7 mKB
Piezometer Plots & Temperature vs Depth Plots

110/14-35-094-6 W4/0

Temperature (°C) and Gamma Ray (API Units)

OB79

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

110/14-35-094-6 W4/0

OB79

Date

Pressure (kPa)

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB79 Pressure @ 263 mKB
OB79 Pressure @ 308 mKB
Piezometer Plots & Temperature vs Depth Plots

102/05-11-095-6 W4/0

Temperature (ºC) and Gamma Ray (API Units)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB80 Pressure @ 259.5 mKB
OB80 Pressure @ 304.5 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

102/12-11-095-6 W4/0

OB81

Depth (mKB)

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

102/12-11-095-6 W4/0

OB81

Pressure (kPag)

Date

OB81 Pressure @ 263.5 mKB
OB81 Pressure @ 308.5 mKB
Piezometer Plots & Temperature vs Depth Plots

105/14-11-095-6 W4/0

OB82

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Clearwater Top
Gamma
01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013  01-Aug-2013  01-Jul-2013  01-Jun-2013  01-May-2013  01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB82

Pressure (kPag)

Date


105/14-11-095-6 W4/0

OB82 Pressure @ 261.5 mKB
OB82 Pressure @ 306.5 mKB
Piezometer Plots & Temperature vs Depth Plots

OB83

Temperature (°C) and Gamma Ray (API Units)

103/04-07-095-5 W4/0

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

106/13-06-095-5 W4/0

OB84

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB84 Pressure @ 252 mKB
OB84 Pressure @ 297 mKB
Piezometer Plots & Temperature vs Depth Plots

100/09-03-095-6 W4/0

OB85

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/09-03-095-6 W4/0

OB85

Pressure (kPag)

Date


OB85 Pressure @ 267 mKB  OB85 Pressure @ 312 mKB
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

100/12-11-095-6 W4/0

OB86

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB86 Pressure @ 263.1 mKB
OB86 Pressure @ 308.1 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

104/14-02-095-6 W4/0

OB87
Piezometer Plots & Temperature vs Depth Plots

104/14-02-095-6 W4/0

OB87

Pressure (kPag)

Date

OB87 Pressure @ 259.3 mKB  OB87 Pressure @ 304.3 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)
Piezometer Plots & Temperature vs Depth Plots

100/15-02-095-6 W4/0

OB88

Pressure (kPag)

Date


0 500 1,000 1,500 2,000 2,500 3,000 3,500

OB88 Pressure @ 259.65 mKB  OB88 Pressure @ 304.65 mKB
Piezometer Plots & Temperature vs Depth Plots

109/14-35-094-6 W4/0

OB89

Pressure (kPag)

Date

OB89 Pressure @ 262.65 mKB
OB89 Pressure @ 307.65 mKB
Piezometer Plots & Temperature vs Depth Plots

100/15-07-095-5 W4/0

OB90

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top
Shoreface Top  Clearwater Top  Gamma  01-Feb-2014  01-Nov-2013
01-Oct-2013  01-Sep-2013  01-Aug-2013  01-Jul-2013  01-Jun-2013
Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure changes over time for OB90 with data points from March 2013 to February 2014. The graph compares OB90 Pressure @ 234 mKB and OB90 Pressure @ 279 mKB.]
Piezometer Plots & Temperature vs Depth Plots

OB91

Temperature (ºC) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB91 Pressure @ 238 mKB
OB91 Pressure @ 283 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma Ray 01-Feb-2014 01-Jan-2014 01-Dec-2013 01-Nov-2013 01-Oct-2013 01-Sep-2013 01-Aug-2013 01-Jul-2013 01-Jun-2013 01-May-2013 01-Apr-2013 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

102/05-02-095-6 W4/0

OB93

Temperature (°C) and Gamma Ray (API Units)

- Depth (mKB)
- Temperature (°C)
- Gamma Ray (API Units)

Key:
- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

102/05-02-095-6 W4/0

OB93

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB93 Pressure @ 266.5 mKB

OB93 Pressure @ 311.5 mKB
Piezometer Plots & Temperature vs Depth Plots

102/13-02-095-6 W4/0  OB94

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250

[Graph showing temperature and gamma ray data with depth, marked with various layers and dates]
Piezometer Plots & Temperature vs Depth Plots

102/13-02-095-6 W4/0

Pressure (kPag)

Date


OB94 Pressure @ 259.3 mKB
OB94 Pressure @ 304.3 mKB
Piezometer Plots & Temperature vs Depth Plots

109/01-10-095-6 W4/0

OB95

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

109/01-10-095-6 W4/0

OB95

Pressure (kPag)

Date

OB95 Pressure @ 266 mKB  OB95 Pressure @ 311 mKB
Piezometer Plots & Temperature vs Depth Plots

100/05-10-095-6 W4/0

OB96

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/05-10-095-6 W4/0

OB96

Pressure (kPag)

Date


OB96 Pressure @ 247 mKB
OB96 Pressure @ 244.55 mKB
OB96 Pressure @ 289.55 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

100/13-09-095-6 W4/0

OB97

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

100/13-09-095-6 W4/0

OB97

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB97 Pressure @ 244.5 mKB
OB97 Pressure @ 289.5 mKB
Piezometer Plots & Temperature vs Depth Plots

100/01-17-095-6 W4/0

OB98

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/01-17-095-6 W4/0

OB98

Pressure (kPag) vs Date

- OB98 Pressure @ 246.25 mKB
- OB98 Pressure @ 291.25 mKB
Piezometer Plots & Temperature vs Depth Plots

100/02-09-095-6 W4/0

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB101

100/02-09-095-6 W4/0

Pressure (KPa)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB101 Pressure @ 241.5 mKB
OB101 Pressure @ 286.5 mKB
Piezometer Plots & Temperature vs Depth Plots

102/09-04-095-6 W4/0

OB102

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

102/09-04-095-6 W4/0

OB102

Pressure (kPag)

Date


OB102 Pressure @ 256 mKB

OB102 Pressure @ 301 mKB
Piezometer Plots & Temperature vs Depth Plots

100/02-17-095-6 W4M/0

OB103

Temperature (°C) and Gamma Ray (API Units)

Depth (mKb)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma

- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013

- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/02-17-095-6 W4M/0

OB103

Pressure (kPag)

Date


0 200 400 600 800 1,000 1,200

OB103 Pressure @ 236.5 mKB

OB103 Pressure @ 281.5 mKB
Piezometer Plots & Temperature vs Depth Plots

102/07-10-095-6 W4M/0

OB105

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

102/07-10-095-6 W4M/0

OB105

Pressure (kPa)

Date


OB105 Pressure @ 267.1 mKB  OB105 Pressure @ 312.1 mKB

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma
01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB106 Pressure @ 308 mKB

OB106 Pressure @ 263 mKB
Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure and temperature data for OB107 over a year, with dates from March 2013 to February 2014. The graph displays pressure in kPa and temperature in °C. The data points are marked with different symbols and colors for pressure and temperature at depths of 249 mKB and 294 mKB.]
Piezometer Plots & Temperature vs Depth Plots

100/15-33-094-6 W4/0

OB110

Pressure (kPag)

Temperature (ºC)

Date

OB110 Pressure @ 267.6 mKB
OB110 Pressure @ 312.6 mKB
OB110 Temperature @ 267.6 mKB
OB110 Temperature @ 312.6 mKB
Piezometer Plots & Temperature vs Depth Plots

OB111

Date

Pressure (KPag)

Temperature (°C)

1-Mar-13
31-Mar-13
30-Apr-13
30-May-13
29-Jun-13
29-Jul-13
28-Aug-13
27-Sep-13
27-Oct-13
26-Nov-13
26-Dec-13
25-Jan-14

OB111 Pressure @ 323.5 mKB
OB111 Temperature @ ECC mKB

SUNCOR
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

OB114 Pressure @ 310.2 mKB
OB114 Temperature @ 310.2 mKB
Piezometer Plots & Temperature vs Depth Plots

**OB118**

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

333
Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure changes over time for OB118 at 266 mKB and 309 mKB from 1-Mar-13 to 1-Feb-14.](image)

- **OB118 Pressure @ 266 mKB**
- **OB118 Pressure @ 309 mKB**

- **OB118 Pressure @ 266 mKB**
- **OB118 Pressure @ 309 mKB**
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

100/09-02-095-06W4/0

OB122

Temperature (ºC) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma

- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

102/15-02-095-06W4/0

OB123

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma Ray

- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB124

104/04-01-095-06W4/0

Depth (mKB)
Piezometer Plots & Temperature vs Depth Plots

100/02-02-095-06W4/0  
OB125

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

100/07-02-095-06W4/0

Temperature (°C) and Gamma Ray (API Units)

OB126

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

OB127

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

01-Feb-2014 01-Jan-2014 01-Nov-2013 01-Oct-2013 01-Sep-2013 01-Aug-2013 01-Jul-2013

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Gamma

01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013  Series 13

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

105/08-02-095-06W4/0

OB128

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top  Shoreface Top  Gamma

01-Feb-2014  01-Jan-2014  01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013  01-Aug-2013

01-Jul-2013  01-Jun-2013  01-May-2013  01-Apr-2013  01-Mar-2013  Series14
Piezometer Plots & Temperature vs Depth Plots

105/08-02-095-06W4/0

OB128

Pressure (kPag)

Date

OB128 Pressure @ 264 mKB
Piezometer Plots & Temperature vs Depth Plots

110/11-02-095-06W4/0

OB129

Temperature (°C) and Gamma Ray (API Units)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

102/09-03-095-06W4/0

OB130

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top
- Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB131 Pressure @ 257 mKB
OB131 Pressure @ 300 mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

OB132

103/07-10-095-06W4/0

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB133

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Series 14
Piezometer Plots & Temperature vs Depth Plots

100/01-16-095-06W4/0

OB134

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

- Devonian Top
- Continental Top
- Channel Base
- Channel Top
- Tidal Flat Top
- Shoreface Top
- Clearwater Top

Gamma
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB134

Pressure (kPag) vs Date

OB134 Pressure @ 264 mKB
OB134 Pressure @ 307 mKB
Piezometer Plots & Temperature vs Depth Plots

**OB135**

Temperature (°C) and Gamma Ray (API Units)

- **Devonian Top**
- **Continental Top**
- **Channel Base**
- **Channel Top**
- **Tidal Flat Top**
- **Shoreface Top**
- **Clearwater Top**

Temperature (°C) and Gamma Ray (API Units) vs Depth (mKB)

- **Gamma**
- 01-Feb-2014
- 01-Jan-2014
- 01-Dec-2013
- 01-Nov-2013
- 01-Oct-2013
- 01-Sep-2013
- 01-Aug-2013
- 01-Jul-2013
- 01-Jun-2013
- 01-May-2013
- 01-Apr-2013
- 01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

106/09-09-095-06W4/0

OB135

Pressure (kPag)

Date

1-Mar-13  
1-Apr-13  
1-May-13  
1-Jun-13  
1-Jul-13  
1-Aug-13  
1-Sep-13  
1-Oct-13  
1-Nov-13  
1-Dec-13  
1-Jan-14  
1-Feb-14

OB135 Pressure @ 236 mKB
Piezometer Plots & Temperature vs Depth Plots

100/11-10-095-06W4/0

OB136

Temperature (ºC) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top
Gamma

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

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Piezometer Plots & Temperature vs Depth Plots

100/11-10-095-06W4/0

OB136

Pressure (kPag)

Date

1-Mar-13
1-Apr-13
1-May-13
1-Jun-13
1-Jul-13
1-Aug-13
1-Sep-13
1-Oct-13
1-Nov-13
1-Dec-13
1-Jan-14
1-Feb-14

OB136 Pressure @ 249.5 mKB
Piezometer Plots & Temperature vs Depth Plots

OB137

Date

Pressure (kPag)

Temperature (°C)

1-Mar-13
31-Mar-13
30-Apr-13
30-May-13
29-Jun-13
29-Jul-13
28-Aug-13
27-Sep-13
27-Oct-13
26-Nov-13
26-Dec-13
25-Jan-14

OB137 Pressure @ 278.5 mKB
OB137 Temperature @ ECC mKB

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure and temperature data over time]

- OB138 Pressure @ 277 mKB
- OB138 Temperature @ ECC mKB
Piezometer Plots & Temperature vs Depth Plots

Temperature (°C) and Gamma Ray (API Units)

OB143

100/16-34-094-06W4/0

Depth (mKB)

Temperature (°C)

Gamma

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013
Piezometer Plots & Temperature vs Depth Plots

OB147

Pressure (kPag) vs Date:
- 1-Mar-13 to 1-Feb-14

Temperature (ºC) vs Date:
- 1-Mar-13 to 1-Feb-14

Legend:
- OB147 Pressure @ 263.3 mKB
- OB147 Temperature @ 263.3 mKB
Piezometer Plots & Temperature vs Depth Plots

100/06-06-095-05W4/0

OB152

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top
Shoreface Top  Clearwater Top  Gamma
01-Feb-2014  01-Jan-2014
01-Dec-2013  01-Nov-2013  01-Oct-2013  01-Sep-2013  01-Aug-2013
Piezometer Plots & Temperature vs Depth Plots

OB152

Date


Pressure (kPag)

0 500 1000 1500 2000 2500

OB152 Pressure @ 263.5 mKB OB152 Pressure @ 276 mKB OB152 Pressure @ 290 mKB
OB152 Pressure @ 296 mKB OB152 Pressure @ 304 mKB
Piezometer Plots & Temperature vs Depth Plots

103/08-01-095-06W4/0

OB153

Temperature (°C) and Gamma Ray (API Units)

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250

Depth (mKB)

252
262
272
282
292
302
312
322

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Nov-2013
01-Oct-2013
01-Sep-2013
01-Aug-2013
Series9

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Gamma
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

109/14-36-094-06W4/0

OB154

Temperature (°C) and Gamma Ray (API Units)

Depth (mKB)

Devonian Top  Continental Top  Channel Base  Channel Top  Tidal Flat Top
Shoreface Top  Gamma  01-Feb-2014  01-Jan-2014  01-Dec-2013
01-Nov-2013  01-Oct-2013  01-Sep-2013  01-Aug-2013  Series9
Piezometer Plots & Temperature vs Depth Plots

109/14-36-094-06W4/0

Pressure (kPag)

Date

OB154 Pressure @ 256 mKB
OB154 Pressure @ 271 mKB
OB154 Pressure @ 299 mKB
OB154 Pressure @ 308 mKB
OB154 Pressure @ 319 mKB
Piezometer Plots & Temperature vs Depth Plots

Pressure (kPag) vs Date for OB155

- OB155 Pressure @ 234 mKB
- OB155 Pressure @ 241.6 mKB
- OB155 Pressure @ 255.3 mKB
- OB155 Pressure @ 264.2 mKB
- OB155 Pressure @ 218.2 mKB
- OB155 Pressure @ 285.7 mKB
Piezometer Plots & Temperature vs Depth Plots

104/07-31-094-05W4/0

OB158

Pressure (kPag)

Date


Temperature (ºC)

OB158 Pressure @ mKB  OB158 Temperature @ mKB
Piezometer Plots & Temperature vs Depth Plots

102/11-08-095-06W4/0

OB164

Date

Pressure (kPag)
0 100 200 300 400 500 600 700

OB164 Pressure @ 242 mKB
Piezometer Plots & Temperature vs Depth Plots

100/06-05-095-06W4/0

OB165

Pressure (kPag)

Date


OB165 Pressure @ 237.6 mKB
OB165 Pressure @ 242.2 mKB
OB165 Pressure @ 254.1 mKB
OB165 Pressure @ 258.6 mKB
OB165 Pressure @ 284.5 mKB
OB165 Pressure @ 301.3 mKB

3.1.1 5d) i) & ii)
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

100/01-32-094-05W4/0

OB167

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<th>OB167 Pressure @ 285 mKB</th>
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Piezometer Plots & Temperature vs Depth Plots

100/03-04-095-05W4/0

OB168

Date
- OB168 Pressure @ 258 mKB
- OB168 Pressure @ 278 mKB
- OB168 Temperature @ 258 mKB
- OB168 Temperature @ 278 mKB

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Piezometer Plots & Temperature vs Depth Plots

100/13-32-094-05W4/0

OB169

Pressure (kPag)

Temperature (ºC)


OB169 Pressure @ 253 mKB
OB169 Pressure @ 270 mKB
OB169 Pressure @ 287 mKB
OB169 Temperature @ 253 mKB
OB169 Temperature @ 270 mKB
OB169 Temperature @ 287 mKB
Piezometer Plots & Temperature vs Depth Plots

OB170 Pressure @ 251.5 mKB
OB170 Pressure @ 267 mKB
OB170 Temperature @ 251.5 mKB
OB170 Temperature @ 267 mKB
Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure and temperature trends for QW1 from 1-Mar-13 to 25-Jan-14. The graph displays the pressure (in kPa) and temperature (in °C) data with specific markers for each date. The y-axis represents pressure ranging from 0 to 1,400 kPa, and the x-axis represents dates from 1-Mar-13 to 25-Jan-14. The graph includes a legend indicating QW1 Pressure @ 145.8 mKB and QW1 Temperature @ Quaternary mKB.](image-url)
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

109/04-10-095-06W4/0

QW4

Pressure (kPag)

Date

Temperature (ºC)

QW4 Pressure @ 145 mKB
QW4 Temperature @ 145 mKB
Piezometer Plots & Temperature vs Depth Plots

100/12-06-095-06W4/0

DS1

Pressure (kPag) vs Date

DS1 Pressure @ 158 mKB
DS1 Pressure @ 351 mKB
DS1 Pressure @ 332.7 mKB
DS1 Pressure @ 334 mKB
DS1 Temperature @ 158 mKB
DS1 Temperature @ 351 mKB
DS1 Temperature @ 332.7 mKB
DS1 Temperature @ 334 mKB
Piezometer Plots & Temperature vs Depth Plots

102/12-06-095-06W4/0

DS2

Date

- DS2 Pressure @ 273.1 mKB
- DS2 Pressure @ 289 mKB
- DS2 Pressure @ 286 mKB
- DS2 Temperature @ 273.1 mKB
- DS2 Temperature @ 289 mKB
- DS2 Temperature @ 286 mKB
Piezometer Plots & Temperature vs Depth Plots

100/13-34-094-06W4/0

Temperature (ºC) and Gamma Ray (API Units)

DS4

01-Feb-2014
01-Jan-2014
01-Dec-2013
01-Oct-2013
01-Sep-2013

01-Aug-2013

01-Jul-2013
01-Jun-2013
01-May-2013
01-Apr-2013
01-Mar-2013

Devonian Top
Continental Top
Channel Base
Channel Top
Tidal Flat Top
Shoreface Top
Clearwater Top

SUNCOR
Piezometer Plots & Temperature vs Depth Plots

100/13-34-094-06W4/0

DS4

Pressure (kPag) vs Date


- DS4 Pressure @ 398.2 mKB
- DS4 Pressure @ 387 mKB
- DS4 Pressure @ 367.5 mKB
- DS4 Pressure @ 341 mKB
- DS4 Pressure @ 212 mKB
- DS4 Pressure @ 341 mKB
Piezometer Plots & Temperature vs Depth Plots

DS5

Pressure (kPag)

DS5 Pressure @ 375.1 mKB
DS5 Pressure @ 187 mKB
DS5 Pressure @ 354 mKB
DS5 Temperature @ Slave Point (Int) mKB
DS5 Temperature @ McMurray (Ext-Failed) mKB
DS5 Temperature @ Elk Point (Int) mKB
DS5 Temperature @ Quaternary (Ext) mKB
DS5 Temperature @ Slave Point (Ext-Failed) mKB

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Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots

100/08-02-095-06W4/0

**DW OB1**

- **Pressure (kPag)**
  - 100/08-02-095-06W4/0
  - Date
  - 1-Mar-13
  - 1-Apr-13
  - 1-May-13
  - 1-Jun-13
  - 1-Jul-13
  - 1-Aug-13
  - 1-Sep-13
  - 1-Oct-13
  - 1-Nov-13
  - 1-Dec-13
  - 1-Jan-14
  - 1-Feb-14

- **Temperature (ºC)**

- **Pressure**
  - DW OB1 Pressure @ 378 mKB
  - DW OB1 Pressure @ 391.5 mKB
  - DW OB1 Temperature @ 364.2 mKB
Piezometer Plots & Temperature vs Depth Plots

1AA/12-30-095-05W4/0

OB DW4

Date

- OB DW4 Pressure @ 362.7 mKB
- OB DW4 Pressure @ 336.2 mKB
- OB DW4 Temperature @ 318 mKB
Piezometer Plots & Temperature vs Depth Plots

100/16-03-095-06W4/0

OB DW12

Pressure (kPag)

Date

0 500 1,000 1,500 2,000 2,500


OB DW12 Pressure @ 364.6 mKB

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Piezometer Plots & Temperature vs Depth Plots

![Graph showing pressure and temperature over time for PP7. The graph includes data for different dates from March 2013 to February 2014, with varying pressures and temperatures.](image)
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots
Piezometer Plots & Temperature vs Depth Plots
Appendix - RST Logs
Appendix - RST Logs
Appendix - RST Logs
Appendix - RST Logs
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