



BlackGold Project Harvest Operations Corp.

Annual Performance - Commercial Scheme Approval No. 11387G

January 2019



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Agenda – 1. Subsurface



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1. Background



- □ Harvest holds 100% ownership of 15 sections in 76-7-W4M
 - located approximately 10 km southeast of Conklin



1. Background



- February 3, 2010 Commercial Scheme Approval No. 11387 for BlackGold Phase 1 for 1,590 m³/d bitumen recovered with the SAGD process.
- September 1, 2010 Amendment Approval No. 11387A transfer of BlackGold Oil Sands Lease from KNOC Canada to Harvest Operations Corp.
- GEO 110308 4D Acquisition plan was Approved
- January 30, 2012 Amendment Approval No. 11387B confirming minor modifications to the plot plan and modification of well trajectories.
- March 7, 2012 Amendment Approval No. 11387C confirming a minor modifications to CPF.
- □ September 26, 2013 Amendment Approval No. 11387D Phase 2 Application to produce an additional 3,180 m³/d bitumen.
- April 22, 2014 Amendment Approval No. 11387E to reclassify well 1AA/06-12-077-06W4M
- September 26, 2014 Amendment Approval No. 11387F increasing the maximum bottom hole operating pressure of the pilot well pairs from 4,000 kPag to 5,500kPag during steam circulation.
- ❑ June 15, 2018 Amendment Approval No. 11387G increasing the maximum bottom hole operating pressure of the pilot well pairs from 4,000 kPag to 5,000kPag during SAGD operations.
- □ Dec 10, 2018 GEO 180081 4D Acquisition plan was approved and GEO 110308 4D Acquisition plan was closed.

SAGD Recovery







Project Area



• Exploration Activity

- O Drilled before 2006 (52 wells)
- Drilled 2007 (19 wells)
- ★ Drilled 2008 (32 wells)
- Drilled 2009 (30 wells)



3D Seismic (23 km²) 2009

 4D Seismic (35.9 km²) GEO180081 (approved area)

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1.2 Geology / Geoscience – Stratigraphy



General Stratigraphy

Stratigraphic Column



Source: Wightman & Pemberton, 1997

Reference Well 9-1-76-7W4M





Location Map





BlackGold McMurray Approved Area Average Reservoir Properties:

| Property | McMurray Project Expansion Approved Area | Pilot East Area (Pad 101, Pad 102- 7-10) | Pilot West Area (Pad 102-1-6) |
|------------------------------------|--|---|----------------------------------|
| Reservoir Top Depth, m TVD | 350 - 370 | 350 - 370 | 350 - 370 |
| Reservoir Bottom Depth, m TVD | 400 - 410 | 400 - 410 | 400 - 410 |
| Original Reservoir Pressure, kPa | 2600 | 2600 | 2600 |
| Original Reservoir Temperature, °C | 12 | 12 | 12 |
| Reservoir Thickness, m | 25 - 30 | 33 - 43 | 22 - 37 |
| Netpay Thickness, m | 18 - 23 | 29 - 39 | 19 - 30 |
| Porosity, % | 31 - 32 | 31 - 33 | 31 - 33 |
| Initial Bitumen Saturation, % | 78 - 81 | 79 - 86 | 75 - 84 |
| OBIP, MM m3 | 69 - 73 | 6.7 | 3.7 |

1.2 Geology / Geoscience – Pay Definition





1.2 Geology / Geoscience – Pay Definition







□ Net pay – entire area with OBIP (GBIP_NET) – McM only





Total Pay Thickness - GBIP_ISO





Structure map for top of bitumen pay





Structure map for bottom of bitumen pay





Structure map for bottom of bitumen pay





Representative composite well log: 1AA/02-12-076-07 W4/0





BlackGold McMurray Reservoir Caprock-Wabiskaw Regional Marine Shale



.

BlackGold seismic cross section

The Q-channel has been incised in Wabiskaw shale formation, BlackGold Oilsands Reservoir's main caprock.





Quaternary Channel Incision – BlackGold Project Area





Map showing the thickness from the top of the Clearwater Fm. to the top of the McMurray Fm. (interval highlighted in yellow, 5-12 ref well)

Summary

1) All wells within the Blackgold SAGD area display formation tops from the McMurray Formation to the top of the Clearwater Formation (no erosion). There is no evidence these formations have been comprimised by Quaternary incision.

2) The majority of wells within the SAGD area display a well-defined Lower Grand Rapids top.

3) The Quaternary sucession does incise into the top of the Lower Grand Rapids in 4 wells within SAGD area.

4) The Quaternary does not incise into the top of the Clearwater shale (Clearwater Formation) within any of the Harvest's Blackgold oil sand leases.

5) There is a minimum thickness of 84 m between the top of the McMurray Formation and the top of the Clearwater Formation.



Existing core logs and Formation Micro-Imager (FMI) logs







Existing cores with bitumen viscosity measurements





Existing cores with hyper-spectra imaging and XRF









1AA 15-11-076-07 1AA 16-02-076-07

1AA 16-11-076-07

17

18

19

25

BlackGold lease cross section – North to South

North

GR

pef B/E

GR

GR

1AA/14-12-076-07W4



South



OPERATIONS COR 24 40

1AA/08-01-076-07W4







A - over the entire Area **B** - over the SAGD Pilot

NOTE:

- none of bottom water intervals is in direct contact with identified SAGD-able pay.
- Stand off from • well-pairs is >10m.

SAGD well-pair

Localized Bottom Water





08-12

.FACIES

RES



□ 2016 January, 30 corner reflectors were installed.





- □ Reflector sites have been placed.
- □ Satellite data was collected and analyzed as a baseline prior to first steam.
 - Each reflector allows monitoring of approximately a 150 m radius



2018 Q3 & Q4 Surface Heave Monitoring Results



2018 Q4 Results



| | 2018 Q3 Cu Displace | umulative ement | 2018 Q4 Cumulative Displacement | | Change in Average Deformation | |
|----------|------------------------|--------------------|------------------------------------|-------|----------------------------------|----------|
| | 08/05/18 – 12/08/18 | | 12/08/18 - 16/11/18 | | (Q4 – Q3) | |
| | (97 days) | | (97 days) | | | |
| | [mm] | [mm/day] | | | [mm] | [mm/day] |
| 102 West | 3.4 | 0.035 | 4.6 | 0.047 | 1.2 | 0.012 |
| 102 East | 1.7 | 0.018 | 3.4 | 0.035 | 1.7 | 0.018 |
| 101 | 0.7 | 0.007 | 5.2 | 0.054 | 4.5 | 0.046 |
| Average | 1.9 | 0.020 | 4.4 | 0.045 | 2.5 | 0.03 |

Deformation changes recorded over BlackGold Pilot SAGD drainage pads are within typical values for SAGD projects.



- □ BlackGold geomechanical data and analyses
 - Mini-fracture physical testing results obtained in 2008.
 - The in-situ minimum stress in the McMurray shale is between 6.01 MPa and 6.9 MPa (16.7 to 19.2 kPa/m).
 - BlackGold geomechanical modeling confirmed that the McMurray cap rock integrity has a maximum down hole pressure of 6 MPa.
 - Approved maximum operating pressure is 5.5 MPa during steam circulation and 5 MPa during SAGD operations.

Agenda – 1. Subsurface



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1.3 Drilling and Completions

□ Well pair trajectories.



• Legend

| _ | Well Pair Trajectory | | |
|---------|----------------------------------|--|--|
| | 3D Seismic (23 km ²) | | |
| 0 | Drilled before 2006 (52 wells) | | |
| | Drilled 2007 (19 wells) | | |
| \star | Drilled 2008 (32 wells) | | |
| * | Drilled 2009 (30 wells) | | |



1.3 Drilling and Completions



All BlackGold SAGD well pairs are spaced about 95 - 100 meters except for 102-4, 102-5 and 102-6 which are spaced about 85 - 90 meters.





Overview of OBS Wells

- □ Harvest drilled 12 observation wells in 2011 to monitor performance
 - 4 clamp type wells installed thermocouples and pressure gauge
 - 8 spool in type wells installed thermocouples



1.3 Drilling and Completions



□ Typical well bore schematic – Injector




□ Typical well bore schematic – Producer during circulation



1.3 Drilling and Completions

□ Typical well bore schematic – Producer on SAGD production with ESP (Electric Submersible Pump)





- Sand retention and retained permeability properties.
- Tolerates wider variation in Particle Size Distribution (PSD).
- Higher Open Flow Area (OFA) than gap-based media.
- Premium media discs flush mounted and tightly secured into the base material.
- 316 SS, 25.4mm disc with OFA of 3.61% at 22 discs/ft.





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Start-Up Strategy

- □ Steam circulation was initiated on all well pairs June 19-21, 2018.
- □ The first ESP installation commenced on August 25, 2018 after 62 days of circulation.
- Rigorous conversion criteria were used to establish 'readiness' for ESP installation/conversion to SAGD.
- ❑ High Temperature ESP's were installed on all 10 well pairs after 62-96 days of circulation. Short circulation times are attributed to increased circulation pressures (5,400 kPa) and well separation (4 meters at the toe, 5 meters in the middle, and 6 meters near the heel).
- Production ramp-up has been constrained by market pricing conditions: however, production performance has exceeded expectations.



- 12 well pairs have been started with 10 converted to ESP September 1-October 5, 2018. The remaining 2 well pairs are operating using steam lift, to assess well pair production potential.
- All ESPs have bubble tubes at the heel for pressure measurement. Bubble tubes present in the IJ strings are also used when functional. The ESP systems leverage the existing DTS to monitor intake temperature.
- □ ½" Heel bubble tubes are installed with the ESPs at the heel to monitor intake pressure
- □ All original ESP systems are still operating.
- □ ESP total fluid production capacity will vary between 300 to 730 m³/day.

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□ Producers:

- 15 DTS fiber system during circulation and SAGD phase.
- 15 bubble tube to toe during circulation phase and 15 bubble tube to both toe and heel during SAGD phase.
- □ Injectors:
 - 4 DTS fiber system during circulation and SAGD phase.
 - 4 bubble tube to toe during circulation and SAGD phase.





Instrumentation in Observation Wells (typical completions)

Thermocouples Inside Casing

Piezometers & Thermocouples Outside Casing



Agenda – 1. Subsurface



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1.6 Seismic



- □ Harvest acquired the 4D base line seismic survey over the Initial Development Area February 2012
 - GEO 110308 Nov 3D Acquisition 4.3km²



Note: Red lines are shot lines; blue lines are receiving lines

1.6 Seismic





1.6 Seismic



□ Harvest Approval GEO180081 (Dec 2018) 4D seismic- Replaces GEO 110308

| TOTAL. | 40,010 327 01,400 314 | 1,000.00 Mi |
|----------|---|-------------|
| TOTAL | 43 378 SP / 61 435 STN | 1.053.35 km |
| A | VIBE POINTS - 1,194 VP (ALL POINTS FALL ON EXISTING PAD ARE | AS) |
| | EXISTING ACCESS 3m - 11.66 km (NOT INCLUDED IN PROGRAM TO | OTAL BELOW) |
| ===: | RECEIVER OPEN/WATERBODY 0m | 16.17 km |
| | RECEIVER EXISTING 1.75m | 166.15 km |
| | RECEIVER EXISTING 1.75m TO BE WIDENED TO 2.75m | 34.50 km |
| | RECEIVER EXISTING 2.75m | 71.52 km |
| | RECEIVER NEW MECH/HC 1.75m | 277.64 km |
| | RECEIVER NEW MECHANICAL 2.75m | 50.00 km |
| | SOURCE EXISTING 2.75m | 210.51 km |
| | SOURCE NEW MECHANICAL 2.75m | 246.16 km |



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Scheme Performance Highlights:

- □ First steam in June 2018.
- □ First well pair on full SAGD occurred in September 2018.
- □ First Oil Production September 3, 2018.
- CPF exceeded uptime expectations resulting in faster time to conversion and less thermal cycles on the wells and equipment.
- □ Ramp rates and performance exceeding expectations.
- □ Project peak rate is expected during Q4 2019.



Performance Prediction Methodology

- Simulation and Butler analytical models used to predict SAGD performance.
- SAGD analogues used to tune peak rates, ramp-up time, and SOR.





Pilot Area Reserve Volumes:

*Total Proved and Probable:



*GLJ Petroleum Consultants Evaluation (December 31, 2018)



| Pad/Area | Area (m2) | Net Pay (m) | Porosity (%) | Initial Oil Saturation (%) | OOIP, (Mm3) | Cum. Oil, Mm3 (as of Nov. 30, 2018) | Recovery, % OOIP | Expected Ultimate Recovery, (Mm3) | Ultimate Recovery as % of OOIP |
|--|-----------|----------------|-----------------|----------------------------------|----------------|--|---------------------|--|---|
| Pilot West (102P01 through 06) | 530.138 | 27 | 31% | 85% | 3.721 | 21 | 0.57% | 1.526 | 41% |
| Pilot East (102P07 - 10, 101P01 - 05) | 861,980 | 30 | 31% | 85% | 6,719 | 60 | 0.90% | 4,300 | 64% |
| Total | 1,392,118 | | | | 10,440 | | | 5,826 | |



Pilot SAGD Performance





Pilot East SAGD Performance





Pilot West SAGD Performance





Excellent Performing Well pair Example: (102P08: Pilot East Area)





Observation Well Monitoring:

- Observation Well 7, 1.2m South from 102P10 between heel & middle
- □ Steam chamber development, 5m in height 5 months after first steam.
- □ Temp and Press from Nov 30, 2018
- Pressures recorded at 201.8mSS, showing 6554 kPa are erroneous, piezometer failed.
 - Max injection pressure did not exceed 5000kPa, as alarm system in place to ensure pressure does not exceed 5000kPa.
 - Temperatures of 253°C recorded at same depth, reflect saturation pressure of ~4200kPa







Lessons Learned:

- □ SAGD Start-up Learning:
- 1. Higher pressure led to reduced circulation time.
- 2. Fiber temperature was used with 100% success rate to accelerate time to SAGD conversion (with earliest conversion at 62 days).
- 3. Difficulty killing wells due to reservoir retaining higher pressure for longer than expected, required heavier kill fluid and longer shut-in duration prior to rig operations.
- 4. Low facility downtime led to shortened circulation times (62-92 days).
- 5. Production chokes not specifically designed for solids erosion resulted in valve failures and required implantation of special monitoring and alarms, and alternate valve design.
- 6. By leveraging full fiber executed controlled heating on initial well warm ups.
- **ESP** Learning:
- 1. Initial ESP designed to accommodate peak production rates were to accommodate turndown of start-up without any early equipment failures and will be future design criteria.
- 2. No additional temperature measurement installed with ESPs as existing fiber has been successful for intake temperature monitoring-bubble tube installed with the ESP is used for downhole pressure monitoring.

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- □ 101P05, 102P01, and 102P02 First Steam in 2019 subject to project capacity/well performance
- □ 4D seismic acquisition in 2020.
- □ No abandonments planned in the next five years.

Agenda – 2. Surface Operations



| 2.1 | Facilities |
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2.1 Facilities – Plot Plan





2.1 Facilities – Plot Plan





2.1 Facilities – 3D View











2018 Facilities Overview

Plant Construction and Commissioning

- □ Construction resumed in Q1 2018 to allow operations to begin in Q2 2018.
- □ Main modifications were the addition of bypasses, control valves, and the final completion of other piping and equipment that were not installed during the original construction.
- □ Final construction of the facility was completed by Q3 2018.

Plant Performance

- □ Commissioning of the facility was started in Q2 2018 with final commissioning of the last major unit operations in Q4 2018.
- □ First Steam to wells was in June 2018.
- □ 12 of 15 well pairs were started over the two well pads with 10 of 12 then converted to ESP production.
- \Box As of Q4 2018, production peaked to over 1,113 m³/day of bitumen.
- Most equipment is achieving high reliability in the early stages with the ramp up exceeding expectations.

2.1 Facilities



Plant and Well pad Operational Issues and Activities

Successes

- Ramp up of Bitumen Production
- High Reliability of Equipment (99%+)
- Inlet Separation Consistency
- Water Treatment and Reuse Commissioning and Operation
- Diluent Recovery System Commissioning and Operation (> 98% recovery of diluent)

□ Challenges:

- $\circ~$ Well pad 102 Choke Valve erosion
- Vapor Recovery Unit (VRU) solids buildup and flaring
- $\circ~\mbox{Trucking logistics}$



Bitumen Production





Steam Injection



Month



Produced Water




Natural Gas from TCPL



73



| 2.1 | Facilities |
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2.2 MARP



2018 MARP Overview

- The updated MARP was submitted and approved in 2017 in accordance with AER Directive 042 requirements.
- MARP has been continually reviewed during the startup process to ensure that the meters are performing as expected.
- During the ramp up of the plant in the last 6 months, proration factors and proper water cuts via the AGAR analyzers at the pads and manual samples have been worked on continually to ensure they are as accurate as possible.
- MARP meter temperature and pressure compensation has also been continuously improved for regulatory volume totalizing including the water balance.

Compliance with regulations

□ Meters will be calibrated as per the requirements within Directive 017.

Solvent and gas injection

□ No immediate plans to use solvent.

2.1 Facilities





Production Sampling

Harvest OPERATIONS CORP.

- □ AGAR's with sampling stations are in place.
- Significant bitumen volumes (oil cuts >10%) were not anticipated until after circulation, allowing time to calibrate meters. Meters have been calibrated twice. Calibration is supported by grab sample cuts.
- □ Single meter for multiple well pairs will help meter calibration. Only 2 AGARs will make oil cut measurement consistency easier.
- □ Chlorides are being used to monitor performance/optimize steam/validate cuts.







2018 MARP Overview

- Well production and injection volumes are estimated by the use of Coriolis meters (emulsion) and vortex meters (injection) for each well as the raw data check for the well tests
- BlackGold utilizes one test separator per pad that automatically cycles through each well on the pad. Well test duration can be altered. Pad 102 wells (8 wells) are tested at 2 per day, 4 days between well tests. Pad 101 wells (4 wells) are tested at 2 per day, 2 days between well tests.
- Typically each well will be in test for 85 hours per month. Test separators are used continuously.
- Well testing validations are completed once per week per pad within the Energy Components software by the engineering team.
- □ This data is rolled up and balanced with the facility production and injection volumes to determine month end pro-rations prior to submission to Petrinex.



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2.3 Water Sources and Uses







Fresh Water Well

- \Box Well test was previously completed and estimated to generate approximately 600 m³/d.
- LSD: 07-14-076-07W4/ ABWS 0149324: TDL: 00413718

List of Brackish Water Wells Completed in the Clearwater B Formation

- □ 1F1/01-11-076-07W4/0 (Main Source well 802A)
- □ 1F1/07-11-076-07W4/0 (Main Source well 801A)
- □ 100/01-11-076-07W4/0 (Backup Well 802B)
- 100/07-11-076-07W4/0 (Backup Well 801B)

Volume of Saline Water

□ The volume of brackish/saline water required for steaming operations is about 608 m³/d for normal operation.

Saline Source Water Well Production Test commenced (Oct 2016)

- □ The total volume of water produced was measured by flow meter installed in the well common header (801-FIT-0104 and 802-FIT-0104) and in CPF (80-FIT-0163) including flow totalizers.
- □ Separate casing vent gas measurements were executed between June, 2018 and October, 2018 to establish brackish source well gas rates. (GLR)

2.3 Water Sources and Uses - Steam Injection Harvest

BlackGold Source Water Use (m3/d)



□ Fresh water inventories were utilized for commissioning and startup.

2.3 Water Sources and Uses





2.3 Water Sources and Uses – Casing Gas



- □ Casing gas vented to atmosphere-rate measurement by 3rd party
- □ 3rd party testing completed October, 2018.
- □ Wells are being operated to maintain gas vent rates below 500 m3/day per well





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□ The water treatment technology is a high pH Mechanical Vapour Compression (MVC) evaporator with a crystallizer and solid forming equipment.

Evaporator Process

- □ The feed water enters the steam stripping de-aerator, which has five stages of separation that lowers the dissolved oxygen level to less than 7 parts per billion.
- □ The split-sump design minimizes energy consumption by evaporating roughly 70% of the total distillate flow in the first stage, or split.
- The remaining 30% of the total distillate flow is produced in the second split under slightly more rigorous operating conditions. Combined distillate from two splits flows through a common distillate collection line.





2.4 Water Treatment Technology

Crystallizer Process

- The liquid waste, or blow-down, from the Evaporator unit is collected in an agitated Crystallizer feed tank.
- The brine is heated a few degrees as it passes through the heater and flashes when it re-enters the vapour body.
- The vapour produced is collected in the vapour body, passes upward through an entrainment separator, and enters the suction side of the rotary lobe type vapour compressor. The vapour is transferred to the shell side of the heater where the vapour condenses, providing the thermal driving force for evaporation. The condensed vapour is collected in the condensate tank and transferred to the evaporator feed tank.
- To control the recirculation brine solids level, a slipstream is removed from the crystallizer recirculating brine and sent to the Crystallizer Waste Tank where it is continually mixed and recirculated to maintain suspension of the solids.







- Performance of the industrial waste water treatment plant has been as expected.
- The Directive 081 Disposal Limit calculated for the facility is 15.6% with the facility Actual Disposal of 0.93%.
- □ The Directive 081 Produced Water Recycle for the facility was 98.6%.
- □ Brackish Water is the predominant make-up source for steam generation.
- □ Fresh Water inventory was utilized for commissioning and start-up of the steam generator.
- Fresh Water was licenced as make-up under a Temporary Diversion Licence (TDL).
- An additional TDL for surface water was sourced for dust suppression from a Borrow Pit located on SML 090073 located north of the CPF.



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- □ There are no disposal wells or land fills associated with the BlackGold Project.
- □ All waste streams are transported offsite within Alberta to AER approved third party waste management facilities.
- □ Waste water streams include crystallizer waste, evaporator waste, produced water in slop oil, and any wash water collected in the facility.
- □ Slop oil was transported to AER approved waste management facilities for recovery.
- □ Third party waste receivers include Tervita, White Swan Environmental Ltd., Secure Energy Services and CNRL.
- □ The BlackGold Project is designed to utilize a proprietary cement plant process as part of its industrial waste water management system.
- □ To date commissioning of the cement plant has not been successful and Harvest will re-evaluate the need for commissioning the cement plant in the later half of 2019.
- □ Solid waste and waste fluids (i.e. sewage, sludge, etc.) produced at the facility trucked out to third party disposal facilities.



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2.6 Sulphur Production – Emissions



- □ Peak SO₂ Emissions were 0.15 tonnes on October 25 during a VRU outage.
- \Box Average SO₂ Emissions During Q3 were 0.0018 tonnes/day.
- **D** Plant Total SO_2 = Flared SO_2 + SO_2 Steam Generator.
- □ The Glycol Heater is supplied by purchased sweet fuel gas.
- □ Steam circulation of well pairs commenced in June of 2018.
- **ESP** conversion commenced in late August and was finalized in October.
- \Box It is expected SO₂ emissions will increase as production ramps up to nameplate rates.
- □ SO₂ production is well below the EPEA Approval emission limits of 0.75 tonnes/day
- □ Sulphur production is well below the 1 tonne/day limit
- \Box Harvest will continue to monitor monthly produced gas H_2S concentrations and sulphur emissions.

| | Total Sulphur Emissions |
|---------|--------------------------------|
| | SO2 (t) |
| Q4 2017 | 0 |
| Q1 2018 | 0 |
| Q2 2018 | 0.00 |
| Q3 2018 | 0.17 |

2.6 Sulphur Production



□ There are no sulphur recovery facilities at the BlackGold Project.





| 2.1 | Facilities |
|-----|-----------------------------------|
| 2.2 | MARP |
| 2.3 | Water Sources and Uses |
| 2.4 | Water Treatment Technology |
| 2.5 | Water and Waste Disposal |
| 2.6 | Sulphur Production |
| 2.7 | Environmental Issues & Compliance |
| 2.8 | Surface – Future Plans |



□ Harvest has not identified any compliance issues with regards to regulatory approval conditions related to the development of the BlackGold Project.



- Temporary Diversion Licence from existing fresh water well completed into the Undifferentiated Quaternary Sediments was authorized on May 1, 2018 as an alternate make-up supply to the saline source.
- Temporary Diversion Licence to utilize surface water for dust suppression on roads undergoing maintenance and upgrades, May 24, 2018.
- □ OSCA Approval 11387G received June 15, 2018 for increase of maximum operating pressure for thermal well pairs to 5MPa during SAGD Operation.
- □ D56 Facility Licence Amendment authorized to update the approved electrical compression capacity at the central processing facility.
- □ Oil Sands Exploration Program OSE180046 Authorized on November 23, 2018.
- BlackGold 4D Seismic Program GEO 180081 Authorized December 10, 2018.

2.7 Environmental Monitoring

Harvest

- Harvest commenced operational monitoring in 2018
- Wetland and Waterbody Monitoring Program
 - Installation of monitoring plots and wells for wetland monitoring.
 - First year of monitoring complete, program progress was updated with the AER in December.
- Wildlife and Caribou Mitigation and Monitoring Programs
 - Camera monitoring program on above ground pipeline crossings.
 - Employee wildlife card program.
 - Comprehensive Wildlife Report was submitted in September 2018 and SIRs responded to in December.\
 - CPP (Caribou Protection Plan)
- Soil Monitoring Program Proposal
 - Authorized in January 2018.
 - Baseline monitoring program executed in April 2018 prior to commencement of operation.
 - No significant impacts were identified.
 - Soil management program not required.
- Ground Water Monitoring Program
 - Program includes near surface and thermal effects monitoring wells.
 - Additional near surface monitoring wells were installed in April.
 - Semi-annual groundwater monitoring events occurred.





Air Emissions Monitoring

- Monthly passive air monitoring around the facility for SO₂ and H₂S indicated compliance with the AAAQG's.
- Continuous emissions Trailer Monitoring was completed prior to commencement of operation from December 2017 to the end of February 2018 with results indicating compliance with the AAAQG's.
- Continuous emissions trailer monitoring during operations results indicate compliance with the AAAQG's.
- Manual stack testing was completed for the Glycol Heater and the Steam Generator and results indicate compliance with the NO_x requirements of Table 3.1 of the EPEA Approval.

□ Continuous Emissions Monitoring Program (CEMS)

- One CEMS package is located on the steam generator exhaust stack for measurement of NOx.
- Stack sampling ports were modified to be compliant with the Alberta CEMS Code and Alberta Air Monitoring Directive prior to commissioning of the steam generator exhaust stack.
- AER authorization received to not utilize unreliable CEMS data in June and early July.
- CEMS component reliability and uptime has been steadily improving as issues are identified and resolved .
- CEMS certification was postponed in November 2018 due to maintenance issues with the Wet O_2 Analyzer.
- A variance was requested from and granted by the AER to extend the certification period for the CEMS unit.
- All data was reported as pre-certification data.

Surface Water Monitoring

- Industrial runoff monitored and tested prior to release and reported annually.
- Industrial runoff parameters meet the limits established in Table 1 of the EPEA Approval.
- Water use reporting for dust control and for steam generation for Temporary Diversion Licences.

Releases



- □ Harvest tracks all non-reportable spill events within the corporate incident tracking system.
- All incidents are reviewed internally to identify casual factors and to ensure that corrective actions are taken.

| Substance | Number of incidents | Total Volume (m3) | AER Notification | Release Location |
|-----------|---------------------------|-------------------------|--|-----------------------------------|
| Glycol | 1 | 0.41 | Release Report and Remediation Reports Submitted | CPF |
| Emulsion | 1 | 6.5 | Release Report and Remediation Reports Submitted | Well Pad 102 production building. |
| Diluent | 1 | 35.4 | Release Report and Remediation Reports Submitted | KM 137, LSD 08-23-073-09 W4M |

- Harvest
- The Reclamation Monitoring Program was submitted on January 15, 2018 and authorized on May 9, 2018.
- □ The Project Level Conservation and Reclamation Program was submitted on October 30, 2017 and authorized on July 3, 2018.
- □ Since the BlackGold Project commenced operations in 2018 as per the PLCRCP reclamation of project development areas is not planned for the next 5 years.
- □ Harvest is compliant with the Alberta Oil Sands Monitoring Program.
- □ Participation in the Alberta Biodiversity Monitoring Institute's 2017 monitoring program.
- □ Harvest is a member of the Explorers and Producers Association of Canada.



| 2.1 | Facilities |
|-----|-----------------------------------|
| 2.2 | MARP |
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| 2.8 | Surface – Future Plans |

2.8 Surface – Future Plans

Harvest

- □ BlackGold completion key dates and timelines:
 - December 2017, construction resumes.
 - Q2 2018, first steam generated.
 - Q3 2018, Electric Submersible Pump (ESP) installations completed.
- □ NG Co-injection application in 2019.
- Debottleneck the existing facility in 2019.





| | Average BHP (kpag) for only days where steam injection occurred-BHP is uncorrected | | | | s uncorrected | |
|-------------|--|------|--------|-----------|---------------|----------|
| Wellpair | gauge blanket gas readings | | | | | |
| | June | July | August | September | October | November |
| 101 pair 1 | 4500 | 5115 | 4957 | 4610 | 4622 | 4396 |
| 101 pair 2 | 4266 | 5094 | 5099 | 4172 | 4873 | 4986 |
| 101 Pair 3 | 4300 | 5090 | 5090 | 4497 | 4725 | 4702 |
| 101 pair 4 | 4667 | 5094 | 5115 | 4464 | 5030 | 5015 |
| 102 pair 3 | 4506 | 4841 | 5027 | 4559 | 4618 | 4355 |
| 102 Pair 4 | 4360 | 4915 | 5071 | 4539 | 4651 | 4502 |
| 102 Pair 5 | 4420 | 4026 | 5070 | 4481 | 4713 | 4314 |
| 102 Pair 6 | 4400 | 5068 | 4943 | 4506 | 4697 | 4590 |
| 102 Pair 7 | 4800 | 5096 | 4983 | 4648 | 4692 | 4603 |
| 102 pair 8 | 4615 | 5090 | 4970 | 4602 | 4660 | 4548 |
| 102 Pair 9 | 4630 | 5050 | 4908 | 4457 | 4468 | 4432 |
| 102 Pair 10 | 4650 | 5037 | 4973 | 4639 | 4575 | 4371 |

□ Observation Well 1 Thermocouple Placement

AS-BUILT











□ Observation Well 2 Thermocouple Placement









Temperature (C)

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OBS-1

OBS-7

OBS-5

□ Observation Well 3 Thermocouple Placement








Temperature (C)

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OBS-7

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Observation Well 4 Thermocouple & Piezometer Placement





Observation Well 4 Temperature Data



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OBS-7

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Observation Well 4 Pressure Data



OBS-1 OBS-2 OB

Observation Well 5 Thermocouple Placement









Temperature (C)

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OBS-2 OBS-1

OBS-7

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□ Observation Well 6 Thermocouple & Piezometer Placement









Temperature (C)

Observation Well 6 Pressure Data



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OBS-7

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□ Observation Well 7 Thermocouple & Piezometer Placement











□ Observation Well 7 Pressure Data



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OBS-1

OBS-5

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□ Observation Well 8 Thermocouple Placement









Temperature (C)

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OBS-2 OBS-1

OBS-7

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□ Observation Well 9 Thermocouple & Piezometer Placement AS-BUILT















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OBS-2 OBS-1

OBS-7

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□ Observation Well 10 Thermocouple Placement





Observation Well 10 Temperature Data





Observation Well 10 (102/04-12-76-7W4M) Thermocouple Data

□ Observation Well 11 Thermocouple Placement





Observation Well 11 Temperature Data



Temperature (C)

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OBS-2 OBS-1

OBS-7

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□ Observation Well 12 Thermocouple Placement





Observation Well 12 Temperature Data



Temperature (C)

085-7 085-7 085-7 085-7 085-7 085-2 085-3 085-3 085-4 085-4 085-4 085-4 085-4 085-4 085-4 085-6 Legend: \$ 085-6 Legend: \$ 085-6 \$ 085-6 \$ 085-7