ATHABASCA OIL CORPORATION

AER HANGINGSTONE PROJECT UPDATE

January 2018

ATHABASCA OIL CORPORATION

INTRODUCTION

PROJECT DESCRIPTION AND STATUS

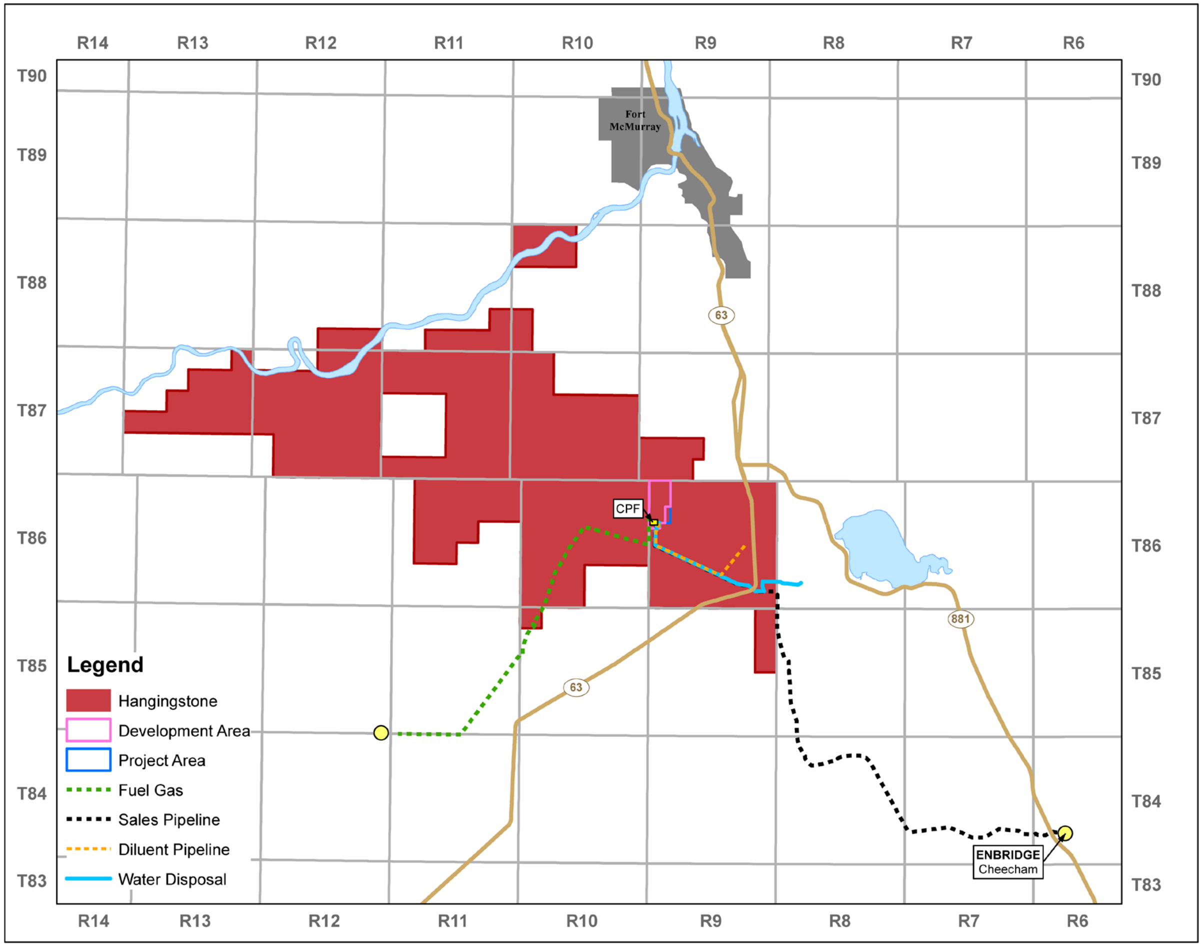
SUBSURFACE

- Geoscience
- Well Design and Instrumentation
    - *Drilling and Completions*
    - *Artificial Lift*
    - *Instrumentation*
- 4-D Seismic and Monitoring
- Scheme Performance
- Future Plans

SURFACE

- Facilities
- Measurement and Reporting
- Water Production, Injection and Uses
- Sulphur Production
- Compliance
- Future Plans

DEVELOPMENT OVERVIEW

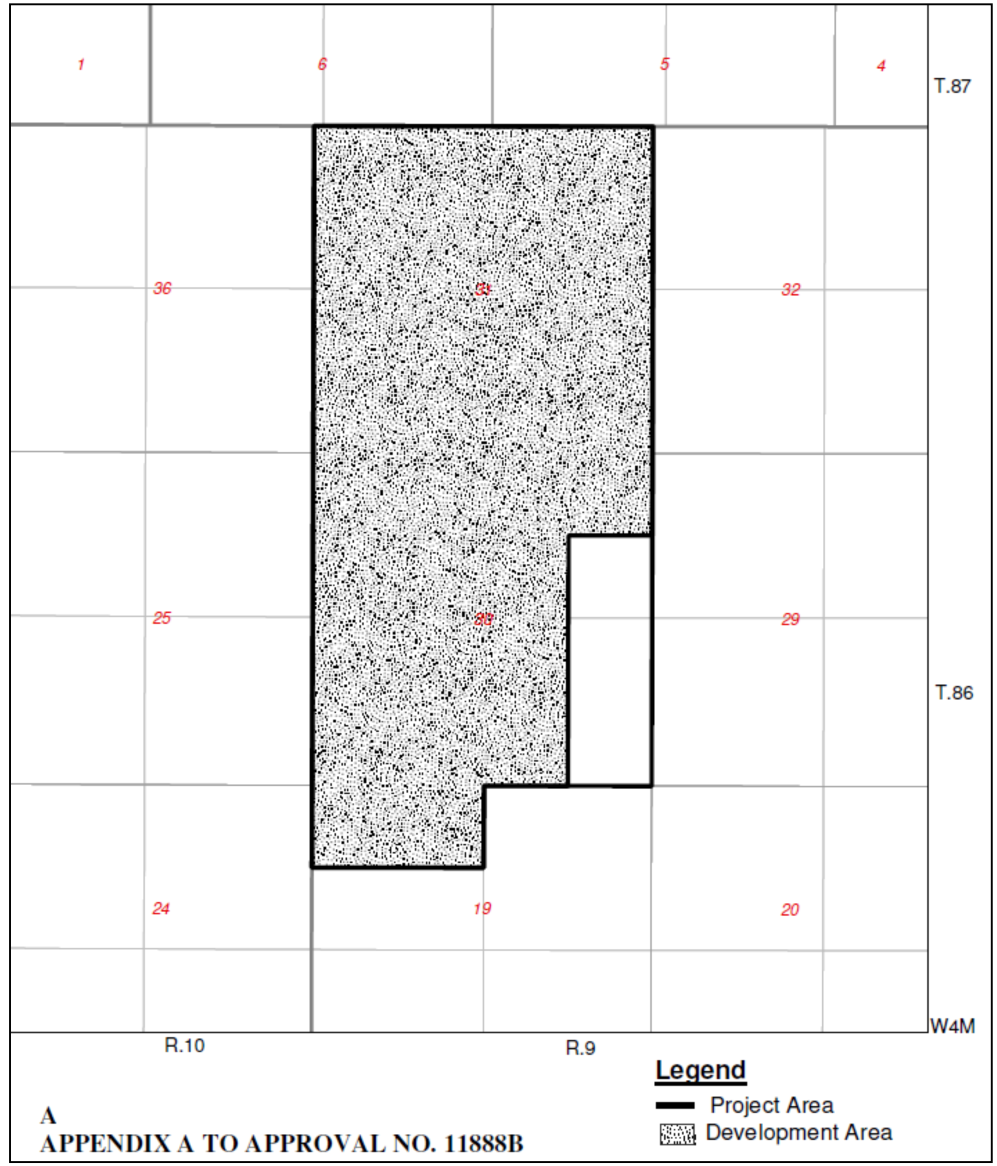


- Project 1 – 1,908 m^3/d (12,000 bbl/d) (March 2015 first steam)
- Project 2A – 1,272 m^3/d (8,000 bbl/d) (current EIA application)
- Project 2B – 5,087 m^3/d (32,000 bbl/d) (current EIA application)
- Project 3 – 4,770 m^3/d (30,000 bbl/d) (current EIA application)

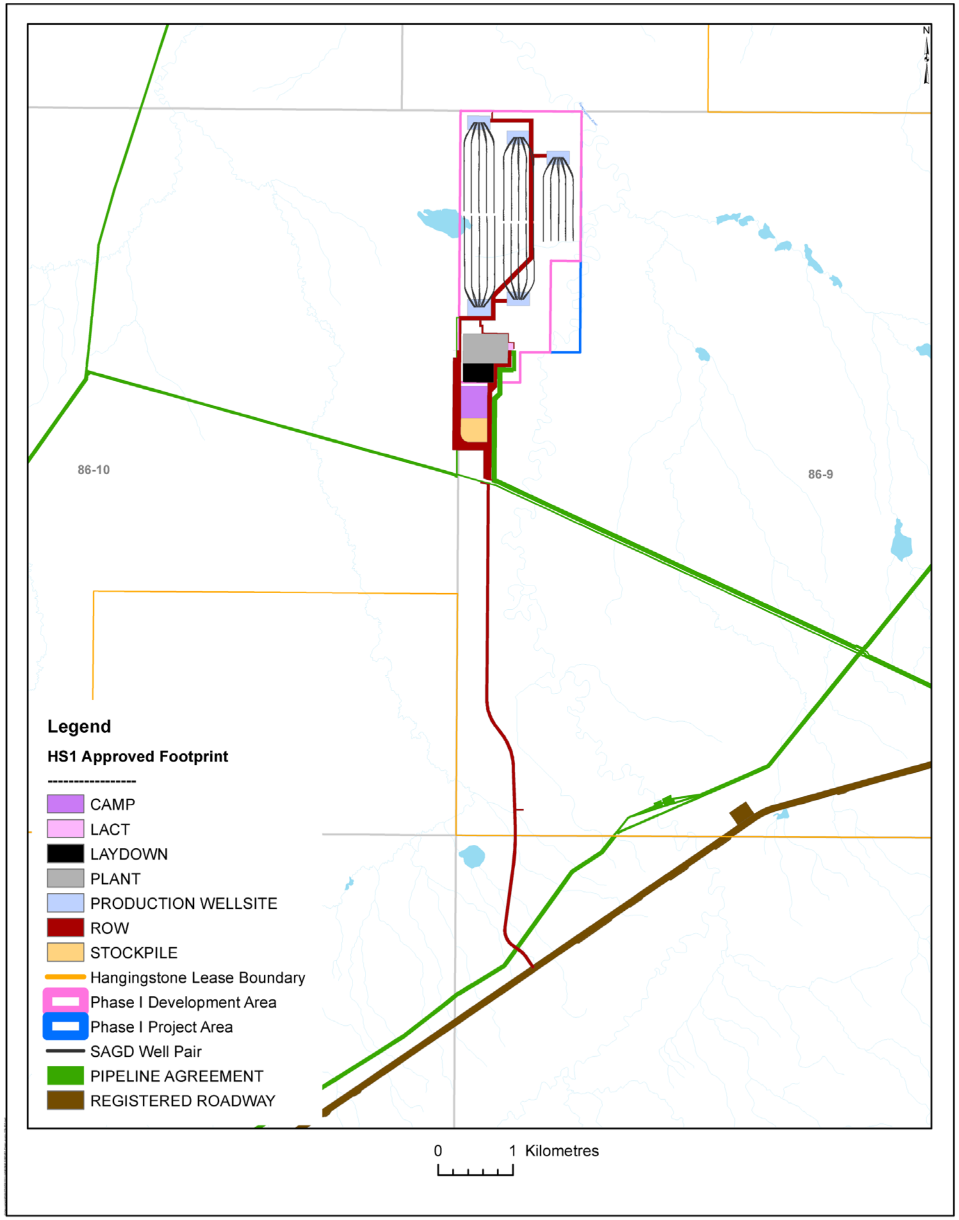
STATUS AND SCHEME MAP

HS1 PROJECT

- First steam (downhole) achieved March 23, 2015
- First oil produced July 2015
- Last SAGD conversion mid March, 2016 (AC01 and AE05)
- As of October 31, 2017 there were 23 well pairs in SAGD mode and 2 well pairs were standing
  - *The two standing wells were drilled as production assurance wells and will be brought on production when there is steam availability*



DESCRIPTION



PROJECT DETAILS

- Located 20 km south of Fort McMurray, AB
- 5 production pads
- 25 horizontal well pairs (5 well pairs per pad)
- Central Processing Facility (CPF) and associated facilities
- Offsite services and utilities

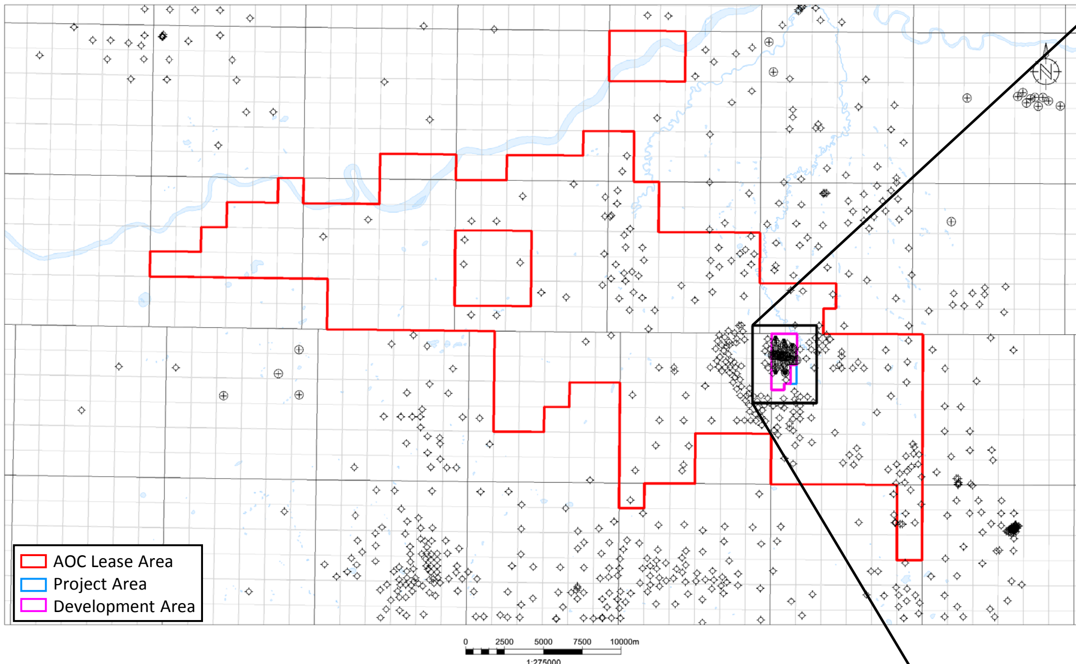
INFRASTRUCTURE

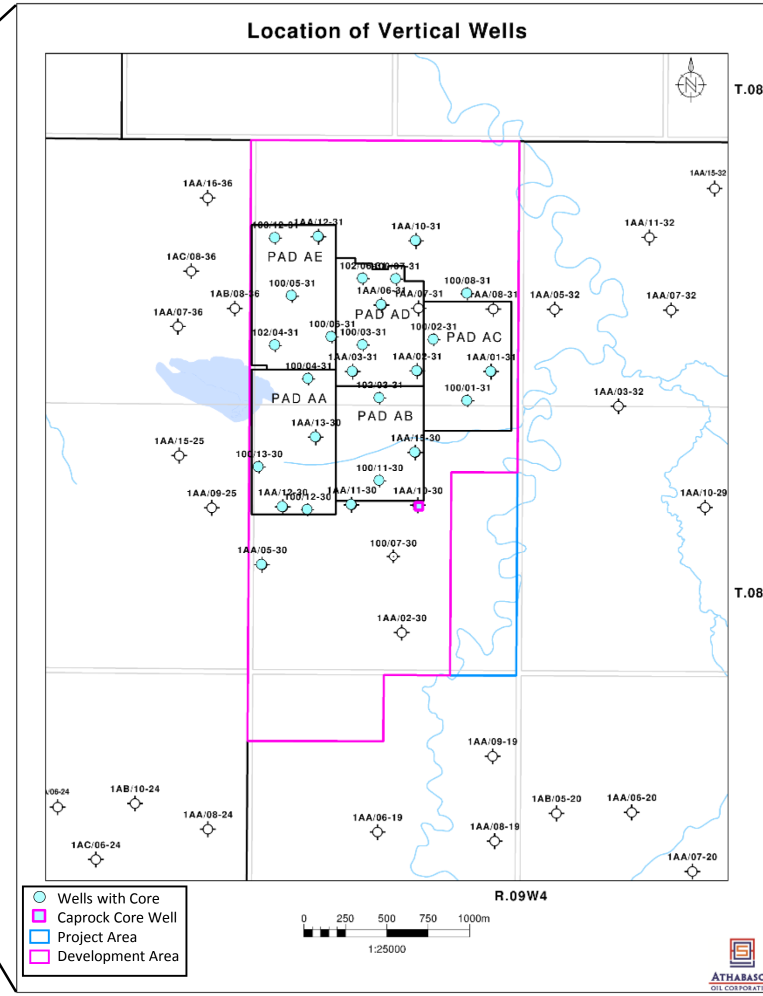
- Fuel gas from TransCanada Pipeline (TCPL)
- Dilbit export to Enbridge Cheecham Terminal
- Diluent from Inter Pipeline (IPL)

SUBSURFACE
GEOSCIENCES

ATHABASCA OIL CORPORATION

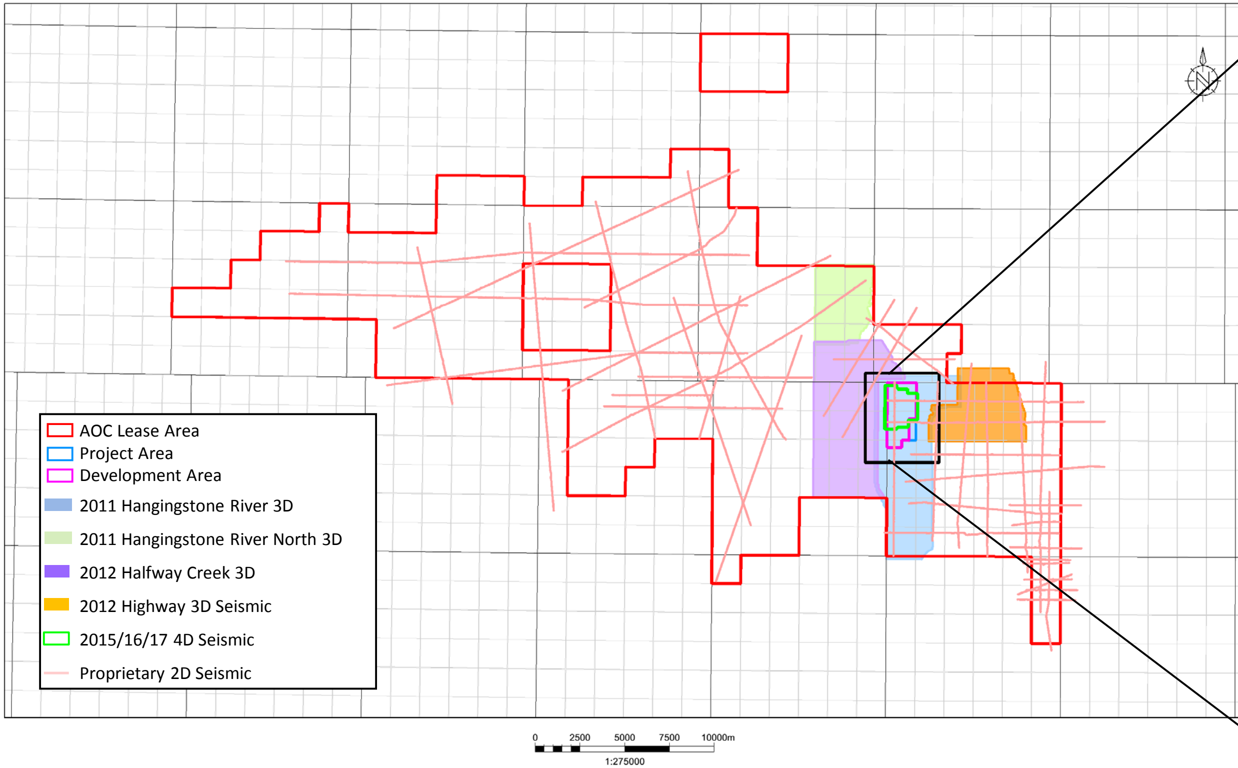
SURFACE DATA OVERVIEW

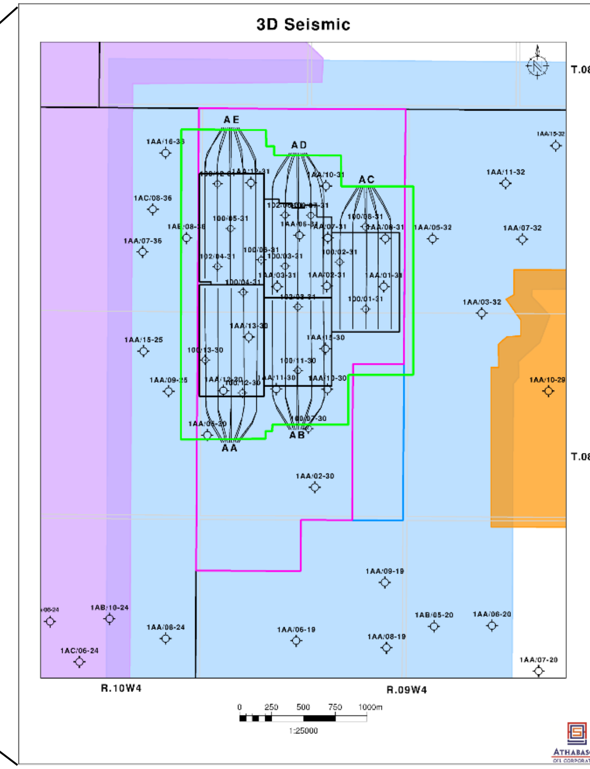




Area	Area (km²)	MCMR Cored Wells	Image Logs	Caprock Core
Development Area	5.1	26	31	1
Project Area	5.6	26	31	1

SUBSURFACE DATA OVERVIEW





3D ACQUIRED IN 2011 AND 2012, MERGED IN 2012

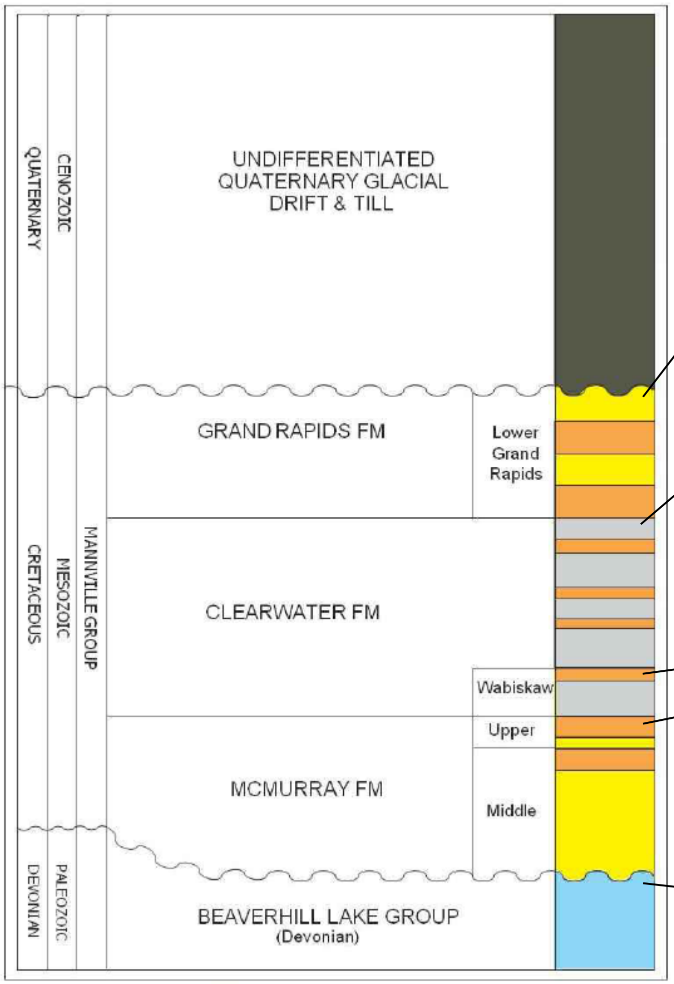
- Total proprietary 2D ~ 450 km
- Total 3D area ~98 km^2 (merged)
  - *Covers development area*
- Total 4D area ~3.72 km^2
  - *Baseline acquired Q1 2014*
  - *First Monitor acquired Q1 2016 / Second Monitor acquired Q1 2017*

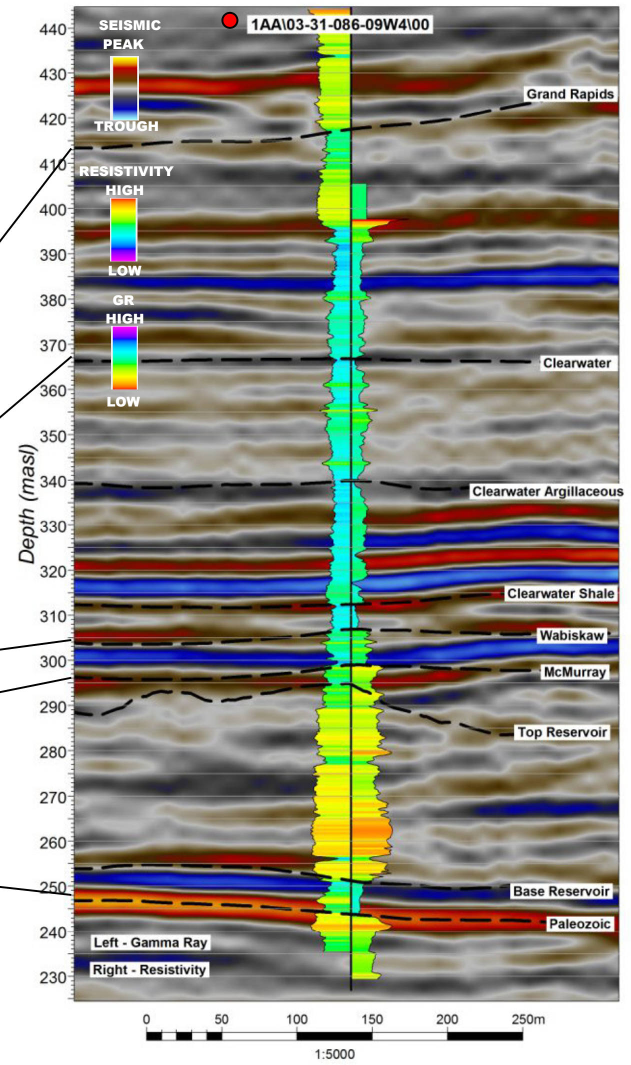
3D/4D PARAMETERS

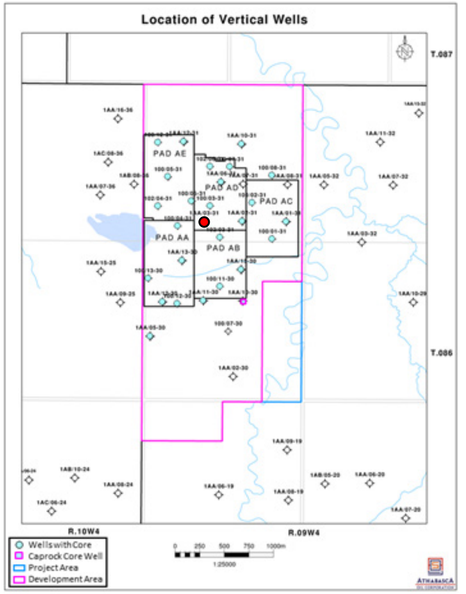
- Source line/source spacing: 60m/20m
- Receiver line/receiver spacing: 40-60m/20m

STRATIGRAPHY AND REFERENCE WELL

MIDDLE MCMURRAY TARGET RESERVOIR







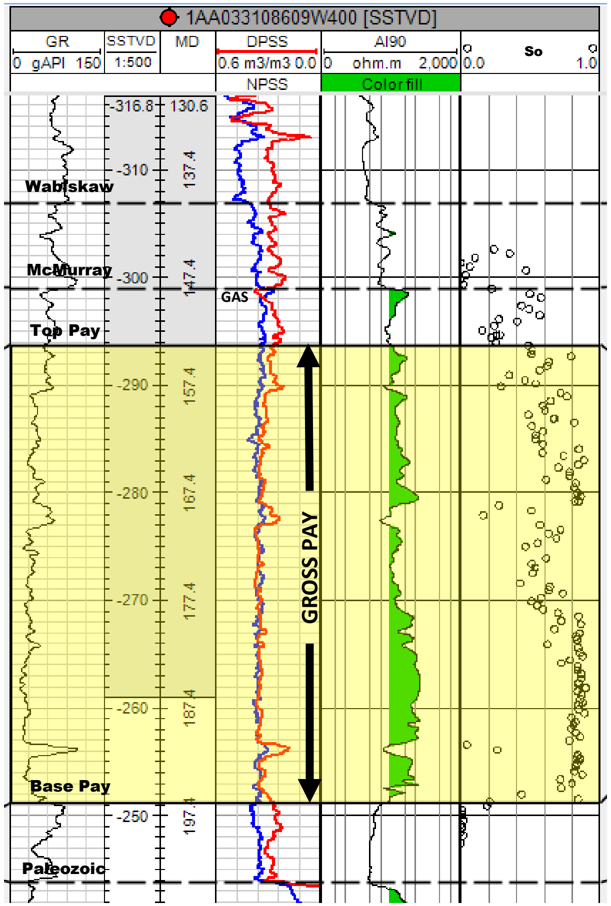
FACIES

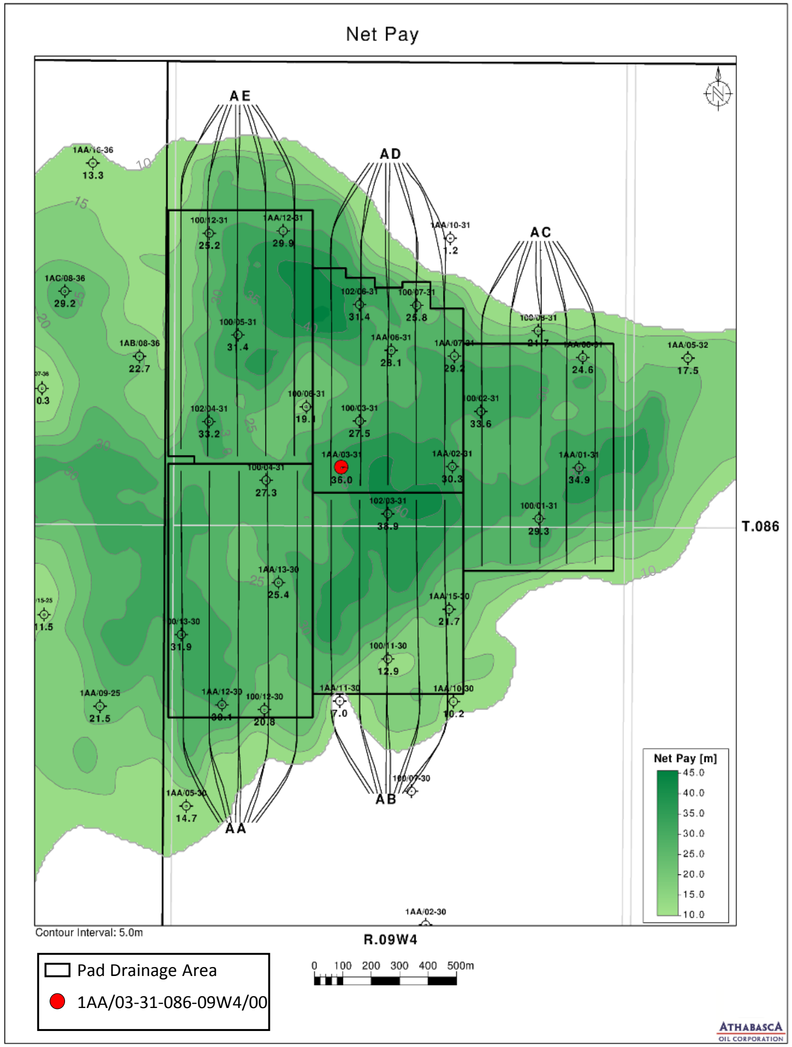
- Sand
- Sandy IHS
- Muddy IHS
- Mudstone
- Limestone

GROSS AND NET PAY

MIDDLE MCMURRAY GROSS PAY DEFINITION

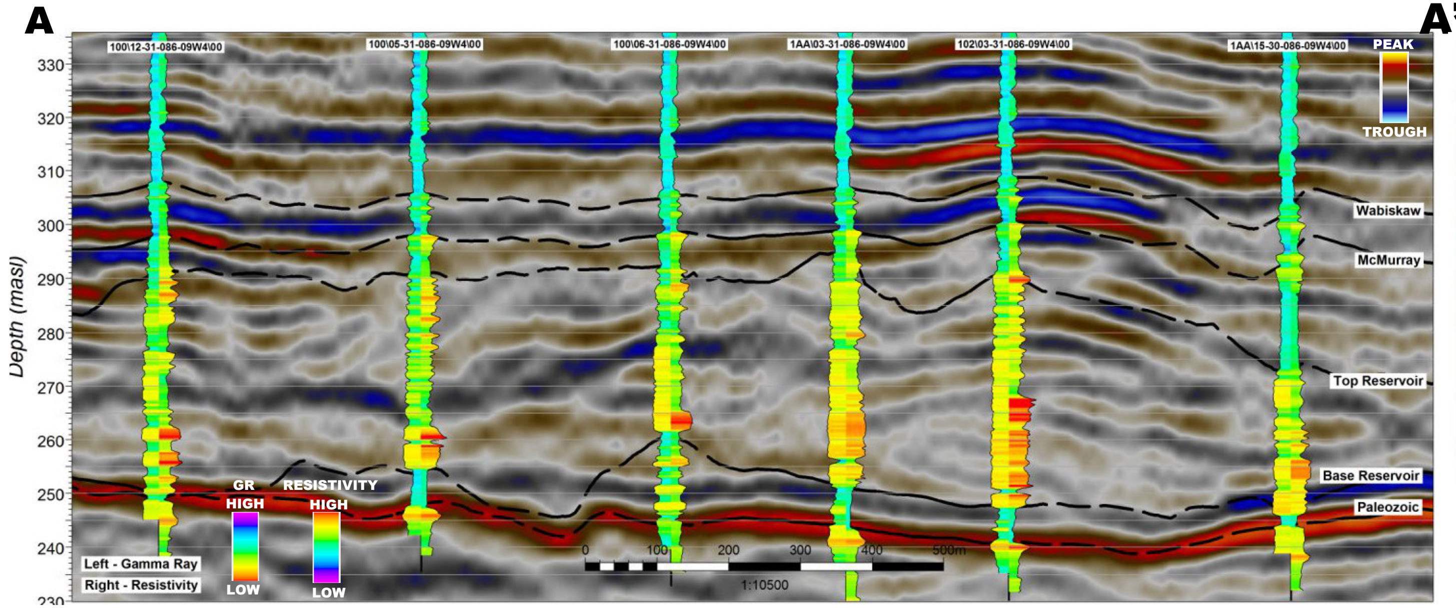
- Calculated between Top and Base Pay
- Thickness >= 10 m
- GR < 70 API
- Density > 27%
- Resistivity >18 ohm-m
- Water Saturation < 50%
- Includes < 1 m thick mud

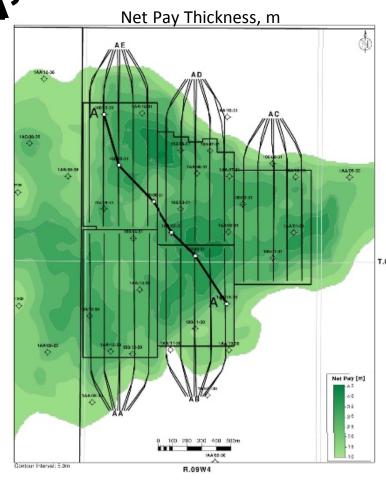


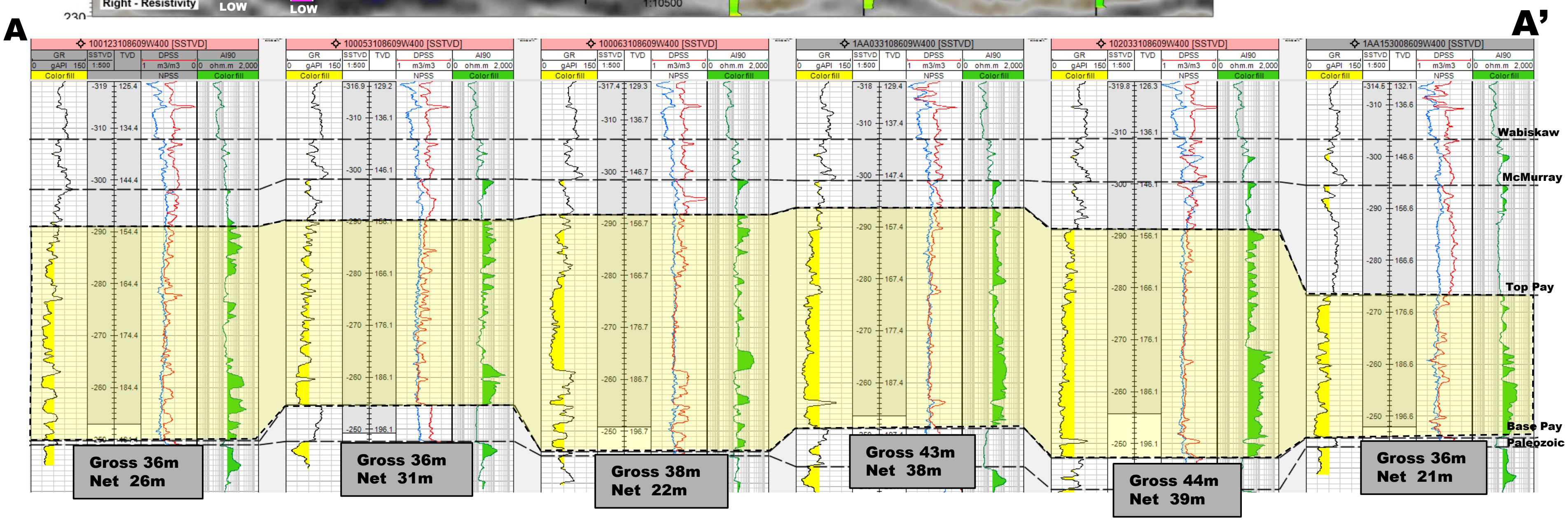


Net pay thickness uses gross pay criteria but excludes mud

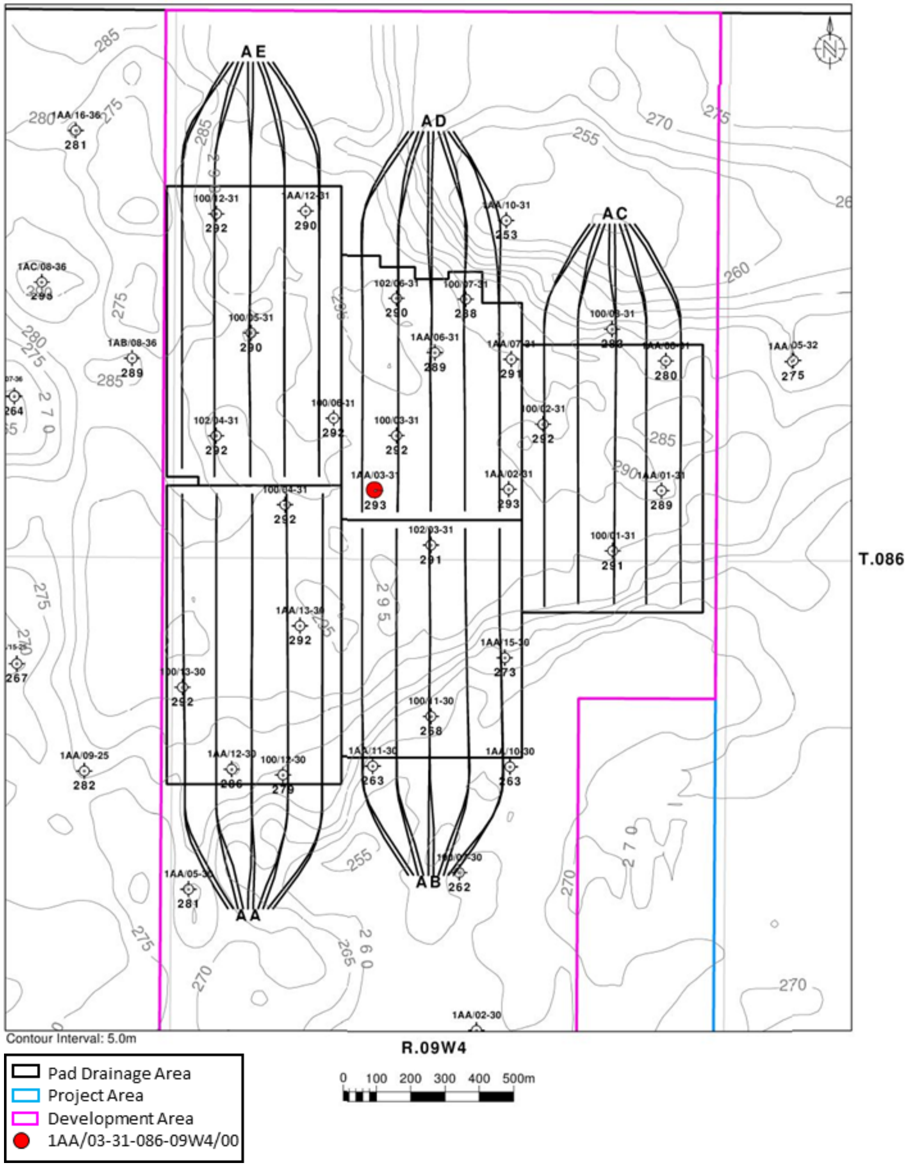
STRUCTURAL CROSS SECTION NW-SE ACROSS HS1 AREA



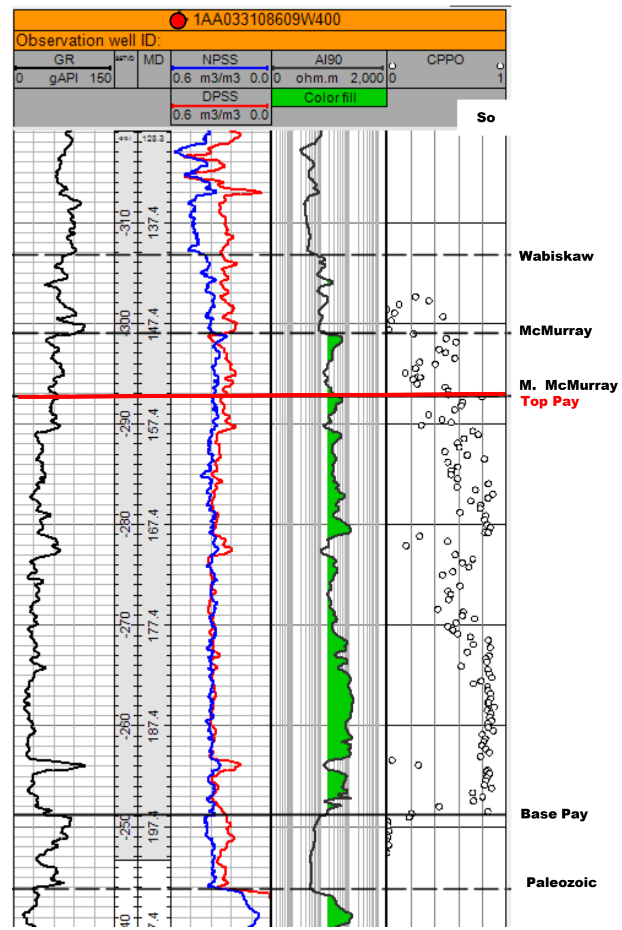




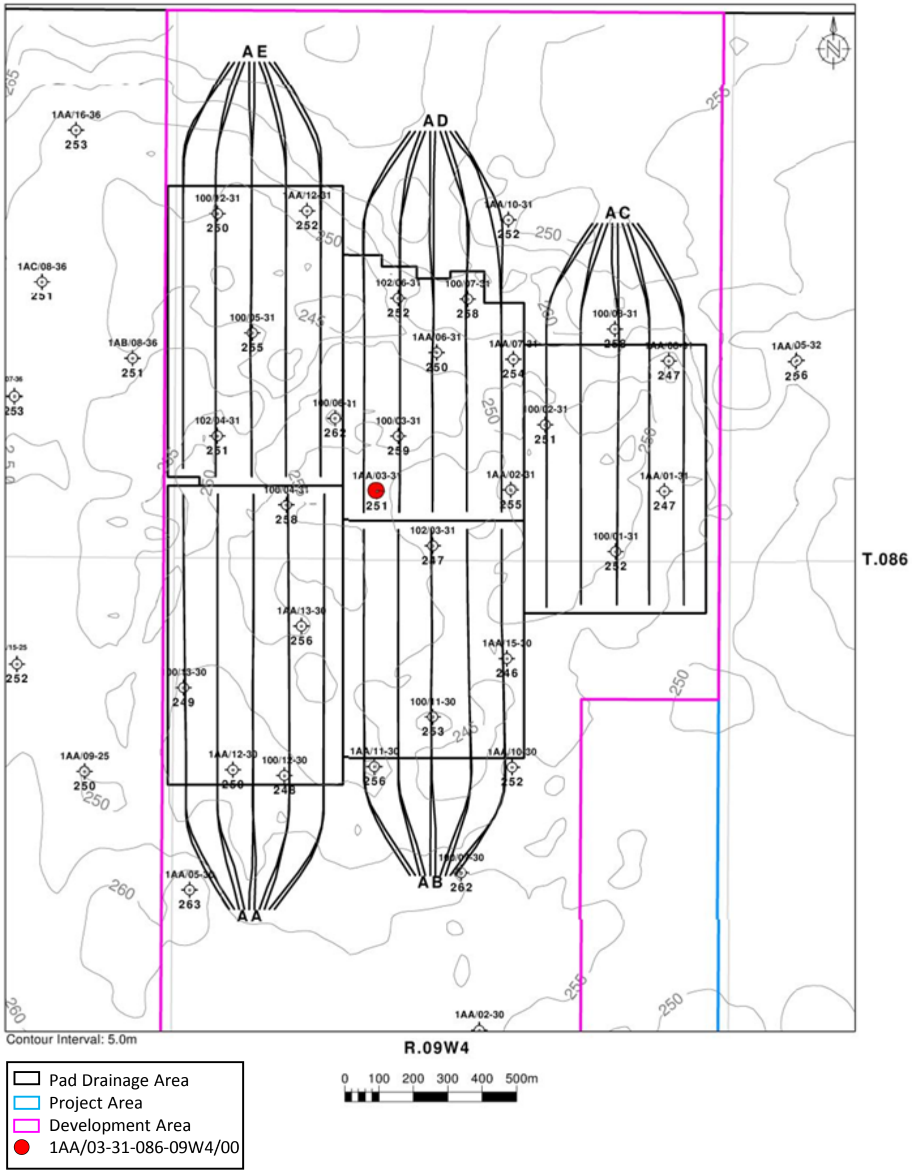
STRUCTURE MAP OF TOP OF BITUMEN PAY



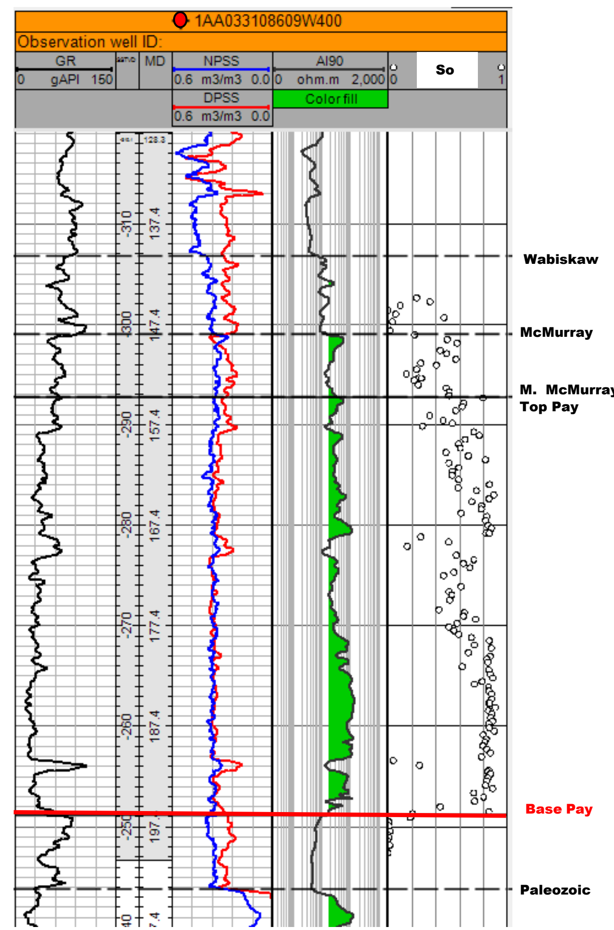
RANGE OF ELEVATION FROM 262 TO 301 MASL, HIGHEST OVER DRAINAGE PADS



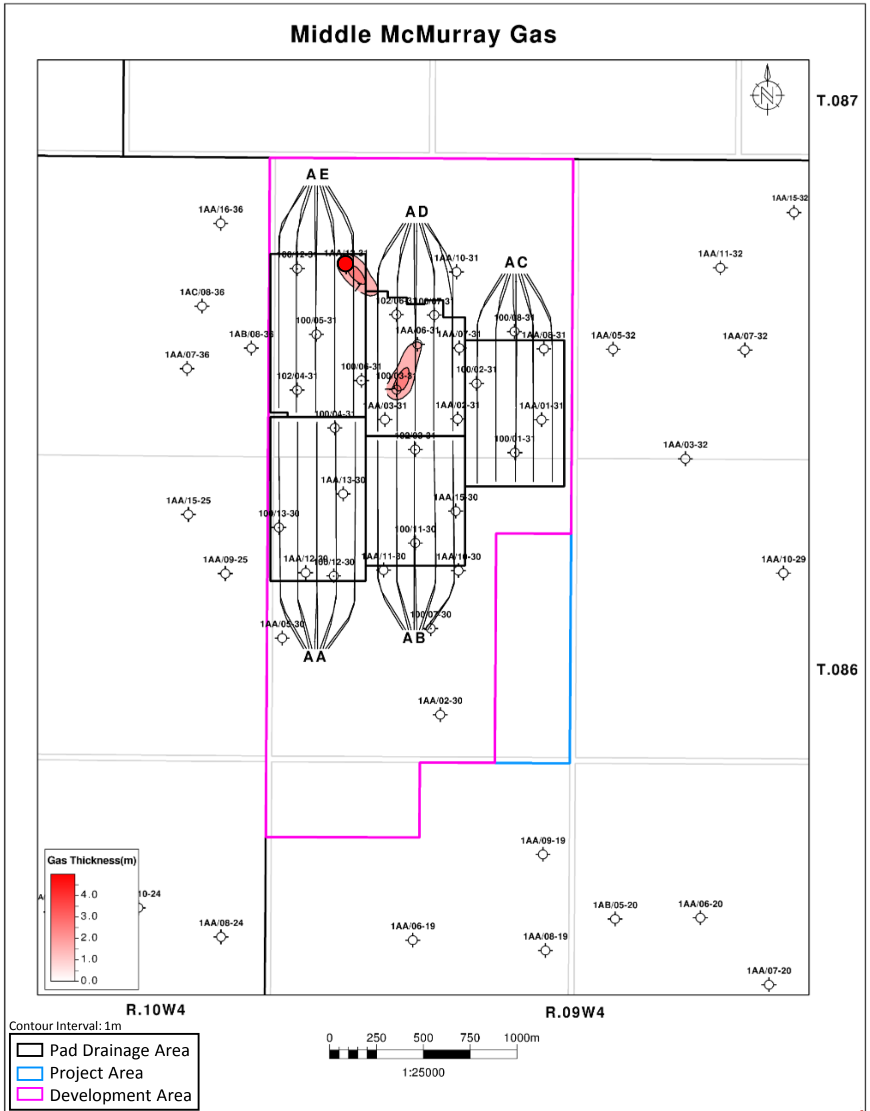
STRUCTURE MAP OF BASE OF BITUMEN PAY



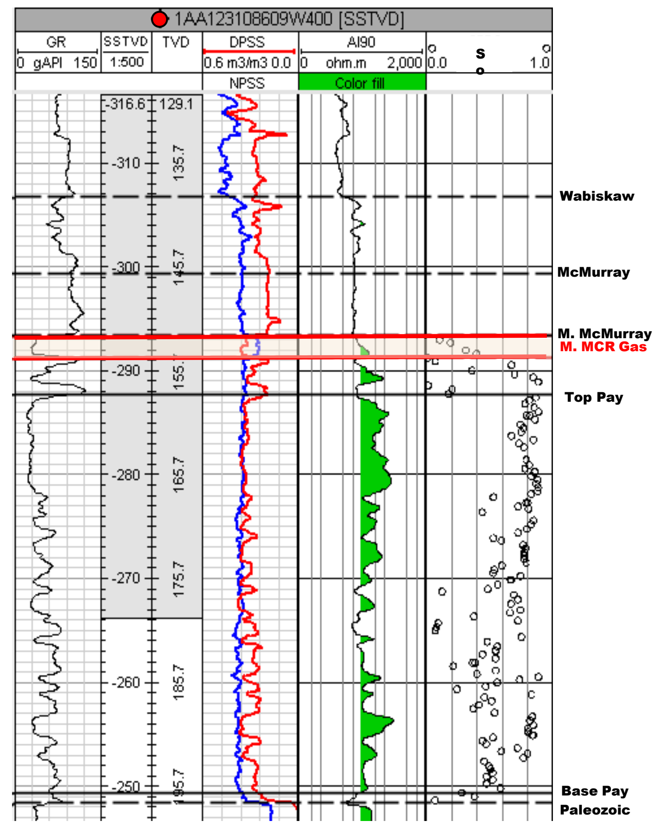
RANGE OF ELEVATION FROM 241 TO 262 MASL, LOW OVER DRAINAGE PADS



ISOPACH MAP OF MIDDLE MCMURRAY FM GAS

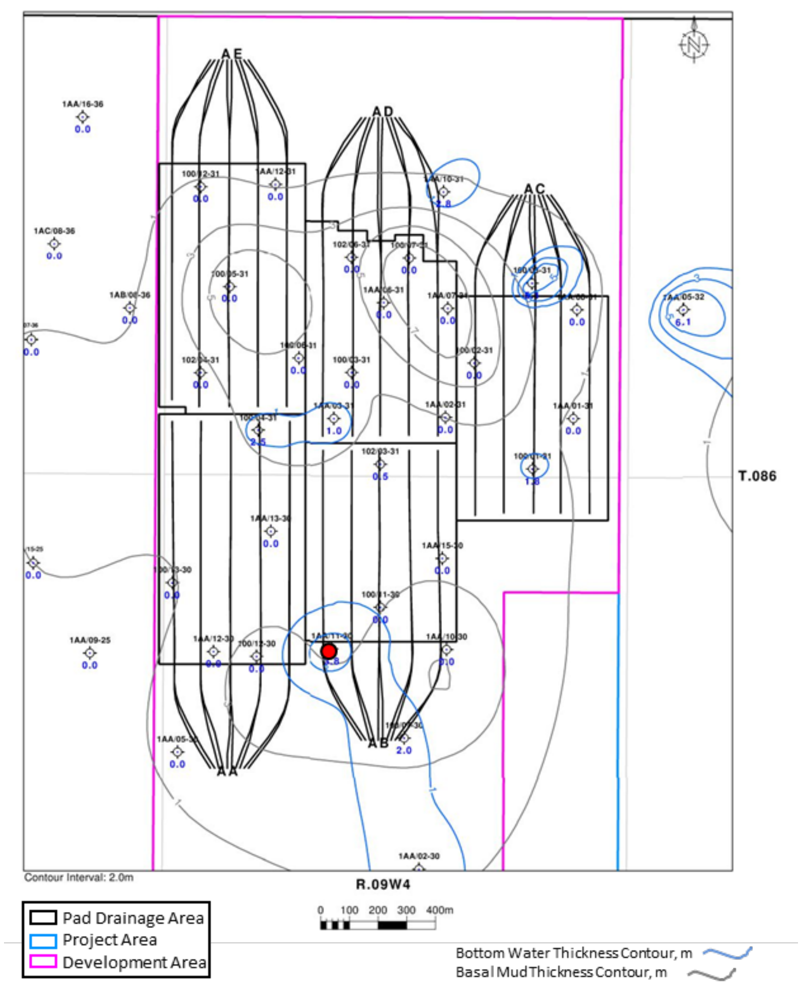


MIDDLE MCMURRAY GAS HAS MINIMAL THICKNESS AND LIMITED DISTRIBUTION WITHIN THE DEVELOPMENT AREA

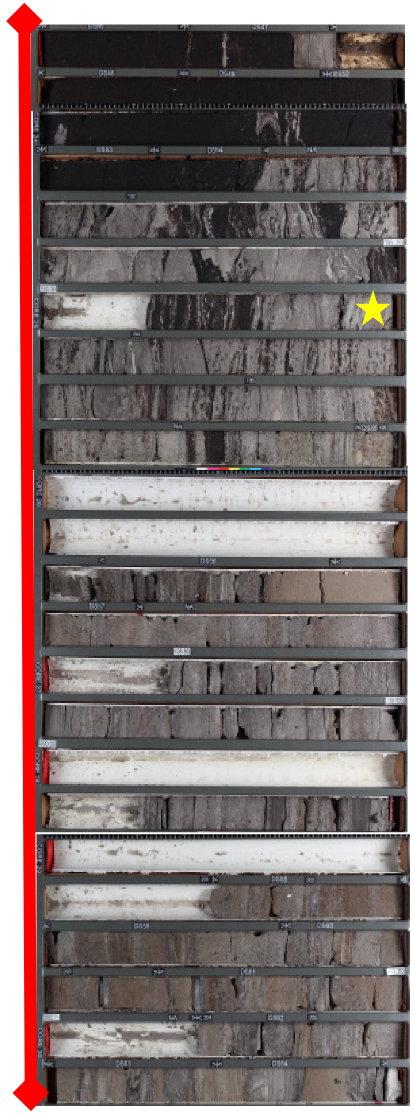


ISOPACH MAP OF MIDDLE MCMURRAY BOTTOM WATER

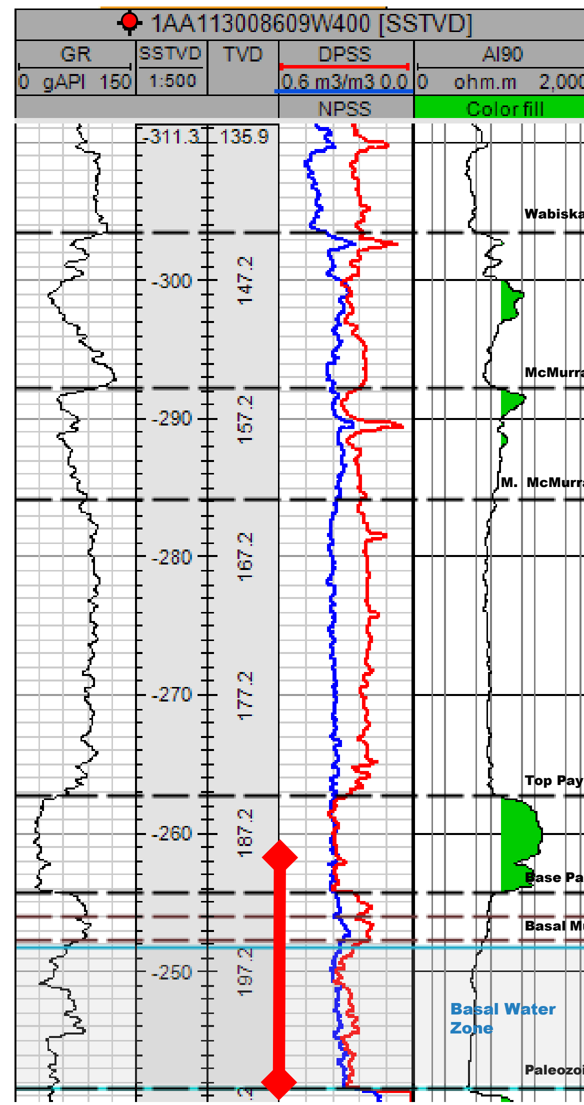
Bottom Water Net Thickness and Basal Mud Thickness



The permeability measured from core within the muddy interval between the bottom water and the bitumen reservoir through interval 193.80 to 193.85 m MD is 4.30 millidarcy (kV) and 71.0 millidarcy (kMax). Denoted on photo by ☆

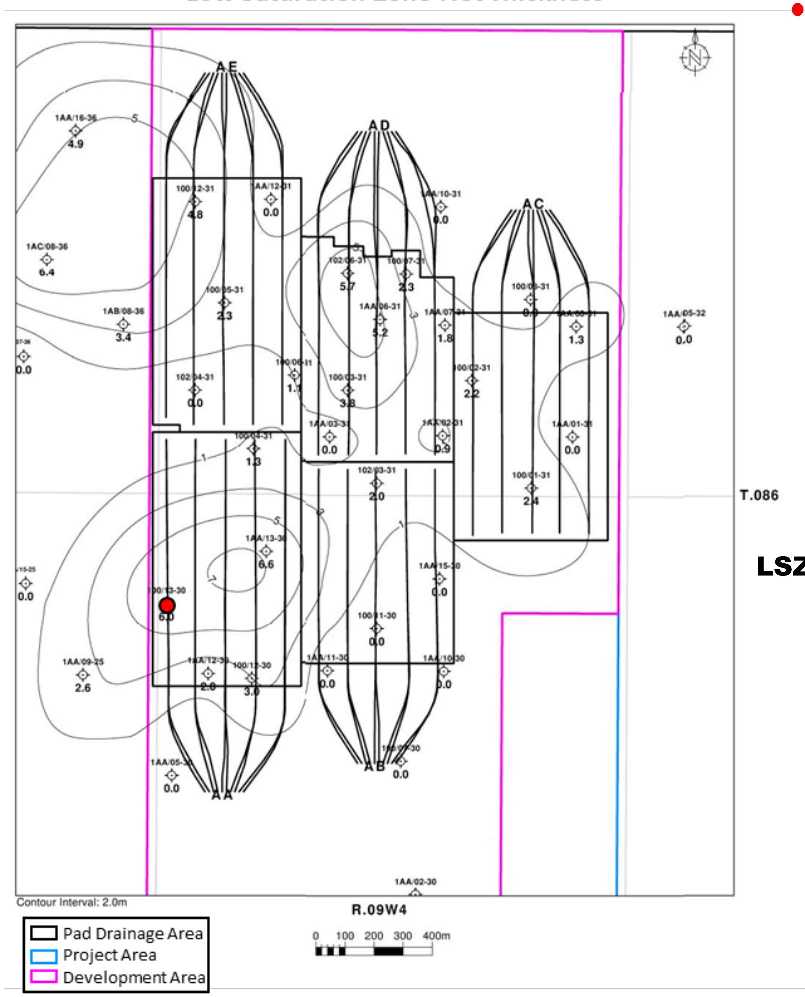


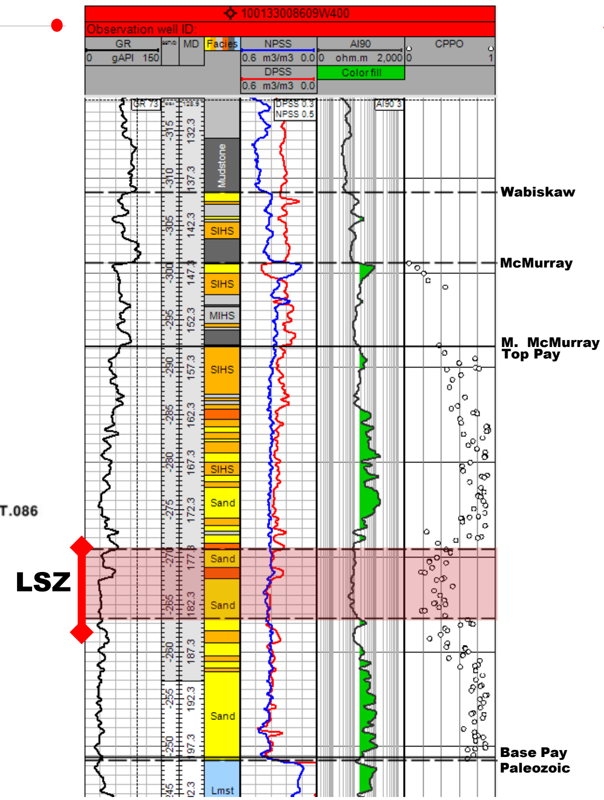
Interbedded mud and water saturated sand



ISOPACH MAP OF MIDDLE MCMURRAY LOW BITUMEN SATURATION

Low Saturation Zone Net Thickness





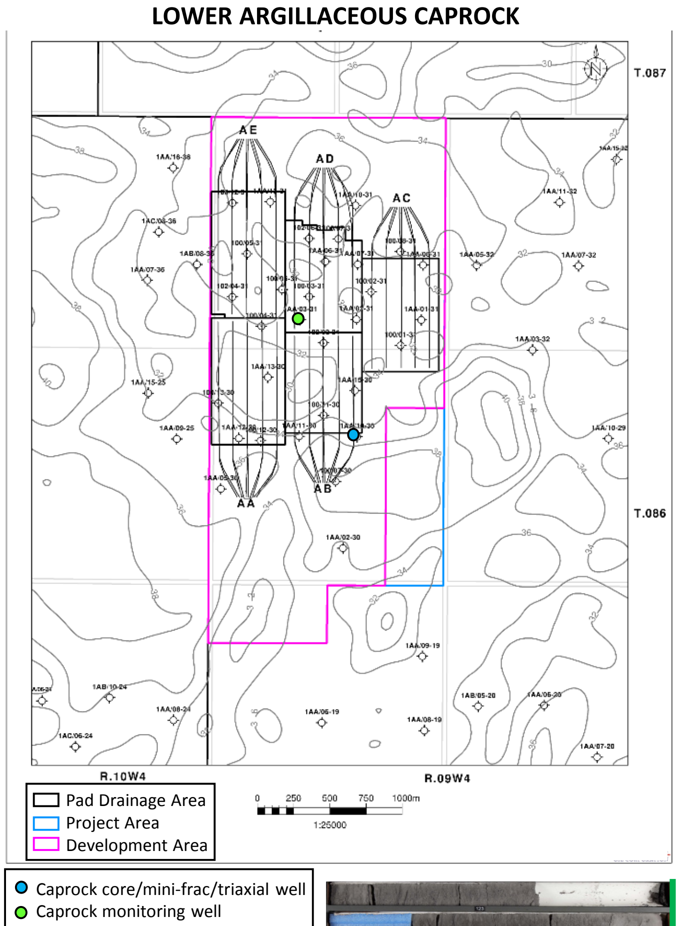
FACIES

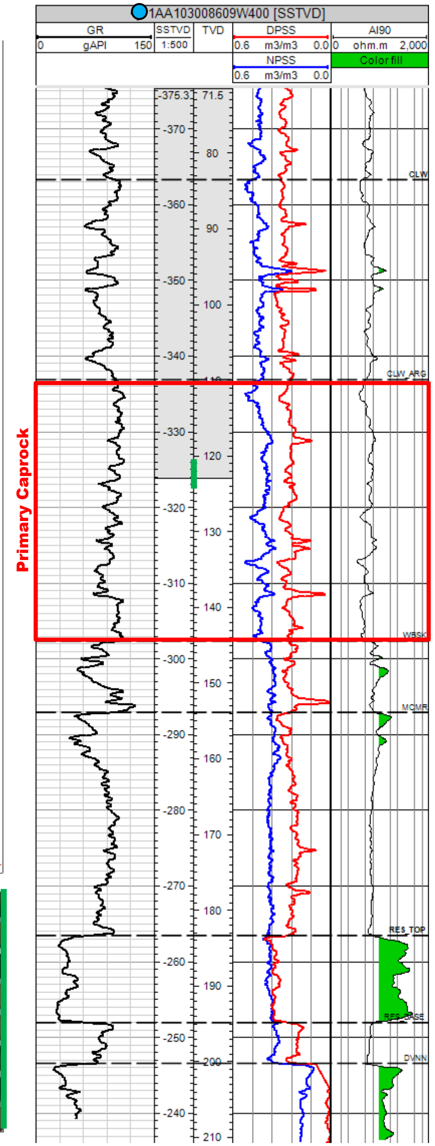
- Sand
- Sandy IHS
- Muddy IHS
- Breccia
- Mudstone
- Limestone

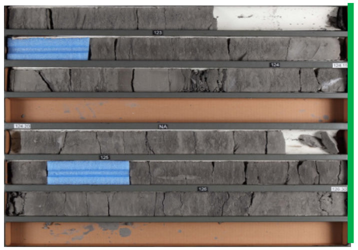
LOW BITUMEN SATURATION ZONE (LSZ)

- GR<60 API, density porosity >0.27 and resistivity 10-18 ohm-m and core water saturation >50%
- Core So= 0.36 and porosity = 0.37, thus the LSZ will still contribute to the overall bitumen production

CAPROCK DESCRIPTION







NO NEW CAPROCK CORE, MINI-FRAC OR TRI-AXIAL TESTING IN 2016/17

- Caprock is defined as the unit between the top of the Clearwater and Wabiskaw
  - *Two main units within the caprock; lower argillaceous and upper silty mud, are composed primarily of shales and siltstones*
- Existing caprock core/mini-frac/triaxial well (2011) was used to define the maximum operating pressure
- One observation well (2012) with one piezometer and two thermocouples in the caprock
  - *No pressure or temperature change has been observed in the Clearwater thermocouples or piezometer for the life of the project*

RESERVOIR PROPERTIES AND OBIP ABOVE PRODUCER

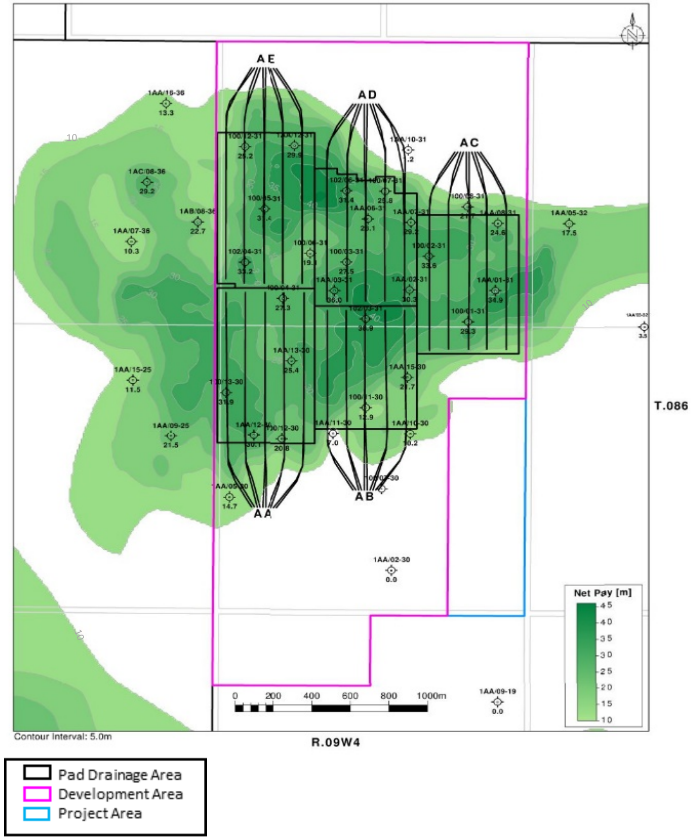
RESERVOIR PROPERTIES

- Typical Producer Depth: 191 TVD (258 masl)
- Initial Reservoir Pressure @ 190m TVD: 600 kPaa
- Initial Reservoir Temperature: 8°C
- Horizontal Permeability: 3,500-4,300 mD
- Vertical Permeability: 2,800-3,600 mD
- Bitumen Viscosity @ initial reservoir temperature: >1mln cP

Gross OBIP = Thickness from Top to Base Pay x Area x Porosity x So

	Avg Por (frac)	Avg So (frac)	OBIP (mln m³)
Drainage Areas	0.36	0.72	15.6
Development Area	0.36	0.72	18.6
Project Area	0.36	0.72	18.6

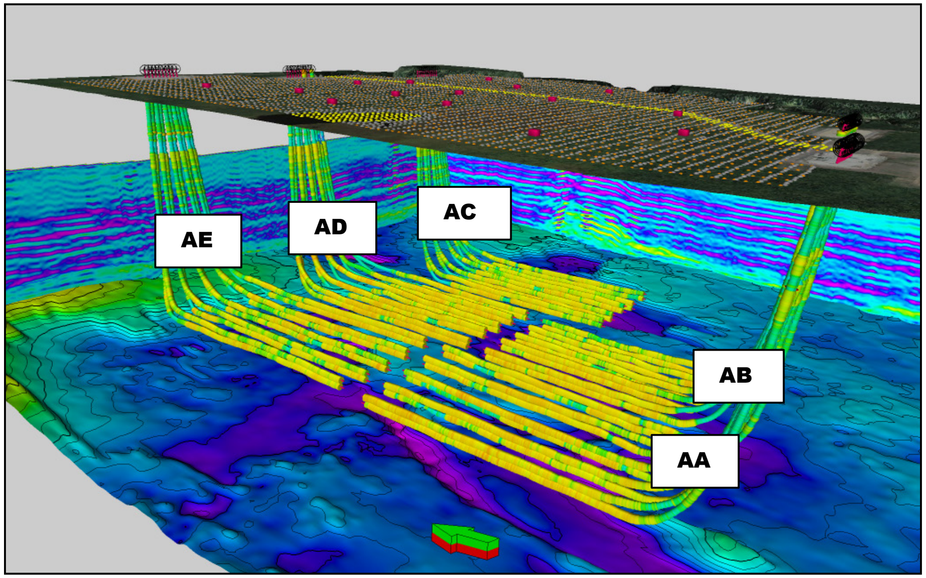
Net Pay Thickness (m) from Top to Base Pay



SUBSURFACE

WELL DESIGN AND INSTRUMENTATION

SAGD DRILLING SUMMARY



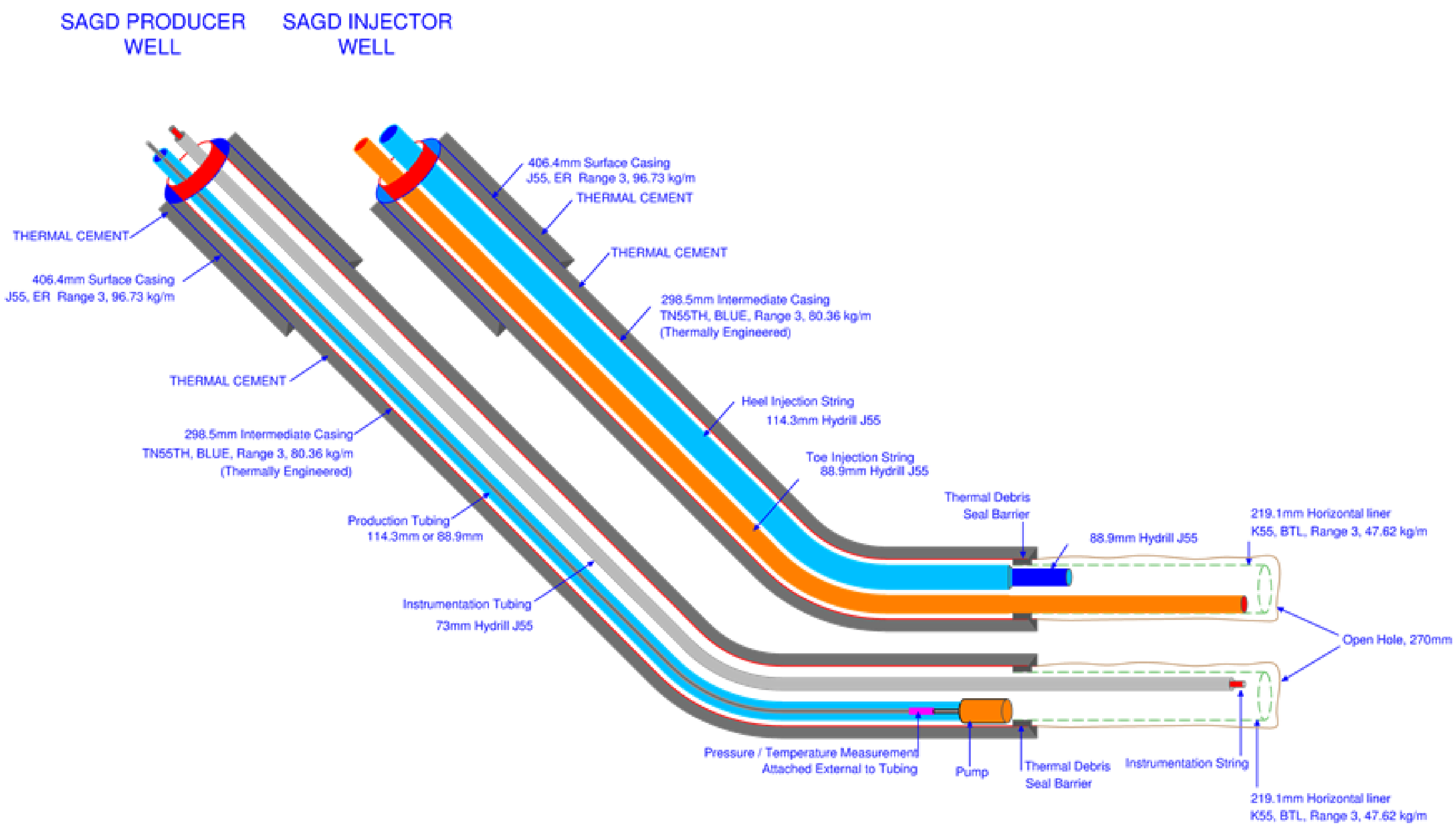
SAGD DRILLING SUMMARY

- 25 well pairs 650-850 m long laterals
- Typical well spacing is 100 m except between pads, which is 130 m
- No new drills during this reporting period

Pad	Average Net Pay thickness above producer (m)	Average Effective Lateral Length in producer (GR<60 API) (m)	Average Percent Reservoir along producer lateral (%)	Well Spacing (m)
AA	23.7	715	86	100
AB	22.4	613	97	100
AC	24.3	674	94	100
AD	26.2	614	96	100
AE	22.6	746	93	100

TYPICAL COMPLETION SCHEMATIC

- Mechanical lift required to bring fluids to surface
- 6 producer wells with all-metal progressing cavity pumps (PCP)
- 19 producer wells with electric submersible pumps (ESP)



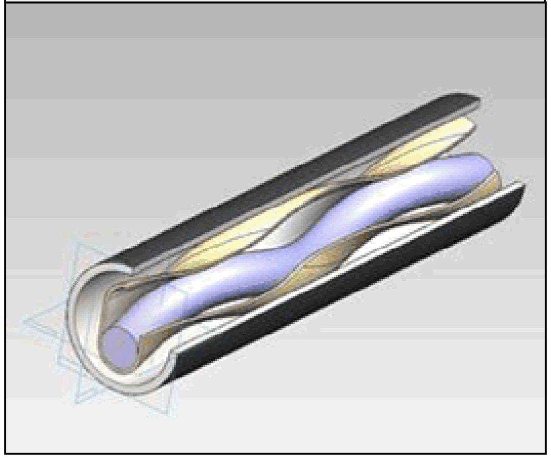
ARTIFICIAL LIFT – TYPES

- All wells initially completed with all-metal PCP
- 19 wells converted to ESP
- Wells and facilities were built with the flexibility to easily convert to ESPs from PCPs

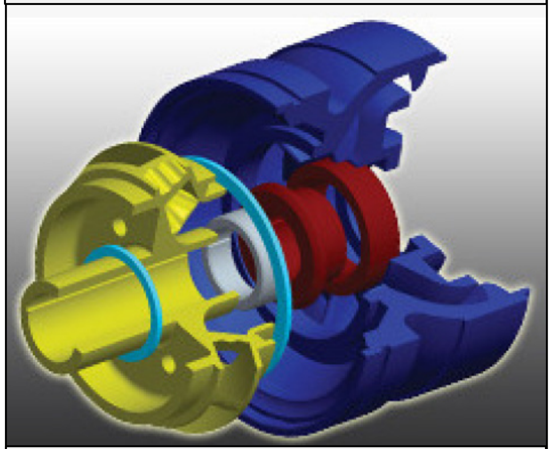
Properties	PCP	ESP
Typical Minimum Rate (m³/d)	100	125
Typical Maximum Rate (m³/d)	600	825

Typical Pump Operating Conditions	
Average BHP (kPag)	1,800
Average BHT (°C)	180

PCP Rotor and Stator



ESP Stage, Impeller, Diffuser



Source: Baker Hughes

Well	Type
AA1	ESP
AA2	ESP
AA3	PCP*
AA4	ESP
AA5	PCP*
AB1	ESP
AB2	ESP
AB3	ESP
AB4	PCP
AB5	ESP
AC1	PCP
AC2	PCP
AC3	ESP
AC4	ESP
AC5	ESP
AD1	ESP
AD2	ESP
AD3	ESP
AD4	PCP
AD5	ESP
AE1	ESP
AE2	ESP
AE3	ESP
AE4	ESP
AE5	ESP

*Production assurance well

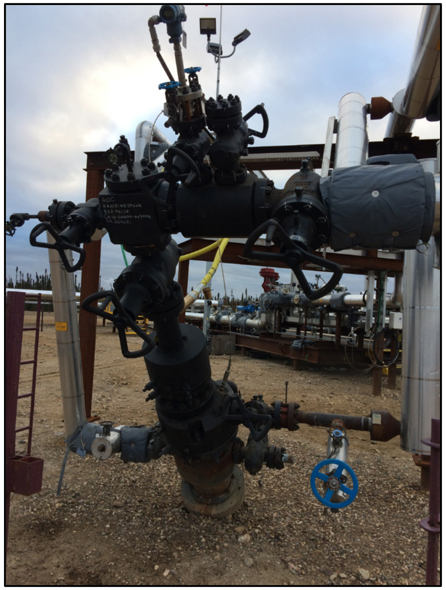
ARTIFICIAL LIFT – PERFORMANCE

PCP PERFORMANCE

- Effective for initial well completion
  - *Successfully steamed through the pump*
  - *Allowed for quick conversion from circulation to SAGD*
  - *Managed a wide range of flow rates*
- All-metal PCPs have performed as expected
- Wellhead pressure reduced on some wells to improve pump efficiency
- Plan to convert PCPs to ESPs as rates improve and wells mature

ESP PERFORMANCE

- 19 wells converted to ESPs



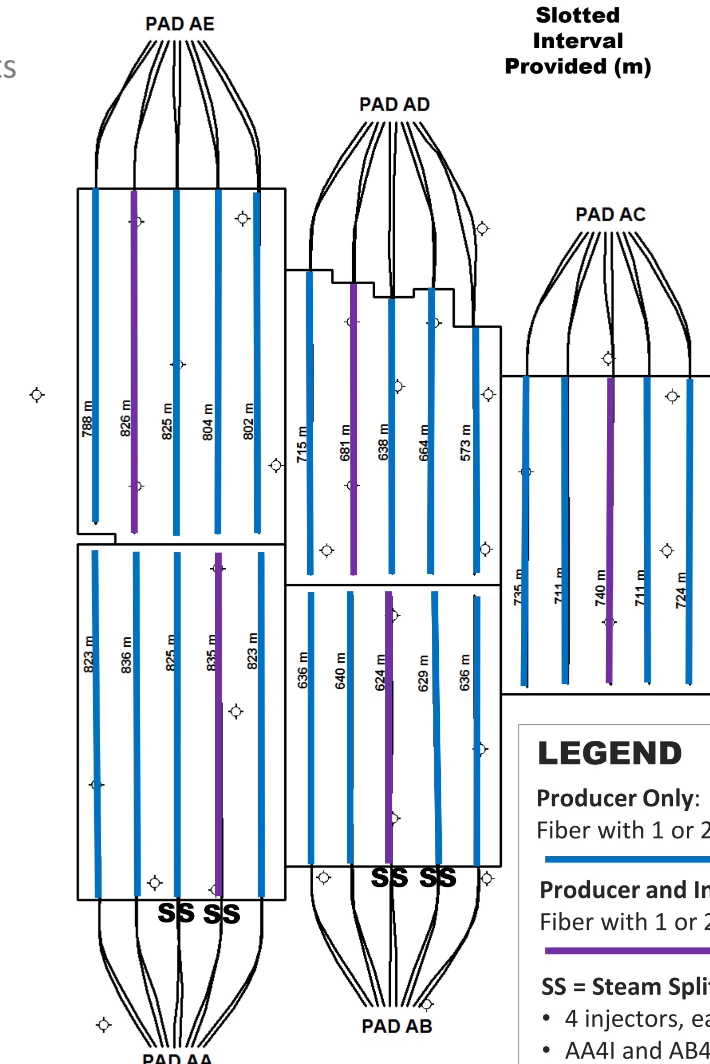
INSTRUMENTATION – SAGD WELL PAIRS

TEMPERATURE

- Two types of fiber for temperature measurements
  - *Fiber Bragg Grating (FBG) and Distributed Temperature Sensing (DTS)*
- Both systems adequate for temperature management along the wellbore

PRESSURE

- Injector BHP is measured with blanket gas
- Producer BHP is measured using optical gauges and/or bubble tubes



LEGEND

Producer Only:
Fiber with 1 or 2 pressure sensors

Producer and Injector:
Fiber with 1 or 2 pressure sensors

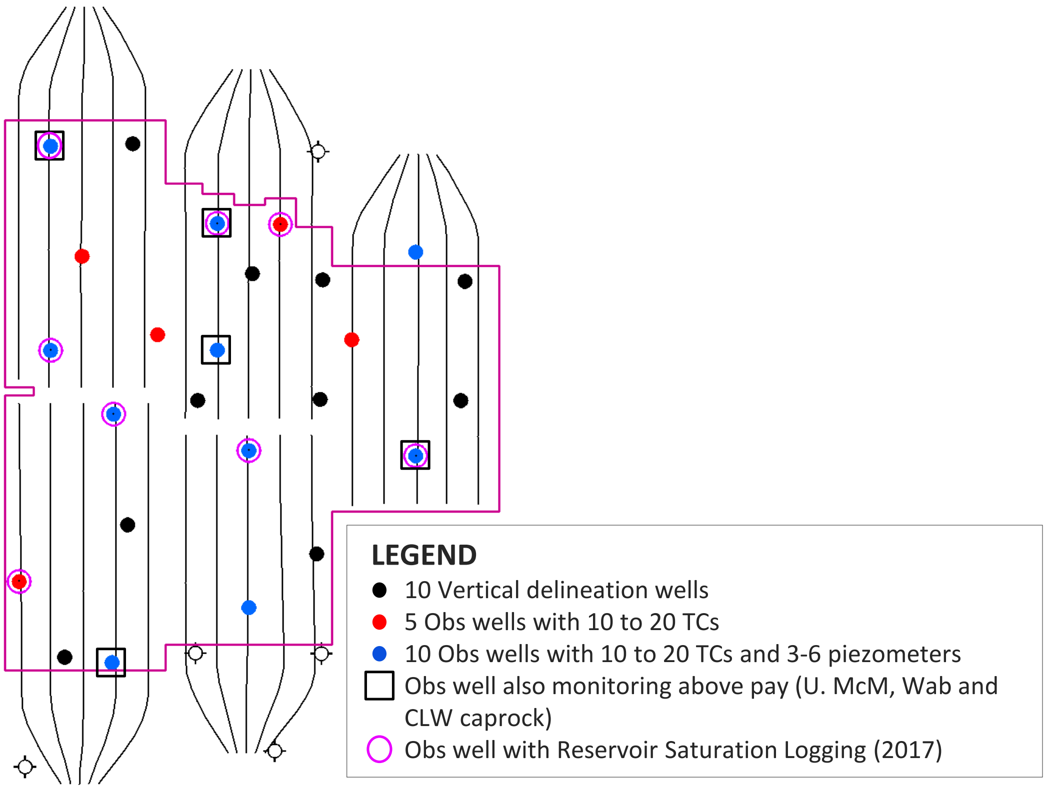
SS = Steam Splitters
- 4 injectors, each with 2 ports
- AA4I and AB4I have slimbore 7” liner

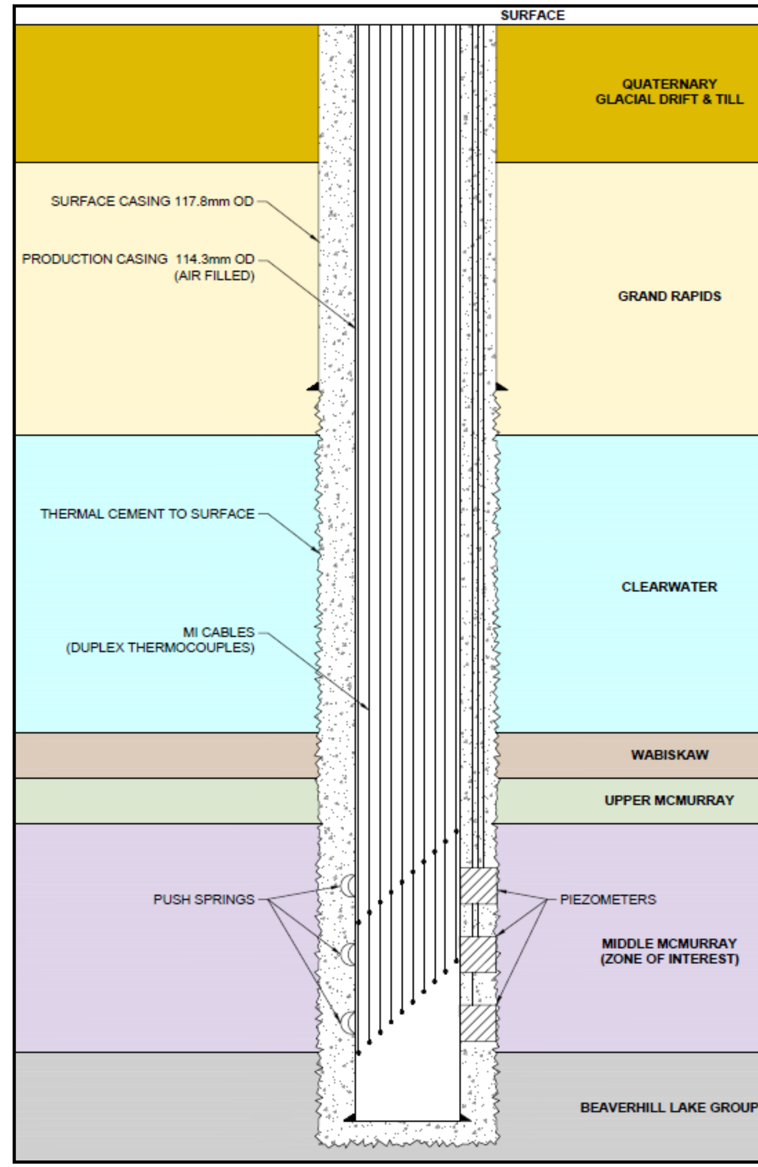
No FCDs installed on producers to date

INSTRUMENTATION – OBSERVATION WELLS

OBSERVATION WELLS

- Some pressure sensors have failed (typically after steam conditions observed)
- Instrumentation used to monitor reservoir pressure and temperature growth





SUBSURFACE

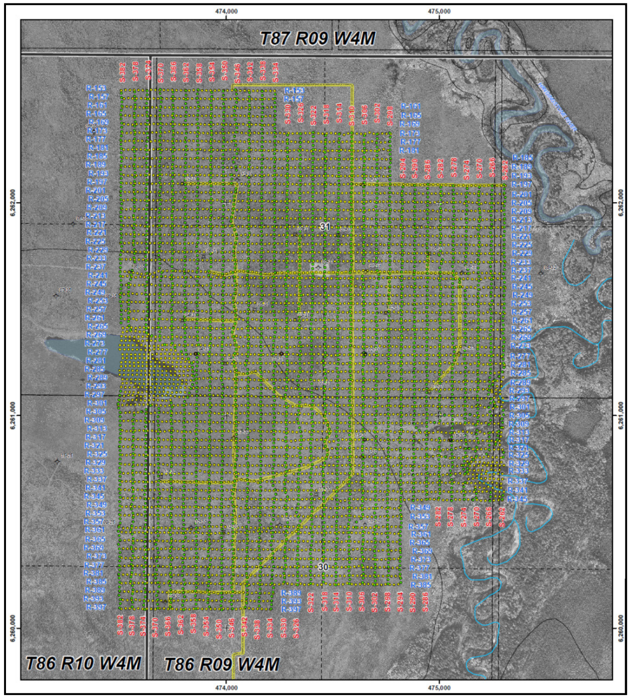
4D SEISMIC AND MONITORING

ATHABASCA OIL CORPORATION

4D SEISMIC

4D SEISMIC STRATEGY

- AOC has buried geophones over the five drainage areas to monitor steam growth and conformance using 4D seismic
  - *Baseline was acquired in Q1 2014*
  - *First monitor was successfully acquired Q1 2016*
  - *Second monitor was successfully acquired Q1 2017*
  - *Next monitor scheduled for Q1 2019*
- Buried geophones allow for year round shooting if needed



ACQUISITION PARAMETERS

- Area: 3.72 km^2
- Source line interval: 60 m, source interval: 20 m
- Receiver line interval: 40 m, receiver interval: 20 m
- Buried receiver depth: 3 m
- Source depth: 6 m

Area	2014				2015				2016				2017				2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Phase 1	☆					▲				★				★							★			

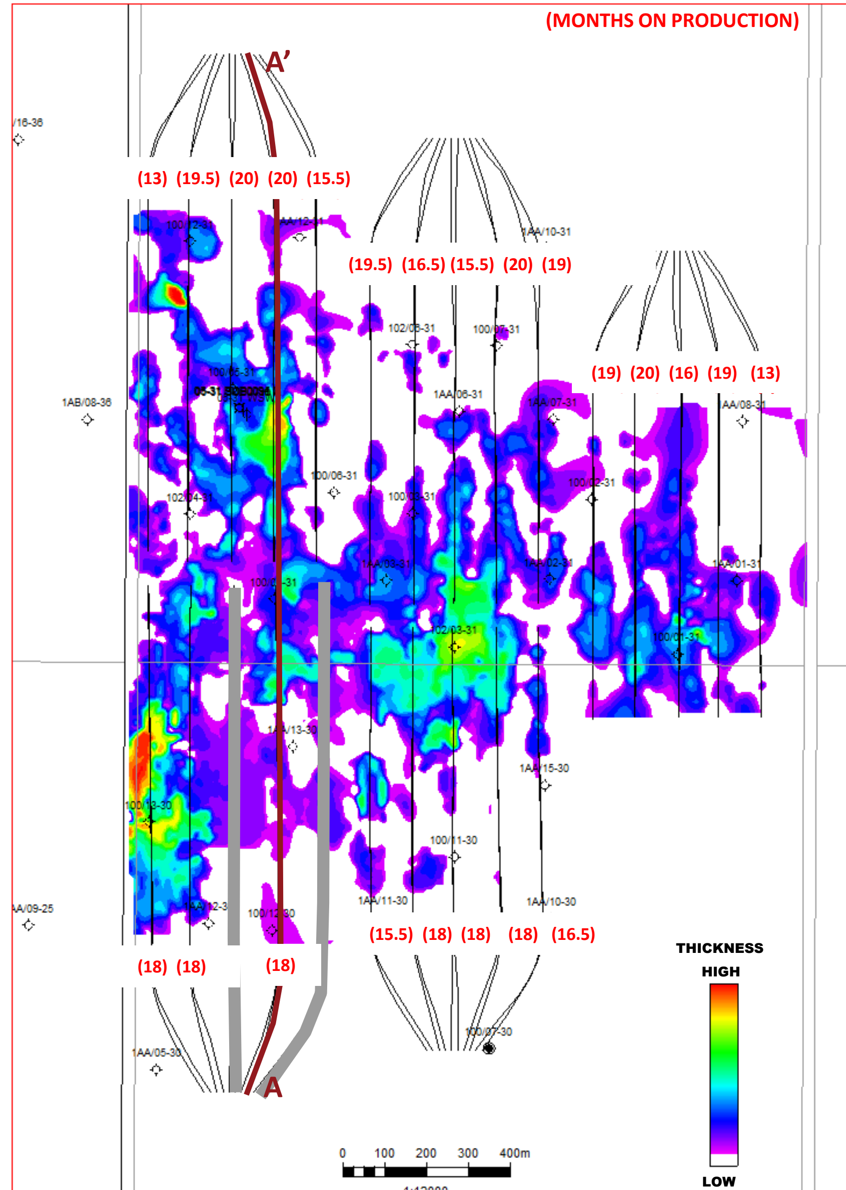
☆ **Baseline** ▲ **First Steam** ★ **Monitor**

4D SEISMIC

4D SEISMIC SECOND MONITOR

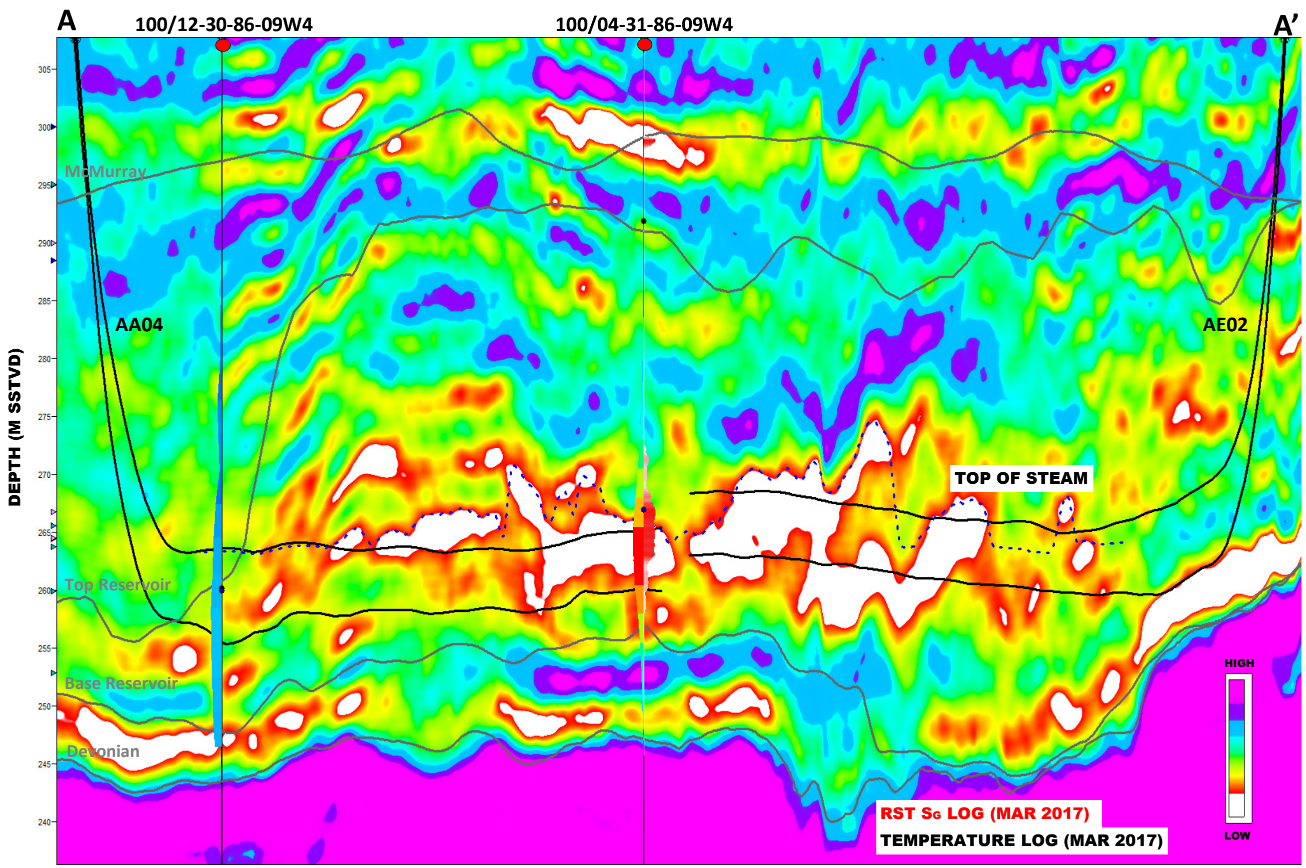
- Acquired in March 2017
  - *Approximately 24 months after first steam*
  - *SAGD conversions range from 13–20 months prior to 4D acquisition*
- Well pairs AA3 and AA5 are production assurance wells (not on production)
- Steam growth seen on 4D monitor correlates with temperature and RST logs on associated observation wells

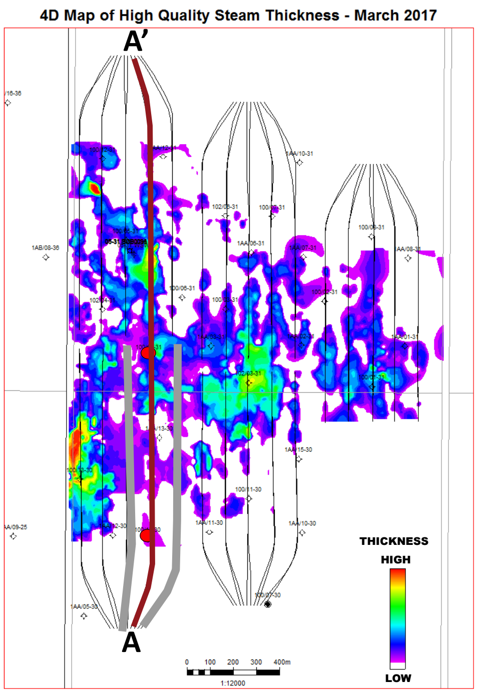
4D Map of High Quality Steam Thickness - March 2017



4D SEISMIC

DENSITY VOLUME (2017 MONITOR)

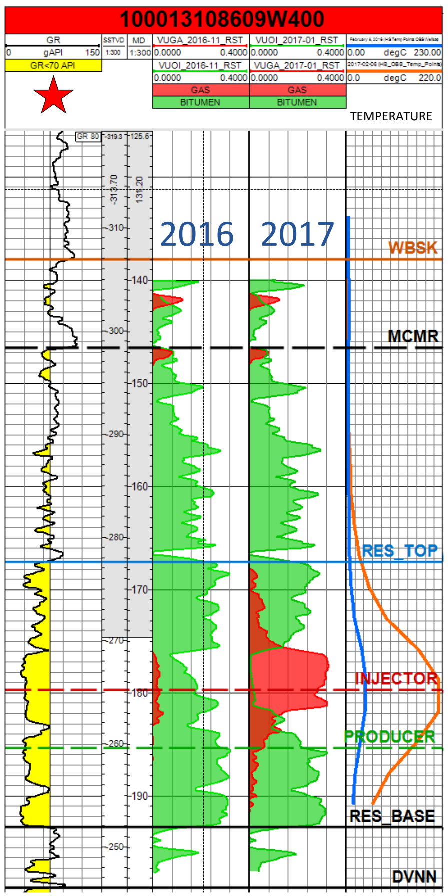


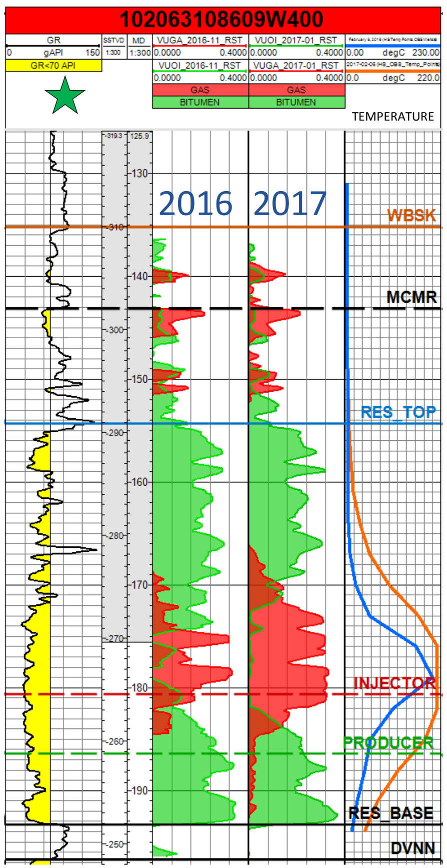


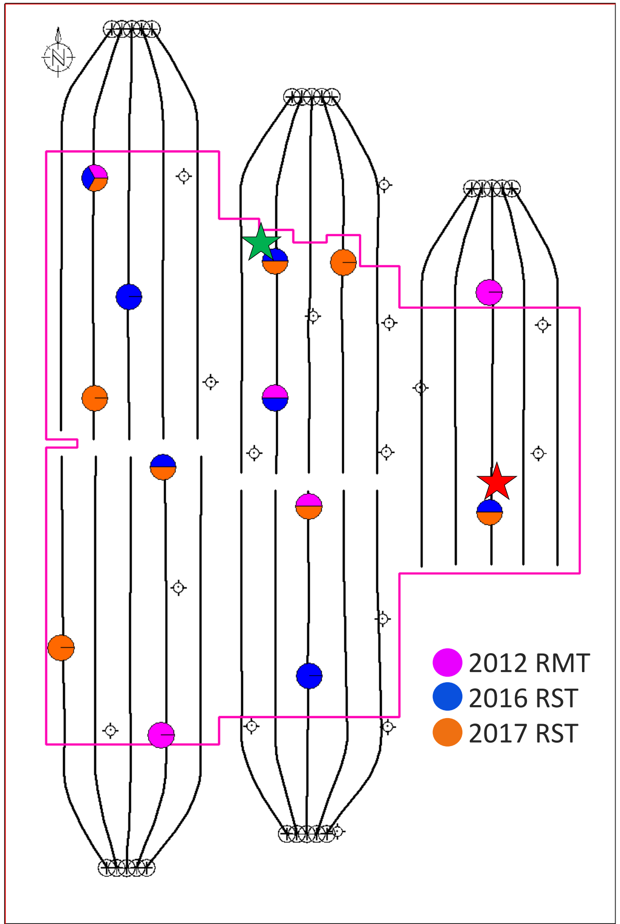
RESERVOIR SATURATION TOOL (RST)

RESERVOIR SATURATION TOOL (RST) RESULTS

- Originally acquired saturation curves on one well per pad in 2012
- In February 2016, acquired saturation logs on 7 different wells, one of which overlapped the baseline curves
- In February 2017 acquired saturation logs on 8 different wells
- RST results show steam chamber thickness correlates with observation well temperature profiles







SURFACE HEAVE MONITORING

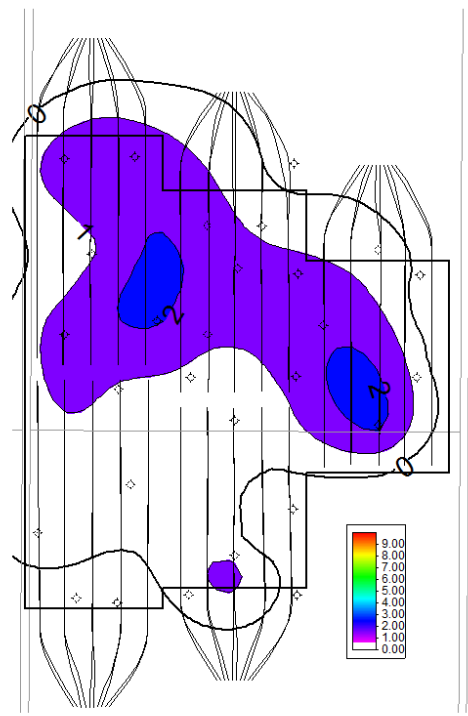
HEAVE MONUMENT PLACEMENT

- 31 permanent surface heave monuments (0.30 x 0.30 m plate)
- Primary means for measuring heave across field
- 15 monuments located at the observation wells and 16 along pipeline corridors and pads

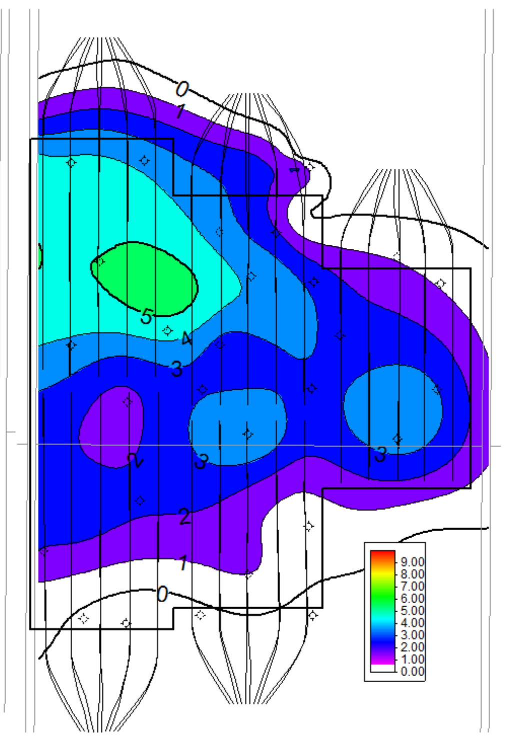
2017 SURVEY/RESULTS

- Real-time Kinematic (RTK) survey method was used. Datum for this survey is ICP009 and position is confirmed by PPP solution
- RTK survey tolerance range is +/- 2 cm
- Minimal change was observed between February 2016 and February 2017 (only two wells outside survey accuracy range)
- The maximum change observed between February 2015 and January 2017 was 5 cm. This occurred over AE Pad which had the greatest steam injection volumes

2015-16 HEAVE DIFFERENCE, CM



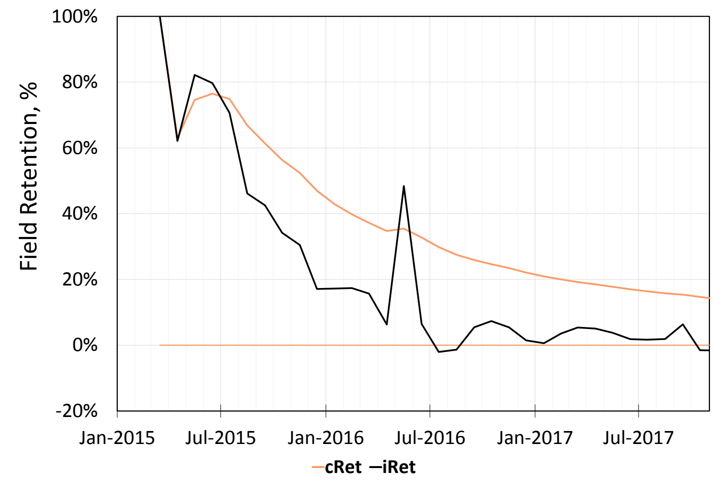
2015-17 HEAVE DIFFERENCE, CM

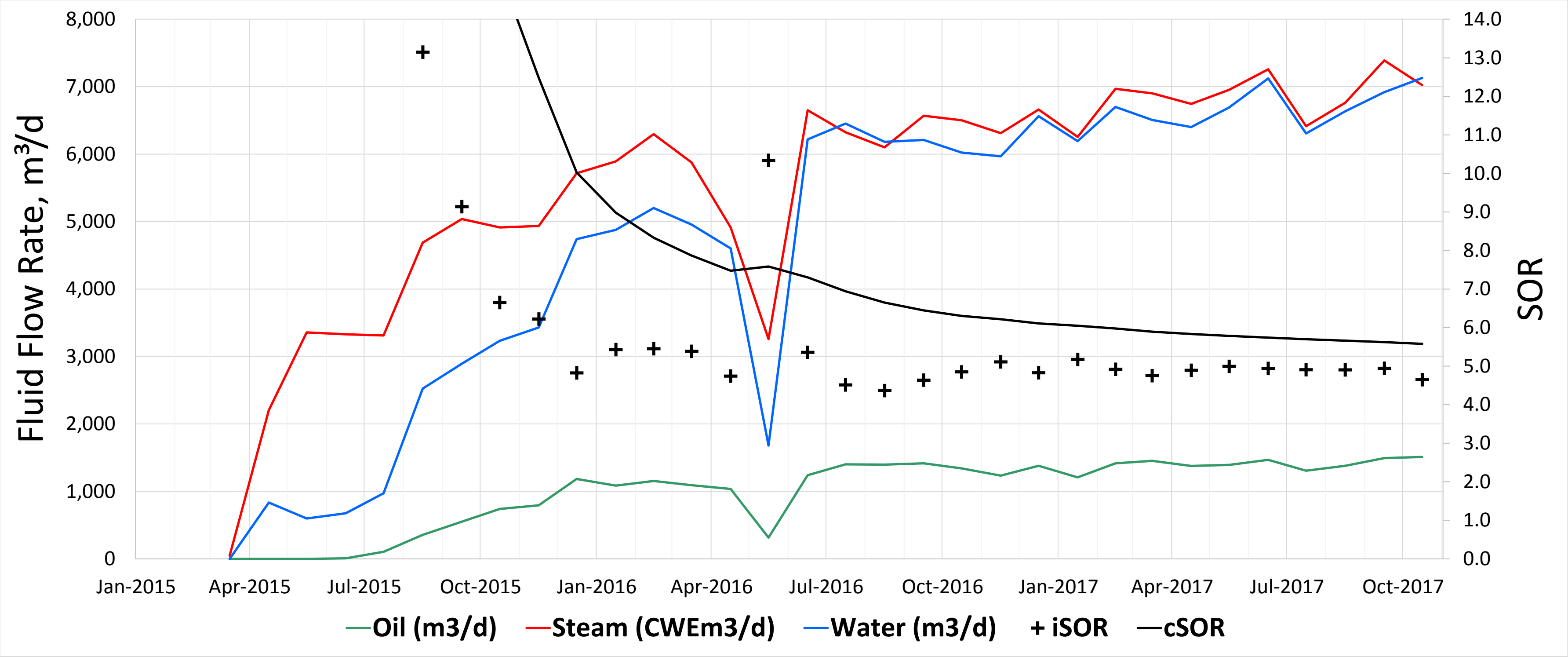


SUBSURFACE
SCHEME PERFORMANCE

FIELD HISTORY

- Continuing production ramp-up and field optimization
- Maximum monthly bitumen rate 1,511 m³/d (9,502 bbl/d) with SOR of 4.6 (Oct 2017)
  - *Currently 23 of the 25 SAGD well pairs on production*
  - *SOR decline will continue as reservoir reaches target operating pressure and upper portions of the reservoir begin to drain*
  - *Improving field sub-cools*
  - *As expected, water retention has reduced over time - providing evidence that the reservoir is bounded*





MOP AND STEAM QUALITY

MAXIMUM OPERATING PRESSURE (MOP)

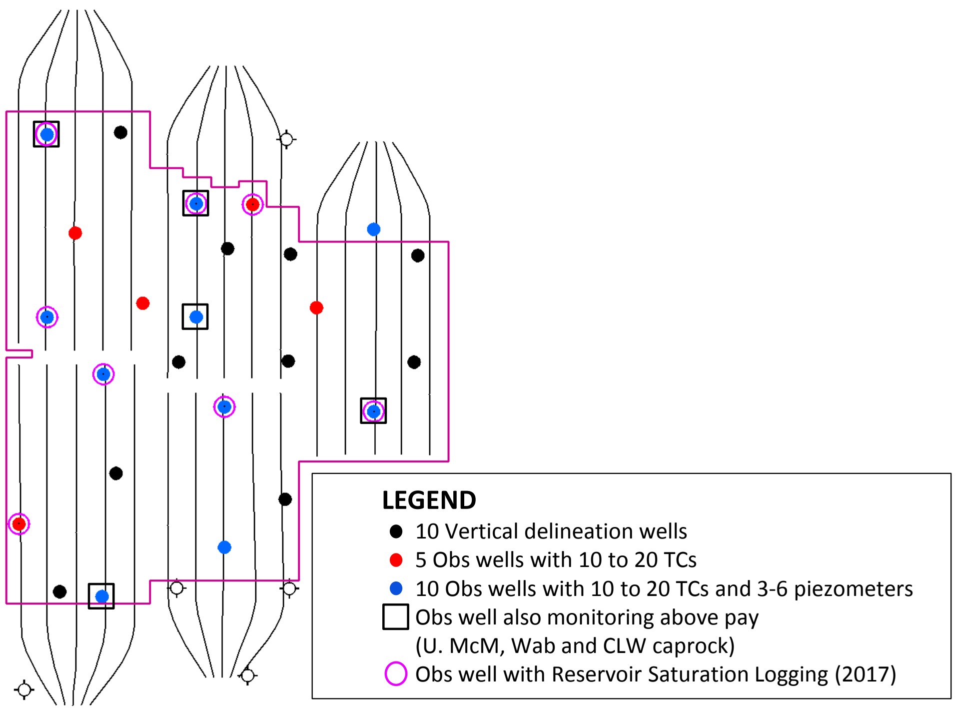
- Approved Maximum Operating Pressure is 2,100 kPag during startup/circulation and SAGD operations
- Request increase of MOP in February 2016 from 1,900 kPag to 2,100 kPag during SAGD mode was approved November 2016
- Injection wells reached new operating pressure targets in October 2017
  - *Average injection pressure of 2,050 kPag*
  - *Currently evaluating results of MOP increase as reservoir pressure continues to increase*

STEAM QUALITY

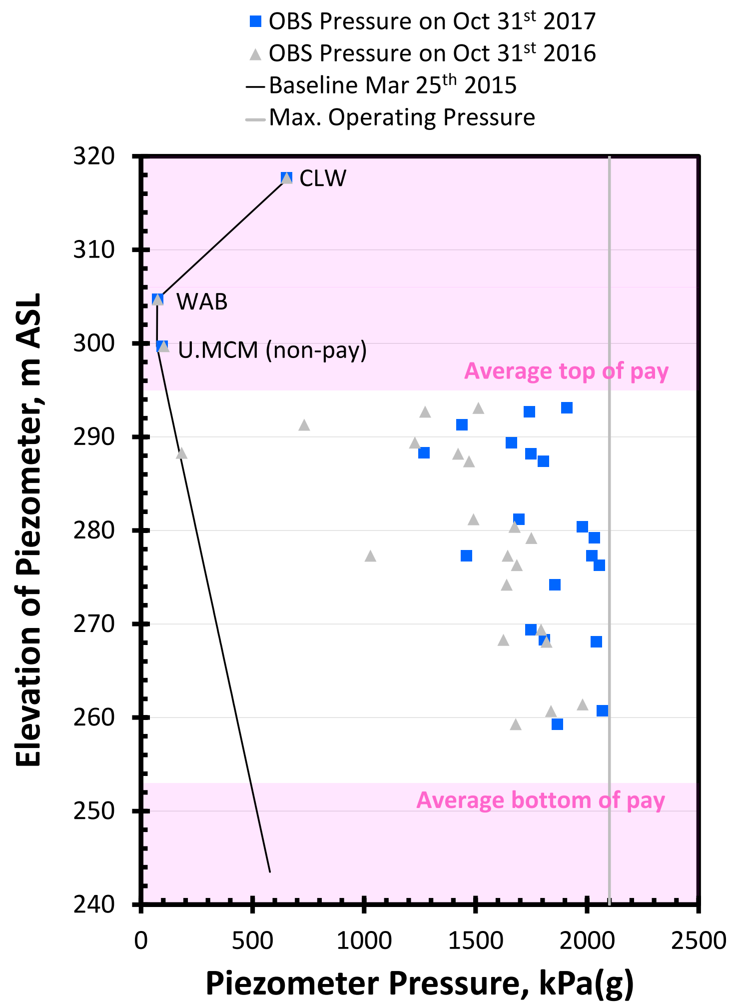
- Steam quality leaving the plant is approximately 98% (incl. Continuous Blow Down (CBD)) at typically 6,000 kPag
- Steam quality decreases to wellheads and is not measured, but has been modelled and estimated to be 95%
- These conditions align with the original design

RESERVOIR PRESSURE

- Piezometers placed throughout the field at various elevations
- Field average pressure indicates the pressure has increased from the Baseline and approaching the MOP pressure of 2,100 kPag
  - *Evidence of vertical and horizontal pressure communication throughout pay across entire field*
  - *No pressure change in caprock*



Piezometer readings at Obs wells

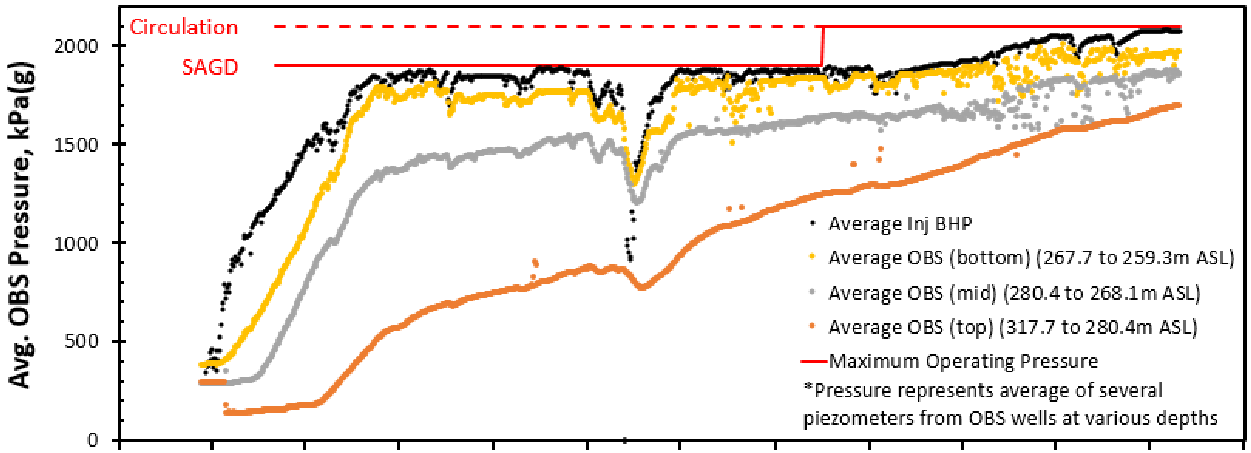


CLW: Clearwater Formation
WAB: Wabiskaw Formation
U.McM: Upper McMurray Formation

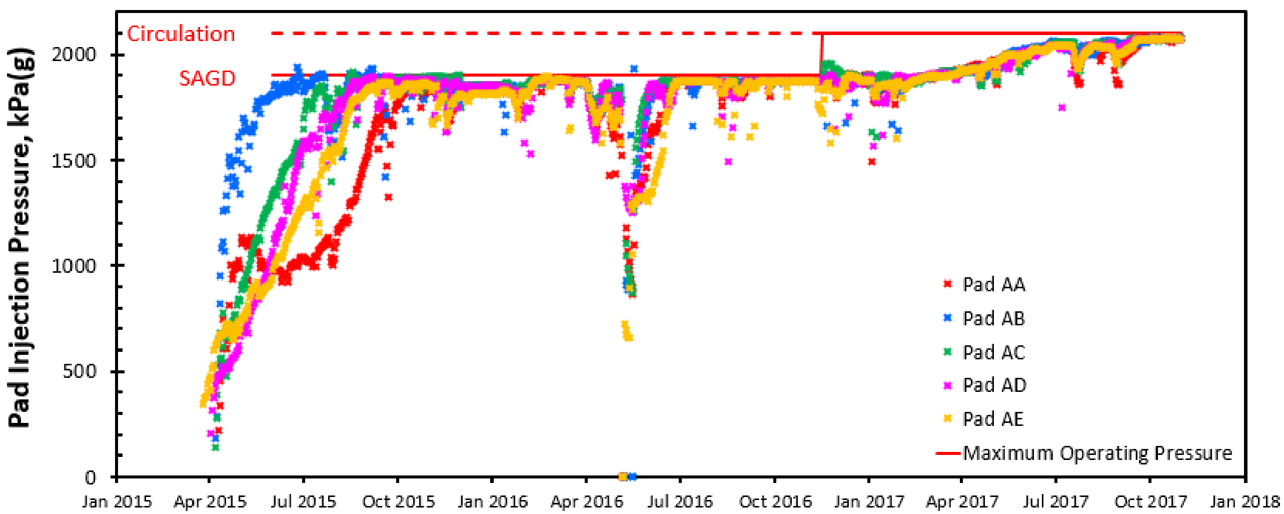
RESERVOIR PRESSURE

- Pressure data shows evidence of pressure communication across entire pay
- Pressure difference between top and bottom of pay is decreasing

Average daily field pressure at base, middle and top of reservoir



Average daily injection pressure in each Pad



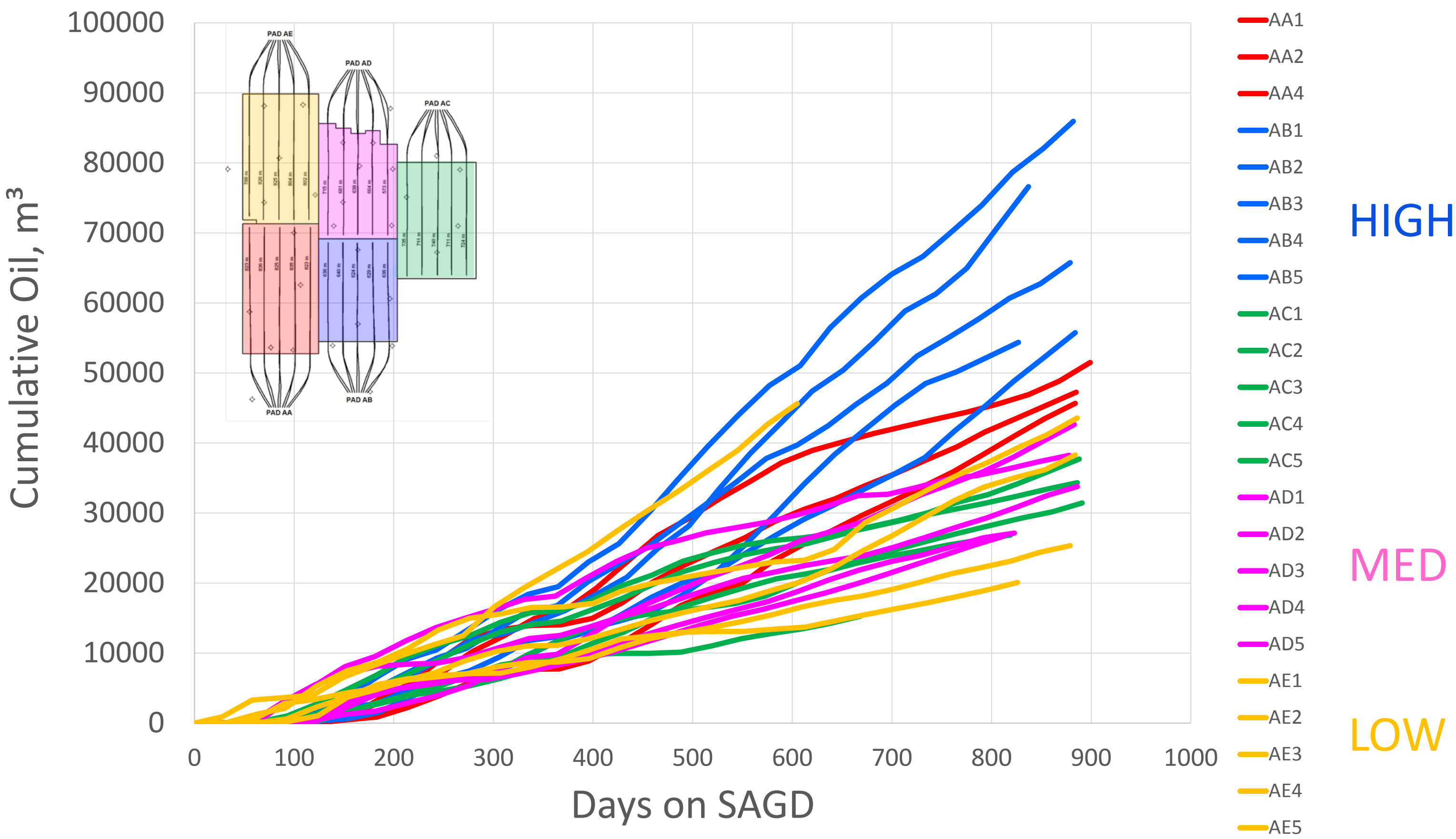
PAD RECOVERY

Pad	Well Pairs	Average Lateral Length (m)	Average Net Pay above Producer (m)	Oil Saturation (frac)	Total Net Pay Porosity (frac)	SAGD-able OBIP (106 m^3)	OBIP (106 m^3)	SAGD-able Predicted Recovery Factor (%)	SAGD-able Recovery Factor (%)	OBIP-based Recovery Factor (%)	Current Recovered (10^3 m^3)
AA	3/5	850	23.7	0.71	0.35	2.68	3.30	50-70	5.4	4.4	144.4
AB	5/5	640	22.4	0.73	0.37	2.21	2.90	50-70	15.3	11.7	338.5
AC	5/5	750	24.3	0.70	0.36	2.52	3.00	50-70	5.8	4.9	145.6
AD	5/5	670	26.2	0.71	0.35	2.52	3.20	50-70	6.7	5.3	168.5
AE	5/5	830	22.6	0.70	0.35	2.53	3.20	50-70	6.8	5.4	172.9
TOTAL	**23/25**					**12.46**	**15.6**	**50-70**	**7.8**	**6.2**	**969.9**

- SAGD-able OBIP values are based on actual producer well placement and reservoir height above producer well. OBIP is gross oil volume between base and top of pay
- Included 25 m at Heel and Toe of Well in both OBIP volumes

PAD PERFORMANCE

- Variation of pad performance depends on geology, pad boundary, well pair trajectories, pump performance and subcool conformance
  - *Pads AB, AD and AE selected as examples of high/medium/low performing pads*
    - *Selection based on cumulative oil recovery*
    - *Differences in the productivity of the wells primarily due to geological variability*

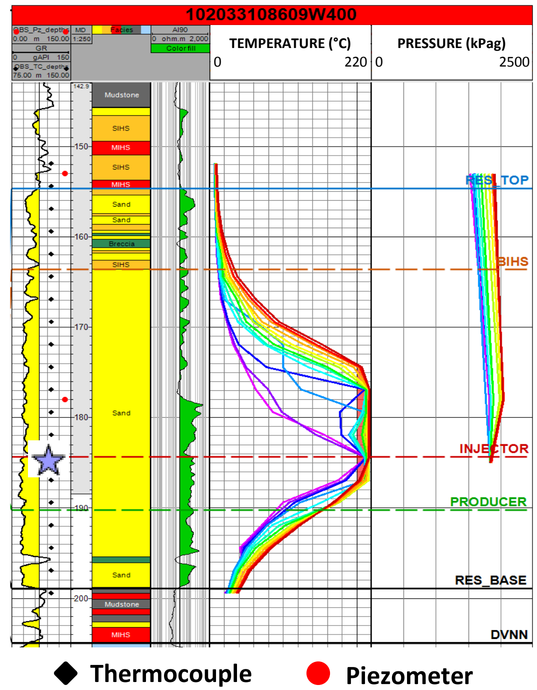


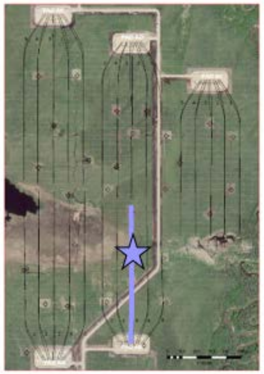
PAD PERFORMANCE – HIGH PAD AB

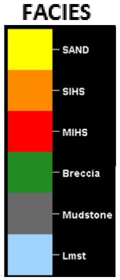
HIGH PAD AB

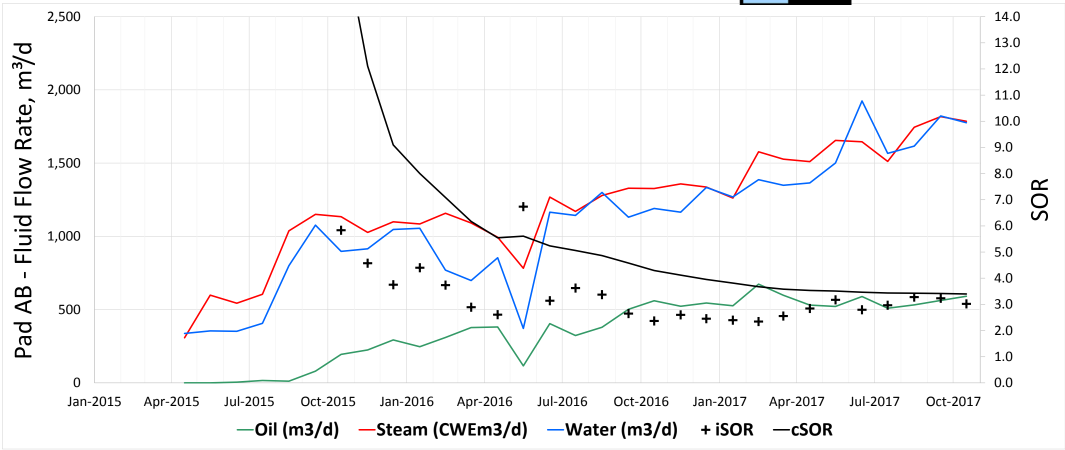
- Cumulative production: 338,560 m^3
- cSOR: 3.4
- Highest reservoir quality
  - *Mostly sandy reservoir*
  - *High oil saturation around well pairs*
  - *Thin low bitumen saturation zone*
- Highest average effective wellbore (97%)
- Partially bounded
- Well 03-31 shows steam chamber development near toe of AB03
- Pressure increase at top of reservoir through IHS

AB03OE, 102/03-31-86-09W4 TOE (6.6m OFFSET)







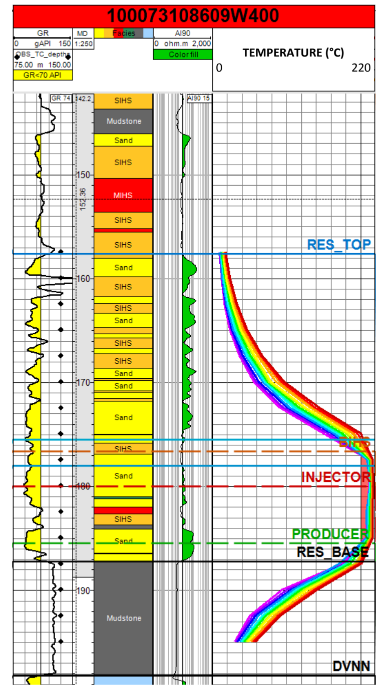


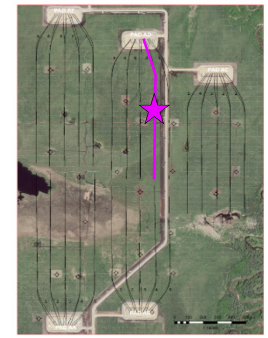
PAD PERFORMANCE – MID PAD AD

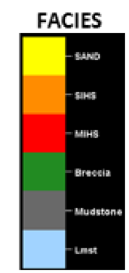
MID PAD AD

- Cumulative production: 169,297 m^3
- cSOR: 6.1
- Average reservoir quality
  - *IHS with high oil saturation in upper reservoir*
  - *Thick low bitumen saturation zone above injection well*
  - *Thickest net pay (26.2 m)*
- Shortest wells
- Most bounded pad
- High average effective wellbore (96%)
- Well 7-31 shows good steam chamber development at heel of AD02
  - *Temperature increase through IHS*
  - *Steam chamber advancing through LSZ*

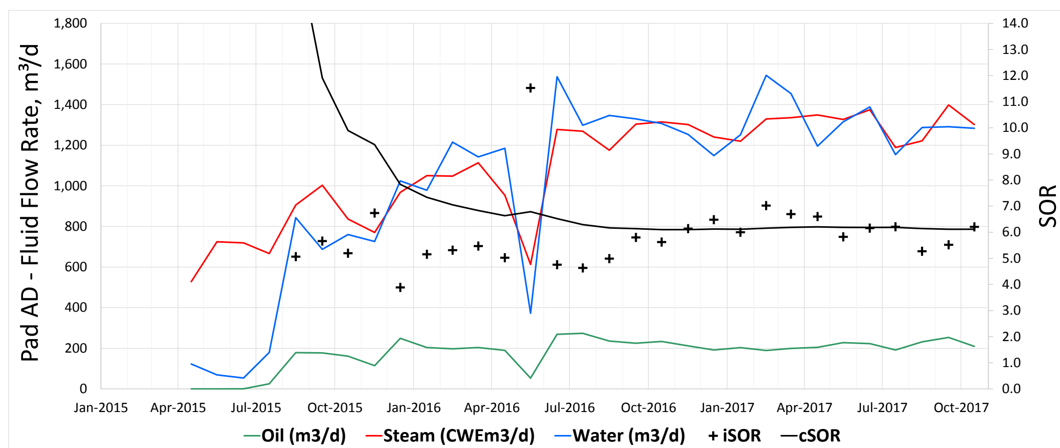
AD02OA, 100/07-31-86-09W4 HEEL (0.7 m OFFSET)







◆ Thermocouple

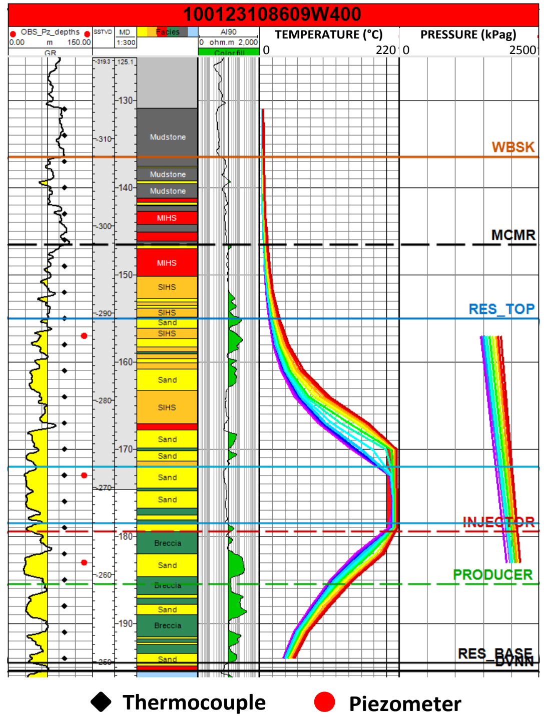


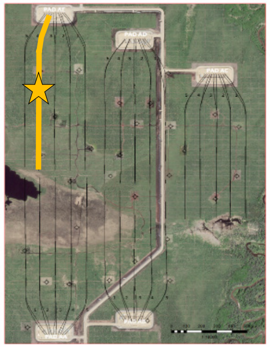
PAD PERFORMANCE – LOW PAD AE

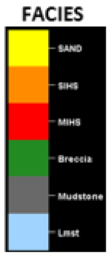
LOW PAD AE

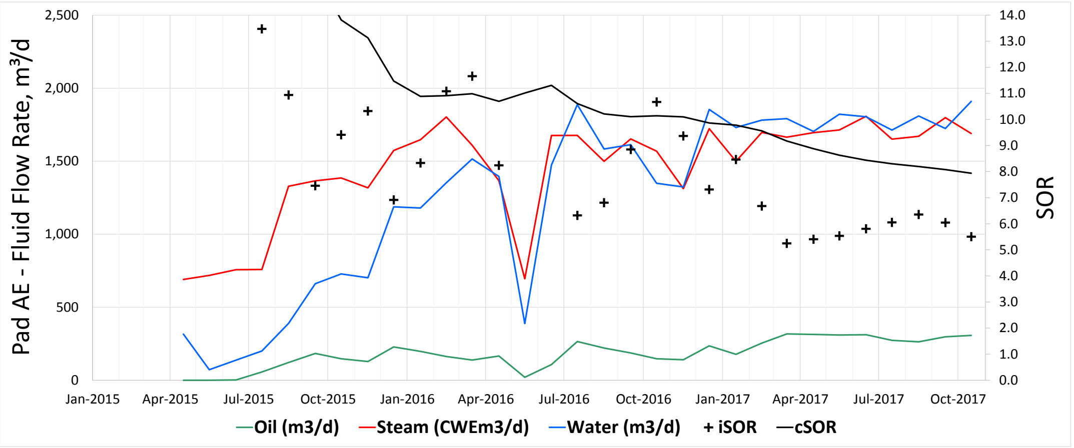
- Cumulative production: 172,442 m^3
- cSOR: 7.9
- Average reservoir quality
  - *Breccia dominated*
  - *Thick low bitumen saturation zone above injection well*
- Unbounded towards west
- Pad performance improved from last year after ESP conversions
- Well 12-31 shows good steam chamber development at heel of AE04
- Pressure increases at top of reservoir through IHS
- Temperature increasing above breccia
  - *Fluid movement along bedding planes and through breccia*
  - *Steam chamber advancing through LSZ*

AE04OA, 100/12-31-86-09W4 HEEL (5.6 m OFFSET)









FUTURE PLANS

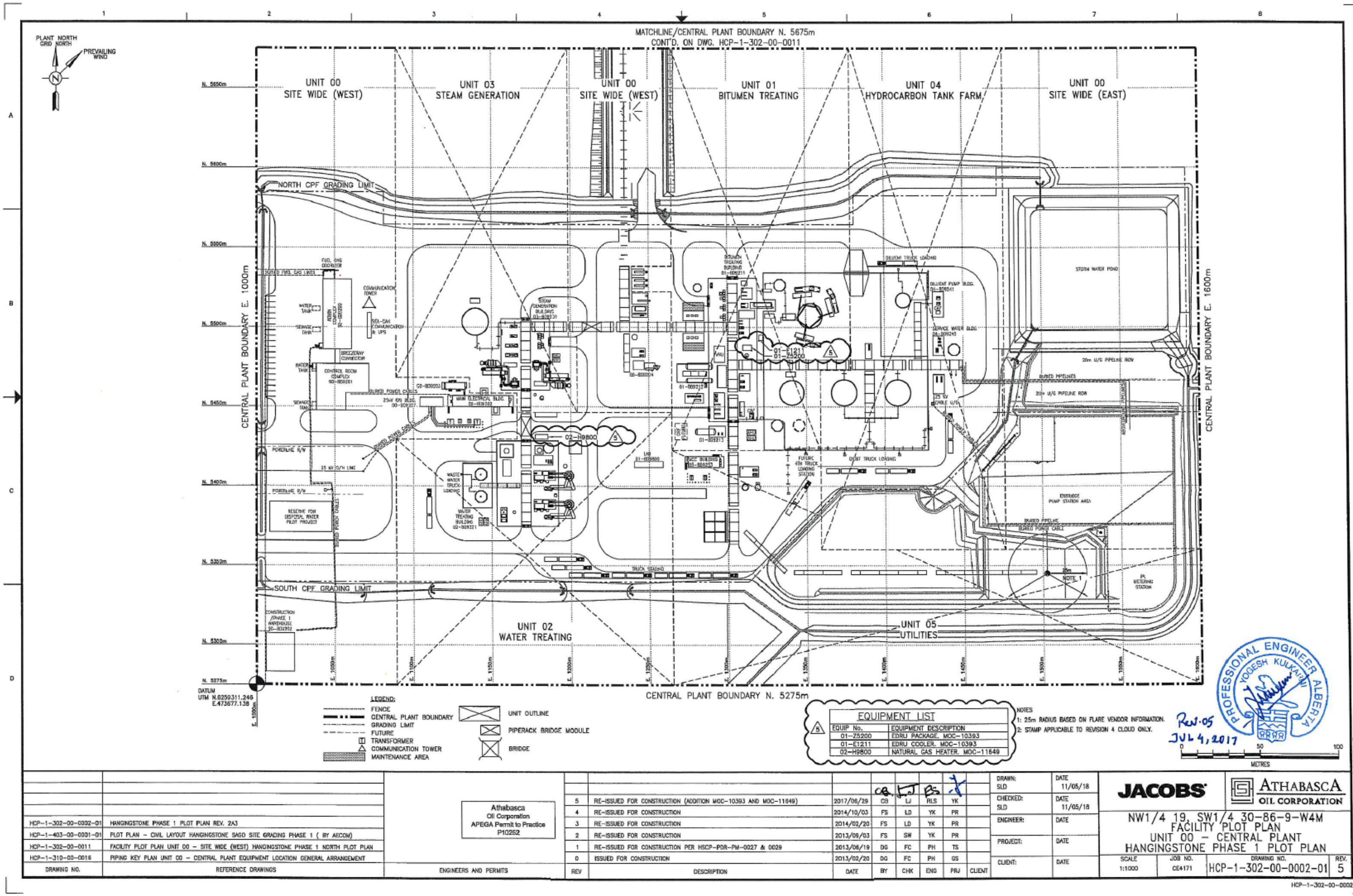
- No new SAGD drills planned for next reporting period
- No abandonments planned in the next 5 years
- Production assurance wells to be brought online pending steam availability
- Expect to convert remaining active PCP wells to ESPs as required
- Evaluating opportunities for Flow Control Devices (FCDs) into one or more producer wells

SURFACE OPERATIONS

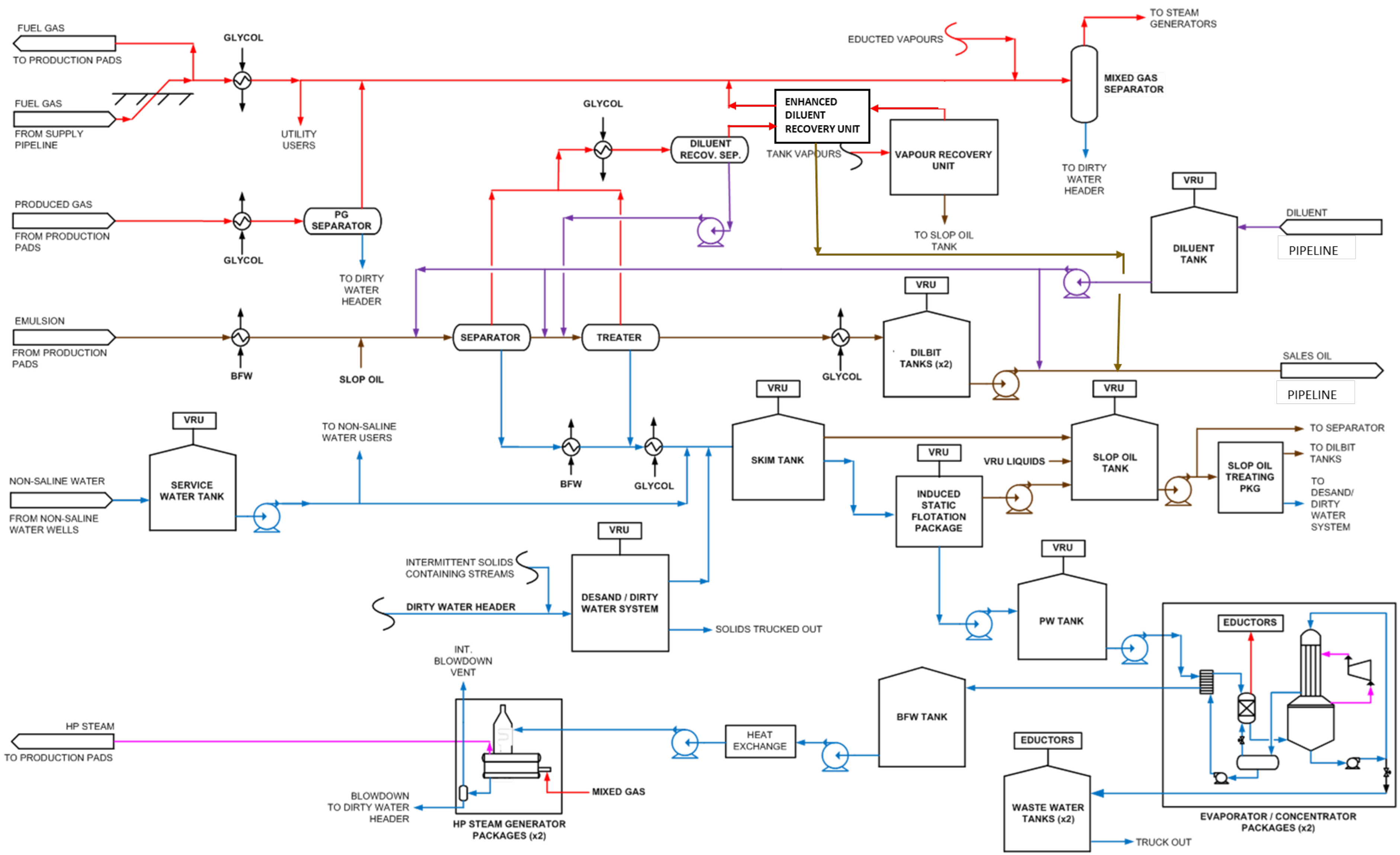
FACILITIES

ATHABASCA
OIL CORPORATION

APPROVED PLOT PLAN



FACILITY SCHEMATIC



SURFACE OPERATIONS

FACILITY PERFORMANCE

ATHABASCA OIL CORPORATION

FACILITY PERFORMANCE

SITE RELIABILITY > 95%

- Based on steam performance
- Integrity management program and predictive maintenance programs have been implemented to maintain higher site reliability

MAJOR ACTIVITIES

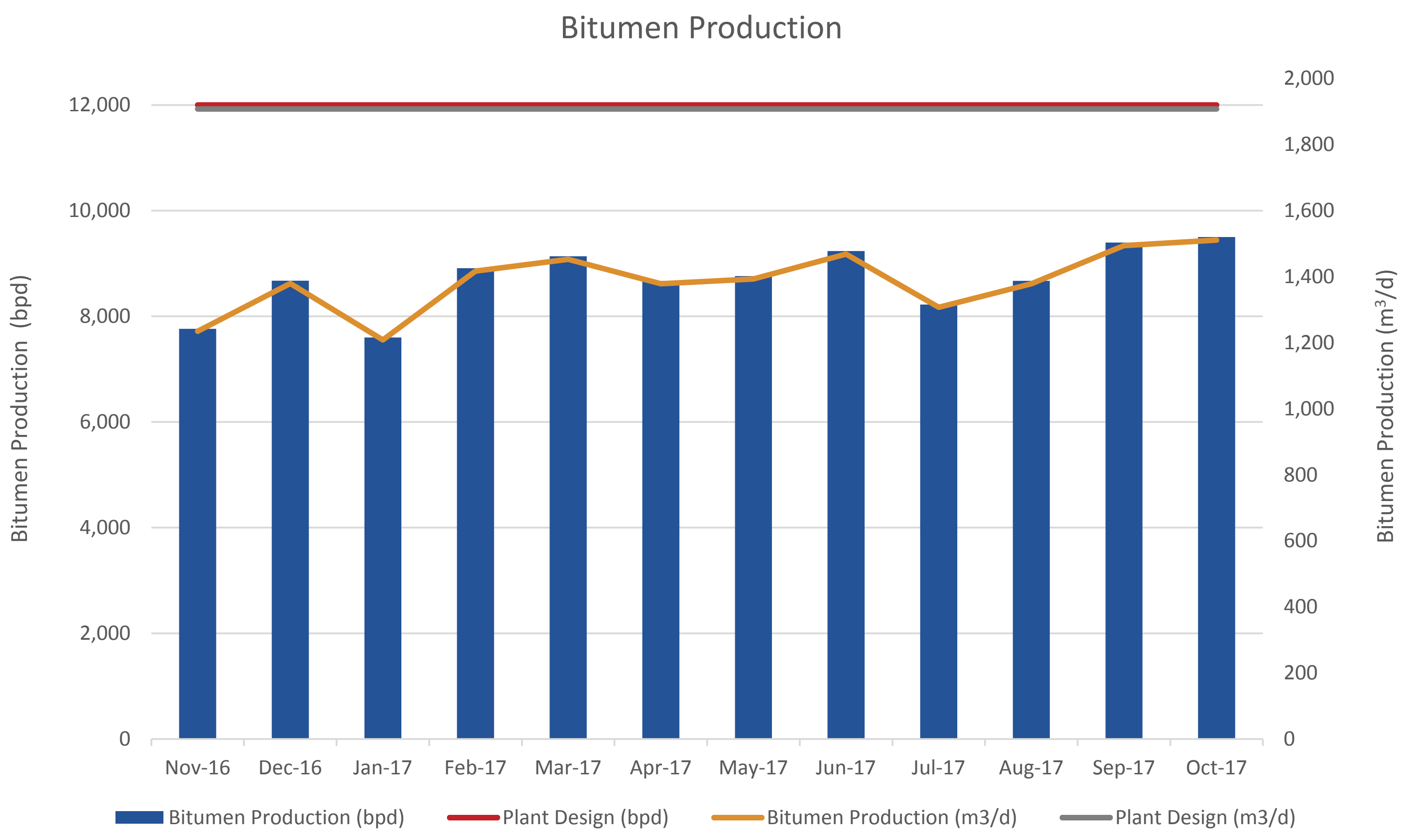
- Boiler Mechanical Cleaning
- Evaporator Mechanical Cleaning
- Enhanced Diluent Recovery System installation and commissioning
- Evaporator Eductor motive fluid electric heater installation and commissioning

MAJOR CHALLENGES

- De-oiling optimization

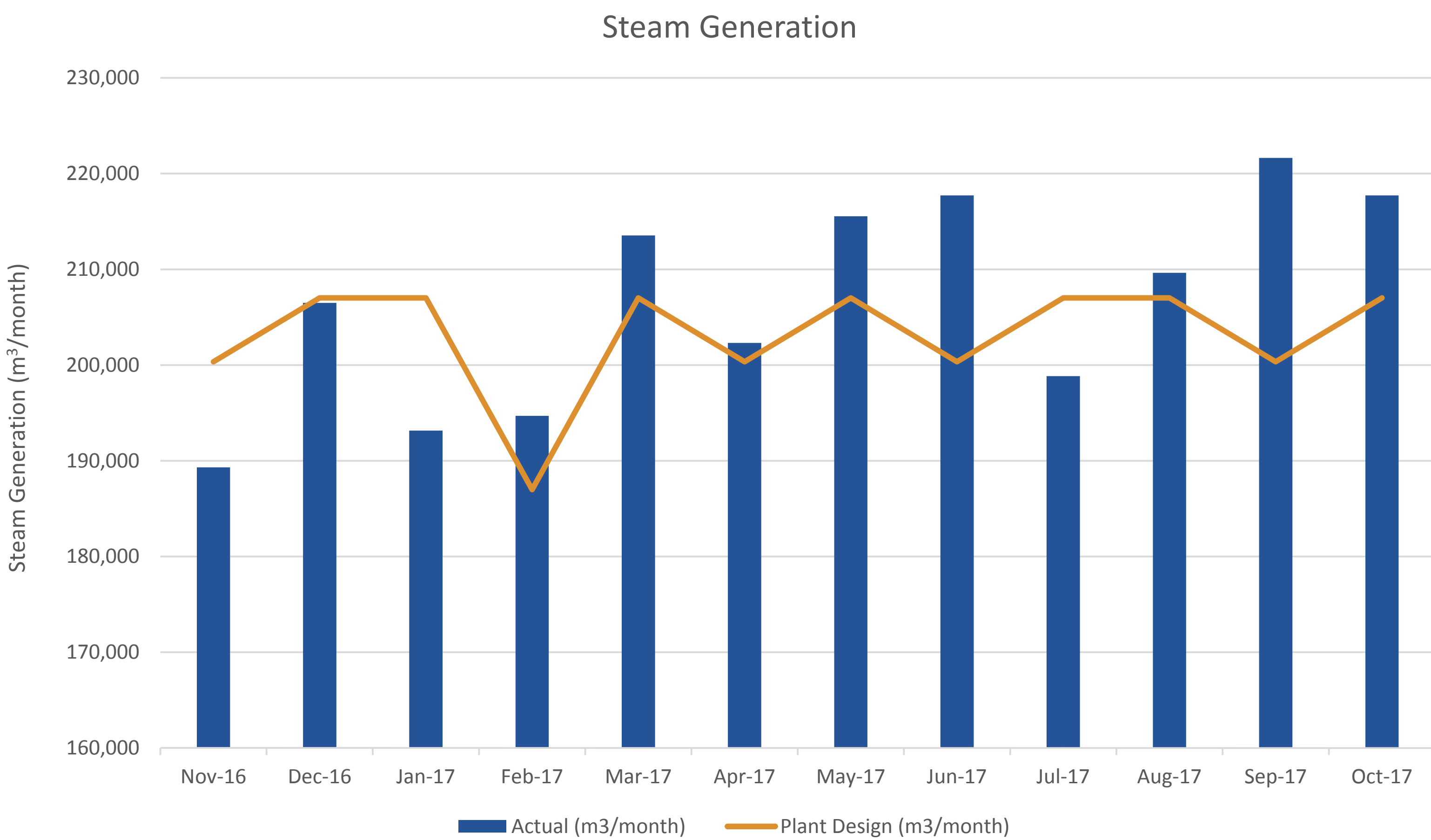
FACILITY PERFORMANCE

BITUMEN PRODUCTION



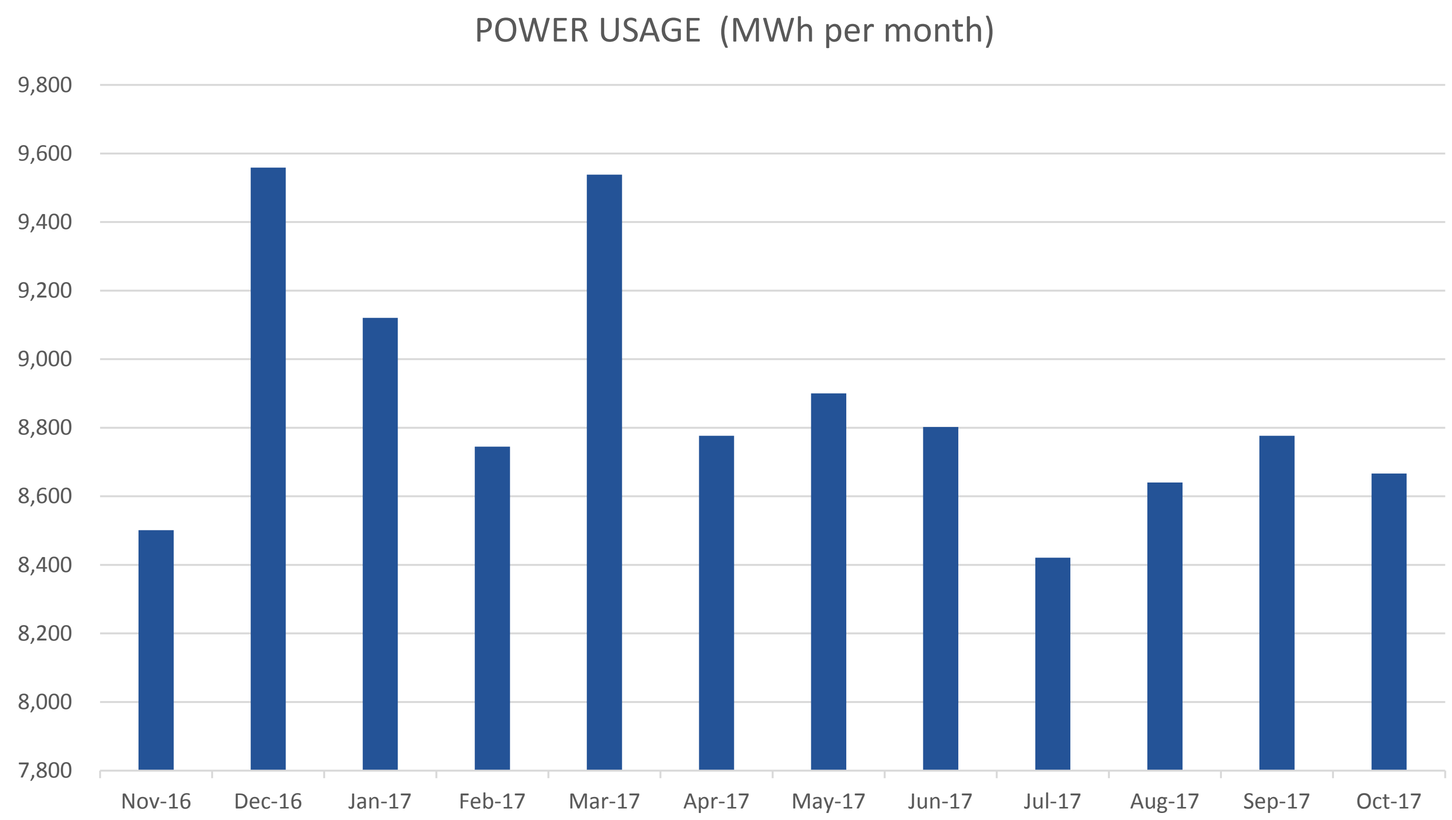
FACILITY PERFORMANCE

STEAM GENERATION



FACILITY PERFORMANCE

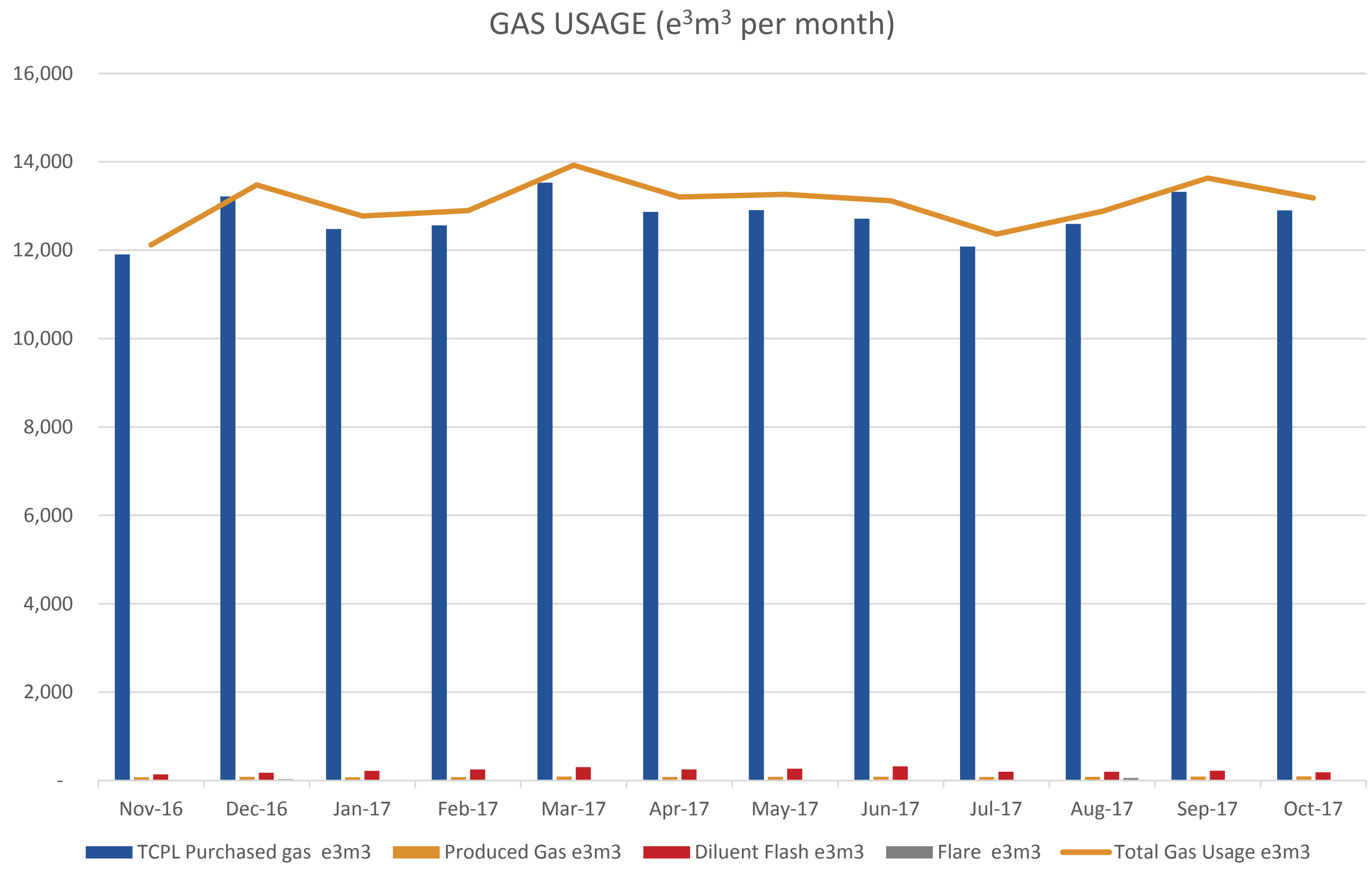
POWER USAGE YTD 106,447 MWH



FACILITY PERFORMANCE

TOTAL GAS USAGE YTD 156,837 e^3m^3

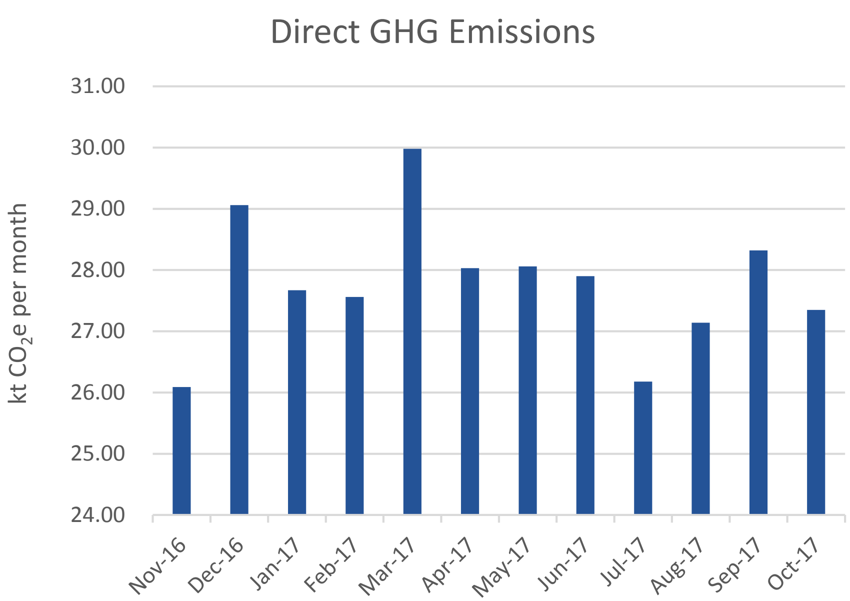
SOLUTION GAS RECOVERY 100%

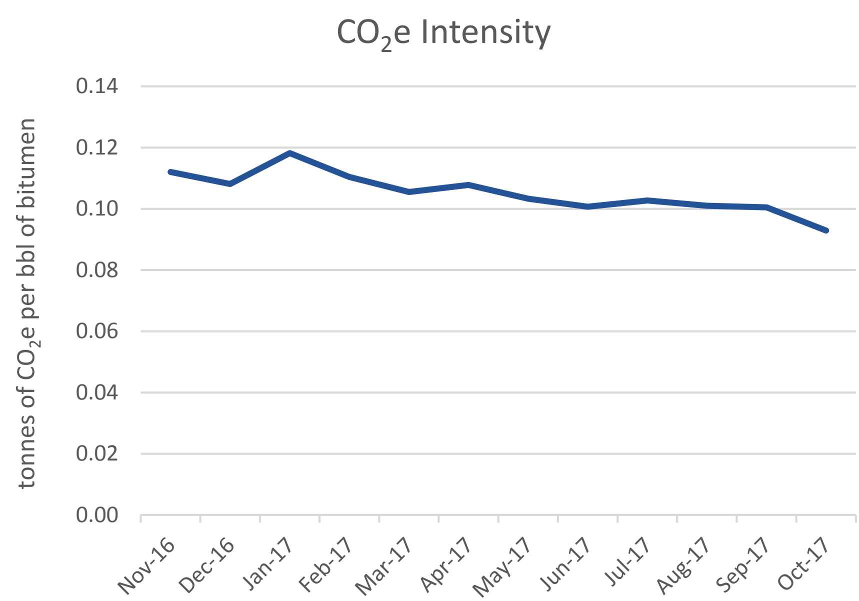


FACILITY PERFORMANCE

DIRECT GHG EMISSIONS FROM NOVEMBER 2016 – OCTOBER 2017 : 333.3 KT CO_2e

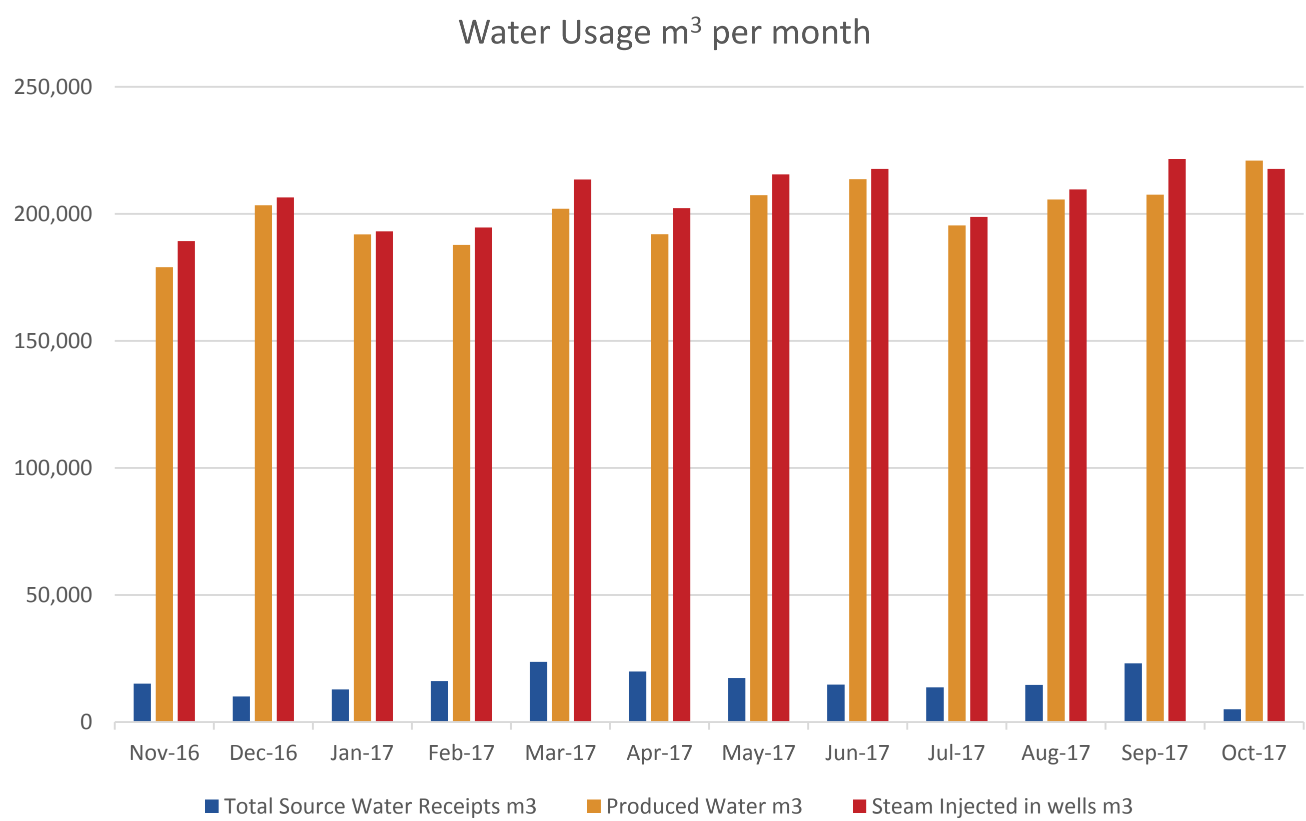
- Sources: stationary combustion, flaring, venting and fugitives
- Calculated using quantification methodology submitted with 2016 SGER data





FACILITY PERFORMANCE

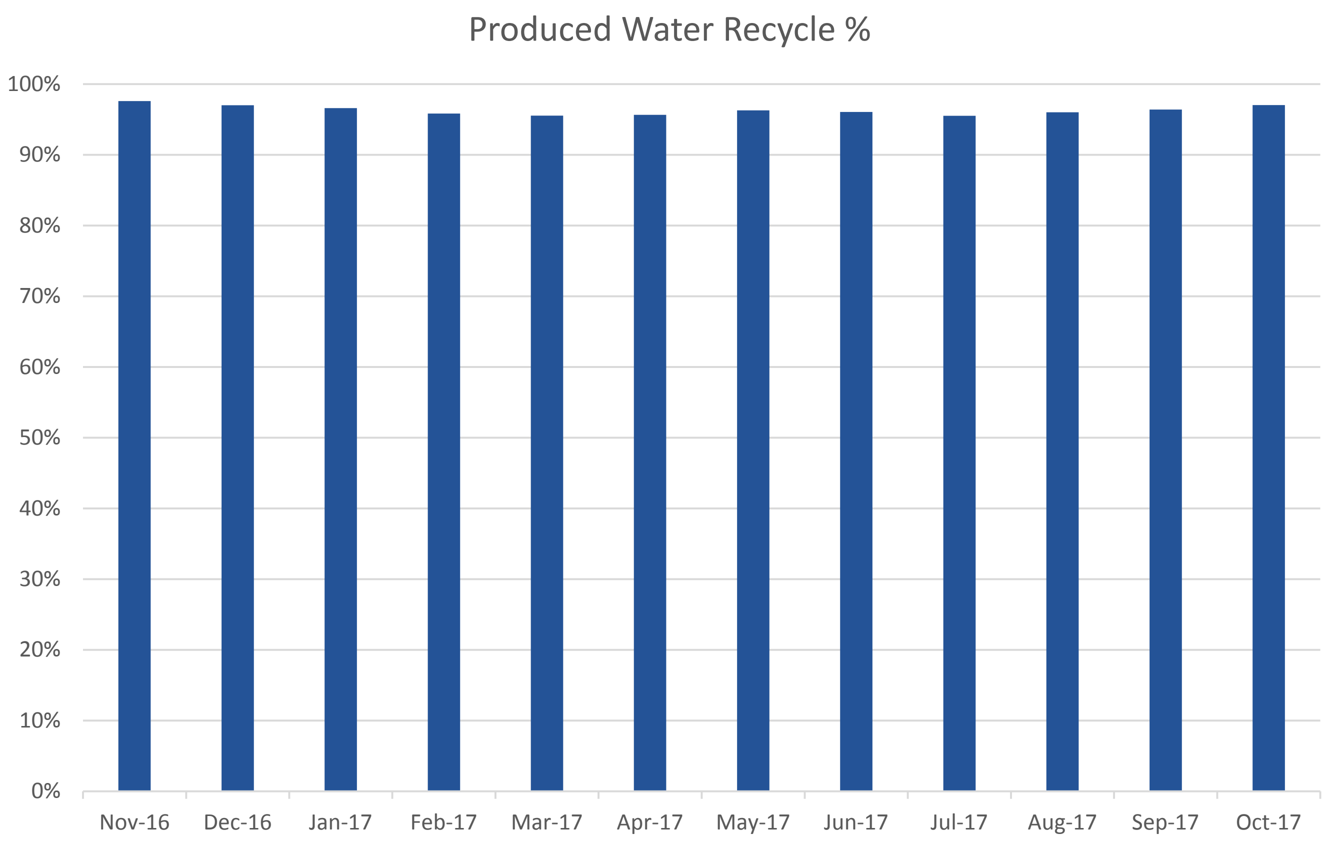
WATER USAGE



FACILITY PERFORMANCE

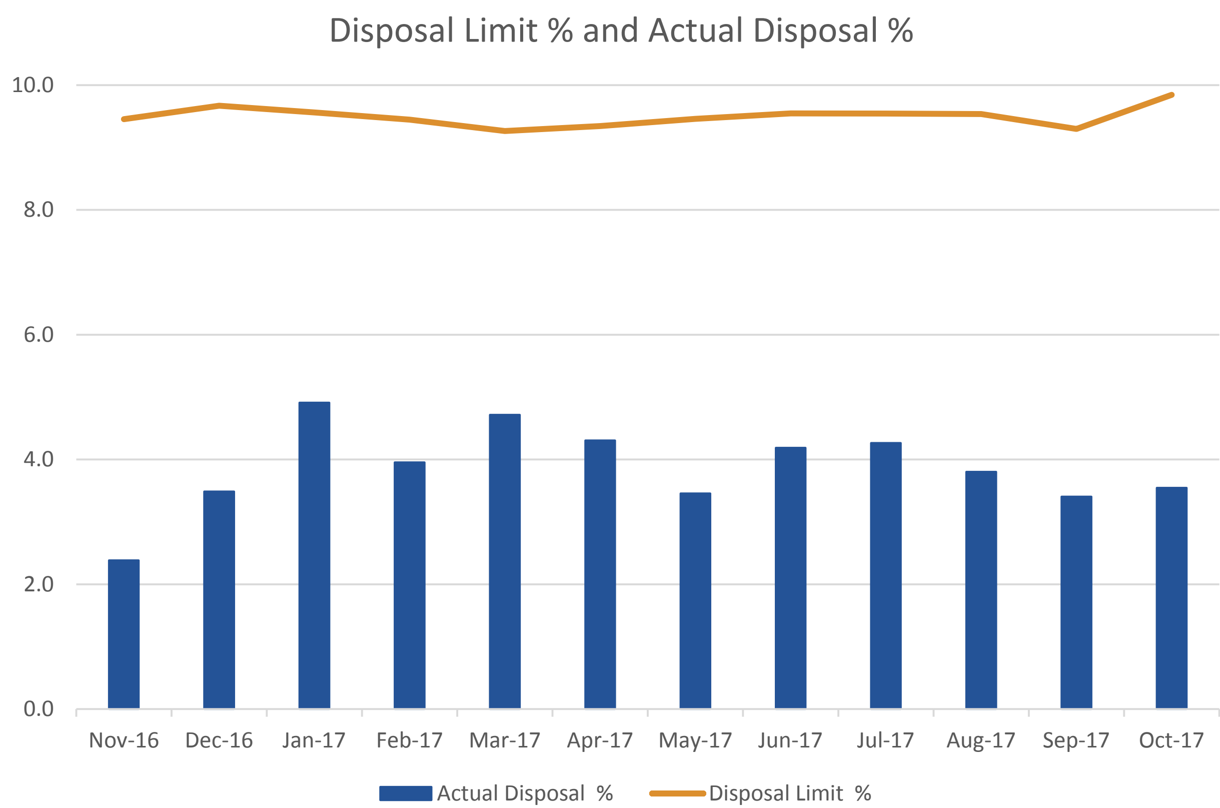
PRODUCED WATER RECYCLE (AVG. 96%)

Directive 081 , Appendix H, Equation 6



FACILITY PERFORMANCE

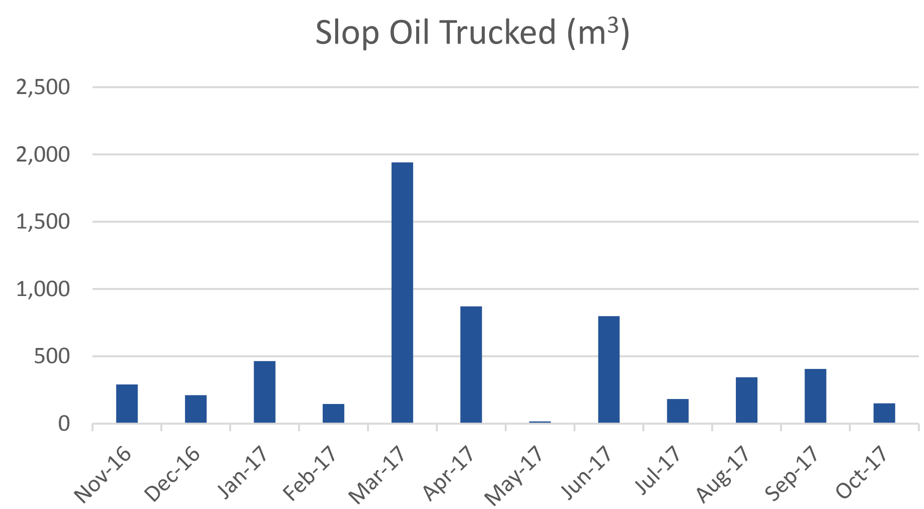
- Disposal Limit % = ((FW In * Df (i.e. 0.03) +PW In * Dp (i.e. 0.10)/ (FW In +PW In))*100
- Actual Disposal % = (Total Disposal)/(FW In +PW In) * 100

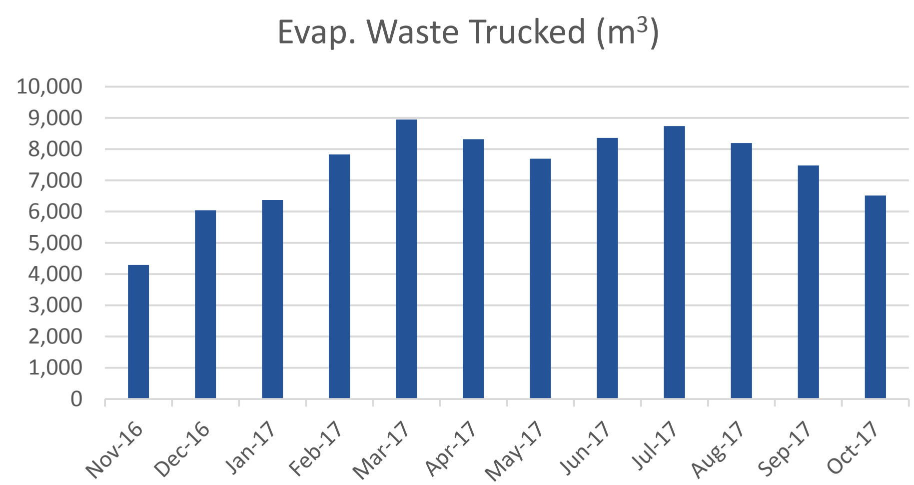


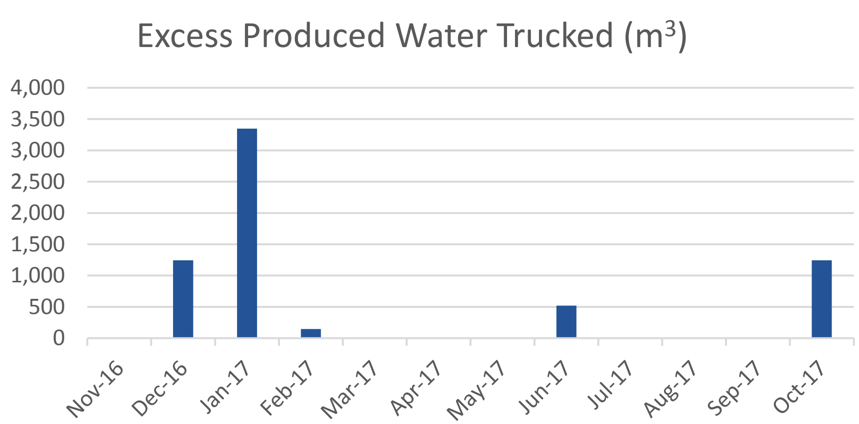
FACILITY PERFORMANCE

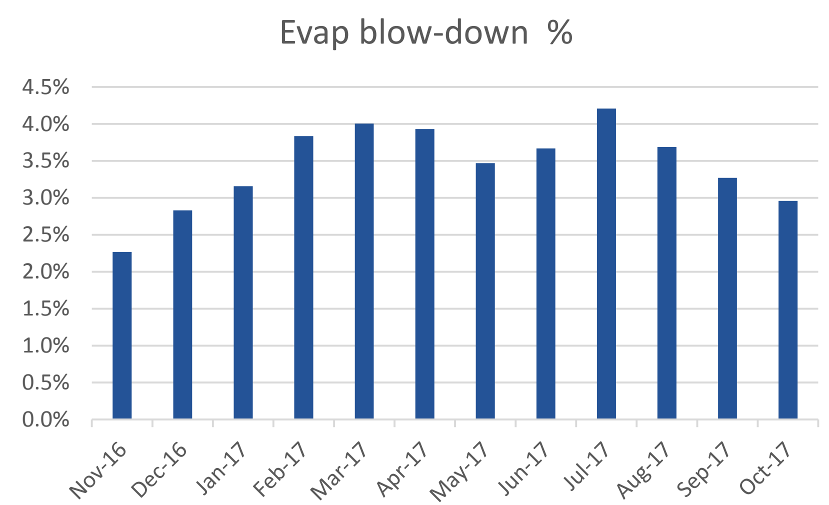
WASTE DISPOSAL

- Waste streams are slop oil, evaporator blowdown and excess produced water









Volumes reported via Petrinex

SURFACE

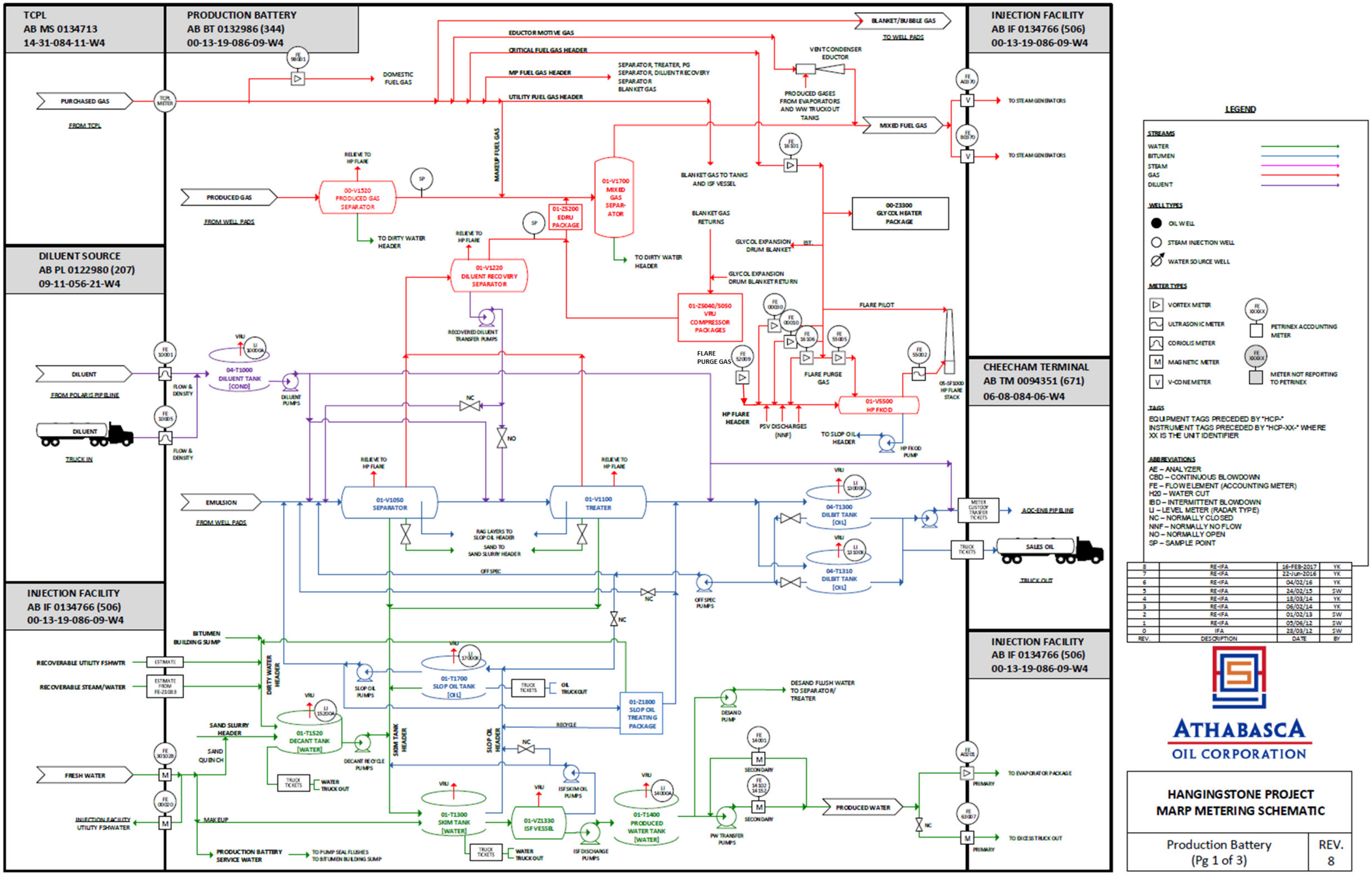
MEASUREMENT, ACCOUNTING AND REPORTING PLAN (*MARP*)

ATHABASCA OIL CORPORATION

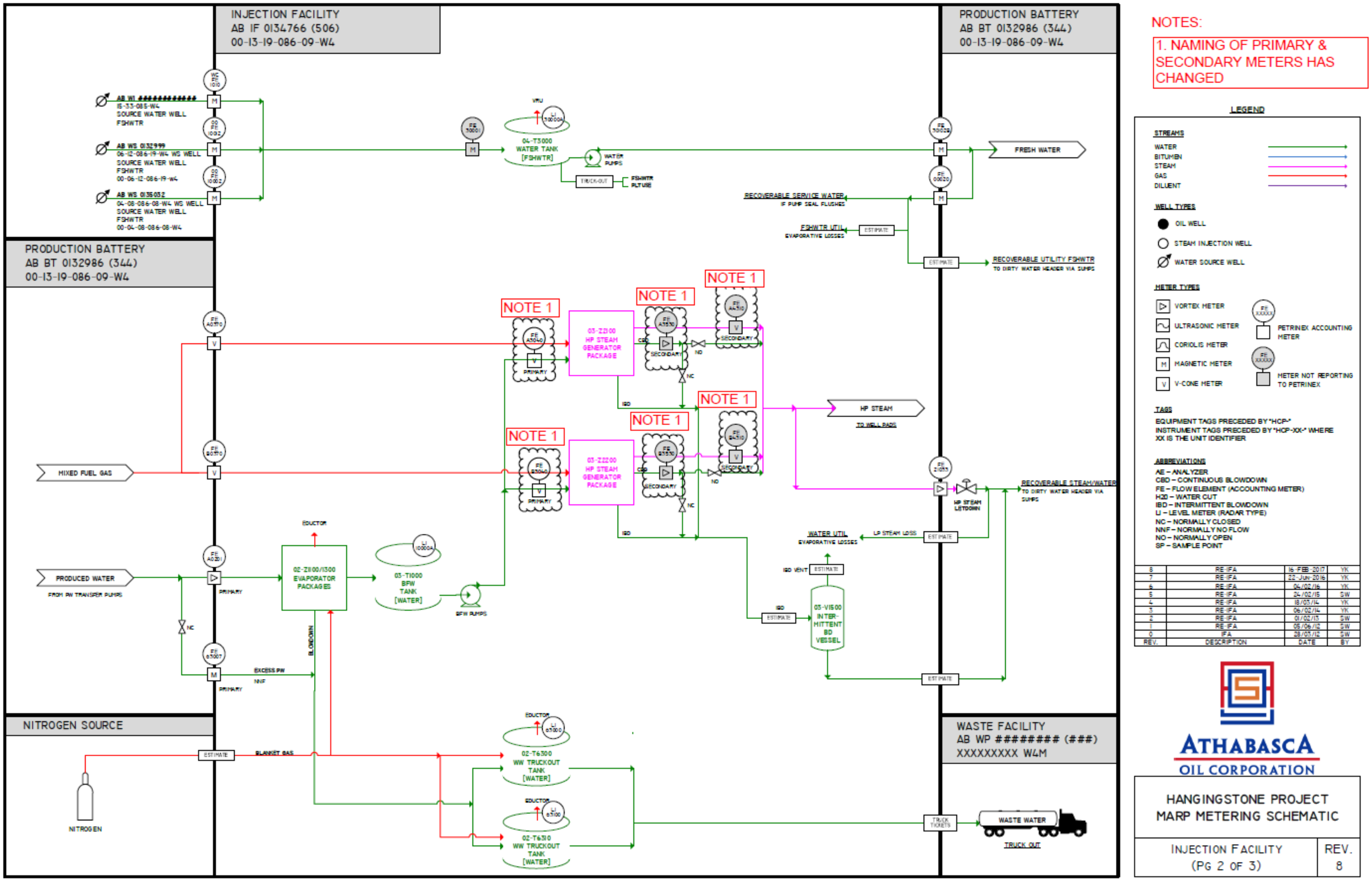
MEASUREMENT, ACCOUNTING AND REPORTING PLAN (MARP) APPROVAL RECEIVED ON OCTOBER 5, 2012

- MARP variance was submitted to AER in February 2017 for changes in steam measurement meters, which was approval by AER and resulted in switching the names of primary and secondary meters

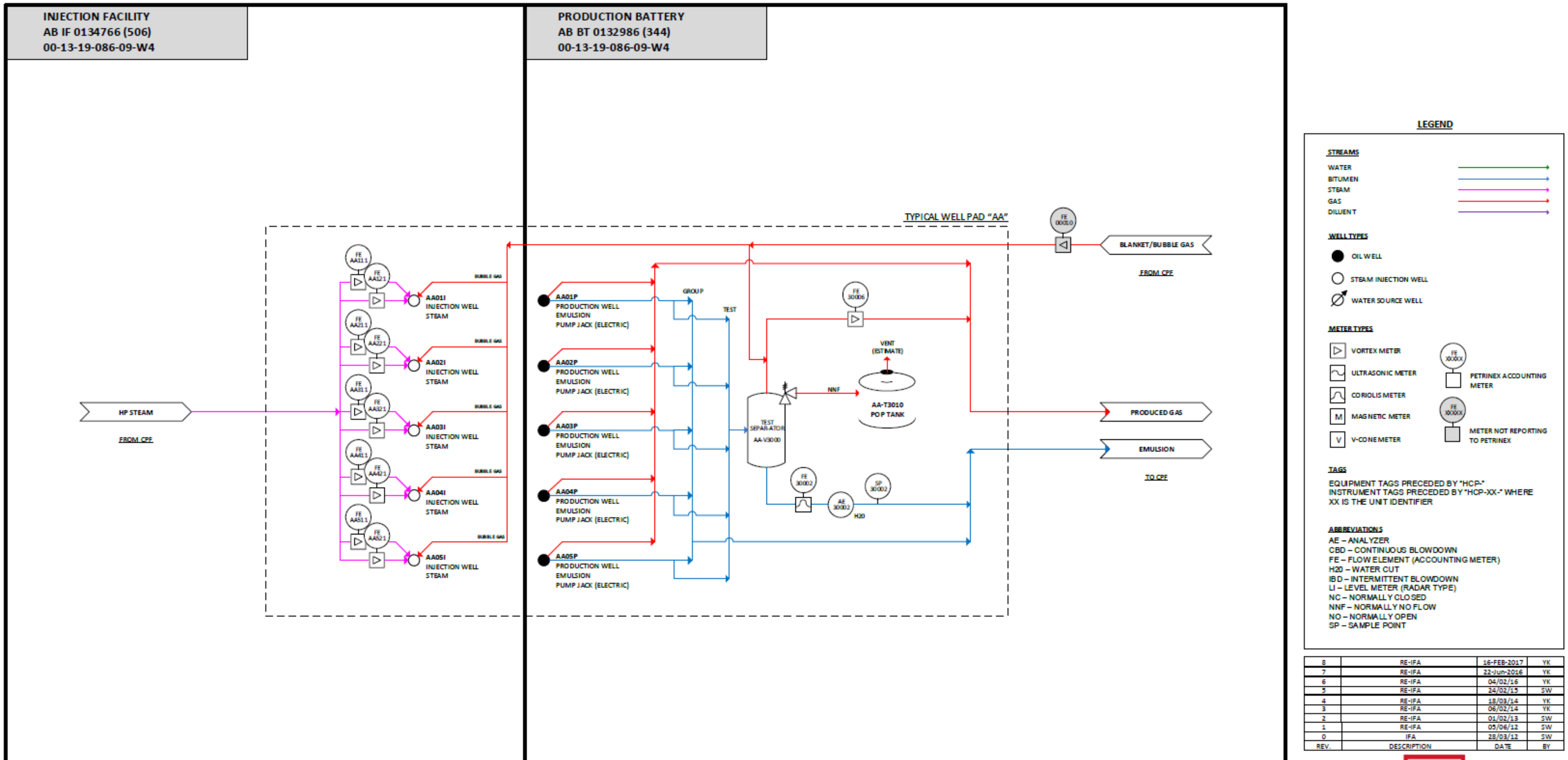
MEASUREMENT SCHEMATICS – BATTERY



MEASUREMENT SCHEMATICS – INJECTION FACILITY



MEASUREMENT SCHEMATICS – WELL PADS



AOC WELL NAMES AND UNIQUE IDs

PAD AA		PAD AB		PAD AC		PAD AD		PAD AE	
AA01I	105/04-31-086-09W4/0	AB01I	106/03-31-086-09W4/0	AC01I	103/16-30-086-09W4/0	AD01I	109/02-31-086-09W4/0	AE01I	116/03-31-086-09W4/0
AA02I	106/04-31-086-09W4/0	AB02I	107/03-31-086-09W4/0	AC02I	100/16-30-086-09W4/0	AD02I	108/02-31-086-09W4/0	AE02I	114/04-31-086-09W4/0
AA03I	107/04-31-086-09W4/0	AB03I	108/03-31-086-09W4/0	AC03I	102/16-30-086-09W4/0	AD03I	118/03-31-086-09W4/0	AE03I	113/04-31-086-09W4/0
AA04I	108/04-31-086-09W4/0	AB04I	103/02-31-086-09W4/0	AC04I	102/15-30-086-09W4/0	AD04I	117/03-31-086-09W4/0	AE04I	112/04-31-086-09W4/0
AA05I	103/03-31-086-09W4/0	AB05I	104/02-31-086-09W4/0	AC05I	100/15-30-086-09W4/0	AD05I	105/03-31-086-09W4/0	AE05I	104/04-31-086-09W4/0
AA01P	103/04-31-086-09W4/0	AB01P	109/03-31-086-09W4/0	AC01P	106/16-30-086-09W4/0	AD01P	102/02-31-086-09W4/0	AE01P	104/03-31-086-09W4/0
AA02P	109/04-31-086-09W4/0	AB02P	110/03-31-086-09W4/0	AC02P	105/16-30-086-09W4/0	AD02P	107/02-31-086-09W4/0	AE02P	117/04-31-086-09W4/0
AA03P	110/04-31-086-09W4/0	AB03P	111/03-31-086-09W4/0	AC03P	104/16-30-086-09W4/0	AD03P	115/03-31-086-09W4/0	AE03P	118/04-31-086-09W4/0
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ATHABASCA
OIL CORPORATION

HANGINGSTONE PROJECT
MARP METERING SCHEMATIC

Well Pads (Pg 3 of 3)	REV. 8

MEASUREMENT METHODOLOGY

WELL PRODUCTION AND INJECTION VOLUMES

- Each well pad has a dedicated test separator with liquid flow meter and water cut analyzer to determine well bitumen and water production
- Wells are individually put on test for one valid testing hour for every 20 hours of operation. Valid well test criteria per approved MARP
- Well gas production prorated from Battery Level GOR using a proration factor of 1. Battery Level GOR is updated monthly
- Steam injection is metered at each individual wellhead. Primary and secondary steam production metering available at the central steam plant

BATTERY SALES OIL

- Sales oil is shipped via pipeline from the Hangingstone Battery. Custody transfer metering is done at the receiving facility

MEASUREMENT TECHNOLOGY

- Well testing uses standard method of test separators with microwave water cut analyzers. New technologies such as multiphase flow meters may be evaluated later

MEASUREMENT METHODOLOGY

STEAM VOLUMES

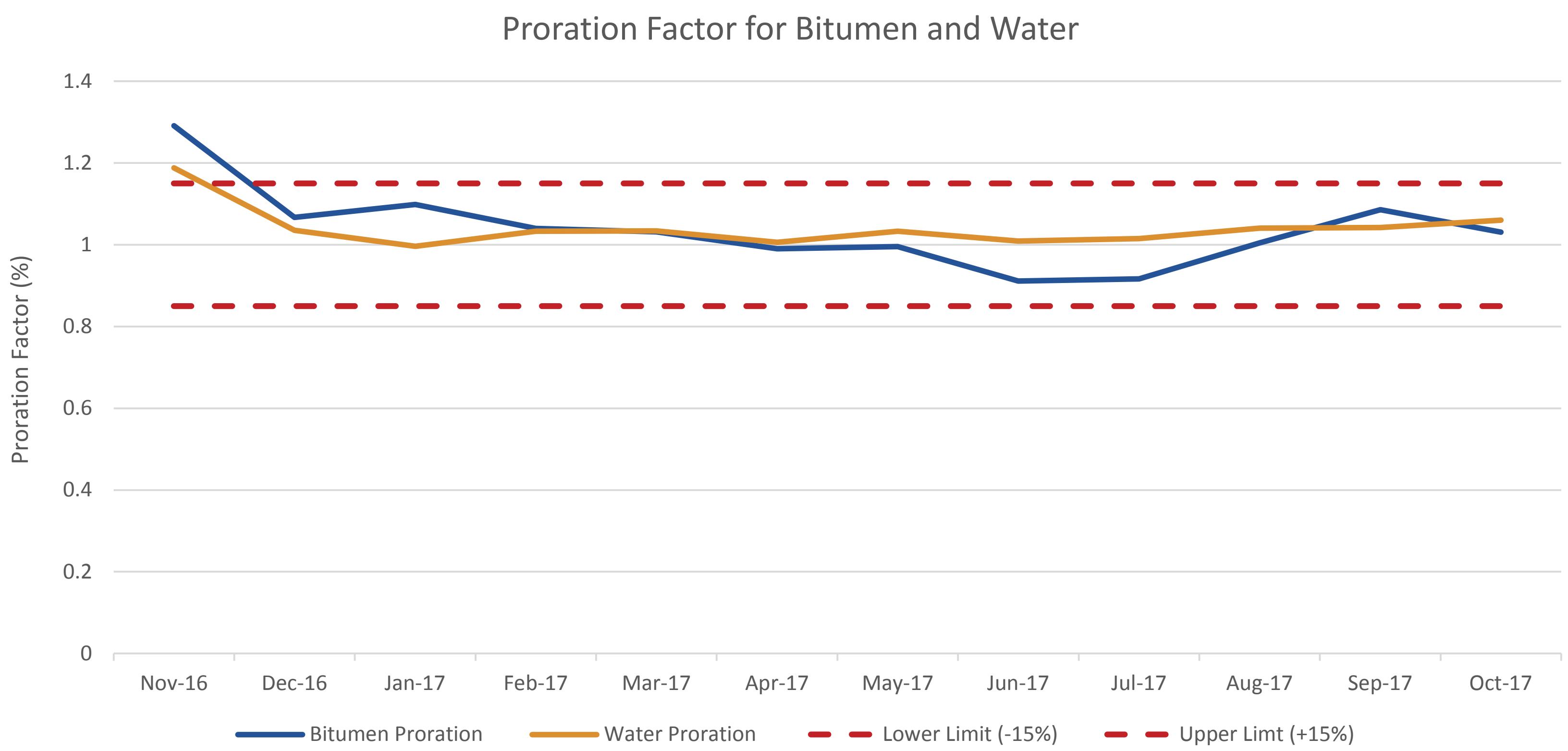
- Steam quality leaving the plant is approximately 98%
- A continuous blowdown (CBD) of approximately 2% is added to the steam of each boiler and is injected into the wells
- Intermittent blow down (IBD) flow is estimated at 0.02% of total water out of the facility using sound engineering practices

PRODUCED WATER VOLUMES

- Produced Water into the facility is calculated using the measured Water Disposition to the Injection Facility plus the Water Dispositions from the Plant plus and changes in Water Inventory less any Water Receipts

MEASUREMENT AND REPORTING

PRORATION OF BITUMEN AND WATER



SURFACE

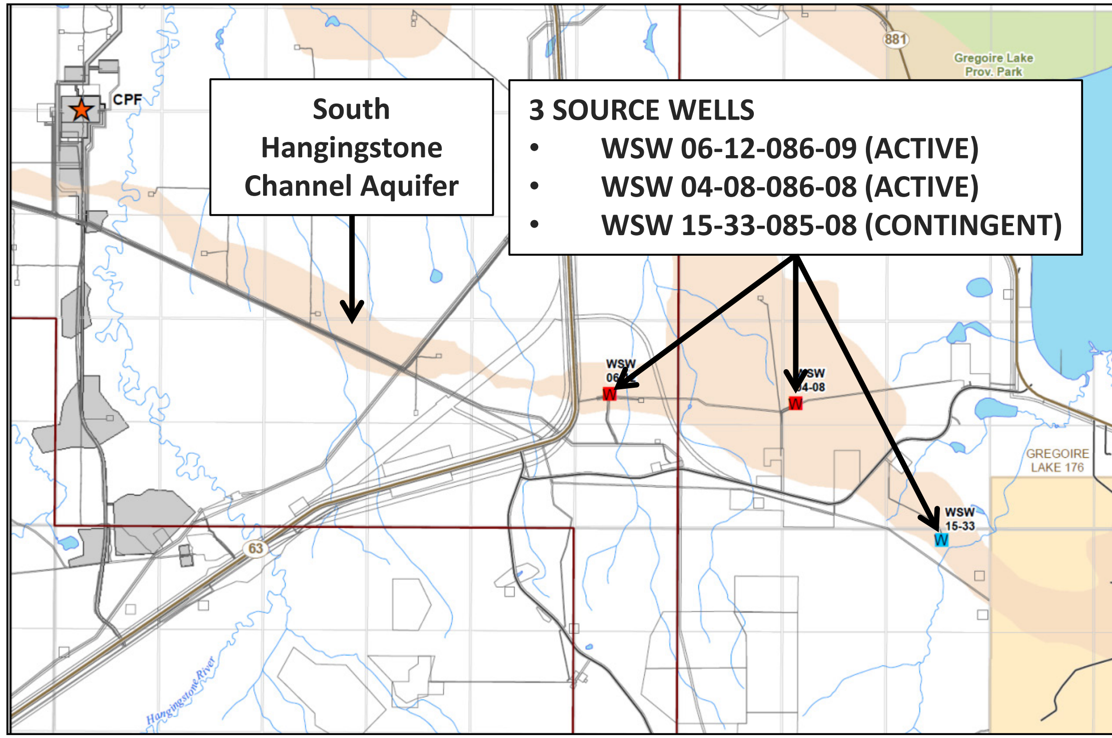
WATER PRODUCTION, INJECTION AND USES

ATHABASCA OIL CORPORATION

WATER PRODUCTION, INJECTION AND USES (TDL)

FRESH WATER WELLS

- Water Diversion License 00316166-01-00 amendment received on March 7, 2016 for 479,975 m^3 annually
- During Nov. 1, 2016 to Oct. 31, 2017 AOC diverted 186,221 m^3

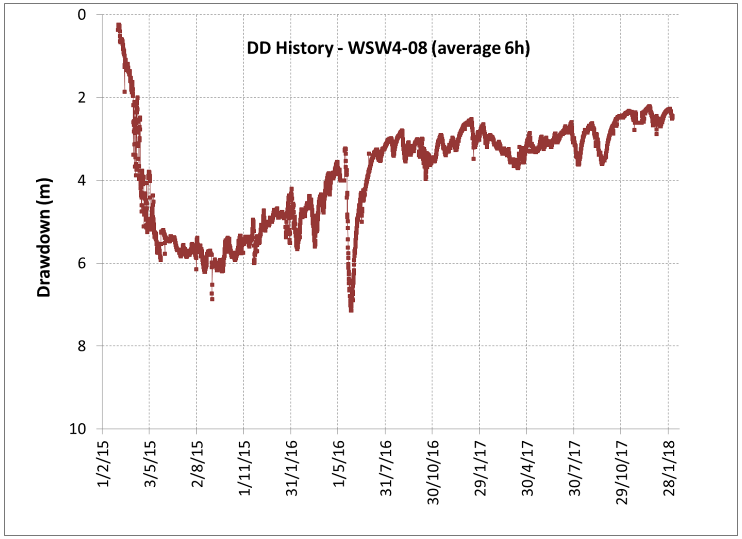


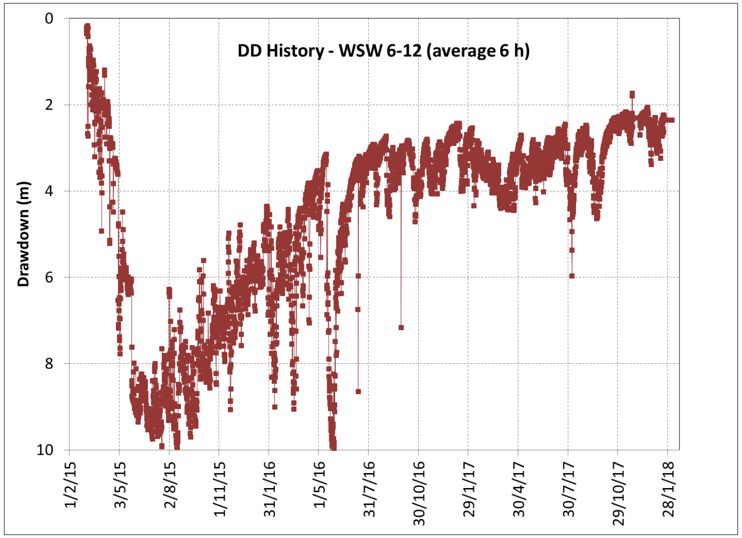
Well ID	Location	Formation	TDS (mg/L)	Maximum Rate of Diversion (m^3/d)
WSW153308508W400	15-33-085-08-W4	Quaternary	286	3,000
WSW061208609W400	06-12-086-09-W4	Quaternary	303	3,000
WSW040808608W400	04-08-086-08-W4	Quaternary	287	3,000

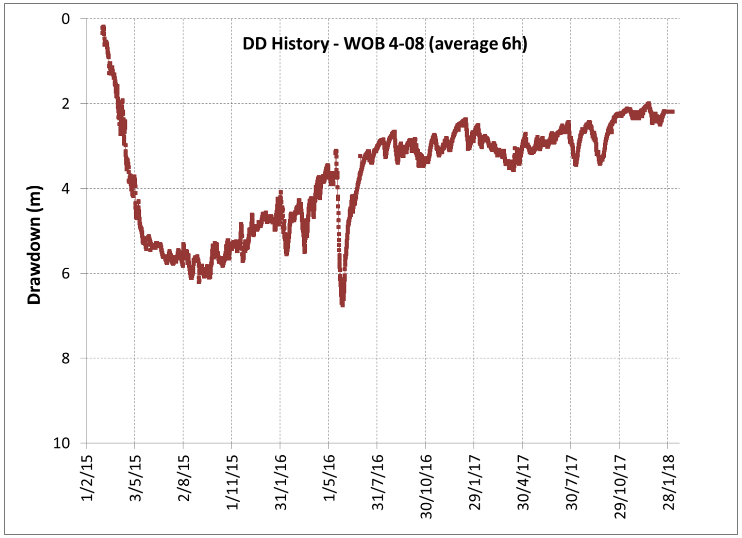
Wells are less than 150 m in depth and not licenced with the AER.
Well IDs are AOC internal identifiers, not UWIs.

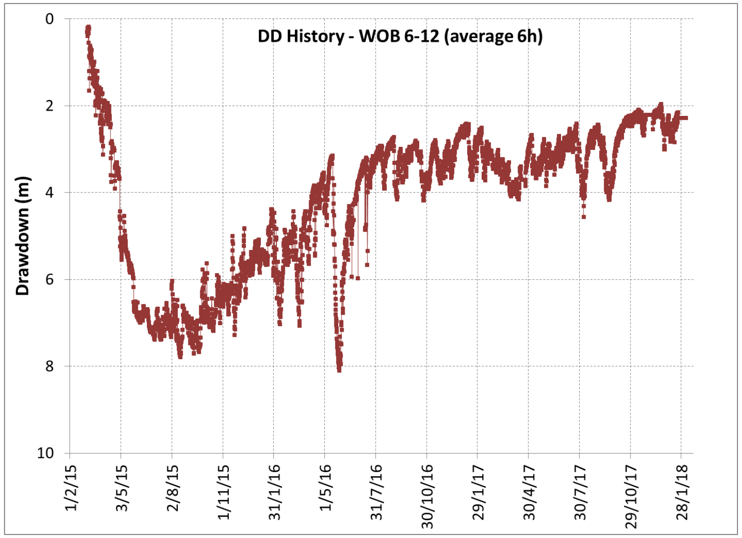
GROUNDWATER MONITORING

WATER SOURCE AND OBSERVATION WELL DRAWDOWN IS STABLE SINCE JUNE 2016 (AFTER THE FIRE), THIS INDICATES THAT DIVERSION IS SUSTAINABLE









FACILITY PERFORMANCE

WATER ANALYSES – PRODUCED WATER (YEARLY AVERAGE)

RESULTS OF CHEMICAL ANALYSES OF WATER		
	UNITS	**PRODUCED WATER**
Calculated Parameters		
Hardness (CaCO3)	mg/L	37
Total Dissolved Solids	mg/L	2635
Elements		
Dissolved Calcium (Ca)	mg/L	10.8
Dissolved Iron (Fe)	mg/L	0.7
Dissolved Magnesium (Mg)	mg/L	2.5
Dissolved Manganese (Mn)	mg/L	0.1
Dissolved Potassium (K)	mg/L	18.8
Dissolved Sodium (Na)	mg/L	922
Anions		
Dissolved Chloride (Cl)	mg/L	1081.5
Dissolved Sulphate (SO4)	mg/L	6.8
Physical Properties		
Conductivity	uS/cm	4325
pH	pH	8.6
Alkalinity (Total as CaCO3)	mg/L	407
Alkalinity (PP as CaCO3)	mg/L	236
Bicarbonate (HCO3)	mg/L	209.5
Carbonate (CO3)	mg/L	141.8
Hydroxide (OH)	mg/L	0.5

FACILITY PERFORMANCE

WATER ANALYSES – SOURCE WATER (YEARLY AVERAGE)

RESULTS OF CHEMICAL ANALYSES OF WATER		
	UNITS	**SOURCE WATER**
Calculated Parameters		
Hardness ($CaCO_3$)	mg/L	199
Total Dissolved Solids	mg/L	300
Elements		
Dissolved Calcium (Ca)	mg/L	56.3
Dissolved Iron (Fe)	mg/L	0.3
Dissolved Magnesium (Mg)	mg/L	14.2
Dissolved Manganese (Mn)	mg/L	0.169
Dissolved Potassium (K)	mg/L	2.85
Dissolved Sodium (Na)	mg/L	38.75
Anions		
Dissolved Chloride (Cl)	mg/L	3.05
Dissolved Sulphate (SO_4)	mg/L	26.0
Physical Properties		
Conductivity	uS/cm	555
pH	pH	7.7
Alkalinity (Total as $CaCO_3$)	mg/L	261.5
Alkalinity (PP as $CaCO_3$)	mg/L	0.5
Bicarbonate (HCO_3)	mg/L	319.0
Carbonate (CO_3)	mg/L	0.5
Hydroxide (OH)	mg/L	0.5

FACILITY PERFORMANCE

WATER ANALYSES – EVAPORATOR BLOWDOWN (YEARLY AVERAGE)

RESULTS OF CHEMICAL ANALYSES OF WATER		
	UNITS	**EVAP 1 SUMP B**
Calculated Parameters		
Hardness (CaCO3)	mg/L	107
Total Dissolved Solids	mg/L	100000
Elements		
Dissolved Calcium (Ca)	mg/L	37.2
Dissolved Iron (Fe)	mg/L	21.2
Dissolved Magnesium (Mg)	mg/L	3.55
Dissolved Manganese (Mn)	mg/L	0.2345
Dissolved Potassium (K)	mg/L	917.5
Dissolved Sodium (Na)	mg/L	39750
Anions		
Dissolved Chloride (Cl)	mg/L	61500
Dissolved Sulphate (SO4)	mg/L	335.0
Physical Properties		
Conductivity	uS/cm	130000
pH	pH	10.8
Alkalinity (Total as CaCO3)	mg/L	27400
Alkalinity (PP as CaCO3)	mg/L	16150
Bicarbonate (HCO3)	mg/L	5.3
Carbonate (CO3)	mg/L	13550.0
Hydroxide (OH)	mg/L	1655

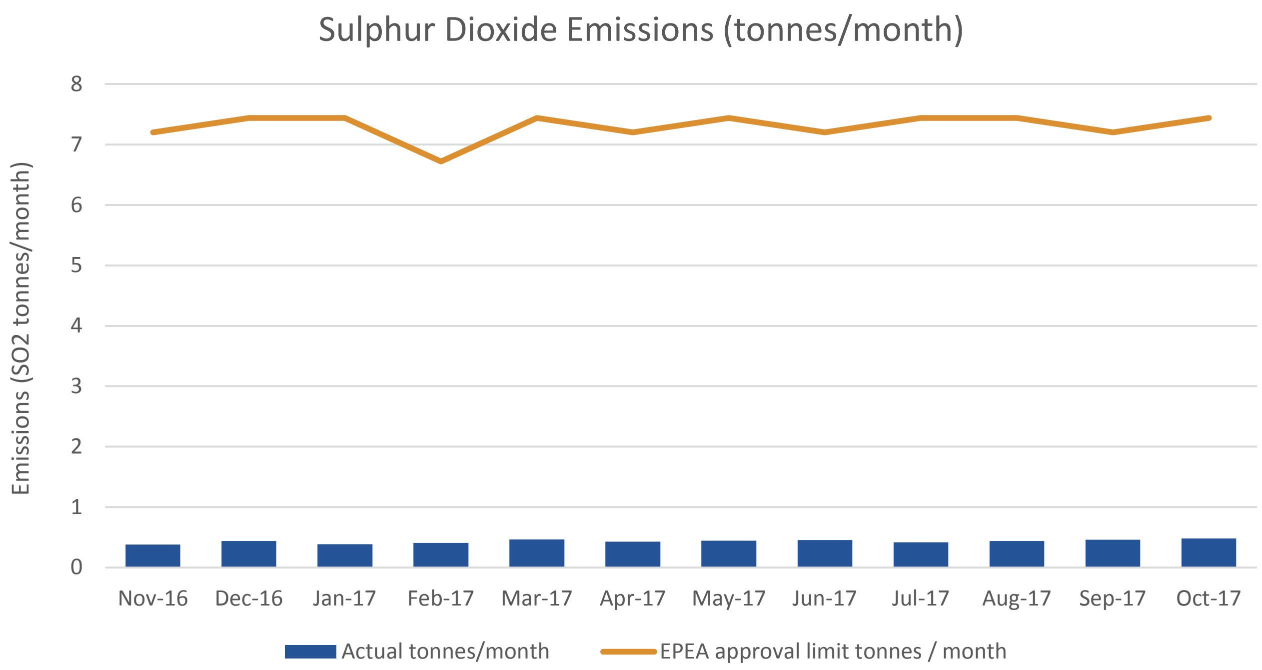
SURFACE
SULPHUR PRODUCTION

ATHABASCA
OIL CORPORATION

SULPHUR PRODUCTION

SULPHUR PRODUCTION

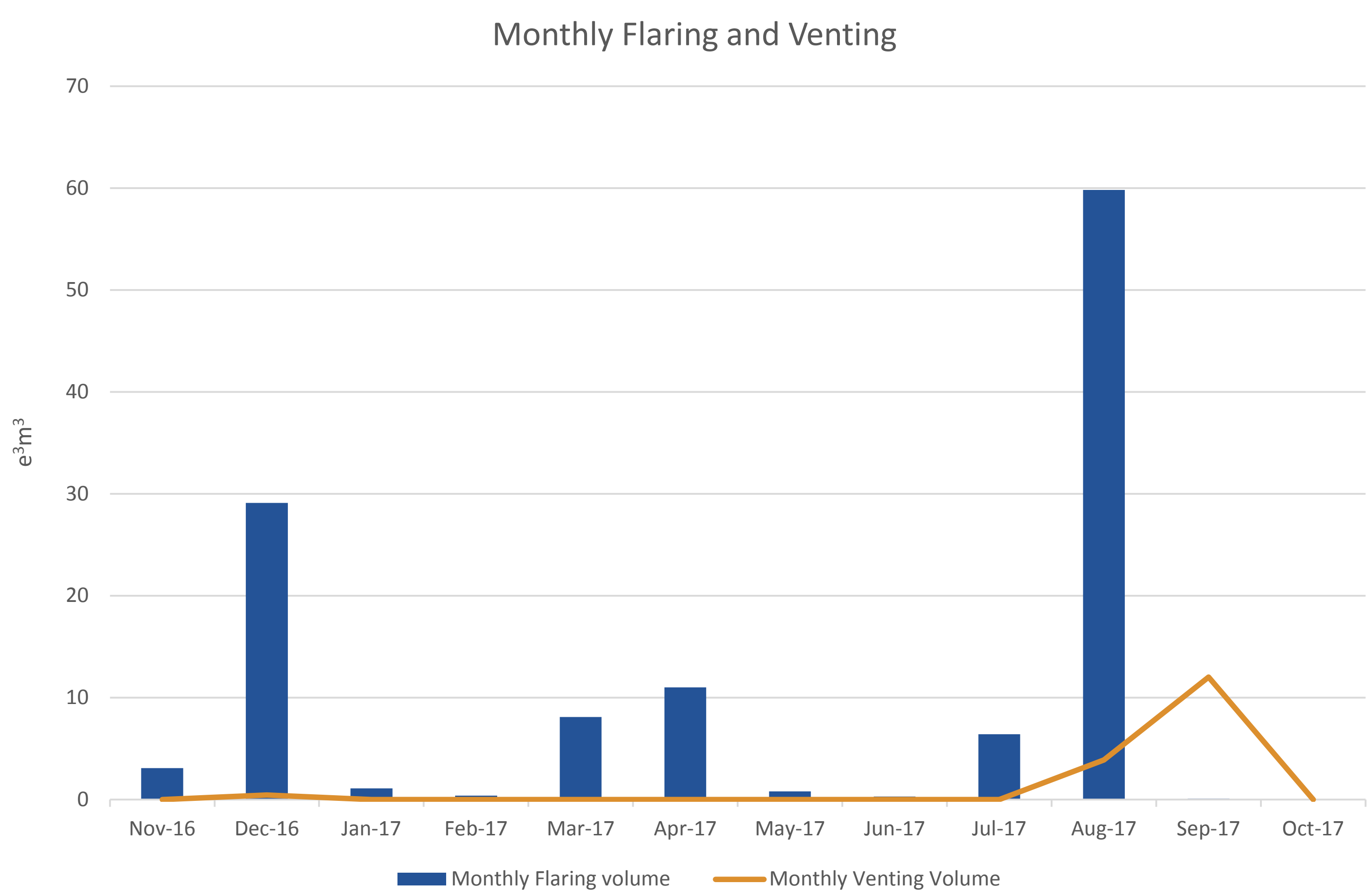
- Currently there are no sulphur recovery facilities at the Hangingstone Project



- SO_2 emissions are calculated based on analytical results of produced gas samples

FLARING AND VENTING

MONTHLY FLARING AND VENTING



COMPLIANCE
ENVIRONMENTAL

ATHABASCA OIL CORPORATION

COMPLIANCE – STATEMENT OF COMPLIANCE

ATHABASCA OIL CORPORATION HANGINGSTONE PROJECT IS IN COMPLIANCE WITH AER APPROVALS AND REGULATORY REQUIREMENTS

- For the period of November 1, 2016 to October 31, 2017, AOC has no unaddressed non-compliant events

APPROVALS AND AMENDMENTS

Date	Approval Summary
November 11, 2016	MOP increase from 1,900 kPa to 2,100 kPa approved (11888E)
December 13, 2016	Three existing and two additional truck load-out stacks added as approved emission sources to EPEA Approval (000289664-00-01)
May 17, 2017	D56 amendment approved to install an Enhanced Diluent Recovery Unit (EDRU)

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COMPLIANCE – MONITORING PROGRAMS

AIR MONITORING

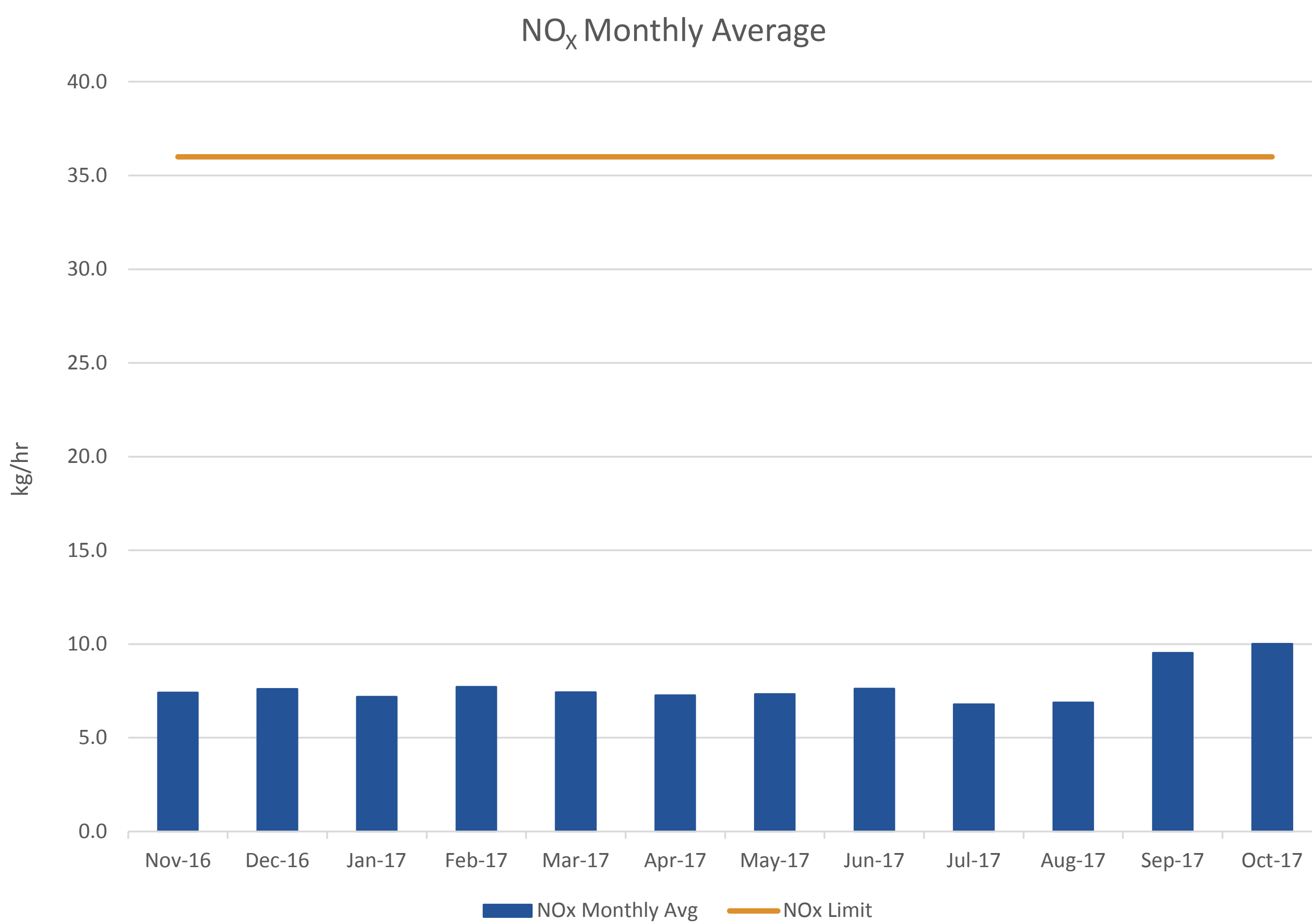
- Monthly air contaminant concentrations for SO_2 and NO_2 summarized monthly and submitted in accordance with EPEA approval requirements
- Passive air monitoring around the facility for SO_2, NO_2 and H_2S
- Performance testing including Cylinder Gas Audits (CGA), Relative Accuracy Test Audits (RATA) and manual stack survey
- The 2017 fugitive emissions survey notes 33 leaks – 2 repaired on the spot, 31 repairs planned for next shutdown

SURFACE WATER MONITORING

- Industrial wastewater and runoff monitored and tested prior to release and reported annually
- Water use reporting for dust control, winter road construction, OSE, drilling and completion activities, Temporary Diversion License (TDL) and Term Water License

COMPLIANCE – MONITORING PROGRAMS

NO_X MONTHLY AVERAGE



COMPLIANCE – MONITORING PROGRAMS

EPEA GROUNDWATER AND SOURCE WATER MONITORING

- Semi-annual groundwater and source water monitoring ongoing
- Groundwater quality results are consistent with previous years
- No new wells added to the program in the past 12 months

SOIL MONITORING

- First soil monitoring event did not identify any significant soil impacts
- Soil management program not required

CARIBOU MONITORING

- Wildlife cameras on above ground pipeline crossings
- Employee wildlife sighting cards

WILDFIRE CLEARING MONITORING

- Update provided September 14, 2017

COMPLIANCE – AUDITS AND INSPECTIONS

AUDITS

- MARP site visit and audit conducted on October 6, 2016 and follow up submission provided by AOC on November 9, 2016
- Pipeline Safety and Loss Management System Self-Assessment and Declaration submitted June 14, 2017
- Injection Pressure audit conducted September 15, 2017
- Compliance Assessment regarding Aboveground Pipeline Wildlife Crossing Directive was submitted November 30, 2017

INSPECTIONS

- Satisfactory Pipeline Detailed Operations Inspection conducted on January 16, 2017
- Satisfactory Inspection conducted on March 28, 2017 in response to an on-lease release within secondary containment inside the Evaporator building

COMPLIANCE – SUMMARY OF NON-COMPLIANCE

- The following list summarizes non-compliance events for the period of November 1, 2016 to October 31, 2017
- For all events, corrective actions were identified and tracked to completion

Event	Corrective Action
December 19, 2016 – Unapproved venting from Well Pad AE Start-Up Production Cooler tube leak	Well Pad AE Start-Up Production Cooler has two bays which are isolatable. AOC positively isolated the bay with the tube leak and continued operation of the Start-Up Production Cooler with remaining single bay
December 21, 2016 – Failure to sign off on submitted CEMS data	The monthly CEMS reporting process was modified
January 27, 2017 – Uncontrolled release of slop oil into tank farm from failed valve on a sample point	Evaluate current valves, piping, temporary hoses and sample tubing to ensure proper freeze protection
March 2, 2017 – Controlled release from evaporator recirculation pump seal failure	The evaporator was safety taken out of service and the failing seal was replaced

COMPLIANCE – SUMMARY OF NON-COMPLIANCE

Event	Corrective Action
April 4, 2017 – Erosion channel created by uncontrolled release of contained surface water on Pad AA	An assessment of all lease berms was completed to ensure no other overflow conditions were present. The AOC lease berm integrity and AOC contained surface water release instruction was reviewed with field operations
May 3, 2017 – Unapproved venting when produced water transfer pumps tripped	The system operated as designed and a rate of change limit was added to the transmitter signal to prevent the controller from tripping the pumps. Cooling feed water will continue to be fed to the evaporator system, preventing a foul vent collection system trip
May 9, 2017 – Uncontrolled release of the CPF surface water pond from seepage through spillway rock layer	Visual inspection of the pond has been added to the AOC Operator round sheet with guidance provided to operate the pond with low levels of water and to pump off the pond more frequently to avoid repeat occurrence
June 6, 2017 – Unapproved venting while manually lowering level on PW tank	The produced water tank emptying procedure was updated to ensure a plug is installed on the overflow piping outside of the tank prior to the level inside the tank getting below the lower end of detection by the level transmitter and Operations has installed a 12" plumbers plug to seal the vent while the level is lowered below the siphon

COMPLIANCE – SUMMARY OF NON-COMPLIANCE

Event	Corrective Action
August 6, 2017 August 10, 2017 August 31, 2017 September 8, 2017 (planned) – Unapproved venting through the evaporator foul vent condenser caused by hydrate formation	Electric motive fluid heaters were installed on the eductors to prevent future hydrate issues on September 8, 2017
September 15, 2017 – Second CEMS pressure differential test not performed in 2016	All CEMS related compliance activities have been set to Regulatory Priority (high) in the AOC enterprise asset management software for maintenance scheduling. The contravention was also discussed with site leadership
September 23, 2017 – Unapproved venting from eductor trip due to process upset	This is how the system is designed and could happen again during a process upset condition

COMPLIANCE – RELEASE REPORTING

No. of Reportable Spills	Volume Released (m^3)
4	9

No. of Flaring Notifications	Volume Flared (e^3m^3)
2	57.3

No. of Reportable Venting Events	Volume Vented (e^3m^3)
8	9.95

- All spills were cleaned up and have been remediated to eliminate any potential for adverse effect
- AOC tracks all release incidents within the Corporate Compliance and Incident Tracking System

COMPLIANCE – REGIONAL INITIATIVES

AOC IS A FUNDING MEMBER OF:

- Wood Buffalo Environmental Association (WBEA)
- Joint Oil Sands Monitoring Program
- Oil Sands Black Bear Partnership

AOC PARTICIPATES IN:

- Various regional CAPP Committees
  - *NE Alberta Caribou Working Group*
  - *Lower Athabasca Regional Planning*

COMPLIANCE – RECLAMATION PROGRAMS

OSE ASSESSMENT AND RECLAMATION WORK IS ONGOING

- Reclamation Certifications applied for OSE programs 120026 and 130006

FUTURE PLANS

ATHABASCA OIL CORPORATION

FUTURE PLANS

HANGINGSTONE EXPANSION PROJECT TECHNICALLY COMPLETE

- Aboriginal Consultation Office (ACO) making final decision on consultation adequacy
  - *Expect decision in Q1 2018*

The expansion includes:

- Increased bitumen recovery capacity from the existing approved 1,908 m^3/d (12,000 bbl/d) to 13,037 m^3/d (82,000 bbl/d) to be developed in two phases:
  - *Project 2A and 2B to add incremental 6,360 m^3/d (40,000 bbl/d)*
  - *Project 3 to add incremental 4,770 m^3/d (30,000 bbl/d)*
- Production life extension from 10 to 40 years
- CPF expansion from 35 ha to 76 ha (no additional site clearing required)

ATHABASCA
OIL CORPORATION

ATHABASCA OIL CORPORATION
SUITE 1200, 215 – 9TH AVENUE SW
CALGARY, AB T2P 1K3
P:403-237-8227
F:403-264-4640