

# Cenovus Foster Creek in-situ oil sands scheme (8623) update for 2015

Subsurface  
Calgary | May 31, 2016



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# Advisory

This presentation contains information in compliance with:

*AER Directive 054 - Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes*

Section 3.1.1 Subsurface Issues Related to Resource Evaluation and Recovery

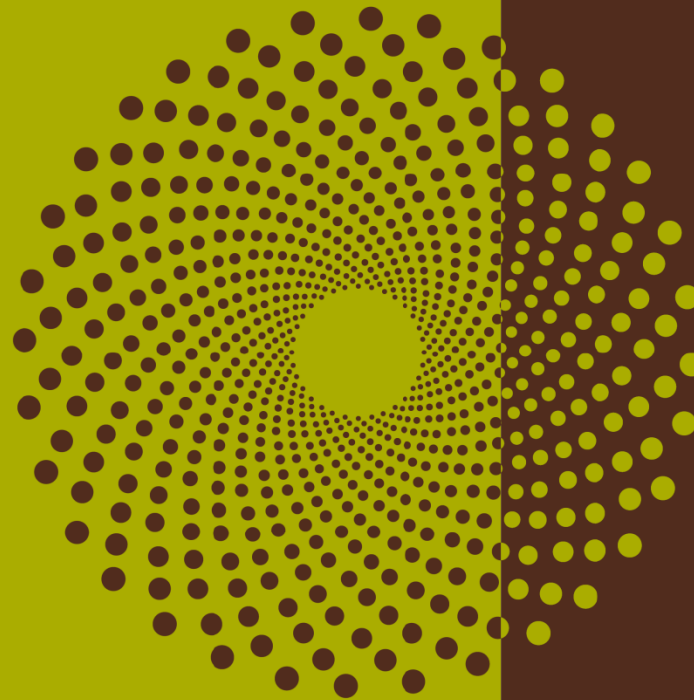
This document contains forward-looking information prepared and submitted pursuant to Alberta regulatory requirements and is not intended to be relied upon for the purpose of making investment decisions, including without limitation, to purchase, hold or sell any securities of Cenovus Energy Inc. The resources estimates contained herein are not reported in accordance with National Instrument 51-101 and are provided solely for the purpose of complying with Alberta regulatory requirements.

Additional information regarding Cenovus Energy Inc., including information regarding contingent resources, is available in our Annual Information Form for the year ended December 31, 2015 and in our Statement of Contingent and Prospective Resources for the year ended December 31, 2015 at [cenovus.com](http://cenovus.com).



# Current project status

Subsection 3.1.1-1



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# About Cenovus

## TSX, NYSE | CVE

Enterprise value	C\$18 billion
Shares outstanding	833 million
2016F production	
Oil sands	151 Mbbls/d
Conventional	54 Mbbls/d
Total liquids	205 Mbbls/d
Natural gas	385 MMcf/d
<b>Total production</b>	<b>269 MBOE/d</b>
2015 proved & probable reserves	3.8 BBOE
Bitumen	
Economic contingent resources*	9.3 Bbbls
Lease rights**	2.0 MM net acres
P&NG rights	4.1 MM net acres
Refining capacity	230 Mbbls/d net

Values are approximate. Forecast production based on February 11, 2016 guidance.

\*See advisory. \*\*Includes an additional 0.5 million net acres of exclusive lease rights to lease on our behalf and our assignee's behalf.



# Foster Creek – current project status



Aerial shot of Foster Creek facility, and steam and emulsion lines

Note that production volumes refer to total cumulative production capacity

- **Phase A - 20k bbls/d on October 2001 (3,180 m<sup>3</sup>/d)**
- **80 MW Cogen on Q1 2003**
- **Phase B - 30k bbls/d (4,770 m<sup>3</sup>/d) complete 2004**
- **Phase C - 60k bbls/d complete 2006 (9,534 m<sup>3</sup>/d)**
- **Phases D & E - 120k bbls/d complete 2009 (19,078 m<sup>3</sup>/d)**
- **Water treating debottleneck and cooling loop complete 2010**
- **Phase F - 150k bbls/d complete 2014**
- **Q1 2016 oil production 121,763 bbls/d (19,358 m<sup>3</sup>/d)**
- **Record oil production day 155,302 bbl (24,730 m<sup>3</sup>)**
- **Approved for Phases A – J**

# Project status – phase D and E update

## Main Plant:

- 120,000 bbls/d (19,078 m<sup>3</sup>/d) oil treating design capacity commissioned in 2009
- Debottleneck on water treating capacity complete in 2010
  - 2014 annualized average was 118,344 bbls/d (18,806 m<sup>3</sup>/d)
  - 2014 exit rate, Dec 2014, was 140,066 bbls/d (22,258 m<sup>3</sup>/d)

## Phases A - E well update:

- E16 Wedge Well™ technology pad on production in June 2014
- E20 Wedge Well™ technology pad on production in August 2014
- E02 Wedge Well™ technology pad on production in September 2014
- E03 Wedge Well™ technology pad on production in November 2014
- E19 Wedge Well™ technology pad on production in December 2014

# Project status – phase F, G and H expansion

## **Expansions have the following design capacities:**

- Phase F – 30k bbls/d oil, online September 2014
- Phase G – 30k bbls/d oil, first production target 2016
  - Phase G Steam online February 2016
- Phase H – 30k bbls/d oil, deferred

## **Phase F well update:**

- W07 Pad on production late February 2016

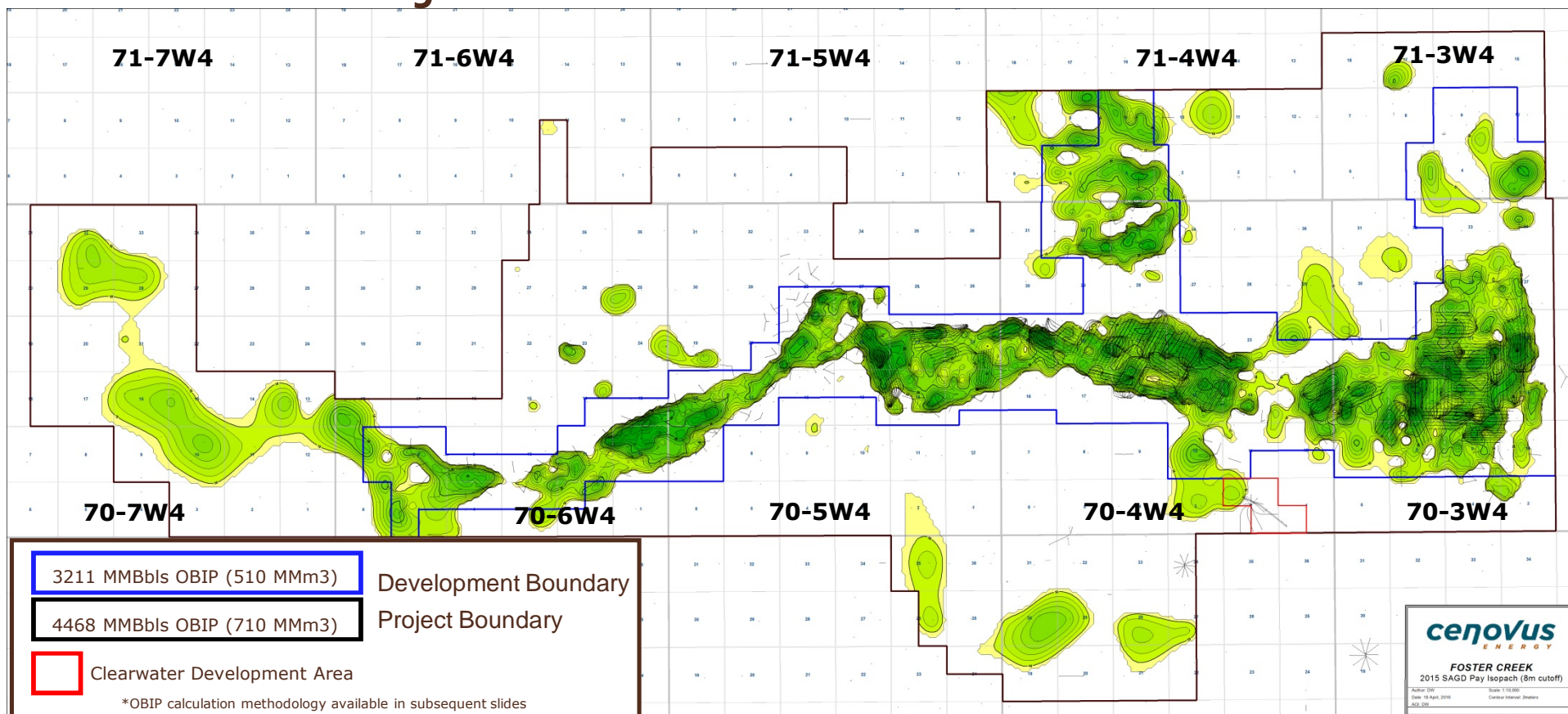
# Geology / geoscience

Subsection 3.1.1 – 2)



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# Current Project Status – SAGD Resource





# Reservoir characteristics

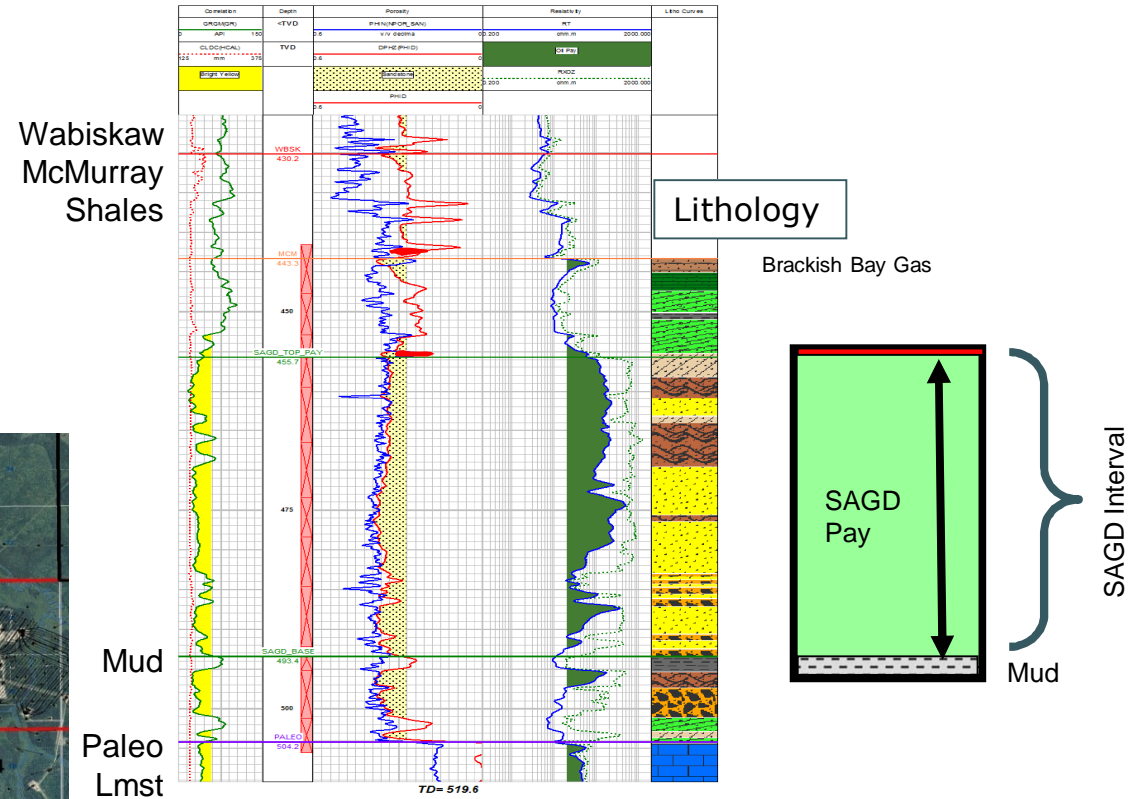
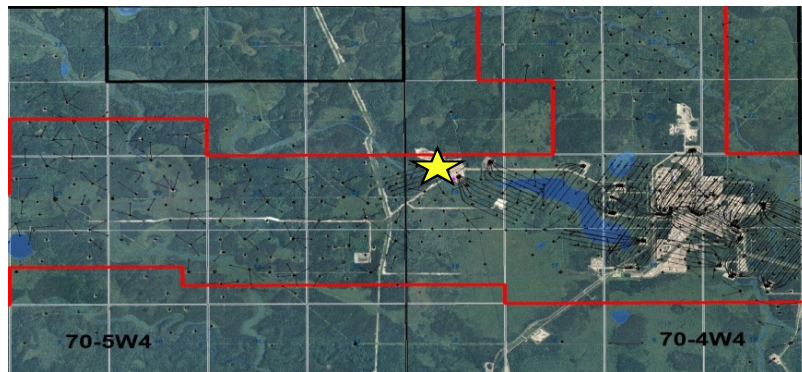
<b>Reservoir Characteristic</b>	<b>West Area</b>	<b>Central Area</b>	<b>East Area</b>
Depth (m subsea)	180 – 225	180 – 225	180 – 225
Thickness (m)	Up to 30+	Up to 30+	Up to 30+
Porosity (%)	34%	34%	32%
Horizontal Permeability (D)	Up to 10 D	Up to 10 D	Up to 8 D
Vertical Permeability (D)	Up to 8 D	Up to 8 D	Up to 6 D
Oil Saturation	~0.85 (0.50 in transition)	~0.85 (0.50 in transition)	~0.85 (0.50 in transition)
Water Saturation	~0.15 (0.50 in transition)	~0.15 (0.50 in transition)	~0.15 (0.50 in transition)
Original Pressure (kPa)	~2700	~2700	~2700
Original Temperature (°C)	12 °C	12 °C	12 °C



# Composite type log: central wells

- Basal mud defines base of pay
- Basal mud is discontinuous and ranges from 0-4 metres in thickness
- Provides a good marker during SAGD operations

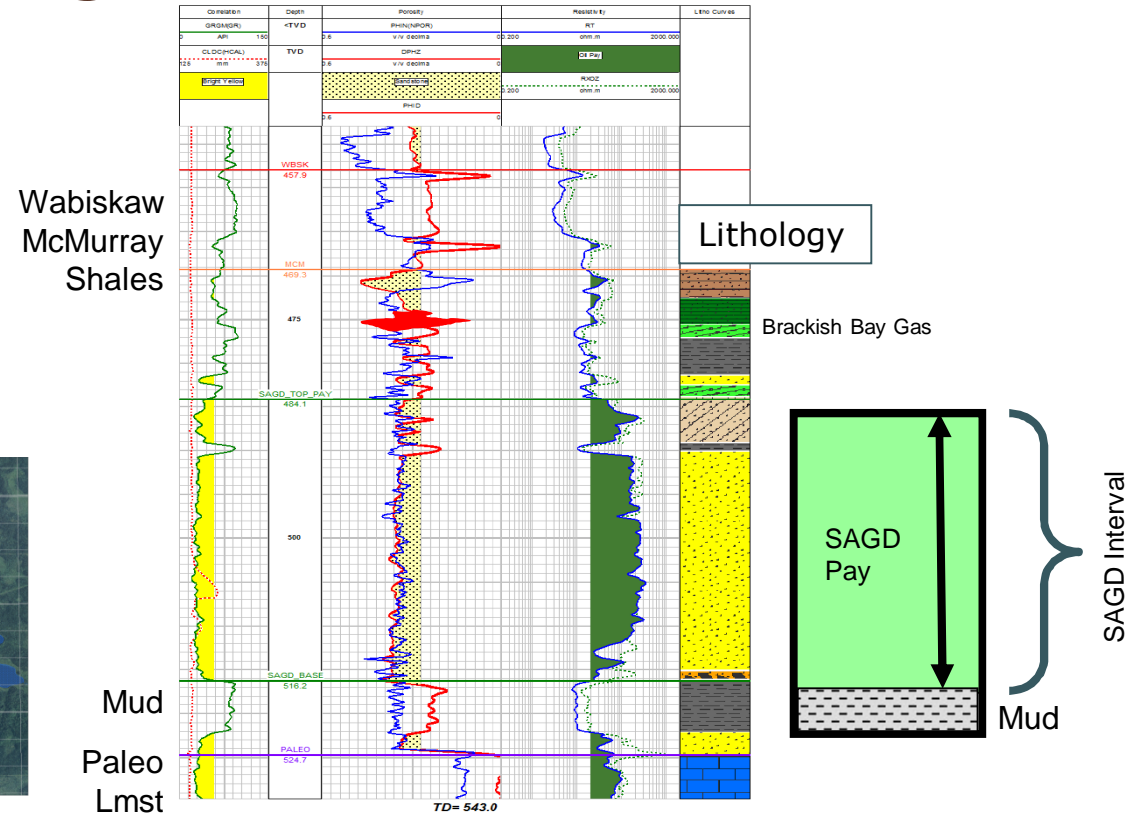
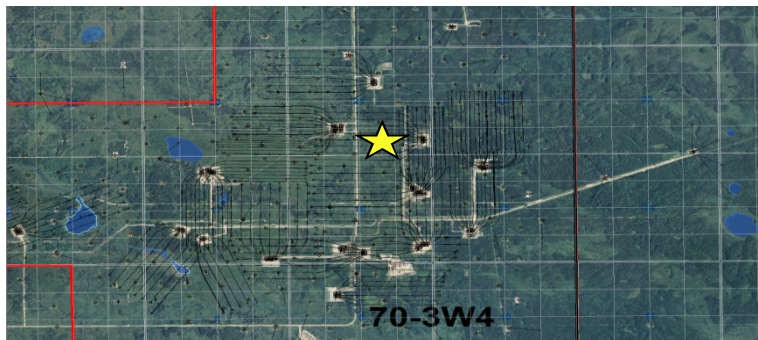
Location: 11-19-70-4W4



# Composite type log: east wells

- Basal mud defines base of pay
- Basal mud is discontinuous and ranges from 0-4 metres in thickness
- Provides a good marker during SAGD operations

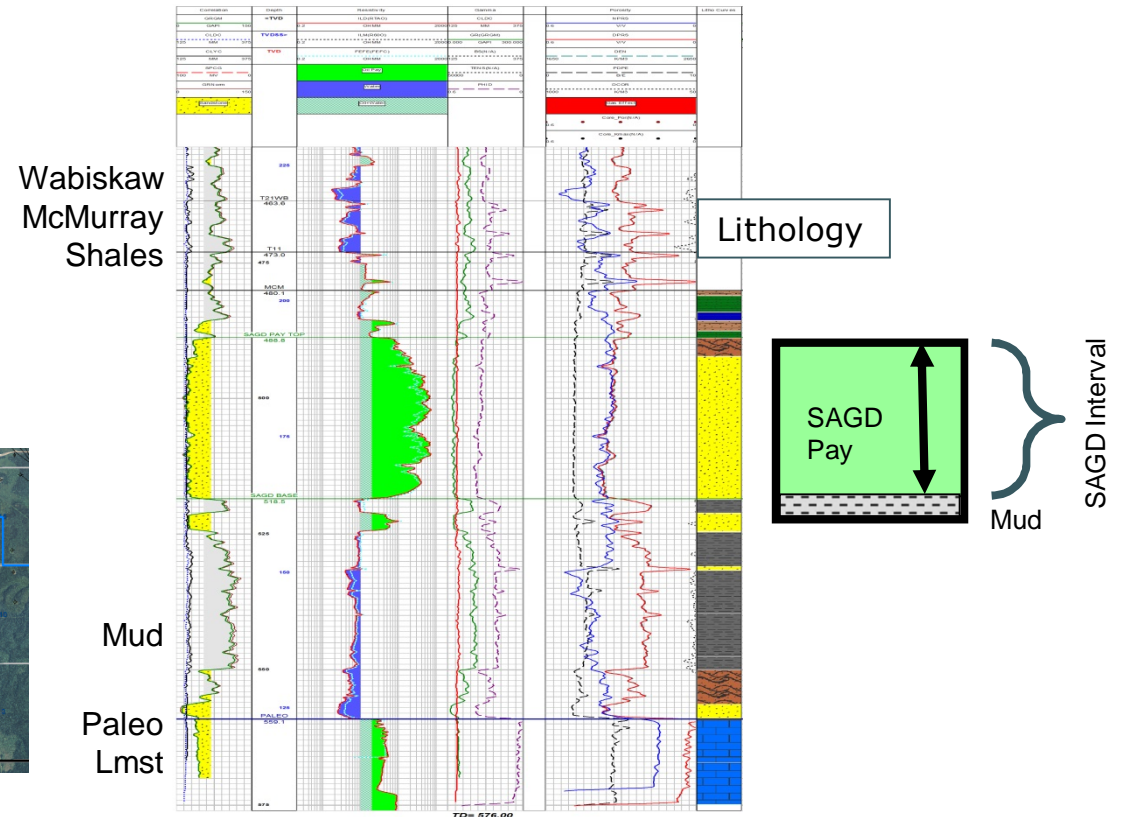
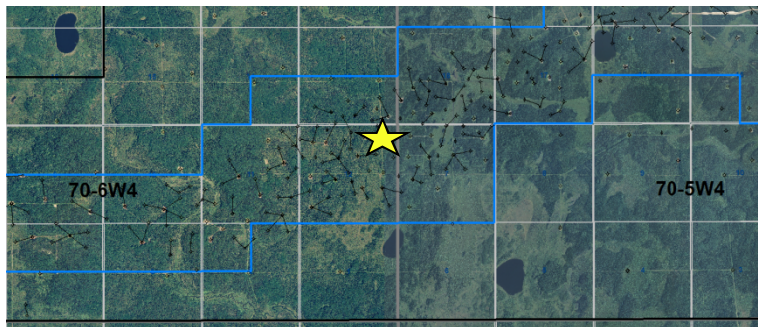
Location: 2-21-70-3W4



# Composite type log: west wells

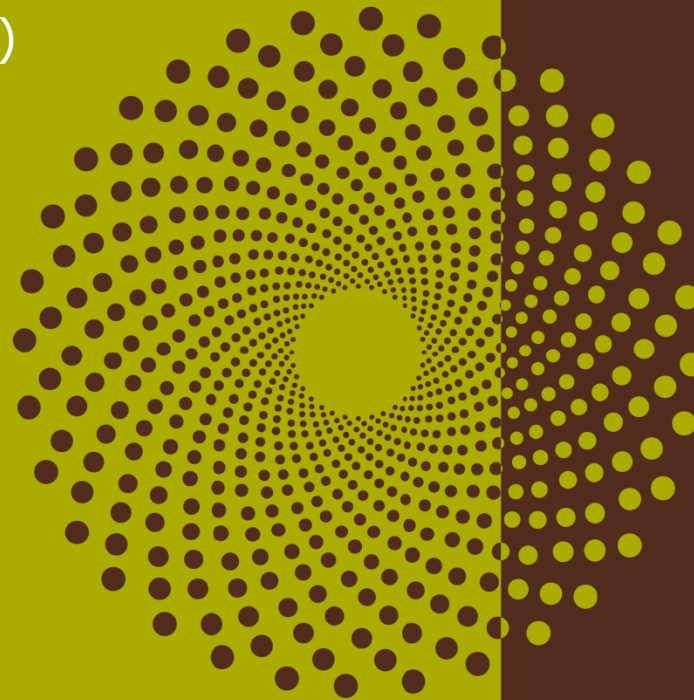
- Basal mud defines base of pay
- Basal mud is discontinuous and ranges from 0-4 metres in thickness
- Provides a good marker during SAGD operations

Location: 16-12-70-6W4



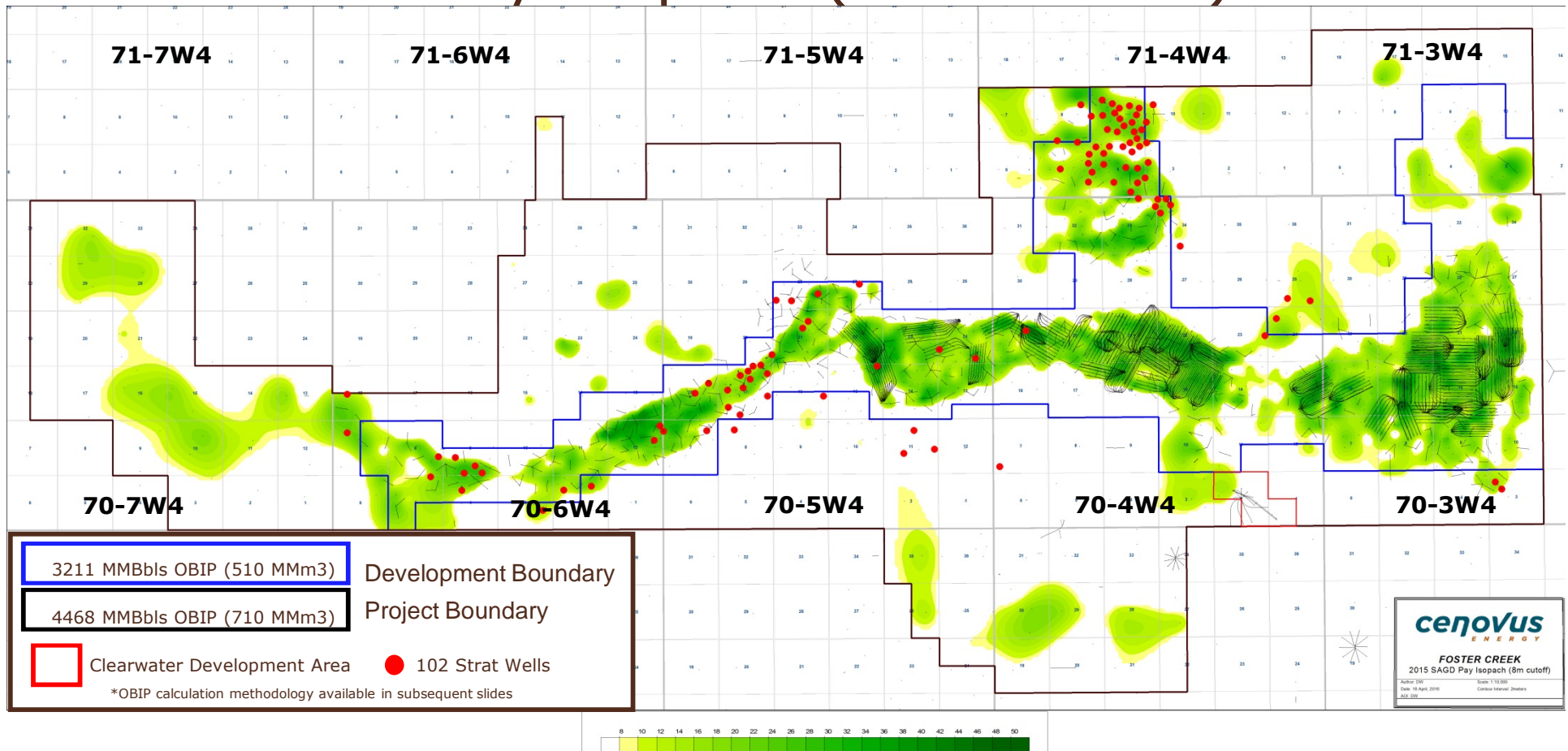
# Maps and core

Subsection 3.1.1 – 2, c, d and f)

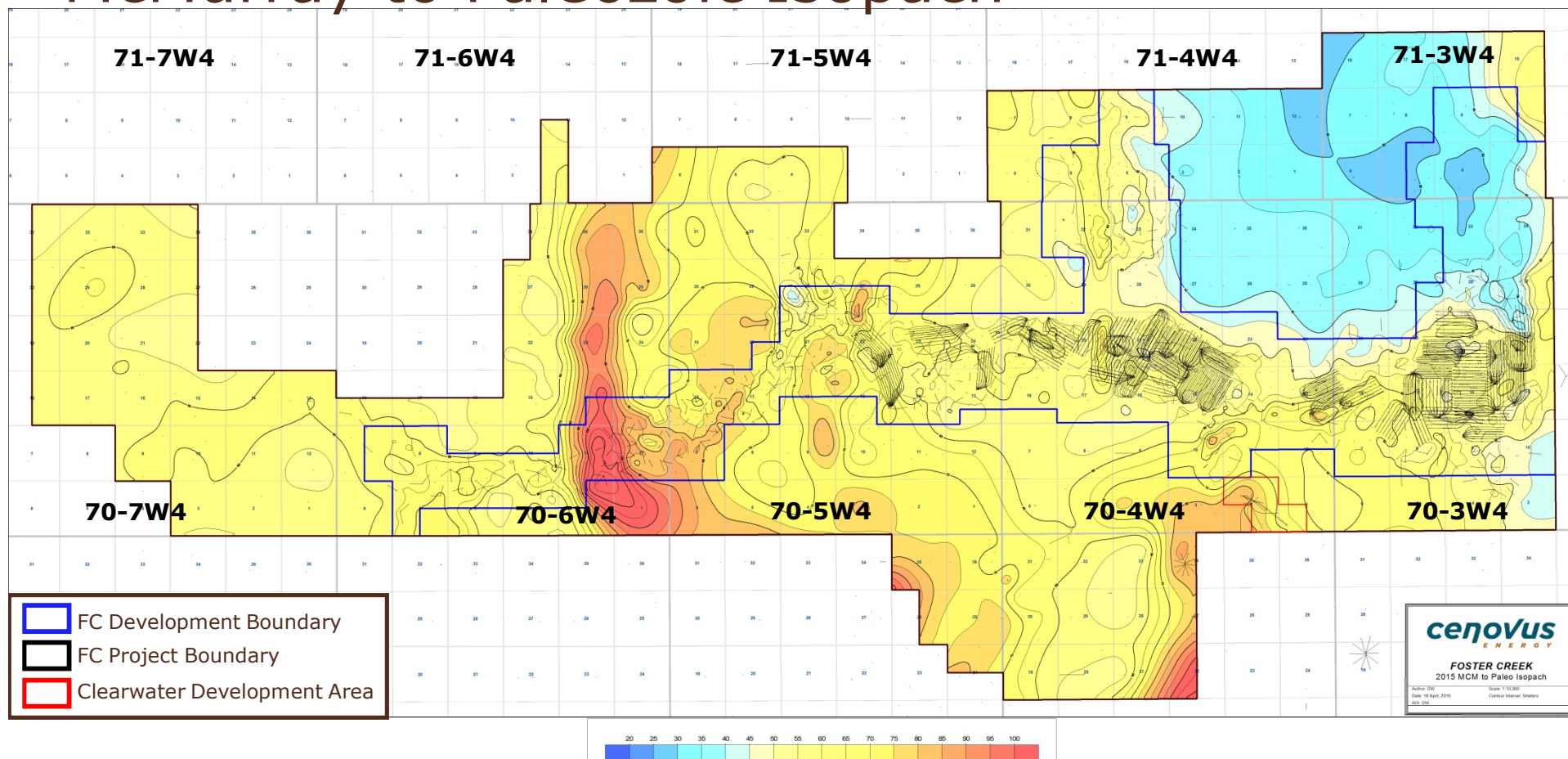




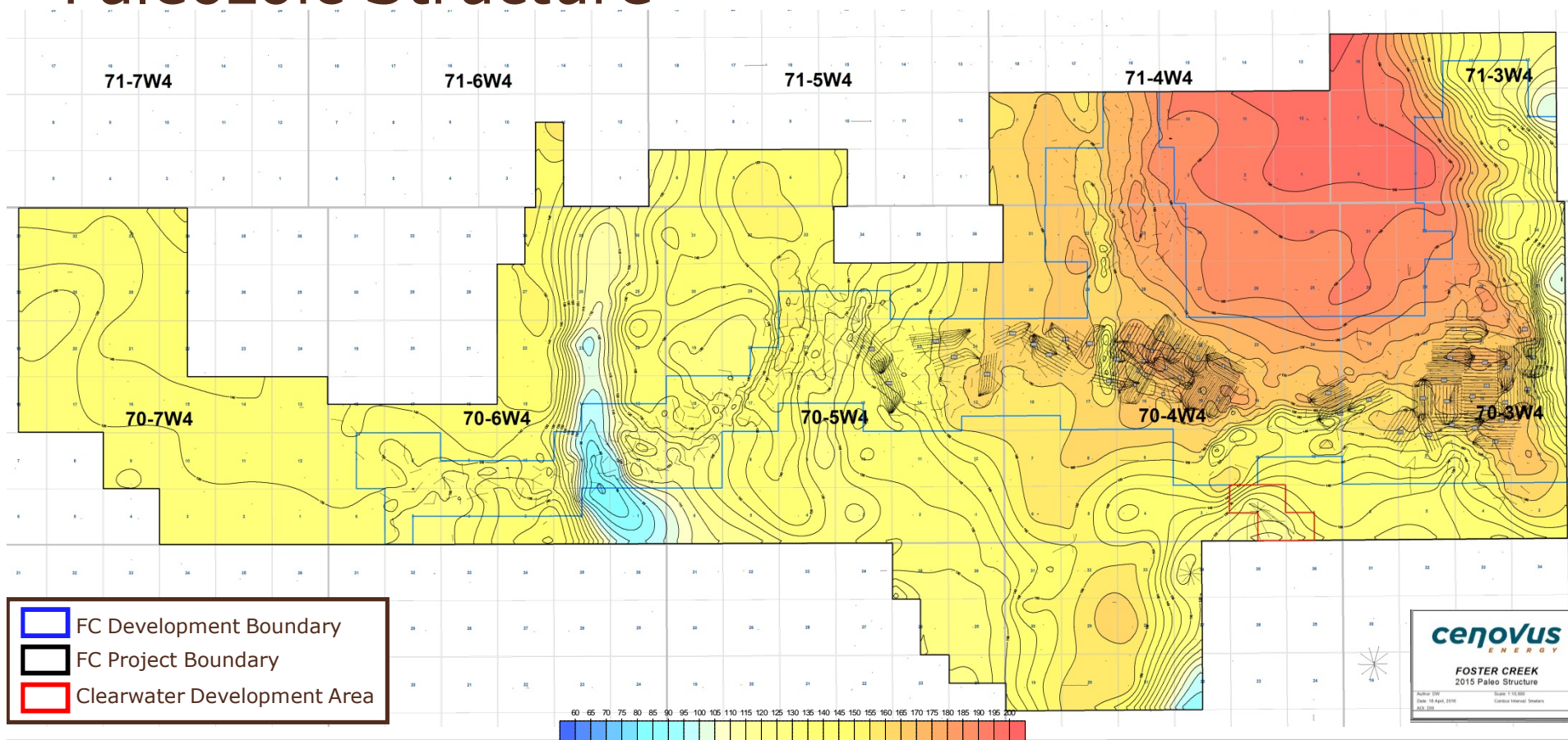
# 2015 SAGD Pay Isopach (2016 Strats)



# McMurray to Paleozoic Isopach

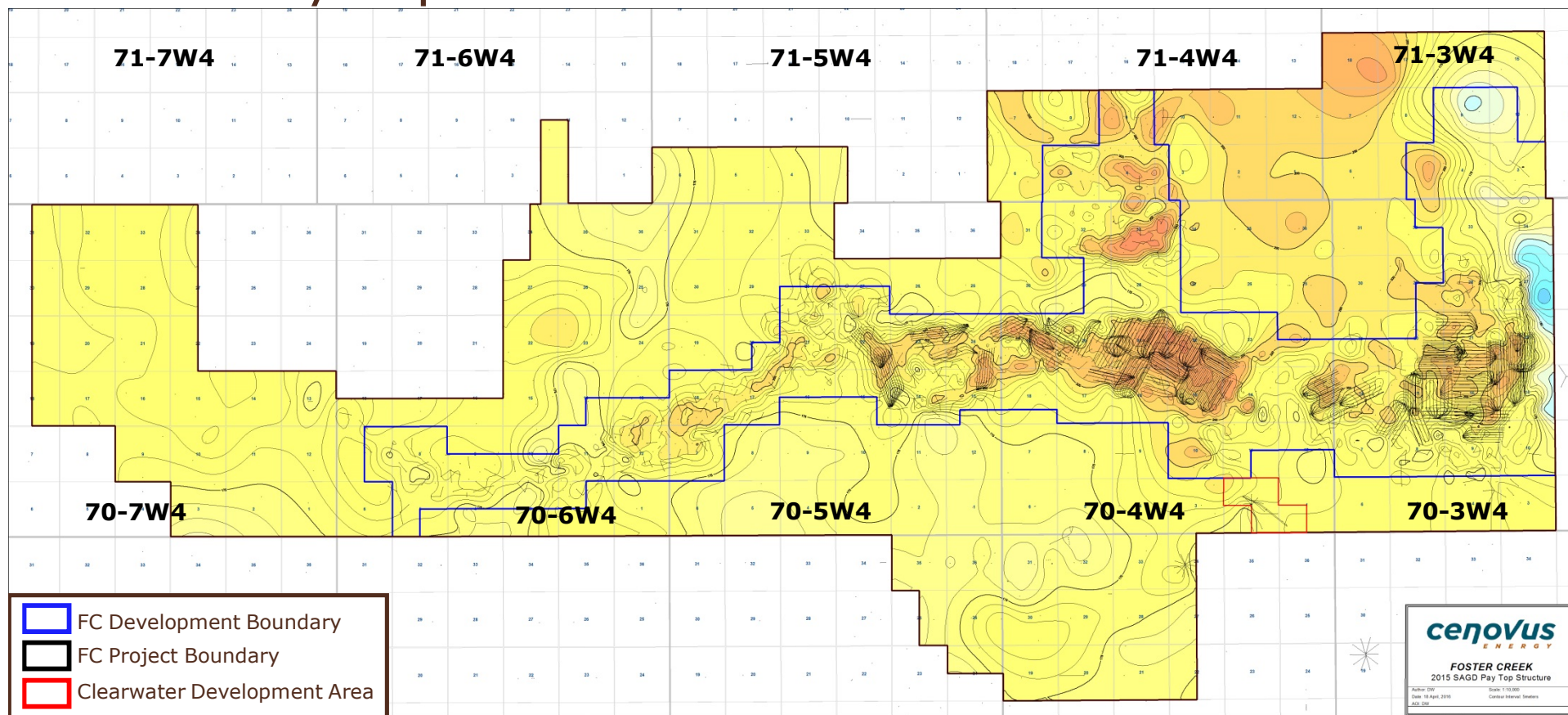


# Paleozoic Structure



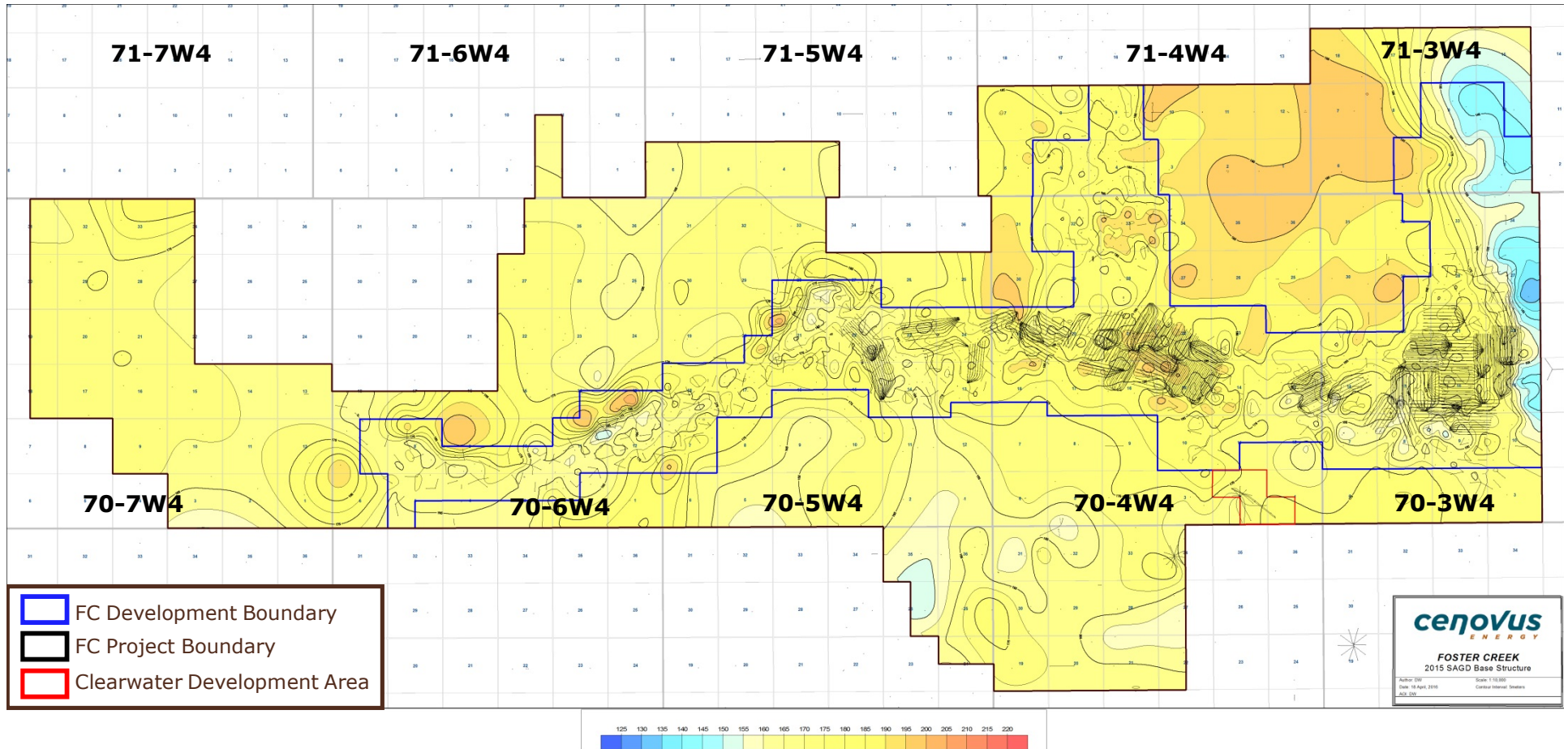


# SAGD Pay Top Structure

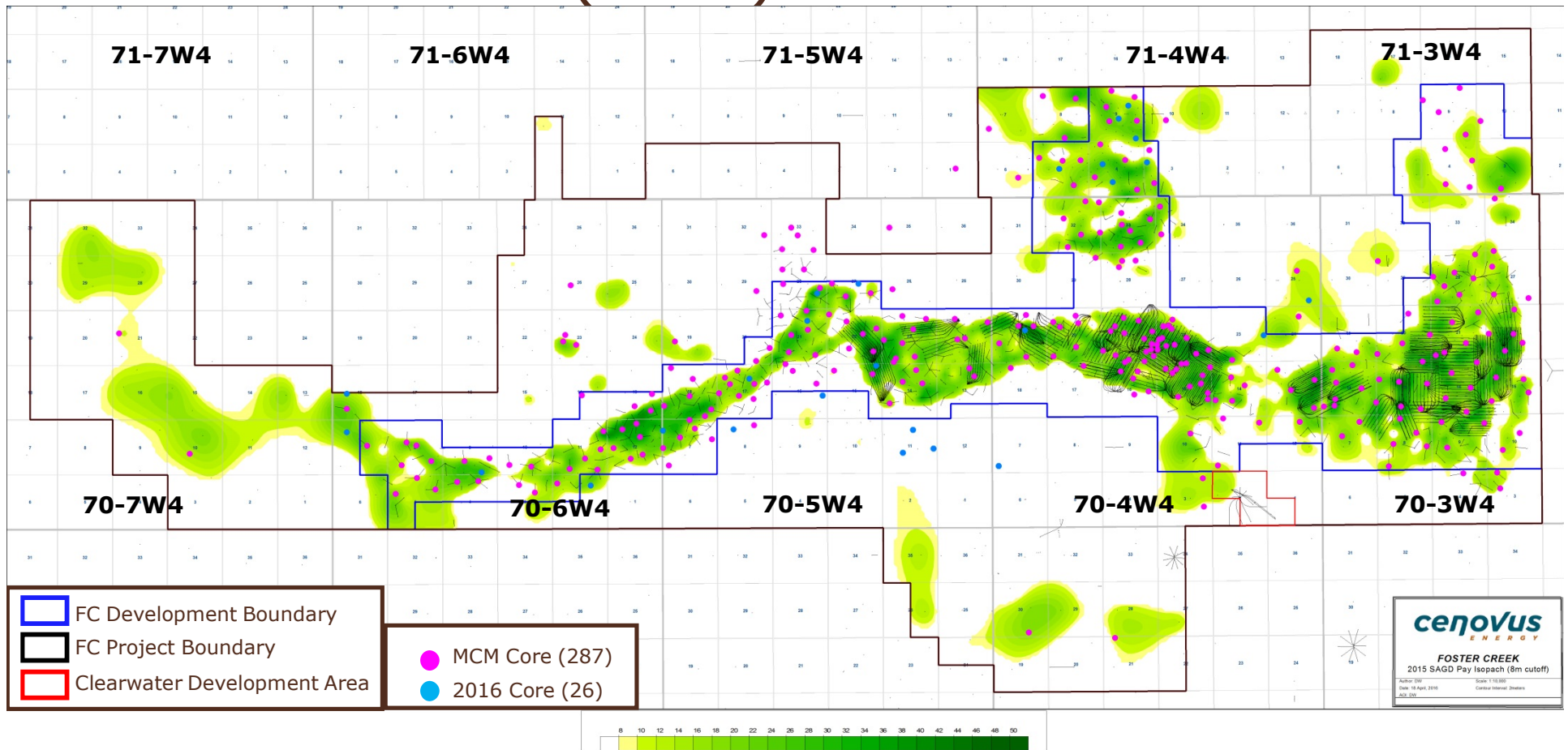




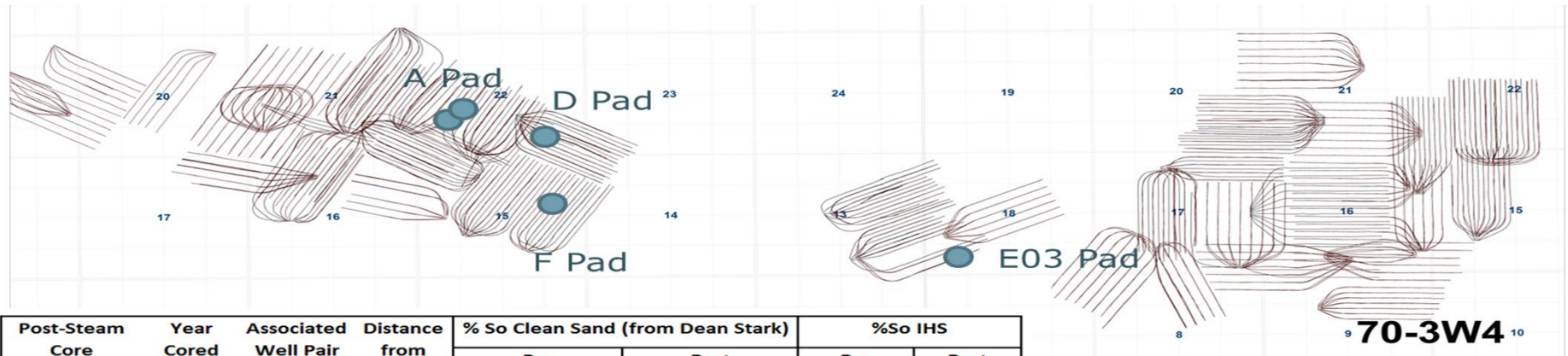
# SAGD Base Structure



# Cored Locations (2016)



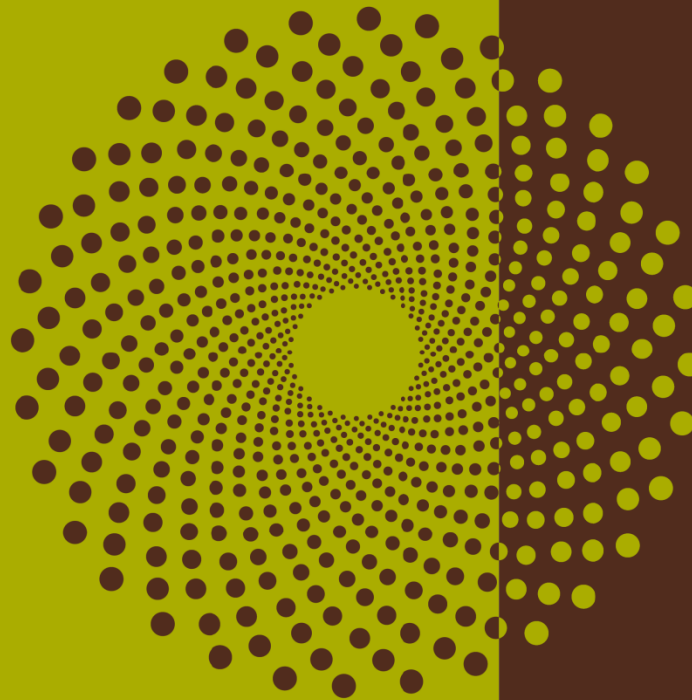
# Post-steam core locations



Post-Steam Core	Year Cored	Associated Well Pair	Distance from Well Pair	% So Clean Sand (from Dean Stark)		%So IHS	
				Pre	Post (in steam chamber)	Pre	Post
3A5-22-70-4	2005	A3	10	92	11-26%	No Lats	No Lats
2D2-22-70-4	2010	D21	27	90	1-21%	65-83%	14-60%
5-22-70-4	2011	A3	17	88	3-20%	No Lats	No Lats
2B9-15-70-4	2012	FP4	32	90	2-34%	No Lats	No Lats
D14-18-70-3	2013	E0306	21	N/A	2-26%	N/A	8-80%

# Cross-sections

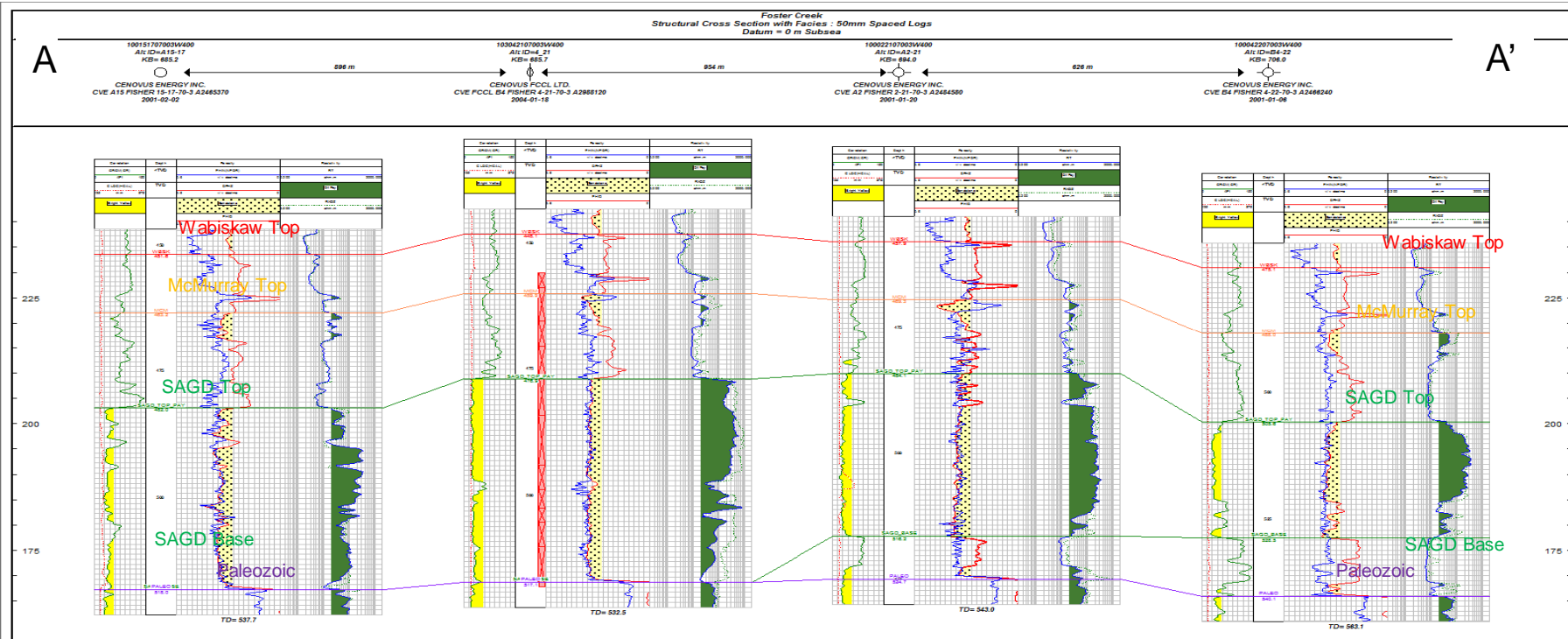
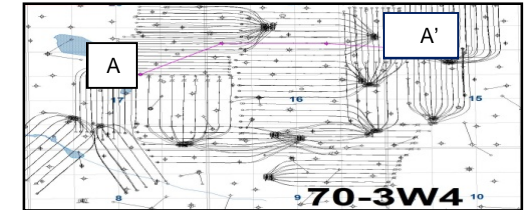
Subsection 3.1.1 – 2, i)



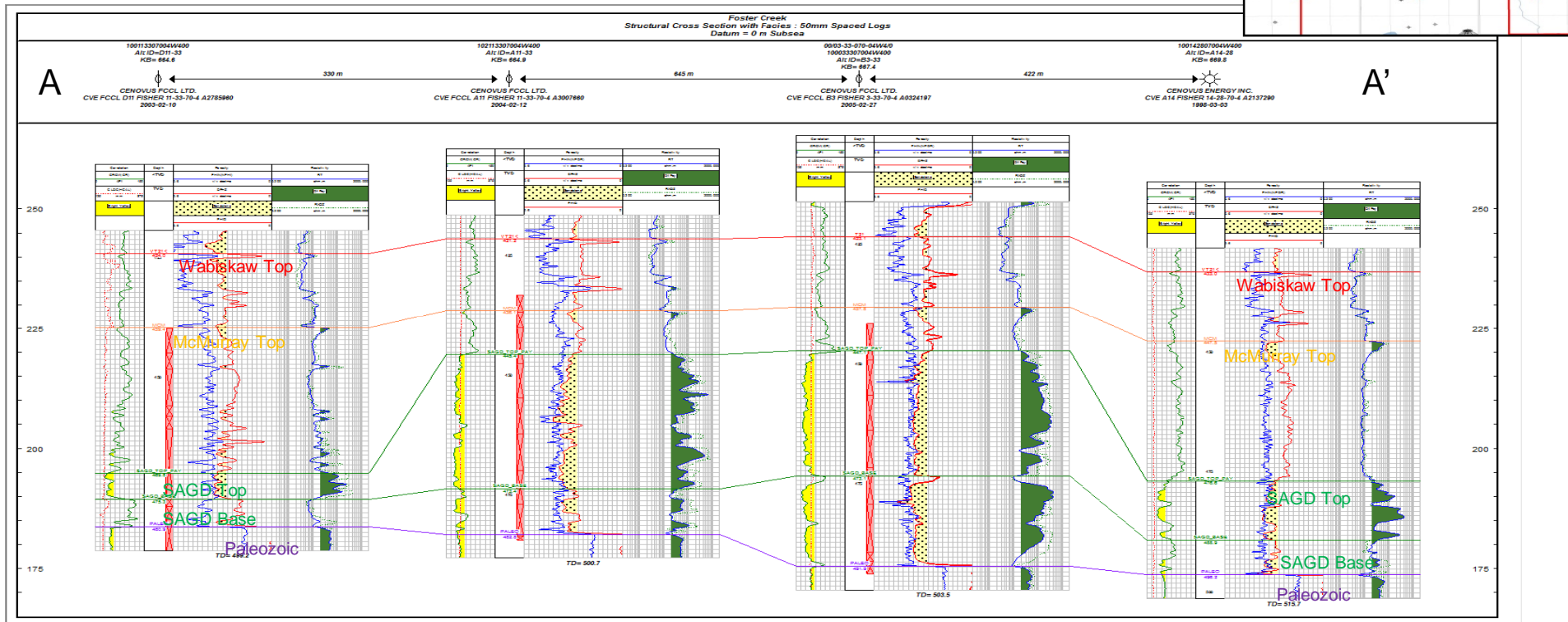




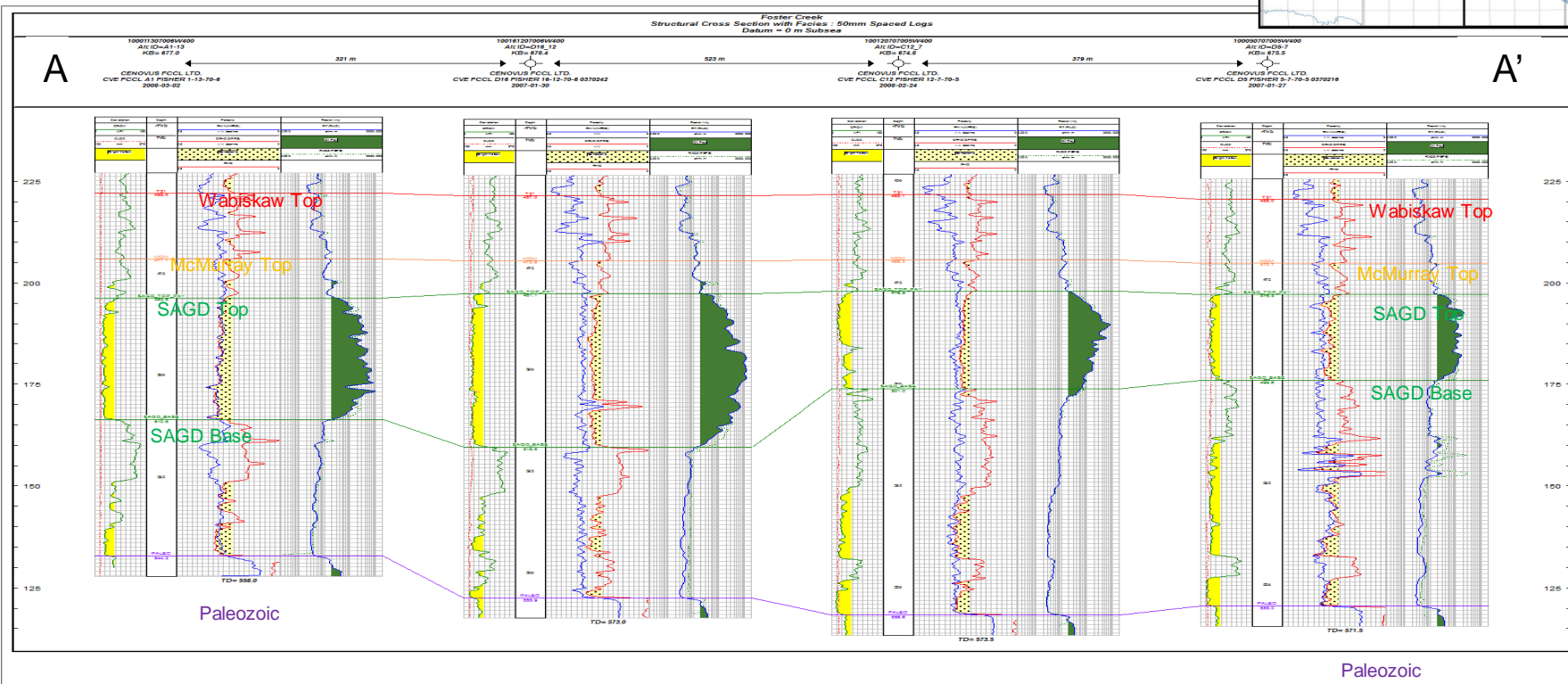
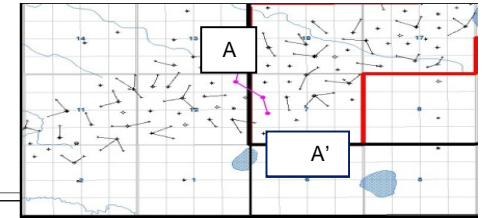
# Representative structural cross-section over East area



# Representative structural cross-section over North area



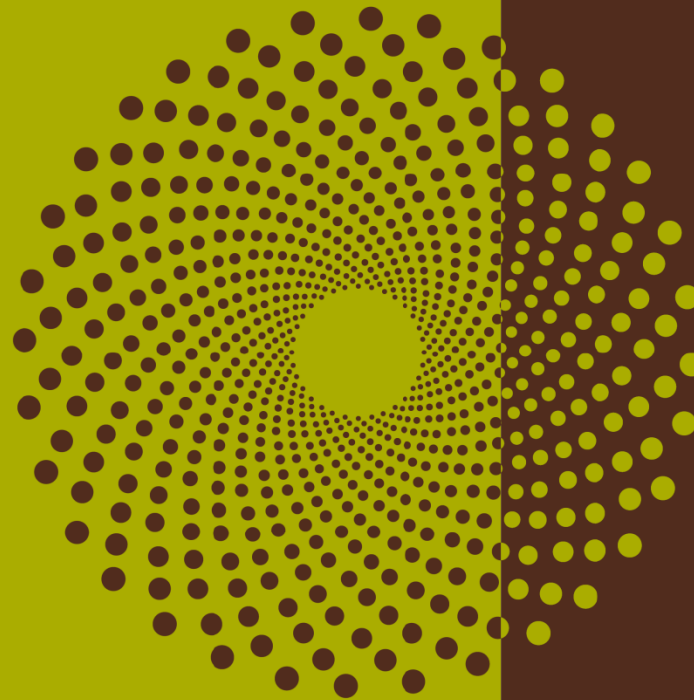
# Representative structural cross-section over West area





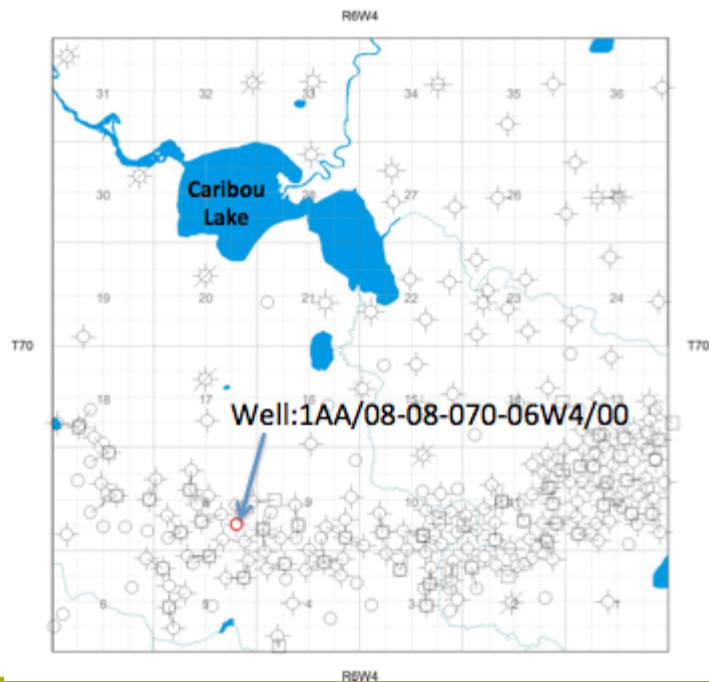
# Geo-mechanical data

Subsection 3.1.1 – 2, j)



# Geomechanical Data

## Sample from Well 1AA/08-08-070-6W4

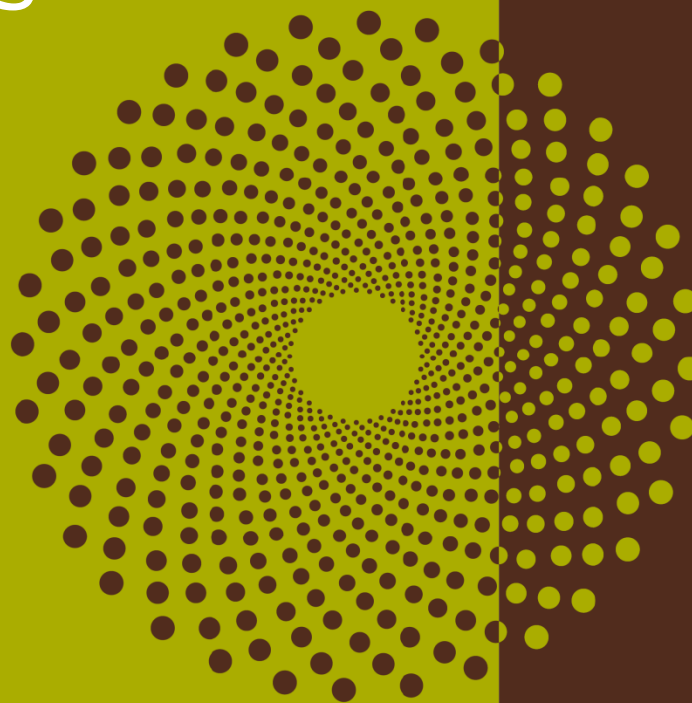


Formation Interval	Depth (m)	Bulk Modulus, K (MPa)	Young's Modulus, E* (MPa)	$c'_{peak}$ (MPa)	$\phi'_{peak}$
T21(CEUDX2)	459.7	213	256	0	30°
T21(CEUDX1)	459.8	178	214	0	17°
T21(CEUDX3 & 4)	460.2	482	578	1.5	25°
* Assumes $\nu=0.3$ . $K = E/3(1-2\nu)$					

Formation Interval	Depth (m)	Bulk Modulus, K (MPa)	Young's Modulus, E* (MPa)	$c'_{peak}$ (MPa)	$\phi'_{peak}$
T11 (CEUDX5, 6 & 7)	466.6	482	578	0.4	32°
* Assumes $\nu=0.3$ . $K = E/3(1-2\nu)$					

# Surface monitoring

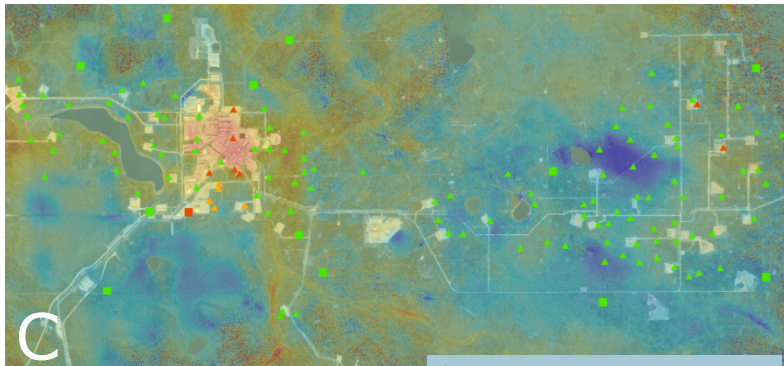
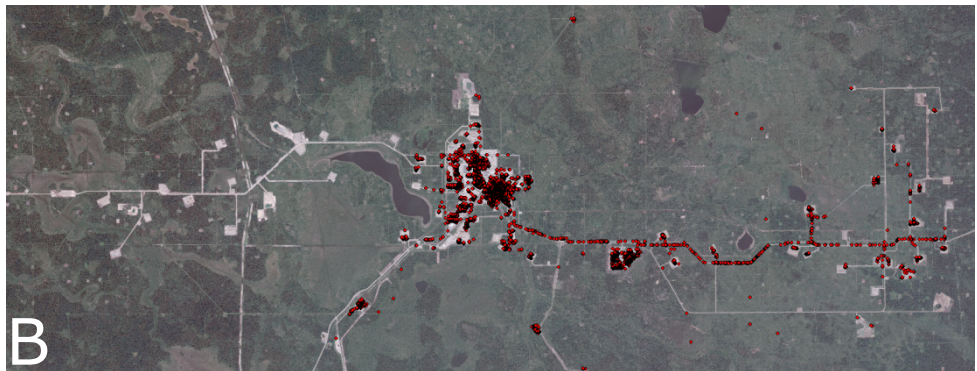
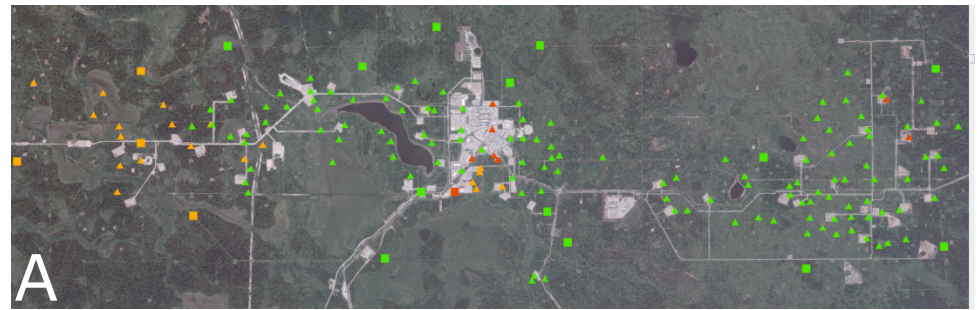
Subsection 3.1.1 – 2, k)



# 2015 Ground Heave Monitoring

Map:

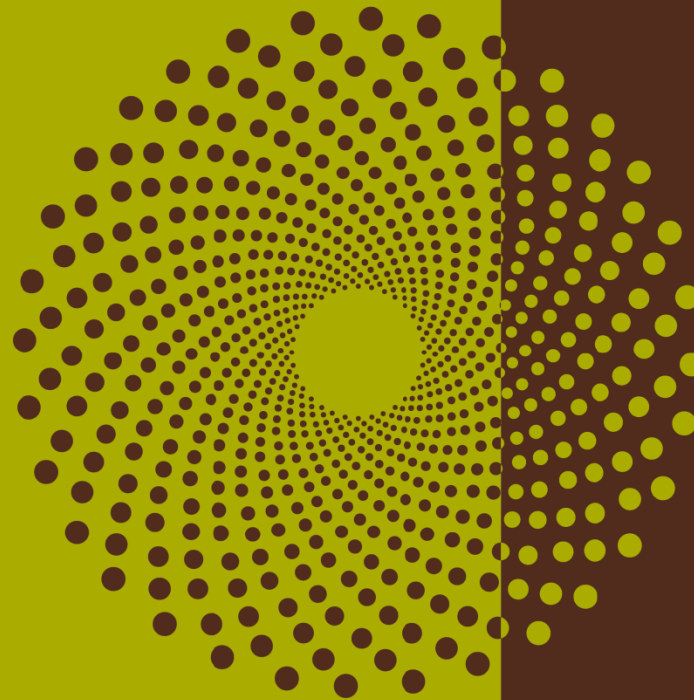
- A) Active CRs: 159
- B) CTM Points: ~22,000
- C) Deformation Maps: 1 per year



- ▲ Active Corner Reflector
- ▲ Active Reference Reflector
- ▲ New Corner Reflector
- ▲ New Reference Reflector
- ▲ Decommissioned Corner Reflector
- ▲ Decommissioned Reference Reflector

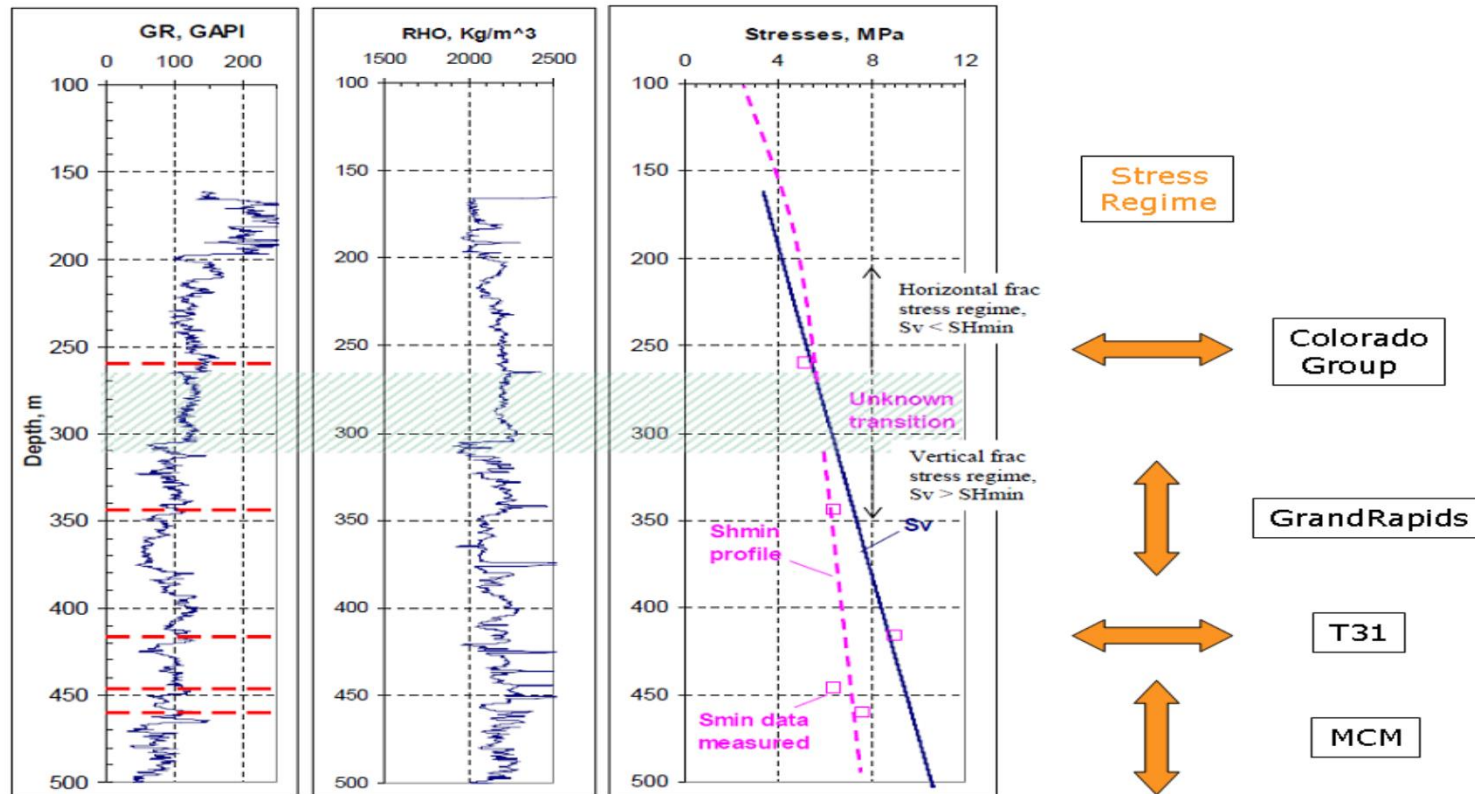
# Caprock integrity

Subsection 3.1.1 – 2, m)



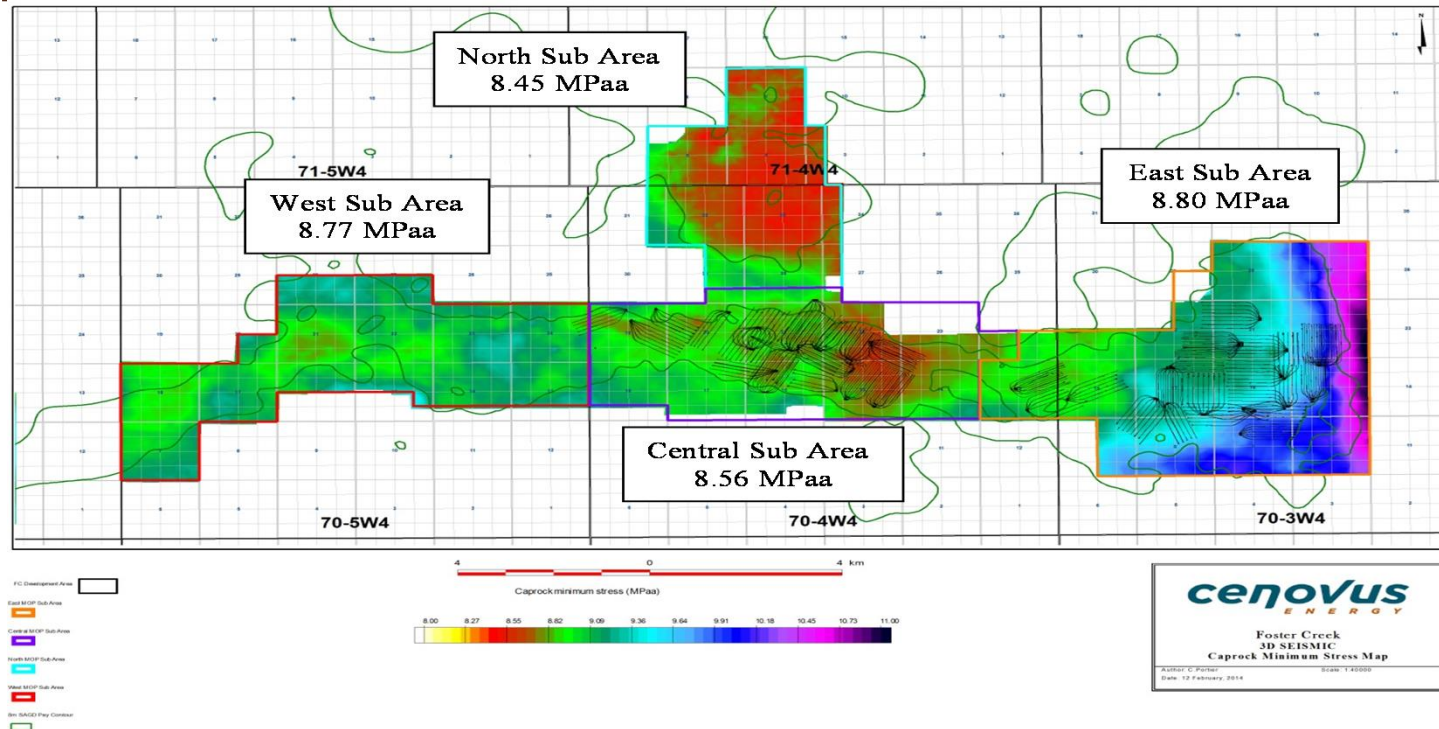
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# Minimum in-situ stress profile





# Caprock minimum in-situ stress



Minimum in-situ stress values in the caprock vary across the project

Smallest minimum in-situ stress values in each sub-area are shown in the above map

# Criteria for determining caprock integrity

**Cenovus determines the minimum in-situ stress of the caprock over the project area through mini frac testing and seismic mapping**

**Minimum in-situ stresses have shown variability across our development area**

**Current project contains four regions with different approved MOP values**

- North – 6.6 MPag
- Central – 6.7 MPag
- West – 6.9 MPag
- East – 6.9 MPag

**Operating pressures in the project vary through the various well stages**

- steam stimulation/circulation: (5.5 – 6.6 MPa)\*
- ramp-up: (3.5 – 5.5 MPa)
- normal operating conditions: (2.0 – 3.5 MPa)

**\* - Note that this upper limit is specific to the MOP of each region**



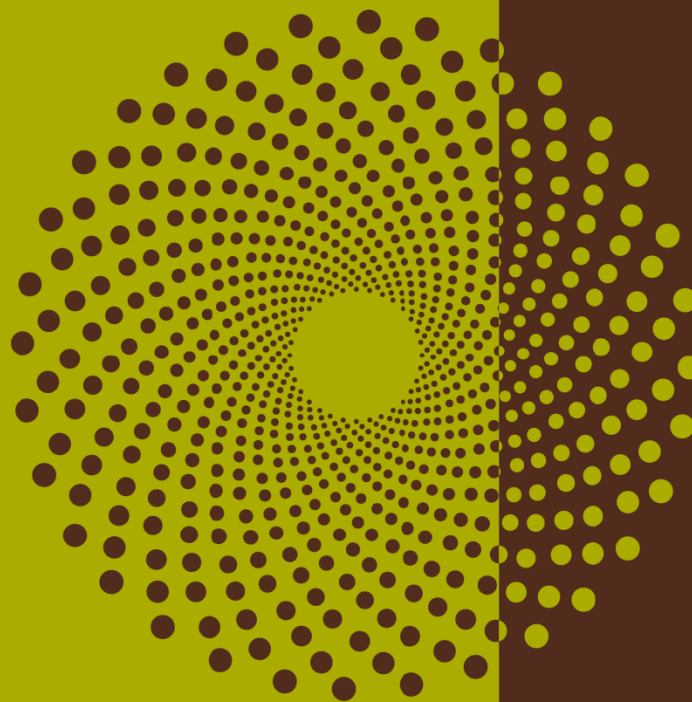
# Caprock Monitoring Plans

**Cenovus monitors caprock integrity through:**

- 1. SAGD injection pressure monitoring**
- 2. Piezometer monitoring in the T31 caprock**
  - Previously 3 locations
  - Added an additional 3 locations in 2015
- 3. Heave monitoring**
- 4. 4D seismic monitoring**

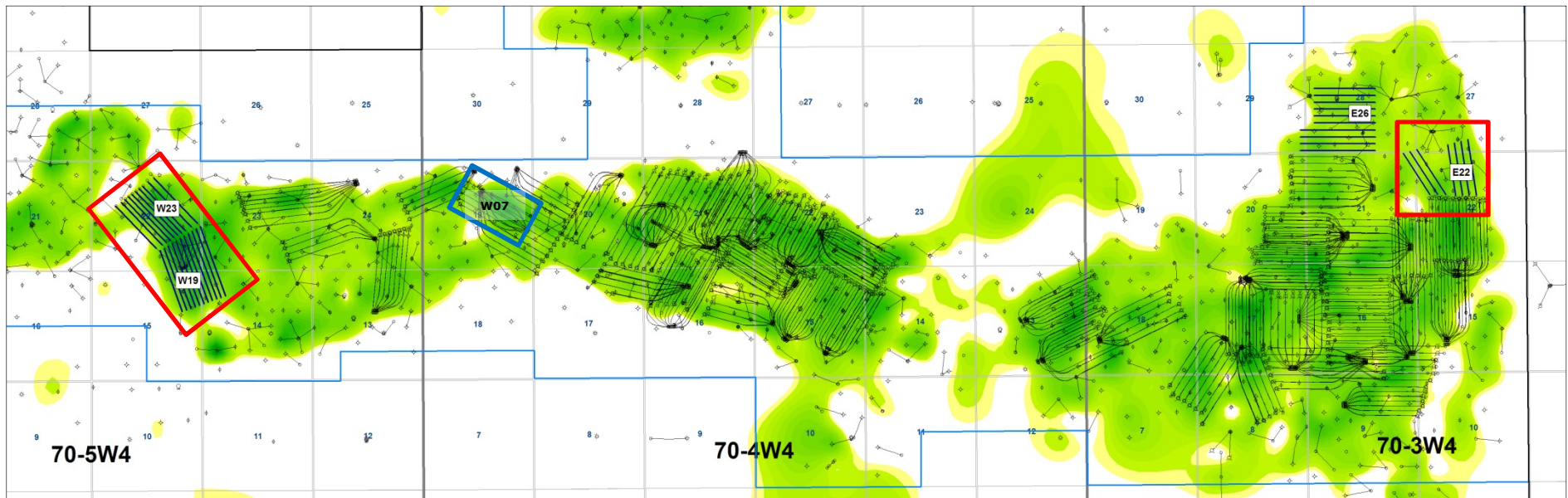
# Drilling and completions

Subsection 3.1.1 – 3)



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# 2015-2016 New SAGD Well Pairs Drilling



## East Pads:

- E22

## West Pads:

- W19, W23



2015 Drilling  
2016 Production

# Inter Well Spacing

## Central Pads

A, B/L, C, D, E/K, F, H, J, M, N – 100m (Pads with Wedge Well™ technology ~50m)

G – 85-100m (with Wedge Well™ technology ~50m)

## East Pads

E02, E03, E04, E07, E08, E10, E11, E12, E14, E15, E16, E19, E20, E21, E24, E25 – 100m (Pads with Wedge Well™ technology ~50m)

E42 – 70-85m

## West Pads

W01, W02, W05, W06, W08, W15 – 100m

W03 – 80-110m

W07, W10 – 80-90m

W18 – 65-100m

# Re-drills and re-entries

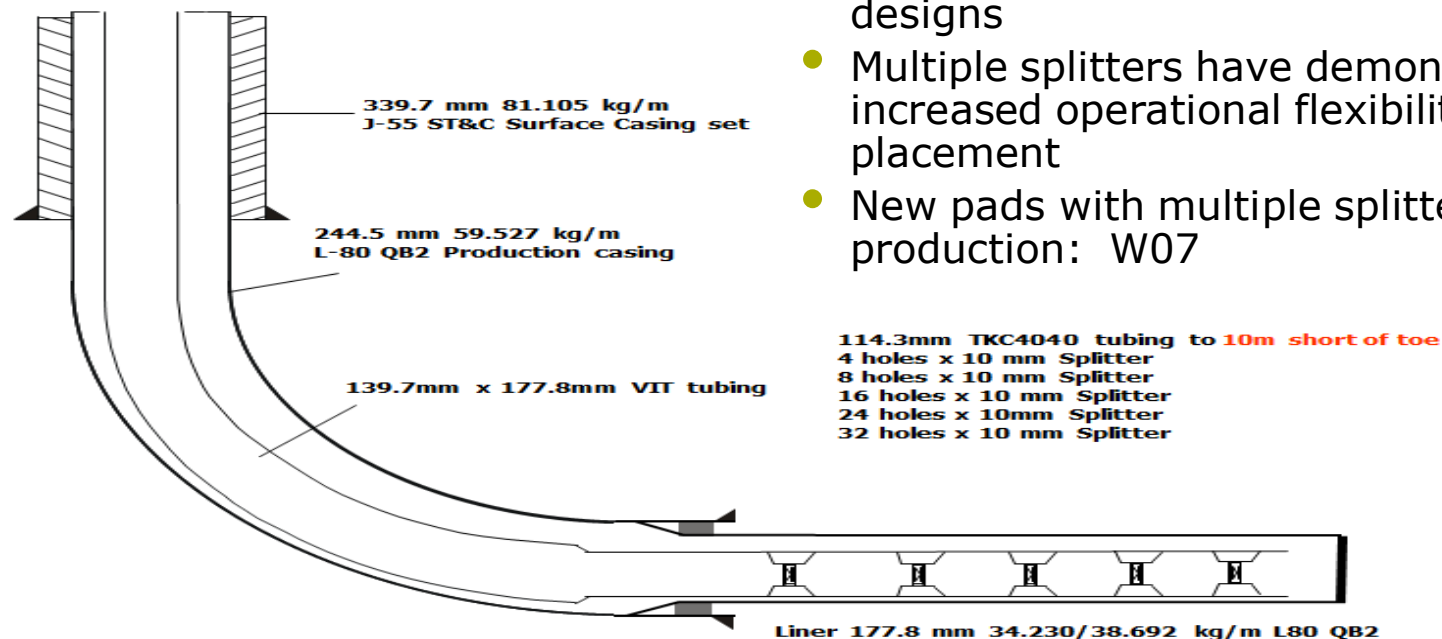
## List of re-drill and re-entry wells in Foster Creek since January 1, 2015

Well Name	Type	Drill Start	Drill Complete	Reason for Remediation
E12P08-1	Step-out	19-Jan-15	28-Jan-15	Primary Liner failure in the Hz slotted section of the well
E24P06-3	Step-out	02-Feb-15	11-Feb-15	Primary Liner failure in the Hz slotted section of the well
E20P06-1	Step-out	07-May-15	16-May-15	Intermediate casing failure
E10P01	Re-entry	03-Jul-15	08-Jul-15	Primary Liner failure in the Hz slotted section of the well
E03I04-1	Step-out	10-Jul-15	17-Jul-15	Re-development to access new reserves
E42P04	Re-entry	19-Jul-15	23-Jul-15	Primary Liner failure in the Hz slotted section of the well
JP08-1	Step-out	25-Jul-15	01-Aug-15	Primary Liner failure in the Hz slotted section of the well
E21I04-1	Step-out	02-Aug-15	13-Aug-15	Re-development to access new reserves
E04P01-1	Step-out	15-Aug-15	18-Aug-15	Primary Liner failure in the Hz slotted section of the well
E08P07	Re-entry	02-Sep-15	05-Sep-15	Primary Liner failure in the Hz slotted section of the well
E07P02-1	Step-out	08-Sep-15	15-Sep-15	Primary Liner failure in the Hz slotted section of the well
E07P03-1	Step-out	17-Sep-15	23-Sep-15	Primary Liner failure in the Hz slotted section of the well
E07I02-1	Step-out	24-Sep-15	30-Sep-15	Primary Liner failure in the Hz slotted section of the well
GI08	New Well	13-Oct-15	20-Oct-15	Re-development to access new reserves
E42P06	Re-entry	23-Oct-15	26-Oct-15	Primary Liner failure in the Hz slotted section of the well
E02P01	Re-entry	28-Oct-15	06-Nov-15	Primary Liner failure in the Hz slotted section of the well
W03P04	Re-entry	07-Nov-15	11-Nov-15	Primary Liner failure in the Hz slotted section of the well
W03P01	Re-entry	12-Nov-15	15-Nov-15	Primary Liner failure in the Hz slotted section of the well
W06P06	Re-entry	17-Nov-15	20-Nov-15	Primary Liner failure in the Hz slotted section of the well
J105	Re-entry	20-Nov-15	25-Nov-15	Primary Liner failure in the Hz slotted section of the well
JP05	Re-entry	25-Nov-15	02-Dec-15	Primary Liner failure in the Hz slotted section of the well
W06P03	Re-entry	01-Dec-15	07-Dec-15	Primary Liner failure in the Hz slotted section of the well
JP06-1	Step-out	08-Dec-15	15-Dec-15	Primary Liner failure in the Hz slotted section of the well

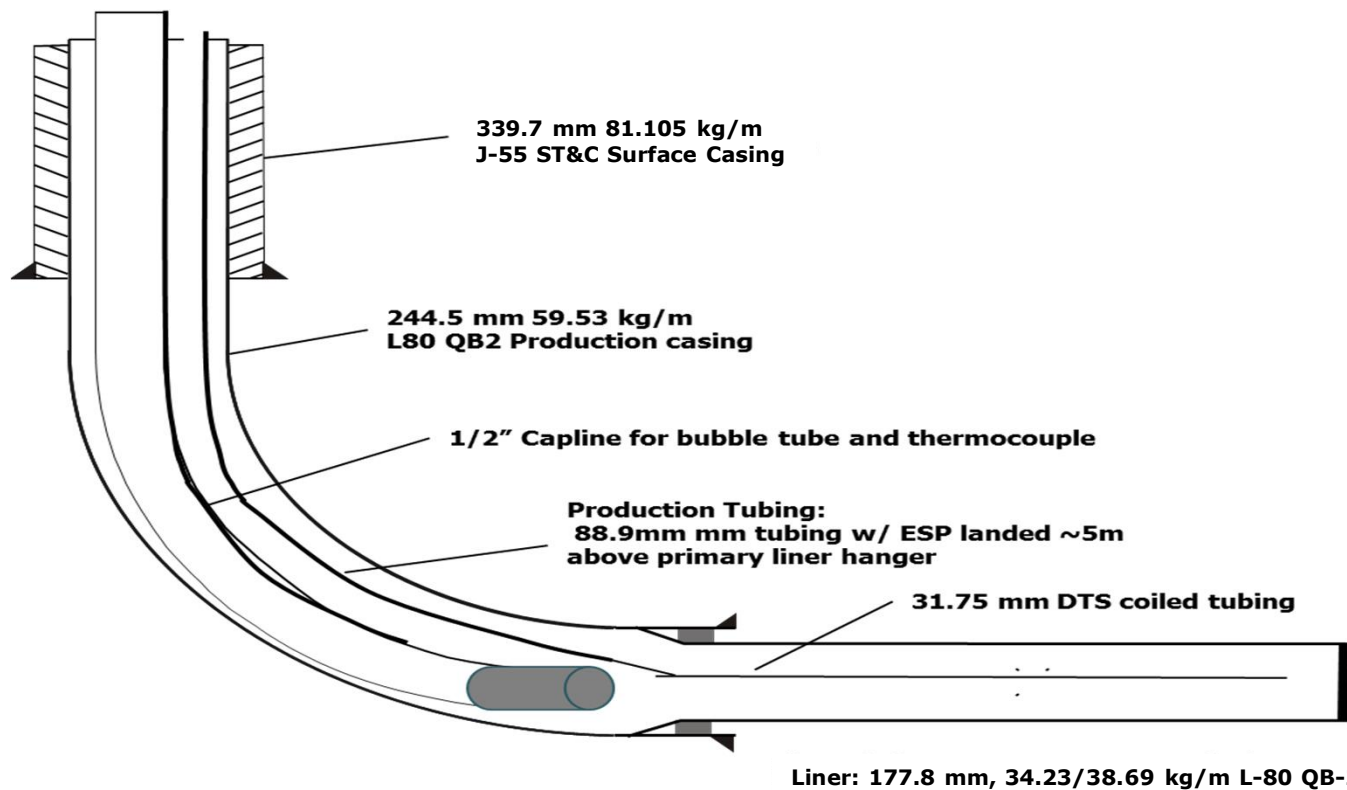
\*Liner failures caused by steam jetting.

# Standard injector completion

- Majority of well pairs at Foster Creek have been started up with single splitter injector designs
- Multiple splitters have demonstrated increased operational flexibility with steam placement
- New pads with multiple splitter designs on production: W07

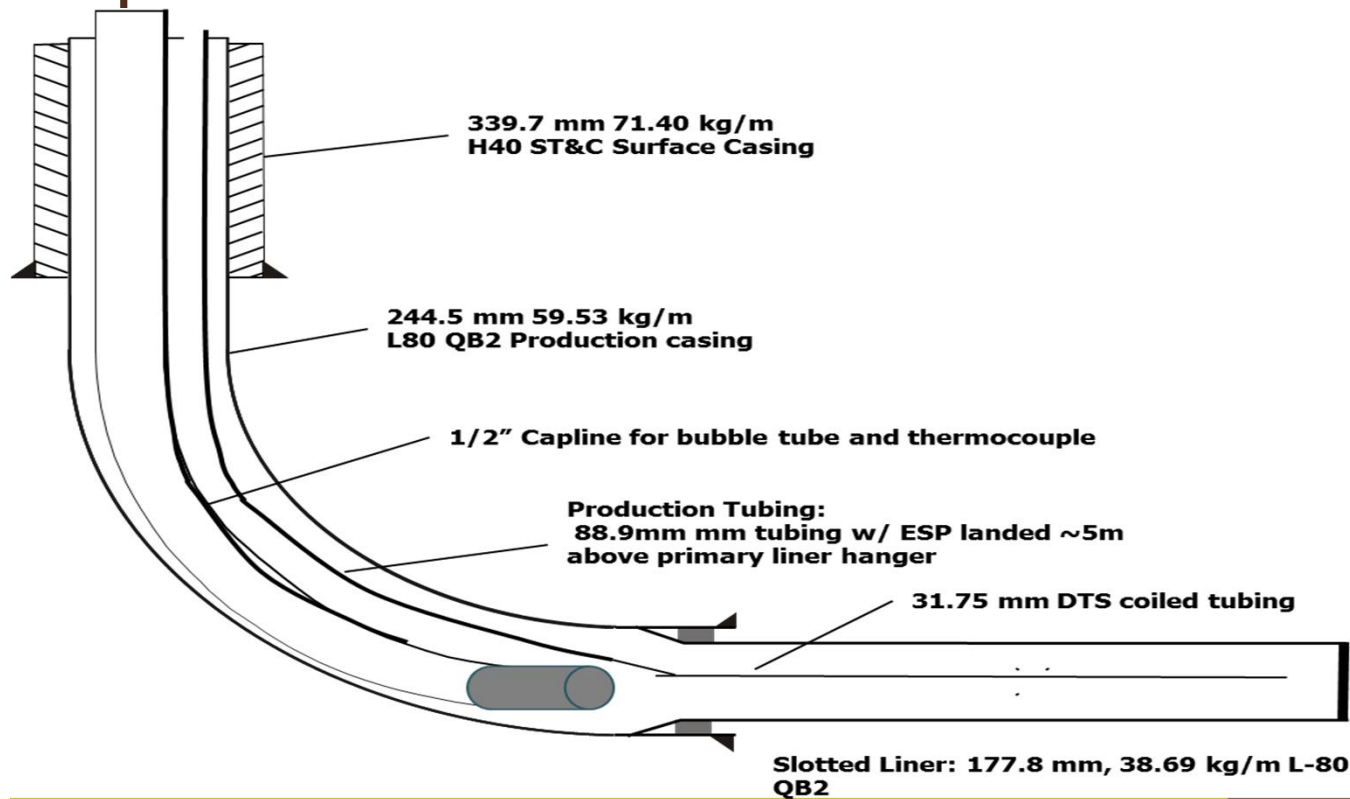


# Standard producer ESP completion



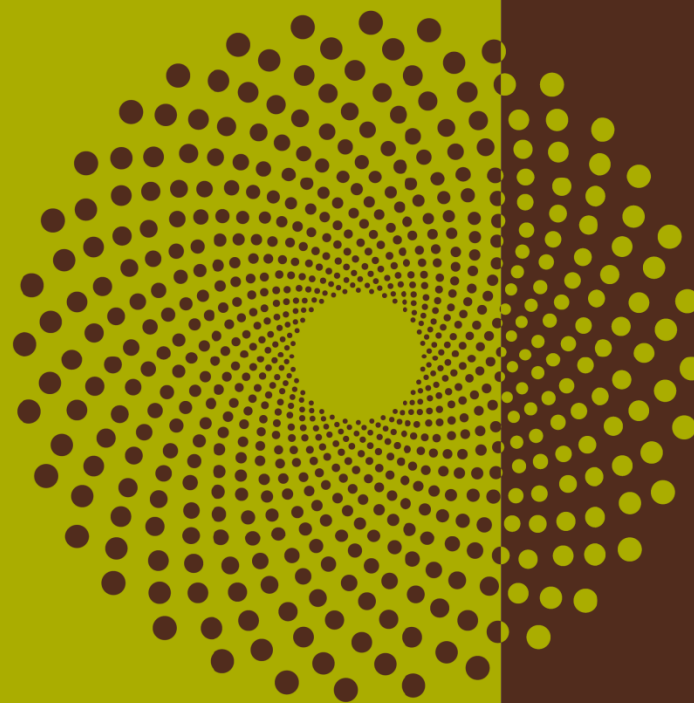


# Standard Wedge Well™ technology completion



# Artificial lift

Subsection 3.1.1 – 4)



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# Artificial lift

## Electric submersible pumps (ESPs)

- all operating SAGD pairs (~243 producers) are currently equipped with ESPs.

## Rod pumps

- 33/97 operating wells utilizing Wedge Well™ technology are equipped with rod pumps
- rod pumps at Foster Creek can range from about 0 – 350 m<sup>3</sup>/d

	ESPs	Rod pumps
Turn down (m <sup>3</sup> /d)	120	0
Max. rate (m <sup>3</sup> /d)	1200	350
Max. operating temp (°C)	255	200+
Number of pumps	243	33
Average run life (months)	11.2	5.0

# Artificial lift – new technology

## ESPs

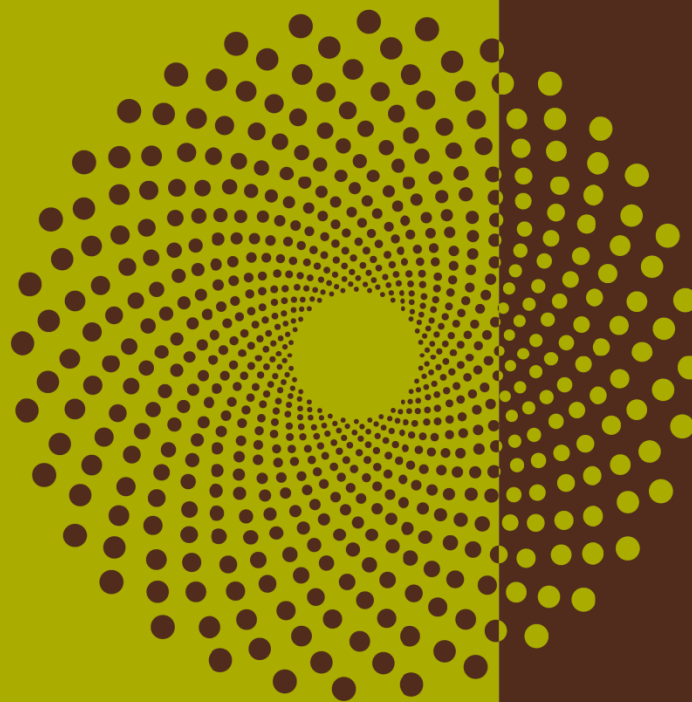
- Working with vendors to increase runtime.

## Rod pumps

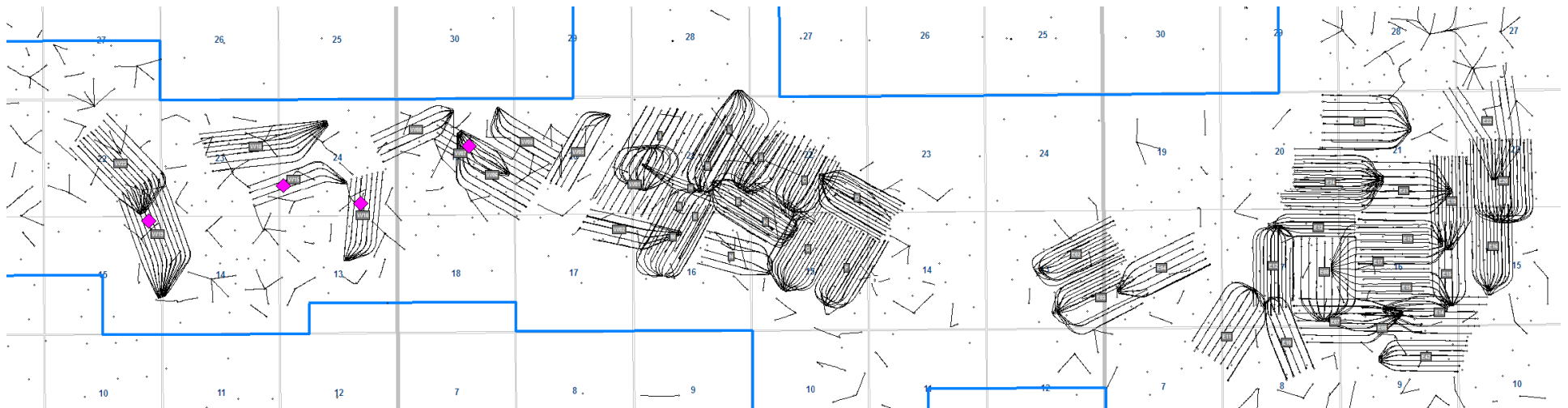
- previously utilizing Wedge Well™ technology
- higher maintenance pump than ESPs, have had problems with sand bridging and can result in slower ramp up to peak production
- All new Wedge Well™ pads to be produced via ESP


# Instrumentation in wells

Subsection 3.1.1 – 5)



# Foster Creek 2016 piezometer locations



 Piezometer

# Piezometer details

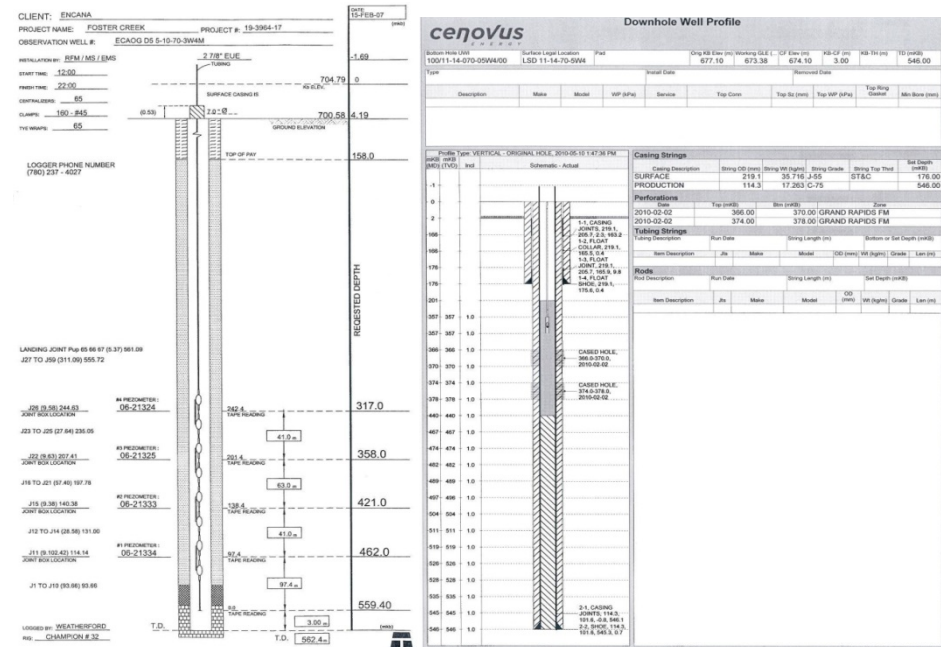
## Three installation types:

## Cemented tubing - vibrating wire piezometers mounted on tubulars and cemented in place (14 wells)

**Hanging wire – pressure / temperature gauges hung from the wellhead to about 10-15m above perforations (9 wells)**

## Cemented casing – High temperature Optical pressure sensors strapped and cemented to the production casing (33 wells)

## Four new McMurray piezometers installed





# Foster Creek temperature and RST data



- Wells selected for RST logging (33)
- Wells selected for Temperature logging (27)

# Instrumentation in SAGD wells

## **SAGD steam injector**

- blanket gas for pressure measurement

## **SAGD producer**

- ½" capline strapped to tubing for bubble tubes and single point thermocouple
- Distributed temperature sensing (DTS) strings installed in all new wells

## **SAGD using our patented Wedge Well™ technology**

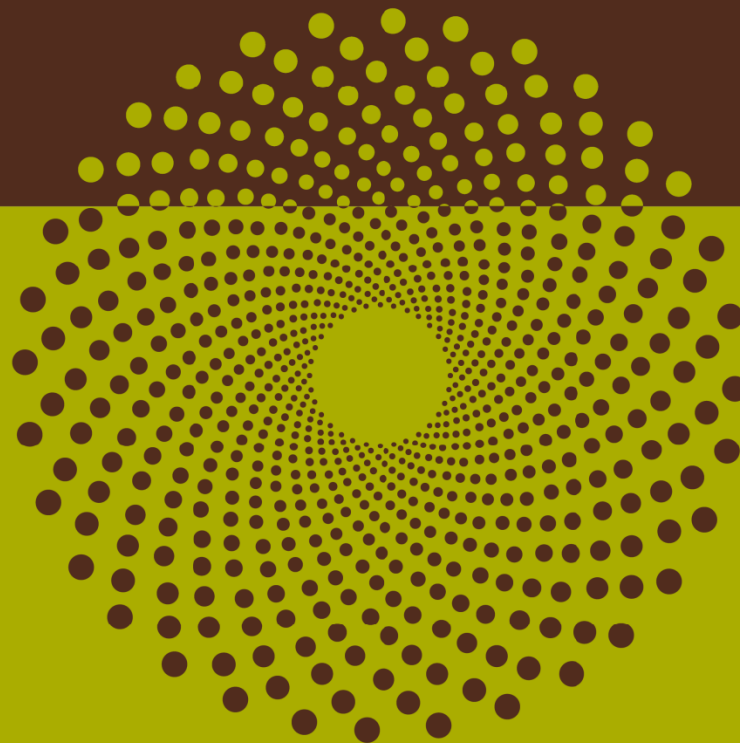
- no downhole instrumentation with rod pumps
- new wells with ESPs to be equipped with ½" capline strapped to production tubing string to measure pressure and temperature

\* Schematics can be seen in subsection 3.1.1 – 3 c)

# Subsection 3.1.1 – 5 c) and d) – instrumentation data

**Requirements under Subsection 3.1.1 5c) and d) are  
located in the Appendix**

# Well Integrity Update



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# Well Integrity

## Intermediate Casing Failures

- Confirmed by pressure tests
- Impairments concentrated within the Joli Fou
- Noted elsewhere in the Colorado Shale Group (200-300m SS)

## 2015 Intermediate Casing Failures

- E20P06 – Failed pressure test

## 2016 Q1 Intermediate Casing Failures

- No failures confirmed by pressure testing



# 2015/Q1 2016 MFC Logging

## 2015

Well	Pressure Test	Action
E07P04	-	-
E11I04	Pass	-
EI26	Pass	Suspended
W06P05	Pass	-
E11I05	Pass	Recompletion
E21I04	Pass	Abandonment
JP06	Pass	Abandonment
W01P03	-	-
E20P06	Failed	Abandonment

## Q1 2016

Well	Pressure Test	Action
E25P08	Pass	Abandonment
E19P12	Pass	Abandonment
E04P06	Pass	Abandonment
E24P08	Pass	Abandonment

# Well Integrity

## Surface Casing Vent Flows

(no steam)

Well	Action	Status
E24P06-1	Repair	Monitoring
BI6	Repair	Monitoring
E04I06	Current investigation	Monitoring

➤ **SWS investigation on-going**

# Well Integrity

## Casing Corrosion

Corrosion Location	Status
Surface Casing Exterior	Mitigation on-going
Surface Casing Interior / Intermediate Casing Exterior	Investigation on-going
Pack-Off	Investigation on-going

# 2015 Well Integrity

## Routine Monitoring

- Integrated review of open and cased hole logs, well and pad history (drilling information, workover history, pressure testing)

## Strain monitoring wells installed

- Baseline data in non-thermally affected zones in laterals
  - 1AB/03-23-070-05W4/00 (FC W20 Pad)
  - 1AD/05-23-070-05W4/00 (FC W20 Pad)
  - 100/05-28-070-03W4/00 (FC E26 Pad)
  - 1AC/07-10-076-06W4/00 (CL H03 Off-pad)
- Proposed installations on pads for vertical builds
- Field measurements scheduled relative to milestone dates

## Geomechanical lab testing

- Pending sensitivities determined by geomechanical simulations

# 2015 Well Integrity

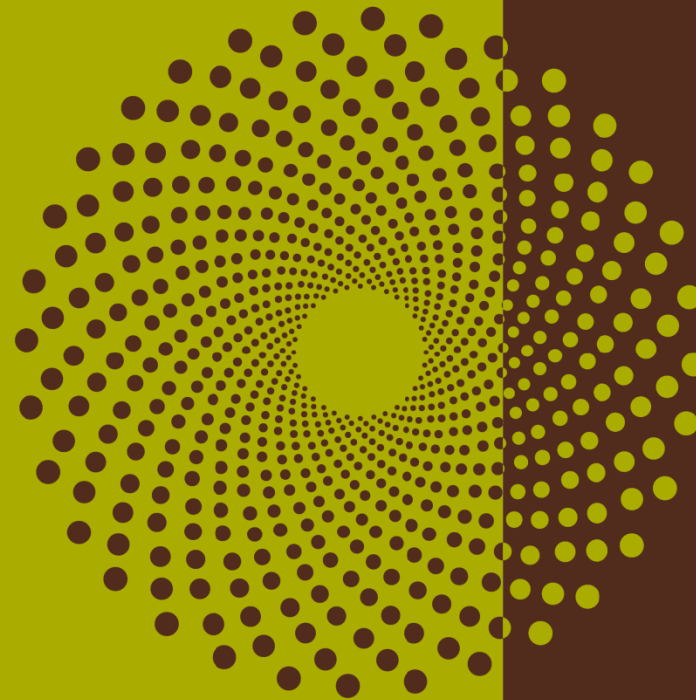
## Joint Industry Projects

- Thermal Well Casing Connection Evaluation Protocol (TWCCEP)
- Synergistic Impacts of Thermal-Mechanical Loading & Environmental Corrosion Cracking on Tubular Materials for Thermal Wells
- NSERC/Foundation CMG Industrial Research Chair in Reservoir Geomechanics for Unconventional Resources
- Well Xplore (CalTran) User Group
- Testing of Alternate Cements for Thermal Well Applications



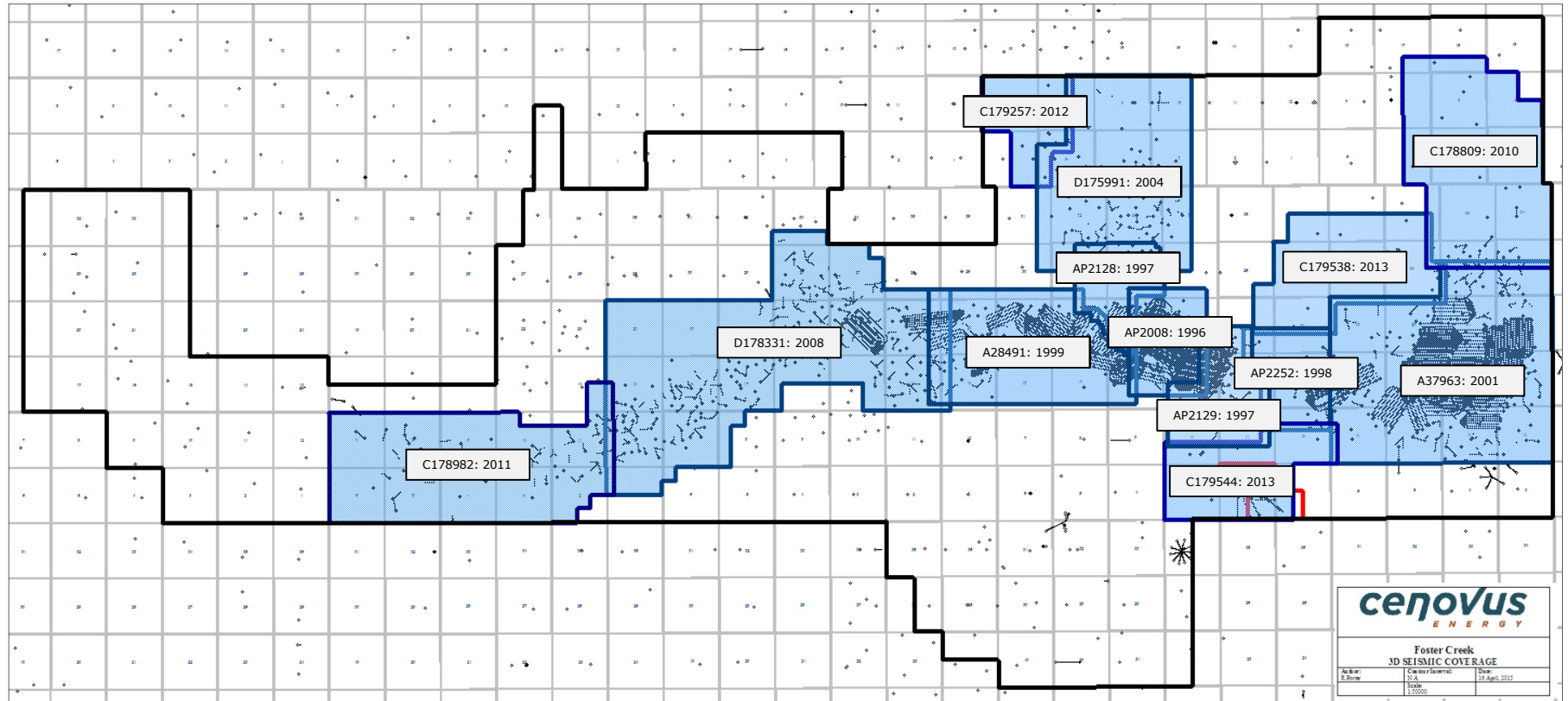
# 4D seismic

Subsection 3.1.1 – 6)

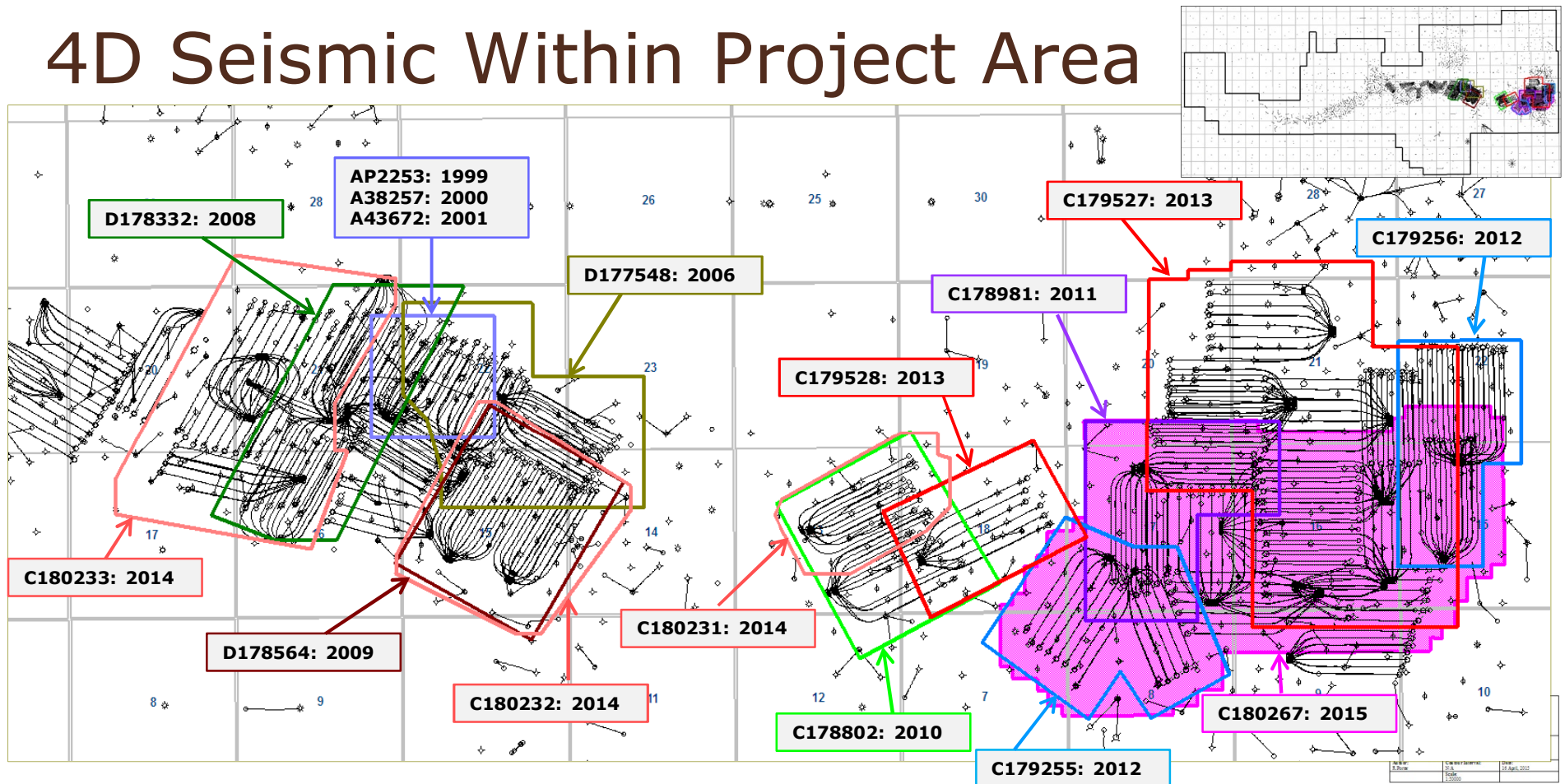


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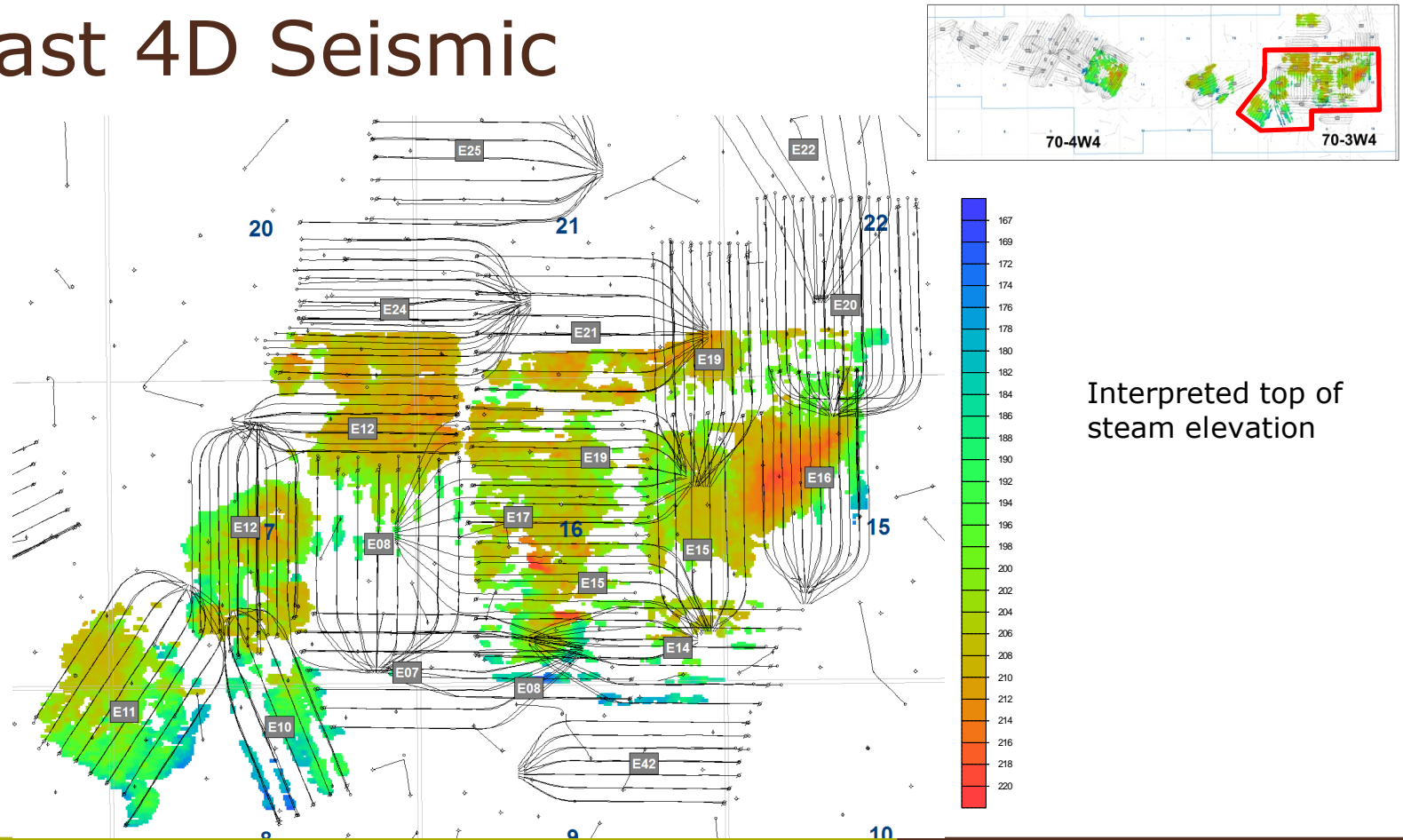
# 3D Seismic Within Project Area



# 4D Seismic Within Project Area

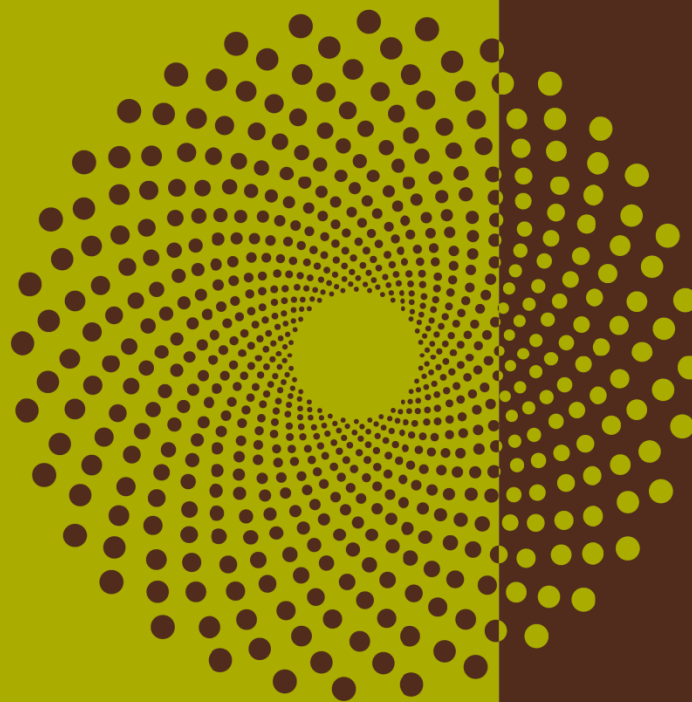


# 2015 East 4D Seismic



# Scheme performance

Subsection 3.1.1 – 7 a)

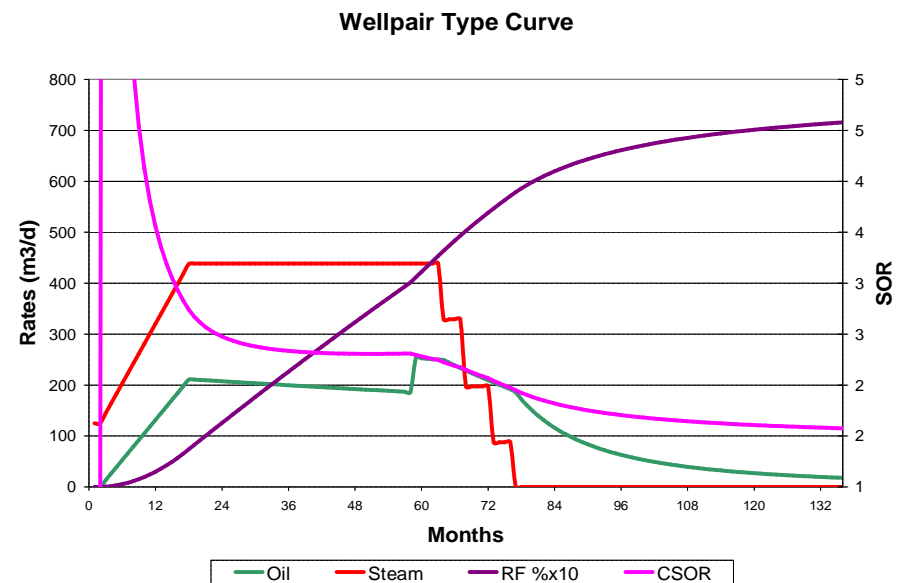


# Scheme performance prediction

**Predict well pair performance based on modified Butler's equation**

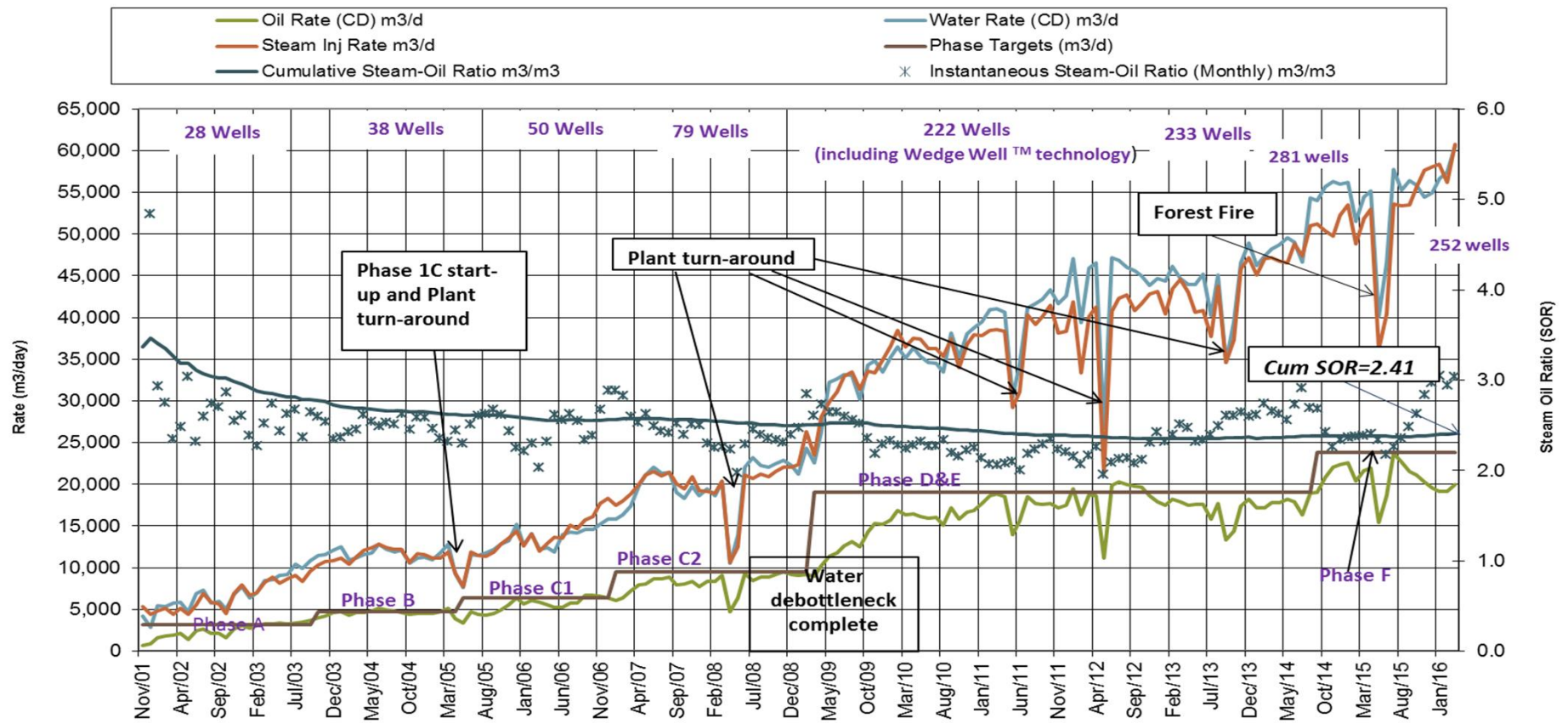
**Predict well pair CSOR using published CSOR correlations (*Edmunds & Chhina 2002*)**

Generate overall scheme production performance by adding individual well forecasts over time to honour predicted steam capacity and water treating availability



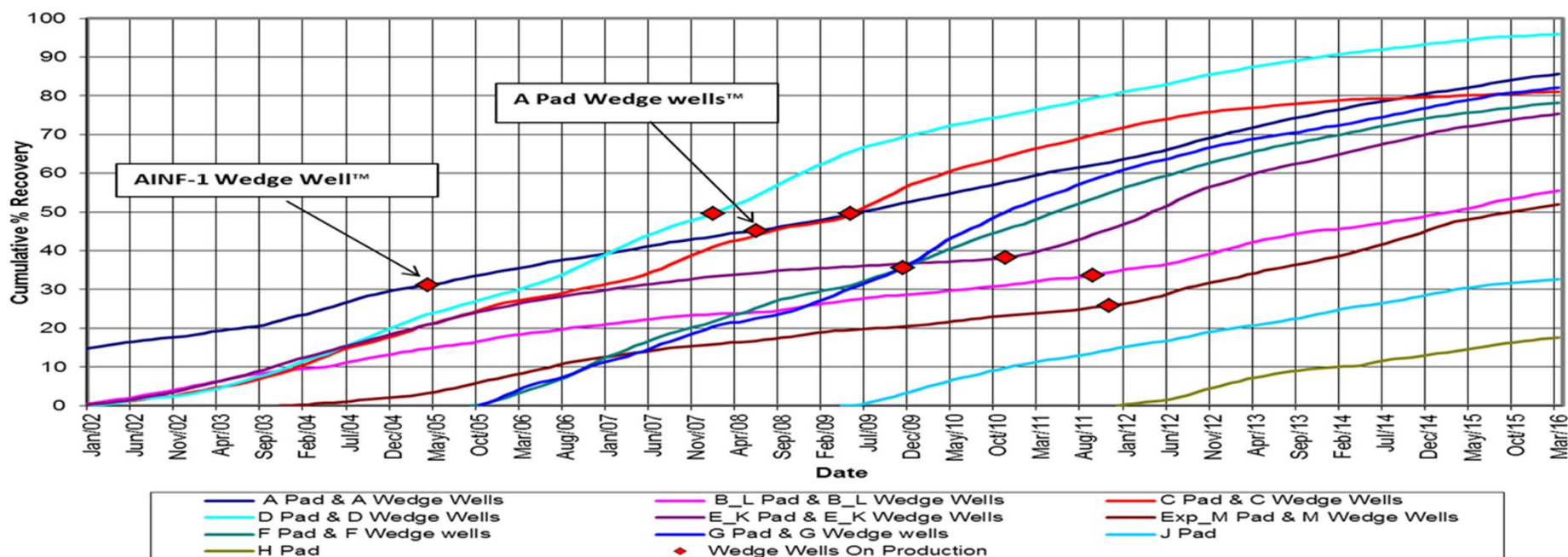


## FOSTER CREEK SAGD Totals



# Central - cumulative % recovery SOIP

Foster Creek - Central Pads  
Cumulative % Recovery SOIP

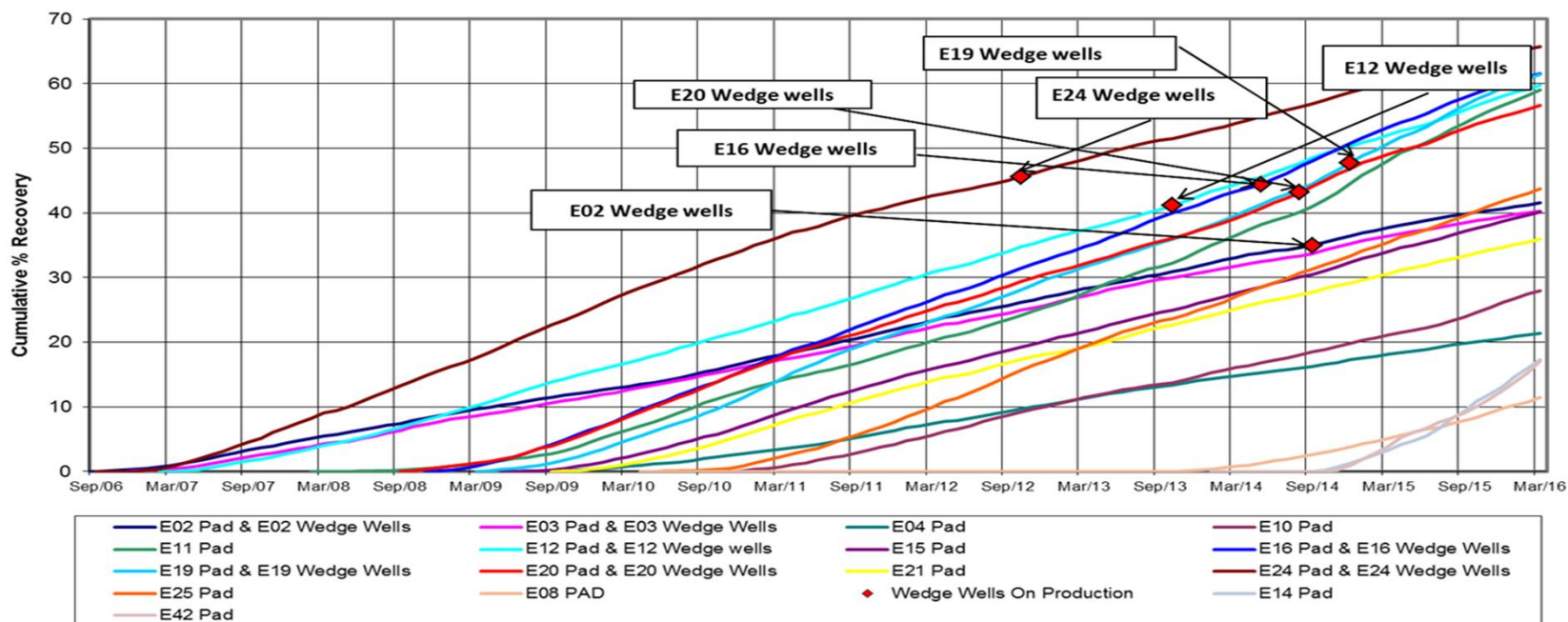


\*Note –A35, AINF-6 & AINF-7 volumes included in E Pad

\*Note that SOIP calculation methodology is available in subsequent slides

# East - cumulative % recovery SOIP

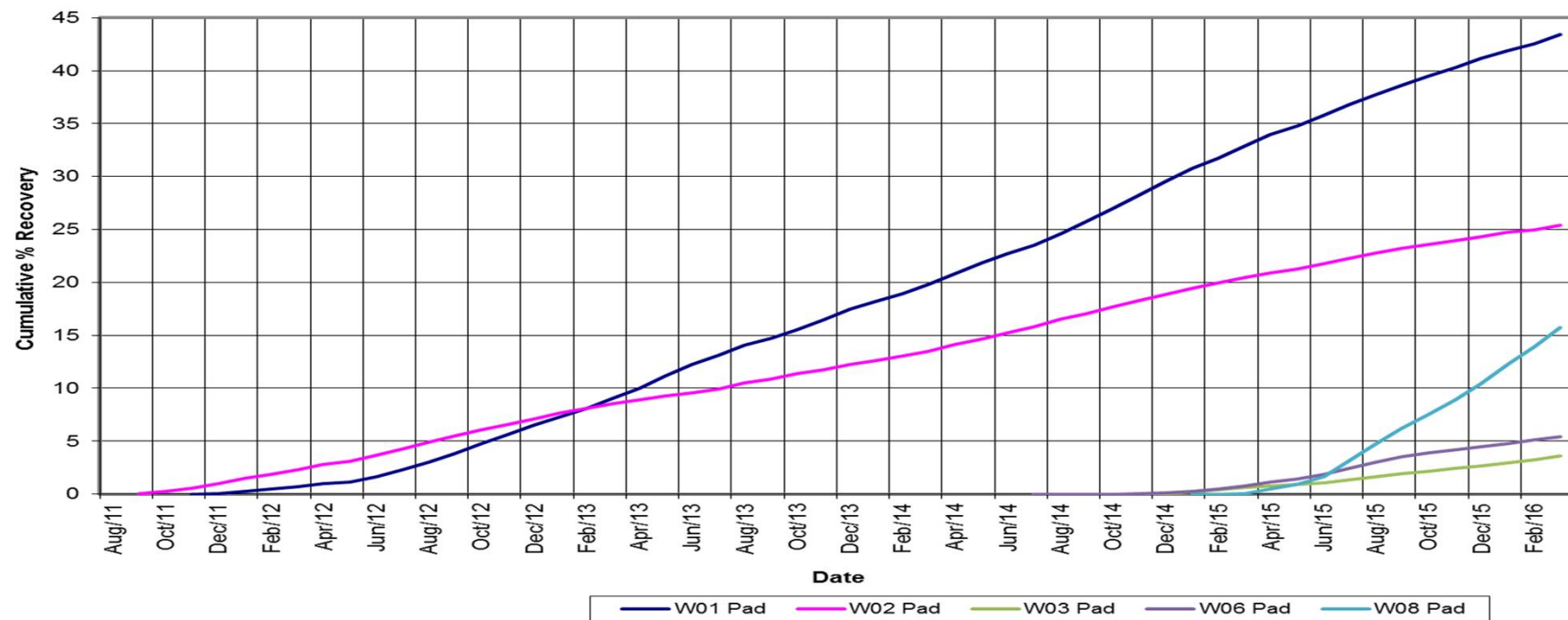
Foster Creek - East Pads  
Cumulative % Recovery SOIP



\*Note that SOIP calculation methodology is available in subsequent slides

# West - cumulative % recovery SOIP

**Foster Creek - West Pads  
Cumulative % Recovery SOIP**



\*Note that SOIP calculation methodology is available in subsequent slides

# Cumulative steam oil ratio – central pads

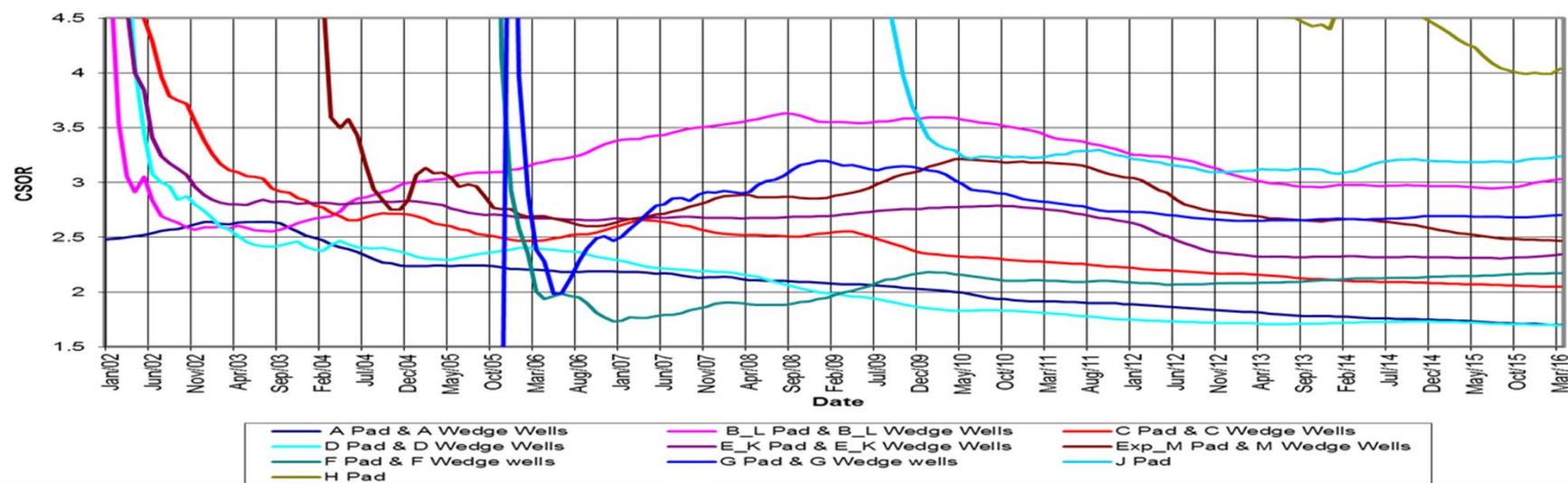
**B / L and EXP / M Pad SORs high due to shut-in periods of wells on pad that were affected by the Colorado Shale issue**

**D, C, A, F and G pads have superior SORs as a result of wells drilled utilizing our patented Wedge Well™ technology**

**D,C and A pad also have started methane co-injection**

\*Note –A35, AINF-6 & AINF-7 volumes included in E Pad

**Foster Creek - Central Pads  
Cumulative Steam Oil Ratio**





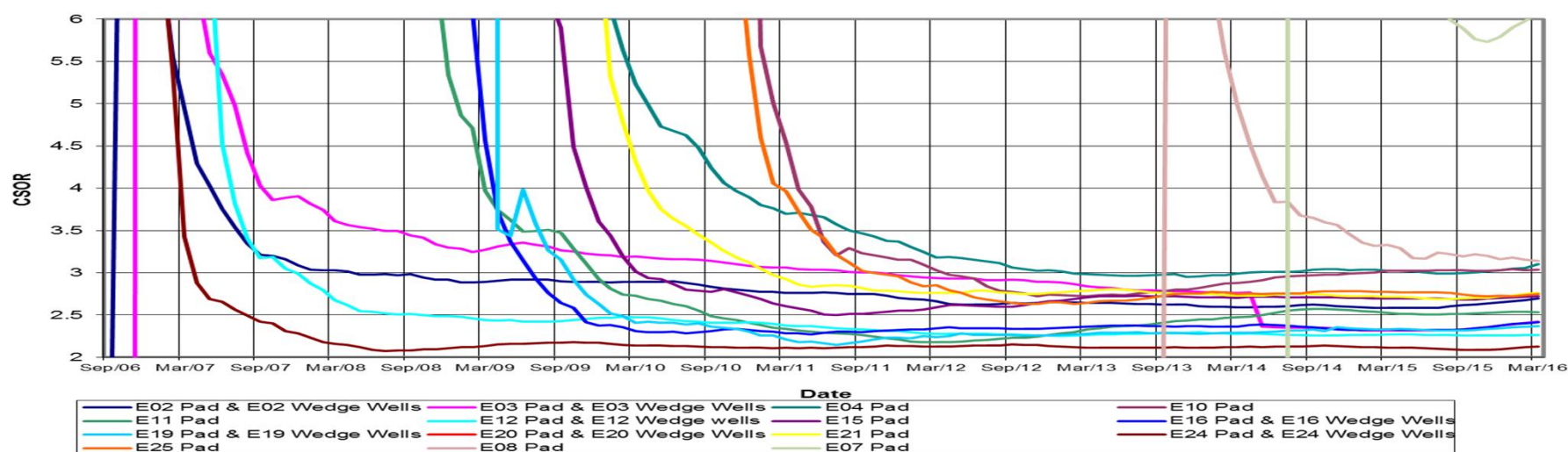
# Cumulative steam oil ratio – East pads

E02 & E03 pads - geology in this area is more heterogeneous than in most areas at Foster Creek and start-up was difficult, requiring several steam stimulations, resulting in a higher CSOR

E24, E16, E19, E20 and E12 pads – all very good geology and well performance, thus, low SORs

E10 & E11 pads have seen some water influx in a couple of wells

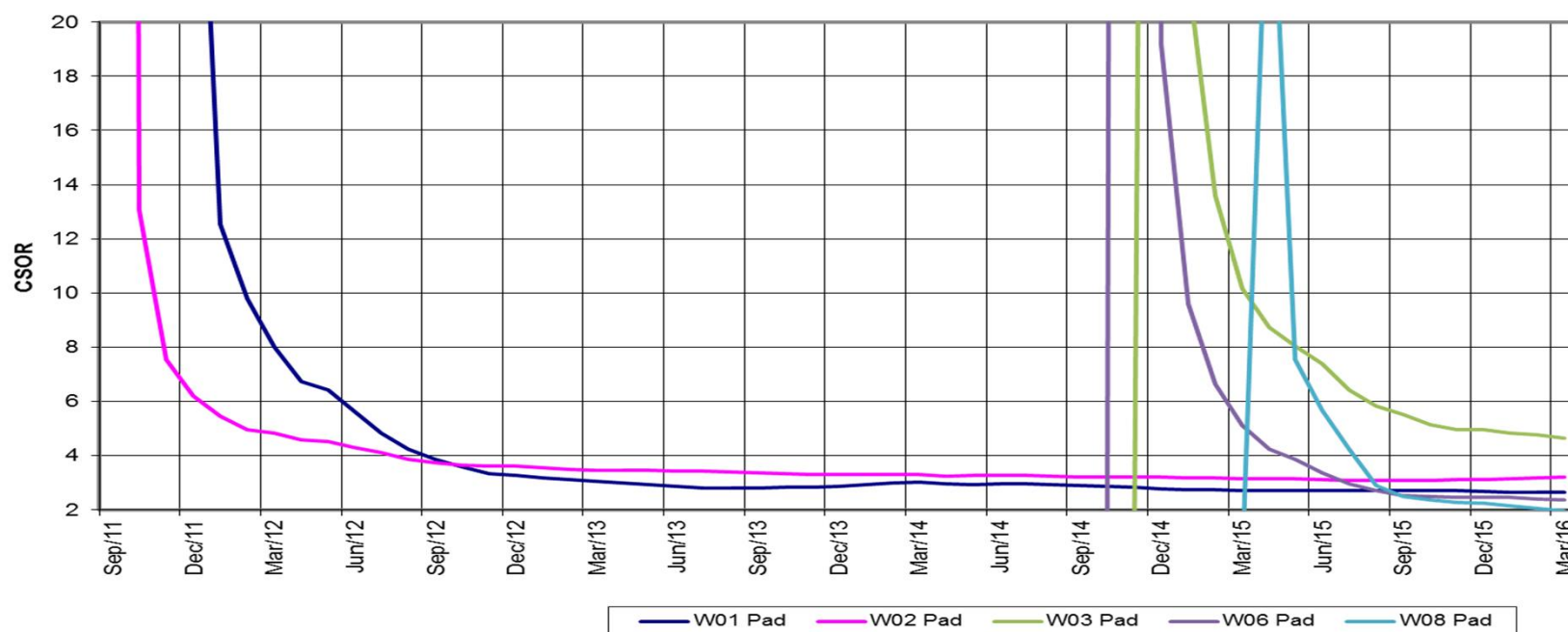
**Foster Creek - East Pads  
Cumulative Steam Oil Ratio**





# Cumulative steam oil ratio – West pads

Foster Creek - West Pads  
Cumulative Steam Oil Ratio



# Actual production vs. approval capacity

## **Foster Creek has met the target rate in Phase A, Phase B, Phase C and Phase D&E applications**

- Phase D&E (Pads J, E04, E08, E11, E15, E16, E19, E20, E21, E25, W01, W02, H) – 120,000 bbl/d (19,080 m<sup>3</sup>/d)
- Phase F (Pads E07, E14, E42, W06, W03, W08) – 30,000 bbl/d (4767 m<sup>3</sup>/d)
- Target daily production between 120,000- 150,000bbl/d throughout the remainder of the year

\*wells drilled utilizing Wedge Well™ technology have been drilled and are on production

Note that production volumes refer to cumulative production capacity on a total production basis

# Steam chamber development

Subsection 3.1.1 – 7 b)



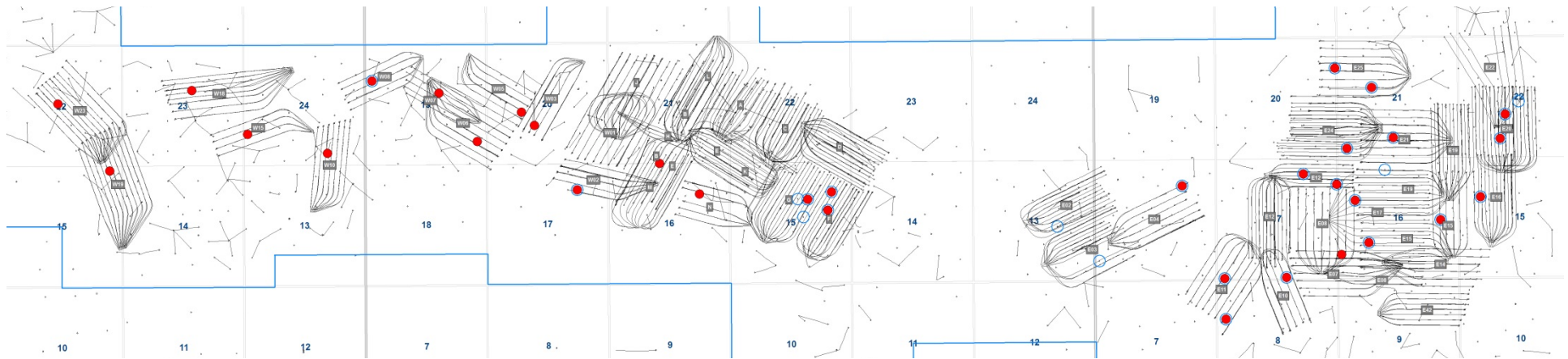
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# Methods for monitoring chamber development

## **Cenovus uses the following methods for monitoring chamber development:**

- Observation wells
- Specialized logging and coring
- Seismic
- Volumetrics

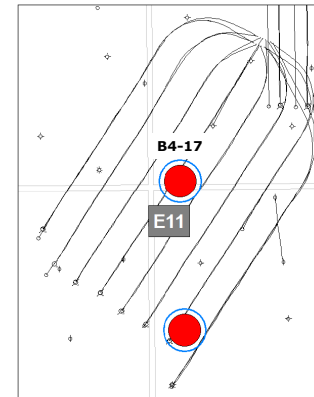
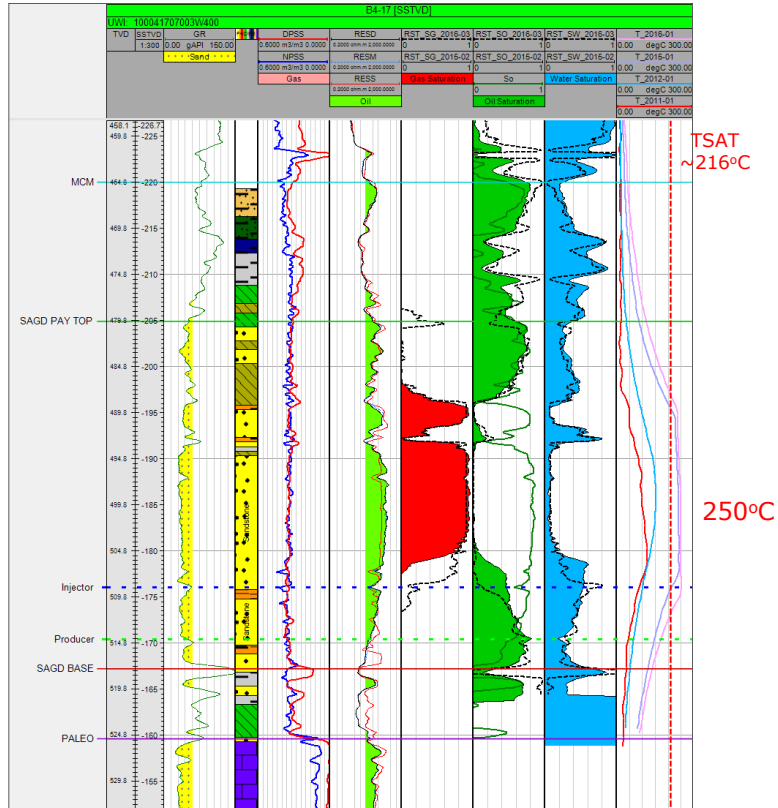
# Foster Creek temperature and RST data



- Wells selected for RST logging (33)
- Wells selected for Temperature logging (27)

# Foster Creek temperature wells

**B4-17**

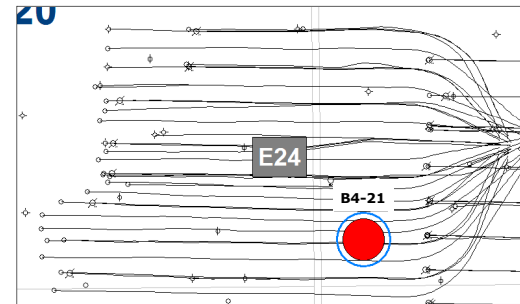
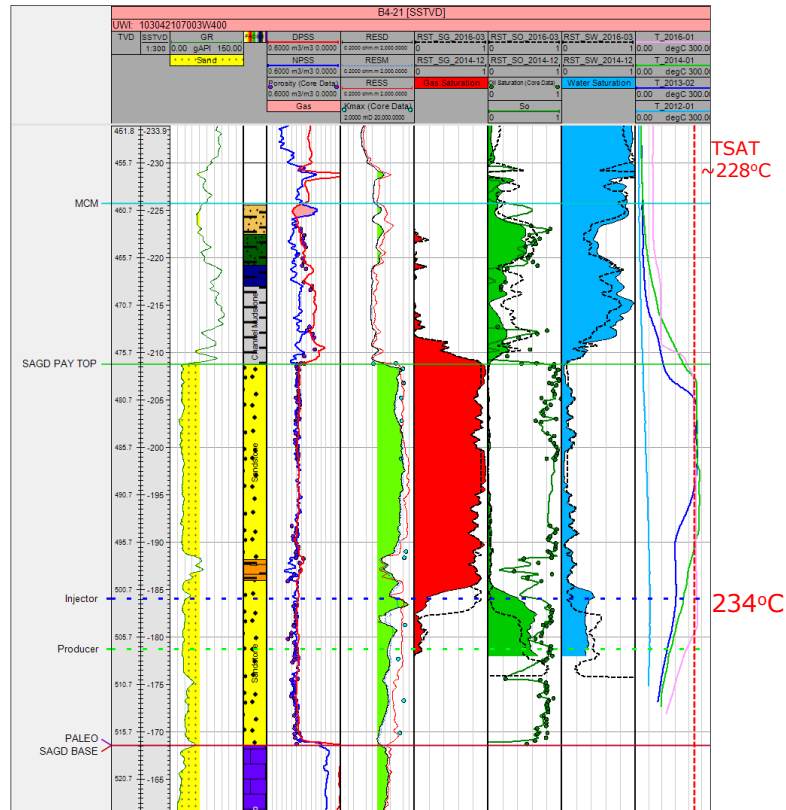


- 23m offset E11-04 well pair



# Foster Creek temperature wells

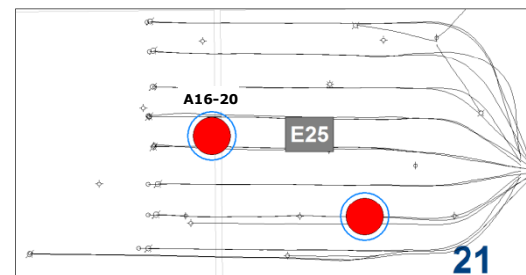
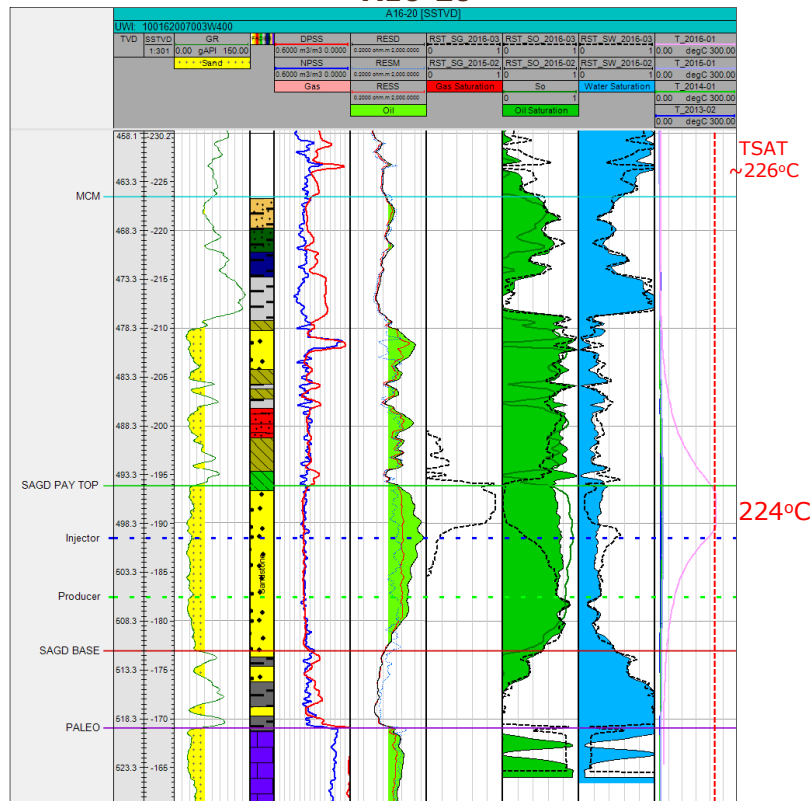
## B4-21



- 8m offset E24-02 well pair

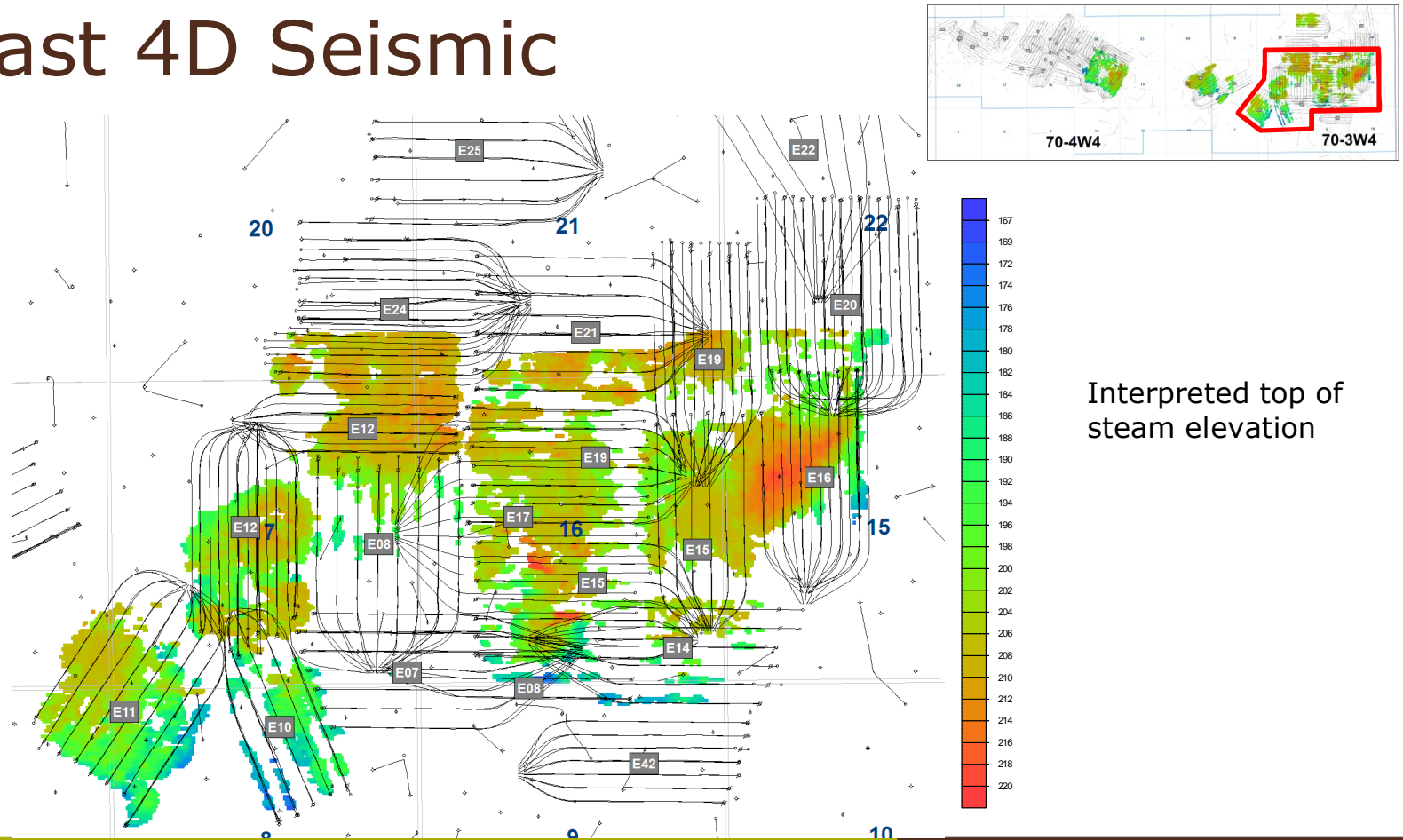
# Foster Creek temperature wells

A16-20

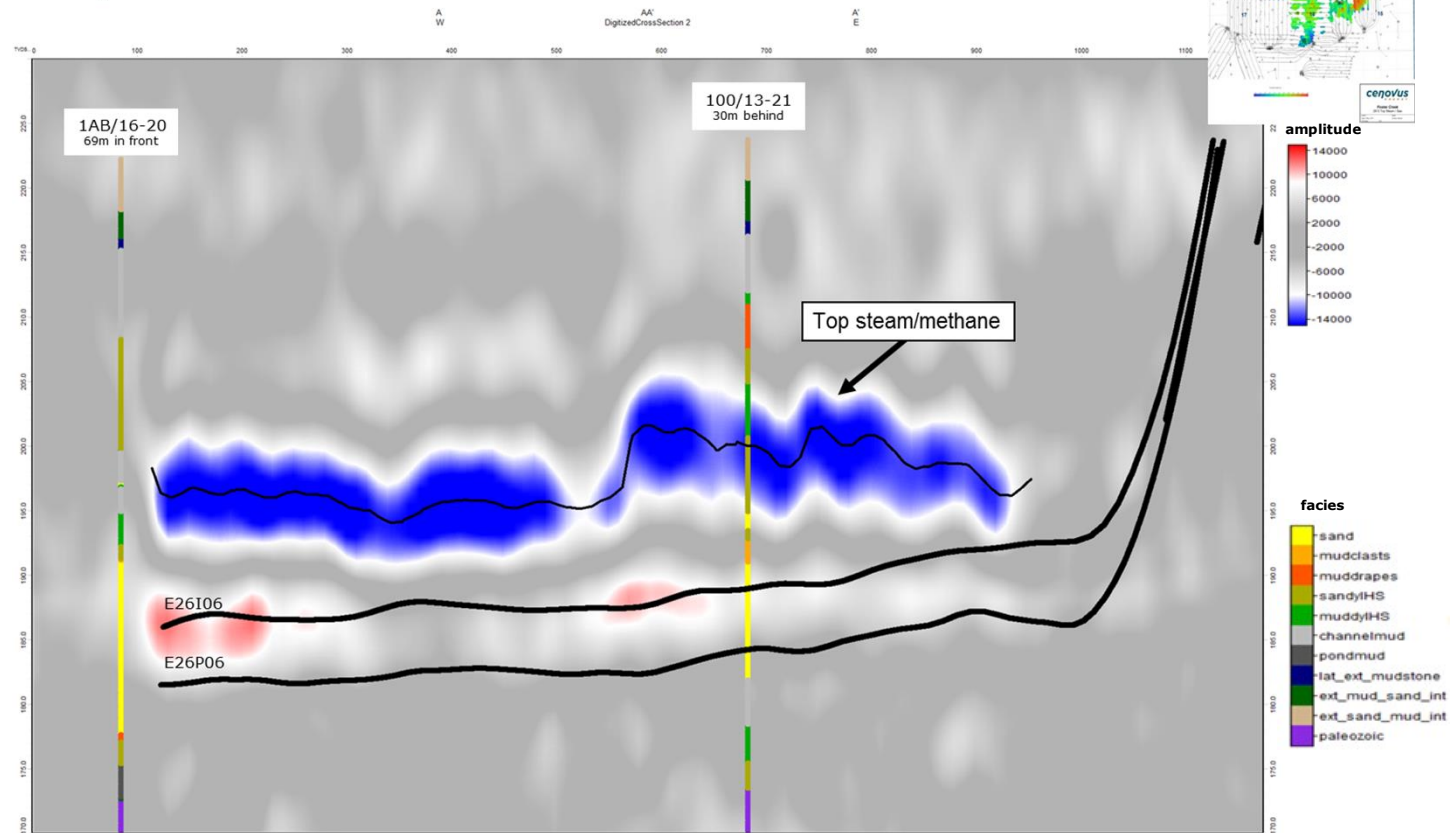


- 32m offset E25-04 well pair

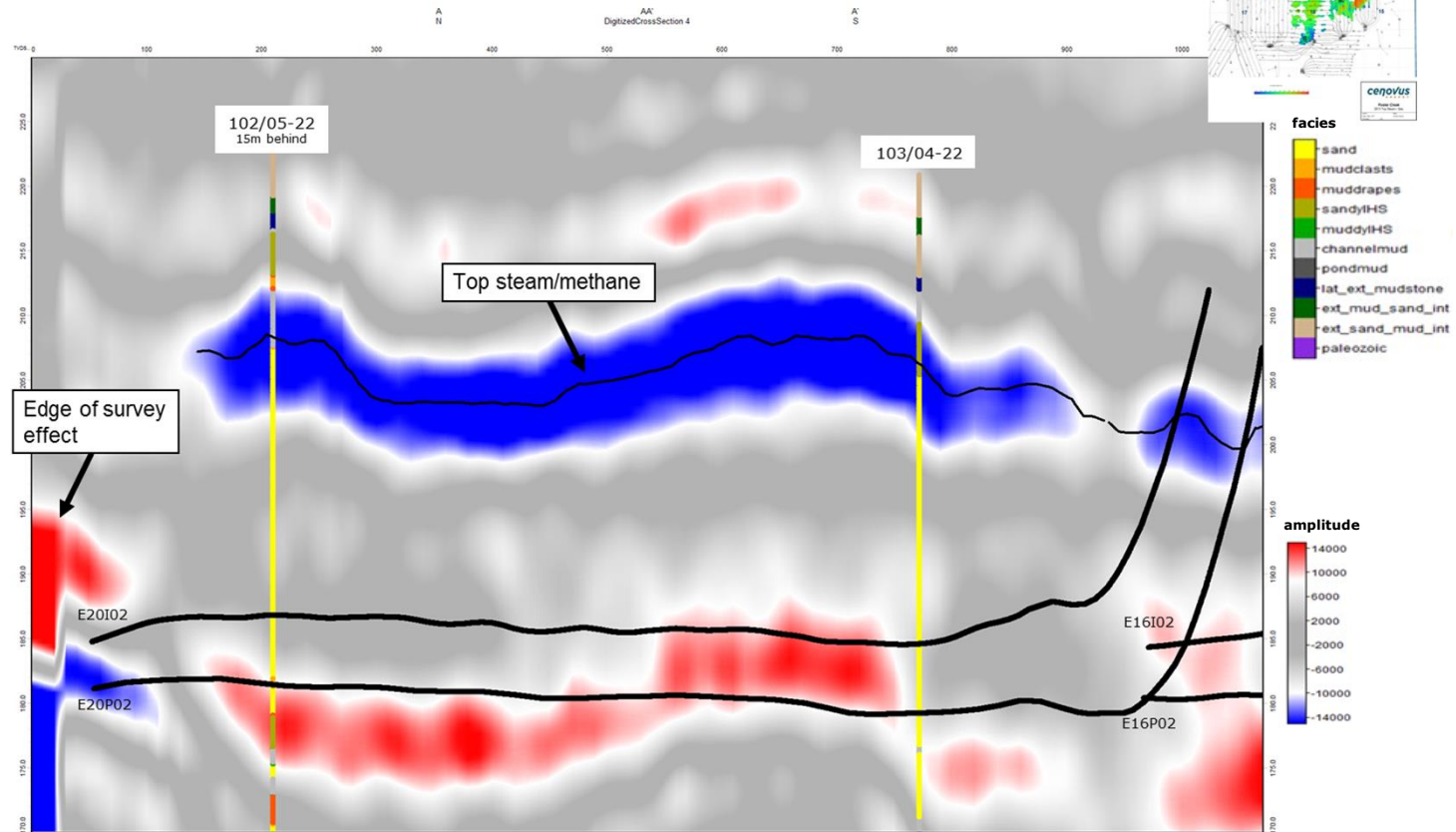
# 2015 East 4D Seismic



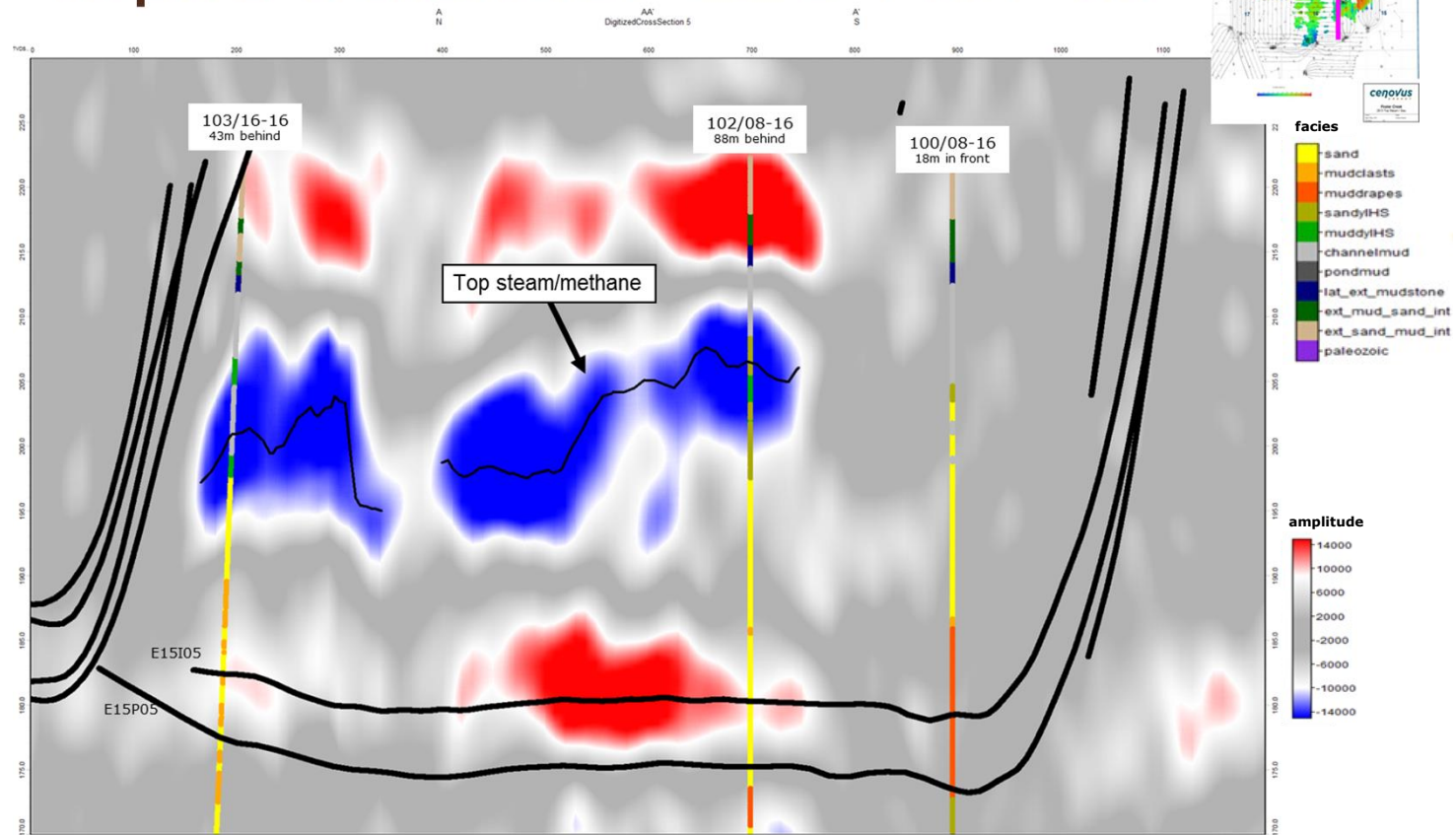
# Time-lapse seismic: E25 Pair 06



# Time-lapse seismic: E20 Pair 02



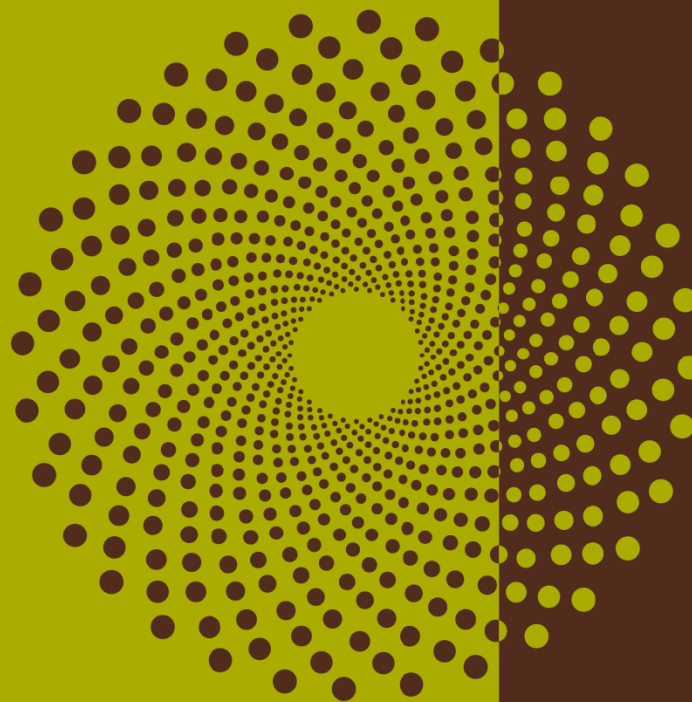
# Time-lapse seismic: E15 Pair 05





# OBIP

Subsection 3.1.1 – 7c



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# Oil in place: SAGDable OIP (SOIP) vs. Productive OIP (POIP)

**Two types of Oil in Place (OIP) are provided:**

- SAGDable OIP and Productive OIP

**SAGDable OIP defined as:**

- $(\text{Planned Length}) \times (\text{Spacing}) \times (\text{Net SAGD Pay: Base to Top SAGD}) \times (S_o) \times (\emptyset)$ 
  - used drilled length for existing well pairs but will use planned length for all future pairs
- a “before-drilling” OOIP, used during planning phase
- doesn’t change after well pair plans finalized
- used to plan additional wells (Wedge Well™ technology, bypassed pay producers, re-drills, new pairs)
- this is essentially a “planned” OOIP, as we would aim to drill the full planned length (typically 800m), and drill the producer well as low as possible in relation to Base SAGD

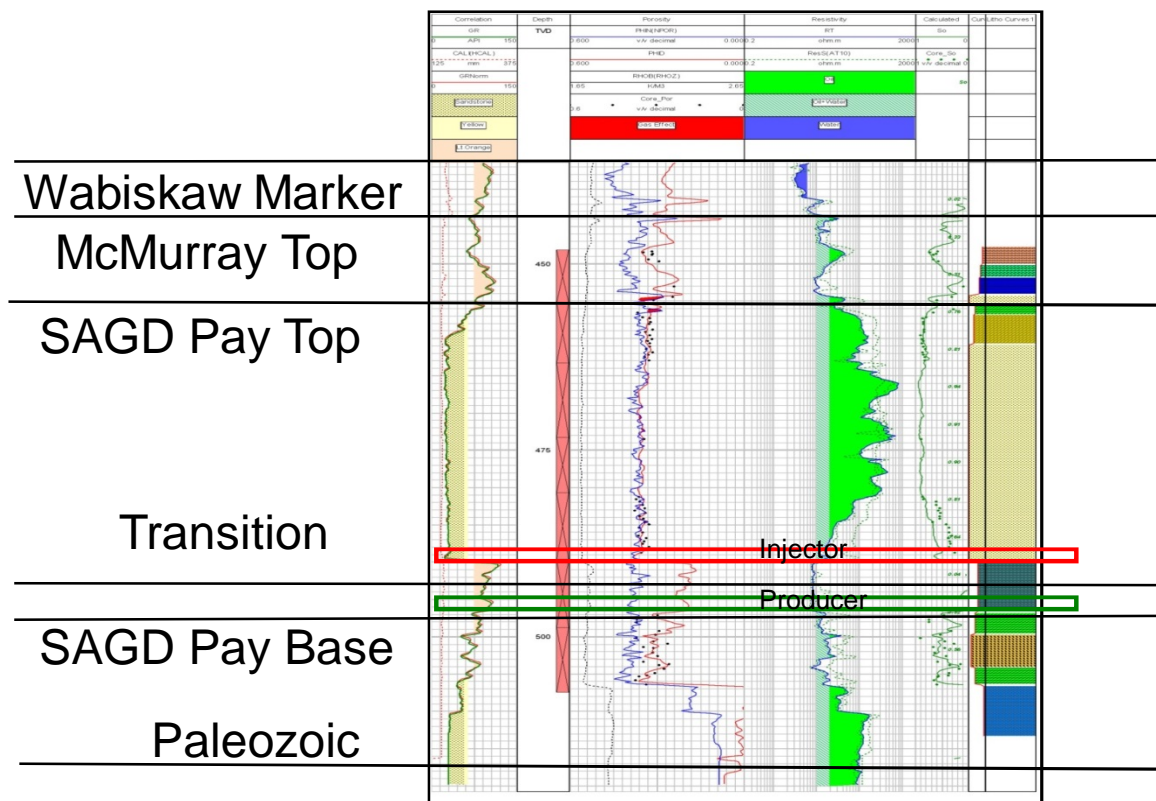
**Productive OIP defined as:**

- $(\text{Effective Length}) \times (\text{Spacing}) \times (\text{Effective Pay: Producer to Top SAGD}) \times (S_o) \times (\emptyset)$
- an “after-drilling” OOIP, based on well pair potential
- changes with time and interpretation (obs. wells, 4D seismic, MWD error, etc.)
- used to plan blowdown strategy
- this reflects actual well pair performance
  - incorporates actual overlapping slotted liner lengths initially (including blank sections <100m)
  - incorporates actual location of the producing well

**Productive OIP almost always < SAGDable OIP**

**Internally updated reserves definitions and methodology in 2010 and review annually. Change in various pads SOIP and POIP values from year to year to better reflect well lengths, placement, recovery factors and production performance**

# SOIP and POIP intervals



Cutoffs:

Gamma: <60 API

Porosity: >27% D

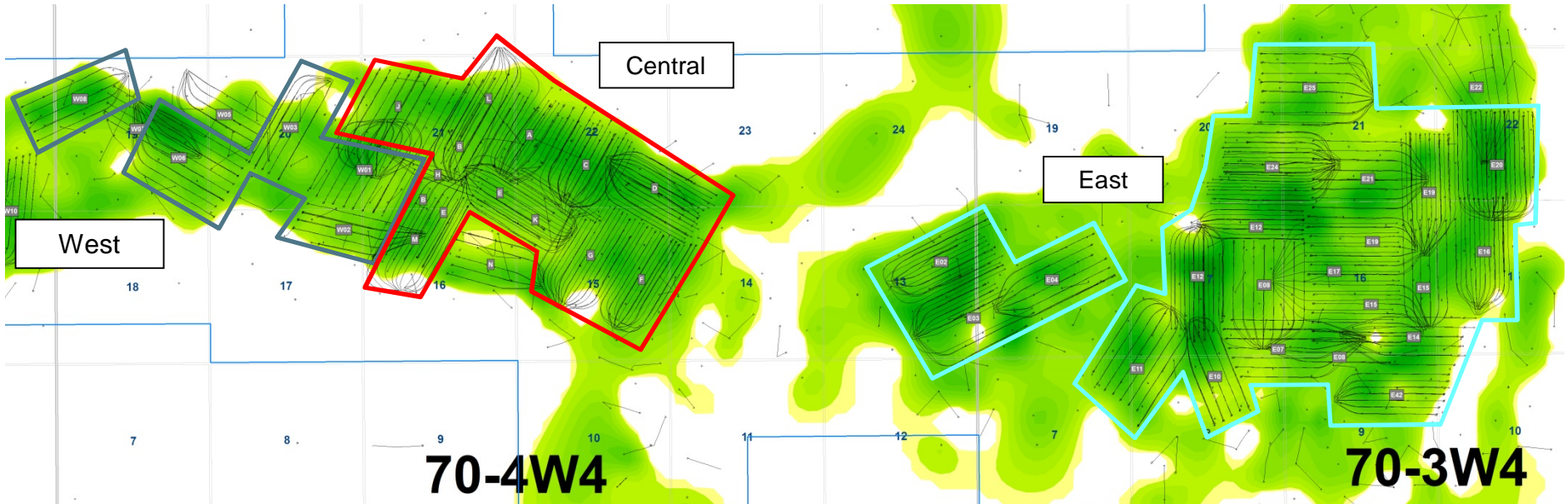
Rt: >20 ohm-m  
(equates to 50% So)

Facies: sand, sand-  
mud clasts, & sand-  
mud drapes.

<1m mud interval

SOIP  
POIP

# OIP – location of areas



East: 17 pads  
Central: 10 pads  
West: 5 pads

# OIP & percent recovery – central

Ultimate recoveries in the central area are now forecasted higher than originally expected due to:

- Wells drilled utilizing our patented Wedge Well™ technology have been successful
- Indications of lower residual oil than originally expected

C, D & G Pads – currently re-evaluating SOIP, POIP and ultimate recoveries, expectation is that these volumes will increase

PAD	SOIP Mm3	POIP Mm3	Cum Oil Mm3 (to Mar 31, 2016)	Recovery % SOIP	Recovery % POIP	Expected Ultimate Recovery Mm3	Ultimate Recovery as % of SOIP
A PAD*-**	3,228	2,952	2,762	86	94	2,900	90%
B_L PAD	4,330	3,274	2407	56	74	2,947	68%
C PAD**	4,592	3,957	3,724	81	94	3,900	85%
D PAD**	4,695	4,198	4,500	96	107	4,600	98%
E_K PAD*	4,625	3,820	3,484	75	91	3,700	80%
EXP_M PAD	4,156	3,110	2,158	52	69	2,593	62%
F PAD**	4,211	3,541	3,294	78	93	3,500	83%
G PAD**	3,265	2,274	2,683	82	118	2,700	83%
H PAD	721	504	127	18	25	420	58%
J PAD	4,170	3,118	1,361	33	44	2,227	53%
<b>Total Central</b>	<b>37,994</b>	<b>30,748</b>	<b>26,502</b>	<b>70</b>	<b>86</b>	<b>29,487</b>	<b>78%</b>
<b>Total FC</b>	<b>122,994</b>	<b>99,775</b>	<b>59,855</b>	<b>49</b>	<b>60</b>	<b>85,007</b>	<b>69%</b>

\*Note - A35, AINF-6 7 AINF-7 excluded from A pad volume and recovery and included in E\_K pad.

\*\*Note – includes wells drilled utilizing Wedge Well™ technology

Pad, area, and Foster Creek totals based on sum of wells

To Mar 31, 2016

# OIP and percent recovery - east

Ultimate recovery includes only existing wells.

Cenovus anticipates infill drilling on most pads that will significantly increase the ultimate recovery, but has not quantified these increases at this time.

\*Note – does not include future Wedge Well™ technology recoverables

\*\*Note – includes wells drilled utilizing Wedge Well™ technology

Pad, area, and Foster Creek totals based on sum of wells

PAD	SOIP Mm3	POIP Mm3	Cum Oil Mm3 (to Mar 31, 2016)	Recovery % SOIP	Recovery % POIP	Expected Ultimate Recovery Mm3	Ultimate Recovery as % of SOIP
E02 PAD	2,993	2,051	1245	42	61	1,749	58%
E03 PAD	3,042	2,079	1225	40	59	1,985	65%
E04 PAD	3,568	2,407	762	21	32	1,925	54%
E07 PAD	2,606	1,849	85	3	5	1,479	57%
E08 PAD	4,676	4,049	533	11	13	3,239	69%
E10 PAD	2,061	1,492	577	28	39	1,194	58%
E11 PAD	3,912	3,409	2311	59	68	2,727	70%
E12 PAD	7,023	4,831	4198	60	87	4,598	65%
E14 PAD	2,148	1,810	371	17	21	1,289	60%
E15 PAD	7,397	5,646	2973	40	53	4,517	61%
E16 PAD	3,486	3,119	2146	62	69	2,512	72%
E19 PAD	6,307	5,850	3876	61	66	4,680	74%
E20 PAD	5,882	4,909	3332	57	68	4,022	68%
E21 PAD	3,930	2,863	1413	36	49	2,291	58%
E24 PAD	5,256	4,931	3454	66	70	4,008	76%
E42 PAD	1,618	1,283	275	17	21	971	60%
E25 PAD	4,137	3,390	1809	44	53	2,712	66%
<b>Total East</b>	<b>70,042</b>	<b>55,968</b>	<b>30,585</b>	<b>44</b>	<b>55</b>	<b>45,898</b>	<b>66%</b>
<b>Total FC</b>	<b>122,994</b>	<b>99,775</b>	<b>59,855</b>	<b>49</b>	<b>60</b>	<b>85,007</b>	<b>69%</b>

To March 31, 2016

# OIP and percent recovery – west

**W01 & W02 pads came online in late 2011**

**W03 & W06 pads came online in late 2014**

**W08 pads came online in early 2015**

PAD	SOIP Mm3	POIP Mm3	Cum Oil Mm3 (to Mar 31, 2016)	Recovery % SOIP	Recovery % POIP	Expected Ultimate Recovery Mm3	Ultimate Recovery as % of SOIP
W01	3,697	3,224	1,606	43	50	2,402	65%
W02	1,753	1,503	446	25	30	1,226	70%
W03	2,532	1,998	91	4	5	1,568	62%
W06	4,566	3,735	247	5	7	2,861	63%
W08	2,409	2,599	379	16	15	1,566	65%
<b>Total West</b>	<b>14,958</b>	<b>13,058</b>	<b>2,769</b>	<b>19</b>	<b>21</b>	<b>9,623</b>	<b>64%</b>
<b>Total FC</b>	<b>122,994</b>	<b>99,775</b>	<b>59,855</b>	<b>49</b>	<b>60</b>	<b>85,007</b>	<b>69%</b>

**\*Note – does not include future Wedge Well™ technology recoverable**

**Pad, area, and Foster Creek totals based on sum of wells**

To March 31, 2016

# Recovery examples

**W02 pad low ultimate recovery example with focus on W02-04 well pair**

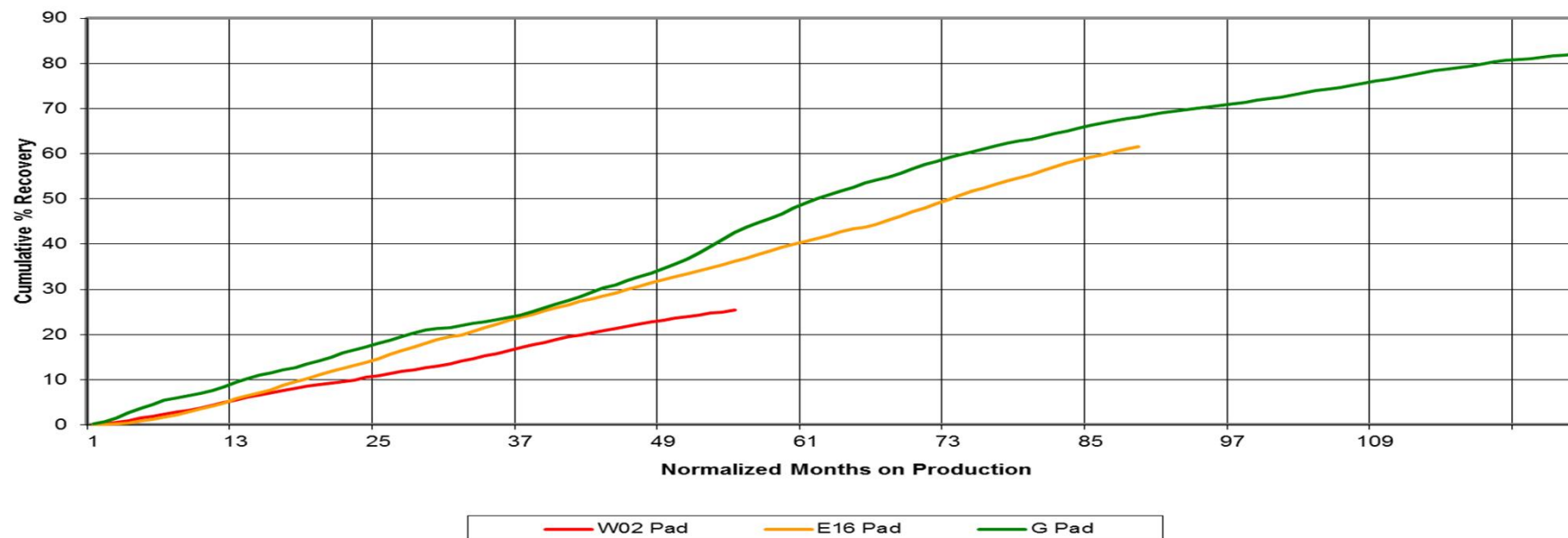
**E16 pad medium ultimate recovery example with focus on E16-01 well pair**

**G pad high ultimate recovery example with focus on GP01 well pair**



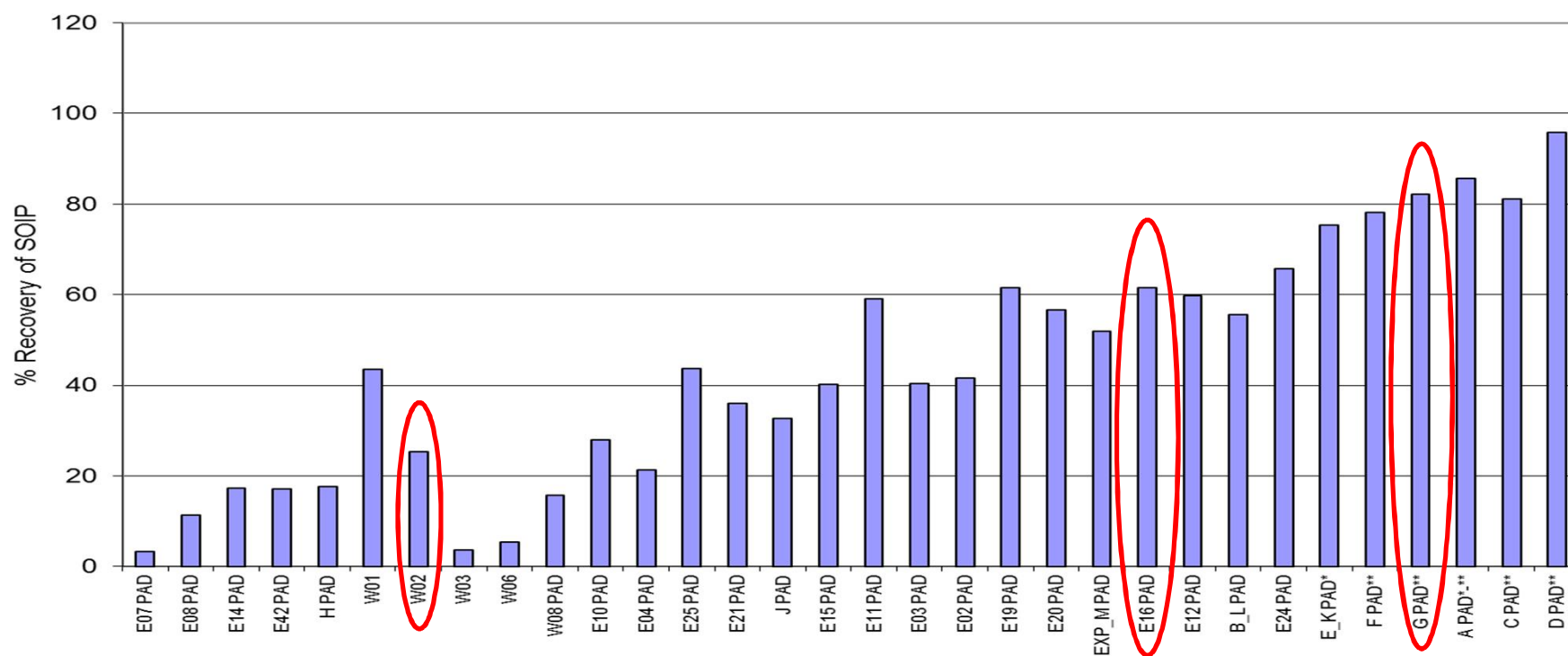
# Recovery examples cumulative percent recovery SOIP

Foster Creek - W02, E16 & G Pads  
Cumulative % Recovery SOIP  
Normalized



# Current percent recovery of SOIP: pad totals

Foster Creek - % Recovery of SOIP per Pad (Mar 31, 2016)



# OBIP – low example

## W02 pad

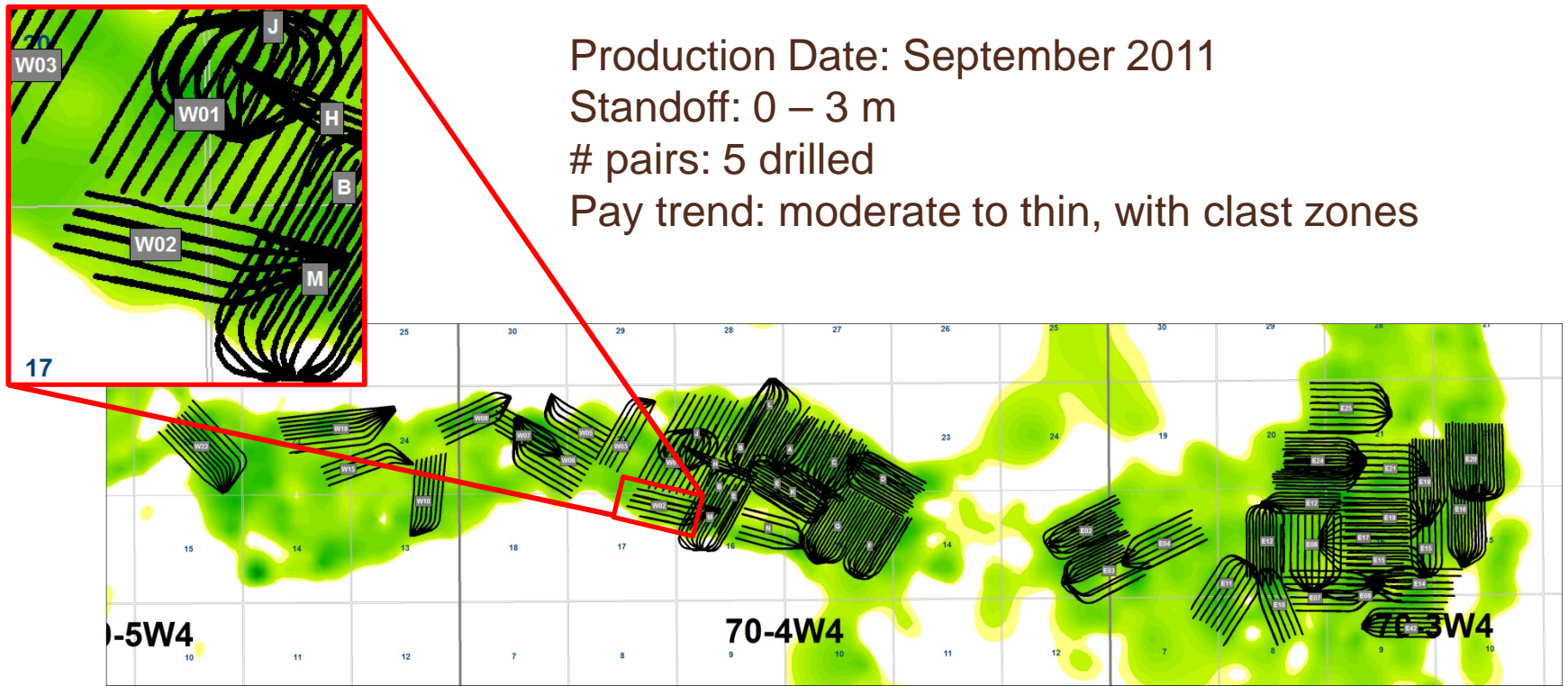
Subsection 3.1.1 – 7 c, iii)



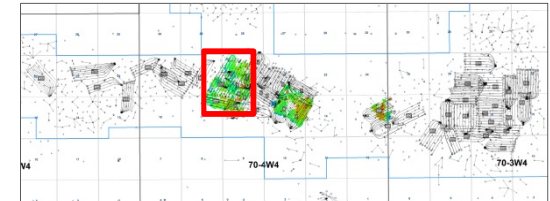
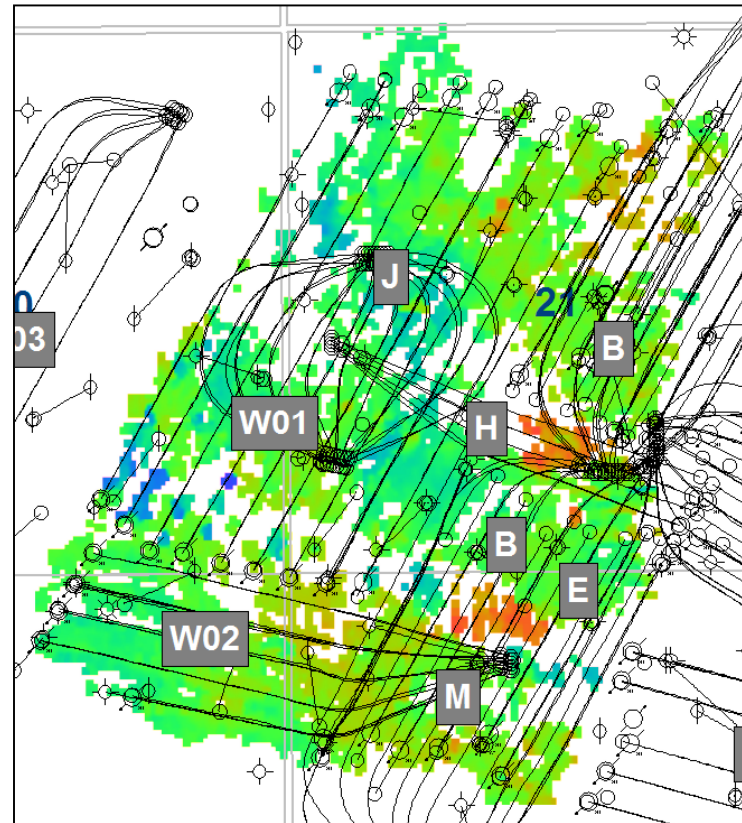
# W02 pad overview

- **W02 pad began production in September 2011 (five pairs)**
- **Generally good quality geology on the edge of the valley, some small variations in SAGD base between well pairs**
- **Pad started up using ESPs, steam stimulations were successful on every well**
- **Initial operating pressures  $\sim 3$  Mpa until pad started communicating with rest of central pad at which point pressures were reduced to  $\sim 2100$  kPa. This resulted in shorter period of operation at higher pressure and the pad to underperform.**
- **Remedial work on P02, P03, and P05 in 2013 - Q1 2014**
- **Currently at  $\sim 25\%$  recovery of SOIP, slightly behind its recovery curve in relation to the age of the pad.**
- **CSOR is currently 3.20, expected to drop as pad is in early life**

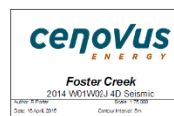
# W02 Pad SAGD Pay



# 2014 W01W02J 4D Seismic



Interpreted top of  
steam elevation



# W02 pad - extent of chamber development

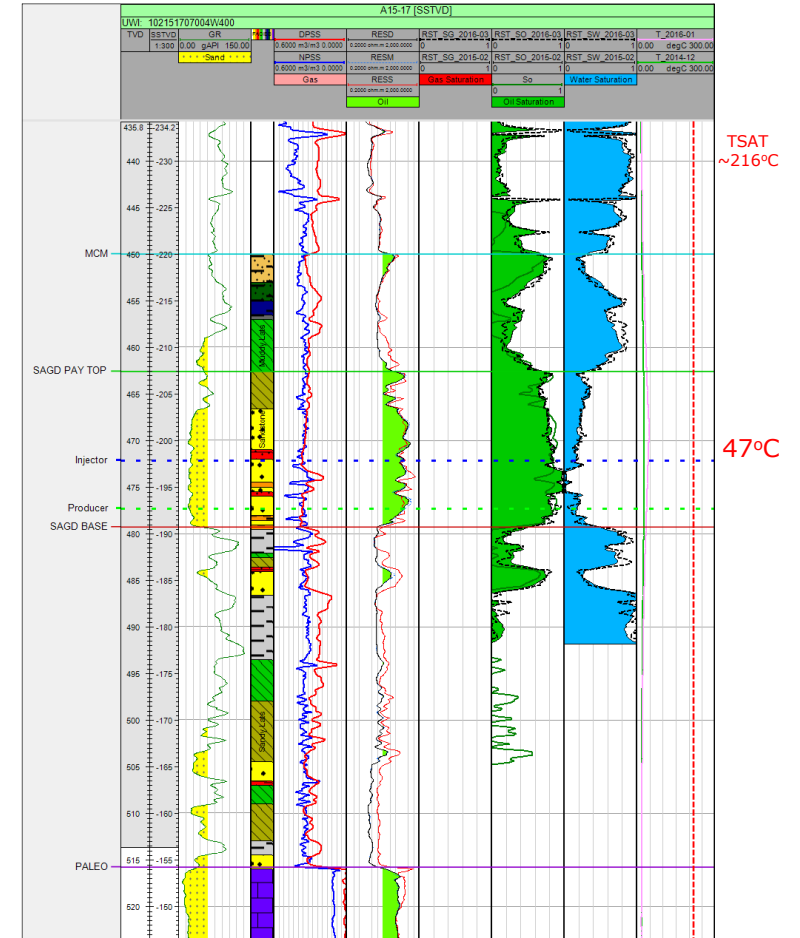
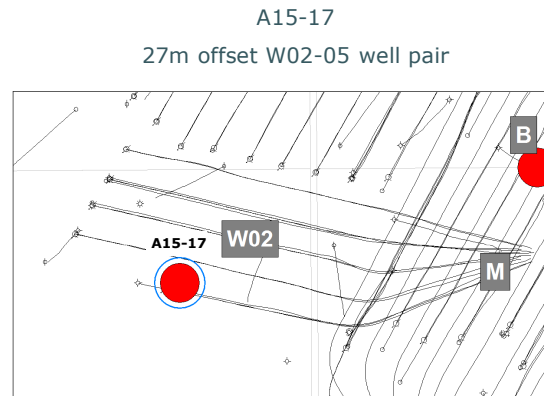
PAD	PAIR	SOIP Mm3	POIP Mm3	Cum Oil Mm3	% Recovery SOIP	% Recovery POIP
W02 PAD	W02-01	443	355	76	17	21
W02 PAD	W02-02	348	301	62	18	21
W02 PAD	W02-03	450	395	132	29	33
W02 PAD	W02-04	389	360	102	26	28
W02 PAD	W02-05	124	92	73	59	80
<b>Total</b>	<b>W02 PAD</b>	<b>1,753</b>	<b>1,503</b>	<b>446</b>	<b>25</b>	<b>30</b>

Expected ultimate recovery (70% of SOIP) = 1,227 Mm3

To March 31, 2016

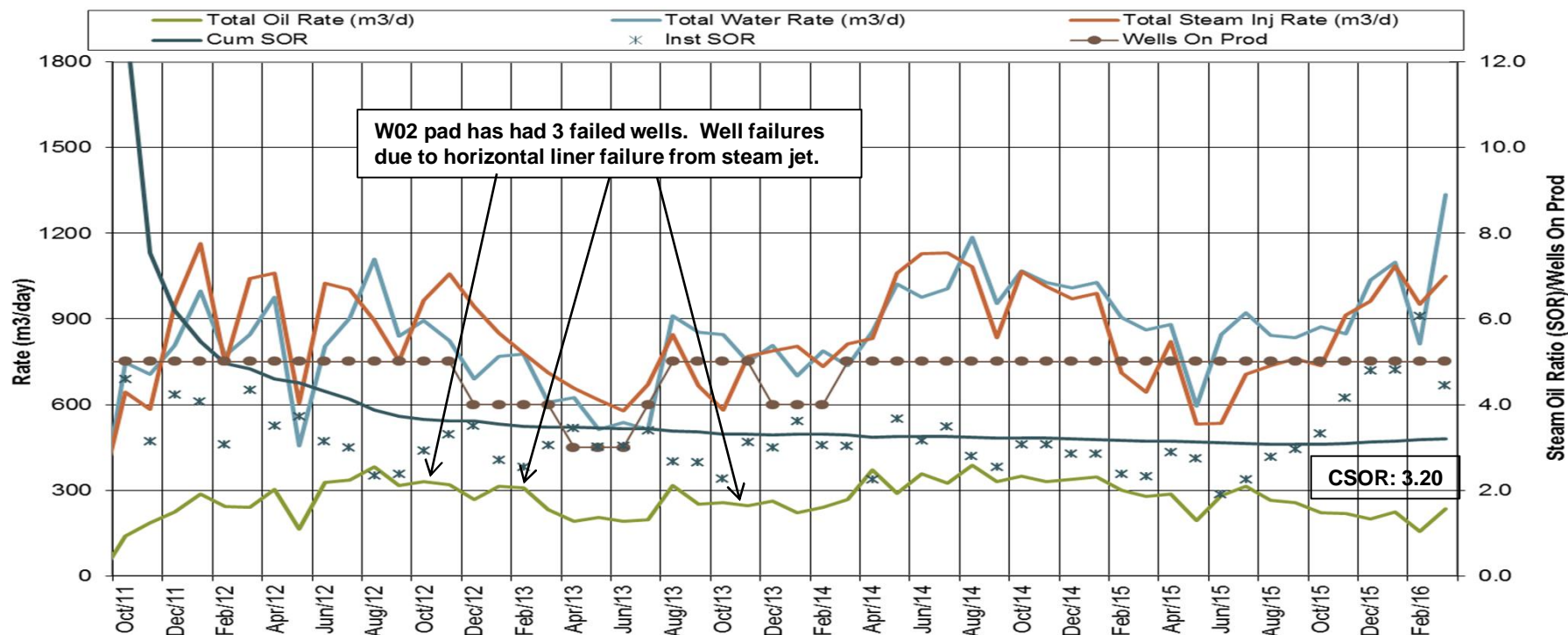


# W02 Pad Temperatures

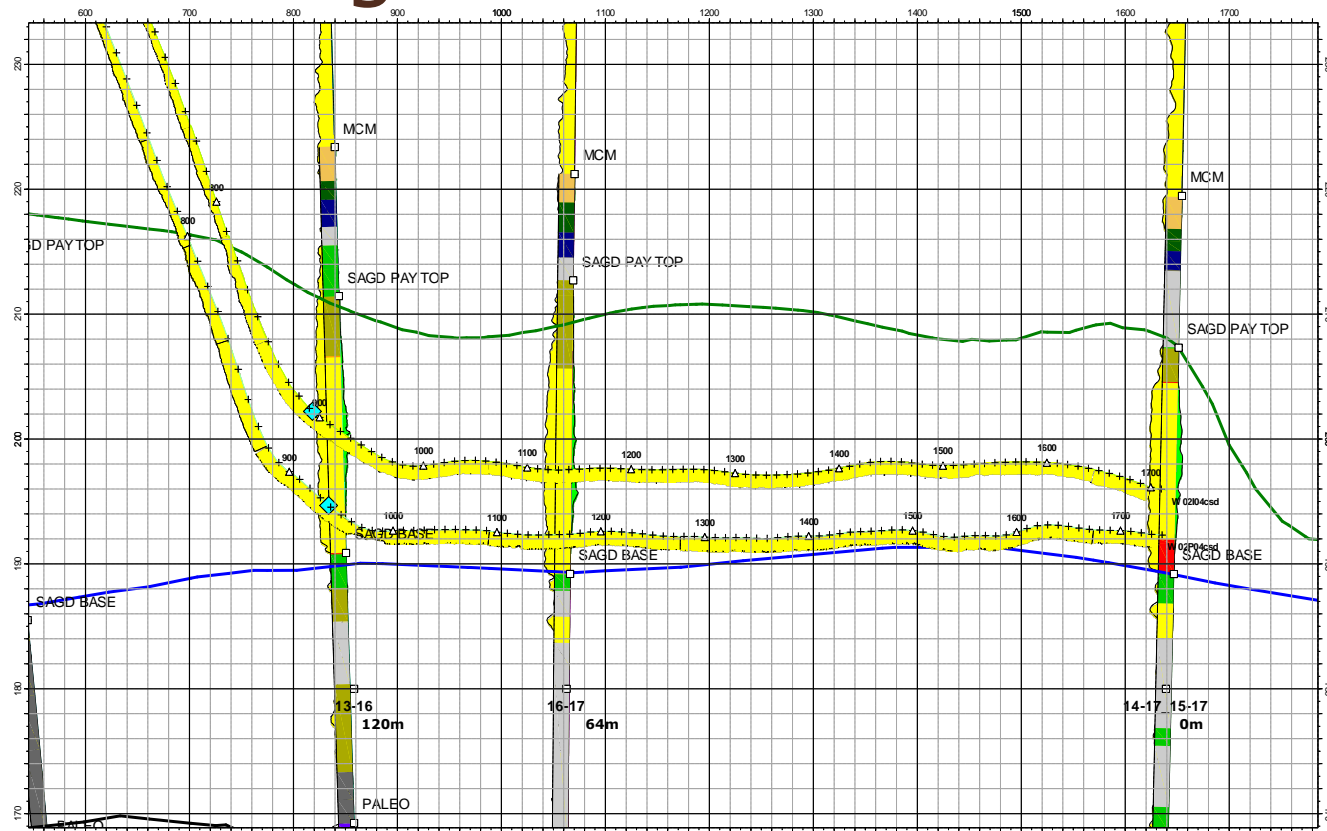


# W02 pad performance

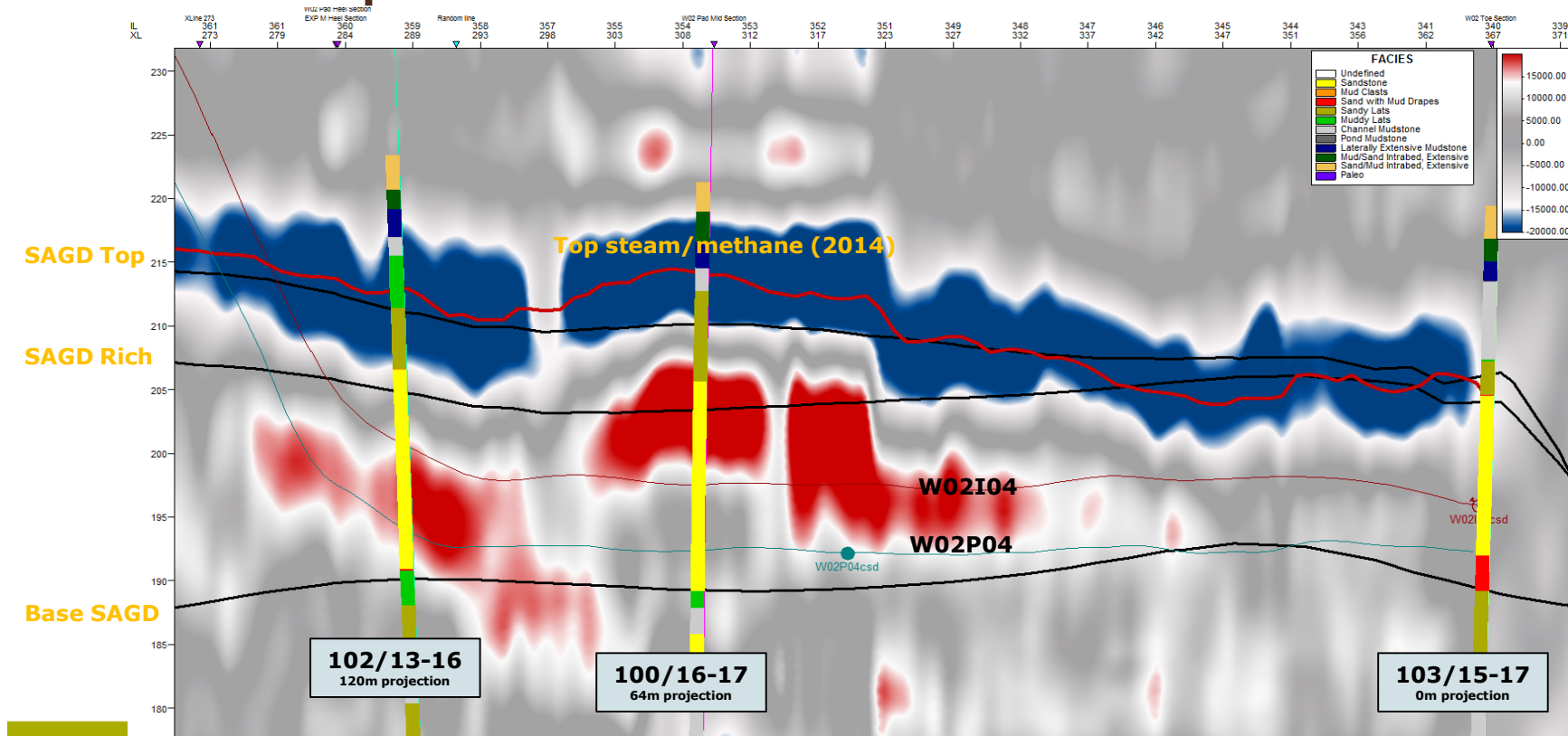
FOSTER CREEK  
W02 Pad Performance



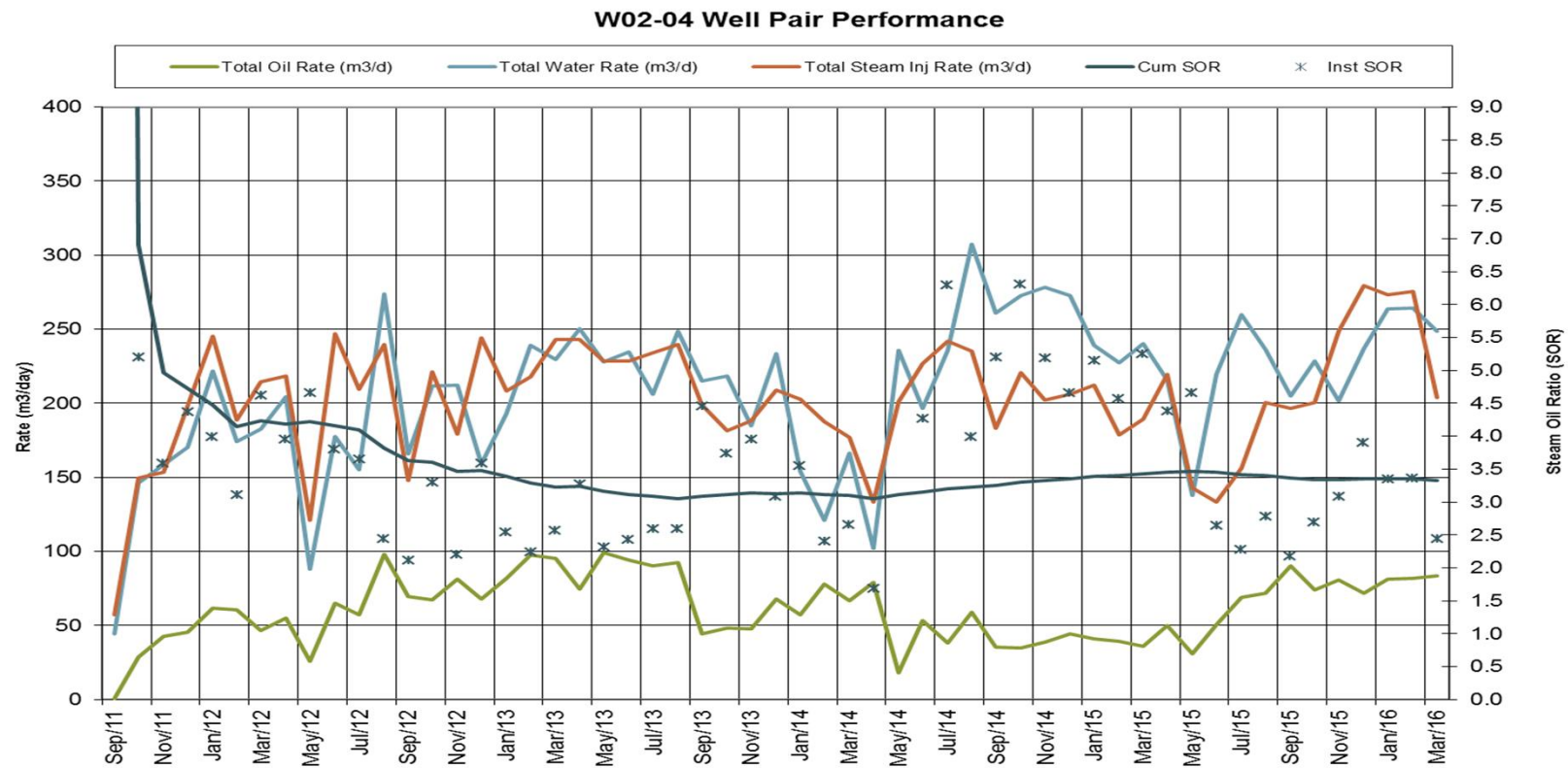
# W02-04 Geological Profile



# Time-lapse seismic: W02 Pair 4



# W02-04 well pair performance



## W02 pad conclusions

- **Pad recovery expected to be ~70% of SOIP**
- **Pad is merged with central pod**
- **Optimization of pad underway after remedial work**
- **Currently at 25% recovery of SOIP**

# OBIP – medium example E16 pad

Subsection 3.1.1 – 7 c, iii)



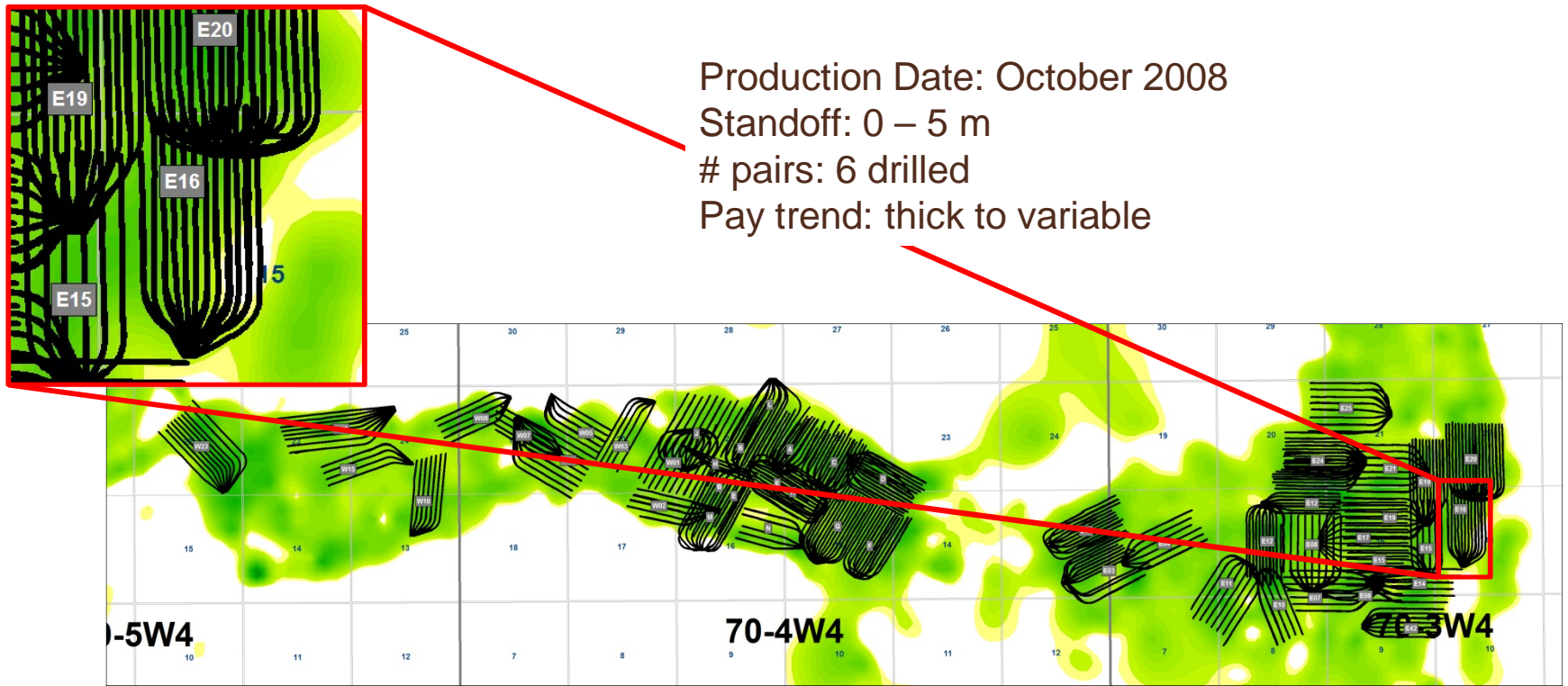
**cenovus**  
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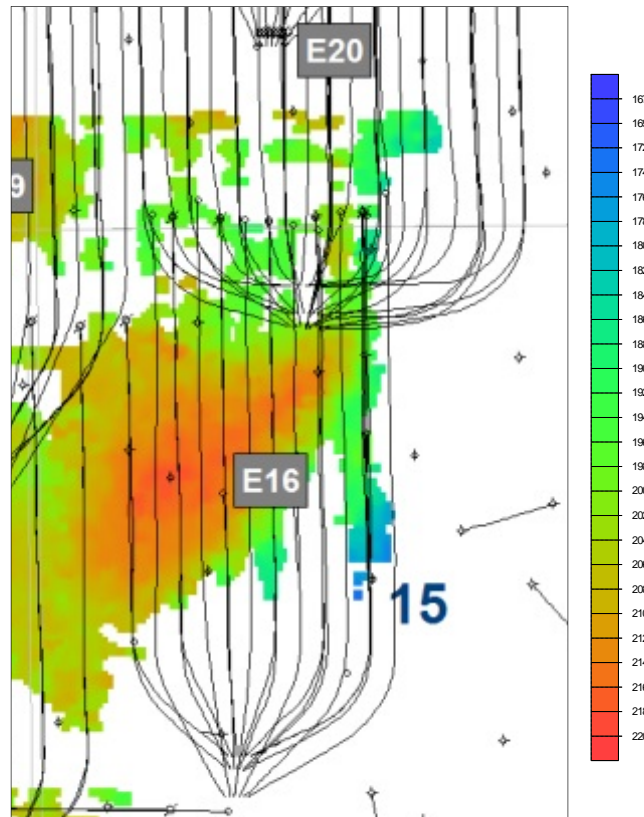
## E16 pad overview

- **E16 pad began production in August 2008 (six pairs)**
- **Steam stimulation start-up method was successful for all pairs**
- **Geology consists of thick to moderately thick channel sands that are fairly consistent throughout, pay trend and thickness slopes down dip to the east**
- **Expected ultimate recovery of this pad is 72% of SOIP**
- **Overall performance is very good to date, with a CSOR of 2.42**
- **Wells utilizing our patented Wedge Well™ technology were drilled in Q4 of 2013**

# E16 Pad SAGD Pay



# E16 4D seismic (2015)



# E16 pad - extent of chamber development

PAD	PAIR	SOIP Mm3	POIP Mm3	Cum Oil Mm3	% Recovery SOIP	% Recovery POIP
E16 PAD	E16-01	515	490	409	79	83
E16 WEDGE	E16W01			32		
E16 PAD	E16-02	689	659	474	69	72
E16 WEDGE	E16W02			44		
E16 PAD	E16-03	696	575	388	56	67
E16 WEDGE	E16W03			32		
E16 PAD	E16-04	586	527	263	45	50
E16 WEDGE	E16W04			21		
E16 PAD	E16-05	508	442	244	48	55
E16 WEDGE	E16W05			13		
E16 PAD	E16-06	492	426	227	46	53
E16 WEDGE	E16W06					
<b>Total</b>	<b>E16 PAD</b>	<b>3,486</b>	<b>3,119</b>	<b>2,147</b>	<b>62</b>	<b>69</b>

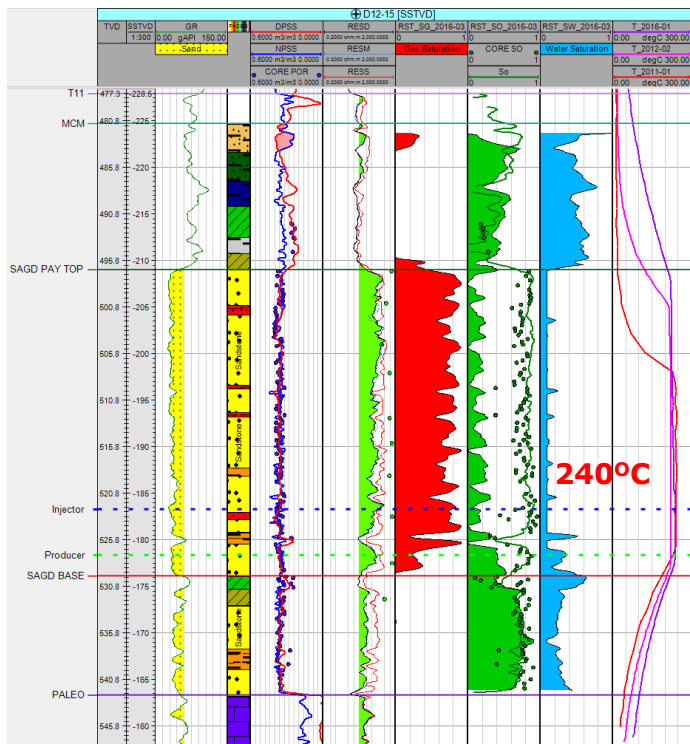
Expected ultimate recovery (72% of SOIP) = 2,510 Mm3

To March 31, 2016

# E16 Pad Temperatures

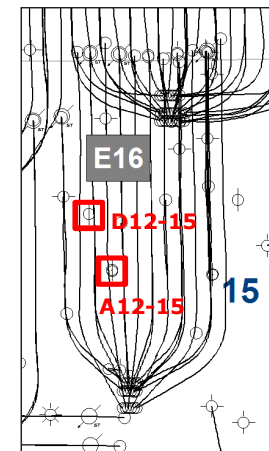
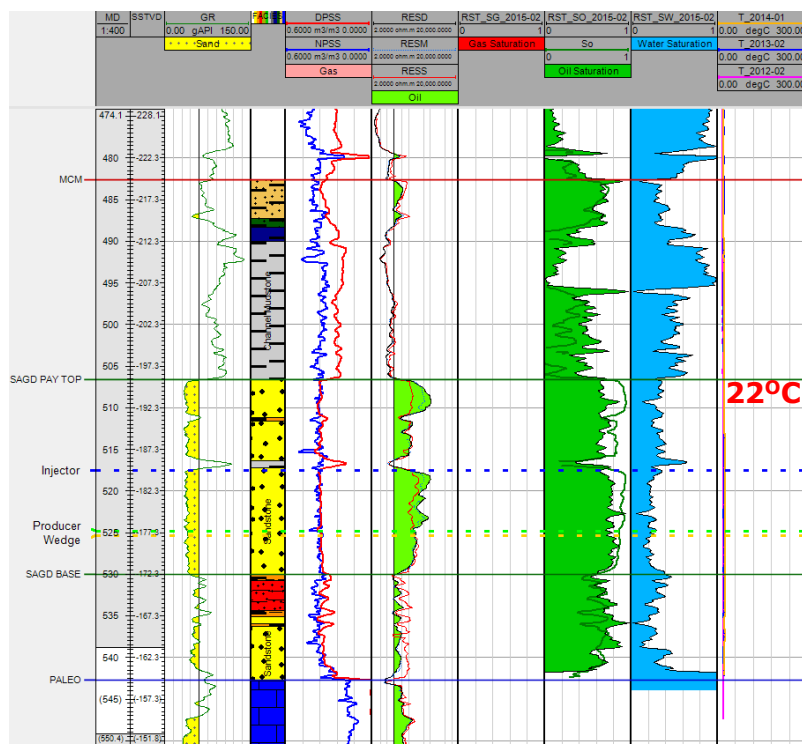
12m away from E16-02 well pair

D12-15

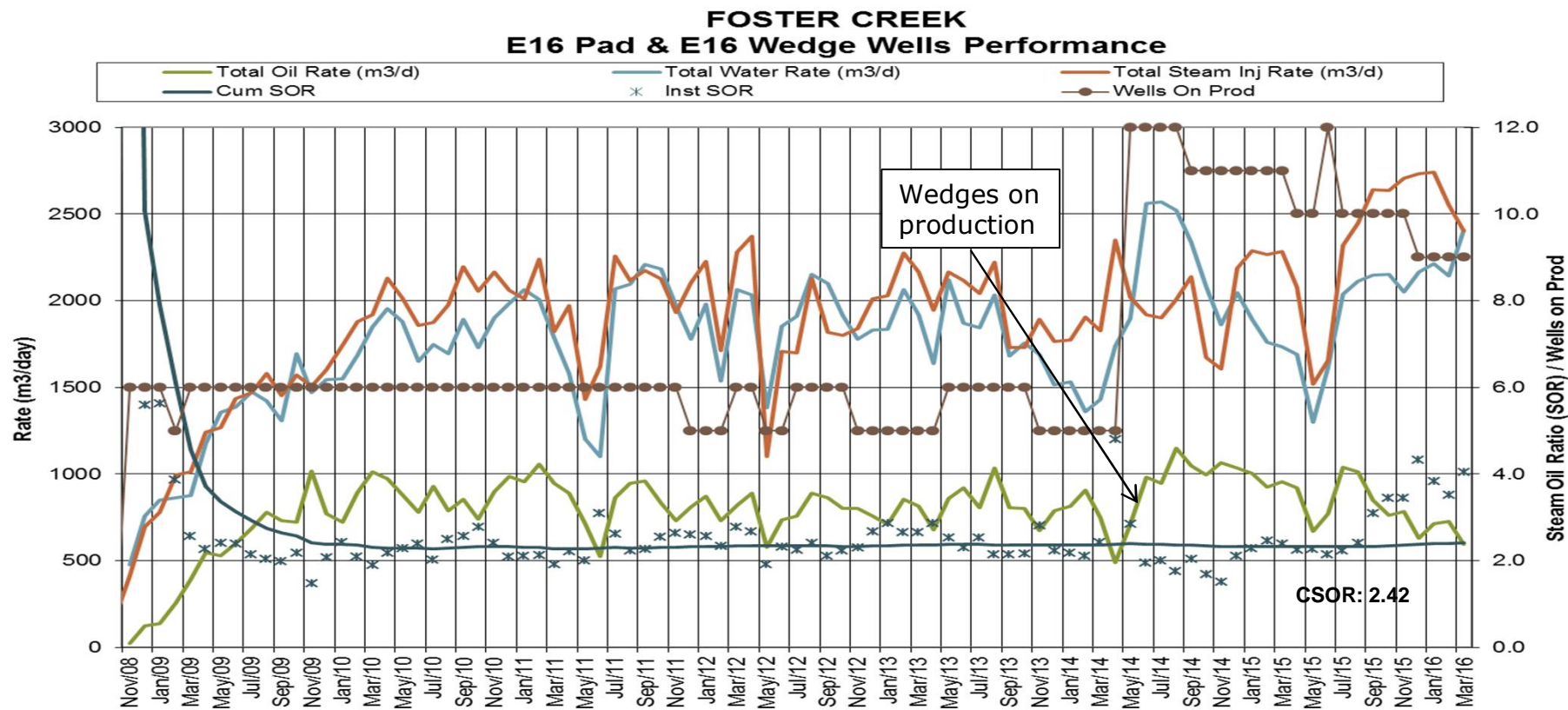


37m away from E16-03 well pair

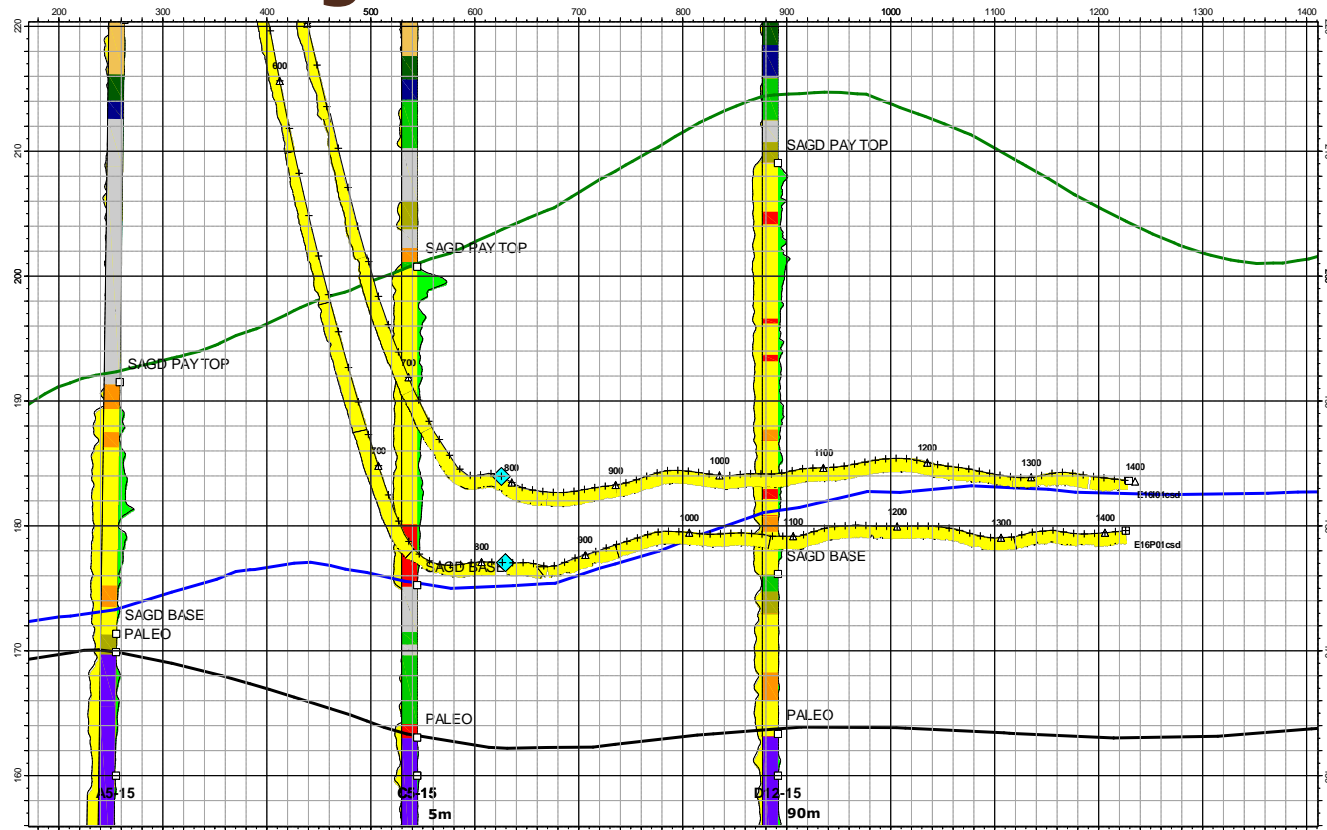
A12-15



# E16 pad performance

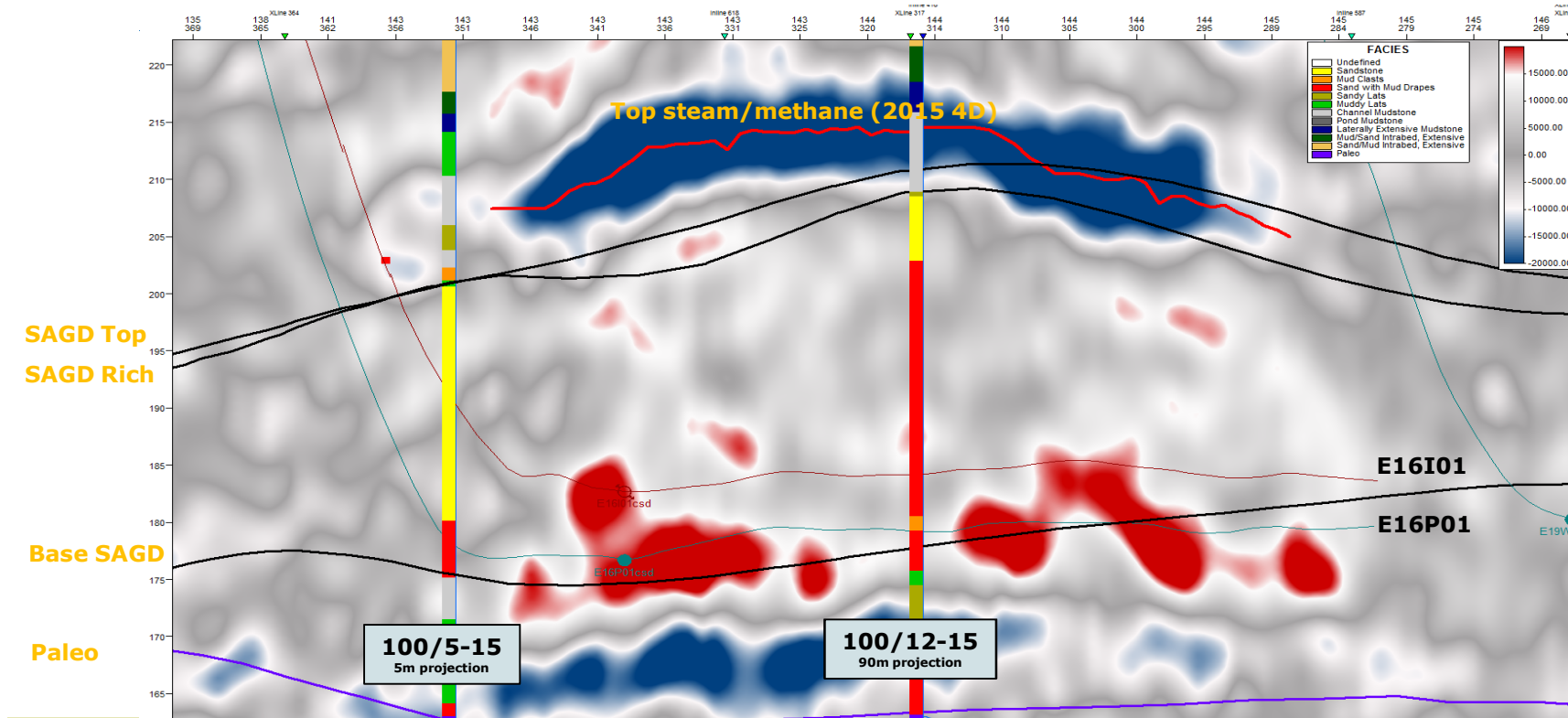


# E16-01 Geological Profile

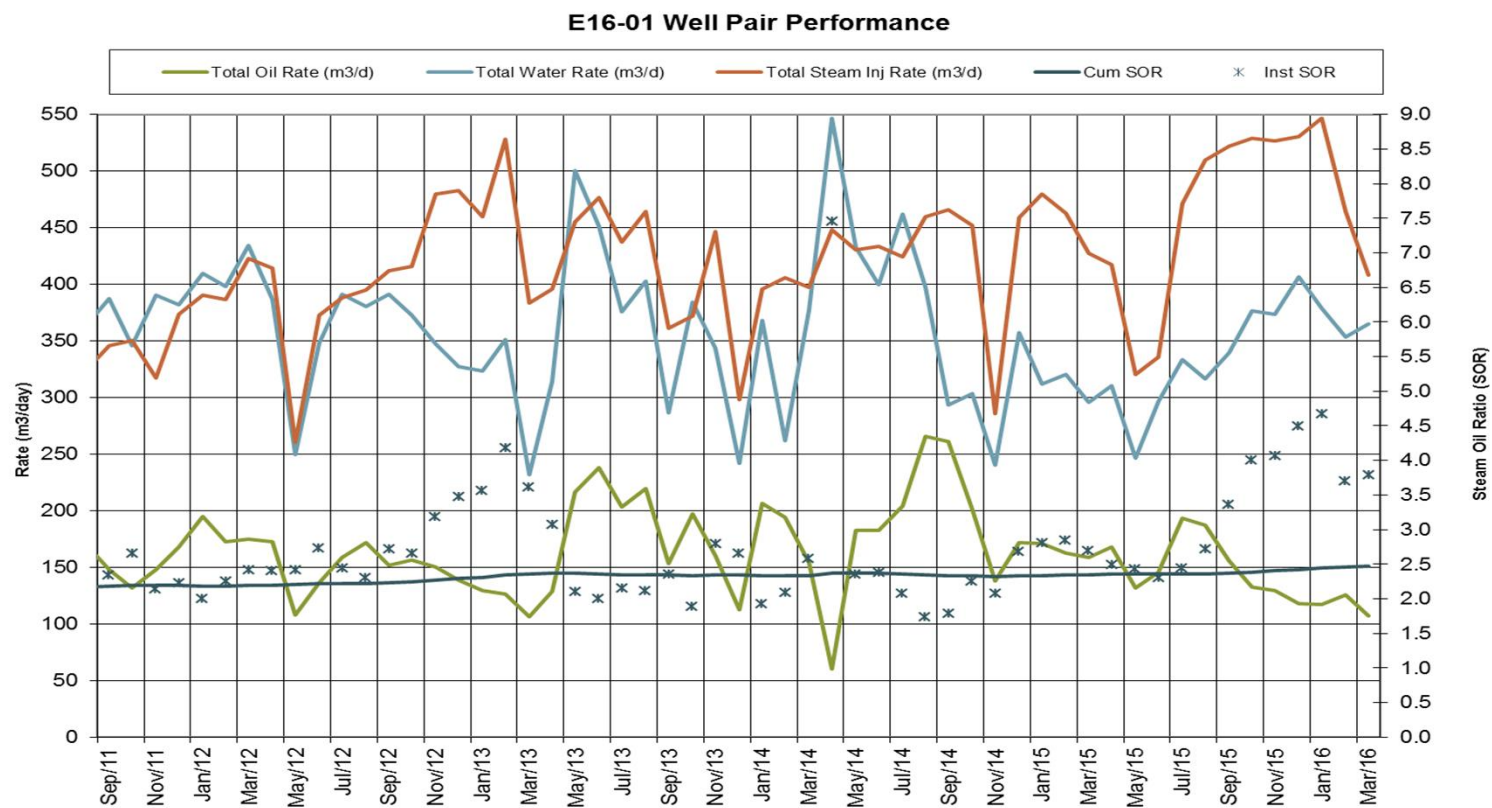




# Time-lapse seismic: E16 Pair 1



# E16-01 well pair performance



# E16 pad conclusions

- Ultimate recovery is based on 72% of SOIP
- Differences between POIP and SOIP are primarily due to standoff from SAGD base
- Ramp up took approximately 20 months to hit peak rates
- 4D seismic was shot in 2012, showing good chamber growth along pairs 1 – 4; remedial work was performed on pairs 5/6 which were redrilled to improve conformance and chamber growth
- Wells utilizing our patented Wedge Well™ technology on production June 2014
- Will continue to use observation wells to help determine changes to steam chamber growth in the future

# OBIP – high example

## G pad

Subsection 3.1.1. – 7c, iii



# G pad overview

- **G pad began production in October 2005 (six pairs)**
- **Thick and high quality geology with slight variation in the depth of the SAGD base and a relatively lower SAGD top at the heel of all the wells**
- **All wedges were started in Q4 of 2009 and Q1 of 2010**
- **Steam decline in mid 2010 to operate pad at central pod pressure, pad production performance as expected**
- **Currently total recovery is 82% of SOIP**

# G pad - extent of chamber development

PAD	PAIR	SOIP Mm3	POIP Mm3	Cum Oil Mm3	% Recovery SOIP	% Recovery POIP
G PAD	GW01	0	0	70		
G PAD	G1	580	422	346	72	100
G PAD	GW02	0	0	79		
G PAD	G2	644	413	306	64	99
G PAD	GW03	0	0	127		
G PAD	G3	687	471	374	72	105
G PAD	GW04	0	0	114		
G PAD	G4	647	470	308	69	95
G PAD	GW05	0	0	166		
G PAD	G5	396	261	288	109	166
G PAD	GW06	0	0	125		
G PAD	G6	312	237	224	94	124
G PAD	GW07	0	0	141		
G PAD	G7			16		
<b>Total</b>	<b>G PAD</b>	<b>3,265</b>	<b>2,274</b>	<b>2,683</b>	<b>82</b>	<b>118</b>

- only ½ of the cum production from GW01 is shown, the other ½ is allocated to F Pad

To March 31, 2016

# G Pad SAGD Pay

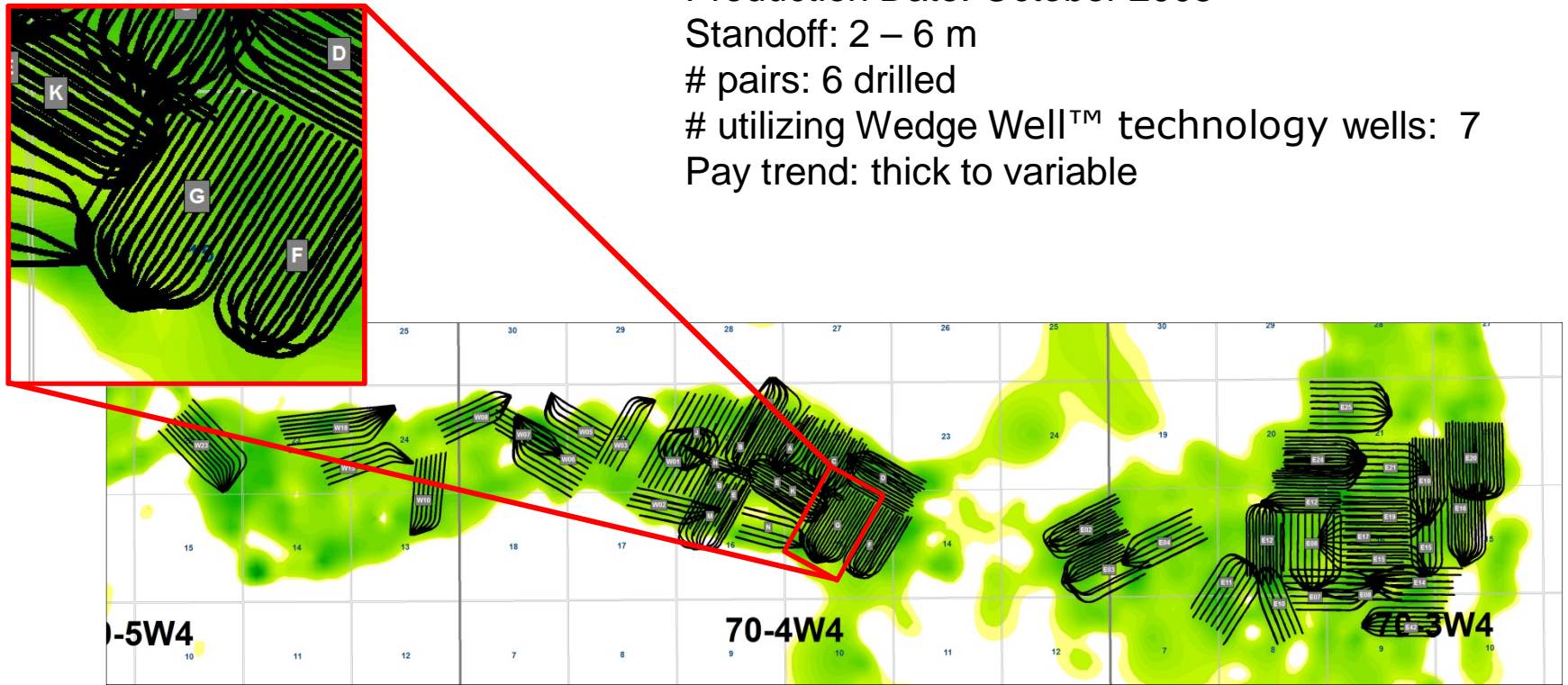
Production Date: October 2005

Standoff: 2 – 6 m

# pairs: 6 drilled

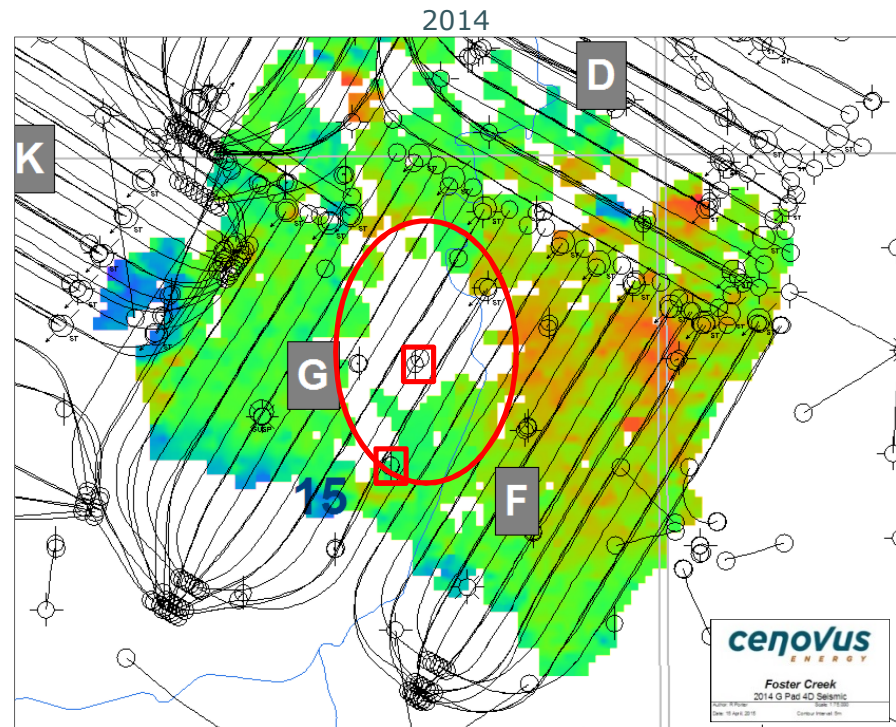
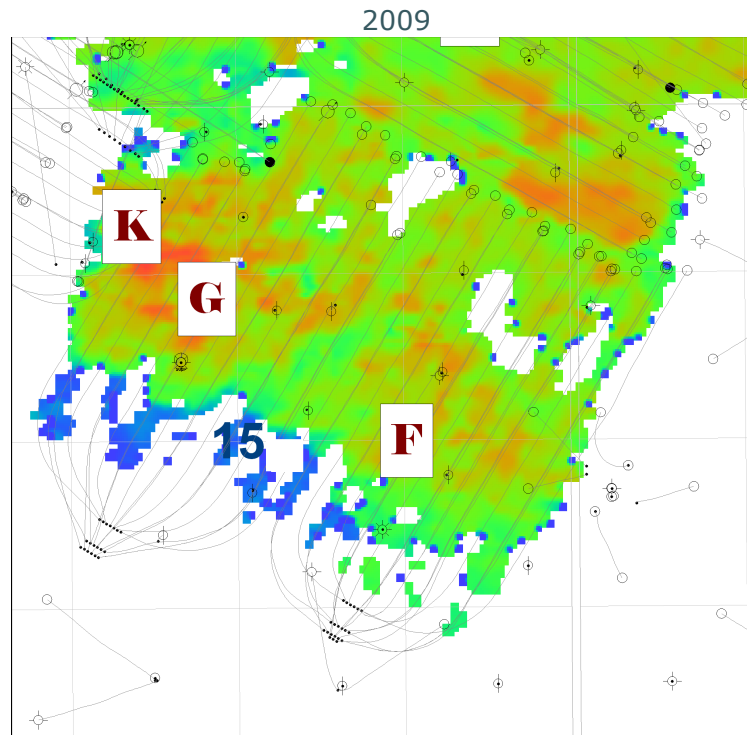
# utilizing Wedge Well™ technology wells: 7

Pay trend: thick to variable





# G Pad 4D Seismic (2009 vs 2014)

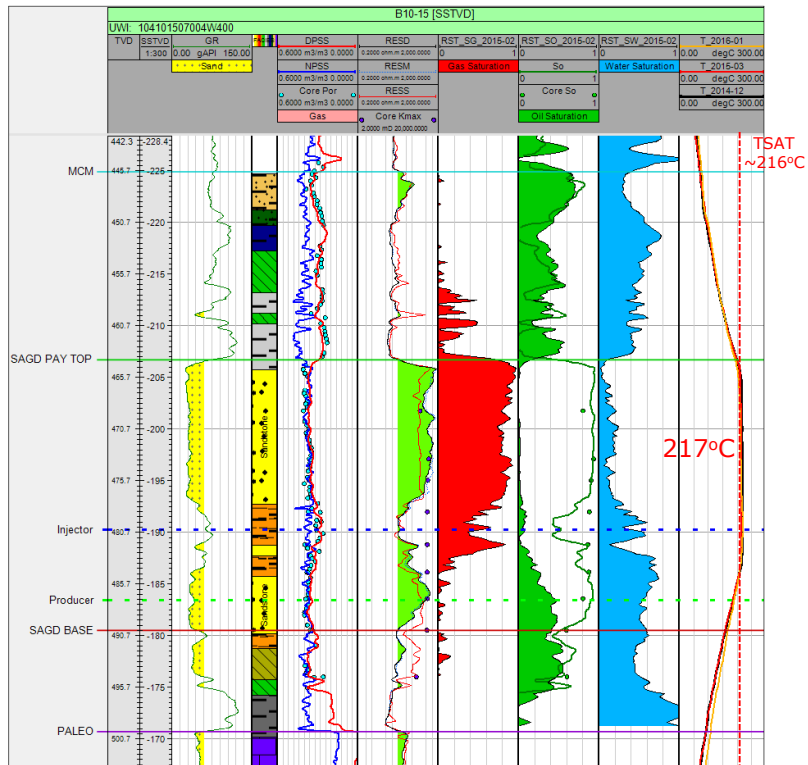


Poor quality seismic data, acquisition related,  
existing steam chamber still present

# G Pad Temperatures

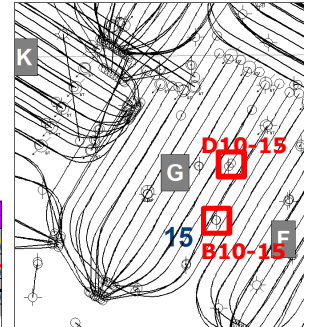
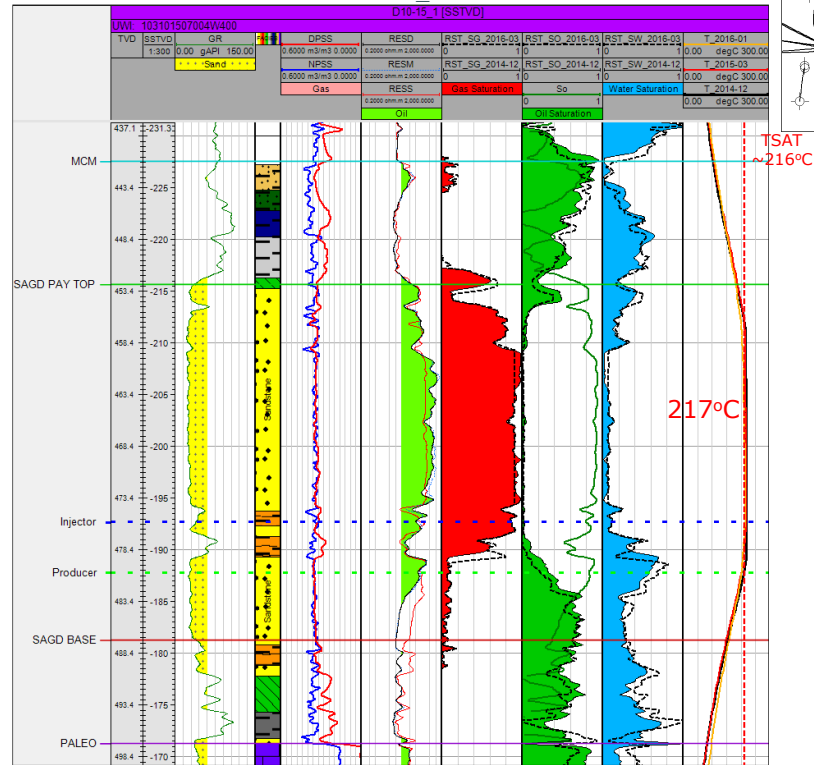
17m away from G-01 well pair

B10-15



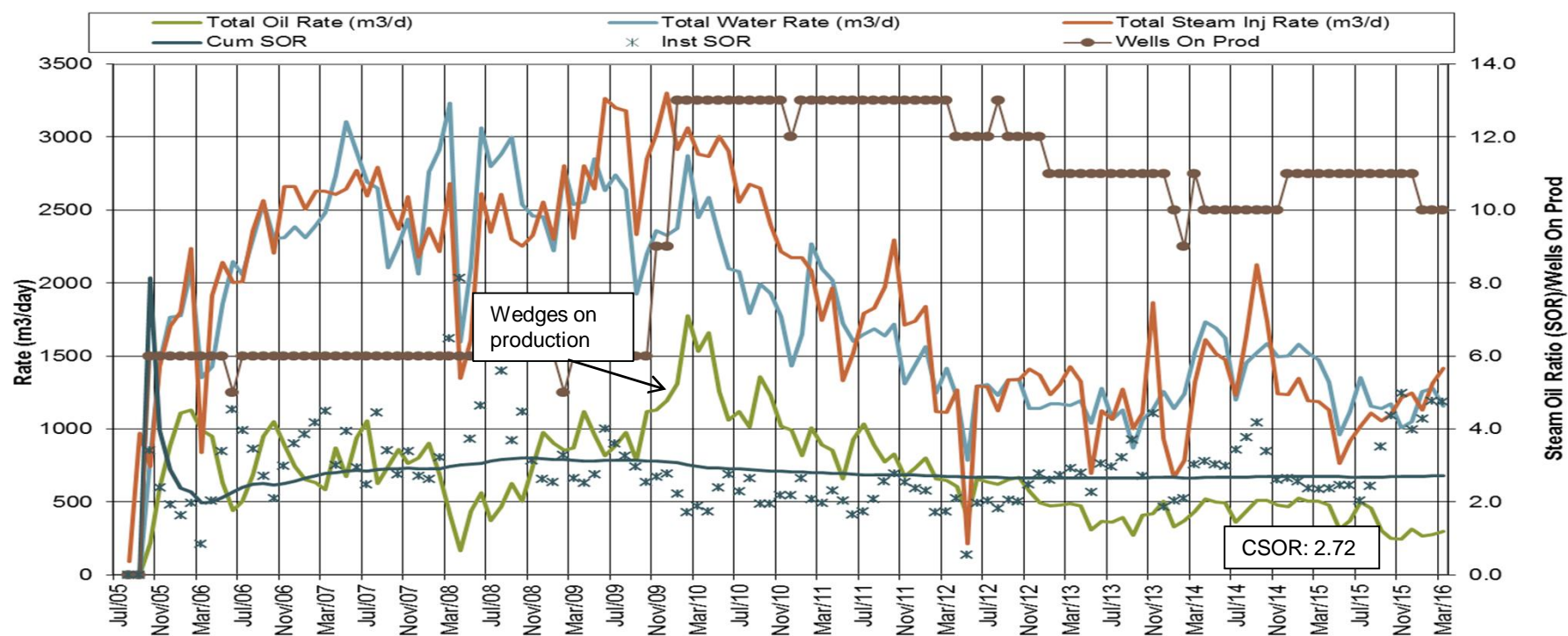
46m away from G-01/02 well pair

D10-15\_1

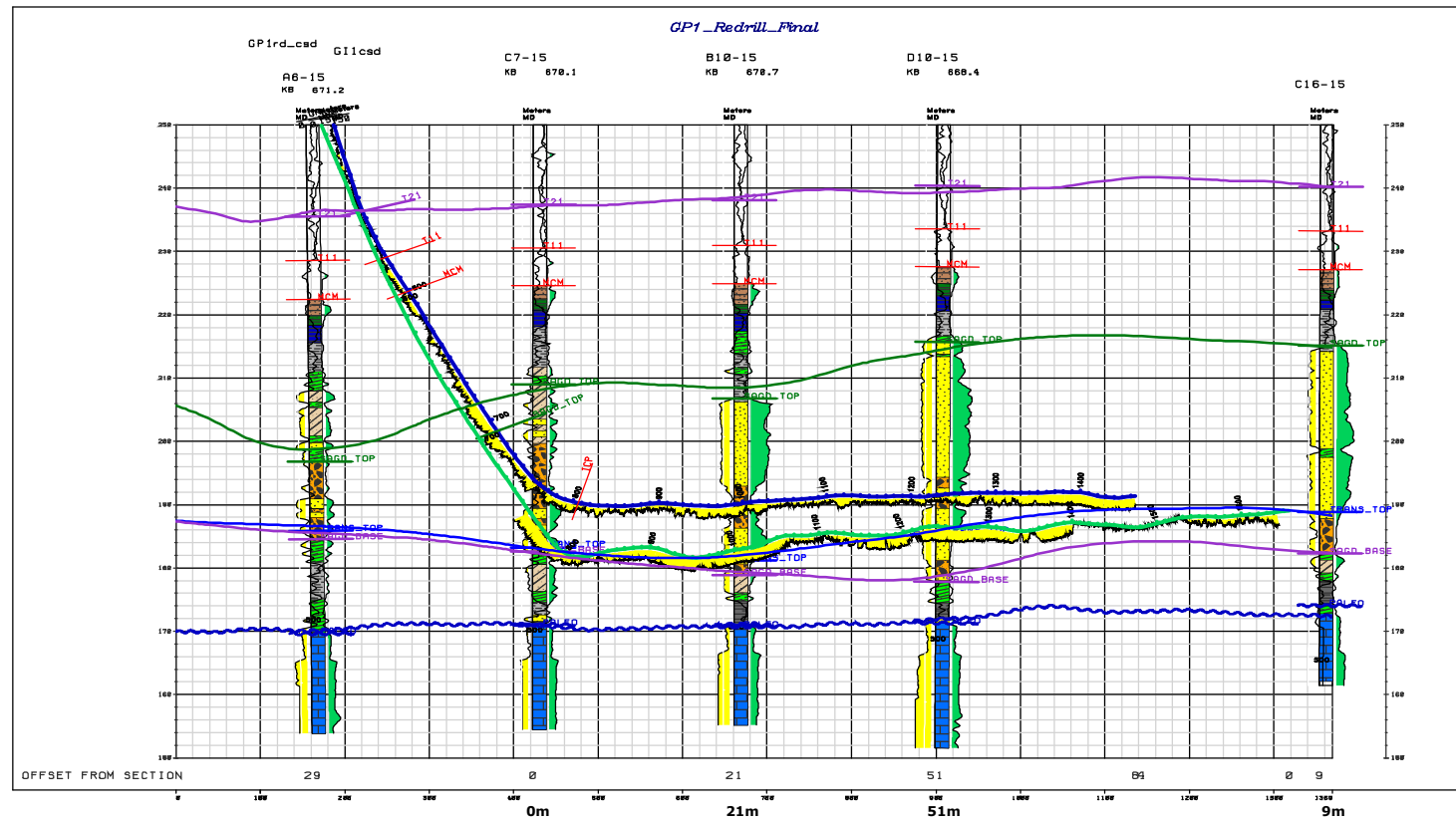


# G pad performance

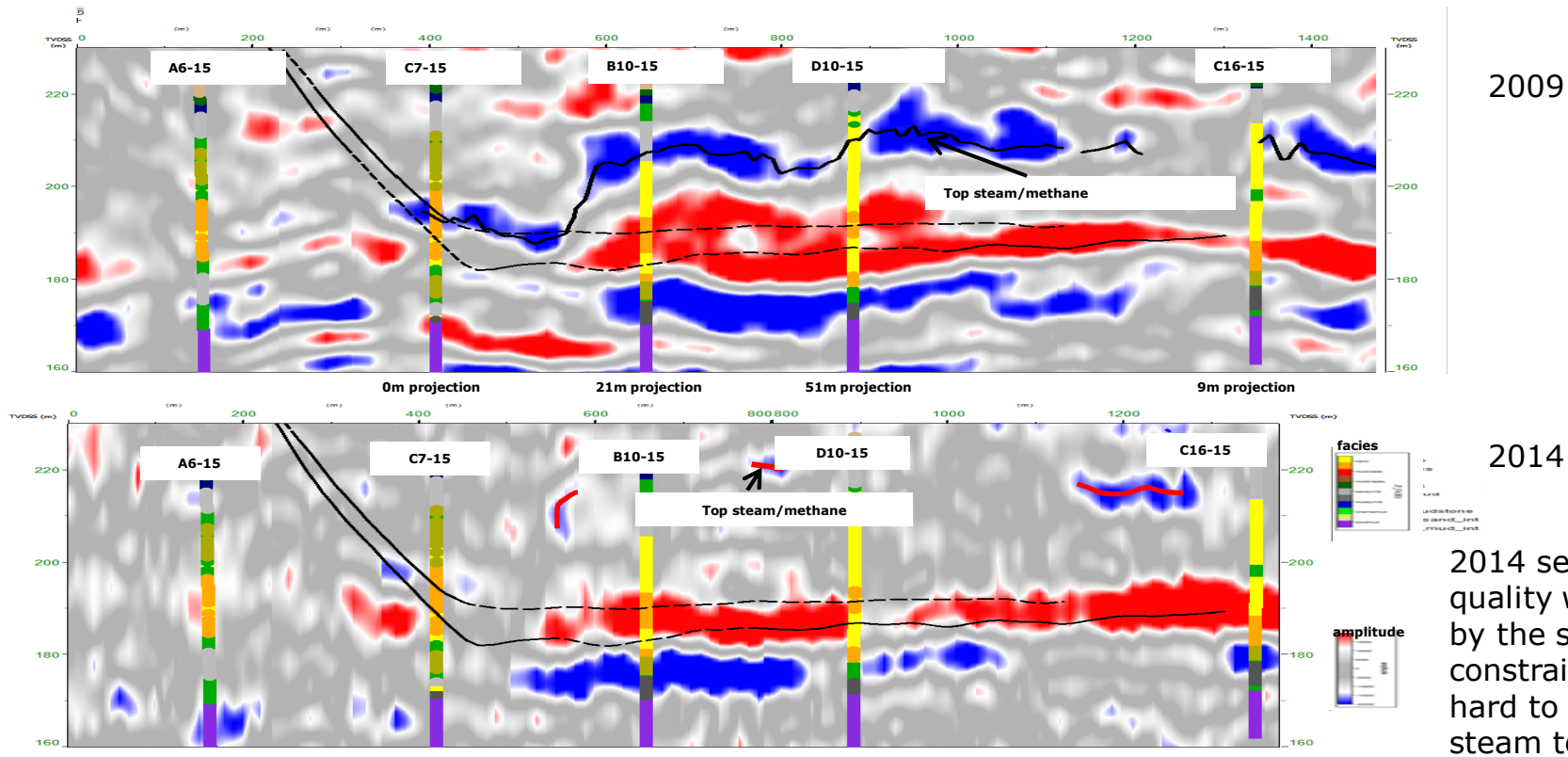
**FOSTER CREEK  
G PAD & G Wedge Wells™ Performance**



# G-01 Geological Profile



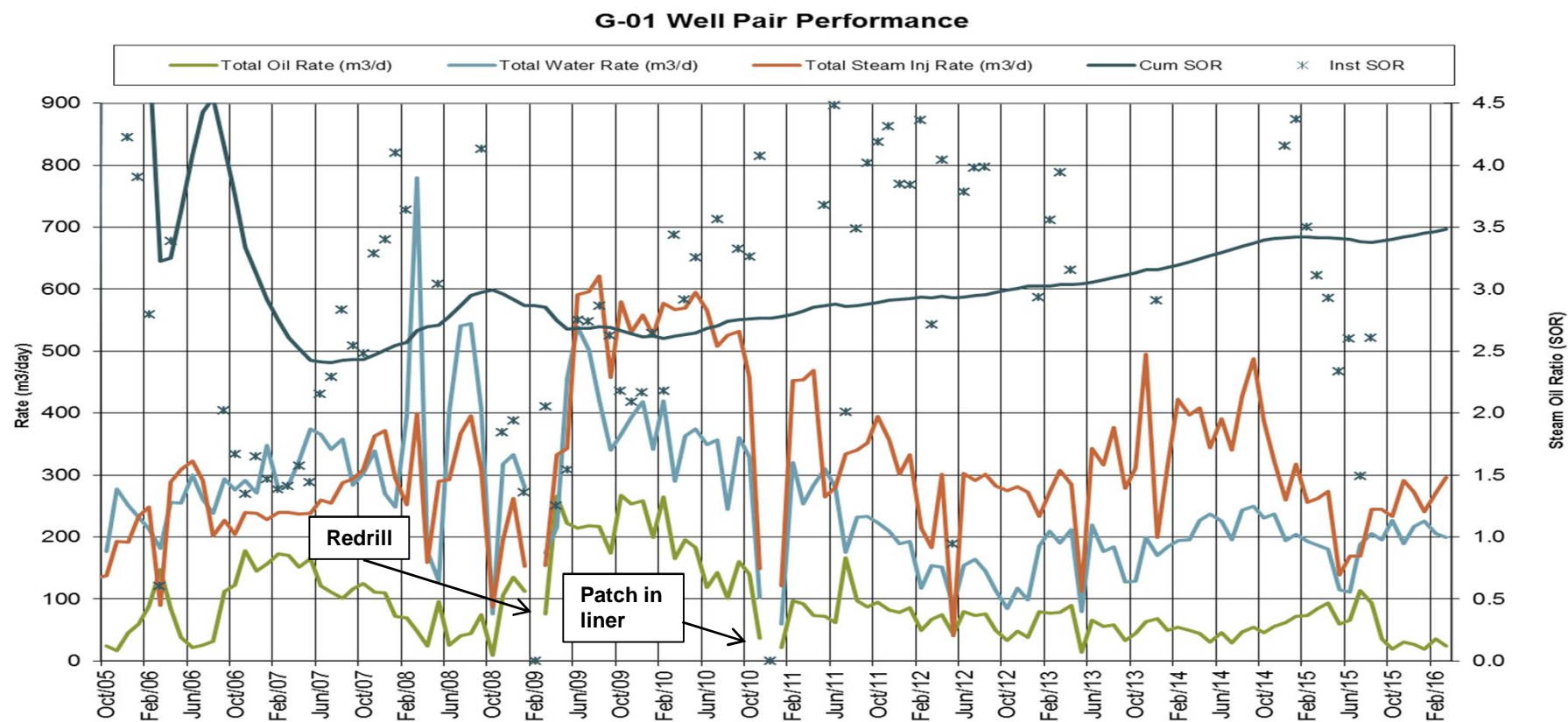
# Time-lapse seismic: G-01 (2009 VS 2014)



2014 seismic quality was affected by the surface constraint. It is hard to interpret steam top.



# G-01 well pair performance



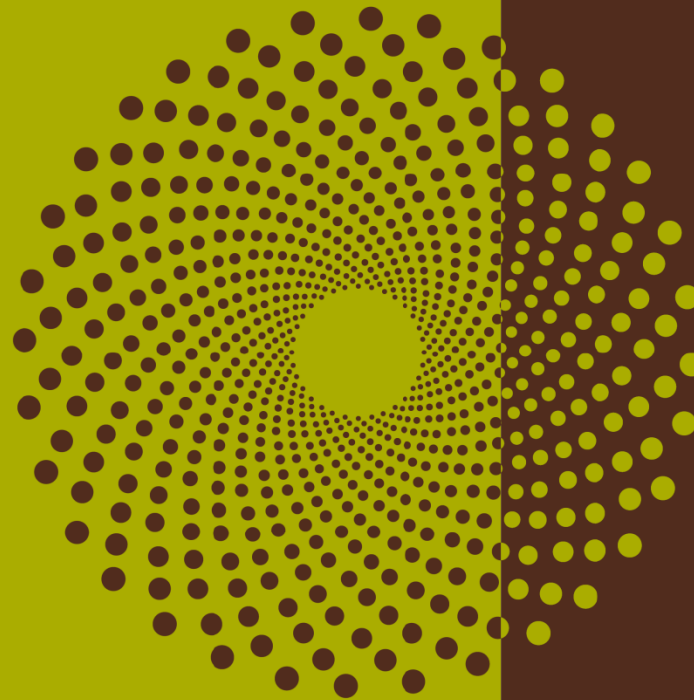
# G pad conclusions

- **Higher than anticipated recovery a result of:**
  - wells drilled utilizing our patented Wedge Well™ technology have been successful
  - lower than anticipated residual oil saturations (15% vs. less than 10%)
- **G pad expansion, drilled new wells in 2014 at 80 m spacing to the west of G pad**



# Pad abandonments

Subsection 3.1.1 – 7c, iv)

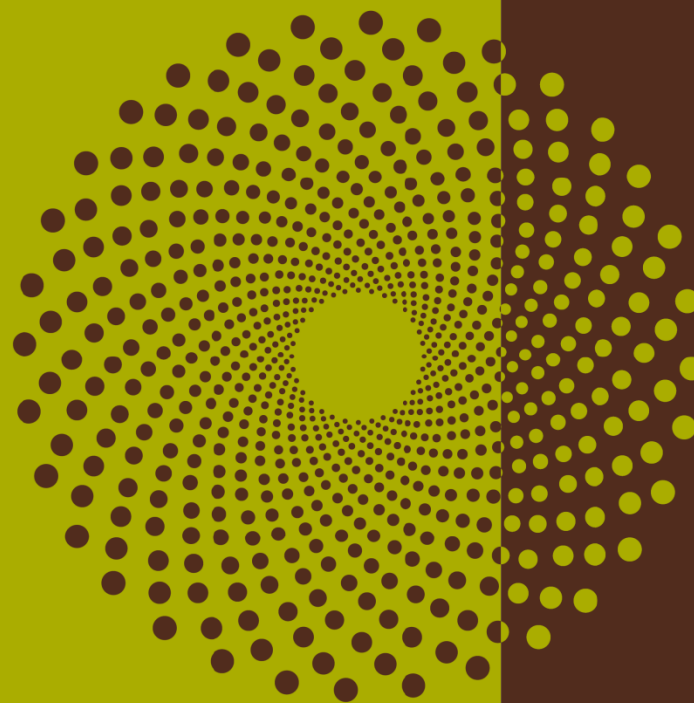


# Pad abandonments

**No pad abandonments are currently planned at Foster Creek in the next 5 years**

# Steam quality

Subsection 3.1.1 – 7d)



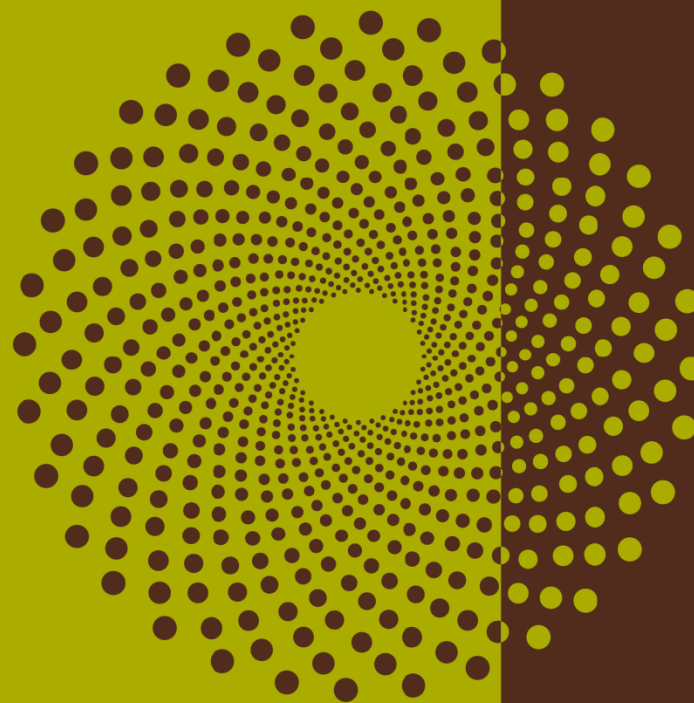
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# Steam quality

- Steam quality will be impacted by pipeline size and distance
- Currently at Foster Creek the steam qualities under normal operation conditions are as follows:
  - central ~ 95%
  - east ~ 94%
  - west - Designed to be ~ 95% as development continues
- Steam is delivered to pads at approximately 7000 – 9000 kPa
- Steam quality is not expected to impact well performance at this time

# Injected fluids

Subsection 3.1.1 – 7e)



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# Injected fluids

## Non-condensable gas

- methane injection started for A Pad in Q1 2012, C Pad in Q4 2011, D Pad in Q3 2010, F Pad in Q2 2014, and G Pad in Q2 2014

## Acid treatments

- wells occasionally treated with HCl to minimize skin

## Solvent

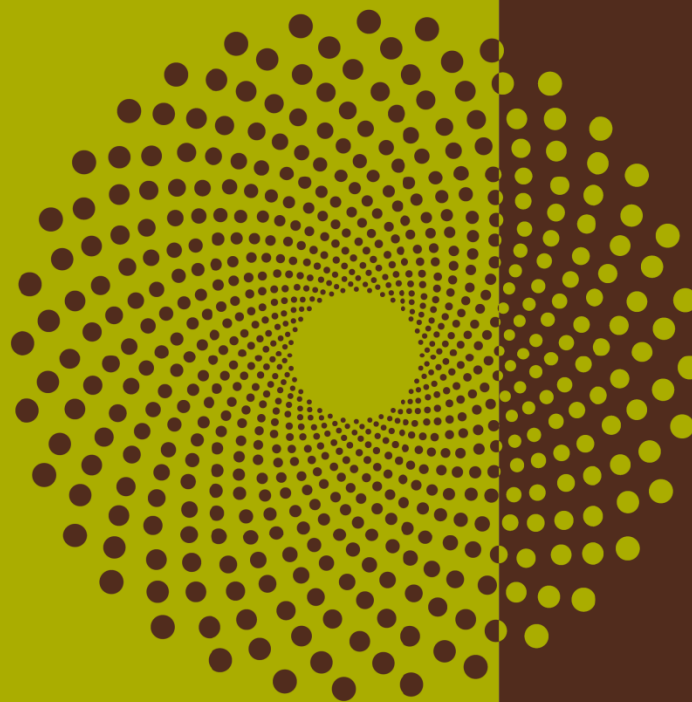
- have used solvent in start-up work-overs and have approval to use this as a potential start-up process

## CO<sub>2</sub>

- injected in E03I05 and E03I06
- pilot concluded in Q4 2013

# 2015 key learnings

Subsection 3.1.1 – 7f)

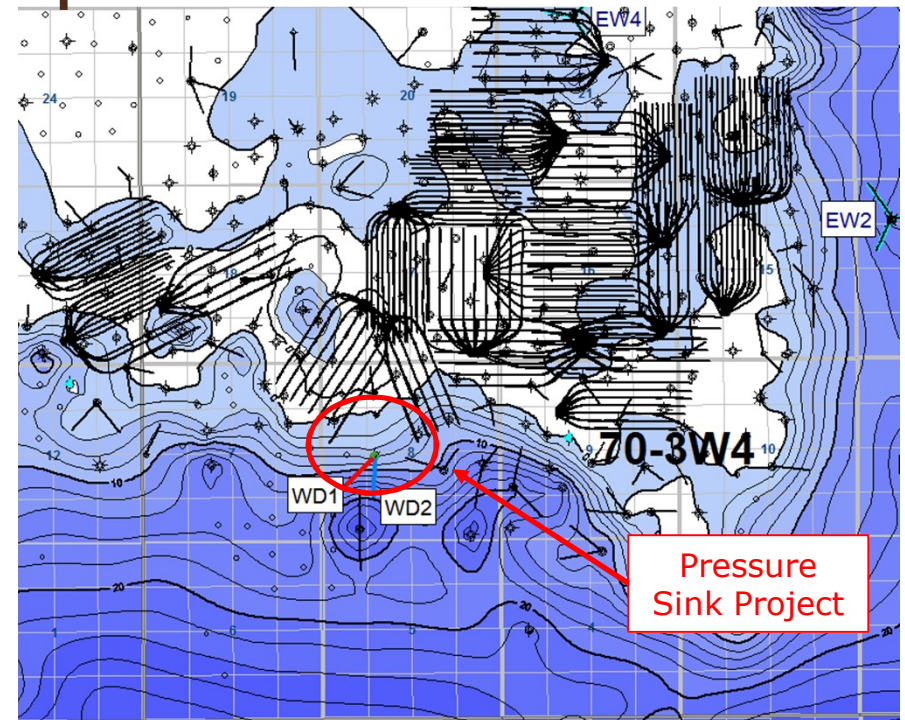


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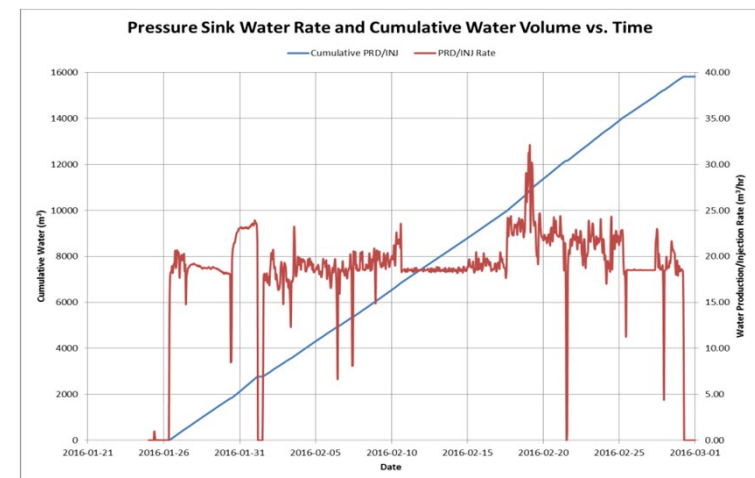
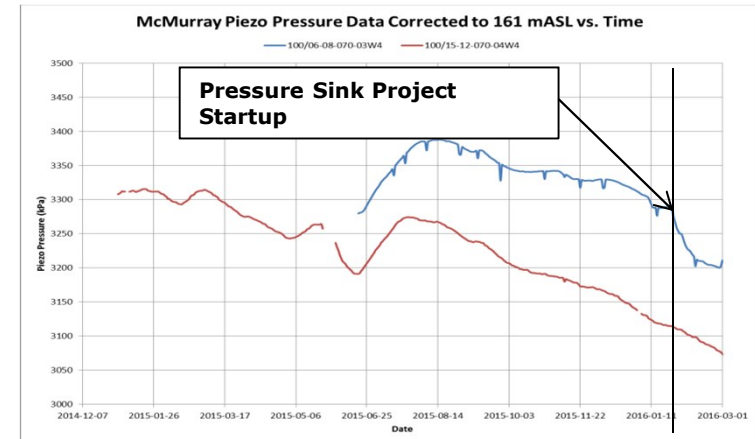
# Pressure Sink Project Update

- **Construction and commissioning completed beginning of 2016**
- **McMurray Producer WD-2 brought online January 26, 2016.**
  - Baseline McMurray sample taken after cleanout had occurred. Gravimetric TDS was 12,000 mg/L. Quarterly samples will be taken going forward
- **As of March 1, 2016 15,820 m<sup>3</sup> of water has been produced out of the McMurray formation and injected into the Lower Grand Rapids formation**
- **Monitoring pressure response created by the sink well which will be used to optimize chamber pressure from nearby pads connected to McMurray bottom water**

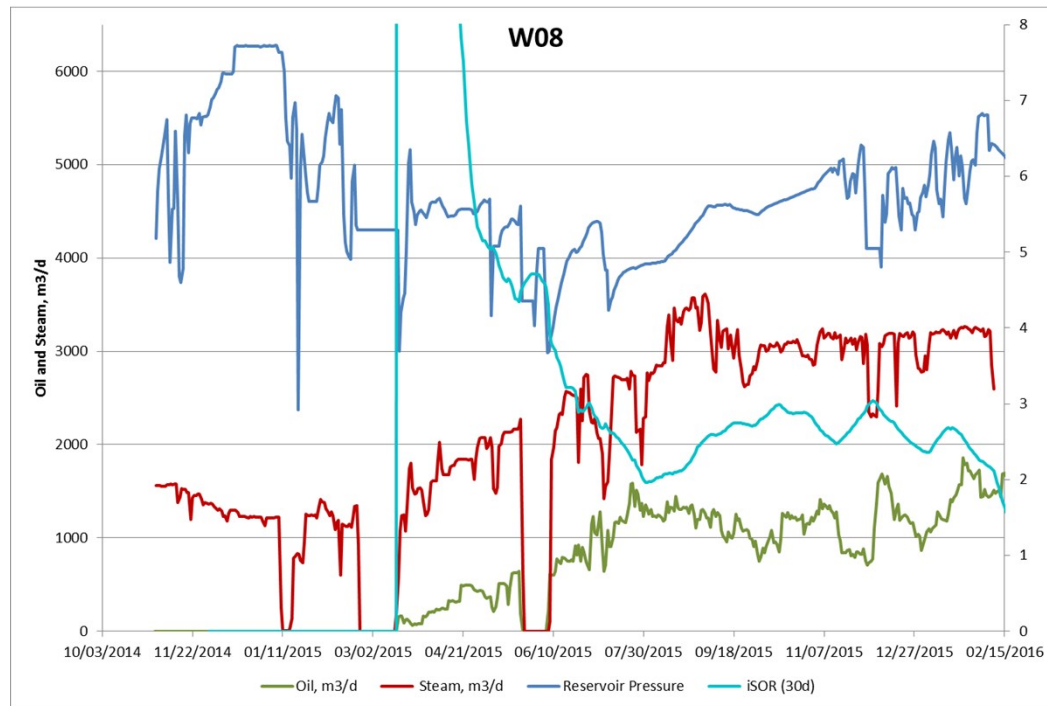


# Pressure Sink

- 100/06-08-070-03W4 piezometer immediately responded to pressure sink well production. This piezometer is located approximately 300m away from the source well WD-2
- 100/15-12-070-04W4 which is approximately 3km away has not shown a definitive response to the start-up of source well WD-2
- Over the next year, SAGD pressures in East Pod and regional bottom water pressure will be continually monitored and source rates adjusted accordingly to optimize steam usage while preventing bottom-water influx

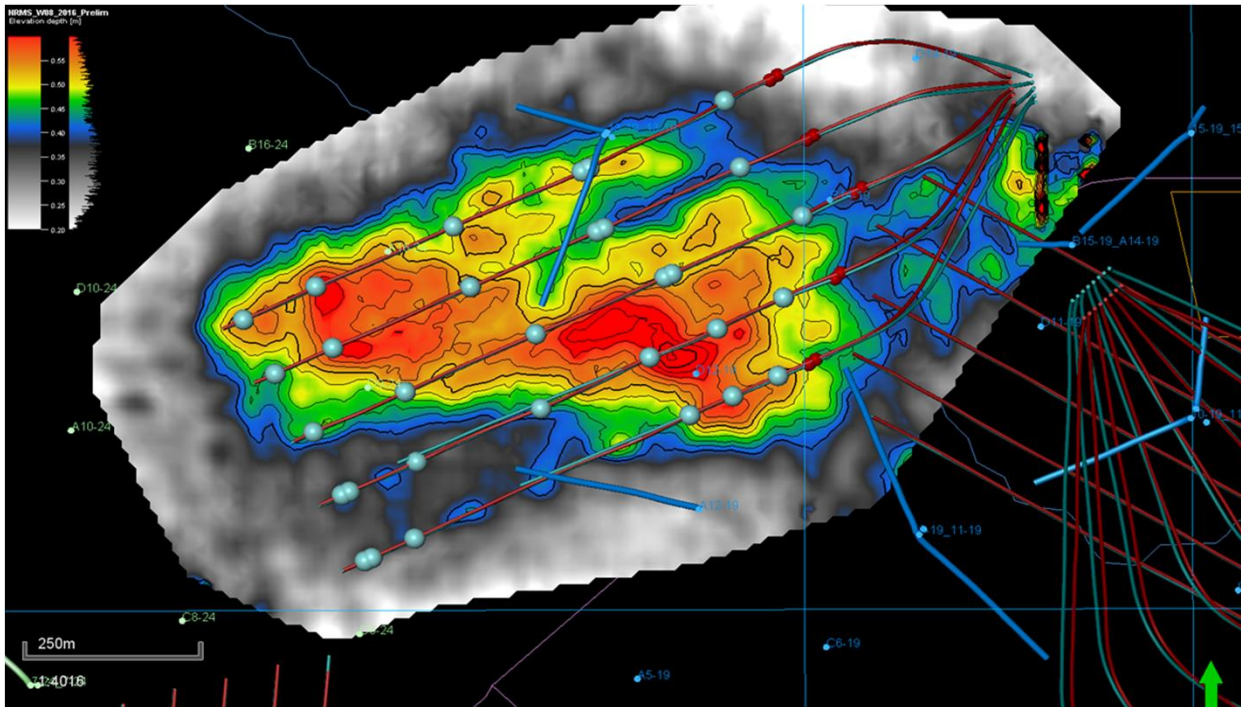


# W08 Pad Ramp-up



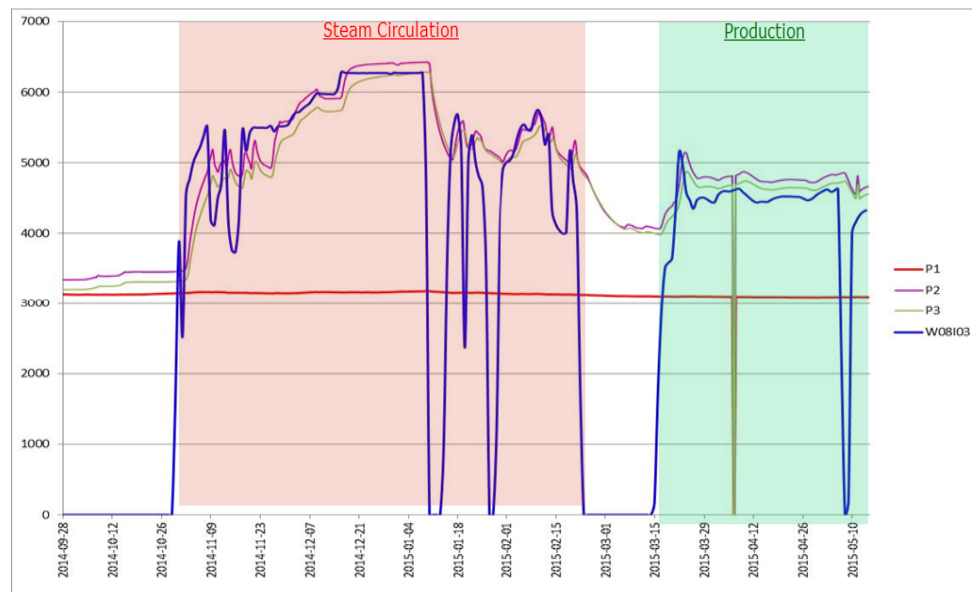
- Fastest Rampup at FC to date
- Ramp up at high pressure of 4500-5000 kPa
- Started with Steam Circulation

# W08 Pad Seismic (2016)



- First year seismic shot indicates chamber coalescence
- Colder zones near toes of P01 and P02 due to bad geology

# Pressure Monitoring



- No Communication with bottom water
- Piezo P2 and P3 in SAGD zone
- Optical Piezo P3 provides nice reservoir pressure verification

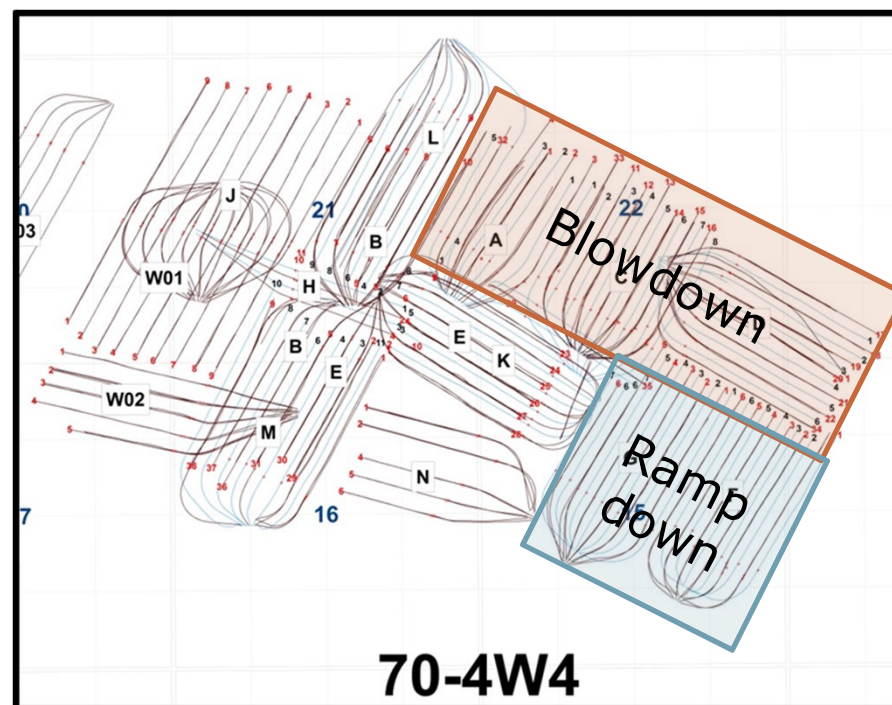
- No Communication with bottom water
- Optical Piezo P3 provides nice reservoir pressure verification



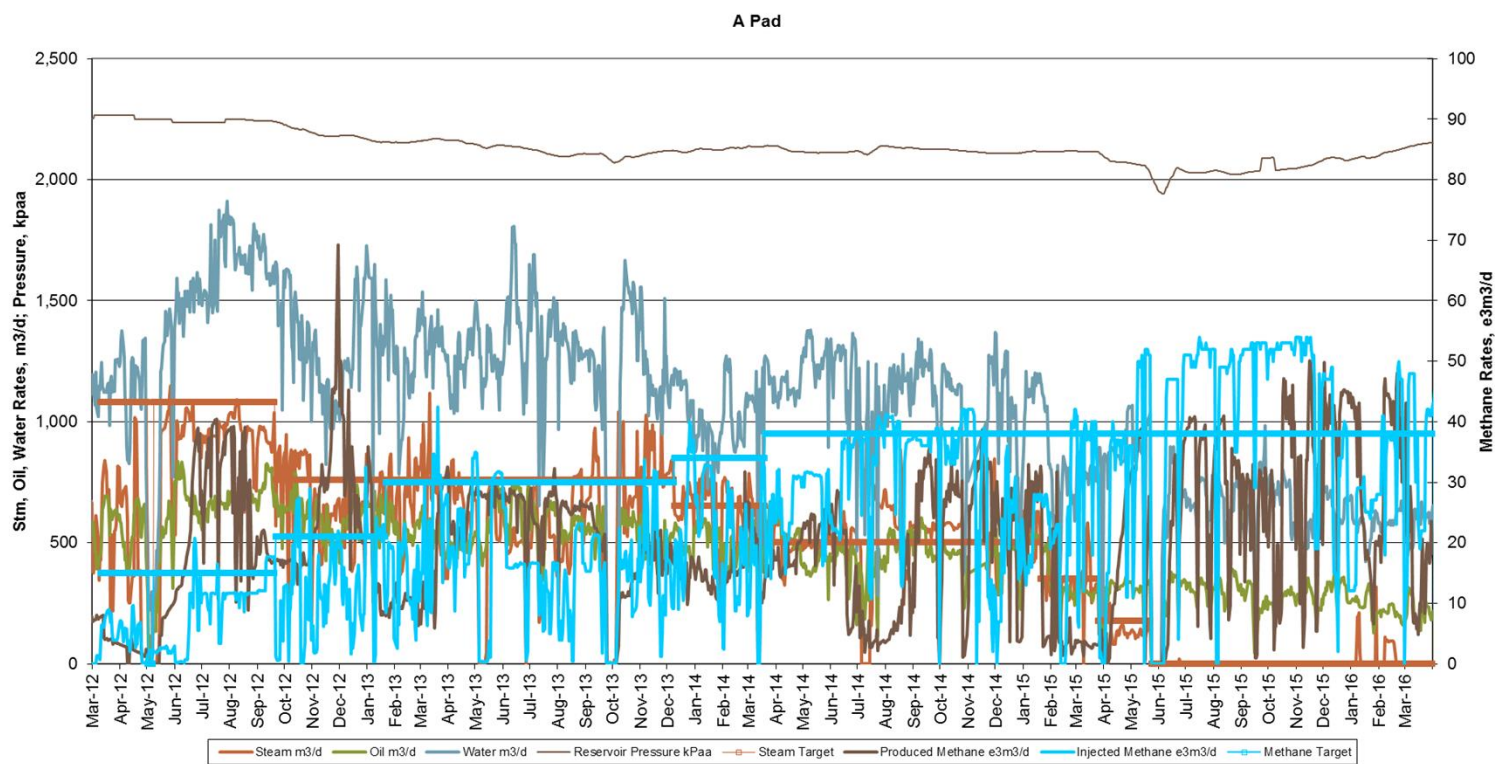
# Current Rampdown/Blowdown

Pad Name	Methane Inj Start Date	Blowdown Start Date
Pad A	Mar 2012	May 2015
Pad C	Nov 2011	Mar 2013
Pad D	Aug 2010	Mar 2015*
Pad F	May 2014	TBD
Pad G	May 2014	TBD

\*Excludes D17, full pad blowdown was May 2015 including D17

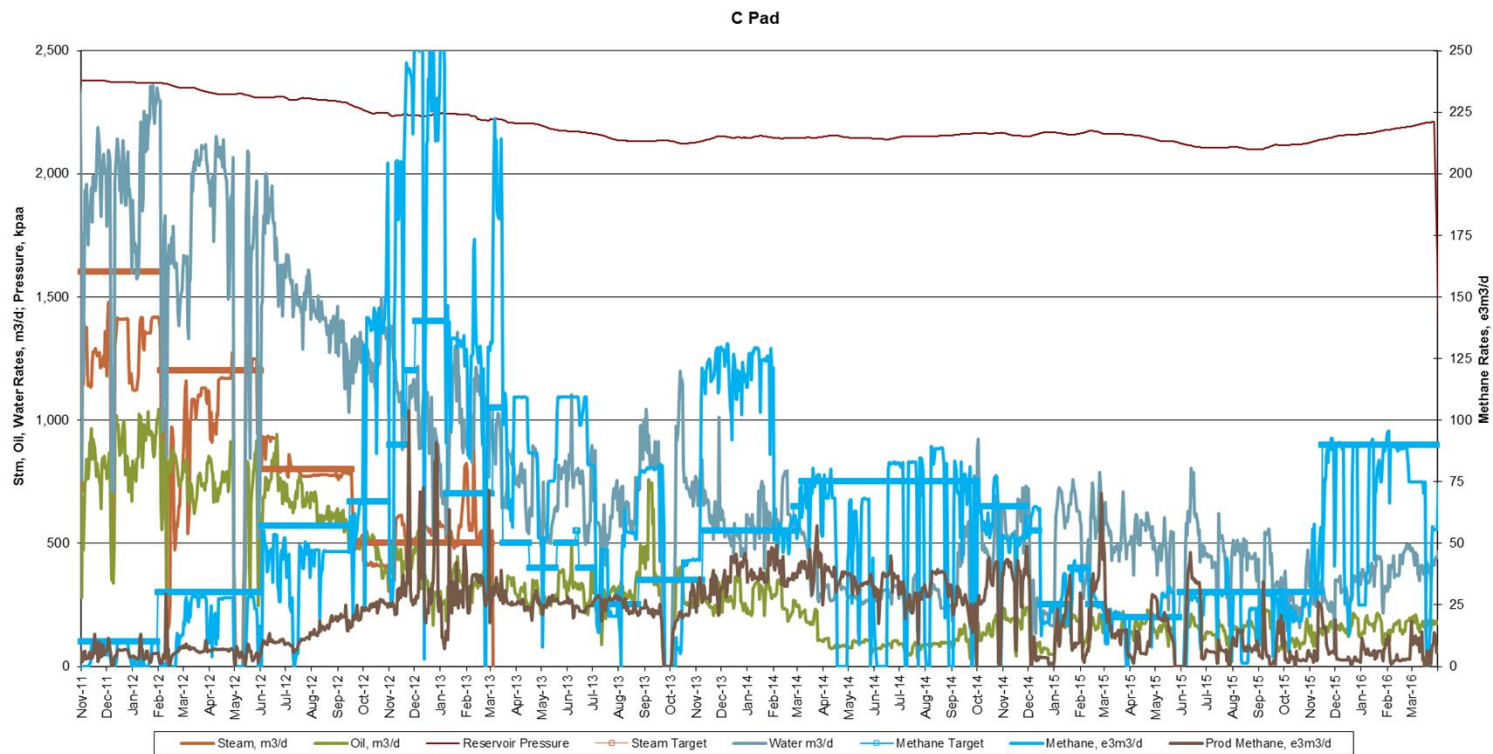


# Pad A – production & injection

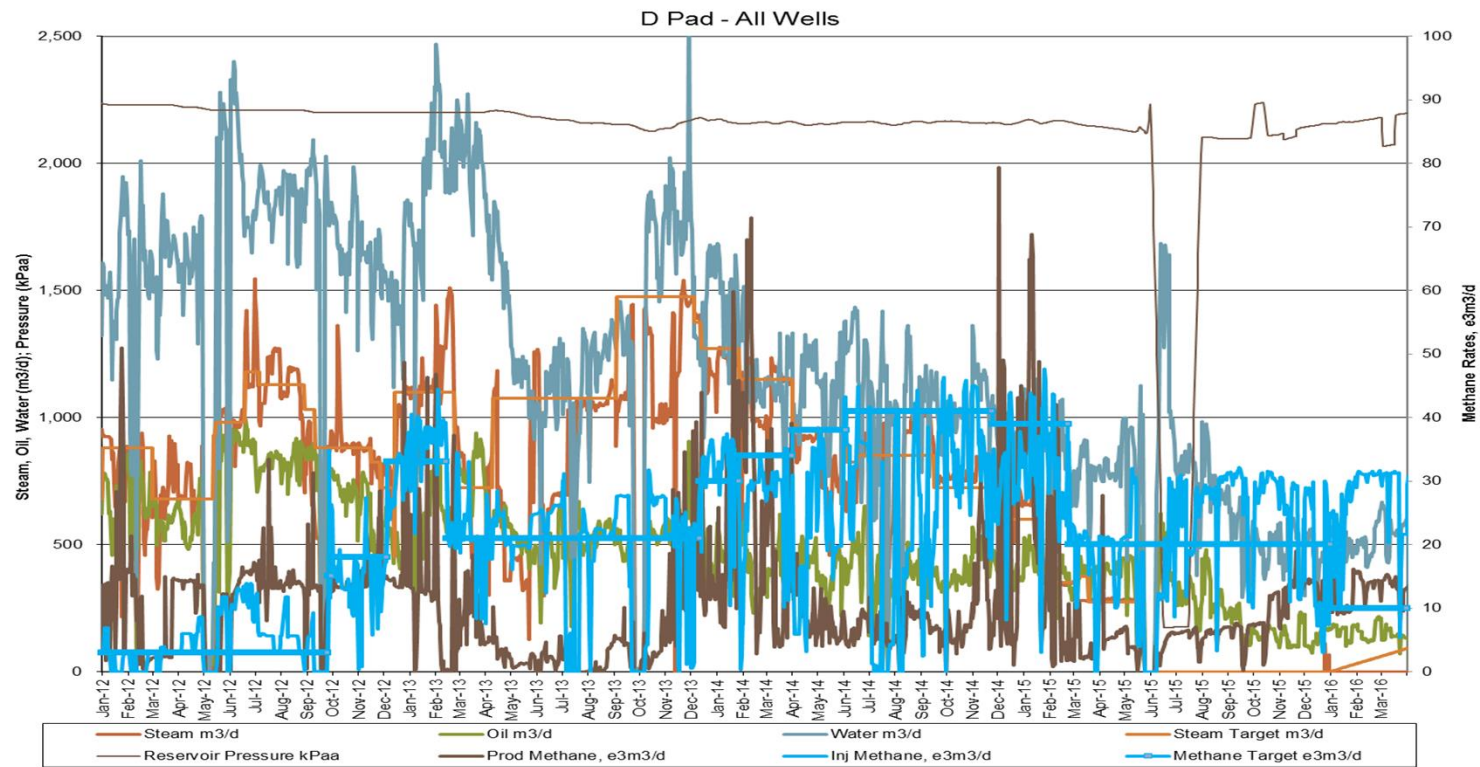




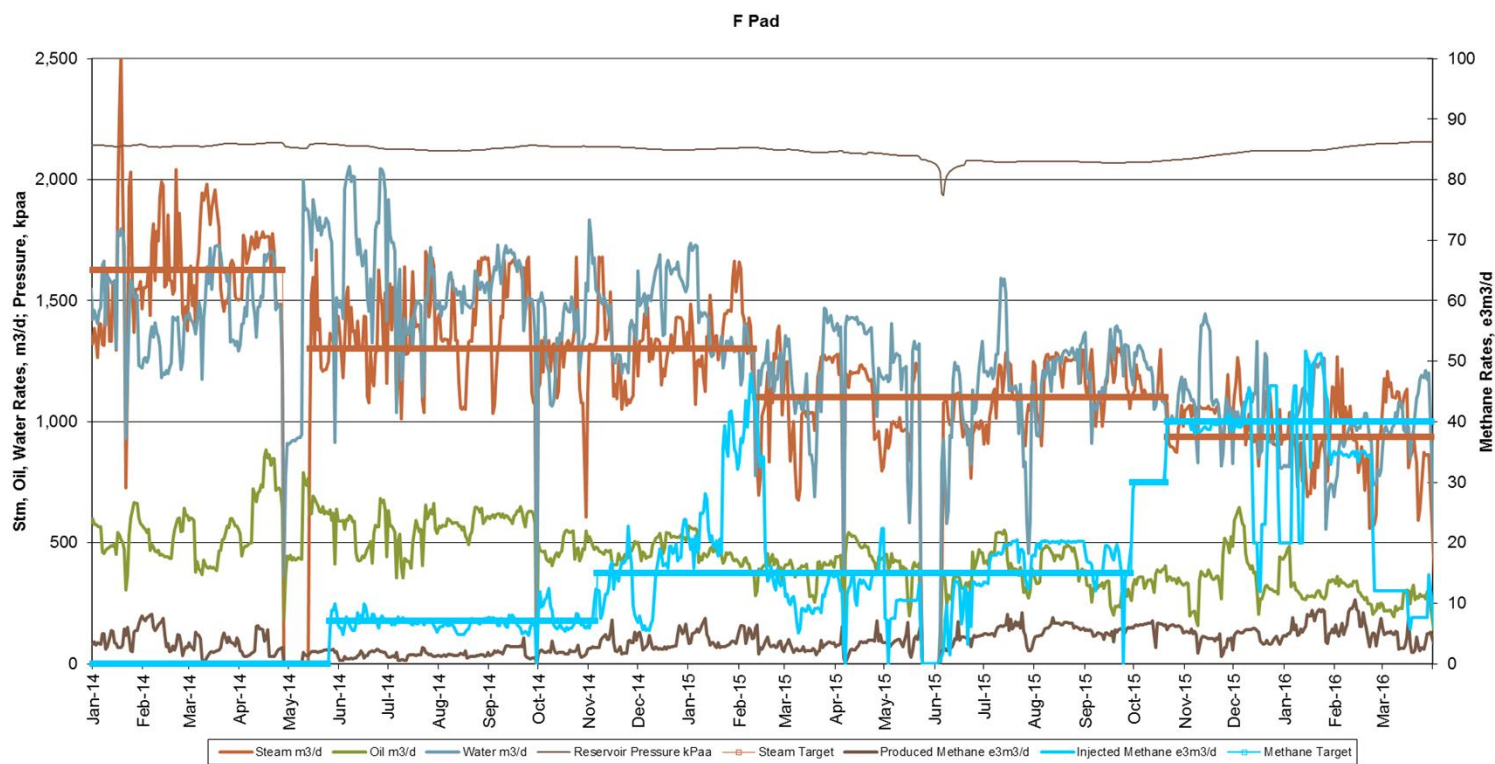
# Pad C – production & injection



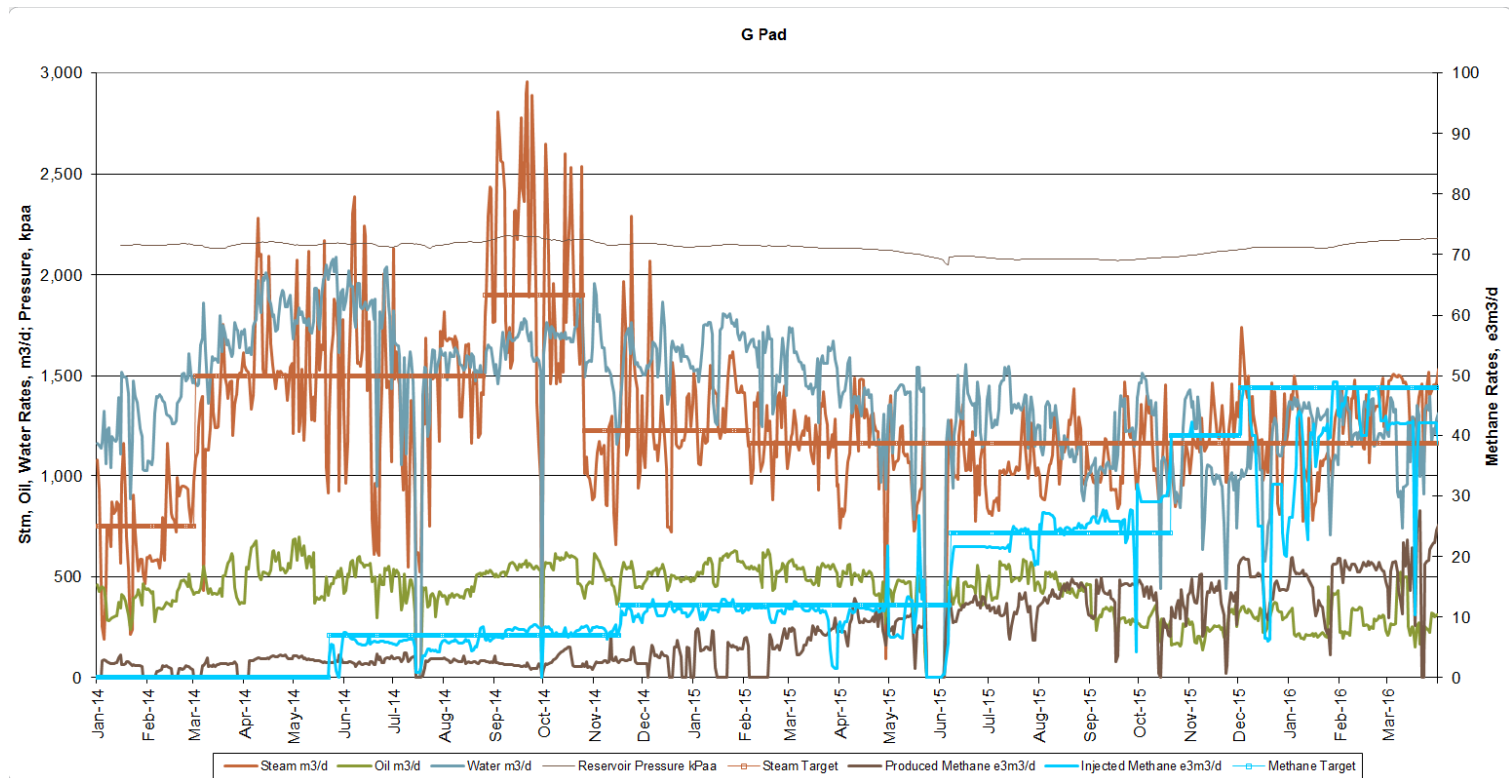
# Pad D – production & injection



# Pad F – production & injection



# Pad G – production & injection



# Ongoing work

- **Methods of injection**

- Reduced number of injectors on a pad
- Top down blowdown – converting existing or redrill high horizontal wells across multiple pads
- Centralized injection (utilizing central pad for injection to support multiple pads)

# Pad performance plots

Subsection 3.1.1 – 7h)



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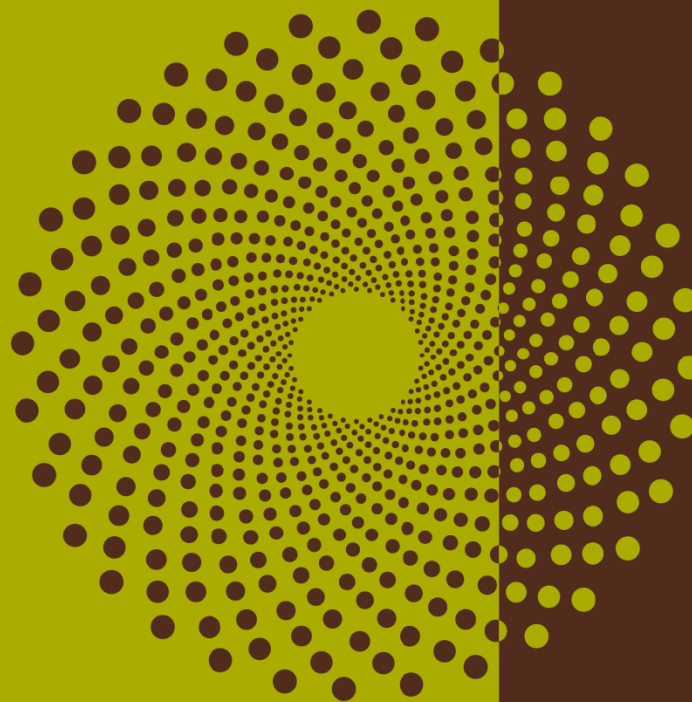
## Subsection 3.1.1 – 7 h) – pad performance plots

Requirements under Subsection 3.1.1  
7 h) are located in the Appendix



# Future plans 2015 initiatives

Subsection 3.1.1 - 8



# Steam Rampdown

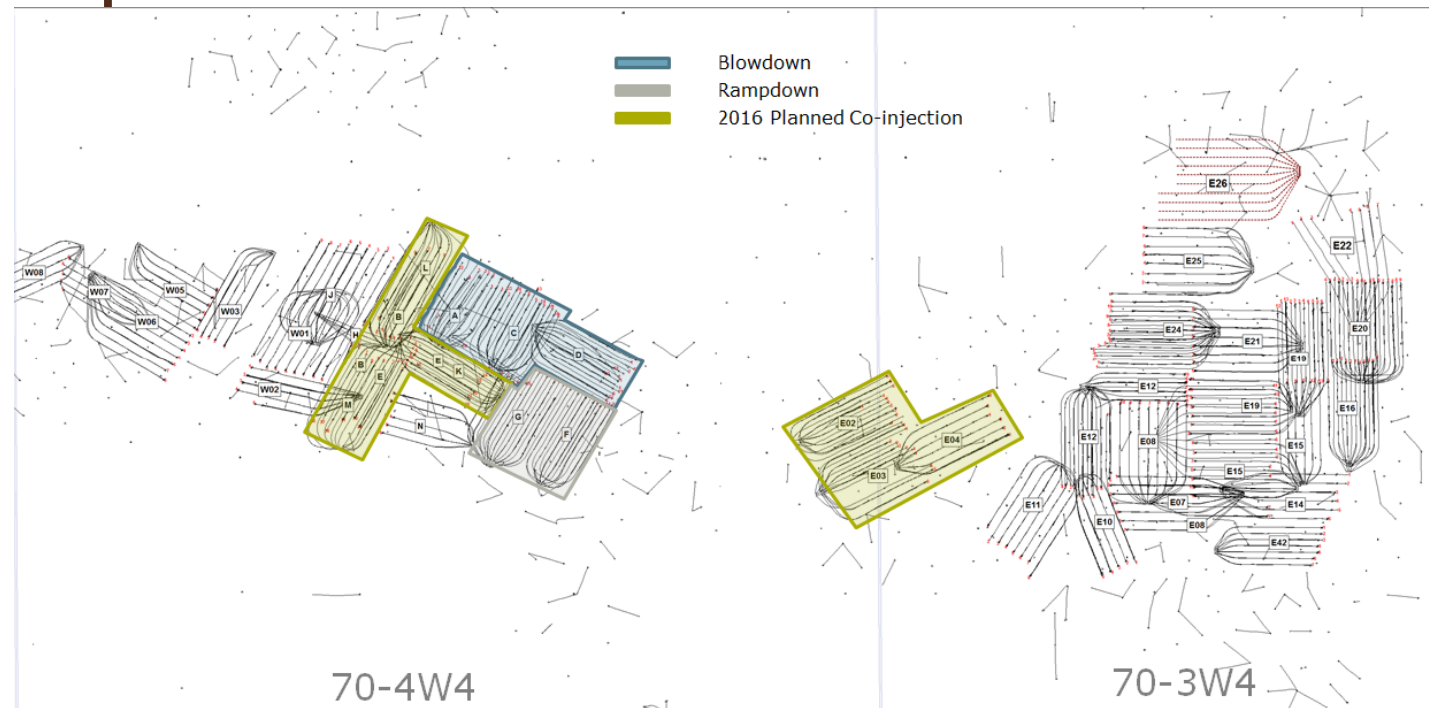
**C Pad on  
blowdown Q1,  
2013**

**D pad on  
blowdown Feb,  
2015**

**A pad on last  
phase of  
rampdown**

**F & G pads started  
coinjection May  
2014**

**B/L, E/K, M\_Exp,  
E02, E03, E04  
planned Co-  
injection to start  
2016**



# 2016 initiatives

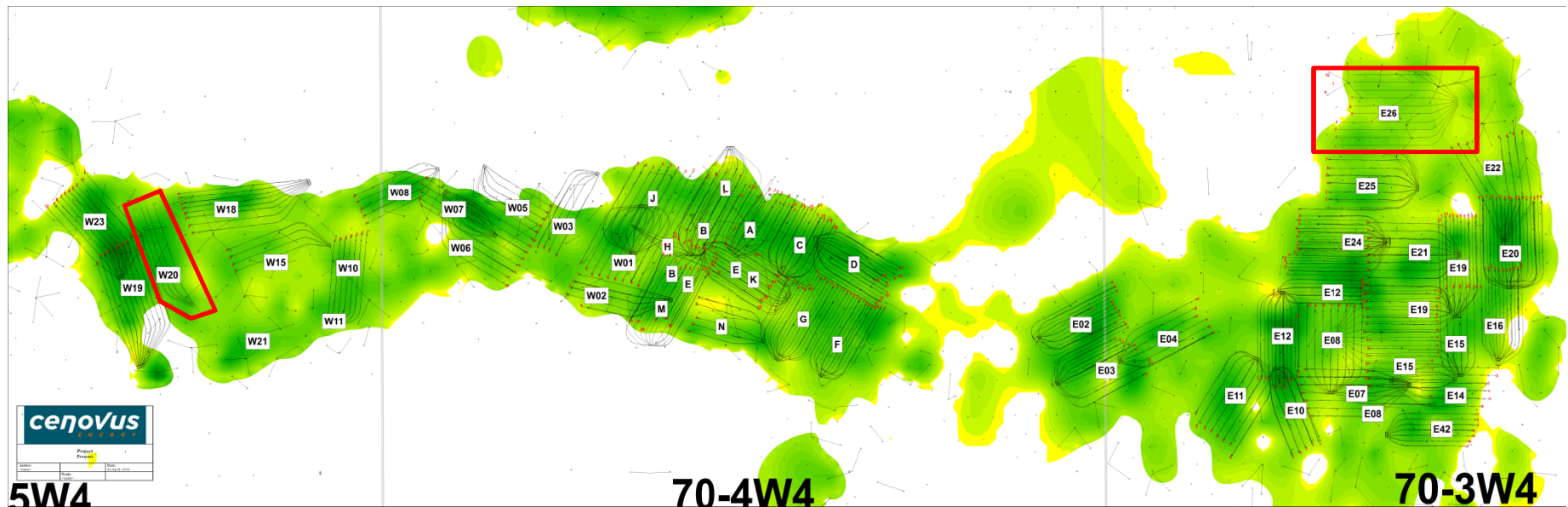
- **Alternate liner trials continue on various pads**
- **Liner and tubing deployed FCDs**
- **Lower Grand Rapids disposal evaluation**
- **Co-injection**
  - surfactant
  - solvent
- **Insulated tubing**
  - Evaluating vendors and technology
- **Npad Trials**
  - Thin pay pilot
  - Propane SAP pilot

# Flow Control Devices

- **Currently testing 8 flow control devices**
  - 4 liner deployed ICDs
  - 3 tubing deployed ICDs
  - 1 liner deployed OCDs
- **Improvements in temperature conformance have been observed at most installations to date**
- **Evaluation still ongoing**

Well Name	Well Type	Date Run	Deployment
W05P05	Producer	11/29/2013	Liner Deployed
W08P01	Producer	12/5/2013	Liner Deployed
GP5-1	Producer	1/14/2014	Liner Deployed
E15P11-1	Producer	7/22/2014	Liner Deployed
E16P06	Producer	11/29/2014	Tubing Deployed
FP2-1	Producer	3/19/2015	Tubing Deployed
DF1 Fisher	Producer	1/9/2014	Tubing Deployed
E15I10	Injector	5/1/2014	Liner Deployed

# 2016 New SAGD Well Pairs Drilling Plans



## East Pads:

- E26

## West Pads:

- W20



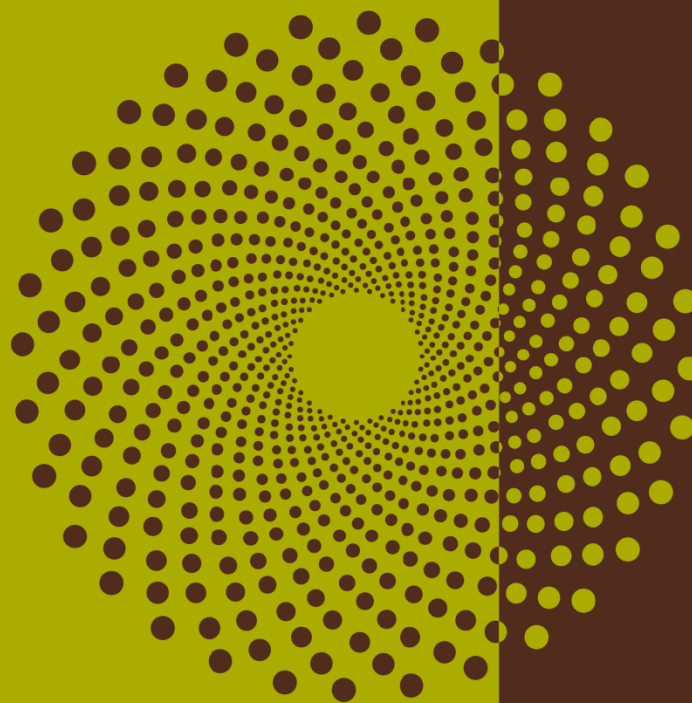
2016 Drilling

# 2015-2016 steam strategy plans

- **Cenovus allocates steam to maintain targeted steam chamber operating pressures from pad to pad**
- **As steam rampdown progresses, steam demand for the project will be reduced, allowing the startup of new pads**
- **In February of 2016 Cenovus increased steam generating capacity through the addition of Phase G**
- **The addition on phase G came several months ahead of schedule which generated a short term steam surplus.**
  - Pressures were allowed to increase across the field, and a number of new pad start-ups were accelerated to bring the field back into balance
- **New steam has been allocated to Phase G pads and existing well pads**

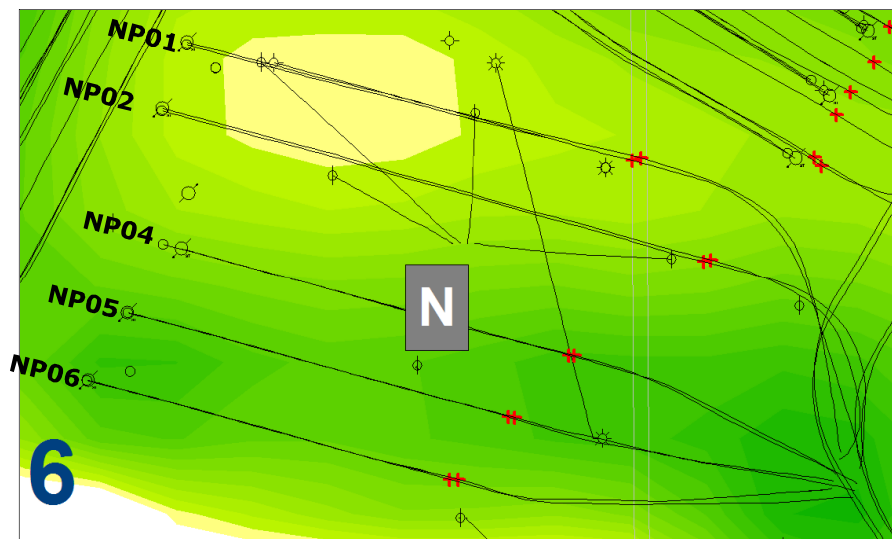
# FC N-Pad Pilot Update

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# N Pad Overview



- **NP01/NP02 are thin pay pilot wells**
- **NP04→NP06 are Propane SAP pilot wells**
- **NP03 was not drilled to maintain isolation between the two pilots**
- **Startup in Q2 2016**

# Thin Pay Pilot Overview

## **NP01 and NP02 drilled 6 & 7m from the SAGD TOP**

- Some pay will be sacrificed for now but may recovered later with a farmer/wedge well

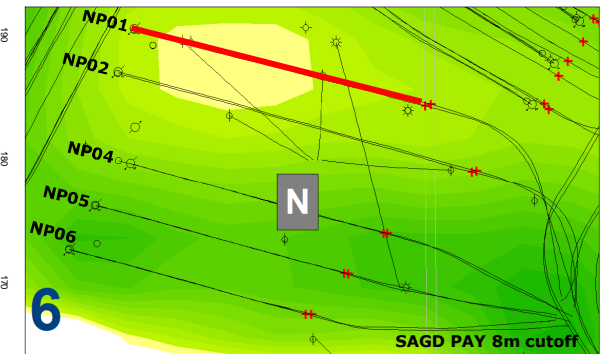
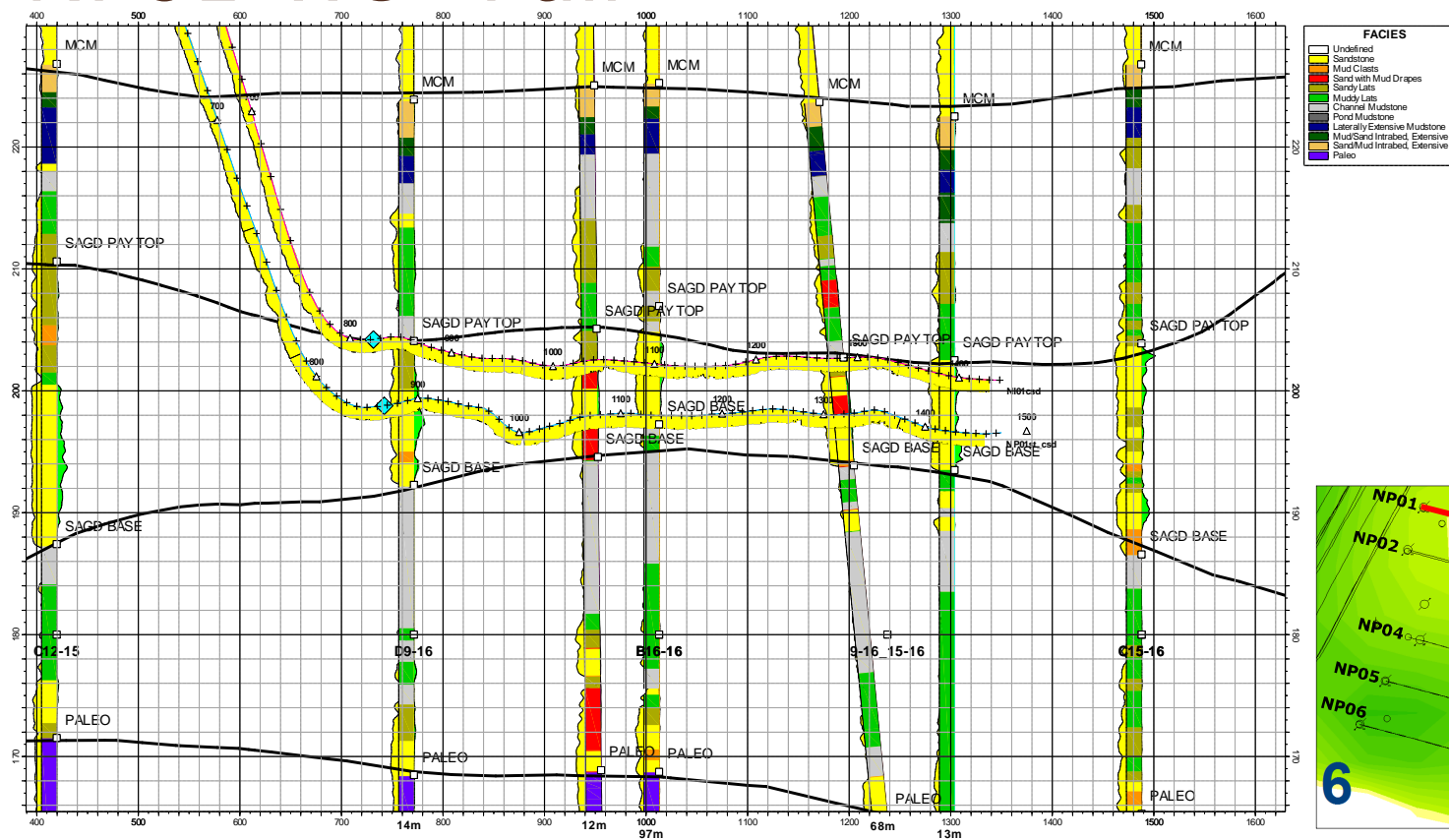
## **NI01 and NI02: drilled 4m high and 3m laterally from producer**

- Vertical ranging from observation wells was used to verify drilling depths and correct MWD uncertainties to ensure accurate thin pay for pilot wells (N01-N02).

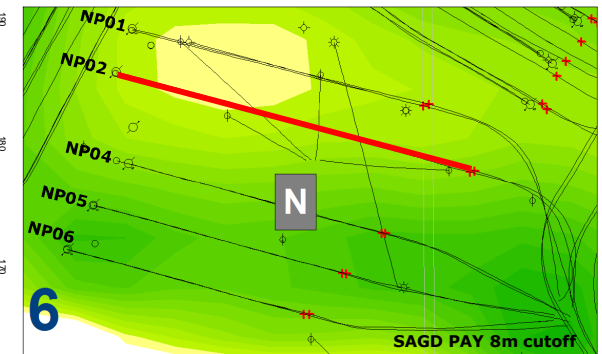
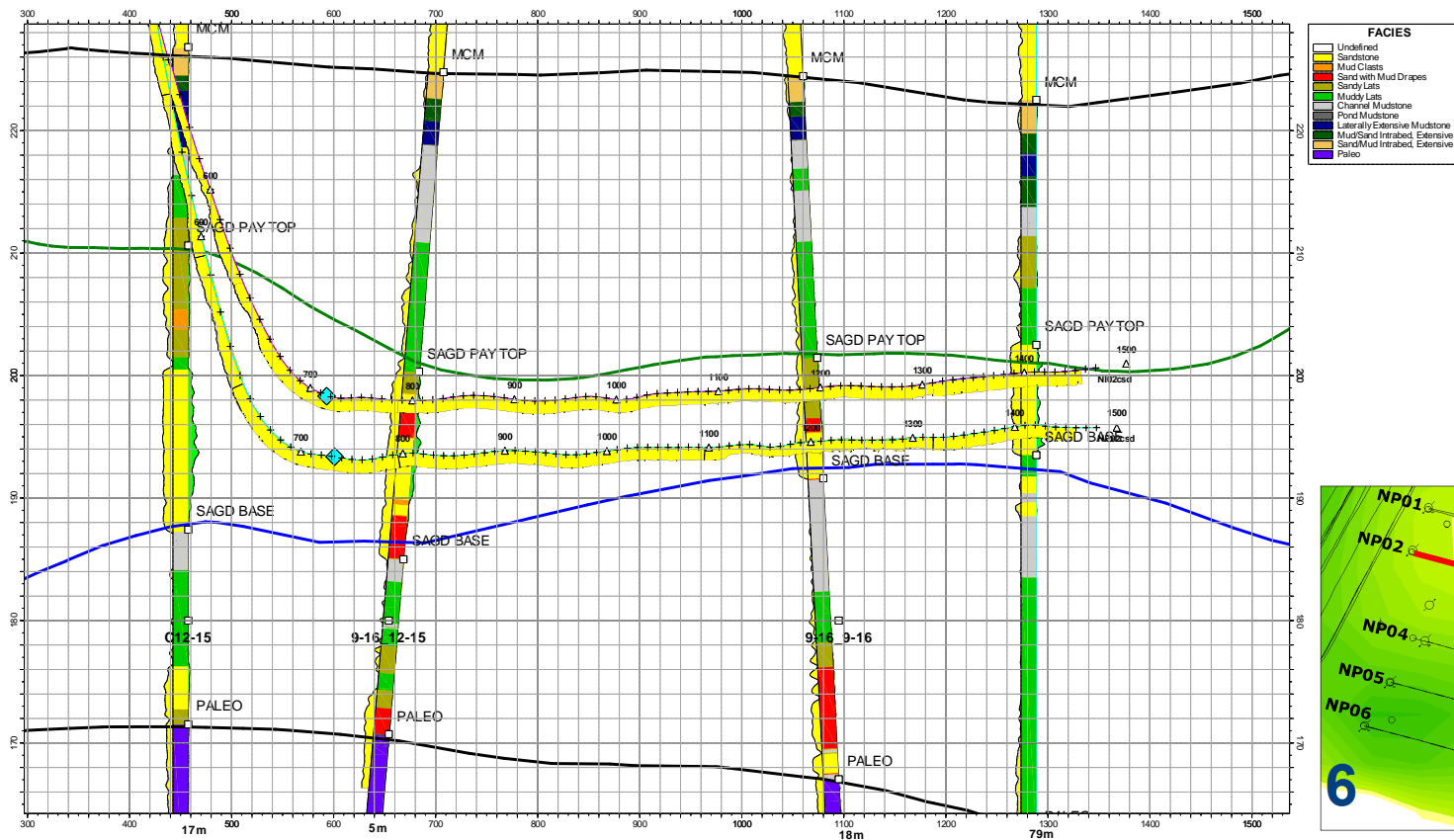
## **Circulation startup since wells were drilled off SAGD base**

- Wells drilled above the transition zone present in FC Central

# NP01 Well Pair



# NP02 Well Pair



# SAP Pilot Overview

## **Propane (C3) SAP pilot is located at NP04-NP06**

- 160m development gap between NP02 and NP04
- Delay startup of NP05 to maintain isolation in NP04 and NP06 for SAP trial
- Wells are short to maintain 150m offset to E pad (West)
  - ~500-550m

**Wells have rich pay thickness ~12-16m**

**~1 year SAGD baseline prior to C3 injection**

# Osprey Pilot

Subsurface



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# Osprey Pilot (Clearwater Formation)

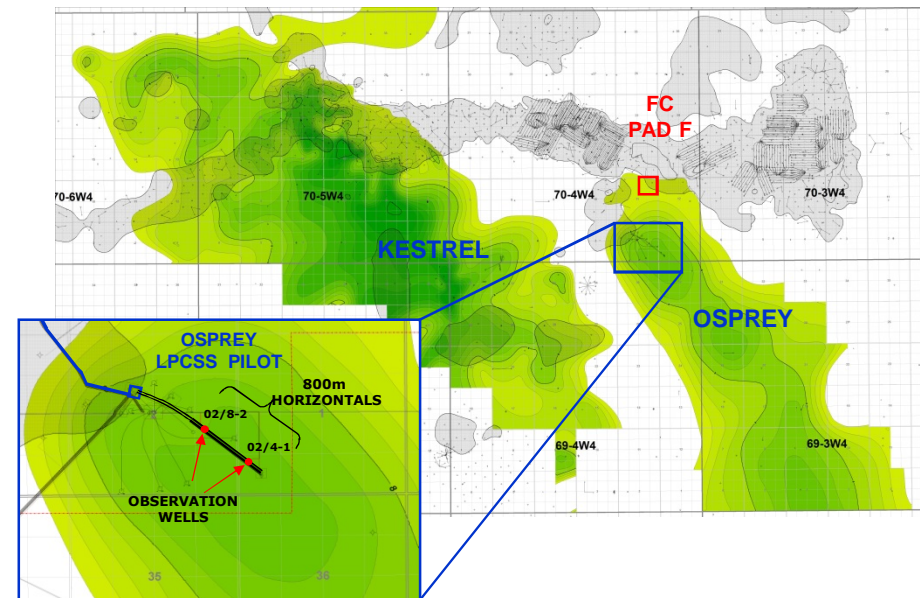
Location: 11-02-70-4W4M

## Facilities:

- 2 horizontal wells
- Rod pumps
- 2 BFW tanks & 2 boiler blowdown tanks
- 1 OTSG & steam separator
- Commissioned December 2013
- First steam injection April 30<sup>th</sup>, 2014
- 4 km south of FC F pad

## Operations:

- Low pressure CSS pilot
- Emulsion ties into F Pad
- Fuel gas from F Pad
- Water source for steam from blowdown disposal line
- Osprey disposal ties into the Foster Creek disposal line





# Overview (As of Dec 31, 2015)

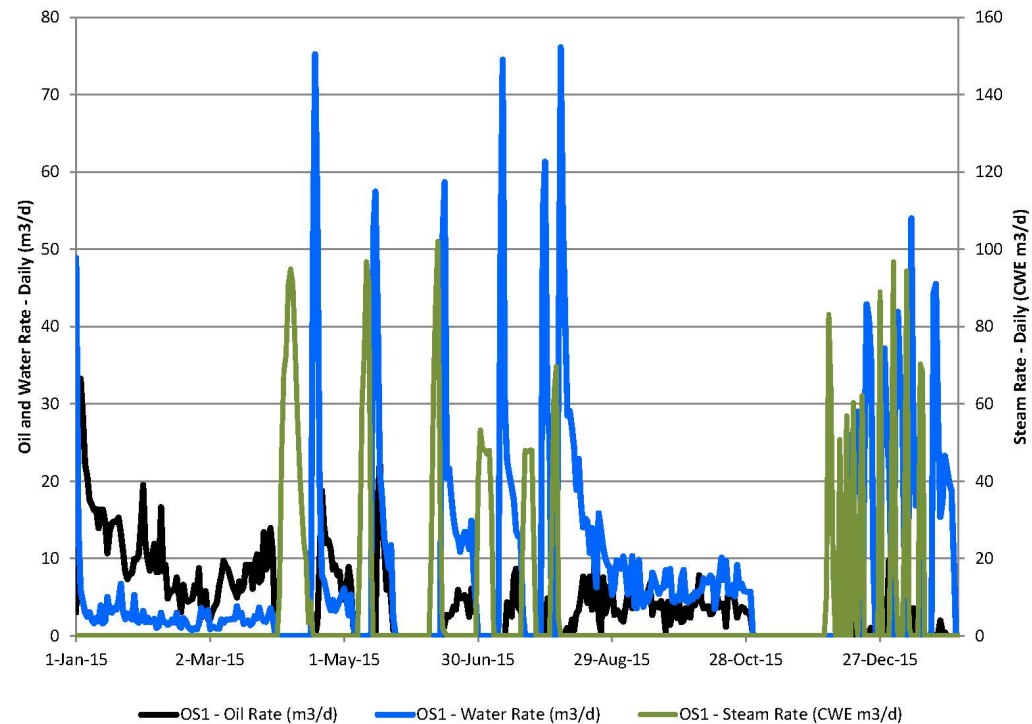
## OS1

- **No circulation**
- **Short Recompletion in Nov to increase the injection diameter and reduce the pressure drop allowing for higher quality steam injection**
- **Completed 14 cycles – 7 before recompletion and 7 post recompletion**
- **Cum Injection: 2660 m<sup>3</sup>    Cum Produced Bitumen: 1465 m<sup>3</sup>**

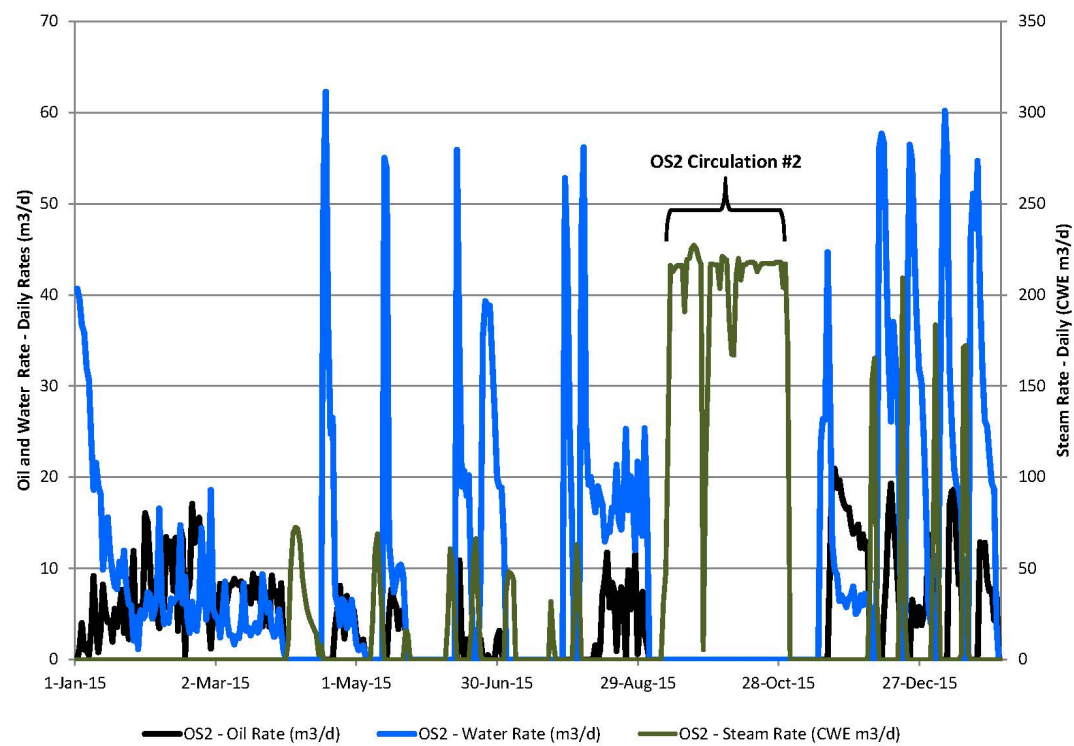
## OS2

- **Circulation #2 - Sep 9 – Nov 1**
- **Completed 14 cycles – 3 cycles after Circulation #2**
- **Cum Injection: 1165 m<sup>3</sup>    Cum Produced Bitumen: 1166 m<sup>3</sup>**

# OS1 2015 Performance Summary



# OS2 2015 Performance Summary



# Learnings

**Increased injectivity with higher quality steam to the formation after November 2015 recompletion on OS1 as evidenced by increased emulsion temperatures at the start of production**

# Summary of Reservoir Properties

Depth	450 m
Thickness	10-12 m
Average porosity	~33%
Average gas saturation	~10%
Average water saturation	~30%
Average bitumen saturation	~60%

# Future Plans

**Suspending operations in early 2016 due to low price environment**

**No plans finalized at this time for future usage of facilities and wells**

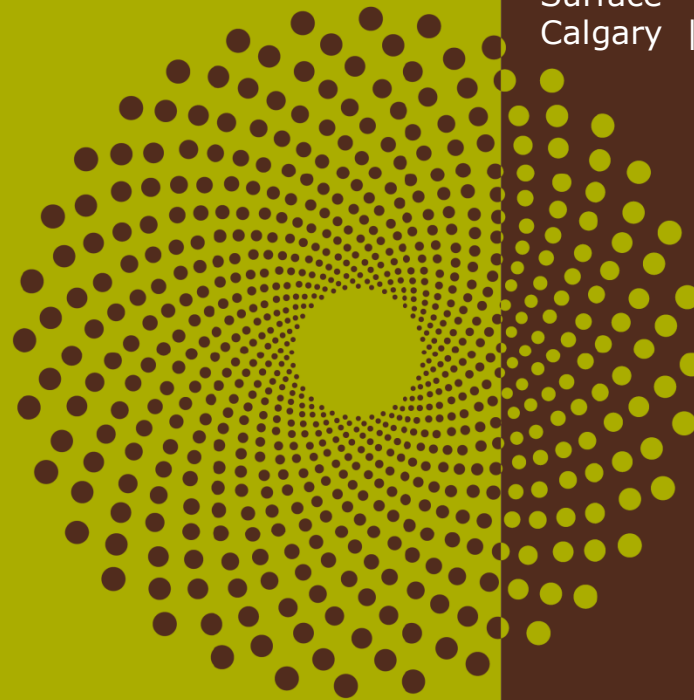
**Assess Osprey learnings to guide potential development plans for Clearwater formation**

Thank you



# Cenovus Foster Creek in-situ oil sands scheme (8623) update for 2015 Operating Year

Surface  
Calgary | June 1, 2016



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# Advisory

This presentation contains information in compliance with:

*AER Directive 054 - Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes*

Section 3.1.1 Subsurface Issues Related to Resource Evaluation and Recovery

This document contains forward-looking information prepared and submitted pursuant to Alberta regulatory requirements and is not intended to be relied upon for the purpose of making investment decisions, including without limitation, to purchase, hold or sell any securities of Cenovus Energy Inc. The resources estimates contained herein are not reported in accordance with National Instrument 51-101 and are provided solely for the purpose of complying with Alberta regulatory requirements.

Additional information regarding Cenovus Energy Inc., including information regarding contingent resources, is available in our Annual Information Form for the year ended December 31, 2015 and in our Statement of Contingent and Prospective Resources for the year ended December 31, 2015 at [cenovus.com](http://cenovus.com).

# About Cenovus

## TSX, NYSE | CVE

Enterprise value	C\$18 billion
Shares outstanding	833 million
2016F production	
Oil sands	151 Mbbls/d
Conventional	54 Mbbls/d
Total liquids	205 Mbbls/d
Natural gas	385 MMcf/d
<b>Total production</b>	<b>269 MBOE/d</b>
2015 proved & probable reserves	3.8 BBOE
Bitumen	
Economic contingent resources*	9.3 Bbbls
Lease rights**	2.0 MM net acres
P&NG rights	4.1 MM net acres
Refining capacity	230 Mbbls/d net

Values are approximate. Forecast production based on February 11, 2016 guidance.

\*See advisory. \*\*Includes an additional 0.5 million net acres of exclusive lease rights to lease on our behalf and our assignee's behalf.



# Foster Creek – current project status



Aerial shot of Foster Creek facility, and steam and emulsion lines

Note that production volumes refer to total cumulative production capacity

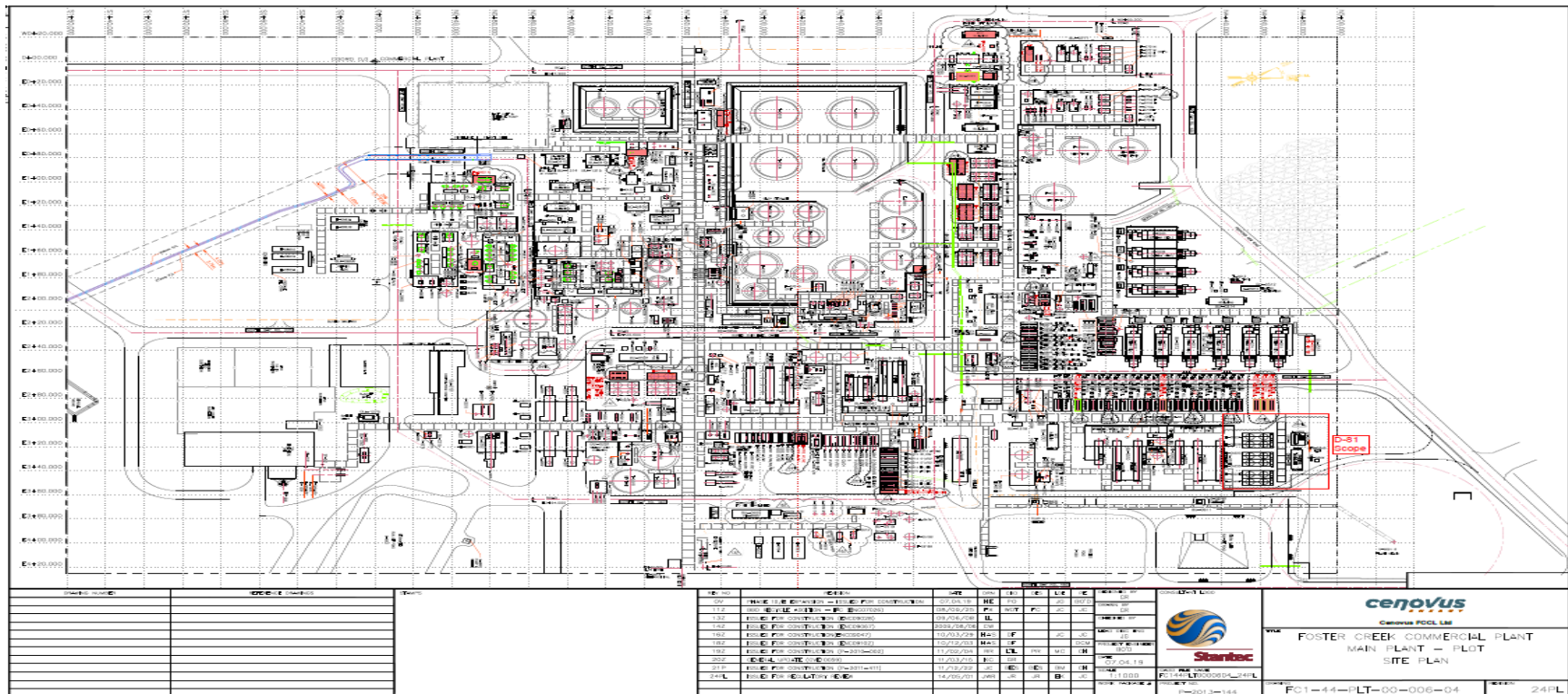
- **Phase A - 20k bbls/d on October 2001 (3,180 m<sup>3</sup>/d)**
- **80 MW Cogen on Q1 2003**
- **Phase B - 30k bbls/d (4,770 m<sup>3</sup>/d) complete 2004**
- **Phase C - 60k bbls/d complete 2006 (9,534 m<sup>3</sup>/d)**
- **Phases D & E - 120k bbls/d complete 2009 (19,078 m<sup>3</sup>/d)**
- **Water treating debottleneck and cooling loop complete 2010**
- **Phase F - 150k bbls/d complete 2014**
- **Q1 2016 oil production 121,763 bbls/d (19,358 m<sup>3</sup>/d)**
- **Record oil production day 155,302 bbl (24,730 m<sup>3</sup>)**
- **Approved for Phases A – J**

# Facilities



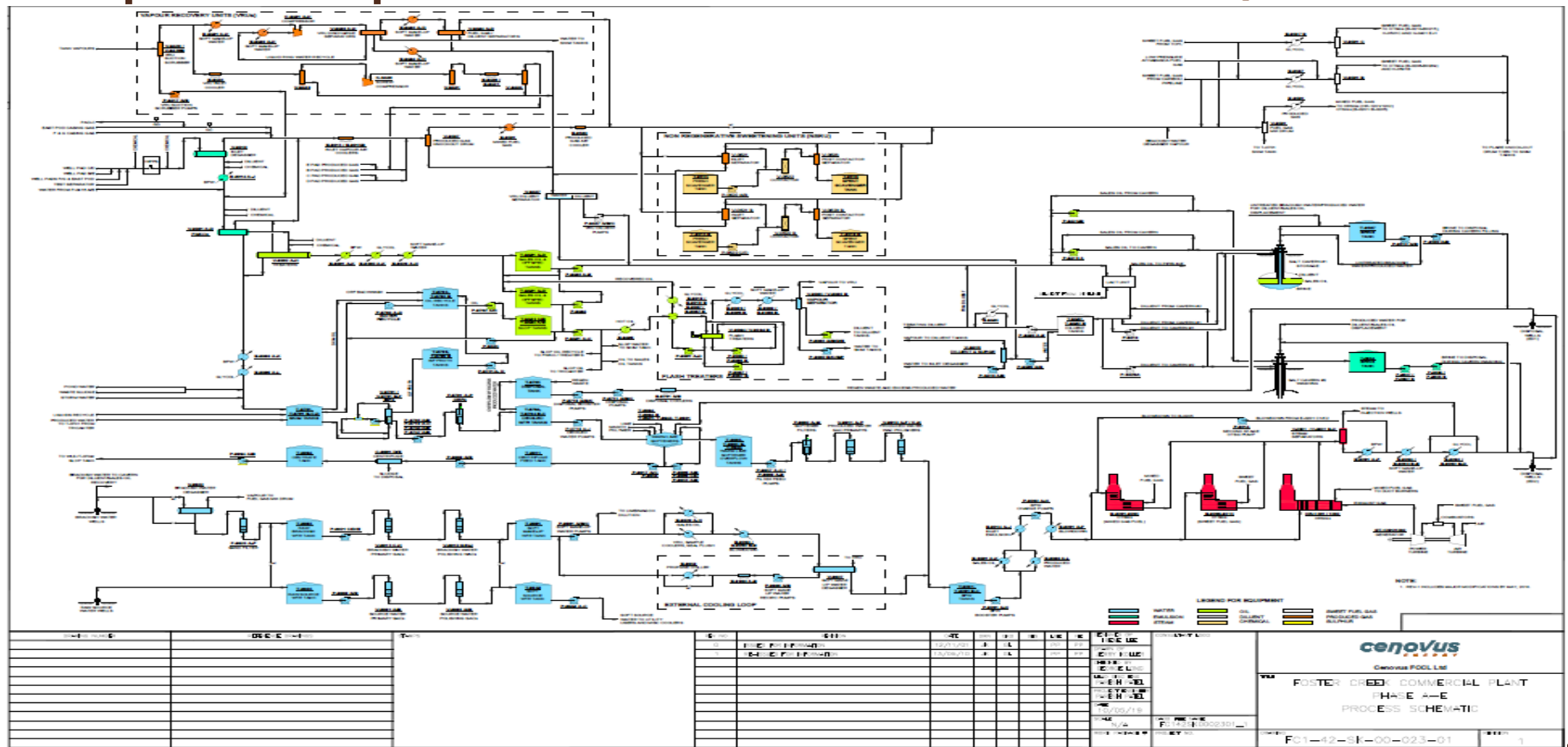
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# Foster Creek A/E plot plan



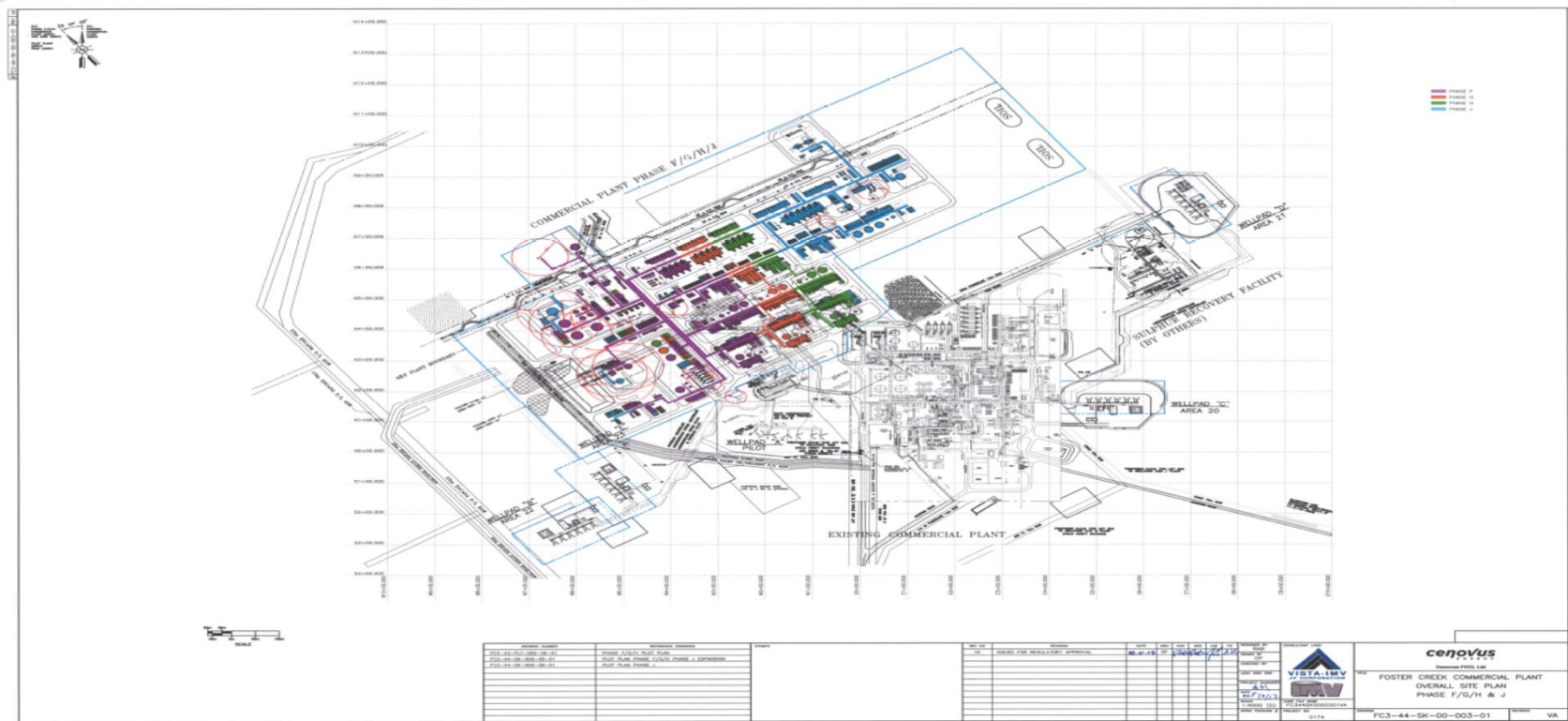


# Simplified process schematic for A/E





# Foster Creek FGH plot plan



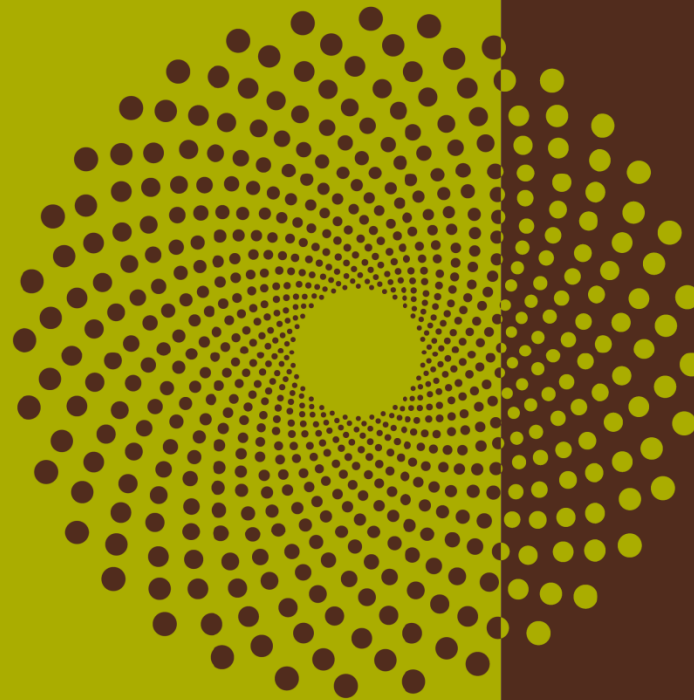
# Phases F, G & H

- Engineering & Procurement completed
  - Phase H 95%
- Construction
  - Phase G 49% complete
    - Major equipment 100%
    - Field piping @ 100%,
    - Field E&I @95%
  - Phase H 16% complete (Construction presently on hold)
    - Piling @100%, cutting and capping @ 87%, concrete @ 61%

# Phase F & G commissioning

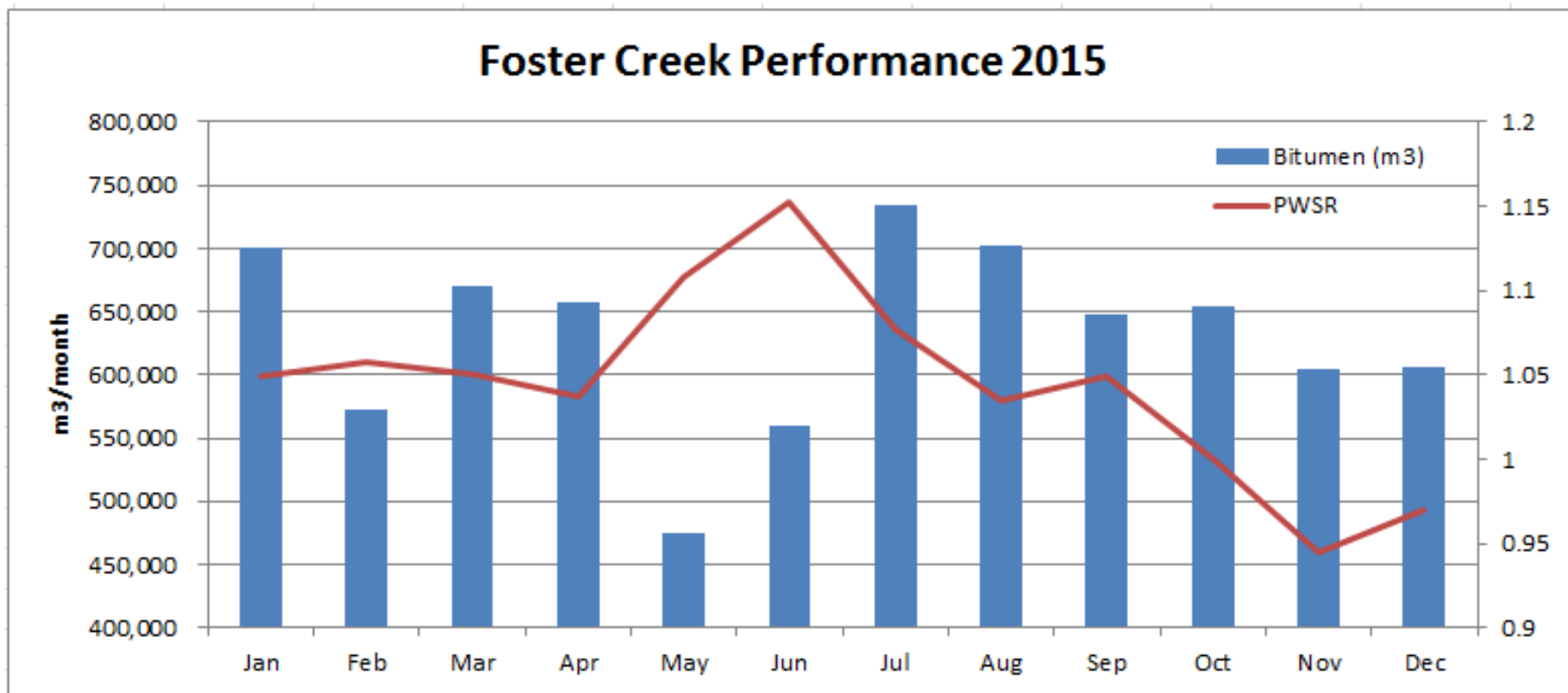
- Phase F started-up successfully last year. Optimization in progress.
- Phase G:
  - Area 02 (Steam generation) - Completed
  - Area 03 (Oil treating) – In progress
  - Area 04 (Tankage & Vapor Recovery) – In progress
  - Area 05 (utilities)- completed
  - Area 07 (De-oiling)- In progress
- Remaining:
  - Area 03 - Flash Treater Package

# Facility performance

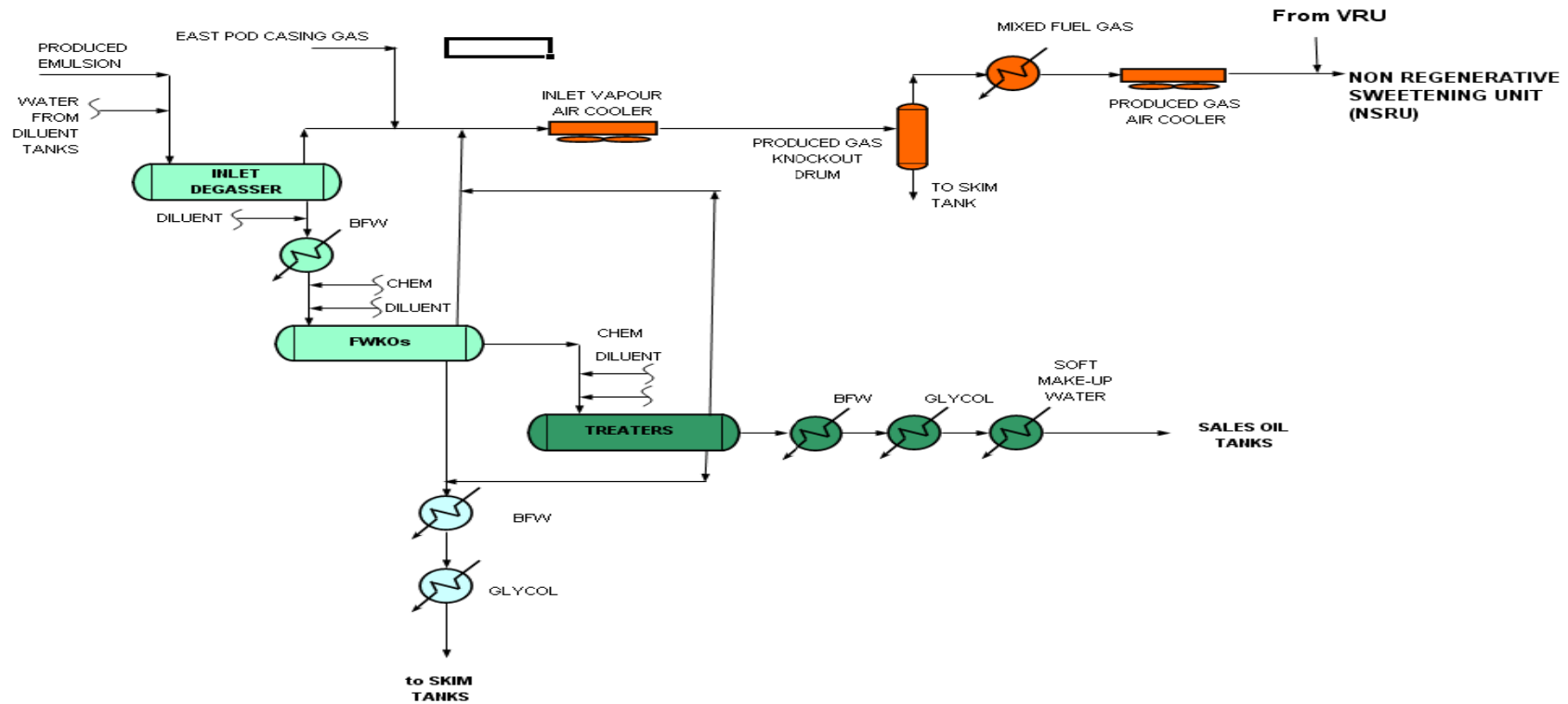


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# Plant performance



# Emulsion treatment

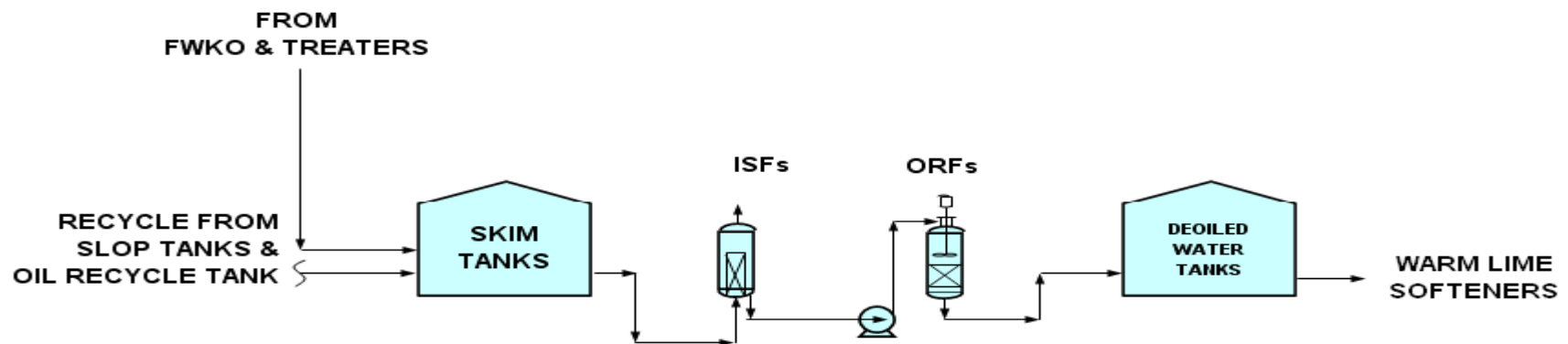


# Area 03: Emulsion treatment

- Two inlet degassers (A/E & FGH)
- Five process trains (A/F), one FWKO + two Treaters per train
- Three Sulphur Removal Units (A/E & FGH) for sweetening produced and recovered gas
- Inlet capacity best achieved rates
  - A~E Phases= 3,235 m<sup>3</sup>/h
  - F Phase= 800 m<sup>3</sup>/h



# Area 07: Produced water de-oiling



# Area 07: Produced water de-oiling

- Five de-oiling trains (A/F)
- First train
  - one skim tank, one ISF and three ORFs
  - Re-configured this train to series operation Skim Tank > Pump > ISF > ORF.
- Second train
  - one skim tank, one smaller ISF and three ORFs
- Third - fifth trains
  - one skim tank, two ISFs and four ORFs

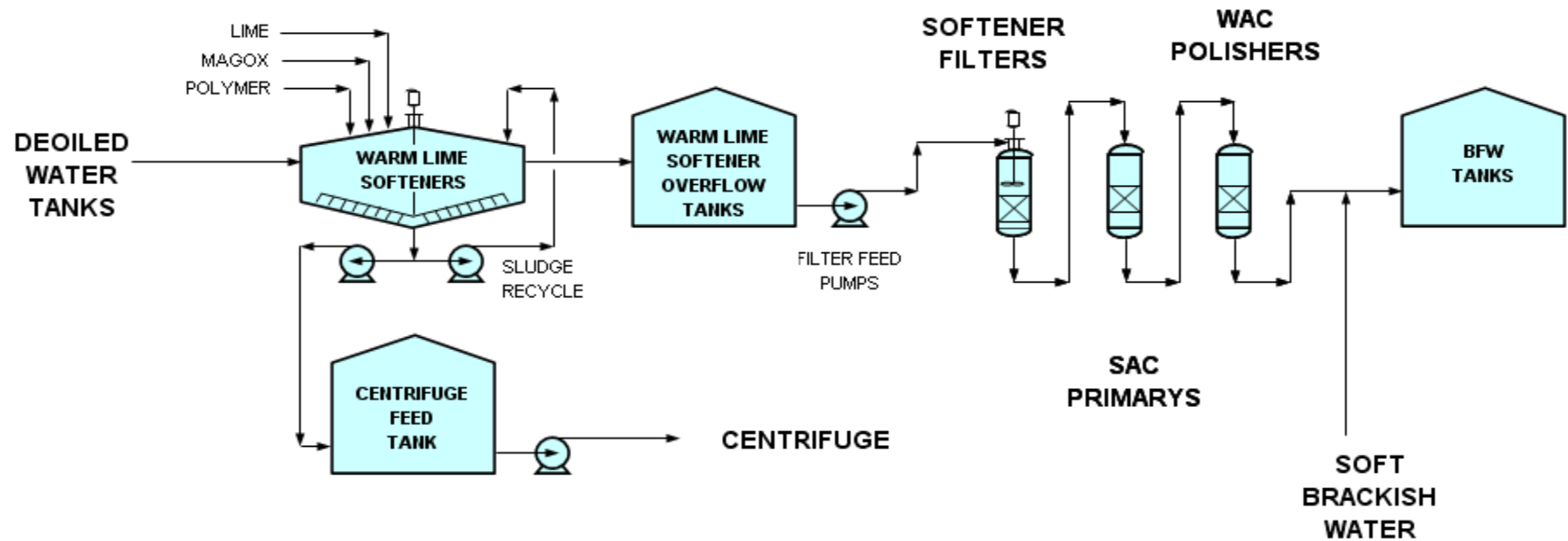
# Area 07: Produced water de-oiling

- Skim tanks
  - Designed for < 4 hours retention time based on nominal capacity  
Actual retention time is much lower
  - Improper oil skimming (XV valve & gravity flow out of tank)
  - There is no solid removal mechanism. Only few nozzles around the perimeter of the tank.
- ISFs
  - Vertical units with about 5-6 minutes of retention time
  - Flocculent injected at inlet
  - Two units are modified with micro-bubbler pumps instead of eductors

# Area 07: Produced water de-oiling

- Oil removal filters (ORF) walnut shell media
- De-oiled produced water oil treatment performance (January 2015 to Dec 2015)
  - Skim tanks inlet average avg. ~118 ppm
    - ISFs inlet average avg. ~125 ppm
    - ORFs inlet average avg. ~25 ppm
    - ORFs outlet average avg. ~10ppm

# Area 08: Water treatment



# Area 08: Produced water treatment

- Three Eimco units tested to 1200/1200/650 m<sup>3</sup>/h
- One Densadeg tested to 500 m<sup>3</sup>/h
- Lime softener filters (LSF) – walnut shell media
- SAC or WAC followed by WAC ion exchange units
- 2015 Average BFW quality
  - silica <25 ppm
  - TDS <2800 ppm
  - hardness <0.25 ppm
  - iron <0.05 ppm
- Phase G water plant expected to be commissioned in Q4-2016

# Directive 081 update

- AER variance issued (May 2015) for modified Dir 081 limits at FC. The variance expires Dec.31, 2017
  - 2016: 131%
  - 2017: 122%
- Parts of the D81 project scope on hold
  - Adding new glycol capacity to remove cooling load off brackish
  - Increased PW capacity to reduce PW to disposal volumes



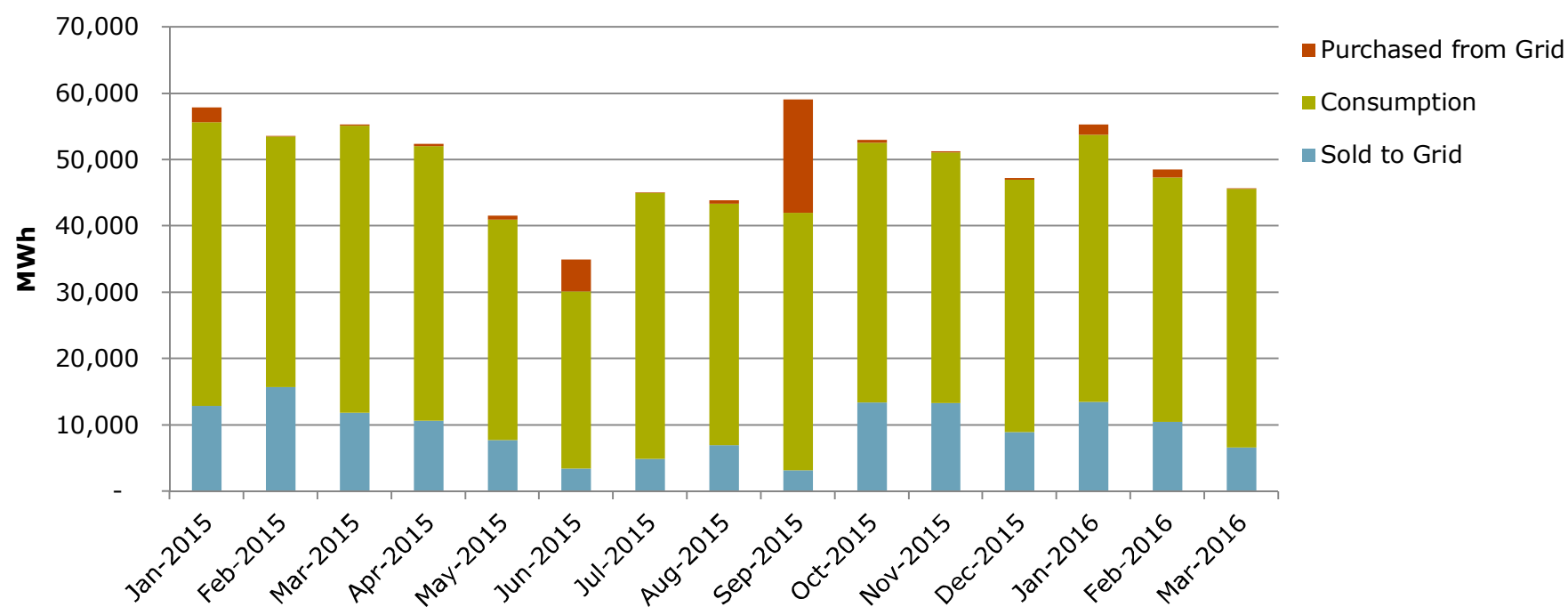
## Area 2/12: Steam Generation

- Two Co-gen units (40 MW each)
- Five 180 MM Btu/hr OTSGs
- Ten 250 MM Btu/hr OTSGs
  - Continuous Emission Monitoring Systems (CEMS) on FC1-B-0206, FC1-B-0210 and FC3-B-0201
  - Operated B-0206 & B-0208 at 87% Steam quality (ongoing)
- Four 275 MM Btu/hr OTSGs
- Four 275 MM Btu/hr Second Stage OTSGs

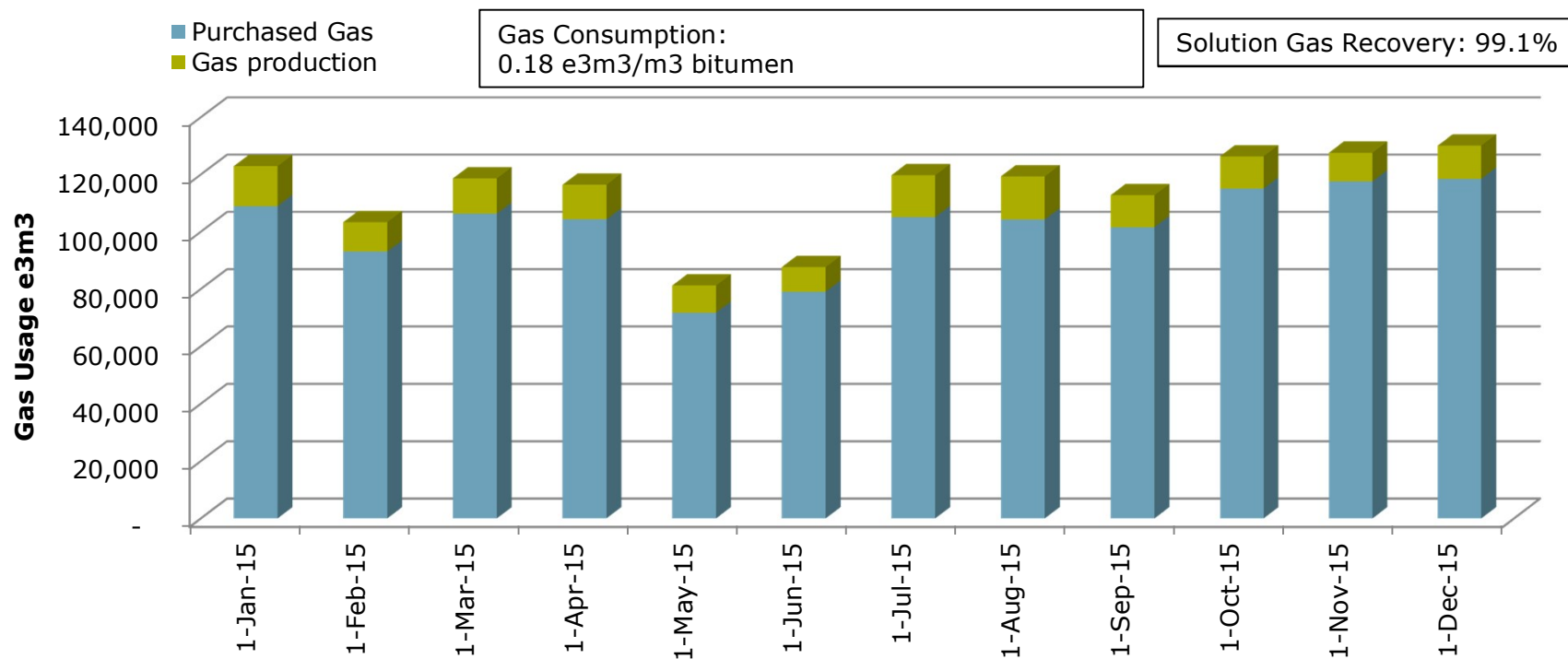
## Area 02: Second stage OTSG – FC3

- Phase-F 2<sup>nd</sup> Stage OTSGs (6 pass, 275 MMBTU/H, TIWW)
  - Four OTSGs, FC3-B-0201/02/03/04 were commissioned in May-2014
  - Operated at ~70% steam quality
  - BFW+BBD blend to maximize steam production
  - 1,542,000 Sm3 BBD used to produce steam in 2015
  - Currently Phase G is acting as the 2<sup>nd</sup> stage phase
- Failures:
  - Tube failures were observed in Phase F in all four boilers in Q4-2014 or Q1-2015.
  - 1 Phase G OTSG saw tube failures in Q1 2016
  - All the failures have been repaired and boilers put back in operation.

# Power generation

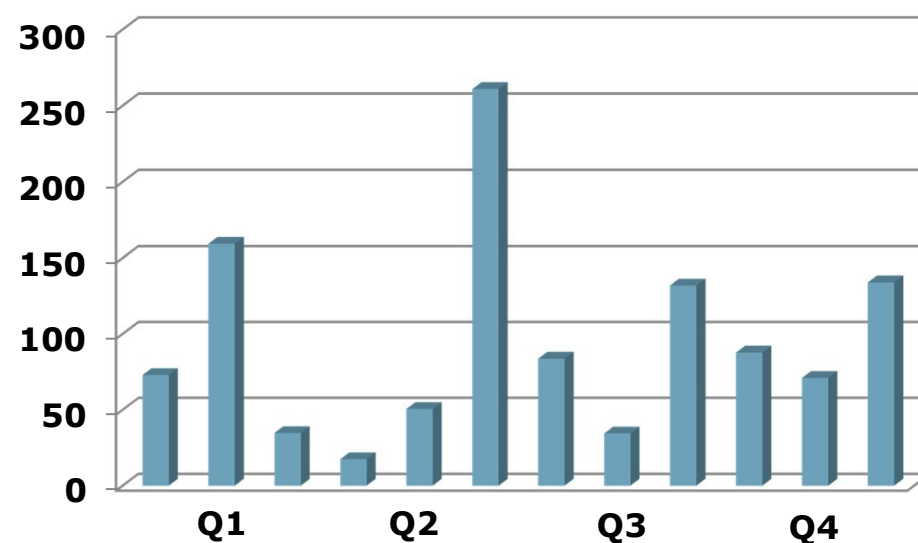


# Gas usage

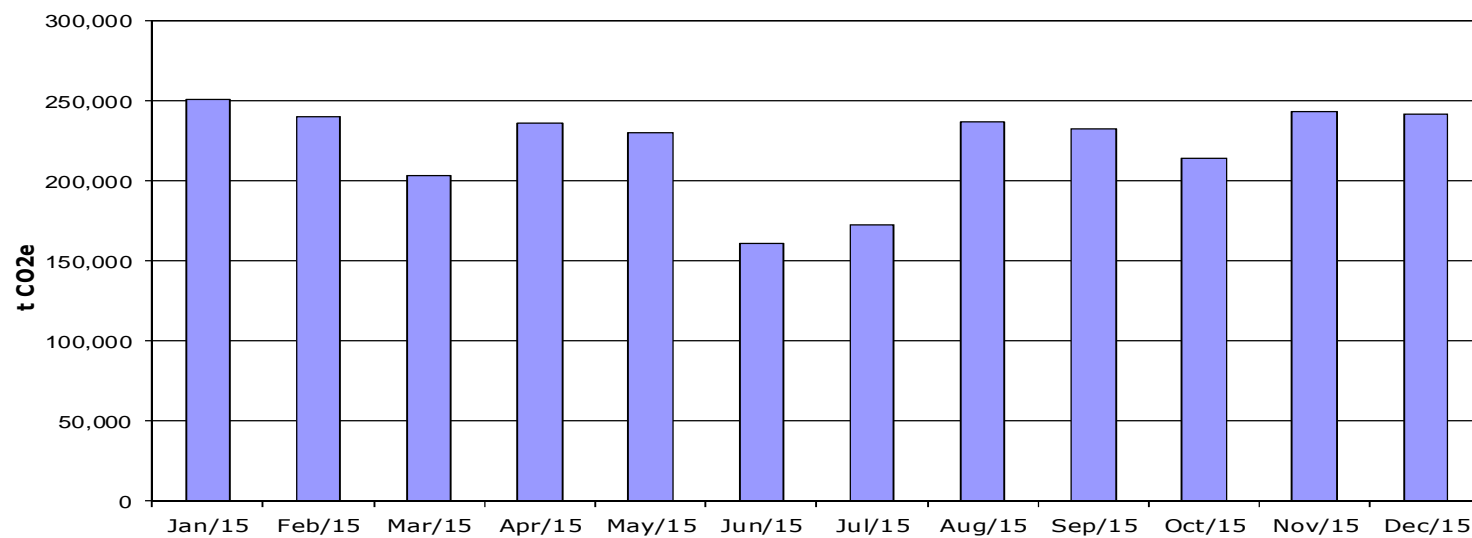


# Flared gas volume (e<sup>3</sup>m<sup>3</sup>/month)

- 2015 total flared gas 1138.5 e<sup>3</sup>m<sup>3</sup>, 0.15 m<sup>3</sup>/m<sup>3</sup> oil, compared to 2002 e<sup>3</sup>m<sup>3</sup> in 2014
- 2015 Q2-Q3 high flaring due to various activities and issues related to new Phase-F start up
  - Phase-F NRSU outage
  - Phase-F Boiler trips



# Greenhouse gas emissions



# Emissions

- GHG emissions including Cogen = 2.662 MtCO<sub>2</sub>e in 2015 (2.537 MtCO<sub>2</sub>e in 2014)
  - Total annual emissions less Deemed GHG Emissions from Cogen = 2.247 MtCO<sub>2</sub>e
  - Reported emissions intensity = 0.3201 tCO<sub>2</sub>e/m<sup>3</sup> bitumen
- Fugitive emissions = 351.30 tCO<sub>2</sub>e in 2015 (197.1 tCO<sub>2</sub>e in 2014)
  - Fugitive emissions include unintentional equipment leaks such as loose flanges, PSVs not sealing properly, equipment wear, etc.
  - Does not include equipment vents that are intentionally designed to vent.
  - Target Emissions Services used for LDAR services



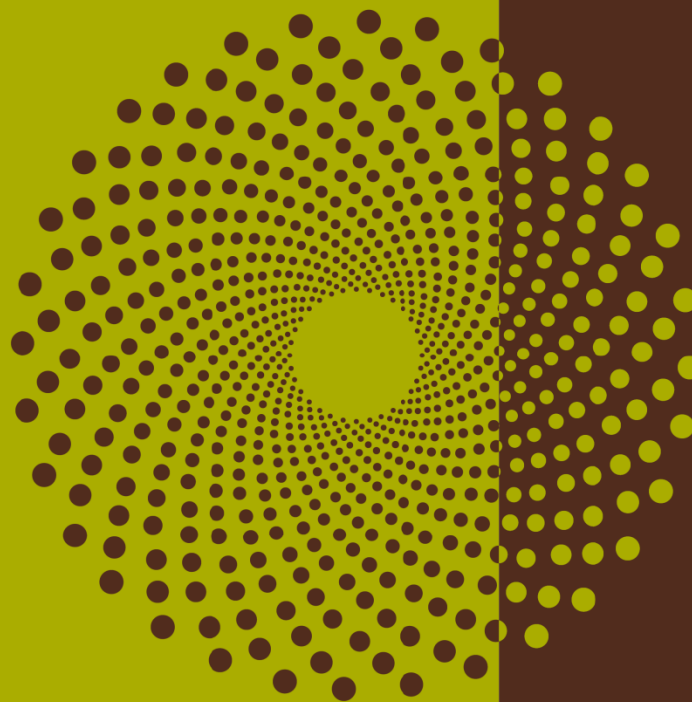
## Area 04: Vapor Recovery Unit (VRU)

- One screw compressor + eight liquid ring compressors
- Construction in progress for
  - Addition of a new screw compressor K-0422
  - VRU header twinning to resolve hydraulics limitations
  - Expected to be commissioned in Q2/Q3-2016
- Four rotary compressors (sliding vane)

## Area 04: Slop handling

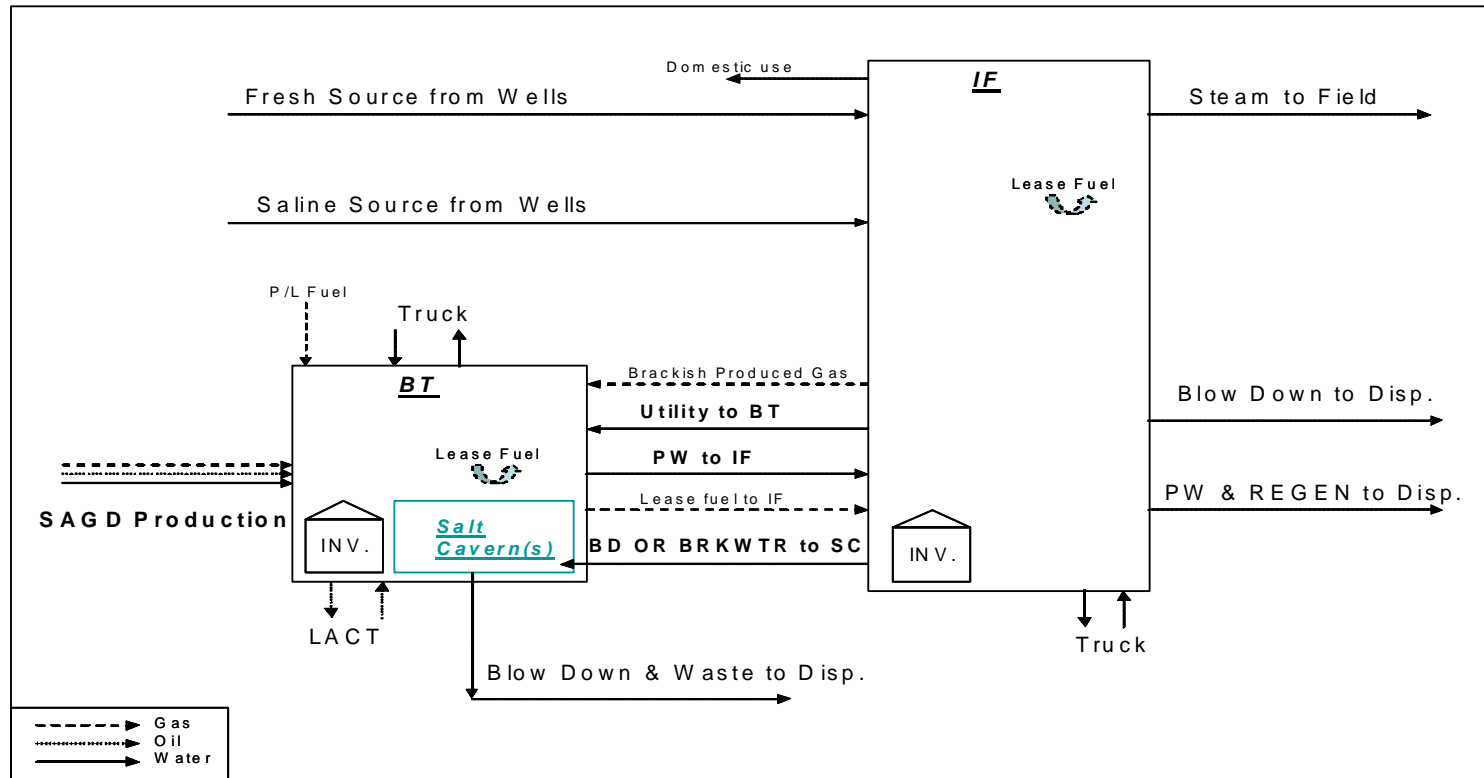
- Eight slop tanks each about 870 m<sup>3</sup>
- Tricanter to treat slop fluid and reduce waste
  - Processing 200 to 350 m<sup>3</sup>/d of slop fluid
  - Water and oil on spec and returned to facility
  - Investigating what other fluids could be treated with this system
- AE plant Flash Treater not being used
- Phase-F one Flash Treater to be commissioned

# Measurement and reporting



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# Simplified MARP schematic



# Foster Creek Facility Scheme Codes

- ABBT0066377 Sub type 344 Production Battery
- ABIF0009473 Sub type 506 Injection Facility
- ABIF0116044 Sub type 506 Salt Cavern 1
- ABIF0116045 Sub type 506 Salt Cavern 2

# MARP approvals

- FGH MARP was approved in April 2011
- Salt caverns are separated from the rest of the plant for production reporting
- Cenovus received Approval #8623 for Emulsion Sampling and Primary/Secondary Water Measurement requirements
- MARP documentation submitted to AER in November 2015

# Methods for estimating injection and production volumes

- Production well metering/estimates:
- Wellhead meters are quadrant edge orifice plate meters for the first 34 pads, manual BS&W samples
- W08 first new well pad with test separator design, all new pads will incorporate test separators
- W08 test separator has had some maintenance issues with water cut meters and level switches. Using manual samples and orifice plate meters if separator is out of service.
- Other initiatives
  - Tried Perm Inc. NMR technology for water cut with favorable results. Continue to work with vendor on development
  - Using NMR benchtop unit in central lab to analyze all manual samples
  - AGAR MPFM installed on W06 pad well pairs WP7 and WP8 which may come on this summer



# Methods for estimating injection and production volumes

- Production is prorated to plant volumes:
  - Oil: sales – diluent +/- inventories + blending shrinkage
  - Water: water entering battery and transferred to the IF (sum of the ORFS +/- inventories + transfers)
- Steam injection meters:
  - Injection well head meters are nozzle-style and V-cone
  - Steam is measured at each injector
  - Steam leaving the plant is calculated using the sum of the boiler feedwater meters minus the blowdown water meters. The plant steam is then prorated to each well.

# Emulsion Meter Acceptance Sampling

## AER Approval 8623

- Allows for the use of sampling principles to determine the health of the emulsion orifice plates located on the Foster Creek Production Pads.
- Inspections are based on a sample size that adequately represents the total number of orifice plates.
- Approval requires 3 wells per pad to be inspected on an annual basis.

# Emulsion Meter Acceptance Sampling

## 2015 Results

- The total lot sample size was 99 emulsion orifice plates
- Based on sampling methodology, an acceptable lot sample must contain  $\leq 4$  failed inspections
- 2015 results showed no failed inspections due to element damage, however, 2 installations were found to have incorrect calibrations
- Lot sample for 2015 accepted

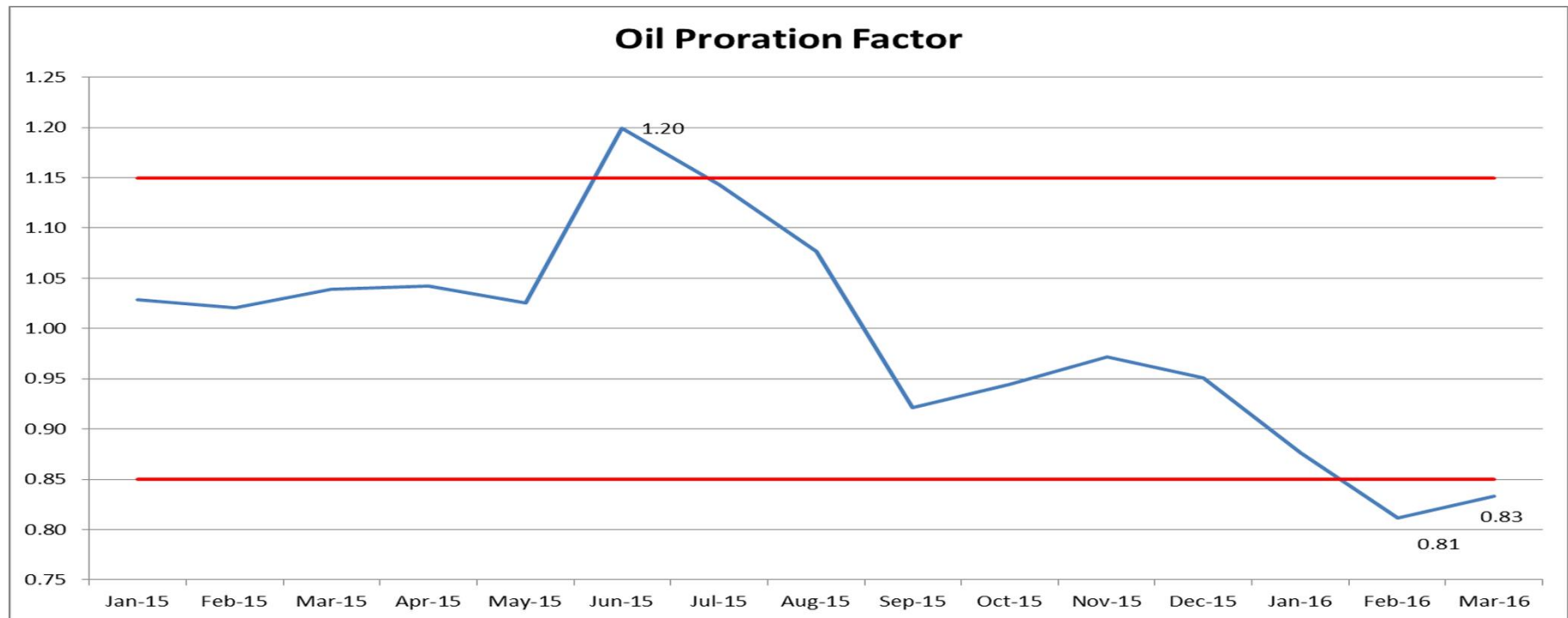
## 2016 Execution Plan

- 3 emulsion wells per pad will be inspected during the course of 2016, for a total of 102
- 2016 lot sample will not contain any orifice plates inspected as part of the 2015 program.

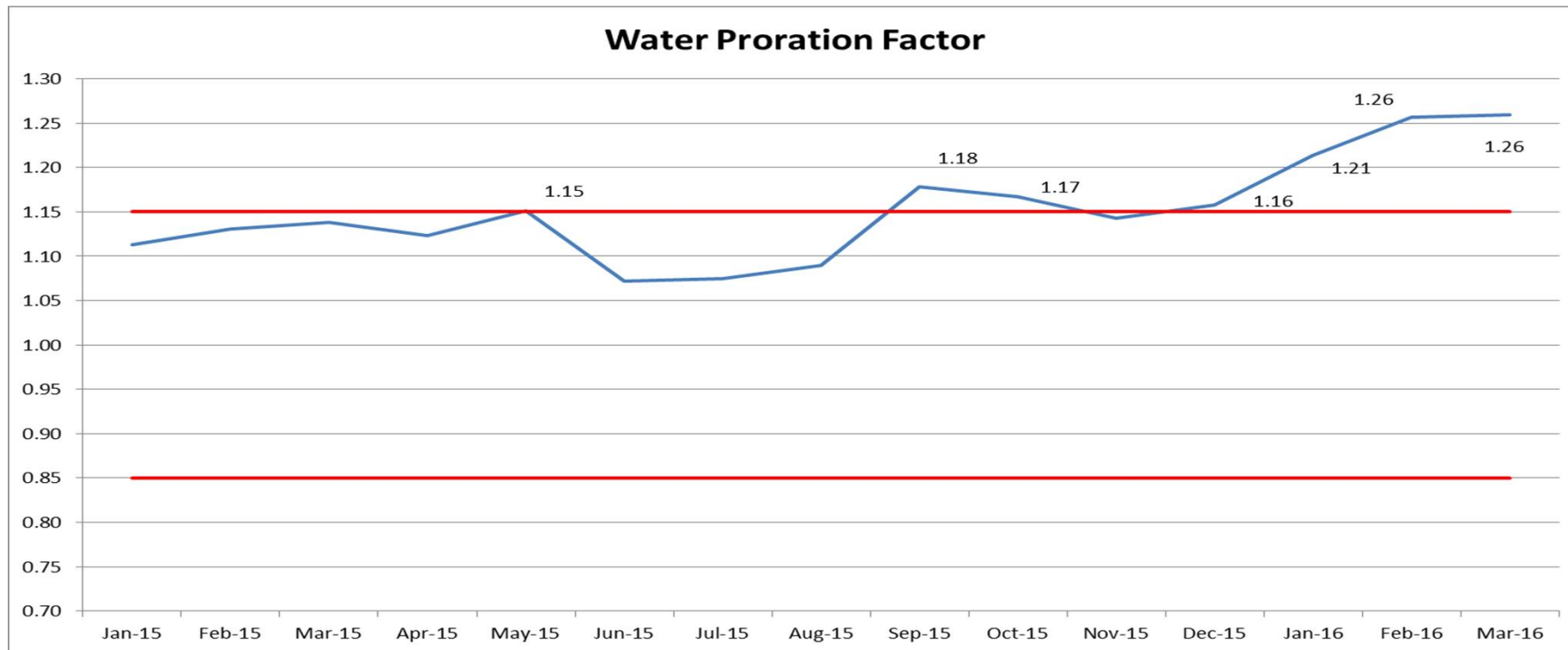
# Proration factors

- Oil and water estimates are obtained from the wellhead meters and manual samples
- Oil and water production is calculated from meters at the plant
- Proration factors are found by dividing the actual production by the estimated
- Gas allocated to each well is determined by GOR for the battery

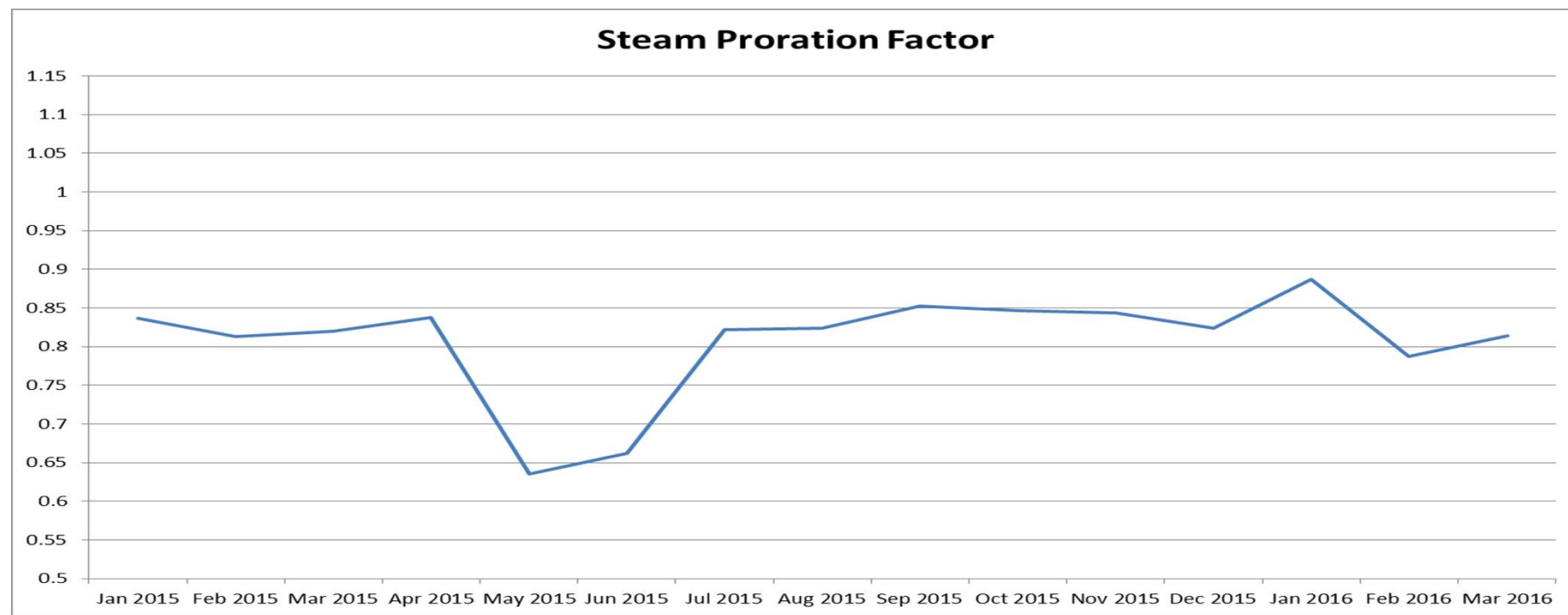
# Oil Proration



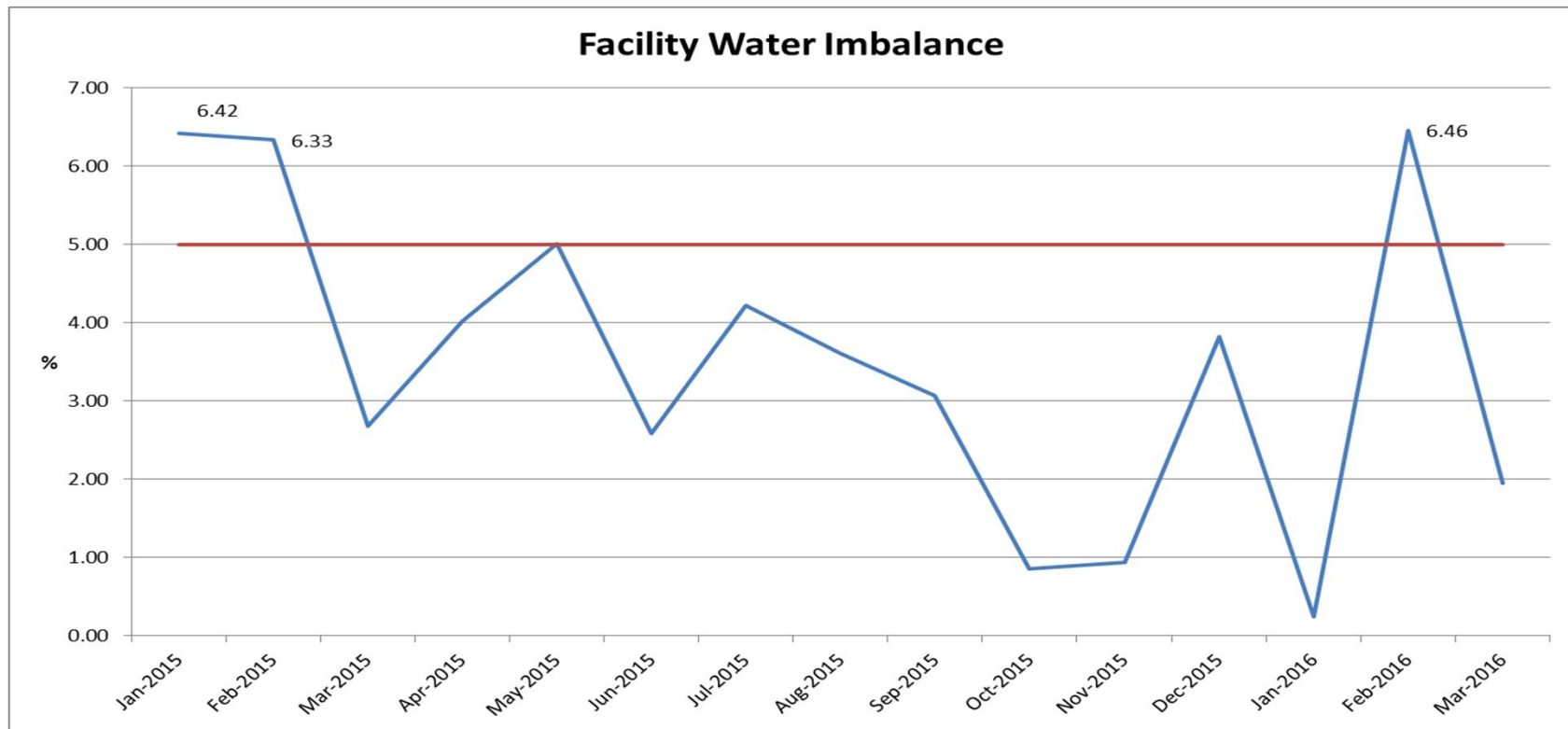
# Water Proration



# Steam Proration



# Facility Water Imbalance





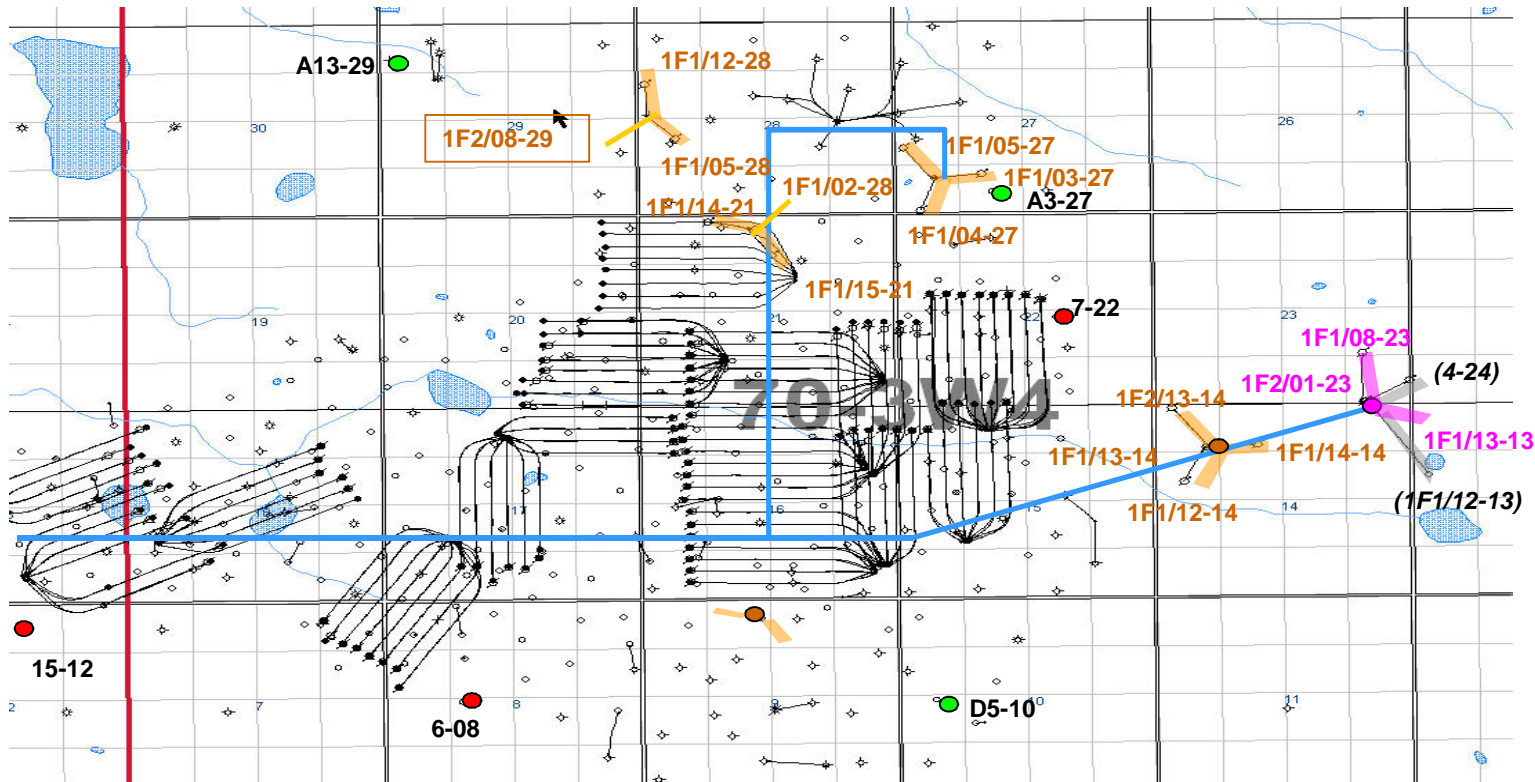
# Optimization of test durations

- Wellhead flow meters are used to measure the flow rate of existing wells at Foster Creek
- This variance from standard testing duration was granted by exemption letter because the wells all have individual flow meters so flow is continuously measured
- Quadrant edge orifice meters have been proven to compare well to coriolis meters
- New test separators have coriolis meters and watercut analyzer on liquid leg (first units are Phase Dynamics – currently working with vendor on calibrations)

# Description of water production, injection and uses



# Current brackish source network



## Legend

- Drilled Deviated Water Source Well
- Drilled Vertical Water Source Well
- Grand Rapids Source Well
- McMurray Source Well
- Grand Rapids Piezometer
- McMurray Piezometer

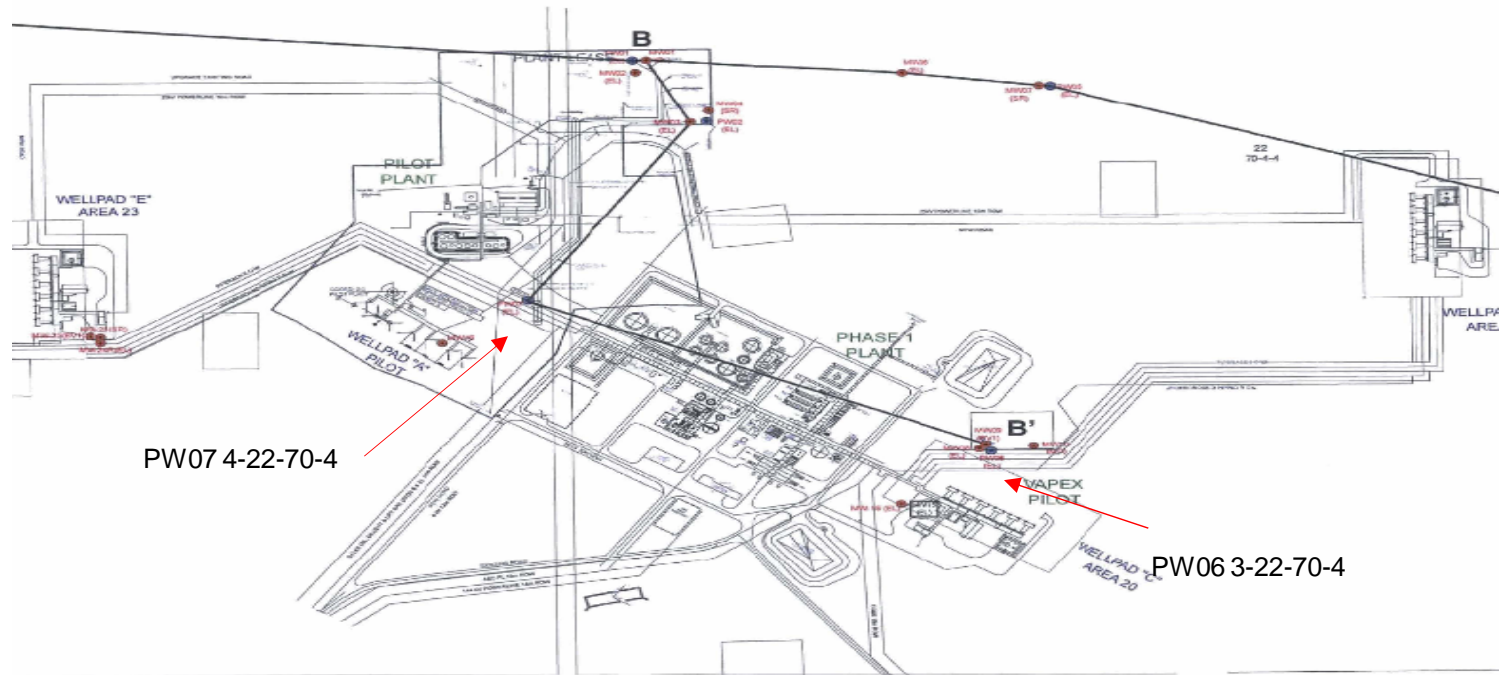
### LGR Wells:

1F2/08-29-070-03W4  
 1F2/12-28-070-03W4  
 1F1/02-28-070-03W4  
 1F1/05-28-070-03W4  
 1F1/05-27-070-03W4  
 1F1/04-27-070-03W4  
 1F2/03-27-070-03W4  
 1F1/15-21-070-03W4  
 1F1/14-21-070-03W4  
 1F1/14-14-070-03W4  
 1F1/13-14-070-03W4  
 1F2/13-14-070-03W4  
 1F1/12-14-070-03W4  
 1F1/15-09-070-03W4  
 1F1/14-09-070-03W4

### McM Wells:

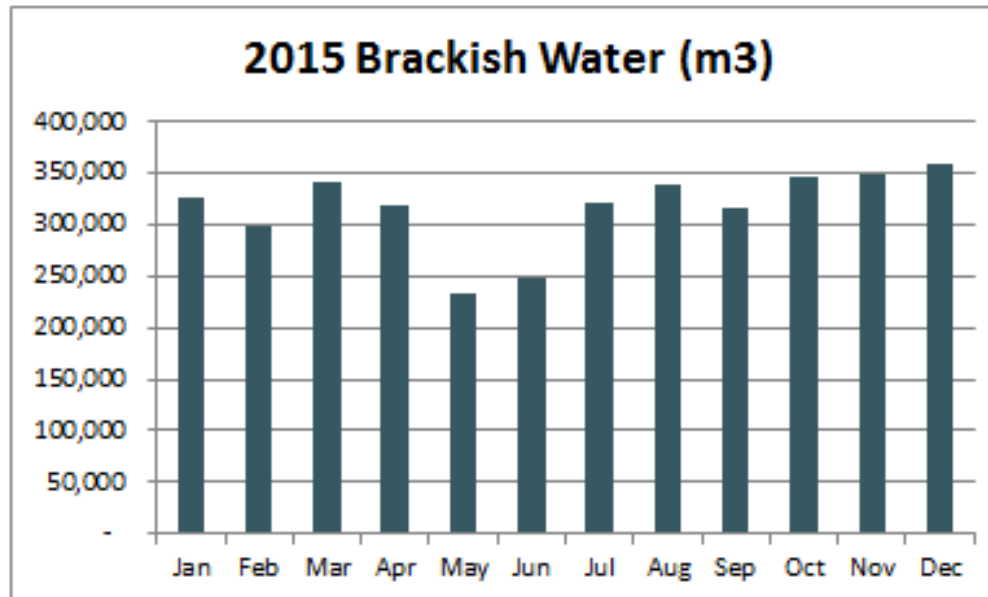
1F1/08-23-070-03W4  
 1F2/01-23-070-03W4  
 1F1/13-13-070-03W4

# Fresh source wells



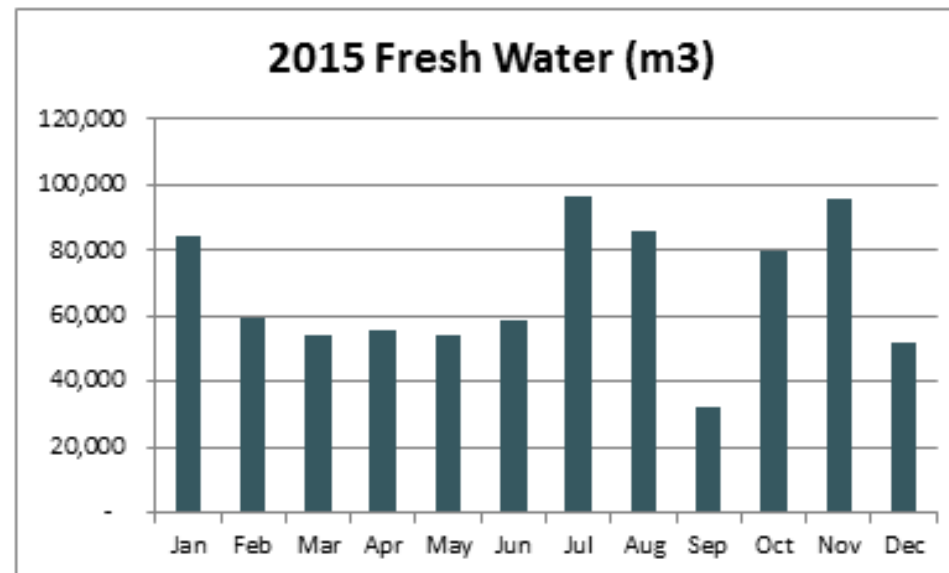
# 2015 monthly saline water use (m<sup>3</sup>)

- Saline water use during 2015 was 3,797,171 m<sup>3</sup> (0.50 m<sup>3</sup>/m<sup>3</sup> oil)
- Saline water used for cooling and makeup



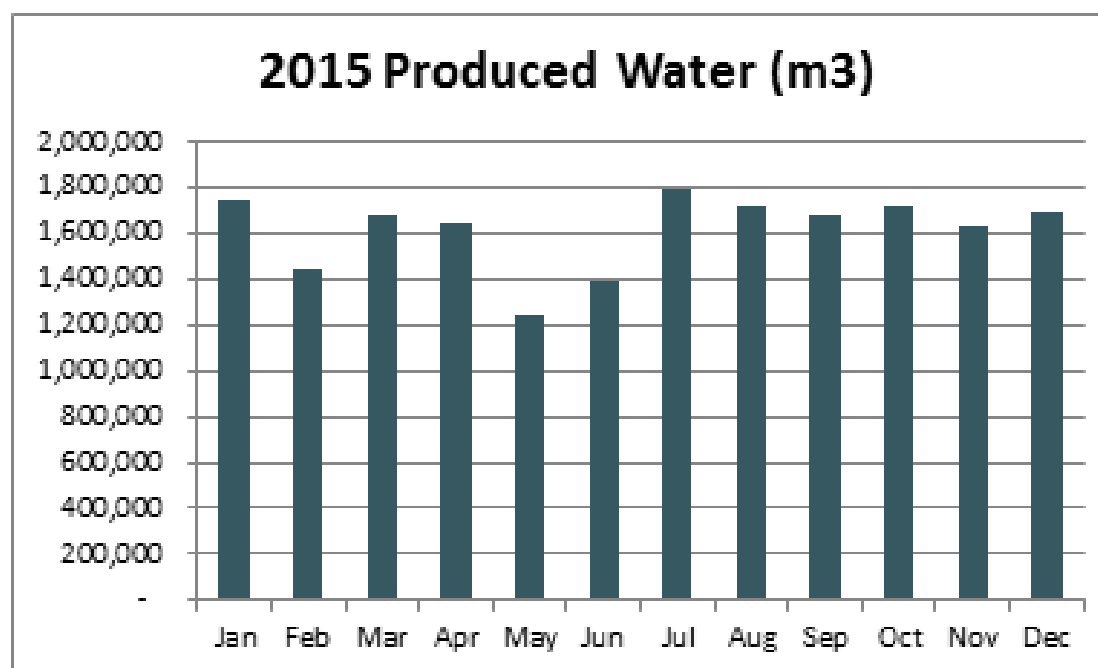
# 2015 monthly fresh water use (m<sup>3</sup>)

- Fresh water used during 2015 was 809,629 m<sup>3</sup> (0.09 m<sup>3</sup>/m<sup>3</sup> bitumen)
- Phase F start up increased fresh water use for BFW make up purposes.



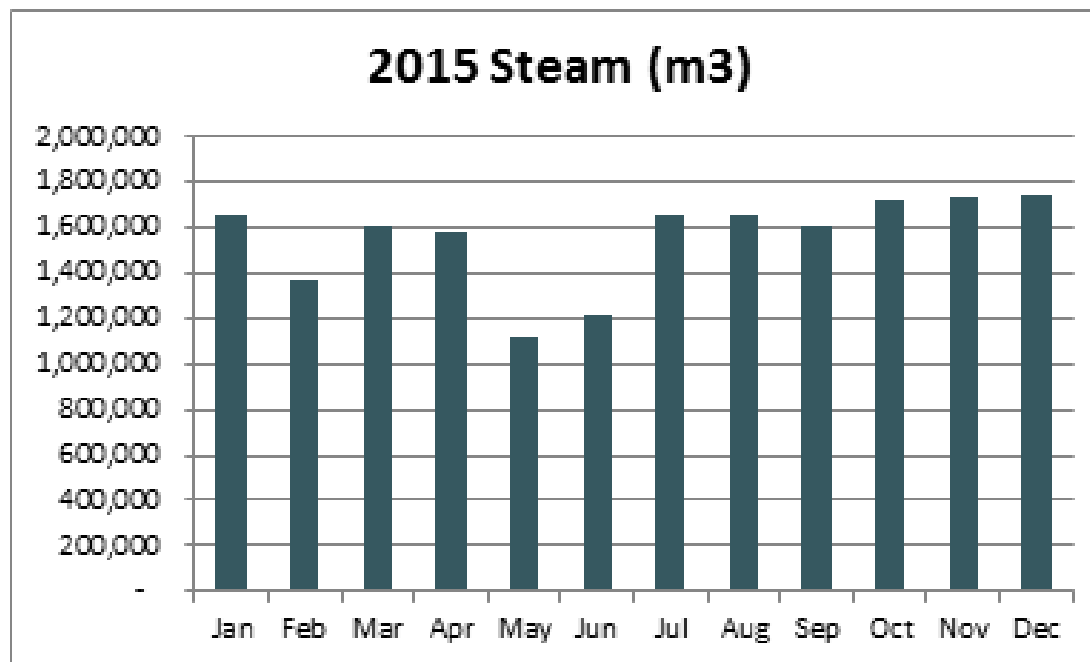
# 2015 Produced water

- Produced Water volume in 2015 was 19,403,957 m<sup>3</sup>



# Steam generation

- Steam generated during 2015 was 18,682,024 m<sup>3</sup>





# Water quality parameters

Mg/L	McMurray	Grand Rapids	Produced	Boiler feed water	Boiler blowdown
TDS	9400	5800	2000	3200	19000
SiO <sub>2</sub>	8.6	8.5	124	15.4	70
Cl	5200	3600	861	1330	4500
Na	3500	2100	700	1010	4800
K	12	7.6	21	18	365
Ca	35	20	13	<1	1
Alkalinity (as CaCO <sub>3</sub> )	1200	300	355	350	1800
pH	8.15	8.25	7.58	9.43	11.95
Fe	2.6	0.6	0.5	<0.02	3

# Foster Creek McMurray water disposal

- Class 1B (28 wells) approval 11351F, Class II (1 well) Approval 11059C
- Water disposal includes water from operations (produced, regens, blowdown) and brines from cavern washing and displacements
- Regens are performed using softened water (brackish + produced) and combined with produced water for disposal
- Well workovers include coil cleanouts and acid stimulations
- Volumes are measured on each individual well by turbine or magnetic meters and pressure is measured at common headers located at the disposal pads

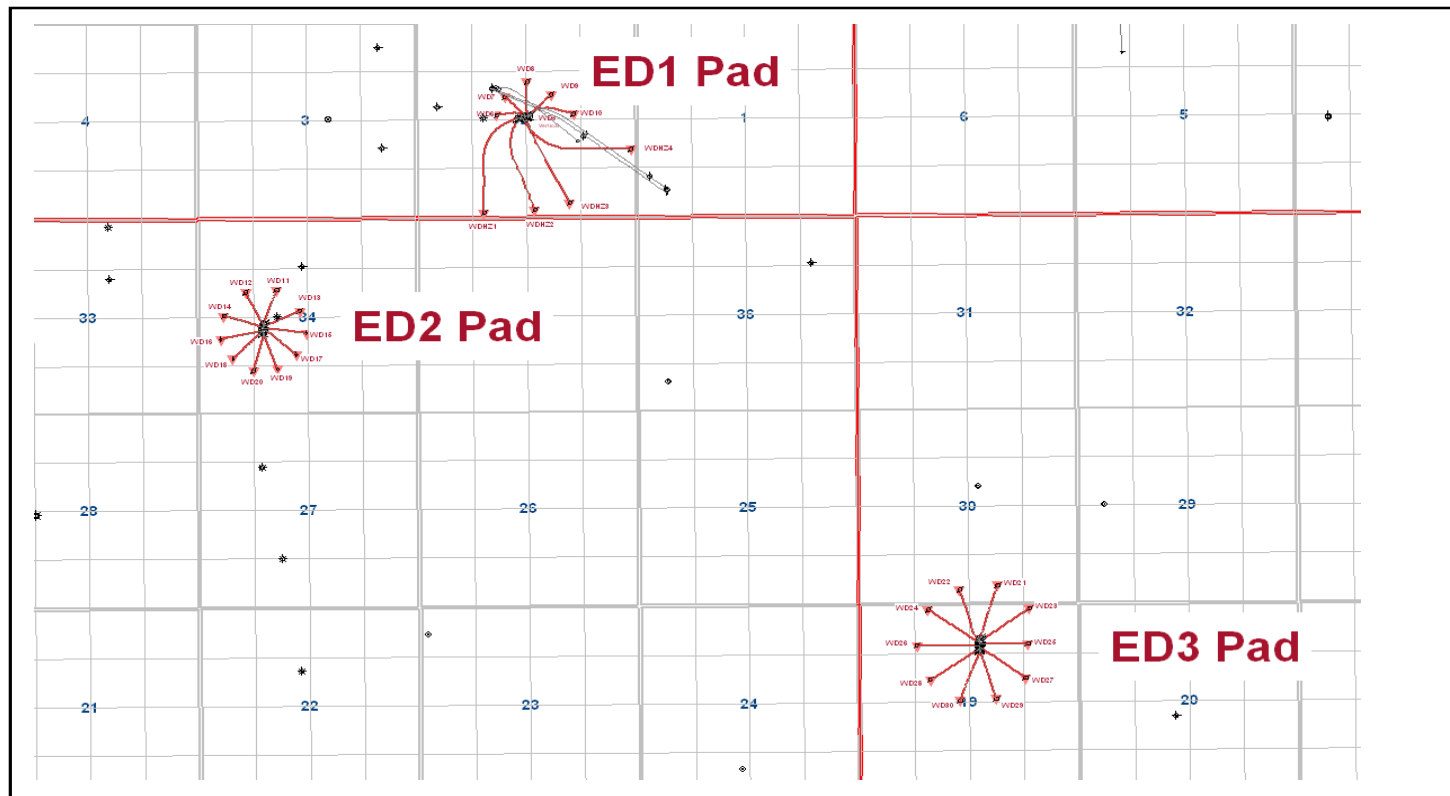
# Foster Creek McMurray water disposal wells

UWI	Approval No.	Classification
102/02-02-070-04W4	11351F	Class IB
100/03-02-070-04W4	11351F	Class IB
100/08-02-070-04W4	11351F	Class IB
103/10-02-070-04W4	11351F	Class IB
104/11-02-070-04W4	11351F	Class IB
105/11-02-070-04W4	11351F	Class IB
104/10-02-070-04W4	11351F	Class IB
100/02-02-070-04W4 (LGR)	11351F	Class IB
102/10-02-070-04W4	11059C	Class II
102/11-34-069-04W4	11351F	Class IB
100/12-34-069-04W4	11351F	Class IB
102/12-34-069-04W4	11351F	Class1B
103/11-34-069-04W4	11351F	Class IB
100/06-34-069-04W4	11315F	Class 1B

# Foster Creek McMurray water disposal wells

UWI	Approval No.	Classification
100/05-34-069-04W4	11351F	Class IB
102/06-34-069-04W4	11351F	Class IB
102/05-34-069-04W4	11351F	Class IB
100/03-34-069-04W4	11351F	Class IB
100/04-34-069-04W4	11351F	Class IB
100/02-30-069-03W4	11351F	Class IB
100/03-30-069-03W4	11351F	Class IB
102/16-19-069-03W4	11351F	Class IB
100/14-19-069-03W4	11351F	Class IB
100/16-19-069-03W4	11351F	Class IB
102/14-19-069-03W4	11351F	Class IB
100/09-19-069-03W4	11351F	Class1B
100/11-19-069-03W4	11351F	Class IB
100/10-19-069-03W4	11315F	Class 1B
102/11-19-069-03W4	11315F	Class 1B

# Current disposal well locations



## Legend

### Disposal Wells:

#### ED1 Pad:

WDHZ 1 – 100/03-02-070-04W4  
 WDHZ 2 – 100/02-02-070-04W4  
 WDHZ 3 – 102/02-02-070-04W4  
 WDHZ 4 – 100/08-02-070-04W4  
 WD6 – 104/11-02-070-03W4  
 WD7 – 105/11-02-070-03W4  
 WD8 – 104/10-02-070-03W4  
 WD9 – 102/10-02-070-03W4  
 WD10 – 103/10-02-070-03W4

#### ED2 Pad:

WD11 – 102/11-34-069-04W4  
 WD12 – 100/12-34-069-04W4  
 WD13 – 103/11-34-069-04W4  
 WD14 – 102/12-34-069-04W4  
 WD15 – 100/06-34-069-04W4  
 WD16 – 100/05-34-069-04W4  
 WD17 – 102/06-34-069-04W4  
 WD18 – 102/05-34-069-04W4  
 WD19 – 100/03-34-069-04W4  
 WD20 – 100/04-34-069-04W4

#### ED3 Pad:

WD21 – 100/02-30-069-03W4  
 WD22 – 100/03-30-069-03W4  
 WD23 – 100/16-19-069-03W4  
 WD24 – 100/14-19-069-03W4  
 WD25 – 100/16-19-069-03W4  
 WD26 – 102/14-19-069-03W4  
 WD27 – 100/09-19-069-03W4  
 WD28 – 100/11-19-069-03W4  
 WD29 – 100/10-19-069-03W4  
 WD30 – 102/11-19-069-03W4

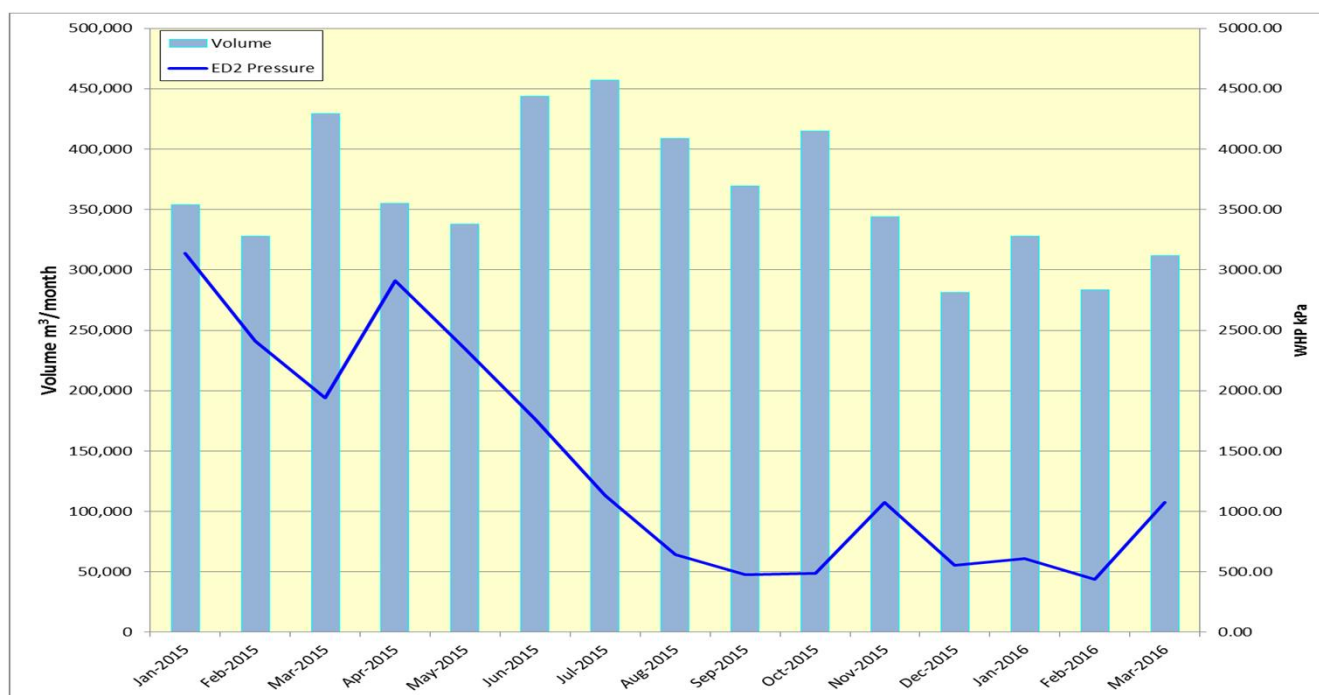
#### Abandoned Disposal well:

WD5 – 103/11-02-070-03W4

# Class 1B approval

**No. 11351F MWHIP 6,250 kPag**

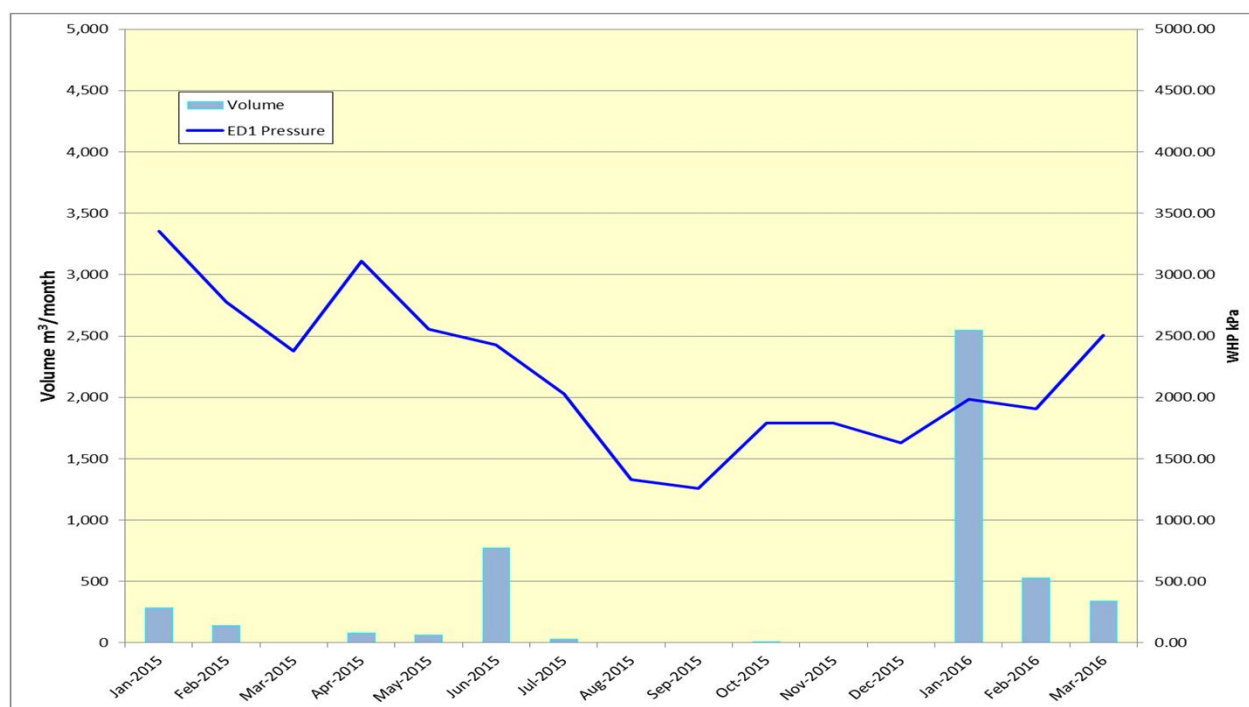
Avg. Operating Temp  
55-60°C



# Class II approval

**No. 11059C MWHIP 6,255 kPa**

Avg. Operating Temp  
40-50°C



# Waste disposal

Foster Creek Waste Streams	2015 Volume (m3)	Location
Slop oil/Desand Fluid	10,577	NewAlta Elk Point/Tervita Coronation/ Tervita Lindbergh Cavern
Drilling waste	21,041	Newalta Elk Point/Tervita Lindbergh Cavern/Tervita Bonnyville Landfill
Lime sludge	31,476	Newalta Elk Point/Tervita Lindbergh Cavern/Tervita Bonnyville Landfill
Contaminated soils	1,446	Newalta Elk Point/Tervita Lindbergh Cavern/Tervita Bonnyville Landfill/RBW Edmonton
Sweetening liquids/sludge	13,401	Absolute Environmental Class Ia Disposal Well/ Cancen New Sarepta/Tervita Unity Cavern
Acid Workover Program	825	Tervita Lindbergh Cavern
Process Solids (TriCanter)	5,565	Newalta Elk Point



# Sulphur production

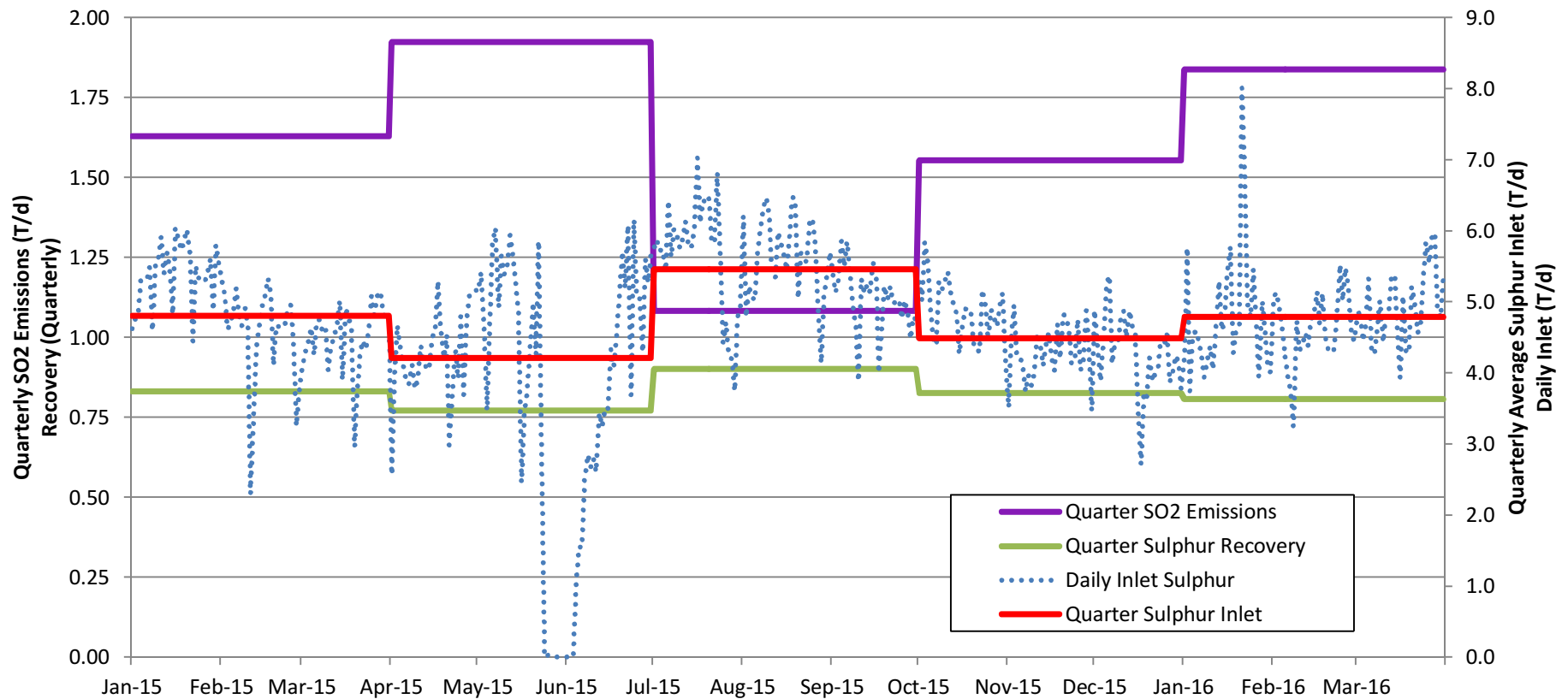


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# Sulphur recovery overview

- Central facility non-regenerative sweetening unit (NRSU) has been used since April 2007 to meet sulphur recovery requirements
- Second unit added in 2010 at Phase A-E – can be used in parallel or for backup
- Third unit was commissioned in Sept 2014 at Phase F
- High operating costs for chemical and disposal
- Balance recoveries on a daily/monthly basis
- Sulphur recovery – Q1 2015: 83.1%, Q2 2015: 77.1%, Q3 2015: 90.1%, Q4 2014: 82.7%, Q1 2016: 80.8%

# Sulphur Recovery



# Sulphur recovery comments

- Sulphur recovery system being reviewed to ensure it has sufficient capacity
- Re-designed and installed new inlet gas sparger (distributor) in all three NRSUs to improve flow rate and reliability. This new sparger significantly reduces fouling and plugging.
- Planning to perform capacity test with the new sparger and FC3 NRSU in Q3 - 2016
- C-Pad compressor reliability has been improved to handle casing gas flows.
- Continued use of non-regenerative sweetening unit (NRSU) technology
- Developed casing gas gathering pipeline model to ensure appropriate capacity at lower pressure drop.

# Environmental issues summary



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# Environmental non-compliance 2015

- AER Events:
  - Zero NOx exceedances
  - Two CEMS availability contraventions
  - Twenty-eight environmental spills were reported and remedial action taken
  - Three 7-day letters submitted
    - Elevated salinity within plant boundary, CPF storm water collection pond sampling process not followed, TDL exceedance
- AESRD Events:
  - TDL Audit completed (was initiated in Dec 2014); satisfactory
  - One 7-day letter submitted
    - Non-Compliance to License approval conditions
  - Camps, two 7-day letters submitted
    - Well depth sampling contravention (Bear's Den)
    - PDL exceedance (Fox Den)
- Federal Events:
  - No non-compliance events

## AER scheme applications – filed in 2015, approval received

Application	Filing Date	Approval
D Pad (WP17 blowdown)	March 13, 2015	May 21, 2015
RD/BD Coinjection Pads (Clauses 23,24,33)	June 17, 2015	August 14, 2015
Osprey Pilot update (temp monitoring)	August 28, 2015	October 13, 2015

## AER scheme applications – filed in 2015, approval received continued

Application	Filing Date	Approval
Microbial Enhanced Start-up (add W10)	October 28, 2015	November 25, 2015
Osprey Dilation	October 30, 2015	December 17, 2015



# Approval amendments – AESRD EPEA

None in 2015

# Annual reporting - 2015

The following reports were submitted as per EPEA Approval 00068492-01-03:

- Annual Groundwater Reports
- Annual C&R Plan
- Annual Air Monitoring Report
- Annual Industrial Runoff Report
- Comprehensive Wildlife Report

# Monitoring programs

Cenovus is required to implement the following monitoring programs as part of EPEA Approval 00068492-01-03:

EPEA Requirement	Report Name	Due Date	Status
Schedule VI, Condition 12	Updated Groundwater Monitoring Program Proposal	June 30, 2015	Submitted & Approved
Schedule VIII, Condition 4	Wildlife Mitigation Program	October 31, 2012	Implemented
Schedule VIII, Condition 19	Updated Wildlife Mitigation Program	June 30, 2015	Submitted
Schedule VIII, Condition 13	Wildlife Monitoring Program	October 31, 2012	Implemented
Schedule VIII, Condition 21	Updated Wildlife Monitoring Program	June 30, 2015	Submitted
Schedule VIII, Condition 9	Woodland Caribou Mitigation and Monitoring Plan	January 31, 2013	Implemented
Schedule VIII, Condition 20	Updated Woodland Caribou Mitigation and Monitoring Plan	May 15, 2015	Submitted
Schedule IX, Condition 41	Updated Wetland Reclamation Trial Program	June 30, 2015	Submitted & Approved
Schedule IX, Condition 47	Reclamation Monitoring Program	July 31, 2013	Implemented
Schedule XI, Condition 2	Updated Wetland Monitoring Program	June 30, 2015	Submitted & Approved
Schedule VII, Condition 1	Soil Monitoring and Management Program Proposal	February 1, 2014	Submitted & Approved
Schedule IX, Condition 28	Project-Level Conservation, Reclamation and Closure Plan	February 1, 2019	Not due yet
Schedule IX, Condition 17	Decommissioning Plan and Land Reclamation Plan	October 31, 2017	Not due yet
		Within six months of the plant ceasing operation	Not due yet

# Goals of monitoring programs

## Wildlife and Caribou Mitigation and Monitoring:

- The monitoring programs propose mitigation measures, metrics, targets, and monitoring objectives
- Monitoring and mitigation uses an outcomes based approach to facilitate continuous improvement
- First Comprehensive Wildlife Report was submitted May 15<sup>th</sup>, 2015

## Mitigation measures are designed in relation to project-related issues that have the potential to affect:

- Wildlife habitat availability and use, including noise and other sensory disturbance
- Wildlife mortality
- Obstruction of movement

# Goals of monitoring continued

## Wetland monitoring:

- Objective is to assess and quantify potential impacts of project infrastructure on surrounding wetlands using selected metrics and targets
- Effects of roads, well pads, borrow pits and CPFs will be monitored throughout the life of the project by assessing key parameters including water quality, water levels, vegetation species composition, cover and vigour

# Collaborative initiatives

Cenovus participates in various collaborative efforts to address industry issues:

- Regional environmental monitoring
- Environmental research
- Stakeholder consultation
- Innovation and continuous improvement

# Collaborative initiatives - Examples

- Canada's Oil Sands Innovation Alliance (COSIA)
- Contributed to over thirty projects including: Wildwatch, LiDEA, Fladry, Geodesign, Functional Quality Land Metric, etc.
- Support for three chairs at the University of Alberta
- Contributor to the Joint Canada-Alberta Oil Sands Monitoring (JOSM)
- Lakeland Industry and Community Association (LICA)
  - Airshed Monitoring
  - Beaver River Watershed Alliance

# Collaborative initiatives continued

- Regional Industry Caribou Collaboration project
- Alberta Chamber of Resources (ARC)
- Chair of the Caribou Committee
- Ecological Monitoring Committee for the Lower Athabasca (EMCLA)
- CAPP Environment Committee



# Reclamation

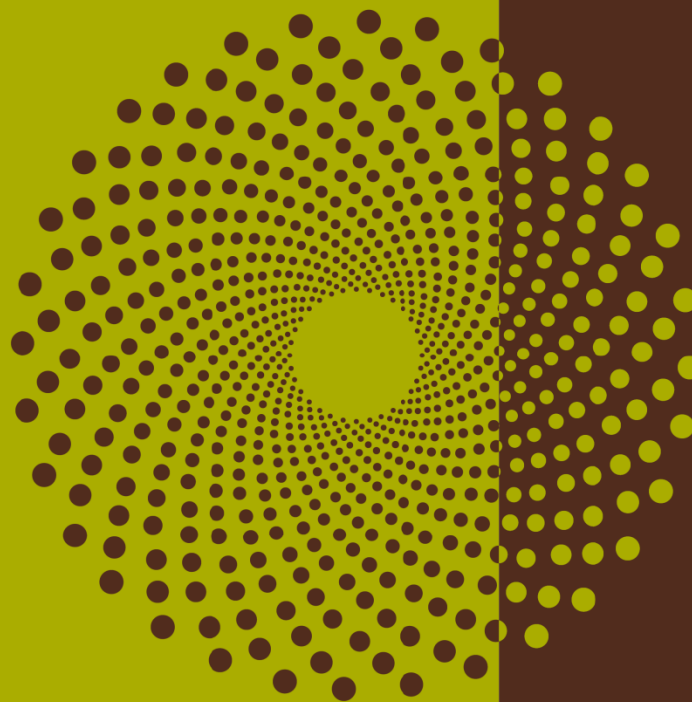
- The Reclamation Monitoring Program was approved in August of 2014
- Final reclamation initiated and/or complete on small portions of the commercial footprint (remote from the CPF) that are no longer required
- Interim reclamation is in progress on approximately 25% of the commercial footprint of Foster Creek
- There is currently no facility abandonment scheduled, consequently no well pad reclamation has commenced

# Reclamation continued

Restoration of legacy 2D seismic initiated in 2012 and continued through 2016:

- TWP 70-1, 70-2, 71-1, 71-2, 72-1, 72-2, 73-1, 73-2 (West of 4<sup>th</sup>)
- Objective is successional advancement, increasing the growth and abundance of conifers and reducing trafficability to large mammals
- Treatments used on linear features include mounding, stand modification and tree planting
- Treatment progress to-date has covered 237 km

# Statement of Compliance



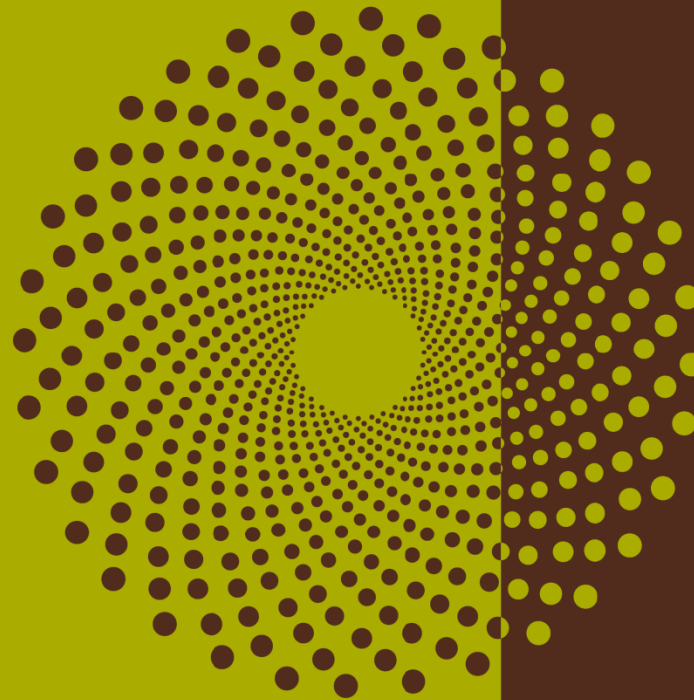
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# Compliance statement

**Cenovus maintains and tracks compliance through the CenTrac conditions/commitment database, Incident Management System (IMS), routine inspections, and dedicated regulatory and environmental staff.**

**Cenovus believes its operations are in compliance with AER approvals and regulatory requirements.**

# Non-compliance



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# AER Non-compliance events

<b>Non-compliance</b>	Unsatisfactory Low Risk Drilling Operation Inspection @ 1-22-70-5W4 W0471917 January 27, 2015
<b>Events that led to non-compliance</b>	The 25m Flare line was not properly secured with stakes or weights.
<b>CVE action plan</b>	The non-compliance was immediately rectified by the rig crew as weights were taken out of the manifold shack and applied to the line.
<b>Status</b>	Compliance achieved on January 28, 2015

# AER Non-compliance events

<b>Notice</b>	Notice of Noncompliance - Outstanding Non-Abandoned Oil Sands Evaluation (OSE) Wells July 15, 2015 (68 wells ~ FC 8 wells)
<b>Events that led to non-compliance</b>	<ul style="list-style-type: none"> <li>- Failure to Complete surface abandonment within specified timeframe; and/or</li> <li>- Failure to report surface abandonments through the DDS system within 30 days of completing the operation</li> </ul>
<b>CVE action plan</b>	Wells were abandoned and entered all pertinent data into the DDS system
<b>Status</b>	Compliance achieved September 14, 2015

<b>Notice</b>	Notice of Noncompliance - Outstanding Serious Surface Casing Vent Flow/Gas Migration (SCVF/GM) @ 2-21-70-4W4 W0239789 August 5, 2015
<b>Events that led to non-compliance</b>	AER records indicate that the well has not been repaired within the required 90 days and remain outstanding.
<b>CVE action plan</b>	Informed AER that the location BI7 WL0239789 has had no vent flow since being shut in April 2012. Well has been removed from DDS serious SCVF list as of August 11, 2015.
<b>Status</b>	Compliance achieved August 11, 2015

# AER Non-compliance events

<b>Notice</b>	Notice of Noncompliance - Outstanding Casing Failure repair @ 2-21-70-4W4 W0239792 November 10, 2015
<b>Events that led to non-compliance</b>	AER records indicate that the well has not been repaired within the required 90 days and remain outstanding
<b>CVE action plan</b>	Repaired the SCVF/GM and submitted the resolution information on the DDS system
<b>Status</b>	Compliance achieved November 23, 2015



# Cenovus Voluntary Self-Disclosures

<b>Non-compliance</b>	Voluntary Self Disclosure - Microbial Start-Up Test Scheme Approval 8623 October 27, 2015
<b>Events that led to non-compliance</b>	Non-compliance event related to clause 28 of Approval 8623UU. Cenovus missed the window during Pad E14 and E42 start-up as the microbial test application was approved on August 19, 2014 and both Pads had their first steam (circulation phase) in May 2014.
<b>CVE action plan</b>	Cenovus is revisiting and updating its internal processes to eliminate similar future occurrences . A Category 2 amendment to Scheme Approval 8623 as per Directive 078 was submitted October 28, 2015 to include Pad W10 for microbial start-up test as per clause 28 and remove the previously approved Pads E14 and E42.
<b>Status</b>	Cat.2 amendment application submitted October 28, 2015. Approval 8623HHH received November 25, 2015.

# Future plans



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# Future projects

**Current capacity is 150,000 bbls/d, target for Phases F,G & H to peak at 210,000 bbls/d. Evaluating opportunities to increase capacity.**

**Currently scoping plant optimization opportunities for Phases A-E**

## **Phases F,G & H update**

- New steam generation and production treating facilities being constructed next to the existing plant
- Phase F: 30,000 bbls/d, Phase G: 30,000 bbls/d, Phase H: 30,000 bbls/d, for total new capacity of 90,000 bbls/d ( $4,770 \text{ m}^3/\text{d} + 4,770 \text{ m}^3/\text{d} + 4,770 \text{ m}^3/\text{d} = 14,310 \text{ m}^3/\text{d}$ )
- Potential for another 35,000 bbls/d of optimization work
- The majority of new expansion is planned to be drilled west of the plant

Note that production volumes refer to production capacity on an incremental basis

# Future projects continued

**Current success in SOR & WOR, and increased efficiencies in plant operations at Foster Creek indicates that Phases A – H may be capable of production greater than 240,000 bbls/d**

## **Upcoming regulatory applications**

- Currently evaluating opportunities to increase project capacity to 310,000 bbl/d (49,286 m<sup>3</sup>/d)
- Additional wells to recover un-swept reserves including injector-producer well pairs and single well producers
- Continued exit strategies for mature pads
- Future phase & sustaining development well pads

**Currently drilling, completing and performing facilities work for sustaining and Phase F and G wells in 2014 through 2016**

Note that production volumes refer to production capacity on an incremental basis

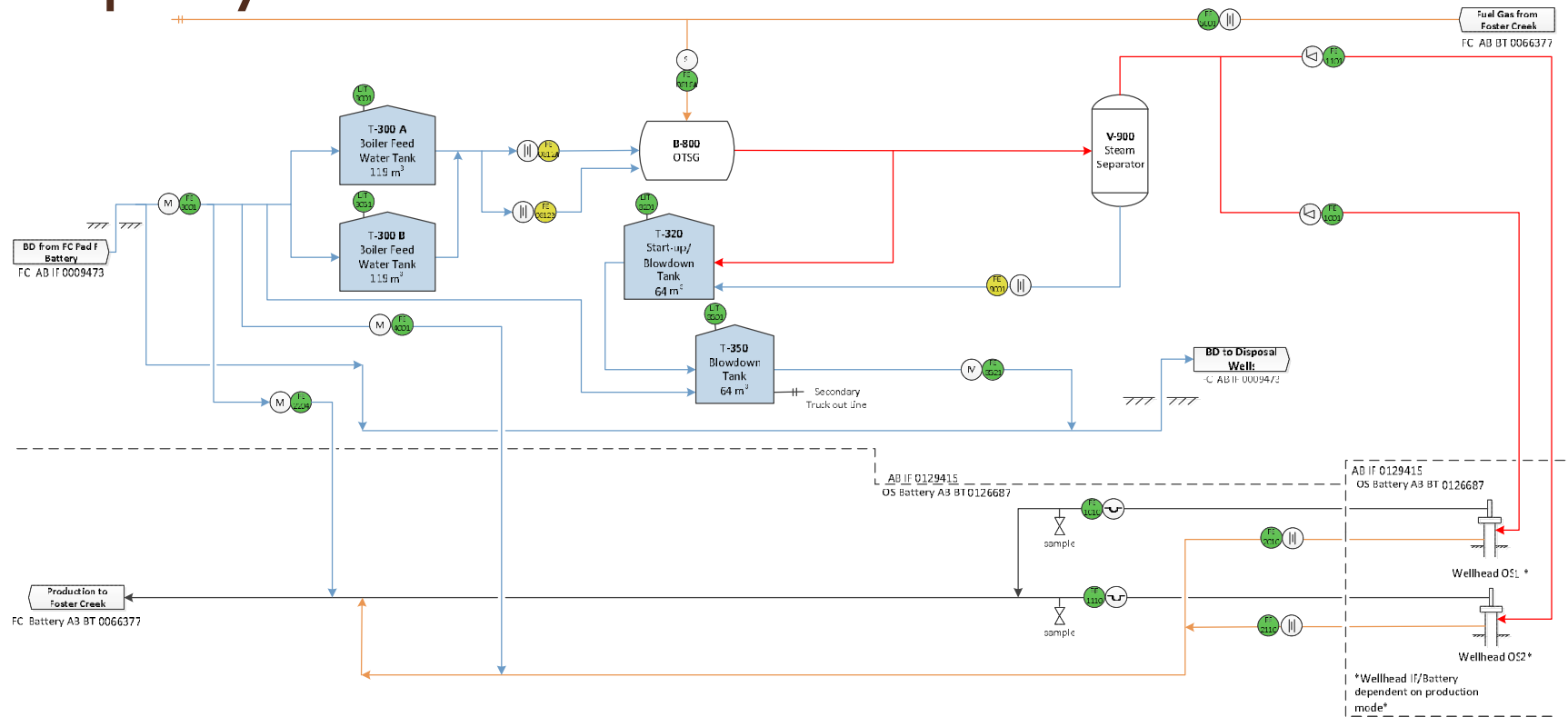
# Osprey Pilot

Surface  
Calgary | June 1, 2016



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# Osprey Process Schematic



# Suspension

## Q1 2016

**Decision was made to suspend the Osprey pilot due to low price environment**

**Facility and well's have been placed in a state of preservation for potential future usage**

# End