PEACE RIVER IN SITU OIL SANDS PROJECT
DIRECTIVE 54 ANNUAL PERFORMANCE PRESENTATION

December 13, 2017

PREMIUM VALUE. DEFINED GROWTH. INDEPENDENT.

Outline – Subsurface

Outline – Surface

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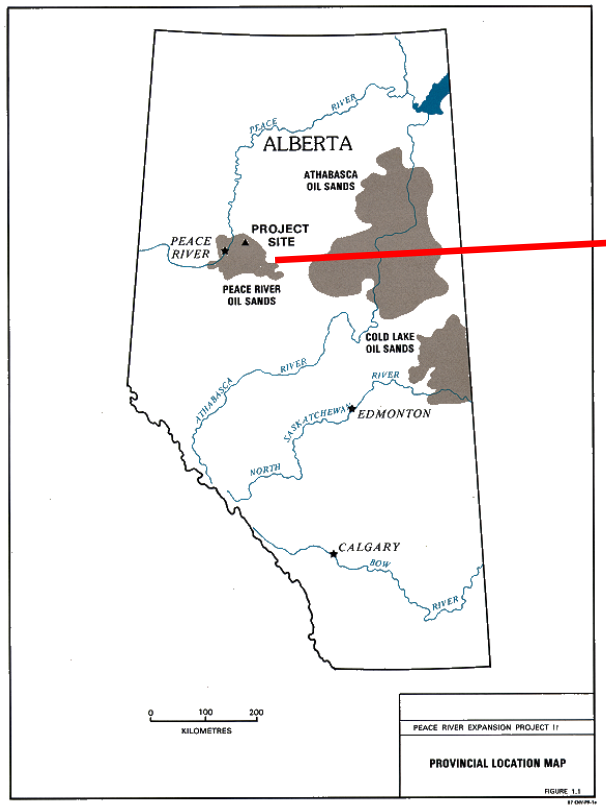
Acronyms

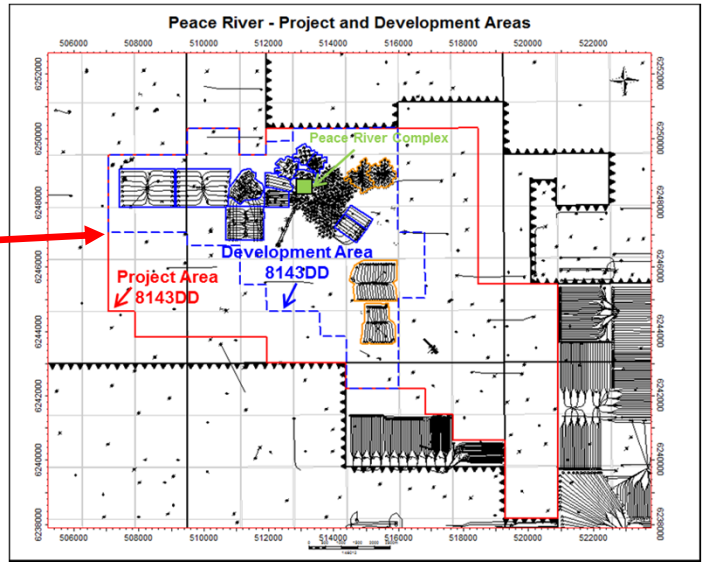
AER	Alberta Energy Regulator
Avg.	average
bbl	barrel, petroleum, (42 U.S. gallons)
BHA	bottom hole assembly
bitwt	bitumen weight
CD	cyclic drive
CDOR	calendar day oil rate
CDSR	calendar day steam rate
cP	centipoise
CSOR	cumulative steam to oil ratio
CSS	cyclic steam simulation
Cumm	cumulative
DFIT	diagnostic fracture injection testing
DI	depletion index
dP	pressure differential
e3m3	thousand cubic metres
ESP	electric submersible pumps
ESRD	Environment and Sustainable Resource Development
FUP	follow up process
HP	horse power
hz	horizontal
ICP	intermediate casing point
IHS	Inclined hetreolithic stratification
InSAR	interferometric synthetic aperture radar
J-Well	horizontal wellbore with toe-up lateral trajectory
KB	Kelly Bushing
kg/m	kilograms per metre
kPA	kiloPascal
kPa/day	kiloPascal per day
LIDAR	laser imaging, detection and ranging
LPCSS	low pressure cyclic steam stimulation
m	metre
m^3	cubic metres
m^3/d	cubic metres per day

Acronyms (...continued)

mD	milli-Darcy
mm	millimetre
MMbbl	million barrels
MPa	megapascal
mTVD	metres true vertical depth
OBIP	original bitumen in place
Obs	observation
ohm·m	ohm·metre
PV	pore volume
PVS, PVStm	pore volume steam
RF	recovery factor
SAGD	steam assisted gravity drainage
SF	steamflood
So	oil saturation
SOR	steam oil ratio
SPM	strokes per minute
SAR	synthetic aperture radar
Tbg.	tubing
TD	total depth
TVD	true vertical depth
VAF	volume over fill-up
WDI	water depletion index
WHT	wellhead temperature
YE	yearly

CNUL Peace River - Location





- Located in Northwestern Alberta
- OBIP 219 Million m³ for the area in Approval 8143DD Development Area

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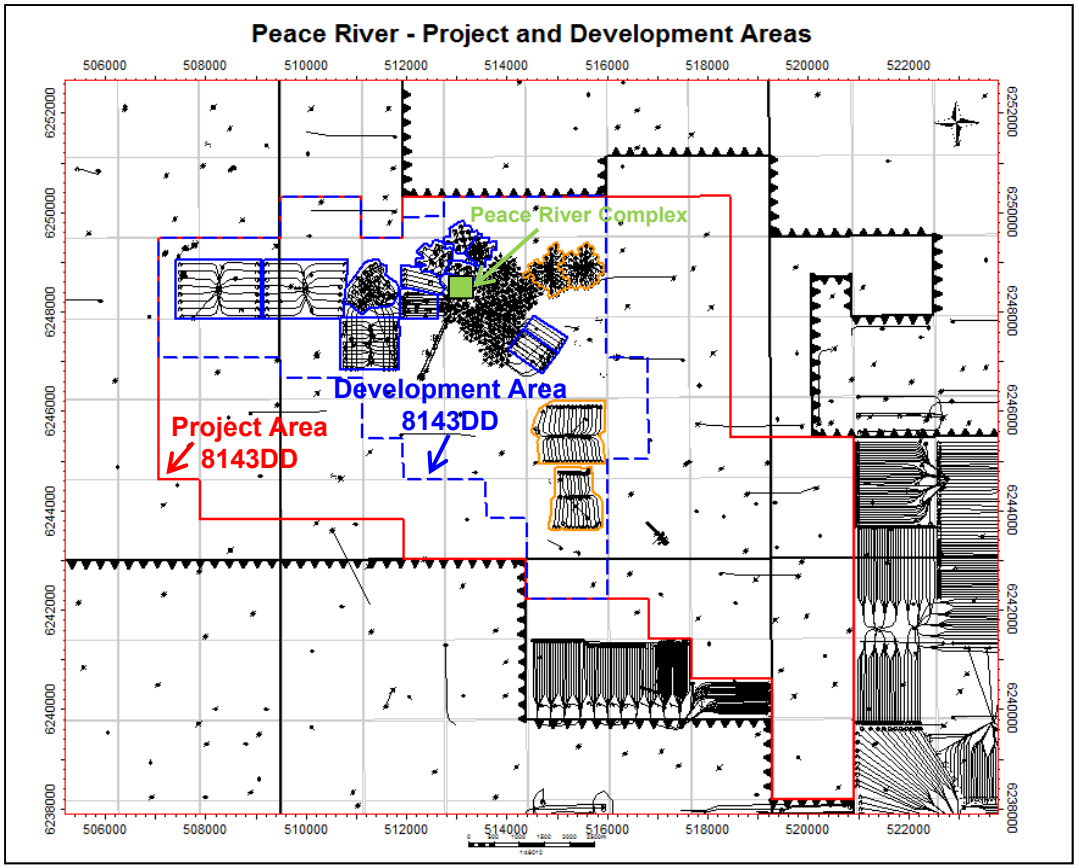
Peace River Approval Areas



Peace River Thermal Area

- Operating Pad
- Suspended Pad
- Lease Boundary
- Approved Project Area
- Approved Development Area

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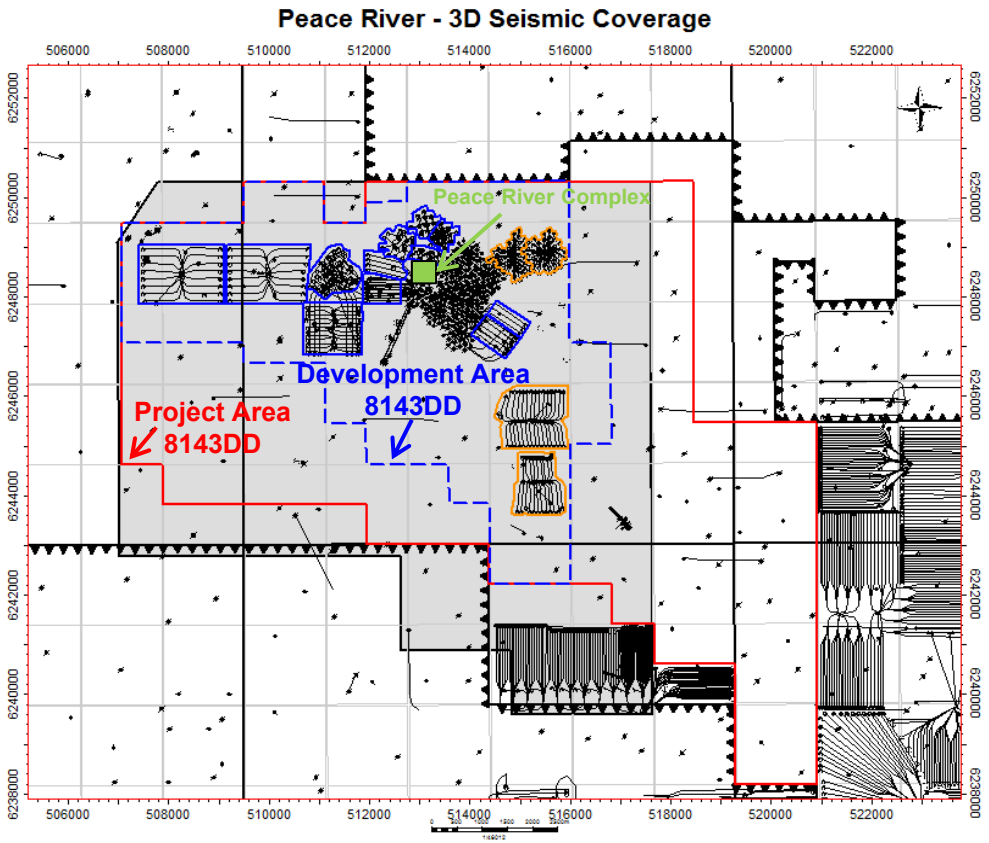
GEOLOGY / GEOSCIENCE

Peace River - Bluesky Reservoir Properties

General Properties	Approval Area
Target Formation	Bluesky
Pay Thickness	15 – 30m
Depth	550 - 600 m TVD
API Gravity	6-11^0
Porosity	0.25 – 0.30
Viscosity	10,000 – 1,000,000 cP (dead oil)
Initial pressure	3,800 kPa (sub-hydro static)
Initial temperature	18°C
Horizontal permeability	0.1 – 10 D (air)
Kv / Kh	0.3 – 0.9
Oil Saturation	0.70 – 0.85

Peace River Seismic Coverage



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- 3D Seismic Area

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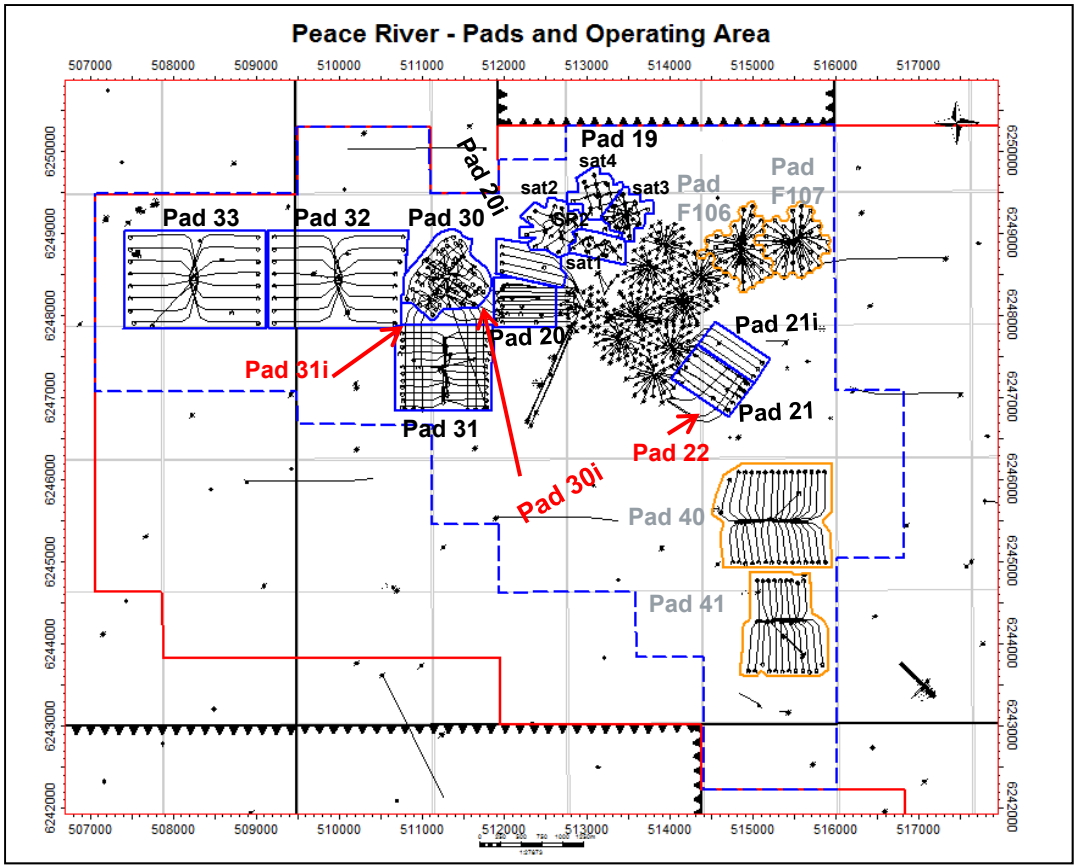
Peace River - Zoom in on Operating Area Pads



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- Suspended Pads:
  - Pads 40 & 41
  - Pads F106 & F107
- Injector Pads:
  - Pads 30i, 31i and 22

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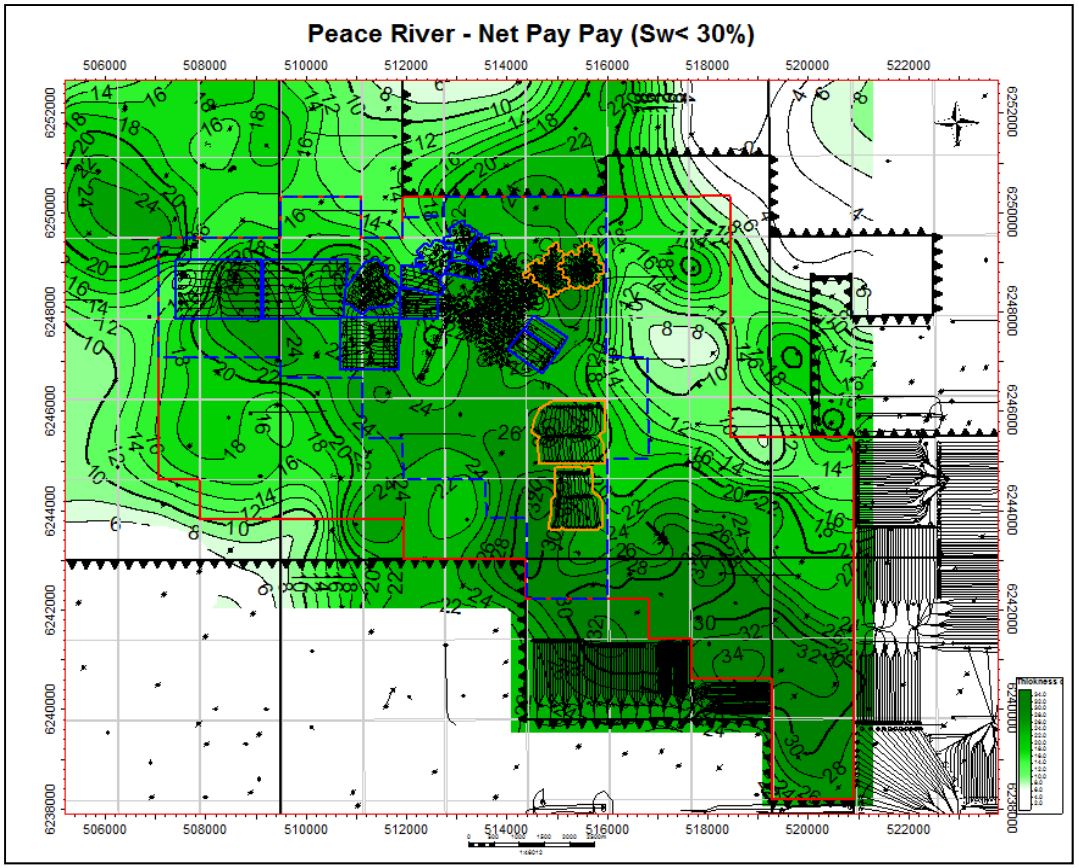
Peace River Project Area - Net Pay Isopach



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Project Area Volumetrics

	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (E3 m^3)
Project Area	**21.6**	**79.3**	**26.6**	**440,000**
Development Area	**22.7**	**81.1**	**27**	**219,000**

- Volumetric calculation:
  - Area × Pay Thickness × Oil Saturation × Porosity

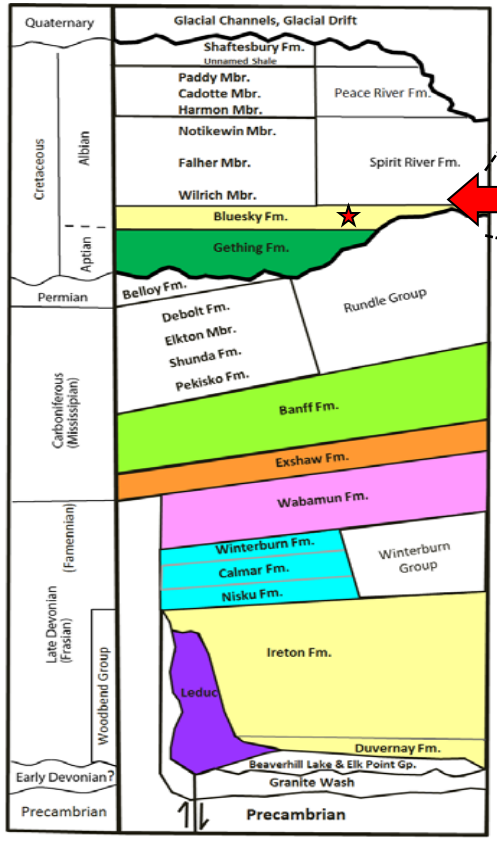
  - **OBIP: Project Area**

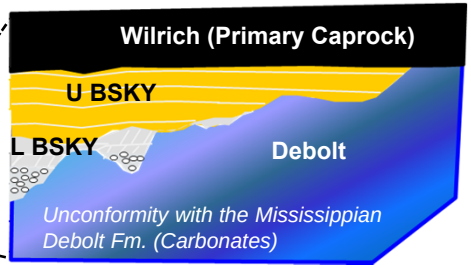
  96,700,000 m^2 × 21.6 m × 0.793 × 0.266 = 440,000 E3 m^3

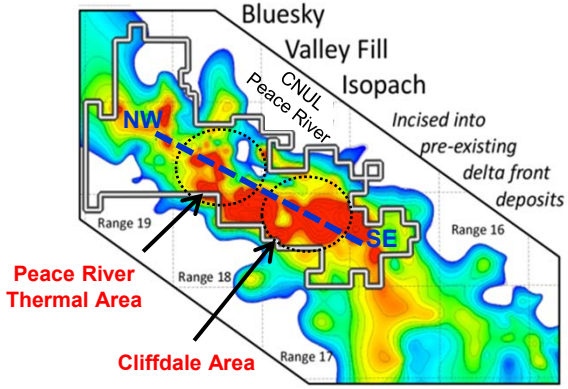
  - **OBIP: Development Area**

  44,000,000 m^2 × 22.7 m × 0.811 × 0.27 = 219,000 E3 m^3

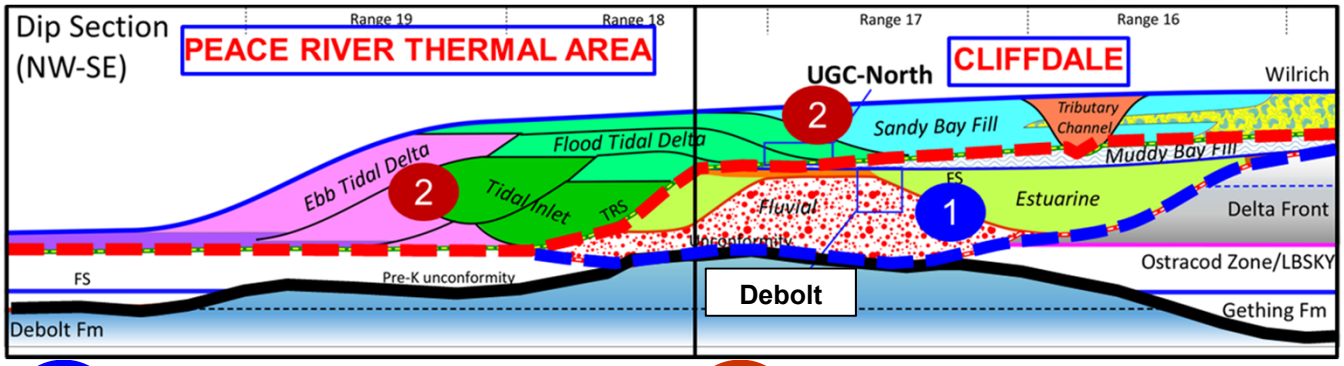
Geology - Stratigraphic Schematic







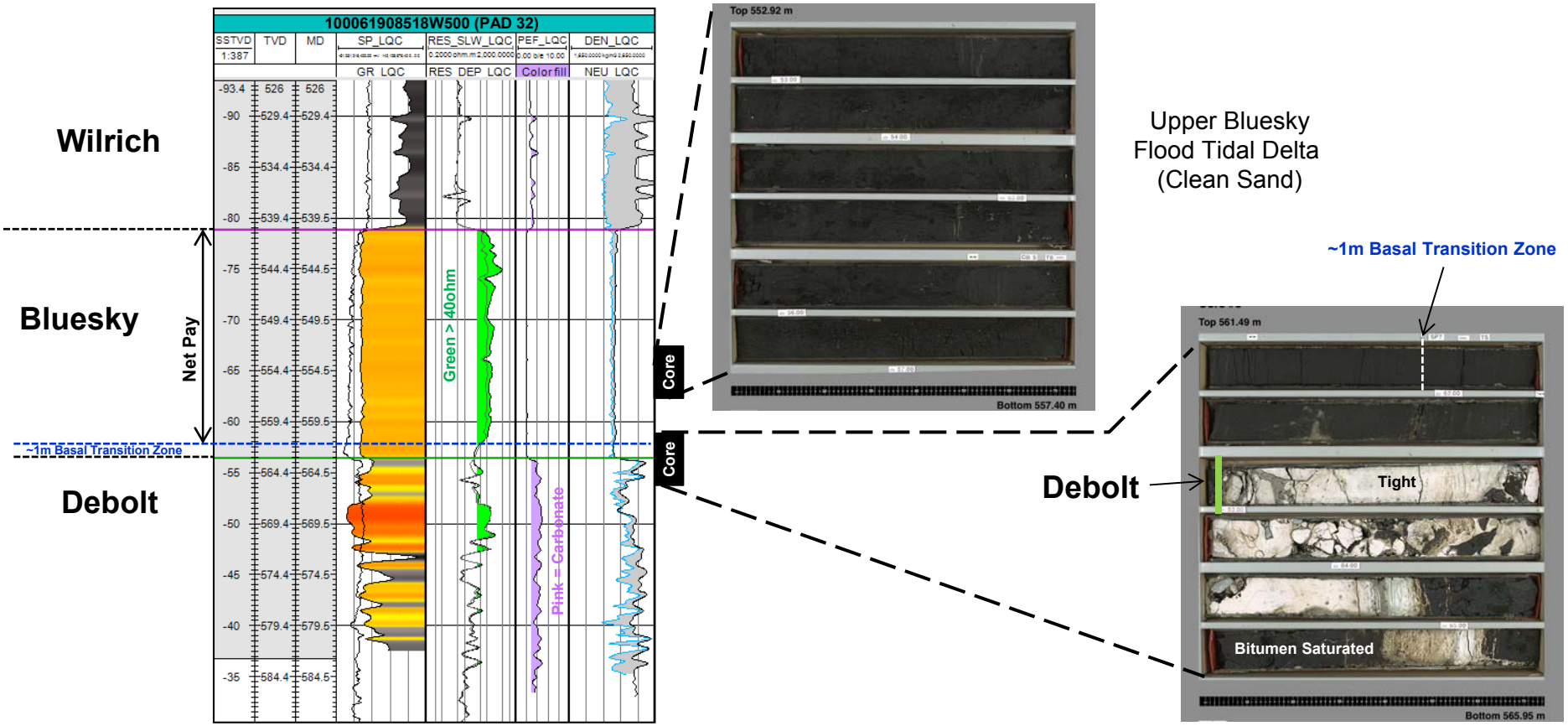
- The depositional environment of the Upper Bluesky (Sandstone) is a marginal marine estuarine complex.



1 **Tidally-influenced estuary with fluvial influx**
- Estuary channels and channel bars
- Fluvial bars

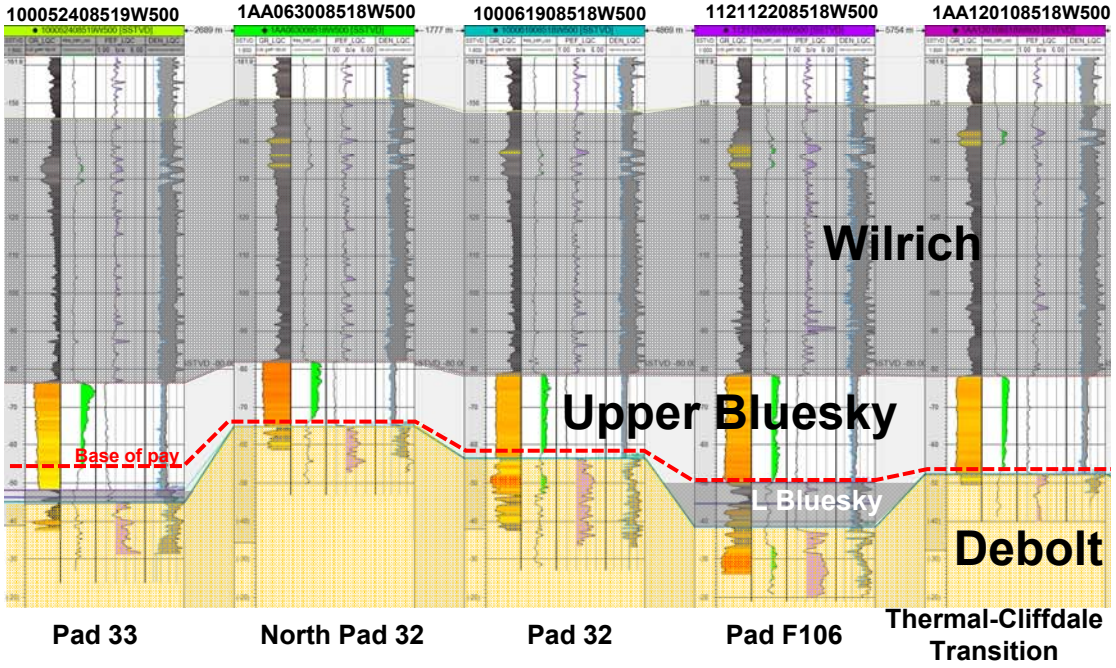
2 **Wave dominated estuary**
- Ebb tidal delta/ flood tidal delta/ Tidal Inlet/ Bay Fill

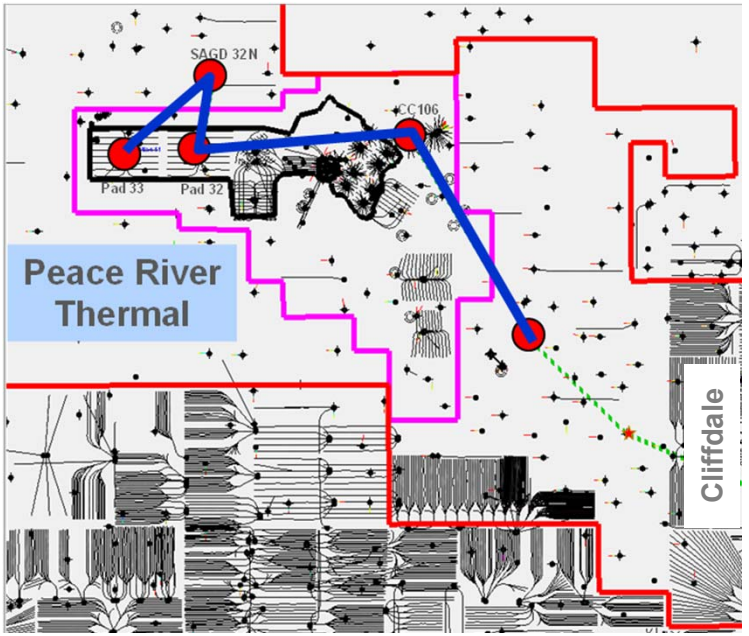
Peace River - Type Log



Peace River Structural Cross-Section

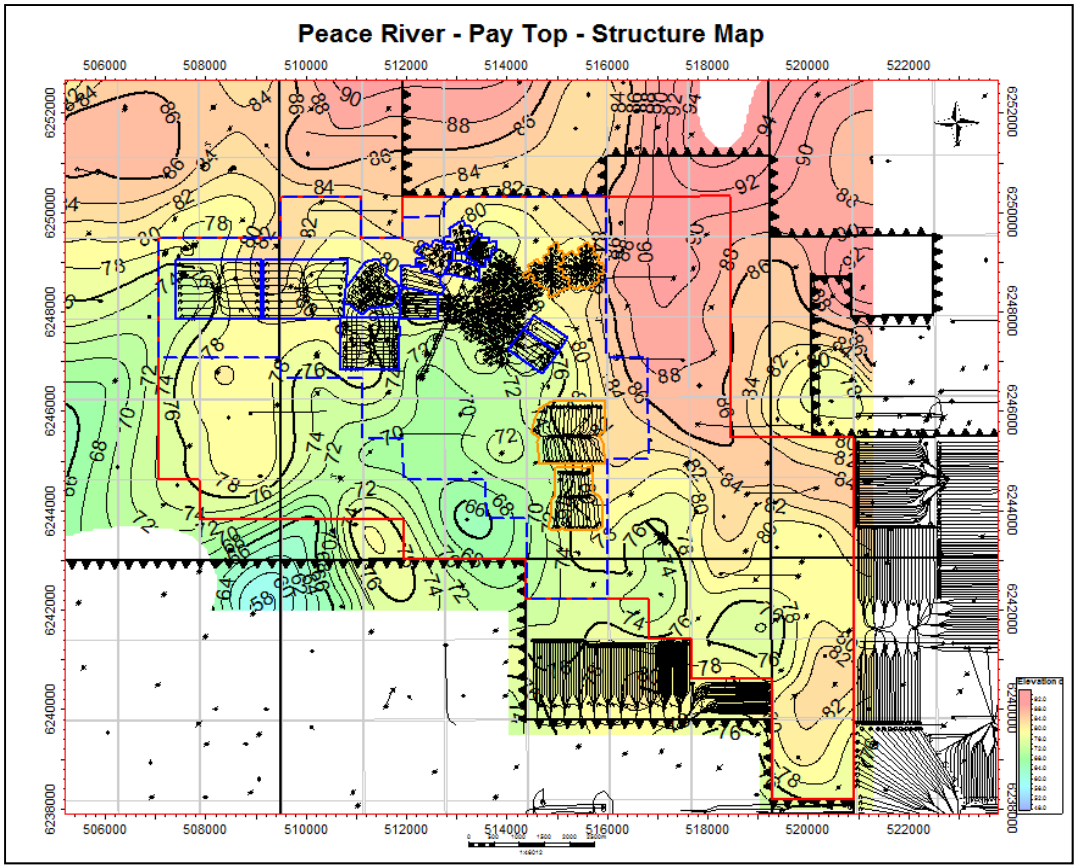
- Wilrich member of Spirit River Fm (Primary Caprock) ~ 80m
- Spirit River Formation minimum continuous Caprock Thickness ~ 240m
- Upper Bluesky Sand sitting on Debolt unconformity or Lower Bluesky filling lows in Debolt
- Reservoir Base Defined Sw = 30% cut-off (equivalent to Resistivity ~40ohms)





Top of Pay = Top of Bluesky (unless gas or lean zone present; not in project area)

Peace River Pay Top Structure



Peace River Thermal Area

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- This is typically the top of the Bluesky unless gas or lean zone with S_w> 30% exist
- Top Lean zones or gas do not exist within the approved Development Area

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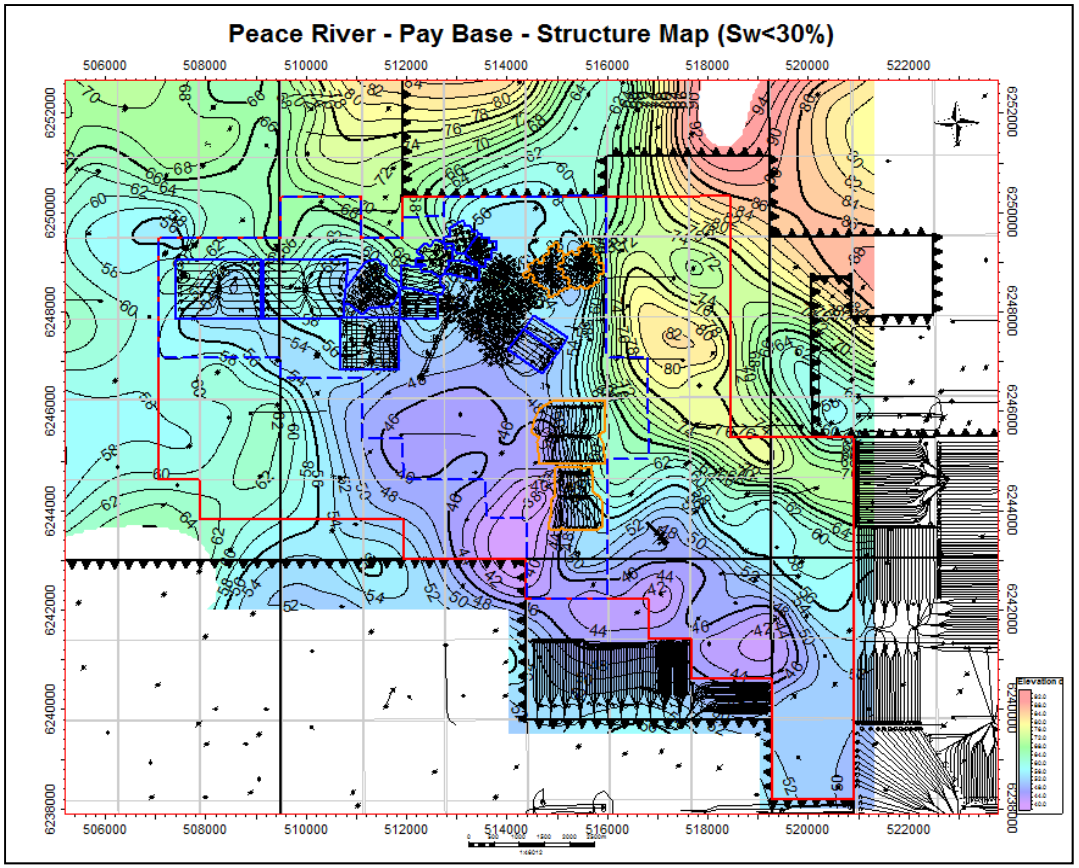
Peace River Pay Base Structure



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- Cut-off for base of pay: Base of continuous sand from Top of pay (normally top of Bluesky) to $S_w \leq 30\%$; equivalent to Res_D ~ 40ohm

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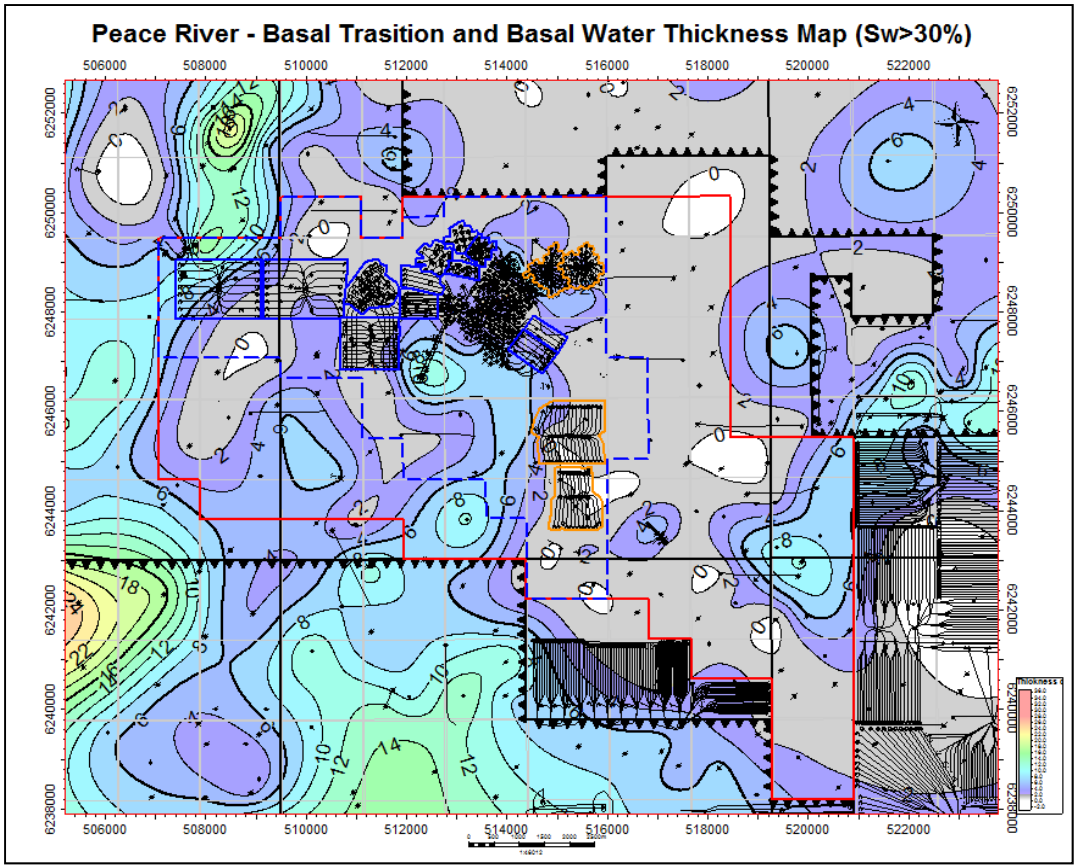
Peace River - Net Water Sand Isopach



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- This thickness map includes a basal transition zone (BTZ) with S_w = 30-50%; and a basal water zone (BWZ) with S_w>50%

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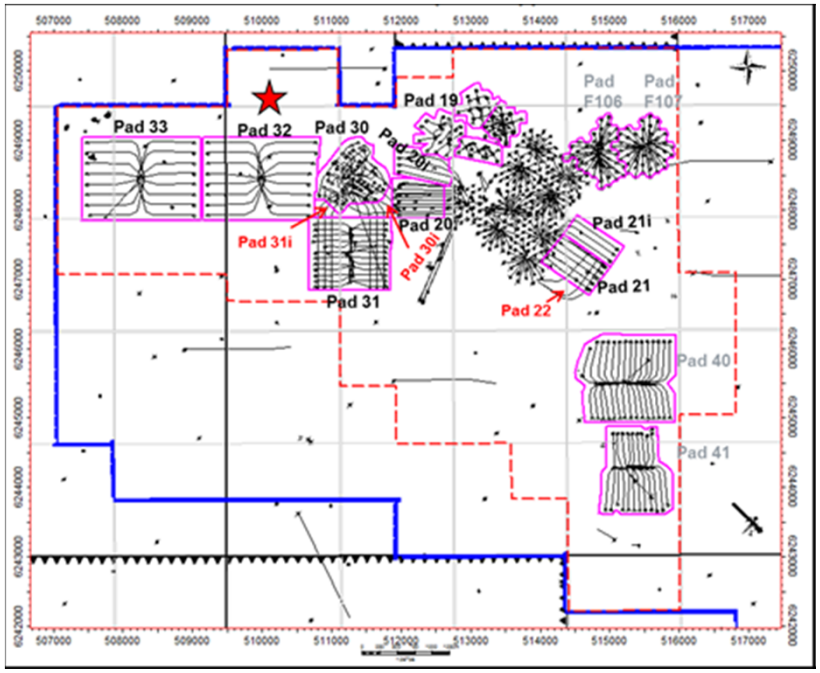
Data Acquisition

- In 2017 one well was drilled and cored North of Pad 32;

  100/03-30-085-18W5

- Data collected: Routine Core Analysis, Standard Log Suite, FMI (Bluesky), Viscosity Measurements



Caprock Integrity

- Caprock: consists of the highly continuous Spirit River Formation (Wilrich/Falher/ Notikewin) which has a minimum thickness of 240m over the approval area.

- Reviewing caprock integrity in regards to the following:
  - In-situ stresses
  - Field observations within the caprocks
  - Potential surveillance improvements
  - Injected steam volume above fill-up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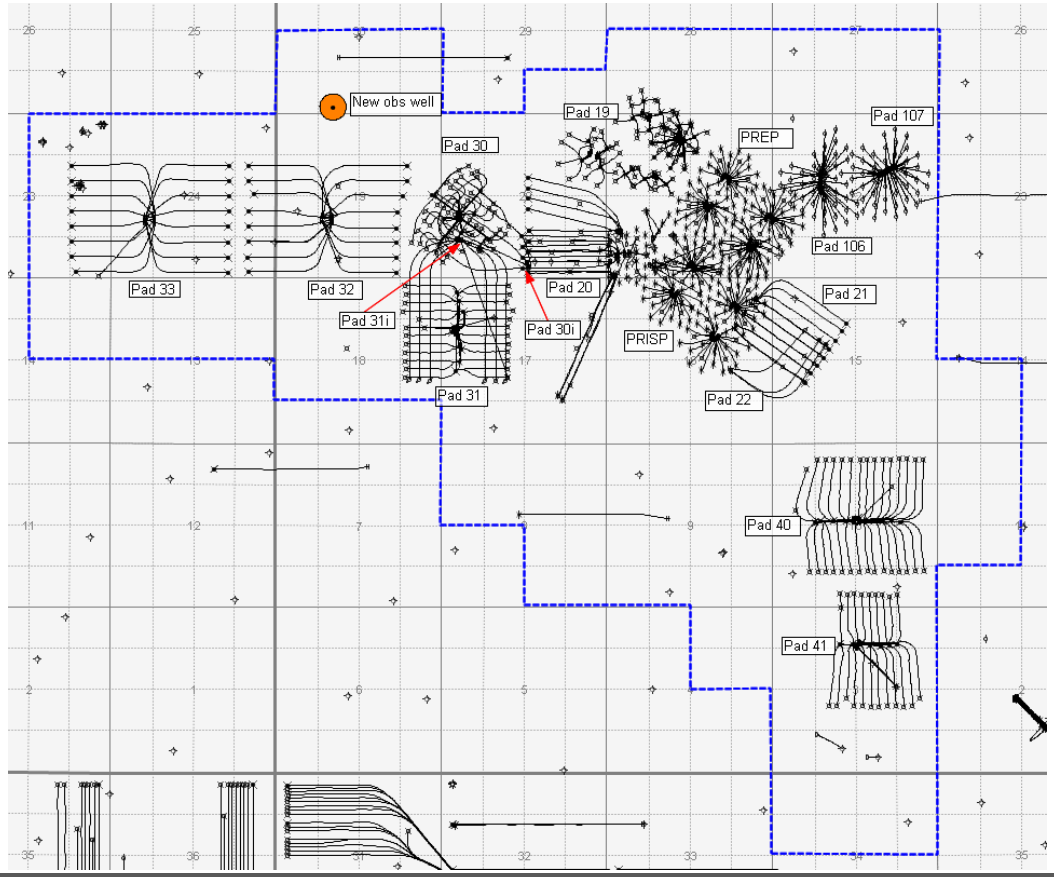
DRILLING & COMPLETIONS

Drilling & Completion Overview

- PRISP & PREP (1979)
  - 31 wells and 212 wells, 7 spot pattern
- Disposal Wells (1978 & 2008)
  - 3 brine disposal, 2 water disposal
- Pad 19 (1996 and infills drilled in 2011)
  - 1 test hole and 15 producers, “soak radial” design
  - Pad 19 infill wells: 10 new producers and 8 new injectors (vertical wells)
- Pad 20/21 SAGD (1997 and phase 3 infills drilled in 2011)
  - 5 well pairs, 5 dual wellbores, 9 observation wells
  - Pad 20 phase 3 injectors (4 new horizontal wells)
- Pad 30/31/40/41 Multi Laterals (2000)
  - 8 “haybob”, 25 “tuning fork”, 6 observation wells
- Pad 20/21 Conversions, Infills, 19 SD (2004)
  - Converted SAGD well to CCS, drilled 7 single lateral infills, 2 steam wells on pad 19
- Pad 32/33 Horizontals (2005)
  - 16 wells per pad, 3 obs wells
- Pad 22 Steam Injectors (2006)
  - 2 steam injectors running over pad 21 conversions, acting as steam drive
- Pad 30 & 31 Steam Injectors (2014)
  - 10 steam injectors 4 over Pad 30 & 6 over Pad 31
- 2 Carmon Creek Wells (2014)
  - Brine disposal well (02/15-27-85-19W5)
  - Delineation well (AA/04-26-85-18W5, D&A)
- Pad 22 Steam Injector (2015)
  - Top down Steam Drive injector 22-04
- Carmon Creek Wells (2014/2015)
  - Pad F106
    - 43 wells, 3 surface holes, 1 Observation well
  - Pad F107
    - 46 wells, 1 Observation well
  - 2 Acid gas injection well & 1 monitoring well
  - 2 water back producers
- No Drilling Activity in 2016
- TH32C Delineation (2017)

Field Map



Peace River Thermal Area

Approved Development Area

2017 Drills

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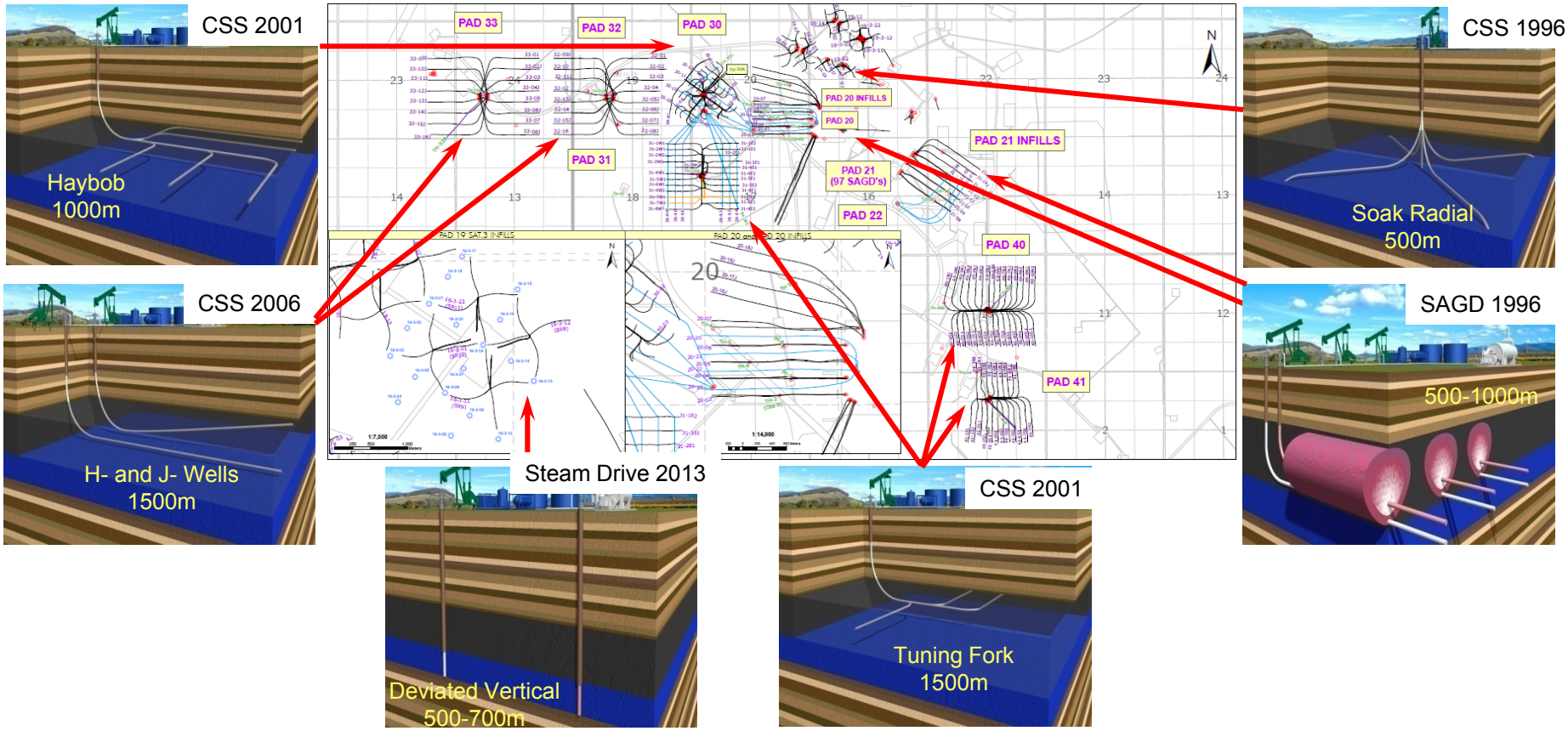
Well Type Overview

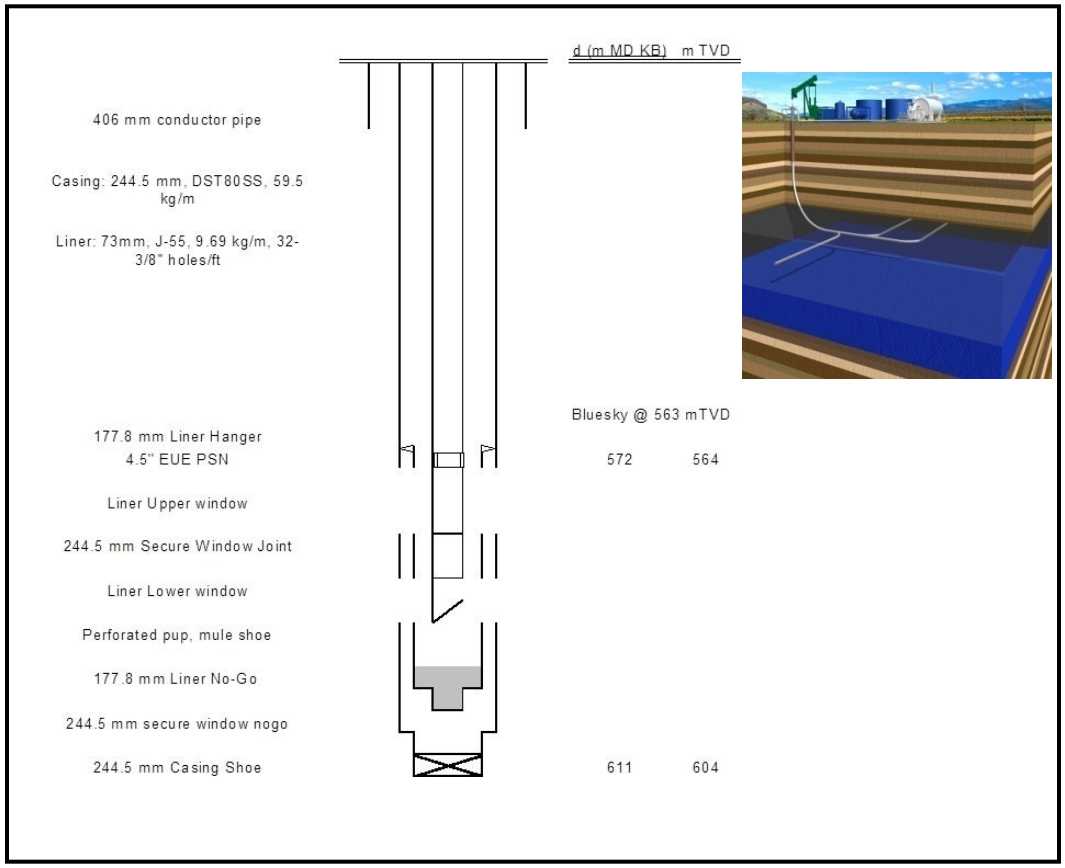


Well Spacing by Pad

- **Pad 19**
  - 100 m horizontal separation between injector and producer vertical wellbores
  - 150 m horizontal separation between producer vertical wellbores
  - Subsurface spacing variable due to soak radial geometry
- **Pad 20**
  - 5m vertical separation between SAGD injectors and producers
  - 100m horizontal separation between SAGD pairs and J-wells
  - 100m horizontal separation between new phase 3 infill injectors
  - 50m horizontal separation between a phase 3 injector and an original SAGD well pair
  - Vertical separation between a phase 3 injector and an original SAGD well pair is 3m to 15m
- **Pad 21/22**
  - 5m vertical separation between SAGD injectors and producers
  - 100m horizontal separation between SAGD pairs and J-wells
- **Pad 21/22**
  - 90m horizontal spacing between pad 22 injectors
  - Pad 22 injectors are 10m to 17m above original SAGD producers
- **Pad 30**
  - Highly variable due to Haybob geometry
  - 2014 injector spacing – 150 – 250m
- **Pad 31**
  - 80 m horizontal separation between laterals
  - 2014 injector spacing 100m
- **Pad 32**
  - 150 m horizontal separation between horizontal wells
- **Pad 33**
  - 150 m horizontal separation between horizontal wells
- **Pad 40**
  - 80 m horizontal separation between laterals
- **Pad 41**
  - 80 m horizontal separation between laterals

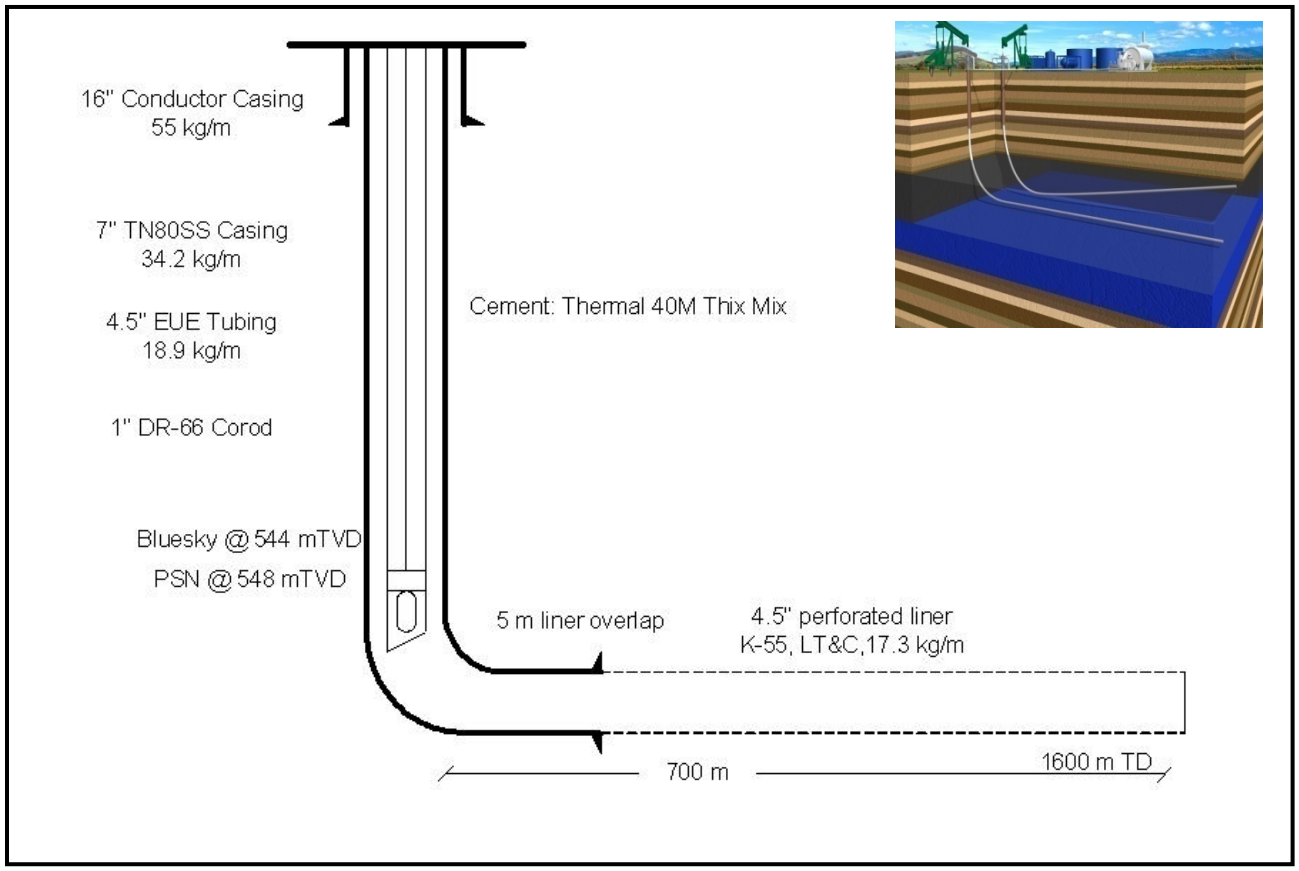
Multi Lateral Completion

- Pads 30, 31, 40, 41
- 244.5 mm L80 Production Casing
- 177.8 mm Window sleeve
- 73 mm Liner
- Thermal cement
- 114.3 mm tubing
- Insert pumps
- 550-700m laterals



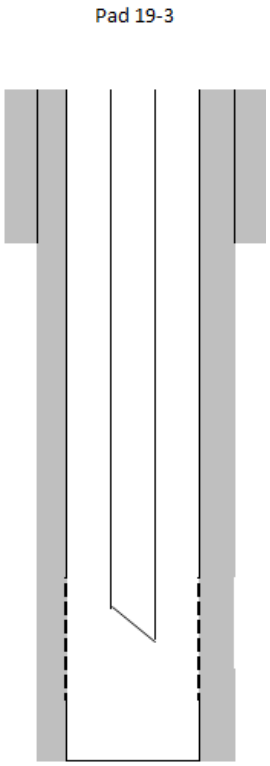
Single Lateral Completion

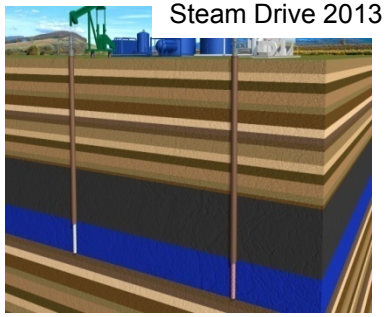
- Pads 32, 33
- 177.8 mm L80 Production Casing
- 114.3 mm Perforated Liner
- 114.3 mm Tubing
- Insert pumps
- Thermal cement
- 500-700 m lateral
- Pump is removed and steam injected down the tubing for high pressure CSS



Vertical Deviated Completion

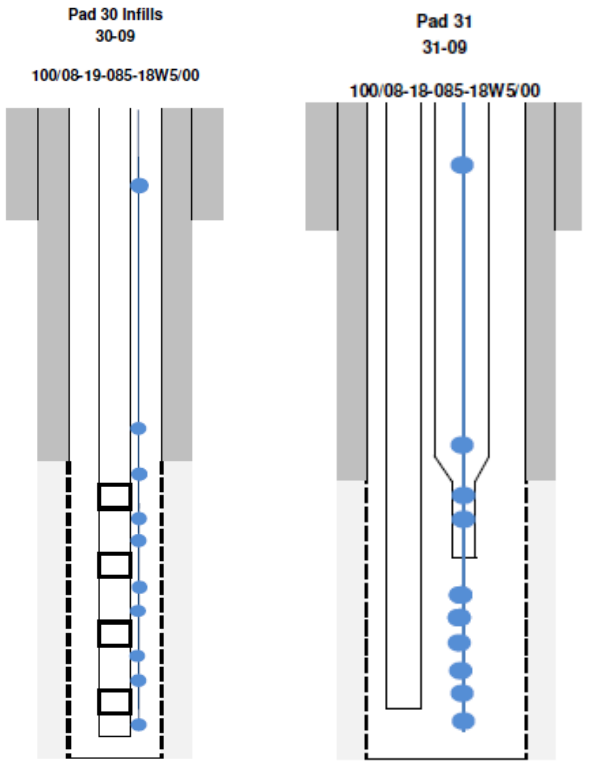
- Pad 19, Satellite 3
- 298 mm Surface Casing
- 219.1 mm L80IRP Production Casing
- 88.9 mm Tubing
- Insert pumps
- Thermal cement
- 19-24 m perforation interval



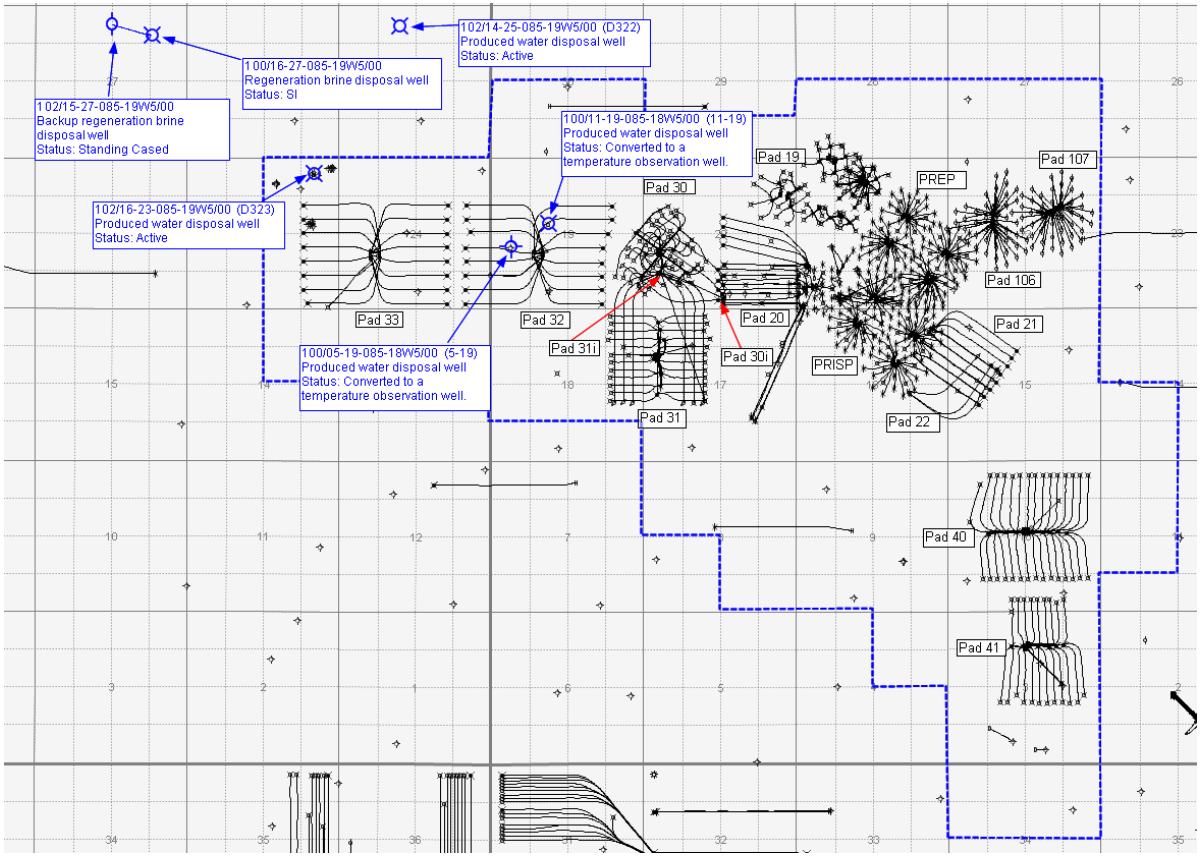

Steam Drive 2013

Horizontal Injector Completion

- Pad 20 Phase 3, Pad 30/31 Infills
- 339 or 298 mm Surface Casing
- 219.1 or 244.9 mm L80IRP Production Casing
- 177.8 or 139 mm wire wrap screen liner
- 88.9 and/or 73 mm Tubing
- Select wells completed with Flow Control Devices
- Thermal cement
- 500-1000 m lateral
- Select wells completed with thermocouples and/or DTS

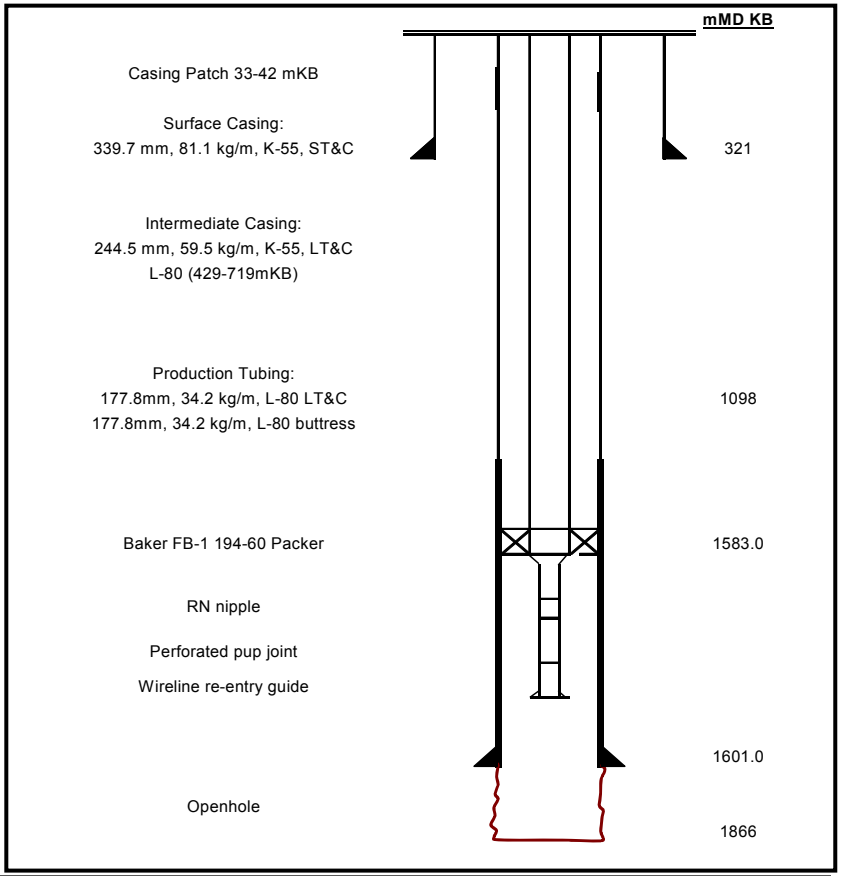


Source & Disposal Wells



Produced & Brine Water Disposal Completion

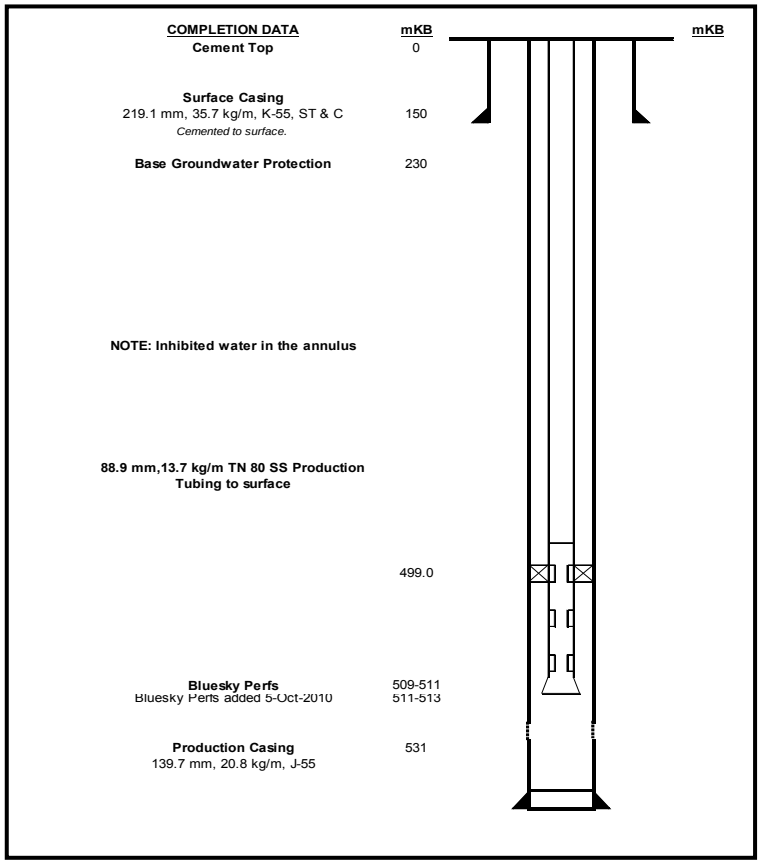
- 02/16-23 & 02/14-25 dispose of produced water, boiler blowdown and brine into the Leduc formation.
- 00/15-27 brine regeneration disposal recently shut in due to pipeline integrity concerns.



Sour Gas Injector Completion

- The 8-11 sour gas injector was completed Nov 2009 as part of the Three Creeks Sour Gas Storage project.

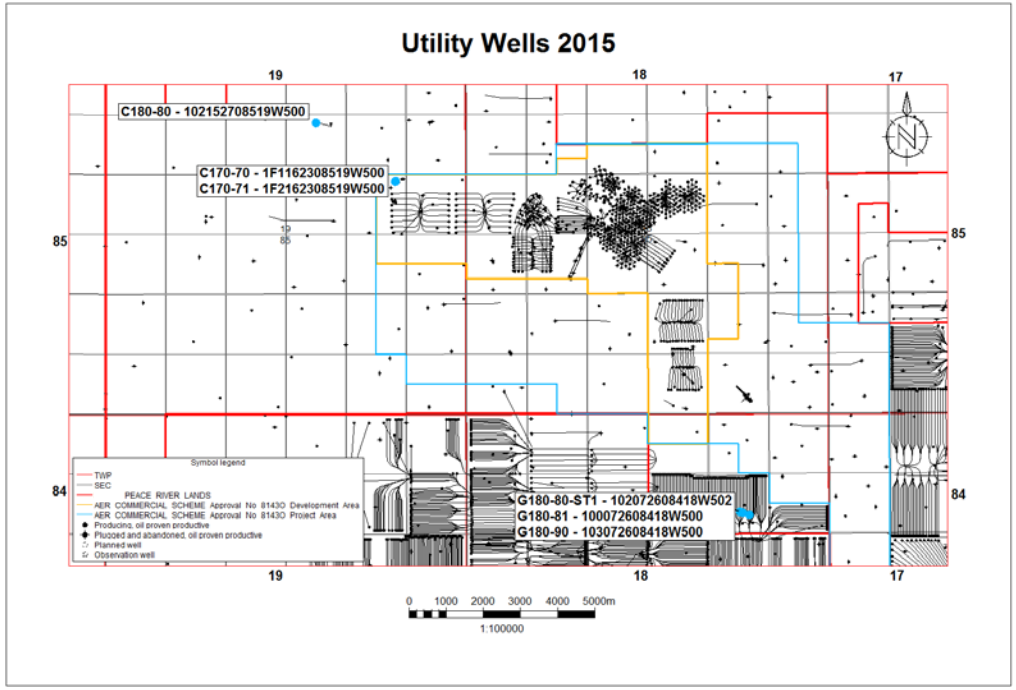
- Injection started Aug 2010.



Utility Well Completion

Drilled 2014/2015 – All wells suspended

- **C180-80** Brine Injection Well Completion
  - Drilled Mar/Apr 2014
  - Completed
  - Suspended
- **G180-80 and G180-81**, Two injectors
  - Drilled Sept-Dec 2014
  - G180-80 required acid wash, step rate test OK
  - Perforated (50m) liner across Middle Leduc
  - No completion hardware installed, suspended
- **G180-90**, Observation well
  - Drilled Sept-Dec 2014
  - TD in Winterburn Formation
  - No completion, suspended
- **C170-70 and C170-71,** Water back producers
  - Drilled Dec 2014 – Jan 2015
  - Did not reach target depth on either well
    - C170-70 cemented intermediate casing @ 1603 mKB, called TD
    - C170-71 int casing @ 1610 mKB, drilled and open to TD @ 1776 mKB
  - No completion, suspended



ARTIFICIAL LIFT

Rod Pumping Specifications

Pumping Units: **Max. Capacity:**

- Pumpjacks:144” – 260” stroke
  - Pump Jacks 280 m3/d
  - Rotoflex: 288’’ stroke 250 m3/d

Automation:

- Pump Off Controllers(POC): load cells, motor sensor, crank sensor, VFD
- XSPOC: Real-time pump cards

Pumps:

- Insert rod pumps, 2.0 – 3.25’’ barrel, 1’’ continuous rod, rod string designs

INSTRUMENTATION SUMMARY

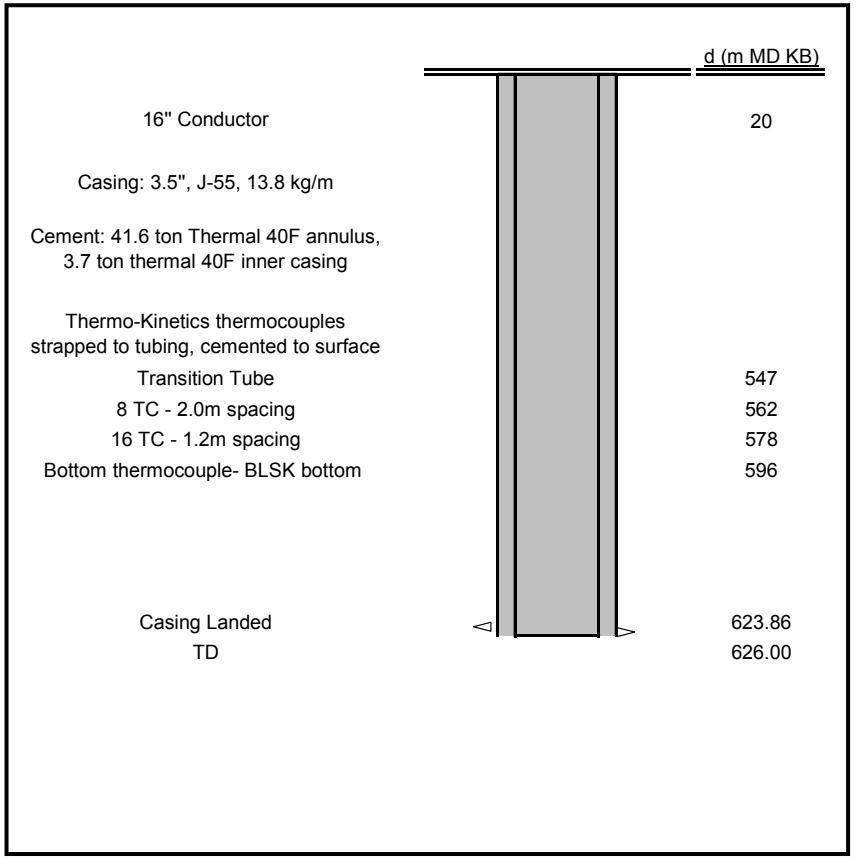
Observation Wells

Well Name	Type of observation well	Well Name	Type of observation well
TH6	Temperature	TH32A	Temperature and micro seismic
TH7	Temperature	TH33A	Temperature and micro seismic
TH8	Temperature	TH33B	Temperature
TH2 (Obs 9)	Temperature	TH40A	Disconnected
TH10	Temperature	TH40B	Temperature
TH11	Temperature	TH41A	Disconnected
TH12	Temperature	12-35	Pressure (Three Creeks)
TH14	Temperature	D320 (5-19)	Temperature – DTS
TH30A	Temperature and micro seismic	D321 (11-19)	Temperature – DTS
TH30C	Temperature, pressure and DTS	R3-19	Temperature – DTS
TH31A	Temperature and micro seismic	TH33	Pressure and temperature
TH31C	Temperature, pressure and DTS		

Typical Temperature Observation Completion

- Thermocouples situated from the Wilrich to the Debolt formations to monitor steam chamber rise and temperature variations over cycle(s).

- 5 wells with DTS installed (Pads 30, 31 & 32)

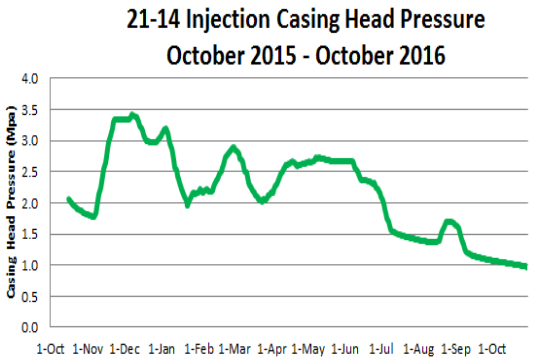


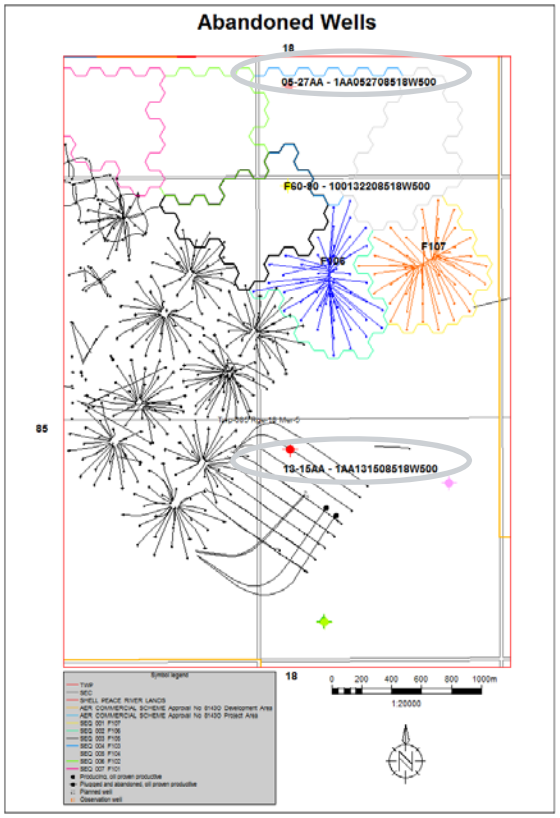
Monitoring of Abandoned Wells

Update required as per AER approval no. 8143Z

Oct 2015 – Oct 2017:

- 1AA052708518W500
  - Pad 106 wells drilled 400m to south – no injection
  - Closest production wells on Pad 19 > 1000m
- 1AA131508518W500
  - Low pressure injection on Pad 21/22; Q3 2017 pad on blowdown
  - No changes observed





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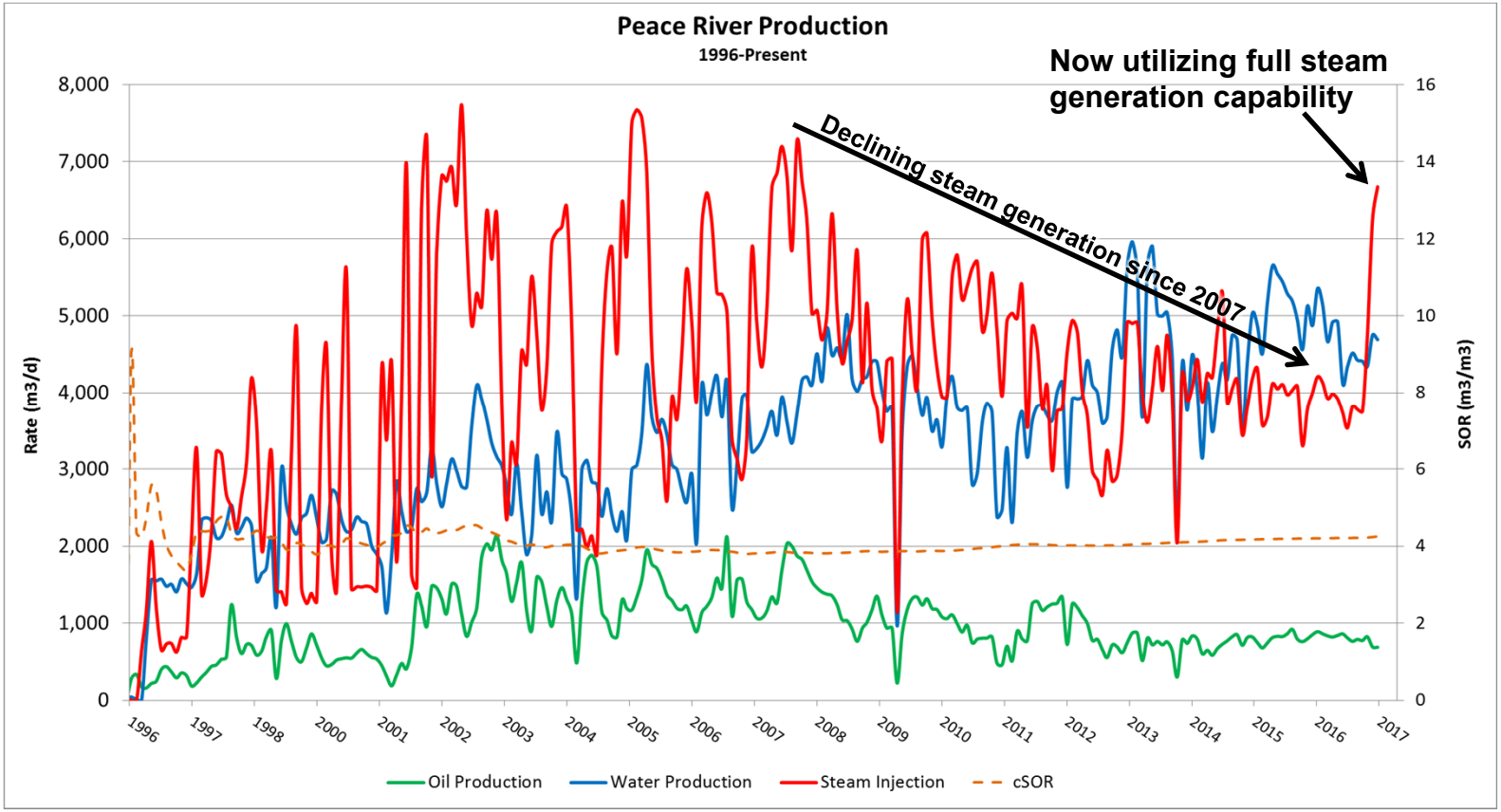
SCHEME PERFORMANCE

Scheme Recovery Processes

Pad	Recovery Process	Date of Conversion
19 Sat 1 and 2	Steamflood	Oct 2012
19 Infills	Steamflood	July 2013
20 Conv	Steamflood	July 2012
20 Infills	Steamflood	June 2012
21 Conv	Steamflood	Jan 2009
21 Infills	Steamflood	Nov 2011
30	Steamflood	Dec 2014
31	Steamflood	Nov 2014
32/33	Cyclic Steam Stimulation (CSS)	Converted to steamflood December 2012 Converted to CSS August 2014
40	Suspended	Converted to steamflood June 2012 Blowdown June 2014 Suspended October 2015
41	Suspended	Converted to steamflood June 2012 Blowdown June 2014 Suspended October 2015

Peace River Production



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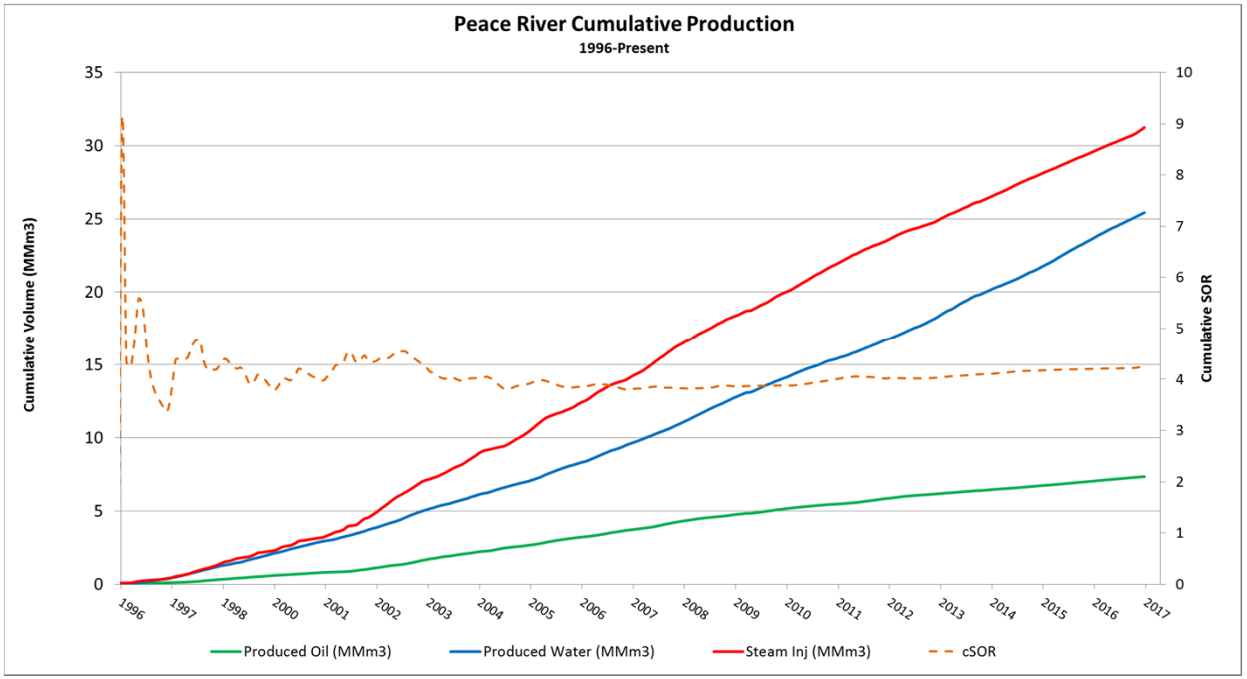
Peace River Production



- All data current as of Oct 2017
  - cOil = 7,345 Mm³
  - cWater = 25,431 Mm³
  - cSteam = 31,238 Mm³
  - Cumulative SOR = 4.3
  - Cumulative WSR = 0.8

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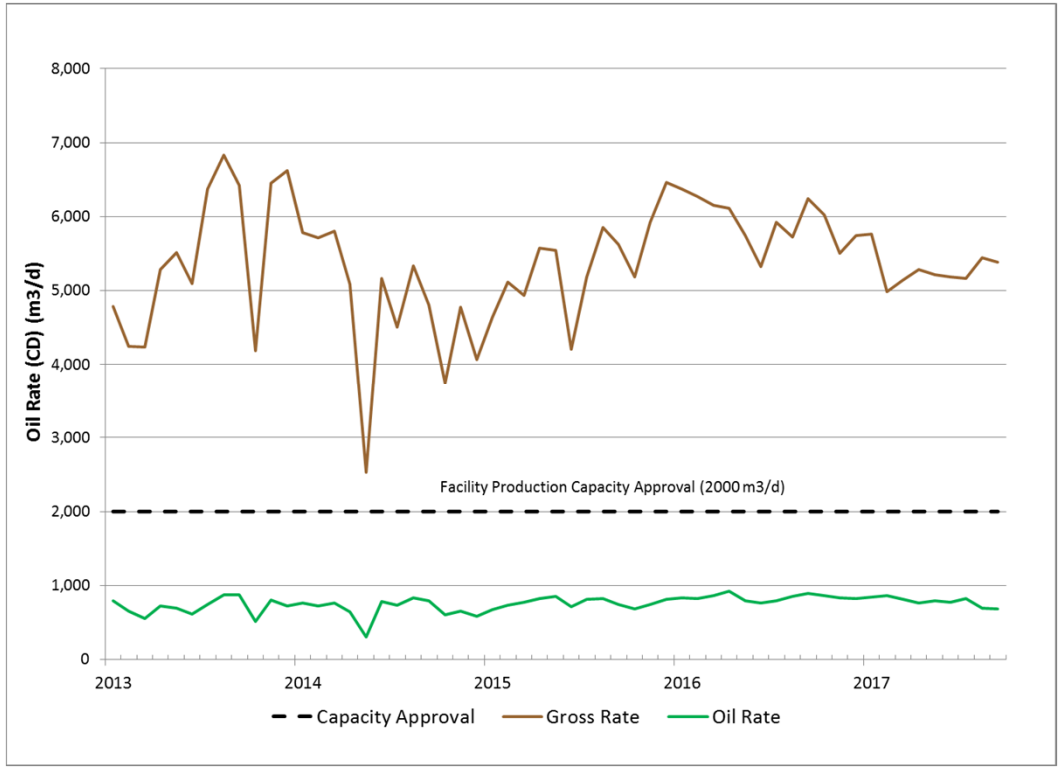
Actual Production vs Approval Capacity



- Bitumen production has continued to decrease since 2007 peak due to maturing pads and reduced steam injection

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Peace River Performance Summary

- Returned to utilizing all steam capacity from PREP boilers in Q3 2017 after acquiring asset in June 2017
- 5 inactive wells restarted
- Conversion from single-well CSS to column CSS on Pad 32 to improve SOR
- Prioritized steam to steamflood pads by SOR
- Initiated liner cleanout program to improve liner access

OBIP & Recovery Factors by Pad

Pad	OBIP (E3 m^3)	Area (m^2)	Pay Thickness (m)	Porosity (%)	Oil Saturation	Cum Oil (E3 m^3)	Current Recovery	Ultimate Recovery
Pad 19 S1	1,060	199,000	23	28	83%	272	26%	26%
Pad 19 S2	1,370	361,000	16	28.5	84%	236	17%	29%
Pad 19 S3	1,110	238,000	21	28	80%	303	27%	30%
Pad 19 S4	1,200	249,000	20	29	84%	224	19%	29%
Pad 20	2,040	423,000	22	27	82%	642	31%	34%
Pad 20i	1,500	339,000	20	27	83%	207	14%	22%
Pad 21	2,350	431,000	25	27	82%	598	26%	29%
Pad 21i	1,520	287,000	25	26	83%	235	15%	31%
Pad 30	4,250	765,000	24	28	83%	829	20%	34%
Pad 31	6,520	1,232,000	23	28	83%	744	11%	34%
Pad 40	8,790	1,676,000	25	26.5	80%	881	10%	26%
Pad 41	5,990	1,134,000	26	26	79%	842	14%	23%
Pad 32	9,650	1,953,000	22	27.5	83%	847	9%	17%
Pad 33	9,800	2,044,000	22	27.5	80%	483	5%	14%
Total	**57,150**					**7,345**	**17%**	

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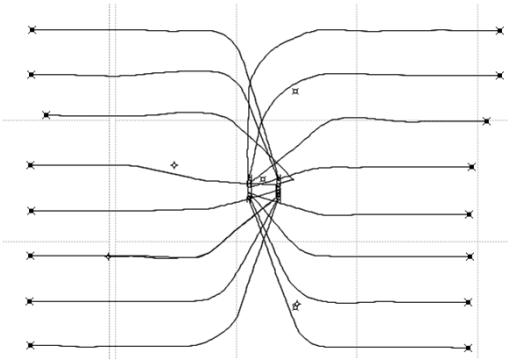
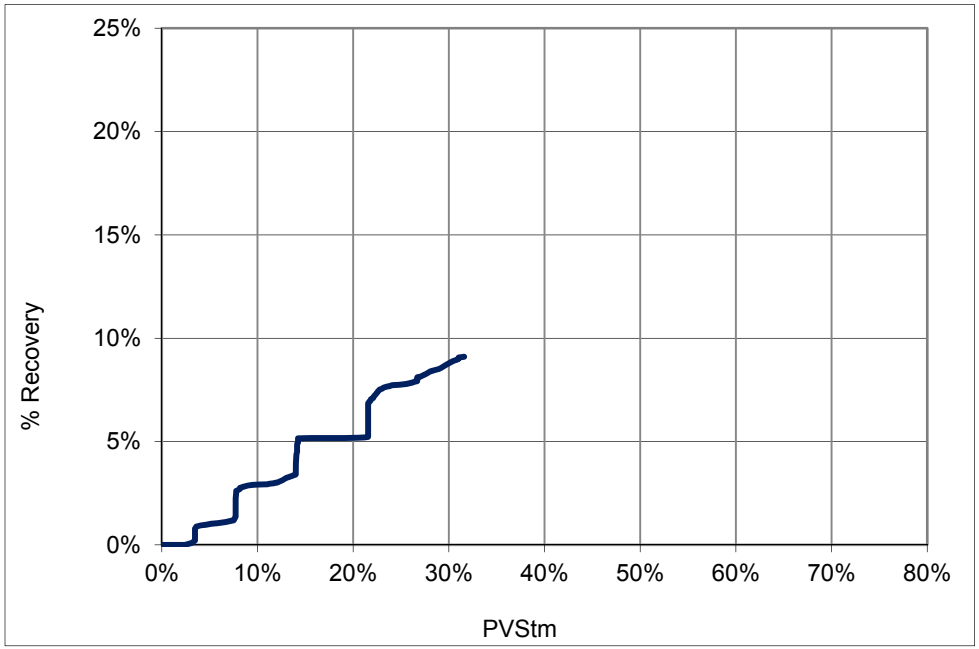
Pad 32 - Low Recovery



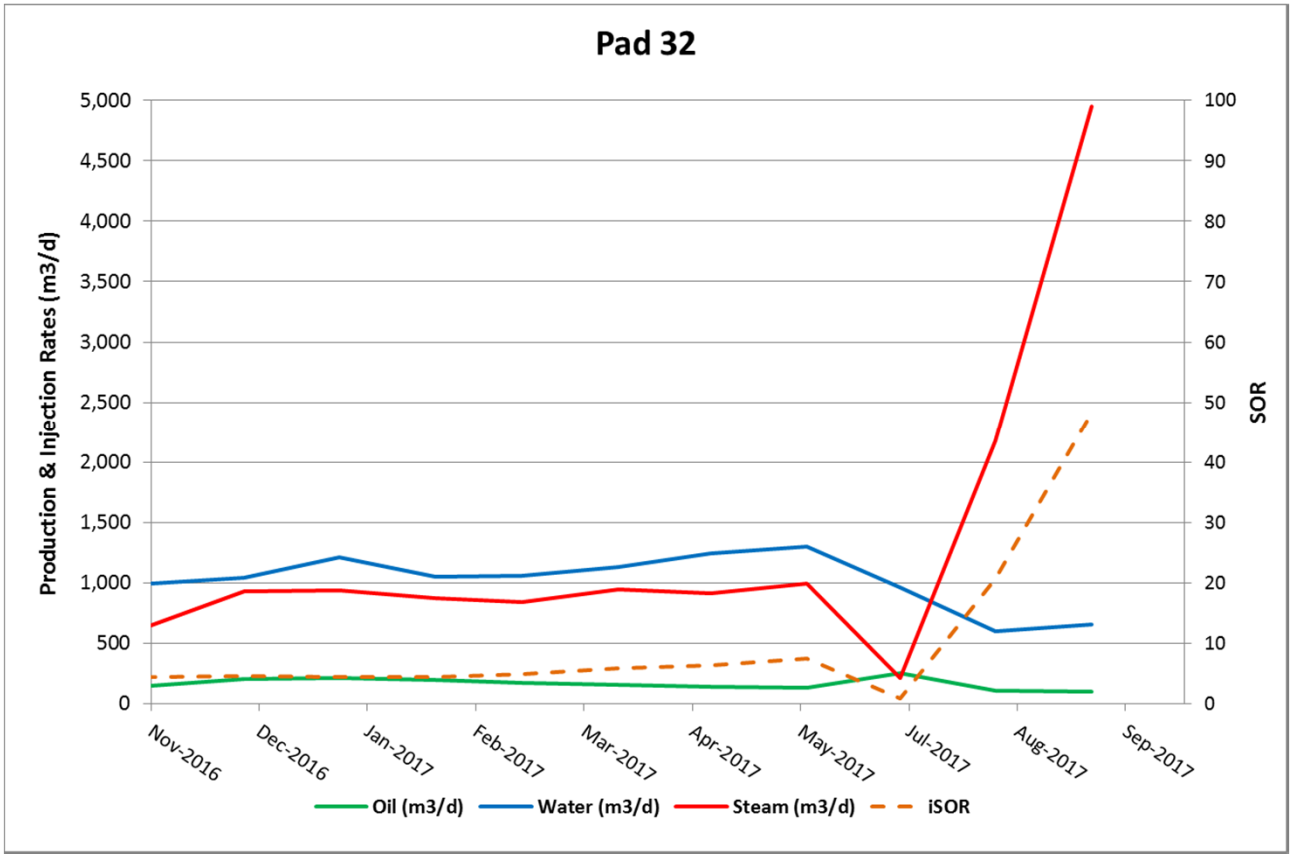
16 CSS Wells

Current RF: 9%

- Spacing: 150m
- Avg. Net Pay: 22m
- Avg. So: 78%
- Avg. Porosity: 28%

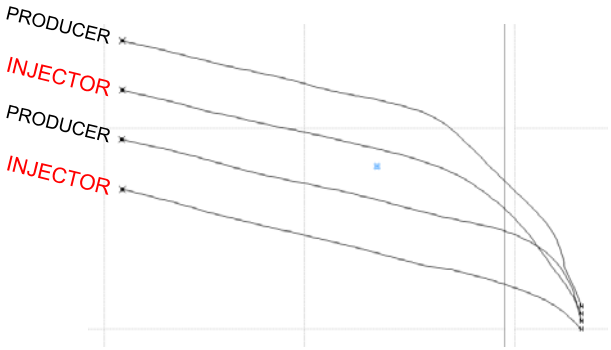


Pad 32 - Low Recovery



- Steaming in recent years has been single well CSS
- Aug 2017: east column of 8 wells returned to block CSS
- Oct 17, 2017: steam shut-in after a casing failure on well 32-01
- 2018 plans:
  - Repair and confirm casing integrity
  - Resume cyclic steam injection

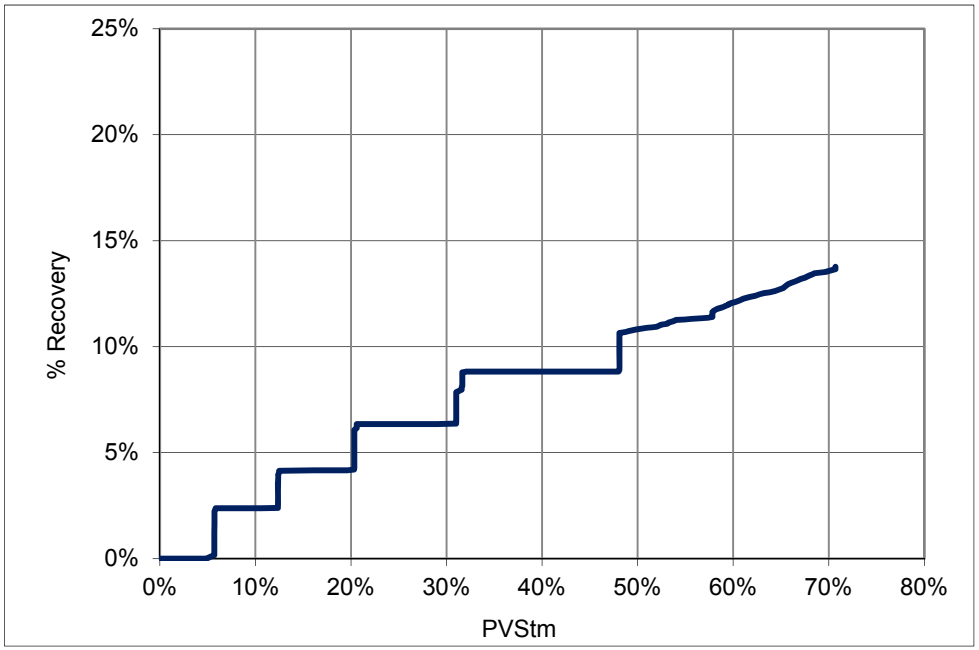
Pad 20 Infills - Medium Recovery



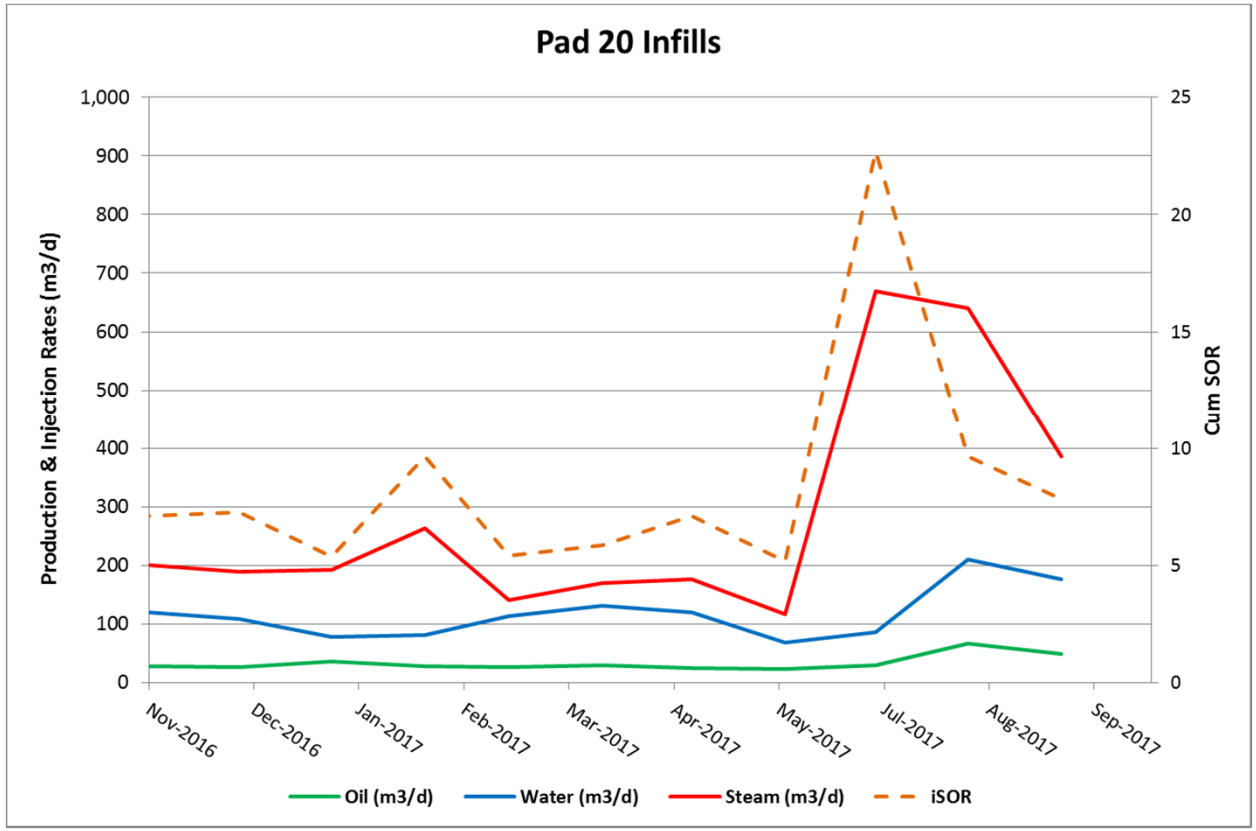
4 well steamflood, initially CSS
Lateral Steamflood (J-Wells)

Current RF: 14%

- Spacing: 100m
- Avg. Net Pay: 20m
- Avg. So: 82%
- Avg. Porosity: 27%

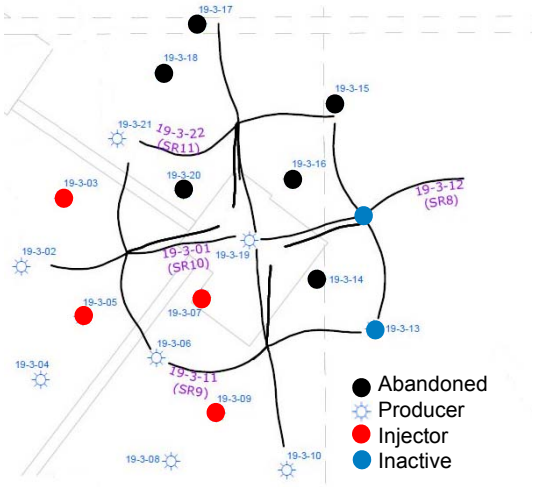


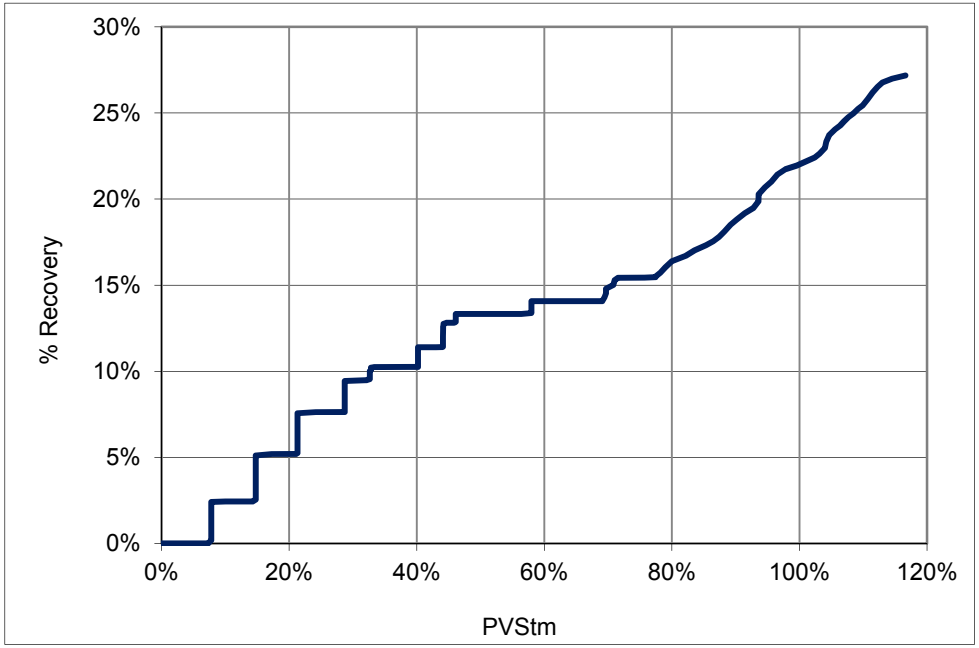
Pad 20 Infills - Medium Recovery



- Steam injection increased in June 2017
- 2018 plans:
  - Monitor response to increased injection and adjust steam allocation based on observed performance

Pad 19 Sat 3 - High Recovery





14 well steamflood

Current RF: 27%

- Spacing: variable
- Avg. Net Pay: 21m
- Avg. So: 83%
- Avg. Porosity: 28%

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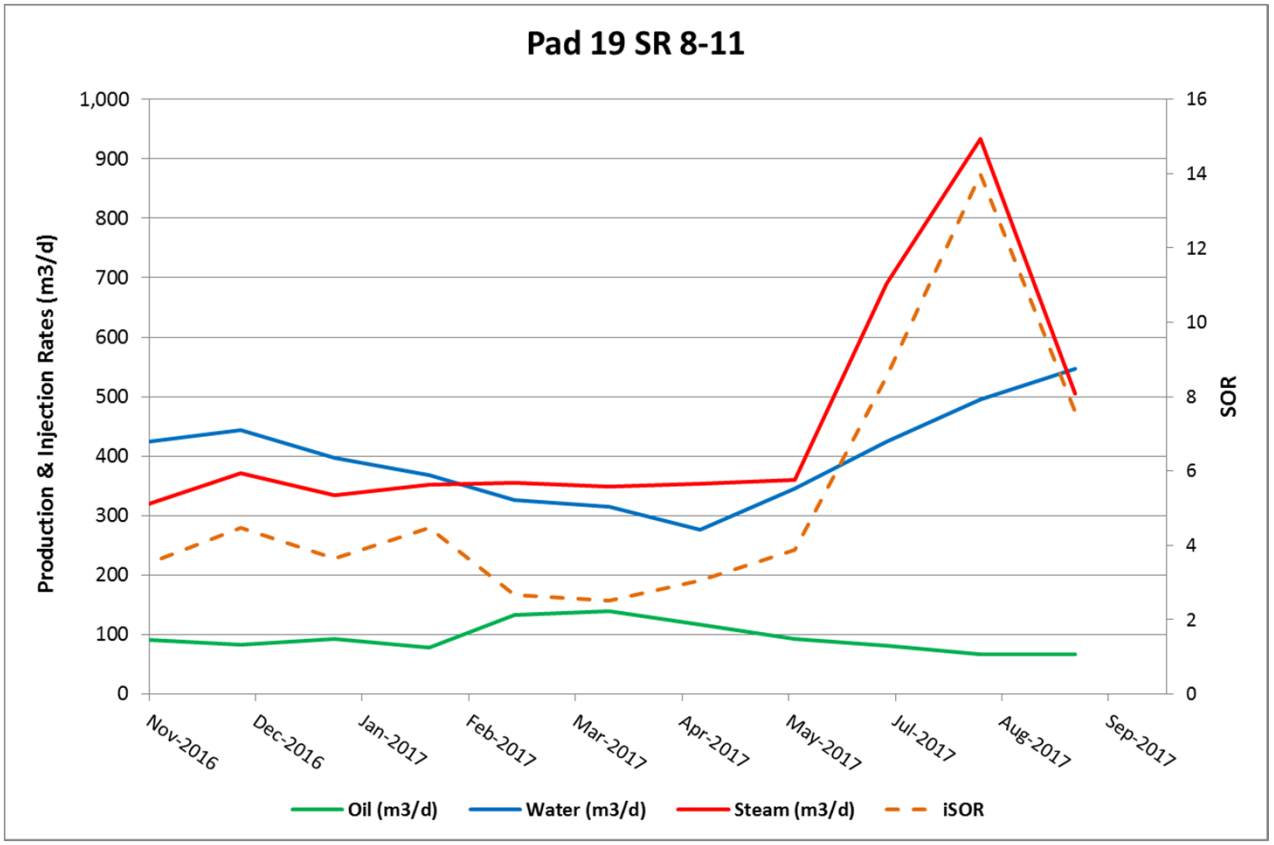
Pad 19 Sat 3 - High Recovery



- Steam injection increased in June 2017
- Restarted 2 inactive wells
- 2018 Plans
  - Restart additional wells that can be incorporated into steamflood process
  - Adjust steam allocation based on observed performance
  - Explore increased steam support to producers to utilize artificial lift capacity

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Factors Impacting Recovery

- Well design
  - Multi-well designs have no clear performance advantage
  - Lack of sand control has resulted in significantly plugged portions of liners
  - Unable to re-enter some wells for cleanouts due to complexity of well design and/or small liner diameters
  - No control of steam placement in laterals

- Inter-well and Inter-pad Communication
  - Reduces thermal efficiency by suboptimal placement of injected steam, and/or quenching of heated reservoir with cooler fluids
  - Examples include: Pad 40-41, Pad 32-33, Pad 32 to Pad 30,31

Key Learnings – Liner Access

- Liner access is limited
  - Majority of liners have no sand control: Perforated pipe only.
  - Tagged hard near heel on 19 wells on Pads 20, 32 and 33
  - Hard fill through 60-80% of liner
  - Flushed liners to the toe

- Difficult to cleanout wells with 2-7/8” liners
  - Pads 30, 31, 40, 41

Key Learnings - Casing Integrity

- CNUL recently became aware of external casing corrosion in Peace River.
  - Corrosion within 1.5m of ground elevation where casing is in contact with soil conditions
  - Inspections ongoing on Pads 32/33
  - At least one well inspected on all active pads

- Remediation Plans
  - Upper sections of casing are being replaced when confirmed unsuitable for process conditions
  - Casing is also being coated where required to prevent further corrosion.


32-14 Casing

2018 Depletion Strategy

- Evaluating CSS vs. steamflood on Pads 32/33 for resumption of steam injection when casing repairs are complete (Q1-2018)
- Continue to optimize steamflood areas
- Continue liner cleanouts to improve steam conformance and drainage

5 Year Outlook of Pad Abandonments

- No pads are scheduled for abandonment from 2018 to 2022

Future Development Plans

- Peace River asset was acquired June 1, 2017.
  - Evaluating future development plans

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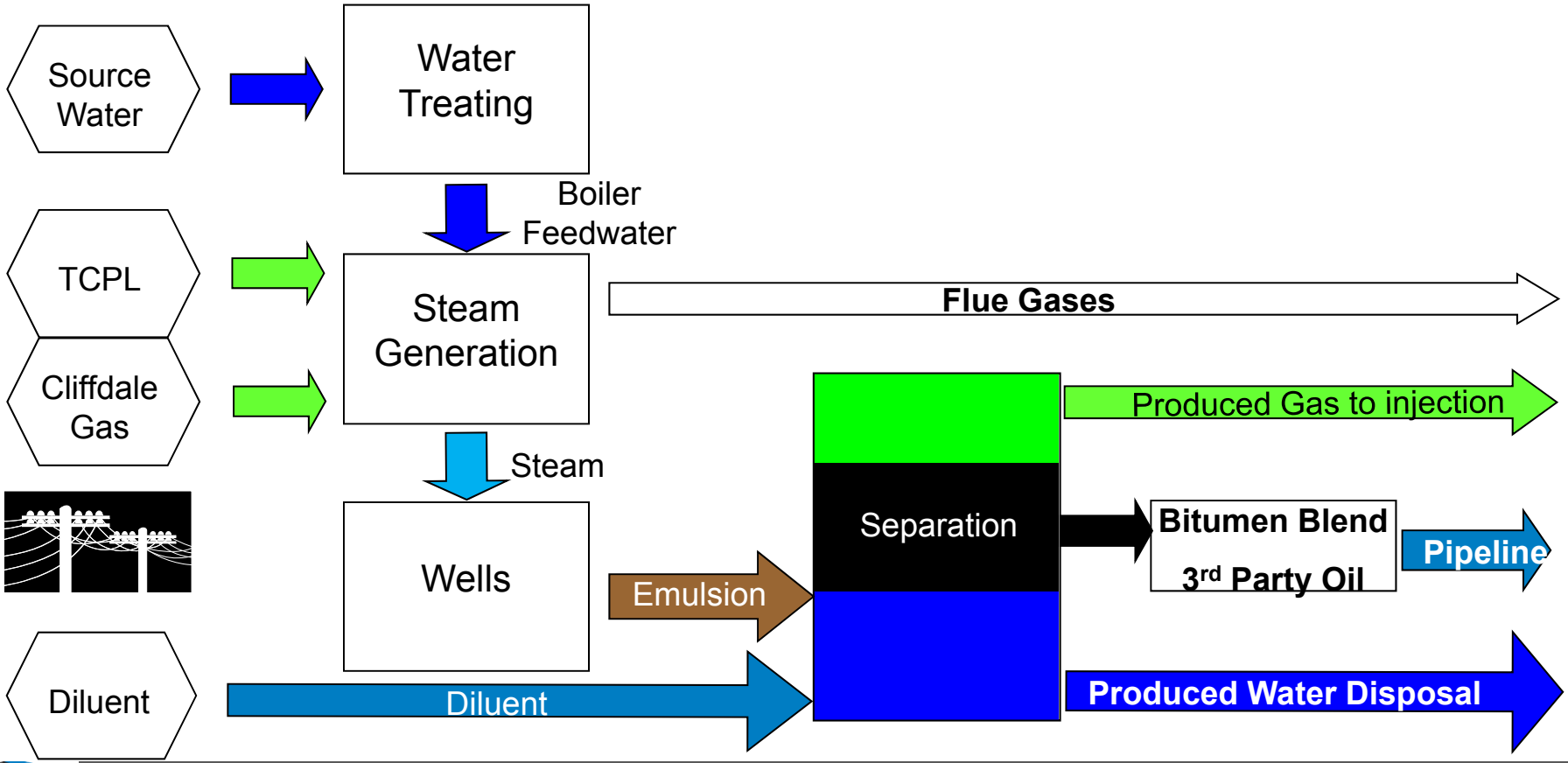
DIRECTIVE 54 SECTION 3.1.2
SURFACE OPERATIONS, COMPLIANCE, AND ISSUES NOT RELATED TO RESOURCE EVALUATION AND RECOVERY

Peace River Plant

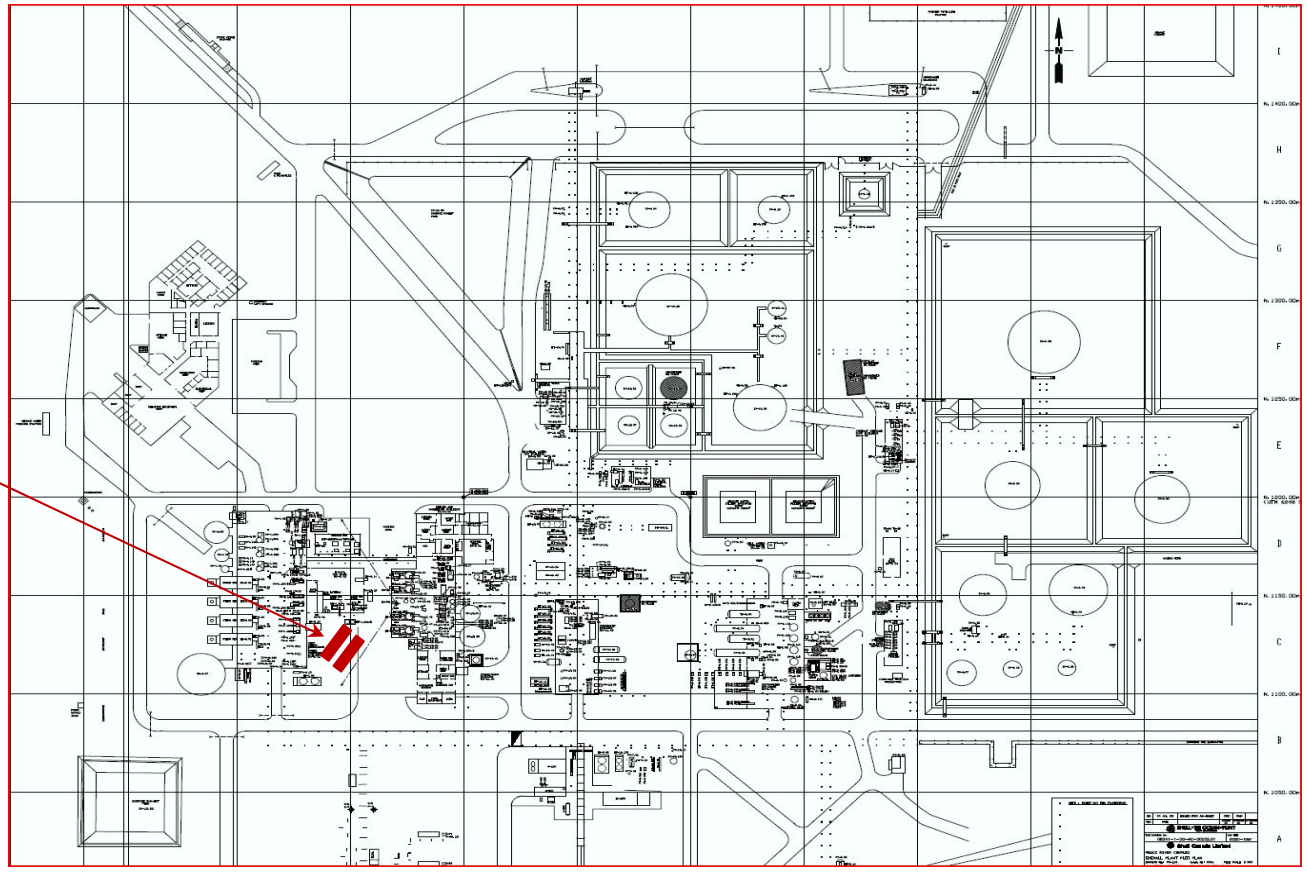
Thermal Production Treating: Process Flow Diagram



2017 Facility Modifications

- Two 1.25 MW power generators (installed late 2016)
- Berm runoff project completed (with exception of Pad 32, which will be completed in spring 2018)
- Brine pipeline shut down (brine co-injected with produced water)

Plot Plan with 2017 Modifications



Facility Performance: Production & Oil Treating

- Production averaged between 30-40% of 2,000 m^3/day licensed capacity in 2017
- Production Separator 1 was cleaned to improve separation
- Demulsifier chemical was changed for cost reduction purposes
- Oil treatment has largely not been an issue due to low oil volumes

Facility Performance: Source Water

- PRC pulls water from the Peace River on a continuous basis. Source water treatment facility located on the east bank of the Peace River
- PRC is licensed to withdraw 4.3 e^6m^3 of water from the Peace River per year (11,813 m^3/day)
- Historical water usage range is 5,000 m^3/day to 11,000 m^3/day
  - YTD fresh water withdrawal (Jan 1 to Sep 30) is 1.4 e^6m^3 or an average of 5,092 m^3/day
  - Before being sent to the main complex, fresh water from source water is treated to:
    - less than 5 ntu, and less than 0 ppm oxygen
- The water softeners were converted to shallow shell technology in 2016
- Waste brine previously disposed down disposal well (16-27) in the Leduc formation but now co-mingled with produced water before disposal down wells at 14-25 and 16-23

Facility Performance: Produced Water

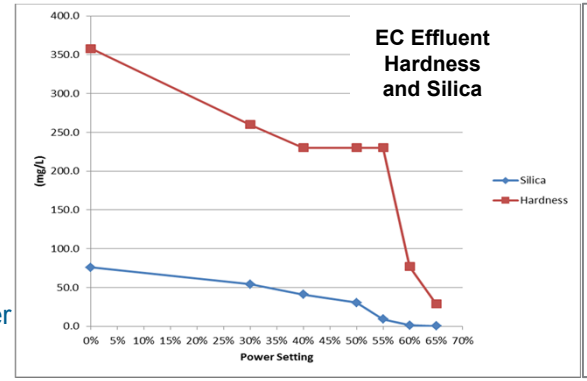
- Typical produced water quality:
  - Produced water TSS 30 mg/L, Oil and Grease 75 ppm, Total Hardness 374 mg/L, Chlorides 3,190 mg/L
- Solids are periodically disposed of through approved waste stream treating companies
- Design produced water handling and injection capacity is 7,977 m^3/day
  - Disposal pump capacity currently limited to 7,400 m3/d
  - Investigation underway to understand cause

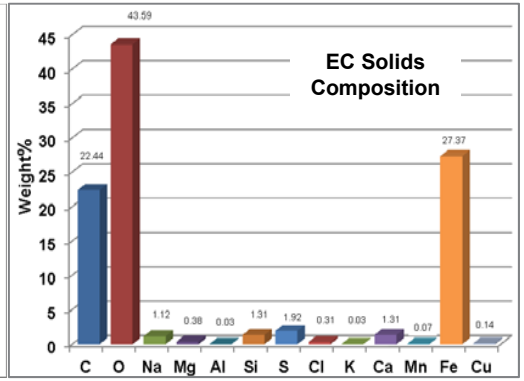
Produced Water Treatment & D81 Compliance

- Directive 81 (D81) Compliance
  - Application submitted Q2 2016, waiver extension granted Q3 2016
  - Approval subject to construction of a commercial produced water treatment and recycling facility before end of 2020
- Electrocoagulation (EC) Demonstration
  - EC Commercial Demonstration trial postponed while options for future development of Peace River leases are being evaluated
  - EC trial summary in Appendix
- Water Treatment Plans
  - Seeking to match the produced water treatment solution to the reservoir strategy and corresponding steam water specification
  - Conventional water treatment technologies such as evaporation and warm lime softening are also being investigated

Electrocoagulation (EC) Trial Summary

- EC trial conducted in Q1, 2016 using 20 gpm pilot scale system
  - Objective: Remove hardness and silica levels to OTSG BFW quality specifications
- Results and conclusions:
  - Proof of Concept (PoC) achieved
    - High levels of silica and hardness removal at >60% power (current density of 0.4 A/in^2)
    - Complete H_2S removal at all power levels
    - Removals significantly better at boiler feedwater pH of ~9
    - TSS levels increased significantly at >60% indicating substantial coagulation is occurring
  - Mechanical / reliability issues and significant downtime of pilot equipment resulted in inconclusive data and need to consider further technology demonstration with respect to the following:
    - Soluble iron observed in effluent at very low at <60% power levels
    - Foaming due to hydrogen gas liberation was observed – requires solution
    - Incomplete data obtained regarding CIP and electrode fouling tendency
    - Incomplete data obtained regarding solids dewaterability
    - No estimate of electrode replacement frequency





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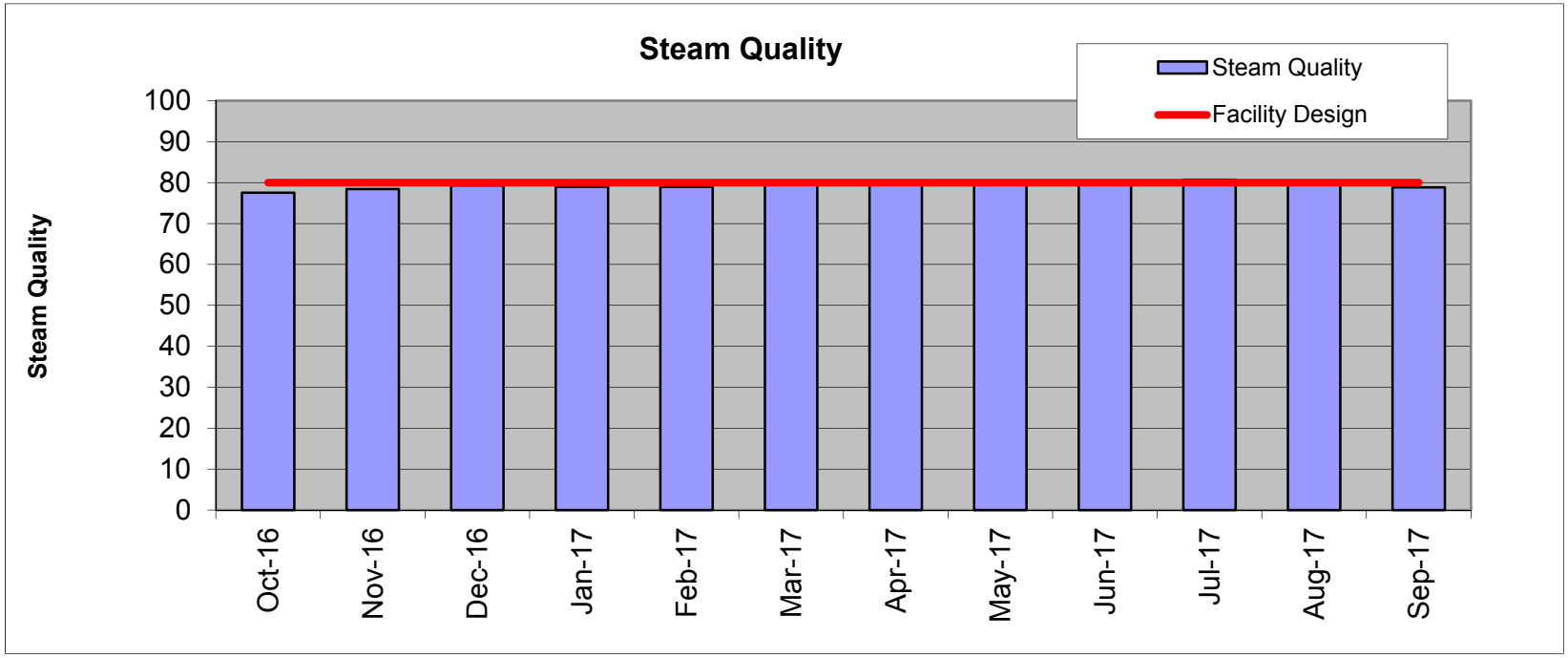
Facility Performance: Steam Generation

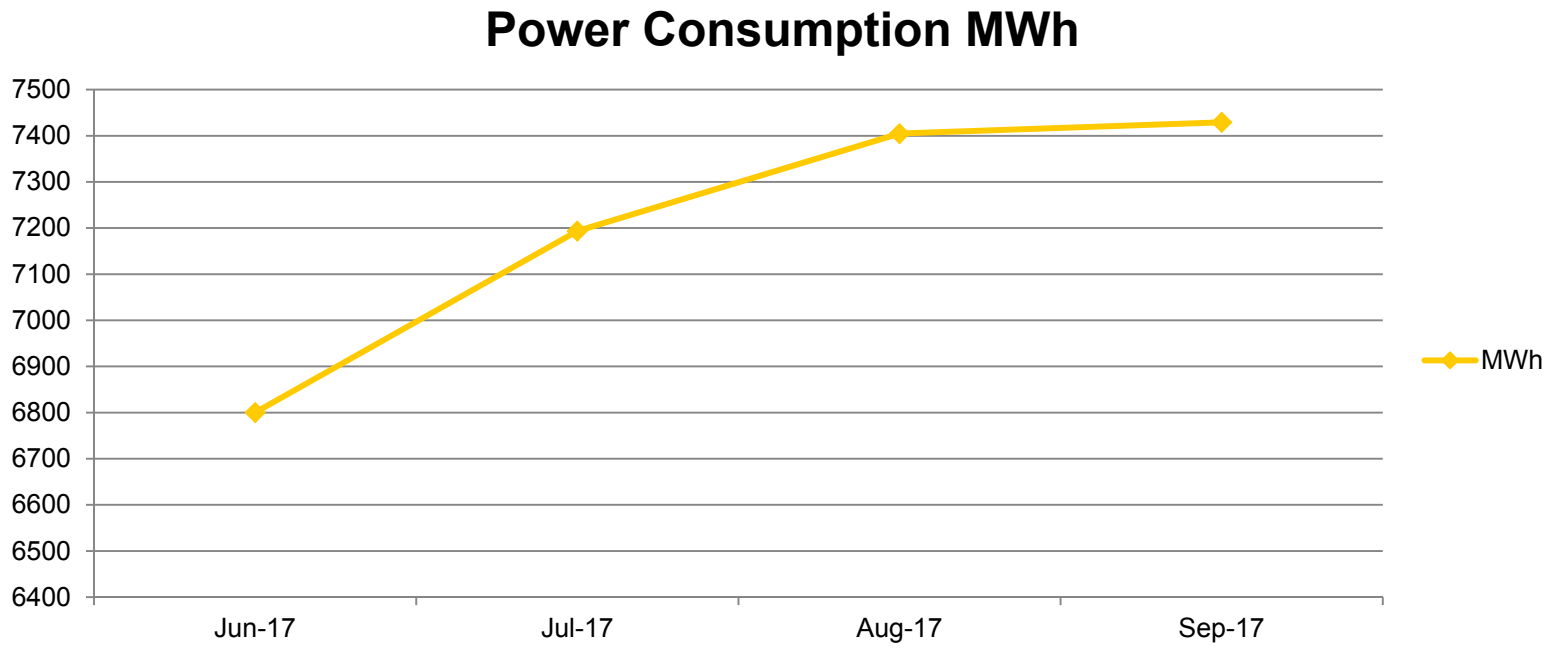
- PRC generates 80% steam quality from four once through steam generators.
- The four steam generators have a total capacity of approximately 8,000 t/d.
- Steam pressures of 14 MPa and 335^{o}C.
- The main complex takes formation steam off the high pressure injection line and utilizes it in the utility steam system. The utility steam uses 700 to 1,500 t/d based on seasonal requirements.
- PRC has a100% utility steam system blowdown recycle back in to the plant steam condensate recovery system.
- All Steam Generators use a mixture of up to 75% Cliffdale and 25% Natural Gas by volume as their fuel source.
- 100% steam quality switch was deferred pending future development plans.

Facility Performance: Steam Generated



- Four PREP boilers at 2000 tons/d capacity each

Facility Performance: Power Usage

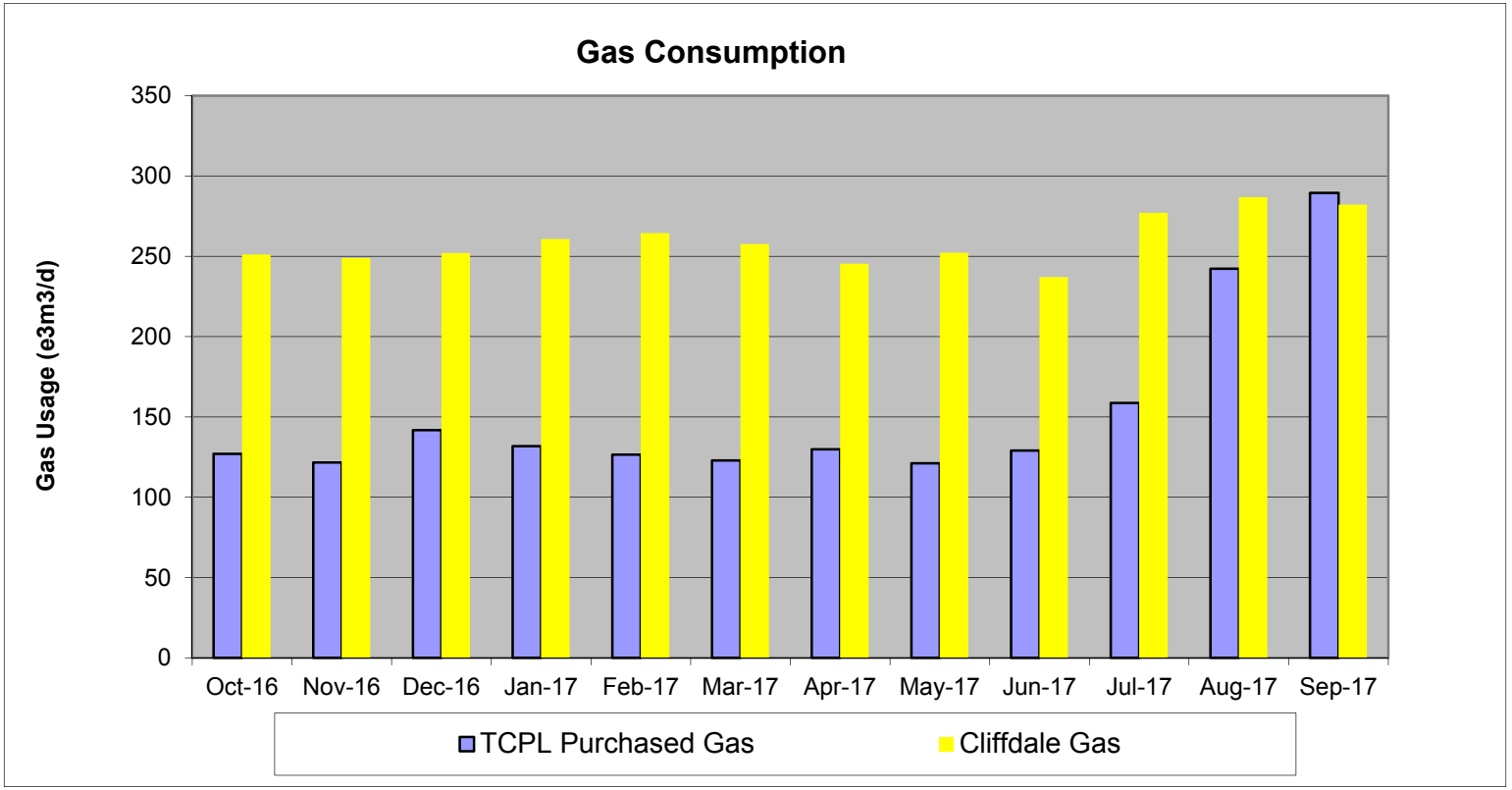


Was unsuccessful in obtaining power consumption data from Shell for the period prior to June 2017

Facility Performance: Gas Usage

- Natural gas is purchased from TransCanada for use as fuel.
- Since June 2010, CVG from the Cliffdale field is being imported to PRC as a fuel source to the boilers
- EPEA licence restrictions limit using sour fuel in the boilers to events less than 72 hours in duration. While Peace River has the capability to burn sour mixed gas it has not been done since 2010.

Facility Performance: Gas Usage

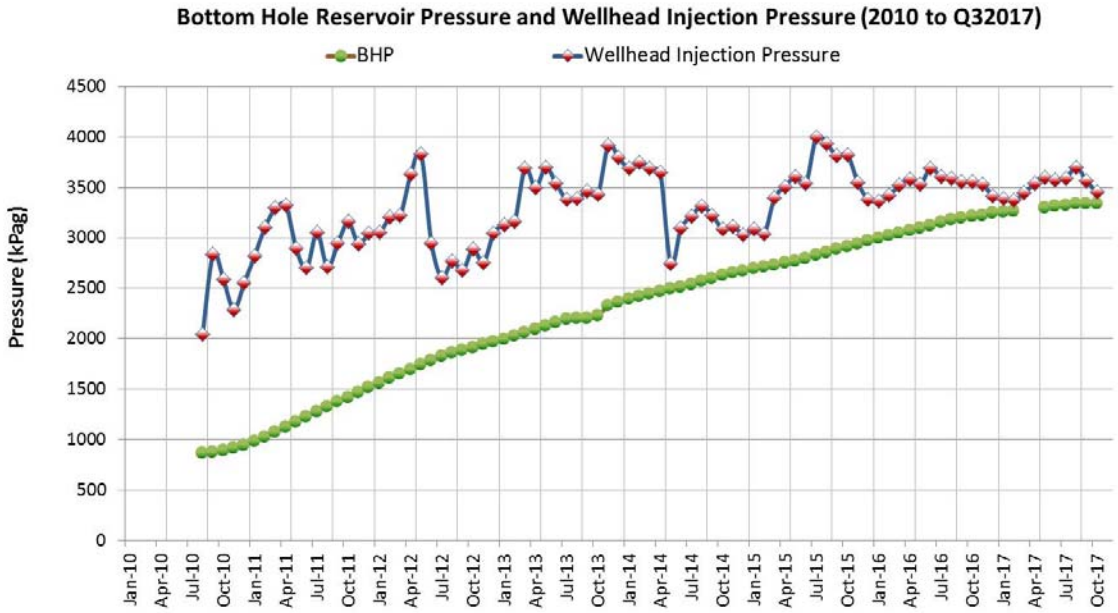


Facility Performance: Three Creeks Compressor

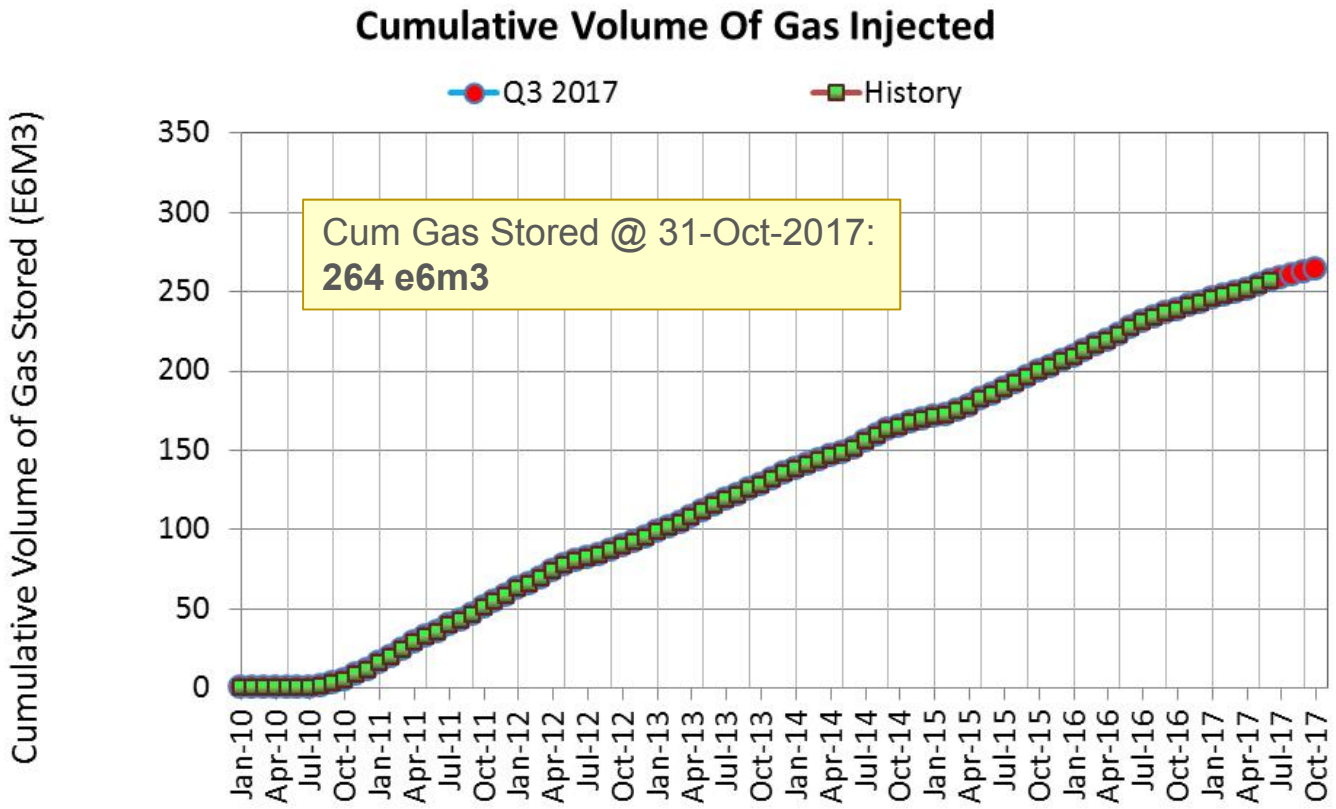
- Three Creeks Gas injection facility has been operational for six years.
- Gas is currently analyzed once per month at the Three Creeks dehydration outlet to the Three Creeks gas injection pipeline. Analysis done by a outside lab.
- 2017 Injection facility reliability is currently 99%. This includes planned maintenance shutdowns.
- Some injectivity concerns observed in 2017. Acid workover did not significantly improve injectivity. Asphaltines not identified in system. Consideration is being given to requesting a higher injection pressure into the reservoir. Increasing the MOP of the surface facilities would also be required to permit higher injection pressures.

Three Creeks Subsurface Information

- Data as per Three Creeks annual progress report submitted Oct 31, 2017
- Obtain D65 approval May 30, 2017 to store gas up to 5,000 kPa(a) static reservoir pressure

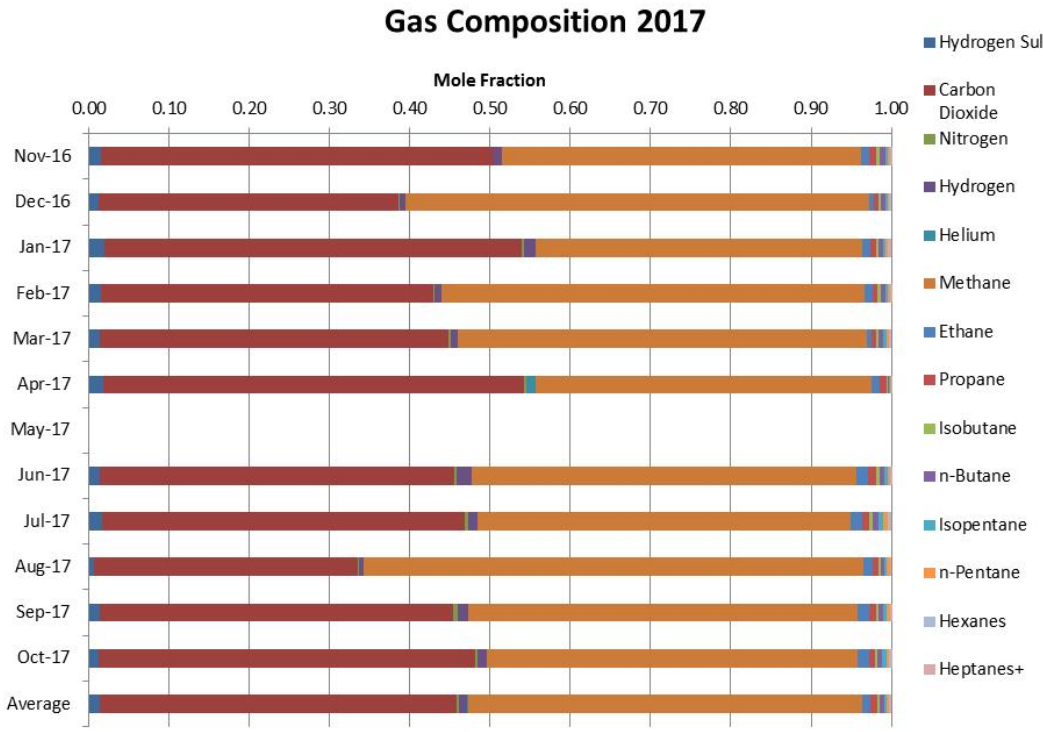


Three Creeks Subsurface Information



Three Creeks Subsurface Information

- Injected gas stream is analyzed once each month. The graph below presents the gas analysis from Nov 2016 to Oct 2017.



May Data Added

Component	Mole Fraction		Liquid Volume mL / m³	Mole Fraction of Previous Analysis
	Air Free As Received	Air & Acid Gas Free As Received		
H_2	0.00894	0.01628		0.00009
He	0.00004	0.00008		0.01105
N_2	0.00306	0.00558		0.00361
CO_2	0.43634	0.00000		0.52353
H_2S	0.01450	0.00000		0.01820
C_1	0.49517	0.90169		0.41932
C_2	0.01211	0.02206	43.0	0.00995
C_3	0.00855	0.01557	31.4	0.00815
iC_4	0.00357	0.00650	15.6	0.00129
nC_4	0.00602	0.01096	25.3	0.00213
iC_5	0.00462	0.00841	22.6	0.00122
nC_5	0.00385	0.00701	18.6	0.00093
C_6	0.00213	0.00388	11.5	0.00039
C_7+	0.00110	0.00201	6.3	0.00014
TOTAL	1.00000	1.00000	174.3	1.00000

Similar to other months.

Three Creeks Subsurface Information

- Injected gas stream is analyzed once every month.
- The table presents the gas analysis for July, August and September 2017.

COMPONENT	JULY	AUGUST	SEPTEMBER
	Mole Fraction (as received)		
Hydrogen (H_2)	0.01124	0.00560	0.01367
Helium (He)	0.00013	0.00008	0.00006
Nitrogen (N_2)	0.00454	0.00201	0.00476
Carbon Dioxide (CO_2)	0.45182	0.32813	0.44080
Hydrogen Sulfide (H_2S)	0.01640	0.00630	0.01360
Methane (C_1)	0.46535	0.62267	0.48456
Ethane (C_2)	0.01440	0.01207	0.01500
Propane (C_3)	0.00906	0.00683	0.00842
Isobutane (iC_4)	0.00396	0.00254	0.00305
n-Butane (nC_4)	0.00687	0.00439	0.00533
Isopentane (iC_5)	0.00643	0.00404	0.00479
n-Pentane ($nC5$)	0.00550	0.00318	0.00381
Hexanes (C_6)	0.00292	0.00149	0.00164
Heptanes (C_{7+})	0.00138	0.00067	0.00051
TOTAL	1.00000	1.00000	1.00000

Measurement, Accounting & Reporting Plan (MARP)

- The following changes to the Measurement, Accounting and Reporting Plan were included in the last submission:
  - Removed Pad 41wells (suspended)
  - Added the disposition of gas used as fuel at the Power Generation

Production Well Testing

- Each well is directed to a test vessel on the pad, except pad 19 sat 1,2,4 & 20
- Well test duration/frequency largely dependent on purge time & number of wells tied into each test separator:

Pad	Separator	Purge time*	Duration Jan-May →June-Oct	Frequency Jan-May →June-Oct
21	2 phase	~3-8 hrs	16 hours → 12 **hours**	2~3x/month → **2x/week**
19 sat 1-2-4 & 20	3 phase	~ 1 to 8 hrs	18 hours → **12 hours**	2~3x/month → **1~2x/week**
19 sat 3	2 phase	~0.5 hrs	24 hours → **6 hours**	3~4x/month → **3x/week**
30, 31	2 phase	~ 0.5 hrs	20 hours → **3 hours**	2~3x/month → **6x/week**
32, 33	2 phase	~ 0.5 hr	20 hours → **3 hours**	2~3x/month → **6x/week**

* Purge time varies for each test, as it is dependent on the production rate of the well. A pre-determined purge volume is applied to each vessel

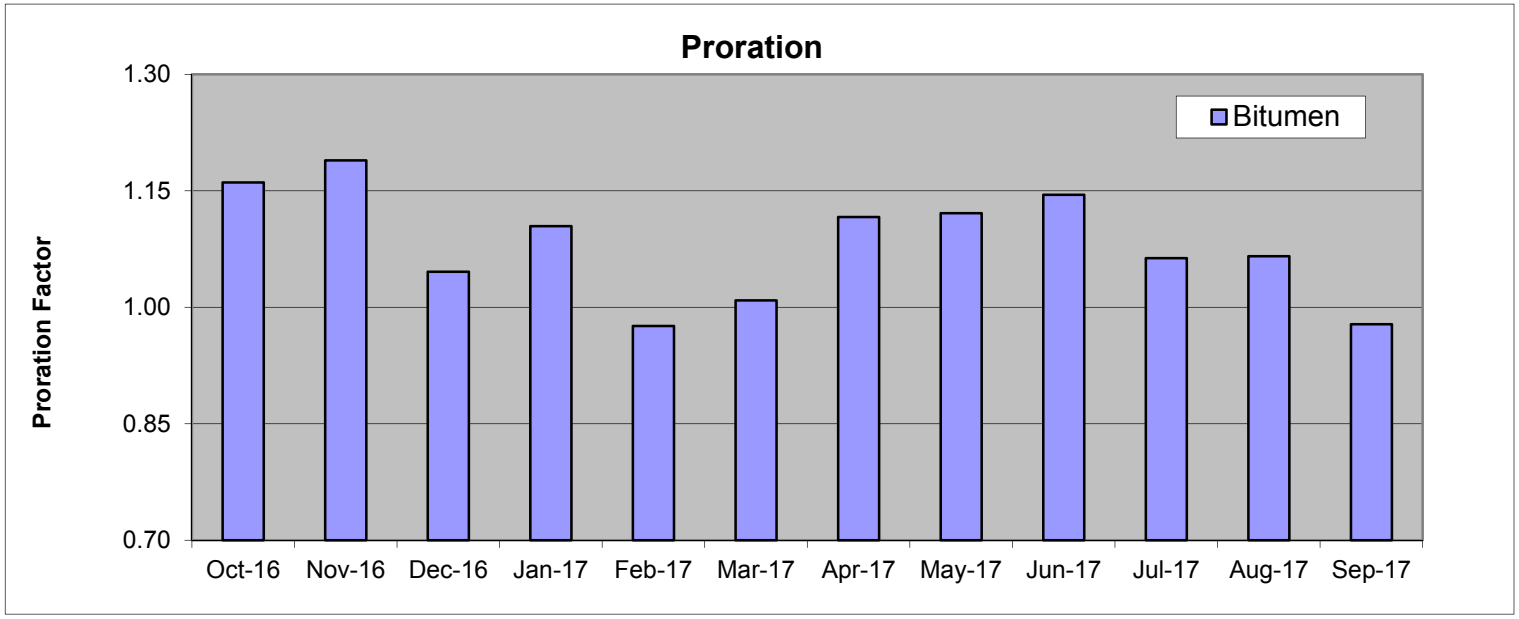
- Flow rates are measured by a Coriolis meter
- Water/bitumen cuts are determined by inline BS&W analyser
- Reported volumes are prorated based on measured total volumes at the plant
- Details of measurement and reporting procedures can be found in the Peace River MARP

Well Testing

- Year To Date Activities
  - Attempted to test flowback wells from CSS cycle (first time @ PRC)
  - More frequent AGAR calibration done by Operations (1/year → 1/month)
  - Implemented new logic for test volume calculation for each separator
  - Conducted investigation and go-forward plan on natural gas adaptation for pressure management on Pad 19's test separator
  - Detailed investigation on-going to identify testing deficiencies in all pads

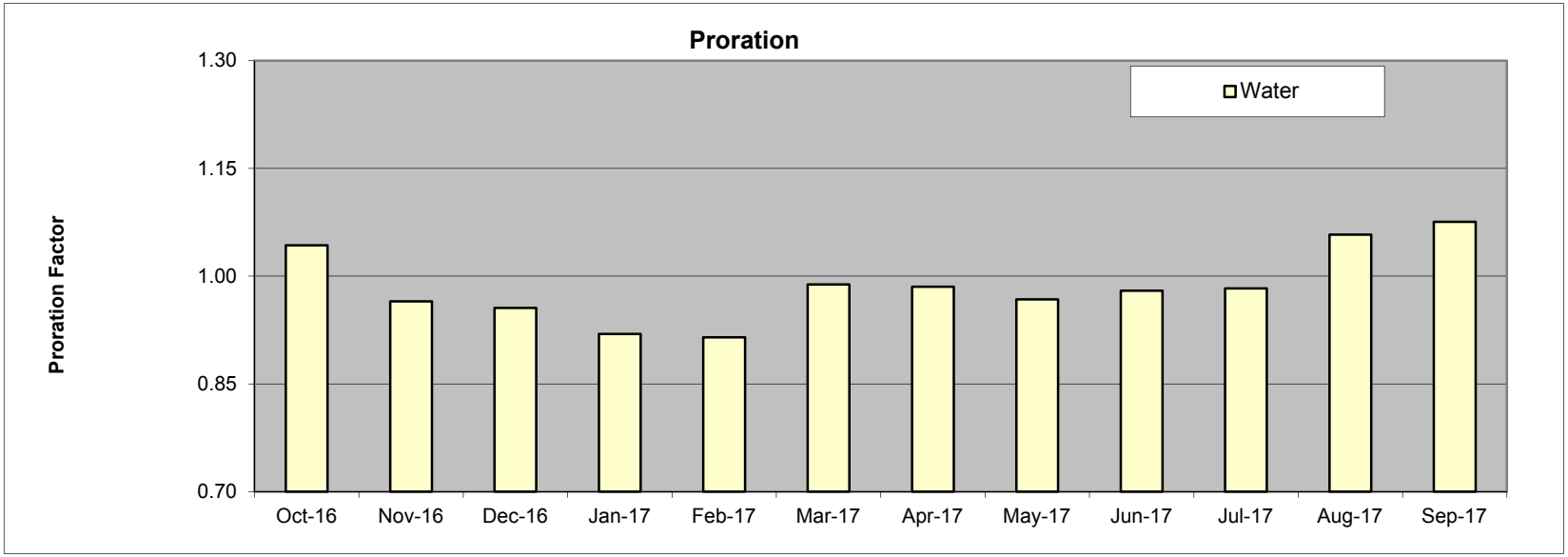
Bitumen Proration

Proration	Oct 2016 – Sep 2017 Range	Oct 2016 - Sep 2017 Average
Bitumen	0.98 – 1.19	1.08



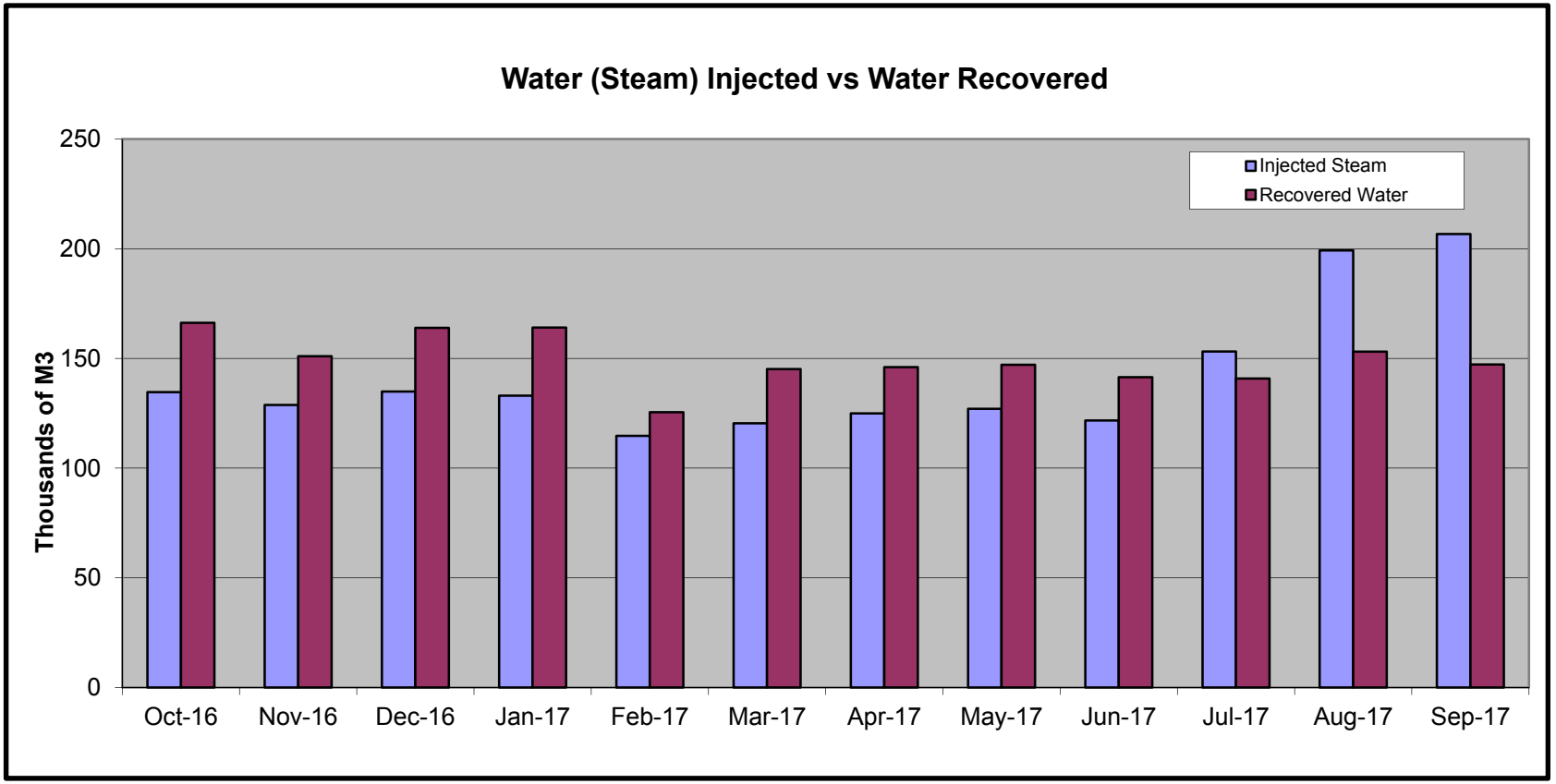
Water Proration

Proration	Oct 2016- Sep 2017 Range	Oct 2016- Sep 2017 Average
Water	0.91 – 1.08	0.99



Implemented the steam volumes used for winterization and test separator pressure into the water recycle calculation to correct the produced water volume.

Steam Injected & Produced Water



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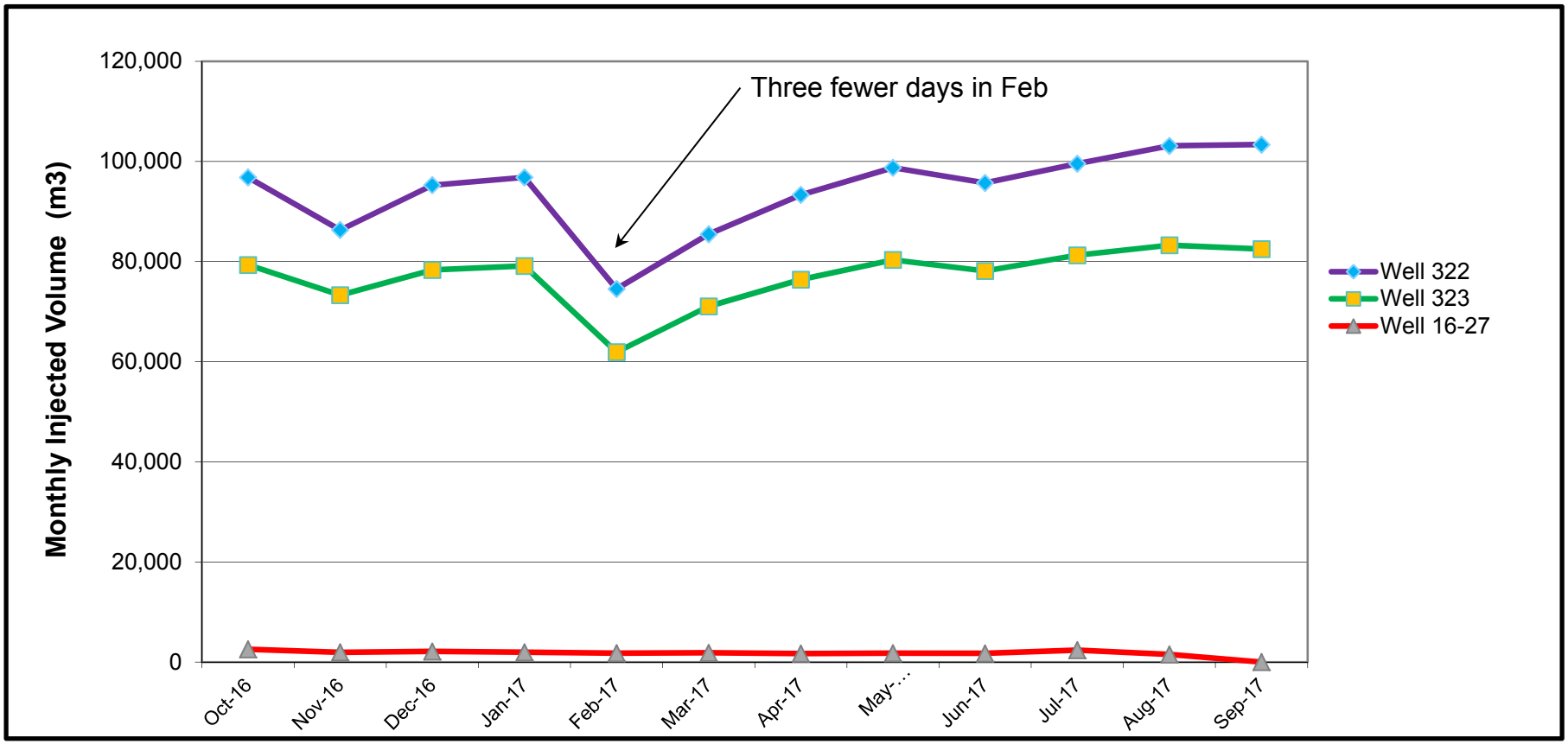
Water Disposal

- Brine Water Disposal Well (100/16-27-85-19W5)
  - Disposed into the Leduc formation until July 2017
  - Used for boiler feed water softener regeneration waste
  - Average Disposal Volume/Day = 63.3 m^3/d
  - Average Upstream Pressure = 2,780 kPa
  - Max Wellhead Pressure = 3602 kPa
  - Typical Total Dissolved Solids (TDS) is 9000 g/m^3
  - Approval up to 4500 kPag wellhead injection pressure (as per approval no. 9953A)
- Ion Exchange Brine Disposal
  - Brine pipeline shut down due to integrity concerns Q2 2017
    - Based on pipeline risk assessment, no leaks detected
    - Pigged, dewatered and nitrogen purged
  - Brine from Ion Exchange regens now being co-disposed with produced water

Water Disposal

- Produced Water Disposal Well 322 (102/14-25-85-19W5)
  - Disposing into the Leduc formation
  - Used as produced water disposal well
  - Average Disposal Volume/Day = 3,093.2 m^3/d
  - Average Pressure = 5,952 kPa
  - Max Pressure = 6,352 kPa
  - Average Temperature = 64 ^oC
  - Typical Total Dissolved Solids (TDS) is 5300 g/m3
  - Approval up to 18,000 kPag (as per approval no. 6308)
- Produced Water Disposal Well 323 (102/16-23-85-19W5)
  - Disposing into the Leduc formation
  - Used as produced water disposal well
  - Average Disposal Volume/Day = 2,534.3 m^3/d
  - Average Pressure = 6,048 kPa
  - Max Pressure = 6,476 kPa
  - Average Temperature = 66 ^oC
  - Typical Total Dissolved Solids (TDS) is 5300 g/m3
  - Approval up to 18,000 kPag (as per approval no. 6308)

Water Disposal Monthly Volumes



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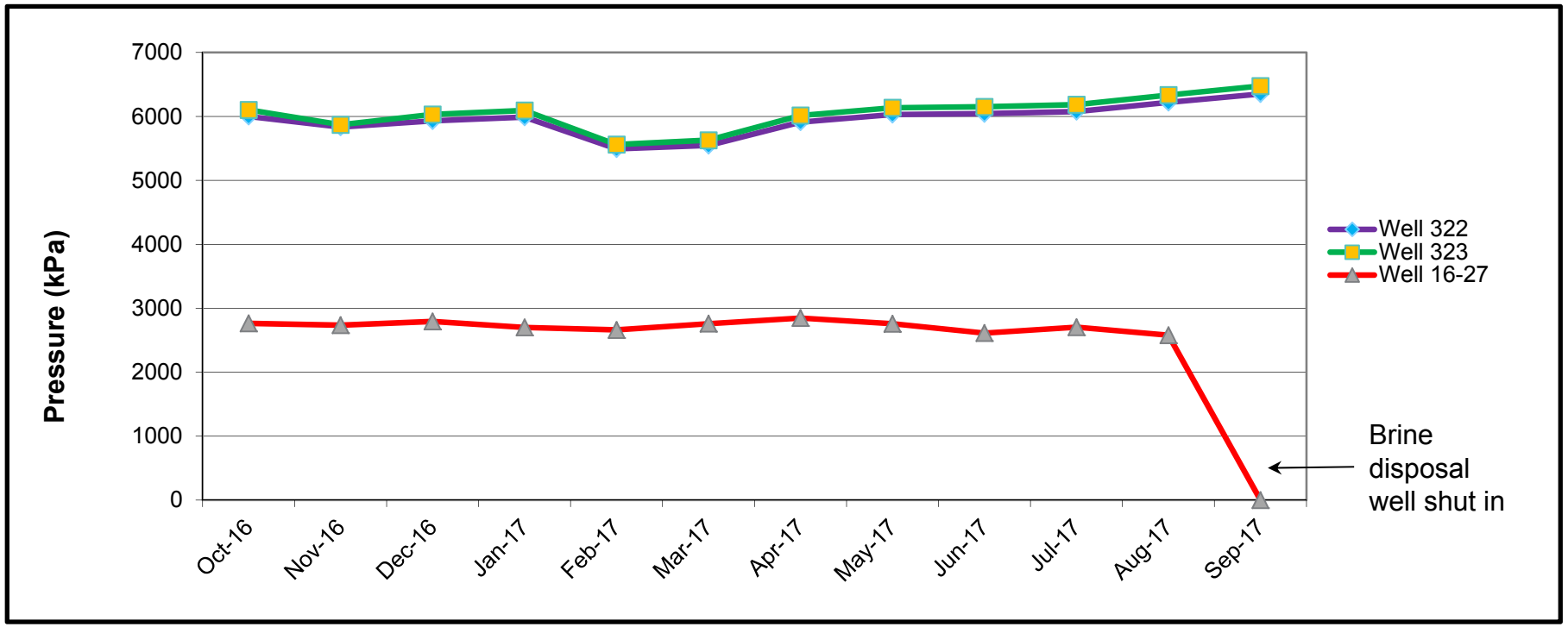
Water Disposal Max Monthly Injection Pressures



- 16-27 Brine Disposal well shut-in September 2017 due to pipeline integrity concerns

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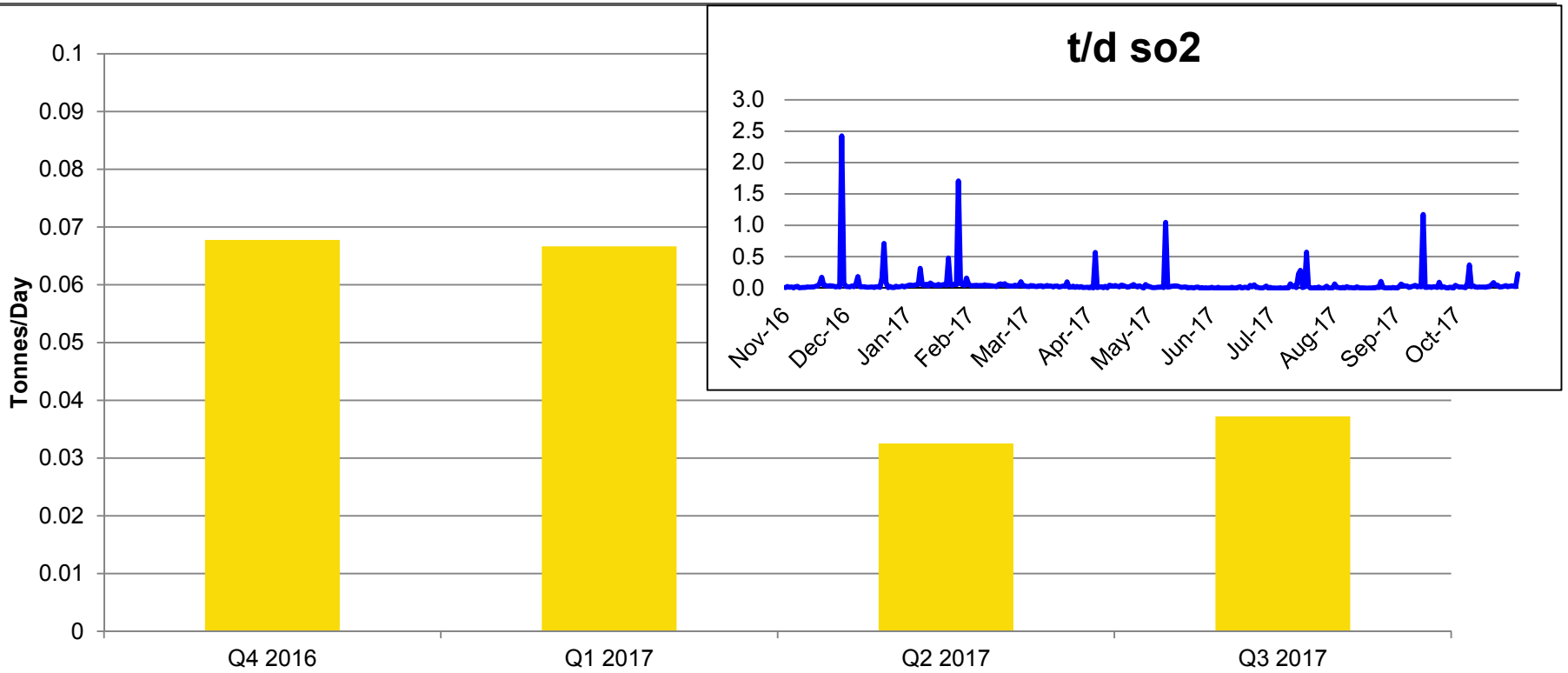
Waste Disposal

- Tervita Corporation– Peace River (12-24-85-19-W5)
  - –Treatment, Recovery & Disposal (TRD) Facility
  - –Primarily hydrocarbon sludge
  - –5,181 m^3 to October 2017

Sulphur Emissions(< 1T/Day)



New AER Operating License has 0.99 T/Day continuous SO2 Sulphur emissions have reduced since 2010 due to PRC produced gas injection into Three Creeks.

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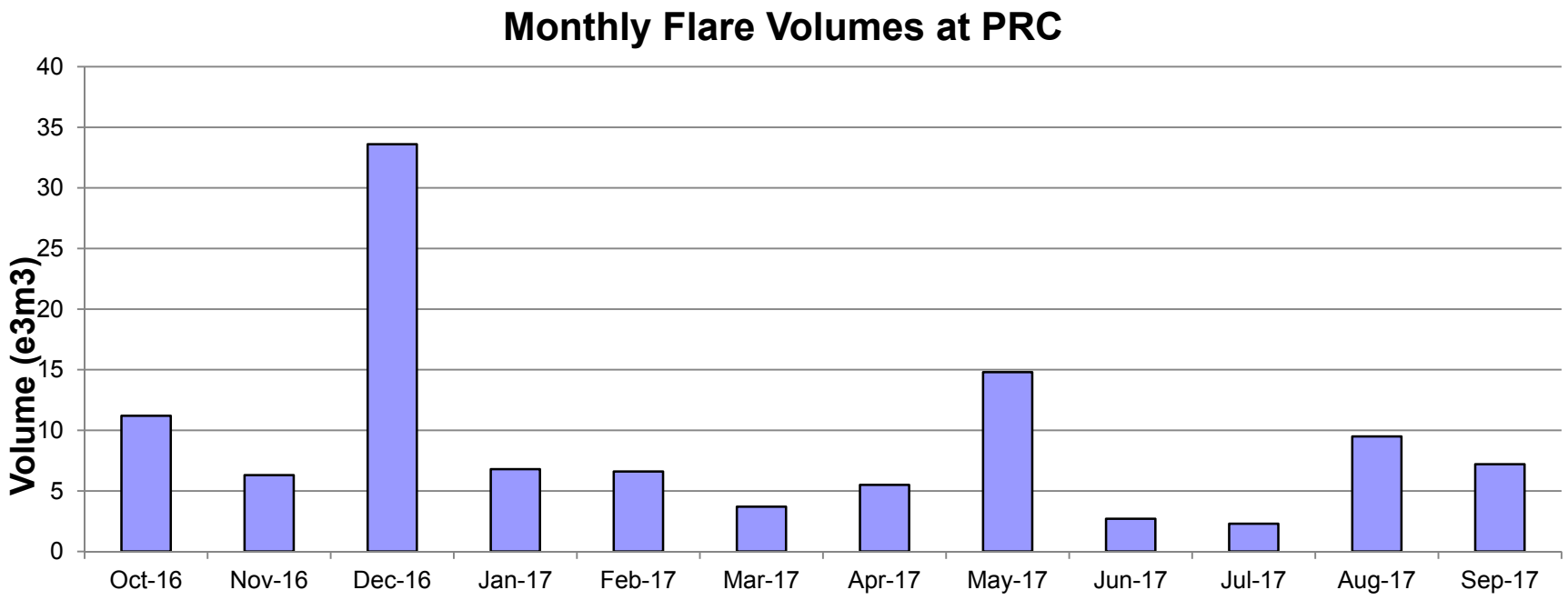
Greenhouse Gas Emissions

- Peace River Complex Greenhouse Gas Emissions
  - November 2017 data is estimated
  - Power Generation totals from onsite generators

Month	Nov 2016-Nov 2017 Total (tCO_2e)	PRC Plant	Power Generation
November	22,000	22,000	0
December	24,400	24,400	0
January	24,200	23,300	900
February	21,600	20,600	1,000
March	23,100	22,000	1,100
April	22,700	21,500	1,200
May	23,200	21,900	1,300
June	22,000	20,700	1,300
July	26,800	25,400	1,400
August	32,700	31,600	1,100
September	34,600	33,400	1,200
October	30,800	29,600	1,200
November*	32,700	31,500	1,200
13 Month Total	340,800	327,900	12,900

Flare Volumes



The high flare volume in December was a result of Blanket Gas Issues from Tank high levels and VRU's down.

Ambient Air Monitoring

- Static/Passive Air Monitoring
  - Twelve passive stations
  - Gathers data on sulphur dioxide and hydrogen sulphide
  - 2017 monitoring and reporting satisfactory

- Continuous Ambient Monitoring data
  - Continuous Monitoring - Monitored parameters: sulphur dioxide, hydrogen sulphide, methane, non-methane hydrocarbons, total hydrocarbons, total reduced sulphur, ambient temperature, wind speed and direction.

Environmental Compliance

- There were no Ambient Air Exceedances at the PRC Environmental Trailer (EPEA Approval 1642-02-10) from October 2016-October 2017. The air trailer maintained over 90% uptime each month as per license requirements.
- Reportable spills and releases at PRC
  - October 2017 there was a casing failure on pad 32-01 during a steam cycle
    - Approximately 28.08 m^3 of kill fluid was used to stop the release.
  - 1 release to atmosphere from tanks (venting) occurred between November 1 and December 31, 2016.
    - Total volume vented for this period was 0.0028 e^3m^3.
  - 1 release to atmosphere from tanks (venting) occurred between January 1 and October 31, 2017 2016.
    - Total volume vented for this period was 0.14 e^3m^3.
  - AER granted approval in fall to release sewage lagoon at elevated TSS levels (BOD was within limits) but lagoon has not been dumped yet
    - Currently evaluating options to manage discharge

Scheme Approval 8143

- Operations at Peace River are consistent with all conditions of Thermal Scheme No. 8143
- Amendments to Scheme Approval no. 8143 received in previous 12 months are provided below.

Amendment	Approval Date	Description
CC	May 30, 2017	Approval Transfer
DD	June 29, 2017	SAGD Pilot

EPEA Approval 1642-02-10

- EPEA Operating Approval Amendments between October 2016-October 2017:
  - 1642-02-09: Removal of three natural gas turbines from approval
  - 1642-02-10: Transfer of Approval

Environmental: Monitoring Program Summary

- Groundwater Program
  - Per EPEA 1642-02-08, PRC has requirements for both groundwater and deep well water testing. Testing and reporting are both required on an annual basis.
  - Testing was completed in October 2017.
  - Results will be reported in the 2017 annual report.

- Soil Monitoring Program
  - Testing was completed in November 2017.
  - Results to be reported in 2017 annual report.

Environmental: Monitoring Program Summary

- Shallow groundwater monitoring program:
  - Groundwater testing occurred in October 2017 on plant piezometers.
  - Results of the GWMP will be summarized in the 2017 Groundwater Monitoring Program Peace River Complex Project Report and submitted in March 2018.
  - Continued groundwater monitoring per EPEA approval.

- Shallow groundwater wells around reclaimed PSDS (Produced Solids Disposal Site):
  - PSDS has been reclaimed and well Pad 32 was built on the location.
  - Piezometers remain around perimeter of well pad
  - No impacts observed in these wells with little variation at a majority of the monitoring locations.
  - Results of the GWMP will be summarized in the 2017 Groundwater Monitoring Program Peace River Complex Project Report and submitted in March 2018.
  - Recommendations were made in the 2016 EPEA GWMP report to discontinue the PSDS monitoring program in 2016. AER was notified of the change.

Environmental: Monitoring Program Summary

- Deep Regional Wells
  - 2004 drilling program (50 and 105 meter depth)
  - 2005 drilling program (70 meter depth)
  - 2009 drilling program (3 wells (each approximately 60, 120 and 270 meters deep)
  - Results of the deep regional well GWMP will be summarized in the 2017 Groundwater Monitoring Program Peace River Complex Project Report (Matrix, 2017) and submitted to AER in March 2018.
  - Continued groundwater monitoring per EPEA approval.

Environmental Studies Program

- Wildlife crossing structures monitored on aboveground pipelines.
  - This data will continue to be assessed and incorporated into the Comprehensive Wildlife Report. The next report is due in 2018.
- Multiple wildlife studies including bird surveys, winter mammal tracking, owl surveys, bat surveys, and amphibian surveys completed in 2015-2017.
- All wildlife data for these surveys is uploaded into the Fish & Wildlife Management Information System (FWMIS) and incorporated into the Comprehensive Wildlife Reports
- eDNA partnered with the Alberta Conservation Association (ACA) on a 3-year amphibian study beginning in 2014 and concluding in 2016.
- Ongoing peatland reclamation research with NAIT Boreal Research Institute.

Environmental Studies Program

EPEA Requirement	Report Name	Due Date	Status
CCP - Schedule VI (1)	Groundwater Monitoring Program (GWMP)	March 31, 2014	Submitted to Alberta Energy regulator (AER) on March 31, 2014; received written authorization from the Director on March 5, 2015.
CCP - Schedule VIII (4) & (9)	Wildlife Monitoring and Mitigation Program (WMMP) Proposal	March 31, 2014	Submitted to ESRD on March 19, 2014 and resubmitted to AER on May 26, 2015. received written authorization from the Director on March 5, 2015. Second Comprehensive Wildlife Report will be submitted before May 15, 2018.
CCP - Schedule XI (1)	Wetland Monitoring Program (WMP) Proposal	December 31, 2014	Request to suspend review of Wetland Monitoring Program Proposal approved on January 12. 2017. A revised Wetland Monitoring Program Proposal will be submitted. The existing wetland monitoring program continues to be conducted.
CCP - Schedule IX (39)	Wetland Reclamation Trial Program Proposal	December 31, 2016	Submitted to AER on December 21, 2016 - AER written authorization received on January 12, 2016. The wetland reclamation trial is being conducted by NAIT Boreal Research Institute at the Airstrip
CCP - Schedule IX (44)	Reclamation Monitoring Program (RMP) Proposal	December 31, 2016	Submitted to AER on January 26, 2017 - AER written authorization received on February 10, 2017
CCP - Schedule XI (26)	Project-Level, Conservation, Reclamation and Closure Plan (PLCRCP)	October 31, 2017	In February 2016, the AER has issued new guidelines to the preparation of the PLCRCP. The due date has been amended to October 31, 2018 [E-File No. 4101-00001642-07].

Reclamation Summary

Shell acquisition inventory: June 1, 2017

- Reclamation activities in 2017:
  - Re-vegetation Program consisted of reforesting 8.17 hectares
  - Approximately 19,400 trees were planted
    - 5 wellsites/2 borrow pits and associated access roads
  - Vegetation assessment and management completed on 28 sites
    - 18 sites – 30.3 hectares – weed control conducted
  - Evaluation of 7 sites for planning full surface reclamation
  - Detailed site assessments (DSA) completed on 4 sites – 3.64 hectares

- Proposed activities in 2018:
  - Reclamation certification application submitted for 5 sites – 4.44 hectares
  - Inventory continues to be evaluated for 2018 budget
    - Vegetation assessment, monitoring and control, tree planting, DSA, Reclamation applications to continue

Environmental Research led by NAIT

- Peatland Restoration
  - Funding is supporting peatland research around the Peace River area (IPAD, pad removal and restoration study, wetland reclamation project at Airstrip and a third project in around the Carmon Creek area that is looking at impacts of linear disturbances on wetland function (carbon, plants etc.)
- Forest Reclamation
  - Airstrip Research: field deployment and monitoring of mixed species container stock (hitchhiker planting), utilization of organic amendments on reclaimed sites, riparian area species selection and timing of plant deployment and integrated approaches (site preparation and native cover crops) to manage undesirable plants on reclaimed sites. Ongoing monitoring.

Future Plans

- Facility modifications to accomplish revised reservoir strategy
- Steam water specification to be developed to coincide with reservoir strategy
- Water treatment options being considered that will align with both the asset development strategy and steam water specification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