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Thermal In-Situ Scheme Progress Report for 2016
Japan Canada Oil Sands Limited Hangingstone

Approval No. 8788 (Demonstration Project)

Vision. Integrity. Stability.

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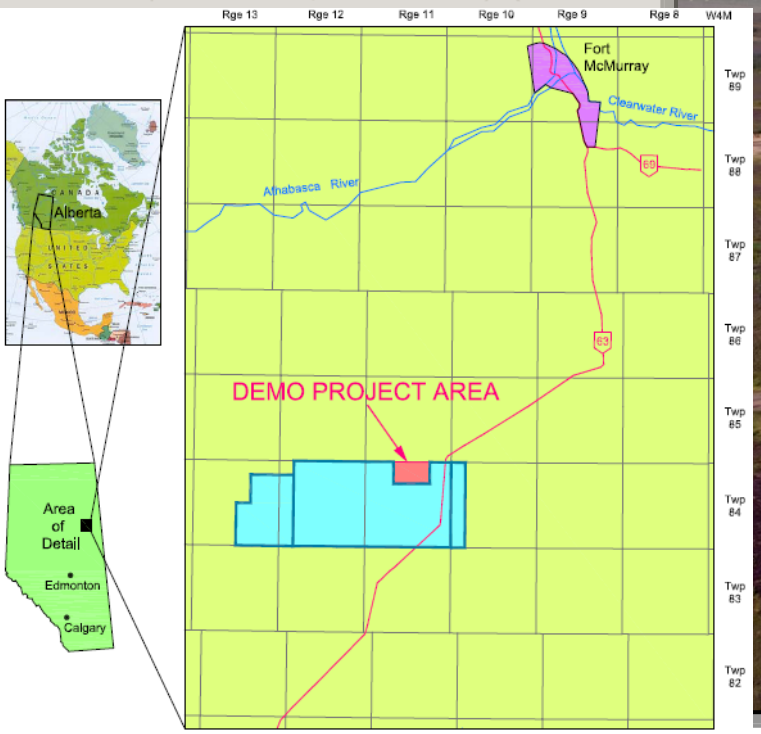
Outline

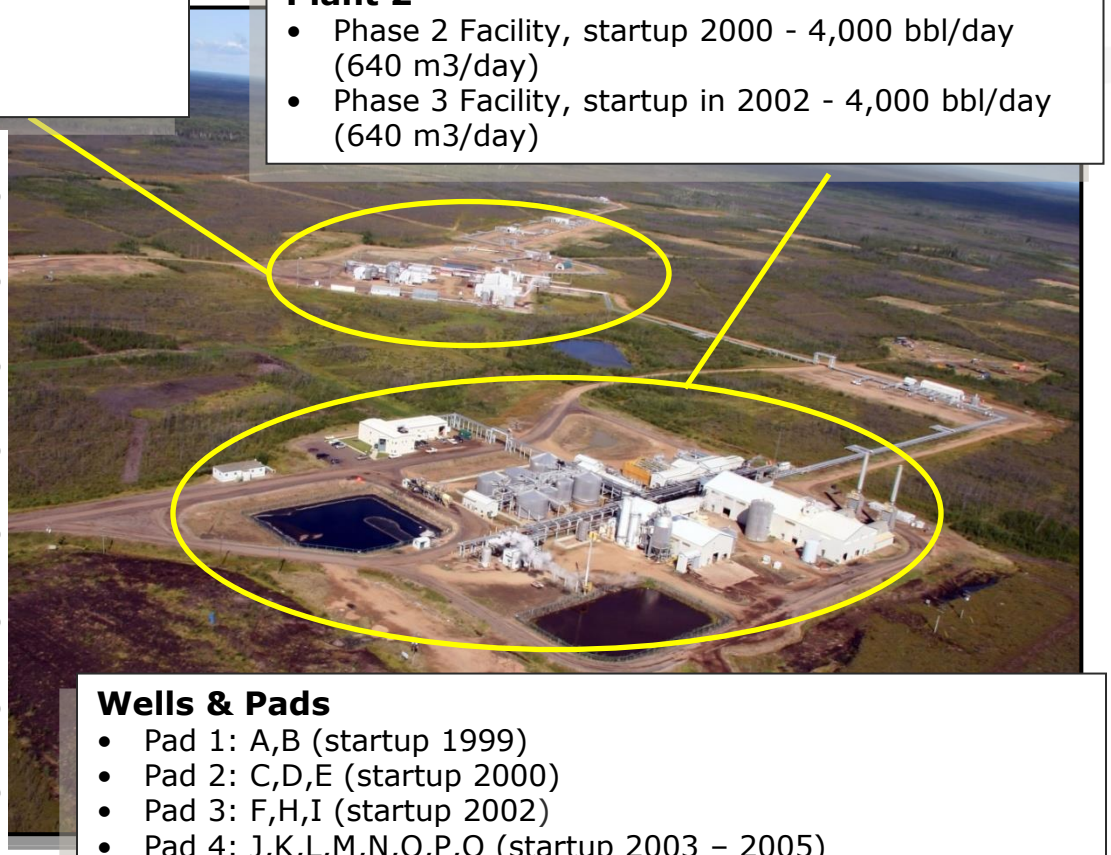
1. Background – Hangingstone Expansion Project
2. Subsurface
   - Geosciences
   - Well Design & Instrumentation
   - Reservoir Performance
3. Surface Operations
   - Facility Design
   - Measurement & Reporting
   - Water
     - Source
     - Disposal
   - Other Wastes
   - Sulphur Emissions
   - Environmental (included but not presented)
   - Compliance Statements & Approvals
   - Future Plans

Demo Scheme No. 8788 Background

Plant 1
- On original PCEJ CSS Site
- Startup 1999 – 2,000 bbl/day (320 m3/day)

Plant 2
- Phase 2 Facility, startup 2000 - 4,000 bbl/day (640 m3/day)
- Phase 3 Facility, startup in 2002 - 4,000 bbl/day (640 m3/day)





- Project located 50 km south of Fort McMurray
- Approved demonstration project area: 3.75 sections
- Approved production capacity: 11,000 bbl/day (1,760 m3/day)

Wells & Pads
- Pad 1: A,B (startup 1999)
- Pad 2: C,D,E (startup 2000)
- Pad 3: F,H,I (startup 2002)
- Pad 4: J,K,L,M,N,O,P,Q (startup 2003 – 2005) (Z startup 2008)
- Pad 5: T (startup 2007); R,S (2008); U startup Nov 2010; V&W drilled in 2011; (W started circulation in May 2013 and put on SAGD in August 2013)
- Pad 6: X started in May 2010 (ESP started in Dec); Y started circulation Nov/11 (Y well ESP started in Feb 2013)

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Subsurface

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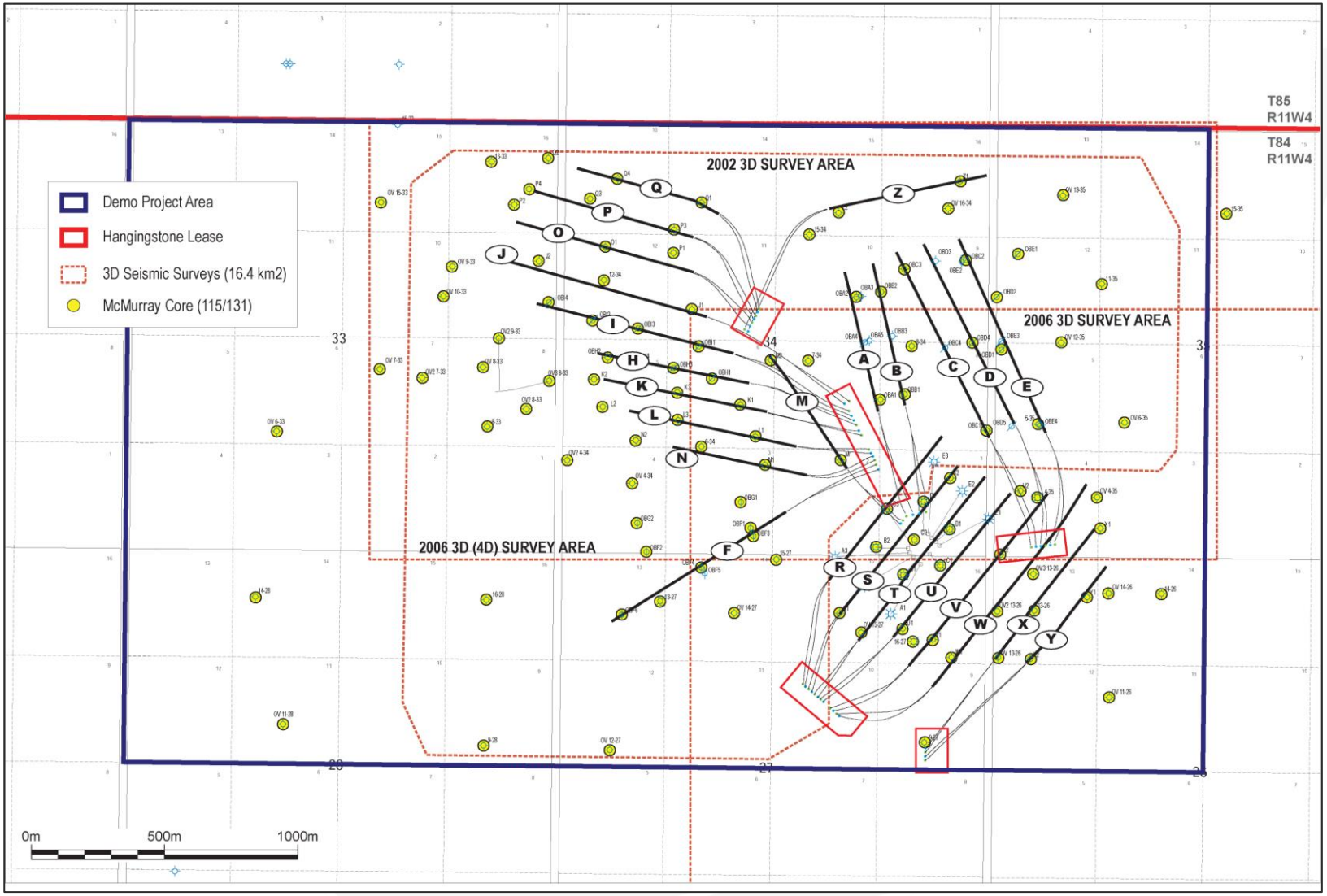
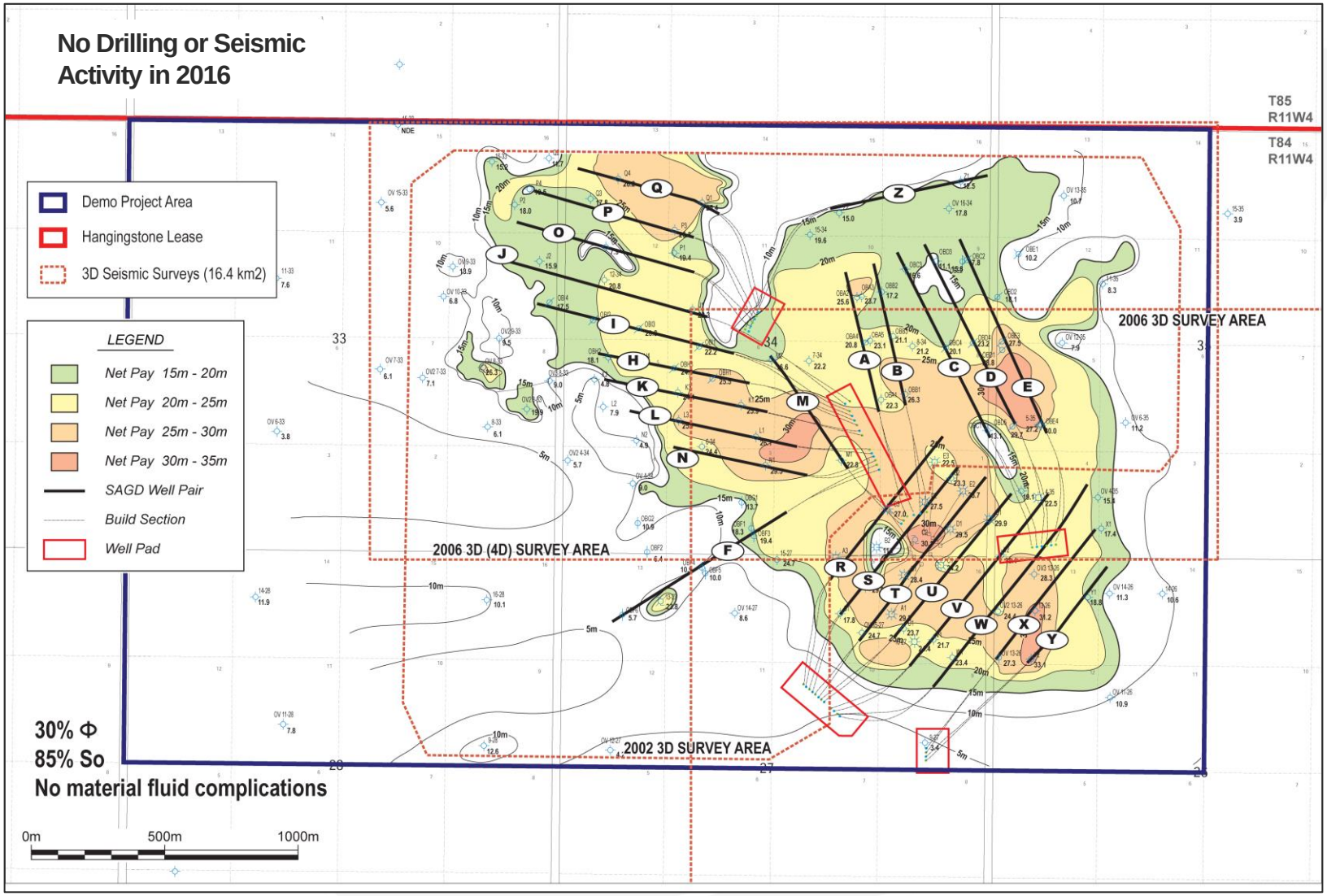
Geosciences

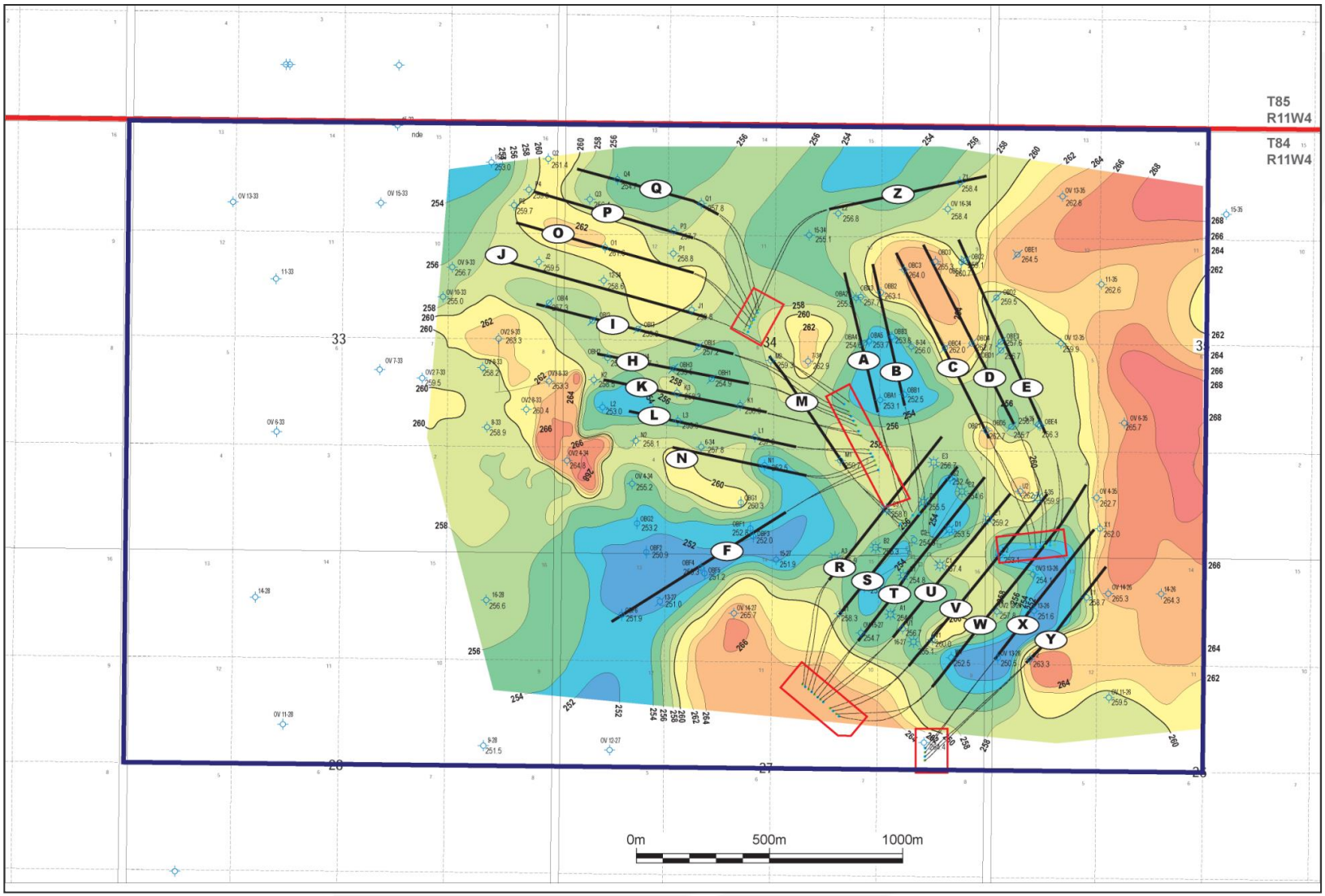
Hangingstone Demo Database



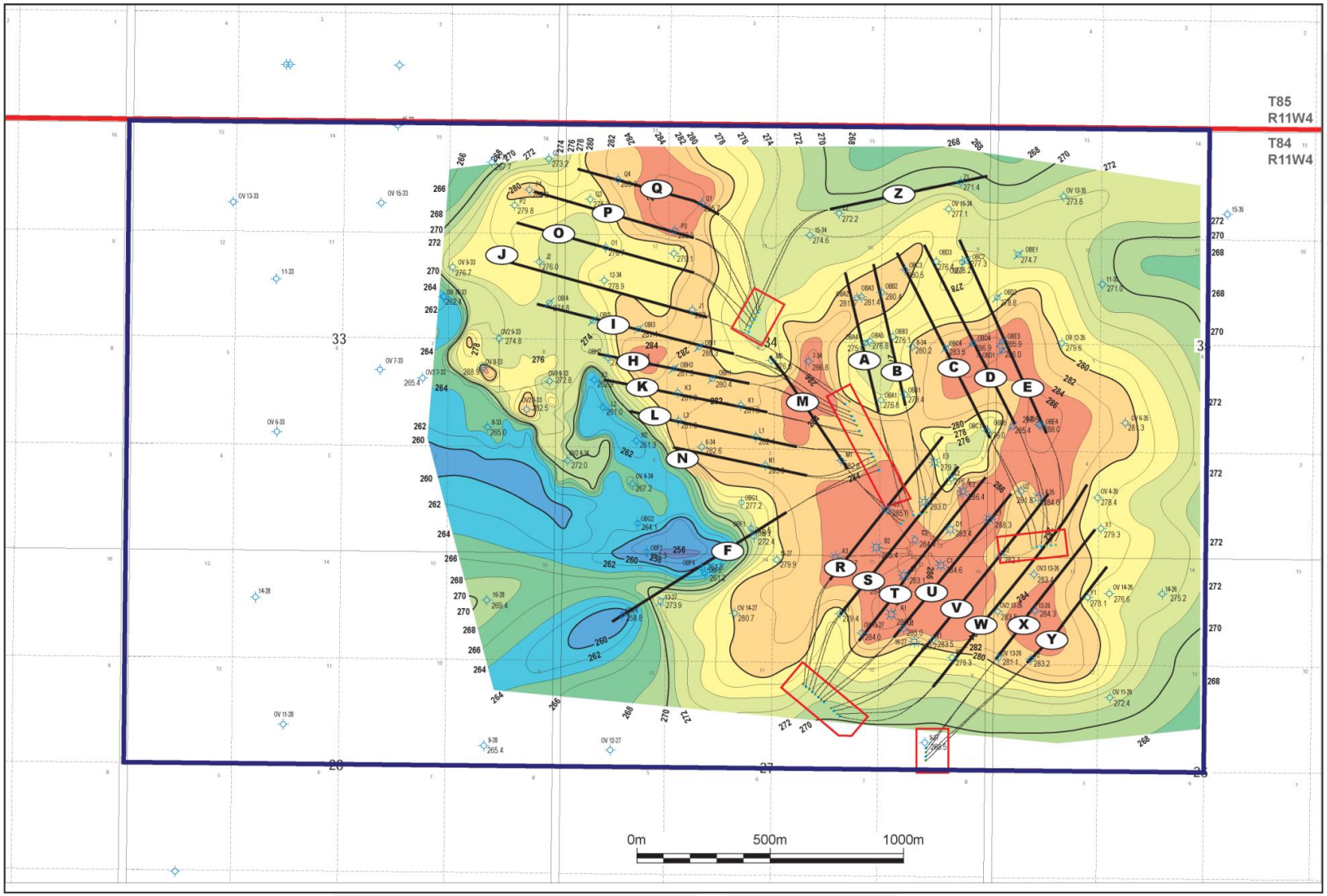
Hangingstone Demo Net Pay



Hangingstone Demo Base Reservoir Structure



Hangingstone Demo Top Reservoir Structure



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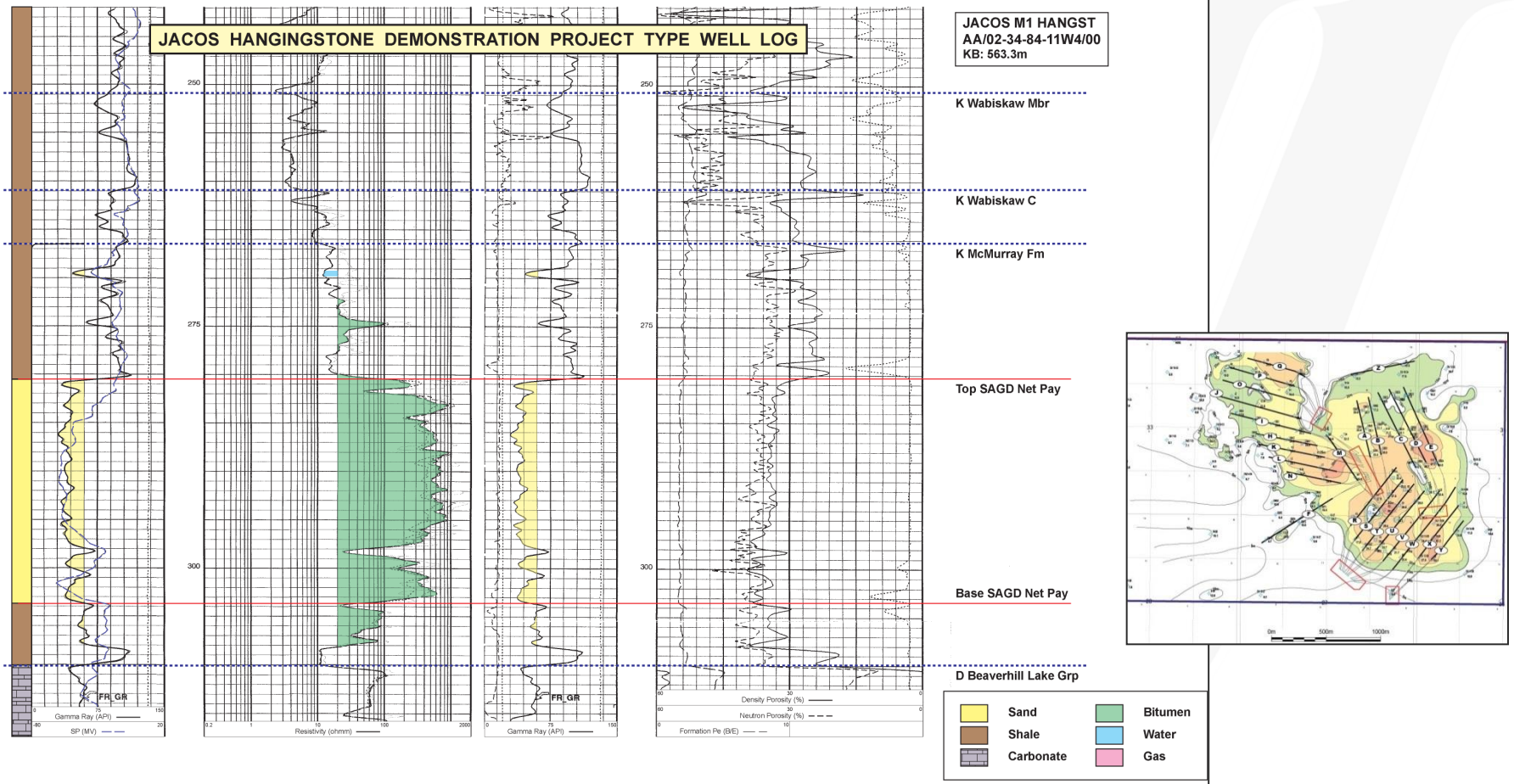
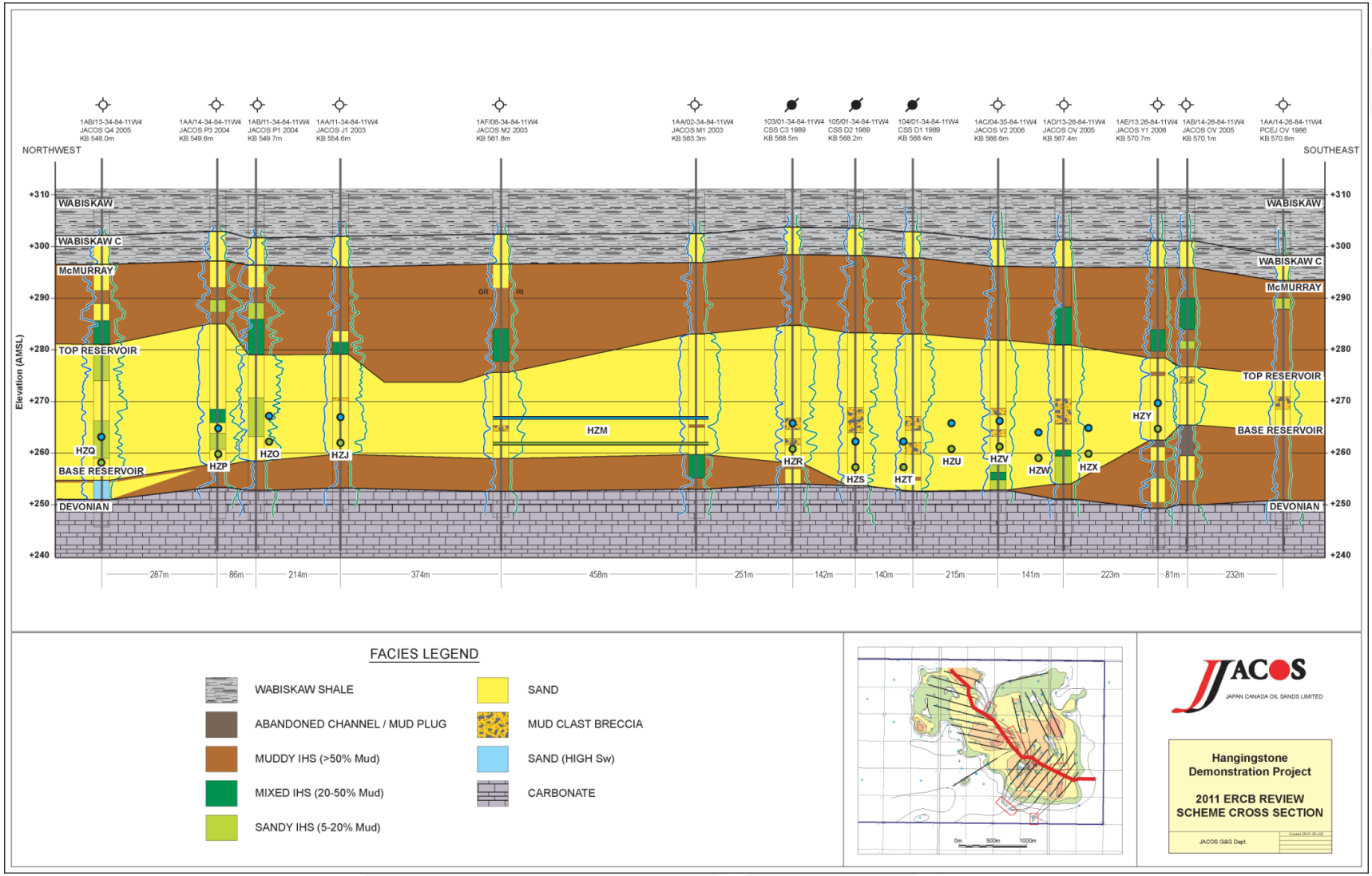
Hangingstone Demo Composite Well



Hangingstone Demo Scheme Cross-Section



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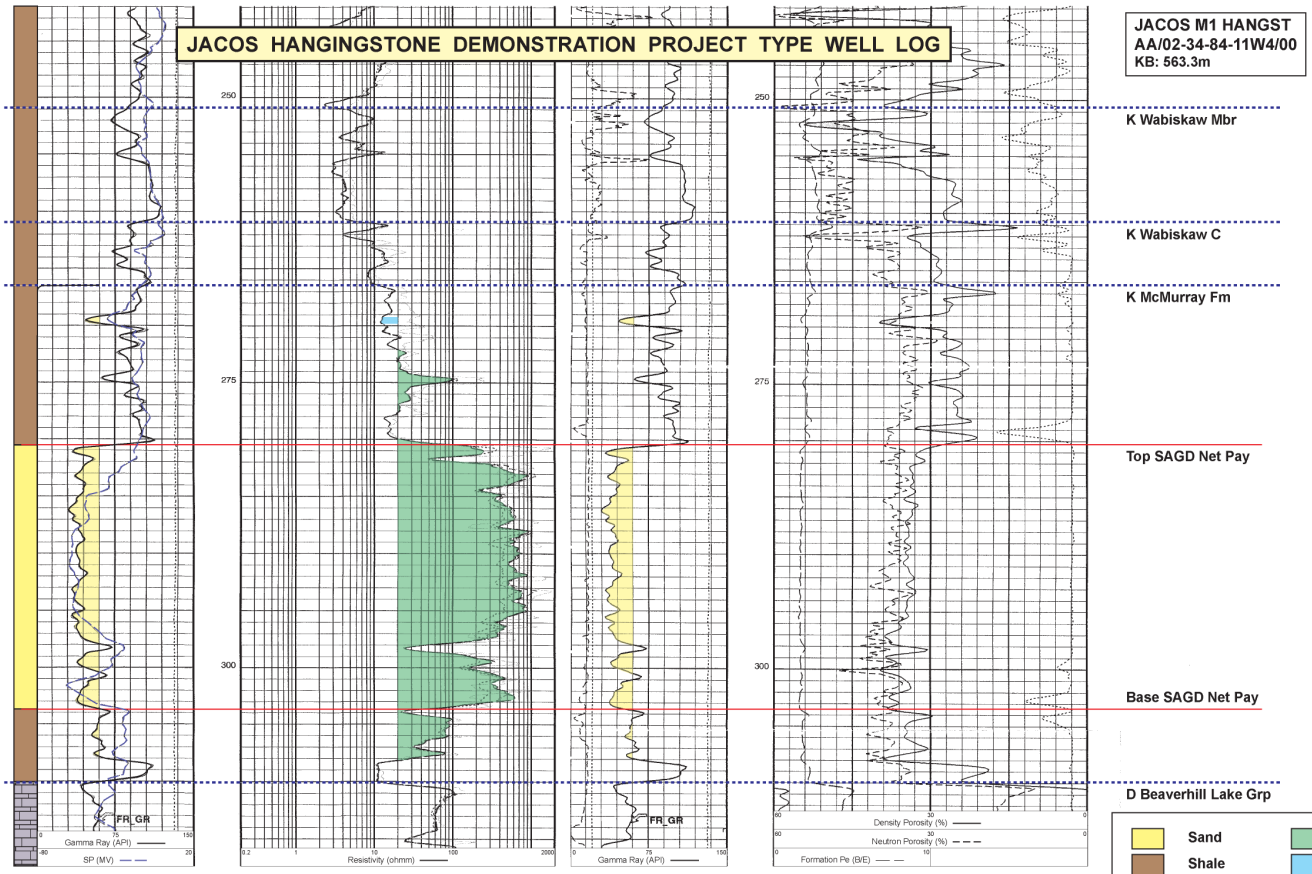

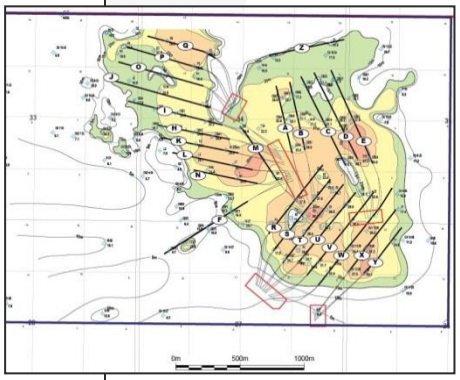

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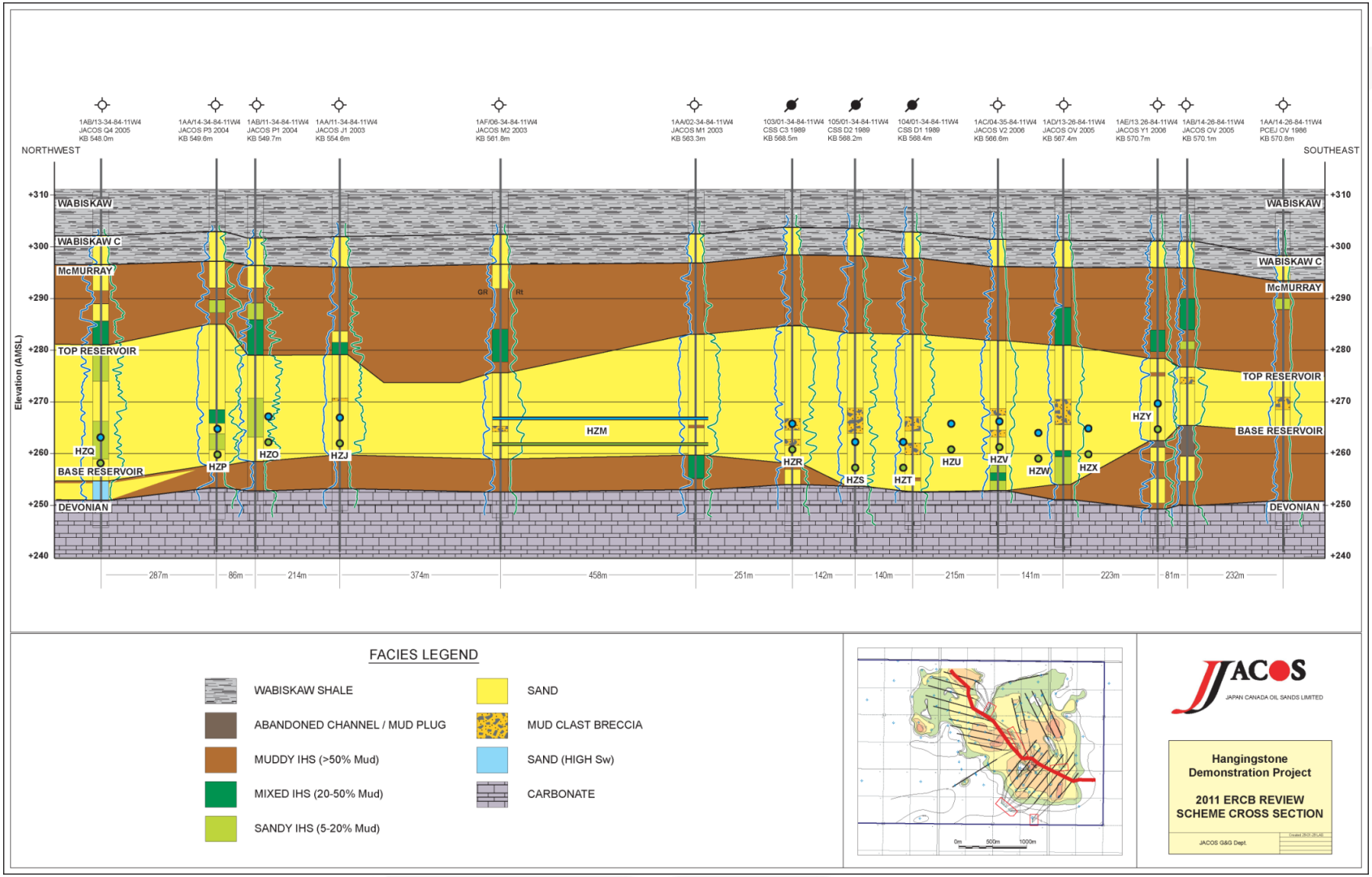


Cap Rock Integrity

- **No change in conclusions - continue to observe no cap rock integrity issues through 2016**
- Initial determination of injection pressures was based on mini-frac tests in 1980s
- 2010 Mini-frac test for Hangingstone Expansion (HE) Project Cap Rock Integrity Study shows consistent results
- HE Project Cap Rock Study concluded 5 MPa to be a safe operating pressure (80% of fracture pressure)
- Ongoing sand production in some wells, but manageable through:
  - Stable operation
  - Higher subcool
- Bottom pressure is regularly measured by purging the annulus with gas; utilizing it as a bubble tube and recording the pressure.

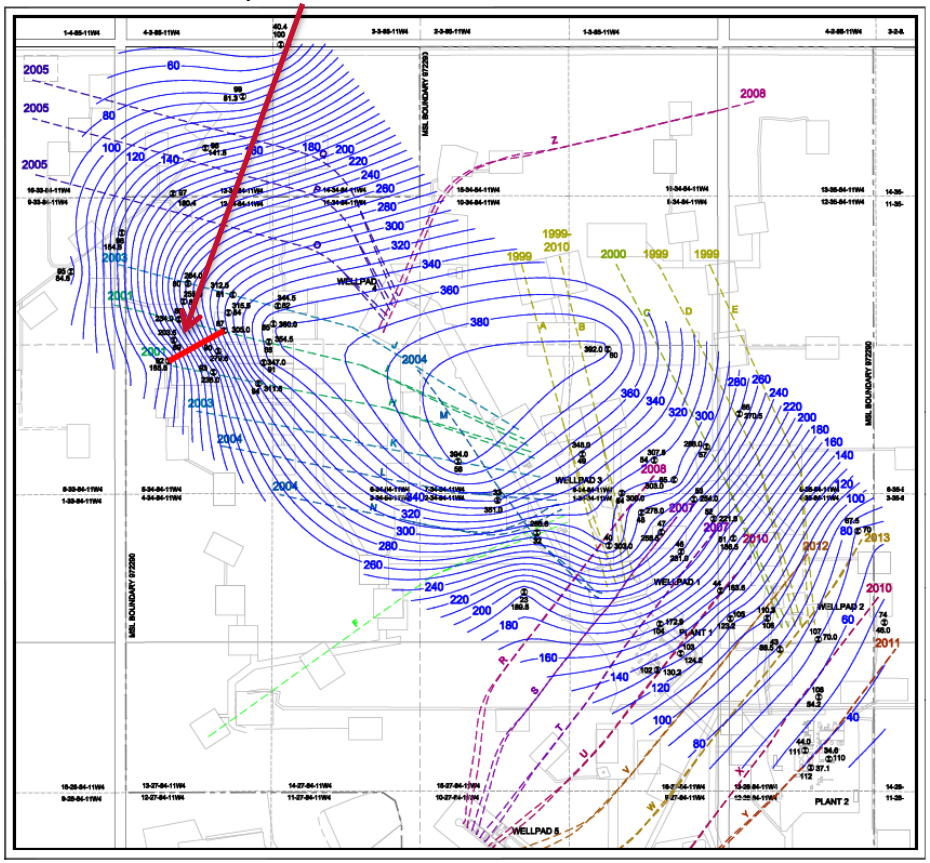
	Depth, m	Min. stress		Vert. stress		Stress regime
		MPa	kPa/m	MPa	kPa/m	
McM Sands	327.0	5.59	17.09	6.91	21.13	V. frac
McM Shale	314.5	5.55	17.65	6.64	21.11	V. frac
WBSK Shale	297.0	6.17	20.77	6.26	21.08	H. frac
CWTR shale	272.0	5.39	19.82	5.73	21.07	H. frac (?)

Surface Heave Monitoring

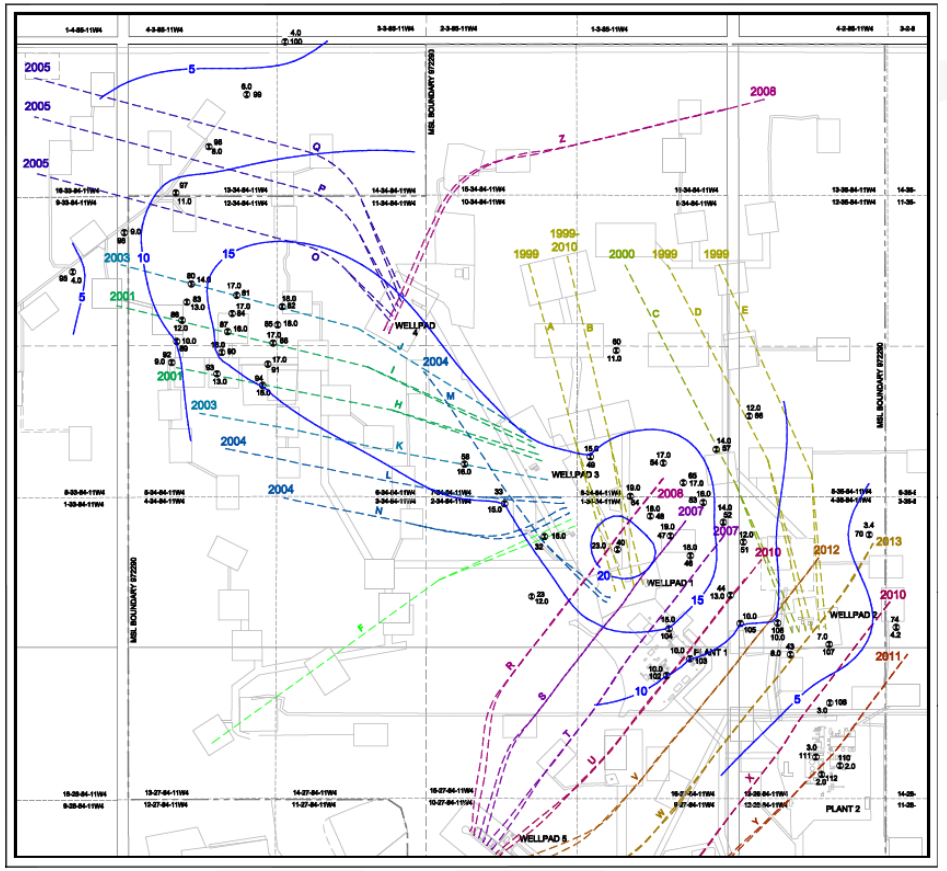
Network of 54 monuments

Cumulative Heave 1999 to 2016: 392 mm

Max Slope: 0.08%



Maximum heave 2015 to 2016: 23 mm



- Modeling predicted max heave of 400mm over 10 years with max slope of 0.12%
  - within structural design tolerances for surface facilities
- Measured heave thus far (17 years of operations) within max heave and slope predictions
- No concerns observed

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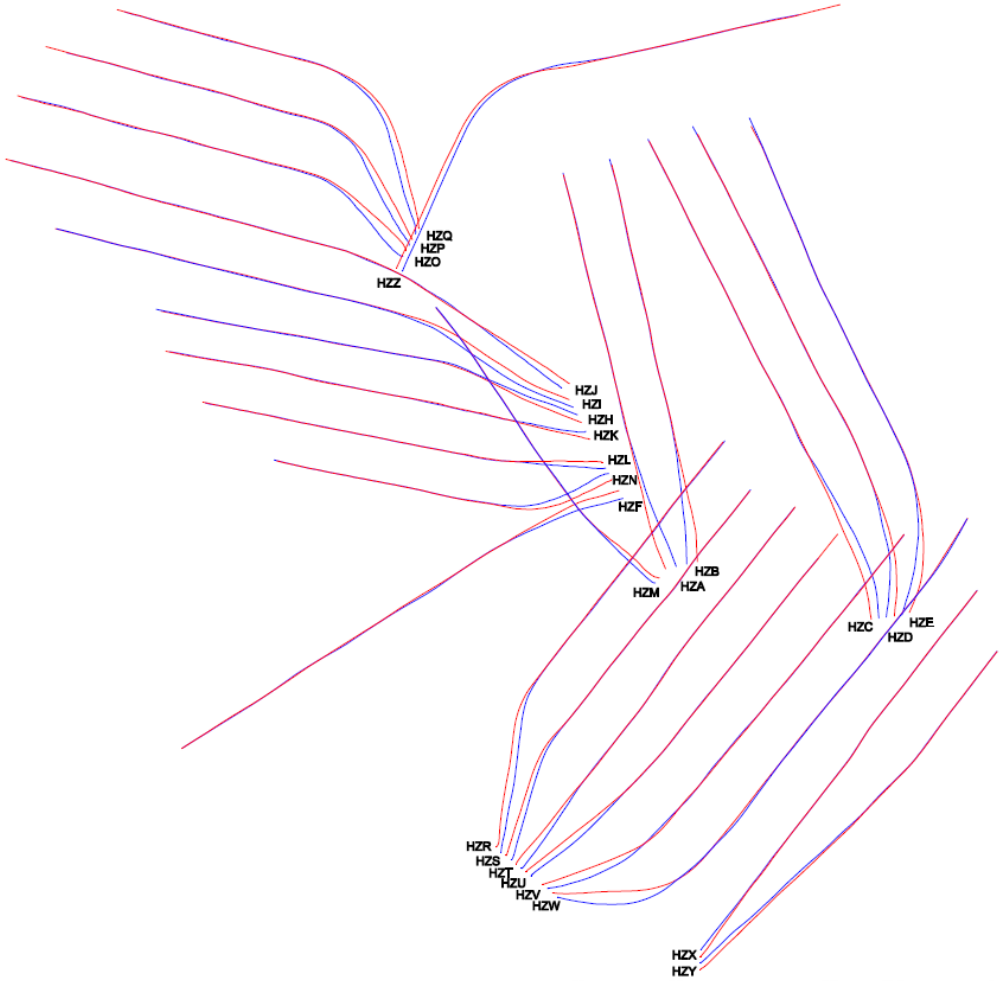
Well Design and Instrumentation

SAGD Well Layout

N/C from 2015 PR

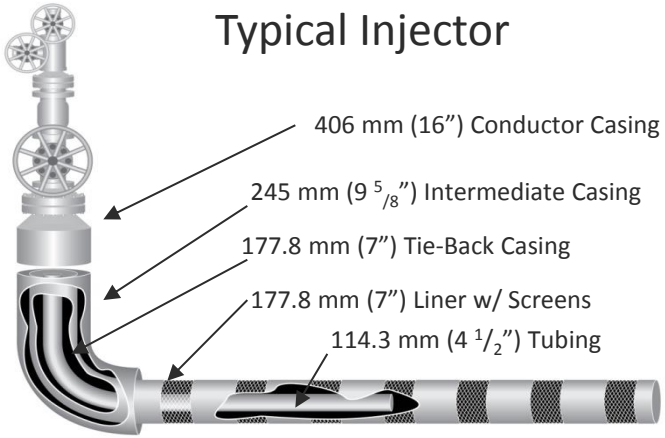


- 24 active well pairs
  - "oldest" wells A/B, started up in July 1999
  - "youngest" wells V and W, started up in July 2012 and May 2013 respectively
- F-Well abandoned 2014

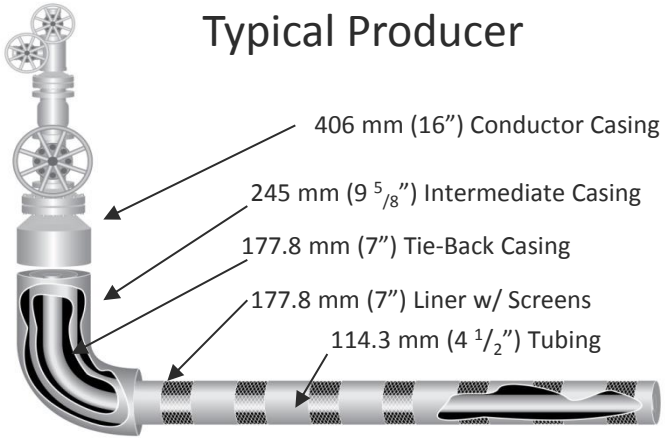
SAGD Well Completions

Approval Nos: 8788L (Demonstration)

Typical Injector



Typical Producer



Well Completions Table

Wellpair	Tie-Back	Liner Size		Screen Type			4-1/2" Tubing	
	Yes/No	7"	8-5/8"	Mesh-Rite	Wire Wrap	Seamed Slotted Liner	To Mid	To Toe
A	Yes	P	-	I/P	-	-	-	P
B	Yes	I/P	-	-	I/P	-	-	I/P
C	Yes	I/P	-	-	I/P	-	-	I/P
D	Yes	I/P	-	P	I	-	-	I/P
E	Yes	I/P	-	I/P	-	-	-	I/P
H	Yes	P	I	-	I/P	-	-	I/P
I	Yes	I/P	-	-	I/P	-	I	P
J	Yes	I/P	-	-	I/P	-	I	P
K	No	I/P	-	-	I/P	-	I	P
L	Yes	I/P	-	-	I/P	-	I	P
M	Yes	I/P	-	-	I/P	-	I	P
N	Yes	I/P	-	-	I/P	-	I	P
O	Yes	I/P	-	-	I/P	-	-	I/P
P	Yes	I/P	-	-	-	I/P	I	P
Q	Yes	I/P	-	-	I/P	-	I	P
R	Yes	I/P	-	-	I	P	I	P
S	Yes	P	I	-	-	I/P	-	I/P
T	Yes	P	I	-	-	I/P	-	I/P
U	Yes	P	I	-	-	I/P	-	I/P
V	Yes	P	I	Failed Liner - 4-1/2"WWS		I/P	-	I/P (2-7/8")
W	Yes	P	I	-	-	I/P	-	I/P
X	Yes	-	I/P	-	-	I/P	-	I
Y	Yes	-	I/P	Failed Liner - 5-1/2"WWS		I/P	-	I
Z	No	P	I	SCVF- 7" Cement to Surface		I/P	-	I

I = Injector Well
P = Producer Well

SAGD Well Completions

- 1999-2004 MeshRite/wire wrap – Limited technology available for "SAGD" applications
  - Isolated cases of sand production
- 2005-2010 Slotted Liner – Commercial emergence of technology, lower cost alternative
  - Good sand control
  - High pressure drops

SAGD Well Completions

Demo Workover Challenges

Contributing factors which resulted in “challenging” workovers

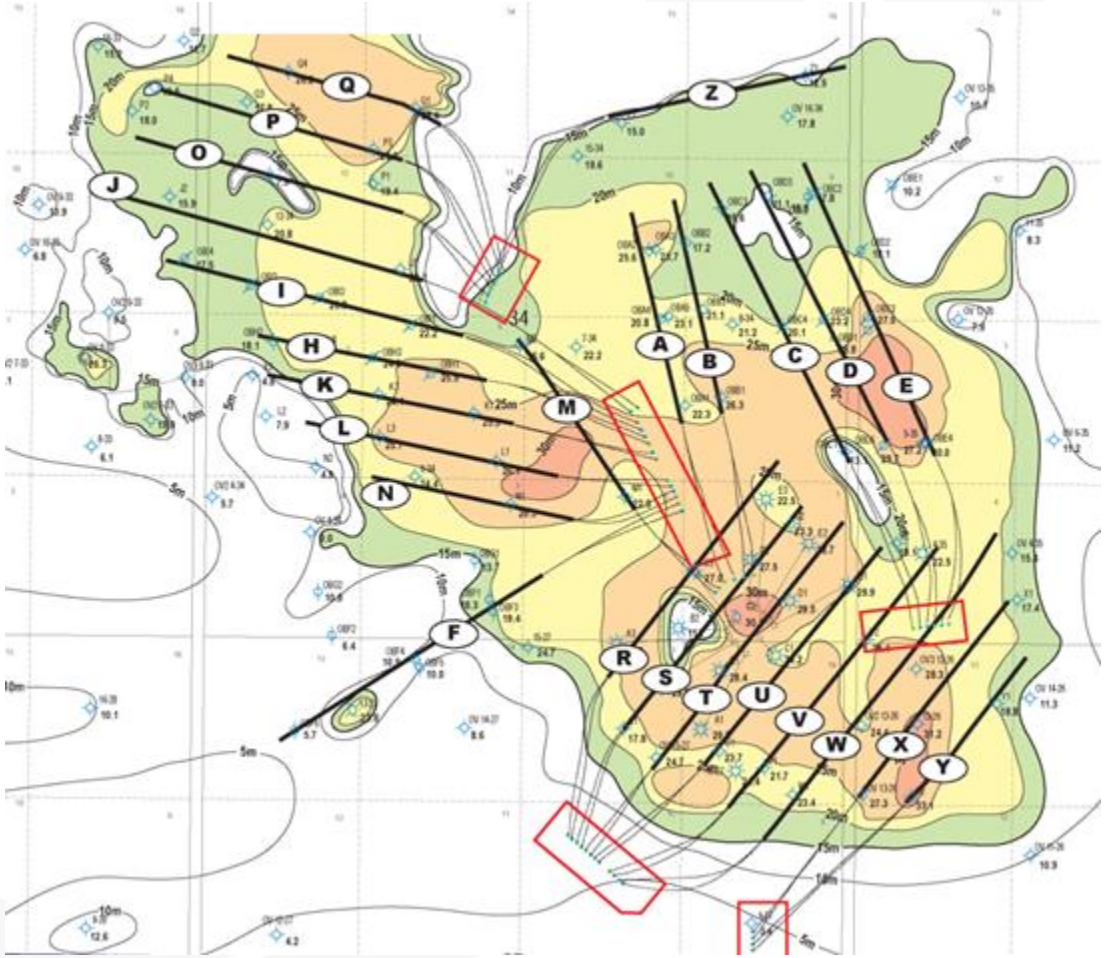
- JACOS DEMO operates at high injection pressures (≈4500kPa) resulting in downhole pressures higher than hydrostatic head
- Failed wells are in communication with adjacent wells making it difficult/impossible to de-pressure the reservoir
- Specialized brine (up to 1.6 density) is required to weight-up the column to perform workovers
  - Well control is difficult due to fluctuating downhole pressures; wells take kill fluids
  - Brine kill fluid returns have negative effect on plant water treatment systems; well produced fluid is trucked out until hardness/chlorides are at acceptable levels

Demo Artificial Lift

Approval Nos. 8788L

N/C from 2015PR

- HZXP/HZYP ESP trial was initiated to test downhole pumps.
- The location of the wells was chosen due to the fact the wells are relatively isolated from the adjacent high pressure wells. The adjacent well (W) was the last well to be brought on stream.
- Eventually when X/Y steam chamber coalesces with W-Well, X/Y will be converted to “natural lift” SAGD wells



Demo Artificial Lift

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N/C from 2015PR

HZXP – Schlumberger Hotline 550 (218°C)

1st ESP pump installed Dec/10 –April/12 (Run Time 487D, Surface Connector Failure).

2nd ESP system installed May/12- June/13 (Run Time 381D, Surface Connector / Electrical Cable Failure).

-3rd ESP pump installed July/13

Operating Temperatures up to 210°C

Intake Pump Pressure – 2000-2800kPa

Production rate - 160-320 m^3/D

ISOR ≈ 2.5

HZYP – Schlumberger Hotline SA3 (250°C)

Pump installed Jan/13, online Feb/13

Operating Temperatures up to 175°C

Intake Pump Pressure – 2000-2800kPa

Production rate - 100-150m^3/D (Reduced rates due to high ΔP, temperature spikes)

ISOR ≈ 4.3

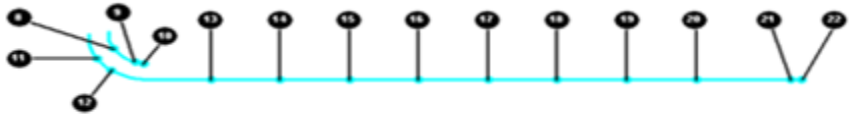
Demo Thermocouple Placement

N/C from 2015PR

Instrumenation in Wells

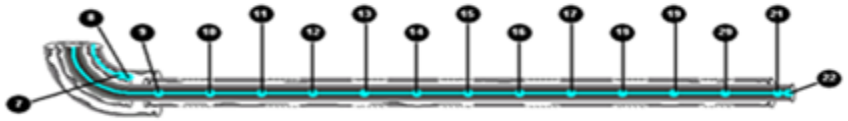
Wells A, B
Injector

Producer



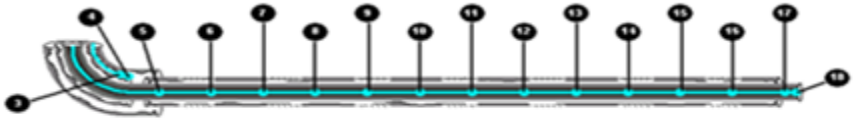
Wells C, H
Injector

Producer



Wells D, E, I
Injector

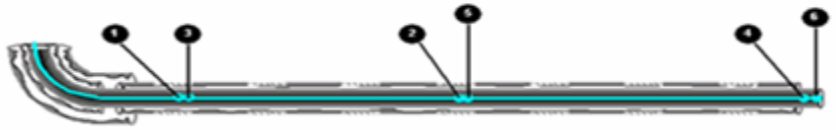
Producer



Wells J, K, L, M, N, O, P, Q, R, S, T
Injector

NO THERMOCOUPLES

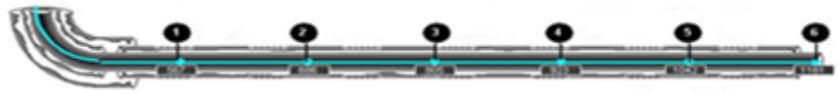
Producer



Well U, V, W, Y
Injector

NO THERMOCOUPLES

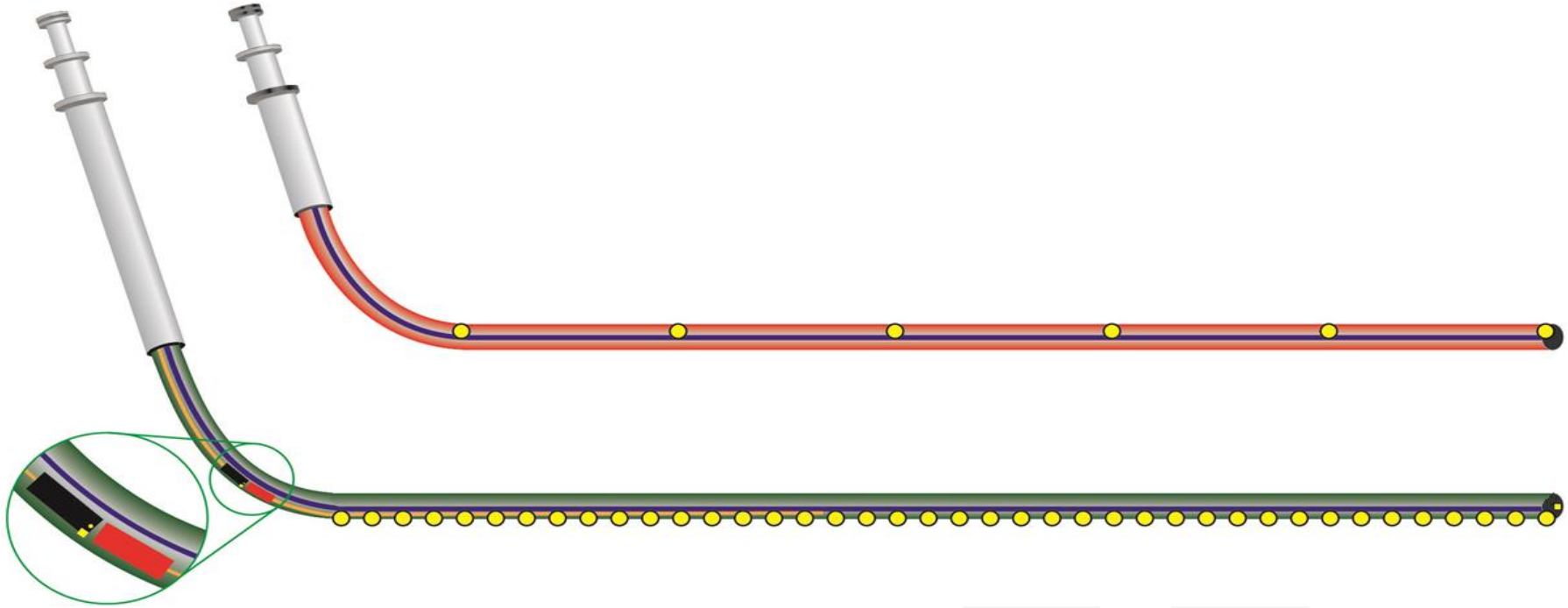
Producer



Demo Instrumentation HZXP (ESP)

Approval Nos. 8788L

N/C from 201PR



HZXI – 6 Thermocouples
HZXP – 40 Point LX-Data Temperature, LX-Data Pressure
ESP – Single Point LX-Data Temperature, LX-Data Pressure

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Reservoir Performance

Reservoir Performance Summary

- 24 SAGD well pairs on production until May 5 2016.
- DEMO Complete Injection and Production shut-down on May 5.
- 2016 average bitumen rate (Jan1 –May 5 2016) ~ 4,532 bbl/day (720.5 m3/day)
- Cumulative bitumen produced from project start-up to 12/31/2016 ~ 35.15 million bbl (5.59 million m3)
- Cumulative SOR to 12/31/2016~ 3.79 (wt/wt) (3.83 V/V)
- OBIP for the developed area is 78 million bbl (12 million m3)
- Recoverable bitumen is estimated at 48million bbl (7.6million m3) (61% Ultimate Recovery)

Steam Injection (Temp, Pressure, Quality)

ANNUAL AVERAGE WELLHEAD PRESSURES AND TEMPERATURES		
2016 (during operation)		
Wells	Pressure (kPa)	Temperature (°C)
A Well	4359	256
B Well	4284	255
C Well	4356	257
D Well	4418	257
E Well	4342	256
H Well	4487	259
I Well	4459	258
J Well	4413	257
K Well	4389	258
L Well	4484	257
M Well	4491	258
N Well	4506	259
O Well	4319	256
P Well	4266	255
Q Well	4274	256
R Well	4710	262
S Well	4582	260
T Well	4635	261
U Well	4537	260
V Well	4485	257
W Well	4499	258
X Well	2551	227
Y Well	3684	247
Z Well	4477	260
Average	4334	256

100% Steam Quality* @:

HZA, HZB, HZC, HZD,HZE

Average Steam quality for the remaining wells ~ 95%

* Steam Traps @ Phase 1&2 Wellheads

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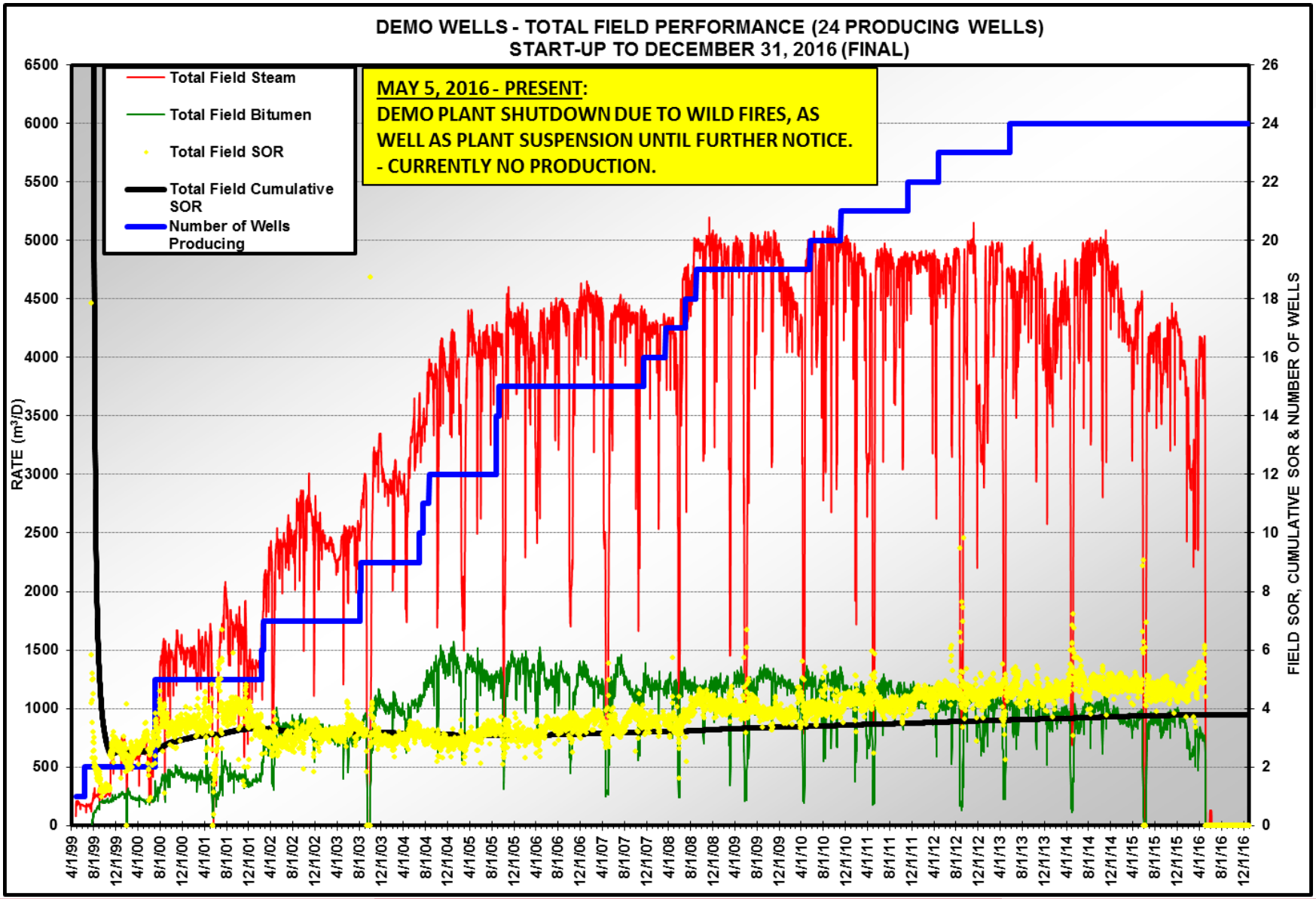
DEMO Field Performance



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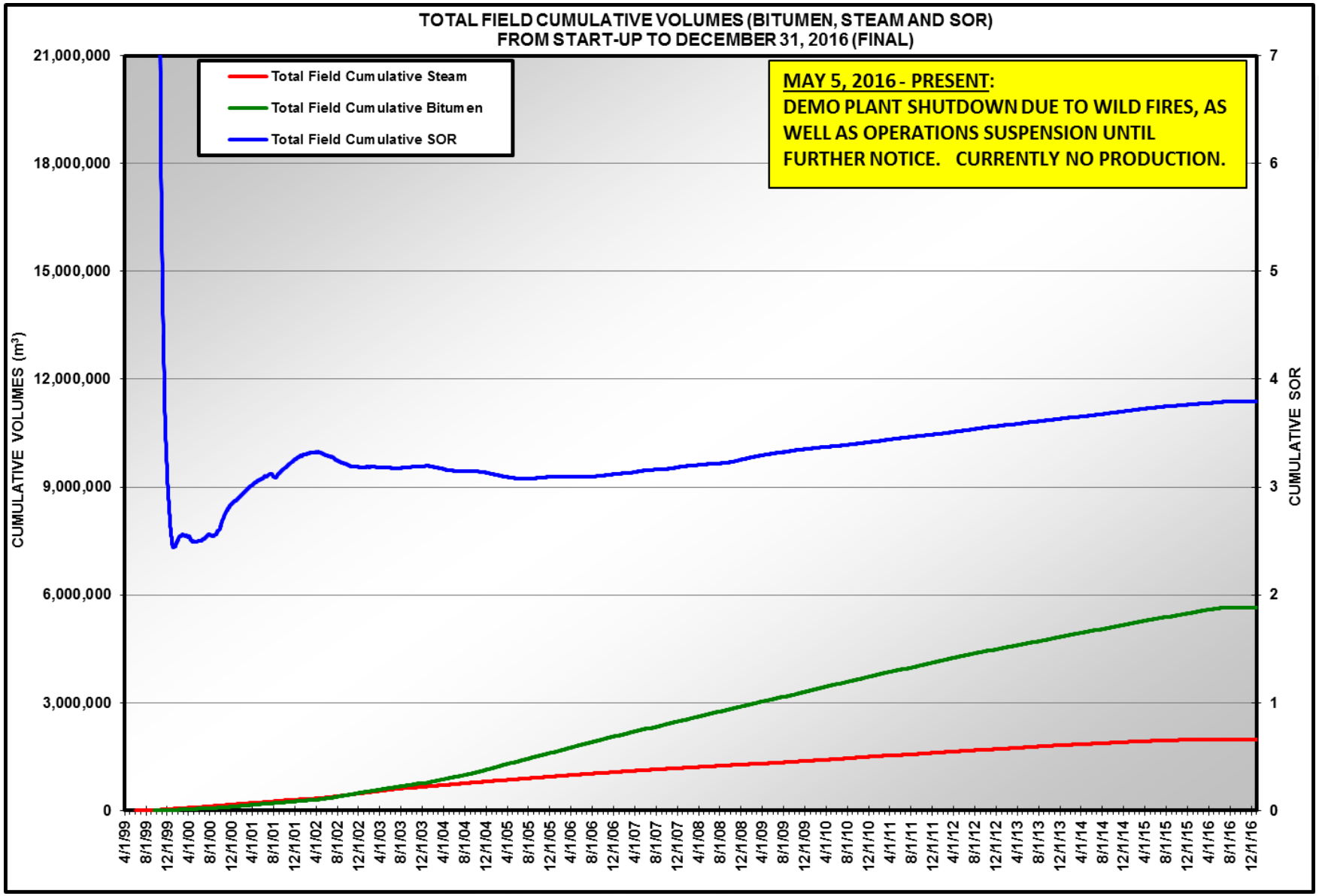
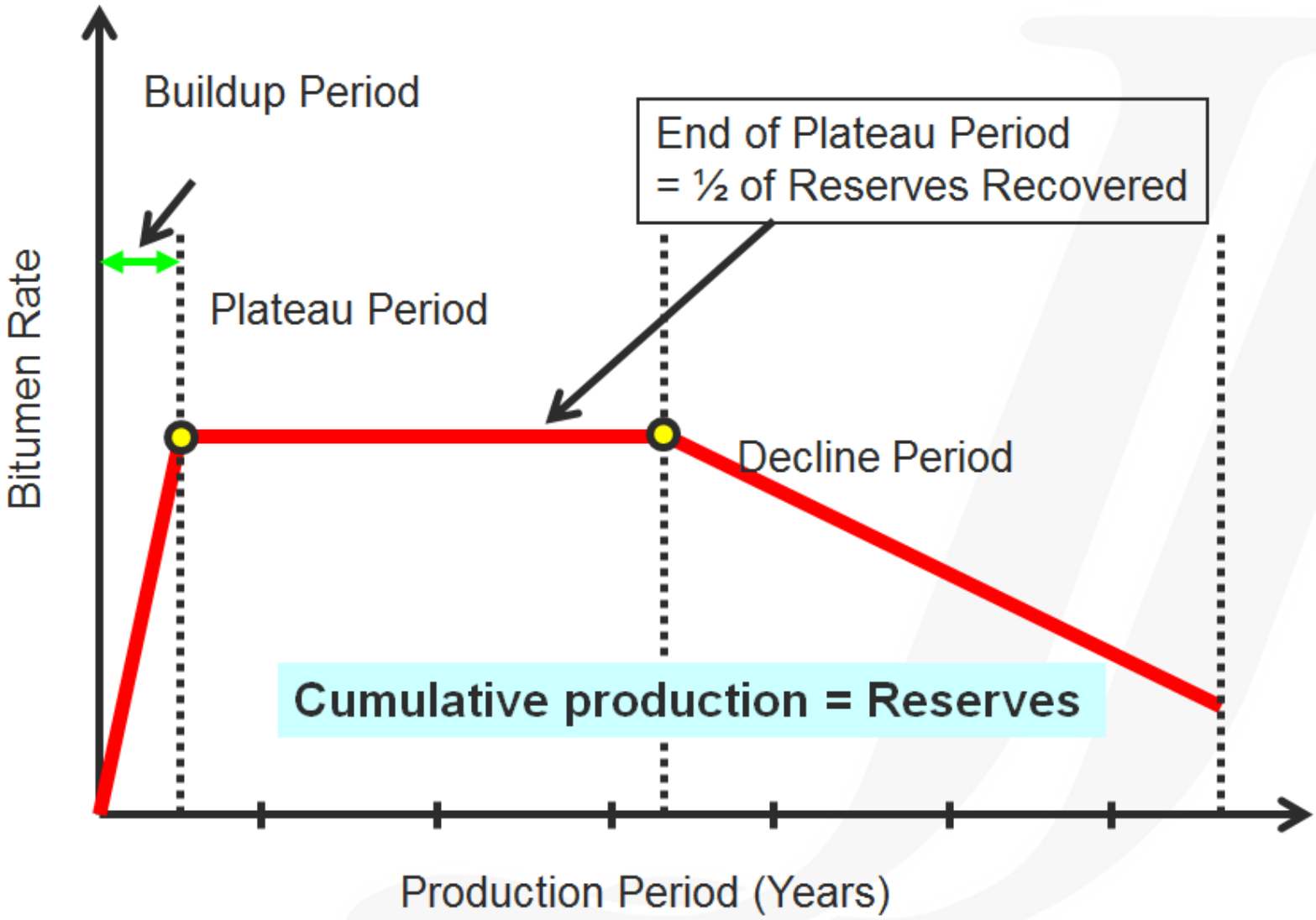
DEMO Field Cumulative Volumes



Generic Production Curve Method

- For bitumen production:
  - SAGD well life consists of build up period, plateau period and decline period.
  - Plateau rate is calculated as a function of effective net thickness.

Generic Production Curve



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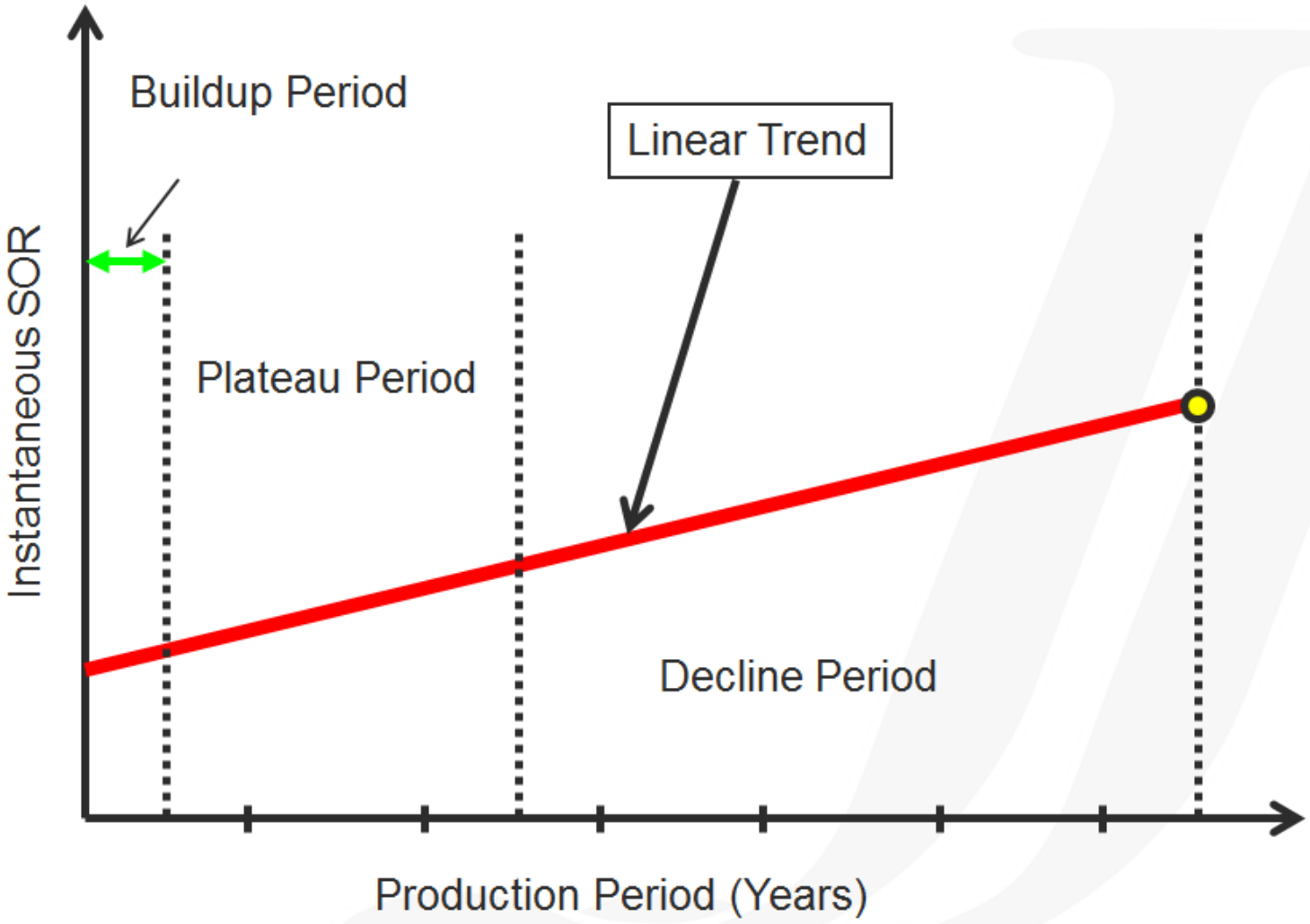
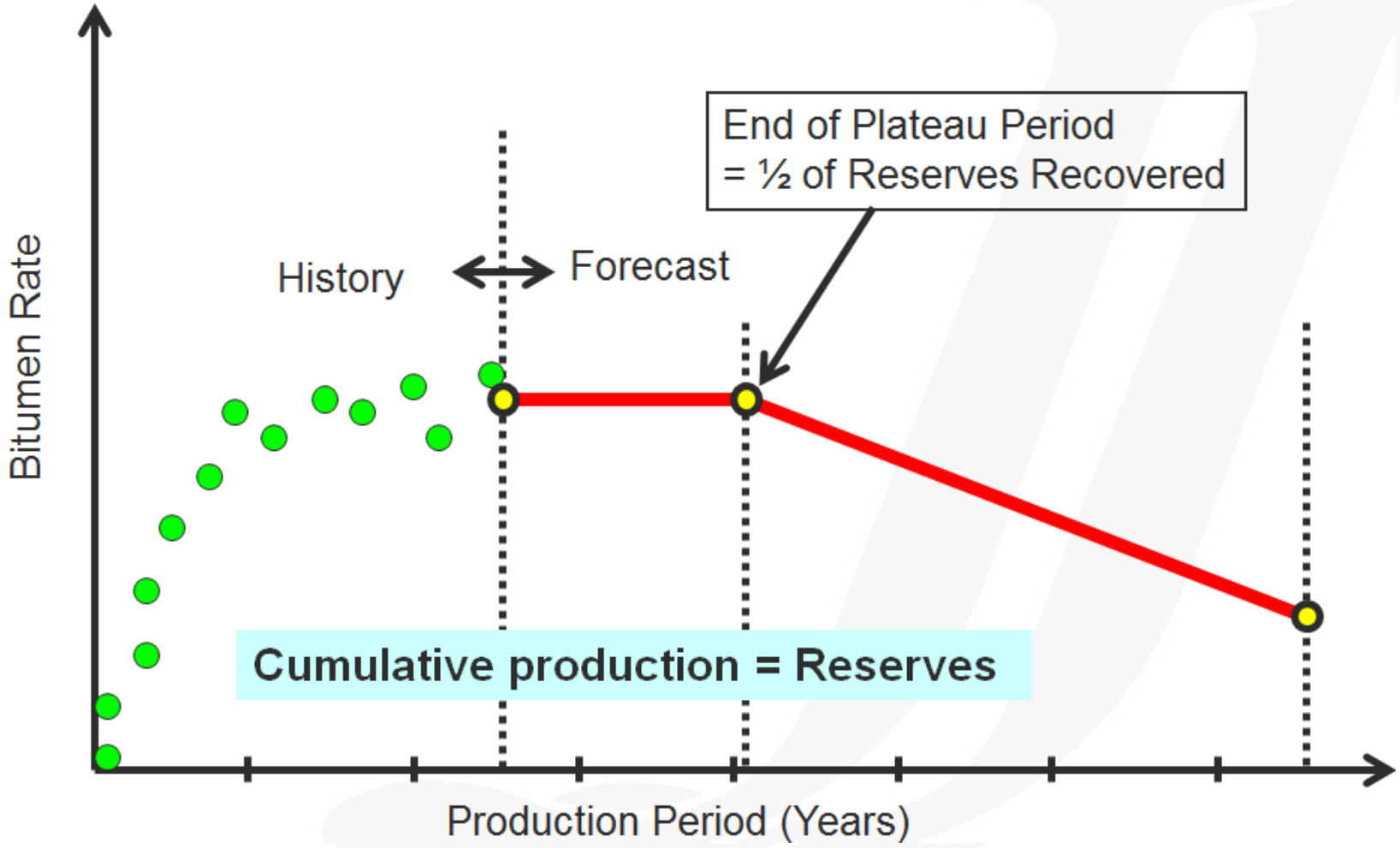
Methodology

- A linear trend is adopted to describe the SOR performance.
- The initial SOR in the demo area has been evaluated as a function of effective net thickness. The initial SOR is classified into four categories of net thickness.
- 10, 15, 20, 25m
- The increasing ratio with time is from simulation results.
- 0.025/month
- The actual trend is close to this prediction.

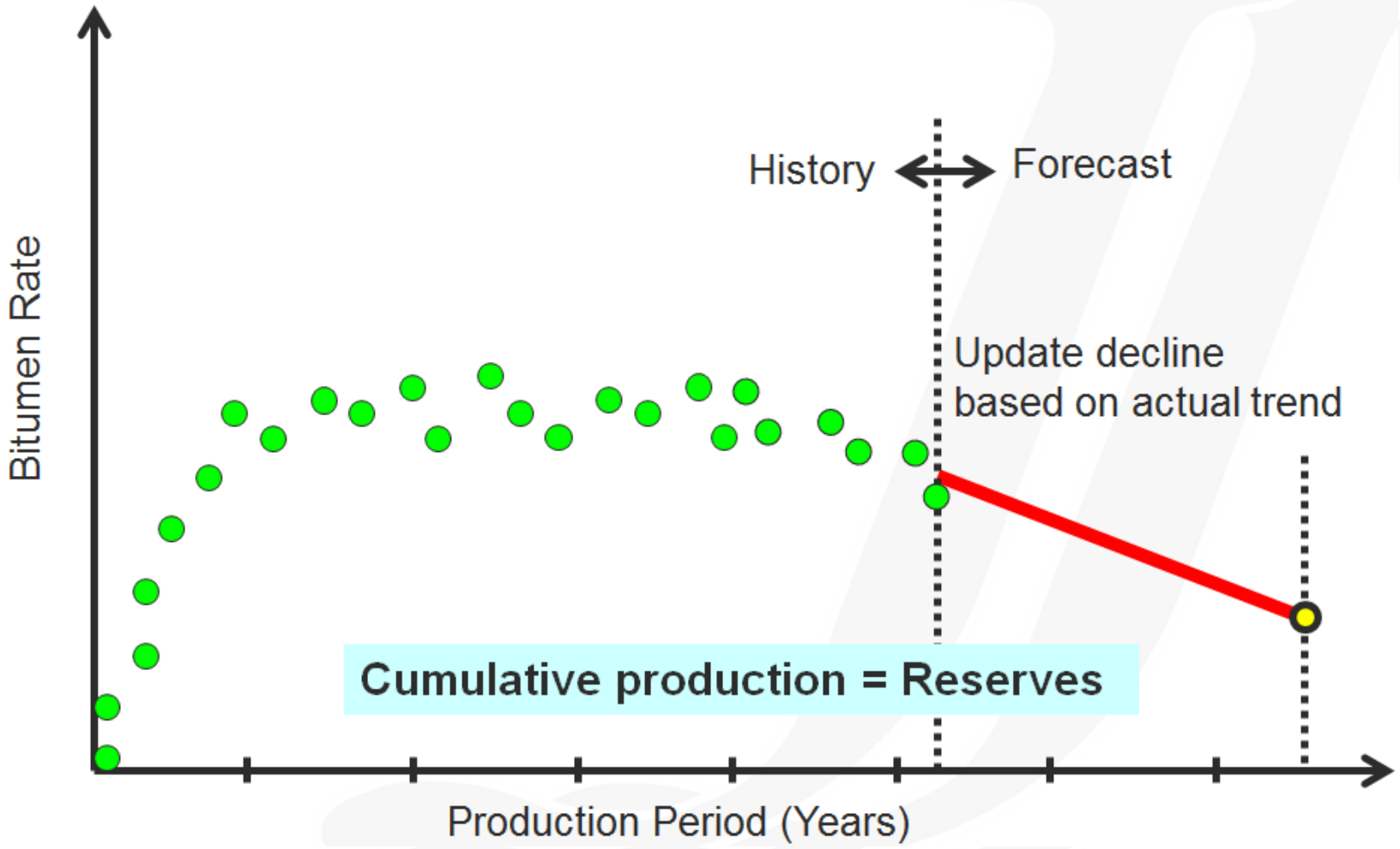
Linear Trend



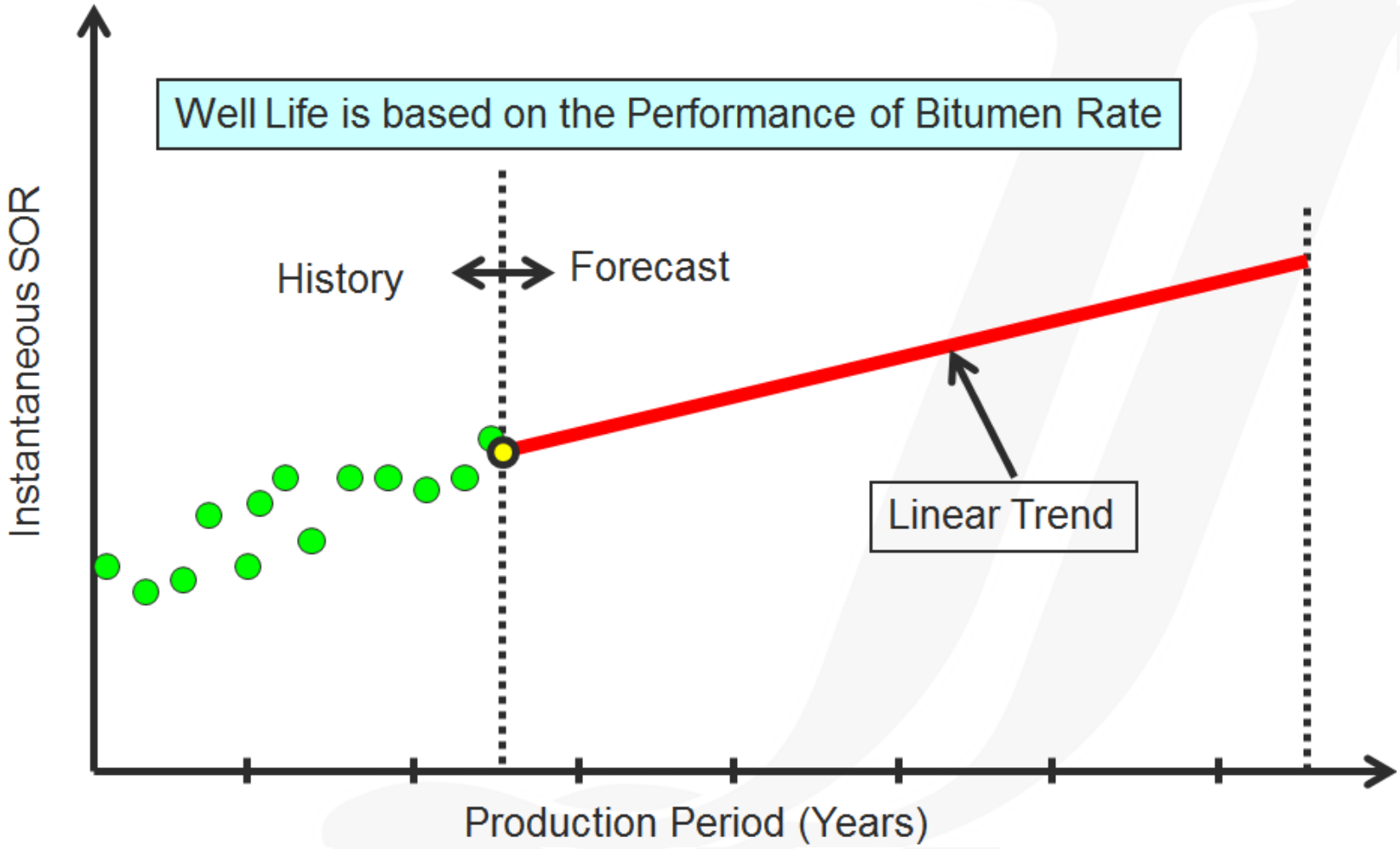
Wells with History - 1



Wells with History - 2



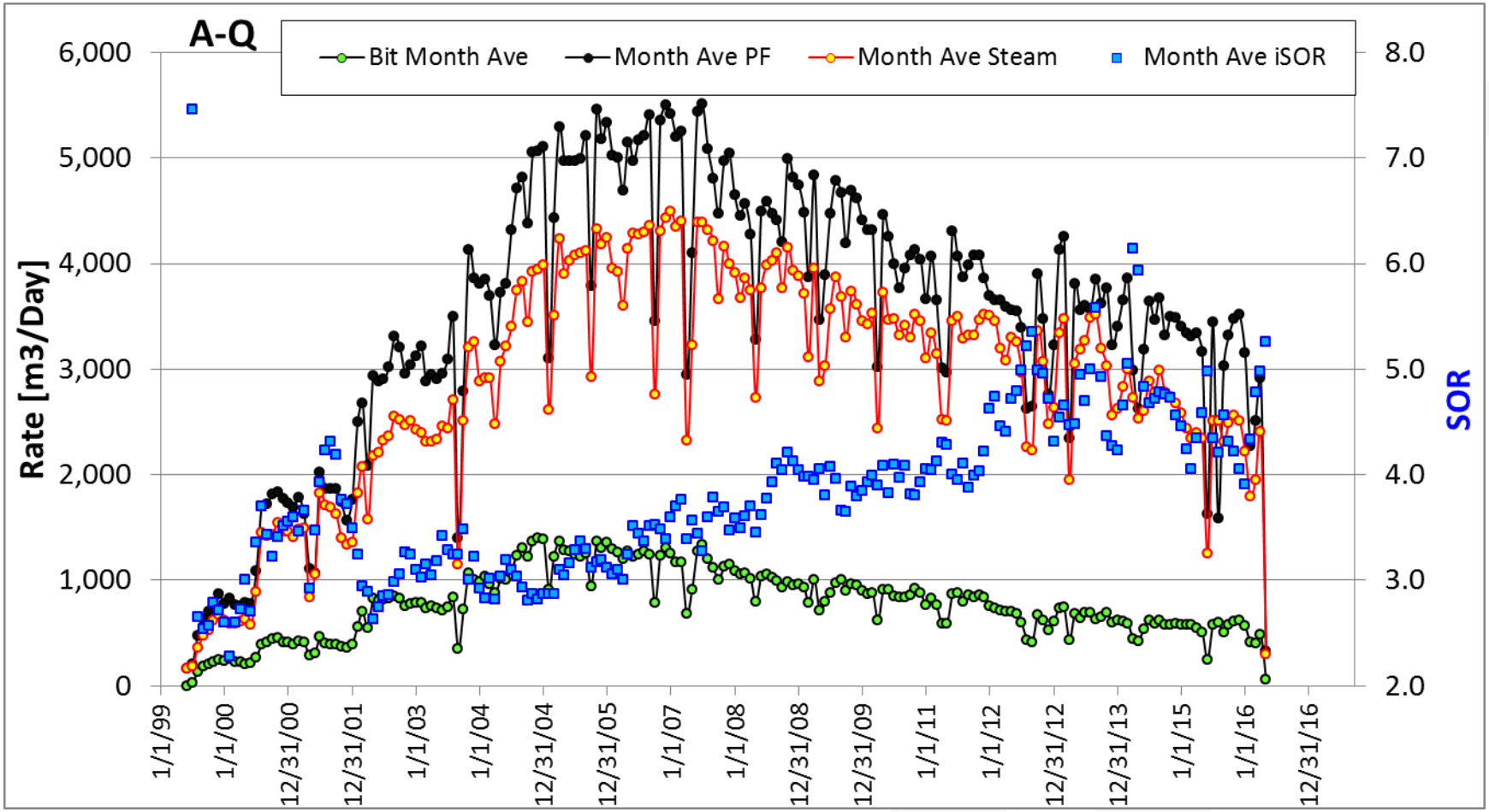
Wells with History - 3



Decline Method

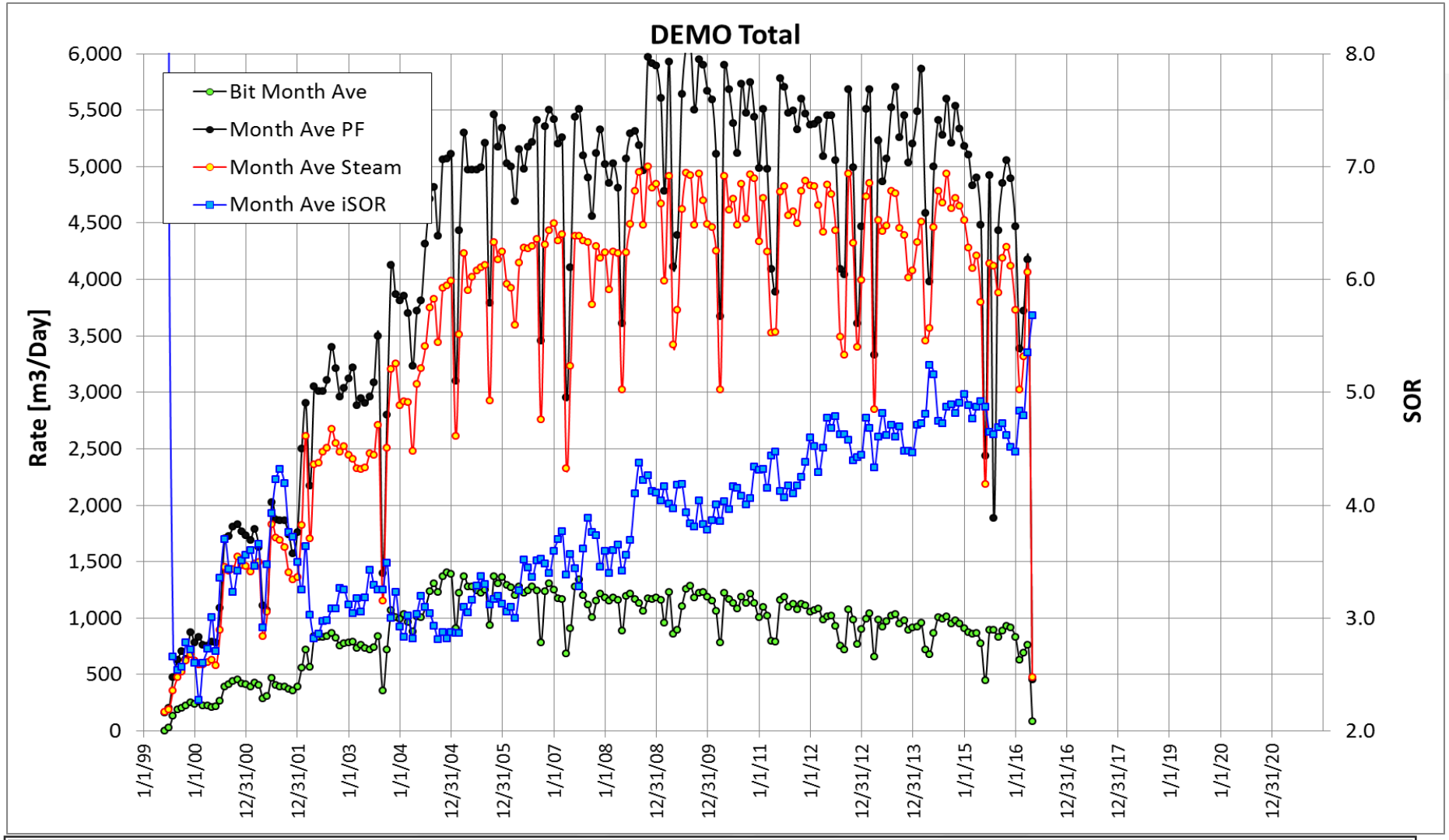
- Adapted to well groups (A to Q pairs) that have enough production history to estimate the decline
- The steam chambers from the well pairs in this group have merged or will merge in the future (Steam chamber between J well and O well have a communication since 2011.)
- A trend that reflects the stable operating period in both bitumen production and SOR is picked for the forecast with assumption that reservoir pressure will be relatively constant (fluctuation in pressure may exist due to marketing of bitumen and gas supply)

A-Q Production History



A – Q well pair production history (DEMO project will remain suspended until economic conditions support the restart and operation of the field)

DEMO Production History



DEMO production history (DEMO project will remain suspended until economic conditions support the restart and operation of the field)

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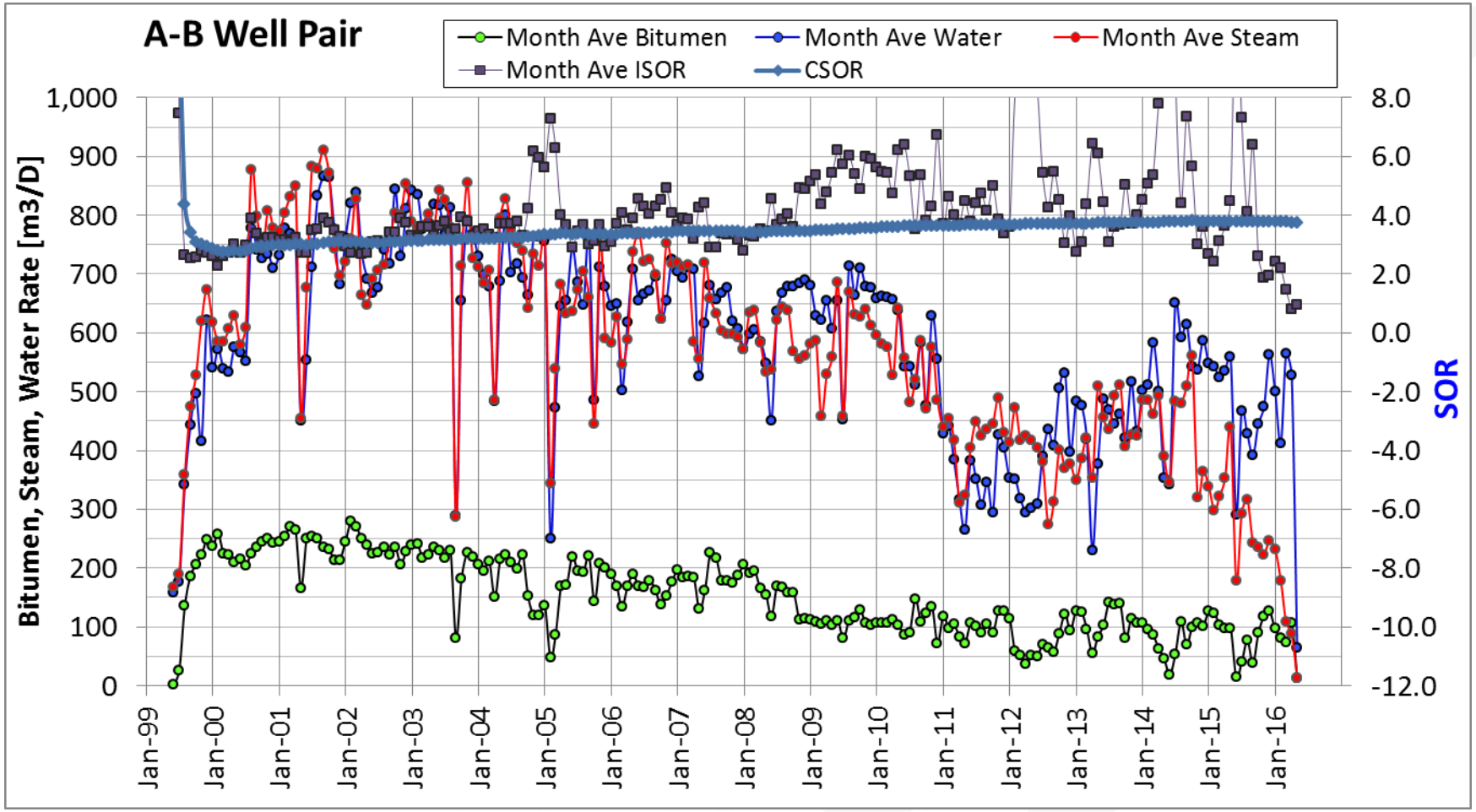
DEMO Well Pairs Recovery Factor

As of the end of Dec-2016

Start Year	Well Pair	Original Bitumen in Place (Mm3)	Cum Produced Bitumen (Mm3)	Current Recovery (%)	Ultimate * Recovery (%)
1999	A,B,C D and E	3,113	1911	60	66
2002	H, I, J and K	2,158	1501		
2004	L, M and N	1,412	795		
2005	O, P and Q	1,203	560		
2007	S and T	1,186	334	28	58
2008	R and Z	913	267	29	44
2010	U and X	1,169	130	11	55
2012	Y and V	845	49	6	54
2013	W	585	35	6	55
	Total	12,584	5,583	44	61

* DEMO was suspended on May 5, 2016 and will remain suspended until economic conditions support the restart and operation of the field

Well Pair Performance Example

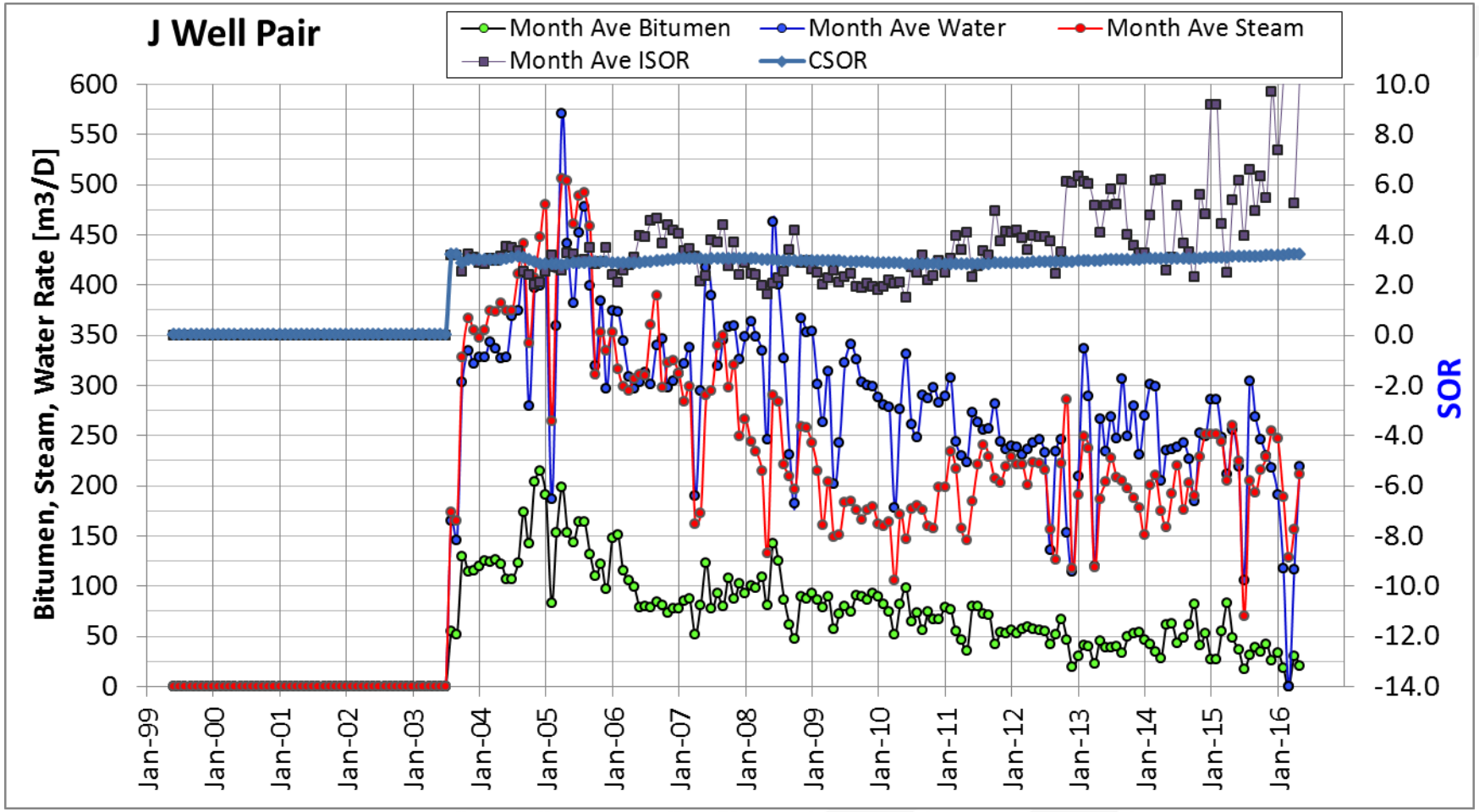


Recovery factor at the end of 2016: 67.9%

A-B Well Pairs Highlights

- These wells have approximately 15 years history and still maintain economic performance.
- These two wells produced ~ 5.85 MMbbl (0.93 million m3) of bitumen and CSOR ~ 3.8
- The steam chambers for the A and B wells have been communicating since late 2001.
- The injection pressure of B is slightly higher than A, thereby sweeping bitumen from B to A. B well is a steam donor
- Drainage west of A pair is beyond 50m. Most of the bitumen in this area is expected to be recovered through the sweep between M and A wells. (M at higher pressure)

Well Pair Performance Example - High

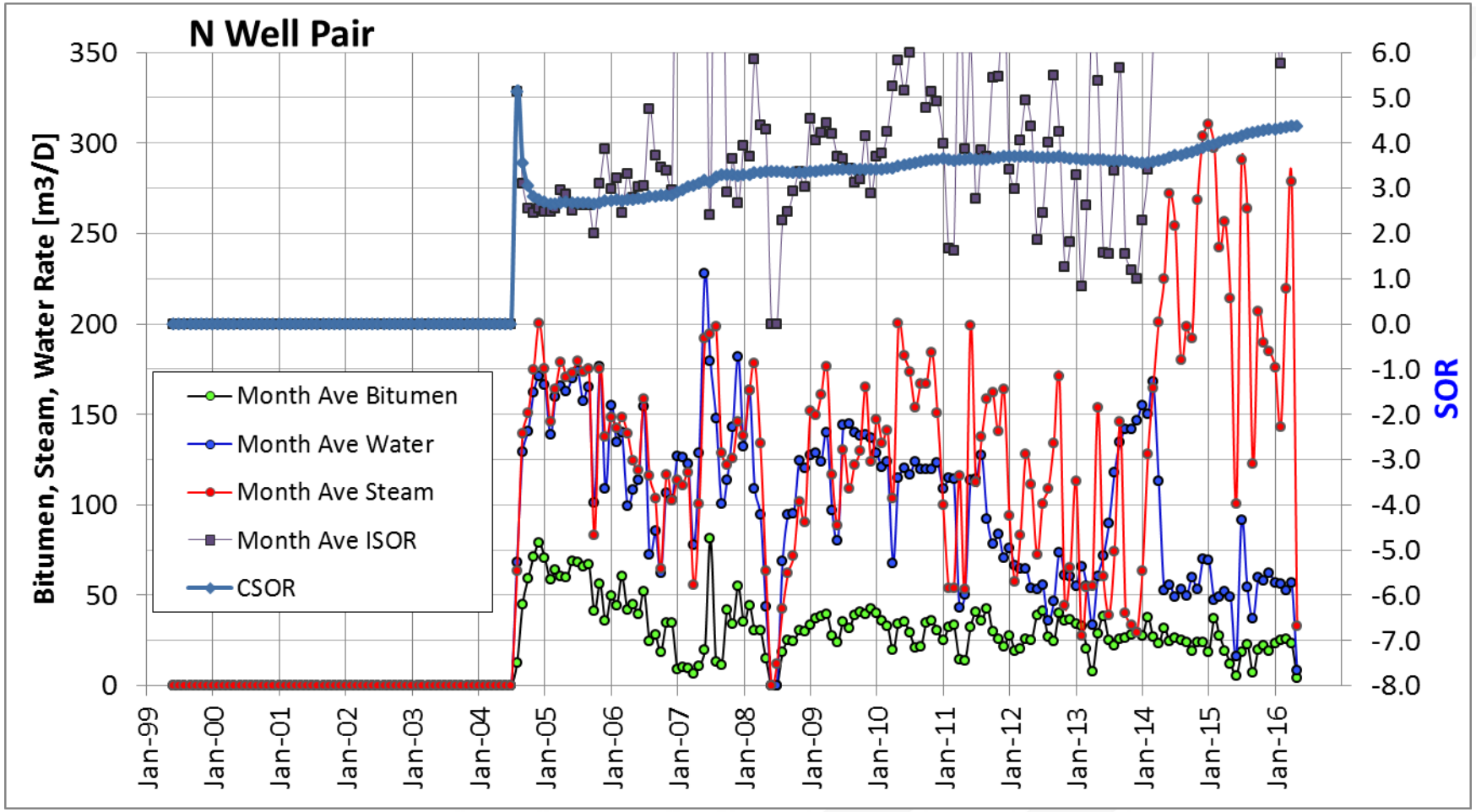


Recovery factor at the end of 2016: 51%

J Well Pair Highlights

- The bitumen production profile appears to be following the typical build up, plateau, and decline periods.
- Well produced ~ 2.3 MMBBL and CSOR ~ 3.2
- The decline rate has moderated in the last 1-3 years.
- The J pair is in communication with the I pair to the south.
- The J pair started communication with the O pair in 2011 to the north and some steam is provided to the O well from J.

Well Pair Performance Example - Low



Recovery factor at the end of 2016: 39.6%

N Well Pair Highlights

- Actual bitumen production is lower than expected (150m3/d).
- Well produced ~ 0.86 MMBBL and CSOR ~ 4.4
  - Potential reasons for this low productivity are:
    The reservoir along the HZ well contains clast facie and these slow down the steam chamber growth. Thermocouple data in the producer indicate that steam chamber growth at the toe is poor; likely due to the previously mentioned clast facie.
  - Steam coning induced sand production. This well has been controlled by production rate which prevents sand influx. This option enables the N well to produce steadily without sand issues.

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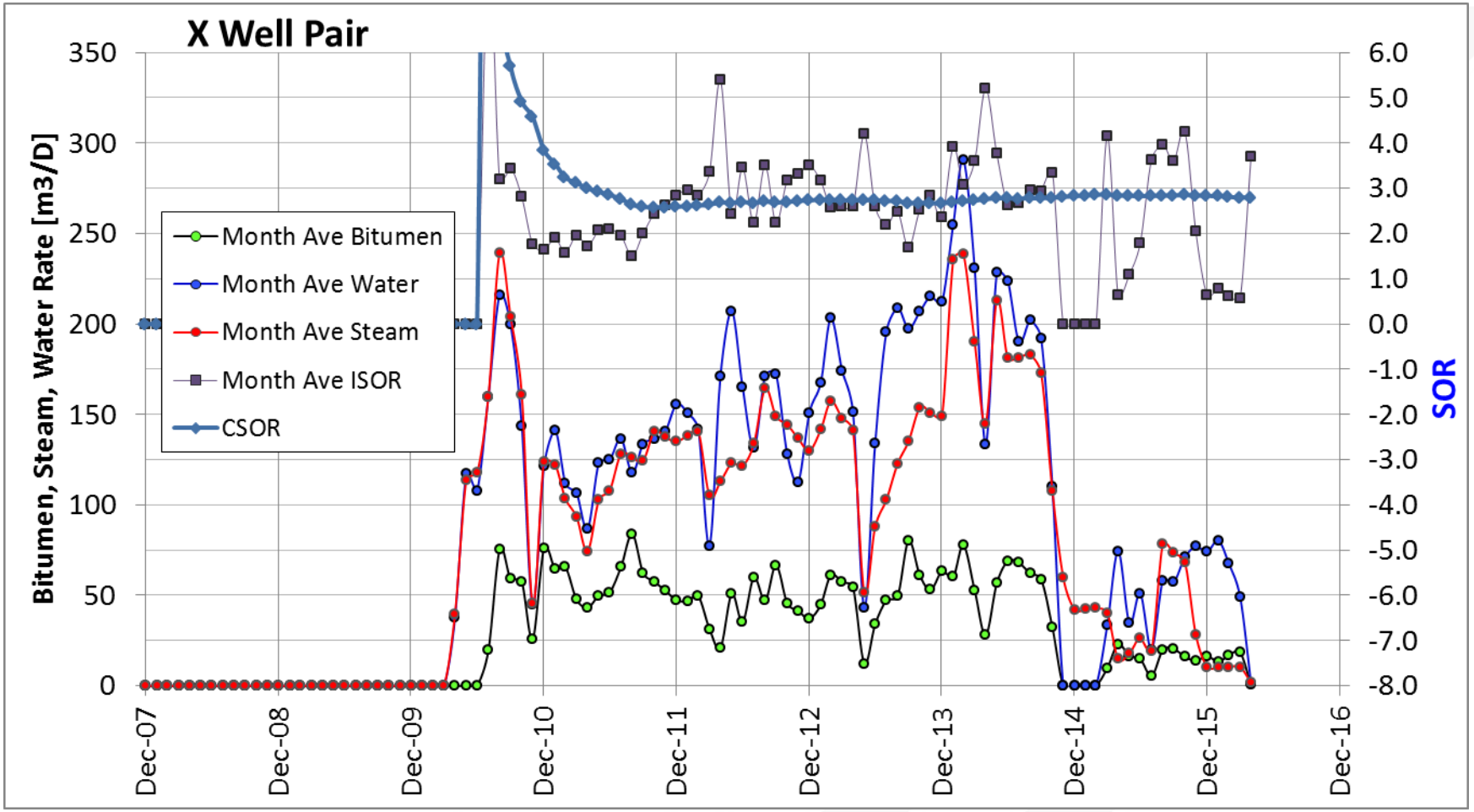
Well Pair Performance Example



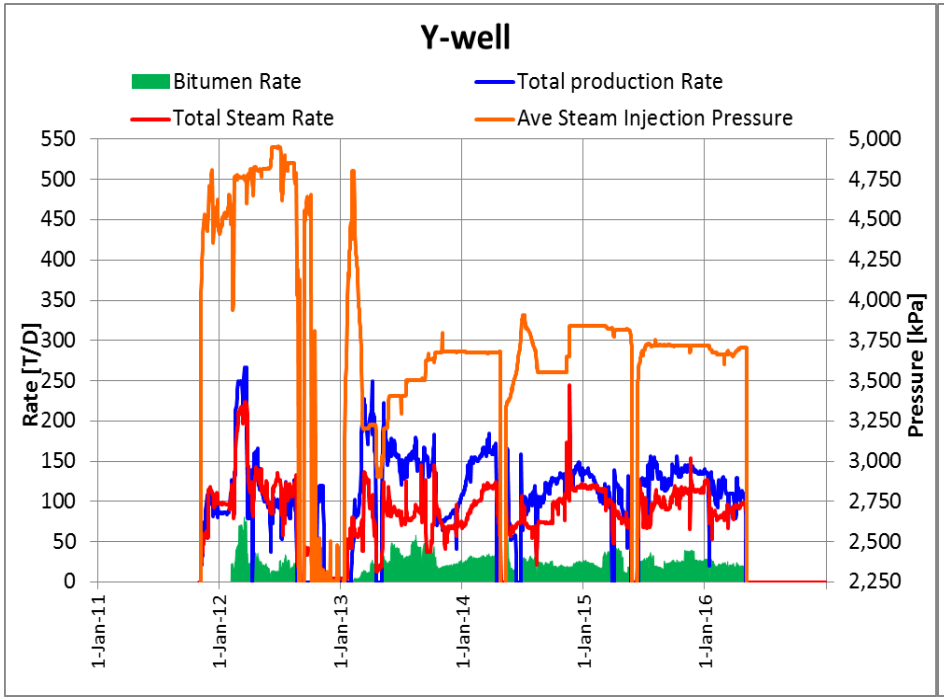
Recovery factor at the end of 2016: 15.3%

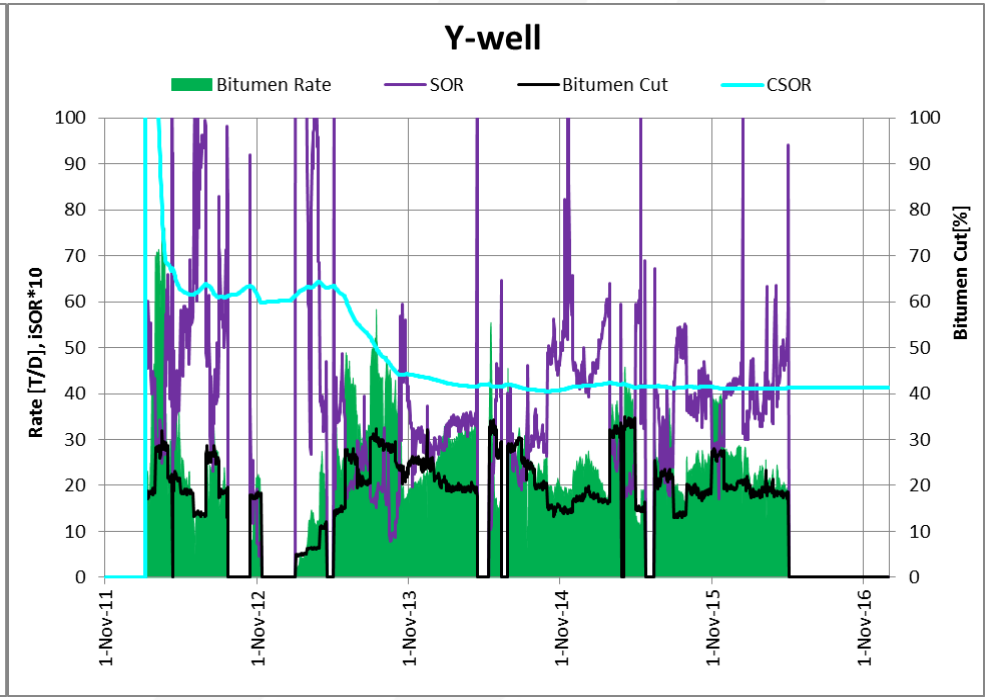
X Well Pair Highlights

- First well with Electrical Submersible Pump (ESP) test in the field.
- Well has produced ~ 0.56 MMBBL & CSOR ~ 2.8
- X pair has maintained good performance since an ESP was installed to operate at low pressure (in December, 2010).
  - Maintained bitumen production
  - Reduced steam rate, which was free to be redeployed into other wells to maximize the total bitumen production from the facility.
  - Reduced SOR
- The second ESP failed in June 2013 (398 days in service) due to control line failure resulting in a short. The third ESP has been installed and running since July 2013.
  (Ref. : First ESP life : 487 days)
- Shut-in in November 2014 due to hot toe.
- Well re-started at lower production rates

Y Well Pair Highlights

- SAGD start-up in Feb 2012
- Sand production observed early in production life
- Liner failure (sand production / plugged well off) Nov 2012, well workover
- Rate control to minimize sand production
- Slowly ramping up production from the well considering past experiences with hot toe





Recovery factor at the end of 2016: 12%

NCG Co-injection

- NCG co-injection carried out from April 15 to May 2 2016 at an average rate of **29,000 sm3/d**
- Cum NCG Co-injected ~510,000 sm3

NCG Co-Injection wells

Well	Max NCG Rate (m3/d)	Avg NCG Rate (m3/d)
A	2,056	1,898
B	2,103	1,891
C	2,185	2,017
D	2,573	2,507
E	2,225	2,060
H	2,772	2,535
I	3,084	3,018
J	3,125	3,035
K	2,644	2,517
L	2,555	2,465
M	4,646	4,577
P	2,119	1,717
Q	2,020	1,788

- Long Term Plan: Field will remain suspended until economic conditions support the restart and operation of the field

NCG injection for pressure maintenance

- Received AER approval inject NCG for pressure maintenance during DEMO suspension. (Temporary approval to July 31, 2017)
  - NCG injection was carried out from June 30 to July 22 2016 at an average rate of **74,000 sm3/d**
  - Cum NCG injected for pressure maintenance **~1,630,000 sm3**

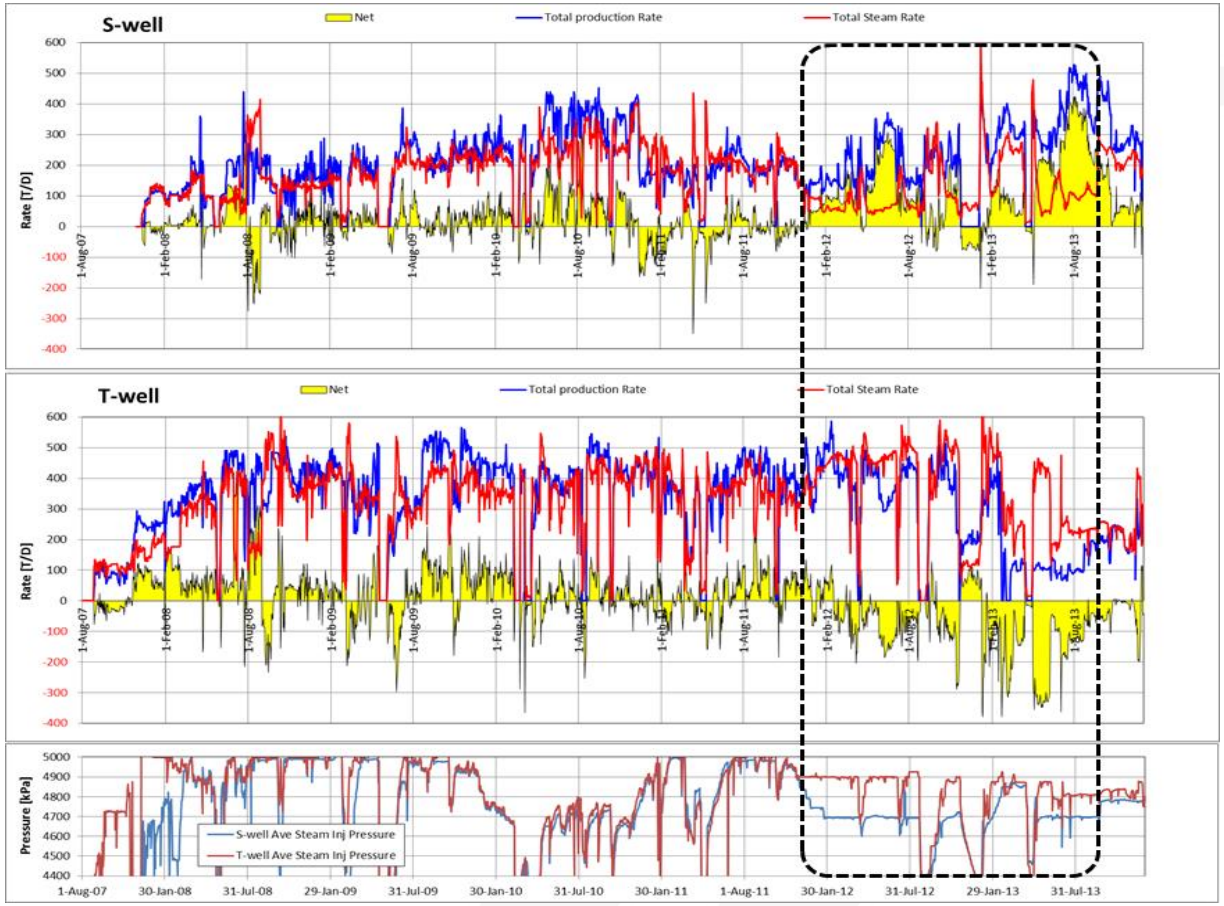
NCG Injection wells

Well	Max NCG Rate (m3/d)	Avg NCG Rate (m3/d)
A	7,538	5,743
C	7,424	6,376
D	7,198	6,269
E	7,524	6,307
H	7,510	6,593
J	7,677	6,431
K	7,401	6,414
L	8,049	6,661
M	7,800	6,661
P	7,332	6,343
Q	7,231	6,268
R	2,113	1,961
S	2,113	1,947
T	2,113	1,942
U	2,113	1,942
W	2,113	1,919

- Long Term Plan: Field will remain suspended until economic conditions support the restart and operation of the field

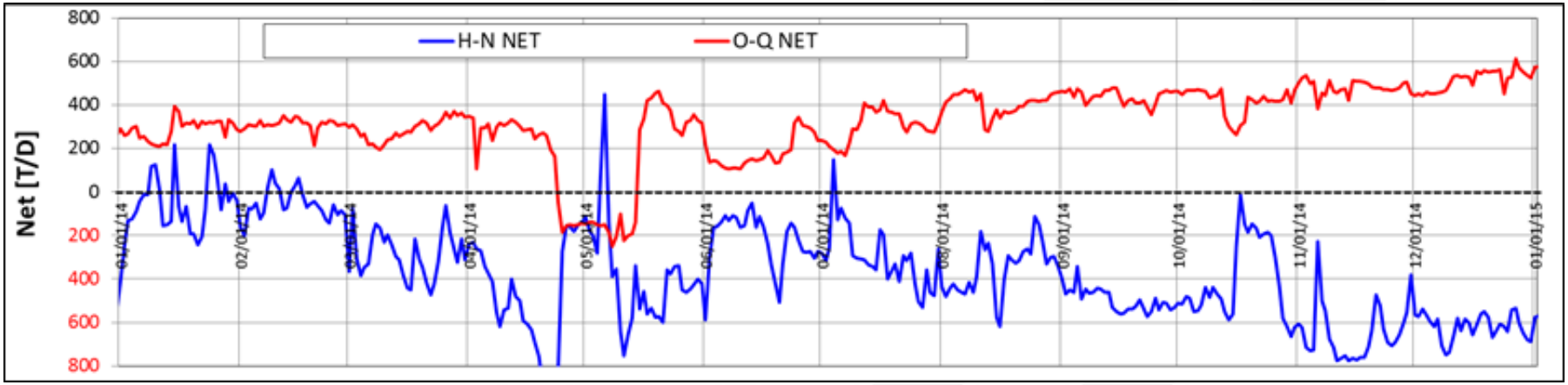
Fluid Communication

- A & B in December 2001
- D & E in April 2005
- H & I in May 2004
- H & K in January 2005
- J & O in March 2011
- S & T in January 2012
- P & O in April 2012



Fluid Communication

- Phases 3 & 4 are thermally mature
- Production from phase 3 wells started in December 2001
- Production from the last wells in phase 4 started in August 2005
- Temperature observation wells show full steam chamber development in the clean sand
- Fluid communication between the wells observed between the phases 3 & 4 and presented below.



Future Development Options

- DEMO will remain suspended until economic conditions support the operation of the facility. Possible future development options include:
  - Lower pressure operation (ESP's)
  - Blowdown

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Surface Operations

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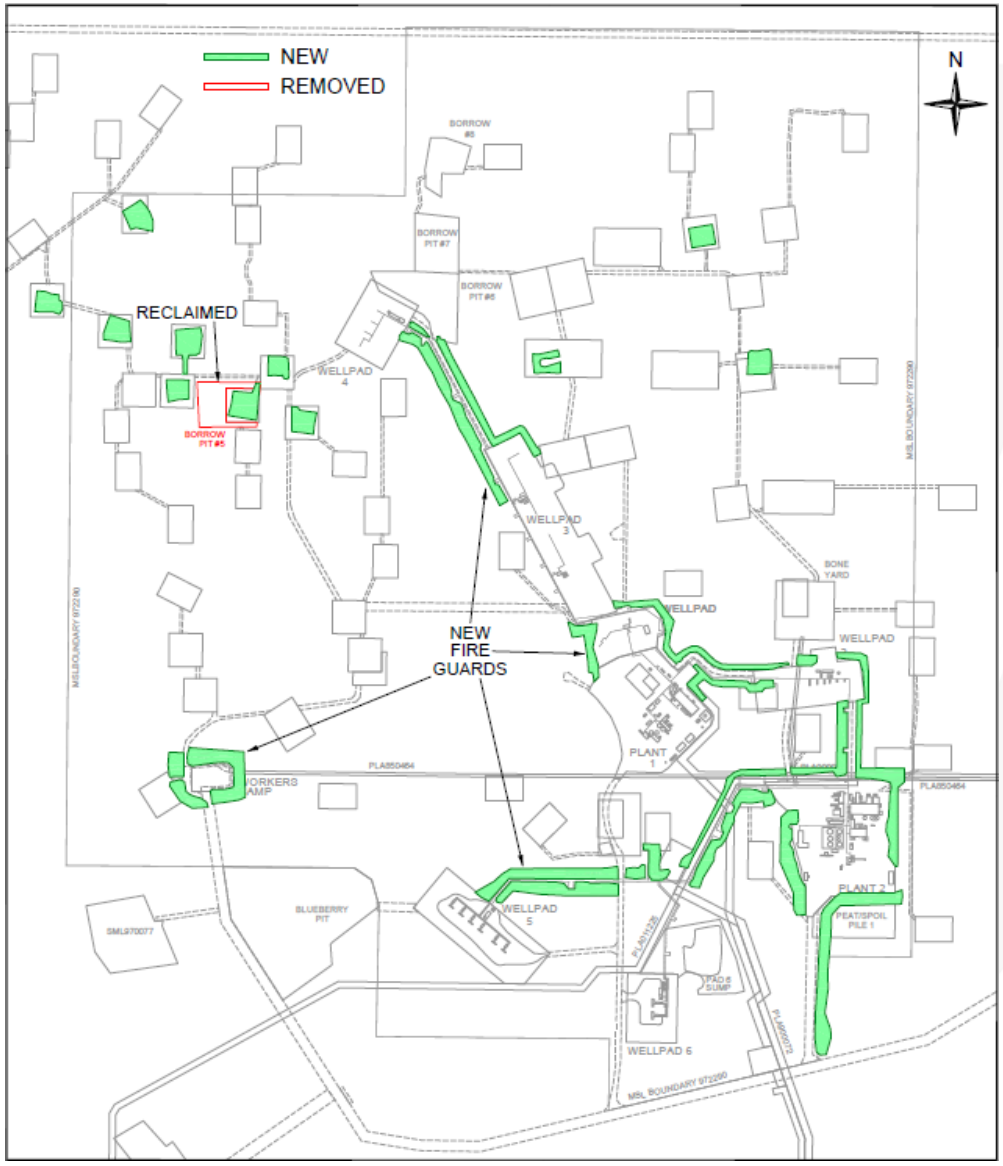
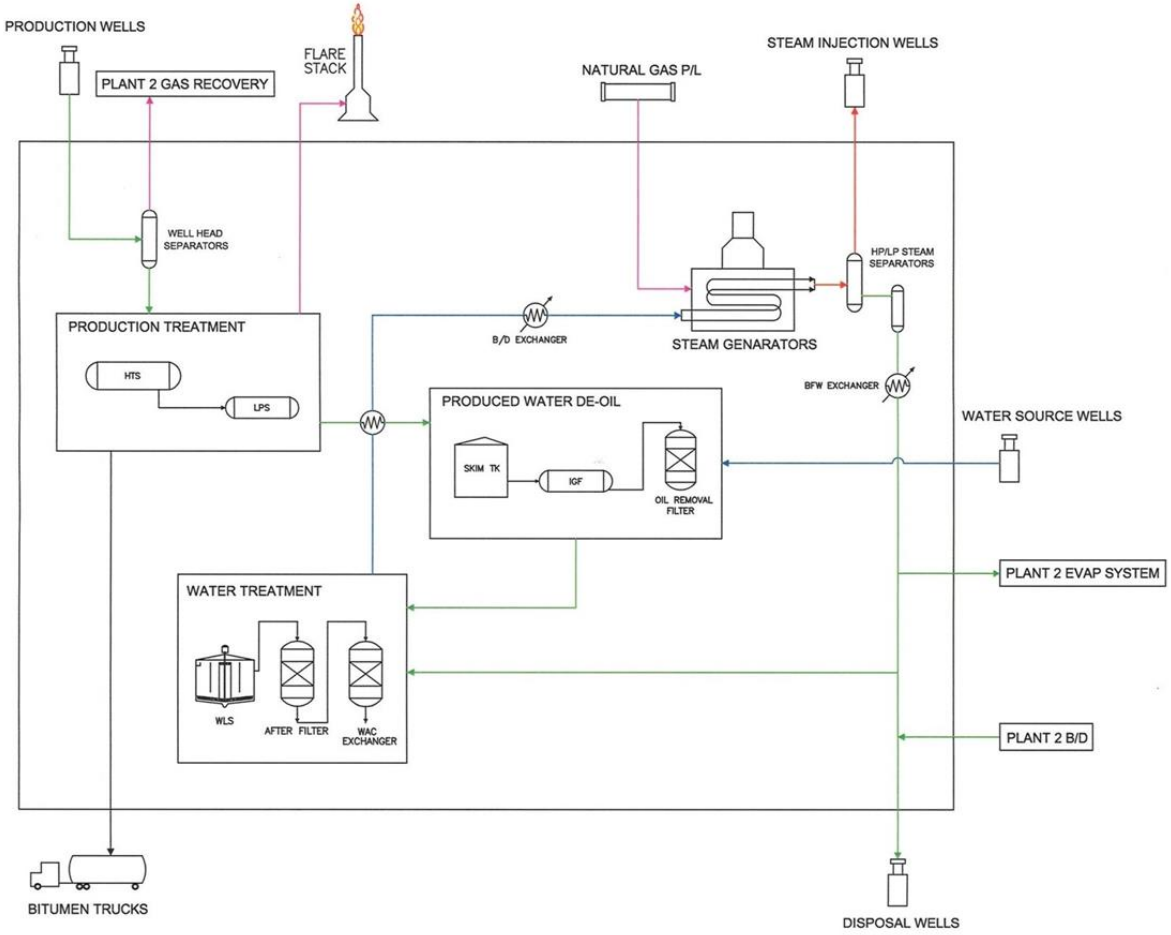
Facility Design

Site Plan Update



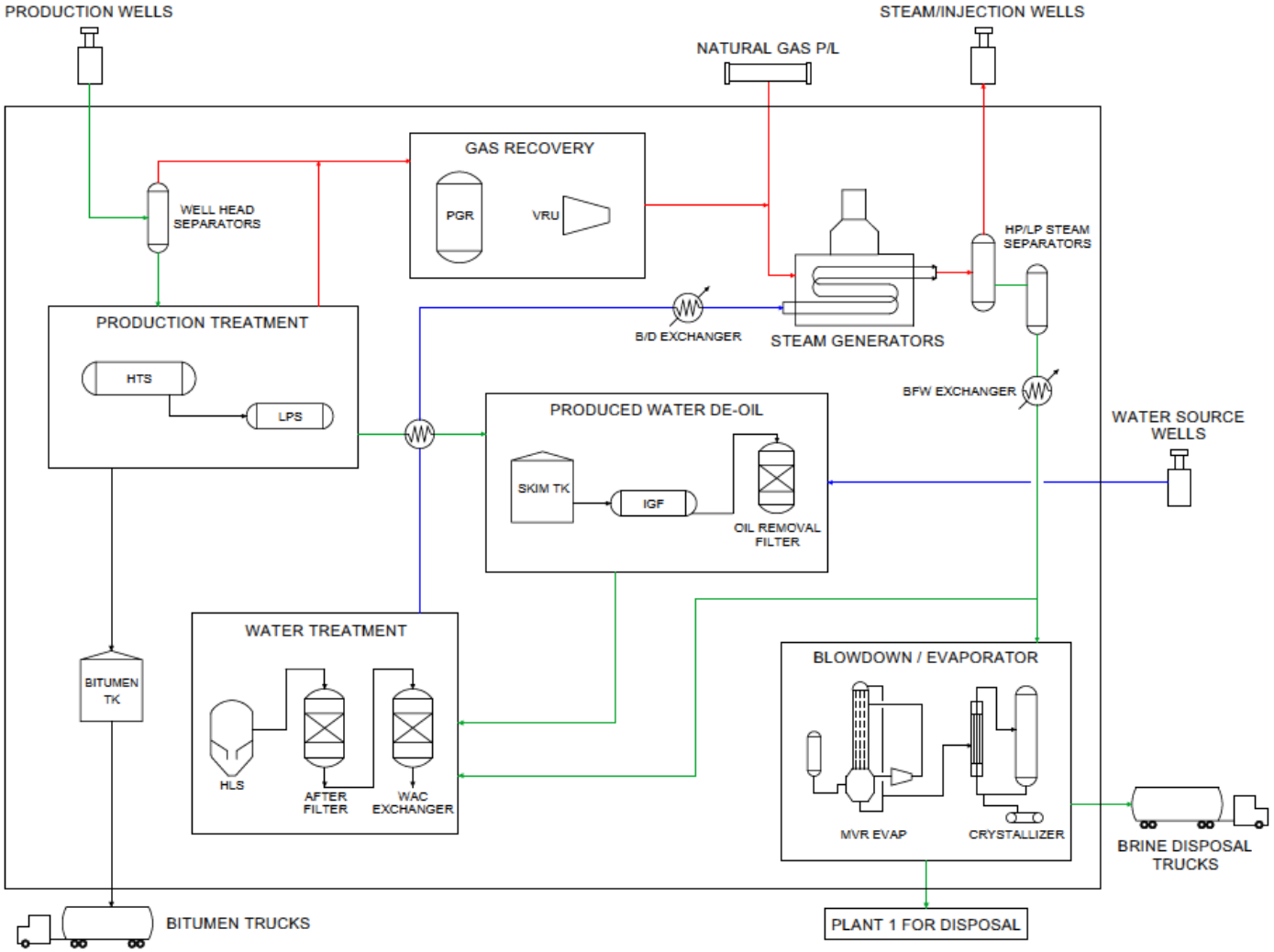
Plant Schematic – Plant 1



Plant 1 was shut down in June, 2015.

- Fuel gas goes to Plant 1 for glycol heater – to be deactivated in 2017
- Concentrated blowdown (brine) for disposal returns from Plant 2 to Plant 1 due to the location of the disposal equipment & pipeline
- No Production Treatment, Bitumen Trucking, Water De-Oiling, Water Treatment, or Steam Generation are occurring at Plant 1

Plant Schematic – Plant 2



Plant 2 was placed in Suspension in May, 2016.

Fuel gas goes to Plant 2 for the glycol heater.

Interconnection capability with Plant 1 remains, primarily for disposal brine (was utilized during the suspension activities)

No Production Treatment, Bitumen Trucking, Water De-Oiling, Water Treatment, or Steam Generation are currently occurring at Plant 2 due to the Suspension

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Facility Performance

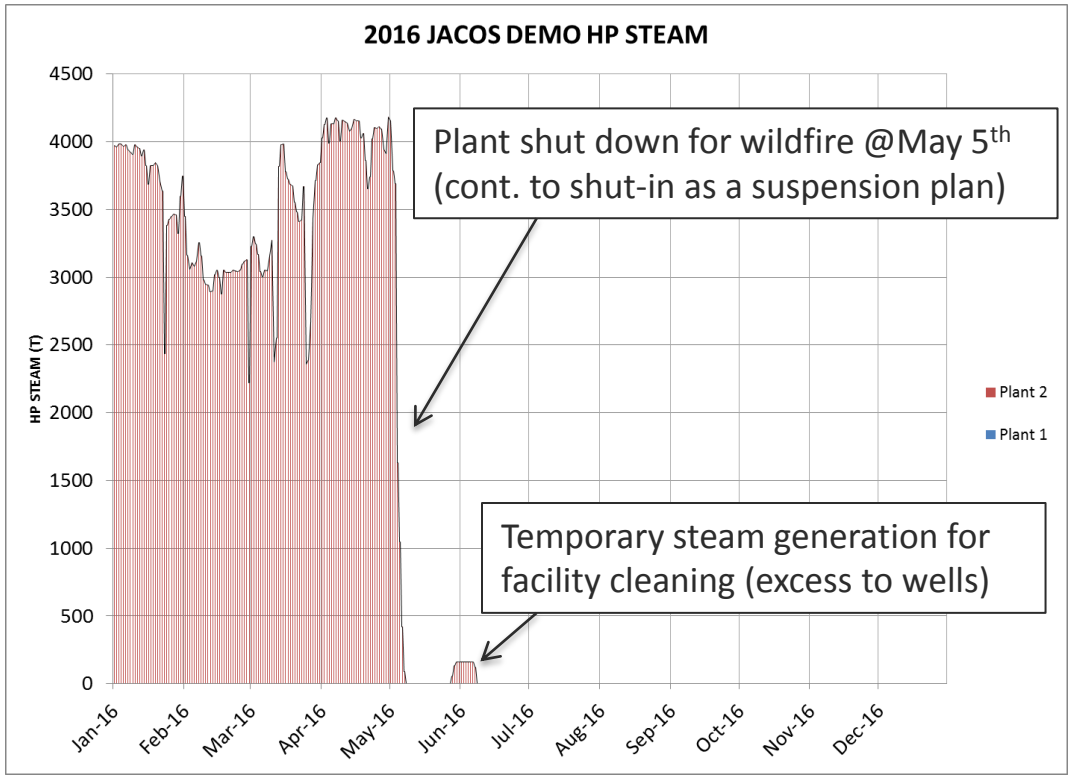
Demo Suspension – May 2016

- Facility operations suspended due to low oil prices.
- Components still operating:
  - Glycol (Utility) Boiler
  - Utilities – Air, Heat, Electrical Power & Heat Tracing are active to maintain facility integrity and permit inspection and maintenance
  - Necessary Secondary Containment monitoring programs remain in effect
  - Brine disposal facilities and pipeline available for use – was used during suspension operations
- Other facilities, including pipelines have been purged and winterized for suspension.
- Necessary secondary containment and other environmental monitoring programs and procedures remain in place.

2016 Major Events From Suspension

- May 2016
  - Fort McMurray wildfire – production shutdown initiated; limited personnel availability – rapid controlled shutdown; facility turnaround activities begin at end of month
- June 2016
  - Facility turnaround / clean-out. Produced bitumen tanks emptied; begin equipment purging.
  - NCG injection for pressure maintenance initiated.
- July 2016
  - Facility turnaround ongoing, equipment cleaning / purging continues.
  - Process Pond cleaning commences – liner repairs required.
  - HZAI well casing failure occurs / NCG injection suspended.
- August 2016
  - Facility turnaround ongoing, equipment cleaning / purging continues.
  - HZAI repair / abandonment.
  - Process Pond repaired / reassessment commences.
- September 2016
  - Facility turnaround substantially complete – plans in place for winterization.
  - HZAI remediation program preparation work commences.
- October / November 2016
  - Winterization substantially complete – Demo fully Suspended.
- December 2016
  - Plan for Demonstration Facility Restart submitted to AER.

Facility Performance – 2016 Service Factor



2016 Service Factor – 98% (to May 5)

- Operations interruptions are described in two categories
- Planned Plant Turnarounds
  - Boiler pigging
  - Contributed ~0.1% of downtime
  - Others (Vessel inspections, PSV maintenance, process equipment cleaning, meter calibration/checks, various repairs) were done after shut-in
- Transportation/Utility Restrictions
  - Limitations in the following
    - Markets
    - Road access
    - Rail limitation
    - Power outage
  - Contributed <2% of downtime

Steam Generation 2016

- Plant 1 (cont. to shut down)
  - B-201A/B – 50 MMBtu/h Boilers
- Plant 2
  - B510/520 – 180 MMBtu/h Boilers
  - B540 – 50 MMBtu/h Boiler

2016	Steam Volume (m^3)			Steam Quality	
	Plant 1	Plant 2	Total	Plant 1	Plant 2
January	0	115,809	115,809	-	76%
February	0	87,919	87,919	-	75%
March	0	102,861	102,861	-	76%
April	0	121,833	121,833	-	76%
May	0	15,332	15,332	-	72%
June	0	1,090	1,090	-	47%
July	0	0	0	-	-
August	0	0	0	-	-
September	0	0	0	-	-
October	0	0	0	-	-
November	0	0	0	-	-
December	0	0	0	-	-
Total	0	444,844	444,844	-	76%
Total (to April)	0	428,422	428,422	-	76%
Daily Average (to April)	0	3,541	3,541		
Design Capacity	1,206	6,009	7,215	80%	80%

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Power & Energy Intensity 2016

2016	Power (kWh)	Power (MW)	Natural Gas* (e^3m^3)	Bitumen (m^3)	Intensity (m^3/m^3)	Nat gas heating value (GJ/e^3m^3)	Intensity** (GJ/m^3)
Jan	2,973,858	4.0	7,420	25,820	287	40.50	11.6
Feb	2,601,136	3.7	5,841	18,124	322	40.52	13.1
Mar	2,737,777	3.7	6,791	21,453	317	40.57	12.8
Apr	2,781,765	3.9	8,501	22,770	373	40.73	15.2
May	1,229,034	1.7	936	2,585	362	40.58	14.7
Jun	899,427	1.2	9	0	-	40.61	-
Jul	768,743	1.0	1,704	0	-	40.76	-
Aug	769,578	1.0	0	0	-	-	-
Sep	886,189	1.2	15	0	-	40.76	-
Oct	1,108,275	1.5	40	0	-	40.76	-
Nov	1,071,093	1.5	7	0	-	40.76	-
Dec (accrual)	1,269,522	1.7	2	0	-	40.76	-
TOTAL	**19,096,397**	**2.2**	**31,264**	**90,751**	**345**	**40.60**	**14.0**
TOTAL (to April)	**11,094,536**	**3.8**	**28,552**	**88,166**	**324**	**40.59**	**13.1**

* - Total natural gas to plant

** - Using monthly nat gas heating values

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Natural/Produced Gas Summary 2016

(e^3m^3)	Purchased Gas	Produced Gas	Flared Gas	Produced Gas Recovery
January	7420	383.2	4.3	98.9%
February	5841	309.0	4.7	98.5%
March	6791	227.6	3.1	98.7%
April	8501	254.3	1.5	99.4%
May	936	52.7	2.6	95.3%
June	9	0.0	0.0	-
July	1704	0.0	0.0	-
August	0	0.0	0.0	-
September	15	0.0	0.0	-
October	40	0.0	0.0	-
November	7	0.0	0.0	-
December	2	0.0	0.0	-
TOTAL	31,264	1,227	16	98.7%

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Measurement & Reporting

Production / Injection

N/C from 2015 PR

- 15 out 24 SAGD well pairs have individual metered wellhead separators; produced fluid rates are continuously measured and recorded
- Two Group/Test separators
  - P / Q / Z Wells
  - R / S / T / U / V / W Wells
- Bitumen cut determined as follows
  - Phase 5 Wells (R→W) – Online Cut Meter (Phase Dynamics)
  - All other wells – Manual bitumen cut measurement (twice a month)
- Steam injection rates are continuously measured at each and every wellhead and prorated to high-pressure steam meters

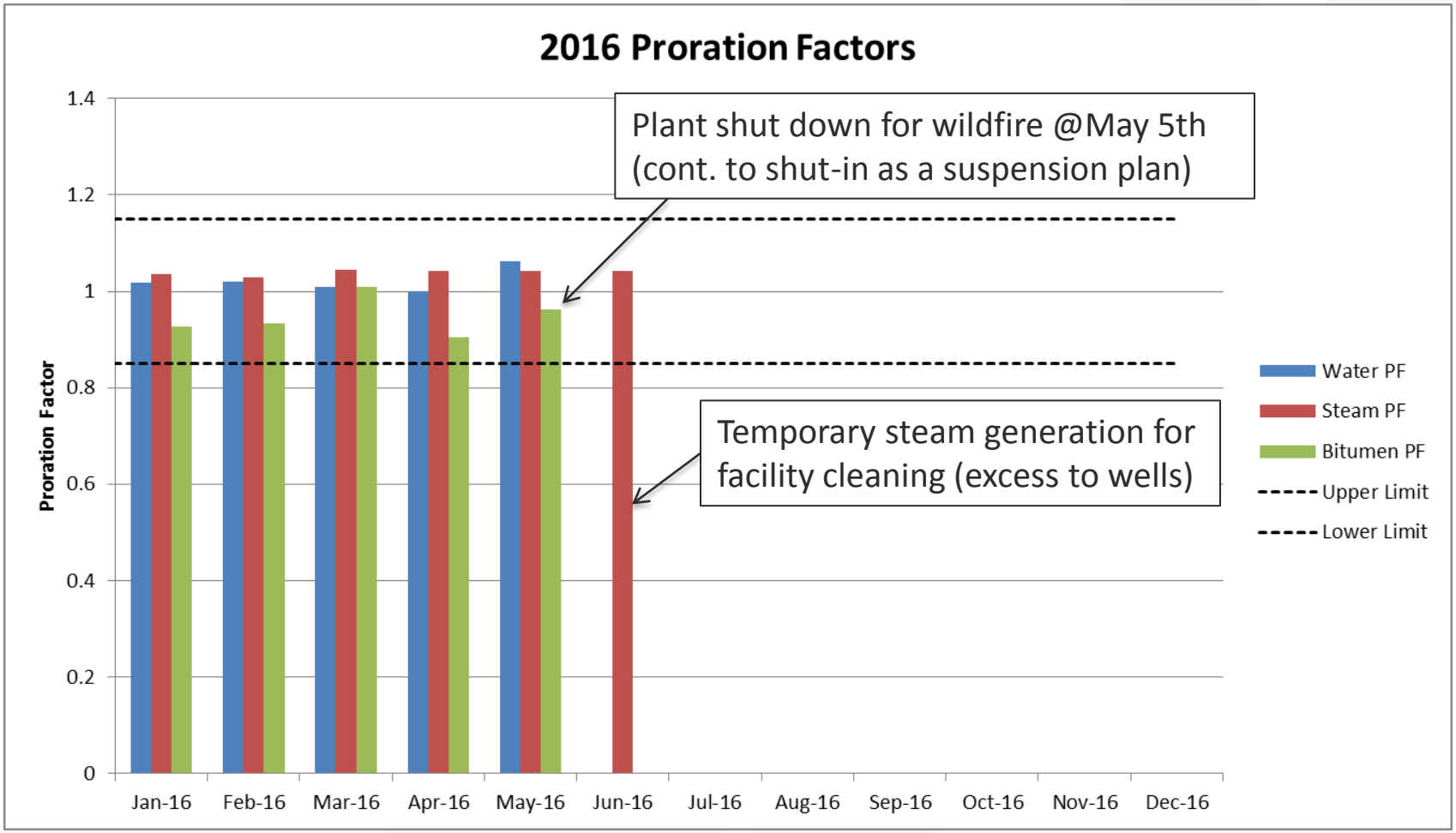
Proration Factor Method

N/C from 2015 PR

- Total daily bitumen production is determined with metered truck-out volumes and inventory levels in sales tanks. The trucked volume is prorated to the custody transfer meter from the receivers trucking terminals.
- ∑ Individual wellhead bitumen is measured/calculated and prorated to the plant production.
- Produced water from each well is calculated with the following formula
  - PW = Produced Fluid – Bitumen
  - Produced water from all the wells is then prorated to the total metered de-oiled produced water
    - (This volume includes all condensed produced steam which is not measured off the liquid leg of the well head separators)

Proration Factors

The average 2016 proration factor for bitumen was 0.948, steam was 1.040, and water was 1.022



Water Balance

- The chart below summarizes the water balance for 2016

(m^3)	IN				OUT							(ABS) Δ(%)
	Produced Water	Raw Water	Inventory Change	Total	Steam / Water to Wells	Disposal to Wells	Disposal to Truck out	Utility Water Out	Evaporation	HE Water	Total	
January	112,607	5,492	-	118,099	115,538	1,831	0	29	1,520	428	119,346	1.1%
February	79,990	13,394	-	93,385	87,667	1,649	0	14	1,953	1,326	92,608	0.8%
March	93,859	10,851	-	104,711	102,861	1,963	0	26	2,239	856	107,945	3.1%
April	102,550	20,271	-	122,822	121,835	1,985	72	27	2,654	552	127,125	3.5%
May	11,497	4,441	-	15,938	14,680	993	0	27	442	3	16,145	1.3%
June	0	1,661	-	1,661	892	681	0	27	0	34	1,634	1.6%
July	0	2,816	-	2,816	2,724	0	0	13	0	4	2,741	2.7%
August	0	6,017	1,125	7,142	6,105	594	0	15	0	320	7,034	1.5%
September	8	616	1,427	2,051	38	1,508	0	18	0	527	2,091	1.9%
October	0	110	120	230	0	127	0	13	0	80	221	3.8%
November	0	13	-	13	0	0	0	13	0	0	13	3.9%
December	5	18	-5	18	6	0	0	12	0	0	18	4.5%
Total	400,516	65,701	2,667	468,884	452,346	11,331	72	232	8,808	4,129	476,919	1.7%

Optimization of Test Duration

N/C from 2015 PR

- Optimization of test duration
  - Achieve the minimum test period and frequency for each well
  - Maximize time & frequency for wells with weak returning pressure and/or unstable operation

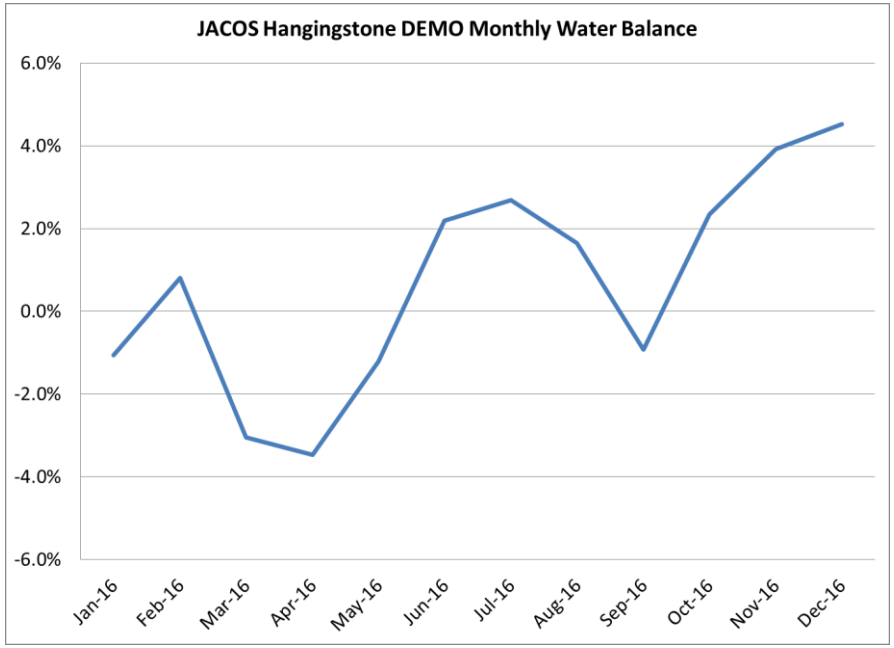
- Minimum test period: 2 days per month
- Minimum test frequency: Target 1 per month
- Minimum BS&W tests: 2 cuts per month

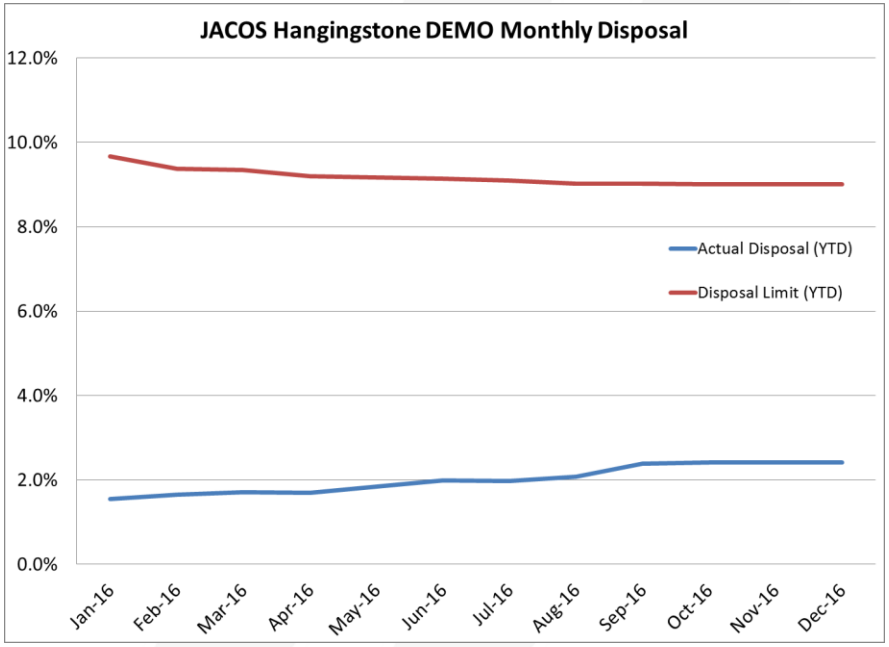
MARP Updates 2016

- No change to MARP in 2016

Directive 81 – Water Disposal Limits

Directive 81: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes





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Water

Water Sources and Uses

Wells - DQ02-2 & DQ06-7
SE 11-084-11W4M

Water Source – fresh groundwater, no brackish water use; no surface water

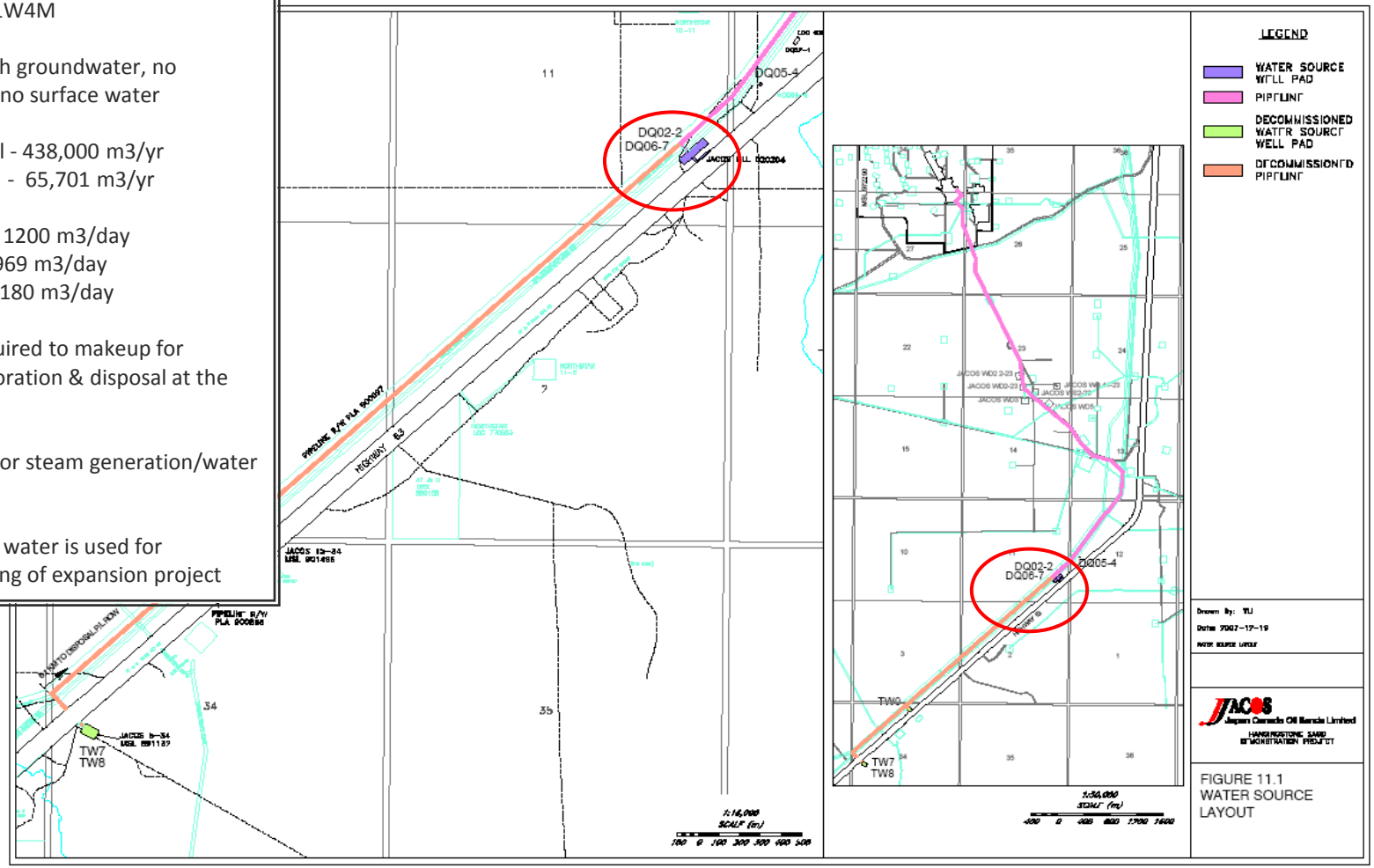
Licensed withdrawal - 438,000 m3/yr
2016 withdrawal - 65,701 m3/yr

Max pumping rate - 1200 m3/day
2016 max day - 969 m3/day
2016 average - 180 m3/day

Source water is required to makeup for reservoir loss, evaporation & disposal at the demo.

Source water used for steam generation/water injection.

Additionally, source water is used for construction & drilling of expansion project



D081 - Disposal Limit and Actual (YTD)

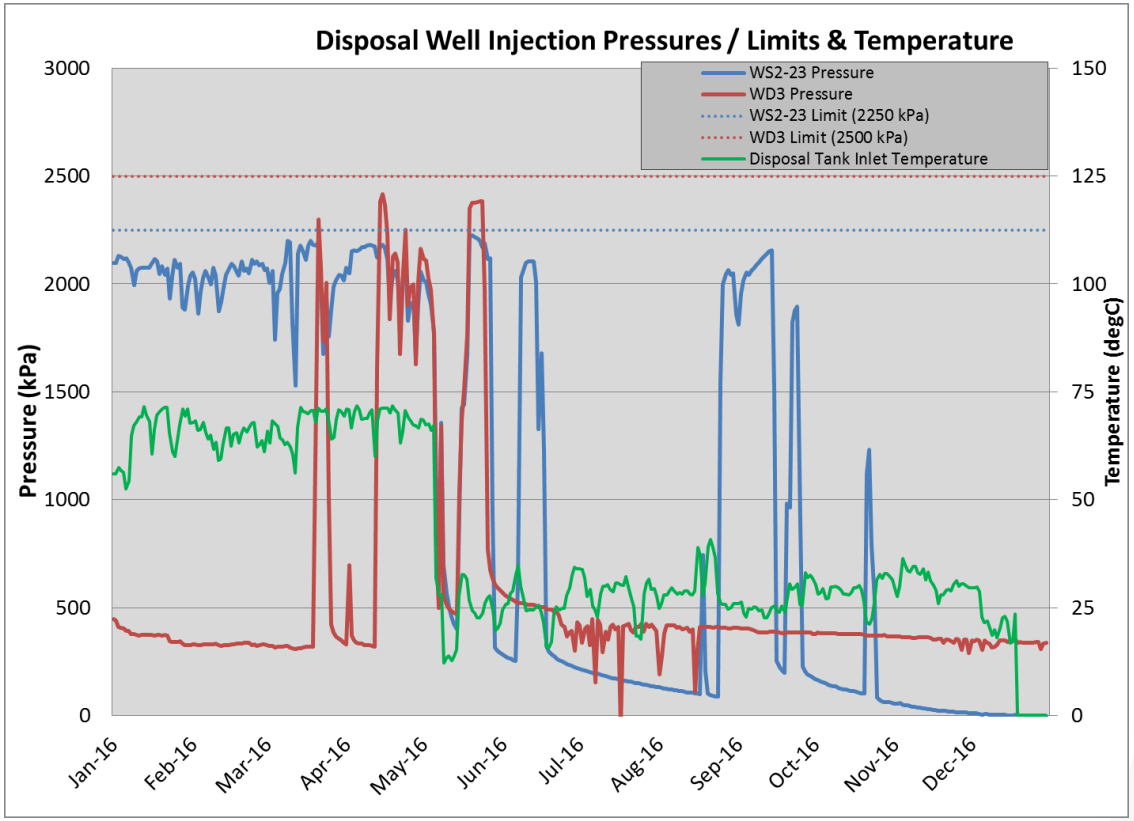
$$Disposal\ Limit\ (\%) = \frac{(Produced\ Water\ * Produced\ Factor) + (Fresh\ water\ * Fresh\ Factor)}{Produced\ Water + Fresh\ Water} * 100\%$$

$$Disposal\ Actual\ (\%) = \frac{Well\ Disposal + Brine\ Trucking}{Produced\ Water + Fresh\ Water} * 100\%$$

	Produced Water, T	Fresh Water, T	Disposal Limit, %	Disposal	Brine Trucked	Disposal Actual, %
Jan-16	112607	5492	9.67%	1829	0	1.55%
Feb-16	79990	13394	9.37%	1670	0	1.65%
Mar-16	93859	10851	9.34%	1914	0	1.71%
Apr-16	102550	20271	9.20%	1939	72	1.69%
May-16	11497	4441	9.16%	979	0	1.85%
Jun-16	0	1661	9.14%	672	0	1.99%
Jul-16	0	2816	9.10%	0	0	1.98%
Aug-16	0	6017	9.02%	584	0	2.08%
Sep-16	8	616	9.02%	1487	0	2.39%
Oct-16	0	110	9.01%	131	0	2.42%
Nov-16	0	13	9.01%	0	0	2.42%
Dec-16	5	18	9.01%	0	0	2.42%
Average	33376	5475	9.17%	934	6	2.01%
Total	400516	65701	9.01%	11204	72	2.42%

**Produced water factor:* 0.1 ; *Fresh water factor:* 0.03

Waste Water Disposal 2016



JACOS CLASS 1b WELLS

WS2-23 F1/02-23-084-11W4/0

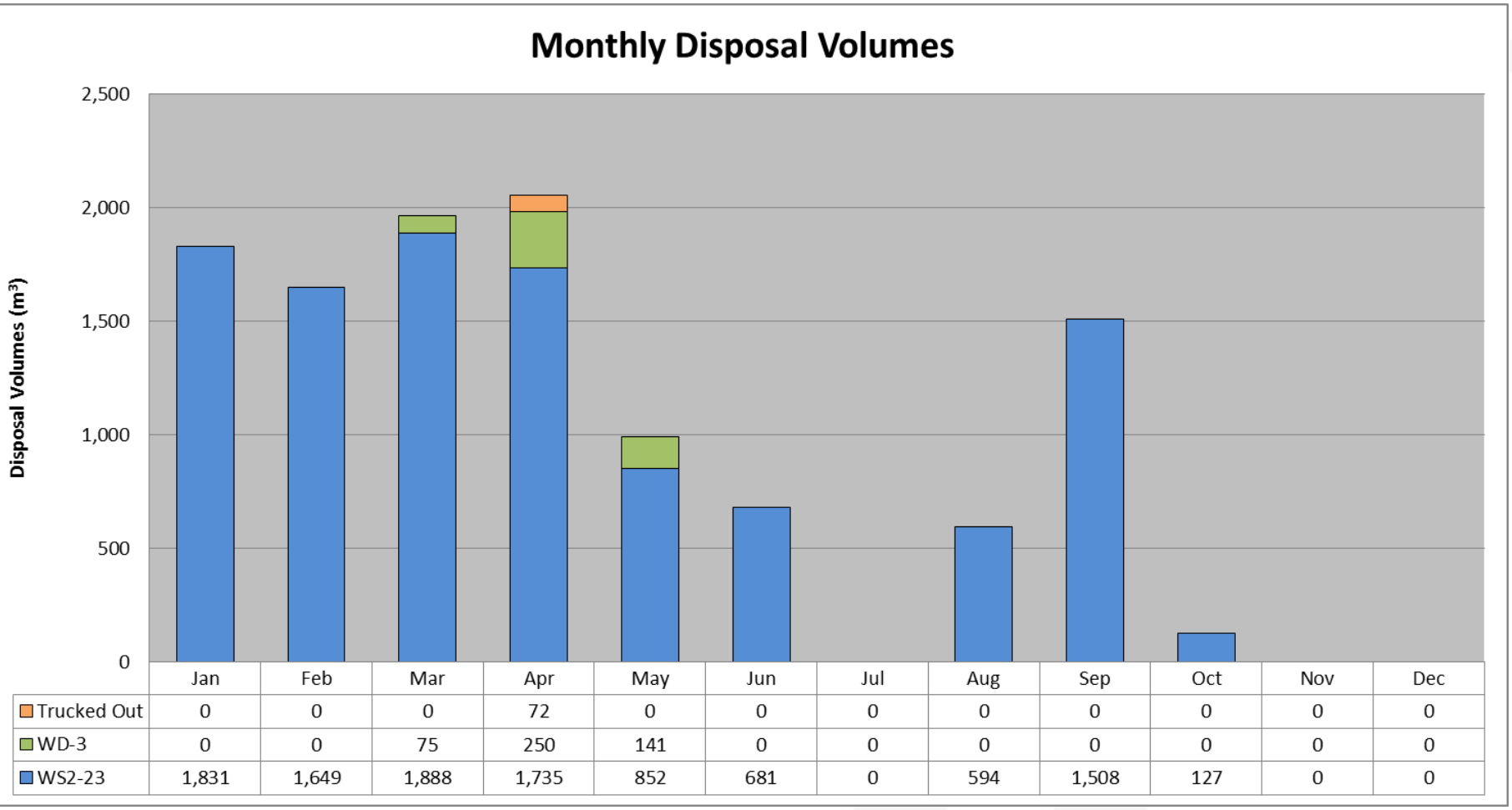
WD-3 00/15-14-084-11W4/0

OFFSITE BRINE DISPOSAL

Absolute 10-17-053-23W4
Worthington Business Park
Edmonton

Rate Summary	2016 Avg Rate (m^3/D)
WD-3	1
WS2-23	30
Total disposal to JACOS wells	31
Brine to offsite disposal	0.2
TOTAL DISPOSAL	31

Waste Water Disposal Volumes 2016



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trucked Out	0	0	0	72	0	0	0	0	0	0	0	0
WD-3	0	0	75	250	141	0	0	0	0	0	0	0
WS2-23	1,831	1,649	1,888	1,735	852	681	0	594	1,508	127	0	0

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Other Wastes

Solid Waste Disposal

Waste Receiver	Location	Waste Description	Quantity	Disposal Method
Tervita - Janvier	SE-03-081-06w4	Lime sludge	3549 tonnes	Landfill
		Sand	175 tonnes	Landfill
		Anthracite	51 tonnes	Landfill
		Walnut shells	24 tonnes	Landfill
Tervita - Bonnyville	NE 09-061-03w4	Lime Sludge	763 tonnes	Landfill
Tervita - Lindbergh	05-26-056-5w4	Drilling fluids	119.7 tonnes	Cavern

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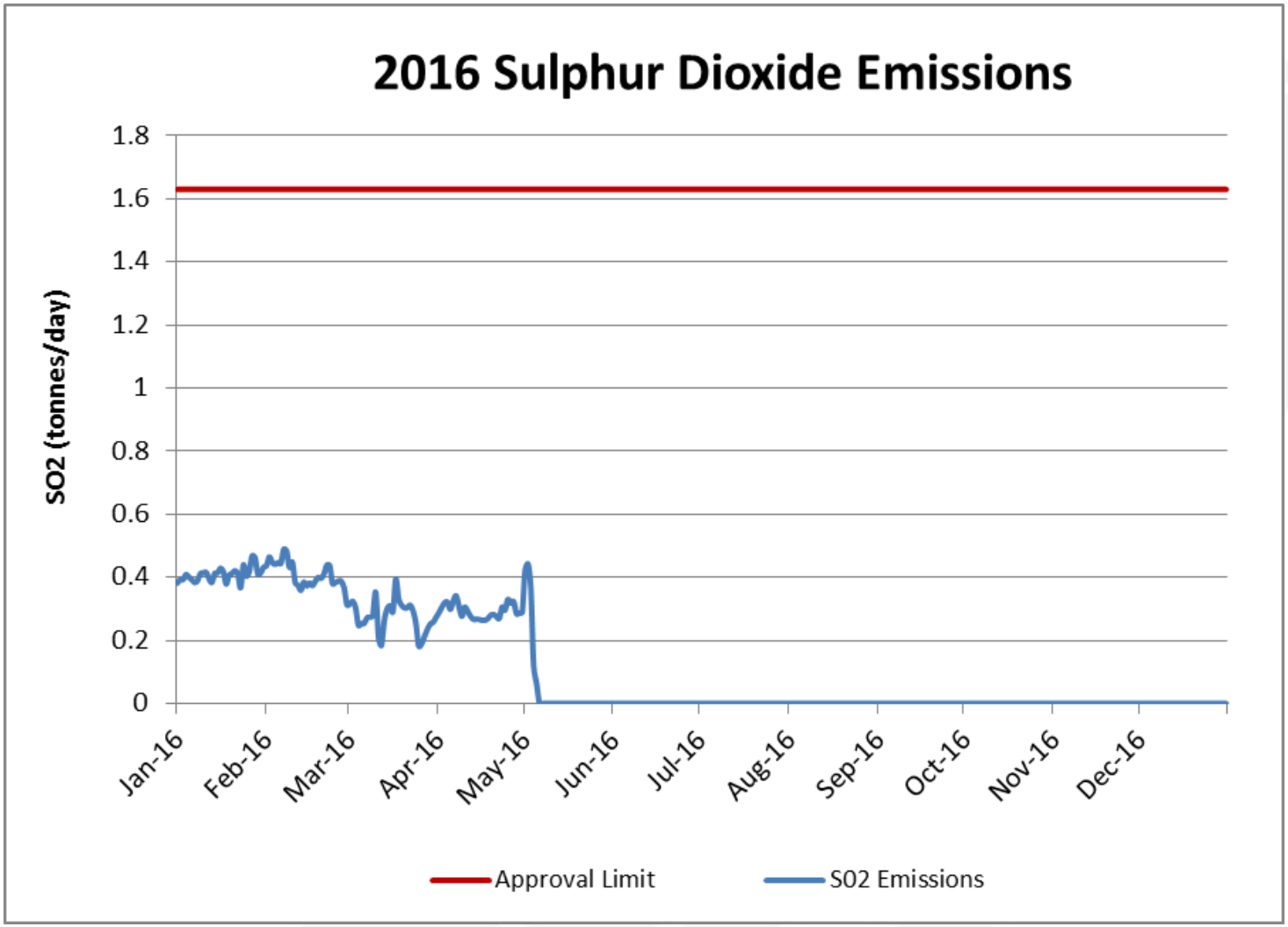
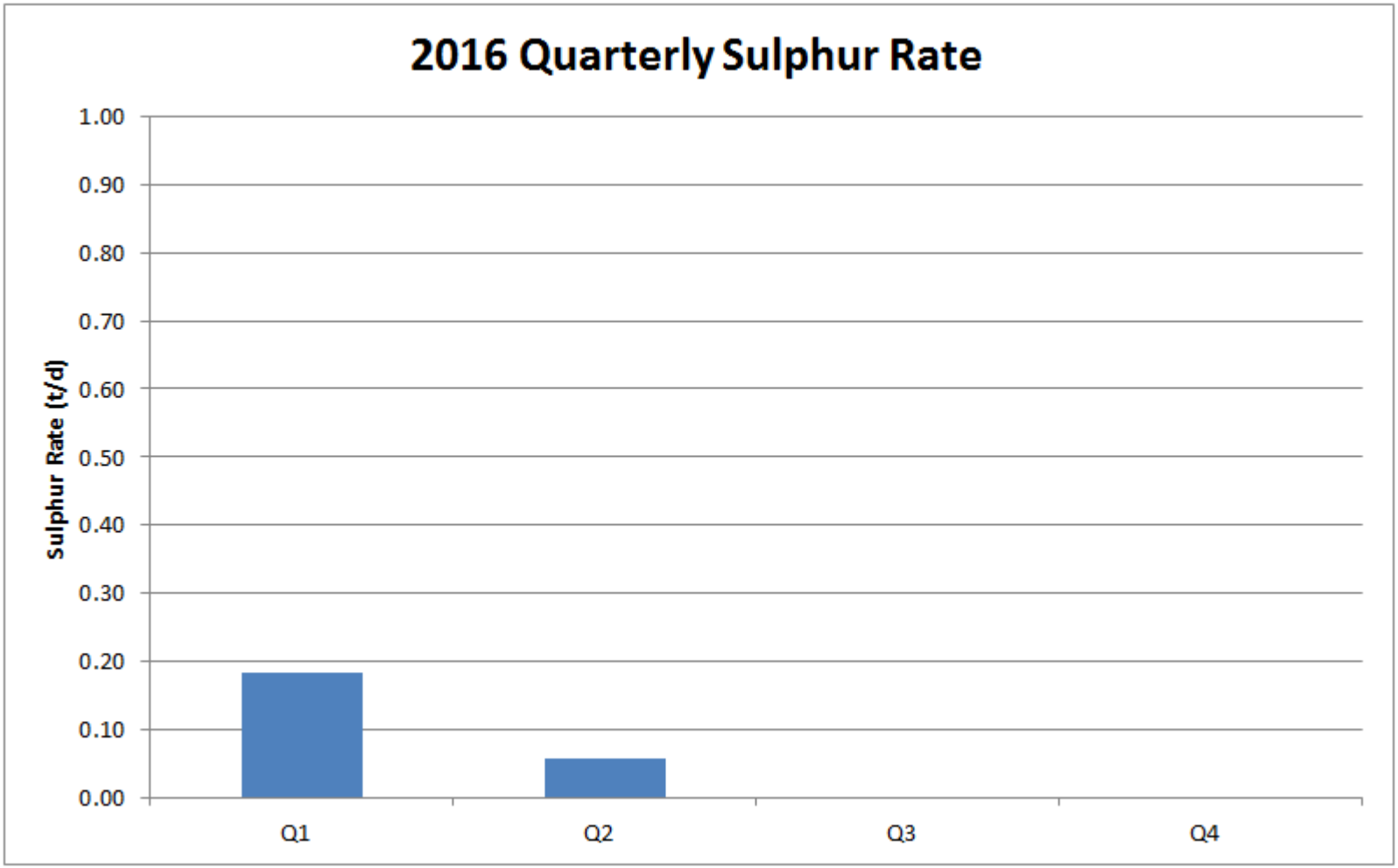
Sulphur Emissions

Sulphur Dioxide Emissions



2016 - Quarterly Sulphur Rate



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Environmental

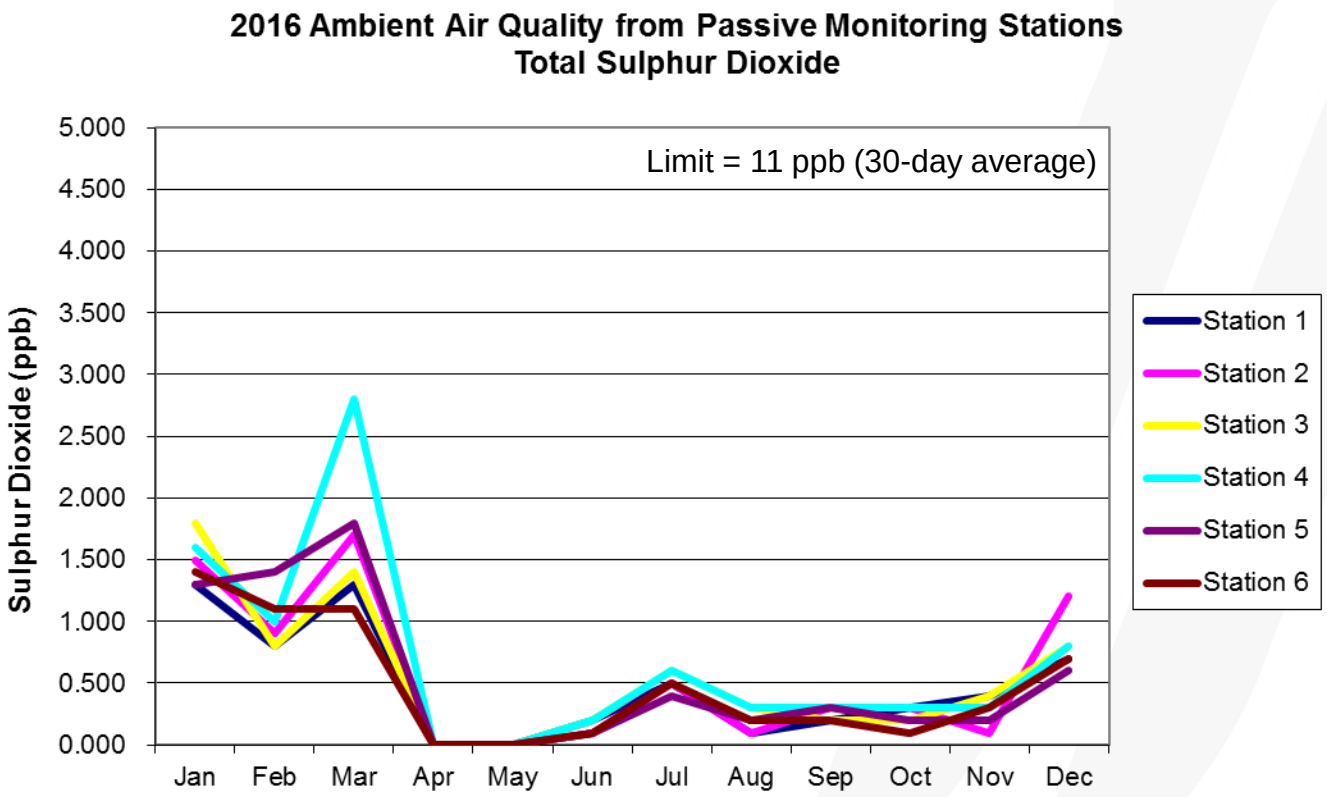
Environmental Monitoring Programs

- Continuous Air Monitoring Program
  - Authorization granted by the AER in Q1 of 2016 to suspend the Continuous Air Monitoring Trailer.
- Routine Annual Monitoring Programs
  - Six passive ambient air monitoring stations collected SO2 and H2S data during 2016 – no exceedances were noted.
  - Groundwater - spring/fall sampling results suggested that five monitoring wells continue to show an increasing trend in chloride concentration. A delineation program in 2015 revealed no source of the impact. Will continue to be monitored and assessed. Additional wells were installed to further assess the hydrology and integrity around the Plant 2 Process Pond – no contamination was found.
  - Water Use – 2016 report in draft; updates to AESRD Water Use Reporting registry ongoing.

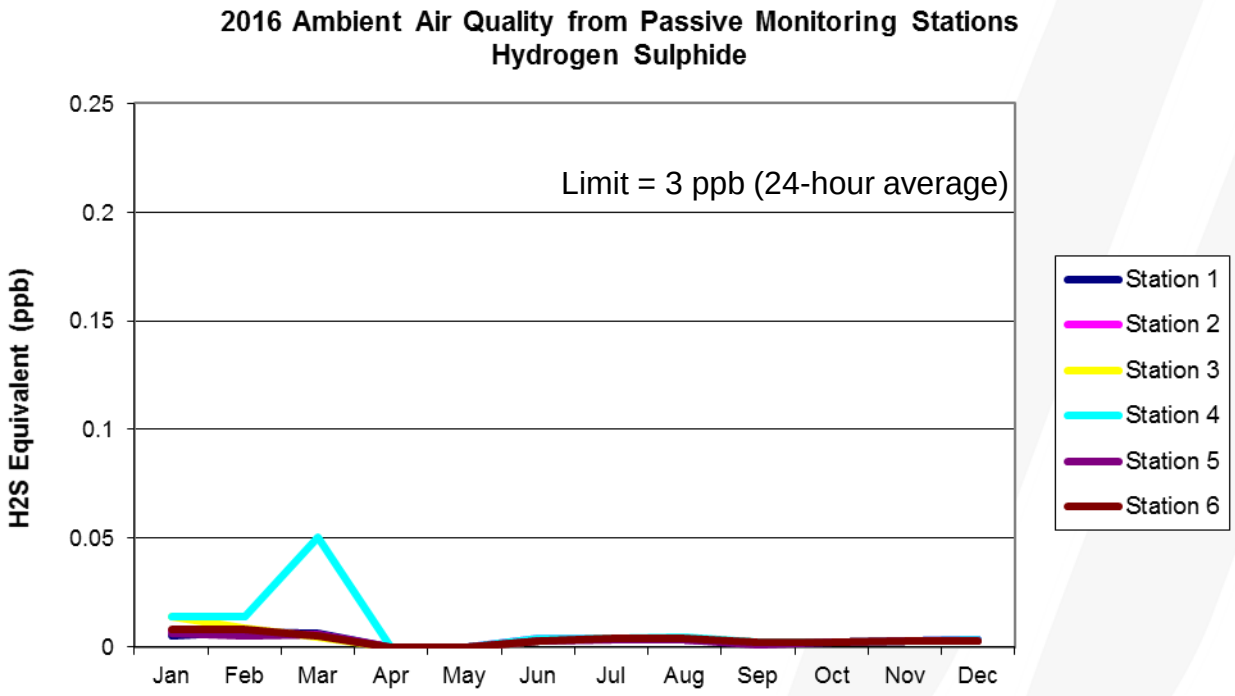
Environmental Monitoring Programs (cont.)

- Routine Annual Monitoring Programs (cont.)
  - Fugitive emission survey (LDAR) was not undertaken in 2016 as the facility was in suspension. Authorization to LDAR granted by the AER in Q2, 2016.
  - Soil Management – no soil management or monitoring events were undertaken in 2016.
  - Stack survey was not undertaken in 2016 as the facility was in suspension. Authorization to suspend stack surveys granted by the AER in Q2, 2016.
  - Heave Monument survey – annual work completed in Q1 of 2016.
  - Vegetation management – work undertaken throughout 2016.
  - All other annual compliance initiatives completed were comparable with findings from previous years.

Ambient Air Quality 2016 – SO_2



Ambient Air Quality 2016 – H_2S



Remediation and Reclamation Progress

- In 2016 remediation work continued on the 5 remaining OSE programs. JACOS received approval to remove 15 deficient sites (under MLL) so the remaining (+250) could be closed in 2017.
- Vegetation management continued at former remote sumps 16-14 and 14-21.
- Planting program was undertaken at 12-27 with community engagement.
- Phase I ESAs were undertaken on observation wells cleared for fire break.
- Throughout 2016 JACOS maintained its involvement in iFROG (COSIA-JIP).

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Compliance Statements & Approvals

Demo Compliance Statement

Approval Nos. 8788L

JACOS is in compliance with conditions of their approval and regulatory requirements, subject to the following:

- During Q1 of 2016, there were a total of 6 reportable flaring events.
- AER Detailed Operational Inspection (ID 442672) completed August 24-26, 2015. Ongoing or Follow Up Items:
  - Plant 1 – Temporary storage tanks (TS-TK-01,-02,-03,-04,-05) remain outstanding.
  - Plant 2 – Lime sludge bin secondary containment improvement remains outstanding due to suspension.
- Hangingstone Demo Temporary Diversion (*Water Act*) Contravention:
  - In the spring of 2016, JACOS withdrew water from a natural source without a TDL. Issue was resolved and contravention was reported to the AER.
- Plant 2 Process Pond Damage, Self-Disclosure, Repair and Monitoring:
  - Damage to the Plant 2 Process Pond primary synthetic liner during shutdown cleaning activities; water ingress through liner breach. Liner repaired but civil assessment of secondary (clay) liner integrity completed and the implementation of an approved monitoring/management program. Currently pond is not being used due to facility suspension.

Demo Compliance Statement (con't.)

- Plant 2 TK-417 Alternate Storage Application/Approval:
  - An alternate storage approval was applied for and approved by the AER . JACOS abided by the conditions of the approval during 2016 – while the facility was operating.

HZAI Casing Failure, Sub-surface release & Monitoring/ Remediation Program Update:

- October 14, 2016 – high level remediation plan submitted and approved by AER. First sampling program undertaken in December 2016.
- December 8, 2016 – detailed Remedial Action Plan (RAP) submitted.
- December 21, 2016 – RAP deficiency letter received from AER.
- Meeting held early in 2017 to discuss RAP deficiency letter and align on a path forward to address deficiencies and submit a revised RAP by February 28, 2017.
- Sampling has continued per the remediation plan and to-date no impacts from the failure have been detected in either the two deep Joli Fou Formation wells, or any of the nine shallow groundwater wells which are being monitored monthly.

Inactive Well Compliance Program (IWCP)

- JACOS has established a Well Compliance Working Group to manage compliance related to Directives 6, 13 and 20.

Year of Program	Target	Actual
1 (ending Mar 31, 2016)	7	10
2 (ending Mar 31, 2017)	5	6

Air Emissions Reporting & Regulatory Approval Limits

- Specified Gas Emitters Regulation (SGER) Compliance Report for 2015 submitted in 2016.
- Facility reported 203,293 tonnes CO_2e total annual emission (TAE).
- National Pollutant Release Inventory (NPRI) report for 2015 – submitted Sept 1, 2016. (Reporting extension was granted due to the wildfire)
- Federal GHG report – submitted June 1, 2016

Regulatory/ Approval Limits

Parameter	Requirement	Actual
Produced Gas Recovery	> 90%	98.7%
SO_2 Emissions	< 1.63 T/d	0.34 T/d
D81 Disposal Limit	< 9.01%	2.42%
Plant 2 B-520 NO_x	< 7.60 kg/hr	Stack testing suspended

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Future Plans

Future Plans

- Demo Project will remain suspended until economic conditions support the re-start of operations.
- HZAI monitoring & remediation program will continue until its objectives are achieved and the AER grants closure.
- Site security and surveillance, including relevant environmental/regulatory monitoring, will be maintained.