

UIC - I - ____11____

**EPA FALL-OFF
TEST**

2017

Chavez, Carl J, EMNRD

From: Robinson, Kelly <Kelly.Robinson@andeavor.com>
Sent: Wednesday, March 21, 2018 3:20 PM
To: Chavez, Carl J, EMNRD
Cc: Griswold, Jim, EMNRD; Powell, Brandon, EMNRD; Davis, Bruce D; Hains, Allen S; Roberts, Tommy D
Subject: RE: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2
Attachments: WNR WDW2 2017 FO Report 121217 Update.pdf

Good Afternoon Sir!

Attached is an electronic copy of Western's response to the comments received from the New Mexico Oil Conservation Division (NMOCD) regarding the request for additional clarification on the flow regime identified during the 2017 Fall-Off Test conducted at the Bloomfield Terminal. A hard copy is being sent to you via FedEx and is expected to arrive at your office tomorrow.

If you have any questions or need additional information, please do not hesitate to contact me at your convenience.

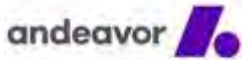
Thanks you so much for your time, and have a great evening!

Kelly R. Robinson - Environmental Supervisor

111 County Road 4990 I Bloomfield, NM 87413

O: (505) 632-4166| C: (505) 801-5616

E: Kelly.Robinson@andeavor.com



Please note: My email address changed to Kelly.Robinson@andeavor.com on July 31, 2017. Please update your records.

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Wednesday, February 21, 2018 4:48 PM
To: Robinson, Kelly <Kelly.Robinson@andeavor.com>
Cc: Griswold, Jim, EMNRD <Jim.Griswold@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>
Subject: FW: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2

Kelly:

The New Mexico Oil Conservation Division (OCD) completed its review of the Western Refining Southwest, Inc. (Western) - Bloomfield Refinery's FOT Report dated December 12, 2017.

Please find below OCD's review comments added to the OCD weekly log yesterday. Also, OCD has attached the Fall-Off Test (FOT) "Nuts and Bolts" guidance document with FOT Log-Log Plot, which describes how to determine a FOT flow regime determination. Based on Western's Figure 2 Log-Log Plot, OCD is unable to confirm the flow regime aspects from the FOT. **OCD requests a more detailed explanation of the flow regime determination in the FOT Report commensurate with FOT Guidance, since the Figure 2 in its present form does not appear to contain the information needed to address the flow regime. Also, the gauges need calibration before the next FOT.** Please submit the information before COB on Wednesday, March 21, 2018.

Carl on 2/20 completed his review of the FOT (10/2-13/2017) and entered the info. into a FOT tracking spreadsheet. Carl is not sure about the results based on the Log-Log graph and lack of radial flow achieved during FOT. Some concerns were: 1) Porosity at ~ 12%, but K was only 3.29 md (~13.94 gpm); 2) Skin: -5.37; 3) $P_{diff} \sim 384.1$ psi; 4) Half fracture: 110 ft.; 5) No boundary conditions were identified; 6) **The well test does not reach radial flow; therefore, the FOT is unanalyzable**, and 7) Gauge calibrations were last conducted on 2/5/2014, which is considered beyond 6 months or outdated.

Please contact me if you have questions.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

“Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?” (To see how, go to: <http://www.emnrd.state.nm.us/OCD> and see “Publications”)

From: Hains, Allen S [<mailto:Allen.S.Hains@andeavor.com>]

Sent: Tuesday, December 12, 2017 4:09 PM

To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>

Cc: Robinson, Kelly <Kelly.Robinson@andeavor.com>; Davis, Bruce D <Bruce.D.Davis@andeavor.com>

Subject: RE: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2

Carl,

The full report is attached.

Thank you,

Allen

From: Hains, Allen S

Sent: Tuesday, December 12, 2017 4:06 PM

To: 'Chavez, Carl J, EMNRD' <CarlJ.Chavez@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>

Cc: Robinson, Kelly <Kelly.Robinson@andeavor.com>; Davis, Bruce D <Bruce.D.Davis@andeavor.com>

Subject: WNR Bloomfield Terminal Injection WDW #2 FOT Report 1 of 2

Carl,

I am sending you this email because Kelly is traveling today and we understand that your FTP site down.

Please find the attached cover letter for the WDW #2 Fall-Off Test report. The test was successful and meets both NMOCD and EPA requirements.

The full report including cover letter will promptly follow this email (2 of 2). If you do not receive the full report, we can set up a cloud-based transfer.

Thank you,

Allen S. Hains
Manager
Remediation Projects

Andeavor
212 N. Clark Street
El Paso, Texas 79905
915 534-1483
915 490-1594 (cell)

Please note the new email address: Allen.S.Hains@andeavor.com





March 20, 2018

Mr. Carl Chavez
New Mexico Oil Conservation Division, Environmental Bureau
1220 South St. Frances Drive
Santa Fe, New Mexico 87505

FedEx Tracking #: 7718 0112 0174

**RE: Western Refining Southwest, Inc. – Bloomfield Terminal
2017 Fall-Off Test Response to Comments dated February 21, 2018
Permit #: UIC-CL-011**

Mr. Chavez,

Western Refining Southwest, Inc. ("Western") received comments from the New Mexico Oil Conservation Division ("NMOCD") on February 21, 2018 via e-mail regarding the 2017 Class 1 Non-Hazardous Injection Well Fall-Off Test conducted at the Bloomfield Terminal. This letter and enclosed updated Fall-Off Test Report address NMOCD's comments and provide the additional clarification requested:

- The updated reservoir analysis better addresses the flow regimes which are:
 - Transient linear flow early in the falloff test,
 - Transient radial flow late in the falloff test,
 - Radial flow was not observed on the test, and
 - Radial flow is not expected with any test of a reasonable time period.
- Analysis of the two transient flow regimes gives a good understanding of the reservoir properties.
- All testing was successful and meets both the OCD and EPA requirements.

If you have any questions or additional requests for information, please feel free to contact me at your convenience at (505) 632-4166.

Sincerely,

A handwritten signature in black ink that reads 'Kelly Robinson' in a cursive script.

Kelly R. Robinson
Environmental Supervisor
Western Refining Southwest, Inc.

cc: B. Powell – NMOCD (Aztec District Office) via e-mail
J. Griswold – NMOCD (Santa Fe Office) via e-mail
B. Davis – Western Refining (Albuquerque)
T. Roberts – Western Refining (Bloomfield)
A. Hains – Western Refining (El Paso)

WILLIAM M. COBB & ASSOCIATES, INC.

Worldwide Petroleum Consultants

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E-Mail: office@wmcobb.com

March 19, 2018

Mr. Bruce Davis
Western Refining Southwest, Inc.
Bloomfield Terminal
P.O. Box 159
Bloomfield, New Mexico 87413

Re: Waste Disposal Well #2
October 2017 Falloff Test
OGRID No. 267595
Update to December 12, 2017 report

Dear Mr. Davis:

Western Refining retained William M Cobb & Associates, Inc to perform the annual bottomhole pressure survey and pressure falloff test analysis on Waste Disposal Well #2. A pressure fall-off test (FOT) and bottomhole pressure survey were conducted on the well at the Western Refining Bloomfield Terminal facility near Bloomfield, New Mexico. The well tests were conducted in accordance with United States Environmental Protection Agency (USEPA) 40 CFR 146.13 and the State of New Mexico Falloff Test Guidelines, dated December 3, 2007. The 2017 pressure falloff test procedure was conducted in accordance with the USEPA's Region 6 "Pressure Falloff Testing Guidelines, Third Revision", dated August 8, 2002, and required by the State of New Mexico as of December 3, 2007. The pressure falloff test and bottomhole pressure survey performed on Waste Disposal Well No. 2 also met the New Mexico Oil Conservation Division's (NMOCD's) requirements for such testing. Note: There are references made in this report to the permit document on file with the OCD for Western Refining in Bloomfield, New Mexico.

FACILITY INFORMATION

Name: Western Refining Southwest, Inc.
Location: 50 County Road 4990 (PO Box 159)
Bloomfield, New Mexico 874 13

WELL INFORMATION

Well Name & No.	OCD UIC or Discharge Plan Permit Number	Well Classification	API Number	Legal Location
WDW #2	UICI-011	Class I Non-hazardous	30-045-35747	2028 FNL, 111 FEL, H Sec 27 T29S R11E

All depths in this report are referenced to ground level (GL) from the drilling rig rotary kelly bushing (RKB), unless the depth is specified as RKB or GL within this document. Appendix A contains the well schematic for Western's Waste Disposal Well No. 2 (WDW-2) and a section of the log covering the perforated interval. Appendix B is a summary of the injection intervals for the well.

The fluid used for the injection test is the terminal treated waste water (effluent). A current waste water (effluent) analysis collected on September 13, 2017 is included in Appendix C. A summary of the formation water is also in Appendix C. The formation water analyses taken on January 25, 2017 is included.

Appendix D contains three well logs for WDW #2 ran by Schlumberger on September 5, 2016. They are: 1) Array Induction log, 2) Neutron Litho density long, and 3) Triple Combo log.

REPORT OF EVENTS

October 2, 2017 8:00 AM – The pre-test injection flow test begins.

October 3, 2017 9:02 AM – Tefteller, Inc. runs tandem bottomhole pressure gauges in the well to monitor the falloff portion of the test.

October 3, 2017 9:36 AM – pre-flow period begins.

October 5, 2017 11:08 AM – well is flowing at 13.84 GPM with an average rate of 14.1 GPM for the 75 hour period. Well is shut-in for falloff test.

October 13, 2017 8:39 AM - falloff test ends after 189.5 hours. A pressure gradient survey is conducted as pressure gauges are retrieved from well.

GENERAL TEST OPERATIONAL CONSIDERATIONS

The falloff testing for WDW-2 was conducted with tandem bottomhole pressure memory gauges with a pre-flow period beginning at 8:00 AM on October 2, 2017 and ending at 8:39 AM on October 13, 2017. The average flow rate for the 75 hour period prior to the beginning of the falloff test was 14.1 GPM with a final flowing rate of 13.84 GPM. On the morning of October 3, 2017, tandem bottom hole pressure memory gauges were lowered into the well and allowed to stabilize. Lowering the gauges in the well had no impact on rates and a minimal impact on surface injection pressures. The well was shut-in for 189.5 hours ending at 8:39 AM on October 13, 2017. Field data are included in Appendix E.

At the end of the falloff test, the bottomhole pressure gauges were pulled from the well making gradient stops every 1,000 feet. Key test data are summarized as follows:

Event	Flow Rate – GPM	Surface PSIG	Bottomhole PSIG	Date/Time
Start of flow	0.0	1040.3	N.A.	10/2/2017 8:00 AM
Final flow rate	13.84	1226.8	4396.7	10/5/2017 11:08 AM
Final falloff pressure	0.0	861	4012.6	10/13/2017 8:39 AM

Final surface pressure	0.0	861	N.A.	
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The memory gauges used are SP-2000 hybrid-quartz gauges provided by Tefteller, Inc. that have a resolution of 0.01 psi and an accuracy of ± 0.05 percent of full scale. The pressure range of the gauges were from 0 – 5,000 psi minimum. The gauges were lowered to the top of the injection interval at 7,312 feet. The recording period was set to record pressures at a minimum of every five minutes and more frequently during the early part of the falloff test period. Calibration certificates are included in Appendix F.

GEOLOGY

The injection zone is the Entrada sandstone formation. The formations occur in Waste Disposal Well No. 2 at the depths shown in the table below. The injection zone is shown in Waste Disposal Well No.2 logs in Appendix D.

Injection Zone Formation	Waste Disposal Well #2 (KB elev = 5,550 ft)	
	MD below KB (ft)	SS Depth (ft)
Bluff Sandstone	Not completed	7031
Entrada Sandstone	7312 to 7470	7308

The Jurassic aged Entrada Sandstone is thought to be one of the best water disposal rock units in the San Juan Basin. The Entrada is the basal formation of the San Rafael Group which also includes the Todilto and Wanakah Formations. The Entrada Sandstone is present throughout the basin's subsurface and crops out along the its margin as step cliffs. The Entrada unconformably overlies the Chinle Formation. The overlying Todilto Formation made up of limestone and anhydrite in dense and thought to an impermeable barrier or seal.

The Entrada Sandstone consists of mottled reddish-brown very fine to medium grained well-sorted, silica cemented quartz sandstone interbedded with thinner reddish-brown siltstones. The sandstone units are assembled in high-angle, large-scale crossbeds indicating eolian environment deposition and with the siltstones representing interdune and sabkha deposition. The cross-stratified sandstone is competent, laterally persistent and with homogenous reservoir properties. Entrada Sandstone gross thickness ranges 60 feet to 330 feet across the basin.

At the Water Disposal Well #2 location the Entrada is 158 feet thick. Based upon the nearby XTO Energy Ashcroft SWD #1 water disposal well density porosities are up to 18 percent with the most porous interval found in the upper 90 feet of the formation where the majority of the density porosities are more than 10 percent. Water Disposal Well #2 has a density porosity of 12.1 percent. The two intervals with the highest porosity are 20 feet from 7,333 feet to 7,353 feet with 14.1 percent porosity and 26 feet from 7,442 feet to 7,468 feet with 14.3 percent porosity.

Permeability for the well as measured by this falloff test is 3.29 md or less.

PREVIOUS FALLOFF TESTS

This is a new disposal well. There are no previous falloff tests.

ANNULUS PRESSURE TESTING

On June 8, 2017, an Annulus Pressure Test (APT) was conducted. The annulus was pressured up to 510 psig and held for 15 minutes. The test was witnessed by the NMOCD and by the operator. The test report and chart recording of the pressure is included in Appendix G and has been reported to the NMOCD using form C-103.

EVALUATION OF THE TEST RESULTS

The raw test data from the test are included in Appendix E with an injection history in Appendix J. This includes details of the build-up portion of the October 2017 test. These falloff data are presented in Figure 1 showing pressure and temperature during the falloff test. The falloff data show no unexpected pressure changes. The pressure drops quickly during the first few minutes and then continues to decline as the pressure in the reservoir adjusts to the no-flow period.

A log-log plot, Figure 2, with a derivative diagnostic plot is used to identify flow regimes as described by Dr. John Lee in chapter 6 of “Estimating Ultimate Recovery of Developed Wells in Low-Permeability Reservoirs” or Monograph 4 published by the Society of Petroleum Evaluation Engineers in 2016. Figure 6.5 of that chapter notes that a slope of $\frac{1}{2}$ is characteristic of transient linear flow. This plot shows a slope of near to 0.50 through 0.17 hours and then drops to a slope of 0.20 at the end of the test. The early time data exhibits transient linear flow as described in SPEE Monograph 4. The later time data is more reasonably represented with a bilinear flow model. Figure 6.6 of the SPEE monograph describes a bilinear flow regime which has a slope of $\frac{1}{4}$ or 0.25. The bilinear flow regime is (page 122) “caused by both linear flow in a fracture (with significant pressure drop from fracture tip to wellbore) and by linear flow in the reservoir toward the fracture”. The bilinear flow pattern is very near to the flow pattern observed with the drawdown data for Disposal Well #2. As will be discussed later, the flow pattern, while very near to a bilinear flow pattern is better matched with a transient radial flow pattern. The early portion of the test is shown in detail in Figure 3 with pressures from 0 to 36 hours which range from 4396.7 psig to 4110.1 psig. The pressure decline is a smooth decline and is flattening over time as expected.

Figure 4 shows the linear characteristics of the falloff test in some detail. It is a plot of falloff pressure versus $\sqrt{t + \Delta t} - \sqrt{\Delta t}$ where t is flow time in hours and Δt is falloff time in hours. Flow time is derived from the total fluid injected and the final flow rate as follows:

Cumulative injection:	2,391,224 gallons
Final flowing rate:	13.84 GPM
Equivalent flowing time (hours):	Gallons/(GPM X 60) = 2,391,224/(13.84*60)
Equivalent flowing time (hours):	3,079 hours

The pressure data, Figure 4, are linear beginning at 9.5 on the x axis. Projection of the data to estimated reservoir pressure is shown in Figure 5. This trend extrapolates to 3,406 psig which is the apparent reservoir pressure. The data shows no indication of ending of a linear flow straight line or of reservoir boundaries when the falloff test ends after 189 hours.

A traditional Horner plot, Figure 6, shows an increasing slope throughout the falloff test. When a straight line is obtained on a Horner plot, the slope of the line can be used to determine the permeability as described in "Pressure Buildup and Flow Test in Wells" published by the Society of Petroleum Engineers in 1967. Chapter 3 (pages 18 to 34) describes the process. Because of the increasing slope at the end of the test, permeability cannot be directly measured from the test data. As the slope increases, calculated permeability decreases. The final trend extrapolated to 3,819 psig is the apparent maximum reservoir pressure because of the increasing slope at the end of the test. The slope measured at the end of the falloff on Figure 6 is a minimum slope possible straight line segment. Because the slope is increasing at the end of the falloff test, it is expected to increase to higher levels had the falloff test been continued for a longer period of time. At the end of the test, the measured slope becomes the minimum possible Horner slope. This minimum slope yields a maximum permeability with the actual permeability not directly measurable from this test. Figure 7 shows increased detail of the Horner plot data at the end of the FOT.

To better understand flow regimes a type curve analysis was prepared using the SPE Monograph 5 "Advances In Well Test Analysis" type curves Figures C.18 and C.19 prepared by Gingen, Ramey and Raghavan. These type curves provide dimensionless pressure for vertically fractured wells in the center of a closed square with no well bore storage. Figure C.18 addresses infinite-conductivity fractures and Figure 3.19 addresses uniform flux fractures. Both address boundary dominated flow with x_e/x_f ratios from 1 to 10 and the uniform flux solution shows boundary ratios to 20. For convenience, the figures are included in this report as Figures 7A and 7B. Figure 7C is a composite of the trendlines on from Figures 7A and 7B showing how the uniform flux fracture and the infinite conductivity fracture compare.

Figures 7A and 7B or both used to better understand the flow regime. During the early segment of the drawdown test the data indicated fracture flow with a uniform flux fracture or a fracture with pressure drops in the fracture. During the late portion of the test, the flow is best matched with the infinite conductivity fracture. No signs of reservoir boundaries are seen in drawdown data. The drawdown data show that the fracture has damage near the wellbore and has little or no damage away from the wellbore as is shown in Figure 7C.

In Figure 7C, the delta PSI curve from Figure 2 is imposed on the type curves 7A and 7B which provides a positive match of the data. The falloff test data match the type curve when the horizontal $t_{dxf} = 1.00$ and $t = 1.2$ hours and when the vertical $P_d = 1.0$ and $\Delta P = 100$.

This match shows that the falloff test is in transient linear flow for about 10 minutes after which the flow regime begins a transition to a transient radial flow regime. At the end of the drawdown's 189.5 hours, the flow regime is a transient radial flow regime and no reservoir boundaries have been encountered. The absence of observed boundary effects show that the X_e/X_f ratio for the flow system is 20 or greater. The type curve analysis with the fit noted gives a calculated permeability of 2.56 md and a fracture half-length of 51 feet. The distance to the boundary is known to be more than a factor of 20 times the half-length or more than 1020 feet.

Absent the presence of reservoir boundaries, the Horner analysis for radial flow does not provide a reliable reservoir permeability. The linear flow analysis likewise provides only indications of reservoir properties. For this reason, the type curve permeability of 2.56 md is considered a more reliable measurement than the 4.24 md determined with radial and linear flow analysis.

It is our opinion that during the falloff test, the data transitioned from transient linear flow to transient radial flow and no boundary effects were observed during the 189.5 hour pressure falloff test.

LONG-TERM PERFORMANCE

Figure 8 is a history of pressures and injection rates. Wellhead injection pressures have been at 1465psig or less and are typically less than 1400 psig. The maximum injection rate is 77 GPM with rates in near 13 GPM being the most common rate.

Figure 9 shows the stabilized flow period of 75 hours prior to beginning the FOT test. The final flowing rate is 13.84 GPM with a final flowing wellhead pressure of 1226.8 psig. The injection rates for the pre falloff flow test range maximum rate of 23 GPM to a final rate of 13.84 GPM with an average rate of 14.1 GPM.

Calculations:

Calculations for permeability with an assumed Horner plot straight line, for time for a pressure transient to reach the edge of the injected water, traditional skin factor and for fracture half length are included.

1. Permeability:

$$\frac{kh}{\mu} = \frac{162.6qB}{m} \text{ where:}$$

q = final flowing rate

B = formation volume factor

m = slope from Horner plot of pressure vs log((t+dt)/dt)

k = permeability – md

h = net pay – feet perforated

μ = viscosity - cp

q = 13.84 GPM

q = 475 BWPD

B = 1.0

m = 69.61 or more (stabilized slope not observed on test)

$$\frac{kh}{\mu} = \frac{162.6qB}{m} = (162.6)(14.1)(24)(60 / 42)(1.0) / 69.61 = 1,108 \text{ md-ft/cp or less}$$

$$kh = (1,108 * 0.47) = 521 \text{ md-ft or less}$$

$$k = 521 / 123 = 4.24 \text{ md or less}$$

2. Radius to edge of injected fluid:

$$r_{\text{waste}} = \sqrt{\frac{0.13368V}{\pi\phi h}}$$

V = total volume injected, gallons

ϕ = porosity of injection zone

h = net pay of injection zone in feet

μ = viscosity in cp

V = 2,556,452 gallons

ϕ = 0.149 (average of perforated interval)

H = 123 feet (perforated interval)

μ = 0.47 cp

$C_t = S_w C_{ws} + C_f = (0.149)(0.00000230) + 0.00000410 = 0.00000444$

$r_{waste} = ((0.13368)(2,556,452)/(\pi(0.149)(123))^{(0.5)}) = 77$ feet

3. Time to reach edge of injected fluid:

$$t_{waste} = \frac{948 C_t \mu r_{waste}^2}{k}$$

$$t_{waste} = (948)(0.00000444)(0.47)(77^2)/4.24 = 2.8 \text{ hours or more}$$

4. Skin factor (with radial flow)

$$S = 1.151 \left[\frac{p_{wf} - p_{1hr}}{m} - \log \left(\frac{k}{\phi \mu C_t r_w^2} \right) + 3.23 \right]$$

p_{wf} = final flowing pressure, psi

p_{1hr} = projected pressure at 1 hour using radial flow straight line, psi

r_w = wellbore radius - feet

$p_{wf} = 4376.7$ psig

$p_{1hr} = 4370$ psig

$r_w = 0.3281$ feet

$S = 1.151[(4376.7 - 4370)/69.6 - \log(4.24/((0.149)(0.47)(0.00000444)(0.3281)^2) + 3.23]$

$S = -5.17$

5. Fracture half length

$$X_f \sqrt{k} = \frac{4.064 q B}{m_L h} \sqrt{\left(\frac{\mu}{\phi C_t} \right)}$$

m_L = slope from linear flow chart of pressure vs $\sqrt{t + \Delta t} - \sqrt{\Delta t}$

$m_L = 70.628$

$X_f k^{0.5} = (4.064)(475)(1.0)/((70.628)(123)(0.47/((0.149)(0.00000444)))^{0.5} = 187 \text{ ft } \sqrt{md}$

$X_f = 187/4.24^{0.5} = 91$ cumulative feet or more

6. Type Curve Analysis

$$t_{dxf} = 0.0002637 k t / (\Phi \mu C_t X_f^2)$$

$$\Delta P = 141.2 Q B \mu P_d / (KH)$$

$$KH = 141.2 Q B \mu P_d / (\Delta P)$$

$$X_f^2 = 0.0002637 k t / (t_{dxf} \Phi \mu C_t)$$

Type Curve Match Point ON Figure 7C:

$\Delta P = 100$ psi at $P_d = 1.0$

$T = 1.2$ hours at $t_{dxf} = 1.0$

Match points show: 1) early time transient linear flow, 2) late time transient radial flow,
 3) no reservoir or drainage boundary,

$$KH = 141.2(475)(1.0)(0.47)*(1.0)/(100) = 314.91 \text{ md-ft}$$

$$K = 2.56 \text{ md}$$

$$X_f^2 = 0.0002637(2.56)(1.2)/((1.0)(0.149)(0.47)(0.00000444)) = 2,601 \text{ ft}^2$$

$$X_f = 51 \text{ feet}$$

AREA OF REVIEW (AOR) UPDATE

The area of review data is attached as Appendix H which shows all wells known to have been drilled within a one mile radius of Water Disposal Well #2. There are 57 wells in the one mile radius of investigation. One of these fifty-nine wells, Ashcroft SWD #1, penetrates the Entrada injection zone. This well is 0.64 miles from the disposal well and is an active water disposal well.

No wells are currently producing from the Entrada injection zone within the AOR.

CONCLUSIONS

All testing was successful and meets both the OCD and EPA requirements. Western Refining fulfills all analysis and reporting requirement of the USEPA's "Pressure Falloff Testing Guideline, Third Revision", issued by Region 6, and dated August 8, 2002, with the submittal of this report. Pressure falloff and bottomhole pressure testing were conducted according to these guidelines.

OTHER

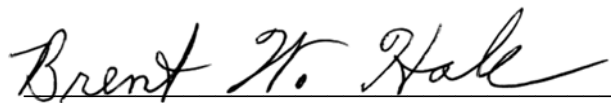
In evaluating available information concerning this appraisal, we have excluded from our consideration all matters as to which legal or accounting interpretation, rather than engineering, may be controlling. As in all aspects of oil and gas evaluation, there are uncertainties inherent in the interpretation of engineering data and conclusions necessarily represent only informed professional judgments.

William M. Cobb & Associates, Inc. is an independent consulting firm. Our compensation is not contingent on the results obtained or reported. This report was prepared by an engineer with more than 30 years of experience in the estimation, assessment, and evaluation of oil and gas production rates and related reservoir properties.

We appreciate the opportunity to be of service to you. If you have questions regarding this report, please contact us.

Sincerely,

WILLIAM M. COBB & ASSOCIATES, INC.



Brent W. Hale
Vice President

Figure 1

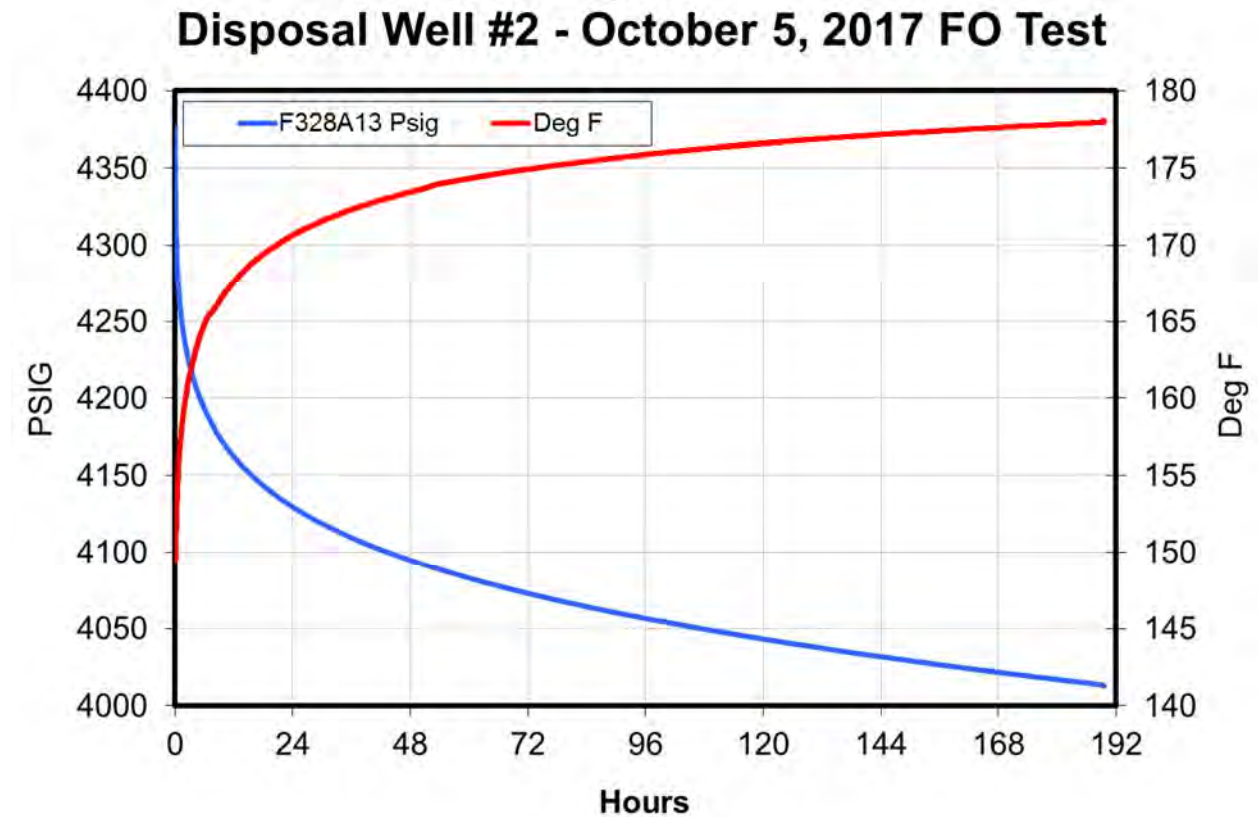


Figure 2

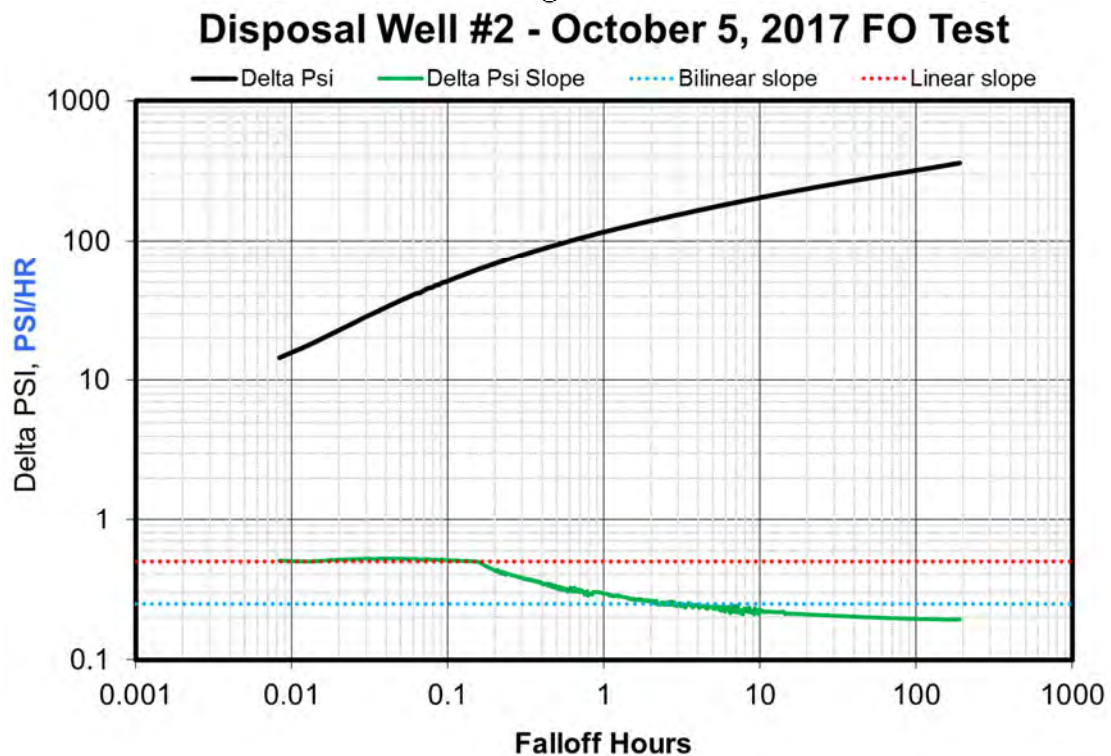


Figure 3
Disposal Well #2 - October 5, 2017 FO Test



Figure 4
Disposal Well #2 - October 5, 2017 FO Test

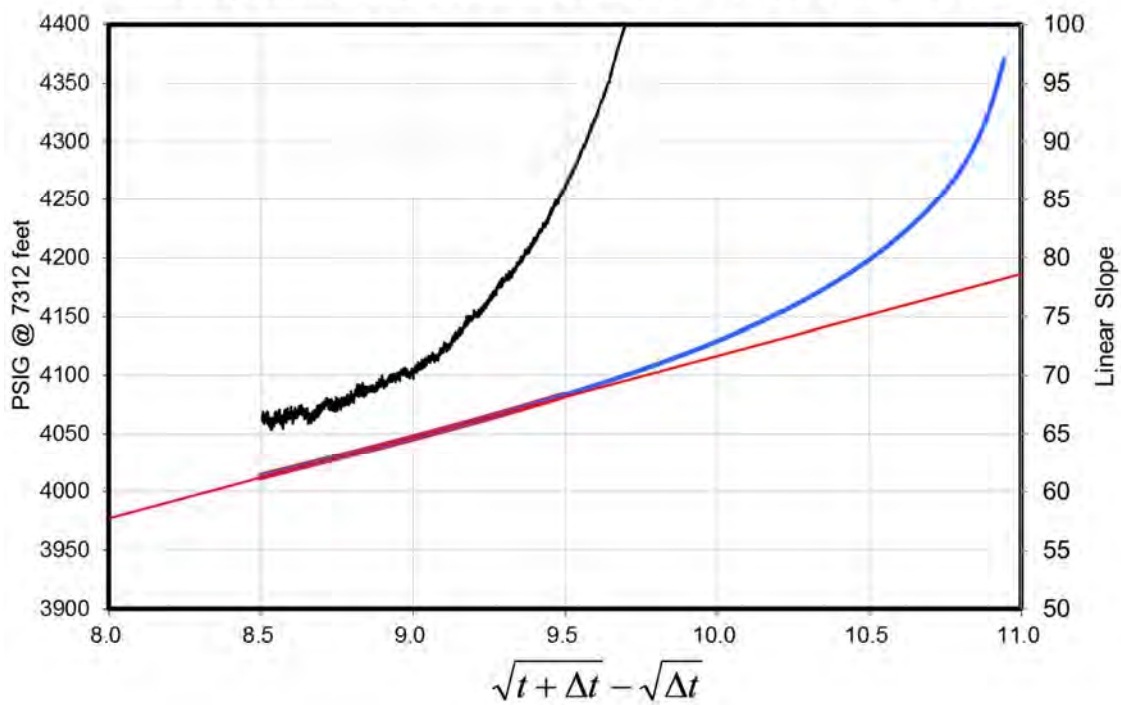


Figure 5

Disposal Well #2 - October 5, 2017 FO Test

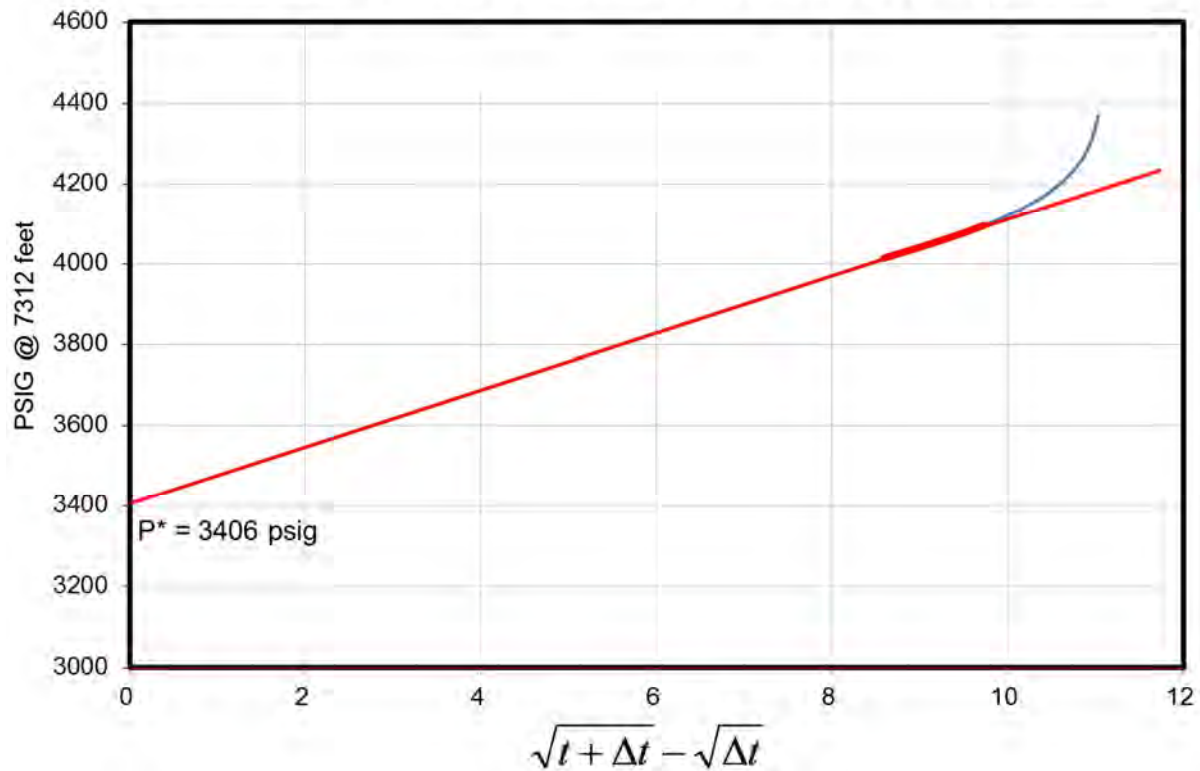


Figure 6

Disposal Well #2 - October 5, 2017 FO Test

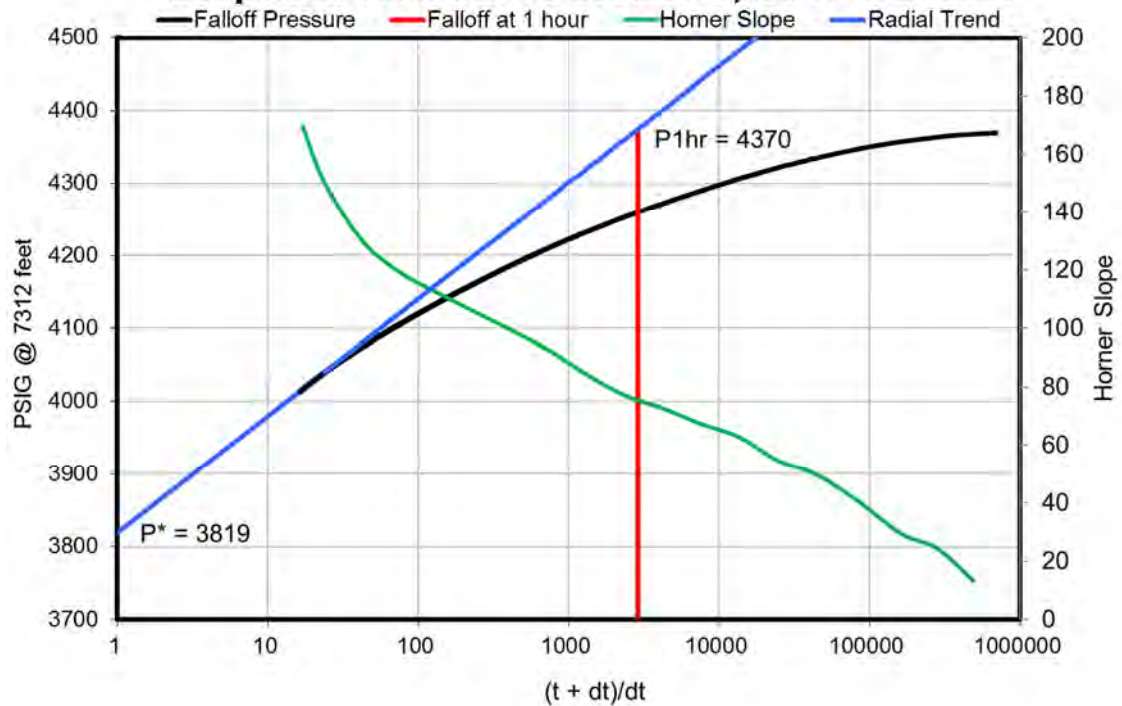


Figure 7

Disposal Well #2 - October 5, 2017 FO Test

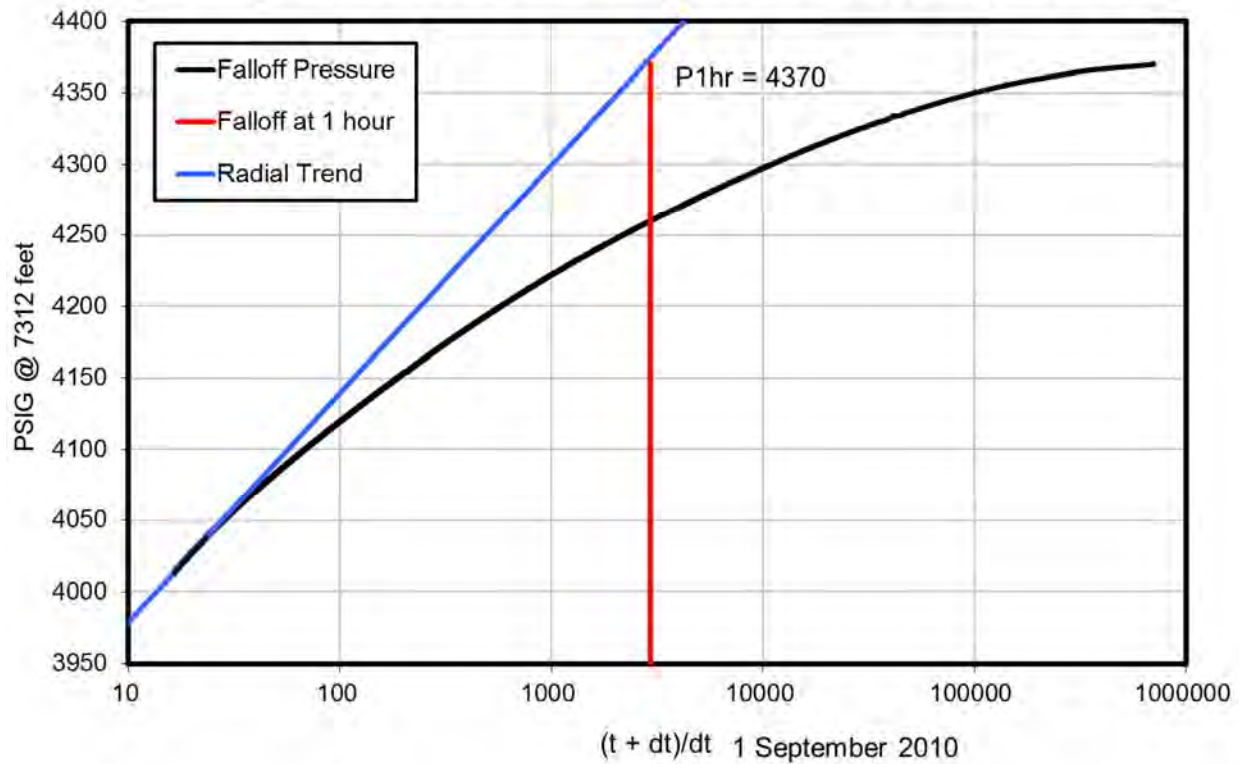


Figure 7A

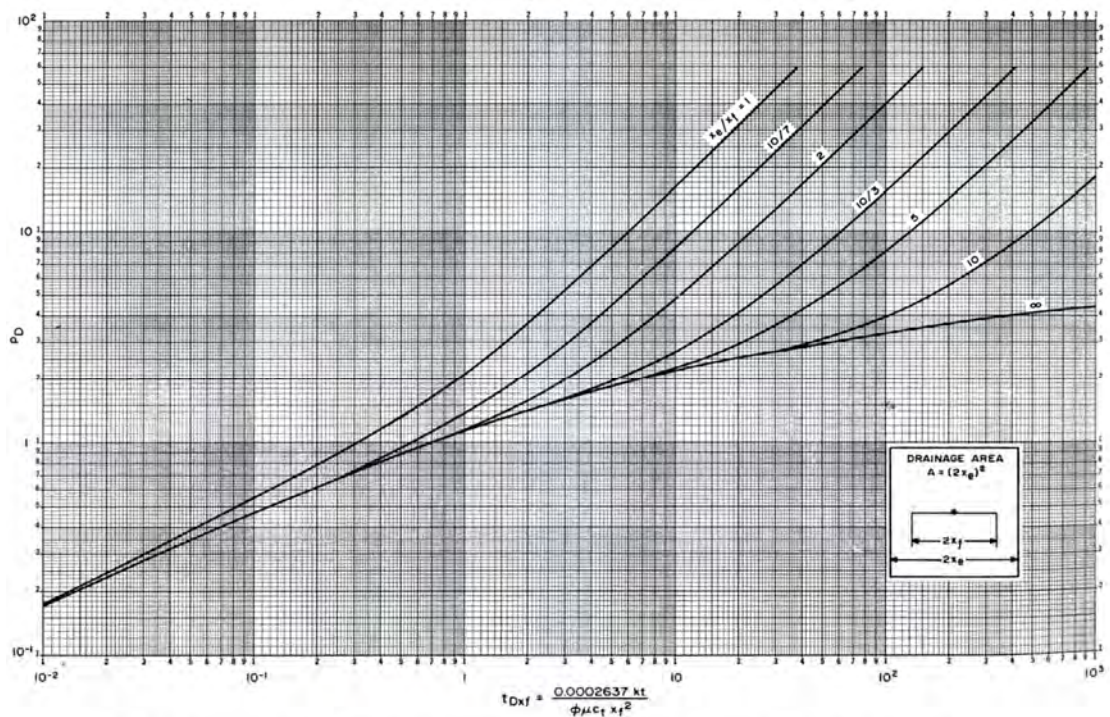


Fig. C.18 Dimensionless pressure for vertically fractured well in the center of a closed square, no wellbore storage, infinite-conductivity
 From: A. F. Gringarten, D. A. Hooton, and D. A. Hooton, 5.7

Figure 7B

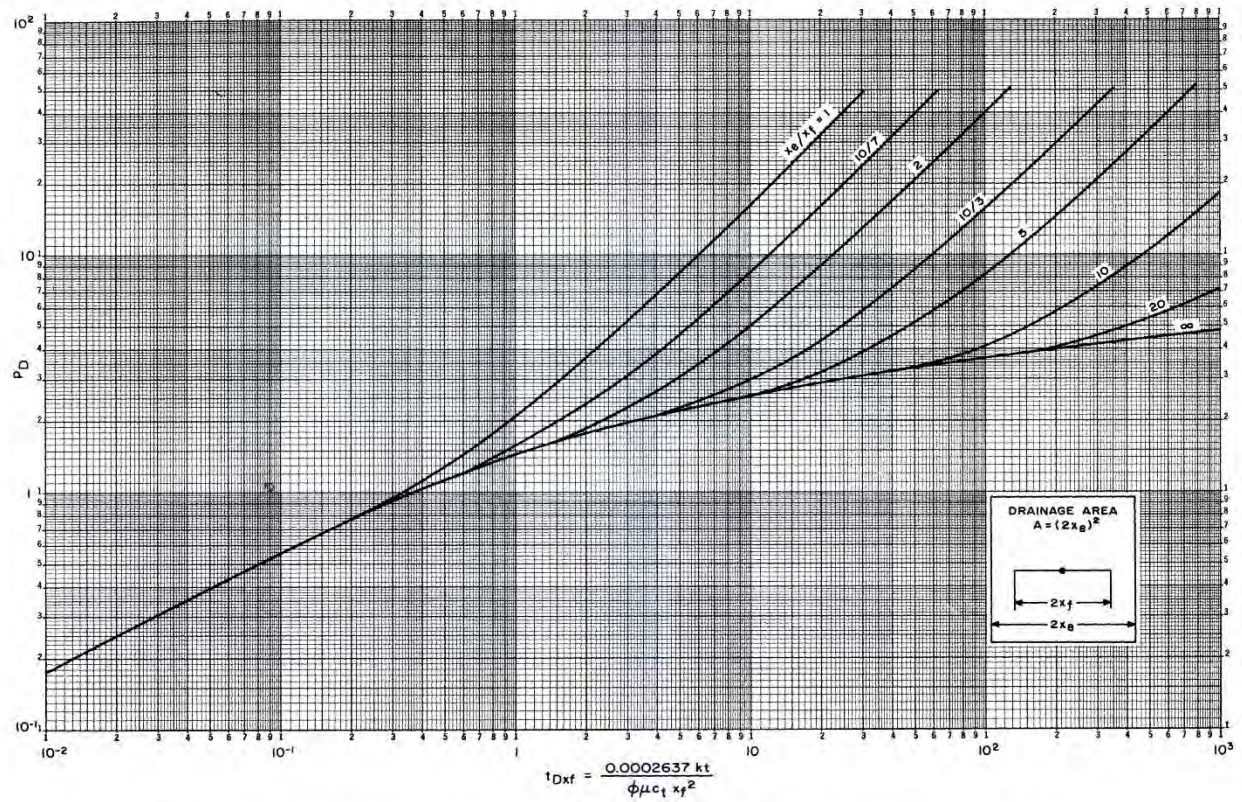


Fig. C.19 Dimensionless pressure for vertically fractured well in the center of a closed square, no wellbore storage, uniform-flux fracture.
 After Gringarten, Ramey and Raghavan.^{6,7}

Figure 7C

Di+sposal Well #2 – October 5, 2017 Test – Type Curve Match

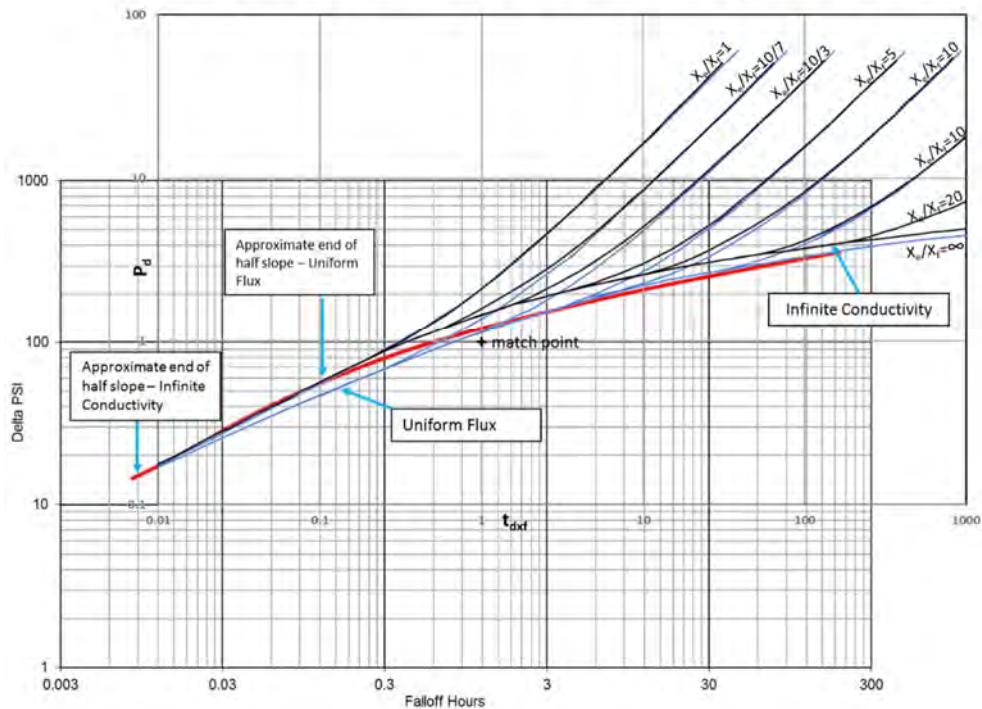


Figure 8
Western Disposal Well #2 Pressure History

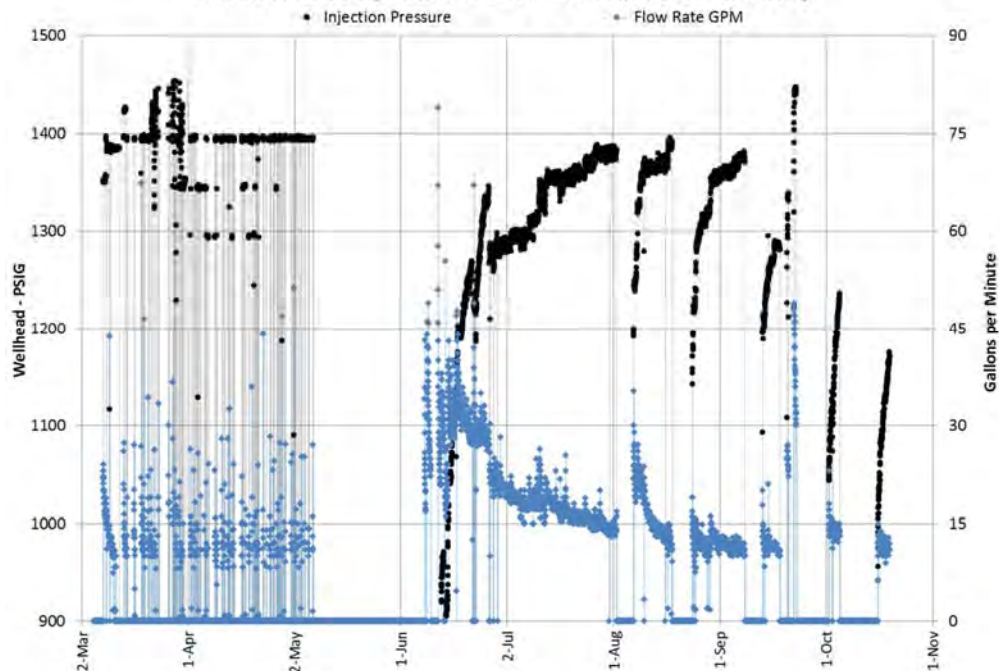


Figure 9
Western Disposal Well #2 Pressure History

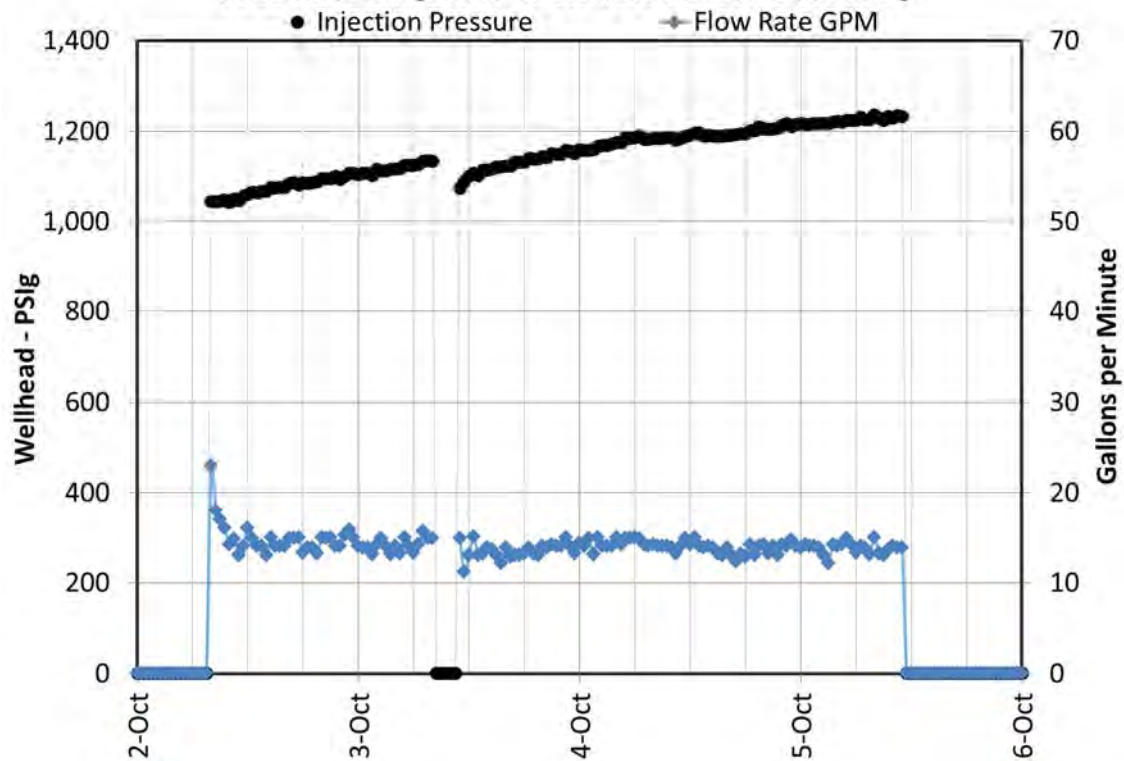
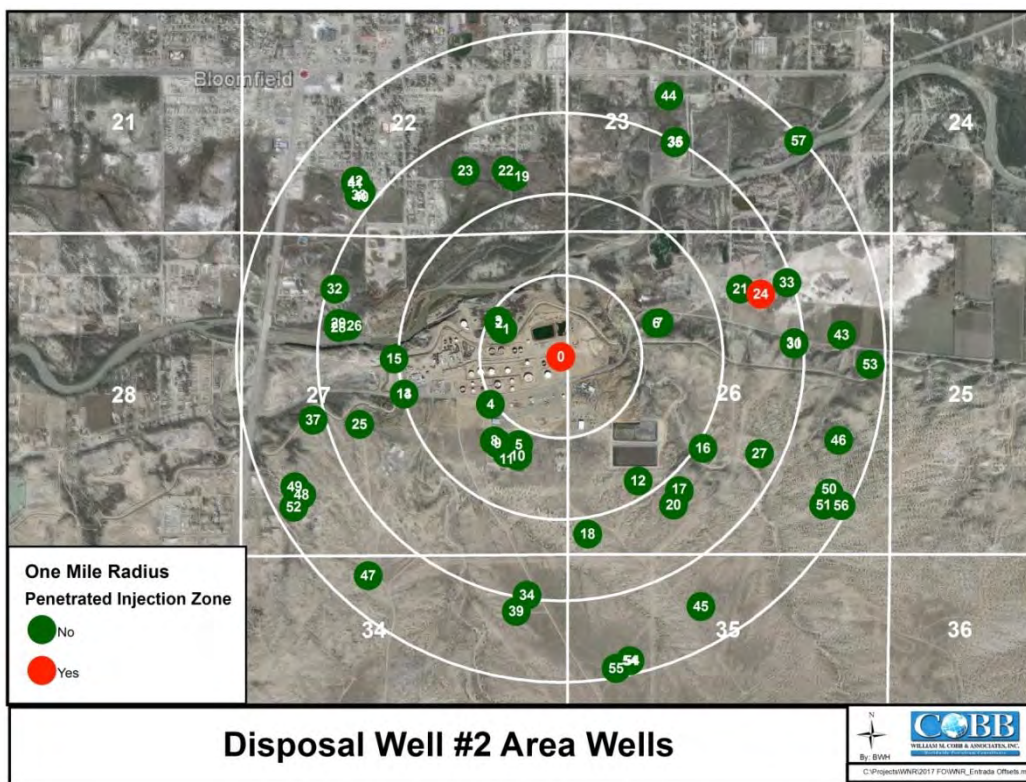


Figure 10

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List of Appendices

Appendix A: Well bore schematic for Disposal Well #1

Appendix B: Summary of injection intervals

Appendix C: Injection and formation fluid analysis

Appendix D: Well Logs

Appendix E: October 5, 2017 Falloff test data

Appendix F: Test gauge calibration certificates

Appendix G: Mechanical Integrity Test Report (MIT)

Appendix H: Table of wells in a one mile radius

Appendix I: Injection History

Appendix A

Well bore schematic for Disposal Well #1

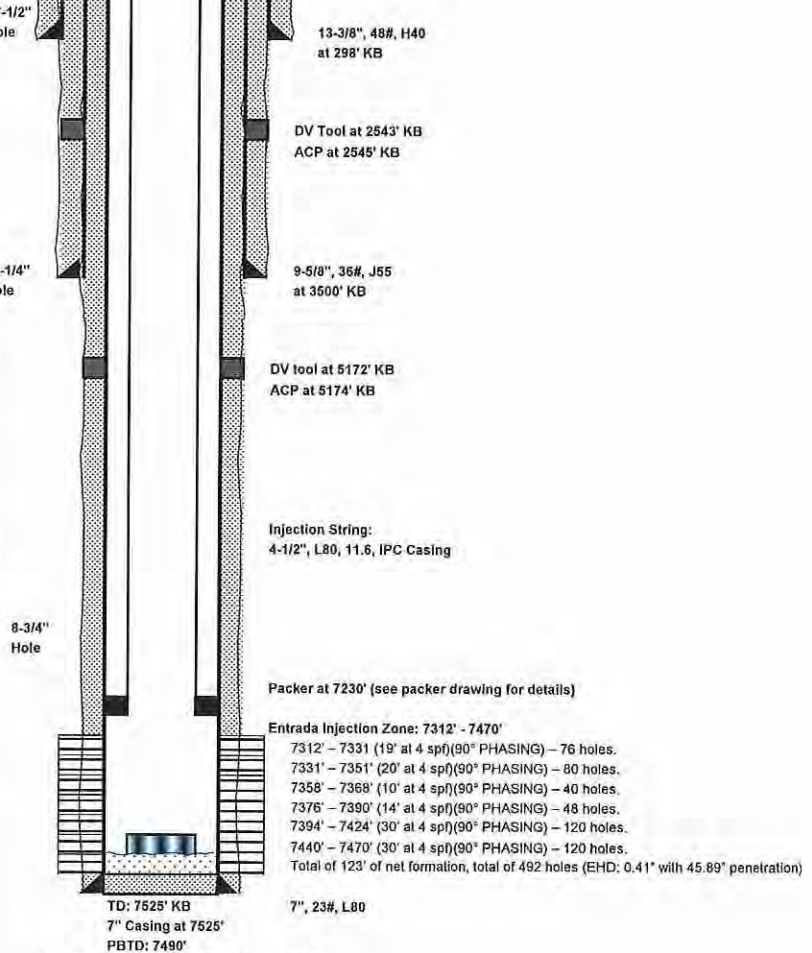
Table 2: A wellbore diagram showing the current configuration of the wellbore.

Well/Facility:	SWD #2	Well Status:	Current
Operator:	Western Refinery	Orig Oper:	
Lease/Op Agmt:		Inj Interval:	
Field:	Entrada	API #:	
County:	San Juan	GR/KB:	14.5'
State:	NM	TD:	7525' KB
Spud:	8/15/2016	PBTD:	7490' KB
Comp. Date:		WI:	
1st Prod:		NRI:	
Xmas tree:			
Surface Loc:	2028' fml & 111' fel		
Sec-Twn-Rge:	Sec 27/T29N/11W		
Comments:	3/7/2017 - Started Injection/Water Disposal Operations		

Date Drawn: October 2016

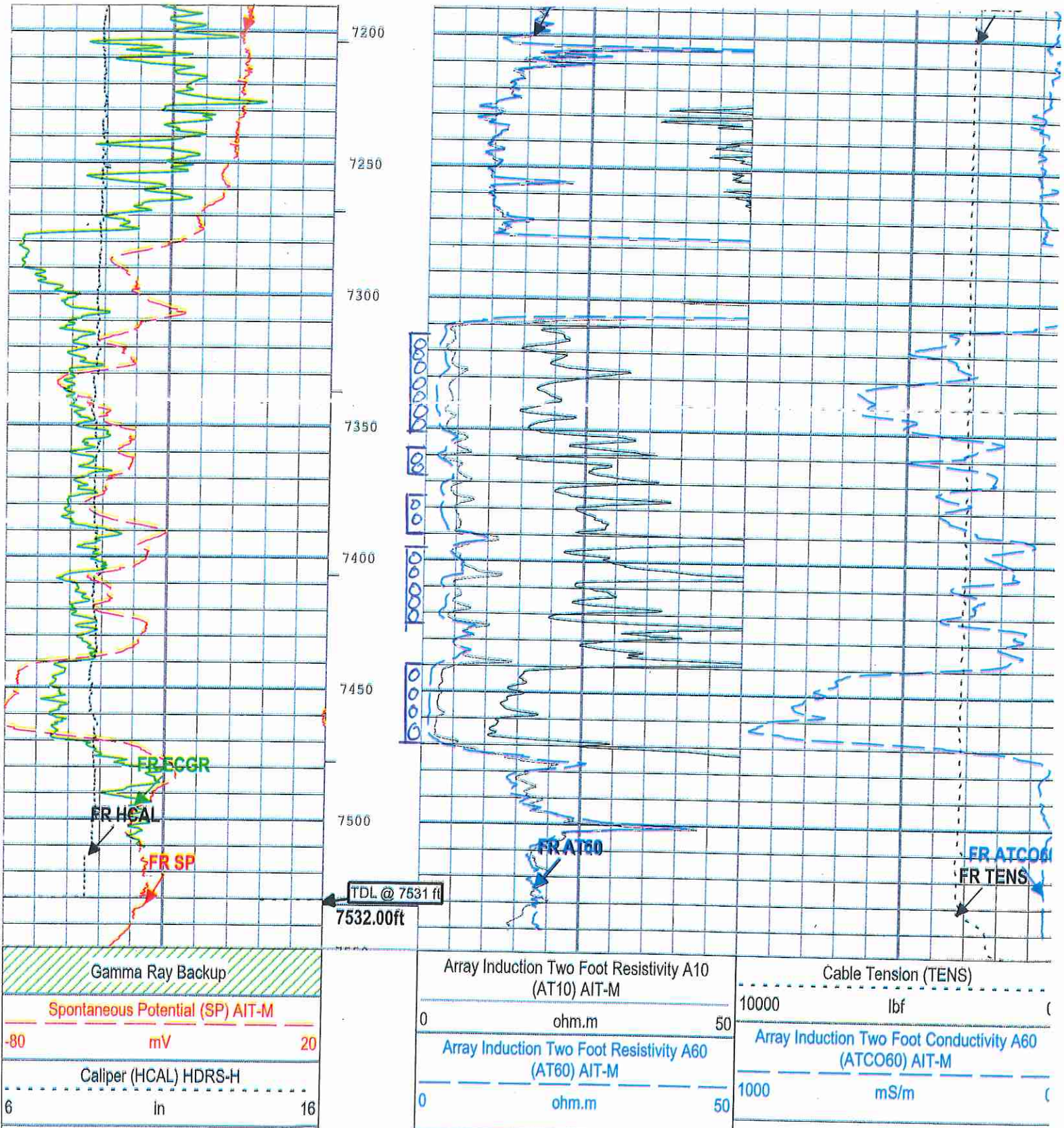


Geologic Markers	
MD	Formation
Surface	Quaternary Alluv
10'	Nacimiento
515'	Ojo Alamo
625'	Kirtland
1203'	Fruitland
1718'	Pictured Cliffs
1880'	Lewis
2660'	Huerfano Bentonite
2688'	Chacra
2877'	Lower Lewis
3337'	Cliff House
3389'	Menefee
4045'	Point Lookout
4432'	Mancos Shale
5301'	Niobrara A
5400'	Niobrara B
5526'	Niobrara C
5606'	Gallup
5848'	Juana Lopez
5966'	Carlile
6056'	Greenhorn
6117'	Graneros
6161'	Dakota
6357'	Burro Canyon
6417'	Morrison
7031'	Bluff Sandstone
7150'	Wanakah
7276'	Todilto
7308'	Entrada
7470'	Chinle
7525'	TD



Note: 7" packer f' 7458'-7476', fill f' 7476'-7490'

Table 1: A copy of the well log showing the Entrada interval to be tested.



Appendix B

Summary of injection intervals

Appendix B

Western Refining Southwest, Inc.

Waste Disposal Well #2

Injection Intervals

Formation	Top	Base
Entrada	7312'	7470'

Appendix C

Injection and formation fluid analysis



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 18, 2017

Kelly Robinson

Western Refining Southwest, Inc.

#50 CR 4990

Bloomfield, NM 87413

TEL: (505) 632-4135

FAX (505) 632-3911

RE: BPT Injection Well 9 13 17

OrderNo.: 1709746

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/14/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

A handwritten signature in black ink, appearing to read 'Andy Freeman', is written over a horizontal line.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 1709746

Date Reported: 10/18/2017

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: Injection Well

Project: BPT Injection Well 9 13 17

Collection Date: 9/13/2017 11:20:00 AM

Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8081: PESTICIDES TCLP							Analyst: MAB
Chlordane	ND	0.030		mg/L	1	9/27/2017 1:41:44 PM	33957
Endrin	ND	0.020		mg/L	1	9/27/2017 1:41:44 PM	33957
gamma-BHC (Lindane)	ND	0.40		mg/L	1	9/27/2017 1:41:44 PM	33957
Heptachlor	ND	0.0080		mg/L	1	9/27/2017 1:41:44 PM	33957
Heptachlor epoxide	ND	0.0080		mg/L	1	9/27/2017 1:41:44 PM	33957
Methoxychlor	ND	10		mg/L	1	9/27/2017 1:41:44 PM	33957
Toxaphene	ND	0.50		mg/L	1	9/27/2017 1:41:44 PM	33957
Surr: Decachlorobiphenyl	85.8	57.8-124		%Rec	1	9/27/2017 1:41:44 PM	33957
Surr: Tetrachloro-m-xylene	81.5	43-114		%Rec	1	9/27/2017 1:41:44 PM	33957
EPA METHOD 8270C TCLP							Analyst: DAM
2-Methylphenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
3+4-Methylphenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
Phenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4-Dinitrotoluene	ND	0.13		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachlorobenzene	ND	0.13		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachlorobutadiene	ND	0.50		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachloroethane	ND	3.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Nitrobenzene	ND	2.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Pentachlorophenol	ND	100		mg/L	1	9/27/2017 4:13:14 PM	33908
Pyridine	ND	5.0		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4,5-Trichlorophenol	ND	400		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4,6-Trichlorophenol	ND	2.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Cresols, Total	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
Surr: 2-Fluorophenol	44.6	15-124		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: Phenol-d5	38.8	15-118		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 2,4,6-Tribromophenol	65.9	15-148		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: Nitrobenzene-d5	82.7	40.6-124		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 2-Fluorobiphenyl	61.8	35.7-128		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 4-Terphenyl-d14	57.0	18.8-115		%Rec	1	9/27/2017 4:13:14 PM	33908
SPECIFIC GRAVITY							Analyst: JRR
Specific Gravity	1.002	0			1	9/15/2017 2:17:00 PM	R45658
EPA METHOD 300.0: ANIONS							Analyst: MRA
Fluoride	5.9	0.50	*	mg/L	5	9/14/2017 3:12:54 PM	R45644
Chloride	600	25	*	mg/L	50	9/27/2017 4:01:08 PM	R45948
Nitrogen, Nitrite (As N)	ND	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Bromide	2.3	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Nitrogen, Nitrate (As N)	ND	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Phosphorus, Orthophosphate (As P)	ND	2.5		mg/L	5	9/14/2017 3:12:54 PM	R45644

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
	D Sample Diluted Due to Matrix	E Value above quantitation range
	H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
	ND Not Detected at the Reporting Limit	P Sample pH Not In Range
	PQL Practical Quantitative Limit	RL Reporting Detection Limit
	S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order **1709746**

Date Reported: **10/18/2017**

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: Injection Well

Project: BPT Injection Well 9 13 17

Collection Date: 9/13/2017 11:20:00 AM

Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS							Analyst: MRA
Sulfate	80	2.5		mg/L	5	9/14/2017 3:12:54 PM	R45644
SM2510B: SPECIFIC CONDUCTANCE							Analyst: JRR
Conductivity	3100	5.0		µmhos/cm	1	9/19/2017 2:03:47 PM	R45747
SM2320B: ALKALINITY							Analyst: JRR
Bicarbonate (As CaCO ₃)	499.0	20.00		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
Carbonate (As CaCO ₃)	ND	2.000		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
Total Alkalinity (as CaCO ₃)	499.0	20.00		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: KS
Total Dissolved Solids	1920	100	*D	mg/L	1	9/22/2017 10:23:00 AM	33959
SM4500-H+B: PH							Analyst: JRR
pH	7.34		H	pH units	1	9/19/2017 2:03:47 PM	R45747
EPA METHOD 7470: MERCURY							Analyst: MED
Mercury	ND	0.00020		mg/L	1	9/27/2017 9:25:56 AM	34071
EPA METHOD 6010B: DISSOLVED METALS							Analyst: TES
Calcium	53	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Magnesium	43	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Potassium	14	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Sodium	530	10		mg/L	10	9/28/2017 1:04:41 PM	A45960
EPA 6010B: TOTAL RECOVERABLE METALS							Analyst: TES
Arsenic	0.035	0.020		mg/L	1	9/19/2017 11:57:19 AM	33882
Barium	0.17	0.020		mg/L	1	9/19/2017 11:57:19 AM	33882
Cadmium	ND	0.0020		mg/L	1	9/19/2017 11:57:19 AM	33882
Chromium	ND	0.0060		mg/L	1	9/19/2017 11:57:19 AM	33882
Lead	ND	0.0050		mg/L	1	9/19/2017 11:57:19 AM	33882
Selenium	ND	0.050		mg/L	1	9/19/2017 11:57:19 AM	33882
Silver	ND	0.0050		mg/L	1	9/19/2017 11:57:19 AM	33882
TCLP VOLATILES BY 8260B							Analyst: RAA
Benzene	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,2-Dichloroethane (EDC)	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
2-Butanone	ND	200		mg/L	200	9/15/2017 1:25:00 AM	T45638
Carbon Tetrachloride	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
Chloroform	ND	6.0		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,4-Dichlorobenzene	ND	7.5		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,1-Dichloroethene	ND	0.70		mg/L	200	9/15/2017 1:25:00 AM	T45638
Hexachlorobutadiene	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
	D Sample Diluted Due to Matrix	E Value above quantitation range
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Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
TCLP VOLATILES BY 8260B							Analyst: RAA
Tetrachloroethene (PCE)	ND	0.70		mg/L	200	9/15/2017 1:25:00 AM	T45638
Trichloroethene (TCE)	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
Vinyl chloride	ND	0.20		mg/L	200	9/15/2017 1:25:00 AM	T45638
Chlorobenzene	ND	100		mg/L	200	9/15/2017 1:25:00 AM	T45638
Surr: 1,2-Dichloroethane-d4	97.4	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: 4-Bromofluorobenzene	95.6	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: Dibromofluoromethane	100	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: Toluene-d8	91.2	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
	D	Sample Diluted Due to Matrix	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
	PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
	S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified



Wet Chemistry by Method 4500 CN E-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Cyanide	ND		0.00500	1	09/21/2017 18:03	<u>WG1023142</u>

Tc

Wet Chemistry by Method 9034-9030B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Sulfide	0.125		0.0500	1	09/18/2017 17:47	<u>WG1021084</u>

Ss

Cn

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
Corrosivity by pH	7.09	<u>T8</u>	1	09/18/2017 10:32	<u>WG1021485</u>

Sr

Qc

Sample Narrative:

L936656-01 WG1021485: 7.09 at 15.2c

GI

Wet Chemistry by Method D93/1010A

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	deg F			date / time	
Flashpoint	DNF at 170		1	09/22/2017 15:11	<u>WG1023539</u>

Al

Sc



Method Blank (MB)

(MB) R3251293-1 09/21/17 17:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Reactive Cyanide	U		0.0018	0.005000

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCS-D)

(LCS) R3251293-2 09/21/17 17:55 • (LCSD) R3251293-3 09/21/17 17:56

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %
Reactive Cyanide	0.100	0.104	0.104	104	104	85-115

L936656-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike-Duplicate (MSD)

(OS) L936656-01 09/21/17 18:03 • (MS) R3251293-4 09/21/17 18:06 • (MSD) R3251293-5 09/21/17 18:07

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Reactive Cyanide	0.100	ND	0.0901	0.0861	86	82	1	75-125			5	20

1. Te 2. Ss 3. Cu 4. Sr 5. Qc 6. Gl 7. Al 8. Sc

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:
L936656

DATE/TIME: 09/22/17 16:01



^{12}C ^{32}S ^{14}Cn ^{28}Si ^{60}Co ^{7}Li ^{27}Al ^{32}S

QUALITY CONTROL SUMMARY

Wet Chemistry by Method 9034-9030B

Method Blank (MB)

(MB) R3250199-1 09/18/17 17:42

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Reactive Sulfide	U		0.0065	0.0500

L934254-02 Original Sample (OS) • Duplicate (DUP)

(OS) L934254-02 09/18/17 17:43 • (DUP) R3250199-4 09/18/17 17:44

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
	mg/l	mg/l		%		%
Reactive Sulfide	1.06	1.06	2	0		20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCS-D)

(LCS) R3250199-2 09/18/17 17:43 • (LCSD) R3250199-3 09/18/17 17:43

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Reactive Sulfide	0.500	0.503	0.511	101	102	85-115			2	20

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:
L936656

DATE/TIME: 09/22/17 16:01



QUALITY CONTROL SUMMARY

L936656-01

L936656-01 Original Sample (OS) • Duplicate (DUP)

(OS) L936656-01 09/18/17 10:32 • (DUP) WG1021485-3 09/18/17 10:32

Analyte	Original Result		DUP Result		DUP RPD		DUP Qualifier		DUP RPD Limits	
	su	7.09	su	7.09	%	0.000	12	12	%	1
Corrosivity by pH										

Sample Narrative:

OS: 7.09 at 15.2c

DUP: 7.09 at 15.2c

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) WG1021485-1 09/18/17 10:32 • (LCSD) WG1021485-2 09/18/17 10:32

Analyte	Spike Amount		LCS Result		LCSD Result		LCS Rec.		LCSD Rec.		Rec. Limits		LCS Qualifier		LCSD Qualifier		RPD		RPD Limits	
	su	10.0	su	9.95	su	9.96	%	99.5	%	99.6	%	98.4-102	%			%	0.100	%		%
Corrosivity by pH																				1

Sample Narrative:

LCS: 9.95 at 20.1c

LCSD: 9.96 at 20.0c

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:

L936656

DATE/TIME:

09/22/17 16:01

1	Tc
2	SS
3	Cn
4	Si
5	Qc
6	Gl
7	Al
8	Sc

WG1U23539

Wet Chemistry by Method D93/1010A

QUALITY CONTROL SUMMARY

L936656-01

ONE LAB. NATIONWIDE.

L936656-01 Original Sample (OS) • Duplicate (DUP)

(OS) L936656-01 09/22/17 15:11 • (DUP) WG1023539-1 09/22/17 15:11

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Flashpoint	deg F DNF at 170	deg F DNF at 170	1	% 0.000	% 10	% 10

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3251560-1 09/22/17 15:11 • (LCSD) R3251560-2 09/22/17 15:11

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Flashpoint	deg F 82.0	deg F 80.3	deg F 80.6	% 98.0	% 98.0	% 96.0-104	% 0.000	% 0.000	% 10	% 10

1	2	3	4	5	6	7	8	9
Ti	Ss	Cn	Sr	Qc	Gl	Al	Sc	

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:

L936656

DATE/TIME:

09/22/17 16:01

Wet Chemistry by Method 2580

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
ORP	mV 71.0		1	09/21/2017 16:57	<u>WG1023075</u>

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

Al

⁸ Sc

L937490-01 Original Sample (OS) • Duplicate (DUP)

(OS) L937490-01 09/21/17 16:57 • (DUP) WG1023075-3 09/21/17 16:57

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
ORP	mV 71.0	mV 70.0	1	% 1.42	%	% 20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) WG1023075-1 09/21/17 16:57 • (LCSD) WG1023075-2 09/21/17 16:57

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
ORP	mV 228	mV 228	mV 229	% 100	% 100	% 90.0-110	%	%	% 0.438	% 20

Tc

Ss

Cn

Sr

Qc

Gl

Al

Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.



Qualifier Description

T8	Sample(s) received past/too close to holding time expiration.
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QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB	SampType: mblk			TestCode: EPA Method 300.0: Anions					
Client ID:	PBW	Batch ID: R45644			RunNo: 45644					
Prep Date:		Analysis Date: 9/14/2017			SeqNo: 1448506		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.100								
Nitrogen, Nitrite (As N)	ND	0.100								
Bromide	ND	0.100								
Nitrogen, Nitrate (As N)	ND	0.100								
Phosphorus, Orthophosphate (As P	ND	0.500								
Sulfate	ND	0.500								

Sample ID	LCS		SampType: lcs		TestCode: EPA Method 300.0: Anions					
Client ID:	LCSW		Batch ID: R45644		RunNo: 45644					
Prep Date:			Analysis Date: 9/14/2017		SeqNo: 1448507		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.541	0.100	0.5000	0	108	90	110			
Nitrogen, Nitrite (As N)	0.953	0.100	1.000	0	95.3	90	110			
Bromide	2.45	0.100	2.500	0	97.9	90	110			
Nitrogen, Nitrate (As N)	2.53	0.100	2.500	0	101	90	110			
Phosphorus, Orthophosphate (As P	4.76	0.500	5.000	0	95.1	90	110			
Sulfate	9.84	0.500	10.00	0	98.4	90	110			

Sample ID	MB	SampType: mblk			TestCode: EPA Method 300.0: Anions					
Client ID:	PBW	Batch ID: R45948			RunNo: 45948					
Prep Date:		Analysis Date: 9/27/2017			SeqNo: 1460425		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								

Sample ID	LCS		SampType: lcs		TestCode: EPA Method 300.0: Anions					
Client ID:	LCSW		Batch ID: R45948		RunNo: 45948					
Prep Date:			Analysis Date: 9/27/2017		SeqNo: 1460426		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.7	0.50	5.000	0	93.5	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	100ng lcs		SampType: LCS		TestCode: TCLP Volatiles by 8260B					
Client ID:	LCSW		Batch ID: T45638		RunNo: 45638					
Prep Date:			Analysis Date: 9/14/2017		SeqNo: 1448337		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.021	0.010	0.02000	0	105	70	130			
1,1-Dichloroethene	0.022	0.010	0.02000	0	110	70	130			
Trichloroethene (TCE)	0.020	0.010	0.02000	0	102	70	130			
Chlorobenzene	0.020	0.010	0.02000	0	99.1	70	130			
Surr: 1,2-Dichloroethane-d4	0.0094		0.01000		94.3	70	130			
Surr: 4-Bromofluorobenzene	0.0097		0.01000		96.6	70	130			
Surr: Dibromofluoromethane	0.0097		0.01000		97.0	70	130			
Surr: Toluene-d8	0.0092		0.01000		91.6	70	130			

Sample ID	rb	SampType: MBLK			TestCode: TCLP Volatiles by 8260B					
Client ID:	PBW	Batch ID: T45638			RunNo: 45638					
Prep Date:		Analysis Date: 9/14/2017			SeqNo: 1448338		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.50								
1,2-Dichloroethane (EDC)	ND	0.50								
2-Butanone	ND	200								
Carbon Tetrachloride	ND	0.50								
Chloroform	ND	6.0								
1,4-Dichlorobenzene	ND	7.5								
1,1-Dichloroethene	ND	0.70								
Hexachlorobutadiene	ND	0.50								
Tetrachloroethene (PCE)	ND	0.70								
Trichloroethene (TCE)	ND	0.50								
Vinyl chloride	ND	0.20								
Chlorobenzene	ND	100								
Surr: 1,2-Dichloroethane-d4	0.0096		0.01000		95.9	70	130			
Surr: 4-Bromofluorobenzene	0.0096		0.01000		96.2	70	130			
Surr: Dibromofluoromethane	0.0096		0.01000		96.0	70	130			
Surr: Toluene-d8	0.0091		0.01000		91.4	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001cms			SampType:	MS			TestCode:	EPA Method 8270C TCLP		
Client ID:	Injection Well			Batch ID:	33908			RunNo:	45933		
Prep Date:	9/18/2017			Analysis Date:	9/27/2017			SeqNo:	1460039		
								Units:	mg/L		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual	
2-Methylphenol	0.069	0.0010	0.1000	0	69.0	23.9	129				
3+4-Methylphenol	0.13	0.0010	0.2000	0	64.6	15	167				
2,4-Dinitrotoluene	0.063	0.0010	0.1000	0	63.3	15	147				
Hexachlorobenzene	0.073	0.0010	0.1000	0	72.5	41.4	136				
Hexachlorobutadiene	0.069	0.0010	0.1000	0	68.5	16.2	134				
Hexachloroethane	0.056	0.0010	0.1000	0	56.5	20.6	124				
Nitrobenzene	0.081	0.0010	0.1000	0	80.8	39.5	134				
Pentachlorophenol	0.028	0.0010	0.1000	0	28.3	15	137				
Pyridine	0.011	0.0010	0.1000	0	11.0	15	129			S	
2,4,5-Trichlorophenol	0.080	0.0010	0.1000	0	79.8	15	158				
2,4,6-Trichlorophenol	0.073	0.0010	0.1000	0	72.9	15	153				
Cresols, Total	0.20	0.0010	0.3000	0	66.1	10.6	179				
Surr: 2-Fluorophenol	0.095		0.2000		47.3	15	124				
Surr: Phenol-d5	0.078		0.2000		38.9	15	118				
Surr: 2,4,6-Tribromophenol	0.13		0.2000		66.7	15	148				
Surr: Nitrobenzene-d5	0.085		0.1000		84.7	40.6	124				
Surr: 2-Fluorobiphenyl	0.070		0.1000		69.6	35.7	128				
Surr: 4-Terphenyl-d14	0.059		0.1000		58.7	18.8	115				

Sample ID	1709746-001cmsd			SampType:	MSD			TestCode:	EPA Method 8270C TCLP		
Client ID:	Injection Well			Batch ID:	33908			RunNo:	45933		
Prep Date:	9/18/2017			Analysis Date:	9/27/2017			SeqNo:	1460040		
								Units:	mg/L		
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual	
2-Methylphenol	0.062	0.0010	0.1000	0	62.5	23.9	129	9.98	20		
3+4-Methylphenol	0.12	0.0010	0.2000	0	61.3	15	167	5.28	20		
2,4-Dinitrotoluene	0.056	0.0010	0.1000	0	56.3	15	147	11.7	23.2		
Hexachlorobenzene	0.071	0.0010	0.1000	0	70.8	41.4	136	2.46	20		
Hexachlorobutadiene	0.065	0.0010	0.1000	0	64.5	16.2	134	5.98	20		
Hexachloroethane	0.051	0.0010	0.1000	0	51.5	20.6	124	9.27	31.3		
Nitrobenzene	0.081	0.0010	0.1000	0	80.9	39.5	134	0.124	26.6		
Pentachlorophenol	0.040	0.0010	0.1000	0	40.5	15	137	35.5	27.9	R	
Pyridine	0.0090	0.0010	0.1000	0	8.96	15	129	20.8	47.4	S	
2,4,5-Trichlorophenol	0.072	0.0010	0.1000	0	71.6	15	158	10.9	36.9		
2,4,6-Trichlorophenol	0.077	0.0010	0.1000	0	77.0	15	153	5.42	37.2		
Cresols, Total	0.18	0.0010	0.3000	0	61.7	10.6	179	6.89	27.4		
Surr: 2-Fluorophenol	0.087		0.2000		43.6	15	124	0	0		
Surr: Phenol-d5	0.074		0.2000		37.0	15	118	0	0		
Surr: 2,4,6-Tribromophenol	0.14		0.2000		68.1	15	148	0	0		

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001cmsd	SampType: MSD			TestCode: EPA Method 8270C TCLP					
Client ID:	Injection Well	Batch ID: 33908			RunNo: 45933					
Prep Date:	9/18/2017	Analysis Date: 9/27/2017			SeqNo: 1460040		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Nitrobenzene-d5	0.082		0.1000		81.7	40.6	124	0	0	
Surr: 2-Fluorobiphenyl	0.070		0.1000		69.8	35.7	128	0	0	
Surr: 4-Terphenyl-d14	0.051		0.1000		51.1	18.8	115	0	0	

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-34071		SampType: MBLK		TestCode: EPA Method 7470: Mercury					
Client ID:	PBW		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459048		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercurv	ND	0.00020								

Sample ID	LCS-34071		SampType: LCS		TestCode: EPA Method 7470: Mercury					
Client ID:	LCSW		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459049		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.0	80	120			

Sample ID	1709746-001DMS		SampType: MS		TestCode: EPA Method 7470: Mercury					
Client ID:	Injection Well		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459053		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0050	0.00020	0.005000	.00004788	98.8	75	125			

Sample ID	1709746-001DMSD		SampType: MSD		TestCode: EPA Method 7470: Mercury					
Client ID:	Injection Well		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459054		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercurv	0.0049	0.00020	0.005000	.00004788	97.9	75	125	0.906	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-A	SampType: MBLK			TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	PBW	Batch ID: A45714			RunNo: 45714					
Prep Date:		Analysis Date: 9/19/2017			SeqNo: 1452976		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								

Sample ID	LCS-A		SampType: LCS		TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	LCSW		Batch ID: A45714		RunNo: 45714					
Prep Date:			Analysis Date: 9/19/2017		SeqNo: 1452977		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	52	1.0	50.00	0	104	80	120			
Magnesium	54	1.0	50.00	0	108	80	120			
Potassium	53	1.0	50.00	0	106	80	120			

Sample ID	MB-A	SampType: MBLK			TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	PBW	Batch ID: A45960			RunNo: 45960					
Prep Date:		Analysis Date: 9/28/2017			SeqNo: 1461012		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0								

Sample ID	LCS-A		SampType: LCS		TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	LCSW		Batch ID: A45960		RunNo: 45960					
Prep Date:			Analysis Date: 9/28/2017		SeqNo: 1461013		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	51	1.0	50.00	0	102	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-33882		SampType: MBLK		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451478		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.020								
Barium	ND	0.020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Lead	ND	0.0050								
Silver	ND	0.0050								

Sample ID	LCS-33882		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451479		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.52	0.020	0.5000	0	103	80	120			
Barium	0.49	0.020	0.5000	0	98.6	80	120			
Cadmium	0.49	0.0020	0.5000	0	98.8	80	120			
Chromium	0.49	0.0060	0.5000	0	98.1	80	120			
Lead	0.48	0.0050	0.5000	0	95.7	80	120			
Silver	0.10	0.0050	0.1000	0	103	80	120			

Sample ID	MB-33882		SampType: MBLK		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451496		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	ND	0.050								

Sample ID	LCS-33882		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451497		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	0.49	0.050	0.5000	0	98.4	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	mb-1		SampType:	MBLK		TestCode:	SM2320B: Alkalinity			
Client ID:	PBW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452652	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID	lcs-1		SampType:	LCS		TestCode:	SM2320B: Alkalinity			
Client ID:	LCSW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452653	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.40	20.00	80.00	0	101	90	110			

Sample ID	mb-2		SampType:	MBLK		TestCode:	SM2320B: Alkalinity			
Client ID:	PBW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452675	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID	lcs-2		SampType:	LCS		TestCode:	SM2320B: Alkalinity			
Client ID:	LCSW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452676	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.92	20.00	80.00	0	101	90	110			

Sample ID	mb-3		SampType:	MBLK		TestCode:	SM2320B: Alkalinity			
Client ID:	PBW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452699	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID	lcs-3		SampType:	LCS		TestCode:	SM2320B: Alkalinity			
Client ID:	LCSW		Batch ID:	R45747		RunNo:	45747			
Prep Date:			Analysis Date:	9/19/2017		SeqNo:	1452700	Units:	mg/L CaCO3	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.84	20.00	80.00	0	101	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001EDUP	SampType:	DUP	TestCode:	Specific Gravity					
Client ID:	Injection Well	Batch ID:	R45658	RunNo:	45658					
Prep Date:		Analysis Date:	9/15/2017	SeqNo:	1449109	Units:				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Specific Gravity	1.001	0						0.110	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-33959		SampType: MBLK		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	PBW		Batch ID: 33959		RunNo: 45804					
Prep Date:	9/20/2017		Analysis Date: 9/22/2017		SeqNo: 1455608		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	LCS-33959		SampType: LCS		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	LCSW		Batch ID: 33959		RunNo: 45804					
Prep Date:	9/20/2017		Analysis Date: 9/22/2017		SeqNo: 1455609		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1020	20.0	1000	0	102	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Western Refining Southw

Work Order Number: 1709746

RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 7:05:00 AM

Completed By: Ashley Gallegos 9/14/2017 9:01:05 AM

Reviewed By: ENM 9/14/17

IO

Ag

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☒
2. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐
5. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☒ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☒ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
9. Was preservative added to bottles? Yes ☐ No ☒ NA ☐
10. VOA vials have zero headspace? Yes ☒ No ☐ No VOA Vials ☐
11. Were any sample containers received broken? Yes ☐ No ☒
12. Does paperwork match bottle labels?
(Note discrepancies on chain of custody) Yes ☒ No ☐
13. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
14. Is it clear what analyses were requested? Yes ☒ No ☐
15. Were all holding times able to be met?
(If no, notify customer for authorization.) Yes ☒ No ☐

of preserved
bottles checked
for pH: 2, 2
(<2 or >12 unless noted)
Adjusted? No
Checked by: Re

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

immediately or within a specified time period, or assess a civil penalty, or both (see Section 74-6-10 NMSA 1978). The compliance order may also include a suspension or termination of this Discharge Permit. OCD may also commence a civil action in district court for appropriate relief, including injunctive relief (see Section 74-6-10(A)(2) NMSA 1978). The Permittee may be subject to criminal penalties for discharging a water contaminant without a discharge permit or in violation of a condition of a discharge permit; making any false material statement, representation, certification or omission of material fact in a renewal application, record, report, plan or other document filed, submitted or required to be maintained under the Water Quality Act; falsifying, tampering with or rendering inaccurate any monitoring device, method or record required to be maintained under the Water Quality Act; or failing to monitor, sample or report as required by a Discharge Permit issued pursuant to a state or federal law or regulation (see Section 74-6-10.2 NMSA 1978).

2. GENERAL FACILITY OPERATIONS:

2.A. QUARTERLY MONITORING REQUIREMENTS FOR CLASS I NON-HAZARDOUS WASTE INJECTION WELL: The Permittee shall properly conduct waste management injection operations at its facility by injecting only non-hazardous (RCRA exempt and RCRA non-hazardous, non-exempt) oil field waste fluids. Injected waste fluids shall not exhibit the RCRA characteristics, i.e., ignitability, reactivity, corrosivity, or toxicity under 40 CFR 261 Subpart "C" 261.21 – 261.24 (July 1, 1992), at the point of injection into WDW-2, based upon environmental analytical laboratory testing. Pursuant to 20.6.2.5207B, the Permittee shall provide analyses of the injected fluids at least quarterly to yield data representative of their toxicity characteristic.

The Permittee shall also analyze the injected fluids quarterly for the following characteristics:

- pH (Method 9040);
- Eh;
- Specific conductance;
- Specific gravity;
- Temperature;
- Major dissolved cations and anions, including: fluoride, calcium, potassium, magnesium, sodium bicarbonate, carbonate, chloride, sulfate, bromide, total dissolved solids, and cation/anion balance using the methods specified in 40 CFR 136.3); and,
- EPA RCRA Characteristics for Ignitability (ASTM Methods); Corrosivity (SW-846) and Reactivity (determined through Permittee's application of knowledge or generating process).

The Permittee shall analyze the injected fluids quarterly for the constituents identified in the Quarterly Monitoring List (below) to demonstrate that the injected fluids do not exhibit the characteristic of toxicity using the Toxicity Characteristic Leaching Procedure, EPA SW-846 Test Method 1311 (see Table 1, 40 CFR 261.24(b)).

**WESTERN REFINING SOUTHWEST, INC.
WASTE DISPOSAL WELL NO. 2**

**UICI-011 (WDW-2)
July 20, 2016**

D010	Selenium	1311	1.0
D011	Silver	1311	5.0
D039	Tetrachloroethylene	8260B	0.7
D040	Trichloroethylene	8021B 8260B	0.5
D041	2,4,5-Trichlorophenol	8270D	400.0
D042	2,4,6-Trichlorophenol	8041A 8270D	2.0
D043	Vinyl chloride	8021B 8260B	0.2

If o-, m-, and p-cresol concentrations cannot be differentiated, then the total cresol (D026) concentration is used.

The regulatory level of total cresol is 200 mg/L.

If the quantitation limit is greater than the regulatory level, then the quantitation limit becomes the regulatory level.

If metals (dissolved), the EPA 1311 TCLP Laboratory Method is required with the exception of Mercury (total).

1. Monitor and Piezometer Wells: Groundwater with a total dissolved solids concentration of less than 10,000 mg/L occurs at an estimated depth of approximately 10 - 30 ft. below ground surface at the WDW-2 well (hereafter, "uppermost water-bearing unit"). Groundwater monitoring well (MW) with GW sampling capability shall be installed proximal to and hydrogeologically downgradient from WDW-2 in order to monitor the uppermost water-bearing unit. The MW shall be screened (15 ft. screen with top of screen positioned 5 ft. above water table) into the uppermost water-bearing unit. The Permittee shall propose a monitoring frequency with chemical monitoring parameters in order to detect potential groundwater contamination either associated with or not associated with WDW-2.

2.B. CONTINGENCY PLANS: The Permittee shall implement its proposed contingency plan(s) included in its application to cope with failure of a system(s) in the Discharge Permit.

2.C. CLOSURE: Prior to closure of the facility, the Permittee shall submit for OCD's approval, a closure plan including a completed form C-103 for plugging and abandonment of the waste injection well. The Permittee shall plug and abandon its well pursuant to 20.6.2.5209 NMAC and as specified in Permit Condition 2.D.

- 1. Pre-Closure Notification:** Pursuant to 20.6.2.5005A NMAC, the Permittee shall submit a pre-closure notification to OCD's Environmental Bureau at least 30 days prior to the date that it proposes to close or to discontinue operation of WDW-2. Pursuant to 20.6.2.5005B NMAC, OCD's Environmental Bureau must approve all proposed well closure activities before the Permittee may implement its proposed closure plan.
- 2. Required Information:** The Permittee shall provide OCD's Environmental Bureau with the following information in the pre-closure notification specified in Permit Condition 2.C.1:
 - Name of facility;
 - Address of facility;
 - Name of Permittee (and owner or operator, if appropriate);

Field Parameters									
Site	Sp. Cond. (uS/cm)	TDS (g/L)	DO (mg/L)	ORP (mV)	pH (Units)	Temp. (F)	Date	Time	Sampler
DWD#2	68,017	44,200	1.33	211.9	5.13	52.3	1/25/2017	11:00 AM	Matt Krakow



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

February 01, 2017

Kelly Robinson

Western Refining Southwest, Inc.

#50 CR 4990

Bloomfield, NM 87413

TEL: (505) 632-4135

FAX (505) 632-3911

RE: DWD #2

OrderNo.: 1701A75

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 1/26/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

A handwritten signature in black ink, appearing to read 'Andy Freeman', is written over a horizontal line.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 1701A75

Date Reported: 2/1/2017

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: DWD 2 Formation Water

Project: DWD #2

Collection Date: 1/25/2017 11:00:00 AM

Lab ID: 1701A75-001

Matrix: AQUEOUS

Received Date: 1/26/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS							Analyst: MRA
Fluoride	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Chloride	23000	2500	*	mg/L	5E	1/27/2017 7:20:01 PM	R40361
Bromide	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Phosphorus, Orthophosphate (As P)	ND	10		mg/L	20	1/26/2017 6:37:17 PM	R40335
Sulfate	910	25	*	mg/L	50	1/27/2017 7:07:36 PM	R40361
Nitrate+Nitrite as N	ND	20		mg/L	100	1/27/2017 7:32:26 PM	R40361
SM2510B: SPECIFIC CONDUCTANCE							Analyst: JRR
Conductivity	94000	50		µmhos/cm	50	1/30/2017 1:40:54 PM	R40366
SM2320B: ALKALINITY							Analyst: JRR
Bicarbonate (As CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Carbonate (As CaCO3)	ND	2.000		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Total Alkalinity (as CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: KS
Total Dissolved Solids	48900	2000	*D	mg/L	1	2/1/2017 3:56:00 PM	29970
EPA 6010B: TOTAL RECOVERABLE METALS							Analyst: pmf
Calcium	1700	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Magnesium	200	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Potassium	450	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Sodium	16000	500		mg/L	500	1/30/2017 11:06:12 AM	29930

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank	Page 1 of 5
	D	Sample Diluted Due to Matrix	E	Value above quantitation range	
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range	
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit	
	S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified	



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LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Hall Environmental
Project: Not Indicated
Lab ID: B17011690-001
Client Sample ID: 1701A75-001C DWD 2 Formation Water

Report Date: 01/27/17
Collection Date: 01/25/17 11:00
Date Received: 01/27/17
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
CORROSIVITY							
pH	6.46	s.u.		0.10		SW9040C	01/27/17 10:54 / jmg

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.



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QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Hall Environmental

Project: Not Indicated

Report Date: 01/27/17

Work Order: B17011690

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	SW9040C	Analytical Run: ORION 720A HZW_170127A							
Lab ID:	ICV	Initial Calibration Verification Standard 01/27/17 10:54							
pH	8.11	s.u.	0.10	101	98	102			
Method:	SW9040C	Batch: R273874							
Lab ID:	B17011690-001ADUP	Sample Duplicate Run: ORION 720A HZW_170127A 01/27/17 10:54							
pH	6.49	s.u.	0.10				0.5	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID MB	SampType: mblk		TestCode: EPA Method 300.0: Anions							
Client ID: PBW	Batch ID: R40335		RunNo: 40335							
Prep Date:	Analysis Date: 1/26/2017		SeqNo: 1264291		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride ND 0.10

Bromide ND 0.10

Phosphorus, Orthophosphate (As P) ND 0.50

Sample ID LCSb	SampType: lcs		TestCode: EPA Method 300.0: Anions							
Client ID: LCSW	Batch ID: R40335		RunNo: 40335							
Prep Date:	Analysis Date: 1/26/2017		SeqNo: 1264293		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride 0.52 0.10 0.5000 0 104 90 110

Bromide 2.4 0.10 2.500 0 96.4 90 110

Phosphorus, Orthophosphate (As P) 4.8 0.50 5.000 0 96.7 90 110

Sample ID MB	SampType: mblk		TestCode: EPA Method 300.0: Anions							
Client ID: PBW	Batch ID: R40361		RunNo: 40361							
Prep Date:	Analysis Date: 1/27/2017		SeqNo: 1265117		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Chloride ND 0.50

Sulfate ND 0.50

Nitrate+Nitrite as N ND 0.20

Sample ID LCS	SampType: lcs		TestCode: EPA Method 300.0: Anions							
Client ID: LCSW	Batch ID: R40361		RunNo: 40361							
Prep Date:	Analysis Date: 1/27/2017		SeqNo: 1265118		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Chloride 4.8 0.50 5.000 0 95.5 90 110

Sulfate 9.7 0.50 10.00 0 97.2 90 110

Nitrate+Nitrite as N 3.5 0.20 3.500 0 98.8 90 110

Qualifiers:

* Value exceeds Maximum Contaminant Level.

D Sample Diluted Due to Matrix

H Holding times for preparation or analysis exceeded

ND Not Detected at the Reporting Limit

R RPD outside accepted recovery limits

S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank

E Value above quantitation range

J Analyte detected below quantitation limits

P Sample pH Not In Range

RL Reporting Detection Limit

W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	MB-29930	SampType: MBLK			TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW	Batch ID: 29930			RunNo: 40375					
Prep Date:	1/27/2017	Analysis Date: 1/30/2017			SeqNo: 1265583		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID	LCS-29930		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 29930		RunNo: 40375					
Prep Date:	1/27/2017		Analysis Date: 1/30/2017		SeqNo: 1265584		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	49	1.0	50.00	0	98.3	80	120			
Magnesium	49	1.0	50.00	0	97.3	80	120			
Potassium	47	1.0	50.00	0	94.9	80	120			
Sodium	48	1.0	50.00	0	95.4	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	mb-1	SampType:	mbk	TestCode:	SM2320B: Alkalinity					
Client ID:	PBW	Batch ID:	R40366	RunNo:	40366					
Prep Date:		Analysis Date:	1/30/2017	SeqNo:	1266120	Units:	mg/L CaCO3			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID	lcs-1	SampType:	lcs	TestCode:	SM2320B: Alkalinity					
Client ID:	LCSW	Batch ID:	R40366	RunNo:	40366					
Prep Date:		Analysis Date:	1/30/2017	SeqNo:	1266121	Units:	mg/L CaCO3			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.04	20.00	80.00	0	97.6	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	MB-29970	SampType: MBLK			TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	PBW	Batch ID: 29970			RunNo: 40436					
Prep Date:	1/31/2017	Analysis Date: 2/1/2017			SeqNo: 1267368		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	LCS-29970		SampType: LCS		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	LCSW		Batch ID: 29970		RunNo: 40436					
Prep Date:	1/31/2017		Analysis Date: 2/1/2017		SeqNo: 1267369		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Western Refining Southw

Work Order Number: 1701A75

RcptNo: 1

Received by/date: 1/26/17

Logged By: Anne Thorne 1/26/2017 7:05:00 AM

Completed By: Anne Thorne 1/26/2017 9:13:16 AM

Reviewed By: [Signature] 1/26/17

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☒
2. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐
5. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☒ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☒ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
9. Was preservative added to bottles? Yes ☐ No ☒ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☒
11. Were any sample containers received broken? Yes ☐ No ☒
12. Does paperwork match bottle labels?
(Note discrepancies on chain of custody) Yes ☒ No ☐
13. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
14. Is it clear what analyses were requested? Yes ☒ No ☐
15. Were all holding times able to be met?
(If no, notify customer for authorization.) Yes ☒ No ☐

of preserved
bottles checked
for pH: 2
(≤ 2 or >12 unless noted)

Adjusted? MP

Checked by: [Signature]

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:	_____	Date:	_____
By Whom:	_____	Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:	_____		
Client Instructions:	_____		

17. Additional remarks:

18. Cooler Information

Cooler No	Temp $^{\circ}\text{C}$	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

Turn-Around Time:

☐ Standard ☒ Rush 2-day

22D#2

Project #: PD-12619031-2

1861

Project Manager:

QA/QC Package:

☒ Standard ☐ Level 4 (Full Validation)

Accreditation

☐ NELAP ☐ Other

☐ EDD (Type)

Date	Time	Matrix
------	------	--------

Date	Time	Matrix	Sample Request ID
------	------	--------	-------------------

✓	00.11	61-30
---	-------	-------

✓	06.11	EP-3
---	-------	------

8

10

100

[illegible]

[illegible]

A blank coordinate plane with a horizontal x-axis and a vertical y-axis intersecting at the origin. The axes are represented by solid black lines. There are tick marks on both axes, but no numerical labels are provided. The grid extends approximately 4 units in each direction from the origin.

[illegible][illegible][illegible][illegible]

Date:	Time:	Relinquish:
-------	-------	-------------

Date:	Time:	Relinquished by:
		<i>[Signature]</i>

11

11

Date:	Time:	Relinquis
-------	-------	-----------

Date: 1/1/2016	Time: 1:00 PM	Relinquished by: [Signature]
----------------	---------------	------------------------------

2

三

possibility. Any sub-contracted data will be clearly notated on the analytical report.

All Anions	EPA Method 300.0	1-500ml unpreserved plastic 1-125 ml H ₂ SO ₄ plastic
Alkalinity	SM2320 B	Volume will come from the 500ml unpreserved plastic
eC	SM 2510B	Volume will come from the 500ml unpreserved plastic
TDS	SM 2540 C	Volume will come from the 500ml unpreserved plastic
Cations	EPA Method 200.7	1-500ml HNO ₃ Plastic
pH	EPA Method 9040	Volume will come from the 500ml unpreserved plastic

SM = Standard Methods

EPA Methods 310.1, 150.1, 160.1, 320.1 and 120.1 have been withdrawn by EPA. Most labs have
We are accredited for all of the tests listed above and we perform these methods regularly for f

We will ship out one bottle set today as listed below. Fill all bottles to the neck and keep the sa
We can rush this work on a 1-2 business day TAT.

1-500ml unpreserved plastic

1-125ml H₂SO₄ Plastic

1-500ml HNO₃ plastic

Appendix D

Well Logs

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express

Triple Combo

County:	San Juan			
Field:	Wildcat			
Location:	Sec 27, T29N, R11W			
Well:	WWD #2			
Company:	Western Refining, Southwest, Inc.			
Location:		Sec 27, T29N, R11W	Elev.:	K.B. 5550.00 ft
Permanent Datum:		SHL: 2028' FNL X 111' FEL		G.L. 5535.00 ft
Log Measured From:		Lat/Long: 36.6986/-107.97035		D.F. 5549.00 ft
Drilling Measured From:		Ground Level	Elev.:	5535.00 f
API Serial No.		Kelly Bushing	15.00 ft	above Perm.Datum
30-045-35747-0000		Kelly Bushing		
Section:		27	Township:	29N
			Range:	11W
Logging Date	05-Sep-2016			

Run Number	One		
Depth Driller	7525.00 ft		
Schlumberger Depth	7532.00 ft		
Bottom Log Interval	7532.00 ft		
Top Log Interval	3498.00 ft		
Casing Driller Size @ Depth	9.625 in @ 3500.00 ft		
Casing Schlumberger	3498 ft		
Bit Size	8.75 in		
Type Fluid In Hole	WBM		
Density	9.9 lbm/gal	55 s	
Fluid Loss	PH 9 cm3	8.6	
MUD	Source of Sample	Active Tank	
RM @ Meas Temp	1.13 ohm.m	@ 68 degF	
RMF @ Meas Temp	0.9 ohm.m	@ 68 degF	
RMC @ Meas Temp	1.4 ohm.m	@ 68 degF	
Source RMF	RMC	Pressed	
RM @ BHT	0.46 @ 177	0.37 @ 177	
Max Recorded Temperatures	177 degF		
Circulation Stopped	Time 06-Sep-2016	20:25:00	
Logger on Bottom	Time 07-Sep-2016	05:00:00	
Unit Number	Location: 9115	FtMorgan, CO	
Recorded By	Avery Becker		
Witnessed By	Larry Candelaria		

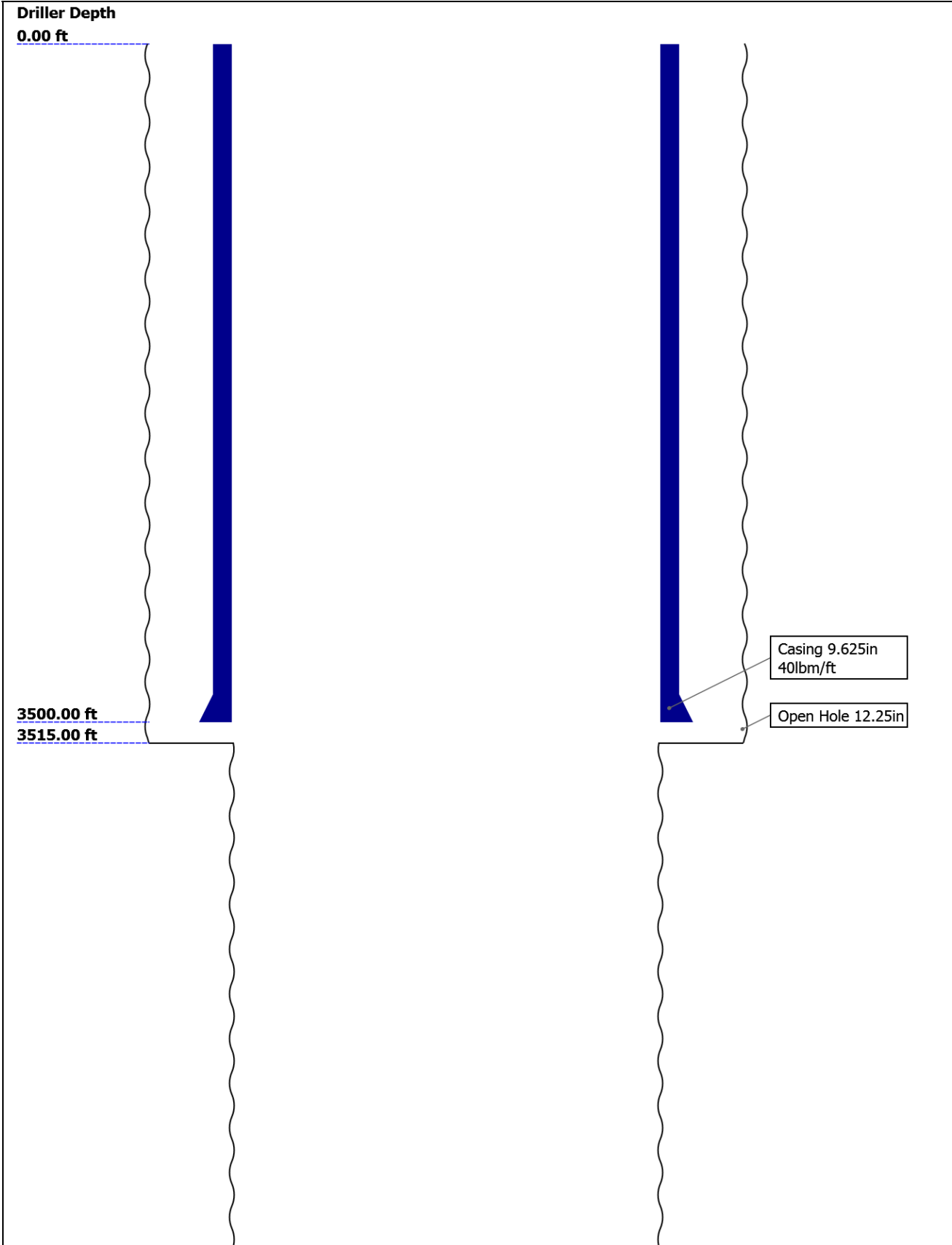
Disclaimer

THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA.

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- 2. Disclaimer
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- 6. Remarks and Equipment Summary
- 7. Depth Summary
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 - 8.1 Integration Summary
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 - 8.3 Log (TripleCombo-5)
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- 9. One 5" Triple Combo
 - 9.1 Composite Summary
 - 9.2 Log (TripleCombo-5 RA)
- 10. Calibration Report
- 11. Tail

Well Sketch



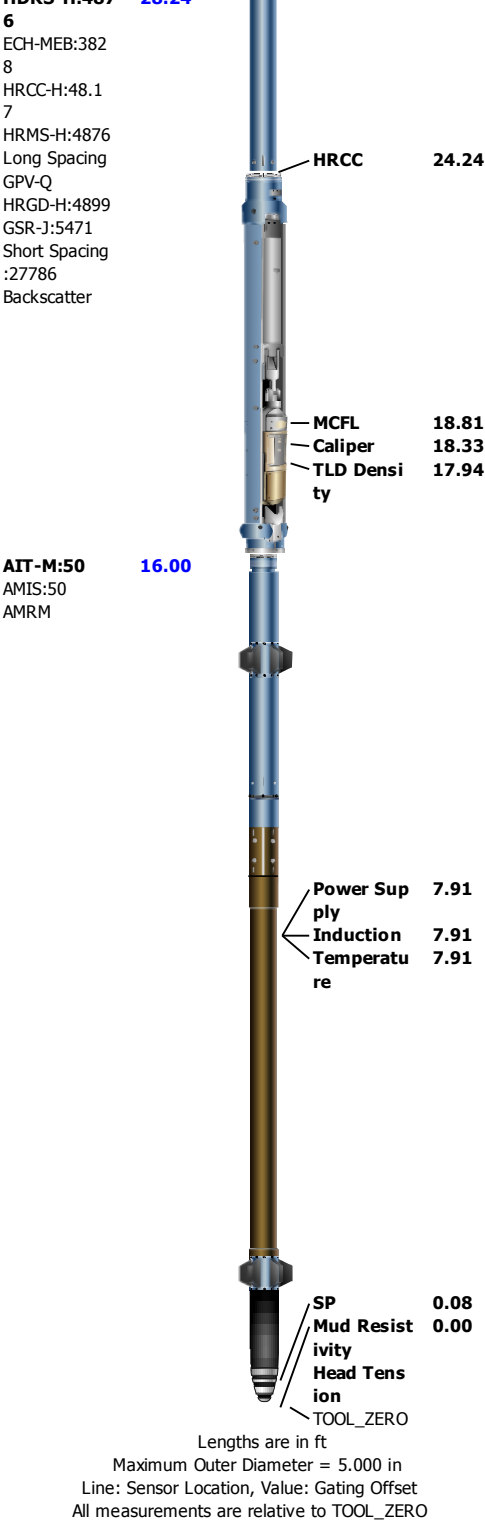


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	12.25	8.75				
Top Driller (ft)	0	3515				
Top Logger (ft)	0	3515				
Bottom Driller (ft)	3515	7525				
Bottom Logger (ft)	3515	7532				
Casing						
Size (in)	9.625					
Weight (lbm/ft)	40					
Inner Diameter (in)	8.835					
Grade	N/A					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	3500					
Bottom Logger (ft)	3498					

Remarks and Equipment Summary

One: Toolstring				One: Remarks	
Equip name LEH-QT LEH-QT	Length 43.57	MP name	Offset	Toolstring run as per tool sketch	
				Matrix: Sandstone (2.65 g/cc)	
				Log may be affected by 20% LCM in drilling mud	
				Caliper check in casing=8.87 in, within tolerance	
				Cement volume calculated using 7 in future casing diameter	
				Rig: Aztec 920	
DTC-H:8980 ECH-KC:1005 3 DTC-H:8980	40.65	CTEM HV	39.75 0.00	Crew: Derrick Hunter	
HGNS-H:481 7 HGNH:4865 NPV-N NSR-F:5068 HGNS-H:4817 HACCZ-H:699 1 HMCA-H	37.65	TelStatus ToolStatus Temperature GR	37.65 37.65 37.62 36.91	Thank you for choosing Schlumberger	
HDPS-H:487	28.24	CNL Porosity HMCA HGNS Accelerometer	30.57 28.24 28.24 0.00		



Depth Summary

	One		
Depth Measuring Device			
Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		
Tension Device			
Type	CMTD-B/A		

Serial Number	147	
Calibration Date	18-Aug-2016	
Calibrator Serial Number	78805A	
Number of Calibration Points	10	
Calibration Root Mean Square Error	7	
Calibration Peak Error	10	

Logging Cable

Type	7-46A-XS		
Serial Number	U715043		
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Land		

One:Depth Control Parameters

Depth Control Remarks

Log Sequence	First Log In the Well	First run in well depth control procedures followed
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary
Rig Up Length At Bottom		
Rig Up Length Correction		
Stretch Correction		
Tool Zero Check At Surface		

One

5" Triple Combo

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

One: Log[4]:Up:S012

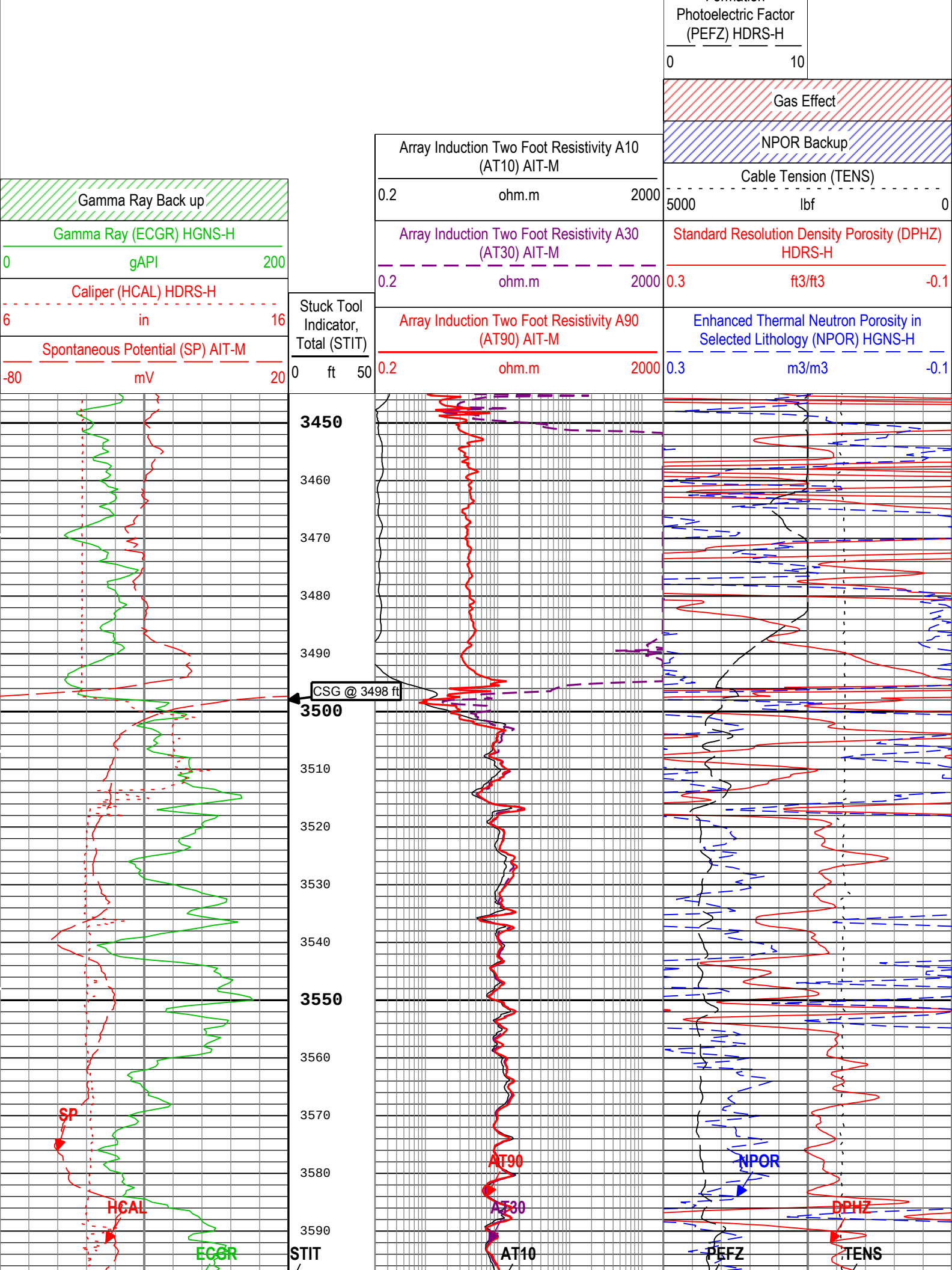
Description: HGNS standard resolution porosities for Platform Express	Format: Log (TripleCombo-5)	Index Scale: 5 in per 100 ft	Index Unit: ft	Index
---	-------------------------------	------------------------------	----------------	-------

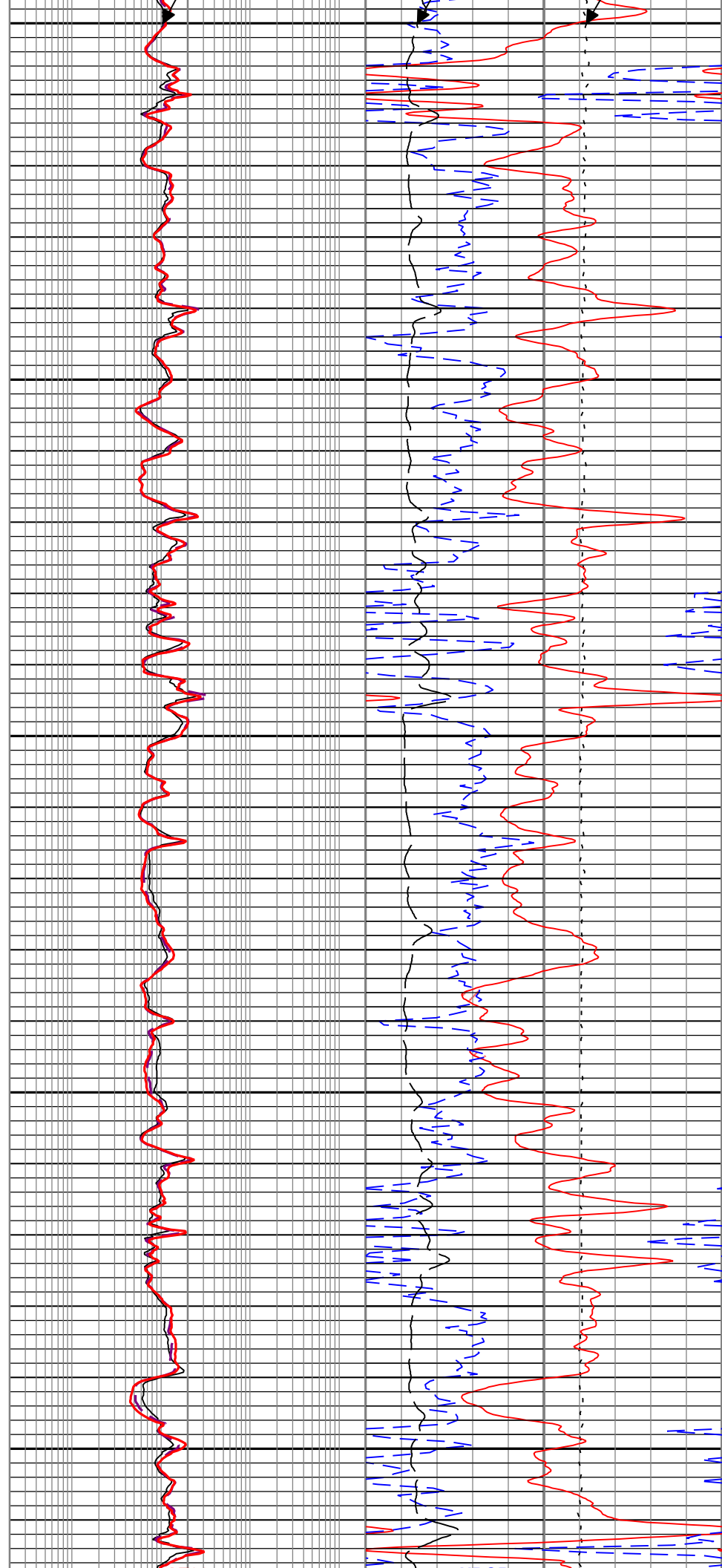
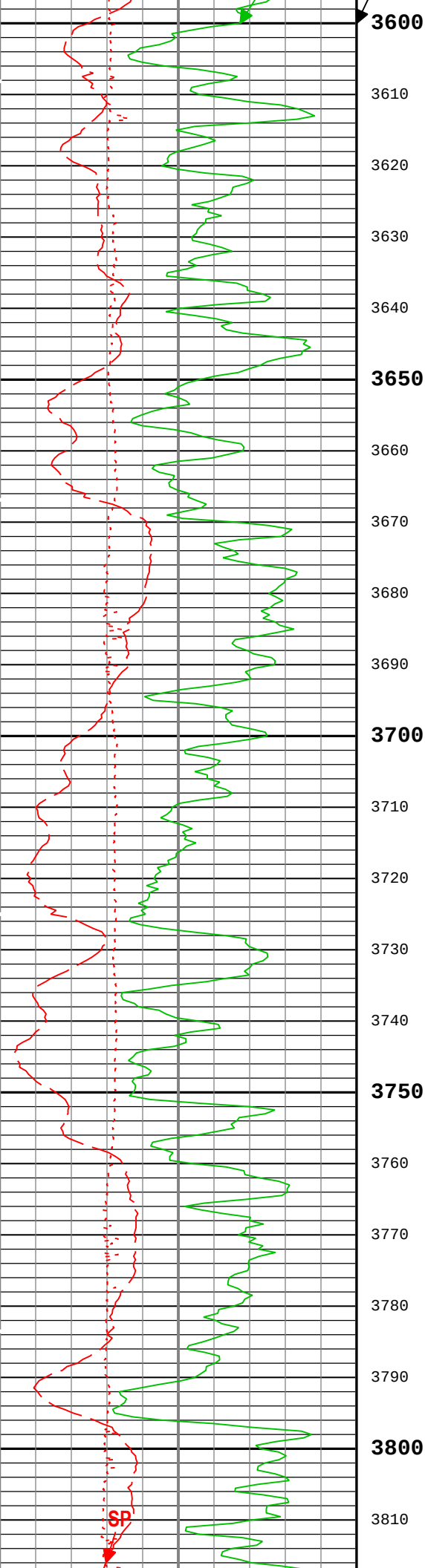
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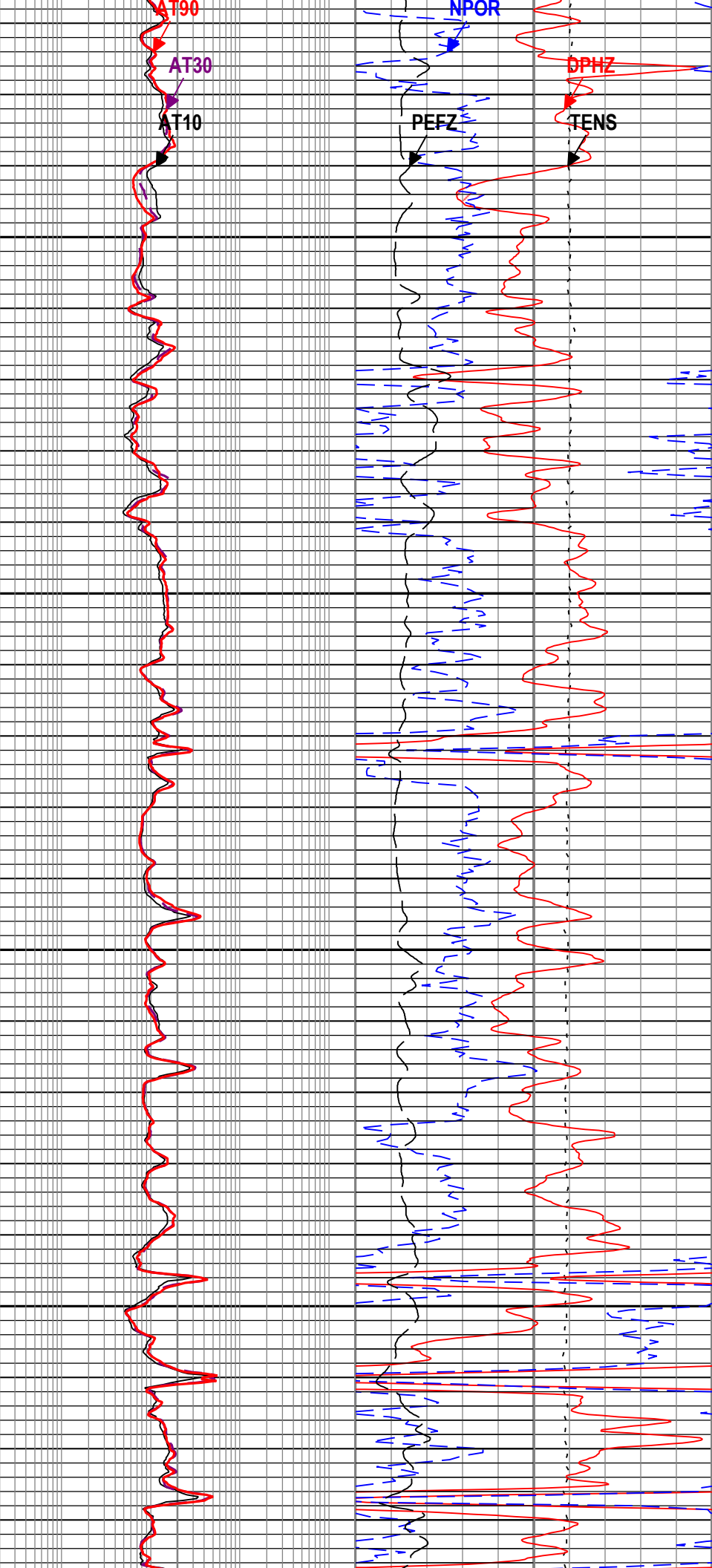
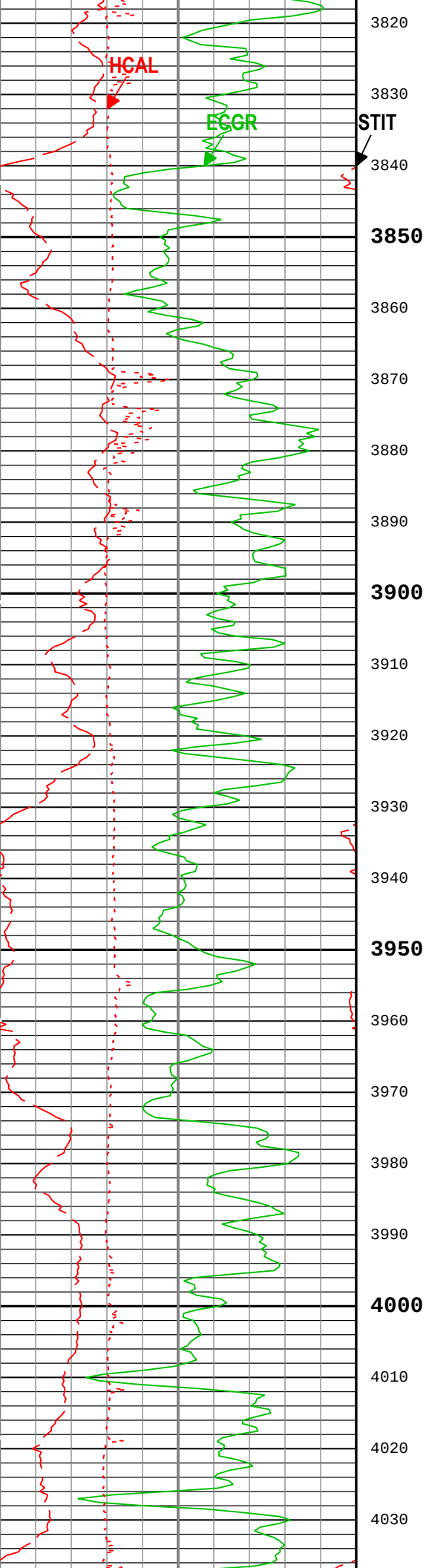
Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT30	AIT-M:AMIS:AMIS	3in
AT90	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
DPHZ	HDRS-H:HRMS-H:HRGD-H	2in
GR	HGNS-H:HGNS-H:HGNS-H	6in
NPOR	HGNS-H:HGNS-H:HGNS-H	6in
PEFZ	HDRS-H:HRMS-H:HRGD-H	2in
SP	AIT-M:AMIS:AMIS	6in
STIT	DepthCorrection	6in
TENS	WLWorkflow	6in
TIME_1900	WLWorkflow	0.1in

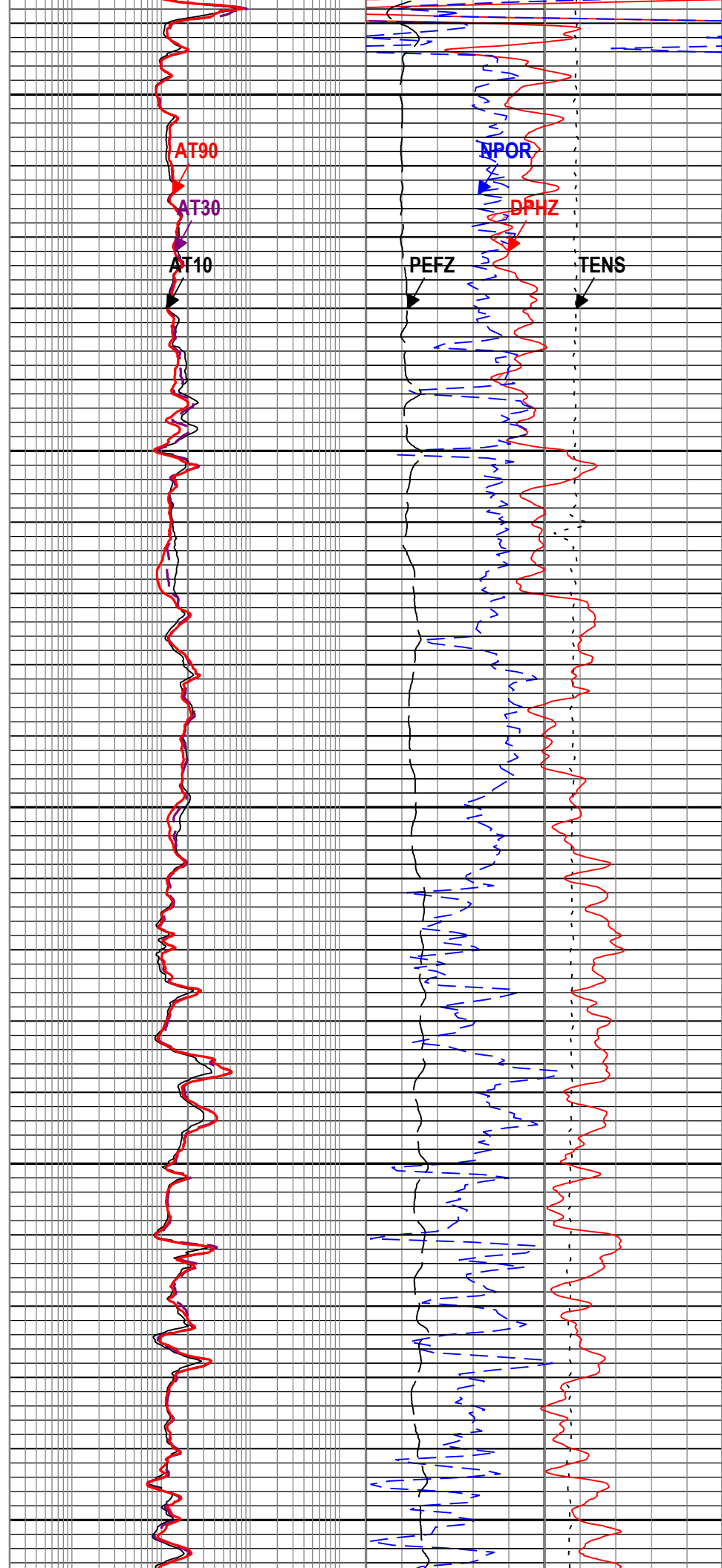
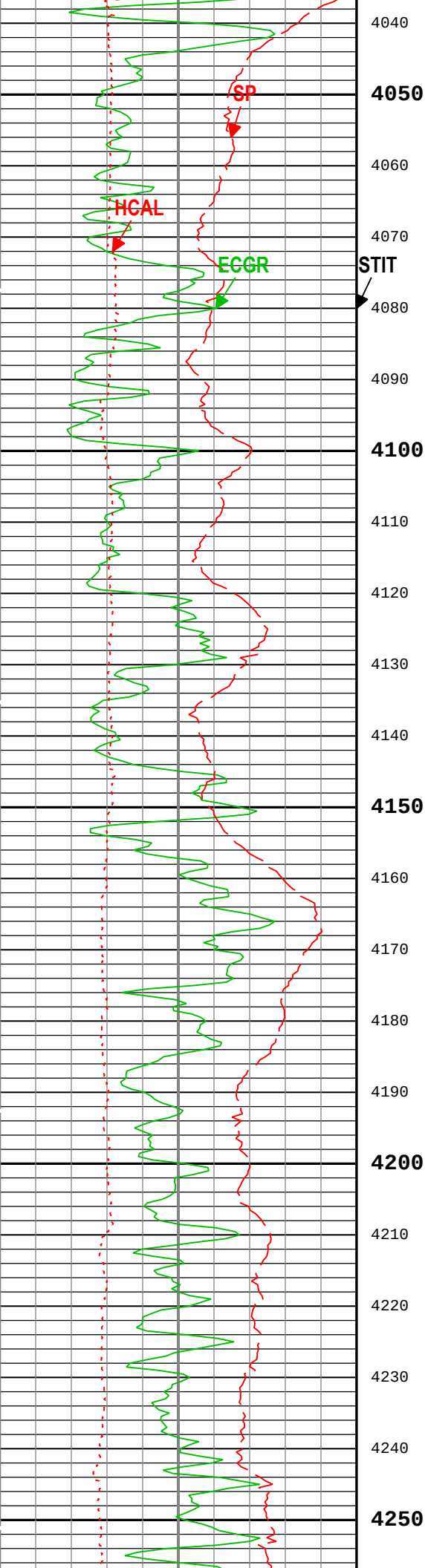
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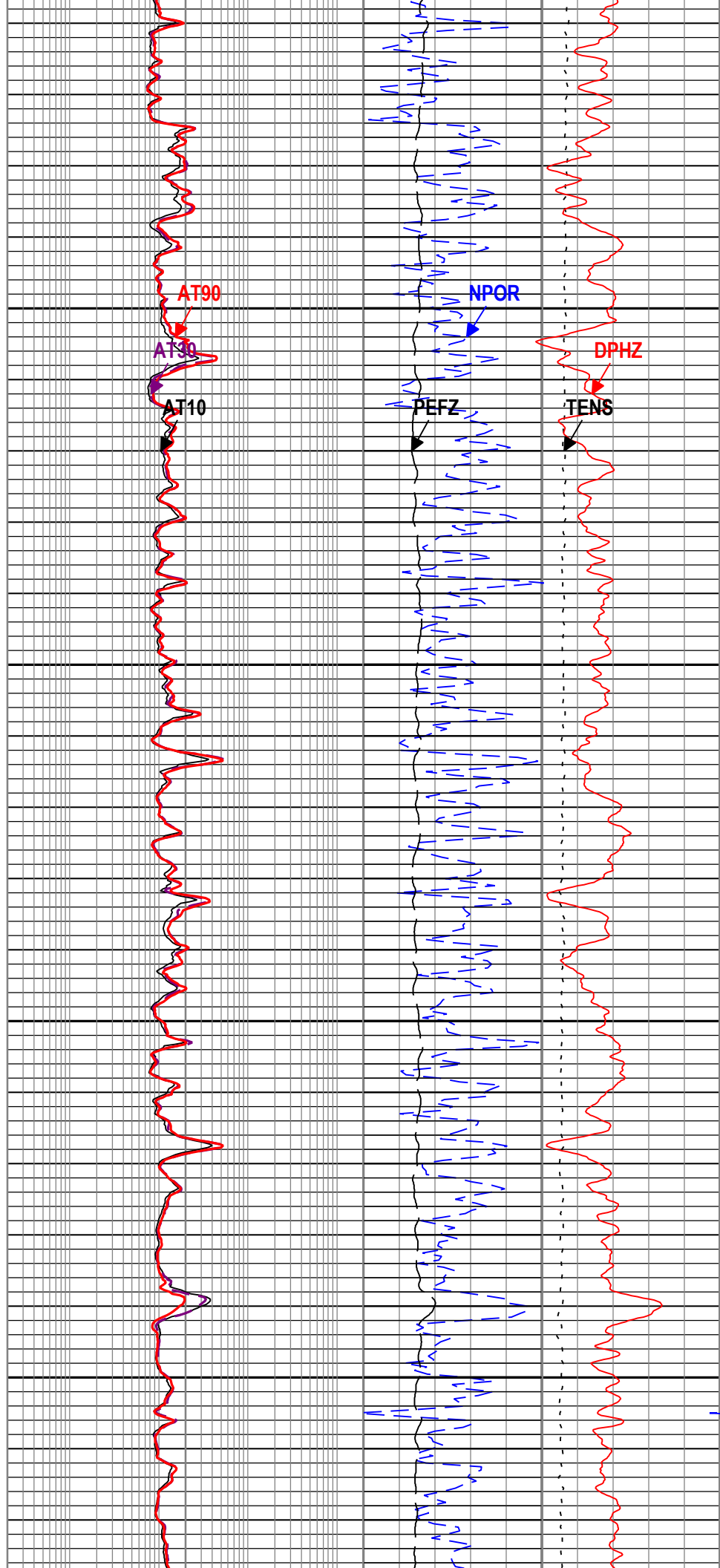
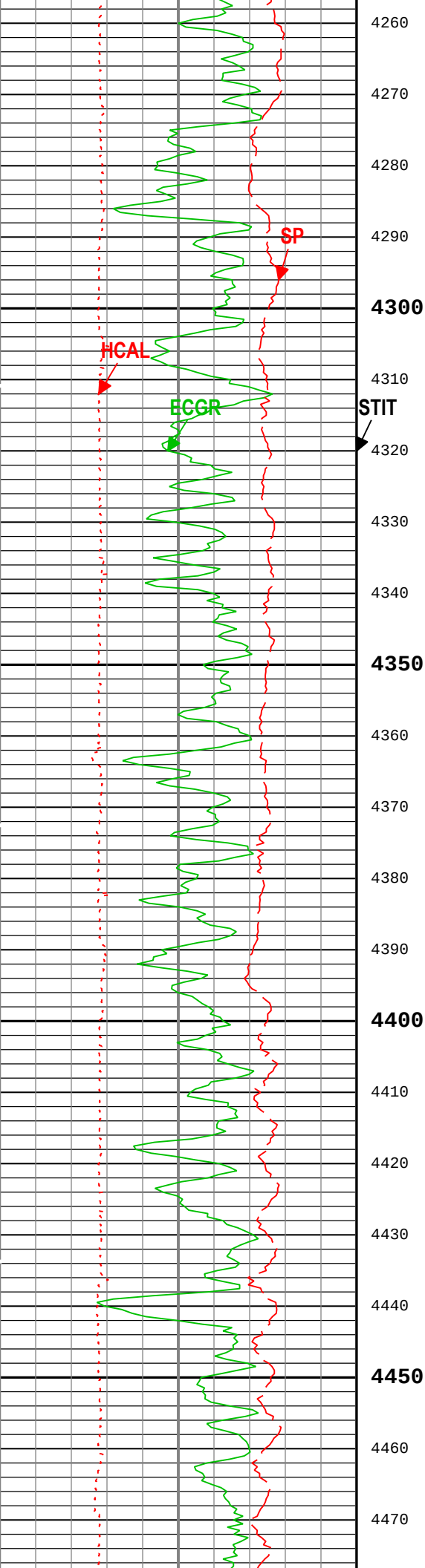
Standard Resolution Formation

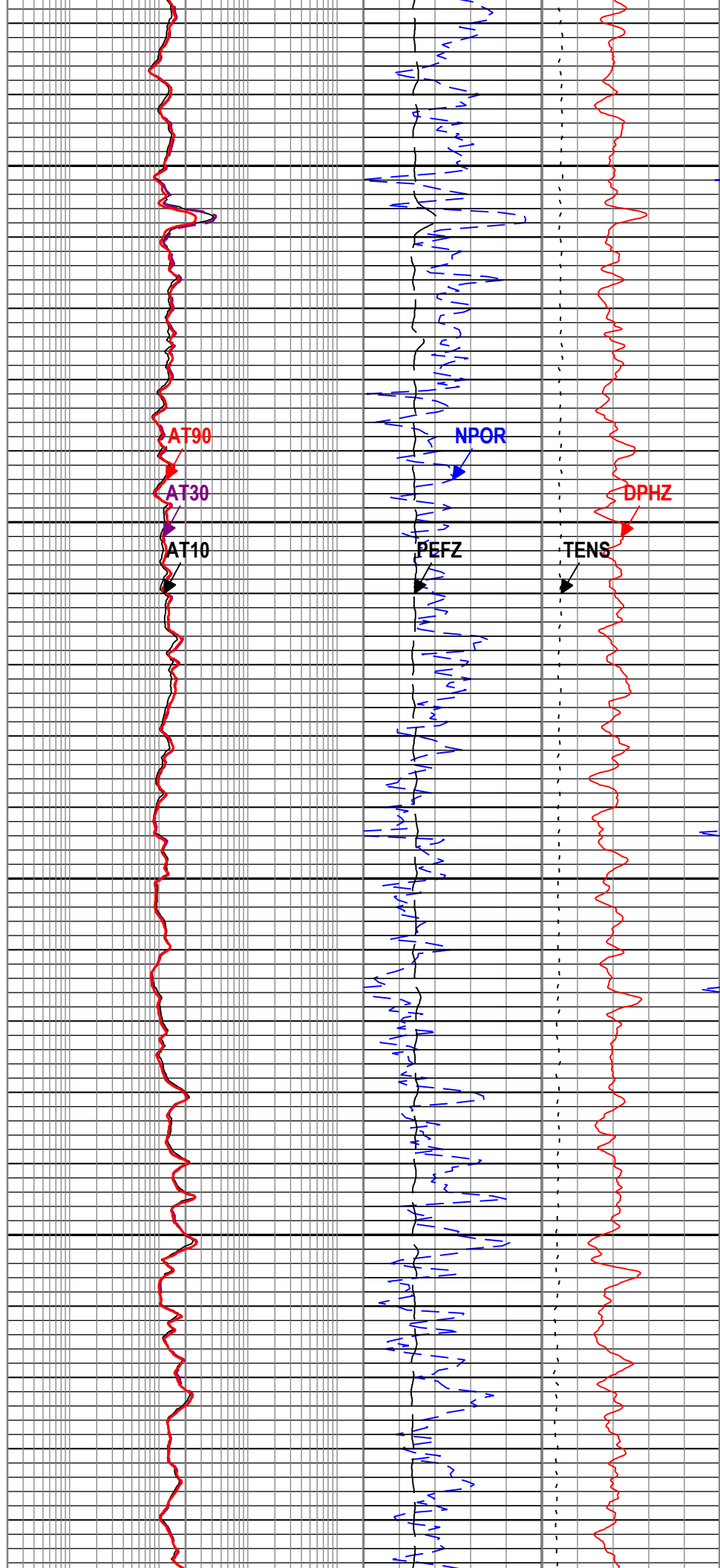
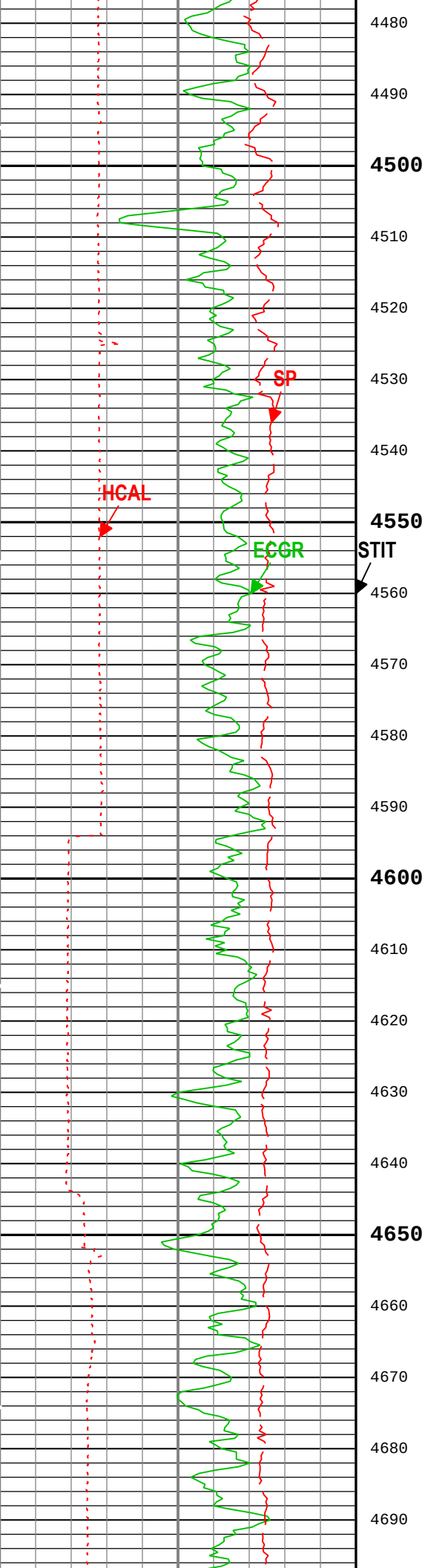


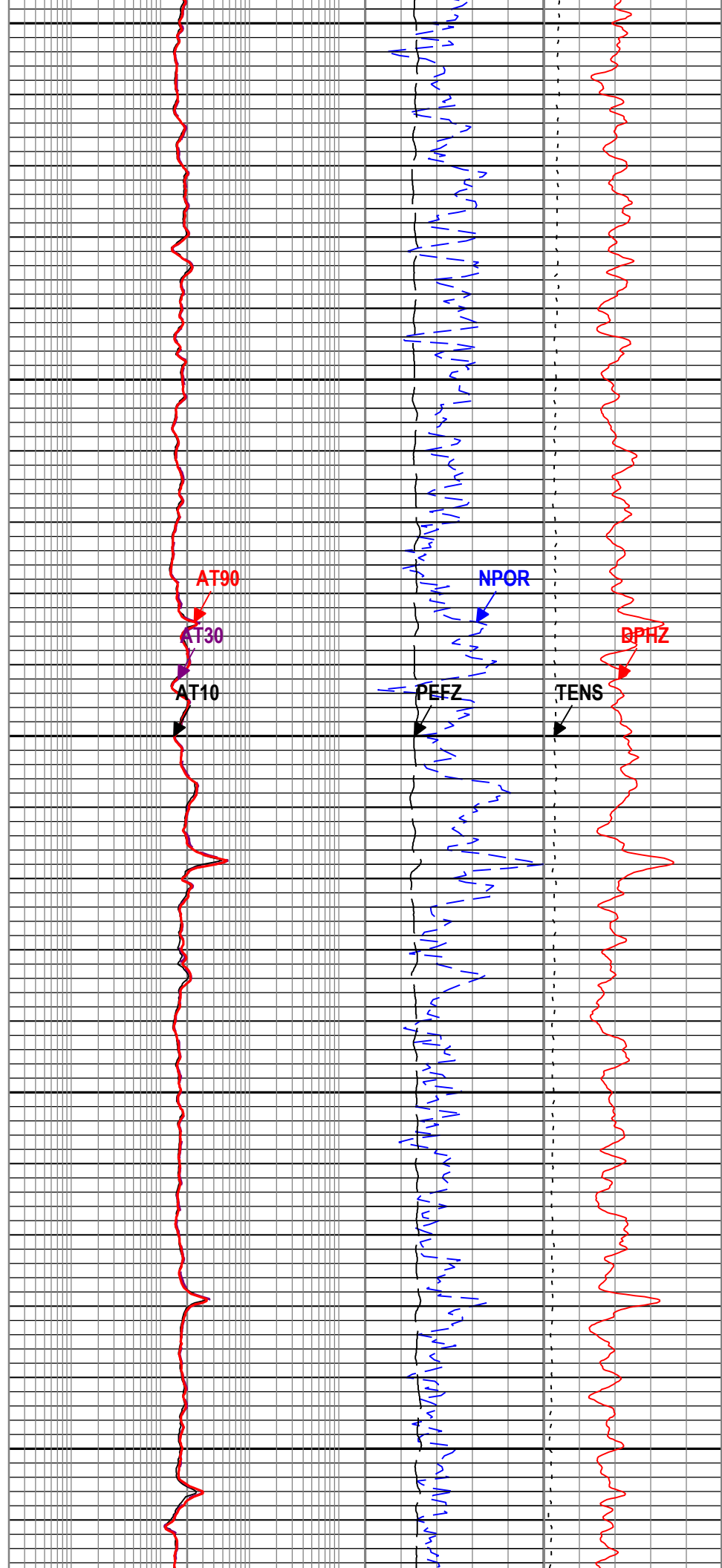
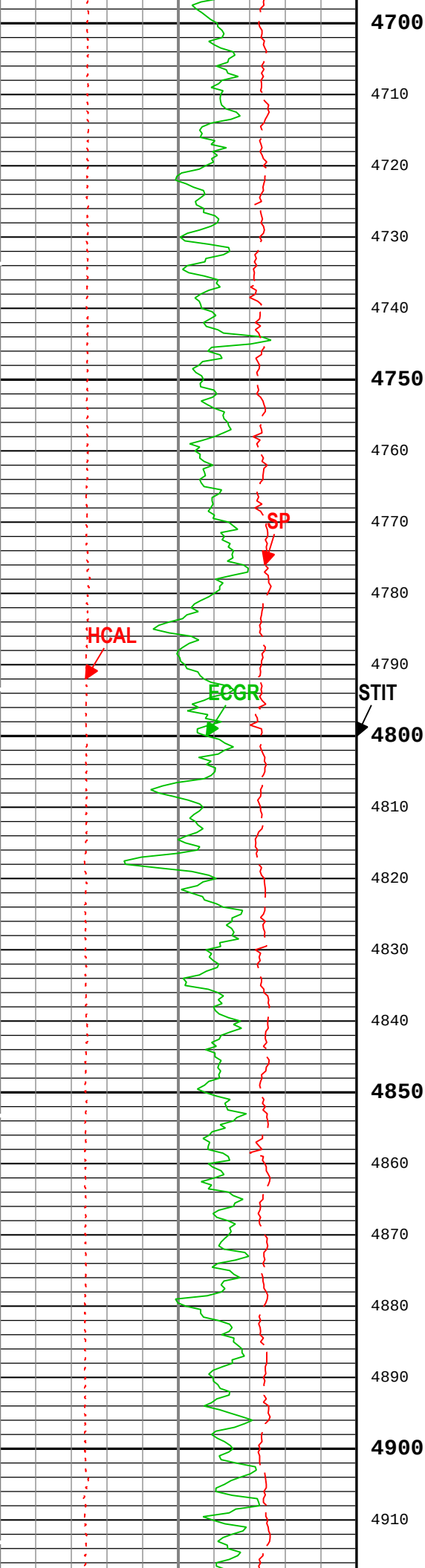


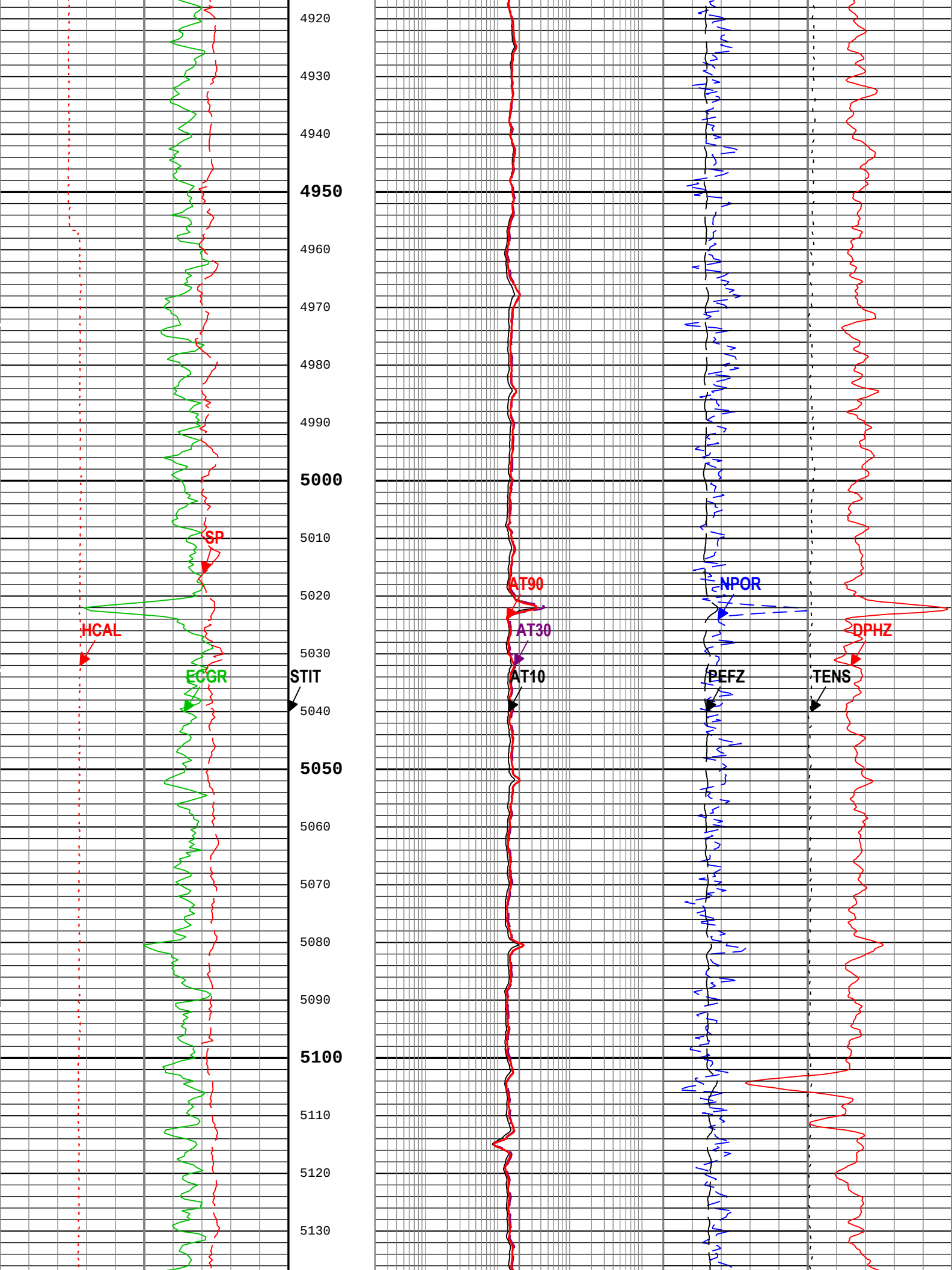


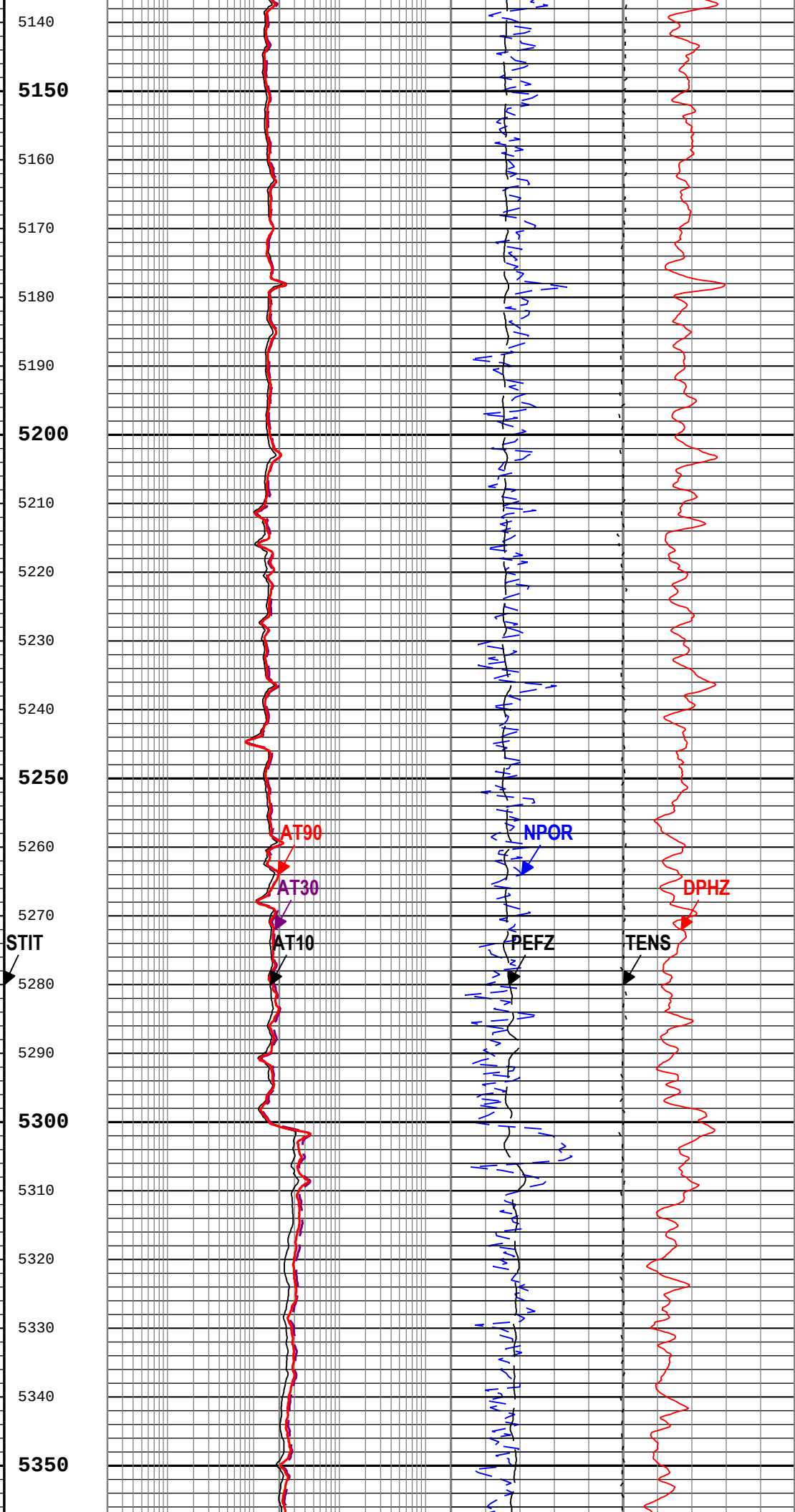
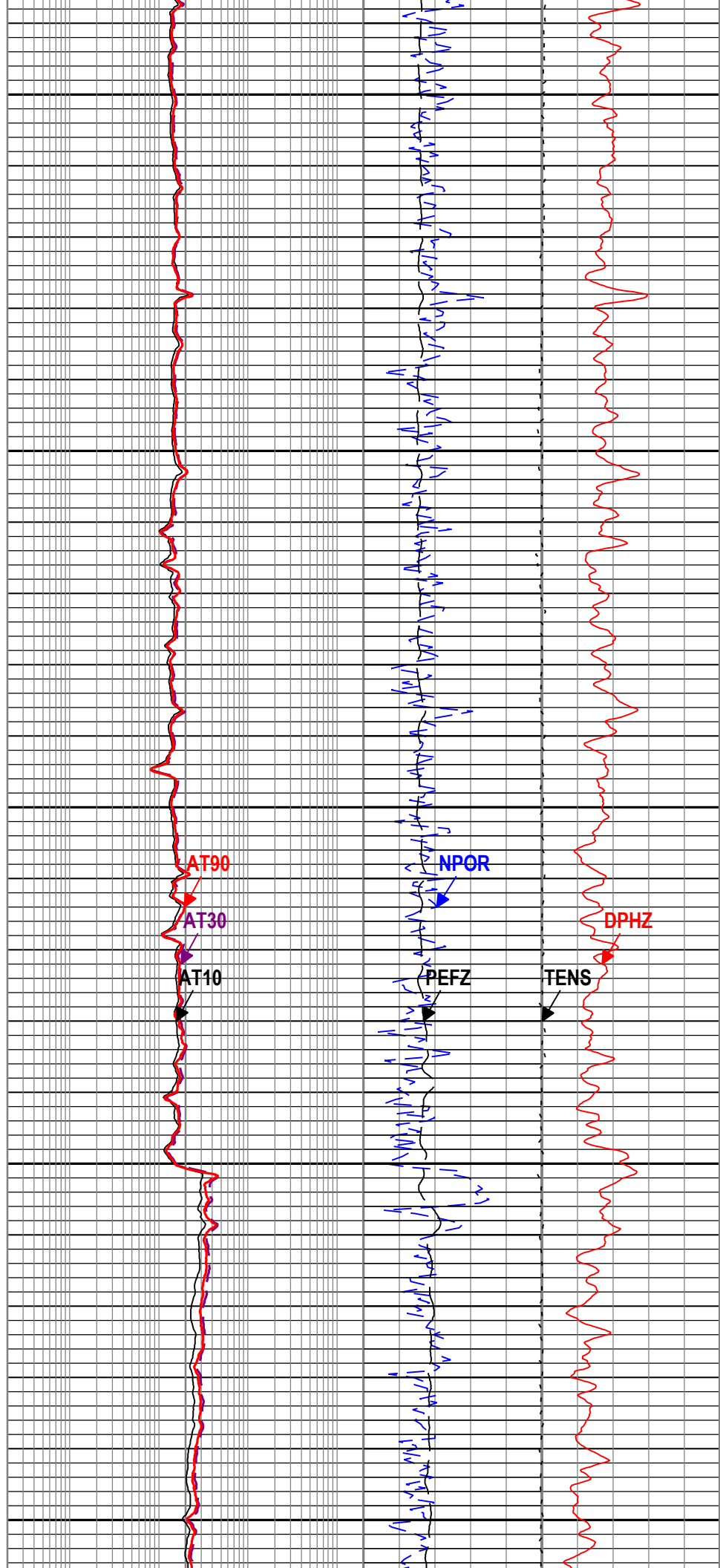
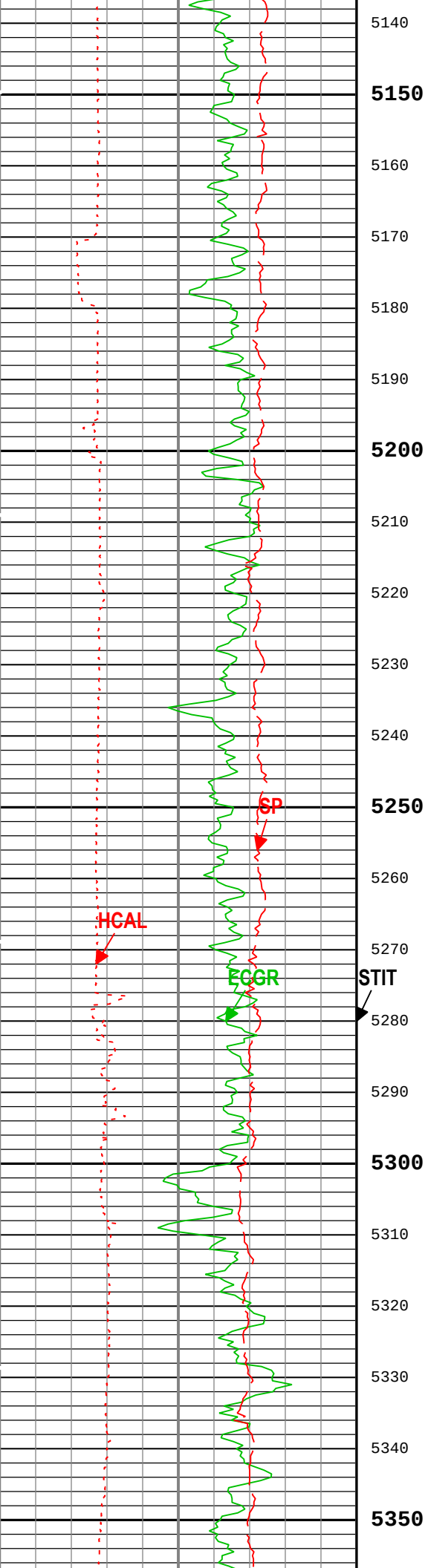


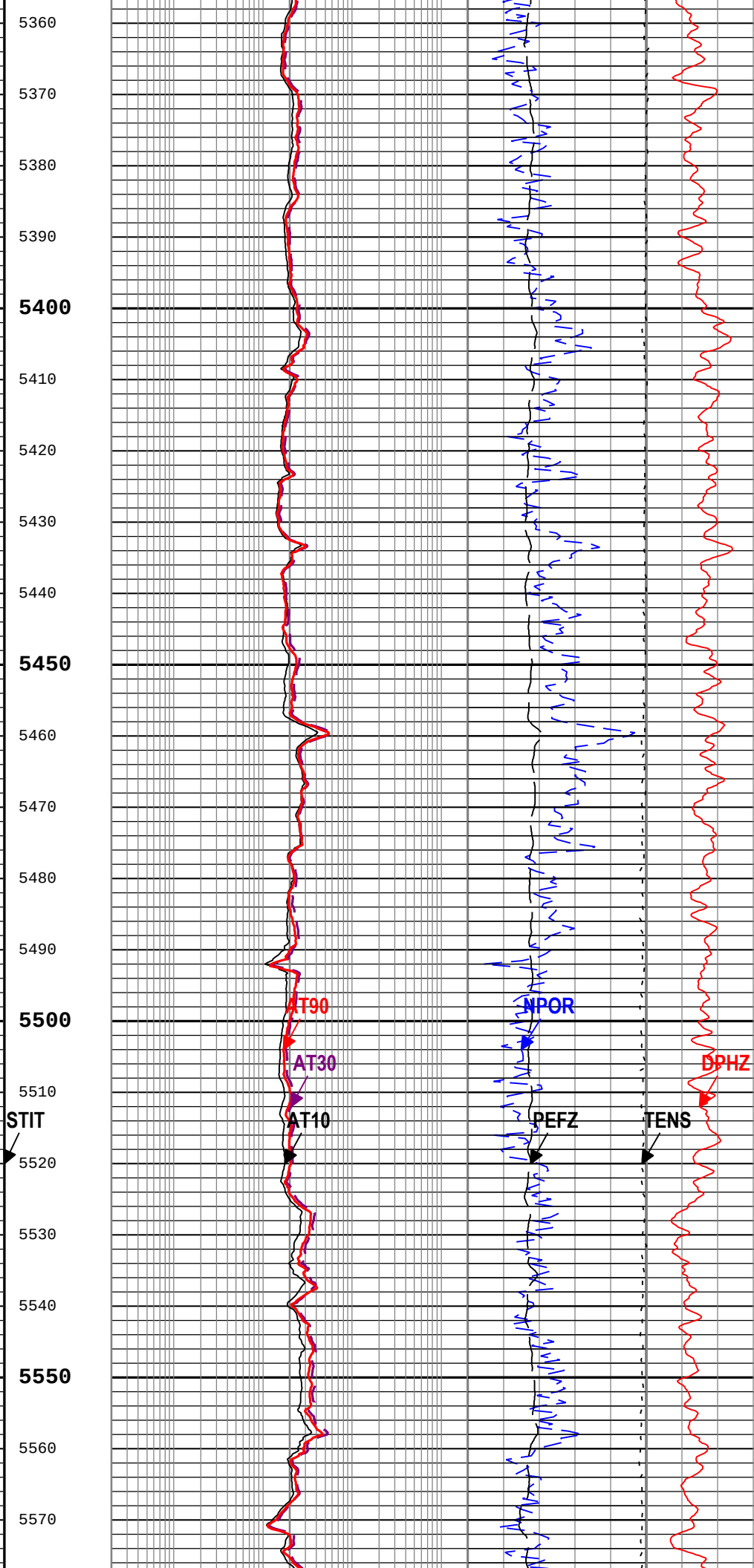
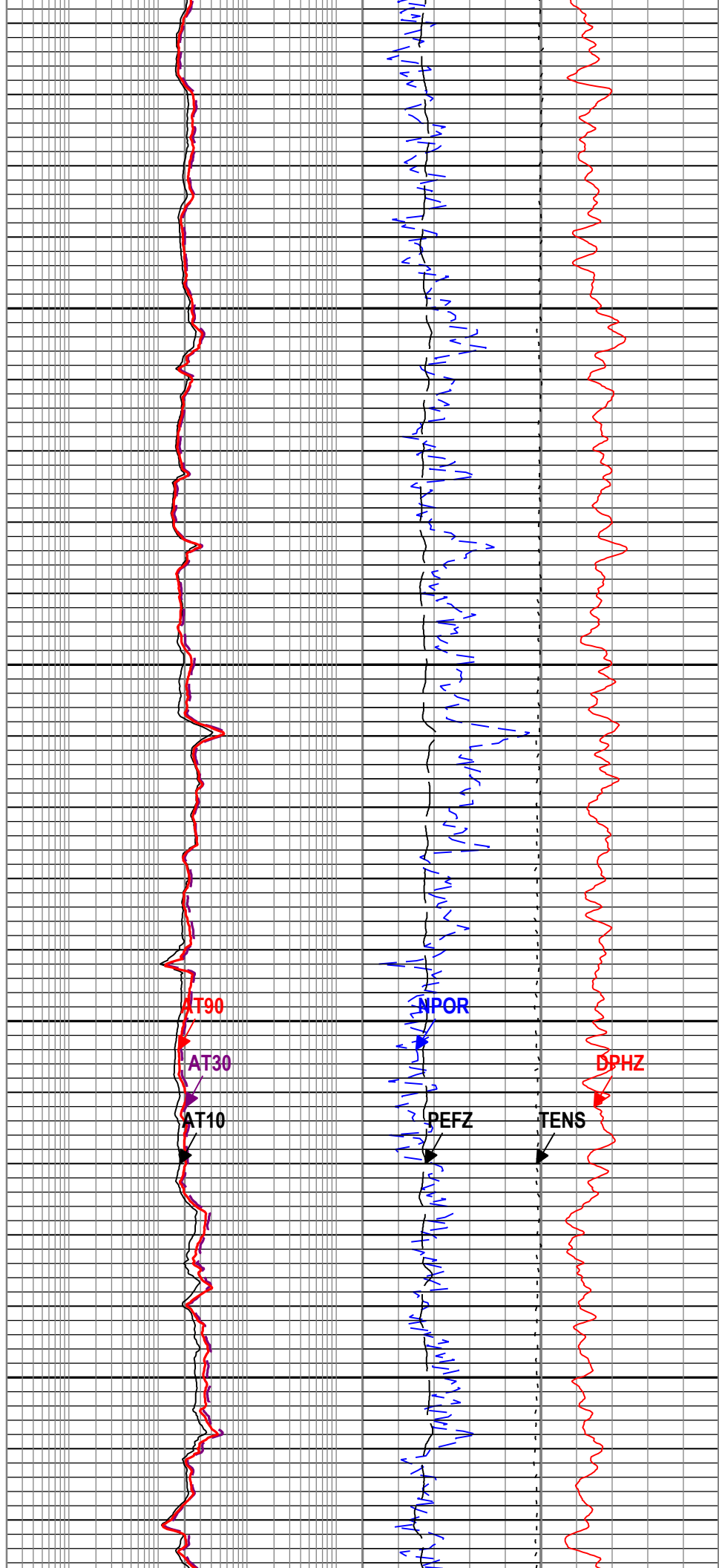
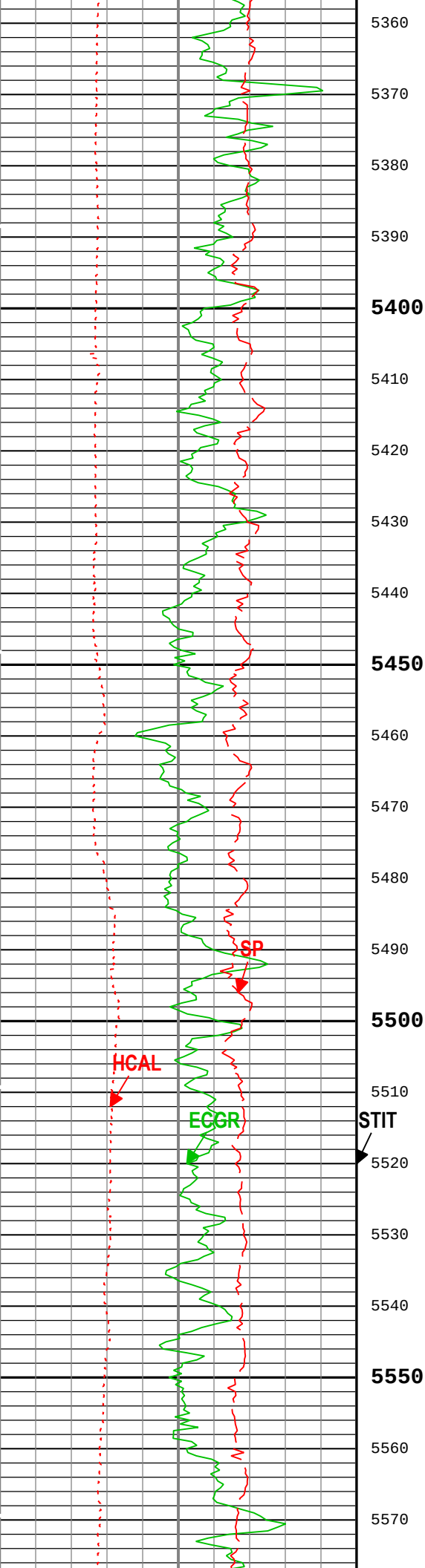


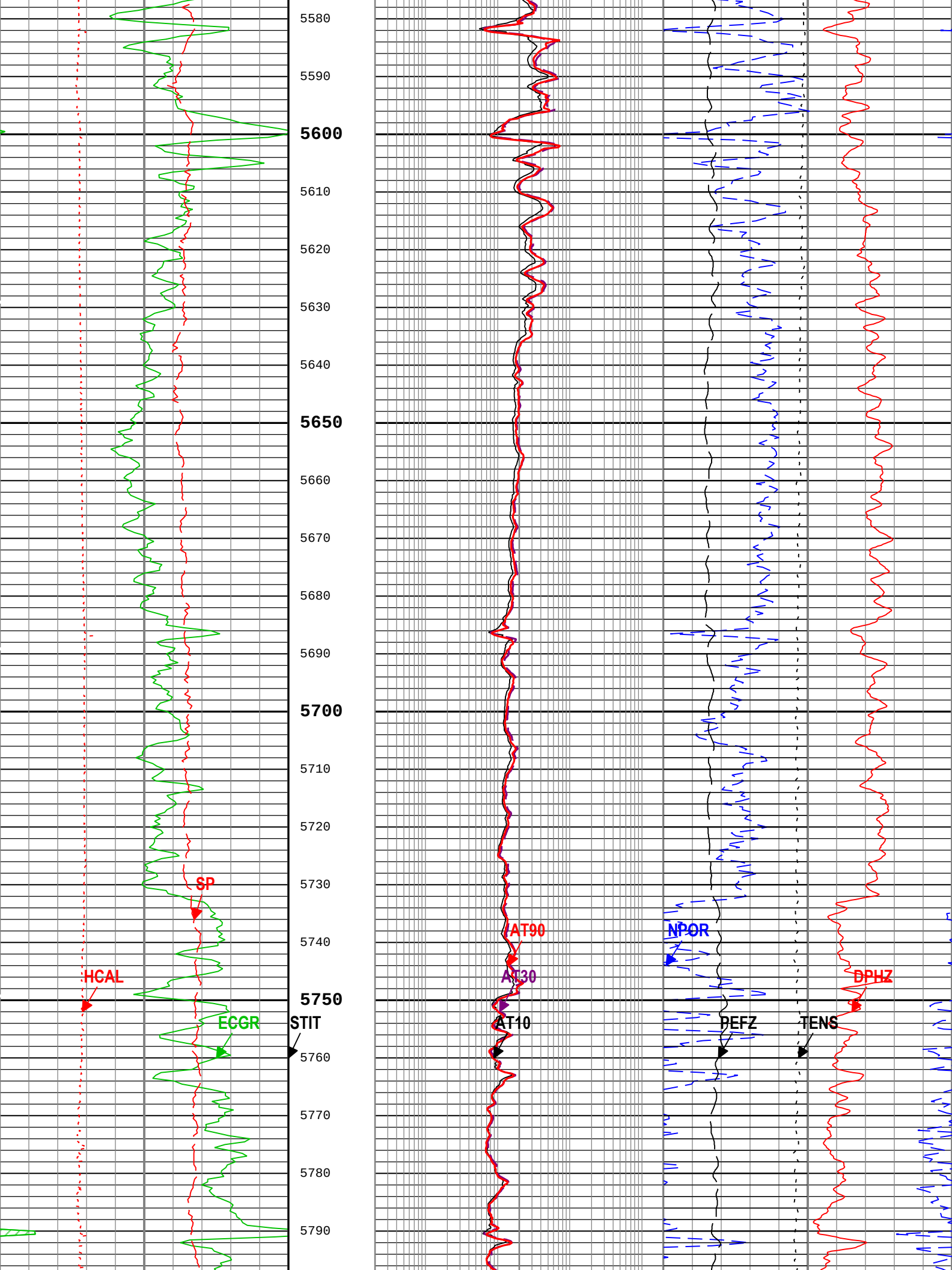


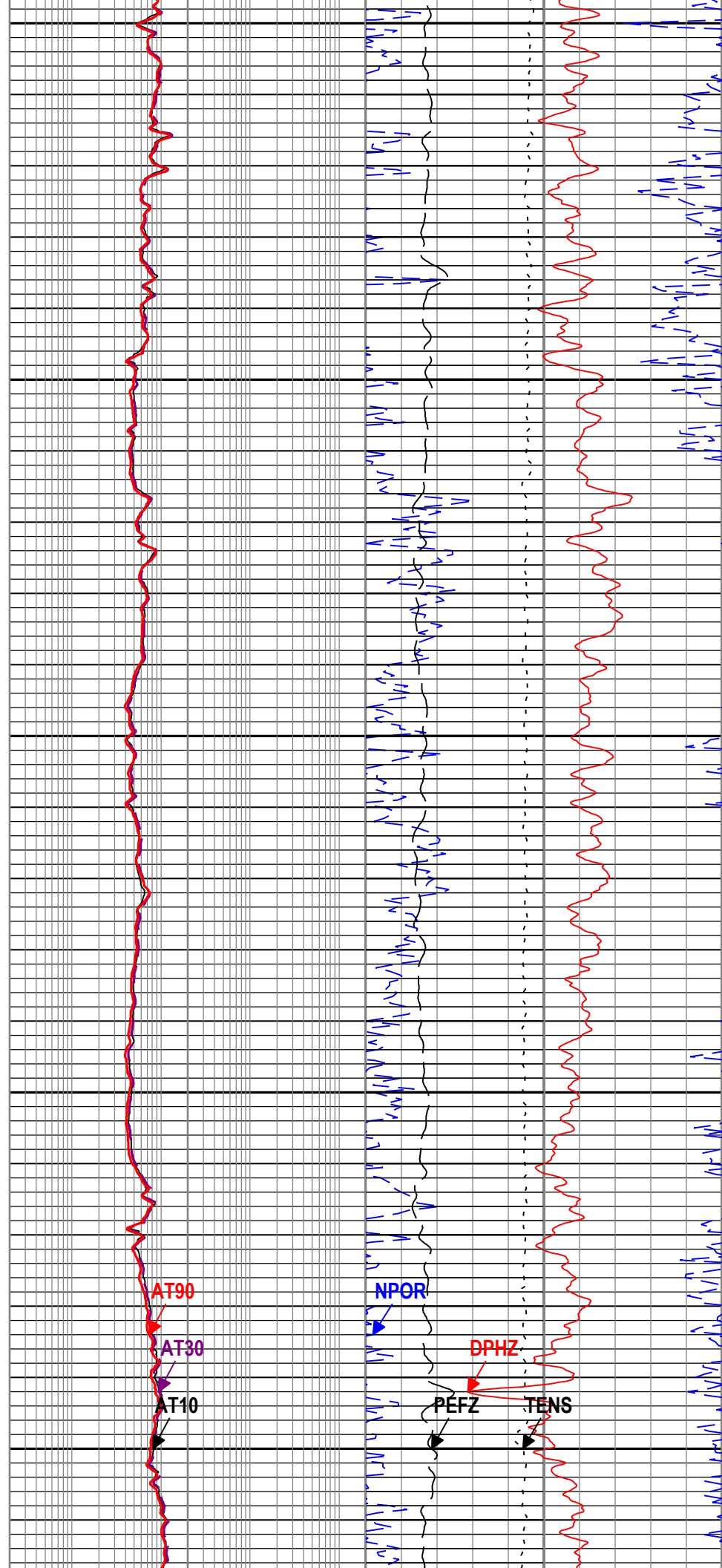
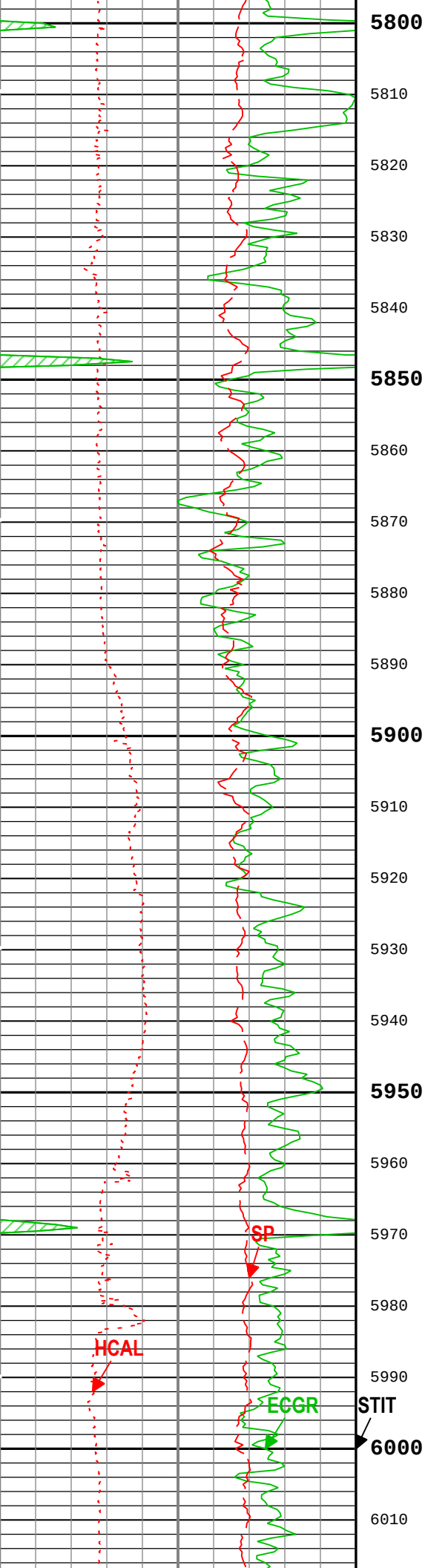


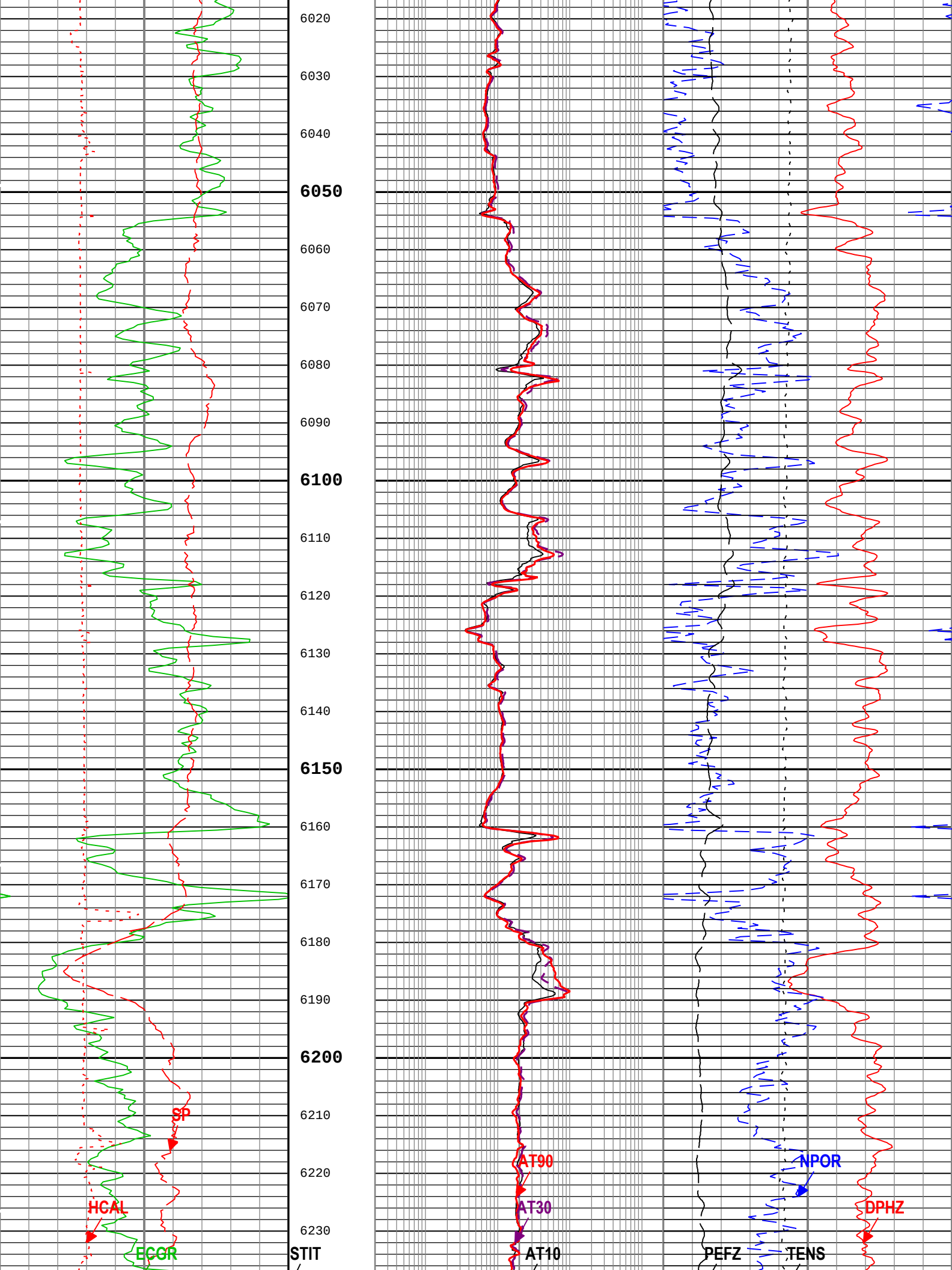


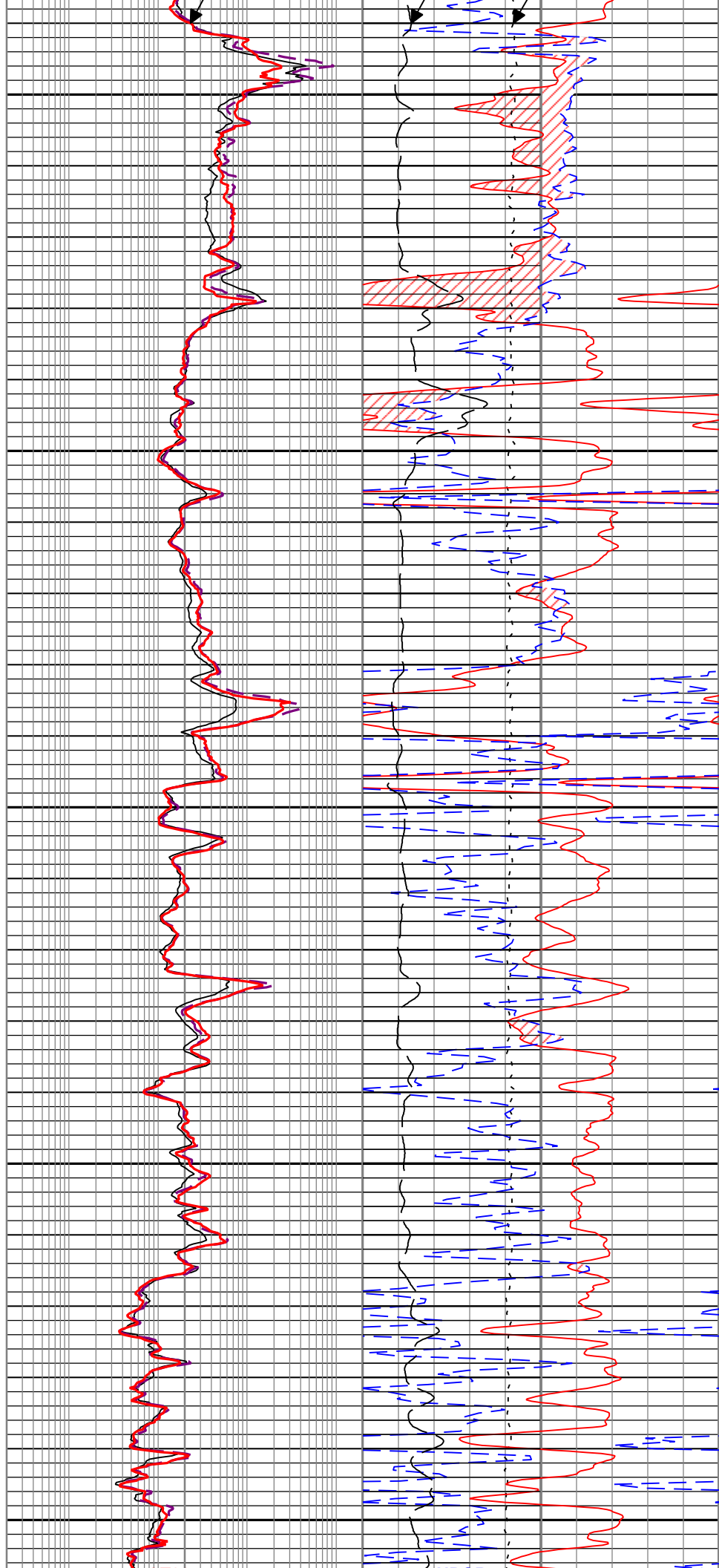
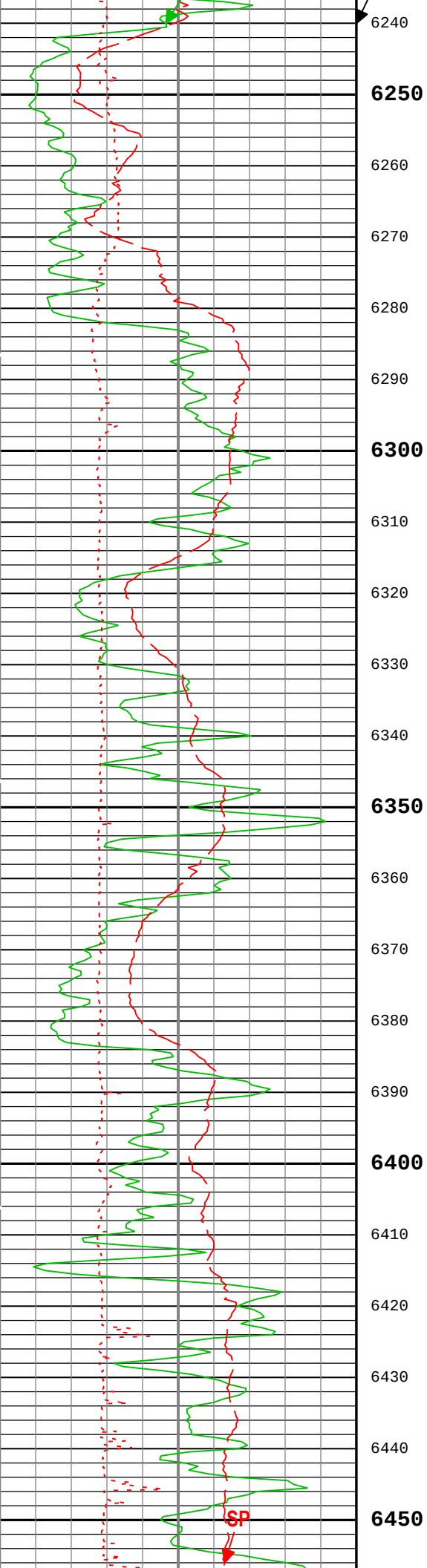


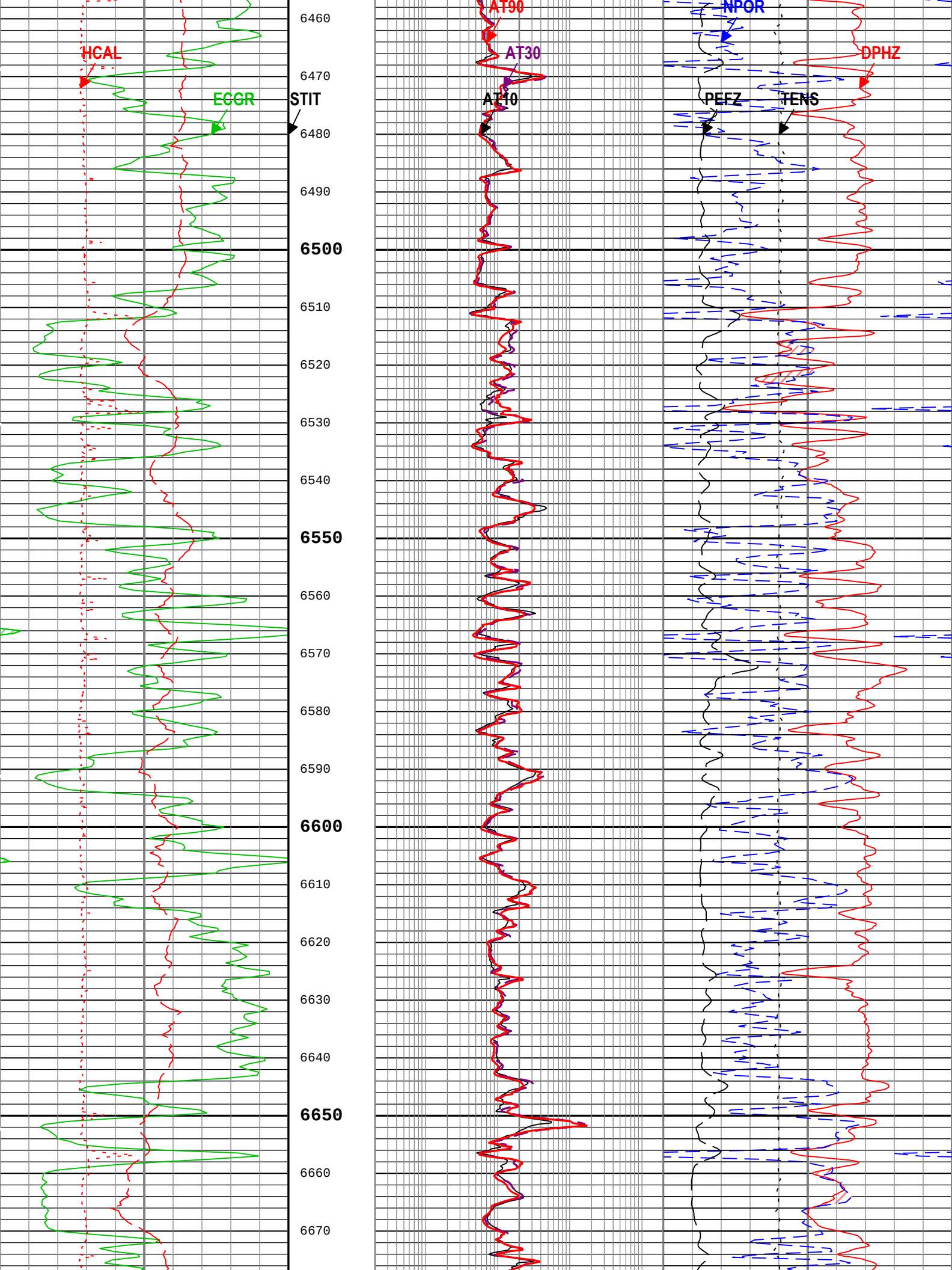


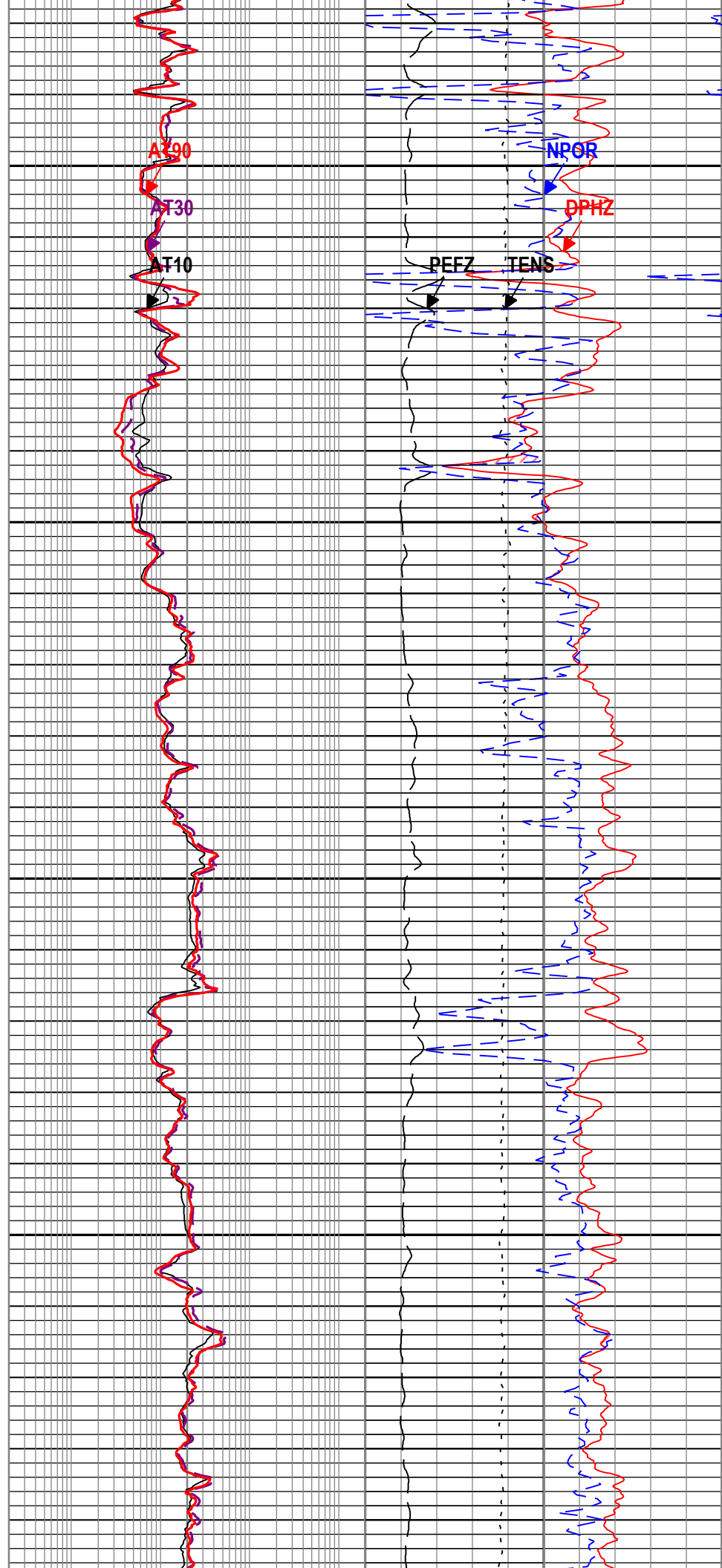
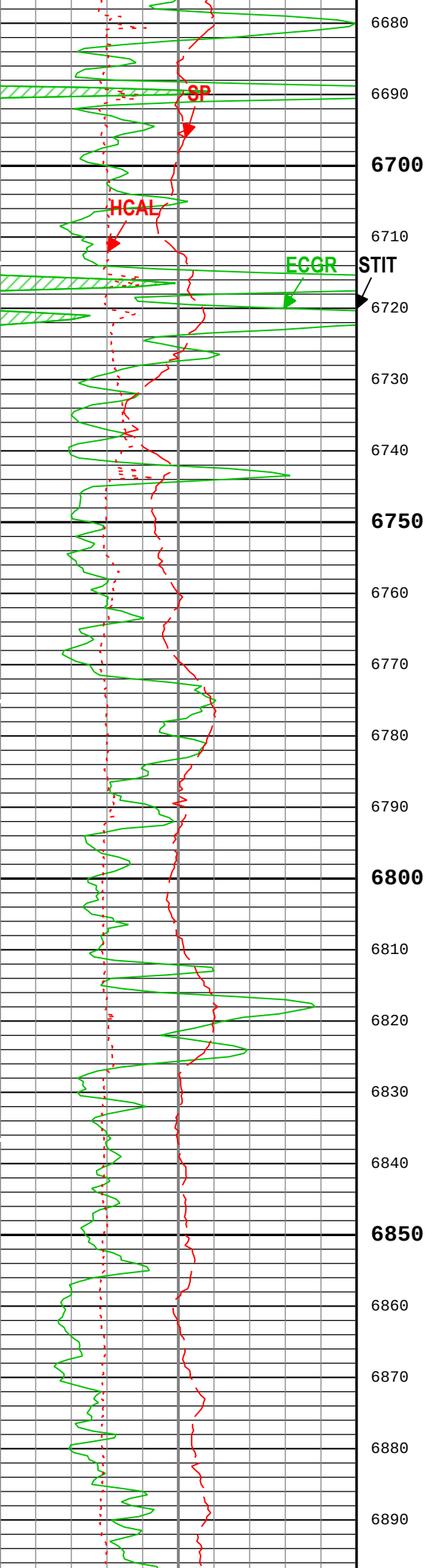


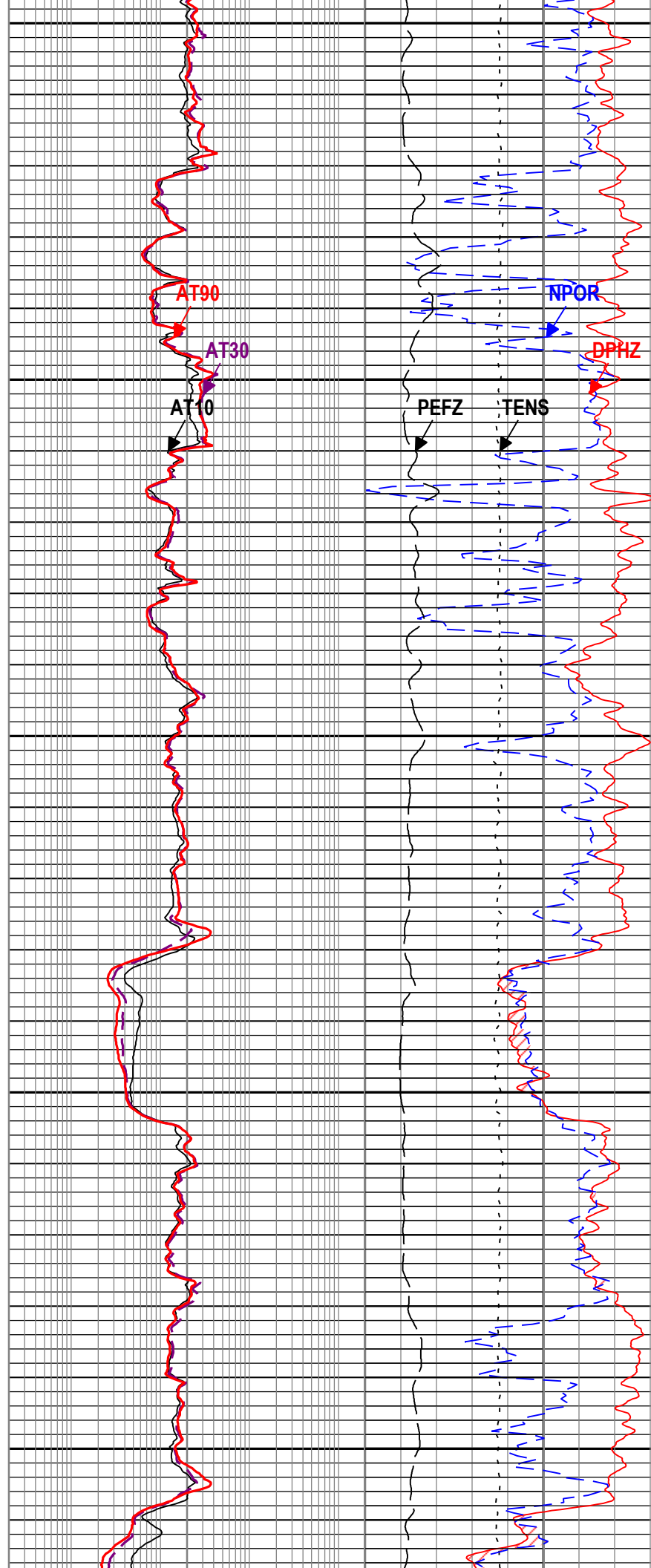
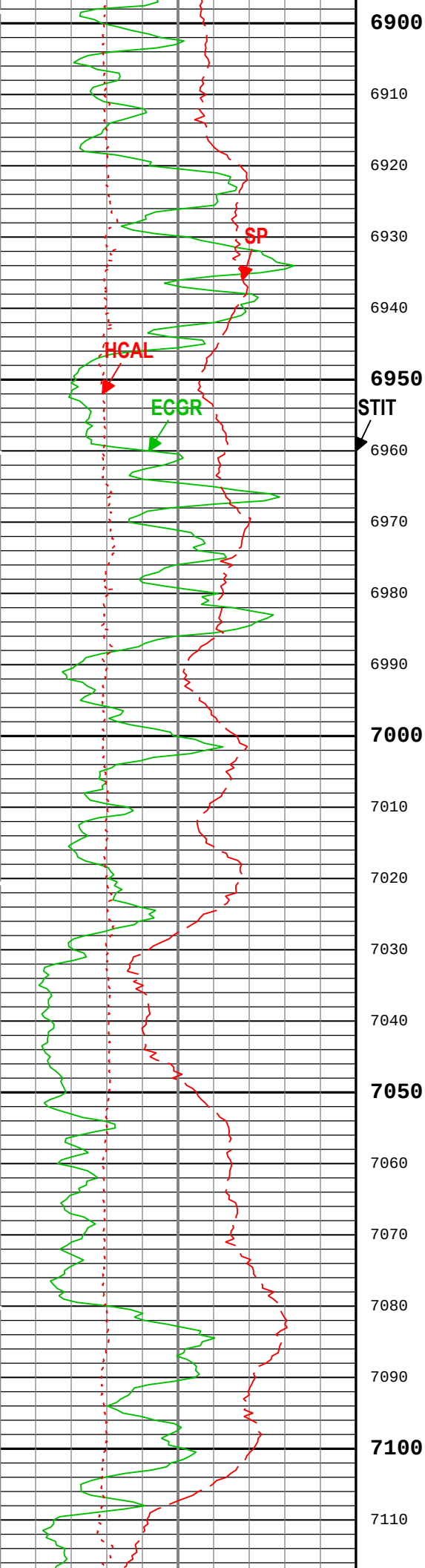


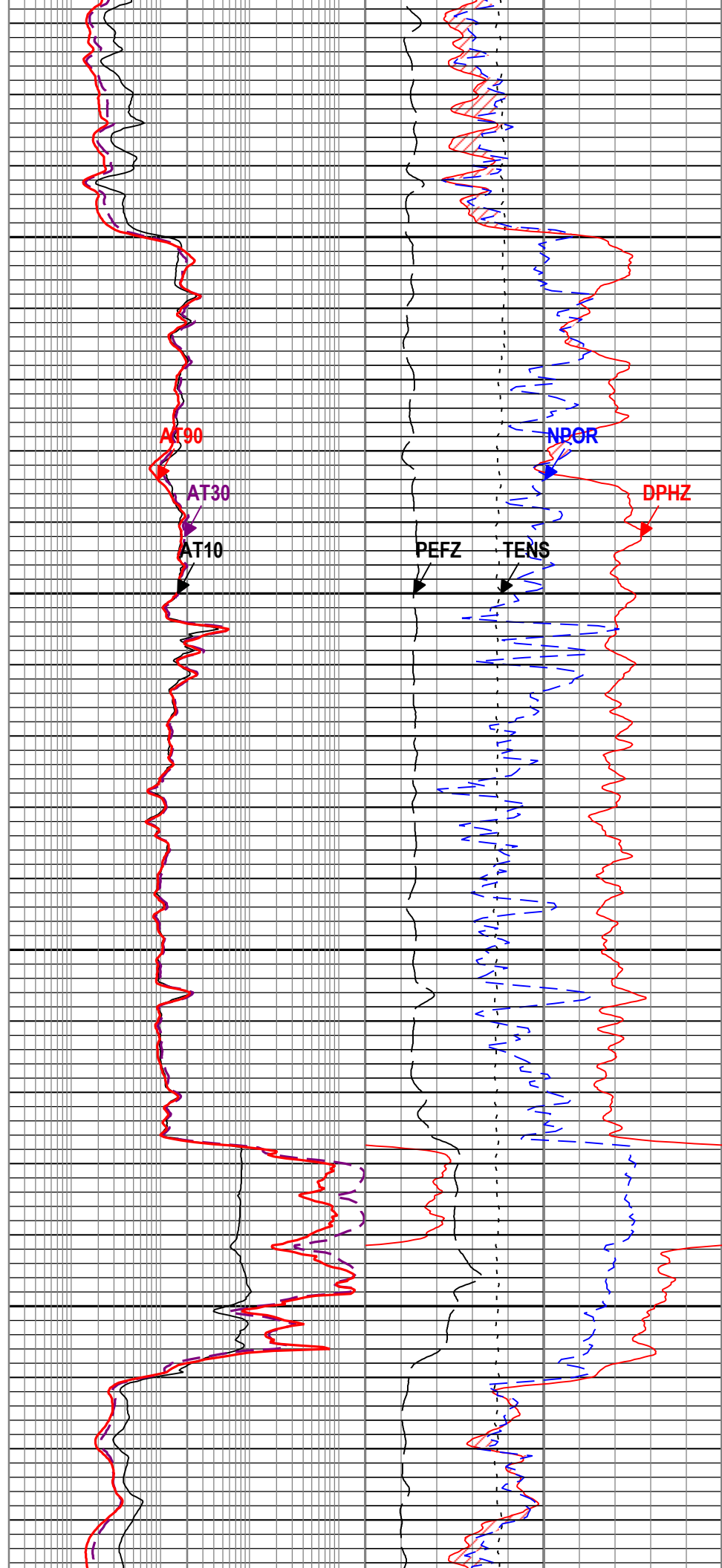
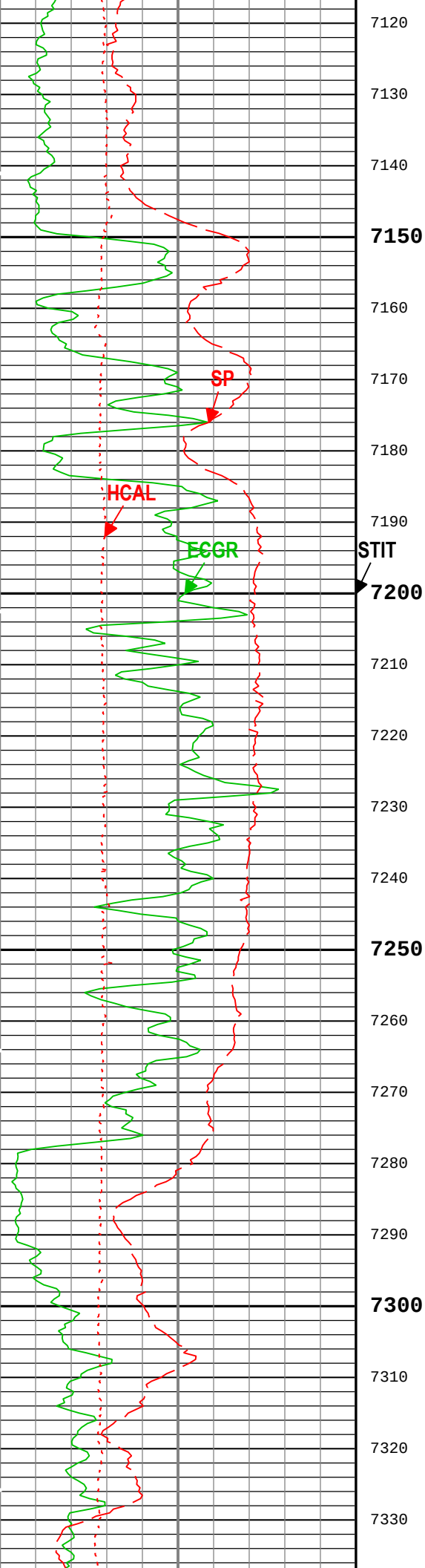


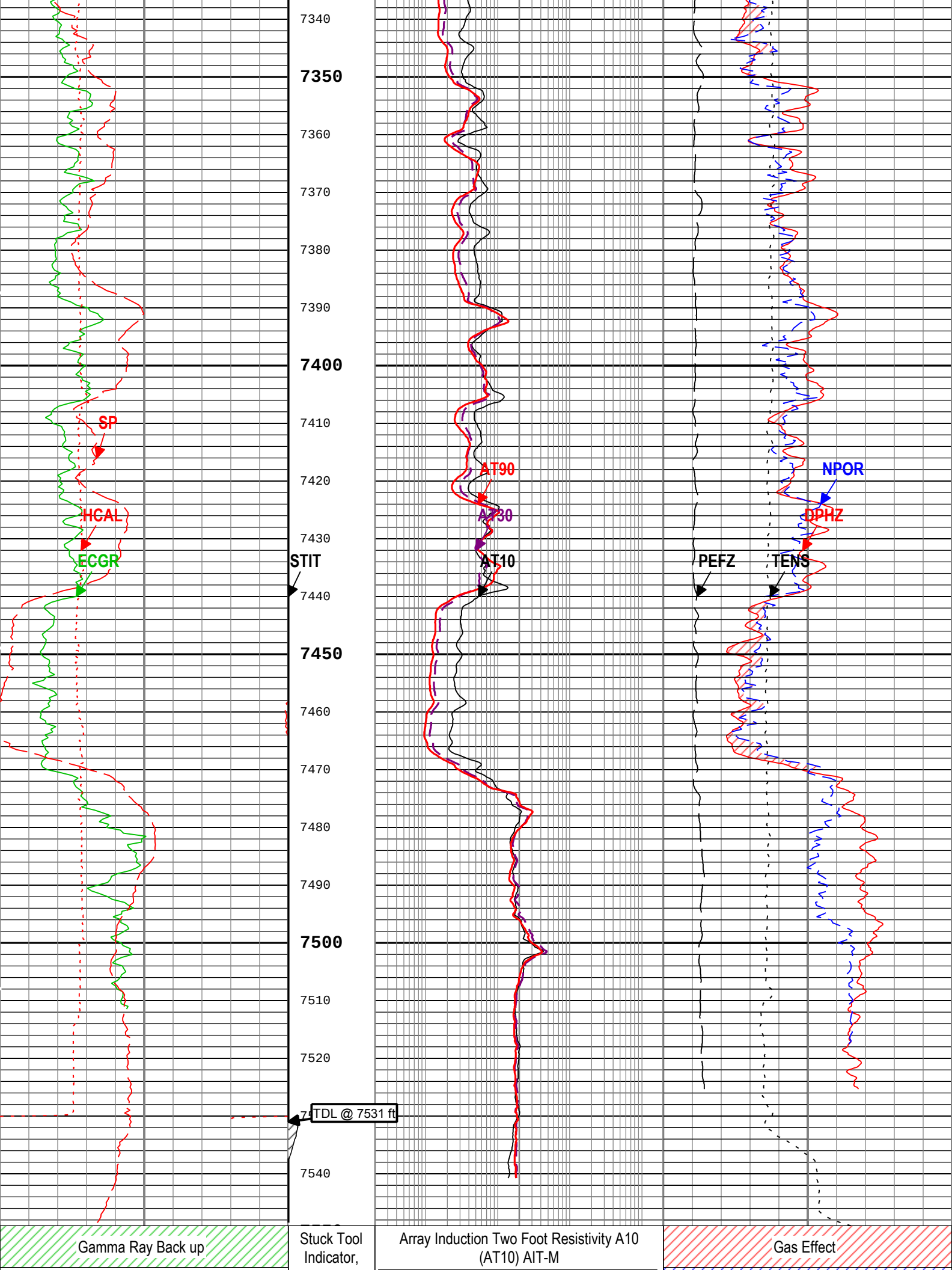












Gamma Ray (ECGR) HGNS-H			Total (STIT)			0.2	ohm.m	2000	NPOR Backup			
0	gAPI		200	0	ft	50	Array Induction Two Foot Resistivity A30 (AT30) AIT-M			Cable Tension (TENS)		
Caliper (HCAL) HDRS-H					0.2			ohm.m	2000	5000	lbf	0
6	in		16		Array Induction Two Foot Resistivity A90 (AT90) AIT-M			Standard Resolution Density Porosity (DPHZ) HDRS-H				
Spontaneous Potential (SP) AIT-M					0.2			ohm.m	2000	0.3	ft3/ft3	-0.1
-80	mV		20							Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H		
										0.3	m3/m3	-0.1
										Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H		
										0	10	

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:13

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532
All depth are actual.			

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One

5" Triple Combo

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[3]:Up	Up	7294.65 ft	7556.27 ft	07-Sep-2016 5:43:06 AM	07-Sep-2016 5:48:19 AM	ON	5.53 ft	No
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

One: Log[4]:Up:S012

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:16

TIME_1900 - Time Marked every 60.00 (s)

Main To Repeat

Repeat To Main

Caliper (HCAL) HDRS-H

6 in 16

Main To Repeat

Repeat To Main

Spontaneous Potential (SP) AIT-M

-80 mV 20

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10

Main To Repeat

Repeat To Main

Cable Tension (TENS)

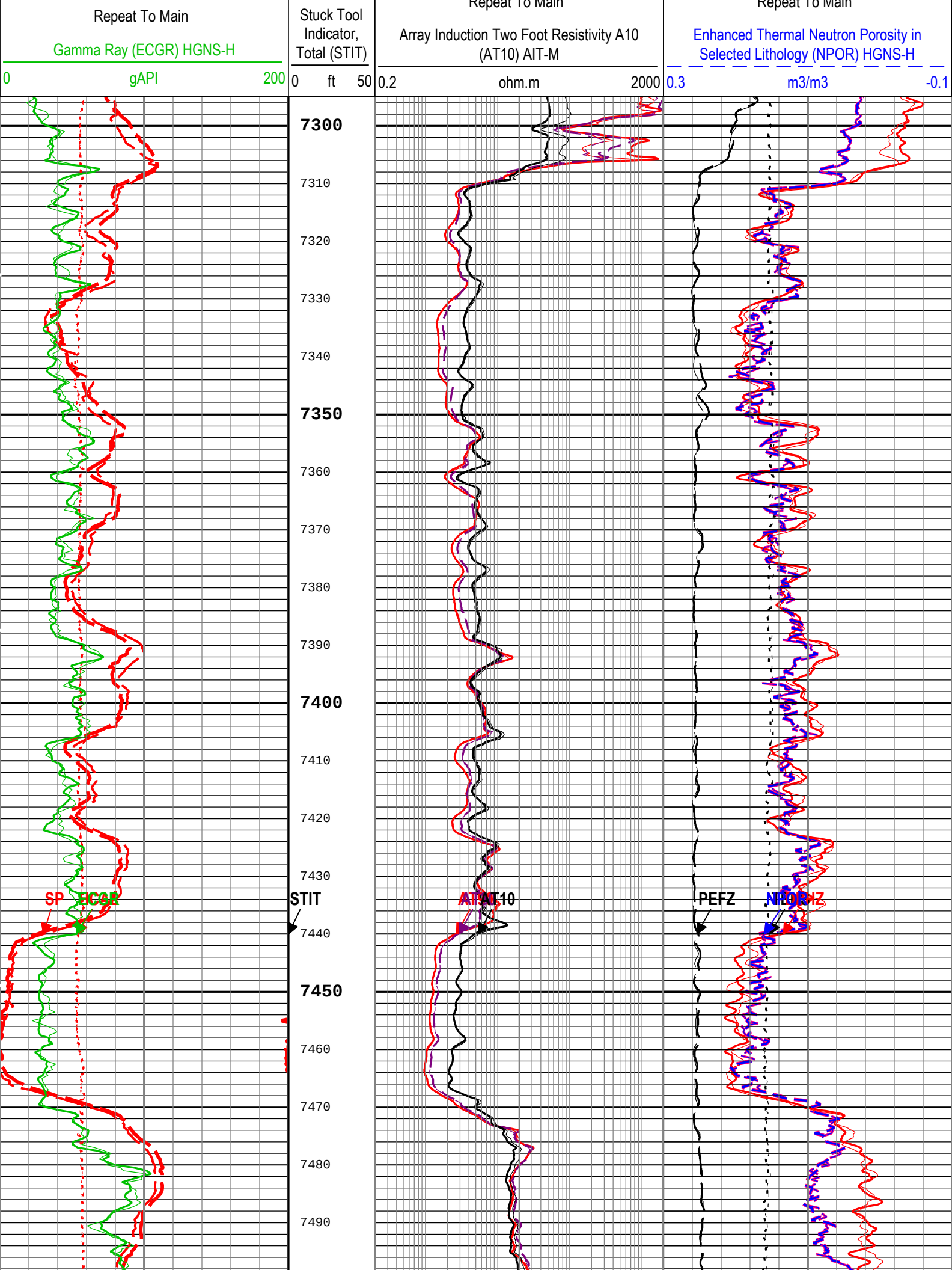
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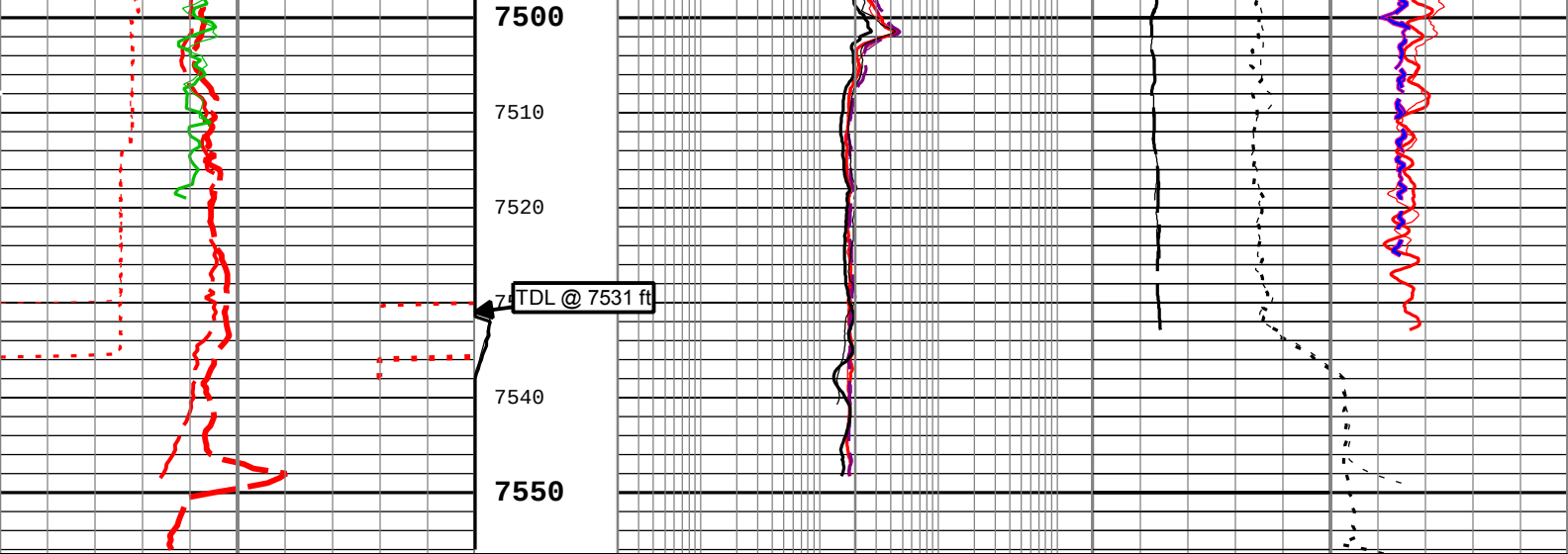
Main To Repeat

Repeat To Main

Standard Resolution Density Porosity (DPHZ) HDRS-H

0.3 ft3/ft3 -0.1





Main To Repeat Repeat To Main Caliper (HCAL) HDRS-H 6 in 16	Main To Repeat Repeat To Main Stuck Tool Indicator, Total (STIT) 0 ft 50	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A90 (AT90) AIT-M 0.2 ohm.m 2000	Main To Repeat Repeat To Main Cable Tension (TENS) 5000 lbf 0
Main To Repeat Repeat To Main Spontaneous Potential (SP) AIT-M -80 mV 20		Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A30 (AT30) AIT-M 0.2 ohm.m 2000	Main To Repeat Repeat To Main Standard Resolution Density Porosity (DPHZ) HDRS-H 0.3 ft3/ft3 -0.1
Main To Repeat Repeat To Main Gamma Ray (ECGR) HGNS-H 0 gAPI 200		Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A10 (AT10) AIT-M 0.2 ohm.m 2000	Main To Repeat Repeat To Main Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H 0.3 m3/m3 -0.1
			Main To Repeat Repeat To Main Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H 0 10

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:16

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	

BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

Calibration Report

AIT-M (Array Induction Tool - M) Calibration - Run One

Primary Equipment :			
File code for AIT-MA Sonde Tool Element	AMIS	50	
Auxiliary Equipment :			
AITM Rm/SP Bottom Nose	AMRM		

AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 20:19:37 05-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit		
Test Loop Gain - 0		Master	1.000	0.950	1.013	1.050		
Test Loop Phase - 0	deg	Master	0	-3.000	1.893	3.000		
Test Loop Gain - 1		Master	1.000	0.950	1.009	1.050		
Test Loop Phase - 1	deg	Master	0	-3.000	0.092	3.000		
Test Loop Gain - 2		Master	1.000	0.950	1.015	1.050		

Test Loop Phase - 2	deg	Master	0	-3.000	-0.008	3.000	
Test Loop Gain - 3		Master	1.000	0.950	1.012	1.050	
Test Loop Phase - 3	deg	Master	0	-3.000	0.319	3.000	
Test Loop Gain - 4		Master	1.000	0.950	0.998	1.050	
Test Loop Phase - 4	deg	Master	0	-3.000	0.071	3.000	
Test Loop Gain - 5		Master	1.000	0.950	1.022	1.050	
Test Loop Phase - 5	deg	Master	0	-3.000	0.391	3.000	
Test Loop Gain - 6		Master	1.000	0.950	1.035	1.050	
Test Loop Phase - 6	deg	Master	0	-3.000	0.531	3.000	
Test Loop Gain - 7		Master	1.000	0.950	1.047	1.050	
Test Loop Phase - 7	deg	Master	0	-3.000	0.270	3.000	

AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM):		20:19:37 05-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Sonde Error Correction Real - 0	mS/m	Master	----	-231.000	-97.409	119.000	
Sonde Error Correction Quad - 0		Master	----	-2250.000	-596.848	2250.000	
Sonde Error Correction Real - 1	mS/m	Master	----	114.000	156.040	204.000	
Sonde Error Correction Quad - 1		Master	----	-625.000	-247.744	625.000	
Sonde Error Correction Real - 2	mS/m	Master	----	66.000	112.609	156.000	
Sonde Error Correction Quad - 2		Master	----	-350.000	120.325	350.000	
Sonde Error Correction Real - 3	mS/m	Master	----	39.000	68.195	89.000	
Sonde Error Correction Quad - 3		Master	----	-250.000	-161.507	250.000	
Sonde Error Correction Real - 4	mS/m	Master	----	15.000	24.223	35.000	
Sonde Error Correction Quad - 4		Master	----	-63.000	-0.939	63.000	
Sonde Error Correction Real - 5	mS/m	Master	----	4.000	15.665	24.000	
Sonde Error Correction Quad - 5		Master	----	-50.000	-27.113	50.000	
Sonde Error Correction Real - 6	mS/m	Master	----	5.000	10.064	15.000	
Sonde Error Correction Quad - 6		Master	----	-30.000	-6.498	30.000	
Sonde Error Correction Real - 7	mS/m	Master	----	-5.000	-1.483	5.000	
Sonde Error Correction Quad - 7		Master	----	-30.000	-4.619	30.000	

AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM):		20:19:37 05-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Coarse Gain		Master	1.000	0.800	0.934	1.200	
Fine Gain		Master	1.000	0.800	0.938	1.200	

AIT Electronics Check - Thru Calibration Check

Master (EEPROM):		20:19:37 05-Aug-2016		Before (Measured):		21:11:27 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Thru Cal Mag - 0	V	Master	----	0.366	0.603	0.854	
		Before	----	0.366	0.603	0.854	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 0	deg	Master	----	137.000	-165.864	-103.000	
		Before	----	137.000	-161.111	-103.000	
		Before-Master	----	----	4.753	----	
Thru Cal Mag - 1	V	Master	----	0.762	1.237	1.778	
		Before	----	0.762	1.237	1.778	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 1	deg	Master	----	136.000	-166.823	-104.000	
		Before	----	136.000	-162.071	-104.000	
		Before-Master	----	----	4.752	----	
Thru Cal Mag - 2	V	Master	----	0.372	0.613	0.868	
		Before	----	0.372	0.613	0.868	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 2	deg	Master	----	132.000	-170.304	-108.000	
		Before	----	132.000	-165.578	-108.000	
		Before-Master	----	----	4.726	----	
Thru Cal Mag - 3	V	Master	----	0.420	0.691	0.980	
		Before	----	0.420	0.691	0.980	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 3	deg	Master	----	131.000	-171.041	-109.000	

		Before	----	131.000	-166.313	-109.000	
		Before-Master	----	----	4.728	----	
Thru Cal Mag - 4	V	Master	----	0.804	1.297	1.876	
		Before	----	0.804	1.296	1.876	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 4	deg	Master	----	125.000	-177.009	-115.000	
		Before	----	125.000	-172.279	-115.000	
		Before-Master	----	----	4.730	----	
Thru Cal Mag - 5	V	Master	----	1.176	1.888	2.744	
		Before	----	1.176	1.887	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 5	deg	Master	----	122.000	-178.544	-118.000	
		Before	----	122.000	-173.812	-118.000	
		Before-Master	----	----	4.732	----	
Thru Cal Mag - 6	V	Master	----	1.176	1.887	2.744	
		Before	----	1.176	1.886	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 6	deg	Master	----	121.000	-178.521	-119.000	
		Before	----	121.000	-173.790	-119.000	
		Before-Master	----	----	4.731	----	
Thru Cal Mag - 7	V	Master	----	0.846	1.358	1.974	
		Before	----	0.846	1.353	1.974	
		Before-Master	----	----	-0.005	----	
Thru Cal Phase - 7	deg	Master	----	115.000	-179.305	-125.000	
		Before	----	115.000	-174.661	-125.000	
		Before-Master	----	----	4.644	----	
SPA Zero	mV	Master		-50.000	0.156	50.000	
		Before		-50.000	0.146	50.000	
		Before-Master	----	----	-0.010	----	
SPA Plus	mV	Master		941.000	988.093	1040.000	
		Before		941.000	988.030	1040.000	
		Before-Master	----	----	-0.063	----	
Temperature Zero	V	Master		-0.050	0.000	0.050	
		Before		-0.050	0.000	0.050	
		Before-Master	----	----	0.000	----	
Temperature Plus	V	Master		0.870	0.915	0.960	
		Before		0.870	0.915	0.960	
		Before-Master	----	----	0.000	----	

HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One			
Primary Equipment :			
HILT High-Resolution Control Cartridge, 150 degC	HRCC-H		48.17
HILT Resistivity Gamma-Ray Density Device, 150 degC	HRGD-H		4899
Auxiliary Equipment :			
HRDD Backscatter Detector	Backscatter		
HRDD Long Spacing Detector	Long Spacing		
HRDD Short Spacing Detector	Short Spacing		27786
Cesium 137 Gamma-Ray Logging Source	GSR-J		5471
HILT High-Resolution Control Cartridge, 150 degC	HRCC-H		48.17
HILT High-Resolution Mechanical Sonde, 150 degC	HRMS-H		4876
Calibration Parameter :			
Small Ring Size (Caliper Calibration Small Ring)	8.00		
Large Ring Size (Caliper Calibration Large Ring)	12.00		

HDRS Caliper Calibration - Caliper Accumulations							
Before (Measured):		21:07:42 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Small Ring	in	Before	8.00	6.00	7.80	10.00	
Large Ring	in	Before	12.00	9.00	12.20	15.00	

HDRS Density Calibration - Inversion Results							
Master (EEPROM):		11:40:40 24-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Rho Aluminum	g/cm3	Master	2.596	2.586	2.600	2.606	
Rho Magnesium	g/cm3	Master	1.686	1.676	1.685	1.696	
Pe Aluminum		Master	2.570	2.470	2.571	2.670	
Pe Magnesium		Master	2.650	2.550	2.618	2.750	
HDRS Density Calibration - Deviation Summary							
Master (EEPROM):		11:40:40 24-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Average Deviation	%	Master	0	-0.6000	0.2221	0.6000	
BS Max Deviation	%	Master	0	-1.6000	0.6566	1.6000	
SS Average Deviation	%	Master	0	-1.0000	0.2278	1.0000	
SS Max Deviation	%	Master	0	-2.5000	0.9144	2.5000	
LS Average Deviation	%	Master	0	-1.5000	0.6741	1.5000	
LS Max Deviation	%	Master	0	-3.5000	1.7270	3.5000	
HDRS Density Calibration - Background Summary							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Window Ratio		Master	1.0000		0.7337		
		Before	0.7337	0.6970	0.7348	0.7704	
		Before-Master	-----	-----	0.0011	-----	
BS Window Sum	1/s	Master	1		25241		
		Before	25241	23979	25499	26504	
		Before-Master	-----	-----	258	-----	
SS Window Ratio		Master	1.0000		0.4797		
		Before	0.4797	0.4557	0.4811	0.5037	
		Before-Master	-----	-----	0.0014	-----	
SS Window Sum	1/s	Master	1		11057		
		Before	11057	10504	11035	11610	
		Before-Master	-----	-----	-22	-----	
LS Window Ratio		Master	1.0000		0.3012		
		Before	0.3012	0.2861	0.3073	0.3162	
		Before-Master	-----	-----	0.0061	-----	
LS Window Sum	1/s	Master	1		1233		
		Before	1233	1171	1232	1294	
		Before-Master	-----	-----	-1	-----	
HDRS Density Calibration - Photo-multiplier High Voltages							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS PM High Voltage	V	Master		1000	1452	2400	
		Before		1000	1449	2400	
		Before-Master	-----	-100	-3	100	
SS PM High Voltage	V	Master		1000	1410	2400	
		Before		1000	1411	2400	
		Before-Master	-----	-100	1	100	
LS PM High Voltage	V	Master		1000	1480	2400	
		Before		1000	1473	2400	
		Before-Master	-----	-100	-7	100	
HDRS Density Calibration - Crystal Quality Resolutions							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Crystal Resolution	%	Master		5.00	11.74	25.00	
		Before		5.00	11.74	25.00	
		Before-Master	-----	-1.00	0.00	1.00	
SS Crystal Resolution	%	Master		5.00	10.26	20.00	
		Before		5.00	10.24	20.00	
		Before-Master	-----	-1.00	-0.02	1.00	
LS Crystal Resolution	%	Master		5.00	8.09	20.00	
		Before		5.00	7.85	20.00	

		Before		3.00	7.83	20.00	
		Before-Master	-----	-1.00	-0.24	1.00	

HDRS MCFL Calibration - MCFL Accumulations

Before (Measured):		21:10:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Main Resistivity	ohm.m	Before	3875	3565	3886	4185	
Deep Resistivity	ohm.m	Before	3830	3524	3830	4136	
Shallow Resistivity	ohm.m	Before	3830	3524	3839	4136	

HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One

Primary Equipment :							
	HILT Gamma-Ray and Neutron Sonde, 150 degC		HGNS-H		4817		
Auxiliary Equipment :							
	HGNS Accelerometer, 150 degC		HACCZ-H		6991		
	AmBe Neutron Logging Source		NSR-F		5068		
Calibration Parameter :							
	Water Temperature						
	Housing Size						
	JIG-BKG (Jig minus background reference)		165				

HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured):		05:14:18 07-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
AZ Vertical Measurement	ft/s2	Before	32.2	31.5	32.0	32.8	

HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM):		00:00:00 15-May-2007					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Accelerometer Manufacturer		Master			QAT_160		
Accelerometer Reference Temperature	degF	Master		30.2	77.0	122.0	
Accelerometer Coefficients - 0		Master	-----	-----	-4298.000	-----	
Accelerometer Coefficients - 1		Master	-----	-----	50.180	-----	
Accelerometer Coefficients - 2		Master	-----	-----	-0.002	-----	
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 4		Master	-----	-----	2.754	-----	
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 7		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 8		Master	-----	-----	300.500	-----	
Accelerometer Coefficients - 9		Master	-----	-----	0.994	-----	

HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM):		15:25:00 19-Jul-2016		Before (Measured):		21:06:20 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Near Zero Measurement	1/s	Master	0	5.0	27.6	40.0	
		Before	0	5.0	28.2	40.0	
		Before-Master	-----	-4.1	0.6	4.1	
Far Zero Measurement	1/s	Master	0	5.0	29.5	40.0	
		Before	0	5.0	29.7	40.0	
		Before-Master	-----	-4.4	0.2	4.4	
Near Plus Measurement	1/s	Master	6031.0	4700.0	5290.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Far Plus Measurement	1/s	Master	2793.0	1900.0	2194.0	2900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Near Corrected Plus Measurement	1/s	Master		4700.0	5156.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	

Far Corrected Plus Measurement	1/s	Master Before Before-Master	----- ----- -----	1900.0 ----- -----	2097.0 ----- -----	2900.0 ----- -----	
--------------------------------	-----	-----------------------------------	-------------------------	--------------------------	--------------------------	--------------------------	---

HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured):		21:11:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RGR Zero Measurement	gAPI	Before	30.0	0	78.9	120.0	
RGR Plus Measurement	gAPI	Before	185.4	157.1	165.1	206.3	
GR Calibration Gain		Before	0.89	0.80	1.00	1.05	

Company:

Well:

Field:

County:

State:

Western Refining, Southwest, Inc.

WWD #2

Wildcat

San Juan

New Mexico

Schlumberger

Platform Express

National Express

Triple Combo

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express	
Compensated Neutron	
Litho-Density	
Sec 27, T29N, R11W	Elev.: K.B. 5550.00 ft
SHL: 2028' FNL X 111' FEL	G.L. 5535.00 ft
Lat/Long: 36.6986/-107.97035	D.F. 5549.00 ft
Permanent Datum:	Ground Level
Log Measured From:	Kelly Bushing
Drilling Measured From:	Kelly Bushing
API Serial No.	Section: 27
30-045-35747-0000	Township: 29N
	Range: 11W

County: San Juan
Field: Wildcat
Location: Sec 27, T29N, R11W
Well: WWD #2
Company: Western Refining, Southwest, Inc.

Logging Date	05-Sep-2016		
Run Number	One		
Depth Driller	7525.00 ft		
Schlumberger Depth	7532.00 ft		
Bottom Log Interval	7532.00 ft		
Top Log Interval	3498.00 ft		
Casing Driller Size @ Depth	9.625 in @ 3500.00 ft		
Casing Schlumberger	3498 ft		
Bit Size	8.75 in		
Type Fluid In Hole	WBM		
Density	9.9 lbm/gal	55 s	
Fluid Loss	PH 9 cm3	8.6	
MUD	Active Tank		
RM @ Meas Temp	1.13 ohm.m	@ 68 degF	
RMF @ Meas Temp	0.9 ohm.m	@ 68 degF	
RMC @ Meas Temp	1.4 ohm.m	@ 68 degF	
Source RMF	RMC Pressed	Calculated	
RM @ BHT	0.46 @ 177	0.37 @ 177	
Max Recorded Temperatures	177 degF		
Circulation Stopped	06-Sep-2016 20:25:00		
Logger on Bottom	07-Sep-2016 05:00:00		
Unit Number	Location: 9115	FtMorgan, CO	
Recorded By	Avery Becker		
Witnessed By	Larry Candelaria		

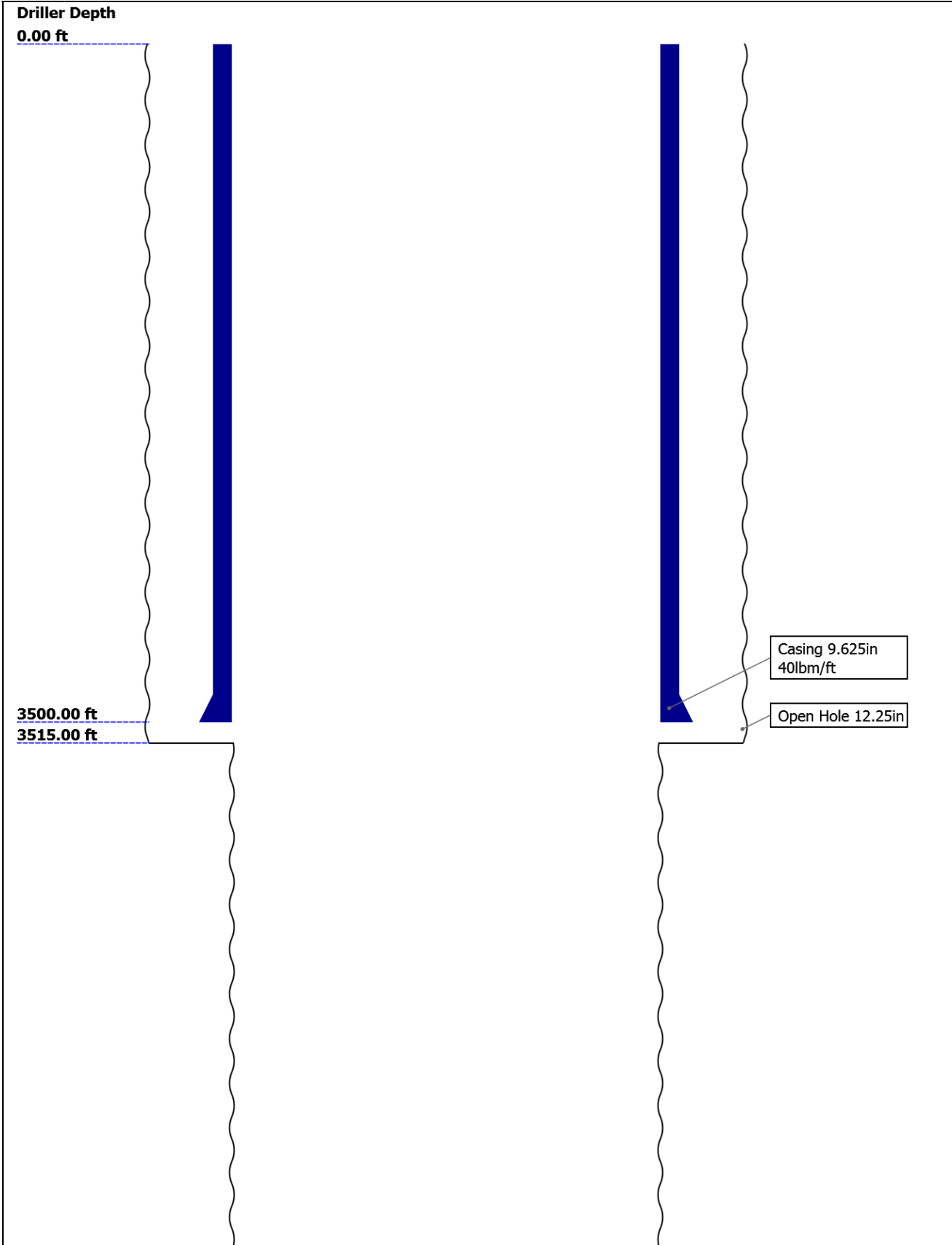
Disclaimer

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- 7. Depth Summary
- 8. One 5" Porosity
 - 8.1 Integration Summary
 - 8.2 Composite Summary
 - 8.3 Log (Porosity-5)
 - 8.4 Parameter Listing
- 9. One 5" Porosity
 - 9.1 Composite Summary
 - 9.2 Log (Porosity-5 RA)
- 10. Calibration Report
- 11. Tail

Well Sketch



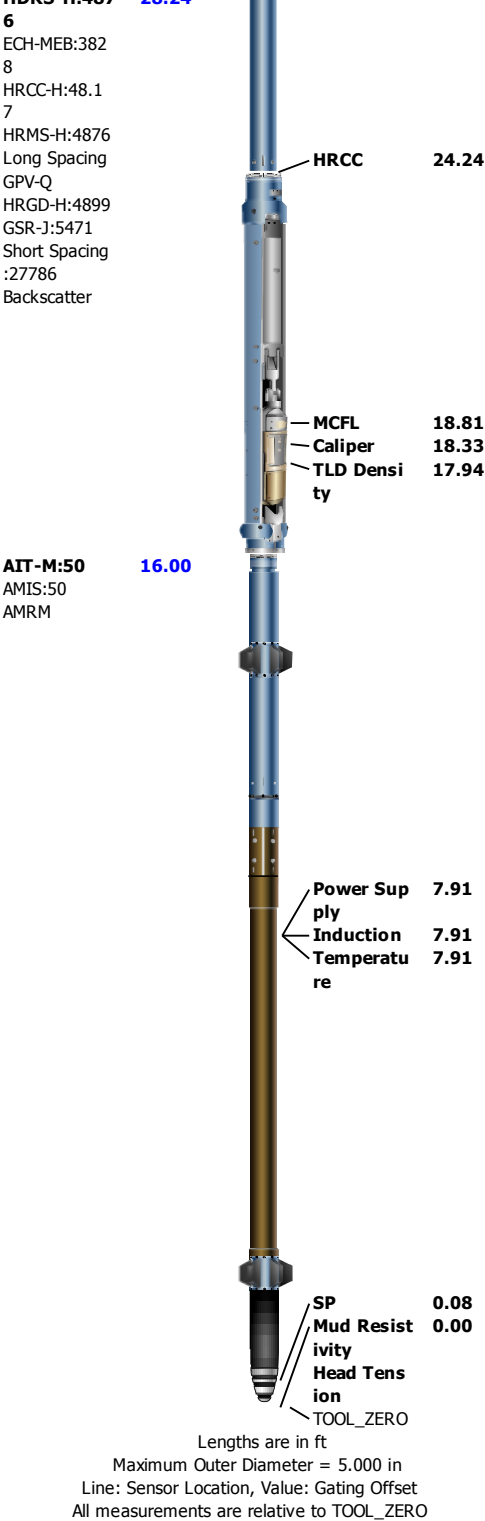


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	12.25	8.75				
Top Driller (ft)	0	3515				
Top Logger (ft)	0	3515				
Bottom Driller (ft)	3515	7525				
Bottom Logger (ft)	3515	7532				
Casing						
Size (in)	9.625					
Weight (lbm/ft)	40					
Inner Diameter (in)	8.835					
Grade	N/A					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	3500					
Bottom Logger (ft)	3498					

Remarks and Equipment Summary

One: Toolstring				One: Remarks
Equip name LEH-QT LEH-QT	Length 43.57	MP name	Offset	Toolstring run as per tool sketch
				Matrix: Sandstone (2.65 g/cc)
				Log may be affected by 20% LCM in drilling mud
				Caliper check in casing=8.87 in, within tolerance
				Cement volume calculated using 7 in future casing diameter
				Rig: Aztec 920
				Crew: Derrick Hunter
				Thank you for choosing Schlumberger
DTC-H:8980 ECH-KC:1005 3 DTC-H:8980	40.65	CTEM HV	39.75 0.00	
HGNS-H:481 7 HGNH:4865 NPV-N NSR-F:5068 HGNS-H:4817 HACCZ-H:699 1 HMCA-H	37.65	TelStatus ToolStatus Temperatu re GR	37.65 37.65 37.62 36.91	
HDPS-H:487	28.24	CNL Porosity HMCA HGNS Accelerometer	30.57 28.24 28.24 0.00	



Depth Summary

	One		
Depth Measuring Device			
Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		
Tension Device			
Type	CMTD-B/A		

Serial Number	147	
Calibration Date	18-Aug-2016	
Calibrator Serial Number	78805A	
Number of Calibration Points	10	
Calibration Root Mean Square Error	7	
Calibration Peak Error	10	

Logging Cable

Type	7-46A-XS		
Serial Number	U715043		
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Land		

One:Depth Control Parameters

Depth Control Remarks

Log Sequence	First Log In the Well	First run in well depth control procedures followed
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary
Rig Up Length At Bottom		
Rig Up Length Correction		
Stretch Correction		
Tool Zero Check At Surface		

One

5" Porosity

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

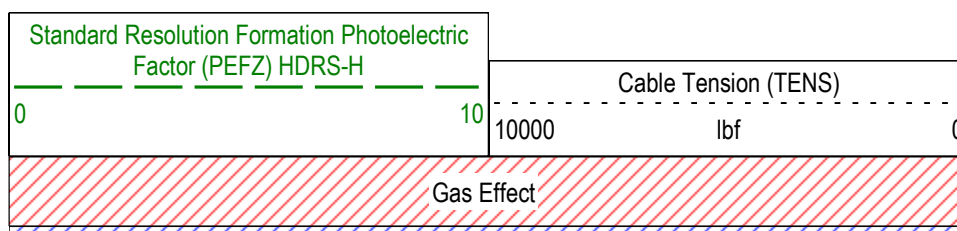
One: Log[4]:Up:S012

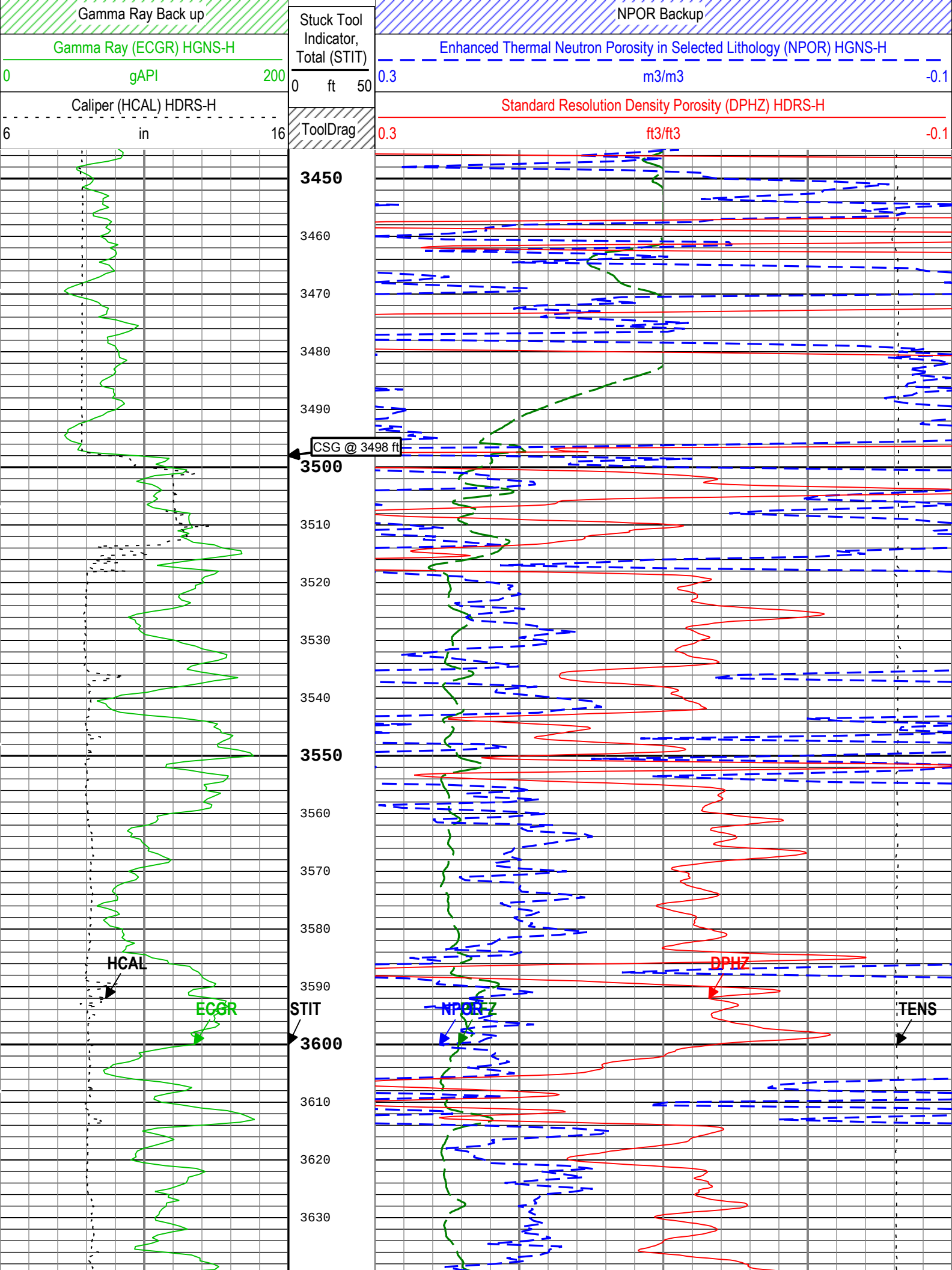
Description: HGNS standard resolution porosities for Platform Express					Format: Log (Porosity-5)	Index Scale: 5 in per 100 ft	Index Unit: ft	Index Type:
---	--	--	--	--	----------------------------	------------------------------	----------------	-------------

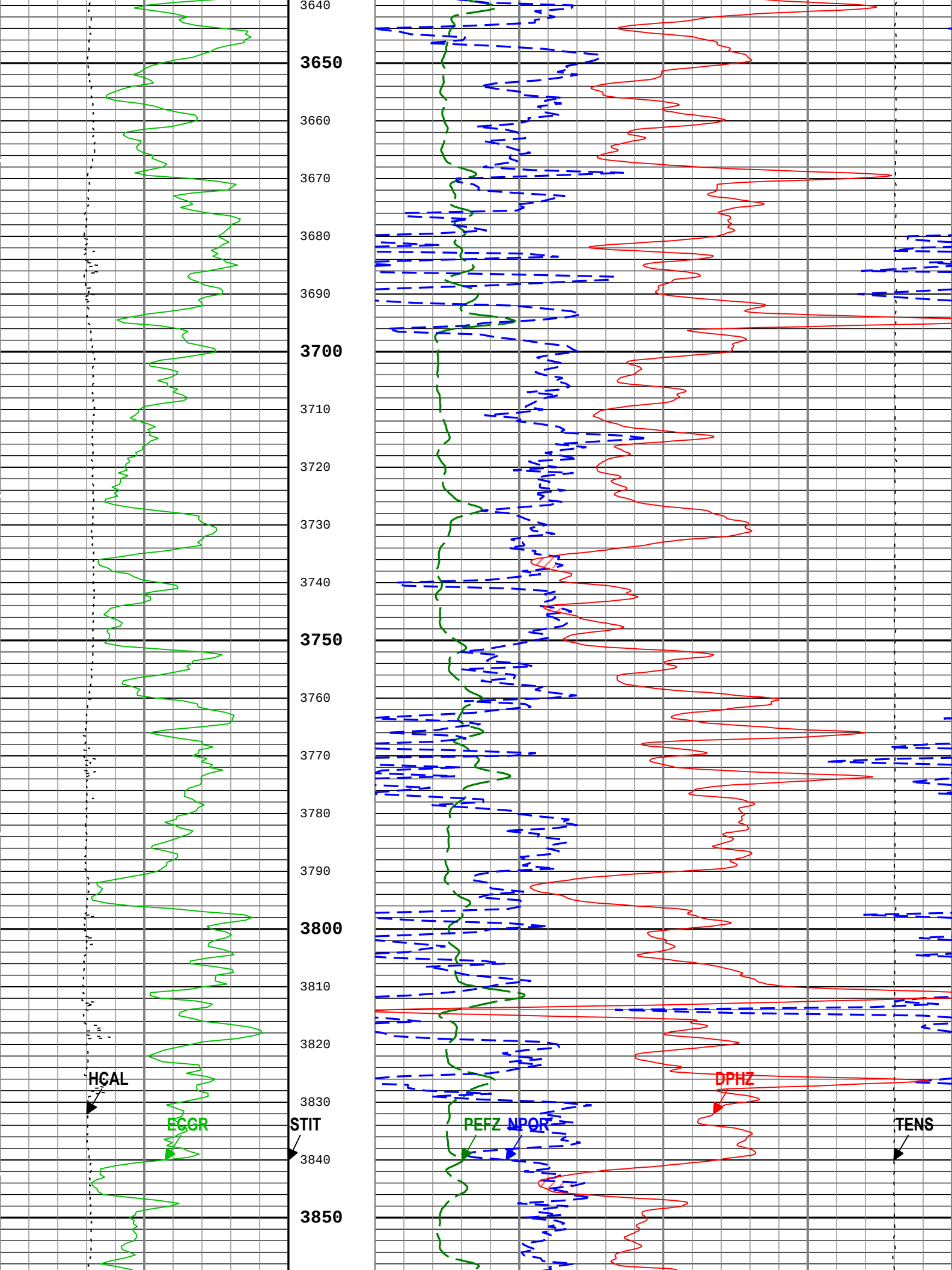
Measured Depth Creation Date: 07-Sep-2016 07:04:46

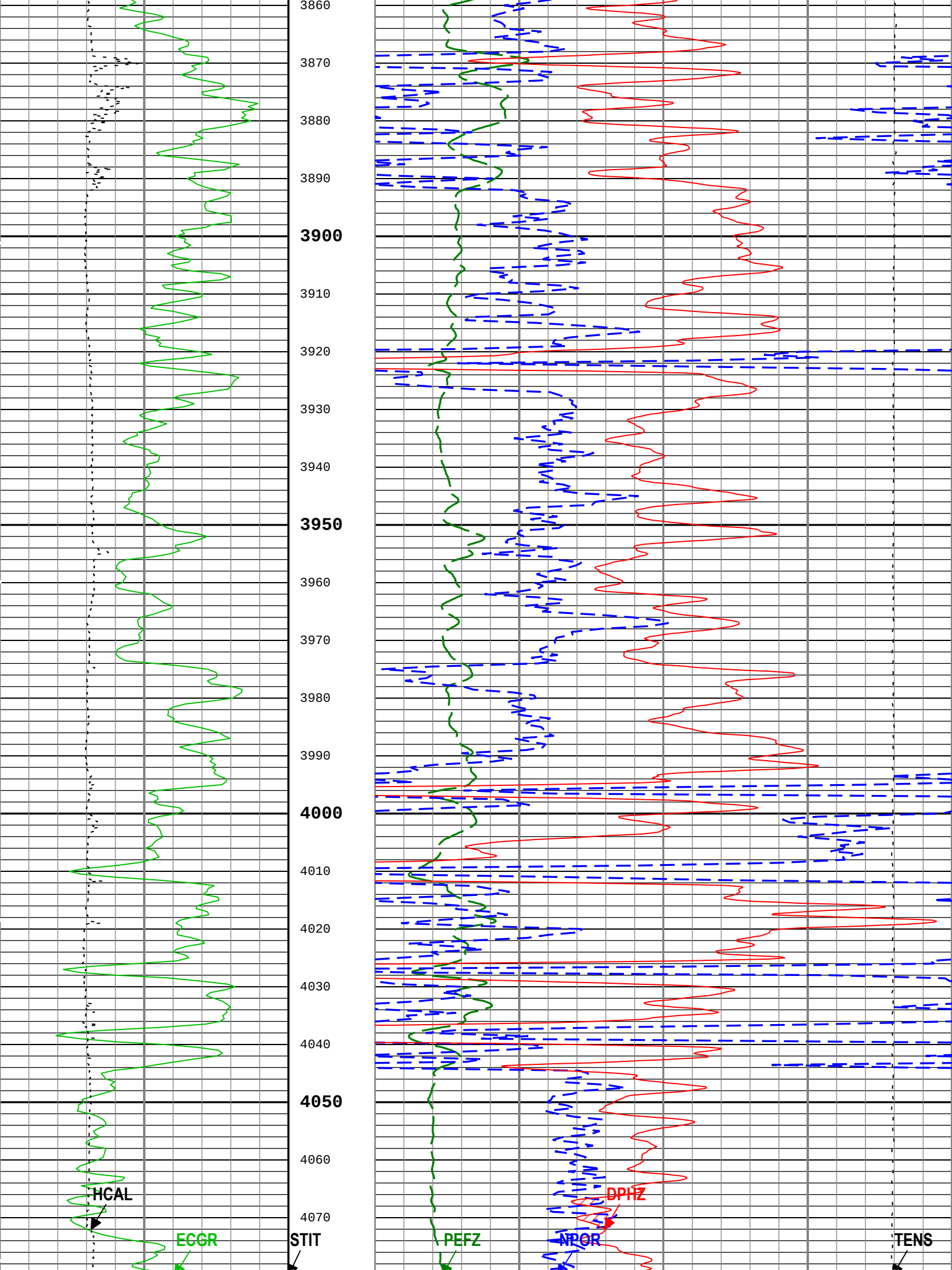
Channel	Source	Sampling
CALI	HDRS-H:HRCC-H:HRCC-H	1in
DPHZ	HDRS-H:HRMS-H:HRGD-H	2in
GR	HGNS-H:HGNS-H:HGNS-H	6in
NPOR	HGNS-H:HGNS-H:HGNS-H	6in
PEFZ	HDRS-H:HRMS-H:HRGD-H	2in
STIT	DepthCorrection	6in
TENS	WLWorkflow	6in
TIME_1900	WLWorkflow	0.1in

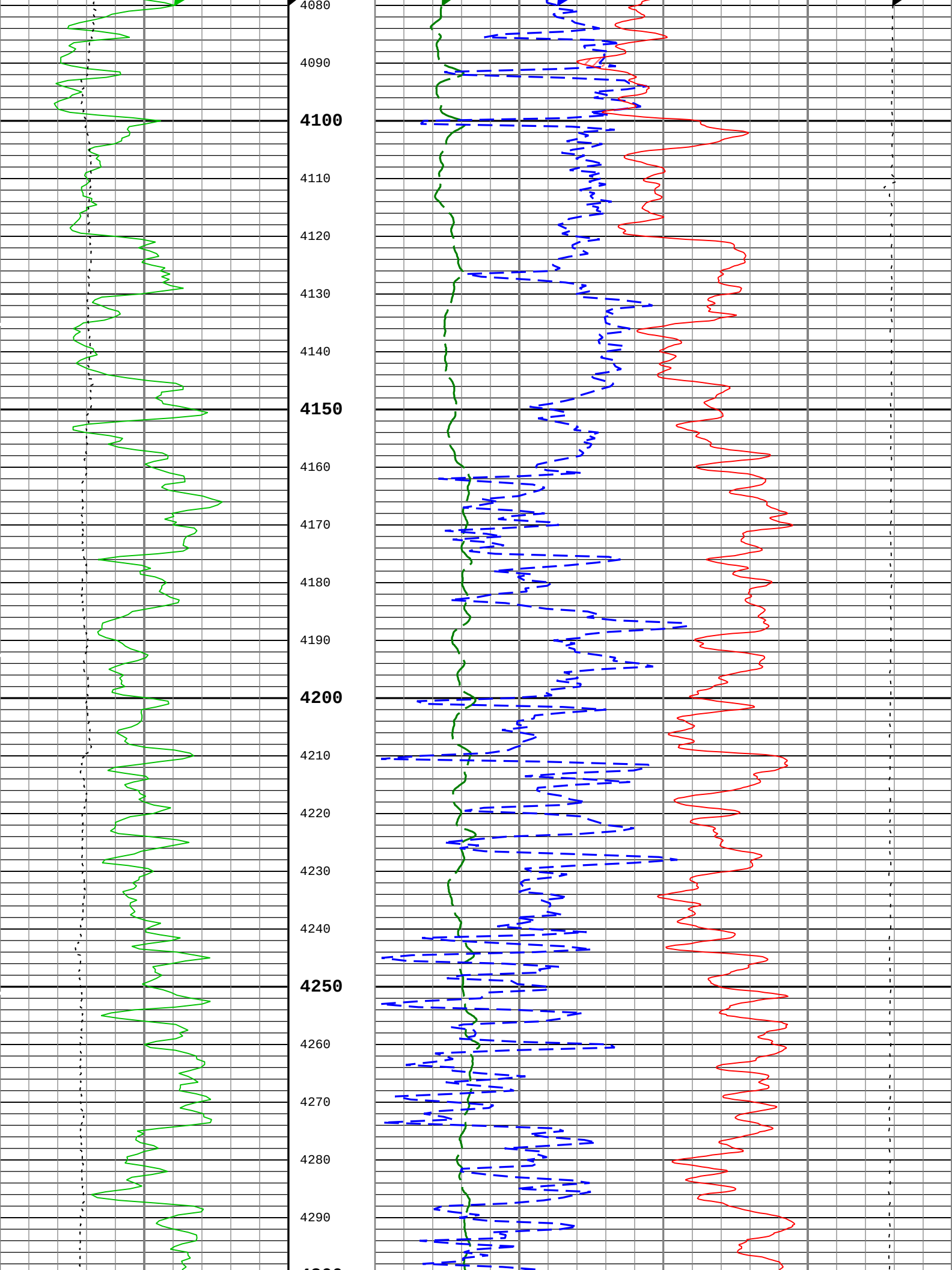
TIME_1900 - Time Marked every 60.00 (s)

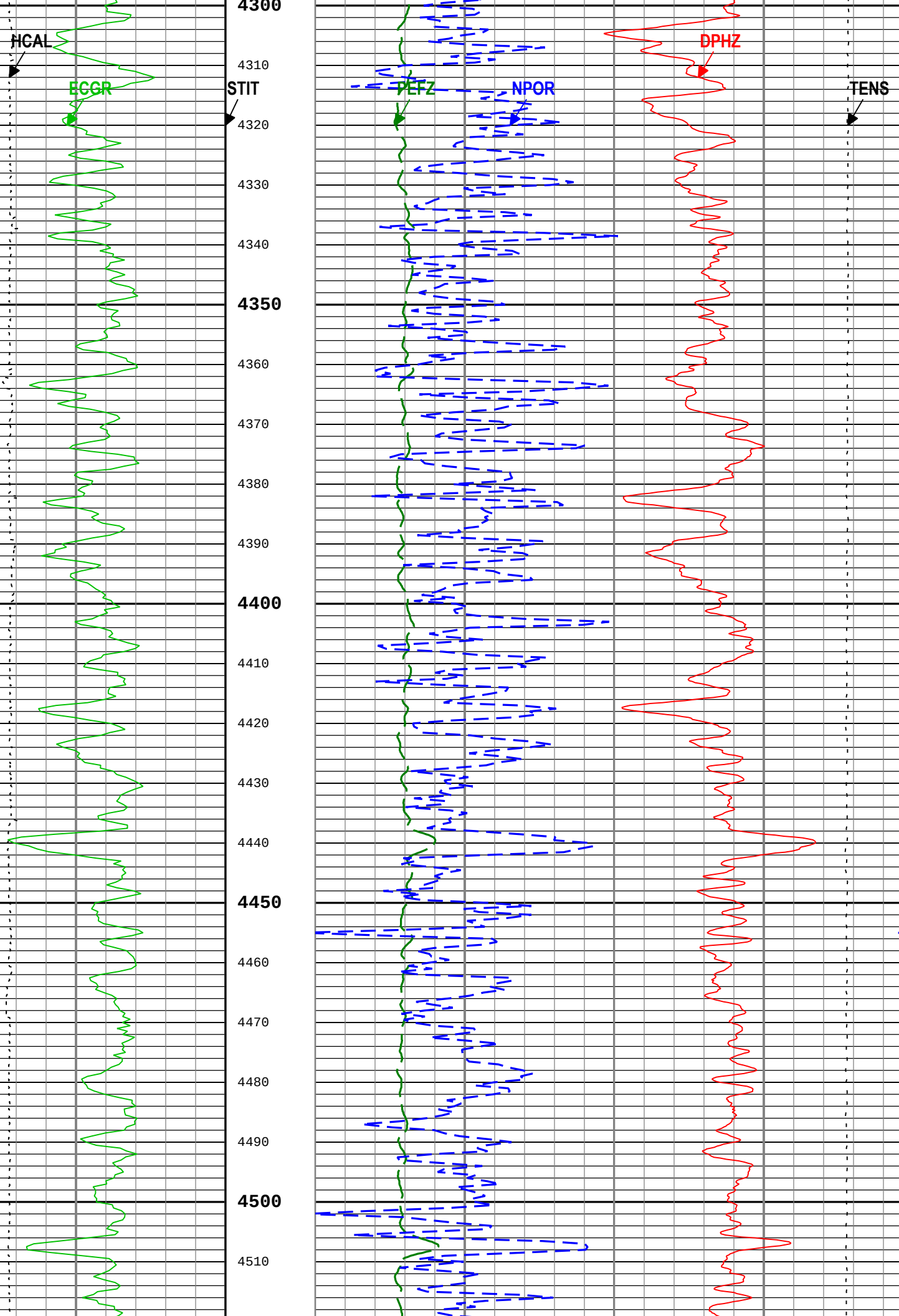


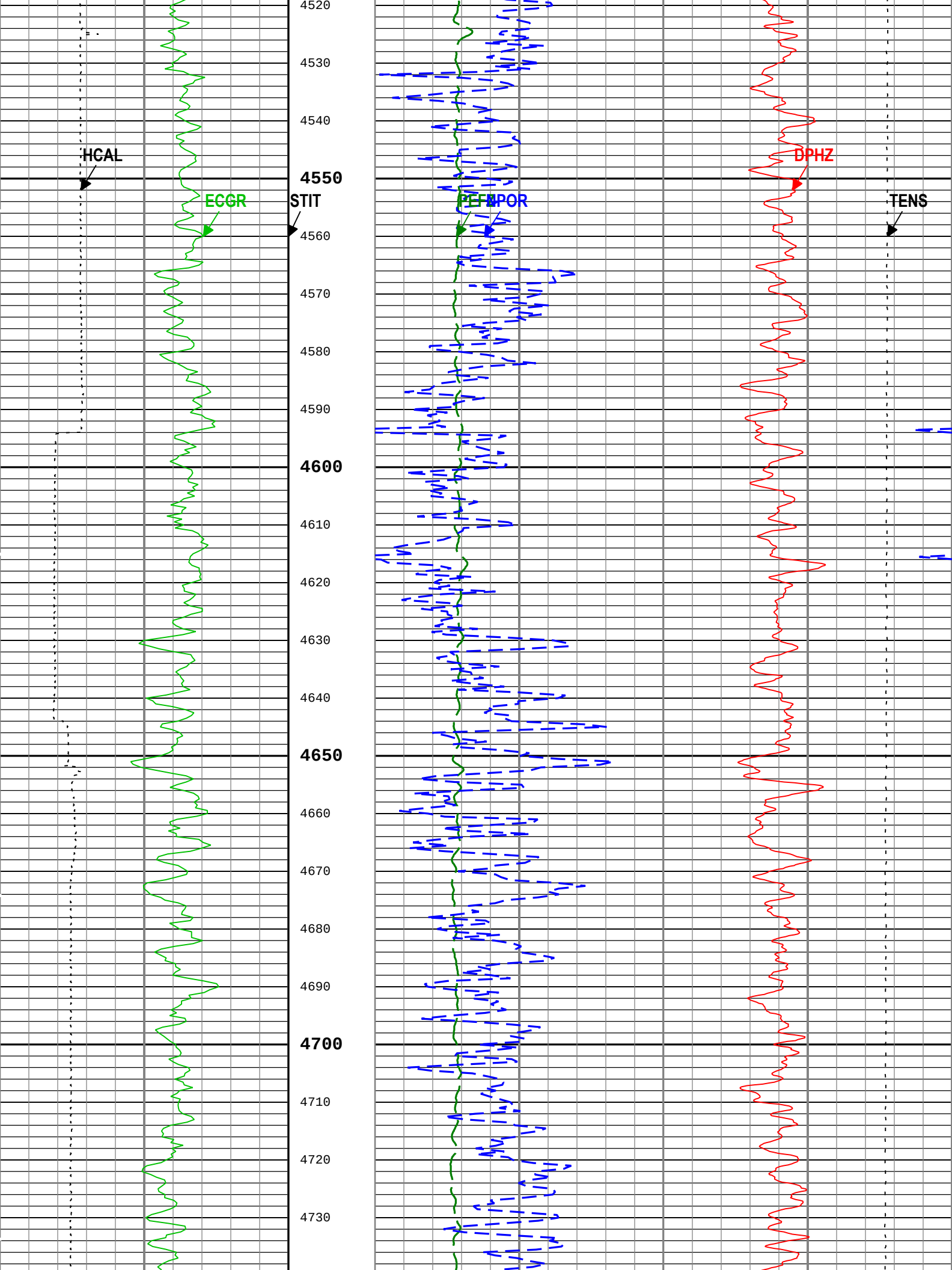


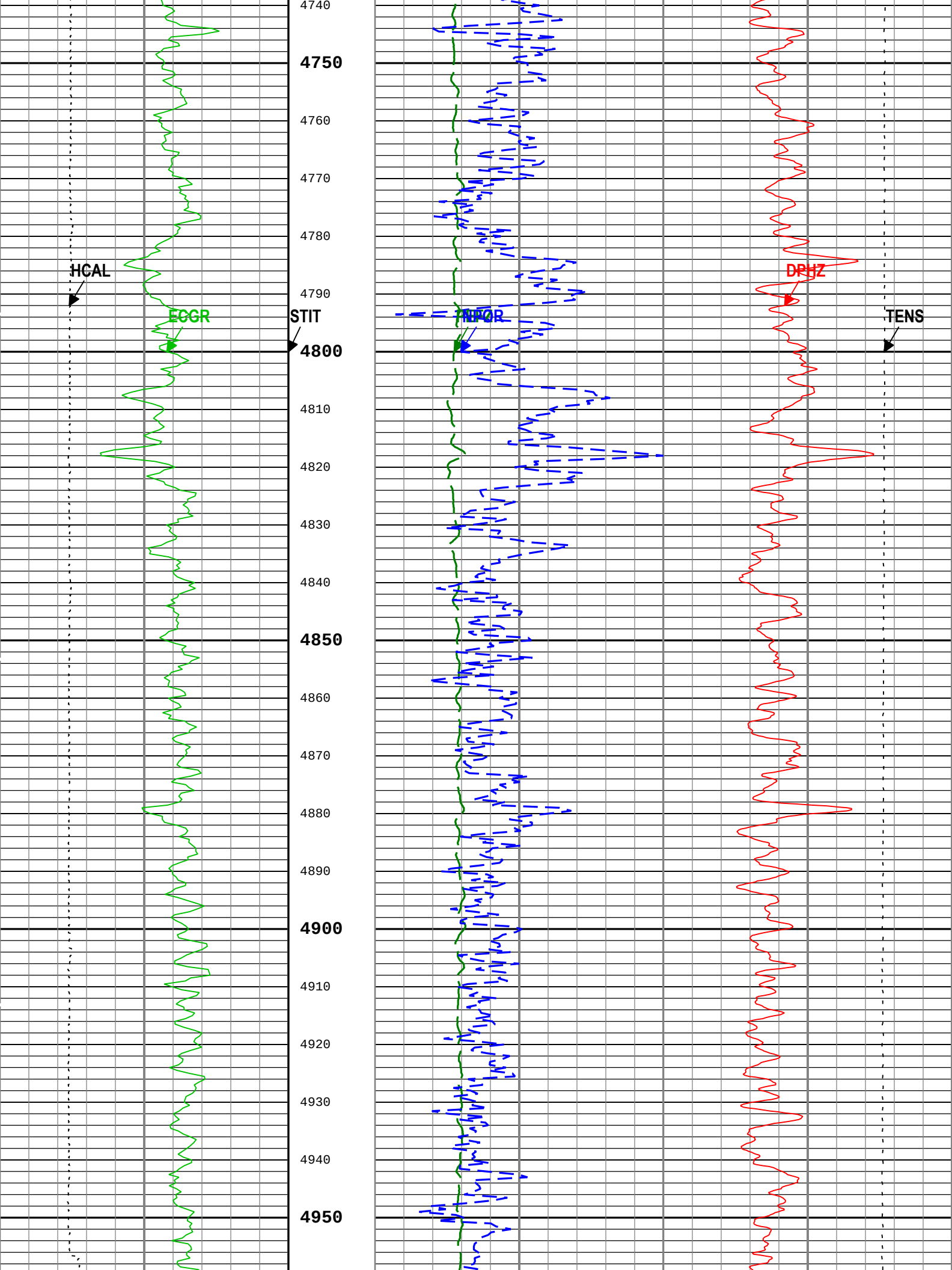


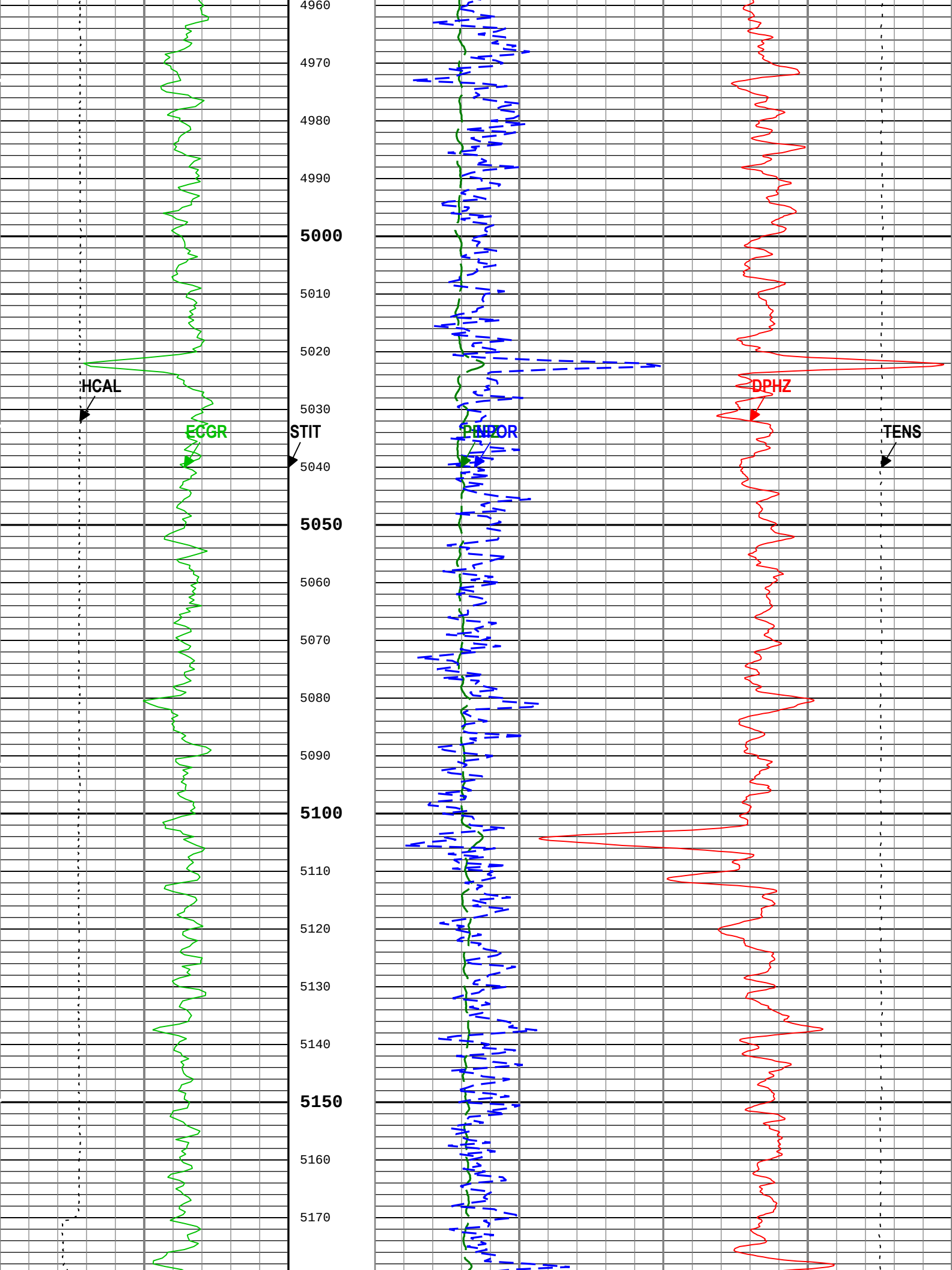


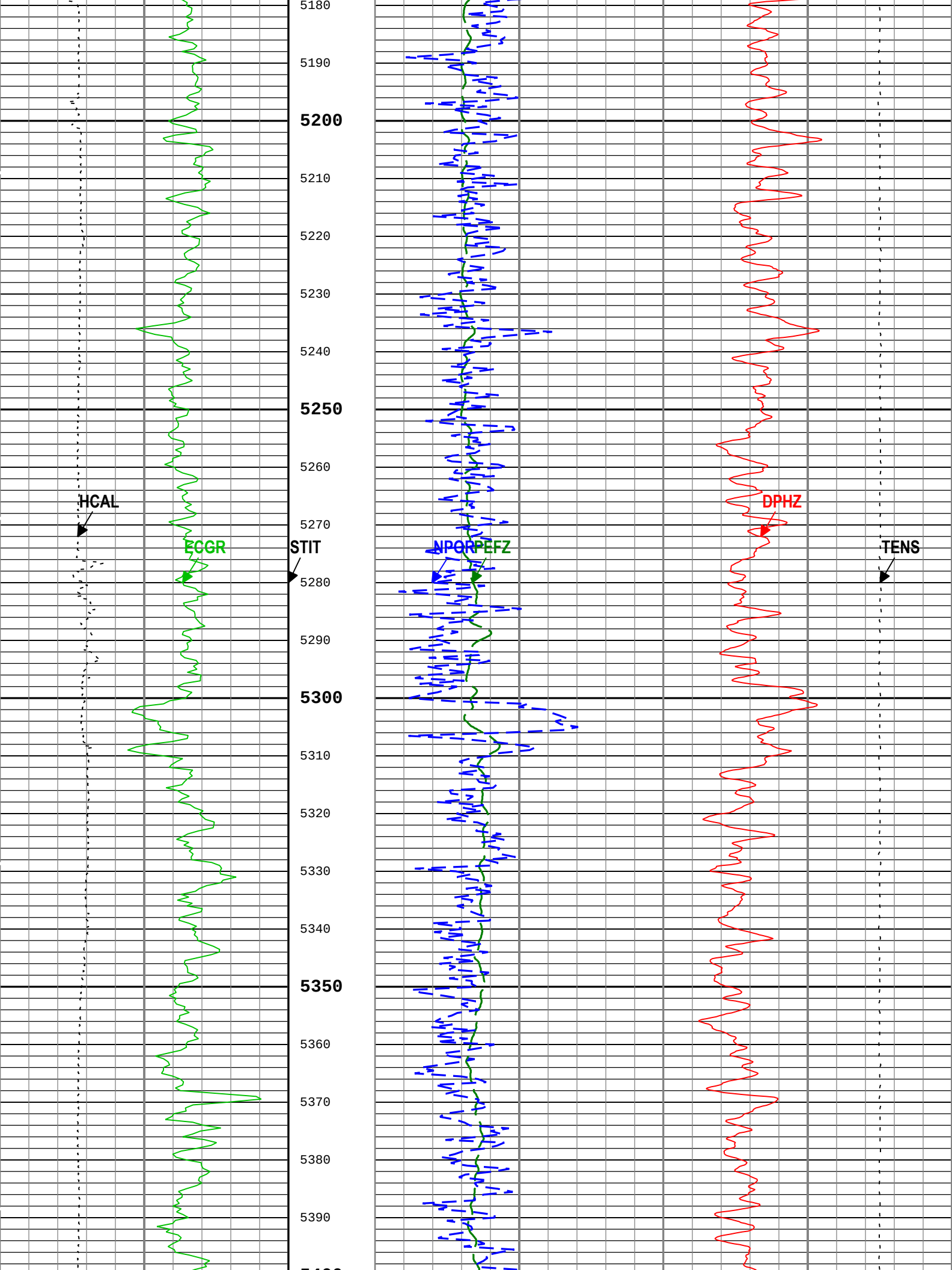


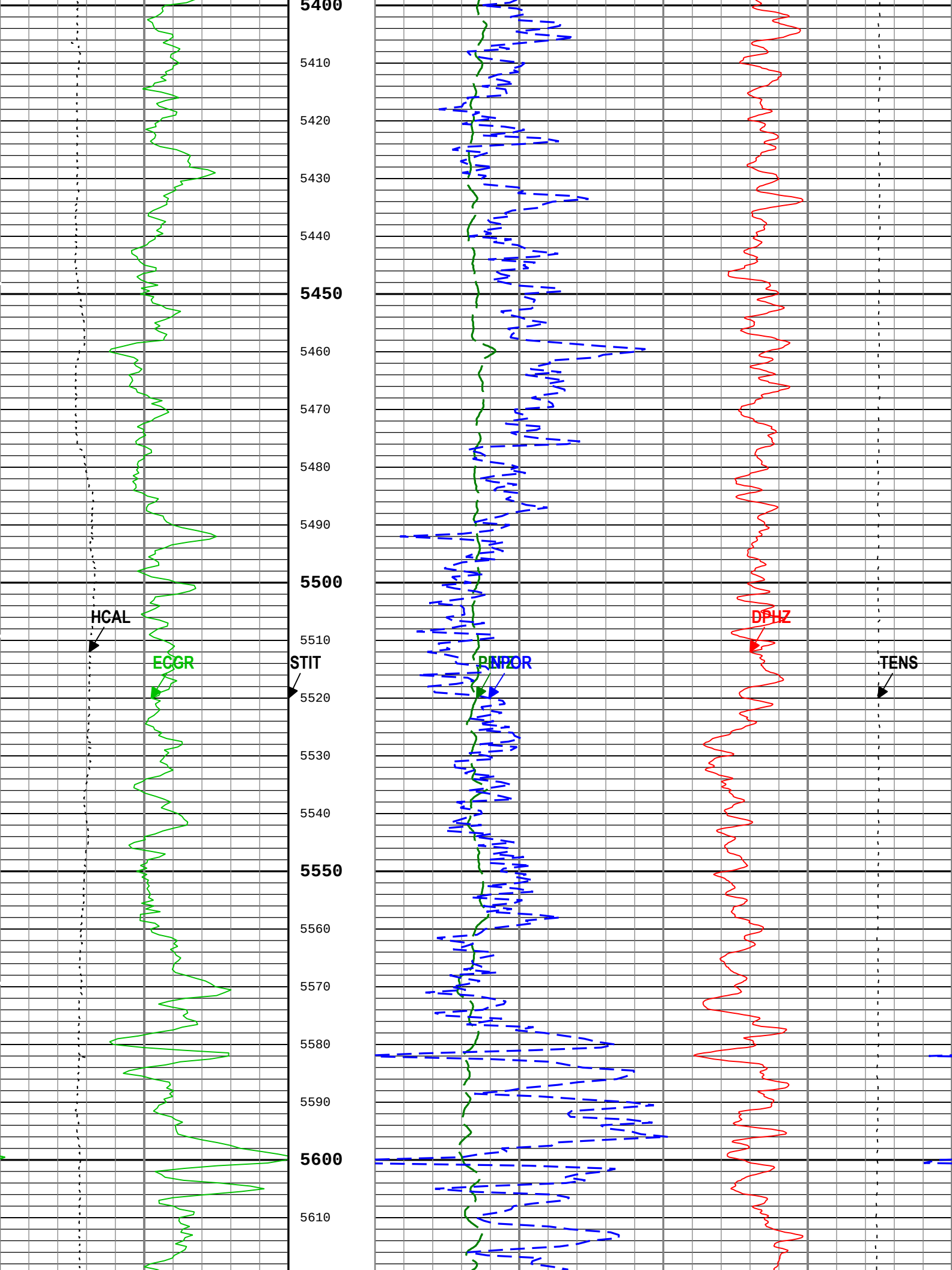


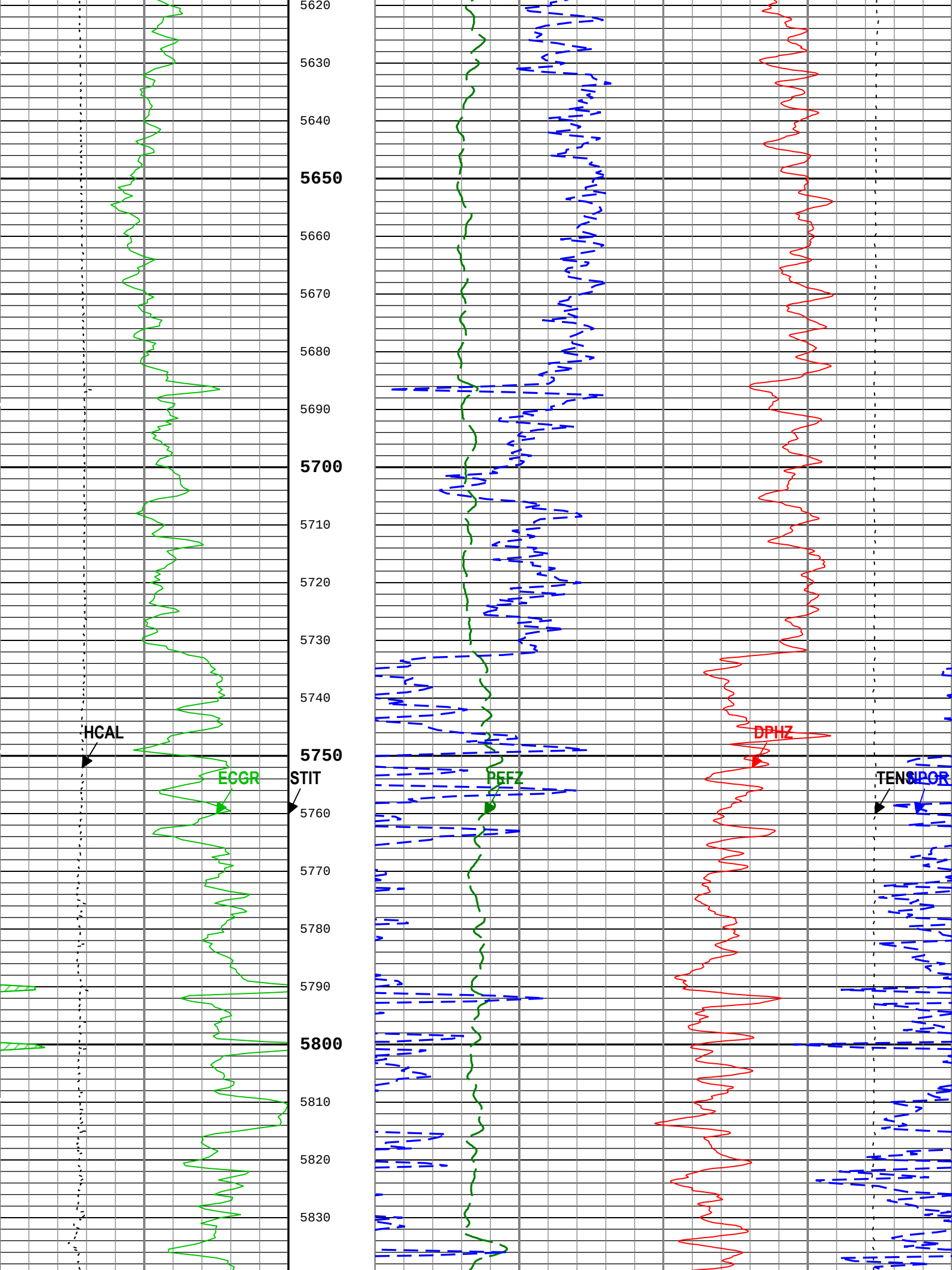


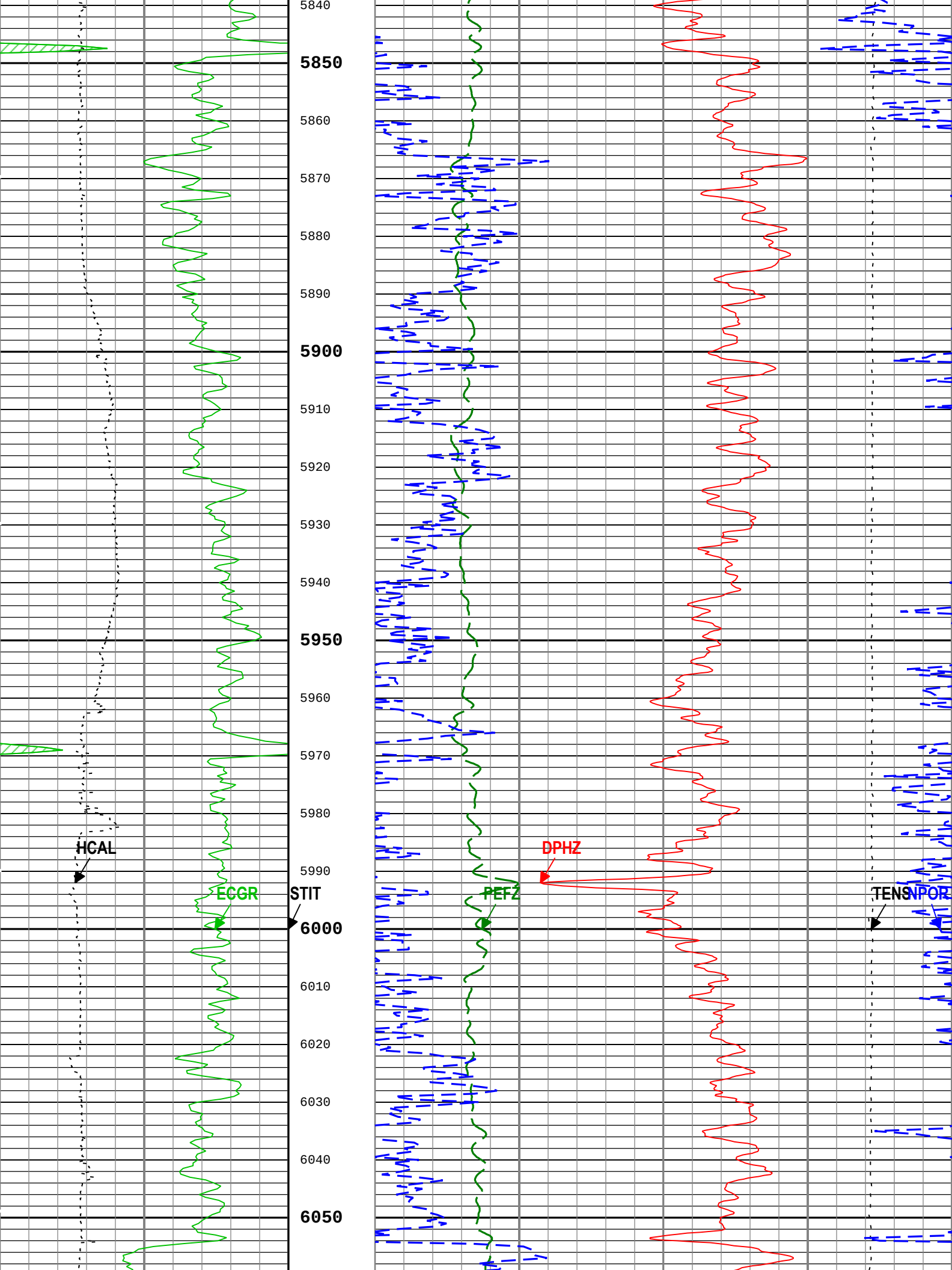


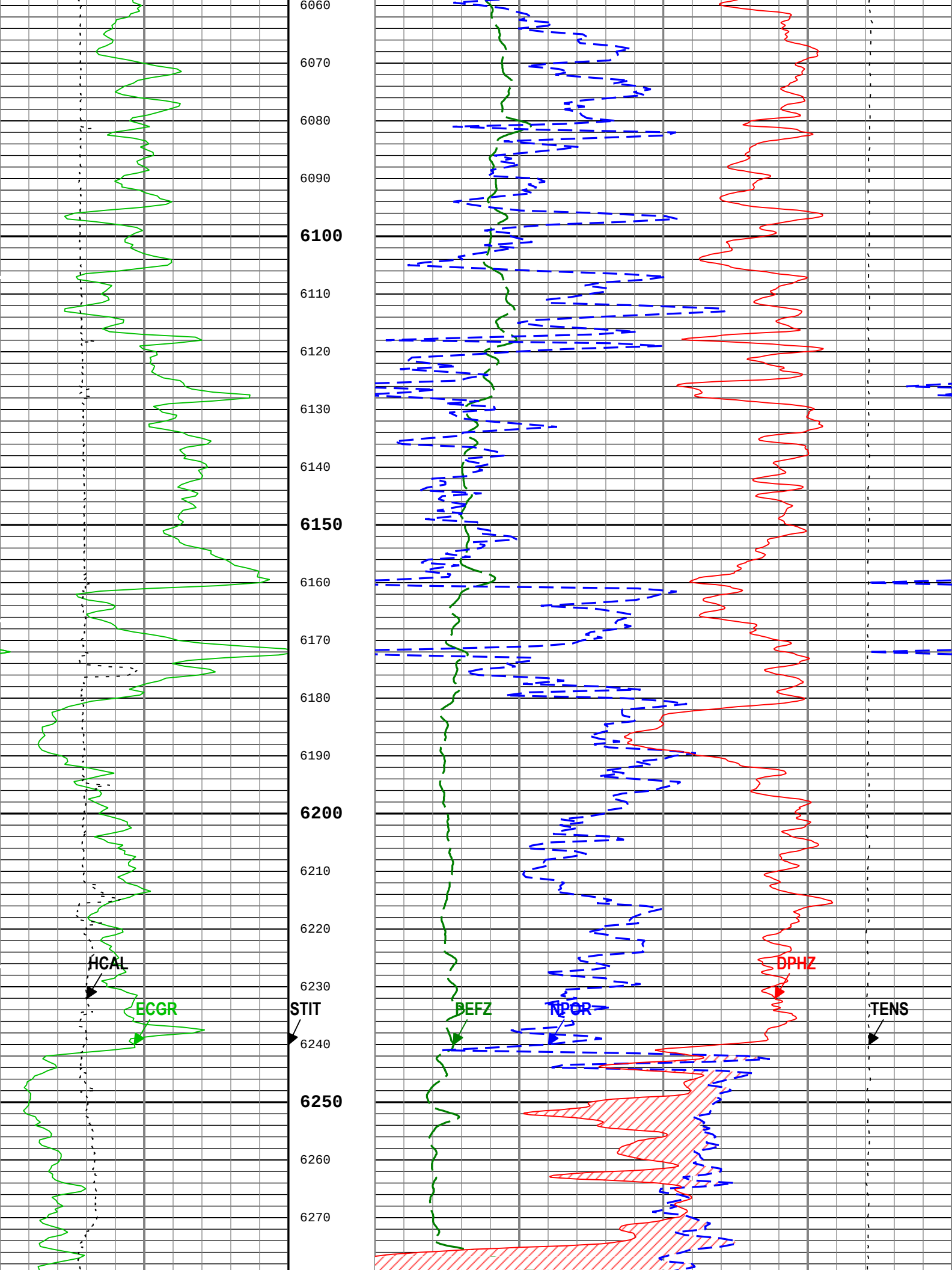


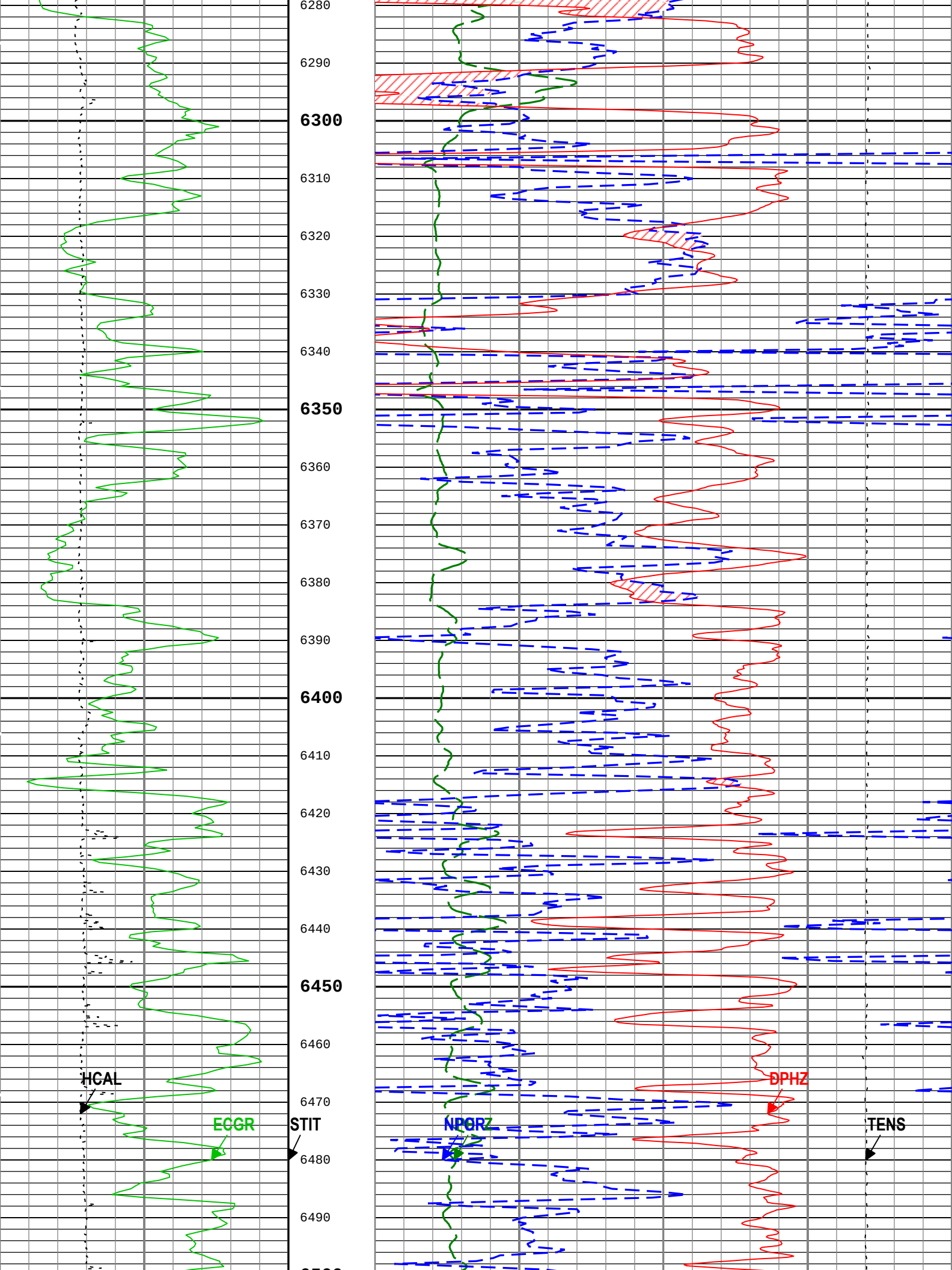


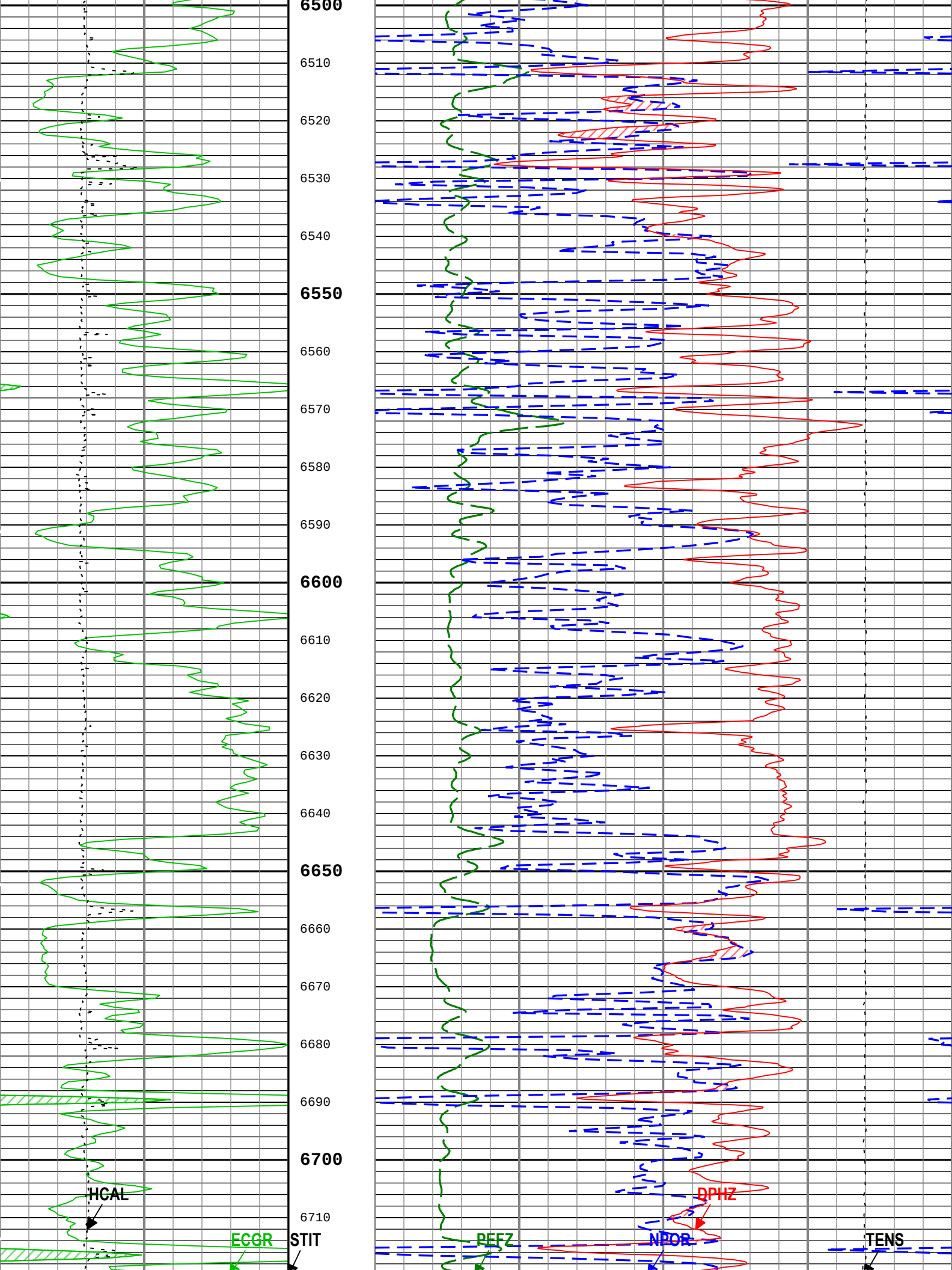


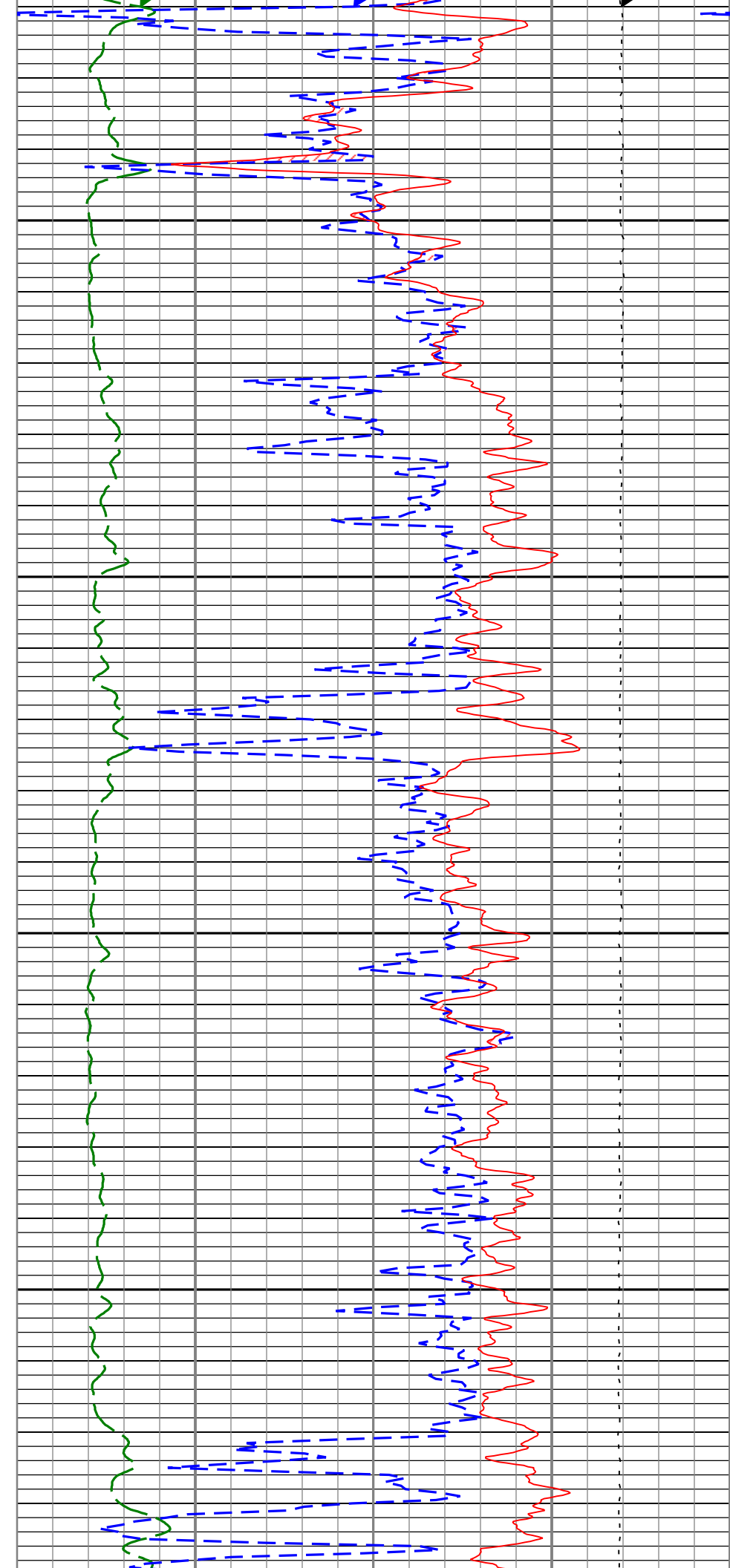
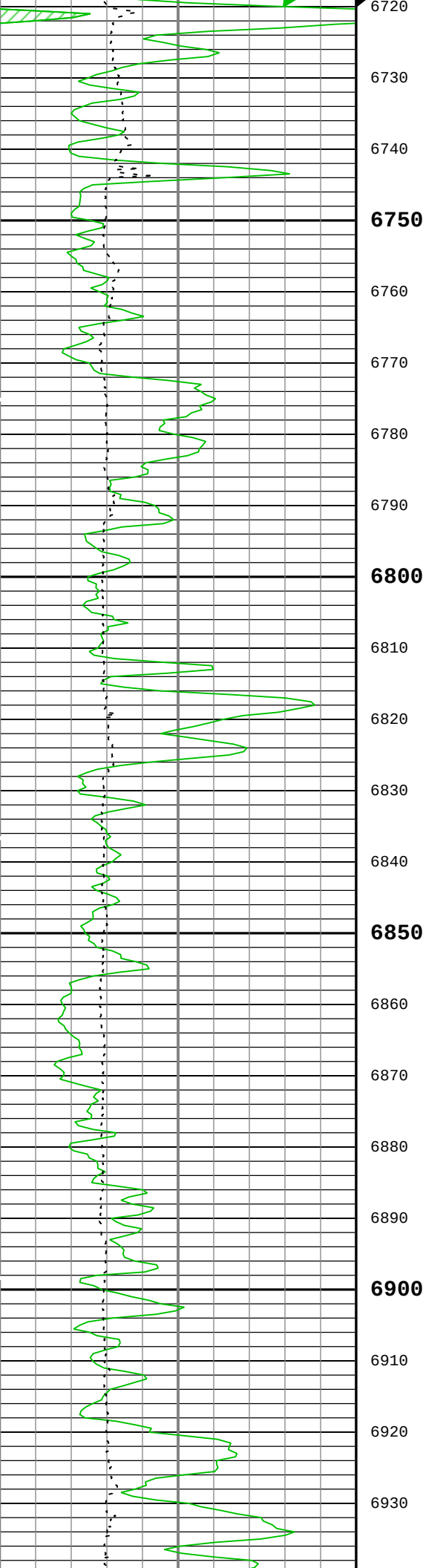


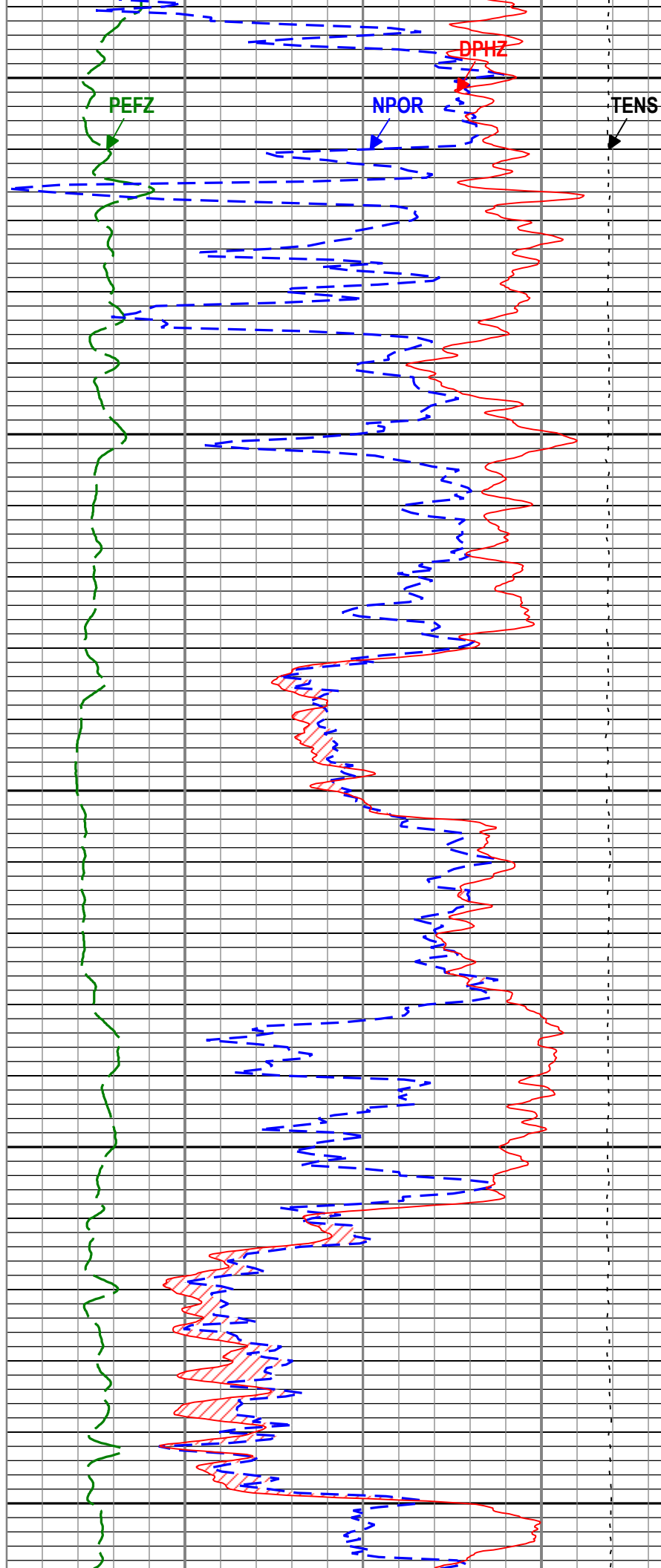
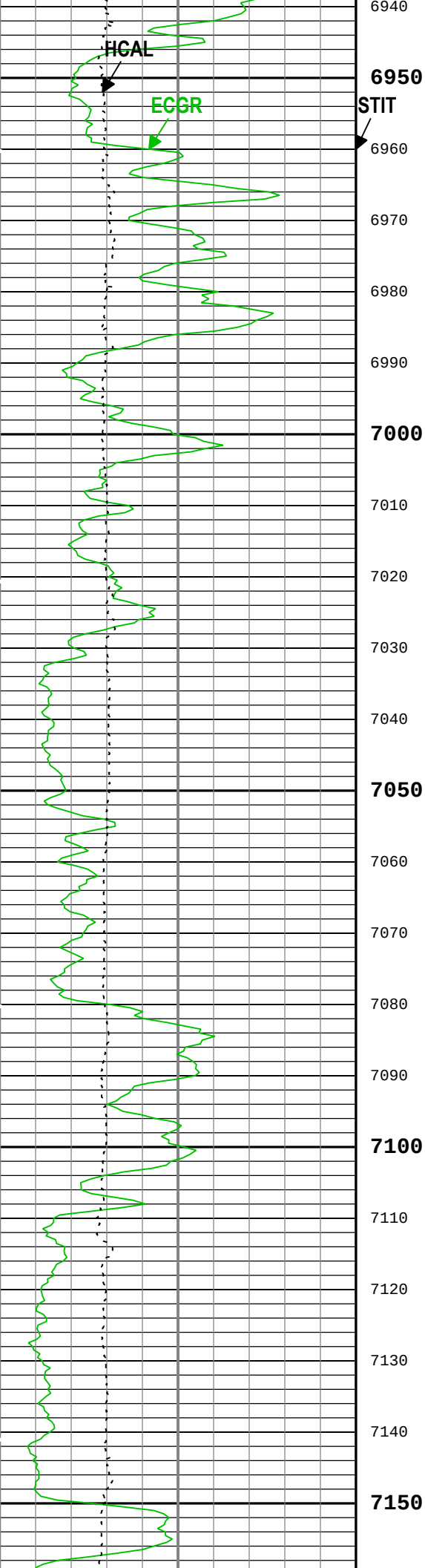


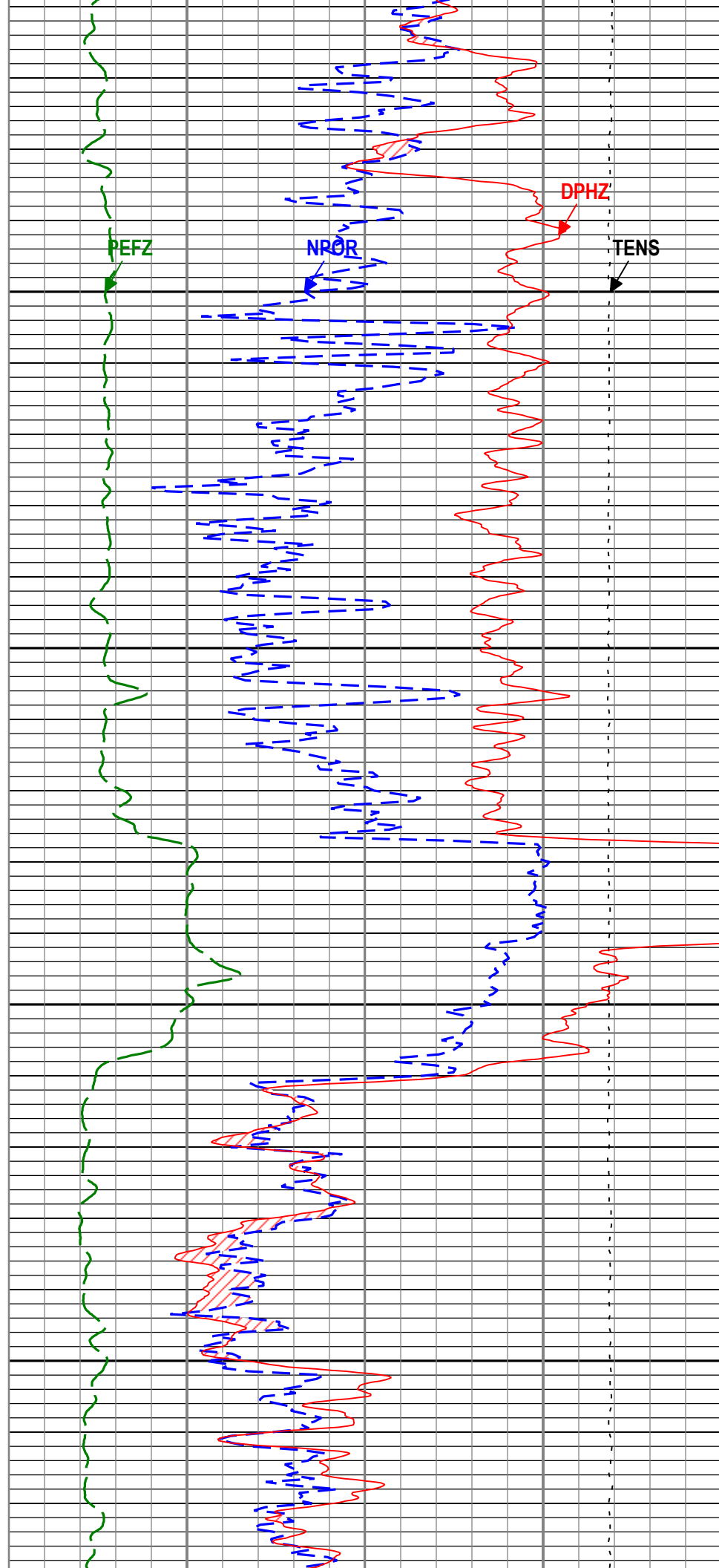
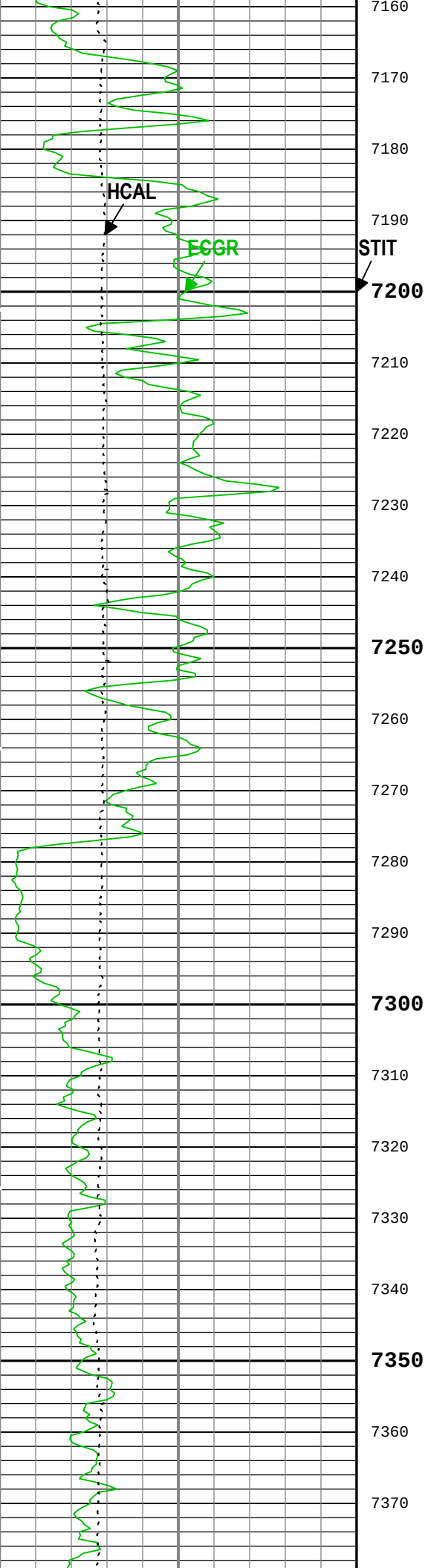


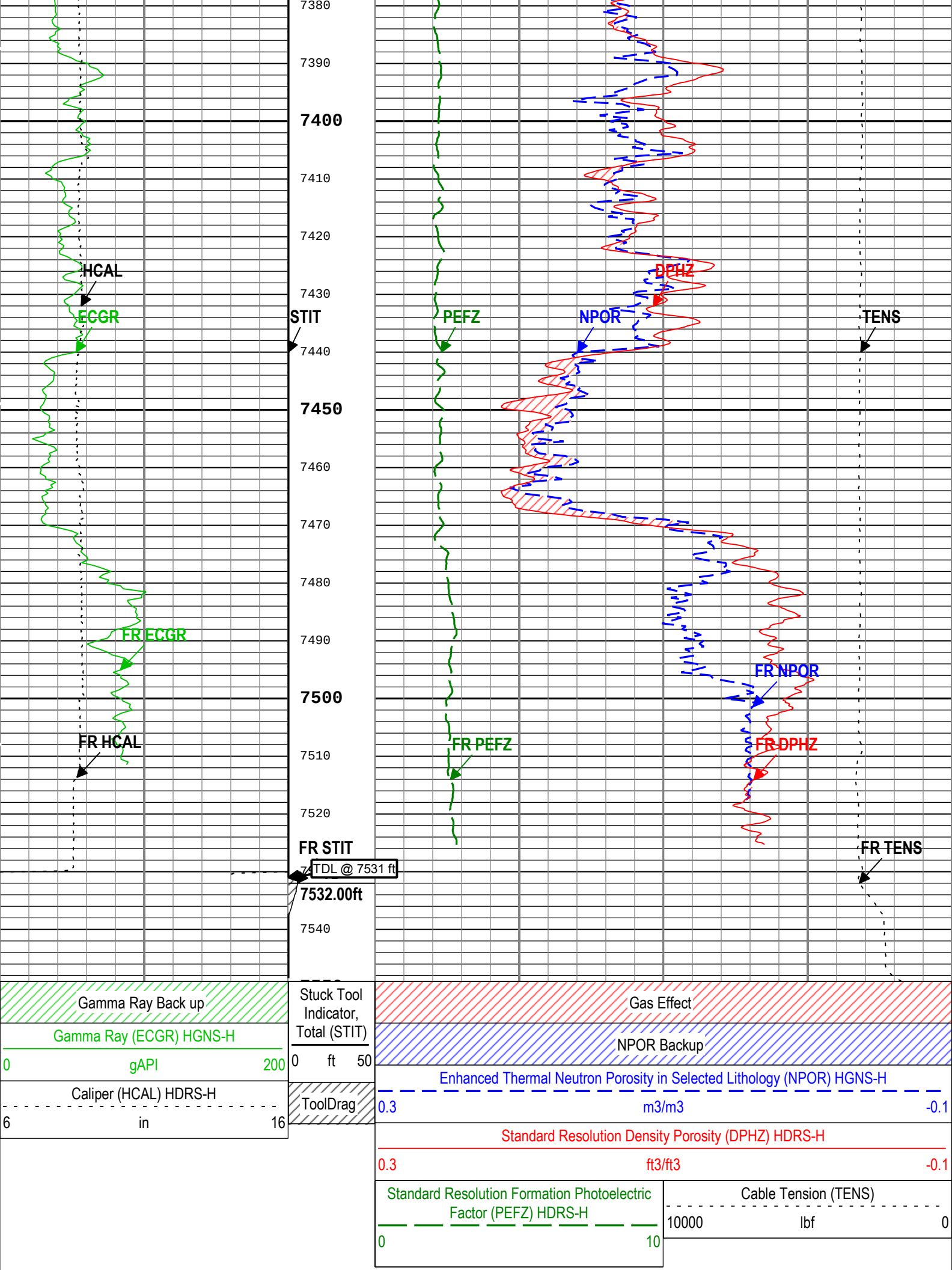












Channel Processing Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

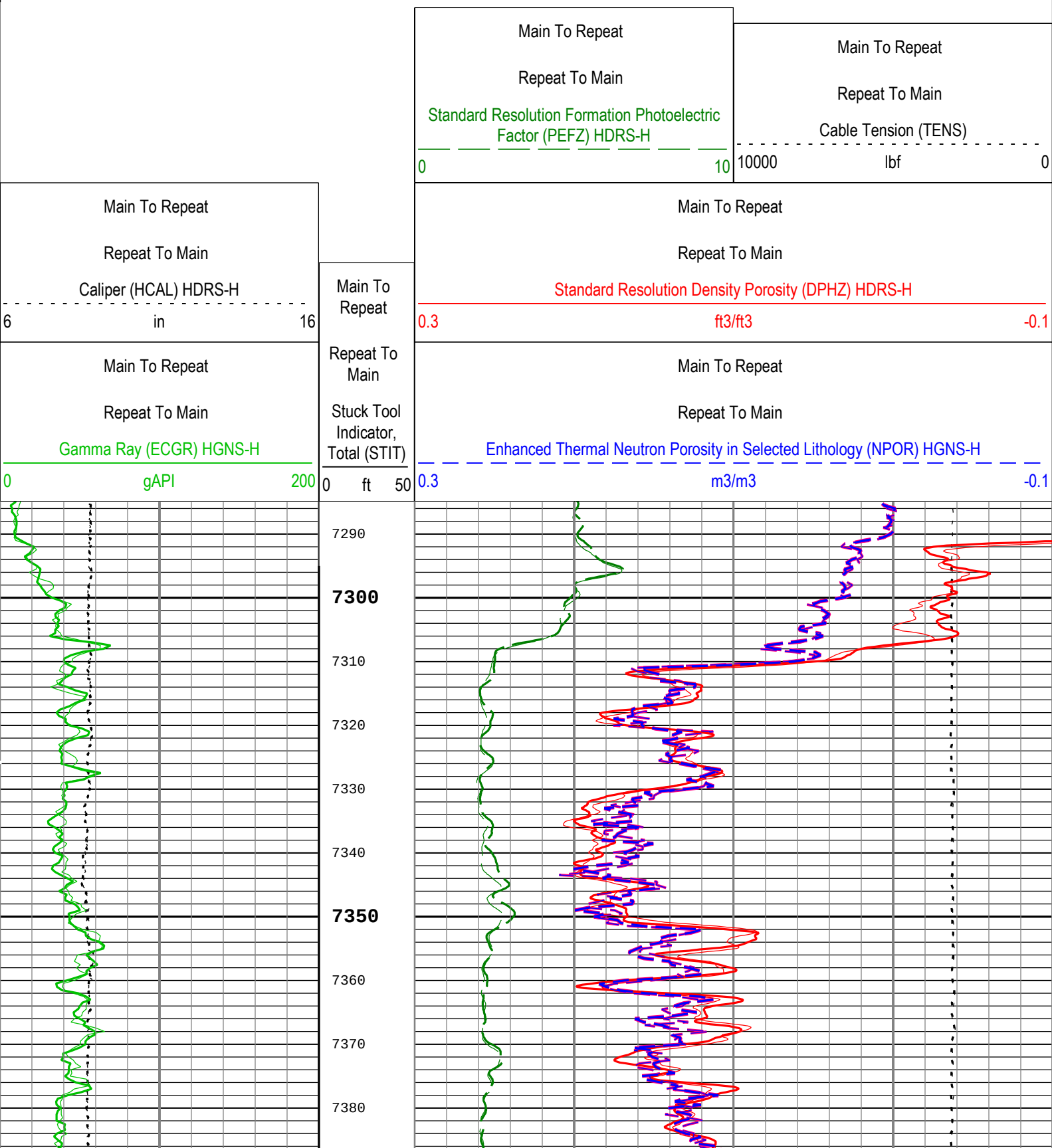
Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

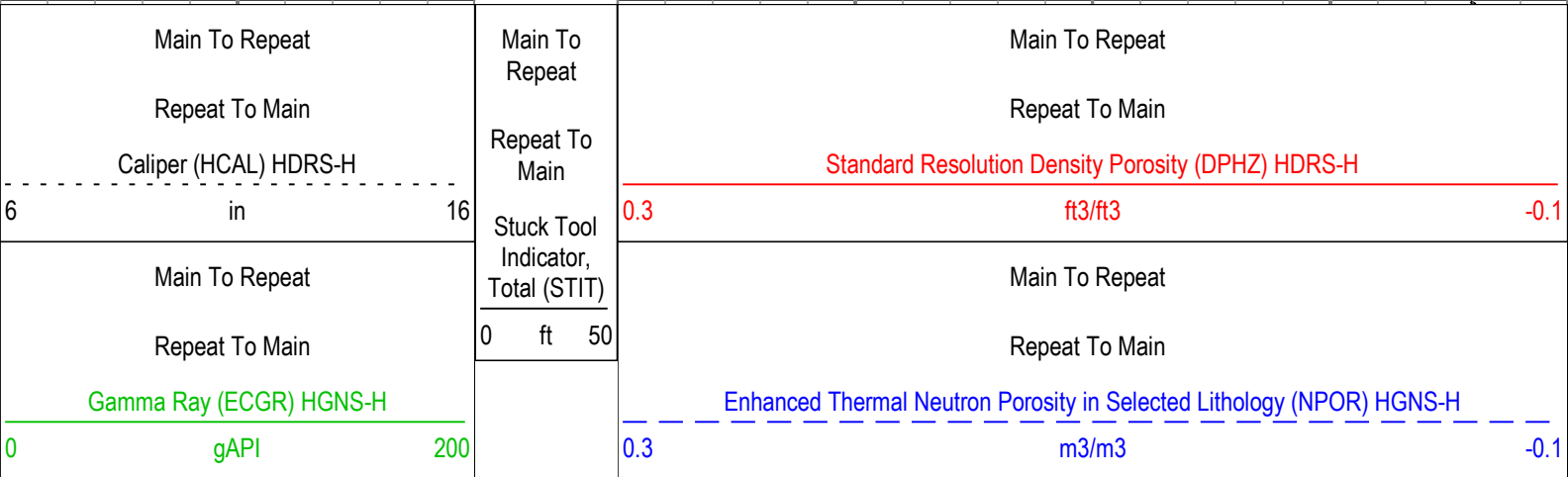
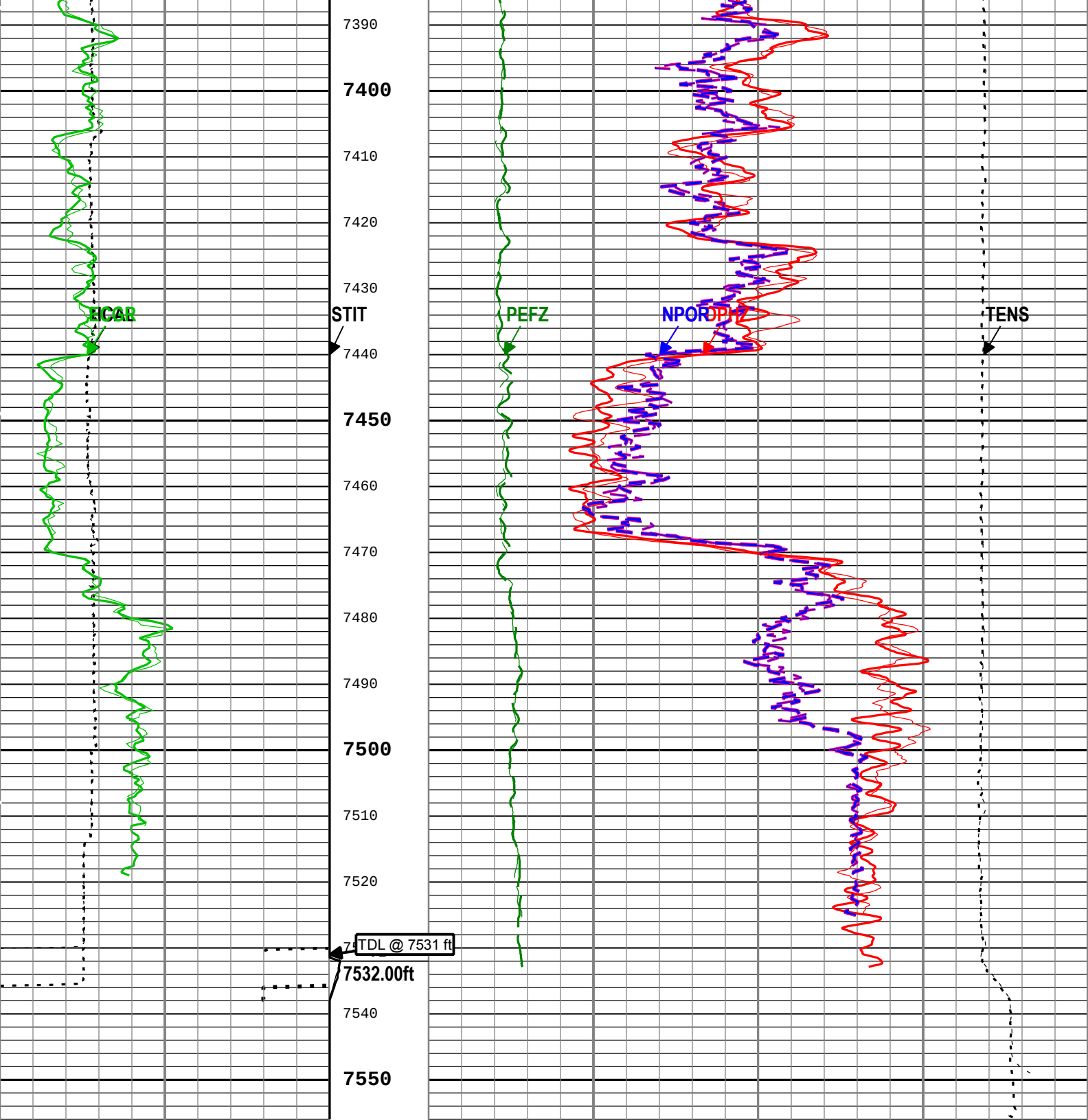
One

5" Porosity

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
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Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOAD_SPEED	Tooling Machine Loading Speed	W/ SECTION	2000	in

Calibration Report

HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One

Primary Equipment :

HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
HILT Resistivity Gamma-Ray Density Device, 150 degC	HRGD-H	4899

Auxiliary Equipment :

HRDD Backscatter Detector	Backscatter	
HRDD Long Spacing Detector	Long Spacing	
HRDD Short Spacing Detector	Short Spacing	27786
Cesium 137 Gamma-Ray Logging Source	GSR-J	5471
HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
HILT High-Resolution Mechanical Sonde, 150 degC	HRMS-H	4876

Calibration Parameter :

Small Ring Size (Caliper Calibration Small Ring)	8.00
Large Ring Size (Caliper Calibration Large Ring)	12.00

HDRS Caliper Calibration - Caliper Accumulations

Before (Measured): 21:07:42 05-Sep-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Small Ring	in	Before	8.00	6.00	7.80	10.00	
Large Ring	in	Before	12.00	9.00	12.20	15.00	

HDRS Density Calibration - Inversion Results

Master (EEPROM): 11:40:40 24-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Rho Aluminum	g/cm3	Master	2.596	2.586	2.600	2.606	
Rho Magnesium	g/cm3	Master	1.686	1.676	1.685	1.696	
Pe Aluminum		Master	2.570	2.470	2.571	2.670	
Pe Magnesium		Master	2.650	2.550	2.618	2.750	

HDRS Density Calibration - Deviation Summary

Master (EEPROM): 11:40:40 24-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Average Deviation	%	Master	0	-0.6000	0.2221	0.6000	
BS Max Deviation	%	Master	0	-1.6000	0.6566	1.6000	
SS Average Deviation	%	Master	0	-1.0000	0.2278	1.0000	
SS Max Deviation	%	Master	0	-2.5000	0.9144	2.5000	
LS Average Deviation	%	Master	0	-1.5000	0.6741	1.5000	
LS Max Deviation	%	Master	0	-3.5000	1.7270	3.5000	

HDRS Density Calibration - Background Summary

Master (EEPROM): 11:40:40 24-Aug-2016

Before (Measured):

21:08:15 05-Sep-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Window Ratio		Master	1.0000		0.7337		
		Before	0.7337	0.6970	0.7348	0.7704	
		Before-Master	-----	-----	0.0011	-----	
BS Window Sum	1/s	Master	1		25241		
		Before	25241	23979	25499	26504	
		Before-Master	-----	-----	258	-----	
SS Window Ratio		Master	1.0000		0.4797		
		Before	0.4797	0.4557	0.4811	0.5037	
		Before-Master	-----	-----	0.0014	-----	
SS Window Sum	1/s	Master	1		11057		
		Before	11057	10504	11035	11610	
		Before-Master	-----	-----	-22	-----	
LS Window Ratio		Master	1.0000		0.3012		
		Before	0.3012	0.2861	0.3073	0.3162	
		Before-Master	-----	-----	0.0061	-----	

LS Window Sum	1/s	Master Before Before-Master	1 1233 -----	1171 -----	1233 1232 -1	1294 -----	
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HDRS Density Calibration - Photo-multiplier High Voltages

Master (EEPROM): 11:40:40 24-Aug-2016		Before (Measured): 21:08:15 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS PM High Voltage	V	Master		1000	1452	2400	
		Before		1000	1449	2400	
		Before-Master	-----	-100	-3	100	
SS PM High Voltage	V	Master		1000	1410	2400	
		Before		1000	1411	2400	
		Before-Master	-----	-100	1	100	
LS PM High Voltage	V	Master		1000	1480	2400	
		Before		1000	1473	2400	
		Before-Master	-----	-100	-7	100	

HDRS Density Calibration - Crystal Quality Resolutions

Master (EEPROM): 11:40:40 24-Aug-2016		Before (Measured): 21:08:15 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Crystal Resolution	%	Master		5.00	11.74	25.00	
		Before		5.00	11.74	25.00	
		Before-Master	-----	-1.00	0.00	1.00	
SS Crystal Resolution	%	Master		5.00	10.26	20.00	
		Before		5.00	10.24	20.00	
		Before-Master	-----	-1.00	-0.02	1.00	
LS Crystal Resolution	%	Master		5.00	8.09	20.00	
		Before		5.00	7.85	20.00	
		Before-Master	-----	-1.00	-0.24	1.00	

HDRS MCFL Calibration - MCFL Accumulations

Before (Measured): 21:10:47 05-Sep-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Main Resistivity	ohm.m	Before	3875	3565	3886	4185	
Deep Resistivity	ohm.m	Before	3830	3524	3830	4136	
Shallow Resistivity	ohm.m	Before	3830	3524	3839	4136	

HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One

Primary Equipment :			
HILT Gamma-Ray and Neutron Sonde, 150 degC		HGNS-H	4817
Auxiliary Equipment :			
HGNS Accelerometer, 150 degC		HACCZ-H	6991
AmBe Neutron Logging Source		NSR-F	5068
Calibration Parameter :			
Water Temperature			
Housing Size			
JIG-BKG (Jig minus background reference)		165	

HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured): 05:14:18 07-Sep-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
AZ Vertical Measurement	ft/s2	Before	32.2	31.5	32.0	32.8	

HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM): 00:00:00 15-May-2007							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Accelerometer Manufacturer		Master			QAT_160		
Accelerometer Reference Temperature	degF	Master		30.2	77.0	122.0	
Accelerometer Coefficients - 0		Master	-----	-----	-4298.000	-----	
Accelerometer Coefficients - 1		Master	-----	-----	50.180	-----	

Accelerometer Coefficients - 2		Master	-----	-----	-0.002	-----	
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 4		Master	-----	-----	2.754	-----	
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 7		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 8		Master	-----	-----	300.500	-----	
Accelerometer Coefficients - 9		Master	-----	-----	0.994	-----	

HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM):		15:25:00 19-Jul-2016		Before (Measured):		21:06:20 05-Sep-2016			
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit			
Near Zero Measurement	1/s	Master	0	5.0	27.6	40.0			
		Before	0	5.0	28.2	40.0			
		Before-Master	----	-4.1	0.6	4.1			
Far Zero Measurement	1/s	Master	0	5.0	29.5	40.0			
		Before	0	5.0	29.7	40.0			
		Before-Master	----	-4.4	0.2	4.4			
Near Plus Measurement	1/s	Master	6031.0	4700.0	5290.0	6900.0			
		Before	----	----	----	----			
		Before-Master	----	----	----	----			
Far Plus Measurement	1/s	Master	2793.0	1900.0	2194.0	2900.0			
		Before	----	----	----	----			
		Before-Master	----	----	----	----			
Near Corrected Plus Measurement	1/s	Master		4700.0	5156.0	6900.0			
		Before	----	----	----	----			
		Before-Master	----	----	----	----			
Far Corrected Plus Measurement	1/s	Master		1900.0	2097.0	2900.0			
		Before	----	----	----	----			
		Before-Master	----	----	----	----			

HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured):		21:11:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RGR Zero Measurement	gAPI	Before	30.0	0	78.9	120.0	
RGR Plus Measurement	gAPI	Before	185.4	157.1	165.1	206.3	
GR Calibration Gain		Before	0.89	0.80	1.00	1.05	

Company:	Western Refining, Southwest, Inc.	Schlumberger
Well:	WWD #2	
Field:	Wildcat	
County:	San Juan	
State:	New Mexico	
Platform Express		
Compensated Neutron		
Litho-Density		

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express	
Array Induction	
with Linear Correlation	
County: San Juan	Well: WWD #2
Field: Wildcat	Location: Sec 27, T29N, R11W
Well: WWD #2	Company: Western Refining, Southwest, Inc.
Location: Sec 27, T29N, R11W	Elev.: K.B. 5550.00 ft
SHL: 2028' FNL X 111' FEL	G.L. 5535.00 ft
Lat/Long: 36.6986/-107.97035	D.F. 5549.00 ft
Permanent Datum:	Ground Level
Log Measured From:	Kelly Bushing
Drilling Measured From:	Kelly Bushing
API Serial No. 30-045-35747-0000	Section: 27
	Township: 29N
	Range: 11W

Logging Date	05-Sep-2016
Run Number	One
Depth Driller	7525.00 ft
Schlumberger Depth	7532.00 ft
Bottom Log Interval	7532.00 ft
Top Log Interval	3498.00 ft
Casing Driller Size @ Depth	9.625 in @ 3500.00 ft
Casing Schlumberger	3498 ft
Bit Size	8.75 in
Type Fluid In Hole	WBM
Density	9.9 lbm/gal
Fluid Loss	PH 9 cm3
Source of Sample	Active Tank
RM @ Meas Temp	1.13 ohm.m @ 68 degF
RMF @ Meas Temp	0.9 ohm.m @ 68 degF
RMC @ Meas Temp	1.4 ohm.m @ 68 degF
Source RMF	RMC Pressed
RM @ BHT	0.46 @ 177 0.37 @ 177
Max Recorded Temperatures	177 degF
Circulation Stopped	06-Sep-2016 20:25:00
Logger on Bottom	07-Sep-2016 05:00:00
Unit Number	9115
Recorded By	Avery Becker
Witnessed By	Larry Candelaria

Disclaimer

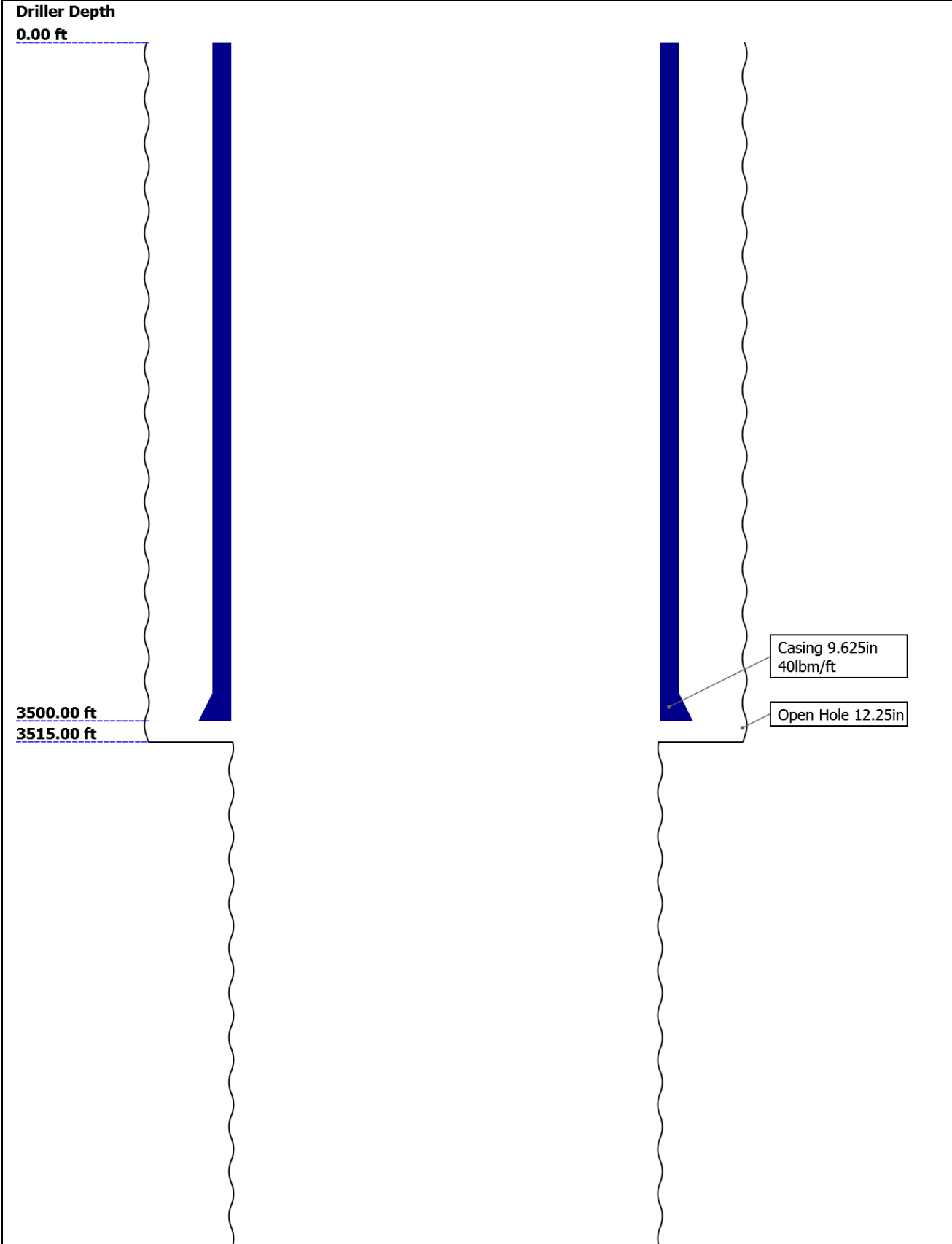
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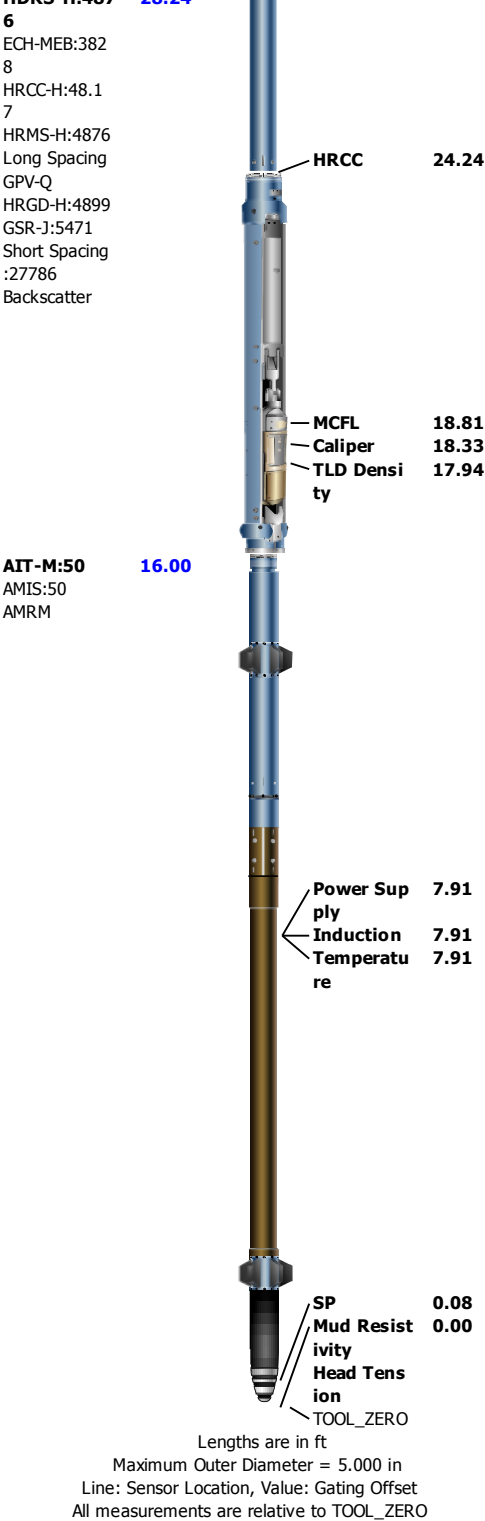
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Well Sketch





Depth Summary

	One		
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Depth Measuring Device

Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		

Tension Device

Type	CMTD-B/A		
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Serial Number	147	
Calibration Date	18-Aug-2016	
Calibrator Serial Number	78805A	
Number of Calibration Points	10	
Calibration Root Mean Square Error	7	
Calibration Peak Error	10	

Logging Cable

Type	7-46A-XS		
Serial Number	U715043		
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Land		

One:Depth Control Parameters

Depth Control Remarks

Log Sequence	First Log In the Well	First run in well depth control procedures followed
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary
Rig Up Length At Bottom		
Rig Up Length Correction		
Stretch Correction		
Tool Zero Check At Surface		

One

2" Induction

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
ICV	Integrated Cement Volume	GCSE_UP_PASS, FCD	623.08	ft3

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

One: Log[4]:Up:S012

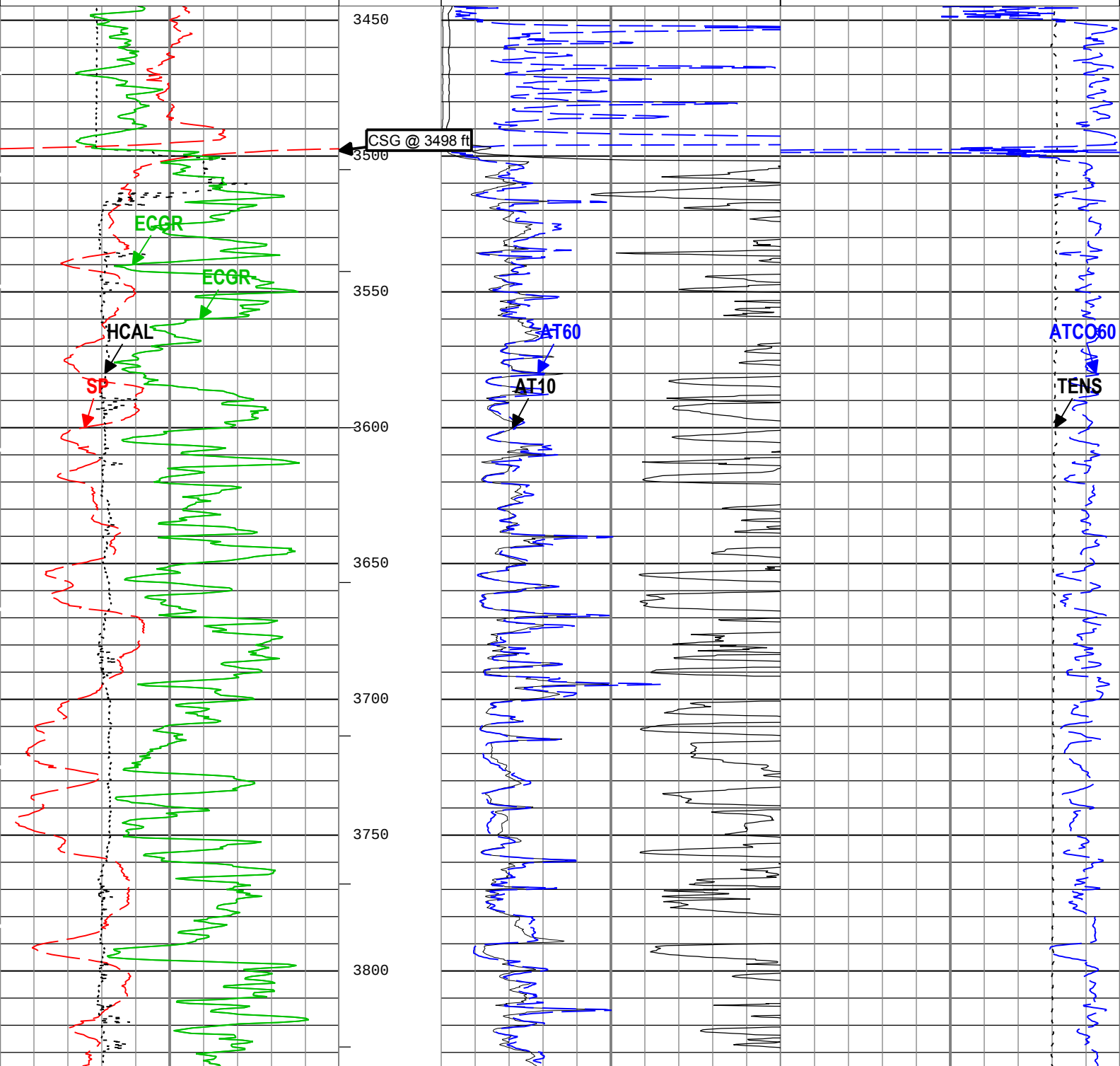
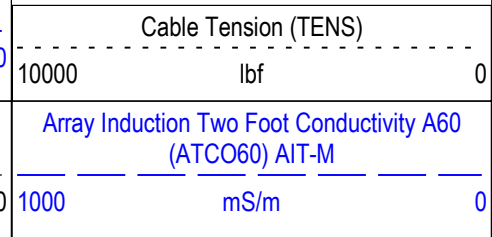
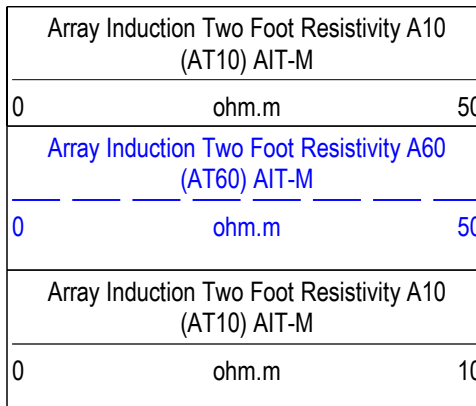
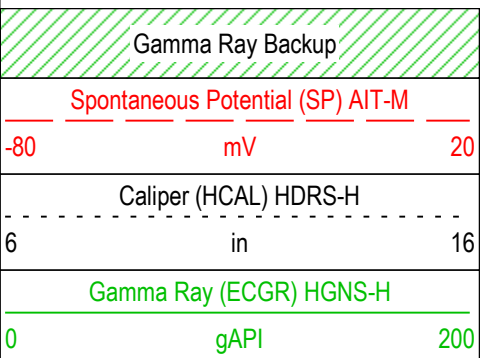
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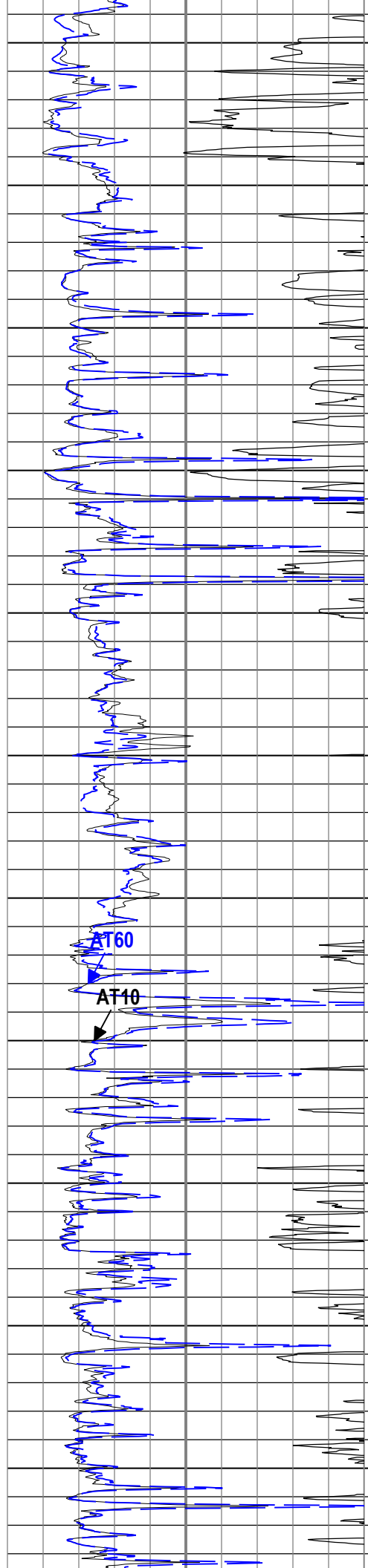
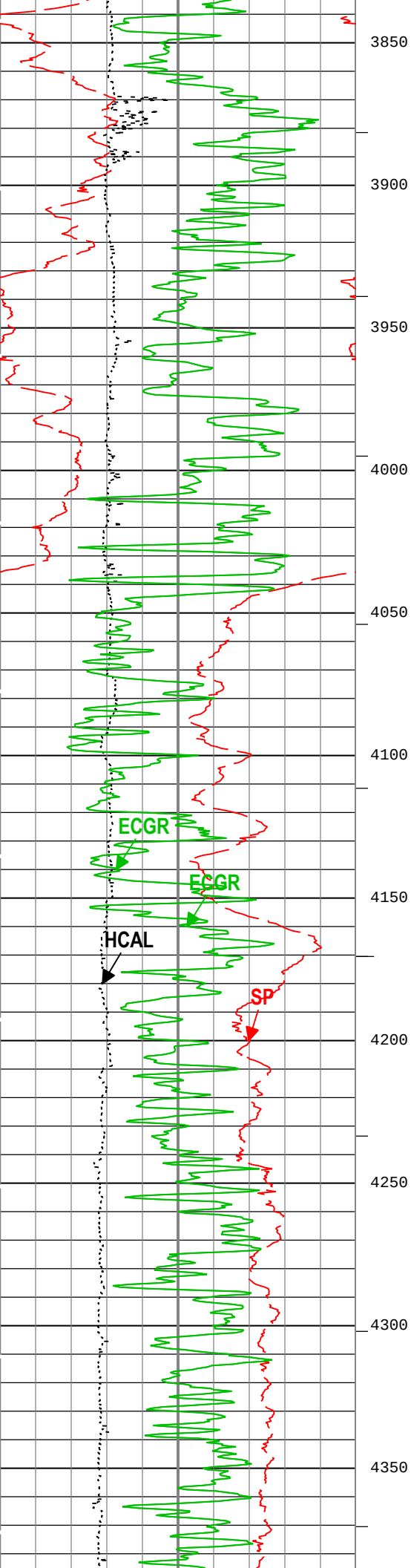
Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT60	AIT-M:AMIS:AMIS	3in
ATCO60	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
GR	HGNS-H:HGNS-H:HGNS-H	6in
ICV	Borehole	6in - RT
SP	AIT-M:AMIS:AMIS	6in
TENS	WI Workflow	6in

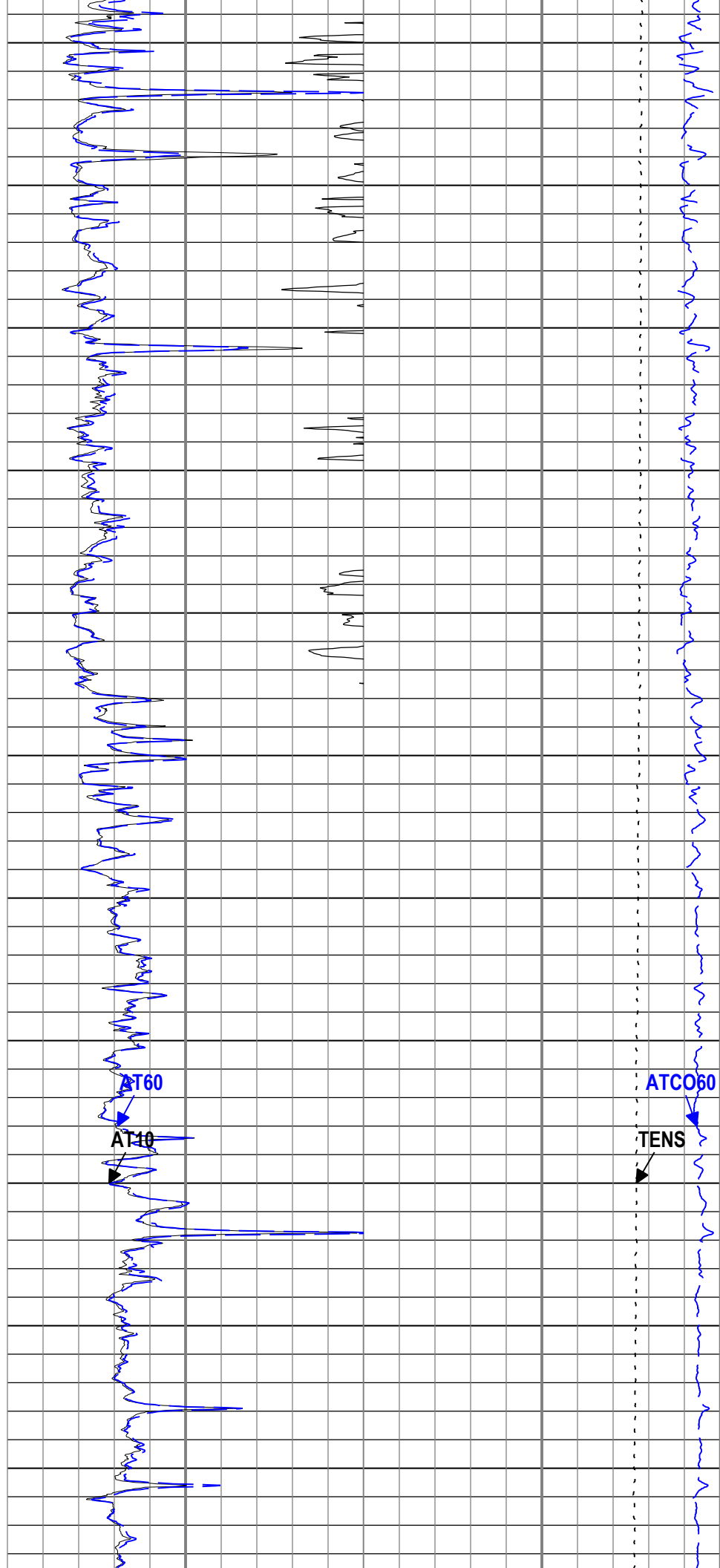
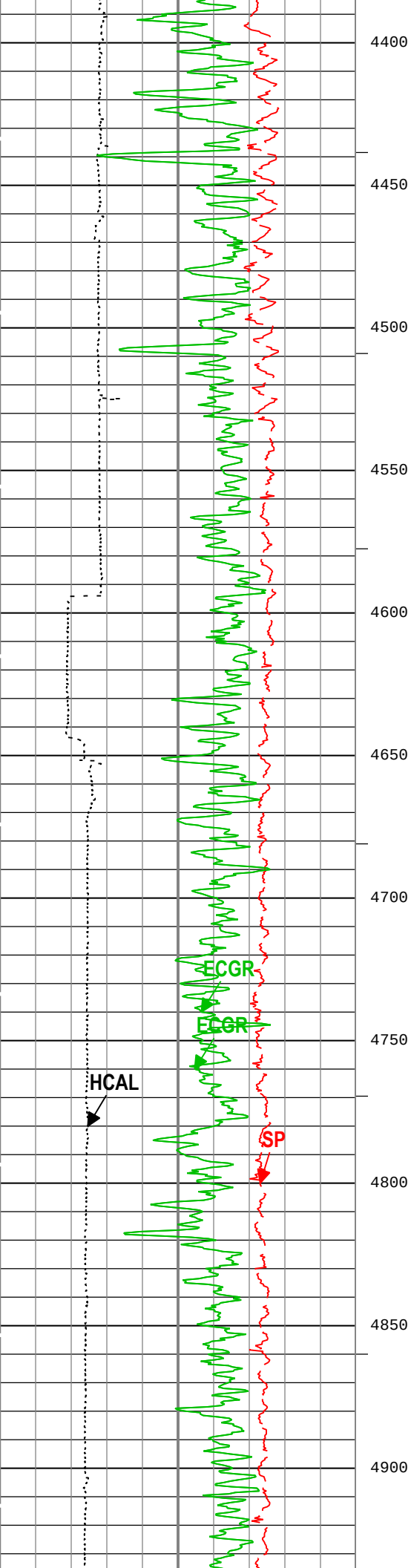
TIME_1900 - Time Marked every 60.00 (s)

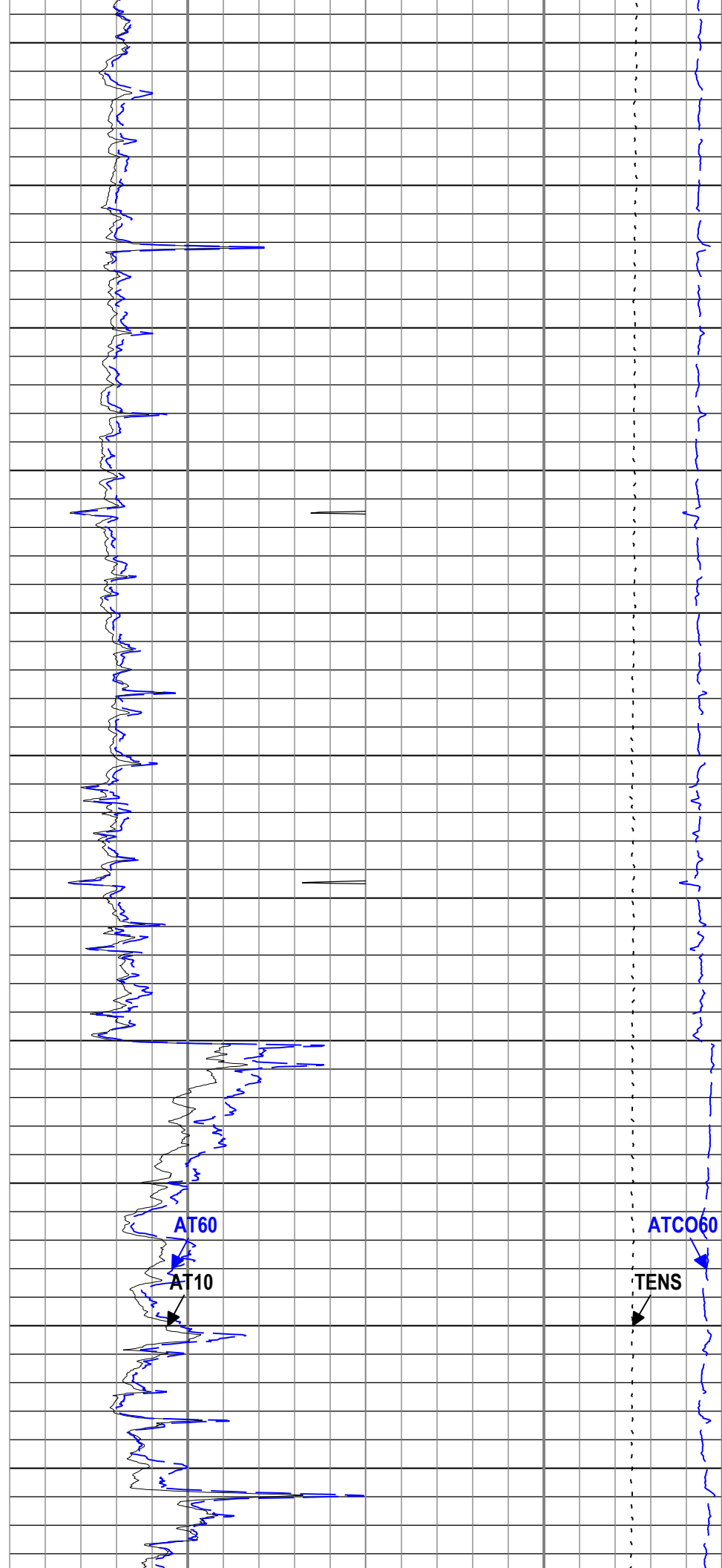
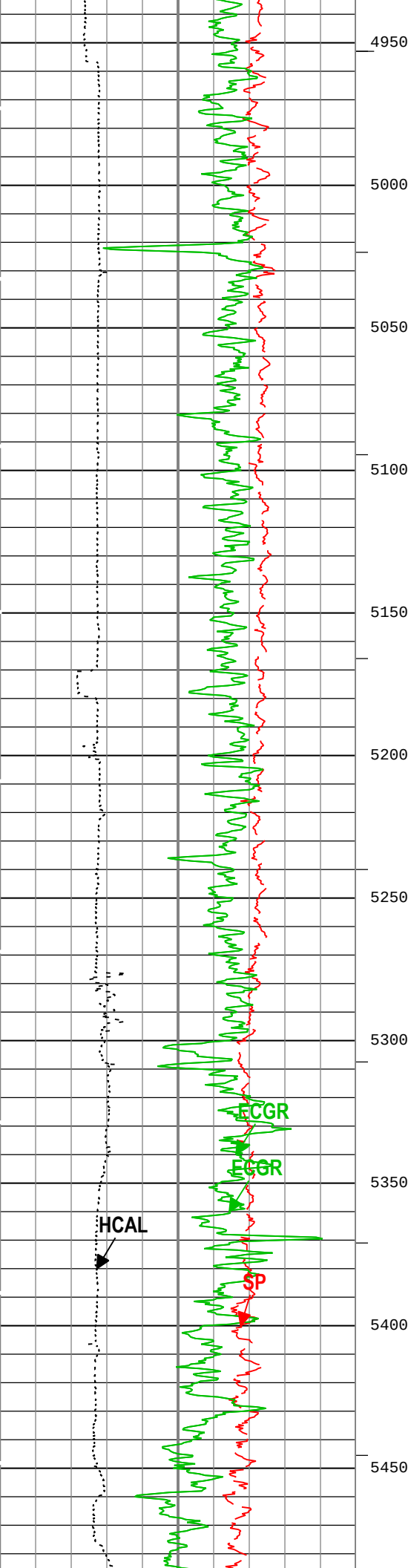
ICV - Integrated Cement Volume every 10.00 (ft3)

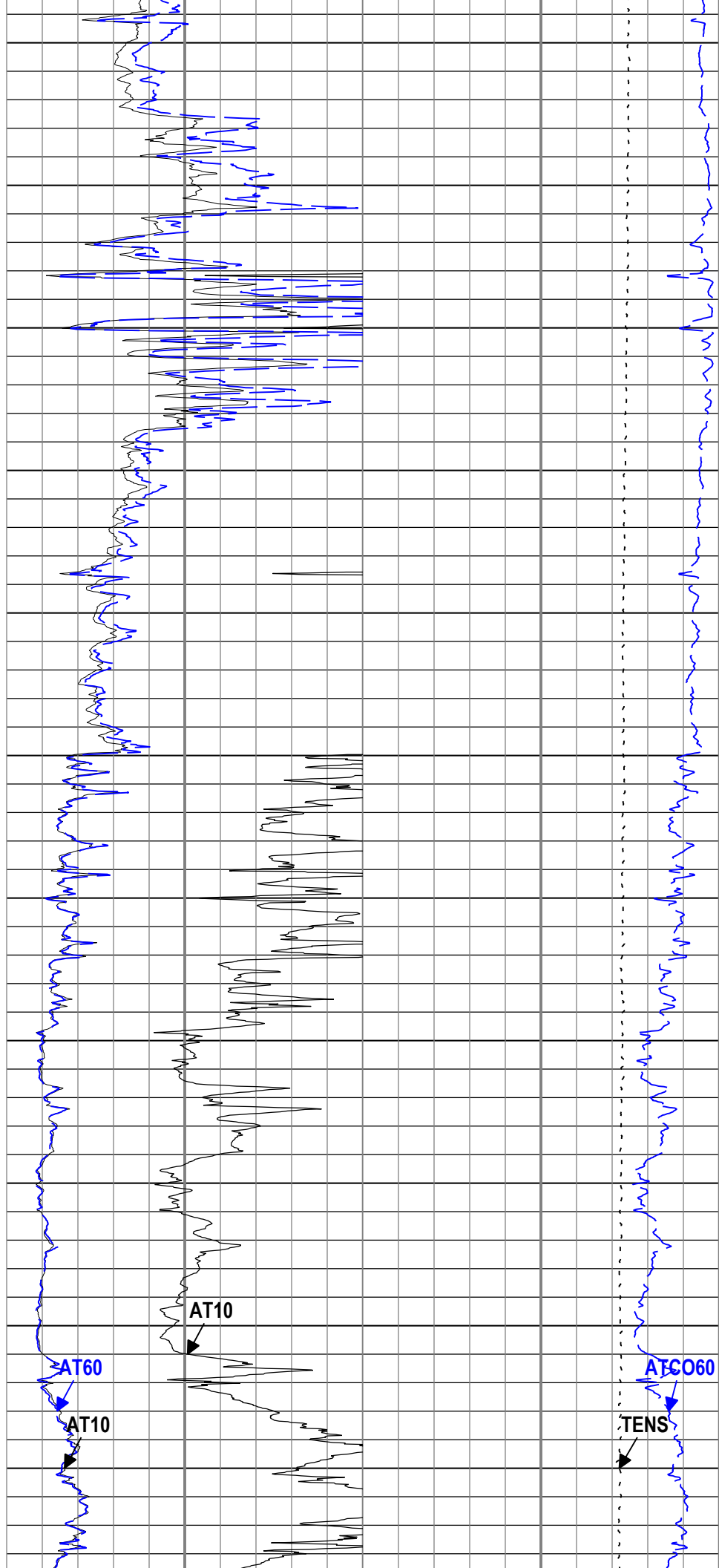
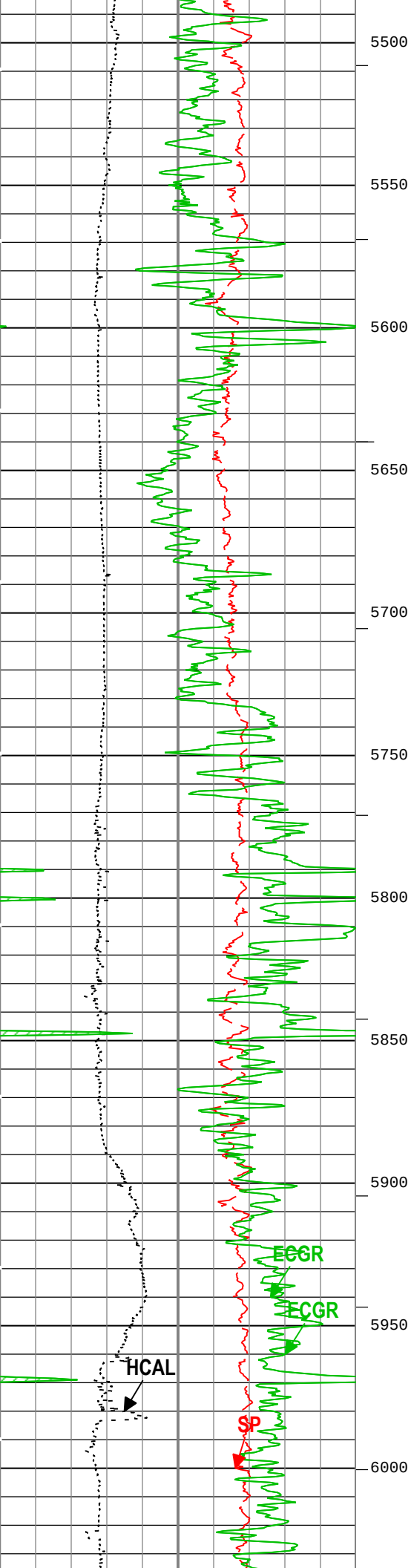
ICV - Integrated Cement Volume every 100.00 (ft3)

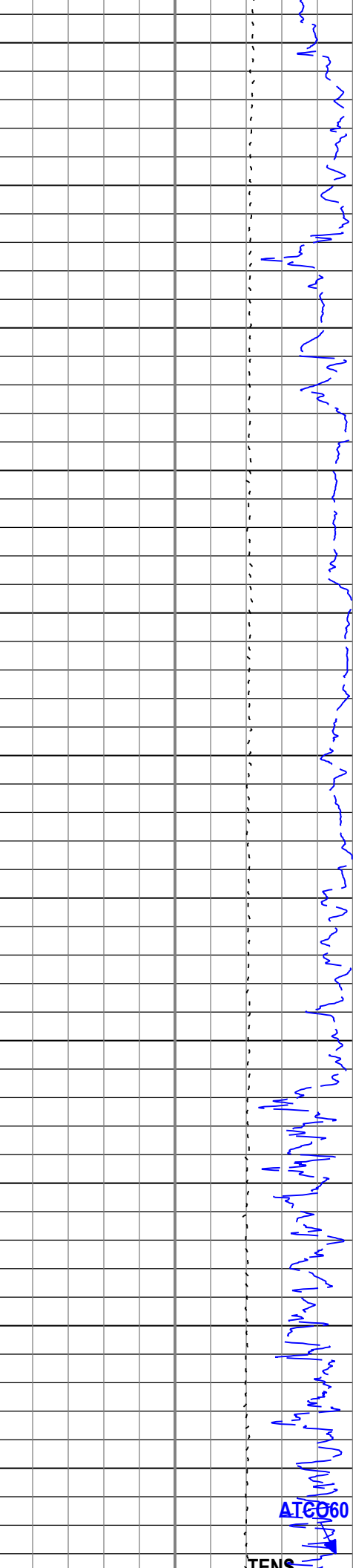
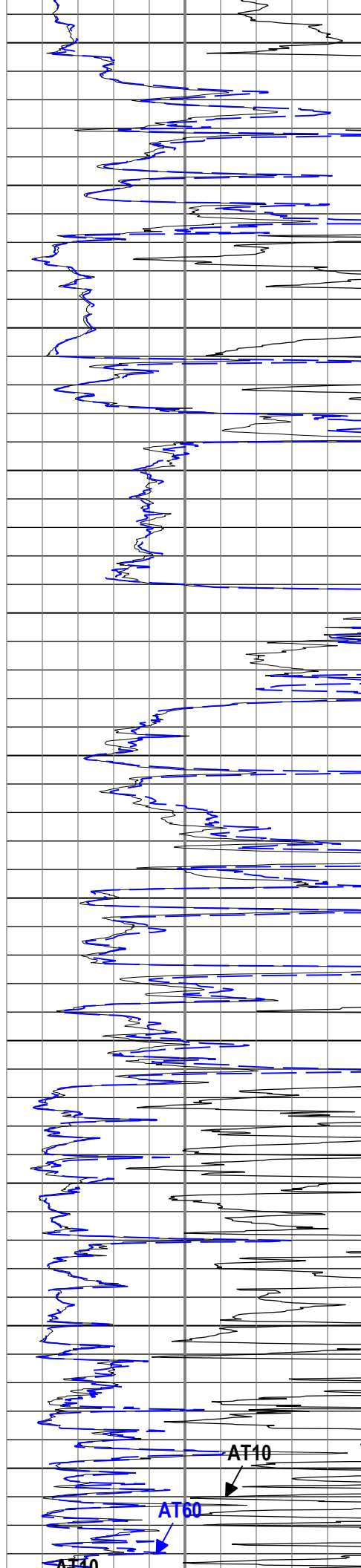
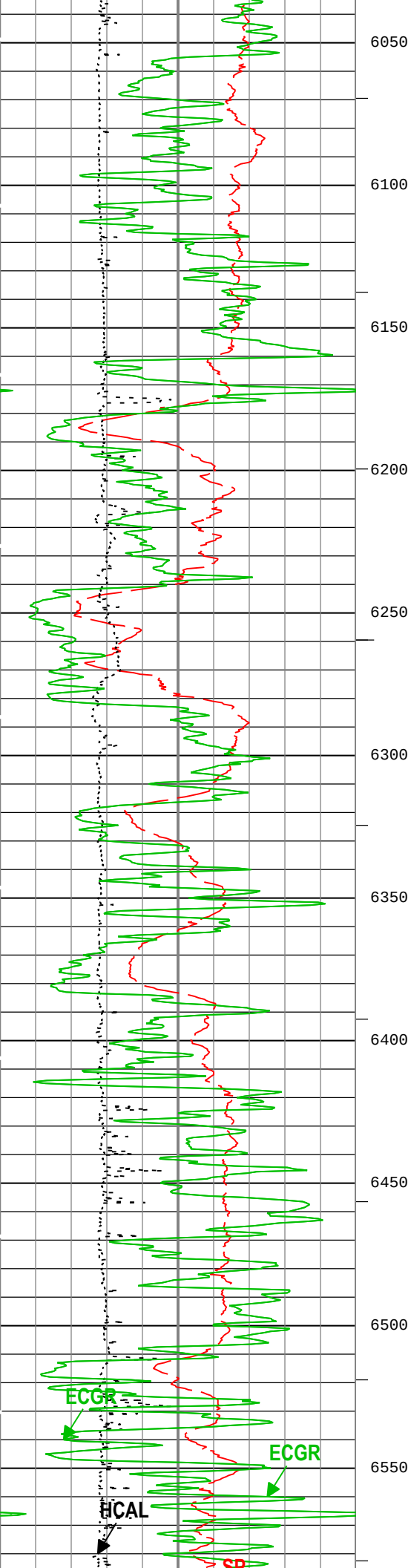


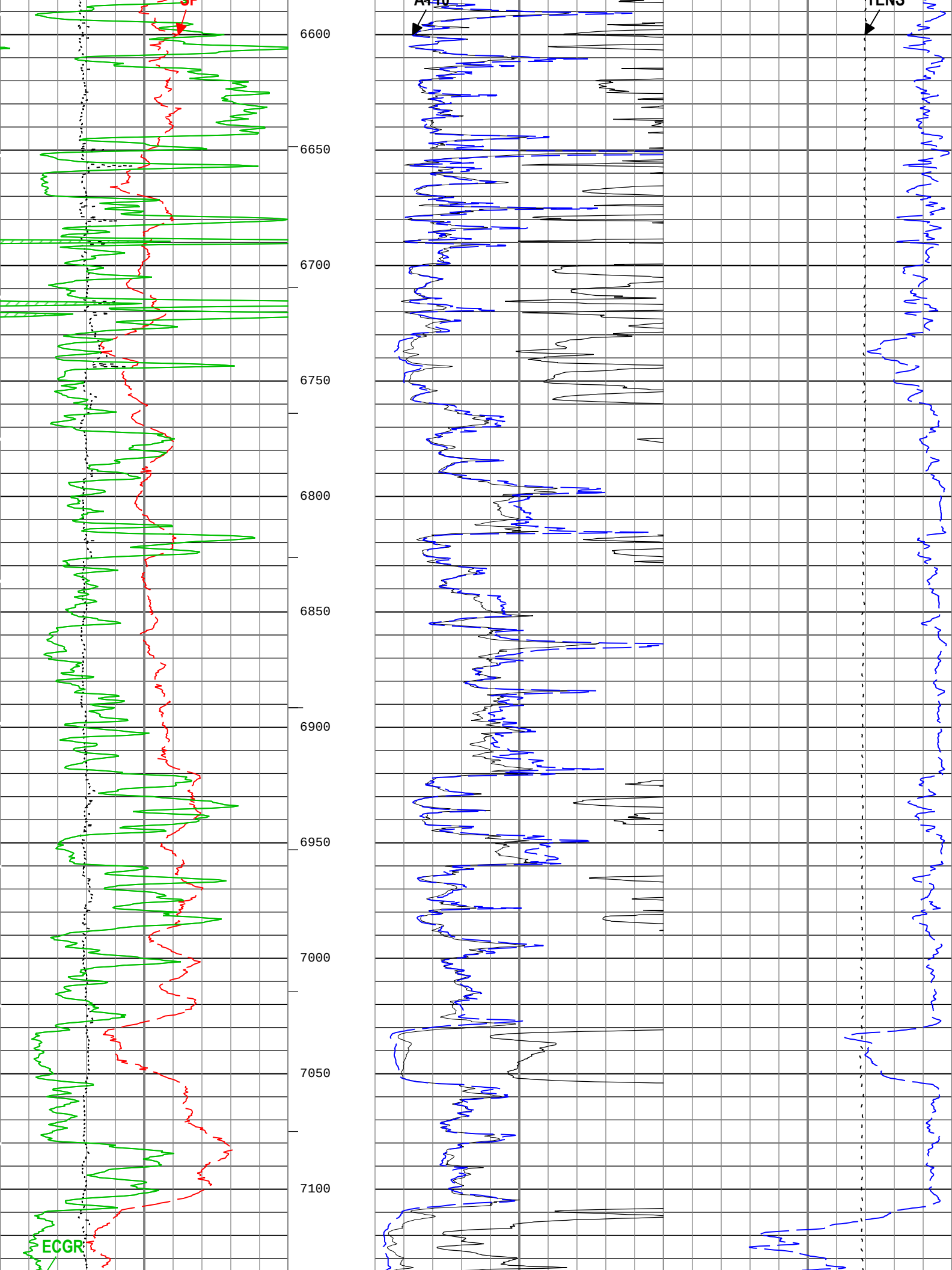


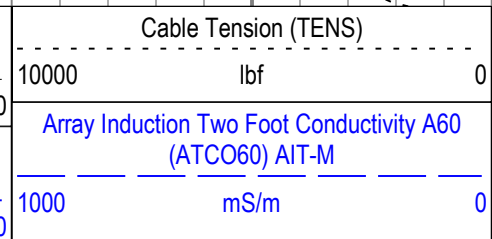
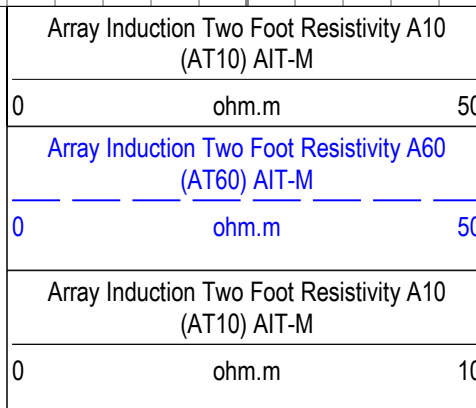
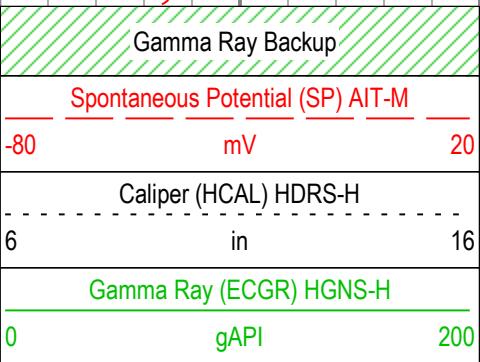
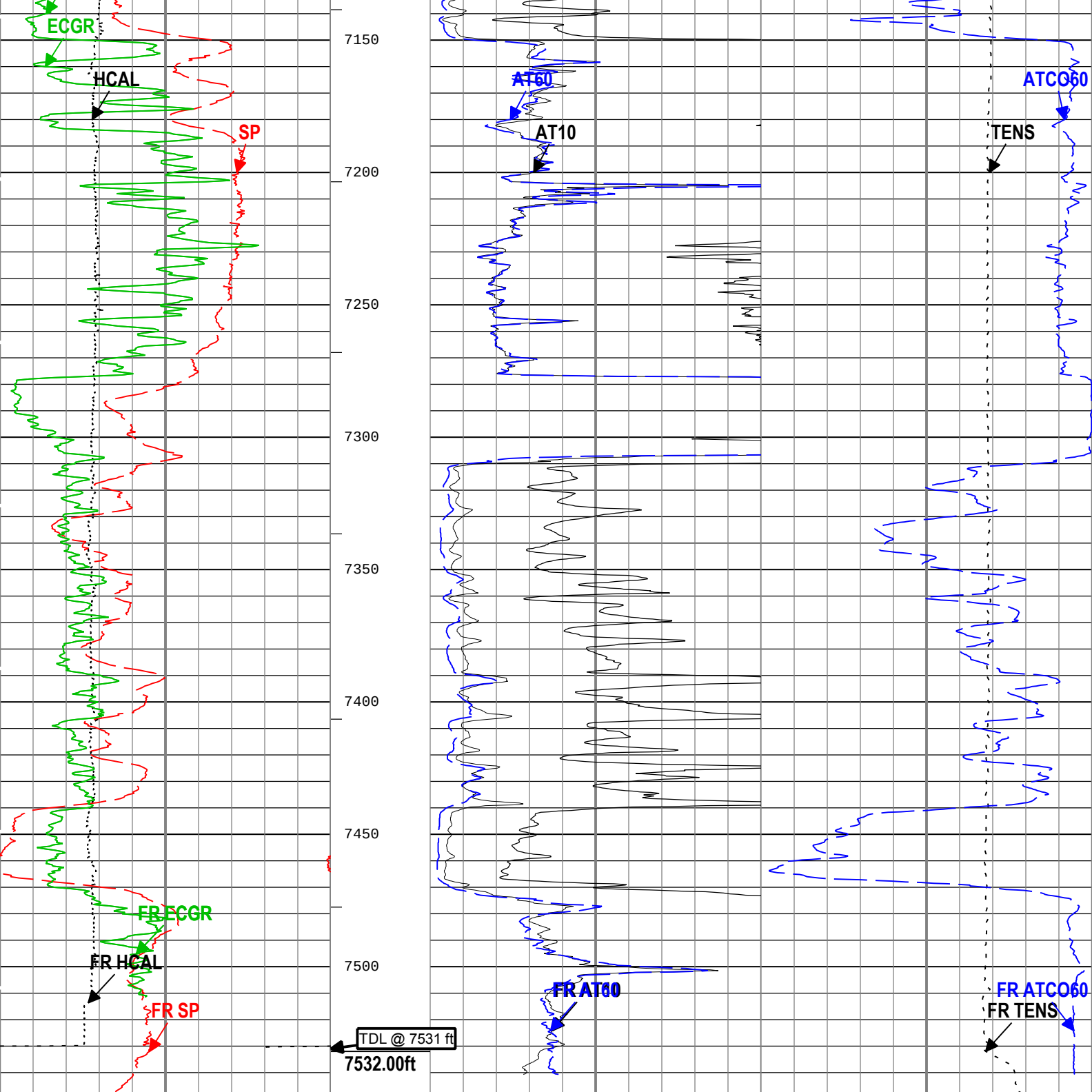












ICV - Integrated Cement Volume every 100.00 (ft3)

ICV - Integrated Cement Volume every 10.00 (ft3)

Channel Processing Parameters**One: Parameters**

Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depths are actual.

Tool Control Parameters**One: Parameters**

Parameter	Description	Tool	Value	Unit
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One**5" Induction****Integration Summary**

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
ICV	Integrated Cement Volume	GCSE_UP_PASS, FCD	623.08	ft3
IHV	Integrated Hole Volume	GCSE_UP_PASS	1705.5	ft3

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero.

Description: AIT Basic Log Two Format: Log (Induction-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:14

Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT20	AIT-M:AMIS:AMIS	3in
AT30	AIT-M:AMIS:AMIS	3in
AT60	AIT-M:AMIS:AMIS	3in
AT90	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
GR	HGNS-H:HGNS-H:HGNS-H	6in
ICV	Borehole	6in - RT
IHV	Borehole	6in - RT
SP	AIT-M:AMIS:AMIS	6in
TENS	WLWorkflow	6in
TIME_1900	WLWorkflow	0.1in

— IHV - Integrated Hole Volume every 10.00 (ft3)

— IHV - Integrated Hole Volume every 100.00 (ft3)

— ICV - Integrated Cement Volume every 10.00 (ft3)

— ICV - Integrated Cement Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

Cable Tension (TENS)

10000

lbf

0

Array Induction Two Foot Resistivity A10 (AT10) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A20 (AT20) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A60 (AT60) AIT-M

0.2

ohm.m

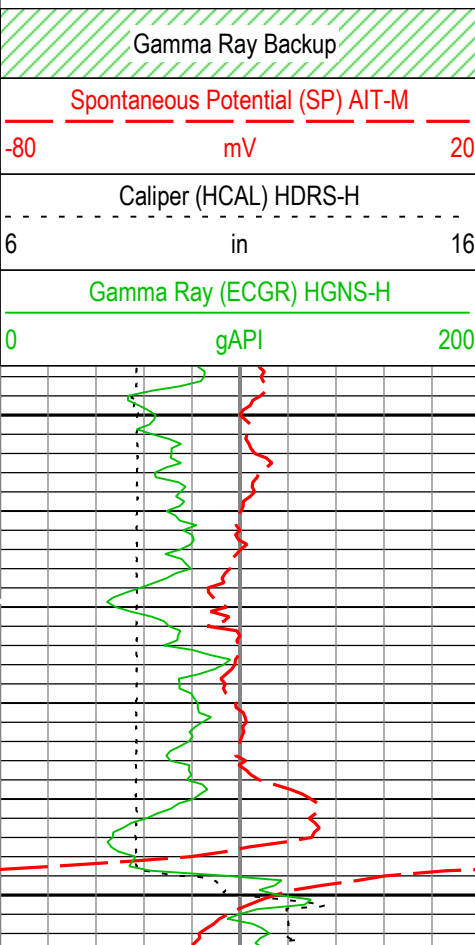
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Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2

ohm.m

2000



3450

3460

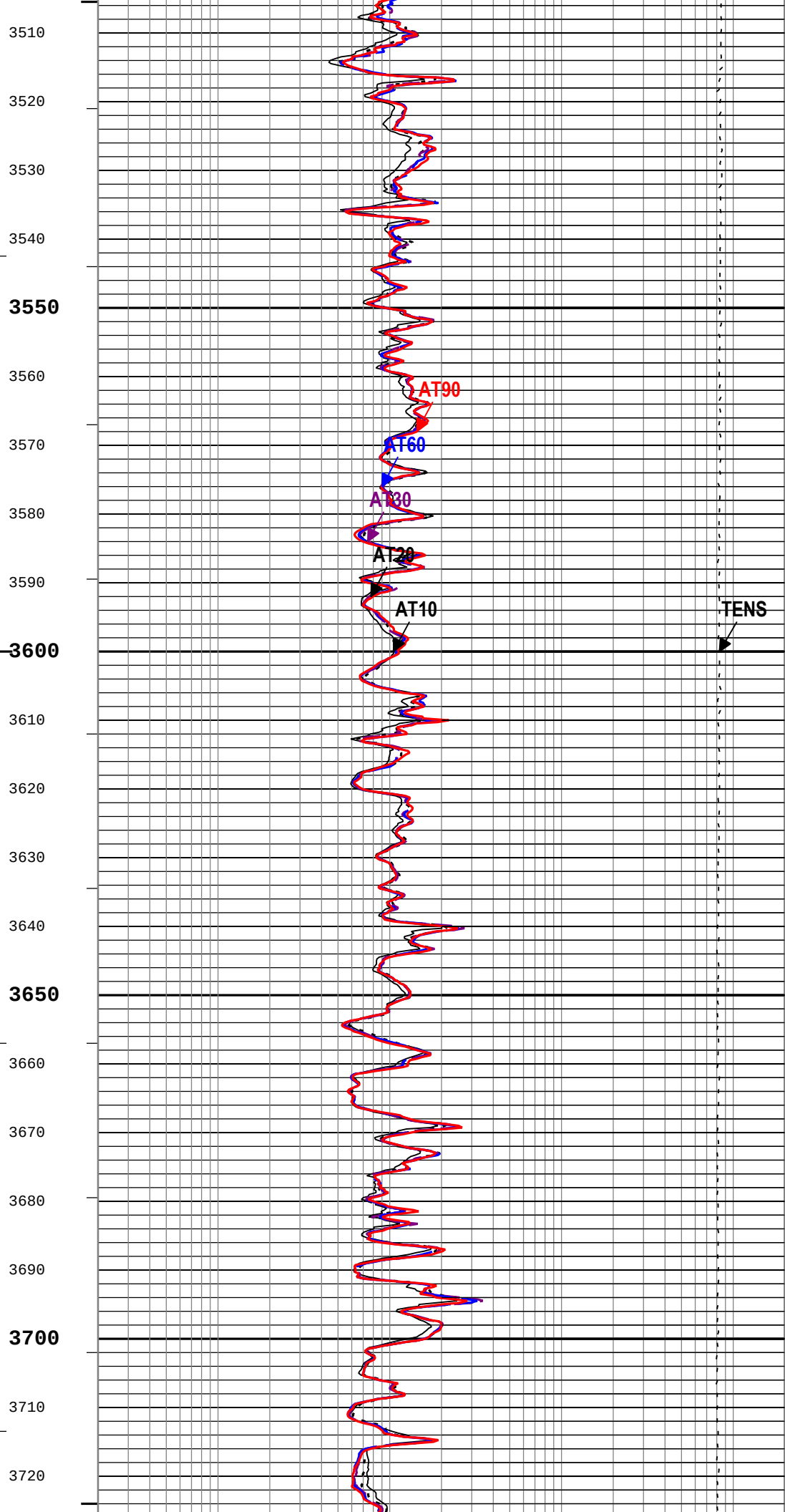
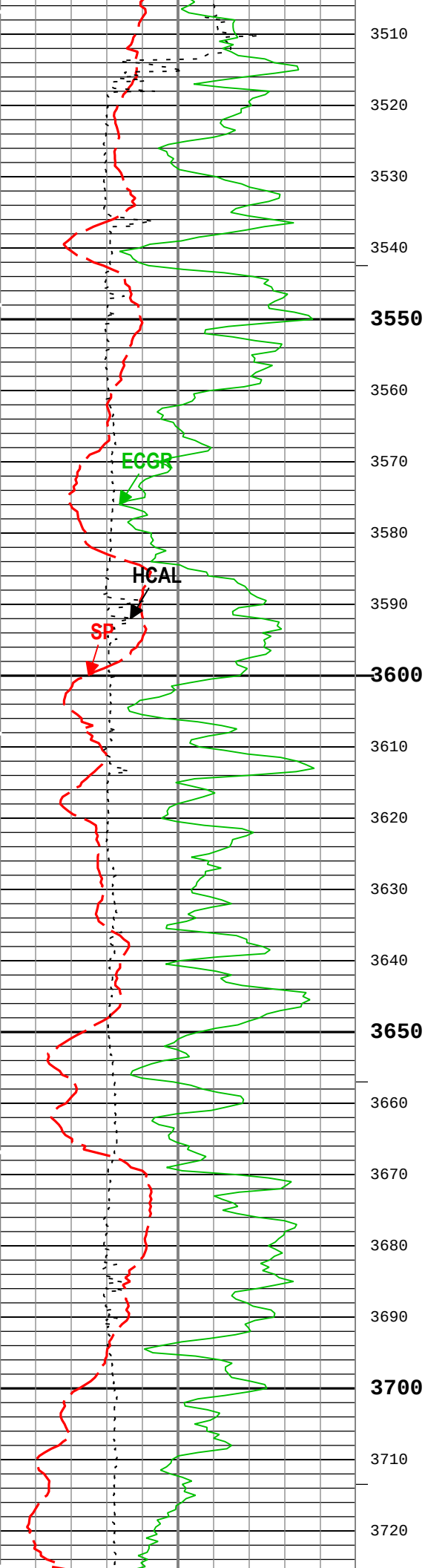
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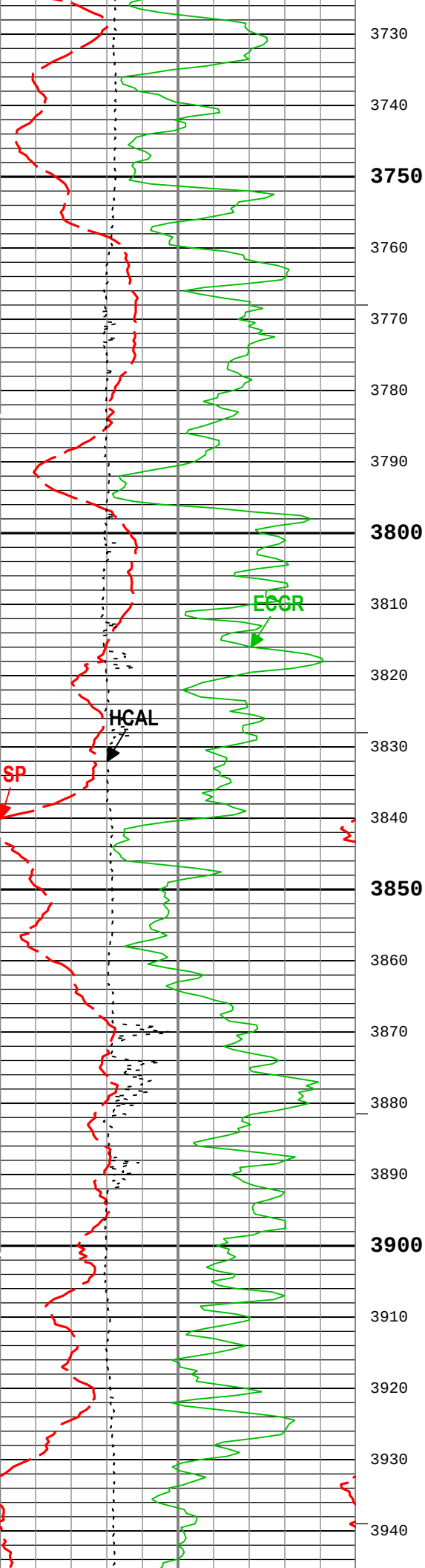
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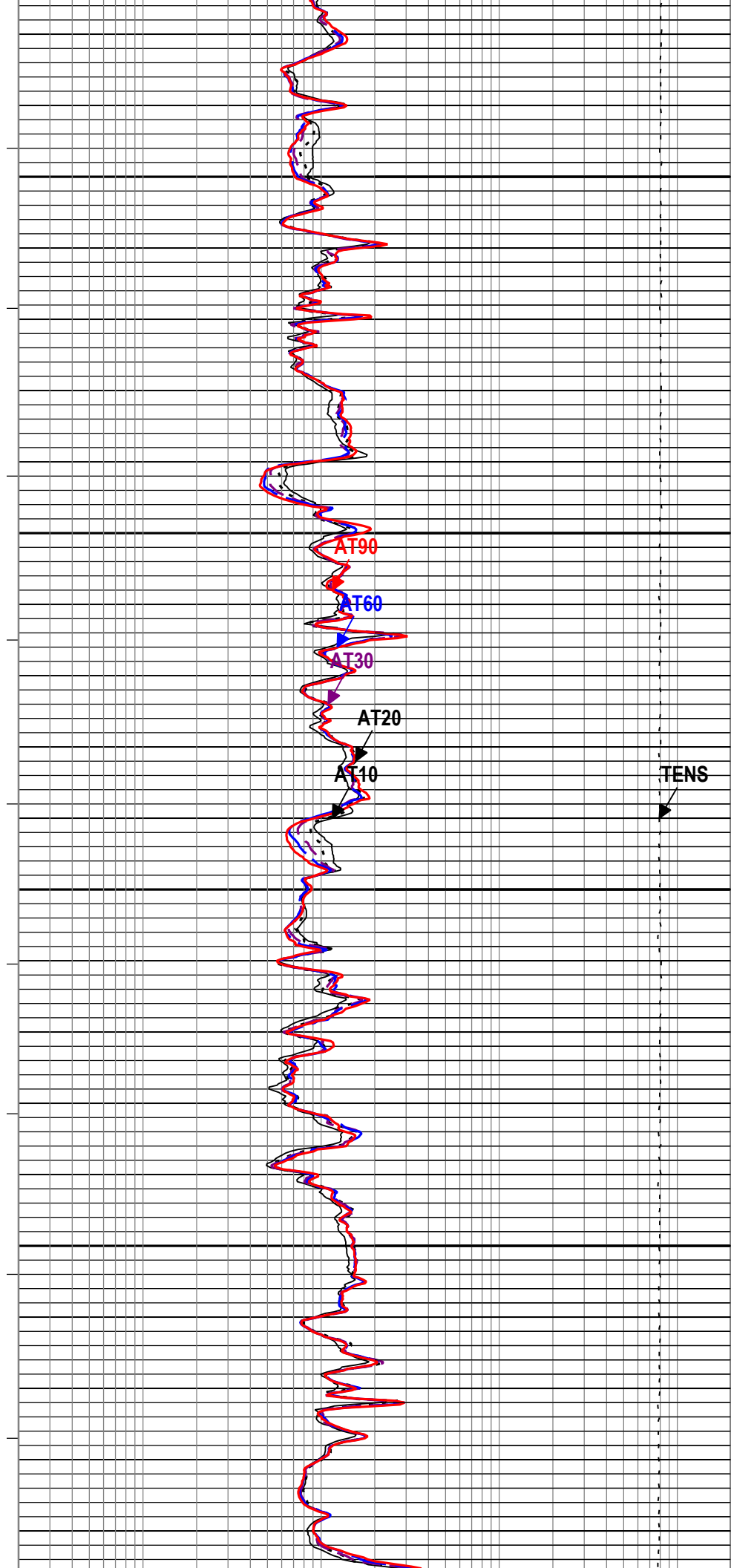
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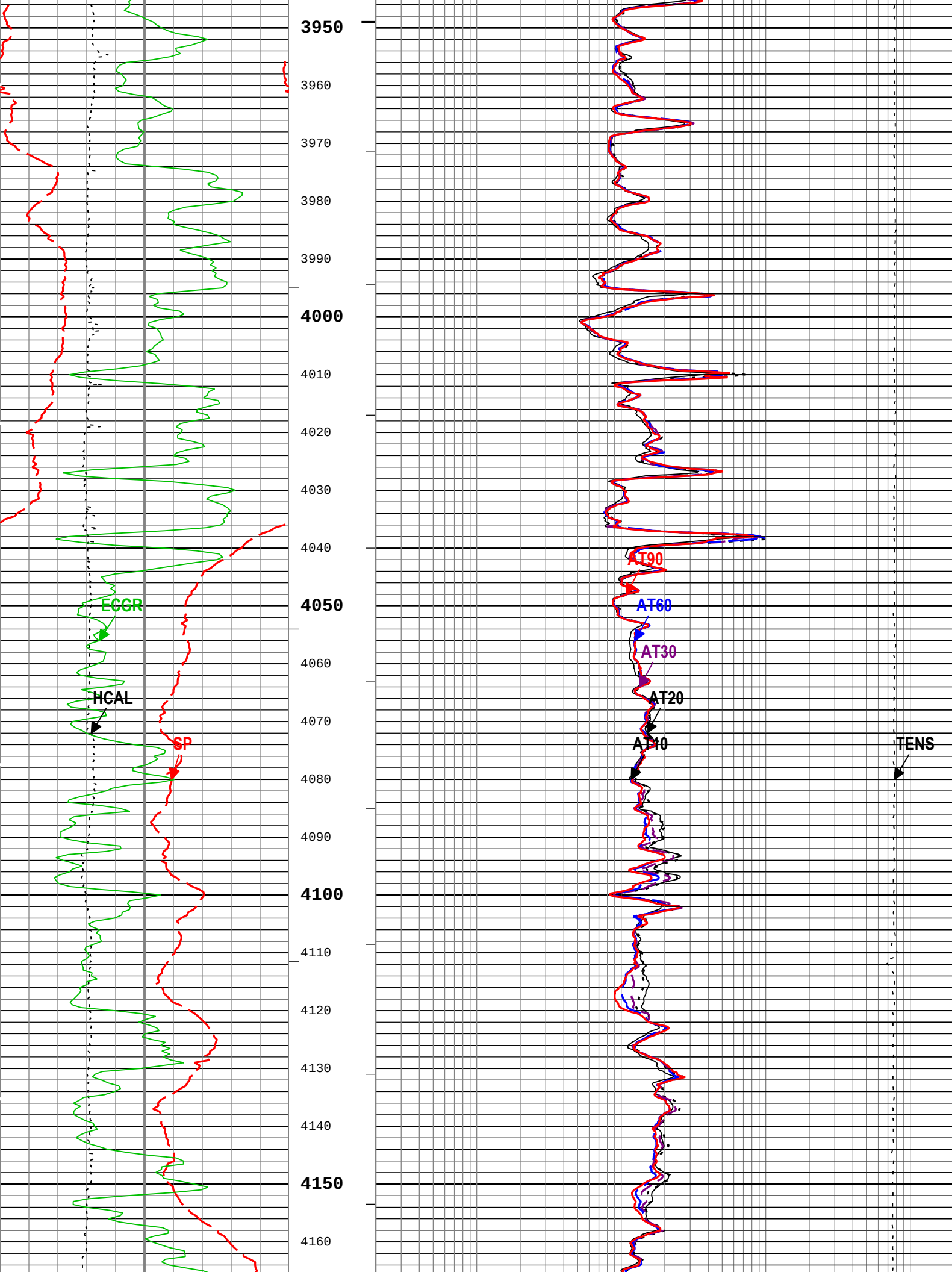
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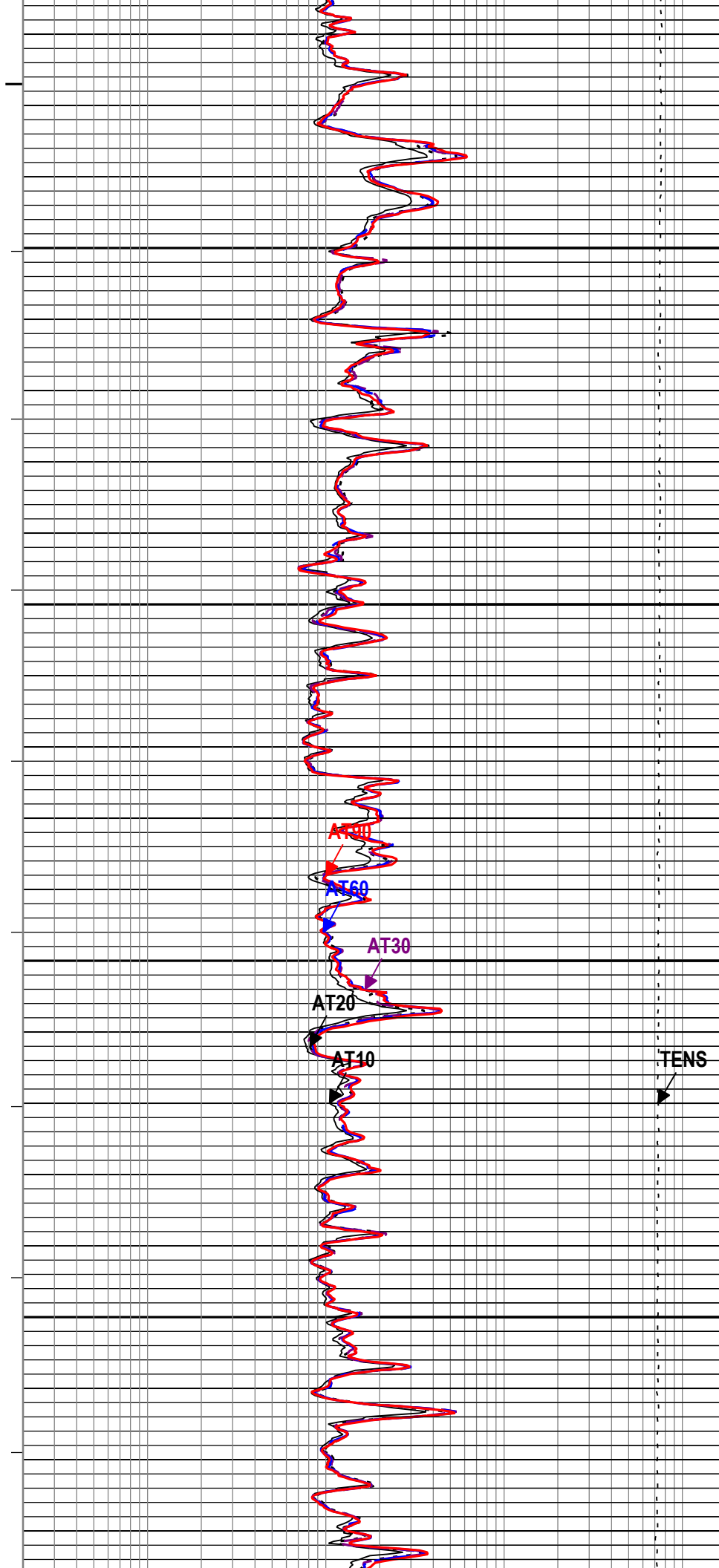
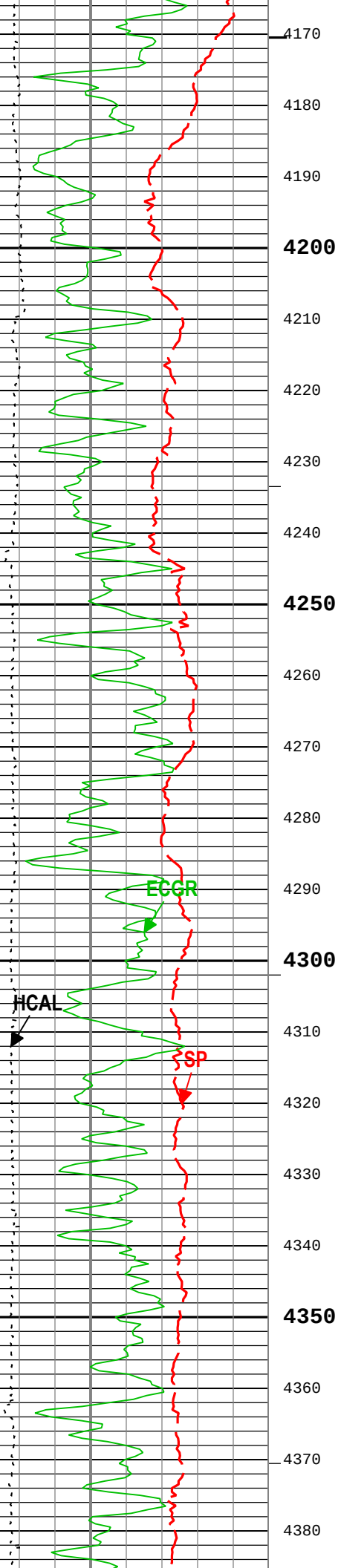


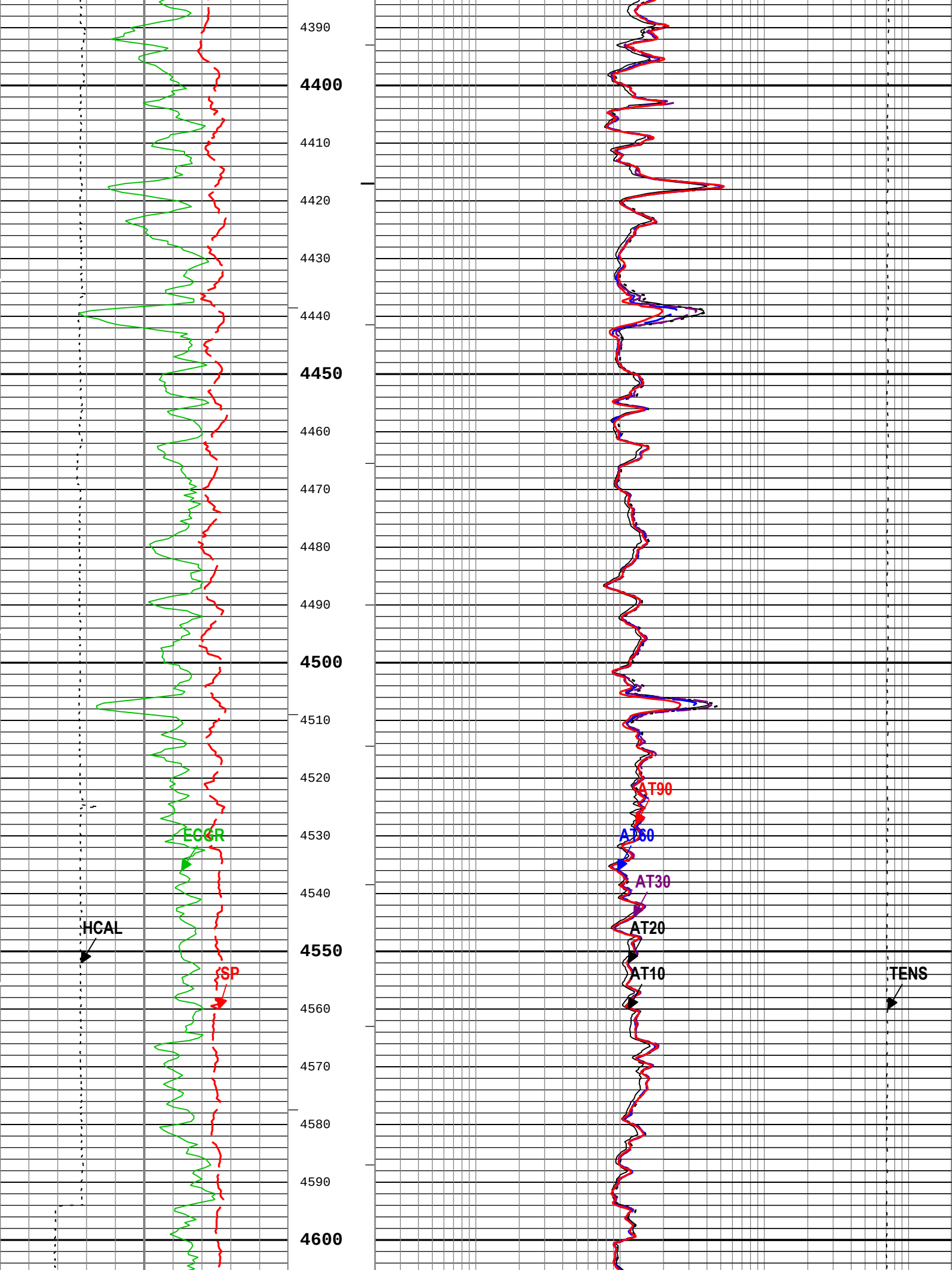


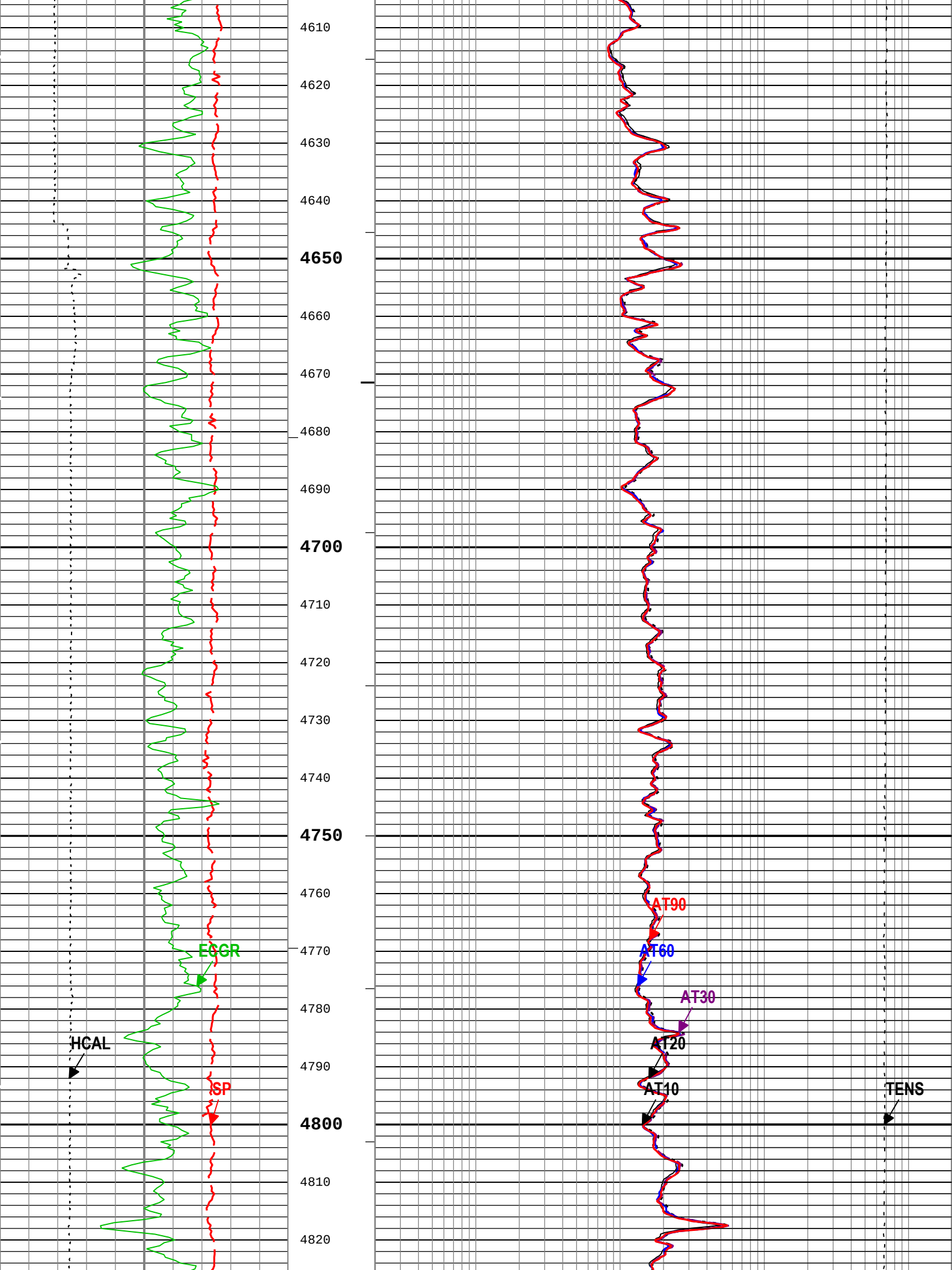
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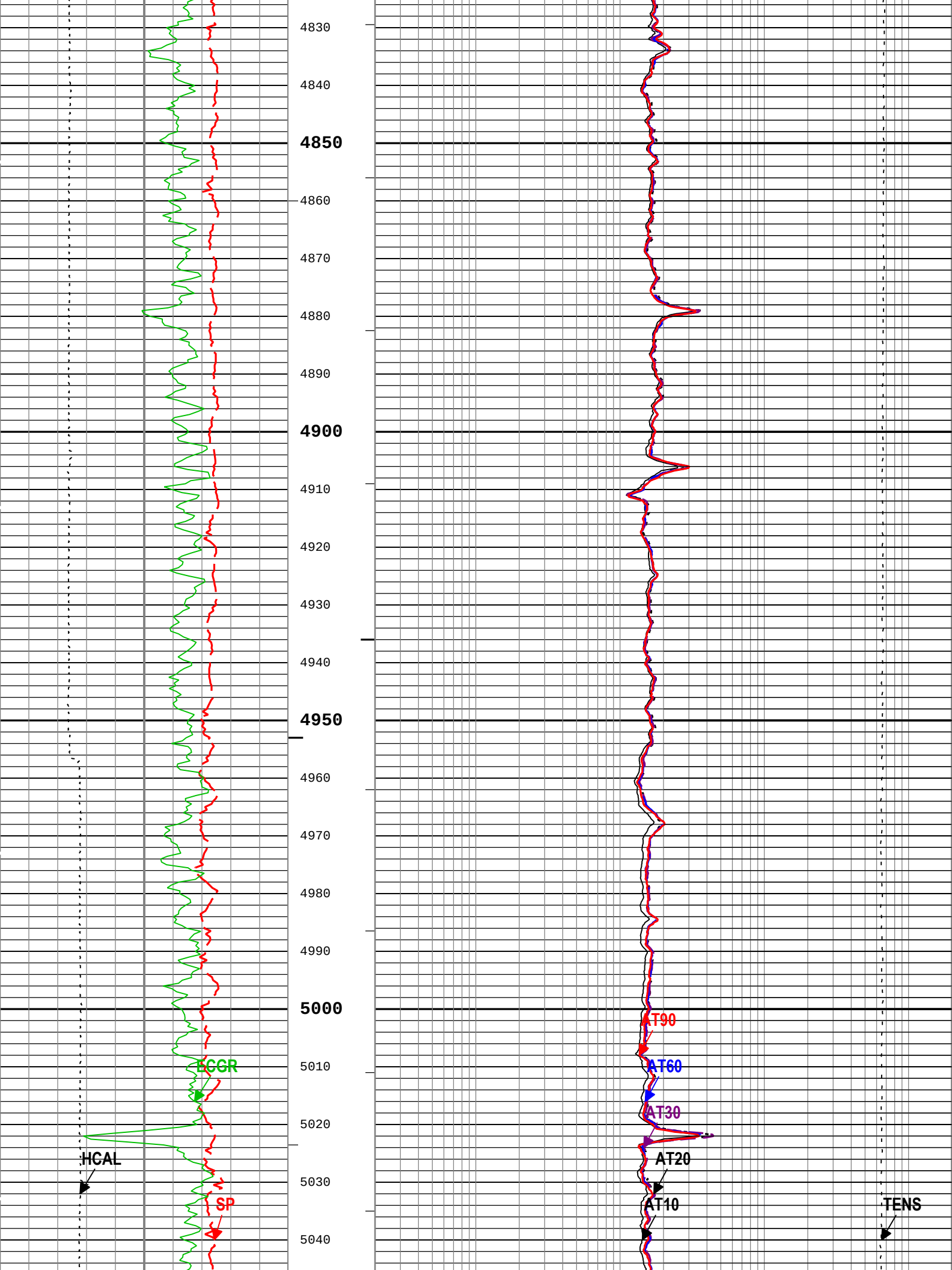


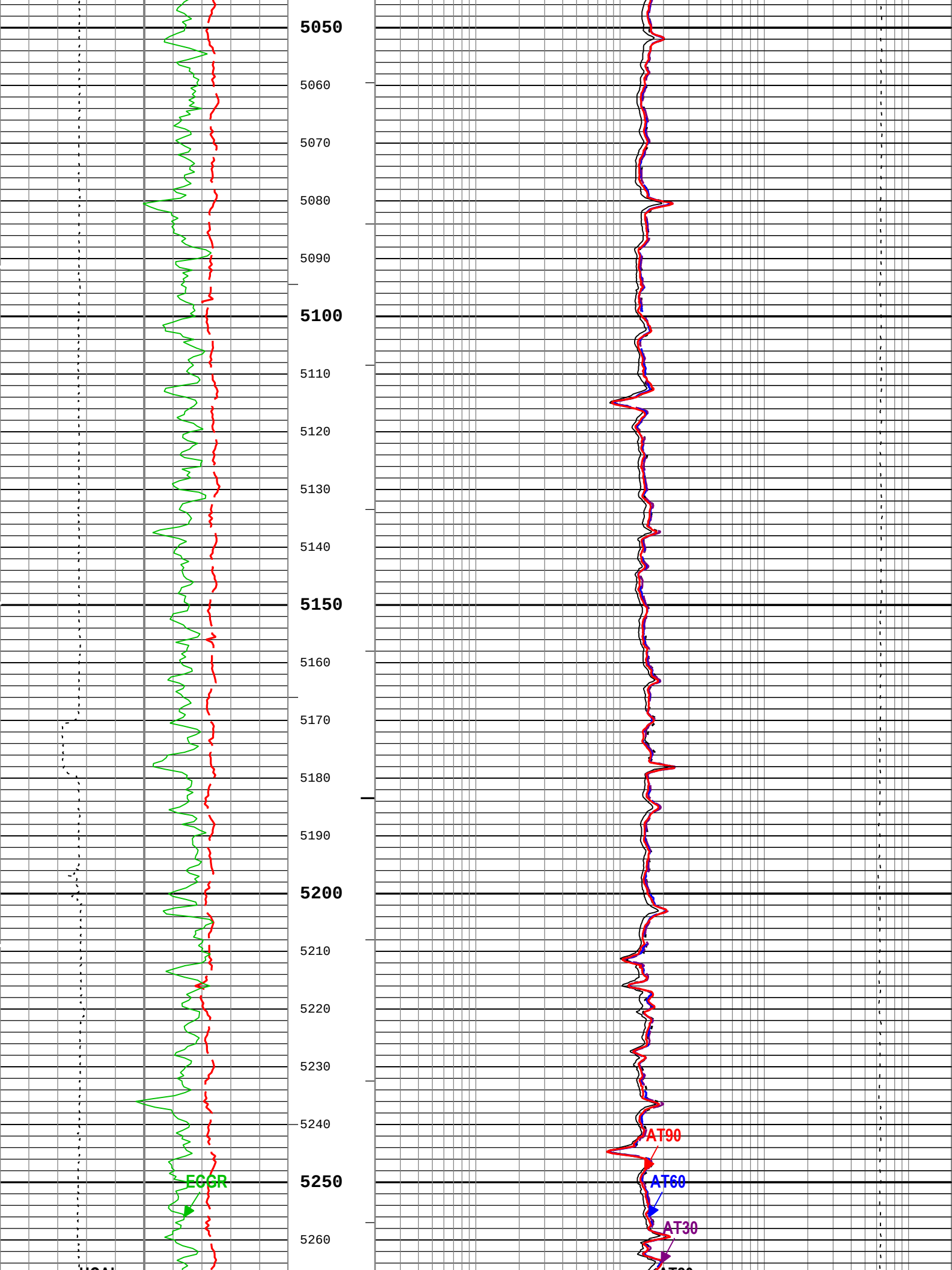


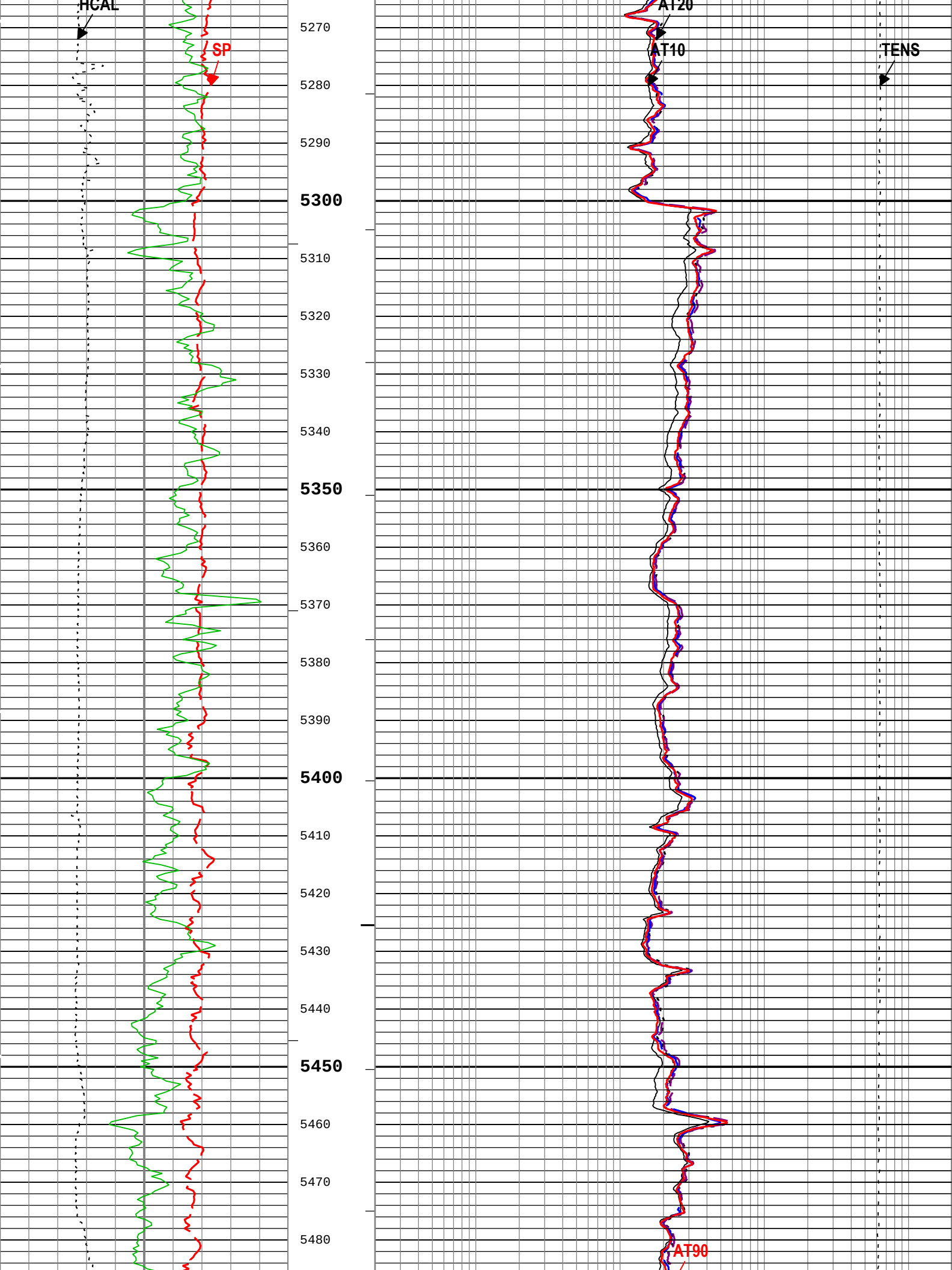


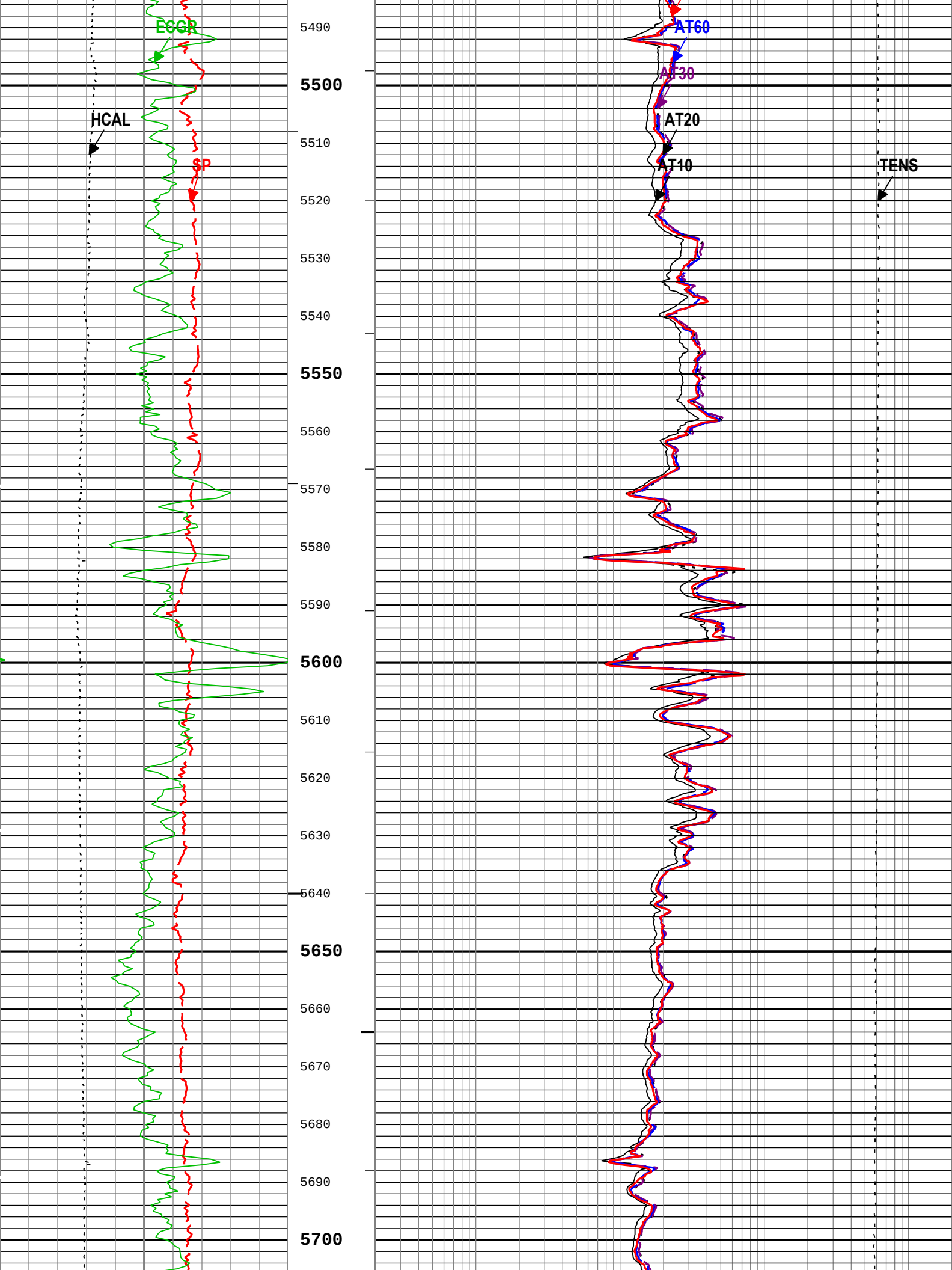


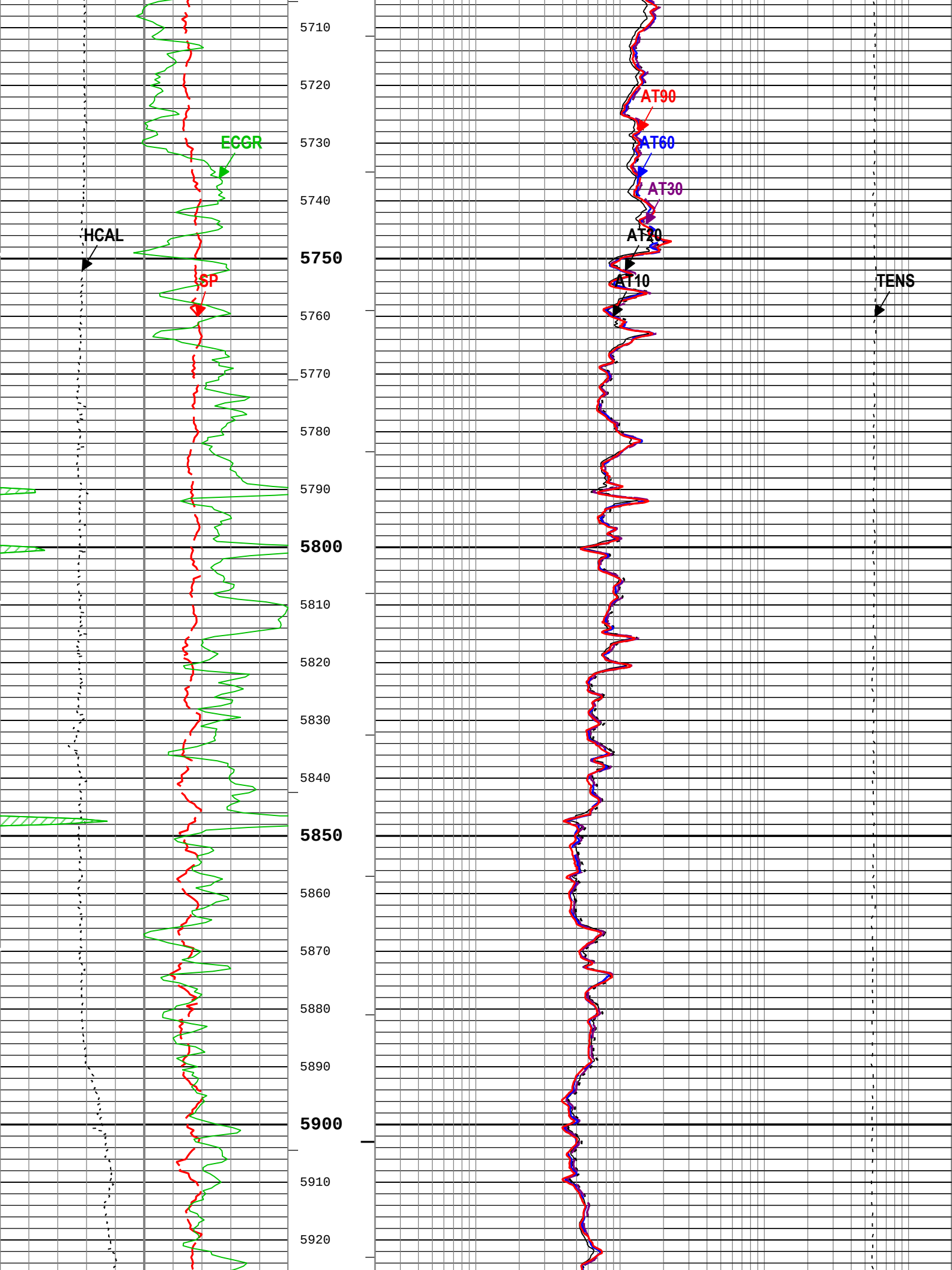


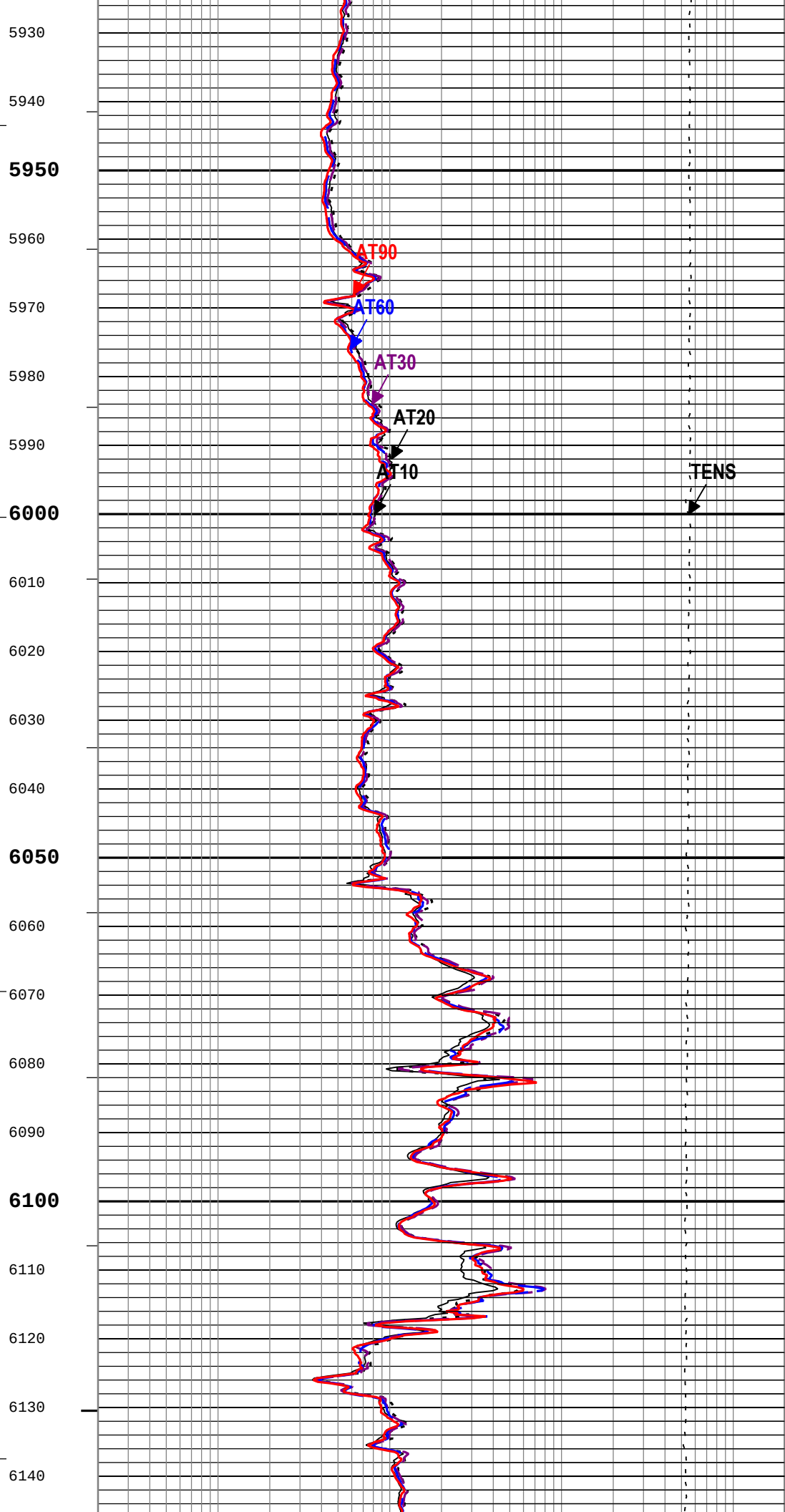
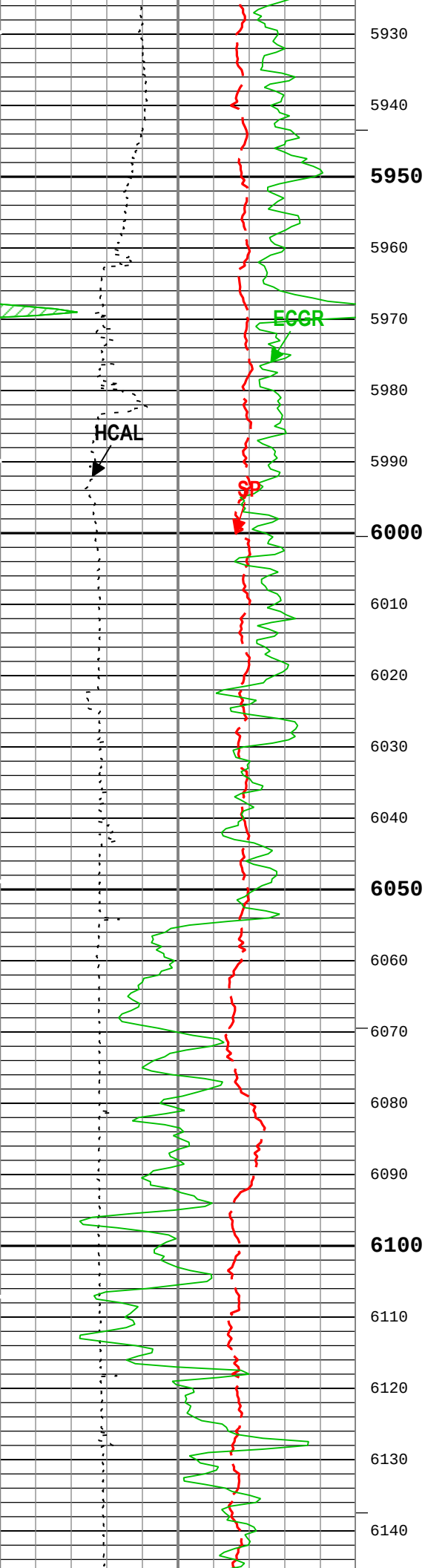


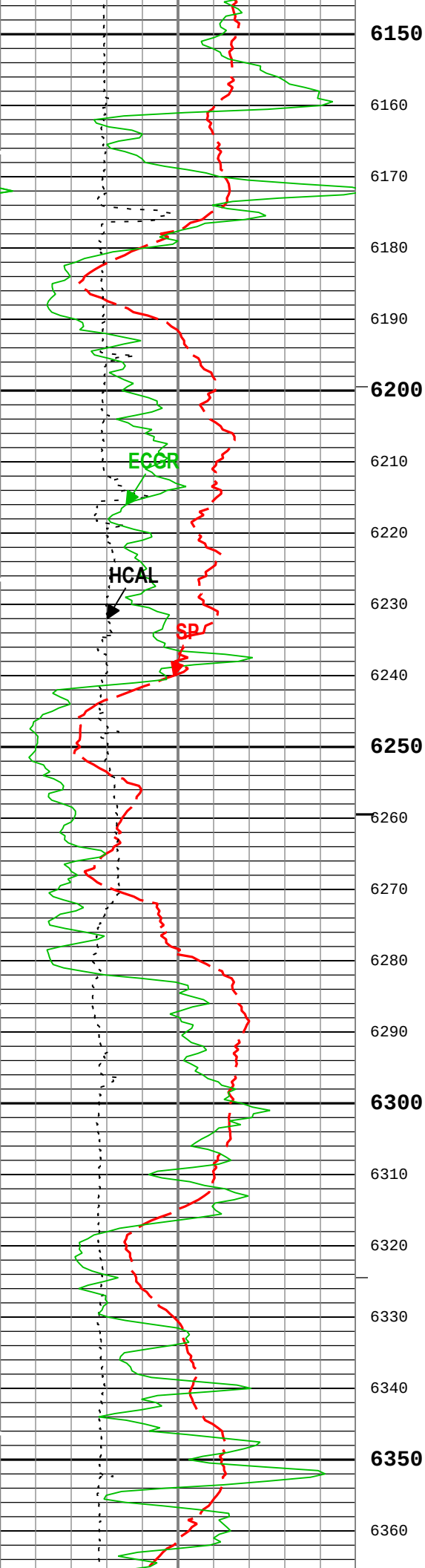












6150

6160

6170

6180

6190

6200

6210

6220

6230

6240

6250

6260

6270

6280

6290

6300

6310

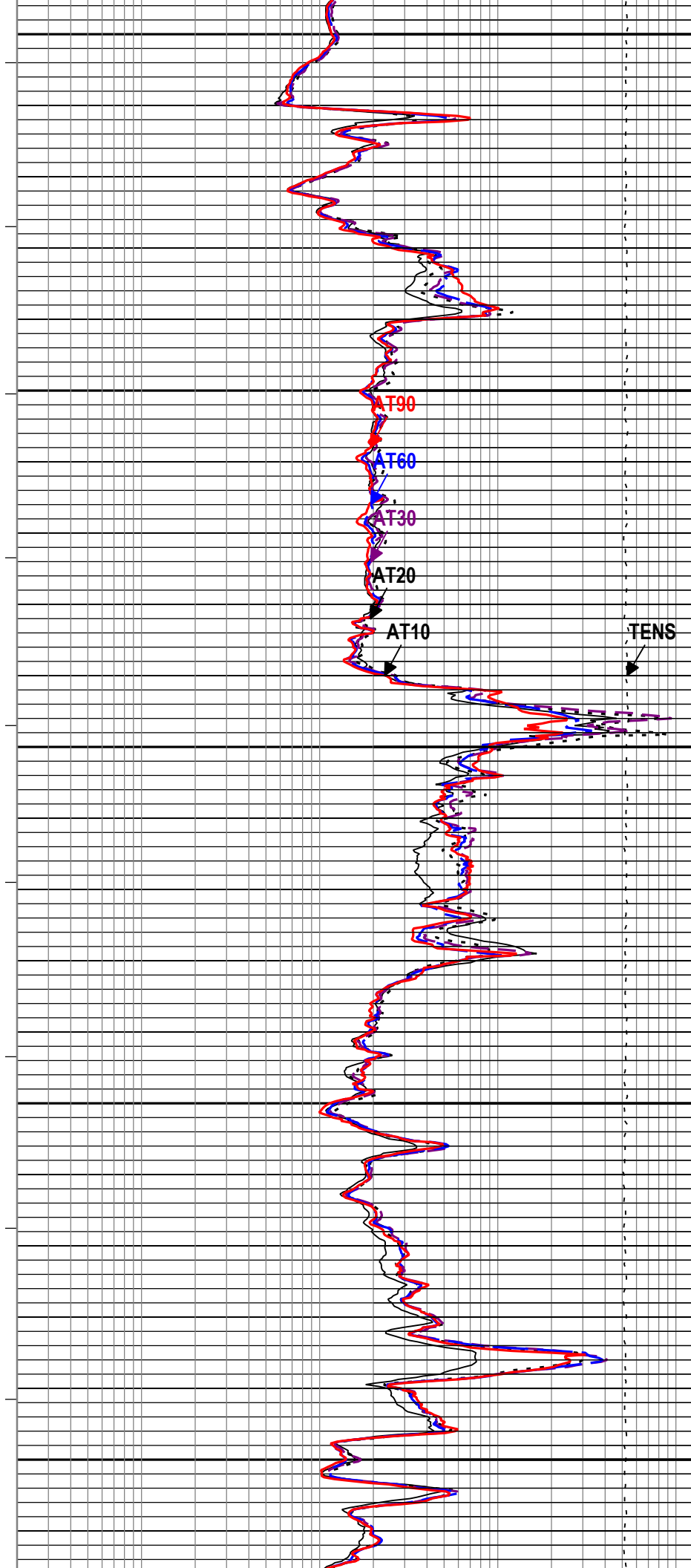
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AT90

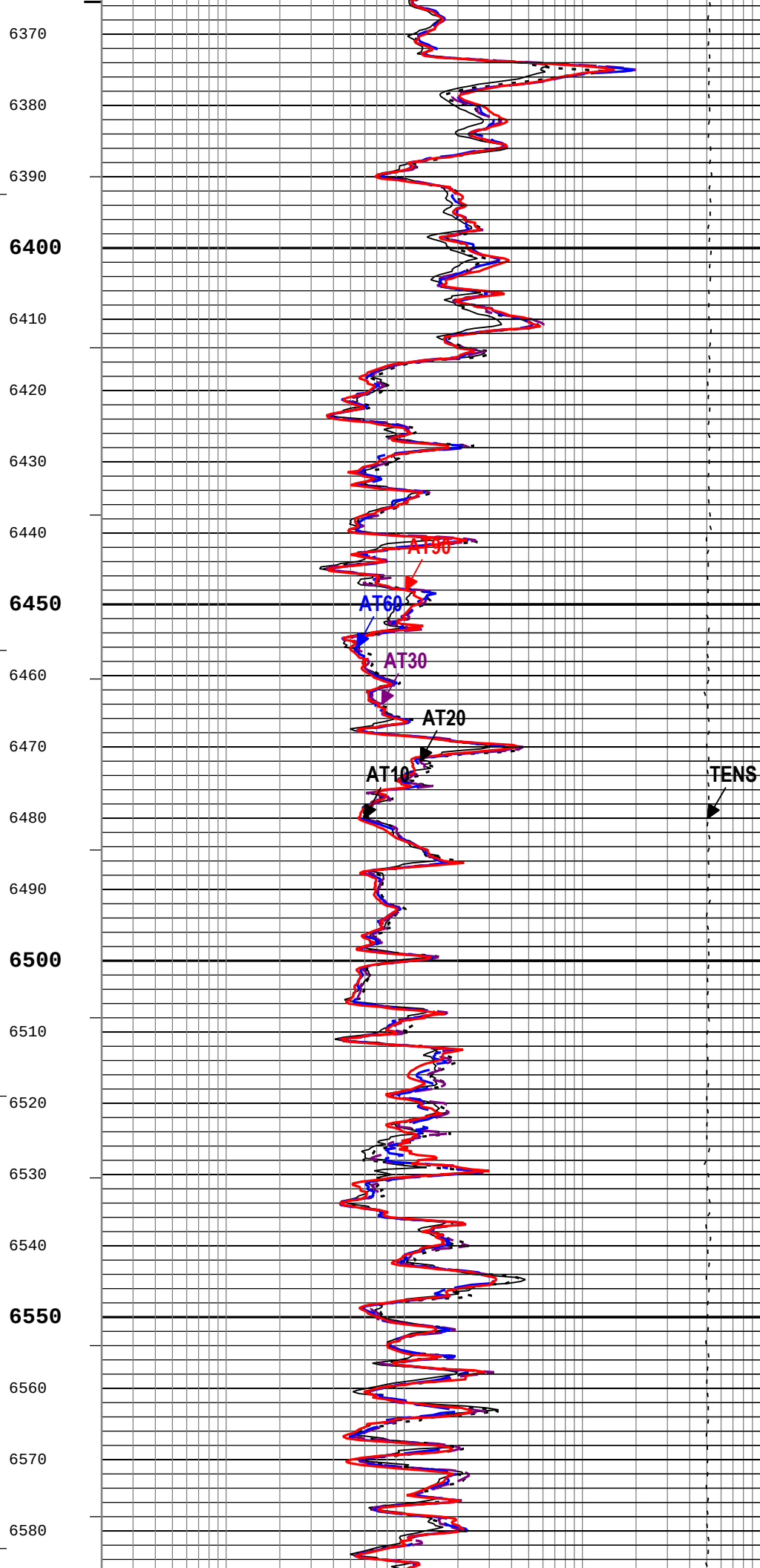
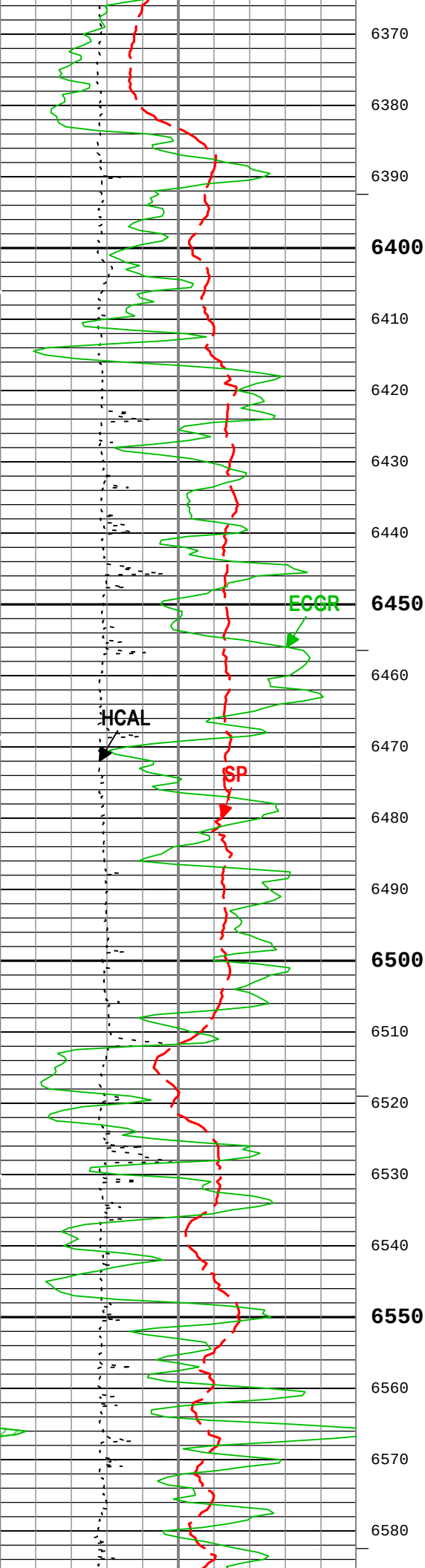
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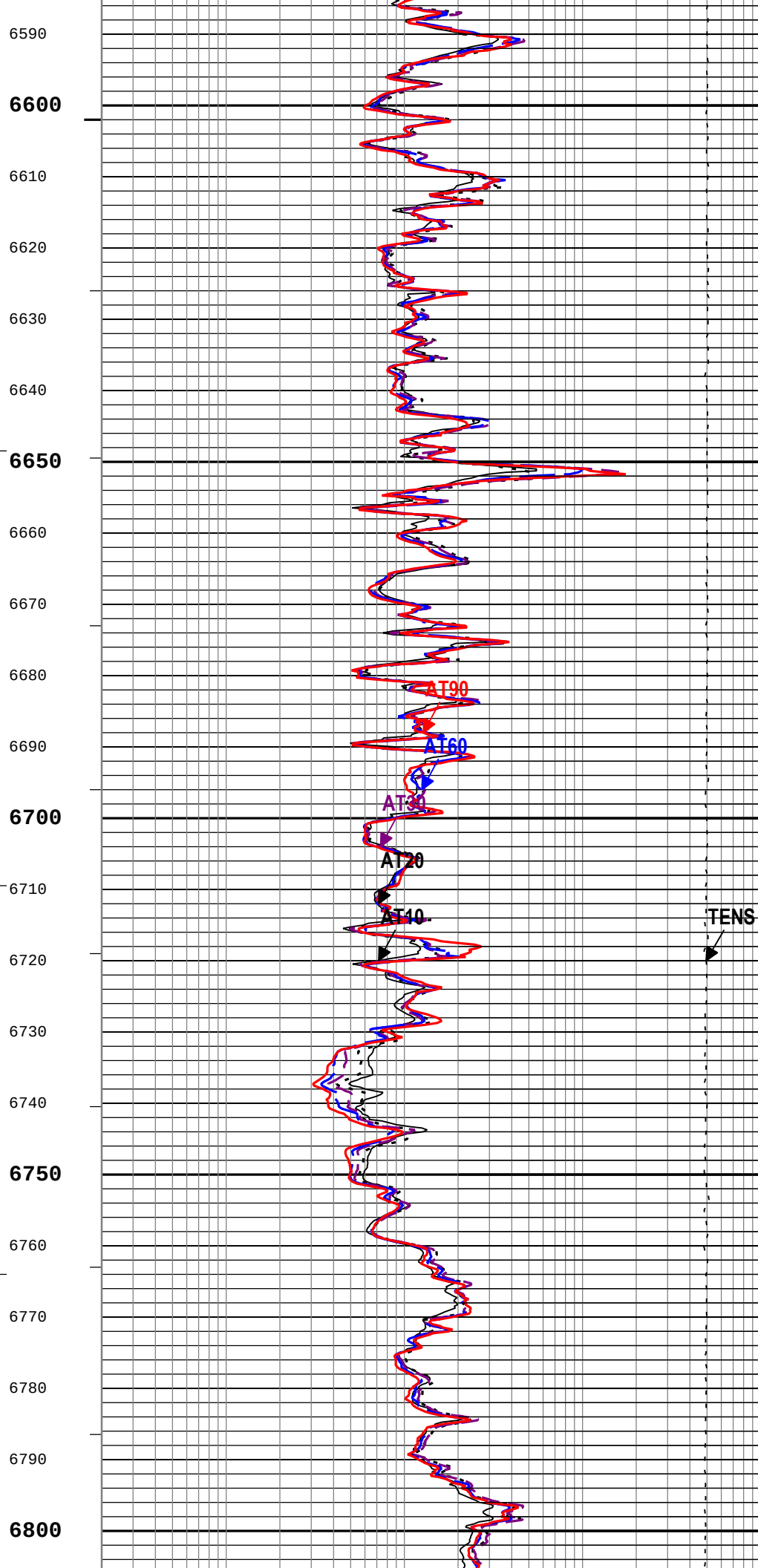
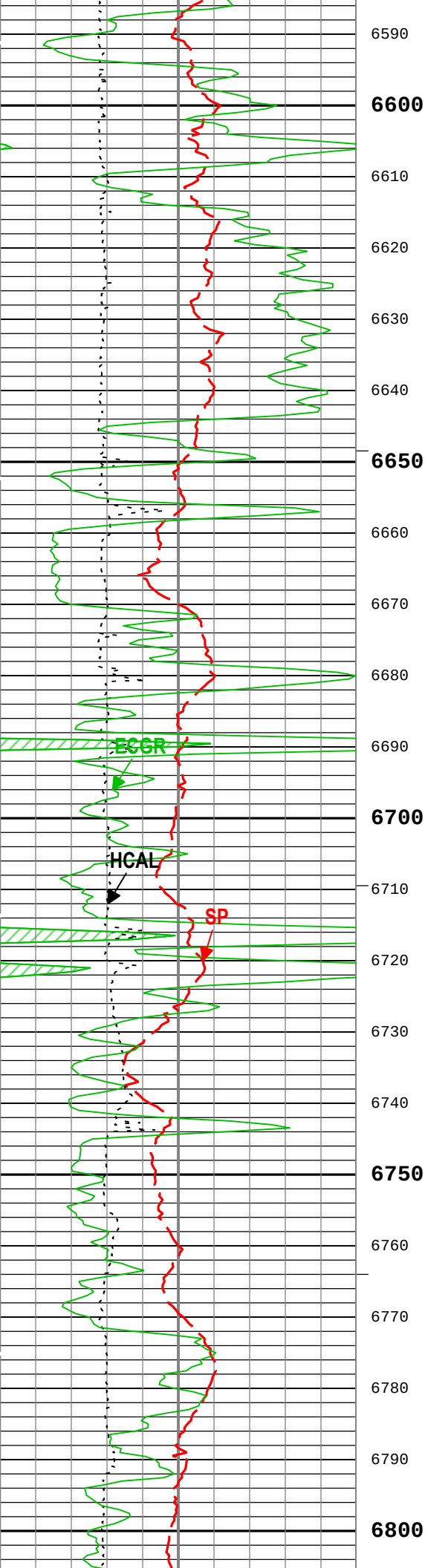
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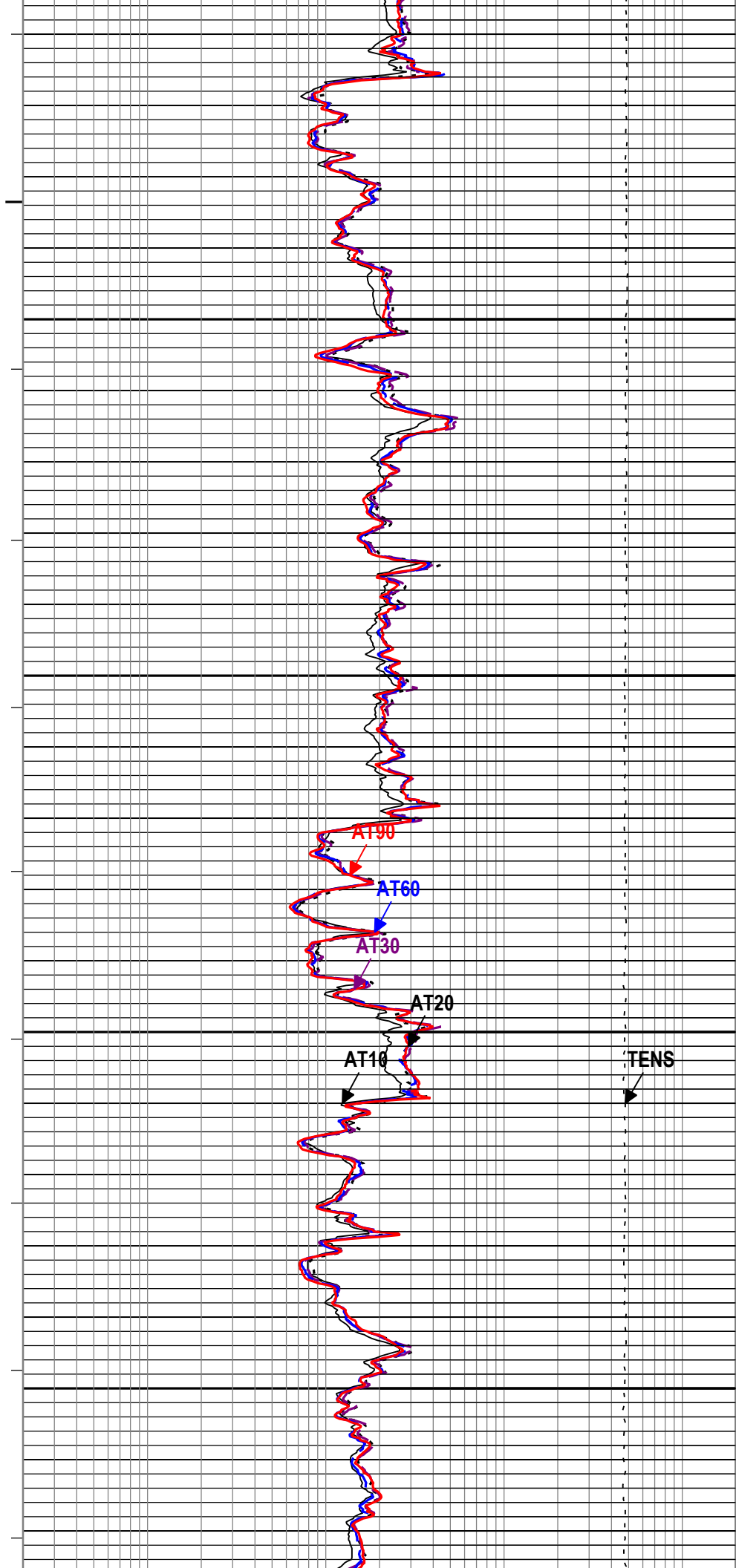
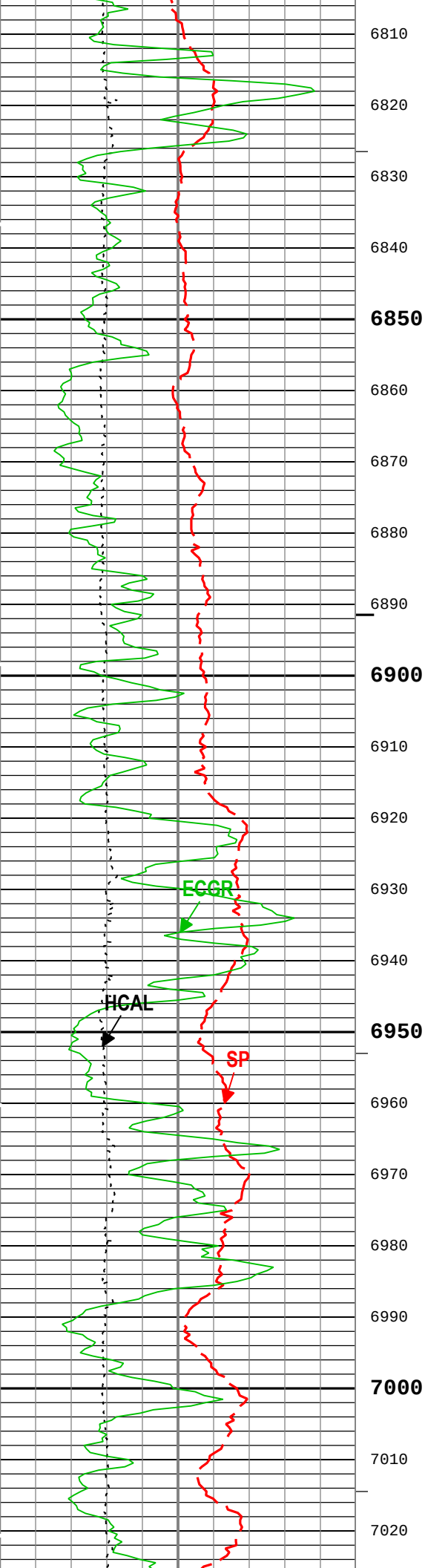
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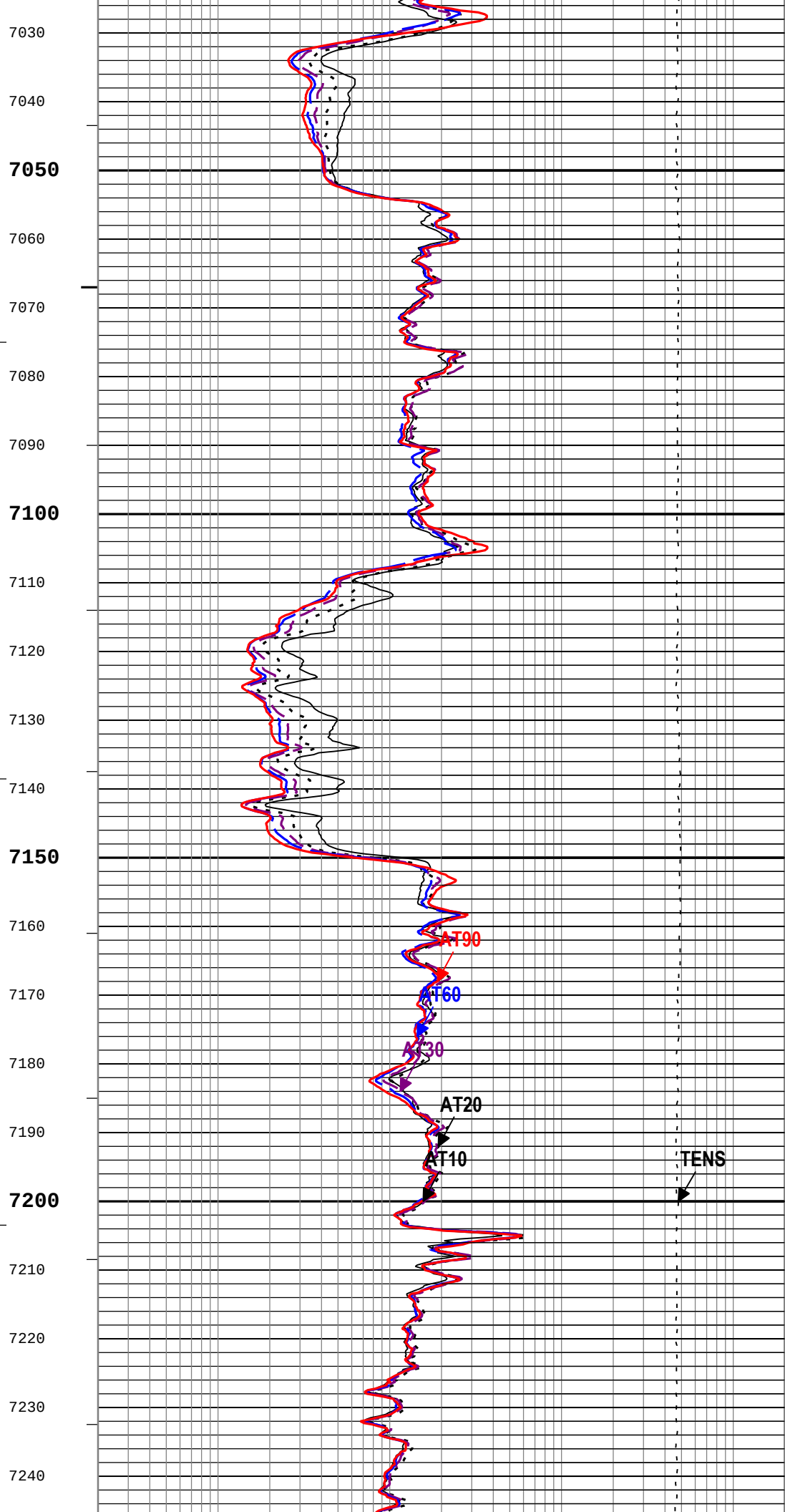
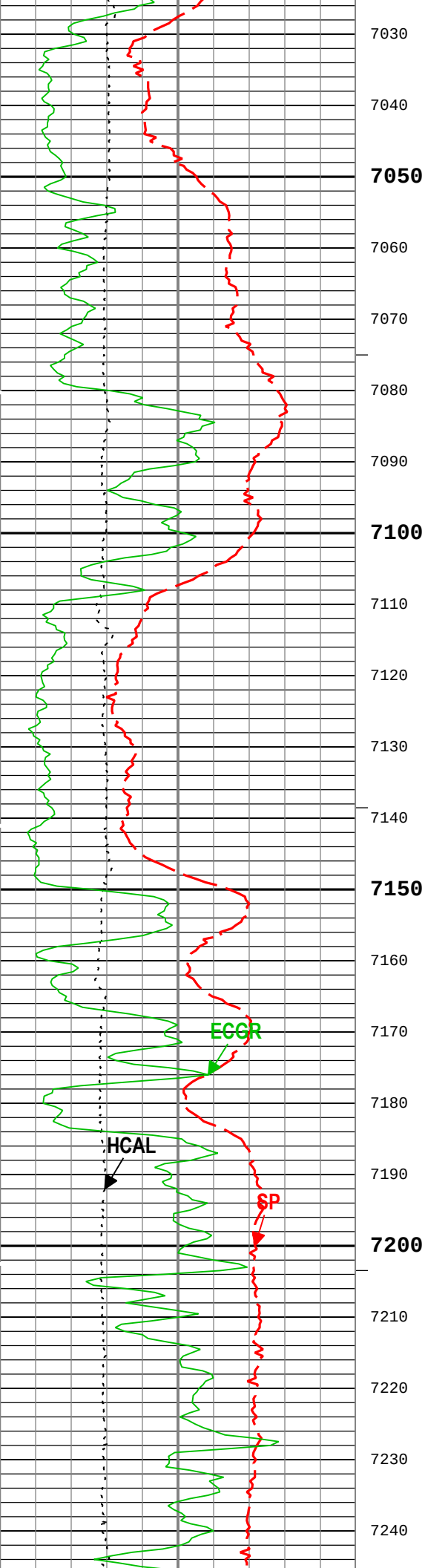
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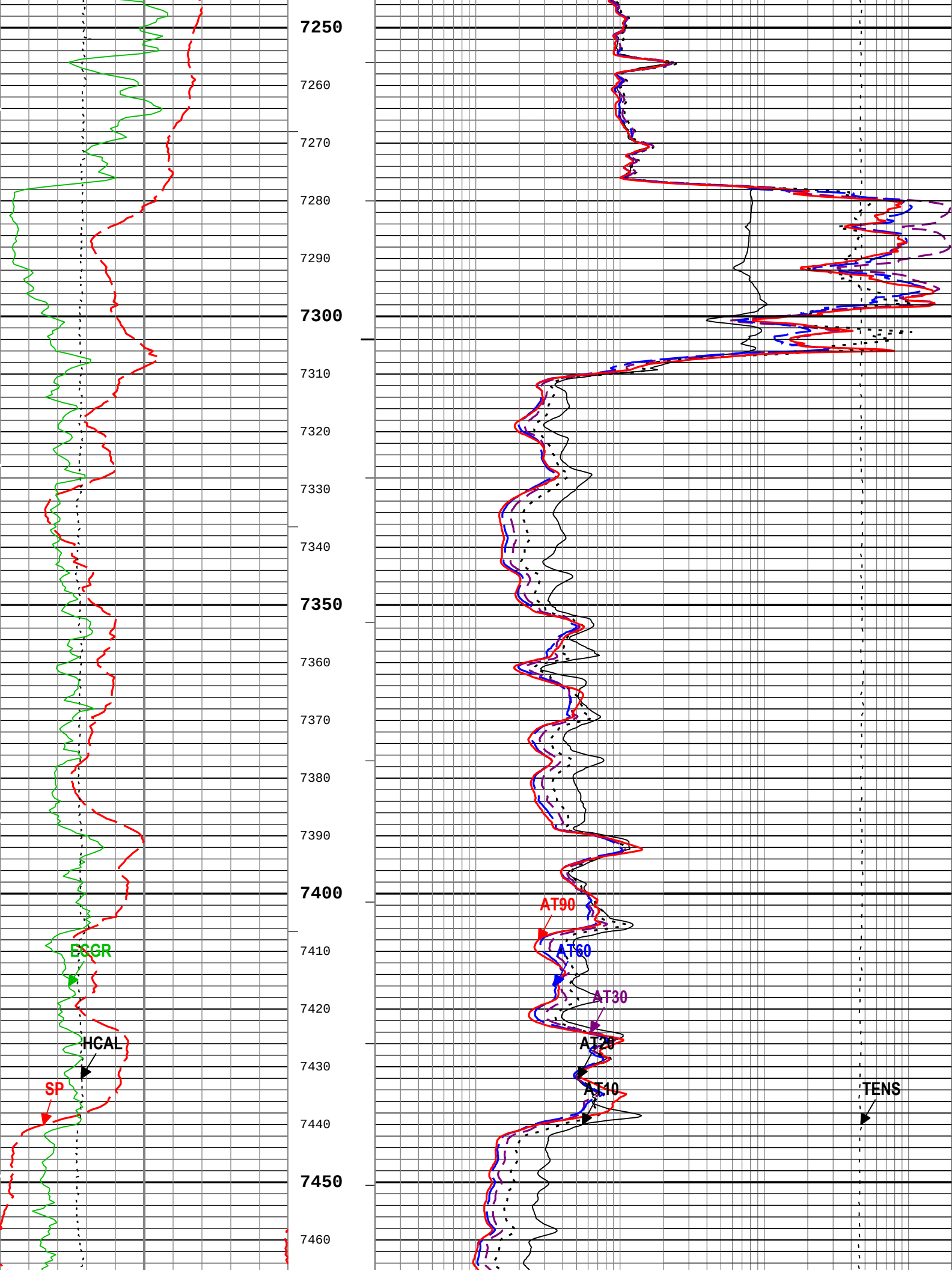
TENS

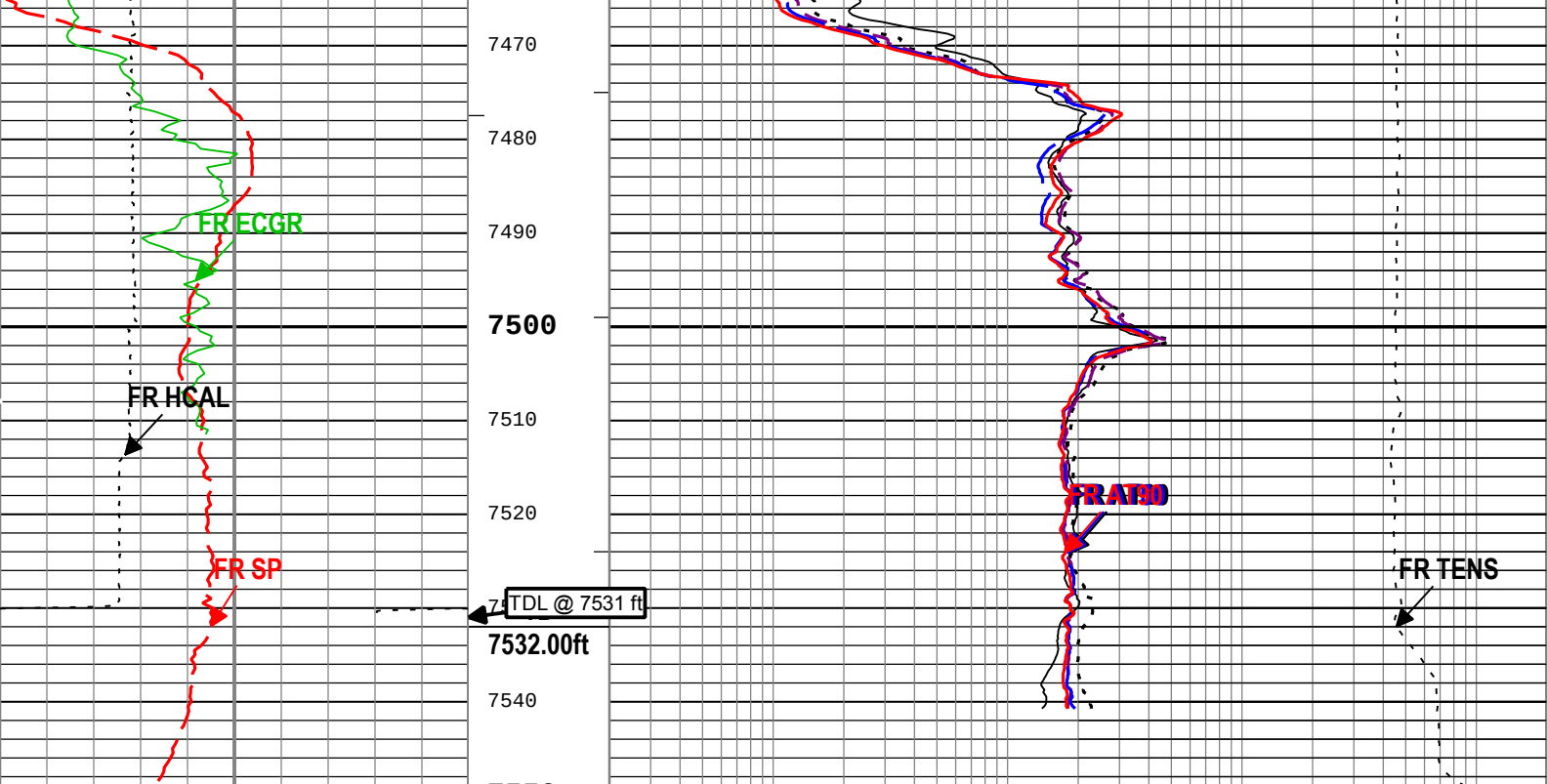












Gamma Ray Backup		
Spontaneous Potential (SP) AIT-M		
-80	mV	20
Caliper (HCAL) HDRS-H		
6	in	16
Gamma Ray (ECGR) HGNS-H		
0	gAPI	200

Array Induction Two Foot Resistivity A10 (AT10) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A20 (AT20) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A30 (AT30) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A60 (AT60) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A90 (AT90) AIT-M		
0.2	ohm.m	2000
Cable Tension (TENS)		
10000	lbf	0

TIME_1900 - Time Marked every 60.00 (s)

- ICV - Integrated Cement Volume every 100.00 (ft3)
- ICV - Integrated Cement Volume every 10.00 (ft3)
- IHV - Integrated Hole Volume every 100.00 (ft3)
- IHV - Integrated Hole Volume every 10.00 (ft3)

Description: AIT Basic Log Two Format: Log (Induction-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:14

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in

CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One

5" Induction

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[3]:Up	Up	7294.65 ft	7556.27 ft	07-Sep-2016 5:43:06 AM	07-Sep-2016 5:48:19 AM	ON	5.53 ft	No
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2
One: Log[4]:Up:S012

Description: AIT Basic Log Two Format: Log (Induction-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:18

—IHV - Integrated Hole Volume every 10.00 (ft3)

—IHV - Integrated Hole Volume every 100.00 (ft3)

— ICV - Integrated Cement Volume every 10.00 (ft3)

— ICV - Integrated Cement Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

Main To Repeat

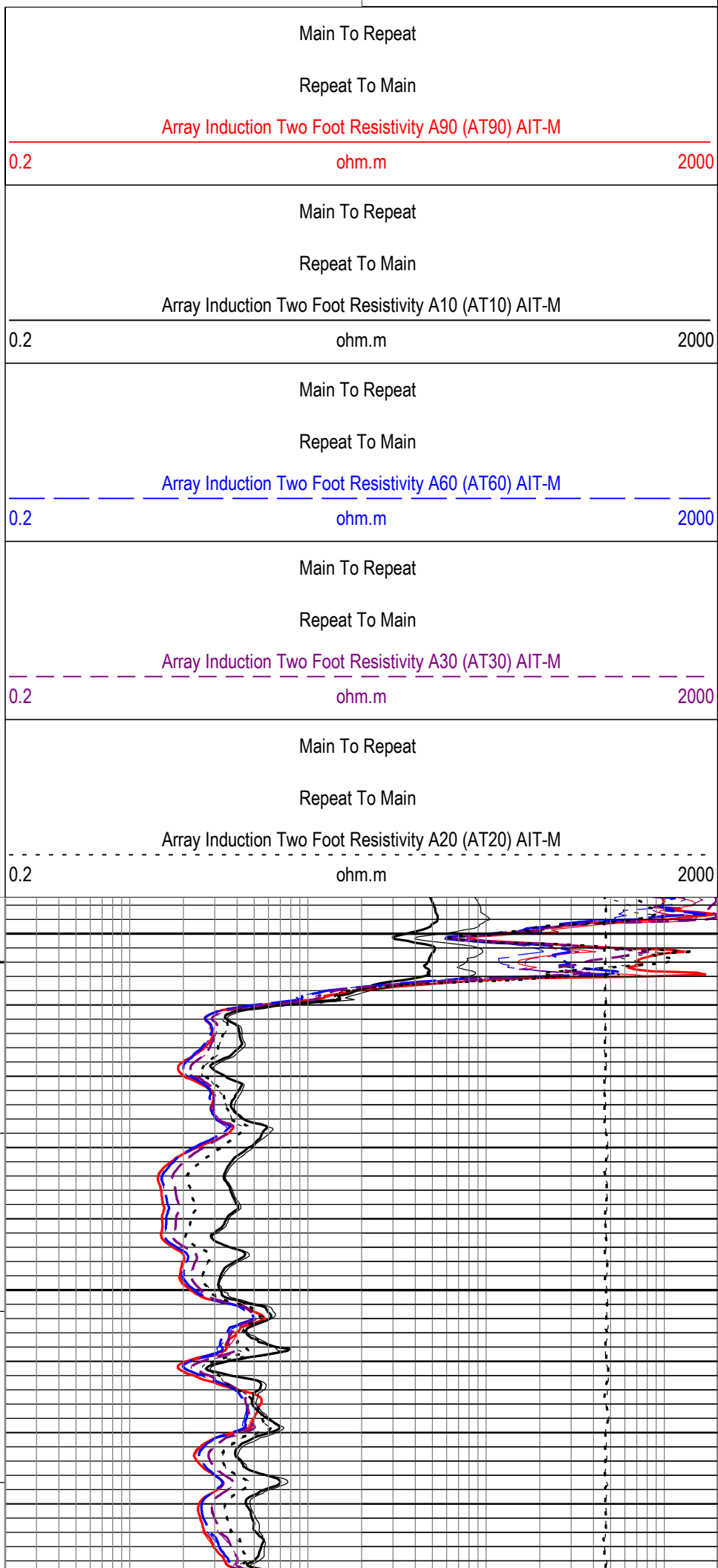
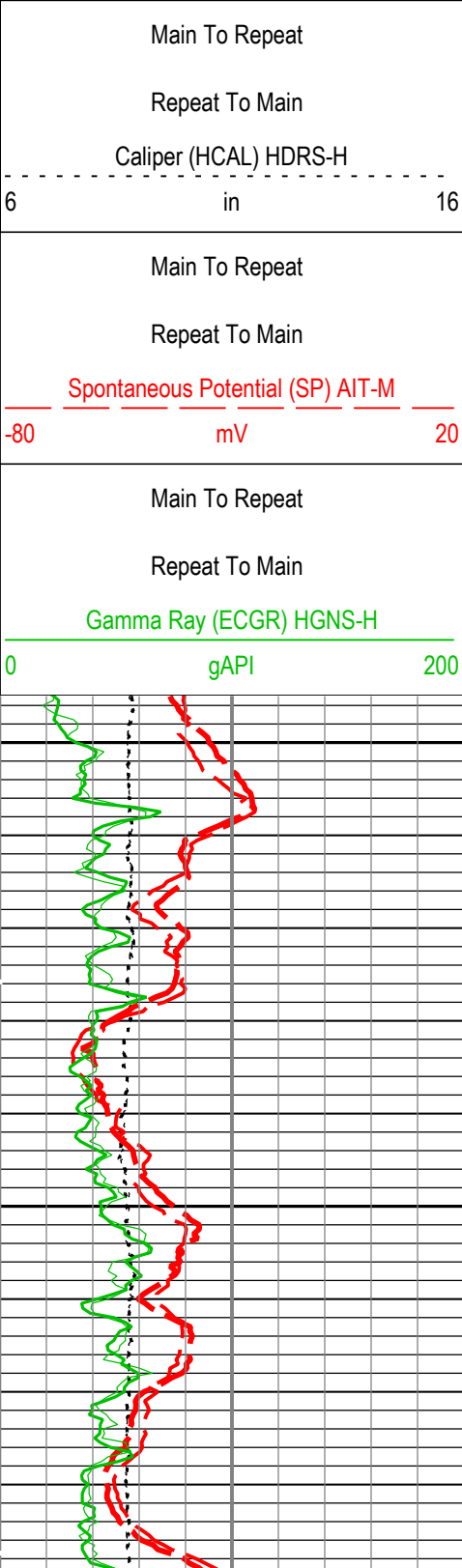
Repeat To Main

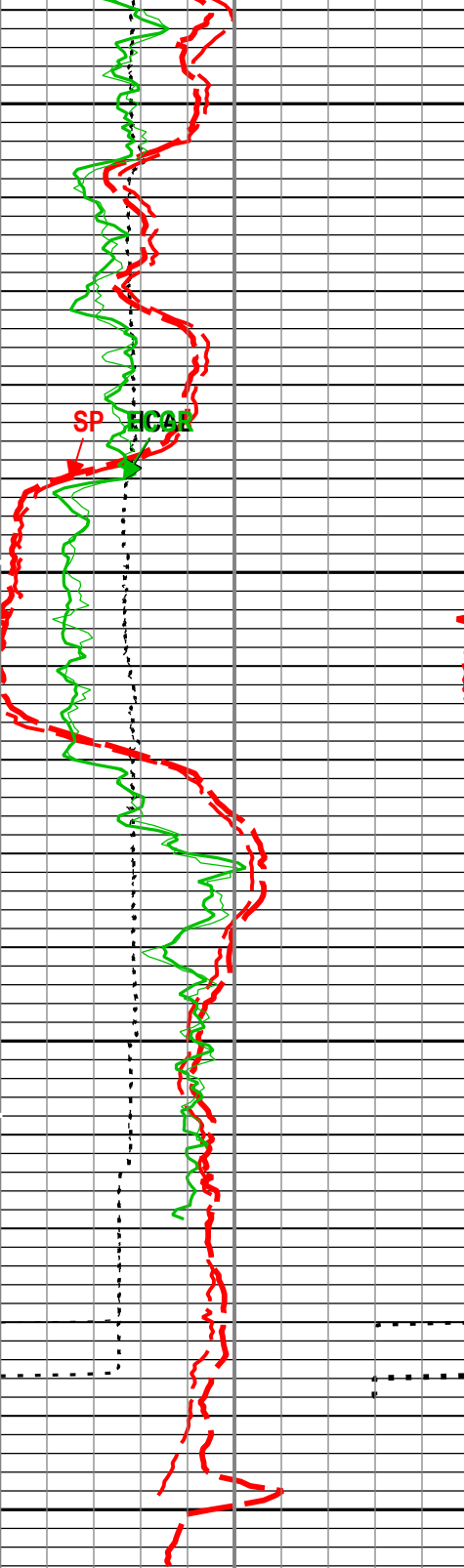
Cable Tension (TENS)

10000

lbf

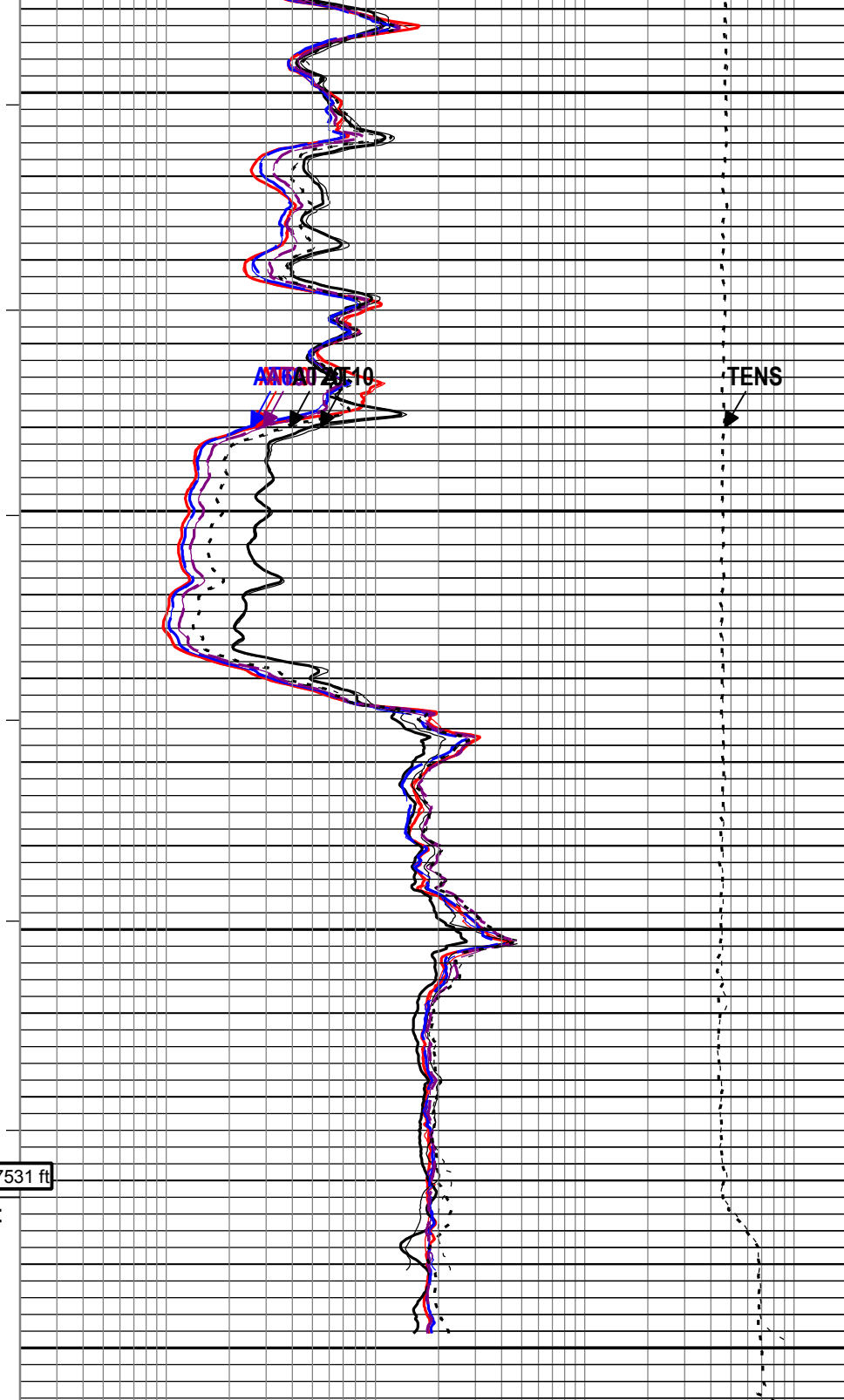
0





7390
7400
7410
7420
7430
7440
7450
7460
7470
7480
7490
7500
7510
7520
7530
7540
7550

TDL @ 7531 ft
7532.00ft



TENS

Main To Repeat
Repeat To Main
Caliper (HCAL) HDRS-H
6 in 16
Main To Repeat
Repeat To Main
Spontaneous Potential (SP) AIT-M
-80 mV 20

Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A90 (AT90) AIT-M
0.2 ohm.m 2000
Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A10 (AT10) AIT-M
0.2 ohm.m 2000

Main To Repeat Repeat To Main Gamma Ray (ECGR) HGNS-H 0gAPI200	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A60 (AT60) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A30 (AT30) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A20 (AT20) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Cable Tension (TENS) 10000lbf0		
TIME_1900 - Time Marked every 60.00 (s)			
└─ICV - Integrated Cement Volume every 100.00 (ft3) └─ICV - Integrated Cement Volume every 10.00 (ft3) └─IHV - Integrated Hole Volume every 100.00 (ft3) └─IHV - Integrated Hole Volume every 10.00 (ft3)			
Description: AIT Basic Log Two Format: Log (Induction-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:18			

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

All depth are actual.

Tool Control Parameters

One: Parameters

Calibration Report

AIT-M (Array Induction Tool - M) Calibration - Run One

50

AMRM

AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 20:19:37 05-Aug-2016

AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM): 20:19:37 05-Aug-2016

AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM):		20:19:37 05-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Coarse Gain		Master	1.000	0.800	0.934	1.200	
Fine Gain		Master	1.000	0.800	0.938	1.200	
AIT Electronics Check - Thru Calibration Check							
Master (EEPROM):		20:19:37 05-Aug-2016		Before (Measured):		21:11:27 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Thru Cal Mag - 0	V	Master	----	0.366	0.603	0.854	
		Before	----	0.366	0.603	0.854	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 0	deg	Master	----	137.000	-165.864	-103.000	
		Before	----	137.000	-161.111	-103.000	
		Before-Master	----	----	4.753	----	
Thru Cal Mag - 1	V	Master	----	0.762	1.237	1.778	
		Before	----	0.762	1.237	1.778	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 1	deg	Master	----	136.000	-166.823	-104.000	
		Before	----	136.000	-162.071	-104.000	
		Before-Master	----	----	4.752	----	
Thru Cal Mag - 2	V	Master	----	0.372	0.613	0.868	
		Before	----	0.372	0.613	0.868	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 2	deg	Master	----	132.000	-170.304	-108.000	
		Before	----	132.000	-165.578	-108.000	
		Before-Master	----	----	4.726	----	
Thru Cal Mag - 3	V	Master	----	0.420	0.691	0.980	
		Before	----	0.420	0.691	0.980	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 3	deg	Master	----	131.000	-171.041	-109.000	
		Before	----	131.000	-166.313	-109.000	
		Before-Master	----	----	4.728	----	
Thru Cal Mag - 4	V	Master	----	0.804	1.297	1.876	
		Before	----	0.804	1.296	1.876	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 4	deg	Master	----	125.000	-177.009	-115.000	
		Before	----	125.000	-172.279	-115.000	
		Before-Master	----	----	4.730	----	
Thru Cal Mag - 5	V	Master	----	1.176	1.888	2.744	
		Before	----	1.176	1.887	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 5	deg	Master	----	122.000	-178.544	-118.000	
		Before	----	122.000	-173.812	-118.000	
		Before-Master	----	----	4.732	----	
Thru Cal Mag - 6	V	Master	----	1.176	1.887	2.744	
		Before	----	1.176	1.886	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 6	deg	Master	----	121.000	-178.521	-119.000	
		Before	----	121.000	-173.790	-119.000	
		Before-Master	----	----	4.731	----	
Thru Cal Mag - 7	V	Master	----	0.846	1.358	1.974	
		Before	----	0.846	1.353	1.974	
		Before-Master	----	----	-0.005	----	
Thru Cal Phase - 7	deg	Master	----	115.000	-179.305	-125.000	
		Before	----	115.000	-174.661	-125.000	
		Before-Master	----	----	4.644	----	
SPA Zero	mV	Master		-50.000	0.156	50.000	
		Before		-50.000	0.146	50.000	
		Before-Master	----	----	-0.010	----	
SPA Plus	mV	Master		941.000	988.093	1040.000	
		Before		941.000	988.030	1040.000	
		Before-Master	----	----	-0.063	----	
Temperature Zero	V	Master		-0.050	0.000	0.050	

		Before		-0.050	0.000	0.050	
		Before-Master	-----	-----	0.000	-----	
Temperature Plus	V	Master		0.870	0.915	0.960	
		Before		0.870	0.915	0.960	
		Before-Master	-----	-----	0.000	-----	

Company:

Western Refining, Southwest, Inc.

Schlumberger

Well:

WWD #2

Field:

Wildcat

County:

San Juan

State:

New Mexico

Platform Expres

Array Induction

with Linear Correlation

Appendix E

October 5, 2017 Falloff test data

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/3/17 8:58:00	0.00	0.0	0.0	60.0	10/3/17 9:02:00	0.00	0.0	0.0	61.2
10/3/17 9:47:15	0.03	49.3	985.4	60.5	10/3/17 9:47:30	0.03	45.5	990.2	62.2
10/3/17 10:02:15	0.04	64.3	976.6	66.0	10/3/17 10:02:30	0.04	60.5	984.8	67.7
10/3/17 10:17:15	0.06	79.3	3,313.8	100.2	10/3/17 10:17:30	0.05	75.5	3,423.5	106.0
10/3/17 10:32:15	0.07	94.3	4,144.1	160.6	10/3/17 10:32:30	0.06	90.5	4,147.0	162.3
10/3/17 10:53:15	0.08	115.3	4,224.2	165.2	10/3/17 10:55:45	0.08	113.8	4,226.4	165.7
10/3/17 11:12:00	0.09	134.0	4,239.4	165.3	10/3/17 11:14:30	0.09	132.5	4,242.1	165.5
10/3/17 11:36:45	0.11	158.8	4,249.5	163.9	10/3/17 11:43:00	0.11	161.0	4,252.9	164.0
10/3/17 12:12:00	0.13	194.0	4,255.9	162.4	10/3/17 12:25:00	0.14	203.0	4,258.1	162.4
10/3/17 12:54:00	0.16	236.0	4,266.7	160.9	10/3/17 13:07:00	0.17	245.0	4,269.4	160.9
10/3/17 13:36:00	0.19	278.0	4,271.9	159.7	10/3/17 13:49:00	0.20	287.0	4,274.2	159.8
10/3/17 14:18:00	0.22	320.0	4,277.3	158.9	10/3/17 14:31:00	0.23	329.0	4,279.3	159.0
10/3/17 15:00:00	0.25	362.0	4,282.9	158.2	10/3/17 15:13:00	0.26	371.0	4,285.0	158.3
10/3/17 15:42:00	0.28	404.0	4,288.3	157.7	10/3/17 15:55:00	0.29	413.0	4,290.3	157.8
10/3/17 16:37:30	0.32	459.5	4,292.8	157.0	10/3/17 16:40:00	0.32	458.0	4,295.5	157.3
10/3/17 17:24:00	0.35	506.0	4,293.4	156.5	10/3/17 17:37:00	0.36	515.0	4,298.0	156.7
10/3/17 18:06:00	0.38	548.0	4,298.6	156.0	10/3/17 18:19:00	0.39	557.0	4,300.7	156.2
10/3/17 18:48:00	0.41	590.0	4,303.8	155.7	10/3/17 19:01:00	0.42	599.0	4,305.7	155.8
10/3/17 19:47:15	0.45	649.3	4,309.9	155.2	10/3/17 19:28:00	0.45	647.8	4,310.5	155.4
10/3/17 20:30:00	0.48	692.0	4,309.2	154.7	10/3/17 20:10:00	0.49	701.0	4,310.9	154.9
10/3/17 21:12:00	0.51	734.0	4,314.5	154.3	10/3/17 20:53:30	0.52	743.0	4,316.1	154.4
10/3/17 22:12:00	0.55	794.0	4,314.4	154.0	10/3/17 21:52:00	0.56	799.3	4,321.0	154.2
10/3/17 22:54:00	0.58	836.0	4,319.9	153.6	10/3/17 22:34:00	0.59	845.0	4,321.0	153.8
10/3/17 23:43:30	0.61	885.5	4,324.3	153.4	10/3/17 23:34:00	0.62	887.0	4,326.2	153.6
10/4/17 0:36:00	0.65	938.0	4,324.5	153.0	10/4/17 0:16:00	0.66	947.0	4,326.2	153.2
10/4/17 1:35:15	0.69	997.3	4,330.7	152.9	10/4/17 1:16:00	0.69	995.8	4,331.3	153.1
10/4/17 2:18:00	0.72	1,040.0	4,329.8	152.5	10/4/17 1:58:00	0.73	1,049.0	4,331.1	152.7
10/4/17 3:00:00	0.75	1,082.0	4,334.9	152.2	10/4/17 2:40:00	0.76	1,091.0	4,336.6	152.4
10/4/17 3:48:45	0.79	1,130.8	4,340.0	152.0	10/4/17 3:40:00	0.79	1,133.0	4,341.5	152.1
10/4/17 4:42:00	0.82	1,184.0	4,339.5	151.5	10/4/17 4:22:00	0.82	1,184.8	4,346.4	151.8
10/4/17 5:24:00	0.85	1,226.0	4,345.0	151.1	10/4/17 5:04:00	0.86	1,235.0	4,346.6	151.3
10/4/17 6:06:00	0.88	1,268.0	4,350.1	150.7	10/4/17 5:47:30	0.89	1,277.0	4,351.5	150.9
10/4/17 7:06:00	0.92	1,328.0	4,350.1	150.4	10/4/17 6:46:00	0.93	1,337.0	4,352.3	150.6
10/4/17 8:06:00	0.96	1,388.0	4,350.3	150.4	10/4/17 7:46:00	0.97	1,397.0	4,351.9	150.6
10/4/17 8:54:00	1.00	1,436.0	4,350.8	150.5	10/4/17 8:46:00	1.00	1,434.5	4,351.6	150.7
10/4/17 9:48:00	1.03	1,490.0	4,350.2	150.6	10/4/17 9:19:00	1.03	1,490.0	4,351.7	150.8
10/4/17 10:48:00	1.08	1,550.0	4,350.3	150.8	10/4/17 10:19:00	1.08	1,550.0	4,351.7	151.1
10/4/17 11:30:00	1.11	1,592.0	4,355.5	150.7	10/4/17 11:07:45	1.11	1,592.0	4,356.6	151.0
10/4/17 12:30:00	1.15	1,652.0	4,354.4	150.7	10/4/17 12:01:00	1.15	1,652.0	4,356.5	151.0
10/4/17 13:30:00	1.19	1,712.0	4,354.8	150.8	10/4/17 13:01:00	1.19	1,712.0	4,356.6	151.1
10/4/17 14:30:00	1.23	1,772.0	4,354.9	150.9	10/4/17 14:01:00	1.23	1,772.0	4,356.5	151.2
10/4/17 15:25:00	1.27	1,827.0	4,354.7	151.1	10/4/17 14:56:00	1.27	1,827.0	4,356.3	151.4
10/4/17 16:20:00	1.31	1,882.0	4,354.9	151.2	10/4/17 15:51:00	1.31	1,882.0	4,356.3	151.5

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/4/17 16:57:00	1.33	1,919.0	4,357.8	151.3	10/4/17 16:37:45	1.33	1,919.0	4,359.2	151.5
10/4/17 17:52:00	1.37	1,974.0	4,357.6	151.3	10/4/17 17:23:00	1.37	1,974.0	4,359.1	151.6
10/4/17 18:29:00	1.40	2,011.0	4,365.1	151.2	10/4/17 18:11:15	1.40	2,011.0	4,366.2	151.3
10/4/17 19:08:15	1.42	2,050.3	4,369.8	150.9	10/4/17 18:55:00	1.42	2,048.0	4,371.4	151.1
10/4/17 20:02:00	1.46	2,104.0	4,369.9	150.5	10/4/17 19:33:00	1.46	2,104.0	4,371.3	150.7
10/4/17 20:57:00	1.50	2,159.0	4,369.8	150.4	10/4/17 20:28:00	1.50	2,159.0	4,371.5	150.6
10/4/17 21:43:45	1.53	2,205.8	4,374.7	150.4	10/4/17 21:23:00	1.53	2,202.8	4,376.7	150.5
10/4/17 22:29:00	1.56	2,251.0	4,377.0	150.1	10/4/17 22:00:00	1.55	2,233.0	4,378.5	150.3
10/4/17 23:24:00	1.60	2,306.0	4,378.9	150.0	10/4/17 22:37:00	1.59	2,288.0	4,378.4	150.2
10/5/17 0:19:00	1.64	2,361.0	4,379.4	149.9	10/4/17 23:21:30	1.61	2,325.0	4,380.7	150.1
10/5/17 1:14:00	1.68	2,416.0	4,382.3	149.8	10/5/17 0:09:00	1.64	2,365.0	4,383.5	150.1
10/5/17 2:09:00	1.72	2,471.0	4,382.3	149.8	10/5/17 0:46:00	1.68	2,417.0	4,383.6	149.9
10/5/17 3:00:15	1.75	2,522.3	4,380.9	149.8	10/5/17 1:41:00	1.71	2,460.8	4,383.9	150.0
10/5/17 3:23:00	1.77	2,545.0	4,387.5	149.7	10/5/17 2:18:00	1.74	2,509.0	4,383.1	150.0
10/5/17 4:18:00	1.81	2,600.0	4,387.2	149.6	10/5/17 3:01:00	1.76	2,528.0	4,388.2	150.0
10/5/17 4:55:00	1.83	2,637.0	4,390.1	149.5	10/5/17 3:32:00	1.79	2,583.0	4,388.6	149.8
10/5/17 5:50:00	1.87	2,692.0	4,393.3	149.3	10/5/17 4:24:45	1.82	2,620.0	4,391.5	149.7
10/5/17 6:45:00	1.91	2,747.0	4,393.3	149.2	10/5/17 5:04:00	1.85	2,660.8	4,394.7	149.6
10/5/17 7:40:00	1.95	2,802.0	4,395.1	149.2	10/5/17 5:41:00	1.88	2,712.0	4,394.9	149.4
10/5/17 8:35:00	1.98	2,857.0	4,395.6	149.1	10/5/17 6:36:00	1.92	2,767.0	4,394.8	149.4
10/5/17 9:27:45	2.02	2,909.8	4,401.1	149.2	10/5/17 7:21:15	1.95	2,804.0	4,396.7	149.3
10/5/17 10:12:00	2.05	2,954.0	4,395.3	149.2	10/5/17 8:13:00	1.99	2,864.0	4,396.8	149.3
10/5/17 11:02:00	2.09	3,004.0	4,395.5	149.3	10/5/17 9:03:00	2.02	2,907.3	4,396.2	149.4
10/5/17 11:03:00	2.09	3,005.0	4,395.5	149.3	10/5/17 9:04:00	2.02	2,907.5	4,396.5	149.4
10/5/17 11:04:00	2.09	3,006.0	4,395.4	149.3	10/5/17 9:05:00	2.02	2,907.8	4,397.0	149.4
10/5/17 11:05:00	2.09	3,007.0	4,395.2	149.3	10/5/17 9:06:00	2.02	2,908.0	4,397.1	149.4
10/5/17 11:06:00	2.09	3,008.0	4,395.4	149.3	10/5/17 9:07:00	2.02	2,908.3	4,397.2	149.4
10/5/17 11:07:00	2.09	3,009.0	4,395.4	149.3	10/5/17 9:08:00	2.02	2,908.5	4,397.2	149.4
10/5/17 11:08:00	2.09	3,010.0	4,384.7	149.3	10/5/17 9:09:00	2.02	2,908.8	4,396.8	149.4
10/5/17 11:08:15	2.09	3,010.3	4,375.9	149.3	10/5/17 9:10:00	2.02	2,909.0	4,397.0	149.4
10/5/17 11:08:30	2.09	3,010.5	4,370.4	149.3	10/5/17 9:11:00	2.02	2,909.3	4,396.9	149.4
10/5/17 11:08:45	2.09	3,010.8	4,365.6	149.3	10/5/17 9:12:00	2.02	2,909.5	4,396.9	149.4
10/5/17 11:11:15	2.09	3,013.3	4,339.6	149.4	10/5/17 9:22:00	2.02	2,912.0	4,396.9	149.4
10/5/17 11:13:45	2.09	3,015.8	4,326.7	149.6	10/5/17 9:28:15	2.03	2,916.0	4,396.9	149.4
10/5/17 11:16:15	2.10	3,018.3	4,317.3	149.9	10/5/17 9:30:45	2.03	2,926.0	4,396.6	149.4
10/5/17 11:18:45	2.10	3,020.8	4,310.2	150.2	10/5/17 9:33:15	2.04	2,936.0	4,396.8	149.4
10/5/17 11:33:45	2.11	3,035.8	4,284.9	152.0	10/5/17 10:25:00	2.08	2,996.0	4,396.9	149.5
10/5/17 11:54:00	2.12	3,056.0	4,266.6	154.0	10/5/17 11:12:15	2.10	3,018.5	4,306.8	151.5
10/5/17 12:54:00	2.16	3,116.0	4,238.6	158.0	10/5/17 11:27:15	2.11	3,033.5	4,284.1	154.0
10/5/17 13:54:00	2.21	3,176.0	4,222.0	160.5	10/5/17 11:42:15	2.12	3,048.5	4,270.6	155.7
10/5/17 14:54:00	2.25	3,236.0	4,210.0	162.4	10/5/17 11:57:15	2.14	3,083.0	4,251.5	158.0
10/5/17 15:54:00	2.29	3,296.0	4,200.5	163.7	10/5/17 12:52:00	2.18	3,143.0	4,231.2	160.3
10/5/17 16:54:00	2.33	3,356.0	4,192.6	164.9	10/5/17 13:52:00	2.22	3,203.0	4,217.3	161.9

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/5/17 17:54:00	2.37	3,416.0	4,185.8	165.9	10/5/17 14:52:00	2.27	3,263.0	4,206.8	163.2
10/5/17 18:54:00	2.41	3,476.0	4,179.8	166.7	10/5/17 15:52:00	2.31	3,323.0	4,198.1	164.2
10/5/17 19:54:00	2.46	3,536.0	4,174.5	167.5	10/5/17 16:52:00	2.35	3,383.0	4,190.8	165.0
10/5/17 20:54:00	2.50	3,596.0	4,169.7	168.2	10/5/17 17:52:00	2.39	3,443.0	4,184.5	165.6
10/5/17 21:54:00	2.54	3,656.0	4,165.3	168.7	10/5/17 18:52:00	2.43	3,503.0	4,178.9	166.0
10/5/17 22:54:00	2.58	3,716.0	4,161.3	169.3	10/5/17 19:52:00	2.47	3,563.0	4,173.8	166.5
10/5/17 23:54:00	2.62	3,776.0	4,157.6	169.8	10/5/17 20:52:00	2.52	3,623.0	4,169.2	166.9
10/6/17 0:54:00	2.66	3,836.0	4,154.0	170.2	10/5/17 21:52:00	2.56	3,683.0	4,165.0	167.3
10/6/17 1:54:00	2.71	3,896.0	4,150.8	170.6	10/5/17 22:52:00	2.60	3,743.0	4,161.1	167.7
10/6/17 2:54:00	2.75	3,956.0	4,147.7	171.0	10/5/17 23:52:00	2.64	3,803.0	4,157.4	168.1
10/6/17 3:54:00	2.79	4,016.0	4,144.8	171.3	10/6/17 0:52:00	2.68	3,863.0	4,154.2	168.4
10/6/17 4:54:00	2.83	4,076.0	4,142.1	171.6	10/6/17 1:52:00	2.72	3,923.0	4,151.2	168.7
10/6/17 5:54:00	2.87	4,136.0	4,139.5	171.9	10/6/17 2:52:00	2.77	3,983.0	4,148.2	169.0
10/6/17 6:54:00	2.91	4,196.0	4,137.1	172.2	10/6/17 3:52:00	2.81	4,043.0	4,145.3	169.2
10/6/17 7:54:00	2.96	4,256.0	4,134.7	172.4	10/6/17 4:52:00	2.85	4,103.0	4,142.7	169.5
10/6/17 8:54:00	3.00	4,316.0	4,132.4	172.7	10/6/17 5:52:00	2.89	4,163.0	4,140.1	169.7
10/6/17 9:54:00	3.04	4,376.0	4,130.2	172.9	10/6/17 6:52:00	2.93	4,223.0	4,137.7	169.9
10/6/17 10:54:00	3.08	4,436.0	4,128.1	173.1	10/6/17 7:52:00	2.97	4,283.0	4,135.4	170.1
10/6/17 11:54:00	3.12	4,496.0	4,126.1	173.3	10/6/17 8:52:00	3.02	4,343.0	4,133.2	170.3
10/6/17 12:54:00	3.16	4,556.0	4,124.1	173.5	10/6/17 9:52:00	3.06	4,403.0	4,131.0	170.5
10/6/17 13:54:00	3.21	4,616.0	4,122.2	173.6	10/6/17 10:52:00	3.10	4,463.0	4,128.9	170.7
10/6/17 14:54:00	3.25	4,676.0	4,120.5	173.8	10/6/17 11:52:00	3.14	4,523.0	4,127.0	170.9
10/6/17 15:54:00	3.29	4,736.0	4,118.8	173.9	10/6/17 12:52:00	3.18	4,583.0	4,125.0	171.0
10/6/17 16:54:00	3.33	4,796.0	4,117.1	174.1	10/6/17 13:52:00	3.22	4,643.0	4,123.2	171.2
10/6/17 17:54:00	3.37	4,856.0	4,115.5	174.2	10/6/17 14:52:00	3.27	4,703.0	4,121.5	171.3
10/6/17 18:54:00	3.41	4,916.0	4,113.8	174.4	10/6/17 15:52:00	3.31	4,763.0	4,119.8	171.5
10/6/17 19:54:00	3.46	4,976.0	4,112.3	174.5	10/6/17 16:52:00	3.35	4,823.0	4,118.2	171.6
10/6/17 20:54:00	3.50	5,036.0	4,110.8	174.6	10/6/17 17:52:00	3.39	4,883.0	4,116.6	171.8
10/6/17 21:54:00	3.54	5,096.0	4,109.2	174.7	10/6/17 18:52:00	3.43	4,943.0	4,115.0	171.9
10/6/17 22:54:00	3.58	5,156.0	4,107.8	174.8	10/6/17 19:52:00	3.47	5,003.0	4,113.4	172.0
10/6/17 23:54:00	3.62	5,216.0	4,106.4	174.9	10/6/17 20:52:00	3.52	5,063.0	4,112.0	172.1
10/7/17 0:54:00	3.66	5,276.0	4,105.0	175.0	10/6/17 21:52:00	3.56	5,123.0	4,110.5	172.2
10/7/17 1:54:00	3.71	5,336.0	4,103.7	175.1	10/6/17 22:52:00	3.60	5,183.0	4,109.0	172.4
10/7/17 2:54:00	3.75	5,396.0	4,102.4	175.2	10/6/17 23:52:00	3.64	5,243.0	4,107.7	172.5
10/7/17 3:54:00	3.79	5,456.0	4,101.1	175.3	10/7/17 0:52:00	3.68	5,303.0	4,106.3	172.6
10/7/17 4:54:00	3.83	5,516.0	4,099.8	175.4	10/7/17 1:52:00	3.72	5,363.0	4,104.9	172.7
10/7/17 5:54:00	3.87	5,576.0	4,098.6	175.5	10/7/17 2:52:00	3.77	5,423.0	4,103.7	172.8
10/7/17 6:54:00	3.91	5,636.0	4,097.4	175.6	10/7/17 3:52:00	3.81	5,483.0	4,102.5	172.9
10/7/17 7:54:00	3.96	5,696.0	4,096.4	175.6	10/7/17 4:52:00	3.85	5,543.0	4,101.2	173.0
10/7/17 8:54:00	4.00	5,756.0	4,095.2	175.7	10/7/17 5:52:00	3.89	5,603.0	4,100.1	173.1
10/7/17 9:54:00	4.04	5,816.0	4,094.0	175.8	10/7/17 6:52:00	3.93	5,663.0	4,098.9	173.1
10/7/17 10:54:00	4.08	5,876.0	4,092.8	175.9	10/7/17 7:52:00	3.97	5,723.0	4,097.7	173.2
10/7/17 11:54:00	4.12	5,936.0	4,091.7	175.9	10/7/17 8:52:00	4.02	5,783.0	4,096.6	173.3

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A						F328A					
F162A13 13 Deg						F328A13 13 Deg					
Date	Days	Minutes	Psig	F		Date	Days	Minutes	Psig	F	
10/7/17 12:54:00	4.16	5,996.0	4,090.6	176.0		10/7/17 9:52:00	4.06	5,843.0	4,095.5	173.4	
10/7/17 13:54:00	4.21	6,056.0	4,089.6	176.1		10/7/17 10:52:00	4.10	5,903.0	4,094.4	173.5	
10/7/17 14:54:00	4.25	6,116.0	4,088.5	176.1		10/7/17 11:52:00	4.14	5,963.0	4,093.2	173.6	
10/7/17 15:54:00	4.29	6,176.0	4,087.5	176.2		10/7/17 12:52:00	4.18	6,023.0	4,092.2	173.6	
10/7/17 16:54:00	4.33	6,236.0	4,086.5	176.2		10/7/17 13:52:00	4.22	6,083.0	4,091.2	173.7	
10/7/17 17:54:00	4.37	6,296.0	4,085.6	176.3		10/7/17 14:52:00	4.27	6,143.0	4,090.2	173.8	
10/7/17 18:54:00	4.41	6,356.0	4,084.6	176.3		10/7/17 15:52:00	4.31	6,203.0	4,089.2	174.0	
10/7/17 19:54:00	4.46	6,416.0	4,083.6	176.4		10/7/17 16:52:00	4.35	6,263.0	4,088.2	174.0	
10/7/17 20:54:00	4.50	6,476.0	4,082.6	176.4		10/7/17 17:52:00	4.39	6,323.0	4,087.2	174.1	
10/7/17 21:54:00	4.54	6,536.0	4,081.6	176.5		10/7/17 18:52:00	4.43	6,383.0	4,086.3	174.1	
10/7/17 22:54:00	4.58	6,596.0	4,080.8	176.5		10/7/17 19:52:00	4.47	6,443.0	4,085.4	174.2	
10/7/17 23:54:00	4.62	6,656.0	4,079.8	176.6		10/7/17 20:52:00	4.52	6,503.0	4,084.4	174.2	
10/8/17 0:54:00	4.66	6,716.0	4,079.0	176.7		10/7/17 21:52:00	4.56	6,563.0	4,083.5	174.3	
10/8/17 1:54:00	4.71	6,776.0	4,078.1	176.7		10/7/17 22:52:00	4.60	6,623.0	4,082.5	174.4	
10/8/17 2:54:00	4.75	6,836.0	4,077.2	176.8		10/7/17 23:52:00	4.64	6,683.0	4,081.6	174.4	
10/8/17 3:54:00	4.79	6,896.0	4,076.3	176.8		10/8/17 0:52:00	4.68	6,743.0	4,080.7	174.5	
10/8/17 4:54:00	4.83	6,956.0	4,075.5	176.9		10/8/17 1:52:00	4.72	6,803.0	4,079.9	174.5	
10/8/17 5:54:00	4.87	7,016.0	4,074.7	176.9		10/8/17 2:52:00	4.77	6,863.0	4,079.1	174.6	
10/8/17 6:54:00	4.91	7,076.0	4,073.9	177.0		10/8/17 3:52:00	4.81	6,923.0	4,078.2	174.6	
10/8/17 7:54:00	4.96	7,136.0	4,073.0	177.0		10/8/17 4:52:00	4.85	6,983.0	4,077.4	174.7	
10/8/17 8:54:00	5.00	7,196.0	4,072.2	177.1		10/8/17 5:52:00	4.89	7,043.0	4,076.6	174.7	
10/8/17 9:54:00	5.04	7,256.0	4,071.5	177.1		10/8/17 6:52:00	4.93	7,103.0	4,075.8	174.8	
10/8/17 10:54:00	5.08	7,316.0	4,070.7	177.2		10/8/17 7:52:00	4.97	7,163.0	4,075.0	174.8	
10/8/17 11:54:00	5.12	7,376.0	4,069.9	177.2		10/8/17 8:52:00	5.02	7,223.0	4,074.2	174.9	
10/8/17 12:54:00	5.16	7,436.0	4,069.1	177.2		10/8/17 9:52:00	5.06	7,283.0	4,073.4	174.9	
10/8/17 13:54:00	5.21	7,496.0	4,068.3	177.3		10/8/17 10:52:00	5.10	7,343.0	4,072.6	174.9	
10/8/17 14:54:00	5.25	7,556.0	4,067.6	177.3		10/8/17 11:52:00	5.14	7,403.0	4,071.8	175.0	
10/8/17 15:54:00	5.29	7,616.0	4,066.8	177.4		10/8/17 12:52:00	5.18	7,463.0	4,071.1	175.0	
10/8/17 16:54:00	5.33	7,676.0	4,066.1	177.4		10/8/17 13:52:00	5.22	7,523.0	4,070.3	175.1	
10/8/17 17:54:00	5.37	7,736.0	4,065.4	177.4		10/8/17 14:52:00	5.27	7,583.0	4,069.6	175.1	
10/8/17 18:54:00	5.41	7,796.0	4,064.7	177.5		10/8/17 15:52:00	5.31	7,643.0	4,068.8	175.2	
10/8/17 19:54:00	5.46	7,856.0	4,063.9	177.5		10/8/17 16:52:00	5.35	7,703.0	4,068.1	175.2	
10/8/17 20:54:00	5.50	7,916.0	4,063.2	177.6		10/8/17 17:52:00	5.39	7,763.0	4,067.4	175.3	
10/8/17 21:54:00	5.54	7,976.0	4,062.5	177.6		10/8/17 18:52:00	5.43	7,823.0	4,066.7	175.3	
10/8/17 22:54:00	5.58	8,036.0	4,061.8	177.6		10/8/17 19:52:00	5.47	7,883.0	4,066.1	175.3	
10/8/17 23:54:00	5.62	8,096.0	4,061.1	177.7		10/8/17 20:52:00	5.52	7,943.0	4,065.4	175.4	
10/9/17 0:54:00	5.66	8,156.0	4,060.4	177.7		10/8/17 21:52:00	5.56	8,003.0	4,064.6	175.4	
10/9/17 1:54:00	5.71	8,216.0	4,059.7	177.7		10/8/17 22:52:00	5.60	8,063.0	4,063.9	175.5	
10/9/17 2:54:00	5.75	8,276.0	4,059.1	177.8		10/8/17 23:52:00	5.64	8,123.0	4,063.2	175.5	
10/9/17 3:54:00	5.79	8,336.0	4,058.5	177.8		10/9/17 0:52:00	5.68	8,183.0	4,062.6	175.5	
10/9/17 4:54:00	5.83	8,396.0	4,057.8	177.8		10/9/17 1:52:00	5.72	8,243.0	4,061.9	175.6	
10/9/17 5:54:00	5.87	8,456.0	4,057.1	177.9		10/9/17 2:52:00	5.77	8,303.0	4,061.3	175.6	
10/9/17 6:54:00	5.91	8,516.0	4,056.5	177.9		10/9/17 3:52:00	5.81	8,363.0	4,060.6	175.6	

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/9/17 7:54:00	5.96	8,576.0	4,055.9	177.9	10/9/17 4:52:00	5.85	8,423.0	4,060.0	175.7
10/9/17 8:54:00	6.00	8,636.0	4,055.3	178.0	10/9/17 5:52:00	5.89	8,483.0	4,059.4	175.7
10/9/17 9:54:00	6.04	8,696.0	4,054.7	178.0	10/9/17 6:52:00	5.93	8,543.0	4,058.8	175.7
10/9/17 10:54:00	6.08	8,756.0	4,054.1	178.0	10/9/17 7:52:00	5.97	8,603.0	4,058.2	175.8
10/9/17 11:54:00	6.12	8,816.0	4,053.5	178.0	10/9/17 8:52:00	6.02	8,663.0	4,057.6	175.8
10/9/17 12:54:00	6.16	8,876.0	4,052.8	178.1	10/9/17 9:52:00	6.06	8,723.0	4,057.0	175.9
10/9/17 13:54:00	6.21	8,936.0	4,052.2	178.1	10/9/17 10:52:00	6.10	8,783.0	4,056.4	175.9
10/9/17 14:54:00	6.25	8,996.0	4,051.6	178.1	10/9/17 11:52:00	6.14	8,843.0	4,055.7	175.9
10/9/17 15:54:00	6.29	9,056.0	4,051.0	178.2	10/9/17 12:52:00	6.18	8,903.0	4,055.2	176.0
10/9/17 16:54:00	6.33	9,116.0	4,050.4	178.2	10/9/17 13:52:00	6.22	8,963.0	4,054.5	176.0
10/9/17 17:54:00	6.37	9,176.0	4,049.9	178.2	10/9/17 14:52:00	6.27	9,023.0	4,053.9	176.0
10/9/17 18:54:00	6.41	9,236.0	4,049.2	178.2	10/9/17 15:52:00	6.31	9,083.0	4,053.3	176.1
10/9/17 19:54:00	6.46	9,296.0	4,048.7	178.3	10/9/17 16:52:00	6.35	9,143.0	4,052.8	176.1
10/9/17 20:54:00	6.50	9,356.0	4,048.2	178.3	10/9/17 17:52:00	6.39	9,203.0	4,052.2	176.1
10/9/17 21:54:00	6.54	9,416.0	4,047.6	178.3	10/9/17 18:52:00	6.43	9,263.0	4,051.7	176.2
10/9/17 22:54:00	6.58	9,476.0	4,047.0	178.3	10/9/17 19:52:00	6.47	9,323.0	4,051.1	176.2
10/9/17 23:54:00	6.62	9,536.0	4,046.4	178.4	10/9/17 20:52:00	6.52	9,383.0	4,050.5	176.2
10/10/17 0:54:00	6.66	9,596.0	4,045.8	178.4	10/9/17 21:52:00	6.56	9,443.0	4,049.9	176.2
10/10/17 1:54:00	6.71	9,656.0	4,045.3	178.4	10/9/17 22:52:00	6.60	9,503.0	4,049.4	176.3
10/10/17 2:54:00	6.75	9,716.0	4,044.7	178.4	10/9/17 23:52:00	6.64	9,563.0	4,048.8	176.3
10/10/17 3:54:00	6.79	9,776.0	4,044.2	178.5	10/10/17 0:52:00	6.68	9,623.0	4,048.2	176.3
10/10/17 4:54:00	6.83	9,836.0	4,043.7	178.5	10/10/17 1:52:00	6.72	9,683.0	4,047.7	176.4
10/10/17 5:54:00	6.87	9,896.0	4,043.1	178.5	10/10/17 2:52:00	6.77	9,743.0	4,047.2	176.4
10/10/17 6:54:00	6.91	9,956.0	4,042.6	178.5	10/10/17 3:52:00	6.81	9,803.0	4,046.6	176.4
10/10/17 7:54:00	6.96	10,016.0	4,042.0	178.6	10/10/17 4:52:00	6.85	9,863.0	4,046.1	176.4
10/10/17 8:54:00	7.00	10,076.0	4,041.5	178.6	10/10/17 5:52:00	6.89	9,923.0	4,045.6	176.5
10/10/17 9:54:00	7.04	10,136.0	4,041.1	178.6	10/10/17 6:52:00	6.93	9,983.0	4,045.1	176.5
10/10/17 10:54:00	7.08	10,196.0	4,040.5	178.6	10/10/17 7:52:00	6.97	10,043.0	4,044.5	176.5
10/10/17 11:54:00	7.12	10,256.0	4,040.0	178.7	10/10/17 8:52:00	7.02	10,103.0	4,044.0	176.5
10/10/17 12:54:00	7.16	10,316.0	4,039.5	178.7	10/10/17 9:52:00	7.06	10,163.0	4,043.5	176.6
10/10/17 13:54:00	7.21	10,376.0	4,039.0	178.7	10/10/17 10:52:00	7.10	10,223.0	4,043.0	176.6
10/10/17 14:54:00	7.25	10,436.0	4,038.4	178.7	10/10/17 11:52:00	7.14	10,283.0	4,042.5	176.6
10/10/17 15:54:00	7.29	10,496.0	4,037.9	178.7	10/10/17 12:52:00	7.18	10,343.0	4,042.0	176.6
10/10/17 16:54:00	7.33	10,556.0	4,037.4	178.8	10/10/17 13:52:00	7.22	10,403.0	4,041.5	176.7
10/10/17 17:54:00	7.37	10,616.0	4,037.0	178.8	10/10/17 14:52:00	7.27	10,463.0	4,041.0	176.7
10/10/17 18:54:00	7.41	10,676.0	4,036.5	178.8	10/10/17 15:52:00	7.31	10,523.0	4,040.4	176.7
10/10/17 19:54:00	7.46	10,736.0	4,036.0	178.8	10/10/17 16:52:00	7.35	10,583.0	4,039.9	176.8
10/10/17 20:54:00	7.50	10,796.0	4,035.5	178.8	10/10/17 17:52:00	7.39	10,643.0	4,039.5	176.8
10/10/17 21:54:00	7.54	10,856.0	4,035.0	178.9	10/10/17 18:52:00	7.43	10,703.0	4,039.1	176.8
10/10/17 22:54:00	7.58	10,916.0	4,034.5	178.9	10/10/17 19:52:00	7.47	10,763.0	4,038.5	176.8
10/10/17 23:54:00	7.62	10,976.0	4,034.0	178.9	10/10/17 20:52:00	7.52	10,823.0	4,038.1	176.9
10/11/17 0:54:00	7.66	11,036.0	4,033.5	178.9	10/10/17 21:52:00	7.56	10,883.0	4,037.5	176.9
10/11/17 1:54:00	7.71	11,096.0	4,033.0	178.9	10/10/17 22:52:00	7.60	10,943.0	4,037.1	176.9

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/11/17 2:54:00	7.75	11,156.0	4,032.5	179.0	10/10/17 23:52:00	7.64	11,003.0	4,036.6	176.9
10/11/17 3:54:00	7.79	11,216.0	4,032.0	179.0	10/11/17 0:52:00	7.68	11,063.0	4,036.1	176.9
10/11/17 4:54:00	7.83	11,276.0	4,031.6	179.0	10/11/17 1:52:00	7.72	11,123.0	4,035.6	177.0
10/11/17 5:54:00	7.87	11,336.0	4,031.1	179.0	10/11/17 2:52:00	7.77	11,183.0	4,035.1	177.0
10/11/17 6:54:00	7.91	11,396.0	4,030.6	179.0	10/11/17 3:52:00	7.81	11,243.0	4,034.6	177.0
10/11/17 7:54:00	7.96	11,456.0	4,030.2	179.0	10/11/17 4:52:00	7.85	11,303.0	4,034.2	177.0
10/11/17 8:54:00	8.00	11,516.0	4,029.8	179.1	10/11/17 5:52:00	7.89	11,363.0	4,033.8	177.1
10/11/17 9:54:00	8.04	11,576.0	4,029.3	179.1	10/11/17 6:52:00	7.93	11,423.0	4,033.3	177.1
10/11/17 10:54:00	8.08	11,636.0	4,028.8	179.1	10/11/17 7:52:00	7.97	11,483.0	4,032.9	177.1
10/11/17 11:54:00	8.12	11,696.0	4,028.4	179.1	10/11/17 8:52:00	8.02	11,543.0	4,032.5	177.1
10/11/17 12:54:00	8.16	11,756.0	4,028.0	179.1	10/11/17 9:52:00	8.06	11,603.0	4,032.0	177.1
10/11/17 13:54:00	8.21	11,816.0	4,027.5	179.2	10/11/17 10:52:00	8.10	11,663.0	4,031.5	177.2
10/11/17 14:54:00	8.25	11,876.0	4,027.0	179.2	10/11/17 11:52:00	8.14	11,723.0	4,031.1	177.2
10/11/17 15:54:00	8.29	11,936.0	4,026.5	179.2	10/11/17 12:52:00	8.18	11,783.0	4,030.7	177.2
10/11/17 16:54:00	8.33	11,996.0	4,026.1	179.2	10/11/17 13:52:00	8.22	11,843.0	4,030.3	177.2
10/11/17 17:54:00	8.37	12,056.0	4,025.7	179.2	10/11/17 14:52:00	8.27	11,903.0	4,029.9	177.2
10/11/17 18:54:00	8.41	12,116.0	4,025.3	179.2	10/11/17 15:52:00	8.31	11,963.0	4,029.4	177.3
10/11/17 19:54:00	8.46	12,176.0	4,024.8	179.3	10/11/17 16:52:00	8.35	12,023.0	4,028.9	177.3
10/11/17 20:54:00	8.50	12,236.0	4,024.3	179.3	10/11/17 17:52:00	8.39	12,083.0	4,028.5	177.3
10/11/17 21:54:00	8.54	12,296.0	4,024.0	179.3	10/11/17 18:52:00	8.43	12,143.0	4,028.1	177.3
10/11/17 22:54:00	8.58	12,356.0	4,023.5	179.3	10/11/17 19:52:00	8.47	12,203.0	4,027.6	177.3
10/11/17 23:54:00	8.62	12,416.0	4,023.1	179.3	10/11/17 20:52:00	8.52	12,263.0	4,027.2	177.3
10/12/17 0:54:00	8.66	12,476.0	4,022.7	179.3	10/11/17 21:52:00	8.56	12,323.0	4,026.8	177.4
10/12/17 1:54:00	8.71	12,536.0	4,022.2	179.4	10/11/17 22:52:00	8.60	12,383.0	4,026.3	177.4
10/12/17 2:54:00	8.75	12,596.0	4,021.8	179.4	10/11/17 23:52:00	8.64	12,443.0	4,025.9	177.4
10/12/17 3:54:00	8.79	12,656.0	4,021.4	179.4	10/12/17 0:52:00	8.68	12,503.0	4,025.5	177.4
10/12/17 4:54:00	8.83	12,716.0	4,020.9	179.4	10/12/17 1:52:00	8.72	12,563.0	4,025.1	177.4
10/12/17 5:54:00	8.87	12,776.0	4,020.6	179.4	10/12/17 2:52:00	8.77	12,623.0	4,024.7	177.5
10/12/17 6:54:00	8.91	12,836.0	4,020.2	179.4	10/12/17 3:52:00	8.81	12,683.0	4,024.2	177.5
10/12/17 7:54:00	8.96	12,896.0	4,019.7	179.4	10/12/17 4:52:00	8.85	12,743.0	4,023.9	177.5
10/12/17 8:54:00	9.00	12,956.0	4,019.3	179.5	10/12/17 5:52:00	8.89	12,803.0	4,023.5	177.5
10/12/17 9:54:00	9.04	13,016.0	4,018.9	179.5	10/12/17 6:52:00	8.93	12,863.0	4,023.0	177.5
10/12/17 10:54:00	9.08	13,076.0	4,018.5	179.5	10/12/17 7:52:00	8.97	12,923.0	4,022.6	177.6
10/12/17 11:54:00	9.12	13,136.0	4,018.1	179.5	10/12/17 8:52:00	9.02	12,983.0	4,022.2	177.6
10/12/17 12:54:00	9.16	13,196.0	4,017.6	179.5	10/12/17 9:52:00	9.06	13,043.0	4,021.7	177.6
10/12/17 13:54:00	9.21	13,256.0	4,017.2	179.5	10/12/17 10:52:00	9.10	13,103.0	4,021.4	177.6
10/12/17 14:54:00	9.25	13,316.0	4,016.8	179.6	10/12/17 11:52:00	9.14	13,163.0	4,021.1	177.6
10/12/17 15:54:00	9.29	13,376.0	4,016.4	179.6	10/12/17 12:52:00	9.18	13,223.0	4,020.7	177.6
10/12/17 16:54:00	9.33	13,436.0	4,016.0	179.6	10/12/17 13:52:00	9.22	13,283.0	4,020.2	177.7
10/12/17 17:54:00	9.37	13,496.0	4,015.7	179.6	10/12/17 14:52:00	9.27	13,343.0	4,019.9	177.7
10/12/17 18:54:00	9.41	13,556.0	4,015.3	179.6	10/12/17 15:52:00	9.31	13,403.0	4,019.5	177.7
10/12/17 19:54:00	9.46	13,616.0	4,014.9	179.6	10/12/17 16:52:00	9.35	13,463.0	4,019.0	177.7
10/12/17 20:54:00	9.50	13,676.0	4,014.5	179.6	10/12/17 17:52:00	9.39	13,523.0	4,018.7	177.7

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/12/17 21:54:00	9.54	13,736.0	4,014.1	179.6	10/12/17 18:52:00	9.43	13,583.0	4,018.3	177.7
10/12/17 22:54:00	9.58	13,796.0	4,013.7	179.7	10/12/17 19:52:00	9.47	13,643.0	4,018.0	177.8
10/12/17 23:54:00	9.62	13,856.0	4,013.4	179.7	10/12/17 20:52:00	9.52	13,703.0	4,017.5	177.8
10/13/17 0:54:00	9.66	13,916.0	4,013.0	179.7	10/12/17 21:52:00	9.56	13,763.0	4,017.1	177.8
10/13/17 1:54:00	9.71	13,976.0	4,012.6	179.7	10/12/17 22:52:00	9.60	13,823.0	4,016.7	177.8
10/13/17 2:54:00	9.75	14,036.0	4,012.2	179.7	10/12/17 23:52:00	9.64	13,883.0	4,016.3	177.8
10/13/17 3:54:00	9.79	14,096.0	4,011.8	179.7	10/13/17 0:52:00	9.68	13,943.0	4,016.0	177.8
10/13/17 4:54:00	9.83	14,156.0	4,011.4	179.7	10/13/17 1:52:00	9.72	14,003.0	4,015.6	177.8
10/13/17 5:54:00	9.87	14,216.0	4,011.0	179.8	10/13/17 2:52:00	9.77	14,063.0	4,015.3	177.9
10/13/17 6:54:00	9.91	14,276.0	4,010.7	179.8	10/13/17 3:52:00	9.81	14,123.0	4,014.9	177.9
10/13/17 7:04:00	9.92	14,286.0	4,010.6	179.8	10/13/17 4:02:00	9.81	14,133.0	4,014.8	177.9
10/13/17 7:14:00	9.93	14,296.0	4,010.5	179.8	10/13/17 4:12:00	9.82	14,143.0	4,014.8	177.9
10/13/17 7:24:00	9.93	14,306.0	4,010.4	179.8	10/13/17 4:22:00	9.83	14,153.0	4,014.7	177.9
10/13/17 7:34:00	9.94	14,316.0	4,010.4	179.8	10/13/17 4:32:00	9.84	14,163.0	4,014.6	177.9
10/13/17 7:44:00	9.95	14,326.0	4,010.3	179.8	10/13/17 4:42:00	9.84	14,173.0	4,014.5	177.9
10/13/17 7:54:00	9.96	14,336.0	4,010.3	179.8	10/13/17 4:52:00	9.85	14,183.0	4,014.4	177.9
10/13/17 8:04:00	9.96	14,346.0	4,010.2	179.8	10/13/17 5:02:00	9.86	14,193.0	4,014.4	177.9
10/13/17 8:14:00	9.97	14,356.0	4,010.1	179.8	10/13/17 5:12:00	9.86	14,203.0	4,014.3	177.9
10/13/17 8:24:00	9.98	14,366.0	4,010.1	179.8	10/13/17 5:22:00	9.87	14,213.0	4,014.3	177.9
10/13/17 8:34:00	9.98	14,376.0	4,009.7	179.9	10/13/17 5:32:00	9.88	14,223.0	4,014.2	177.9
10/13/17 8:35:00	9.98	14,377.0	4,009.7	179.9	10/13/17 5:33:00	9.88	14,224.0	4,014.2	177.9
10/13/17 8:36:00	9.98	14,378.0	4,009.8	179.9	10/13/17 5:34:00	9.88	14,225.0	4,014.2	177.9
10/13/17 8:37:00	9.99	14,379.0	4,009.7	179.9	10/13/17 5:35:00	9.88	14,226.0	4,014.2	177.9
10/13/17 8:38:00	9.99	14,380.0	4,009.7	180.0	10/13/17 5:36:00	9.88	14,227.0	4,014.2	177.9
10/13/17 8:39:00	9.99	14,381.0	3,981.2	180.0	10/13/17 5:37:00	9.88	14,228.0	4,014.2	177.9
10/13/17 8:39:15	9.99	14,381.3	3,968.2	180.0	10/13/17 5:38:00	9.88	14,229.0	4,014.2	177.9
10/13/17 8:39:30	9.99	14,381.5	3,954.9	180.1	10/13/17 5:39:00	9.88	14,230.0	4,014.2	177.9
10/13/17 8:39:45	9.99	14,381.8	3,941.1	180.2	10/13/17 5:40:00	9.88	14,231.0	4,014.2	177.9
10/13/17 8:42:15	9.99	14,384.3	3,876.3	181.3	10/13/17 5:50:00	9.89	14,241.0	4,014.1	177.9
10/13/17 8:44:45	9.99	14,386.8	3,876.9	181.5	10/13/17 6:00:00	9.90	14,251.0	4,014.1	177.9
10/13/17 8:47:15	9.99	14,389.3	3,682.3	180.9	10/13/17 6:10:00	9.90	14,261.0	4,014.0	177.9
10/13/17 8:49:45	9.99	14,391.8	3,456.8	177.2	10/13/17 6:20:00	9.91	14,271.0	4,013.9	177.9
10/13/17 8:52:15	10.00	14,394.3	3,456.8	172.2	10/13/17 6:30:00	9.92	14,281.0	4,013.8	177.9
10/13/17 8:54:45	10.00	14,396.8	3,455.5	168.1	10/13/17 6:40:00	9.92	14,291.0	4,013.8	177.9
10/13/17 8:57:15	10.00	14,399.3	3,213.1	165.1	10/13/17 6:50:00	9.93	14,301.0	4,013.8	177.9
10/13/17 8:59:45	10.00	14,401.8	3,031.9	158.0	10/13/17 7:00:00	9.94	14,311.0	4,013.7	177.9
10/13/17 9:02:15	10.00	14,404.3	3,030.1	151.6	10/13/17 7:10:00	9.95	14,321.0	4,013.6	177.9
10/13/17 9:04:45	10.00	14,406.8	3,027.7	147.2	10/13/17 7:20:00	9.95	14,331.0	4,013.5	177.9
10/13/17 9:07:15	10.01	14,409.3	2,692.5	143.0	10/13/17 7:30:00	9.96	14,341.0	4,013.5	177.9
10/13/17 9:09:45	10.01	14,411.8	2,600.7	137.2	10/13/17 7:40:00	9.97	14,351.0	4,013.4	177.9
10/13/17 9:12:15	10.01	14,414.3	2,599.4	131.5	10/13/17 7:50:00	9.97	14,361.0	4,013.3	177.9
10/13/17 9:14:45	10.01	14,416.8	2,597.3	128.1	10/13/17 8:00:00	9.98	14,371.0	4,012.7	178.0
10/13/17 9:17:15	10.01	14,419.3	2,213.1	124.3	10/13/17 8:10:00	9.99	14,378.8	3,971.3	178.4

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/13/17 9:19:45	10.02	14,421.8	1,739.4	117.0	10/13/17 8:20:00	9.99	14,381.3	3,878.9	180.1
10/13/17 9:22:15	10.02	14,424.3	1,737.7	108.5	10/13/17 8:30:00	9.99	14,383.8	3,879.4	181.1
10/13/17 9:24:45	10.02	14,426.8	1,735.2	101.6	10/13/17 8:40:00	9.99	14,386.3	3,751.8	181.2
10/13/17 9:27:15	10.02	14,429.3	1,447.6	97.0	10/13/17 8:42:30	9.99	14,388.8	3,469.9	178.4
10/13/17 9:29:45	10.02	14,431.8	1,302.5	90.0	10/13/17 8:45:00	9.99	14,391.3	3,460.2	173.7
10/13/17 9:32:15	10.02	14,434.3	1,300.3	84.1	10/13/17 8:47:30	10.00	14,393.8	3,458.0	169.4
10/13/17 9:34:45	10.03	14,436.8	1,298.0	80.1	10/13/17 8:50:00	10.00	14,396.3	3,290.2	166.3
10/13/17 9:37:15	10.03	14,439.3	957.7	76.6	10/13/17 8:52:30	10.00	14,398.8	3,032.7	160.0
10/13/17 9:39:45	10.03	14,441.8	866.5	72.0	10/13/17 8:55:00	10.00	14,401.3	3,032.6	153.2
10/13/17 9:42:15	10.03	14,444.3	866.2	66.8	10/13/17 8:57:30	10.00	14,403.8	3,030.4	148.3
10/13/17 9:44:45	10.03	14,446.8	864.6	63.6	10/13/17 9:00:00	10.00	14,406.3	2,783.1	144.2
10/13/17 9:47:15	10.03	14,449.3	857.7	61.9	10/13/17 9:02:30	10.01	14,408.8	2,602.2	138.9
10/13/17 9:49:45	10.04	14,451.8	856.9	61.3	10/13/17 9:05:00	10.01	14,411.3	2,600.4	132.8
10/13/17 9:53:00	10.04	14,455.0	0.0	61.3	10/13/17 9:07:30	10.01	14,413.8	2,598.8	129.0
10/13/17 9:55:30	10.04	14,457.5	0.0	61.7	10/13/17 9:10:00	10.01	14,416.3	2,310.8	125.7
10/13/17 9:58:00	10.04	14,460.0	0.0	62.1	10/13/17 9:12:30	10.01	14,418.8	1,810.6	119.0
10/13/17 10:00:30	10.04	14,462.5	0.0	62.2	10/13/17 9:15:00	10.01	14,421.3	1,740.5	110.5
10/13/17 10:09:00	10.05	14,471.0	0.0	60.5	10/13/17 9:17:30	10.02	14,423.8	1,736.9	103.1
					10/13/17 9:20:00	10.02	14,426.3	1,543.0	98.3
					10/13/17 9:22:30	10.02	14,428.8	1,303.9	91.9
					10/13/17 9:25:00	10.02	14,431.3	1,303.8	85.8
					10/13/17 9:27:30	10.02	14,433.8	1,301.6	81.5
					10/13/17 9:30:00	10.03	14,436.3	1,054.4	78.1
					10/13/17 9:32:30	10.03	14,438.8	869.2	73.9
					10/13/17 9:35:00	10.03	14,441.3	870.3	67.9
					10/13/17 9:37:30	10.03	14,443.8	869.9	63.3
					10/13/17 9:40:00	10.03	14,446.3	864.8	60.7
					10/13/17 9:42:30	10.03	14,448.8	860.7	60.2
					10/13/17 9:45:00	10.04	14,451.3	859.3	60.6
					10/13/17 9:47:30	10.04	14,453.8	0.0	61.4
					10/13/17 9:50:00	10.04	14,456.3	0.9	62.3
					10/13/17 9:52:30	10.04	14,458.8	0.8	63.1
					10/13/17 9:55:00	10.05	14,468.0	2.5	60.7
					10/13/17 9:57:30	10.05	14,478.0	2.5	60.3

Appendix F

Test gauge calibration certificates



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	772.83	-1.25	-0.0250%
1498.24	1497.46	-0.78	-0.0156%
2222.36	2220.75	-1.61	-0.0322%
2946.53	2944.89	-1.64	-0.0328%
3670.66	3669.06	-1.60	-0.0320%
4394.87	4393.46	-1.41	-0.0283%
5119.00	5117.54	-1.46	-0.0292%
4394.87	4393.90	-0.97	-0.0195%
3670.66	3669.82	-0.84	-0.0168%
2946.53	2945.67	-0.86	-0.0173%
2222.36	2221.50	-0.86	-0.0172%
1498.24	1497.46	-0.78	-0.0156%
774.08	773.32	-0.76	-0.0151%
0.01	0.01	0.00	0.0000%

Oven Temperature: 273.3 °F

Probe Temperature: 273.5 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.71	0.70	0.0139%
774.08	774.96	0.88	0.0177%
1498.24	1499.12	0.88	0.0176%
2222.36	2222.99	0.63	0.0126%
2946.53	2947.04	0.51	0.0102%
3670.66	3671.23	0.57	0.0113%
4394.87	4395.53	0.66	0.0133%
5119.00	5119.94	0.94	0.0187%
4394.87	4396.16	1.29	0.0258%
3670.66	3671.99	1.33	0.0265%
2946.53	2947.97	1.44	0.0287%
2222.36	2223.84	1.48	0.0296%
1498.24	1499.73	1.49	0.0299%
774.08	775.18	1.10	0.0220%
0.01	0.25	0.24	0.0049%

Oven Temperature: 144.7 °F

Probe Temperature: 144.7 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.90	-0.19	-0.0037%
1498.24	1497.87	-0.38	-0.0075%
2222.36	2221.81	-0.55	-0.0110%
2946.53	2945.90	-0.63	-0.0126%
3670.66	3669.99	-0.67	-0.0134%
4394.87	4394.44	-0.43	-0.0087%
5119.00	5118.94	-0.06	-0.0012%
4394.87	4394.97	0.10	0.0019%
3670.66	3670.88	0.22	0.0045%
2946.53	2946.76	0.23	0.0046%
2222.36	2222.61	0.25	0.0050%
1498.24	1498.39	0.15	0.0031%
774.08	774.11	0.03	0.0007%
0.01	0.01	0.00	0.0000%

Oven Temperature: 179.7 °F

Probe Temperature: 179.6 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.21	-0.87	-0.0175%
1498.24	1497.32	-0.92	-0.0185%
2222.36	2221.23	-1.14	-0.0227%
2946.53	2945.55	-0.98	-0.0196%
3670.66	3669.54	-1.12	-0.0224%
4394.87	4394.04	-0.83	-0.0166%
5119.00	5118.21	-0.79	-0.0158%
4394.87	4394.41	-0.47	-0.0093%
3670.66	3670.40	-0.26	-0.0053%
2946.53	2945.98	-0.55	-0.0109%
2222.36	2222.05	-0.31	-0.0061%
1498.24	1497.93	-0.31	-0.0062%
774.08	773.76	-0.32	-0.0064%
0.01	0.01	0.00	0.0000%

Oven Temperature: 253.9 °F

Probe Temperature: 253.8 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

11-July-2017

Gauge Model SP-2000 Pressure Range 5K
Gauge S/N 328 Accuracy +/-0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.67	-0.41	-0.0082%
1498.24	1497.45	-0.79	-0.0158%
2222.36	2221.56	-0.80	-0.0160%
2946.53	2946.12	-0.41	-0.0082%
3670.66	3670.01	-0.65	-0.0130%
4394.87	4394.33	-0.54	-0.0108%
5119.00	5118.90	-0.10	-0.0020%
4394.87	4395.08	0.21	0.0042%
3670.66	3671.10	0.44	0.0088%
2946.53	2947.05	0.52	0.0104%
2222.36	2222.82	0.46	0.0092%
1498.24	1498.64	0.40	0.0080%
774.08	774.48	0.40	0.0080%
0.01	0.62	0.61	0.0122%

Oven Temperature: 178.8 °F

Probe Temperature: 177.9 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

11-July-2017

Gauge Model
Gauge S/N

SP-2000
328

Pressure Range 5K
Accuracy +/-0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.11	0.10	0.0020%
774.08	773.86	-0.22	-0.0044%
1498.24	1497.71	-0.53	-0.0106%
2222.36	2221.44	-0.92	-0.0184%
2946.53	2945.47	-1.06	-0.0212%
3670.66	3669.65	-1.01	-0.0202%
4394.87	4393.92	-0.95	-0.0190%
5119.00	5118.53	-0.47	-0.0094%
4394.87	4394.68	-0.19	-0.0038%
3670.66	3670.46	-0.20	-0.0040%
2946.53	2946.75	0.22	0.0044%
2222.36	2222.81	0.45	0.0090%
1498.24	1499.02	0.78	0.0156%
774.08	775.17	1.09	0.0218%
0.01	0.01	0.00	0.0000%

Oven Temperature: 218.7 °F

Probe Temperature: 218.6 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM

Appendix G

Mechanical Integrity Test Report (MIT)



NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

MECHANICAL INTEGRITY TEST REPORT

(TA OR UIC)

Date of Test 6-8-17 Operator Western Ref. SW Inc. API # 30-0 45-35747

Property Name Waste Dis. Well Well # 2 Location: Unit H Sec 27 Twn 29 Rge 11

Land Type:

State _____
Federal _____
Private ☒ _____
Indian _____

Well Type:

Water Injection _____
Salt Water Disposal ☒ _____
Gas Injection _____
Producing Oil/Gas _____
Pressure observation _____

Temporarily Abandoned Well (Y/N): 0

TA Expires: _____

Casing Pres. 0
Bradenhead Pres. 0
Tubing Pres. 610
Int. Casing Pres. 0

Tbg. SI Pres. _____
Tbg. Inj. Pres. _____

Max. Inj. Pres. _____

Pressured annulus up to 510 psi. for 30 mins. Test passed/failed

REMARKS:

packer set 7230
top plug 1312-7470
dropped to 505 held last 15 min.

By T. A. P. (Operator Representative)

Witness Monica Kuebeling (NMOCD)

(Position)

Revised 02-11-02



NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
AZTEC DISTRICT OFFICE
1000 RIO BRAZOS ROAD
AZTEC NM 87410
(505) 334-6178 FAX: (505) 334-6170
[http://emnrd.state.nm.us/ocd/District III/3distrct.htm](http://emnrd.state.nm.us/ocd/District%20III/3distrct.htm)

BRADENHEAD TEST REPORT

(submit 1 copy to above address)

Date of Test 6-8-17 Operator Western Energy API #30-0 45-35747
Property Name Waste Disposal Well Well No. 2 Location: Unit H Section 27 Township 29 Range 11
Well Status (Shut-In or Producing) Initial PSI: Tubing 600 Intermediate 0 Casing 100 Bradenhead 0

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

Testing	PRESSURE			INTERM	
	BH	Int	Csg	Int	Csg
TIME					
5 min	<u>0</u>	<u>0</u>	<u>100</u>	<u>0</u>	<u>100</u>
10 min	<u>0</u>	<u>0</u>	<u>100</u>	<u>0</u>	<u>100</u>
15 min	<u>0</u>	<u>0</u>	<u>100</u>	<u>0</u>	<u>100</u>
20 min					
25 min					
30 min					

FLOW CHARACTERISTICS	
BRADENHEAD	INTERMEDIATE
Steady Flow	
Surges	
Down to Nothing	<u>/</u>
Nothing	
Gas	<u>/</u>
Gas & Water	
Water	

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR _____ FRESH _____ SALTY _____ SULFUR _____ BLACK _____

5 MINUTE SHUT-IN PRESSURE

BRADENHEAD 0

INTERMEDIATE 0

REMARKS:

BH - Puff when opened. Nothing when
opened after 5 min shut-in. 2nd. light blow
to head at 5 sec. Nothing when opened after
5 min shut-in

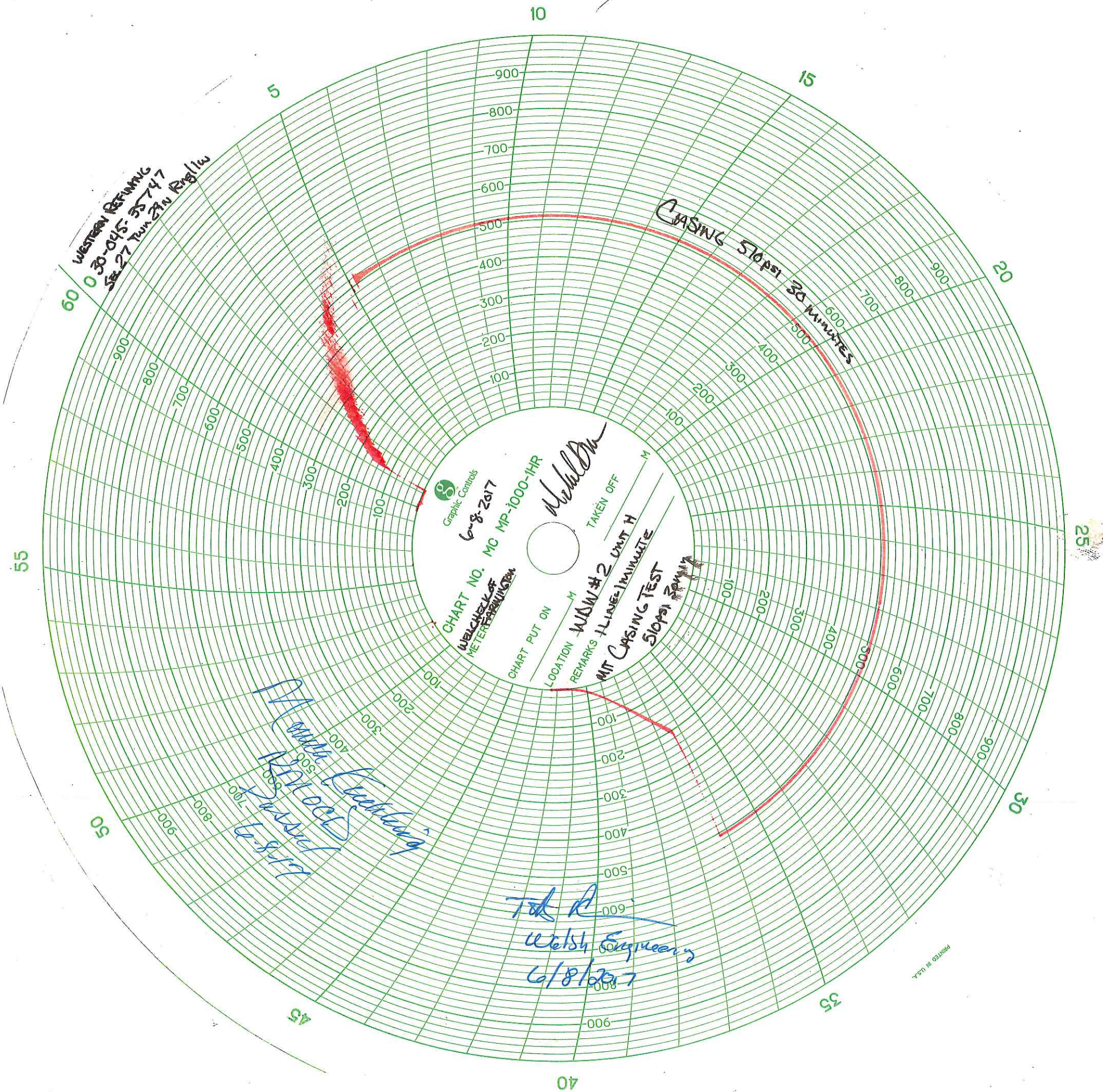
By John R. [Signature]

Witness Monica [Signature]

Site Supervisor

(Position)

E-mail address _____



Appendix H

Table of wells in a one mile radius

Disposal Well #2 and Area Wells

Miles				Perf			Pne Inj						
Map to	DW2	Wellname	#	API No	Perf Top	Botto m	Total Depth	P&A Date	ULSTR	Operator	Reservoir	Status	Zone
Seq													
0	-	Waste Disposal Well	2	30-045-35747	7312	7470	7470		H-27-29N-11W	WESTERN REFINING	ENTRADA	ACTIVE INJ	Yes
1	0.20	JACQUE	2	30-045-34409	1483	1689	1689		H-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
2	0.22	DAVIS GAS COM F	1E	30-045-24084	2701	2810	6262		H-27-29N-11W	XTO ENERGY, INC.	CHACRA	ACTIVE	No
2	0.22	DAVIS GAS COM F	1E	30-045-24084	6163	6262	6262		H-27-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
3	0.22	PRE-ONGARD WELL	0	30-045-07883			1759		H-27-29N-11W	PRE-ONGARD WELL	Unknown	INACTIVE	No
4	0.26	DISPOSAL	1	30-045-29002	3276	3514	3514	P & A	I-27-29N-11W	SAN JUAN REFINING	MESAVERDE	P & A	No
5	0.30	DAVIS GAS COM F	1R	30-045-30833	5314	5646	6177		I-27-29N-11W	XTO ENERGY, INC.	GALLUP	ACTIVE	No
5	0.30	DAVIS GAS COM F	1R	30-045-30833	6177	6308	6177		I-27-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	3970	4030	4030	P & A	F-26-29N-11W	BP AMERICA	MESAVERDE	P & A	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	1462	1645	4030		F-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	2631	2772	4030	P & A	F-26-29N-11W	XTO ENERGY, INC.	CHACRA	P & A	No
7	0.32	SULLIVAN GAS COM D	1E	30-045-24083	6086	6242	6242		F-26-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
8	0.33	DAVIS GAS COM F	1	30-045-07825	6157	6298	6298	P & A	I-27-29N-11W	BP AMERICA	DAKOTA	P & A	No
9	0.33	DAVIS GAS COM G	1	30-045-23554	2827	2839	2839	P & A	I-27-29N-11W	XTO ENERGY, INC.	CHACRA	P & A	No
10	0.33	JACQUE	1	30-045-34463	1543	1714	1714		I-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
11	0.34	PRE-ONGARD WELL	1	30-045-07812	1692*	1746*	1804	P & A	I-27-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
12	0.45	CALVIN	1	30-045-12003	6176	6348	6348		M-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
13	0.49	LAUREN KELLY	1	30-045-02133	1474*	1679*	3028*		-27-29N-11W	(N/A)	FRUITLAND COAL	INACTIVE	No
14	0.49	GARLAND B	1	30-045-02134	1474*	1679*	3028*		-27-29N-11W	(N/A)	PICTURED CLIFFS	INACTIVE	No
15	0.51	MANGUM	1S	30-045-34266	1474*	1679*	1850		F-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	INACTIVE	No
16	0.52	CALVIN	3	30-045-25612	5295	5870	5870		K-26-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
17	0.55	CALVIN	100	30-045-31118	1468	1760	1760		N-26-29N-11W	HILCORP ENERGY	FRUITLAND COAL	ACTIVE	No
18	0.55	PRE-ONGARD WELL	0	30-045-07776					M-26-29N-11W	PRE-ONGARD WELL	(N/A)	INACTIVE	No
19	0.57	NANCY HARTMAN	2	30-045-26721	2627	2754	2754		P-22-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No
20	0.57	CONGRESS	9	30-045-24572	2746	2869	2869		N-26-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No
21	0.59	SULLIVAN GAS COM D	1	30-045-07733	6047	6160	6160		B-26-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
22	0.60	HARTMAN	1	30-045-07961	6072	6274	6274	P & A	P-22-29N-11W	MANANA GAS INC	DAKOTA	P & A	No
23	0.64	GRACE PEARCE	1	30-045-07959	1380	1466	1466	P & A	O-22-29N-11W	JOHN C PICKETT	FRUITLAND SAND	P & A	No
24	0.64	ASHCROFT SWD	1	30-045-30788	6952	7070	7382		B-26-29N-11W	XTO ENERGY, INC.	Morrison Bluff Entrada	ACTIVE INJ	Yes
24	0.64	ASHCROFT SWD	1	30-045-30788	7224	7382	7382		B-26-29N-11W	XTO ENERGY, INC.	ENTRADA	ACTIVE INJ	Yes
25	0.65	CONGRESS	18	30-045-25673	1680	1770	5808		K-27-29N-11W	HILCORP ENERGY	PICTURED CLIFFS	ACTIVE	No
25	0.65	CONGRESS	18	30-045-25673	5419	5808	5808		K-27-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
26	0.66	MANGUM	1E	30-045-24673	6024	6160	6160		F-27-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
27	0.68	CALVIN	1F	30-045-33093	6172	6430	6430		J-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
28	0.69	MARIAN S	1	30-045-27365	2578	2710	2710		F-27-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No
29	0.69	LAUREN KELLY	1	30-045-27361	1326	1354	1354		F-27-29N-11W	MANANA GAS INC	FRUITLAND SAND	ACTIVE	No
30	0.72	PRE-ONGARD WELL	1X	30-045-29107	1474*	1679*	3028*	P & A	G-26-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
31	0.72	PRE-ONGARD WELL	X	30-045-07870	1692*	1746*	1442	P & A	G-26-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
32	0.72	PRE-ONGARD WELL	0	30-045-07896					G-27-29N-11W	PRE-ONGARD WELL	(N/A)	INACTIVE	No
33	0.73	EARL B SULLIVAN	1	30-045-23163	2750	2761	2761		B-26-29N-11W	XTO ENERGY, INC.	CHACRA	ACTIVE	No
34	0.74	CONGRESS	16	30-045-25657	6086	6148	6148		A-34-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
35	0.75	STATE GAS COM BS	1	30-045-23550	1470	1648	2761		K-23-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No

Disposal Well #2 and Area Wells

Miles				Perf											
Map to					Perf	Botto	Total							Pne Inj	
Seq	DW2	Wellname	#	API No	Top	m	Depth	P&A Date	ULSTR	Operator	Reservoir	Status	Zone		
35	0.75	STATE GAS COM BS	1	30-045-23550	2746	2761	2761		K-23-29N-11W	HOLCOMB OIL& GAS	CHACRA	INACTIVE	No		
36	0.75	PEARCE GAS COM	1	30-045-07985	6154	6182	6182	P & A	K-23-29N-11W	BP AMERICA	DAKOTA	P & A	No		
37	0.78	MANGUM	1	30-045-07835	6102	6214	6214	P & A	L-27-29N-11W	BURLINGTON	DAKOTA	P & A	No		
37	0.78	MANGUM	1	30-045-07835	1388	1661	6214		L-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No		
38	0.79	MARY JANE	1	30-045-26731	2622	2732	2732		N-22-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No		
39	0.80	SUMMIT	9	30-045-24574	2747	2857	2857		A-34-29N-11W	HILCORP ENERGY	CHACRA	INACTIVE	No		
40	0.80	ROYAL FLUSH	1	30-045-34312	1440	1608	1608		N-22-29N-11W	MANANA GAS INC	FRUITLAND COAL	ACTIVE	No		
41	0.83	COOK	1	30-045-07940	6052	6226	6226		N-22-29N-11W	MANANA GAS INC	DAKOTA	ACTIVE	No		
42	0.83	COOK	2	30-045-13089	1390	1410	1410		N-22-29N-11W	MANANA GAS INC	FRUITLAND SAND	ACTIVE	No		
43	0.87	SULLIVAN	2	30-045-07868	1444	1478	1478		H-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND SAND	ACTIVE	No		
44	0.87	PRE-ONGARD WELL	1	30-045-08009	1443	1468	1468	P & A	K-23-29N-11W	PRE-ONGARD WELL	FRUITLAND SAND	P & A	No		
45	0.88	CONGRESS	15	30-045-25675	5369	5943	5943		C-35-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No		
46	0.89	DELO	10	30-045-21457	2852	2856	2856		I-26-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No		
47	0.90	SUMMIT	15	30-045-25707	5326	5970	5970		C-34-29N-11W	SOUTHLAND ROYALTY	GALLUP	ACTIVE	No		
48	0.90	PRE-ONGARD WELL	1	30-045-07903	1664	1747	1747	P & A	M-27-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No		
49	0.91	GARLAND	3	30-045-24573	2668	2790	2790		M-27-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No		
50	0.93	CALVIN	2	30-045-25195	5346	5530	5530		P-26-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No		
51	0.93	CALVIN	1E	30-045-24772	6209	6363	6363		P-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No		
52	0.94	GARLAND B	1R	30-045-21732	1648	1678	1678	P & A	M-27-29N-11W	BURLINGTON	PICTURED CLIFFS	P & A	No		
53	0.95	EARL B SULLIVAN	2	30-045-25621	1535	1706	5622		H-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No		
53	0.95	EARL B SULLIVAN	2	30-045-25621	5264	5622	5622		H-26-29N-11W	HOLCOMB OIL& GAS	GALLUP	INACTIVE	No		
54	0.96	CONGRESS	4E	30-045-24837	2784	2906	6328		E-35-29N-11W	HILCORP ENERGY	CHACRA	ACTIVE	No		
54	0.96	CONGRESS	4E	30-045-24837	6216	6328	6328		E-35-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No		
55	0.97	LEA ANN	1	30-045-20752	1776	1790	1790	P & A	E-35-29N-11W	CHAPARRAL ENERGY	PICTURED CLIFFS	P & A	No		
56	0.98	DELO	11	30-045-22639	940	945	945	P & A	P-26-29N-11W	GENERAL MINERALS	FARMINGTON	P & A	No		
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No		
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	MANCOS	INACTIVE	No		
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	CHACRA	INACTIVE	No		

* Estimated for area

Appendix I

Injection History

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
6-Mar-17								
7-Mar-17								
8-Mar-17	20.63		-	1,353	1,353	1,018	42,756	0.49
9-Mar-17	16.17		-	1,289	1,392	1,570	65,933	0.39
10-Mar-17	13.63	1.00	1,310	1,380	1,383	2,010	84,413	0.32
11-Mar-17	10.19	1.00	1,381	1,382	1,383	2,344	98,448	0.24
12-Mar-17	6.75	2.22	1,382	1,382	1,383	2,391	100,422	0.16
13-Mar-17		9.43	957	1,135	1,383	2,391	100,422	
14-Mar-17	15.68	14.92	888	1,116	1,423	2,601	109,235	0.37
15-Mar-17	11.01	7.06	957	1,195	1,423	2,703	113,526	0.26
16-Mar-17		24.48	845	891	953	2,703	113,526	
17-Mar-17	12.35	18.83	813	1,061	1,393	2,869	120,498	0.29
18-Mar-17		25.14	814	863	940	2,869	120,498	
19-Mar-17	18.76	25.24	777	1,001	1,393	3,044	127,848	0.45
20-Mar-17	15.50	11.82	867	1,057	1,392	3,166	132,972	0.37
21-Mar-17	15.43	16.85	825	1,028	1,393	3,303	138,726	0.37
22-Mar-17	12.19	10.91	852	1,153	1,429	3,503	147,126	0.29
23-Mar-17	10.98	9.86	897	1,202	1,442	3,647	153,174	0.26
24-Mar-17	20.30	13.25	910	1,017	1,442	3,720	156,240	0.48
25-Mar-17		29.08	808	849	906	3,720	156,240	
26-Mar-17		40.00	758	781	807	3,720	156,240	
27-Mar-17	20.44	25.46	746	898	1,443	3,817	160,314	0.49
28-Mar-17	17.96	21.81	757	1,030	1,451	4,003	168,126	0.43
29-Mar-17	14.06	6.75	904	1,133	1,451	4,177	175,434	0.33
30-Mar-17	12.65	8.97	862	1,172	1,447	4,341	182,322	0.30
31-Mar-17	9.55	5.29	977	1,258	1,428	4,453	187,026	0.23
1-Apr-17		13.50	888	1,046	1,351	4,452	186,984	
2-Apr-17	13.05	19.65	830	1,073	1,393	4,563	191,646	0.31
3-Apr-17	13.65	8.62	915	1,148	1,393	4,601	193,242	0.32
4-Apr-17	12.81	9.62	912	1,146	1,393	4,713	197,946	0.30
5-Apr-17	15.08	11.63	905	1,072	1,343	4,735	198,870	0.36
6-Apr-17	10.50	20.38	838	981	1,342	4,779	200,718	0.25
7-Apr-17	12.17	14.03	881	1,048	1,393	4,848	203,616	0.29
8-Apr-17		29.00	805	845	914	4,848	203,616	
9-Apr-17	12.78	28.26	774	988	1,393	4,945	207,690	0.30
10-Apr-17	10.32	15.17	842	996	1,393	4,997	209,874	0.25
11-Apr-17	14.44	23.03	793	1,004	1,393	5,100	214,200	0.34
12-Apr-17	11.88	14.06	873	1,015	1,392	5,170	217,140	0.28
13-Apr-17	13.40	14.96	837	1,109	1,393	5,298	222,516	0.32
14-Apr-17	13.13	15.02	878	1,020	1,393	5,340	224,280	0.31
15-Apr-17	13.94	18.27	856	1,014	1,393	5,384	226,128	0.33
16-Apr-17		35.33	790	819	856	5,385	226,170	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
17-Apr-17	12.38	19.65	776	1,108	1,392	5,492	230,664	0.29
18-Apr-17	11.35	18.98	850	966	1,393	5,538	232,596	0.27
19-Apr-17	11.90	21.83	819	988	1,392	5,590	234,780	0.28
20-Apr-17	14.86	21.26	826	1,010	1,392	5,669	238,098	0.35
21-Apr-17	10.98	12.15	889	1,126	1,393	5,763	242,046	0.26
22-Apr-17	9.68	19.04	861	995	1,392	5,798	243,516	0.23
23-Apr-17	18.02	23.16	825	1,000	1,393	5,850	245,700	0.43
24-Apr-17	11.40	26.15	825	905	1,393	5,879	246,918	0.27
25-Apr-17	14.02	23.94	800	972	1,393	5,950	249,900	0.33
26-Apr-17	14.77	20.50	818	981	1,392	6,025	253,050	0.35
27-Apr-17	12.57	18.41	819	1,040	1,393	6,125	257,250	0.30
28-Apr-17	14.99	14.69	866	1,067	1,393	6,205	260,610	0.36
29-Apr-17	12.51	16.48	862	1,015	1,393	6,272	263,424	0.30
30-Apr-17		28.58	803	847	927	6,272	263,424	
1-May-17	15.36	23.69	784	1,023	1,392	6,371	267,582	0.37
2-May-17	16.68	15.60	859	1,046	1,392	6,443	270,606	0.40
3-May-17	11.94	19.11	846	954	1,392	6,485	272,370	0.28
4-May-17	13.15	20.95	842	972	1,393	6,555	275,310	0.31
5-May-17	15.83	26.90	817	908	1,392	6,598	277,116	0.38
6-May-17	12.06	24.98	795	940	1,392	6,669	280,098	0.29
7-May-17	13.26	29.74	782	917	1,393	6,721	282,282	0.32
8-May-17		29.38	809	829	853	6,721	282,282	
9-May-17						6,721	282,282	
10-May-17						6,721	282,282	
11-May-17						6,721	282,282	
12-May-17						6,721	282,282	
13-May-17						6,721	282,282	
14-May-17						6,721	282,282	
15-May-17						6,721	282,282	
16-May-17						6,721	282,282	
17-May-17						6,721	282,282	
18-May-17						6,721	282,282	
19-May-17						6,721	282,282	
20-May-17						6,721	282,282	
21-May-17						6,721	282,282	
22-May-17						6,721	282,282	
23-May-17						6,721	282,282	
24-May-17						6,721	282,282	
25-May-17						6,721	282,282	
26-May-17						6,721	282,282	
27-May-17						6,721	282,282	
28-May-17						6,721	282,282	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
29-May-17						6,721	282,282	
30-May-17						6,721	282,282	
31-May-17						6,721	282,282	
1-Jun-17						6,721	282,282	
2-Jun-17						6,721	282,282	
3-Jun-17						6,721	282,282	
4-Jun-17						6,721	282,282	
5-Jun-17						6,721	282,282	
6-Jun-17						6,721	282,282	
7-Jun-17		103.72	560	561	563	6,721	282,282	
8-Jun-17	24.63	115.97	555	606	694	7,063	296,646	0.59
9-Jun-17	36.48	3.00	613	746	847	7,897	331,667	0.87
10-Jun-17	25.00	8.05	703	788	848	8,308	348,936	0.60
11-Jun-17		26.74	653	674	701	8,308	348,936	
12-Jun-17	36.52	39.78	640	749	847	8,973	376,866	0.87
13-Jun-17	28.85		844	901	957	9,968	418,649	0.69
14-Jun-17	24.21	2.33	819	898	966	10,555	443,303	0.58
15-Jun-17	29.41		909	982	1,042	11,569	485,891	0.70
16-Jun-17	31.20		1,038	1,066	1,092	12,632	530,537	0.74
17-Jun-17	32.36		1,060	1,115	1,158	13,713	575,939	0.77
18-Jun-17	35.60		1,158	1,185	1,192	14,938	627,389	0.85
19-Jun-17	31.60		1,188	1,200	1,218	16,020	672,832	0.75
20-Jun-17	31.12		1,213	1,228	1,242	17,084	717,521	0.74
21-Jun-17	29.22		1,237	1,247	1,257	18,085	759,563	0.70
22-Jun-17	32.05	3.44	1,072	1,189	1,262	18,741	787,122	0.76
23-Jun-17	27.95	1.09	1,149	1,224	1,248	19,653	825,426	0.67
24-Jun-17	29.04	1.00	1,252	1,271	1,295	20,642	866,964	0.69
25-Jun-17	29.54		1,294	1,310	1,326	21,658	909,629	0.70
26-Jun-17	27.60	1.00	1,322	1,326	1,335	22,604	949,361	0.66
27-Jun-17	22.91	2.40	1,183	1,271	1,337	23,237	975,954	0.55
28-Jun-17	21.34	1.81	1,214	1,271	1,278	23,953	1,006,026	0.51
29-Jun-17	21.17	1.48	1,242	1,277	1,288	24,678	1,036,469	0.50
30-Jun-17	20.91	1.58	1,274	1,279	1,284	25,386	1,066,212	0.50
1-Jul-17	20.11	1.73	1,277	1,281	1,284	26,075	1,095,150	0.48
2-Jul-17	19.54	2.00	1,279	1,281	1,285	26,741	1,123,122	0.47
3-Jul-17	19.53	1.73	1,278	1,287	1,293	27,416	1,151,465	0.46
4-Jul-17	19.06	2.00	1,288	1,291	1,293	28,071	1,178,982	0.45
5-Jul-17	18.46	2.17	1,288	1,291	1,293	28,709	1,205,771	0.44
6-Jul-17	18.14	2.77	1,278	1,290	1,293	29,331	1,231,902	0.43
7-Jul-17	17.63	3.00	1,278	1,290	1,293	29,935	1,257,270	0.42
8-Jul-17	18.10	3.00	1,289	1,295	1,307	30,556	1,283,345	0.43
9-Jul-17	18.08	2.85	1,289	1,304	1,308	31,178	1,309,476	0.43

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
10-Jul-17	18.46	3.02	1,304	1,307	1,313	31,793	1,335,299	0.44
11-Jul-17	20.50	2.54	1,308	1,325	1,342	32,482	1,364,237	0.49
12-Jul-17	18.51	2.58	1,328	1,332	1,343	33,116	1,390,865	0.44
13-Jul-17	18.62	2.88	1,319	1,338	1,353	33,761	1,417,955	0.44
14-Jul-17	18.71	3.00	1,349	1,351	1,355	34,401	1,444,842	0.45
15-Jul-17	17.66	3.00	1,348	1,351	1,353	35,004	1,470,168	0.42
16-Jul-17	17.78	3.02	1,347	1,350	1,353	35,588	1,494,696	0.42
17-Jul-17	17.06	3.37	1,330	1,344	1,354	36,152	1,518,377	0.41
18-Jul-17	17.08	3.57	1,339	1,347	1,353	36,714	1,541,981	0.41
19-Jul-17	17.31	3.60	1,347	1,351	1,353	37,282	1,565,844	0.41
20-Jul-17	16.04	4.00	1,348	1,351	1,354	37,831	1,588,902	0.38
21-Jul-17	16.11	4.00	1,348	1,354	1,359	38,383	1,612,079	0.38
22-Jul-17	15.77	4.00	1,353	1,356	1,358	38,925	1,634,850	0.38
23-Jul-17	15.72	3.88	1,354	1,356	1,358	39,465	1,657,530	0.37
24-Jul-17	15.81	4.00	1,354	1,360	1,368	40,007	1,680,287	0.38
25-Jul-17	15.70	4.00	1,362	1,366	1,369	40,542	1,702,757	0.37
26-Jul-17	14.99	4.20	1,364	1,366	1,370	41,054	1,724,261	0.36
27-Jul-17	15.18	4.48	1,365	1,372	1,379	41,573	1,746,059	0.36
28-Jul-17	15.27	4.89	1,374	1,376	1,378	42,086	1,767,612	0.36
29-Jul-17	14.96	4.27	1,373	1,376	1,379	42,603	1,789,319	0.36
30-Jul-17	14.39	4.17	1,374	1,376	1,379	43,097	1,810,074	0.34
31-Jul-17	14.06	4.38	1,374	1,376	1,378	43,580	1,830,353	0.33
1-Aug-17	14.31	4.46	1,374	1,376	1,378	44,069	1,850,898	0.34
2-Aug-17	14.21	6.89	1,185	1,316	1,379	44,381	1,864,002	0.34
3-Aug-17		18.85	1,118	1,146	1,183	44,381	1,864,002	
4-Aug-17		25.67	1,078	1,097	1,117	44,381	1,864,002	
5-Aug-17		30.54	1,048	1,062	1,078	44,381	1,864,002	
6-Aug-17		34.56	1,023	1,035	1,048	44,381	1,864,002	
7-Aug-17	23.70	20.40	1,013	1,128	1,241	44,805	1,881,803	0.56
8-Aug-17	21.81	2.63	1,245	1,283	1,322	45,546	1,912,932	0.52
9-Aug-17	21.33	2.15	1,323	1,339	1,352	46,277	1,943,626	0.51
10-Aug-17	19.08	2.88	1,276	1,355	1,363	46,931	1,971,095	0.45
11-Aug-17	16.75	3.00	1,358	1,361	1,363	47,508	1,995,336	0.40
12-Aug-17	15.38	3.38	1,359	1,361	1,364	48,033	2,017,386	0.37
13-Aug-17	14.20	4.00	1,359	1,361	1,363	48,522	2,037,924	0.34
14-Aug-17	13.88	4.31	1,360	1,365	1,369	49,000	2,058,000	0.33
15-Aug-17	13.49	4.77	1,364	1,366	1,369	49,466	2,077,565	0.32
16-Aug-17	12.92	5.00	1,304	1,365	1,368	49,909	2,096,178	0.31
17-Aug-17	12.63	5.00	1,366	1,378	1,388	50,346	2,114,525	0.30
18-Aug-17	11.05	7.96	1,176	1,307	1,388	50,556	2,123,352	0.26
19-Aug-17		20.27	1,110	1,138	1,174	50,556	2,123,352	
20-Aug-17		26.99	1,071	1,089	1,108	50,556	2,123,352	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
21-Aug-17		31.58	1,043	1,056	1,070	50,556	2,123,352	
22-Aug-17		35.75	1,019	1,030	1,042	50,556	2,123,352	
23-Aug-17		39.38	999	1,009	1,019	50,556	2,123,352	
24-Aug-17	12.29	19.73	993	1,131	1,218	50,817	2,134,314	0.29
25-Aug-17	12.19	5.26	1,216	1,263	1,288	51,178	2,149,476	0.29
26-Aug-17	12.28	4.94	1,286	1,296	1,303	51,600	2,167,200	0.29
27-Aug-17	11.92	5.33	1,301	1,308	1,310	52,009	2,184,378	0.28
28-Aug-17	10.87	5.87	1,306	1,314	1,318	52,386	2,200,212	0.26
29-Aug-17	12.14	5.67	1,315	1,330	1,349	52,806	2,217,852	0.29
30-Aug-17	13.21	5.35	1,345	1,350	1,354	53,255	2,236,710	0.31
31-Aug-17	12.19	6.00	1,349	1,352	1,354	53,674	2,254,308	0.29
1-Sep-17	11.95	6.19	1,349	1,355	1,359	54,089	2,271,738	0.28
2-Sep-17	11.98	6.40	1,355	1,356	1,358	54,496	2,288,832	0.29
3-Sep-17	11.43	6.81	1,354	1,356	1,359	54,885	2,305,170	0.27
4-Sep-17	11.26	7.04	1,354	1,358	1,362	55,266	2,321,165	0.27
5-Sep-17	11.67	7.00	1,359	1,364	1,370	55,667	2,338,007	0.28
6-Sep-17	11.37	7.00	1,364	1,369	1,374	56,054	2,354,268	0.27
7-Sep-17	11.09	7.00	1,370	1,372	1,374	56,430	2,370,060	0.26
8-Sep-17	10.80	12.77	1,131	1,237	1,374	56,548	2,375,016	0.26
9-Sep-17		24.83	1,076	1,100	1,129	56,548	2,375,016	
10-Sep-17		30.85	1,043	1,058	1,075	56,548	2,375,016	
11-Sep-17		35.54	1,018	1,029	1,042	56,548	2,375,016	
12-Sep-17		39.42	997	1,007	1,017	56,548	2,375,016	
13-Sep-17	12.91	24.00	989	1,112	1,209	56,798	2,385,516	0.31
14-Sep-17	11.39	7.04	1,209	1,231	1,244	57,178	2,401,476	0.27
15-Sep-17	12.32	5.06	1,248	1,260	1,291	57,597	2,419,074	0.29
16-Sep-17	11.34	5.00	1,262	1,270	1,284	57,987	2,435,447	0.27
17-Sep-17	11.35	5.00	1,278	1,283	1,286	58,376	2,451,792	0.27
18-Sep-17	10.71	10.45	1,065	1,169	1,283	58,514	2,457,588	0.26
19-Sep-17		24.35	1,018	1,038	1,064	58,514	2,457,588	
20-Sep-17	24.90	15.89	1,005	1,143	1,331	58,842	2,471,364	0.59
21-Sep-17		21.25	1,001	1,026	1,070	58,842	2,471,364	#VALUE!
22-Sep-17	40.71	23.54	991	1,284	1,439	59,781	2,510,802	0.97
23-Sep-17	30.17	11.86	1,052	1,123	1,440	59,837	2,513,154	0.72
24-Sep-17		24.73	1,008	1,027	1,051	59,837	2,513,154	
25-Sep-17		32.10	981	993	1,007	59,837	2,513,154	
26-Sep-17		37.31	961	970	980	59,837	2,513,154	
27-Sep-17		41.25	944	952	960	59,837	2,513,154	
28-Sep-17		44.67	930	937	944	59,837	2,513,154	
29-Sep-17		47.83	918	924	930	59,837	2,513,154	
30-Sep-17		50.23	907	912	918	59,837	2,513,154	
1-Oct-17		52.96	896	901	906	59,837	2,513,154	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
2-Oct-17	14.89	22.80	893	1,012	1,103	60,176	2,527,392	0.35
3-Oct-17	13.74	3.63	1,068	1,120	1,152	60,598	2,545,116	0.33
4-Oct-17	13.97	2.54	1,155	1,184	1,211	61,079	2,565,311	0.33
5-Oct-17	13.79	6.73	1,002	1,125	1,228	61,307	2,574,894	0.33
6-Oct-17		23.17	954	973	1,000	61,307	2,574,894	
7-Oct-17		32.42	928	940	953	61,307	2,574,894	
8-Oct-17		38.14	910	919	928	61,307	2,574,894	
9-Oct-17		42.13	896	903	910	61,307	2,574,894	
10-Oct-17		37.25	884	890	895	61,307	2,574,894	
11-Oct-17		37.48	873	878	883	61,307	2,574,894	
12-Oct-17		40.44	864	868	873	61,307	2,574,894	
13-Oct-17		42.56	856	860	864	61,307	2,574,894	
14-Oct-17		44.52	848	852	856	61,307	2,574,894	
15-Oct-17		45.96	841	844	848	61,307	2,574,894	
16-Oct-17	11.45	21.94	838	946	1,047	61,542	2,584,757	0.27
17-Oct-17	11.77	1.00	1,057	1,084	1,108	61,941	2,601,515	0.28
18-Oct-17	11.30		1,106	1,124	1,143	62,328	2,617,769	0.27
19-Oct-17	11.37		1,140	1,155	1,169	62,637	2,630,747	0.27

Hains, Allen S

From: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>
Sent: Tuesday, December 12, 2017 4:59 PM
To: Hains, Allen S
Subject: RE: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2

Allen:

Received.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

“Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?” (To see how, go to: <http://www.emnrd.state.nm.us/OCD> and see “Publications”)

From: Hains, Allen S [mailto:Allen.S.Hains@andeavor.com]
Sent: Tuesday, December 12, 2017 4:09 PM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>
Cc: Robinson, Kelly <Kelly.Robinson@andeavor.com>; Davis, Bruce D <Bruce.D.Davis@andeavor.com>
Subject: RE: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2

Carl,

The full report is attached.

Thank you,

Allen

From: Hains, Allen S
Sent: Tuesday, December 12, 2017 4:06 PM
To: 'Chavez, Carl J, EMNRD' <CarlJ.Chavez@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>
Cc: Robinson, Kelly <Kelly.Robinson@andeavor.com>; Davis, Bruce D <Bruce.D.Davis@andeavor.com>
Subject: WNR Bloomfield Terminal Injection WDW #2 FOT Report 1 of 2

Carl,

I am sending you this email because Kelly is traveling today and we understand that your FTP site down.

Please find the attached cover letter for the WDW #2 Fall-Off Test report. The test was successful and meets both NMOCD and EPA requirements.

The full report including cover letter will promptly follow this email (2 of 2). If you do not receive the full report, we can set up a cloud-based transfer.

Thank you,

Allen S. Hains
Manager
Remediation Projects

Andeavor
212 N. Clark Street
El Paso, Texas 79905
915 534-1483
915 490-1594 (cell)

Please note the new email address: Allen.S.Hains@andeavor.com



Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Wednesday, February 21, 2018 4:48 PM
To: 'Robinson, Kelly'
Cc: Griswold, Jim, EMNRD; Powell, Brandon, EMNRD
Subject: FW: WNR Bloomfield Terminal Injection WDW #2 FOT Report 2 of 2
Attachments: WNR WDW2 2017 FO Report (12-12-2017).pdf; Nuts and Bolts of a FOT.pdf

Kelly:

The New Mexico Oil Conservation Division (OCD) completed its review of the Western Refining Southwest, Inc. (Western) - Bloomfield Refinery's FOT Report dated December 12, 2017.

Please find below OCD's review comments added to the OCD weekly log yesterday. Also, OCD has attached the Fall-Off Test (FOT) "Nuts and Bolts" guidance document with FOT Log-Log Plot, which describes how to determine a FOT flow regime determination. Based on Western's Figure 2 Log-Log Plot, OCD is unable to confirm the flow regime aspects from the FOT. **OCD requests a more detailed explanation of the flow regime determination in the FOT Report commensurate with FOT Guidance, since the Figure 2 in its present form does not appear to contain the information needed to address the flow regime. Also, the gauges need calibration before the next FOT.** Please submit the information before COB on Wednesday, March 21, 2018.

Carl on 2/20 completed his review of the FOT (10/2-13/2017) and entered the info. into a FOT tracking spreadsheet. Carl is not sure about the results based on the Log-Log graph and lack of radial flow achieved during FOT. Some concerns were: 1) Porosity at ~ 12%, but K was only 3.29 md (~13.94 gpm); 2) Skin: -5.37; 3) $P_{diff} \sim 384.1$ psi; 4) Half fracture: 110 ft.; 5) No boundary conditions were identified; 6) **The well test does not reach radial flow; therefore, the FOT is unanalyzable**, and 7) Gauge calibrations were last conducted on 2/5/2014, which is considered beyond 6 months or outdated.

Please contact me if you have questions.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

"Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?" (To see how, go to: <http://www.emnrd.state.nm.us/OCD> and see "Publications")

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Thank you,

Allen S. Hains
Manager
Remediation Projects

Andeavor
212 N. Clark Street
El Paso, Texas 79905
915 534-1483
915 490-1594 (cell)

Please note the new email address: Allen.S.Hains@andeavor.com



The Nuts and Bolts of Falloff Testing

Sponsored by EPA Region 6



Ken Johnson

Environmental Engineer

(214) 665-8473

johnson.ken-e@epa.gov

Susie Lopez

Engineer

(214) 665-7198

lopez.susan@epa.gov

March 5, 2003

Ken Johnson has a BS in Chemical Engineering from Texas A&M and a Master in Civil Engineering with an Environmental Engineering option from the University of Texas at Arlington. Ken has worked in the Region 6 Groundwater/UIC Section reviewing no migration petition submittals; injection well pressure transient tests; and production logs for the past 4 years. Prior to the EPA, Ken worked over 3 years at the TNRCC Region 4 Office in Arlington as an Industrial and Hazardous Waste Field Inspector. Ken also has extensive injection well experience, having worked over 13 years in the oil and gas industry and served as one of the company's experts in falloff test analysis. Ken is a Registered Professional Engineer in Texas and holds an industrial and hazardous waste inspector certification from the TNRCC.

Susie Lopez has a BS in Mechanical Engineering from Oklahoma State University and is a registered Professional Engineer in the State of Oklahoma. Susie has worked with EPA's Ground Water/UIC Section for the past eleven years where she has been involved with the processing of no migration petitions and the review of falloff tests for Class I hazardous waste injection wells. Prior to the EPA, Susie worked with falloff tests for ten years in the oil and gas industry in the production, reservoir, and reservoir simulation engineering aspects of the industry.

Identifying Flow Regimes

- Create a master **diagnostic** plot, the **log-log plot**
- Log-log plot contains two curves
- Individual flow regimes:
 - Characteristic shape
 - Sequential order
 - Specific separation
- Critical flow regime - **radial flow**

The first plot used to identify flow regimes is the log-log plot.

The log-log plot is a master diagnostic plot that contains two curves, a pressure curve and a derivative curve

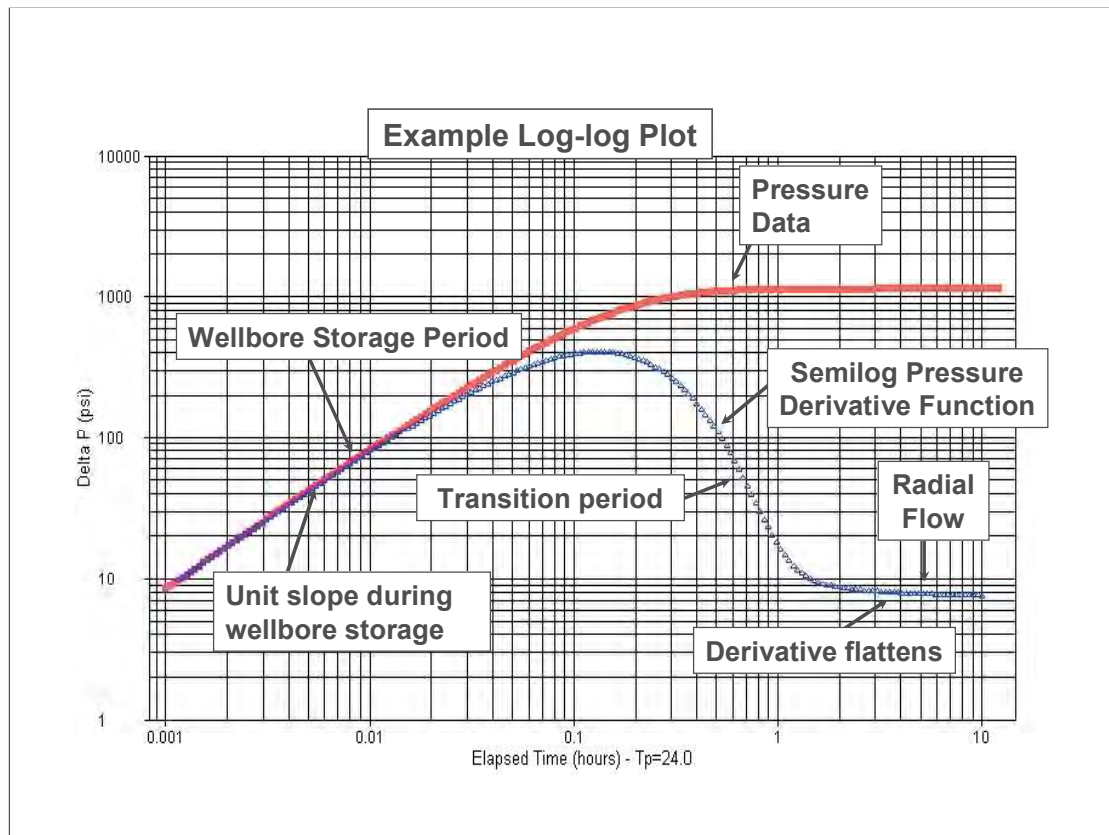
The log-log plot identifies the various stages and flow regimes present in a falloff test

Individual flow regimes have characteristic slopes and a sequential order on the log-log plot with the critical flow regime being **radial flow**.

The radial flow portion of the log-log plot is identified and then the corresponding timeframe on the semilog plot is used for the calculations

Flow regimes are characterized by specific slopes and trends for P and P' , as well as specific separation between the two curves

The radial flow portion is the critical flow regime because it is the portion of the test that the calculations are based



Pressure curve - red

Derivative curve - blue

Wellbore storage period: Pressure and derivative curves overlay on a unit slope

Radial flow: Derivative flattens

Notice the pressure curve flattens prior to radial flow so the pressure curve is not a good indicator of radial flow

Log-log Plot Pressure Functions

Rate variations prior to falloff test determine how the pressure function is to be plotted

Constant rate - Plot pressure

Variable rate - Normalize pressure

Just like the time function, rate variations prior to the shut-in of the well determine how pressure is plotted on the Y axis

Constant rate - Plot pressure

Variable rate - Normalize pressure data or normalize time function using the rates. P/q term

December 12, 2017

Carl Chavez
New Mexico Oil Conservation Division
Environmental Bureau
1220 South St. Francis Dr.
Santa Fe, NM 87505

Via Electronic Submittal

Re: Western Refining Southwest, Inc. – Bloomfield Refinery
2017 Fall-Off Test
Non-Hazardous Injection Well
Permit # - UIC-CL-011
API # - 30-045-35747

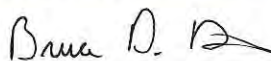
Mr. Chavez:

Bloomfield Refinery is submitting the 2017 Fall-Off Test. The well is located in Unit Letter H, Section 27, Township 29 North, Range 11 West, NMPM, San Juan County, New Mexico and is operated by Western Refining Southwest, Inc.

If you need more information, please contact me at (602) 286-1929.

Sincerely,

WESTERN REFINING SOUTHWEST, INC.



By: Bruce Davis
Senior Manager
Southwest Terminals

Cc: Brandon Powell – NMOCD (Aztec District Office)
Dale Roberts – Western Refining (WNR – Bloomfield)
Allen Hains – Western Refining (WNR – El Paso)

December 12, 2017

Carl Chavez
New Mexico Oil Conservation Division
Environmental Bureau
1220 South St. Francis Dr.
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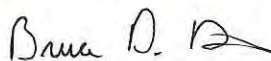
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Dale Roberts – Western Refining (WNR – Bloomfield)
Allen Hains – Western Refining (WNR – El Paso)

WILLIAM M. COBB & ASSOCIATES, INC.

Worldwide Petroleum Consultants

12770 Coit Road, Suite 907
Dallas, Texas 75251

(972) 385-0354
Fax: (972) 788-5165
E-Mail: office@wmcobb.com

December 12, 2017

Mr. Bruce Davis
Western Refining Southwest, Inc.
Bloomfield Terminal
P.O. Box 159
Bloomfield, New Mexico 87413

Re: Waste Disposal Well #2
October 2017 Falloff Test
OGRID No. 267595

Dear Mr. Davis:

Western Refining retained William M Cobb & Associates, Inc to perform the annual bottomhole pressure survey and pressure falloff test analysis on Waste Disposal Well #2. A pressure fall-off test (FOT) and bottomhole pressure survey were conducted on the well at the Western Refining Bloomfield Terminal facility near Bloomfield, New Mexico. The well tests were conducted in accordance with United States Environmental Protection Agency (USEPA) 40 CFR 146.13 and the State of New Mexico Falloff Test Guidelines, dated December 3, 2007. The 2017 pressure falloff test procedure was conducted in accordance with the USEPA's Region 6 "Pressure Falloff Testing Guidelines, Third Revision", dated August 8, 2002, and required by the State of New Mexico as of December 3, 2007. The pressure falloff test and bottomhole pressure survey performed on Waste Disposal Well No. 2 also met the New Mexico Oil Conservation Division's (NMOCD's) requirements for such testing. Note: There are references made in this report to the permit document on file with the OCD for Western Refining in Bloomfield, New Mexico.

FACILITY INFORMATION

Name: Western Refining Southwest, Inc.
Location: 50 County Road 4990 (PO Box 159)
Bloomfield, New Mexico 874 13

WELL INFORMATION

Well Name & No.	OCD UIC or Discharge Plan Permit Number	Well Classification	API Number	Legal Location
WDW #2	UICI-011	Class I Non-hazardous	30-045-35747	2028 FNL, 111 FEL, H Sec 27 T29S R11E

All depths in this report are referenced to ground level (GL) from the drilling rig rotary kelly bushing (RKB), unless the depth is specified as RKB or GL within this document. Appendix A

contains the well schematic for Western's Waste Disposal Well No. 2 (WDW-2) and a section of the log covering the perforated interval. Appendix B is a summary of the injection intervals for the well.

The fluid used for the injection test is the terminal treated waste water (effluent). A current waste water (effluent) analysis collected on September 13, 2017 is included in Appendix C. A summary of the formation water is also in Appendix C. The formation water analyses taken on January 25, 2017 is included.

Appendix D contains three well logs for WDW #2 ran by Schlumberger on September 5, 2016. They are: 1) Array Induction log, 2) Neutron Litho density long, and 3) Triple Combo log.

REPORT OF EVENTS

October 2, 2017 8:00 AM – The pre-test injection flow test begins.

October 3, 2017 9:02 AM – Tefteller, Inc. runs tandem bottomhole pressure gauges in the well to monitor the falloff portion of the test.

October 3, 2017 9:36 AM – pre-flow period begins.

October 5, 2017 11:08 AM – well is flowing at 13.84 GPM with an average rate of 14.1 GPM for the 75 hour period. Well is shut-in for falloff test.

October 13, 2017 8:39 AM - falloff test ends after 189.5 hours. A pressure gradient survey is conducted as pressure gauges are retrieved from well.

GENERAL TEST OPERATIONAL CONSIDERATIONS

The falloff testing for WDW-2 was conducted with tandem bottomhole pressure memory gauges with a pre-flow period beginning at 8:00 AM on October 2, 2017 and ending at 8:39 AM on October 13, 2017. The average flow rate for the 75 hour period prior to the beginning of the falloff test was 14.1 GPM with a final flowing rate of 13.84 GPM. On the morning of October 3, 2017, tandem bottom hole pressure memory gauges were lowered into the well and allowed to stabilize. Lowering the gauges in the well had no impact on rates and a minimal impact on surface injection pressures. The well was shut-in for 189.5 hours ending at 8:39 AM on October 13, 2017. Field data are included in Appendix E.

At the end of the falloff test, the bottomhole pressure gauges were pulled from the well making gradient stops every 1,000 feet. Key test data are summarized as follows:

Event	Flow Rate – GPM	Surface PSIG	Bottomhole PSIG	Date/Time
Start of flow	0.0	1040.3	N.A.	10/2/2017 8:00 AM
Final flow rate	13.84	1226.8	4396.7	10/5/2017 11:08 AM
Final falloff pressure	0.0	861	4012.6	10/13/2017 8:39 AM
Final surface pressure	0.0	861	N.A.	

The memory gauges used are SP-2000 hybrid-quartz gauges provided by Tefteller, Inc. that have a resolution of 0.01 psi and an accuracy of ± 0.05 percent of full scale. The pressure range of the gauges were from 0 – 5,000 psi minimum. The gauges were lowered to the top of the injection interval at 7,312 feet. The recording period was set to record pressures at a minimum of every five minutes and more frequently during the early part of the falloff test period. Calibration certificates are included in Appendix F.

GEOLOGY

The injection zone is the Entrada sandstone formation. The formations occur in Waste Disposal Well No. 2 at the depths shown in the table below. The injection zone is shown in Waste Disposal Well No.2 logs in Appendix D.

Injection Zone Formation	Waste Disposal Well #2 (KB elev = 5,550 ft)	
	MD below KB (ft)	SS Depth (ft)
Bluff Sandstone	Not completed	7031
Entrada Sandstone	7312 to 7470	7308

The Jurassic aged Entrada Sandstone is thought to be one of the best water disposal rock units in the San Juan Basin. The Entrada is the basal formation of the San Rafael Group which also includes the Todilto and Wanakah Formations. The Entrada Sandstone is present throughout the basin's subsurface and crops out along the its margin as step cliffs. The Entrada unconformably overlies the Chinle Formation. The overlying Todilto Formation made up of limestone and anhydrite in dense and thought to an impermeable barrier or seal.

The Entrada Sandstone consists of mottled reddish-brown very fine to medium grained well-sorted, silica cemented quartz sandstone interbedded with thinner reddish-brown siltstones. The sandstone units are assembled in high-angle, large-scale crossbeds indicating eolian environment deposition and with the siltstones representing interdune and sabkha deposition. The cross-stratified sandstone is competent, laterally persistent and with homogenous reservoir properties. Entrada Sandstone gross thickness ranges 60 feet to 330 feet across the basin.

At the Water Disposal Well #2 location the Entrada is 158 feet thick. Based upon the nearby XTO Energy Ashcroft SWD #1 water disposal well density porosities are up to 18 percent with the most porous interval found in the upper 90 feet of the formation where the majority of the density porosities are more than 10 percent. Water Disposal Well #2 has a density porosity of 12.1 percent. The two intervals with the highest porosity are 20 feet from 7,333 feet to 7,353 feet with 14.1 percent porosity and 26 feet from 7,442 feet to 7,468 feet with 14.3 percent porosity.

Permeability for the well as measured by this falloff test is 3.29 md or less.

PREVIOUS FALLOFF TESTS

This is a new disposal well. There are no previous falloff tests.

ANNULUS PRESSURE TESTING

On June 8, 2017, an Annulus Pressure Test (APT) was conducted. The annulus was pressured up to 510 psig and held for 15 minutes. The test was witnessed by the NMOCD and by the operator. The test report and chart recording of the pressure is included in Appendix G and has been reported to the NMOCD using form C-103.

EVALUATION OF THE TEST RESULTS

The raw test data from the test are included in Appendix E with an injection history in Appendix J. This includes details of the build-up portion of the October 2017 test. These falloff data are presented in Figure 1 showing pressure and temperature during the falloff test. The falloff data show no unexpected pressure changes. The pressure drops quickly during the first few minutes and then continues to decline as the pressure in the reservoir adjusts to the no-flow period.

A log-log plot, Figure 2, with a derivative diagnostic plot is used to identify flow regimes. This plot shows a slope of near to 0.50 at 120 hours but shows no apparent linear flow for the duration of the test.

The early portion of the test is shown in detail in Figure 3 with pressures from 0 to 36 hours which range from 4396.7 psig to 4110.1 psig. The pressure decline is a smooth decline and is flattening over time as expected.

Figure 4 shows the linear characteristics of the falloff test in some detail. It is a plot of falloff pressure versus $\sqrt{t + \Delta t} - \sqrt{\Delta t}$ where t is flow time in hours and Δt is falloff time in hours. Flow time is derived from the total fluid injected and the final flow rate as follows:

Cumulative injection:	2,391,224 gallons
Final flowing rate:	13.84 GPM
Equivalent flowing time (hours):	Gallons/(GPM X 60) = 2,391,224/(13.84*60)
Equivalent flowing time (hours):	3,079 hours

The pressure data, Figure 4, are linear beginning at 9.5 on the x axis. Projection of the data to estimated reservoir pressure is shown in Figure 5. This trend extrapolates to 3,406 psig which is the apparent reservoir pressure. The data shows no indication of ending of a linear flow straight line or of reservoir boundaries when the falloff test ends after 189 hours.

A traditional Horner plot, Figure 6, shows an increasing slope throughout the falloff test. Because of the increasing slope at the end of the test, permeability cannot be directly measured from the test data. This trend extrapolated to 3,819 psig as the apparent maximum reservoir pressure because of the increasing slope at the end of the test. The slope measured on Figure 6 is a minimum slope, which yields a maximum permeability. Figure 7 shows increased detail of the Horner plot data at the end of the FOT.

LONG-TERM PERFORMANCE

Figure 8 is a history of pressures and injection rates. Wellhead injection pressures have been at 1465 psig or less and are typically less than 1400 psig. The maximum injection rate is 77 GPM with rates in near 13 GPM being the most common rate.

Figure 9 shows the stabilized flow period of 75 hours prior to beginning the FOT test. The final flowing rate is 13.84 GPM with a final flowing wellhead pressure of 1226.8 psig. The injection rates for the pre falloff flow test range maximum rate of 23 GPM to a final rate of 13.84 GPM with an average rate of 14.1 GPM.

Calculations:

Calculations for permeability with an assumed Horner plot straight line, for time for a pressure transient to reach the edge of the injected water, traditional skin factor and for fracture half length are included.

1. Permeability:

$$\frac{kh}{\mu} = \frac{162.6qB}{m} \text{ where:}$$

q = final flowing rate

B = formation volume factor

m = slope from Horner plot of pressure vs $\log((t+dt)/dt)$

k = permeability – md

h = net pay – feet

μ = viscosity - cp

q = 14.1 GPM

q = 475 BWPD

B = 1.0

m = 69.61 or more (stabilized slope not observed on test)

$$\frac{kh}{\mu} = \frac{162.6qB}{m} = (162.6)(14.1)(24)(60/42)(1.0)/69.61 = 1,108 \text{ md-ft/cp or less}$$

$$kh = (1,108 * 0.47) = 521 \text{ md-ft or less}$$

$$k = 521/158 = 3.30 \text{ md or less}$$

2. Radius to edge of injected fluid:

$$r_{\text{waste}} = \sqrt{\frac{0.13368V}{\pi\phi h}}$$

V = total volume injected, gallons

ϕ = porosity of injection zone

h = net pay of injection zone in feet

μ = viscosity in cp

V = 2,556,452 gallons

ϕ = 0.121

H = 158 feet

μ = 0.47 cp

$$c_t = 0.000002904$$

$$r_{waste} = \sqrt{\frac{(0.13368)(2,556,452)}{\pi(0.121)(158)}} = 75 \text{ feet}$$

3. Time to reach edge of injected fluid:

$$t_{waste} = \frac{948c_t\mu r_{waste}^2}{k}$$

$$t_{waste} = \frac{(948)(0.000002904)(0.47)(75^2)}{3.30} = 2.2 \text{ hours or more}$$

4. Skin factor (with radial flow)

$$S = 1.151 \left[\frac{p_{wf} - p_{1hr}}{m} - \log \left(\frac{k}{\phi \mu c_t r_w^2} \right) + 3.23 \right]$$

p_{wf} = final flowing pressure, psi
 p_{1hr} = projected pressure at 1 hour using radial flow straight line, psi
 r_w = wellbore radius - feet
 $p_{wf} = 4376.7$ psig
 $p_{1hr} = 4370$ psig
 $r_w = 0.3281$ feet

$$S = 1.151 \left[\frac{4376.7 - 4370}{69.6} - \log \left(\frac{3.30}{(0.121)(0.47)(0.000002904)(0.3281)^2} \right) + 3.23 \right]$$

$S = -5.37$

5. Fracture half length

$$X_f \sqrt{k} = \frac{4.064qB}{m_L h} \sqrt{\left(\frac{\mu}{\phi c_t} \right)}$$

m_L = slope from linear flow chart of pressure vs $\sqrt{t + \Delta t} - \sqrt{\Delta t}$
 $m_L = 70.628$

$$X_f \sqrt{k} = \frac{4.064(467)(1.0)}{(70.628)(158)} \sqrt{\left(\frac{0.47}{(0.121)(0.000002904)} \right)} = 200 \text{ ft } \sqrt{md}$$

$$X_f = \frac{200}{\sqrt{3.30}} = 110 \text{ cumulative feet or more}$$

AREA OF REVIEW (AOR) UPDATE

The area of review data is attached as Appendix H which shows all wells known to have been drilled within a one mile radius of Water Disposal Well #2. There are 57 wells in the one mile radius of investigation. One of these fifty-nine wells, Ashcroft SWD #1, penetrates the Entrada injection zone. This well is 0.64 miles from the disposal well and is an active water disposal well.

No wells are currently producing from the Entrada injection zone within the AOR.

CONCLUSIONS

All testing was successful and meets both the OCD and EPA requirements. Western Refining fulfills all analysis and reporting requirement of the USEPA's "Pressure Falloff Testing Guideline, Third Revision", issued by Region 6, and dated August 8, 2002, with the submittal of this report. Pressure falloff and bottomhole pressure testing were conducted according to these guidelines.

OTHER

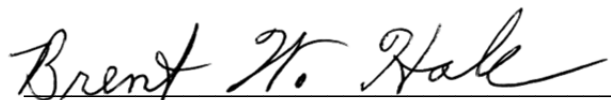
In evaluating available information concerning this appraisal, we have excluded from our consideration all matters as to which legal or accounting interpretation, rather than engineering, may be controlling. As in all aspects of oil and gas evaluation, there are uncertainties inherent in the interpretation of engineering data and conclusions necessarily represent only informed professional judgments.

William M. Cobb & Associates, Inc. is an independent consulting firm. Our compensation is not contingent on the results obtained or reported. This report was prepared by an engineer with more than 30 years of experience in the estimation, assessment, and evaluation of oil and gas production rates and related reservoir properties.

We appreciate the opportunity to be of service to you. If you have questions regarding this report, please contact us.

Sincerely,

WILLIAM M. COBB & ASSOCIATES, INC.

A handwritten signature in black ink, reading "Brent W. Hale", written over a horizontal line.

Brent W. Hale
Vice President

Figure 1

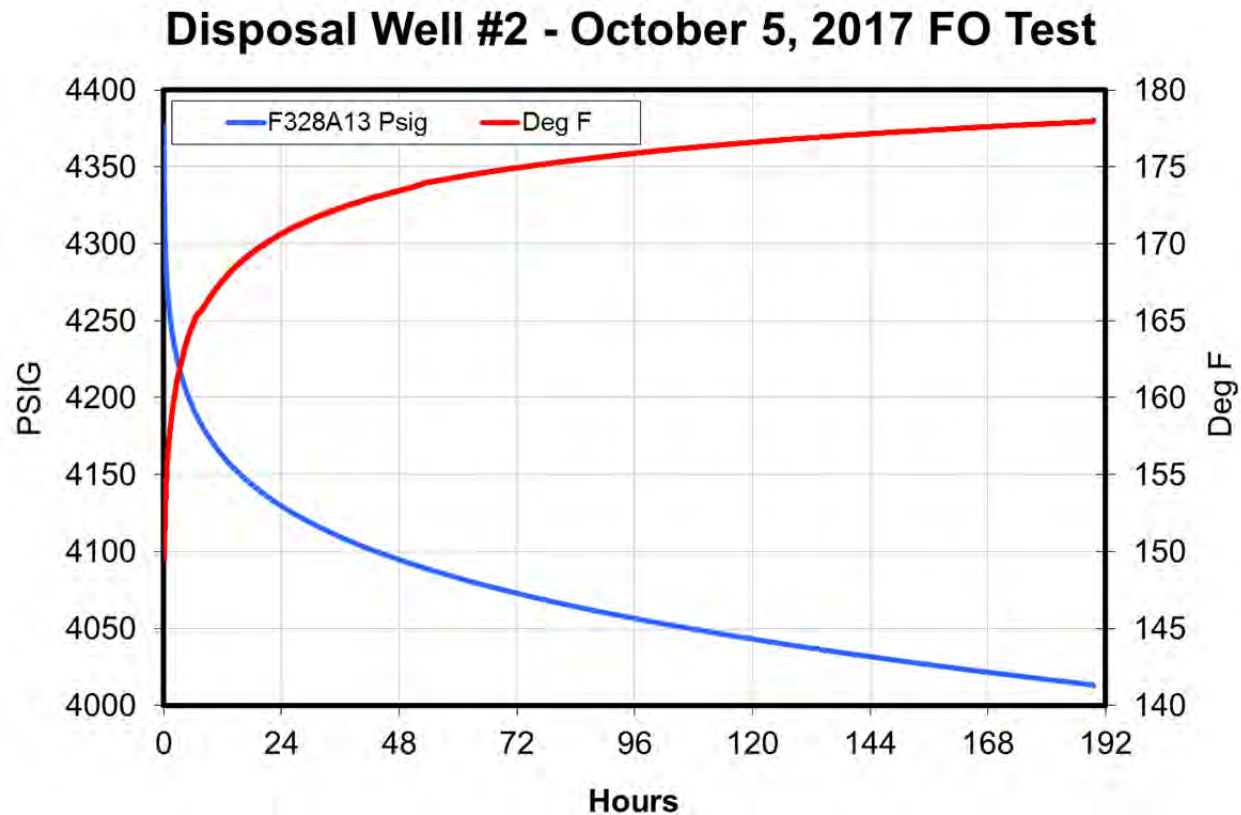


Figure 2

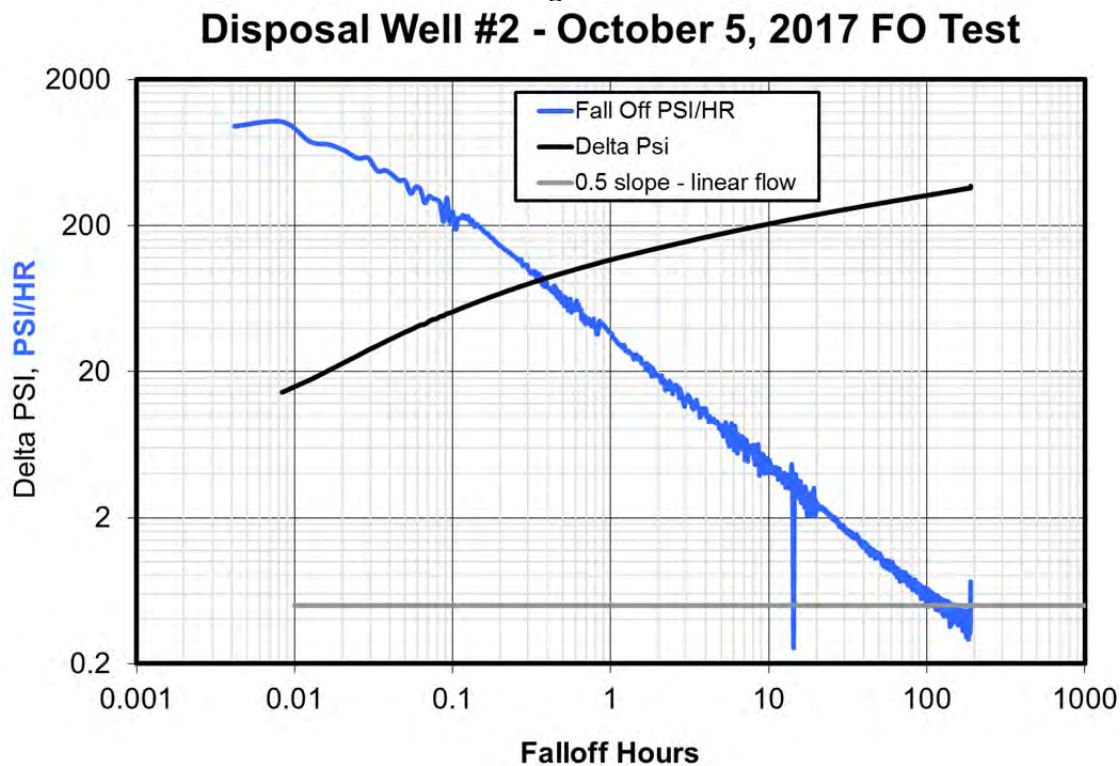


Figure 3
Disposal Well #2 - October 5, 2017 FO Test

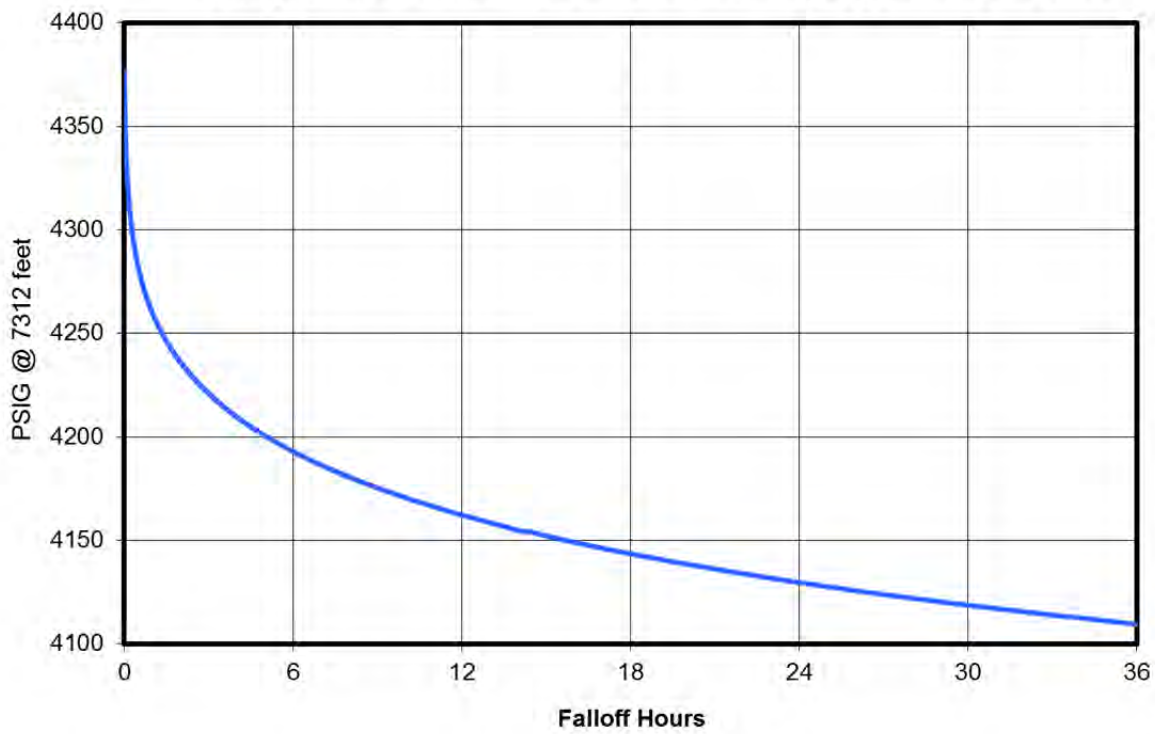


Figure 4
Disposal Well #2 - October 5, 2017 FO Test

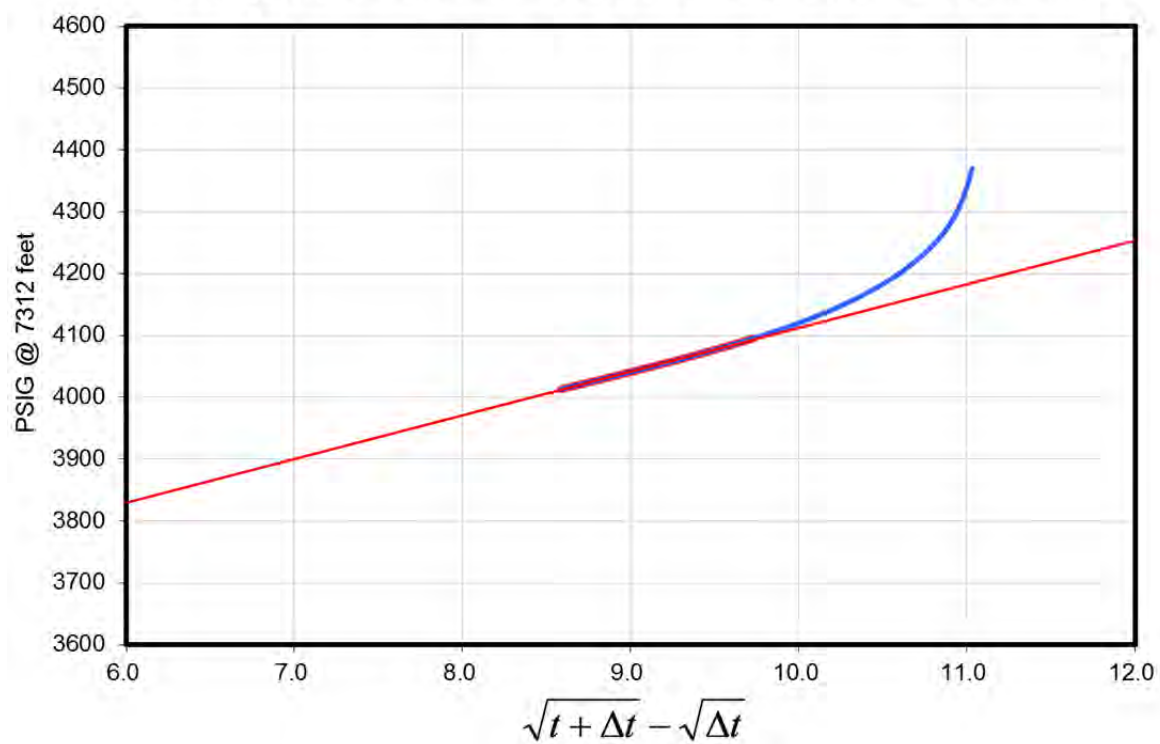


Figure 5

Disposal Well #2 - October 5, 2017 FO Test

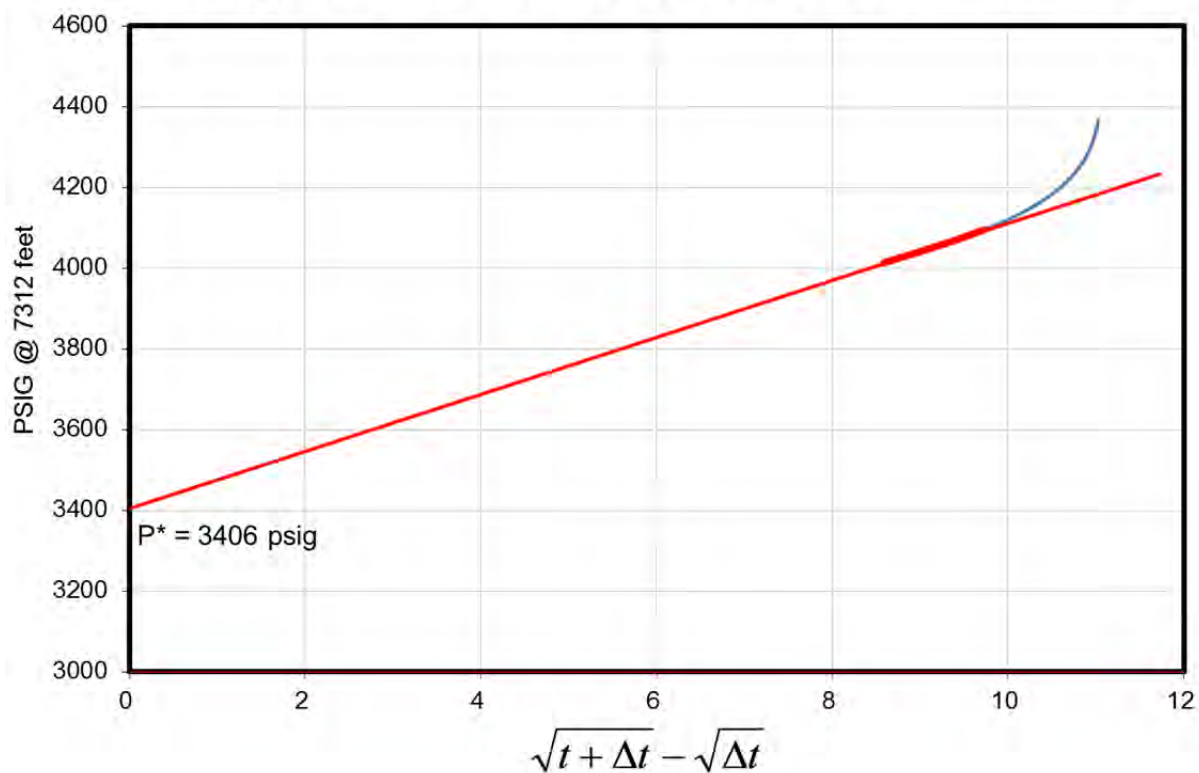


Figure 6

Disposal Well #2 - October 5, 2017 FO Test

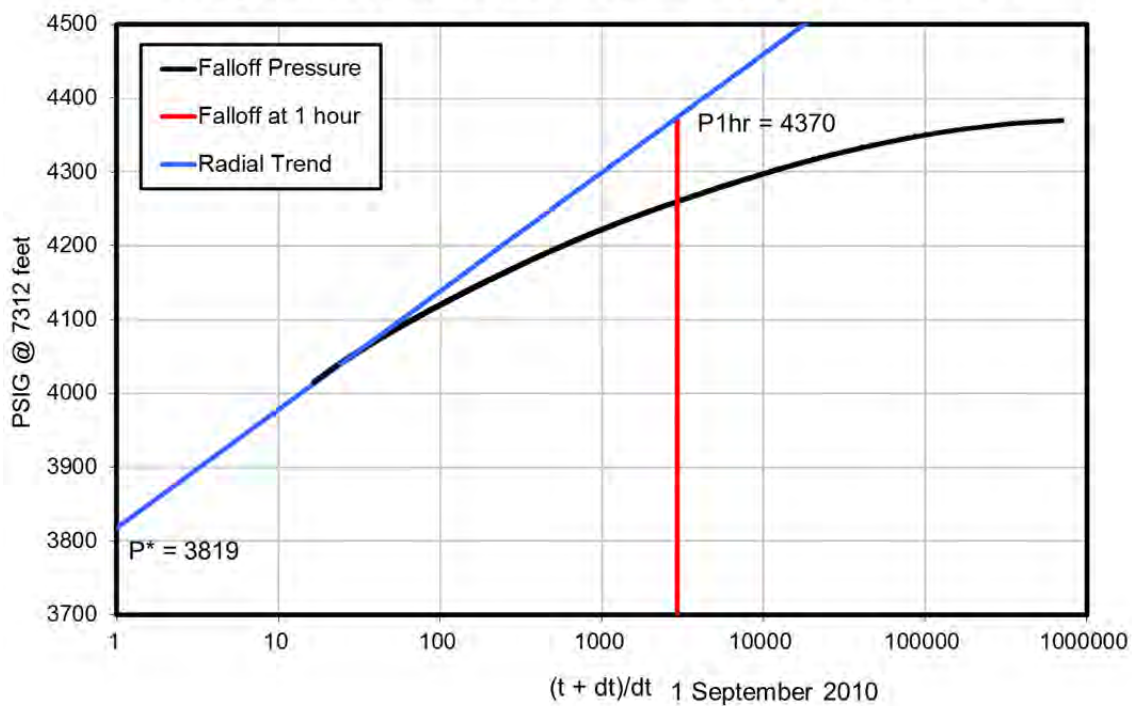


Figure 7

Disposal Well #2 - October 5, 2017 FO Test

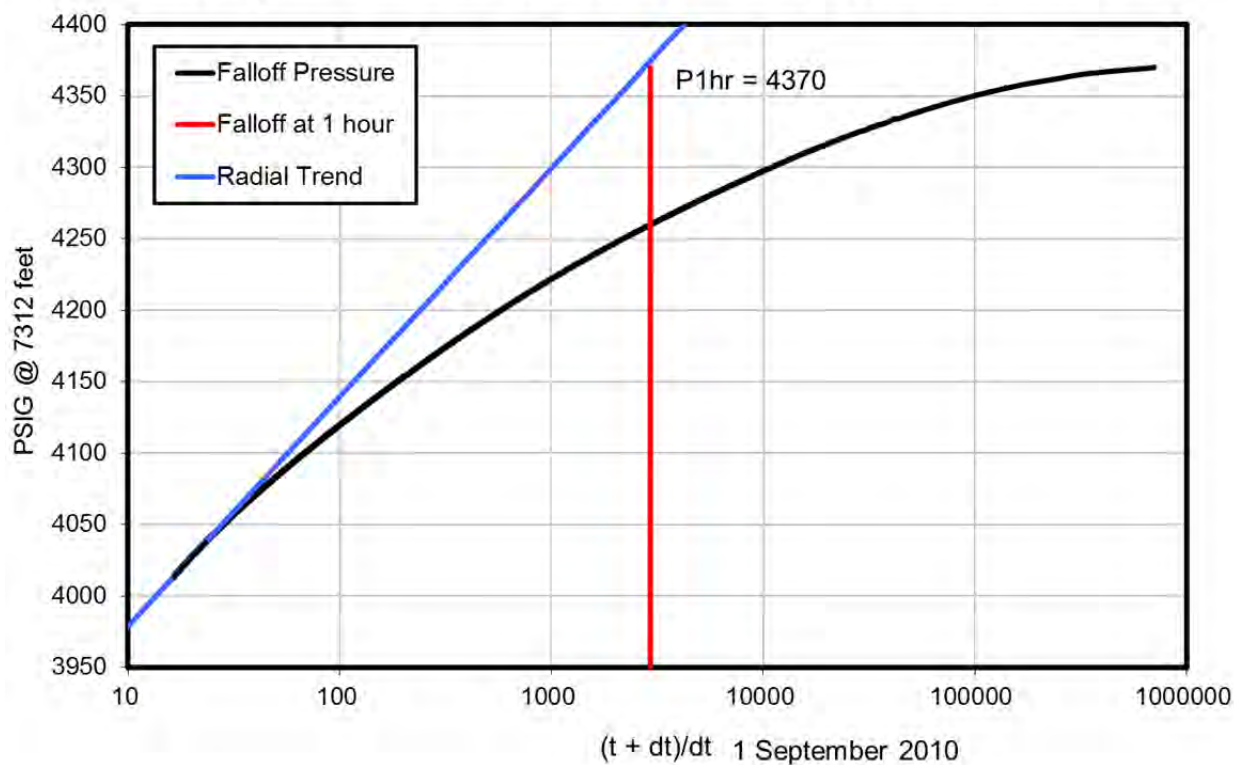
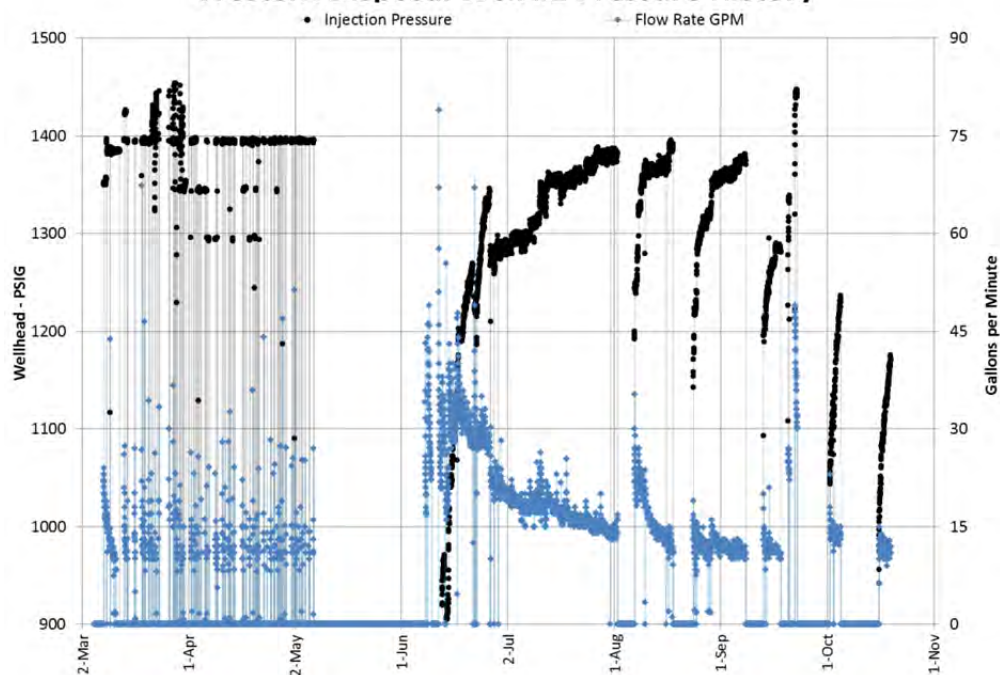
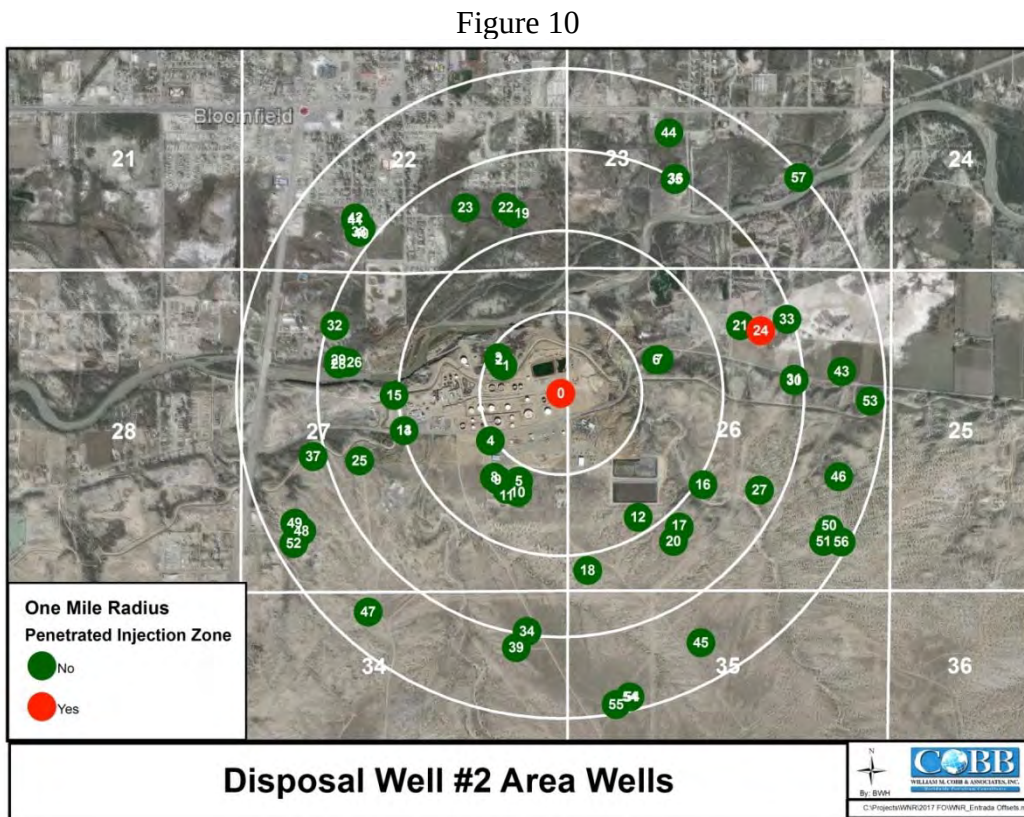
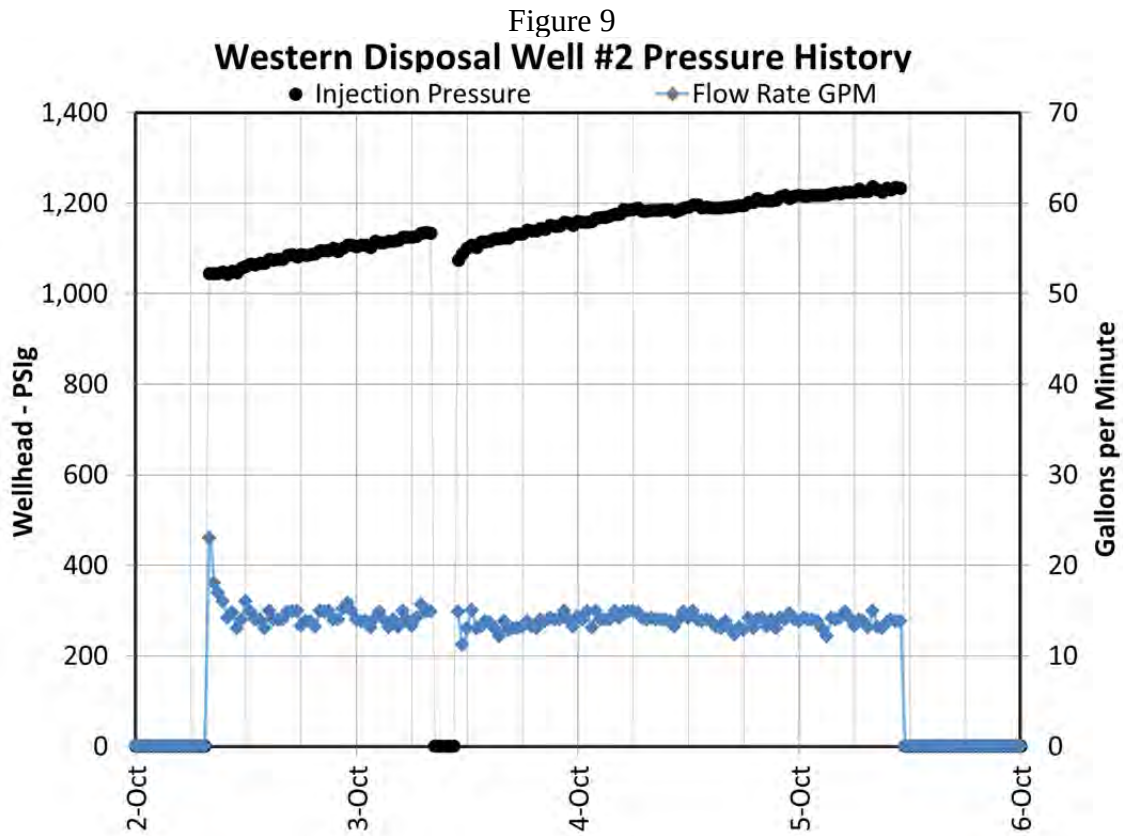


Figure 8

Western Disposal Well #2 Pressure History





List of Appendices

Appendix A: Well bore schematic for Disposal Well #1

Appendix B: Summary of injection intervals

Appendix C: Injection and formation fluid analysis

Appendix D: Well Logs

Appendix E: October 5, 2017 Falloff test data

Appendix F: Test gauge calibration certificates

Appendix G: Mechanical Integrity Test Report (MIT)

Appendix H: Table of wells in a one mile radius

Appendix I: Injection History

Appendix A

Well bore schematic for Disposal Well #1

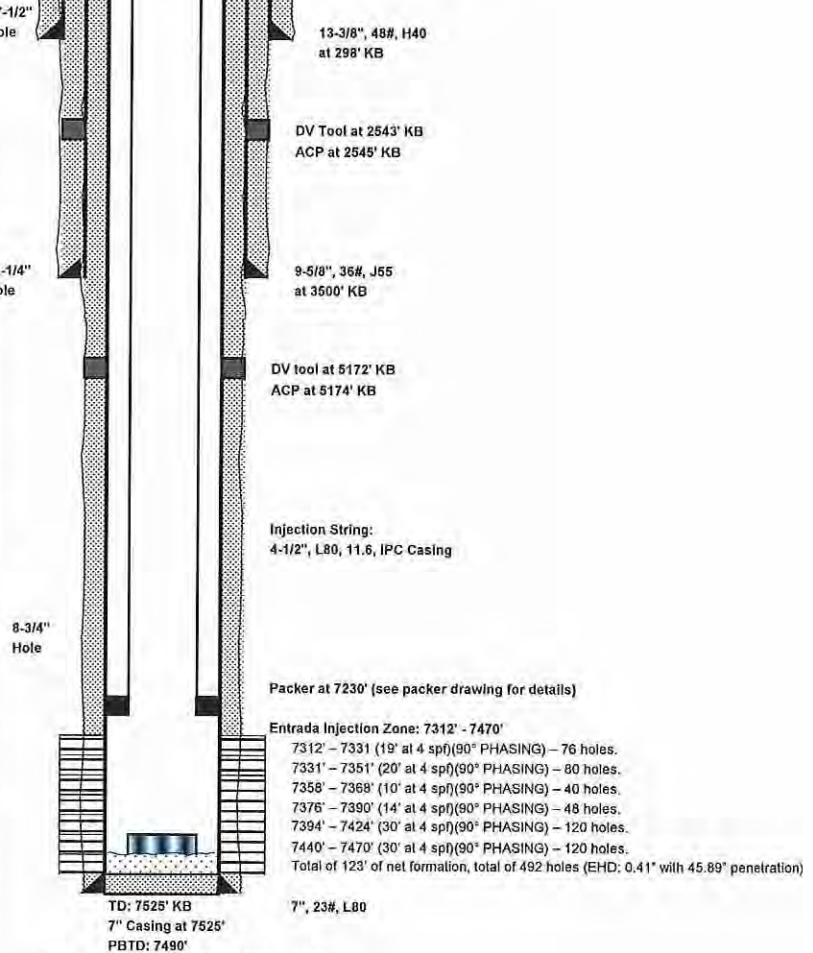
Table 2: A wellbore diagram showing the current configuration of the wellbore.

Well/Facility:	SWD #2	Well Status:	Current
Operator:	Western Refinery	Orig Oper:	
Lease/Op Agmt:		Inj Interval:	
Field:	Entrada	API #:	
County:	San Juan	GR/KB:	14.5'
State:	NM	TD:	7525' KB
Spud:	8/15/2016	PBTD:	7490' KB
Comp. Date:		WI:	
1st Prod:		NRI:	
Xmas tree:			
Surface Loc:	2028' fml & 111' fel		
Sec-Twn-Rge:	Sec 27/T29N/11W		
Comments:	3/7/2017 - Started Injection/Water Disposal Operations		

Date Drawn: October 2016

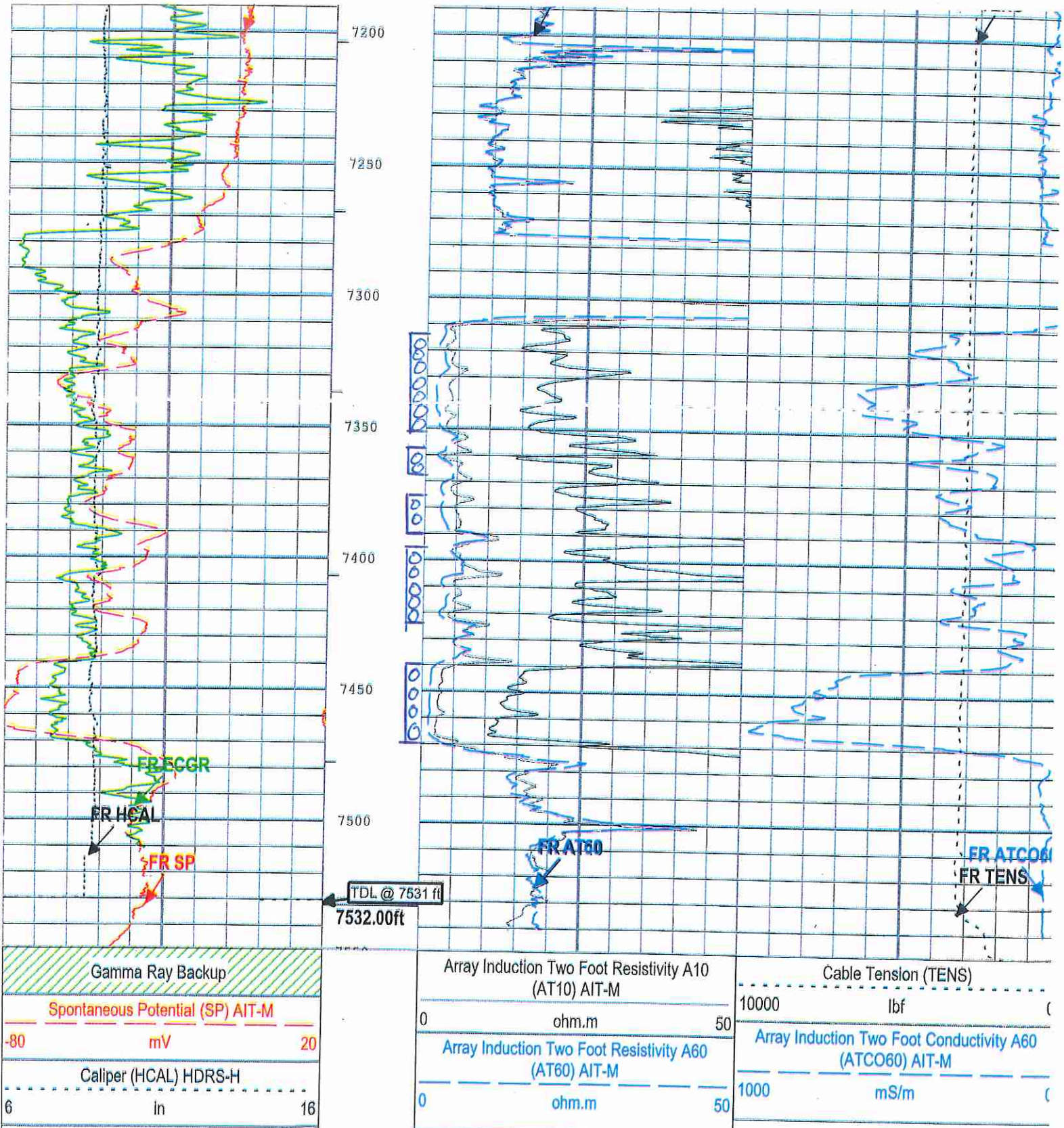


Geologic Markers	
MD	Formation
Surface	Quaternary Alluv
10'	Nacimiento
515'	Ojo Alamo
625'	Kirtland
1203'	Fruitland
1718'	Pictured Cliffs
1880'	Lewis
2660'	Huerfano Bentonite
2688'	Chacra
2877'	Lower Lewis
3337'	Cliff House
3389'	Menefee
4045'	Point Lookout
4432'	Mancos Shale
5301'	Niobrara A
5400'	Niobrara B
5526'	Niobrara C
5606'	Gallup
5848'	Juana Lopez
5966'	Carlile
6056'	Greenhorn
6117'	Graneros
6161'	Dakota
6357'	Burro Canyon
6417'	Morrison
7031'	Bluff Sandstone
7150'	Wanakah
7276'	Todilto
7308'	Entrada
7470'	Chinle
7525'	TD



Note: 7" packer f' 7458'-7476', fill f' 7476'-7490'

Table 1: A copy of the well log showing the Entrada interval to be tested.



Appendix B

Summary of injection intervals

Appendix B

Western Refining Southwest, Inc.

Waste Disposal Well #2

Injection Intervals

Formation	Top	Base
Entrada	7312'	7470'

Appendix C

Injection and formation fluid analysis



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

October 18, 2017

Kelly Robinson

Western Refining Southwest, Inc.

#50 CR 4990

Bloomfield, NM 87413

TEL: (505) 632-4135

FAX (505) 632-3911

RE: BPT Injection Well 9 13 17

OrderNo.: 1709746

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 9/14/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

A handwritten signature in black ink, appearing to read 'Andy Freeman', is written over a horizontal line.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 1709746

Date Reported: 10/18/2017

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: Injection Well

Project: BPT Injection Well 9 13 17

Collection Date: 9/13/2017 11:20:00 AM

Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8081: PESTICIDES TCLP							Analyst: MAB
Chlordane	ND	0.030		mg/L	1	9/27/2017 1:41:44 PM	33957
Endrin	ND	0.020		mg/L	1	9/27/2017 1:41:44 PM	33957
gamma-BHC (Lindane)	ND	0.40		mg/L	1	9/27/2017 1:41:44 PM	33957
Heptachlor	ND	0.0080		mg/L	1	9/27/2017 1:41:44 PM	33957
Heptachlor epoxide	ND	0.0080		mg/L	1	9/27/2017 1:41:44 PM	33957
Methoxychlor	ND	10		mg/L	1	9/27/2017 1:41:44 PM	33957
Toxaphene	ND	0.50		mg/L	1	9/27/2017 1:41:44 PM	33957
Surr: Decachlorobiphenyl	85.8	57.8-124		%Rec	1	9/27/2017 1:41:44 PM	33957
Surr: Tetrachloro-m-xylene	81.5	43-114		%Rec	1	9/27/2017 1:41:44 PM	33957
EPA METHOD 8270C TCLP							Analyst: DAM
2-Methylphenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
3+4-Methylphenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
Phenol	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4-Dinitrotoluene	ND	0.13		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachlorobenzene	ND	0.13		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachlorobutadiene	ND	0.50		mg/L	1	9/27/2017 4:13:14 PM	33908
Hexachloroethane	ND	3.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Nitrobenzene	ND	2.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Pentachlorophenol	ND	100		mg/L	1	9/27/2017 4:13:14 PM	33908
Pyridine	ND	5.0		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4,5-Trichlorophenol	ND	400		mg/L	1	9/27/2017 4:13:14 PM	33908
2,4,6-Trichlorophenol	ND	2.0		mg/L	1	9/27/2017 4:13:14 PM	33908
Cresols, Total	ND	200		mg/L	1	9/27/2017 4:13:14 PM	33908
Surr: 2-Fluorophenol	44.6	15-124		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: Phenol-d5	38.8	15-118		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 2,4,6-Tribromophenol	65.9	15-148		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: Nitrobenzene-d5	82.7	40.6-124		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 2-Fluorobiphenyl	61.8	35.7-128		%Rec	1	9/27/2017 4:13:14 PM	33908
Surr: 4-Terphenyl-d14	57.0	18.8-115		%Rec	1	9/27/2017 4:13:14 PM	33908
SPECIFIC GRAVITY							Analyst: JRR
Specific Gravity	1.002	0			1	9/15/2017 2:17:00 PM	R45658
EPA METHOD 300.0: ANIONS							Analyst: MRA
Fluoride	5.9	0.50	*	mg/L	5	9/14/2017 3:12:54 PM	R45644
Chloride	600	25	*	mg/L	50	9/27/2017 4:01:08 PM	R45948
Nitrogen, Nitrite (As N)	ND	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Bromide	2.3	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Nitrogen, Nitrate (As N)	ND	0.50		mg/L	5	9/14/2017 3:12:54 PM	R45644
Phosphorus, Orthophosphate (As P)	ND	2.5		mg/L	5	9/14/2017 3:12:54 PM	R45644

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
	D Sample Diluted Due to Matrix	E Value above quantitation range
	H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
	ND Not Detected at the Reporting Limit	P Sample pH Not In Range
	PQL Practical Quantitative Limit	RL Reporting Detection Limit
	S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 1709746

Date Reported: 10/18/2017

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: Injection Well

Project: BPT Injection Well 9 13 17

Collection Date: 9/13/2017 11:20:00 AM

Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS							Analyst: MRA
Sulfate	80	2.5		mg/L	5	9/14/2017 3:12:54 PM	R45644
SM2510B: SPECIFIC CONDUCTANCE							Analyst: JRR
Conductivity	3100	5.0		µmhos/cm	1	9/19/2017 2:03:47 PM	R45747
SM2320B: ALKALINITY							Analyst: JRR
Bicarbonate (As CaCO ₃)	499.0	20.00		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
Carbonate (As CaCO ₃)	ND	2.000		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
Total Alkalinity (as CaCO ₃)	499.0	20.00		mg/L CaCO ₃	1	9/19/2017 2:03:47 PM	R45747
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: KS
Total Dissolved Solids	1920	100	*D	mg/L	1	9/22/2017 10:23:00 AM	33959
SM4500-H+B: PH							Analyst: JRR
pH	7.34		H	pH units	1	9/19/2017 2:03:47 PM	R45747
EPA METHOD 7470: MERCURY							Analyst: MED
Mercury	ND	0.00020		mg/L	1	9/27/2017 9:25:56 AM	34071
EPA METHOD 6010B: DISSOLVED METALS							Analyst: TES
Calcium	53	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Magnesium	43	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Potassium	14	5.0		mg/L	5	9/19/2017 1:02:14 PM	A45714
Sodium	530	10		mg/L	10	9/28/2017 1:04:41 PM	A45960
EPA 6010B: TOTAL RECOVERABLE METALS							Analyst: TES
Arsenic	0.035	0.020		mg/L	1	9/19/2017 11:57:19 AM	33882
Barium	0.17	0.020		mg/L	1	9/19/2017 11:57:19 AM	33882
Cadmium	ND	0.0020		mg/L	1	9/19/2017 11:57:19 AM	33882
Chromium	ND	0.0060		mg/L	1	9/19/2017 11:57:19 AM	33882
Lead	ND	0.0050		mg/L	1	9/19/2017 11:57:19 AM	33882
Selenium	ND	0.050		mg/L	1	9/19/2017 11:57:19 AM	33882
Silver	ND	0.0050		mg/L	1	9/19/2017 11:57:19 AM	33882
TCLP VOLATILES BY 8260B							Analyst: RAA
Benzene	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,2-Dichloroethane (EDC)	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
2-Butanone	ND	200		mg/L	200	9/15/2017 1:25:00 AM	T45638
Carbon Tetrachloride	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
Chloroform	ND	6.0		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,4-Dichlorobenzene	ND	7.5		mg/L	200	9/15/2017 1:25:00 AM	T45638
1,1-Dichloroethene	ND	0.70		mg/L	200	9/15/2017 1:25:00 AM	T45638
Hexachlorobutadiene	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
	D Sample Diluted Due to Matrix	E Value above quantitation range
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	ND Not Detected at the Reporting Limit	P Sample pH Not In Range
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Analytical Report

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CLIENT: Western Refining Southwest, Inc.

Client Sample ID: Injection Well

Project: BPT Injection Well 9 13 17

Collection Date: 9/13/2017 11:20:00 AM

Lab ID: 1709746-001

Matrix: AQUEOUS

Received Date: 9/14/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
TCLP VOLATILES BY 8260B							Analyst: RAA
Tetrachloroethene (PCE)	ND	0.70		mg/L	200	9/15/2017 1:25:00 AM	T45638
Trichloroethene (TCE)	ND	0.50		mg/L	200	9/15/2017 1:25:00 AM	T45638
Vinyl chloride	ND	0.20		mg/L	200	9/15/2017 1:25:00 AM	T45638
Chlorobenzene	ND	100		mg/L	200	9/15/2017 1:25:00 AM	T45638
Surr: 1,2-Dichloroethane-d4	97.4	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: 4-Bromofluorobenzene	95.6	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: Dibromofluoromethane	100	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638
Surr: Toluene-d8	91.2	70-130		%Rec	200	9/15/2017 1:25:00 AM	T45638

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
	D	Sample Diluted Due to Matrix	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
	PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
	S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified



Wet Chemistry by Method 4500 CN E-2011

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Cyanide	ND		0.00500	1	09/21/2017 18:03	<u>WG1023142</u>

² Tc

Wet Chemistry by Method 9034-9030B

Analyte	Result	Qualifier	RDL	Dilution	Analysis	Batch
	mg/l		mg/l		date / time	
Reactive Sulfide	0.125		0.0500	1	09/18/2017 17:47	<u>WG1021084</u>

³ Ss⁴ Cn

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
Corrosivity by pH	7.09	<u>T8</u>	1	09/18/2017 10:32	<u>WG1021485</u>

⁵ Sr⁶ Qc

Sample Narrative:

L936656-01 WG1021485: 7.09 at 15.2c

⁷ GI

Wet Chemistry by Method D93/1010A

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	deg F			date / time	
Flashpoint	DNF at 170		1	09/22/2017 15:11	<u>WG1023539</u>

⁸ Al⁹ Sc



Method Blank (MB)

(MB) R3251293-1 09/21/17 17:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Reactive Cyanide	U		0.0018	0.005000

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCS-D)

(LCS) R3251293-2 09/21/17 17:55 - (LCSD) R3251293-3 09/21/17 17:56

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCS Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Reactive Cyanide	0.100	0.104	0.104	104	104	85-115		0	0	20

L936656-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike-Duplicate (MSD)

(OS) L936656-01 09/21/17 18:03 • (MS) R3251293-4 09/21/17 18:06 • (MSD) R3251293-5 09/21/17 18:07

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Reactive Cyanide	0.100	ND	0.0901	0.0861	86	82	1	75-125			5	20

1. Te 2. Ss 3. Cu 4. Sr 5. Qc 6. Gl 7. Al 8. Sc

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:
L936656

DATE/TIME: 09/22/17 16:01

L936656-01

Method Blank (MB)

(MB) R3250199-1 09/18/17 17:42					
Analyte	MB Result	MB Qualifier	MB MDL	MB RDL	
	mg/l		mg/l	mg/l	
Reactive Sulfide	U		0.0065	0.0500	
L934254-02 Original Sample (OS) • Duplicate (DUP)					

(OS) L934254-02 09/18/17 17:43 • (DUP) R3250199-4 09/18/17 17:44					
Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP RPD Limits
	mg/l	mg/l		%	%
Reactive Sulfide	1.06	1.06	2	0	20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3250199-2 09/18/17 17:43 • (LCSD) R3250199-3 09/18/17 17:43					
Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	Rec. Limits
	mg/l	mg/l	mg/l	%	%
Reactive Sulfide	0.500	0.503	0.511	101	85-115
				LCSD Rec.	RPD Limits
				%	%
				102	20

Tc

Ss

Cn

Si

Qc

Gl

Al

Sc



QUALITY CONTROL SUMMARY

L936656-01

L936656-01 Original Sample (OS) • Duplicate (DUP)

(OS) L936656-01 09/18/17 10:32 • (DUP) WG1021485-3 09/18/17 10:32

Analyte	Original Result		DUP Result		DUP RPD		DUP Qualifier		DUP RPD Limits	
	su	7.09	su	7.09	%	0.000	12	%	%	1
Corrosivity by pH										

Sample Narrative:

OS: 7.09 at 15.2c

DUP: 7.09 at 15.2c

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) WG1021485-1 09/18/17 10:32 • (LCSD) WG1021485-2 09/18/17 10:32

Analyte	Spike Amount		LCS Result		LCSD Result		LCS Rec.		LCSD Rec.		Rec. Limits		LCS Qualifier		LCSD Qualifier		RPD		RPD Limits	
	su	10.0	su	9.95	su	9.96	%	99.5	%	99.6	%	98.4-102	%			%	0.100	%	%	1
Corrosivity by pH																				

Sample Narrative:

LCS: 9.95 at 20.1c

LCSD: 9.96 at 20.0c

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:

L936656

DATE/TIME:

09/22/17 16:01

Tc	3	4	5	6	7	8	9
SS	Cn	Sl	Qc	Gl	Al	Sc	

L936656-01 Original Sample (OS) • Duplicate (DUP)

(OS) L936656-01 09/22/17 15:11 • (DUP) WG1023539-1 09/22/17 15:11

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Flashpoint	deg F DNF at 170	deg F DNF at 170	1	% 0.000	%	% 10

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3251560-1 09/22/17 15:11 • (LCSD) R3251560-2 09/22/17 15:11

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Flashpoint	deg F 82.0	deg F 80.3	deg F 80.6	% 98.0	% 98.0	% 96.0-104	% 0.000	% 0.000	% 10	% 10

1	2	3	4	5	6	7	8	9
Ti	Ss	Cn	Sr	Qc	Gl	Al	Sc	

ACCOUNT:

Hall Environmental Analysis Laboratory

PROJECT:

SDG:

L936656

DATE/TIME:

09/22/17 16:01

Wet Chemistry by Method 2580

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
ORP	mV 71.0		1	09/21/2017 16:57	<u>WG1023075</u>

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

Al

⁸ Sc

L937490-01 Original Sample (OS) • Duplicate (DUP)

(OS) L937490-01 09/21/17 16:57 • (DUP) WG1023075-3 09/21/17 16:57

Analyte	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
ORP	mV 71.0	mV 70.0	1	% 1.42	%	% 20

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) WG1023075-1 09/21/17 16:57 • (LCSD) WG1023075-2 09/21/17 16:57

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
ORP	mV 228	mV 228	mV 229	% 100	% 100	% 90.0-110	%	%	% 0.438	% 20

Tc

Ss

Cn

Sr

Qc

Gl

Al

Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.
Qualifier	Description
T8	Sample(s) received past/too close to holding time expiration.



QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB	SampType: mblk			TestCode: EPA Method 300.0: Anions					
Client ID:	PBW	Batch ID: R45644			RunNo: 45644					
Prep Date:		Analysis Date: 9/14/2017			SeqNo: 1448506		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	ND	0.100								
Nitrogen, Nitrite (As N)	ND	0.100								
Bromide	ND	0.100								
Nitrogen, Nitrate (As N)	ND	0.100								
Phosphorus, Orthophosphate (As P	ND	0.500								
Sulfate	ND	0.500								

Sample ID	LCS		SampType: lcs		TestCode: EPA Method 300.0: Anions					
Client ID:	LCSW		Batch ID: R45644		RunNo: 45644					
Prep Date:			Analysis Date: 9/14/2017		SeqNo: 1448507		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Fluoride	0.541	0.100	0.5000	0	108	90	110			
Nitrogen, Nitrite (As N)	0.953	0.100	1.000	0	95.3	90	110			
Bromide	2.45	0.100	2.500	0	97.9	90	110			
Nitrogen, Nitrate (As N)	2.53	0.100	2.500	0	101	90	110			
Phosphorus, Orthophosphate (As P	4.76	0.500	5.000	0	95.1	90	110			
Sulfate	9.84	0.500	10.00	0	98.4	90	110			

Sample ID	MB	SampType: mblk			TestCode: EPA Method 300.0: Anions					
Client ID:	PBW	Batch ID: R45948			RunNo: 45948					
Prep Date:		Analysis Date: 9/27/2017			SeqNo: 1460425		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	ND	0.50								

Sample ID	LCS		SampType: lcs		TestCode: EPA Method 300.0: Anions					
Client ID:	LCSW		Batch ID: R45948		RunNo: 45948					
Prep Date:			Analysis Date: 9/27/2017		SeqNo: 1460426		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Chloride	4.7	0.50	5.000	0	93.5	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	100ng lcs	SampType:	LCS	TestCode:	TCLP Volatiles by 8260B					
Client ID:	LCSW	Batch ID:	T45638	RunNo:	45638					
Prep Date:		Analysis Date:	9/14/2017	SeqNo:	1448337	Units:	mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.021	0.010	0.02000	0	105	70	130			
1,1-Dichloroethene	0.022	0.010	0.02000	0	110	70	130			
Trichloroethene (TCE)	0.020	0.010	0.02000	0	102	70	130			
Chlorobenzene	0.020	0.010	0.02000	0	99.1	70	130			
Surr: 1,2-Dichloroethane-d4	0.0094		0.01000		94.3	70	130			
Surr: 4-Bromofluorobenzene	0.0097		0.01000		96.6	70	130			
Surr: Dibromofluoromethane	0.0097		0.01000		97.0	70	130			
Surr: Toluene-d8	0.0092		0.01000		91.6	70	130			

Sample ID	rb	SampType:	MBLK	TestCode:	TCLP Volatiles by 8260B					
Client ID:	PBW	Batch ID:	T45638	RunNo:	45638					
Prep Date:		Analysis Date:	9/14/2017	SeqNo:	1448338	Units:	mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.50								
1,2-Dichloroethane (EDC)	ND	0.50								
2-Butanone	ND	200								
Carbon Tetrachloride	ND	0.50								
Chloroform	ND	6.0								
1,4-Dichlorobenzene	ND	7.5								
1,1-Dichloroethene	ND	0.70								
Hexachlorobutadiene	ND	0.50								
Tetrachloroethene (PCE)	ND	0.70								
Trichloroethene (TCE)	ND	0.50								
Vinyl chloride	ND	0.20								
Chlorobenzene	ND	100								
Surr: 1,2-Dichloroethane-d4	0.0096		0.01000		95.9	70	130			
Surr: 4-Bromofluorobenzene	0.0096		0.01000		96.2	70	130			
Surr: Dibromofluoromethane	0.0096		0.01000		96.0	70	130			
Surr: Toluene-d8	0.0091		0.01000		91.4	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001cms		SampType: MS		TestCode: EPA Method 8270C TCLP					
Client ID:	Injection Well		Batch ID: 33908		RunNo: 45933					
Prep Date:	9/18/2017		Analysis Date: 9/27/2017		SeqNo: 1460039		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.069	0.0010	0.1000	0	69.0	23.9	129			
3+4-Methylphenol	0.13	0.0010	0.2000	0	64.6	15	167			
2,4-Dinitrotoluene	0.063	0.0010	0.1000	0	63.3	15	147			
Hexachlorobenzene	0.073	0.0010	0.1000	0	72.5	41.4	136			
Hexachlorobutadiene	0.069	0.0010	0.1000	0	68.5	16.2	134			
Hexachloroethane	0.056	0.0010	0.1000	0	56.5	20.6	124			
Nitrobenzene	0.081	0.0010	0.1000	0	80.8	39.5	134			
Pentachlorophenol	0.028	0.0010	0.1000	0	28.3	15	137			
Pyridine	0.011	0.0010	0.1000	0	11.0	15	129			S
2,4,5-Trichlorophenol	0.080	0.0010	0.1000	0	79.8	15	158			
2,4,6-Trichlorophenol	0.073	0.0010	0.1000	0	72.9	15	153			
Cresols, Total	0.20	0.0010	0.3000	0	66.1	10.6	179			
Surr: 2-Fluorophenol	0.095		0.2000		47.3	15	124			
Surr: Phenol-d5	0.078		0.2000		38.9	15	118			
Surr: 2,4,6-Tribromophenol	0.13		0.2000		66.7	15	148			
Surr: Nitrobenzene-d5	0.085		0.1000		84.7	40.6	124			
Surr: 2-Fluorobiphenyl	0.070		0.1000		69.6	35.7	128			
Surr: 4-Terphenyl-d14	0.059		0.1000		58.7	18.8	115			

Sample ID	1709746-001cmsd		SampType: MSD		TestCode: EPA Method 8270C TCLP					
Client ID:	Injection Well		Batch ID: 33908		RunNo: 45933					
Prep Date:	9/18/2017		Analysis Date: 9/27/2017		SeqNo: 1460040		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
2-Methylphenol	0.062	0.0010	0.1000	0	62.5	23.9	129	9.98	20	
3+4-Methylphenol	0.12	0.0010	0.2000	0	61.3	15	167	5.28	20	
2,4-Dinitrotoluene	0.056	0.0010	0.1000	0	56.3	15	147	11.7	23.2	
Hexachlorobenzene	0.071	0.0010	0.1000	0	70.8	41.4	136	2.46	20	
Hexachlorobutadiene	0.065	0.0010	0.1000	0	64.5	16.2	134	5.98	20	
Hexachloroethane	0.051	0.0010	0.1000	0	51.5	20.6	124	9.27	31.3	
Nitrobenzene	0.081	0.0010	0.1000	0	80.9	39.5	134	0.124	26.6	
Pentachlorophenol	0.040	0.0010	0.1000	0	40.5	15	137	35.5	27.9	R
Pyridine	0.0090	0.0010	0.1000	0	8.96	15	129	20.8	47.4	S
2,4,5-Trichlorophenol	0.072	0.0010	0.1000	0	71.6	15	158	10.9	36.9	
2,4,6-Trichlorophenol	0.077	0.0010	0.1000	0	77.0	15	153	5.42	37.2	
Cresols, Total	0.18	0.0010	0.3000	0	61.7	10.6	179	6.89	27.4	
Surr: 2-Fluorophenol	0.087		0.2000		43.6	15	124	0	0	
Surr: Phenol-d5	0.074		0.2000		37.0	15	118	0	0	
Surr: 2,4,6-Tribromophenol	0.14		0.2000		68.1	15	148	0	0	

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001cmsd	SampType:	MSD		TestCode:	EPA Method 8270C TCLP				
Client ID:	Injection Well	Batch ID:	33908		RunNo:	45933				
Prep Date:	9/18/2017	Analysis Date:	9/27/2017		SeqNo:	1460040		Units:	mg/L	
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Nitrobenzene-d5	0.082		0.1000		81.7	40.6	124	0	0	
Surr: 2-Fluorobiphenyl	0.070		0.1000		69.8	35.7	128	0	0	
Surr: 4-Terphenyl-d14	0.051		0.1000		51.1	18.8	115	0	0	

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-34071		SampType: MBLK		TestCode: EPA Method 7470: Mercury					
Client ID:	PBW		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459048		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercurv	ND	0.00020								

Sample ID	LCS-34071		SampType: LCS		TestCode: EPA Method 7470: Mercury					
Client ID:	LCSW		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459049		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	0	97.0	80	120			

Sample ID	1709746-001DMS		SampType: MS		TestCode: EPA Method 7470: Mercury					
Client ID:	Injection Well		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459053		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0050	0.00020	0.005000	.00004788	98.8	75	125			

Sample ID	1709746-001DMSD		SampType: MSD		TestCode: EPA Method 7470: Mercury					
Client ID:	Injection Well		Batch ID: 34071		RunNo: 45912					
Prep Date:	9/26/2017		Analysis Date: 9/27/2017		SeqNo: 1459054		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Mercury	0.0049	0.00020	0.005000	.00004788	97.9	75	125	0.906	20	

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-A	SampType: MBLK			TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	PBW	Batch ID: A45714			RunNo: 45714					
Prep Date:		Analysis Date: 9/19/2017			SeqNo: 1452976		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								

Sample ID	LCS-A		SampType: LCS		TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	LCSW		Batch ID: A45714		RunNo: 45714					
Prep Date:			Analysis Date: 9/19/2017		SeqNo: 1452977		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	52	1.0	50.00	0	104	80	120			
Magnesium	54	1.0	50.00	0	108	80	120			
Potassium	53	1.0	50.00	0	106	80	120			

Sample ID	MB-A	SampType: MBLK			TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	PBW	Batch ID: A45960			RunNo: 45960					
Prep Date:		Analysis Date: 9/28/2017			SeqNo: 1461012		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	ND	1.0								

Sample ID	LCS-A		SampType: LCS		TestCode: EPA Method 6010B: Dissolved Metals					
Client ID:	LCSW		Batch ID: A45960		RunNo: 45960					
Prep Date:			Analysis Date: 9/28/2017		SeqNo: 1461013		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Sodium	51	1.0	50.00	0	102	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-33882		SampType: MBLK		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451478		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	ND	0.020								
Barium	ND	0.020								
Cadmium	ND	0.0020								
Chromium	ND	0.0060								
Lead	ND	0.0050								
Silver	ND	0.0050								

Sample ID	LCS-33882		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451479		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Arsenic	0.52	0.020	0.5000	0	103	80	120			
Barium	0.49	0.020	0.5000	0	98.6	80	120			
Cadmium	0.49	0.0020	0.5000	0	98.8	80	120			
Chromium	0.49	0.0060	0.5000	0	98.1	80	120			
Lead	0.48	0.0050	0.5000	0	95.7	80	120			
Silver	0.10	0.0050	0.1000	0	103	80	120			

Sample ID	MB-33882		SampType: MBLK		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451496		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	ND	0.050								

Sample ID	LCS-33882		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 33882		RunNo: 45714					
Prep Date:	9/15/2017		Analysis Date: 9/19/2017		SeqNo: 1451497		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Selenium	0.49	0.050	0.5000	0	98.4	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID mb-1	SampType: MBLK			TestCode: SM2320B: Alkalinity						
Client ID: PBW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452652		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID lcs-1	SampType: LCS			TestCode: SM2320B: Alkalinity						
Client ID: LCSW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452653		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.40	20.00	80.00	0	101	90	110			

Sample ID mb-2	SampType: MBLK			TestCode: SM2320B: Alkalinity						
Client ID: PBW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452675		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID lcs-2	SampType: LCS			TestCode: SM2320B: Alkalinity						
Client ID: LCSW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452676		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.92	20.00	80.00	0	101	90	110			

Sample ID mb-3	SampType: MBLK			TestCode: SM2320B: Alkalinity						
Client ID: PBW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452699		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID lcs-3	SampType: LCS			TestCode: SM2320B: Alkalinity						
Client ID: LCSW	Batch ID: R45747			RunNo: 45747						
Prep Date:	Analysis Date: 9/19/2017			SeqNo: 1452700		Units: mg/L CaCO3				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	80.84	20.00	80.00	0	101	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.	B Analyte detected in the associated Method Blank
D Sample Diluted Due to Matrix	E Value above quantitation range
H Holding times for preparation or analysis exceeded	J Analyte detected below quantitation limits
ND Not Detected at the Reporting Limit	P Sample pH Not In Range
PQL Practical Quantitative Limit	RL Reporting Detection Limit
S % Recovery outside of range due to dilution or matrix	W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	1709746-001EDUP	SampType:	DUP	TestCode:	Specific Gravity					
Client ID:	Injection Well	Batch ID:	R45658	RunNo:	45658					
Prep Date:		Analysis Date:	9/15/2017	SeqNo:	1449109	Units:				
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Specific Gravity	1.001	0						0.110	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Detection Limit
S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1709746

18-Oct-17

Client: Western Refining Southwest, Inc.

Project: BPT Injection Well 9 13 17

Sample ID	MB-33959		SampType: MBLK		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	PBW		Batch ID: 33959		RunNo: 45804					
Prep Date:	9/20/2017		Analysis Date: 9/22/2017		SeqNo: 1455608		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	LCS-33959		SampType: LCS		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	LCSW		Batch ID: 33959		RunNo: 45804					
Prep Date:	9/20/2017		Analysis Date: 9/22/2017		SeqNo: 1455609		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1020	20.0	1000	0	102	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
PQL Practical Quantitative Limit
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Western Refining Southw

Work Order Number: 1709746

RcptNo: 1

Received By: Isaiah Ortiz 9/14/2017 7:05:00 AM

Completed By: Ashley Gallegos 9/14/2017 9:01:05 AM

Reviewed By: ENM 9/14/17

IC

Ag

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☒
2. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐
5. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☒ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☒ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
9. Was preservative added to bottles? Yes ☐ No ☒ NA ☐
10. VOA vials have zero headspace? Yes ☒ No ☐ No VOA Vials ☐
11. Were any sample containers received broken? Yes ☐ No ☒
12. Does paperwork match bottle labels?
(Note discrepancies on chain of custody) Yes ☒ No ☐
13. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
14. Is it clear what analyses were requested? Yes ☒ No ☐
15. Were all holding times able to be met?
(If no, notify customer for authorization.) Yes ☒ No ☐

of preserved
bottles checked
for pH: 2, 2
(<2 or >12 unless noted)
Adjusted? No
Checked by: Re

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

Chain-of-Custody Record

Client: Western Refining

Mailing Address: 50 CR4990

Bloomfield, NM 87413

Phone #: 505-632-4169

email or Fax#:

QA/QC Package: ☒ Standard ☐ Level 4 (Full Validation)

Accreditation: ☒ NELAP ☐ Other

☐ EDD (Type)

Date Time Matrix Sample Request ID

9-13-17 11:20 H₂O Injection Well

Turn-Around Time:

☒ Standard ☐ Rush

Project Name:

BPT-Injection Well-9-13-17

Project #:

PO# 12621258

Project Manager:

Kelly Robinson

Sampler: Mott Krakow

On Ice: ☒ Yes ☐ No

Sample Temperature: LO

Container Type and #

Preservative Type

HEAL No.

1709746

-001

Amber

HCL

HNO₃

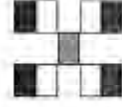
HNO₃

Poly

NaOH

Zn Acetate

NaOH



HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4801 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

BTEX + MTBE + TMBs (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAHs (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F, Cl, NO ₃ , NO ₂ , PO ₄ , SO ₄)	8081 Pesticides / 8082 PCBs	8260B (VOA)	8270 (Semi-VOA)	Air Bubbles (Y or N)
---------------------------	------------------------------	-----------------------------	--------------------	--------------------	--------------------------	---------------	--	-----------------------------	-------------	-----------------	----------------------

See Analyte List

Remarks:

See analyte list

Received by:

Christine 9/13/17 11:20

Received by:

Christine 9/14/17 07:05

immediately or within a specified time period, or assess a civil penalty, or both (see Section 74-6-10 NMSA 1978). The compliance order may also include a suspension or termination of this Discharge Permit. OCD may also commence a civil action in district court for appropriate relief, including injunctive relief (see Section 74-6-10(A)(2) NMSA 1978). The Permittee may be subject to criminal penalties for discharging a water contaminant without a discharge permit or in violation of a condition of a discharge permit; making any false material statement, representation, certification or omission of material fact in a renewal application, record, report, plan or other document filed, submitted or required to be maintained under the Water Quality Act; falsifying, tampering with or rendering inaccurate any monitoring device, method or record required to be maintained under the Water Quality Act; or failing to monitor, sample or report as required by a Discharge Permit issued pursuant to a state or federal law or regulation (see Section 74-6-10.2 NMSA 1978).

2. GENERAL FACILITY OPERATIONS:

2.A. QUARTERLY MONITORING REQUIREMENTS FOR CLASS I NON-HAZARDOUS WASTE INJECTION WELL: The Permittee shall properly conduct waste management injection operations at its facility by injecting only non-hazardous (RCRA exempt and RCRA non-hazardous, non-exempt) oil field waste fluids. Injected waste fluids shall not exhibit the RCRA characteristics, i.e., ignitability, reactivity, corrosivity, or toxicity under 40 CFR 261 Subpart "C" 261.21 – 261.24 (July 1, 1992), at the point of injection into WDW-2, based upon environmental analytical laboratory testing. Pursuant to 20.6.2.5207B, the Permittee shall provide analyses of the injected fluids at least quarterly to yield data representative of their toxicity characteristic.

The Permittee shall also analyze the injected fluids quarterly for the following characteristics:

- pH (Method 9040);
- Eh;
- Specific conductance;
- Specific gravity;
- Temperature;
- Major dissolved cations and anions, including: fluoride, calcium, potassium, magnesium, sodium bicarbonate, carbonate, chloride, sulfate, bromide, total dissolved solids, and cation/anion balance using the methods specified in 40 CFR 136.3); and,
- EPA RCRA Characteristics for Ignitability (ASTM Methods); Corrosivity (SW-846) and Reactivity (determined through Permittee's application of knowledge or generating process).

The Permittee shall analyze the injected fluids quarterly for the constituents identified in the Quarterly Monitoring List (below) to demonstrate that the injected fluids do not exhibit the characteristic of toxicity using the Toxicity Characteristic Leaching Procedure, EPA SW-846 Test Method 1311 (see Table 1, 40 CFR 261.24(b)).

**WESTERN REFINING SOUTHWEST, INC.
WASTE DISPOSAL WELL NO. 2**

**UICI-011 (WDW-2)
July 20, 2016**

D010	Selenium	1311	1.0
D011	Silver	1311	5.0
D039	Tetrachloroethylene	8260B	0.7
D040	Trichloroethylene	8021B 8260B	0.5
D041	2,4,5-Trichlorophenol	8270D	400.0
D042	2,4,6-Trichlorophenol	8041A 8270D	2.0
D043	Vinyl chloride	8021B 8260B	0.2

If o-, m-, and p-cresol concentrations cannot be differentiated, then the total cresol (D026) concentration is used.

The regulatory level of total cresol is 200 mg/L.

If the quantitation limit is greater than the regulatory level, then the quantitation limit becomes the regulatory level.

If metals (dissolved), the EPA 1311 TCLP Laboratory Method is required with the exception of Mercury (total).

1. Monitor and Piezometer Wells: Groundwater with a total dissolved solids concentration of less than 10,000 mg/L occurs at an estimated depth of approximately 10 - 30 ft. below ground surface at the WDW-2 well (hereafter, "uppermost water-bearing unit"). Groundwater monitoring well (MW) with GW sampling capability shall be installed proximal to and hydrogeologically downgradient from WDW-2 in order to monitor the uppermost water-bearing unit. The MW shall be screened (15 ft. screen with top of screen positioned 5 ft. above water table) into the uppermost water-bearing unit. The Permittee shall propose a monitoring frequency with chemical monitoring parameters in order to detect potential groundwater contamination either associated with or not associated with WDW-2.

2.B. CONTINGENCY PLANS: The Permittee shall implement its proposed contingency plan(s) included in its application to cope with failure of a system(s) in the Discharge Permit.

2.C. CLOSURE: Prior to closure of the facility, the Permittee shall submit for OCD's approval, a closure plan including a completed form C-103 for plugging and abandonment of the waste injection well. The Permittee shall plug and abandon its well pursuant to 20.6.2.5209 NMAC and as specified in Permit Condition 2.D.

- 1. Pre-Closure Notification:** Pursuant to 20.6.2.5005A NMAC, the Permittee shall submit a pre-closure notification to OCD's Environmental Bureau at least 30 days prior to the date that it proposes to close or to discontinue operation of WDW-2. Pursuant to 20.6.2.5005B NMAC, OCD's Environmental Bureau must approve all proposed well closure activities before the Permittee may implement its proposed closure plan.
- 2. Required Information:** The Permittee shall provide OCD's Environmental Bureau with the following information in the pre-closure notification specified in Permit Condition 2.C.1:
 - Name of facility;
 - Address of facility;
 - Name of Permittee (and owner or operator, if appropriate);

Field Parameters									
Site	Sp. Cond. (uS/cm)	TDS (g/L)	DO (mg/L)	ORP (mV)	pH (Units)	Temp. (F)	Date	Time	Sampler
DWD#2	68,017	44,200	1.33	211.9	5.13	52.3	1/25/2017	11:00 AM	Matt Krakow



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

February 01, 2017

Kelly Robinson

Western Refining Southwest, Inc.

#50 CR 4990

Bloomfield, NM 87413

TEL: (505) 632-4135

FAX (505) 632-3911

RE: DWD #2

OrderNo.: 1701A75

Dear Kelly Robinson:

Hall Environmental Analysis Laboratory received 1 sample(s) on 1/26/2017 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

A handwritten signature in black ink, appearing to read 'Andy Freeman', is written over a horizontal line.

Andy Freeman

Laboratory Manager

4901 Hawkins NE

Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Analytical Report

Lab Order 1701A75

Date Reported: 2/1/2017

CLIENT: Western Refining Southwest, Inc.

Client Sample ID: DWD 2 Formation Water

Project: DWD #2

Collection Date: 1/25/2017 11:00:00 AM

Lab ID: 1701A75-001

Matrix: AQUEOUS

Received Date: 1/26/2017 7:05:00 AM

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 300.0: ANIONS							Analyst: MRA
Fluoride	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Chloride	23000	2500	*	mg/L	5E	1/27/2017 7:20:01 PM	R40361
Bromide	ND	2.0		mg/L	20	1/26/2017 6:37:17 PM	R40335
Phosphorus, Orthophosphate (As P)	ND	10		mg/L	20	1/26/2017 6:37:17 PM	R40335
Sulfate	910	25	*	mg/L	50	1/27/2017 7:07:36 PM	R40361
Nitrate+Nitrite as N	ND	20		mg/L	100	1/27/2017 7:32:26 PM	R40361
SM2510B: SPECIFIC CONDUCTANCE							Analyst: JRR
Conductivity	94000	50		µmhos/cm	50	1/30/2017 1:40:54 PM	R40366
SM2320B: ALKALINITY							Analyst: JRR
Bicarbonate (As CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Carbonate (As CaCO3)	ND	2.000		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
Total Alkalinity (as CaCO3)	255.3	20.00		mg/L CaCO3	1	1/30/2017 11:39:53 AM	R40366
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: KS
Total Dissolved Solids	48900	2000	*D	mg/L	1	2/1/2017 3:56:00 PM	29970
EPA 6010B: TOTAL RECOVERABLE METALS							Analyst: pmf
Calcium	1700	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Magnesium	200	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Potassium	450	20		mg/L	20	1/30/2017 10:59:56 AM	29930
Sodium	16000	500		mg/L	500	1/30/2017 11:06:12 AM	29930

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:	*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank	Page 1 of 5
	D	Sample Diluted Due to Matrix	E	Value above quantitation range	
	H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits	
	ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range	
	R	RPD outside accepted recovery limits	RL	Reporting Detection Limit	
	S	% Recovery outside of range due to dilution or matrix	W	Sample container temperature is out of limit as specified	



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LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: Hall Environmental
Project: Not Indicated
Lab ID: B17011690-001
Client Sample ID: 1701A75-001C DWD 2 Formation Water

Report Date: 01/27/17
Collection Date: 01/25/17 11:00
Date Received: 01/27/17
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
CORROSIVITY							
pH	6.46	s.u.		0.10		SW9040C	01/27/17 10:54 / jmg

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.



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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: Hall Environmental

Project: Not Indicated

Report Date: 01/27/17

Work Order: B17011690

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	SW9040C	Analytical Run: ORION 720A HZW_170127A							
Lab ID:	ICV	Initial Calibration Verification Standard 01/27/17 10:54							
pH	8.11	s.u.	0.10	101	98	102			
Method:	SW9040C	Batch: R273874							
Lab ID:	B17011690-001ADUP	Sample Duplicate Run: ORION 720A HZW_170127A 01/27/17 10:54							
pH	6.49	s.u.	0.10				0.5	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID MB	SampType: mblk		TestCode: EPA Method 300.0: Anions							
Client ID: PBW	Batch ID: R40335		RunNo: 40335							
Prep Date:	Analysis Date: 1/26/2017		SeqNo: 1264291		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride ND 0.10

Bromide ND 0.10

Phosphorus, Orthophosphate (As P) ND 0.50

Sample ID LCSb	SampType: lcs		TestCode: EPA Method 300.0: Anions							
Client ID: LCSW	Batch ID: R40335		RunNo: 40335							
Prep Date:	Analysis Date: 1/26/2017		SeqNo: 1264293		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Fluoride 0.52 0.10 0.5000 0 104 90 110

Bromide 2.4 0.10 2.500 0 96.4 90 110

Phosphorus, Orthophosphate (As P) 4.8 0.50 5.000 0 96.7 90 110

Sample ID MB	SampType: mblk		TestCode: EPA Method 300.0: Anions							
Client ID: PBW	Batch ID: R40361		RunNo: 40361							
Prep Date:	Analysis Date: 1/27/2017		SeqNo: 1265117		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Chloride ND 0.50

Sulfate ND 0.50

Nitrate+Nitrite as N ND 0.20

Sample ID LCS	SampType: lcs		TestCode: EPA Method 300.0: Anions							
Client ID: LCSW	Batch ID: R40361		RunNo: 40361							
Prep Date:	Analysis Date: 1/27/2017		SeqNo: 1265118		Units: mg/L					
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual

Chloride 4.8 0.50 5.000 0 95.5 90 110

Sulfate 9.7 0.50 10.00 0 97.2 90 110

Nitrate+Nitrite as N 3.5 0.20 3.500 0 98.8 90 110

Qualifiers:

* Value exceeds Maximum Contaminant Level.

D Sample Diluted Due to Matrix

H Holding times for preparation or analysis exceeded

ND Not Detected at the Reporting Limit

R RPD outside accepted recovery limits

S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank

E Value above quantitation range

J Analyte detected below quantitation limits

P Sample pH Not In Range

RL Reporting Detection Limit

W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	MB-29930	SampType: MBLK			TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	PBW	Batch ID: 29930			RunNo: 40375					
Prep Date:	1/27/2017	Analysis Date: 1/30/2017			SeqNo: 1265583		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								
Potassium	ND	1.0								
Sodium	ND	1.0								

Sample ID	LCS-29930		SampType: LCS		TestCode: EPA 6010B: Total Recoverable Metals					
Client ID:	LCSW		Batch ID: 29930		RunNo: 40375					
Prep Date:	1/27/2017		Analysis Date: 1/30/2017		SeqNo: 1265584		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	49	1.0	50.00	0	98.3	80	120			
Magnesium	49	1.0	50.00	0	97.3	80	120			
Potassium	47	1.0	50.00	0	94.9	80	120			
Sodium	48	1.0	50.00	0	95.4	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	mb-1	SampType:	mbk	TestCode:	SM2320B: Alkalinity					
Client ID:	PBW	Batch ID:	R40366	RunNo:	40366					
Prep Date:		Analysis Date:	1/30/2017	SeqNo:	1266120	Units:	mg/L CaCO3			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	ND	20.00								

Sample ID	lcs-1	SampType:	lcs	TestCode:	SM2320B: Alkalinity					
Client ID:	LCSW	Batch ID:	R40366	RunNo:	40366					
Prep Date:		Analysis Date:	1/30/2017	SeqNo:	1266121	Units:	mg/L CaCO3			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Alkalinity (as CaCO3)	78.04	20.00	80.00	0	97.6	90	110			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: 1701A75

01-Feb-17

Client: Western Refining Southwest, Inc.

Project: DWD #2

Sample ID	MB-29970	SampType: MBLK			TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	PBW	Batch ID: 29970			RunNo: 40436					
Prep Date:	1/31/2017	Analysis Date: 2/1/2017			SeqNo: 1267368		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID	LCS-29970		SampType: LCS		TestCode: SM2540C MOD: Total Dissolved Solids					
Client ID:	LCSW		Batch ID: 29970		RunNo: 40436					
Prep Date:	1/31/2017		Analysis Date: 2/1/2017		SeqNo: 1267369		Units: mg/L			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

* Value exceeds Maximum Contaminant Level.
D Sample Diluted Due to Matrix
H Holding times for preparation or analysis exceeded
ND Not Detected at the Reporting Limit
R RPD outside accepted recovery limits
S % Recovery outside of range due to dilution or matrix

B Analyte detected in the associated Method Blank
E Value above quantitation range
J Analyte detected below quantitation limits
P Sample pH Not In Range
RL Reporting Detection Limit
W Sample container temperature is out of limit as specified



Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Western Refining Southw

Work Order Number: 1701A75

RcptNo: 1

Received by/date: 1/26/17

Logged By: Anne Thorne 1/26/2017 7:05:00 AM

Completed By: Anne Thorne 1/26/2017 9:13:16 AM

Reviewed By: [Signature] 1/26/17

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☒
2. Is Chain of Custody complete? Yes ☒ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☒ No ☐ NA ☐
5. Were all samples received at a temperature of $>0^{\circ}\text{C}$ to 6.0°C ? Yes ☒ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☒ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☒ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☒ No ☐
9. Was preservative added to bottles? Yes ☐ No ☒ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☒
11. Were any sample containers received broken? Yes ☐ No ☒
12. Does paperwork match bottle labels?
(Note discrepancies on chain of custody) Yes ☒ No ☐
13. Are matrices correctly identified on Chain of Custody? Yes ☒ No ☐
14. Is it clear what analyses were requested? Yes ☒ No ☐
15. Were all holding times able to be met?
(If no, notify customer for authorization.) Yes ☒ No ☐

of preserved
bottles checked
for pH: 2
(≤ 2 or >12 unless noted)

Adjusted? MP

Checked by: [Signature]

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☒

Person Notified:	_____	Date:	_____
By Whom:	_____	Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:	_____		
Client Instructions:	_____		

17. Additional remarks:

18. Cooler Information

Cooler No	Temp $^{\circ}\text{C}$	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.0	Good	Yes			

Chain-of-Custody Record

Client: Western Refining

Mailing Address: 50 CR 4990

Bloomfield, NM 87413

Phone #: 505-632-4169

email or Fax#:

QA/QC Package:

☒ Standard ☐ Level 4 (Full Validation)

Accreditation

☐ NELAP ☐ Other

☐ EDD (Type)

Turn-Around Time:

☐ Standard ☒ Rush 2-day

Project Name:

DWD #2

Project #:

PD-12619031-2

Project Manager:

Kelly Robinson

Sampler: Math Krakow

On Ice: ☒ Yes ☐ No

Sample Temperature: 10

Container Type and #

Preservative Type

HEAL No.

1701A75

1-500ml

1-500ml

1-125ml

H₂O

DWD2 Formation water

1-500ml

1-500ml

1-125ml

H₂O

DWD2 Formation water

1-500ml

1-500ml

1-125ml

H₂O

DWD2 Formation water

1-500ml

1-500ml

1-125ml

H₂O

DWD2 Formation water

1-500ml

1-500ml

1-125ml

H₂O

Date: 25/17

Time: 1447

Relinquished by: [Signature]

Date: 25/17

Time: 1800

Relinquished by: [Signature]

Date: 25/17

Time: 1800

Relinquished by: [Signature]

Received by: [Signature]

Date: 12/17

Time: 1447

Received by: [Signature]

Date: 12/17

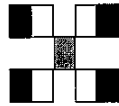
Time: 0700

Received by: [Signature]

Date: 12/17

Time: 0700

Remarks:



**HALL ENVIRONMENTAL
ANALYSIS LABORATORY**

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

BTEX + MTBE + TMBs (8021)
BTEX + MTBE + TPH (Gas only)
TPH 8015B (GRO / DRO / MRO)
TPH (Method 418.1)
EDB (Method 504.1)
PAH's (8310 or 8270 SIMS)
RCRA 8 Metals
Anions (F, Cl, NO₃, NO₂, PO₄, SO₄)
8081 Pesticides / 8082 PCBs
8260B (VOA)
8270 (Semi-VOA)
See attached

Air Bubbles (Y or N)

All Anions	EPA Method 300.0	1-500ml unpreserved plastic 1-125 ml H ₂ SO ₄ plastic
Alkalinity	SM2320 B	Volume will come from the 500ml unpreserved plastic
eC	SM 2510B	Volume will come from the 500ml unpreserved plastic
TDS	SM 2540 C	Volume will come from the 500ml unpreserved plastic
Cations	EPA Method 200.7	1-500ml HNO ₃ Plastic
pH	EPA Method 9040	Volume will come from the 500ml unpreserved plastic

SM = Standard Methods

EPA Methods 310.1, 150.1, 160.1, 320.1 and 120.1 have been withdrawn by EPA. Most labs have
We are accredited for all of the tests listed above and we perform these methods regularly for 1

We will ship out one bottle set today as listed below. Fill all bottles to the neck and keep the sample
We can rush this work on a 1-2 business day TAT.

1-500ml unpreserved plastic

1-125ml H₂SO₄ Plastic

1-500ml HNO₃ plastic

Appendix D

Well Logs

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express

Triple Combo

County:	San Juan		
Field:	Wildcat		
Location:	Sec 27, T29N, R11W		
Well:	WWD #2		
Company:	Western Refining, Southwest, Inc.		
Location:		Sec 27, T29N, R11W	Elev.: K.B. 5550.00 ft
Permanent Datum:		SHL: 2028' FNL X 111' FEL	G.L. 5535.00 ft
Log Measured From:		Lat/Long: 36.6986/-107.97035	D.F. 5549.00 ft
Drilling Measured From:		Ground Level	Elev.: 5535.00 f
API Serial No.		Kelly Bushing	15.00 ft above Perm.Datum
30-045-35747-0000		Kelly Bushing	
		Section:	Township:
		27	29N
			Range:
			11W

Logging Date	05-Sep-2016		
Run Number	One		
Depth Driller	7525.00 ft		
Schlumberger Depth	7532.00 ft		
Bottom Log Interval	7532.00 ft		
Top Log Interval	3498.00 ft		
Casing Driller Size @ Depth	9.625 in @ 3500.00 ft		
Casing Schlumberger	3498 ft		
Bit Size	8.75 in		
Type Fluid In Hole	WBM		
Density	9.9 lbm/gal	55 s	
Fluid Loss	PH	8.6	
MUD			
Source of Sample	Active Tank		
RM @ Meas Temp	1.13 ohm.m @ 68 degF		
RMF @ Meas Temp	0.9 ohm.m @ 68 degF		
RMC @ Meas Temp	1.4 ohm.m @ 68 degF		
Source RMF	RMC	Pressed	Calculated
RM @ BHT	0.46 @ 177	0.37 @ 177	
Max Recorded Temperatures	177 degF		
Circulation Stopped	06-Sep-2016	20:25:00	
Logger on Bottom	07-Sep-2016	05:00:00	
Unit Number	9115	FtMorgan, CO	
Recorded By	Avery Becker		
Witnessed By	Larry Candelaria		

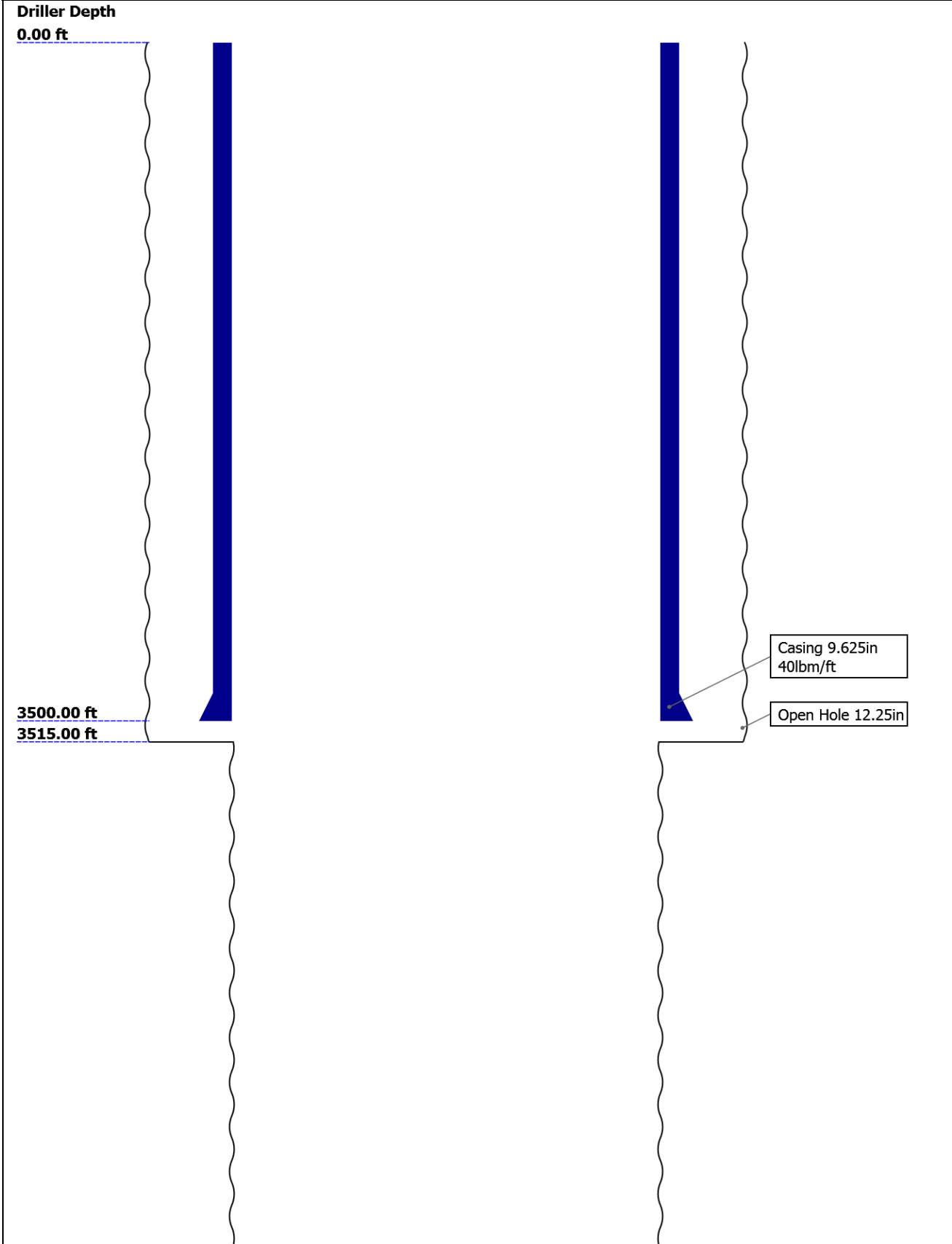
Disclaimer

THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA.

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 - 8.3 Log (TripleCombo-5)
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- 9. One 5" Triple Combo
 - 9.1 Composite Summary
 - 9.2 Log (TripleCombo-5 RA)
- 10. Calibration Report
- 11. Tail

Well Sketch



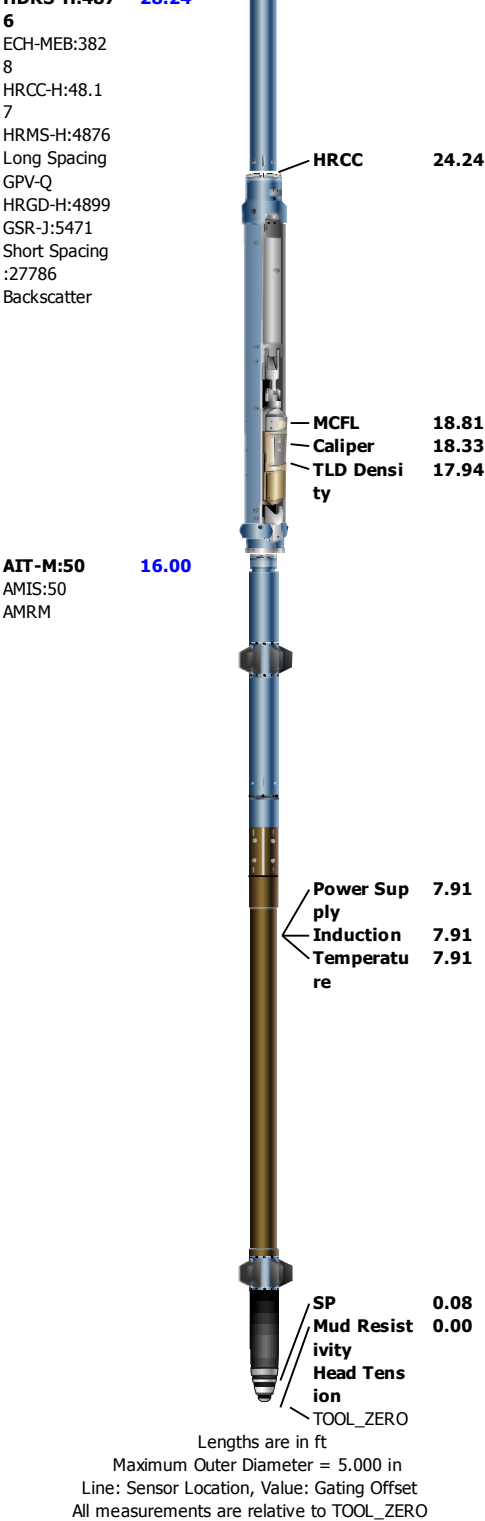


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	12.25	8.75				
Top Driller (ft)	0	3515				
Top Logger (ft)	0	3515				
Bottom Driller (ft)	3515	7525				
Bottom Logger (ft)	3515	7532				
Casing						
Size (in)	9.625					
Weight (lbm/ft)	40					
Inner Diameter (in)	8.835					
Grade	N/A					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	3500					
Bottom Logger (ft)	3498					

Remarks and Equipment Summary

One: Toolstring				One: Remarks
Equip name LEH-QT LEH-QT	Length 43.57	MP name	Offset	Toolstring run as per tool sketch
				Matrix: Sandstone (2.65 g/cc)
				Log may be affected by 20% LCM in drilling mud
				Caliper check in casing=8.87 in, within tolerance
				Cement volume calculated using 7 in future casing diameter
				Rig: Aztec 920
				Crew: Derrick Hunter
				Thank you for choosing Schlumberger
DTC-H:8980 ECH-KC:1005 3 DTC-H:8980	40.65	CTEM HV	39.75 0.00	
HGNS-H:481 7 HGNH:4865 NPV-N NSR-F:5068 HGNS-H:4817 HACCZ-H:699 1 HMCA-H	37.65	TelStatus ToolStatus Temperature GR	37.65 37.65 37.62 36.91	
HDPS-H:487	28.24	CNL Porosity HMCA HGNS Accelerometer	30.57 28.24 28.24 0.00	



Depth Summary

	One		
Depth Measuring Device			
Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		
Tension Device			
Type	CMTD-B/A		

Serial Number	147	
Calibration Date	18-Aug-2016	
Calibrator Serial Number	78805A	
Number of Calibration Points	10	
Calibration Root Mean Square Error	7	
Calibration Peak Error	10	

Logging Cable

Type	7-46A-XS		
Serial Number	U715043		
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Land		

One:Depth Control Parameters

Depth Control Remarks

Log Sequence	First Log In the Well	First run in well depth control procedures followed
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary
Rig Up Length At Bottom		
Rig Up Length Correction		
Stretch Correction		
Tool Zero Check At Surface		

One

5" Triple Combo

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

One: Log[4]:Up:S012

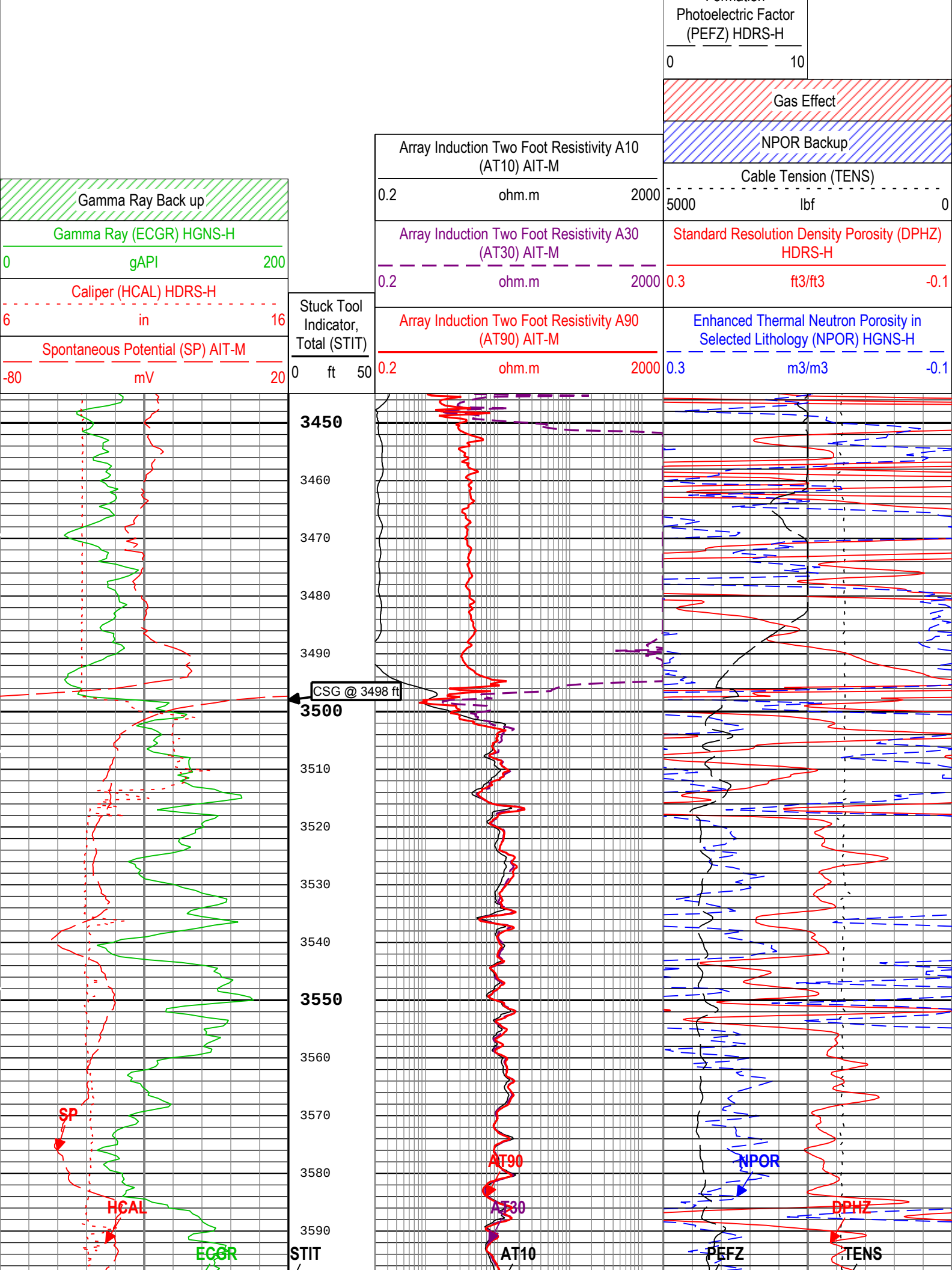
Description: HGNS standard resolution porosities for Platform Express	Format: Log (TripleCombo-5)	Index Scale: 5 in per 100 ft	Index Unit: ft	Index
---	-------------------------------	------------------------------	----------------	-------

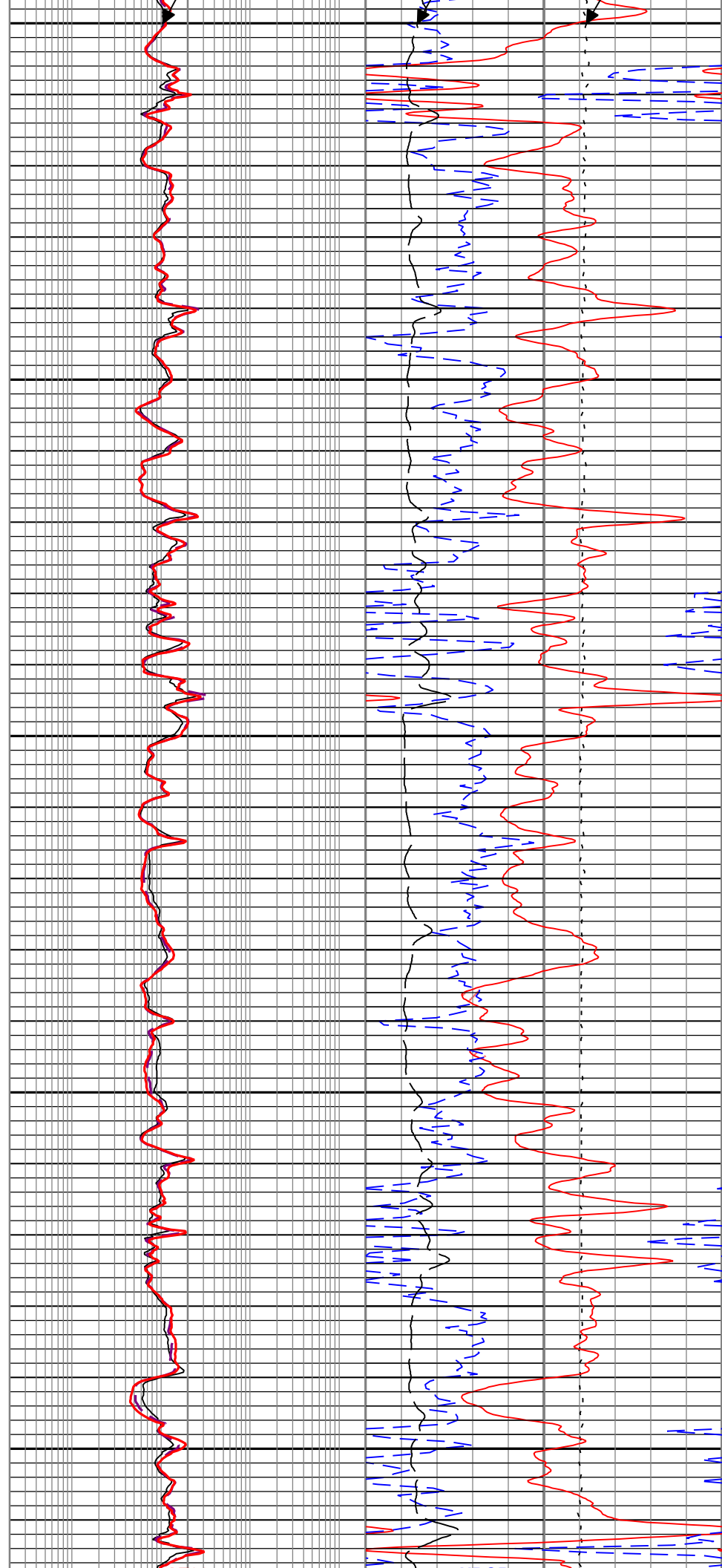
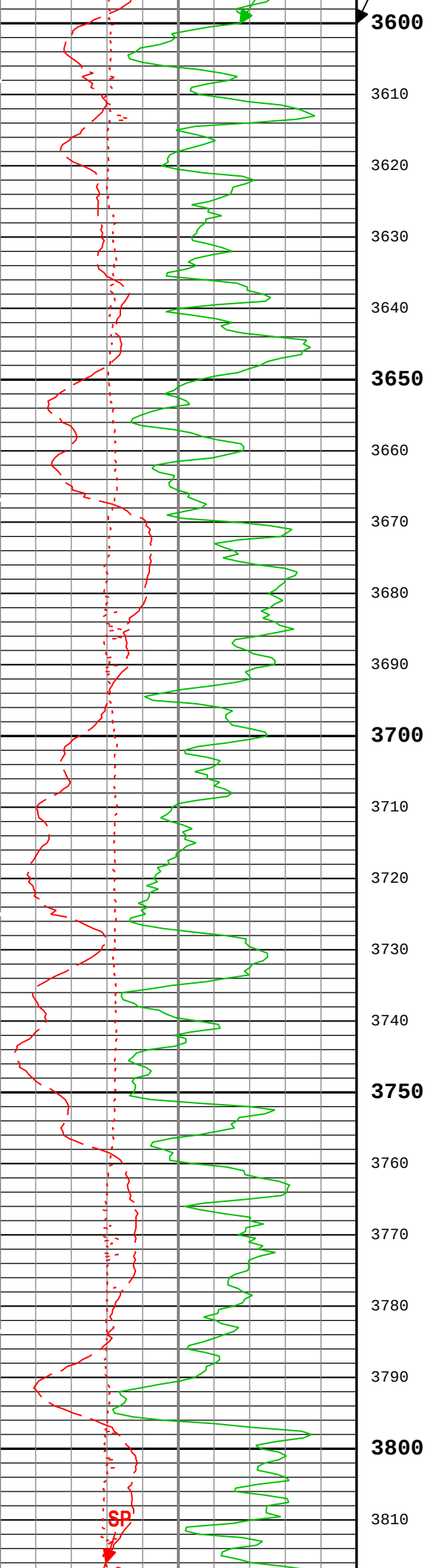
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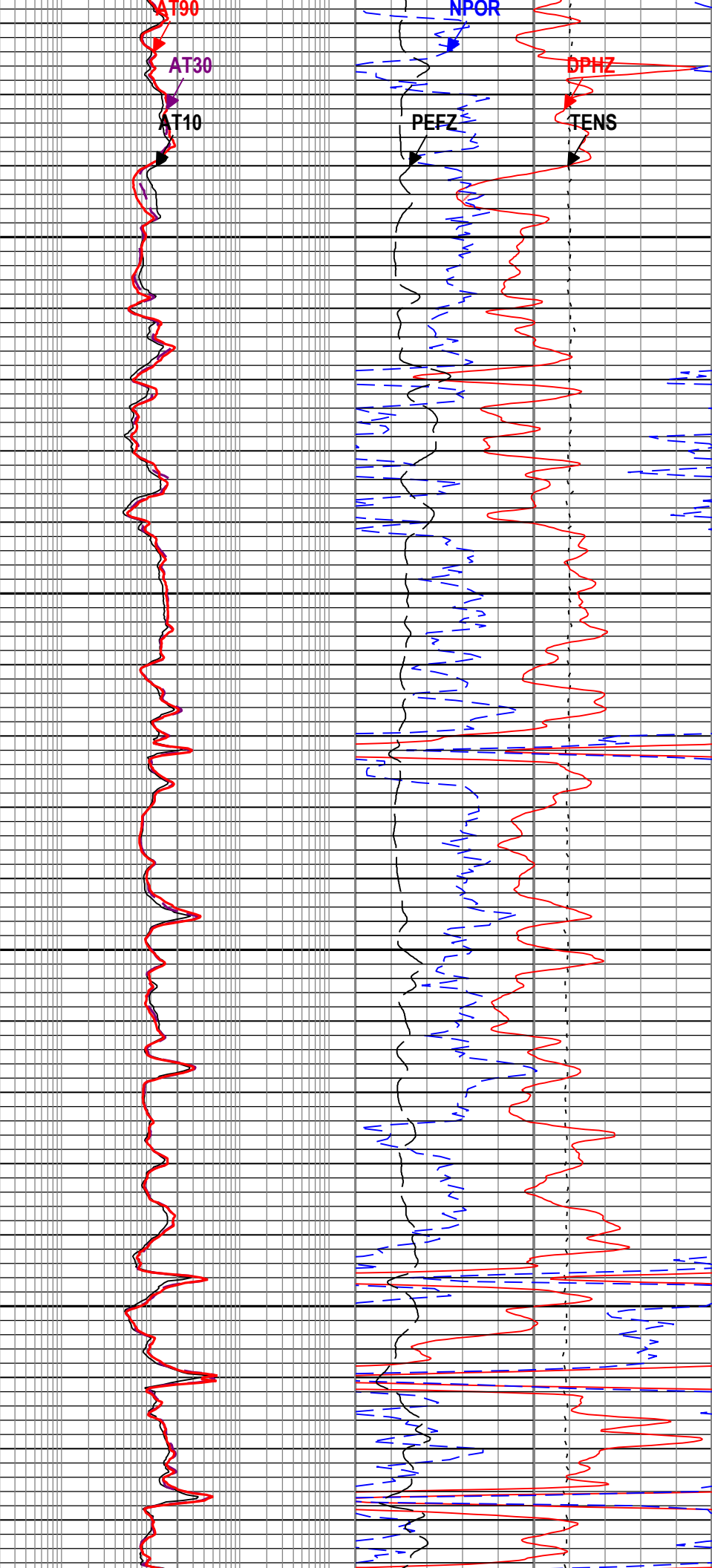
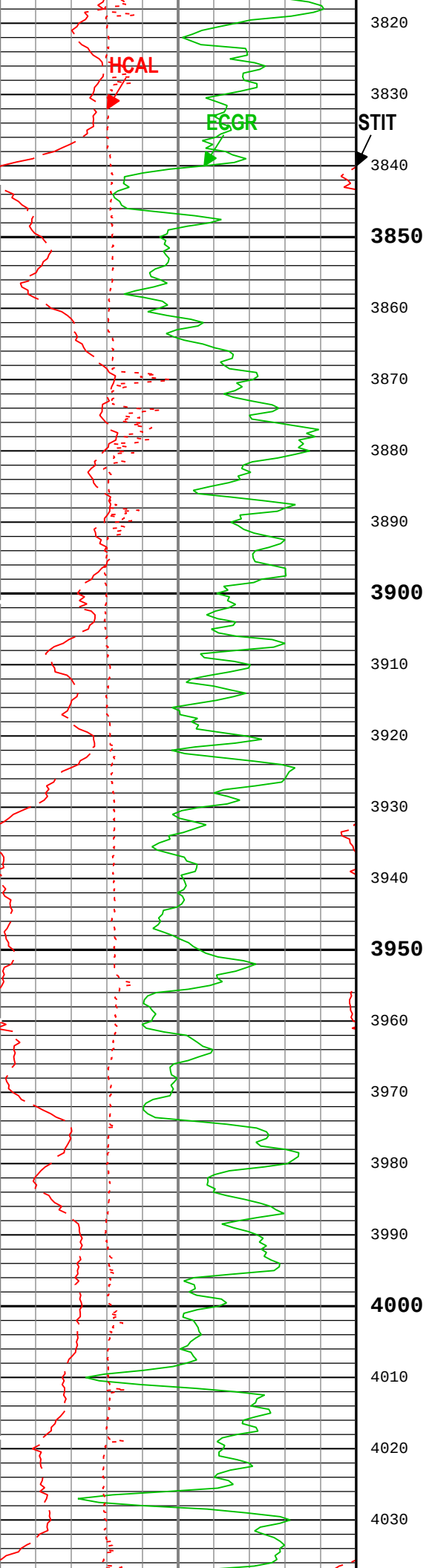
Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT30	AIT-M:AMIS:AMIS	3in
AT90	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
DPHZ	HDRS-H:HRMS-H:HRGD-H	2in
GR	HGNS-H:HGNS-H:HGNS-H	6in
NPOR	HGNS-H:HGNS-H:HGNS-H	6in
PEFZ	HDRS-H:HRMS-H:HRGD-H	2in
SP	AIT-M:AMIS:AMIS	6in
STIT	DepthCorrection	6in
TENS	WLWorkflow	6in
TIME_1900	WLWorkflow	0.1in

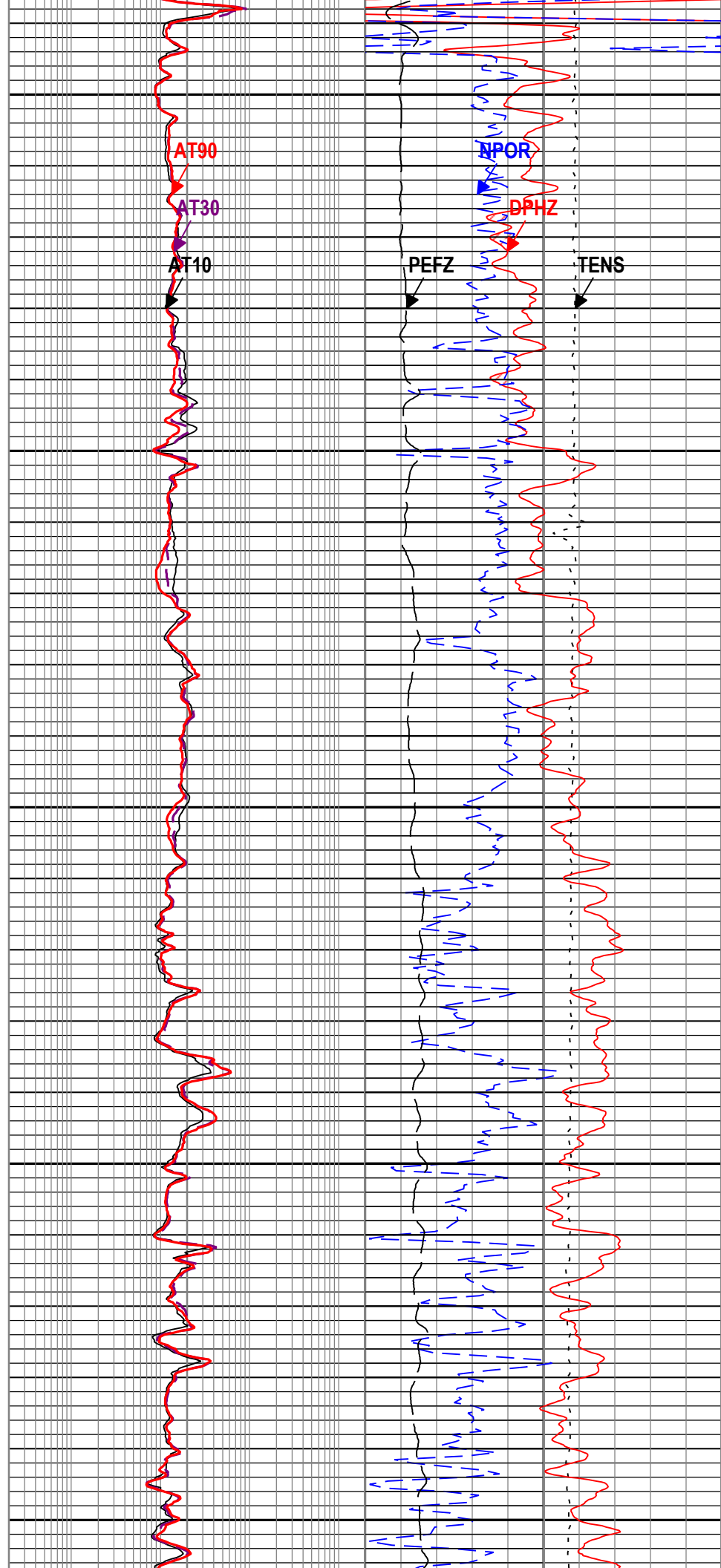
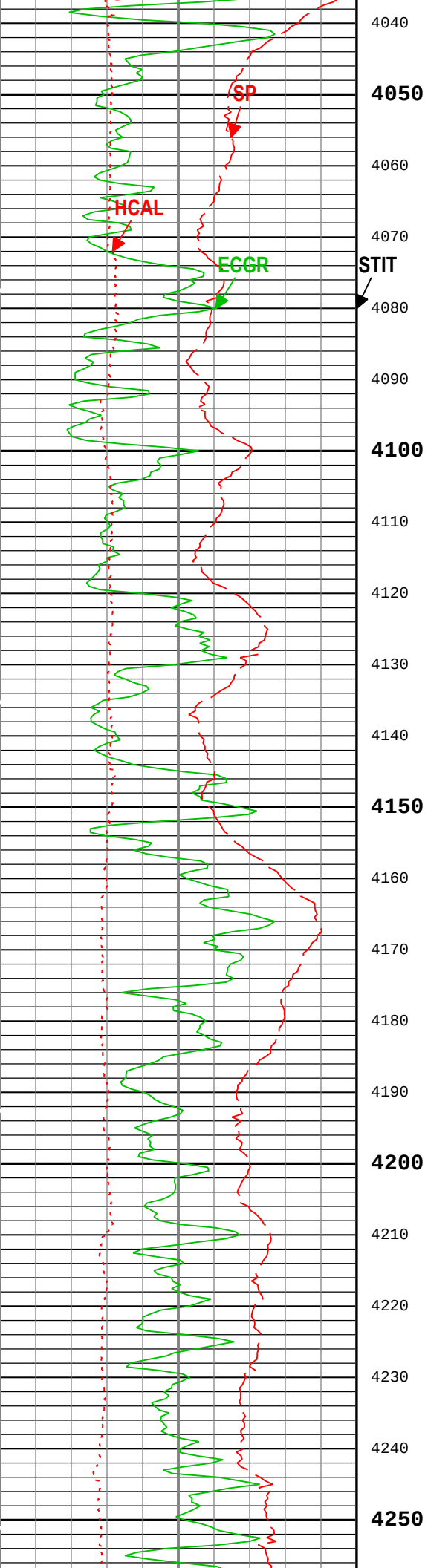
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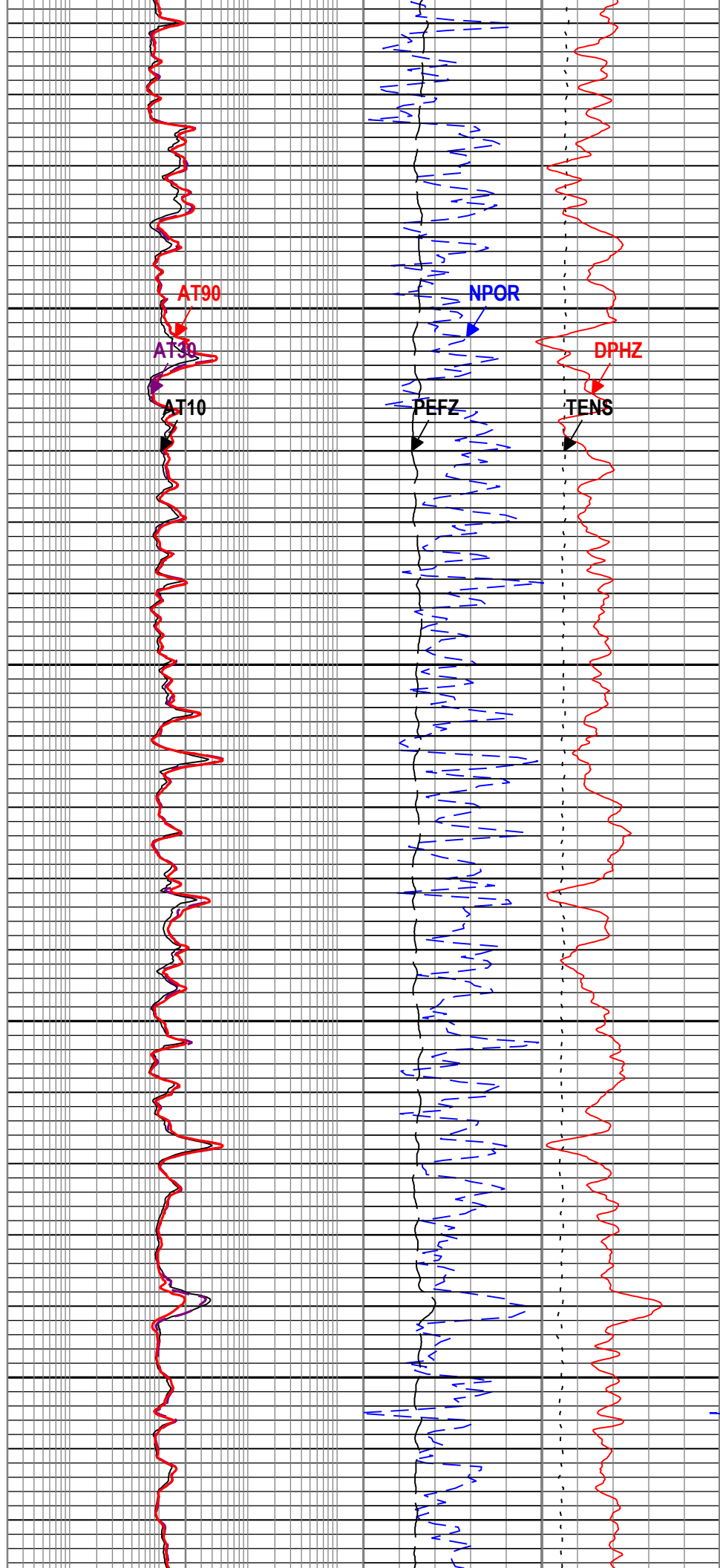
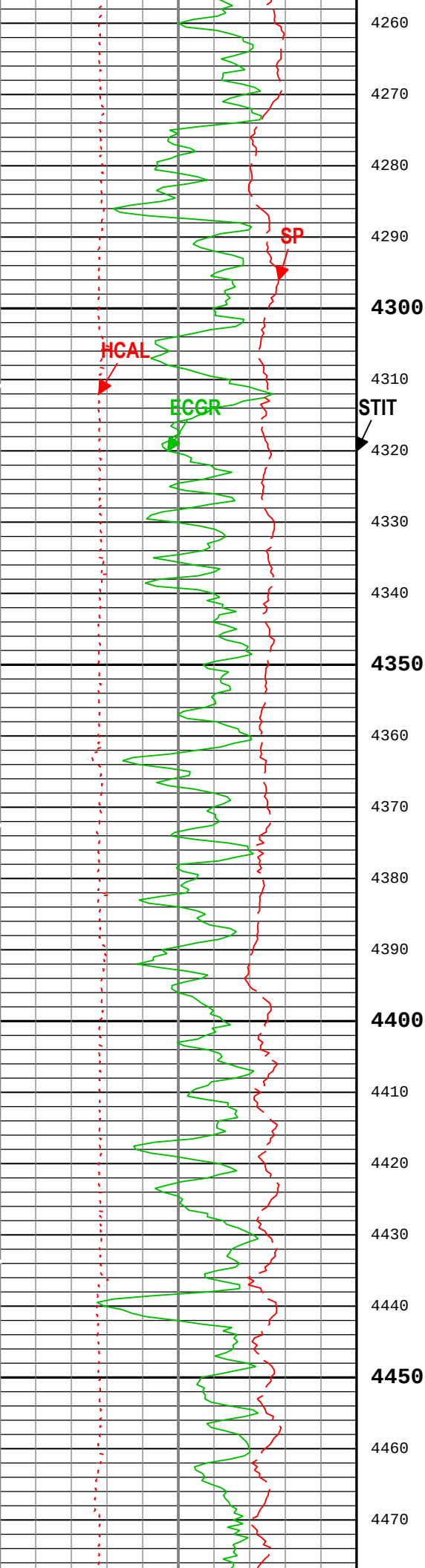
Standard Resolution Formation

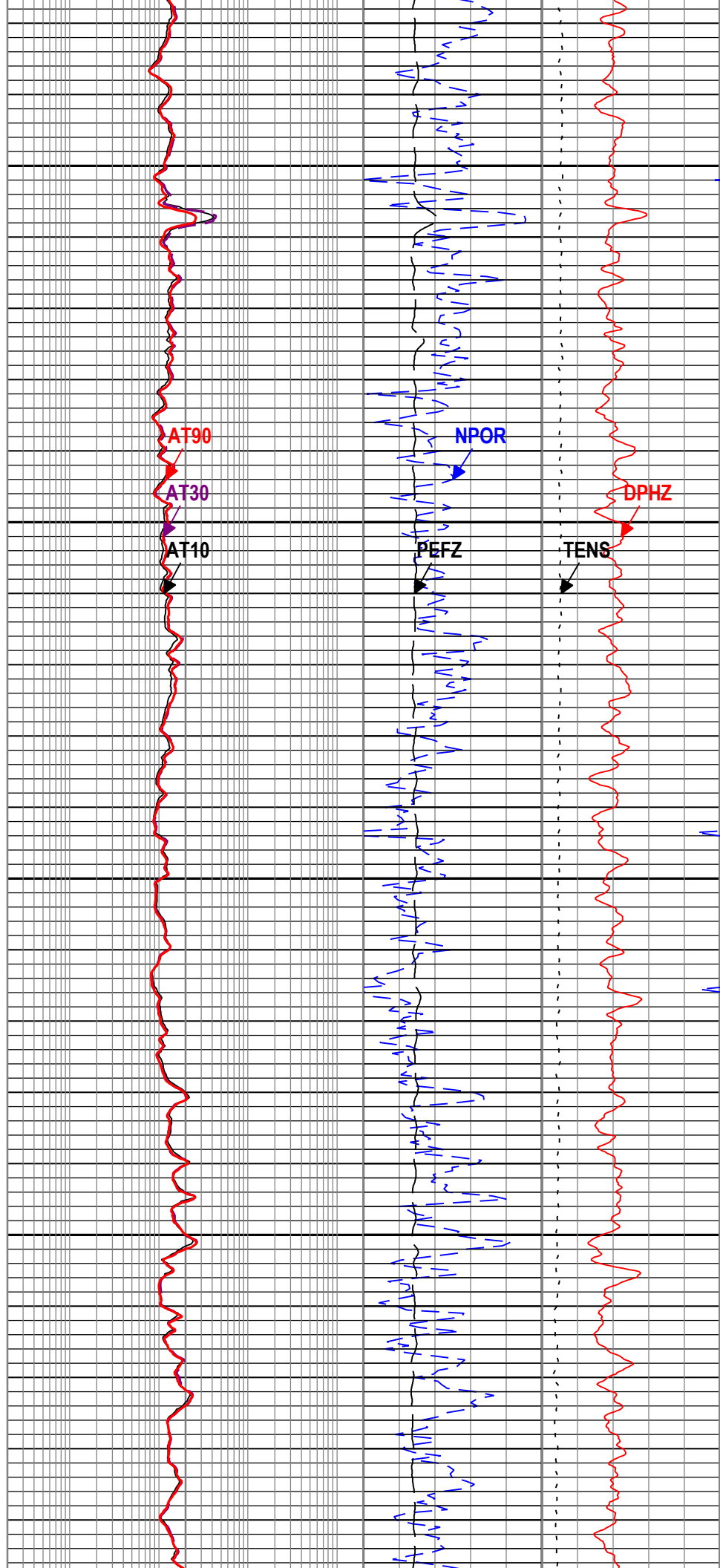
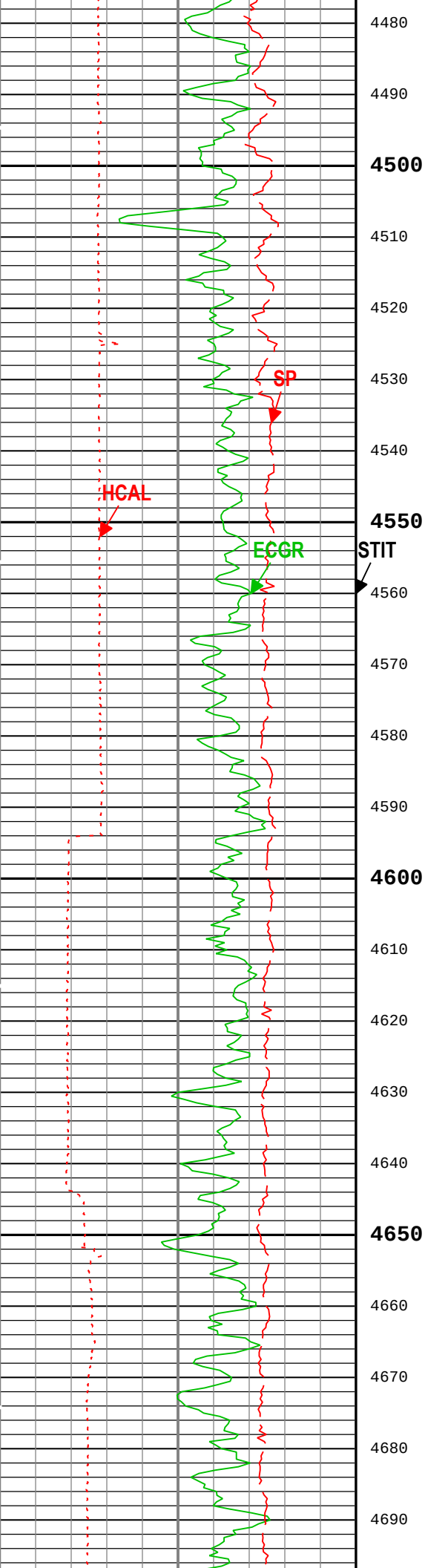


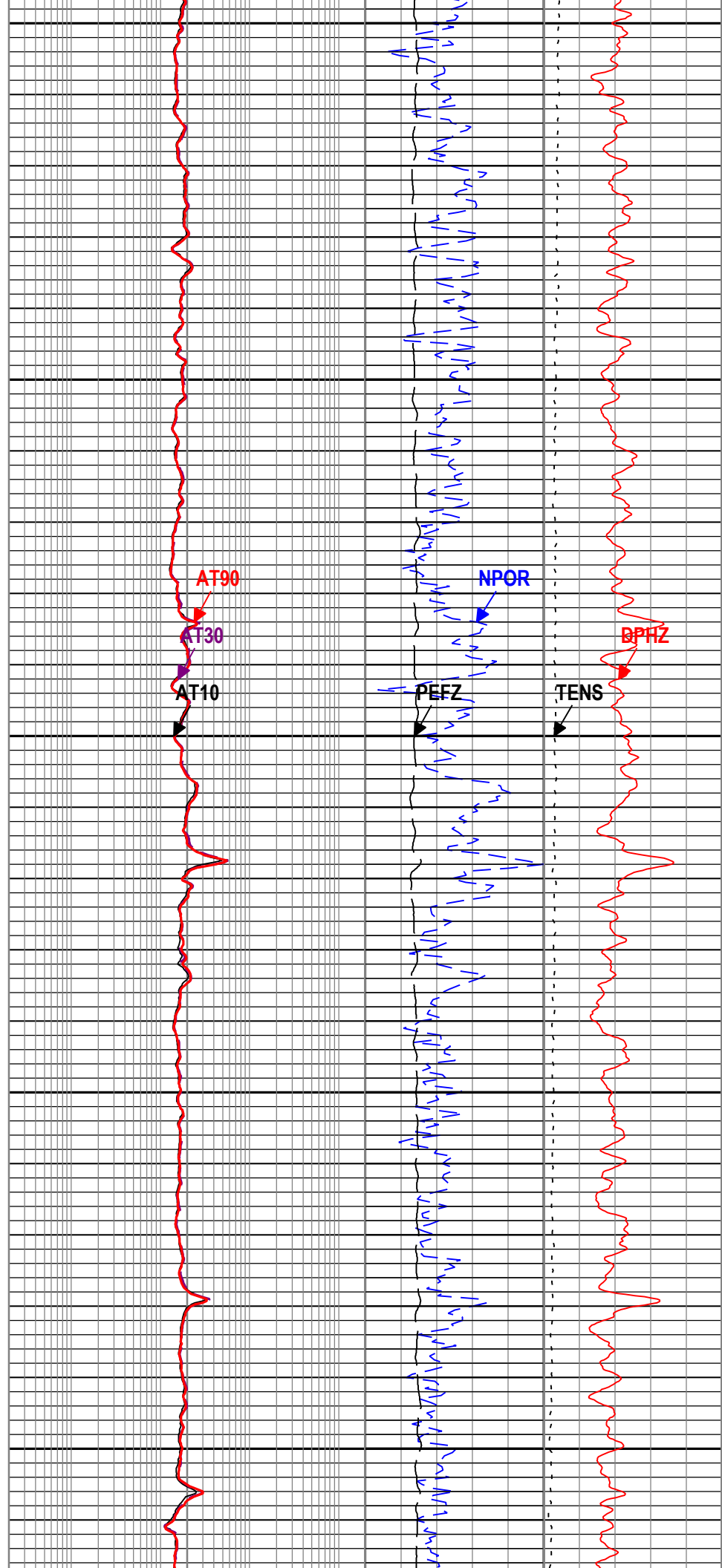
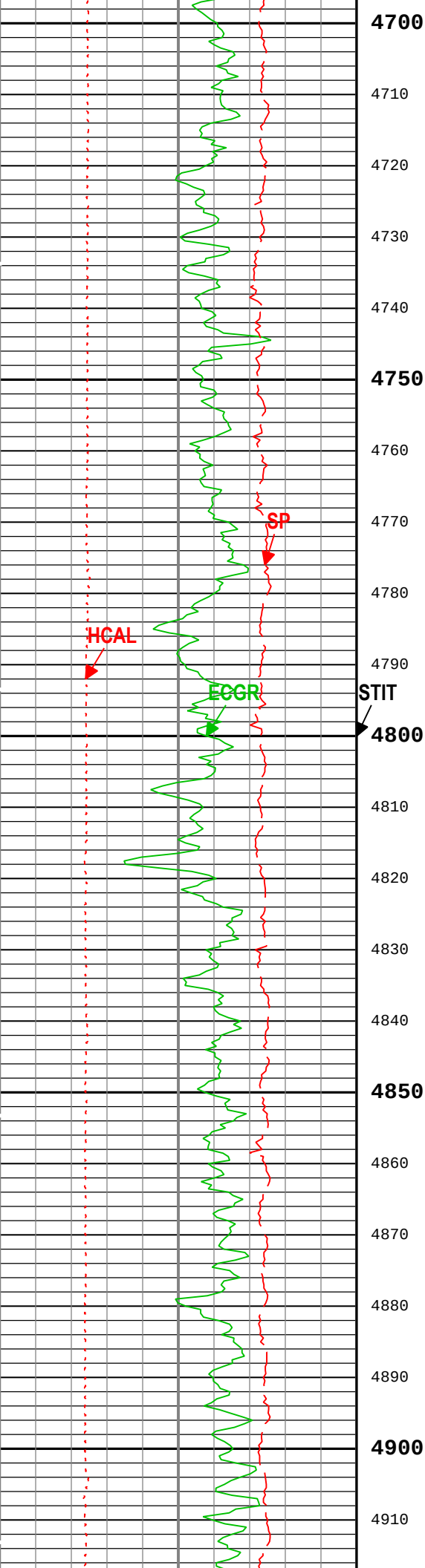


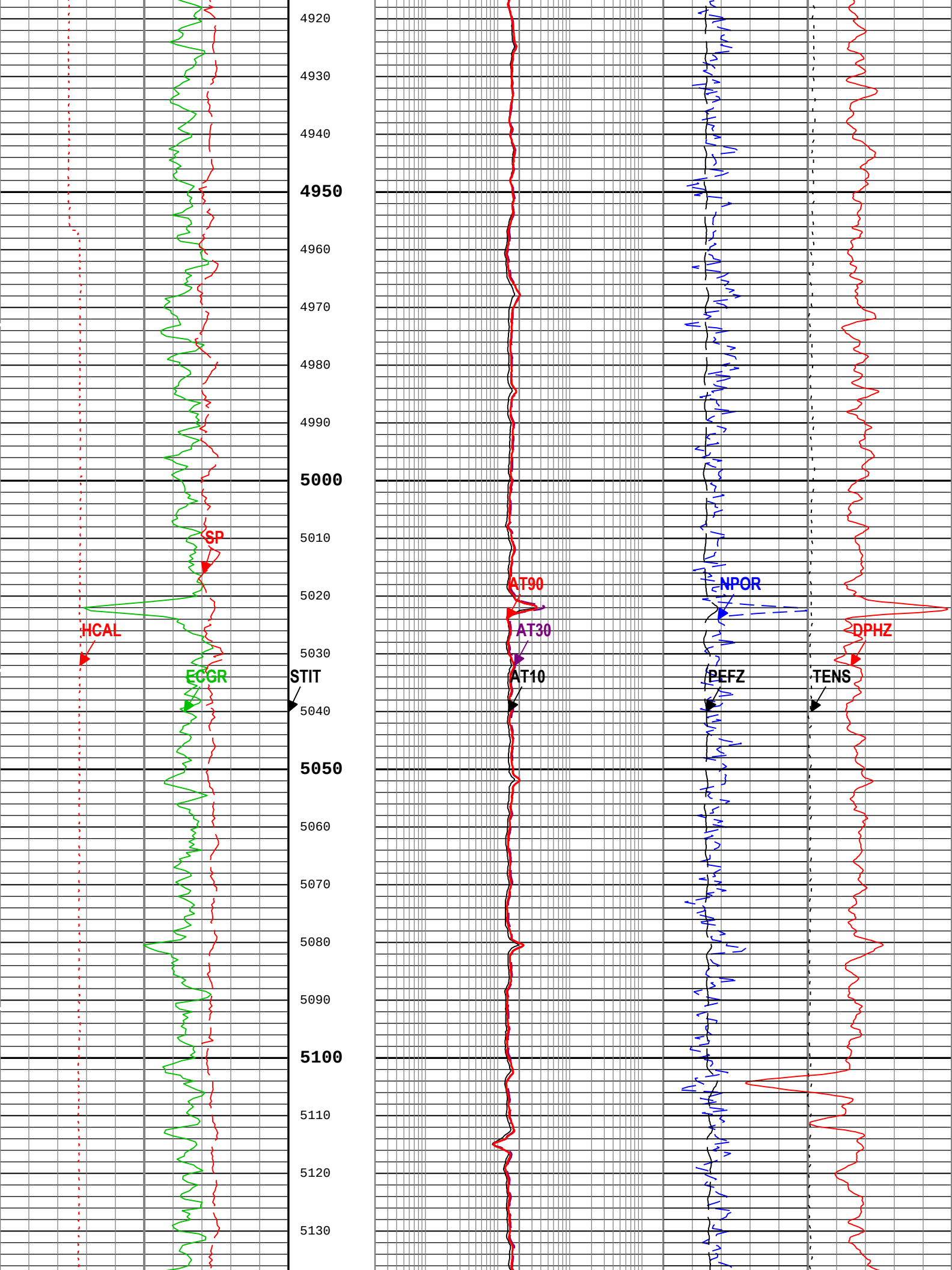


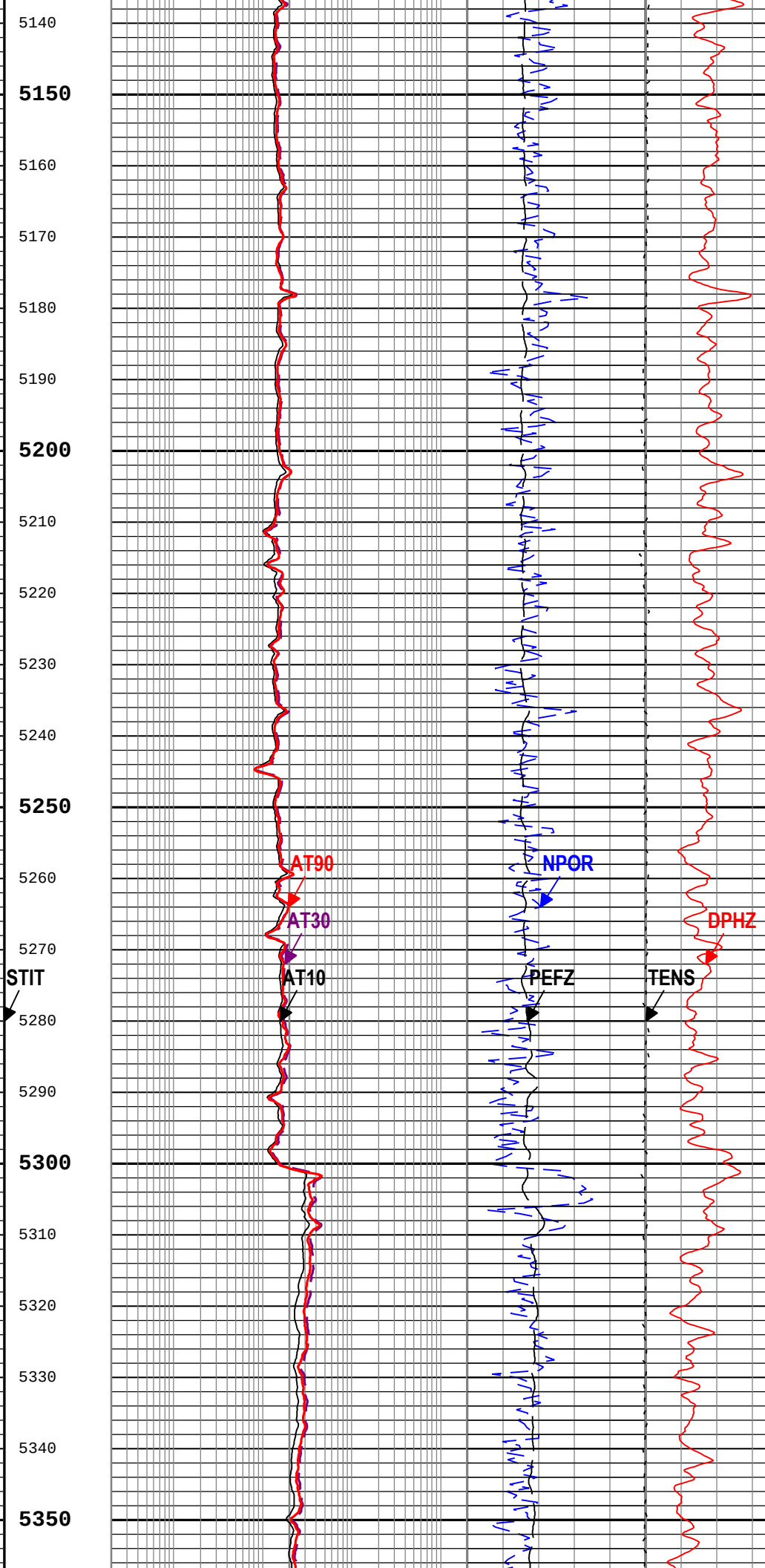
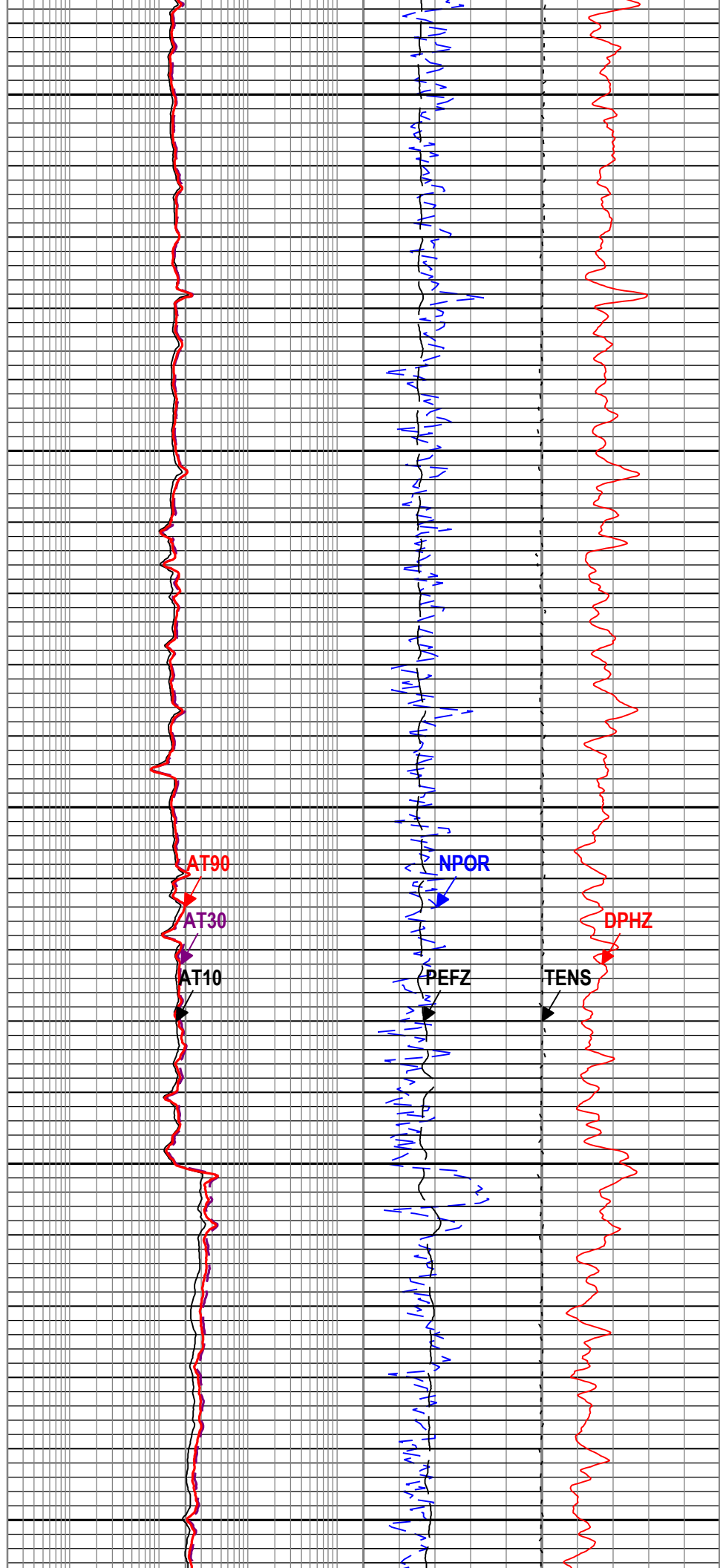
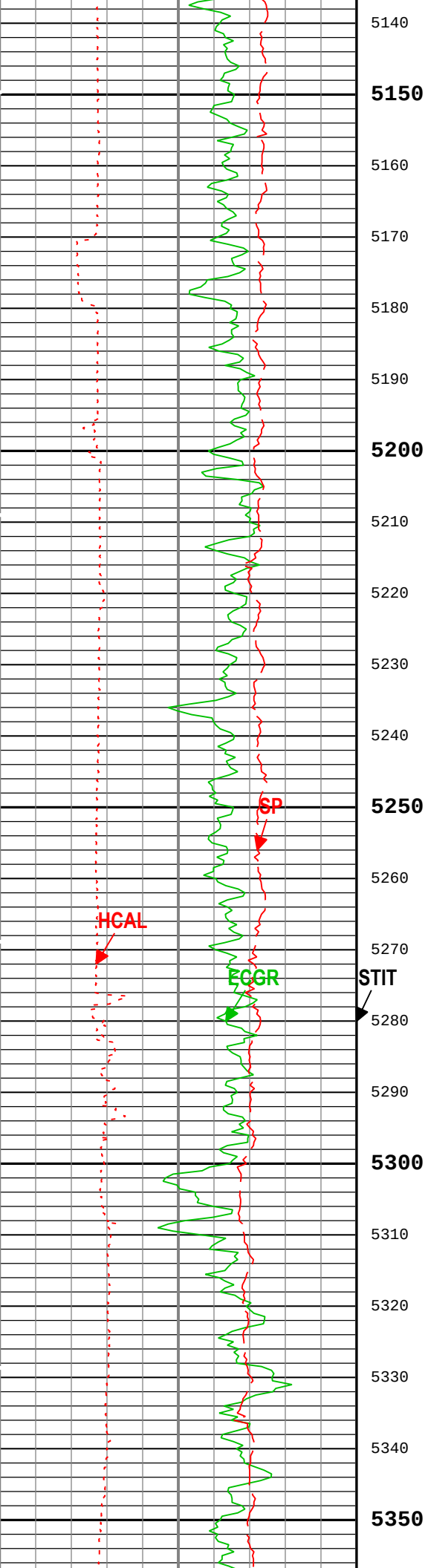


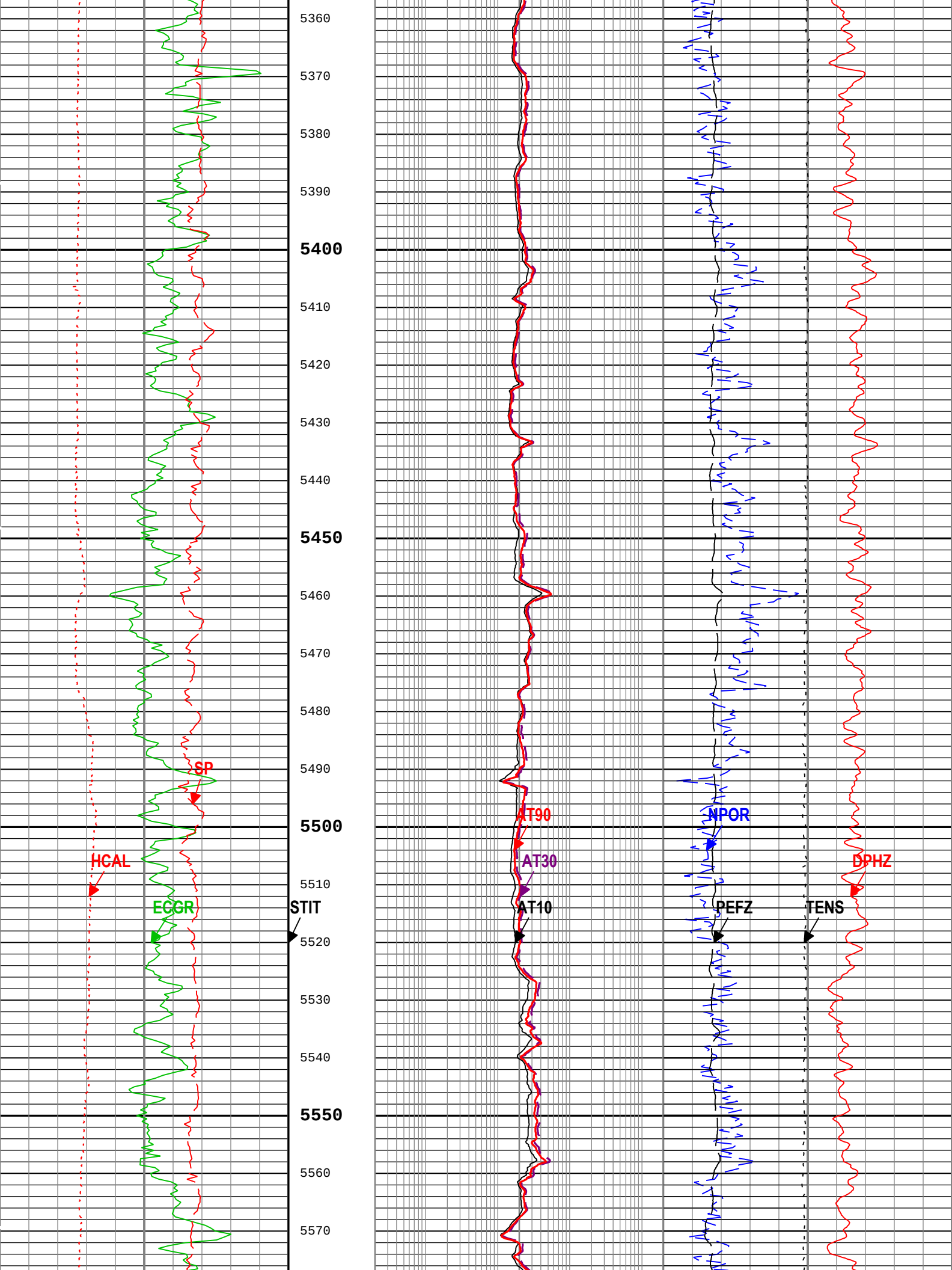
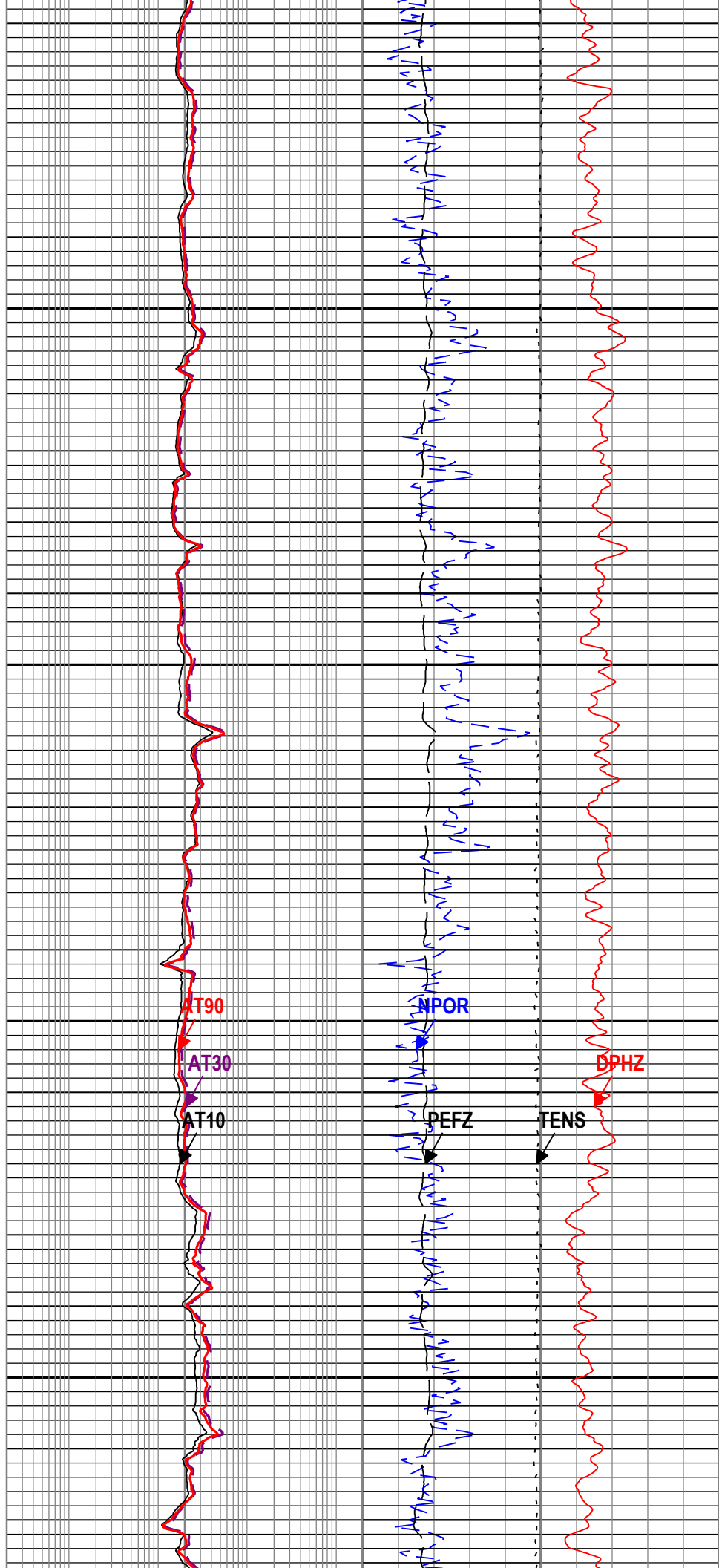
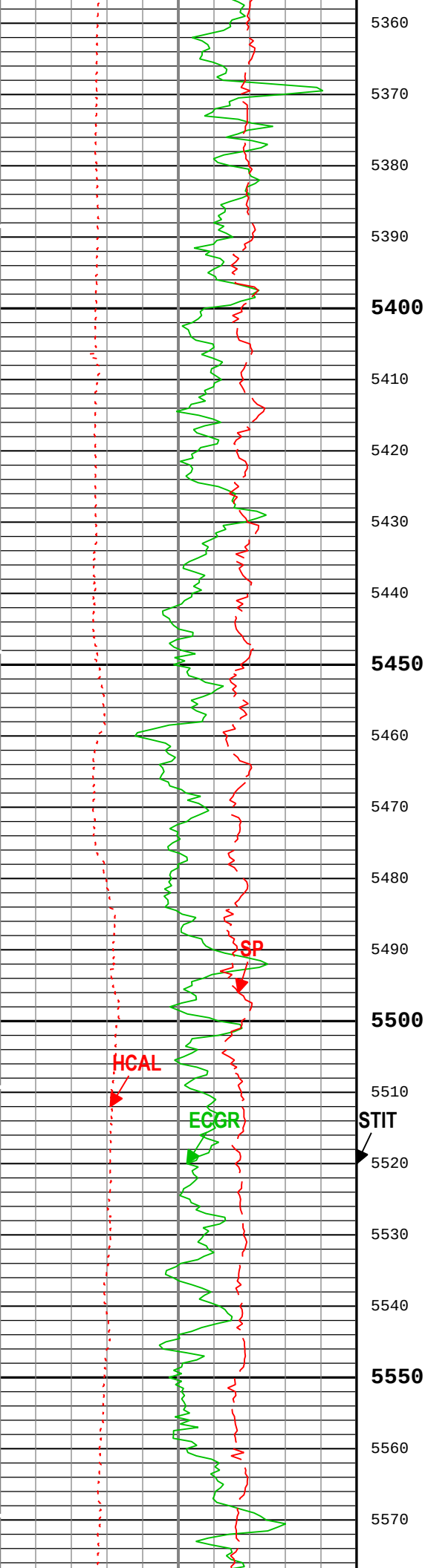


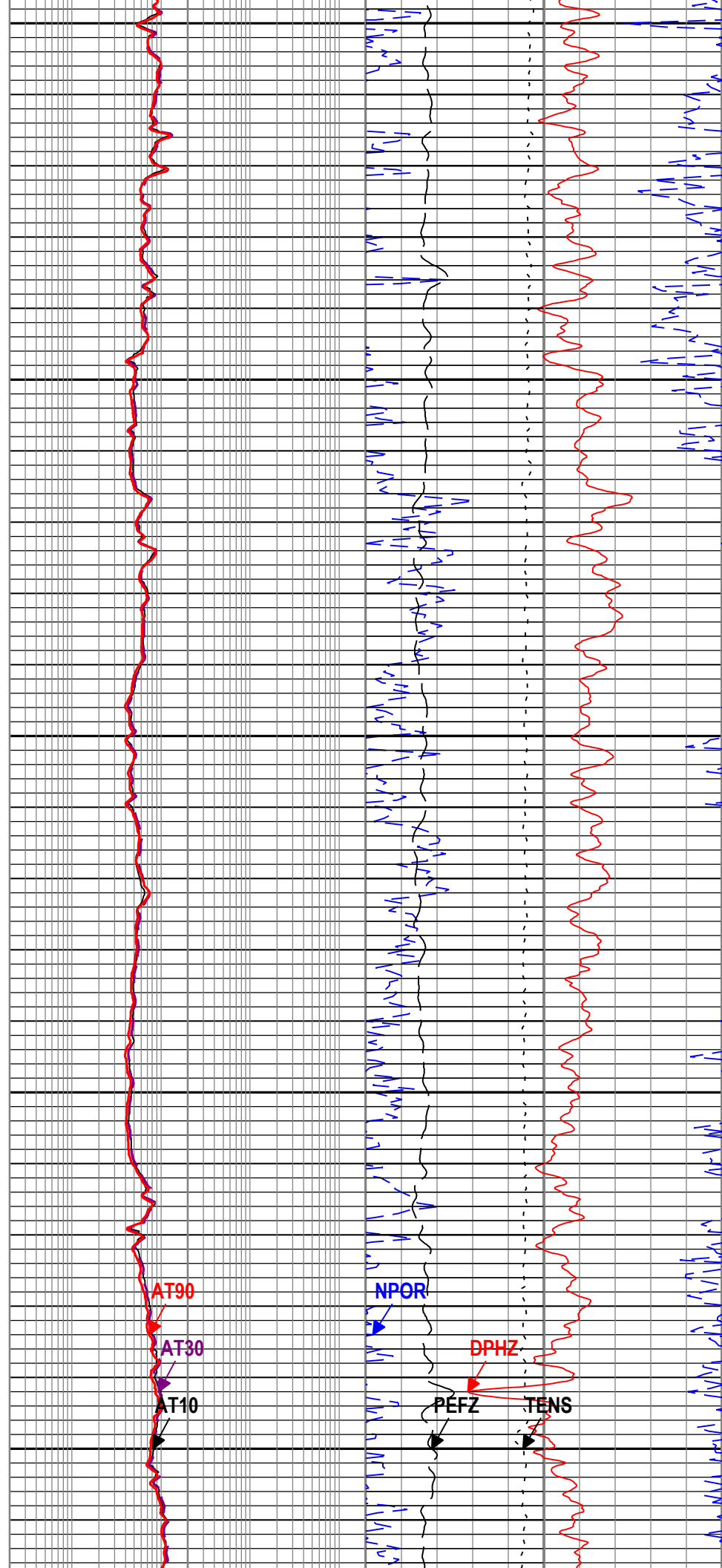
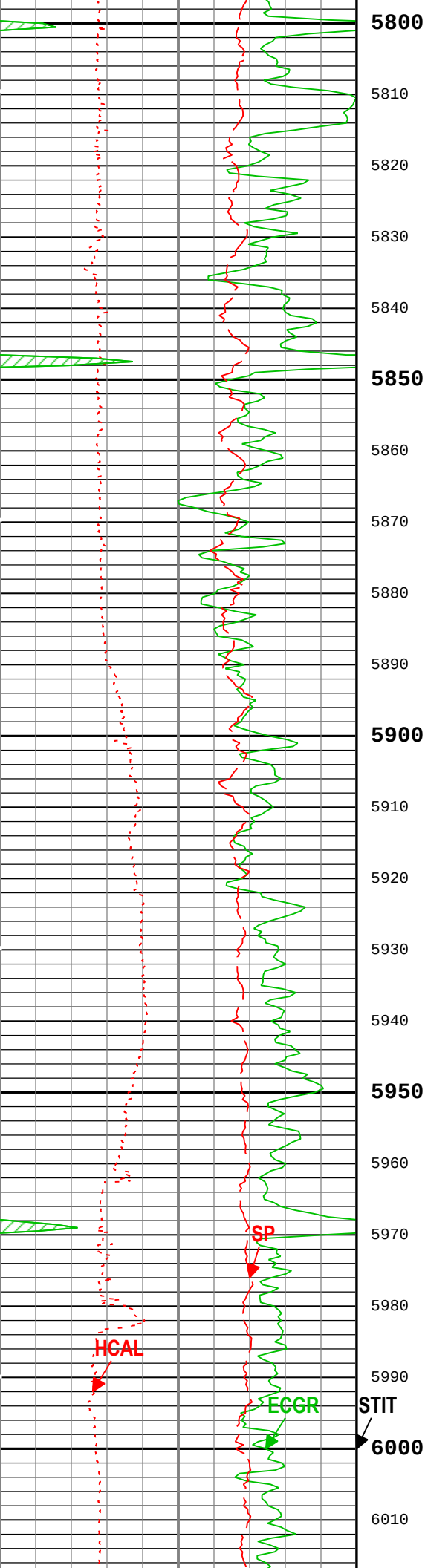


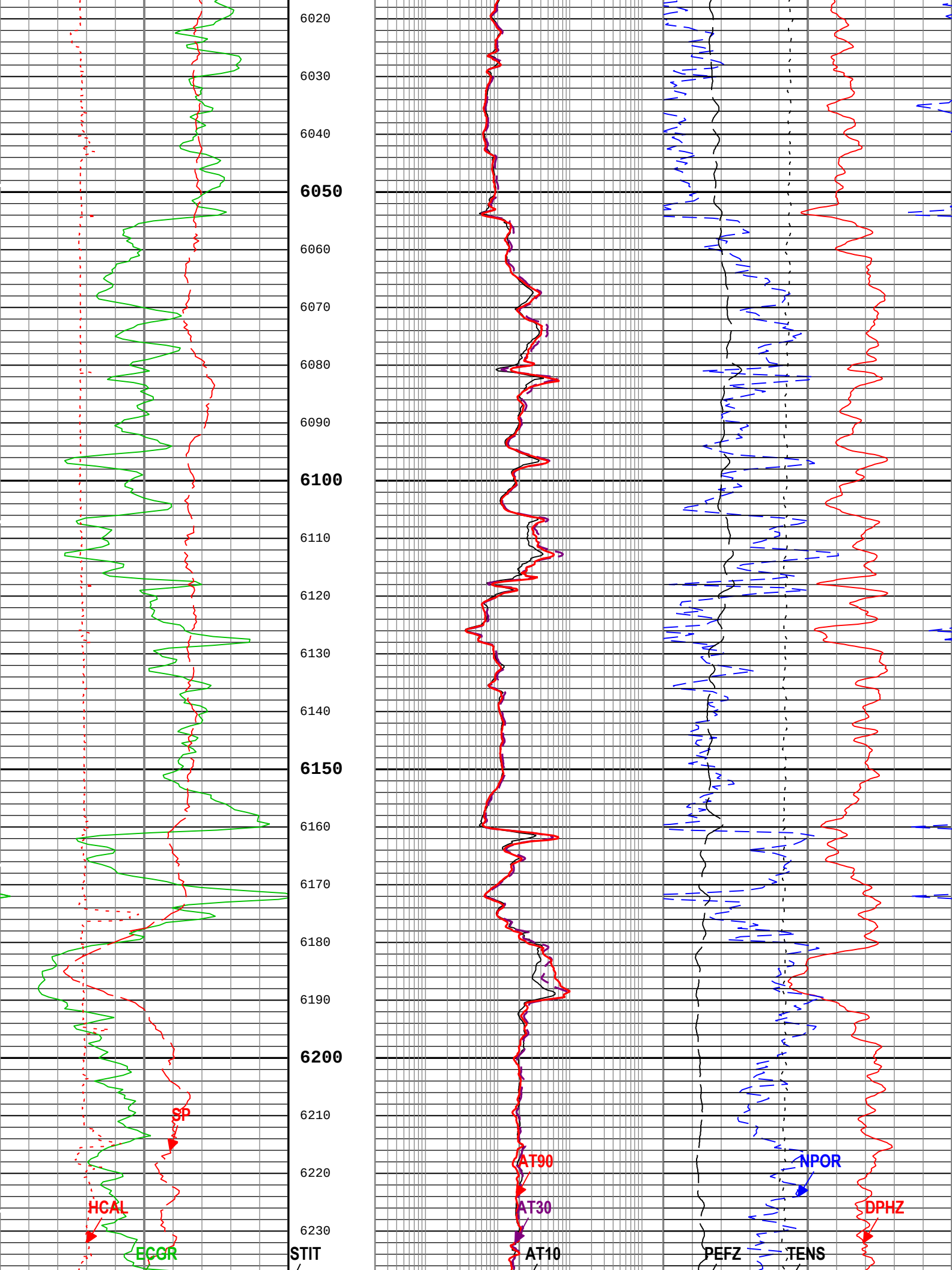


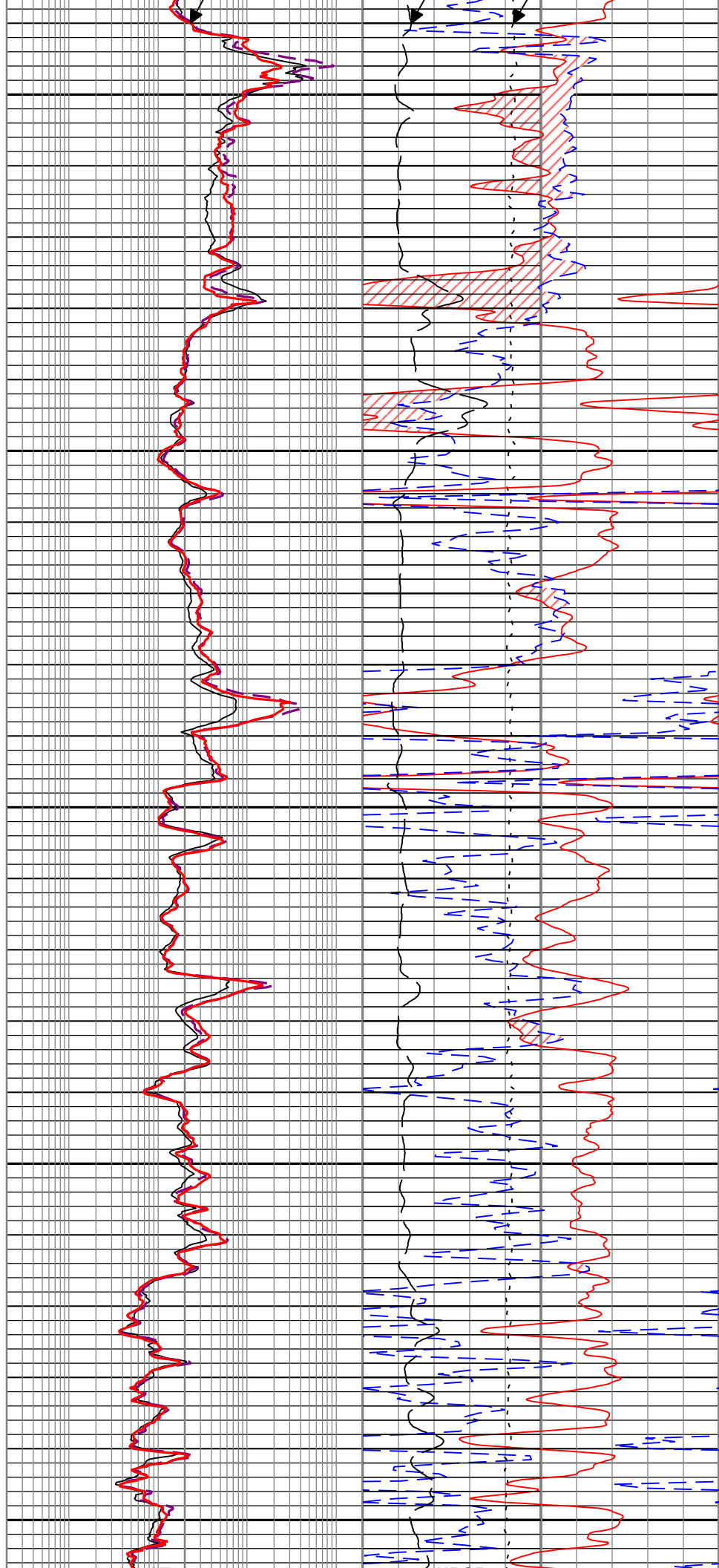
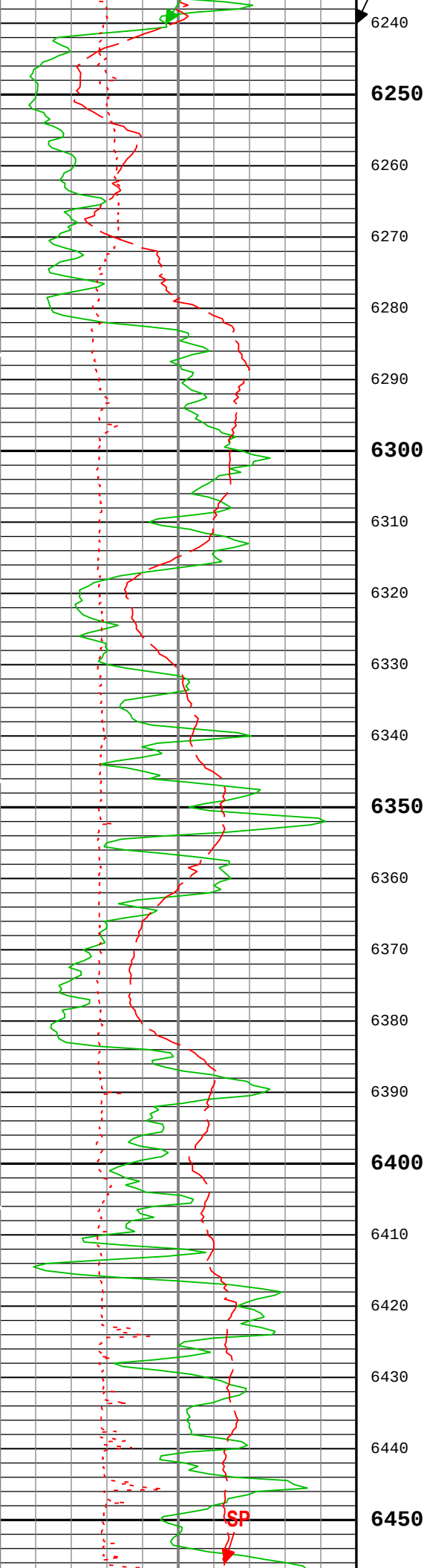


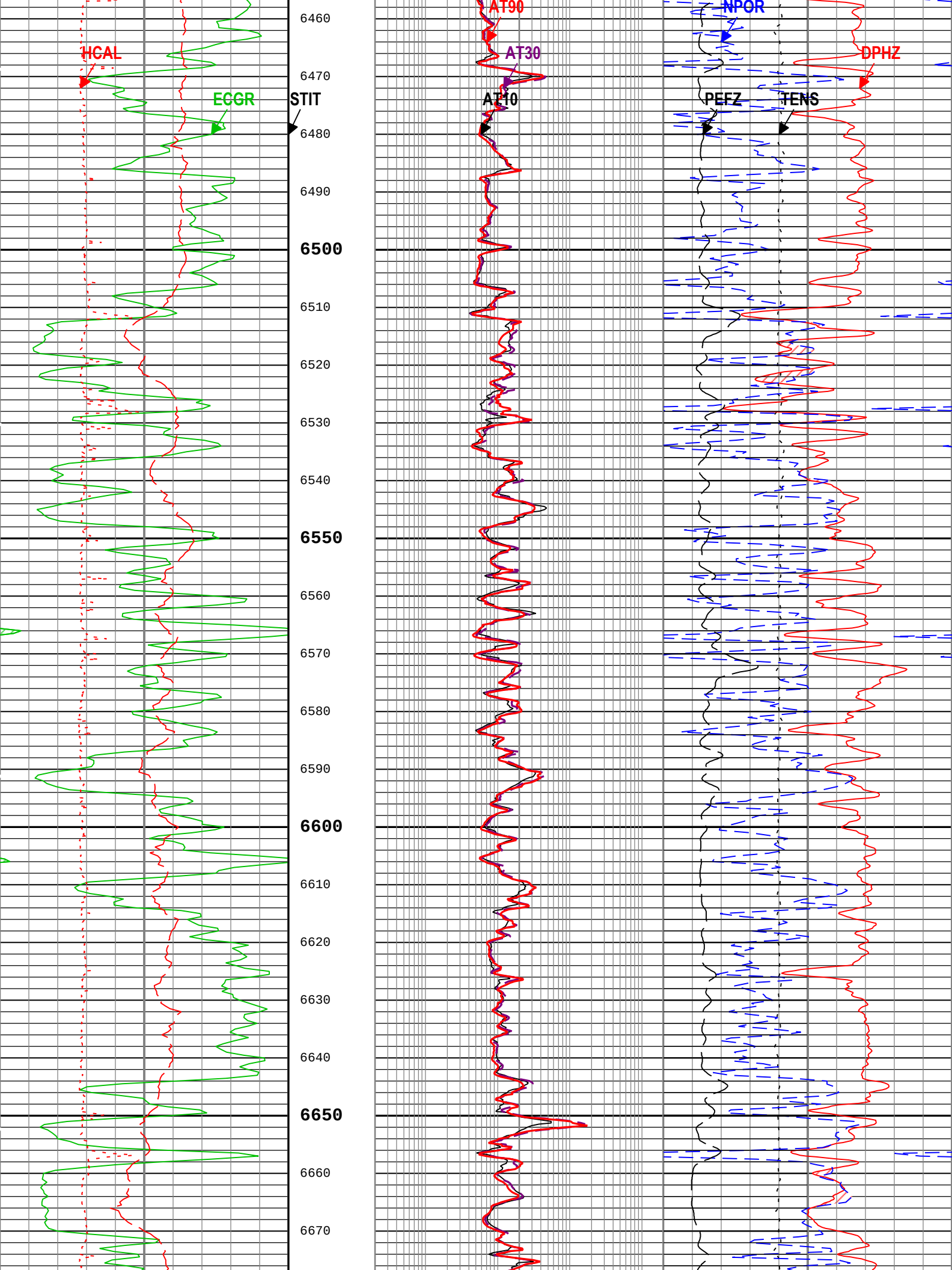


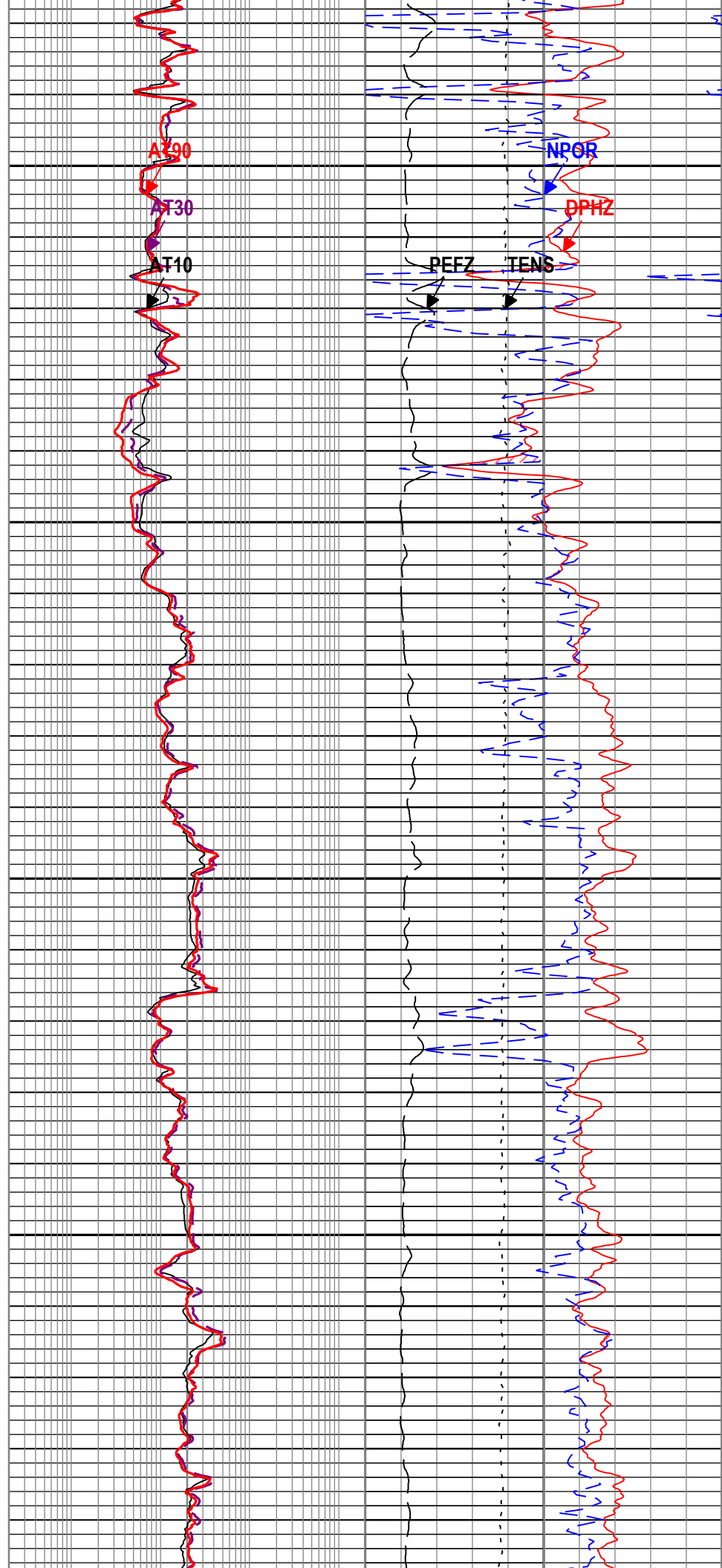
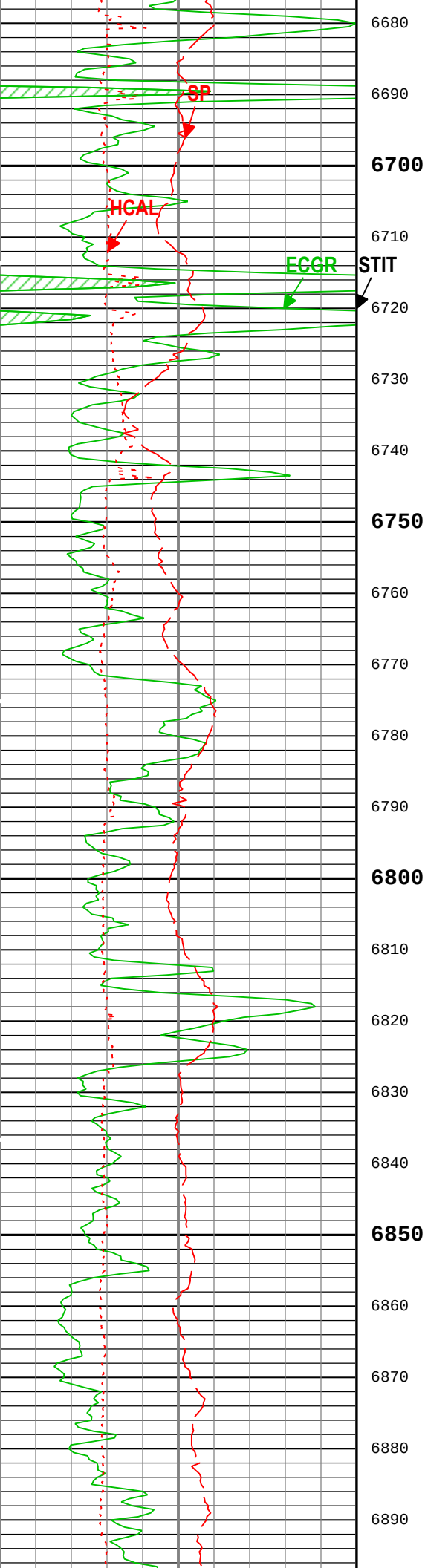


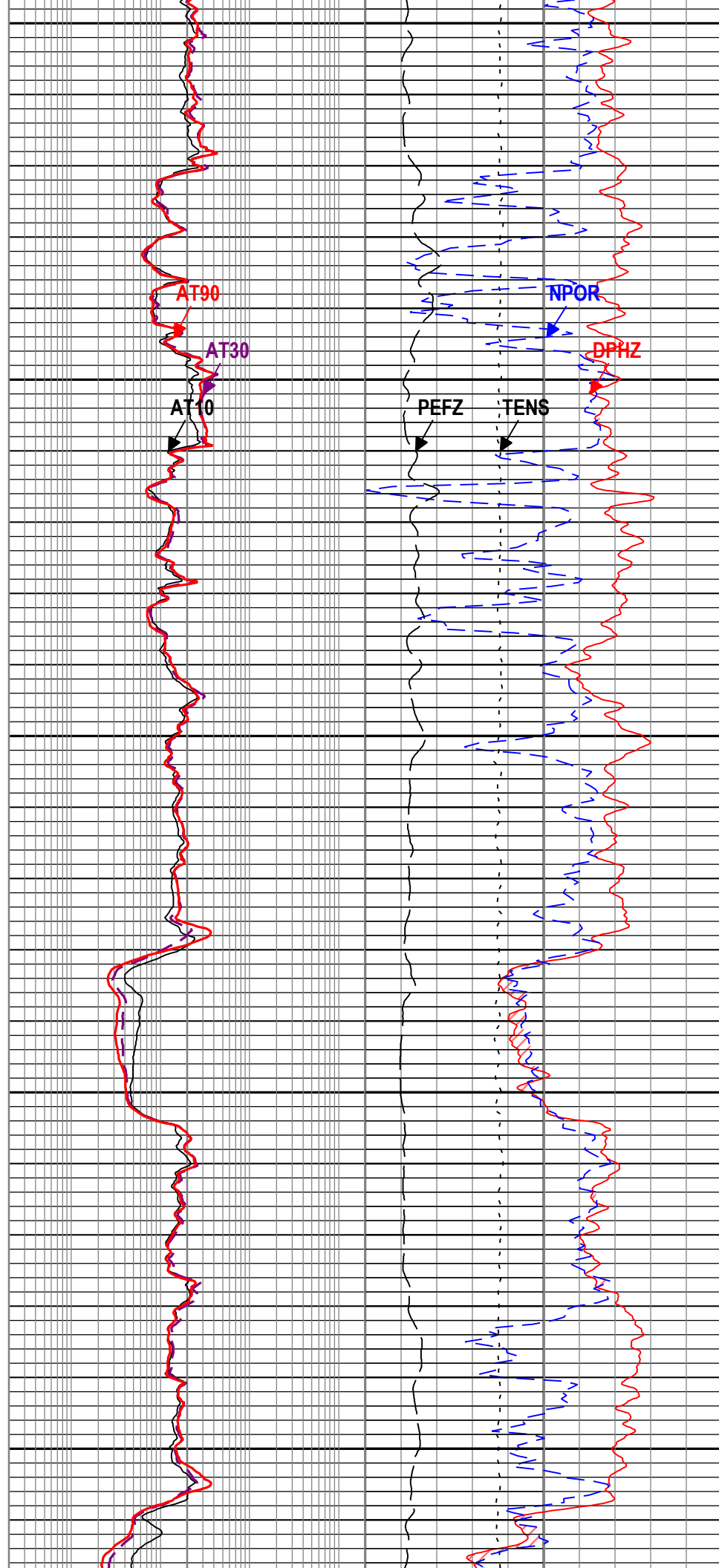
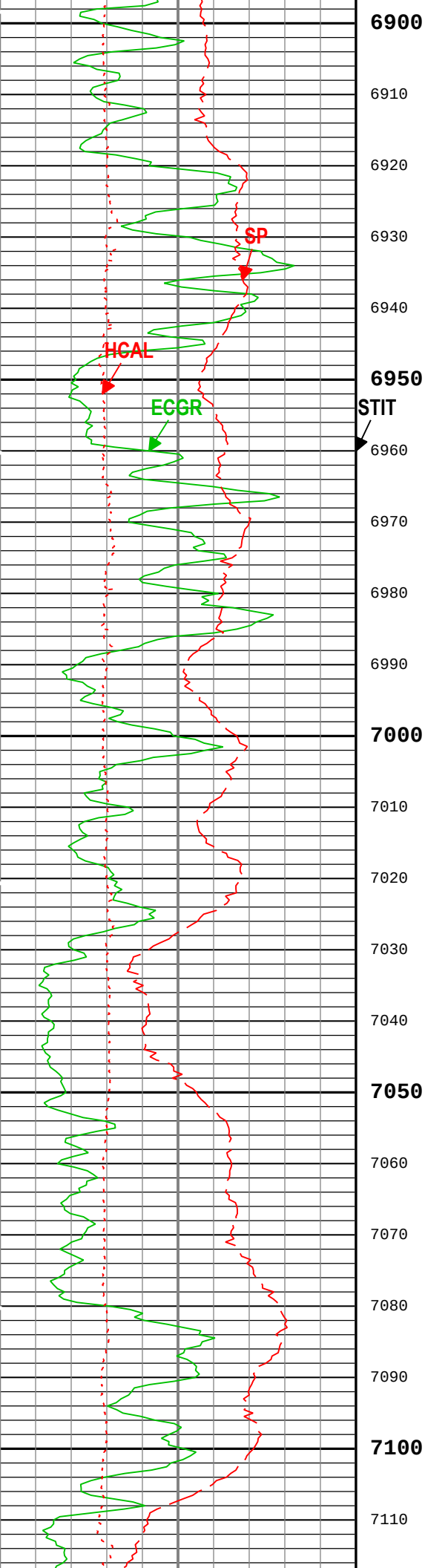


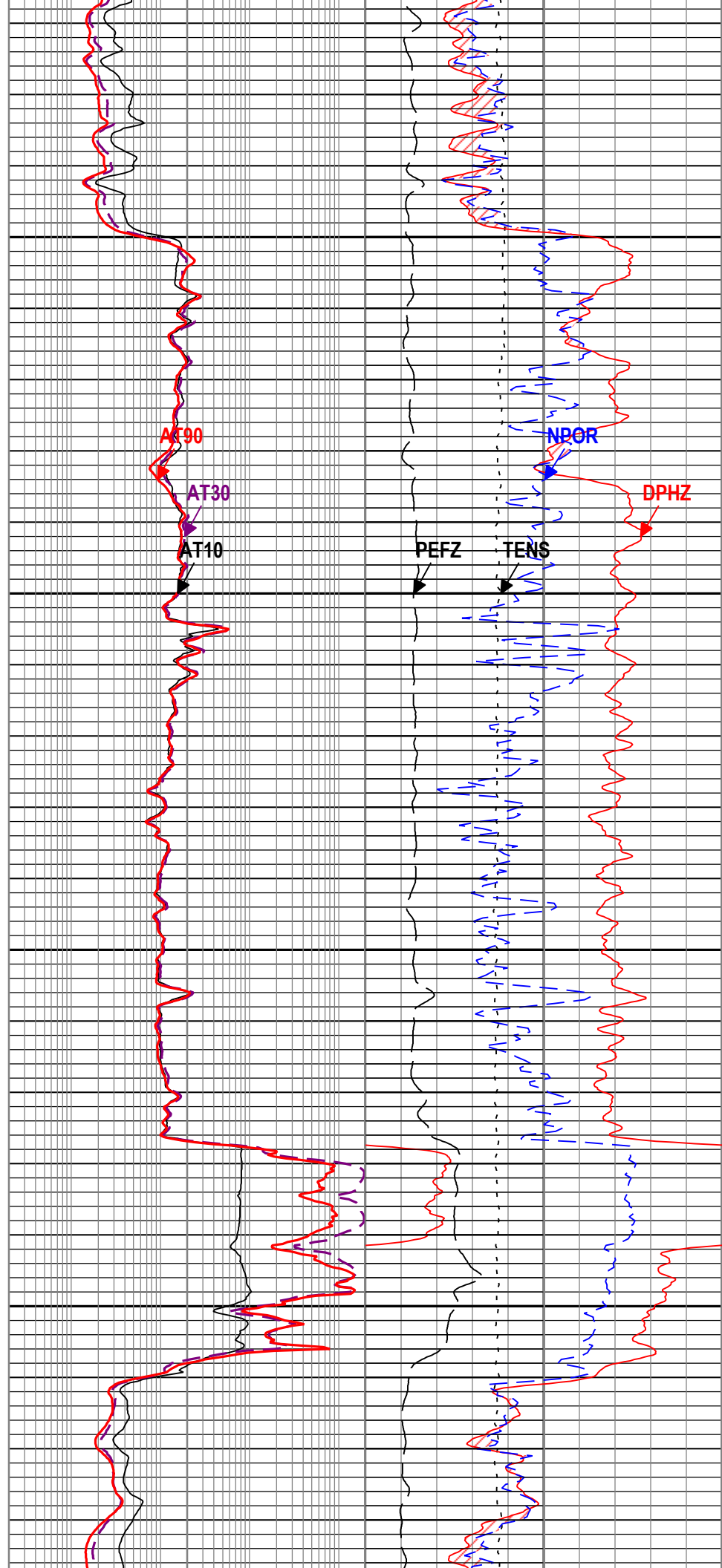
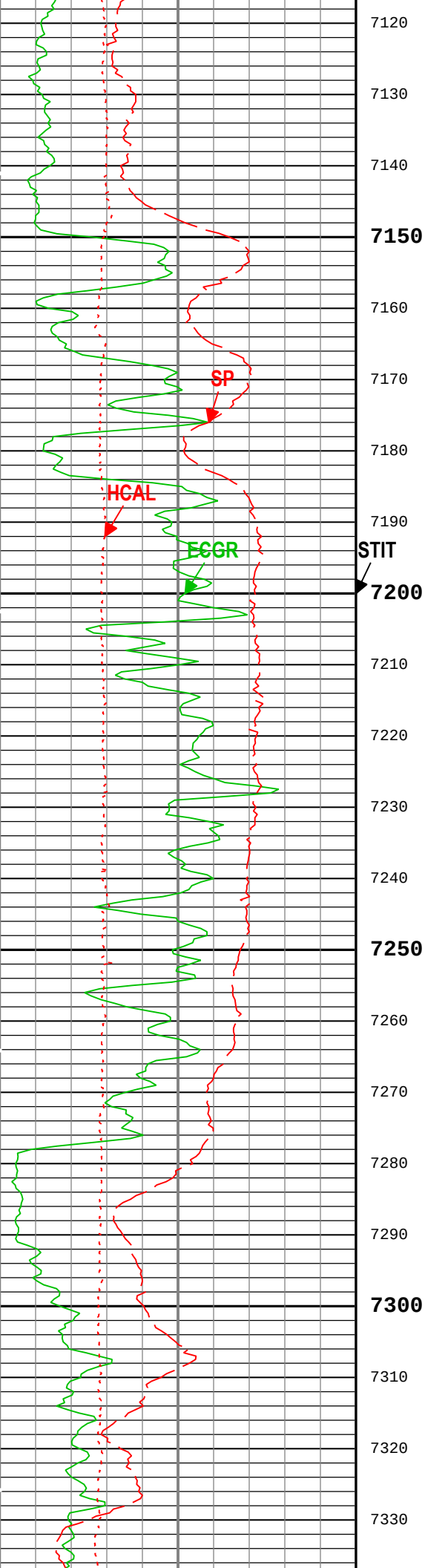


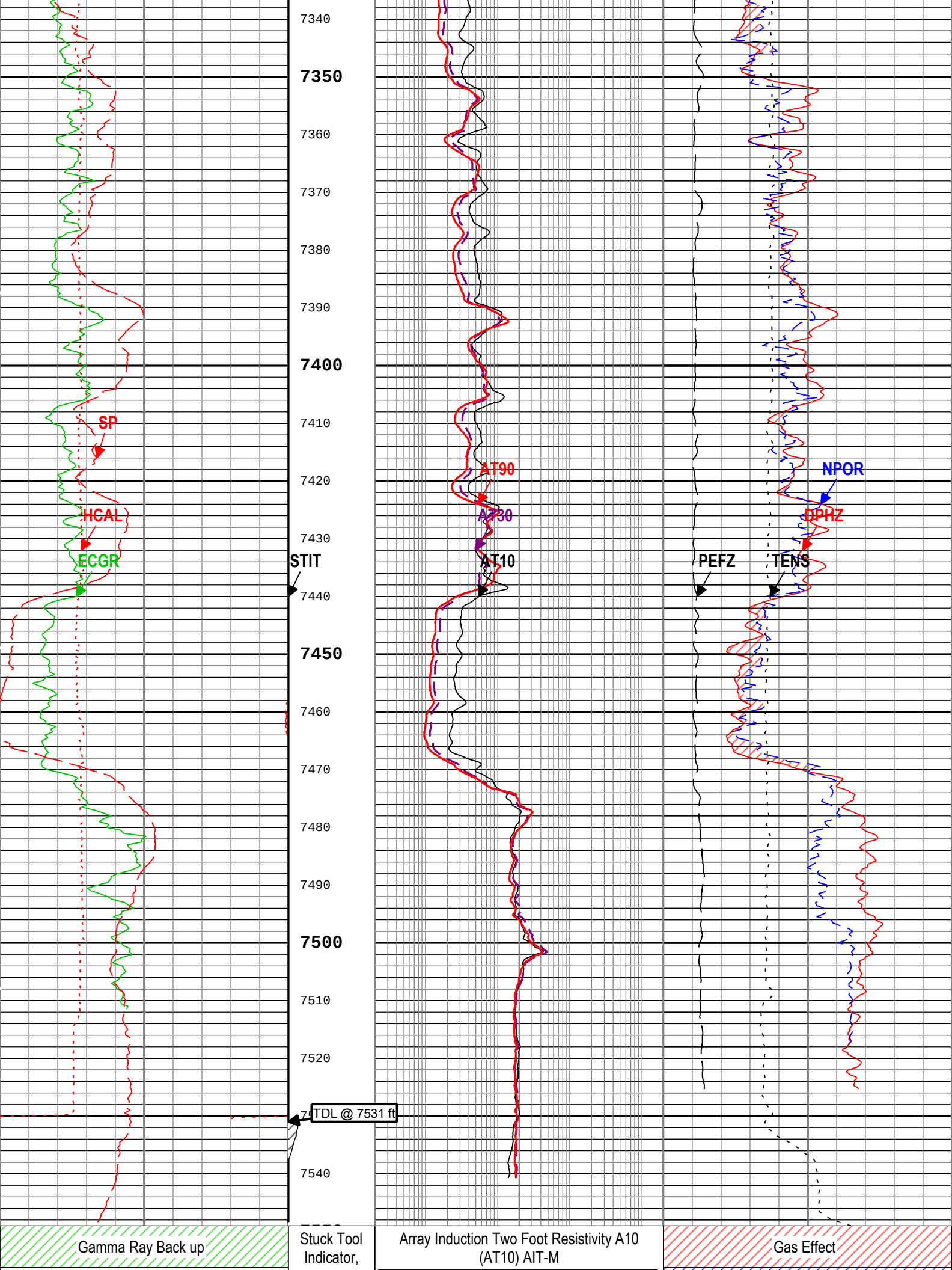












Gamma Ray (ECGR) HGNS-H			Total (STIT)			0.2	ohm.m	2000	NPOR Backup			
0	gAPI		200	0	ft	50	Array Induction Two Foot Resistivity A30 (AT30) AIT-M			Cable Tension (TENS)		
Caliper (HCAL) HDRS-H					0.2			ohm.m	2000	5000	lb	0
6	in		16		Array Induction Two Foot Resistivity A90 (AT90) AIT-M			Standard Resolution Density Porosity (DPHZ) HDRS-H				
Spontaneous Potential (SP) AIT-M					0.2			ohm.m	2000	0.3	ft3/ft3	-0.1
-80	mV		20	0.3			Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H			0.3		
				0.3			m3/m3			-0.1		
				Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H			0			10		

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:13

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532
All depth are actual.			

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One

5" Triple Combo

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[3]:Up	Up	7294.65 ft	7556.27 ft	07-Sep-2016 5:43:06 AM	07-Sep-2016 5:48:19 AM	ON	5.53 ft	No
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2
One: Log[4]:Up:S012

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:16

TIME_1900 - Time Marked every 60.00 (s)

Main To Repeat

Repeat To Main

Caliper (HCAL) HDRS-H

6 in 16

Main To Repeat

Repeat To Main

Spontaneous Potential (SP) AIT-M

-80 mV 20

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2 ohm.m 2000

Main To Repeat

Repeat To Main

Main To Repeat

Repeat To Main

Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H

0 10

Main To Repeat

Repeat To Main

Cable Tension (TENS)

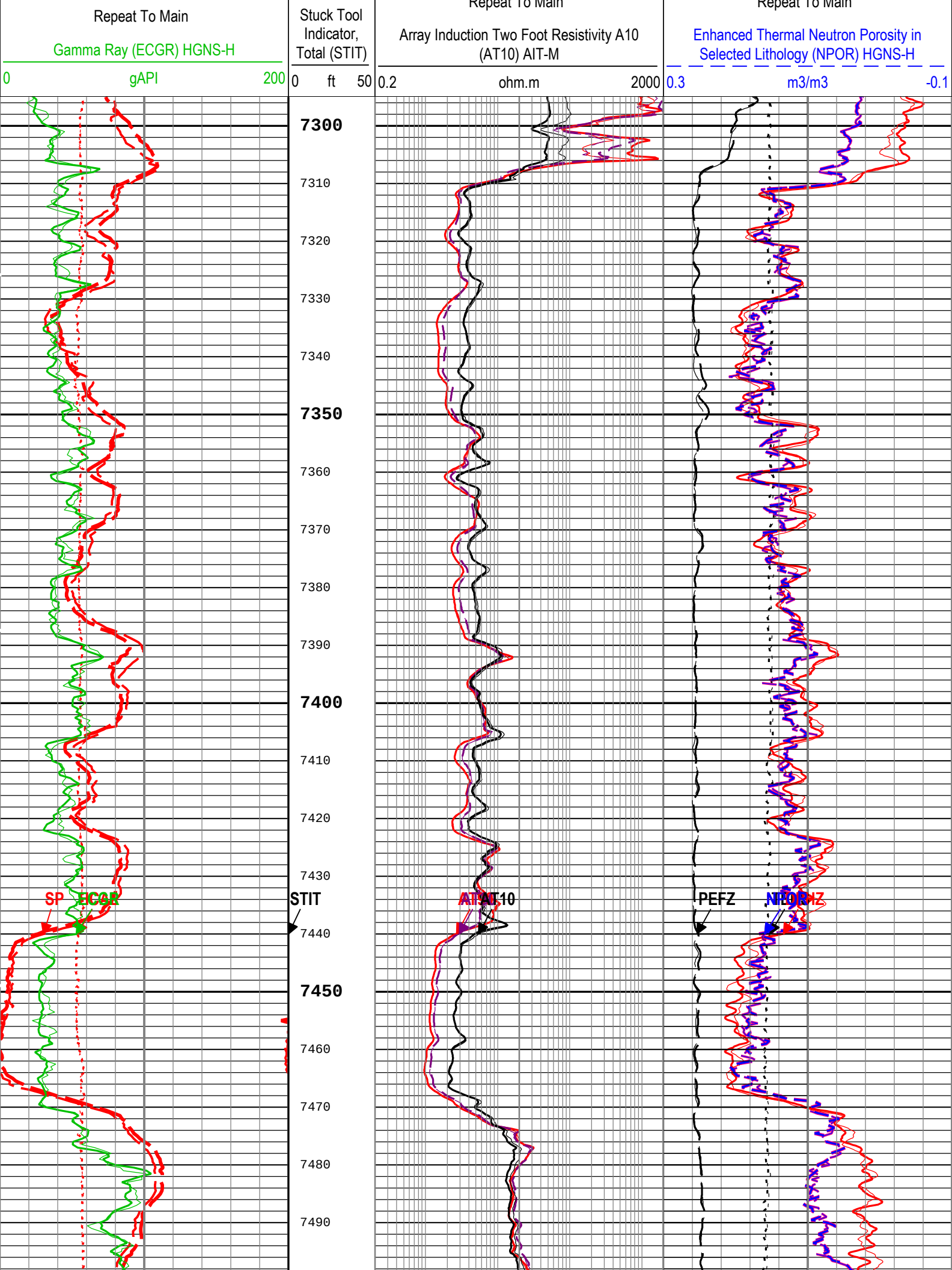
5000 lbf 0

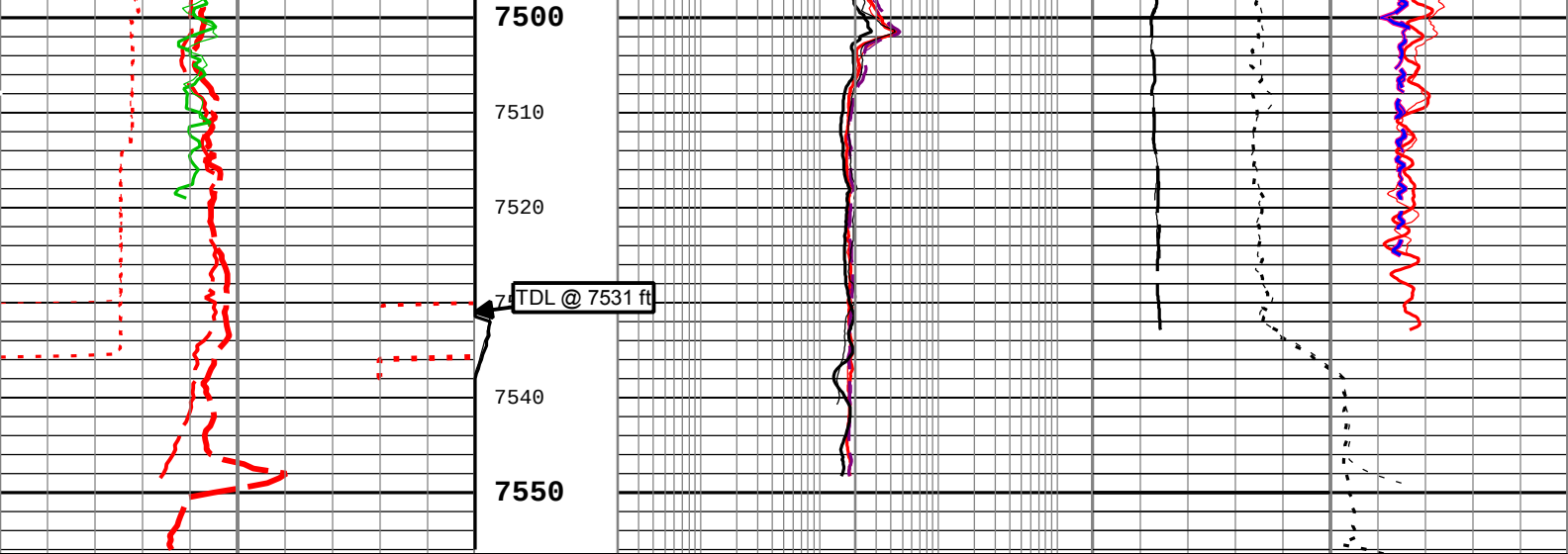
Main To Repeat

Repeat To Main

Standard Resolution Density Porosity (DPHZ) HDRS-H

0.3 ft3/ft3 -0.1





Main To Repeat Repeat To Main Caliper (HCAL) HDRS-H 6in16	Main To Repeat Repeat To Main Stuck Tool Indicator, Total (STIT) 0ft50	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A90 (AT90) AIT-M 0.2ohm.m2000	Main To Repeat Repeat To Main Cable Tension (TENS) 5000lbf0
Main To Repeat Repeat To Main Spontaneous Potential (SP) AIT-M -80mV20		Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A30 (AT30) AIT-M 0.2ohm.m2000	Main To Repeat Repeat To Main Standard Resolution Density Porosity (DPHZ) HDRS-H 0.3ft3/ft3-0.1
Main To Repeat Repeat To Main Gamma Ray (ECGR) HGNS-H 0gAPI200		Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A10 (AT10) AIT-M 0.2ohm.m2000	Main To Repeat Repeat To Main Enhanced Thermal Neutron Porosity in Selected Lithology (NPOR) HGNS-H 0.3m3/m3-0.1
			Main To Repeat Repeat To Main Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H 010

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (TripleCombo-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:05:16

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	

BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

Calibration Report

AIT-M (Array Induction Tool - M) Calibration - Run One

Primary Equipment :			
File code for AIT-MA Sonde Tool Element	AMIS	50	
Auxiliary Equipment :			
AITM Rm/SP Bottom Nose	AMRM		

AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 20:19:37 05-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit		
Test Loop Gain - 0		Master	1.000	0.950	1.013	1.050		
Test Loop Phase - 0	deg	Master	0	-3.000	1.893	3.000		
Test Loop Gain - 1		Master	1.000	0.950	1.009	1.050		
Test Loop Phase - 1	deg	Master	0	-3.000	0.092	3.000		
Test Loop Gain - 2		Master	1.000	0.950	1.015	1.050		

Test Loop Phase - 2	deg	Master	0	-3.000	-0.008	3.000	
Test Loop Gain - 3		Master	1.000	0.950	1.012	1.050	
Test Loop Phase - 3	deg	Master	0	-3.000	0.319	3.000	
Test Loop Gain - 4		Master	1.000	0.950	0.998	1.050	
Test Loop Phase - 4	deg	Master	0	-3.000	0.071	3.000	
Test Loop Gain - 5		Master	1.000	0.950	1.022	1.050	
Test Loop Phase - 5	deg	Master	0	-3.000	0.391	3.000	
Test Loop Gain - 6		Master	1.000	0.950	1.035	1.050	
Test Loop Phase - 6	deg	Master	0	-3.000	0.531	3.000	
Test Loop Gain - 7		Master	1.000	0.950	1.047	1.050	
Test Loop Phase - 7	deg	Master	0	-3.000	0.270	3.000	
AIT Sonde Calibration - Sonde Error Correction							
Master (EEPROM): 20:19:37 05-Aug-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Sonde Error Correction Real - 0	mS/m	Master	----	-231.000	-97.409	119.000	
Sonde Error Correction Quad - 0		Master	----	-2250.000	-596.848	2250.000	
Sonde Error Correction Real - 1	mS/m	Master	----	114.000	156.040	204.000	
Sonde Error Correction Quad - 1		Master	----	-625.000	-247.744	625.000	
Sonde Error Correction Real - 2	mS/m	Master	----	66.000	112.609	156.000	
Sonde Error Correction Quad - 2		Master	----	-350.000	120.325	350.000	
Sonde Error Correction Real - 3	mS/m	Master	----	39.000	68.195	89.000	
Sonde Error Correction Quad - 3		Master	----	-250.000	-161.507	250.000	
Sonde Error Correction Real - 4	mS/m	Master	----	15.000	24.223	35.000	
Sonde Error Correction Quad - 4		Master	----	-63.000	-0.939	63.000	
Sonde Error Correction Real - 5	mS/m	Master	----	4.000	15.665	24.000	
Sonde Error Correction Quad - 5		Master	----	-50.000	-27.113	50.000	
Sonde Error Correction Real - 6	mS/m	Master	----	5.000	10.064	15.000	
Sonde Error Correction Quad - 6		Master	----	-30.000	-6.498	30.000	
Sonde Error Correction Real - 7	mS/m	Master	----	-5.000	-1.483	5.000	
Sonde Error Correction Quad - 7		Master	----	-30.000	-4.619	30.000	
AIT Mud Calibration - Mud Calibration Gain							
Master (EEPROM): 20:19:37 05-Aug-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Coarse Gain		Master	1.000	0.800	0.934	1.200	
Fine Gain		Master	1.000	0.800	0.938	1.200	
AIT Electronics Check - Thru Calibration Check							
Master (EEPROM): 20:19:37 05-Aug-2016Before (Measured): 21:11:27 05-Sep-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Thru Cal Mag - 0	V	Master	----	0.366	0.603	0.854	
		Before	----	0.366	0.603	0.854	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 0	deg	Master	----	137.000	-165.864	-103.000	
		Before	----	137.000	-161.111	-103.000	
		Before-Master	----	----	4.753	----	
Thru Cal Mag - 1	V	Master	----	0.762	1.237	1.778	
		Before	----	0.762	1.237	1.778	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 1	deg	Master	----	136.000	-166.823	-104.000	
		Before	----	136.000	-162.071	-104.000	
		Before-Master	----	----	4.752	----	
Thru Cal Mag - 2	V	Master	----	0.372	0.613	0.868	
		Before	----	0.372	0.613	0.868	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 2	deg	Master	----	132.000	-170.304	-108.000	
		Before	----	132.000	-165.578	-108.000	
		Before-Master	----	----	4.726	----	
Thru Cal Mag - 3	V	Master	----	0.420	0.691	0.980	
		Before	----	0.420	0.691	0.980	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 3	deg	Master	----	131.000	-171.041	-109.000	

		Before	----	131.000	-166.313	-109.000	
		Before-Master	----	----	4.728	----	
Thru Cal Mag - 4	V	Master	----	0.804	1.297	1.876	
		Before	----	0.804	1.296	1.876	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 4	deg	Master	----	125.000	-177.009	-115.000	
		Before	----	125.000	-172.279	-115.000	
		Before-Master	----	----	4.730	----	
Thru Cal Mag - 5	V	Master	----	1.176	1.888	2.744	
		Before	----	1.176	1.887	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 5	deg	Master	----	122.000	-178.544	-118.000	
		Before	----	122.000	-173.812	-118.000	
		Before-Master	----	----	4.732	----	
Thru Cal Mag - 6	V	Master	----	1.176	1.887	2.744	
		Before	----	1.176	1.886	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 6	deg	Master	----	121.000	-178.521	-119.000	
		Before	----	121.000	-173.790	-119.000	
		Before-Master	----	----	4.731	----	
Thru Cal Mag - 7	V	Master	----	0.846	1.358	1.974	
		Before	----	0.846	1.353	1.974	
		Before-Master	----	----	-0.005	----	
Thru Cal Phase - 7	deg	Master	----	115.000	-179.305	-125.000	
		Before	----	115.000	-174.661	-125.000	
		Before-Master	----	----	4.644	----	
SPA Zero	mV	Master		-50.000	0.156	50.000	
		Before		-50.000	0.146	50.000	
		Before-Master	----	----	-0.010	----	
SPA Plus	mV	Master		941.000	988.093	1040.000	
		Before		941.000	988.030	1040.000	
		Before-Master	----	----	-0.063	----	
Temperature Zero	V	Master		-0.050	0.000	0.050	
		Before		-0.050	0.000	0.050	
		Before-Master	----	----	0.000	----	
Temperature Plus	V	Master		0.870	0.915	0.960	
		Before		0.870	0.915	0.960	
		Before-Master	----	----	0.000	----	

HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One			
Primary Equipment :			
	HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
	HILT Resistivity Gamma-Ray Density Device, 150 degC	HRGD-H	4899
Auxiliary Equipment :			
	HRDD Backscatter Detector	Backscatter	
	HRDD Long Spacing Detector	Long Spacing	
	HRDD Short Spacing Detector	Short Spacing	27786
	Cesium 137 Gamma-Ray Logging Source	GSR-J	5471
	HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
	HILT High-Resolution Mechanical Sonde, 150 degC	HRMS-H	4876
Calibration Parameter :			
	Small Ring Size (Caliper Calibration Small Ring)	8.00	
	Large Ring Size (Caliper Calibration Large Ring)	12.00	

HDRS Caliper Calibration - Caliper Accumulations							
Before (Measured):		21:07:42 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Small Ring	in	Before	8.00	6.00	7.80	10.00	
Large Ring	in	Before	12.00	9.00	12.20	15.00	

HDRS Density Calibration - Inversion Results							
Master (EEPROM):		11:40:40 24-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Rho Aluminum	g/cm3	Master	2.596	2.586	2.600	2.606	
Rho Magnesium	g/cm3	Master	1.686	1.676	1.685	1.696	
Pe Aluminum		Master	2.570	2.470	2.571	2.670	
Pe Magnesium		Master	2.650	2.550	2.618	2.750	
HDRS Density Calibration - Deviation Summary							
Master (EEPROM):		11:40:40 24-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Average Deviation	%	Master	0	-0.6000	0.2221	0.6000	
BS Max Deviation	%	Master	0	-1.6000	0.6566	1.6000	
SS Average Deviation	%	Master	0	-1.0000	0.2278	1.0000	
SS Max Deviation	%	Master	0	-2.5000	0.9144	2.5000	
LS Average Deviation	%	Master	0	-1.5000	0.6741	1.5000	
LS Max Deviation	%	Master	0	-3.5000	1.7270	3.5000	
HDRS Density Calibration - Background Summary							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Window Ratio		Master	1.0000		0.7337		
		Before	0.7337	0.6970	0.7348	0.7704	
		Before-Master	-----	-----	0.0011	-----	
BS Window Sum	1/s	Master	1		25241		
		Before	25241	23979	25499	26504	
		Before-Master	-----	-----	258	-----	
SS Window Ratio		Master	1.0000		0.4797		
		Before	0.4797	0.4557	0.4811	0.5037	
		Before-Master	-----	-----	0.0014	-----	
SS Window Sum	1/s	Master	1		11057		
		Before	11057	10504	11035	11610	
		Before-Master	-----	-----	-22	-----	
LS Window Ratio		Master	1.0000		0.3012		
		Before	0.3012	0.2861	0.3073	0.3162	
		Before-Master	-----	-----	0.0061	-----	
LS Window Sum	1/s	Master	1		1233		
		Before	1233	1171	1232	1294	
		Before-Master	-----	-----	-1	-----	
HDRS Density Calibration - Photo-multiplier High Voltages							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS PM High Voltage	V	Master		1000	1452	2400	
		Before		1000	1449	2400	
		Before-Master	-----	-100	-3	100	
SS PM High Voltage	V	Master		1000	1410	2400	
		Before		1000	1411	2400	
		Before-Master	-----	-100	1	100	
LS PM High Voltage	V	Master		1000	1480	2400	
		Before		1000	1473	2400	
		Before-Master	-----	-100	-7	100	
HDRS Density Calibration - Crystal Quality Resolutions							
Master (EEPROM):		11:40:40 24-Aug-2016		Before (Measured):		21:08:15 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Crystal Resolution	%	Master		5.00	11.74	25.00	
		Before		5.00	11.74	25.00	
		Before-Master	-----	-1.00	0.00	1.00	
SS Crystal Resolution	%	Master		5.00	10.26	20.00	
		Before		5.00	10.24	20.00	
		Before-Master	-----	-1.00	-0.02	1.00	
LS Crystal Resolution	%	Master		5.00	8.09	20.00	
		Before		5.00	7.85	20.00	

		Before	-----	3.00	7.83	20.00	
		Before-Master	-----	-1.00	-0.24	1.00	

HDRS MCFL Calibration - MCFL Accumulations

Before (Measured):		21:10:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Main Resistivity	ohm.m	Before	3875	3565	3886	4185	
Deep Resistivity	ohm.m	Before	3830	3524	3830	4136	
Shallow Resistivity	ohm.m	Before	3830	3524	3839	4136	

HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One

Primary Equipment :			
HILT Gamma-Ray and Neutron Sonde, 150 degC		HGNS-H	4817
Auxiliary Equipment :			
HGNS Accelerometer, 150 degC		HACCZ-H	6991
AmBe Neutron Logging Source		NSR-F	5068
Calibration Parameter :			
Water Temperature			
Housing Size			
JIG-BKG (Jig minus background reference)		165	

HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured):		05:14:18 07-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
AZ Vertical Measurement	ft/s2	Before	32.2	31.5	32.0	32.8	

HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM):		00:00:00 15-May-2007					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Accelerometer Manufacturer		Master			QAT_160		
Accelerometer Reference Temperature	degF	Master		30.2	77.0	122.0	
Accelerometer Coefficients - 0		Master	-----	-----	-4298.000	-----	
Accelerometer Coefficients - 1		Master	-----	-----	50.180	-----	
Accelerometer Coefficients - 2		Master	-----	-----	-0.002	-----	
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 4		Master	-----	-----	2.754	-----	
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 7		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 8		Master	-----	-----	300.500	-----	
Accelerometer Coefficients - 9		Master	-----	-----	0.994	-----	

HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM):		15:25:00 19-Jul-2016		Before (Measured):		21:06:20 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Near Zero Measurement	1/s	Master	0	5.0	27.6	40.0	
		Before	0	5.0	28.2	40.0	
		Before-Master	-----	-4.1	0.6	4.1	
Far Zero Measurement	1/s	Master	0	5.0	29.5	40.0	
		Before	0	5.0	29.7	40.0	
		Before-Master	-----	-4.4	0.2	4.4	
Near Plus Measurement	1/s	Master	6031.0	4700.0	5290.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Far Plus Measurement	1/s	Master	2793.0	1900.0	2194.0	2900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Near Corrected Plus Measurement	1/s	Master		4700.0	5156.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	

Far Corrected Plus Measurement	1/s	Master Before Before-Master	----- ----- -----	1900.0 ----- -----	2097.0 ----- -----	2900.0 ----- -----	
--------------------------------	-----	-----------------------------------	-------------------------	--------------------------	--------------------------	--------------------------	---

HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured):		21:11:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RGR Zero Measurement	gAPI	Before	30.0	0	78.9	120.0	
RGR Plus Measurement	gAPI	Before	185.4	157.1	165.1	206.3	
GR Calibration Gain		Before	0.89	0.80	1.00	1.05	

Company:

Well:

Field:

County:

State:

Western Refining, Southwest, Inc.

WWD #2

Wildcat

San Juan

New Mexico

Schlumberger

Platform Express

National Express

Triple Combo

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express	
Compensated Neutron	
Litho-Density	
Sec 27, T29N, R11W	Elev.: K.B. 5550.00 ft
SHL: 2028' FNL X 111' FEL	G.L. 5535.00 ft
Lat/Long: 36.6986/-107.97035	D.F. 5549.00 ft
Permanent Datum:	Ground Level
Log Measured From:	Kelly Bushing
Drilling Measured From:	Kelly Bushing
API Serial No.	Section: 27
30-045-35747-0000	Township: 29N
	Range: 11W

County: San Juan
Field: Wildcat
Location: Sec 27, T29N, R11W
Well: WWD #2
Company: Western Refining, Southwest, Inc.

Logging Date	05-Sep-2016		
Run Number	One		
Depth Driller	7525.00 ft		
Schlumberger Depth	7532.00 ft		
Bottom Log Interval	7532.00 ft		
Top Log Interval	3498.00 ft		
Casing Driller Size @ Depth	9.625 in @ 3500.00 ft		
Casing Schlumberger	3498 ft		
Bit Size	8.75 in		
Type Fluid In Hole	WBM		
Density	9.9 lbm/gal	55 s	
Fluid Loss	PH 9 cm3	8.6	
MUD	Active Tank		
RM @ Meas Temp	1.13 ohm.m	@ 68 degF	
RMF @ Meas Temp	0.9 ohm.m	@ 68 degF	
RMC @ Meas Temp	1.4 ohm.m	@ 68 degF	
Source RMF	RMC Pressed	Calculated	
RM @ BHT	0.46 @ 177	0.37 @ 177	
Max Recorded Temperatures	177 degF		
Circulation Stopped	06-Sep-2016 20:25:00		
Logger on Bottom	07-Sep-2016 05:00:00		
Unit Number	Location: 9115	FtMorgan, CO	
Recorded By	Avery Becker		
Witnessed By	Larry Candelaria		

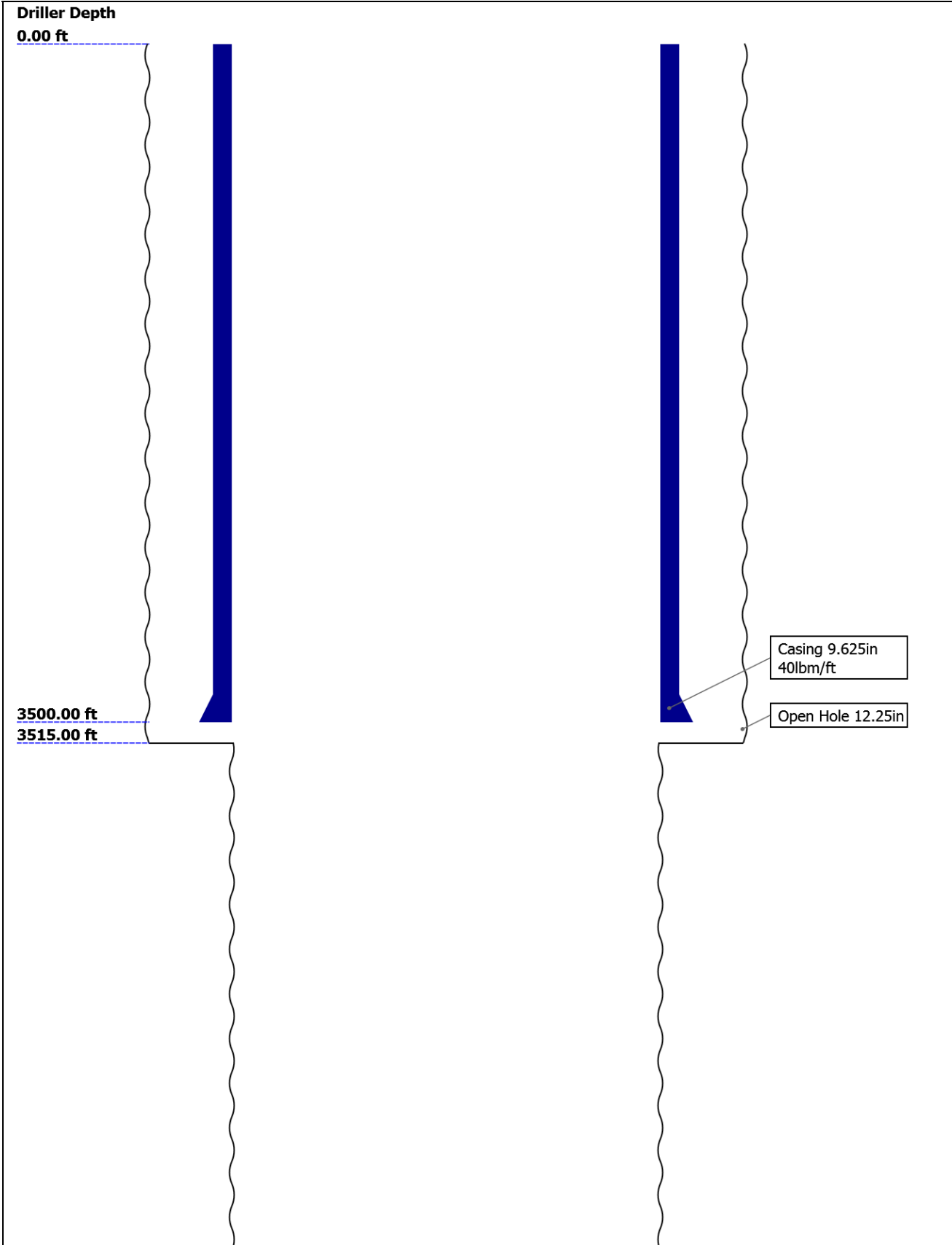
Disclaimer

THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA.

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- 9. One 5" Porosity
 - 9.1 Composite Summary
 - 9.2 Log (Porosity-5 RA)
- 10. Calibration Report
- 11. Tail

Well Sketch



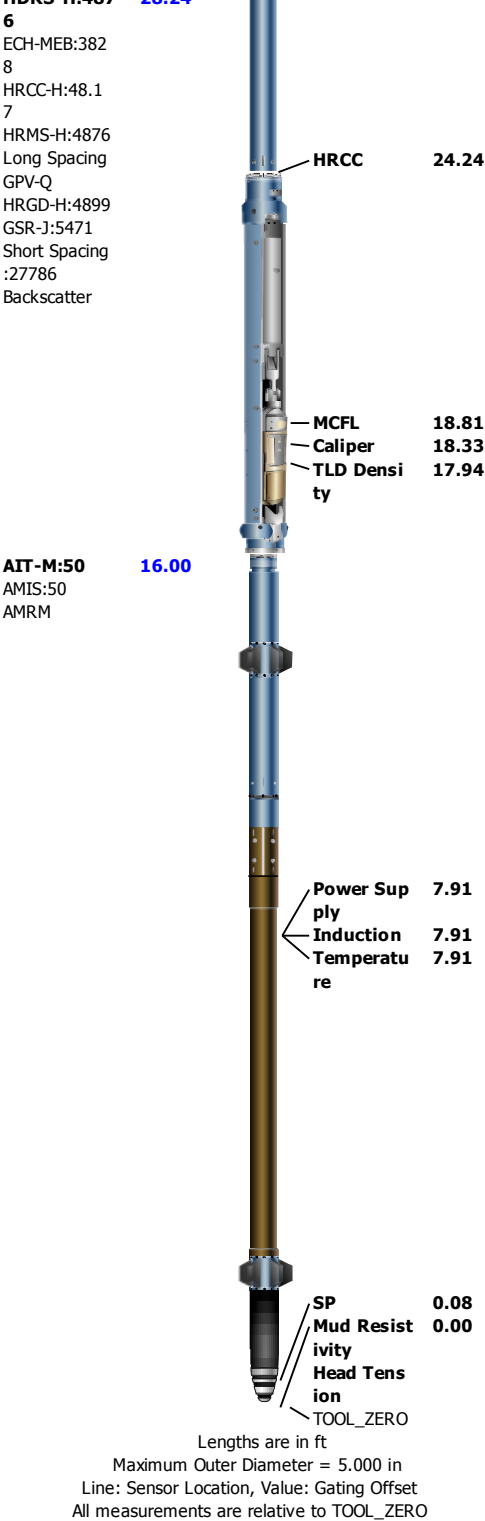


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	12.25	8.75				
Top Driller (ft)	0	3515				
Top Logger (ft)	0	3515				
Bottom Driller (ft)	3515	7525				
Bottom Logger (ft)	3515	7532				
Casing						
Size (in)	9.625					
Weight (lbm/ft)	40					
Inner Diameter (in)	8.835					
Grade	N/A					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	3500					
Bottom Logger (ft)	3498					

Remarks and Equipment Summary

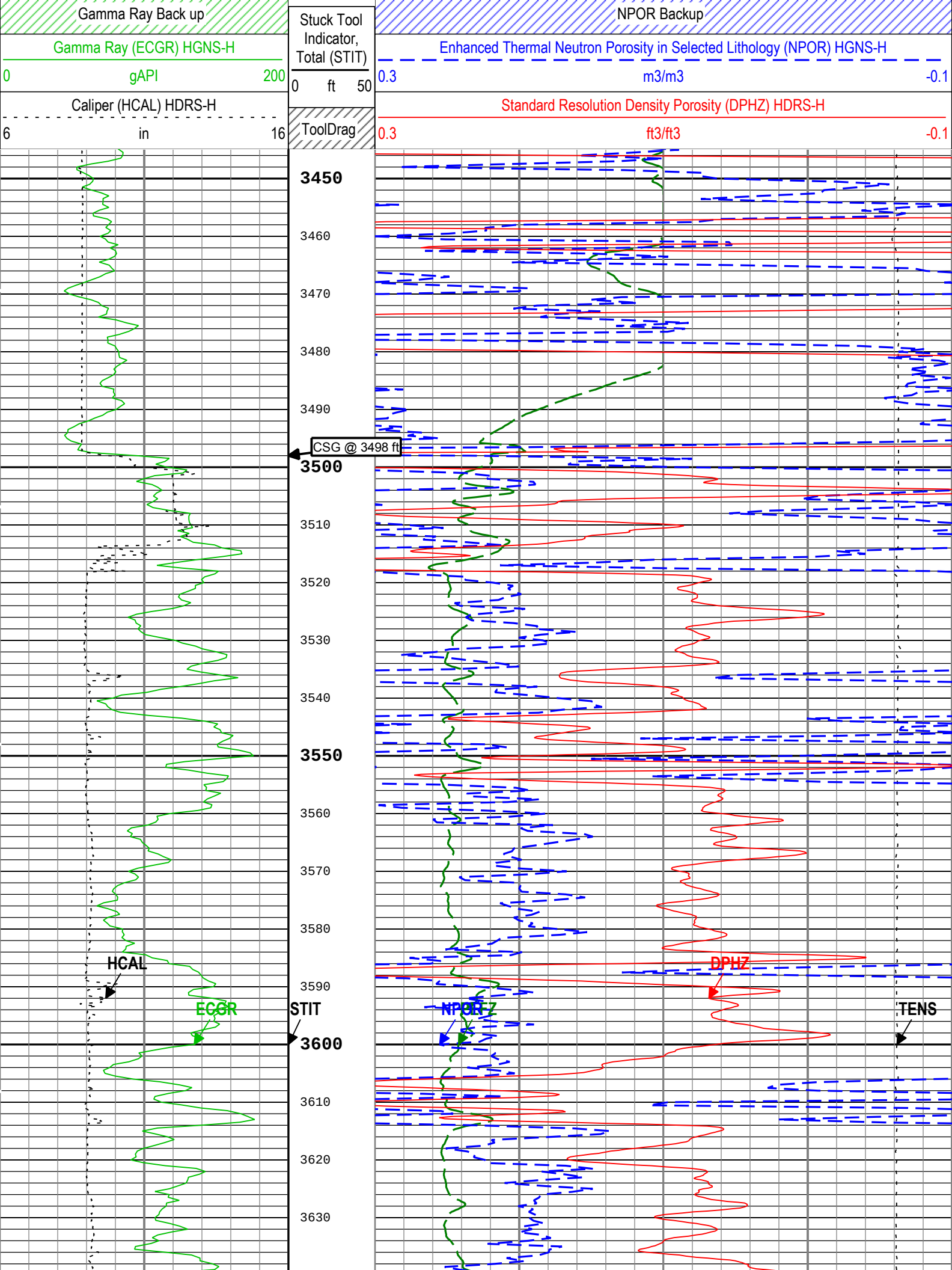
One: Toolstring				One: Remarks	
Equip name LEH-QT LEH-QT	Length 43.57	MP name	Offset	Toolstring run as per tool sketch	
				Matrix: Sandstone (2.65 g/cc)	
				Log may be affected by 20% LCM in drilling mud	
				Caliper check in casing=8.87 in, within tolerance	
				Cement volume calculated using 7 in future casing diameter	
				Rig: Aztec 920	
				Crew: Derrick Hunter	
				Thank you for choosing Schlumberger	
DTC-H:8980 ECH-KC:1005 3 DTC-H:8980	40.65	CTEM HV	39.75 0.00		
HGNS-H:481 7 HGNH:4865 NPV-N NSR-F:5068 HGNS-H:4817 HACCZ-H:699 1 HMCA-H	37.65	TelStatus ToolStatus Temperature GR	37.65 37.65 37.62 36.91		
HDPS-H:487	28.24	CNL Porosity HMCA HGNS Accelerometer	30.57 28.24 28.24 0.00		

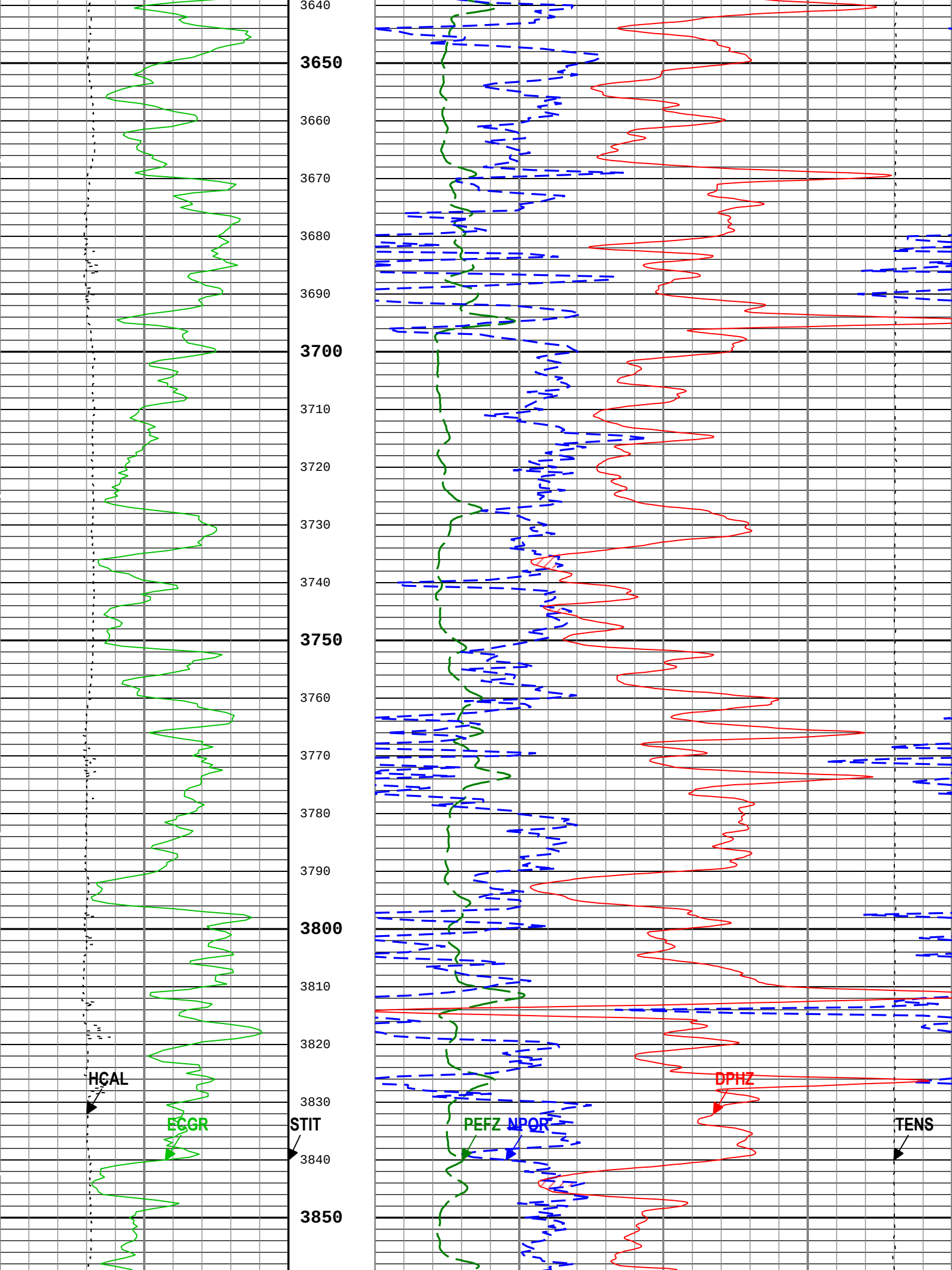


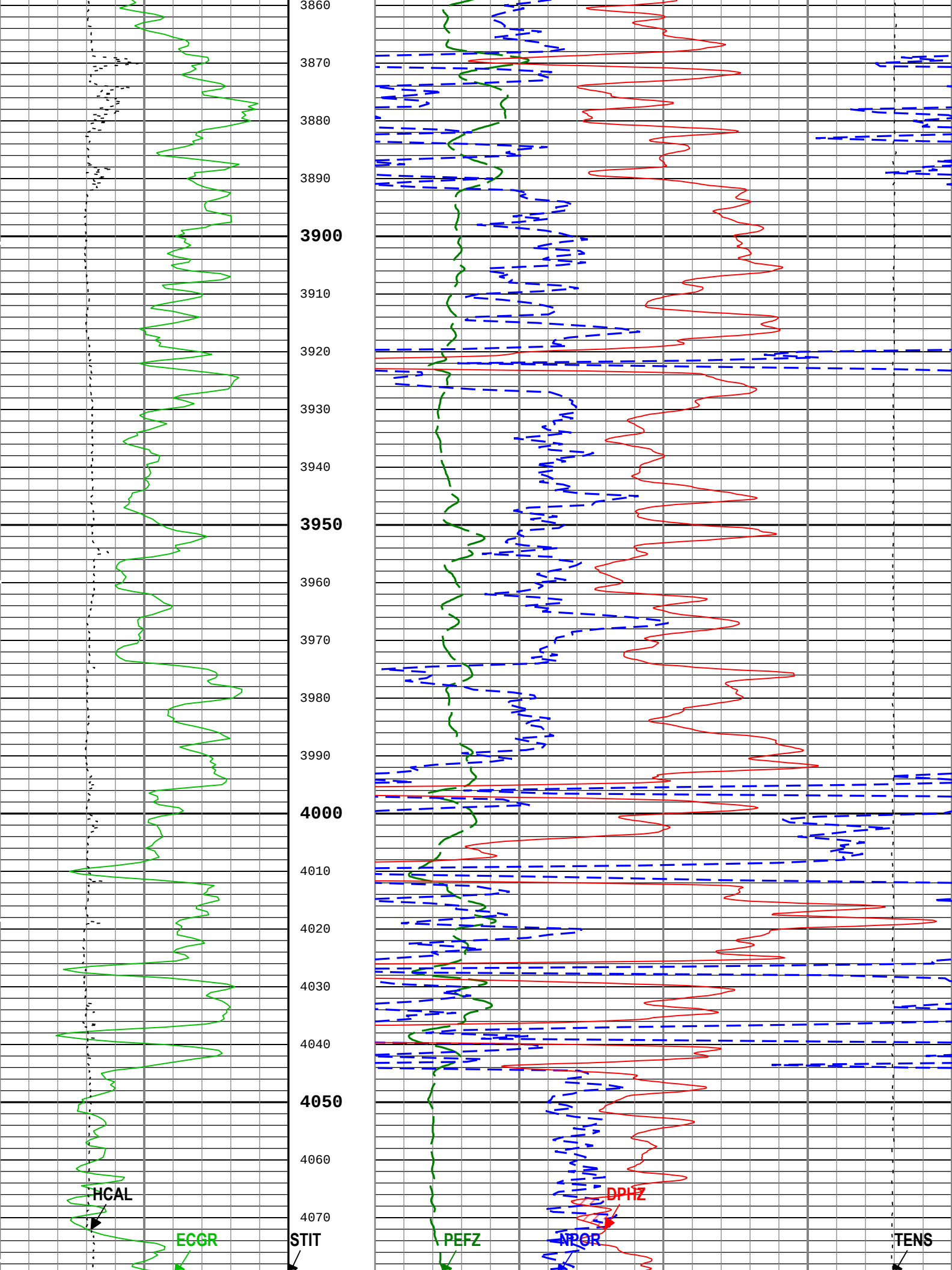
Depth Summary

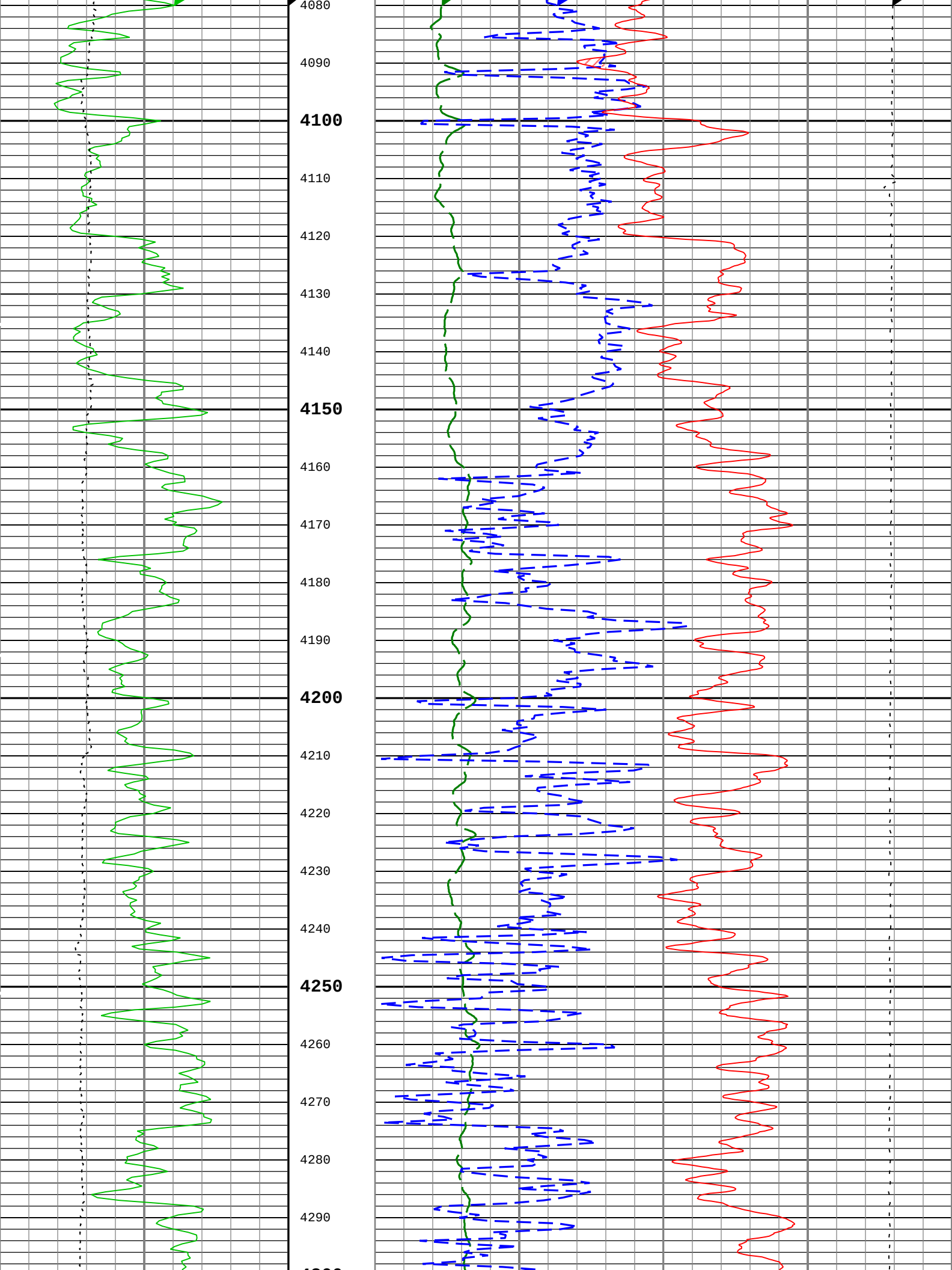
	One		
Depth Measuring Device			
Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		
Tension Device			
Type	CMTD-B/A		

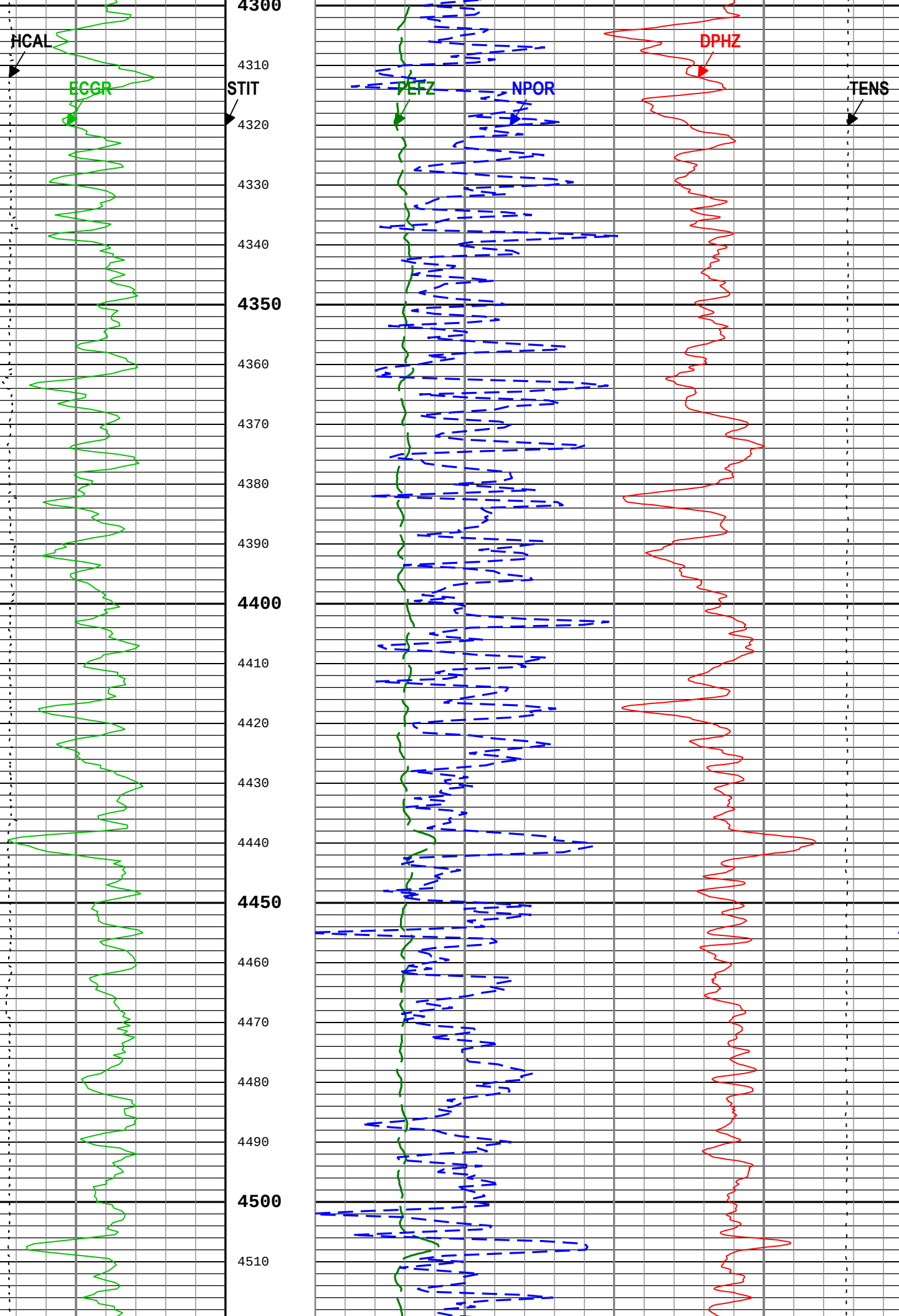
Serial Number	147								
Calibration Date	18-Aug-2016								
Calibrator Serial Number	78805A								
Number of Calibration Points	10								
Calibration Root Mean Square Error	7								
Calibration Peak Error	10								
Logging Cable									
Type	7-46A-XS								
Serial Number	U715043								
Length	24000.00 ft								
Conveyance Type	Wireline								
Rig Type	Land								
One:Depth Control Parameters		Depth Control Remarks							
Log Sequence	First Log In the Well	First run in well depth control procedures followed							
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary							
Rig Up Length At Bottom									
Rig Up Length Correction									
Stretch Correction									
Tool Zero Check At Surface									
One									
5" Porosity									
Pass Summary									
Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No
All depths are referenced to toolstring zero									
Log	Company:Western Refining, Southwest, Inc. Well:WWD #2 One: Log[4]:Up:S012								
Description: HGNS standard resolution porosities for Platform Express Format: Log (Porosity-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:46									
Channel	Source	Sampling							
CALI	HDRS-H:HRCC-H:HRCC-H	1in							
DPHZ	HDRS-H:HRMS-H:HRGD-H	2in							
GR	HGNS-H:HGNS-H:HGNS-H	6in							
NPOR	HGNS-H:HGNS-H:HGNS-H	6in							
PEFZ	HDRS-H:HRMS-H:HRGD-H	2in							
STIT	DepthCorrection	6in							
TENS	WLWorkflow	6in							
TIME_1900	WLWorkflow	0.1in							
TIME_1900 - Time Marked every 60.00 (s)									
Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H 0 10 Cable Tension (TENS) 10000 lbf 0 Gas Effect									

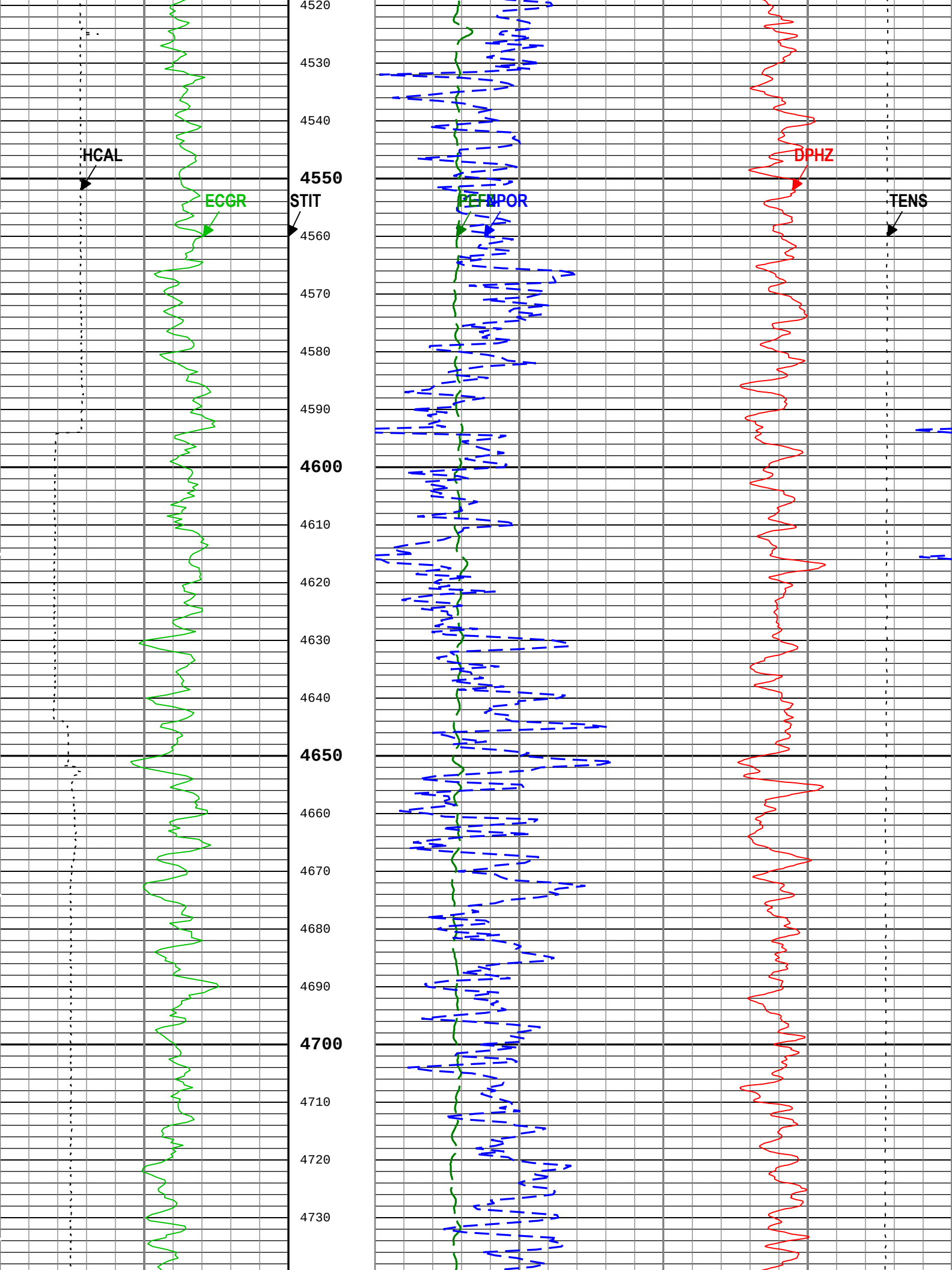


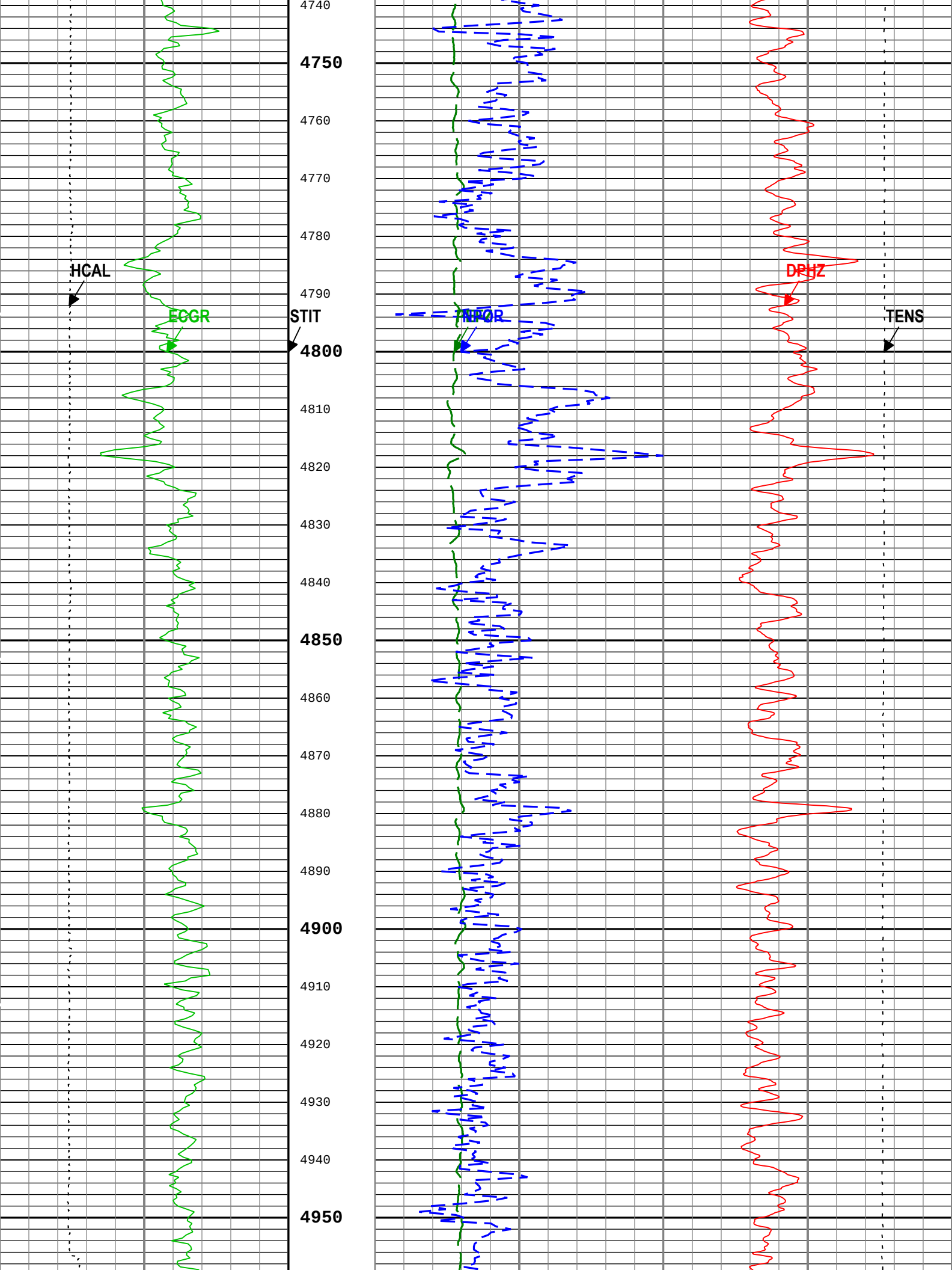


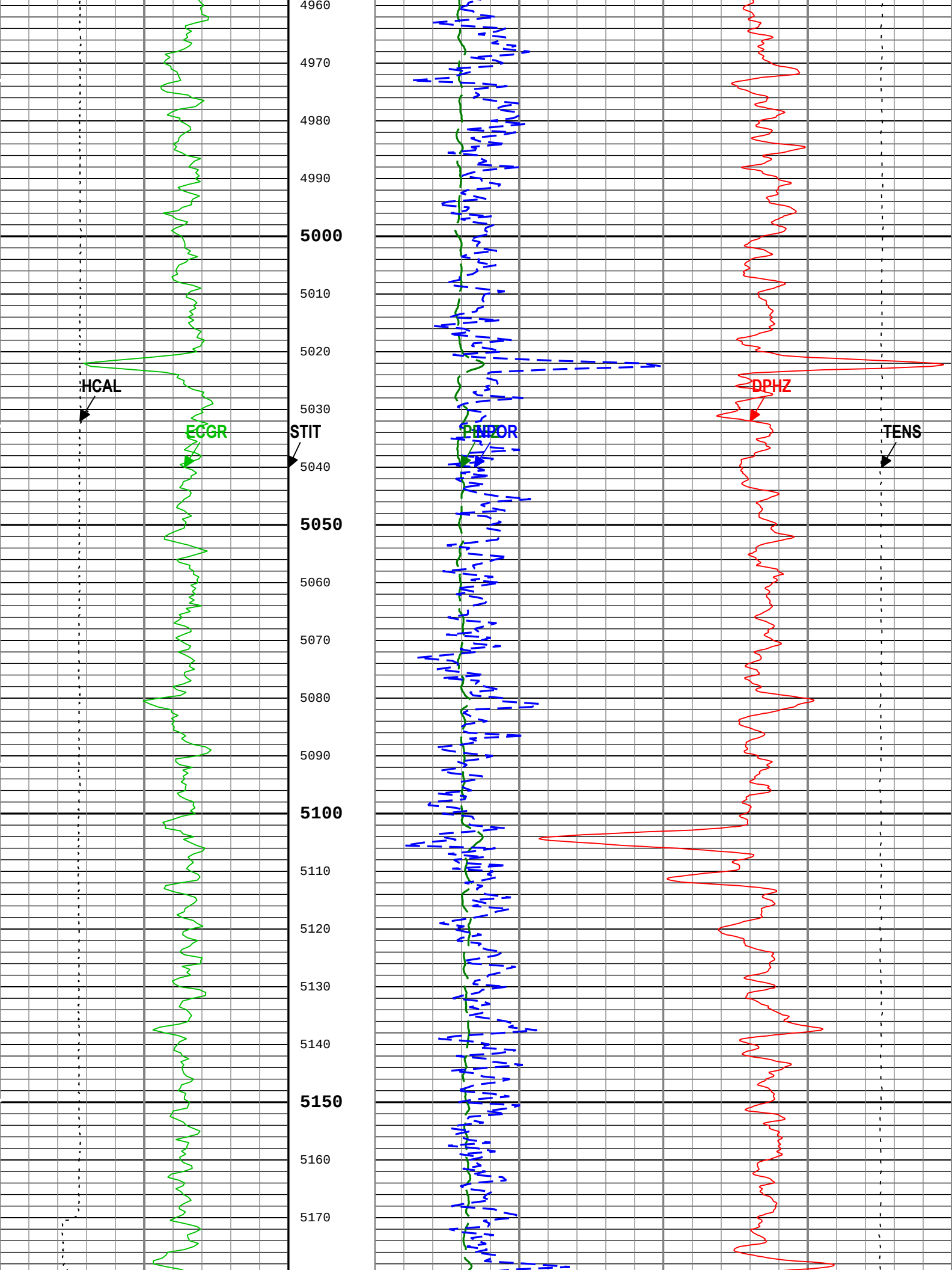


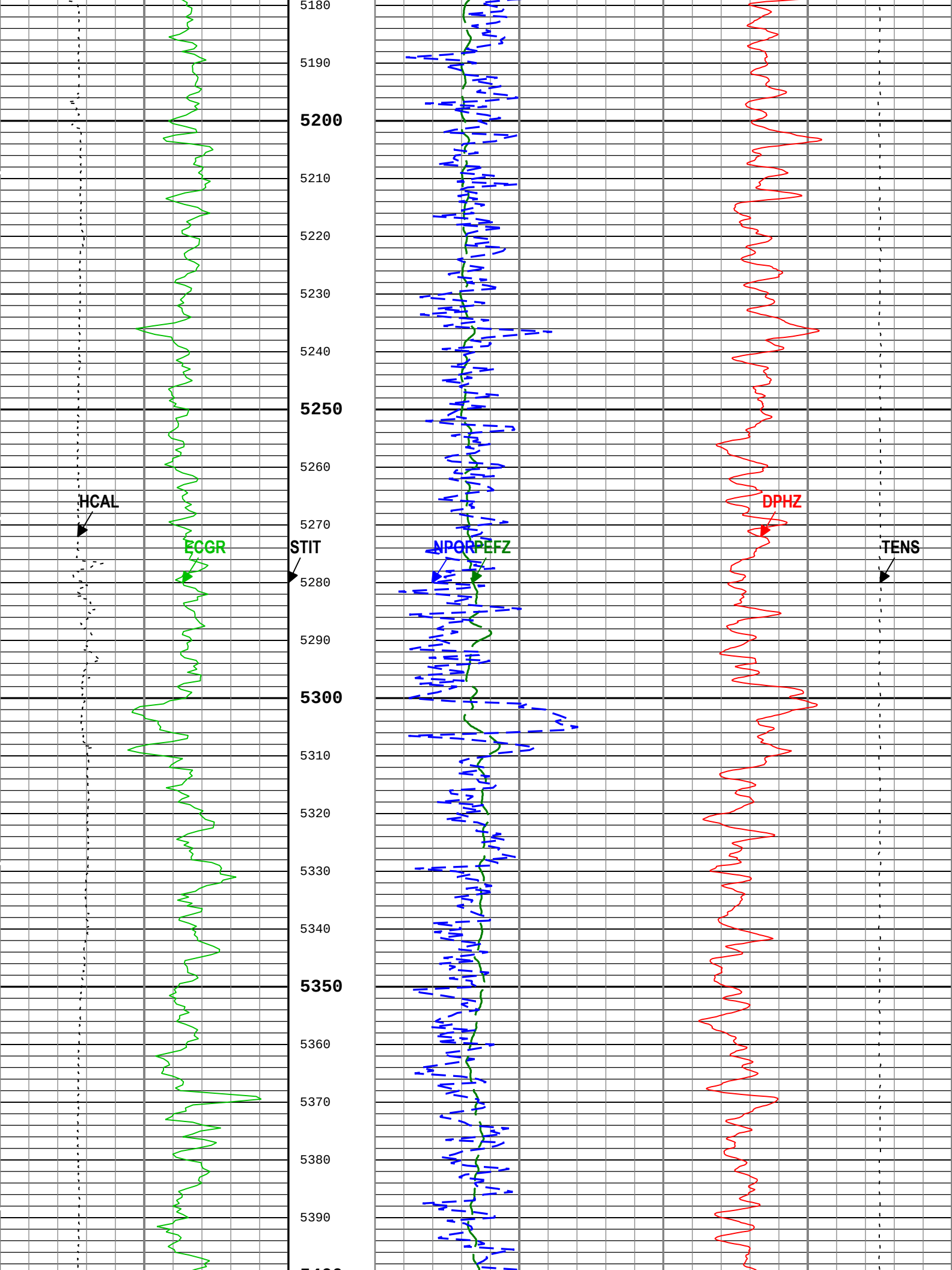


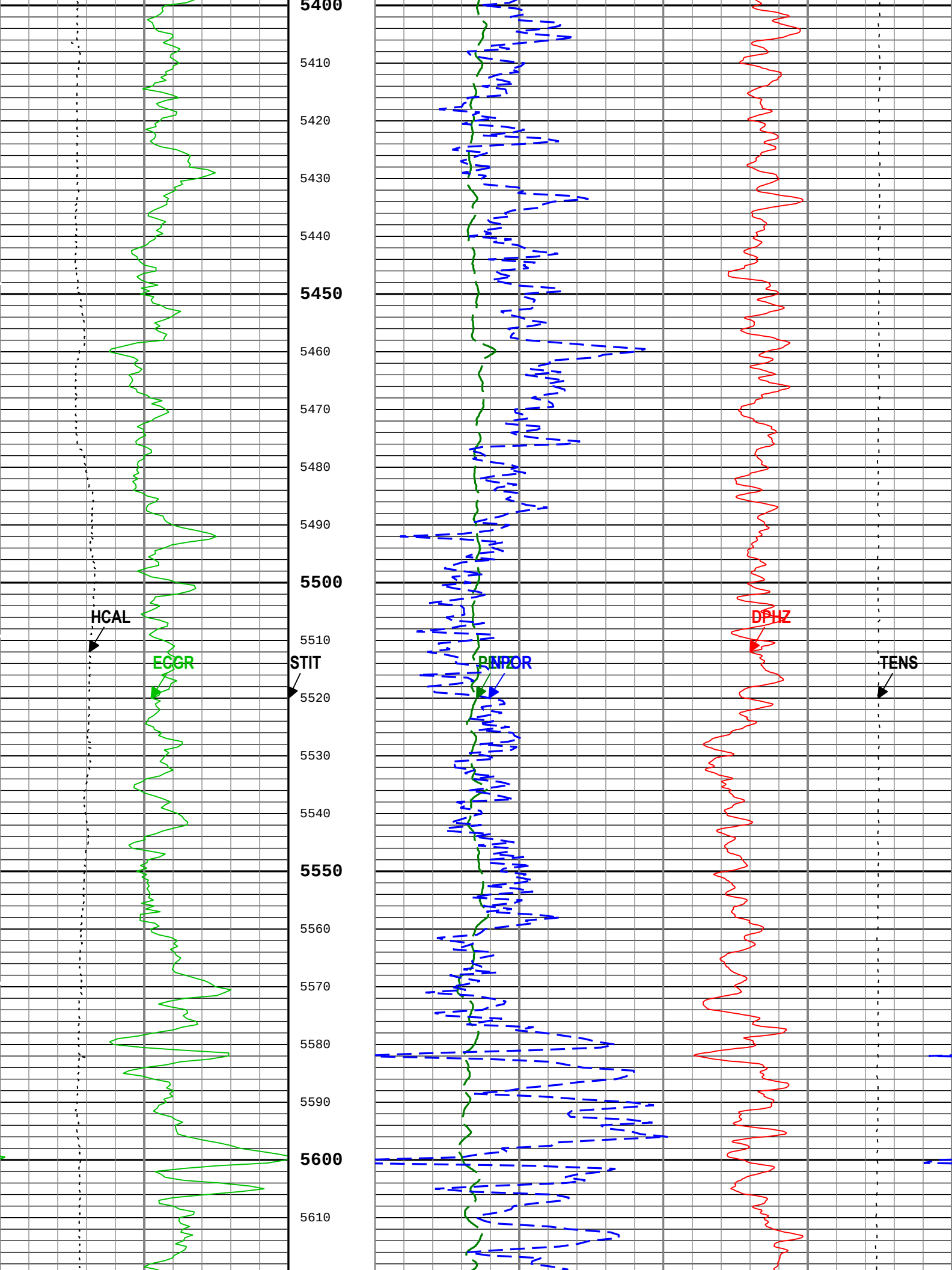


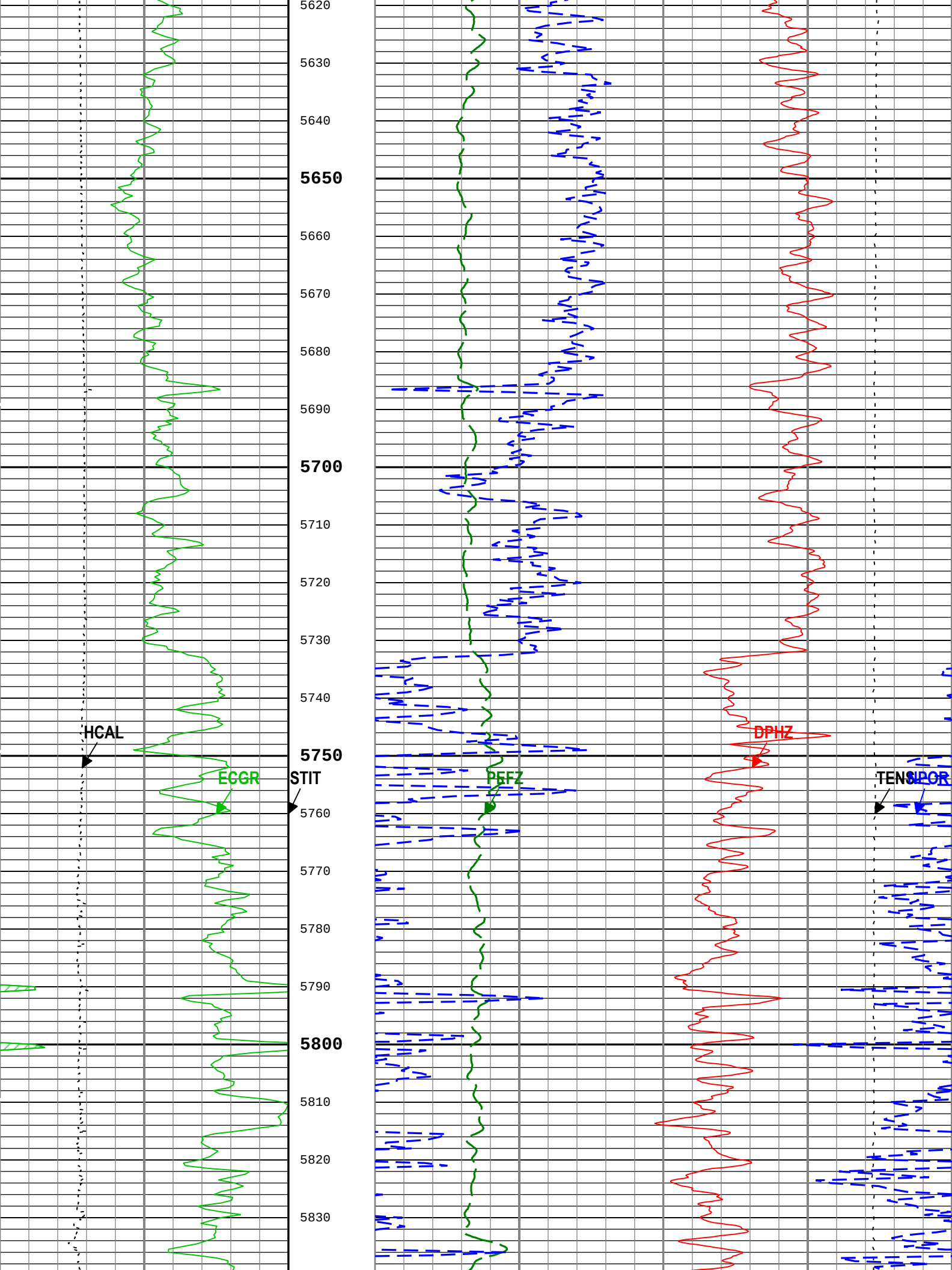


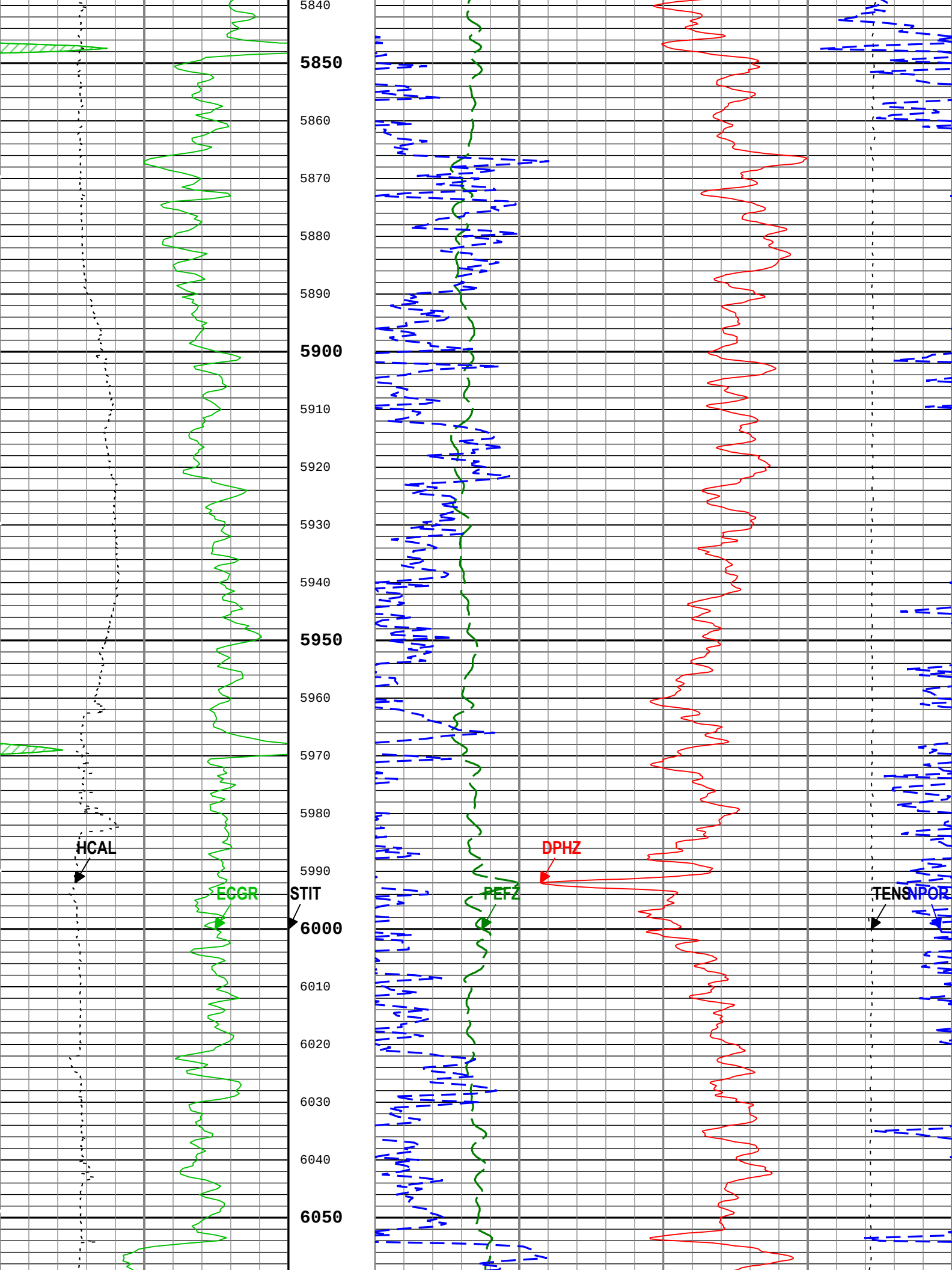


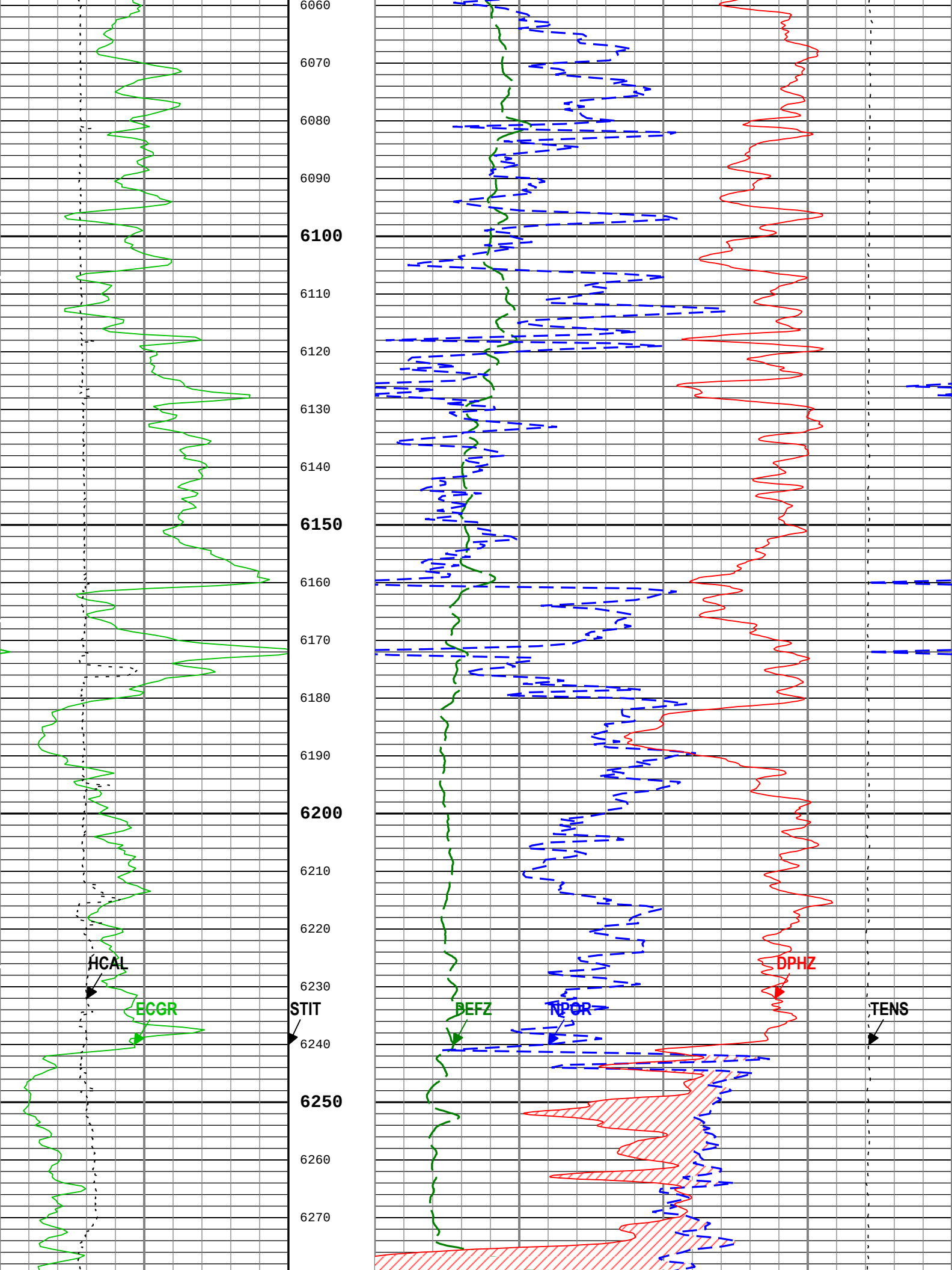


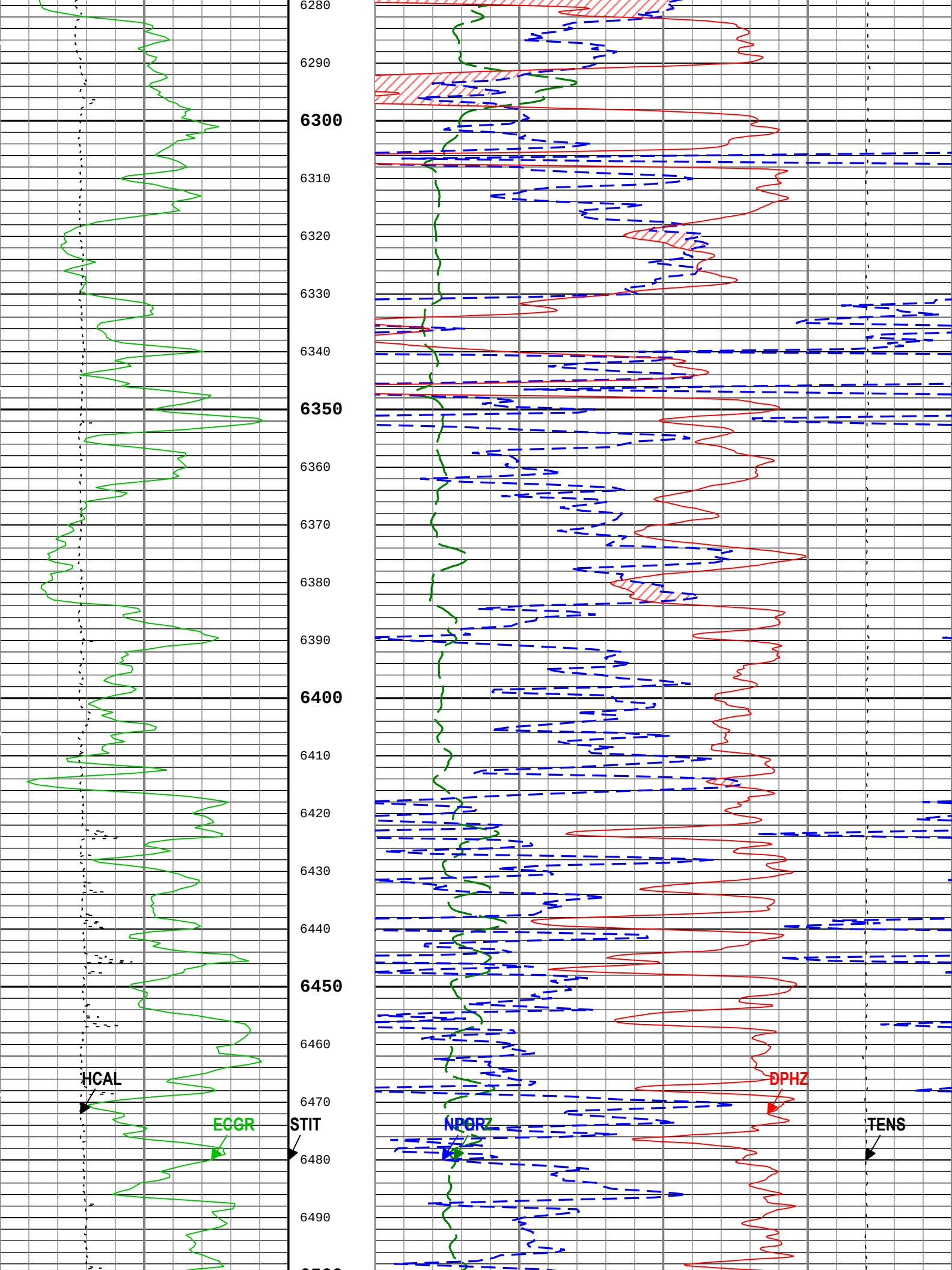


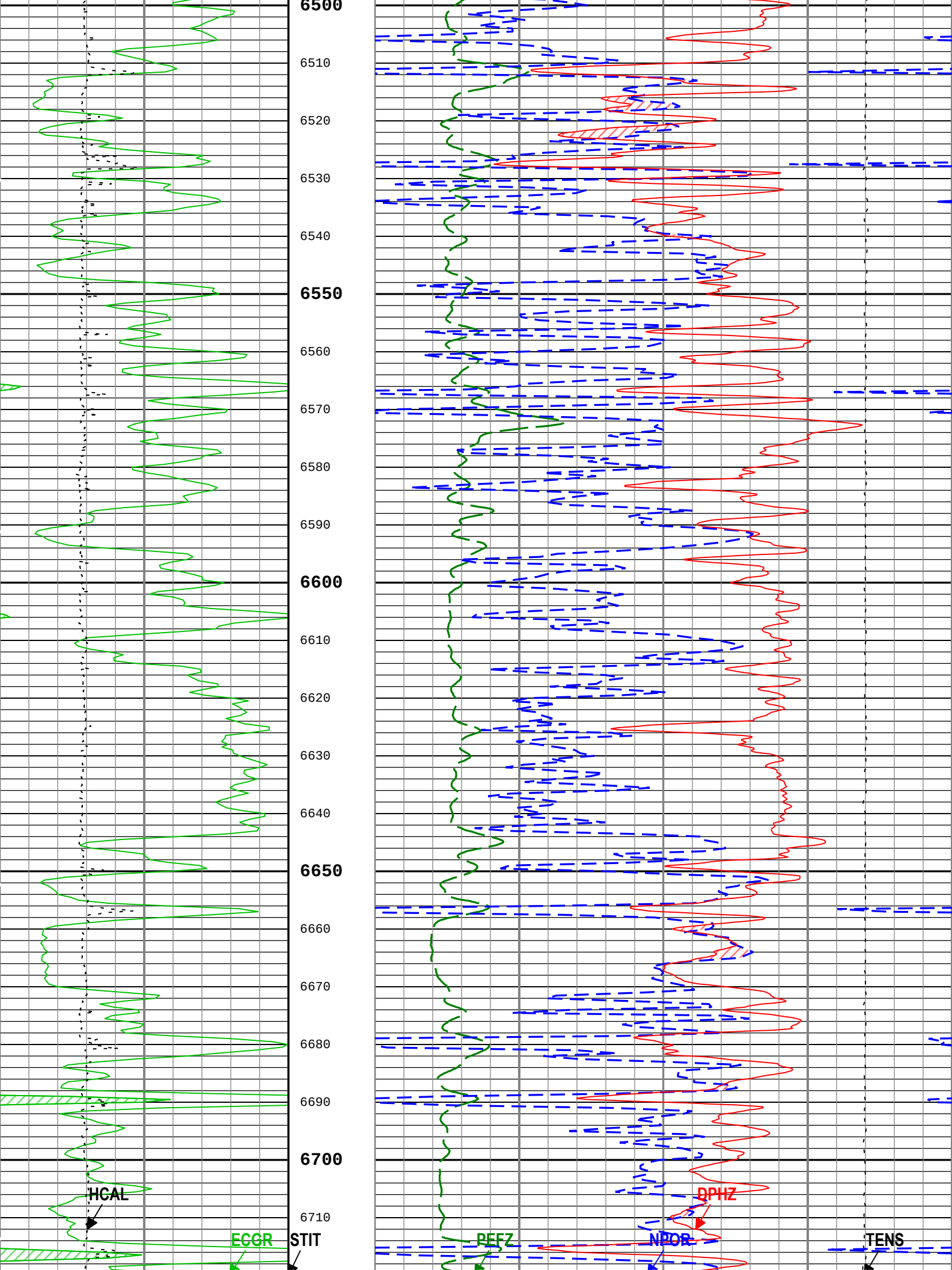


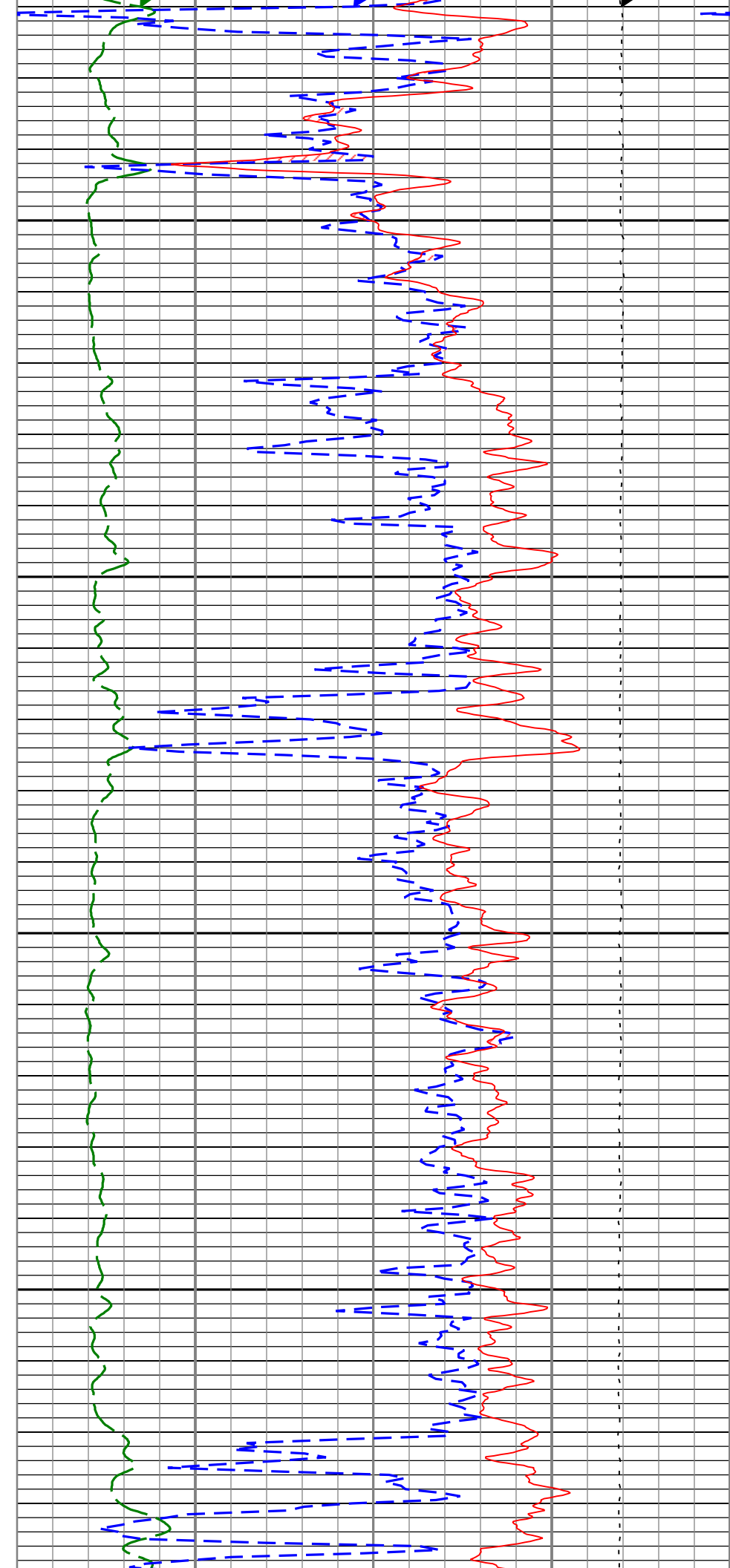
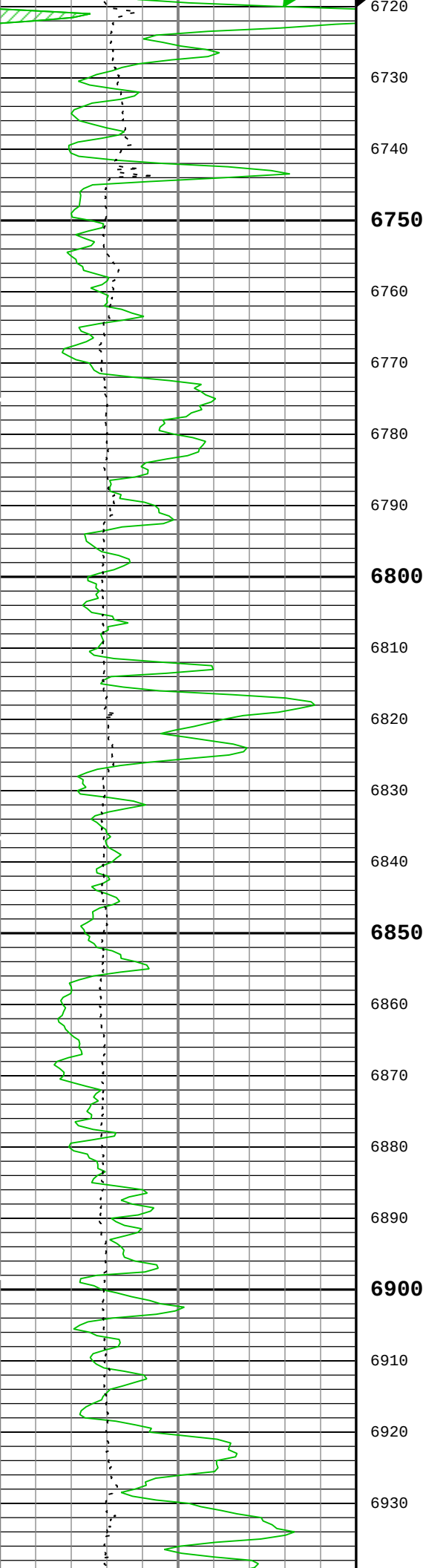


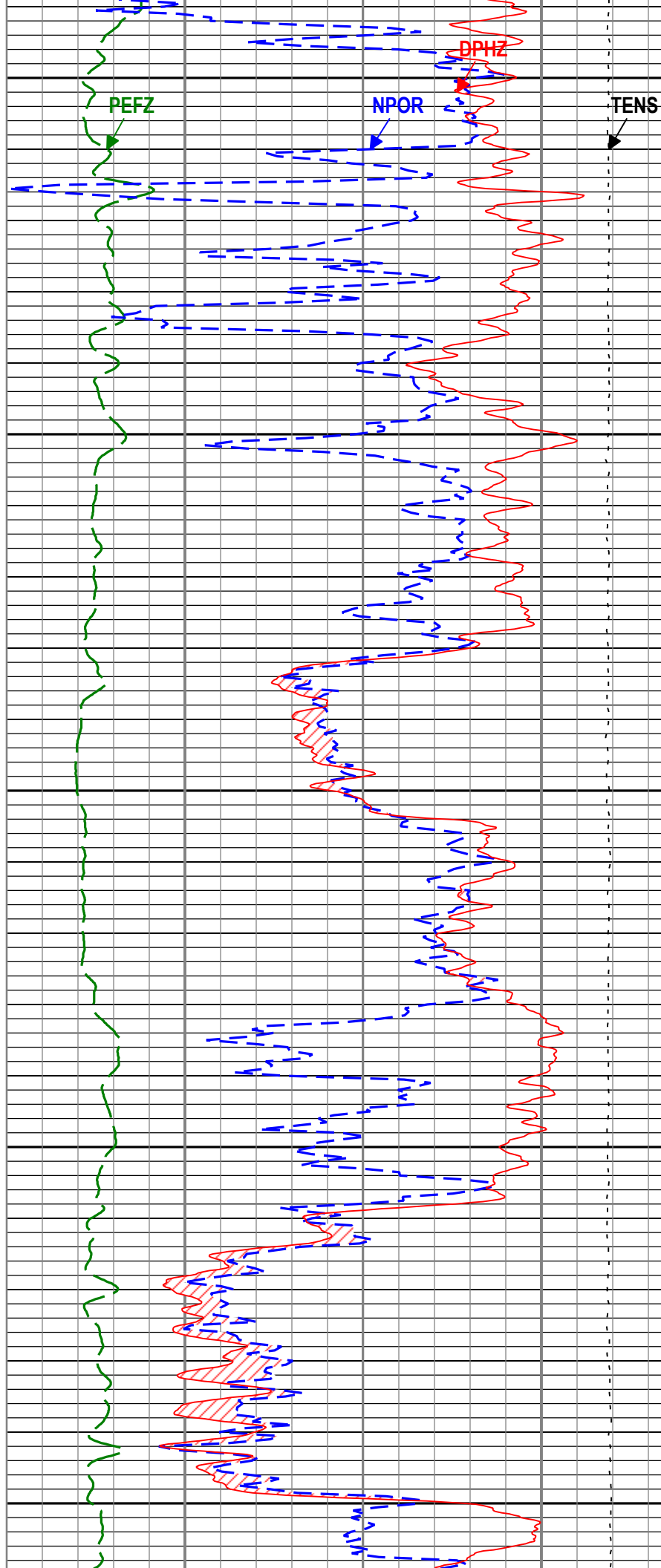
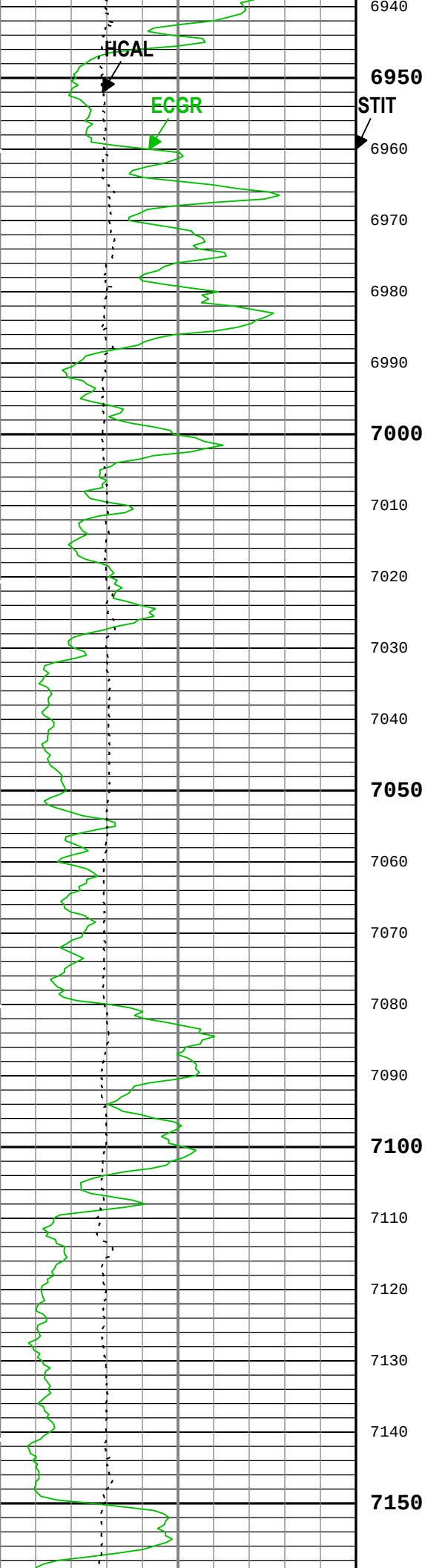


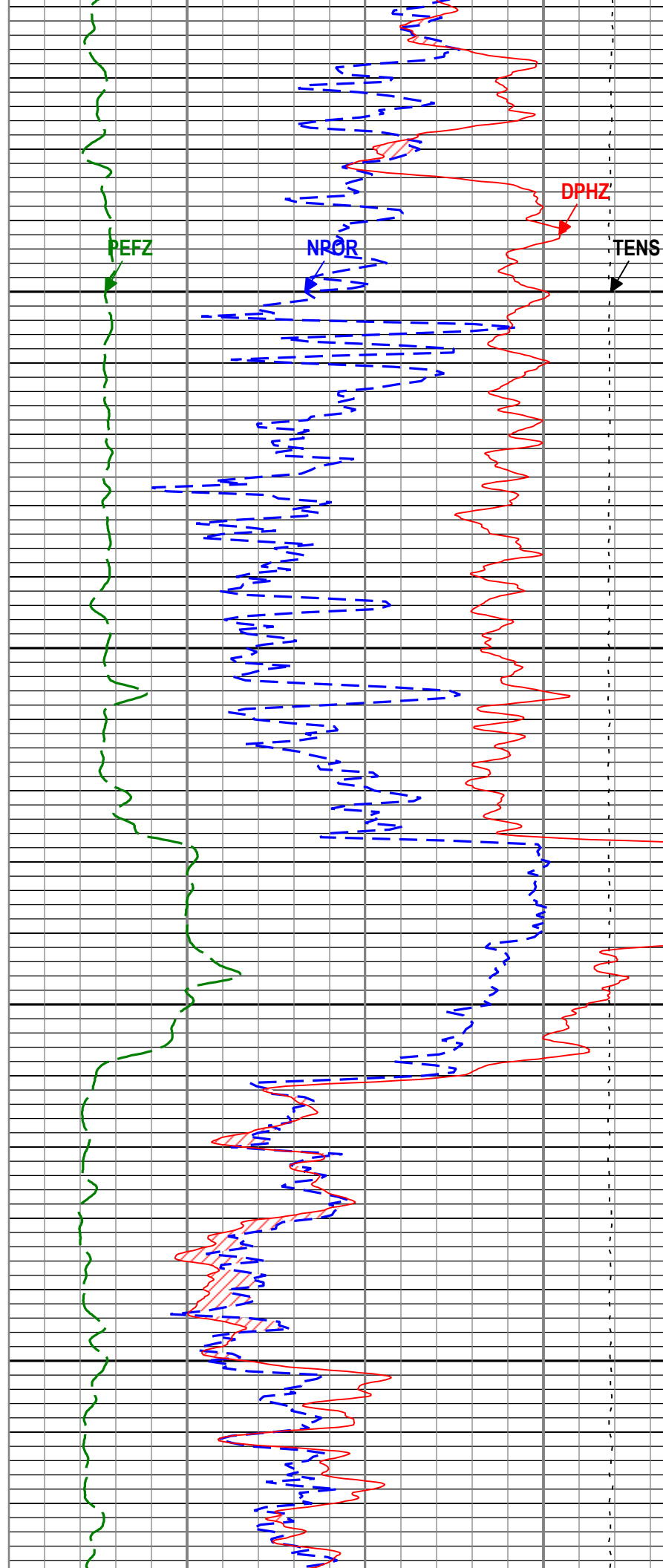
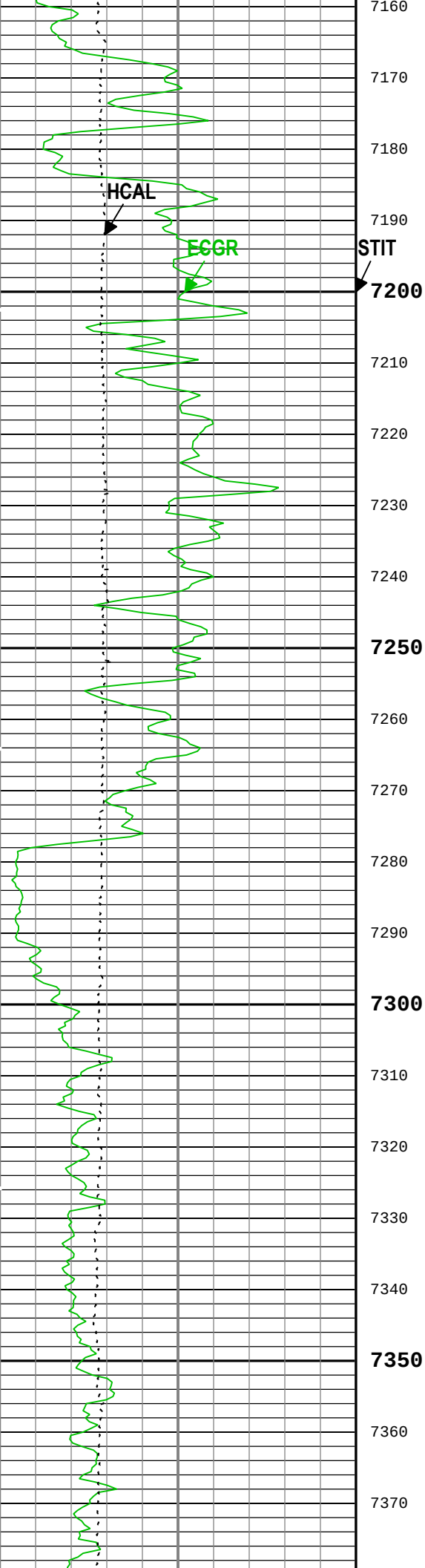


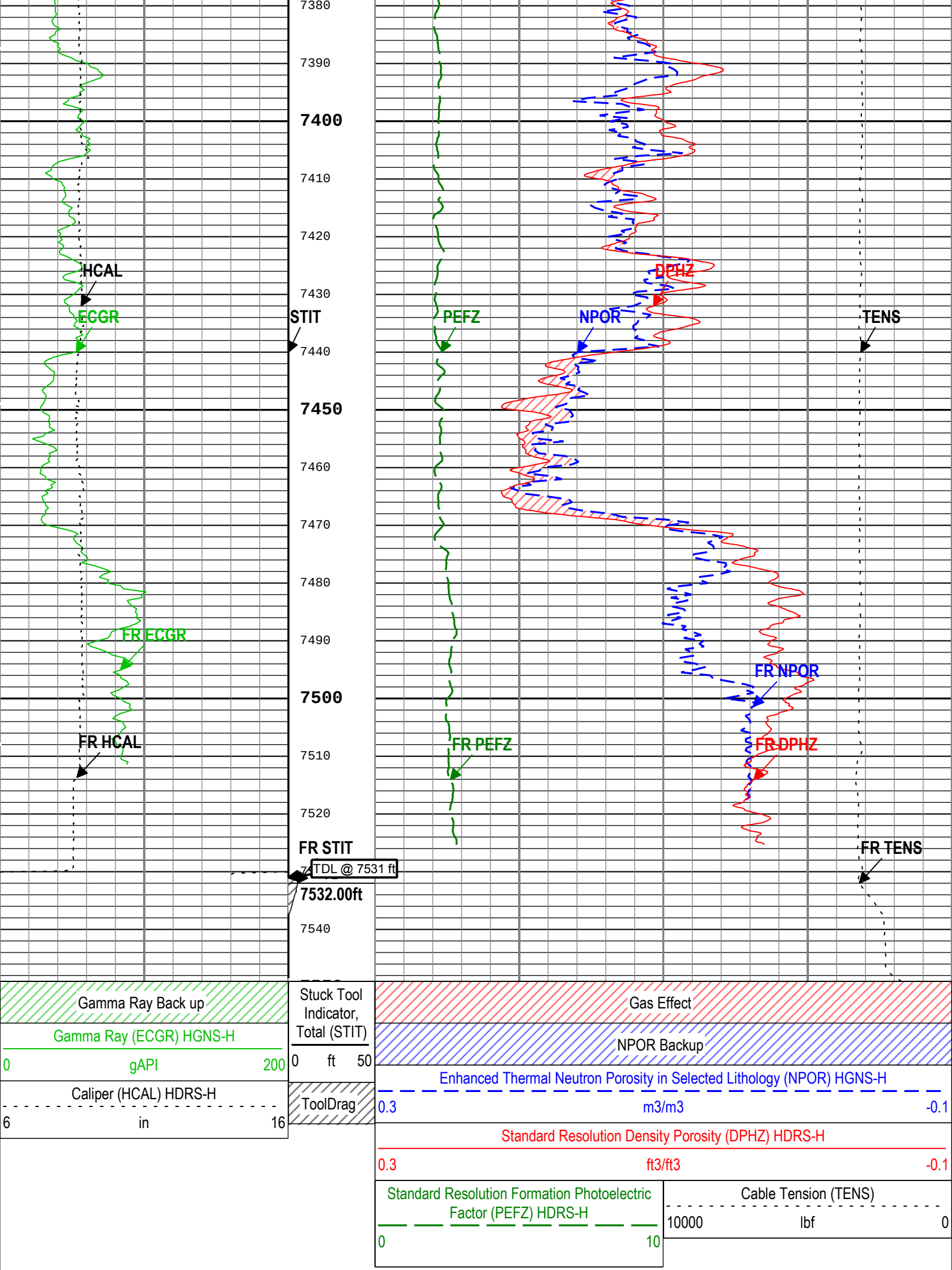












Description: HGNS standard resolution porosities for Platform Express Format: Log (Porosity-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:46

Channel Processing Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

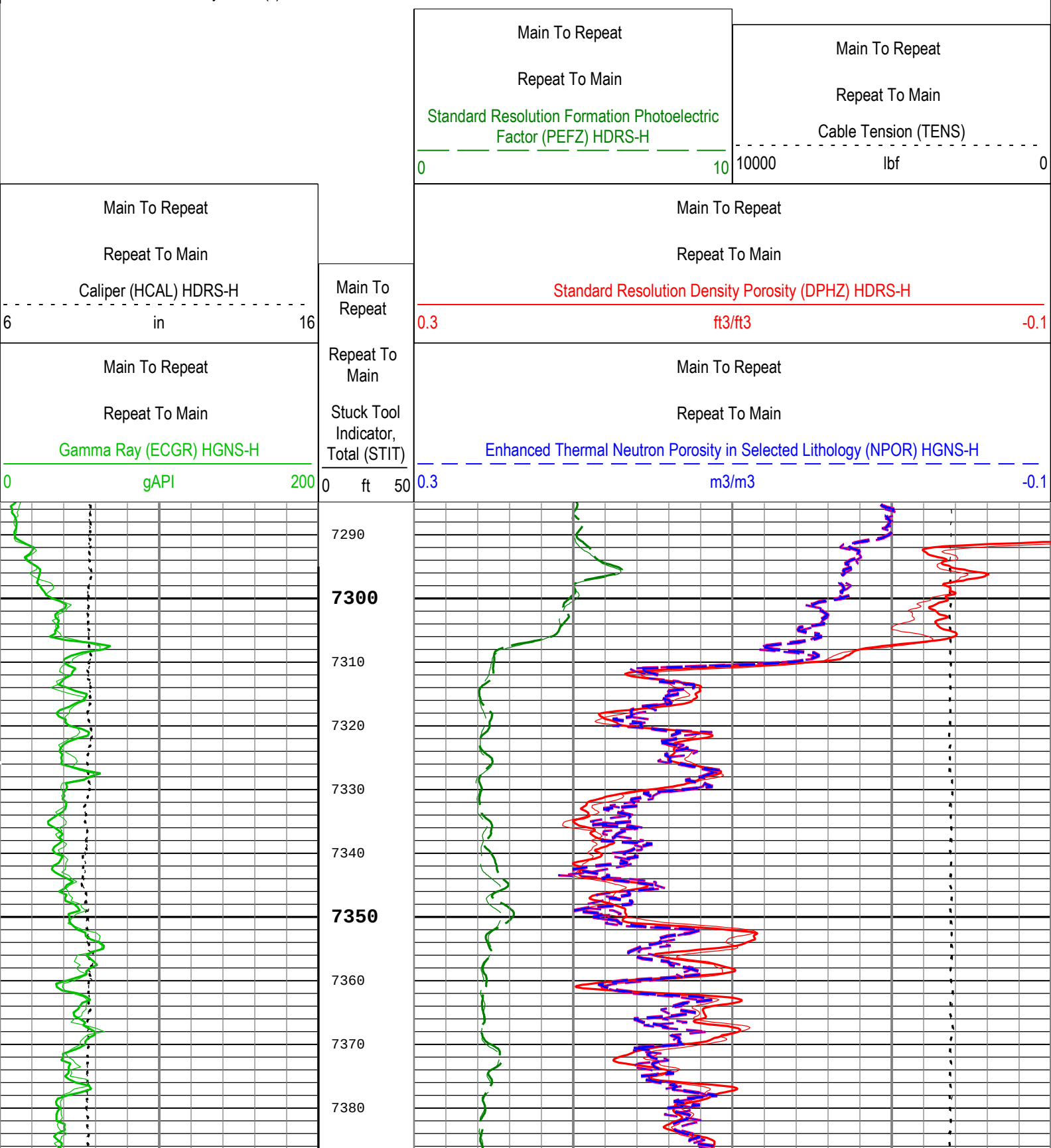
Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

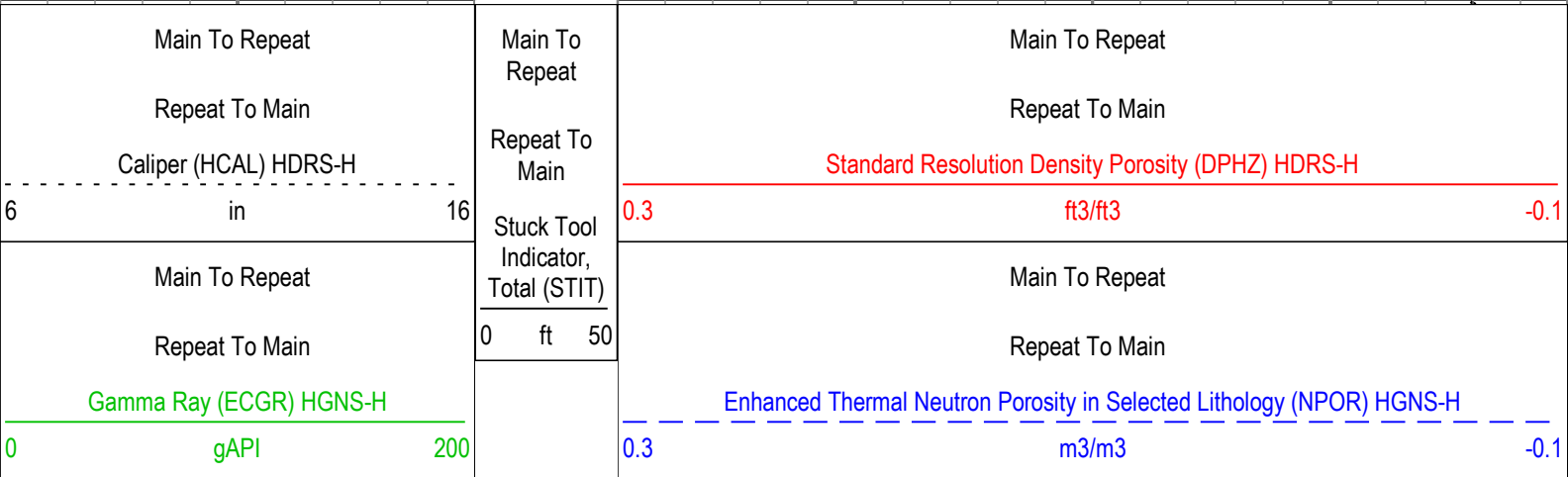
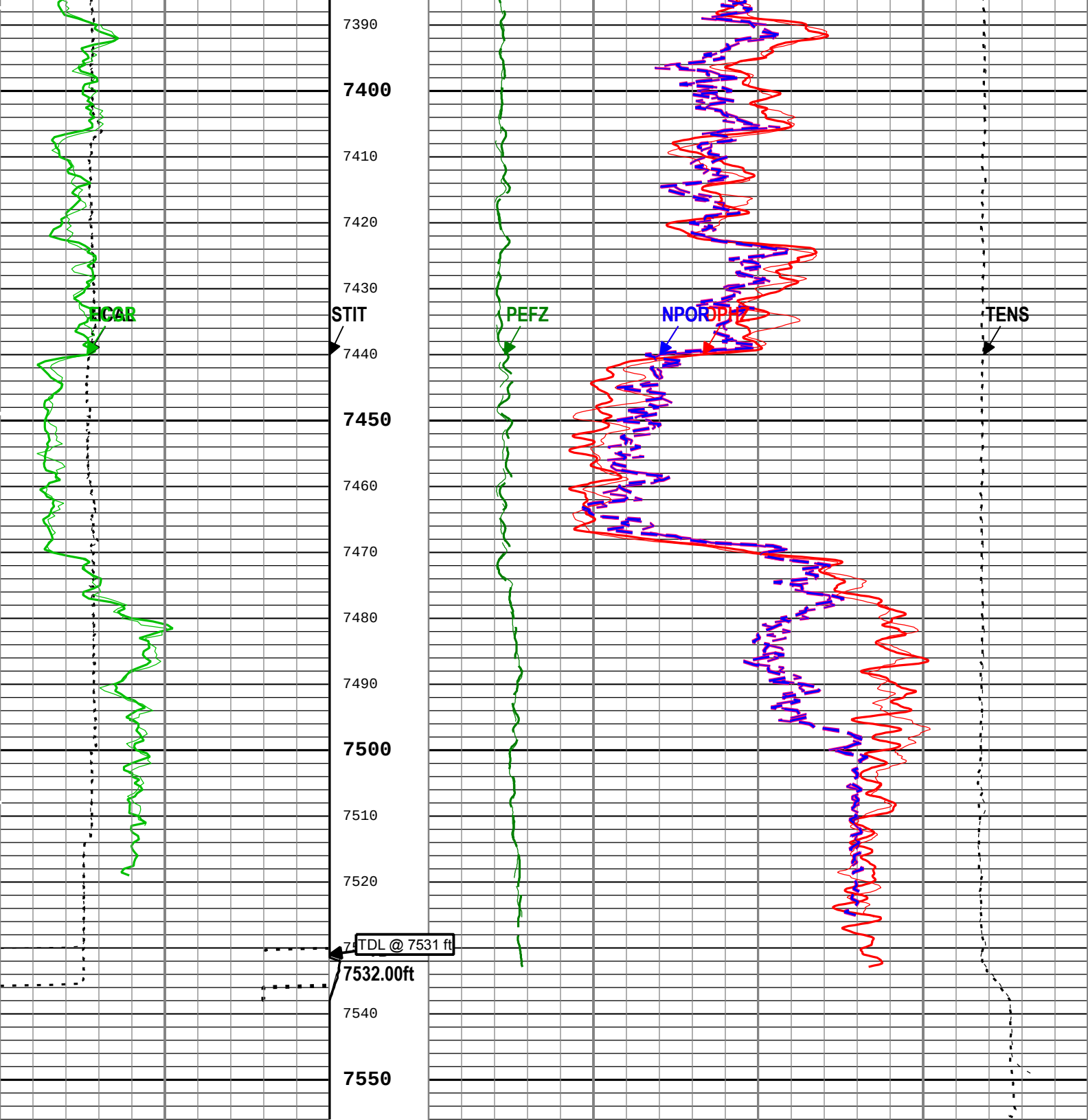
One

5" Porosity

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
----------	----------------	-----------	-----	--------	-------	------	----------	-------------	-----------------------





	Main To Repeat Repeat To Main Standard Resolution Formation Photoelectric Factor (PEFZ) HDRS-H 010	Main To Repeat Repeat To Main Cable Tension (TENS) 10000lbft0
--	---	--

TIME_1900 - Time Marked every 60.00 (s)

Description: HGNS standard resolution porosities for Platform Express Format: Log (Porosity-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:49

Channel Processing Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BHT	Bottom Hole Temperature	Borehole	177	degF
BS	Bit Size	WLSESSION	Depth Zoned	in
BSAL	Borehole Salinity	Borehole	900	ppm
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
DFT_WATER	Drilling Fluid Water Type	Borehole	WBM	
DHC	Density Hole Correction	HDRS-H	Bit Size	
FD	Fluid Density	Borehole	1	g/cm3
FSAL	Formation Salinity	Borehole	0	ppm
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
GTSE	Generalized Temperature Selection, from Measured or Computed Temperature	Borehole	CTEM	
HSCO	Hole Size Correction Option	HGNS-H	Yes	
MATR	Rock Matrix for Neutron Porosity Corrections	Borehole	SANDSTONE	
MDEN	Matrix Density for Density Porosity	Borehole	2.65	g/cm3
MFST	Mud Filtrate Sample Temperature	Borehole	68	degF
RMFS	Resistivity of Mud Filtrate Sample	Borehole	0.9	ohm.m
SOCO	Standoff Correction Option	HGNS-H	Yes	
TD	Total Measured Depth	Borehole	7532	ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
HMCA_BOARD_TYPE	HMCA Board Type	HGNS-H	1	
HRGD_BOARD_TYPE	HRGD Board Type	HDRS-H	WITH_HET	
MAX_LOG_SPEED	Tool Bit Maximum Logging Speed	WLSESSION	2222	ft/s

Calibration Report

HDRS-H (HILT Density and Rxo Sonde, 150 degC) Calibration - Run One

Primary Equipment :

HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
HILT Resistivity Gamma-Ray Density Device, 150 degC	HRGD-H	4899

Auxiliary Equipment :

HRDD Backscatter Detector	Backscatter	
HRDD Long Spacing Detector	Long Spacing	
HRDD Short Spacing Detector	Short Spacing	27786
Cesium 137 Gamma-Ray Logging Source	GSR-J	5471
HILT High-Resolution Control Cartridge, 150 degC	HRCC-H	48.17
HILT High-Resolution Mechanical Sonde, 150 degC	HRMS-H	4876

Calibration Parameter :

Small Ring Size (Caliper Calibration Small Ring)	8.00
Large Ring Size (Caliper Calibration Large Ring)	12.00

HDRS Caliper Calibration - Caliper Accumulations

Before (Measured): 21:07:42 05-Sep-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Small Ring	in	Before	8.00	6.00	7.80	10.00	
Large Ring	in	Before	12.00	9.00	12.20	15.00	

HDRS Density Calibration - Inversion Results

Master (EEPROM): 11:40:40 24-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Rho Aluminum	g/cm3	Master	2.596	2.586	2.600	2.606	
Rho Magnesium	g/cm3	Master	1.686	1.676	1.685	1.696	
Pe Aluminum		Master	2.570	2.470	2.571	2.670	
Pe Magnesium		Master	2.650	2.550	2.618	2.750	

HDRS Density Calibration - Deviation Summary

Master (EEPROM): 11:40:40 24-Aug-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Average Deviation	%	Master	0	-0.6000	0.2221	0.6000	
BS Max Deviation	%	Master	0	-1.6000	0.6566	1.6000	
SS Average Deviation	%	Master	0	-1.0000	0.2278	1.0000	
SS Max Deviation	%	Master	0	-2.5000	0.9144	2.5000	
LS Average Deviation	%	Master	0	-1.5000	0.6741	1.5000	
LS Max Deviation	%	Master	0	-3.5000	1.7270	3.5000	

HDRS Density Calibration - Background Summary

Master (EEPROM): 11:40:40 24-Aug-2016

Before (Measured):

21:08:15 05-Sep-2016

Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Window Ratio		Master	1.0000		0.7337		
		Before	0.7337	0.6970	0.7348	0.7704	
		Before-Master	-----	-----	0.0011	-----	
BS Window Sum	1/s	Master	1		25241		
		Before	25241	23979	25499	26504	
		Before-Master	-----	-----	258	-----	
SS Window Ratio		Master	1.0000		0.4797		
		Before	0.4797	0.4557	0.4811	0.5037	
		Before-Master	-----	-----	0.0014	-----	
SS Window Sum	1/s	Master	1		11057		
		Before	11057	10504	11035	11610	
		Before-Master	-----	-----	-22	-----	
LS Window Ratio		Master	1.0000		0.3012		
		Before	0.3012	0.2861	0.3073	0.3162	
		Before-Master	-----	-----	0.0061	-----	

LS Window Sum	1/s	Master Before Before-Master	1 1233 -----	1171 -----	1233 1232 -1	1294 -----	
---------------	-----	-----------------------------------	--------------------	---------------	--------------------	---------------	--

HDRS Density Calibration - Photo-multiplier High Voltages

Master (EEPROM): 11:40:40 24-Aug-2016		Before (Measured): 21:08:15 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS PM High Voltage	V	Master		1000	1452	2400	
		Before		1000	1449	2400	
		Before-Master	-----	-100	-3	100	
SS PM High Voltage	V	Master		1000	1410	2400	
		Before		1000	1411	2400	
		Before-Master	-----	-100	1	100	
LS PM High Voltage	V	Master		1000	1480	2400	
		Before		1000	1473	2400	
		Before-Master	-----	-100	-7	100	

HDRS Density Calibration - Crystal Quality Resolutions

Master (EEPROM): 11:40:40 24-Aug-2016		Before (Measured): 21:08:15 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
BS Crystal Resolution	%	Master		5.00	11.74	25.00	
		Before		5.00	11.74	25.00	
		Before-Master	-----	-1.00	0.00	1.00	
SS Crystal Resolution	%	Master		5.00	10.26	20.00	
		Before		5.00	10.24	20.00	
		Before-Master	-----	-1.00	-0.02	1.00	
LS Crystal Resolution	%	Master		5.00	8.09	20.00	
		Before		5.00	7.85	20.00	
		Before-Master	-----	-1.00	-0.24	1.00	

HDRS MCFL Calibration - MCFL Accumulations

Before (Measured): 21:10:47 05-Sep-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Main Resistivity	ohm.m	Before	3875	3565	3886	4185	
Deep Resistivity	ohm.m	Before	3830	3524	3830	4136	
Shallow Resistivity	ohm.m	Before	3830	3524	3839	4136	

HGNS-H (HILT Gamma-Ray and Neutron Sonde, 150 degC) Calibration - Run One

Primary Equipment :			
HILT Gamma-Ray and Neutron Sonde, 150 degC		HGNS-H	4817
Auxiliary Equipment :			
HGNS Accelerometer, 150 degC		HACCZ-H	6991
AmBe Neutron Logging Source		NSR-F	5068
Calibration Parameter :			
Water Temperature			
Housing Size			
JIG-BKG (Jig minus background reference)		165	

HGNS Accelerometer Calibration - Accelerometer Accumulations

Before (Measured): 05:14:18 07-Sep-2016							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
AZ Vertical Measurement	ft/s2	Before	32.2	31.5	32.0	32.8	

HGNS Accelerometer EEPROM - Accelerometer EEPROM Read

Master (EEPROM): 00:00:00 15-May-2007							
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Accelerometer Manufacturer		Master			QAT_160		
Accelerometer Reference Temperature	degF	Master		30.2	77.0	122.0	
Accelerometer Coefficients - 0		Master	-----	-----	-4298.000	-----	
Accelerometer Coefficients - 1		Master	-----	-----	50.180	-----	

Accelerometer Coefficients - 2		Master	-----	-----	-0.002	-----	
Accelerometer Coefficients - 3		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 4		Master	-----	-----	2.754	-----	
Accelerometer Coefficients - 5		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 6		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 7		Master	-----	-----	0.000	-----	
Accelerometer Coefficients - 8		Master	-----	-----	300.500	-----	
Accelerometer Coefficients - 9		Master	-----	-----	0.994	-----	

HGNS Neutron Calibration - HGNS Neutron Accumulations

Master (EEPROM):		15:25:00 19-Jul-2016		Before (Measured):		21:06:20 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Near Zero Measurement	1/s	Master	0	5.0	27.6	40.0	
		Before	0	5.0	28.2	40.0	
		Before-Master	-----	-4.1	0.6	4.1	
Far Zero Measurement	1/s	Master	0	5.0	29.5	40.0	
		Before	0	5.0	29.7	40.0	
		Before-Master	-----	-4.4	0.2	4.4	
Near Plus Measurement	1/s	Master	6031.0	4700.0	5290.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Far Plus Measurement	1/s	Master	2793.0	1900.0	2194.0	2900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Near Corrected Plus Measurement	1/s	Master		4700.0	5156.0	6900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	
Far Corrected Plus Measurement	1/s	Master		1900.0	2097.0	2900.0	
		Before	-----	-----	-----	-----	
		Before-Master	-----	-----	-----	-----	

HGNS Gamma-Ray Calibration - Gamma-Ray Accumulations

Before (Measured):		21:11:47 05-Sep-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
RGR Zero Measurement	gAPI	Before	30.0	0	78.9	120.0	
RGR Plus Measurement	gAPI	Before	185.4	157.1	165.1	206.3	
GR Calibration Gain		Before	0.89	0.80	1.00	1.05	

Company:	Western Refining, Southwest, Inc.	Schlumberger
Well:	WWD #2	
Field:	Wildcat	
County:	San Juan	
State:	New Mexico	
Platform Express		
Compensated Neutron		
Litho-Density		

Company: Western Refining, Southwest, Inc.

Well: WWD #2

Field: Wildcat

County: San Juan State: New Mexico

Platform Express	
Array Induction	
with Linear Correlation	
County: San Juan	Well: WWD #2
Field: Wildcat	Location: Sec 27, T29N, R11W
Well: WWD #2	Company: Western Refining, Southwest, Inc.
Logging Date: 05-Sep-2016	Run Number: One
Depth Driller: 7525.00 ft	Schlumberger Depth: 7532.00 ft
Bottom Log Interval: 7532.00 ft	Top Log Interval: 3498.00 ft
Casing Driller Size @ Depth: 9.625 in @ 3500.00 ft	Casing Schlumberger: 3498 ft
Bit Size: 8.75 in	Type Fluid In Hole: WBM
Density: 9.9 lbm/gal	Viscosity: 55 s
Fluid Loss: 9 cm3	PH: 8.6
MUD Source of Sample: Active Tank	RM @ Meas Temp: 1.13 ohm.m @ 68 degF
RM @ Meas Temp: 0.9 ohm.m @ 68 degF	RMC @ Meas Temp: 1.4 ohm.m @ 68 degF
Source RMC: Pressed	RM @ BHT: 0.46 @ 177 0.37 @ 177
Max Recorded Temperatures: 177 degF	Circulation Stopped: 06-Sep-2016 20:25:00
Logger on Bottom: 07-Sep-2016 05:00:00	Unit Number: 9115
Recorded By: Avery Becker	Witnessed By: Larry Candelaria

Disclaimer

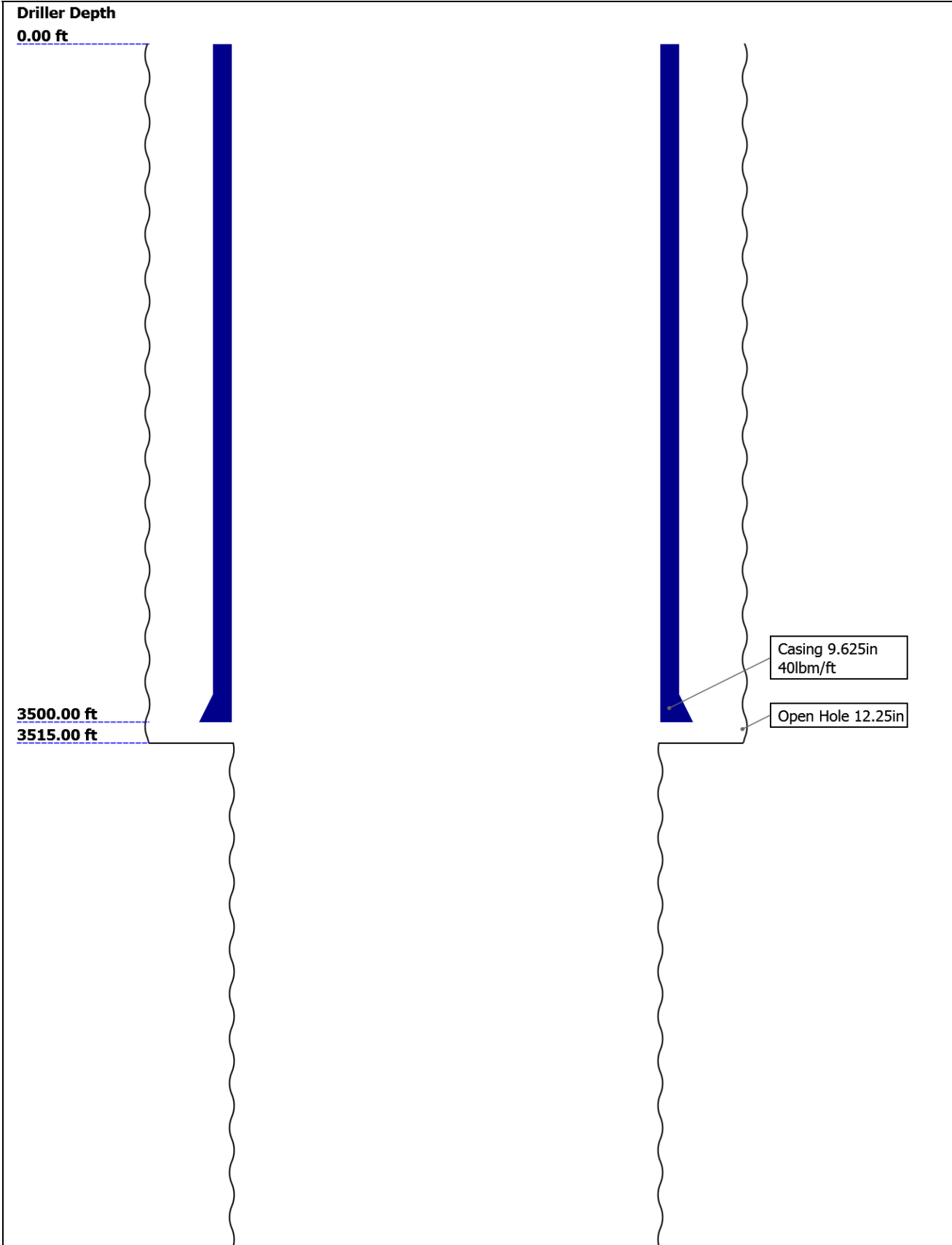
THE USE OF AND RELIANCE UPON THIS RECORDED-DATA BY THE HEREIN NAMED COMPANY (AND ANY OF ITS AFFILIATES, PARTNERS, REPRESENTATIVES, AGENTS, CONSULTANTS AND EMPLOYEES) IS SUBJECT TO THE TERMS AND CONDITIONS AGREED UPON BETWEEN SCHLUMBERGER AND THE COMPANY, INCLUDING: (a) RESTRICTIONS ON USE OF THE RECORDED-DATA; (b) DISCLAIMERS AND WAIVERS OF WARRANTIES AND REPRESENTATIONS REGARDING COMPANY'S USE AND RELIANCE UPON THE RECORDED-DATA; AND (c) CUSTOMER'S FULL AND SOLE RESPONSIBILITY FOR ANY INFERENCE DRAWN OR DECISION MADE IN CONNECTION WITH THE USE OF THIS RECORDED-DATA.

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Well Sketch



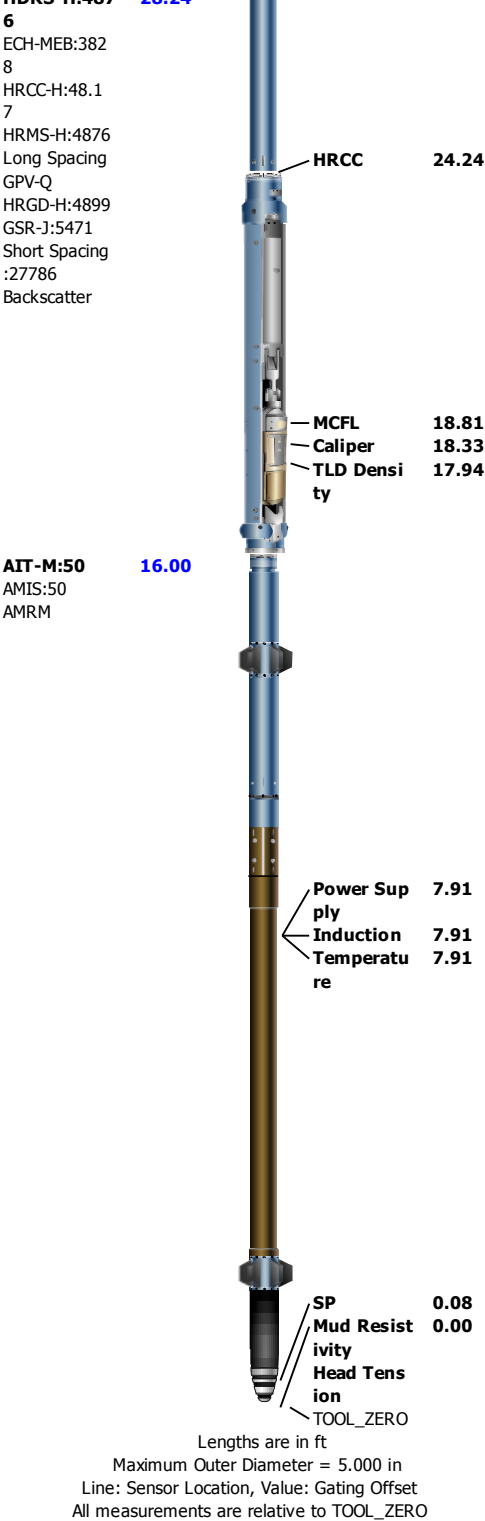


Borehole Size/Casing/Tubing Record

Bit						
Bit Size (in)	12.25	8.75				
Top Driller (ft)	0	3515				
Top Logger (ft)	0	3515				
Bottom Driller (ft)	3515	7525				
Bottom Logger (ft)	3515	7532				
Casing						
Size (in)	9.625					
Weight (lbm/ft)	40					
Inner Diameter (in)	8.835					
Grade	N/A					
Top Driller (ft)	0					
Top Logger (ft)	0					
Bottom Driller (ft)	3500					
Bottom Logger (ft)	3498					

Remarks and Equipment Summary

One: Toolstring				One: Remarks	
Equip name LEH-QT LEH-QT	Length 43.57	MP name	Offset	Toolstring run as per tool sketch	
				Matrix: Sandstone (2.65 g/cc)	
				Log may be affected by 20% LCM in drilling mud	
				Caliper check in casing=8.87 in, within tolerance	
				Cement volume calculated using 7 in future casing diameter	
DTC-H:8980 ECH-KC:1005 3 DTC-H:8980	40.65	CTEM HV	39.75 0.00	Rig: Aztec 920	
HGNS-H:481 7 HGNH:4865 NPV-N NSR-F:5068 HGNS-H:4817 HACCZ-H:699 1 HMCA-H	37.65	TelStatus ToolStatus Temperature GR	37.65 37.65 37.62 36.91	Crew: Derrick Hunter	
				Thank you for choosing Schlumberger	
HDPS-H:487	28.24	CNL Porosity HMCA HGNS Accelerometer	30.57 28.24 28.24 0.00		



Depth Summary

	One		
--	-----	--	--

Depth Measuring Device

Type	IDW-JA		
Serial Number	6568		
Calibration Date	23-Dec-2015		
Calibrator Serial Number			
Calibration Cable Type	7-46A-XS		
Wheel Correction 1	-1		
Wheel Correction 2	0		

Tension Device

Type	CMTD-B/A		
------	----------	--	--

Serial Number	147	
Calibration Date	18-Aug-2016	
Calibrator Serial Number	78805A	
Number of Calibration Points	10	
Calibration Root Mean Square Error	7	
Calibration Peak Error	10	

Logging Cable

Type	7-46A-XS		
Serial Number	U715043		
Length	24000.00 ft		
Conveyance Type	Wireline		
Rig Type	Land		

One:Depth Control Parameters

Depth Control Remarks

Log Sequence	First Log In the Well	First run in well depth control procedures followed
Rig Up Length At Surface		IDW used as primary depth device, z-chart used for secondary
Rig Up Length At Bottom		
Rig Up Length Correction		
Stretch Correction		
Tool Zero Check At Surface		

One

2" Induction

Integration Summary

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
ICV	Integrated Cement Volume	GCSE_UP_PASS, FCD	623.08	ft3

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2

One: Log[4]:Up:S012

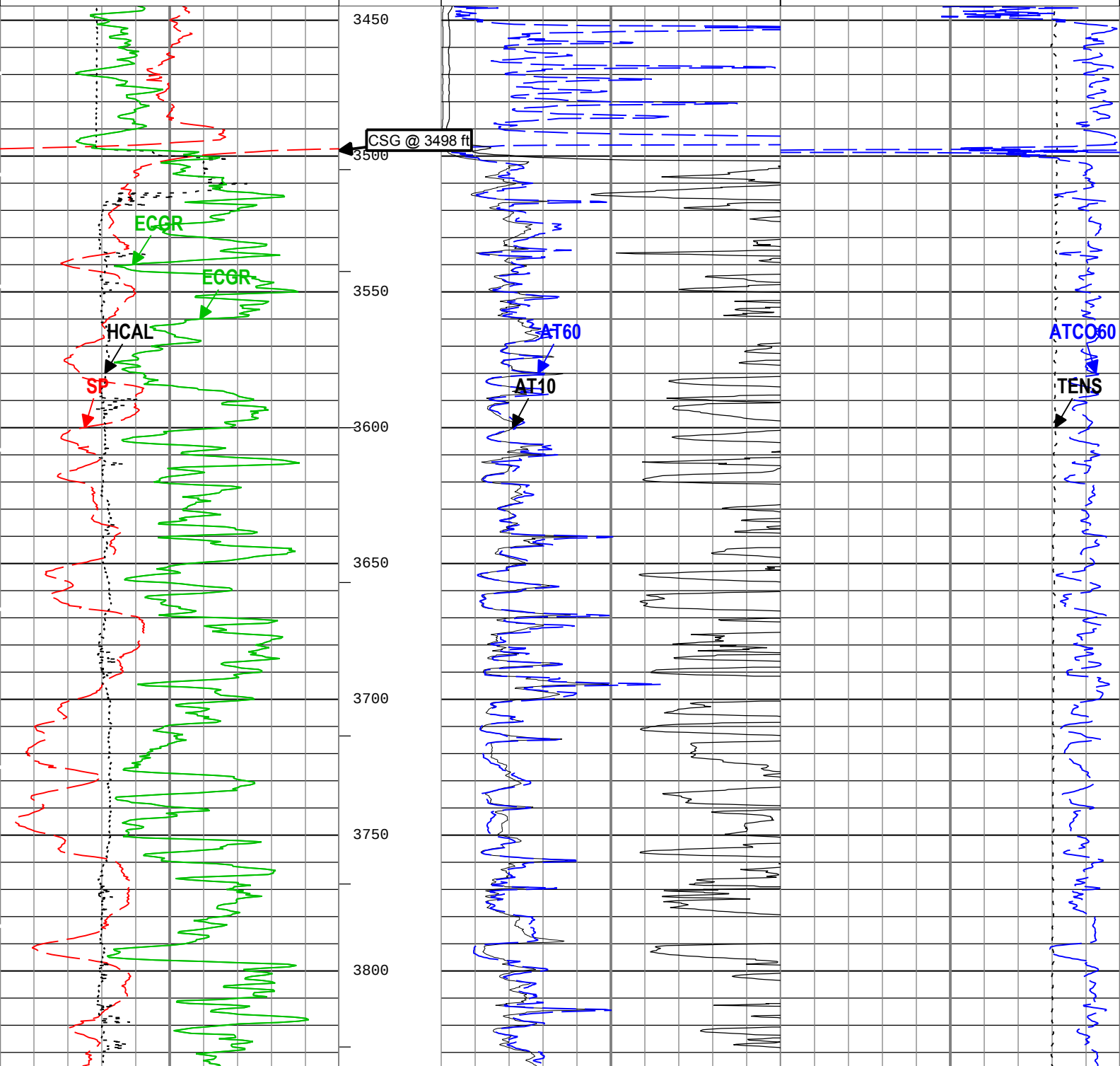
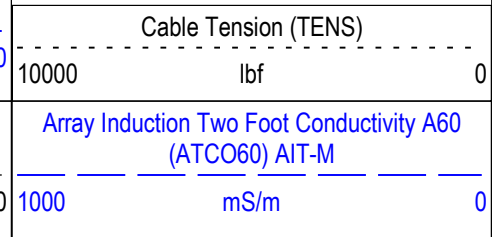
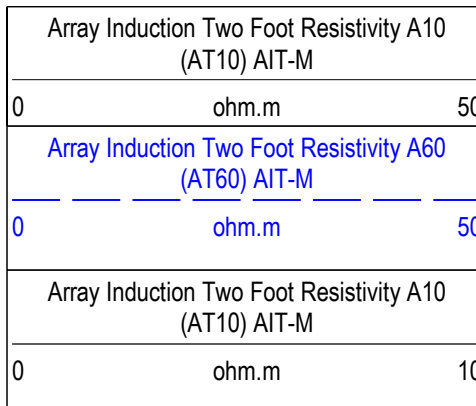
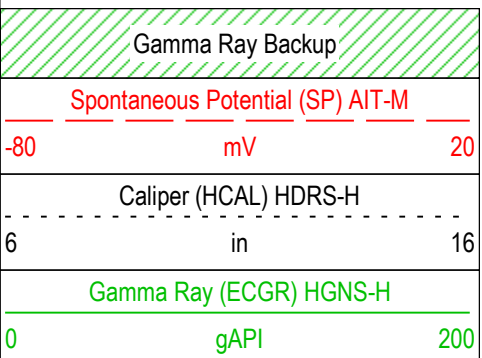
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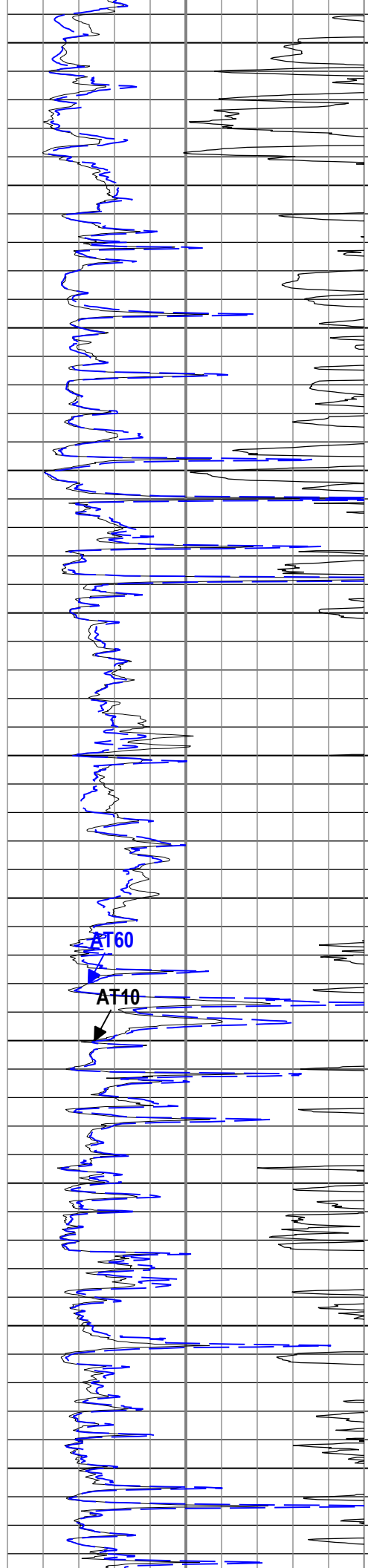
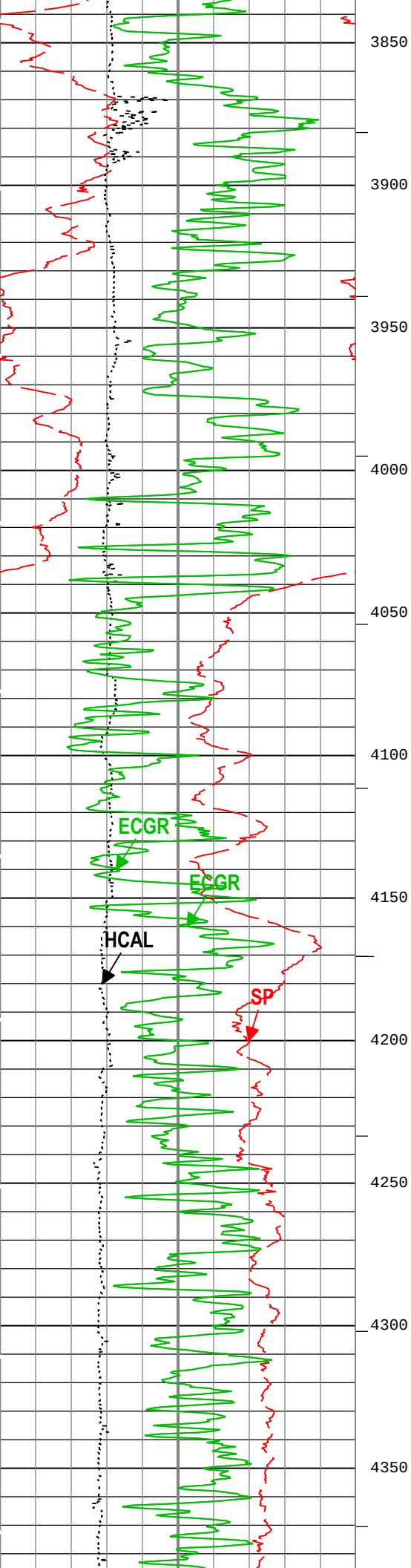
Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT60	AIT-M:AMIS:AMIS	3in
ATCO60	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
GR	HGNS-H:HGNS-H:HGNS-H	6in
ICV	Borehole	6in - RT
SP	AIT-M:AMIS:AMIS	6in
TENS	WI Workflow	6in

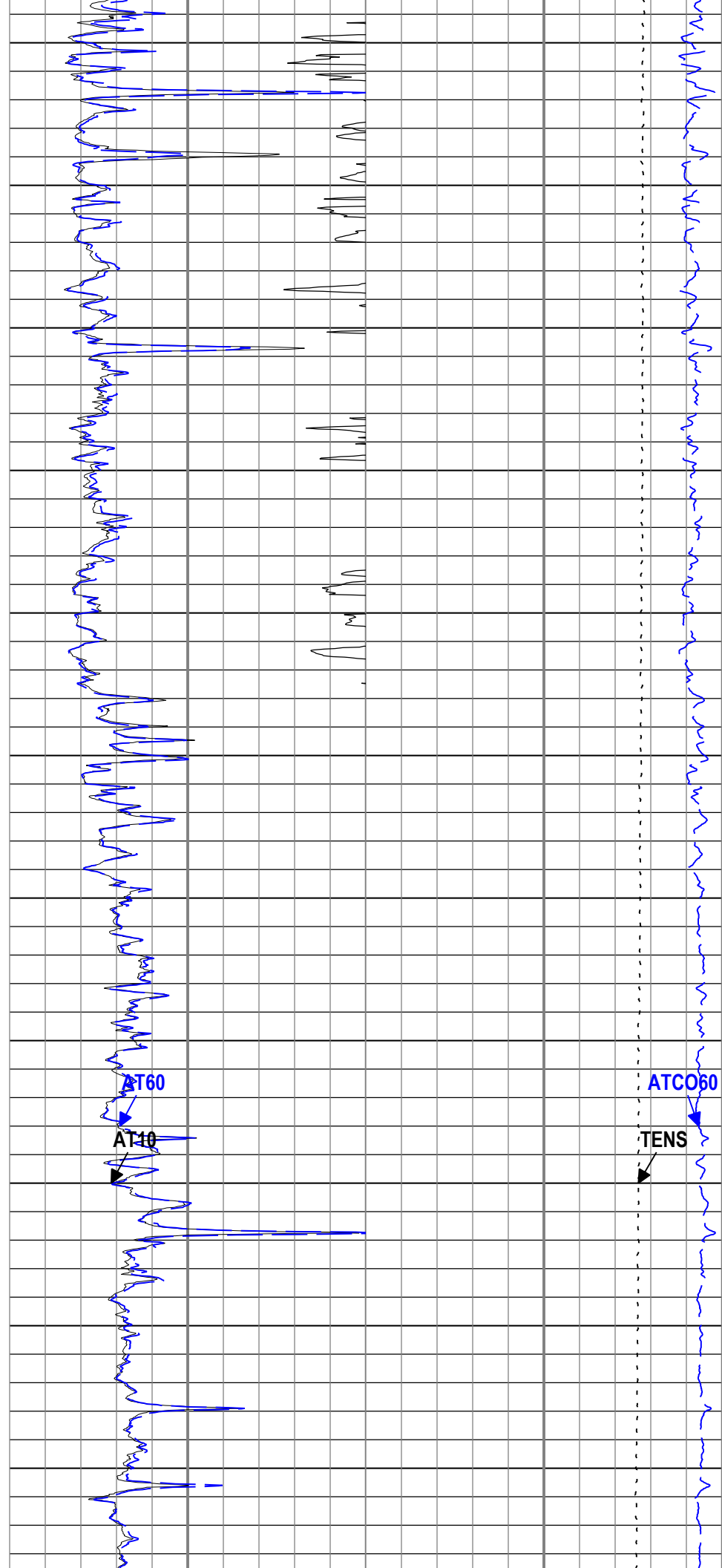
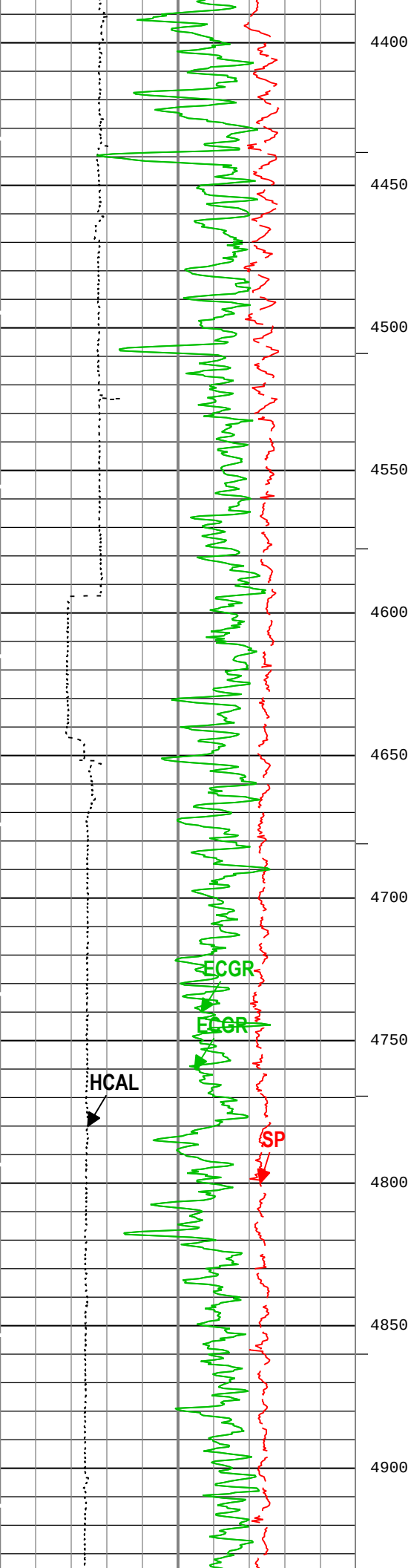
TIME_1900 - Time Marked every 60.00 (s)

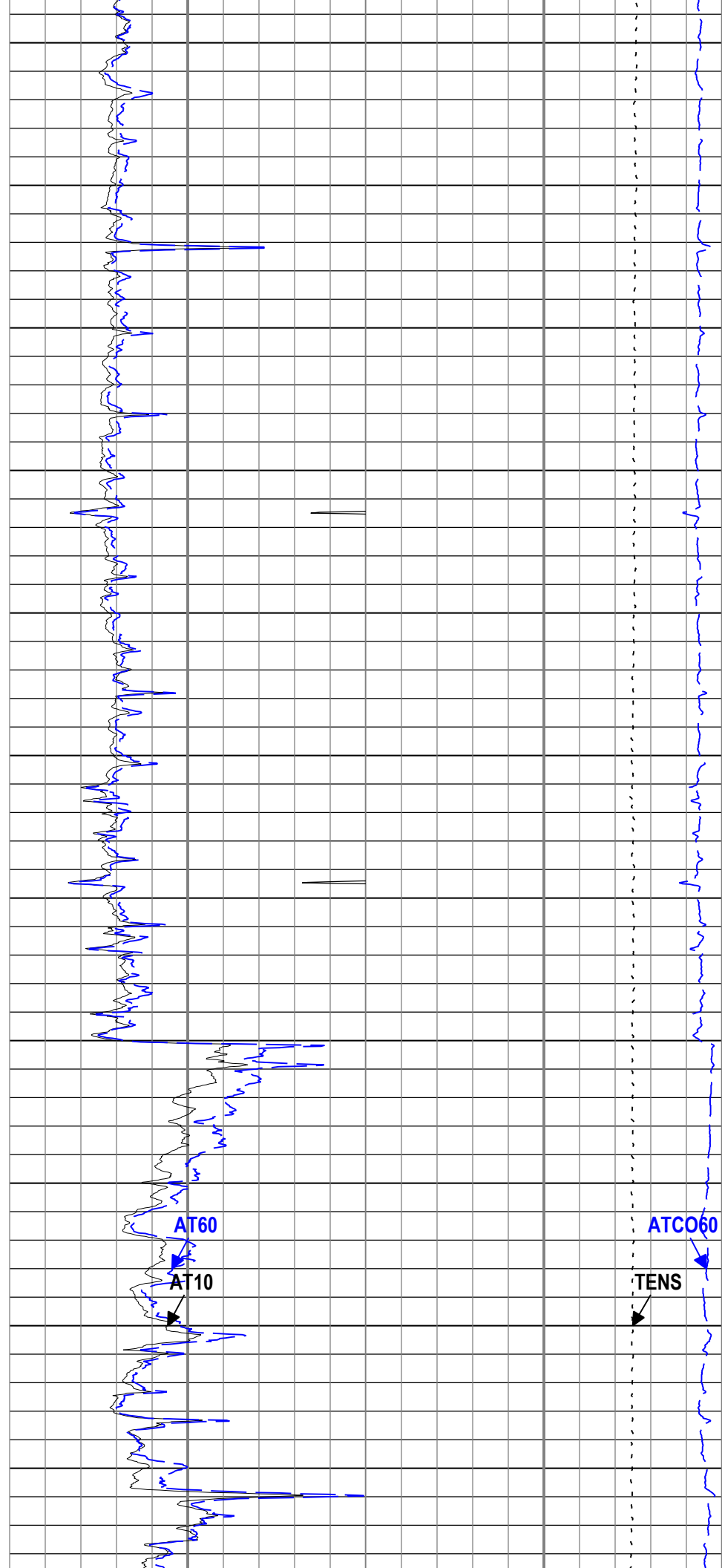
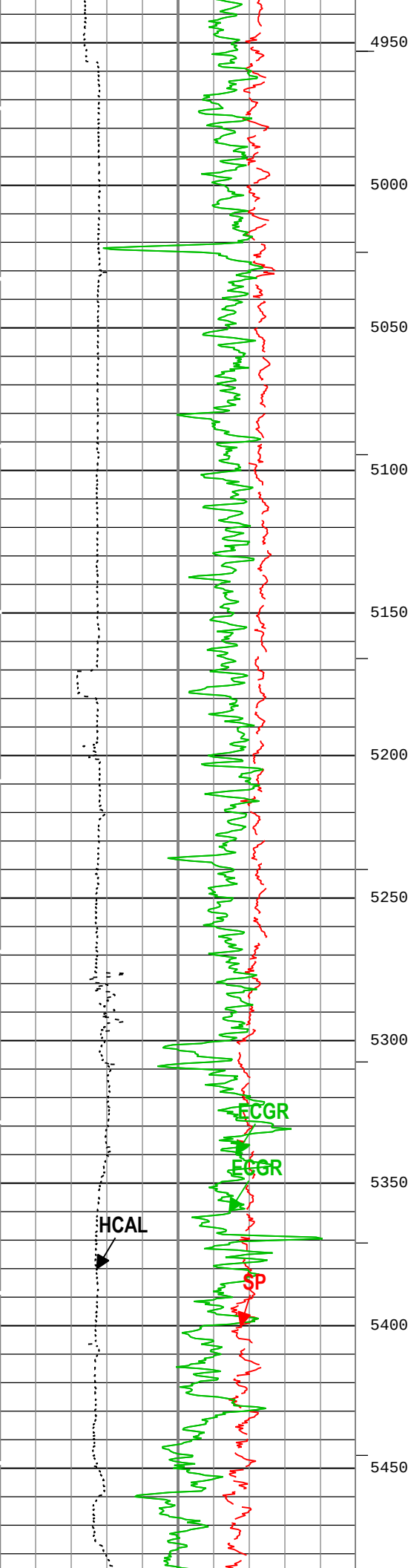
ICV - Integrated Cement Volume every 10.00 (ft3)

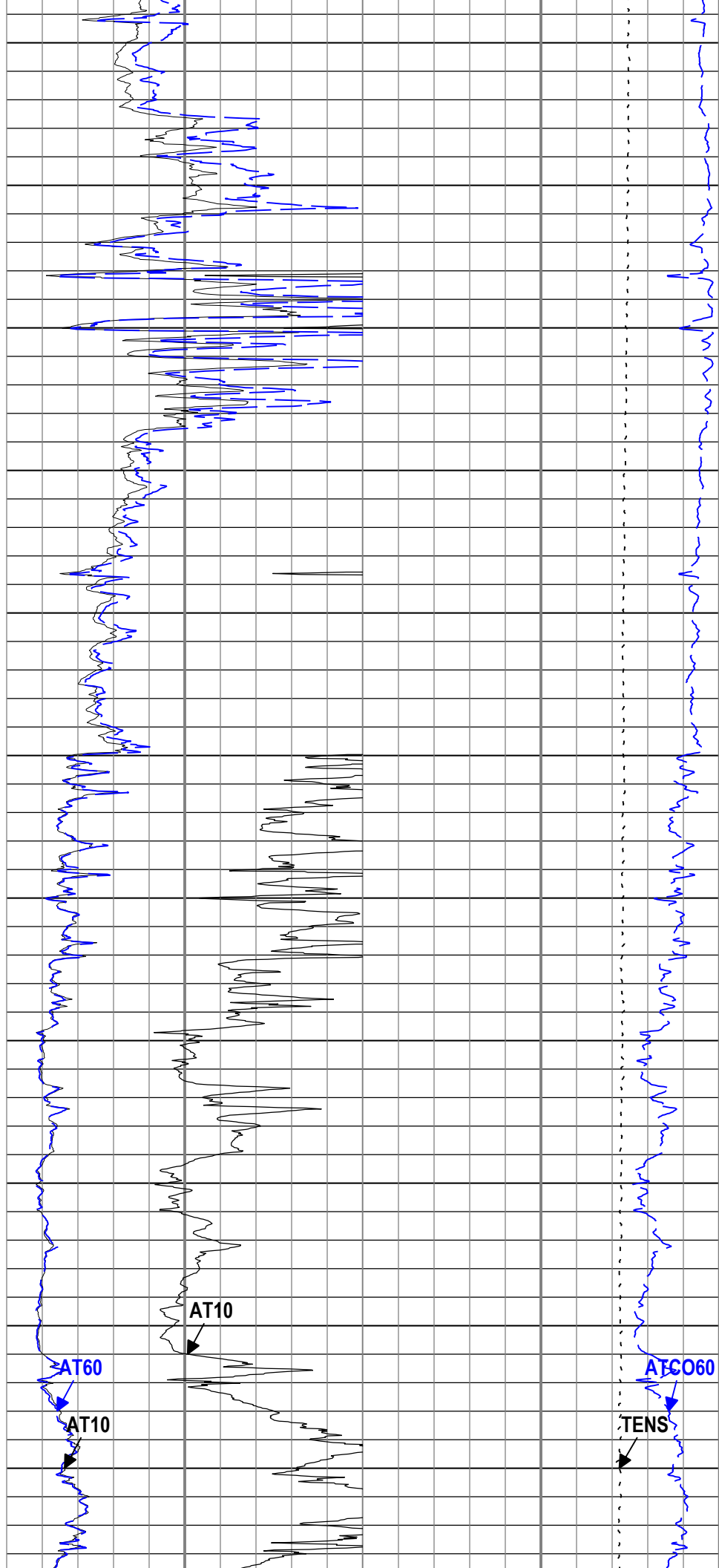
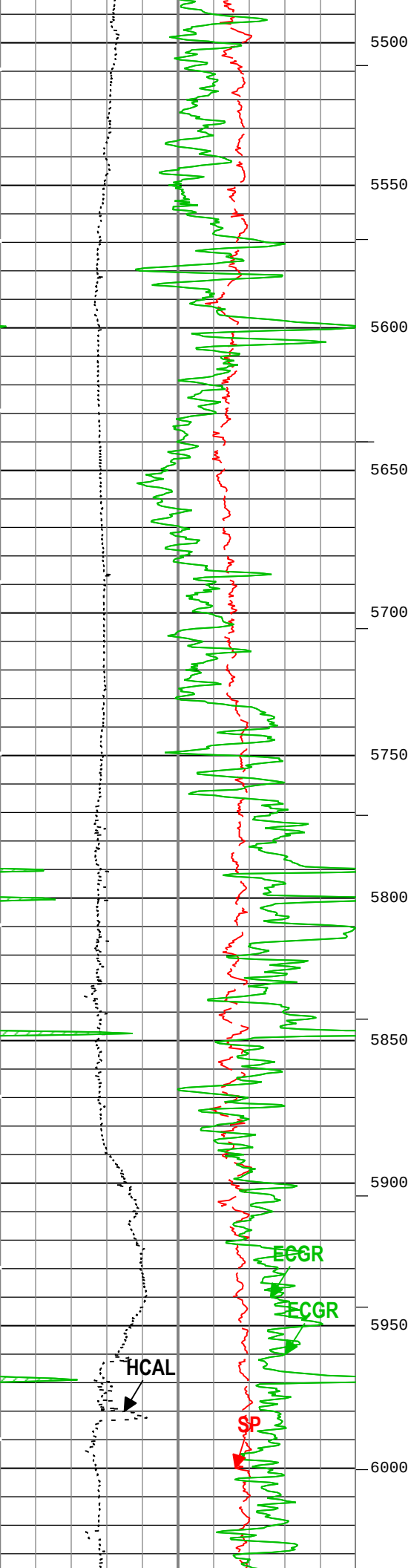
ICV - Integrated Cement Volume every 100.00 (ft3)

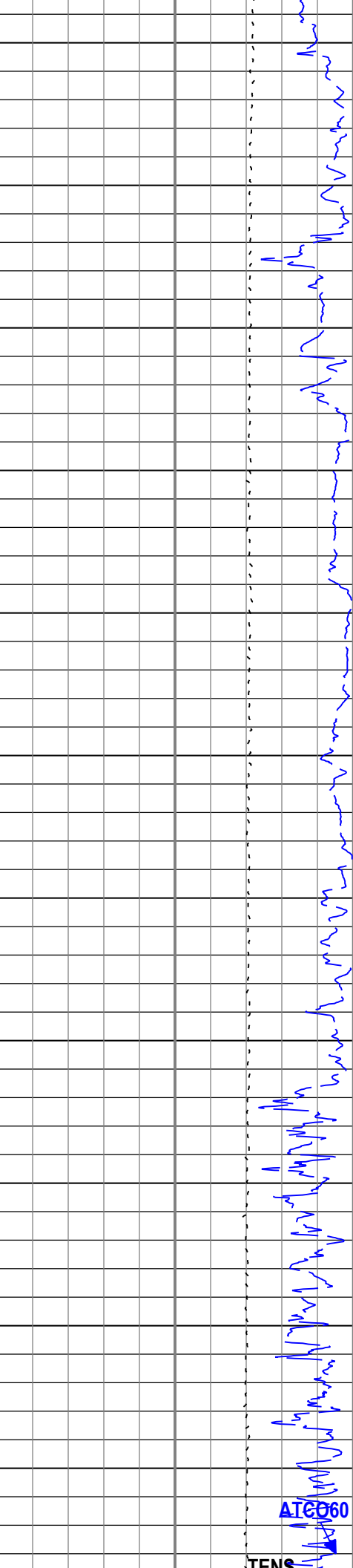
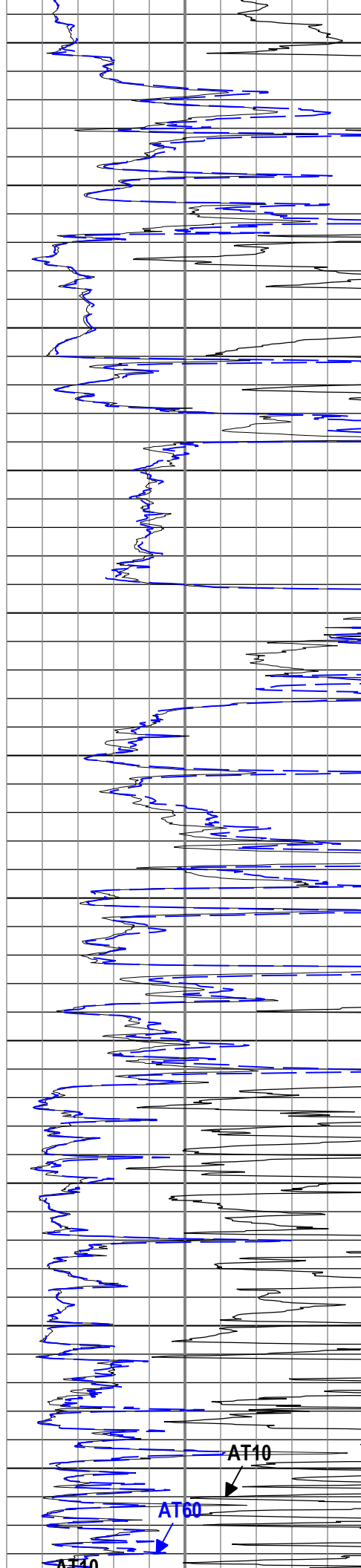
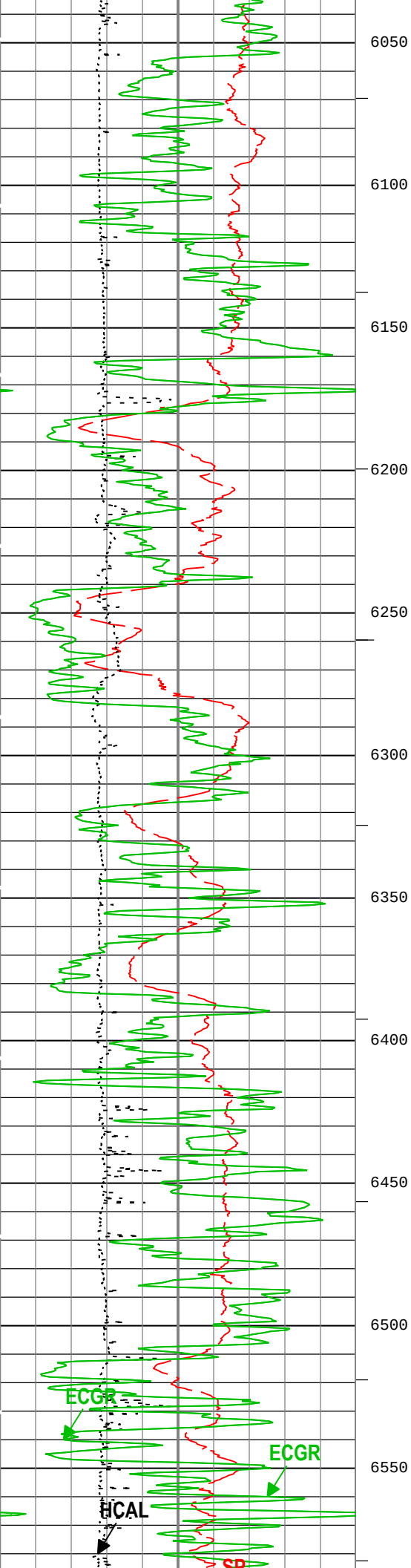


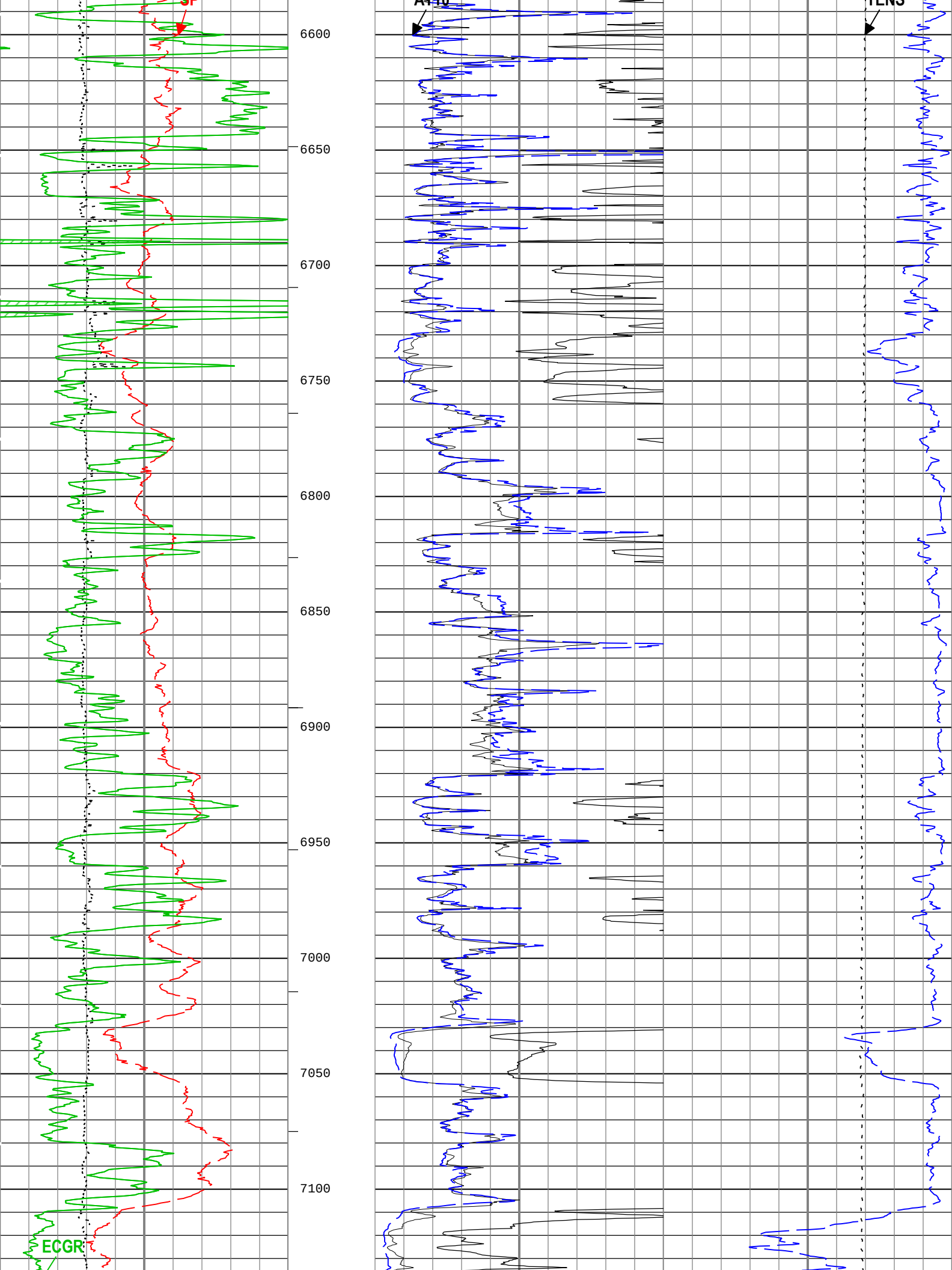


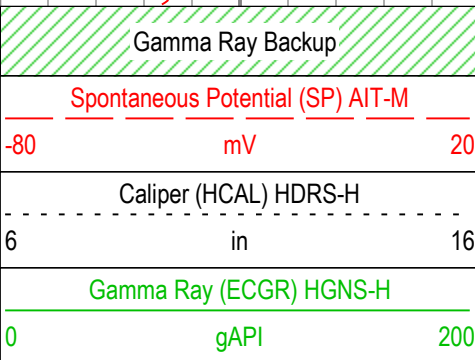
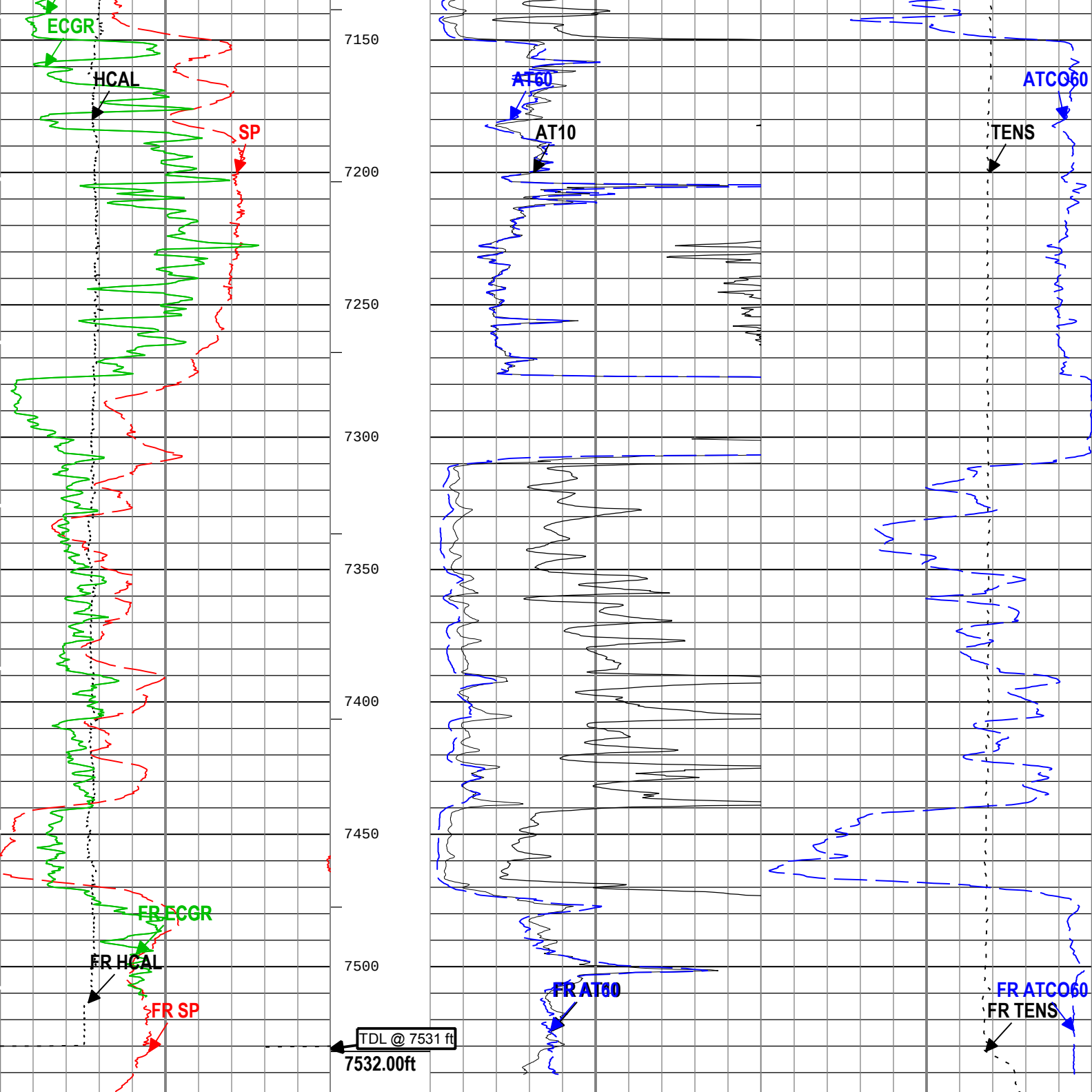












Array Induction Two Foot Resistivity A10 (AT10) AIT-M		
0	ohm.m	50
Array Induction Two Foot Resistivity A60 (AT60) AIT-M		
0	ohm.m	50
Array Induction Two Foot Resistivity A10 (AT10) AIT-M		
0	ohm.m	10

Cable Tension (TENS)		
10000	lbf	0
Array Induction Two Foot Conductivity A60 (ATCO60) AIT-M		
1000	mS/m	0

ICV - Integrated Cement Volume every 100.00 (ft3)
ICV - Integrated Cement Volume every 10.00 (ft3)

Channel Processing Parameters**One: Parameters**

Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depths are actual.

Tool Control Parameters**One: Parameters**

Parameter	Description	Tool	Value	Unit
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One**5" Induction****Integration Summary**

Output Channel(s)	Output Description	Input Parameter	Output Value	Unit
ICV	Integrated Cement Volume	GCSE_UP_PASS, FCD	623.08	ft3
IHV	Integrated Hole Volume	GCSE_UP_PASS	1705.5	ft3

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero.

Description: AIT Basic Log Two Format: Log (Induction-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:14

Channel	Source	Sampling
AT10	AIT-M:AMIS:AMIS	3in
AT20	AIT-M:AMIS:AMIS	3in
AT30	AIT-M:AMIS:AMIS	3in
AT60	AIT-M:AMIS:AMIS	3in
AT90	AIT-M:AMIS:AMIS	3in
CALI	HDRS-H:HRCC-H:HRCC-H	1in
GR	HGNS-H:HGNS-H:HGNS-H	6in
ICV	Borehole	6in - RT
IHV	Borehole	6in - RT
SP	AIT-M:AMIS:AMIS	6in
TENS	WLWorkflow	6in
TIME_1900	WLWorkflow	0.1in

— IHV - Integrated Hole Volume every 10.00 (ft3)

— IHV - Integrated Hole Volume every 100.00 (ft3)

— ICV - Integrated Cement Volume every 10.00 (ft3)

— ICV - Integrated Cement Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

Cable Tension (TENS)

10000

lbf

0

Array Induction Two Foot Resistivity A10 (AT10) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A20 (AT20) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A30 (AT30) AIT-M

0.2

ohm.m

2000

Array Induction Two Foot Resistivity A60 (AT60) AIT-M

0.2

ohm.m

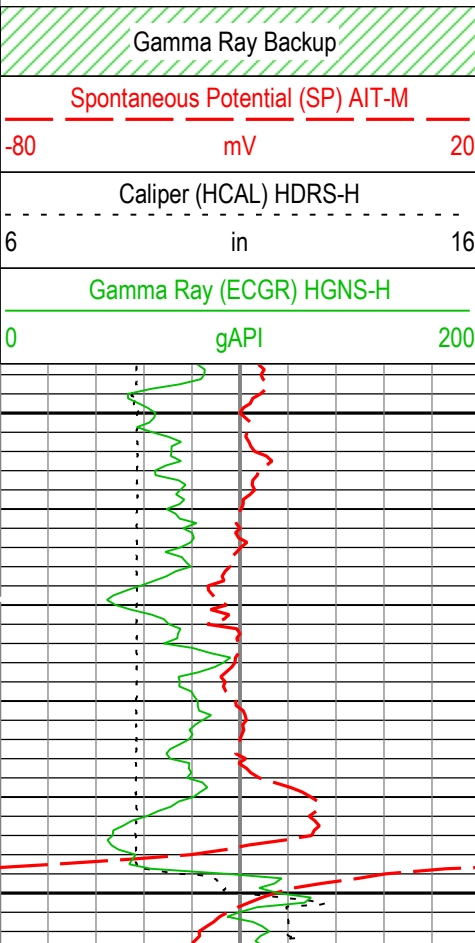
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Array Induction Two Foot Resistivity A90 (AT90) AIT-M

0.2

ohm.m

2000



3450

3460

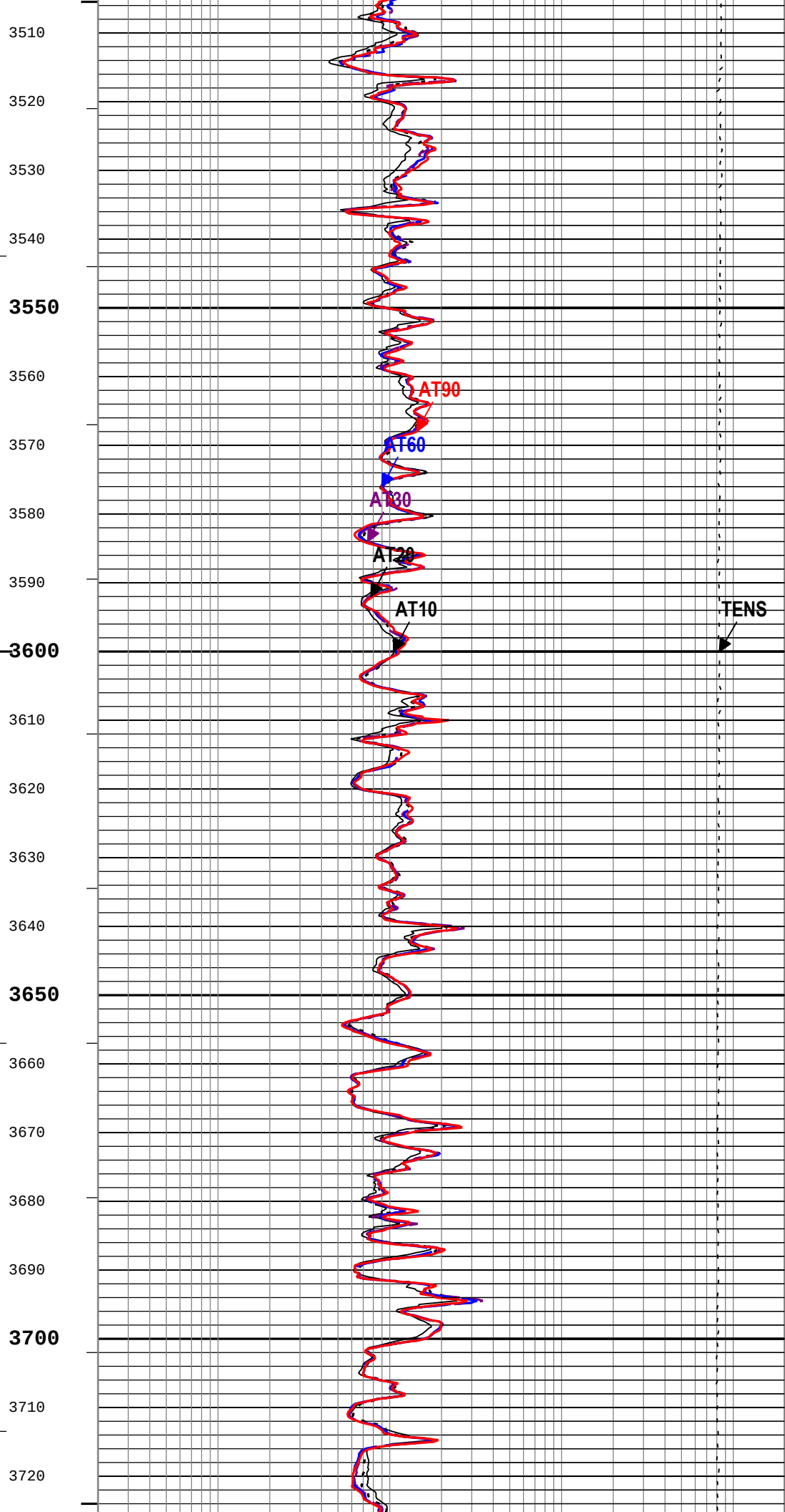
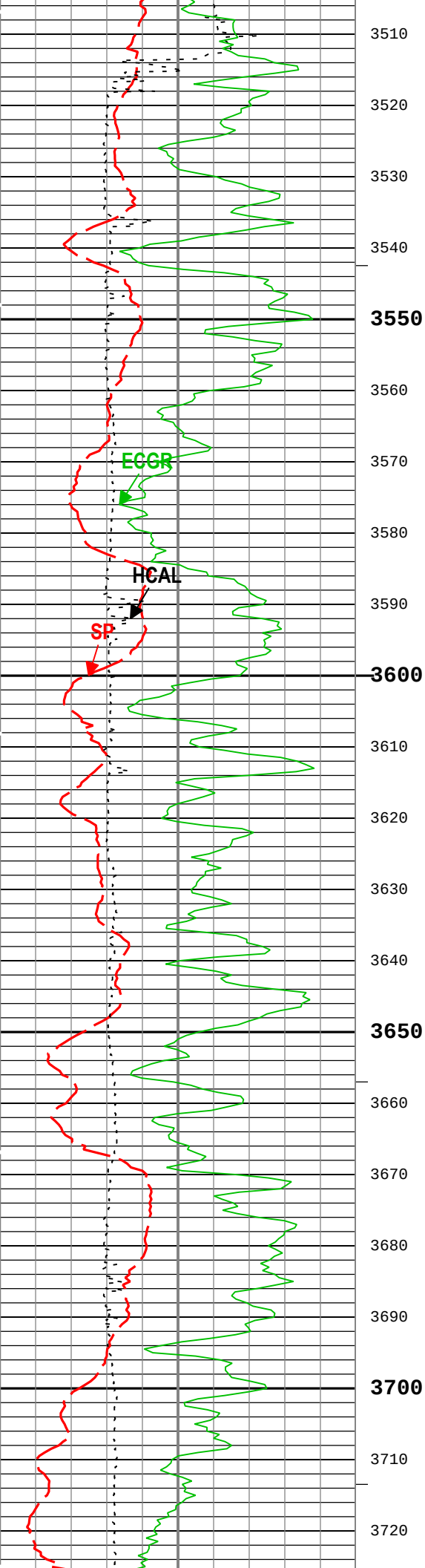
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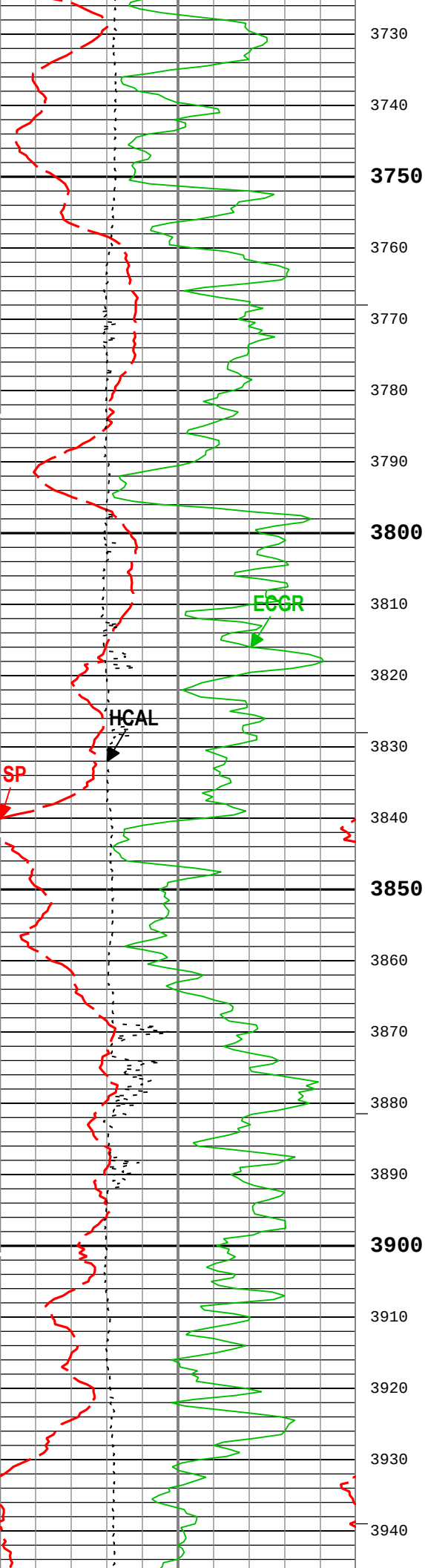
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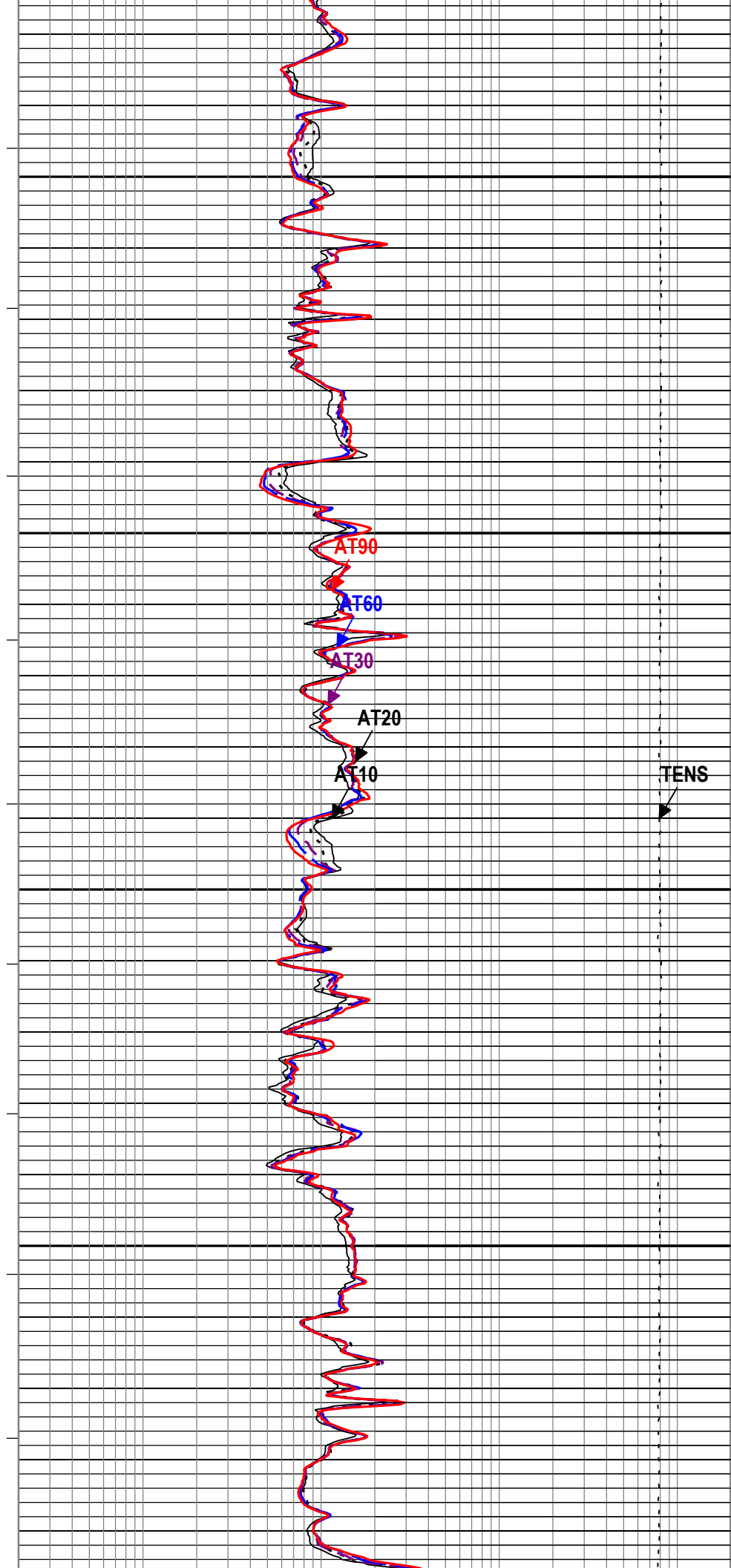
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CSG @ 3498 ft

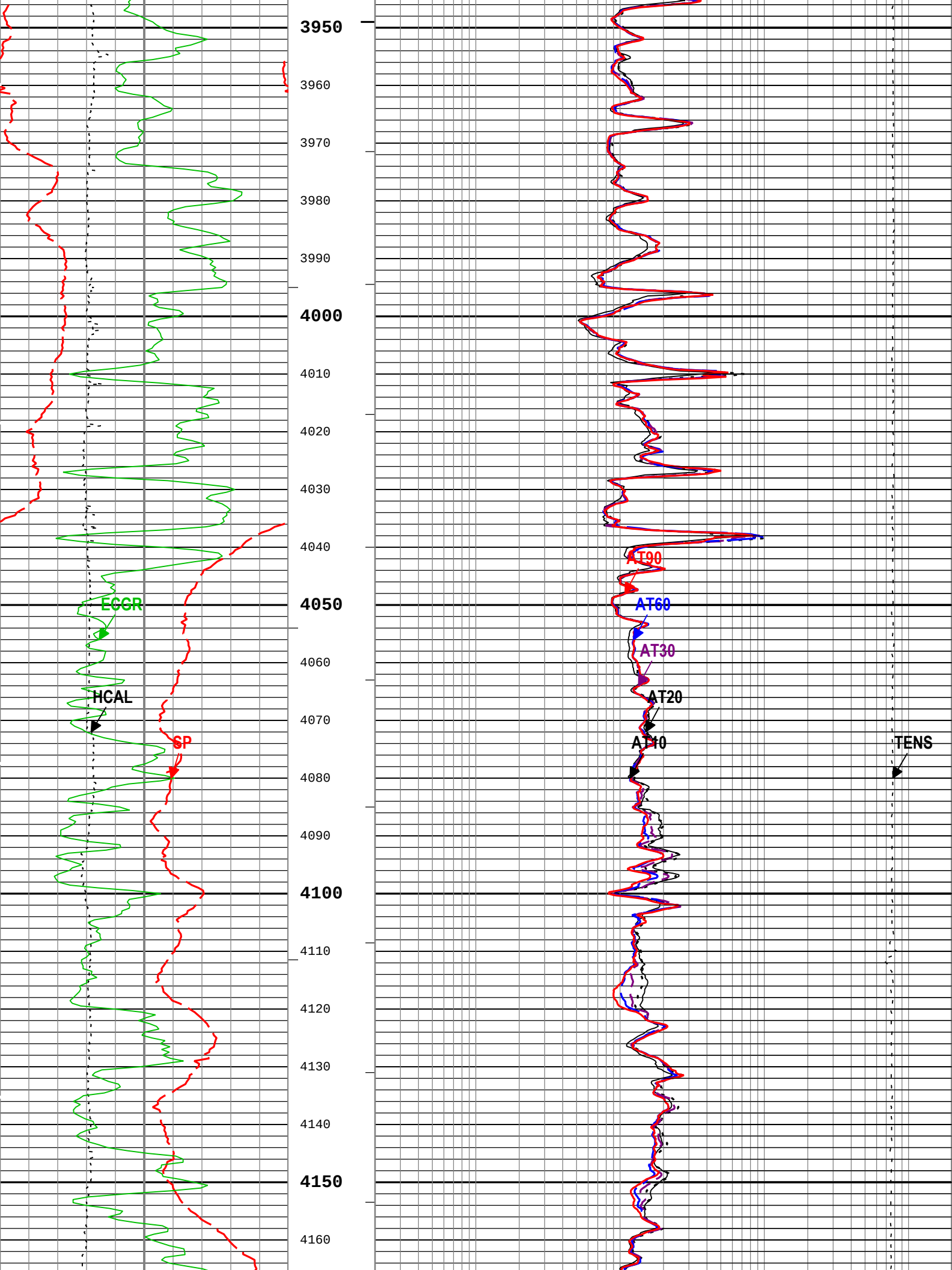


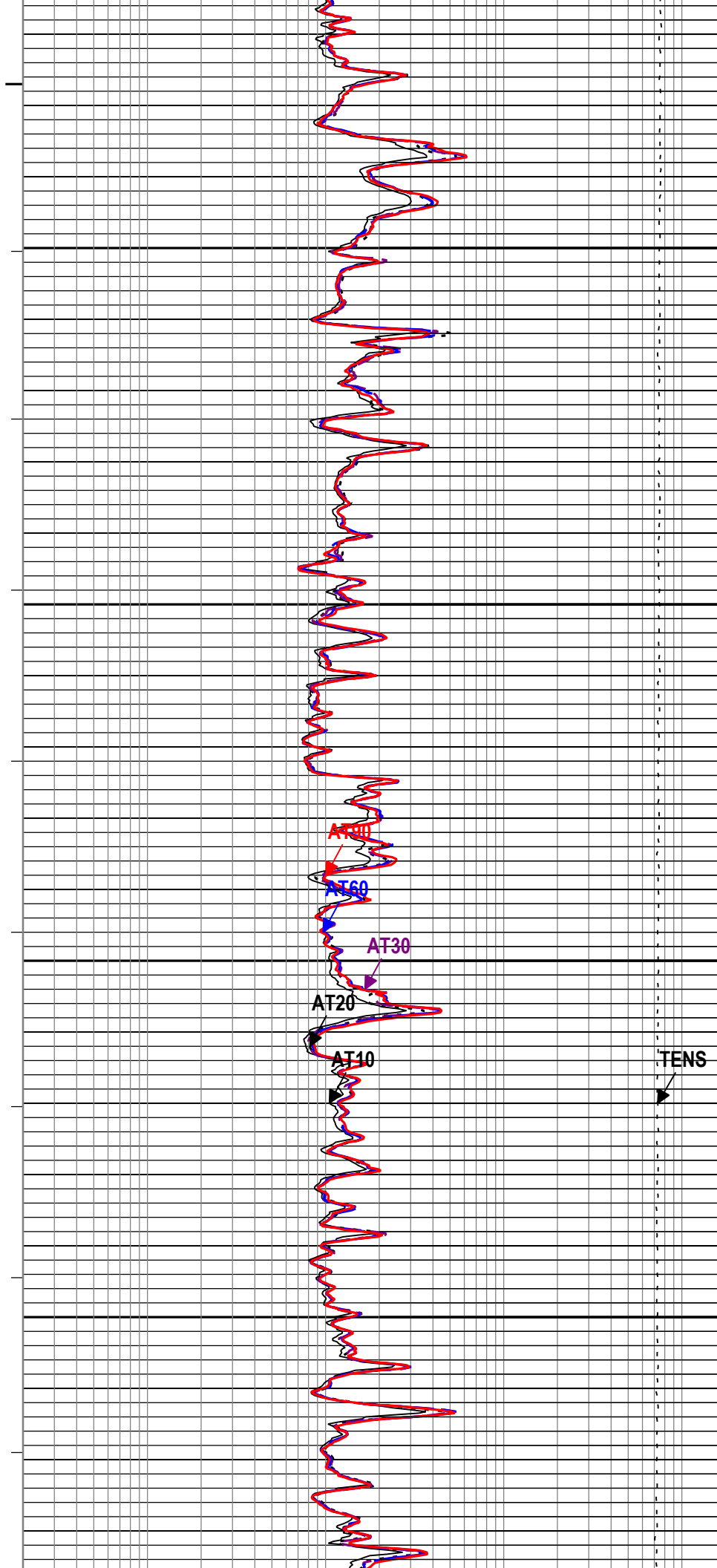
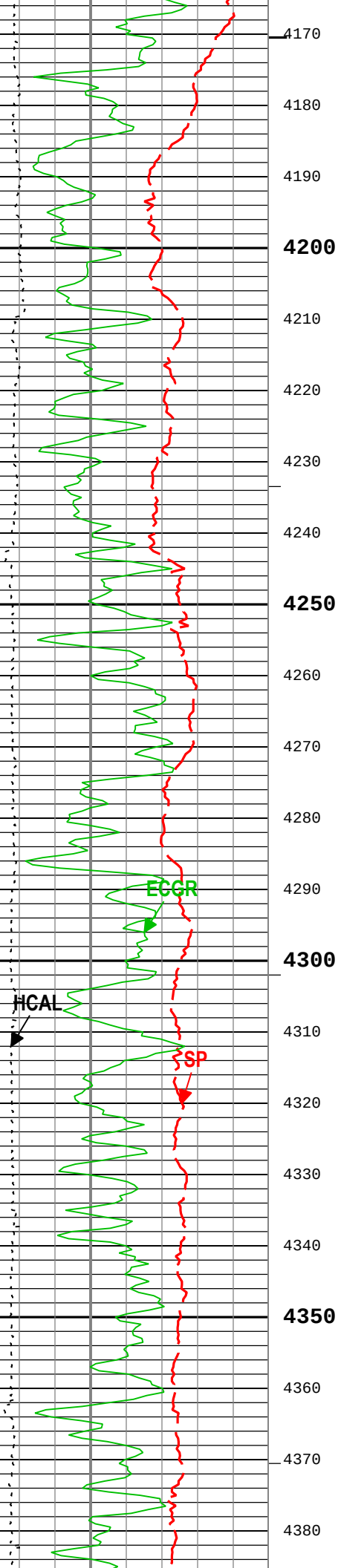


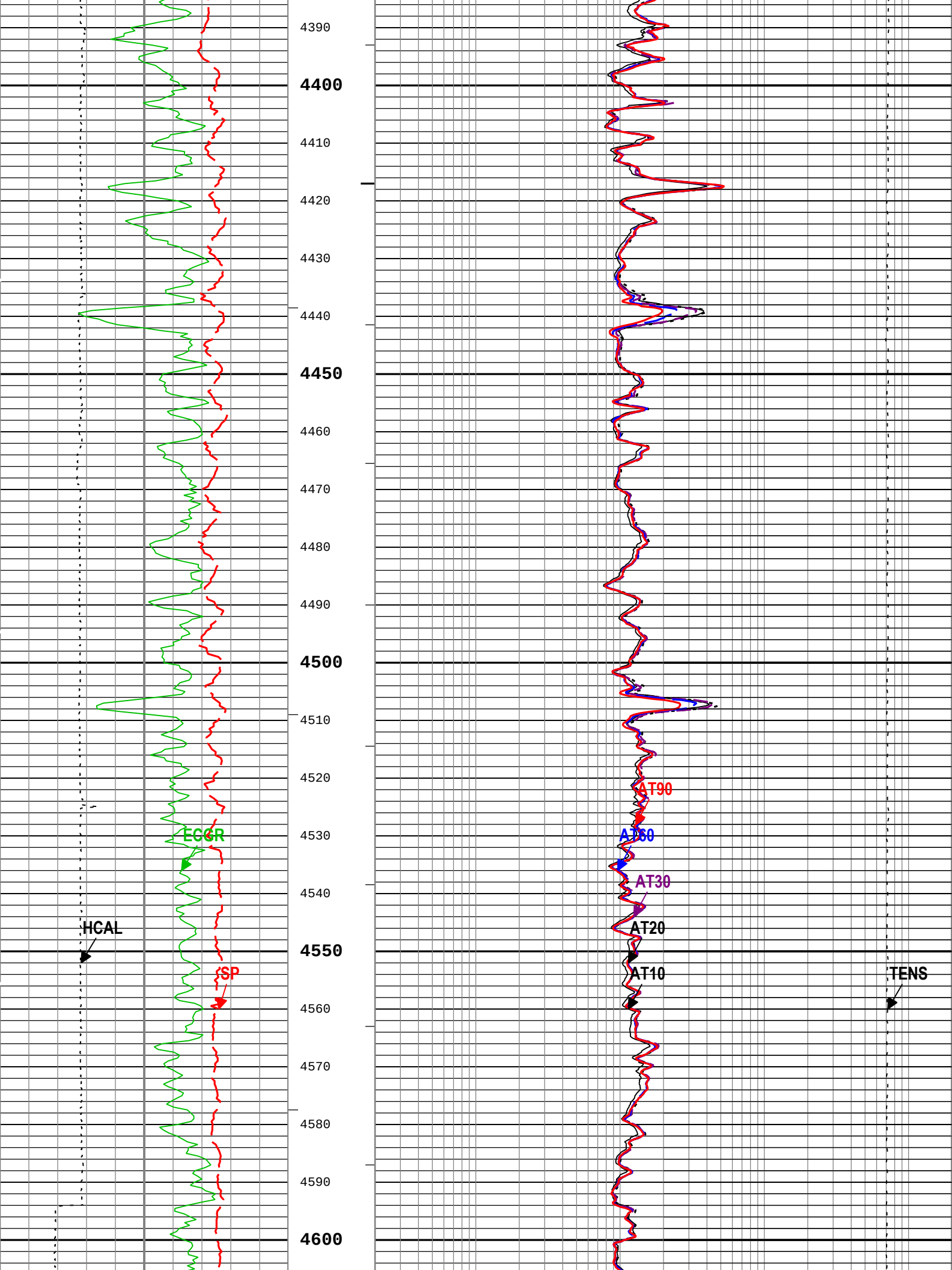
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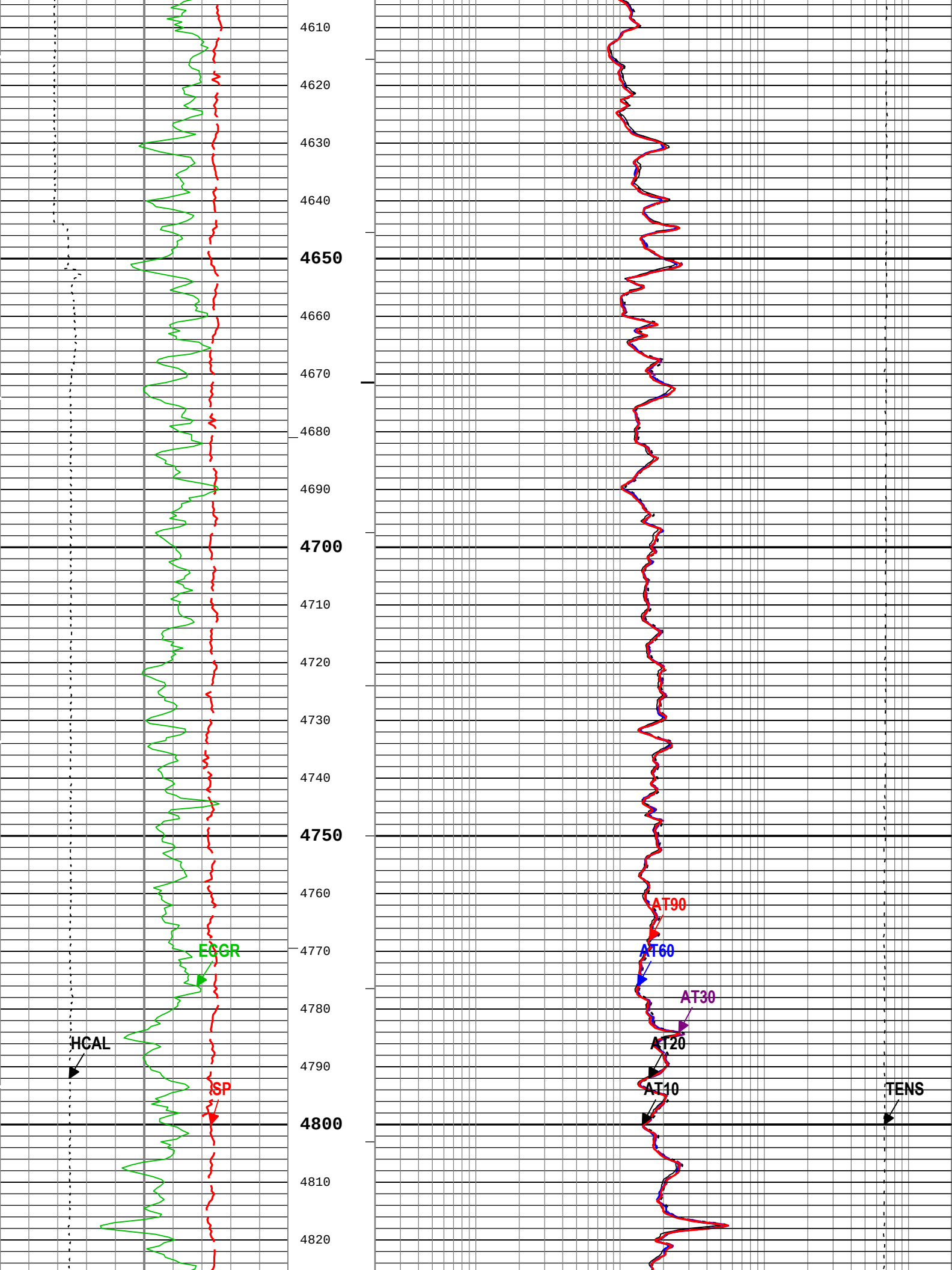


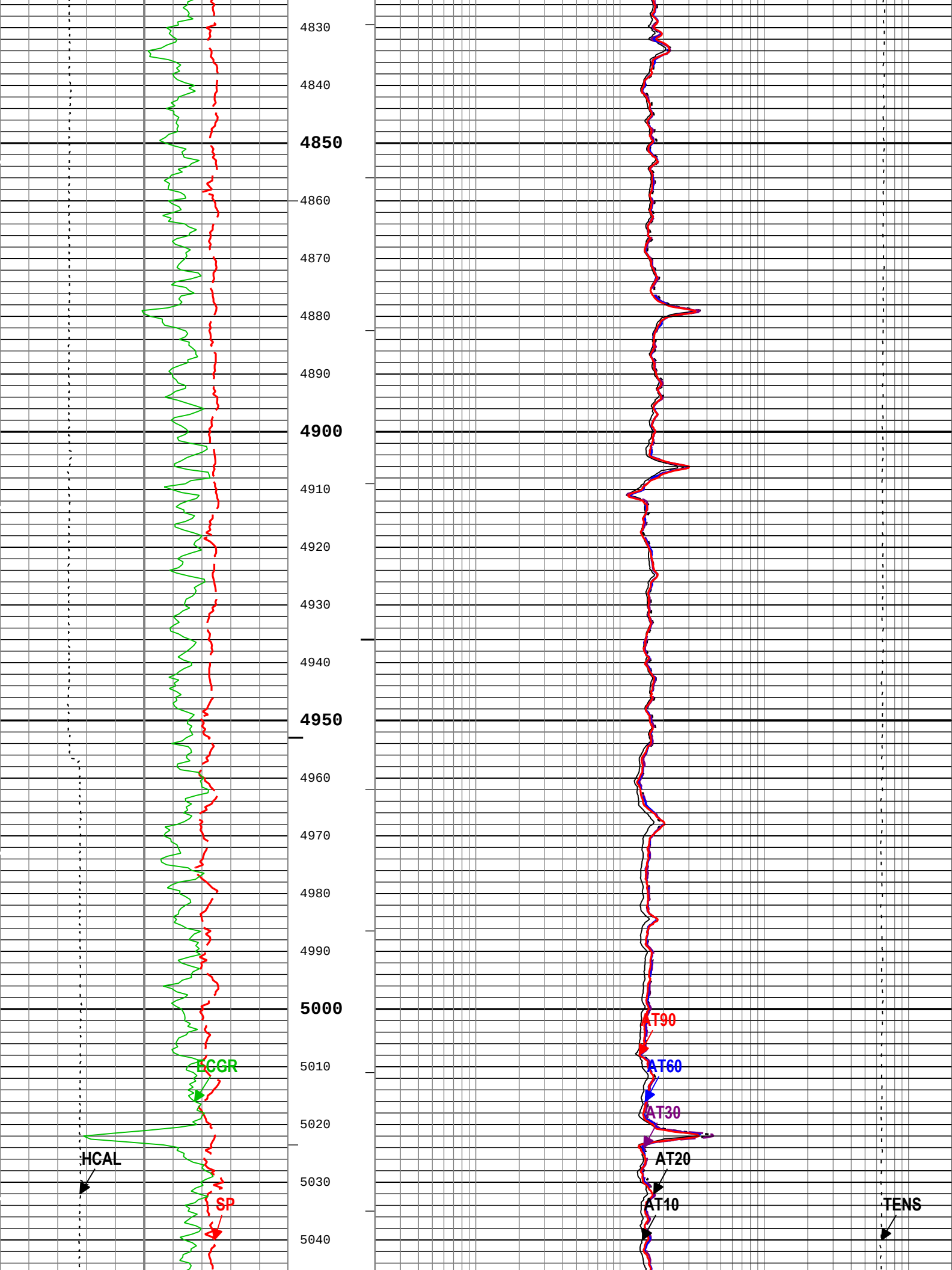
TENS

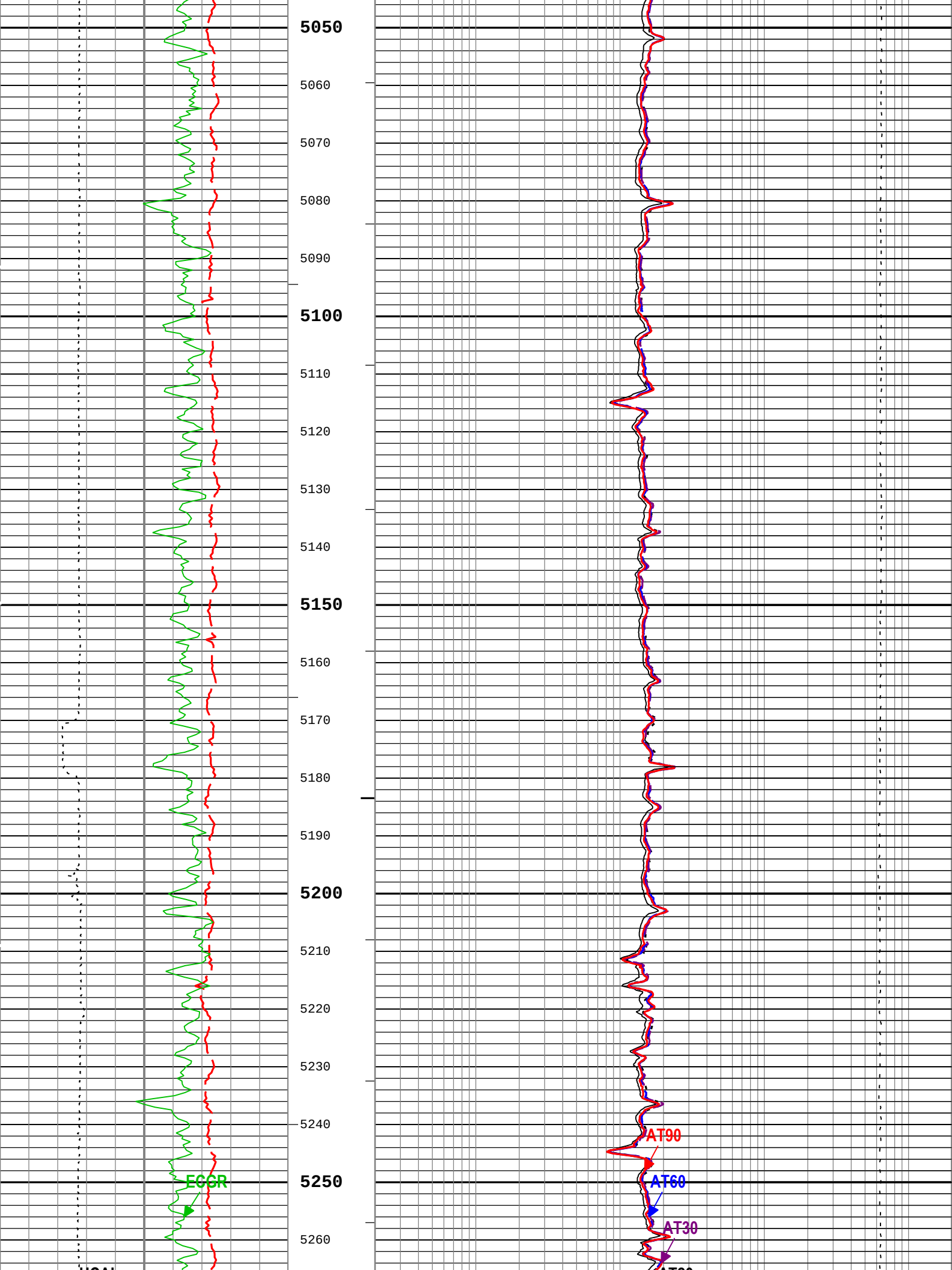


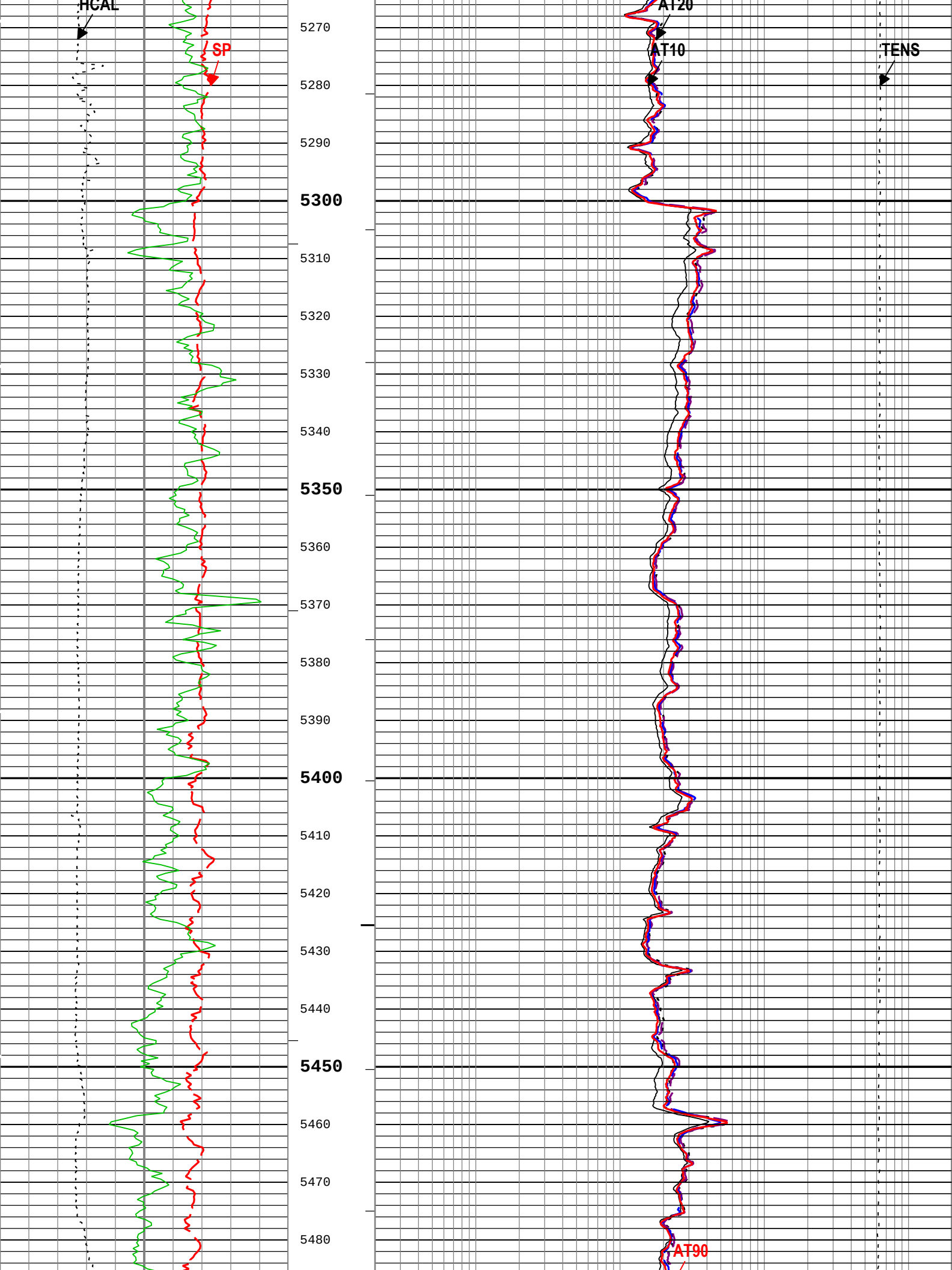


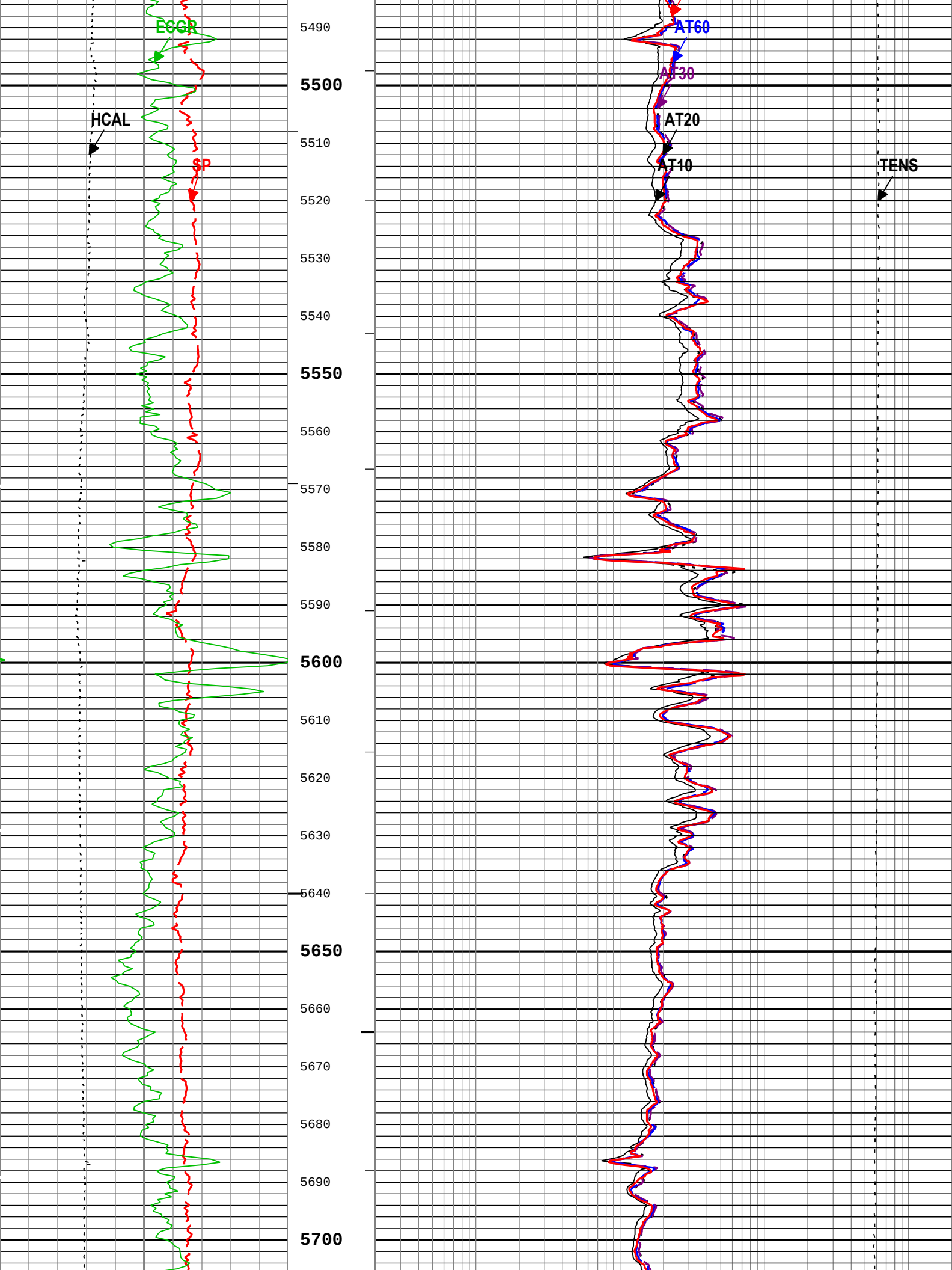


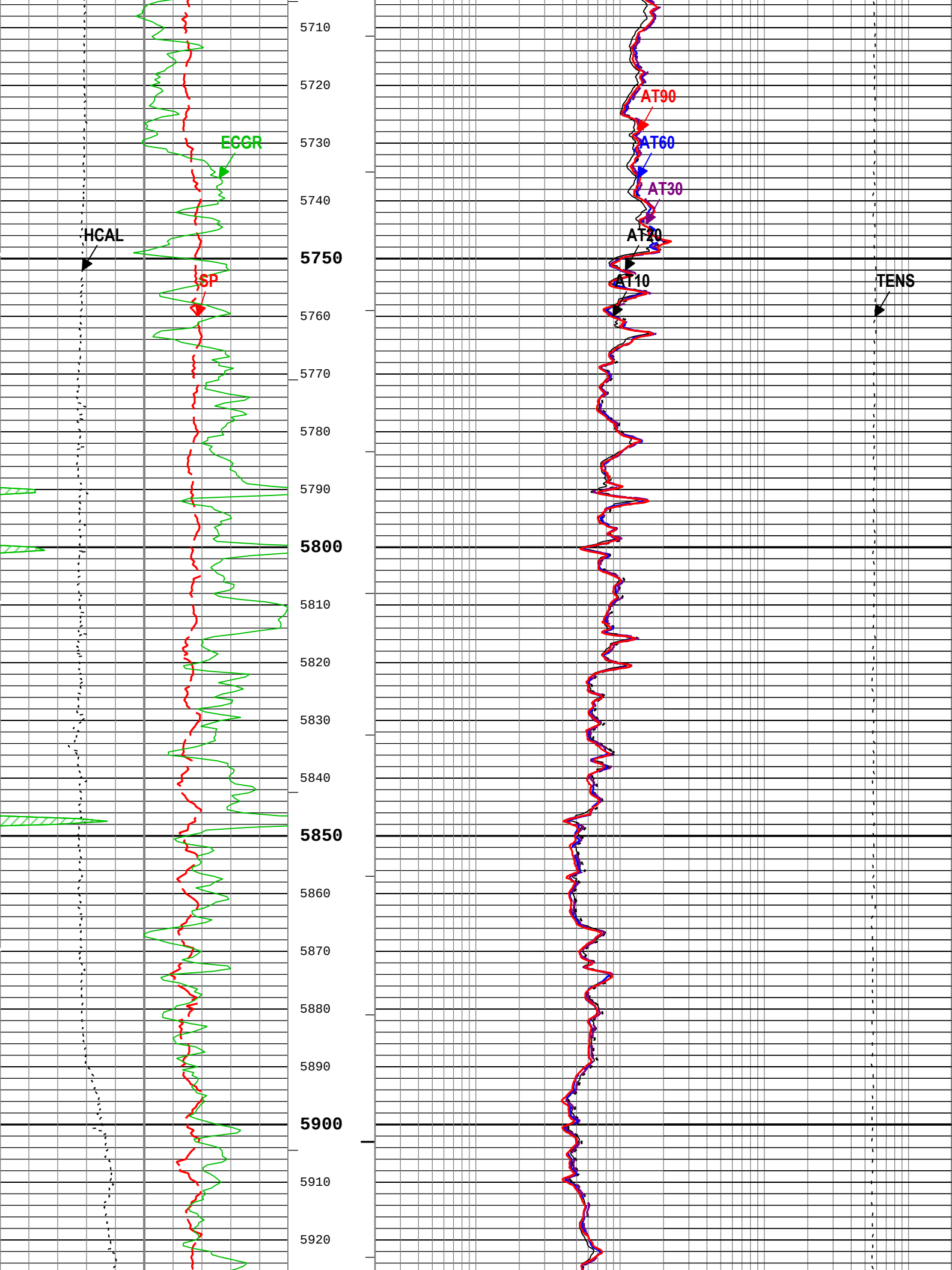


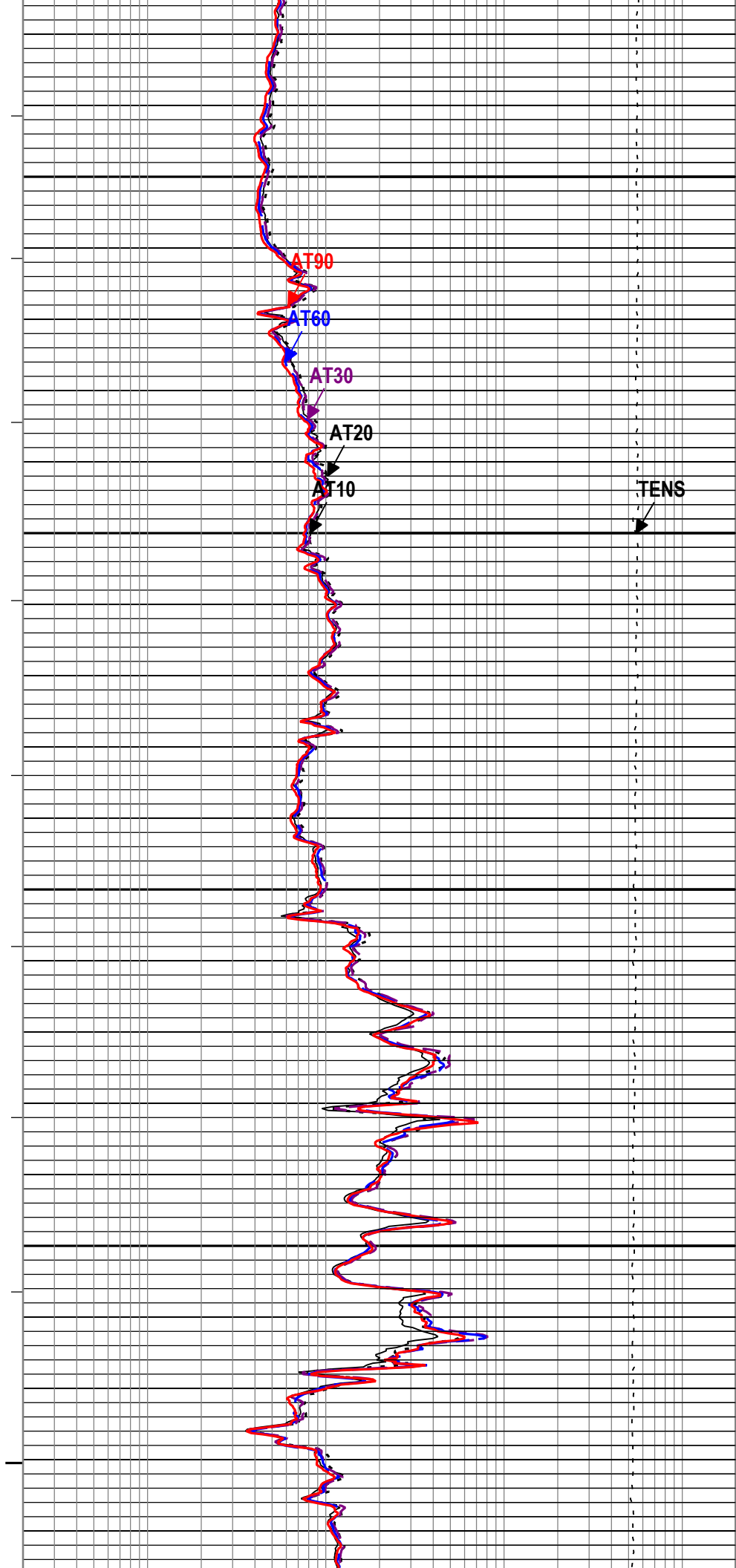
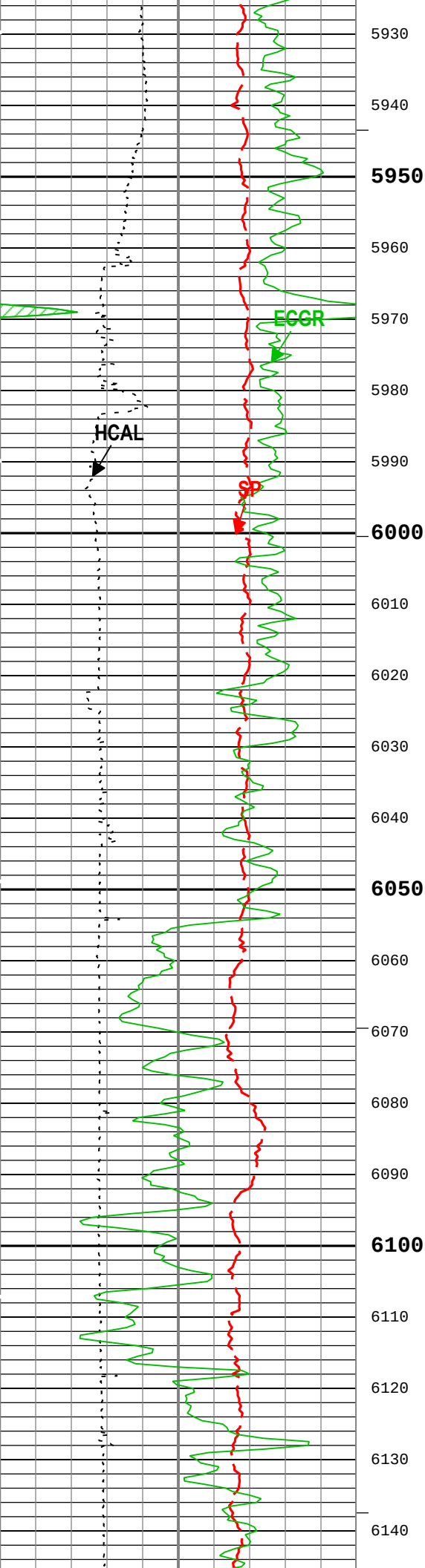


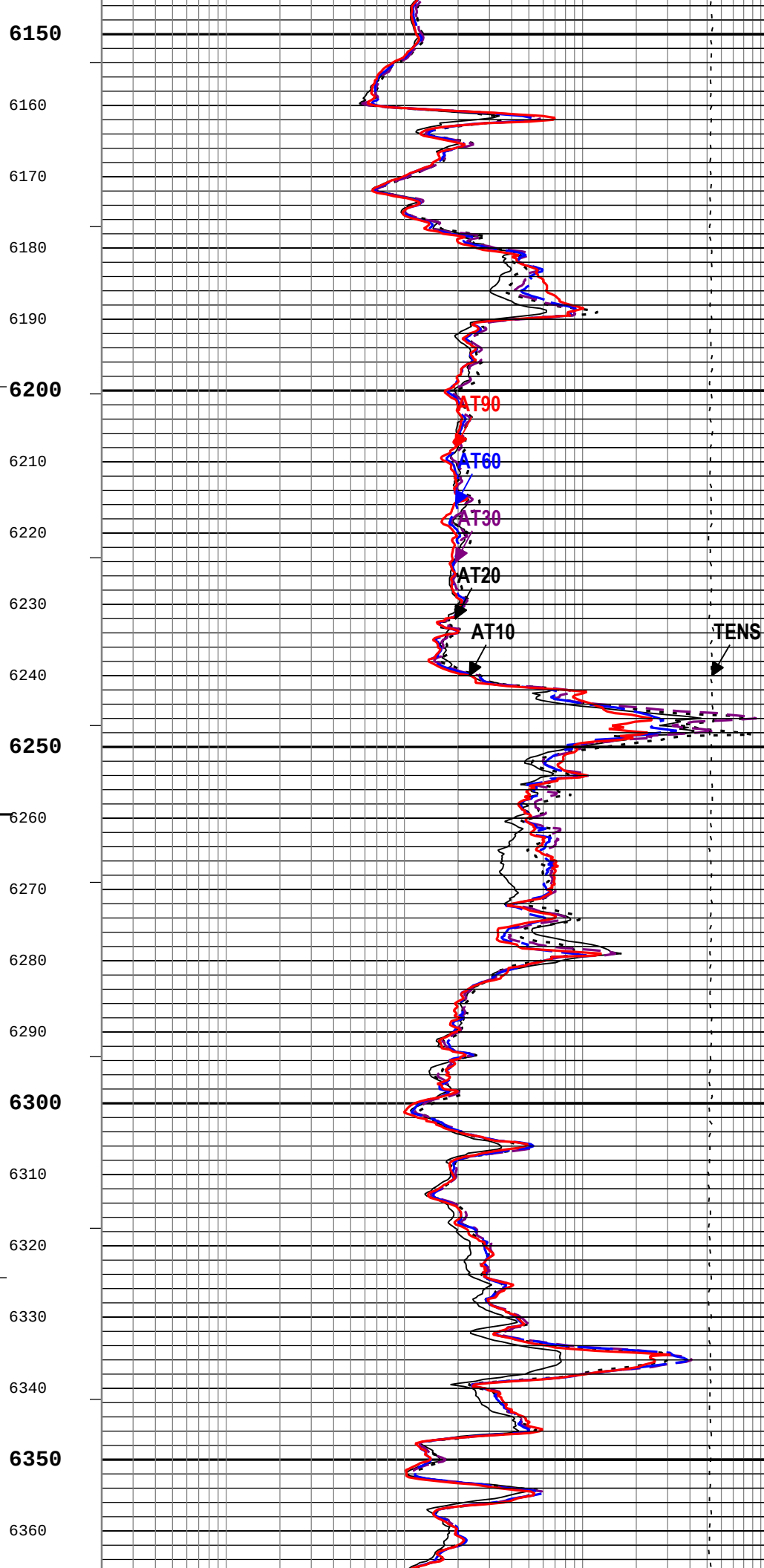
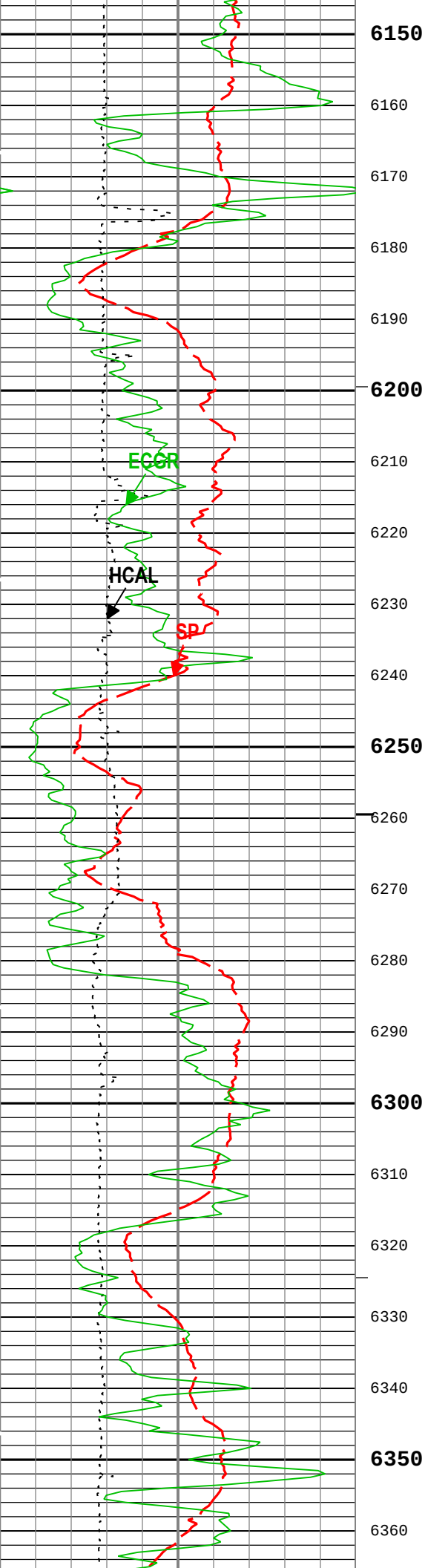


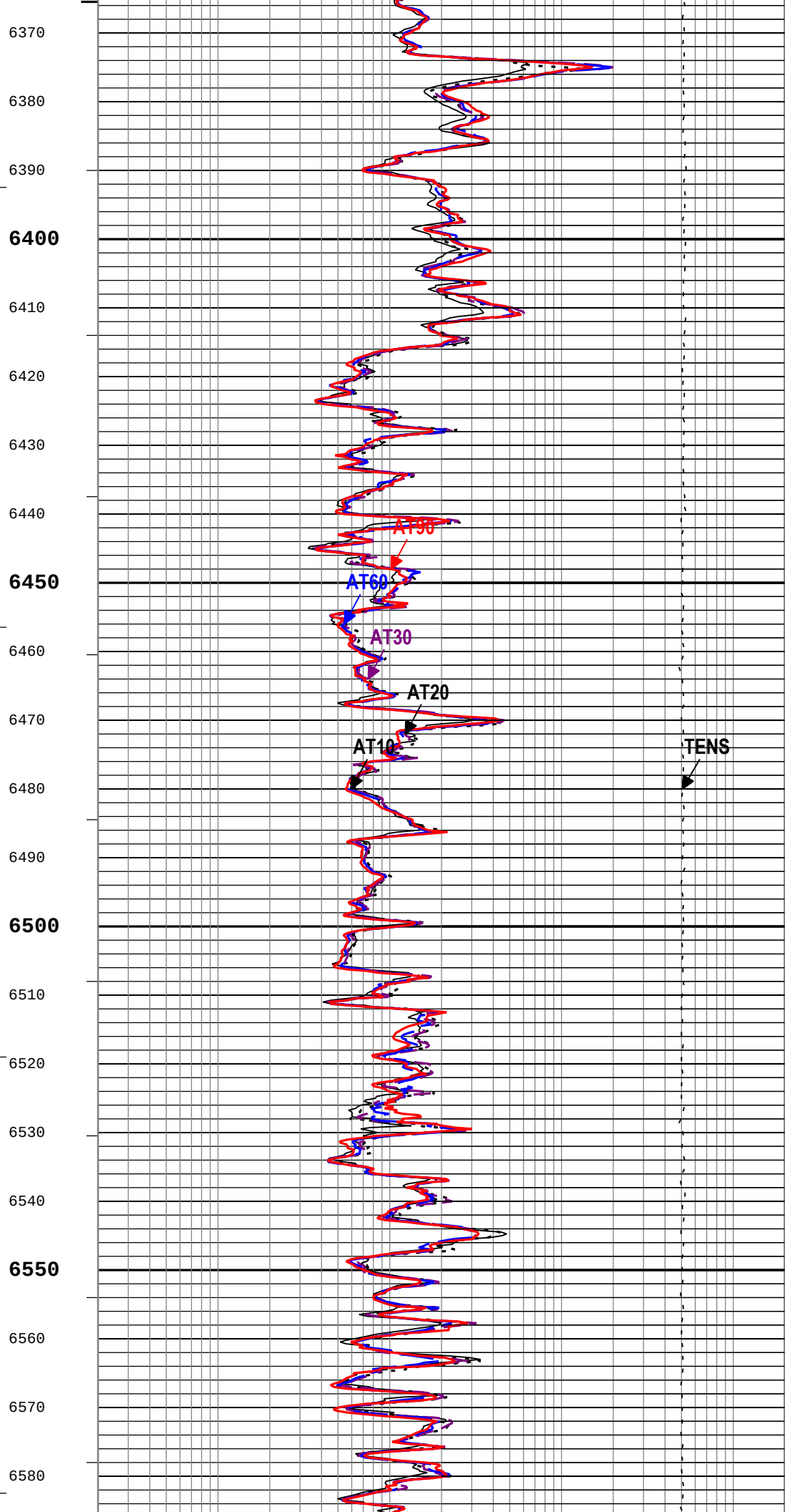
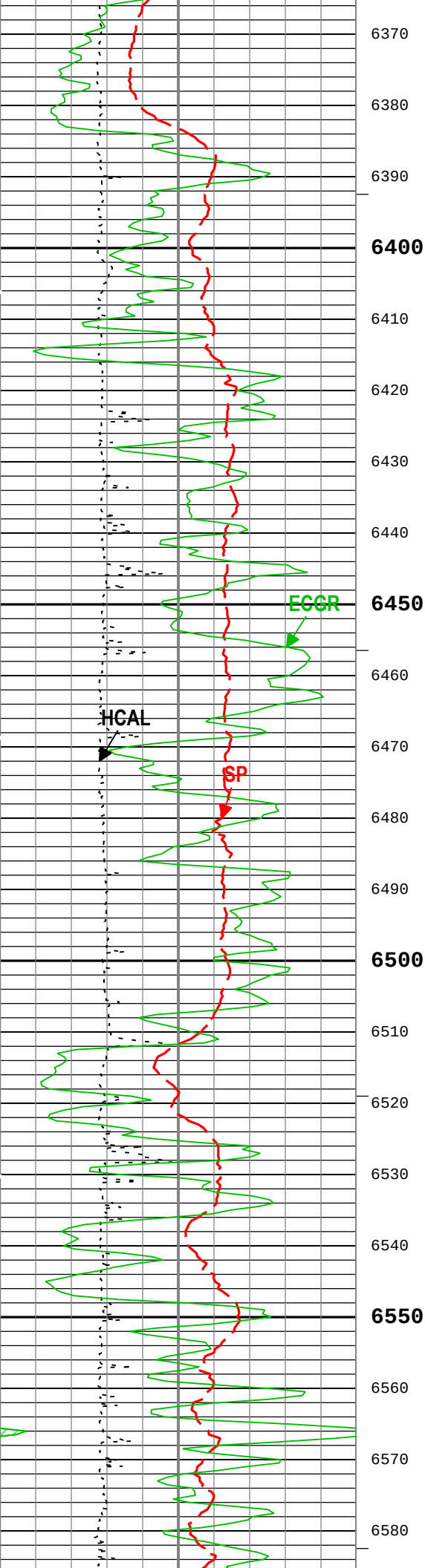


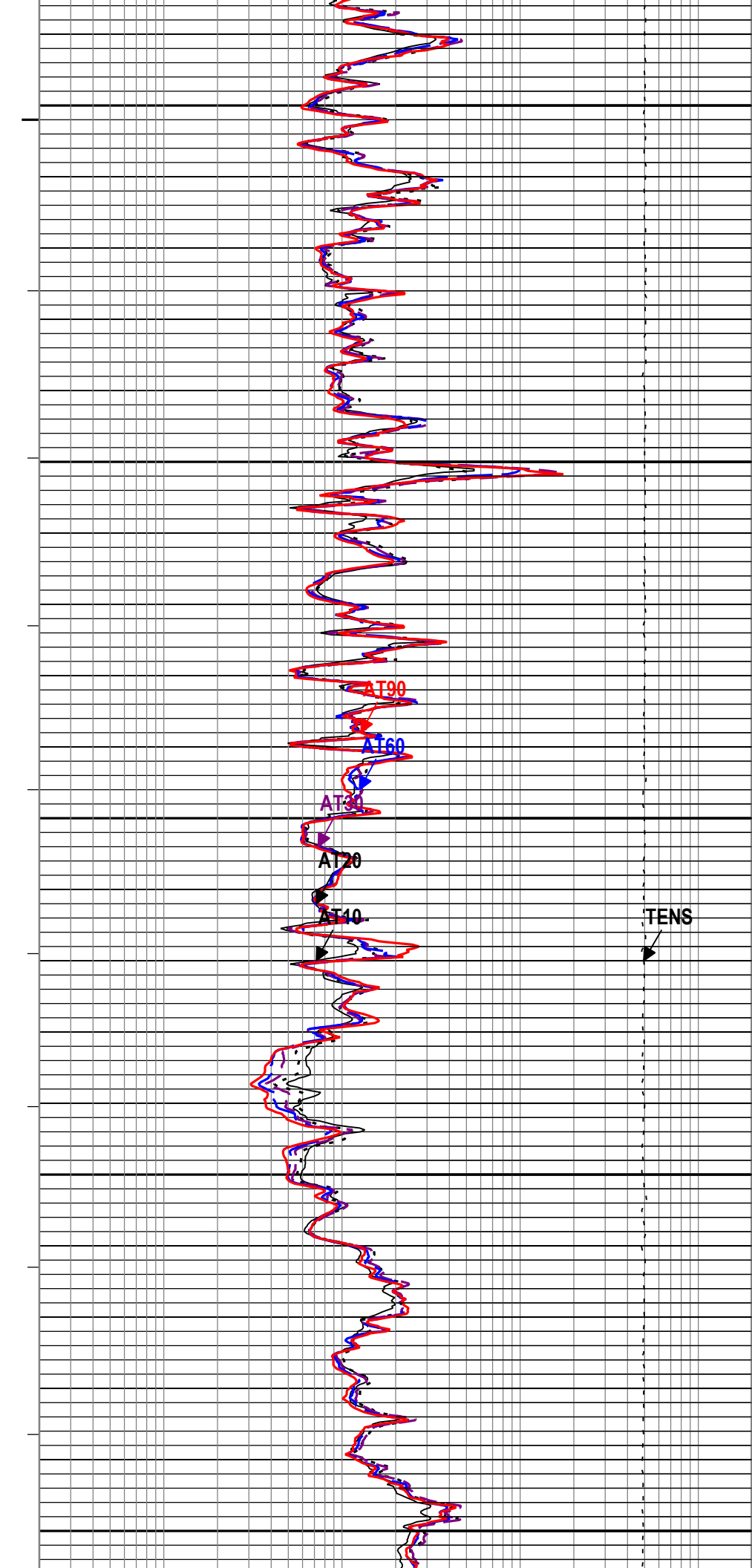
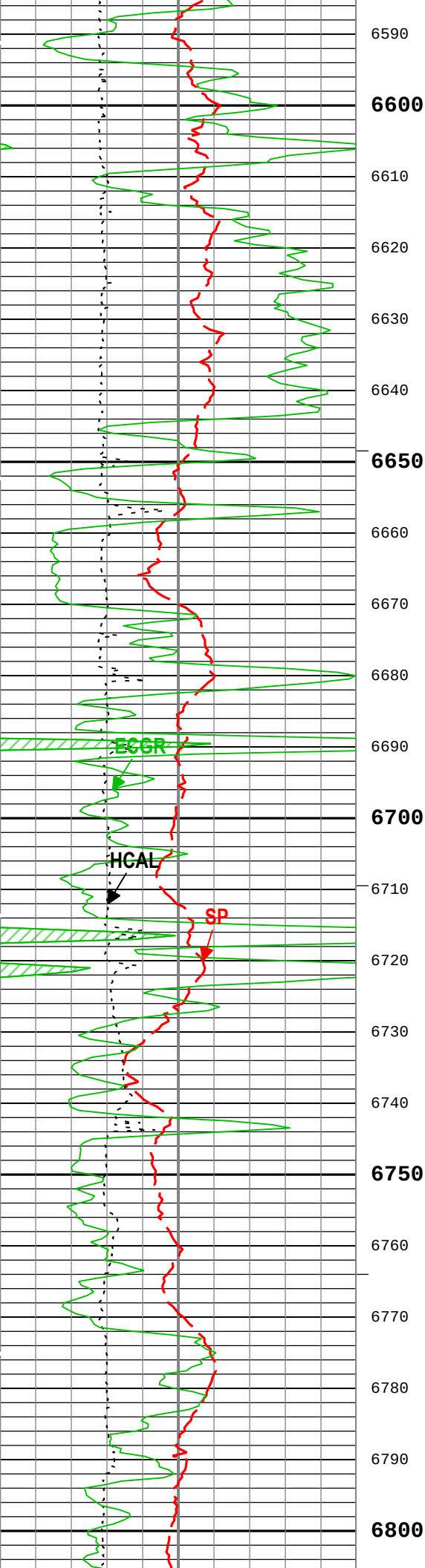


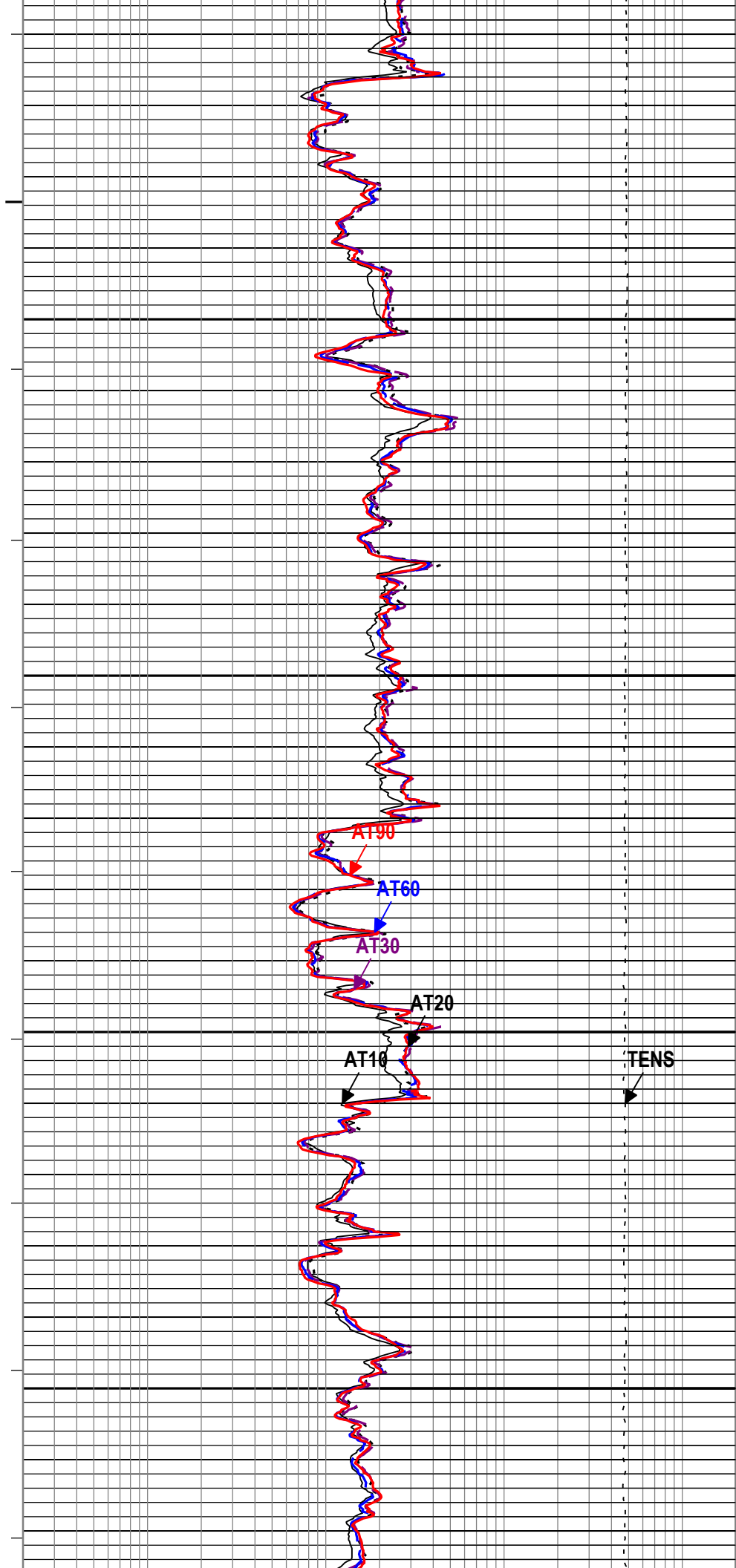
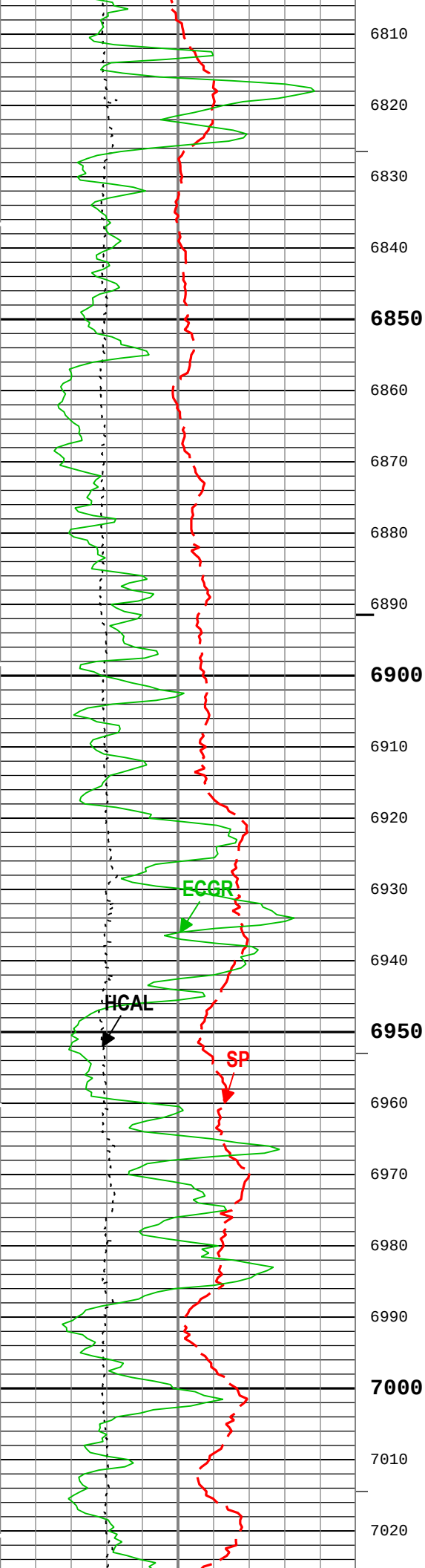


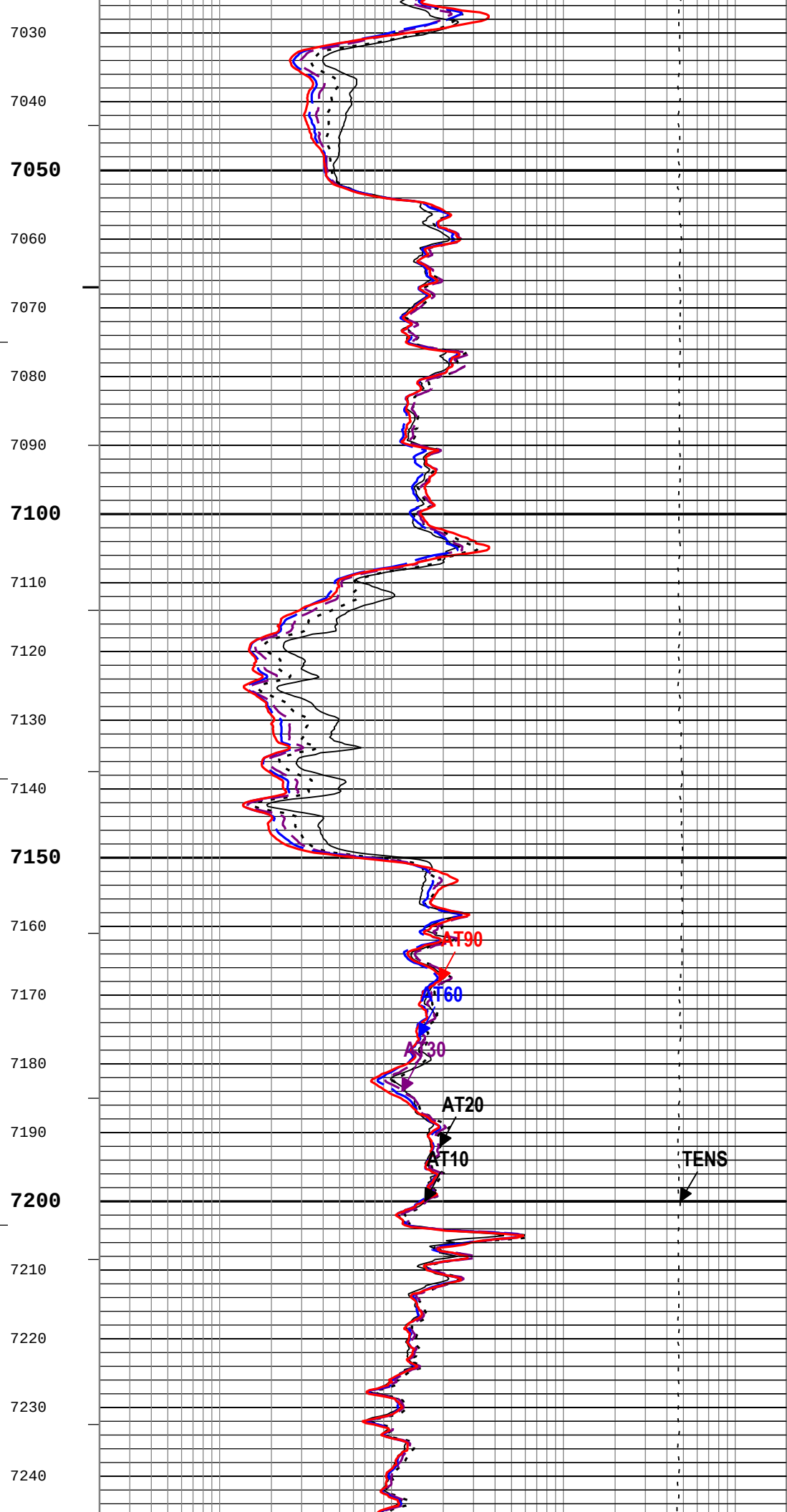
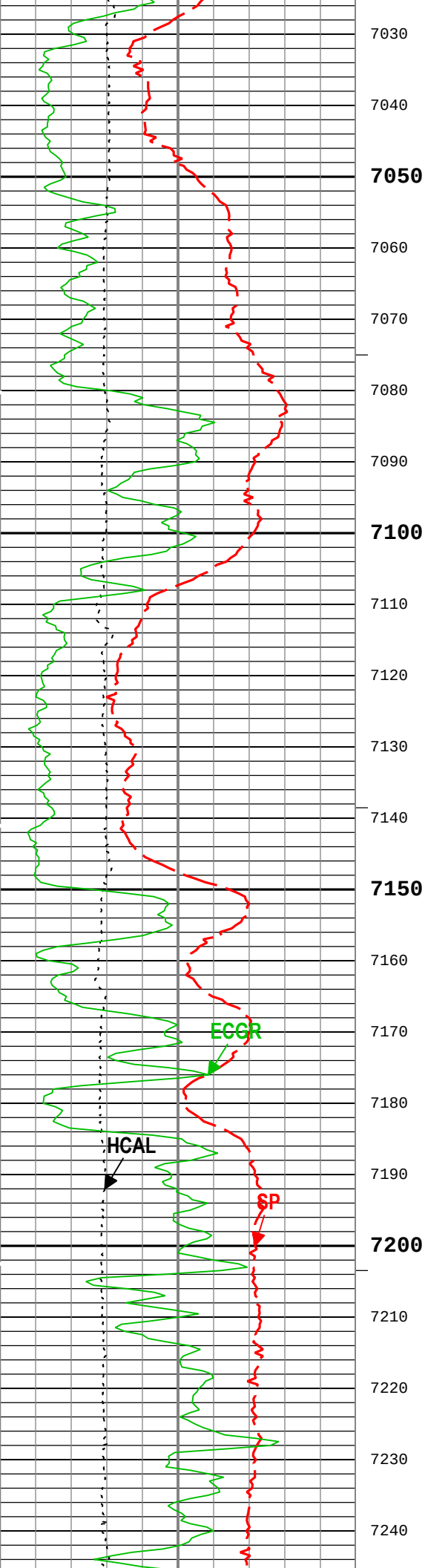


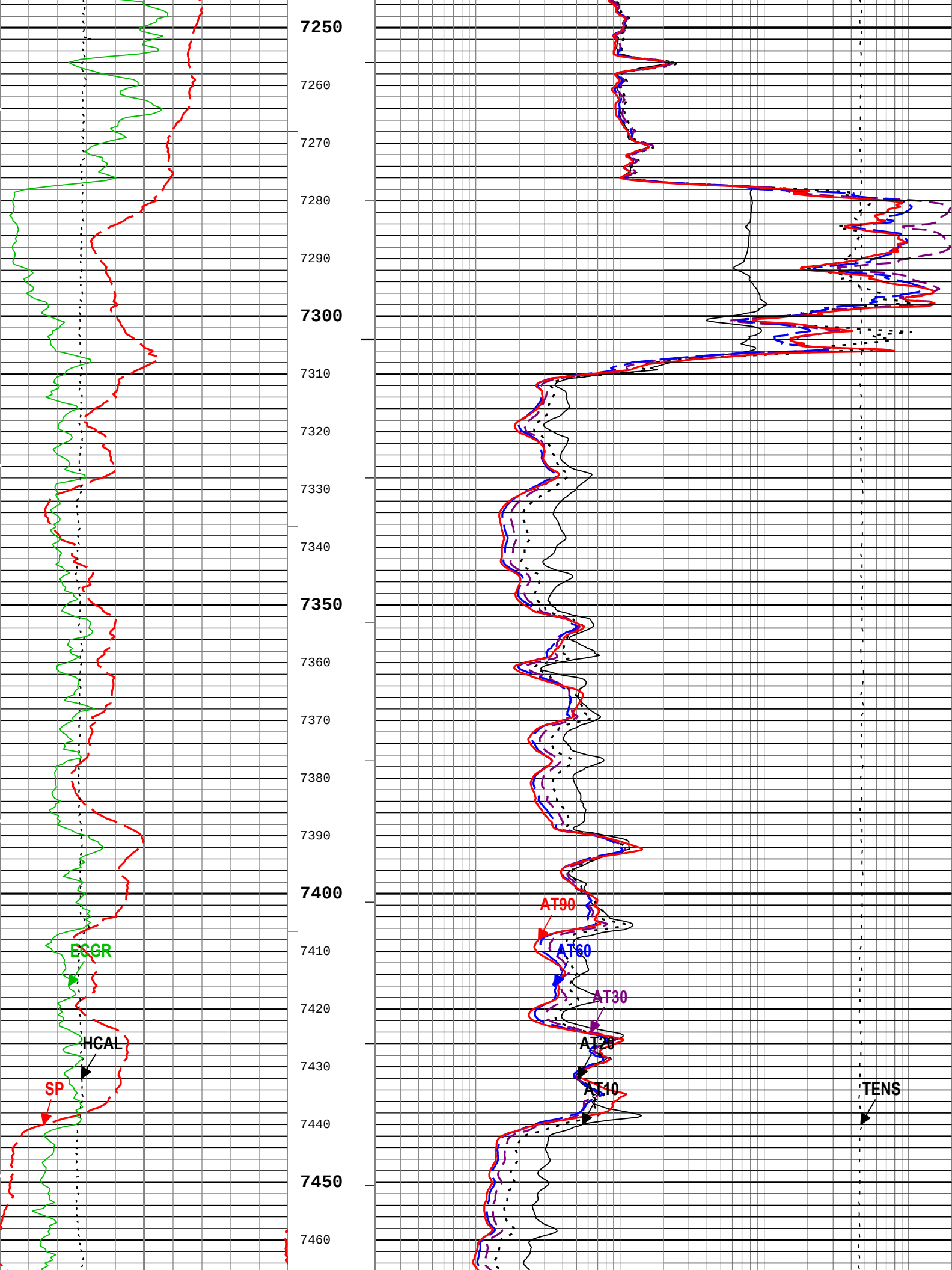


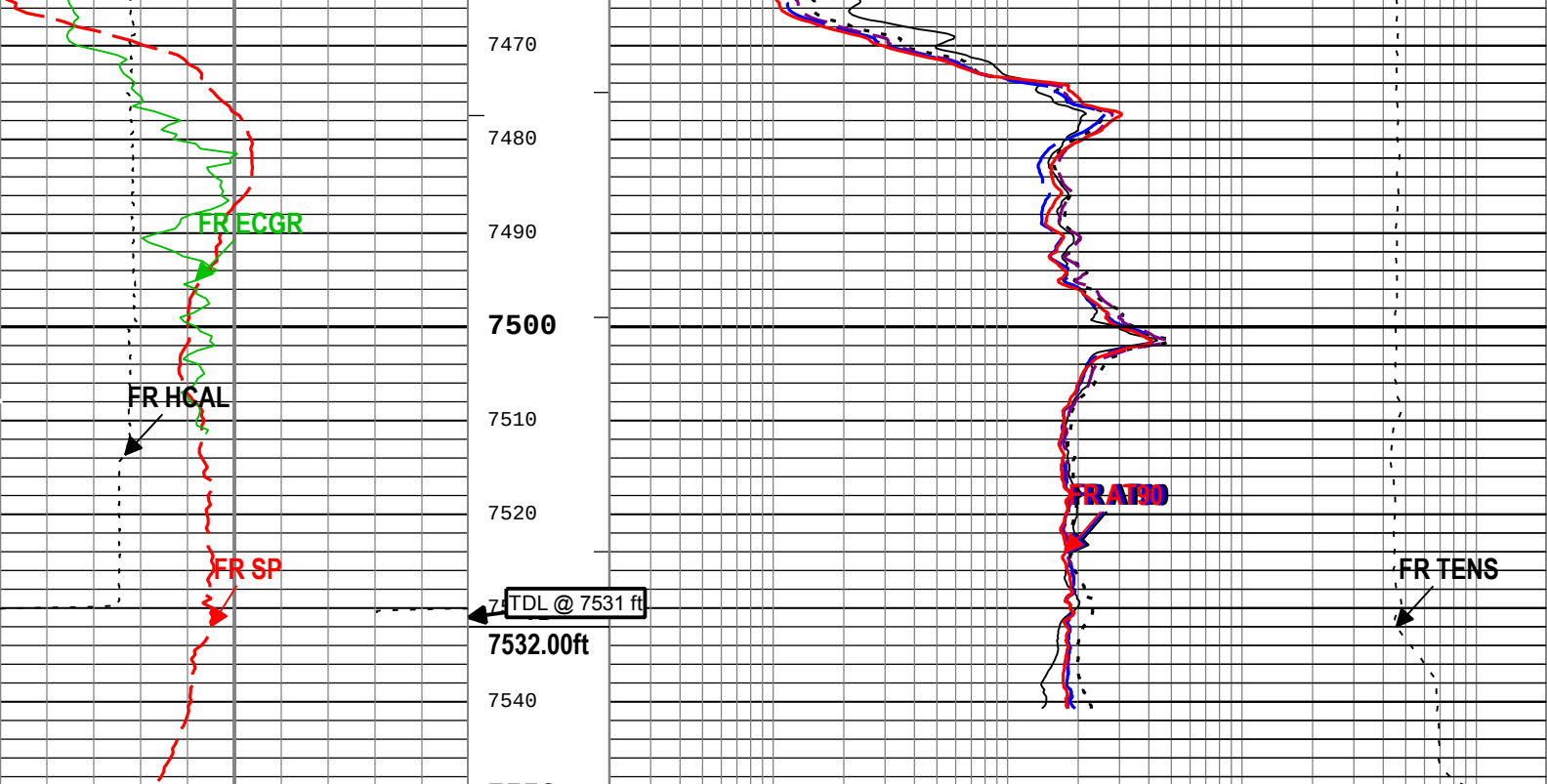












Gamma Ray Backup		
Spontaneous Potential (SP) AIT-M		
-80	mV	20
Caliper (HCAL) HDRS-H		
6	in	16
Gamma Ray (ECGR) HGNS-H		
0	gAPI	200

Array Induction Two Foot Resistivity A10 (AT10) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A20 (AT20) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A30 (AT30) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A60 (AT60) AIT-M		
0.2	ohm.m	2000
Array Induction Two Foot Resistivity A90 (AT90) AIT-M		
0.2	ohm.m	2000
Cable Tension (TENS)		
10000	lbf	0

TIME_1900 - Time Marked every 60.00 (s)

- ICV - Integrated Cement Volume every 100.00 (ft3)
- ICV - Integrated Cement Volume every 10.00 (ft3)
- IHV - Integrated Hole Volume every 100.00 (ft3)
- IHV - Integrated Hole Volume every 10.00 (ft3)

Description: AIT Basic Log Two Format: Log (Induction-5) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:14

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in

CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

Parameter	Value	Start (ft)	Stop (ft)
BS	12.25		3515
BS	8.75	3515	7532

All depth are actual.

Tool Control Parameters

One: Parameters

Parameter	Description	Tool	Value	Unit
MAX_LOG_SPEED	Toolstring Maximum Logging Speed	WLSESSION	3600	ft/h

One

5" Induction

Software Version

Acquisition System	Version
Maxwell 2016 SP2	6.2.68624.3100

Pass Summary

Run Name	Pass Objective	Direction	Top	Bottom	Start	Stop	DSC Mode	Depth Shift	Include Parallel Data
One	Log[3]:Up	Up	7294.65 ft	7556.27 ft	07-Sep-2016 5:43:06 AM	07-Sep-2016 5:48:19 AM	ON	5.53 ft	No
One	Log[4]:Up	Up		7548.83 ft	07-Sep-2016 5:52:06 AM		ON	0.00 ft	No

All depths are referenced to toolstring zero

Log

Company:Western Refining, Southwest, Inc. Well:WWD #2
One: Log[4]:Up:S012

Description: AIT Basic Log Two Format: Log (Induction-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:18

—IHV - Integrated Hole Volume every 10.00 (ft3)

—IHV - Integrated Hole Volume every 100.00 (ft3)

— ICV - Integrated Cement Volume every 10.00 (ft3)

— ICV - Integrated Cement Volume every 100.00 (ft3)

TIME_1900 - Time Marked every 60.00 (s)

Main To Repeat

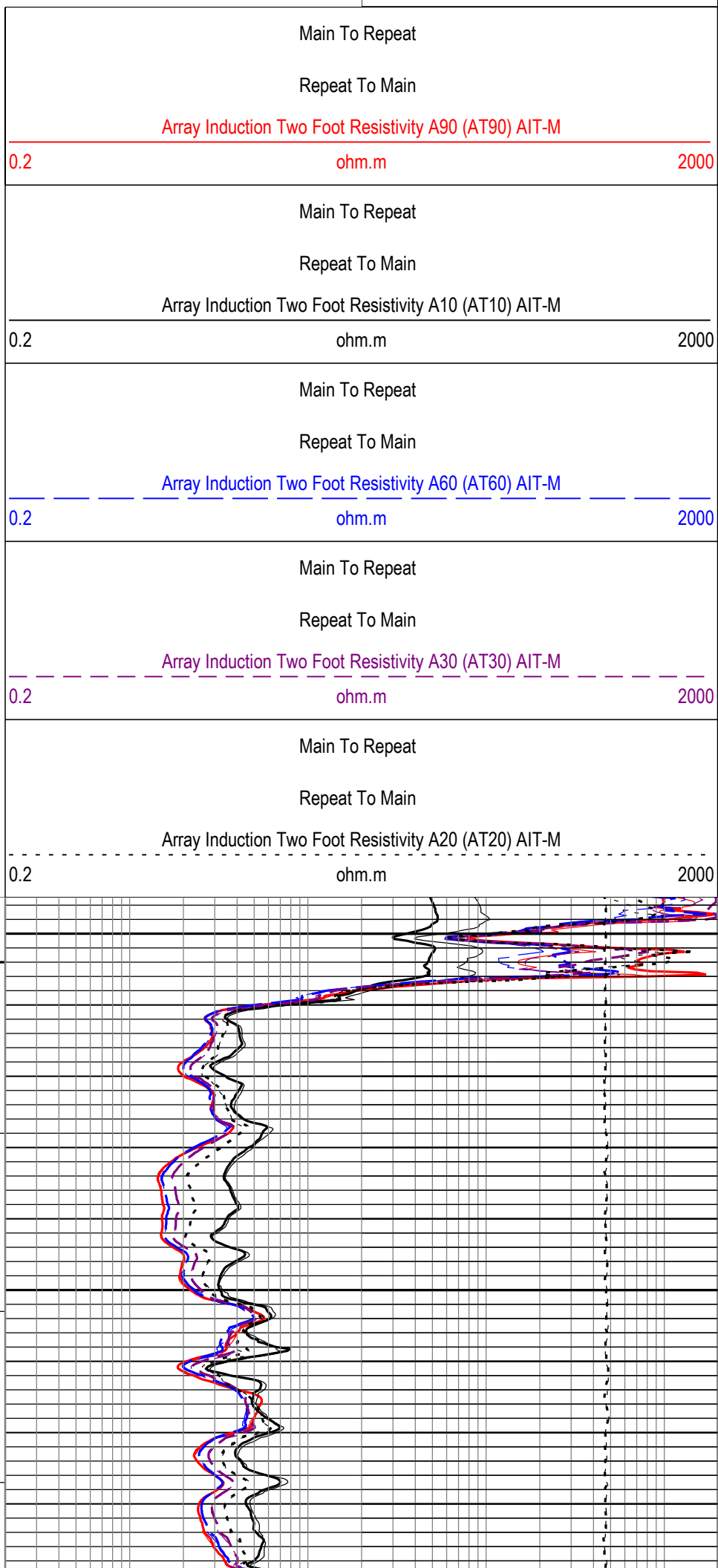
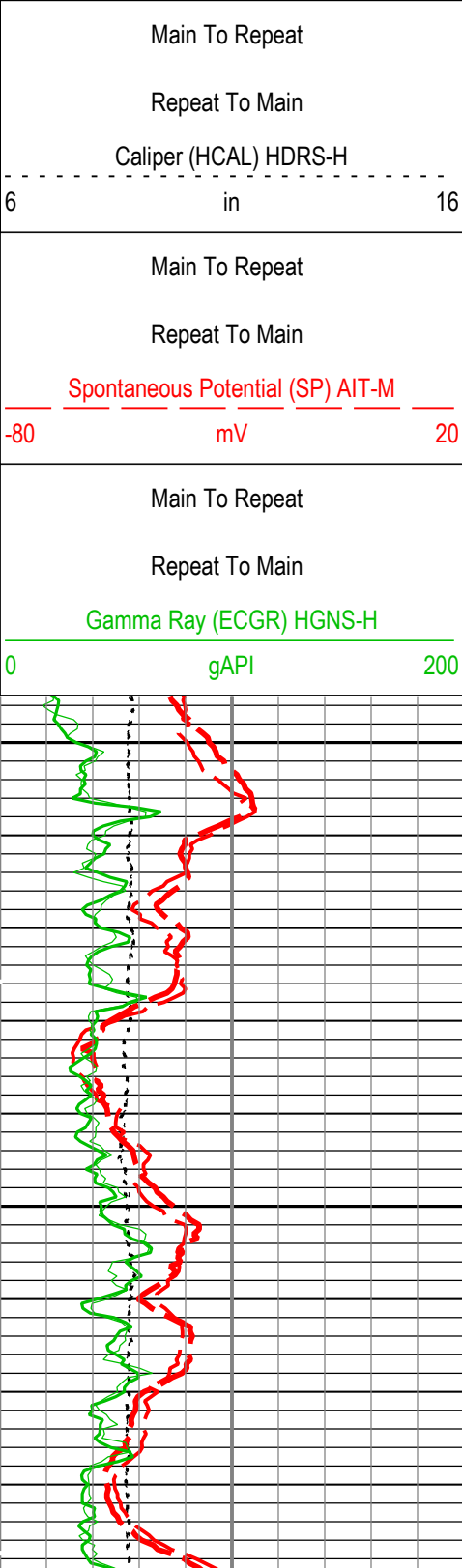
Repeat To Main

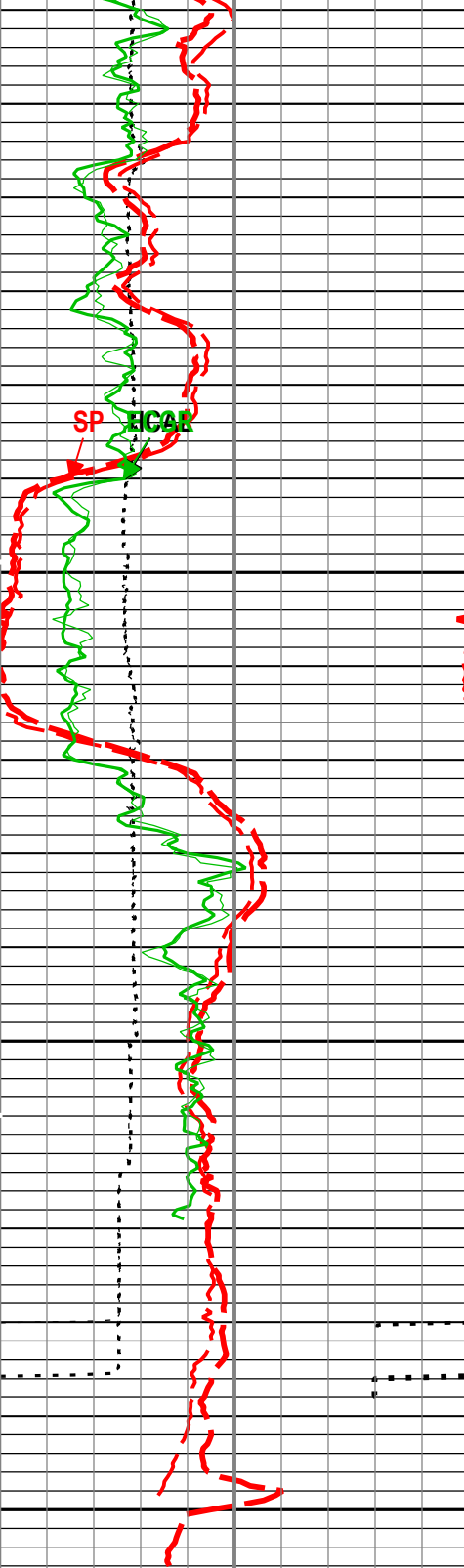
Cable Tension (TENS)

10000

lbf

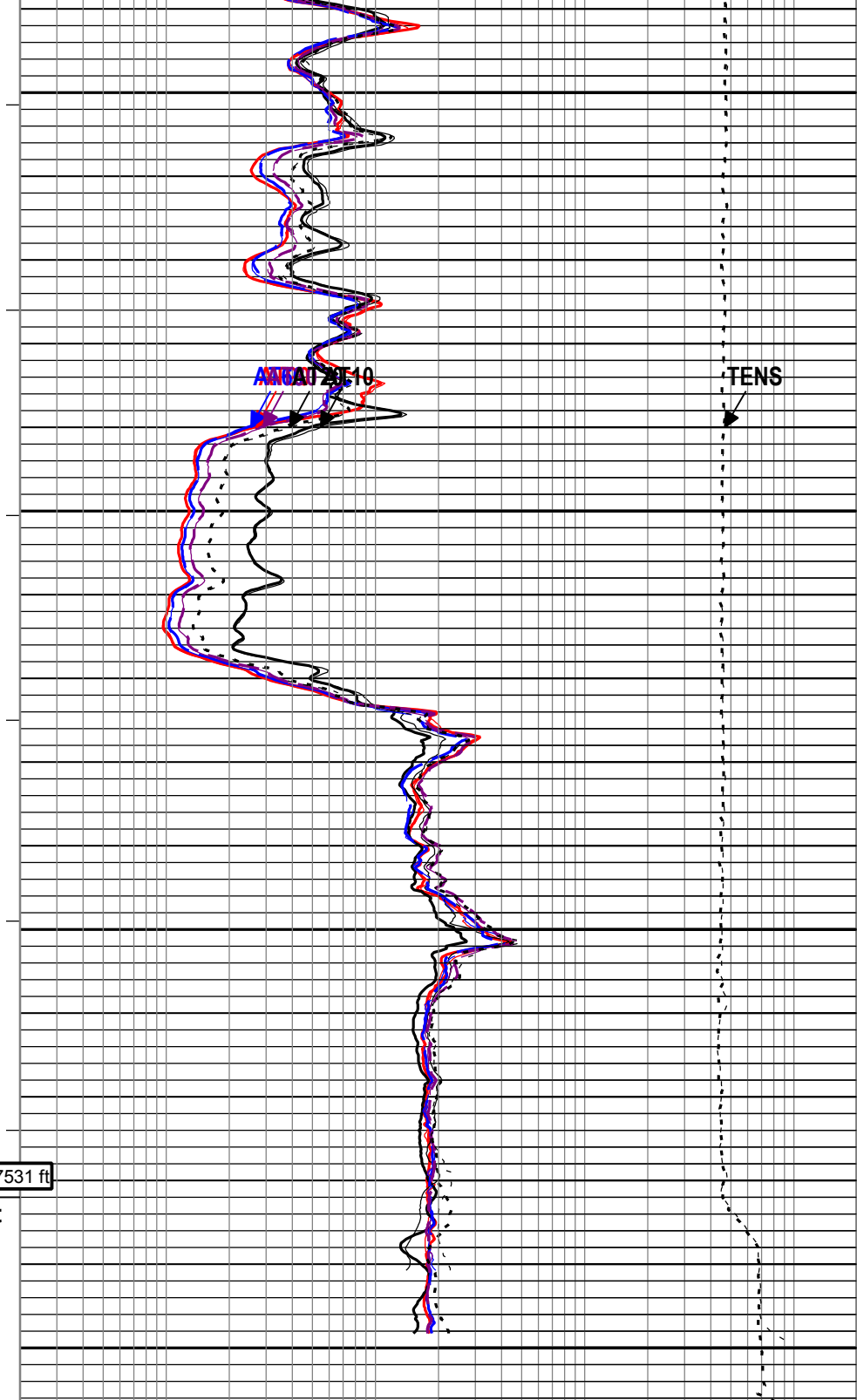
0





7390
7400
7410
7420
7430
7440
7450
7460
7470
7480
7490
7500
7510
7520
7530
7540
7550

TDL @ 7531 ft
7532.00ft



TDL @ 7531 ft
7532.00ft

Main To Repeat
Repeat To Main
Caliper (HCAL) HDRS-H
6 in 16
Main To Repeat
Repeat To Main
Spontaneous Potential (SP) AIT-M
-80 mV 20

Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A90 (AT90) AIT-M
0.2 ohm.m 2000
Main To Repeat
Repeat To Main
Array Induction Two Foot Resistivity A10 (AT10) AIT-M
0.2 ohm.m 2000

Main To Repeat Repeat To Main Gamma Ray (ECGR) HGNS-H 0gAPI200	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A60 (AT60) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A30 (AT30) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Array Induction Two Foot Resistivity A20 (AT20) AIT-M 0.2ohm.m2000		
	Main To Repeat Repeat To Main Cable Tension (TENS) 10000lbf0		
TIME_1900 - Time Marked every 60.00 (s)			
ICV - Integrated Cement Volume every 100.00 (ft3) ICV - Integrated Cement Volume every 10.00 (ft3) IHV - Integrated Hole Volume every 100.00 (ft3) IHV - Integrated Hole Volume every 10.00 (ft3)			
Description: AIT Basic Log Two Format: Log (Induction-5 RA) Index Scale: 5 in per 100 ft Index Unit: ft Index Type: Measured Depth Creation Date: 07-Sep-2016 07:04:18			

Channel Processing Parameters				
One: Parameters				
Parameter	Description	Tool	Value	Unit
ABHM	Array Induction Borehole Correction Mode	AIT-M	Compute Standoff	
ASTA	Array Induction Tool Standoff	AIT-M	0.6	in
ISSBAR	Barite Mud Presence Flag	Borehole	Yes	
BHS	Borehole Status (Open or Cased Hole)	Borehole	Open	
BS	Bit Size	WLSESSION	Depth Zoned	in
CALI_SHIFT	CALI Supplementary Offset	HDRS-H	0.1	in
CBLO	Casing Bottom (Logger)	WLSESSION	3498	ft
CDEN	Cement Density	HGNS-H	2	g/cm3
CSODDRL	Casing Outer Diameter - Zoned along driller depths	WLSESSION	9.625	in
DFD	Drilling Fluid Density	Borehole	9.9	lbm/gal
DFT	Drilling Fluid Type	Borehole	Water	
FCD	Future Casing (Outer) Diameter	WLSESSION	7	in
GCSE_DOWN_PASS	Generalized Caliper Selection for WL Log Down Passes	Borehole	BS(RT)	
GCSE_UP_PASS	Generalized Caliper Selection for WL Log Up Passes	Borehole	CALI	
GRSE	Generalized Mud Resistivity Selection, from Measured or Computed Mud Resistivity	Borehole	AMF	
SOCO	Standoff Correction Option	HGNS-H	Yes	
SPDR	SP Drift Per Foot	AIT-M	0	mV/ft

Depth Zone Parameters

All depth are actual.

Tool Control Parameters

One: Parameters

Calibration Report

AIT-M (Array Induction Tool - M) Calibration - Run One

50

AMRM

AIT Sonde Calibration - Test Loop Gain

Master (EEPROM): 20:19:37 05-Aug-2016

AIT Sonde Calibration - Sonde Error Correction

Master (EEPROM): 20:19:37 05-Aug-2016

AIT Mud Calibration - Mud Calibration Gain

Master (EEPROM):		20:19:37 05-Aug-2016					
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Coarse Gain		Master	1.000	0.800	0.934	1.200	
Fine Gain		Master	1.000	0.800	0.938	1.200	
AIT Electronics Check - Thru Calibration Check							
Master (EEPROM):		20:19:37 05-Aug-2016		Before (Measured):		21:11:27 05-Sep-2016	
Measurement	Unit	Phase	Nominal	Low Limit	Actual	High Limit	
Thru Cal Mag - 0	V	Master	----	0.366	0.603	0.854	
		Before	----	0.366	0.603	0.854	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 0	deg	Master	----	137.000	-165.864	-103.000	
		Before	----	137.000	-161.111	-103.000	
		Before-Master	----	----	4.753	----	
Thru Cal Mag - 1	V	Master	----	0.762	1.237	1.778	
		Before	----	0.762	1.237	1.778	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 1	deg	Master	----	136.000	-166.823	-104.000	
		Before	----	136.000	-162.071	-104.000	
		Before-Master	----	----	4.752	----	
Thru Cal Mag - 2	V	Master	----	0.372	0.613	0.868	
		Before	----	0.372	0.613	0.868	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 2	deg	Master	----	132.000	-170.304	-108.000	
		Before	----	132.000	-165.578	-108.000	
		Before-Master	----	----	4.726	----	
Thru Cal Mag - 3	V	Master	----	0.420	0.691	0.980	
		Before	----	0.420	0.691	0.980	
		Before-Master	----	----	0.000	----	
Thru Cal Phase - 3	deg	Master	----	131.000	-171.041	-109.000	
		Before	----	131.000	-166.313	-109.000	
		Before-Master	----	----	4.728	----	
Thru Cal Mag - 4	V	Master	----	0.804	1.297	1.876	
		Before	----	0.804	1.296	1.876	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 4	deg	Master	----	125.000	-177.009	-115.000	
		Before	----	125.000	-172.279	-115.000	
		Before-Master	----	----	4.730	----	
Thru Cal Mag - 5	V	Master	----	1.176	1.888	2.744	
		Before	----	1.176	1.887	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 5	deg	Master	----	122.000	-178.544	-118.000	
		Before	----	122.000	-173.812	-118.000	
		Before-Master	----	----	4.732	----	
Thru Cal Mag - 6	V	Master	----	1.176	1.887	2.744	
		Before	----	1.176	1.886	2.744	
		Before-Master	----	----	-0.001	----	
Thru Cal Phase - 6	deg	Master	----	121.000	-178.521	-119.000	
		Before	----	121.000	-173.790	-119.000	
		Before-Master	----	----	4.731	----	
Thru Cal Mag - 7	V	Master	----	0.846	1.358	1.974	
		Before	----	0.846	1.353	1.974	
		Before-Master	----	----	-0.005	----	
Thru Cal Phase - 7	deg	Master	----	115.000	-179.305	-125.000	
		Before	----	115.000	-174.661	-125.000	
		Before-Master	----	----	4.644	----	
SPA Zero	mV	Master		-50.000	0.156	50.000	
		Before		-50.000	0.146	50.000	
		Before-Master	----	----	-0.010	----	
SPA Plus	mV	Master		941.000	988.093	1040.000	
		Before		941.000	988.030	1040.000	
		Before-Master	----	----	-0.063	----	
Temperature Zero	V	Master		-0.050	0.000	0.050	

		Before		-0.050	0.000	0.050	
		Before-Master	-----	-----	0.000	-----	
Temperature Plus	V	Master		0.870	0.915	0.960	
		Before		0.870	0.915	0.960	
		Before-Master	-----	-----	0.000	-----	

Company:

Western Refining, Southwest, Inc.

Well:

WWD #2

Field:

Wildcat

County:

San Juan

State:

New Mexico

Platform Expres

Array Induction

with Linear Correlation

Schlumberger

Appendix E

October 5, 2017 Falloff test data

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/3/17 8:58:00	0.00	0.0	0.0	60.0	10/3/17 9:02:00	0.00	0.0	0.0	61.2
10/3/17 9:47:15	0.03	49.3	985.4	60.5	10/3/17 9:47:30	0.03	45.5	990.2	62.2
10/3/17 10:02:15	0.04	64.3	976.6	66.0	10/3/17 10:02:30	0.04	60.5	984.8	67.7
10/3/17 10:17:15	0.06	79.3	3,313.8	100.2	10/3/17 10:17:30	0.05	75.5	3,423.5	106.0
10/3/17 10:32:15	0.07	94.3	4,144.1	160.6	10/3/17 10:32:30	0.06	90.5	4,147.0	162.3
10/3/17 10:53:15	0.08	115.3	4,224.2	165.2	10/3/17 10:55:45	0.08	113.8	4,226.4	165.7
10/3/17 11:12:00	0.09	134.0	4,239.4	165.3	10/3/17 11:14:30	0.09	132.5	4,242.1	165.5
10/3/17 11:36:45	0.11	158.8	4,249.5	163.9	10/3/17 11:43:00	0.11	161.0	4,252.9	164.0
10/3/17 12:12:00	0.13	194.0	4,255.9	162.4	10/3/17 12:25:00	0.14	203.0	4,258.1	162.4
10/3/17 12:54:00	0.16	236.0	4,266.7	160.9	10/3/17 13:07:00	0.17	245.0	4,269.4	160.9
10/3/17 13:36:00	0.19	278.0	4,271.9	159.7	10/3/17 13:49:00	0.20	287.0	4,274.2	159.8
10/3/17 14:18:00	0.22	320.0	4,277.3	158.9	10/3/17 14:31:00	0.23	329.0	4,279.3	159.0
10/3/17 15:00:00	0.25	362.0	4,282.9	158.2	10/3/17 15:13:00	0.26	371.0	4,285.0	158.3
10/3/17 15:42:00	0.28	404.0	4,288.3	157.7	10/3/17 15:55:00	0.29	413.0	4,290.3	157.8
10/3/17 16:37:30	0.32	459.5	4,292.8	157.0	10/3/17 16:40:00	0.32	458.0	4,295.5	157.3
10/3/17 17:24:00	0.35	506.0	4,293.4	156.5	10/3/17 17:37:00	0.36	515.0	4,298.0	156.7
10/3/17 18:06:00	0.38	548.0	4,298.6	156.0	10/3/17 18:19:00	0.39	557.0	4,300.7	156.2
10/3/17 18:48:00	0.41	590.0	4,303.8	155.7	10/3/17 19:01:00	0.42	599.0	4,305.7	155.8
10/3/17 19:47:15	0.45	649.3	4,309.9	155.2	10/3/17 19:28:00	0.45	647.8	4,310.5	155.4
10/3/17 20:30:00	0.48	692.0	4,309.2	154.7	10/3/17 20:10:00	0.49	701.0	4,310.9	154.9
10/3/17 21:12:00	0.51	734.0	4,314.5	154.3	10/3/17 20:53:30	0.52	743.0	4,316.1	154.4
10/3/17 22:12:00	0.55	794.0	4,314.4	154.0	10/3/17 21:52:00	0.56	799.3	4,321.0	154.2
10/3/17 22:54:00	0.58	836.0	4,319.9	153.6	10/3/17 22:34:00	0.59	845.0	4,321.0	153.8
10/3/17 23:43:30	0.61	885.5	4,324.3	153.4	10/3/17 23:34:00	0.62	887.0	4,326.2	153.6
10/4/17 0:36:00	0.65	938.0	4,324.5	153.0	10/4/17 0:16:00	0.66	947.0	4,326.2	153.2
10/4/17 1:35:15	0.69	997.3	4,330.7	152.9	10/4/17 1:16:00	0.69	995.8	4,331.3	153.1
10/4/17 2:18:00	0.72	1,040.0	4,329.8	152.5	10/4/17 1:58:00	0.73	1,049.0	4,331.1	152.7
10/4/17 3:00:00	0.75	1,082.0	4,334.9	152.2	10/4/17 2:40:00	0.76	1,091.0	4,336.6	152.4
10/4/17 3:48:45	0.79	1,130.8	4,340.0	152.0	10/4/17 3:40:00	0.79	1,133.0	4,341.5	152.1
10/4/17 4:42:00	0.82	1,184.0	4,339.5	151.5	10/4/17 4:22:00	0.82	1,184.8	4,346.4	151.8
10/4/17 5:24:00	0.85	1,226.0	4,345.0	151.1	10/4/17 5:04:00	0.86	1,235.0	4,346.6	151.3
10/4/17 6:06:00	0.88	1,268.0	4,350.1	150.7	10/4/17 5:47:30	0.89	1,277.0	4,351.5	150.9
10/4/17 7:06:00	0.92	1,328.0	4,350.1	150.4	10/4/17 6:46:00	0.93	1,337.0	4,352.3	150.6
10/4/17 8:06:00	0.96	1,388.0	4,350.3	150.4	10/4/17 7:46:00	0.97	1,397.0	4,351.9	150.6
10/4/17 8:54:00	1.00	1,436.0	4,350.8	150.5	10/4/17 8:46:00	1.00	1,434.5	4,351.6	150.7
10/4/17 9:48:00	1.03	1,490.0	4,350.2	150.6	10/4/17 9:19:00	1.03	1,490.0	4,351.7	150.8
10/4/17 10:48:00	1.08	1,550.0	4,350.3	150.8	10/4/17 10:19:00	1.08	1,550.0	4,351.7	151.1
10/4/17 11:30:00	1.11	1,592.0	4,355.5	150.7	10/4/17 11:07:45	1.11	1,592.0	4,356.6	151.0
10/4/17 12:30:00	1.15	1,652.0	4,354.4	150.7	10/4/17 12:01:00	1.15	1,652.0	4,356.5	151.0
10/4/17 13:30:00	1.19	1,712.0	4,354.8	150.8	10/4/17 13:01:00	1.19	1,712.0	4,356.6	151.1
10/4/17 14:30:00	1.23	1,772.0	4,354.9	150.9	10/4/17 14:01:00	1.23	1,772.0	4,356.5	151.2
10/4/17 15:25:00	1.27	1,827.0	4,354.7	151.1	10/4/17 14:56:00	1.27	1,827.0	4,356.3	151.4
10/4/17 16:20:00	1.31	1,882.0	4,354.9	151.2	10/4/17 15:51:00	1.31	1,882.0	4,356.3	151.5

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/4/17 16:57:00	1.33	1,919.0	4,357.8	151.3	10/4/17 16:37:45	1.33	1,919.0	4,359.2	151.5
10/4/17 17:52:00	1.37	1,974.0	4,357.6	151.3	10/4/17 17:23:00	1.37	1,974.0	4,359.1	151.6
10/4/17 18:29:00	1.40	2,011.0	4,365.1	151.2	10/4/17 18:11:15	1.40	2,011.0	4,366.2	151.3
10/4/17 19:08:15	1.42	2,050.3	4,369.8	150.9	10/4/17 18:55:00	1.42	2,048.0	4,371.4	151.1
10/4/17 20:02:00	1.46	2,104.0	4,369.9	150.5	10/4/17 19:33:00	1.46	2,104.0	4,371.3	150.7
10/4/17 20:57:00	1.50	2,159.0	4,369.8	150.4	10/4/17 20:28:00	1.50	2,159.0	4,371.5	150.6
10/4/17 21:43:45	1.53	2,205.8	4,374.7	150.4	10/4/17 21:23:00	1.53	2,202.8	4,376.7	150.5
10/4/17 22:29:00	1.56	2,251.0	4,377.0	150.1	10/4/17 22:00:00	1.55	2,233.0	4,378.5	150.3
10/4/17 23:24:00	1.60	2,306.0	4,378.9	150.0	10/4/17 22:37:00	1.59	2,288.0	4,378.4	150.2
10/5/17 0:19:00	1.64	2,361.0	4,379.4	149.9	10/4/17 23:21:30	1.61	2,325.0	4,380.7	150.1
10/5/17 1:14:00	1.68	2,416.0	4,382.3	149.8	10/5/17 0:09:00	1.64	2,365.0	4,383.5	150.1
10/5/17 2:09:00	1.72	2,471.0	4,382.3	149.8	10/5/17 0:46:00	1.68	2,417.0	4,383.6	149.9
10/5/17 3:00:15	1.75	2,522.3	4,380.9	149.8	10/5/17 1:41:00	1.71	2,460.8	4,383.9	150.0
10/5/17 3:23:00	1.77	2,545.0	4,387.5	149.7	10/5/17 2:18:00	1.74	2,509.0	4,383.1	150.0
10/5/17 4:18:00	1.81	2,600.0	4,387.2	149.6	10/5/17 3:01:00	1.76	2,528.0	4,388.2	150.0
10/5/17 4:55:00	1.83	2,637.0	4,390.1	149.5	10/5/17 3:32:00	1.79	2,583.0	4,388.6	149.8
10/5/17 5:50:00	1.87	2,692.0	4,393.3	149.3	10/5/17 4:24:45	1.82	2,620.0	4,391.5	149.7
10/5/17 6:45:00	1.91	2,747.0	4,393.3	149.2	10/5/17 5:04:00	1.85	2,660.8	4,394.7	149.6
10/5/17 7:40:00	1.95	2,802.0	4,395.1	149.2	10/5/17 5:41:00	1.88	2,712.0	4,394.9	149.4
10/5/17 8:35:00	1.98	2,857.0	4,395.6	149.1	10/5/17 6:36:00	1.92	2,767.0	4,394.8	149.4
10/5/17 9:27:45	2.02	2,909.8	4,401.1	149.2	10/5/17 7:21:15	1.95	2,804.0	4,396.7	149.3
10/5/17 10:12:00	2.05	2,954.0	4,395.3	149.2	10/5/17 8:13:00	1.99	2,864.0	4,396.8	149.3
10/5/17 11:02:00	2.09	3,004.0	4,395.5	149.3	10/5/17 9:03:00	2.02	2,907.3	4,396.2	149.4
10/5/17 11:03:00	2.09	3,005.0	4,395.5	149.3	10/5/17 9:04:00	2.02	2,907.5	4,396.5	149.4
10/5/17 11:04:00	2.09	3,006.0	4,395.4	149.3	10/5/17 9:05:00	2.02	2,907.8	4,397.0	149.4
10/5/17 11:05:00	2.09	3,007.0	4,395.2	149.3	10/5/17 9:06:00	2.02	2,908.0	4,397.1	149.4
10/5/17 11:06:00	2.09	3,008.0	4,395.4	149.3	10/5/17 9:07:00	2.02	2,908.3	4,397.2	149.4
10/5/17 11:07:00	2.09	3,009.0	4,395.4	149.3	10/5/17 9:08:00	2.02	2,908.5	4,397.2	149.4
10/5/17 11:08:00	2.09	3,010.0	4,384.7	149.3	10/5/17 9:09:00	2.02	2,908.8	4,396.8	149.4
10/5/17 11:08:15	2.09	3,010.3	4,375.9	149.3	10/5/17 9:10:00	2.02	2,909.0	4,397.0	149.4
10/5/17 11:08:30	2.09	3,010.5	4,370.4	149.3	10/5/17 9:11:00	2.02	2,909.3	4,396.9	149.4
10/5/17 11:08:45	2.09	3,010.8	4,365.6	149.3	10/5/17 9:12:00	2.02	2,909.5	4,396.9	149.4
10/5/17 11:11:15	2.09	3,013.3	4,339.6	149.4	10/5/17 9:22:00	2.02	2,912.0	4,396.9	149.4
10/5/17 11:13:45	2.09	3,015.8	4,326.7	149.6	10/5/17 9:28:15	2.03	2,916.0	4,396.9	149.4
10/5/17 11:16:15	2.10	3,018.3	4,317.3	149.9	10/5/17 9:30:45	2.03	2,926.0	4,396.6	149.4
10/5/17 11:18:45	2.10	3,020.8	4,310.2	150.2	10/5/17 9:33:15	2.04	2,936.0	4,396.8	149.4
10/5/17 11:33:45	2.11	3,035.8	4,284.9	152.0	10/5/17 10:25:00	2.08	2,996.0	4,396.9	149.5
10/5/17 11:54:00	2.12	3,056.0	4,266.6	154.0	10/5/17 11:12:15	2.10	3,018.5	4,306.8	151.5
10/5/17 12:54:00	2.16	3,116.0	4,238.6	158.0	10/5/17 11:27:15	2.11	3,033.5	4,284.1	154.0
10/5/17 13:54:00	2.21	3,176.0	4,222.0	160.5	10/5/17 11:42:15	2.12	3,048.5	4,270.6	155.7
10/5/17 14:54:00	2.25	3,236.0	4,210.0	162.4	10/5/17 11:57:15	2.14	3,083.0	4,251.5	158.0
10/5/17 15:54:00	2.29	3,296.0	4,200.5	163.7	10/5/17 12:52:00	2.18	3,143.0	4,231.2	160.3
10/5/17 16:54:00	2.33	3,356.0	4,192.6	164.9	10/5/17 13:52:00	2.22	3,203.0	4,217.3	161.9

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/5/17 17:54:00	2.37	3,416.0	4,185.8	165.9	10/5/17 14:52:00	2.27	3,263.0	4,206.8	163.2
10/5/17 18:54:00	2.41	3,476.0	4,179.8	166.7	10/5/17 15:52:00	2.31	3,323.0	4,198.1	164.2
10/5/17 19:54:00	2.46	3,536.0	4,174.5	167.5	10/5/17 16:52:00	2.35	3,383.0	4,190.8	165.0
10/5/17 20:54:00	2.50	3,596.0	4,169.7	168.2	10/5/17 17:52:00	2.39	3,443.0	4,184.5	165.6
10/5/17 21:54:00	2.54	3,656.0	4,165.3	168.7	10/5/17 18:52:00	2.43	3,503.0	4,178.9	166.0
10/5/17 22:54:00	2.58	3,716.0	4,161.3	169.3	10/5/17 19:52:00	2.47	3,563.0	4,173.8	166.5
10/5/17 23:54:00	2.62	3,776.0	4,157.6	169.8	10/5/17 20:52:00	2.52	3,623.0	4,169.2	166.9
10/6/17 0:54:00	2.66	3,836.0	4,154.0	170.2	10/5/17 21:52:00	2.56	3,683.0	4,165.0	167.3
10/6/17 1:54:00	2.71	3,896.0	4,150.8	170.6	10/5/17 22:52:00	2.60	3,743.0	4,161.1	167.7
10/6/17 2:54:00	2.75	3,956.0	4,147.7	171.0	10/5/17 23:52:00	2.64	3,803.0	4,157.4	168.1
10/6/17 3:54:00	2.79	4,016.0	4,144.8	171.3	10/6/17 0:52:00	2.68	3,863.0	4,154.2	168.4
10/6/17 4:54:00	2.83	4,076.0	4,142.1	171.6	10/6/17 1:52:00	2.72	3,923.0	4,151.2	168.7
10/6/17 5:54:00	2.87	4,136.0	4,139.5	171.9	10/6/17 2:52:00	2.77	3,983.0	4,148.2	169.0
10/6/17 6:54:00	2.91	4,196.0	4,137.1	172.2	10/6/17 3:52:00	2.81	4,043.0	4,145.3	169.2
10/6/17 7:54:00	2.96	4,256.0	4,134.7	172.4	10/6/17 4:52:00	2.85	4,103.0	4,142.7	169.5
10/6/17 8:54:00	3.00	4,316.0	4,132.4	172.7	10/6/17 5:52:00	2.89	4,163.0	4,140.1	169.7
10/6/17 9:54:00	3.04	4,376.0	4,130.2	172.9	10/6/17 6:52:00	2.93	4,223.0	4,137.7	169.9
10/6/17 10:54:00	3.08	4,436.0	4,128.1	173.1	10/6/17 7:52:00	2.97	4,283.0	4,135.4	170.1
10/6/17 11:54:00	3.12	4,496.0	4,126.1	173.3	10/6/17 8:52:00	3.02	4,343.0	4,133.2	170.3
10/6/17 12:54:00	3.16	4,556.0	4,124.1	173.5	10/6/17 9:52:00	3.06	4,403.0	4,131.0	170.5
10/6/17 13:54:00	3.21	4,616.0	4,122.2	173.6	10/6/17 10:52:00	3.10	4,463.0	4,128.9	170.7
10/6/17 14:54:00	3.25	4,676.0	4,120.5	173.8	10/6/17 11:52:00	3.14	4,523.0	4,127.0	170.9
10/6/17 15:54:00	3.29	4,736.0	4,118.8	173.9	10/6/17 12:52:00	3.18	4,583.0	4,125.0	171.0
10/6/17 16:54:00	3.33	4,796.0	4,117.1	174.1	10/6/17 13:52:00	3.22	4,643.0	4,123.2	171.2
10/6/17 17:54:00	3.37	4,856.0	4,115.5	174.2	10/6/17 14:52:00	3.27	4,703.0	4,121.5	171.3
10/6/17 18:54:00	3.41	4,916.0	4,113.8	174.4	10/6/17 15:52:00	3.31	4,763.0	4,119.8	171.5
10/6/17 19:54:00	3.46	4,976.0	4,112.3	174.5	10/6/17 16:52:00	3.35	4,823.0	4,118.2	171.6
10/6/17 20:54:00	3.50	5,036.0	4,110.8	174.6	10/6/17 17:52:00	3.39	4,883.0	4,116.6	171.8
10/6/17 21:54:00	3.54	5,096.0	4,109.2	174.7	10/6/17 18:52:00	3.43	4,943.0	4,115.0	171.9
10/6/17 22:54:00	3.58	5,156.0	4,107.8	174.8	10/6/17 19:52:00	3.47	5,003.0	4,113.4	172.0
10/6/17 23:54:00	3.62	5,216.0	4,106.4	174.9	10/6/17 20:52:00	3.52	5,063.0	4,112.0	172.1
10/7/17 0:54:00	3.66	5,276.0	4,105.0	175.0	10/6/17 21:52:00	3.56	5,123.0	4,110.5	172.2
10/7/17 1:54:00	3.71	5,336.0	4,103.7	175.1	10/6/17 22:52:00	3.60	5,183.0	4,109.0	172.4
10/7/17 2:54:00	3.75	5,396.0	4,102.4	175.2	10/6/17 23:52:00	3.64	5,243.0	4,107.7	172.5
10/7/17 3:54:00	3.79	5,456.0	4,101.1	175.3	10/7/17 0:52:00	3.68	5,303.0	4,106.3	172.6
10/7/17 4:54:00	3.83	5,516.0	4,099.8	175.4	10/7/17 1:52:00	3.72	5,363.0	4,104.9	172.7
10/7/17 5:54:00	3.87	5,576.0	4,098.6	175.5	10/7/17 2:52:00	3.77	5,423.0	4,103.7	172.8
10/7/17 6:54:00	3.91	5,636.0	4,097.4	175.6	10/7/17 3:52:00	3.81	5,483.0	4,102.5	172.9
10/7/17 7:54:00	3.96	5,696.0	4,096.4	175.6	10/7/17 4:52:00	3.85	5,543.0	4,101.2	173.0
10/7/17 8:54:00	4.00	5,756.0	4,095.2	175.7	10/7/17 5:52:00	3.89	5,603.0	4,100.1	173.1
10/7/17 9:54:00	4.04	5,816.0	4,094.0	175.8	10/7/17 6:52:00	3.93	5,663.0	4,098.9	173.1
10/7/17 10:54:00	4.08	5,876.0	4,092.8	175.9	10/7/17 7:52:00	3.97	5,723.0	4,097.7	173.2
10/7/17 11:54:00	4.12	5,936.0	4,091.7	175.9	10/7/17 8:52:00	4.02	5,783.0	4,096.6	173.3

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A						F328A					
F162A13 13 Deg						F328A13 13 Deg					
Date	Days	Minutes	Psig	F		Date	Days	Minutes	Psig	F	
10/7/17 12:54:00	4.16	5,996.0	4,090.6	176.0		10/7/17 9:52:00	4.06	5,843.0	4,095.5	173.4	
10/7/17 13:54:00	4.21	6,056.0	4,089.6	176.1		10/7/17 10:52:00	4.10	5,903.0	4,094.4	173.5	
10/7/17 14:54:00	4.25	6,116.0	4,088.5	176.1		10/7/17 11:52:00	4.14	5,963.0	4,093.2	173.6	
10/7/17 15:54:00	4.29	6,176.0	4,087.5	176.2		10/7/17 12:52:00	4.18	6,023.0	4,092.2	173.6	
10/7/17 16:54:00	4.33	6,236.0	4,086.5	176.2		10/7/17 13:52:00	4.22	6,083.0	4,091.2	173.7	
10/7/17 17:54:00	4.37	6,296.0	4,085.6	176.3		10/7/17 14:52:00	4.27	6,143.0	4,090.2	173.8	
10/7/17 18:54:00	4.41	6,356.0	4,084.6	176.3		10/7/17 15:52:00	4.31	6,203.0	4,089.2	174.0	
10/7/17 19:54:00	4.46	6,416.0	4,083.6	176.4		10/7/17 16:52:00	4.35	6,263.0	4,088.2	174.0	
10/7/17 20:54:00	4.50	6,476.0	4,082.6	176.4		10/7/17 17:52:00	4.39	6,323.0	4,087.2	174.1	
10/7/17 21:54:00	4.54	6,536.0	4,081.6	176.5		10/7/17 18:52:00	4.43	6,383.0	4,086.3	174.1	
10/7/17 22:54:00	4.58	6,596.0	4,080.8	176.5		10/7/17 19:52:00	4.47	6,443.0	4,085.4	174.2	
10/7/17 23:54:00	4.62	6,656.0	4,079.8	176.6		10/7/17 20:52:00	4.52	6,503.0	4,084.4	174.2	
10/8/17 0:54:00	4.66	6,716.0	4,079.0	176.7		10/7/17 21:52:00	4.56	6,563.0	4,083.5	174.3	
10/8/17 1:54:00	4.71	6,776.0	4,078.1	176.7		10/7/17 22:52:00	4.60	6,623.0	4,082.5	174.4	
10/8/17 2:54:00	4.75	6,836.0	4,077.2	176.8		10/7/17 23:52:00	4.64	6,683.0	4,081.6	174.4	
10/8/17 3:54:00	4.79	6,896.0	4,076.3	176.8		10/8/17 0:52:00	4.68	6,743.0	4,080.7	174.5	
10/8/17 4:54:00	4.83	6,956.0	4,075.5	176.9		10/8/17 1:52:00	4.72	6,803.0	4,079.9	174.5	
10/8/17 5:54:00	4.87	7,016.0	4,074.7	176.9		10/8/17 2:52:00	4.77	6,863.0	4,079.1	174.6	
10/8/17 6:54:00	4.91	7,076.0	4,073.9	177.0		10/8/17 3:52:00	4.81	6,923.0	4,078.2	174.6	
10/8/17 7:54:00	4.96	7,136.0	4,073.0	177.0		10/8/17 4:52:00	4.85	6,983.0	4,077.4	174.7	
10/8/17 8:54:00	5.00	7,196.0	4,072.2	177.1		10/8/17 5:52:00	4.89	7,043.0	4,076.6	174.7	
10/8/17 9:54:00	5.04	7,256.0	4,071.5	177.1		10/8/17 6:52:00	4.93	7,103.0	4,075.8	174.8	
10/8/17 10:54:00	5.08	7,316.0	4,070.7	177.2		10/8/17 7:52:00	4.97	7,163.0	4,075.0	174.8	
10/8/17 11:54:00	5.12	7,376.0	4,069.9	177.2		10/8/17 8:52:00	5.02	7,223.0	4,074.2	174.9	
10/8/17 12:54:00	5.16	7,436.0	4,069.1	177.2		10/8/17 9:52:00	5.06	7,283.0	4,073.4	174.9	
10/8/17 13:54:00	5.21	7,496.0	4,068.3	177.3		10/8/17 10:52:00	5.10	7,343.0	4,072.6	174.9	
10/8/17 14:54:00	5.25	7,556.0	4,067.6	177.3		10/8/17 11:52:00	5.14	7,403.0	4,071.8	175.0	
10/8/17 15:54:00	5.29	7,616.0	4,066.8	177.4		10/8/17 12:52:00	5.18	7,463.0	4,071.1	175.0	
10/8/17 16:54:00	5.33	7,676.0	4,066.1	177.4		10/8/17 13:52:00	5.22	7,523.0	4,070.3	175.1	
10/8/17 17:54:00	5.37	7,736.0	4,065.4	177.4		10/8/17 14:52:00	5.27	7,583.0	4,069.6	175.1	
10/8/17 18:54:00	5.41	7,796.0	4,064.7	177.5		10/8/17 15:52:00	5.31	7,643.0	4,068.8	175.2	
10/8/17 19:54:00	5.46	7,856.0	4,063.9	177.5		10/8/17 16:52:00	5.35	7,703.0	4,068.1	175.2	
10/8/17 20:54:00	5.50	7,916.0	4,063.2	177.6		10/8/17 17:52:00	5.39	7,763.0	4,067.4	175.3	
10/8/17 21:54:00	5.54	7,976.0	4,062.5	177.6		10/8/17 18:52:00	5.43	7,823.0	4,066.7	175.3	
10/8/17 22:54:00	5.58	8,036.0	4,061.8	177.6		10/8/17 19:52:00	5.47	7,883.0	4,066.1	175.3	
10/8/17 23:54:00	5.62	8,096.0	4,061.1	177.7		10/8/17 20:52:00	5.52	7,943.0	4,065.4	175.4	
10/9/17 0:54:00	5.66	8,156.0	4,060.4	177.7		10/8/17 21:52:00	5.56	8,003.0	4,064.6	175.4	
10/9/17 1:54:00	5.71	8,216.0	4,059.7	177.7		10/8/17 22:52:00	5.60	8,063.0	4,063.9	175.5	
10/9/17 2:54:00	5.75	8,276.0	4,059.1	177.8		10/8/17 23:52:00	5.64	8,123.0	4,063.2	175.5	
10/9/17 3:54:00	5.79	8,336.0	4,058.5	177.8		10/9/17 0:52:00	5.68	8,183.0	4,062.6	175.5	
10/9/17 4:54:00	5.83	8,396.0	4,057.8	177.8		10/9/17 1:52:00	5.72	8,243.0	4,061.9	175.6	
10/9/17 5:54:00	5.87	8,456.0	4,057.1	177.9		10/9/17 2:52:00	5.77	8,303.0	4,061.3	175.6	
10/9/17 6:54:00	5.91	8,516.0	4,056.5	177.9		10/9/17 3:52:00	5.81	8,363.0	4,060.6	175.6	

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/9/17 7:54:00	5.96	8,576.0	4,055.9	177.9	10/9/17 4:52:00	5.85	8,423.0	4,060.0	175.7
10/9/17 8:54:00	6.00	8,636.0	4,055.3	178.0	10/9/17 5:52:00	5.89	8,483.0	4,059.4	175.7
10/9/17 9:54:00	6.04	8,696.0	4,054.7	178.0	10/9/17 6:52:00	5.93	8,543.0	4,058.8	175.7
10/9/17 10:54:00	6.08	8,756.0	4,054.1	178.0	10/9/17 7:52:00	5.97	8,603.0	4,058.2	175.8
10/9/17 11:54:00	6.12	8,816.0	4,053.5	178.0	10/9/17 8:52:00	6.02	8,663.0	4,057.6	175.8
10/9/17 12:54:00	6.16	8,876.0	4,052.8	178.1	10/9/17 9:52:00	6.06	8,723.0	4,057.0	175.9
10/9/17 13:54:00	6.21	8,936.0	4,052.2	178.1	10/9/17 10:52:00	6.10	8,783.0	4,056.4	175.9
10/9/17 14:54:00	6.25	8,996.0	4,051.6	178.1	10/9/17 11:52:00	6.14	8,843.0	4,055.7	175.9
10/9/17 15:54:00	6.29	9,056.0	4,051.0	178.2	10/9/17 12:52:00	6.18	8,903.0	4,055.2	176.0
10/9/17 16:54:00	6.33	9,116.0	4,050.4	178.2	10/9/17 13:52:00	6.22	8,963.0	4,054.5	176.0
10/9/17 17:54:00	6.37	9,176.0	4,049.9	178.2	10/9/17 14:52:00	6.27	9,023.0	4,053.9	176.0
10/9/17 18:54:00	6.41	9,236.0	4,049.2	178.2	10/9/17 15:52:00	6.31	9,083.0	4,053.3	176.1
10/9/17 19:54:00	6.46	9,296.0	4,048.7	178.3	10/9/17 16:52:00	6.35	9,143.0	4,052.8	176.1
10/9/17 20:54:00	6.50	9,356.0	4,048.2	178.3	10/9/17 17:52:00	6.39	9,203.0	4,052.2	176.1
10/9/17 21:54:00	6.54	9,416.0	4,047.6	178.3	10/9/17 18:52:00	6.43	9,263.0	4,051.7	176.2
10/9/17 22:54:00	6.58	9,476.0	4,047.0	178.3	10/9/17 19:52:00	6.47	9,323.0	4,051.1	176.2
10/9/17 23:54:00	6.62	9,536.0	4,046.4	178.4	10/9/17 20:52:00	6.52	9,383.0	4,050.5	176.2
10/10/17 0:54:00	6.66	9,596.0	4,045.8	178.4	10/9/17 21:52:00	6.56	9,443.0	4,049.9	176.2
10/10/17 1:54:00	6.71	9,656.0	4,045.3	178.4	10/9/17 22:52:00	6.60	9,503.0	4,049.4	176.3
10/10/17 2:54:00	6.75	9,716.0	4,044.7	178.4	10/9/17 23:52:00	6.64	9,563.0	4,048.8	176.3
10/10/17 3:54:00	6.79	9,776.0	4,044.2	178.5	10/10/17 0:52:00	6.68	9,623.0	4,048.2	176.3
10/10/17 4:54:00	6.83	9,836.0	4,043.7	178.5	10/10/17 1:52:00	6.72	9,683.0	4,047.7	176.4
10/10/17 5:54:00	6.87	9,896.0	4,043.1	178.5	10/10/17 2:52:00	6.77	9,743.0	4,047.2	176.4
10/10/17 6:54:00	6.91	9,956.0	4,042.6	178.5	10/10/17 3:52:00	6.81	9,803.0	4,046.6	176.4
10/10/17 7:54:00	6.96	10,016.0	4,042.0	178.6	10/10/17 4:52:00	6.85	9,863.0	4,046.1	176.4
10/10/17 8:54:00	7.00	10,076.0	4,041.5	178.6	10/10/17 5:52:00	6.89	9,923.0	4,045.6	176.5
10/10/17 9:54:00	7.04	10,136.0	4,041.1	178.6	10/10/17 6:52:00	6.93	9,983.0	4,045.1	176.5
10/10/17 10:54:00	7.08	10,196.0	4,040.5	178.6	10/10/17 7:52:00	6.97	10,043.0	4,044.5	176.5
10/10/17 11:54:00	7.12	10,256.0	4,040.0	178.7	10/10/17 8:52:00	7.02	10,103.0	4,044.0	176.5
10/10/17 12:54:00	7.16	10,316.0	4,039.5	178.7	10/10/17 9:52:00	7.06	10,163.0	4,043.5	176.6
10/10/17 13:54:00	7.21	10,376.0	4,039.0	178.7	10/10/17 10:52:00	7.10	10,223.0	4,043.0	176.6
10/10/17 14:54:00	7.25	10,436.0	4,038.4	178.7	10/10/17 11:52:00	7.14	10,283.0	4,042.5	176.6
10/10/17 15:54:00	7.29	10,496.0	4,037.9	178.7	10/10/17 12:52:00	7.18	10,343.0	4,042.0	176.6
10/10/17 16:54:00	7.33	10,556.0	4,037.4	178.8	10/10/17 13:52:00	7.22	10,403.0	4,041.5	176.7
10/10/17 17:54:00	7.37	10,616.0	4,037.0	178.8	10/10/17 14:52:00	7.27	10,463.0	4,041.0	176.7
10/10/17 18:54:00	7.41	10,676.0	4,036.5	178.8	10/10/17 15:52:00	7.31	10,523.0	4,040.4	176.7
10/10/17 19:54:00	7.46	10,736.0	4,036.0	178.8	10/10/17 16:52:00	7.35	10,583.0	4,039.9	176.8
10/10/17 20:54:00	7.50	10,796.0	4,035.5	178.8	10/10/17 17:52:00	7.39	10,643.0	4,039.5	176.8
10/10/17 21:54:00	7.54	10,856.0	4,035.0	178.9	10/10/17 18:52:00	7.43	10,703.0	4,039.1	176.8
10/10/17 22:54:00	7.58	10,916.0	4,034.5	178.9	10/10/17 19:52:00	7.47	10,763.0	4,038.5	176.8
10/10/17 23:54:00	7.62	10,976.0	4,034.0	178.9	10/10/17 20:52:00	7.52	10,823.0	4,038.1	176.9
10/11/17 0:54:00	7.66	11,036.0	4,033.5	178.9	10/10/17 21:52:00	7.56	10,883.0	4,037.5	176.9
10/11/17 1:54:00	7.71	11,096.0	4,033.0	178.9	10/10/17 22:52:00	7.60	10,943.0	4,037.1	176.9

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/11/17 2:54:00	7.75	11,156.0	4,032.5	179.0	10/10/17 23:52:00	7.64	11,003.0	4,036.6	176.9
10/11/17 3:54:00	7.79	11,216.0	4,032.0	179.0	10/11/17 0:52:00	7.68	11,063.0	4,036.1	176.9
10/11/17 4:54:00	7.83	11,276.0	4,031.6	179.0	10/11/17 1:52:00	7.72	11,123.0	4,035.6	177.0
10/11/17 5:54:00	7.87	11,336.0	4,031.1	179.0	10/11/17 2:52:00	7.77	11,183.0	4,035.1	177.0
10/11/17 6:54:00	7.91	11,396.0	4,030.6	179.0	10/11/17 3:52:00	7.81	11,243.0	4,034.6	177.0
10/11/17 7:54:00	7.96	11,456.0	4,030.2	179.0	10/11/17 4:52:00	7.85	11,303.0	4,034.2	177.0
10/11/17 8:54:00	8.00	11,516.0	4,029.8	179.1	10/11/17 5:52:00	7.89	11,363.0	4,033.8	177.1
10/11/17 9:54:00	8.04	11,576.0	4,029.3	179.1	10/11/17 6:52:00	7.93	11,423.0	4,033.3	177.1
10/11/17 10:54:00	8.08	11,636.0	4,028.8	179.1	10/11/17 7:52:00	7.97	11,483.0	4,032.9	177.1
10/11/17 11:54:00	8.12	11,696.0	4,028.4	179.1	10/11/17 8:52:00	8.02	11,543.0	4,032.5	177.1
10/11/17 12:54:00	8.16	11,756.0	4,028.0	179.1	10/11/17 9:52:00	8.06	11,603.0	4,032.0	177.1
10/11/17 13:54:00	8.21	11,816.0	4,027.5	179.2	10/11/17 10:52:00	8.10	11,663.0	4,031.5	177.2
10/11/17 14:54:00	8.25	11,876.0	4,027.0	179.2	10/11/17 11:52:00	8.14	11,723.0	4,031.1	177.2
10/11/17 15:54:00	8.29	11,936.0	4,026.5	179.2	10/11/17 12:52:00	8.18	11,783.0	4,030.7	177.2
10/11/17 16:54:00	8.33	11,996.0	4,026.1	179.2	10/11/17 13:52:00	8.22	11,843.0	4,030.3	177.2
10/11/17 17:54:00	8.37	12,056.0	4,025.7	179.2	10/11/17 14:52:00	8.27	11,903.0	4,029.9	177.2
10/11/17 18:54:00	8.41	12,116.0	4,025.3	179.2	10/11/17 15:52:00	8.31	11,963.0	4,029.4	177.3
10/11/17 19:54:00	8.46	12,176.0	4,024.8	179.3	10/11/17 16:52:00	8.35	12,023.0	4,028.9	177.3
10/11/17 20:54:00	8.50	12,236.0	4,024.3	179.3	10/11/17 17:52:00	8.39	12,083.0	4,028.5	177.3
10/11/17 21:54:00	8.54	12,296.0	4,024.0	179.3	10/11/17 18:52:00	8.43	12,143.0	4,028.1	177.3
10/11/17 22:54:00	8.58	12,356.0	4,023.5	179.3	10/11/17 19:52:00	8.47	12,203.0	4,027.6	177.3
10/11/17 23:54:00	8.62	12,416.0	4,023.1	179.3	10/11/17 20:52:00	8.52	12,263.0	4,027.2	177.3
10/12/17 0:54:00	8.66	12,476.0	4,022.7	179.3	10/11/17 21:52:00	8.56	12,323.0	4,026.8	177.4
10/12/17 1:54:00	8.71	12,536.0	4,022.2	179.4	10/11/17 22:52:00	8.60	12,383.0	4,026.3	177.4
10/12/17 2:54:00	8.75	12,596.0	4,021.8	179.4	10/11/17 23:52:00	8.64	12,443.0	4,025.9	177.4
10/12/17 3:54:00	8.79	12,656.0	4,021.4	179.4	10/12/17 0:52:00	8.68	12,503.0	4,025.5	177.4
10/12/17 4:54:00	8.83	12,716.0	4,020.9	179.4	10/12/17 1:52:00	8.72	12,563.0	4,025.1	177.4
10/12/17 5:54:00	8.87	12,776.0	4,020.6	179.4	10/12/17 2:52:00	8.77	12,623.0	4,024.7	177.5
10/12/17 6:54:00	8.91	12,836.0	4,020.2	179.4	10/12/17 3:52:00	8.81	12,683.0	4,024.2	177.5
10/12/17 7:54:00	8.96	12,896.0	4,019.7	179.4	10/12/17 4:52:00	8.85	12,743.0	4,023.9	177.5
10/12/17 8:54:00	9.00	12,956.0	4,019.3	179.5	10/12/17 5:52:00	8.89	12,803.0	4,023.5	177.5
10/12/17 9:54:00	9.04	13,016.0	4,018.9	179.5	10/12/17 6:52:00	8.93	12,863.0	4,023.0	177.5
10/12/17 10:54:00	9.08	13,076.0	4,018.5	179.5	10/12/17 7:52:00	8.97	12,923.0	4,022.6	177.6
10/12/17 11:54:00	9.12	13,136.0	4,018.1	179.5	10/12/17 8:52:00	9.02	12,983.0	4,022.2	177.6
10/12/17 12:54:00	9.16	13,196.0	4,017.6	179.5	10/12/17 9:52:00	9.06	13,043.0	4,021.7	177.6
10/12/17 13:54:00	9.21	13,256.0	4,017.2	179.5	10/12/17 10:52:00	9.10	13,103.0	4,021.4	177.6
10/12/17 14:54:00	9.25	13,316.0	4,016.8	179.6	10/12/17 11:52:00	9.14	13,163.0	4,021.1	177.6
10/12/17 15:54:00	9.29	13,376.0	4,016.4	179.6	10/12/17 12:52:00	9.18	13,223.0	4,020.7	177.6
10/12/17 16:54:00	9.33	13,436.0	4,016.0	179.6	10/12/17 13:52:00	9.22	13,283.0	4,020.2	177.7
10/12/17 17:54:00	9.37	13,496.0	4,015.7	179.6	10/12/17 14:52:00	9.27	13,343.0	4,019.9	177.7
10/12/17 18:54:00	9.41	13,556.0	4,015.3	179.6	10/12/17 15:52:00	9.31	13,403.0	4,019.5	177.7
10/12/17 19:54:00	9.46	13,616.0	4,014.9	179.6	10/12/17 16:52:00	9.35	13,463.0	4,019.0	177.7
10/12/17 20:54:00	9.50	13,676.0	4,014.5	179.6	10/12/17 17:52:00	9.39	13,523.0	4,018.7	177.7

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/12/17 21:54:00	9.54	13,736.0	4,014.1	179.6	10/12/17 18:52:00	9.43	13,583.0	4,018.3	177.7
10/12/17 22:54:00	9.58	13,796.0	4,013.7	179.7	10/12/17 19:52:00	9.47	13,643.0	4,018.0	177.8
10/12/17 23:54:00	9.62	13,856.0	4,013.4	179.7	10/12/17 20:52:00	9.52	13,703.0	4,017.5	177.8
10/13/17 0:54:00	9.66	13,916.0	4,013.0	179.7	10/12/17 21:52:00	9.56	13,763.0	4,017.1	177.8
10/13/17 1:54:00	9.71	13,976.0	4,012.6	179.7	10/12/17 22:52:00	9.60	13,823.0	4,016.7	177.8
10/13/17 2:54:00	9.75	14,036.0	4,012.2	179.7	10/12/17 23:52:00	9.64	13,883.0	4,016.3	177.8
10/13/17 3:54:00	9.79	14,096.0	4,011.8	179.7	10/13/17 0:52:00	9.68	13,943.0	4,016.0	177.8
10/13/17 4:54:00	9.83	14,156.0	4,011.4	179.7	10/13/17 1:52:00	9.72	14,003.0	4,015.6	177.8
10/13/17 5:54:00	9.87	14,216.0	4,011.0	179.8	10/13/17 2:52:00	9.77	14,063.0	4,015.3	177.9
10/13/17 6:54:00	9.91	14,276.0	4,010.7	179.8	10/13/17 3:52:00	9.81	14,123.0	4,014.9	177.9
10/13/17 7:04:00	9.92	14,286.0	4,010.6	179.8	10/13/17 4:02:00	9.81	14,133.0	4,014.8	177.9
10/13/17 7:14:00	9.93	14,296.0	4,010.5	179.8	10/13/17 4:12:00	9.82	14,143.0	4,014.8	177.9
10/13/17 7:24:00	9.93	14,306.0	4,010.4	179.8	10/13/17 4:22:00	9.83	14,153.0	4,014.7	177.9
10/13/17 7:34:00	9.94	14,316.0	4,010.4	179.8	10/13/17 4:32:00	9.84	14,163.0	4,014.6	177.9
10/13/17 7:44:00	9.95	14,326.0	4,010.3	179.8	10/13/17 4:42:00	9.84	14,173.0	4,014.5	177.9
10/13/17 7:54:00	9.96	14,336.0	4,010.3	179.8	10/13/17 4:52:00	9.85	14,183.0	4,014.4	177.9
10/13/17 8:04:00	9.96	14,346.0	4,010.2	179.8	10/13/17 5:02:00	9.86	14,193.0	4,014.4	177.9
10/13/17 8:14:00	9.97	14,356.0	4,010.1	179.8	10/13/17 5:12:00	9.86	14,203.0	4,014.3	177.9
10/13/17 8:24:00	9.98	14,366.0	4,010.1	179.8	10/13/17 5:22:00	9.87	14,213.0	4,014.3	177.9
10/13/17 8:34:00	9.98	14,376.0	4,009.7	179.9	10/13/17 5:32:00	9.88	14,223.0	4,014.2	177.9
10/13/17 8:35:00	9.98	14,377.0	4,009.7	179.9	10/13/17 5:33:00	9.88	14,224.0	4,014.2	177.9
10/13/17 8:36:00	9.98	14,378.0	4,009.8	179.9	10/13/17 5:34:00	9.88	14,225.0	4,014.2	177.9
10/13/17 8:37:00	9.99	14,379.0	4,009.7	179.9	10/13/17 5:35:00	9.88	14,226.0	4,014.2	177.9
10/13/17 8:38:00	9.99	14,380.0	4,009.7	180.0	10/13/17 5:36:00	9.88	14,227.0	4,014.2	177.9
10/13/17 8:39:00	9.99	14,381.0	3,981.2	180.0	10/13/17 5:37:00	9.88	14,228.0	4,014.2	177.9
10/13/17 8:39:15	9.99	14,381.3	3,968.2	180.0	10/13/17 5:38:00	9.88	14,229.0	4,014.2	177.9
10/13/17 8:39:30	9.99	14,381.5	3,954.9	180.1	10/13/17 5:39:00	9.88	14,230.0	4,014.2	177.9
10/13/17 8:39:45	9.99	14,381.8	3,941.1	180.2	10/13/17 5:40:00	9.88	14,231.0	4,014.2	177.9
10/13/17 8:42:15	9.99	14,384.3	3,876.3	181.3	10/13/17 5:50:00	9.89	14,241.0	4,014.1	177.9
10/13/17 8:44:45	9.99	14,386.8	3,876.9	181.5	10/13/17 6:00:00	9.90	14,251.0	4,014.1	177.9
10/13/17 8:47:15	9.99	14,389.3	3,682.3	180.9	10/13/17 6:10:00	9.90	14,261.0	4,014.0	177.9
10/13/17 8:49:45	9.99	14,391.8	3,456.8	177.2	10/13/17 6:20:00	9.91	14,271.0	4,013.9	177.9
10/13/17 8:52:15	10.00	14,394.3	3,456.8	172.2	10/13/17 6:30:00	9.92	14,281.0	4,013.8	177.9
10/13/17 8:54:45	10.00	14,396.8	3,455.5	168.1	10/13/17 6:40:00	9.92	14,291.0	4,013.8	177.9
10/13/17 8:57:15	10.00	14,399.3	3,213.1	165.1	10/13/17 6:50:00	9.93	14,301.0	4,013.8	177.9
10/13/17 8:59:45	10.00	14,401.8	3,031.9	158.0	10/13/17 7:00:00	9.94	14,311.0	4,013.7	177.9
10/13/17 9:02:15	10.00	14,404.3	3,030.1	151.6	10/13/17 7:10:00	9.95	14,321.0	4,013.6	177.9
10/13/17 9:04:45	10.00	14,406.8	3,027.7	147.2	10/13/17 7:20:00	9.95	14,331.0	4,013.5	177.9
10/13/17 9:07:15	10.01	14,409.3	2,692.5	143.0	10/13/17 7:30:00	9.96	14,341.0	4,013.5	177.9
10/13/17 9:09:45	10.01	14,411.8	2,600.7	137.2	10/13/17 7:40:00	9.97	14,351.0	4,013.4	177.9
10/13/17 9:12:15	10.01	14,414.3	2,599.4	131.5	10/13/17 7:50:00	9.97	14,361.0	4,013.3	177.9
10/13/17 9:14:45	10.01	14,416.8	2,597.3	128.1	10/13/17 8:00:00	9.98	14,371.0	4,012.7	178.0
10/13/17 9:17:15	10.01	14,419.3	2,213.1	124.3	10/13/17 8:10:00	9.99	14,378.8	3,971.3	178.4

Appendix E FO Test Raw Data

F162A13.RAW G162204.CAL 15612

F328A13.RAW G328711.CAL 15612

F162A					F328A				
F162A13 13 Deg					F328A13 13 Deg				
Date	Days	Minutes	Psig	F	Date	Days	Minutes	Psig	F
10/13/17 9:19:45	10.02	14,421.8	1,739.4	117.0	10/13/17 8:20:00	9.99	14,381.3	3,878.9	180.1
10/13/17 9:22:15	10.02	14,424.3	1,737.7	108.5	10/13/17 8:30:00	9.99	14,383.8	3,879.4	181.1
10/13/17 9:24:45	10.02	14,426.8	1,735.2	101.6	10/13/17 8:40:00	9.99	14,386.3	3,751.8	181.2
10/13/17 9:27:15	10.02	14,429.3	1,447.6	97.0	10/13/17 8:42:30	9.99	14,388.8	3,469.9	178.4
10/13/17 9:29:45	10.02	14,431.8	1,302.5	90.0	10/13/17 8:45:00	9.99	14,391.3	3,460.2	173.7
10/13/17 9:32:15	10.02	14,434.3	1,300.3	84.1	10/13/17 8:47:30	10.00	14,393.8	3,458.0	169.4
10/13/17 9:34:45	10.03	14,436.8	1,298.0	80.1	10/13/17 8:50:00	10.00	14,396.3	3,290.2	166.3
10/13/17 9:37:15	10.03	14,439.3	957.7	76.6	10/13/17 8:52:30	10.00	14,398.8	3,032.7	160.0
10/13/17 9:39:45	10.03	14,441.8	866.5	72.0	10/13/17 8:55:00	10.00	14,401.3	3,032.6	153.2
10/13/17 9:42:15	10.03	14,444.3	866.2	66.8	10/13/17 8:57:30	10.00	14,403.8	3,030.4	148.3
10/13/17 9:44:45	10.03	14,446.8	864.6	63.6	10/13/17 9:00:00	10.00	14,406.3	2,783.1	144.2
10/13/17 9:47:15	10.03	14,449.3	857.7	61.9	10/13/17 9:02:30	10.01	14,408.8	2,602.2	138.9
10/13/17 9:49:45	10.04	14,451.8	856.9	61.3	10/13/17 9:05:00	10.01	14,411.3	2,600.4	132.8
10/13/17 9:53:00	10.04	14,455.0	0.0	61.3	10/13/17 9:07:30	10.01	14,413.8	2,598.8	129.0
10/13/17 9:55:30	10.04	14,457.5	0.0	61.7	10/13/17 9:10:00	10.01	14,416.3	2,310.8	125.7
10/13/17 9:58:00	10.04	14,460.0	0.0	62.1	10/13/17 9:12:30	10.01	14,418.8	1,810.6	119.0
10/13/17 10:00:30	10.04	14,462.5	0.0	62.2	10/13/17 9:15:00	10.01	14,421.3	1,740.5	110.5
10/13/17 10:09:00	10.05	14,471.0	0.0	60.5	10/13/17 9:17:30	10.02	14,423.8	1,736.9	103.1
					10/13/17 9:20:00	10.02	14,426.3	1,543.0	98.3
					10/13/17 9:22:30	10.02	14,428.8	1,303.9	91.9
					10/13/17 9:25:00	10.02	14,431.3	1,303.8	85.8
					10/13/17 9:27:30	10.02	14,433.8	1,301.6	81.5
					10/13/17 9:30:00	10.03	14,436.3	1,054.4	78.1
					10/13/17 9:32:30	10.03	14,438.8	869.2	73.9
					10/13/17 9:35:00	10.03	14,441.3	870.3	67.9
					10/13/17 9:37:30	10.03	14,443.8	869.9	63.3
					10/13/17 9:40:00	10.03	14,446.3	864.8	60.7
					10/13/17 9:42:30	10.03	14,448.8	860.7	60.2
					10/13/17 9:45:00	10.04	14,451.3	859.3	60.6
					10/13/17 9:47:30	10.04	14,453.8	0.0	61.4
					10/13/17 9:50:00	10.04	14,456.3	0.9	62.3
					10/13/17 9:52:30	10.04	14,458.8	0.8	63.1
					10/13/17 9:55:00	10.05	14,468.0	2.5	60.7
					10/13/17 9:57:30	10.05	14,478.0	2.5	60.3

Appendix F

Test gauge calibration certificates



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	772.83	-1.25	-0.0250%
1498.24	1497.46	-0.78	-0.0156%
2222.36	2220.75	-1.61	-0.0322%
2946.53	2944.89	-1.64	-0.0328%
3670.66	3669.06	-1.60	-0.0320%
4394.87	4393.46	-1.41	-0.0283%
5119.00	5117.54	-1.46	-0.0292%
4394.87	4393.90	-0.97	-0.0195%
3670.66	3669.82	-0.84	-0.0168%
2946.53	2945.67	-0.86	-0.0173%
2222.36	2221.50	-0.86	-0.0172%
1498.24	1497.46	-0.78	-0.0156%
774.08	773.32	-0.76	-0.0151%
0.01	0.01	0.00	0.0000%

Oven Temperature: 273.3 °F

Probe Temperature: 273.5 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.71	0.70	0.0139%
774.08	774.96	0.88	0.0177%
1498.24	1499.12	0.88	0.0176%
2222.36	2222.99	0.63	0.0126%
2946.53	2947.04	0.51	0.0102%
3670.66	3671.23	0.57	0.0113%
4394.87	4395.53	0.66	0.0133%
5119.00	5119.94	0.94	0.0187%
4394.87	4396.16	1.29	0.0258%
3670.66	3671.99	1.33	0.0265%
2946.53	2947.97	1.44	0.0287%
2222.36	2223.84	1.48	0.0296%
1498.24	1499.73	1.49	0.0299%
774.08	775.18	1.10	0.0220%
0.01	0.25	0.24	0.0049%

Oven Temperature: 144.7 °F

Probe Temperature: 144.7 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.90	-0.19	-0.0037%
1498.24	1497.87	-0.38	-0.0075%
2222.36	2221.81	-0.55	-0.0110%
2946.53	2945.90	-0.63	-0.0126%
3670.66	3669.99	-0.67	-0.0134%
4394.87	4394.44	-0.43	-0.0087%
5119.00	5118.94	-0.06	-0.0012%
4394.87	4394.97	0.10	0.0019%
3670.66	3670.88	0.22	0.0045%
2946.53	2946.76	0.23	0.0046%
2222.36	2222.61	0.25	0.0050%
1498.24	1498.39	0.15	0.0031%
774.08	774.11	0.03	0.0007%
0.01	0.01	0.00	0.0000%

Oven Temperature: 179.7 °F

Probe Temperature: 179.6 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

5-February-2014

Gauge Model SP-2000 Pressure Range 5 K
Gauge S/N 162 Accuracy 0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.21	-0.87	-0.0175%
1498.24	1497.32	-0.92	-0.0185%
2222.36	2221.23	-1.14	-0.0227%
2946.53	2945.55	-0.98	-0.0196%
3670.66	3669.54	-1.12	-0.0224%
4394.87	4394.04	-0.83	-0.0166%
5119.00	5118.21	-0.79	-0.0158%
4394.87	4394.41	-0.47	-0.0093%
3670.66	3670.40	-0.26	-0.0053%
2946.53	2945.98	-0.55	-0.0109%
2222.36	2222.05	-0.31	-0.0061%
1498.24	1497.93	-0.31	-0.0062%
774.08	773.76	-0.32	-0.0064%
0.01	0.01	0.00	0.0000%

Oven Temperature: 253.9 °F

Probe Temperature: 253.8 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

11-July-2017

Gauge Model SP-2000 Pressure Range 5K
Gauge S/N 328 Accuracy +/-0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.01	0.00	0.0000%
774.08	773.67	-0.41	-0.0082%
1498.24	1497.45	-0.79	-0.0158%
2222.36	2221.56	-0.80	-0.0160%
2946.53	2946.12	-0.41	-0.0082%
3670.66	3670.01	-0.65	-0.0130%
4394.87	4394.33	-0.54	-0.0108%
5119.00	5118.90	-0.10	-0.0020%
4394.87	4395.08	0.21	0.0042%
3670.66	3671.10	0.44	0.0088%
2946.53	2947.05	0.52	0.0104%
2222.36	2222.82	0.46	0.0092%
1498.24	1498.64	0.40	0.0080%
774.08	774.48	0.40	0.0080%
0.01	0.62	0.61	0.0122%

Oven Temperature: 178.8 °F

Probe Temperature: 177.9 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM



ACCURACY VERIFICATION

11-July-2017

Gauge Model SP-2000 Pressure Range 5K
Gauge S/N 328 Accuracy +/-0.05% Full Scale

Applied Pressure psig	Recorded Pressure psig	Difference	
		psi	Percent (%)
0.01	0.11	0.10	0.0020%
774.08	773.86	-0.22	-0.0044%
1498.24	1497.71	-0.53	-0.0106%
2222.36	2221.44	-0.92	-0.0184%
2946.53	2945.47	-1.06	-0.0212%
3670.66	3669.65	-1.01	-0.0202%
4394.87	4393.92	-0.95	-0.0190%
5119.00	5118.53	-0.47	-0.0094%
4394.87	4394.68	-0.19	-0.0038%
3670.66	3670.46	-0.20	-0.0040%
2946.53	2946.75	0.22	0.0044%
2222.36	2222.81	0.45	0.0090%
1498.24	1499.02	0.78	0.0156%
774.08	775.17	1.09	0.0218%
0.01	0.01	0.00	0.0000%

Oven Temperature: 218.7 °F

Probe Temperature: 218.6 °F

Smart Gauge Calibration accuracy is confirmed.

Calibrated with RUSKA Pressure Standard, model # 2451-700-00

Serial #26618, Mass Set Serial #25608

Compensated to local acceleration due to gravity

Verified by: CM

Appendix G

Mechanical Integrity Test Report (MIT)



NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

MECHANICAL INTEGRITY TEST REPORT

(TA OR UIC)

Date of Test 6-8-17 Operator Western Ref. SW Inc. API # 30-0 45-35747

Property Name Waste Dis. Well Well # 2 Location: Unit H Sec 27 Twn 29 Rge 11

Land Type:

State _____
Federal _____
Private ☒ _____
Indian _____

Well Type:

Water Injection _____
Salt Water Disposal ☒ _____
Gas Injection _____
Producing Oil/Gas _____
Pressure observation _____

Temporarily Abandoned Well (Y/N): 0

TA Expires: _____

Casing Pres. 0
Bradenhead Pres. 0
Tubing Pres. 610
Int. Casing Pres. 0

Tbg. SI Pres. _____
Tbg. Inj. Pres. _____

Max. Inj. Pres. _____

Pressured annulus up to 510 psi. for 30 mins. Test passed/failed

REMARKS:

packer set 7230
top plug 1312-7470
dropped to 505 hld last 15 min.

By T. A. P. (Operator Representative)

Witness Monica Kuebeling (NMOCD)

(Position)

Revised 02-11-02



NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
AZTEC DISTRICT OFFICE
1000 RIO BRAZOS ROAD
AZTEC NM 87410
(505) 334-6178 FAX: (505) 334-6170
[http://emnrd.state.nm.us/ocd/District III/3distric.htm](http://emnrd.state.nm.us/ocd/District%20III/3distric.htm)

BRADENHEAD TEST REPORT

(submit 1 copy to above address)

Date of Test 6-8-17 Operator Western Energy API #30-0 45-35747
Property Name Waste Disposal Well Well No. 2 Location: Unit H Section 27 Township 29 Range 11
Well Status (Shut-In or Producing) Initial PSI: Tubing 600 Intermediate 0 Casing 100 Bradenhead 0

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

Testing	PRESSURE			INTERM	
	BH	Int	Csg	Int	Csg
TIME					
5 min	0	0	100	0	100
10 min	0	0	100	0	100
15 min	0	0	100	0	100
20 min					
25 min					
30 min					

FLOW CHARACTERISTICS	
BRADENHEAD	INTERMEDIATE
Steady Flow	
Surges	
Down to Nothing	✓
Nothing	
Gas	✓
Gas & Water	
Water	

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR _____ FRESH _____ SALTY _____ SULFUR _____ BLACK _____

5 MINUTE SHUT-IN PRESSURE

BRADENHEAD 0

INTERMEDIATE 0

REMARKS:

BH - Puff when opened. Nothing when
opened after 5 min shut-in. 2nd. light blow
to head at 5 sec. Nothing when opened after
5 min shut-in

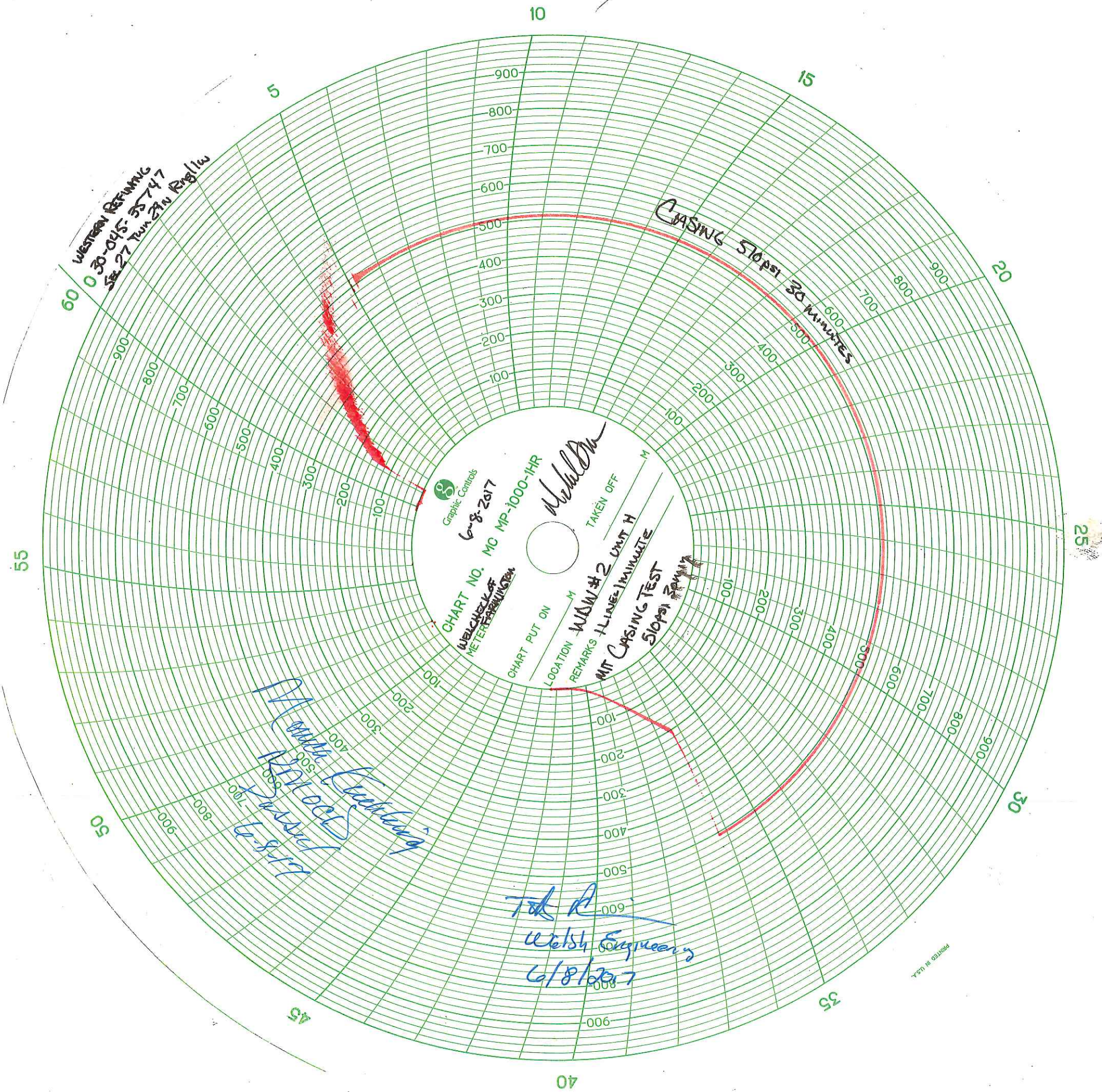
By John R. [Signature]

Witness

Mona [Signature]

(Position)

E-mail address _____



Appendix H

Table of wells in a one mile radius

Disposal Well #2 and Area Wells

Miles				Perf			Pne Inj						
Map to	DW2	Wellname	#	API No	Perf Top	Botto m	Total Depth	P&A Date	ULSTR	Operator	Reservoir	Status	Zone
Seq													
0	-	Waste Disposal Well	2	30-045-35747	7312	7470	7470		H-27-29N-11W	WESTERN REFINING	ENTRADA	ACTIVE INJ	Yes
1	0.20	JACQUE	2	30-045-34409	1483	1689	1689		H-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
2	0.22	DAVIS GAS COM F	1E	30-045-24084	2701	2810	6262		H-27-29N-11W	XTO ENERGY, INC.	CHACRA	ACTIVE	No
2	0.22	DAVIS GAS COM F	1E	30-045-24084	6163	6262	6262		H-27-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
3	0.22	PRE-ONGARD WELL	0	30-045-07883			1759		H-27-29N-11W	PRE-ONGARD WELL	Unknown	INACTIVE	No
4	0.26	DISPOSAL	1	30-045-29002	3276	3514	3514	P & A	I-27-29N-11W	SAN JUAN REFINING	MESAVERDE	P & A	No
5	0.30	DAVIS GAS COM F	1R	30-045-30833	5314	5646	6177		I-27-29N-11W	XTO ENERGY, INC.	GALLUP	ACTIVE	No
5	0.30	DAVIS GAS COM F	1R	30-045-30833	6177	6308	6177		I-27-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	3970	4030	4030	P & A	F-26-29N-11W	BP AMERICA	MESAVERDE	P & A	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	1462	1645	4030		F-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
6	0.31	DAVIS GAS COM J	1	30-045-25329	2631	2772	4030	P & A	F-26-29N-11W	XTO ENERGY, INC.	CHACRA	P & A	No
7	0.32	SULLIVAN GAS COM D	1E	30-045-24083	6086	6242	6242		F-26-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
8	0.33	DAVIS GAS COM F	1	30-045-07825	6157	6298	6298	P & A	I-27-29N-11W	BP AMERICA	DAKOTA	P & A	No
9	0.33	DAVIS GAS COM G	1	30-045-23554	2827	2839	2839	P & A	I-27-29N-11W	XTO ENERGY, INC.	CHACRA	P & A	No
10	0.33	JACQUE	1	30-045-34463	1543	1714	1714		I-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No
11	0.34	PRE-ONGARD WELL	1	30-045-07812	1692*	1746*	1804	P & A	I-27-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
12	0.45	CALVIN	1	30-045-12003	6176	6348	6348		M-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
13	0.49	LAUREN KELLY	1	30-045-02133	1474*	1679*	3028*		-27-29N-11W	(N/A)	FRUITLAND COAL	INACTIVE	No
14	0.49	GARLAND B	1	30-045-02134	1474*	1679*	3028*		-27-29N-11W	(N/A)	PICTURED CLIFFS	INACTIVE	No
15	0.51	MANGUM	1S	30-045-34266	1474*	1679*	1850		F-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	INACTIVE	No
16	0.52	CALVIN	3	30-045-25612	5295	5870	5870		K-26-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
17	0.55	CALVIN	100	30-045-31118	1468	1760	1760		N-26-29N-11W	HILCORP ENERGY	FRUITLAND COAL	ACTIVE	No
18	0.55	PRE-ONGARD WELL	0	30-045-07776					M-26-29N-11W	PRE-ONGARD WELL	(N/A)	INACTIVE	No
19	0.57	NANCY HARTMAN	2	30-045-26721	2627	2754	2754		P-22-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No
20	0.57	CONGRESS	9	30-045-24572	2746	2869	2869		N-26-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No
21	0.59	SULLIVAN GAS COM D	1	30-045-07733	6047	6160	6160		B-26-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No
22	0.60	HARTMAN	1	30-045-07961	6072	6274	6274	P & A	P-22-29N-11W	MANANA GAS INC	DAKOTA	P & A	No
23	0.64	GRACE PEARCE	1	30-045-07959	1380	1466	1466	P & A	O-22-29N-11W	JOHN C PICKETT	FRUITLAND SAND	P & A	No
24	0.64	ASHCROFT SWD	1	30-045-30788	6952	7070	7382		B-26-29N-11W	XTO ENERGY, INC.	Morrison Bluff Entrada	ACTIVE INJ	Yes
24	0.64	ASHCROFT SWD	1	30-045-30788	7224	7382	7382		B-26-29N-11W	XTO ENERGY, INC.	ENTRADA	ACTIVE INJ	Yes
25	0.65	CONGRESS	18	30-045-25673	1680	1770	5808		K-27-29N-11W	HILCORP ENERGY	PICTURED CLIFFS	ACTIVE	No
25	0.65	CONGRESS	18	30-045-25673	5419	5808	5808		K-27-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
26	0.66	MANGUM	1E	30-045-24673	6024	6160	6160		F-27-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
27	0.68	CALVIN	1F	30-045-33093	6172	6430	6430		J-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No
28	0.69	MARIAN S	1	30-045-27365	2578	2710	2710		F-27-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No
29	0.69	LAUREN KELLY	1	30-045-27361	1326	1354	1354		F-27-29N-11W	MANANA GAS INC	FRUITLAND SAND	ACTIVE	No
30	0.72	PRE-ONGARD WELL	1X	30-045-29107	1474*	1679*	3028*	P & A	G-26-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
31	0.72	PRE-ONGARD WELL	X	30-045-07870	1692*	1746*	1442	P & A	G-26-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No
32	0.72	PRE-ONGARD WELL	0	30-045-07896					G-27-29N-11W	PRE-ONGARD WELL	(N/A)	INACTIVE	No
33	0.73	EARL B SULLIVAN	1	30-045-23163	2750	2761	2761		B-26-29N-11W	XTO ENERGY, INC.	CHACRA	ACTIVE	No
34	0.74	CONGRESS	16	30-045-25657	6086	6148	6148		A-34-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No
35	0.75	STATE GAS COM BS	1	30-045-23550	1470	1648	2761		K-23-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No

Disposal Well #2 and Area Wells

Miles					Perf									
Map to					Perf	Botto	Total							Pne Inj
Seq	DW2	Wellname	#	API No	Top	m	Depth	P&A Date	ULSTR	Operator	Reservoir	Status	Zone	
35	0.75	STATE GAS COM BS	1	30-045-23550	2746	2761	2761		K-23-29N-11W	HOLCOMB OIL& GAS	CHACRA	INACTIVE	No	
36	0.75	PEARCE GAS COM	1	30-045-07985	6154	6182	6182	P & A	K-23-29N-11W	BP AMERICA	DAKOTA	P & A	No	
37	0.78	MANGUM	1	30-045-07835	6102	6214	6214	P & A	L-27-29N-11W	BURLINGTON	DAKOTA	P & A	No	
37	0.78	MANGUM	1	30-045-07835	1388	1661	6214		L-27-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No	
38	0.79	MARY JANE	1	30-045-26731	2622	2732	2732		N-22-29N-11W	MANANA GAS INC	CHACRA	ACTIVE	No	
39	0.80	SUMMIT	9	30-045-24574	2747	2857	2857		A-34-29N-11W	HILCORP ENERGY	CHACRA	INACTIVE	No	
40	0.80	ROYAL FLUSH	1	30-045-34312	1440	1608	1608		N-22-29N-11W	MANANA GAS INC	FRUITLAND COAL	ACTIVE	No	
41	0.83	COOK	1	30-045-07940	6052	6226	6226		N-22-29N-11W	MANANA GAS INC	DAKOTA	ACTIVE	No	
42	0.83	COOK	2	30-045-13089	1390	1410	1410		N-22-29N-11W	MANANA GAS INC	FRUITLAND SAND	ACTIVE	No	
43	0.87	SULLIVAN	2	30-045-07868	1444	1478	1478		H-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND SAND	ACTIVE	No	
44	0.87	PRE-ONGARD WELL	1	30-045-08009	1443	1468	1468	P & A	K-23-29N-11W	PRE-ONGARD WELL	FRUITLAND SAND	P & A	No	
45	0.88	CONGRESS	15	30-045-25675	5369	5943	5943		C-35-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No	
46	0.89	DELO	10	30-045-21457	2852	2856	2856		I-26-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No	
47	0.90	SUMMIT	15	30-045-25707	5326	5970	5970		C-34-29N-11W	SOUTHLAND ROYALTY	GALLUP	ACTIVE	No	
48	0.90	PRE-ONGARD WELL	1	30-045-07903	1664	1747	1747	P & A	M-27-29N-11W	PRE-ONGARD WELL	PICTURED CLIFFS	P & A	No	
49	0.91	GARLAND	3	30-045-24573	2668	2790	2790		M-27-29N-11W	SOUTHLAND ROYALTY	CHACRA	ACTIVE	No	
50	0.93	CALVIN	2	30-045-25195	5346	5530	5530		P-26-29N-11W	HILCORP ENERGY	GALLUP	ACTIVE	No	
51	0.93	CALVIN	1E	30-045-24772	6209	6363	6363		P-26-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No	
52	0.94	GARLAND B	1R	30-045-21732	1648	1678	1678	P & A	M-27-29N-11W	BURLINGTON	PICTURED CLIFFS	P & A	No	
53	0.95	EARL B SULLIVAN	2	30-045-25621	1535	1706	5622		H-26-29N-11W	HOLCOMB OIL& GAS	FRUITLAND COAL	ACTIVE	No	
53	0.95	EARL B SULLIVAN	2	30-045-25621	5264	5622	5622		H-26-29N-11W	HOLCOMB OIL& GAS	GALLUP	INACTIVE	No	
54	0.96	CONGRESS	4E	30-045-24837	2784	2906	6328		E-35-29N-11W	HILCORP ENERGY	CHACRA	ACTIVE	No	
54	0.96	CONGRESS	4E	30-045-24837	6216	6328	6328		E-35-29N-11W	HILCORP ENERGY	DAKOTA	ACTIVE	No	
55	0.97	LEA ANN	1	30-045-20752	1776	1790	1790	P & A	E-35-29N-11W	CHAPARRAL ENERGY	PICTURED CLIFFS	P & A	No	
56	0.98	DELO	11	30-045-22639	940	945	945	P & A	P-26-29N-11W	GENERAL MINERALS	FARMINGTON	P & A	No	
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	DAKOTA	ACTIVE	No	
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	MANCOS	INACTIVE	No	
57	0.99	PEARCE GAS COM	1E	30-045-24082	6078	6263	6263		J-23-29N-11W	XTO ENERGY, INC.	CHACRA	INACTIVE	No	

* Estimated for area

Appendix I

Injection History

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
6-Mar-17								
7-Mar-17								
8-Mar-17	20.63		-	1,353	1,353	1,018	42,756	0.49
9-Mar-17	16.17		-	1,289	1,392	1,570	65,933	0.39
10-Mar-17	13.63	1.00	1,310	1,380	1,383	2,010	84,413	0.32
11-Mar-17	10.19	1.00	1,381	1,382	1,383	2,344	98,448	0.24
12-Mar-17	6.75	2.22	1,382	1,382	1,383	2,391	100,422	0.16
13-Mar-17		9.43	957	1,135	1,383	2,391	100,422	
14-Mar-17	15.68	14.92	888	1,116	1,423	2,601	109,235	0.37
15-Mar-17	11.01	7.06	957	1,195	1,423	2,703	113,526	0.26
16-Mar-17		24.48	845	891	953	2,703	113,526	
17-Mar-17	12.35	18.83	813	1,061	1,393	2,869	120,498	0.29
18-Mar-17		25.14	814	863	940	2,869	120,498	
19-Mar-17	18.76	25.24	777	1,001	1,393	3,044	127,848	0.45
20-Mar-17	15.50	11.82	867	1,057	1,392	3,166	132,972	0.37
21-Mar-17	15.43	16.85	825	1,028	1,393	3,303	138,726	0.37
22-Mar-17	12.19	10.91	852	1,153	1,429	3,503	147,126	0.29
23-Mar-17	10.98	9.86	897	1,202	1,442	3,647	153,174	0.26
24-Mar-17	20.30	13.25	910	1,017	1,442	3,720	156,240	0.48
25-Mar-17		29.08	808	849	906	3,720	156,240	
26-Mar-17		40.00	758	781	807	3,720	156,240	
27-Mar-17	20.44	25.46	746	898	1,443	3,817	160,314	0.49
28-Mar-17	17.96	21.81	757	1,030	1,451	4,003	168,126	0.43
29-Mar-17	14.06	6.75	904	1,133	1,451	4,177	175,434	0.33
30-Mar-17	12.65	8.97	862	1,172	1,447	4,341	182,322	0.30
31-Mar-17	9.55	5.29	977	1,258	1,428	4,453	187,026	0.23
1-Apr-17		13.50	888	1,046	1,351	4,452	186,984	
2-Apr-17	13.05	19.65	830	1,073	1,393	4,563	191,646	0.31
3-Apr-17	13.65	8.62	915	1,148	1,393	4,601	193,242	0.32
4-Apr-17	12.81	9.62	912	1,146	1,393	4,713	197,946	0.30
5-Apr-17	15.08	11.63	905	1,072	1,343	4,735	198,870	0.36
6-Apr-17	10.50	20.38	838	981	1,342	4,779	200,718	0.25
7-Apr-17	12.17	14.03	881	1,048	1,393	4,848	203,616	0.29
8-Apr-17		29.00	805	845	914	4,848	203,616	
9-Apr-17	12.78	28.26	774	988	1,393	4,945	207,690	0.30
10-Apr-17	10.32	15.17	842	996	1,393	4,997	209,874	0.25
11-Apr-17	14.44	23.03	793	1,004	1,393	5,100	214,200	0.34
12-Apr-17	11.88	14.06	873	1,015	1,392	5,170	217,140	0.28
13-Apr-17	13.40	14.96	837	1,109	1,393	5,298	222,516	0.32
14-Apr-17	13.13	15.02	878	1,020	1,393	5,340	224,280	0.31
15-Apr-17	13.94	18.27	856	1,014	1,393	5,384	226,128	0.33
16-Apr-17		35.33	790	819	856	5,385	226,170	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
17-Apr-17	12.38	19.65	776	1,108	1,392	5,492	230,664	0.29
18-Apr-17	11.35	18.98	850	966	1,393	5,538	232,596	0.27
19-Apr-17	11.90	21.83	819	988	1,392	5,590	234,780	0.28
20-Apr-17	14.86	21.26	826	1,010	1,392	5,669	238,098	0.35
21-Apr-17	10.98	12.15	889	1,126	1,393	5,763	242,046	0.26
22-Apr-17	9.68	19.04	861	995	1,392	5,798	243,516	0.23
23-Apr-17	18.02	23.16	825	1,000	1,393	5,850	245,700	0.43
24-Apr-17	11.40	26.15	825	905	1,393	5,879	246,918	0.27
25-Apr-17	14.02	23.94	800	972	1,393	5,950	249,900	0.33
26-Apr-17	14.77	20.50	818	981	1,392	6,025	253,050	0.35
27-Apr-17	12.57	18.41	819	1,040	1,393	6,125	257,250	0.30
28-Apr-17	14.99	14.69	866	1,067	1,393	6,205	260,610	0.36
29-Apr-17	12.51	16.48	862	1,015	1,393	6,272	263,424	0.30
30-Apr-17		28.58	803	847	927	6,272	263,424	
1-May-17	15.36	23.69	784	1,023	1,392	6,371	267,582	0.37
2-May-17	16.68	15.60	859	1,046	1,392	6,443	270,606	0.40
3-May-17	11.94	19.11	846	954	1,392	6,485	272,370	0.28
4-May-17	13.15	20.95	842	972	1,393	6,555	275,310	0.31
5-May-17	15.83	26.90	817	908	1,392	6,598	277,116	0.38
6-May-17	12.06	24.98	795	940	1,392	6,669	280,098	0.29
7-May-17	13.26	29.74	782	917	1,393	6,721	282,282	0.32
8-May-17		29.38	809	829	853	6,721	282,282	
9-May-17						6,721	282,282	
10-May-17						6,721	282,282	
11-May-17						6,721	282,282	
12-May-17						6,721	282,282	
13-May-17						6,721	282,282	
14-May-17						6,721	282,282	
15-May-17						6,721	282,282	
16-May-17						6,721	282,282	
17-May-17						6,721	282,282	
18-May-17						6,721	282,282	
19-May-17						6,721	282,282	
20-May-17						6,721	282,282	
21-May-17						6,721	282,282	
22-May-17						6,721	282,282	
23-May-17						6,721	282,282	
24-May-17						6,721	282,282	
25-May-17						6,721	282,282	
26-May-17						6,721	282,282	
27-May-17						6,721	282,282	
28-May-17						6,721	282,282	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
29-May-17						6,721	282,282	
30-May-17						6,721	282,282	
31-May-17						6,721	282,282	
1-Jun-17						6,721	282,282	
2-Jun-17						6,721	282,282	
3-Jun-17						6,721	282,282	
4-Jun-17						6,721	282,282	
5-Jun-17						6,721	282,282	
6-Jun-17						6,721	282,282	
7-Jun-17		103.72	560	561	563	6,721	282,282	
8-Jun-17	24.63	115.97	555	606	694	7,063	296,646	0.59
9-Jun-17	36.48	3.00	613	746	847	7,897	331,667	0.87
10-Jun-17	25.00	8.05	703	788	848	8,308	348,936	0.60
11-Jun-17		26.74	653	674	701	8,308	348,936	
12-Jun-17	36.52	39.78	640	749	847	8,973	376,866	0.87
13-Jun-17	28.85		844	901	957	9,968	418,649	0.69
14-Jun-17	24.21	2.33	819	898	966	10,555	443,303	0.58
15-Jun-17	29.41		909	982	1,042	11,569	485,891	0.70
16-Jun-17	31.20		1,038	1,066	1,092	12,632	530,537	0.74
17-Jun-17	32.36		1,060	1,115	1,158	13,713	575,939	0.77
18-Jun-17	35.60		1,158	1,185	1,192	14,938	627,389	0.85
19-Jun-17	31.60		1,188	1,200	1,218	16,020	672,832	0.75
20-Jun-17	31.12		1,213	1,228	1,242	17,084	717,521	0.74
21-Jun-17	29.22		1,237	1,247	1,257	18,085	759,563	0.70
22-Jun-17	32.05	3.44	1,072	1,189	1,262	18,741	787,122	0.76
23-Jun-17	27.95	1.09	1,149	1,224	1,248	19,653	825,426	0.67
24-Jun-17	29.04	1.00	1,252	1,271	1,295	20,642	866,964	0.69
25-Jun-17	29.54		1,294	1,310	1,326	21,658	909,629	0.70
26-Jun-17	27.60	1.00	1,322	1,326	1,335	22,604	949,361	0.66
27-Jun-17	22.91	2.40	1,183	1,271	1,337	23,237	975,954	0.55
28-Jun-17	21.34	1.81	1,214	1,271	1,278	23,953	1,006,026	0.51
29-Jun-17	21.17	1.48	1,242	1,277	1,288	24,678	1,036,469	0.50
30-Jun-17	20.91	1.58	1,274	1,279	1,284	25,386	1,066,212	0.50
1-Jul-17	20.11	1.73	1,277	1,281	1,284	26,075	1,095,150	0.48
2-Jul-17	19.54	2.00	1,279	1,281	1,285	26,741	1,123,122	0.47
3-Jul-17	19.53	1.73	1,278	1,287	1,293	27,416	1,151,465	0.46
4-Jul-17	19.06	2.00	1,288	1,291	1,293	28,071	1,178,982	0.45
5-Jul-17	18.46	2.17	1,288	1,291	1,293	28,709	1,205,771	0.44
6-Jul-17	18.14	2.77	1,278	1,290	1,293	29,331	1,231,902	0.43
7-Jul-17	17.63	3.00	1,278	1,290	1,293	29,935	1,257,270	0.42
8-Jul-17	18.10	3.00	1,289	1,295	1,307	30,556	1,283,345	0.43
9-Jul-17	18.08	2.85	1,289	1,304	1,308	31,178	1,309,476	0.43

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
10-Jul-17	18.46	3.02	1,304	1,307	1,313	31,793	1,335,299	0.44
11-Jul-17	20.50	2.54	1,308	1,325	1,342	32,482	1,364,237	0.49
12-Jul-17	18.51	2.58	1,328	1,332	1,343	33,116	1,390,865	0.44
13-Jul-17	18.62	2.88	1,319	1,338	1,353	33,761	1,417,955	0.44
14-Jul-17	18.71	3.00	1,349	1,351	1,355	34,401	1,444,842	0.45
15-Jul-17	17.66	3.00	1,348	1,351	1,353	35,004	1,470,168	0.42
16-Jul-17	17.78	3.02	1,347	1,350	1,353	35,588	1,494,696	0.42
17-Jul-17	17.06	3.37	1,330	1,344	1,354	36,152	1,518,377	0.41
18-Jul-17	17.08	3.57	1,339	1,347	1,353	36,714	1,541,981	0.41
19-Jul-17	17.31	3.60	1,347	1,351	1,353	37,282	1,565,844	0.41
20-Jul-17	16.04	4.00	1,348	1,351	1,354	37,831	1,588,902	0.38
21-Jul-17	16.11	4.00	1,348	1,354	1,359	38,383	1,612,079	0.38
22-Jul-17	15.77	4.00	1,353	1,356	1,358	38,925	1,634,850	0.38
23-Jul-17	15.72	3.88	1,354	1,356	1,358	39,465	1,657,530	0.37
24-Jul-17	15.81	4.00	1,354	1,360	1,368	40,007	1,680,287	0.38
25-Jul-17	15.70	4.00	1,362	1,366	1,369	40,542	1,702,757	0.37
26-Jul-17	14.99	4.20	1,364	1,366	1,370	41,054	1,724,261	0.36
27-Jul-17	15.18	4.48	1,365	1,372	1,379	41,573	1,746,059	0.36
28-Jul-17	15.27	4.89	1,374	1,376	1,378	42,086	1,767,612	0.36
29-Jul-17	14.96	4.27	1,373	1,376	1,379	42,603	1,789,319	0.36
30-Jul-17	14.39	4.17	1,374	1,376	1,379	43,097	1,810,074	0.34
31-Jul-17	14.06	4.38	1,374	1,376	1,378	43,580	1,830,353	0.33
1-Aug-17	14.31	4.46	1,374	1,376	1,378	44,069	1,850,898	0.34
2-Aug-17	14.21	6.89	1,185	1,316	1,379	44,381	1,864,002	0.34
3-Aug-17		18.85	1,118	1,146	1,183	44,381	1,864,002	
4-Aug-17		25.67	1,078	1,097	1,117	44,381	1,864,002	
5-Aug-17		30.54	1,048	1,062	1,078	44,381	1,864,002	
6-Aug-17		34.56	1,023	1,035	1,048	44,381	1,864,002	
7-Aug-17	23.70	20.40	1,013	1,128	1,241	44,805	1,881,803	0.56
8-Aug-17	21.81	2.63	1,245	1,283	1,322	45,546	1,912,932	0.52
9-Aug-17	21.33	2.15	1,323	1,339	1,352	46,277	1,943,626	0.51
10-Aug-17	19.08	2.88	1,276	1,355	1,363	46,931	1,971,095	0.45
11-Aug-17	16.75	3.00	1,358	1,361	1,363	47,508	1,995,336	0.40
12-Aug-17	15.38	3.38	1,359	1,361	1,364	48,033	2,017,386	0.37
13-Aug-17	14.20	4.00	1,359	1,361	1,363	48,522	2,037,924	0.34
14-Aug-17	13.88	4.31	1,360	1,365	1,369	49,000	2,058,000	0.33
15-Aug-17	13.49	4.77	1,364	1,366	1,369	49,466	2,077,565	0.32
16-Aug-17	12.92	5.00	1,304	1,365	1,368	49,909	2,096,178	0.31
17-Aug-17	12.63	5.00	1,366	1,378	1,388	50,346	2,114,525	0.30
18-Aug-17	11.05	7.96	1,176	1,307	1,388	50,556	2,123,352	0.26
19-Aug-17		20.27	1,110	1,138	1,174	50,556	2,123,352	
20-Aug-17		26.99	1,071	1,089	1,108	50,556	2,123,352	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
21-Aug-17		31.58	1,043	1,056	1,070	50,556	2,123,352	
22-Aug-17		35.75	1,019	1,030	1,042	50,556	2,123,352	
23-Aug-17		39.38	999	1,009	1,019	50,556	2,123,352	
24-Aug-17	12.29	19.73	993	1,131	1,218	50,817	2,134,314	0.29
25-Aug-17	12.19	5.26	1,216	1,263	1,288	51,178	2,149,476	0.29
26-Aug-17	12.28	4.94	1,286	1,296	1,303	51,600	2,167,200	0.29
27-Aug-17	11.92	5.33	1,301	1,308	1,310	52,009	2,184,378	0.28
28-Aug-17	10.87	5.87	1,306	1,314	1,318	52,386	2,200,212	0.26
29-Aug-17	12.14	5.67	1,315	1,330	1,349	52,806	2,217,852	0.29
30-Aug-17	13.21	5.35	1,345	1,350	1,354	53,255	2,236,710	0.31
31-Aug-17	12.19	6.00	1,349	1,352	1,354	53,674	2,254,308	0.29
1-Sep-17	11.95	6.19	1,349	1,355	1,359	54,089	2,271,738	0.28
2-Sep-17	11.98	6.40	1,355	1,356	1,358	54,496	2,288,832	0.29
3-Sep-17	11.43	6.81	1,354	1,356	1,359	54,885	2,305,170	0.27
4-Sep-17	11.26	7.04	1,354	1,358	1,362	55,266	2,321,165	0.27
5-Sep-17	11.67	7.00	1,359	1,364	1,370	55,667	2,338,007	0.28
6-Sep-17	11.37	7.00	1,364	1,369	1,374	56,054	2,354,268	0.27
7-Sep-17	11.09	7.00	1,370	1,372	1,374	56,430	2,370,060	0.26
8-Sep-17	10.80	12.77	1,131	1,237	1,374	56,548	2,375,016	0.26
9-Sep-17		24.83	1,076	1,100	1,129	56,548	2,375,016	
10-Sep-17		30.85	1,043	1,058	1,075	56,548	2,375,016	
11-Sep-17		35.54	1,018	1,029	1,042	56,548	2,375,016	
12-Sep-17		39.42	997	1,007	1,017	56,548	2,375,016	
13-Sep-17	12.91	24.00	989	1,112	1,209	56,798	2,385,516	0.31
14-Sep-17	11.39	7.04	1,209	1,231	1,244	57,178	2,401,476	0.27
15-Sep-17	12.32	5.06	1,248	1,260	1,291	57,597	2,419,074	0.29
16-Sep-17	11.34	5.00	1,262	1,270	1,284	57,987	2,435,447	0.27
17-Sep-17	11.35	5.00	1,278	1,283	1,286	58,376	2,451,792	0.27
18-Sep-17	10.71	10.45	1,065	1,169	1,283	58,514	2,457,588	0.26
19-Sep-17		24.35	1,018	1,038	1,064	58,514	2,457,588	
20-Sep-17	24.90	15.89	1,005	1,143	1,331	58,842	2,471,364	0.59
21-Sep-17		21.25	1,001	1,026	1,070	58,842	2,471,364	#VALUE!
22-Sep-17	40.71	23.54	991	1,284	1,439	59,781	2,510,802	0.97
23-Sep-17	30.17	11.86	1,052	1,123	1,440	59,837	2,513,154	0.72
24-Sep-17		24.73	1,008	1,027	1,051	59,837	2,513,154	
25-Sep-17		32.10	981	993	1,007	59,837	2,513,154	
26-Sep-17		37.31	961	970	980	59,837	2,513,154	
27-Sep-17		41.25	944	952	960	59,837	2,513,154	
28-Sep-17		44.67	930	937	944	59,837	2,513,154	
29-Sep-17		47.83	918	924	930	59,837	2,513,154	
30-Sep-17		50.23	907	912	918	59,837	2,513,154	
1-Oct-17		52.96	896	901	906	59,837	2,513,154	

WDW #2 Injection History

Date	Flow Rate GPM	Average Casing Pressure	Minimum Injection Pressure	Average Injection Pressure	Maximum Injection Pressure	Totalizer BBLs	Gallons Injected	Flow Rate bbl/min
2-Oct-17	14.89	22.80	893	1,012	1,103	60,176	2,527,392	0.35
3-Oct-17	13.74	3.63	1,068	1,120	1,152	60,598	2,545,116	0.33
4-Oct-17	13.97	2.54	1,155	1,184	1,211	61,079	2,565,311	0.33
5-Oct-17	13.79	6.73	1,002	1,125	1,228	61,307	2,574,894	0.33
6-Oct-17		23.17	954	973	1,000	61,307	2,574,894	
7-Oct-17		32.42	928	940	953	61,307	2,574,894	
8-Oct-17		38.14	910	919	928	61,307	2,574,894	
9-Oct-17		42.13	896	903	910	61,307	2,574,894	
10-Oct-17		37.25	884	890	895	61,307	2,574,894	
11-Oct-17		37.48	873	878	883	61,307	2,574,894	
12-Oct-17		40.44	864	868	873	61,307	2,574,894	
13-Oct-17		42.56	856	860	864	61,307	2,574,894	
14-Oct-17		44.52	848	852	856	61,307	2,574,894	
15-Oct-17		45.96	841	844	848	61,307	2,574,894	
16-Oct-17	11.45	21.94	838	946	1,047	61,542	2,584,757	0.27
17-Oct-17	11.77	1.00	1,057	1,084	1,108	61,941	2,601,515	0.28
18-Oct-17	11.30		1,106	1,124	1,143	62,328	2,617,769	0.27
19-Oct-17	11.37		1,140	1,155	1,169	62,637	2,630,747	0.27

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, September 15, 2017 11:12 AM
To: 'John Thompson'; Powell, Brandon, EMNRD; Perrin, Charlie, EMNRD; Kuehling, Monica, EMNRD
Cc: Hains, Allen S; Schmaltz, Randy; kelly.robinson@wnr.com; Griswold, Jim, EMNRD
Subject: RE: Western Refining Southwest, Inc. - WDW #2 Fall Off Test application
Attachments: C-103 FOT OCD COAs 9-15-2017.pdf

John:

Good morning. Please find attached the New Mexico Oil Conservation Division (OCD) above subject C-103 approval with conditions.

Please contact me if you have questions.

Thank you.

Mr. Carl J. Chavez, CHMM (#13099)
New Mexico Oil Conservation Division
Energy Minerals and Natural Resources Department
1220 South St Francis Drive
Santa Fe, New Mexico 87505
Ph. (505) 476-3490
E-mail: CarlJ.Chavez@state.nm.us

“Why not prevent pollution, minimize waste to reduce operating costs, reuse or recycle, and move forward with the rest of the Nation?” (To see how, go to: <http://www.emnrd.state.nm.us/OCD> and see “Publications”)

From: John Thompson [mailto:john@walsheng.net]
Sent: Wednesday, September 13, 2017 8:00 PM
To: Chavez, Carl J, EMNRD <CarlJ.Chavez@state.nm.us>; Powell, Brandon, EMNRD <Brandon.Powell@state.nm.us>; Perrin, Charlie, EMNRD <charlie.perrin@state.nm.us>; Kuehling, Monica, EMNRD <monica.kuehling@state.nm.us>
Cc: Hains, Allen S <Allen.S.Hains@andeavor.com>; Schmaltz, Randy <Randy.Schmaltz@wnr.com>; kelly.robinson@wnr.com
Subject: Western Refining Southwest, Inc. - WDW #2 Fall Off Test application

Hi Carl,

Here is a scanned copy of the hard copy that was filed with the NMOCD – Aztec office (actually will drop it off tomorrow) for your review.

Please contact Allen Hains or myself if you have any questions or concerns.

Thanks!

John C. Thompson

Walsh Engineering & Production Corp.

O 505.327.4892

C 505.320.1748

E john@walsheng.net

Submit 1 Copy To Appropriate District Office
District I - (575) 393-6161
1625 N. French Dr., Hobbs, NM 88240
District II - (575) 748-1283
811 S. First St., Artesia, NM 88210
District III - (505) 334-6178
1000 Rio Brazos Rd., Aztec, NM 87410
District IV - (505) 476-3460
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
Revised July 18, 2013

SUNDRY NOTICES AND REPORTS ON WELLS (DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)		WELL API NO. 30-045-35747
1. Type of Well: Oil Well ☐ Gas Well ☒ Other Waste Water Disposal Well		5. Indicate Type of Lease STATE ☐ FEE ☒
2. Name of Operator Western Refining Southwest, Inc.		6. State Oil & Gas Lease No.
3. Address of Operator #50 County Road 4990 (PO Box 159), Bloomfield, NM 87413		7. Lease Name or Unit Agreement Name
4. Well Location Unit Letter <u>H</u> : <u>2028</u> feet from the <u>North</u> line and <u>111'</u> feet from the <u>East</u> line Section <u>27</u> Township <u>29N</u> Range <u>11W</u> NMPM San Juan County		8. Well Number WDW #2
11. Elevation (Show whether DR, RKB, RT, GR, etc.) 5535' GL		9. OGRID Number 267595
		10. Pool name or Wildcat SWD; Entrada

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:

PERFORM REMEDIAL WORK ☐ PLUG AND ABANDON ☐
TEMPORARILY ABANDON ☐ CHANGE PLANS ☐
PULL OR ALTER CASING ☐ MULTIPLE COMPL ☐
DOWNHOLE COMMINGLE ☐
CLOSED-LOOP SYSTEM ☐
OTHER: Fall Off Test

SUBSEQUENT REPORT OF:

REMEDIAL WORK ☐ ALTERING CASING ☐
COMMENCE DRILLING OPNS ☐ P AND A ☐
CASING/CEMENT JOB ☐

OTHER:

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 19.15.7.14 NMAC. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

As required by permit, Western Refining Southwest, Inc. intends to perform a Fall Off Test (FOT) as per the attached general procedure:

Spud Date: 8/15/2016

Rig Release Date: 9/9/2016

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE [Signature] TITLE Engineer/Agent DATE 8/27/2017

Type or print name John Thompson E-mail address: john@walsheng.net PHONE: 505-320-1748

For State Use Only

APPROVED BY: Carl J. Chavez TITLE Environmental Engineer DATE 9/15/2017
Conditions of Approval (if any)

please see attachment.

Western Refining Southwest Inc.
Waste Disposal Well #2 (UICI-011)
C-103 Fall-Off Test- FOT Form
OCD Santa Fe Office
Conditions of Approval
(9/15/2017)

- 1) The Permittee shall comply with the "Test Plan" requirements (i.e., Section V – IX) "New Mexico Oil Conservation Division UIC Class I Well Fall-Off Test Guidance" dated December 3, 2007.
- 2) The Permittee shall exclude the Miller Dyes Hutchinson (MDH) Plot from the FOT as U.S. EPA and OCD do not recommend the use of this plot for FOTs. Other replacement plots to determine the appropriate time function for the semi-log plot or pressure transient analysis are: 1. Horner Plot; 2. Agarwal Equivalent Time Plot; and 3. Superposition Time Plot. These plots can give different results for the same test. Use of the appropriate plot with the correct time function is critical for the analysis.
- 3) The Permittee shall ensure a pseudo-steady state injection rate is achieved that is sufficient to produce a measurable pressure buildup that will result in a valid FOT. Pseudo-steady state means the pressure response from the well has encountered all the boundaries around the well and is steady (+/- 10%) before shut-off to ensure accuracy and minimize pressure anomalies in the derivative plot.
- 4) The Permittee shall use an injection zone thickness (h) of 158 feet commensurate with the injection well perforated interval thickness in FOT calculations.
- 5) The Permittee shall submit a temperature and pressure gauge calibration certificate showing the date(s) the gauges were last calibrated along with the manufacturer's recommended frequency of calibration.

Please be advised that OCD's approval does not relieve Western Refining Southwest Inc. from responsibility if their operations pose a threat to ground water, water supply/diversion, surface water, human health or the environment. In addition, OCD approval does not relieve Western Refining Southwest Inc. of responsibility for compliance with any other federal, state, or local laws and/or regulations.