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Thermal In-Situ Scheme Progress Report for 2015
Japan Canada Oil Sands Limited Hangingstone

Approval No. 8788 (Demonstration Project)

Presented on February 23, 2016

Vision. Integrity. Stability.

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Agenda

1. Background – Hangingstone Expansion Project	
• Demonstration	Enzo Pennacchioli
• Expansion	Enzo Pennacchioli
2. Subsurface	
• Geosciences	Leigh Skinner
• Well Design & Instrumentation	Bob Park
• Reservoir Performance	Christian Canas
3. Surface Operations	
• Facility Design	Bob Park
• Measurement & Reporting	“
• Water	“
▪ Source	
▪ Disposal	
• Other Wastes	Bob Park
• Sulphur Emissions	“
• Environmental (included but not presented)	Enzo Pennacchioli
• Compliance Statements & Approvals	Enzo Pennacchioli
• Future Plans	Enzo Pennacchioli
4. Discussion	

Demo Scheme No. 8788 Background

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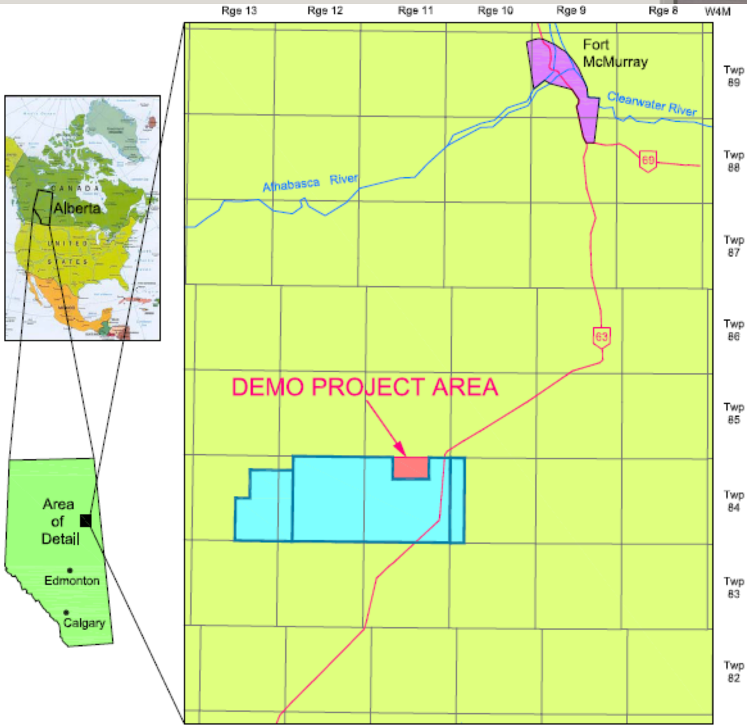
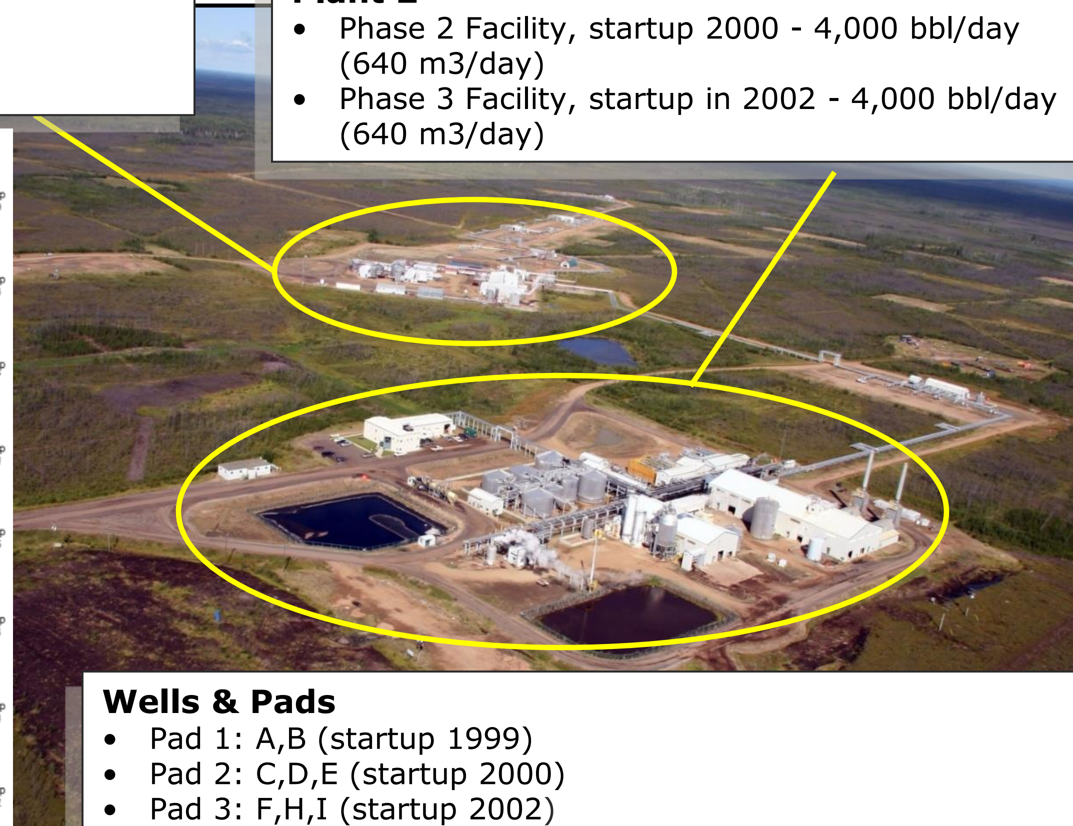
Plant 1
- On original PCEJ CSS Site
- Startup 1999 – 2,000 bbl/day (320 m3/day)

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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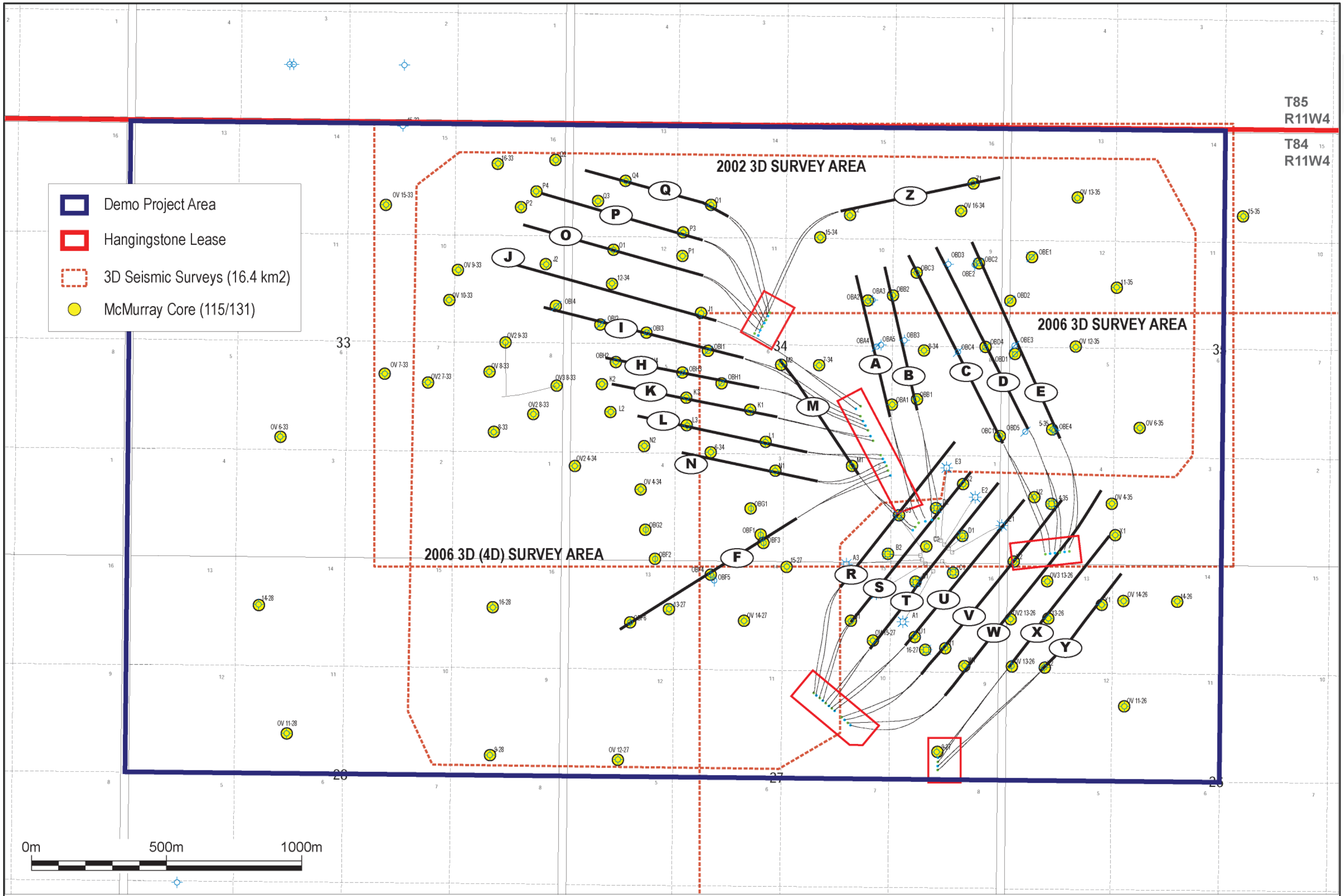
Subsurface

Geosciences

Hangingstone Demo Database



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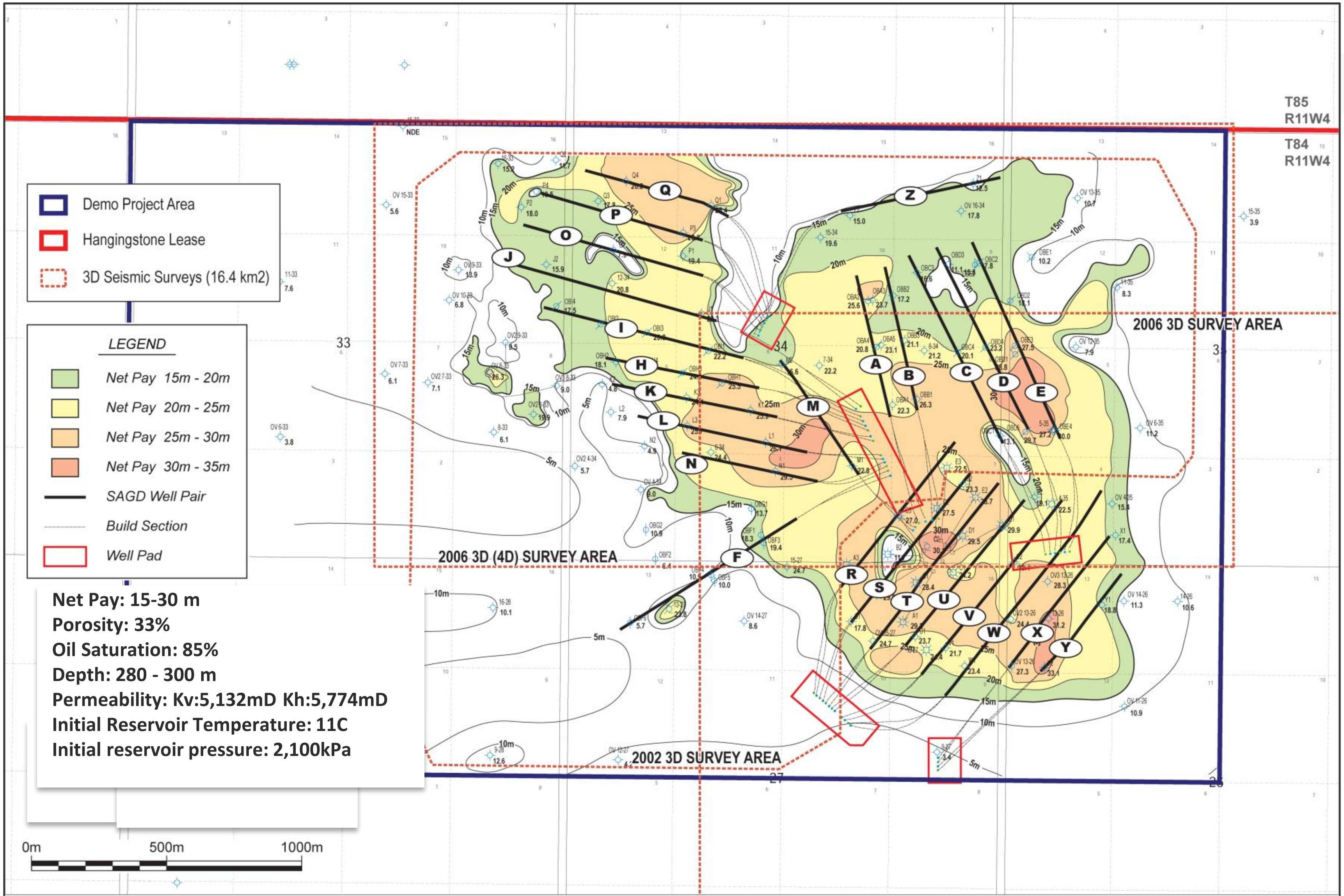
Hangingstone Demo Net Pay



Net Pay: 15-30 m
Porosity: 33%
Oil Saturation: 85%
Depth: 280 - 300 m
Permeability: Kv:5,132mD Kh:5,774mD
Initial Reservoir Temperature: 11C
Initial reservoir pressure: 2,100kPa

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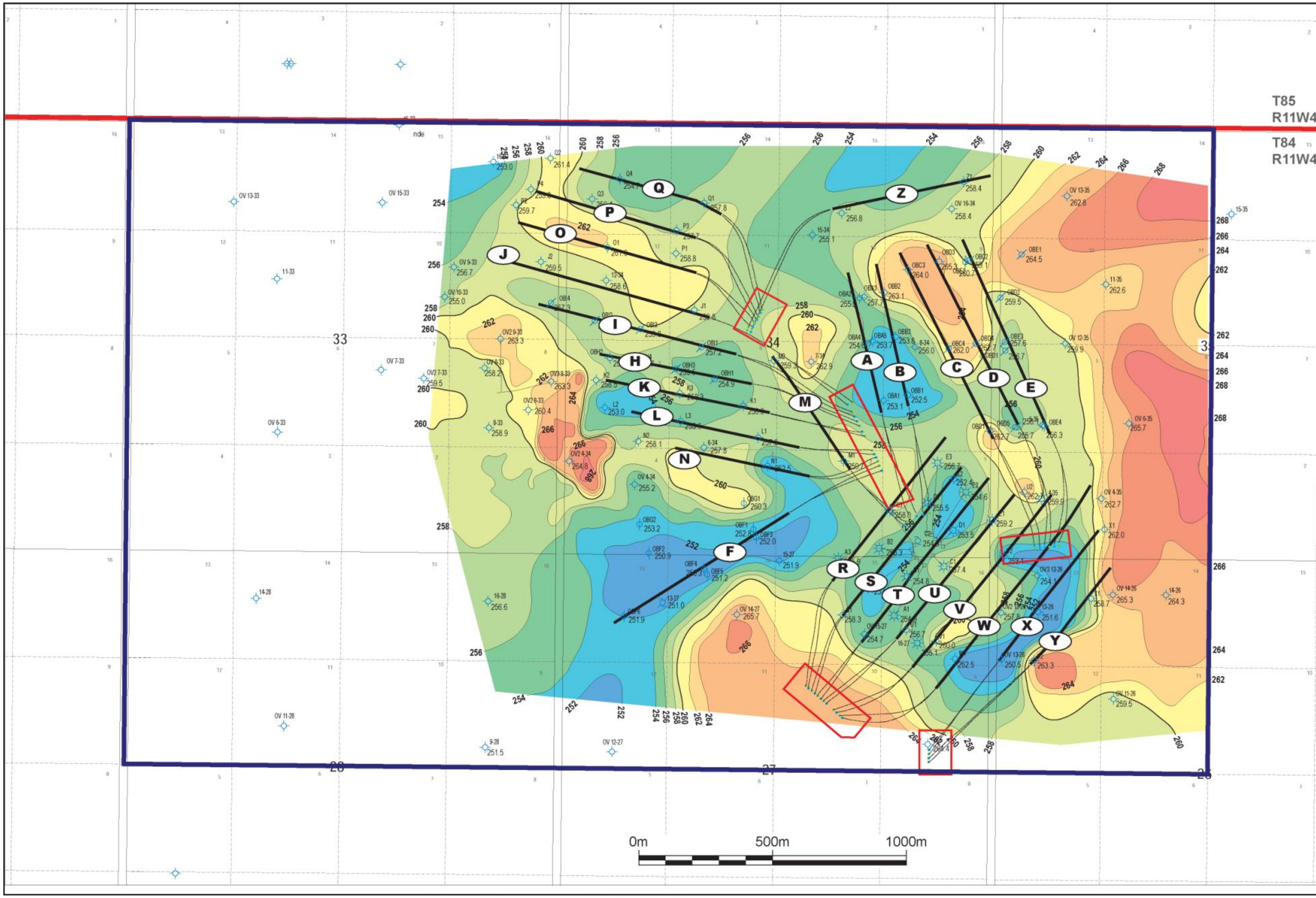
Hangingstone Demo Base Reservoir Structure



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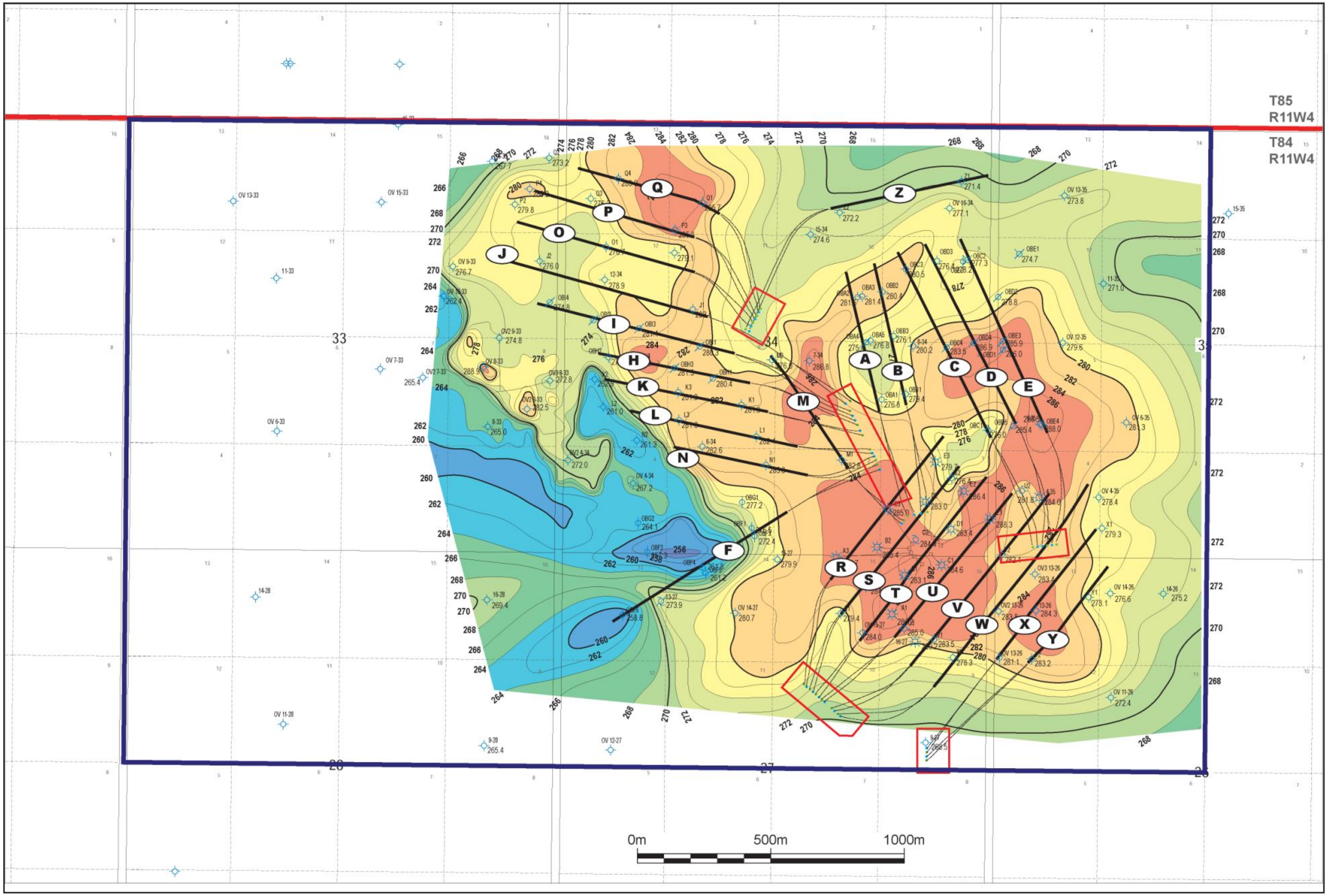
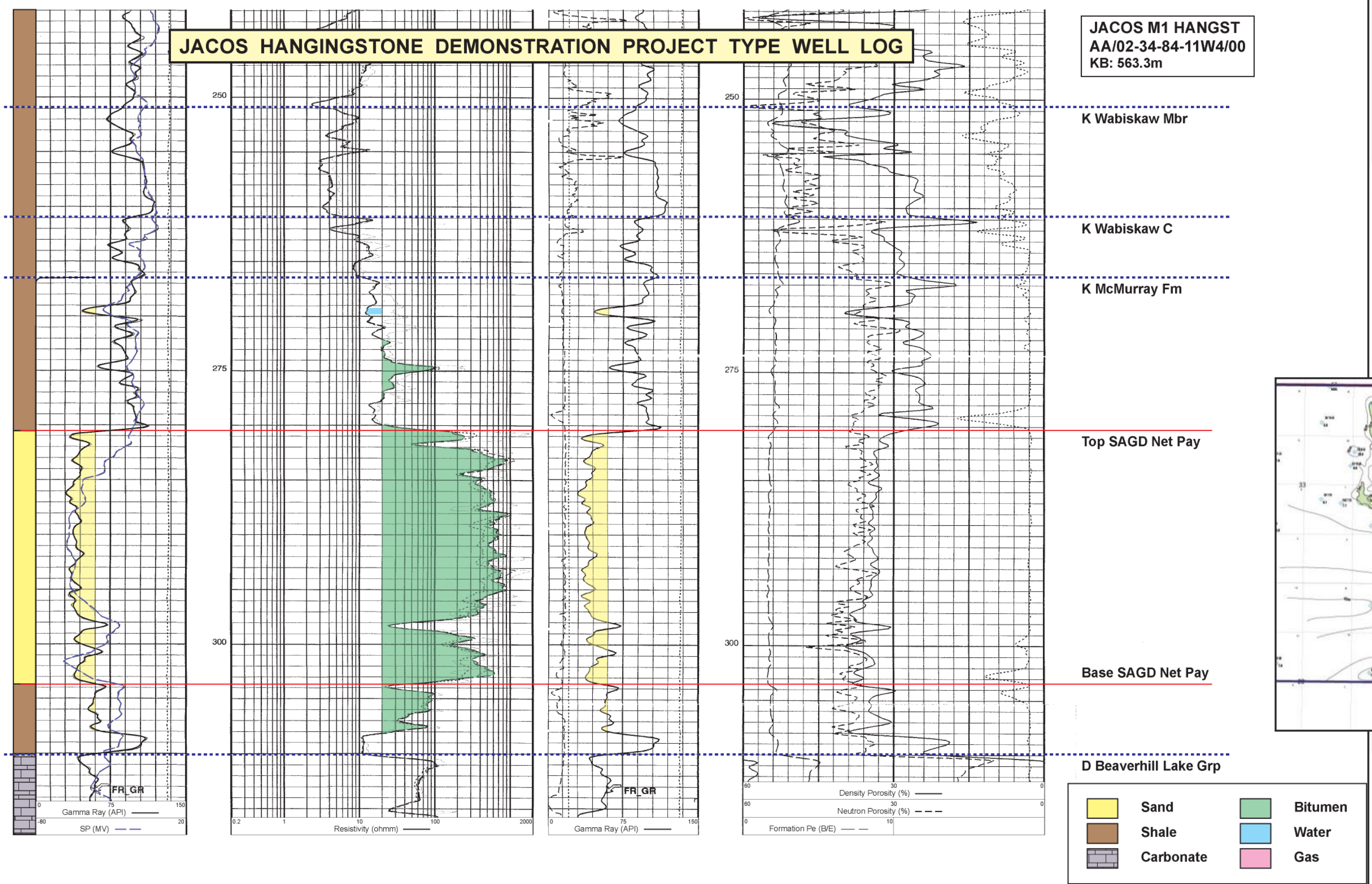
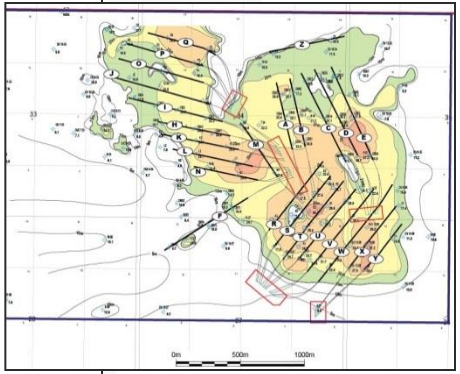
Hangingstone Demo Top Reservoir Structure



Hangingstone Demo Composite Well





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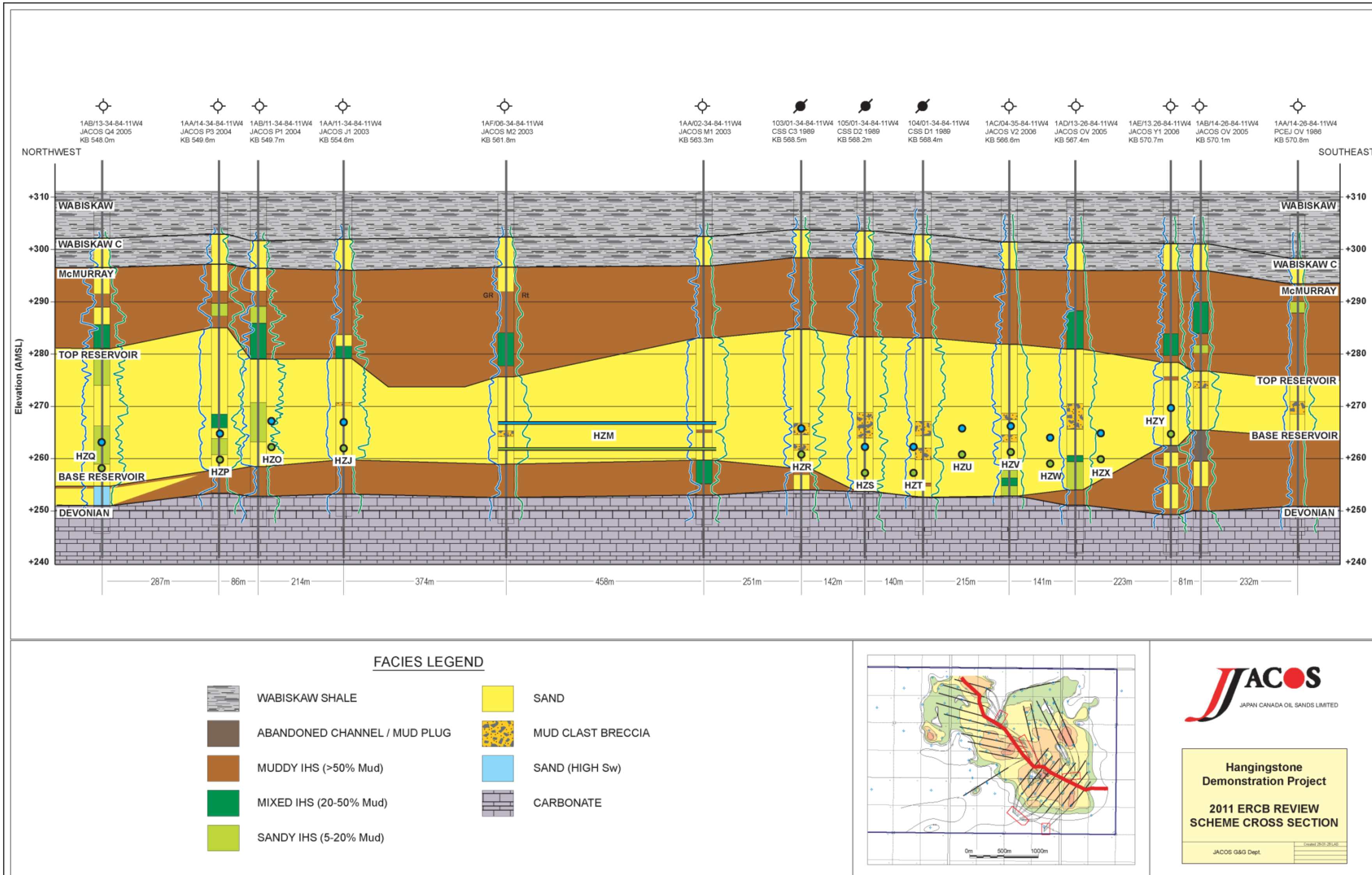
Hangingstone Demo Scheme Cross-Section



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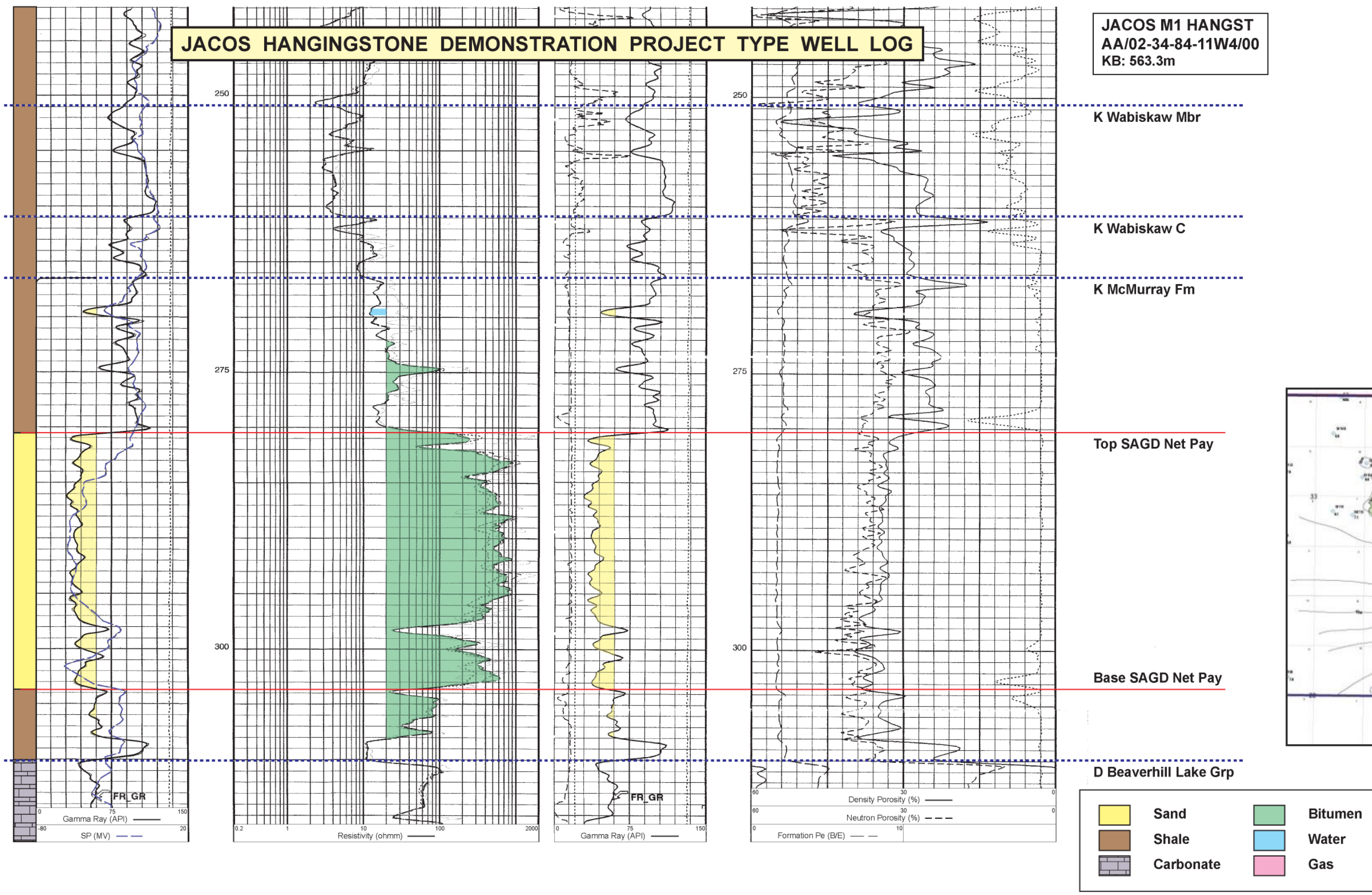
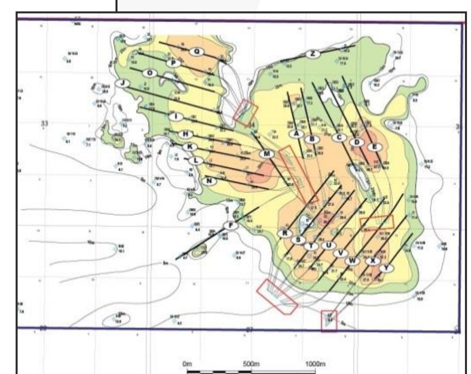
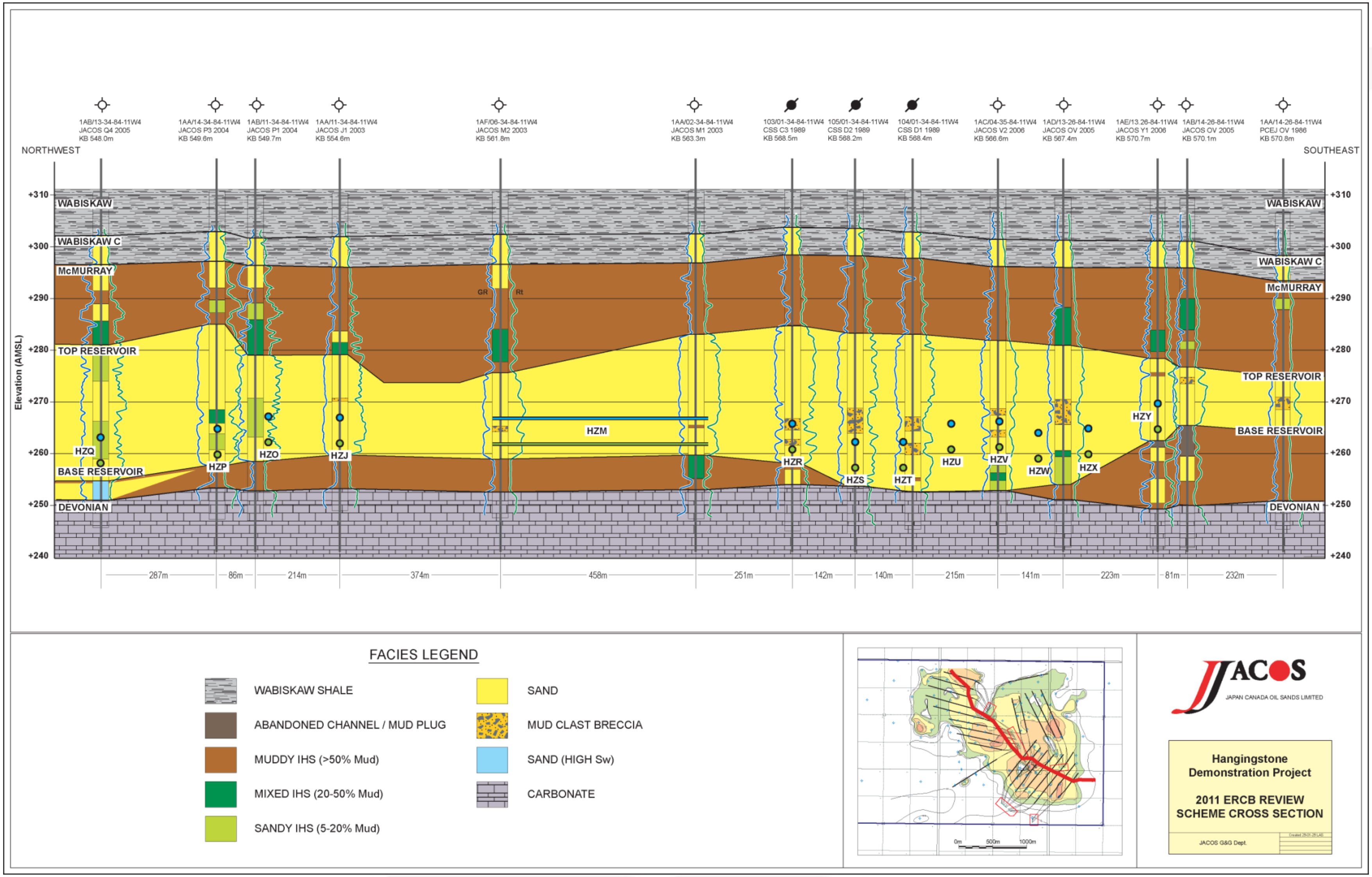
Hangingstone Demo Composite Well





Hangingstone Demo Scheme Cross-Section



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Cap Rock Integrity

- **No change in conclusions - continue to observe no cap rock integrity issues through 2015**
- 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 (?)

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Surface Heave Monitoring

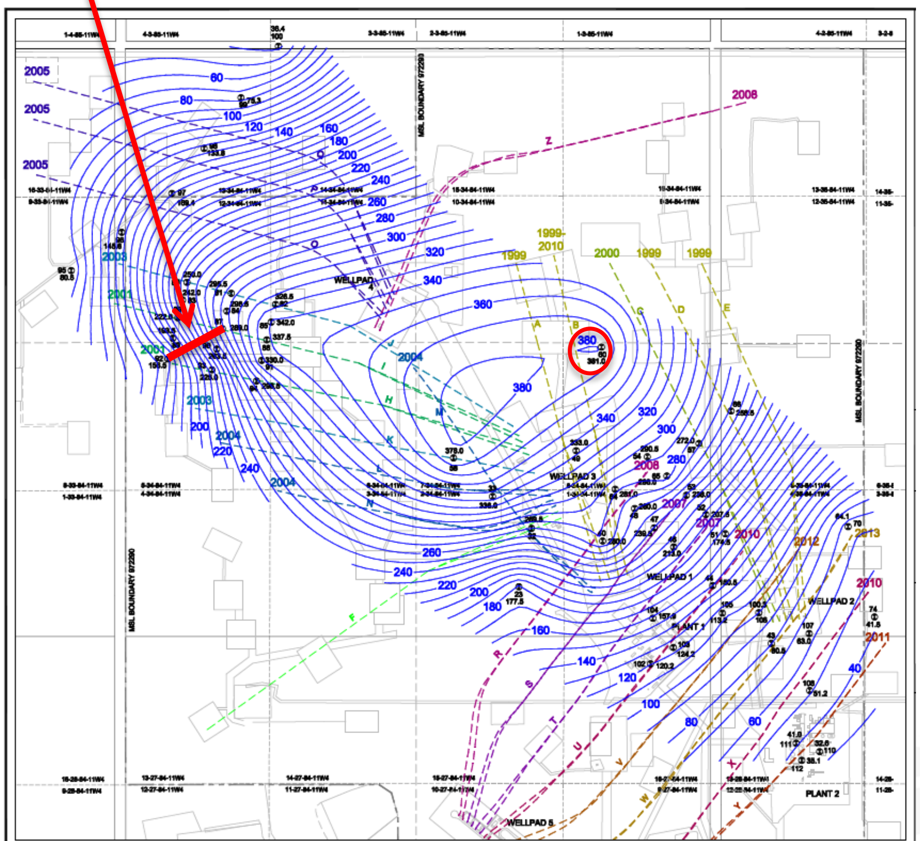
Maximum heave in 2014-2015: 31.0 mm

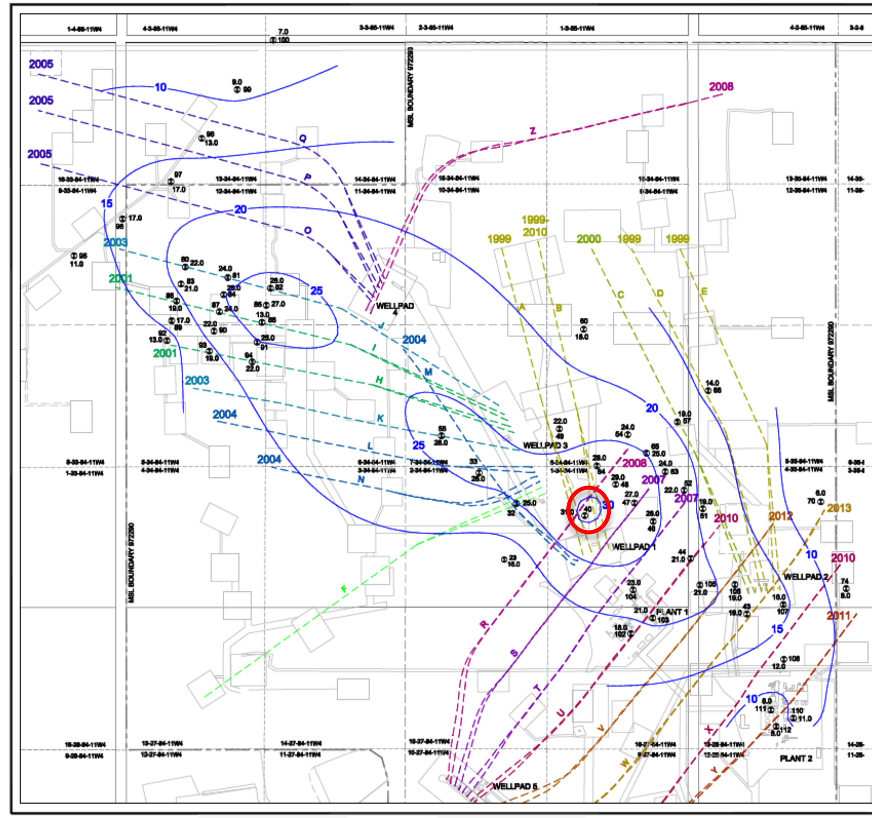
vs. 2013 – 2014: 40.0 mm

Network of 54 monuments

Cumulative Heave 1999-2015: 381 mm

Max Slope: 0.078% (increase of 0.006% from 2014)





- 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 within predictions
- No concerns observed

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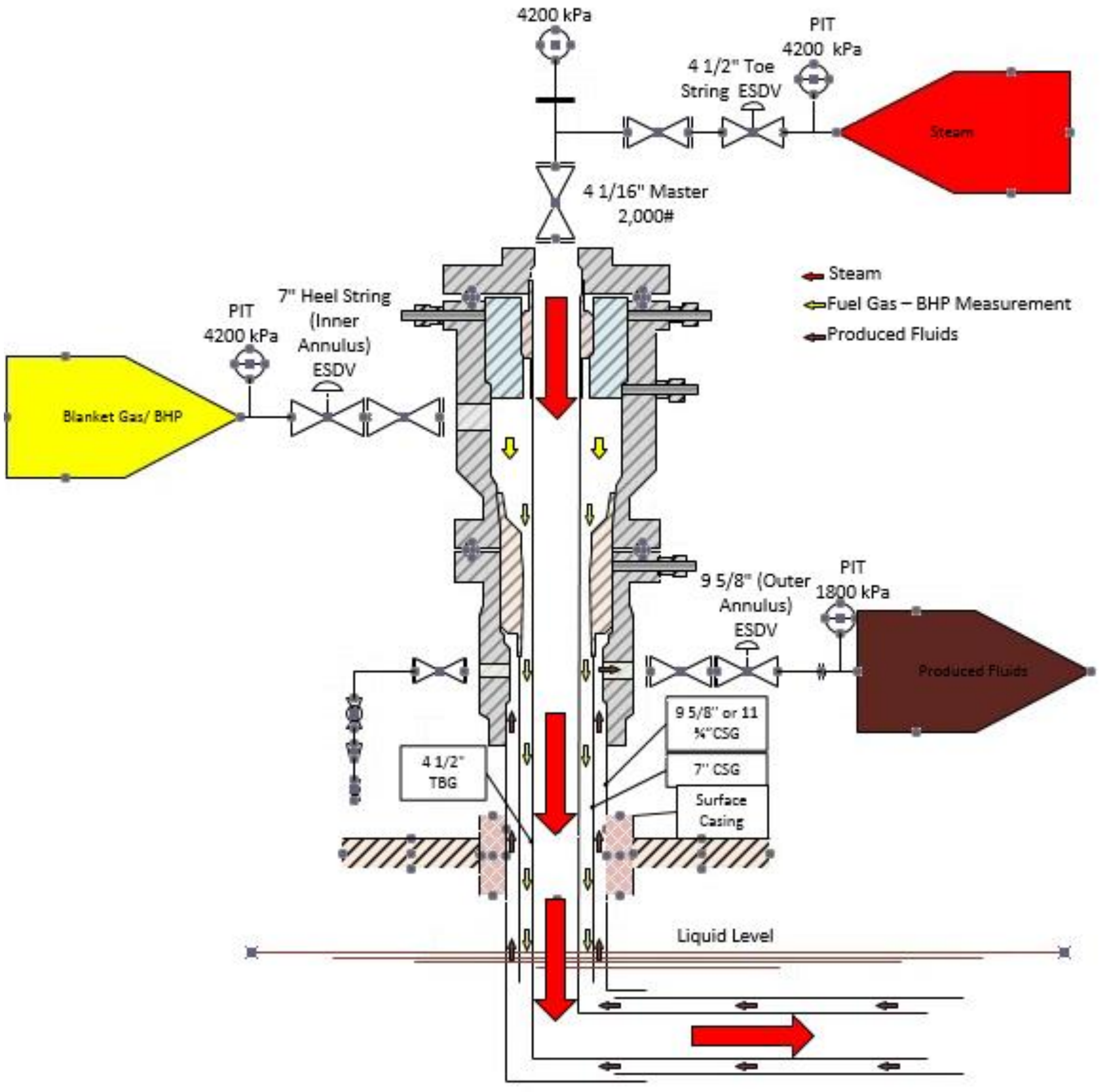
Well Design and Instrumentation

Bottom Hole Pressure (BHP) Measurement

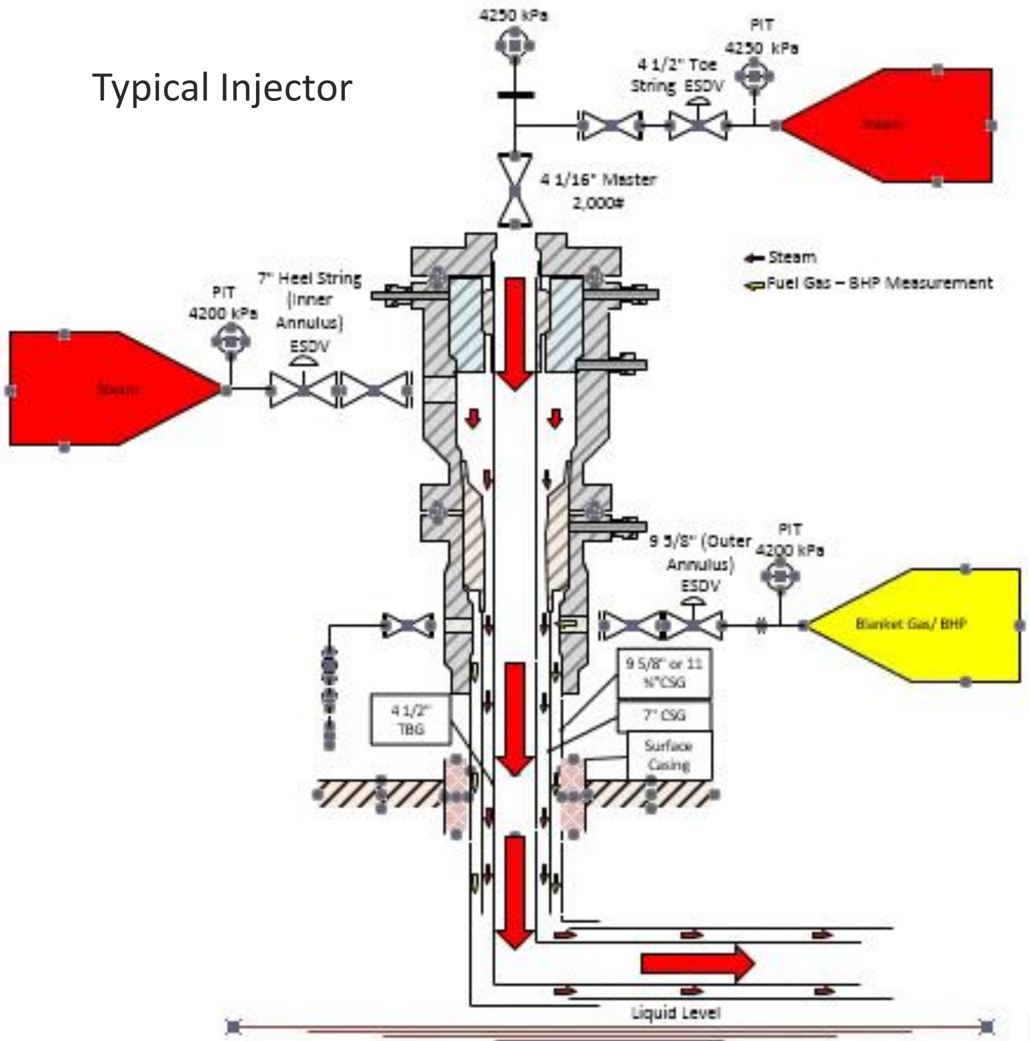


Startup Circulation mode on Injector and Producer:

- A small amount of gas is injected down the 7" inner annulus to displace liquids and eliminate possible buildup of a liquid column (similar to bubble tube testing) in the vertical section. This provides accurate continuous BHP measurement, and reduces heat transfer between the injected steam to the toe (4 ½" tubing) and the produced fluid (PF) returns from the outer annulus
- Steam rates vary depending on PF return temperatures at the surface facilities

Bottom Hole Pressure (BHP) Measurement

Typical Injector



SAGD Mode: Injector

- Gas is injected intermittently down the 9-5/8" or outer annulus to displace liquids and eliminate possible buildup of a liquid column in the vertical section
- Surface steam injection pressure is a reliable proxy for downhole pressure.
- Small pressure drop between the surface and actual downhole pressure due to frictional losses does not vary significantly over time
- Some injectors with reliable instrument thermocouple points are used as a secondary data source
- Steam injection rates (toe or heel) vary depending on well conformance

SAGD Mode: Producer

- Heel BHP measurements are similar to the Injector wells whereby gas is injected intermittently down the outer annulus
- This allows operating delta T (Injector/Producer) set points to provide liner integrity and production optimization.
- Emulsion/Bitumen returns are produced either from the toe or heel sections, depending on temperature profile of the producer lateral
- ¾" instrument coil (thermocouples) are placed inside the producer 4 ½" toe strings

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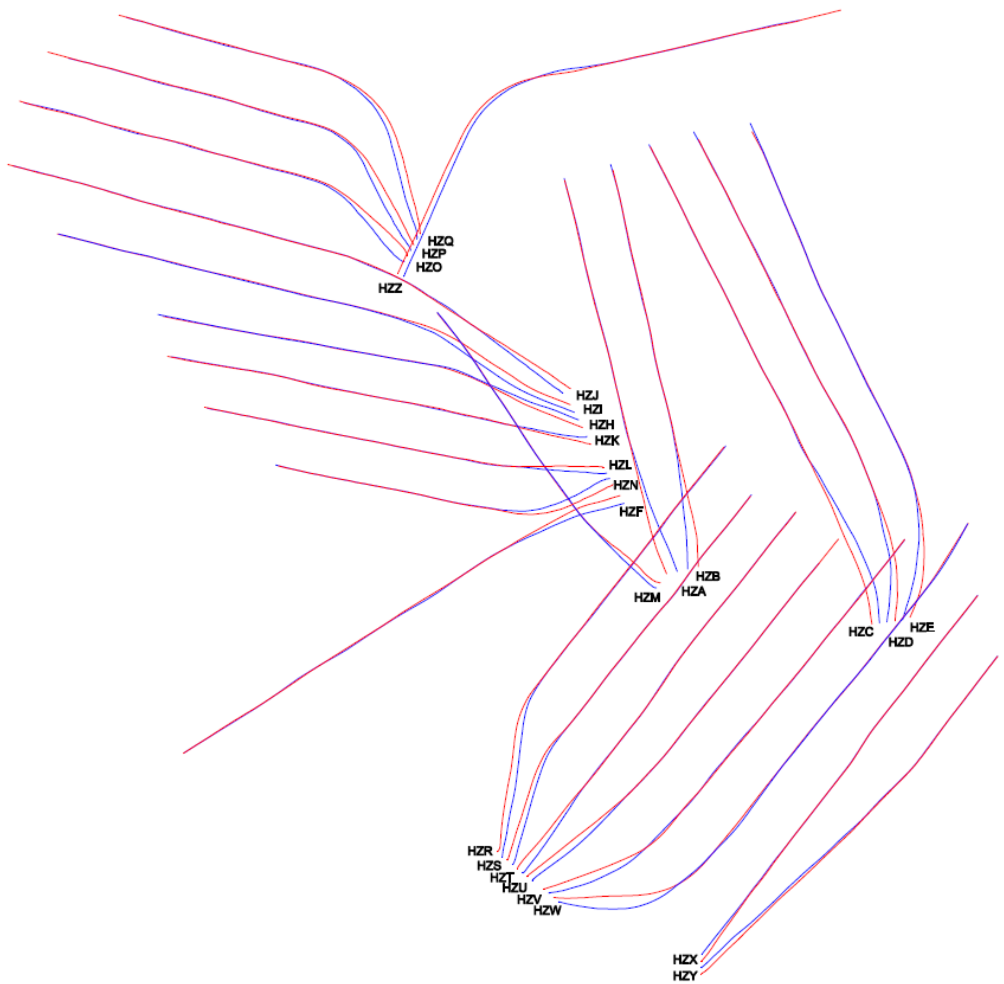
SAGD Well Layout

N/C from 2014 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

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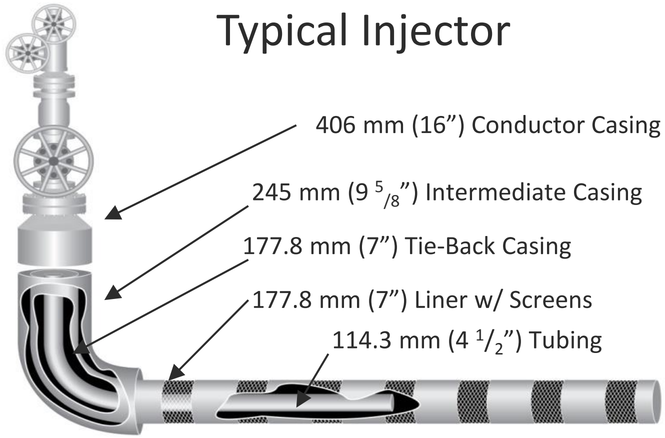
SAGD Well Completions

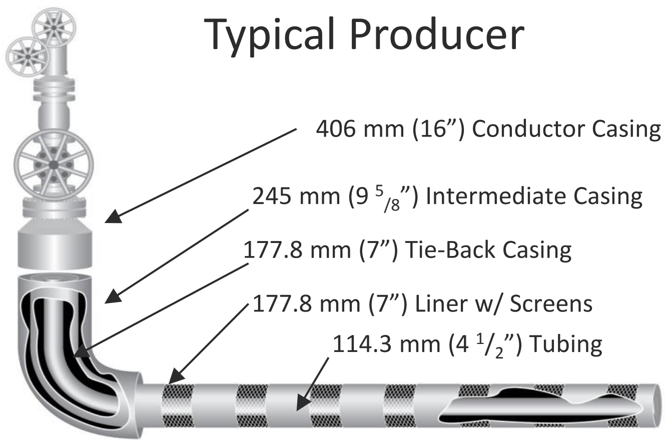
N/C from 2014 PR

Approval Nos: 8788K (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	I/P	-	I/P	-	-	-	I/P
B	Yes	I/P	-	-	I/P	-	-	I/P
C	Yes	I/P	-	-	I/P	-	-	I/P
D	Yes	I/P	-	-	I/P	-	-	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

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SAGD Well Completions

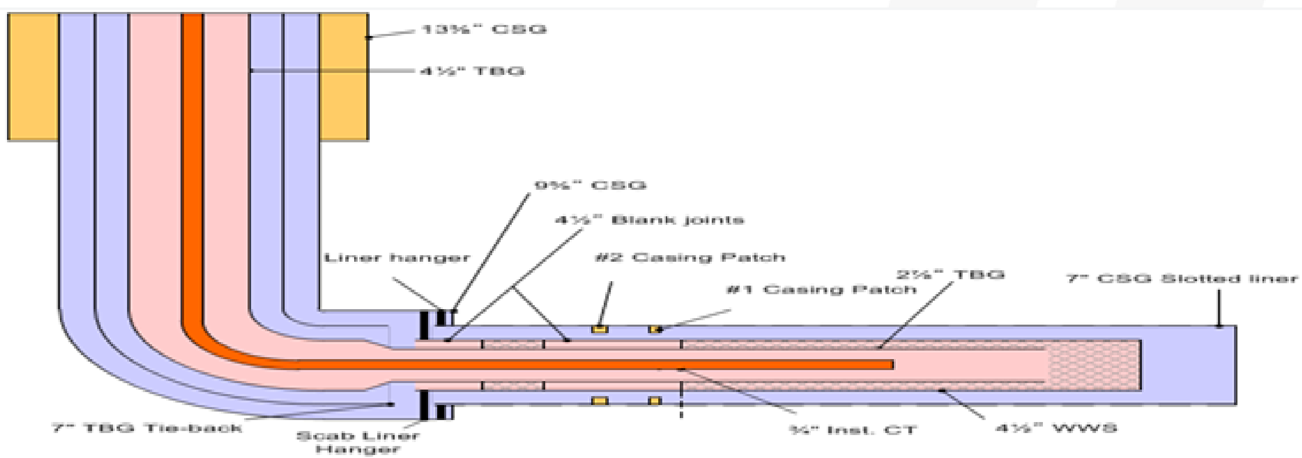
- 1999-2004 MeshRite/wire wrap – Limited technology available for “SAGD” applications
  - Isolated cases of sand production

- 2005-2010 Slotted Liner – Commercial emergence of technology, lower cost alternative
  - Good sand control
  - High pressure drops

SAGD Well Completions

HZVP Liner Failure/ Workover

- SAGD start-up in July 2012
- Liner failure (sand production / plugged well off) June 2013
- Well workover Aug – Oct 2013
- Installed one 7” casing patch, issues with casing patch setting tool
- Installed scab liner w/ 0.005” Wire-Wrapped-Screen
  - Restarted SAGD in June 2014
  - Replaced instrumentation coil - mechanical failure
  - Fluid recovery of calcium chloride/nitrate heavy brine solution before commingling with produced fluid returns to CPF
  - Well running at conservative rates, BS&W sampling show intermittent traces of solids, and bitumen slowly increasing



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SAGD Well Completions

Demo Workover Challenges

Contributing factors which resulted in “challenging” workovers

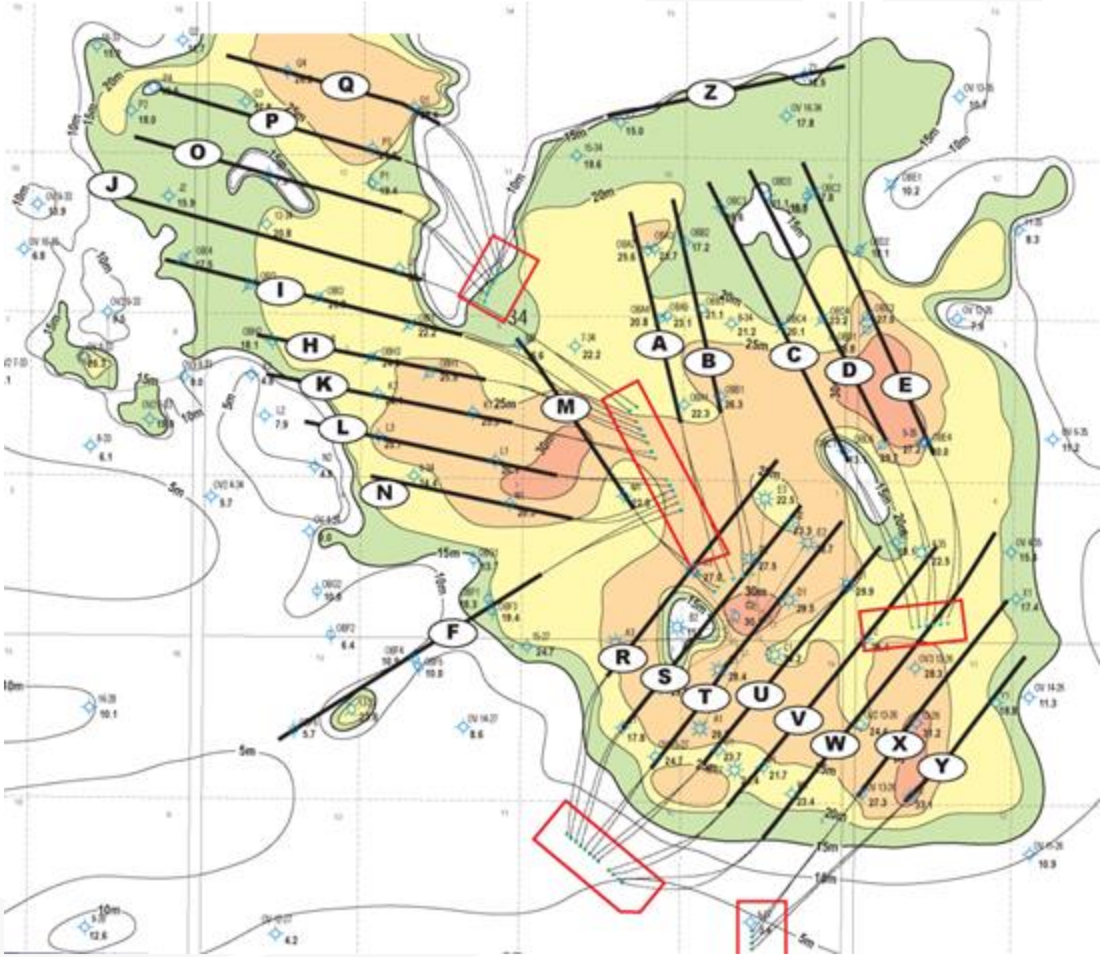
- JACOS DEMO operates at high injection pressures (≈4500kPa) resulting in downhole pressures higher than hydrostatic head
- Failed wells are in communication with adjacent wells making it difficult/impossible to de-pressure the reservoir
- Specialized brine (up to 1.6 density) is required to weight-up 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. 8788K

N/C from 2014PR

- 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 2014PR

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

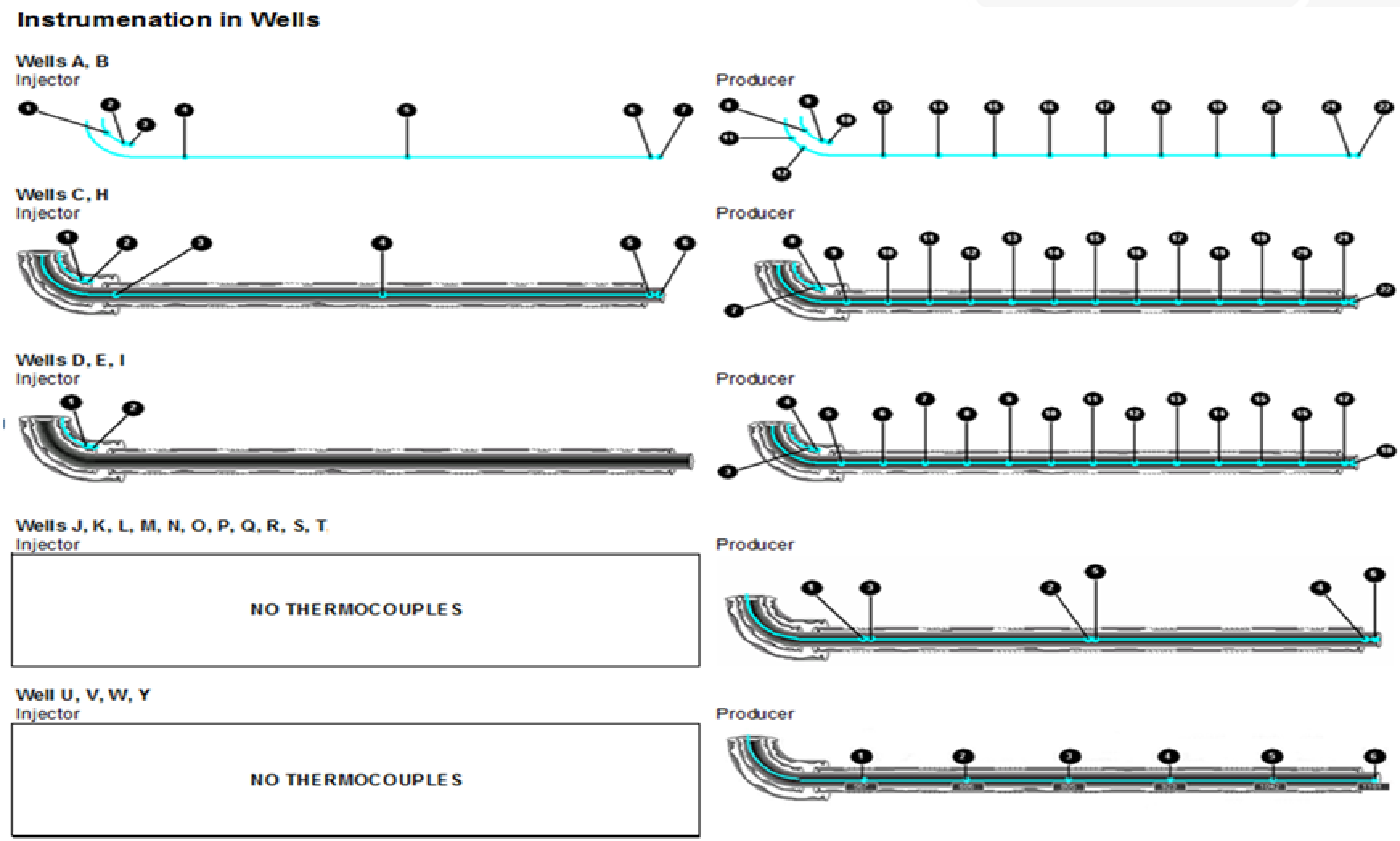
HZYP – Schlumberger Hotline SA3 (250°C)

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 2014PR



Demo Instrumentation HZXP (ESP)

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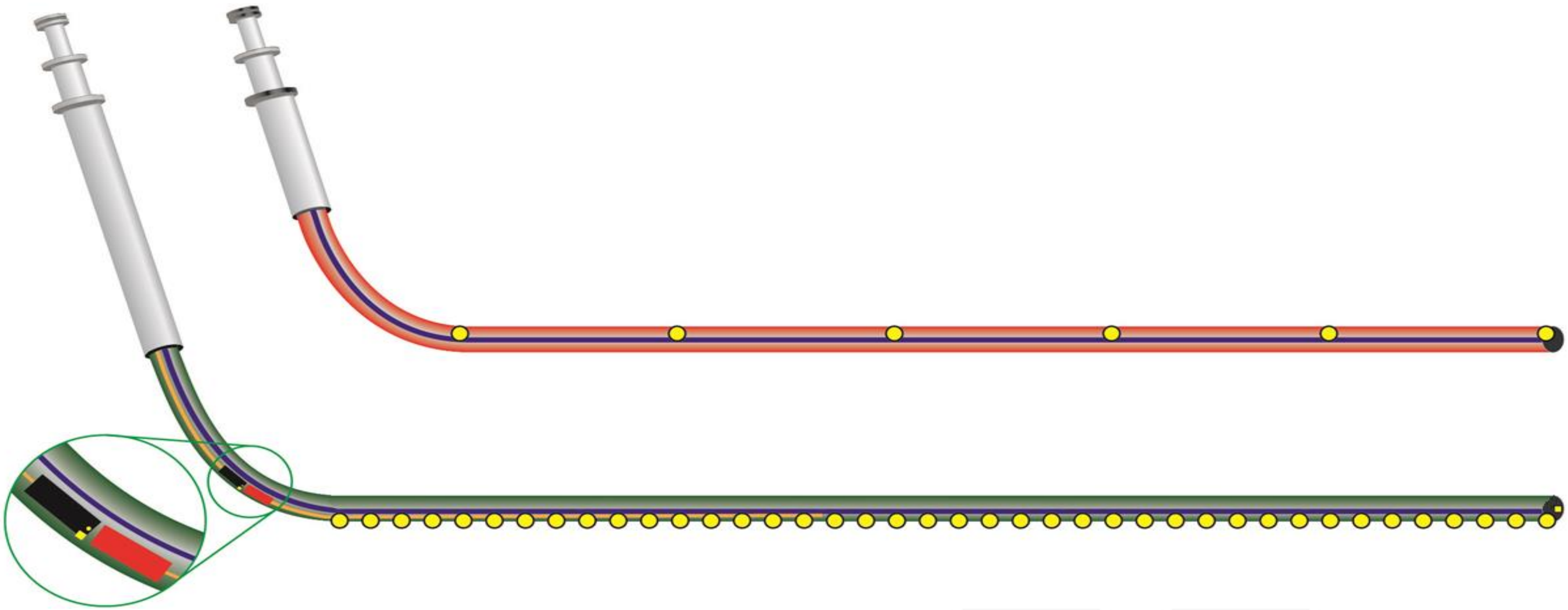
<u>N/C from 2014PR</u>



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

- Currently producing 24 SAGD well pairs
- 2015 average bitumen rate ~ 5,284 bbl/day (840 m3/day)
- Cumulative bitumen produced from project startup to 12/31/2015 ~ 34.58 million bbl (5.5 million m3)
- Cumulative SOR to 12/31/2015~ 3.77 (wt/wt) (3.81 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)

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Steam Injection (Temp, Pressure, Quality)

ANNUAL AVERAGE WELLHEAD PRESSURES AND TEMPERATURES		
2015		
Wells	Pressure (kPa)	Temperature (°C)
A Well	4443	257
B Well	4415	258
C Well	4451	258
D Well	4463	258
E Well	4452	258
H Well	4609	260
I Well	4443	258
J Well	4549	259
K Well	4514	259
L Well	4617	259
M Well	4611	260
N Well	4633	259
O Well	4366	257
P Well	4325	256
Q Well	4319	256
R Well	4806	263
S Well	4678	262
T Well	4746	263
U Well	4638	261
V Well	4580	258
W Well	4665	260
X Well	3567	246
Y Well	3754	248
Z Well	4532	260
Average	4466	258

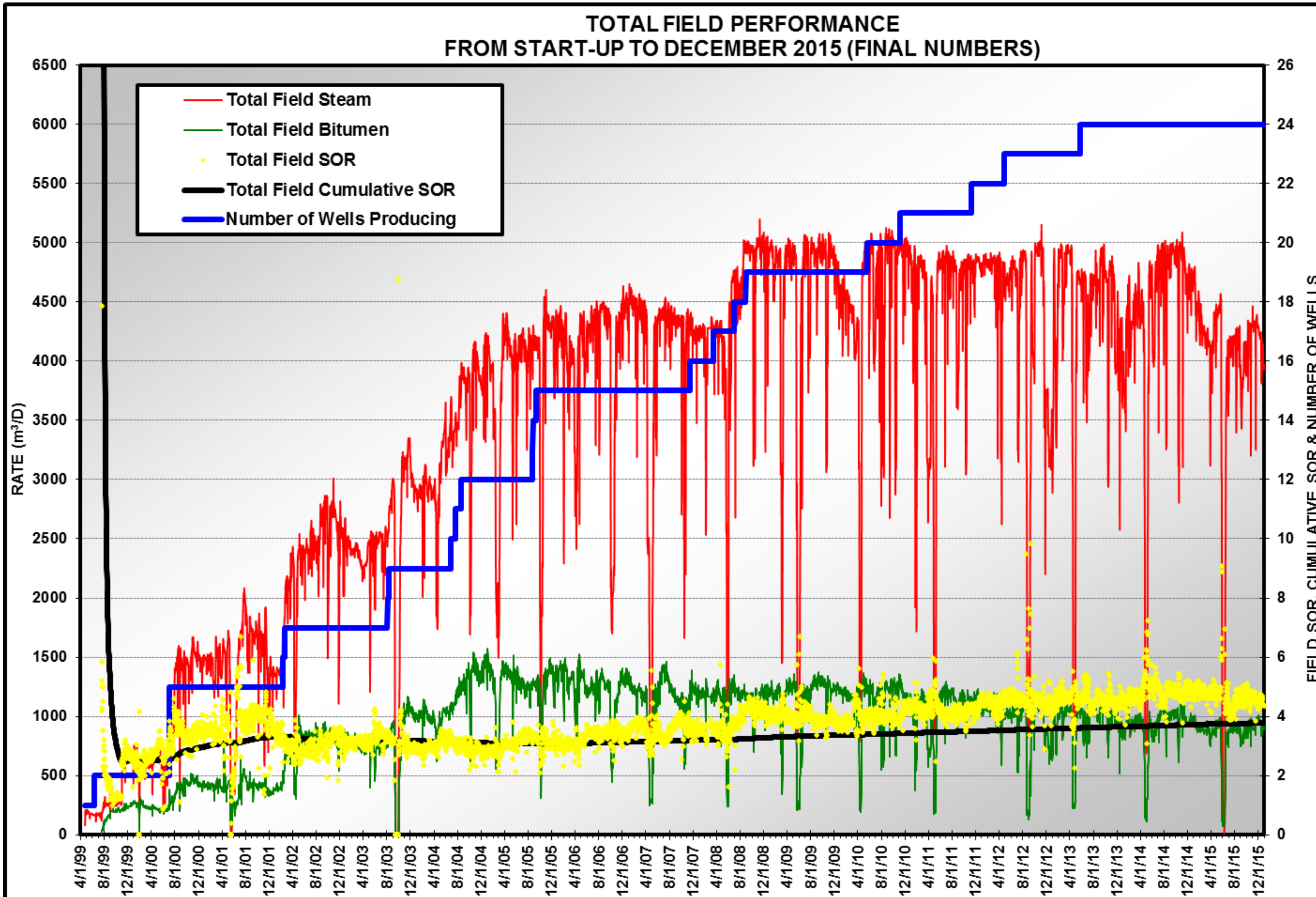
100% Steam Quality* @:

HZA, HZB, HZC, HZD,HZE

Average Steam quality for the remaining wells ~ 95%

* Steam Traps @ Phase 1&2 Wellheads

DEMO Field Performance



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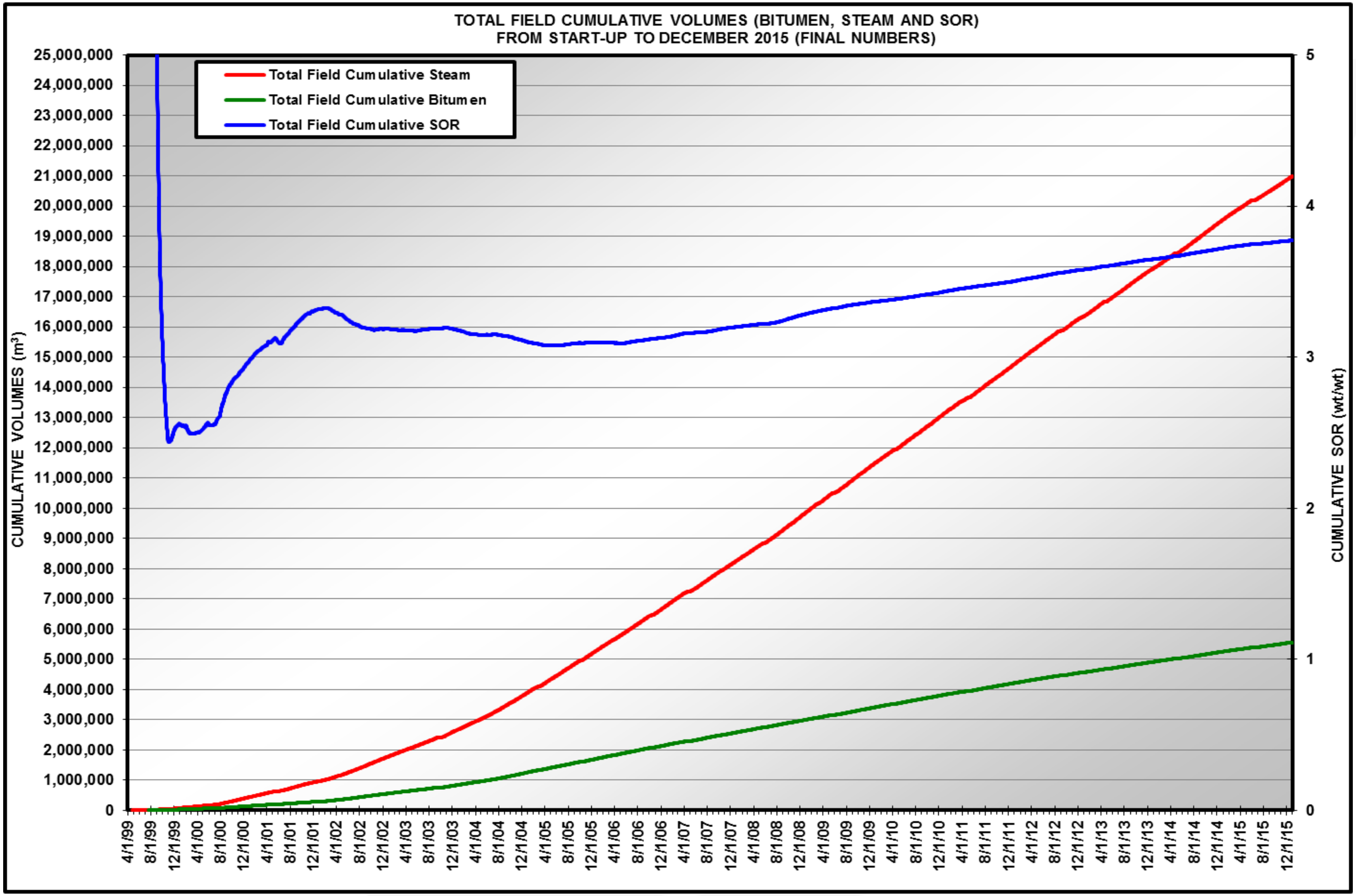
DEMO Field Cumulative Volumes

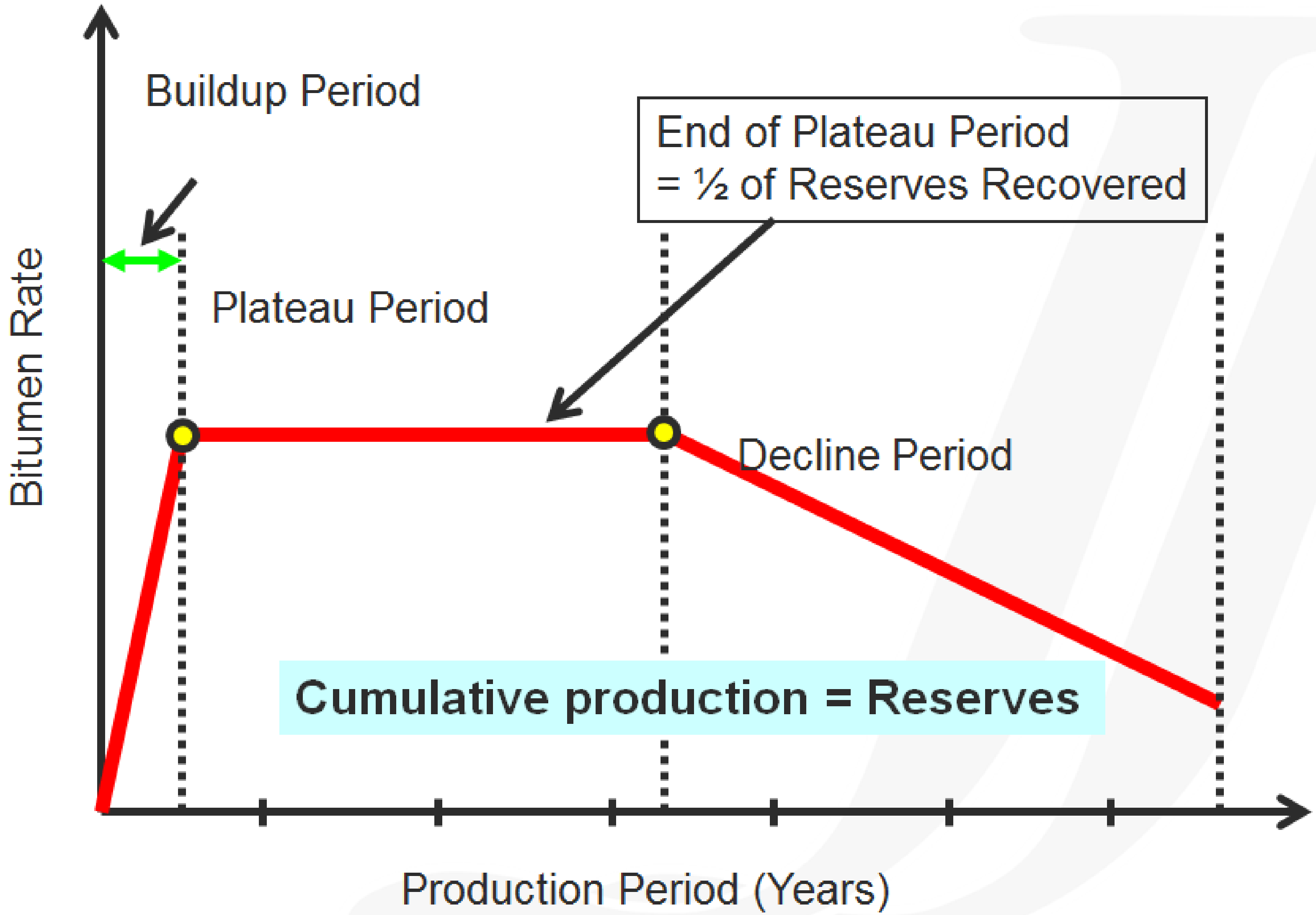


Generic Production Curve Method

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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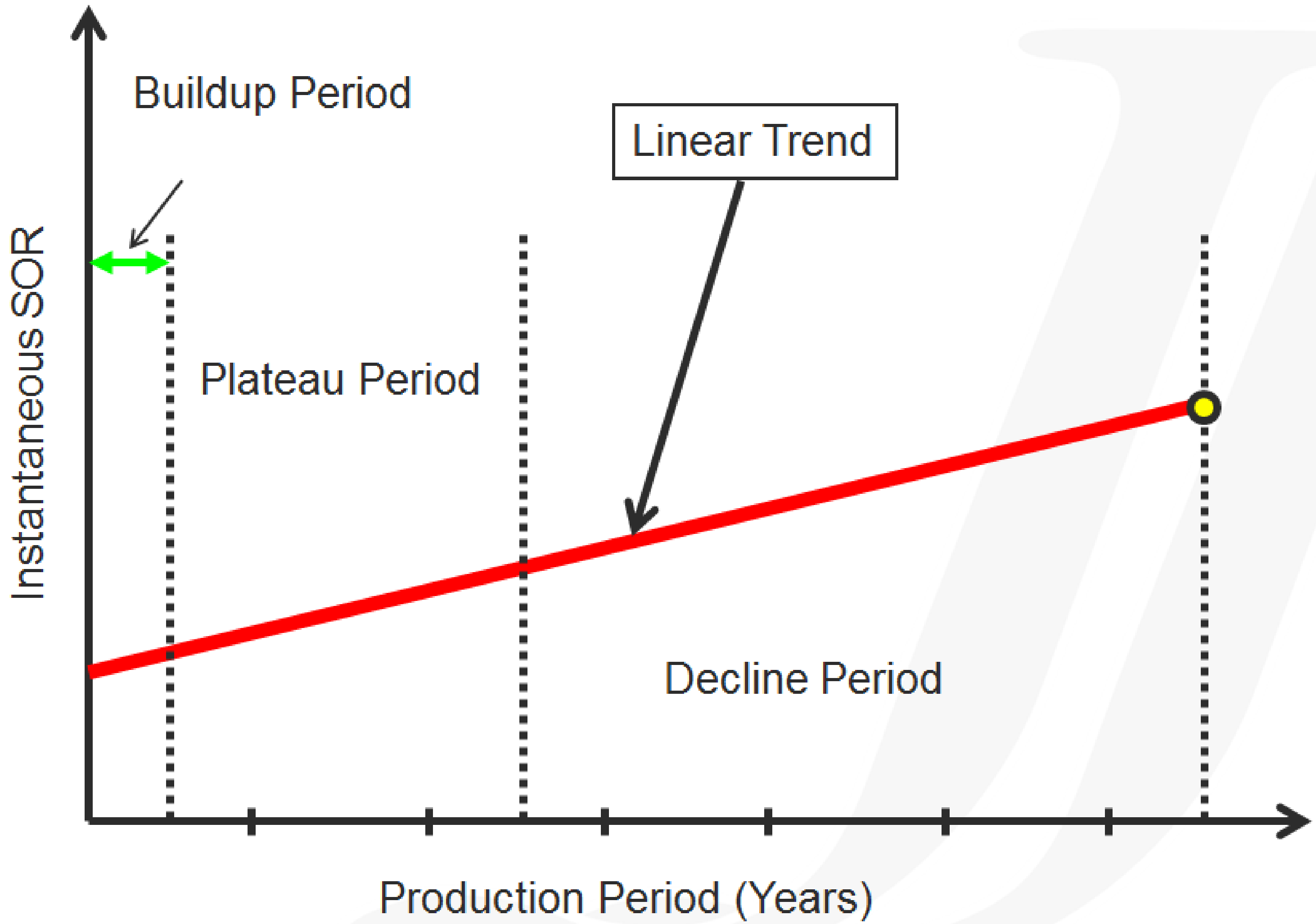
Methodology

- 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



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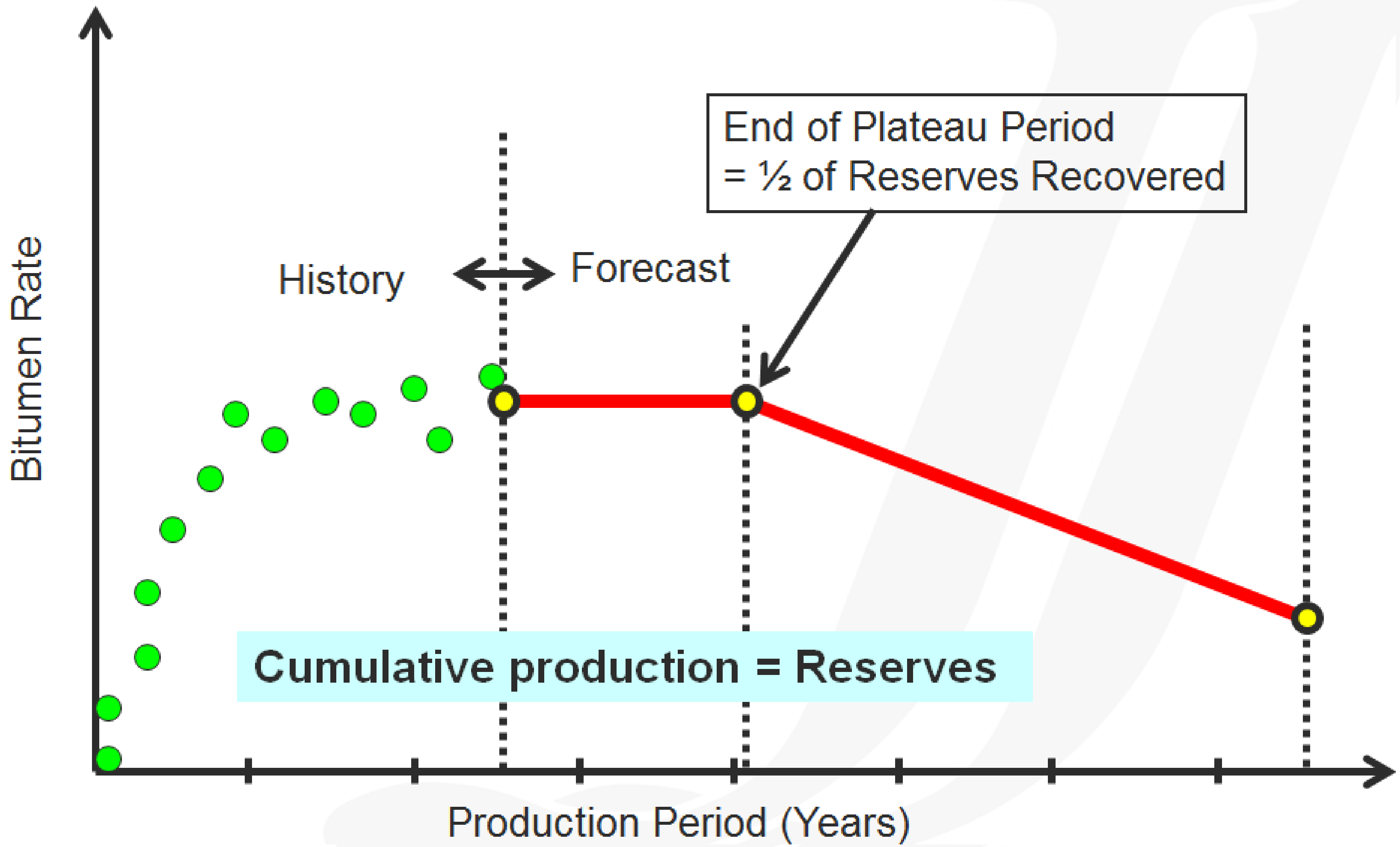
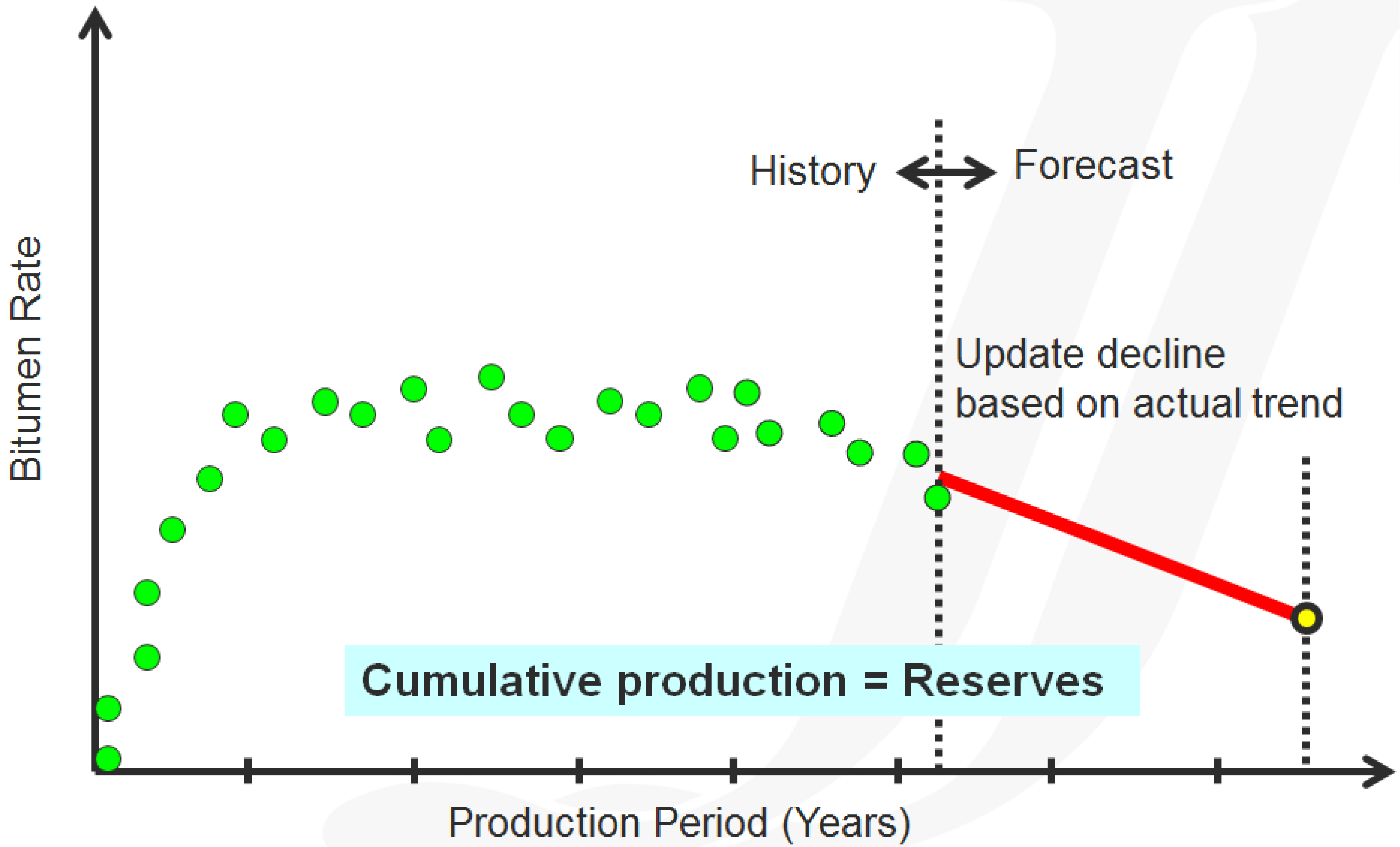
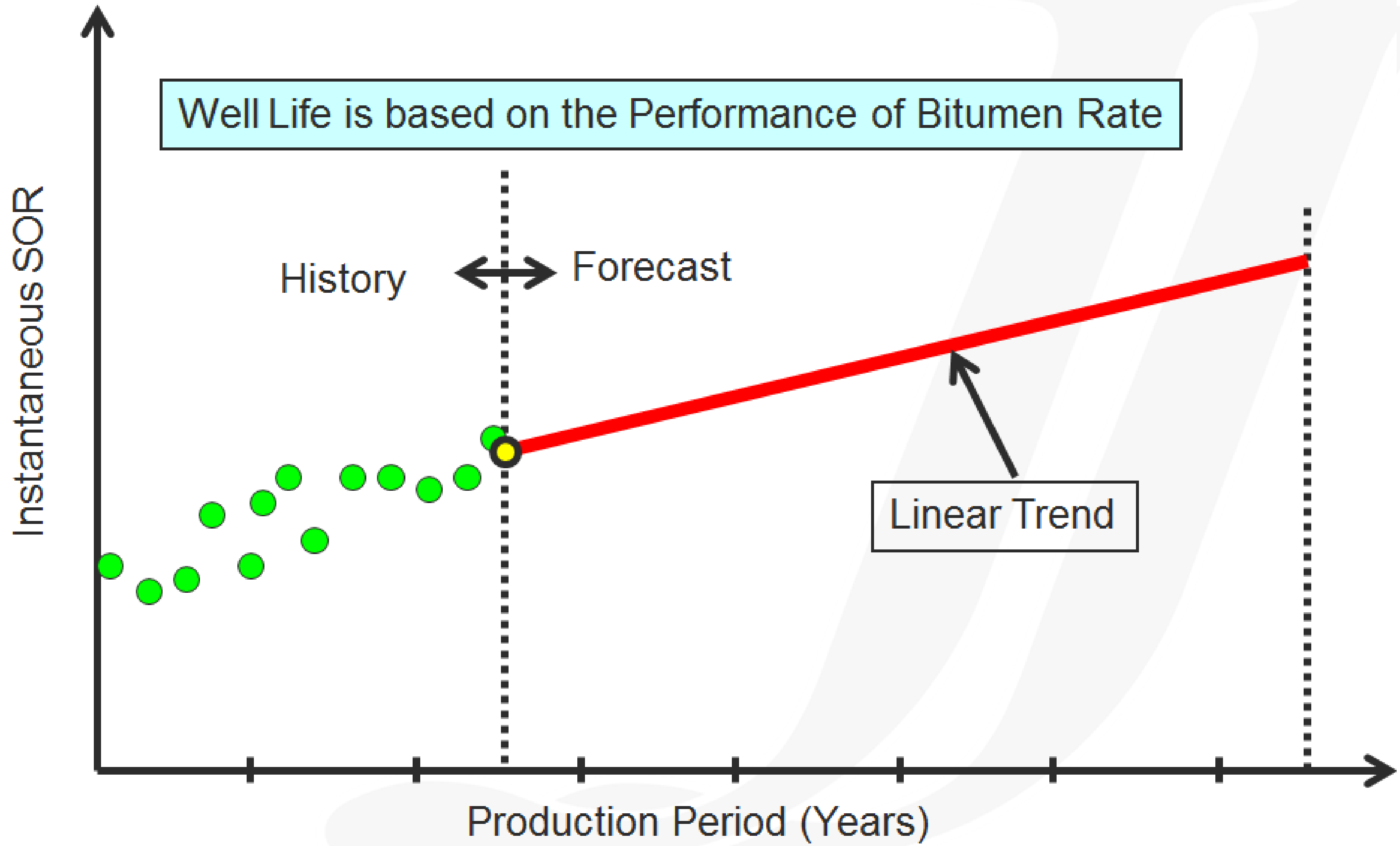
Wells with History - 1



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)

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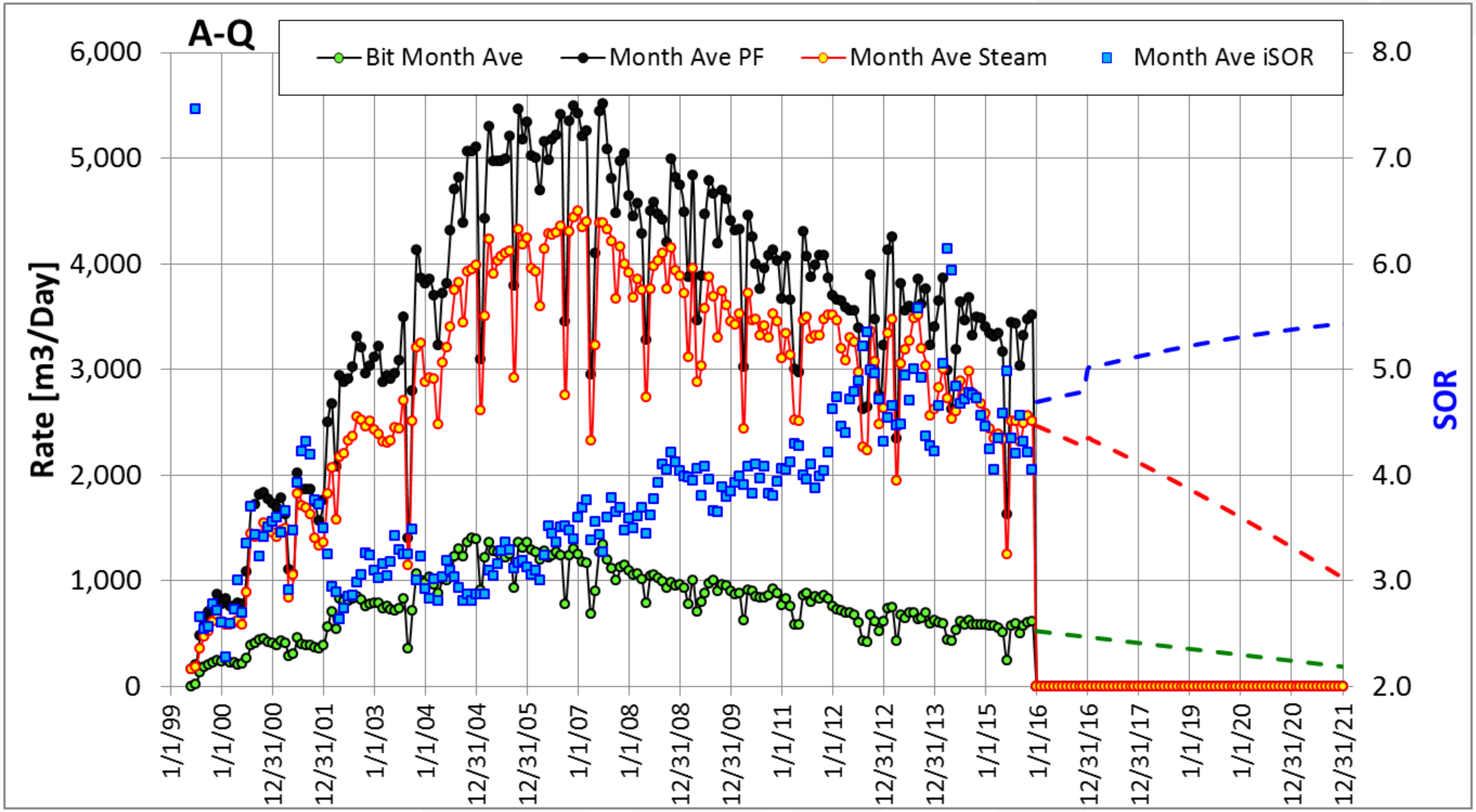
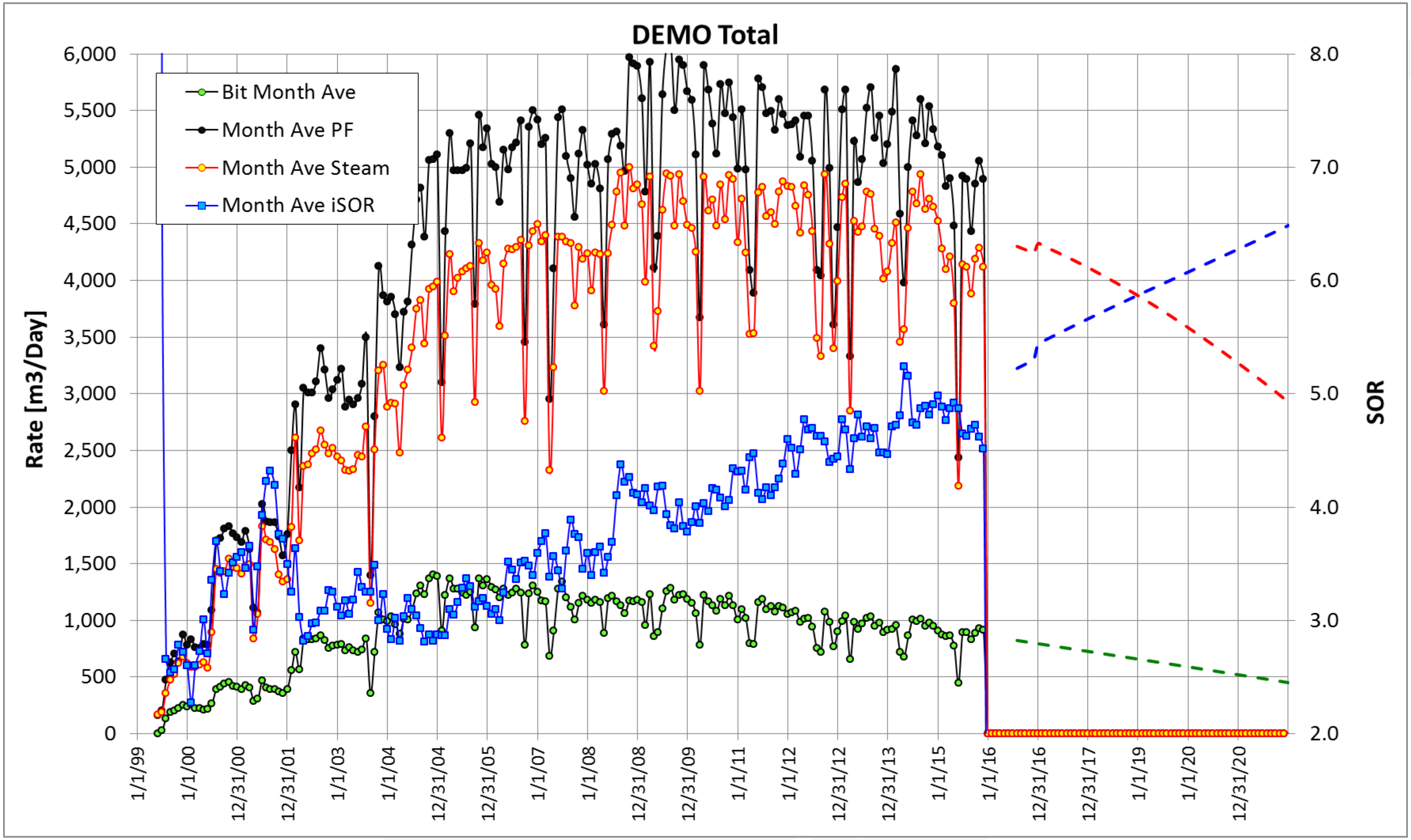
A-Q Production Forecast

Decline predicted from A – Q well pair production history



DEMO Production Forecast



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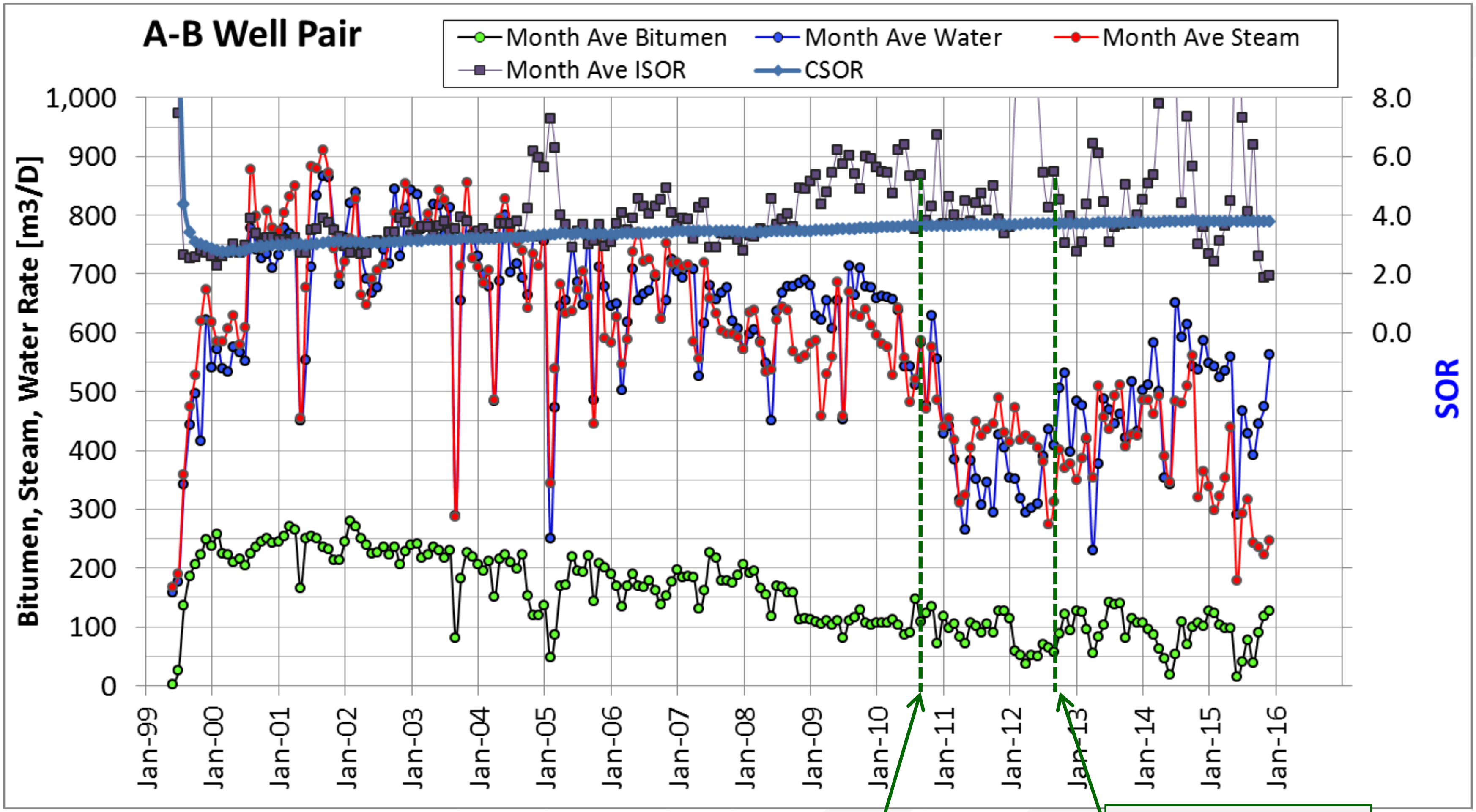
DEMO Well Pairs Recovery Factor

<table>
<tr><th>Start Year</th><th>Well Pair</th><th>Original Bitumen in Place (Mm3)</th><th>Cum Produced Bitumen (Mm3)</th><th>Current Recovery (%)</th><th>Ultimate Recovery (%)</th></tr>
<tr><td>1999</td><td>A,B,C D and E</td><td>3,113</td><td>1915</td><td rowspan="4">60</td><td rowspan="4">66</td></tr>
<tr><td>2002</td><td>H, I, J and K</td><td>2,158</td><td>1491</td></tr>
<tr><td>2004</td><td>L, M and N</td><td>1,412</td><td>788</td></tr>
<tr><td>2005</td><td>O, P and Q</td><td>1,203</td><td>552</td></tr>
<tr><td>2007</td><td>S and T</td><td>1,186</td><td>324</td><td>27</td><td>58</td></tr>
<tr><td>2008</td><td>R and Z</td><td>913</td><td>258</td><td>28</td><td>44</td></tr>
<tr><td>2010</td><td>U and X</td><td>1,169</td><td>125</td><td>11</td><td>55</td></tr>
<tr><td>2012</td><td>Y and V</td><td>845</td><td>45</td><td>5</td><td>54</td></tr>
<tr><td>2013</td><td>W</td><td>585</td><td>33</td><td>6</td><td>55</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Total</td><td>12,584</td><td>5,531</td><td>44</td><td>61</td></tr>
</table>

Well Pair Performance Example

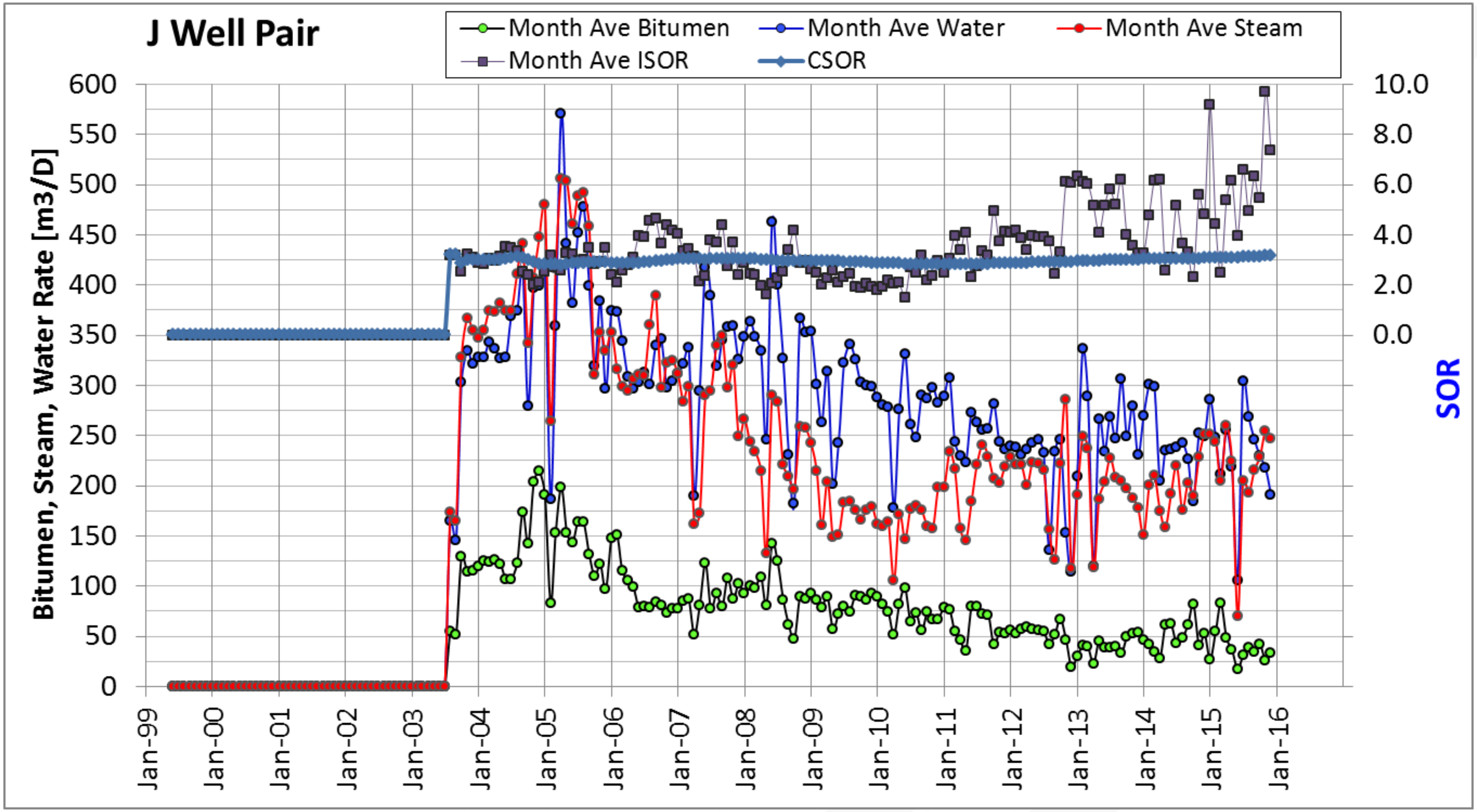


Recovery factor at the end of 2015: 67.4%

A-B Well Pairs Highlights

- These wells have approximately 15 years history and were maintaining economic performance prior to price reductions.
- These two wells produced ~ 5.8 MMbbl (0.92 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)
- NCG co-injection on A and B well pairs was conducted in parts of 2012 and 2013. No NCG since 2014

Well Pair Performance Example - High



Recovery factor at the end of 2015: 51%

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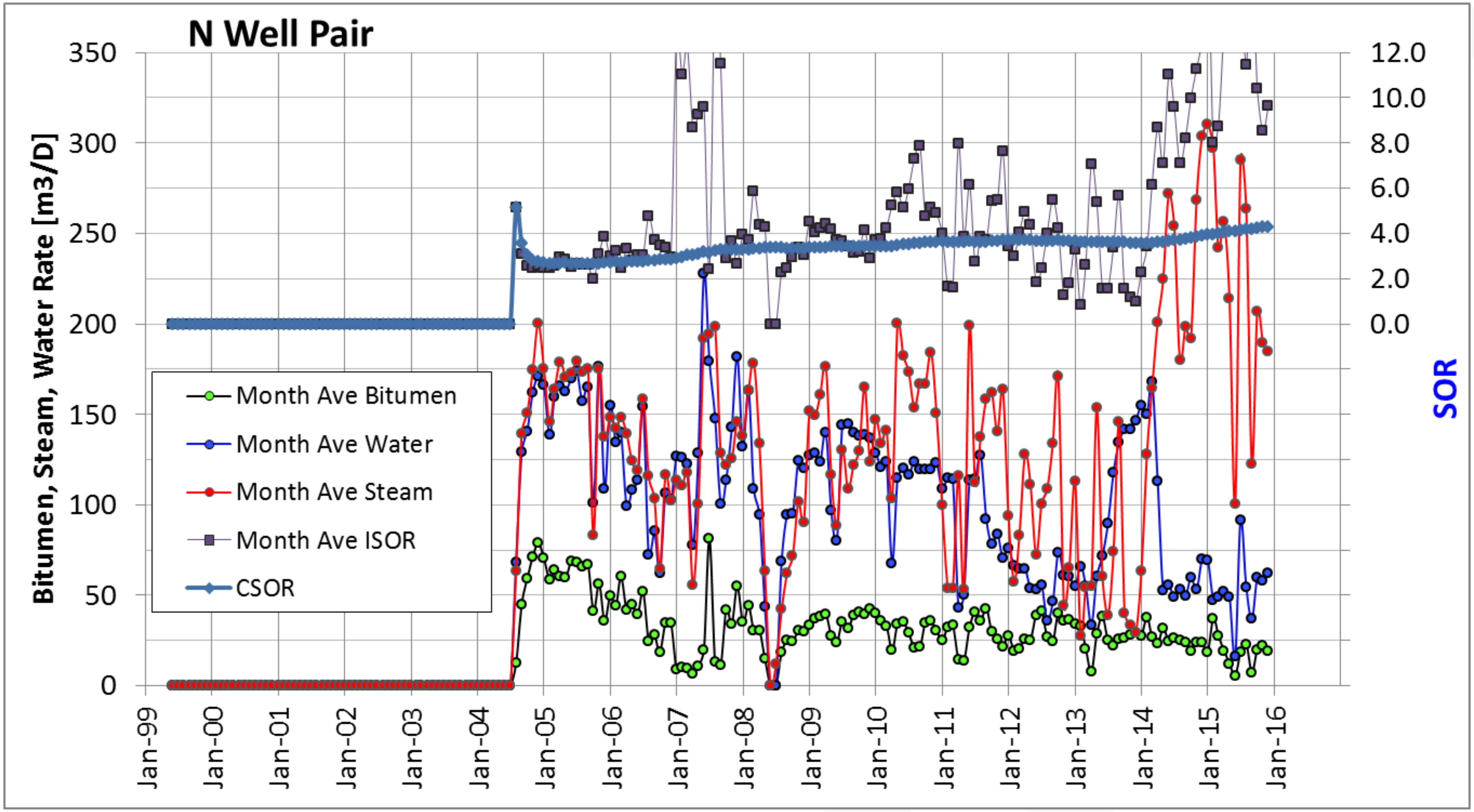
J Well Pair Highlights

- J pair has maintained good performance over the past year.
- The bitumen production profile appears to be following the typical build up, plateau, and decline periods.
- Well produced ~ 2.3 MMBBL and CSOR ~ 3.1
- 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 2015: 39%

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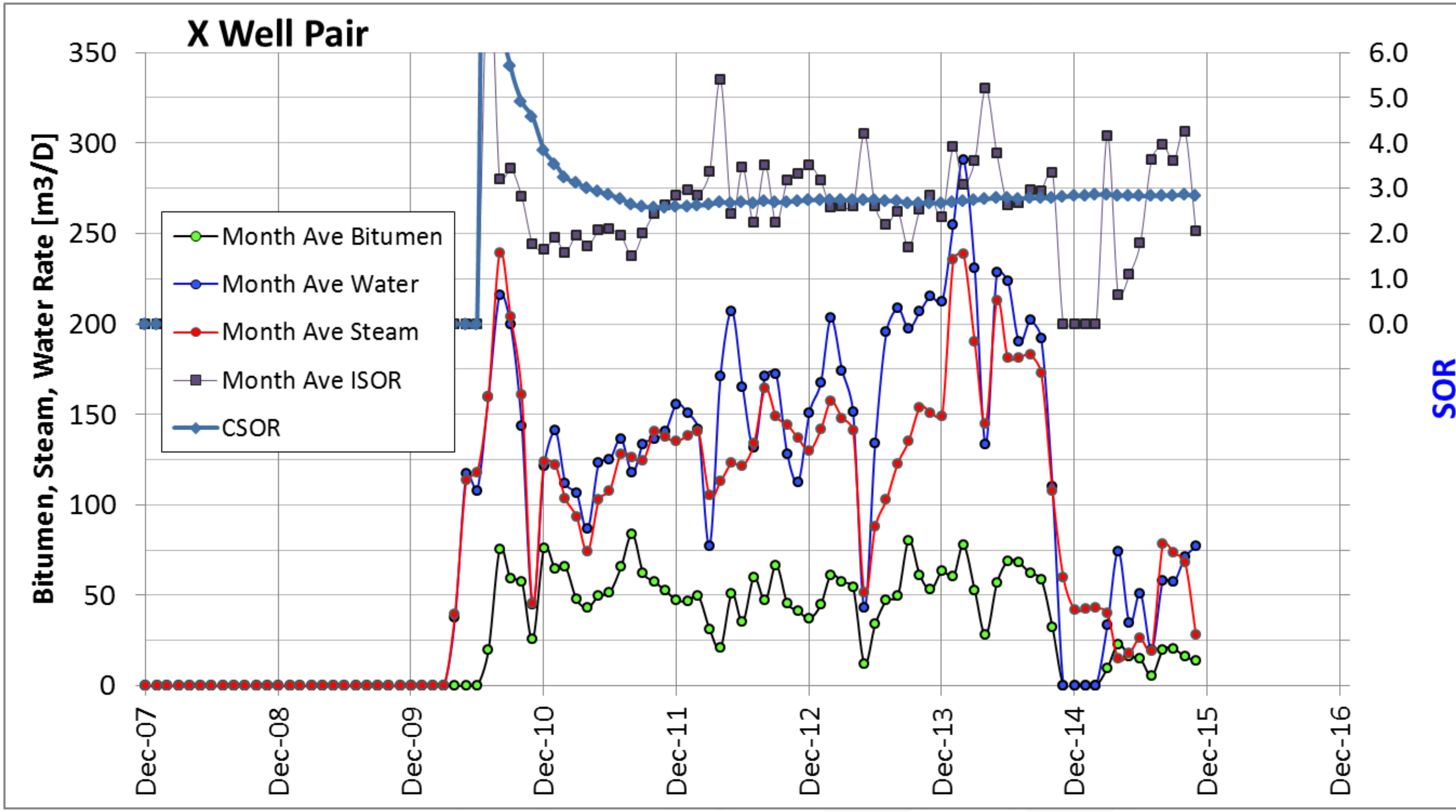
N Well Pair Highlights

- Actual bitumen production is lower than expected (150m3/d).
- Well produced ~ 0.85 MMBBL and CSOR ~ 4.3
- Potential reasons for this low productivity are:
  - The reservoir along the HZ well contains clast facies 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.
  - From April 2014 till Mid 2015 Steam was increased considerably in order to try and improve the drainage from N well. Additionally, we wanted to promote fluid mobilization to other wells in phase 3 by having N well act as a donor. The extra steam came from phase 5 resulting from the workover in that phase

Well Pair Performance Example



Recovery factor at the end of 2014: 14.9%

X Well Pair Highlights

- First well with ESP test in the field.
- Well produced ~ 0.55 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)

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X Well Pair Highlights

- X well was shut-in from November 2014 to April 2015 due to hot toe
  - Hot toe was mitigated by shutting steam injection allowing the injector to cool down
  - 75 C water was injected into the injector well. This cooled down both the injector and the producer’s toe.
  - After this, steam resumed at trickle rates and production restarted at reduced rates
  - Chamber Pressure has been declining and the interruption of steam is also allowing the temperature to dissipate so that water flashing in the producer liner is prevented.

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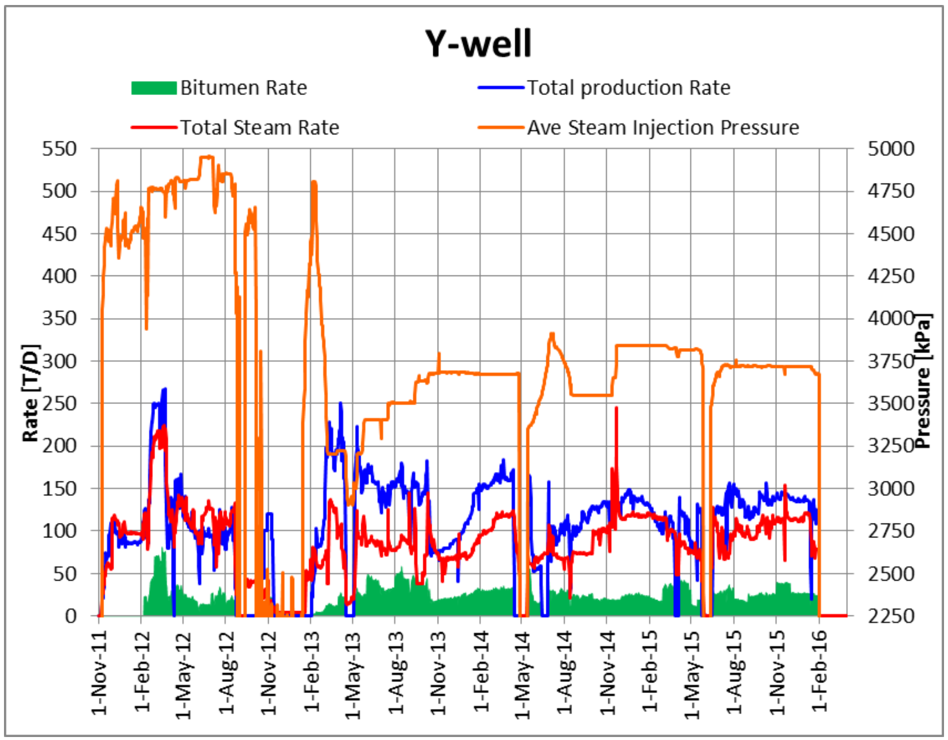
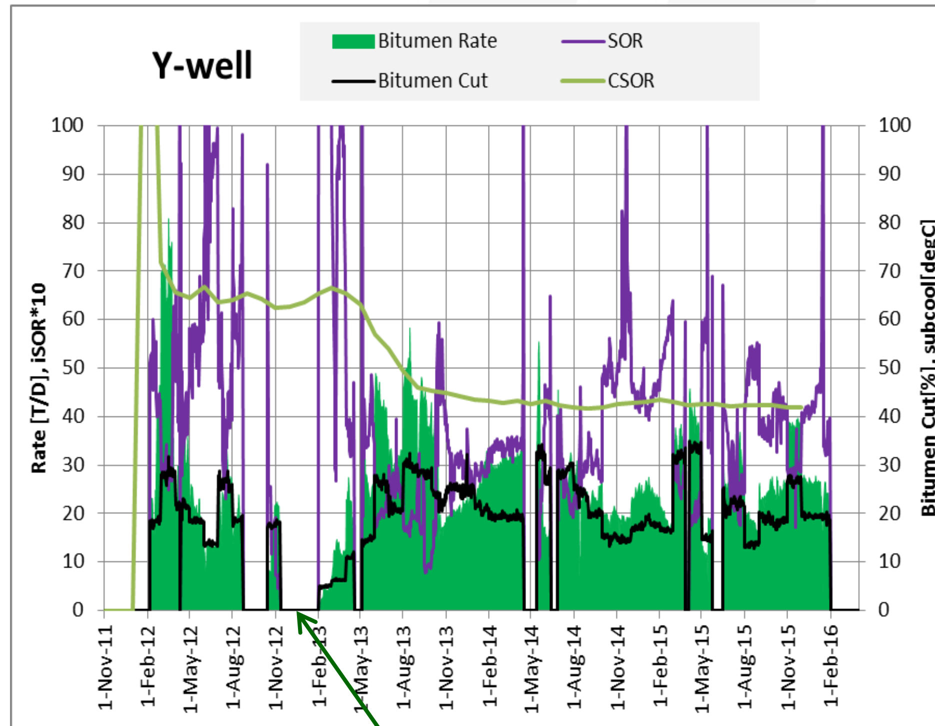
Y Well Pair Highlights

- 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 2015: 11%

Workover

NCG Co-injection – (N/A in 2015)

- Received AER approval to co-inject NCG in H-Q
  - No NCG co-injection happened in 2015 because we had excess of steam
  - A-Q NCG Co-Injection start date still to be determined. This will be subject to steam requirement/availability

- Long Term Plan
  - Target NCG rate for Phases 1&2 as per approval
  - Target NCG rate for Phases 3&4 as per approval

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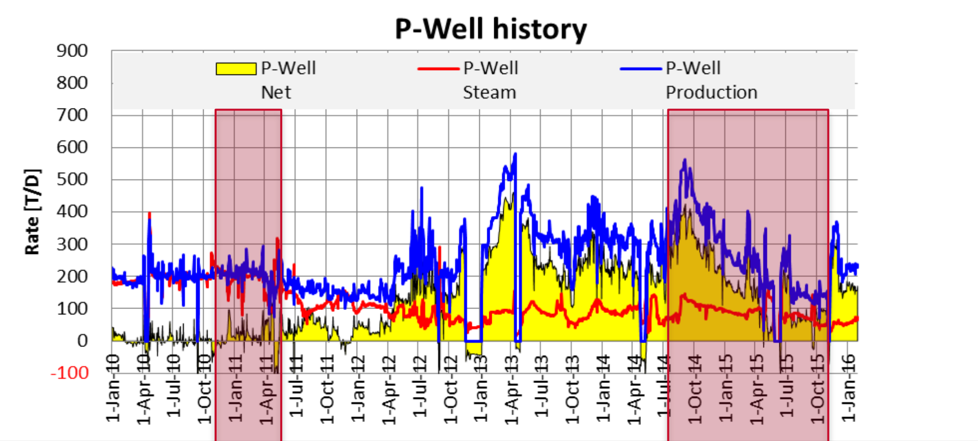
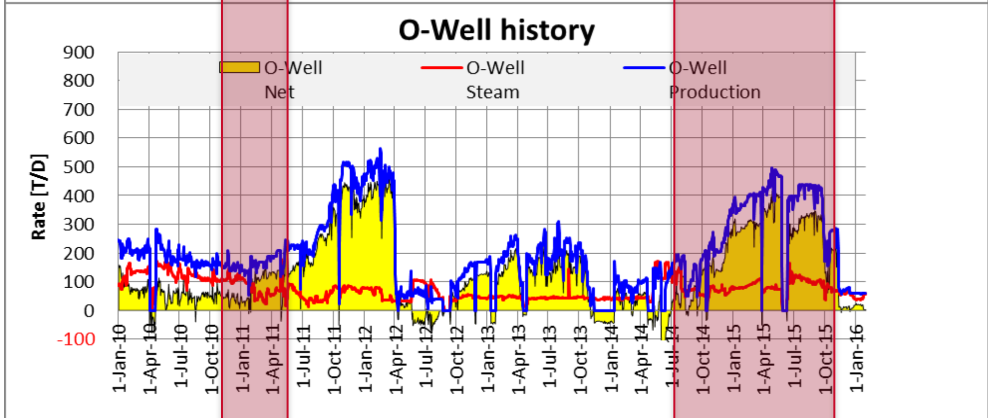
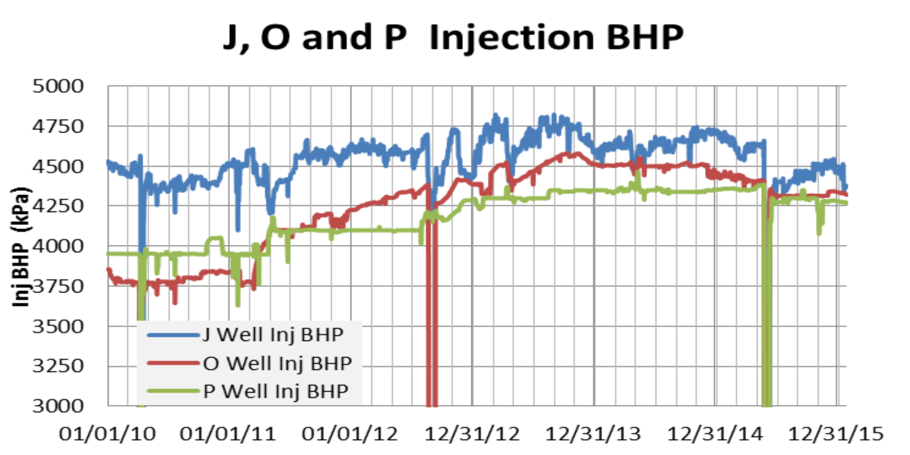
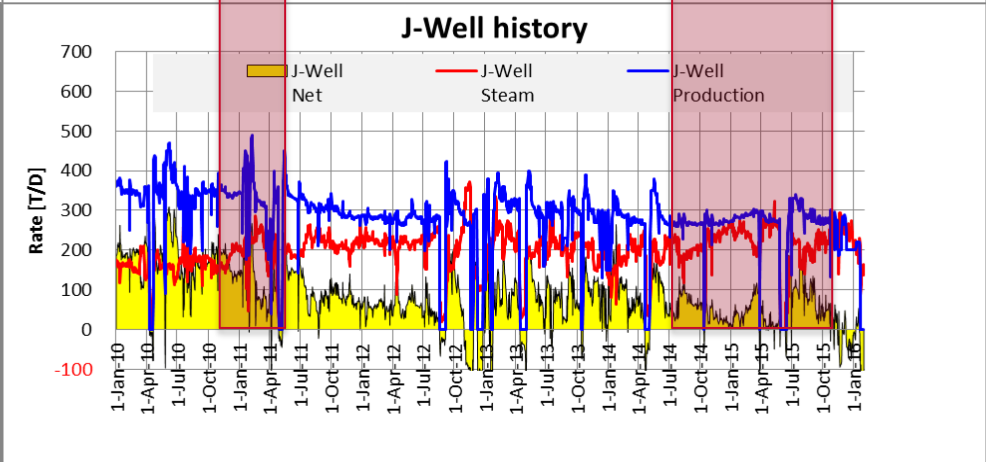
Fluid Communication

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



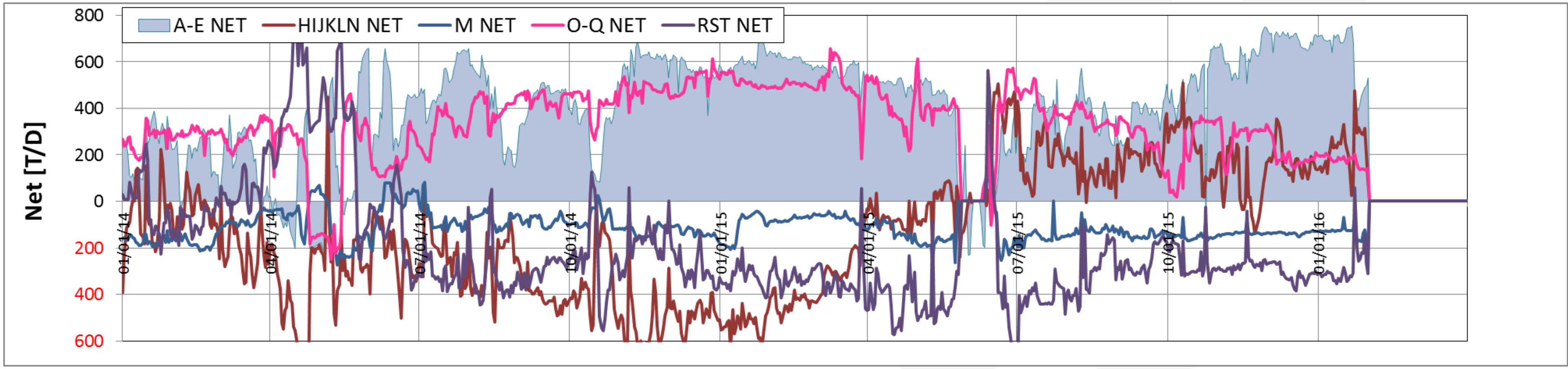






Fluid Communication

- Well Pads 3 & 4 are thermally mature
  - Production from well pad 3 started in December 2001
  - Production from the last wells in well pad 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 Well Pads 3 & 4 and presented below.



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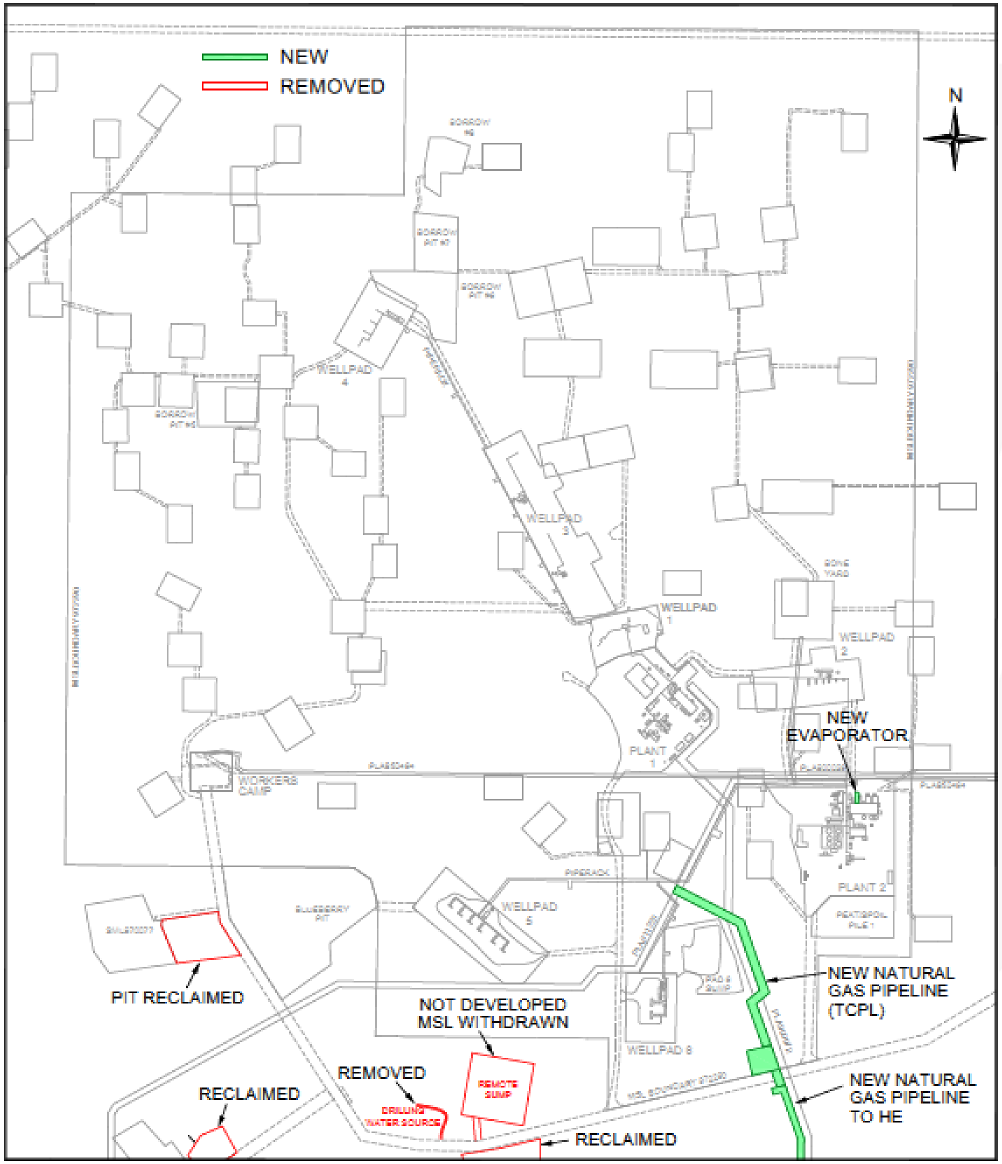
Future Development Options

- Lower pressure operation
- NCG Co-injection for A-E and H-Q wells. The timing to start will be determined based on steam requirement/availability.
- Blowdown

Surface Operations

Facility Design

Site Plan Update



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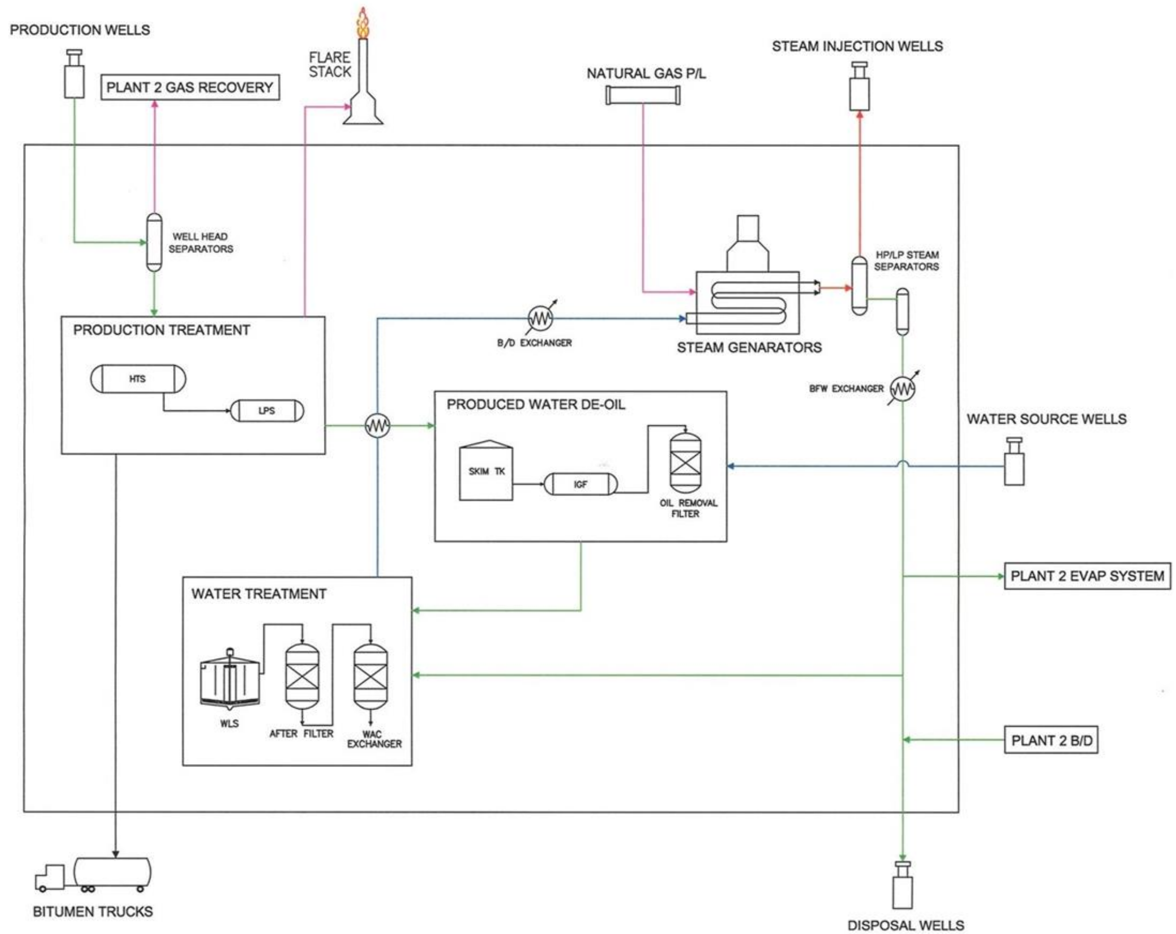
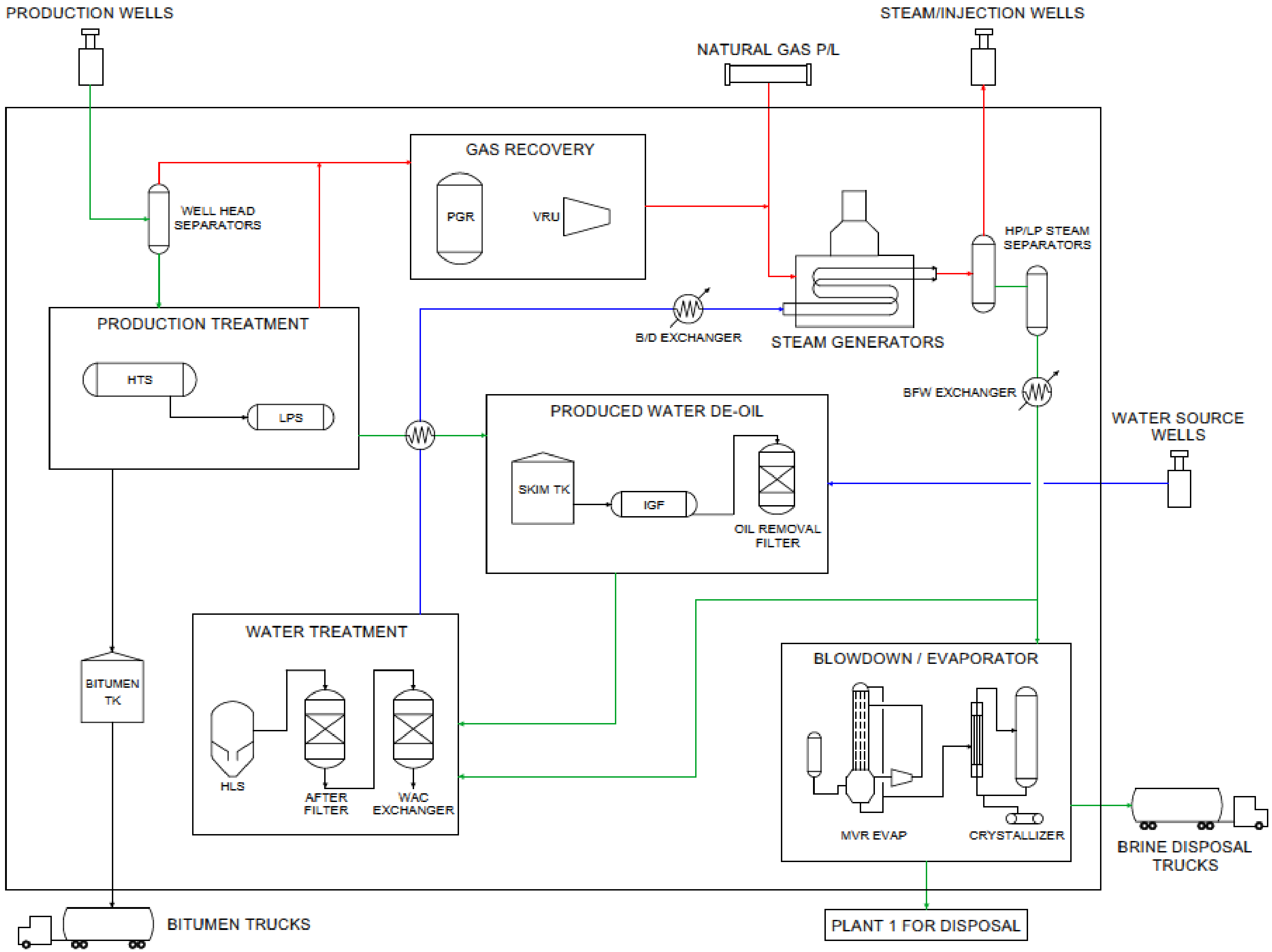
Plant Schematic – Plant 1



Plant 1 was shut down in June, 2015.

- Fuel gas goes to Plant 1 for glycol heater – to be deactivated in 2016
- 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



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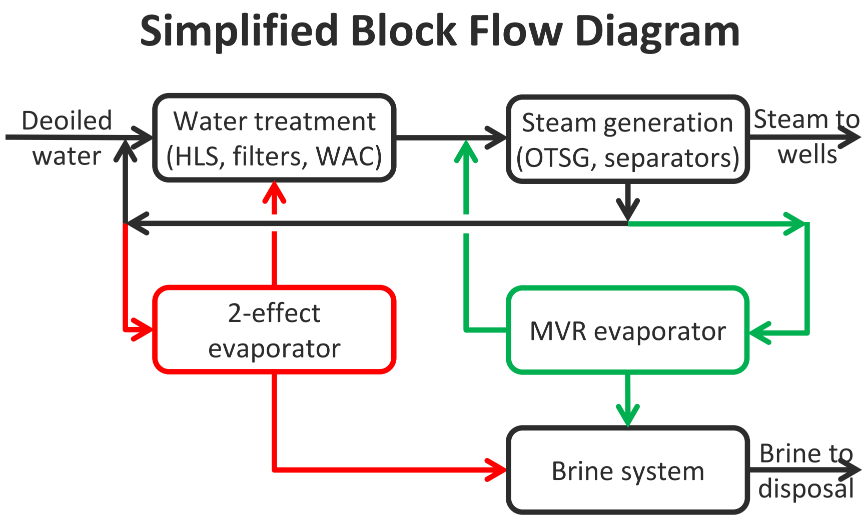
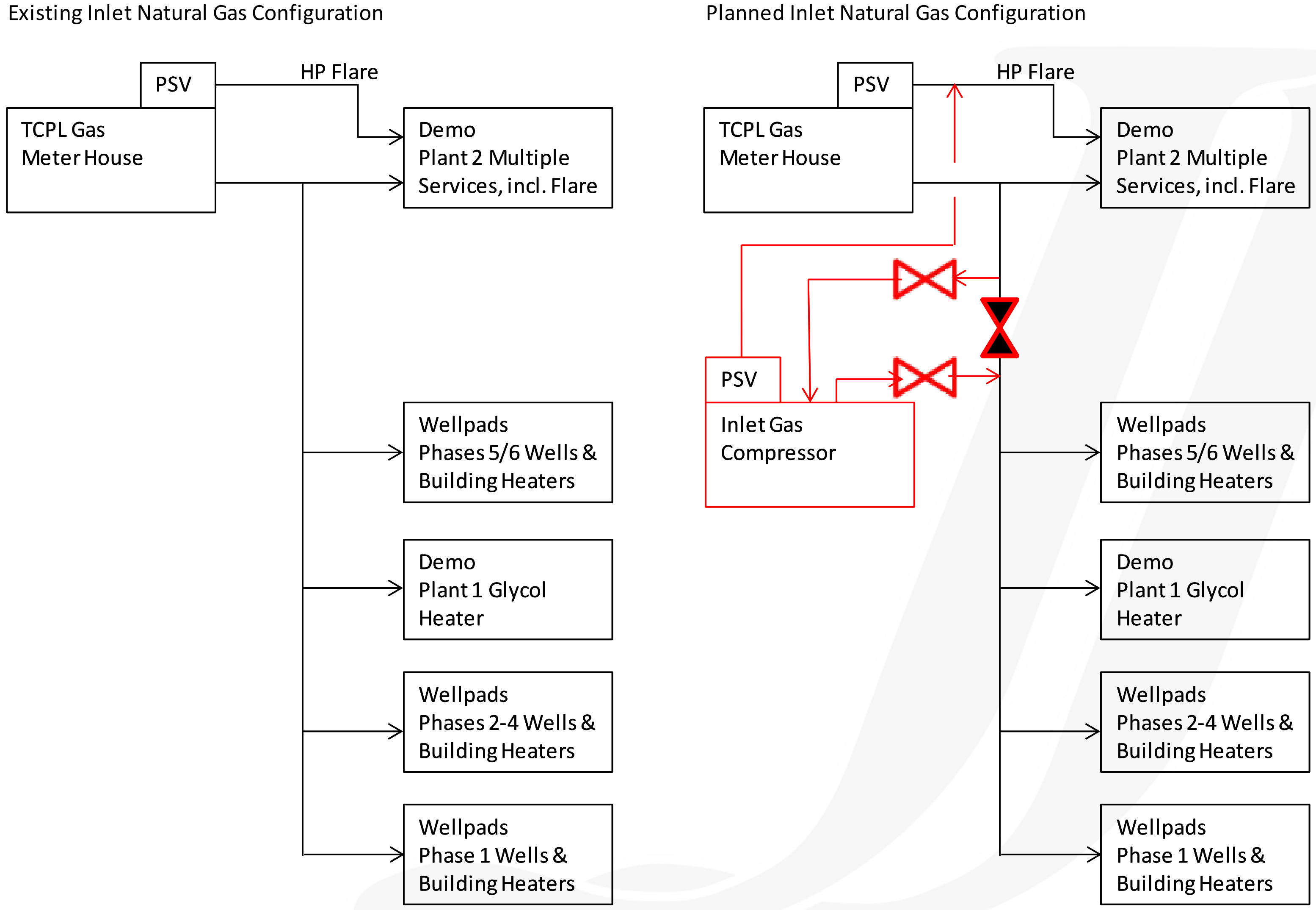
Mechanical Vapor Recompression Evaporator

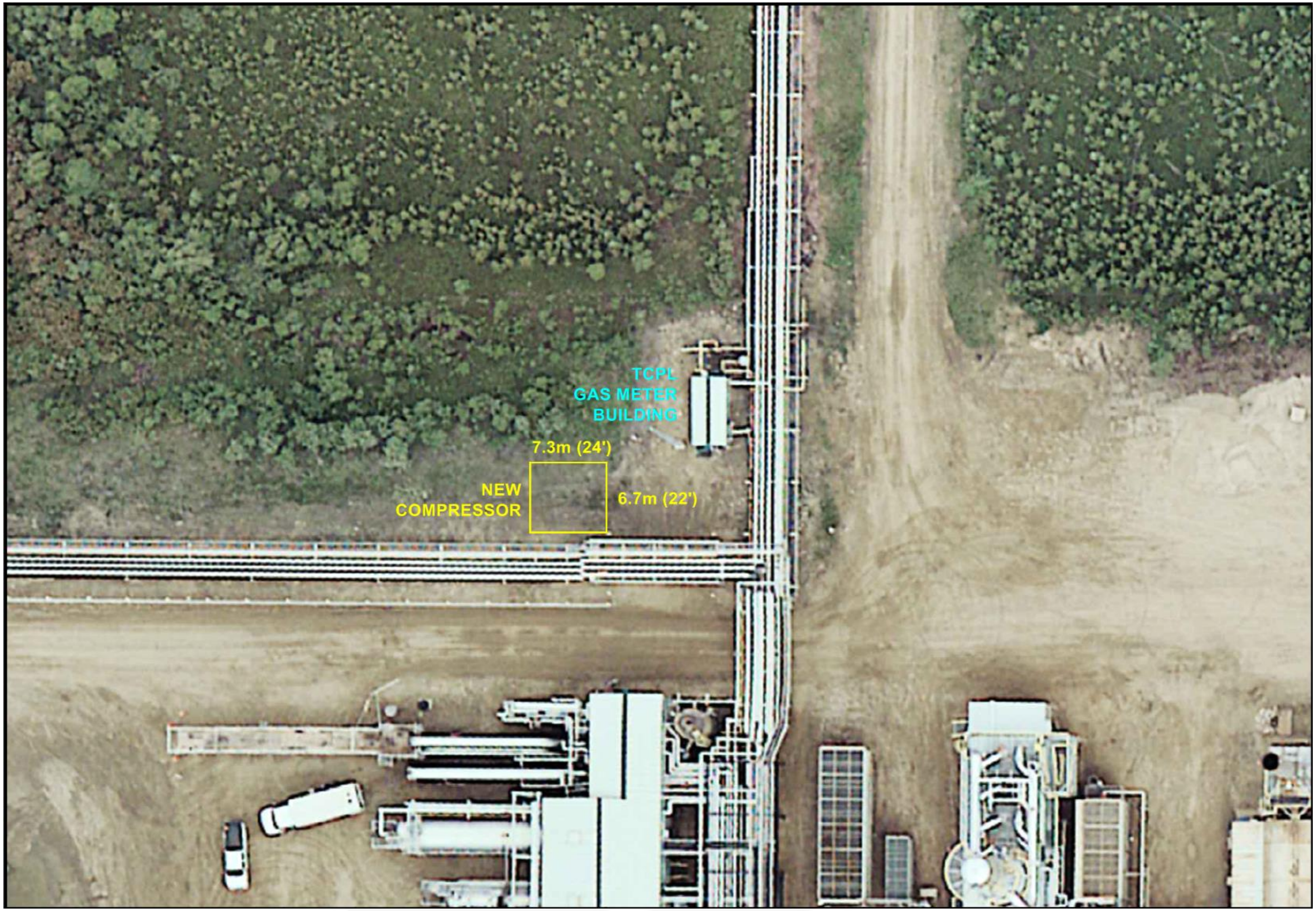


- Fall 2016 turn-around avoided
- MVR Evaporator start-up July, 2015
- Heat and water recovery improved
- Improved water quality
- Chemical savings on water treatment
- Gas savings on steam generation
- Increased electrical cost

New Inlet Fuel Gas Compressor



New Inlet Compressor Location



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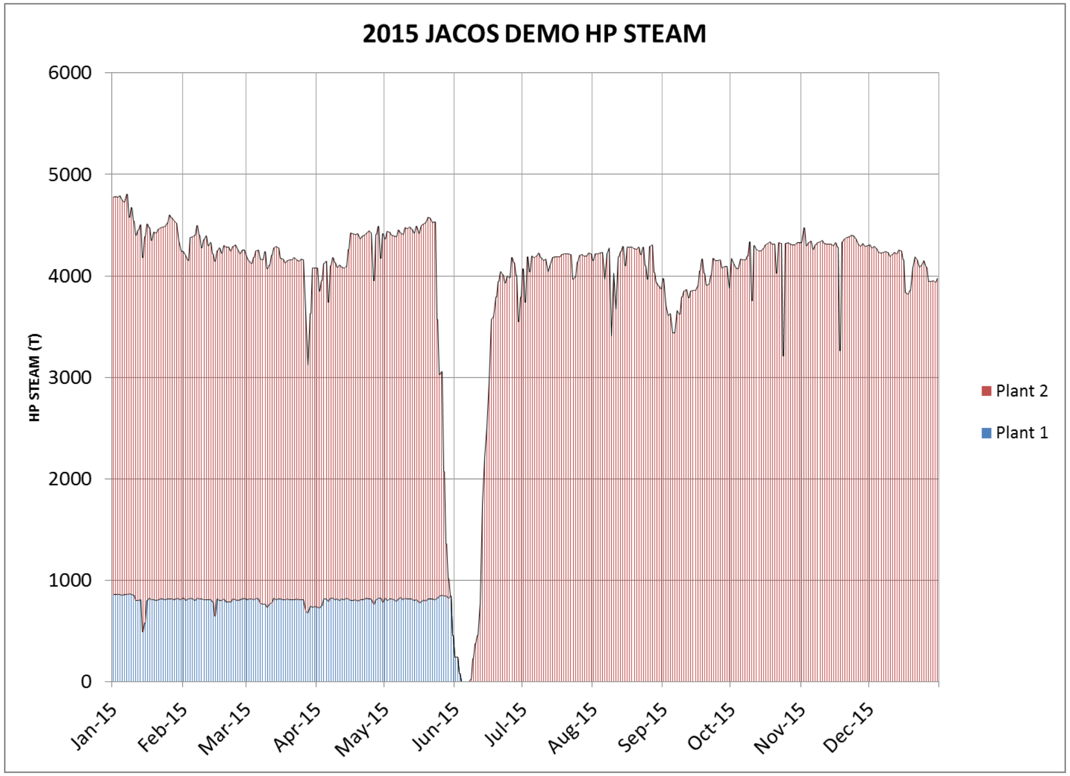
Facility Performance

Plant 1 – Shutdown June 2015

- Why Plant 1 is Shutdown?
  - Demo Steam Requirements Decreasing
  - New MVR Evaporator shifted Water Treating to Plant 2
- Plant 1 Components Still Operating:
  - Brine Disposal (historically used for both Plant 1 and 2)
  - Glycol (Utility) Boiler – hope to shut down before winter 2016/17
  - All Secondary Containment monitoring programs remain in effect
- Decommissioning and Clean-Out is ongoing

Facility Performance – 2015 Service Factor



2015 Service Factor – 94%

- Operations interruptions are described in two categories
- Planned Plant Turnarounds
  - Major – May-June 2015
    - Vessel inspections, PSV maintenance, process equipment cleaning, meter calibration/checks, boiler pigging, various repairs
    - TCPL tie-in
- Contributed ~5% of downtime
- Transportation/Utility Restrictions
  - Limitations in the following
    - Markets
    - Road access
    - Rail limitation
- Contributed <1% of downtime

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Steam Generation 2015

- Plant 1
  - B-201A/B – 50 MMBtu/h Boilers
- Plant 2
  - B510/520 – 180 MMBtu/h Boilers
  - B540 – 50 MMBtu/h Boiler

2015	Steam Volume (m^3)			Steam Quality	
	Plant 1	Plant 2	Total	Plant 1	Plant 2
January	25,120	115,421	140,541	74%	75%
February	22,503	97,604	120,106	74%	75%
March	24,452	102,757	127,209	73%	75%
April	24,098	102,445	126,543	74%	75%
May	24,984	93,056	118,040	74%	75%
June	578	65,822	66,400	70%	74%
July	0	128,638	128,638	-	74%
August	0	127,957	127,957	-	75%
September	0	116,674	116,674	-	75%
October	0	130,220	130,220	-	75%
November	0	128,902	128,902	-	76%
December	0	127,925	127,925	-	76%
Total	121,734	1,337,422	1,459,156	74%	75%
Daily Average	334	3,664	3,998		
Design Capacity	1,206	6,009	7,215	80%	80%

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Power & Energy Intensity 2015

Power (kWh&MW) & Intensity [Natural Gas (m^3 & GJ)/Bitumen (m^3)]

2015	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	2,491,929	3.3	9,376	28,169	333	40.24	13.4
Feb	2,229,354	3.3	7,950	24,529	324	40.16	13.0
Mar	2,413,174	3.2	8,344	26,647	313	40.16	12.6
Apr	2,272,495	3.2	8,286	25,910	320	40.09	12.8
May	2,200,150	3.0	7,598	23,931	317	39.64	12.6
Jun	1,573,422	2.2	4,597	13,460	342	40.44	13.8
Jul	2,192,045	2.9	8,277	27,636	299	40.70	12.2
Aug	2,799,181	3.8	8,487	27,603	307	40.61	12.5
Sep	2,737,752	3.8	7,554	24,826	304	40.38	12.3
Oct	2,974,704	4.0	8,382	27,508	305	40.42	12.3
Nov	2,993,592	4.2	8,234	27,858	296	40.42	11.9
Dec	3,038,018	4.1	8,104	28,299	286	40.32	11.5
TOTAL	**29,915,816**	**3.4**	**95,189**	**306,373**	**311**	**40.30**	**12.5**

* - Total natural gas to plant

** - Using monthly nat gas heating values

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Natural/Produced Gas Summary 2015

(e^3m^3)	Purchased Gas	Produced Gas	Flared Gas	Produced Gas Recovery
January	9,376	346.1	30.4	91.2%
February	7,950	309.8	23.9	92.3%
March	8,344	366.5	25.4	93.1%
April	8,286	300.3	14.1	95.3%
May	7,598	280.1	21.1	92.5%
June	4,597	163.3	7.6	95.3%
July	8,277	376.0	4.1	98.9%
August	8,487	295.1	9.8	96.7%
September	7,554	266.0	1.7	99.4%
October	8,382	335.5	3.4	99.0%
November	8,234	350.5	1.4	99.6%
December	8,104	398.8	0.2	99.9%
TOTAL	95,189	3,788	143	96.2%

Measurement & Reporting

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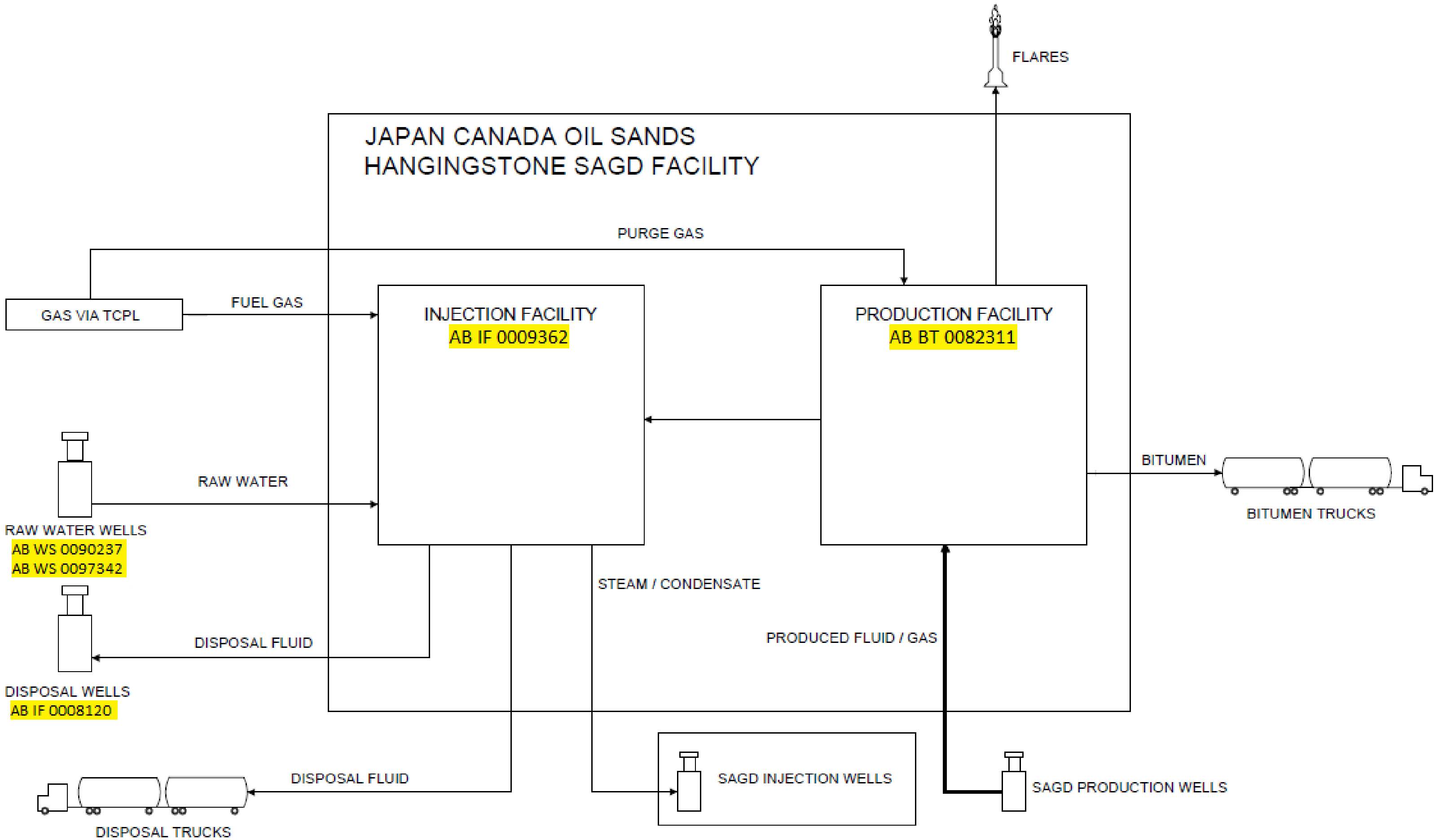
Facility Codes



Production / Injection

N/C from 2014 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

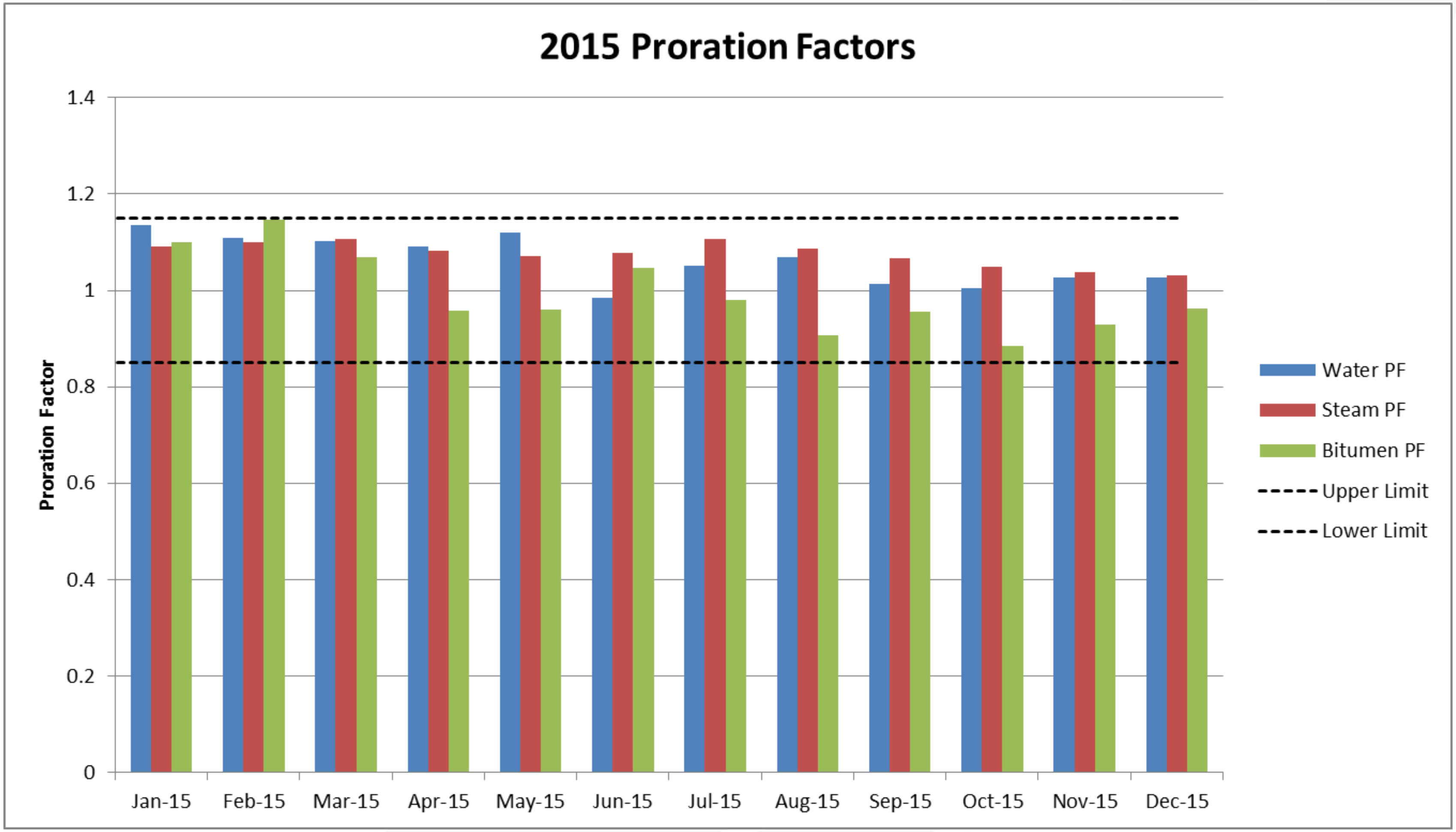
Proration Factor Method

N/C from 2014 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 2015 proration factor for bitumen was 0.992, steam was 1.075, and water was 1.061



Water Balance

The chart below summarizes the water balance for 2015

(m^3)	IN			OUT							(ABS) Δ(%)
	Produced Water	Raw Water	Total	Steam to Wells	Disposal to Wells	Disposal to Truck out	Utility Water Out	Evaporation	HE Water	Total	
January	132,372	22,967	155,339	140,266	2,631	0	24	5,376	3,208	151,505	2.5%
February	113,150	16,885	130,035	119,859	2,110	0	24	4,914	1,149	128,056	1.5%
March	123,108	14,713	137,821	126,935	2,322	0	30	5,270	646	135,203	1.9%
April	121,208	17,197	138,405	126,277	2,190	0	25	5,046	1,257	134,795	2.6%
May	114,967	14,145	129,112	117,767	2,083	0	34	4,340	970	125,194	3.0%
June	59,666	10,157	69,823	65,500	968	40	30	2,520	914	69,971	0.2%
July	124,925	7,000	131,926	128,365	2,120	40	16	4,757	1,218	136,516	3.5%
August	124,006	6,892	130,898	127,684	2,126	40	28	3,168	775	133,821	2.2%
September	108,165	10,552	118,716	116,411	1,971	0	28	2,351	180	120,940	1.9%
October	122,953	8,493	131,446	129,948	2,077	0	29	2,589	456	135,098	2.8%
November	123,667	7,097	130,764	128,639	2,179	0	28	2,296	222	133,364	2.0%
December	123,411	6,365	129,776	127,653	2,129	0	29	2,054	151	132,016	1.7%
Total	1,391,599	142,463	1,534,062	1,455,303	24,905	120	325	44,681	11,145	1,536,479	0.2%

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Optimization of Test Duration

N/C from 2014 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

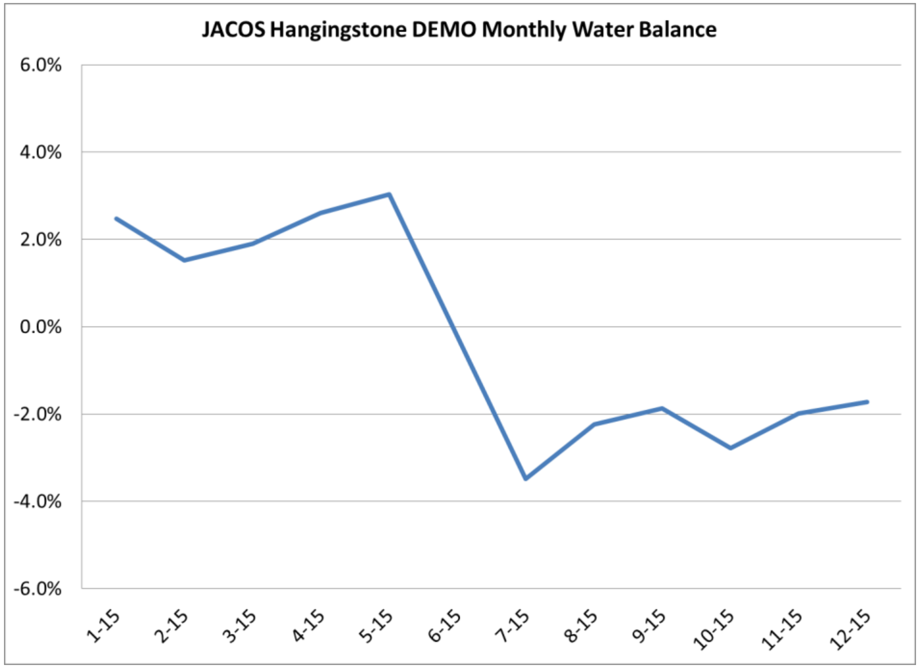
MARP Updates 2015

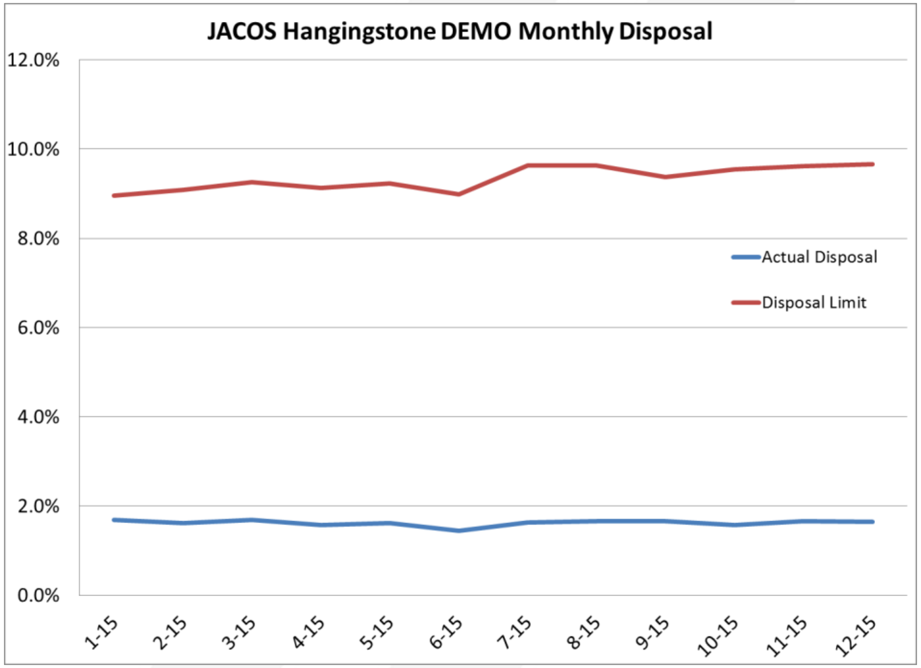
- New to JACOS 2015 MARP
  - General updates associated with Plant 1 shutdown
  - Update of flow diagrams
  - Inactive meters highlighted in meter list
  - Evaporation calculation/diagram updates

- MVR Evaporator updates
  - Updated flow diagrams
  - Evaporation calculation/diagram updates

Directive 81 – Water Disposal Limits

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





Water

Water Sources and Uses

Wells

DQ02-2, DQ06-7:

Loc: SE 11-084-11W4M
WA Licence: 00229371-02-00
Aquifer: Muriel Lake Formation

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

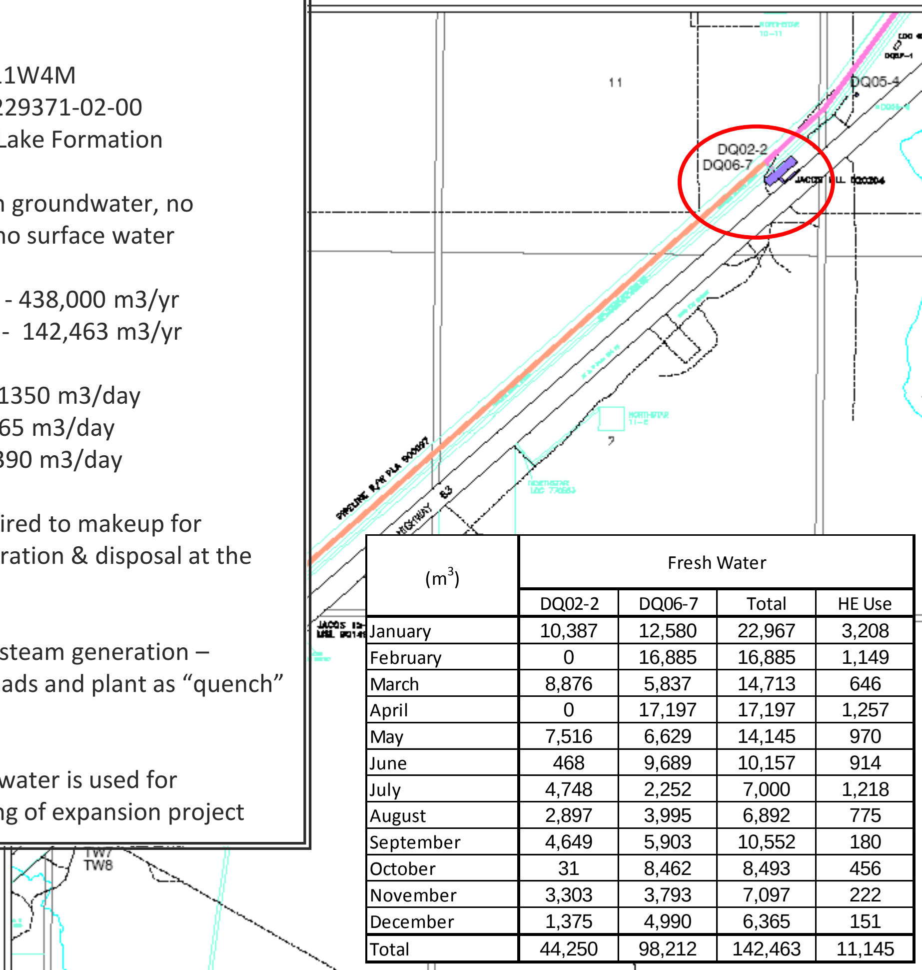
Licensed withdrawal - 438,000 m3/yr
2015 withdrawal - 142,463 m3/yr

Max pumping rate - 1350 m3/day
2015 max day - 865 m3/day
2015 average - 390 m3/day

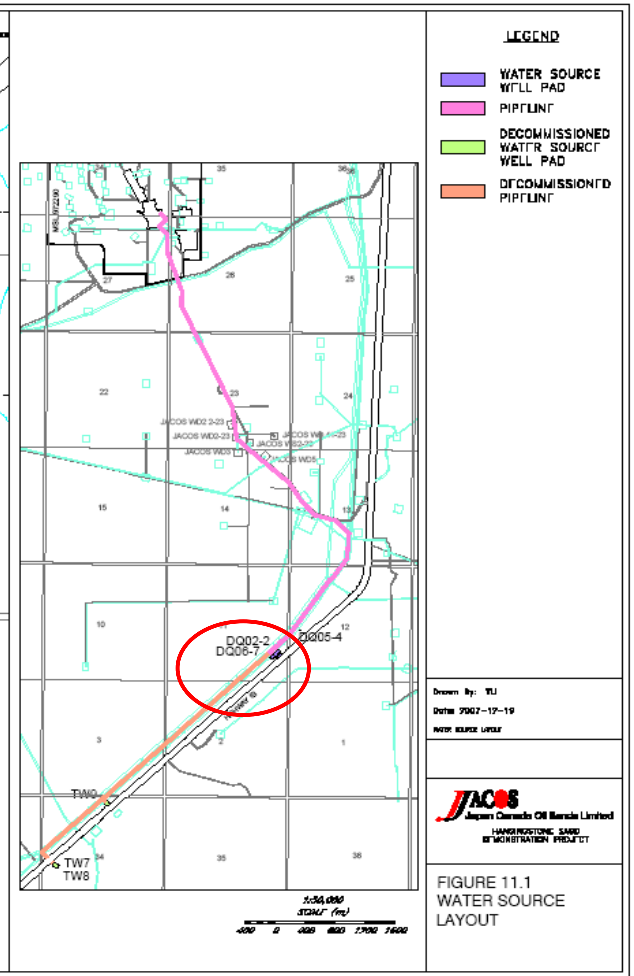
Source water is required to makeup for reservoir loss, evaporation & disposal at the demo.

All makeup used for steam generation – introduced at wellheads and plant as "quench" water

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



(m^3)	Fresh Water			
	DQ02-2	DQ06-7	Total	HE Use
January	10,387	12,580	22,967	3,208
February	0	16,885	16,885	1,149
March	8,876	5,837	14,713	646
April	0	17,197	17,197	1,257
May	7,516	6,629	14,145	970
June	468	9,689	10,157	914
July	4,748	2,252	7,000	1,218
August	2,897	3,995	6,892	775
September	4,649	5,903	10,552	180
October	31	8,462	8,493	456
November	3,303	3,793	7,097	222
December	1,375	4,990	6,365	151
Total	44,250	98,212	142,463	11,145



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Disposal Limit and Actual

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

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

	Produced Water (m^3)	Fresh Water (m^3)	Disposal Limit, %	Disposal (m^3)	Brine Trucked (m^3)	Disposal Actual, %
Jan-15	132372	22967	8.97%	2631	0	1.69%
Feb-15	113150	16885	9.09%	2110	0	1.62%
Mar-15	123108	14713	9.25%	2322	0	1.68%
Apr-15	121208	17197	9.13%	2190	0	1.58%
May-15	114967	14145	9.23%	2083	0	1.61%
Jun-15	59666	10157	8.98%	968	40	1.44%
Jul-15	124925	7000	9.63%	2120	40	1.64%
Aug-15	124006	6892	9.63%	2126	40	1.65%
Sep-15	108165	10552	9.38%	1971	0	1.66%
Oct-15	122953	8493	9.55%	2077	0	1.58%
Nov-15	123667	7097	9.62%	2179	0	1.67%
Dec-15	123411	6365	9.66%	2129	0	1.64%
Average	115967	11872	9.34%	2075	10	1.62%
Total	1391599	142463	9.35%	24905	120	1.63%

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

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Produced Water

- Produced Water Recycle = (Steam Injection – Fresh Water) / Produced Water
- Reservoir Loss = 1 – (Produced Water / Steam Injection)

(m^3)	Fresh Water to Demo	Produced Water Volume	Steam Injection Volume	Produced Water Recycle	Reservoir Loss
January	19,759	132,372	140,266	91%	5.6%
February	15,736	113,150	119,859	92%	5.6%
March	14,067	123,108	126,935	92%	3.0%
April	15,940	121,208	126,277	91%	4.0%
May	13,175	114,967	117,767	91%	2.4%
June	9,243	59,666	65,500	94%	8.9%
July	5,782	124,925	128,365	98%	2.7%
August	6,117	124,006	127,684	98%	2.9%
September	10,372	108,165	116,411	98%	7.1%
October	8,037	122,953	129,948	99%	5.4%
November	6,875	123,667	128,639	98%	3.9%
December	6,214	123,411	127,653	98%	3.3%
Total	**131,318**	**1,391,599**	**1,455,303**	**95%**	**4.4%**

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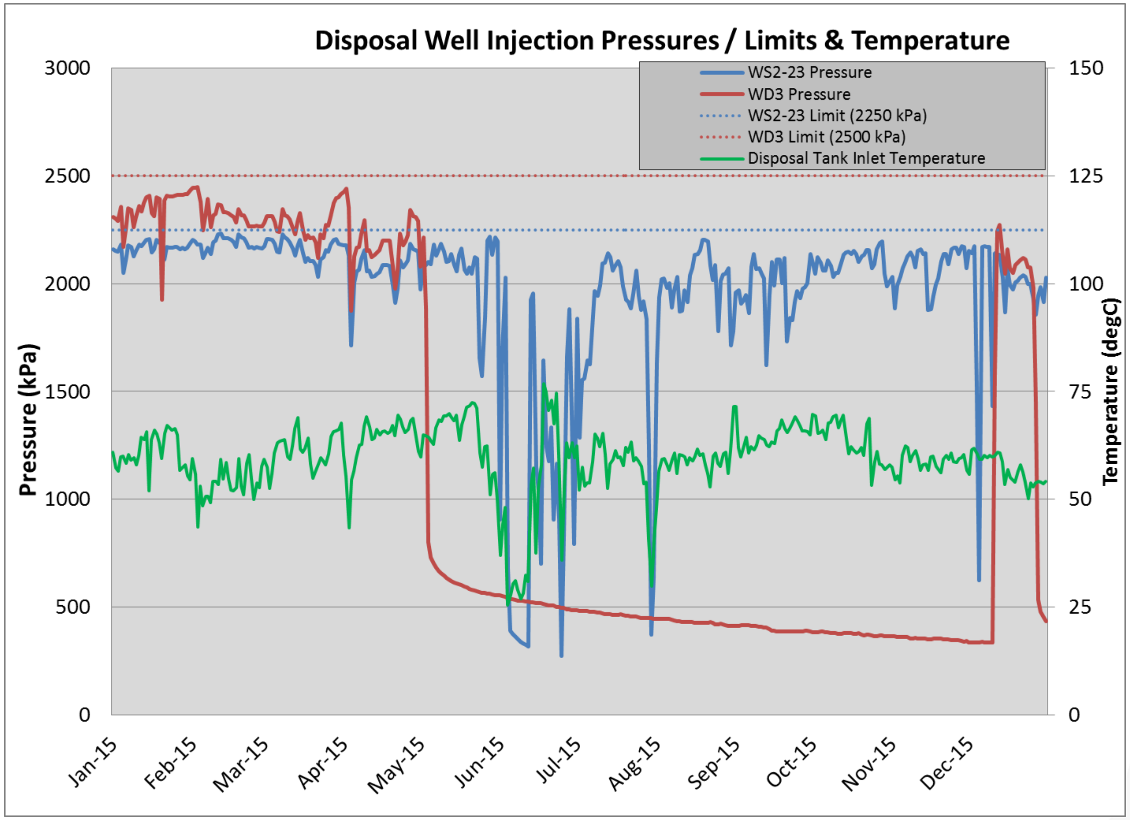
Waste Water Disposal 2015



JACOS CLASS 1b WELLS – McMurray Fm.

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	2015 Avg Rate (m^3/D)
WD-3	4
WS2-23	64
Total disposal to JACOS wells	69
Brine to offsite disposal well	0
TOTAL DISPOSAL	69

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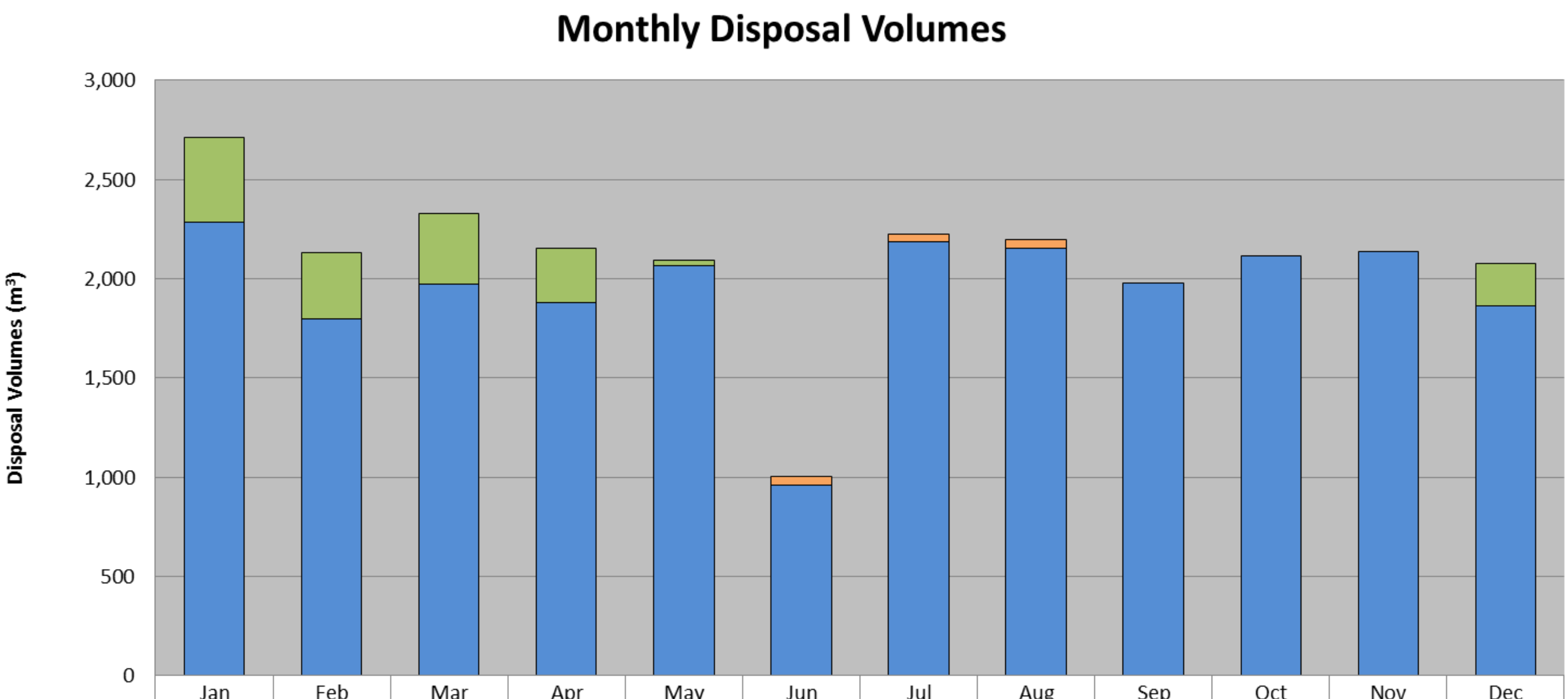
Waste Water Disposal Volumes 2015



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trucked Out	0	0	0	0	0	40	40	40	0	0	0	0
WD-3	424	330	359	275	27	0	0	0	0	0	0	215
WS2-23	2,286	1,798	1,970	1,879	2,066	961	2,184	2,155	1,976	2,114	2,137	1,863

Other Wastes

Solid Waste Disposal

Types of Solid Waste

- Lime Sludge
- Sand
- Spent filter media

SOLID WASTE DISPOSAL

12.5 tonne/day

Class II Oilfield Landfills:
Tervita Janvier SE-03-081-06W4M

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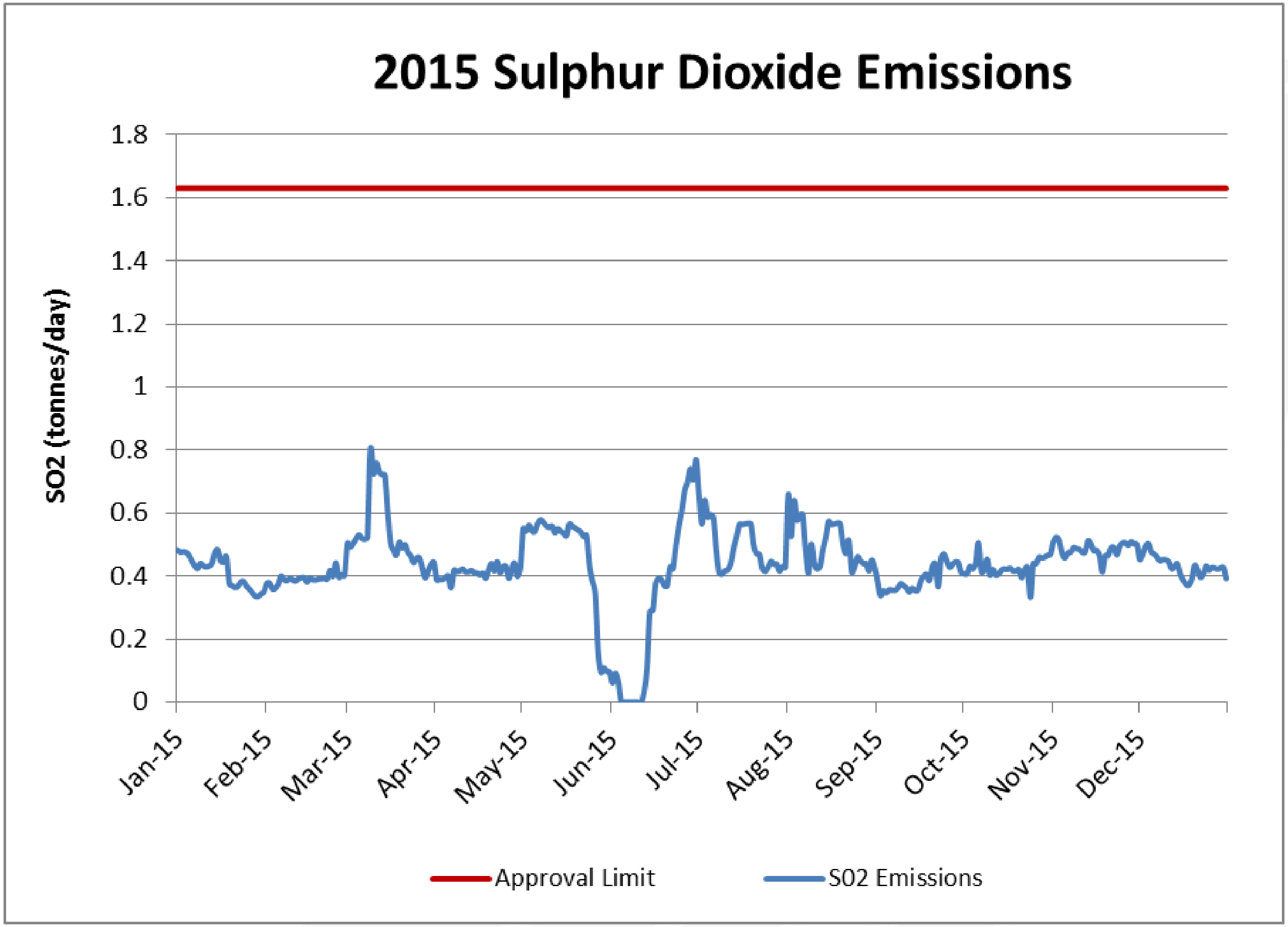
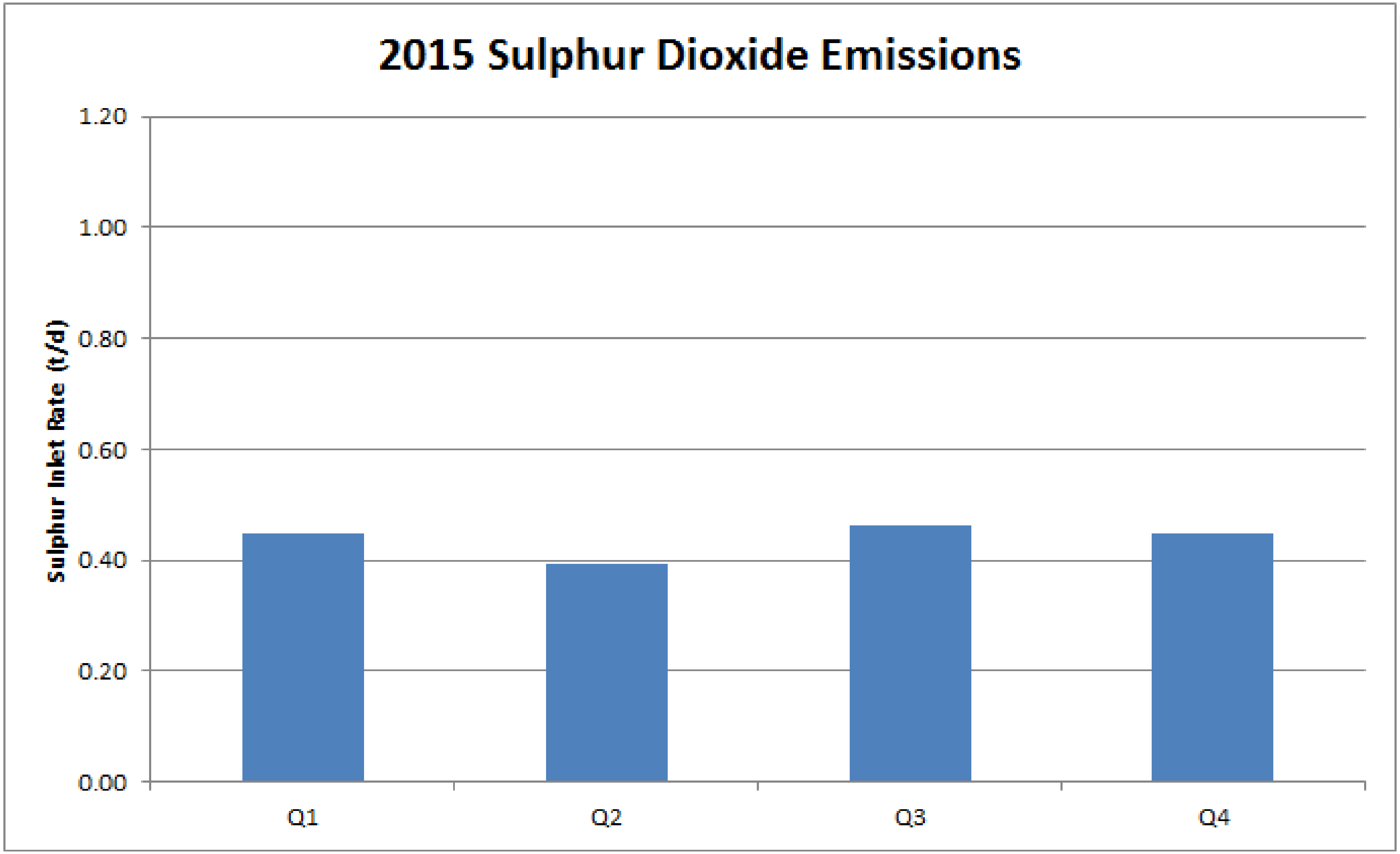
Sulphur Emissions

Sulphur Dioxide Emissions



Quarterly Sulphur Dioxide Emissions

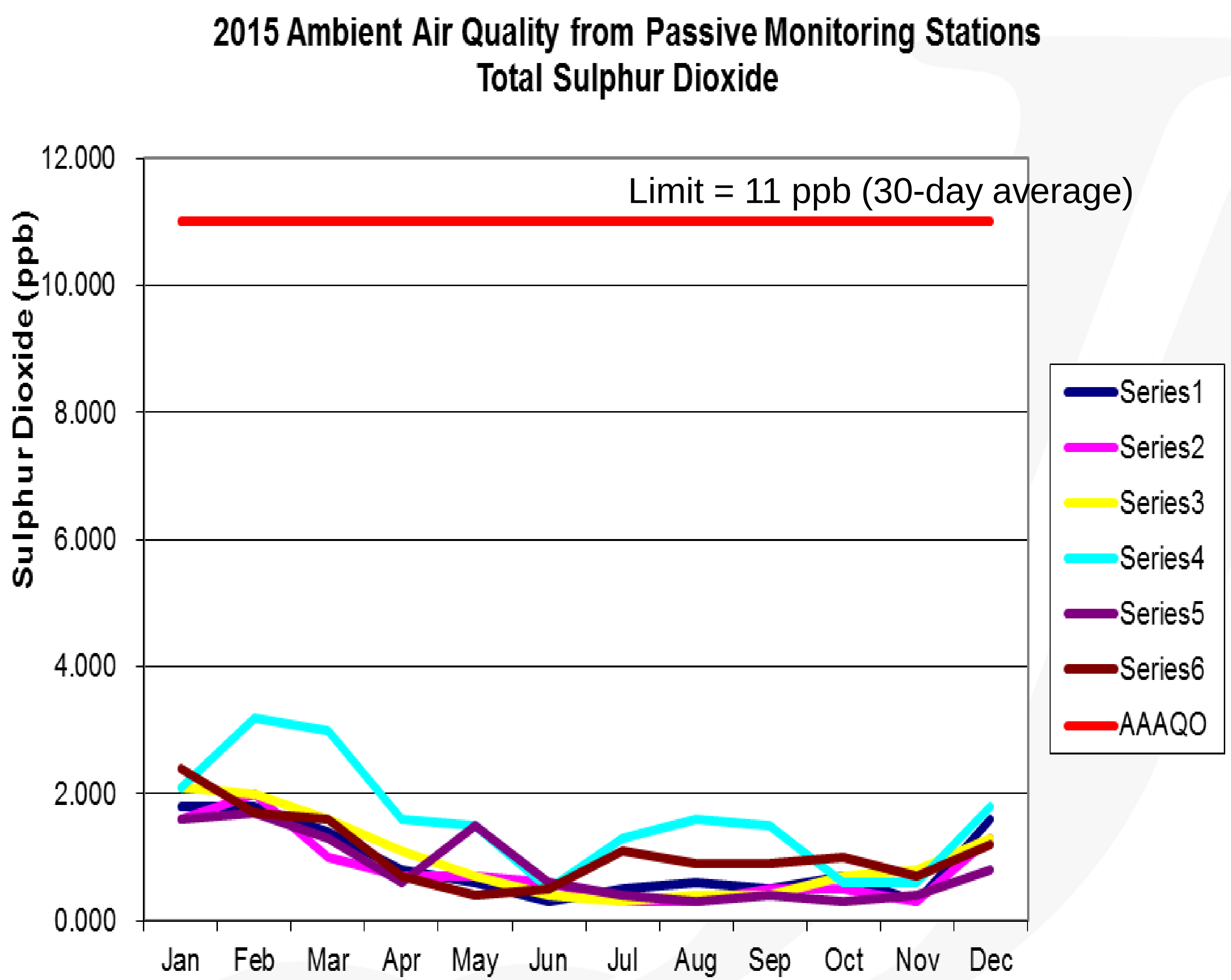


Environmental

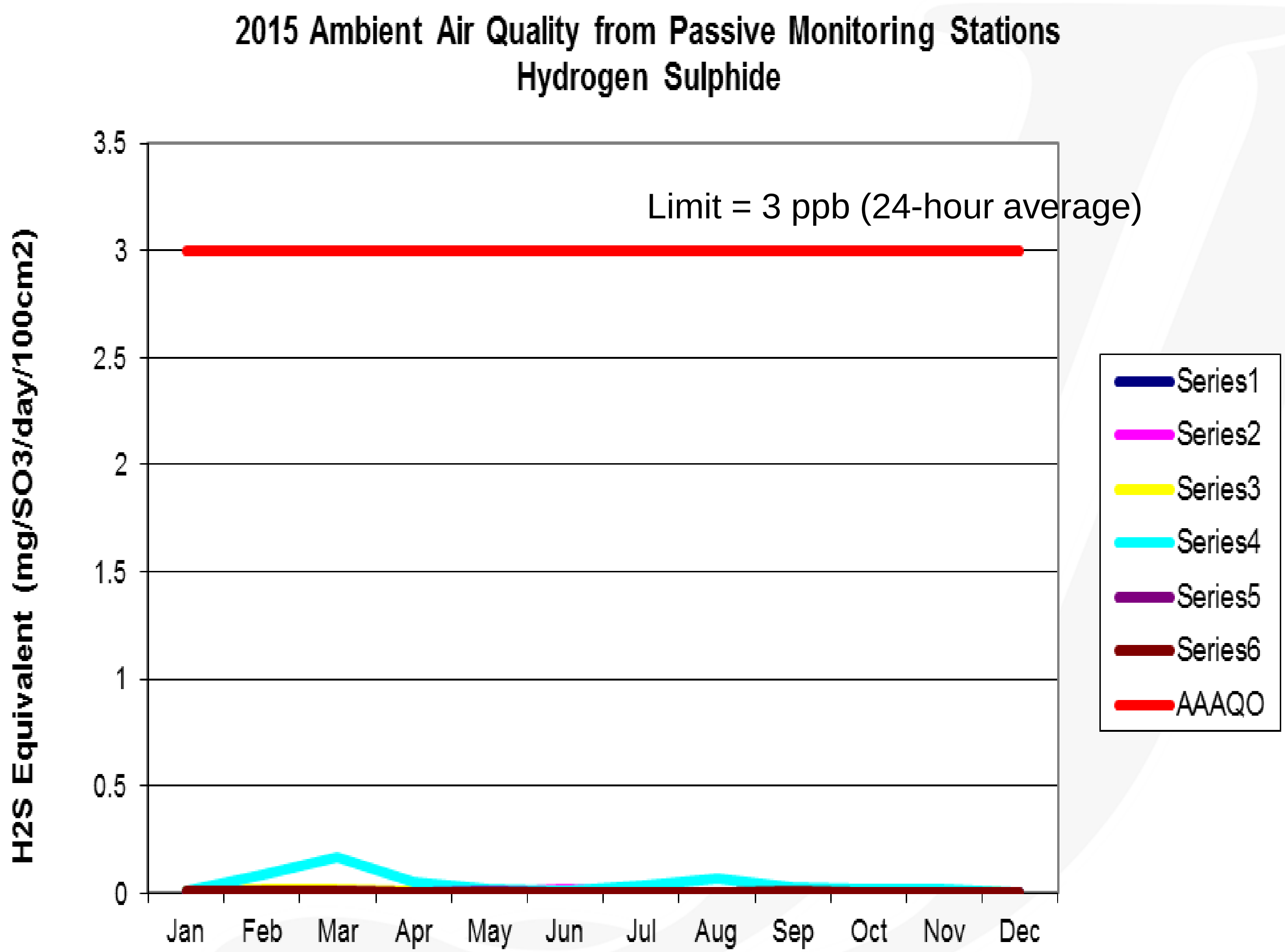
Environmental Monitoring Programs

- Active Ambient air monitoring program:
  - Data collected from January 1st to July 31st, 2015 (6 months in 2015) as per approval; in compliance with all AAAQO.
- Routine Annual monitoring programs:
  - Six passive ambient air monitoring stations collected SO_2 and H_2S data during 2015 – no exceedances were noted.
  - Groundwater - spring/fall sampling results were largely comparable to previous years. Increasing trends in parameters were still noted at ENV98-1A. A soil delineation program was undertaken in 2015 to investigate the exceedance.
  - Fugitive emission survey (LDAR) results were in compliance with CCME guidelines. Each year ongoing minor repairs continue to be made.
  - Water Use - report in draft; updates to AESRD Water Use Reporting registry ongoing.
  - Soil Management – from the previous Soil Monitoring Program, in 2015 mitigation measures were developed as part of the Soil Management Program.
  - Stack survey results were in alignment with previous years and in compliance with approved limits.
  - Heave Monument survey – annual work completed in Q1 of 2015.
  - Vegetation management – work undertaken throughout 2015
  - All other annual compliance initiatives completed were comparable with findings from previous years.

Ambient Air Quality 2015 – SO_2



Ambient Air Quality 2015 – H_2S



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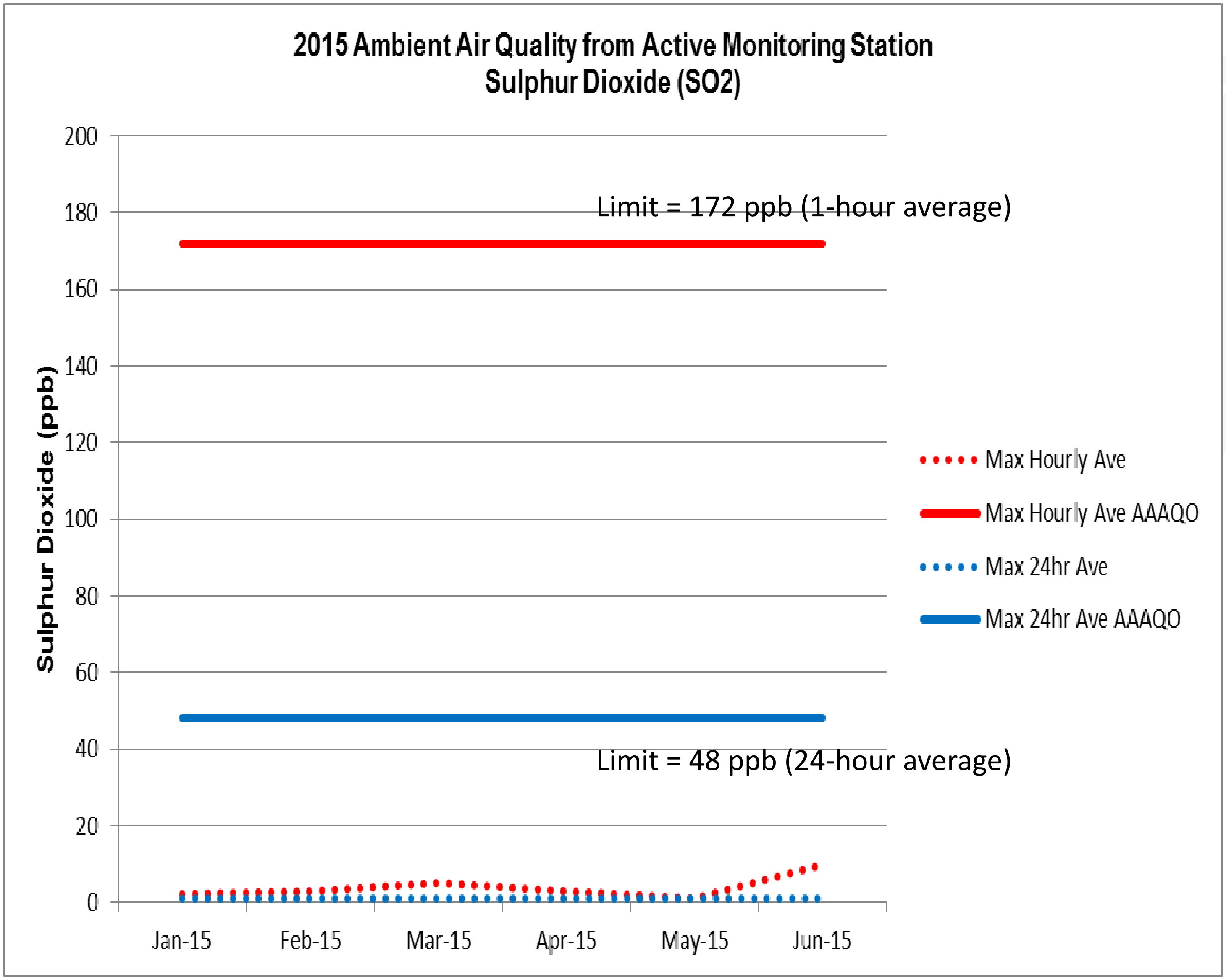
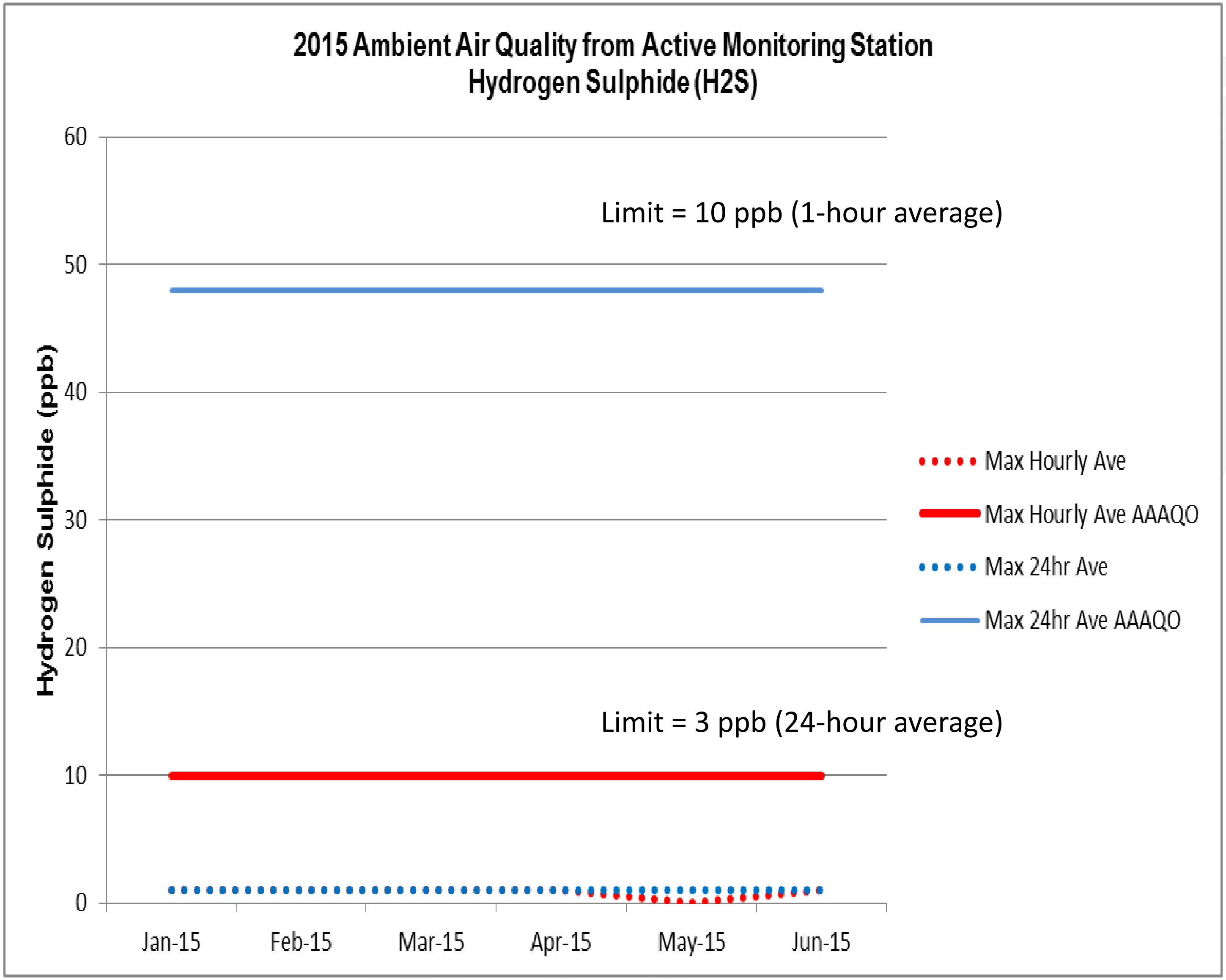
Ambient Air Quality 2015 – SO_2



Ambient Air Quality 2015 – H_2S



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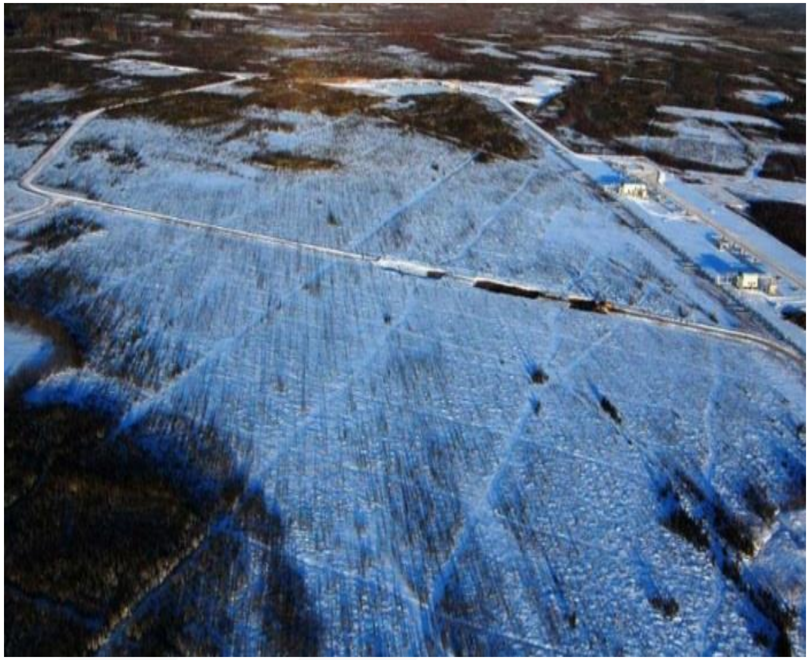
Regional Initiative Involvement

CAPP	CEMA
iFROG – COSIA JIP (wetland monitoring research group)	**JOSM/AEMERA**



Remediation and Reclamation Progress

- In 2015 remediation work continued on the 5 remaining OSE programs.
- Vegetation management continued at former remote sumps 16-14 and 14-21.
- A Supplemental Phase 2 ESA was conducted at 04-35-84-11
- The 2009 and 2010 OSE programs received reclamation certificates (34.77 ha)
- Remediation work was undertaken at three historical remote sumps, 03-27, 05-27, and 13-21-84-11. Drilling waste and contaminated material removed from sites.
- Throughout 2015 JACOS maintained its involvement in iFROG (COSIA-JIP)

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Compliance Statements & Approvals

Demo Compliance Statement

Approval Nos. 8788K

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

- AER Detailed Operational Inspection (ID 442672) completed August 24-26, 2015. Ongoing or Follow Up Items:
  - Plant 2 - Alternate storage approval received for lime slurry tank secondary containment system (TK-417)
  - Plant 2 – Proposed design for centrifuged sludge secondary containment upgrades presented to AER
  - Plant 2 - tank farm clay compaction testing completed and compliance with D55 confirmed
  - Plant 1 - process pond has been emptied of fluid. Remaining solids to be removed in spring 2016
  - Plant 1 – storage tank, piping and vessel emptying and cleaning work is progressing
  - Some minor D56 licensing issues are being resolved
- AER Pipeline Operations Inspection (IDs 445-598,601,603,660,684) completed December 15, 2015. All inspections ‘satisfactory’, with some follow up items:
  - Signage to be installed on new pipeline installations
  - Signage corrections to be done on existing pipeline watercourse crossing

HZII Wellhead Leak & Repair Status

FIS No. 291042

- October 19, 2014 - small volume steam leak was observed on injector well head.
- Steam injection immediately shut-in and wellhead gas blanketed.
  - Leak stopped.
- Due to discontinuation of wellhead components, repair was delayed.
- June 12, 2015 wellhead was frozen and repaired successfully.
  - No internal corrosion found.

Inactive Well Compliance Program (IWCP)

- JACOS was required to bring 20% (7 wells) of its IWCP wells into compliance by March 31, 2016.
- To date:
  - Ten (10) wells brought into compliance
  - JACOS has established a Well Compliance Working Group to manage compliance related to Directives 6, 13 and 20.

Greenhouse Gas Emissions & Regulatory Approval Limits

- SGER Compliance Report for 2014 submitted
- Restated baseline emission intensity and 2010 to 2014 reports after discovery of error that overstated emissions
- Received reimbursement for overpaid GHG credits for 2010 – 2013 in 2015.
- NPRI & Federal GHG reports for 2014 – submitted June 1, 2015

Regulatory/ Approval Limits

Parameter	Requirement	Actual
Solution Gas Recovery	> 90%	90.4%
SO_2 Emissions	< 1.63 T/d	0.46T/d
D81 Disposal Limit	< 9.04%	1.83%
Plant 2 B-520 NO_x	< 7.60 kg/hr	3.15 kg/hr

Future Plans

Potential Suspension of DEMO Operations

- Due to current economic conditions, DEMO operations is not economically feasible. If low prices continue for the foreseeable future, DEMO operations will be suspended in Q2 2016 and possibly restarted when economics are positive.
- Plant will be shut down and safely preserved.
- Wells will be shut-in and wellheads winterized.
- Reservoir maintenance (gas/steam injection) is being investigated to assist with re-start of SAGD well pairs.
- A shut-down surveillance and monitoring program will be established to ensure equipment and facilities are safe and the environment is protected.

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Discussion