

# BlackGold Oil Sands Project

## *Directive 054* 2022 Annual Performance Report

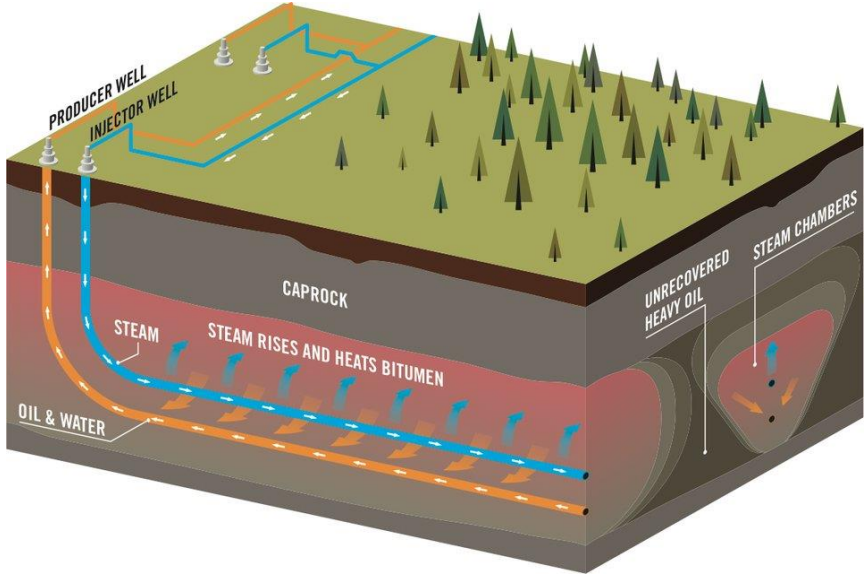
## Commercial Scheme Approval No. 11387

**February 2, 2024, Update**

# Introduction

# Background

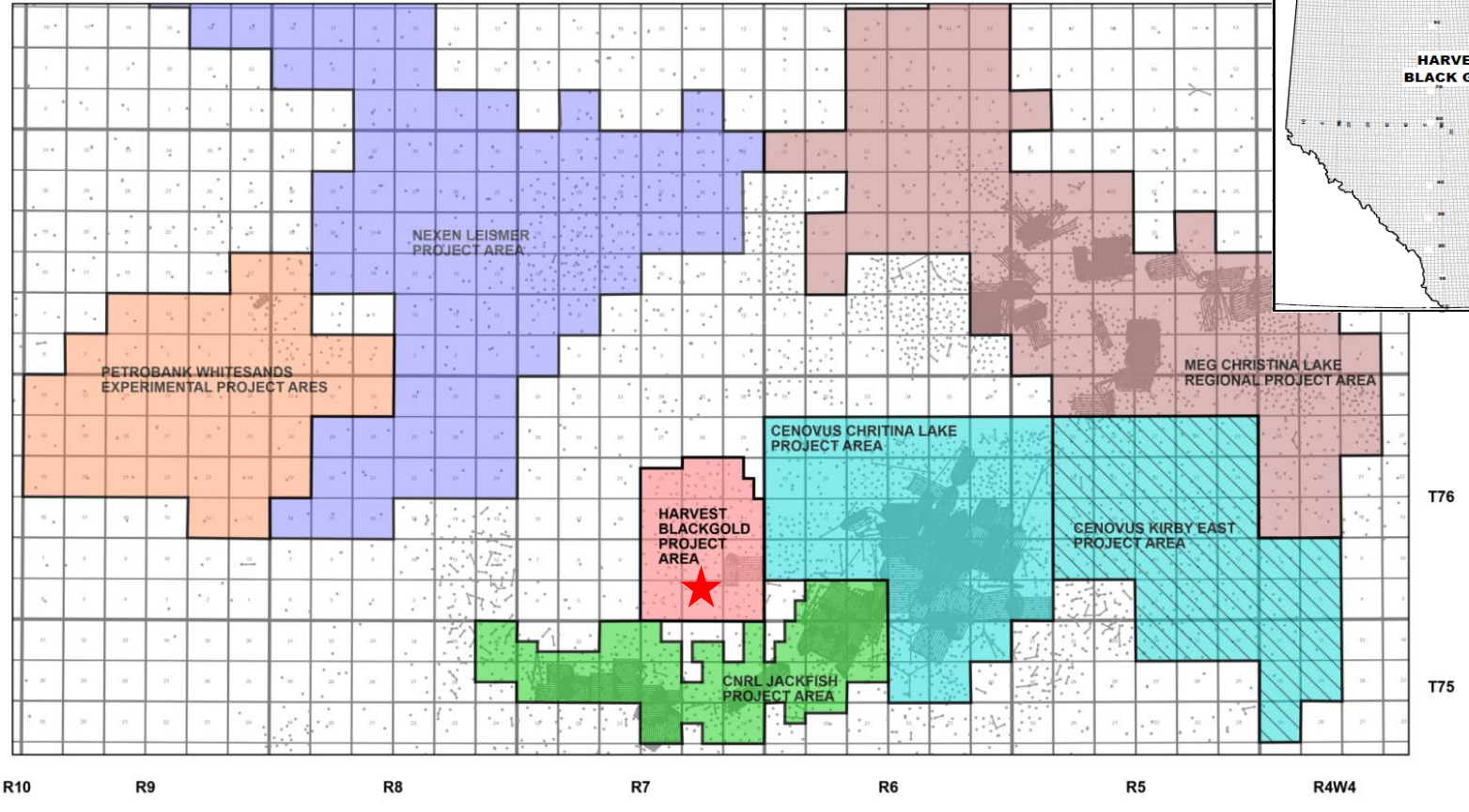
- BlackGold is a steam-assisted gravity drainage (SAGD) project owned and operated by Harvest Operations Corp.
- Phase 1 Commercial Scheme Approval received in 2010 for 1,590 $m^3/d$ bitumen production on an annual average basis
- Phase 2 approved in 2013 for an additional 3,180 $m^3/d$ (4,770 $m^3/d$ total) bitumen production
- Phase 1 became operational in 2018
- Phase 2 has not yet received final investment decision (FID)




**SAGD Recovery Process**

# Location

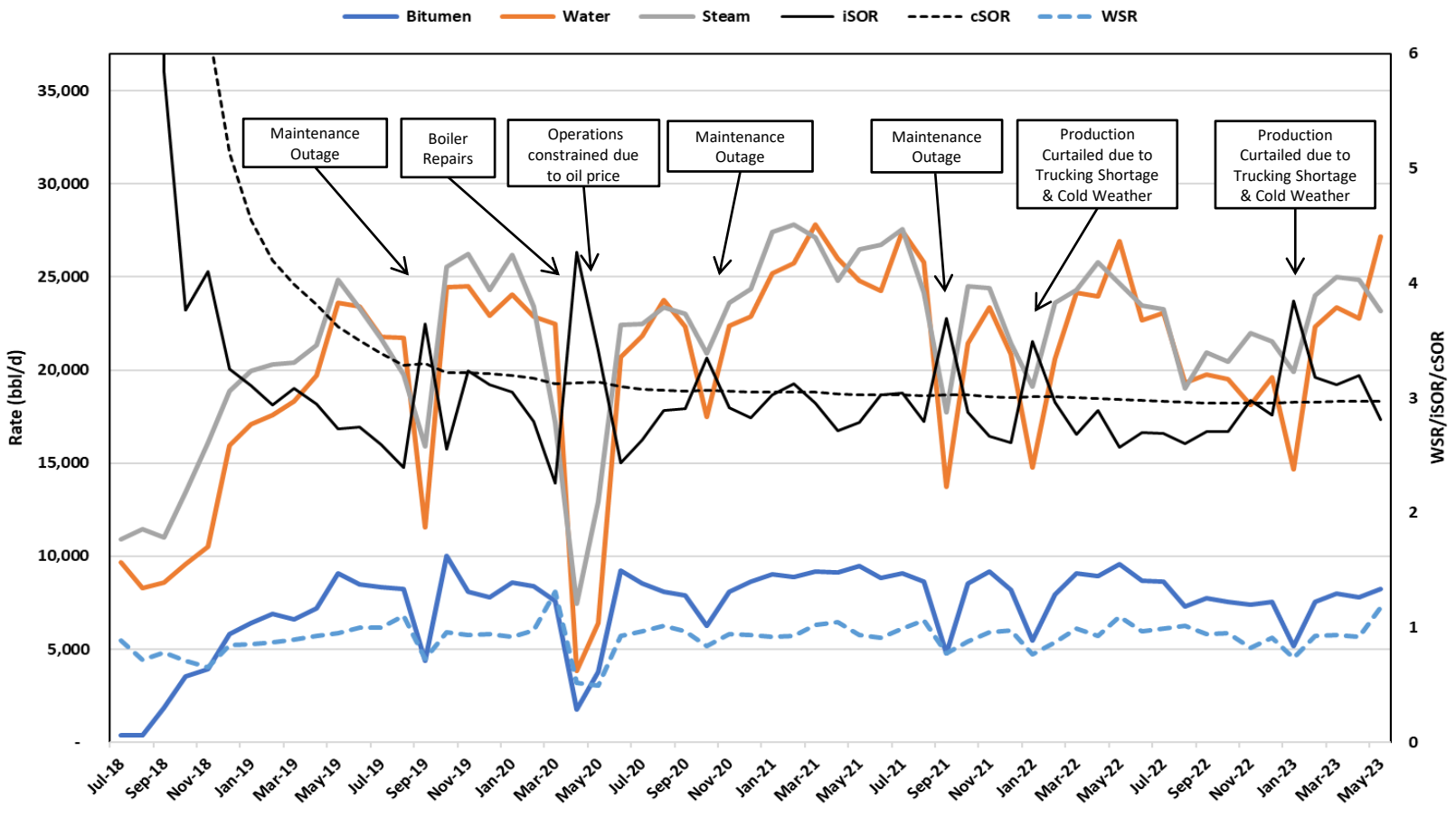
- Project area covers 12 sections of land in 76-7-W4M, approximately 10km southeast of Conklin, Alberta



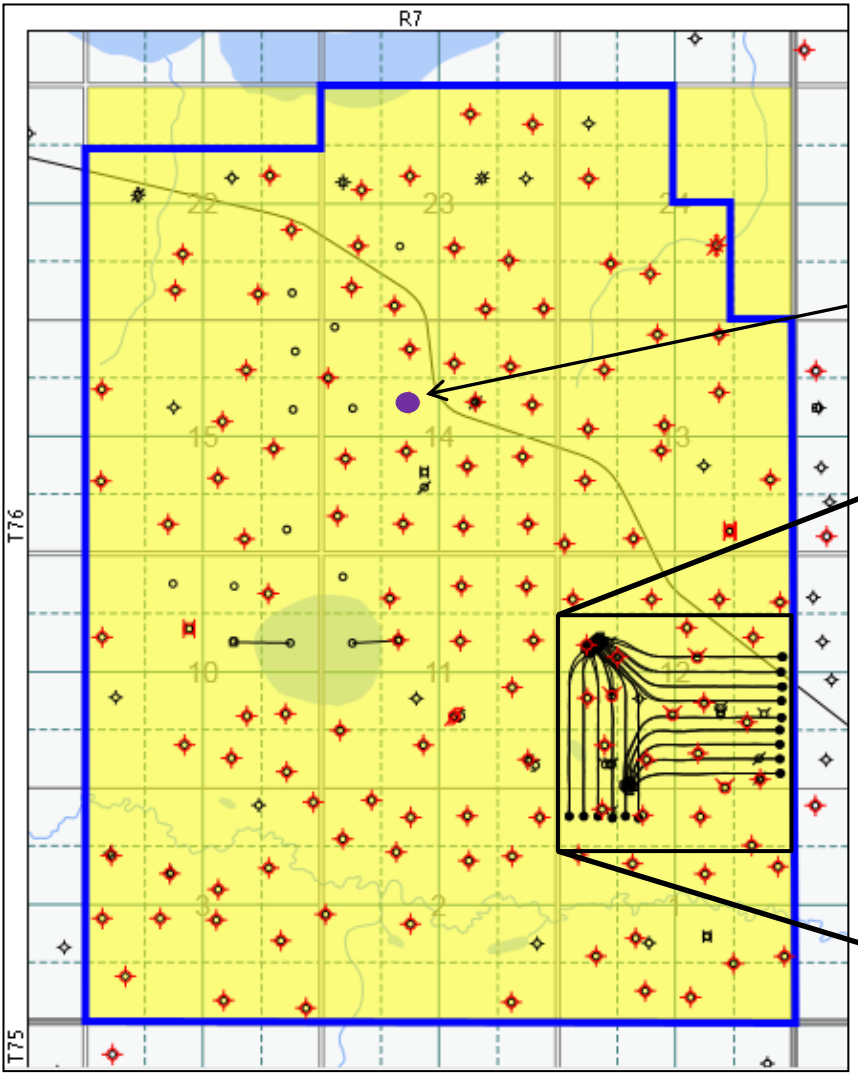
# Directive 054 Section 4.2

# Subsurface

# Scheme Performance



# Drainage Patterns

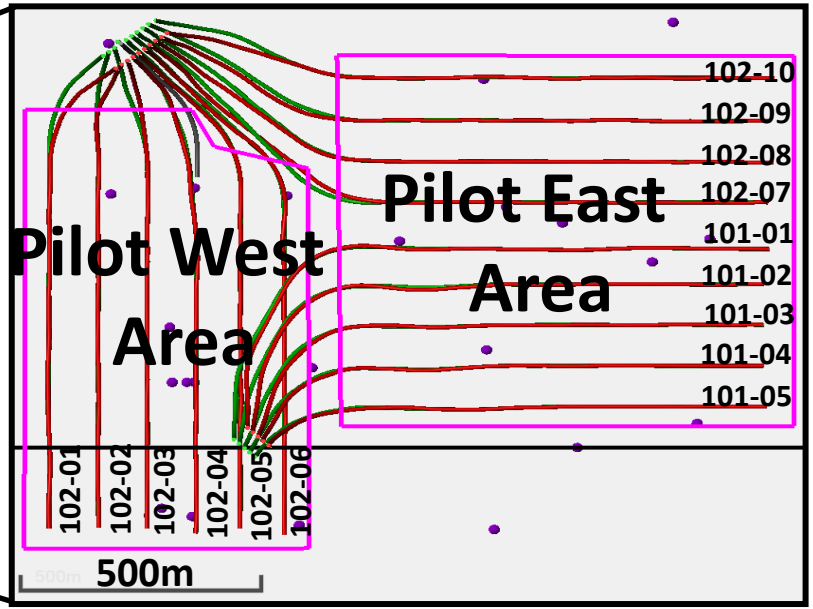



Stratigraphic
Reference Well
1AA/11-14-76-7W4

Legend

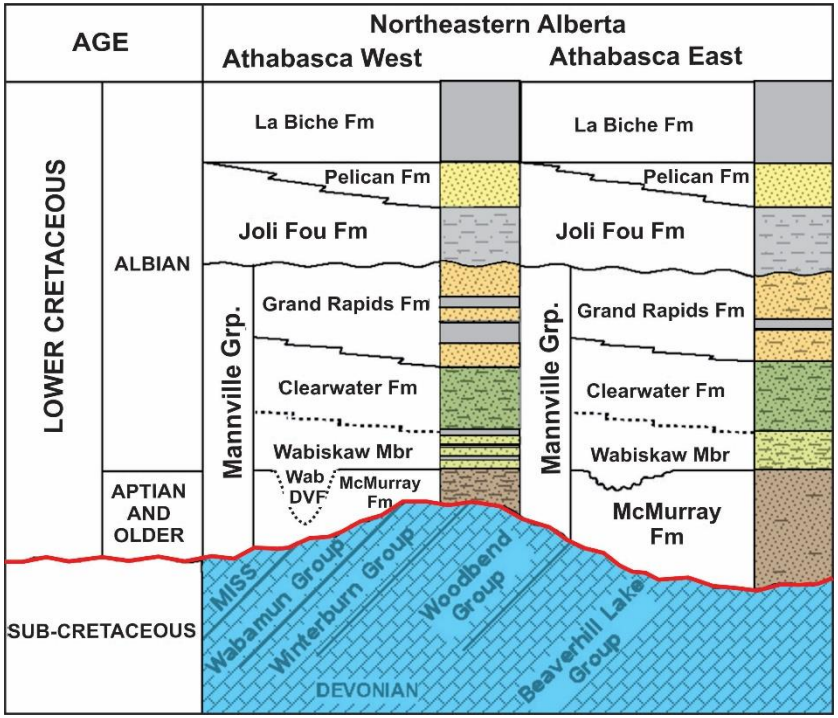
: Project/Development Area

: Well with core (131 wells)



# BlackGold Stratigraphy

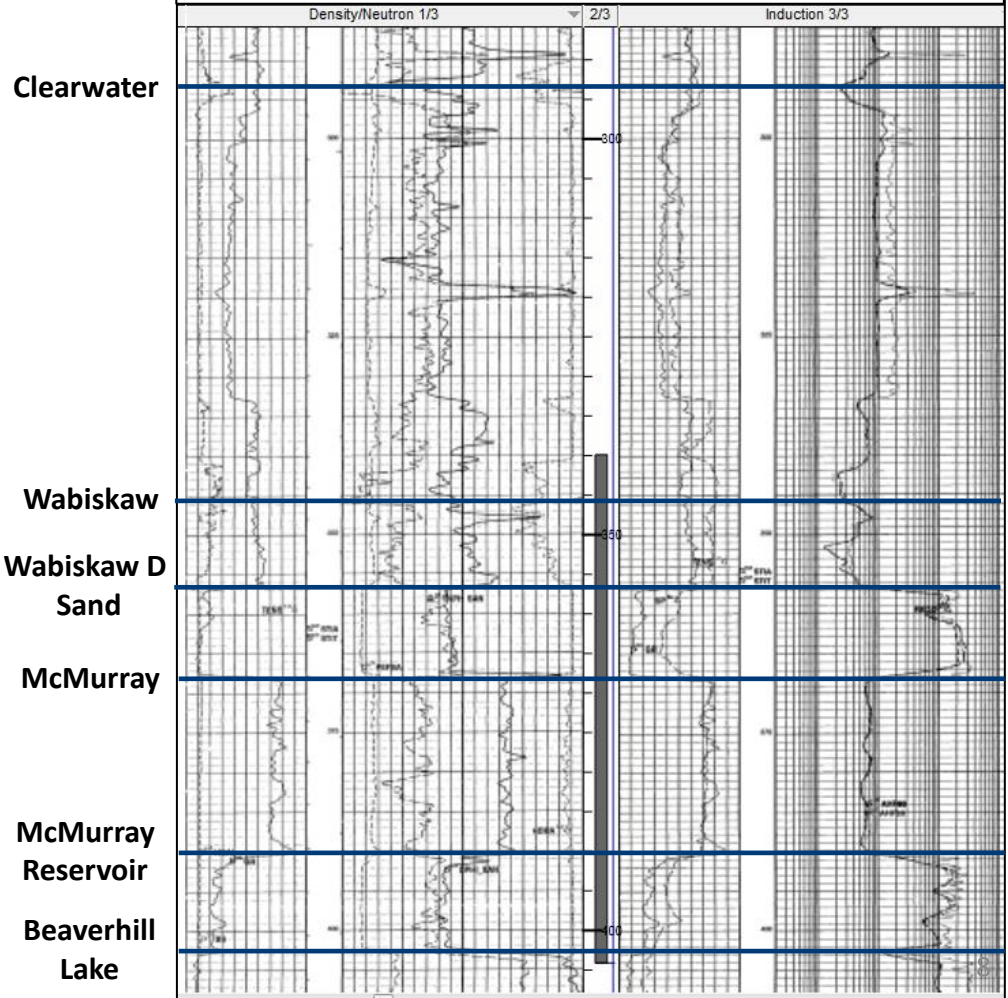
## Stratigraphic Column



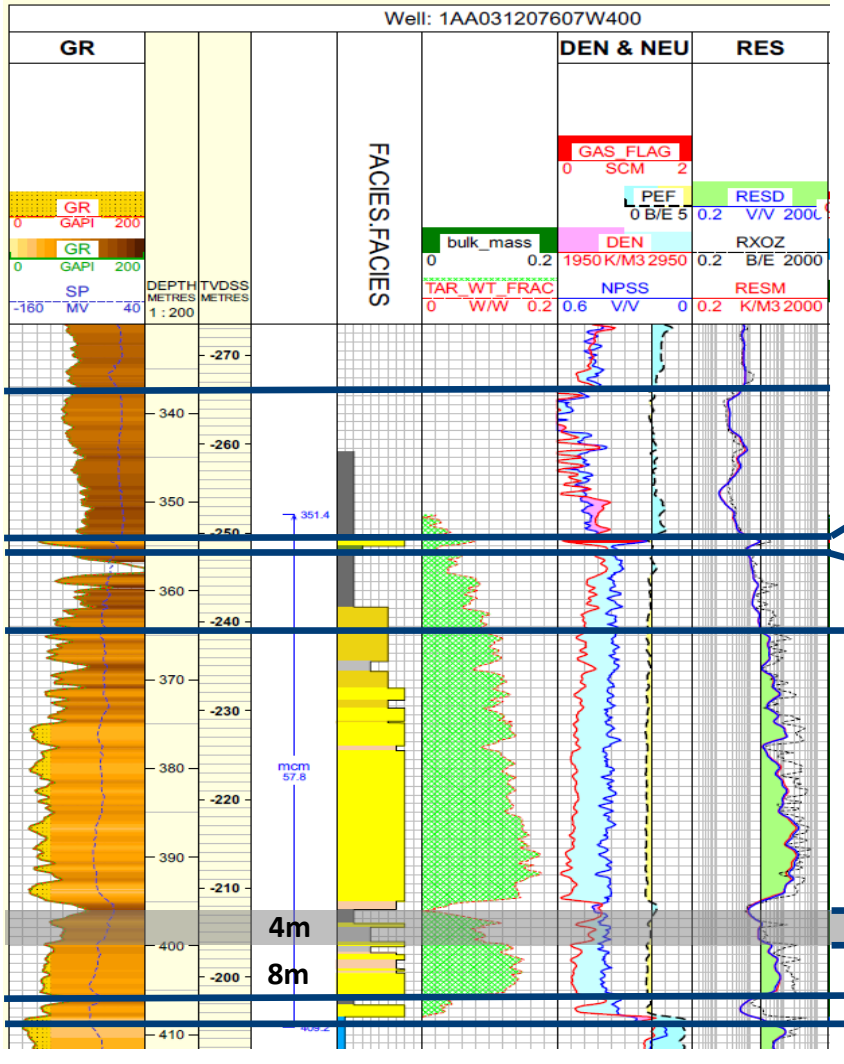

Source: Wightman & Pemberton, 1997

## Stratigraphic Reference Well

## 1AA/11-14-76-7W4M



# BlackGold SAGDable Net Pay Definition

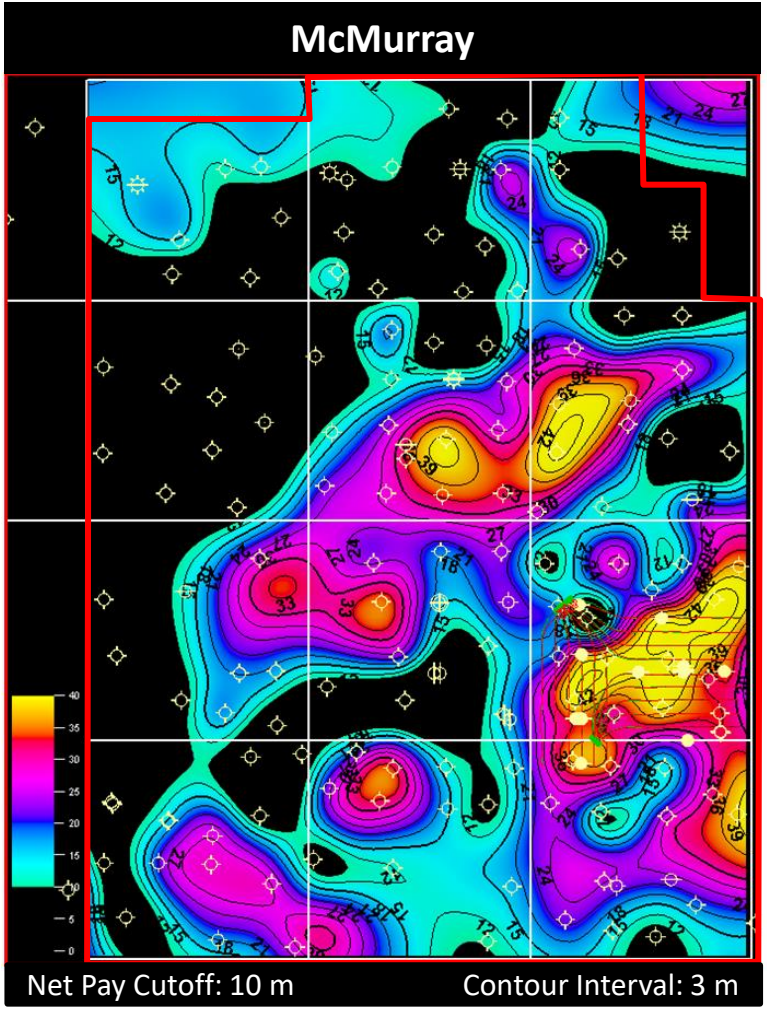


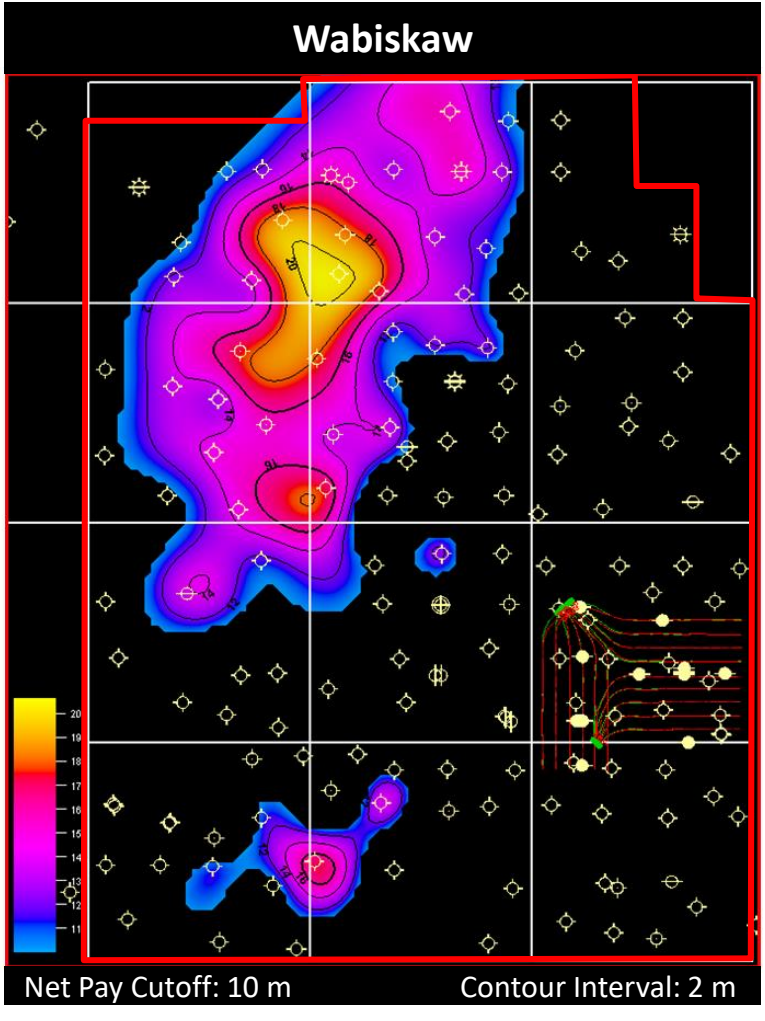

Net Pay Criteria:

- Resistivity (RT) >= 20 ohm-m
- Porosity (DPSS) >= 27%
- > 10 m continuous net pay
- No continuous breaks > 1 m

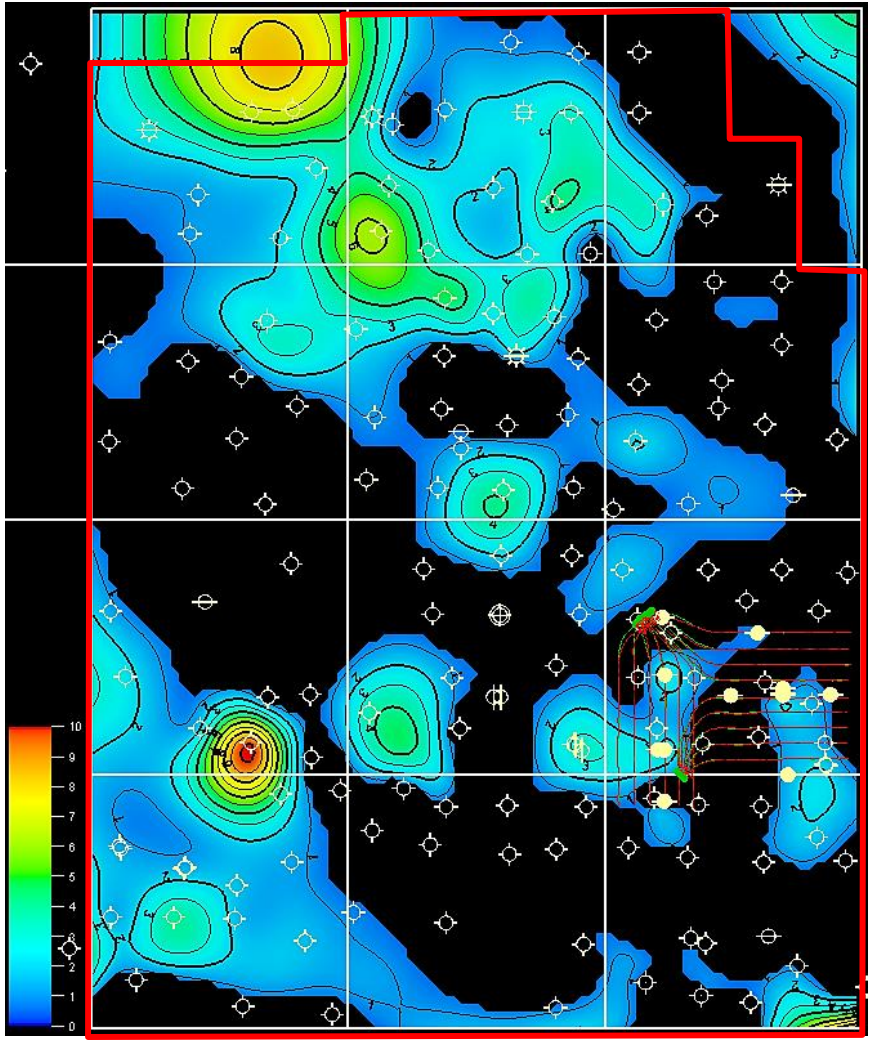
**NOTE:** 10m continuous pay is defined from cores, images and well logs. Not all shale breaks are continuous

# McMurray and Wabiskaw SAGDable Net Pay



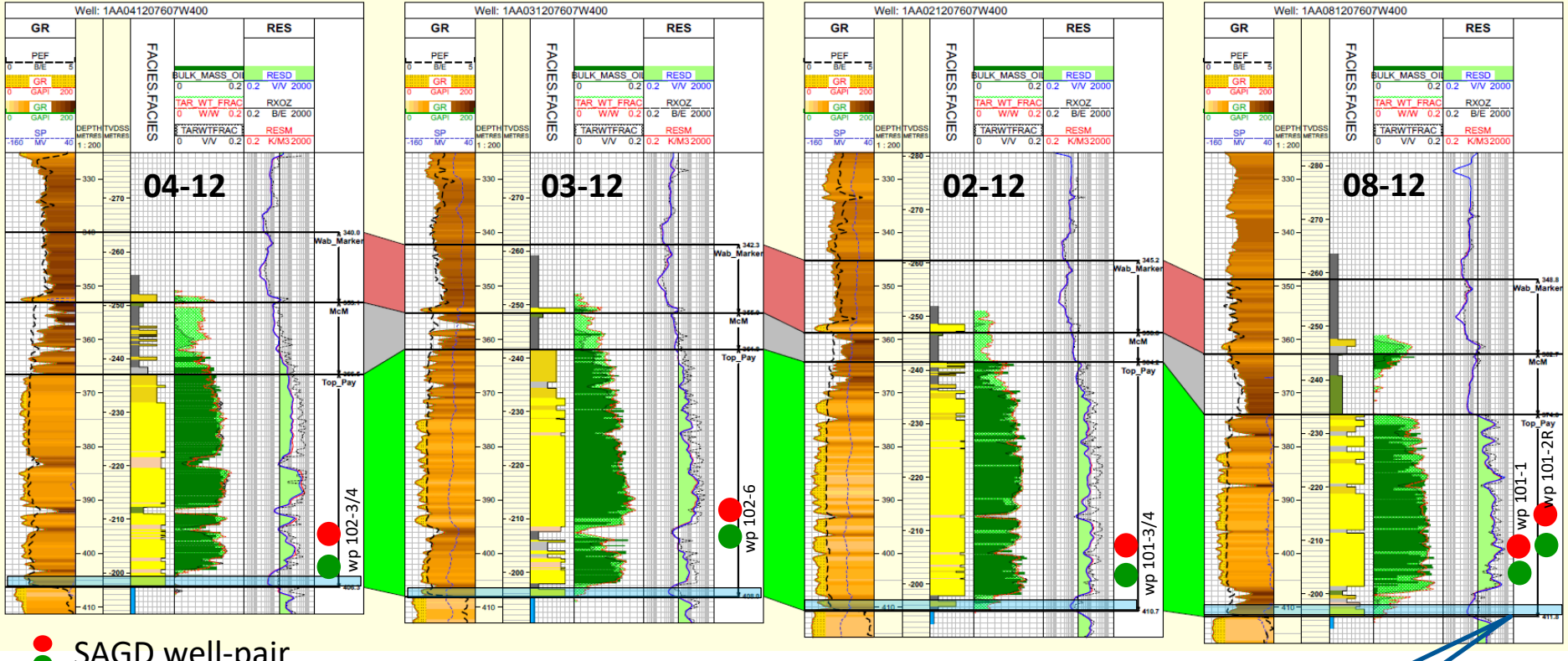
# McMurray Bottom Water Isopach




- Localized bottom water present over project/development area
- No McMurray formation top gas identified

Contour Interval: 1 m
Project Area:

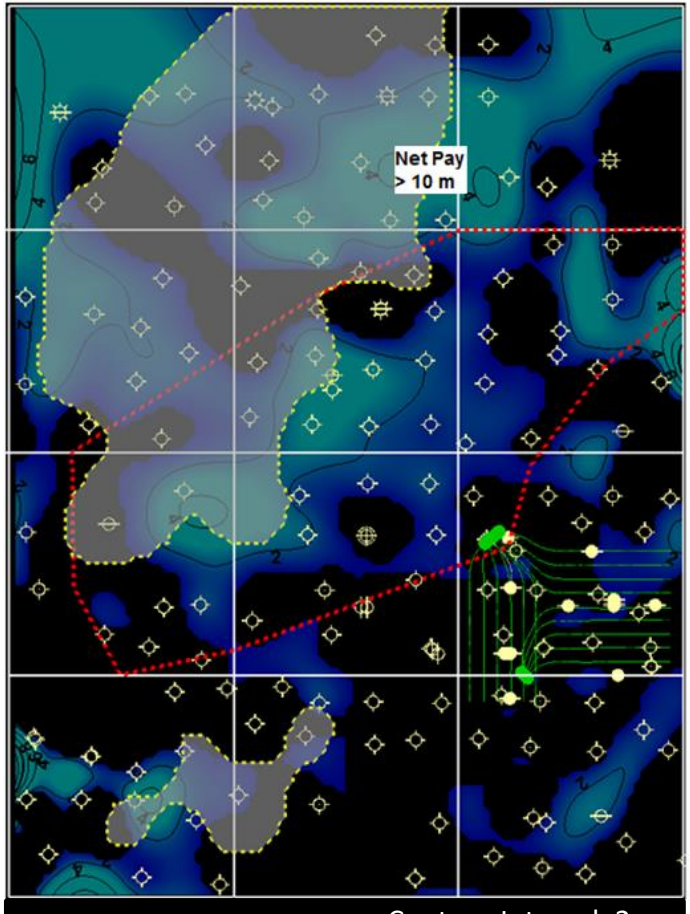
# McMurray Bottom Water




- Bottom water is generally localized and thin, and is usually either vertically distant or stratigraphically separate from identified SAGDable pay

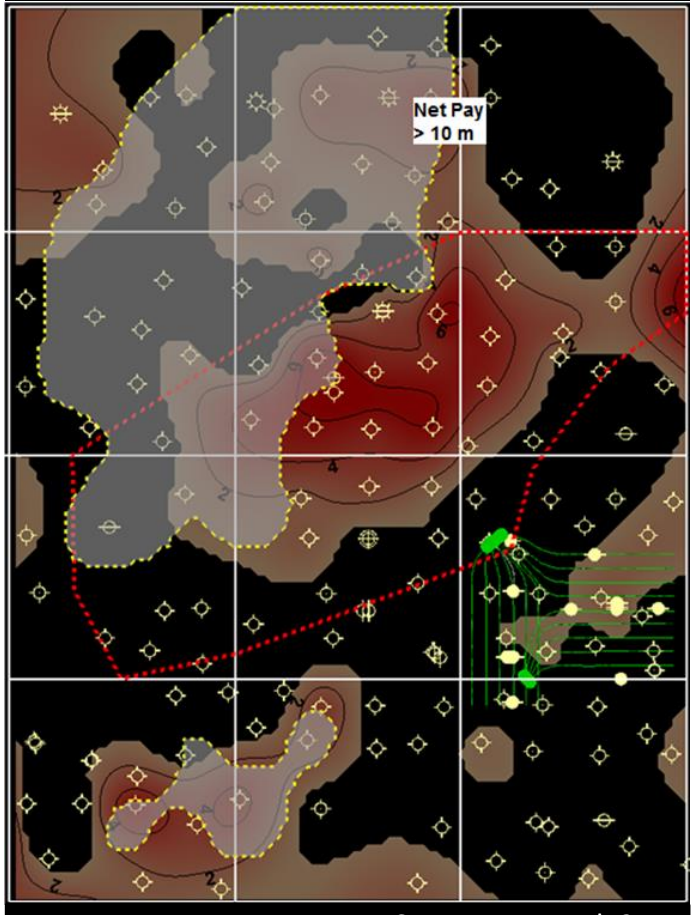
# Wabiskaw Top Water and Top Gas Isopach

## Top Water




Contour Interval: 2 m

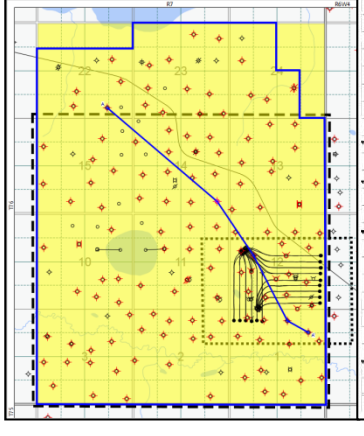
## Top Gas

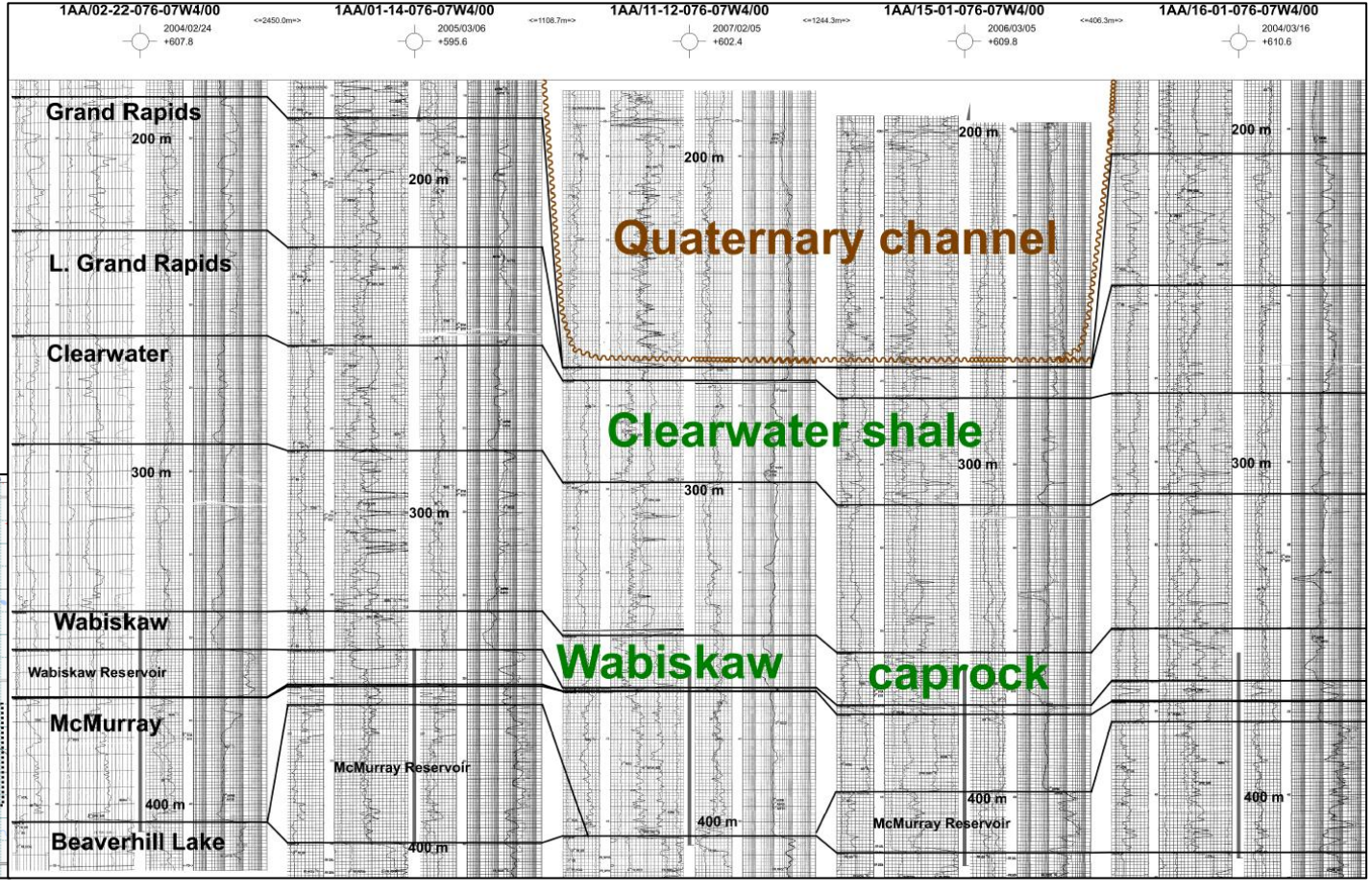



Contour Interval: 2 m

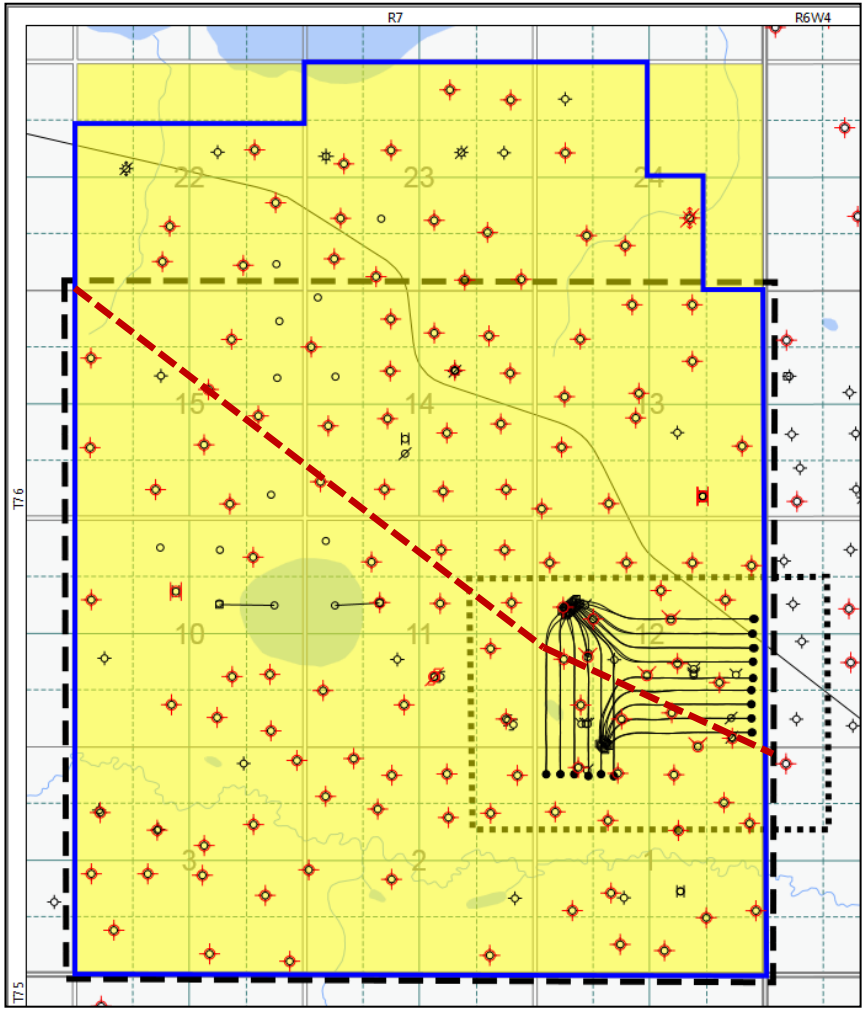
# Geomechanical Anomalies

- No karsting in project area
- No salt dissolution
- Quaternary channel does not incise Clearwater shale, or Wabiskaw caprock
- Datum: sea level





# Seismic 3D and 4D location




Project Area

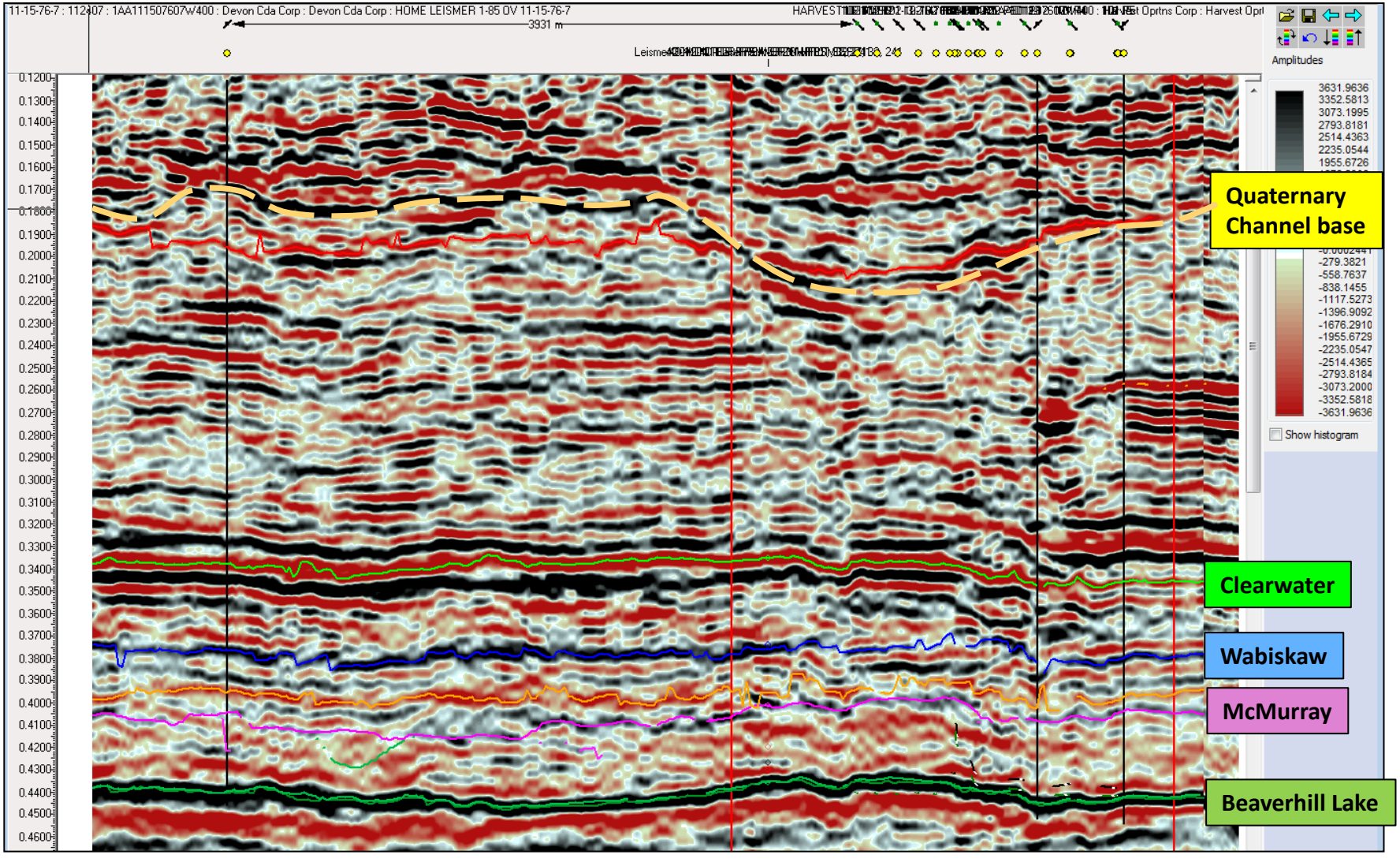
3D Seismic (23 km$^2$) 2007

4D Seismic (4.5 km$^2$)
Baseline: 2012
Monitor: 2020*

Seismic example

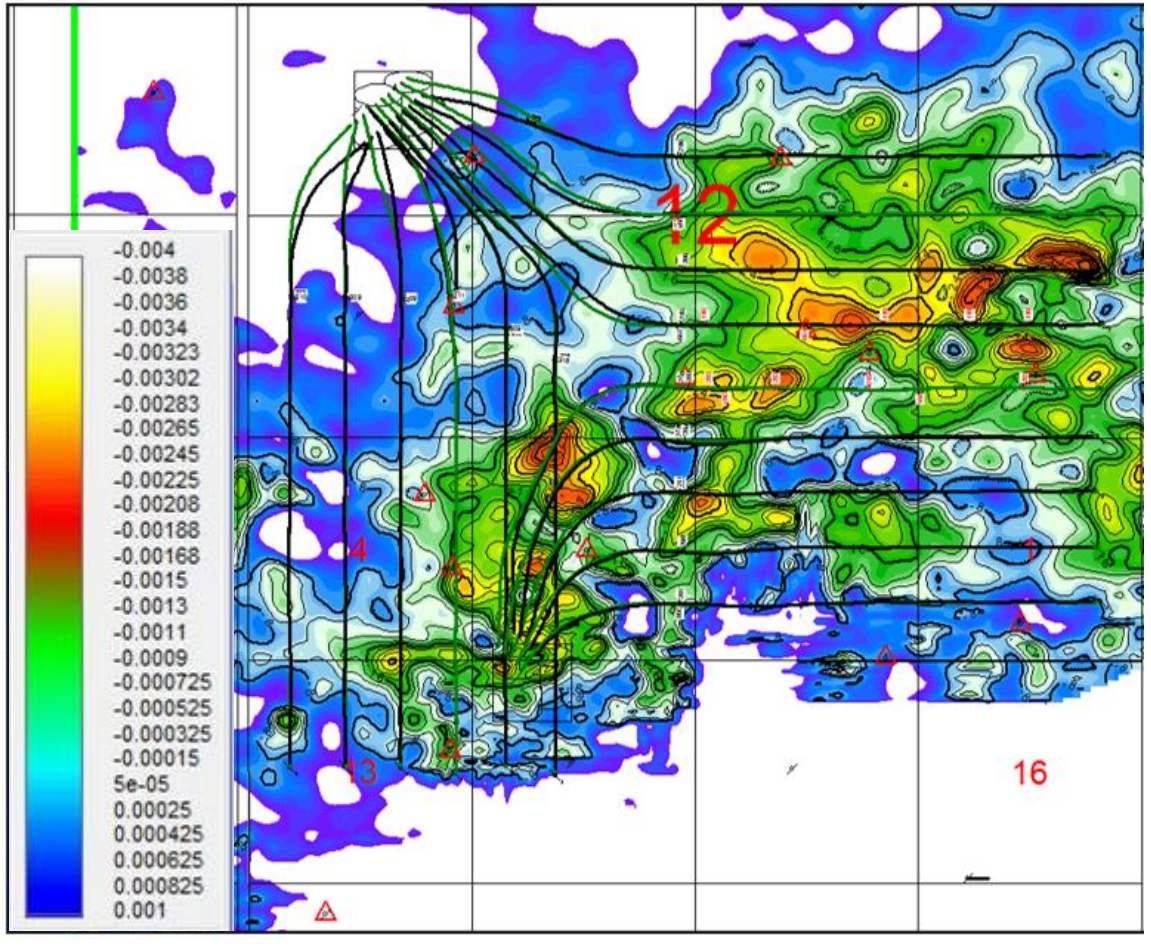
* 2020 was last seismic acquisition

# Example Seismic Line from 3D

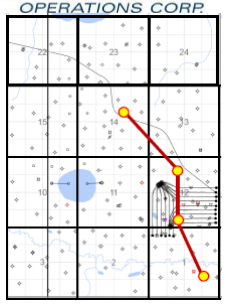


# 4D Seismic

- Reservoir heating by steam injection decreases sonic velocity of “heated zone”, resulting in depressed Beaverhill Lake (BHL) formation top in time domain (2020 BHL 2-way time > 2012 BHL 2-way time).
- No 2022 update
- Map is BHL time 2012 – BLH time 2020. Scale is seconds.
- Negative numbers show increase in 2-way travel time due to reservoir heating

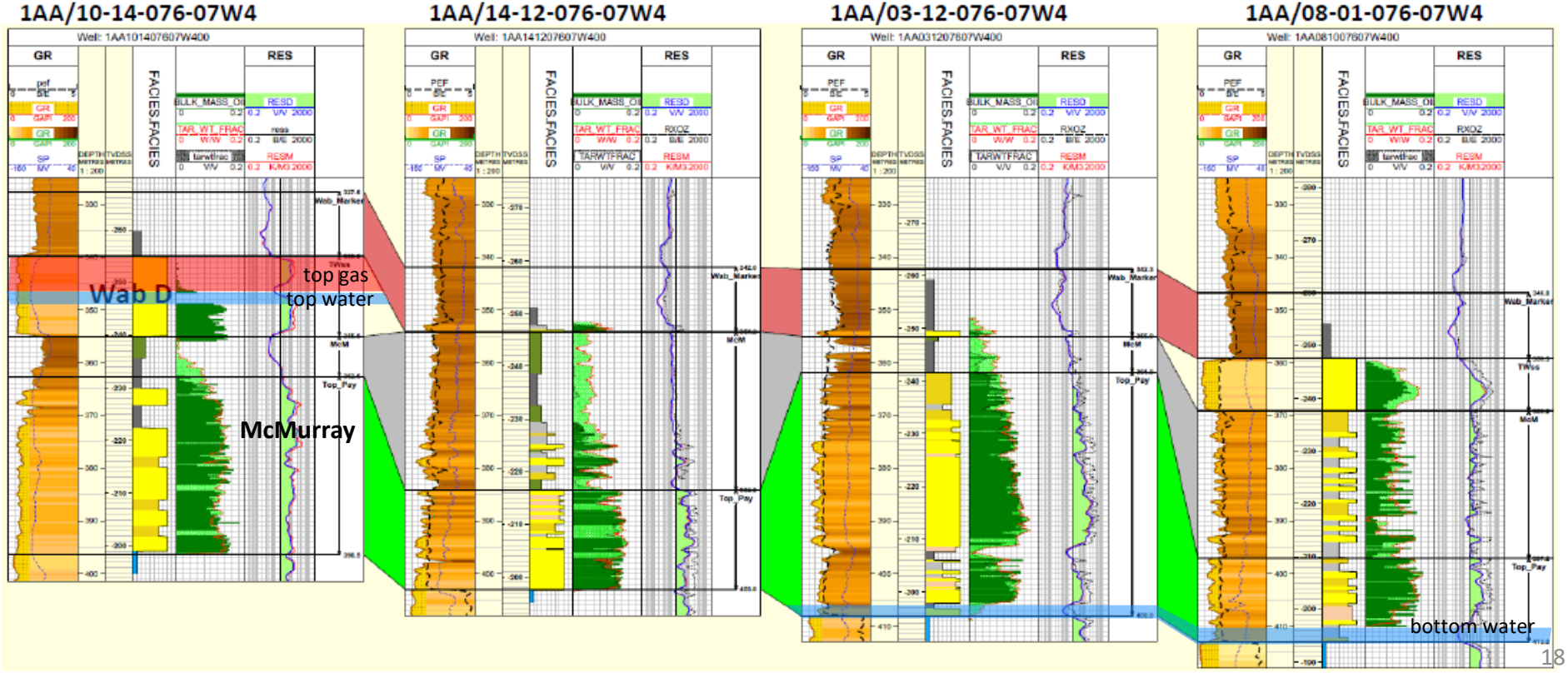


# Representative Well Cross Section



North

South



# Original Bitumen in Place and Well Pattern Properties

| Property | McMurray | | | Wabiskaw |
|---|---|---|---|---|
| | Project / Development Area | Pilot East | Pilot West | Project / Development Area |
| Area (ha) | 2946 | 86.3 | 52.9 | 2946 |
| Original bitumen in place (MM $m^3$) | 68.8 | 6.7 | 3.7 | 17.7 |
| Produced to date (MM $m^3$)* | 1.89 | 1.34 | 0.55 | 0 |
| Recovery to Date (%)* | 2.7 | 20.0 | 14.8 | 0 |
| Producible Bitumen (MM m3) | 32.8 | 3.5 | 1.4 | 7.5 |
| Ultimate Recoverable (MM $m^3$) | 33.7 | 4.3 | 1.5 | 7.5 |
| Ultimate Recoverable (%) | 49 | 64 | 41 | 42 |
| Net Pay (m) | 15.3 | 26.0 | 26.7 | 12.7 |
| Porosity (%) | 0.31 | 0.31 | 0.31 | 0.33 |
| Oil Saturation | 0.77 | 0.77 | 0.77 | 0.77 |
| Vertical Permeability (mD) | 2600 | 2600 | 2600 | TBD |
| Horizontal Permeability (mD) | 4500 | 4500 | 4500 | 5000 |

*Note: Recovered volumes as of December 31, 2022

# Co-Injection

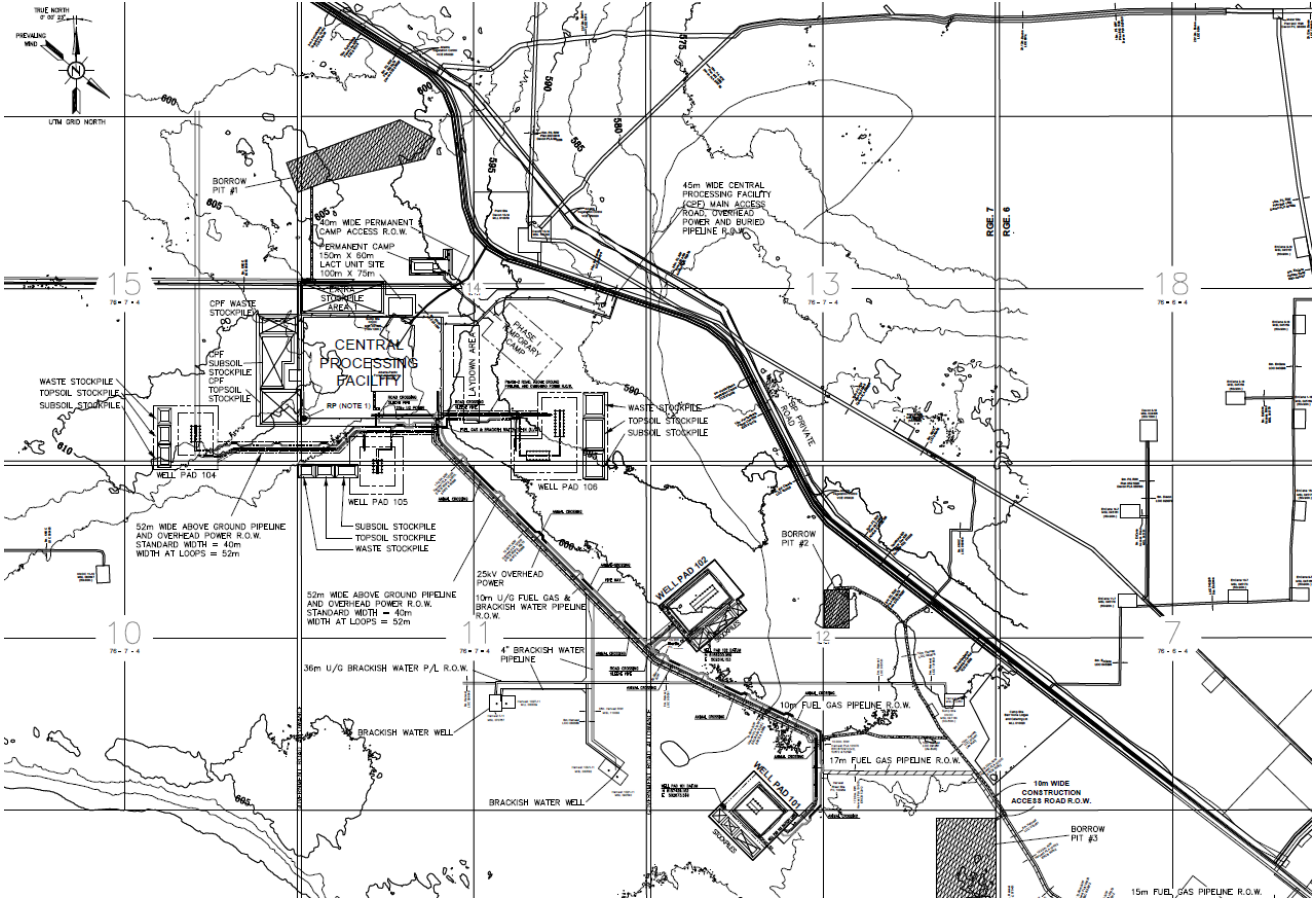
- Co-injection is not currently used at the BlackGold Project
- Harvest is continuing to evaluate optimal timing to initiate Non-Condensable Gas co-injection

# Directive 054 Section 4.3

## Surface

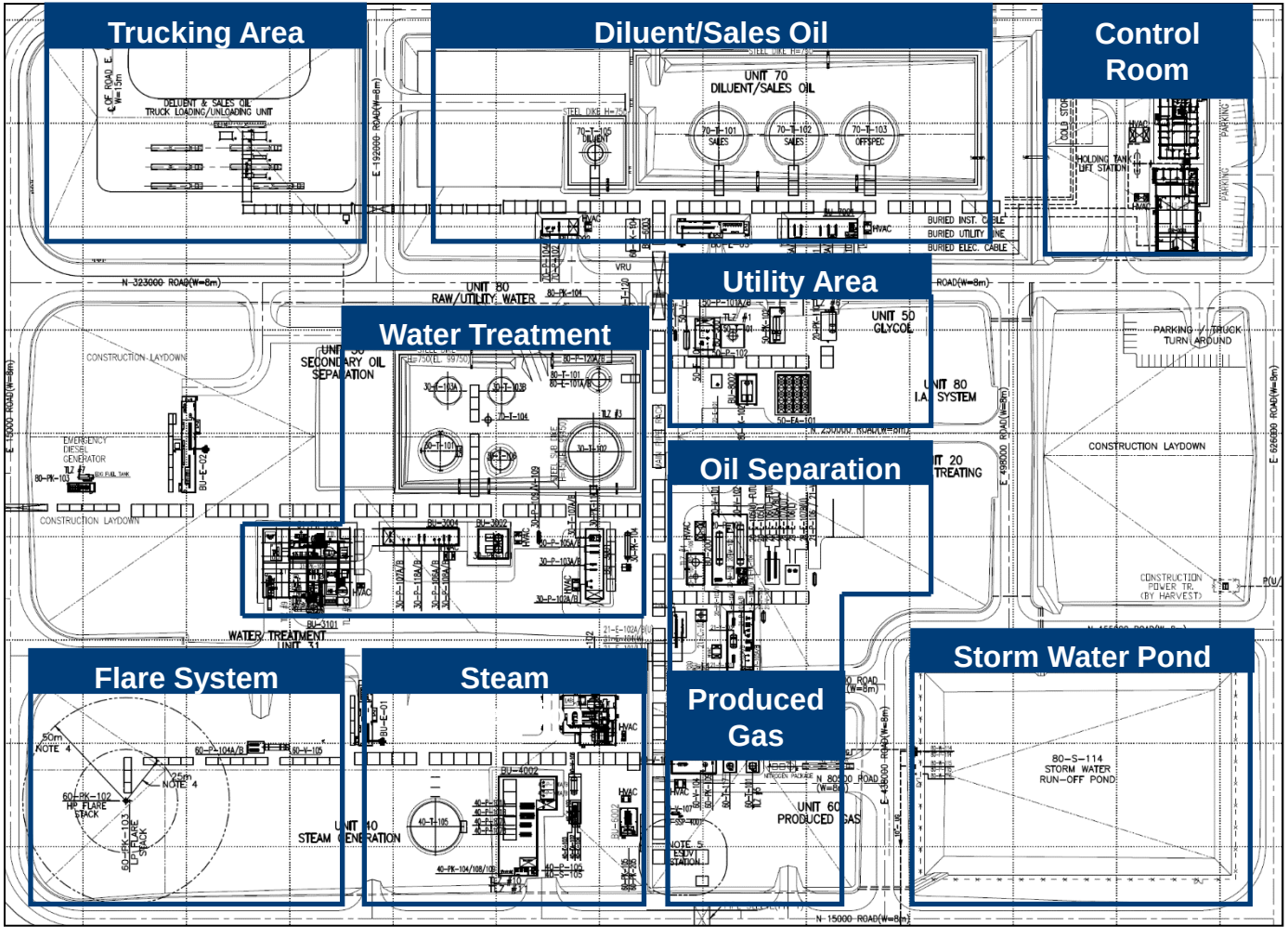
# Built and Planned Surface Infrastructure

- As-built infrastructure includes a central processing facility, two SAGD well pads, source water pads, pipelines, roads and operations camp
- Location of planned Phase 2 well pad locations (Pad 104, 105, 106) subject to change



# Built and Planned Surface Infrastructure

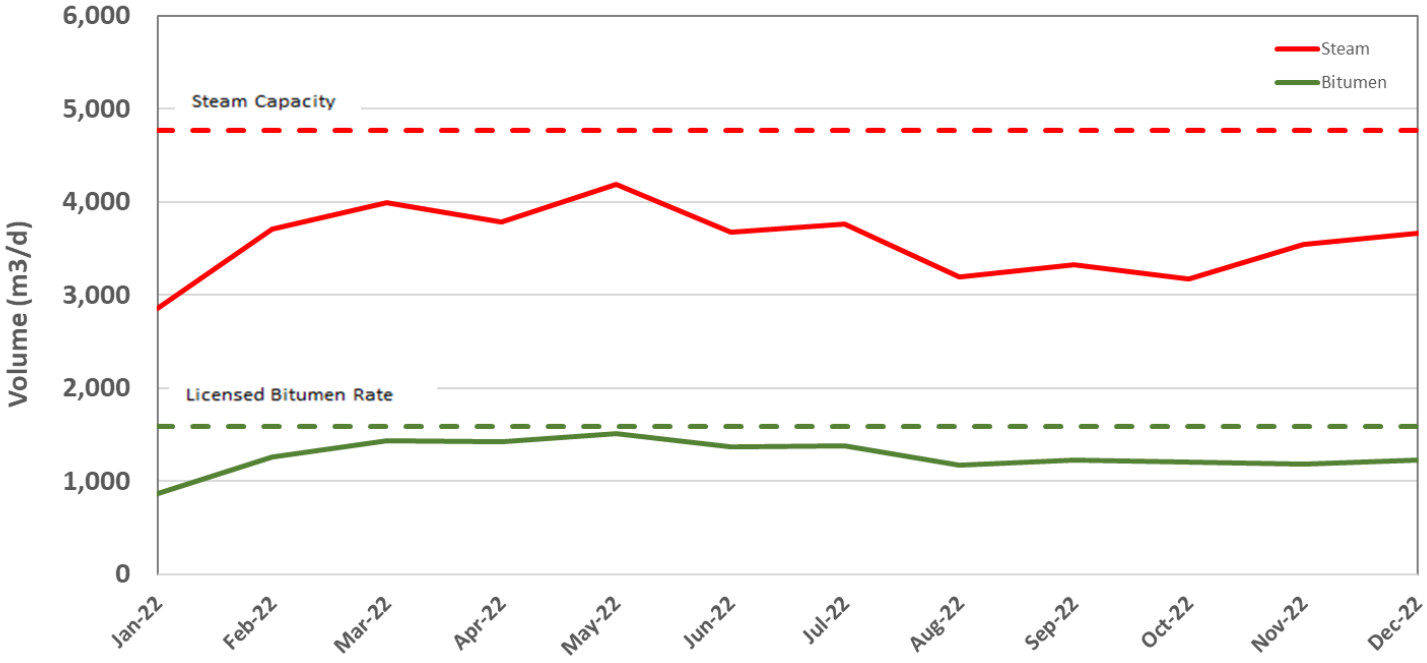
- Existing Phase 1 infrastructure shown
- Phase 2 infrastructure to be located within same plot space as Phase 1



# Central Processing Facility Modifications

- The following modifications, which did not require AER applications, were completed in 2022:
  - Due to ongoing issues with the Continuous Emissions Monitoring System (CEMS), Harvest initiated the procurement of a new CEMS unit in 2021. The new CEMS was commissioned and went online on May 6, 2022.
  - Repairs to the floor of Sales Oil Tank 70-T-101 were completed in Q4 2022.
  - Repairs to piping connecting the vapour recovery unit to the LP flare were completed in Q4 2022.

# Facility Bitumen and Steam Rates

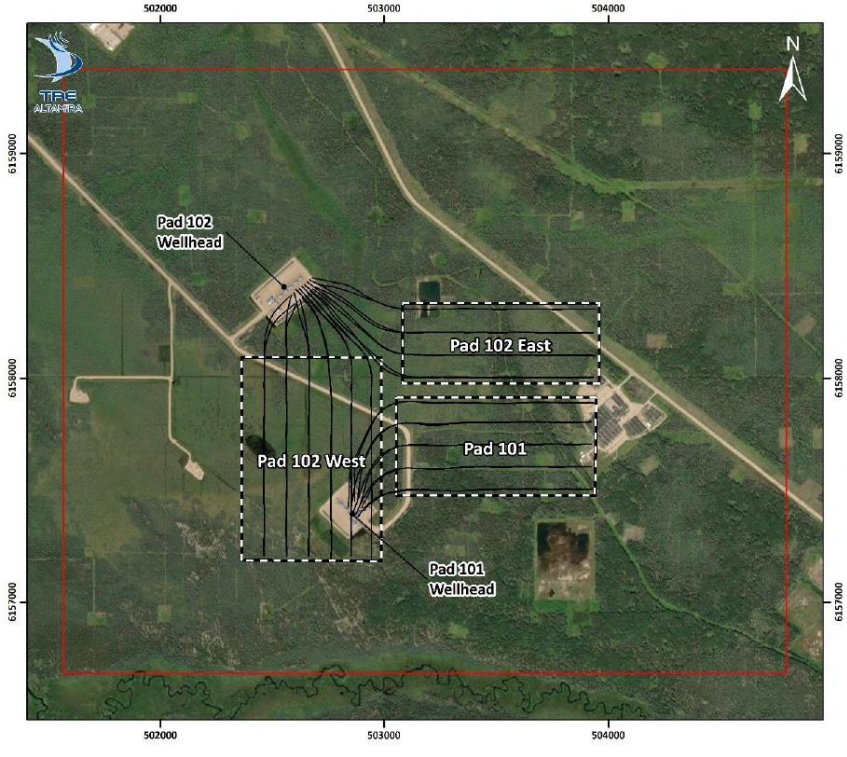



*Note - January 2022 - Production curtailed weather-related issues led to a shortage of trucks available to transport sales oil.

# Historical and Upcoming Activity

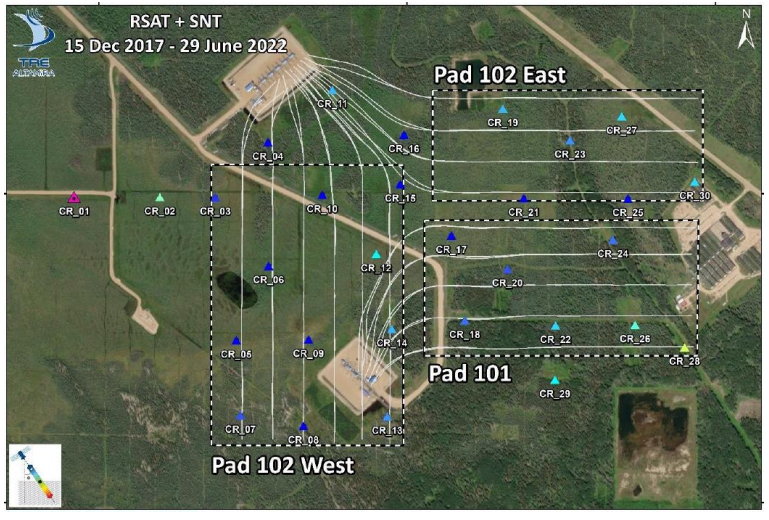
# Surface Heave Monitoring

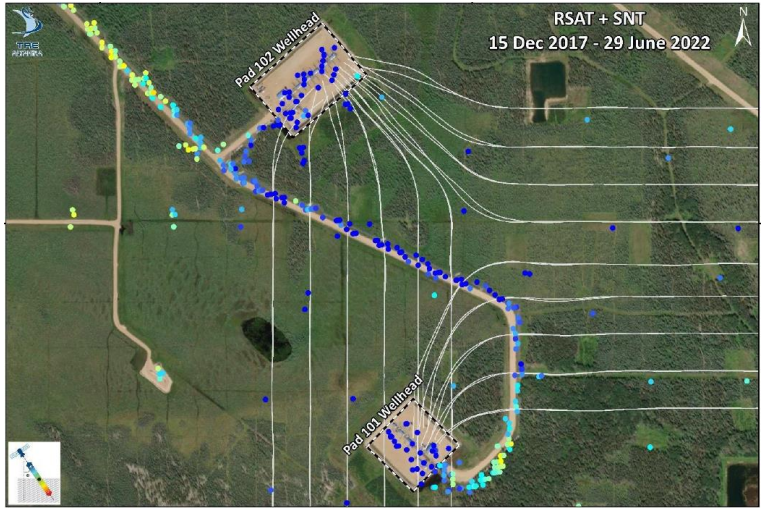
- TRE Altamira (A CLS Group Company) provides surface heave monitoring
- The program measures:
  - ground displacement using both Natural Reflectors (NRs) and 30 Corner Reflectors (CRs) and
  - the “annual average displacement (mm/yr) calculated from a linear regression of the displacement time series over the analysis period” (i.e., amount of displacement measured against original baseline).
  - Satellite image acquisitions occur on a 12-day revisit frequency
- Original baseline was acquired in December 2017 prior to Project “first steam” in June 2018
- The area of interest covers 8.67 km$^2$ which includes Well Pad 101 and Well Pad 102 and their drainage patterns.
- Report provided to AER covers heave monitoring periods:
  - 15 December 2017 to 29 June 2022, in general
  - 23 May 2020 to 29 May 2021, and 29 May 2021 to 29 June 2022, in particular



# Surface Heave Monitoring

- CR displacement values over the drainage pads were higher for 2020–2021, showing on average +7 mm of heave compared to +5 mm for 2021–2022.
- CRs with the highest heave during both annual periods were:
  - CR17 (Pad 101) showing the highest value for 2020-2021 (+16 mm) and
  - CR21 (Pad 102 East) showing the highest value for 2021-2022 (+14 mm)
- Over the wellheads, NRs recorded the highest cumulative displacement values over Pad 101 for both annual periods, with a maximum value of +23 mm for 2020-2021 and a maximum value of +25 mm for 2021-2022.
- For 2017-2022:
  - On average, CR cumulative displacement values over the drainage pads were highest over Pad 102 West (+29 mm), followed by Pad 102 East (+25 mm) and Pad 101 (+19 mm).
  - Over the wellheads, NRs recorded the highest cumulative displacement values over Pad 101 (+47 mm), followed by Pad 102 (+40 mm).



# Suspension and Abandonment Activity

- On October 27, 2019, 101-02 ESP failed due to high solids loading and the well was later diagnosed with a compromised sand control liner
  - In March 2021,  the injector was returned to service to provide pressure support for the neighboring well pairs. Injection was suspended in June 2022, and the well was abandoned and redrilled in October 2022. There are currently no plans to commence injection in this well.
  - The existing producer is currently suspended as per *Directive 013: Suspension Requirements for Wells* (2022)

- None of BlackGold's wells have reached the ramp-down or blow-down stage

# Regulatory and Operational Changes

## Regulatory Changes

- **Application No. 1938197** - June 1, 2022, Directive 023, Category 1 amendment application to:
  - Drill via sidetrack or from surface (contingency) well pair 101-02 at Well Pad 101, and
  - Drill via sidetrack or from surface (contingency) well producer 102-10 at Well Pad 102.
- **Application No. 1938486** - June 28, 2022, Directive 023, Category 1 amendment application to:
  - Drill via sidetrack or from surface (contingency) well producer 101-03 at Well Pad 101.
- **Application No. 1940891** - November 1, 2022, Directive 023, Category 2 amendment application to:
  - Drill two outfill SAGD well pairs on Well Pad 102,
  - Relocate initial phase Well Pad 103 and its associated 10 well pairs, and
  - Remove Well Pad 110 from the expansion phase.
- **Application No. 1942656** - April 6, 2023, Directive 023, Category 1 amendment application to:
  - Drill via sidetrack or from surface (contingency) well producer 101-04 at Well Pad 101, and
  - Drill via sidetrack or from surface (contingency) well producer 102-09 at Well Pad 102.

## Operational Changes

- The new CEMS was commissioned and went online on May 6, 2022.

# Technology Pilots

- 102-06 injector well also equipped with Vacuum Insulated Tubing (VIT)
  - After the installation of the VIT in April 2021, the temperature in the intermediate decreased 125˚C to allow for higher quality steam. The SOR on this well pair has improved with the installation of a shiftable Flow Control Device (FCD).
- Shiftable FCDs on the injectors allow further optimization post-installation and remain part of Harvest's future completion design strategy.
  - The wells with FCD completions have seen improved conformance along the horizontal.

# Operational Challenges and Lessons Learned

- Production was curtailed in January 2022 as weather-related issues led to a shortage of trucks available to transport sales oil.
- ESP and well performance optimization ongoing to improve pump run-life.

# 2022 Compliance History

| Reference No. | Date | Reportable Incident/ Voluntary Self-Disclosure/ Contravention | Remediation or Compliance Efforts |
|---|---|---|---|
| EDGE 0390337 | May 9, 2022 | 20.5 m3 off-lease release of diluted bitumen due to a trucking incident at 04-22-045-11W4M. Truck and lead trailer remained upright, however, the pup trailer disconnected and rolled. | Spill cleaned up and remediated. |
| EDGE 0406985 | November 21, 2022 | 5.00 m3 release of raw emulsion due to the non-routine failure of a control valve in the Well Pad 102 Pump Building. | Spill cleaned up and remediated. |
| FIS 20222640 | November 24, 2022 | Temporary low-pressure flare hydrocarbon carry-over and fire incident. Fire extinguished and approximately 50 liters of light hydrocarbons released to central processing facility pad surface. | Associated spill cleaned up and remediated. |
| EDGE 0407941 | December 22, 2022 | 0.001 m3 off-lease release of condensate due to a truck and B-train trailer roll-over at NE-07-067-12W4M. | Spill cleaned up and remediated. |

# Future Plans

**Planned 2023 activities:**

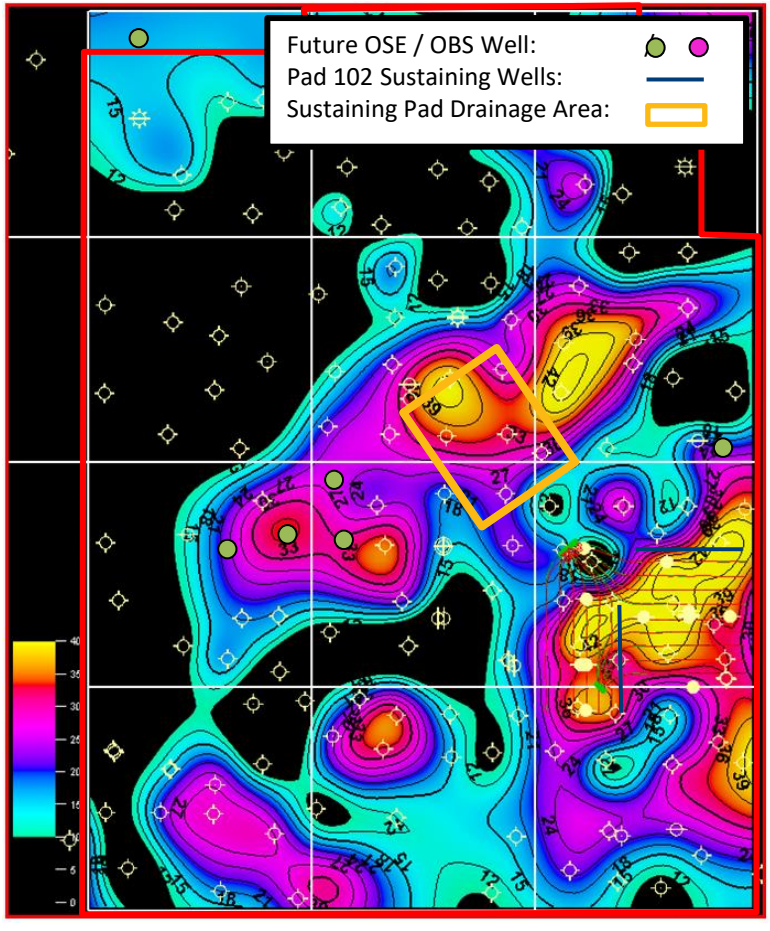
- Execution of re-drills: 101-04 producer, 102-09 producer
- Drill two additional well pairs on Well Pad 102

**Anticipated applications in 2023/2024:**

- Re-drill from surface well pair 101-02

**Anticipated five-year development plan:**

- Drill sustaining well pairs on Well Pad 103
- Re-drills/In-fills as required
- Drill observation well(s)
- Additional 4D seismic over pilot area
- Additional OSE wells to de-risk development
- Investment decision on Phase 2
- Cogeneration




Locations shown are approximate and subject to change