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KIRBY IN SITU OIL SANDS PROJECT
DIRECTIVE 54 ANNUAL PERFORMANCE PRESENTATION

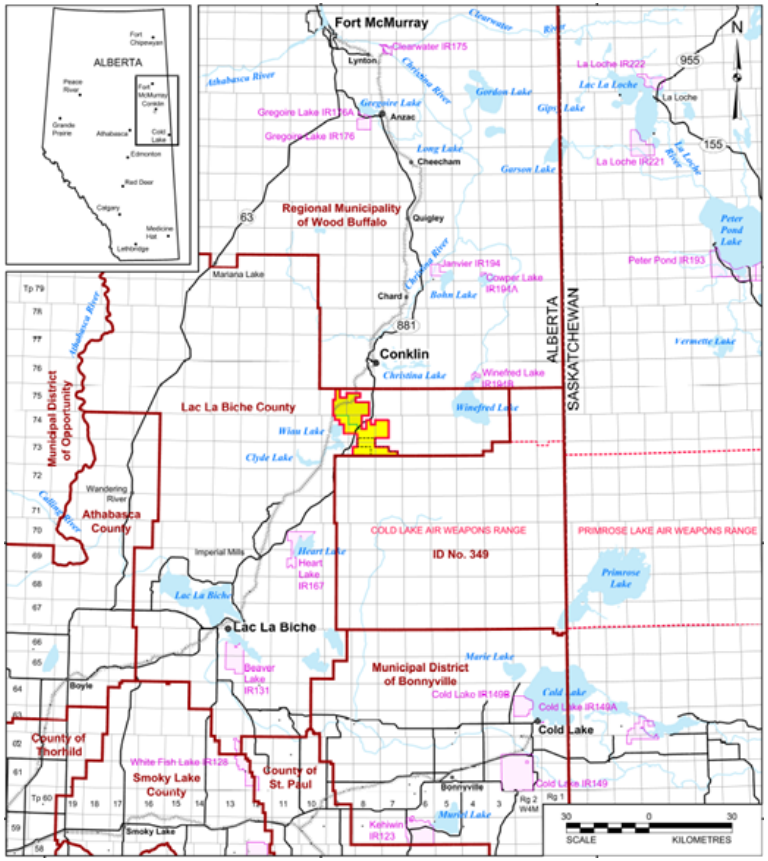
September 2017

PREMIUM VALUE. DEFINED GROWTH. INDEPENDENT.

Outline – Subsurface

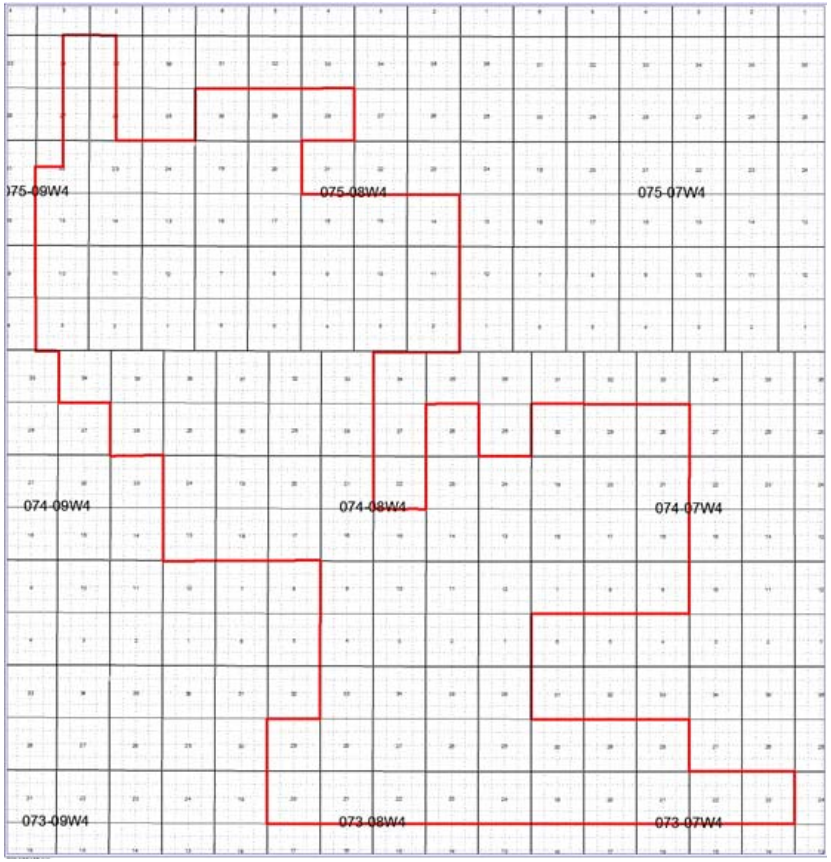
Outline – Surface

Background
Location of Kirby Project



Approved Project Area

Background
Scheme Approval 11475 Project Area



- Recovery Process: Steam Assisted Gravity Drainage (SAGD)

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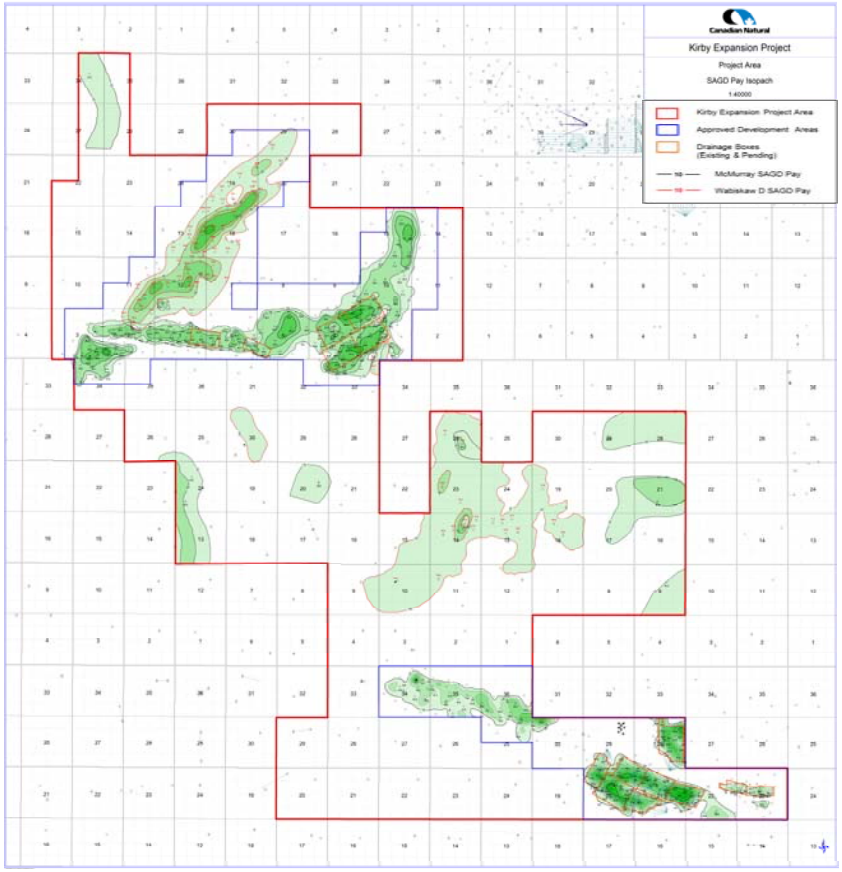
DIRECTIVE 54 SECTION 3.1.1
SUBSURFACE ISSUES RELATED TO RESOURCE EVALUATION AND RECOVERY

Geology
Project Area SAGD Pay Isopach



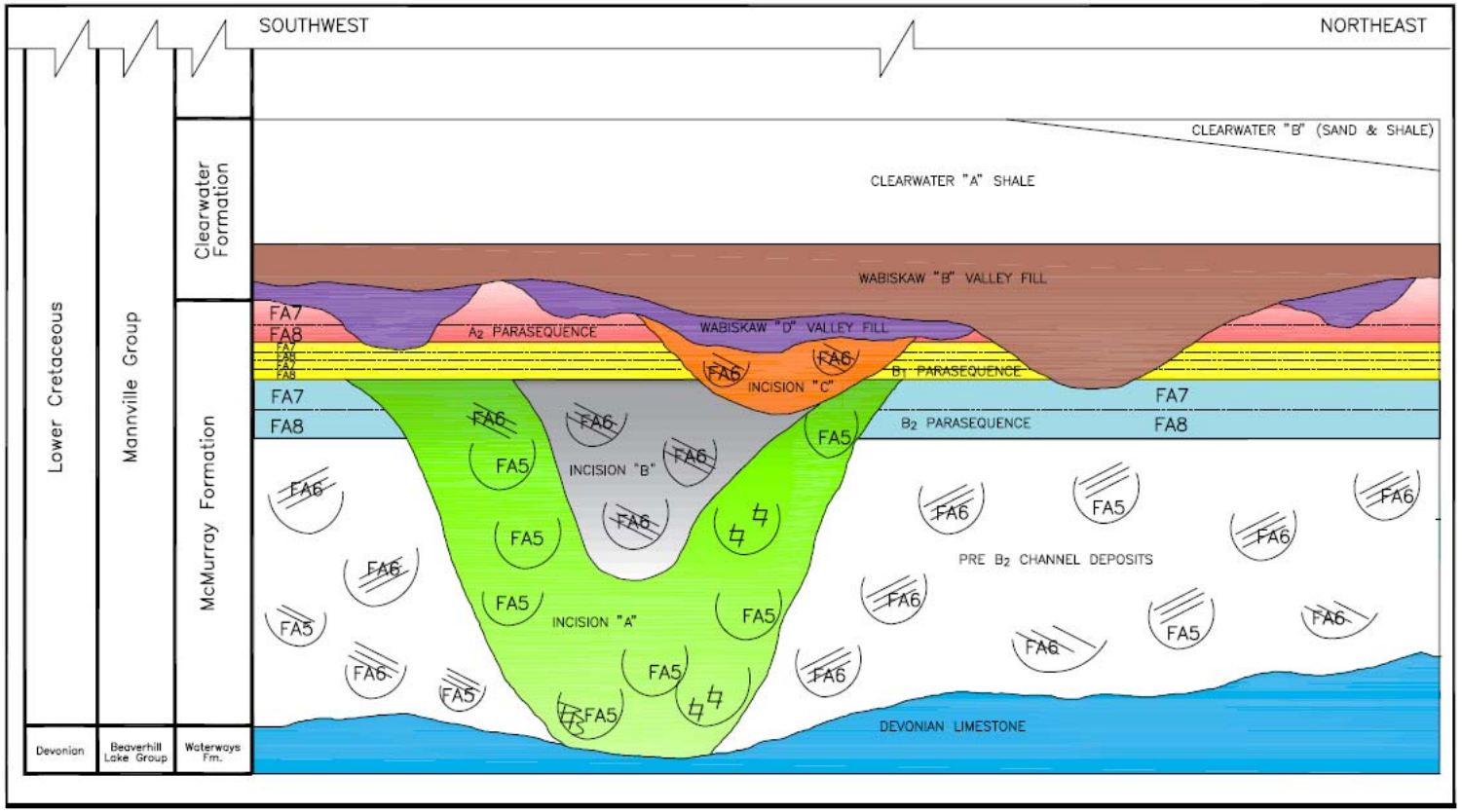
Geology
Project Area Volumetrics

	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (e^3m^3)
Kirby Approved Project Area	14.6	78.6	32.8	275,515

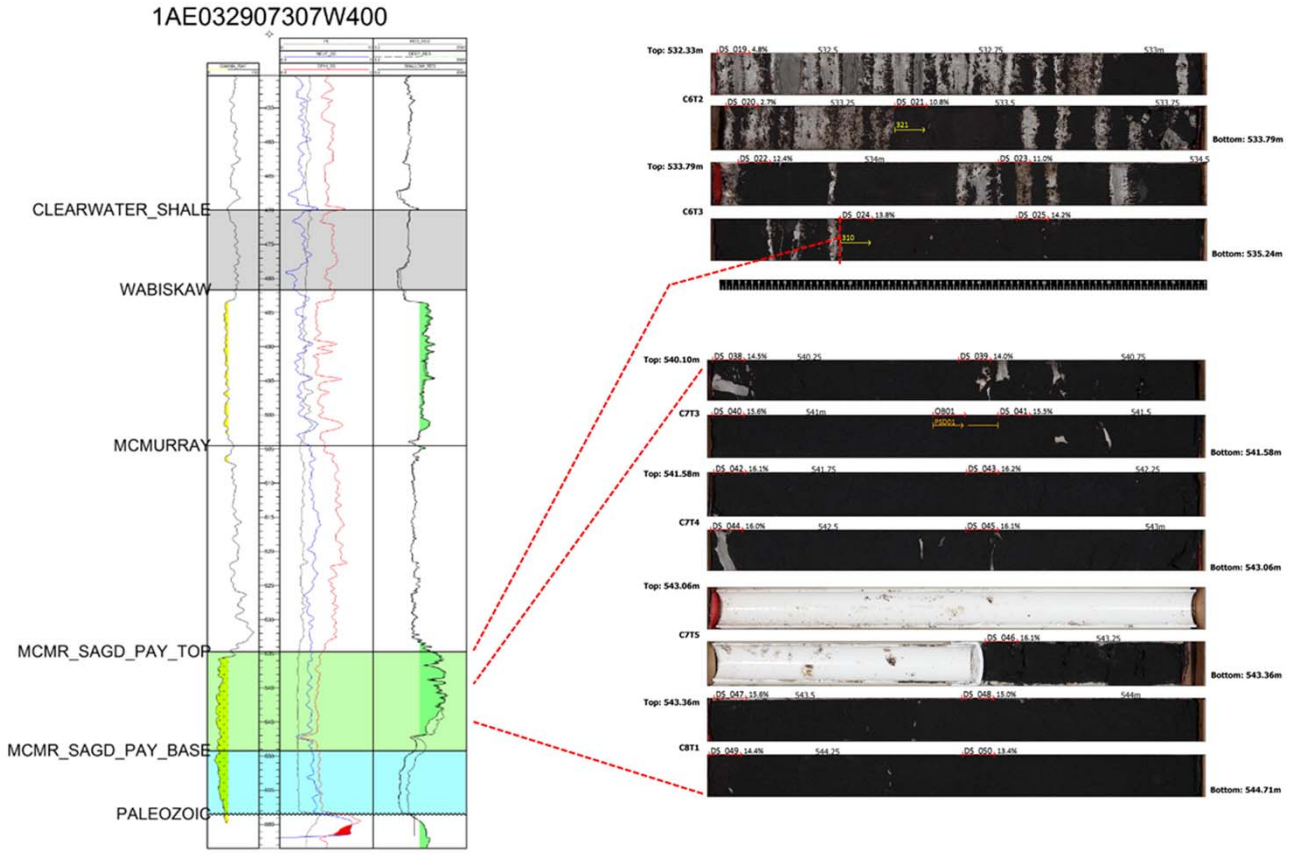
OBIP = Original Bitumen In Place

Volumetric calculation = Area within 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

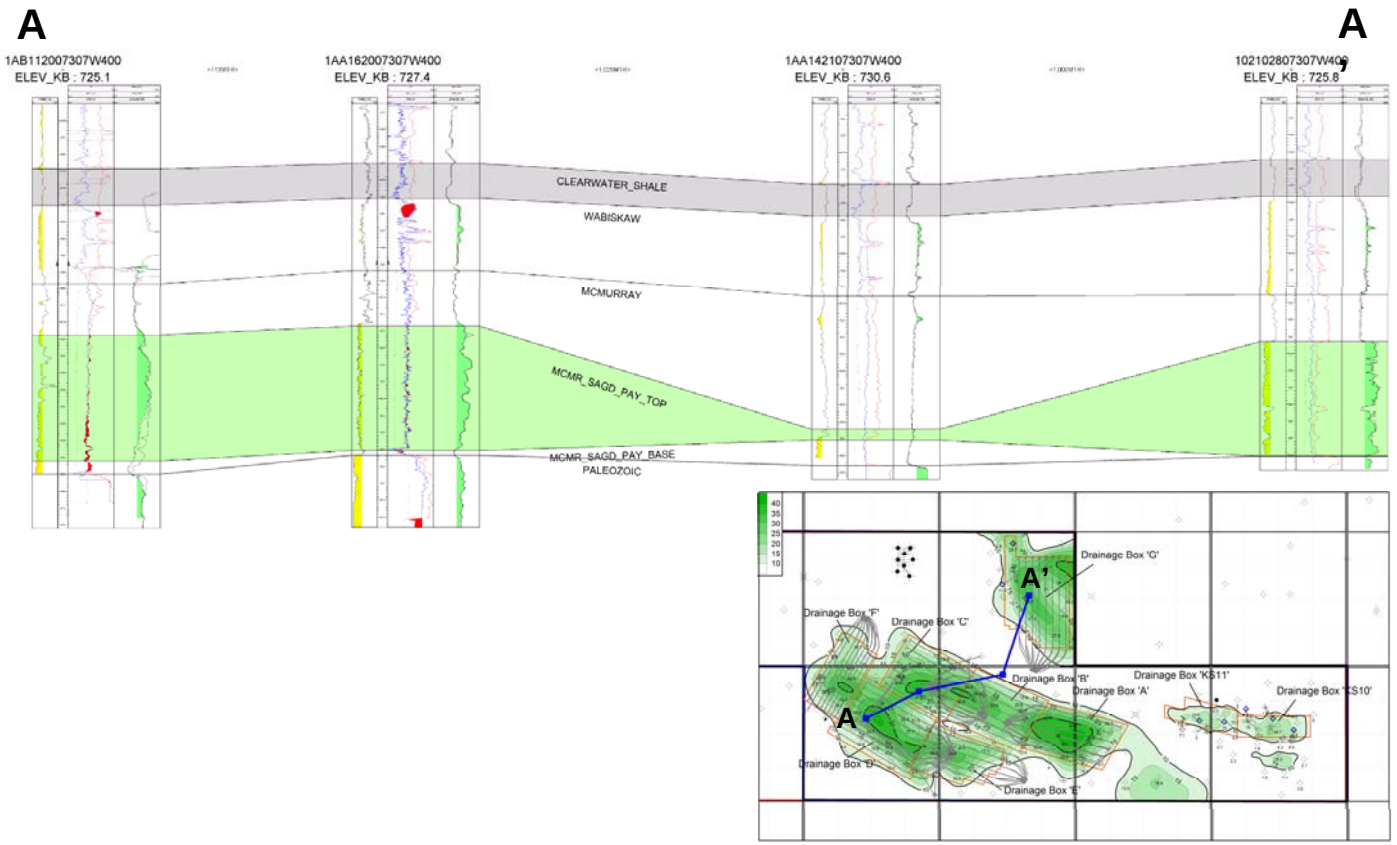
Geology
Stratigraphic Schematic



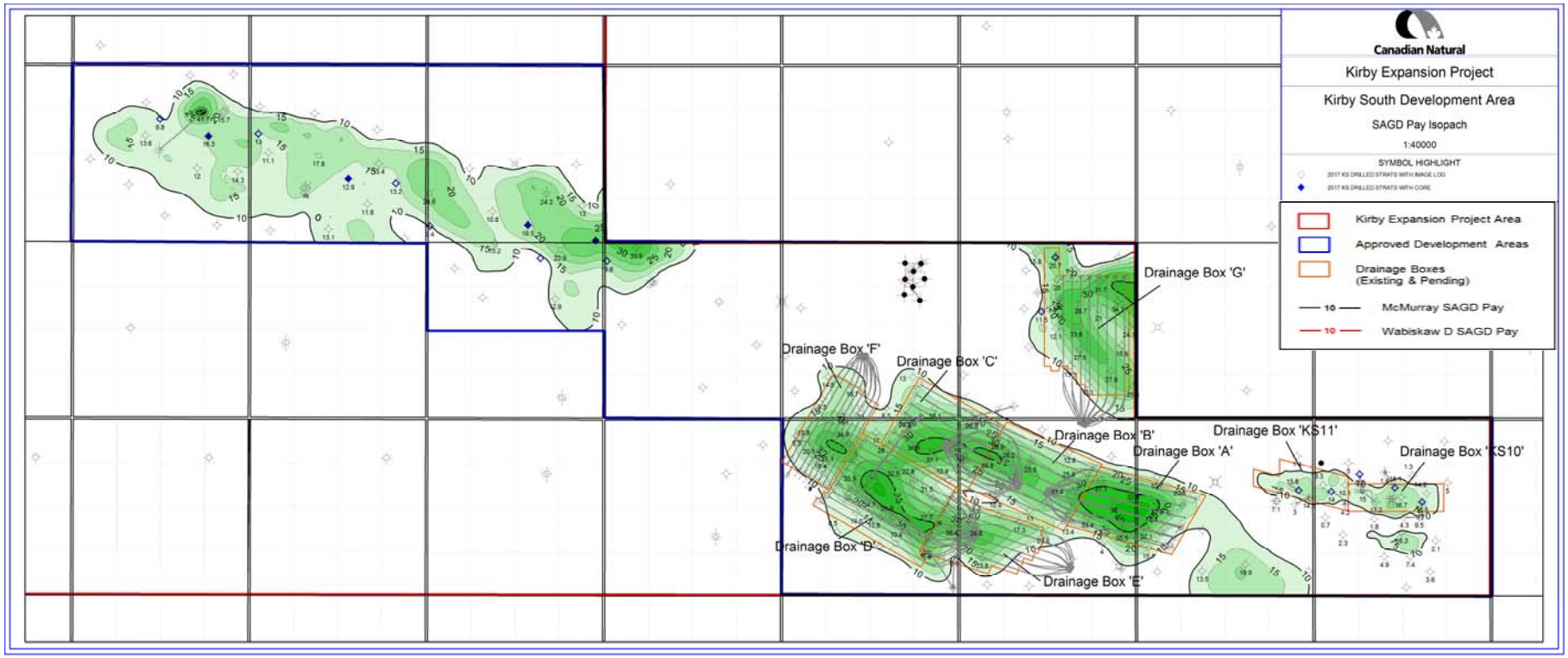
Geology
Kirby South Type Log



Geology
Kirby South Structural Cross-Section

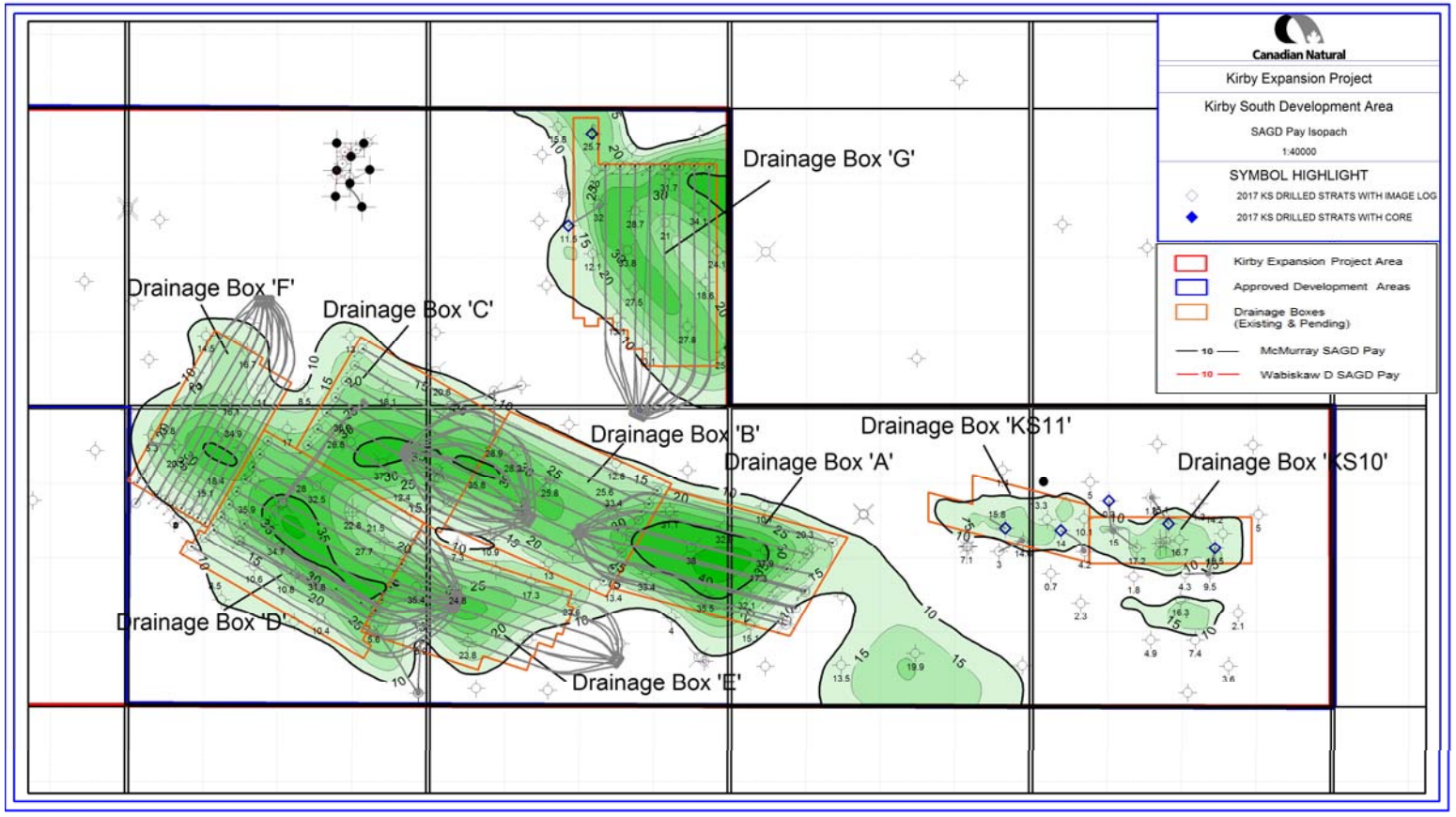


Geology
Kirby South Development Area



- Recovery Process: Steam Assisted Gravity Drainage (SAGD)

Geology
Kirby South SAGD Pay Isopach



Geology
Kirby South Development Area Volumetrics

	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (e^3m^3)
Kirby South Approved Development Area	19.7	76.6	33.5	54,000

OBIP = Original Bitumen In Place

Volumetric calculation = Area within 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

Geology
Kirby South Drainage Area Volumetrics

Drainage Area	Area (m^2)	Oil Saturation (%)	Porosity (%)	Pay Thickness (m)	DBIP (e^3m^3)
A	600,017	67.9	33.3	28.9	3,920
B	669,345	75.4	32.8	23.4	3,880
C	629,989	78.3	33.4	25.4	4,180
D	809,000	79.5	33.3	26.3	5,610
E	502,828	75.5	34.2	23.1	3,000
F	462,018	77.6	33.3	21.0	2,510
G	790,445	82.9	33.2	23.9	5,200

DBIP = Developable Bitumen In Place

Volumetric calculation = Area within drainage box boundary and 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

Geology
Average Reservoir Properties

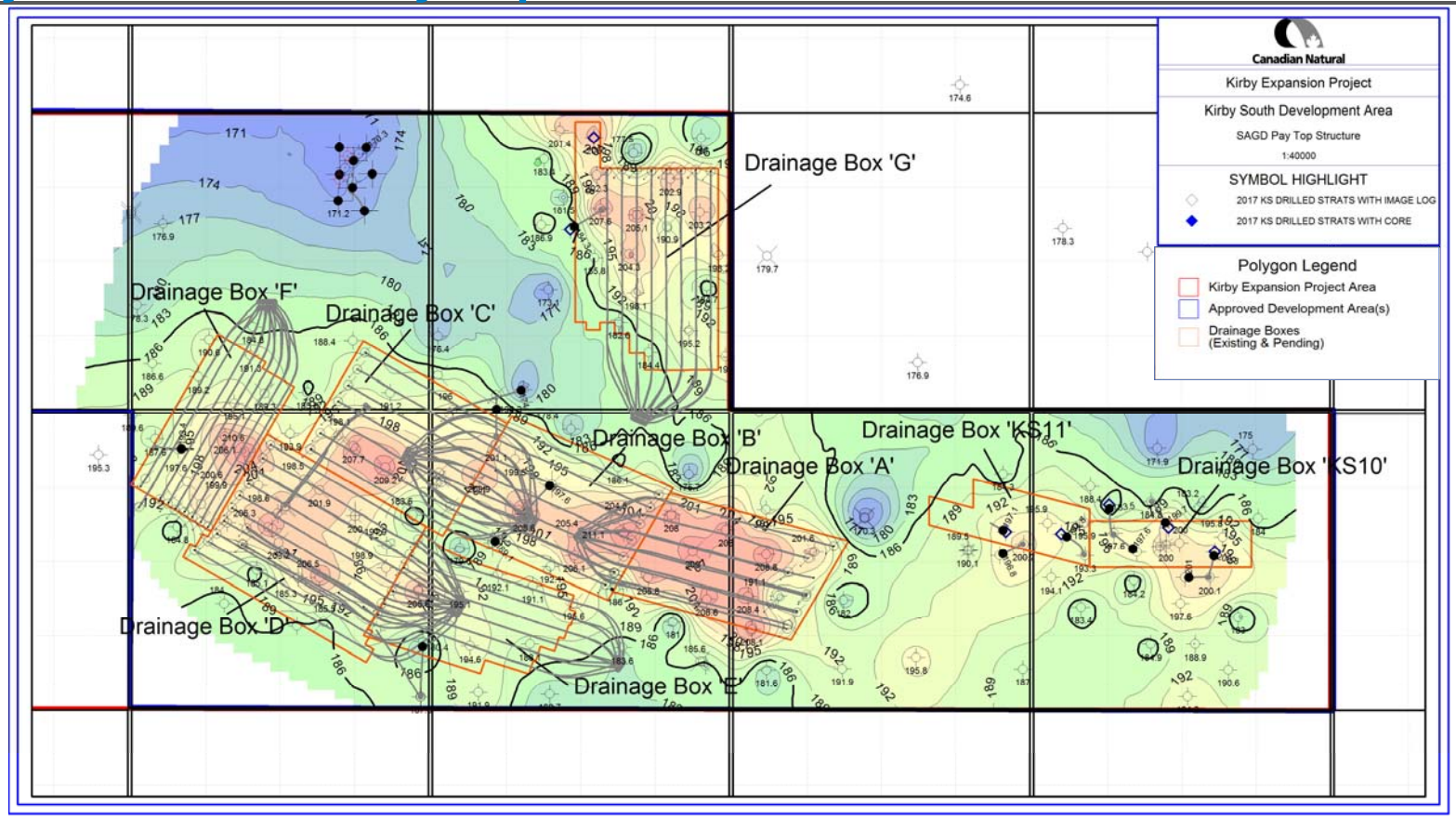
	Initial Reservoir Pressure (kPa)	Initial Bottom Water Pressure (kPa)	Initial Reservoir Temperature (°C)	Average Depth of Reservoir, McMR SAGD Pay Top (mTVD)	Average Pay Thickness (m)	Average Porosity, Φ (%)
Kirby South Operating Area	~2600	~2550	13	530	21.9	33.2
Kirby Approved Project Area	~2600	~2550	13	490	14.8	32.7

	Average Oil Saturation (%)	Average Water Saturation (%)	Average Horizontal Permeability from OB plugs, Kh (mD)	Average Vertical Permeability from OB plugs, Kv (mD)	Kv/Kh Ratio
Kirby South Operating Area	74.8	25.2	6410	5260	0.82
Kirby Approved Project Area	78.4	21.6	6560	5510	0.84

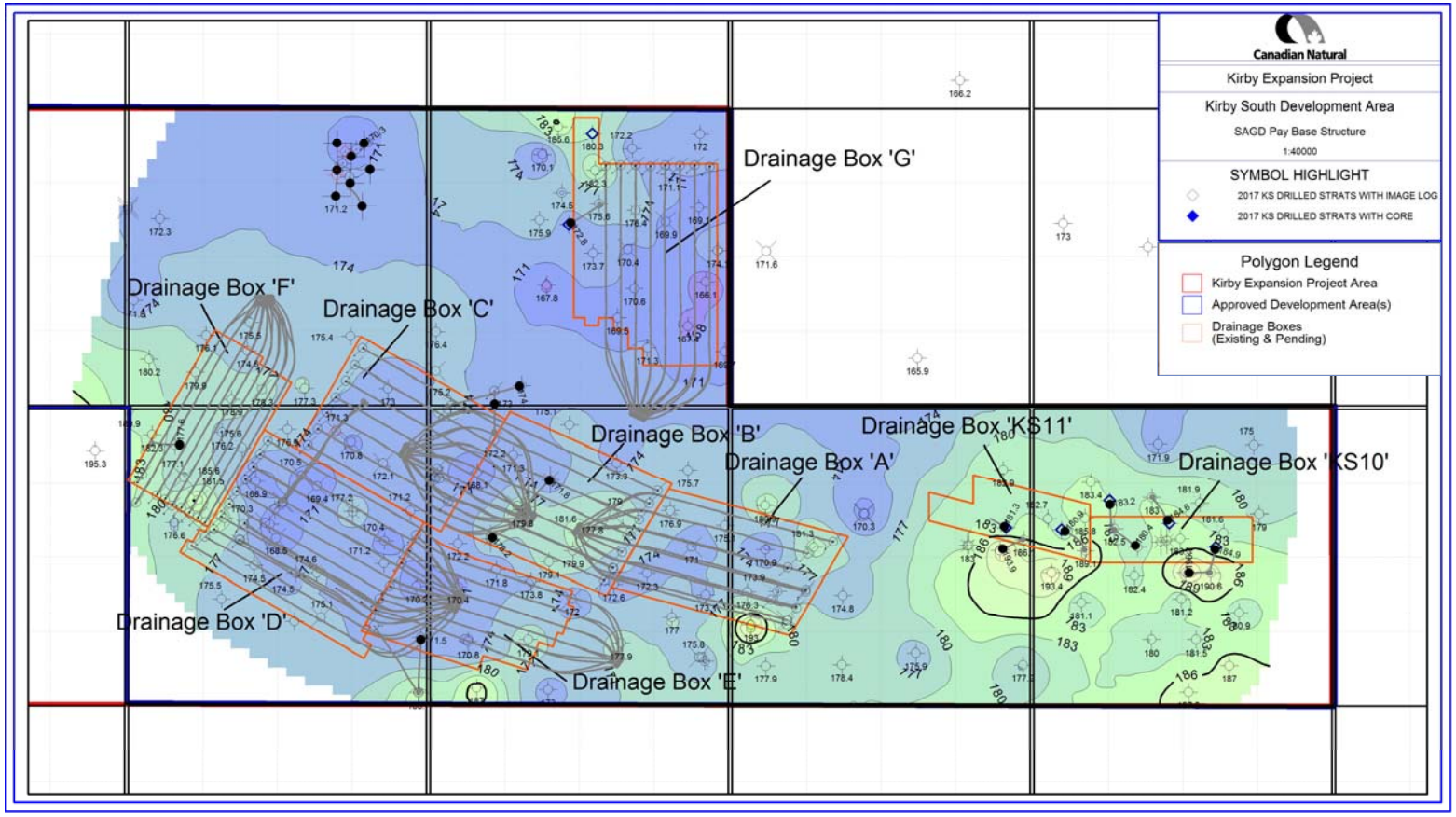
Geology
Kirby South 2017 Special Core Analysis

- No special core analysis performed on Kirby South cores in 2017

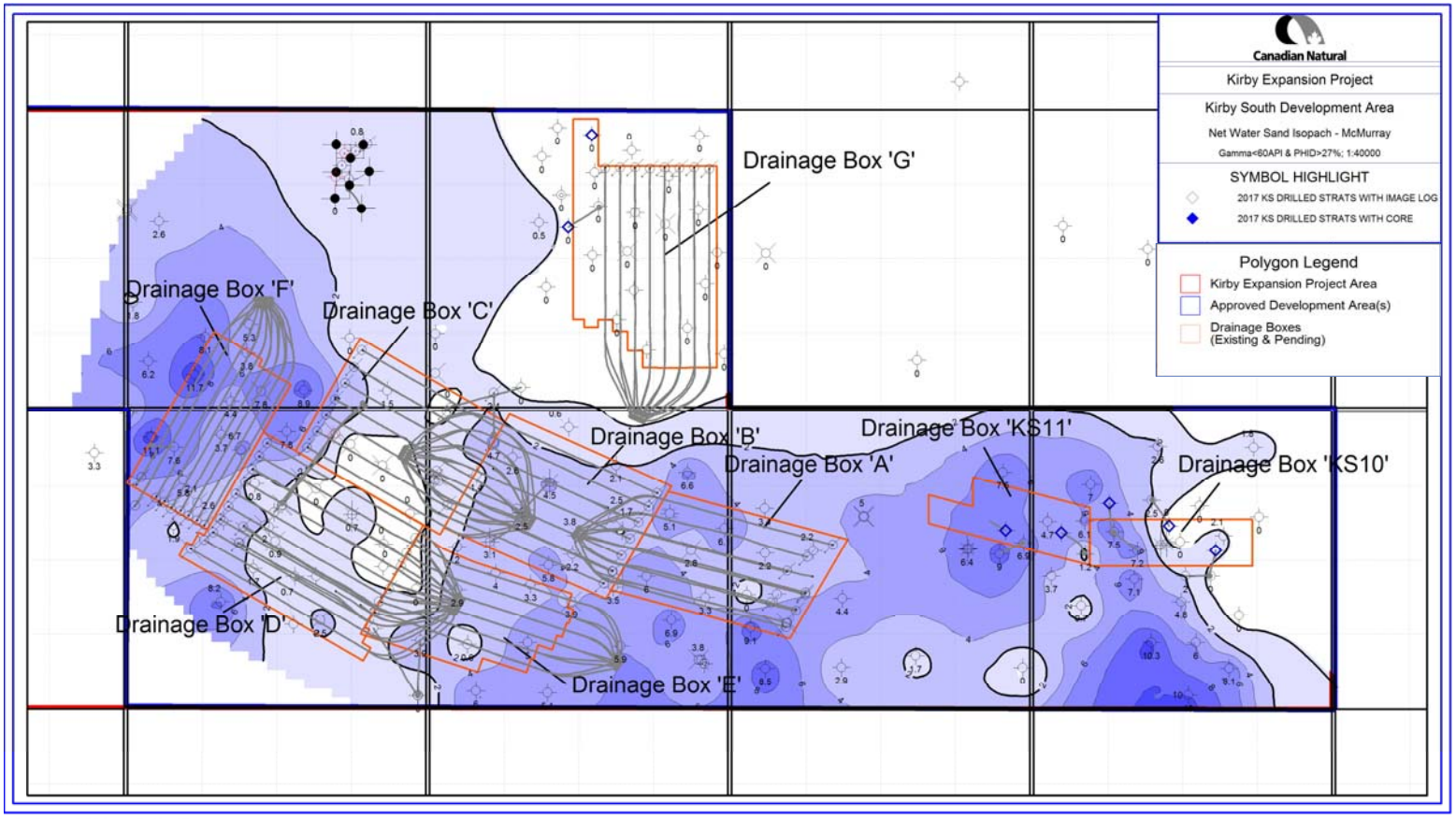
Geology
Kirby South SAGD Pay Top Structure



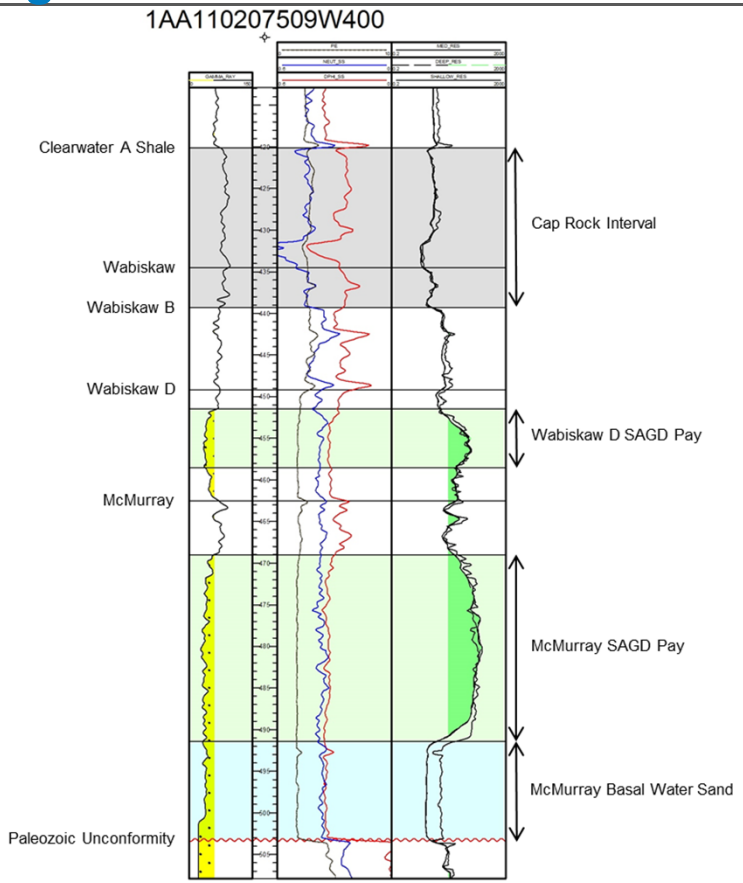
Geology
Kirby South SAGD Pay Base Structure



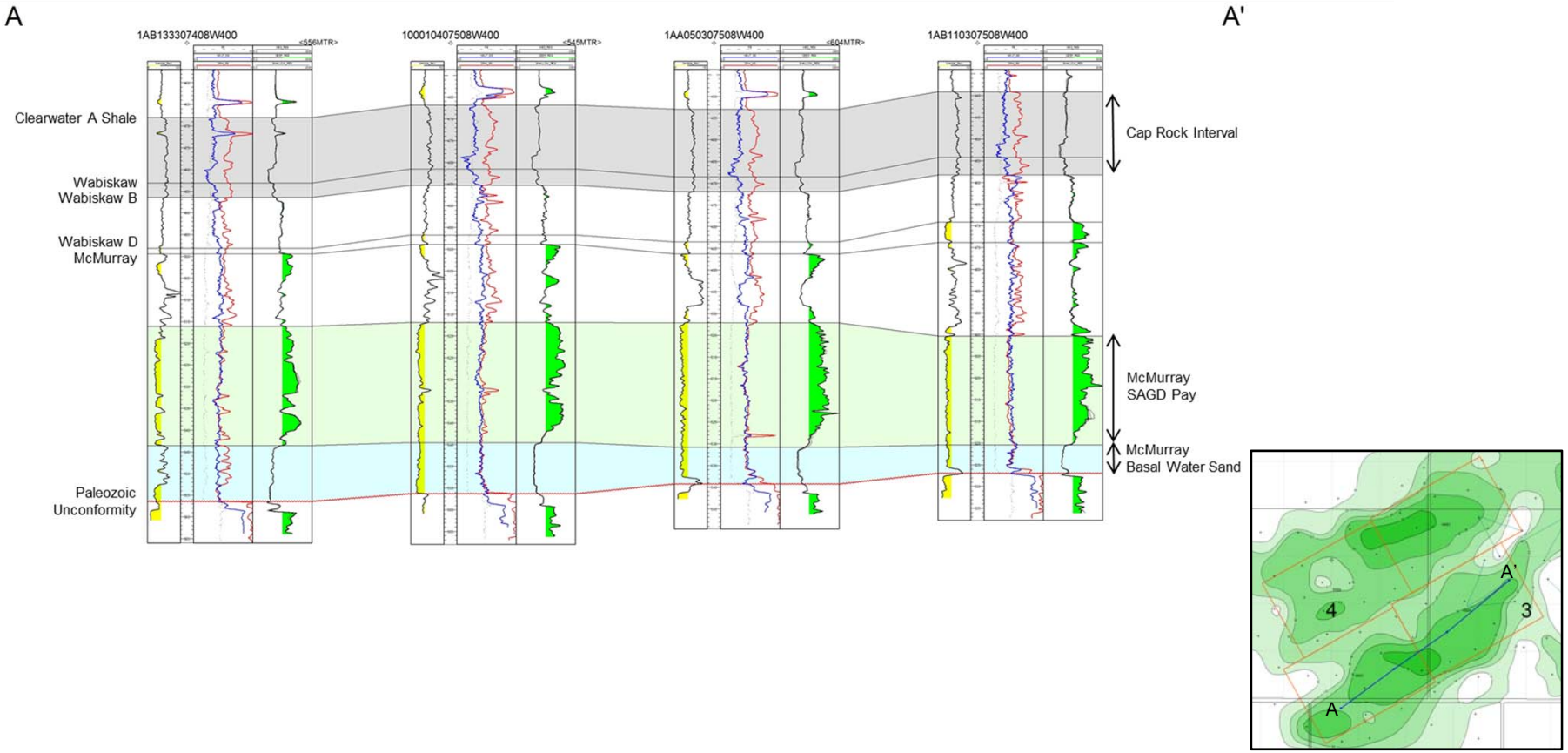
Geology
Kirby South Net Water Sand Isopach



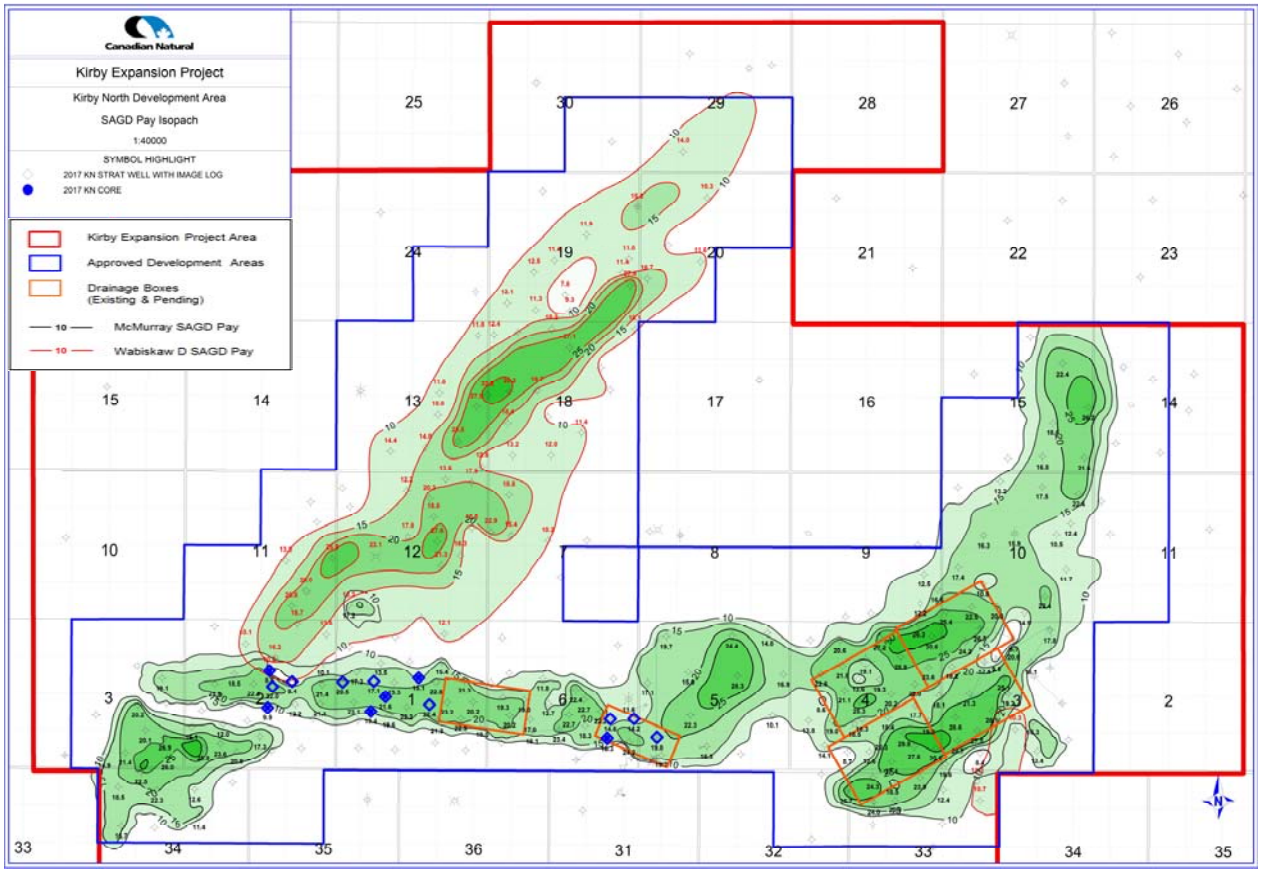
Geology
Kirby North Type Log



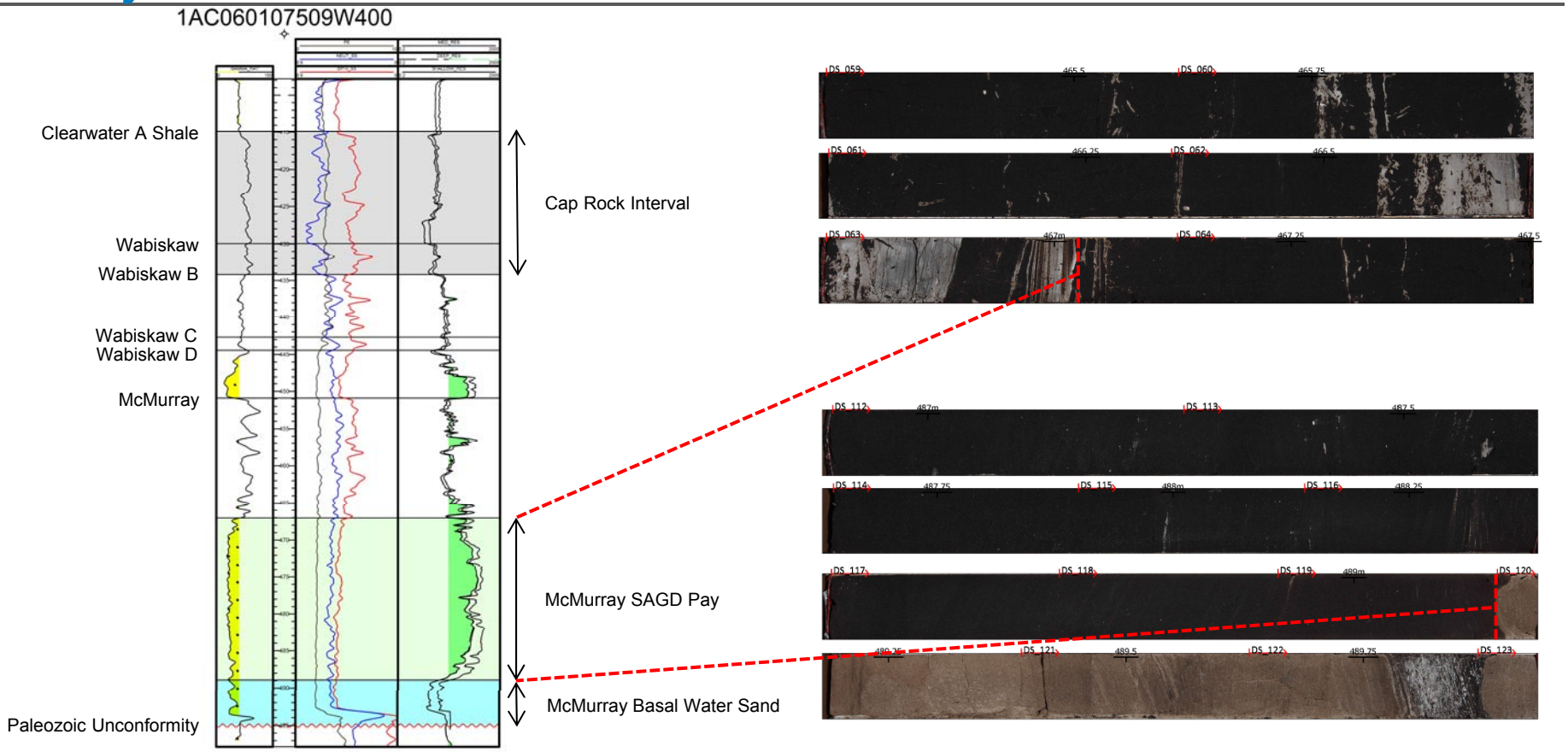
Geology
Kirby North Structural Cross Section



Geology
Kirby North SAGD Pay Isopach



Geology
Kirby North 2017 Core Photos



Geology
Kirby North 2017 Special Core Analysis

- No special core analysis performed on Kirby North cores in 2017

Geology
Kirby North Development Area Volumetrics

	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (e^3m^3)
Wabiskaw D Reservoir	**15.6**	**77.5**	**32.8**	**43,691**
McMurray Reservoir	**17.8**	**80.5**	**32.7**	**78,887**
Kirby North Approved Development Area				**122,578**

OBIP = Original Bitumen In Place

Volumetric calculation = Area within 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

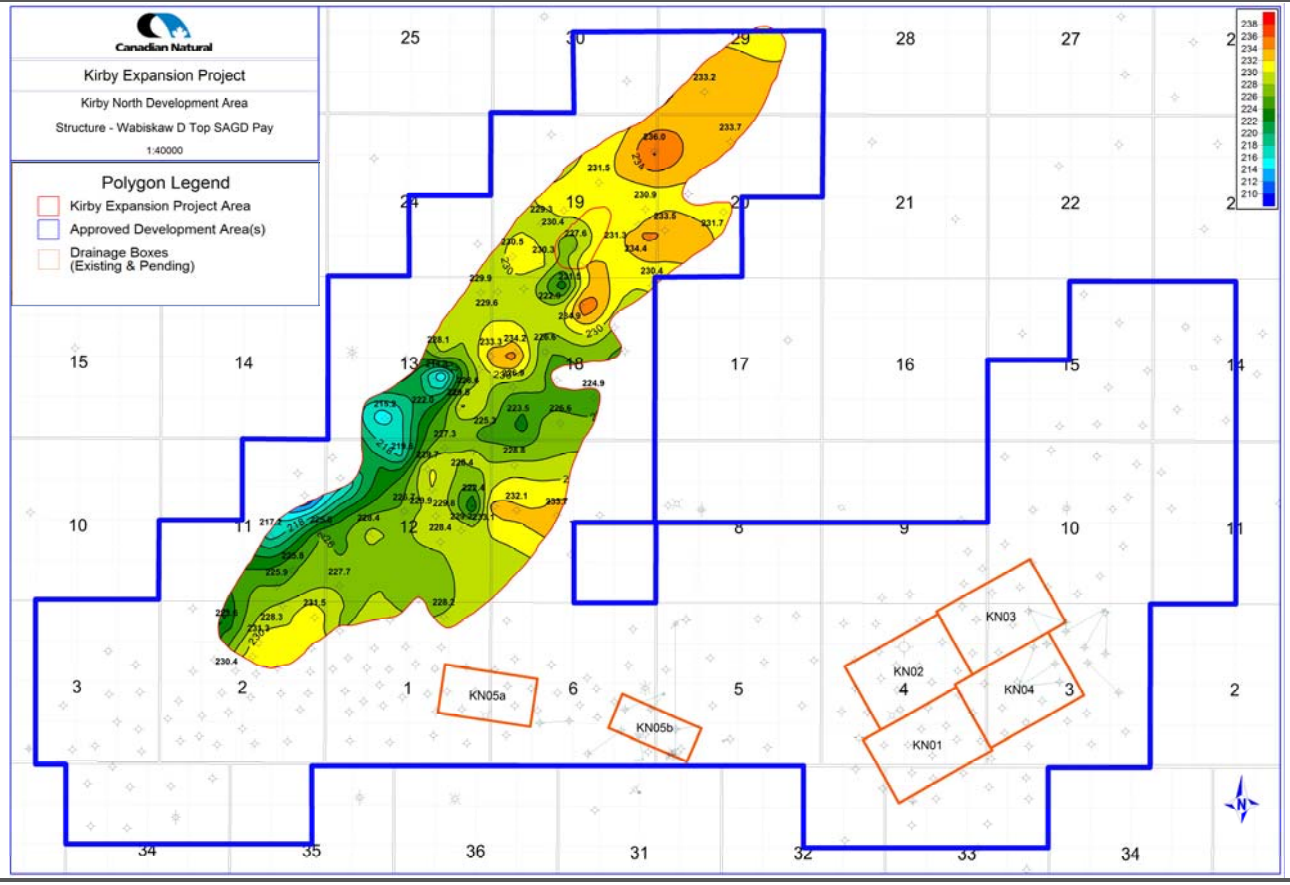
Geology
Kirby North Drainage Area Volumetrics

Drainage Area	Area (m2)	Oil Saturation (%)	Porosity (%)	Pay Thickness (m)	DBIP (e^3m^3)
KN01	763,120	80.3	32.6	22	4,391
KN02	757,079	82.2	32.4	21.7	4,360
KN03	763,033	84.3	33.1	23.4	4,981
KN04	763,316	84.2	33.4	22.5	4,821
KN05a	443,723	81.2	33.5	20.1	2,422
KN05b	308,198	73.7	34.6	17.5	1,374

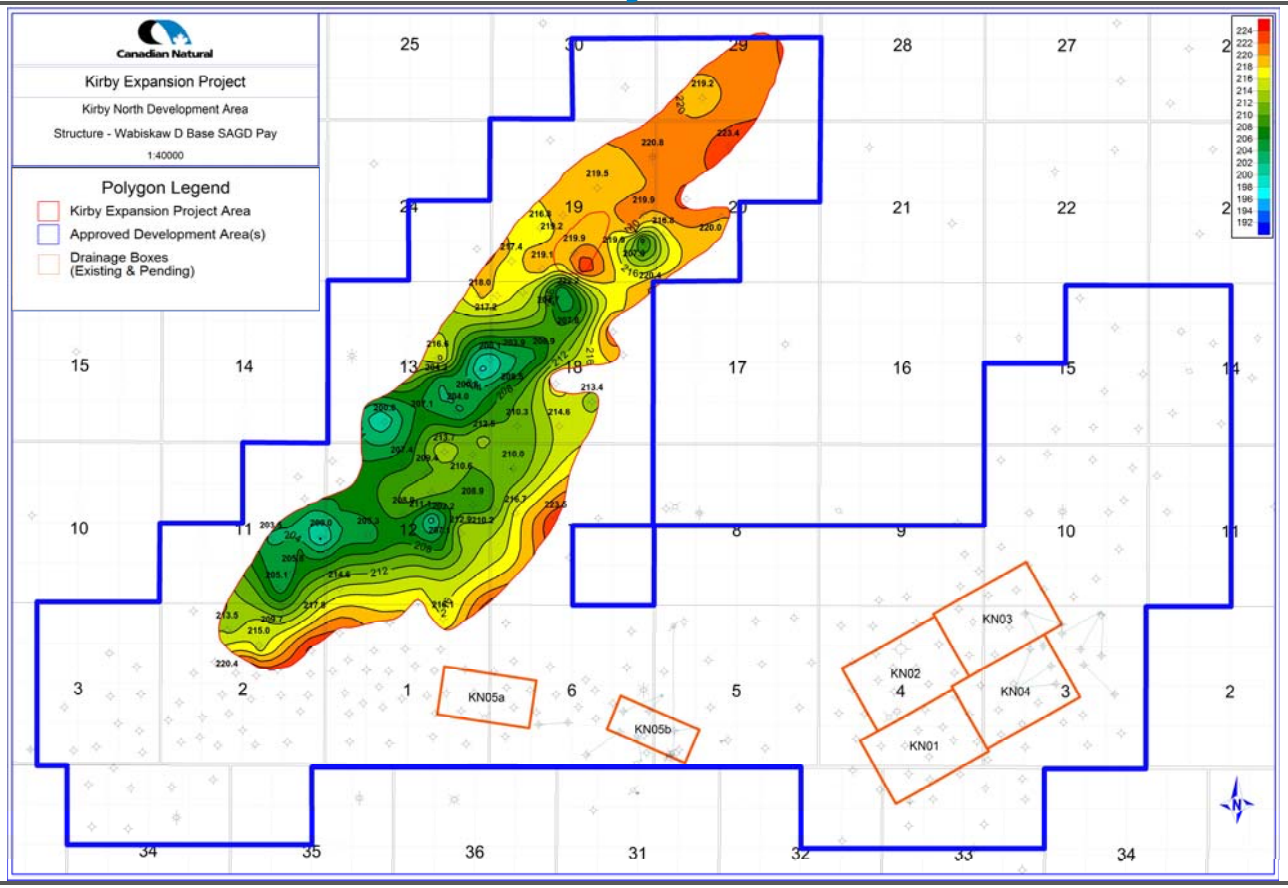
DBIP = Developable Bitumen In Place

Volumetric calculation = Area within drainage box boundary and 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

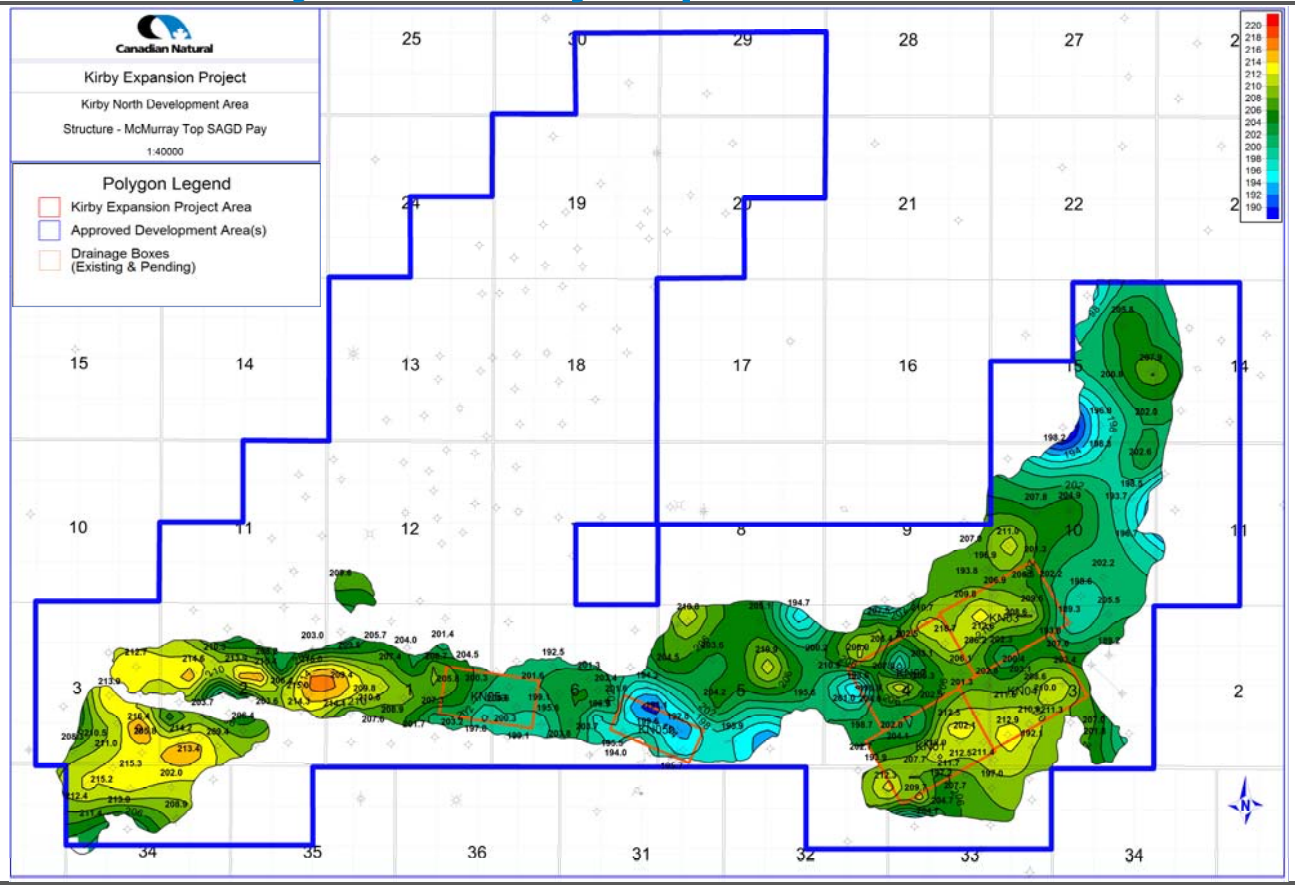
Geology
Kirby North Wabiskaw D SAGD Pay Top Structure



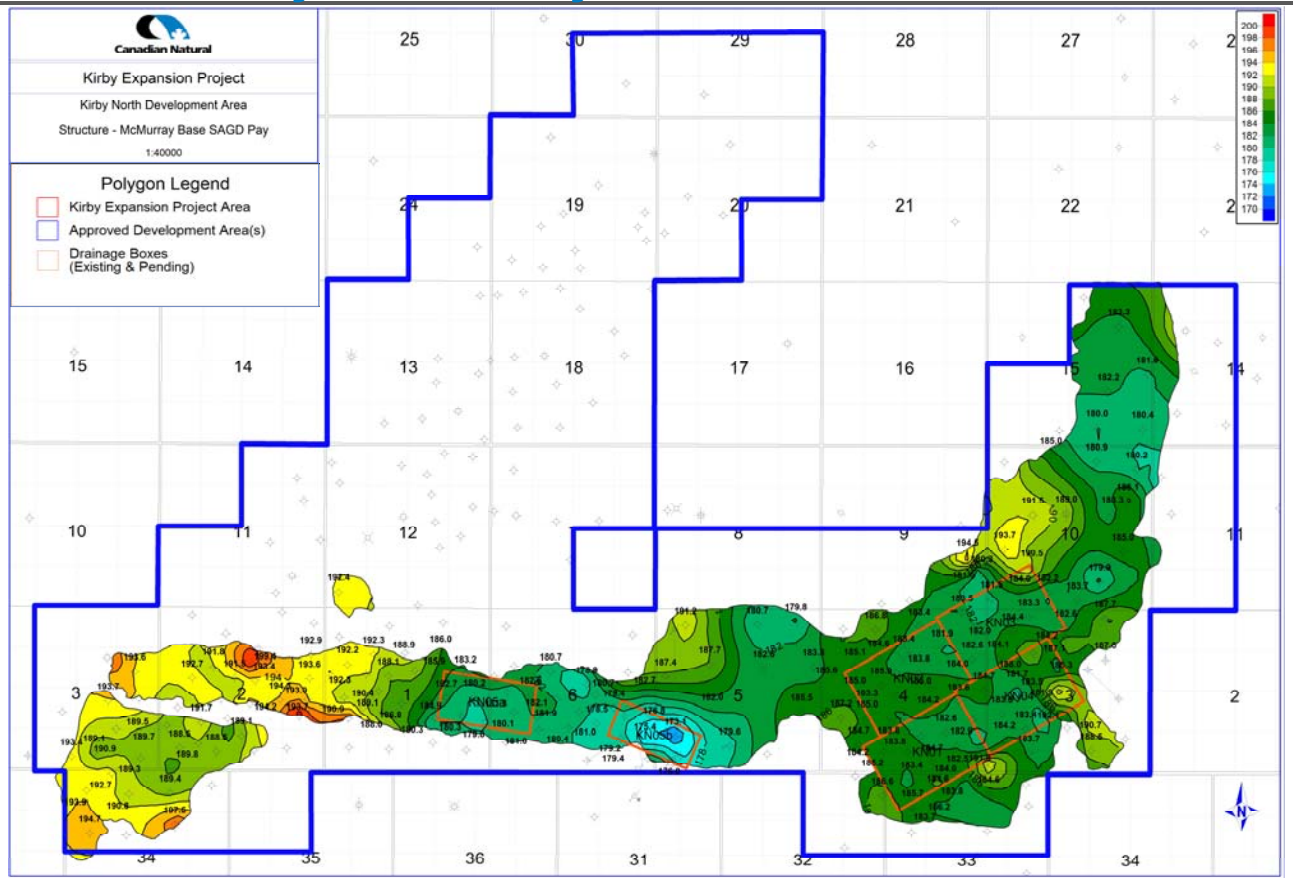
Geology
Kirby North Wabiskaw D SAGD Pay Base Structure



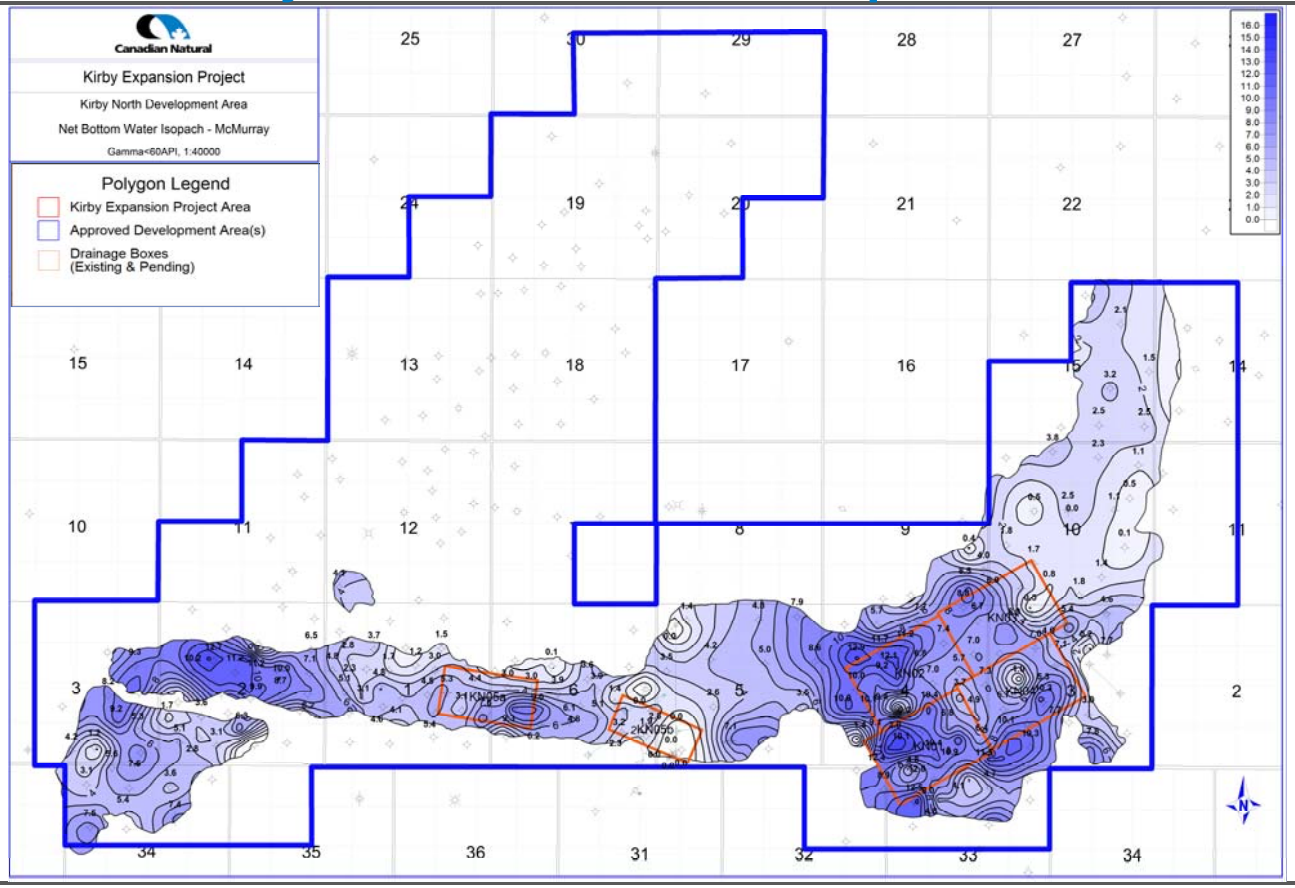
Geology
Kirby North McMurray SAGD Pay Top Structure



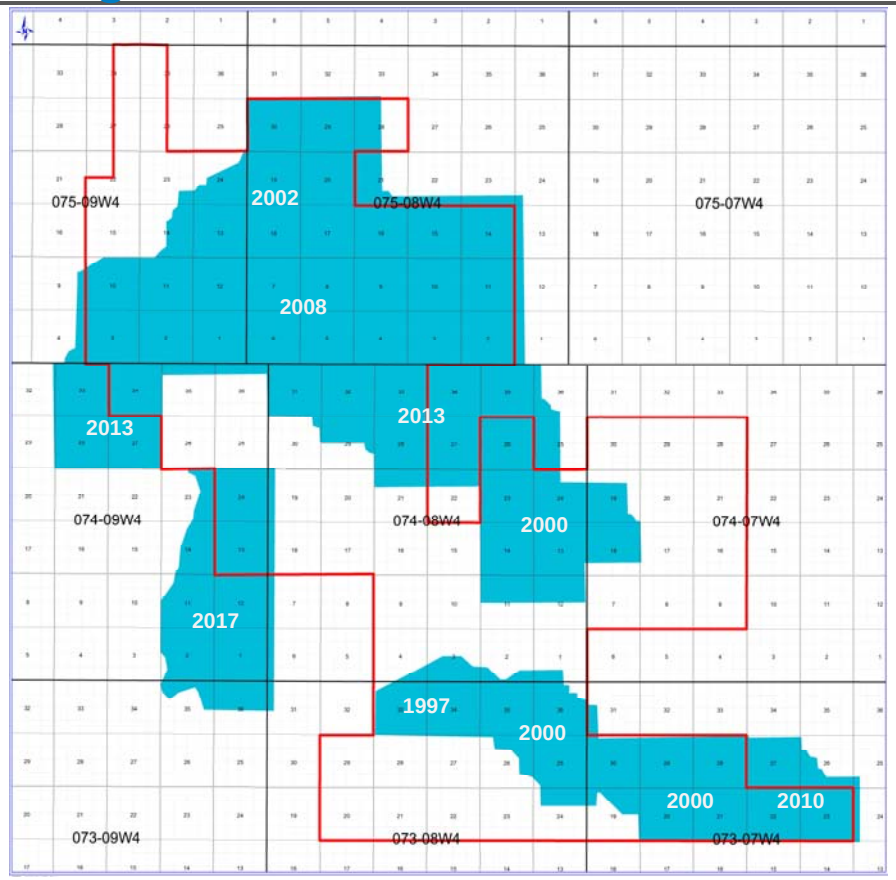
Geology
Kirby North McMurray SAGD Pay Base Structure



Geology
Kirby North McMurray Net Bottom Water Isopach



Geology
3D Seismic Coverage



Approved Project Area

3D seismic Coverage

Note: 4D seismic was acquired over the Kirby South Pads A-F operational area in 2015

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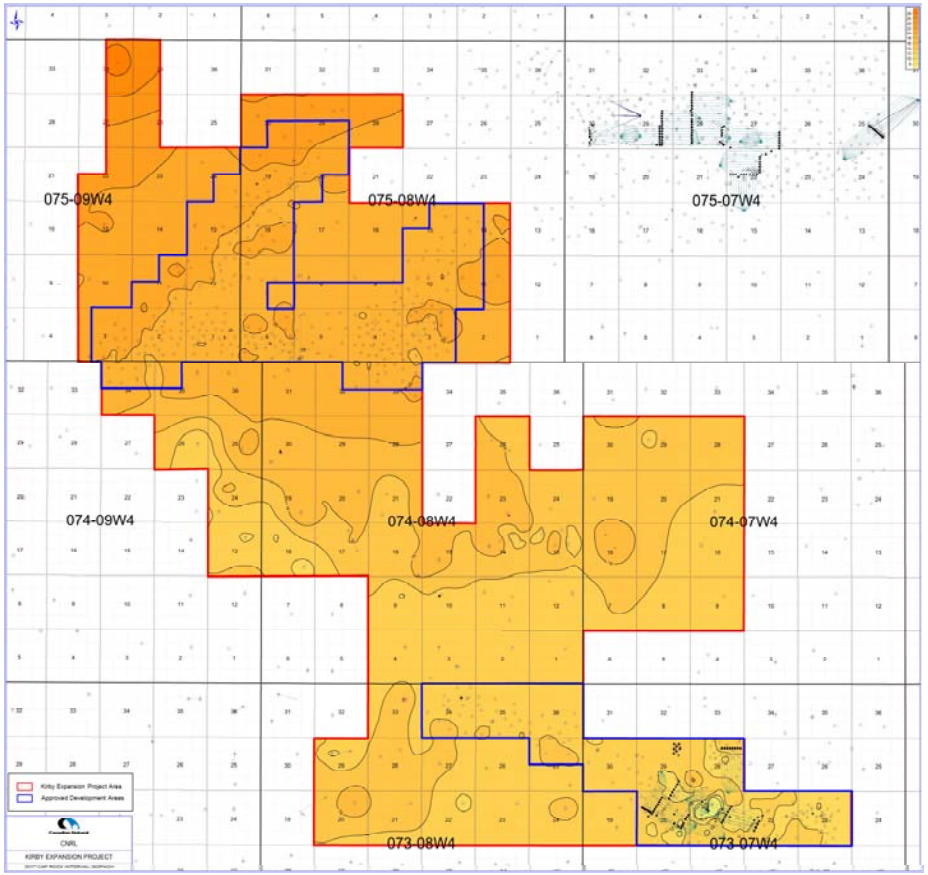
Geology
Cap Rock Interval Isopach Map



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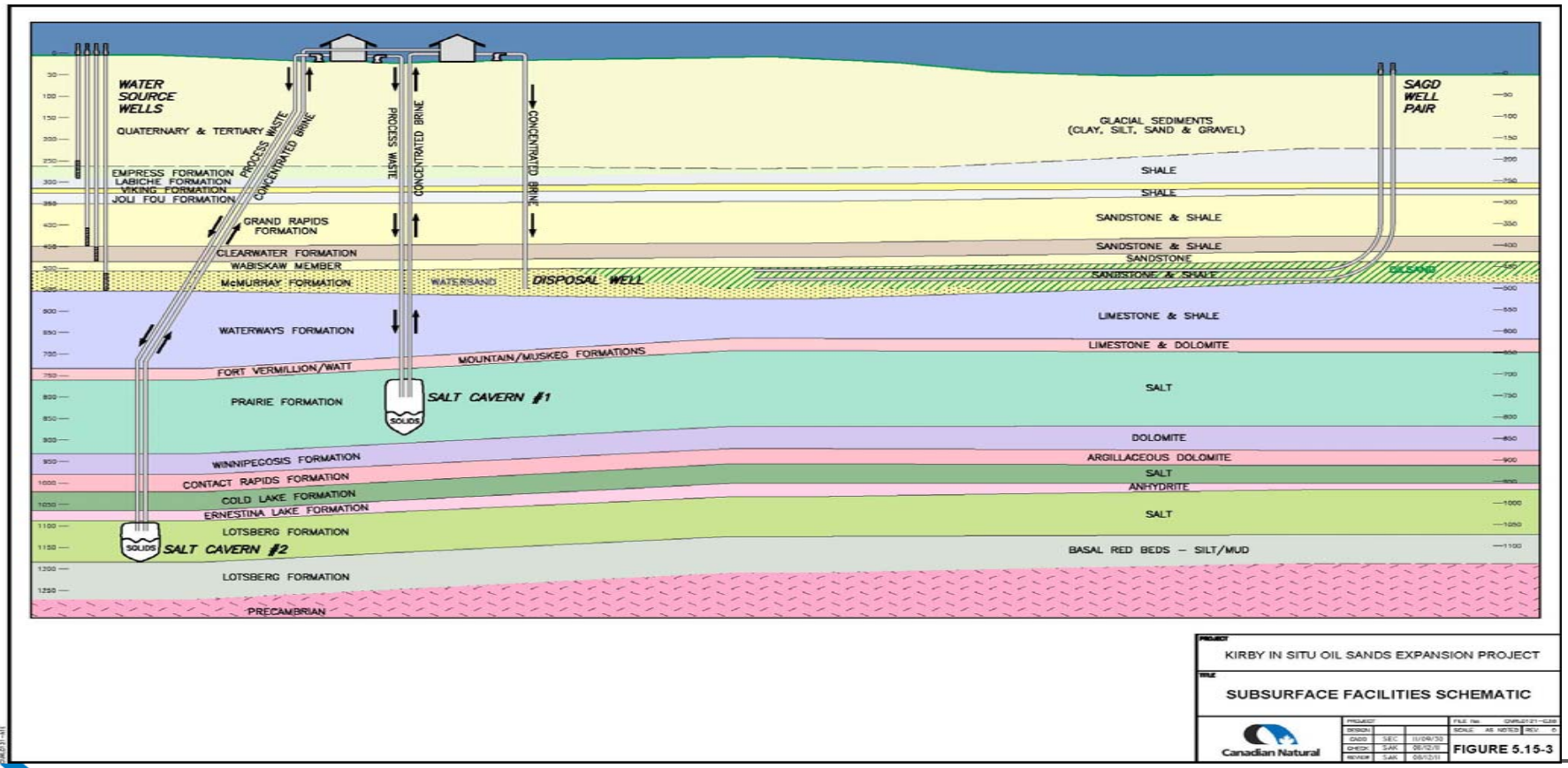
KIRBY SOUTH WELLS

Kirby South Formation and Well Placement Overview



Completion Summary

- Production: majority of wells are equipped with ESPs.

AL Type	Well Count	Lift Capacity (m3/d)	Operating Temperature (DegC)
ESP	47	150-1000	<250
Rod Pump	1	0-300	<250

- Injection: majority of wells are completed with a heel and toe string
- Completions are continually optimized as required by well behavior
  - Outflow control devices are installed to improve steam distribution in the injector
  - Scab liners are installed to enhance toe production in the producer and reduce heel hot spots
  - Inflow control devices are installed to limit single point breakthrough and/or to control to wellbore hydraulics

Completion Tool	OCD	Scab Liner	ICD
Well Count	11	20	11

ICDs	OCDs
A5P	C2
B2	C3
B3	C4
B6	D1
C6	D4
C7	E2
D6	E5
D7	E6
F4	F1
F5	F2
F6	F4

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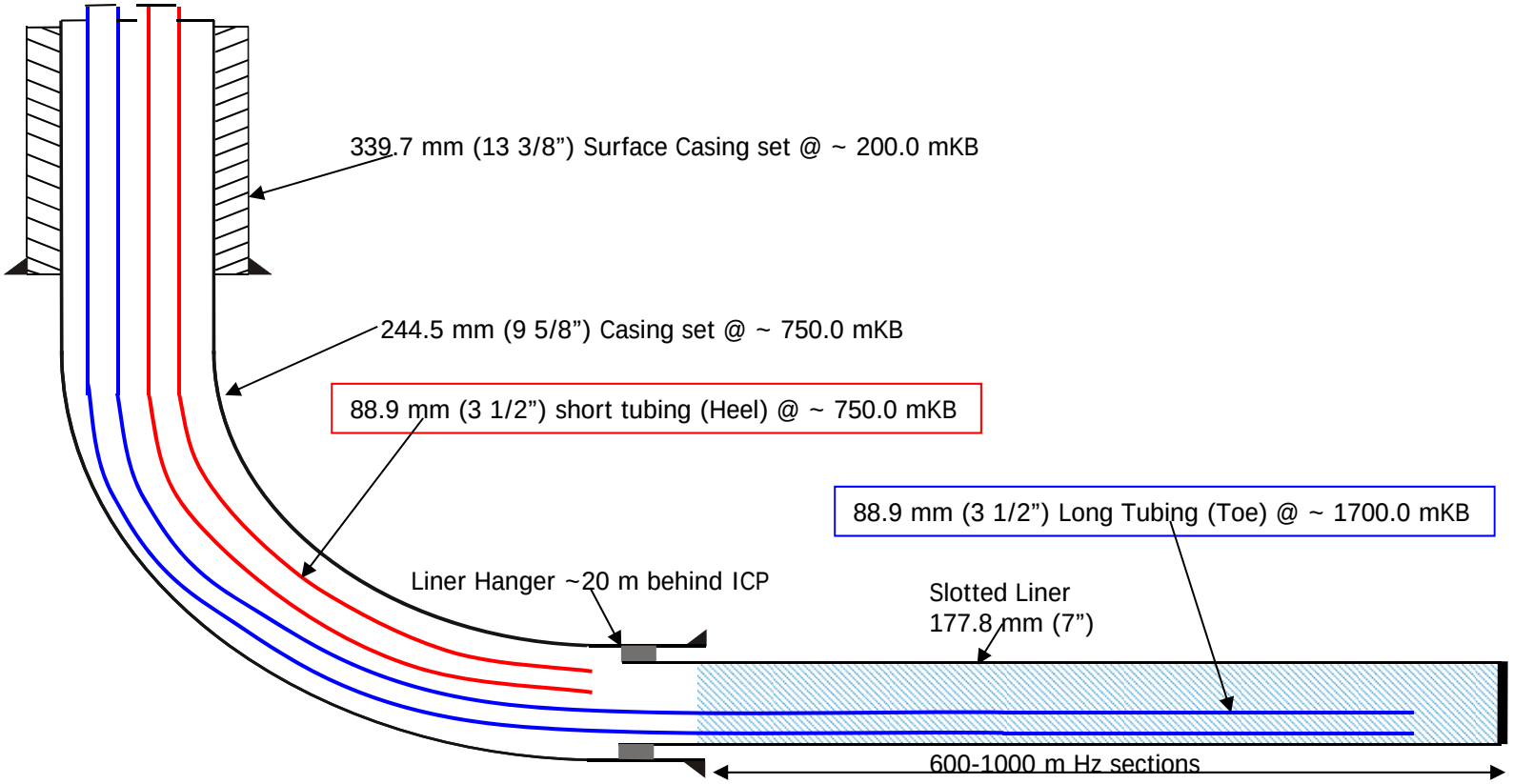
Some OCDs and ICDs are shiftable tools in the closed position.

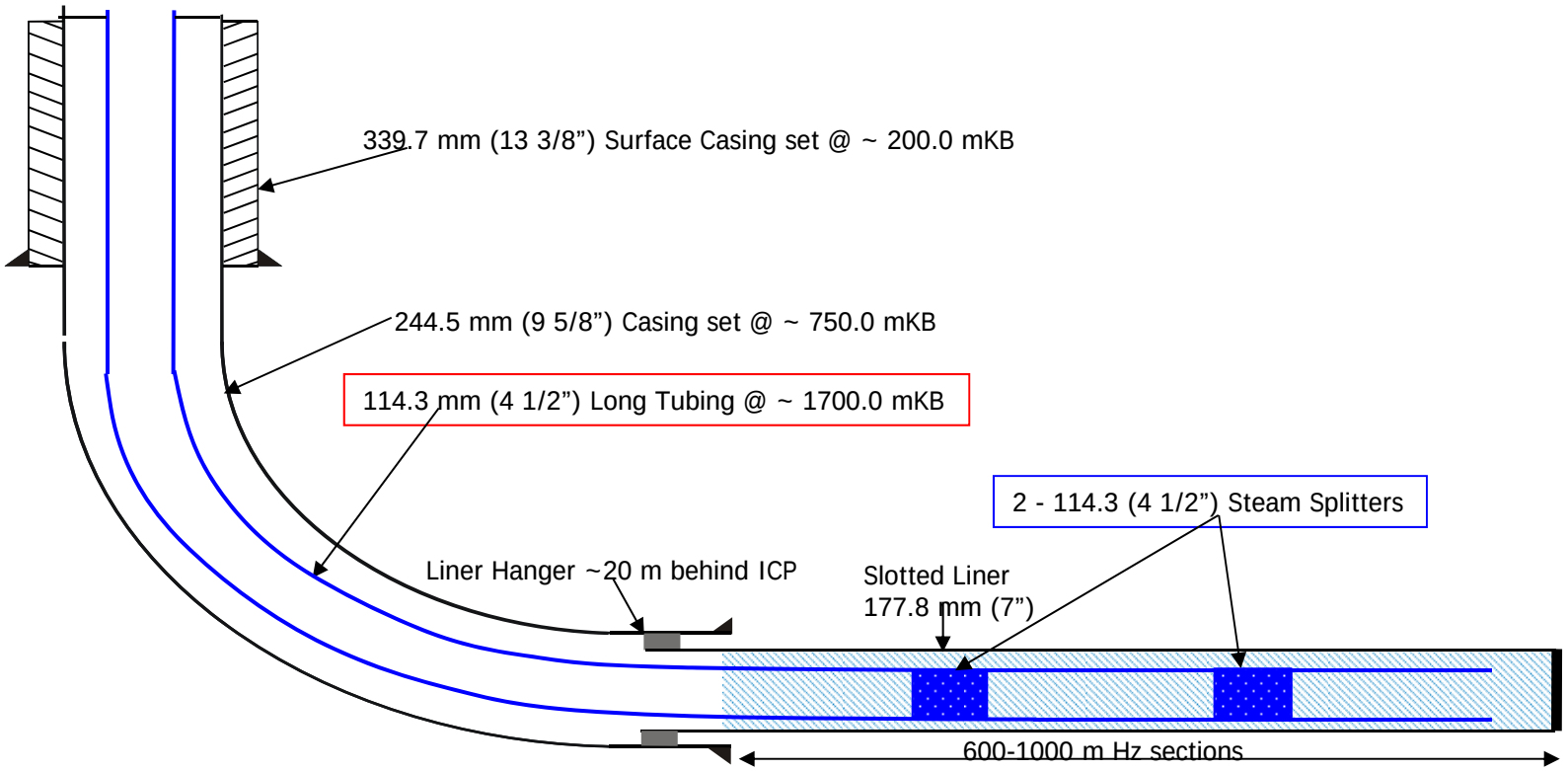
Instrumentation Summary

- Blanket gas pressure is used to monitor bottom hole pressures for SAGD injection wells.
- SAGD producers are equipped with fiber optic temperature monitoring (DTS) along the lateral and bubble tubes with surface measurement for heel or toe pressure.
- Observation wells gather multiple temperatures and pressures at various elevations.

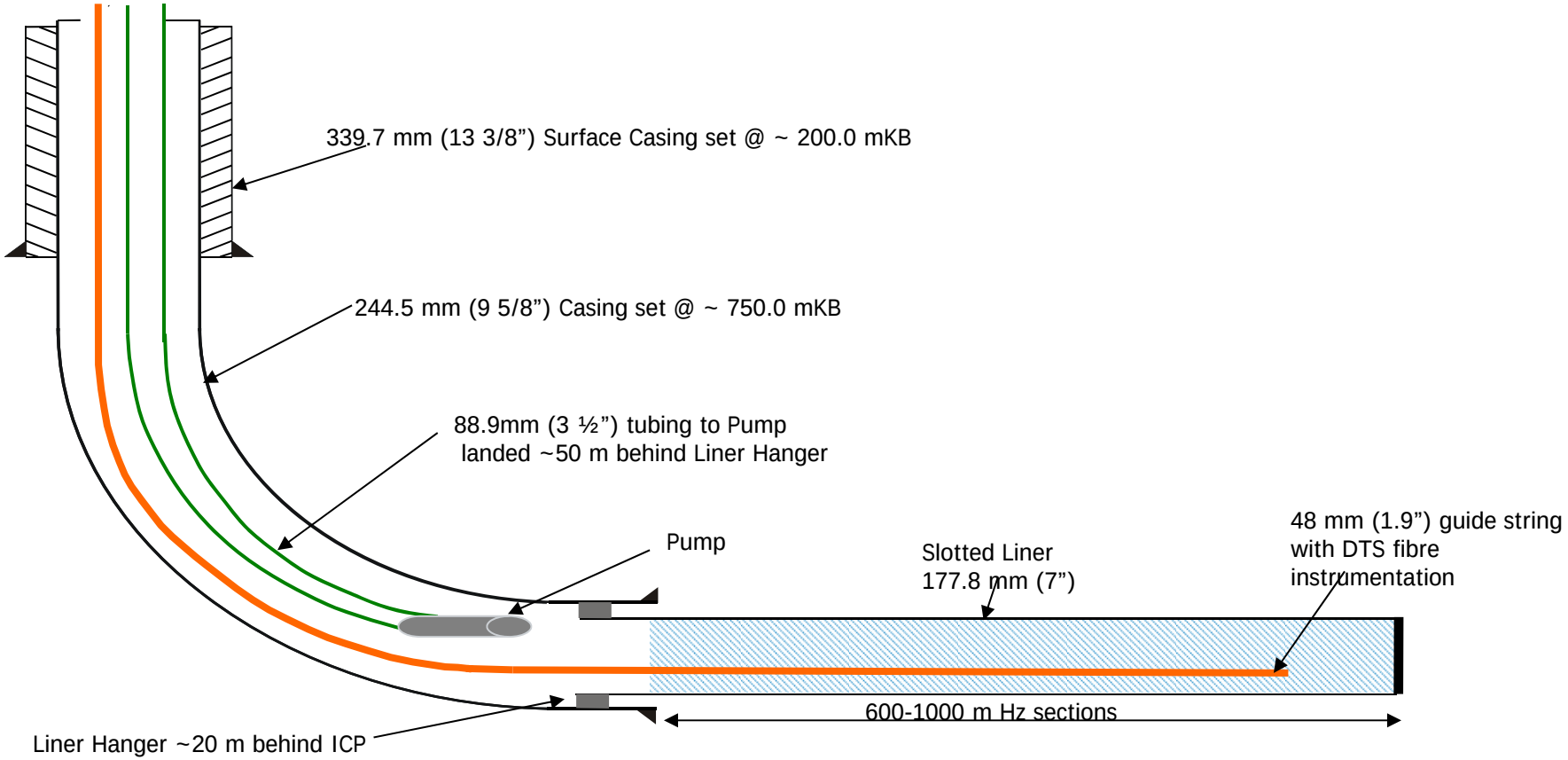
Well Schematics
Injection Well (Dual String)



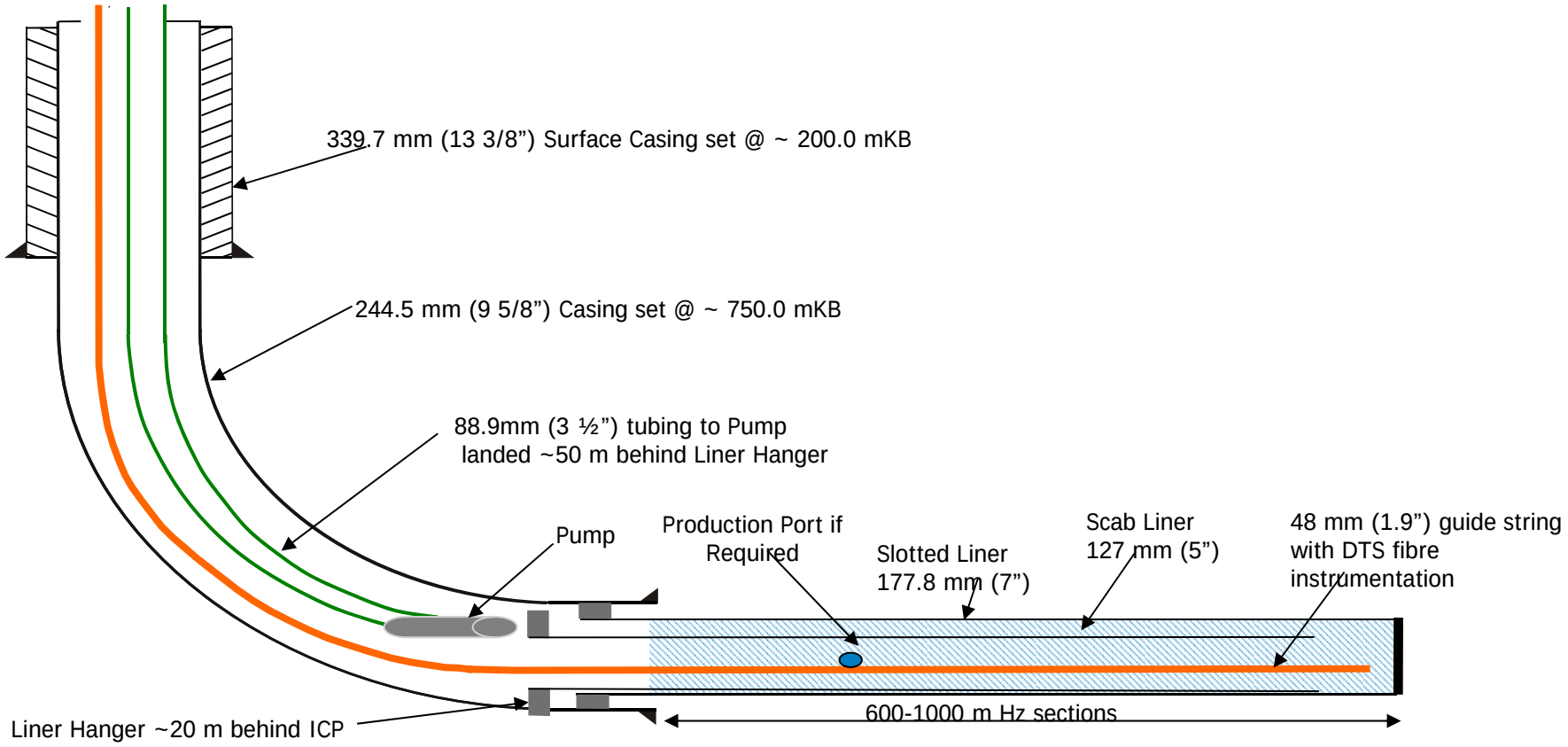
Well Schematics
Injection Well (Single String)



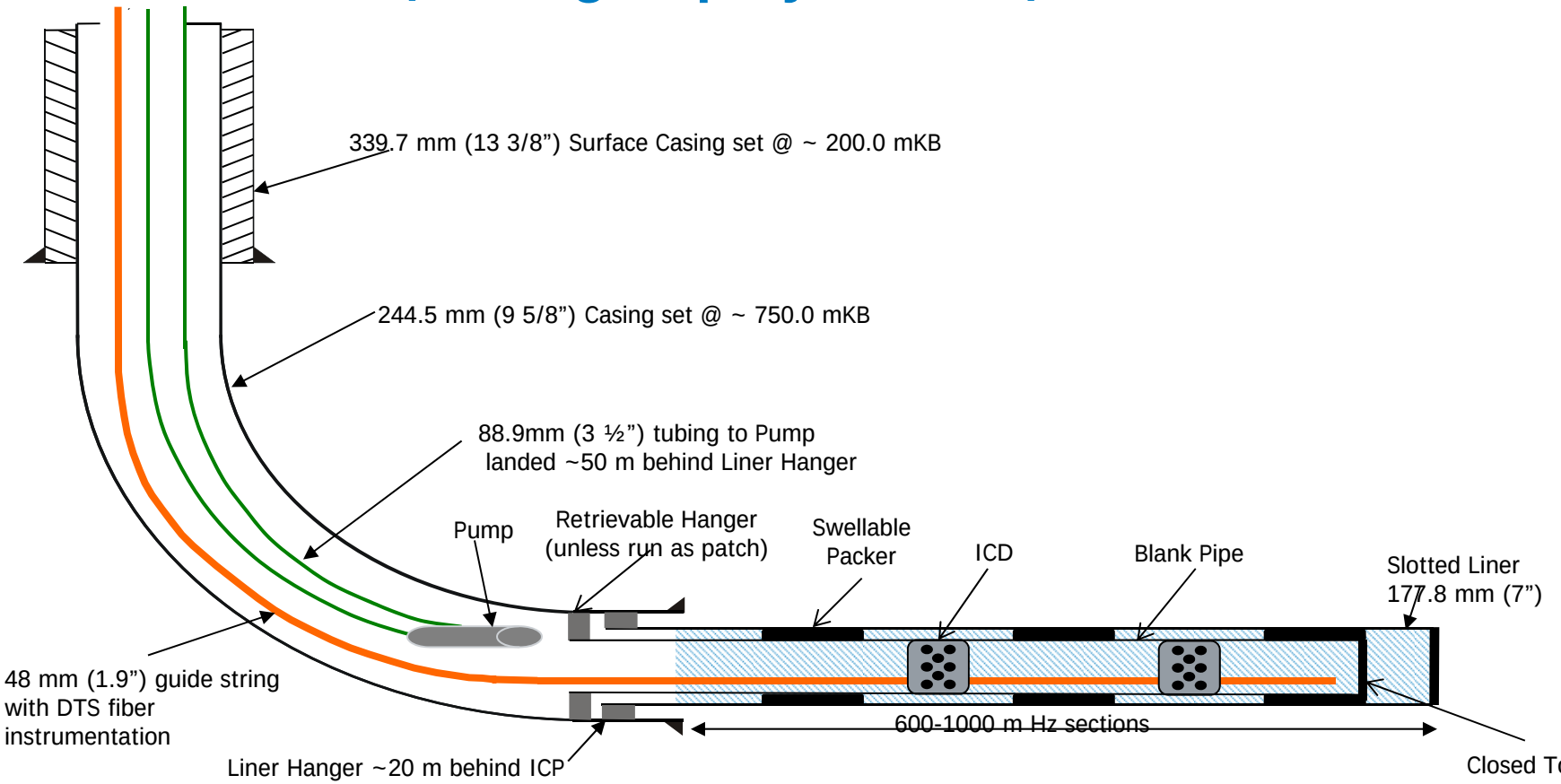
Well Schematics
Production Well



Well Schematics
Production Well (Scab Liner)



Well Schematics
Production Well (Tubing Deployed ICDs)



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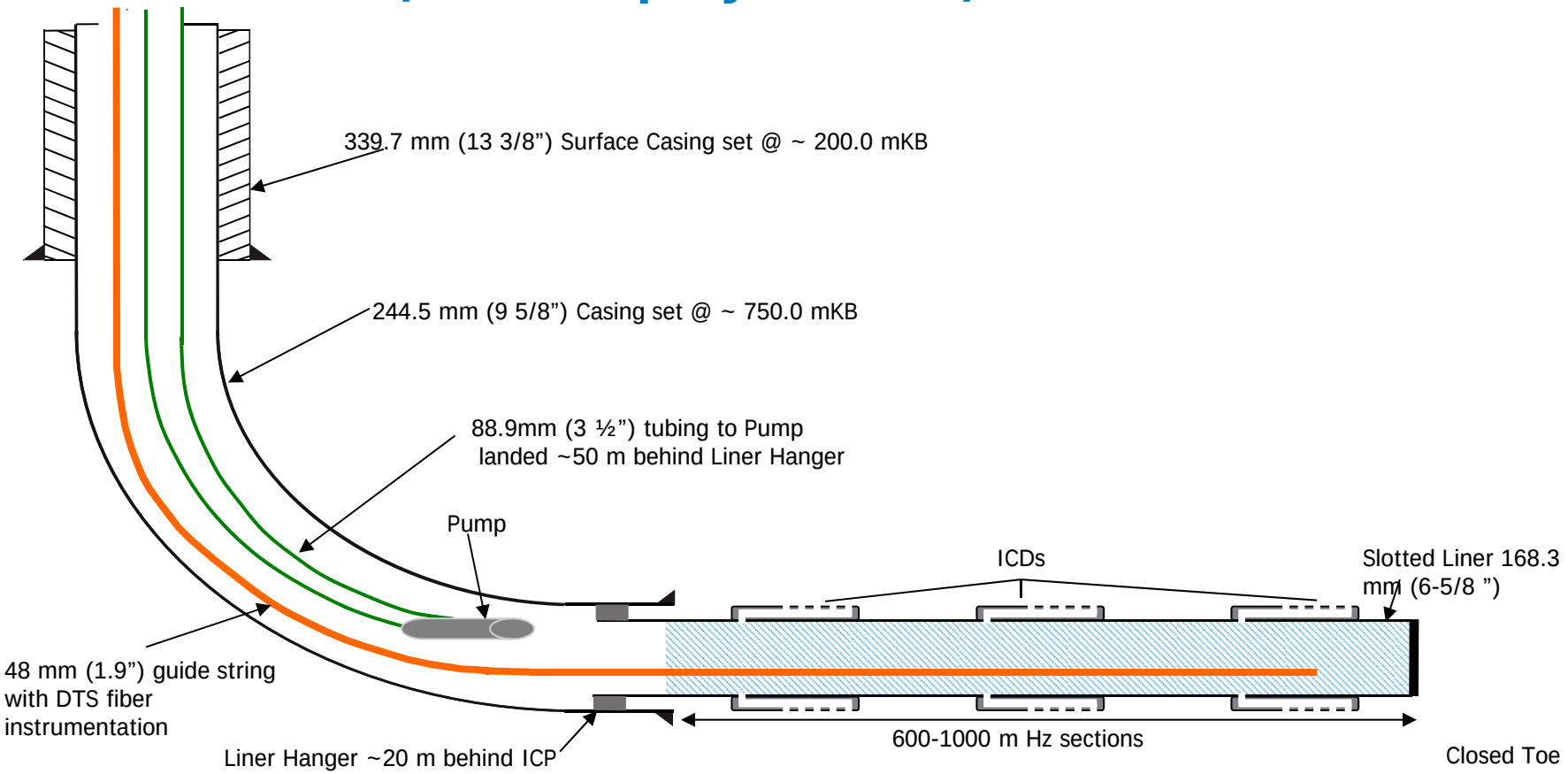
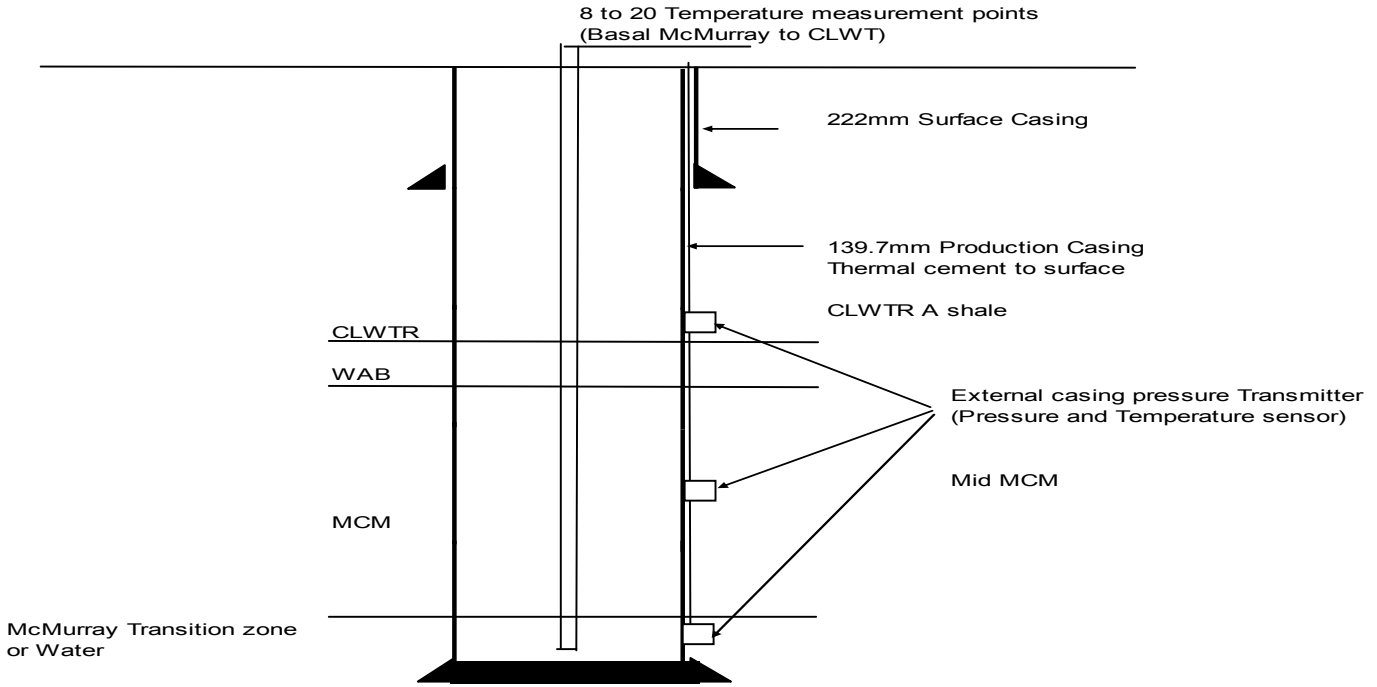
Well Schematics
Production Well (Liner Deployed ICDs)



Completion Optimization

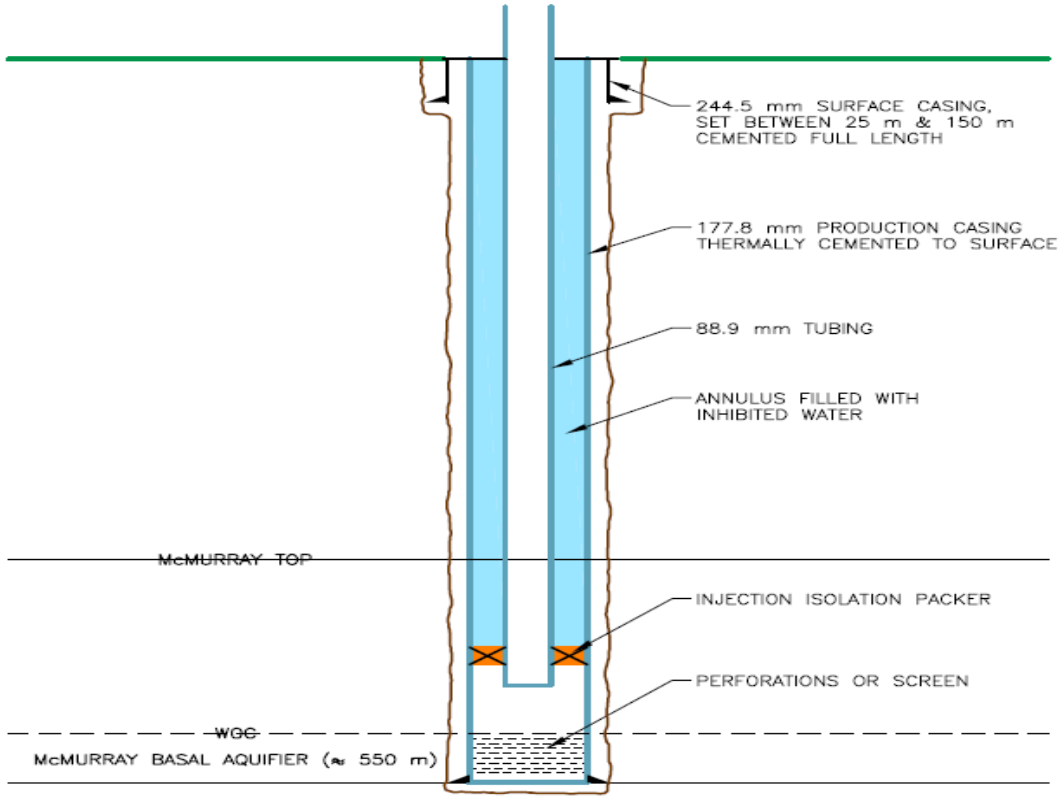
- Steam splitter and scab liner installations/removals were selected based on specific opportunities for each well.
  - Steam splitters to target a specific stream distribution in the injector
  - Scab liner installs to encourage toe development and minimize heel temperature variations
  - Scab liner removals to promote heel development after toe fluids are mobile
- ICDs and swellable packers strings were used to limit single point breakthrough and/or to control to wellbore hydraulics

Well Schematics
Observation Well

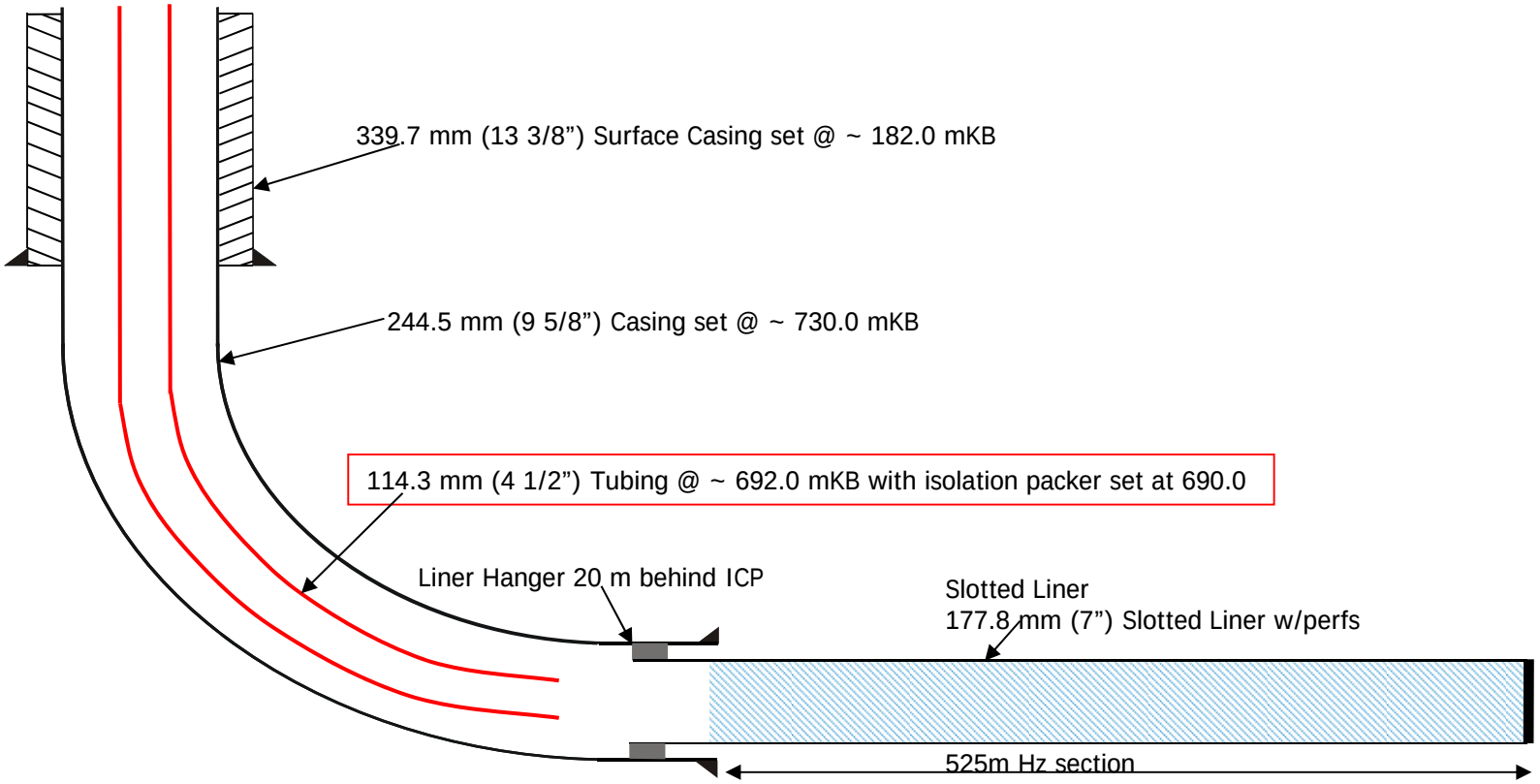


Note: Shows a plan for 2011-2013 drilled observation wells, as previous wells don't have external casing transmitters

Well Schematics
Disposal Well



Well Schematics
13-20 Hz Water Disposal Well



Operational Strategy
SAGD

- Injection Strategies
  - Steam down heel and toe string in dual string completion
  - Steam down single long string with steam splitters
- Pump fluid from producer using artificial lift
- Operate wells based on a target steam chamber pressure and target subcool
- Steam chamber pressure is measured by blanket gas pressure in the injector and is controlled by the steam injection rate
  - Target pressure chosen to balance bottom water where it exists, typically 2.5 MPa to 3.5 MPa

Operational Strategy
SAGD Continued

- Subcool is the difference between saturated temperature at producer pressure and the highest temperature along the producer lateral
  - Target chosen to maximize production and minimize live steam production

- To optimize pressure and subcool target, a combination of parameters are monitored including:
  - Water retention in reservoir
  - Chlorides concentration in produced water
  - Steam Oil Ratio (SOR)
  - Bottom hole pressures

Kirby South Drilling Activity Update

- Completed Drilling operations:
  - Re-Drills:
    - B2P
      - Reason for re-drill: loss of sand control
      - Offset from original producer: vertical 0 m, horizontal 5 m North
    - A1P&I
      - Reason for re-drill: Well pair was underperforming and producer had loss of sand control; review of geology indicated re-drilling at higher elevation would improve performance
      - Offsets from original producer and injector: vertical +13 m, horizontal 25 m North
    - D7P
      - Reason for re-drill: First re-drill lost sand control, remediated well with ICD (failed). Well was re-drilled a second time.
      - Offset from original producer: vertical 0 m, horizontal 10 m North (5 m North from Re-drill)
  - New Drills:
    - D9P&I, D10P&I, F8P&I, F9P&I
  - Infills:
    - B3PI

Kirby South
SAGD Well Spacing

Pad	Number of Well Pairs	Inter well Spacing (m)
A	6	100
B	7	100
C	7	100
D	10	80
E	6	80
F	9	50
G	8	80

- Original well spacing on Pads A, B, & C were 100 m.
- Well spacing was optimized from 100 m to 80 m to achieve improved CDOR, SOR and recovery factors for wells with less bottom water influence.
- F Pad spacing was decreased to 50 m where thicker bottom water exists to lessen the slumping of oil and therefore improve CDOR, SOR and recovery factor.
- Infills are typically drilled half way between wells.

Kirby South Performance
Pad Recoveries

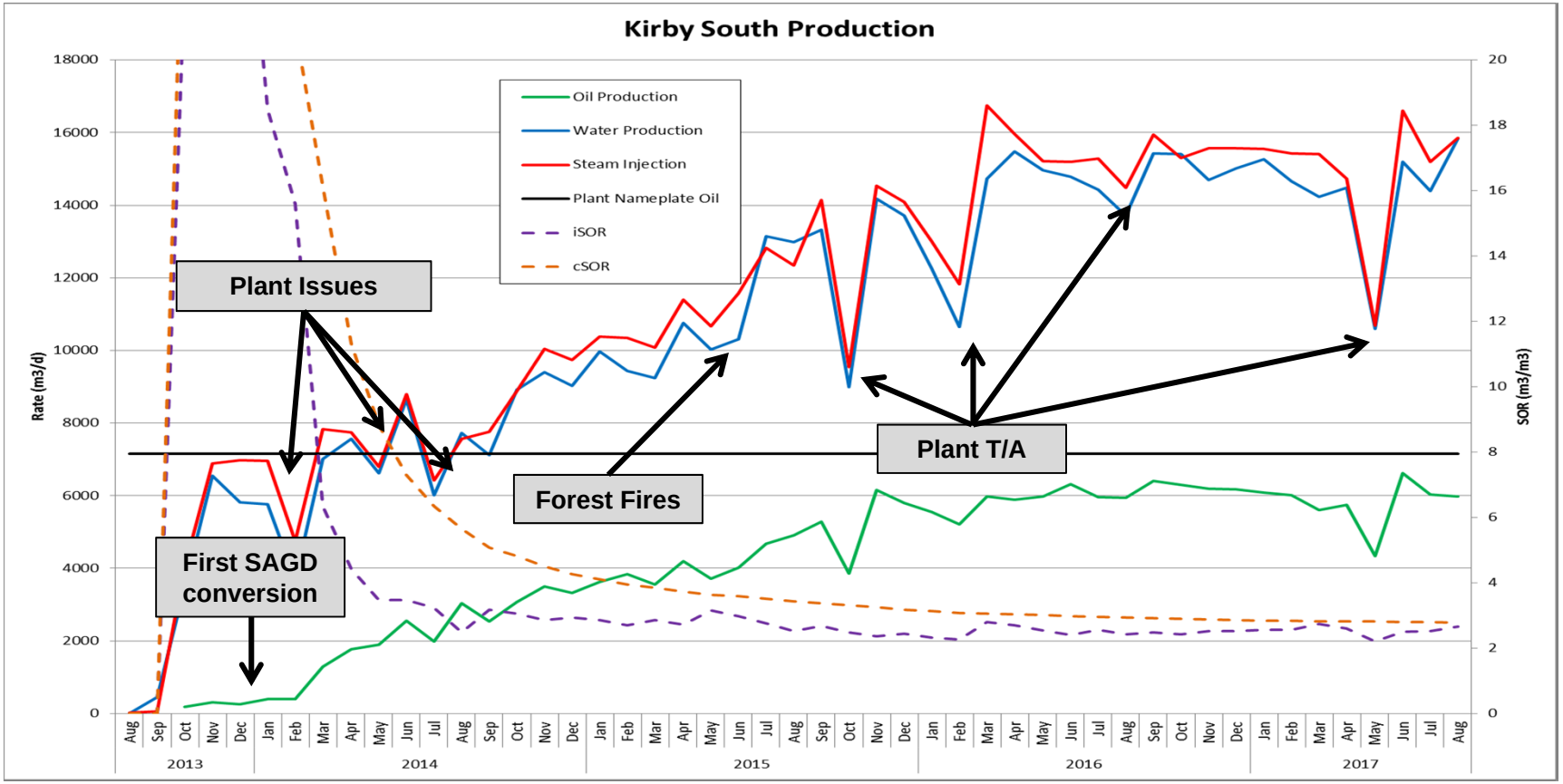
Pad	DBIP (E3m3)	Ult. Recovery (E3m3)	Cum Oil (E3m3)	RF (%)
A	3,920	2,352	589	15.0%
B	3,880	2,328	845	21.8%
C	4,180	2,508	1199	28.7%
D	5,610	3,306	922	16.4%
E	3,000	1,800	839	28.0%
F	2,510	1,506	528	21.0%
G	5,200	2,718	1015	19.5%
Total	**27,530**	**16,518**	**5937**	**21.5%**

Recovery as of August 13, 2017

DBIP = Developable Bitumen In Place

Volumetric calculation = Area within drainage box boundary and 10m contour **x** SAGD thickness **x** avg. oil saturation **x** avg. porosity

Kirby South Performance
Kirby Field Production

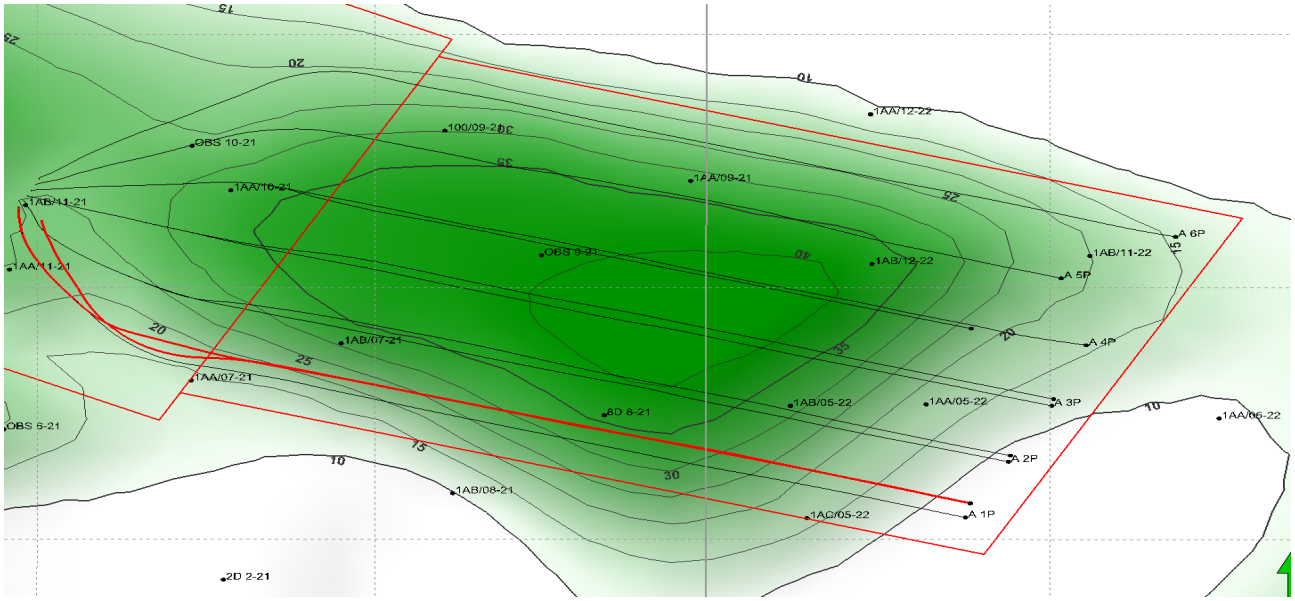


Kirby South Performance Summary

- Reservoir performance is similar to expectations, currently optimizing well-pair conformance.
- Plant turnarounds:
  - October 2015: Evap cleaning and Boiler 2 inspection
  - February 2016: Evap 3 cleaning and Boiler 5 inspection
  - August 2016: Evap 1 cleaning and Boiler 1 inspection
  - May 2017: Major vessels regulatory inspections and maintenance
- Record oil production to date ~7,120 m^3/d (44,790bbl/d)
- 8 wells lost sand control, 8 wells remediated

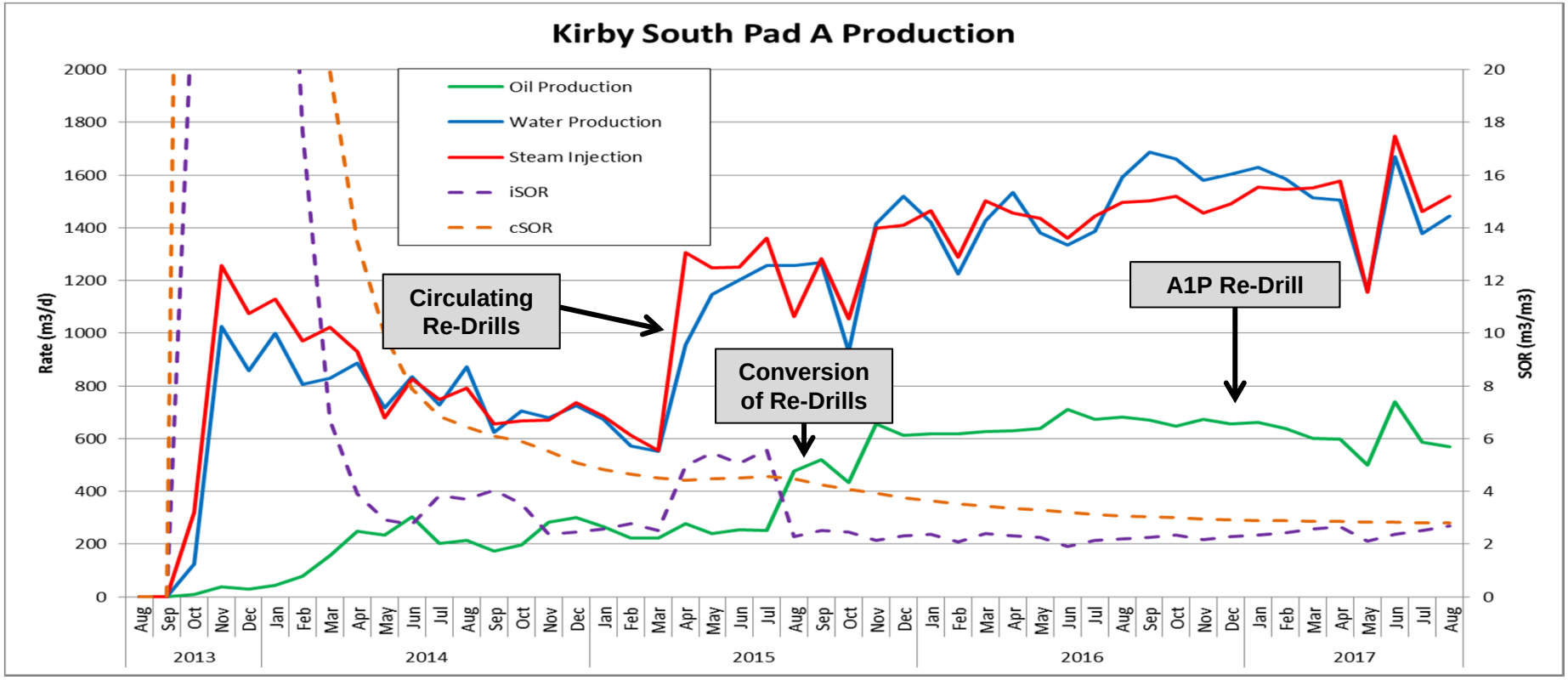
Well	Well	Remediation
A5	1	TD ICD
B3	2	TD ICD
C6	3	TD ICD
C7	4	TD ICD
D7	5	Re-Drill & LD ICD
F4	6	TD ICD
F5	7	TD ICD
F6	8	TD ICD

Kirby South Performance – Low Recovery Pad A



- SAGD well pair: 6
- First steam: Oct. 2013
- Inter-well pair spacing: 100 m
- Avg. net pay: 29 m
- Avg. So: 68%
- Avg. porosity: 33%
- Current RF: 15.0%

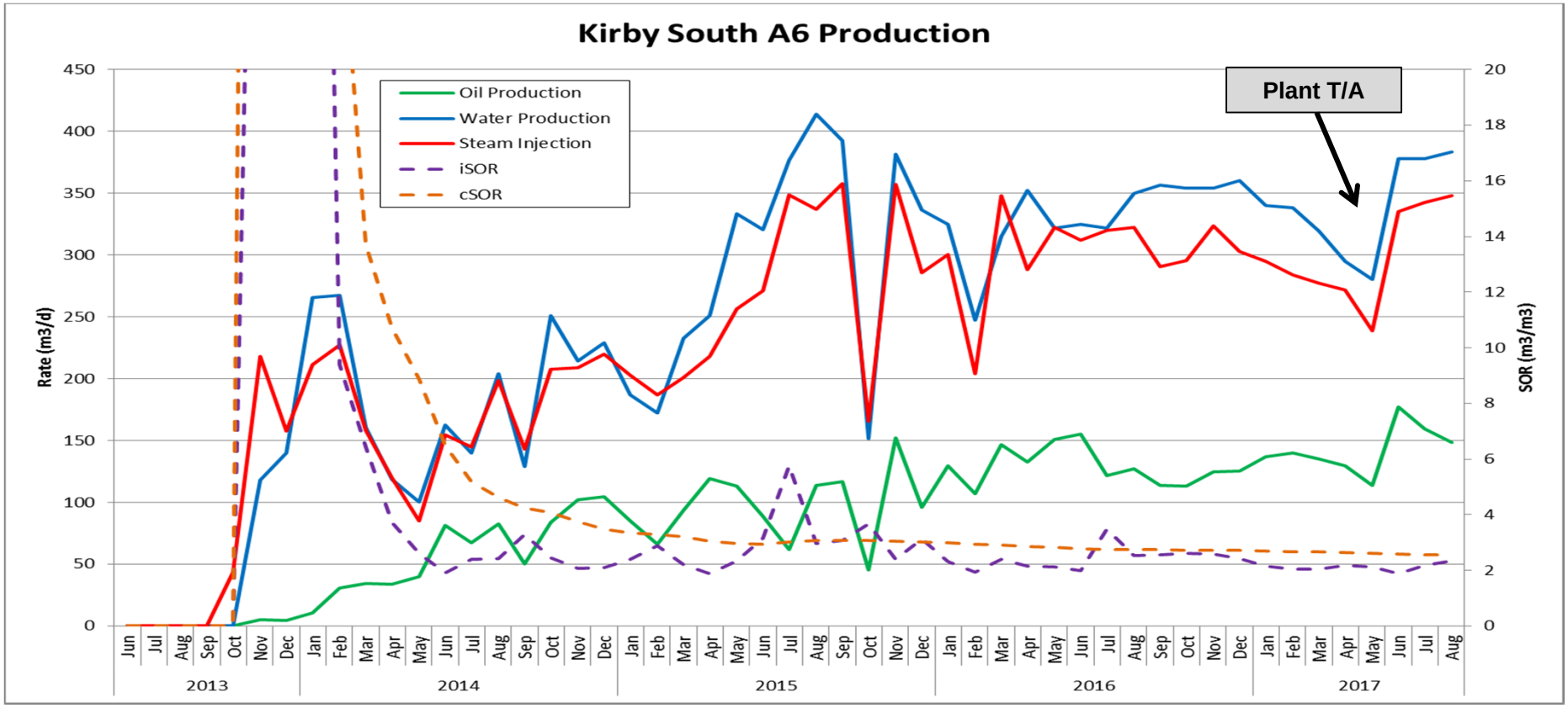
Kirby South Performance
Pad A Production



Canadian Natural

Re-drills successfully targeted better reservoir.

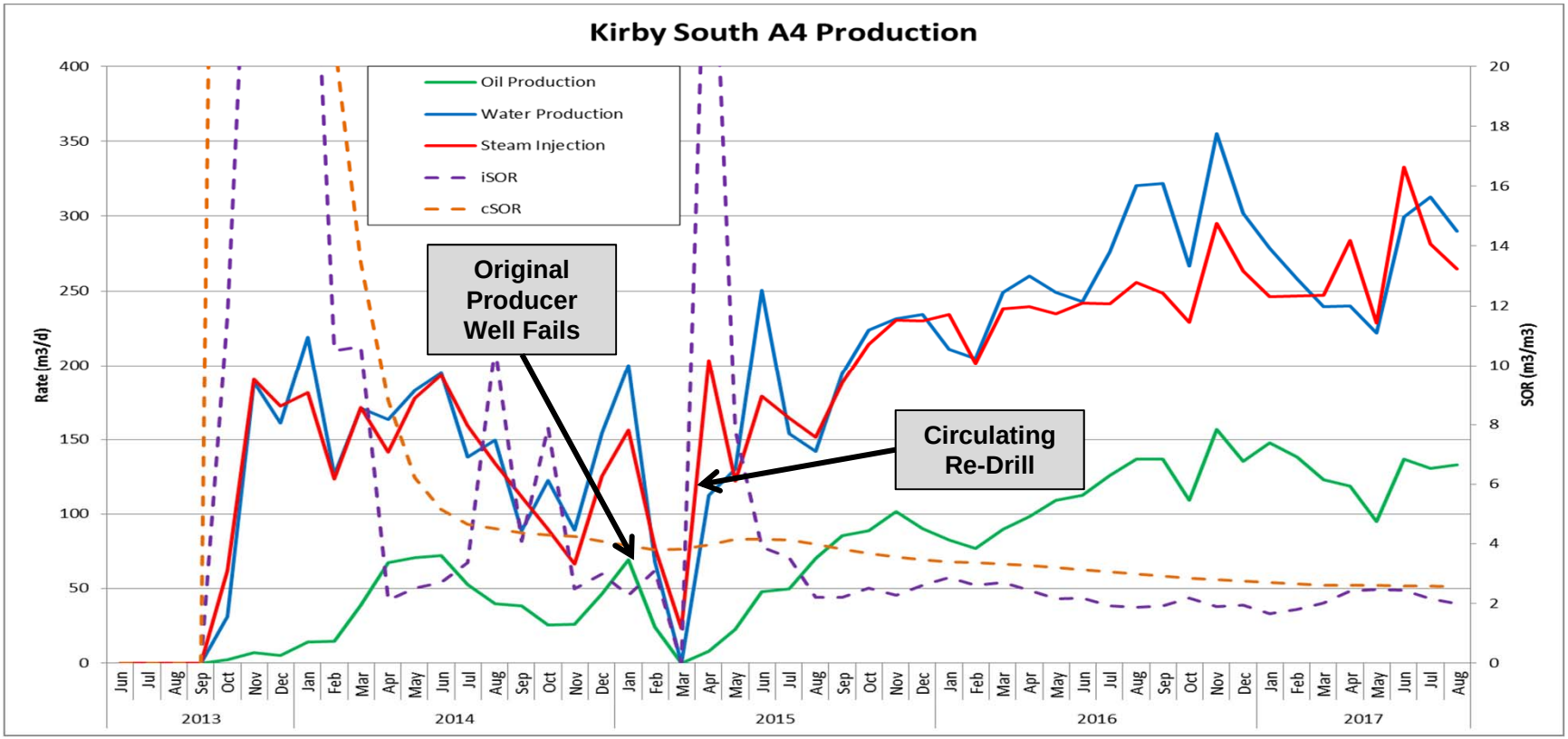
Kirby South Performance
High Recovery Pad A Well Pair



Canadian Natural

Best performer

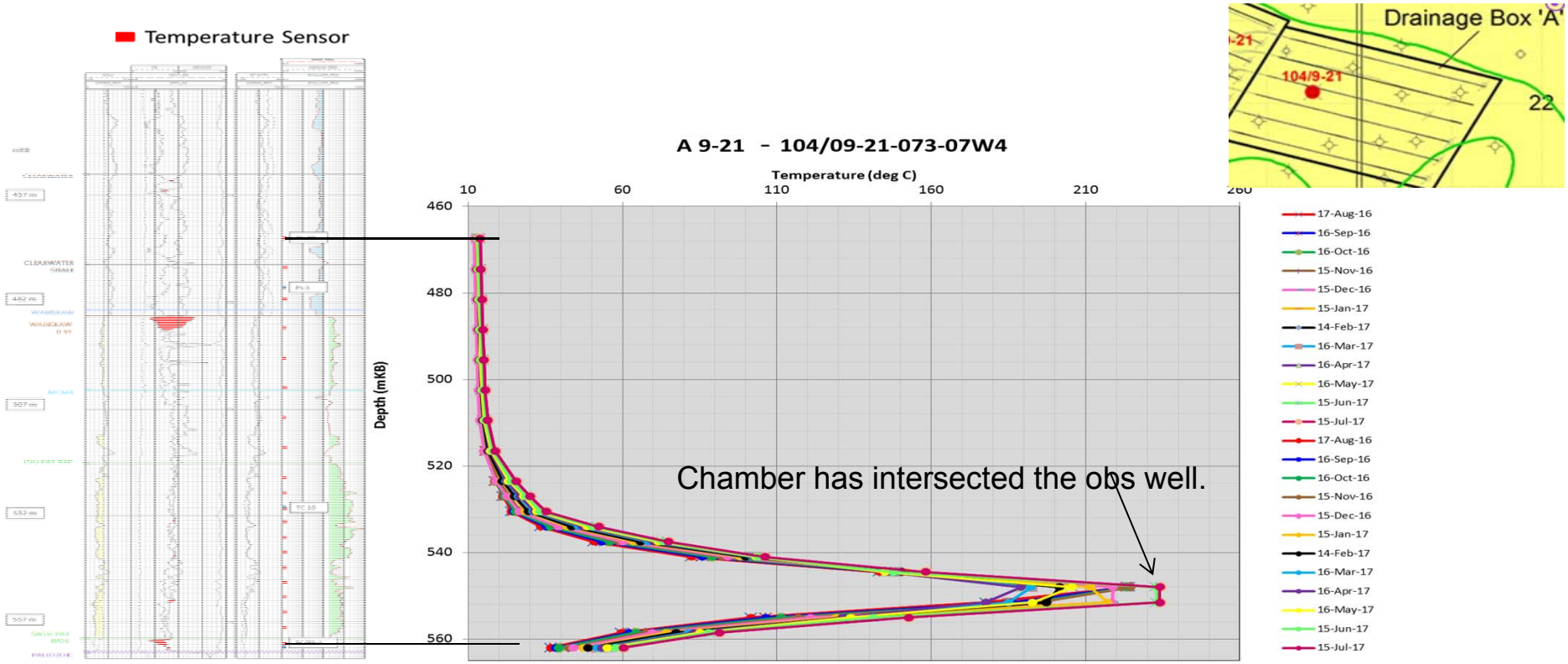
Kirby South Performance
Low Recovery Pad A Well Pair



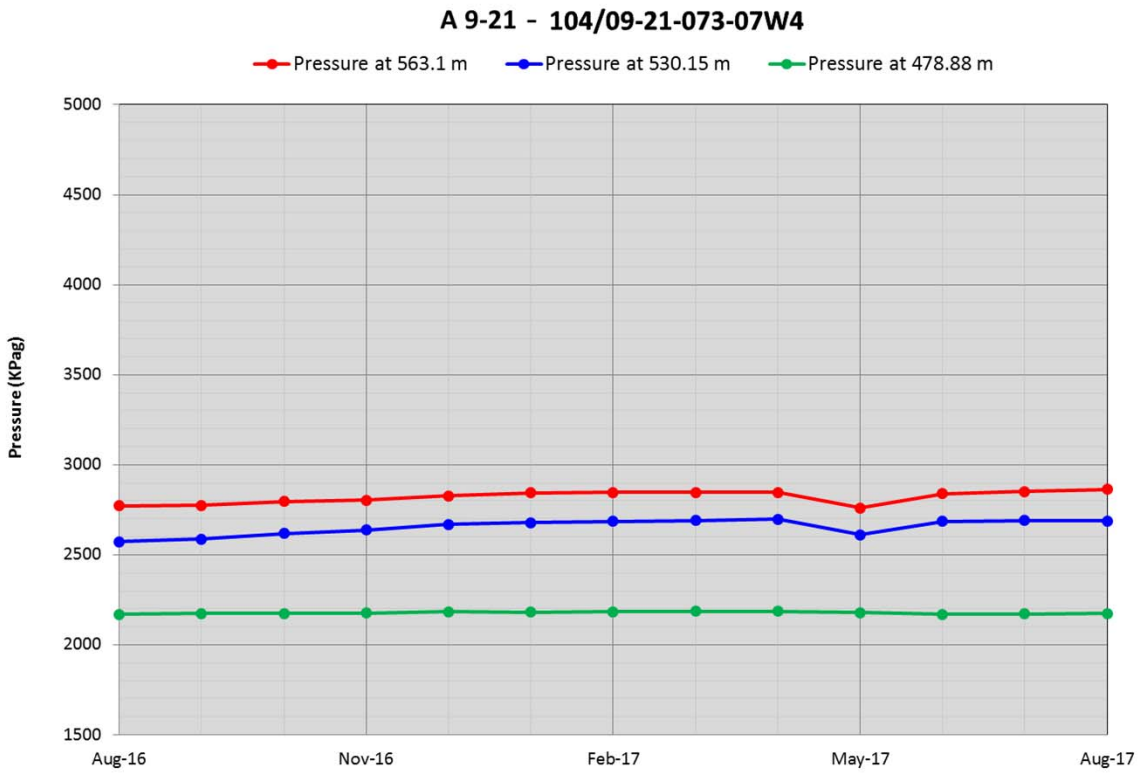
Canadian Natural

Re-drill successful, ramping to targeted performance

Kirby South Performance
Pad A Obs Well – 26 metres from A4



Kirby South Performance
Pad A Obs Well Pressures



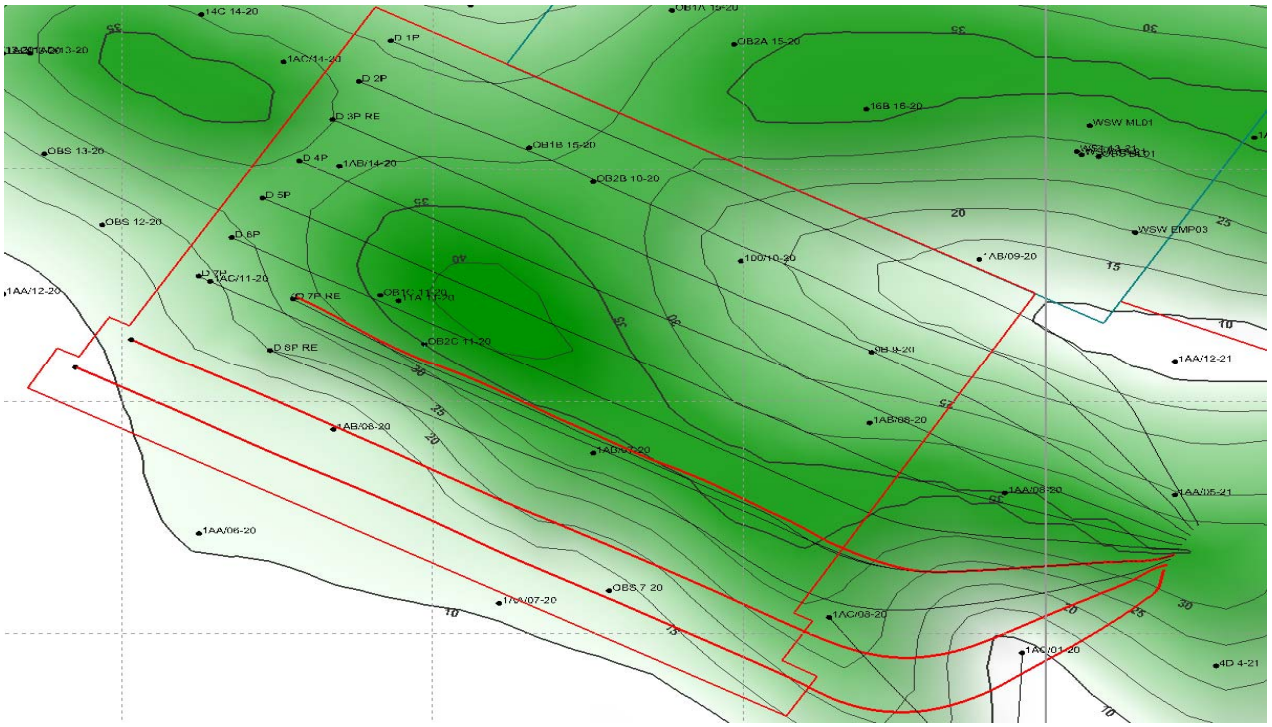
- BW pressure changes as pad pressures are increased / decreased
- McMurray pressure is being influenced by SAGD pressure (26m from A4)
- Clearwater gauge landed in impermeable shale
- Clearwater declining pressure result of gauge effects and does not indicate change in cap rock properties

Canadian Natural

Kirby South Performance
Pad A Key Learnings

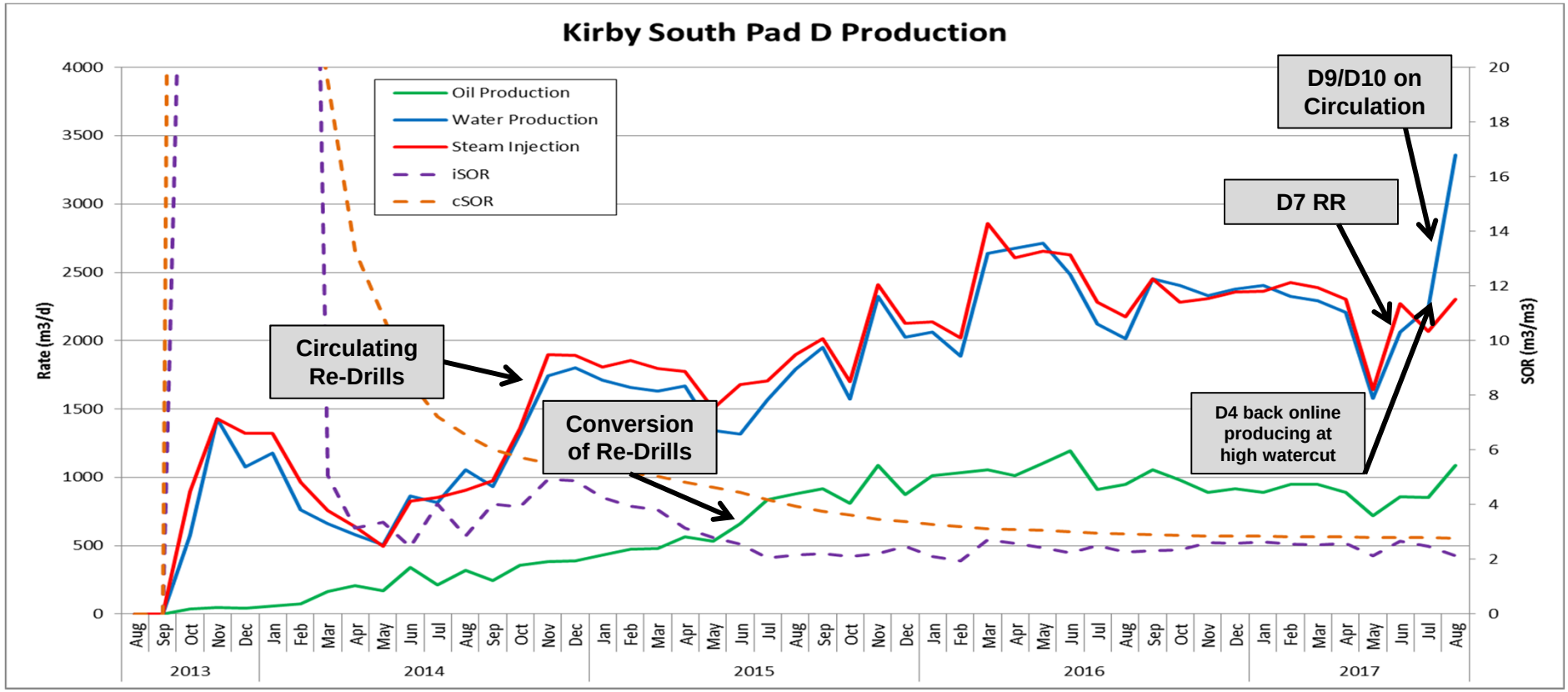
- Pad A has performed at reservoir expectations through this year
- Redrill of A1 Q4-2016 has not performed to expectation

Kirby South Performance – Mid Recovery
Pad D



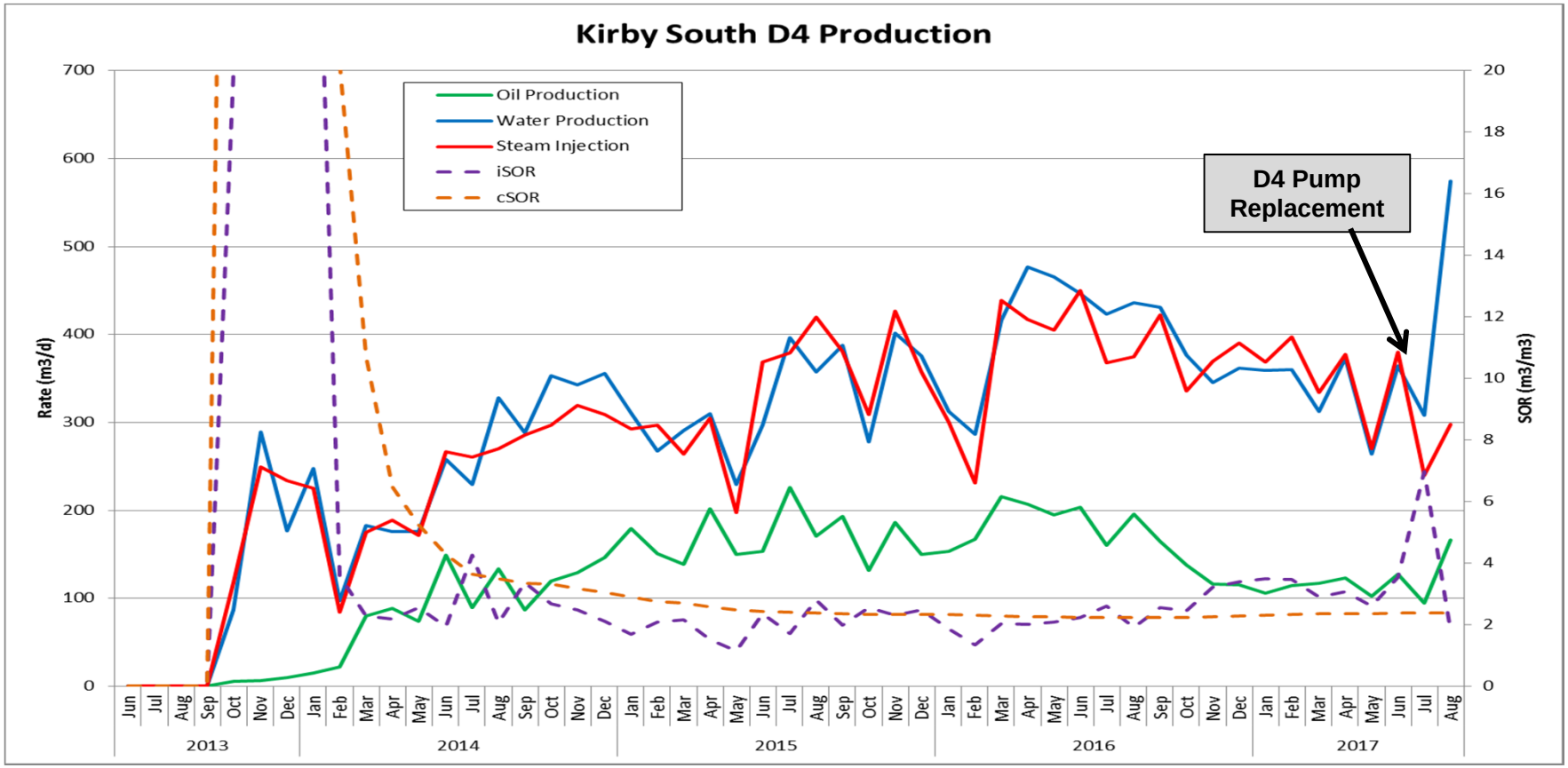
- SAGD well pair: 10
- First steam: Oct. 2013
- Inter-well pair spacing: 80 m
- Avg. net pay: 26 m
- Avg. So: 80%
- Avg. porosity: 33%
- Current RF: 16.7%

Kirby South Performance
Pad D Production



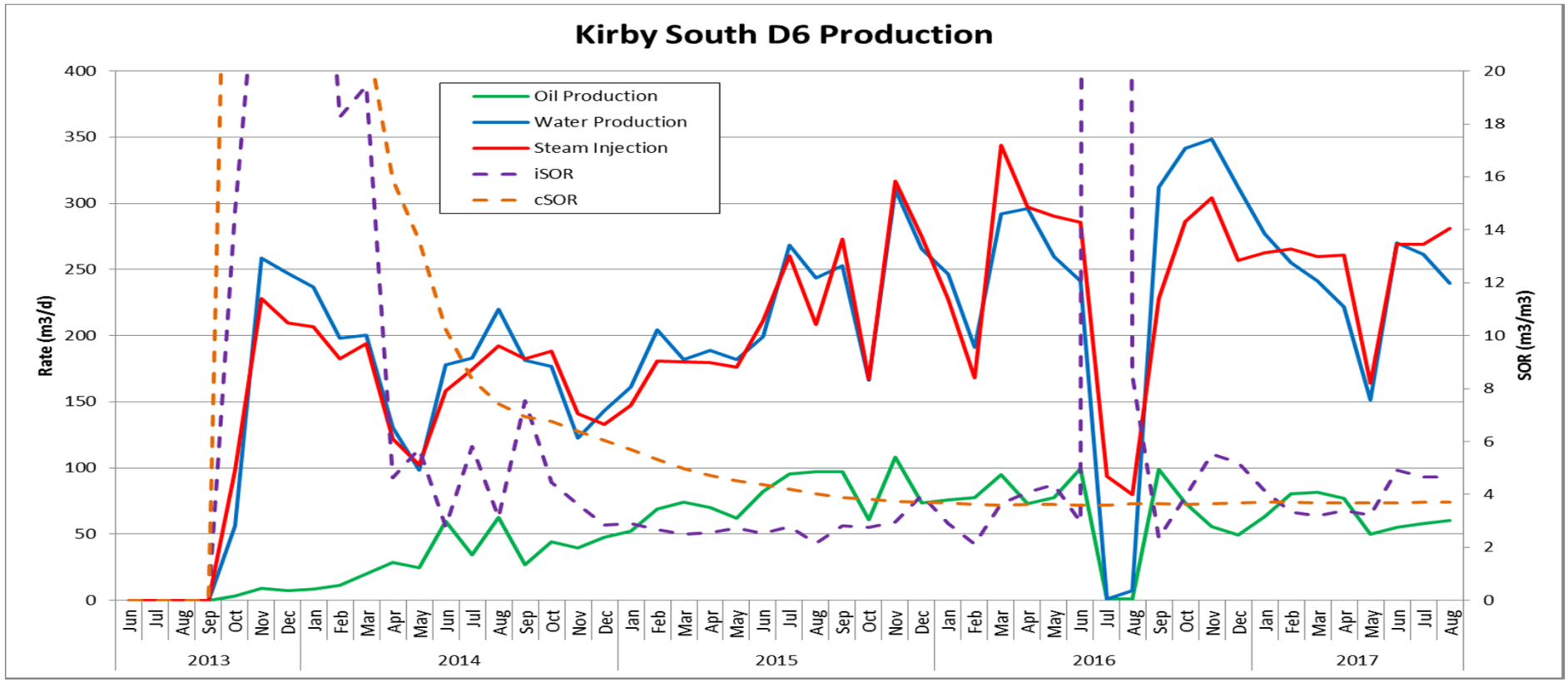
Canadian Natural

Kirby South Performance
High Recovery Pad D Well Pair



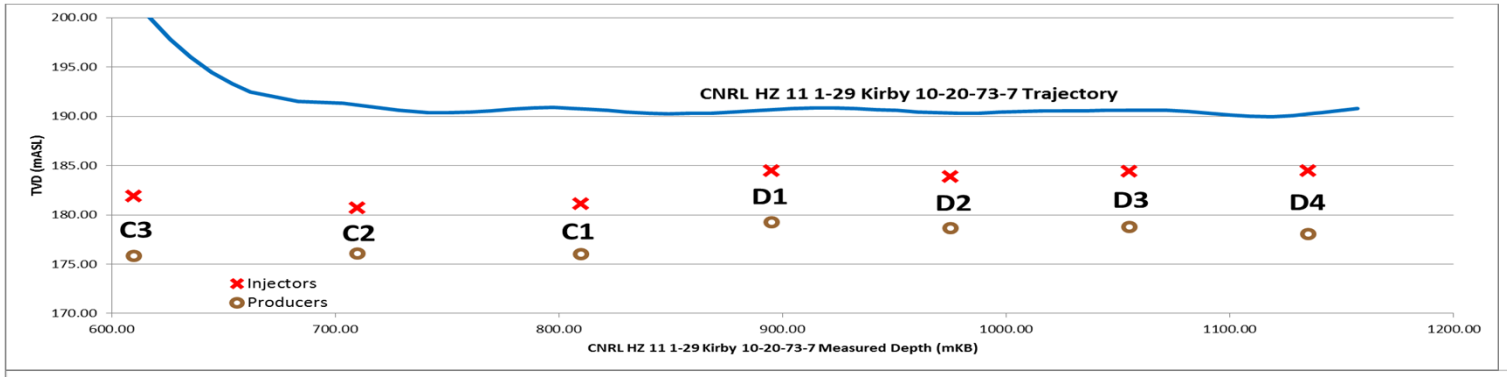
Canadian Natural

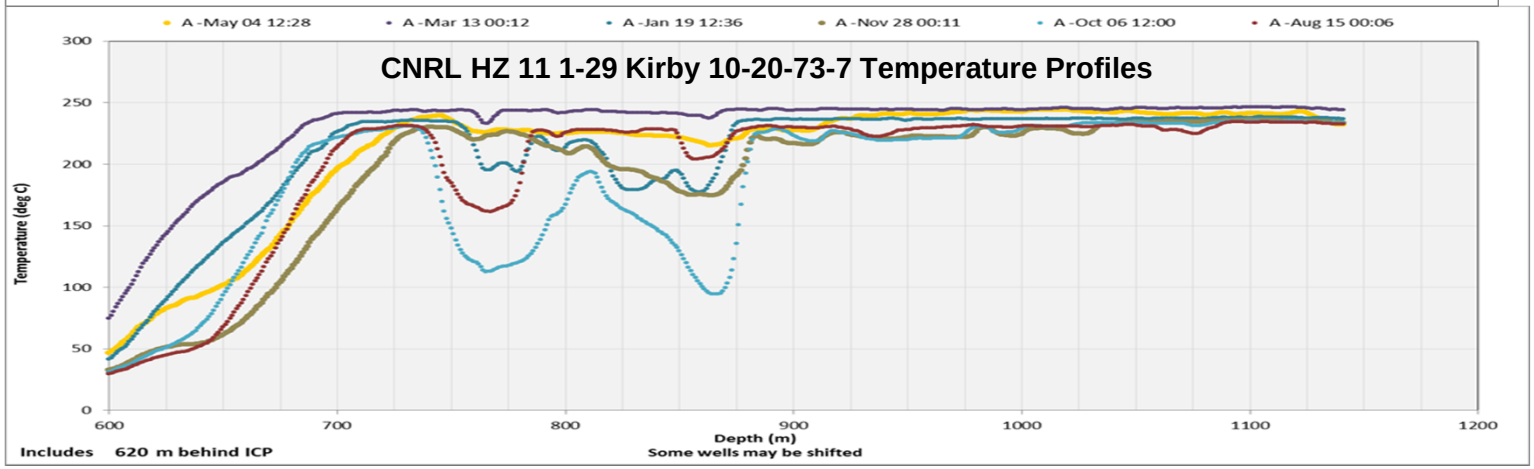
Kirby South Performance
Low Recovery Pad D Well Pair



Canadian Natural

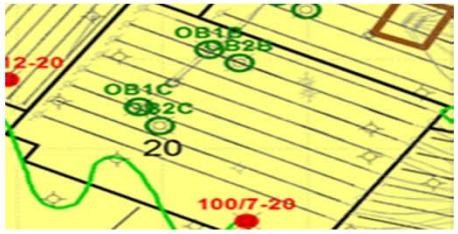
Kirby South Performance
Horizontal Observation Well

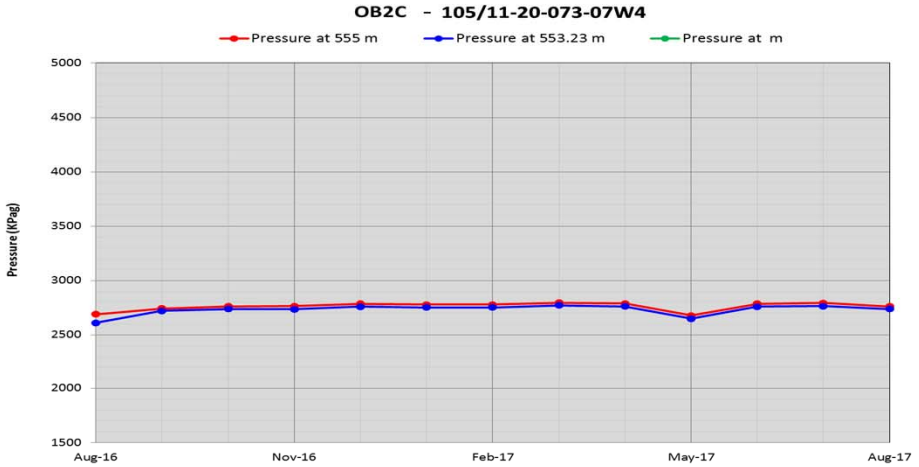


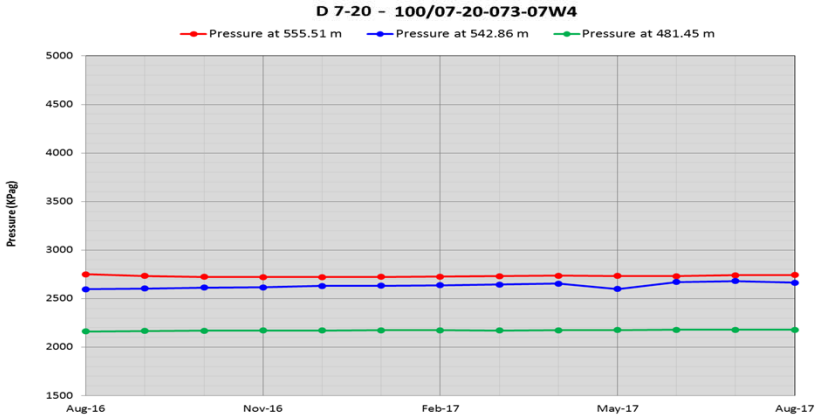


Canadian Natural

Kirby South Performance
Pad D Obs Well Pressures



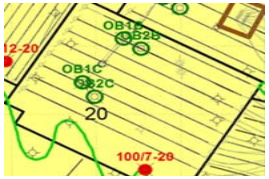




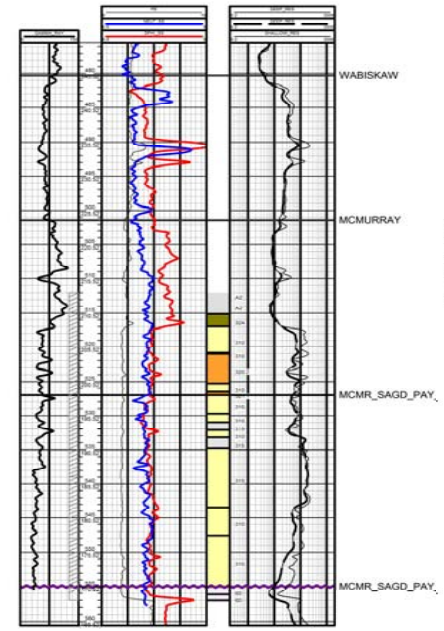
- Pad D Obs wells show good pressure sensitivities to changes in SAGD operations

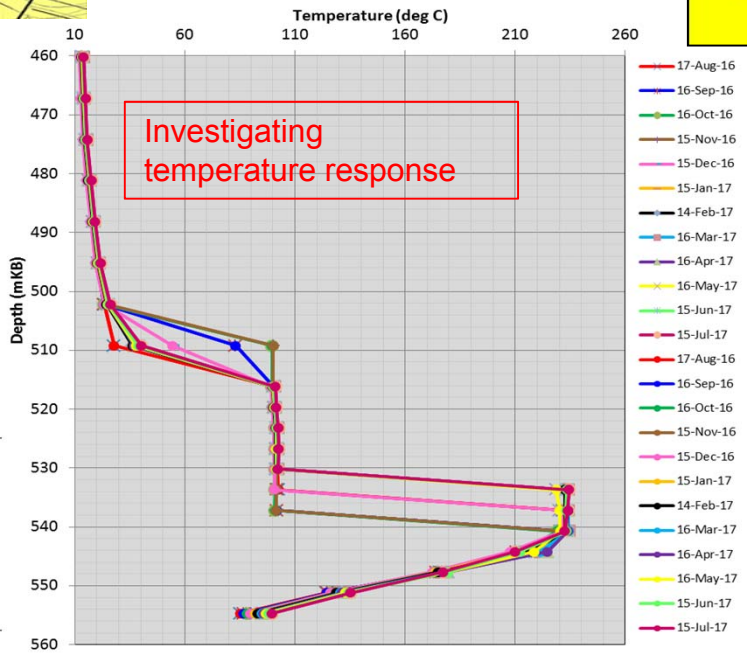
Canadian Natural

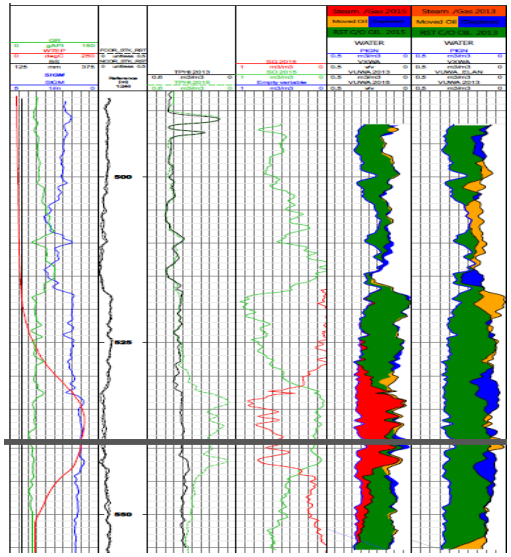
Kirby South Performance
Pad D Obs Well – 5 m From D2



UNIT	FACIES ASSOCIATION	FACIES CODE	FACIES	DESCRIPTION
McMurray	FA6c	340	Massive mud	Massive (structureless) mud. 0% Sand.
		335	Mud with silt interbeds	sand <10%
		324	Very Muddy IHS (mud > sand)	sand 10-35%
	FA6b	323	Muddy IHS (mud = sand)	sand 35-50%
		322	Mixed IHS (sand = mud)	sand 50-65%
	FA6a	321	Sandy- Mixed IHS (sand > mud)	sand 65-80%
		320	Sandy IHS (sand > mud)	sand 80-90%
	FA5b	317	Breccia	Mud clasts (>10%) in sand matrix. 70-100% mud clasts.
		316	Breccia	Mud clasts (>10%) in sand matrix. 40-70% mud clasts.
		315	Breccia	Mud clasts (>10%) in sand matrix. 10-40% mud clasts.
	FA5a	310	Fine- to medium-grained cross-stratified sand	Well-sorted sand (90-100%).
		300	Coarse- to medium-grained cross-stratified sand	Poorly-sorted sand (100%).

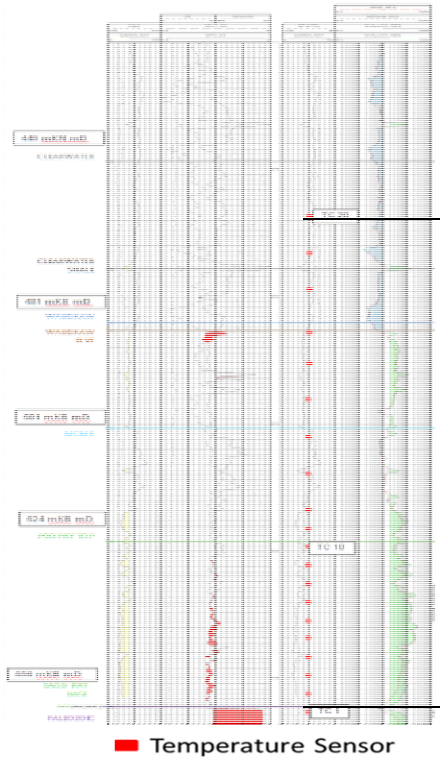


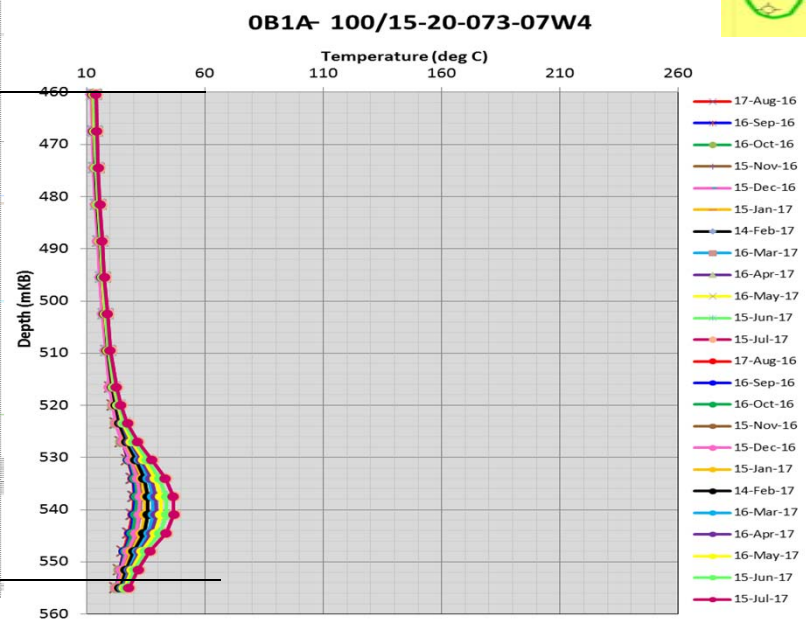


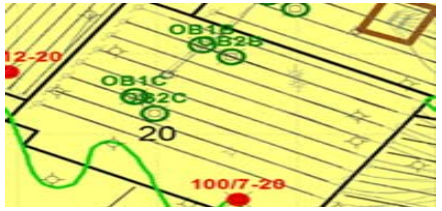


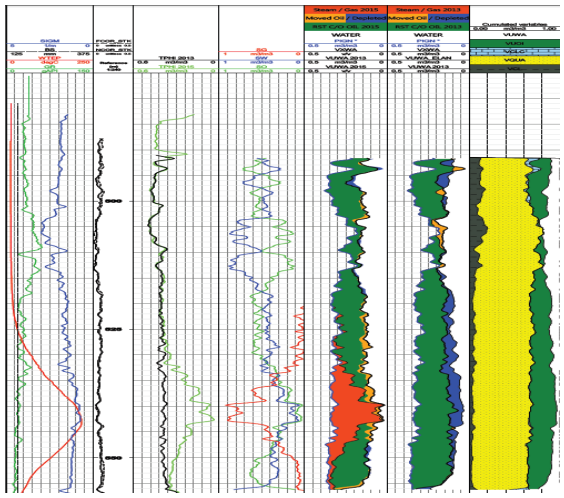
Canadian Natural

Kirby South Performance
Pad D Obs Well – 5.5 m From D2







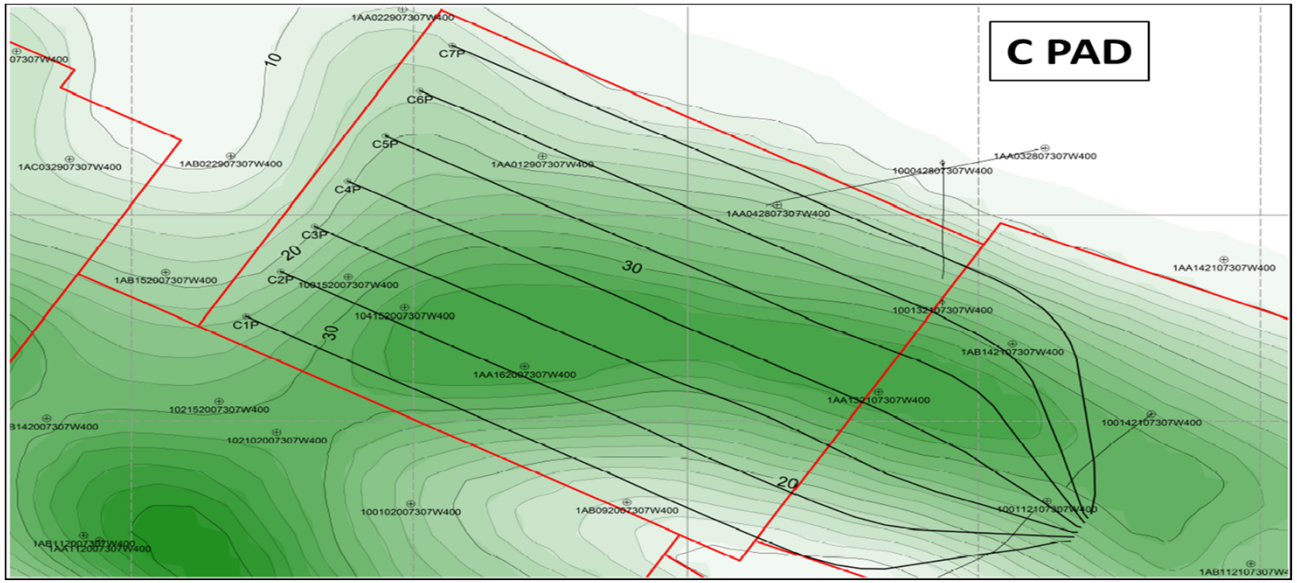


Canadian Natural

Kirby South Performance
Pad D Key Learnings

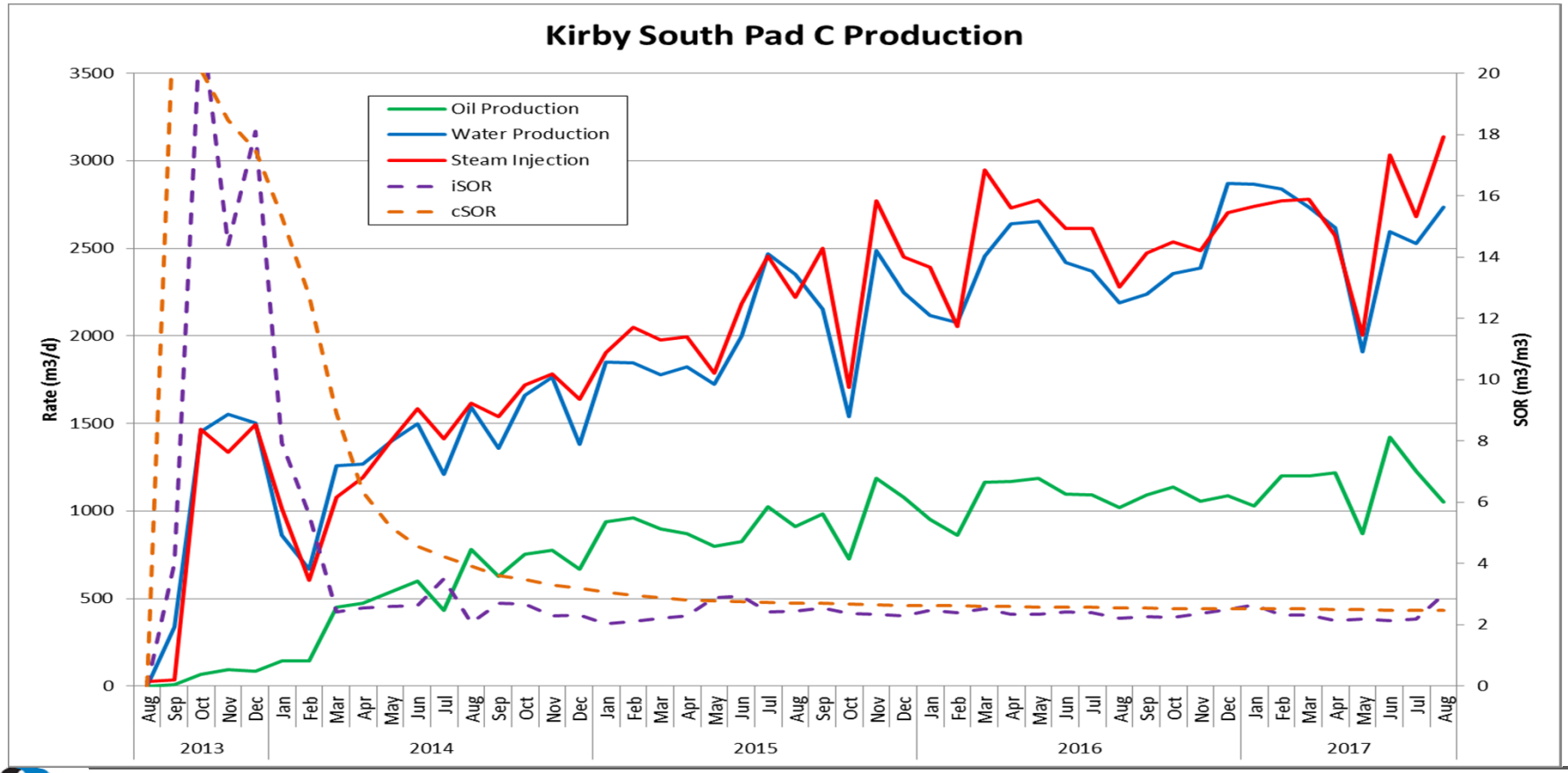
- Reservoir performance is meeting expectations
- Both step out pairs drilled and on circulation as of Q3 2017
- Known communication through old RAX SAGD pilot
  - To date no performance issues due to RAX pilot
  - Long term strategy to balance pressures between C & D pad
  - Continually monitor RAX pressure and temperatures

Kirby South Performance
Pad C – High Recovery Pad



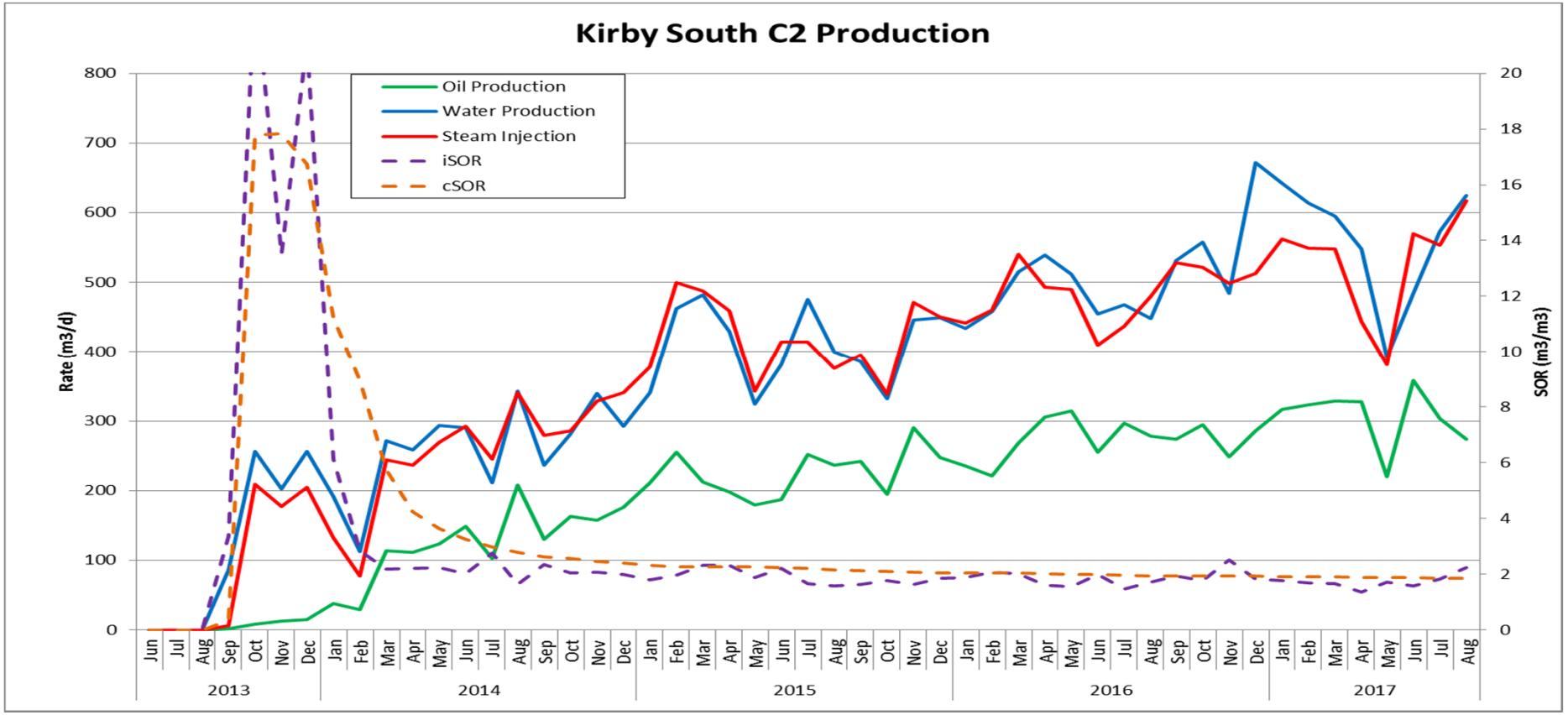
- SAGD well pair: 7
- First steam: Sept. 2013
- Inter-well pair spacing: 100 m
- Avg. net pay: 25 m
- Avg. So: 78%
- Avg. porosity: 33%
- Current RF: 28.7%

Kirby South Performance
Pad C Production



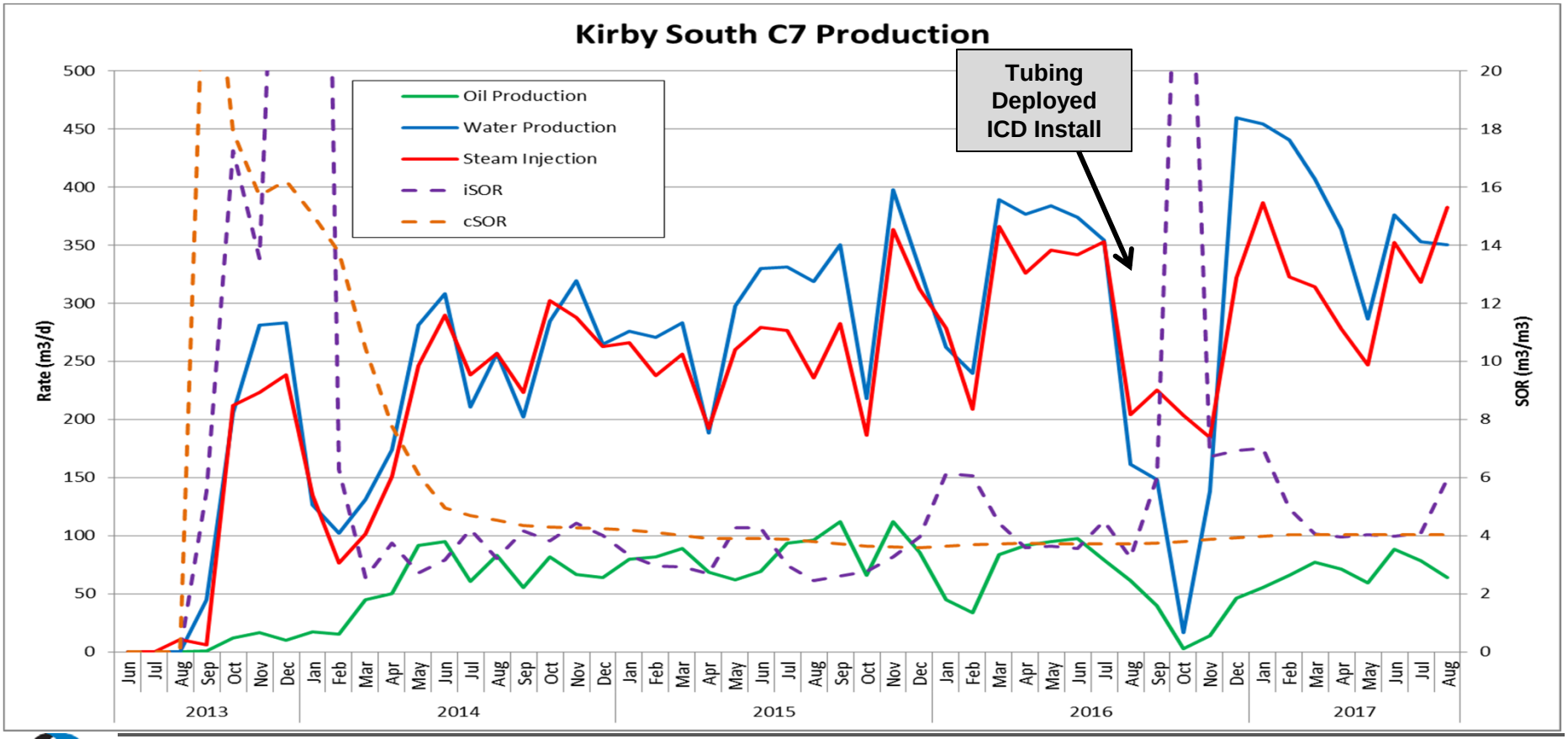
Canadian Natural

Kirby South Performance
High Recovery Pad C Well Pair



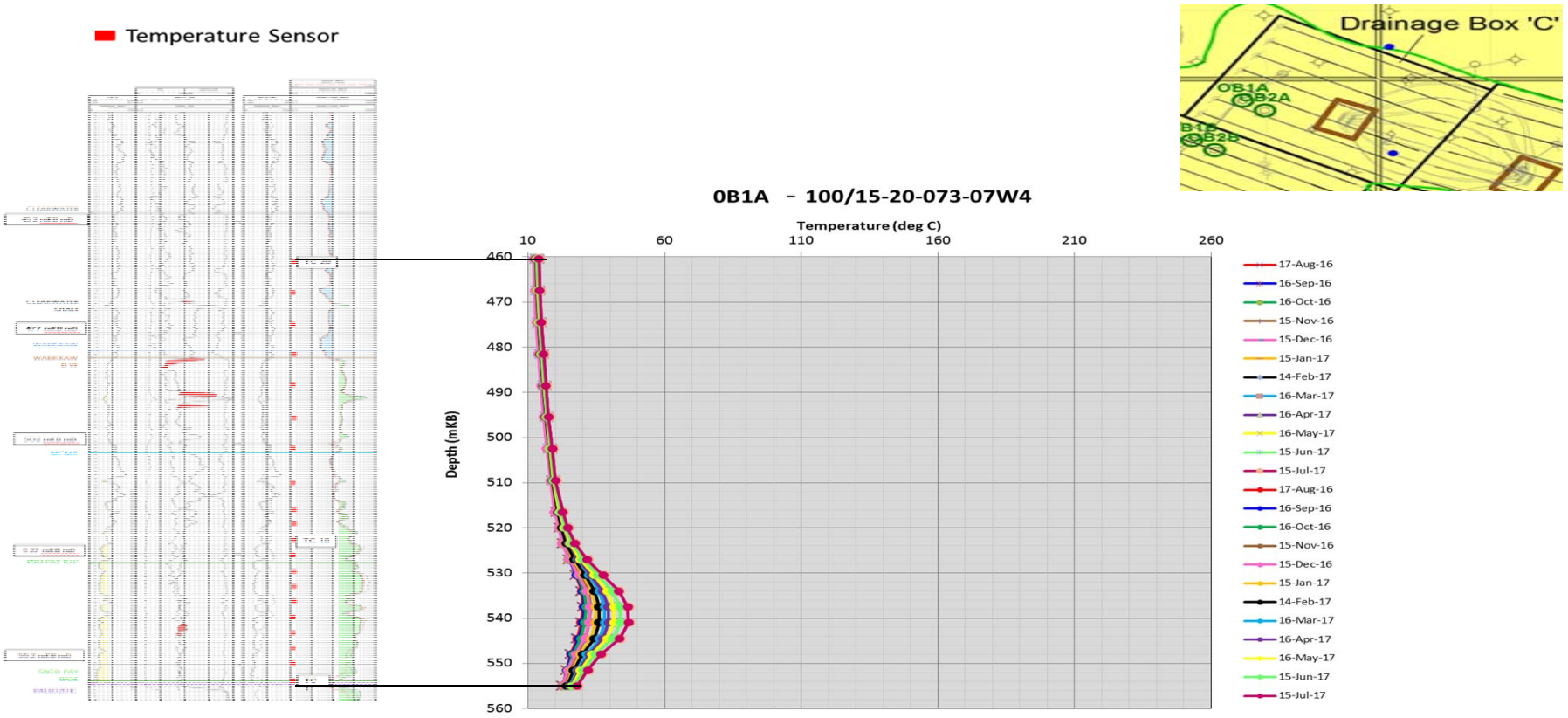
Canadian Natural

Kirby South Performance
Low Recovery Pad C Well Pair



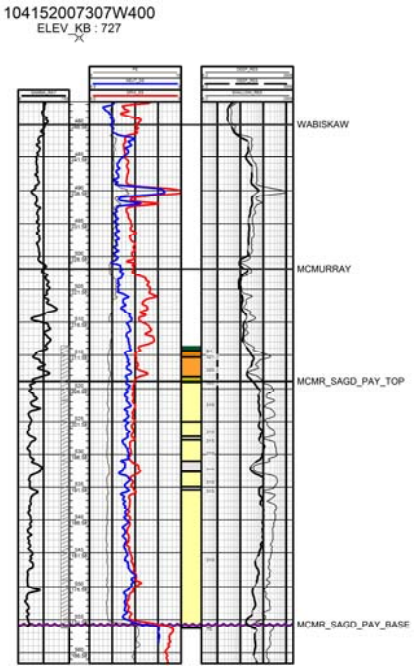
Canadian Natural

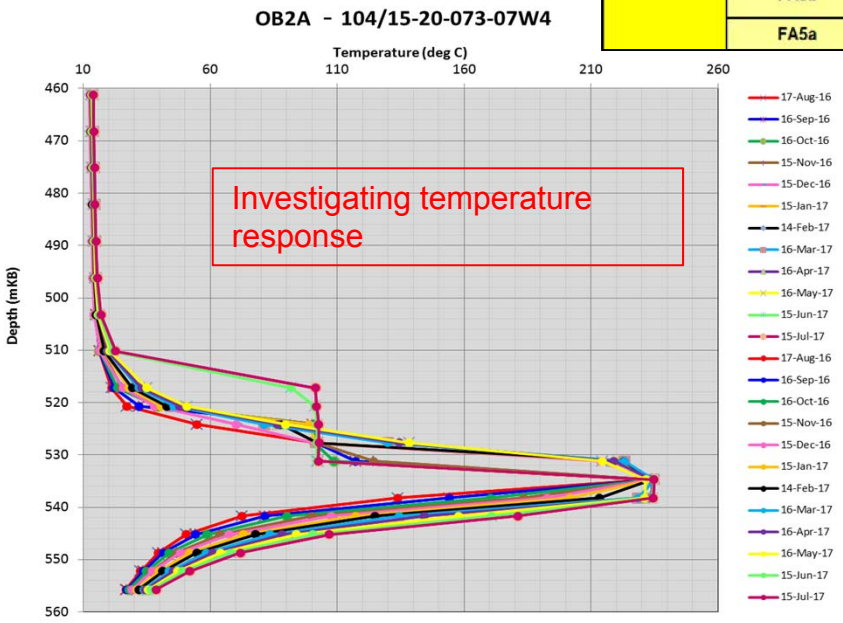
Kirby South Performance
Pad C Obs Well – 36 m From C2

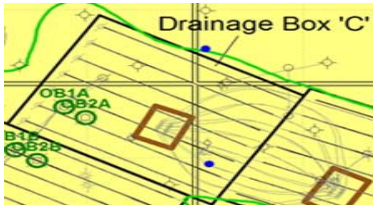


Kirby South Performance
Pad C Obs Well – 27 m From C2

UNIT	FACIES ASSOCIATION	FACIES CODE	FACIES	DESCRIPTION
McMurray	FA6c	340	Massive mud	Massive (structureless) mud. 0% Sand
		335	Mud with silt interbeds	sand <10%
		324	Very Muddy IHS (mud > sand)	sand 10-35%
	FA6b	323	Muddy IHS (mud > sand)	sand 35-50%
		322	Mixed IHS (sand = mud)	sand 50-65%
	FA6a	321	Sandy- Mixed IHS (sand > mud)	sand 65-80%
		320	Sandy IHS (sand > mud)	sand 80-90%
	FA5b	317	Breccia	Mud clasts (>10%) in sand matrix. 70-100% mud clasts.
		316	Breccia	Mud clasts (>10%) in sand matrix. 40-70% mud clasts.
		315	Breccia	Mud clasts (>10%) in sand matrix. 10-40% mud clasts.
	FA5a	310	Fine- to medium-grained cross-stratified sand	Well-sorted sand (90-100%).
		300	Coarse- to medium-grained cross-stratified sand	Poorly-sorted sand (100%).







Canadian Natural

Kirby South Performance
Pad C Key Learnings

- Reservoir performance is meeting expectations
- Upside production is contributing to some of the wells performance
- Chamber communication is observed in a high level on C pad
- Known communication through old RAX SAGD pilot
  - No impact on production

Kirby South Performance
5 Year Outlook – Pad Abandonments

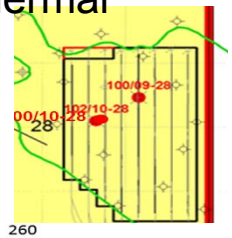
- No expected pad abandonments in the next 5 years

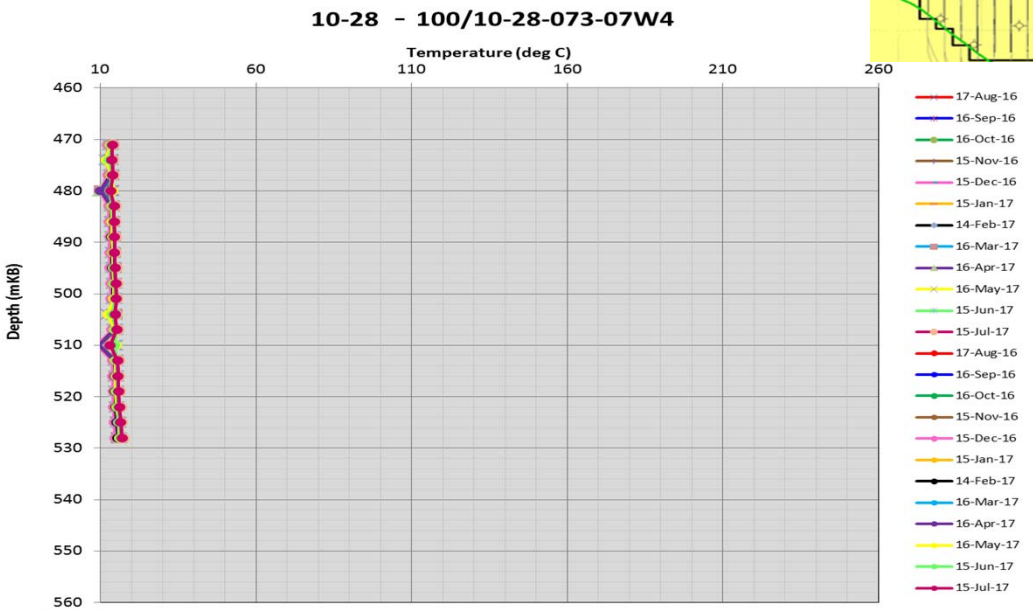
Kirby South Performance
Wellhead Steam Quality

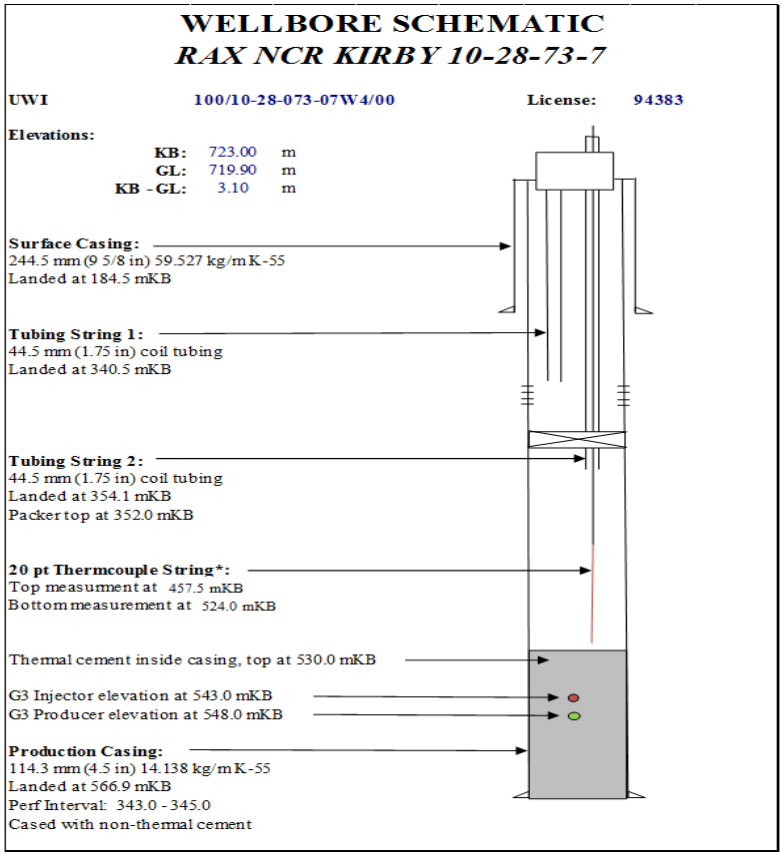
- During steady operations, wellhead quality should be 95% or greater
- There is some evidence that certain pads and wells have experienced slightly lower quality during start-up
  - This is not expected to have an impact on recovery
- E-Pad Co-injection
  - 7 E3m3/d started in July 2017
  - No GOR or SOR effects seen yet

Kirby South Observation Well Results
100/10-28-073-07W4 – 4 m From G3

Colony gas well to evaluate the ability of non-thermal cement to maintain hydraulic isolation in a thermal environment







Canadian Natural

No thermal impacts

Kirby South Observation Well Results
Overall Performance

- 100/09-28-073-07W4/00
  - Appears to have fluid migrating into well from bottom. Data not required for pad monitoring, but potential to blow well dry and re-run fiber string this winter for pad optimization.
- 100/10-28-073-07W4/00
  - 1 TC showing erroneous data but not effecting monitoring purpose of well, therefore no action to be taken.
- Annual preventative maintenance program for all observation wells.

Kirby South Observation Well Results
Overall Performance

- 1AB/11-20-073-07W4/00 OB1C
  - Well is cased to 498.0 mKB and has an estimated cement top within the casing of 475.0 mKB. A 10 point thermocouple string is landed from 446.0 – 473.0 mKB across the Clearwater cap rock. There are no plans to enter this well.

- 100/06-21-073-07W4/00
  - In March 2014, the thermocouple string was pulled and the McMurray bottom water was perforated because the external pressure gauge was not providing accurate data. An internal pressure gauge was run and the thermocouple string was **not** re-run. There are no plans to enter this well.

Future Plans – Approved Drills

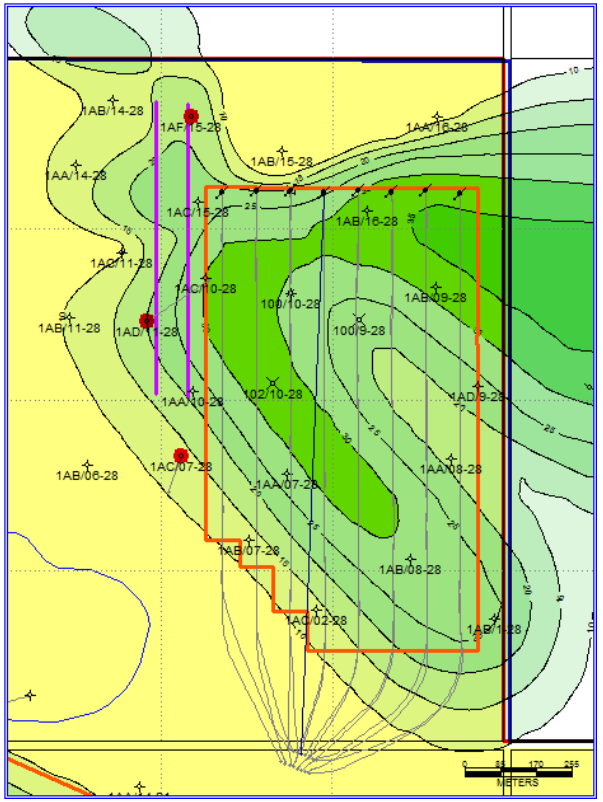
- Continue to optimize SAGD pairs
- Approved wells to be drilled in the next year:
  - Infills:
    - 4 on B pad to be drilled in remainder September
    - 7 on C pad to be drilled after B pad infills
  - Step Outs:
    - D11 Approved
    - G9 and G10 Approved

Future Plans – Evaluation Potential

- Pending favorable economic conditions, the following future plans are contemplated:
  - Infills:
    - Pad A application to be submitted
    - Pad D and G currently evaluating
  - Scheme Amendments:
    - KS 10/11 pads D78 application submitted in July
    - KSW pad application in progress

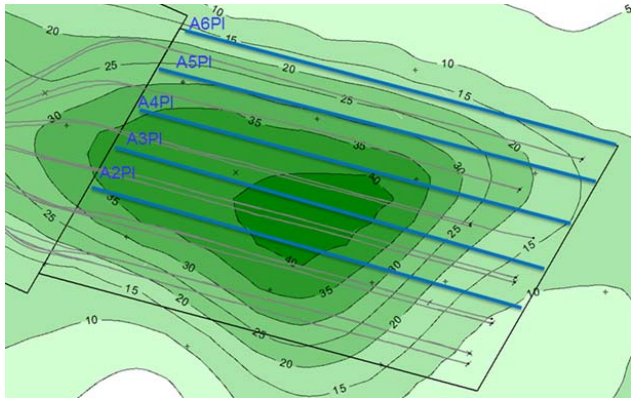
Future Plans - G Step Outs

- 2 step outs planned on G Pad (G9 & G10)
  - Wells to be drilled West of existing well pairs
    - G9 will be 75m from G1
    - D10 will be 65m from G9
  - 980m well lengths
  - 10-34m pay height
  - D78 approval received Sept. 5, 2017
  - Drilling planned for Q4 2017/Q1 2018



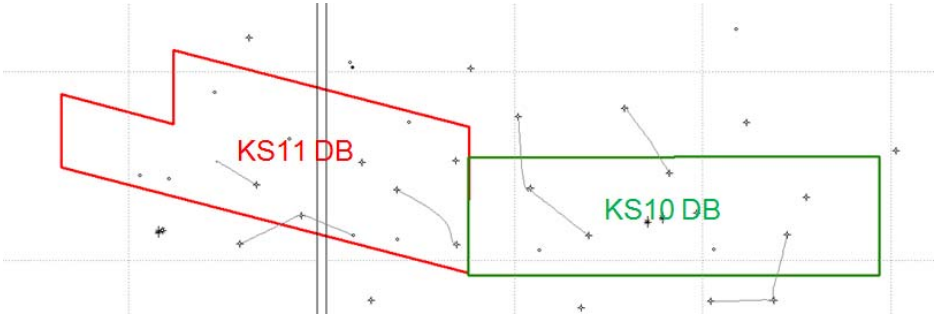
Future Plans - A Pad Infills

- 5 infills planned on A pad
  - Plan to drill 5 infill producers spaced 50m from existing producers
  - 10-40m pay height
  - Plan to drill at the same TVD as existing A Pad wells
  - D78 amendment submitted in Aug. 2017



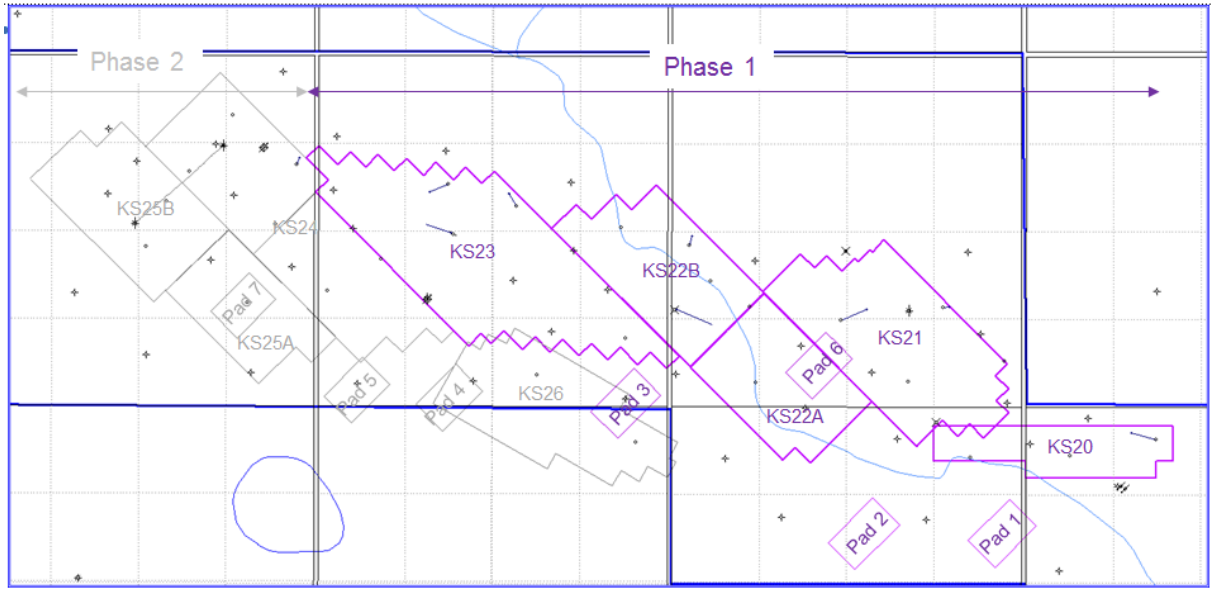
Future Plans - KS10 & 11

- Adding two drainage boxes KS10 & KS11 to Kirby South Development Area
  - 5 well pairs planned in KS10 and 6 well pairs planned in KS11
- 600-900m in lateral length
- 50m spacing
- D78 application submitted in July 2017



Future Plans – KS20-26

- Request to add 9 drainage boxes in the KSW development (KS20 to KS26)
  - 60 well pairs planned
- Currently preparing D78 application to be submitted in Sept. 2017

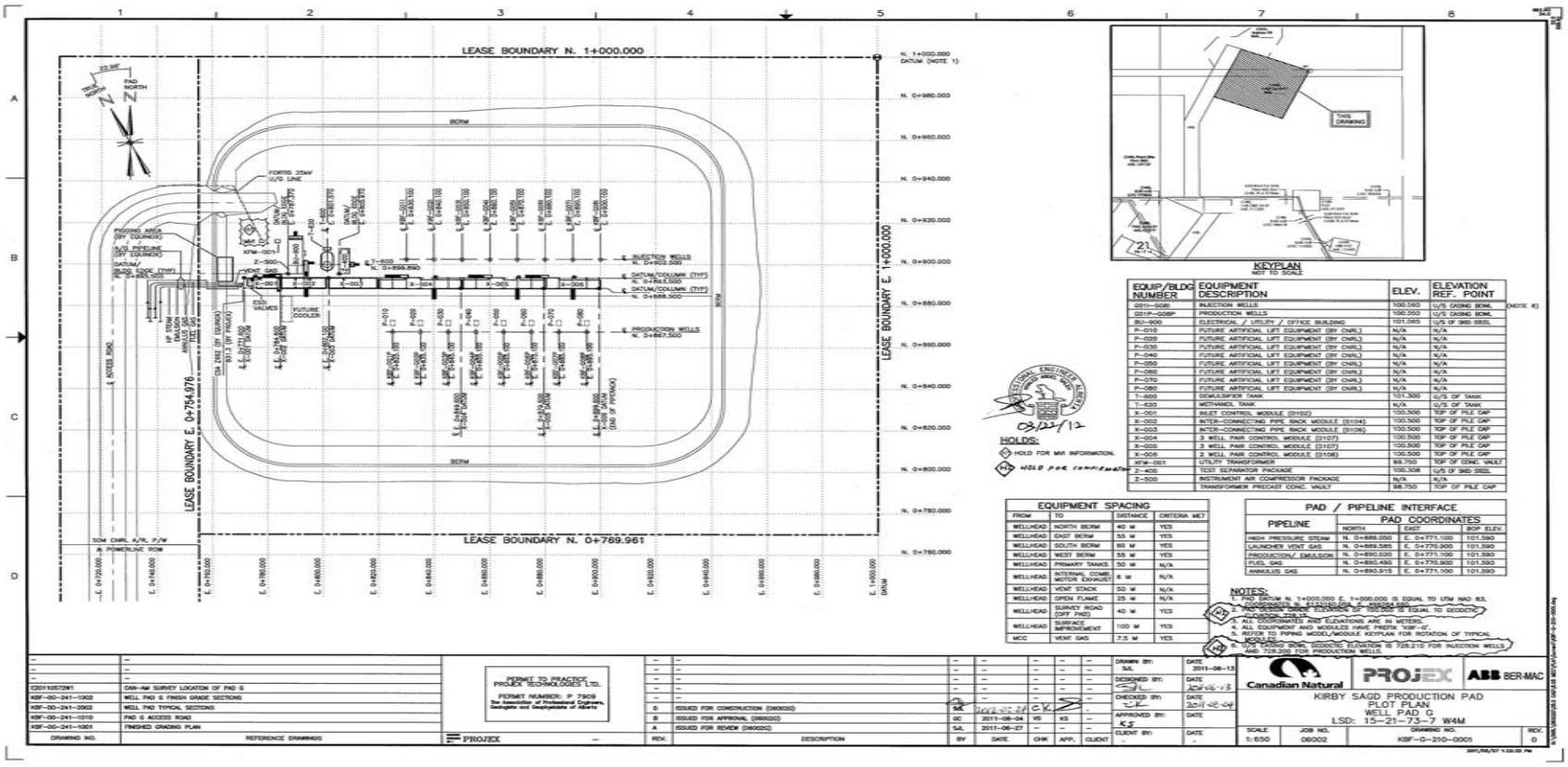


DIRECTIVE 54 SECTION 3.1.2
SURFACE OPERATIONS, COMPLIANCE AND ISSUES NOT RELATED TO RESOURCE EVALUATION AND RECOVERY

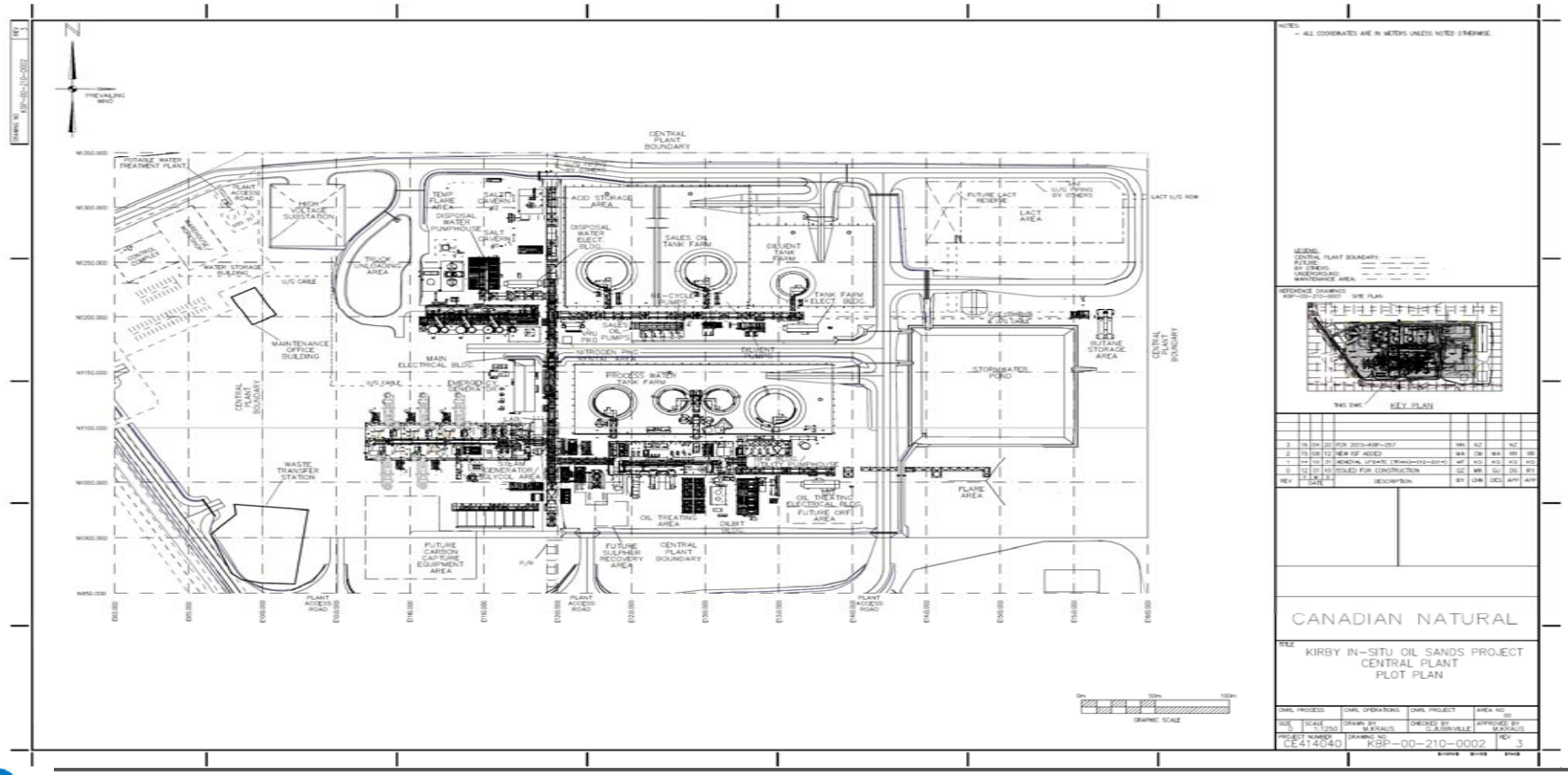
Surface Facilities Overview
Plot Plans

- Detailed Site Plot Plans:
  - Kirby SAGD Production Pad Plot Plan
    - Dwg No. KBF-G-210-0001
  - Kirby South Central Plant Plot Plan
    - Dwg No. KBP-00-210-0002
- Simplified Schematic:
  - Kirby In-Situ Oil Sands Project Simplified Schematic

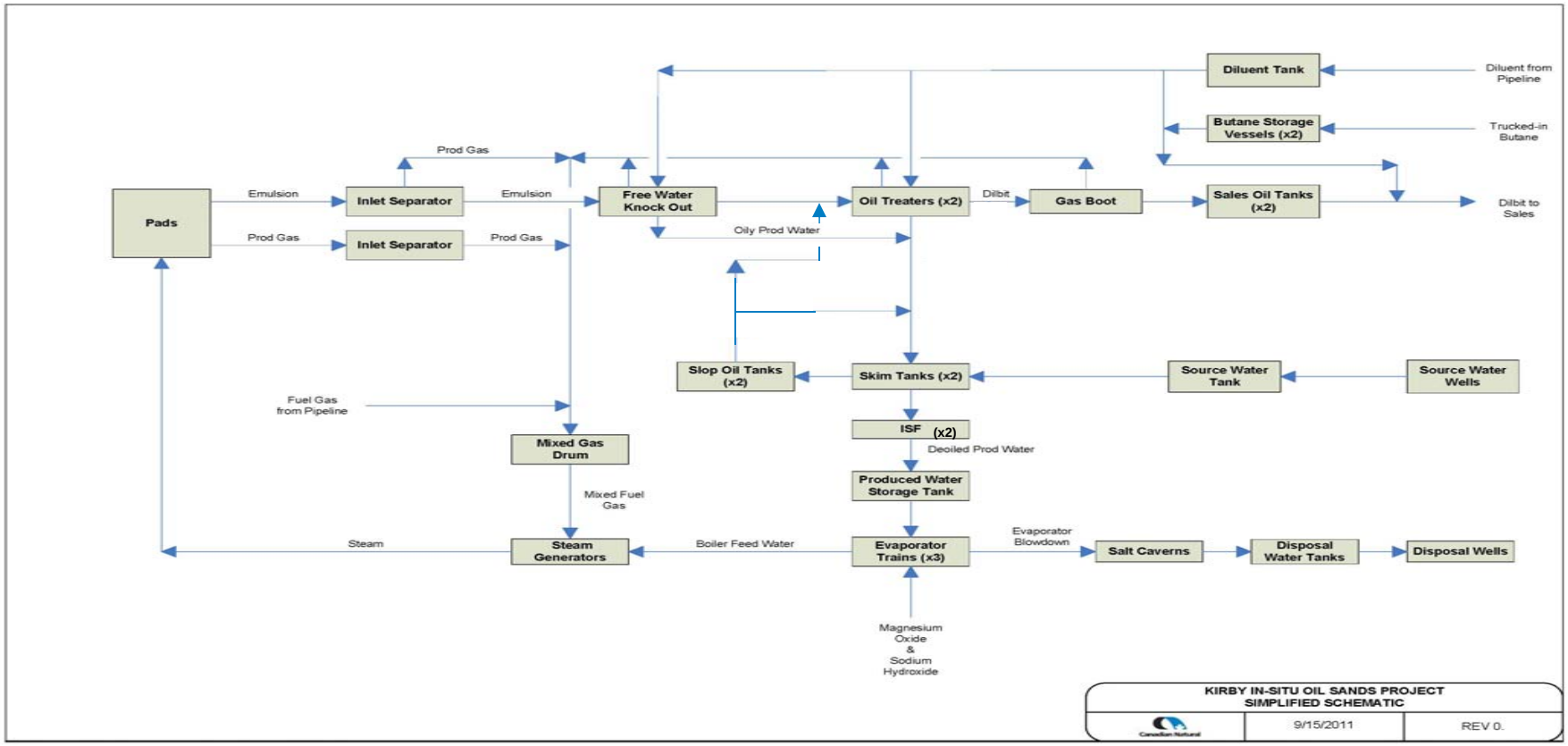
Surface Facilities Overview
Kirby South SAGD Production Pad Plot Plan



Surface Facilities Overview
Kirby South Central Plant Plot Plan



Surface Facilities Overview
Kirby Simplified Schematic



Surface Facilities Overview
Kirby South Modifications

- Summary of Modifications since August 2016
  - A compressor was added on Pad E for produced gas co-injection with steam to improve steam-oil-ratio while having minimal impact on oil rates.
  - Disposal filtering skid bypassed from disposal wellheads except during pigging operations.
  - Small facility modifications during the May turnaround (tank bypasses).
  - Meter upgrades: Added Butane meter and upgraded1-FT-3290 & 2-FT-0051 flow meters.
  - Upsized inlet separator emulsion outlet control valve 1-LV-1000C.
  - Tie-ins completed for Pad B, C, D, F, and G for step outs/infills.
  - Constructions completed on Pad D and F for step outs.
  - Permanent gas tie-in from West Kirby compressor stations sales line to Kirby supply line.
  - Tie-in new disposal well 100/09-19-073-08W4.

Kirby South Facility Performance
Oil Treating/Produced Water De-oiling Area

- Overall water quality and oil treating targets have been met
  - –Oil treating is running very stable, short term upsets from well ramp ups after acid stimulation activities is still experienced, but are manageable
    - Optimization work continues on the chemical program and pressure optimization trials.
  - –PW de-oiling upsets leading to evaporator fouling and additional cleanings has been nearly eliminated
  - –New production record reached on June 3rd, 44,790 BPD.
  - –Treatment of slop generated on site has been improved through process and chemical program optimization
    - Recycled most of the slop back to FWKO

Kirby South Facility Performance
Water Treatment Area

- Great performance in the evaporators – reached name plate capacity after the May plant turnaround
- Water upsets affecting evaporator performance has been nearly eliminated, increasing steam availability
- Disposal well injectivity is no longer limited with monthly disposal line pigging program
- Pre-heater fouling due to brackish water hardness is an ongoing issue.

Kirby South Facility Performance
Boilers

- No tubing failures since 2014. No casing failures since August 2016
- One casing failure on Boiler 4 in August 2016 due to high vibrations knocking refractory off the casing walls. Lots of tuning and shimming work was done on boiler 4 to remedy the vibration issue.
- All boilers' refractory were inspected during the turnaround and all were in good shape. NDT and a more detailed inspection will be performed on the boilers in 2018 for regulatory inspections.
- All boilers have met nameplate capacity after the May turnaround.

Kirby South Facility Performance
Salt Caverns

- Salt caverns continue to manage evaporator blowdown solids

- Caverns are operating in series, Cavern 2 is receiving concentrate (brine) from Cavern 1

- 2017 Sonar Logging
  - Cavern 1 last completed on October, 2016, another sonar logging scheduled September 2017
  - Cavern 2 last completed on June, 2016, another sonar logging scheduled September 2017

Kirby South Facility Performance
Power Consumption

- Power Consumption on a monthly basis

Month	Total Power Consumption (kWh)
Sep -16	17,129,300
Oct -16	17,318,494
Nov -16	17,091,532
Dec -16	17,745,480
Jan -17	17,804,724
Feb -17	15,897,516
Mar -17	17,717,028
Apr -17	16,360,645
May -17	12,694,176
Jun -17	17,400,680
Jul -17	17,252,878
Aug-17	17,527,219

Kirby South Facility Performance
Gas Usage

- Gas Usage on a monthly basis

Month	Total Purchased Gas e3m3	Total Gas Produced e3m3	Total Gas Vented e3m3	Total Solution Gas to Flare e3m3	Solution Gas Recovered %
Sep-16	28,137	848	-	11.7	98.6
Oct-16	27,330	1,300	-	11.4	99.1
Nov-16	27,169	1,135	-	5.1	99.6
Dec-16	28,466	1,002	-	5.1	99.5
Jan-17	27,965	1,288	-	6.1	99.5
Feb-17	24,894	1,329	-	5.6	99.6
Mar-17	27,908	1,268	-	5.7	99.6
Apr-17	24,838	1,615	-	11.1	99.3
May-17	19,835	140.6	-	10.9	92.2
Jun-17	28,506	1,209	16.2	6.1	99.5
Jul-17	27,170	951	-	7.8	99.2
Aug-17	27,774	1,167	-	5.2	99.6

Kirby South – Greenhouse Gas Emissions

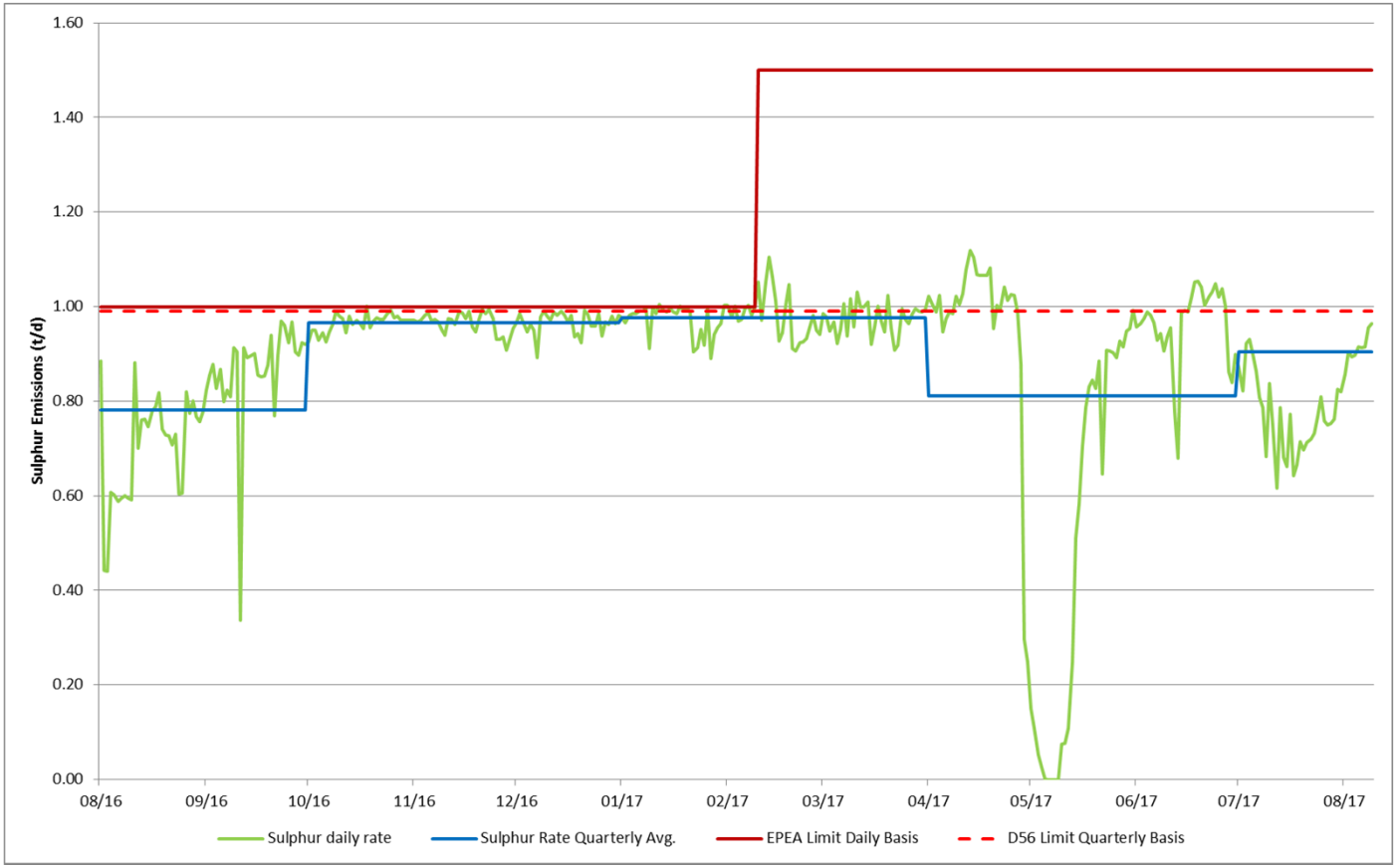
- Kirby South Greenhouse Gas Emissions
  - 2016 emissions are actuals
  - 2017 emissions are estimates
    - Will be verified Q1 2018

Month	2016/2017 (tCO2e)
September	62,360
October	59,520
November	58,840
December	61,240
January	61,750
February	55,110
March	60,430
April	56,340
May	48,490
June	63,870
July	59,140
August	61,980

Kirby South Facility Performance
Emissions

- Kirby Sulphur Emissions
  - –No exceedance of the EPEA daily SO2 emissions limit (2.0 t/d before Feb 10th, 3.0 t/d after Feb 10th)
  - –No exceedance of the AER D56 calendar quarterly sulphur limit of 0.99 t/d
  - –No plans for sulphur recovery installation at this time
  - –Contingency plan is to reduce production if the sulphur emission rate approaches the EPEA or D56 limit

Kirby South Facility Performance
Sulphur Emissions



Canadian Natural

Kirby South Facility Performance
Ambient Air Quality Results

- Air Quality monitoring trailers is scheduled to be deployed and in service from Sept – Dec 2017 and Jan – Mar 2018. No continuous monitoring data from August 2016 to August 2017

- There were no SO2, H2S, or NO2 monthly readings above the Alberta Ambient Air Quality Objective from August 2016 to August 2017

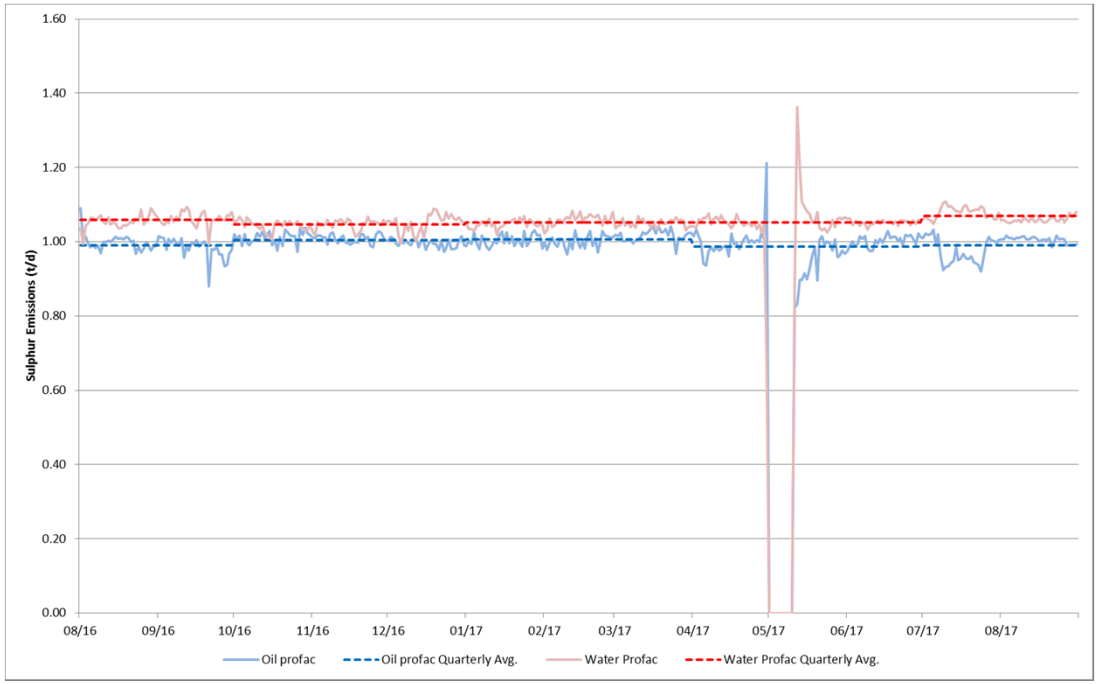
Measurement and Reporting Summary

- MARP approved in October 2011 and last updated in February 2017
  - Disposal well 100/09-19-073-08W4 was added to the document, the disposal well flow meter is 1019FQI2000.
  - Kirby South Gas Injection was added to the document for E pad produced gas co-injection.
  - Solution gas flare calculation modified as per discussion with AER, MARP document updated.
- Methods for estimating well production and injection volumes:
  - Produced emulsion from the scheme is commingled at the battery. Bitumen and water production from the battery will be prorated to each well using monthly proration test data and proration factors
    - Total Battery Oil (Water) / Total Test Oil (Water) at Wells = Oil (Water) Proration Factor
    - Oil (Water) Proration Factor * Each Well Test Oil (Water) Volume = Oil (Water) Allocated to Each Well
  - Gas is allocated to each well using a Field GOR
    - Total Solution Gas Produced + Total Co-injected Produced Gas/ Total Battery Oil = Gas Oil Ratio
    - Gas Oil Ratio * Oil Allocated to Each Well = Gas Allocated to Each Well
  - Injected steam volumes will be continuously measured at the wellhead and prorated to the total steam leaving the injection facility
- Test Durations
  - Based on operating experience to date, well test duration has been optimized at 1 hour and each well is tested 3 to 4 times per day.

Measurement and Reporting
Proration Factors

– 100% compliance with D17 (3-month avg. range 0.85-1.15)

– The spike in May 2017 is due to ramp up after full plant turnaround



Future Plans – Surface
Kirby South Planned 2017 – 2018 Activities

- Central Plant
  - Evap outages for maintenance and boiler outages for regulatory inspections
  - Disposal filter optimization trial with permanent filter skids by the well heads
  - Internal inspections on Skim tanks, slop oil tanks, sales oil tanks and butane bullets

- Pads
  - Piping modifications on step outs, infills and re-drills
    - 7 infill wells on Pad C, 4 infill wells on Pad B
    - Potential wells on Pad D and Pad G

Kirby North Site Activities Summary

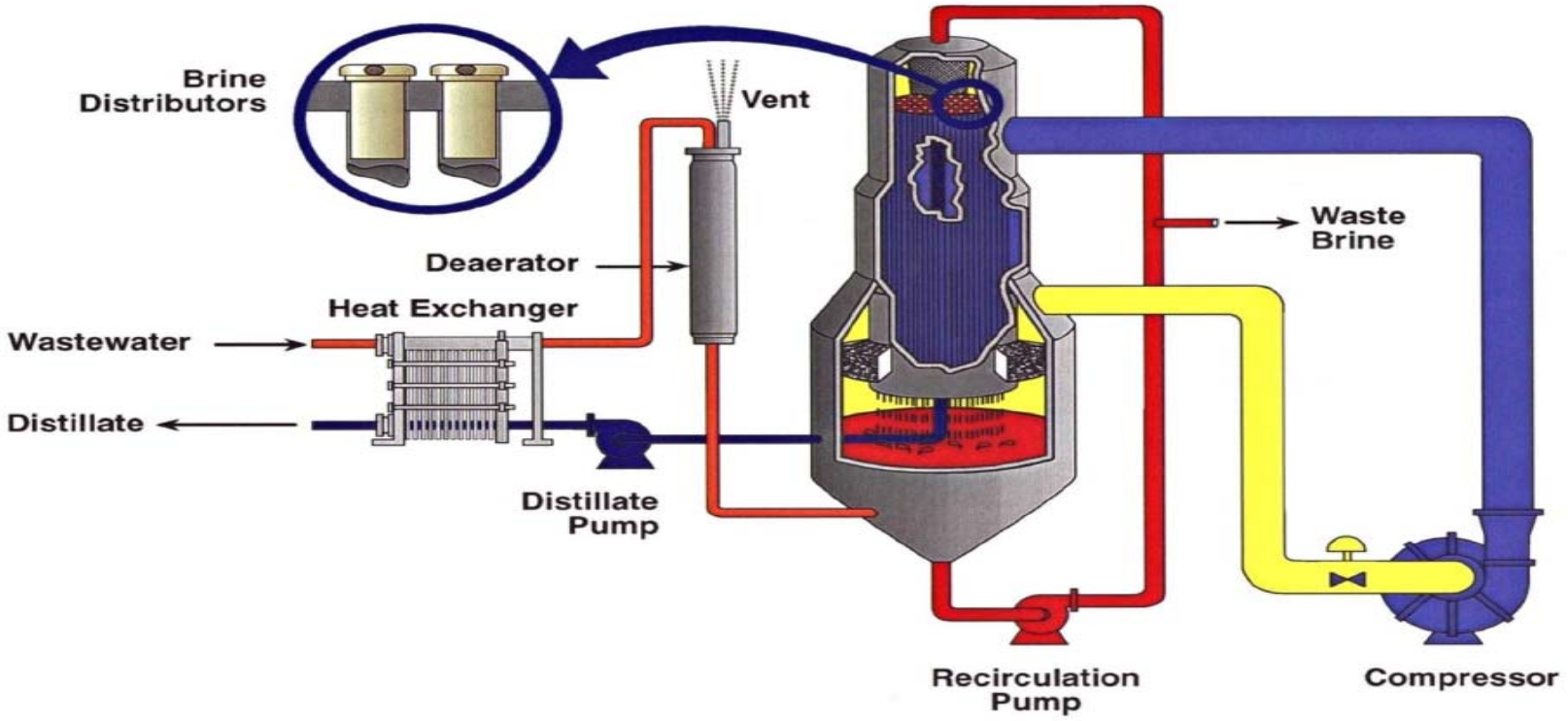
- Central Plant
  - Civil work for equipment/building foundations completed
  - Piping module assembly contracts awarded and kicked off
  - Plant mechanical and electrical contracts awarded and kicked off
  - Module setting resumed for main rack, oil treating and water treating areas
  - Tank painting, insulating and internal coating completed
  - IGF orders completed and ready to ship to site
- Pads & Pipelines
  - Detailed engineering of pad design completed
  - Pipeline engineering and surveying completed and materials ordered
- Steam-in planned for late, 2019

Water Treatment Technology Summary

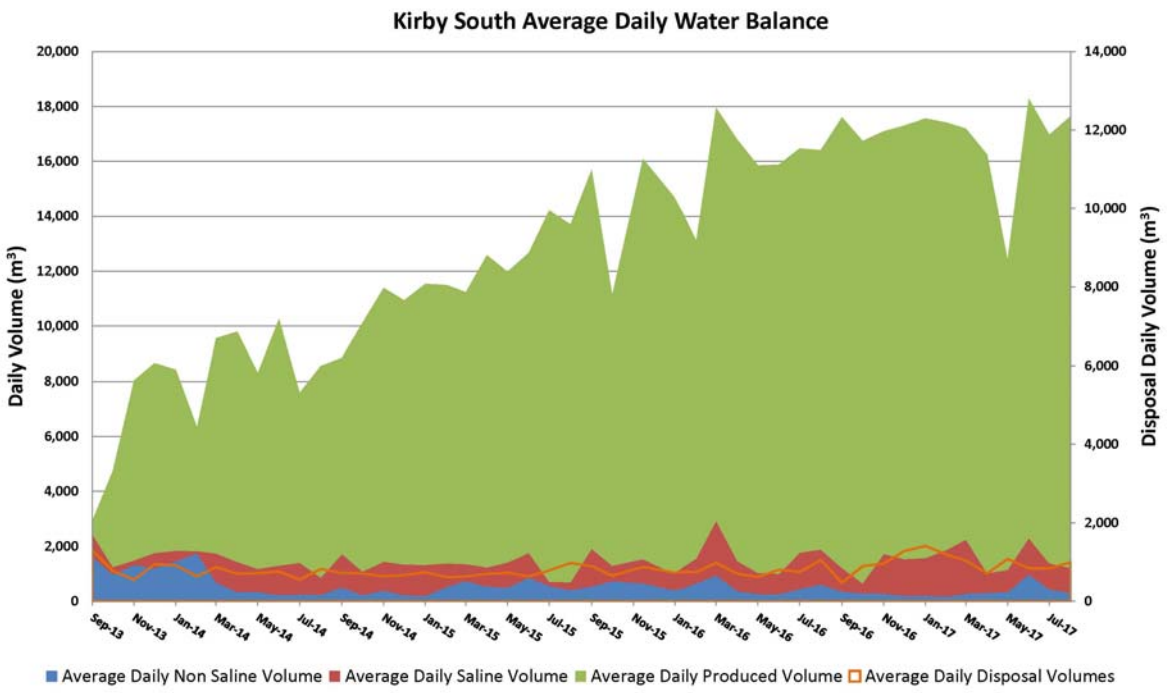
- Mechanical Vapor Compression (MVC) evaporators selected for BFW treatment
  - Treatment of both recycled produced water and makeup water
  - Evaporator blow down solids disposal to on-site salt cavern
  - Silica Sorption process selected vs. high pH process from application

Water Treatment Technology
Schematic

Mechanical Vapor Compression Evaporator:



Kirby South Produced and Make-up Water Usage



Water Sources

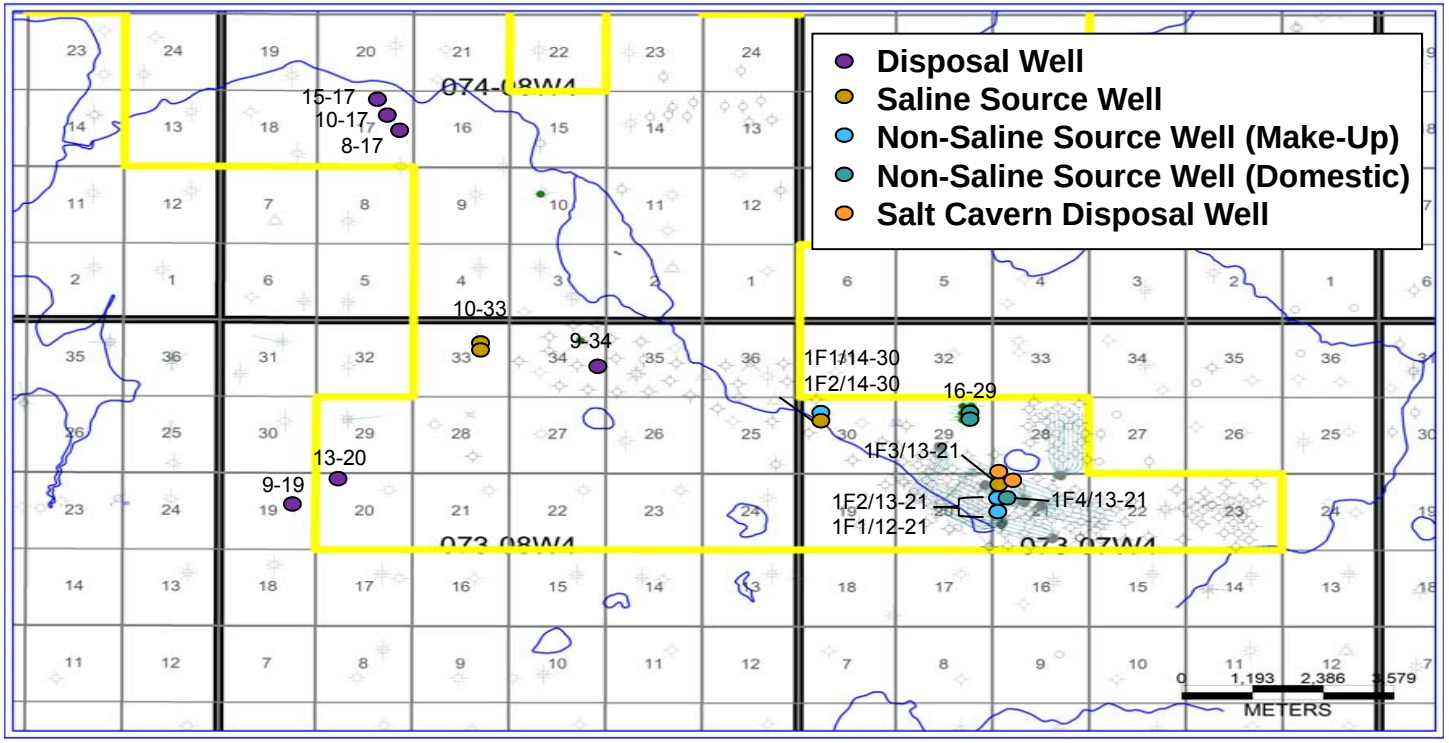
- Saline
  - McMurray Fm
    - TDS 14,500 ppm
    - Pressure balance and make-up
  - Grand Rapids
    - TDS 4,500 ppm
    - Make-up
- Non-Saline
  - Grand Rapids
    - TDS 2,450 ppm
    - Make-up
  - Empress Fm
    - TDS 550 ppm
    - Utility and Make-up

Kirby South Produced and Make-up Water Usage

Month	Non-saline Volume	Saline Volume	Non Saline Make-Up Percentage	Injection	Produced	PWR
Sep-16	10,500	25,814	29	14,027	491,741	97
Oct-16	8,772	11,363	44	27,632	490,012	94
Nov-16	8,235	43,374	16	28,761	483,560	94
Dec-16	5,817	41,760	12	39,614	498,614	92
Jan-17	6,254	42,383	13	43,616	500,453	91
Feb-17	4,612	47,772	9	33,233	449,048	92
Mar-17	8,543	61,136	12	32,077	495,809	93
Apr-17	8,891	21,627	29	21,127	456,806	95
May-17	10,329	25,016	29	33,336	345,488	90
Jun-17	27,113	39,743	41	25,131	518,556	95
Jul-17	11,253	29,546	28	25,963	488,422	95
Aug-17	8,115	27,919	23	30,566	510,249	94
2016-2017 Totals	118,434	417,453	22	355,083	5,728,758	94

- Directive 81 Disposal Limit = 12%, Actual Disposal = 6% for 2016-2017
- Potable Water
  - A total of 16,242 m3 of water was used to supply KS camps and office complex
  - Water Act Diversion licenses received for KN Camp and CPF office (effective May 26, 2017).
    - With the recommencement of Kirby North project construction, a total of 2,570 m3 has been used for since May

Kirby South Source and Disposal Well Map



Kirby South Source Wells - Saline

Well Name	Use	Unique Well Identifier
McMurray Source Wells		
CNRL WSW01 Kirby 14-30-73-7	Make-up Source (not used)	1F1/14-30-73-7W4M
CNRL WSW MC01 Kirby 10-33-73-8	Make-up Source	1F1/10-33-73-8 W4M
CNRL WSW MC02 Kirby 10-33-73-8	Make-up Source	1F2/10-33-73-8 W4M
Grand Rapids Source Well		
CNRL WSW GR01 Kirby 13-21-73-7	Make-up Source	1F3/13-21-073-07W4M

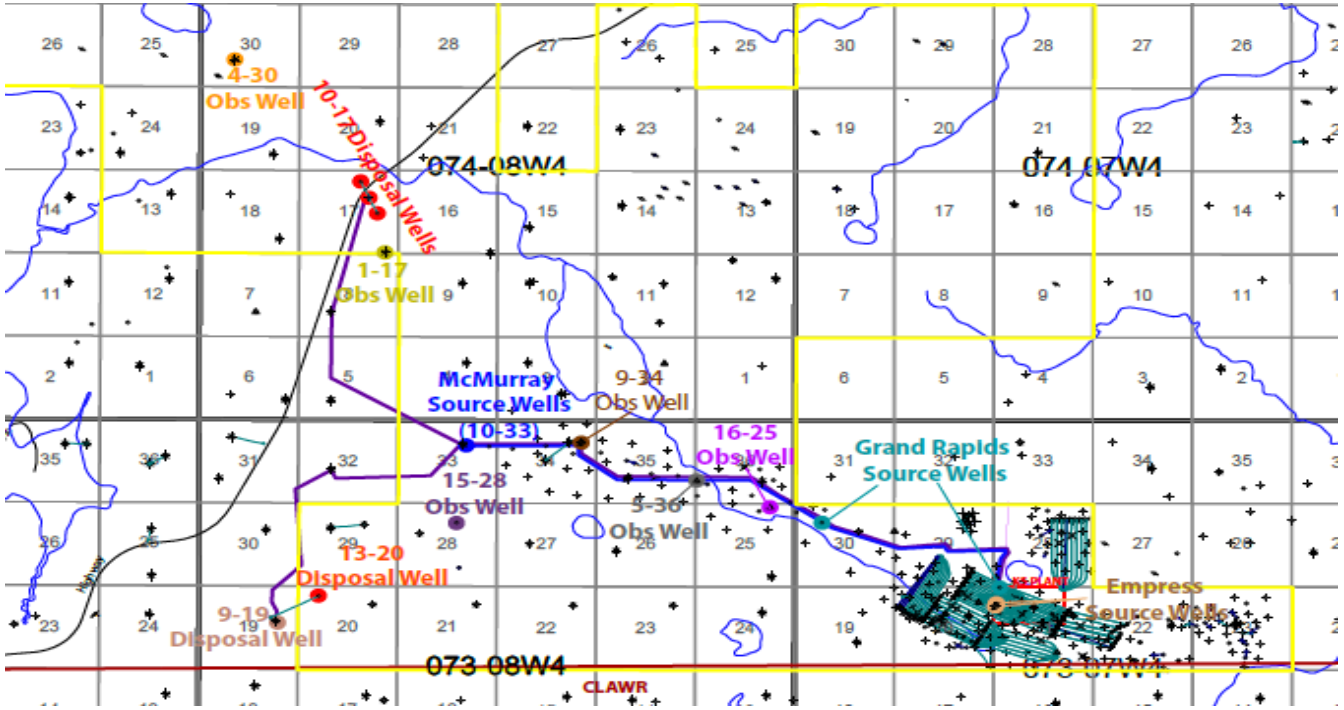
Kirby South Source Wells – Non-Saline

Well Name	Use	Unique Well Identifier
GRAND RAPIDS Formation		
Grand Rapids Source Wells		
CNRL WSW02 Kirby 14-30-73-7	Make-up Source	1F2/14-30-73-8W4M
EMPRESS Formation Source Wells		
CNRL WSW Kirby 13-21-73-7	Utility Source	1F2/13-21-73-07W4M
CNRL WSW EMP03 12-21-73-7	Utility Source	1F1/12-21-73-07W4M
MURIEL LAKE Formation - Source Wells		
CNRL WSW ML03 Kirby 13-21-73-7	Domestic Source	1F4/13-21-73-7W4M
ETHEL LAKE Formation - Source and Standby Wells		
CNRL WSW EL01 Kirby 16-29-73-7	Domestic Source	1F1/16-29-73-7W4M
CNRL WSW EL02 Kirby 15-29-73-7	Domestic Source	No UWI No license required

Kirby North Source Wells – Non-Saline

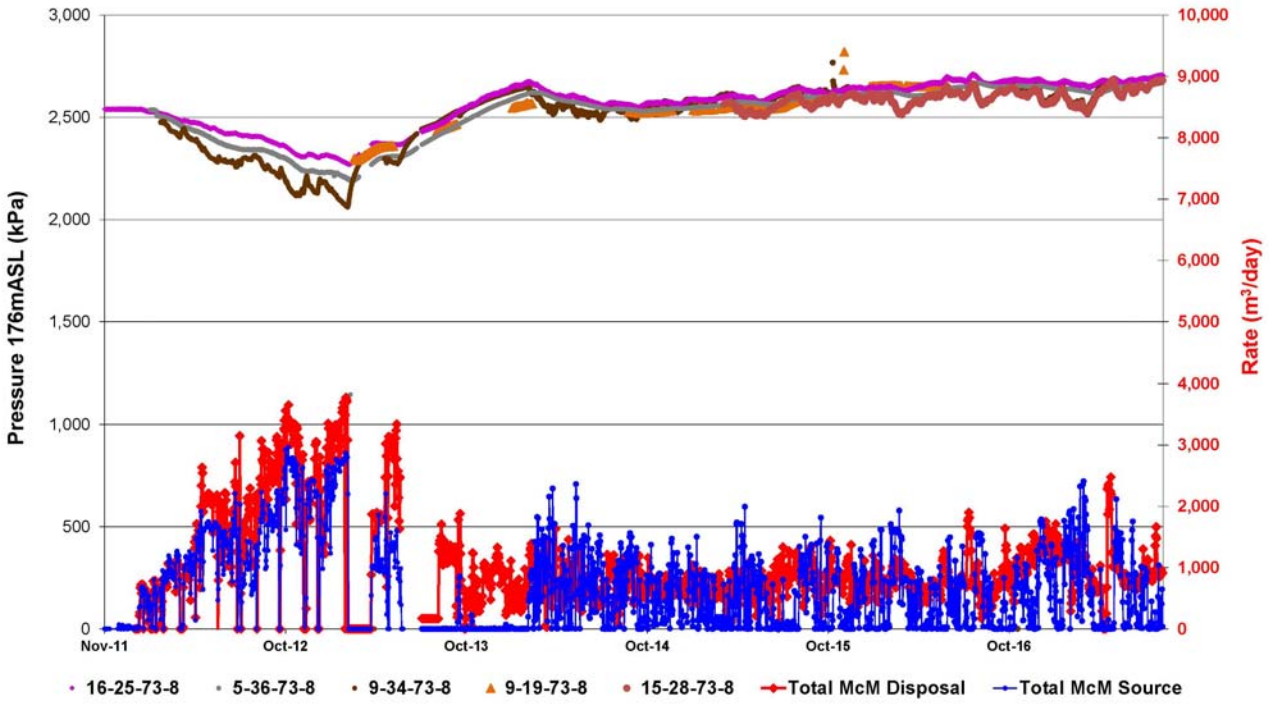
Well Name	Use	Unique Well Identifier
ETHEL LAKE Formation - Source Well		
CNRL WSW QT01 Kirby NW-21-74-8	Domestic Source	No UWI No license required
BONNYVILLE Formation - Source and Standby Wells		
CNRL WSW BNY01 Kirby NW-26-74-9	Domestic Source	No UWI No license required
CNRL WSW BNY02 Kirby NW-26-74-9	Domestic Source	No UWI No license required

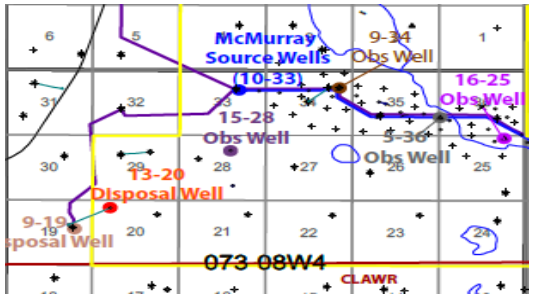
Kirby South McMurray Pressure Balance Scheme Update



Kirby South Pressure Balance Scheme Update

- McMurray Fm Basal Aquifer pressures Kirby South 10-33 well area

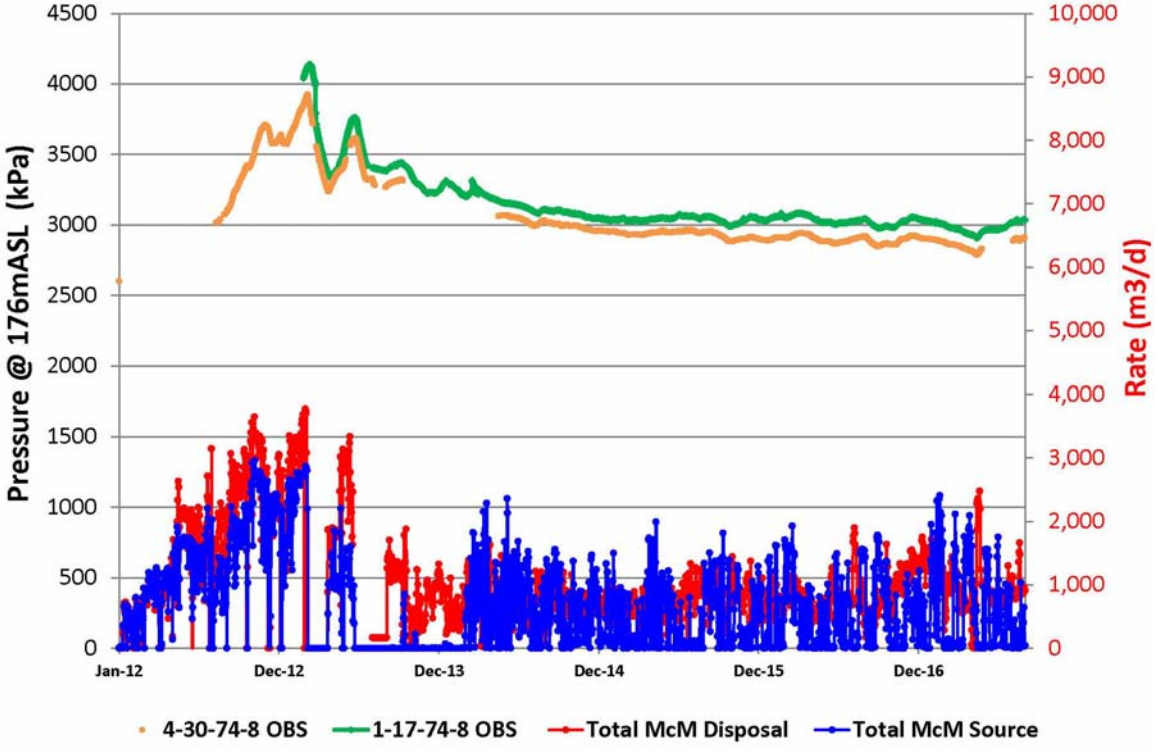


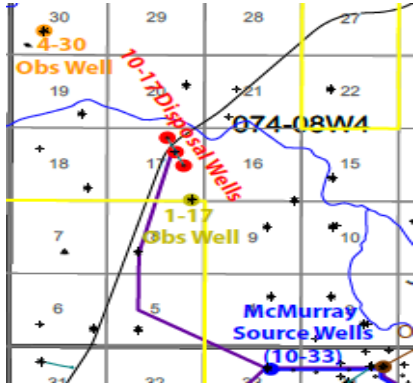


- Current pressures in all observation wells slightly above the initial pressures (~140kPa)
- Current pressures similar a year ago in all observation wells

Kirby South McMurray Pressure Balance Scheme Update

- McMurray Fm Basal Aquifer pressure near 10-17-74-8 disposal area





- Pressure increased early on during cavern washing
- Decreased to ~3,000kPa and holding since 2014
- Approximately 400kPa above original static pressure

Kirby South McMurray Pressure Balance Scheme Update

- Chemistry analysis
  - All saline water source wells (annually)

	1F1/10-33-073-08W4	1F3/13-21-73-07W4 (Grand Rapids)
Date	October 3, 2016	October 3, 2016
Total Dissolved Solids	15,100 mg/L	4,640 mg/L

  - McMurray Observation wells (every five years)

	00/15-28-073-08W4	00/01-17-074-08W4
Date	March 10, 2014	March 16, 2014
Total Dissolved Solids	16,800 mg/L	12,500 mg/L

Kirby South Pressure Balance Groundwater Flow Model

- The McMurray pressure balance numerical model was updated in November, 2016 and results were presented to AER in January, 2017
- Data used to update the numerical model
  - Production and disposal volumes up to September 30, 2016 added to model
  - Pressure data at observation wells up to September 30, 2016 used for history matching
  - Periodic disposal volumes at 100/9-34-73-8w4
- The calculated pressure responses in observation wells matched new observation data without changes to the model geology and boundary conditions.

Kirby South Disposal Wells

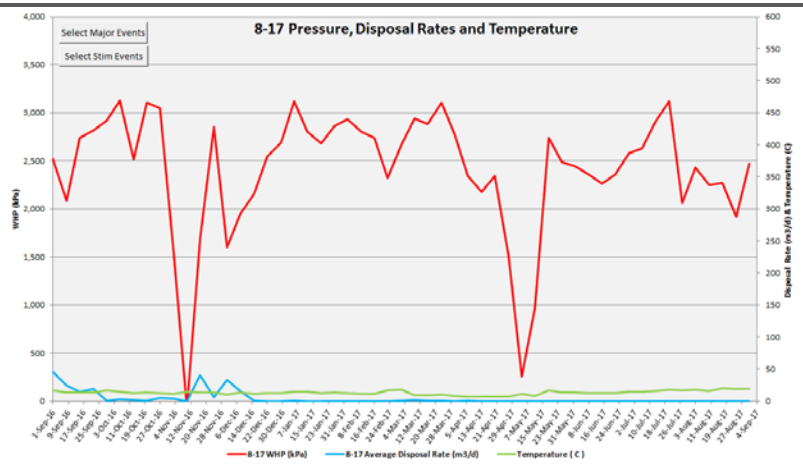
Well Name	Use	Unique Well Identifier
McMurray Disposal Wells		
RAX Kirby 9-34-73-8	Disposal (used periodically)	00/09-34-073-08W4M
CNRL WDW01 Kirby 8-17-74-8	Disposal	00/08-17-074-08W4M
CNRL WDW02 Kirby 10-17-74-8	Disposal	02/10-17-074-08W4M
CNRL WDW03 Kirby 15-17-74-8	Disposal	00/15-17-074-08W4M
CNRL WDW HZ MCM05 Kirby 13-20-73-8	Disposal	00/13-20-073-08W4M
CNRL WDW MCM06 Kirby 9-19-73-8	Disposal	100/09-19-073-08W4M

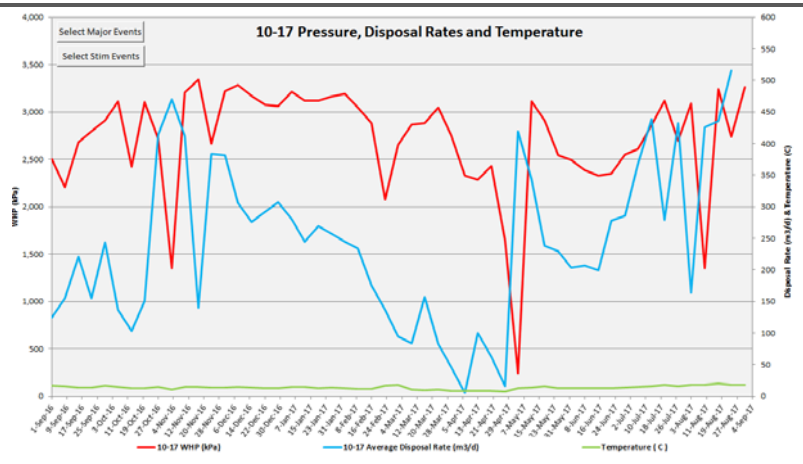
Salt Cavern Wells		
CNRL CAVERN VERT KIRBY 13-21-73-7	Prairie Evaporate	00/13-21-073-07W4M
CNRL CAVERN DD KIRBY 4-28-73-7	Lotsburg	02/04-28-073-07W4M

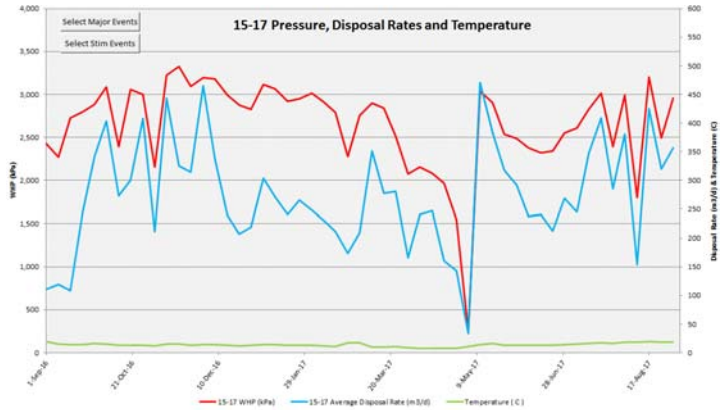
Kirby South Disposal

- Injectivity decline caused by:
  - Solids
  - Oil in water
  - Scale
- Implemented improvements
  - Caverns operated in series to remove more solids
  - Second set of filters improved solids removal
  - Second ISF reduced OIW numbers < 20ppm
  - Excess PW with OIW >20ppm has to go through caverns
  - Antiscale injection
  - Regular pigging plan to evaluate Antiscale effectiveness
  - 9-19 conversion; currently best well
- Results
  - Injectivity stopped declining

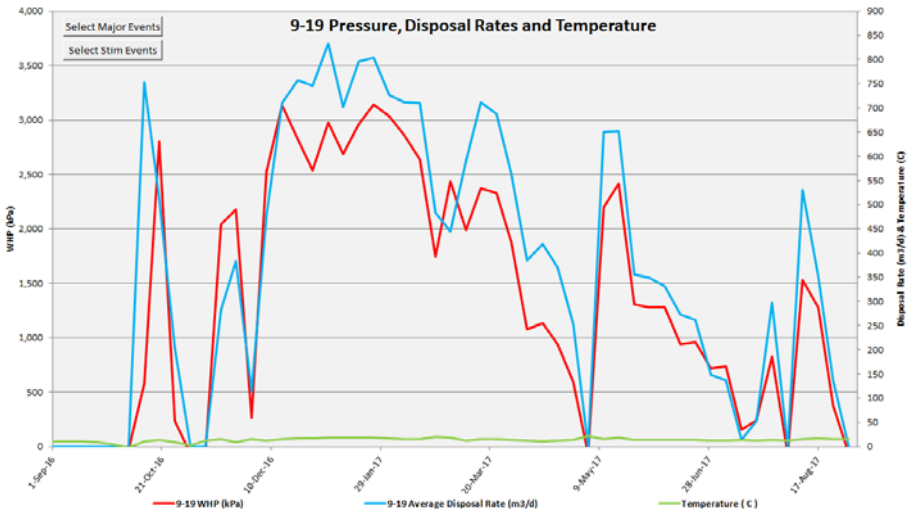
Kirby South Disposal

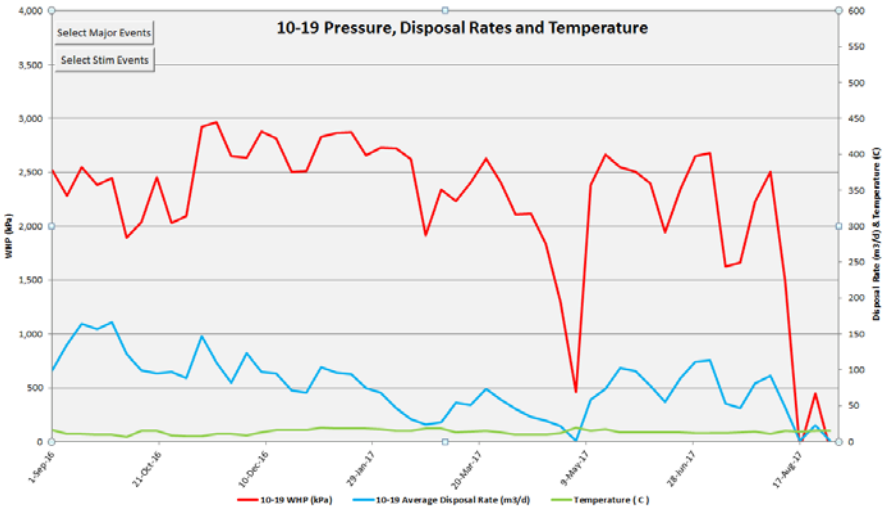




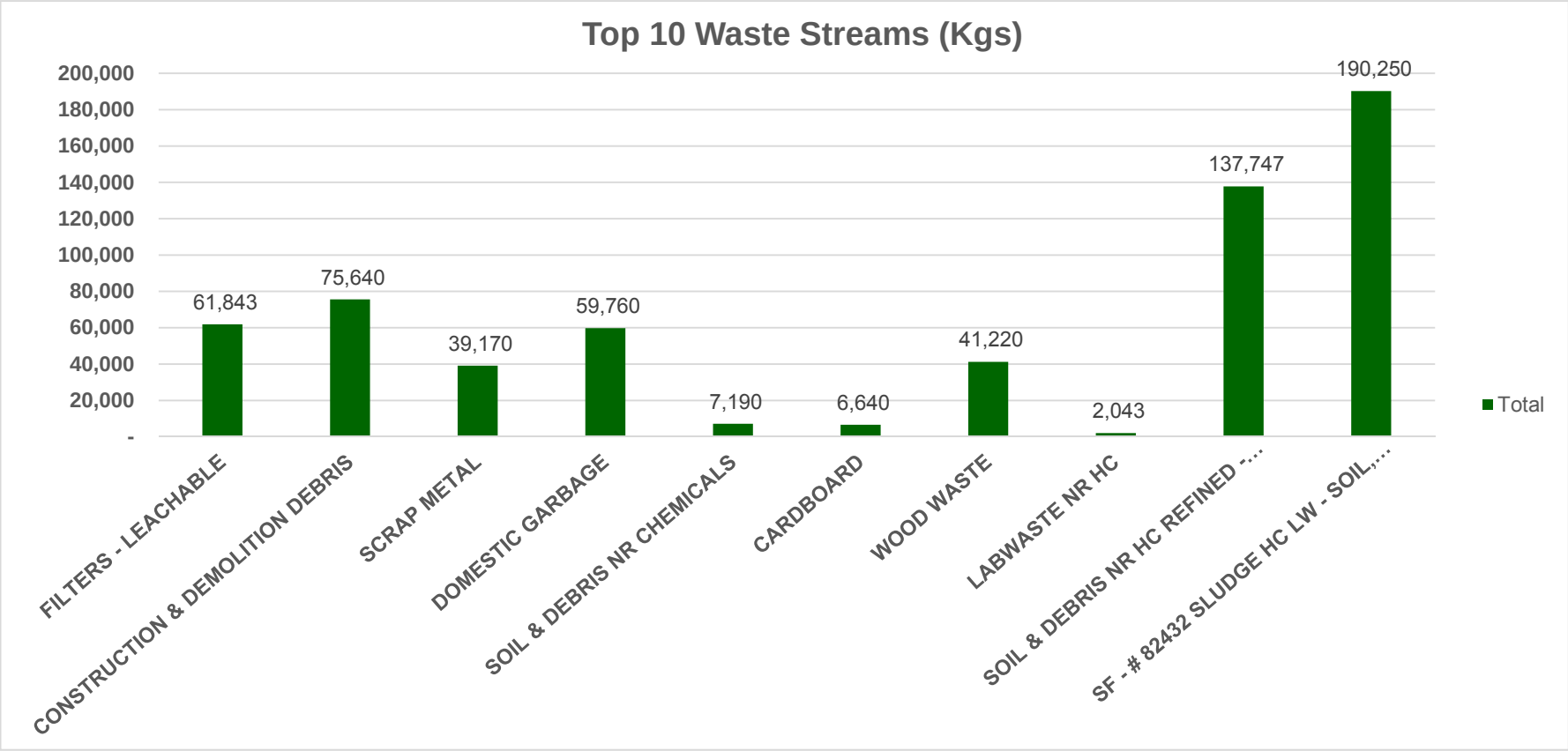


Kirby South Disposal

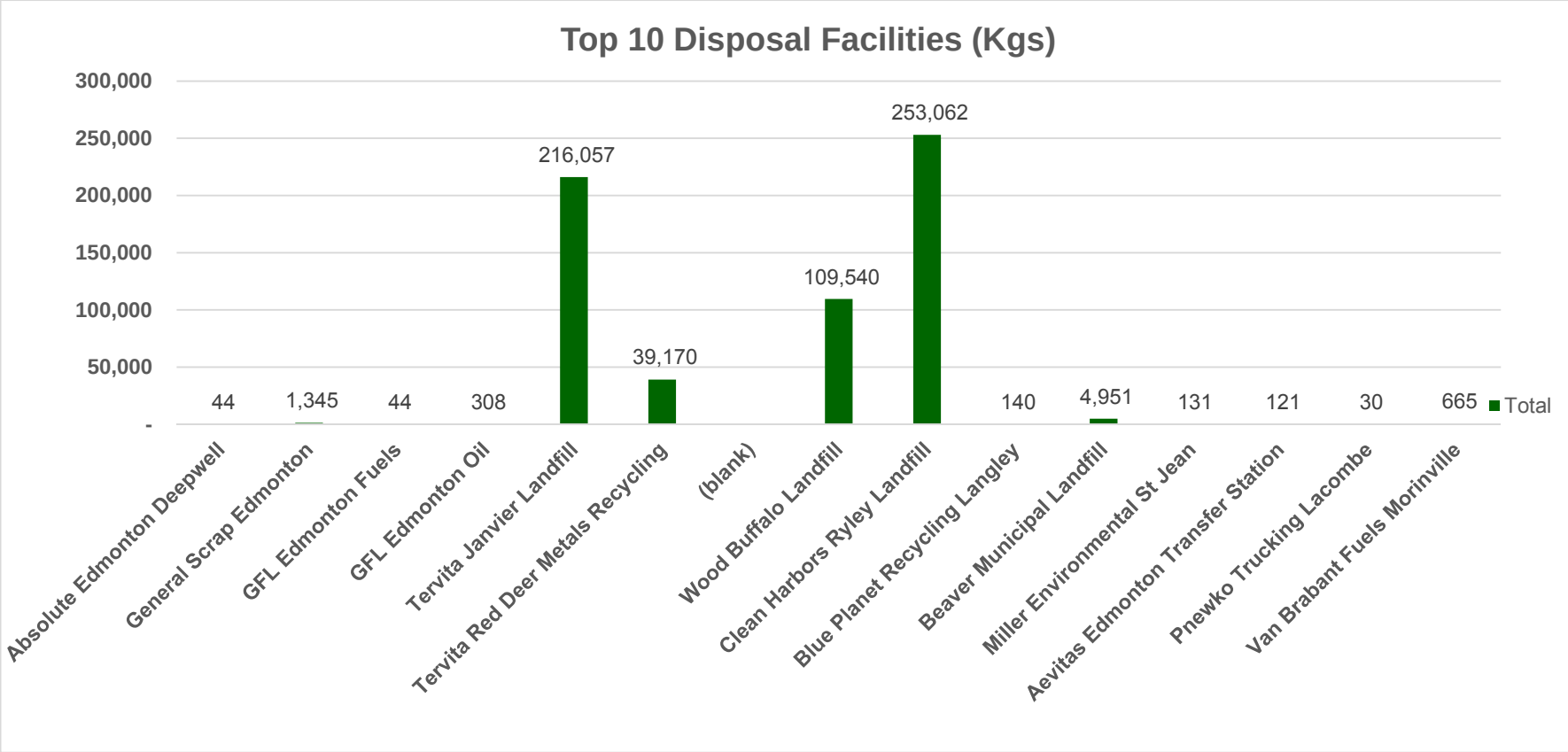




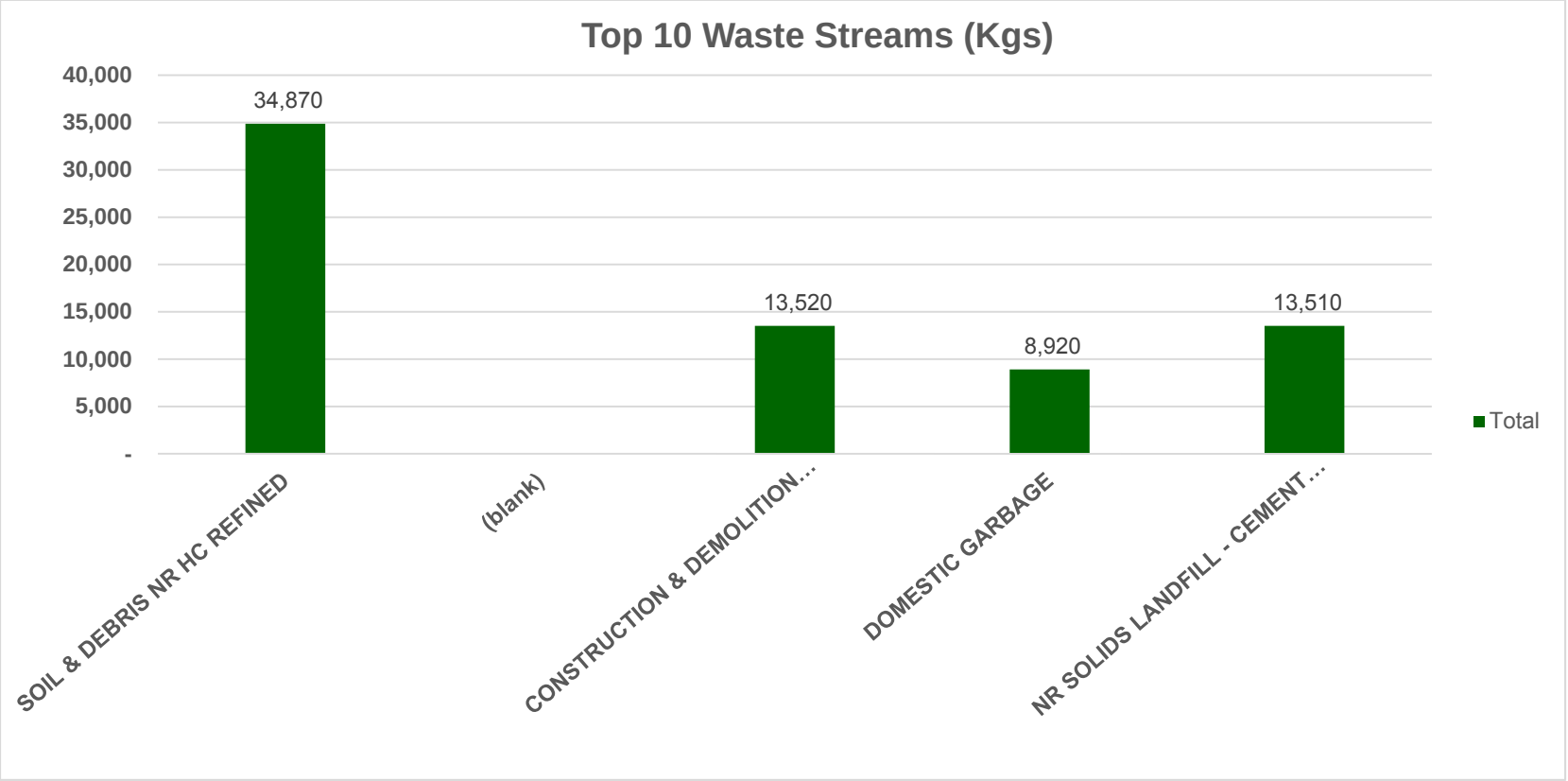
Kirby South Waste Disposal



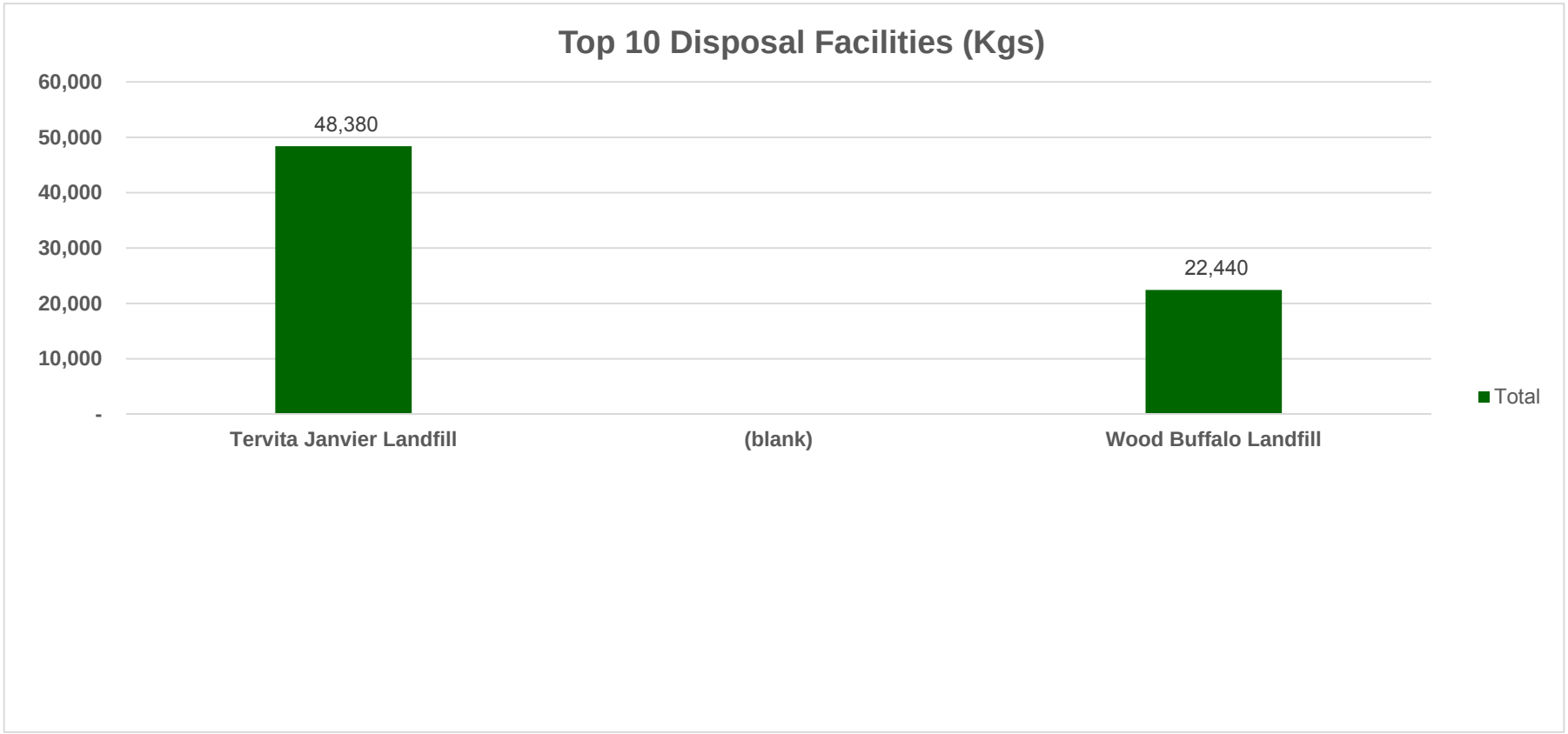
Kirby South Waste Disposal



Kirby North Waste Disposal



Kirby North Waste Disposal



Environmental Summary
Monitoring Programs

- Wildlife Mitigation Plan and Monitoring Program
  - Monitoring mitigation efficacy (above ground pipelines, barriers to wildlife movement, effects of human presence)
  - 27 remote cameras deployed throughout the project
    - 13 species detected, including three provincially sensitive species and one federally threatened species (woodland caribou)
    - Frequent caribou sightings near Kirby South Plant reported by onsite staff
  - 23 camera stations monitoring linear deactivation (initiated in Feb 2015)
    - 10 mammal species recorded
    - Noted correlation between low carnivore detections along treated lines
  - 22 species of concern (17 bird species, 5 mammals) observed in the Kirby Project area in 2015
  - Comprehensive wildlife report completed and submitted in 2017

Environmental Summary
Monitoring Programs

- Wetland and Waterbody Monitoring Program
  - Two monitoring stations showed water level response is sensitive to discharges of industrial waste water from nearby pads or the Kirby South CPF.
  - One culvert surveys completed at Kirby South and Kirby North in 2017.
    - Mitigation measures to be applied to most problematic culverts following the surveys.
    - Additional mitigation measures being applied throughout the year to meet target of repairing all damaged culverts within one year from time of assessment.
  - Overall indication that project infrastructure has some effect on wetlands in Kirby South.
    - Corrective measures include improvements to road and culvert design in problematic areas to alleviate water impoundment

Environmental Summary
Monitoring Programs

- Groundwater Monitoring Program
  - –Well pad monitoring program to monitor potential effect of steam injection on mineral solubility and mobilization of trace elements
    - 1 monitoring well on each Pad B, Pad D, Pad F
    - No impacts to groundwater quality identified
    - Sub-regional groundwater monitoring program focusing on deeper, Quaternary- and Tertiary-aged aquifers.
  - –Central Plant monitoring program monitors groundwater conditions within shallow sediments
    - 20 groundwater monitoring wells at CPF
    - Increase in chloride concentration in monitoring well P12-06.
      - Continued monitoring to evaluate Cl concentration trends

Environmental Summary
Monitoring Programs

- Air Monitoring
  - –Source Monitoring
    - Two RATAs conducted on Generator 1 in 2017
    - CEMS at steam generator measures SO2 and NO2
    - Two cylinder gas audits conducted in 2017
      - Results show CEMS code is met
    - One manual stack survey conducted on Generator 3 in 2017
    - No significant trends in emissions data
  - –Ambient Air Monitoring
    - Continuous ambient air monitoring station located 0.7 km from plant site on G-Pad
    - Five passive monitoring stations located around the plant site
      - All passive exposure monitoring results for SO2, H2S, NO2 and O3 were low for the monitoring period

Environmental Summary
Reclamation Activities

- Reclamation Activities
  - Re-vegetation Program consisted of reforesting 3 ha in spring 2017
  - Reclamation certificate application submitted for SML100131
- Reclamation Monitoring
  - Objectives are to ensure:
    - land is reclaimed to an equivalent land capability
    - appropriate replacement of all salvaged topsoil on re-contoured areas
    - sustainable, diverse vegetation growth on all disturbed areas
    - pre-disturbance wildlife carrying capacities are obtained
  - Regular site monitoring throughout reclaimed areas within the Project Area
- Reporting
  - 2016 Annual C&R Report was submitted on March 31, 2017
  - PLRCP due to AER October 31, 2017

Environmental Summary
Reclamation Activities

- Reclamation Compliance (under EPEA)
  - Subsoil stockpiles were capped with topsoil and revegetated for erosion control
    - Non-compliance identified during AER audit
      - EPEA Approval Schedule IX, Condition 5 states “stockpile all topsoil separately from subsoil”
    - The practice of capping subsoil stockpiles with topsoil has ceased

Environmental Summary
Provincial/Federal Programs

- Lower Athabasca Regional Plan (LARP)
  - Participation in the South Athabasca Oil Sands (SAOS) area for Groundwater Management
- Provincial and Federal Woodland Caribou Recovery Policies
  - Participating in GOA processes to develop and implement range-level caribou recovery plans and province-wide action plan (CAPP).
  - Participating in caribou research (COSIA, RICC, FLMF)
  - Engaging with the GOA and Government of Canada to understand opportunities for knowledge transfer and to address data gaps (COSIA and CAPP).
- Alberta Wetland Policy
  - Participating in discussions with AEP and the AER regarding implementation of the policy in the Green Area of Alberta (CAPP)
- Alberta's Climate Leadership Plan (CLP)
  - Working with AER and GOA on development of various aspects of the CLP including the oil sands emission limit and performance standards

Approvals
Commercial Oil Sands Scheme

Commercial Oil Sands Scheme		
11475	September 2010	Commercial Oil Sands Scheme Approval
11475A	November 2010	Revise initial development Pads A to G
11475B	November 2011	Change inter-well spacing Drainage Area D
11475C	December 2011	Change inter-well spacing in Drainage Area B
11475D	May 2012	Change inter-well spacing in Drainage Area E
11475E	June 2012	Evaluation of on-lease McMurray brackish water
11475F	August 2012	Change inter-well spacing in Drainage Area G
11475G	September 2012	Change inter-well spacing in Drainage Area F Addition to Drainage Area D
11475H	April 2013	Evaluation of off-lease Clearwater brackish water

Approvals
Commercial Oil Sands Scheme

Commercial Oil Sands Scheme		
11475I	January 2014	Operational Strategy amendment
11475J	March 2014	Trajectory and lateral length modifications in Drainage Area G
11475K	May 2014	Approval of Kirby In Situ Oil Sands Expansion Project
11475L	November 2014	Revise initial Kirby North development Pads KN01-KN05
11475M	December 2014	Redrill well pairs A1, A2, A3
11475N	May 2015	Additional Kirby South and Kirby North disposal wells
11475O	July 2016	Conversion of existing Kirby South observation well to disposal well
11475P	January 2017	Kirby South B Pad Infills and NCG Co-Injection
11475Q	March 2017	Kirby South E Pad Gas Co-Injection
11475R	April 2017	Kirby South C Pad Infills/NCG Co-Injection and D10 Well Pair Extension
11475S	August 2017	Kirby North KN05b Approval
11475T	September 2017	Kirby South G Pad Step Outs Approval

Approvals
EPEA and Water Act

Environmental Protection and Enhancement Act		
237382-00-00	April 2011	Approval of Kirby In Situ Oil Sands Project
237382-00-01	July 2014	Approval of Kirby In Situ Oil Sands Expansion Project
237382-00-02	February 2015	Amend Kirby South steam generator NOx limit to include efficiency credit
237382-00-03	February 2017	Kirby South Daily Sulphur Dioxide Limit
Water Act		
00334375-00-00 (Kirby South)	August 2013	Groundwater diversion license, Empress Unit 1 and Grand Rapids Formation
00334375-01-00 (Kirby South)	August 2015	Renewal of Groundwater diversion license
00334375-01-01 (Kirby South)	March 2017	Amendment to include drilling, construction, ice-roads and dust control
00288494-00-00 (Kirby South)	April 2011	Groundwater diversion license, Ethel Lake Formation
00327156-00-00 (Kirby South)	August 2013	Industrial surface runoff diversion license
00303825-00-00 (Kirby North)	July 2014	Preliminary Certificate groundwater diversion, Empress Terrace Formation

In Compliance

Approvals
EPEA and Water Act

Water Act		
00303820-00-00 (Kirby North)	September 2014	Industrial surface runoff diversion license
00297299-00-00 (Kirby South)	December 2011	Groundwater diversion license, Muriel Lake Formation
00297299-00-01 (Kirby South)	November 2014	Amendment to decrease allocation
00390209-00-00 (Kirby North)	May 2017	Groundwater diversion license, Bonnyville Formation
00391822-00-00 (Kirby North)	May 2017	Groundwater diversion license, Ethel Lake Formation
In Compliance		

Approvals
Disposal

Class 1b Cavern Disposal		
11716	November 2011	Cavern Solution Mining
11716A	July 2013	Class 1b Cavern Disposal • Prairie Evaporites formation through well 00/13-21-073-07W4 • Lotsberg formation through well 00/04-28-073-07W4
11716B	June 2015	Modify testing requirements. Approval modified to reference *CSA Z341.4*
In Compliance		

Approvals
Disposal

Class Ib Disposal		
11761	December 2011	Class Ib Disposal • 00/08-17-74-08W4 • 02/10-17-74-08W4 • 00/15-17-74-08W4
11761A	April 2013	Modify pH requirements
11761B	March 2014	Amend MWHIP
11761C	May 2015	Additional Kirby South disposal well • 100/13-21-73-08W4 Additional Kirby North disposal well • 02/08-22-74-10W4
11761D	July 2016	Conversion of existing observation well to disposal well • 100/09-19-73-8W4
In Compliance		

Approvals
Disposal (continued)

Class II Disposal		
9113	June 2002	Class II Disposal • 00/08-22-074-10W4/0 • 00/09-34-073-08W4/0
9594	September 2003	Transferred to Canadian Natural from Rio Alto Exploration
9594A	December 2011	Approval of Kirby In Situ Oil Sands Project
9594B	May 2014	Approval of Kirby In Situ Oil Sands Expansion Project

In Compliance

Approvals
Facility License

Facility License		
F42290	October 2010	Kirby South Phase 1 Central Processing Facility
F42290 amended	July 2013	Amended for KS1 CPF to reflect stream day rates and number of compressors and pumps
F44051	July 2014	Kirby North Phase 1 Central Processing Facility
In Compliance		

Compliance Summary

- Reportable Spills
  - 2 reportable spills: produced water
- EPEA Contraventions
  - Two reportable flaring events October 4, 2016 and November 5, 2016
  - Two uncontrolled releases of surface water runoff as a result of heavy precipitation and berm overflow/breach July 14 & July 24, 2017
- Water Act
  - Water Act License No. 00150748: Data not reported to WURS. This license has since been cancelled*.
  - Water Act License No. 00303820: Data not reported to WURS*.
  - Water Act Licence No. 00334375: Datalogger malfunction and associated loss of data discovered during monthly download. New Datalogger installed.
  - Water Act Licence No. 00334375: Datalogger malfunction and associated loss of data discovered during monthly download. New Datalogger installed.

*Identified through the COA and resolved.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