Subsurface Agenda

1. Background
2. Geology / Geoscience
3. Drilling & Completions
4. Artificial Lift
5. Well Instrumentation
6. Scheme Performance
1. Background
Project Overview

Approved Development Area as per AER Scheme Approval No. 11522H

- CORED WELLS
- IPC OIL SANDS
- LEASE HOLDINGS
Project Summary

- AER Scheme Approval No. 11522H
- One (1) Operating SAGD Well Pair
- Portage area on Oil Sands Lease 7407060158
- Pilot site located in 02-36-076-18W4
- Target formation is the Lower Grand Rapids Unit 1 (L.GR1)
- Initial reservoir data:
  - Pressure: 1700 KPA
  - Temperature: 13°C
  - Depth: 300m
- Traditional SAGD recovery process
- IPC is the 100% W.I. Owner
Blackrod Pilot Site
**Project Milestones – 10-36 WP2**

- **Feb 2012** AER Approval No. 11522C for 10-36 WP2 and facility expansion
- **Feb 2013** Drilled 10-36 WP2
- **Oct 2013** Commission Phase 2 Pilot Facility Expansion
- **Nov 2013** Commence Circulation Phase
- **Mar 2014** Convert to SAGD Production Phase
- **Apr 2015** Production surpasses commercial rate of 400 bopd
- **Dec 2016** 21 consecutive month of +500 bopd with an iSOR of <3.0
- **Dec 2017** Produced 645,000 cumulative barrels of oil
- **Dec 2018** Produced 800,000 cumulative barrels of oil
- **Dec 2019** Produced 900,000 cumulative barrels of oil
- **Feb 2020** Shut in for 15-36 WP3 Circulation Phase
Project Milestones – 15-36 WP3

- **Aug 2018**  
  AER Approval No. 11522G for 15-36 WP3

- **Sept 2019**  
  Drilled 15-36 WP3

- **Feb 2020**  
  Commence Circulation Phase
2. Geology / Geoscience
Original Bitumen in Place

• OBIP_{WP2} = A \cdot h \cdot S_o \cdot \bar{\theta} \cdot B_o
  = (100 \, \text{m} \times 1050 \, \text{m}) \times 25 \, \text{m} \times 0.63 \times 0.34 \times 1.0
  = 562,275 \, \text{m}^3

• OBIP_{WP3} = A \cdot h \cdot S_o \cdot \bar{\theta} \cdot B_o
  = (100 \, \text{m} \times 1550 \, \text{m}) \times 25 \, \text{m} \times 0.63 \times 0.34 \times 1.0
  = 830,025 \, \text{m}^3

Where:

- OBIP = Original Bitumen In Place
- A = Drainage Area
- h = Thickness
- S_o = Oil Saturation
- \bar{\theta} = Average Porosity
- B_o = Expansion Factor
- WP_2 = 2nd Pilot Well Pair drilled at 10-36-076-18W4
- WP_3 = 3rd Pilot Well Pair drilled at 15-36-076-18W4
Lower Grand Rapids (L. GR) Net Pay Map

- Existing lease and access selected for Pilot surface location
- Bottom hole locations for both Pilot Well Pairs selected based on offsetting well control
- L. GR is a Shoreface deposit consisting of three (3) coarsening-upward parasequences:
  - L. GR Unit 1 = upper to middle shoreface bitumen target zone
  - L. GR Unit 2 = middle to lower shoreface transition zone
  - L. GR Unit 3 = bottom H2O saturated aquifer

LOG CUTOFFS
- Gamma Ray < 75 API
- Resistivity > 20 Ohm.m
- Porosity > 33%

Legend

<table>
<thead>
<tr>
<th>Blackrod SAGD Pilot Project</th>
<th>Phase 1 Development Area</th>
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</thead>
<tbody>
<tr>
<td>13-25 WP1</td>
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<tr>
<td>10-36 WP2</td>
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<tr>
<td>15-36 WP3</td>
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</tbody>
</table>
L. GR Unit 3 Bottom Water Isopach Map
Type Log

LOG CUTOFFS
- Gamma Ray < 75 API
- Resistivity > 20 Ohm.m
- Porosity > 33%
**L.GR1** Core Characteristics:

- Oil saturation: 0.60
- Bitumen weight: 11%
- Net pay thickness: 26 m
- Porosity: 36%
- Vertical permeability: 3024 mD
- Horizontal permeability: 3450 mD
- Kv/Kh: 0.88
- API Gravity: 9.8 (at 15.6 °C)
• 15-36 producer well was drilled with a minimum 5m standoff from LGR2 transition zone

• LGR2 transitions from 30% oil saturation to 100% water
Seismic

3D X-Line along 13-25 WP1

3D Seismic Area Coverage
Primary Cap Rock

- MFS (Maximum Flooding Shale)
- Directly overlays Lower Grand Rapids formation
- Regionally extensive
- 3 m average thickness
- Mini Frac Analysis:
  - Performed on the 13-25-076-18W4 OSE Core Hole
  - Initial Breakdown Pressure = 8500 kPa
  - Closure Pressure Gradient = 13.7 kPa/m
MFS Cap Rock Structure Map
MFS Cap Rock Base Depth Map
Secondary Cap Rock

• Joli Fou formation
• 45 m above Lower Grand Rapids formation
• Regionally extensive
• 20 m average thickness

• Mini Frac Analysis:
  – Performed on the 01-36-076-18W4 OSE Core Hole
  – Initial Breakdown Pressure = 12,750 kPa
  – Closure Pressure Gradient Range = 19.4 kPa/m
Joli Fou Cap Rock Isopach Map
Joli Fou Cap Rock Structure Map
Joli Fou Cap Rock Base Depth Map
3. Drilling and Completions
2nd SAGD PILOT INJECTOR WELL

SAGD PRODUCTION PHASE

BRI HZ INJ2 102 PORTAGE 10-36-76-18

Well Name: BRI HZ INJ2 102 PORTAGE 10-36-76-18
UWI: 102/10-36-076-18W4/0
Licence #: 0453330

Surface Coord: 156.8 m S of N Sec. 25, 666.3 m W of E Sec. 25

KOP: 133.1 m KB
DLS: 9 – 14 deg / 30m Long / Guide String: Landing @ 1344.8 m KB

Completion: 09-May-15 RIH w/ CTU to close GDA Steam Splitters

Well History:

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2nd SAGD Pilot Injector Well - Circulation & Warm-up & Production Phase

Surface Hole: 444.4 mm
Surface Casing: 110.4 m KB
Size: 339.7 mm, 81.10 kg/m, J55, ST&C
Drift ID = 316.46 mm
Cemented to surface with Thermal cement

Intermediate Hole: 314.8 mm
Intermediate Casing: 214.6 mm TVD / 268.3 m MD
Size: 244.5 mm, 69.52 kg/m, L80, QB2 connections
Drift ID = 220.45 mm
Cemented to surface with Thermal cement

Mud Type: Fresh Water - Gel Chem

Long / Guide String: Landing @ 1344.8 m KB
Coupling OD = 96.8 mm (flush joint)

Weatherford SS GDA’s: Landing @ 759.3 and 1029.2 m KB
Size: OD = 143.0mm; ID = 71.45mm
Ports = 9.931mm
Note: GDA’s Closed

Weatherford 5G LD: Landing @ 1030.0 m KB
Coupling OD = 96.8 mm (flush joint)

Short String: Landing @ 405.0 m KB
Size: 88 mm, 13.06 kg/m, L80, SMLS, TKC FJL
Coupling OD = 96.8 mm (flush joint)

Drift ID = 158.52 mm

Slots: Rolled Top 0.012" x 0.020"

Weatherford SL: Landing @ 1384.8 m MD
Coupling OD = 96.8 mm (flush joint)

Weatherford 5G LD: Landing @ 1030.0 m KB
Coupling OD = 96.8 mm (flush joint)

Weatherford 5G LD: Landing @ 1030.0 m KB
Coupling OD = 96.8 mm (flush joint)

Completion: Mar. 16, 2013 Circulation & SAGD Phase
Completion: Mar. 4, 2014 RIH w/ CTU to open GDA Steam Splitters
Completion: Mar. 16, 2013 RIH w/ CTU to close GDA Steam Splitters

Rig Release: Mar. 2, 2013

Well Purpose:

2nd SAGD Pilot Injector Well - Circulation & Warm-up & Production Phase

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2nd SAGD Pilot Injector Well - Circulation & Warm-up & Production Phase

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Size: OD = 143.0mm; ID = 71.45mm
Ports = 9.931mm
Note: GDA’s Closed

Weatherford 5G LD: Landing @ 1344.8 m KB
Coupling OD = 96.8 mm (flush joint)

Short String: Landing @ 405.0 m KB
Size: 88 mm, 13.06 kg/m, L80, SMLS, TKC FJL
Coupling OD = 96.8 mm (flush joint)

Weatherford SL: Landing @ 1384.8 m MD
Coupling OD = 96.8 mm (flush joint)

Weatherford 5G LD: Landing @ 1030.0 m KB
Coupling OD = 96.8 mm (flush joint)

Completion: Mar. 16, 2013 Circulation & SAGD Phase
Completion: Mar. 4, 2014 RIH w/ CTU to open GDA Steam Splitters
Completion: Mar. 16, 2013 RIH w/ CTU to close GDA Steam Splitters

Rig Release: Mar. 2, 2013

Well Purpose:

2nd SAGD Pilot Injector Well - Circulation & Warm-up & Production Phase

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Size: 88 mm, 13.06 kg/m, L80, SMLS, TKC FJL
Coupling OD = 96.8 mm (flush joint)

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Completion: Mar. 16, 2013 RIH w/ CTU to close GDA Steam Splitters

Rig Release: Mar. 2, 2013
2nd SAGD PILOT PRODUCER WELL
SAGD PRODUCTION PHASE
BRI HZ PRD2 100 PORTAGE 10-36-76-18

Well Name: BRI HZ PRD2 100 PORTAGE 10-36-76-18
Licence #: 0453203
Well Purpose: KB - GL:

Surface Hole:
- Size: 444.5 mm
- Surface Casing: 107.0 m KB
- Size: 339.7 mm, 81.10 kg/m, J55, ST&C
- Drift ID = 316.46 mm
- Cemented to surface with Thermal cement
- Mud Type: Fresh Water - Gel Chem

Intermediate Hole:
- Size: 311.0 mm
- Intermediate Casing: 320.9 m TVD / 460.0 m MD
- Size: 244.5 mm, 59.53 kg/m, L80, TBlue connections
- Drift ID = 220.45 mm
- Cemented to surface with Thermal cement
- Mud Type: Fresh Water - Gel Chem

KOP:
- Size: 52.4 mm, 4.84 kg/m, J55, IJ
- Coupling OD = 52.4 mm
- Instrumentation: Thermocouples @ 419, 519, 619, 719, 819, 919, 1019, 1119, 1219, 1319 m KB
- Drift ID = 42.1 mm
- Nitrogen Purging Bubble Tube @ 1329 m KB
- Note: Bundle string will come to location pre-fabricated with instrumentation already positioned inside 31.8 mm coil tubing

Target:
- Size: 88.9 mm, 13.69 kg/m, L80, TKC 4040 HOI connections, shaved
- WWS Liner: Landing @ 1391.4 m MD w/ Hanger Set @ 446.0 m MD
- Coupling OD = 101.6 mm
- Drift ID = 158.52 mm
- 158.75 mm centralizers

Pump:
- Baker “ULTRA SAGD” ESP 66-400P29CSHD c/w WWS: 0.014” 158.75 mm centralizers

Cable:
- Baker Centriline Lead Flat cable c/w heel bubble tube landing @ 411.3 m (317.4 m TVD)

Workover:
- Mar. 17, 2015
- Spud:
- Mar. 10, 2014
- Completion:
- Mar. 10, 2014
- Circulation Phase:
- Mar. 10, 2014

Well History

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2nd SAGD PILOT PRODUCER WELL - Circulation/Warm-up Phase

2nd SAGD PILOT PRODUCER WELL - Production Phase

2nd SAGD PILOT PRODUCER WELL - Production Phase
• Injector Well:
  – No modifications

• Producer Well:
  – No modifications
Well Name: BLACKPEARL INJ3 PORTAGE 15-36-76-18
UWI: 103/15-36-076-18W4/0
Licence #: 0493899
Surface Coords: 155.6 m S of N Sec. 26
Surface: 244.3 m W of E Sec. 36
RD: 819.15 m
GL: 813.50 m

KB: 619.15 m
GL: 613.90 m
Surface Hole: 444.5 mm
Surface Casing: 96.5 mKB
Size: 339.7 mm, 81.10 kg/m, J55, ST&C
Drift ID = 316.46 mm
Cemented to surface with Thermal cement
Mud Type: Fresh Water - Gel Chem

Intermediate Hole: 311.4 mm
Intermediate Casing: 315 mTVD / 437 mMD
Size: 244.5 mm, 59.53 kg/m, L80, QB2 connections
Special Drift ID = 222.45 mm
Cemented to surface with Thermal cement
Mud Type: Floc Water - Encapsulation Polymer

KOP: 117 mKB
DLS: 6 - 12deg / 30m Long / Guide String: Landing @ 410 mKB Long / Guide String: Landing @ 1797.5 mKB
Size: 88.9mm, 13.69 kg/m, J55, TKC FJ150
Coupling OD = 88.9 mm (flush joint)
Size: 88.9mm, 13.69 kg/m, J55, 4040 HOI
Coupling OD = 107.95 mm (beveled)

Weatherford SS GDA's: Landing @ 1050.0 and 1510.0 mKB
Size: OD = 143.0 mm / ID = 71.45 mm
Note: GDA's remain closed during Circulation Phase

Short String: Landing @ 410.0 mKB
Size: 88.9mm, 13.69 kg/m, J55, T2C JG150
Coupling OD = 88.9 mm (flush joint)

Mud Type: Encapsulation Polymer

TL: 317.43 mTVD / 1861 mMD

Note: GDA's remain closed during Circulation Phase
Well Name: BLACKPEARL PRD3 PORTAGE 15-36-76-18
UWI: 104/15-36-076-18W4/0
Licence #: 0493913
Surface: 165.7 m S of N Sec. 25
Coords: 639.8 m W of E Sec. 36
RD: 618.20 m
GL: 613.80 m

Surface Hole: 444.5 mm
Size: 339.7 mm, 81.10 kg/m, J55, ST&C
Drift ID = 316.46 mm
Cemented to surface with Thermal cement
Mud Type: Fresh Water - Gel Chem

Intermediate Hole: 311.0 mm
Intermediate Casing: 222.1 m TVD / 489.00 m MD
Size: 244.5 mm, 59.53 kg/m, L80, QB2 connections
Special Drift ID = 222.45 mm
Cemented to surface with Thermal cement
Mud Type: Floc Water - Encapsulation Polymer

KOP: 132 m
DLS: 3 – 11.7 kg/m / 30m

Long / Guide String: Landing @ 460m KB
Size: 88.9mm, 13.69 kg/m, J55, TKC FJ150
Coupling OD = 88.9 mm (flush joint)
Note: Bundle string will arrive to location with fiber already pumped inside 31.8 mm coil tubing

TD: 322 m TVD / 1885 m MD

Well History
DATE
REMARKS
3rd SAGD Producer Well - Circulation / Warm-up Phase.
3rd SAGD PILOT PRODUCER WELL
CIRCULATION PHASE
4. Artificial Lift
Electrical Submersible Pump

- Fluid production via “Ultra Temp” Electrical Submersible Pumps (ESP)
- ESP advantages:
  - Operate and lift fluids at controlled downhole pressures
  - Maintain continuous fluid production
- Variable Flow Drive (VFD) utilized to control pump speed and production rates
- WP2 ESP ran for +1600 prior to failing in Sept 2019
5. Well Instrumentation
10-36 WP2 – Obs Wells

• Toe Obs Well:
  – 100/07-36-076-18W4
  – 17.5 m West of WP2
  – Thermocouples to monitor temperature above, below, and within L.GR1
  – P/T gauge to monitor pressure & temperature within L.GR3 aquifer

• Heel Obs Well:
  – 100/02-36-076-18W4
  – 16.1 m East of WP2
  – Thermocouples to monitor temperature above, below, and within L.GR1
  – P/T gauge to monitor pressure & temperature within L.GR3 aquifer
10-36 WP2 – Instrumentation Overview

![Diagram of geological layers and wells](ImageURL)
15-36 WP3 – Instrumentation Overview

VIKING / JOLI FOU / UPPER GRAND RAPIDS

CAPPING SHALE

LOWER GRAND RAPIDS UNIT 1

Toe bubble tube

DTS FIBER OPTICS

Heel bubble tube

LOWER GRAND RAPIDS UNIT 2

LOWER GRAND RAPIDS UNIT 3

CLEARWATER

GROSMONT

15-36-76-18W4 WP3 Producer
15-36-76-18W4 WP3 Injector

Not to Scale
Groundwater Monitoring Wells

• 100/03-36-076-18W4 GWM:
  - Directionally drilled from 14-25 lease
  - PCP to sample/analyze non-saline L.GR3 H₂O
  - P/T gauge to monitor pressure & temperature within L.GR3 aquifer

• 100/14-25-076-18W4 GWM:
  - Directionally drilled from 14-25 lease
  - PCP to sample/analyze non-saline L.GR3 H₂O
  - P/T gauge to monitor pressure & temperature within L.GR3 aquifer

• 100/15-25-076-18W4 GWM:
  - PCP to sample/analyze non-saline Viking H₂O
  - P/T gauge to monitor pressure & temperature within Viking aquifer

* Annual Groundwater Monitoring Summary Report Submitted to the AER in Q1 2020
6. Scheme Performance
• 71 months of SAGD Production Phase
• Maturing steam chamber / Oil production in decline
• Oil production currently averaging 56 m$^3$/d
• Applied Learnings:
  • Improved well design (i.e. longer HZ section and WWS for sand control)

• Objective(s):
  • Evaluate SAGD performance from a commercial well pair prototype
  • Target 100% up-time

• Well Placement:
  • “Cautious” placement above L. GR Unit 3 Bottom Water
10-36 WP2 Key Learnings

- Longer ramp-up periods now expected at Blackrod
- WWS favorable to the Blackrod L. GR reservoir
- Scab liner effective in protecting ESP and facilitating heat conformance across HZ section
- Heat conformance can be achieved across 950+ m HZ section
10-36 WP2 Oil Production as of Dec 31, 2019

- Cumulative Production = 147,600 m³
- Recovery = 26.2%
- Ultimate Recovery = 40 - 50%
- CSOR including Circ. Phase = 3.80
- CSOR during Prod. Phase only = 3.65
- Average Rate during Prod. Phase = 68.32 m³/day (429.66 bopd)
- Current Rate = 56.37 m³/day (354.5 bopd)
• Average Steam Chamber Pressure = 2070 kPa

• Average Surface Steam Temperature = 265 °C

• Wellhead Steam Quality = 95 – 100%
• Objective(s):
  • Evaluate heat conformance across a longer Hz lateral
  • Evaluate new completion including flow control devices
  • Target 100% up-time

• Well Placement:
  • Producer well placed 5m above LGR2 Transition Zone
  • Targeted 5.5m separation between injector and producer
  • Well drilled south to north 120m east of WP2
Surface Operations Agenda

1. Facilities
2. Measurement & Reporting
3. Water Source
4. Disposal
5. Environmental
6. Compliance Statement
1. Facilities
Pilot Facility Performance

- No issues with bitumen treatment, water treatment, or steam generation
- Pilot Facility uptime 97.3% in 2019
- Generated steam, produced bitumen, produced water, and produced gas volumes reported to Petrinex
- Pilot facility is reported as single well battery, therefore no proration factors
- Purchased gas volumes reported to Petrinex
- Flared gas volumes reported to AER and Petrinex
- SO$_2$ & NO$_x$ emissions and ambient air quality data submitted to AER both monthly and annually as per terms of EPEA Approval 00264736-00-02
- GHG emissions reporting not required for Blackrod Pilot Facility as per terms of EPEA Approval 00264736-00-02
Fuel gas is combined with produced gas upstream of flare to maintain a minimum lower heating value of 12MJ/m³
Pilot Facility Monthly Volumes

Monthly Flaring and Venting

Flared Gas Volume (e3m3)

Small upset during start-up after shut-down for drilling

Flared Gas Volume (e3m3)
Monthly Venting Volumes
• Installed produced water treatment package in preparation for completing 1 year trial.

• Commissioning is ongoing, no water has been treated to date.
2. Measurement & Reporting
• IPC remains compliant with AER Directive 017 as well as Directive 042 as per the terms of our approved MARP (Measurement, Accounting, and Reporting Plan)

• To validate compliance with Directive 017 and Directive 042, IPC performs a detailed EPAP (Enhanced Production Audit Program) review annually as per Directive 076 with an independent consulting group
3. Water Source
Blackrod Water Source(s)

- 1F1/14-24-076-18W4 L.GR3 WSW:
  - Non-saline (~3700 TDS)
  - AER Water Act Licence No. 00308617-01-00 valid until Jun 2019
  - Approved for 109,500 m³ annually
  - Production volumes reported to AER and Petrinex
  - 100/14-24-076-18W4 monitoring well 20 m North of 1F1/14-24 WSW
  - No issues with water softening process

- 1F1/15-25-076-18W4 Grosmont Member D WSW:
  - Saline (~13,800 TDS)
  - No issues with saline treatment process
Blackrod Water Source(s)

Monthly Source Water Volumes

Volume (M³)

Jun-11 to Dec-19

LGR (14-24-76-18W4)  Grosmont (15-25-76-18W4)
4. Disposal
• Produced Water:
  – 100/02-25-076-18W4 Class 1b Disposal Well
  – AER Scheme Approval No. 11703A
  – Disposal into Grosmont Members B, A
  – Maximum wellhead injection pressure of 6300 kPa
  – This well continues to operate on vacuum with no pressure at the wellhead
  – All disposal volumes reported to Petrinex
Annual volume of high-quality nonsaline make-up water was less than 500,000 m³, therefore Blackrod facility is exempt from disposal limit.
5. Environmental Issues
• No environmental issues to date

• IPC remains compliant with the terms of AER Approval No. 264736-00-00:
  – CPP (Caribou Protection Plan)
  – Air Monitoring
  – Groundwater Monitoring
  – Soil Monitoring
  – Etc.
6. Compliance
• Passive air monitoring stations, no exceedance of $\text{SO}_2$, $\text{NO}_x$, $\text{H}_2\text{S}$ emissions

• Industrial Waste (i.e. sewage, sludge, etc.) trucked out to third party disposal facilities.

• All Industrial Runoff was within parameters and pumped off lease

• GHG emissions reporting not required for Blackrod Pilot Facility as per terms of EPEA Approval 00264736-00-02
Under Section 4.1.17 and 4.1.18 of the EPEA approval, IPC is required to conduct a manual stack survey on the 15 MW steam generator once within six months of commissioning.

A manual stack survey was conducted which gave an average mass flow rate of 0.28 kg/h which is below the 1.4 kg/hr limit for NOx in the approval.

Monthly NOx is calculated by using the hourly emissions rate and knowing the monthly run time hours.
Blackrod SO2 Emissions

SO2 Daily Emissions

- SO2 Peak Rate
- SO2 Average Rate
- SO2 Limit
Blackrod Industrial Runoff Monitoring

Industrial Runoff Released Volumes

Industrial Runoff Average pH

Industrial Runoff Average Chlorides
Blackrod Compliance

• To the best of IPC’s knowledge, the Blackrod SAGD Pilot Project is currently in full compliance with all conditions and regulatory requirements related to AER Scheme Approval No. 11522H
Blackrod Future Plans
1. Ongoing Pilot Objectives
Ongoing Pilot Objectives

• Complete warm-up on WP3 and convert to production phase.

• Trial new produced water treatment technology

  - Commissioning will be completed in Q1 2020 followed by a 1-year trial. Learnings from the trial will be applied to the commercial facility design.
2. SAGD Commercial Development
• Commercial SAGD Application No. 1728831- Approved

• 80,000 bbl/d (12,720 m3/d) to be developed in phases, with the first phase planned for 20,000 bbl/d; two additional phases of 30,000 bbl/d each to follow
1. Pressure & Temperature Data
   • 10-36 WP2
   • Heel & Toe Observation Wells