SPE INWELL MONITORING & SURVEILLANCE SEMINAR

FRACTURE CHEMICAL TRACERS IN THE CHISWICK FIELD

M. LANGFORD - SPIRIT ENERGY

SPIRIT ENERGY

October 2019

Outline

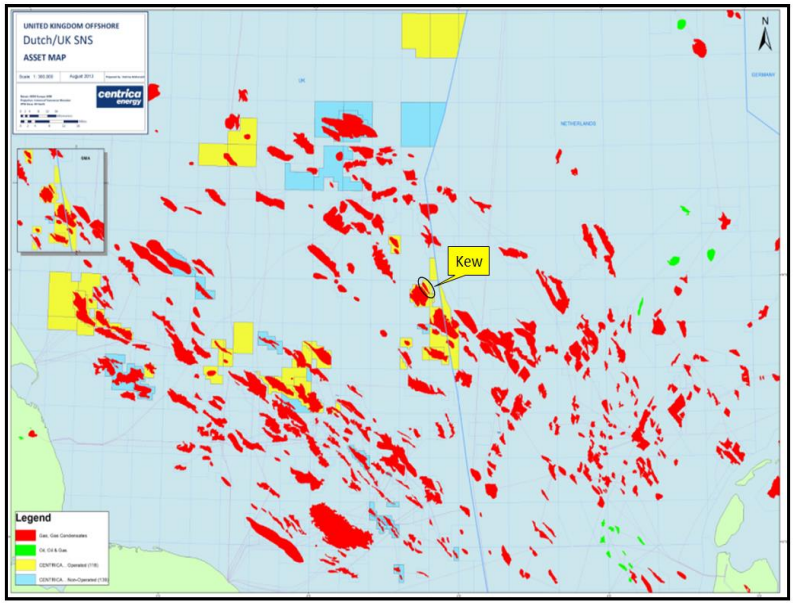
- The challenges of stranded gas fields
- Kew/Chiswick field history and overview
- The challenges of developing Kew/Chiswick
- Development strategy and execution of chemical tracers
- Conclusions

Stranded Gas Fields in the Southern North Sea

- Over 100 gas accumulations can be found in the SNS and are well documented within SPE literature (Coghlan et al. 2013; Schulte et al. 2012).

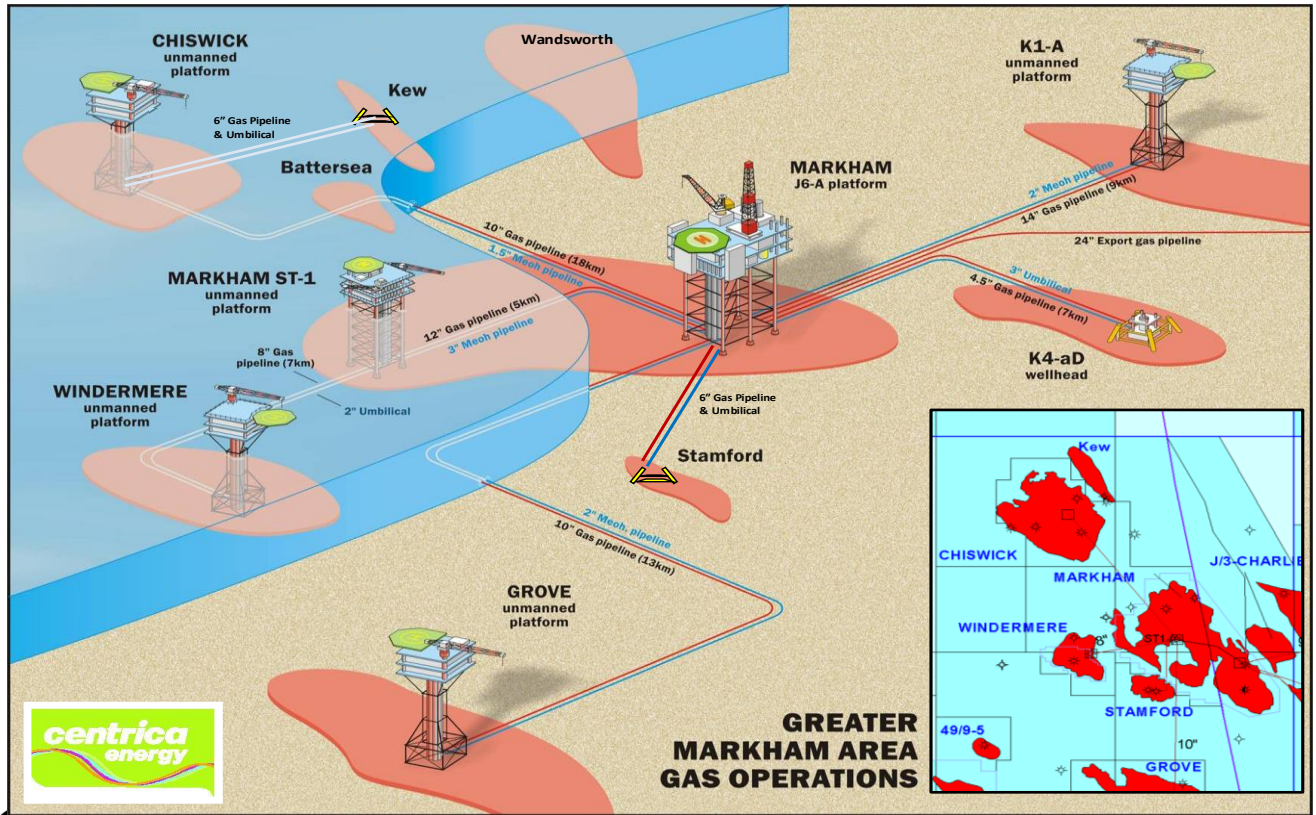
- Tight reservoirs, distant infrastructure, small volumes, and anomalous gas qualities are amongst the main reasons why these resources have not yet been developed.

- Difficult for subsea, interventions on PLT in horizontal wells



SPIRIT ENERGY

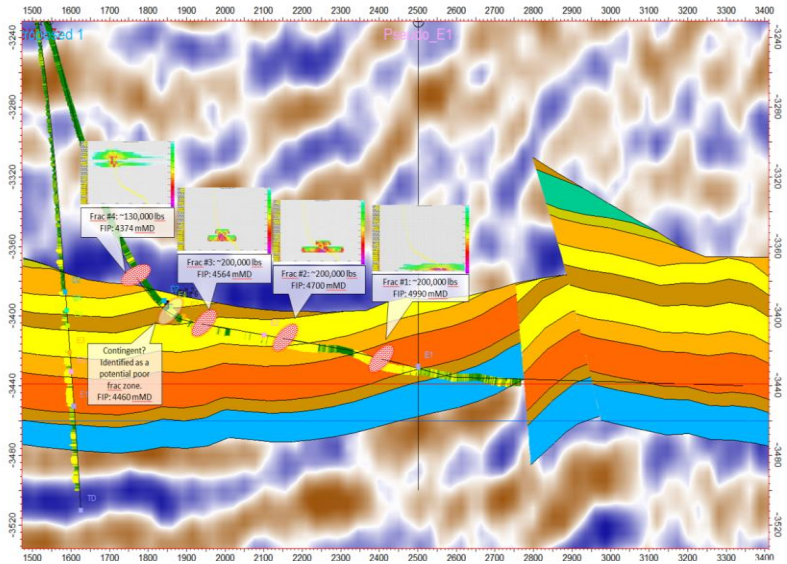
Infrastructure Layout



SPIRIT ENERGY

Kew Development Plan

- Sub-horizontal well drilled in order to target all the sand bodies
- One hydraulic fracture planned in each of the target sands plus crossing into additional sands
- The combination of horizontal drilling and hydraulic fracturing were found to be the optimum development option for KEW reservoir.
- Chemical tracers pumped within the frac fluids

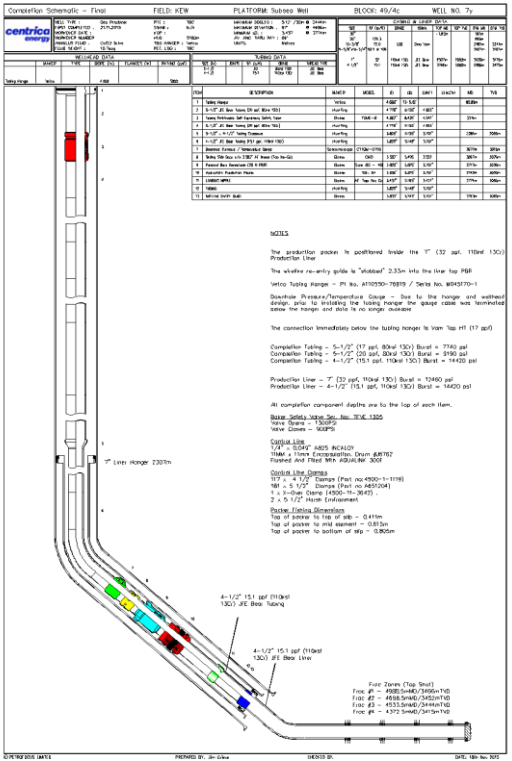


SPIRIT ENERGY

Kew Drilling and Completion

- Hydraulic fracturing performed through the final completion/production string
- Design tried and tested within our portfolio
- Increased weight of tubulars to cater for all load scenarios
    - tri-axial, burst, collapse, tension, compression
- Real time DHPG key to understand fracture performance
    - Decisions can be made on the fly with actual BH gauge data
    - no need to extrapolate from surface readouts.
- Monobore from 5-1/2” x-over all the way to TD for ease of CT

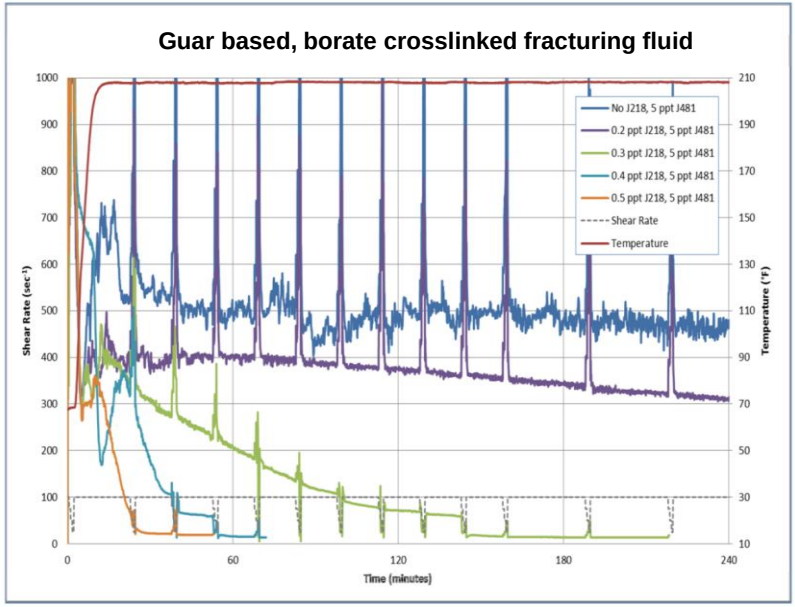
****PLANNED TO PUMP CHEMICAL FRAC TRACERS FOR CLEAN-UP EFFICIENCY AND RESERVOIR UNDERSTANDING****



SPIRIT ENERGY

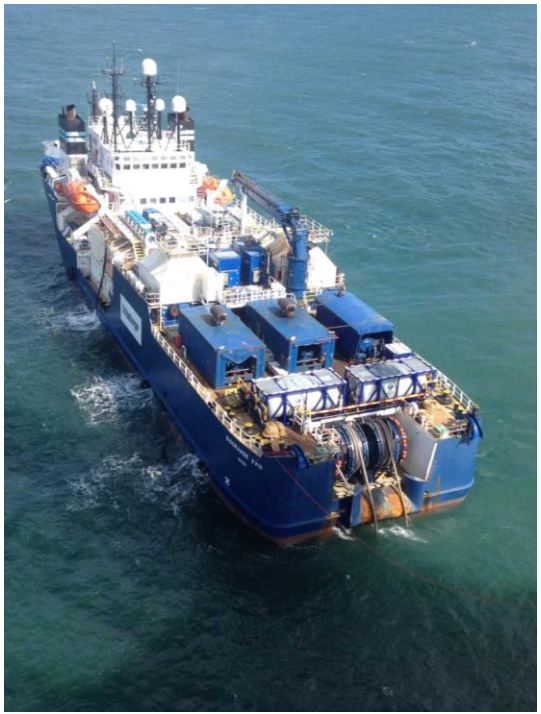
Kew Hydraulic Fracturing Planning

- A borate crosslinked fresh water fluid was used to initiate the fractures and transport the proppant.
- A dedicated stimulation vessel was used for the execution phase as it allows higher flexibility in treatment execution.
- Frac tracers fluids pumped within the frac fluid itself (ppm concentrations).



SPIRIT ENERGY

Kew Hydraulic Fracturing Execution



SPIRIT ENERGY

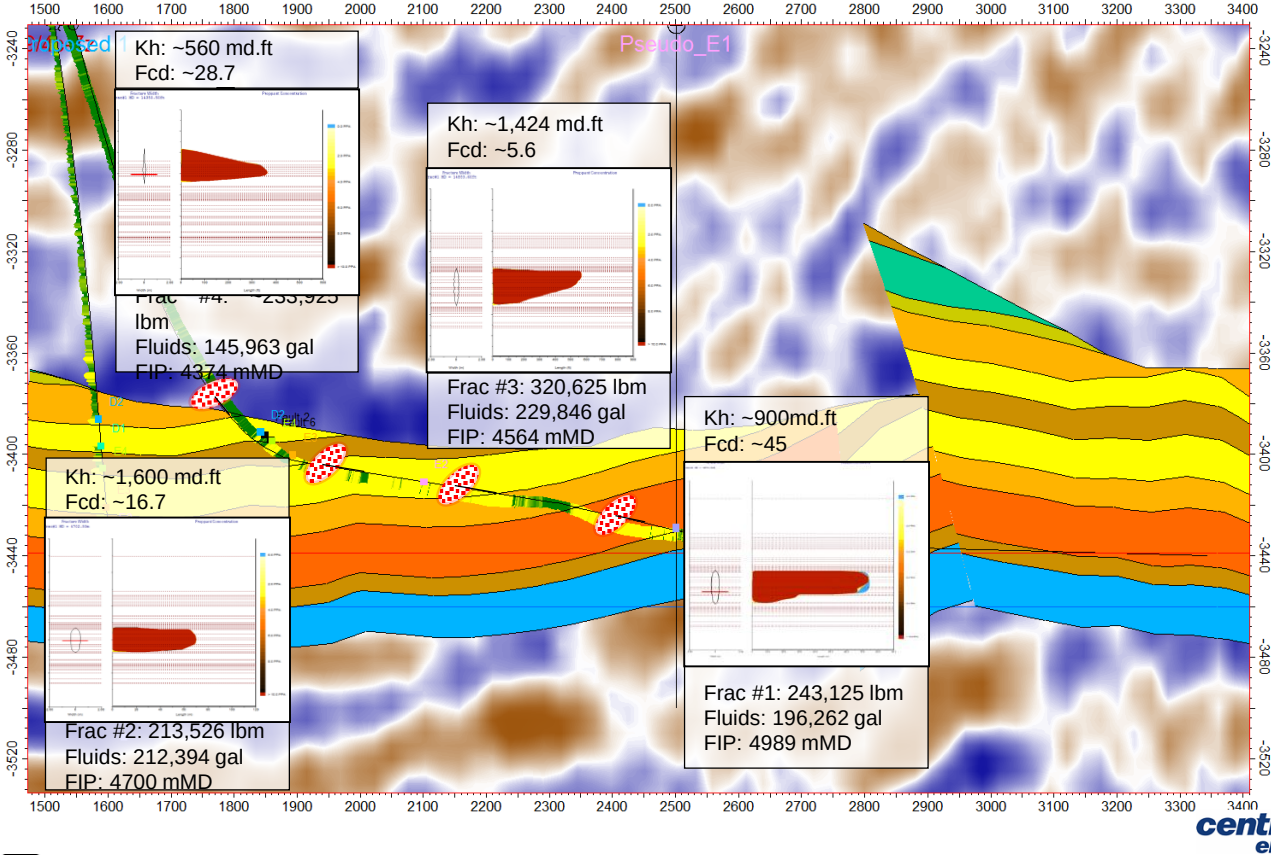
Kew Hydraulic Fracturing Execution

- Four hydraulic fracturing stages were successfully executed
- Over a million pounds of proppant pumped

PARAMETER	Z1	Z2	Z3	Z4	All Zones
	Well: 49/4c-7Y				
Main job execution date	20th Sept	25th Sept	6th Oct	8th Oct	
Total Slurry (bbl), Data & MainFRAC	4,898.5	5,234.0	5,773.0	3608.0	19,514.0
Total Clean (gal), Data & MainFRAC	196,262	212,394	229,846	145,963	784,465
Total 100-Mesh sand Data & MainFRAC (lbm)	5,270	11,701	6,418	17,652	41,041
Total 16/30 ISP MainFRAC (lbm)	243,125	213,526	320,625	233,925	1,011,201
Max Rate MainFRAC (BPM)	35.5	40.0	40.5	36.0	-
Ave Surface Pressure MainFRAC (psi)	5,270	3,988	5,111	5685	-
Max. Surface Pressure MainFRAC (psi)	7,104	8,010	7,061	8177	-
Ave BH Pressure (psi) – DataFRAC only	9,162	5,229	5,280	2021	-
Max. BH Pressure (psi) – DataFRAC only	3,695	12,074	10,076	11,541	-

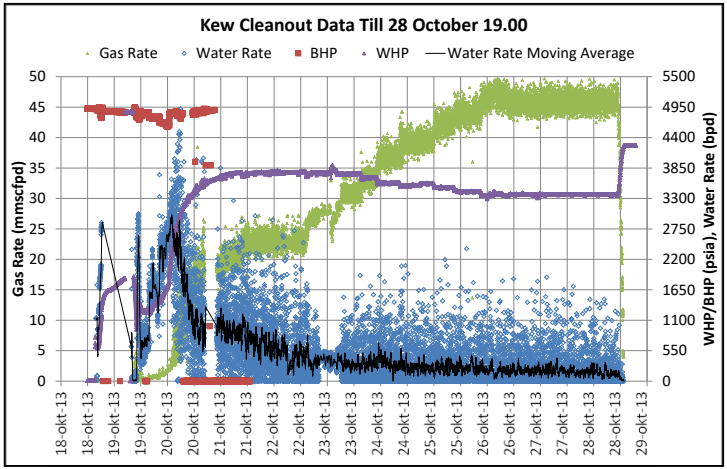
SPIRIT ENERGY

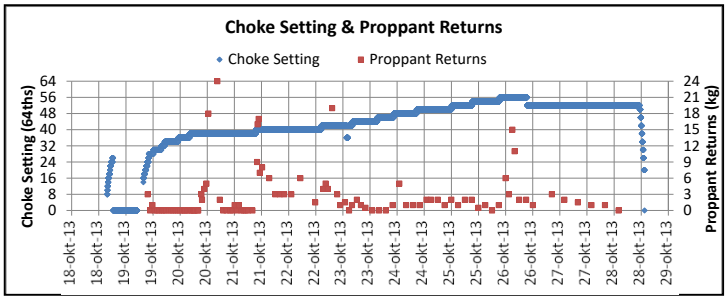
Kew Horizontal Well Fracturing Execution Results



Kew Post Frac Clean-up

- Choke size 52/64” fixed.
- FWHP 3370 psi.
- Gas rate ~45 mmscfpd.
- Condensate rate 420 bbls/d.
- Water rate 179 bbls/d.
- Proppant rate trace. 1kg over the previous 12 hours.
- BSW 38%.
- Cumulative condensate 2470 bbls.
- Cumulative water 5325 bbls.
- Cumulative proppant 290kg.
- PVT sampling complete.





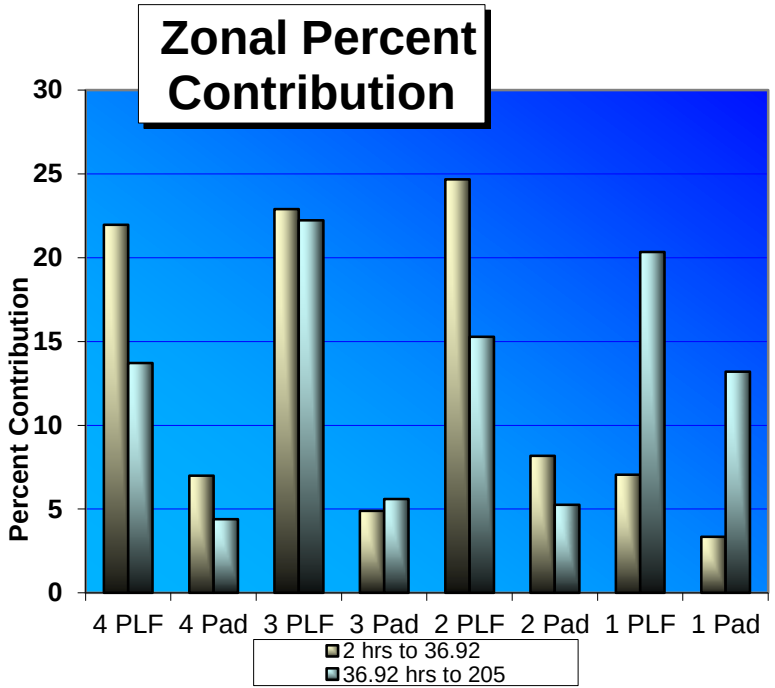
SPIRIT ENERGY

Tracer Objectives

- Be in a chemical form that will move with the fracture fluids, without being adsorbed onto the formation or otherwise lost through chemical, thermal or biological instability problems.
- Be able to be reliably detected at ultra-low levels.
- Be uniquely distinguishable from all other tracers used in the field.
- Be produced at concentrations which will cause no damage to terrestrial or sea life, and not adversely affect the atmosphere or biosphere.
- Be available in sufficient quantities at a reasonable cost.

Kew Evaluation of Chemical Tracers

- Chemical tracers were used to evaluate the clean-out efficiency
- For each fracturing stage two tracers were used, one in the pad and one in the proppant stages
- All 8 tracers used (ppm) were North Sea compliant and do not affect the fracturing fluids properties
- The tracers showed good indication of all the fractures flowing



SPIRIT ENERGY

Centrica Energy KEW 49/4c-7/72 KY Normalized Data Table

Key
>200
150 to 200
100 to 150
70 to 100
50 to 70
35 to 50
25 to 35
17 to 25
12 to 17
8 to 12
5 to 8
3 to 5
2 to 3
1 to 2
0.05 to 1

			Normalized Chemical Frac Tracer Concentration, ppb									
		Traced Segment	4 PLF	4 Pad	3 PLF	3 Pad	2 PLF	2 Pad	1 PLF	1 Pad		
		Stim Date	10/8/13	10/8/13	10/5/13	10/5/13	9/25/13	9/25/13	9/21/13	9/21/13	Totals	Avgs
		Traced Fluid vol (Gal)	56,255	29,781	80,278	50,108	60,906	60,103	60,443	45,693	443,567	55,446
	FPE 8.3	CFT Injected (g)	160	85	228	142	175	173	173	130	1,266	158
		% Injected	12.6%	6.7%	18.0%	11.2%	13.8%	13.7%	13.7%	10.3%		
	Cum Vol*	Sample Date	Sample Type	CFT 1500	CFT 2000	CFT 1200	CFT 1600	CFT 1100	CFT 1400	CFT 1000	CFT 1700	CFT Total ppb	Calc Chlorides Total
1	106	10/19/13 9:30	Water (Produced)	1.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0	2.8	3,320
2	135	10/19/13 10:30	Water (Produced)	2.6	1.7	0.0	0.0	0.0	0.0	0.0	0.0	4.2	5,036
3	218	10/19/13 11:30	Water (Produced)	2.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4,999
4	245	10/19/13 12:30	Water (Produced)	106.0	48.2	0.4	0.0	0.0	0.0	0.0	0.0	154.6	95,494
5	272	10/19/13 13:30	Water (Produced)	88.0	76.5	8.0	2.9	1.8	0.7	0.0	0.0	177.9	67,113
6	303	10/19/13 14:30	Water (Produced)	39.5	35.3	14.1	4.8	8.0	2.4	0.0	0.0	104.0	35,909
7	330	10/19/13 15:30	Water (Produced)	36.6	29.2	14.3	4.4	9.3	2.9	0.0	0.0	96.7	35,139
8	396	10/19/13 16:30	Water (Produced)	33.1	22.6	12.1	3.9	13.4	4.1	0.0	0.0	89.1	32,613
9	463	10/19/13 17:30	Water (Produced)	31.4	20.2	13.6	4.1	13.3	4.3	0.3	0.0	87.0	30,529
10	535	10/19/13 18:30	Water (Produced)	30.5	19.4	15.1	4.6	13.2	4.1	0.5	0.3	87.7	30,690
11	603	10/19/13 19:30	Water (Produced)	27.1	16.6	17.3	5.2	14.4	4.8	1.2	0.5	87.1	26,146
12	667	10/19/13 20:30	Water (Produced)	24.5	14.8	17.4	5.0	14.0	4.6	1.8	1.0	83.1	24,406
13	953	10/19/13 23:30	Water (Produced)	23.0	13.6	20.0	6.7	15.6	5.1	4.4	2.6	90.9	23,134
14	1292	10/20/13 2:30	Water (Produced)	12.8	7.7	12.5	4.2	40.7	13.9	3.9	2.4	98.0	23,680
15	1598	10/20/13 5:30	Water (Produced)	19.5	11.5	17.4	6.3	30.7	10.7	6.3	4.1	106.6	24,466
16	1829	10/20/13 8:30	Water (Produced)	22.7	12.9	21.1	6.7	28.4	9.4	9.2	5.9	116.5	24,486
17	1995	10/20/13 11:30	Water (Produced)	24.1	13.7	22.2	7.7	28.6	9.7	12.4	7.8	126.3	24,815
18	2114	10/20/13 14:30	Water (Produced)	24.4	13.4	20.6	8.0	27.2	9.4	13.8	8.7	125.5	26,652
19	2465	10/20/13 17:30	Water (Produced)	25.9	14.1	23.0	8.1	29.8	9.8	15.0	9.4	135.1	26,949
20	2555	10/20/13 20:25	Water (Produced)	26.3	14.5	23.4	8.9	29.5	10.1	17.6	11.3	141.5	30,080
21	2858	10/21/13 2:30	Water (Produced)	24.2	13.3	27.1	9.3	33.8	11.5	19.3	12.7	151.1	26,766
22	3060	10/21/13 8:30	Water (Produced)	23.0	13.0	24.8	10.0	30.3	10.6	22.8	15.2	149.6	30,164
23	3296	10/21/13 14:30	Water (Produced)	21.6	12.5	24.3	9.5	28.5	9.7	24.5	16.6	147.2	31,083
24	3410	10/21/13 20:30	Water (Produced)	21.6	12.7	25.4	9.6	27.8	9.8	27.2	18.8	152.8	32,524
25	3546	10/22/13 2:30	Water (Produced)	20.4	12.1	25.1	9.2	25.7	9.1	28.3	20.1	150.0	32,153
26	3647	10/22/13 8:30	Water (Produced)	20.5	12.5	25.8	9.4	23.5	8.4	31.2	22.6	153.9	31,576
27	3735	10/22/13 14:30	Water (Produced)	20.0	11.9	25.1	9.7	21.9	7.9	33.2	24.3	153.9	33,614
28	3872	10/22/13 20:30	Water (Produced)	16.7	10.5	22.0	7.7	20.7	7.6	28.3	21.8	135.2	30,443
29	4030	10/23/13 8:30	Water (Produced)	19.5	12.1	24.4	8.7	20.5	7.3	31.5	24.9	148.9	35,723
30	4113	10/23/13 20:30	Water (Produced)	22.0	13.1	25.6	9.9	18.4	6.5	35.7	30.0	161.2	36,080
31	4248	10/24/13 8:30	Water (Produced)	26.5	15.7	30.7	11.6	21.4	7.6	43.0	38.1	194.5	35,514
32	4308	10/24/13 20:30	Water (Produced)	20.4	12.7	24.7	10.6	19.0	6.9	41.6	36.5	172.5	35,204
33	4369	10/25/13 8:30	Water (Produced)	21.3	13.0	23.7	9.9	17.1	5.9	35.9	34.0	160.8	36,990
34	4424	10/25/13 20:30	Water (Produced)	21.4	13.5	23.4	10.4	15.8	5.8	36.5	35.8	162.6	38,037
35	4965	10/26/13 20:30	Water (Produced)	21.7	14.4	23.5	11.3	14.9	5.2	35.8	37.0	163.7	39,363
36	5242	10/27/13 20:30	Water (Produced)	20.6	13.3	23.1	10.7	14.0	4.8	32.2	34.8	153.6	37,796
	614 Avg BPD		Avg ppb	26.2	16.5	18.6	6.9	18.6	6.4	16.5	13.3	123.1	31,630
			% total ppb from Stage	21.3%	13.4%	15.1%	5.6%	15.2%	5.2%	13.4%	10.8%	100.0%	
			% total ppb @ last sample	13.4%	8.6%	15.0%	7.0%	9.1%	3.2%	21.0%	22.7%	100.0%	
			Mass Balance Recov'd (g)	18.7	6.0	25.0	5.9	21.1	7.1	17.3	10.6	111.8	
			% of Total Recovery	16.7%	5.4%	22.4%	5.3%	18.9%	6.4%	15.4%	9.5%	100.0%	
			SLR	10.0	8.0	10.0	4.7	10.0	4.7	10.0	9.3	8.3	
			No Flow Zones	0		0	Deduct						
			Heel/Toe Ratio	1.4		0	Deduct						
			14 Day flow decline	N/A		0	Deduct						
			Traced Fluid Recovered	8.8%									

DIAGNOSTIC METRICS

Flow Profile Effectiveness (FPE): A total well score (0-10) based on the weighted average SLR minus deductions for no flow zones, heel/toe ratios greater than 2 and flow decline greater than 50%.

Segment Load Recovery (SLR): A score of 0-10 given to each traced segment or stage based on the percentage of total recovered grams divided by the percentage of tracer injected.

No Flow Zones: Any stage or segment which tracer is not detected.

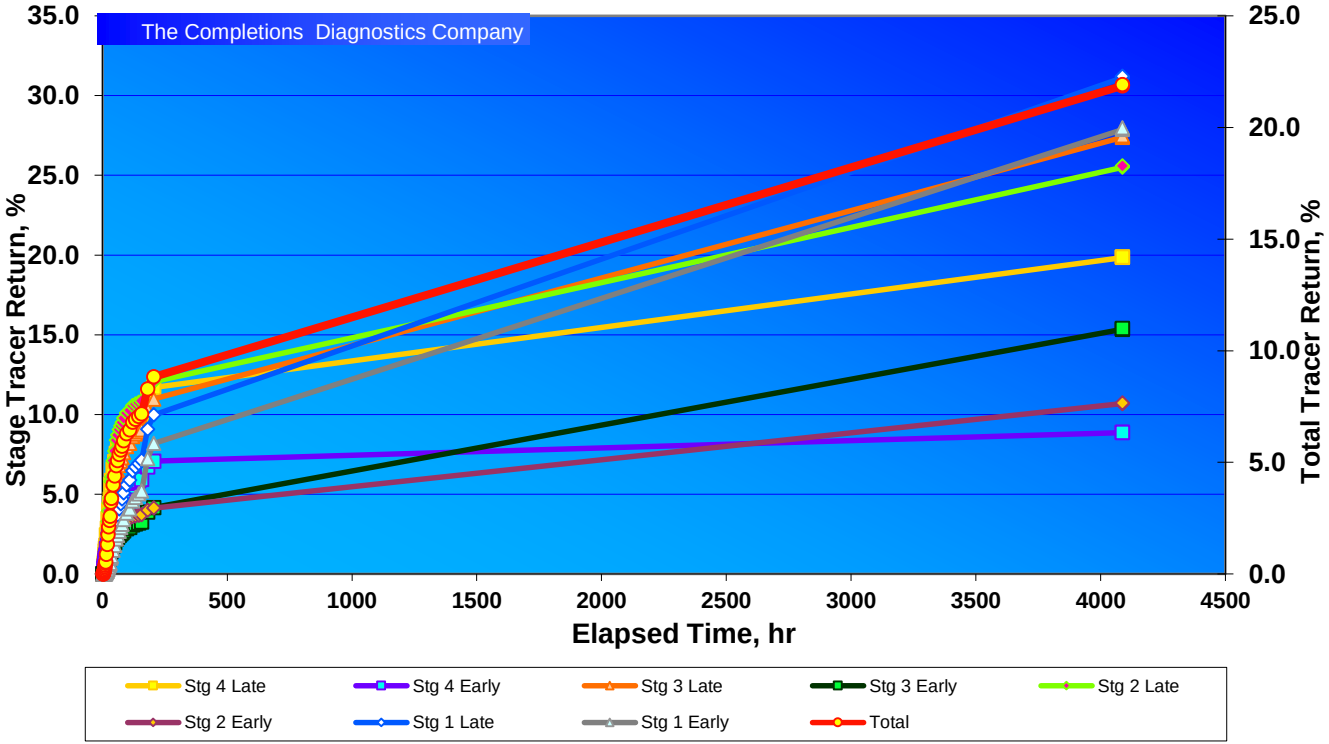
Heel/Toe Ratio: The average concentration of the heel stage or segment divided by average concentration of the toe stage or segment. Ratios greater than two suggest an imbalance in the flow profile.

Evaluation of Chemical Tracers (6+ MONTHS)

- Chemical tracers again sampled 6+ months from initial sampling
- 3 samples taken and sent for analysis
- All three are showing tracer detection, indicating that frac fluids are still returning from the well
- The tracers showed good indication of all the fractures flowing

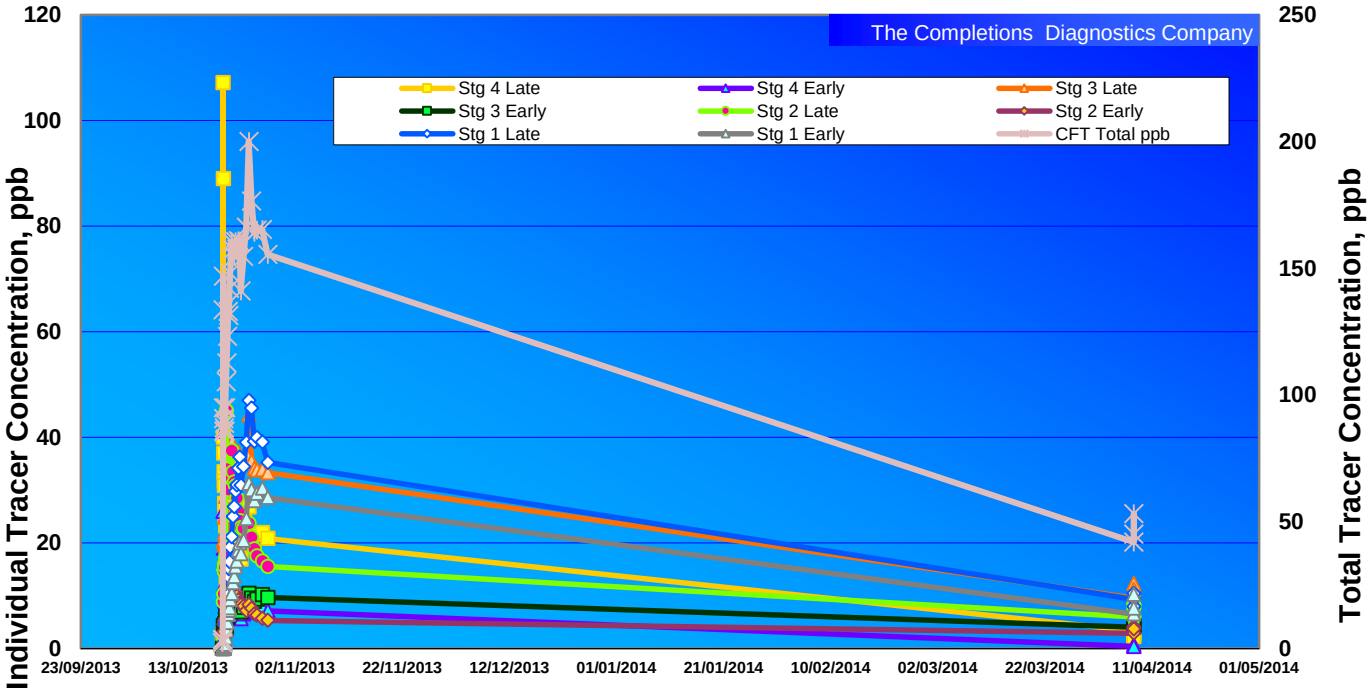
SPIRIT ENERGY

Tracer Return vs Elapsed Flowback Time



SPIRIT ENERGY

Tracer Concentration vs Time



SPIRIT ENERGY

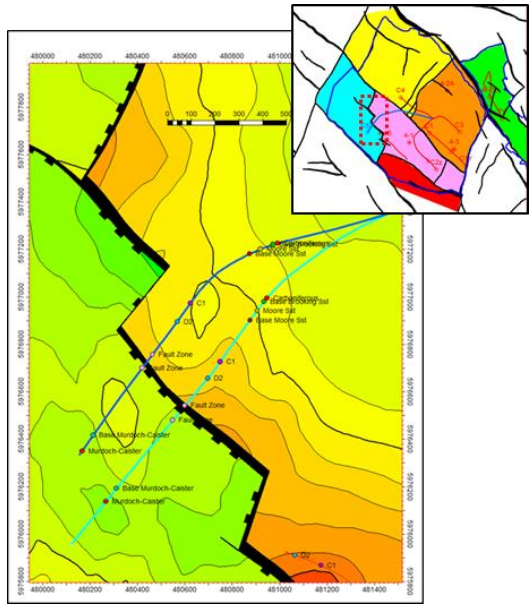
CASE STUDY #2 CHISWICK C5Y WELL

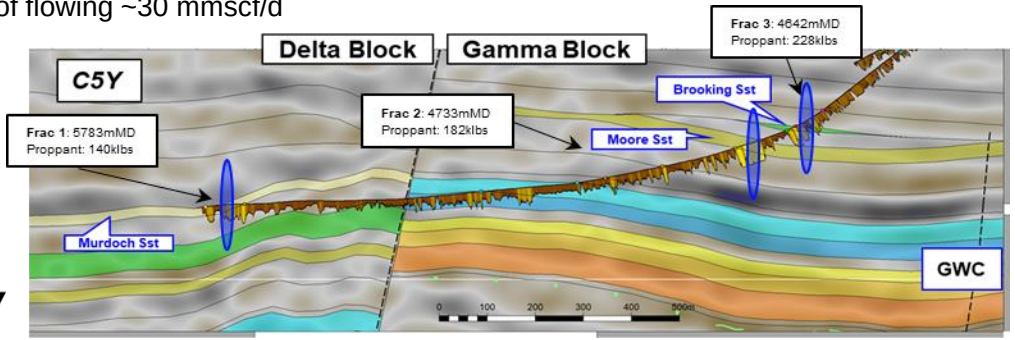
Well Objectives

- 5th production well on Chiswick Gas Field (Carboniferous reservoir)
- Develop Gamma West (pink) and Delta (blue) fault blocks
- Acquire log and pressure data
- Reliable completion of up to 6 hydraulic fractures (plug & perf)

Results

- 3 fracs placed (1 in Delta and 2 in Gamma)
- 550,000 lbs proppant pumped, 13,400bbls pumped
- Well capable of flowing ~30 mmscf/d





SPIRIT ENERGY

C5 WELL COMPLETION

Chiswick Infill | FIELD: Chiswick | PLATFORM: Chiswick | BLOCK: 49-4a | WELL: C5

SPIRIT ENERGY

WELL TYPE:	Gas Producer	FLUID WT:	11.3	MAX DOGLEG:	@
FIRST COMPLETED:	25/04/19	RTE:		MAX DEVIATION:	@
WORKOVER DATE:		SWAB:		MINIMUM ID:	@
WORKOVER NO.:		KOP:		AV PAY ANGLE:	
ANNULUS FLUID:	CaCl	HUD:		REF LOG:	

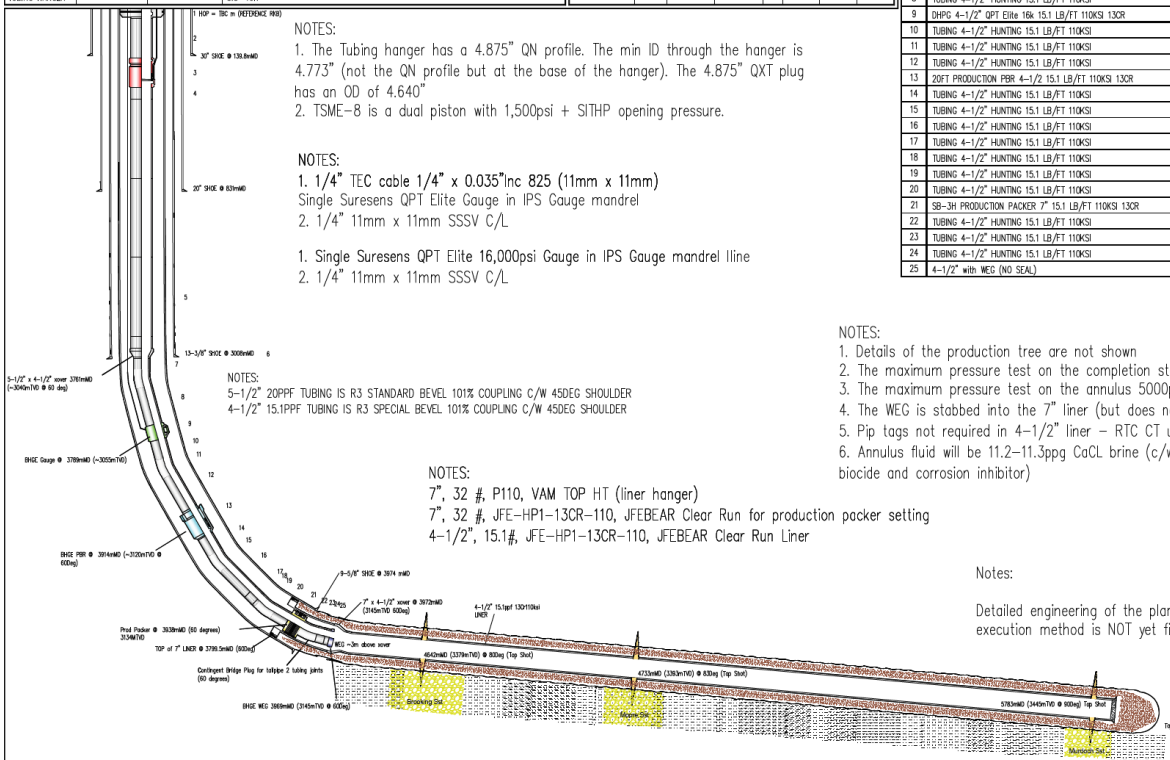
WELLHEAD DATA

DESCRIPTION	MAKER	TYPE	SIZE & PRESSURE
XMAS TREE 5K			
UNIHEAD			20.3/4" x 13.3/8" 10K SL-IT UNIHEAD
TUBING SPOOL			
TUBING HANGER			5.5" 10K

CASING / LINER / TUBING DATA

SIZE	WEIGHT	GRADE	CONN.	JNTS	TOP MD	BTM MD	BTM TVD
30"	1" WT	X52	BUTTWELD				
20"	129.3	X56	EBOMT				
13-3/8"	72	L80	DINO VAM				
10-3/4"	109						
9-5/8"	53.5		VAM TOP				
5.5"(80ksi)	20	13Cr	JFE BEAR				
4.5"(110ksi)	15.1	13Cr	JFE BEAR				

ITEM	DESCRIPTION	ID	OD	LENGTH	MD (m)	TVD (m)
1	TUBING HANGER c/w 4.875" QN NIPPLE (QXT lock OD = 4.640")	4.773	13.552		32.16 HOP	
2	TUBING 5-1/2" HUNTING 20 LB/FT 13Cr80	4.778	6.126			
3	TSME-8 TRSCSSV c/w 4.562" AF Nipple	4.562	8.490		3741.6m	3741.6m
4	TUBING 5-1/2" HUNTING 20 LB/FT 13Cr80	4.778	6.126			
5	TUBING 5-1/2" HUNTING 20 LB/FT 80 ksi, 13Cr	4.778	6.126			
6	5-1/2" X 4-1/2" CROSSOVER	3.826	5.010		3761.3m	3040m
7	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
8	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
9	DHPG 4-1/2" QPT Elite 16k 15.1 LB/FT 110KSI 13CR	3.752	6.127		3789.4m	3055m
10	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
11	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
12	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
13	20FT PRODUCTION PBR 4-1/2 15.1 LB/FT 110KSI 13CR	3.820	5.875		3914.1m	3120m
14	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
15	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
16	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
17	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
18	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
19	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
20	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
21	SB-3H PRODUCTION PACKER 7" 15.1 LB/FT 110KSI 13CR	3.820	5.875		3938.5m	3134m
22	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
23	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
24	TUBING 4-1/2" HUNTING 15.1 LB/FT 110KSI	3.826	5.010			
25	4-1/2" with WEG (NO SEAL)	3.842	5.163	3969.2m (Bottom)		3145m



NOTES:
1. The Tubing hanger has a 4.875" QN profile. The min ID through the hanger is 4.773" (not the QN profile but at the base of the hanger). The 4.875" QXT plug has an OD of 4.640"
2. TSME-8 is a dual piston with 1,500psi + SITHP opening pressure.

NOTES:
1. 1/4" TEC cable 1/4" x 0.035"Inc 825 (11mm x 11mm)
Single Suresens QPT Elite Gauge in IPS Gauge mandrel
2. 1/4" 11mm x 11mm SSSV C/L

1. Single Suresens QPT Elite 16,000psi Gauge in IPS Gauge mandrel Iline
2. 1/4" 11mm x 11mm SSSV C/L

NOTES:
5-1/2" 20PPF TUBING IS R3 STANDARD BEVEL 101% COUPLING C/W 45DEG SHOULDER
4-1/2" 15.1PPF TUBING IS R3 SPECIAL BEVEL 101% COUPLING C/W 45DEG SHOULDER

NOTES:
7", 32 #, P110, VAM TOP HT (liner hanger)
7", 32 #, JFE-HP1-13CR-110, JFEBEAR Clear Run for production packer setting
4-1/2", 15.1#, JFE-HP1-13CR-110, JFEBEAR Clear Run Liner

NOTES:
1. Details of the production tree are not shown
2. The maximum pressure test on the completion string 6000psi
3. The maximum pressure test on the annulus 5000psi
4. The WEG is stabbed into the 7" liner (but does not seal)
5. Pip tags not required in 4-1/2" liner - RTC CT utilised
6. Annulus fluid will be 11.2-11.3ppg CaCL brine (c/w oxygen scavanger, biocide and corrosion inhibitor)

Notes:

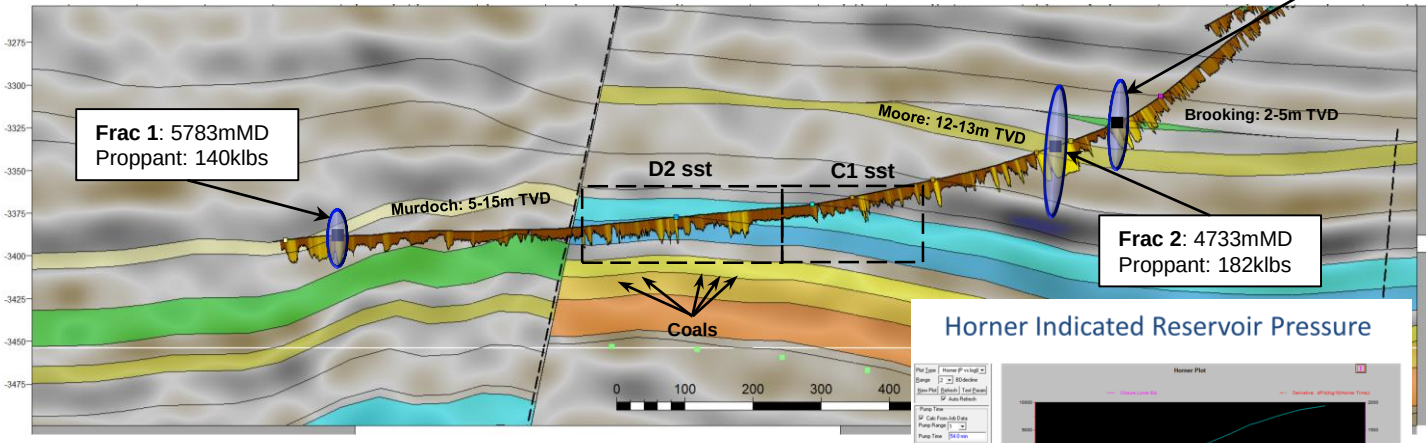
Detailed engineering of the planned fracture stimulation execution method is NOT yet finalised

Nipple Sleeve not run due to costs and risks of sleeve placement

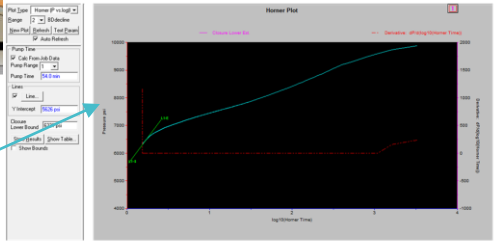
FRAC LOCATION

Total Proppant:	**550 klbs**
Total liquid:	**13,412 bbls**

Frac 3: 4642mMD
Proppant: 228 klbs

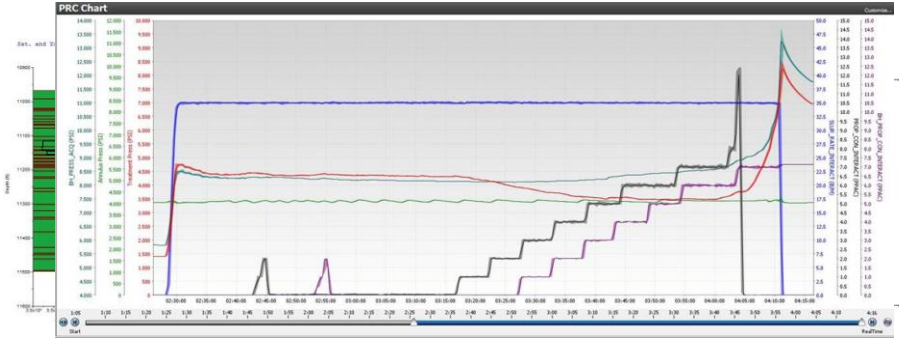


Horner Indicated Reservoir Pressure

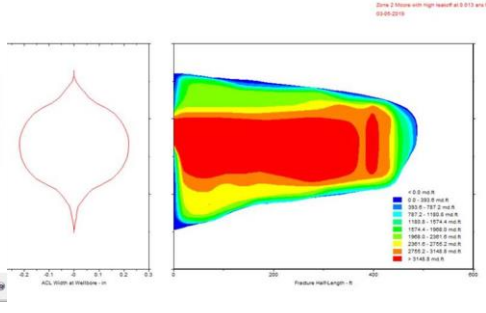


3 fracs:

1. Murdoch: 5783.13 mMD, 140 klbs of 16/30 G2CarboPROP — pressure: virgin ~5700 psi
2. Moore: 4733.00 mMD, 182 klbs of proppant (Xf~450ft) — pressure: 3688.37 psi
3. Brooking: 4642.11 mMD, 262 klbs (228 klbs reservoir) — pressure: 4689.66 psi

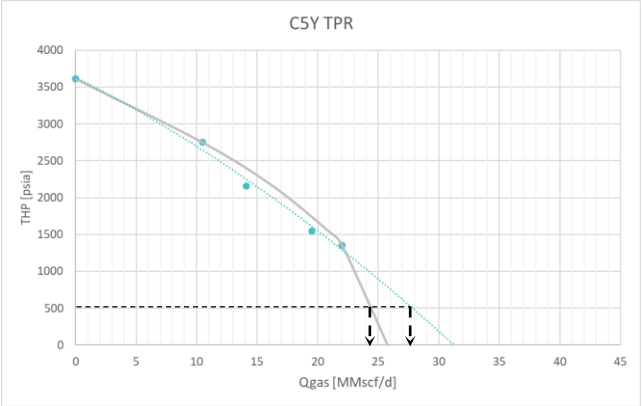


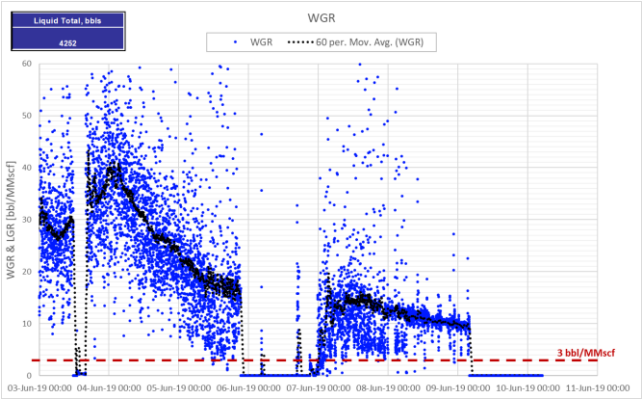
- Following SDT the indicated reservoir pressure < 5,626 psi at the BHPg depth



C5Y CLEANOUT SUMMARY

- After 10 days of clean-up the well was switched to 60/64” fixed choke on 09th June 00:00 am.
- After flowing for 4 hours the well was SI on 09th of June at 04:00 am
- Flowing BHP was stable and little proppant returns were seen, WGR was around 9-10 bbls/MMscf
- A couple of months of production is required to determine connected volume and EUR





C5Y TRACER ANALYSIS

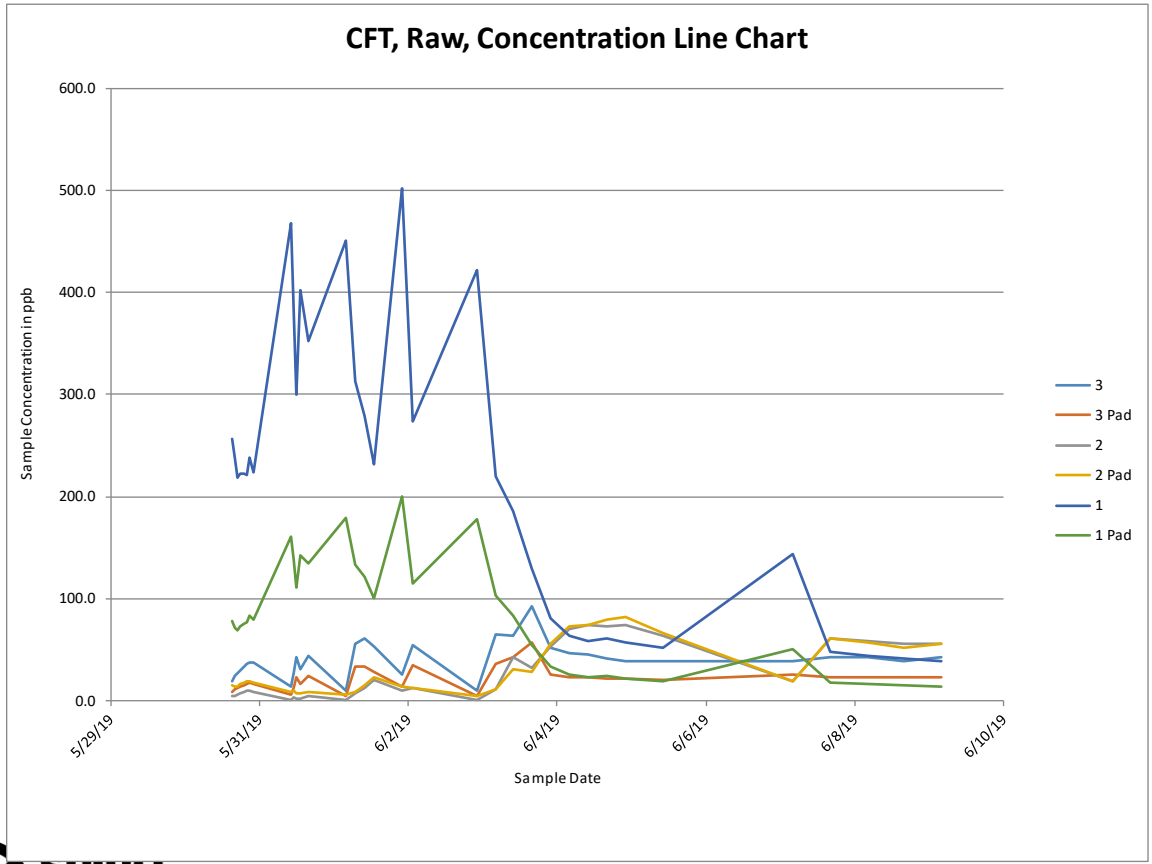
CFT Contributions (Data in ppb)

Traced Segment	3	3 Pad	2	2 Pad	1	1 Pad
Perforations (ft)	15228-15252	15228-15252	15528-15535	15528-15535	18974-18993	18974-18993
Stim Date	5/18/19	5/18/19	5/14/19	5/14/19	5/12/19	5/12/19
Traced Fluid (gal)	65,160	70,000	54,952	75,000	50,059	14,000
Prop (lbs)	262,403	0	182,300	0	146,392	0
Tracer Injected (g)	188	202	158	216	144	40
% Injected	20%	21%	17%	23%	15%	4%

Sample Date	CFT 1900	CFT 1600	CFT 1400	CFT 1300	CFT 1100	CFT 1000
5/30/19 15:00	15.8	6.2	3.7	10.8	281.7	302.8
5/30/19 16:00	20.3	8.5	4.4	10.3	261.5	281.4
5/30/19 17:00	22.3	9.3	5.6	10.3	240.1	269.4
5/30/19 18:00	24.6	10.4	7.1	11.8	243.4	282.1
5/30/19 19:00	27.6	11.6	8.6	13.1	243.3	294.3
5/30/19 20:00	29.8	12.2	9.2	13.4	242.4	302.2
5/30/19 21:00	31.7	13.3	9.1	13.4	261.4	328.0
5/30/19 22:00	31.5	13.1	8.9	12.5	245.2	311.8
5/31/19 10:00	11.4	4.3	0.6	6.2	513.4	628.5
5/31/19 11:00	22.2	9.4	2.4	6.8	419.8	541.7
5/31/19 12:00	36.2	17.6	1.8	5.1	329.4	434.9
5/31/19 13:00	25.3	12.2	1.9	5.2	441.3	555.4
5/31/19 16:00	36.9	18.8	3.8	5.8	386.8	527.3
6/1/19 4:00	7.8	2.9	0.3	3.8	493.8	702.0
6/1/19 7:00	47.2	26.0	7.1	5.6	343.4	521.6
6/1/19 10:00	51.2	25.6	11.7	10.7	305.0	475.3
6/1/19 13:00	44.8	22.4	19.6	16.4	254.3	393.2
6/1/19 22:00	21.7	10.4	9.5	9.8	550.6	782.3
6/2/19 1:30	45.7	27.2	12.7	8.9	299.5	451.1
6/2/19 22:00	7.6	3.0	0.6	3.4	462.6	695.8
6/3/19 4:00	55.0	28.4	11.1	8.4	241.3	405.0
6/3/19 10:00	53.4	32.9	42.6	22.3	204.1	325.4
6/3/19 16:00	77.5	44.8	32.0	20.7	141.8	211.0
6/3/19 22:00	43.0	19.4	52.9	40.8	88.1	131.2
6/4/19 4:00	39.3	17.6	69.6	53.0	69.1	98.9
6/4/19 10:00	37.6	17.4	73.5	54.3	64.5	90.5
6/4/19 16:00	34.3	17.0	73.2	57.7	66.7	94.3
6/4/19 22:00	32.2	16.5	74.5	59.8	62.3	86.1
6/5/19 10:00	32.8	16.0	63.8	48.0	56.2	72.8
6/7/19 4:00	32.5	20.1	18.7	13.4	157.4	199.4
6/7/19 16:00	36.0	17.9	60.8	44.2	51.8	68.5
6/8/19 4:00	35.3	18.0	58.5	42.1	47.6	61.4
6/8/19 16:00	32.9	17.6	55.9	38.2	45.4	58.1
6/9/19 4:00	36.1	18.0	55.0	40.2	42.7	54.8

SPIRIT ENERGY

C5 TRACER ANALYSIS FLOW PROFILE



SPIRIT ENERGY

Conclusions

- Horizontal drilling and hydraulic fracturing helped develop a reservoir that was initially considered below the economic limit
- Using chemical tracers provided a qualitative view of fracture flowback efficiency near and medium term
- Fracs still flowing 6+ months down the line as indicated by additional sampling from the platform
- Good understanding for reservoir management. Long term understanding of flow contribution by regular sampling possible.

SPIRIT ENERGY