Suncor MacKay River Project
2017 AER Performance Presentation

Reporting Period: September 1, 2016 to August 31, 2017

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- Sub Surface Presentation
- Surface Presentation

Suncor MacKay River Project
2017 AER Performance Presentation: Subsurface
Commercial Scheme Approval No. 8668

November 1st, 2017
Reporting Period September 1, 2016 – August 31, 2017

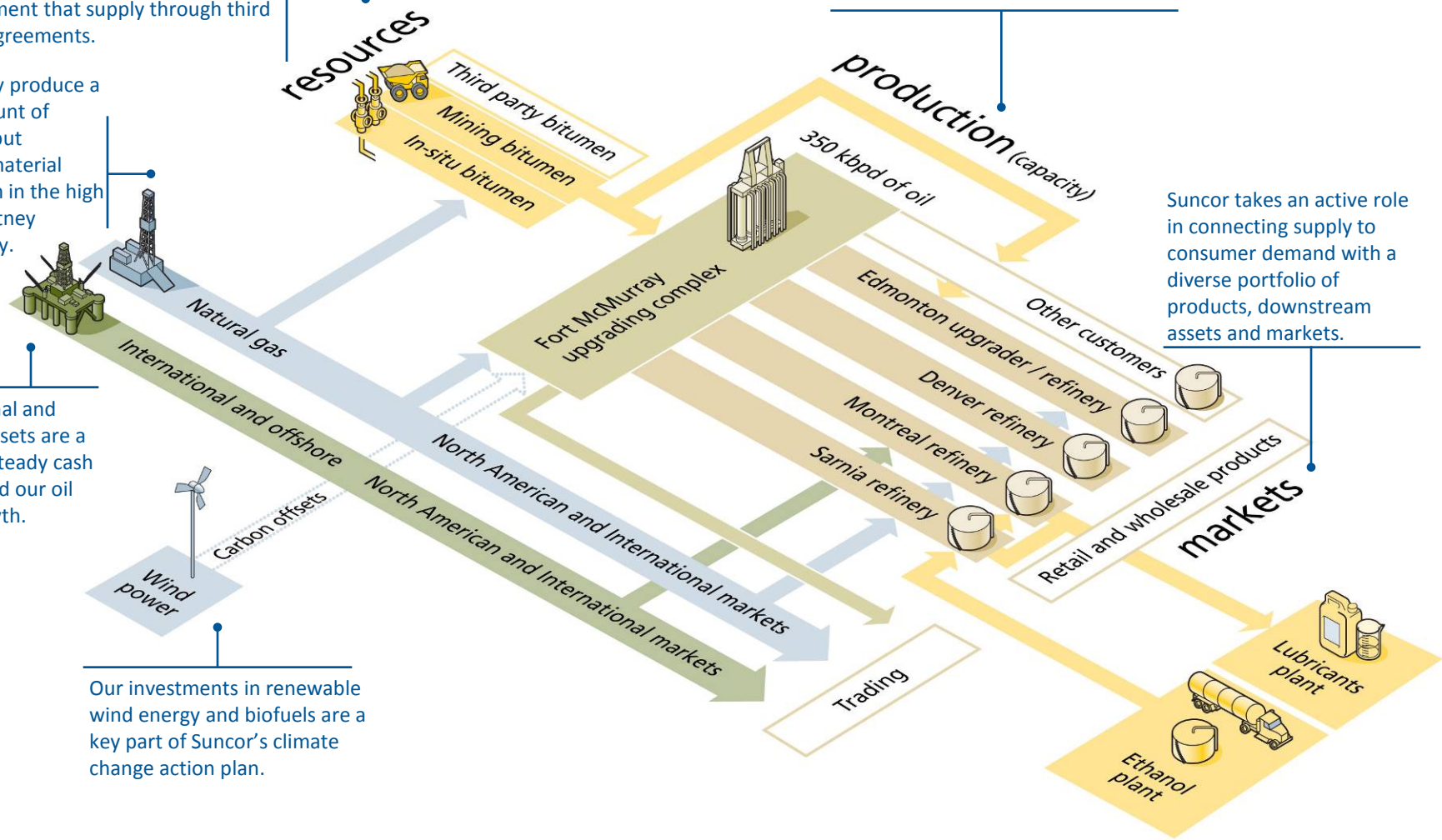
The Suncor Strategy

To provide greater reliability and flexibility to our feedstock supplies, we produce bitumen through mining and in-situ recovery technologies and supplement that supply through third party agreements.

A staged approach to increasing crude oil production capacity allows Suncor to better manage capital costs and incorporate new ideas and new technologies into our facilities.

We currently produce a limited amount of natural gas but maintain a material land position in the high quality Montney resource play.

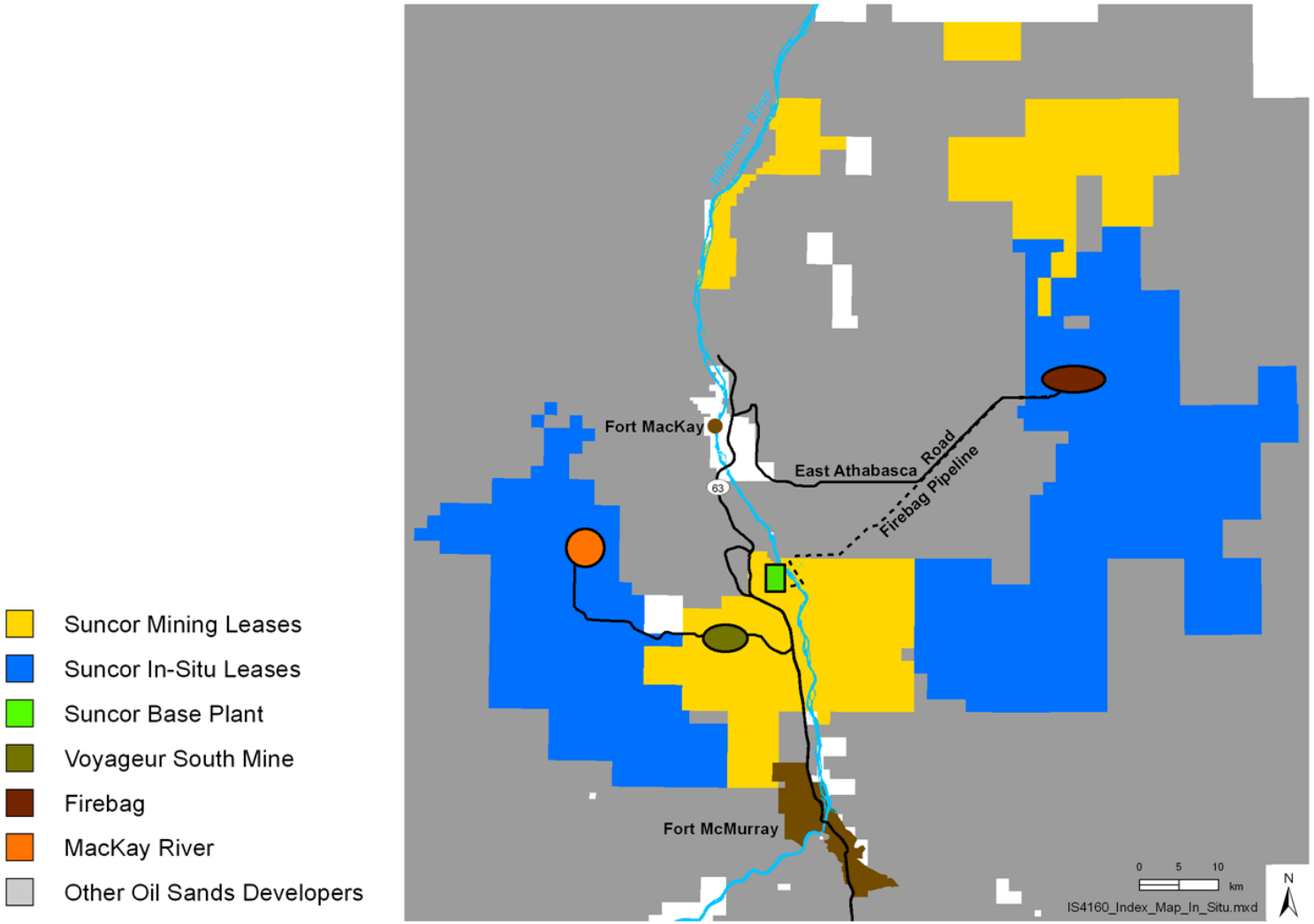
Suncor takes an active role in connecting supply to consumer demand with a diverse portfolio of products, downstream assets and markets.



International and offshore assets are a source of steady cash flow to fund our oil sands growth.

Our investments in renewable wind energy and biofuels are a key part of Suncor's climate change action plan.

Suncor has High Quality Leases in Close Proximity



AER Directive 054
2017 Performance Presentation

Section 3.1.1 – Subsurface Issues Related to Resource Evaluation and Recovery

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- Background
- Geoscience/Seismic
- Caprock Integrity
- Drilling and Completions
- Artificial Lift
- Instrumentation
- Scheme Performance
- Future Plans

Background

3.1.1.1

MacKay River Project Overview

- Company's first operated steam-assisted gravity drainage (SAGD) facility - located 60 km NW of Fort McMurray
- Current Approved Bitumen Production Rate 11,600 m^3/d (73 kbpd)
- Adjacent to Suncor Dover (UTF / AOSTRA) Project
- Horizontal production wells are placed in the McMurray Formation at a depth of 98
  - 145m from surface
- No extensive underlying water or gas over bitumen issues in current development areas
- Initial development had 25 well pairs with first steam in September 2002 and first production in November 2002 (Phase 1)
- 112 well pairs have been subsequently added

Producing Well Pairs	**110**
Non-Producing Well Pairs	**25**
Abandoned/Planned for Abandonment Well Pairs	**2**
Total Well Pairs	**137**

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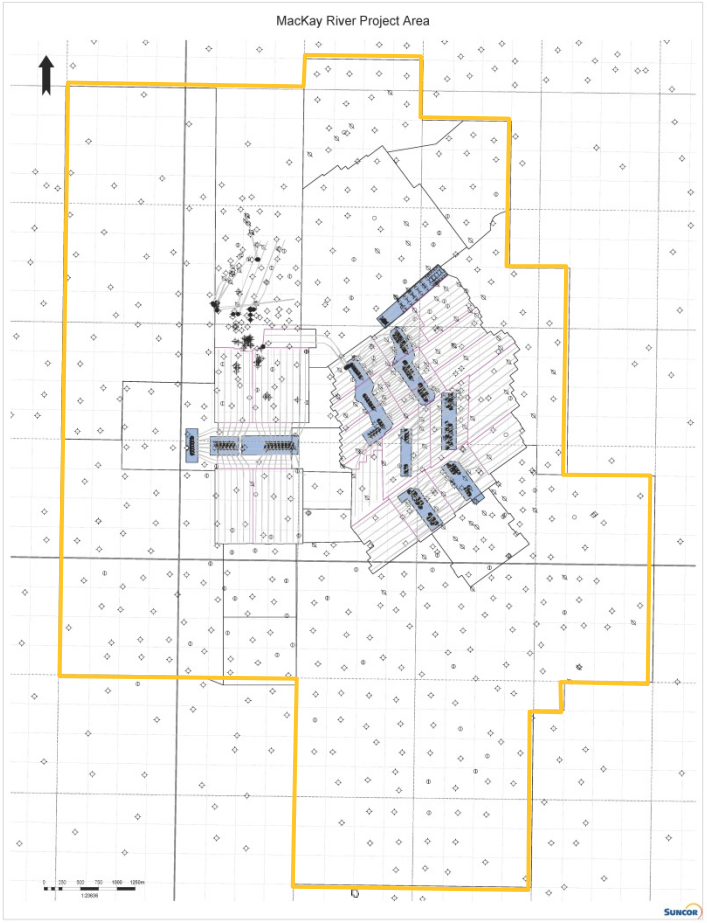
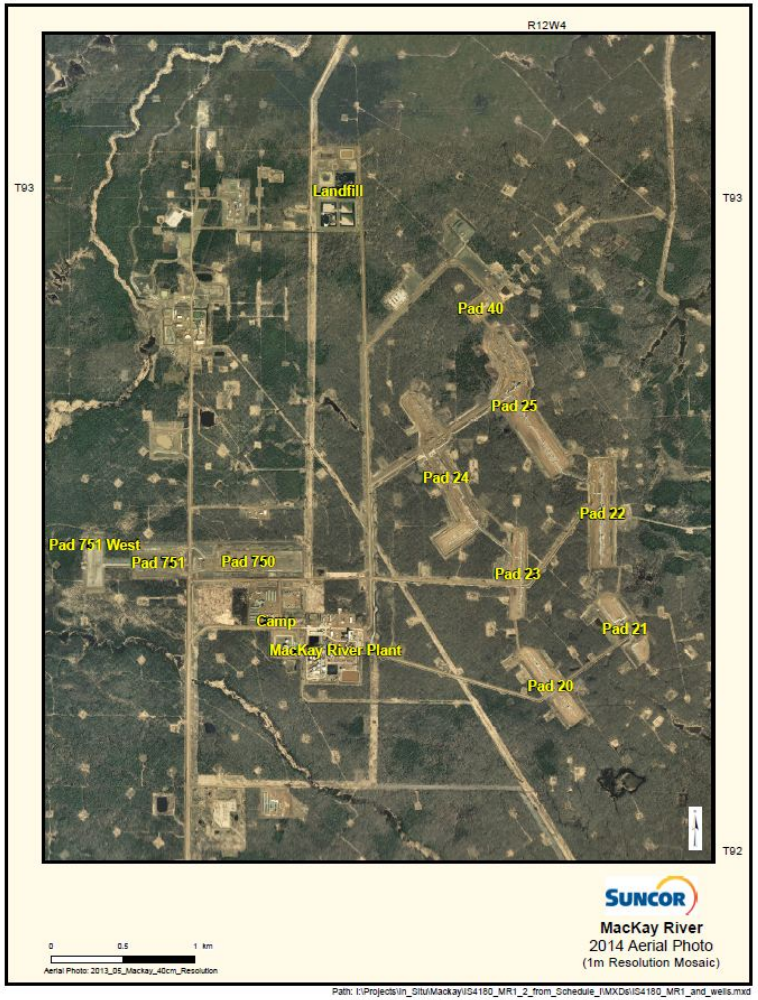
Project Area and Project Site

- Current Project Area (PA) approximately 24 ½ sections





Scheme Approval Amendments

- **Amendment 8668A**
  - Changed annual average volume to 33,000 bpd (5,250 m^3/d)
- **Amendment 8668B**
  - Increase to project area
- **Amendment 8668C**
  - Additional project area
  - Approval to inject non-condensable gas
- **Amendment 8668D**
  - Additions to project area
  - Increase to annual average volume to 72,964 bpd (11,600 m^3/d)
- **Amendment 8668E**
  - Approval to drill four well pairs
- **Amendment 8668F**
  - Approval to change approval holder from Petro-Canada to Suncor
- **Amendment 8668G**
  - Approval to undertake amendments & modifications to CPF systems
  - Approval tie-in 6 well pairs to well testing facilities
- **Amendment 8668H**
  - Approval to conduct non-condensable gas injection test on Pad 21 wells
- **Amendment 8668I**
  - Approval to conduct non-condensable gas injection at the Section 16 Test Project
- **Amendment 8668J**
  - Approval to transfer portions of the Dover project area into the MacKay River project area
- **Amendment 8668K**
  - Approval to tie-in 16 well pairs to well testing facilities
- **Amendment 8668L**
  - Approval to the remove the limiting factor of a mole percent restriction for the B Pattern non-condensable gas injection test on Pad 21
- **Amendment 8668M**
  - Approval to inject chemical into Pad 22 wells
- **Amendment 8668N**
  - Approval to abandon 3 wells and suspend 1 well on Pad 20
- **Amendment 8668O**
  - Approval to change Phase 5F well trajectories
- **Amendment 8668P**
  - Approval to develop Pads 750/751/28 and add 2 sections to project area
- **Amendment 8668Q**
  - Approval to conduct a pilot of water treatment technologies
- **Amendment 8668R**
  - Approval to abandon well G1I
- **Amendment 8668S**
  - Approval to conduct chemical injection test on Pad 21 (D-Pattern Injectors)

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Scheme Approval Amendments

- **Amendment 8668T**
  - Pad 819 Approval
- **Amendment 8668U**
  - Maximum Operating Pressure Approval
- **Amendment 8668V**
  - NCG Expansion Project and Phase 5D/F Chemical Injection Approval
- **Amendment 8668W**
  - MR CPF Expansion Project and Directive 081 Waiver Approval
- **Amendment 8668X**
  - Administrative reissue approval
- **Amendment 8668Y**
  - WHIP for Phases 5B2, 5D and 5F Patterns approval
- **Amendment 8668Z:**
  - Pad 828 change from 3 well pairs to 2 wells pairs and correction of well UWIs on Pad 21 Chemical Injection Test (D-Pattern Injectors) approval issued December 10, 2014.
- **Amendment 8668AA:**
  - Phase 1 NCG design amendment approval issued December 19, 2014.
- **Amendment 8668BB:**
  - Phase 2 and Phase 3 Chemical Co-Injection (E, F and G Patterns) approval issued January 1, 2015.
- **Amendment 8668CC:**
  - Approval for E1P Sidetrack well issued January 27, 2015.
- **Amendment 8668DD:**
  - Approval for NN6P Sidetrack well issued February 3, 2015.
- **Amendment 8668EE:**
  - Approval for VX™ multiphase meter on Pad 824 issued February 19, 2015.
- **Amendment 8668FF:**
  - Approval for NCG Test at OO5I well on pad 24 issued March 17, 2015.
- **Amendment 8668GG:**
  - Approval to conduct CO2 Co-Injection at the OO9 well pair on Pad 24 issued April 13, 2015.
- **Amendment 8668HH:**
  - CO2 Co-Injection amendment to change to OO8 well pair on Pad 24 issued.
- **Amendment 8668II:**
  - Pad 824 Thermal Compatibility Assessment approval issued July 14, 2015.
- **Amendment 8668JJ:**
  - Approval for NCG Test at OO7I issued July 29, 2015.
- **Amendment 8668KK:**
  - Approval for an alternate MOP Strategy Trial.
- **Amendment 8668LL:**
  - Approval for C2IPB Sidetrack Well.
- **Amendment 8668MM:**
  - Approval for Pad 750 Thermal Compatibility Assessment.

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Scheme Approval Amendments

- **Amendment 8668NN:**
  - Approval to increase MWHIP for all operating wells.
- **Amendment 8668OO:**
  - Approval to alter DA, DB, DC and DF Pattern MWHIPS;
- **Approval to adjust CO2 co-injection rate;**
  - Approval to extend chemical co-injection test at the D pattern wells on Pad 21.
- **Amendment 8668PP:**
  - Approval for abandonment of A3I.
- **Amendment 8668QQ:**
  - Approval to change Clause 32.
- **Amendment 8668RR**:
  - CO2 Extension
- **Amendment 8668SS:**
  - Phase 2 and 3 NCG Injection
- **Amendment 8668TT:**
  - Temporary Increase to BH MOP for Unloading
- **Amendment 8668UU:**
  - Subsurface Heating Pilot

Amendments Made in Reporting Year

- **Amendment 8668RR:**
  - CO2 Extension
- **Amendment 8668SS:**
  - Phase 2 and 3 NCG Injection
- **Amendment 8668TT:**
  - Temporary Increase to BH MOP for Unloading
- **Amendment 8668UU:**
  - Subsurface Heating Pilot

Geoscience / Seismic

3.1.1.2, 3.1.1.6

Oil Sands Facies and Gross Bitumen Pay

Facies:
Defined by visual mud index (VMI)

Cutoffs:
F1 (Sandstone) = 0-5% VMI
F2 (Sandy IHS*) = 5-15% VMI
F3 (IHS*) = 15-30% VMI
F4 (Muddy IHS*) = 30-70% VMI
F5 (Mudstone) = 70-100% VMI
F10 (Breccia) = variable

* IHS = inclined, interbedded, sand and shale

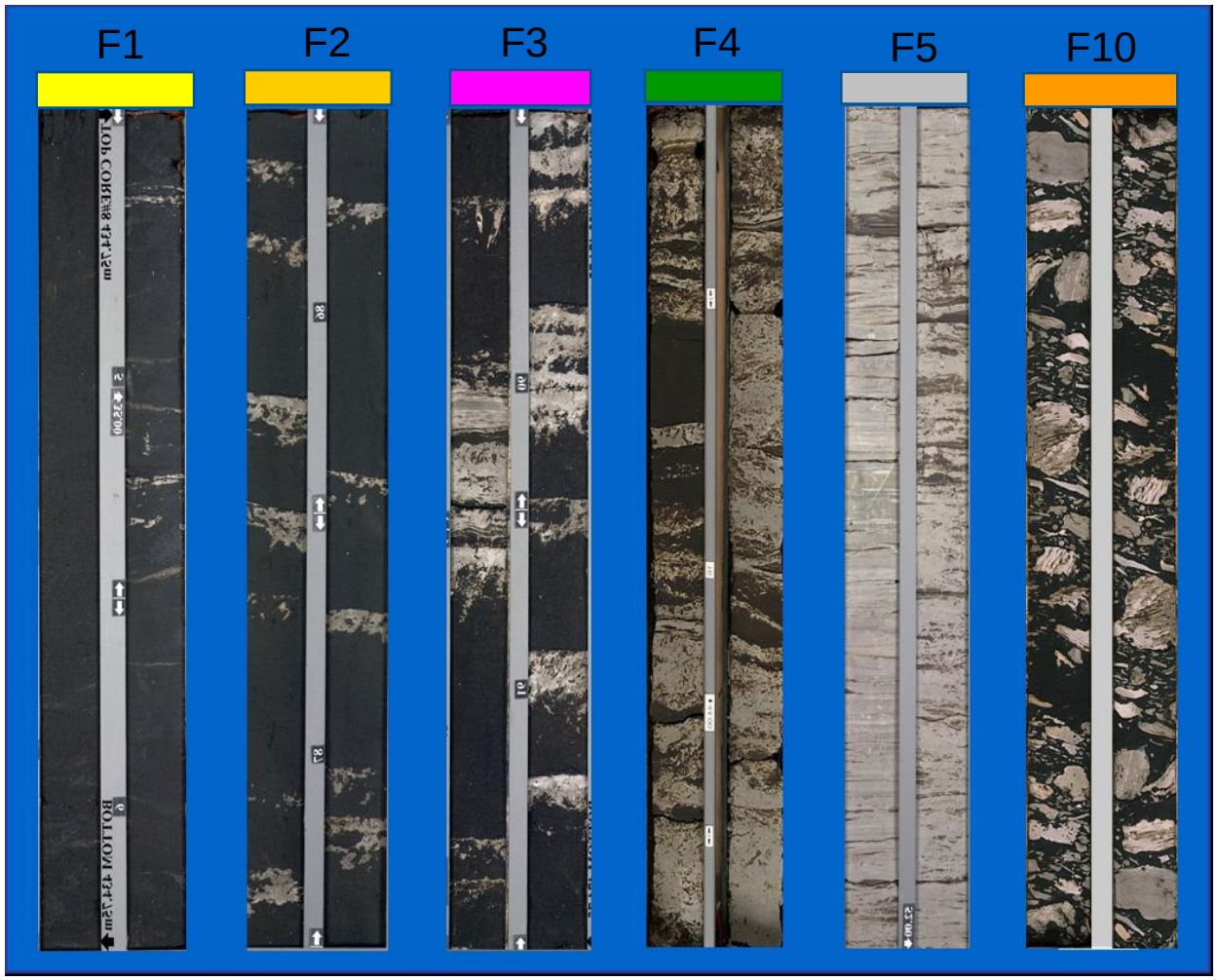
Pay:
Includes Facies F1, F2, and F10
Can include F3-F5, if < 2m thick

Weight percent bitumen > 6%

Generally > 30% Porosity
- PA averages 31.1% in clean sands

Permeability ~ 1 to 5 Darcy's

> 10m for OBIP volumetric



Pattern OBIP Calculation

Gross Rock Volume (GRV) = total rock volume derived from Continuous Reservoir map

Original Bitumen in Place = product of the GRV multiplied by the average Porosity, and the average Oil Saturation over entire reservoir interval

$$OBIP=GRV * So * Por$$

New reservoir mapping includes non reservoir facies in calculation which are rectified via averaging of porosity and saturation values over the entire interval via petrophysics. Allows for consistency of calculation applied to all areas

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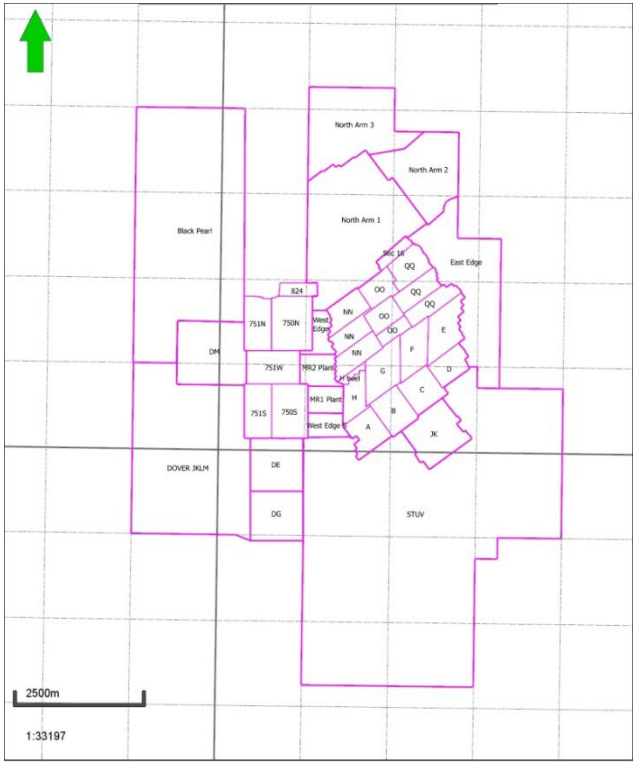
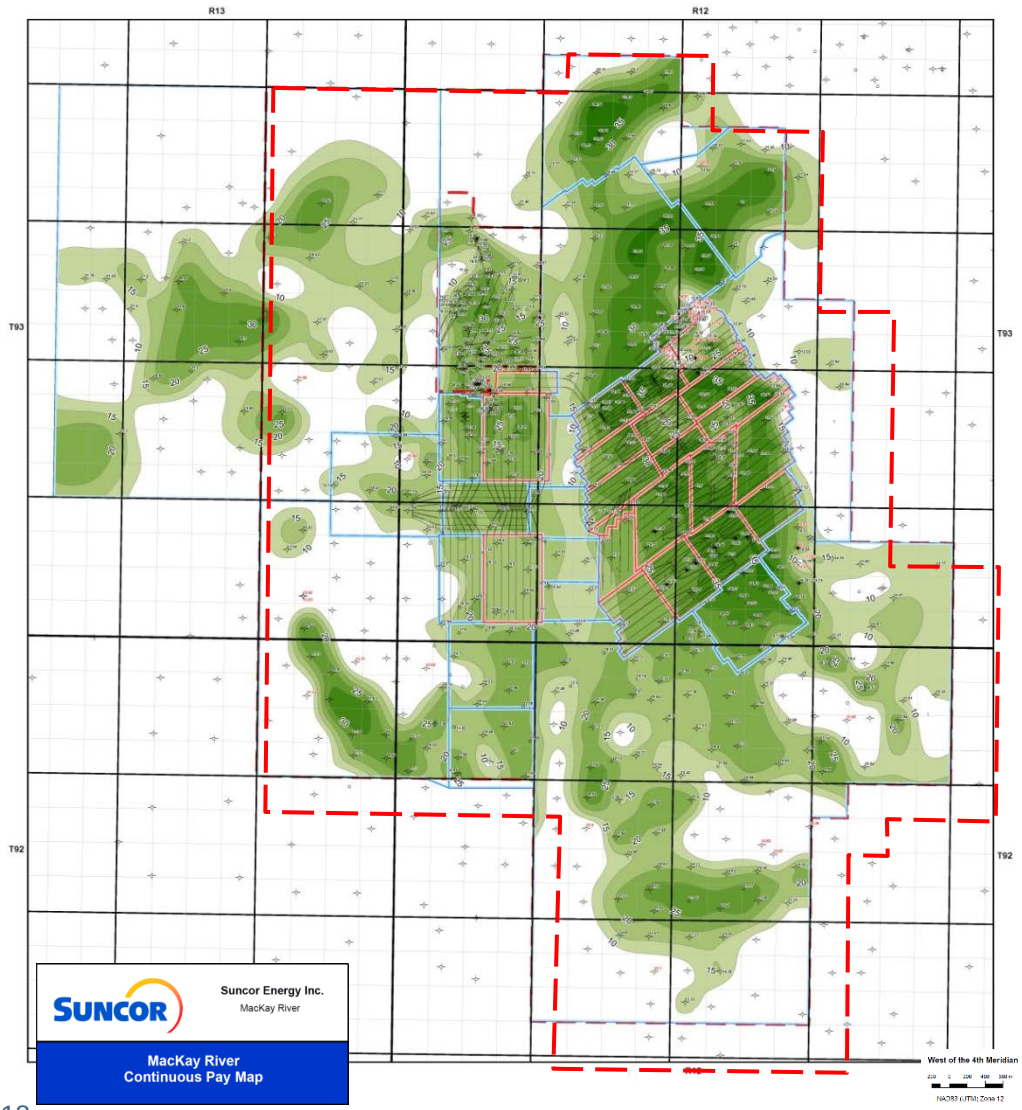
Reservoir Properties and Base Case OBIP

Average Reservoir Properties				Volumes	
Pattern	So	Phi	h (m)	Area (m2)	OBIP(e^3m^3)
A	71%	33.6%	21.8	466 540	2,446
B	81%	34.2%	27.1	476 900	3,585
C	83%	34.1%	33.2	475 650	4,503
D	83%	33.9%	28.8	362 280	2,993
E	81%	33.9%	27.9	583 380	4,328
F	82%	34.0%	29.5	475 130	3,908
G	78%	33.7%	28.2	584 380	4,342
H	80%	33.7%	21.8	334 650	1,928
NN (Phase 4/5)	78%	34.0%	26.3	1 068 850	7,453
OO (Phase 4/5)	77%	33.8%	28.1	787 620	5,658
QQ (Phase 4/5)	75%	33.7%	25.8	1 119 660	7,487
Pad 824	84%	32.5%	18.5	182 220	936
750N	79%	32.9%	23.3	795 630	4,797
750S	73%	33.7%	18.3	710 750	3,217
				Subtotal	56,645
Total approval area	73%	33%	25.6	8 423 640	220,990



Average Reservoir Depth = 109 m TVD, Pi = 400 kPa, Ti = 6-7 ^oC , K_{max} = 1.7-8.5 D, K_{min} = 1.1-6.5 D

Bitumen Pay Isopach



2017 MacKay Bitumen Pay

Contour Interval = 5m

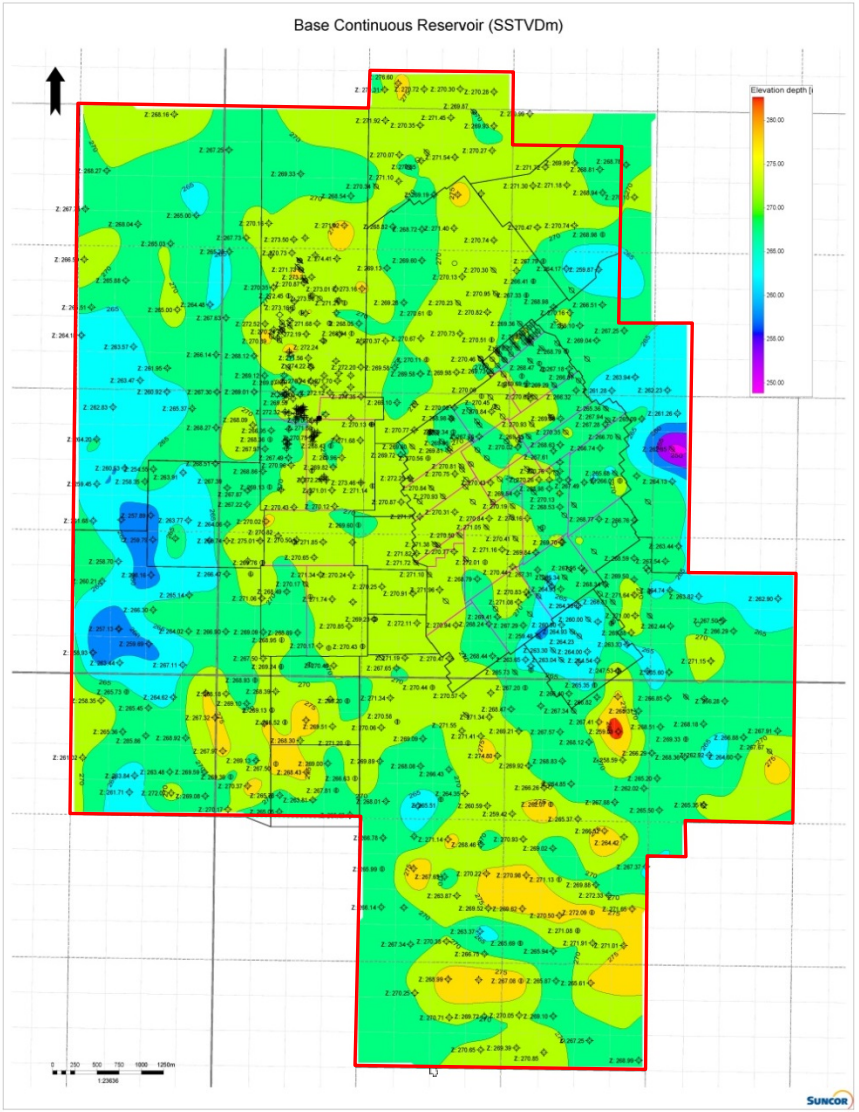
Legend

Continuous Pay Interval (5m)

- 10-15
- 15-20
- 20-25
- 25-30
- 30-35
- 35-40

- MacKay PA
- Reserves - Producing Area
- Reserve Area
- MacKay - Dover Hz Well Trajectories
- ***25.1*** Continuous Reservoir Thickness
- ***25.1*** Upper Stacked Continuous Reservoir Thickness

Base of Reservoir Structure Map



T 93

T 92

R13 R12W4

Legend

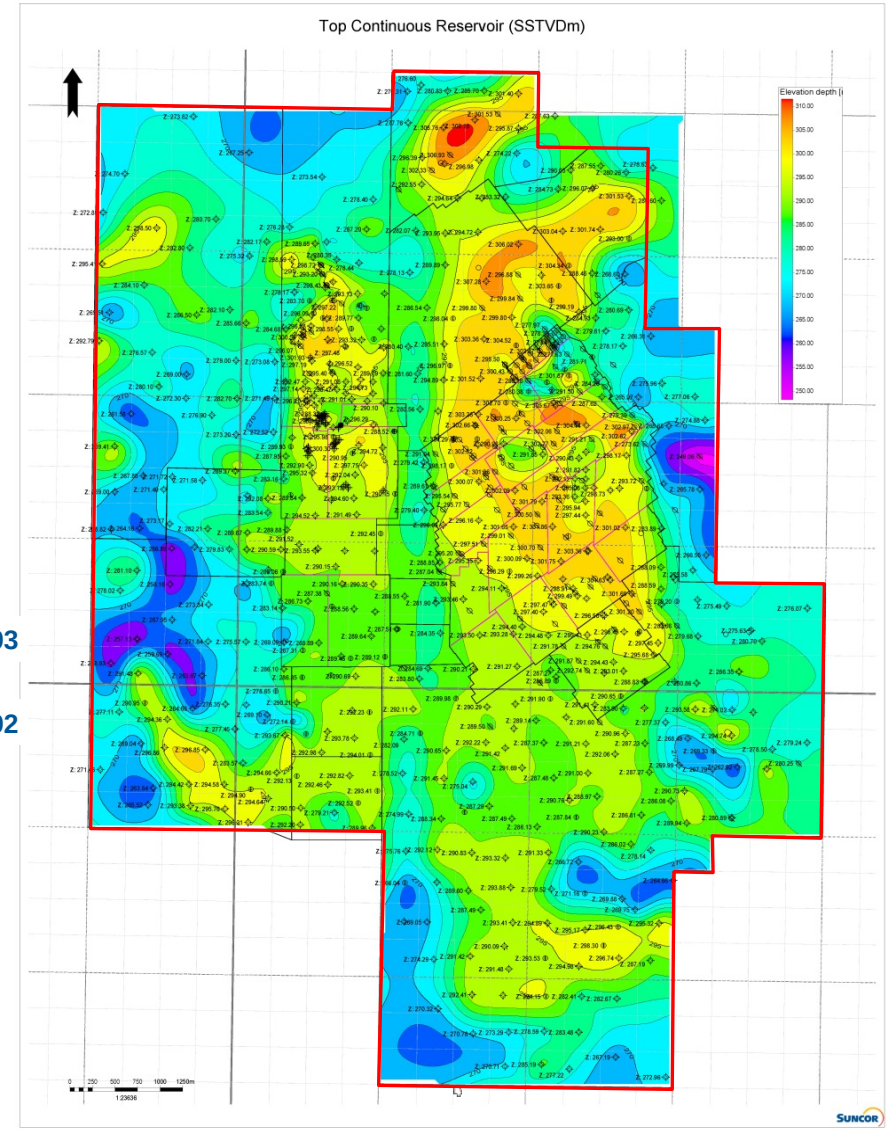
Approved PA Boundary

Contour Interval =5m

2017 MacKay Base of Reservoir

Contour Interval = 5m

Top of Reservoir Structure Map



Legend

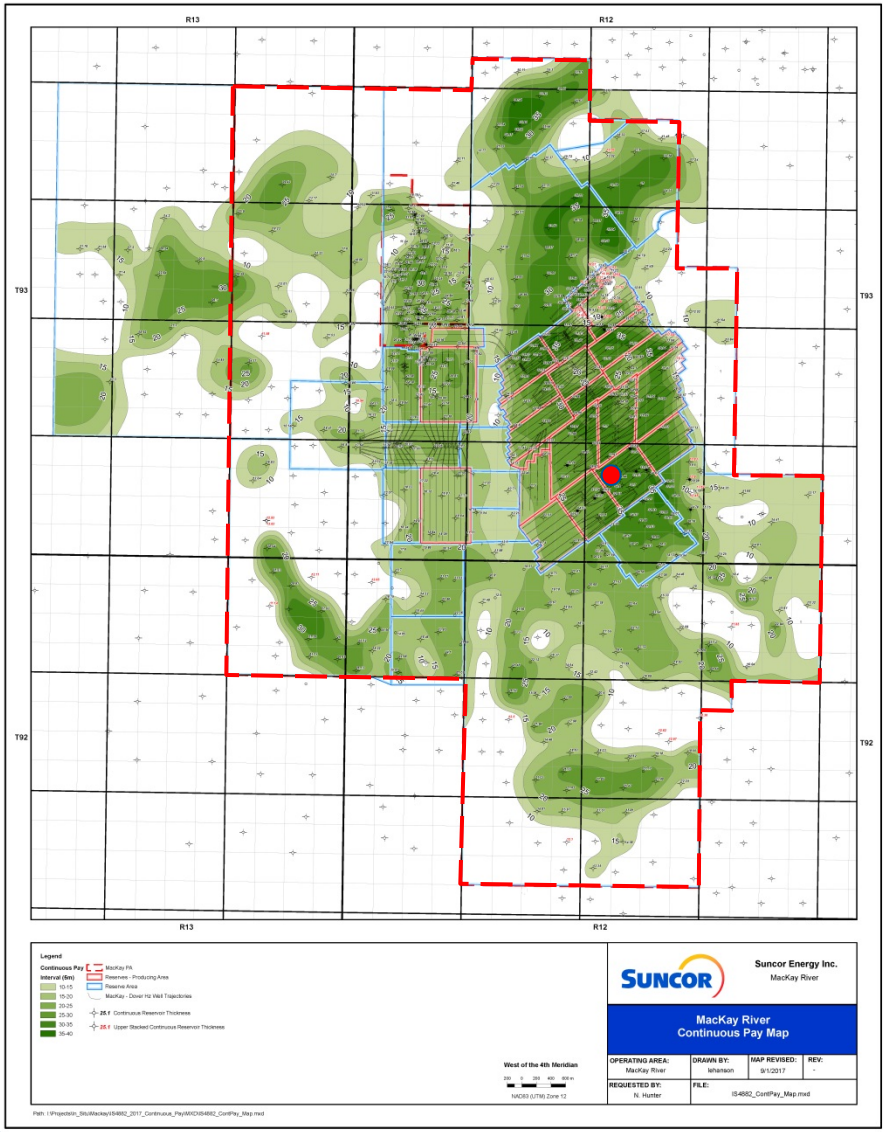
Approved PA Boundary

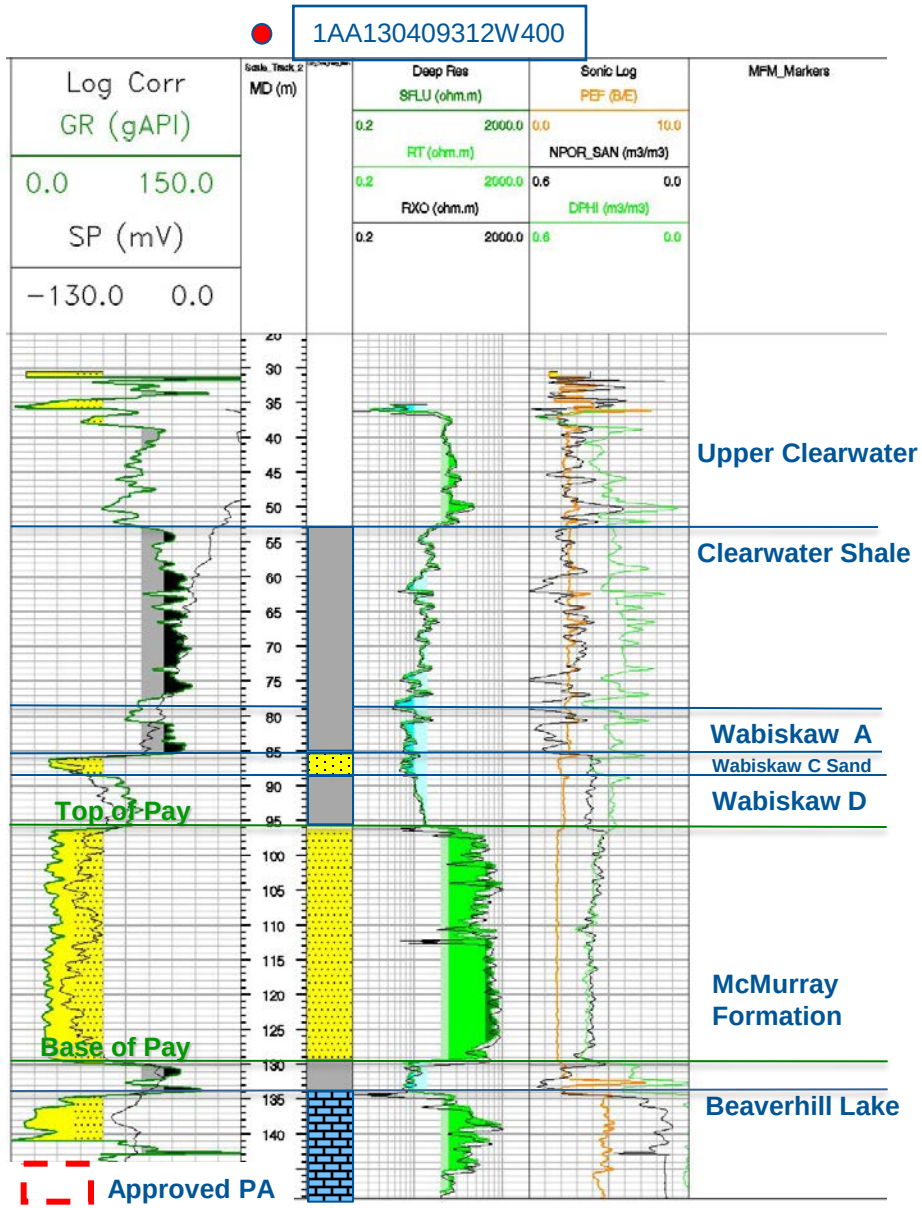
Contour Interval =5m

2017 MacKay Top of Reservoir

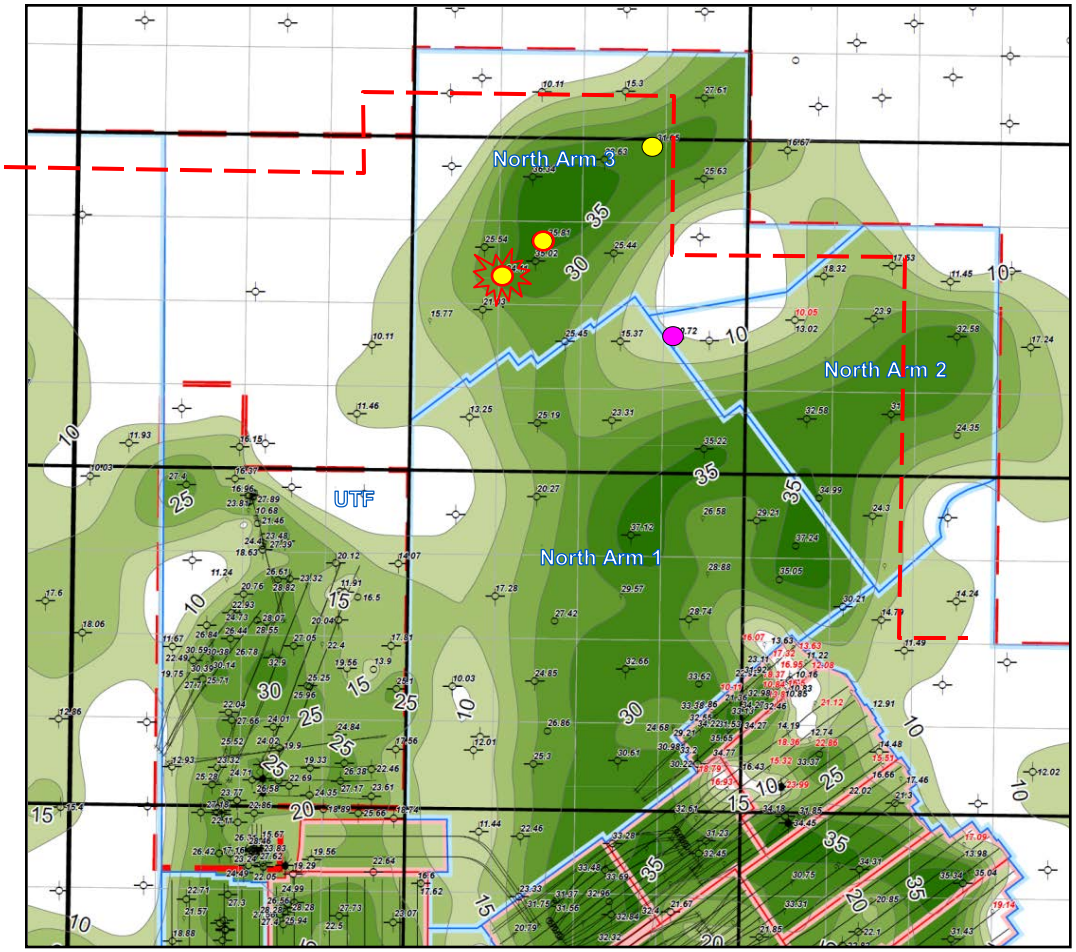
Contour Interval = 5m

MacKay River Stratigraphy





2016-17 Activities – Vertical Wells



- 3 vertical wells:
  - Observation wells
- 1 Slant Well
- Core analyses/Special testing
  - FMI
  - Mini-frac
  - 1 well geomechanical testing (evaluating)
  - 1 Slant core

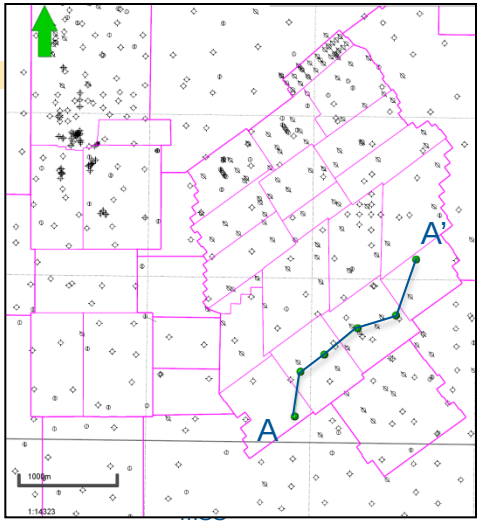
2017 MacKay Bitumen Pay

Contour Interval = 5m

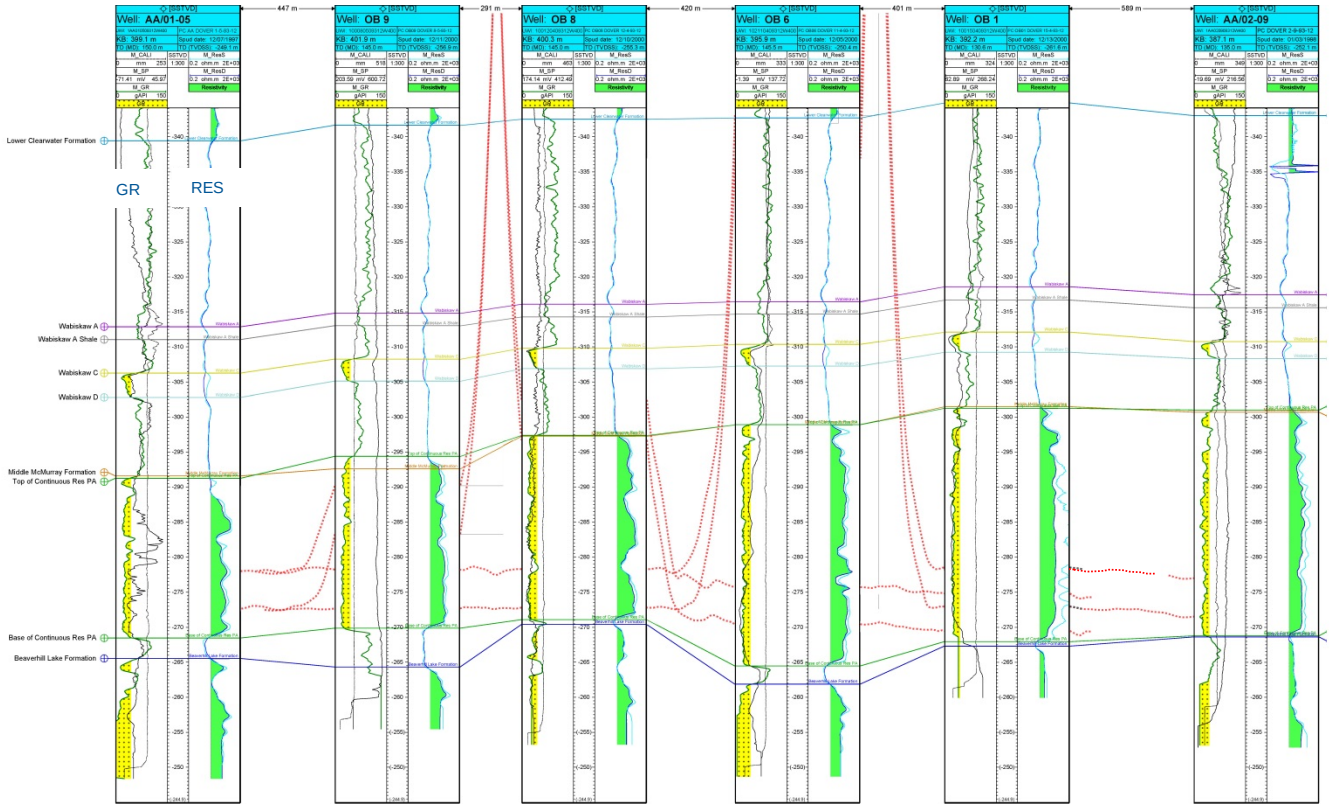
Legend

- **Mini-frac**
- **Geomechanical core**
- **Slant well**
- **Vertical Observation wells**
- **Existing SAGD wells**

Phase 1

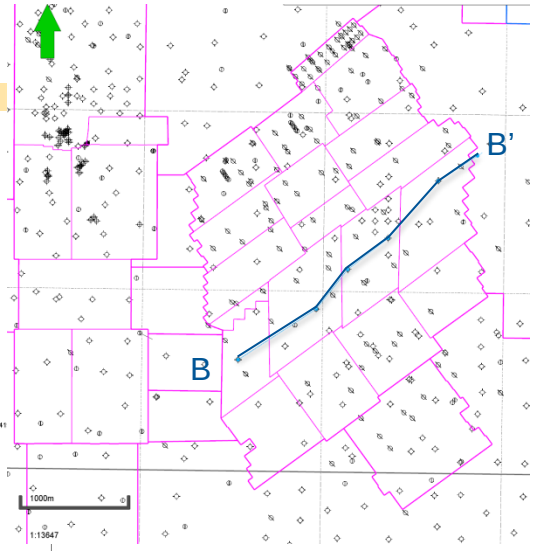


A Pad 20 Pad 21 A'

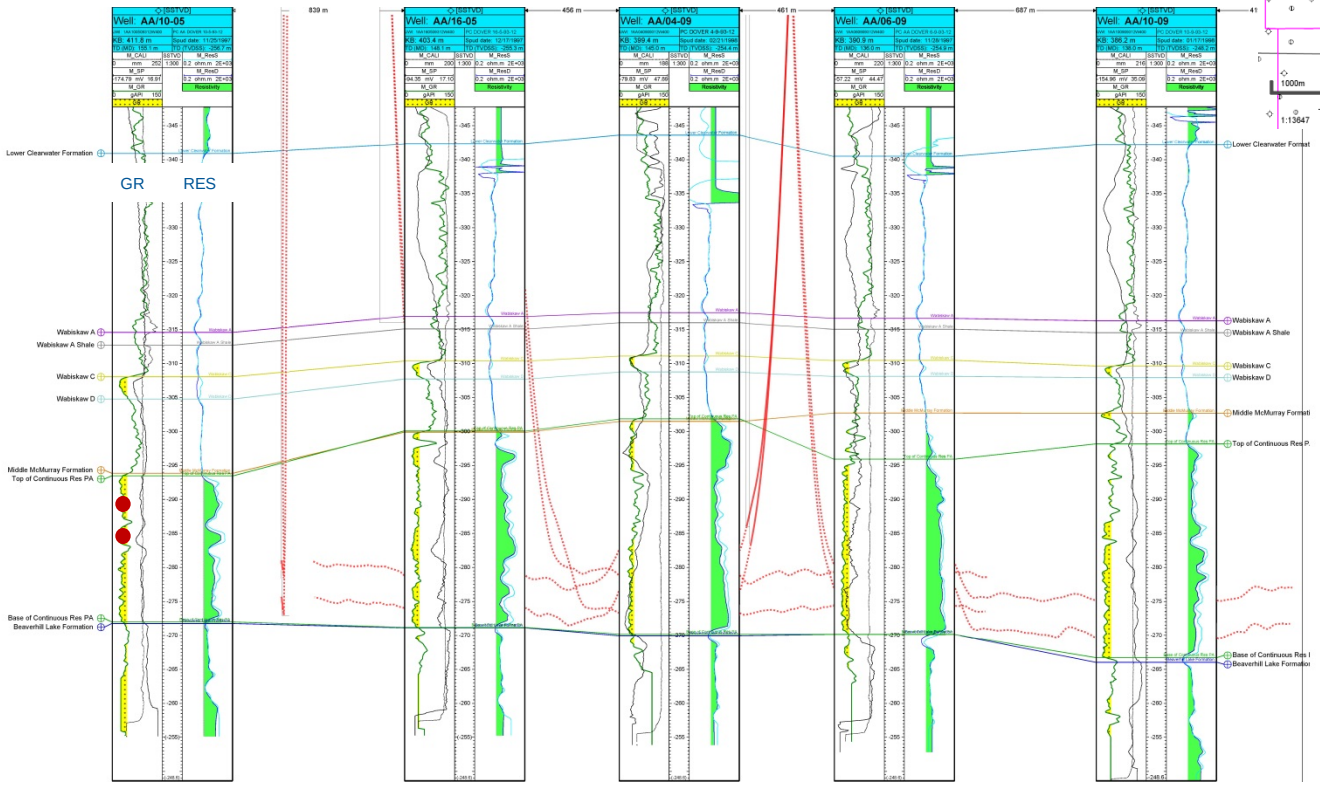


A Pattern B Pattern C Pattern D Pattern

Phases 2, 3 and 4

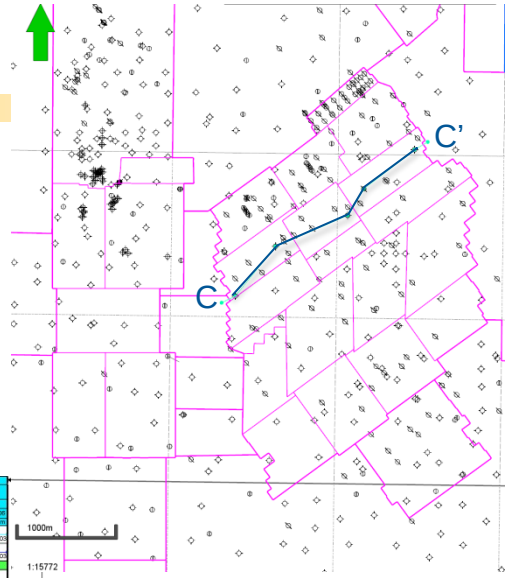


B Pad 22 Pad 23 B'

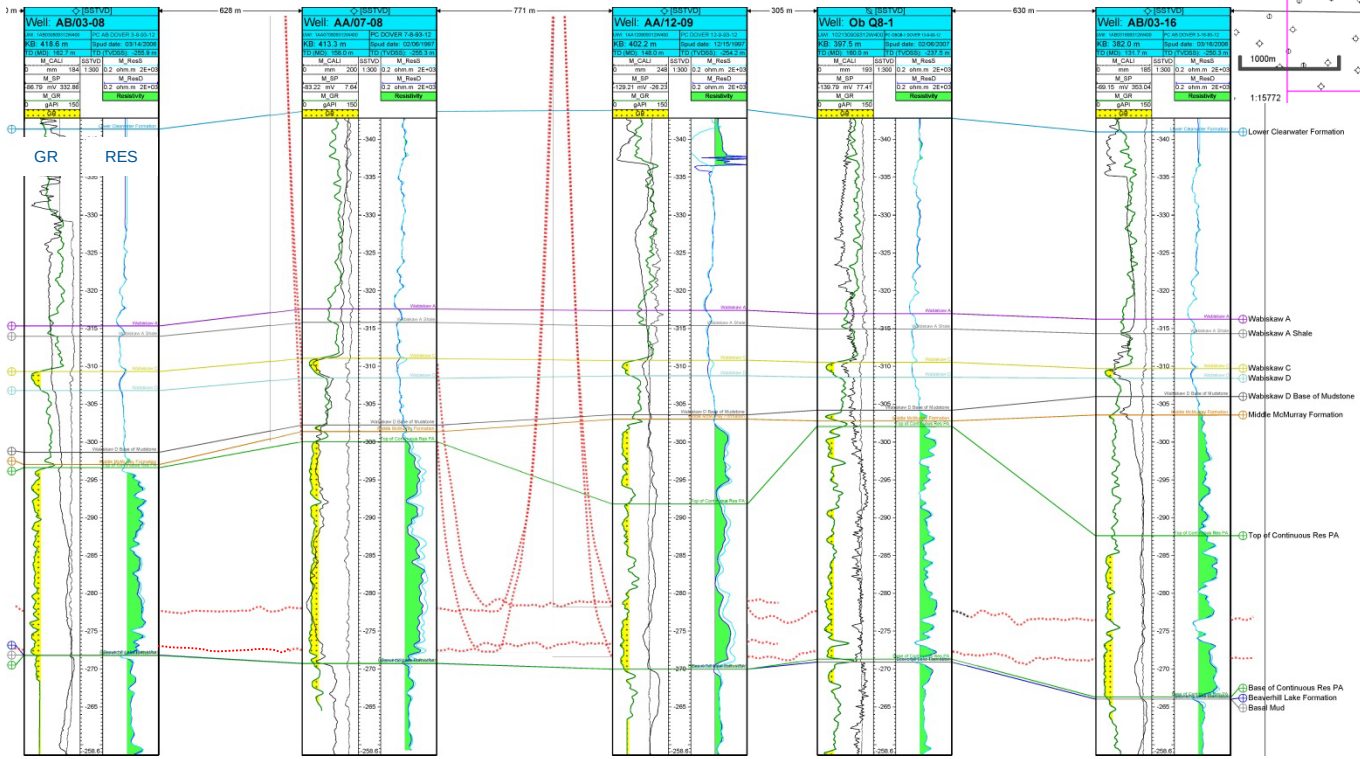


H Pattern G Pattern F Pattern E Pattern

Phase 5

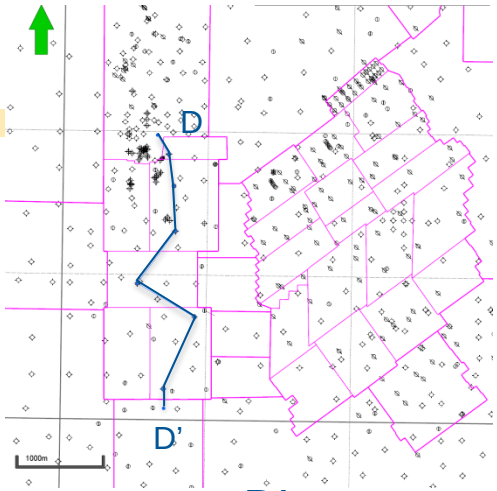


C Pad 24 Pad 25 C'



NN Pattern OO Pattern QQ Pattern

Pads 824 / 750 / 751



D

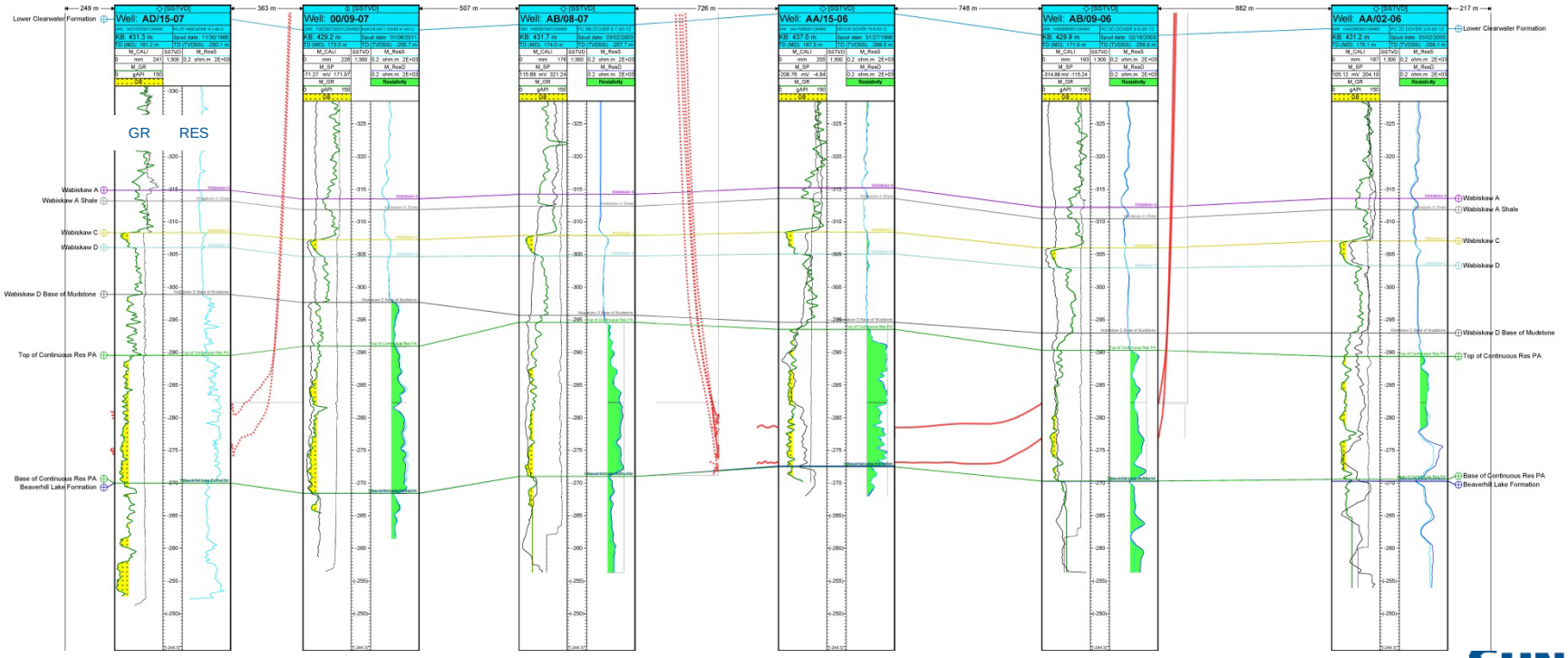
Pad 824

Pad 750

Pad 751W

Pad 750

D'



824

750N

751W

750S

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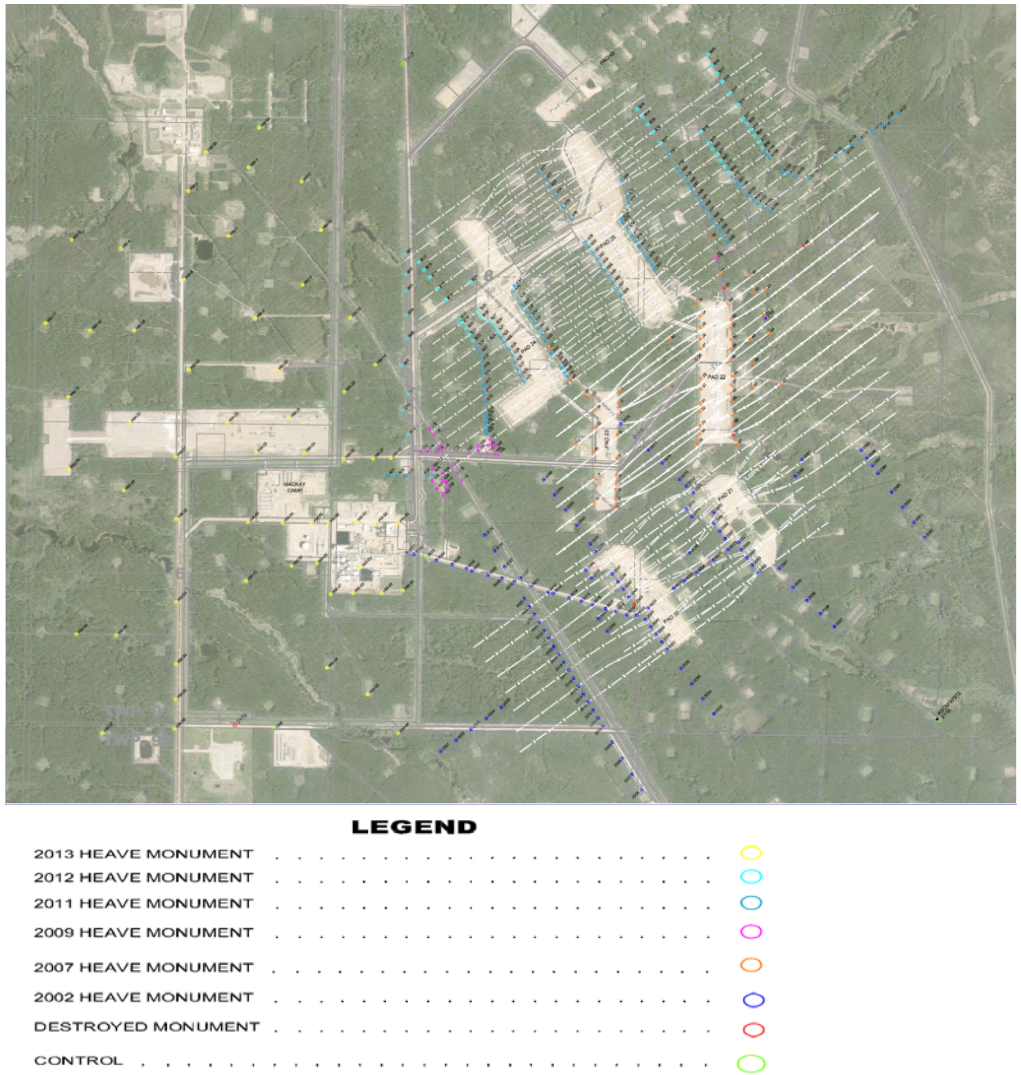
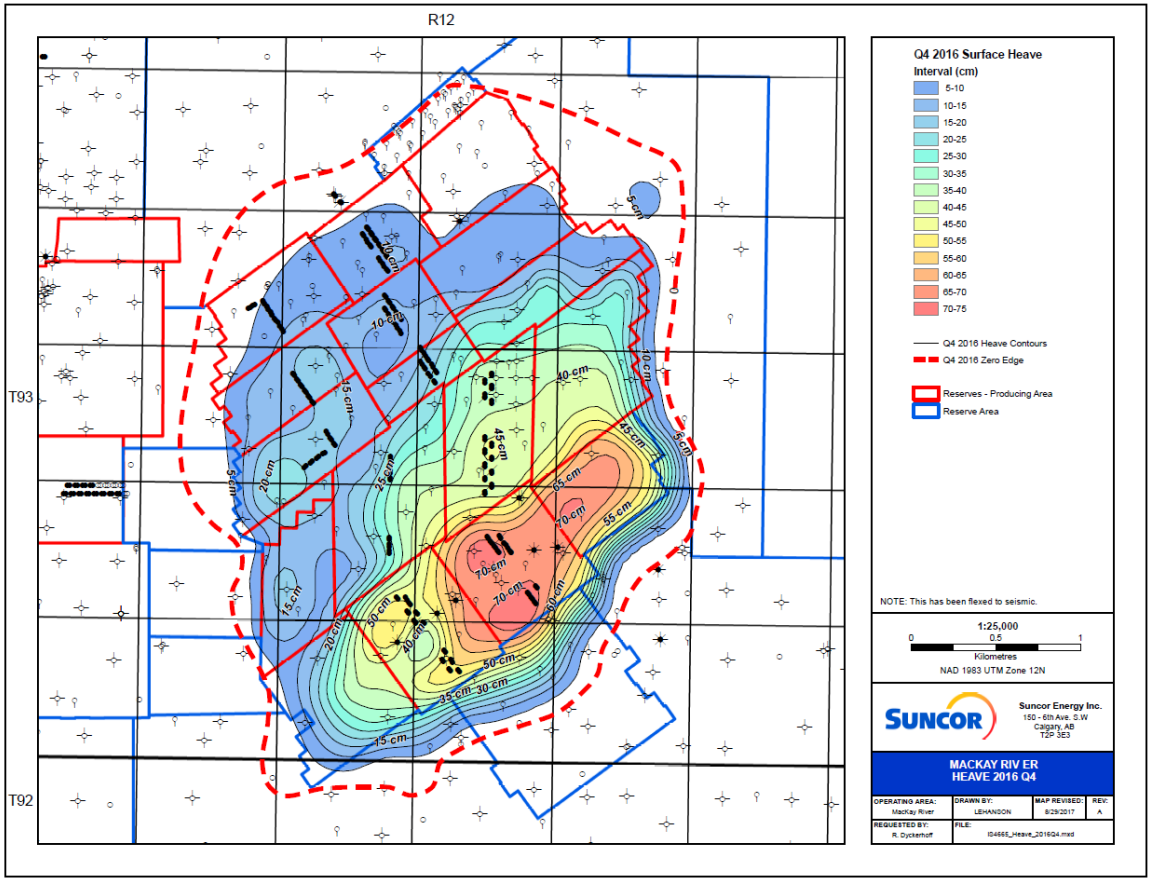
Steam Chamber Development: Surface Heave Monitoring



- 418 active monuments exist over MacKay River for heave measurement and monitoring
- No new monuments installed since August 2016
- Survey History:
  - 1st: Fall 2002
  - 2nd: Dec 2006
  - 3rd: Fall/Winter 2007/08
  - 4th: Nov 2008
  - 5th: Jan/Feb 2010
  - 6th: Nov 2010
  - 7th: Dec 2011
  - 8th: Dec 2012
  - 9th: Oct 2013
  - 10th: Oct 2014
  - 11th: Oct 2015
  - 12th: Oct 2016

2D Surface Heave: Change from Baseline to October 2016



Q4 2016 Surface Heave Map

Survey strategy

- Heave surveys are performed at different frequencies depending on well vintage:
  - Q1 2016 baseline survey of 750/751
  - Q4 2016 heave survey for full field

Heave monitoring application:

- Field performance monitoring coupled with seismic

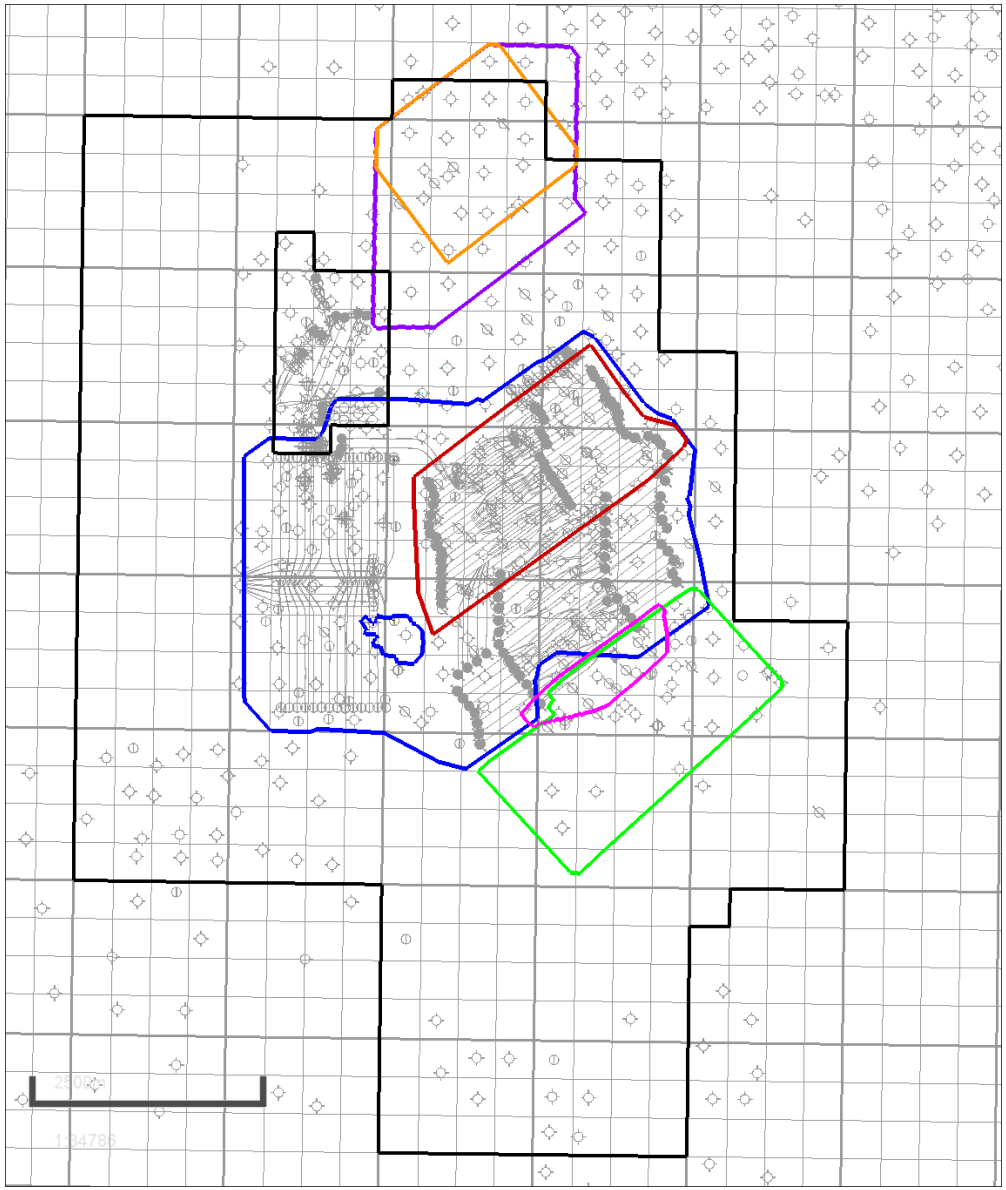
Future heave survey plans:

- Combined 750/751/824 survey planned for Q4 2017

3.1.1.2 :l

3.1.1.6 :a

MacKay River – 3D / 4D Seismic Activity 2017



2017 3D

2016 3D

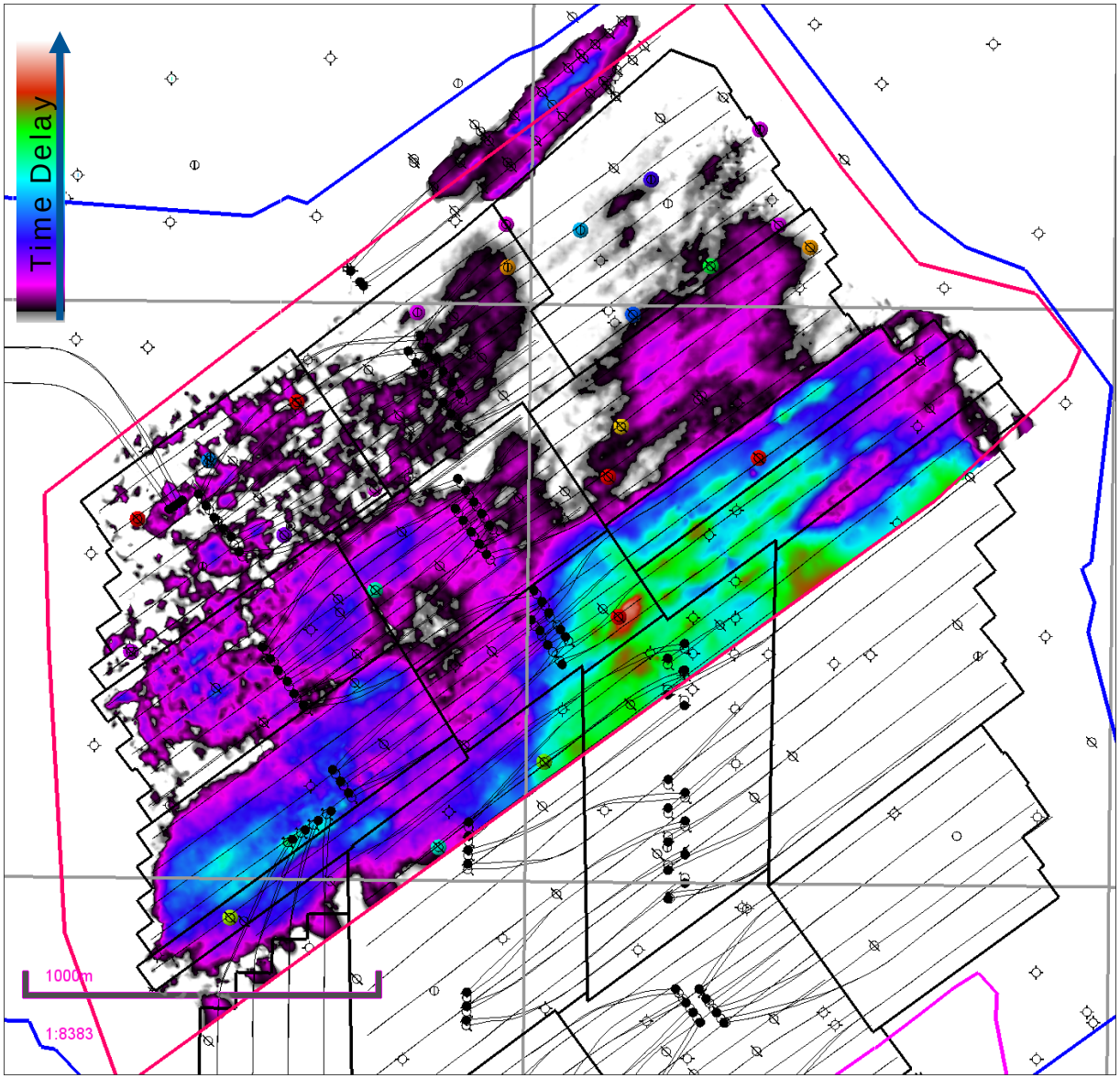
2016 4D

2014 4D

2013 3D / 4D

2011 3D / 4D

4D Seismic – Steam Chamber Thickness (March 2016)



Caprock Integrity

3.1.1.2 j,m

MacKay River Coupled Geomechanics / Reservoir Workflow

1 - Data Gathering
- SAGD well operations (Rate/Pressure)
- Ob well pressure (Piezometer)
- Ob well temperature (Thermocouple/Fiber)
- Surface heave (Monuments)
- Cores and borehole image log analysis
- Rock geo-mechanical properties (Lab tests)
- In situ stress (mini-frac tests)

2 – Data Interpretation

Reservoir Physics
- Well performance
- Pressure Leak-off
- Heat transfer

Geomechanics
- Stress state
- Rock behavior
  - Shear failure conditions
  - Tensile failure conditions
  - Permeability change
- Thermal expansion
- Reservoir level deformations

3 - Coupled Reservoir Geomechanics
- Update pressures and temperature
- Update stress state
- Recalibrate models using history match to field data
- Forecast/Design for safe development

4 - Learnings
- Sensitize key variables within uncertainty range
- Quantify geomechanical risks
- Verify and update MOP
- Recommend/Design further measurements / lab tests

Geomechanics analysis for safe optimal MacKay River operations

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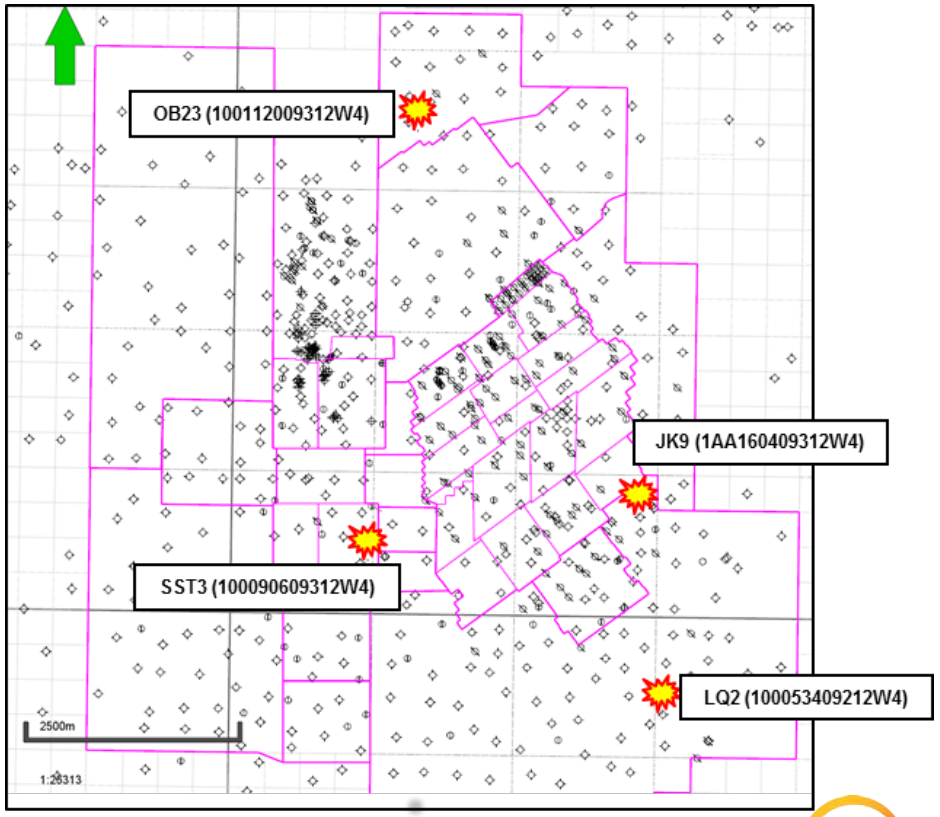
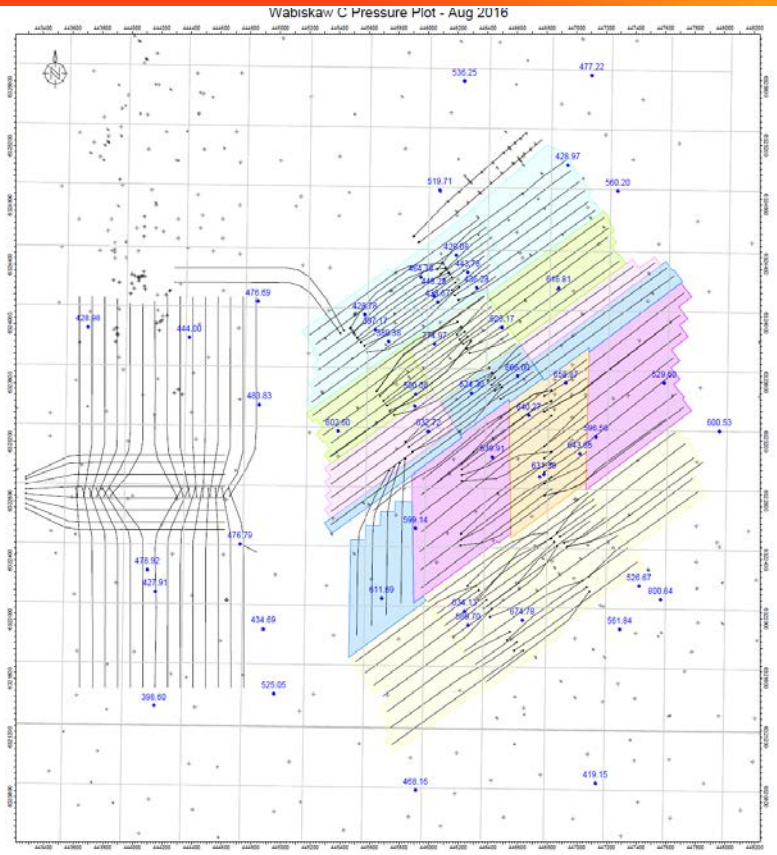
Geomechanics: Mini-frac Test

- New mini-frac tests conducted at OB23 (100/11-20-93-12W4/0)
- Fracture gradient within operating area still holds at or above 21 kPag/m:
  - Fracture gradient measured (kPag/m) from mini-frac test

Formation	OB23 (2017)	JK-9 (2014)	LQ2 (2011)	SST3 (2008)
Clearwater	Evaluation on-going	22.3	21.3	24.1
Wabiskaw A		21.1	21.2	-
Wabiskaw D		22.1	22.6	24.3
McMurray		-	21.1	19.9



Monitoring: Wab C Pressure & Temperature



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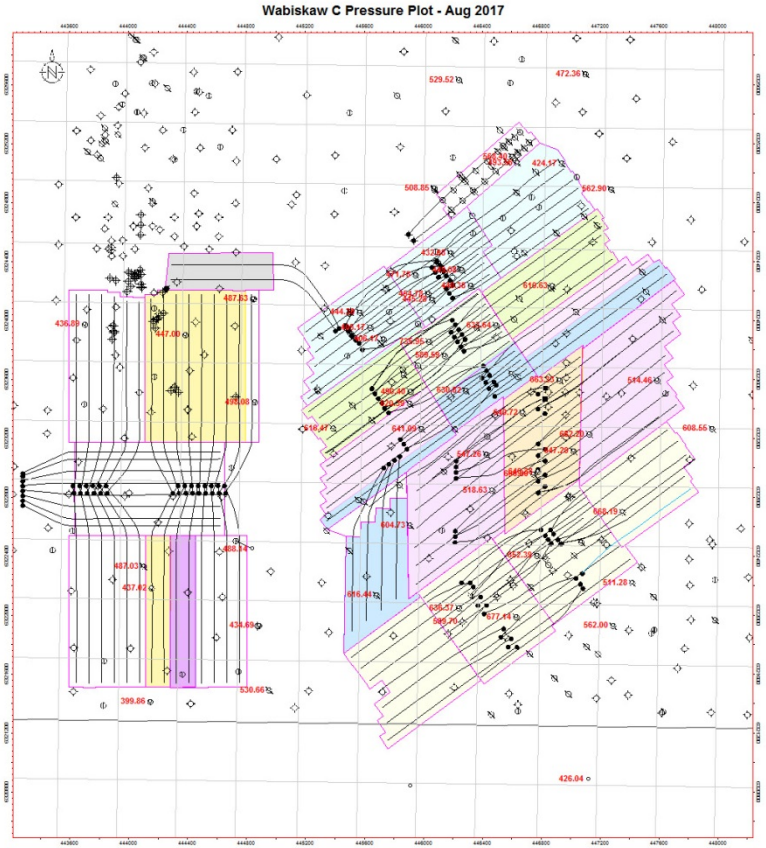

Average pressure increase of 2kPa from August 2016 to August 2017:

- Pressures are below hydrostatic and well below fracture pressures

15 wells with elevated temperatures (>30°C) directly above mature SAGD operations:

- 6 wells between 90°C and 143°C; 9 wells between 30°C and 90°C
- Elevated temperatures are within the expected range as depicted by heat conduction calculations
- Ongoing analysis and simulation efforts are continuing to further understand underlying mechanisms

Geomechanics: Geomechanical Simulation Studies

Continuous Improvement to Geomechanical Models

- Continued calibration of the model with an integrated dataset (SAGD performance data, pressure and temperature data acquired from the Wab C and McMurray, and surface heave)

- Verified sufficient factor of safety to tensile and shear failure in the caprock

Drilling and Completions

3.1.1.3

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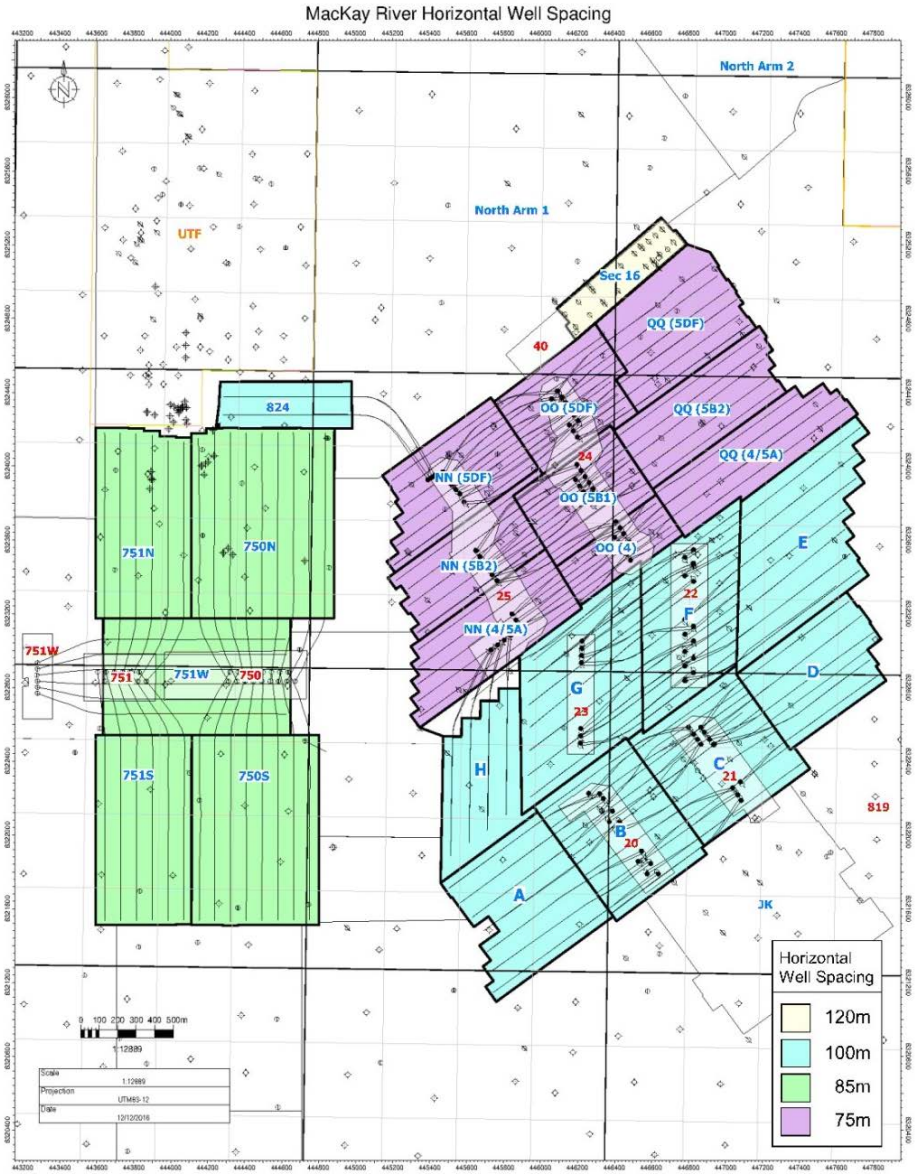
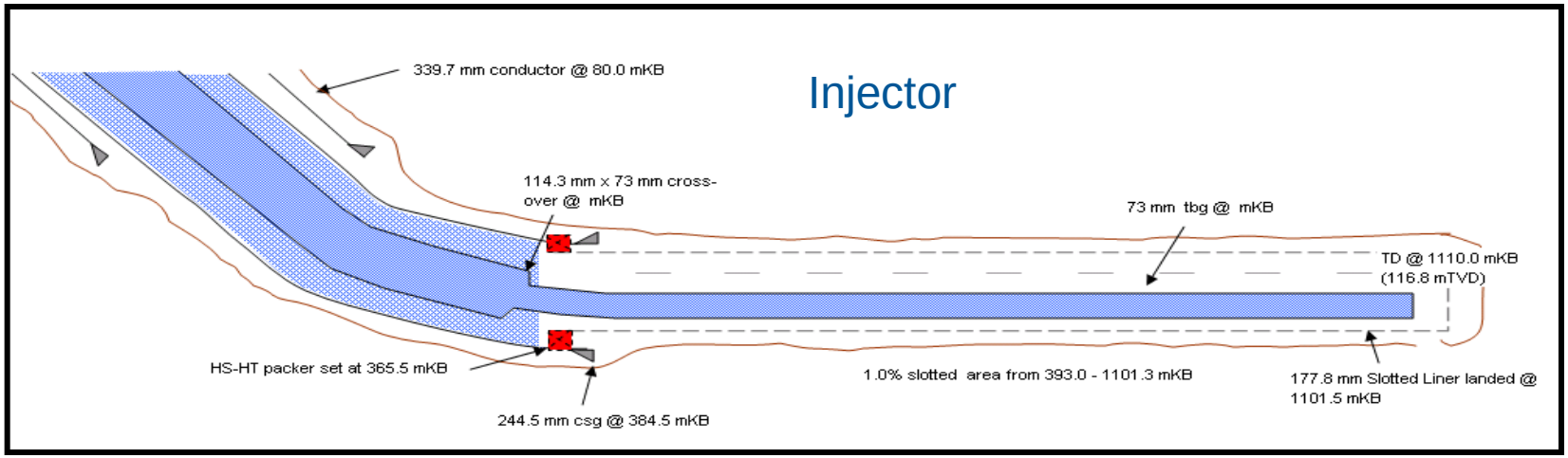
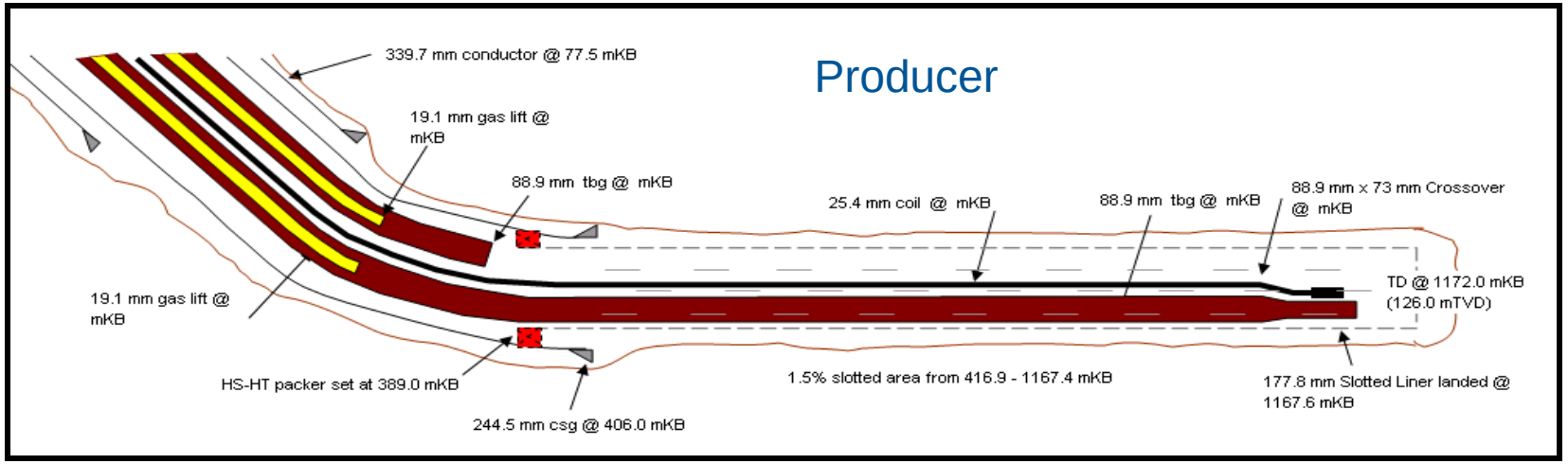
Mackay River Well Layout and Spacing Map



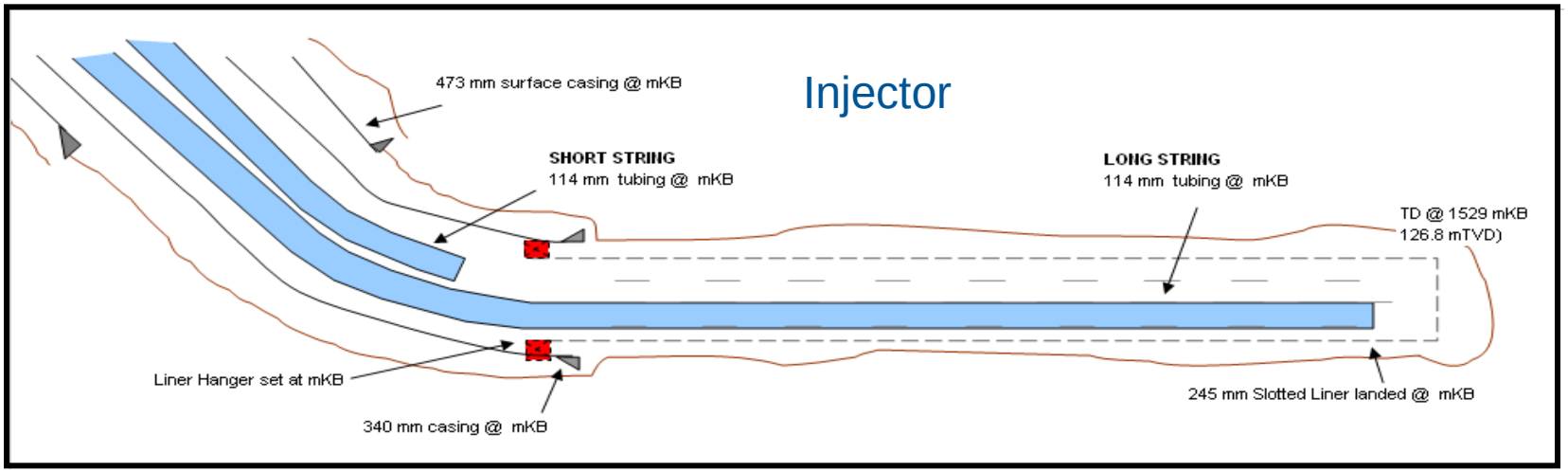
- 110 producing well pairs at MacKay River on 7 pads
- Optimal well spacing is evaluated for each new development

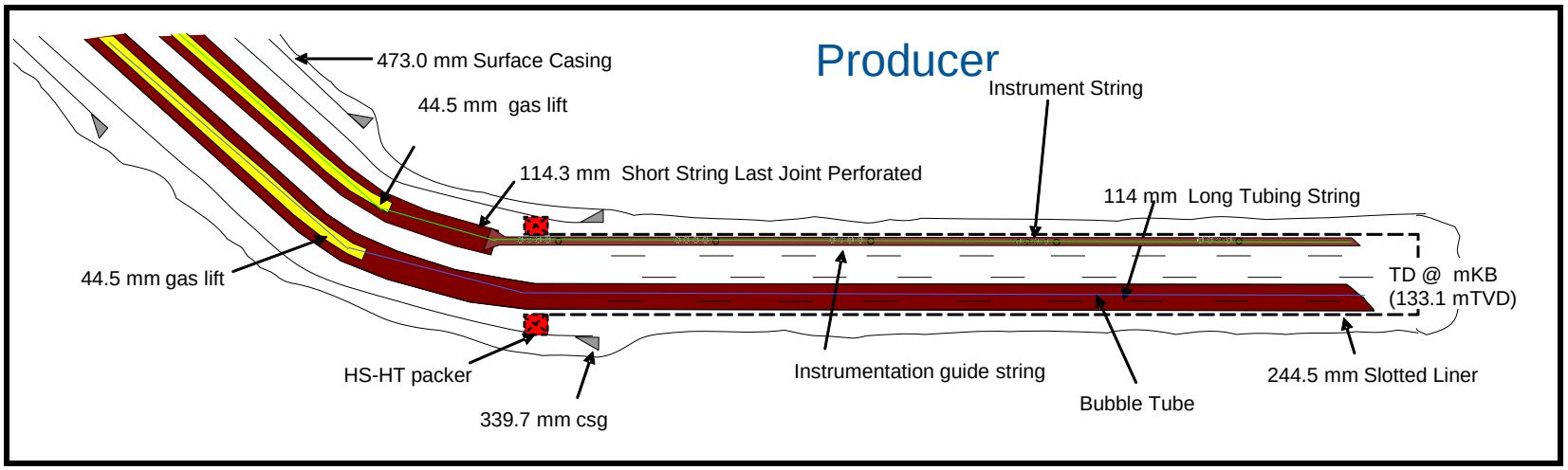
Typical Well Completions – Phase 1-4 Type



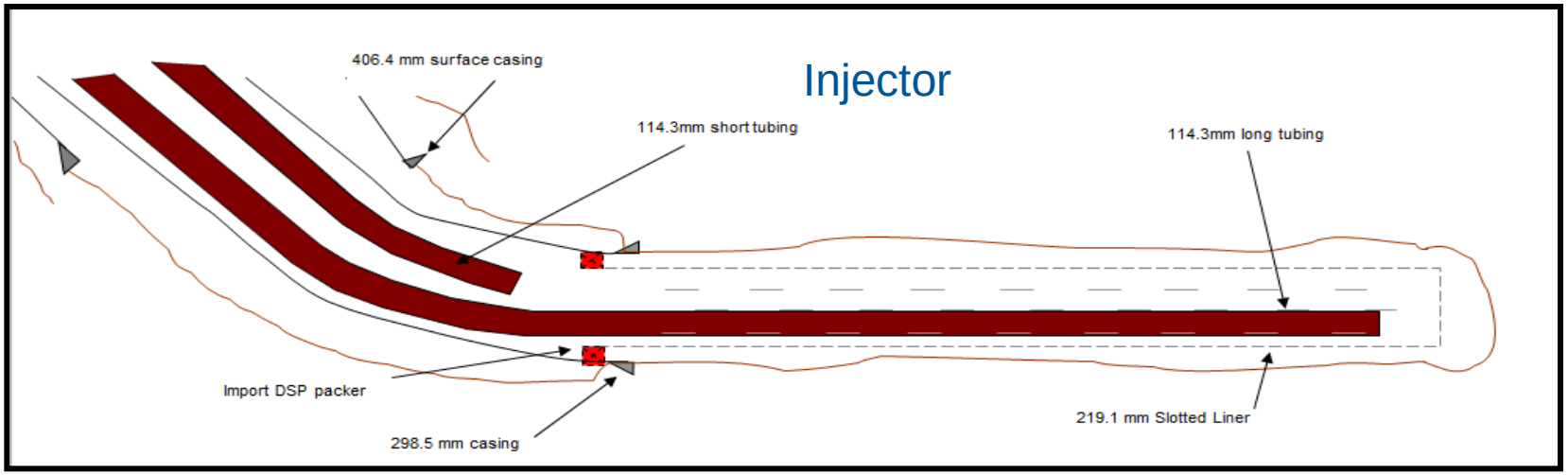


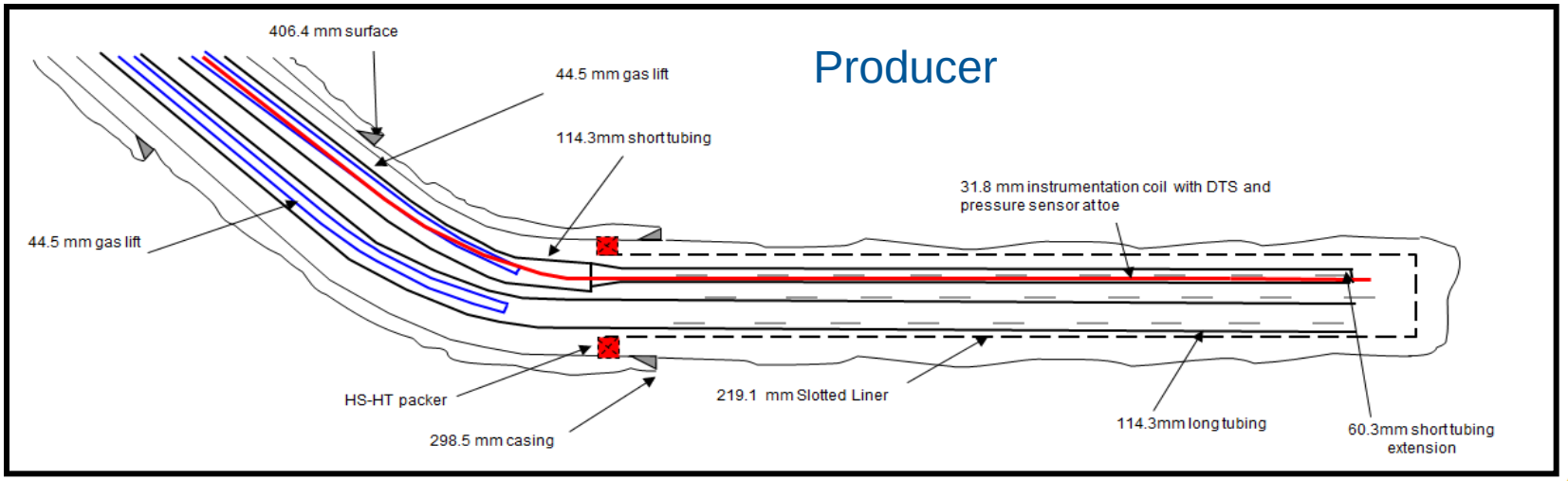
Typical Well Completions – Phase 5 Type



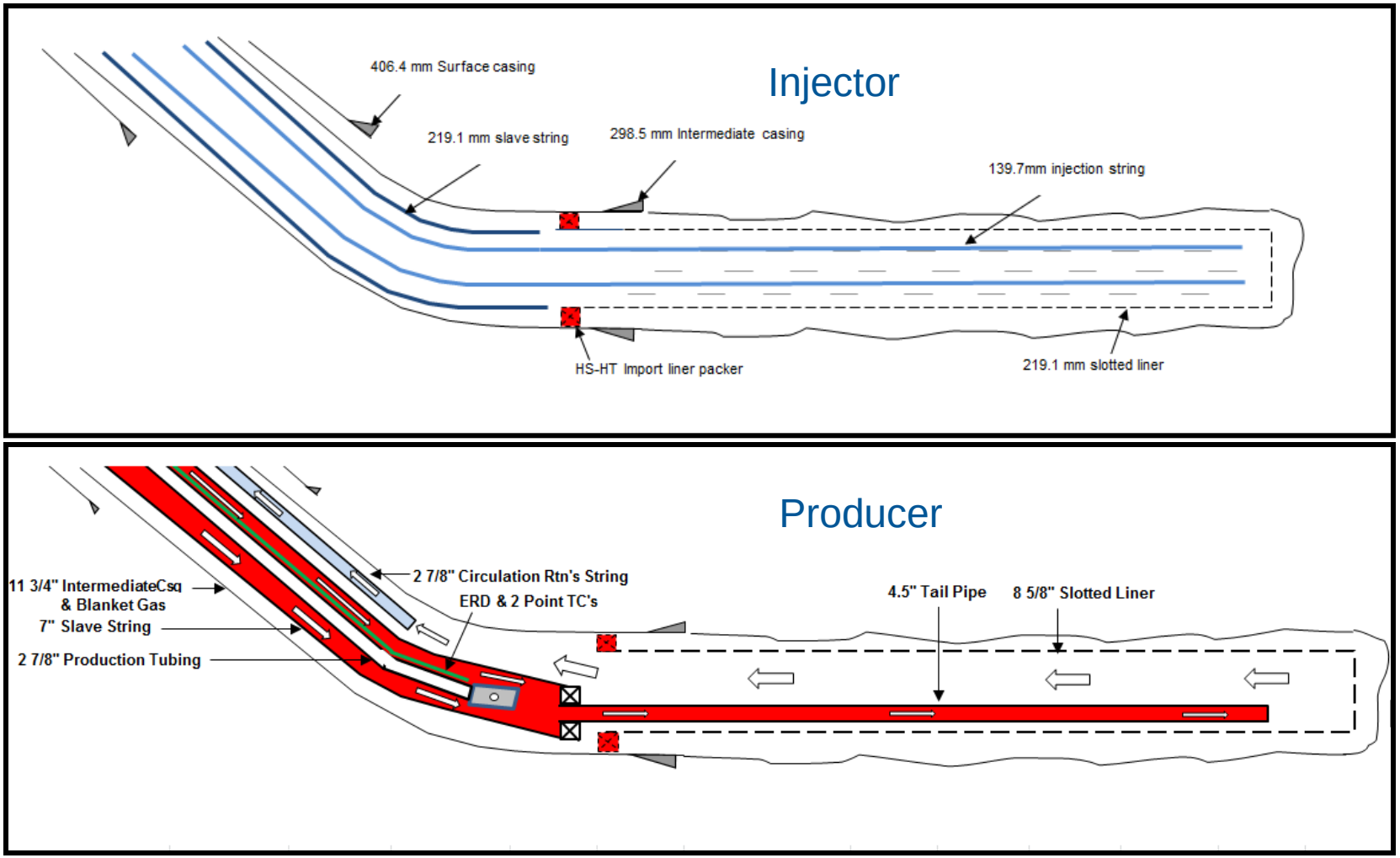


Typical Well Completions – Pad 750 Type

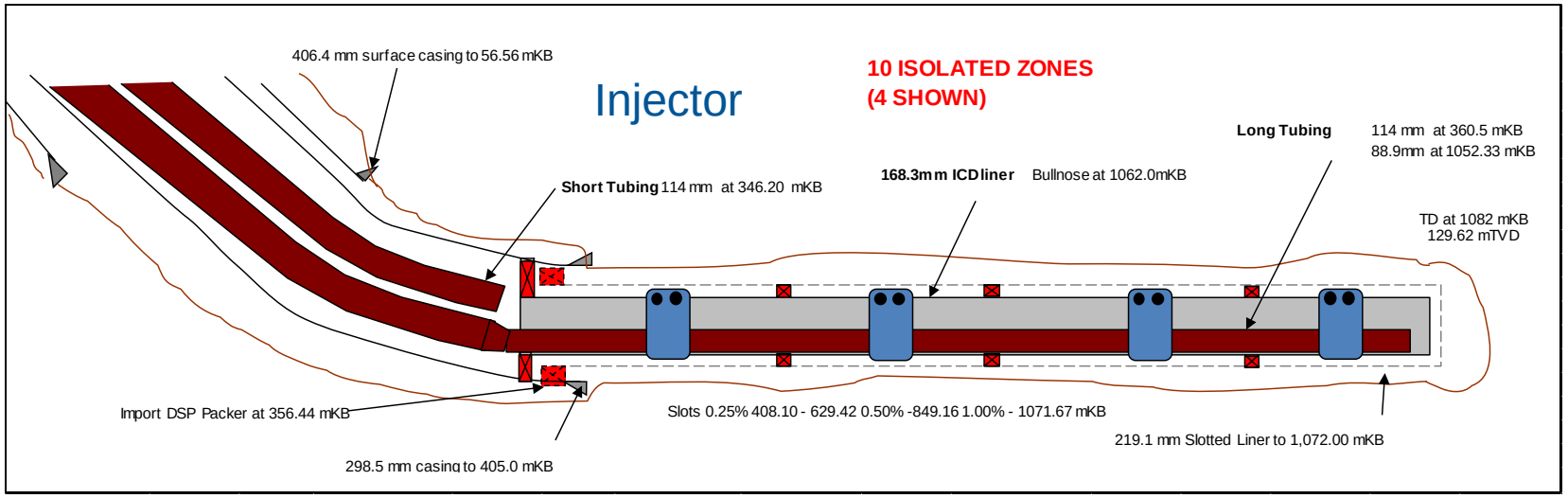


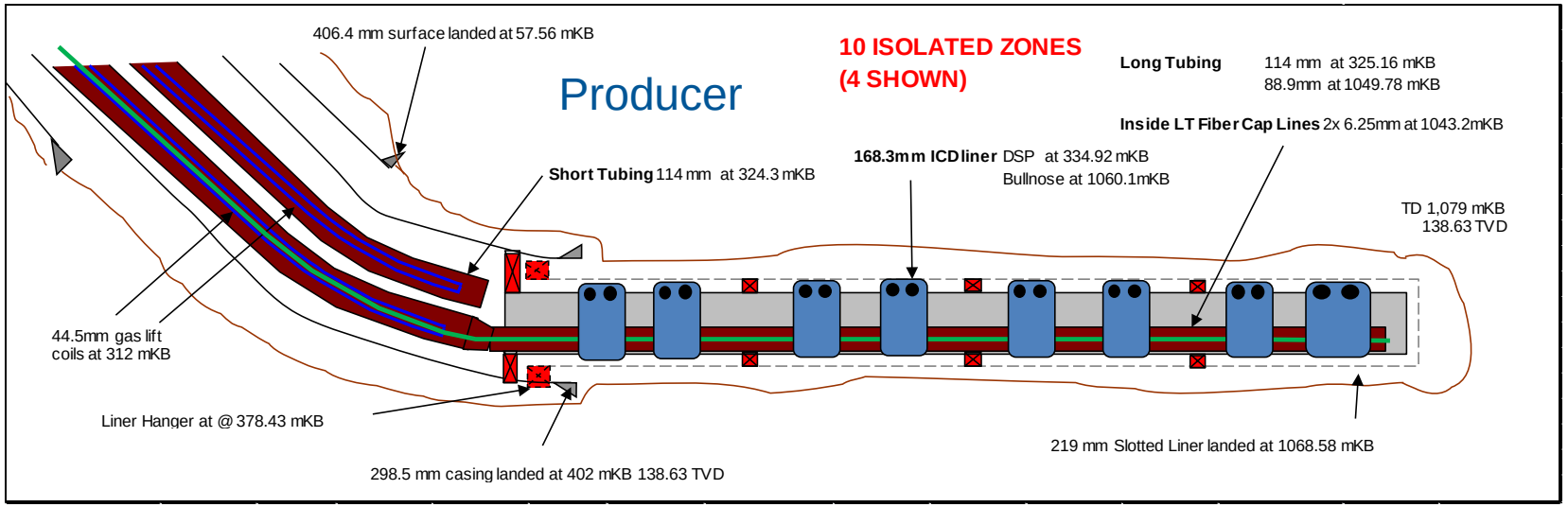


Typical Well Completions – Pad 824 (DSAGD)



Typical Well Completions – Flow Control Devices





Typical completion diagram for producer and injector in isolation

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Key Learnings: Wellbore Integrity Management

- ***Wellbore integrity management*** is a high priority focused on wellbore containment over a wells' full life cycle
  - **In Situ Well Integrity Standard** – comprehensive document developed to guide employees on well integrity considerations and practices through the life cycle of thermal wellbores (design, construction, operation and retirement)
    - **Monitoring and surveillance** for liner failures and intermediate casing failures**;**
    - **Wellbore thermal shock mitigation** for start-up after outages
    - **Erosion/corrosion monitoring program**
    - **Monitoring and repair of SCVFs**
      - Regular monitoring of pressure, rate and/or bubbles & H_2S concentration (annually for non-serious SCVFs, monthly – quarterly for serious SCVFs)
      - Gas venting rates continue to decline indicating remediation work may have been successful
      - Innovative repair techniques (i.e. SMART tool)

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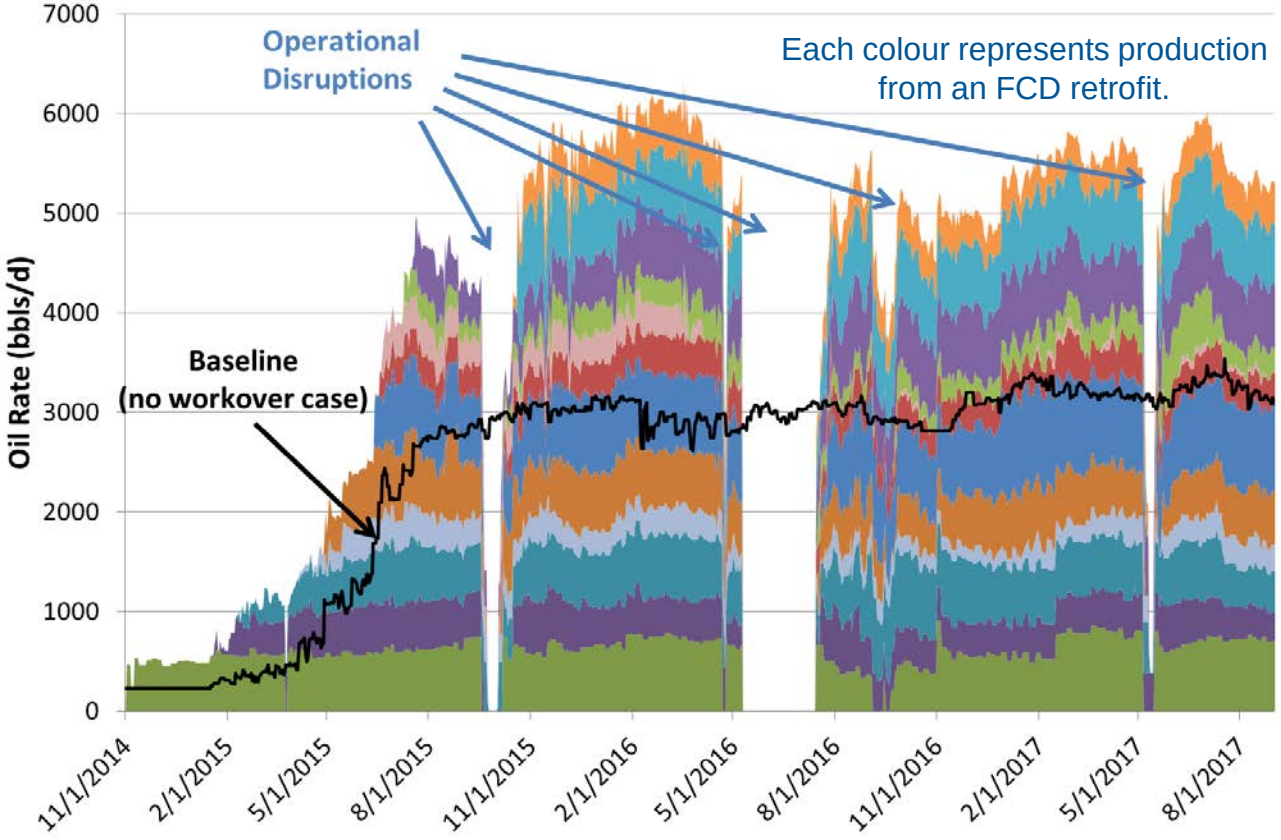
Flow Control Device Implementations

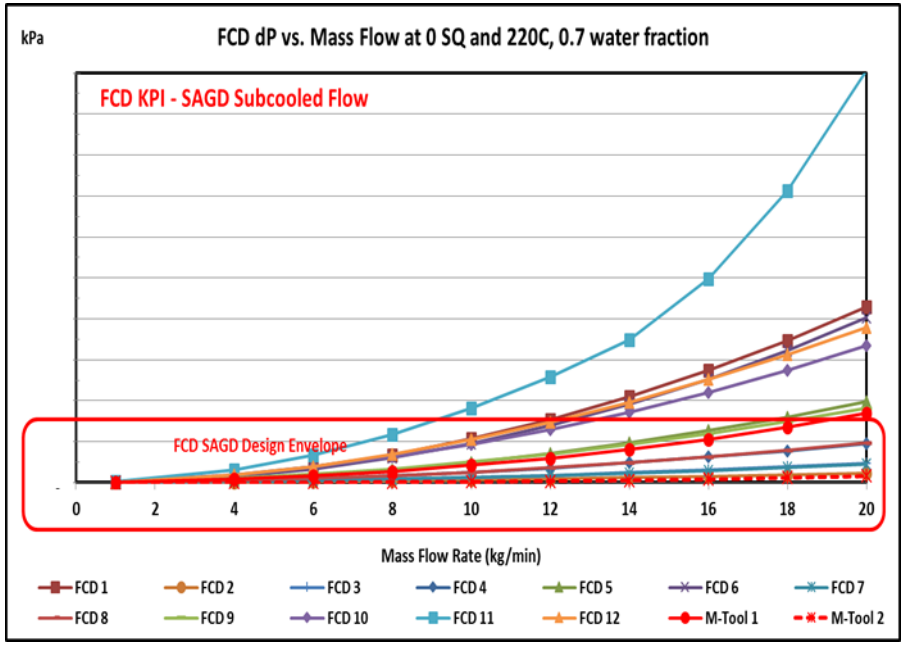
Wide use of flow control devices (FCDs)

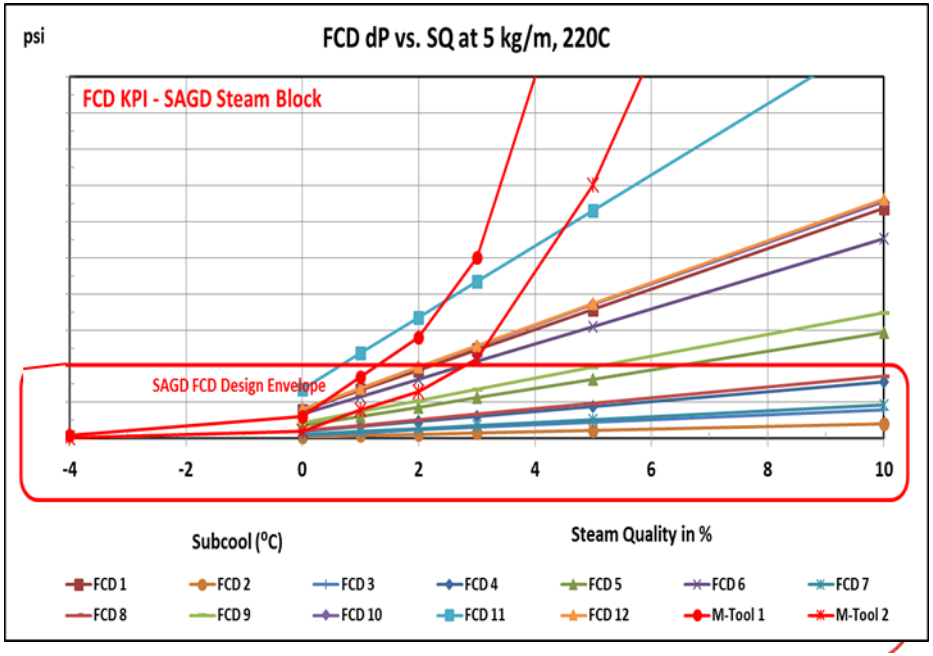
- Roughly 15% of production at Mackay River is now from wells with FCDs, mostly retrofits
- Improving design and implementation through field experience
- Used as a hot spot problem solver



Flow Control Device (FCD) Technology Improvements

- Lab testing in a flow loop provides SAGD operational limits specific to each device that is difficult to obtain from field data
  - Pressure drop vs flow rate for each FCD – specific to FCD geometry
  - Steam limiting capabilities – current devices have similar performance, however better performance is desired
  - Erosion testing – must manage max velocity in order not to fail a device, with each device exhibiting different erosion tolerance



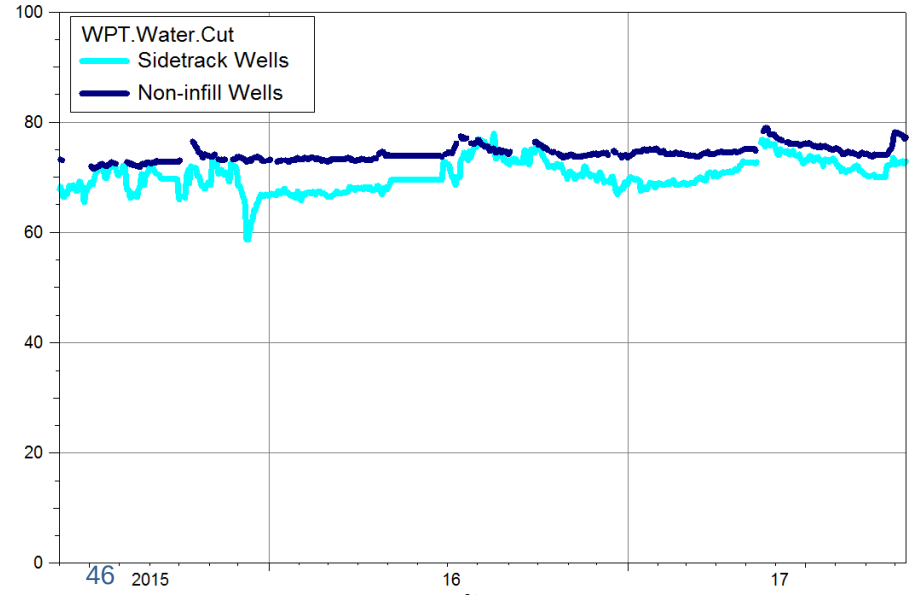


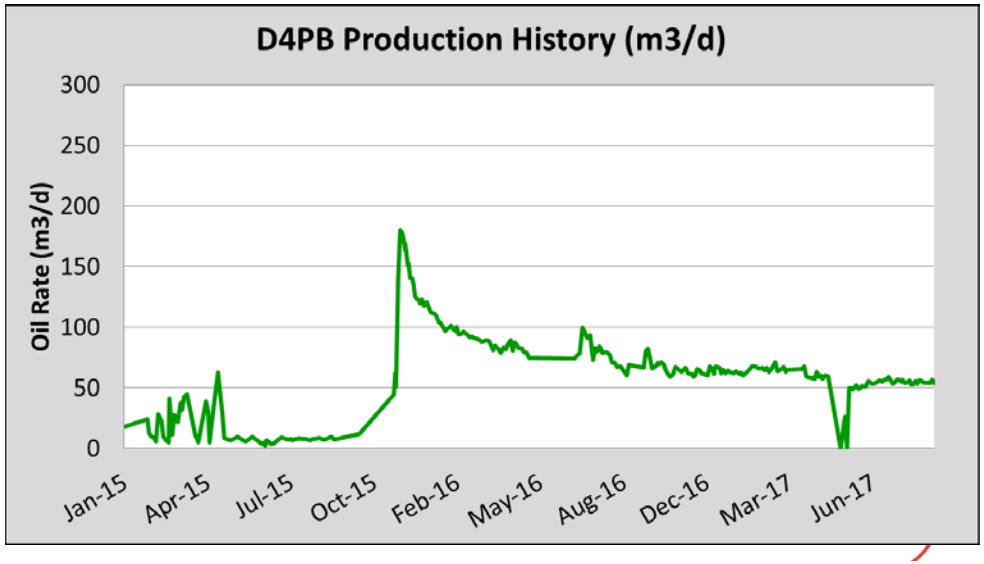
Key Learnings: Infill and Sidetracked wells

Infill and Sidetracked Wells

- Overall strong performance of infills vs. original/offset wells in terms of
  - Incremental oil rates
  - Lower water cuts
- Periodic surges in flow correlating to water cut seen at infill C2IPB
- New sand control (WWS, PPSS) performing up to expectations (lower ΔP relative to slotted liner designs)

MR Sidetrack WC vs. Non-Infill WC





Key Learnings: Pad 824 DSAGD Learnings

- The successful conversion of Pad 824 shows that it is possible to circulate a well with a DSAGD completion at MacKay River
  - The previous DSAGD completions in Firebag were bullheaded
  - The ESPs started up successfully after steaming past them
  - Subsequent circulation has been used since start-up to aid in ramp-up after unplanned outages
- ESP run life is on target with expectations from Firebag
- The VX meter has been valuable in understanding the real time impact of operating parameters (injection pressures and rates) on well performance

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Artificial Lift

3.1.1.4

Artificial Lift

- Almost all existing SAGD production wells designed for gas lift:
  - Low cost completion
  - Recover gas
  - No downhole moving parts
- Lift capacity sufficient for production rates and reservoir pressures
  - Maximum total fluid rates up to 700 m^3/d and average total fluid rates of 200 m^3/d over reporting period
  - Lower pressure patterns generally require higher gas lift rates
- Producing wells with downhole pumps
  - F1P, ESP since February 2009, current pump installed July 2017
    - Previous pump ran for ~2300 days
  - OO3P, ESP since October 2009, current pump installed March 2012
  - 824P1/P2, DSAGD completion installed in May 2015. Production since Feb 2016 (current pumps)

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Instrumentation

3.1.1.5

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Well Downhole Instrumentation

- Phase 1 (25 well pairs)
  - Temperature optic fibre in 1 producer is functional today (C2)
- Phase 2 (14 well pairs)
  - Temperature fibre optic installed in G6P
  - P/T gauge installed in G6I
- Phase 3 (7 well pairs)
  - No instrumentation
- Phase 4 (10 well pairs)
  - No instrumentation except temperature fibre optics in OO3 I & P
  - Temperature fibre optic installed in NN1P
- Phase 5A (6 well pairs)
  - Pressure - bubble tube to the toe in every producer
  - Two producers equipped with 6 point thermocouple bundle to the toe (QQ5, NN5)

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Well Downhole Instrumentation

- Phase 5B-1 (6 well pairs)
  - Pressure - bubble tube to the toe in every producer except OO5
  - All producers equipped with 6 point thermocouple bundle to the toe except OO5 and OO9 which have temperature fibre optic
- Phase 5B-2 (10 well pairs)
  - Pressure – bubble tube to the toe in every producer
  - All producers equipped with 6 point thermocouple bundle to the toe, except QQ9
- Phase 5D&F (18 well pairs)
  - Pressure – bubble tube to the toe in every producer except OO well pairs which have pressure gauges
  - All producers equipped with fibre optic to the toe, except OO10
- Pad 824 (2 well pairs)
  - All producers equipped with ERD (P/T) and 2 point thermocouple on pump
- Pad 750 (12 well pairs)
  - Pressure – ERD at the toe in every producer
  - All producers equipped with fibre optic to the toe

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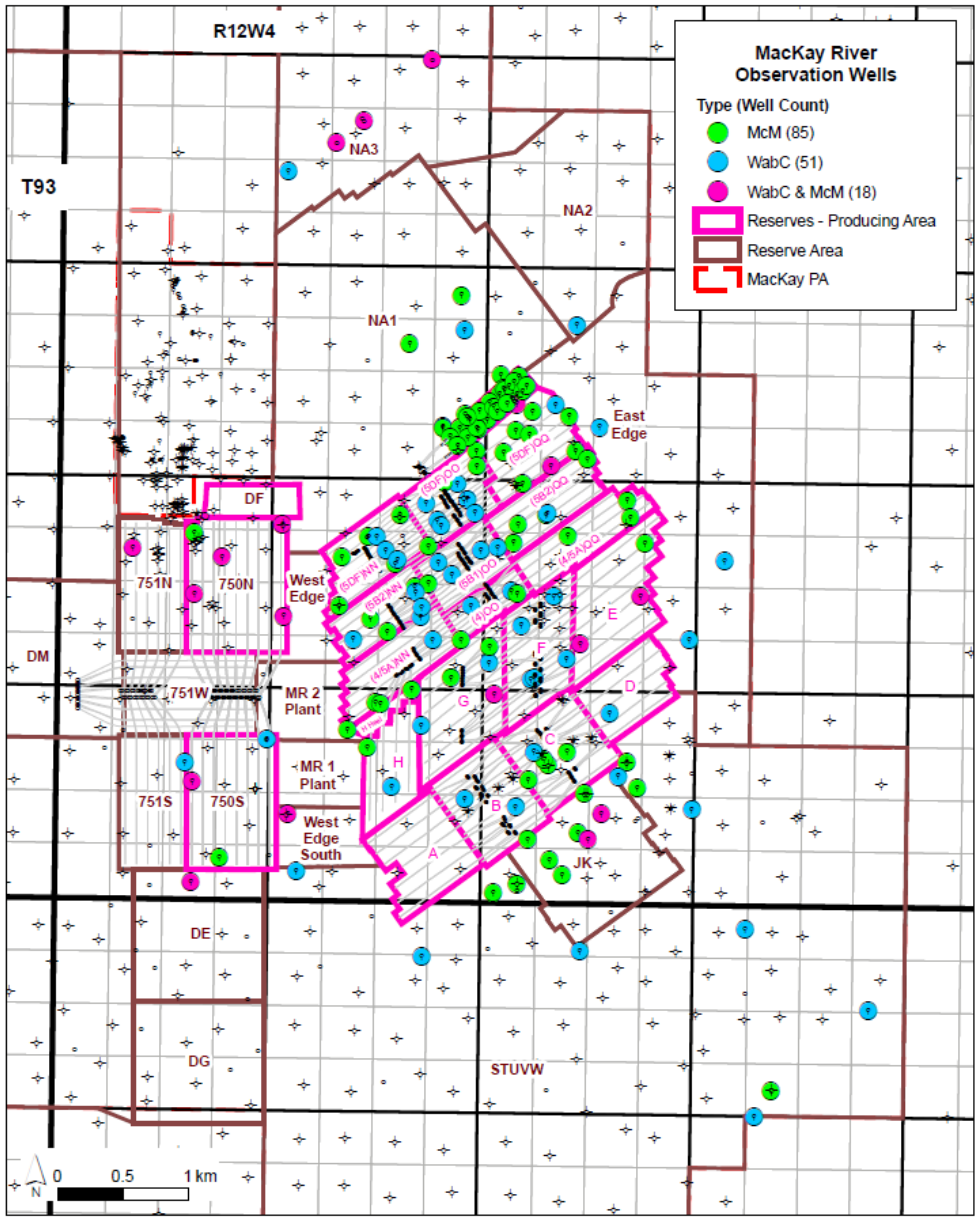
Observation Wells



Observation wells	
85	McM
51	Wab C
18	Wab C & McM
154	**Total**

Observation Well Overview

- Total of 154 licensed observation wells at MacKay River
- Observation wells at MacKay River serve three main purposes
  1. Reservoir optimization (steam chamber monitoring)
     - 42 wells with fibre optic cable from surface to TD
       - 7 wells with fibre optic cable and McM pressure sensors
     - 51 wells with thermocouple bundles
       - 44 wells with thermocouples and McM pressure sensors
  2. Wabiskaw C pressure monitoring
     - 66 wells with a single pressure / temperature sensor dedicated to WabC.
       - 15 wells with WabC pressure / temperature combined with McM temperature
  3. Subsurface Monitoring (outside of producing area)
     - 4 wells with thermocouple bundles and pressure sensors
     - 15 wells with a single pressure / temperature sensor (5 McM, 10 WabC)
     - 1 well with pressure / temperature in both McM and WabC
- Current observation well design incorporates thermocouple measurement as this provides sufficient resolution for steam chamber monitoring and is preferred for remote well locations

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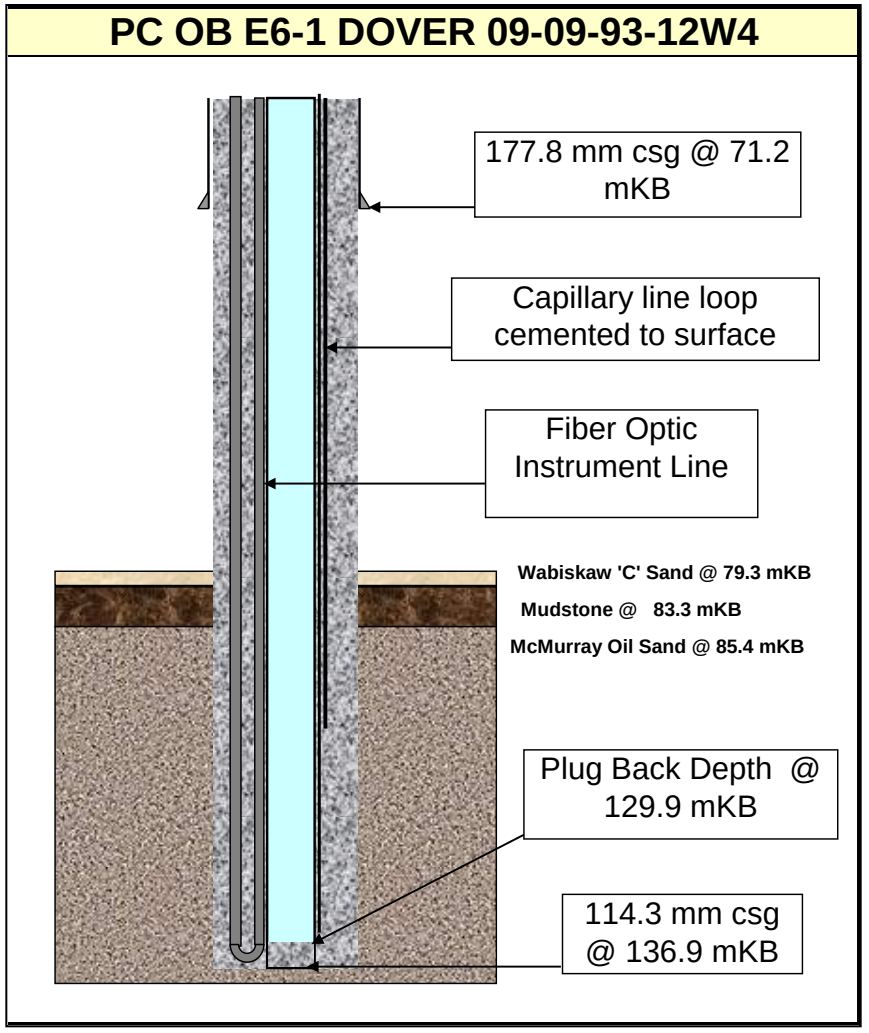
Typical Observation Well Design

McMurray Observation Well (Type 1):

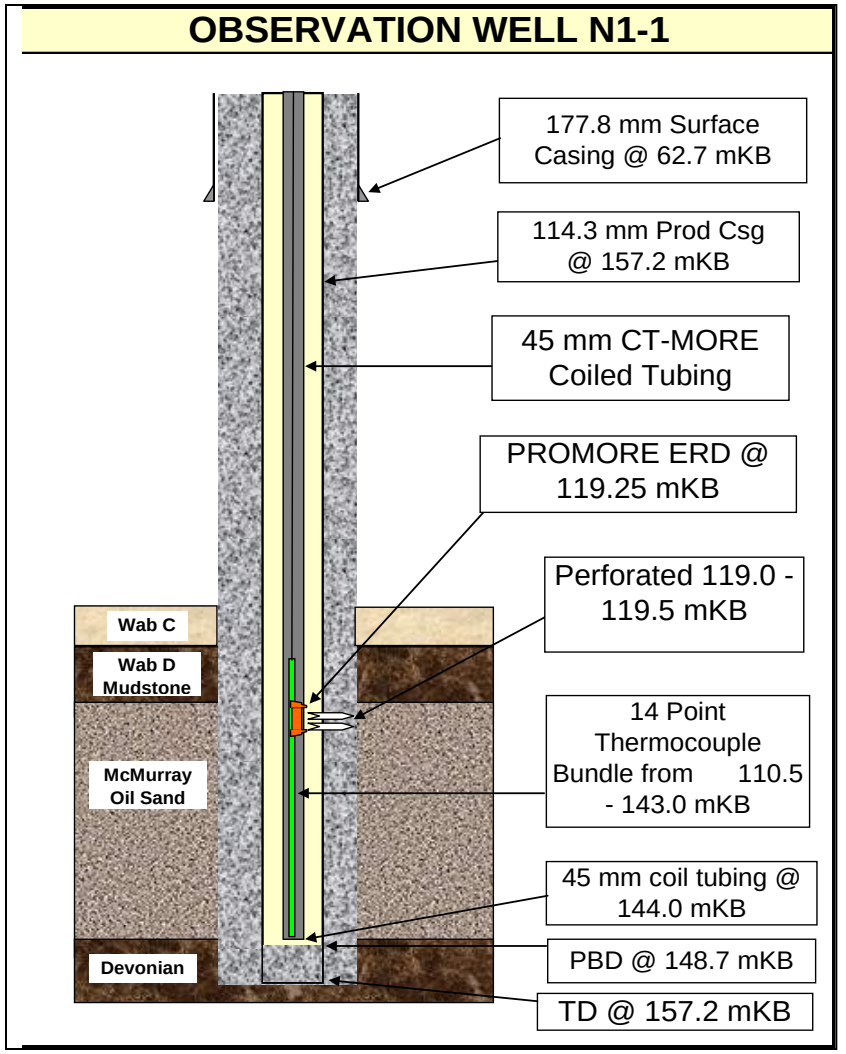
- Capillary line loop cemented outside casing
- Fibre optic cable pumped into capillary line loop to provide temperature profile along entire vertical well depth
- Allows for close monitoring of steam chamber development
- There are no reliability concerns with the Type 1 observation well temperature data



Typical Observation Well Design

McMurray Observation Well (Type 2):

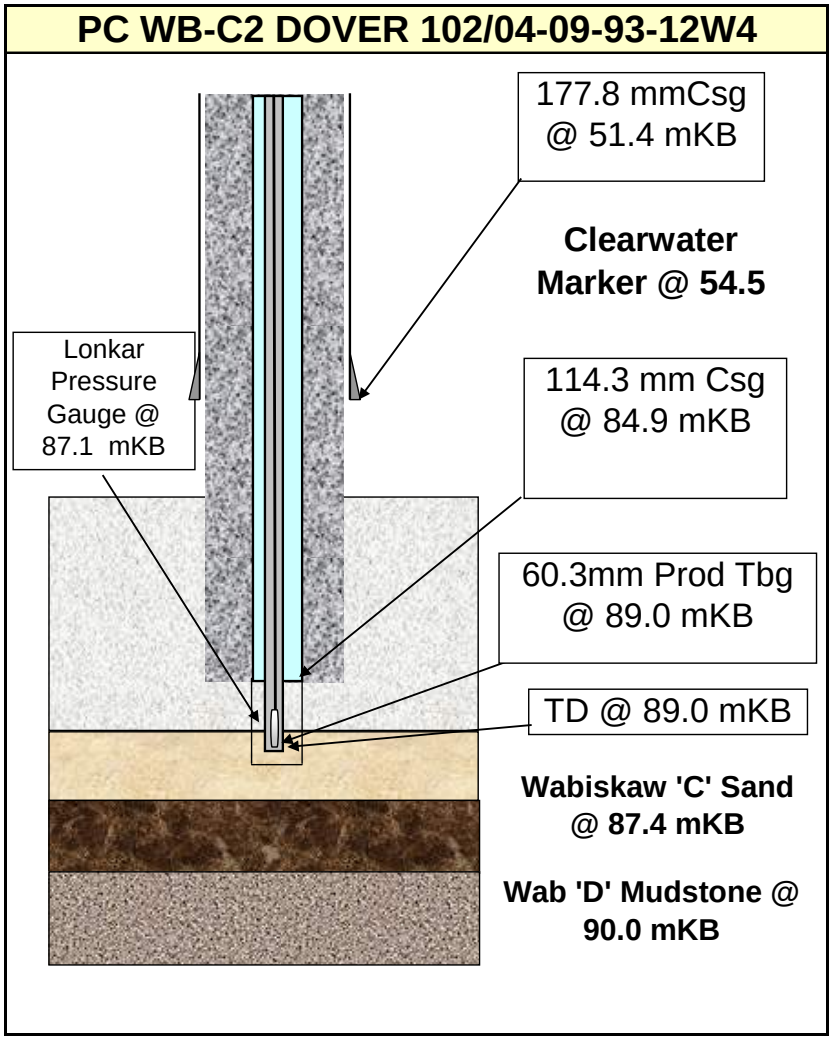
- Coiled tubing instrument string containing 14 thermocouples and 1 P/T gauge run inside 114 mm intermediate casing
- Perforated near the top of the McMurray oil sands zone
- Pressure / temp gauge positioned at MPP
- 14 point thermocouple bundle collects temperature data across the McMurray
- 24 point thermocouple bundle go forward design



Typical Observation Well Design

Wabiskaw C Observation Well:

- Open hole into Wabiskaw C sand
- Wellbore does not penetrate Wabiskaw D mudstone or McMurray sand
- Pressure / temp gauge landed inside tubing



Scheme Performance

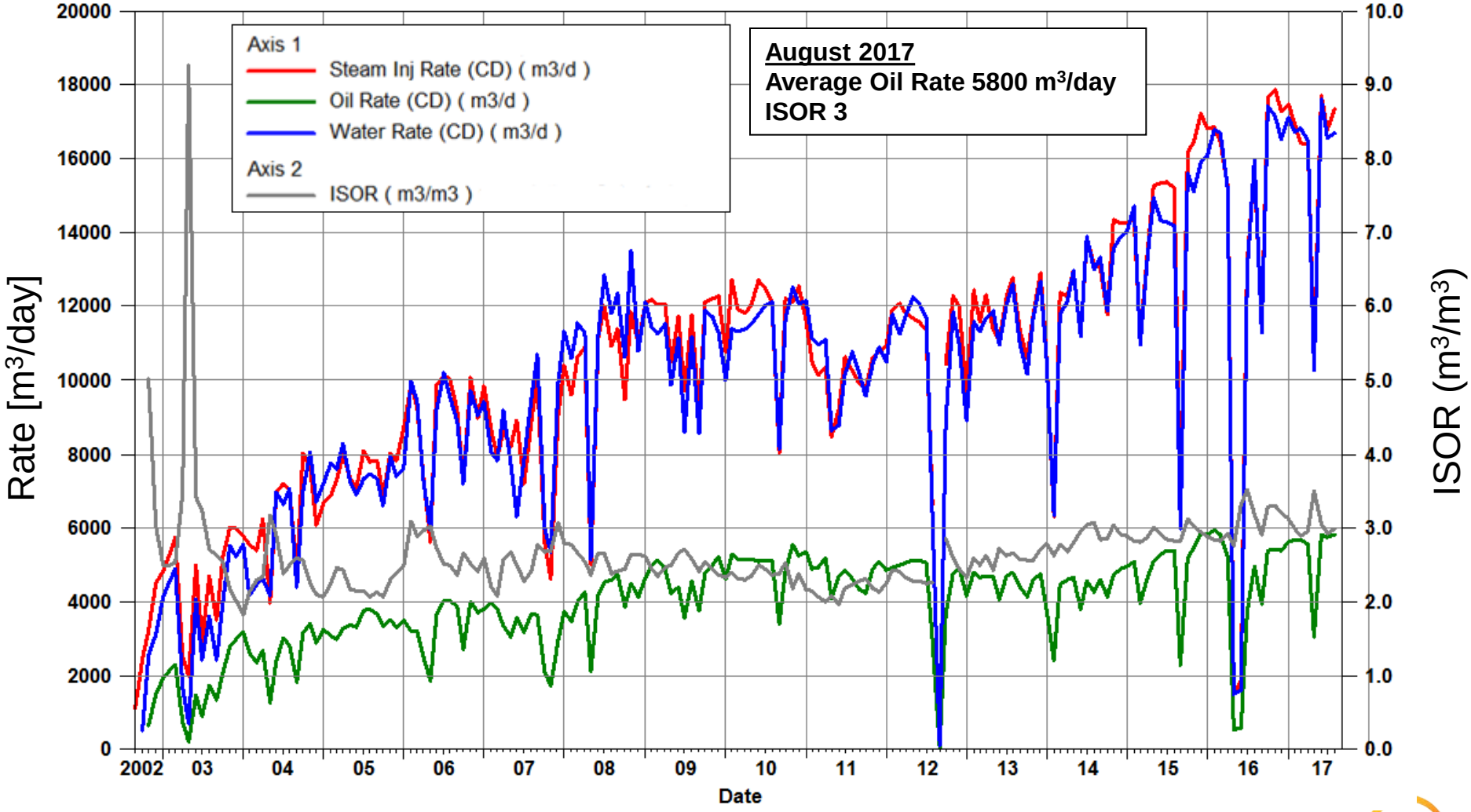
3.1.1.7

Summary of Operating Wells

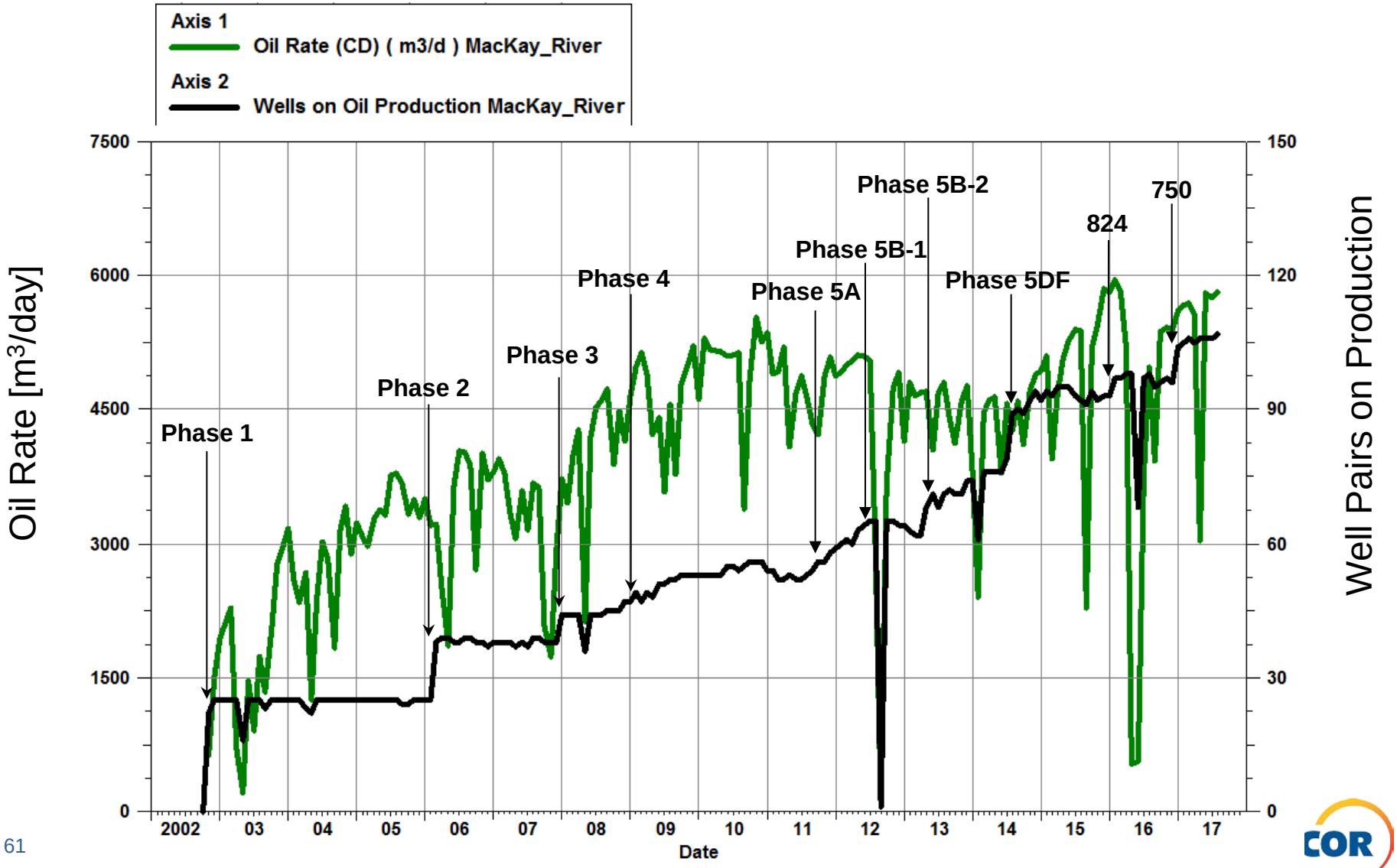
Pad	Pattern	Phase	# Well pairs	First steam to Pad
20	A	1	7	Sept 2002
	C		6	
21	B		7	
	D		5	
22	E	2	7	Jan 2006
	G		7	
23	F	3	7	Sept 2007
24	OO	4	3	Oct 2008 - Apr 2009
		5B-1	6	Feb 2012
		5DF	6	May 2014
	H	4	4	Feb 2009 - Jun 2010
25	QQ	4	2	Nov 2008
		5A	2	Jul 2011
		5B-2	5	Jan - May 2013
		5DF	6	June 2014
	NN	4	1	Dec 2008
		5A	4	Jun - Jul 2011
		5B-2	5	Jan - Feb 2013
		5DF	6	June 2014

Pad	# Well pairs	First steam to Pad
824	2	Oct 2015
750N	8	Sept 2016
750S	4	Sept 2016 / July 2017

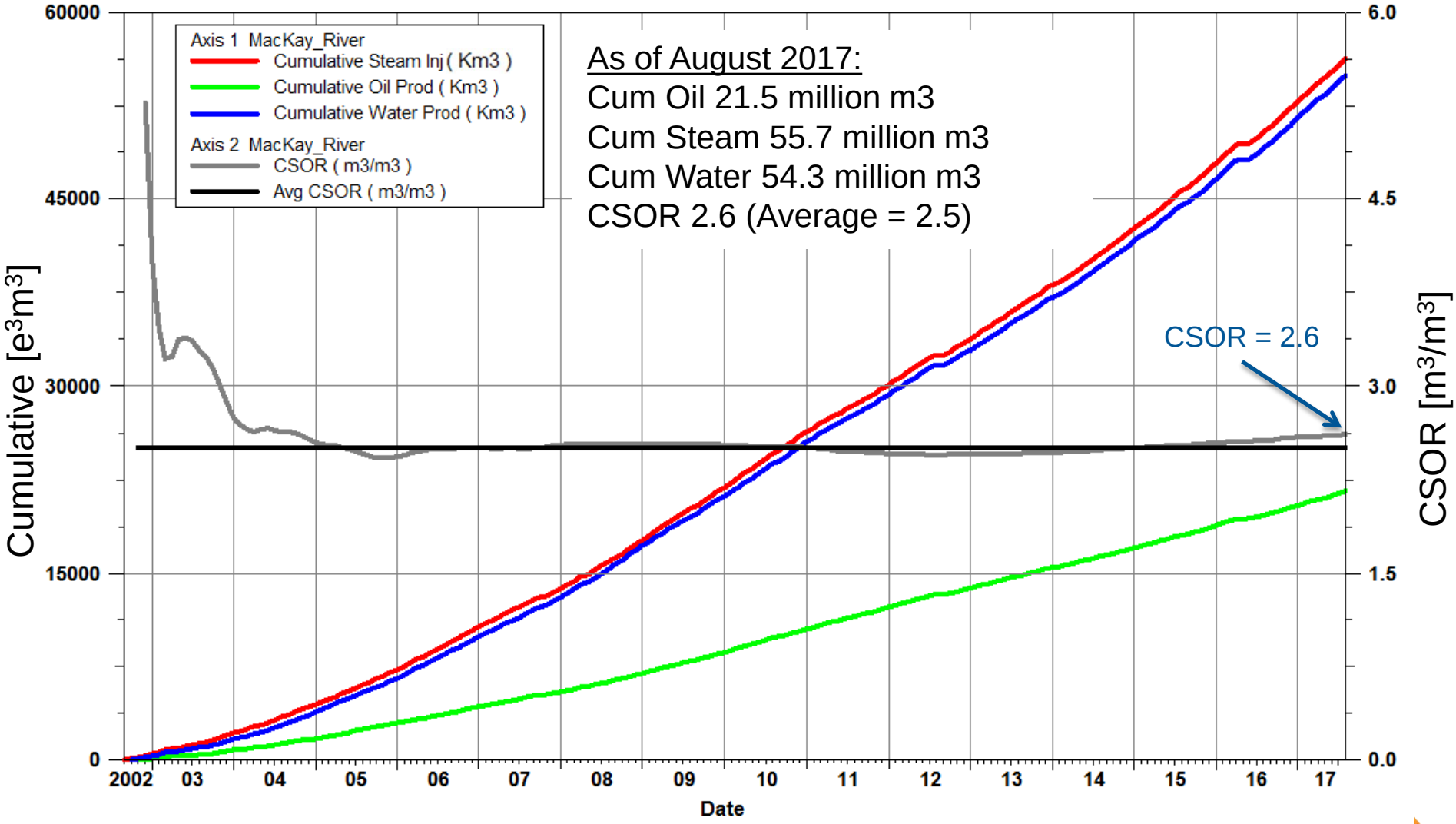
Fluid Rates


Axis 1
Steam Inj Rate (CD) (m3/d)
Oil Rate (CD) (m3/d)
Water Rate (CD) (m3/d)
Axis 2
ISOR (m3/m3)
August 2017
Average Oil Rate 5800 m³/day
ISOR 3
Rate [m³/day]
ISOR (m³/m³)
Date
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2002
03
04
05
06
07
08
09
10
11
12
13
14
15
16
17

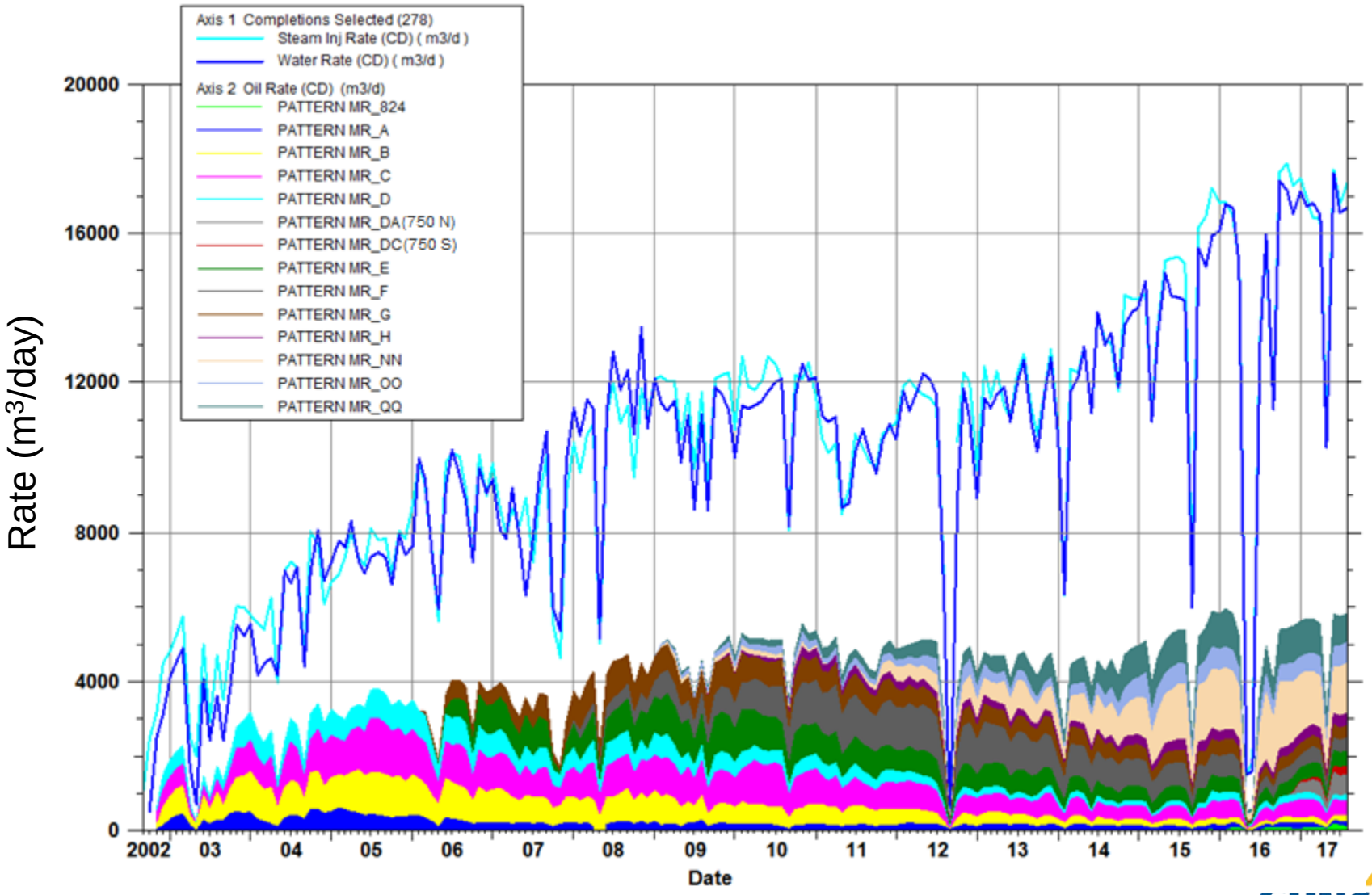
Producing Well Count



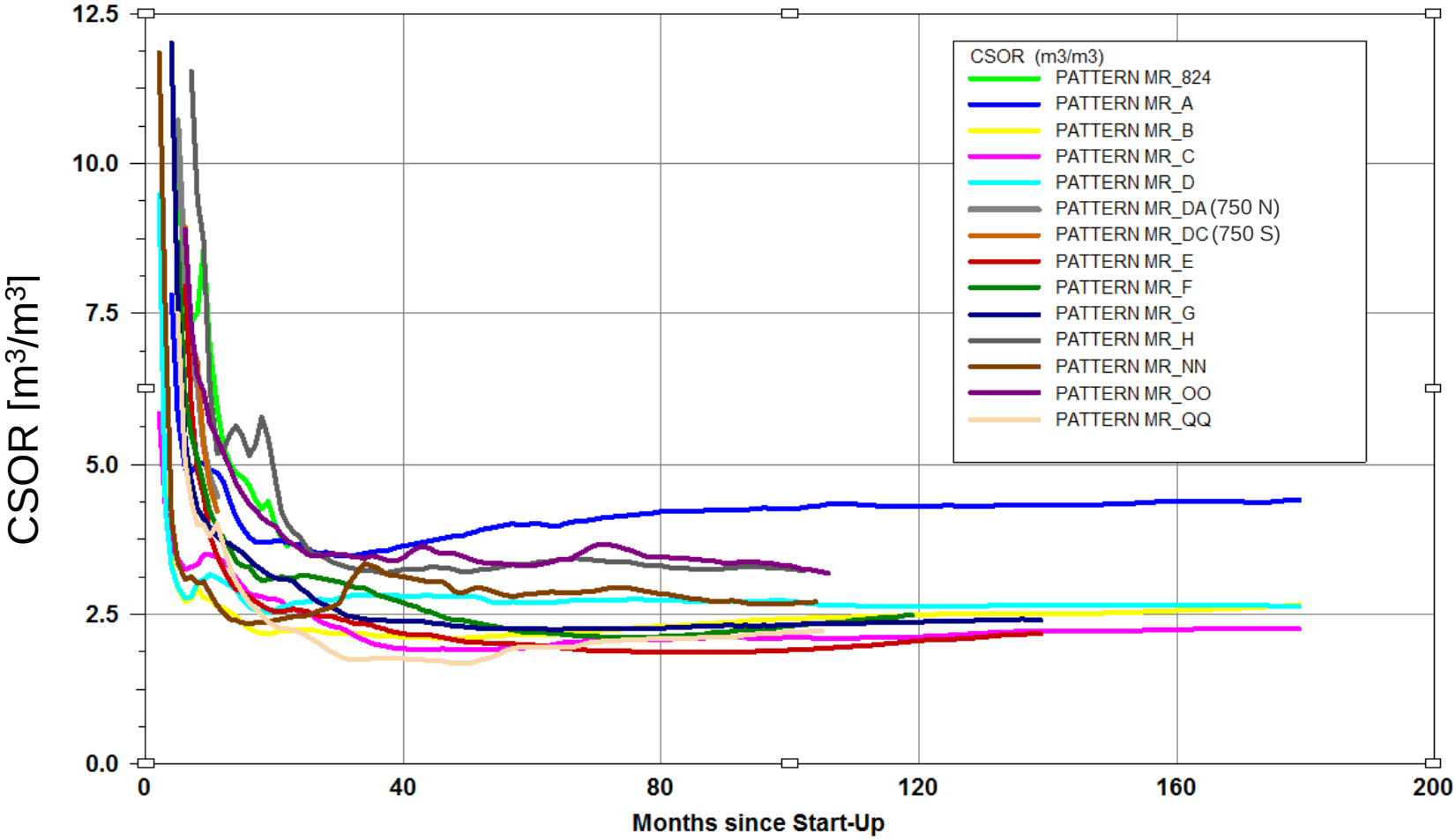
Cumulative Fluid Volumes



Average Oil Rate per Pattern



CSOR by Pattern (August 2017)



- E wells have the lowest CSOR
- NN wells have a mid range CSOR
- A Pattern has the highest CSOR

Performance Summary by Pattern

Pattern	OBIP [e³ m³]	Cum. Oil (Aug. 2017) [e³ m³]	Recovery up to August 2017 [%]	CSOR (Aug. 2017) [m³/m³]	ISOR (Aug. 2017) [m³/m³]	Ultimate Recovery [%]
Pattern A	**2,446**	**1,075**	44%	4.4	4.37	49%
Pattern B	**3,585**	**2,731**	76%	2.7	6.84	78%
Pattern C	**4,503**	**3,631**	81%	2.3	2.41	87%
Pattern D	**2,993**	**1,981**	66%	2.6	2.69	73%
Pattern E	**4,328**	**2,422**	56%	2.2	3.85	71%
Pattern F	**3,908**	**2,465**	63%	2.5	4.87	78%
Pattern G	**4,342**	**1,998**	46%	2.4	2.32	60%
Pattern H	**1,928**	**528**	27%	3.2	2.7	55%
Pattern NN	**7,453**	**2,010**	27%	2.7	2.89	57%
Pattern OO	**5,658**	**956**	17%	3.2	2.01	37%
Pattern QQ	**7,487**	**1,493**	20%	2.2	2.37	46%
Pad 824	**936**	**38**	4%	3.6	2.56	51%
Pad 750 (WP1-8)	**4,214**	**97**	2%	4.5	2.92	51%
Pad 750 (WP14-17)	**1,540**	**30**	2%	4.2	2.94	54%
Total	**55,321**	**21,455**	**39%**	**2.6**	**3.0**	60%

Pattern Examples Based on Recovery

	ISOR [m^3/m^3]	CSOR [m^3/m^3]	Cum Oil [10^3m^3]	Peak Oil Rate [m^3/d/well pair]	Current Oil Rate [m^3/d/well pair]	Comments
OO Pattern **Low Recovery**	2.2	3.2	921	43-151	6 - 68	• Challenging geology • 15 well pairs in pattern • 17% recovery to date (ultimate RF: 37%) • Producing for 8 years
G Pattern **Medium Recovery**	2.1	2.4	1,977	115-208	17 - 94	• Medium quality geology • 7 wells pairs in pattern • 44% recovery to date (ultimate RF: 60%) • Producing for 11 years
C Pattern **High Recovery**	2.5	2.3	3,606	182 - 299	10 - 154	• High quality geology • 6 well pairs in pattern • 81% recovery to date (ultimate RF: 87%) • Producing for nearly 15 years

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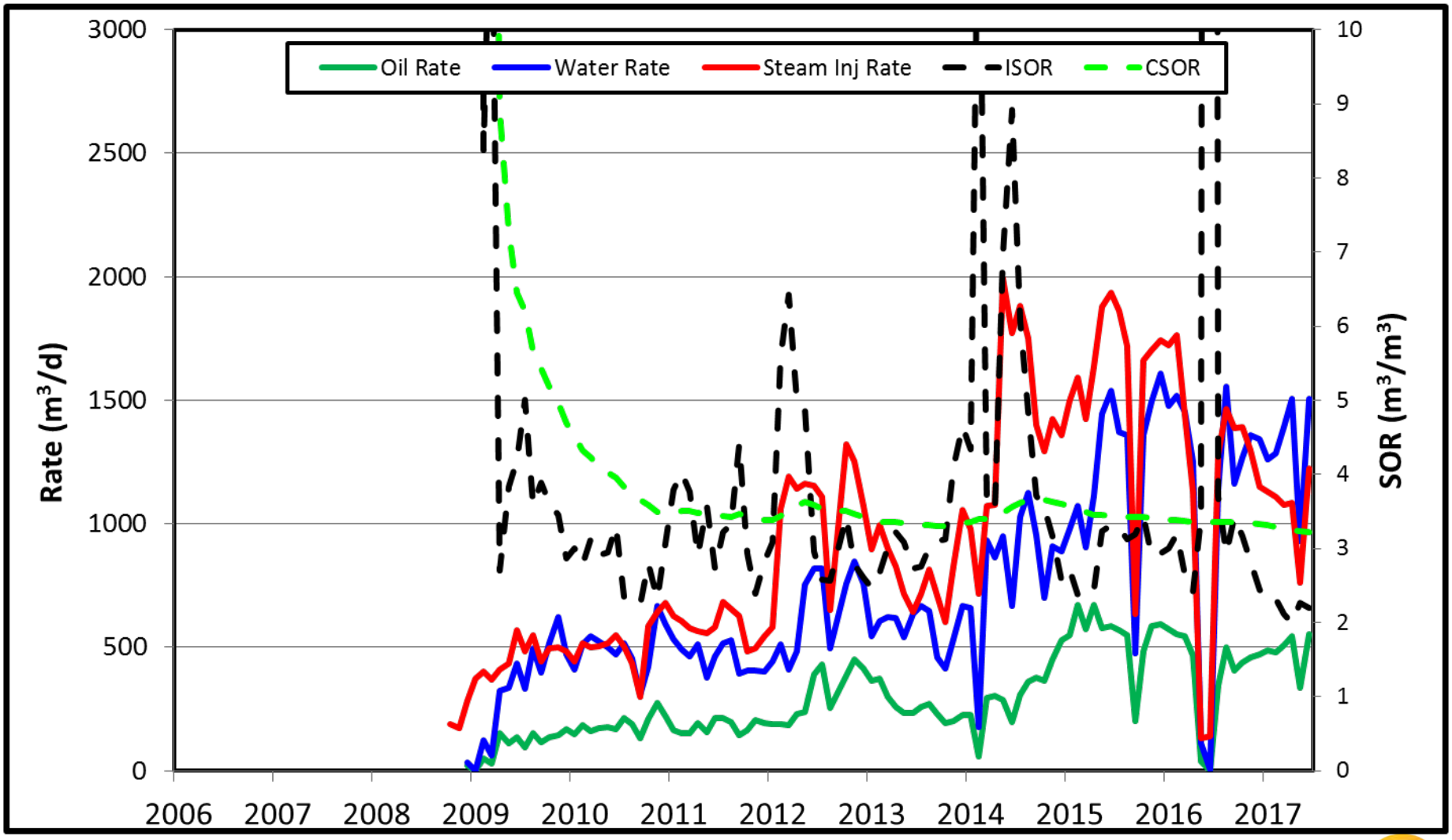
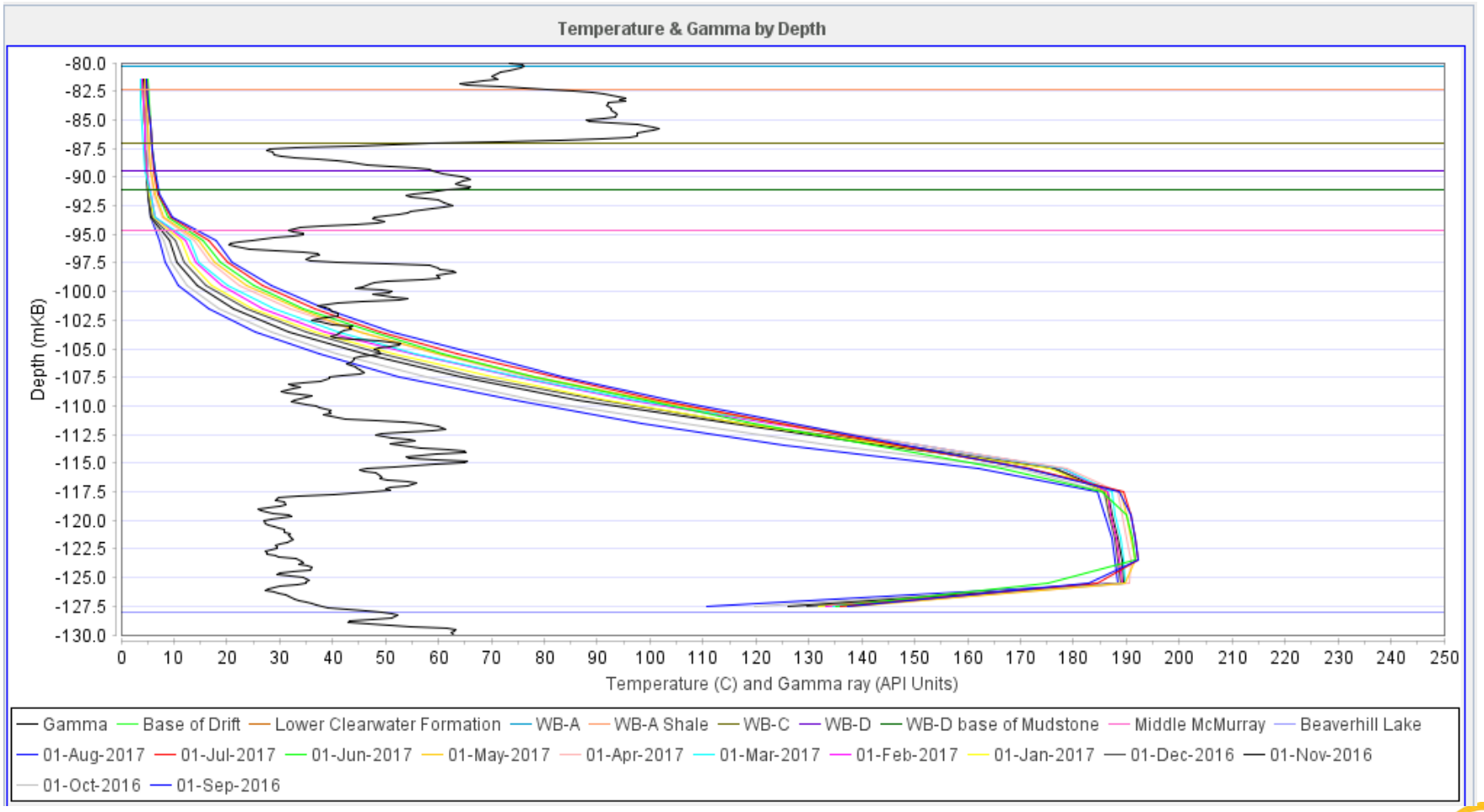
OO Pattern – Low Recovery (15 well pairs)

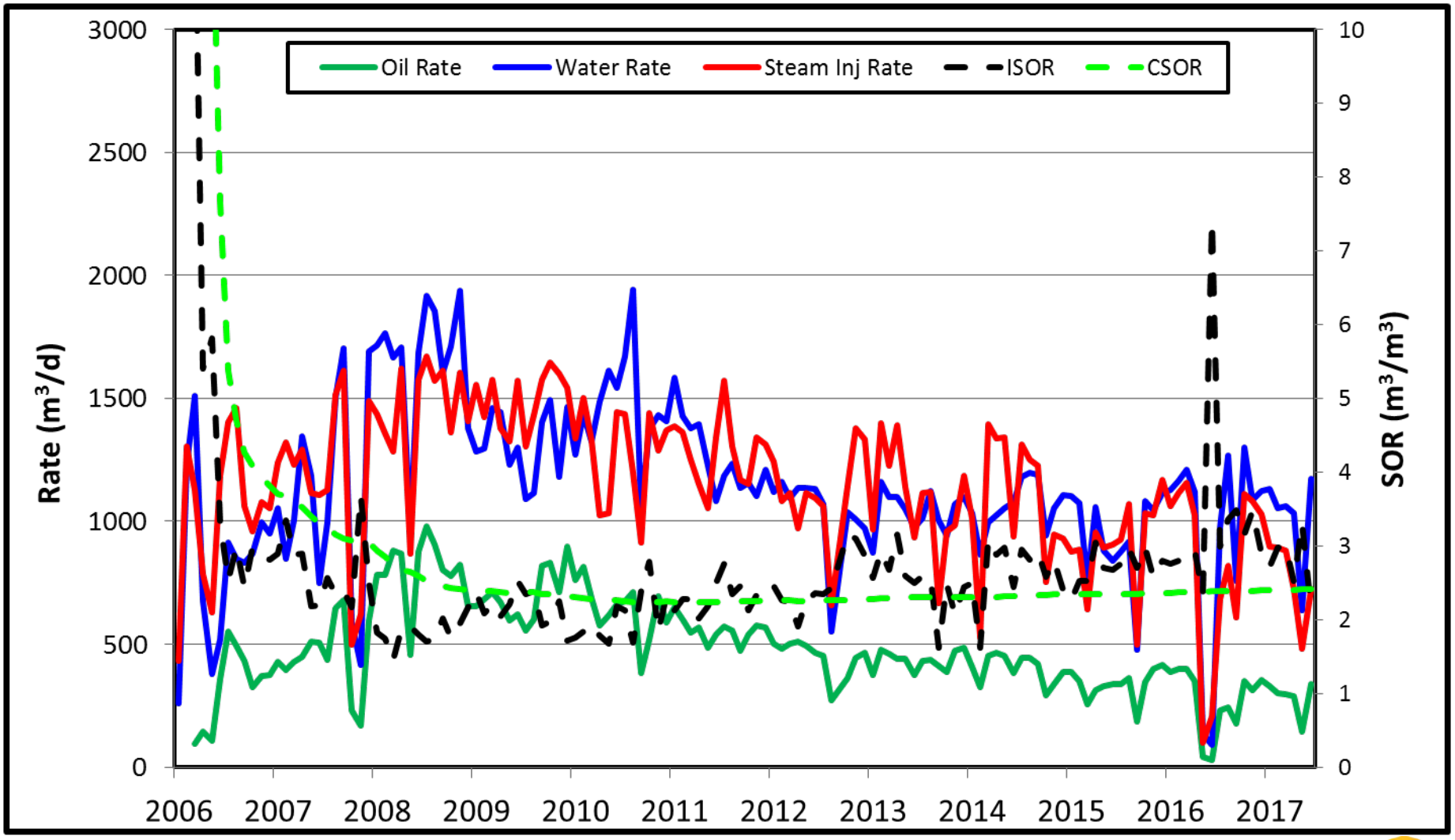


OO Pattern – Observation Well Temperature

OBOO1 – Toe of OO-14 Well Pair (Low Recovery)

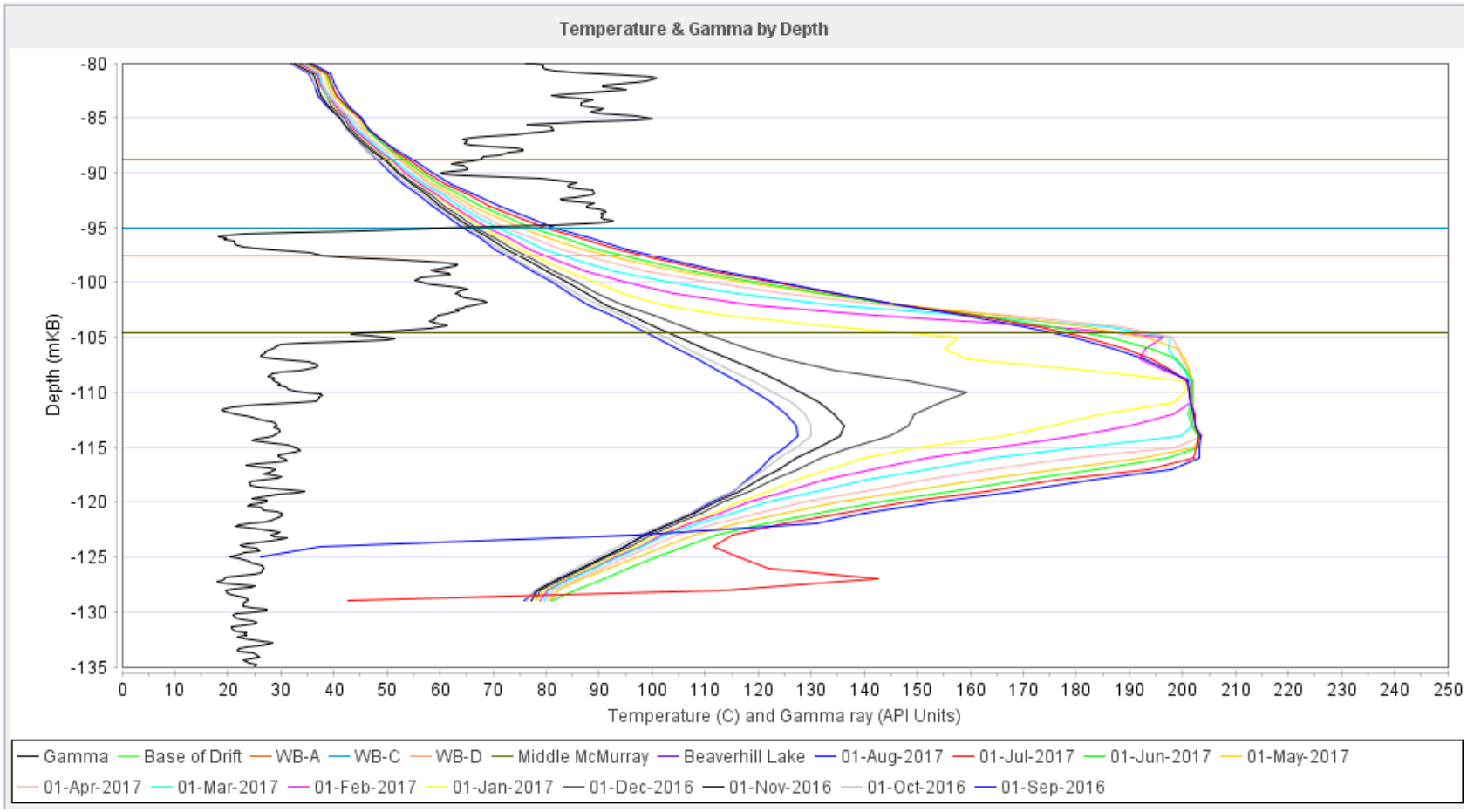


G Pattern – Medium Recovery (7 well pairs)

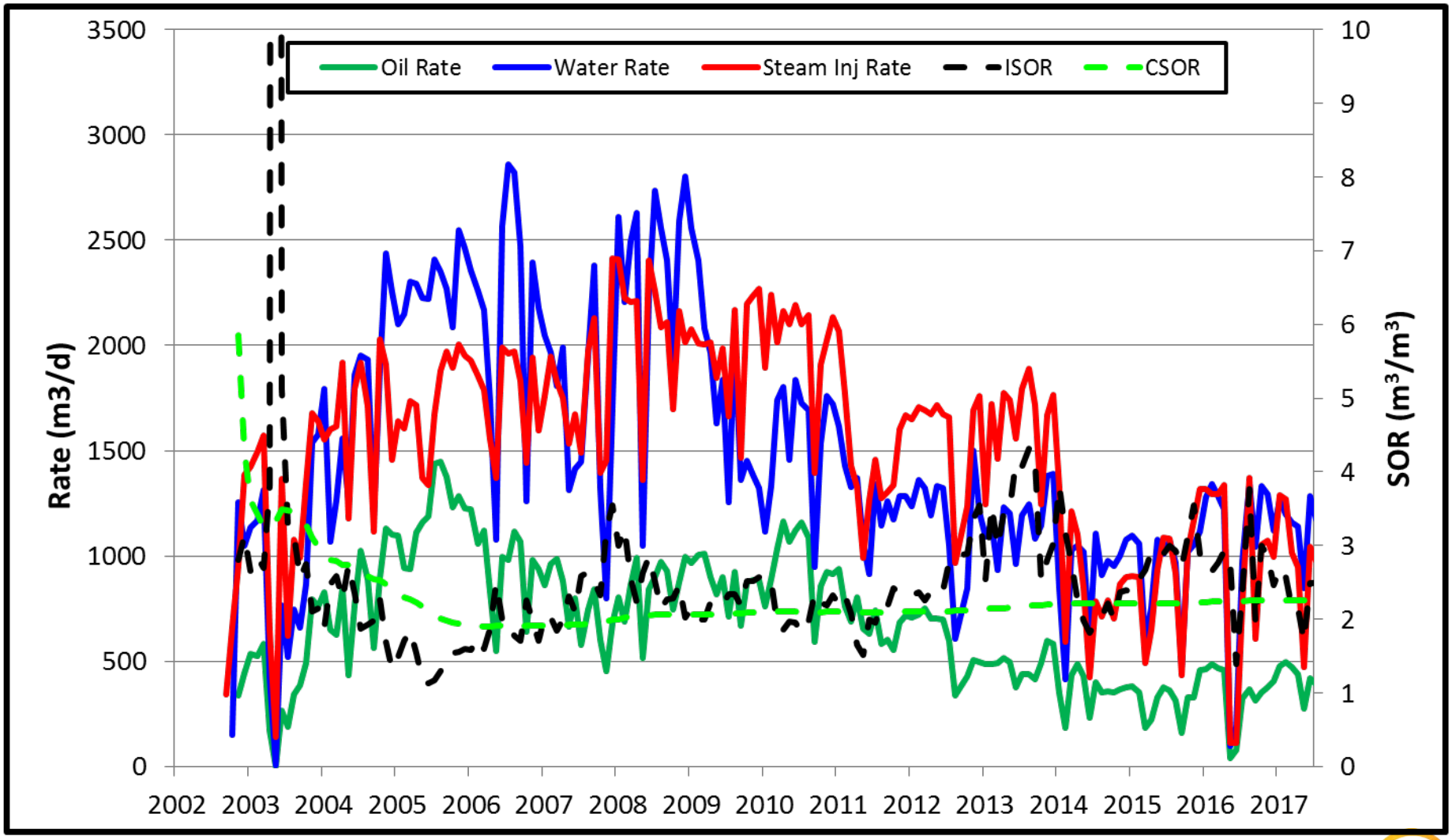


G Pattern – Observation Well Temperature

OBG6-1 – Heel of G-6 Well Pair (Medium Recovery)



C Pattern – High Recovery (6 well pairs)

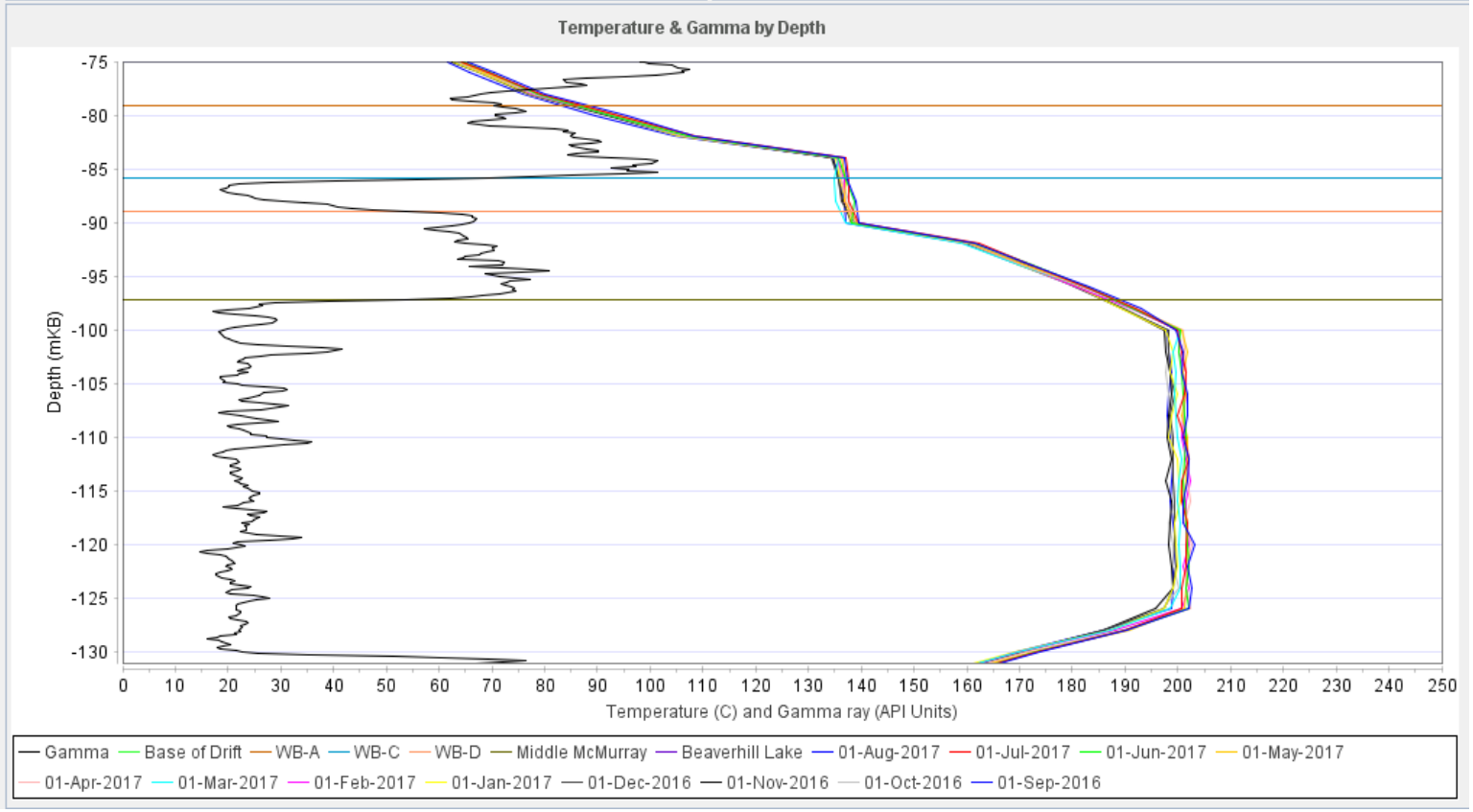


C Pattern – Observation Well Temperature

OB04 – Heel of C4 Well Pair (High Recovery)

Pattern	C	**Status**	Observation (T)
Well	OB04	**Instrumentation**	Fibre
UWI	103/12-04-093-12W4/0	**Critical**	No
License	0245042	**Vendor**	Promore
		Connected to PI	Yes

Trend Start: 01-Sep-2016 12:00 AM
Trend End: 31-Aug-2017 12:00 AM
Show Gamma: Yes
Temperature Scale: Min 0 Max 250
Chart Frequency: Monthly
Show Formations: Yes
Depth Scale: Min 75 Max 131



Pad Abandonment Outlook

- The strategy for future well and pad (including surface equipment) abandonments is under development

- Do not anticipate abandonment of operating Pads during the next 5 year
  - Pads 20 and 21 (A/C and B/D patterns) are the most mature and are expected to be under pressure maintenance within 5 years
  - Individual wells may be suspended or abandoned as required

- Pad 40 expected to be abandoned within the next 5 years
  - Three of four wells on pad abandoned (NP, NI and SP)
  - Considerations for surface equipment are under review

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Steam Injection Conditions

Pattern	Wells	Maximum Operating Pressure	
		Surface	Bottomhole
		(kPag)	(kPag)
A	A1-7	2120	1690
B	B1-7	2020	1600
C	C1-6	1745	1390
D	D1-5	1555	1240
E (S)	E1-4	1640	1310
E (N)	E5-7	1600	1270
F	F1-7	1680	1340
G	G1-7	1935	1530
H	H1-4	2225	1780
NN	NN1-5	2100	1680
NN	NN6-10	2185	1750
NN	NN11-16	2125	1700
OO	OO1-3	1870	1490
OO	OO4-9	1910	1520
OO	OO10-15	1880	1500
QQ	QQ2-5	1535	1210
QQ	QQ6-10	1500	1200
QQ	QQ11-16	1500	1200
824	824WP1-2	2320	2060
750 N	WP1-9	2380	2110
750 S	WP14-17	2410	2140

- Approved MOPs based on the methodology detailed in Application 1724610
- Approved Bottomhole MOP at 80% of the fracture closure pressure
- MOPs are set by shallowest point in each pattern to allow for intra-pattern communication
- Steam injection pressure limits are enforced at wellhead on tubing and annulus via pressure transmitters; Phase 1 wells are monitored via manual pressure measurement at the wellhead every second day
- Steam injection pressure is reduced as required to maintain estimated bottomhole pressure below MOP for neighboring patterns in communication

Stewardship to Maximum Bottom-hole Operating Pressure

Pattern	Wells	Maximum Operating Pressure	Average pressure Sep 16- Aug 17
		Bottomhole (kPag)	Bottomhole (kPag)
A	A1-7	1690	1243
B	B1-7	1600	1195
C	C1-6	1390	1273
D	D1-5	1240	1183
E (S)	E1-4	1310	1214
E (N)	E5-7	1270	1185
F	F1-7	1340	1194
G	G1-7	1530	1281
H	H1-4	1780	1567
NN	NN1-5	1680	1480
NN	NN6-10	1750	1514
NN	NN11-16	1700	1464
OO	OO1-3	1490	1214
OO	OO4-9	1520	1363
OO	OO10-15	1500	1241
QQ	QQ2-5	1210	1155
QQ	QQ6-10	1200	1208*
QQ	QQ11-16	1200	1124
824	824WP1-2	2060	1831
750 N	WP1-9	2110	1982
750 S	WP14-17	2140	1350**

* Suncor had temporary approval to be above the 80% limit for QQ6-10

**Measured from ERD gauges as no LRT data available

- All of the Mackay wells in SAGD are currently operating at pressures below the approved maximum bottomhole operating pressure
- Alarm systems are in place to ensure the approved maximum bottomhole operating pressures are not exceeded
- Steam injection pressure is reduced as required to maintain estimated bottomhole pressure below maximum bottomhole operating pressure

Impact

- Lower production rates in low MOP areas
- Slower ramp-up post planned outage's
- Impacts new well conversions in low MOP areas
- Small impact to mature wells performance

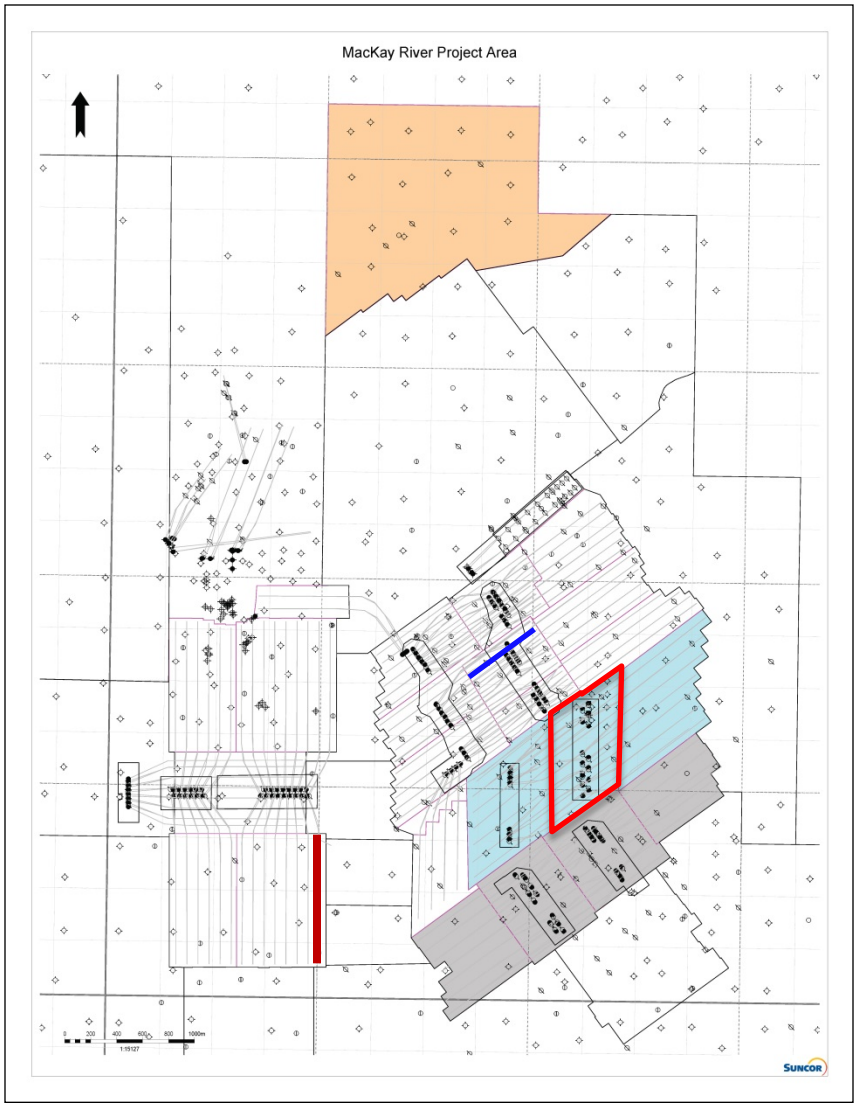
Stewardship to Maximum Bottom-hole Operating Pressure

- For SAGD wells with no downhole instrumentation **Step-down Tests (SDT)** and **Low Rate Tests (LRT)** are performed and used to calculate estimated chamber pressure to ensure that the Maximum Bottomhole Injection Pressure (MBHIP) is not exceeded

- **SDTs** are conducted by lowering the steam injection rate in steps and allowing pressures to stabilize between steps

- **LRTs** are conducted on wells that do not have reliable SDT correlations by reducing the steam injection rates low enough to estimate the chamber pressure

New Technology Projects – Near Term



NCG Co-Injection Expansion

- A/B/C/D first injection in October 2016
- E/F/G first injection planned for 2018

Surfactant Co-Injection Pilot Expansion (F)

- First Injection commenced Q4 2016

CO_2 Co-Injection Pilot Well (OO8)

- Intermittent injection from April 2016 to December 2016
- CO_2 concentrations to gradually increase to approved levels
- Suncor seeking to extend life of Pilot

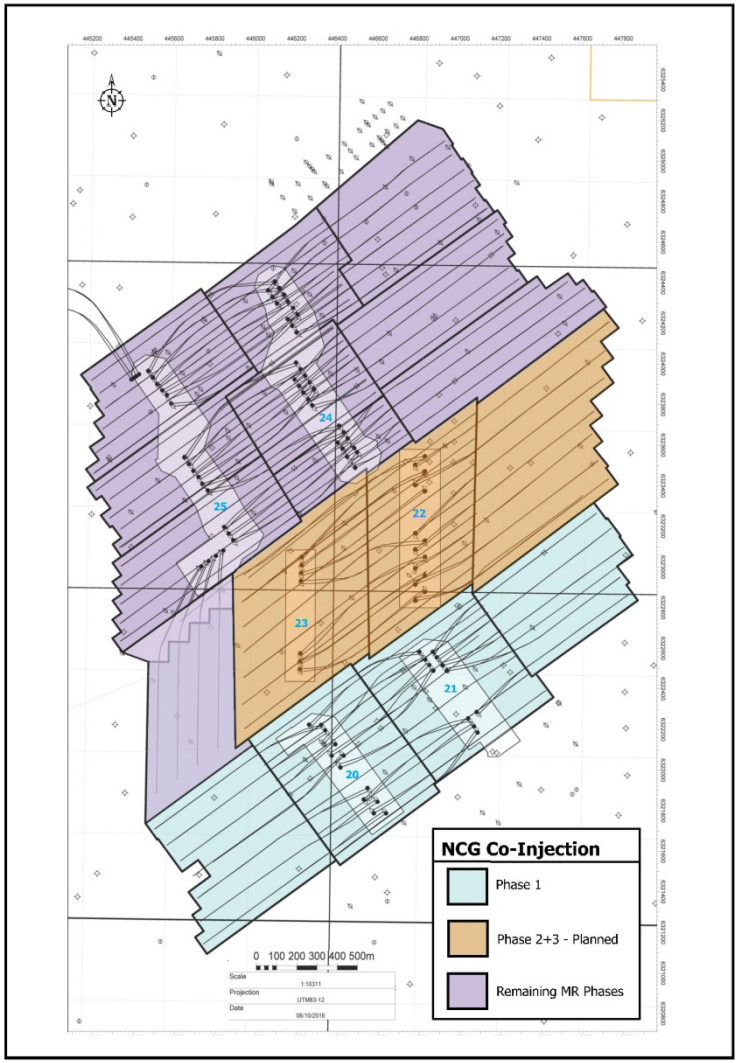
Closed Loop Hot Oil Circulation Pilot (750S10)

- First injection planned in 2018

In Situ Demonstration Facility (ISDF)

- Demonstration facility currently at scoping stage
- Integrated Application expected for Q4 2017

SAGD NCG Co-Injection Strategy



Pilot

- NCG co-injection into B pattern commenced October 2011
- Injection was based on steam availability

Stage 1

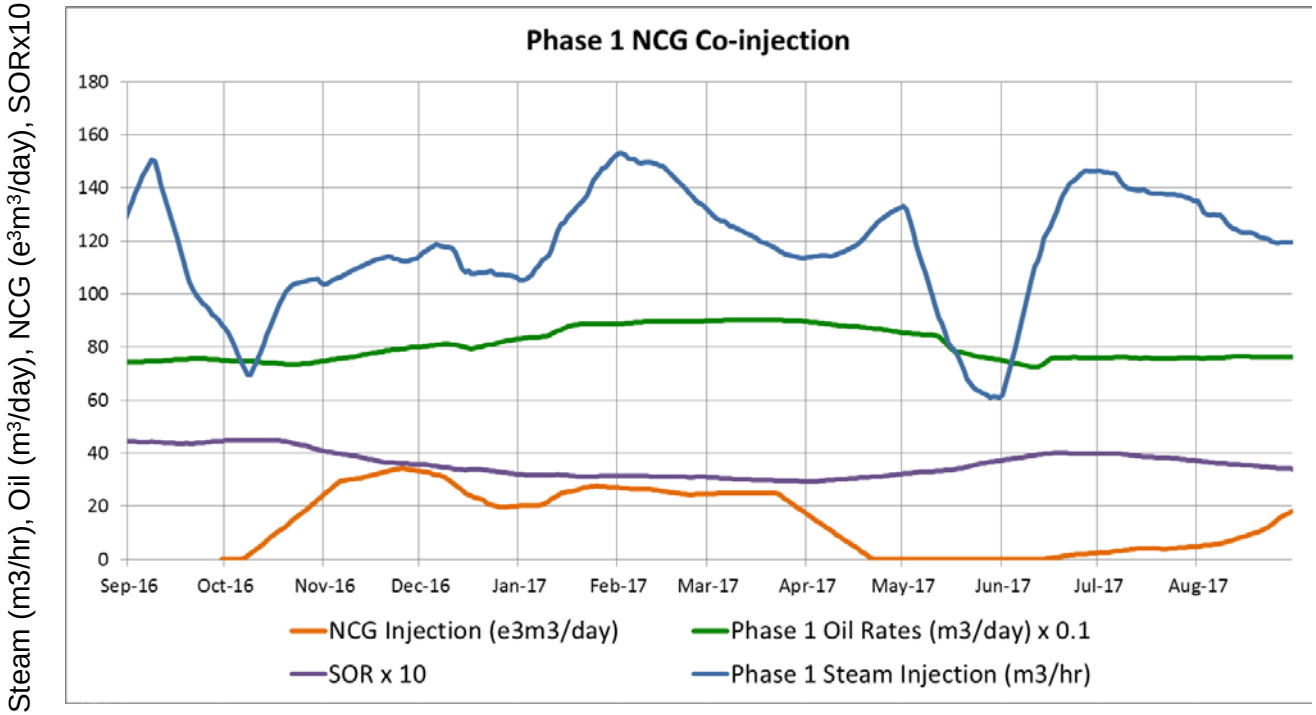
- NCG co-injection to A, B, C, D patterns began October 2016
- Reducing and reallocating steam to other pads to optimize field

Stage 2

- NCG co-injection into E, F, G, patterns work in progress
- Planning First NCG Co-Injection 2018

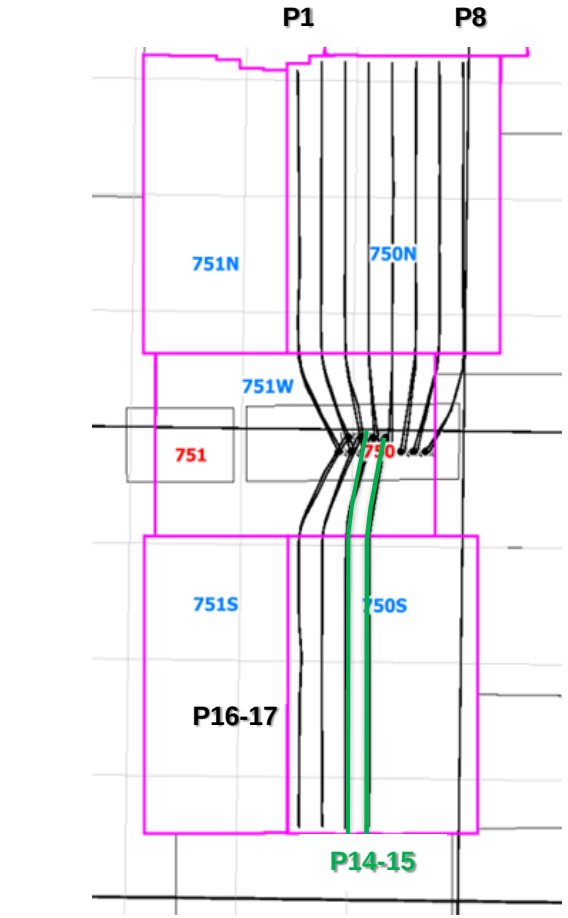
Key Learnings – Phase 1 NCG Co-Injection

- 9% Steam cut (August 2017) at a replacement ratio of 10 sm^3/m^3 CWE
- Plan to continue increasing steam cut and NCG injection pending steam demand of developing wells on Pad 750
- No significant impact to oil rates has been observed and partial pressure cooling effects have not been observed on OB wells within the patterns



Pad 750 Well Pair Start-Up Update

- 10 wells pairs (WPs 1-8, 16 & 17) commenced circulation steam injection in Sept / Oct 2016
- Converted to SAGD in Q1 2017
- 2 wells pairs (WPs 14 & 15) commenced circulation steam injection in July 2017
- Steam circulation ~110 days prior to SAGD conversion
- Steam quality at the end of header resulted in delay of circulation and conversion of 750WP8
- During the circulation phase, well pairs were operated below approved BH MOP
- 2110 kPa & 2140 kPa on Pad 750 North & South, respectively

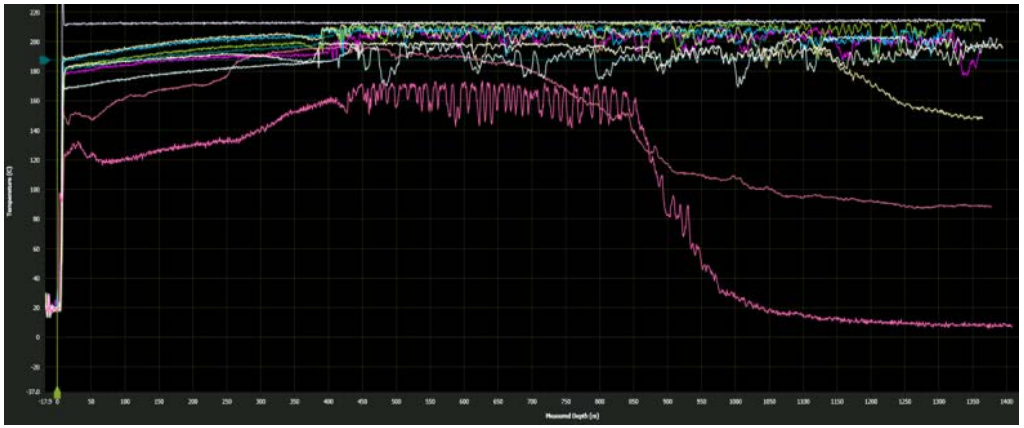


Pad 750 Well Pair Start-Up Key Learnings

Instrumentation learnings during the circulation phase:

- BHP measurement (with blanket gas at the heels and an ERD at the toe of each producer) allowed for operations near BH MOP without exceedances
  - Safe and efficient unloading of wells prior to steam injection

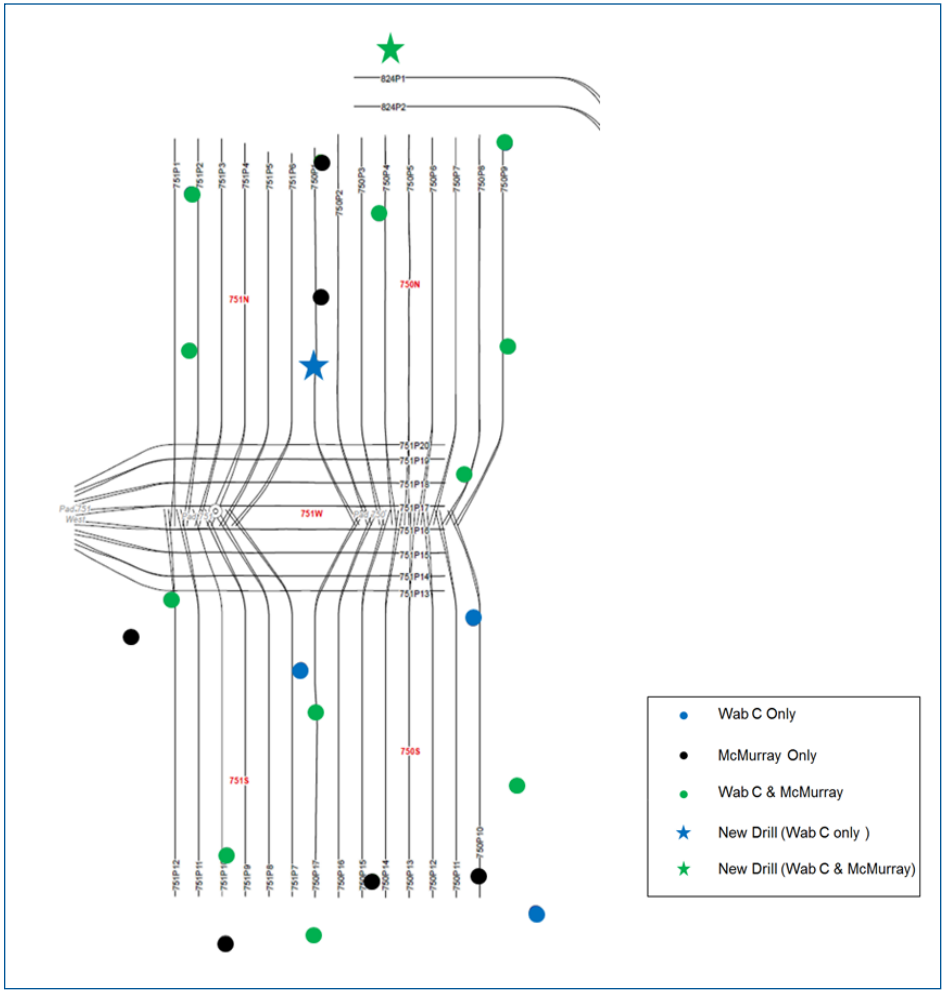
- Fibre in the producer wells provided learnings
  - Impacts from outages
  - Loss of steam to toe
  - Recovery time after an outage
  - Not achieving saturated conditions in the wellbore with lower rates
  - Heat transfer cooling through birch channel



Pad 750 test separator put in operation ~1 week after circulation commenced, allowing for:

- Collection of Well Production Test data on the well pairs early in the life of the wells
- Data contributed to adjustments to the circulation / conversion strategy

Updated Monitoring Plan for Pads 750, 751 and 824



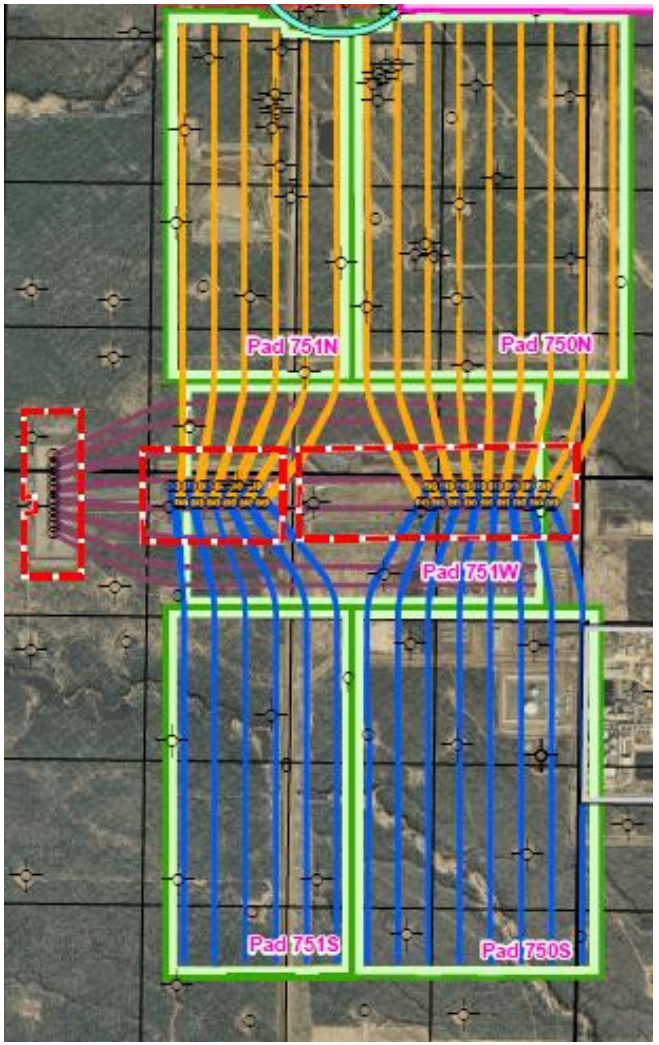
- The monitoring plan for Pads 750, 751 and 824 has been updated as shown
- Suncor will construct a new well to the north of Pad 824
  - The well will be instrumented to obtain both pressure and temperature data in the cap-rock interval and temperature data in the reservoir interval
- Suncor will also construct a second well near the heels of the NW cluster of Pad 750 wells
  - The well will be instrumented to obtain pressure and temperature data in the cap-rock interval
- Suncor is currently in the planning stage for these wells which are anticipated to be completed by mid-2018

Future Plans

3.1.1.8

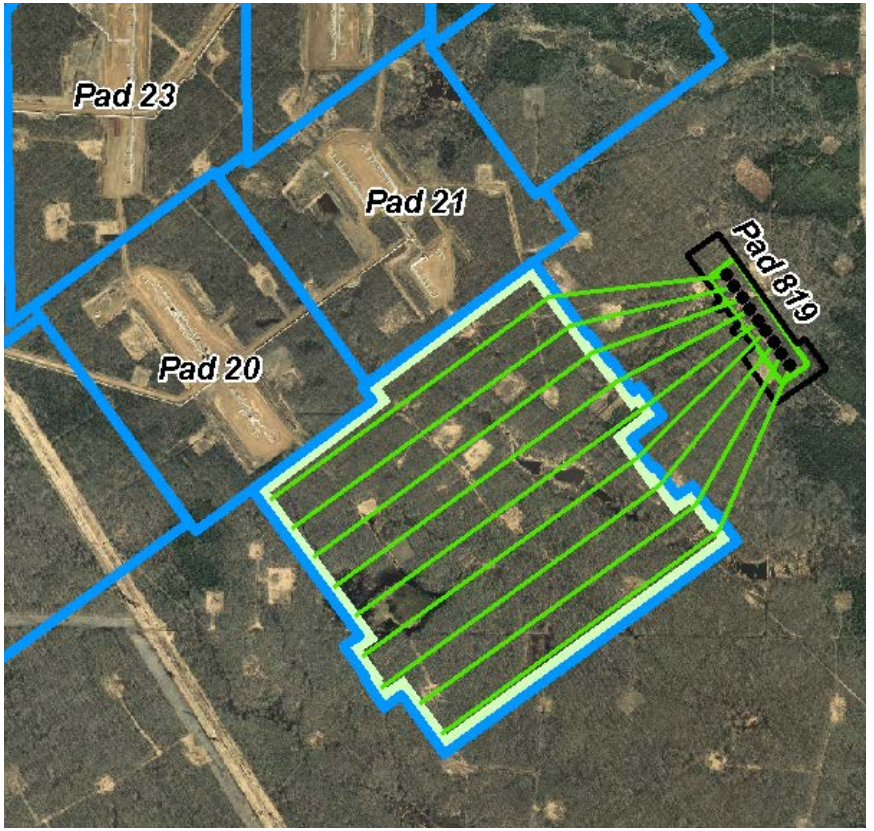
Future Development: Pads 750/751

- Pad 750/751 is a future area of development within the MacKay River PA
  - To provide sustaining production for the existing MR1 central processing facility (CPF)
- Approval received August 7, 2012
  - 35 well pairs and 2 single producers in total
- Drilling completed June 2014
  - 12 well pairs on Pad 750 commenced operation in 2016/2017
- Pad 751 and remaining Pad 750 completions will occur in 2018/2019
  - Tentative start up date 2020



Future Development: Pad 819

- Pad 819 is a future area of development within the MacKay River PA
  - To provide sustaining production for the existing MR1 central processing facility (CPF)
- Directive 078 amendment approval received in January 2014
  - 9 well pairs located south of existing infrastructure
- Drilling planned to be completed in 2020
- First steam expected in 2022



Suncor MacKay River Project
2017 AER Performance Presentation: Surface Commercial Scheme Approval No. 8668

AER Directive 054
2017 Performance Presentation

Section 3.1.2 – Surface Operations, Compliance, and Issues not related to Resource Evaluation and Recovery

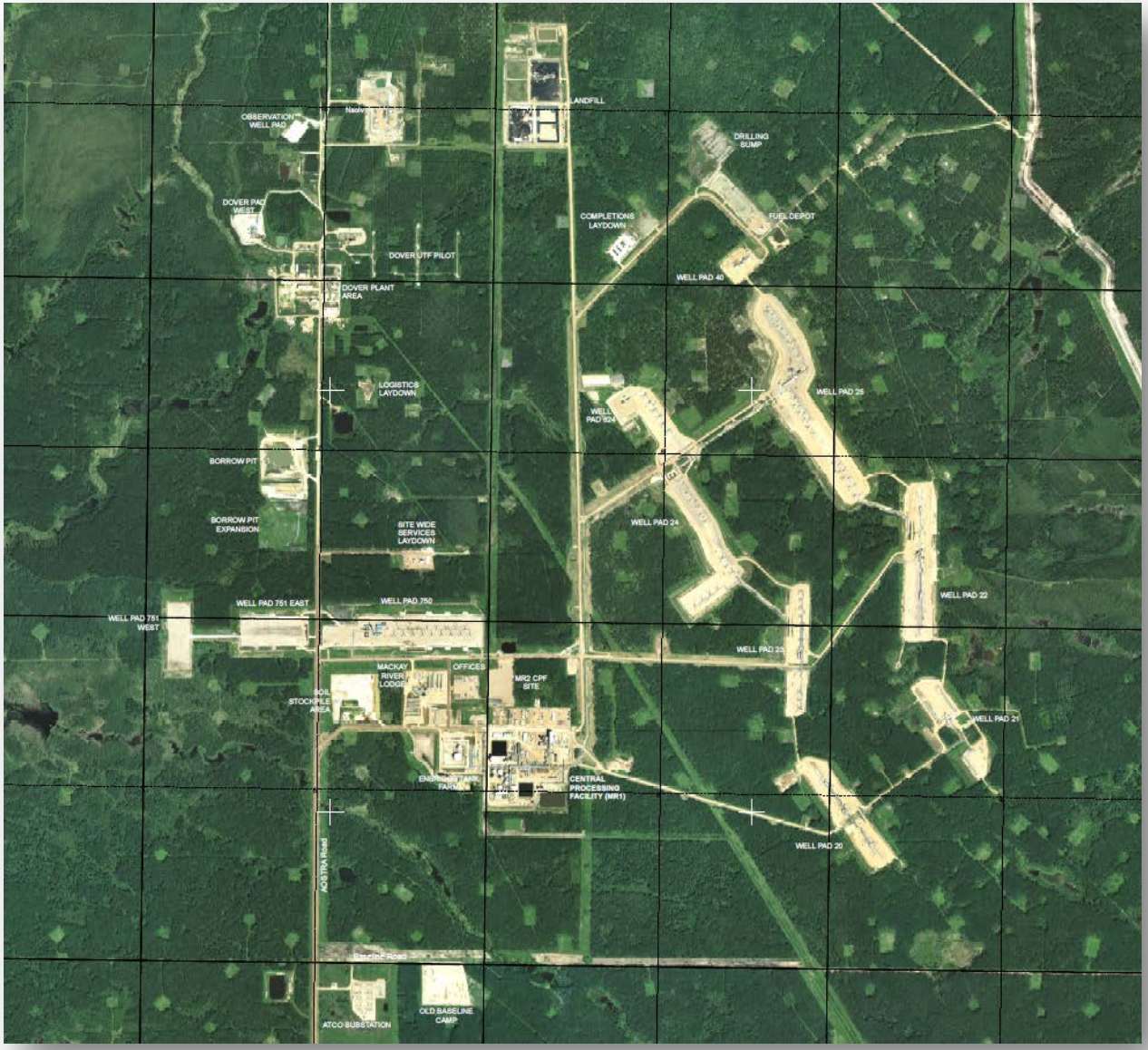
Table of Contents

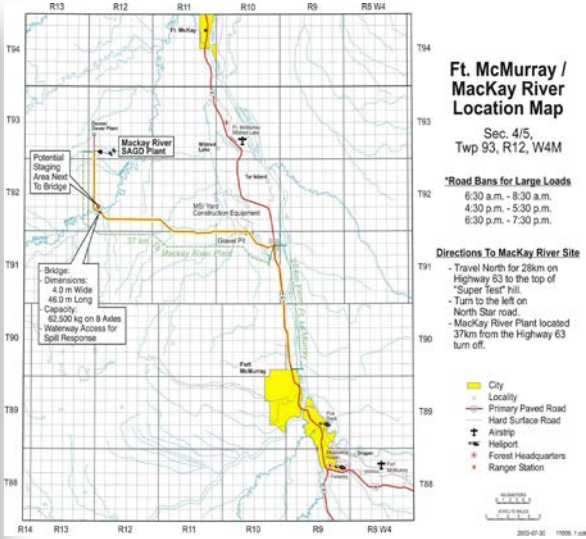
- Introduction
- Facilities
- Central Processing Facilities (CPF) Performance
- Measurement and Reporting
- Water Production, Injection and Use
- Sulphur Production
- Environmental Performance
- Future Plans

MacKay River Performance Presentation

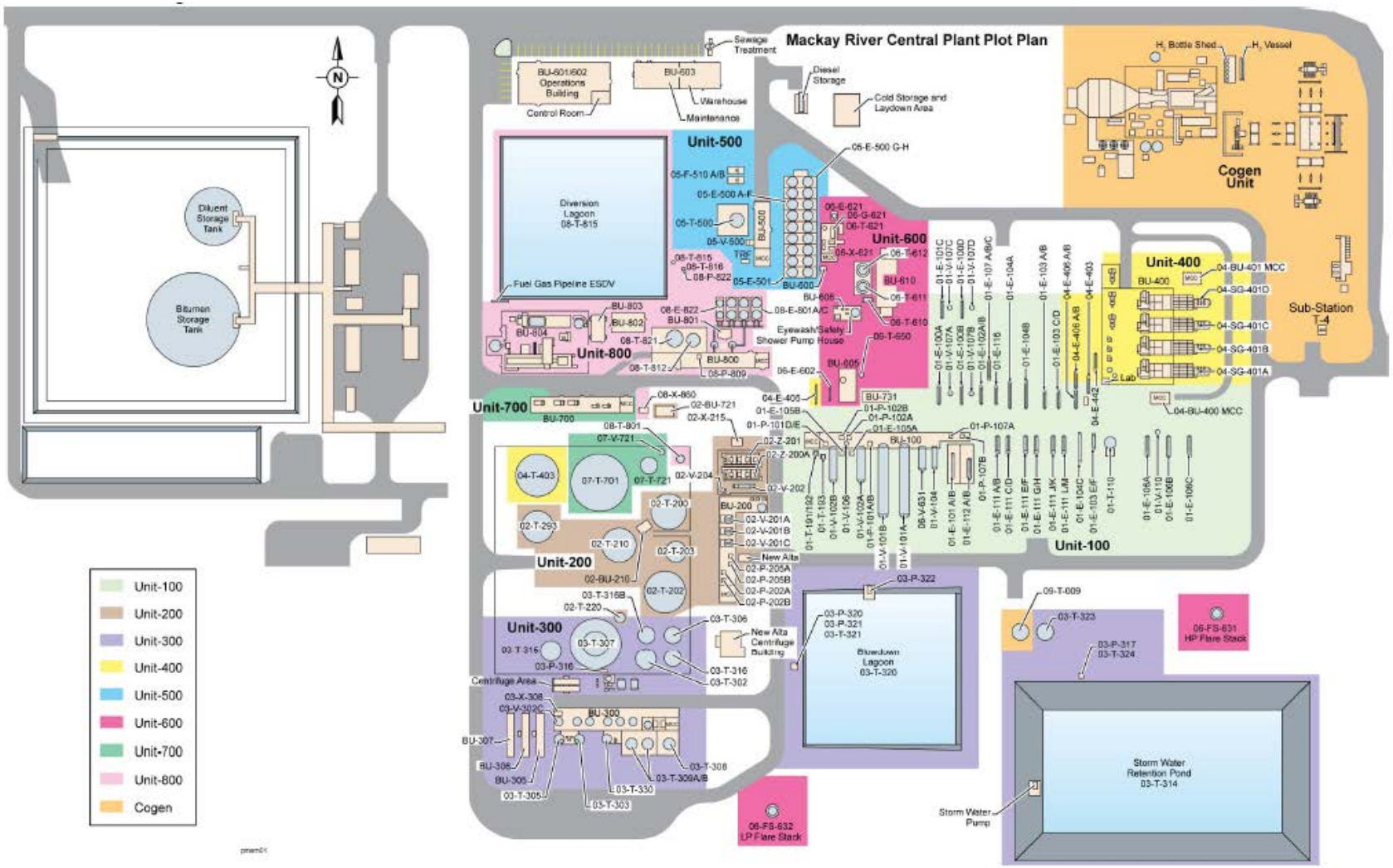
Facilities

MacKay River Project Site

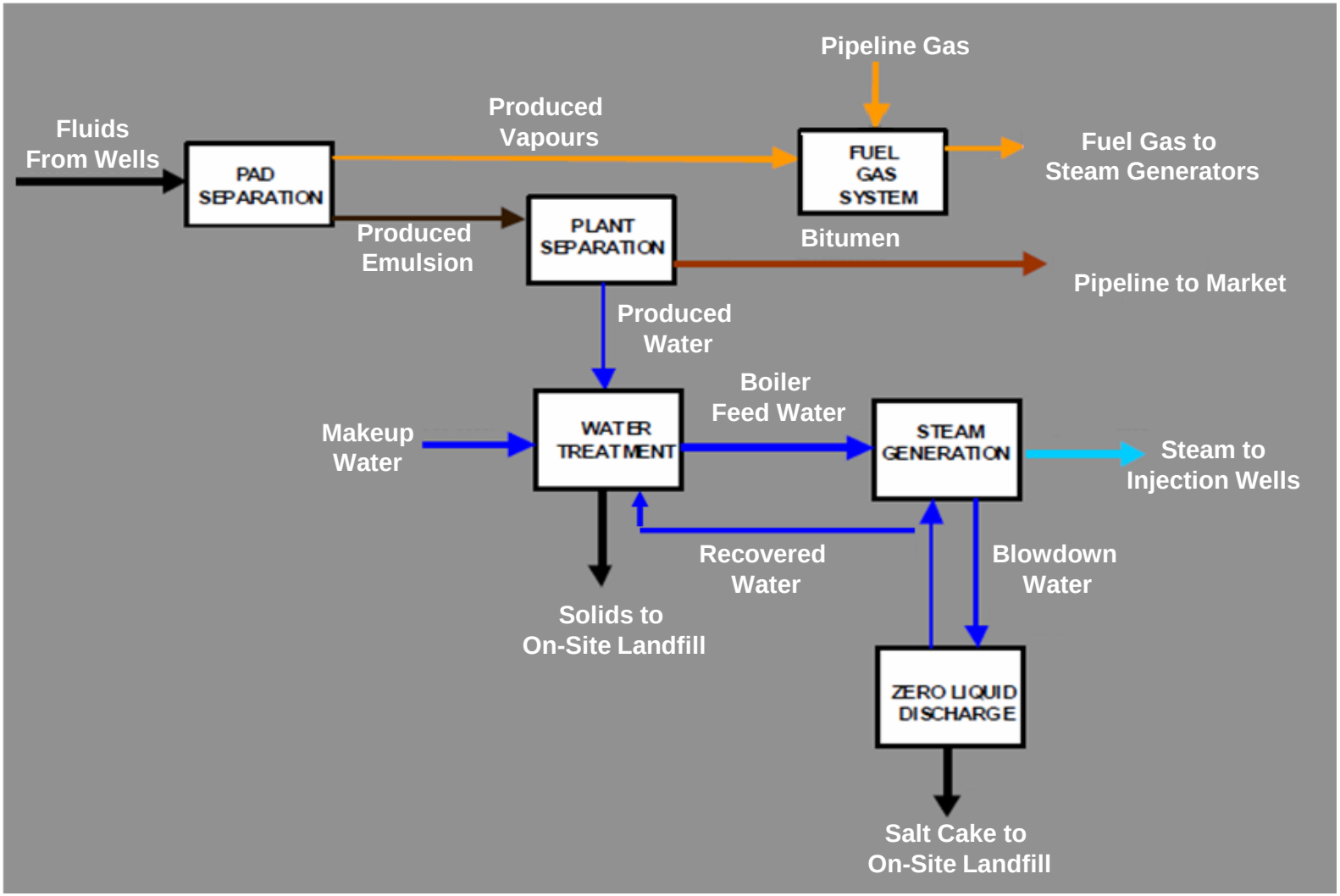




CPF Plot Plan



Simplified CPF Process Block Diagram



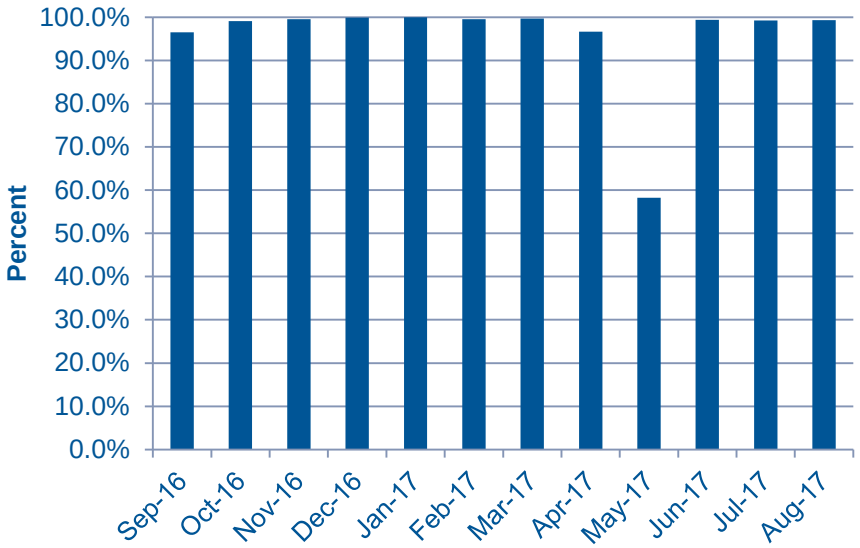
MacKay River Performance Presentation

Central Processing Facility Performance

CPF Performance (September 2016 to August 2017)

The reliability of the facility has been steady:

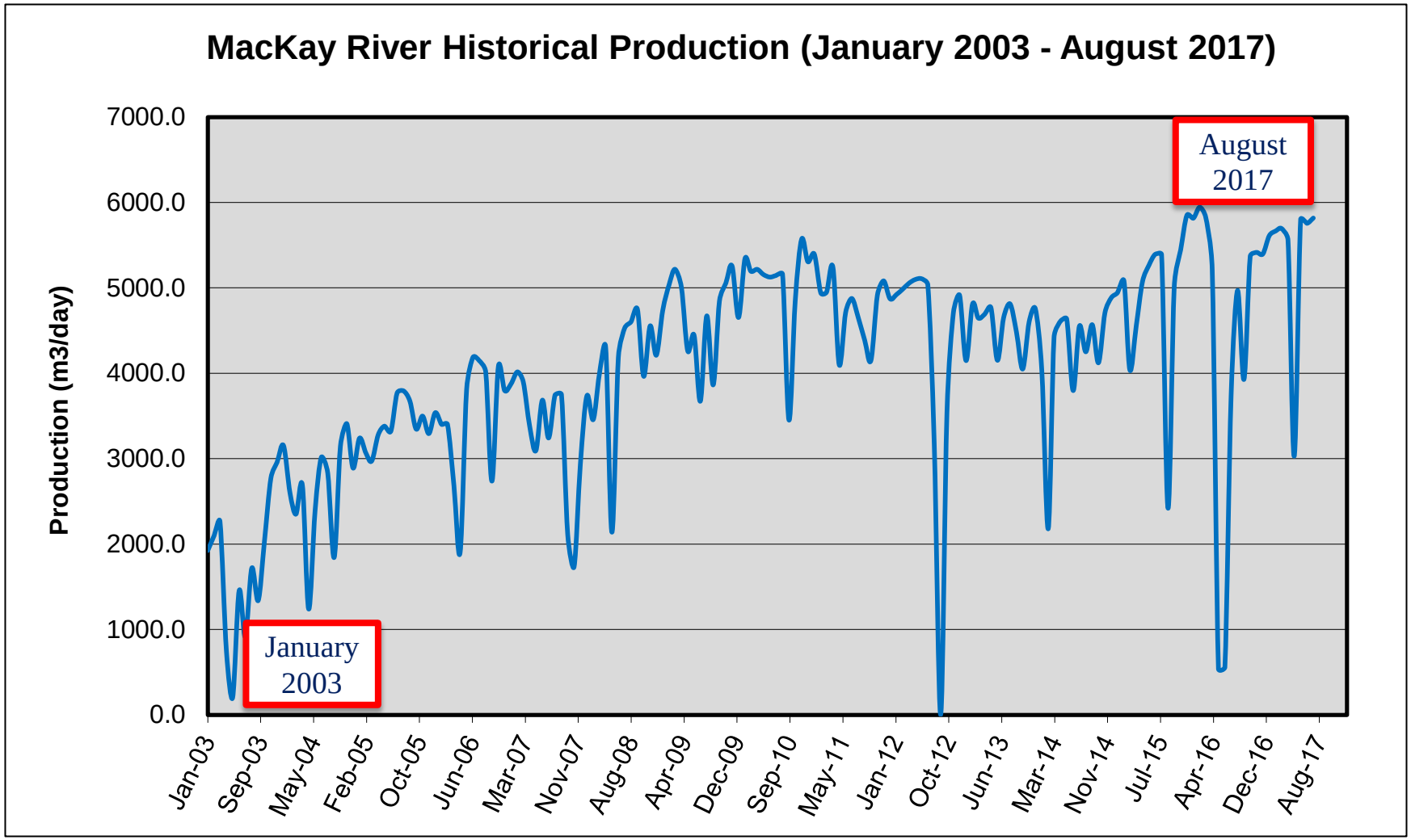
Average 95.6% (September 2016 to August 2017)



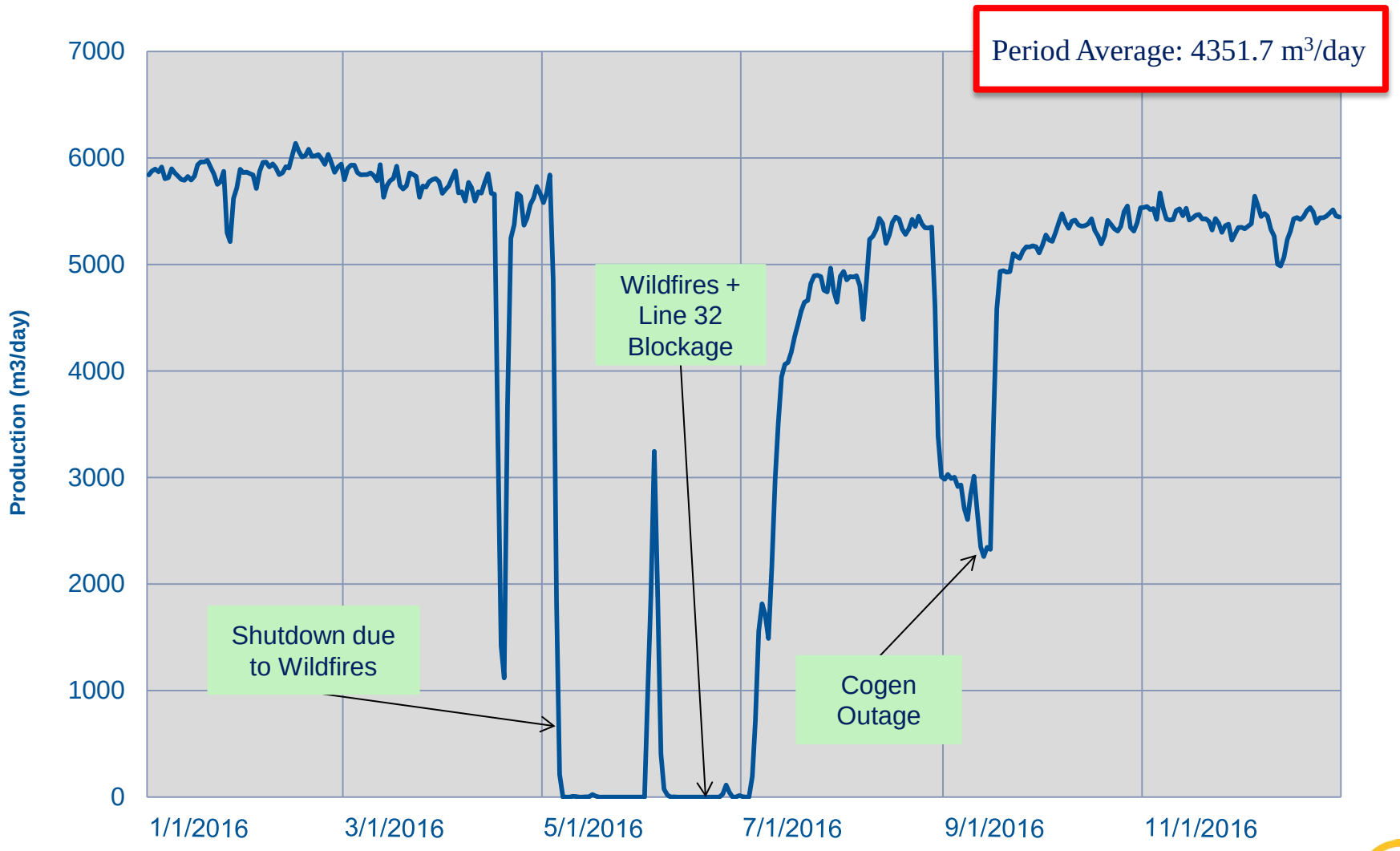
Major challenges:

- Water processing challenges as a result of the Pad 750 start up in September 2016.
- Planned Cogen outage during the month of September 2016.
- Plant was shutdown from April 29th to May 9th due to unplanned WLS outage.

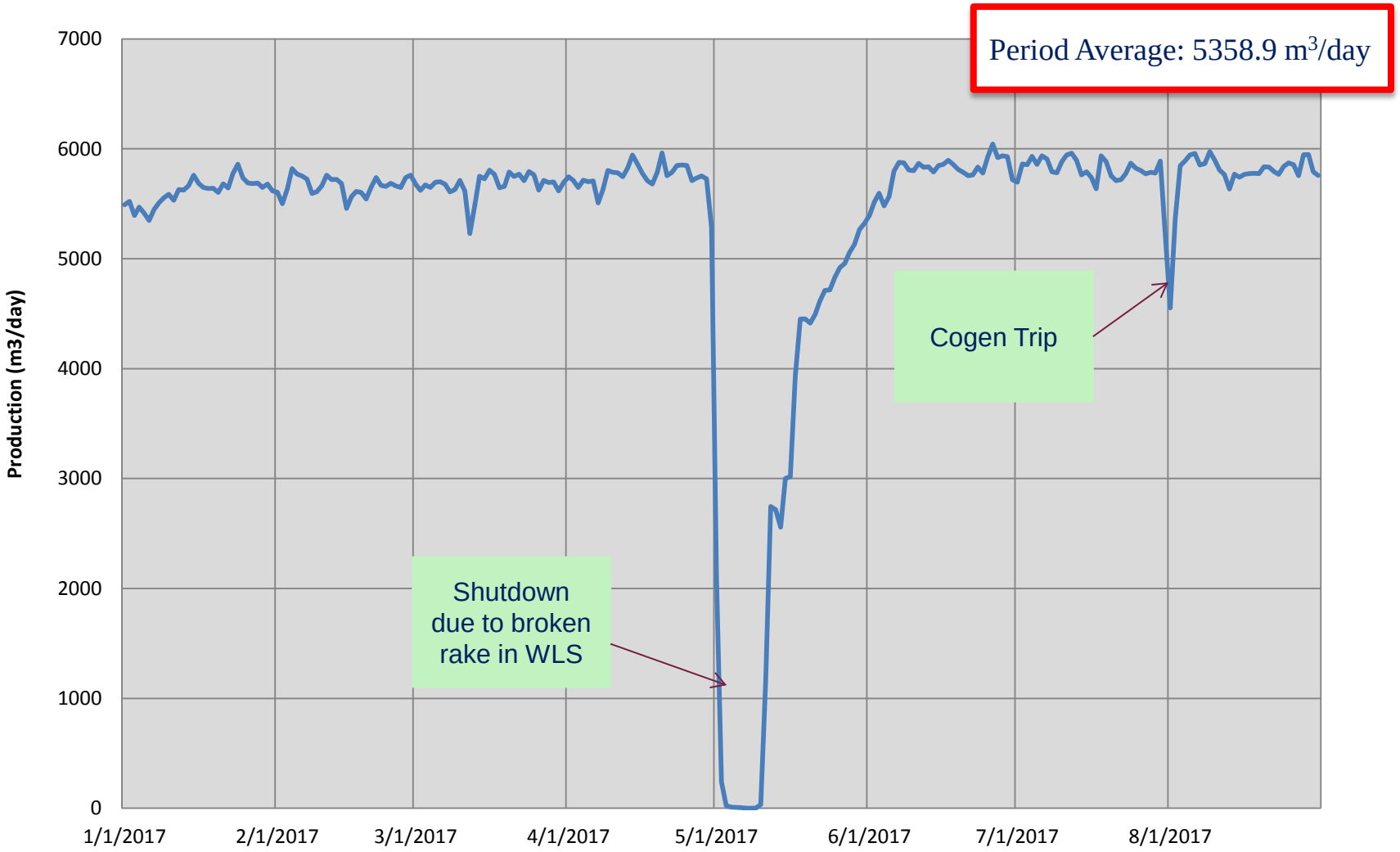
Historical Production (January 2003 – 2017 YTD)



Production (2016)



Production (January 2017 to August 2017)



Water Treatment Technology

Warm Lime Softening (WLS) and Weak Acid Cation (WAC) softening for produced water;

Zero Liquid Discharge (ZLD) System on blowdown slip stream:

- Evaporators: one steam and one mechanical driven;
- Crystallizer: Steam driven;
- Dryer: gas fired;
- Filter press (2): back up for dryer.

Boiler Feed Water Quality

Parameter	Avg. Value (Sept 2016 – Aug 2017)	Max Value During Period	BFW Specifications
Temperature, ºC	153.6	161.2	140 – 170
Hardness (Dissolved), mg/L	0.23	1.06	< 1.0
Total Dissolved Solids, mg/L	6620.3	8261.3	< 8000
Silica, as SiO2, mg/L	20.1	124.4	< 50.0

Water Treatment Successes and Challenges

The WLS performance has been steady since :

- Reliability is 95% :
  - Consecutive days within spec: 215 days Parameters: temperature, hardness, total dissolved solids, pH, silica, oil, free oxygen, total dissolved iron;
  - Reliability of the slurry system has improved significantly with new chemical treatment program.

Challenges:

- Plant was shutdown from April 29th to May 9th due to unplanned WLS outage.

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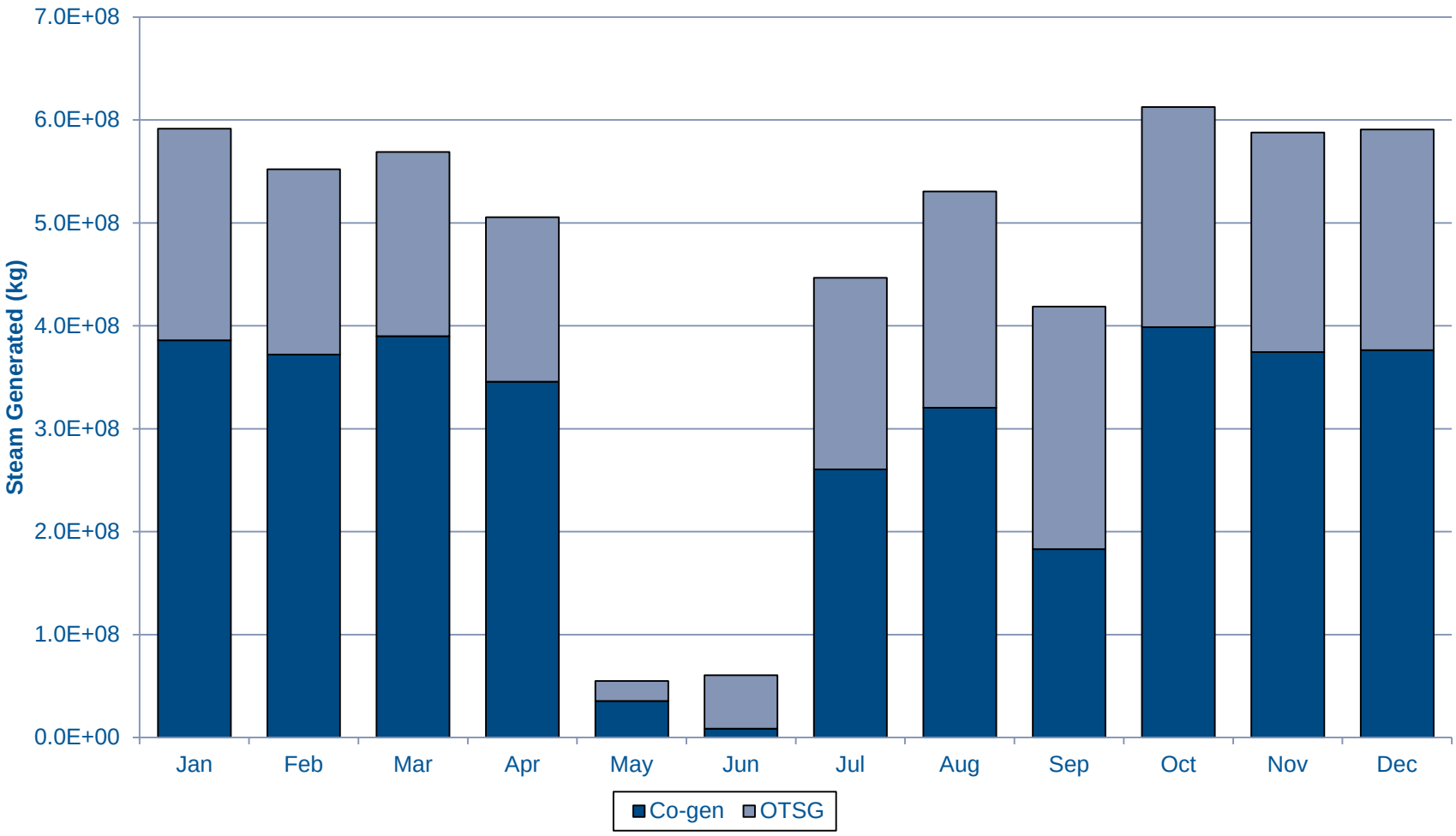
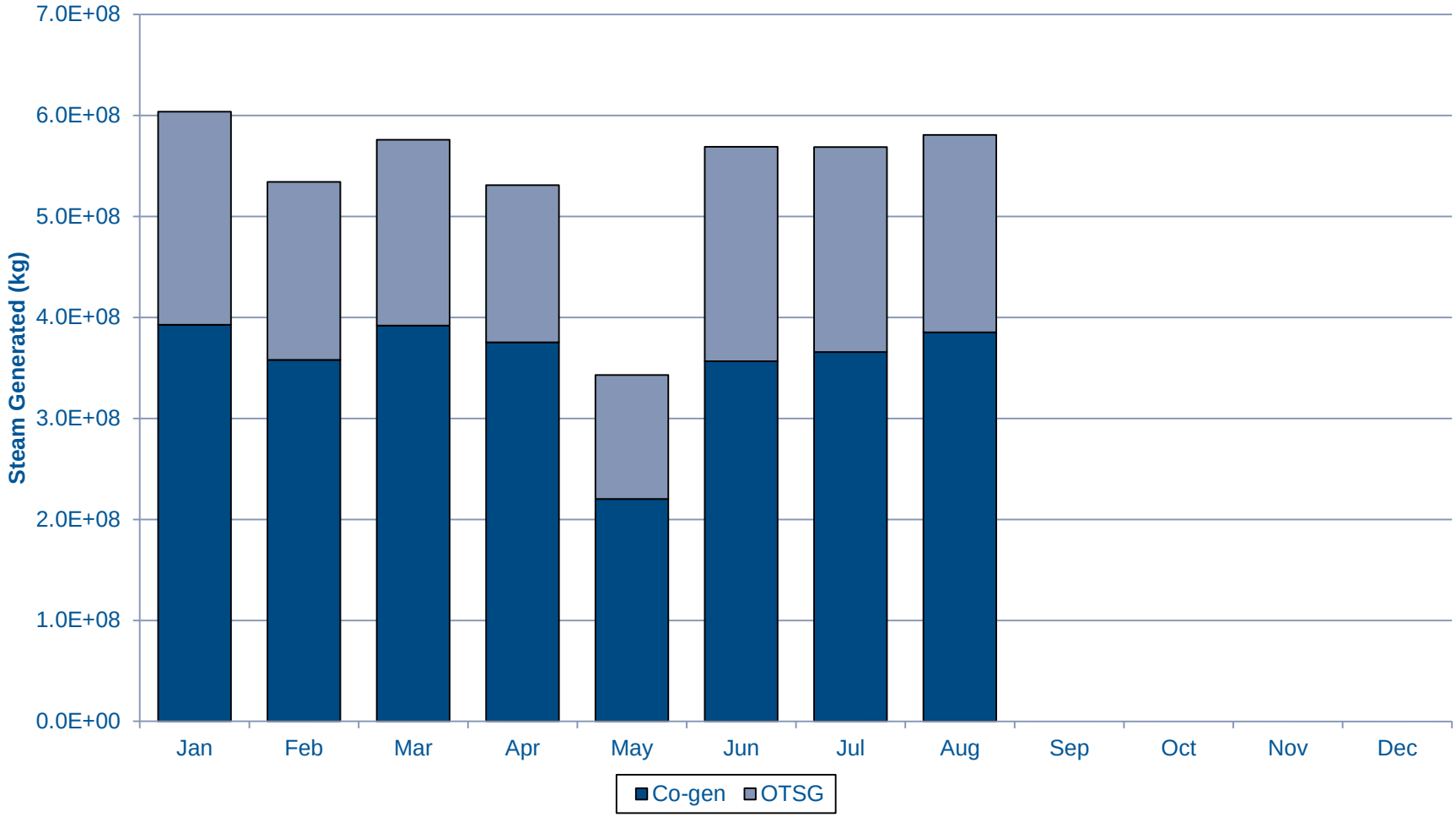
Steam Generation (2016)



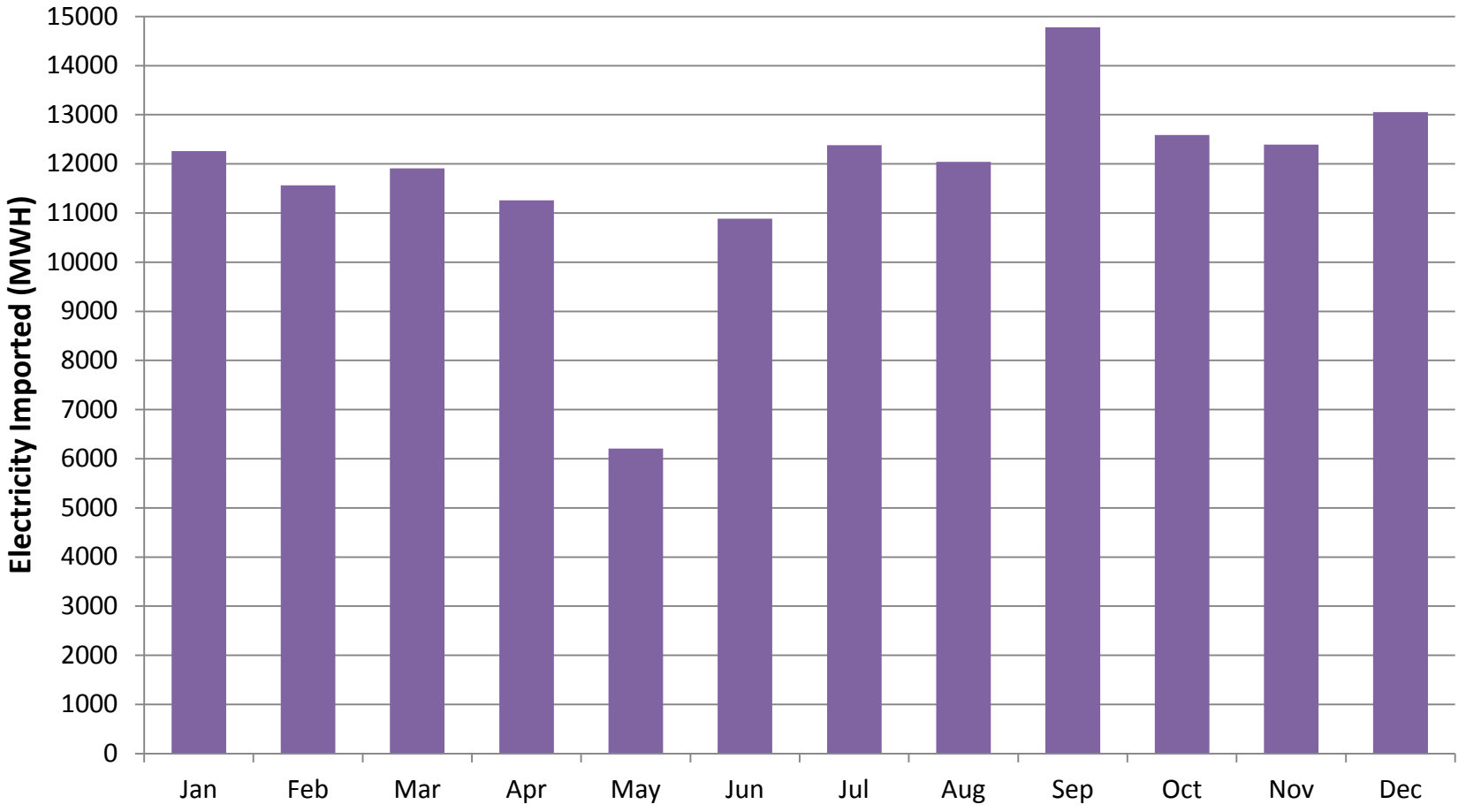
Steam Quality from Co-gen is maintained approximately 77% and OTSG is approximately 80%

Steam Generation (2017 YTD)



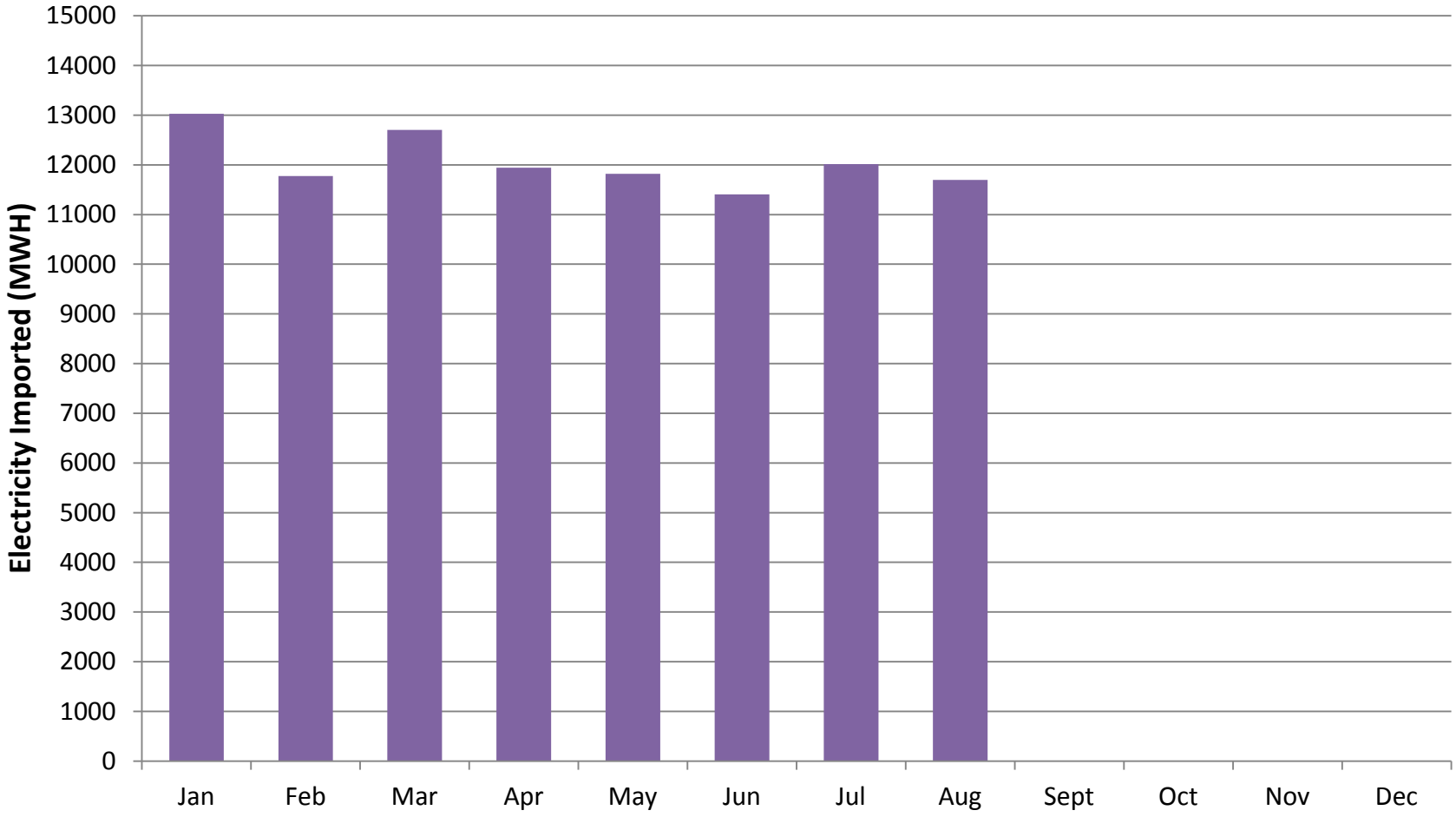
Steam Quality from Co-gen is maintained approximately 77% and OTSG is approximately 80%

Power Imported (2016)



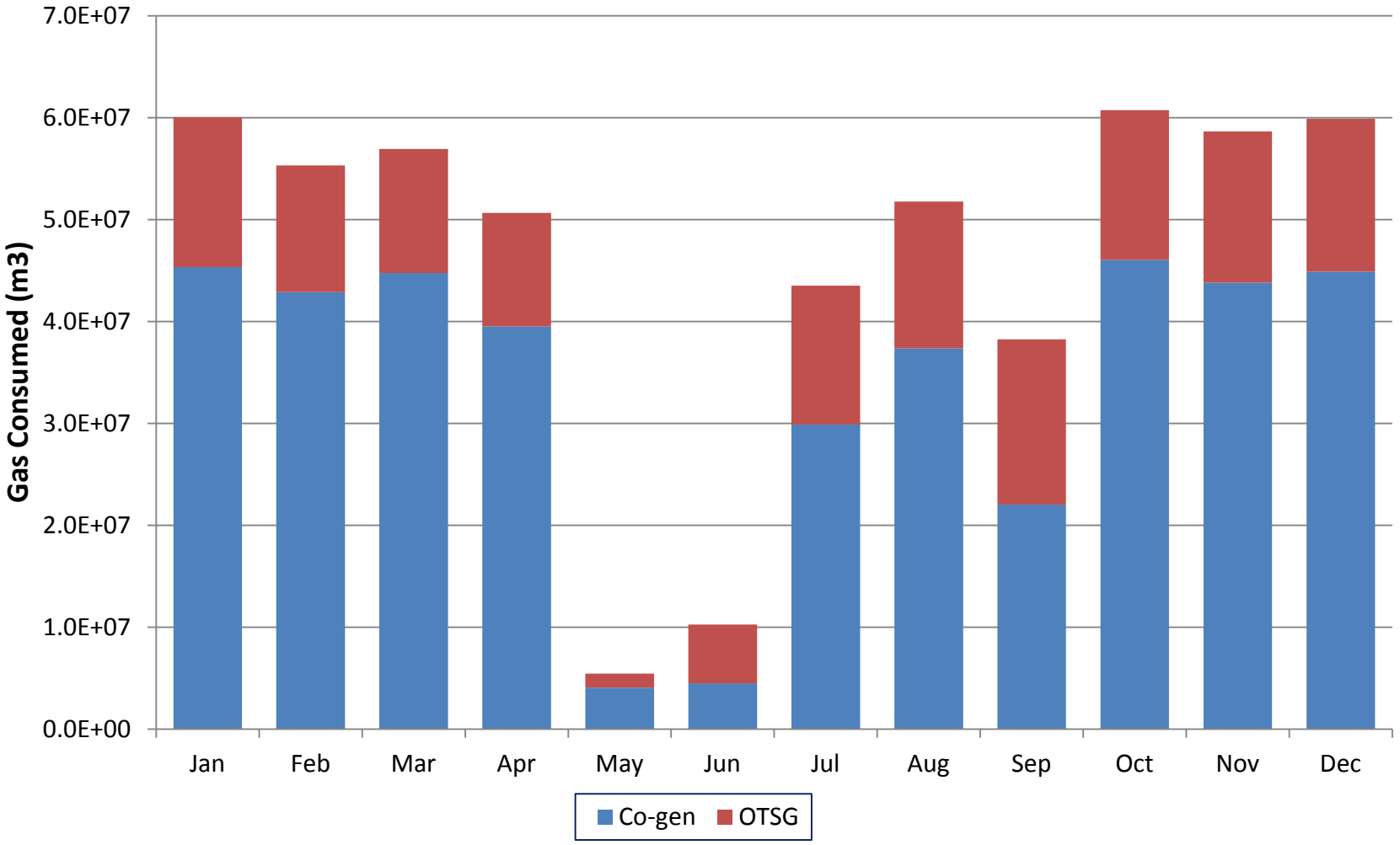
*Note: All power imported into Mackay River is consumed

Power Imported (2017 YTD)

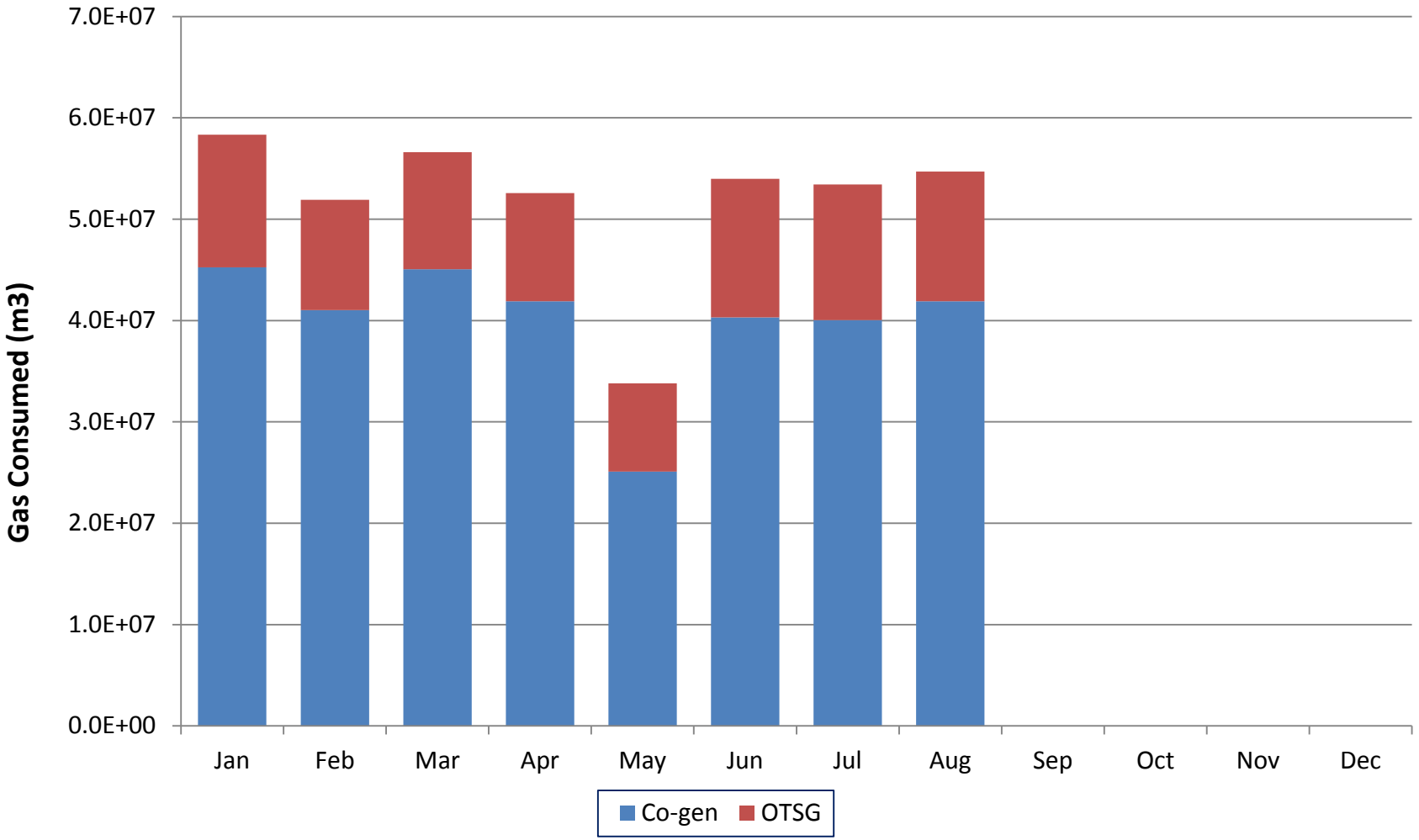


*Note: All power imported into Mackay River is consumed

Gas Consumption (2016)



Gas Consumption (2017 YTD)



Energy Intensity

Energy Intensity Formula

- Energy Intensity (GJ/m^3) = Total energy consumed by site / Sales bitumen volume;
- Total energy consumed by site (GJ) = Energy used to make steam and blowdown in Cogen + Natural Gas imported to site + Solution gas to Cogen + Electricity consumed by site – Mixed gas to Cogen duct firing:
  - Note that the term “site” does not include Cogeneration.
- Energy used to make steam and blowdown in Cogen (GJ) = BFW Mass Flow Rate to Cogen x Hourly average difference in enthalpy between steam and BFW.

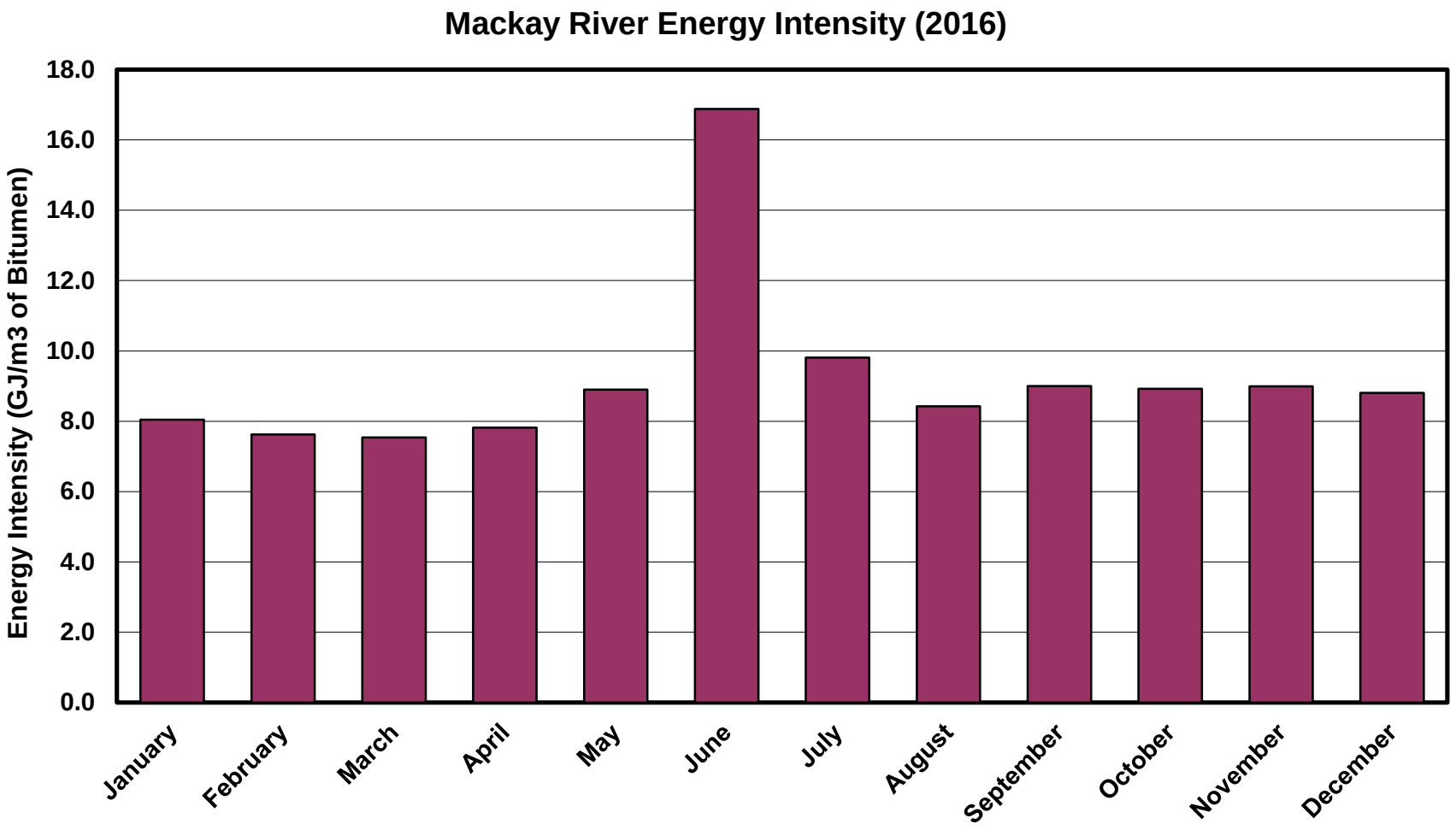
Cogeneration with TransCanada Energy

- Energy exchange: TransCanada Energy (TCE) provides steam and electricity to Suncor in exchange for BFW and a “fee”;

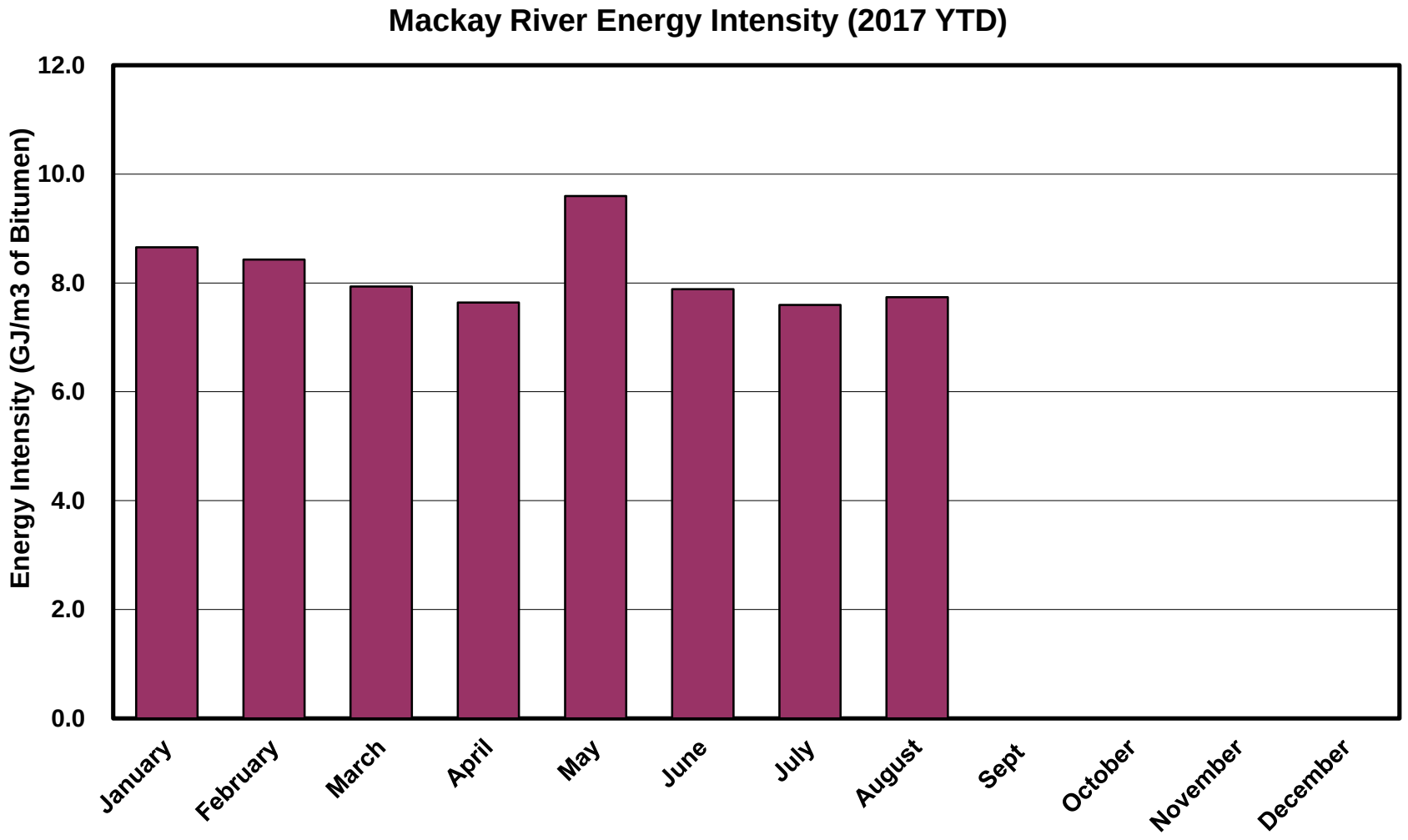
- A large portion of the steam used in the injection wells is recovered by Suncor as produced water. This produced water supplies most of the feedwater required for the HRSG.;

- A portion of the electrical power generated by the cogeneration plant is sold to Suncor for use onsite as well as at other offsite locations. In addition to the power contracted to Suncor, up to 150 MW of power is made available to Alberta consumers

Energy Intensity (2016)



Energy Intensity (2017 YTD)



MacKay River Performance Presentation

Measurement and Reporting

Measurement Accounting & Reporting Plan (MARP)

- Primary produced steam measurement method updated to boiler feed water – blowdown.
  - HP steam meter 04-FIT-1002 was found to be irreparable on September 13th
- Annual internal update to be finalized by November 30th
- MacKay River Report Codes:
  - Battery – AB BT 0067097;
  - Injection Facility – AB IF 0009498;
  - Meter Station – AB MS 0084090.

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Water Balance

- **Steam**:
  - Primary produced steam:
    - Annubar steam meter (04-FI-1002) plus liquid carryover:
    - During an internal meter inspection completed on September 13, 2017 it was discovered the MARP annubar meter for primary high pressure steam measurement, 04-FI-1002 was broken and irreparable.
    - Steam Injection to Wells = BFW to Steam Generators – Boiler Blowdown – Utility Steam – LP Steam – Condensate from Pads
  - Secondary produced steam:
    - Sum of steam meters from steam separators (04-FI-600, 04-FI-1001) minus steam sent to production heaters (01-FI-162) and any steam vented (04-FI-283).

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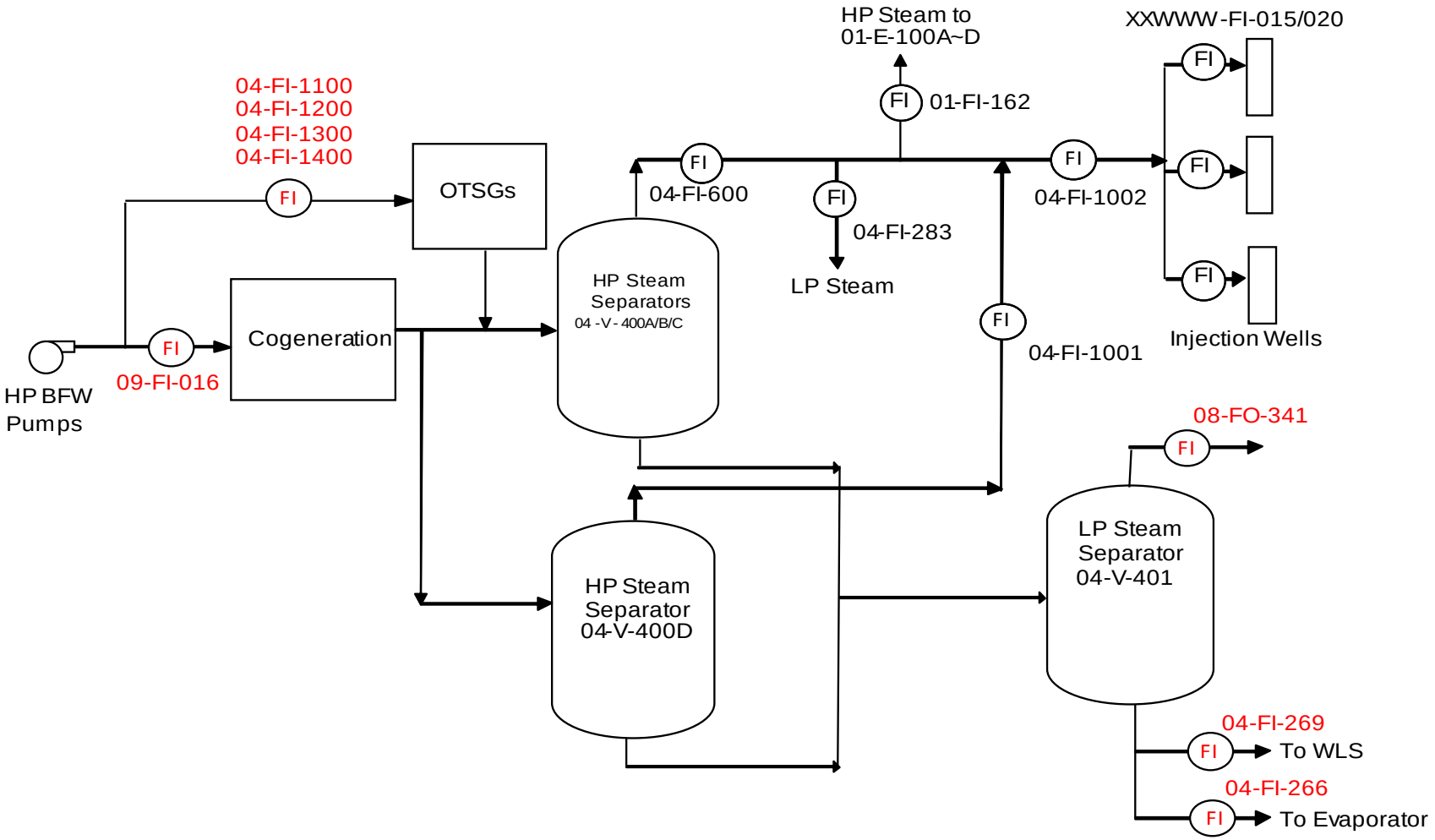
Water Balance Continued



Water Balance Continued

- **Raw Water** = Σ Water Source wells (3 water source wells);
- **Accumulation** = Closing Inventory – Opening Inventory;
- **Produced Water** = Produced water to WLS + Accumulation – Others:
  - Produced Water to WLS = 02-FI-500 + bypass + 02-FI-306;
  - Others include: Raw water, BLD Recycle, BFW to VRU.
- Details of measurement and reporting procedures may be found in the MARP;
- Water from the crystallizer is metered at the crystallizer outlet before it goes to the dryer:
  - Truck tickets capture the volume of water trucked off-site;
  - Volumes reported in Petrinex.

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Well Testing Strategy

Test Separators are used to test all wells for production allocation

- **Fully compliant with Directive 017**

Pad 20 Well Testing Strategy

- 13 active SAGD producers, 4 hour tests (+ purge time)

Pad 21 Well Testing Strategy

- 12 active SAGD producers, 4 hour tests (+ purge time)

Pads 22 Well Testing Strategy

- 23 active SAGD producers, 5.5 hour tests (+ purge time)
- No long grandfathered as a result of the Directive 017 update
- Phase 4 (NN1 and QQ2-3) are tested via Pad 22 Test Separator
- Phase 5A (NN2-5, QQ4-5) are tested via Pad 22 Test Separator

Pads 23/24 Well Testing Strategy

- 14 active SAGD producers, 7-7.5 hour tests (+ purge time)
- Pad 24 Phase 4 (OO1-3) are tested via Pad 23 Test Separator
- Pad 24 (H1-4) are tested via Pad 23 Test Separator

Pad 25 Well Testing Strategy

- V-100 Test Separator
  - 10 active SAGD producers, 5 hour tests (+ purge time)
- V-1100 Test Separator
  - *12 active SAGD producers,* 4 hour tests (+ purge time)
- V-1150 Test Separator
  - *12 active SAGD producers*, 4-5 hours test (+ purge time)
  - Pad 24 Phase 5B1 (OO4-9) are tested via V-1150
  - Pad 24 Phase 5DF (OO10-15) are tested via V-1150

Pad 824 Well Testing Strategy

- 2 active SAGD producers, 7 hour tests (+ purge time)
- Wells are tested via Vx Meter

Pad 750 Well Testing Strategy

- Pad 750 Test Separator V-8350
- 10 active SAGD producers, 5 hour tests (+ purge time)

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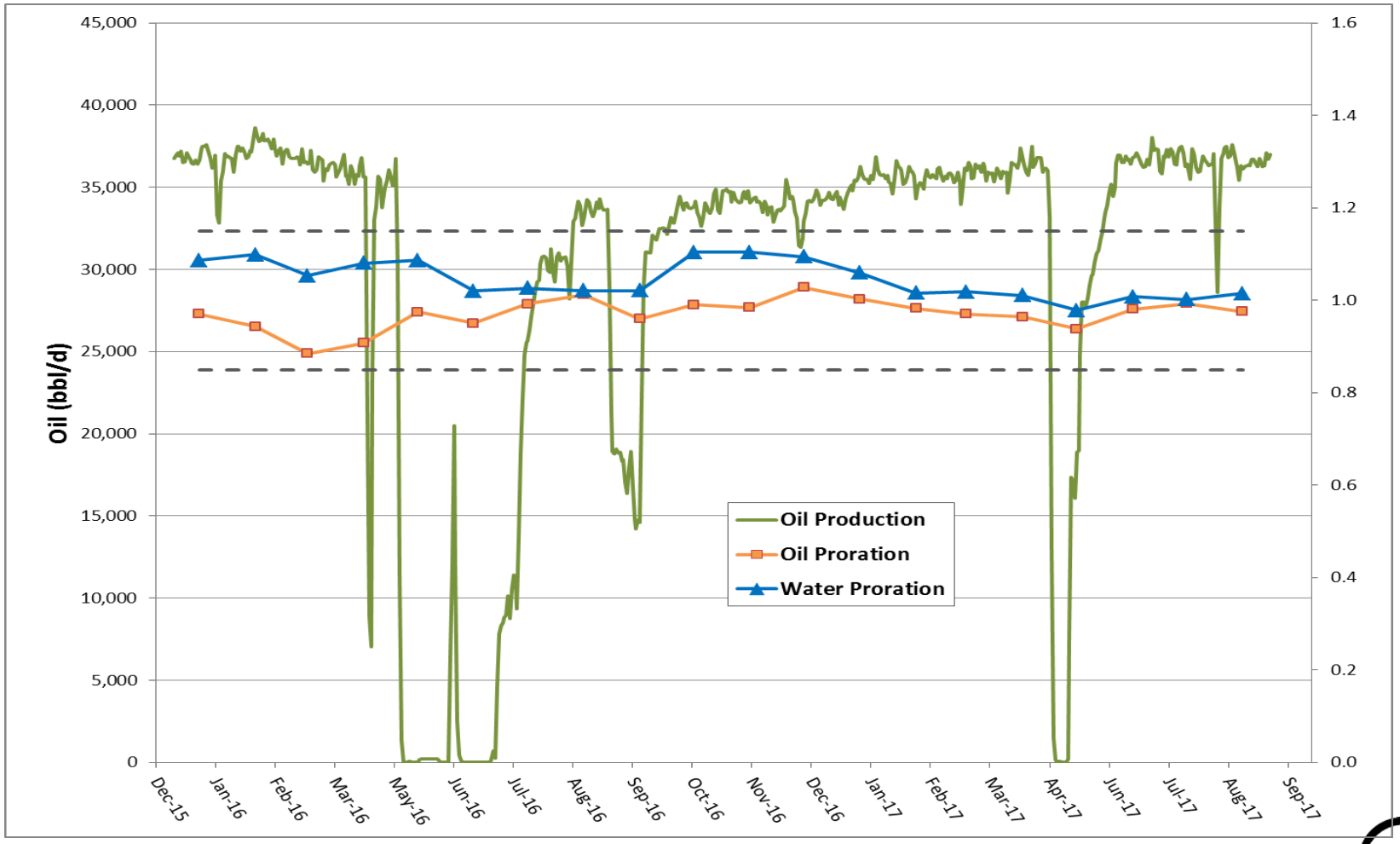
Proration of Oil and Water

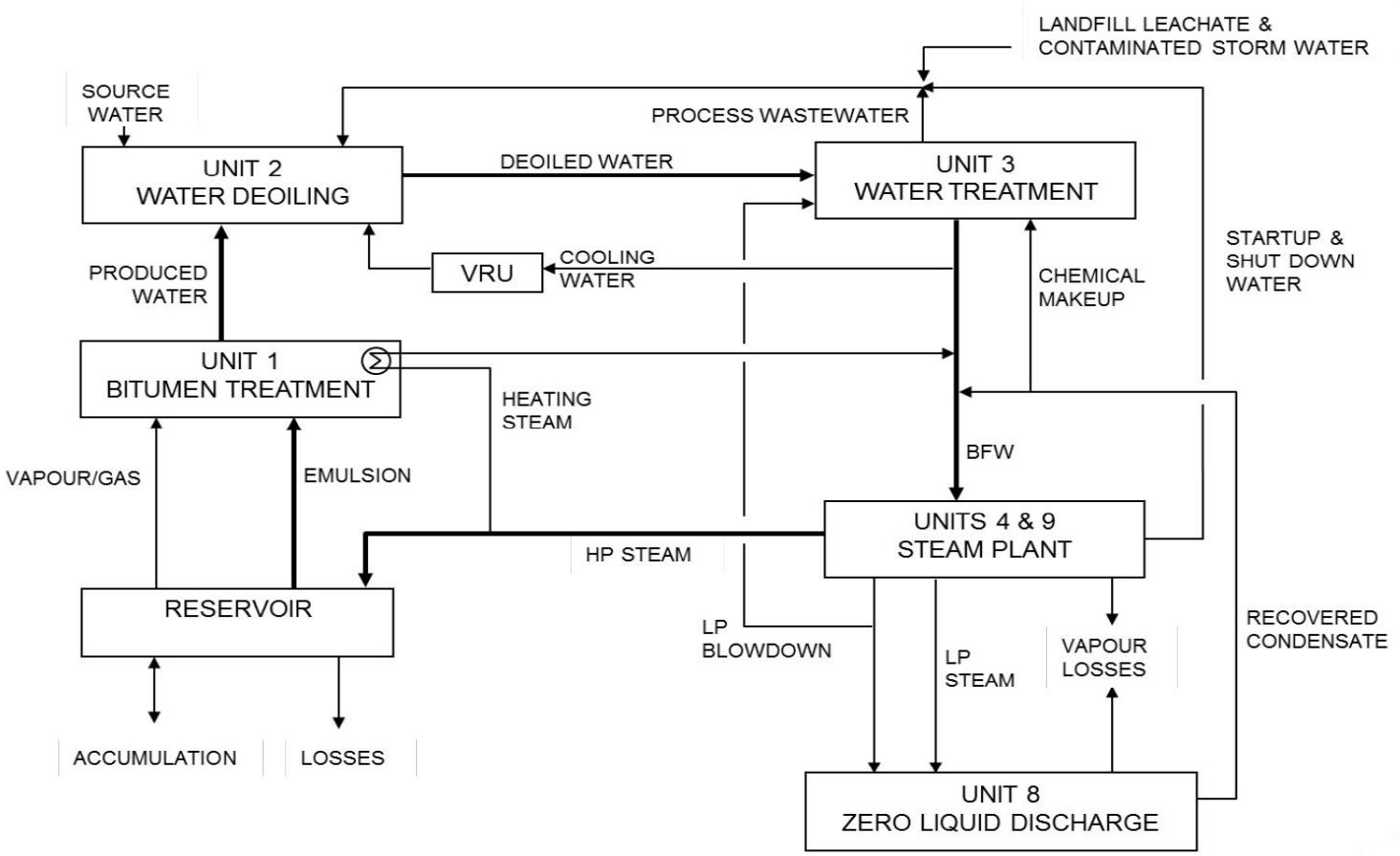
- Average for 2016: Oil Factor = 0.97 Water Factor = 1.06
- Average for 2017 YTD: Oil Factor = 0.98 Water Factor = 1.01



MacKay River Performance Presentation

Water Production, Injection and Use

CPF Water Traffic



Fresh Water

Source Water Wells

- *Water Act* Licence No. 00188229-03-00 (511,000 m^3/year) Birch Channel Aquifer (Renewal issued August 2017):

1. 13-05-093-12W4 (GD-SW-212-53; formerly WSW-1), max. rate 450 m^3/day;
2. 04-08-093-12W4 (GD-SW-213-86; formerly WSW-2), max. rate 1368 m^3/day;
3. 04-08-093-12W4 (GD-SW-215-91; formerly WSW-3), max. rate 1411 m^3/day.

Domestic Water Well:

- *Water Act* Licence No. 00249470-01-00 (25,550 m3/y) Birch Channel Aquifer (Currently not in use):

4. 12-05-093-12W4 (CWSW-SW-218-55), max. rate 123 m3/day.

Monthly reporting for Source Water Wells and Domestic Water Well is done through Water Use Reporting System (WURS).

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Raw Water Source Wells

Source Well - SW-212-53			
Test	Parameter	Water Analysis Result (5-Oct-15)	Water Analysis Result (29-Sep-2016)
Physical	EC (uS/cm)	855	842
	pH (units)	8.32	7.8
	Tot Hard as CaCo2 (mg/L)	398	434
	Tot Alk as CaCO3 (mg/L)	363	376
Indicators	Chloride:D (mg/L)	<0.5	0.53
	Sulphate:D (mg/L)	111	113
	Iron:D (mg/L)	<0.03	5.6
	Manganese:D (mg/L)	0.258	0.272
	TDS-calculated (mg/L)	504	526
cations, anions, and ion balance	Calcium:D (mg/L)	105	115
	Magnesium:D (mg/L)	33	35.7
	Potassium:D (mg/L)	5.36	5.5
	Sodium:D (mg/L)	31.8	30.9
	Bicarbonate:D (mg/L)	363	376
	Carbonate:D (mg/L)	<5	<5
	Hydroxide:D (mg/L)	<5	<5
	Fluoride:D (mg/L)	0.205	0.25
	Ion balance % (%)	99.7	103
nitrogen parameters	NO2 as N (mg/L)	<0.01	<0.01
	NO3 and N (mg/L)	<0.02	<0.02
	NO2 + NO3 as N (mg/L)	<0.022	<0.022
	DKN (mg/L)	-	-
	TKN (mg/L)	-	-
	Tot Amm N (mg/L)	-	-
phenols	phenols (mg/L)	-	-
PAH	Naphthenic Acids (mg/L)	-	-

Typical water quality assessment parameters;

Monitoring station GD-SW-212-53 (formerly WSW-1);

Results shown are from 2015 and 2016.

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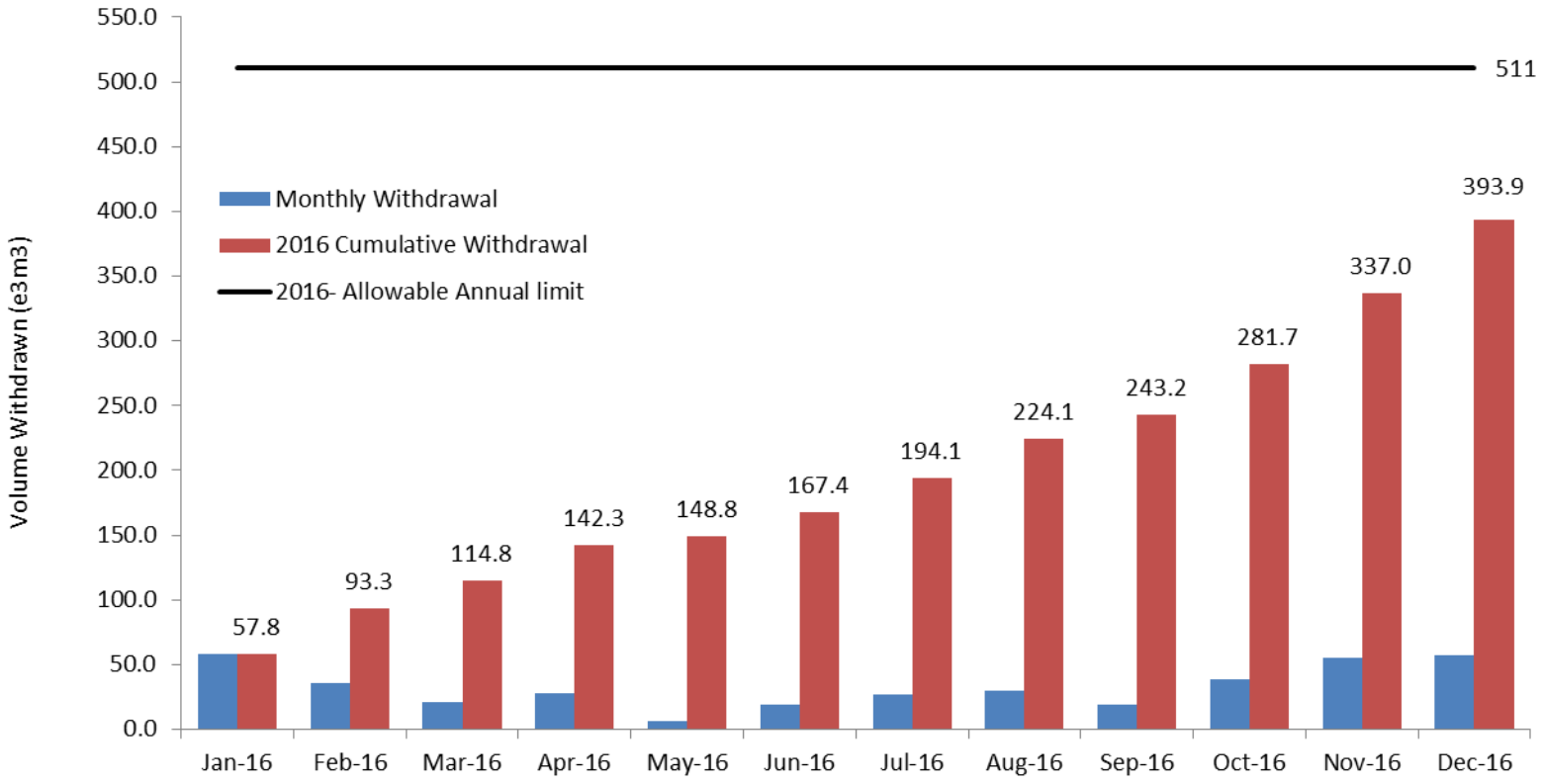
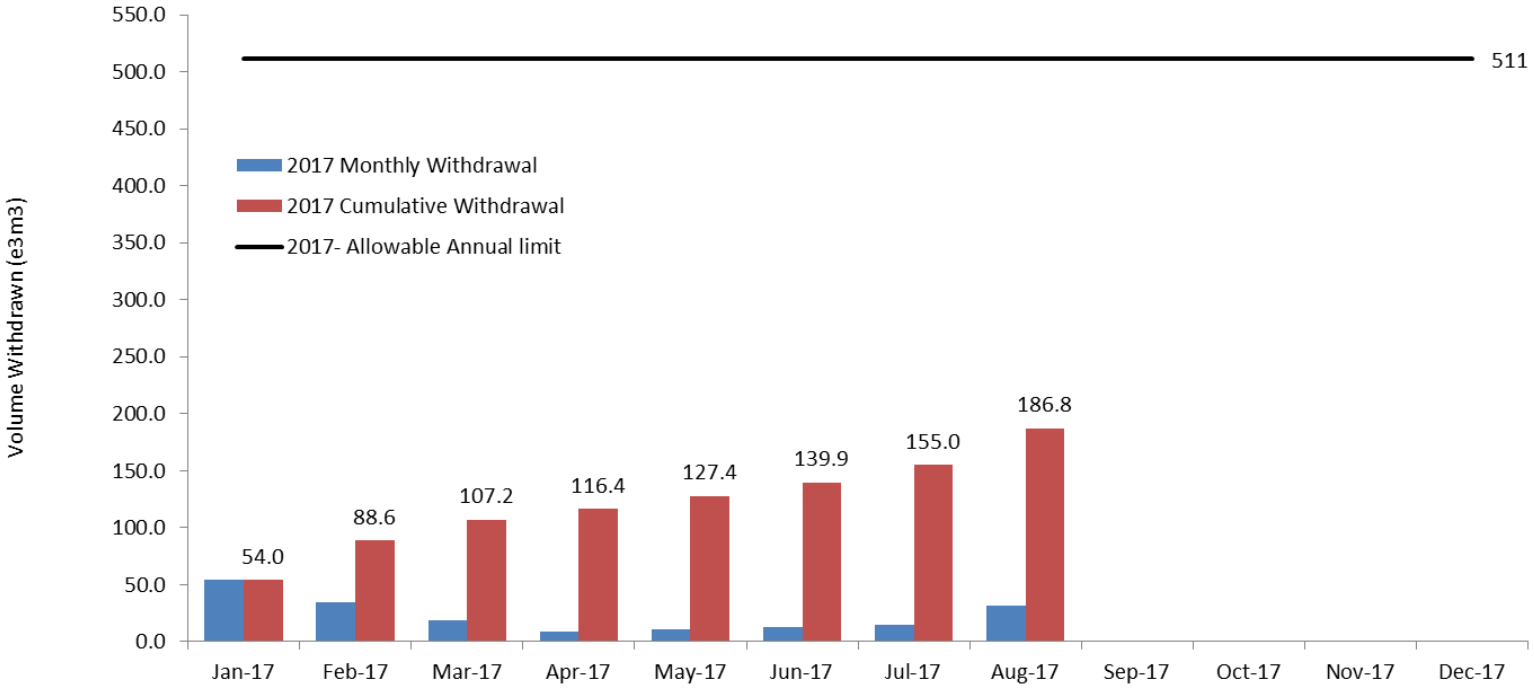
Raw Water Withdrawal – Source Wells (2016)



- Regulatory allowable limit from *Water Act* Licence No. 188229 is 511e^{3}m^3 per year;
- In 2016 MacKay River withdrawal water was from the Water Licence No. 00188229-03-00 – Total 393.9 e3m3.
- The total diversion limit of 511e^{3}m^3 per year is shown (black line).

Raw Water Withdrawal – Source Wells (2017 YTD)



- Regulatory allowable limit from *Water Act* Licence No. 188229 is 511e^{3}m^3 per year

Raw Water Withdrawal – Domestic Well (2017)

- Water well casing failure on September 9, 2011; well was abandoned and a replacement well drilled July 2013;
- No water has been withdrawn from this well (2017 YTD). Suncor has hauled Potable Water since then.
- A project to produce Potable water from the well under License 249470 (limit of 25e3m3 /year) is on going and it is expected to be on line by the end of 2017 (to be confirmed)

Overall Facility Water Balance

Overall Facility Water Balance										
	Inlet Streams				Outlet Streams					Water Balance (%)
	Produced Water	Fresh Water		Produced Water	Steam	Disposal	Produced Water		Fresh Water	
	PW1 (m3)	FW1 (m3)	FW4 (m3)	PW4 (m3)	INT (m3)	DIT (m3)	PW5 (m3)	PW7 (m3)	FW5 (m3)	
Sep-16	338922.344	19,368.82	-	26213.7	341,656.46	4,627.30	25951.647	756.5	-	3.0%
Oct-16	540109.16	37,750.19	-	25951.647	546,732.36	2,790.00	26416.808	1909.2	-	4.3%
Nov-16	514510.276	46,067.23	-	26416.808	536,357.25	1,676.00	23464.898	1048.9	-	4.2%
Dec-16	512509.73	55,754.42	-	23464.898	535,876.33	737.00	25357.969	2431.7	-	4.6%
Jan-17	530554.11	53,955.20	-	25358	542,479.50	-	24710.673	975.1	32.20	6.8%
Feb-17	468523.3	34,574.90	32.20	24710.673	474,824.10	-	23916.8	861.7	28.30	5.3%
Mar-17	521765.6	18,574.10	28.30	23916.8	509,605.40	-	25048.9	558.1	28.60	5.1%
Apr-17	495025.1	9,185.80	28.60	25048.9	491,600.50	-	27683.2	707.7	33.90	1.8%
May-17	318293.2	10,961.70	33.90	27683.2	328,482.60	2,253.60	28205.5	737.9	35.20	-0.8%
Jun-17	528866.1	12,505.30	35.20	28205.5	531,196.50	5,153.70	27784.9	1776.2	30.00	0.6%
Jul-17	513962.2	15,098.50	30.00	27784.9	520,633.80	-	26504.7	1546.1	26.50	1.5%
Aug-17	517908.8	31,825.50	26.50	26504.7	537,943.20	456.70	24168.6	1415.6	34.00	2.1%

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Overall Facility Water Balance

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

Freshwater

- REC (FW1): The sum of all freshwater streams received. MacKay River receives fresh water from three source water wells.
- INVOP (FW4): Fresh water tank opening inventory. This volume is carried forward from last month's closing inventory.
- INVCL (FW5): Fresh water tank closing inventory. This volume takes into consideration levels in Fresh water tanks.

Steam

- INJ (INT): The total steam injected at the wells. Steam is metered by subtracting total BFW feed to all OTSG and Cogen at MR minus the total blowdown.

Water

- REC (PW1): The water received from the wells..
- INVCL (PW5): Water tank closing inventory. This volume takes into consideration levels in water tanks.
- INVOP (PW4): Water tank opening inventory. This volume is carried forward from last months closing inventory.
- INJ (DIT): Water disposed from the facility.
- UTIL (PW7): Water Stream used at the injection facility for utility and waste steam and not recovered due to venting.

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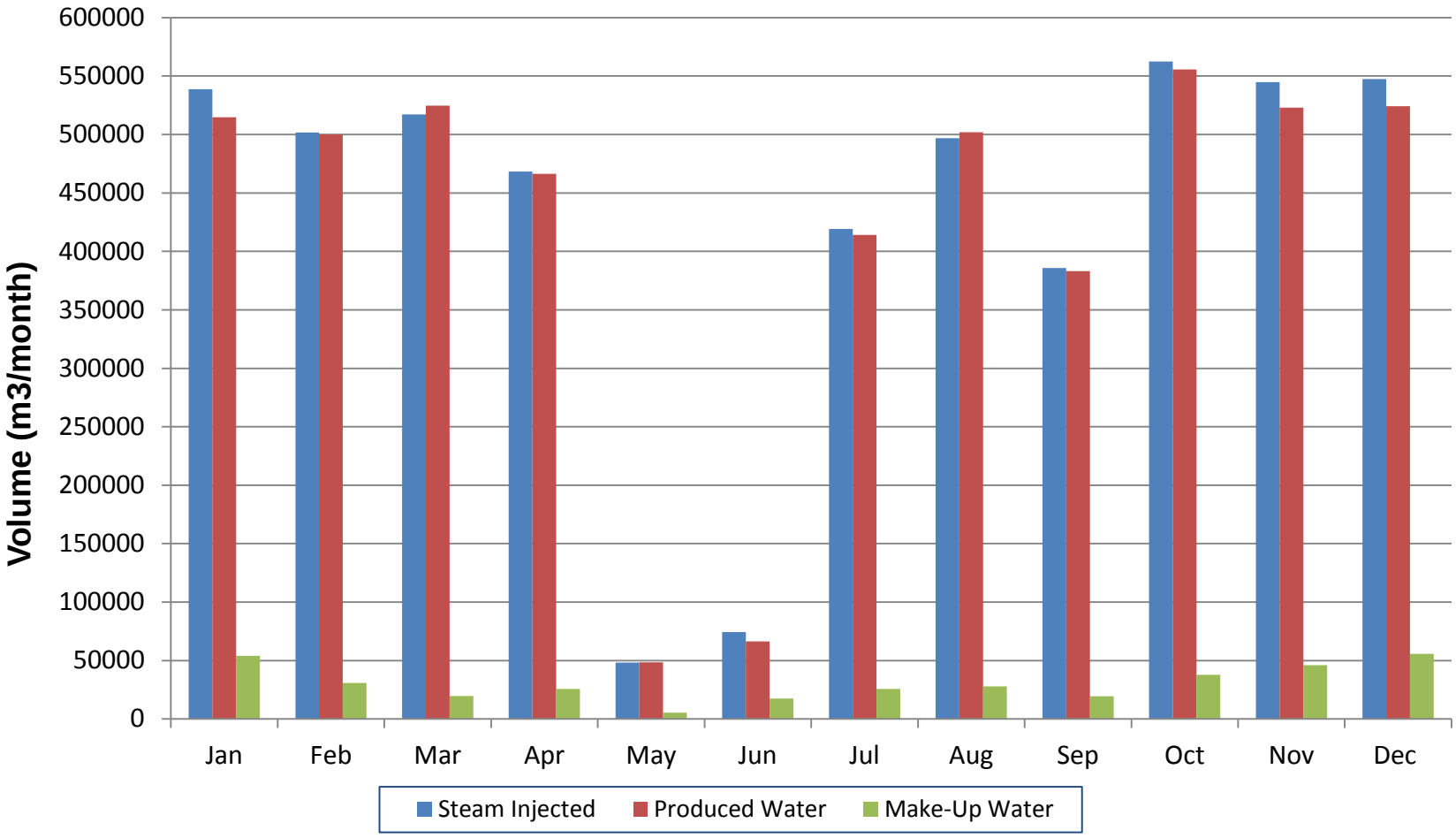
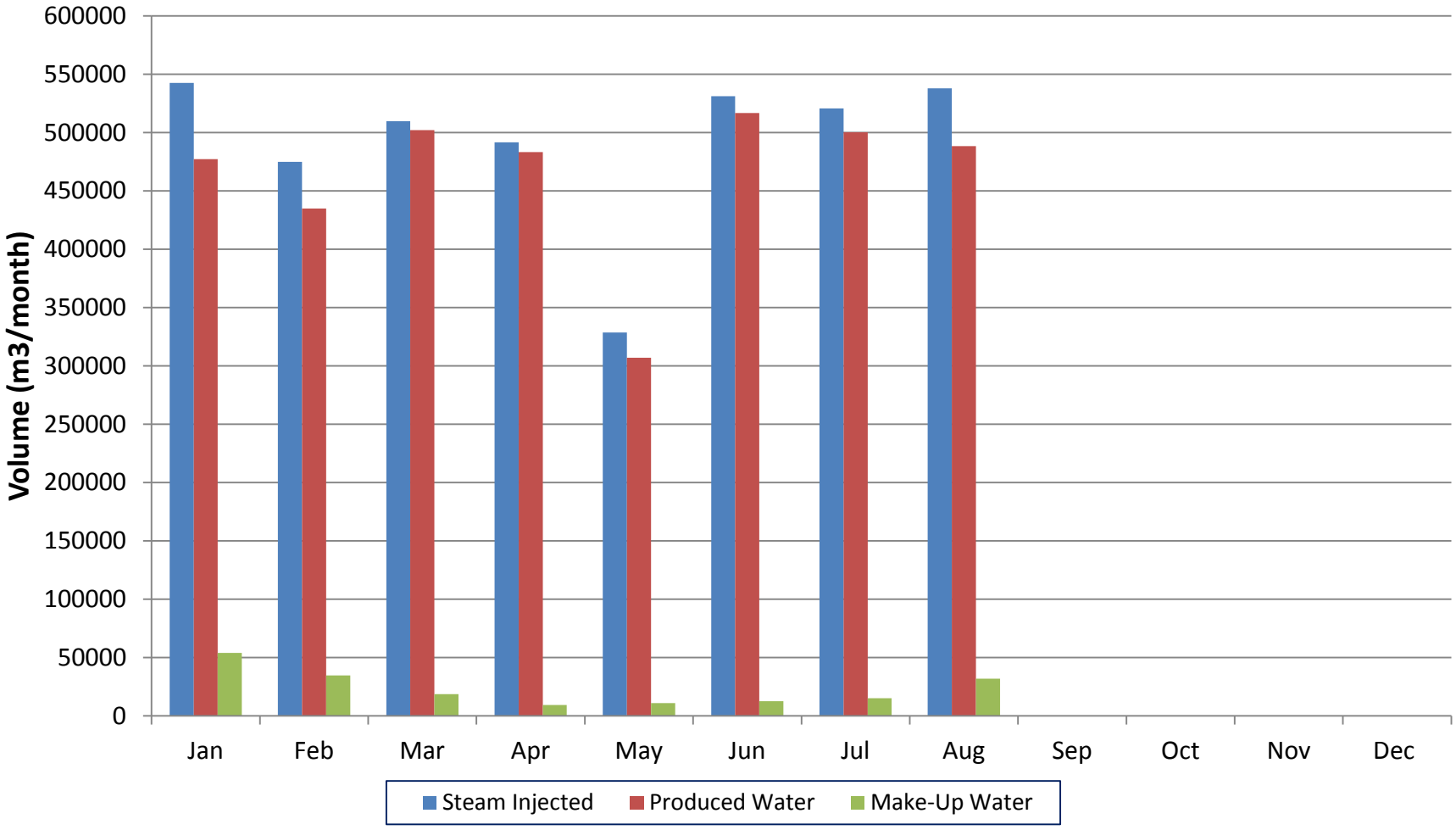
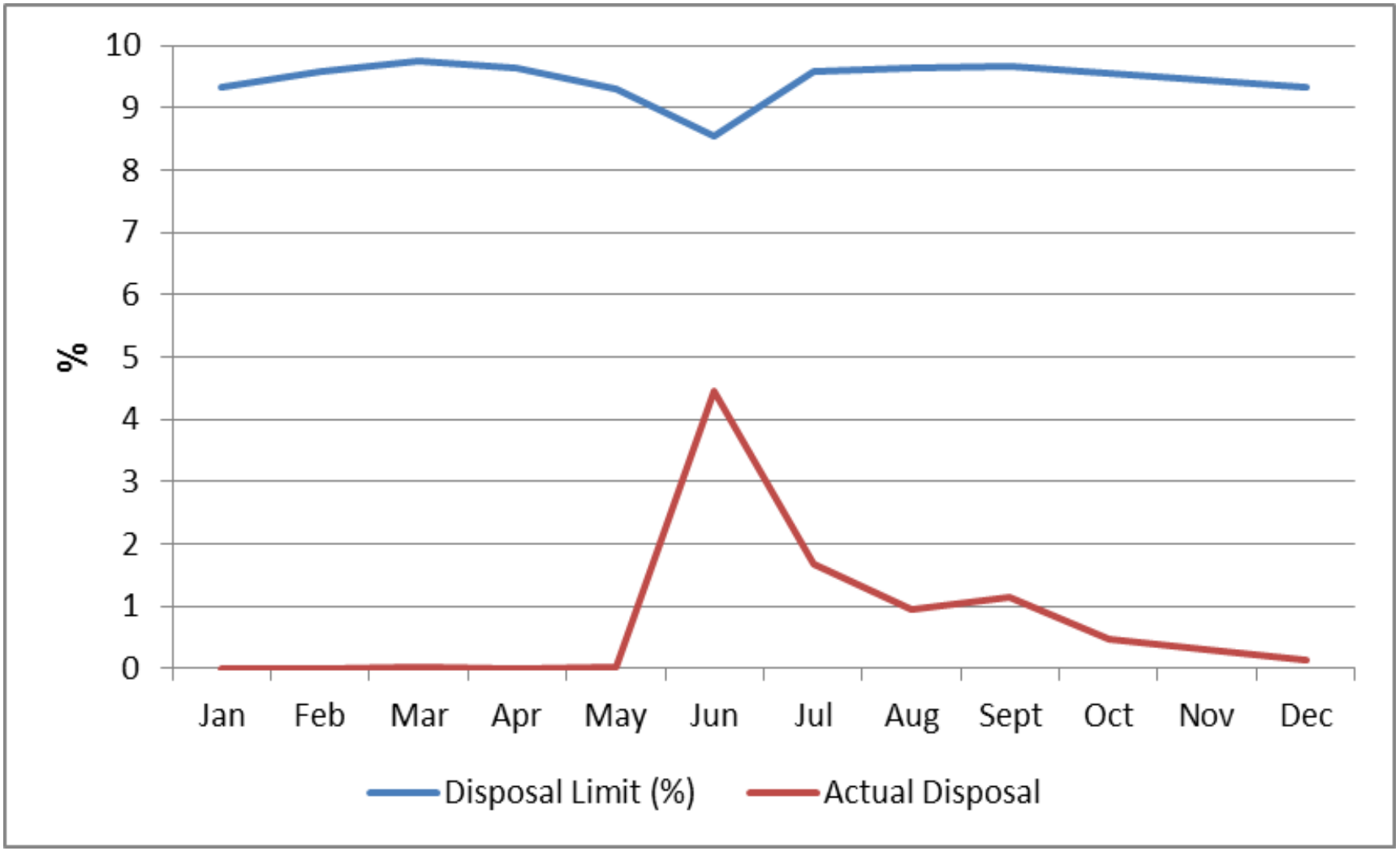
Water Balance (2016)



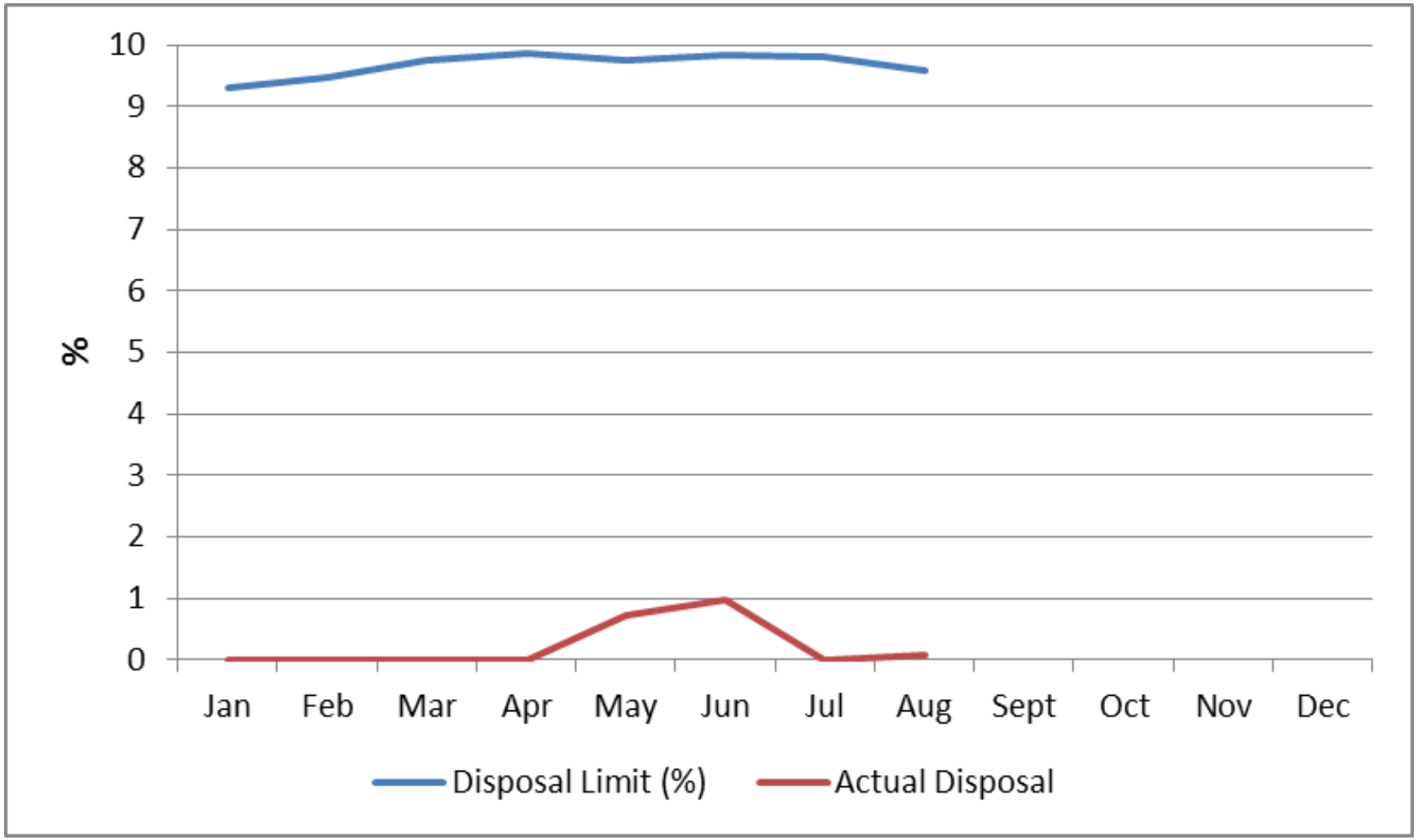
Water Balance (2017 YTD)



Water Disposal % (2016)



Water Disposal % (2017 YTD)



Low Pressure Blowdown Recycle (2016 & 2017 YTD)

Blowdown Recycle = 100%:

- Blowdown treated in the Water Plant:
  - YTD: 51,230 m^3/month
    2016: 50,165 m^3/month(Lower as a result of plant shutdowns due to wildfires)
- Blowdown treated in the Zero Liquid Discharge (ZLD) Plant:
  - YTD: 38,486 m^3/month
    2016: 33,719 m^3/month (Lower as a result of plant shutdowns due to wildfires)

Trucked volumes from Diversion Lagoon:

- 2017: 7,864 m^3 (January 1,2017 – August 31, 2017);
- 2016: 25,964 m^3 (January 1,2016 – August 31, 2016).

Note: The diversion lagoon is filled by crystallizer concentrate during purges *and* by landfill leachate after periods of rain.

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MacKay River Landfill / Waste Management

AER Approval WM-072E Class II Oilfield Landfill – Waste Streams :

- Warm lime Softener Sludge – residual from the water treatment plant (Unit 200) = solids , lime and polymers
- Salt Waste – Residual from the evaporator - Unit 800 waste = salt brine dust.

Volumes of solids (salt/lime) to landfill

Year	Volume (m^3)
2015	28,019
2016	20,685
2017	16,646 *

Source: Annual Landfill Report

Total volume of landfill fluids to facility

Year	Volume (m^3)
2015	14,465
2016	25,988
2017	20,449 *

Source: Annual Landfill Report

*Volumes estimated in August 2017

- Waste services contract in place:
  - Addresses hazardous, scrap metal, domestic waste.

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MacKay River Landfill / Volume of fill Survey

Survey was completed on June 11 2017 by drone

Off-Site Brine Water Disposal

Location of disposal site:

- Eco Industrial Waste Plant;
- 11-17-53-23-W4M.

- Brine water is disposed of off-site when the diversion tank and diversion lagoon reach capacity and the ZLD system cannot process the boiler blowdown from Unit 400.

- Water sources in the diversion lagoon include: precipitation, leachate from the MacKay River Landfill and excess boiler blowdown water during upset conditions.

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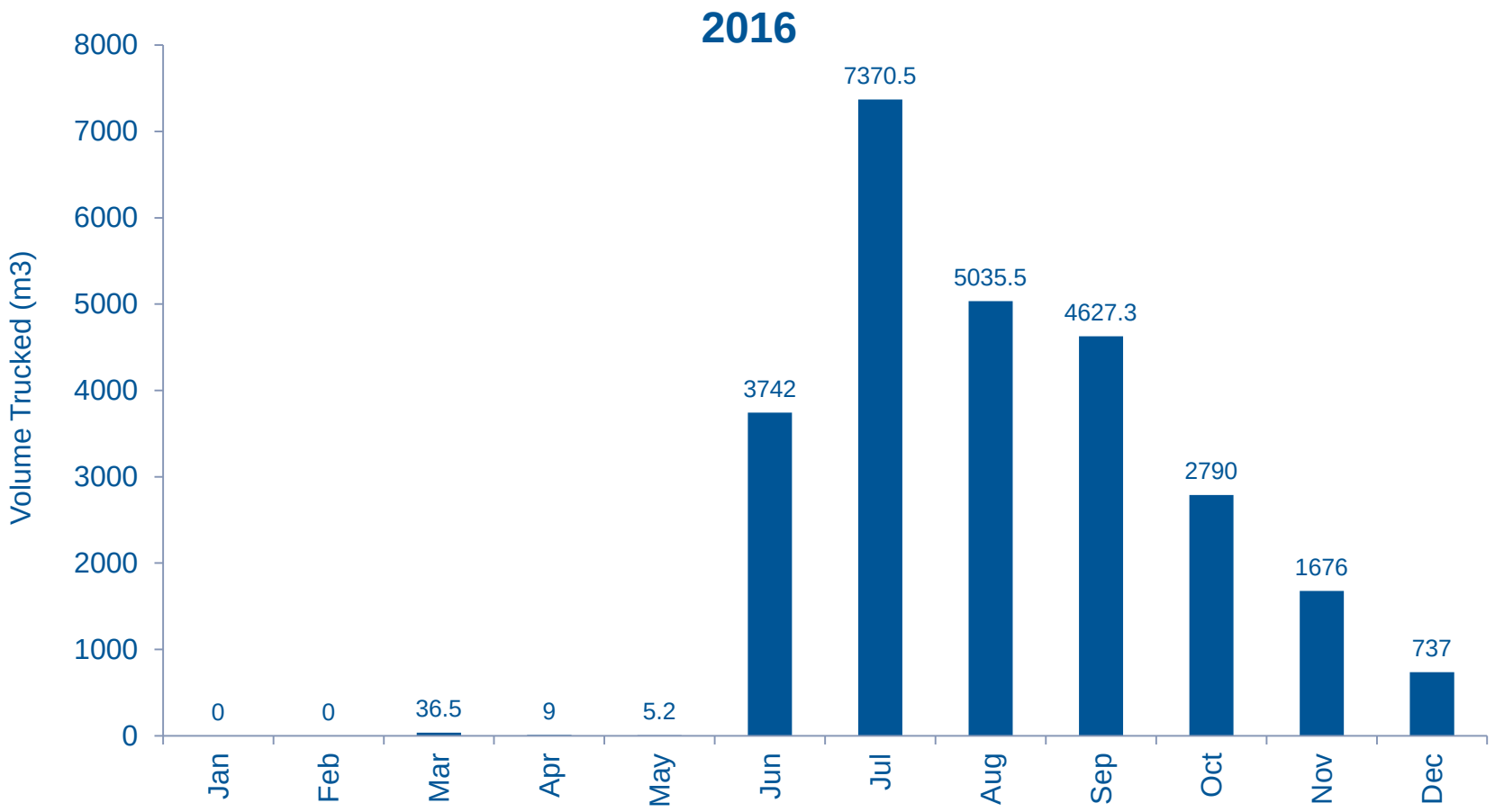
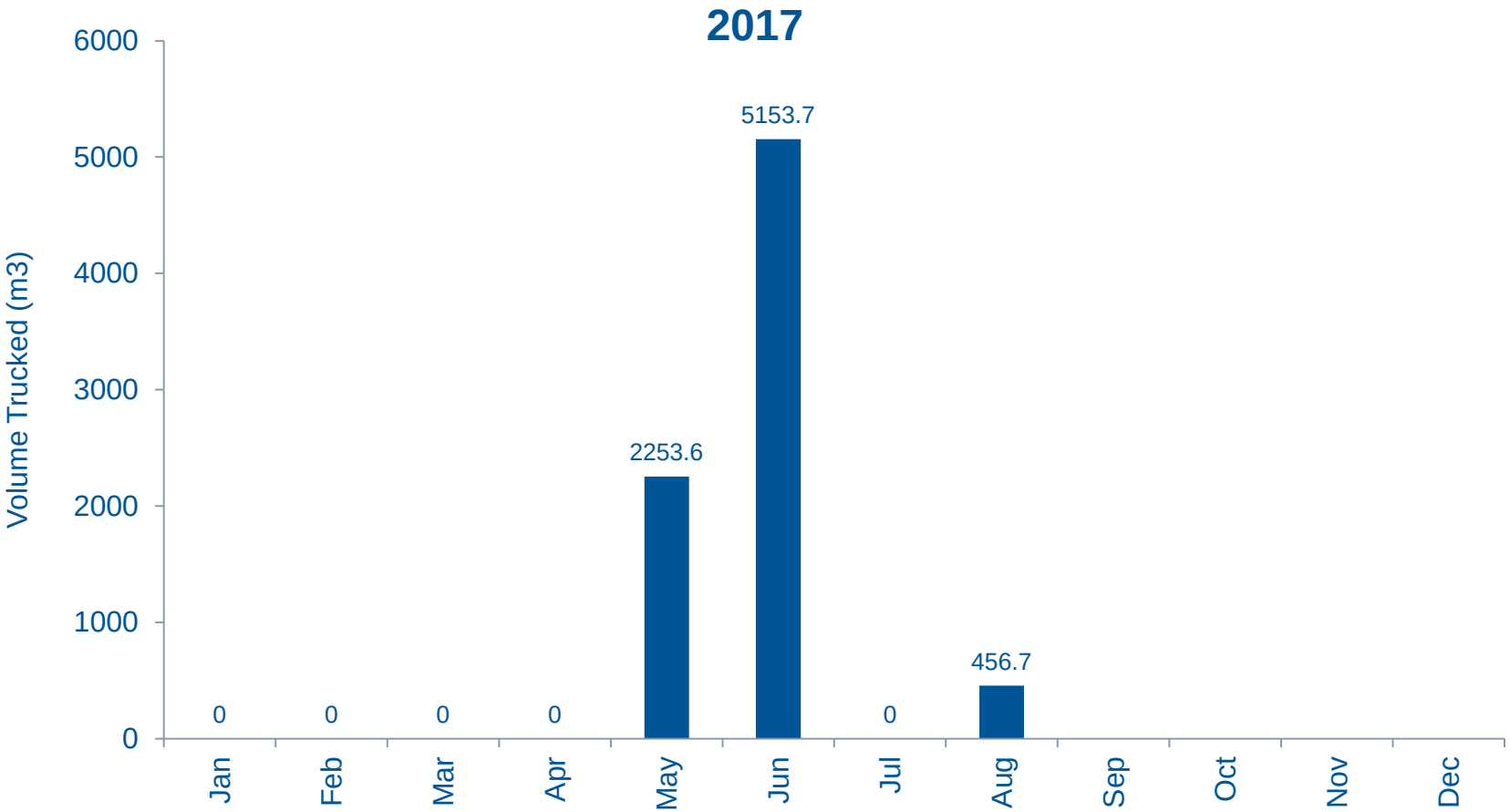
Off-Site Brine Water Disposal (2016)



- Volumes reported via Petrinex

Off-Site Brine Water Disposal (2017 YTD)



- Volumes reported via Petrinex

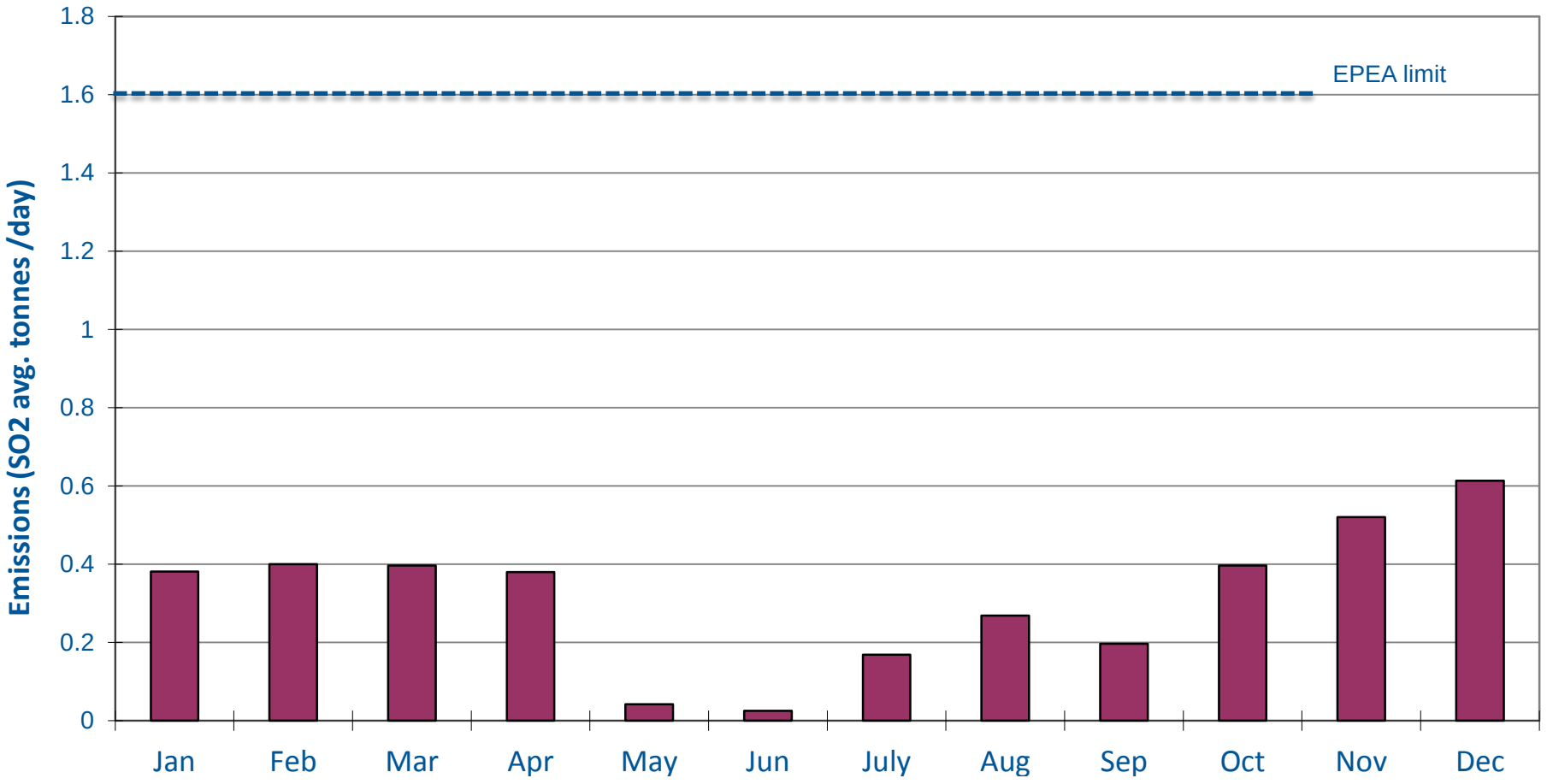
MacKay River Performance Presentation

Sulphur Production

Sulphur Production

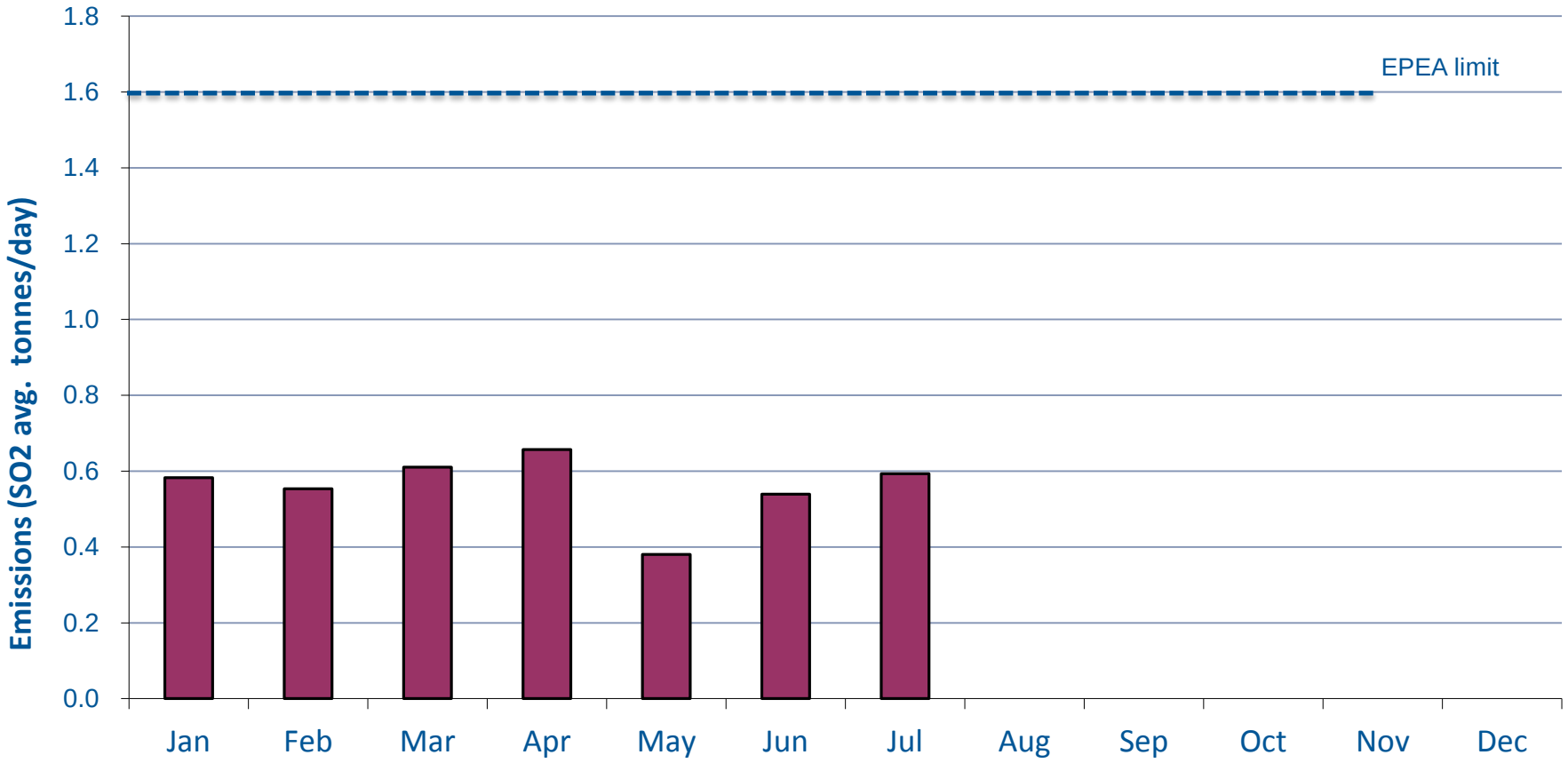
- Currently there are no sulphur recovery facilities at the MacKay River Project;
- All produced sulphur is burnt in the overall process;
- Present trends indicate an SRU will not be required for the Project;
- Suncor will continue to monitor the sulphur trends.

Sulphur Dioxide Emissions (2016)



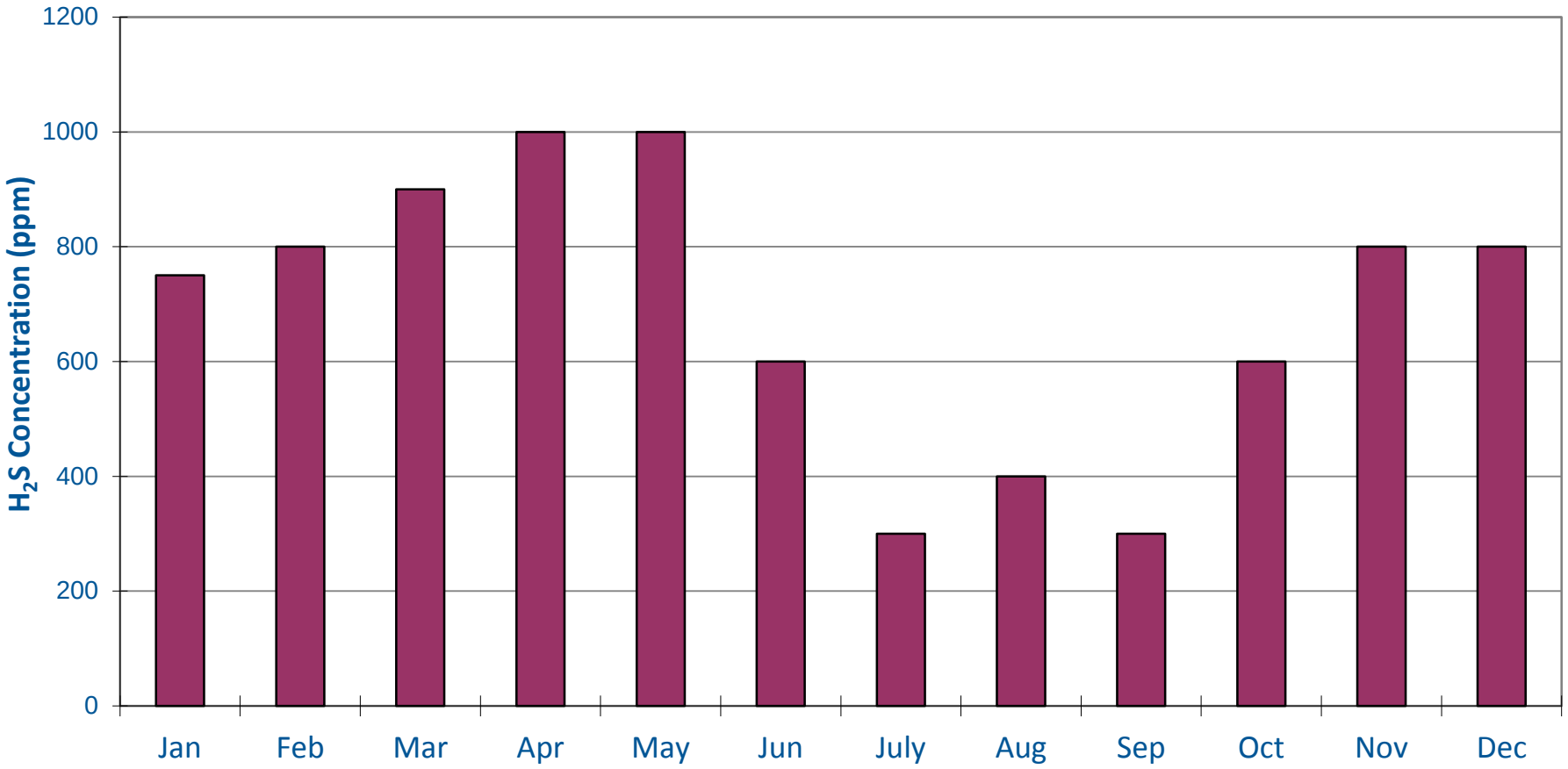
- SO_2 emissions are based engineering estimations that use H2S results from monthly produced gas samples

Sulphur Dioxide Emissions (2017 YTD)



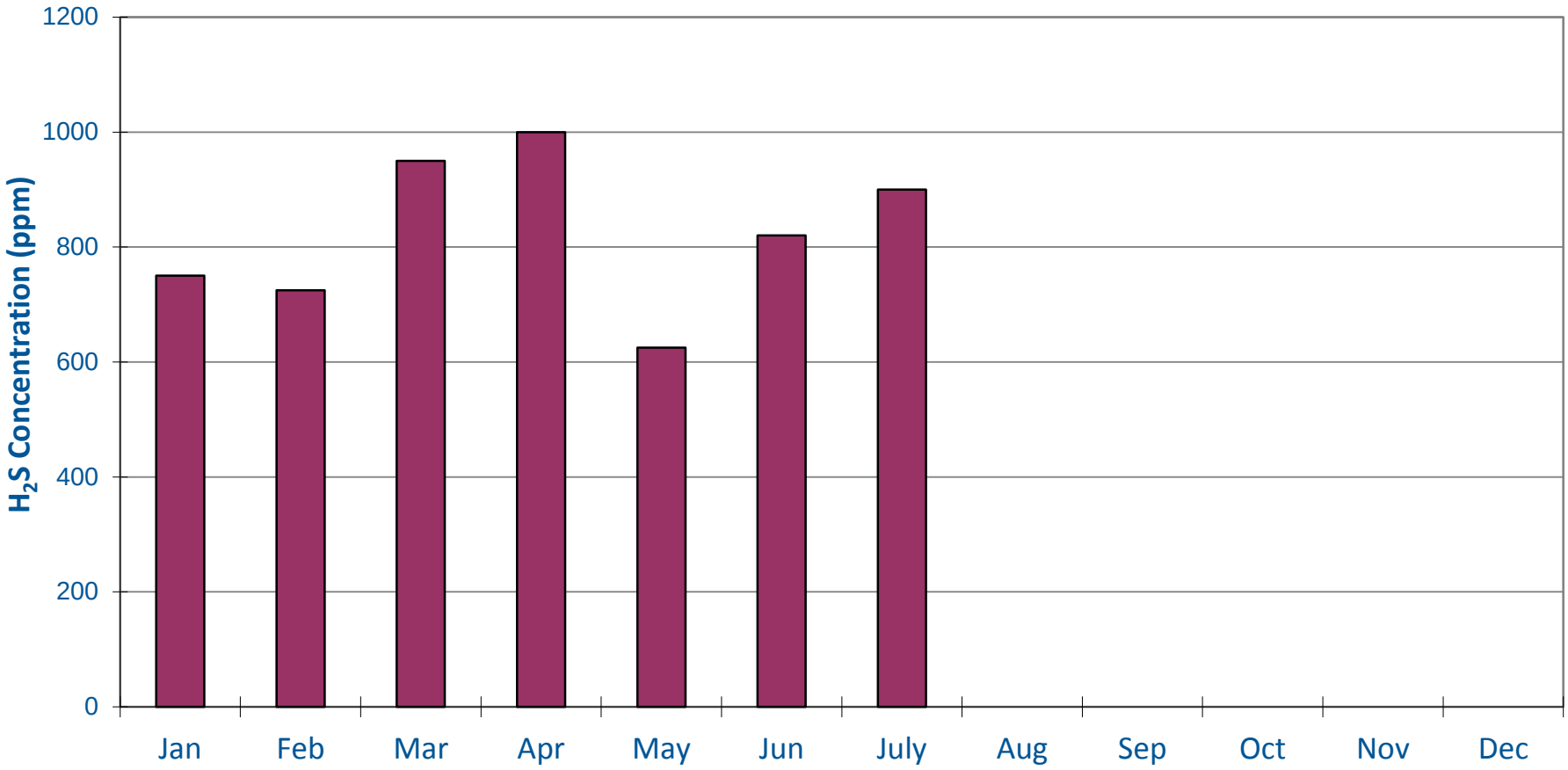
- SO_2 emissions are based engineering estimations that use H2S results from monthly produced gas samples

H_2S Concentration (2016)



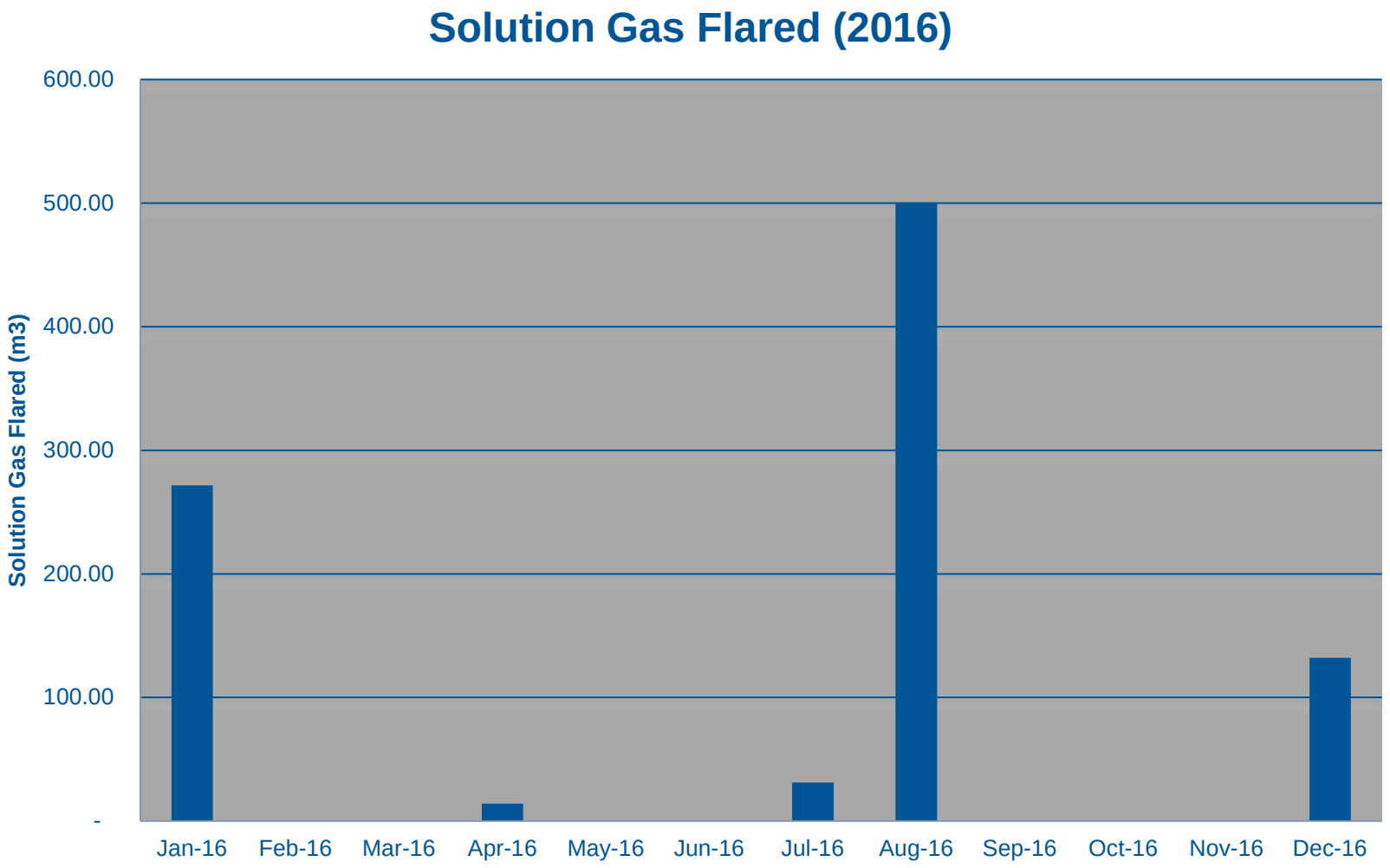
- H_2S concentrations are measured in monthly produced gas samples.

H_2S Concentration (2017 YTD)

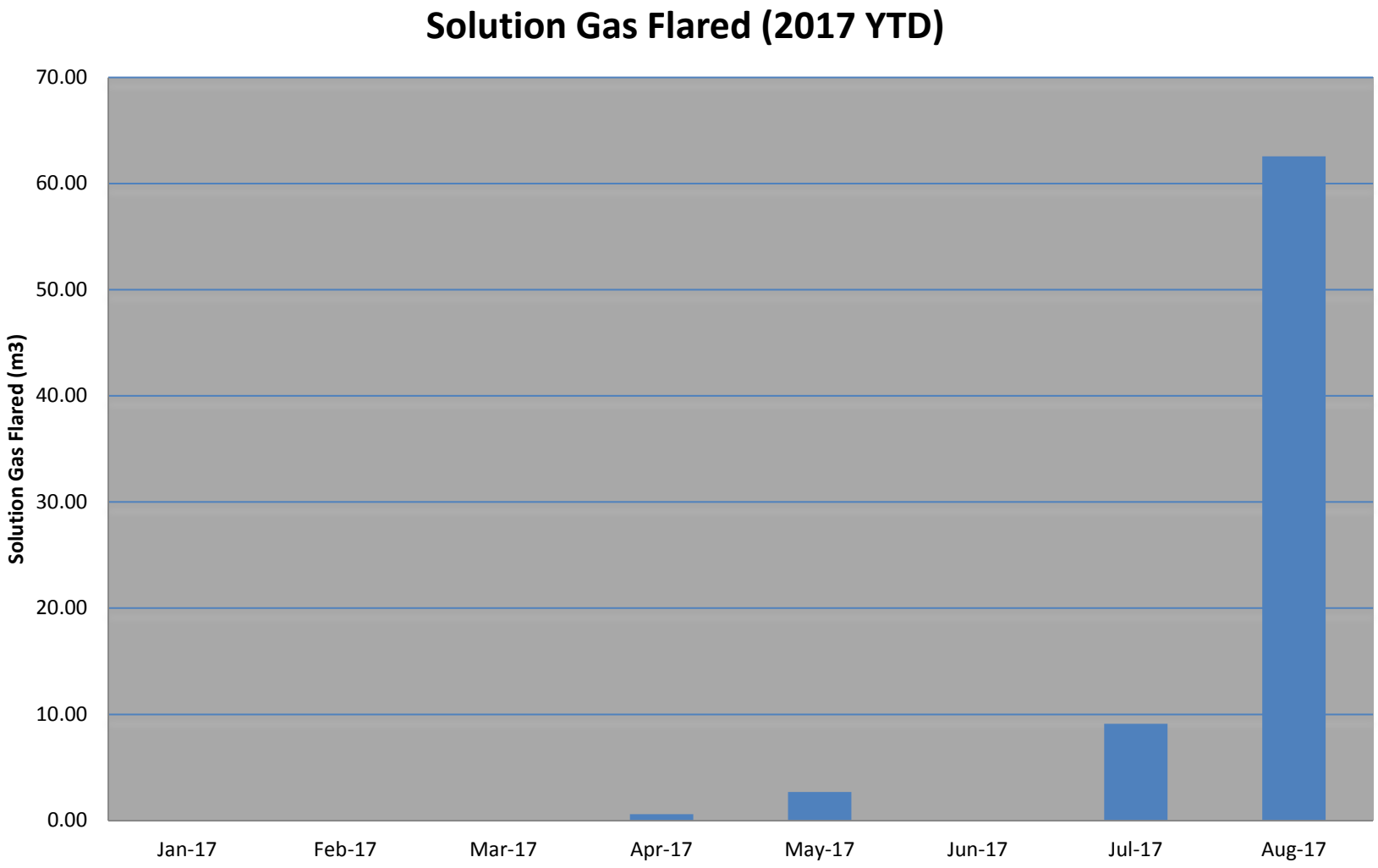


- H_2S concentrations are measured in monthly produced gas samples.

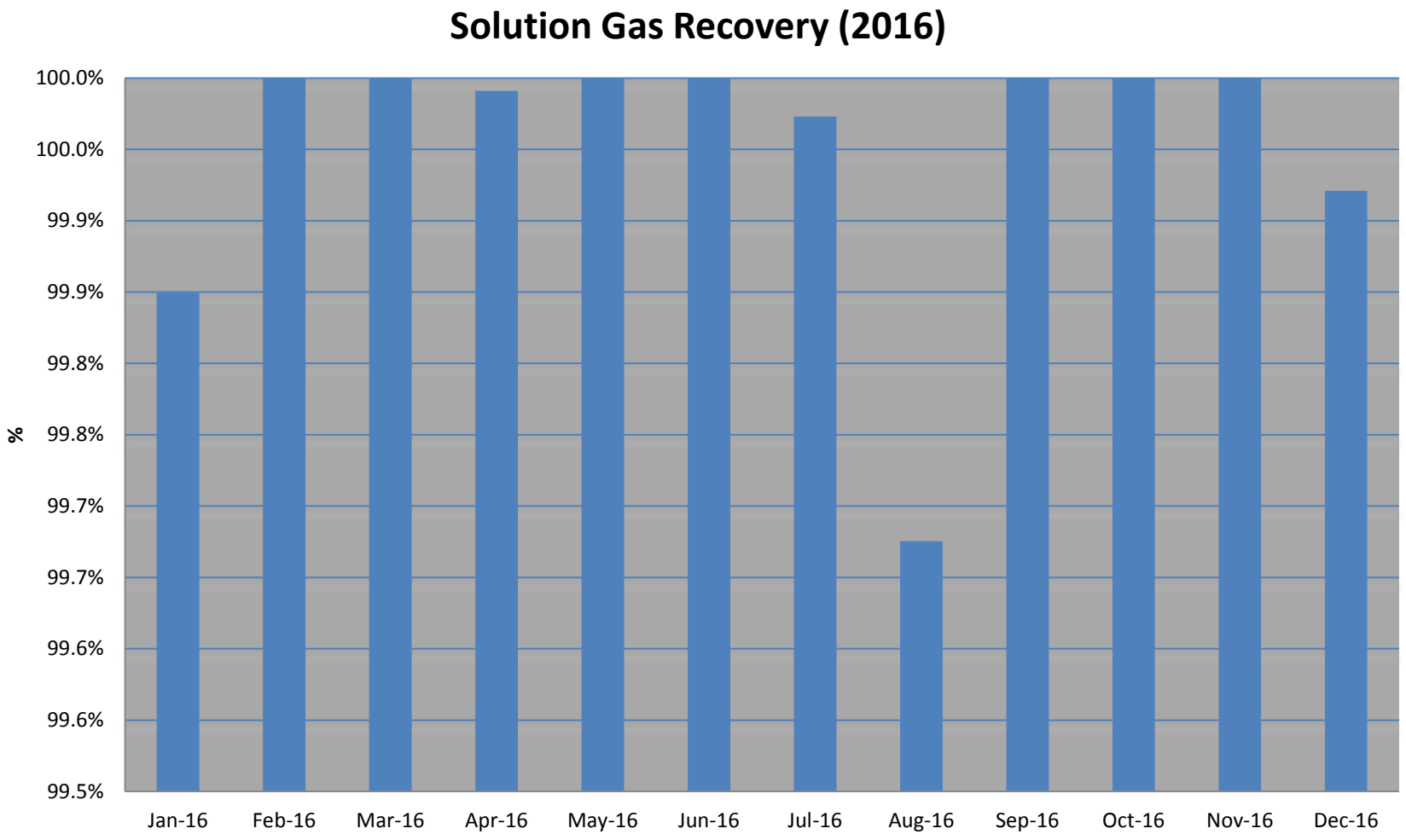
Solution Gas Flared (2016)



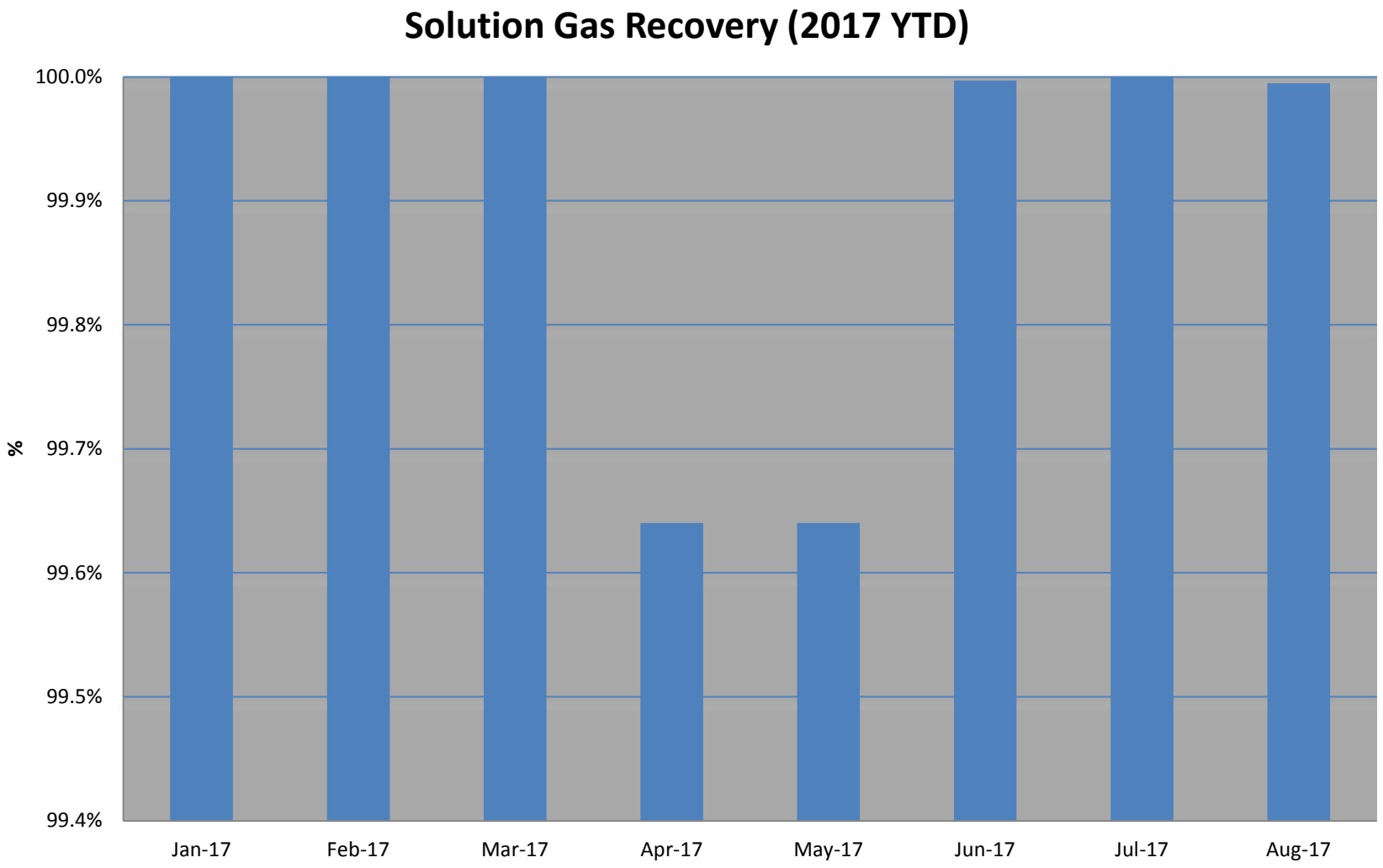
Solution Gas Flared (2017 YTD)



Solution Gas Recovery (2016)



Solution Gas Recovery (2017 YTD)



MacKay River Performance Presentation

Environmental Performance

Greenhouse Gas Emissions (GHG)

Submitted the annual SGER report to Alberta Climate Change Office and NPRI GHG report to Environment Canada:

- GHG calculation methodology developed to improve transparency.

Total direct emissions for 2016:

- 295,093 tonnes of CO_2equiv;
- Total emissions have been reported to ACCO.

Total direct emissions for 2017 (Budget):

- 437,249 tonnes of CO_2equiv*;
- Total emissions will be reported to ACCO.

Approved baseline emissions intensity:

- 0.1174 tCO_2e/m^3 (Global Warming Potential Updated).

* 2017 actual data to be verified in 2018

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Ambient Air Monitoring

- WBEA Air Monitoring Stations:
  - Ambient air quality data available for viewing on WBEA website.

- Passive Air Monitoring:
  - Four passive air monitoring stations at MacKay River;
  - Monthly passive air monitoring performed by a site representative and sample analysis reports submitted to AER by Suncor for H_2S and SO_2 ;
  - In 2016 passive sampling results showed: average H2S concentration was 0.10 ppb and average SO2 was 0.48 ppb;
  - In 2017 (YTD) passive sampling results showed: average H_2S concentration was 0.06 and average SO2 was 0.59 ppb.

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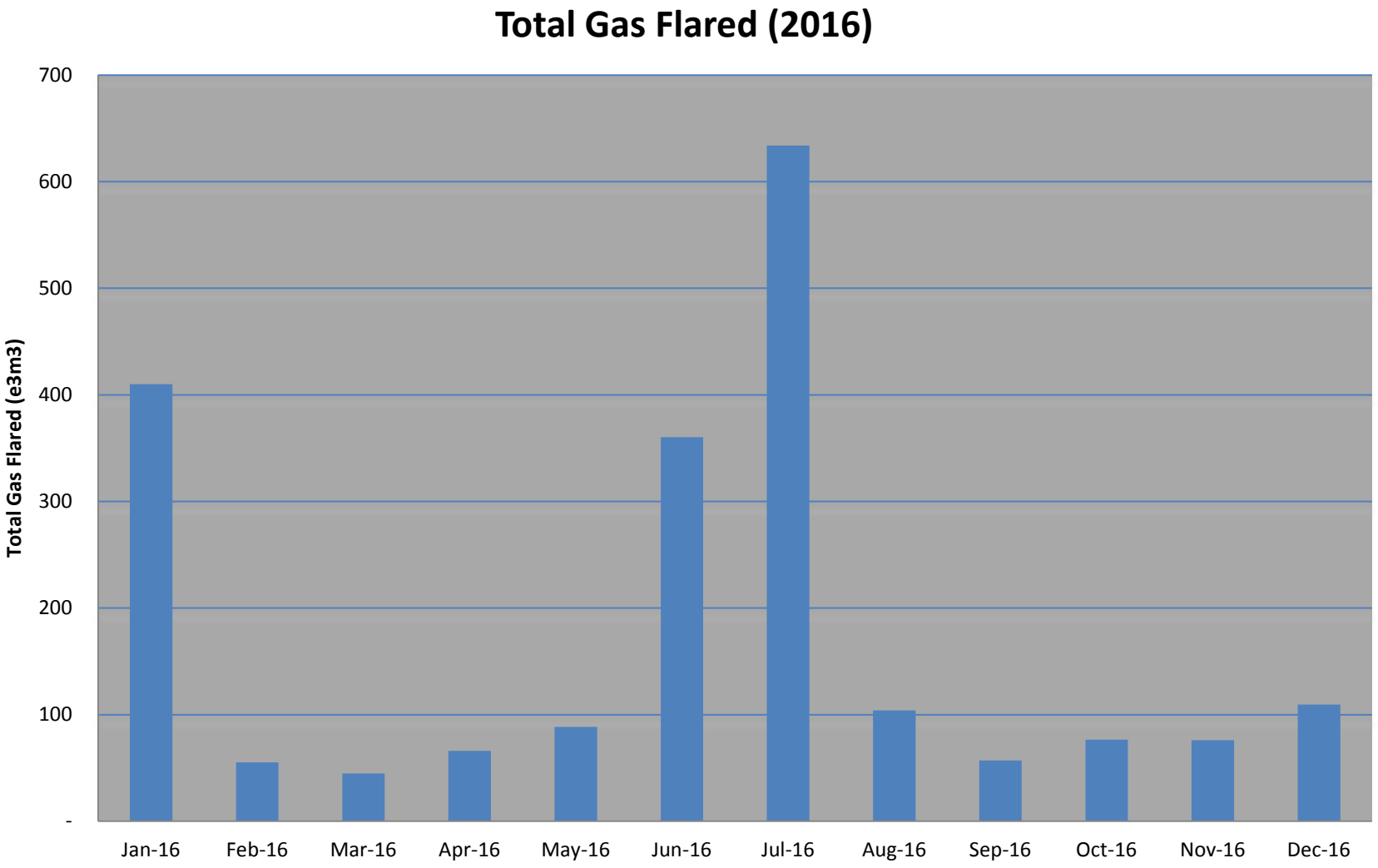
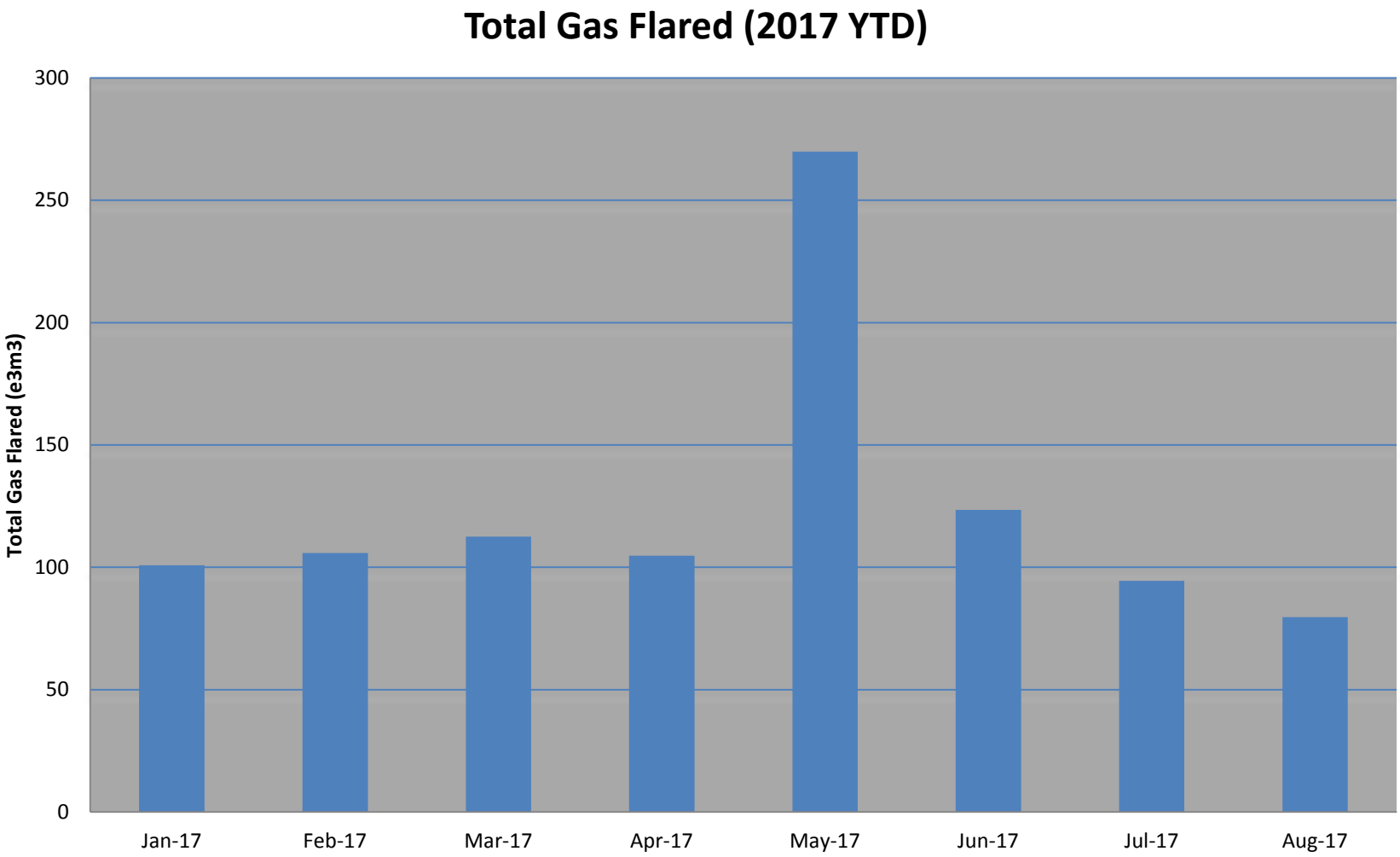
Total Flared Gas (2016)



Total Flared Gas (2017 YTD)



Regulatory Compliance (2016 and 2017 YTD)

- **2016:**
  - March 1, 2016: AER site visit to discuss stack testing (Warren Grimes);
  - March 7, 2016: MARP Inspection (Paulette Bugajski);
  - March 16, 2016: Inspection of flow meters on Pads (Tim Chrest);
  - April 12, 2016: Landfill Inspection (Phoebe Thompson);
  - June 14, 2016: Post-Wildfire Inspection (Phoebe Thompson / Kelsey Martin);
  - Nov 07, 2016: Blowdown fluid release inspection – (Glen Wolfe)

- **2017:**
  - May 30, 2017: Landfill Inspection (Phoebe Thompson);
  - May 30, 2017: Hydrochloric Acid Release (Phoebe Thompson)
  - May 31, 2017 AER conducted Watercourse Crossing Inspection along the Aostra road.(Virginia Hudges)

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Incident Summary (2016– 2017 YTD)

AER Reportable Releases for 2016

- 7 reportable spills;
- 11 reportable flaring events.
- 5 contravention reports (Landfill)

Voluntary Self Disclosures 2016

- WSW's missing Dataloggers – remediation/installation complete Sept 2016;
- Landfill – tear in liner of Phase II cell – repair complete June 2016.
- Leachate Head volumes exceed 300mm

AER Reportable Releases for 2017 (YTD – Sept 30):

- 6 reportable spills;
- 6 reportable flaring events.
- 5 contravention reports

Voluntary Self Disclosures 2017 (YTD – Sept 30):

- Injection of NCG without AER authorization (BEST Site)
- MARP – missed internal inspection to fulfill D17;
- Landfill – underdrain issues .
- Landfill – Phase II cell issues
- Missing to submit D56 notification in regards to abandoned pipeline
- Failure of the primary measurement as per D17.

Environmental training:

- Core environmental awareness training requirement;
- Development of the new internal run off release procedure.
- Development of the new Landfill operation manual
- Highlights Spill Awareness, Waste Management, Flaring reporting, wildlife management, etc.

Scheme Approval Amendments

- **Amendment 8668A**
  - Changed annual average volume to 33,000 bpd (5,250 m^3/d)
- **Amendment 8668B**
  - Increase to project area
- **Amendment 8668C**
  - Additional project area
  - Approval to inject non-condensable gas
- **Amendment 8668D**
  - Additions to project area
  - Increase to annual average volume to 72,964 bpd (11,600 m^3/d)
- **Amendment 8668E**
  - Approval to drill four well pairs
- **Amendment 8668F**
  - Approval to change approval holder from Petro-Canada to Suncor
- **Amendment 8668G**
  - Approval to undertake amendments & modifications to CPF systems
  - Approval tie-in 6 well pairs to well testing facilities
- **Amendment 8668H**
  - Approval to conduct non-condensable gas injection test on Pad 21 wells
- **Amendment 8668I**
  - Approval to conduct non-condensable gas injection at the Section 16 Test Project
- **Amendment 8668J**
  - Approval to transfer portions of the Dover project area into the MacKay River project area
- **Amendment 8668K**
  - Approval to tie-in 16 well pairs to well testing facilities
- **Amendment 8668L**
  - Approval to the remove the limiting factor of a mole percent restriction for the B Pattern non-condensable gas injection test on Pad 21
- **Amendment 8668M**
  - Approval to inject chemical into Pad 22 wells
- **Amendment 8668N**
  - Approval to abandon 3 wells and suspend 1 well on Pad 20
- **Amendment 8668O**
  - Approval to change Phase 5F well trajectories
- **Amendment 8668P**
  - Approval to develop Pads 750/751/28 and add 2 sections to project area
- **Amendment 8668Q**
  - Approval to conduct a pilot of water treatment technologies
- **Amendment 8668R**
  - Approval to abandon well G1I
- **Amendment 8668S**
  - Approval to conduct chemical injection test on Pad 21 (D-Pattern Injectors)

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Scheme Approval Amendments

- **Amendment 8668T**
  - Pad 819 Approval
- **Amendment 8668U**
  - Maximum Operating Pressure Approval
- **Amendment 8668V**
  - NCG Expansion Project and Phase 5D/F Chemical Injection Approval
- **Amendment 8668W**
  - MR CPF Expansion Project and Directive 081 Waiver Approval
- **Amendment 8668X**
  - Administrative reissue approval
- **Amendment 8668Y**
  - WHIP for Phases 5B2, 5D and 5F Patterns approval
- **Amendment 8668Z:**
  - Pad 828 change from 3 well pairs to 2 wells pairs and correction of well UWIs on Pad 21 Chemical Injection Test (D-Pattern Injectors) approval issued December 10, 2014.
- **Amendment 8668AA:**
  - Phase 1 NCG design amendment approval issued December 19, 2014.
- **Amendment 8668BB:**
  - Phase 2 and Phase 3 Chemical Co-Injection (E, F and G Patterns) approval issued January 1, 2015.
- **Amendment 8668CC:**
  - Approval for E1P Sidetrack well issued January 27, 2015.
- **Amendment 8668DD:**
  - Approval for NN6P Sidetrack well issued February 3, 2015.
- **Amendment 8668EE:**
  - Approval for VX™ multiphase meter on Pad 824 issued February 19, 2015.
- **Amendment 8668FF:**
  - Approval for NCG Test at OO5I well on pad 24 issued March 17, 2015.
- **Amendment 8668GG:**
  - Approval to conduct CO2 Co-Injection at the OO9 well pair on Pad 24 issued April 13, 2015.
- **Amendment 8668HH:**
  - CO2 Co-Injection amendment to change to OO8 well pair on Pad 24 issued.
- **Amendment 8668II:**
  - Pad 824 Thermal Compatibility Assessment approval issued July 14, 2015.
- **Amendment 8668JJ:**
  - Approval for NCG Test at OO7I issued July 29, 2015.
- **Amendment 8668KK:**
  - Approval for an alternate MOP Strategy Trial.
- **Amendment 8668LL:**
  - Approval for C2IPB Sidetrack Well.
- **Amendment 8668MM:**
  - Approval for Pad 750 Thermal Compatibility Assessment.

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Scheme Approval Amendments

- **Amendment 8668NN:**
  - Approval to increase MWHIP for all operating wells.
- **Amendment 8668OO:**
  - Approval to alter DA, DB, DC and DF Pattern MWHIPS;
- **Approval to adjust CO2 co-injection rate;**
  - Approval to extend chemical co-injection test at the D pattern wells on Pad 21.
- **Amendment 8668PP:**
  - Approval for abandonment of A3I.
- **Amendment 8668QQ:**
  - Approval to change Clause 32.
- **Amendment 8668RR**:
  - CO2 Extension
- **Amendment 8668SS:**
  - Phase 2 and 3 NCG Injection
- **Amendment 8668TT:**
  - Temporary Increase to BH MOP for Unloading
- **Amendment 8668UU:**
  - Subsurface Heating Pilot

Amendments Made in Reporting Year

- **Amendment 8668RR:**
  - CO2 Extension
- **Amendment 8668SS:**
  - Phase 2 and 3 NCG Injection
- **Amendment 8668TT:**
  - Temporary Increase to BH MOP for Unloading
- **Amendment 8668UU:**
  - Subsurface Heating Pilot

Current Amendments / Applications

- Currently there are no applications under review that are related to MacKay River;
- Suncor will be submitting a separate scheme approval in Q4 2017 for the In Situ Solvent Demonstration Facility that will be located within the MacKay River project area.

Environmental Initiatives

Suncor supports the Joint Oil Sands Monitoring Program and is also an active member of:

- The Wood Buffalo Environmental Association (WBEA) and its continued work through JOSM;
- The Alberta Biodiversity Monitoring Institute (ABMI);
- The Athabasca Watershed Planning and Advisory Council (AWC-WPAC);
- The Canadian Oil Sands Innovation Alliance (COSIA);
- Mining Association of Canada Toward Sustainable Mining initiative;
- Oil Sands Spill Coop Area Y;
- Alberta Association of Conservation Offsets (AACO).

Suncor is in ongoing consultation with:

- Regional stakeholders;
- Aboriginal Communities and the local Municipality.

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Land Disturbance and Reclamation

- Total area of land cleared in 2015 was 12.05 ha:
  - Pad 8.24– 4.35 ha;
  - SML 140005 – 7.0 ha;
  - Gathering Line – 0.7 ha.

- No tree clearing, soil conservation or reclamation activities took place in support of the project in 2016; however, ~20 ha of firebreaks were installed to protect the facility (3 ha on Suncor dispositions; 17 ha off Suncor dispositions).

- Estimated total area of land to be cleared in 2017:
  - A small observation well was constructed in Q1 2017 and is the only disturbance planned for 2017

- A Project-Level Conservation, Reclamation & Closure Plan (PLCRCP) is due to AER October 31, 2018. The Plan will follow AER's SED-001 and will consider Suncor's experience writing the Firebag PLCRCP due October 31, 2017.

Note: Estimated numbers do not include oil sands exploration (OSE) programs

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Regulatory Compliance

- As noted earlier Suncor has communicated with the AER regarding:
  - Landfill findings (AER Ref#: 312291); and
  - Source groundwater level monitoring (AER Ref #: 308679).

- Suncor Energy Inc. is in compliance with all regulatory approvals, decisions, regulations and conditions as described in Decision Report 2000-50; specifically pertaining to:
  - Plant and waste management facility location,
  - Ground level ozone and VOC monitoring,
  - Groundwater monitoring wells,
  - Surface water quality monitoring, and
  - Participation in Regional Initiatives.

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Summary of Key Learnings (Operations)

- Continued focus on Suncor's Safety Task force initiatives driving and reinforcing correct behaviours:
  - Primary focus on operational discipline and leadership;
  - Dedication to improving onsite process and personal safety.

- Continual focus on process indicators continues high performance of reliability:
  - Record consecutive days without unplanned steam outages;
  - Record consecutive days of on-spec boiler feed water.

- Many learnings from a safety and onsite performance perspective post fire at Mackay River- well performance, pipeline availability, etc.;

- Focus on brine dryer operation has significantly reduced offsite disposal. Further improvements and efficiencies to be realized.

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MacKay River Performance Presentation

Future Plans

Future Plans

Project Description	Comments	Status
Mackay River optimization .	Unlocking throughput availability with improvements and testing to design	Currently being evaluated.
Pad 750 ramp up	Continue with ramping up production from Pad 750	Ongoing.
Pad 751 development and construction	Sustaining production	Currently in development


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