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PS Platform

Interpretation Results - Final Report

Client: Cimarex Energy Company

Well: Adrianne 6 Federal #1

Field: Chosa Draw

County: Eddy, New Mexico

API: 30-015-34319

Log Date: 7-Apr-2017

Analyst: Leonid Kolomytsev

Daniel Amyotte

Casey Chadwick

Production logging
with confidence

Cimarex Energy Company
Adrianne 6 Federal #1
7-Apr-2017

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Logging Objective:

Flow contribution from each perforation.

Well Bore Information:

Production Tubing: 2-3/8" 4.7# L-80 @ 8399.5' MD

Production Casing: 5-1/2" 17# P-110 @ 12235' MD

Perforations: 6 Stages / 48 Perforations Clusters

Correlation: by Field Engineer to Haliburton Radial Cement Bond Log dated 02-Mar-2006.

Logging Tool: Standard PSP-DEFT w/ 2.25" FBS on Digital Slickline (DSL)

General Logging Procedure:

RU & RIH w/ Gauge Ring. Report Tag Depth. ROH.

RU & RIH w/ PSP. Record Main Flowing Passes at variable logging speeds
(based on well conditions) from Top Log Interval (TLI) to Bottom Log Interval (BLI).

Record Main Station Stops (at least 2 minutes each) between perforations, stages, major changes in flow regime, or as directed by client or production log analyst.

Record any addition Flowing Passes and/or Station Stops as needed or requested.

ROH. Delivery data to interpreter.

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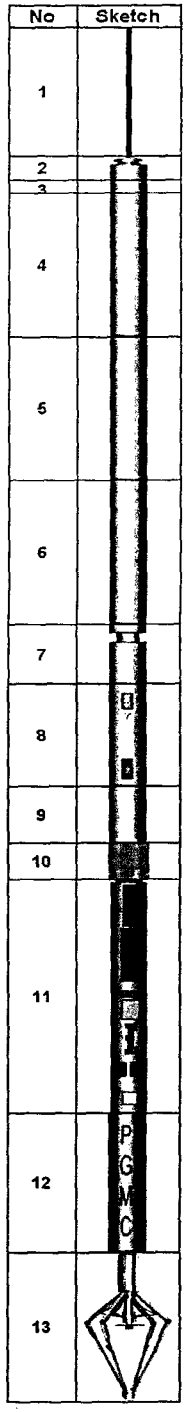
PL Tool Diagram:

Tool String							
No	**Tool**	**Tool S/N**	**Length (ft)**	**Weight (lbm)**	**Diam. (in)**	**Sensors (ft) Cumulative Offsets**	**Offset (ft)**
1	DSL125				0.15		
2	DIH	001	0.82	4.85	1.69		
3	XOverGoGoBox 1.6875	004	0.44	1.50	1.69		
4	ESB 1.6875 5ft	001	4.95	70.55	1.69		
5	ESB 1.6875 5ft	002	4.95	70.55	1.69		
6	ESB 1.6875 5ft	003	4.95	70.55	1.69		
7	BMC	001	2.07	10.80	1.69	DSL.DHTE (-26.25) DSL.BMCTemp (-25.93) DSL.SHCK (-25.76) DSL.FORCE (-25.76) DSL.DRFT (-25.76)	0.00 -1.15 0.00 0.00 -0.98
8	DCC	004	3.54	18.08	1.69	DSL.GR (-24.09) DSL.CCLN (-22.05)	-2.85 -0.82
9	DCR		1.98	13.23	1.69		
10	DPI		1.25	6.83	1.69		
11	PBMS-A		8.17	33.95	1.69	PBMS.WELL_T (-11.34) PBMS.SAPPHIRE_P (-11.24)	-1.50 -1.40
12	PGMC-B		4.76	23.37	1.69	PGMC.ACCELERO_INC (-8.29) PGMC.WFDE_COMP (-8.29)	-3.20 -3.20
13	PFCS-A		5.09	19.71	1.69	PFCS.RELATIVE_BEARING (-3.48) PFCS.CALIPER_Y (-1.90) PFCS.SPINNER_FREQ (-1.90) PFCS.CALIPER_X (-1.90) PFCS.PROBE_AVG_CLK_CPS (-1.50) PFCS.PROBE_AVG_BUBBLE_CPS (-1.50)	-3.48 -1.90 -1.90 -1.90 -1.50 -1.50

13 tools	**Total**	**42.97**	**343.97**		**Zero @ Bottom**
	DSL	**42.97**	**343.97**		
	Pyro				
	Mech / Others				
	Mobile Weight				

Surface Equipment		
Unit	ASEP	
Computer	Laptop	
DTR	DTR-A	
PCE	PCE-Generic	



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Interpretation Results: Surface Flowrate Results - Stage

Formation	Stage	Perforations		Gas (mcfpd)	Oil (bpd)	Water (bpd)	Gas (%)	Oil (%)	Water (%)
Wolfcamp	6	8446	8641	30	--	100	3.4%	--	17.9%
	5	9038	9244	180	--	65	20.3%	--	11.6%
	4	9294	9510	45	--	100	5.1%	--	17.9%
	3	9694	9896	325	--	100	36.7%	--	17.9%
Cisco Canyon	2	9952	10146	50	--	145	5.6%	--	25.9%
	1	10196	10304	255	--	50	28.8%	--	8.9%
Total				885	--	560	100.0%	--	100.0%

Interpretation Results: Surface Flowrate Results - Detail

Formation	Stage	Perforations		Gas (mcfpd)	Oil (bpd)	Water (bpd)	Gas (%)	Oil (%)	Water (%)
Wolfcamp	6	8446	8447	trace	--	0	trace	--	0.0%
		8497	8498	trace	--	0	trace	--	0.0%
		8523	8524	trace	--	0	trace	--	0.0%
		8542	8543	10	--	0	1.1%	--	0.0%
		8576	8577	10	--	20	1.1%	--	3.6%
		8599	8600	10	--	30	1.1%	--	5.4%
		8617	8618	0	--	20	0.0%	--	3.6%
		8640	8641	0	--	30	0.0%	--	5.4%
Wolfcamp	5	9038	9039	155	--	0	17.5%	--	0.0%
		9049	9050	0	--	0	0.0%	--	0.0%
		9069	9070	15	--	15	1.7%	--	2.7%
		9091	9092	trace	--	20	trace	--	3.6%
		9142	9143	0	--	10	0.0%	--	1.8%
		9159	9160	10	--	10	1.1%	--	1.8%
		9183	9184	trace	--	0	trace	--	0.0%
		9215	9216	trace	--	0	trace	--	0.0%
		9243	9244	trace	--	10	trace	--	1.8%
Wolfcamp	4	9294	9295	10	--	0	1.1%	--	0.0%
		9313	9314	0	--	10	0.0%	--	1.8%
		9335	9336	10	--	10	1.1%	--	1.8%
		9364	9365	0	--	0	0.0%	--	0.0%
		9387	9388	0	--	10	0.0%	--	1.8%
		9409	9410	10	--	10	1.1%	--	1.8%
		9425	9426	0	--	10	0.0%	--	1.8%
		9467	9468	15	--	20	1.7%	--	3.6%
		9508	9510	0	--	30	0.0%	--	5.4%
Wolfcamp	3	9694	9695	210	--	0	23.7%	--	0.0%
		9713	9714	45	--	30	5.1%	--	5.4%
		9739	9740	25	--	10	2.8%	--	1.8%
		9763	9764	10	--	20	1.1%	--	3.6%
		9821	9822	25	--	0	2.8%	--	0.0%
		9844	9845	10	--	20	1.1%	--	3.6%
		9868	9869	trace	--	10	trace	--	1.8%
		9895	9896	0	--	10	0.0%	--	1.8%

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Interpretation Results: Surface Flowrate Results - Detail (Continued)

Formation	Stage	Perforations		Gas (mcfpd)	Oil (bpd)	Water (bpd)	Gas (%)	Oil (%)	Water (%)
Cisco Canyon	2	9952	9953	trace	--	10	trace	--	1.8%
		9981	9982	10	--	0	1.1%	--	0.0%
		10010	10011	15	--	20	1.7%	--	3.6%
		10037	10038	10	--	10	1.1%	--	1.8%
		10061	10062	0	--	20	0.0%	--	3.6%
		10091	10092	15	--	40	1.7%	--	7.1%
		10114	10115	trace	--	30	trace	--	5.4%
		10145	10146	0	--	15	0.0%	--	2.7%
Cisco Canyon	1	10196	10197	240	--	0	27.1%	--	0.0%
		10223	10224	0	--	0	0.0%	--	0.0%
		10236	10237	0	--	10	0.0%	--	1.8%
		10263	10264	15	--	20	1.7%	--	3.6%
		10291	10293	0	--	10	0.0%	--	1.8%
		10302	10304	0	--	10	0.0%	--	1.8%
Total				885	--	560	100.0%	--	100.0%

Cimarex Energy Company
Adrianne 6 Federal #1
7-Apr-2017

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Interpretation Remarks

This interpretation is based on PSP Production Log data recorded on 07-Apr-2017 in memory on slickline. The Field Engineer (FE) is Blake Melcher. Four down and up main logging passes were recorded over the main logging interval under flowing conditions. Color coding is as follows: D1/U1-Red, D2/U2-Dk Blue, D3/U3-Green, D4/U4-Lt Blue, D5-Grey (correlation pass). Down pass curves have solid coding. Up pass have dashed coding. Station stops are presented as circles at their respective depths.

Main logging passes are correlated by Field Engineer to Haliburton Radial Cement Bond Log dated 02-Mar-2006. Top Log Interval (TLI) is observed @ 8300' MD. Bottom Log Interval (BLI) is observed @ 10434' MD.

EOT is observed on the averaged X-Y caliper measurement (C1C2) @ 8408" MD. The average X-Y caliper measurement (C1C2) is consistent and agrees with nominal ID. A nominal ID of 4.892" is used in the interpretation calculations.

Downhole pressure (WPRE) is stable during the main passes. Down and Up passes are used in the interpretation calculations.

Downhole temperature (WTEP) trends are repeatable. Down pass temperatures are used preferentially in the interpretation calculations.

All DEFT (electrical) probes are functioning properly and the basis of the water holdup (Yw) image. DEFT (electrical) probe measurements are most consistent on down passes which are used preferentially in the interpretation calculations. DEFT (electrical) probes provide a confident measurement of water holdup, independent of PVT information, by counting the hydrocarbon bubbles during a dominate water flow regime or water droplets during a dominate gas or oil flow regime.

The gradiomanometer density measurement (WFDE) is confident and used in the interpretation calculations.

Spinner response is consistent and provides a confident slope and liquid threshold for downhole in-situ spinner calibrations. All spinner passes are used in the spinner calibrations and apparent velocity calculations.

Total downhole rates (QZT) are calculated using the apparent spinner velocity, a nominal casing ID, averaged water holdup (Yw), fluid density (WFDE) and an established water-hydrocarbons flow model. Rates are calculated downhole and presented in downhole barrels on the log snapshots. Calculated downhole rates are then converted to surface rates at standard conditions and presented in the above table.

PVT Information: Oil gravity of 52.2 API, Gas gravity of 0.6824 s.g. Water salinity 52257 ppm was provided by Cimarex .

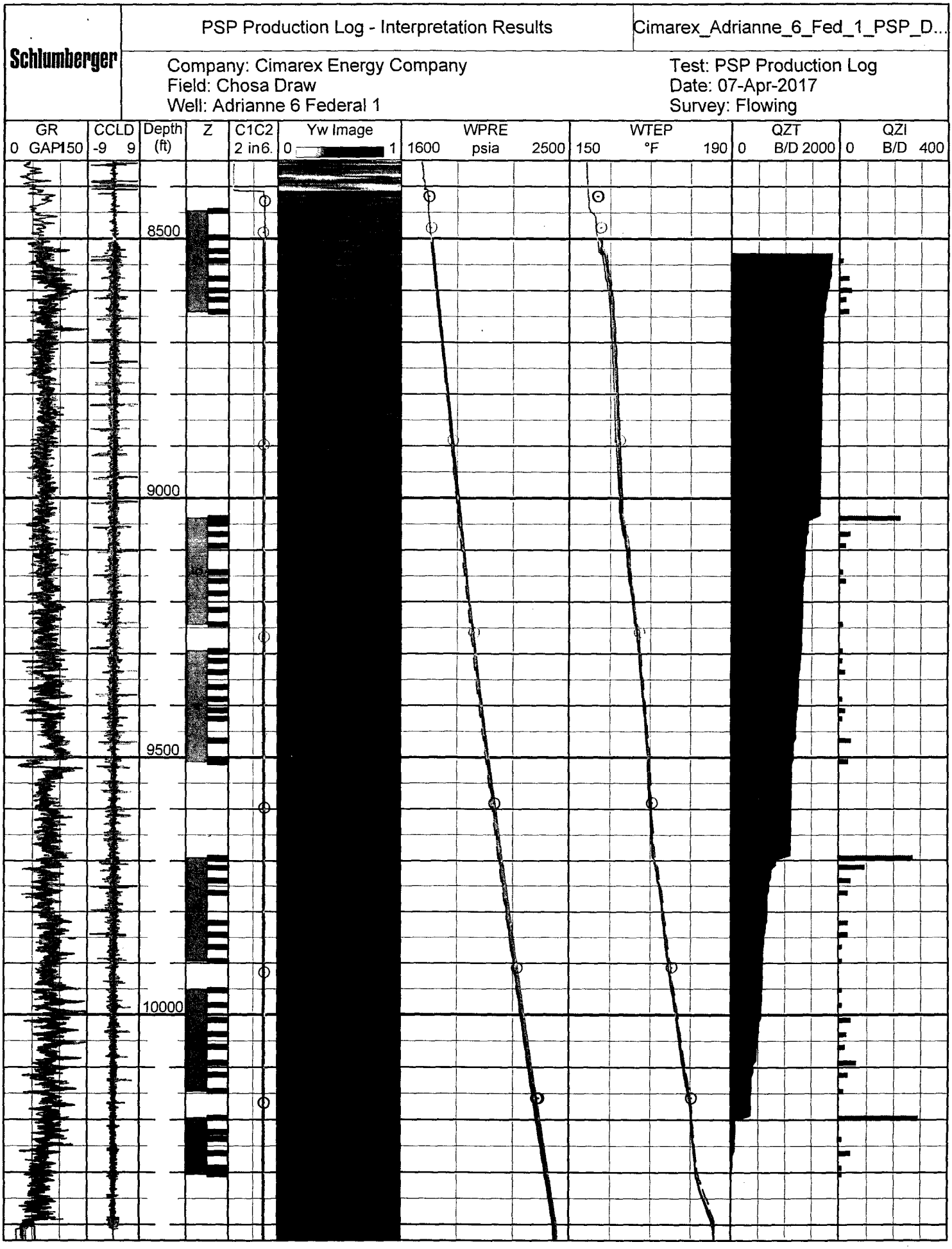
* A report of "trace" gas production is based on temperature, water holdup and density but does not appear to be of sufficient volume to observed on the spinner. Therefore, "trace" gas suggests minimal or negligible gas production, if any, into the wellbore.

Some interference between the logging tool and End of Assy is observed near the top perforation interval. Unable to get contribution for the top perforation interval. Gray shading is used in the table above to indicate this region.

Overall, data quality is high and the downhole environment is stable resulting in a high level of confidence in gas/water interpretation calculations and results.

Leonid Kolomytsev, Production Engineer
Schlumberger, Houston, TX, USA

Casey Chadwick, Production Logging Domain Champion,
North America Wireline, Houston, TX, USA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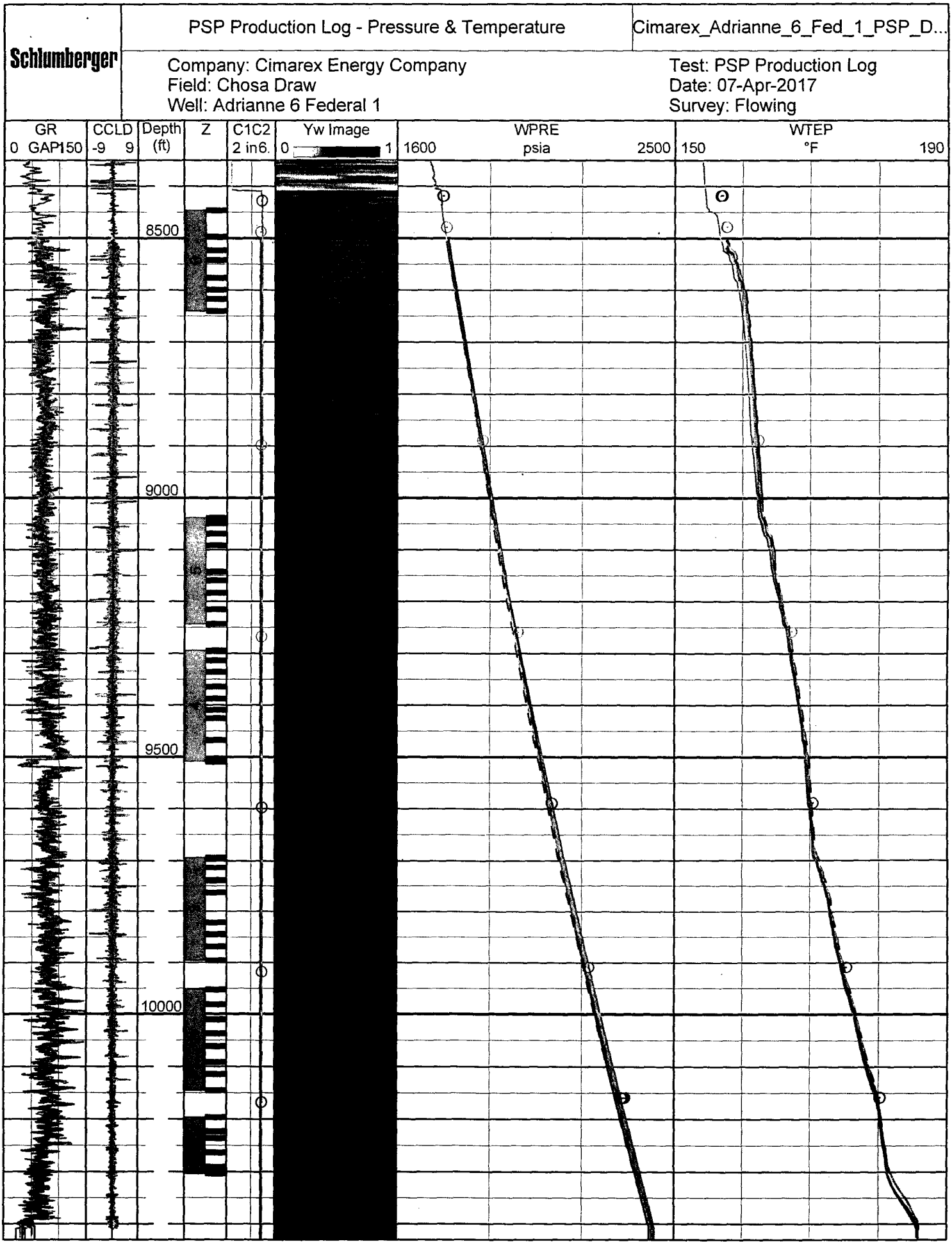
PSP Production Log - Interpretation Results
Cimarex_Adrianne_6_Fed_1_PSP_D...
Company: Cimarex Energy Company
Field: Chosa Draw
Well: Adrianne 6 Federal 1
Test: PSP Production Log
Date: 07-Apr-2017
Survey: Flowing
GR
0 GAPI150
CCLD
-9 9
Depth
(ft)
Z
C1C2
2 in6.
Yw Image
0 1
WPRE
1600 psia 2500
WTEP
150 °F 190
QZT
0 B/D 2000
QZI
0 B/D 400
8500
9000
9500
10000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PSP Production Log - Pressure & Temperature
Cimarex_Adrianne_6_Fed_1_PSP_D...
Company: Cimarex Energy Company
Field: Chosa Draw
Well: Adrianne 6 Federal 1
Test: PSP Production Log
Date: 07-Apr-2017
Survey: Flowing
GR
0 GAPI150
CCLD
-9 9
Depth
(ft)
Z
C1C2
2 in6.
Yw Image
0 1
WPRE
1600 psia 2500
WTEP
150 °F 190
8500
9000
9500
10000

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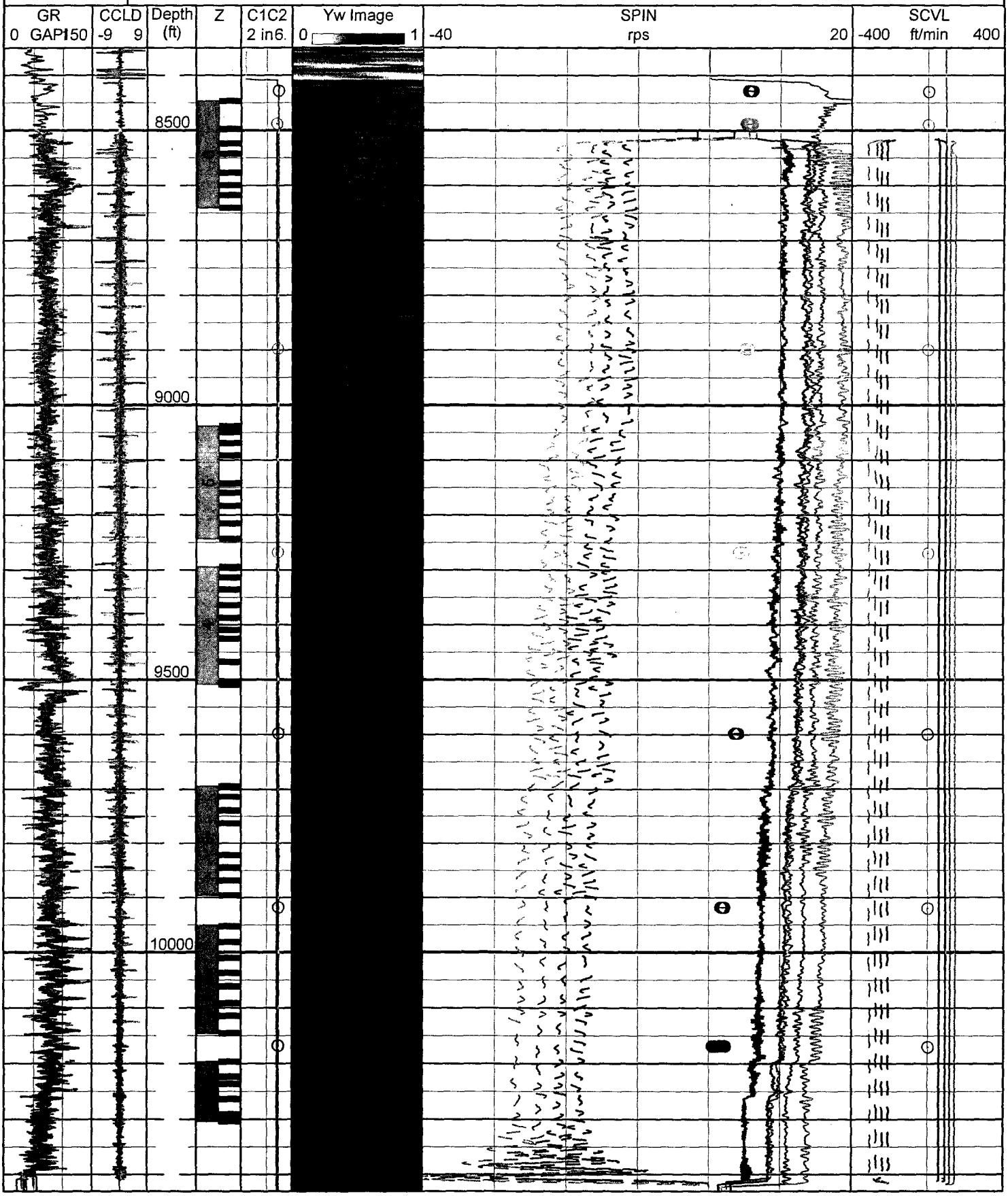
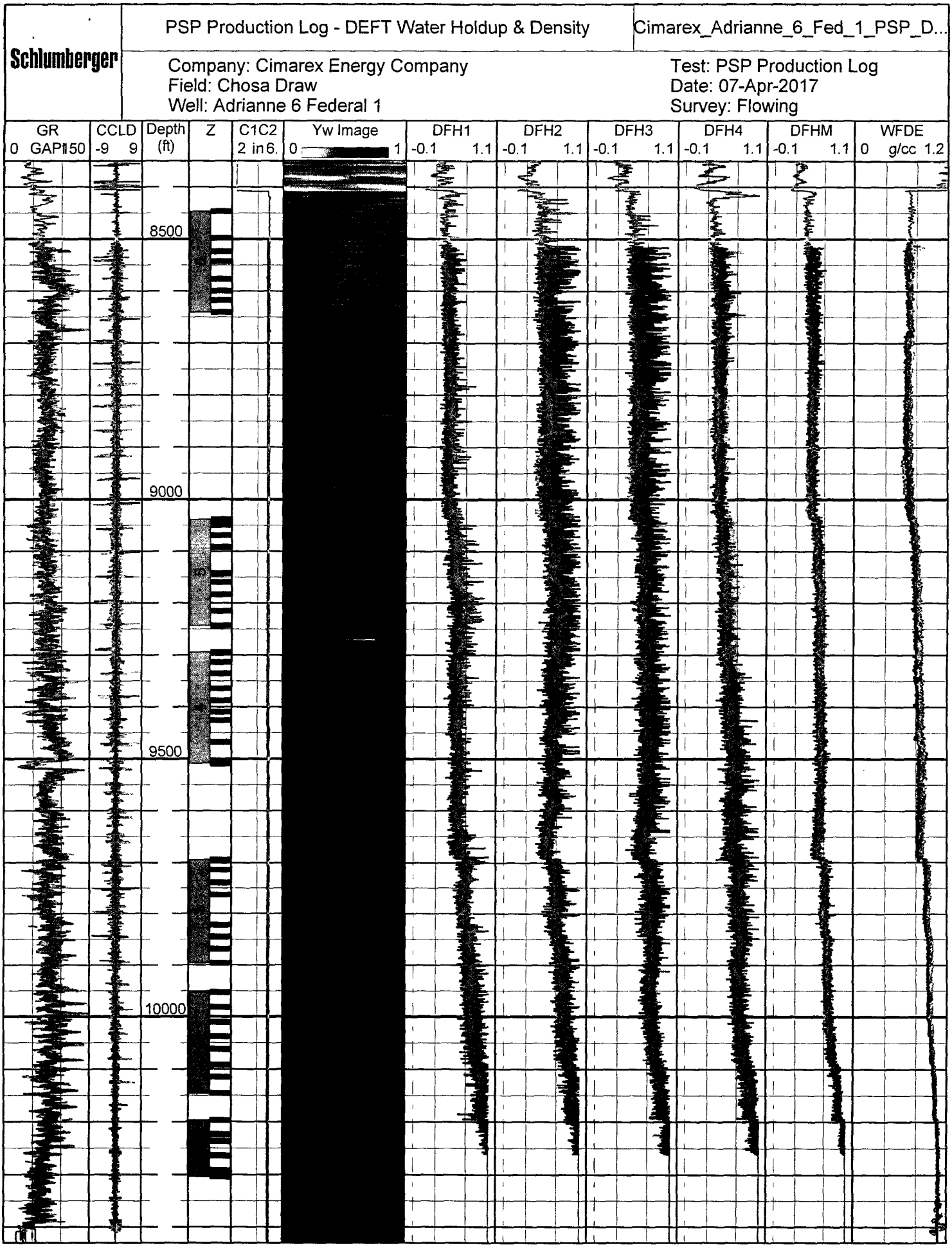
PSP Production Log - Spinner & Cable Velocity

Cimarex_Adrianne_6_Fed_1_PSP_D...

Company: Cimarex Energy Company
Field: Chosa Draw
Well: Adrianne 6 Federal 1

Test: PSP Production Log
Date: 07-Apr-2017
Survey: Flowing

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PSP Production Log - DEFT Water Holdup & Density
Cimarex_Adrianne_6_Fed_1_PSP_D...
Company: Cimarex Energy Company
Field: Chosa Draw
Well: Adrianne 6 Federal 1
Test: PSP Production Log
Date: 07-Apr-2017
Survey: Flowing
GR
0 GAPI 150
CCLD
-9 9
Depth
(ft)
Z
C1C2
2 in 6.
Yw Image
0 1
DFH1
-0.1 1.1
DFH2
-0.1 1.1
DFH3
-0.1 1.1
DFH4
-0.1 1.1
DFHM
-0.1 1.1
WFDE
0 g/cc 1.2
8500
9000
9500
10000

PSP & FSI Interpretation Mnemonics

CALI_FSI	Flow Scanner Caliper
CCLC/CCLD	Casing Collar Locator
CVEL/SCVL	Cable Velocity
D1RB	DEFT Relative Bearing Probe 1
DFBFx_FSI (0-5)	FSI Vertical DEFT Bubble Count Array (0-Bot, 5-Top)
DFBM	PSP Mean DEFT Bubble Count
DFBx (1-4)	PSP Individual Probe DEFT Bubble Count
DFHFx_FSI (0-5)	FSI Vertical DEFT Water Holdup Array (0-Bot, 5-Top)
DFHM	PSP Mean DEFT Water Holdup
DFHx (1-4)	PSP Individual Probe DEFT Water Holdup
GHBFx_FSI (0-5)	FSI Vertical GHOST Bubble Count Array (0-Bot, 5-Top)
GHBM2	PSP Mean GHOST Bubble Count
GHBx (5-8)	PSP Individual Probe GHOST Bubble Count
GHHFx_FSI (0-5)	FSI Vertical GHOST Gas Holdup Array (0-Bot,5-Top)
GHHM2	PSP Mean GHOST Gas Holdup
GHHx (5-8)	PSP Individual Probe GHOST Gas Holdup
GR	Gamma Ray
HTEN	Head Tension/Compression
MWFD	Pressure Derived Density
PFC1	PSP Caliper 1 (X)
PFC2	PSP Caliper 2 (Y)
RB_FSI	FSI Relative Bearing
SPIN/SPI1	Full Bore Spinner / Inline Spinner
SPIFx_FSI (0-4)	FSI Vertical Micro-Spinner Array (0-Bot, 4-Top)
WFDE	Gradio Well Fluid Density
WPRE	Well Pressure
WTEP	Well Temperature

Color Coding is typically the same for all the curves that belong to the same pass
RED – Pass One / Dk Blue – Pass Two / Green – Pass Three / Lt Blue – Pass Four

VAFV/VAPP	Apparent fluid velocity (gas, water & oil)
QGI, QOI, QWI	Interval Gas, Oil, Water Rates (down hole unless stated otherwise)
QGT, QOT, QWT	Cumulative Gas, Oil, Water Rates (down hole unless stated otherwise)

Tool Mnemonics List

DEFT	Digital Fluid Entry Tool (Resistivity Probes)
GHOST	Gas Holdup Optical Sensor Tool (Optical Probes)
FSI	Flow Scanner Imager
PSP	Production Services Platform
PBMS	Production Basic Measurement Sonde (Temperature, Pressure, CCL, GR)
PCMS	Production Compression Measurement Sonde
PGMC	Production GradioManometer Carrier (Density)
PFCS	Production Flowmeter Caliper Sonde (Holdup, Caliper, Full Bore Spinner)
PILS	Production In-Line Spinner