CADOTTE CSS PILOT

Final Performance Presentation

June 13, 2016

Annual D054 Performance Presentation

Updated Presentation, July 18, 2016

MURPHY OIL CORPORATION

Agenda

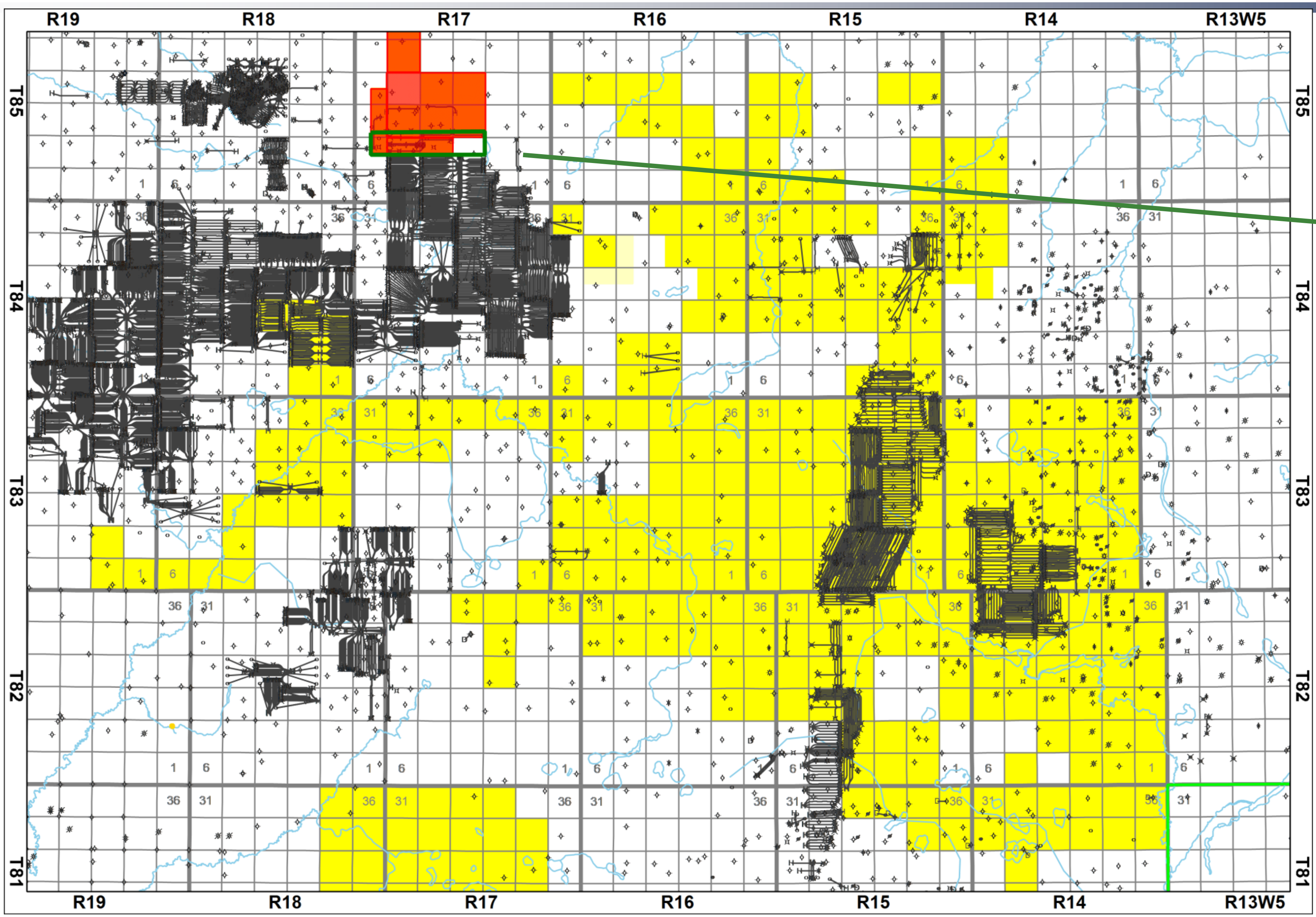
- **Subsurface**
- **Surface**
- **Future Plans**
- **Conclusions**

Subsurface

- **Background**
- **Geology**
- **Wells**
- **Performance**

Subsurface

- **Background**
- Geology
- Wells
- Performance



Datum: NAD27 Projection: Stereographic DLS Version AB: ATS 2.6, BC: PRB 2.0, SK: STS 2.5, MB: MLI07

Cadotte Pilot (085-17W5)

Well 1: S0/04-17
Well 2: 00/16-09
Well 3: 00/12-08
Well 4: 00/13-08
Well 5: 02/13-08

Cadotte Pilot
Murphy Acreage

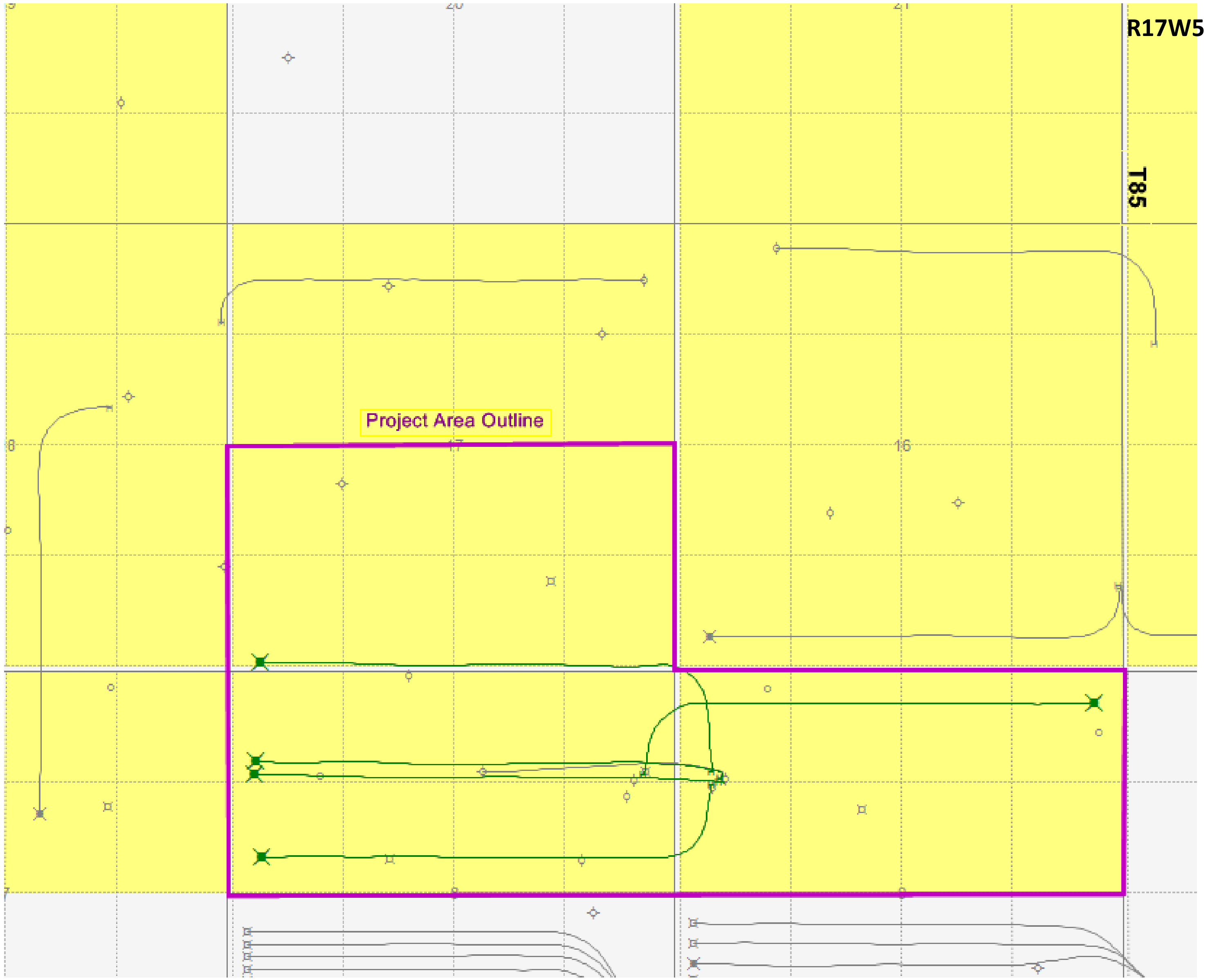
Cadotte CSS – History

- Intent - test the viability of HCSS in Cadotte with 3 Upper Bluesky wells and 2 Lower Bluesky wells
- First steam - May 2013
- 3 existing wellbores used – presented challenges
  - Cumulative oil production of 12,758 m^3 before first steam
  - Well placement not ideal – geology & reserves
  - Existing wellbores not ideal for thermal injection/production
    - 04-17 suspect mechanical damage or obstructions hindering steam conformance & build section not ideal for placement of reciprocating pump – severe doglegs which gave us production challenges
    - Wells drilled in lower perm (Upper Bluesky) which is not the ideal placement for thermal exploitation in this reservoir
- 2 new wells drilled into Lower Bluesky
  - Good permeability, no voidage prior to first steam, wells completed with thermal liners and casing, and build sections complete with tangents for rod pump configuration
- To-date 5 wells tested with two new wells in Lower Bluesky showing the most promise with good injectivity and high IP rates
- Steam generator – 7,320 kWh
  - 250m^3/day

Approvals History

Application Number		Project Summary	Approval Number		Approval Date	Expiry Date
AER	AESRD		AER	AESRD		
1685253	[redacted]	3 well CSS pilot	11778	-	16-Feb-12	N/A
1746800	[redacted]	increase steam slug size	11778A	-	14-Dec-12	N/A
[redacted]	001-322432	3 well CSS pilot	-	322432-00-00	5-Sep-13	31-Aug-23
1769634	[redacted]	increase steam inj. Pressure 12.4 Mpa	11778B	-	29-Nov-13	N/A
1781023	[redacted]	Added 2 wells	11778C	-	10-Jun-14	N/A

Map of Scheme



Horizontal CSS Design

- Inject ~80% quality steam at wellhead
- Injection rates upto 250 m^3/d cold water equivalent (CWE)
- Injection volume typically increases with successful cycles and mobilizes more oil farther into the reservoir
- Post injection - soak for 5 to 15 days to allow latent heat of vaporization from steam to deliver energy into reservoir (condensation)
- Post soak – produce until minimum temperature
  - ~40°C – Upper Bluesky (lower viscosity)
  - ~60°C – Lower Bluesky (higher viscosity)
- Repeat process

Cap rock integrity

- Mini frac test conducted on the Wilrich Shale in well 1-18-85-17W5
- Additional lab tests were conducted on the Wilrich Shale to measure its geomechanical properties
- Both sets of results were fed into an analytical model
- Results of this evaluation gave a conservative MOP of 12.4 MPa (bottom hole pressure)
- This ensures that operation remains within the shear and tensile strength limits of the overlying Wilrich Shale formation

Agenda

- Background
- **Geology**
- Wells
- Performance

Geology

i) Depositional Overview

ii) Type Log

iii) Seismic

iv) Top Bluesky Structure

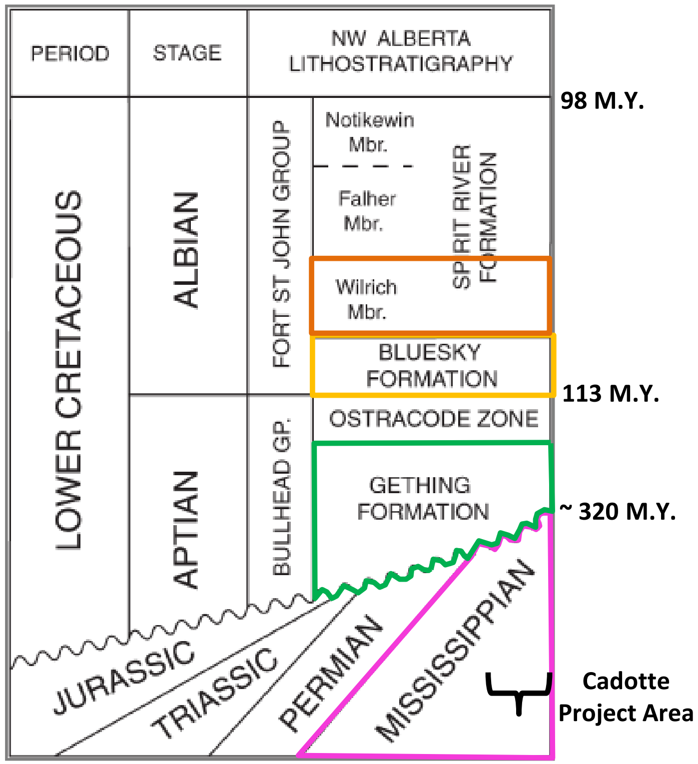
v) Base Bluesky Structure

vi) Structural Cross Section & Average Reservoir Parameters

vii) Bluesky Net Pay & OBIP

viii) Bluesky Mineralogy

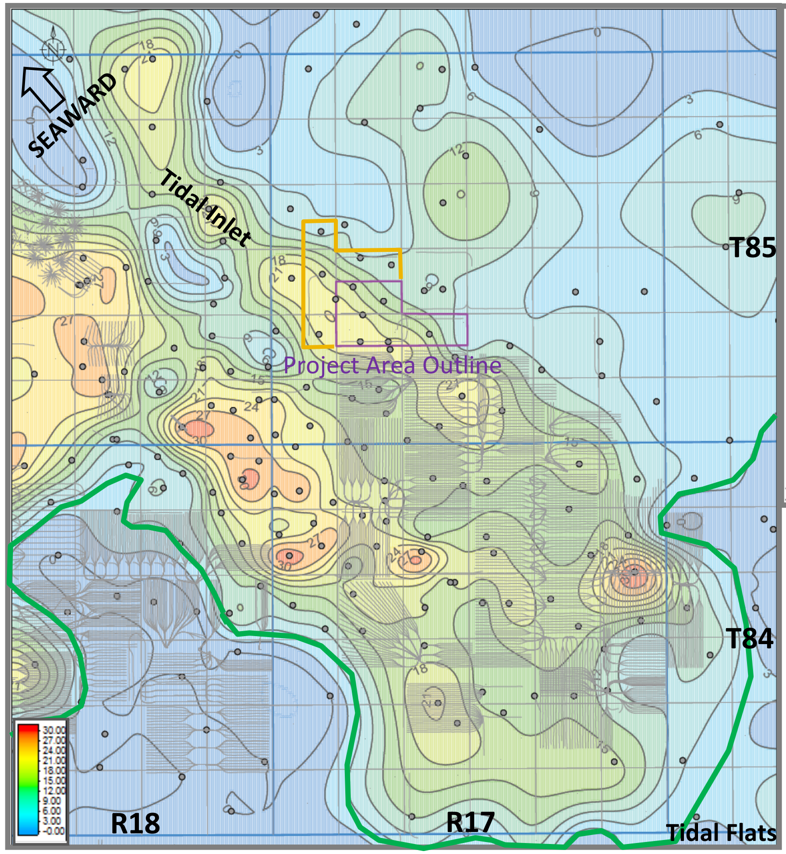
Geologic Time Scale



Slightly modified after Hubbard *et al.*2004

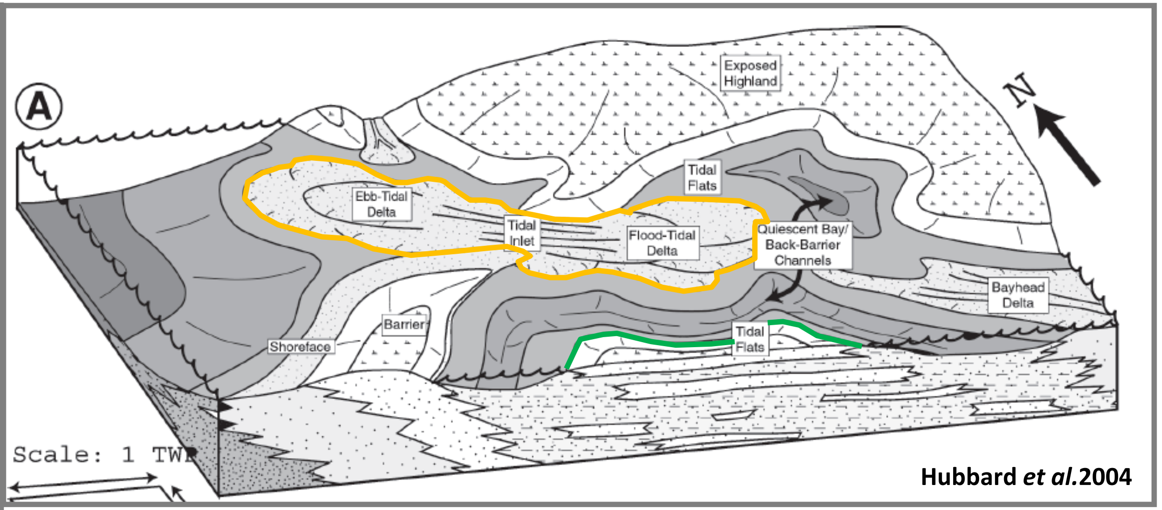
Depositional Overview

Regional Net Pay Map



Contour Interval 3 m

Block Model

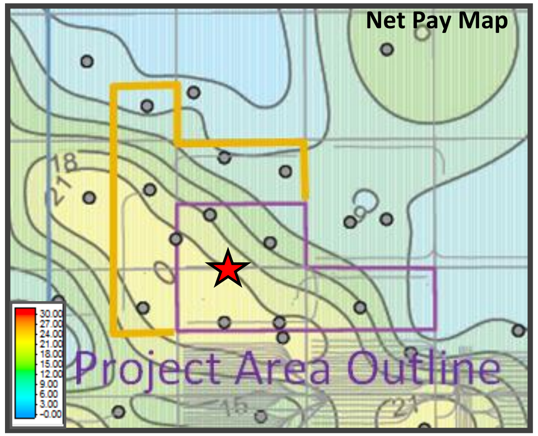


1. Mississippian low filled with Gething sand & mud (coastal plain material)
2. Sea level low-stand cuts valley and erodes Gething
3. Reworked sands deposited in to valley as Bluesky
4. Flood tidal delta and shallow water estuarine facies deposited (lower facies)
5. Tidal Inlet sediments deposited next in deeper water environment (upper facies)
6. Rapid sea level flooding event leads to capping by Wilrich shales

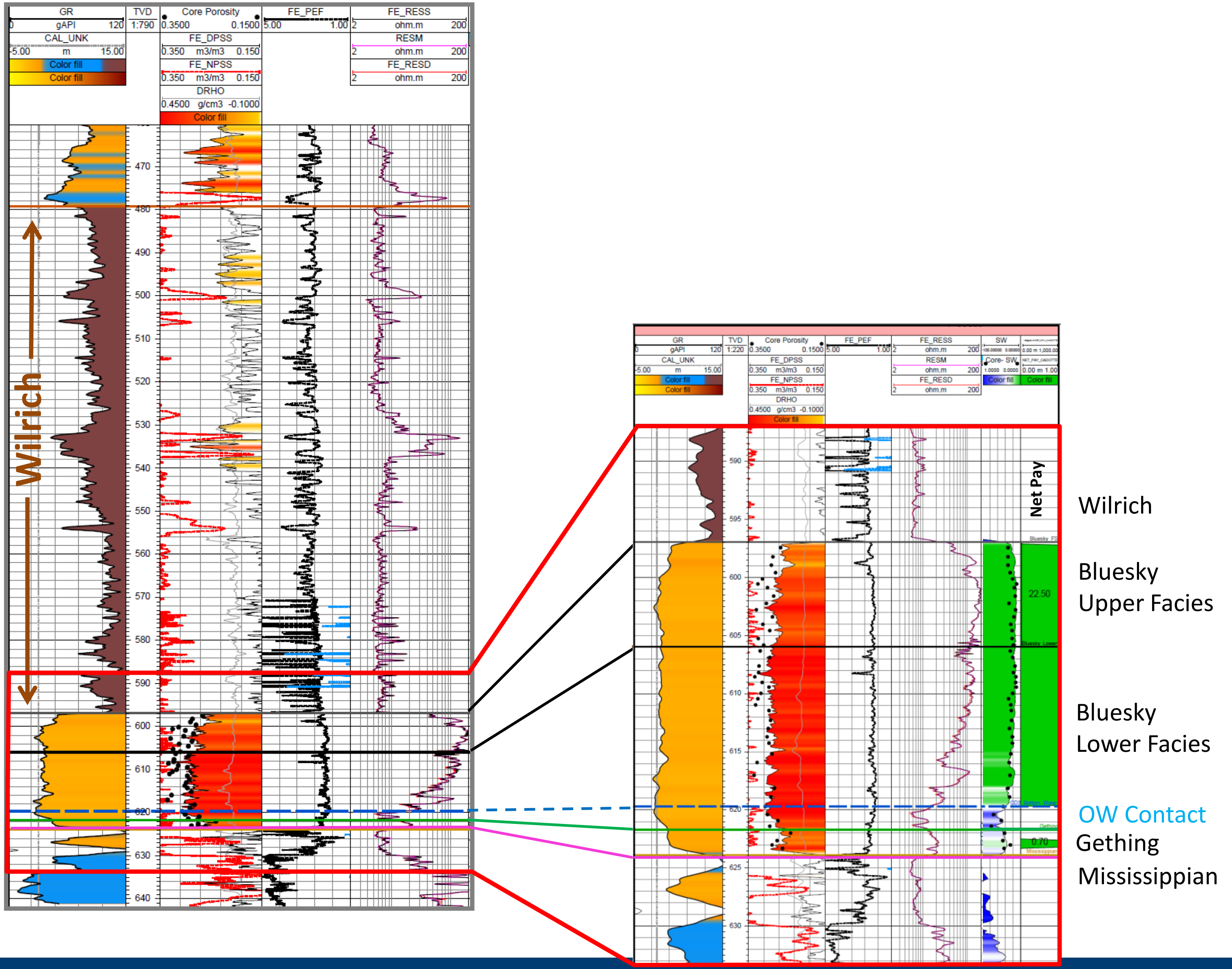
Cadotte type log

Net Pay Criteria

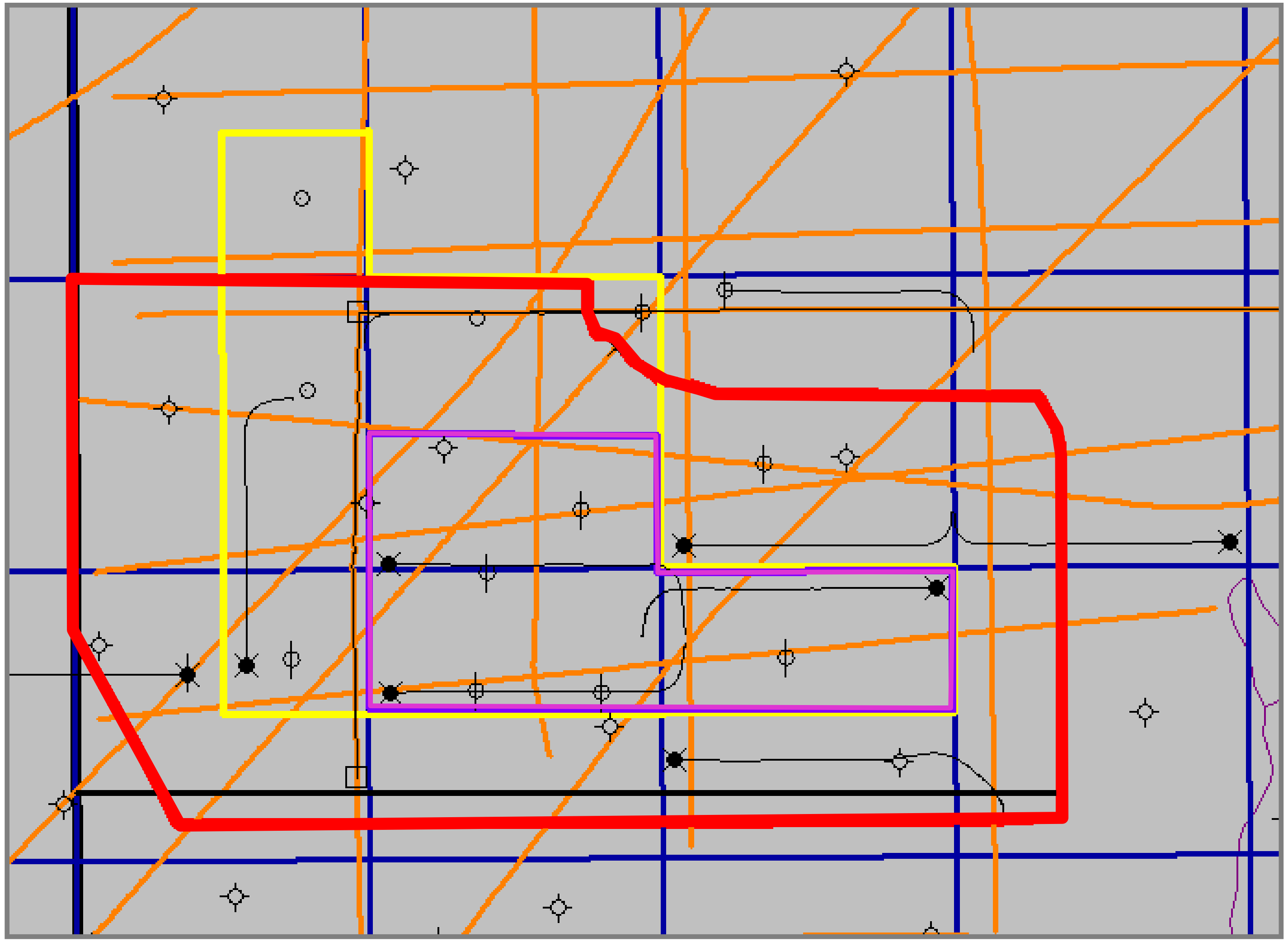
Gamma Ray < 65 API
Porosity > 22 %
Water Saturation (Archie) < 40 %
RW= 0.294



MURPHY CADOTTE 11-8-85-17

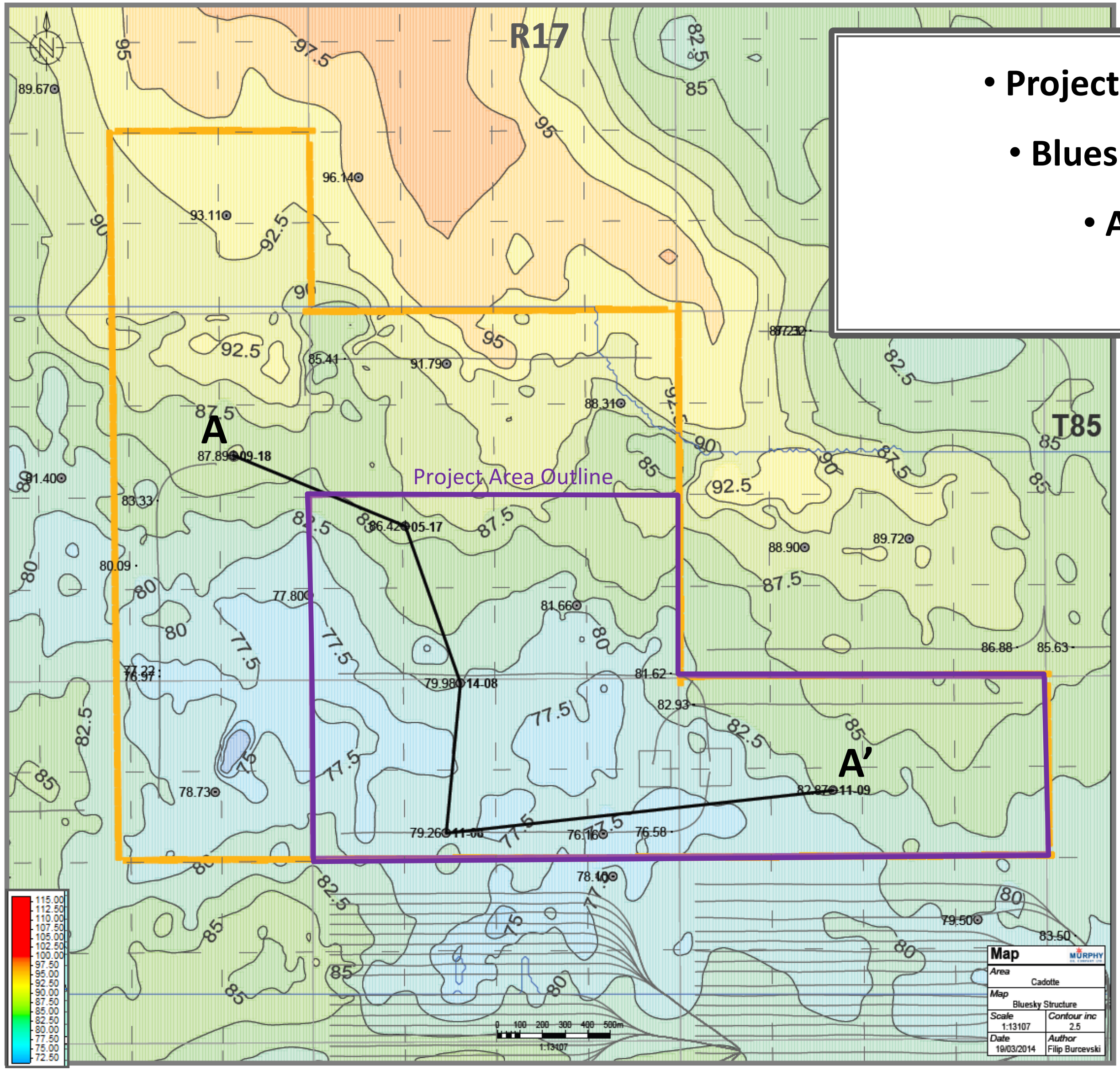


Seismic



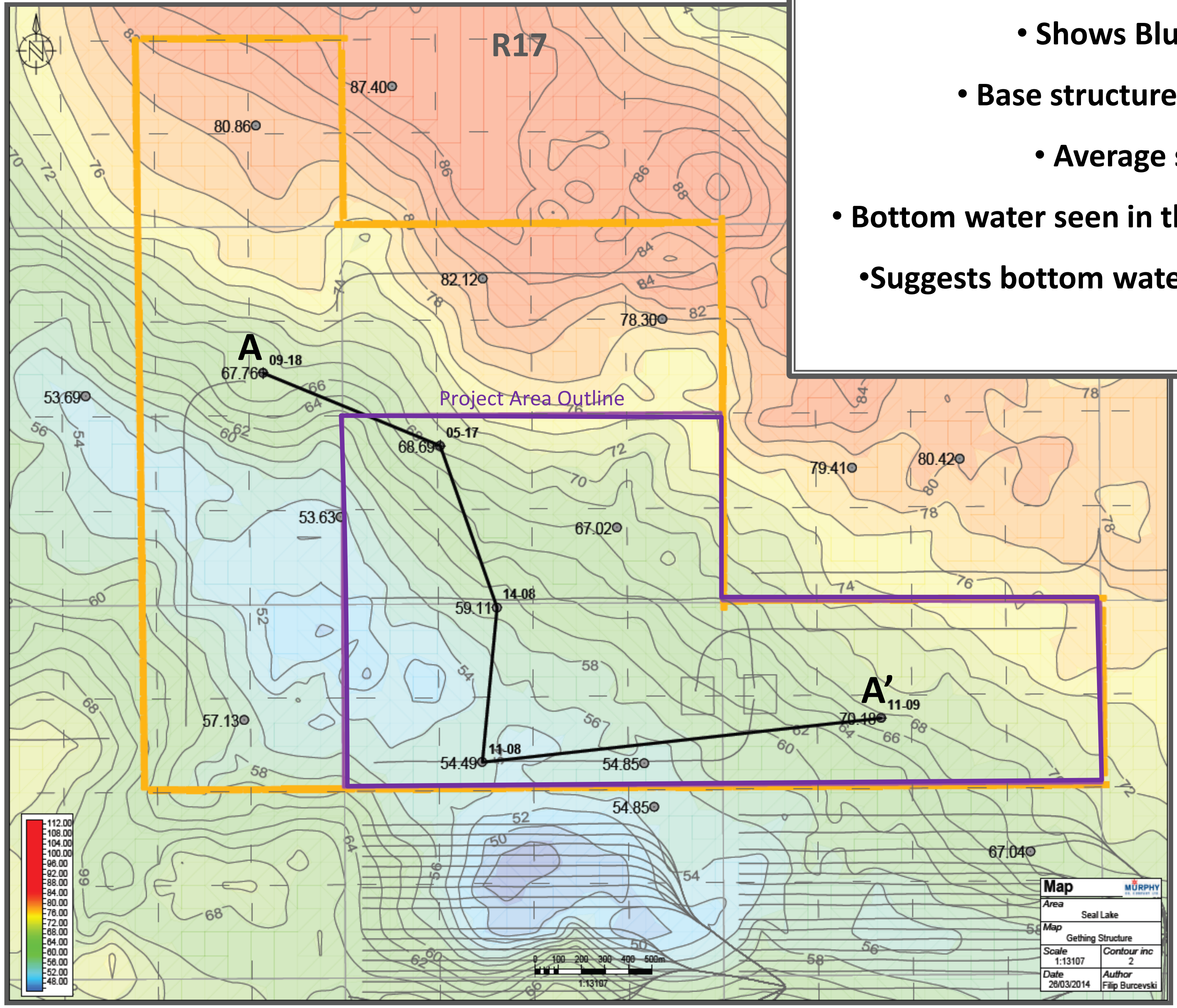
Legend
- 2D Seismic
- 3D Seismic Outline
- Murphy Acreage
- Project Area Outline

Top Bluesky Structure

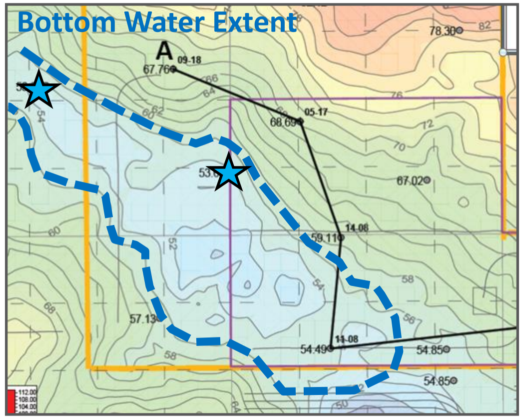


- Project area sits in relative structural low
- Bluesky elevation change is 10 meters
- Average structural dip is 0.4˚

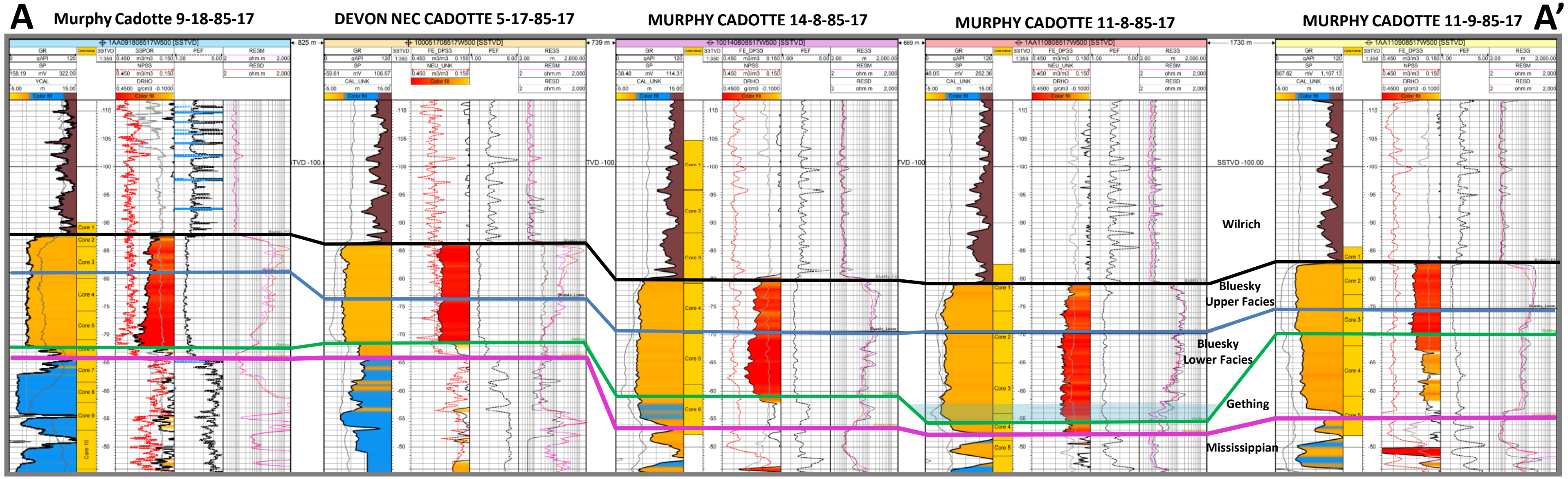
Base Bluesky Structure

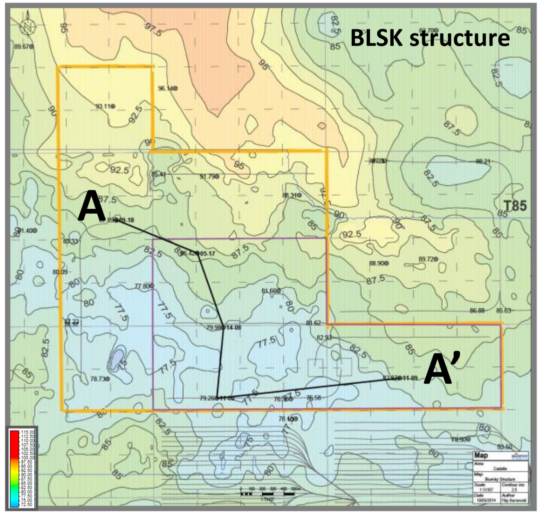


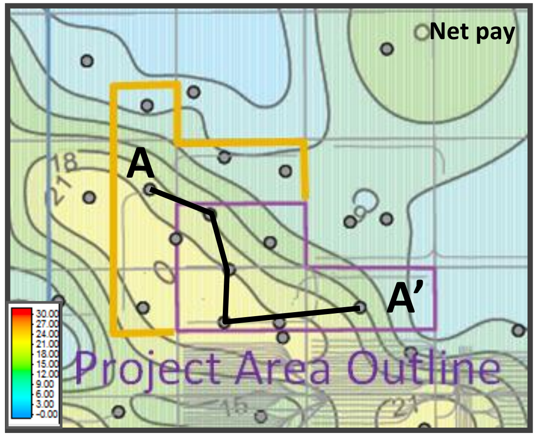
- Shows Bluesky accommodation
- Base structure elevation change of 24 m
- Average structural dip of 0.9˚
- Bottom water seen in three wells at similar subsea depths
- Suggests bottom water leg in deepest portion of valley



Structural Cross Section & Average Reservoir Parameters



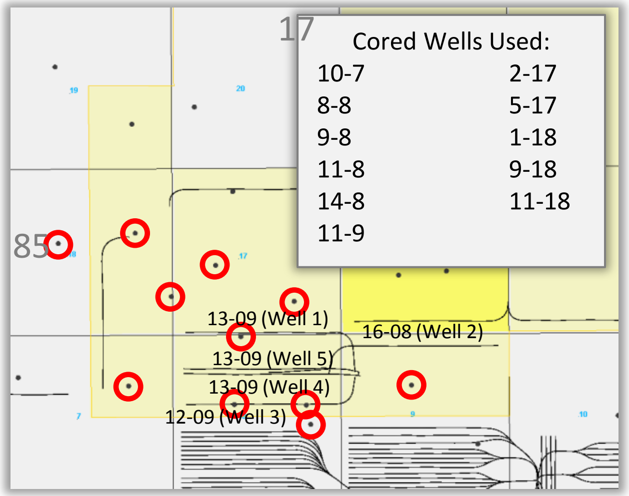


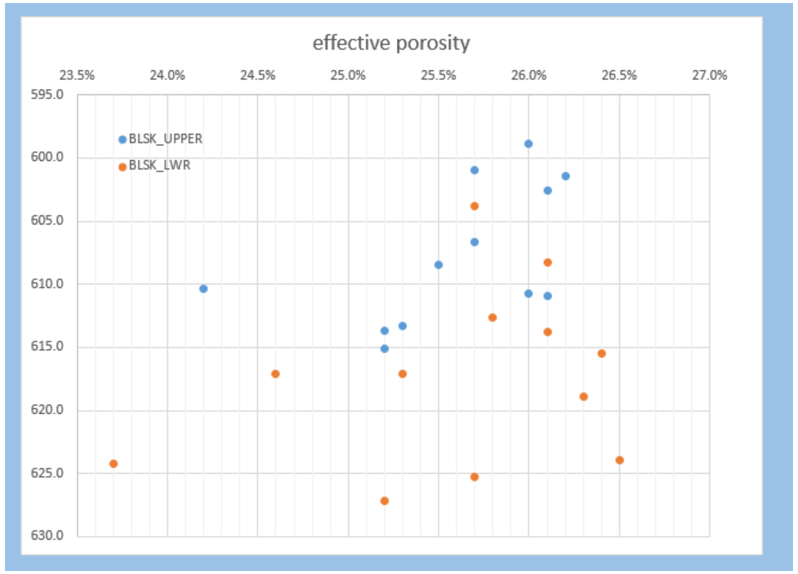


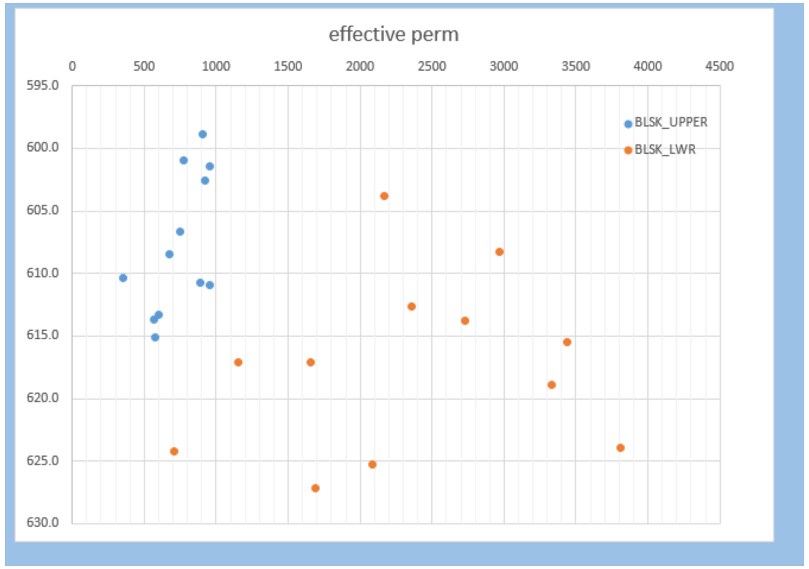
Average Reservoir Parameters

- Average reservoir thickness is 20 meters
- Average depth is 600 m TVD
- Average Core Porosity: 30%
- Viscosity Range: 50,000 - 200,000 cP
- Average Permeability Upper Facies (KMAX): 0.7D
- Average Permeability Lower Facies (KMAX): 4.0D
- Average grain size: Fine - Medium

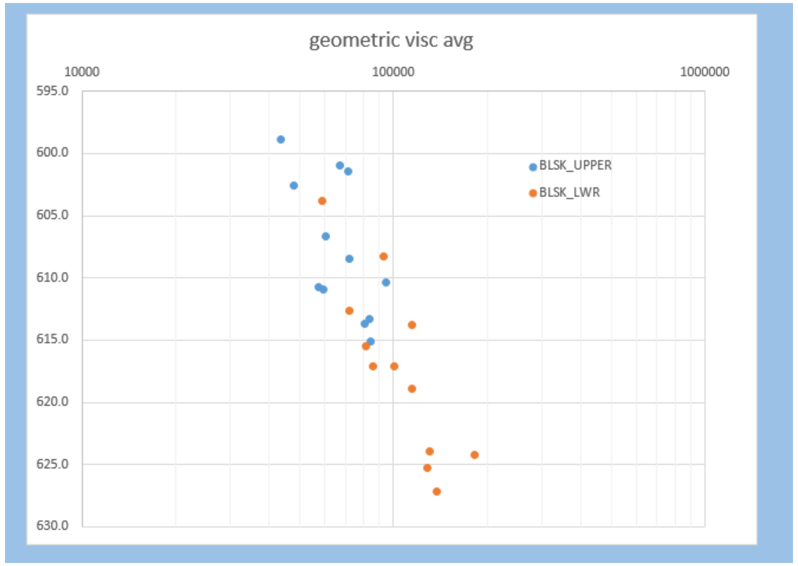
Comparison of Upper and Lower Bluesky Reservoir Properties

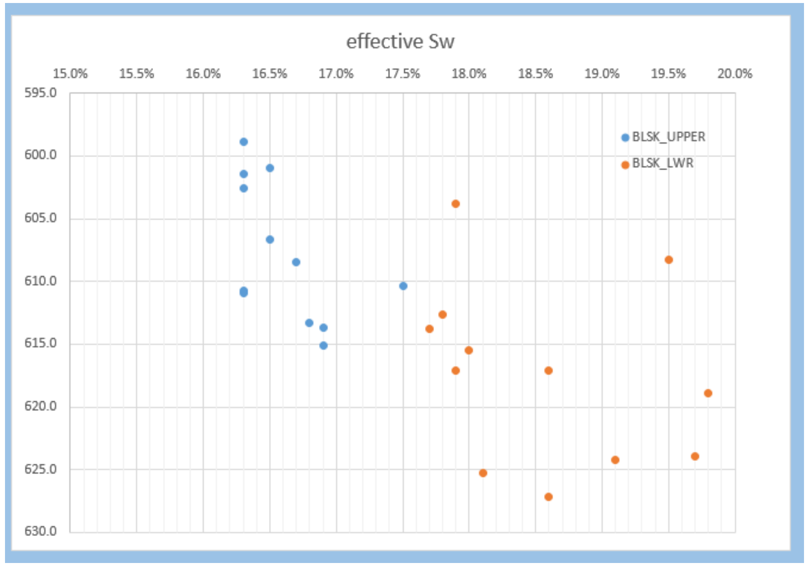






100051708517W500	DEVON NEC CADOTTE 5-17-85-17
100090808517W500	MURPHY CADOTTE 9-8-85-17
100140808517W500	MURPHY CADOTTE 14-8-85-17
1AA011808517W500	MURPHY CADOTTE 1-18-85-17
1AA021708517W500	MURPHY CADOTTE 2-17-85-17
1AA080808517W500	SHELL CADOTTE 8-8-85-17
1AA080908517W500	SCL H99-05 CADOTTE 8-9-85-17
1AA091708517W500	MURPHY CADOTTE 9-17-85-17
1AA091808517W500	MURPHY CADOTTE 9-18-85-17
1AA110808517W500	MURPHY CADOTTE 11-8-85-17
1AA110908517W500	MURPHY CADOTTE 11-9-85-17
1AA111808517W500	SHELL CADOTTE 11-18-85-17



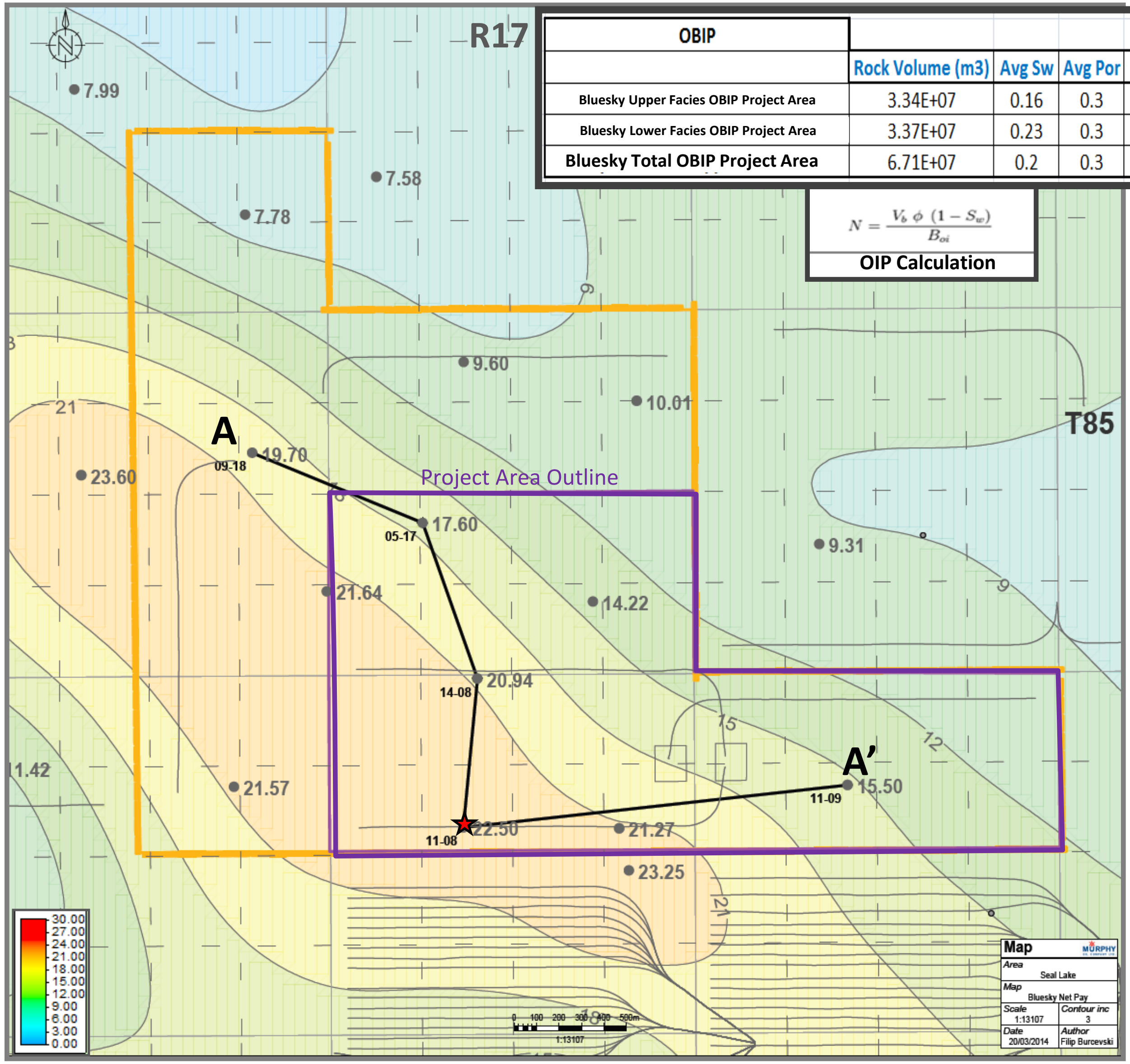


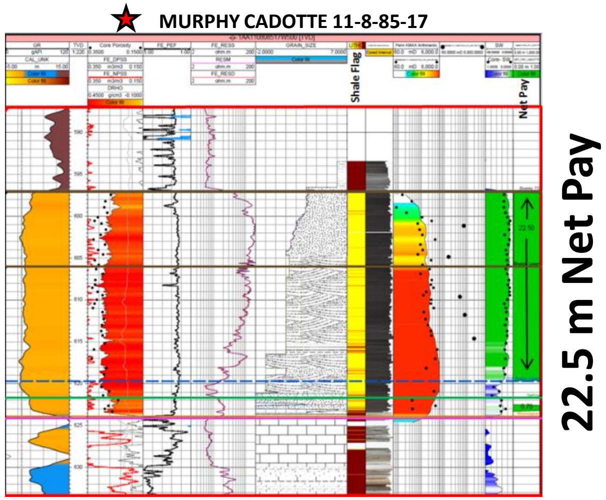
Bluesky Net Pay & OBIP

OBIP	Rock Volume (m3)	Avg Sw	Avg Por	B	OIP (m3)	OIIP (bbl)	Area (m2)	Sections	OIP Per Section
Bluesky Upper Facies OBIP Project Area	3.34E+07	0.16	0.3	1.02	8.25E+06	51,882,059	3901650	1.5	34,440,472
Bluesky Lower Facies OBIP Project Area	3.37E+07	0.23	0.3	1.02	7.62E+06	47,954,553	3901650	1.5	31,833,305
Bluesky Total OBIP Project Area	6.71E+07	0.2	0.3	1.02	1.59E+07	99,836,612	3901650	1.5	66,273,777

$$N = \frac{V_b \, \phi \, (1 - S_w)}{B_{oi}}$$

OIP Calculation



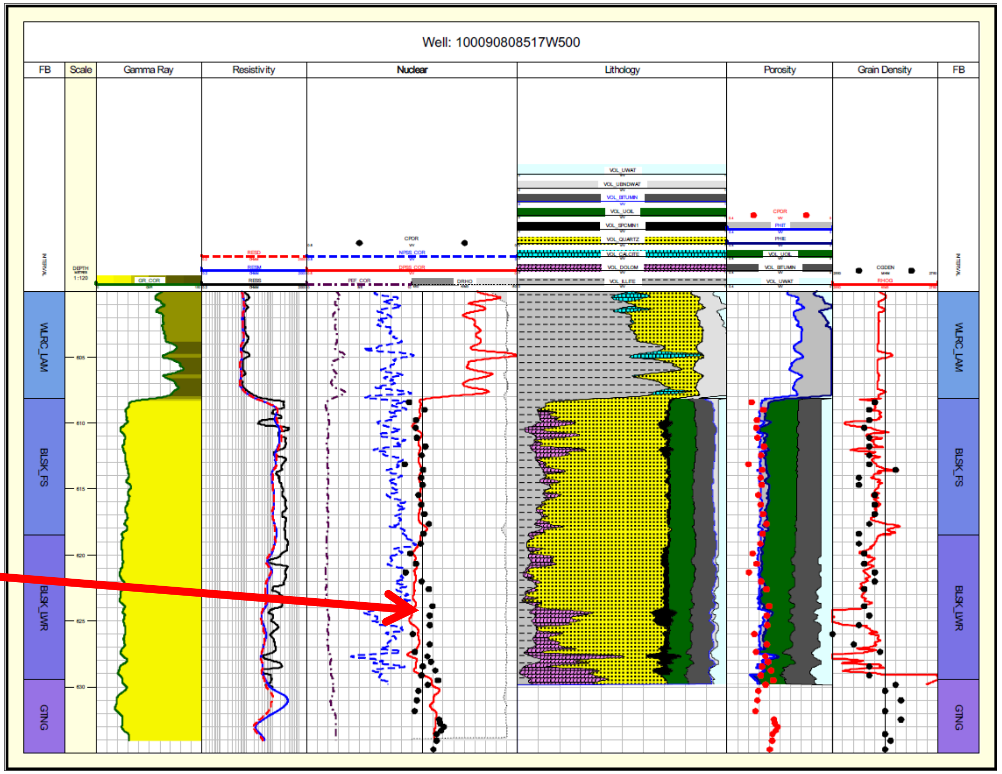


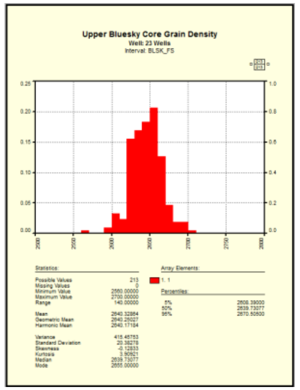
Net Pay Criteria

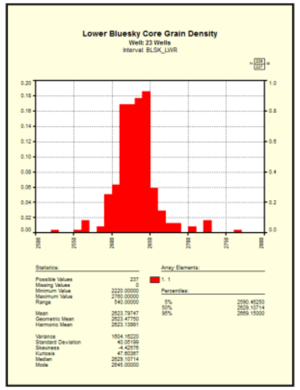
Gamma Ray < 65 API
Porosity > 22 %
Water Saturation (Archie) < 40 %
RW= 0.294

Bluesky Mineralogy

- **XRD analysis in three wells:**
  - 05-17-085-17W5, 06-16-085-17W5, 09-08-085-17W5
  - Quartz Content is approximately 55–80%
  - Dolomite Content is approximately 4–31%
  - Clay Content is approximately 13% to 23% (approximately $^{2}/_{3}$ Kaolinite, $^{1}/_{3}$ Illite)
  - XRD calculated grain densities are between 2,670 to 2,720 kg/m^3
- **Core grain density and porosity read lower than standard sandstone density porosity**
- **This density difference suggests the possibility of a very "light" material being present**
  - Upper Bluesky Core Grain Density Average: 2,640 kg/m^3
  - Lower Bluesky Core Grain Density Average: 2,623 kg/m^3
  - Carbonaceous material appears responsible for lowering the grain density
  - Carbonaceous material commonly observed in core



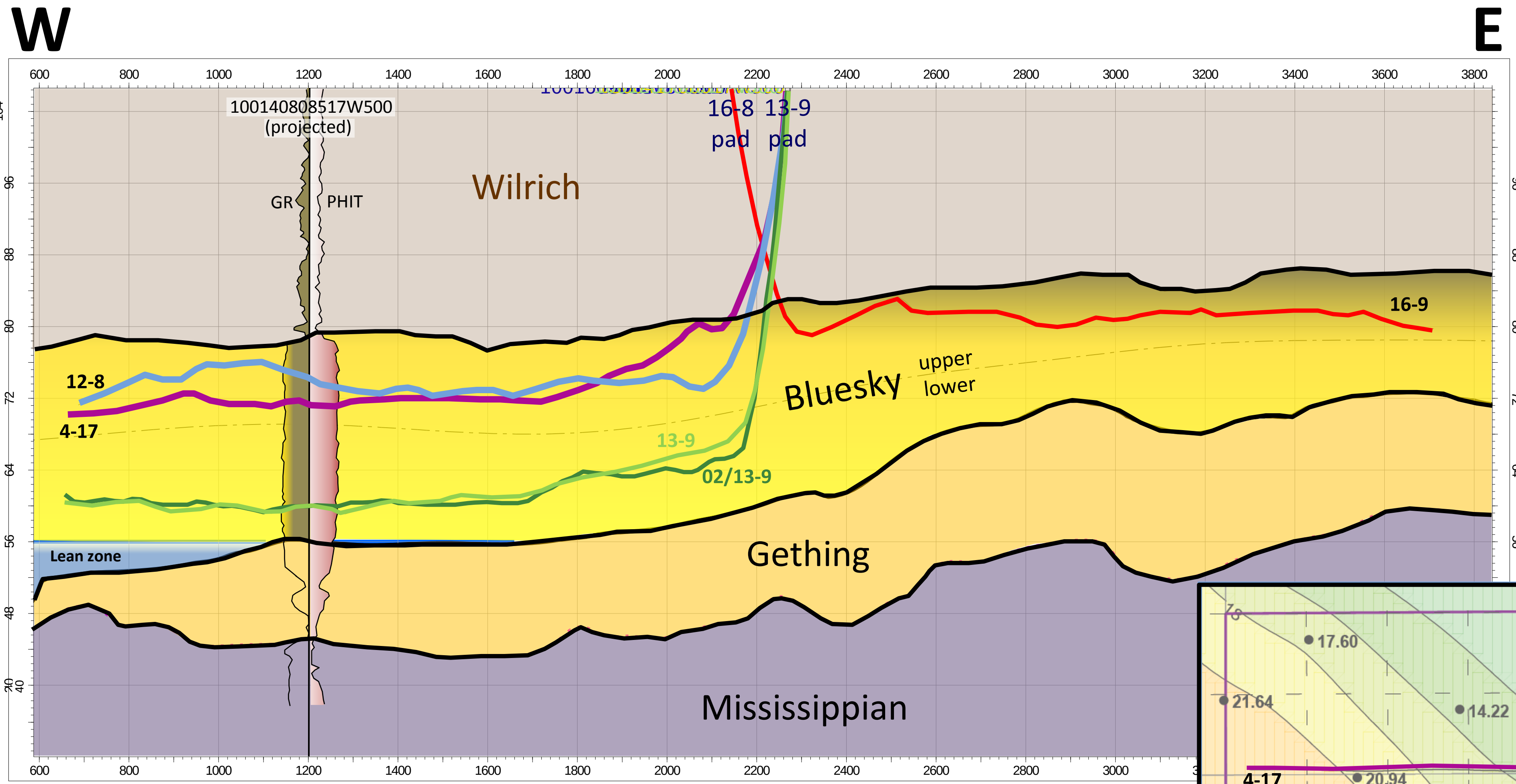


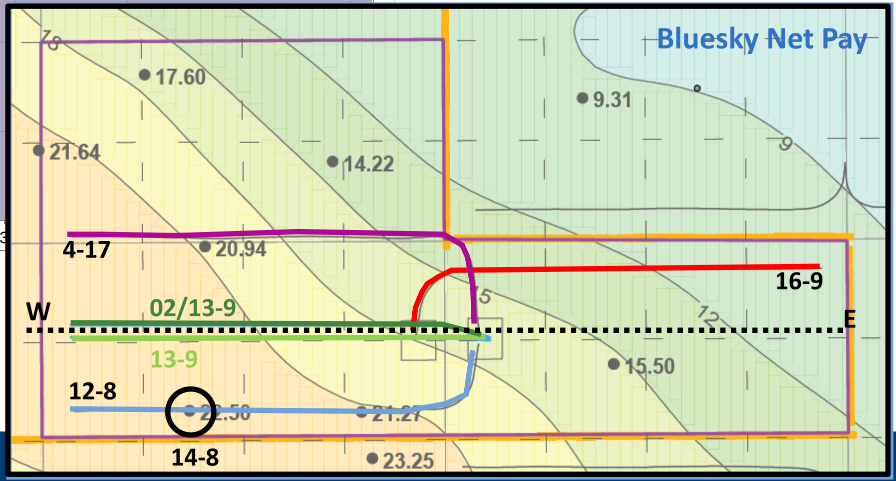


Subsurface

- Background
- Geology
- **Wells**
- Performance

Cadotte: Schematic West to East section*



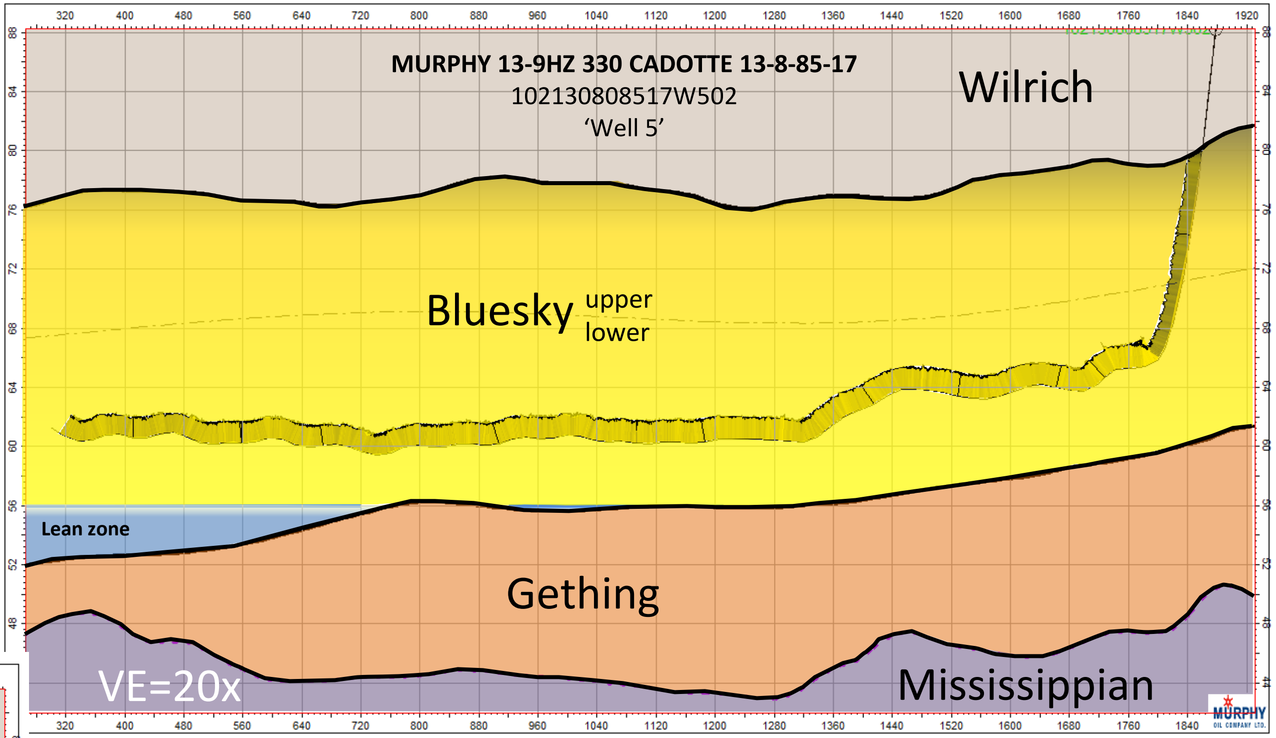


* W-E Line of section through recent 13-9 wells. Adjacent wells projected.

13-9 Pad: Wells 4 & 5 (2014)

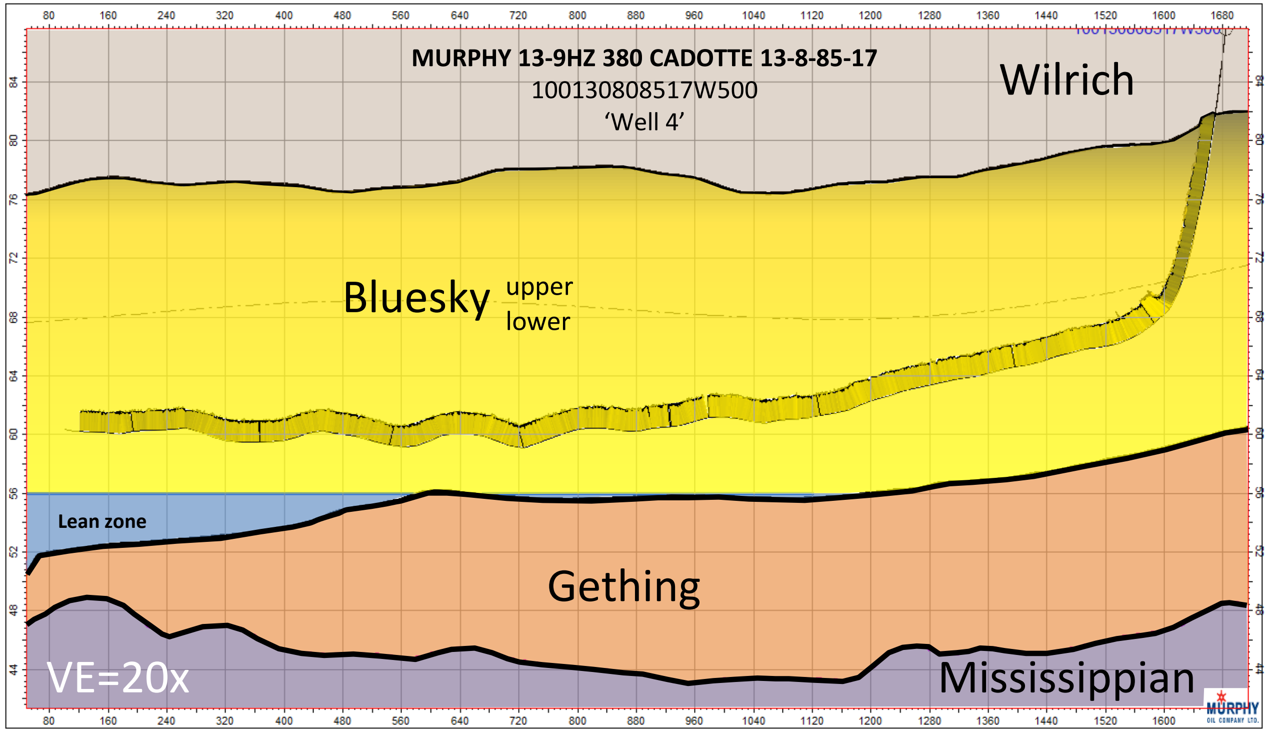
13-9 330 - 102130808517W502 (Well 5)

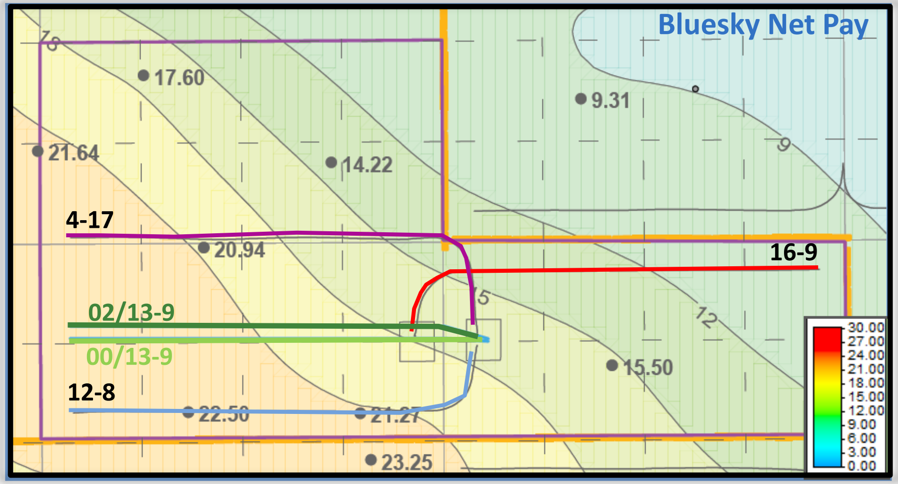
RR: 26 July 2014



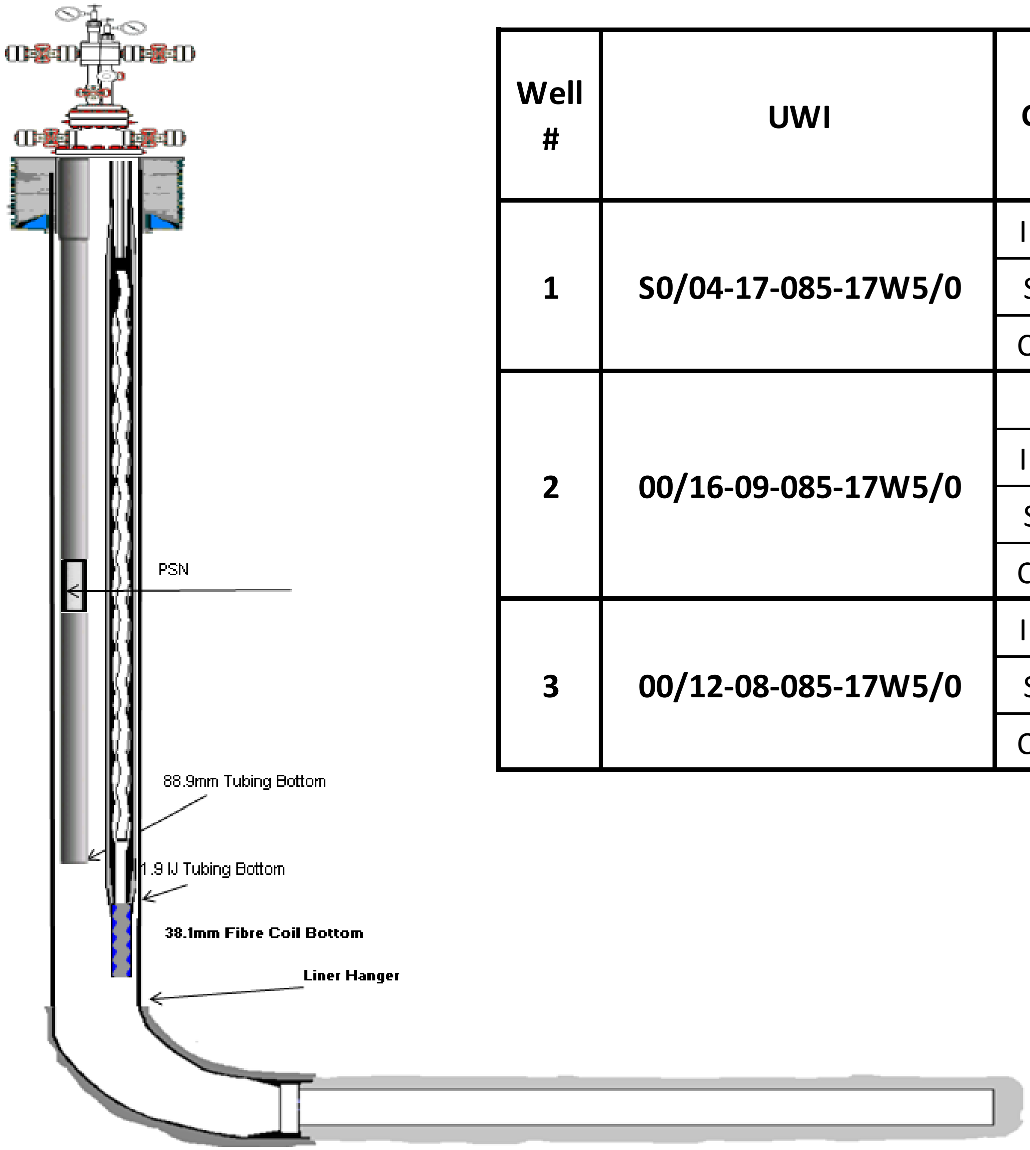
13-9 380 - 100130808517W500 (Well 4)

RR: 10 July 2014





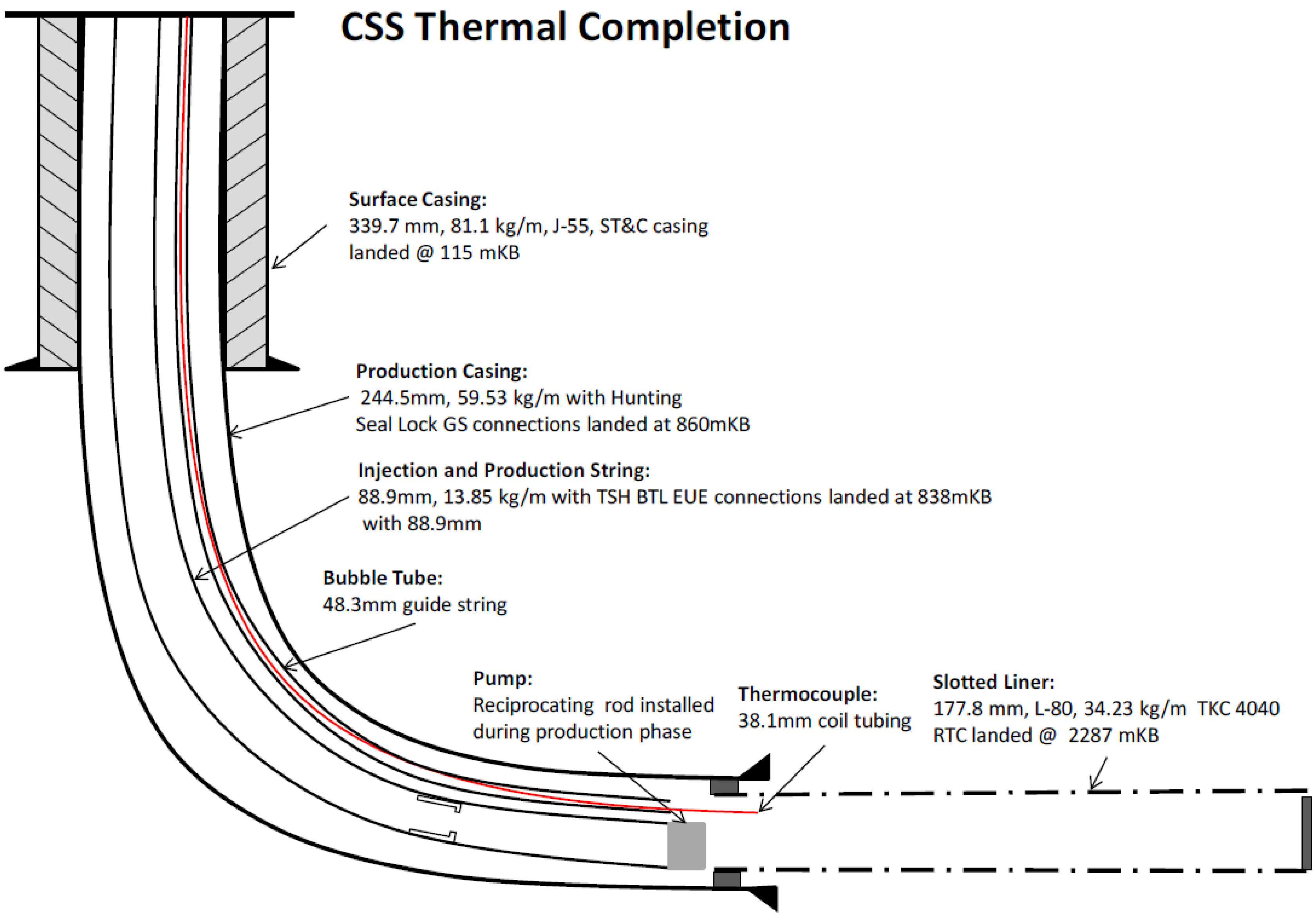
Wellbore Diagram Wells 1, 2 & 3



Well #	UWI	Casing String	OD (mm)	Type	Weight (kg/m)	Landed Depth (m KB)	Comments
1	S0/04-17-085-17W5/0	Intermediate	219.1	L-80	47.621	983.0	Standard surface casing not run, conductor pipe set at 20 m KB
		Slotted Liner	139.7	J-55	20.834	2,426.0	
		Coiled Tubing	31.8			1,624.5	
2	00/16-09-085-17W5/0	Surface	339.7	J-55	81.105	115.0	
		Intermediate	219.1	L-80	47.621	860.0	
		Slotted Liner	139.7	J-55	20.834	2,287.0	
		Coiled Tubing	31.8			1,550.0	
3	00/12-08-085-17W5/0	Intermediate	219.1	L-80	47.621	863.0	Standard surface casing not run, conductor pipe set at 20 m KB
		Slotted Liner	139.7	J-55	20.834	2,302.0	
		Coiled Tubing	31.8			1,475.5	

- **Fiber optic temperature measurement through coiled tubing**
- **Bubble tube pressure measurement**

Wellbore Diagram Wells 4 & 5



Well 4 & 5 Drilling

- **Well 4 (S380) was drilled as planned with lateral ~3m above Gething in Lower Bluesky**
  - Used Gyro survey tool to guarantee perfect well placement
- **Well 5 (S330) drilling complications**
  - Gyro tool was not used due to costs of drilling
  - Well veered off towards well 4 due to MWD malfunction
  - Came within ~15m of hitting well 4 when magnetic interference was noticed
  - A new MWD and Gyro were ran to confirm well survey
- **Well 5 Drilling Remediation**
  - Backed out of the lateral and used a bridge plug with multiple cement plugs to isolate dead leg
  - Sidetracked off of cement plug to complete the drilling of the well correct azimuth
  - Ran blank liner joints across the dead leg to minimize risk of steam communication to well 4

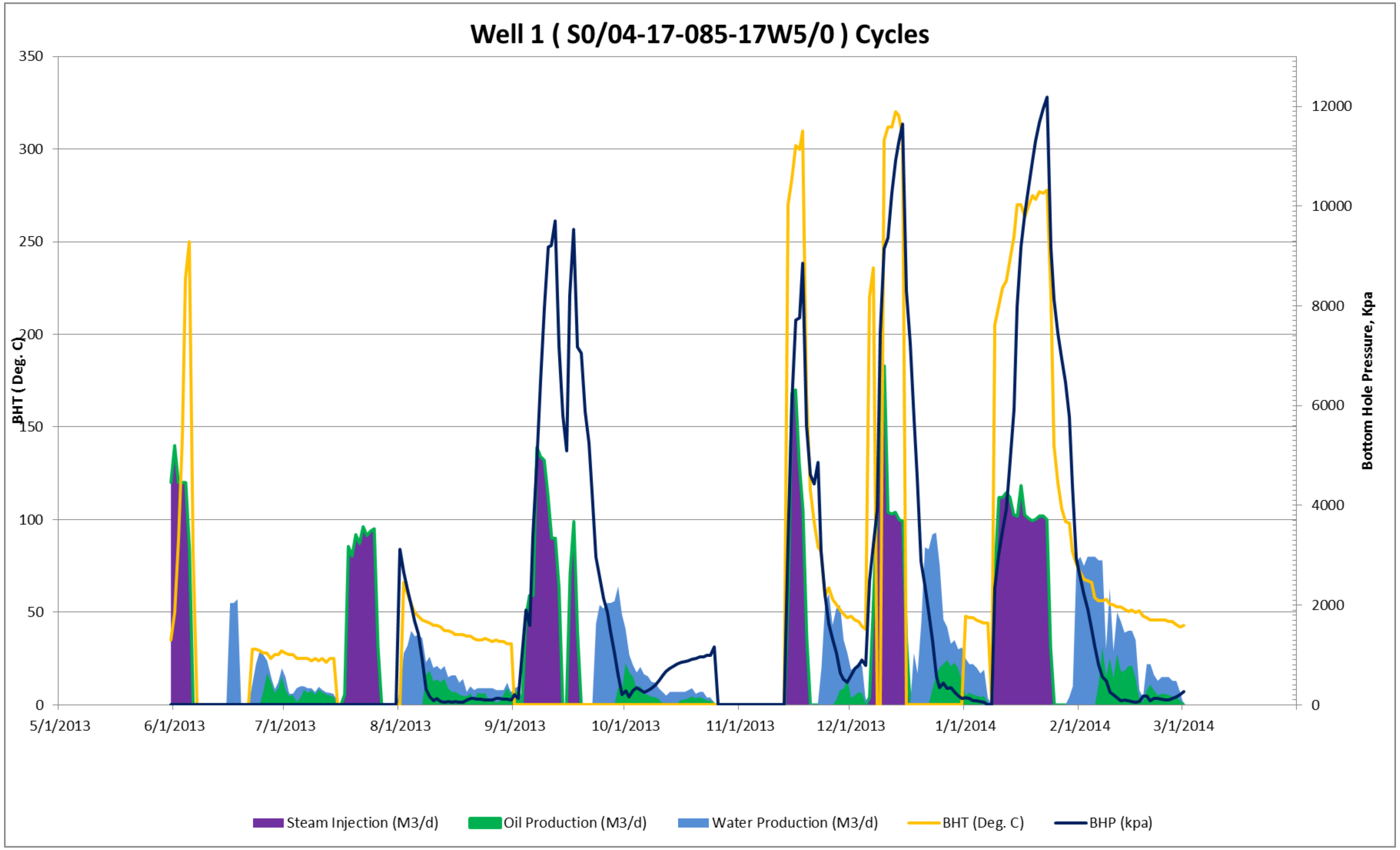
Artificial Lift

- Surface Pumping Equipment
  - Hydraulic pump jack with electric drive motors
    - Currently using both Tundra SSI pumping units(multiple sizes) and Weatherford VSH2
- Bottom hole Pumps
  - Original Wells 100/16-09-085-17W5 and 100/12-08-085-17W5
    - 63.5 mm rod insert pumps
    - Pump size constrained by tubing and casing size
    - Wells were not completed to accommodate rod pumps
  - New Drills Well 4 S380 and Well 5 S330
    - 82.55 mm rod insert pumps
    - Larger tubing and anticipated higher IP rates

Subsurface

- Background
- Geology
- Wells
- **Performance**

Well 1 0S/04-17 Performance

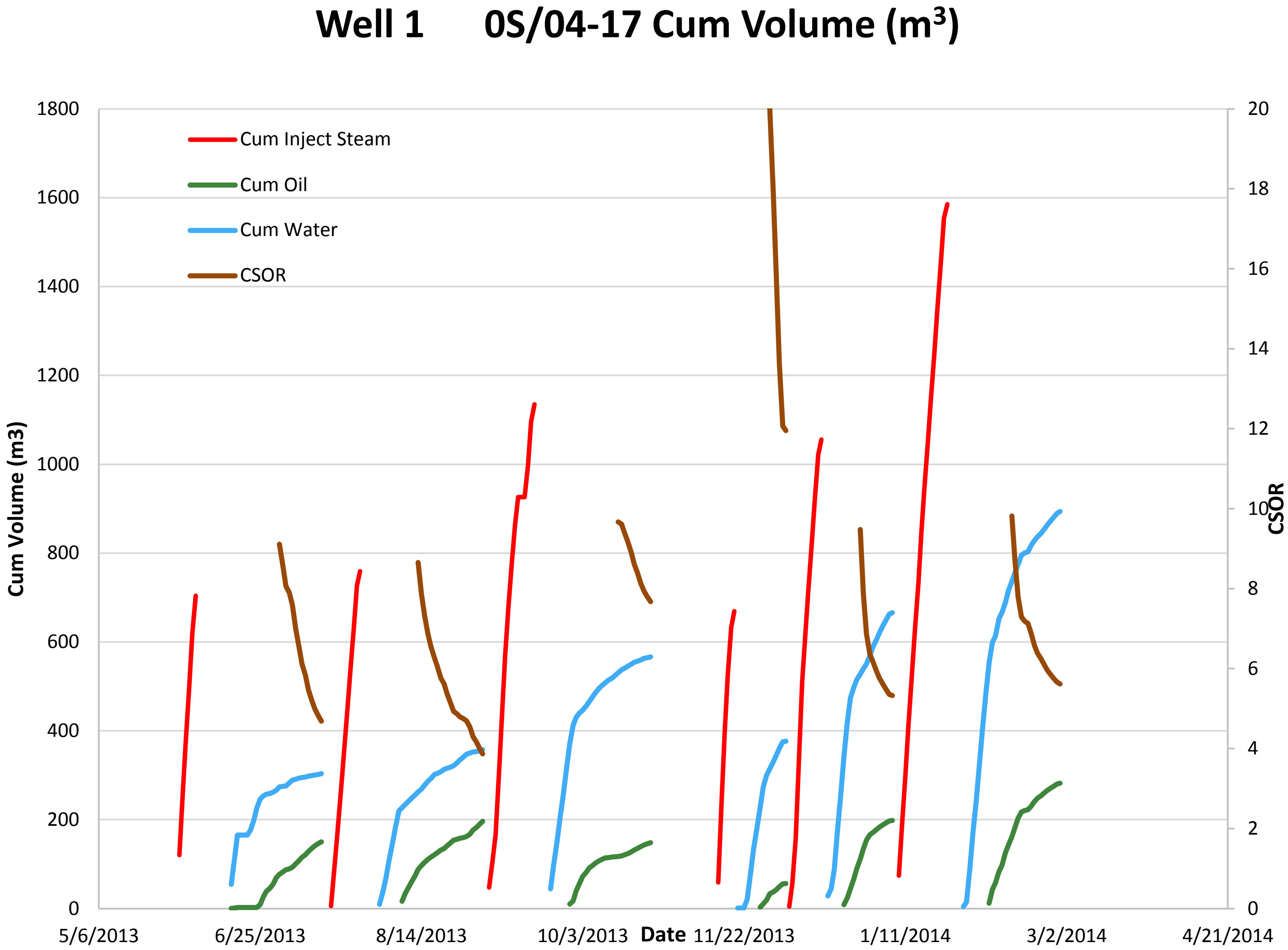


- **Cycle 3 production shut-in on October 24, 2013, due to:**
  - Low oil production rates in October, final 15 days averaged 6.7 m^3/d
  - Temperature of produced fluids for final 15 days averaged 28°C, below the recommended shut-in temperature of the Upper Bluesky (40°C)
  - OTSG used for Cycle 2 of Well 2 (100/16-09) until November 10, 2013, followed by initiation of Cycle 4 at Well 1

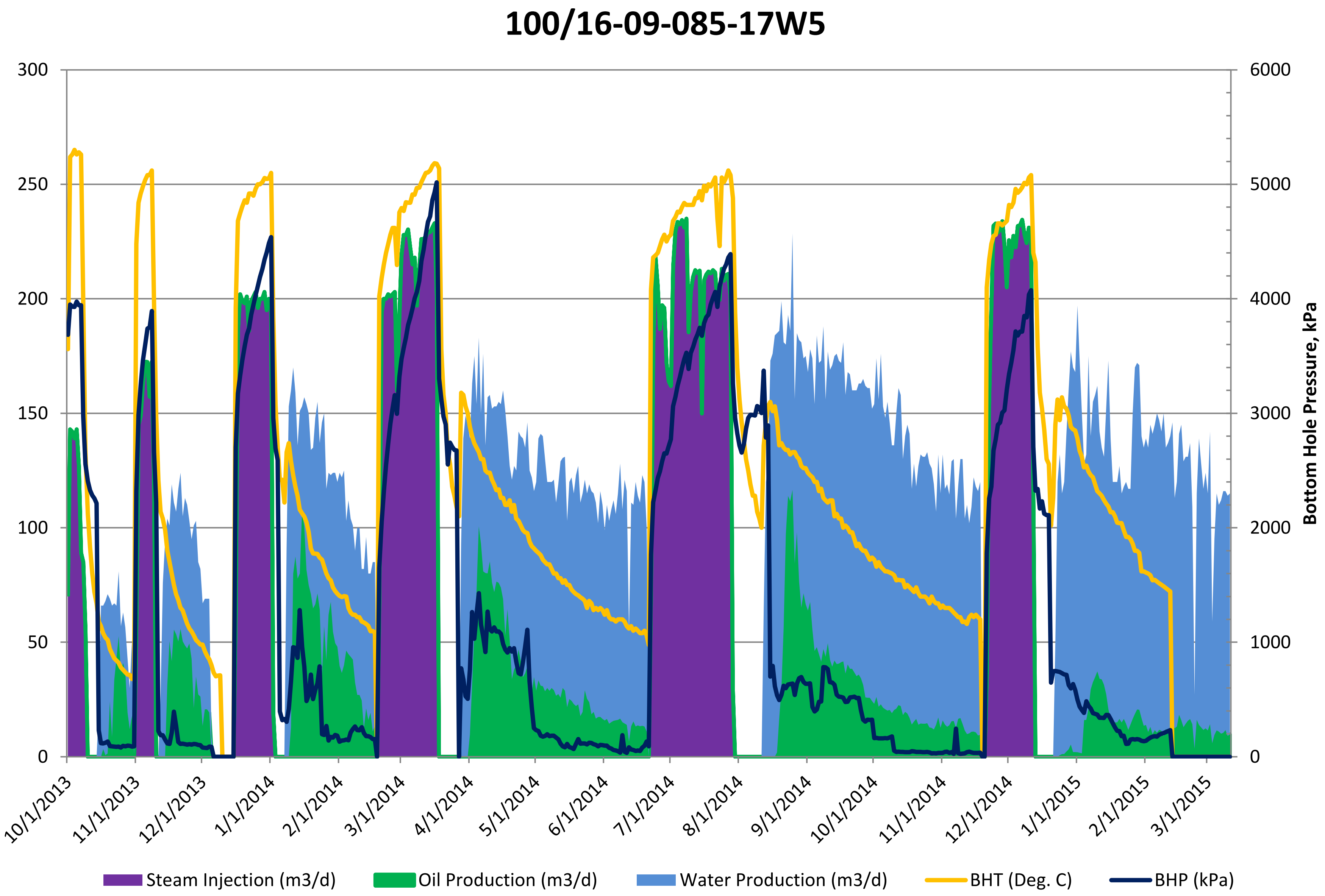
Well 1 0S/04-17 Performance

6 Cycles completed

	Cumulative Volume (m3)			
Cycles	Steam	Oil	Water	CSOR
1	704	150	303	4.7
2	759	196	358	3.9
3	1135	148	566	7.7
4	669	56	376	12
5	1056	198	666	5.3
6	1585	282	894	5.6



Well 2 100/16-09 Performance

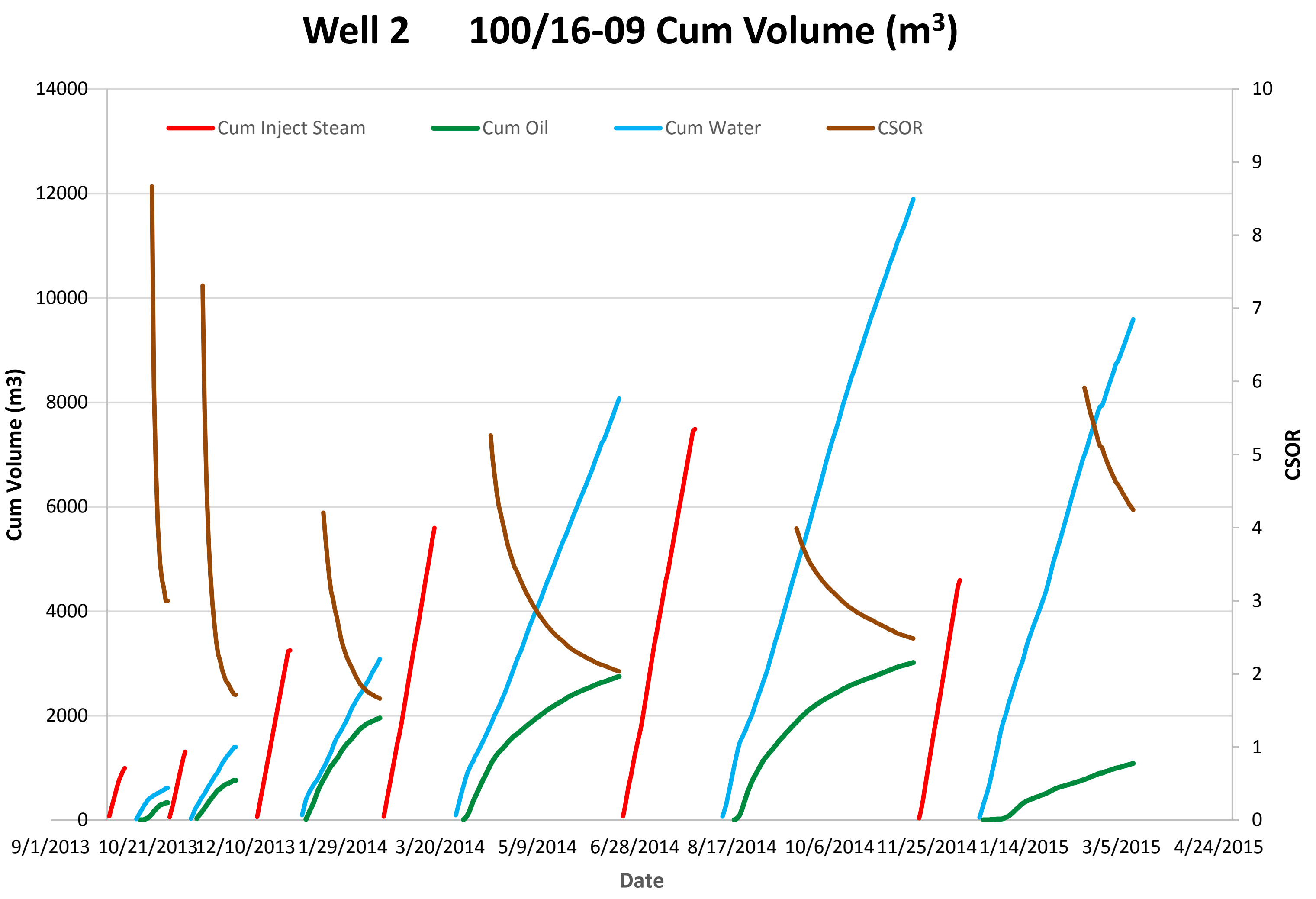


- **OTSG boiler tube failure occurred at ~19:00, December 12, 2014**
  - Cycle 6 steam injection therefore ended prematurely
- **Cycle 6 continued with planned soak period, followed by production**

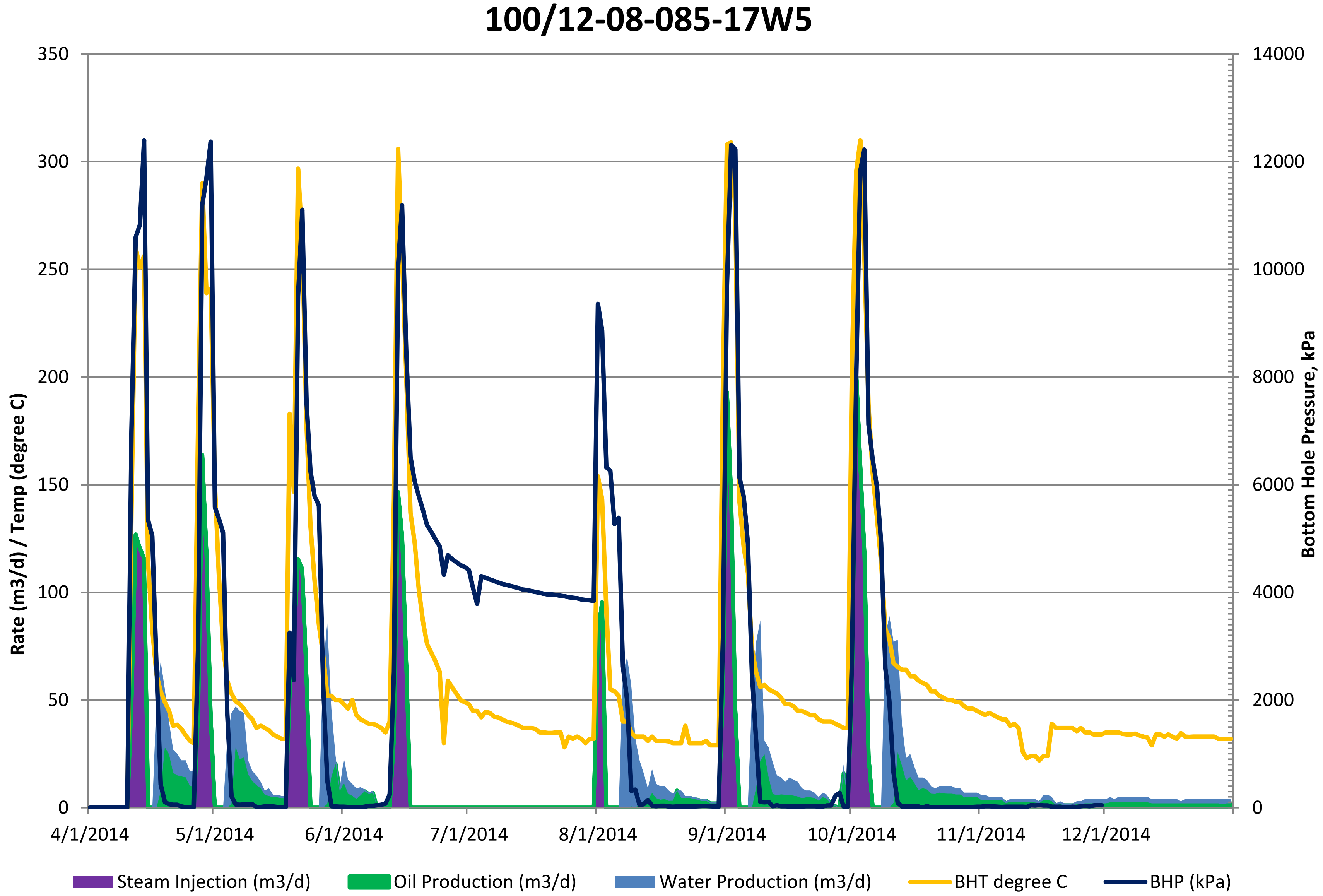
Well 2 100/16-09 Performance

6 Cycles completed

	Cumulative Volume (m3)			
Cycles	Steam	Oil	Water	CSOR
1	993	333	613	3.0
2	1308	763	1398	1.7
3	3251	1954	3088	1.7
4	5593	2751	8072	2.0
5	7488	3015	11892	2.5
6	4594	1083	9591	4.2



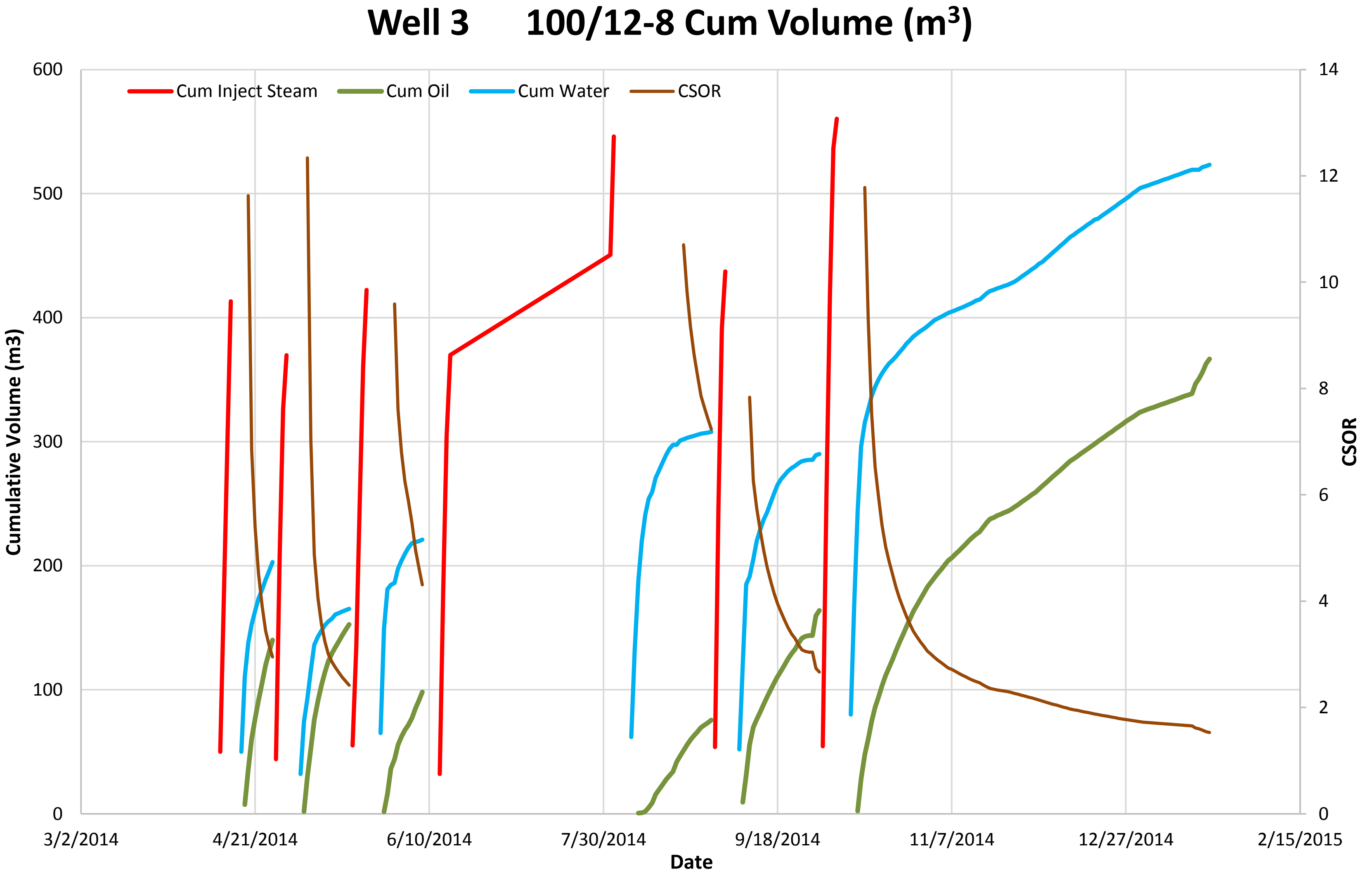
Well 3 100/12-08 Performance



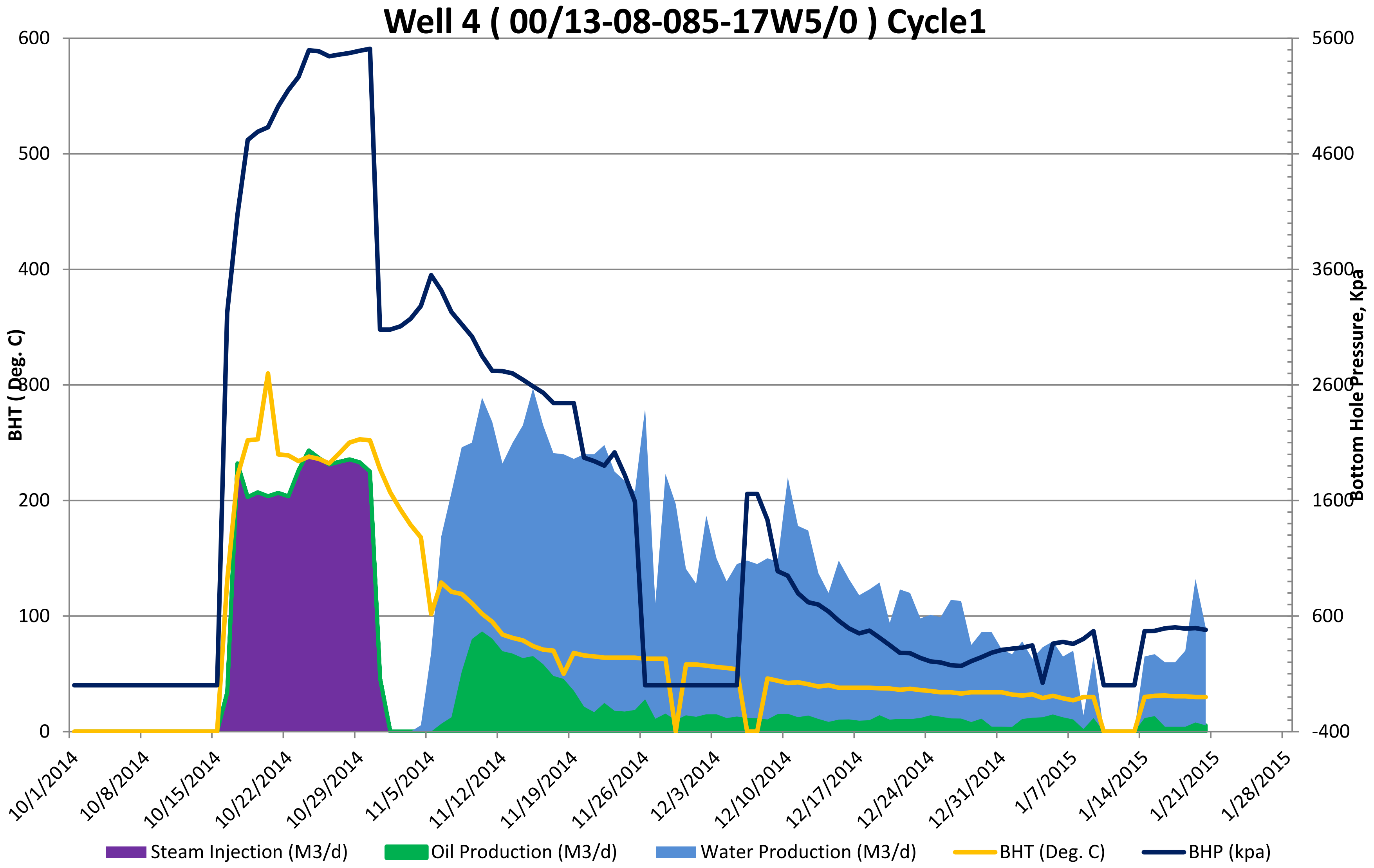
- During 4th cycle drilling of well 4 & 5 occurred, therefore no production during that time.

Well 3 100/12-08 Performance

	Cumulative Volume (m3)			
Cycles	Steam	Oil	Water	CSOR
1	413	140	203	3.0
2	370	153	165	2.4
3	422	98	221	4.3
4	546	75	308	7.2
5	437	164	290	2.7
6	560	367	523	1.5



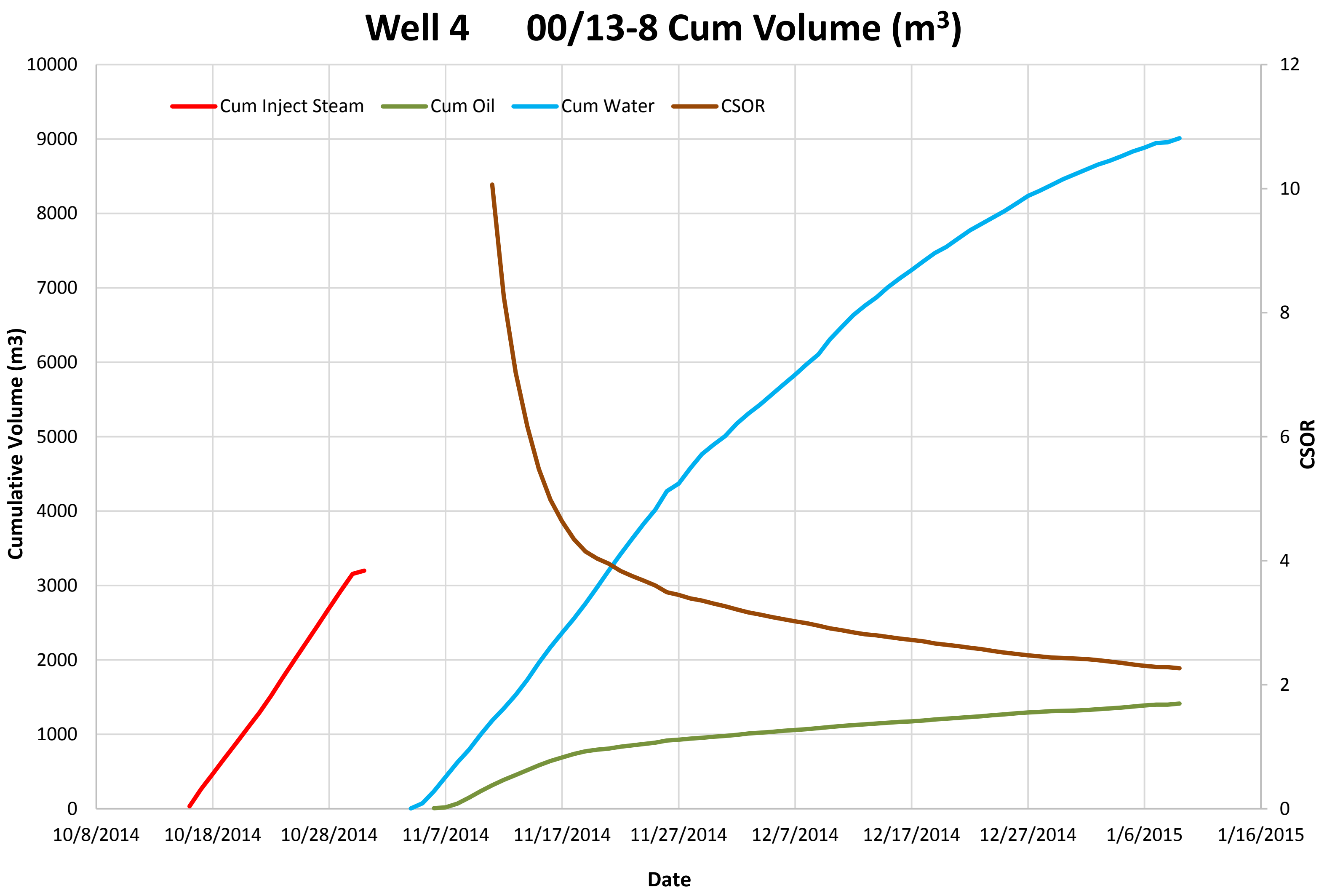
Well 4 100/13-08 Performance



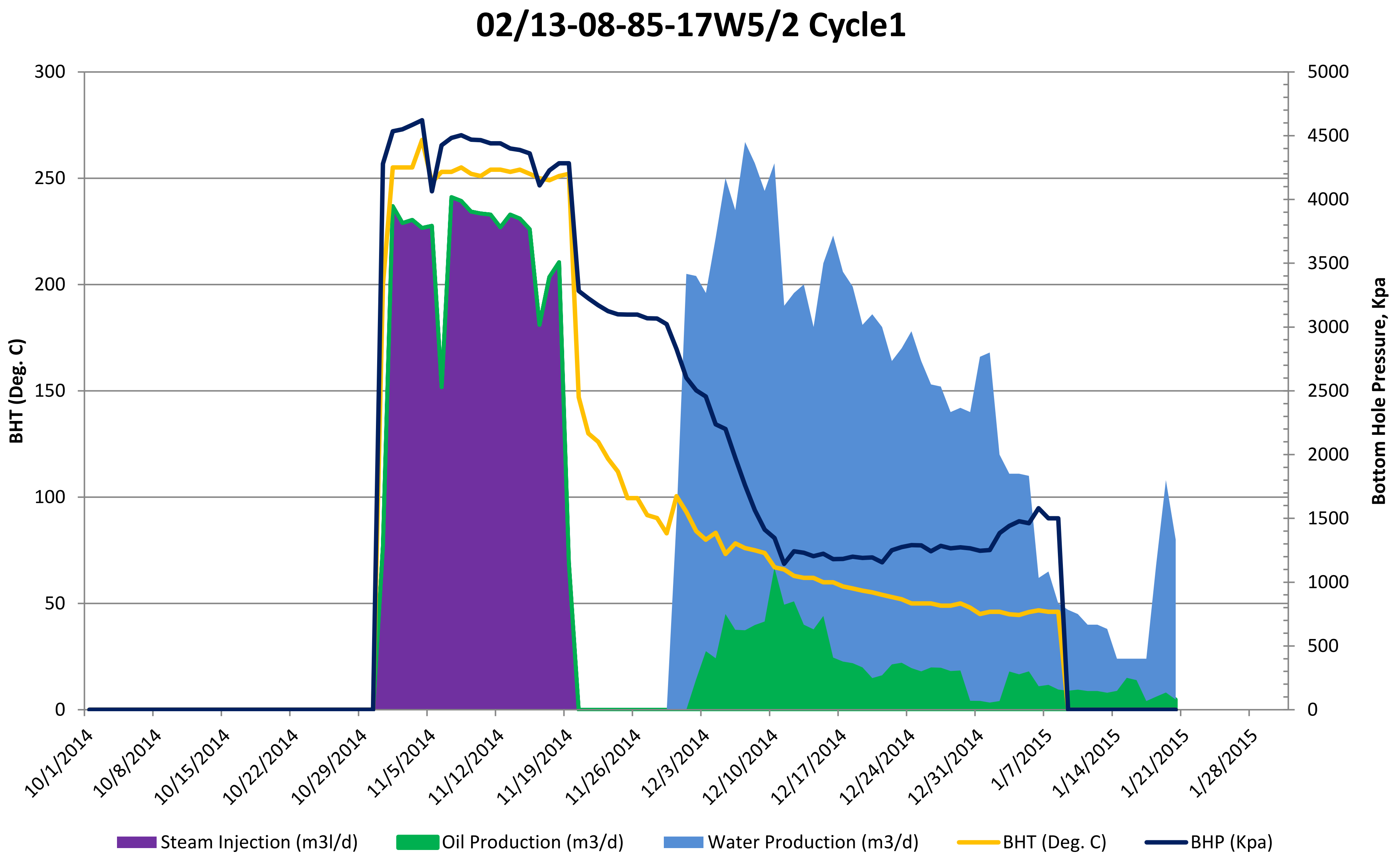
- The well responded well the 1st CSS cycle
- Cum oil 1,412 m^3
- Cum steam 3,200 m^3
- CSOR: 2.3

Well 4 100/13-08 Performance

	Cumulative Volume (m3)			
Cycles	Steam	Oil	Water	CSOR
1	3200	1412	9009	2.3



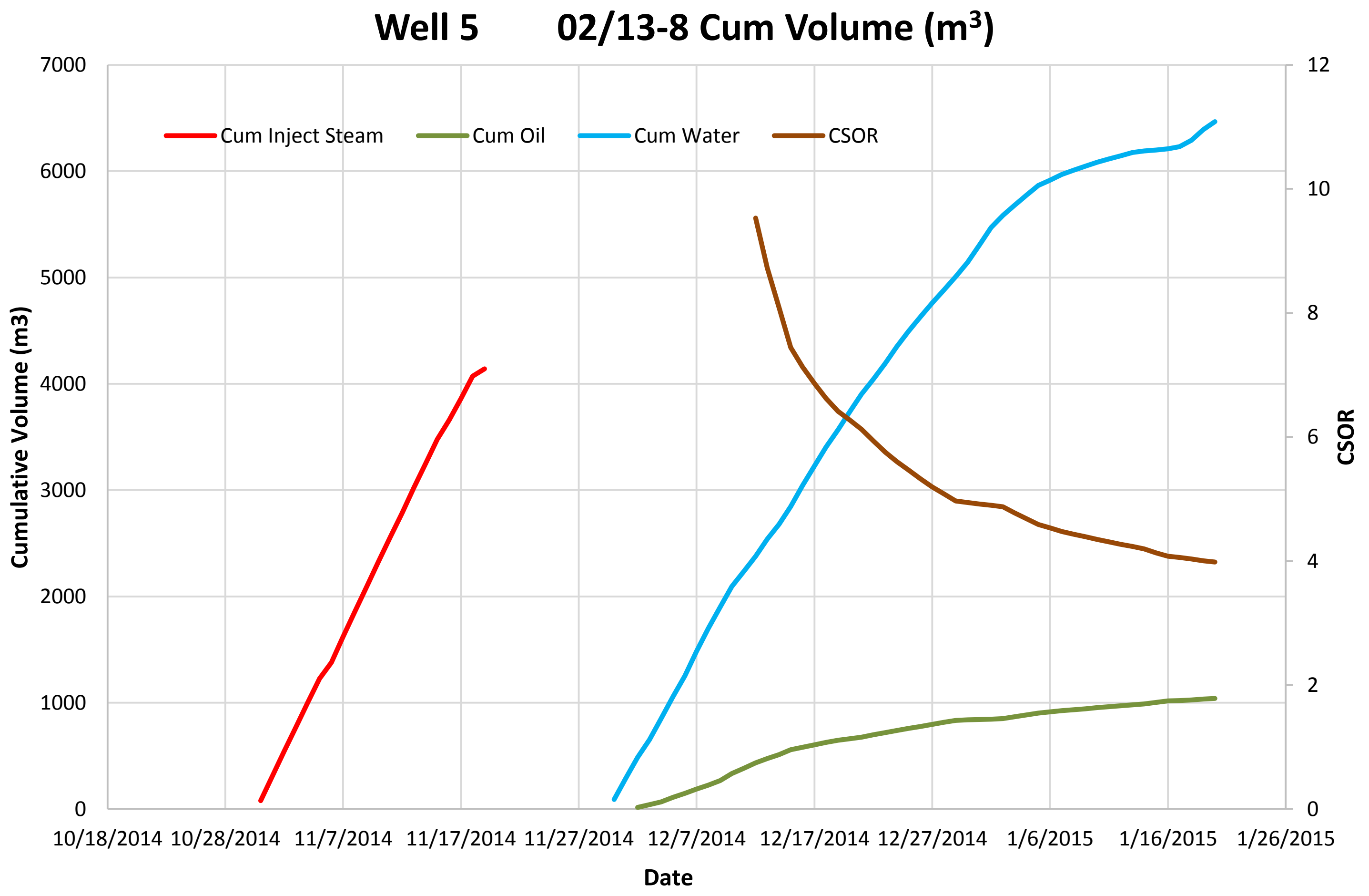
Well 5 102/13-08 Performance



- The well responded well the 1st CSS cycle
- Cum oil 1,039 m^3
- Cum steam: 4,141 m^3
- CSOR: 4.0

Well 5 102/13-08 Performance

	Cumulative Volume (m3)			
Cycles	Steam	Oil	Water	CSOR
1	4141	1039	6467	4.0



Recoveries for each Well

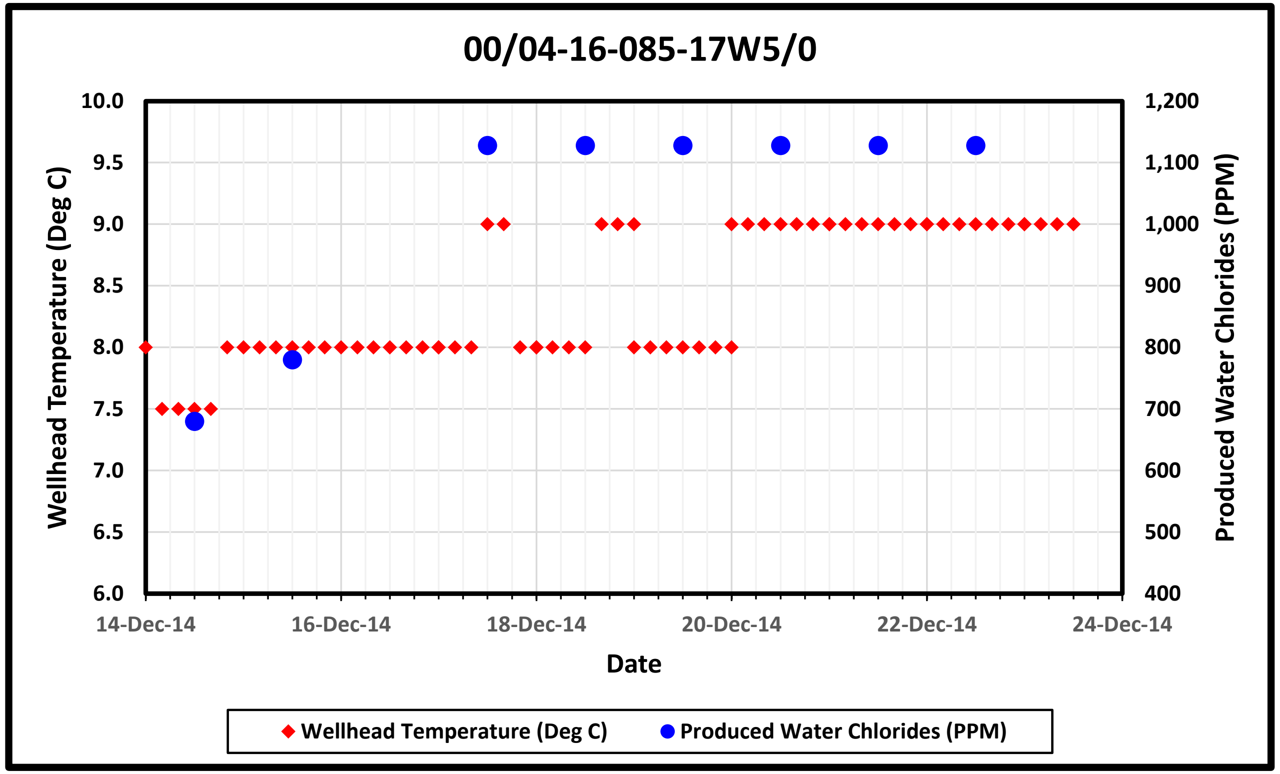
Well #	UWI	Cumulative Production @ December 31, 2015 (m^3)			Producing Formation	Recovered Oil (% of Thermal EUR)	Ultimate RF (Thermal)
		Primary	Thermal	Total			
1	**S0/04-17-085-17W5/0**	3,601	928	4,528	Upper Bluesky	2.8%	15%
2	**00/16-09-085-17W5/0**	8,023	9,520	17,543	Upper Bluesky	21.3%	15%
3	**00/12-08-085-17W5/0**	1,186	873	2,059	Upper Bluesky	2.6%	15%
4	**00/13-08-085-17W5/0**	0	777	777	Lower Bluesky	1.9%	22%
5	**02/13-08-085-17W5/0**	0	528	528	Lower Bluesky	1.3%	22%

- **Errors in calculations were identified in column "Recovered Oil (% of Thermal EUR)", which have been corrected**
- **Ultimate recovery factors (thermal) for each well are tied to the respective OOIP for the producing formation**

Well 2 Discussion

- **Well 2, even though it had no Lower Bluesky, showed a lateral facies change in the Upper Bluesky which gave it much higher permeability than the Upper Bluesky in wells 1 and 3 (well 2 was closer to the shoreline = higher energy)**
  - This combined with the lower viscosity of the oil drilled at the top of the zone, resulted in well 2 having the best overall production of the first three wells (all drilled into the Upper Bluesky) on both primary and thermal

Offsetting Primary Well Observations

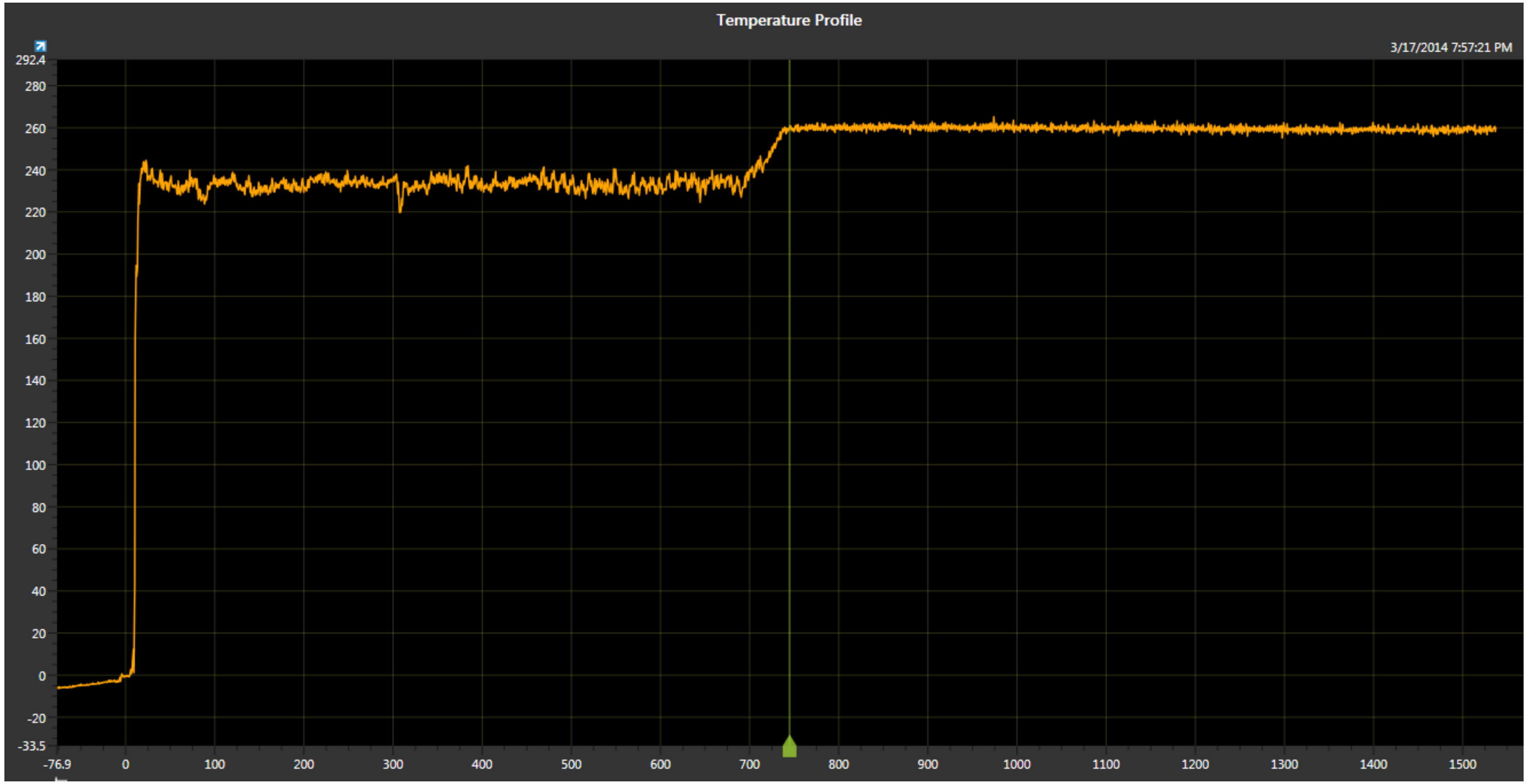


- **A minor temperature increase at surface was identified at the offsetting primary well 04-16-085-17W5 in December, 2014, along with an increase in produced water chlorides**
- **The AER was notified of this event and the potential that the change in temperature and produced water chlorides may be a result of the Cadotte Thermal Pilot operations due to proximity to well 16-09-085-17W5**
- **Murphy is of the opinion that this minor change in producing conditions is *not* a result of the Cadotte Thermal pilot operations:**
  - Inter-well distance between 04-16 and 16-09 is significant (250 m)
  - Minor temperature and produced water composition fluctuations are common in primary producing wells
- **Data shown was communicated/discussed with the AER field office, no formal report has been written with respect to this event**
  - The 04-16 well has not produced since December 2014
  - In the event that the Cadotte Thermal pilot is restarted in the future, monitoring of the 04-16 well will be included as part of the startup/thermal producing program

Example of Temperature profile (fiber-optic)

Fiber-optic's installed in well 1, 2, and 3.

00/16-09-085-17W5/0 (well 2)



Fiber Optic Learnings

- **Advantages**
  - Useful for determining where production is coming form in the horizontal in particular from well 2
  - Can easily determine steam conformance in all wells
  - Accurate and real time information accessible remotely
  - Great for trending and analyzing well performance from a steam and production standpoint

- **Disadvantages**
  - Not really suitable for temperatures above 300°C seen in Well 1 and 3 unless additional design measures are taken
  - Expensive compared to thermocouples
  - Had multiple failures on well 1 resulting in downtime

Individual Well Production Discussion

1. **Well 2 (00/16-09-085-17W5/0)**
   - Fiber optic data shows steam/heat conformance throughout horizontal section
   - Analysis of production cycles 3 – 6 illustrated a rise in the heel temperature due to the flow of hot fluid from the horizontal section of the well
2. **Well 1 (S0/04-17-085-17W5/0) and Well 3 (00/12-08-085-17W5/0)**
   - Analysis of the steam and production cycles indicated that steam was only getting to the heel with warm fluid at the toe
   - Actual production data confirmed near wellbore stimulus occurred as rod hang-up would occur due to a lack of heat in the produced fluid
3. **Well 4 (00/13-08-085-17W5/0) and Well 5 (02/13-08-085-17W5/0)**
   - Bottom hole temperature data does show an increase in temperature in the first production cycle for both wells, assuming that this is a similar phenomena that occurred in Well 2, with steam/heat conformance beyond the heel of the well
   - Only one cycle in Wells 4 and 5 before failure of OTSG, thermocouples used instead of fiber optic

Agenda

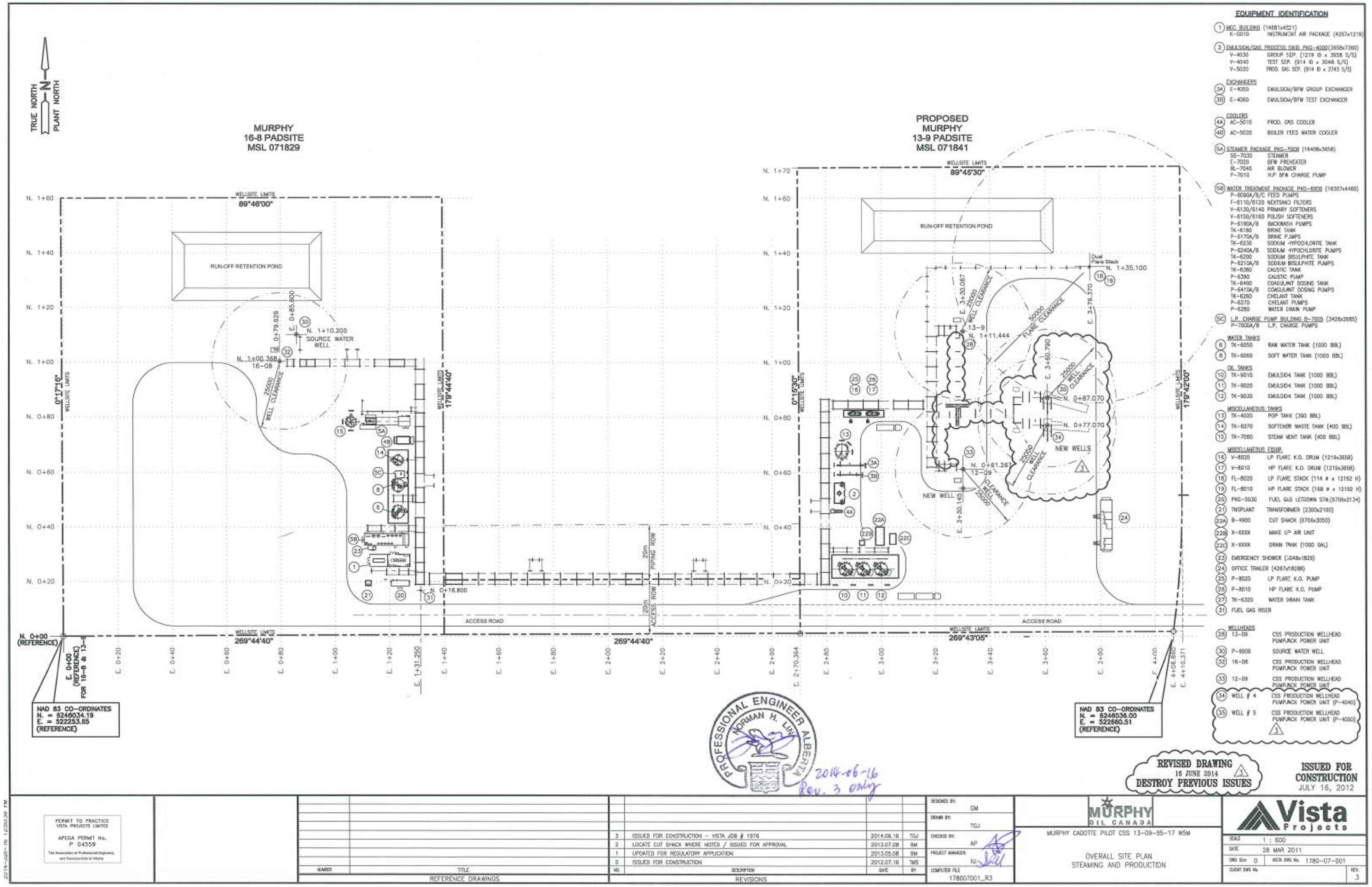
- Subsurface
- **Surface**
- Future Plans
- Conclusions

Surface

- Facilities
- Facility Performance
- Measurement and Reporting
- Water Uses
- Sulphur Production
- Summary of Environmental Issues
- Compliance

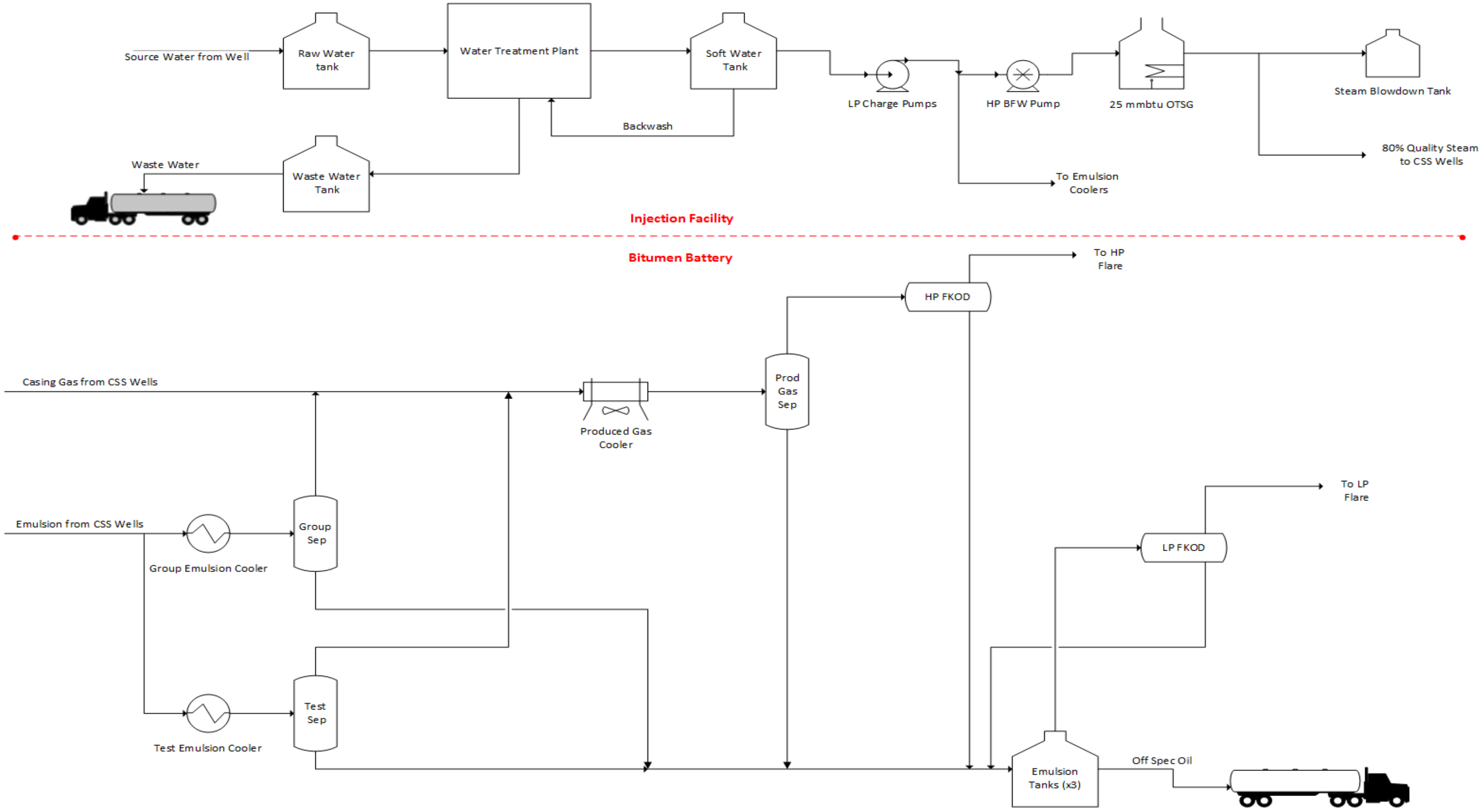
Facilities

Murphy Cadotte CSS Pilot – Plot Plan



Facilities

Murphy Cadotte CSS Pilot - Plant Schematic



Facility Performance

- Bitumen Treatment
  - Each production well can be pumped to either the group or test system
    - Each system is comprised of an emulsion cooler and a 2-phase separator and associated instrumentation
  - Emulsion is then sent to one of 3 emulsion tanks (159 m^3 each)
    - Heat + retention time used to dry oil to 1-10% BS&W
    - Off-spec oil is trucked to 1-26-083-15 W5M Oil Cleaning Facility
    - Produced water is trucked to 4-22-084-18 W5M salt water disposal well
- Water Treatment
  - Package designed to treat fresh water and produce BFW suitable for a 7,320 kWh OTSG
    - Includes 2 x 100% trains encompassing iron removal, softener and polisher
- Steam Generation
  - Maximum output of OTSG = 250 m^3/d CWE steam @ 80% quality

Facility Performance - Power

- **POWER CONSUMPTION – Import**
- **No power generation**

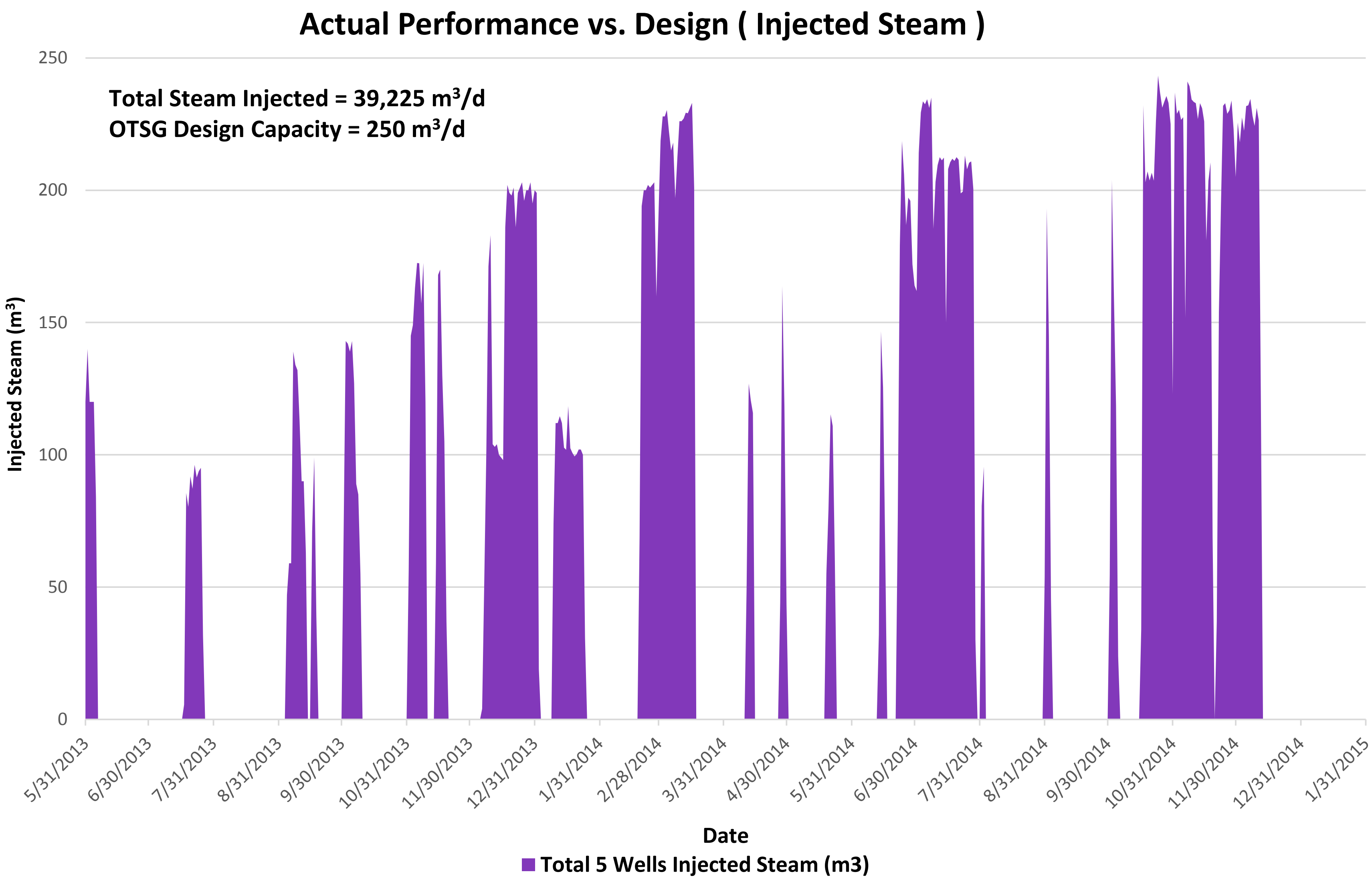
MONTH	TOTAL POWER CONSUMPTION (kWh)
1/1/2014	199,530.09
2/1/2014	189,890.42
3/1/2014	200,993.76
4/1/2014	190,020.24
5/1/2014	180,698.76
6/1/2014	153,982.52
7/1/2014	149,219.57
8/1/2014	149,404.40
9/1/2014	192,517.63
10/1/2014	227,481.97
11/1/2014	288,451.03
12/1/2014	288,970.49
1/1/2015	263,373.98
2/1/2015	201,841.00
3/1/2015	192,213.78
4/1/2015	182,605.64
5/1/2015	174,333.26
6/1/2015	163,611.71
7/1/2015	172,496.09
8/1/2015	81,818.28
9/1/2015	16,640.16
10/1/2015	19,235.75
11/1/2015	25,581.29
12/1/2015	29,815.94
1/1/2016	44,854.85
2/1/2016	44,933.48

Facility Performance - Gas

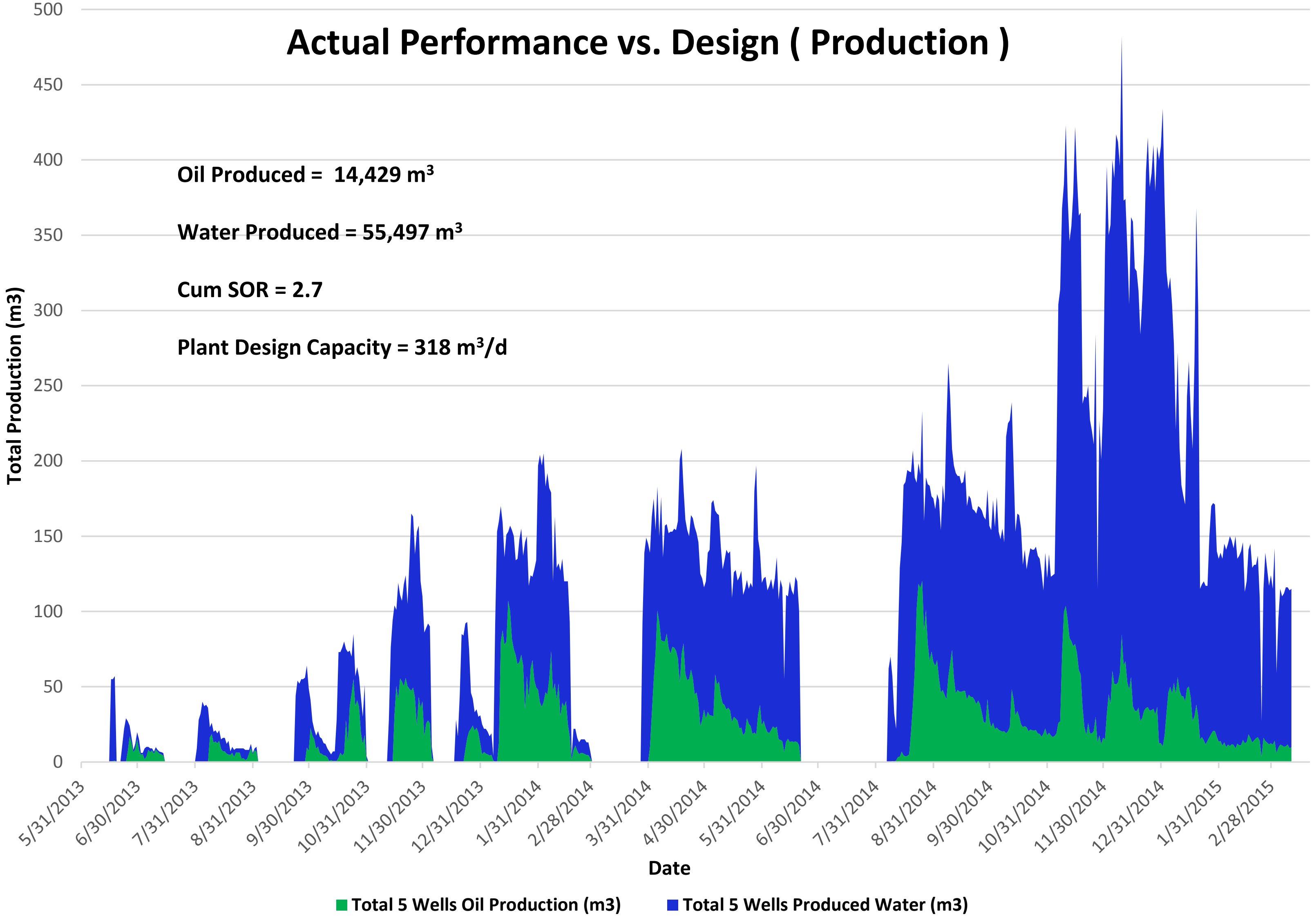
- All gas produced is flared. No gas conservation.
- Fuel gas is purchased via third party gas line
- No venting.
- Lessons learned:
  - Set up facility to potentially use produced gas (not as clean) to eliminate routine flaring.
  - Not economical to send produced gas to processing facility (~20 km+ distance).

Month	Gas Production (e3m3)	Flared Gas (e3m3)	Fuel Gas (purchased E3m3)	Vented Gas (e3m3)	Recovered Gas (e3m3)
Jan-14	55.9	57	153.4	0	0
Feb-14	32.1	33.1	113.2	0	0
Mar-14	0	1.1	136.4	0	0
Apr-14	39.9	42	18.3	0	0
May-14	50.4	52.7	27.1	0	0
Jun-14	18.8	21	24.2	0	0
Jul-14	0	1.3	4.3	0	0
Aug-14	41	42.1	2.9	0	0
Sep-14	0.2	16.1	0.2	0	0
Oct-14	27.3	1.6	41.6	0	0
Nov-14	0.3	0	40.5	0	0
Dec-14	20.1	20.1	14.4	0	0
Jan-15	20.3	20.3	0	0	0
Feb-15	0.3	0.3	0	0	0
Mar-15	0.1	0.1	2.5	0	0
Apr-15	0.5	0.5	0	0	0
May-15	0.3	0.3	0	0	0
Jun-15	33	33	0.4	0	0
Jul-15	45.3	45.3	1.1	0	0
Aug-15	9.9	9.7	0	0	0
Sep-15	0	0	0	0	0
Oct-15	0	0	0	0	0
Nov-15	0	0	0	0	0
Dec-15	0	0	0	0	0

Facility Performance



Facility Performance



Facility Performance

- Operating Issues
  - OTSG – Initial challenges encountered with control philosophy
  - New control panel installed to mitigate burner control issues
- Reliability
  - Were unable to meet target steam slugs on 16-09 initially due to OTSG reliability issues
  - Building around OTSG for cold weather and new control system installed to increase reliability
  - Achieved target steam rates of 250 m^3/d
- Downtime
  - December 2015 a major boiler tube failure was found
  - Market conditions made economics on repair unfavourable
  - Source water problem led to failure

Measurement and Reporting

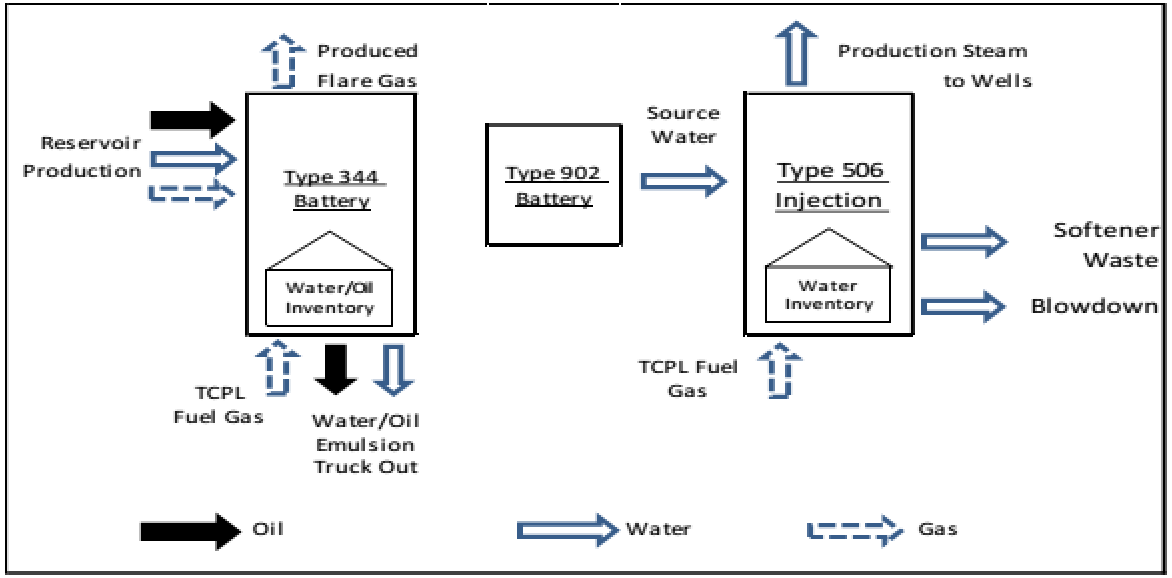
- Updated MARP submitted February 6, 2015 – Revision 3
  - No major changes to testing philosophy
  - MARP updated and submitted to include wells 4 and 5

- Production Volumes
  - Wells tested using a 2-phase separator and prorated on facility actuals
    - Coriolis meter and water cut analyzer used on the liquids dump for tested oil volume
    - Oil production volumes credited back to facility at receipt point (1-26)
  - Casing gas measured by orifice meters
  - Steam injected volumes measured by BFW into OTSG (vortex and turbine meters) as well as wellhead venturi meter
  - Source water measured by turbine meter

Measurement and Reporting

- **Corresponding facility codes (left) and process schematic (right) are shown below.**

Surface Location	Description	Registry Subtype	Facility ID
13-09-085-17W5M	Oil Battery	344	AB BT 0126293
13-09-085-17W5M	Steam Injection Facility	506	AB IF 0127947
16-08-085-17W5	Source Water Well	902	AB BT 0127681



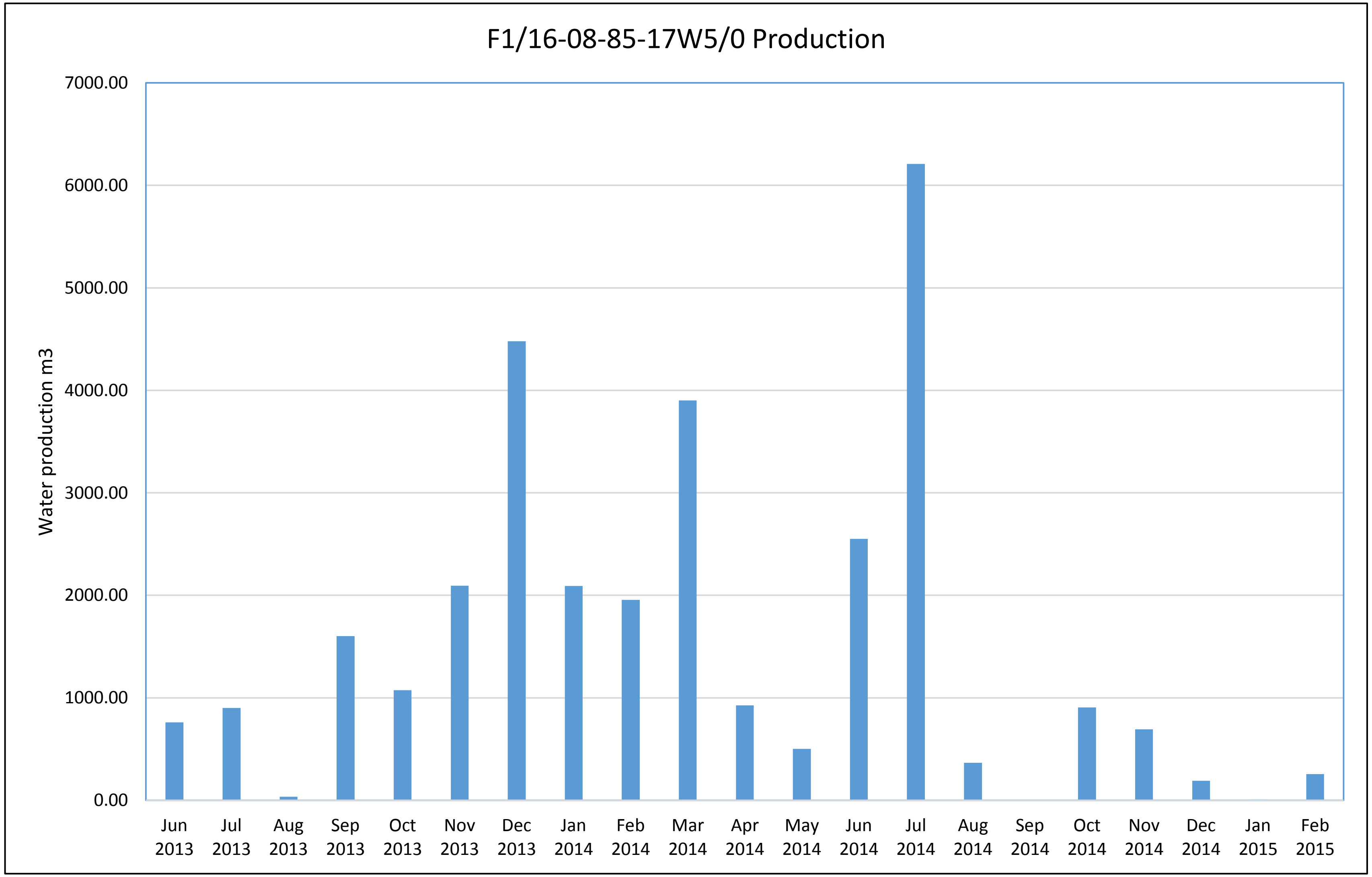
Source Water

- WSW: F1/16-08-085-17W5/0
- Paddy formation (fresh)
- Cum extracted: 31,501.7 m^3 water
  - No source water volumes extracted since February, 2015

Month	Water m^3
Jun 2013	760.00
Jul 2013	900.40
Aug 2013	35.00
Sep 2013	1602.00
Oct 2013	1075.00
Nov 2013	2093.00
Dec 2013	4478.00
Jan 2014	2091.50
Feb 2014	1956.80
Mar 2014	3901.90
Apr 2014	925.80
May 2014	501.30
Jun 2014	2550.50
Jul 2014	6210.20
Aug 2014	366.00
Sep 2014	0.00
Oct 2014	905.20
Nov 2014	693.00
Dec 2014	191.00
Jan 2015	8.40
Feb 2015	256.70
Total	**31,501.70**

Source Water Volumes

No source water volumes extracted since February, 2015



Production Accounting Reported Volumes

Well 1 S0/04-17-085-17W5/0

Month	Monthly Oil (m3)	Monthly Gas Monthly Water (E3M3)	Monthly Water (m3)	Mon Inj Steam (m3)	Battery Oil Proration Factor	Battery Water Proration Factor
Jun-13	0	0	410.6	760		1
Jul-13	80.6	4.2	126.9	834		1
Aug-13	186.7	0.1	391.9	0	1.03	1.14
Sep-13	14.7	6.9	488.2	1167	1	1.14
Oct-13	143.3	11.6	174.6	0	1.02	0.82
Nov-13	20.3	0.8	352.1	669	0.94	1.12
Dec-13	150	15.1	801.5	1056	1.03	1.08
Jan-14	82.4	3.1	177	1583	0.95	0.94
Feb-14	249.5	11.6	844	0	0.82	1.06

Production Accounting Reported Volumes

Well 2 00/16-09-085-17W5/0

Month	Monthly Oil (m3)	Monthly Gas Monthly Water (E3M3)	Monthly Water (m3)	Mon Inj Steam (m3)	Battery Oil Proration Factor	Battery Water Proration Factor
Jun-13	0	0	0	0		1
Jul-13	0	0	0	0		1
Aug-13	22.6	0.1	476.6	0	1.03	1.14
Sep-13	5.9	2.7	62.8	150	1	1.14
Oct-13	218.8	17.7	601.2	939	1.02	0.82
Nov-13	603.7	22.7	1388.8	1295	0.94	1.12
Dec-13	143.9	14.2	205	3030	1.03	1.08
Jan-14	1385.9	52.8	2038	218	0.95	0.94
Feb-14	443.3	20.5	1223.7	1820.8	0.82	1.06
Mar-14			427.7	3771.9	3.03	0.81
Apr-14	1521.9	36.4	2968.3	0	0.96	1.06
May-14	659	40.9	3036.6	0	0.87	1.02
Jun-14	383.9	15.8	1923.9	1594.5	1.39	0.97
Jul-14	820.8	38.1	2454.7	5893.2		
Aug-14		0.1	16.7		0.91	0.95
Sep-14	1039.7	0.1	4125.8		0.84	1.08
Oct-14	519.1	16.2	3734.6		0.97	0.97
Nov-14	196.5	0.1	1861.6		0.88	1.00
Dec-14	5.7		1344.4		0.92	1.00
Jan-15	250.5	0.1	4118.7		0.48	1.05
Feb-15	188.2	0.3	3128.7		0.63	0.85
Mar-15	247	0.1	3205.4		0.82	0.86
Apr-15	167.4	0.5	2660.3		0.63	0.92
May-15	295.4	0.3	2730.7		0.97	0.99
Jun-15	122.4	33	2345.6		0.60	1.42
Jul-15	248.2	45.3	2099		0.89	0.87
Aug-15	53	9.9	603.8		0.87	1.07

Production Accounting Reported Volumes

Well 3   00/12-08-085-17W5/0

Month	Monthly Oil (m3)	Monthly Gas Monthly Water (E3M3)	Monthly Water (m3)	Mon Inj Steam (m3)	Battery Oil Proration Factor	Battery Water Proration Factor
Jun-13	0	0	410.6	760		1
Jul-13	80.6	4.2	126.9	834		1
Aug-13	186.6	0.1	391.9	0	1.03	1.14
Sep-13	14.7	6.9	488.2	1167	1	1.14
Oct-13	143.3	11.6	174.6	0	1.02	0.82
Nov-13	20.3	0.8	352.1	669	0.94	1.12
Dec-13	150	15.1	801.5	1056	1.03	1.08
Jan-14	82.4	3.1	177	1583.5	0.95	0.94
Feb-14	249.5	11.6	844	0	0.82	1.06
Mar-14	35.2		28.7		3.03	0.81
Apr-14	147.9	3.5	223.2	782.8	0.96	1.06
May-14	154	9.5	378.8	422.3	0.87	1.02
Jun-14	73.4	3	35	431	1.39	0.97
Jul-14						
Aug-14	61.7	2.9	311	230	0.91	0.95
Sep-14		0.1	184		0.84	1.08
Oct-14	133	0.1	404.4	584.2	0.97	0.97
Nov-14	177.2	11.1	382.4	512.5	0.88	1.00
Dec-14	64.2	0.1	40		0.92	1.00
Jan-15	33.9		65		0.48	1.05
Feb-15	27.8	9.7	30.8		0.63	0.85

Production Accounting Reported Volumes

Well 4 00/13-08-085-17W5/0

Month	Monthly Oil (m3)	Monthly Gas Monthly Water (E3M3)	Monthly Water (m3)	Mon Inj Steam (m3)	Battery Oil Proration Factor	Battery Water Proration Factor
Oct-14				3200.4	1.02	0.82
Nov-14	524.7	0.1	5235.3		0.88	1.00
Dec-14	182.1	6	3741.7		0.92	1.00
Jan-15	70.2	4.4	1265.3		0.48	1.05

Production Accounting Reported Volumes

Well 5   02/13-08-085-17W5/0

Month	Monthly Oil (m3)	Monthly Gas Monthly Water (E3M3)	Monthly Water (m3)	Mon Inj Steam (m3)	Battery Oil Proration Factor	Battery Water Proration Factor
Nov-14				213.9	0.88	1.00
Dec-14	431.1	14.1	5283.2		0.92	1.00
Jan-15	97.3	6.1	1501.9		0.48	1.05

Produced and Waste Water

- Produced water reported in Petrinex.
- Destination:
  - 04-22-084-18W5 – salt water disposal well
  - 12-24-085-19W5 – Tervita sand and waste disposal well

Month	Produced Water (m3)	Waste Water (m3) [1]
Jan-14	2215	2379
Feb-14	2068	1869
Mar-14	456	705
Apr-14	3192	3014
May-14	3415	3217
Jun-14	1959	2440
Jul-14	0	337
Aug-14	2766	2832
Sep-14	4530	4592
Oct-14	4117	4302
Nov-14	7137	7474
Dec-14	10434	10439
Jan-15	6917	0
Feb-15	3129	0
Mar-15	3205	0
Apr-15	2660	0
May-15	2731	0
Jun-15	2346	0
Jul-15	2099	0
Aug-15	604	0
Sep-15	0	0
Oct-15	0	0
Nov-15	0	0
Dec-15	0	0

Sulphur Production & Ambient Air Quality Objectives (AAQO)

- **Produced gas is sweet and directed to flare (casing to HP and solution to LP)**
  - The sulphur production (t/d) from flare volumes is zero (allowed 0.004 t/d).
  - Monthly gas analysis showed mostly zero with some “trace” of H_2S
- **Ambient Air Quality Objectives (right tables)**
  - Four passive air monitors for each pollutant (S02 H2S, N02) sampled on a daily basis for one month.
  - Value shown is a peak from 4 samplers.
  - No exceedance from AAQO.

Pollutant	AAQO Guideline
SO_2	< 48 ppb, 24h
H_2S	< 3 ppb, 24h
NO_2	< 11 ppb, 30-day avg

Passive Air Monitor Samples (ppb)			
Year/Max	SO_2	H_2S	NO_2
2014	1.2 (Oct)	0.14 (Nov)	7.9 (July)
2015	0.40 (May)	0.11 (Aug)	3.1 (Oct)

Environmental Issues

- EPEA approval 322432-00-00 received to operate its Cadotte thermal project September 5, 2013
  - EPEA approval is suspended for 2016 year, because wells, facility, and pipelines are shutdown.
  - To monitor and keep records of run-off ponds internally.
- Summary of Monitoring
  - Disturbance and Stockpile Report – Submitted March 5, 2014 (one-time).
  - Passive Air Monitoring and Reporting – Measures NO_2, SO_2 and H_2S monthly
    - Reports submitted to EPEA monthly starting Oct. 2013 with last one for February 2016 month.
    - No limits exceeded to date
  - Annual Air Emissions Report – submitted March 31, 2015
  - Ground Water Monitoring – submitted March 31, 2015
  - Industrial Waste Water and Runoff Report – submitted March 31, 2015

Compliance

- Murphy is in compliance with all regulatory bodies (AER, EPEA, AB Env, and DFO). Specifics shown below and in Suspension section.

- **Flaring**
  - No issues in 2014 (0.8 e3m^3/d) and 2015 (0.3 e3m^3/d)

- **F1/16-08-085-17W5/0 Source Water Well**
  - Monthly reports were submitted to Petrinex since production started in June 2013.
  - Annual Waters reports submitted for 2014 and 2015 years.

- **Manual Stack Survey Extension – submitted Feb. 25, 2014**
  - Once Through Steam Generator tube failure in Dec 2014, no steam in 2015, therefore, no stack survey for 2015.

Agenda

- Subsurface
- Surface
- **Future Plans**
- Conclusions

Future Plans

- Project is currently on hold and suspended.

- Future plans will be revisited once project is planned for re-start.

Agenda

- Subsurface
- Surface
- Future Plans
- **Conclusions**

Conclusions

- **D54 Performance**
  - Pilot performance results were mixed, especially in the initial three wells which were not drilled as fit for purpose HCSS producers
    - Drilled as primary producers in the Upper Bluesky, subsequently utilized as HCSS wells in the thermal pilot
    - Well 1 shut-in early due to poor performance, wells 2 & 3 were more successful
  - Wells 4 & 5, drilled into the Lower Bluesky, have indicated good performance in the first cycle with a combined CSOR of 3.0
    - Well 4 CSOR of 2.3, well 5 CSOR of 4.0