**PIONEER**
Pioneer Energy Services

# INJECTION SURVEY
# SPIN / TEMP / PRESS / RAT

Company EXPEDITION WATER SOLUTIONS
Well EWS #3A
Field WATTENBERG
County WELD
State COLORADO Country USA

Company EXPEDITION WATER SOLUTIONS
Well EWS #3A
Field WATTENBERG
County WELD
State COLORADO Country USA
Location: API #: 051234388
SEC 23 TWP 4N RGE 66W

Other Services
NONE

Permanent Datum Elevation
Log Measured From
Drilling Measured From

Elevation
K.B.
D.F.
G.L.

| | |
|---|---|
| Date | 29 JAN 2017 |
| Run Number | 1 AND 2 |
| Depth Driller | 12,259 FT. |
| Depth Logger | 11,636 FT. |
| Bottom Logged Interval | 11,636 FT. |
| Top Log Interval | 7,500 FT. |
| Open Hole Size | 6.125 IN. |
| Type Fluid | INJ WATER |
| Density / Viscosity | N/A |
| Max. Recorded Temp. | 277 F |
| Estimated Cement Top | N/A |
| Time Well Ready | N/A |
| Time Logger on Bottom | 12:30 |
| Equipment Number | P-53 |
| Location | FT. MORGAN |
| Recorded By | J. ZARYCKI |
| Witnessed By | T. GIMBALL |

| Borehole Record | | | | Tubing Record | | | |
|---|---|---|---|---|---|---|---|
| Run Number | Bit | From | To | Size | Weight | From | To |
| | | | | 4-1/2" | 11.6# | SURF | 10526' |

| Casing Record | Size | Wgt/Ft | Top | Bottom |
|---|---|---|---|---|
| Surface String | 9-5/8" | 36# | SURF | 1039' |
| Prot. String | 7" | 26# | SURF | 10601' |
| Production String | | | | |
| Liner | 4-1/2" | 11.6# | 10550' | 11,660' |

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

## Comments

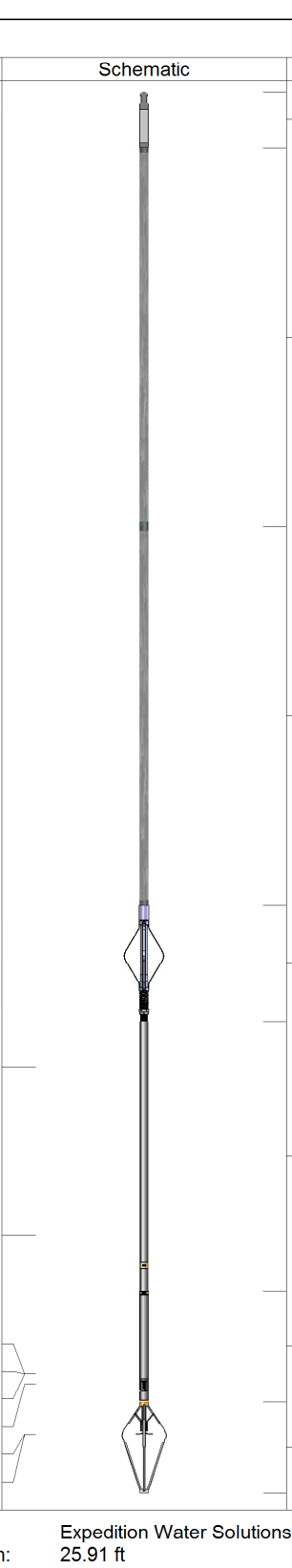
CORRELATED TO: PIONEER GAMMA RAY NEUTRON LOG 23 JAN 2017

Run 1 - Spinner Temp Pressure - WHP 1350 PSI at 5 BPM

Run 2 - RAT Temp - WHP 11000 PSI at 2 BPM

| Sensor | Offset (ft) |
|---|---|
| CCL | 7.87 |
| GR | 4.76 |
| PTEMP | 2.19 |
| PRESS | 2.19 |
| PTEMP | 2.19 |
| TEMP | 2.01 |
| CUPSPIN | 1.08 |
| CDWSPIN | 1.08 |

Schematic

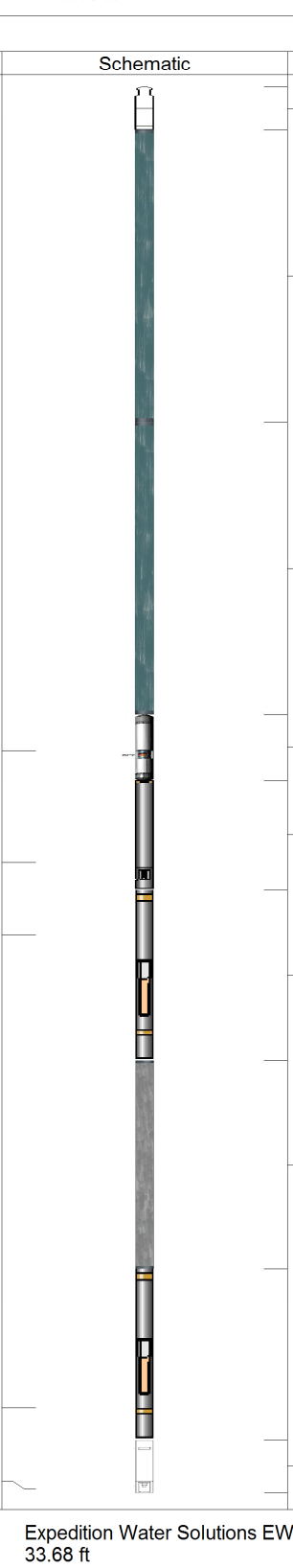


| Description | Length (ft) | O.D. (in) | Weight (lb |
|---|---|---|---|
| Cable Head-Titan 143<br>1 7/16" Titan Cable Head (1" Fish Top) | 1.03 | 1.43 | 2.00 |
| Tungsten-1-3/8x7<br>Weigh Bar Tungten 1-3/8" x 7' | 7.00 | 1.38 | 54.00 |
| Tungsten-1-3/8x7<br>Weigh Bar Tungten 1-3/8" x 7' | 7.00 | 1.38 | 54.00 |
| Centralizer-169 Hotwell<br>1 3/8" Centralizer | 2.17 | 1.38 | 11.02 |
| Lee_PL-Lee-Telemetry (TEL-1103-004)<br>Lee Telemetry (GR/CCL) | 4.97 | 1.38 | 14.20 |
| Lee_PL-Lee-PTF (PTF-1103-007)<br>Lee Pressure Temperature Tool | 2.06 | 1.38 | 5.00 |
| Lee_PL-Lee-FB-5in (FB-501)<br>Spinner 5in Full Bore | 1.67 | 1.38 | 4.00 |

Dataset: Expedition Water Solutions EWS 3 SpinTempPressRAT 20170129.db: field/well/run1/RIH
Total length: 25.91 ft
Total weight: 144.22 lb
O.D.: 1.43 in

| Sensor | Offset (ft) |
|---|---|
| CCL | 15.75 |
| Ejector | 13.08 |
| DET | 11.33 |
| DET#2 | 0.00 |
| TEMP | 1.94 |

Schematic



| Description | Length (ft) | O.D. (in) | Weight (lb |
|---|---|---|---|
| Titan-1.4375<br>1 7/16 Titan Type II Cable Head | 1.03 | 1.44 | 5.00 |
| Sinker-tit_1440_7<br>Titan 1 7/16" Sinker Bar 7' | 7.00 | 1.44 | |
| Sinker-tit_1440_7<br>Titan 1 7/16" Sinker Bar 7' | 7.00 | 1.44 | |
| CCL-TRACER (TRACCL)<br>TRACER CCL | 1.58 | 1.38 | 10.00 |
| TREJCT-Probe (0002)<br>Probe 1.375" Tracer Ejector | 2.63 | 1.38 | 9.00 |
| TRDET-Probe_top (0001) | 4.08 | 1.38 | 15.00 |
| Tungsten-1-3/8x5<br>Weigh Bar Tungten 1-3/8" x 5' | 5.00 | 1.38 | 38.00 |
| TRDET #2 -Probe (0003)<br>Probe 1.375" Detector#2(bttm) | 4.08 | 1.38 | 10.00 |
| TEMP-pro_1380 (pro_1380.1)<br>Probe 1 3/8" Temperature | 1.27 | 1.38 | 12.00 |

Dataset: Expedition Water Solutions EWS 3 SpinTempPressRAT 20170129.db: field/well/run1/RAT_AFGR
Total length: 33.68 ft
Total weight: 99.00 lb
O.D.: 1.44 in

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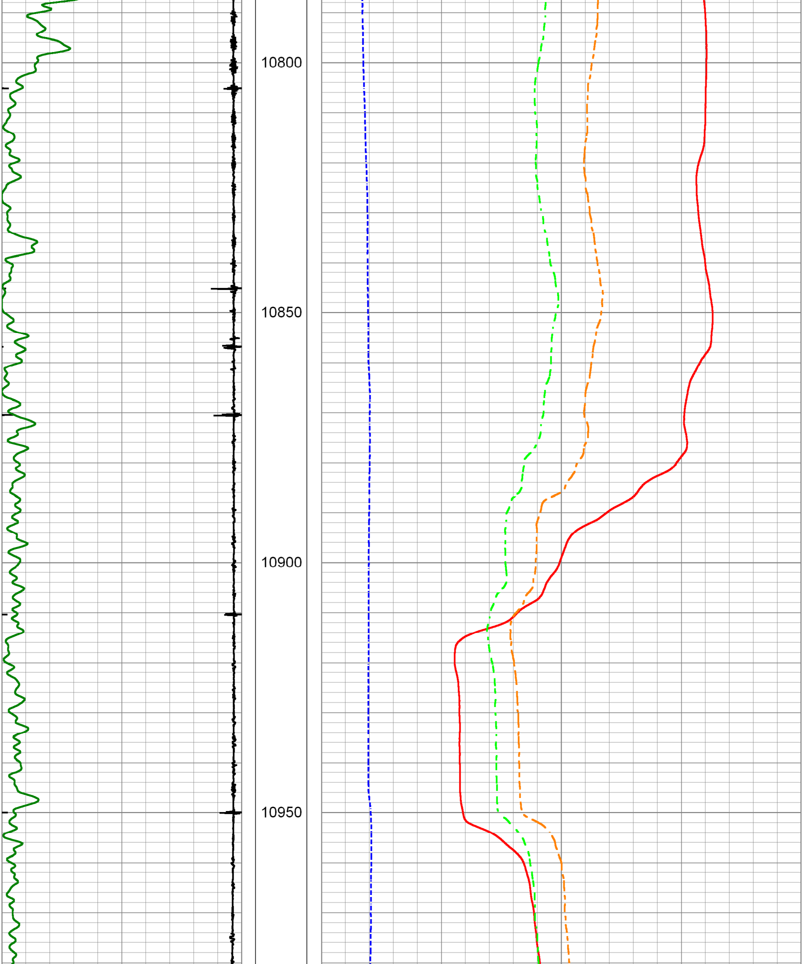
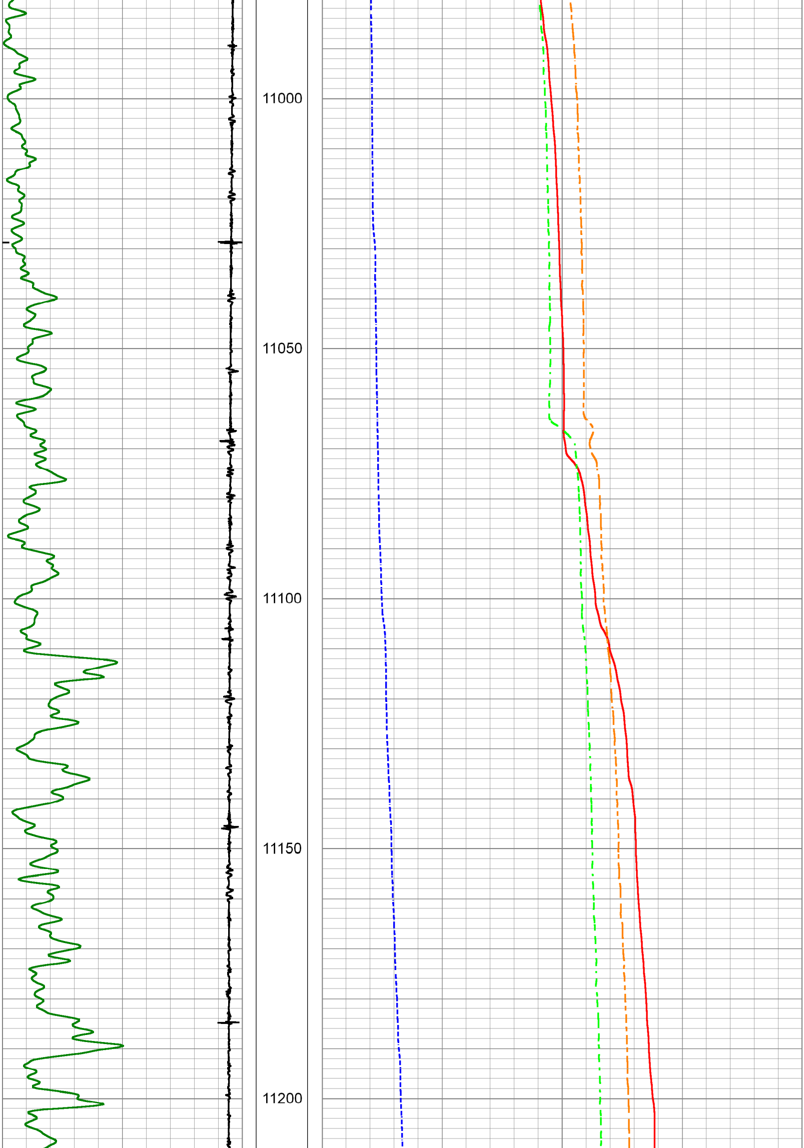
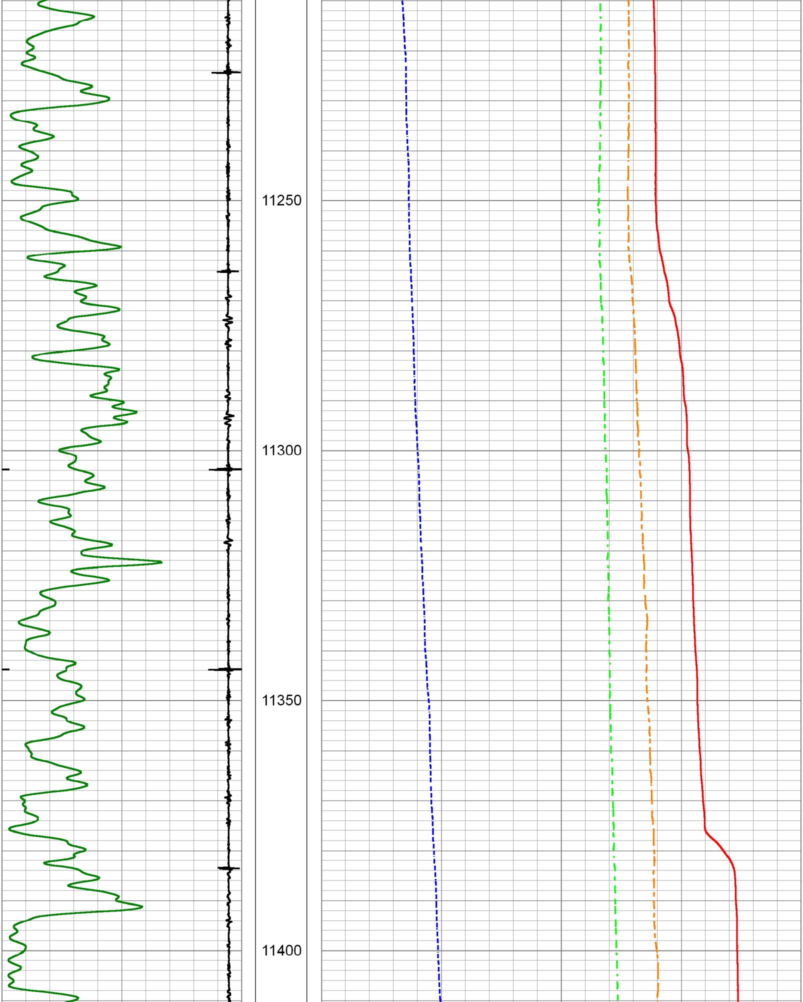
## Temperature Overlay

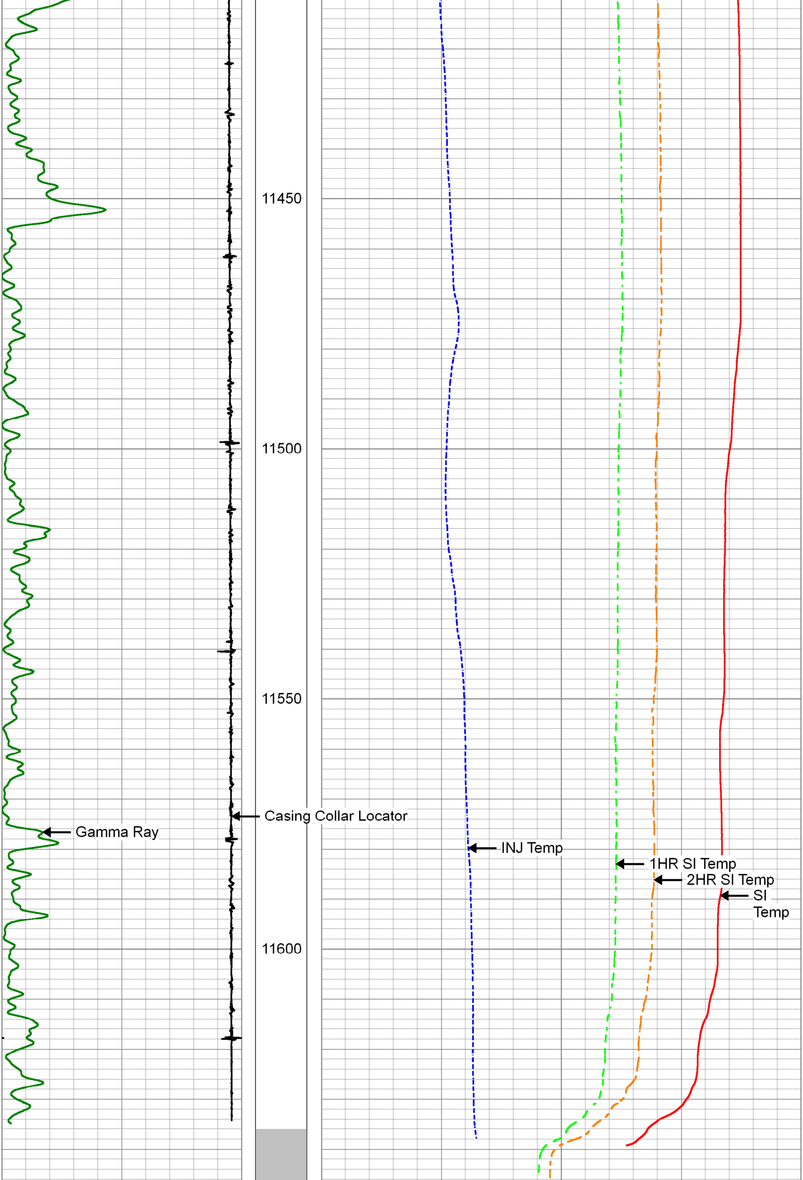
Overnight SI, Injecting, 1 HR SI, 2 HR SI

| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | ./.Temps/merge1 |
| Presentation Format | temp_ovr |
| Dataset Creation | Tue Jan 31 10:01:31 2017 |
| Charted by | Depth in Feet scaled 1:240 |









190 Casing Collar Locator -10
0 Gamma Ray 50

200 SI Temp (degF) 280
200 INJ Temp (degF) 280
200 1HR SI Temp (degF) 280
200 2HR SI Temp (degF) 280

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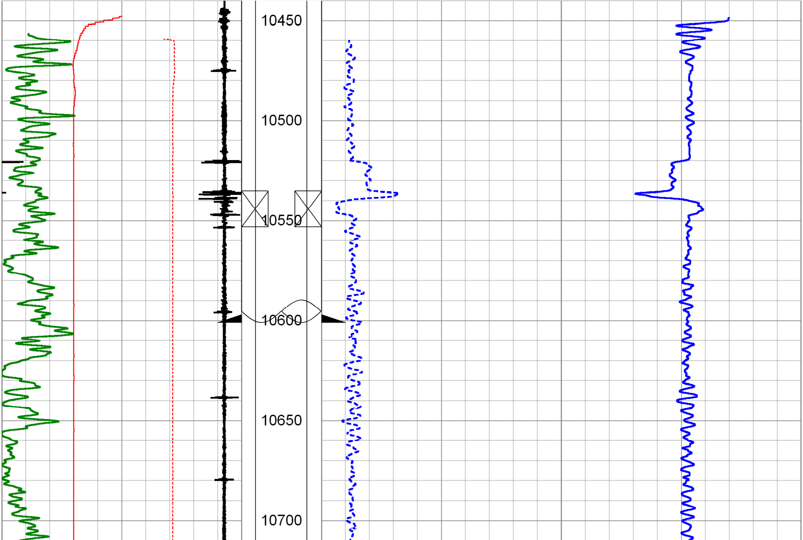
# Spinner Up / Down Overlay

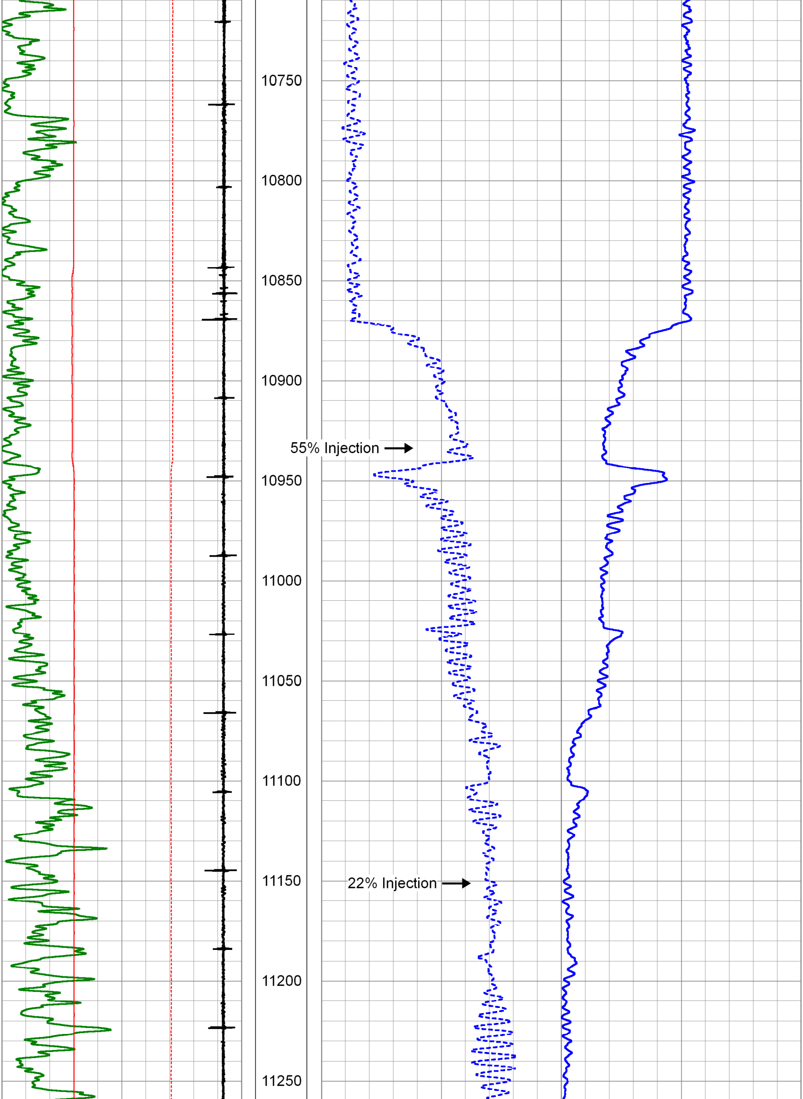
## 80 FPM Up / Down Injecting 5 BPM

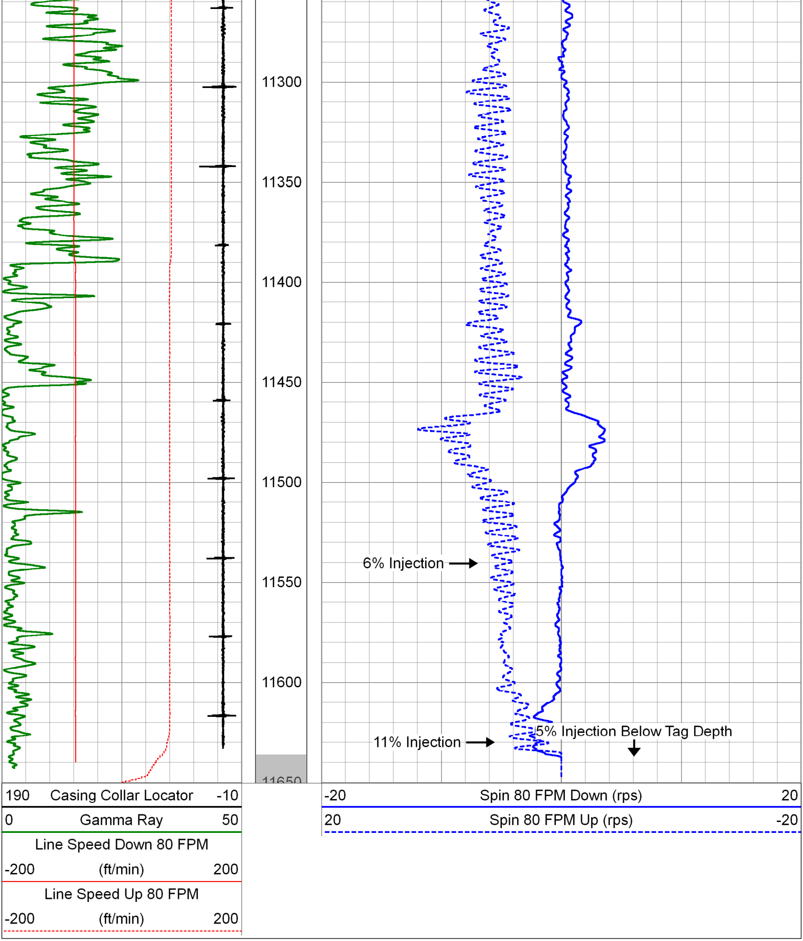
| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | INJ_80_UpDn |
| Presentation Format | lee_pl_jz |
| Dataset Creation | Sun Jan 29 13:33:20 2017 |
| Charted by | Depth in Feet scaled 1:600 |

190 Casing Collar Locator -10
0 Gamma Ray 50
Line Speed Down 80 FPM
-200 (ft/min) 200
Line Speed Up 80 FPM
-200 (ft/min) 200

-20 Spin 80 FPM Down (rps) 20
20 Spin 80 FPM Up (rps) -20







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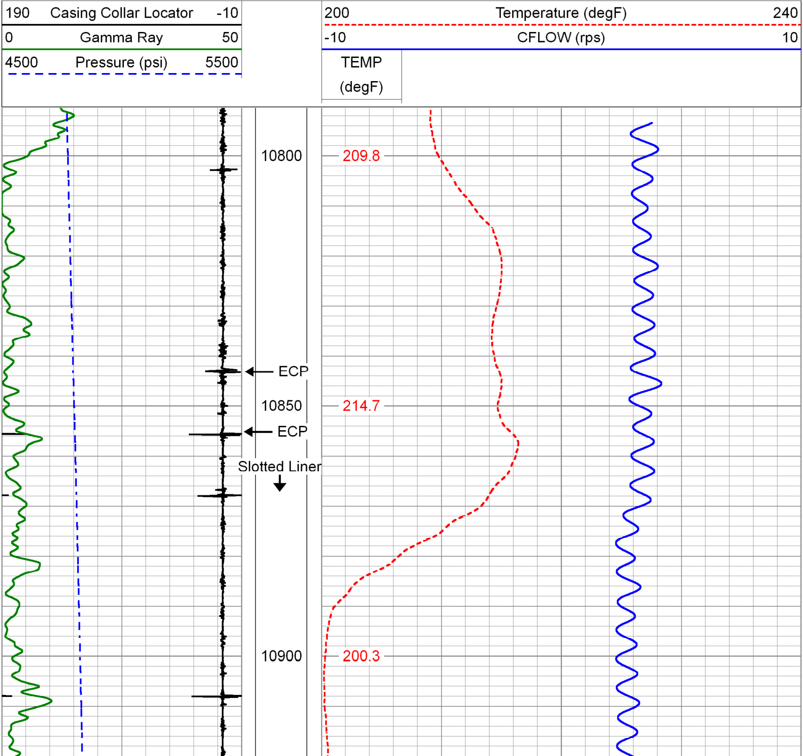
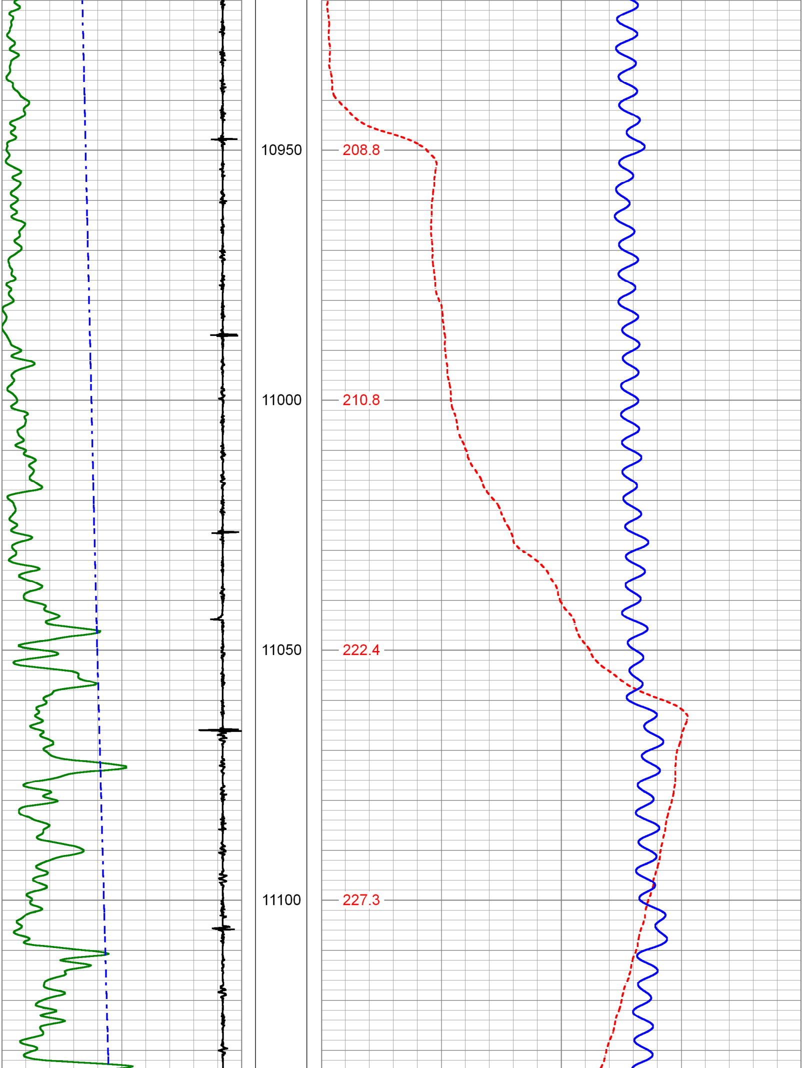
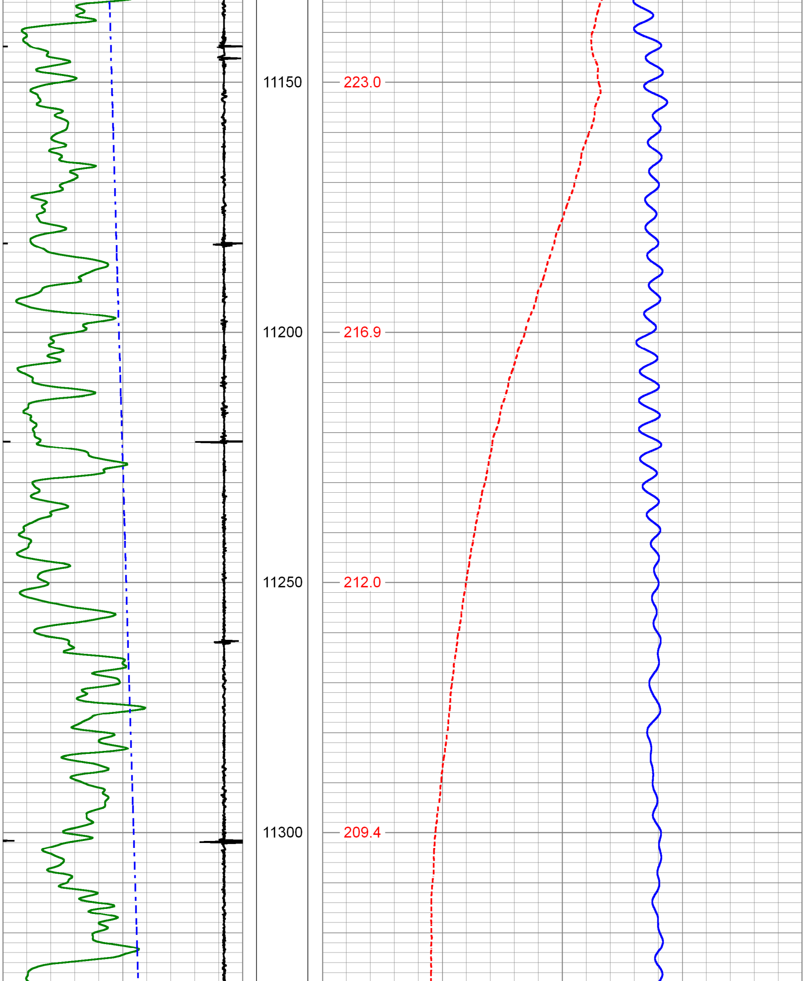
# Cross Flow Check

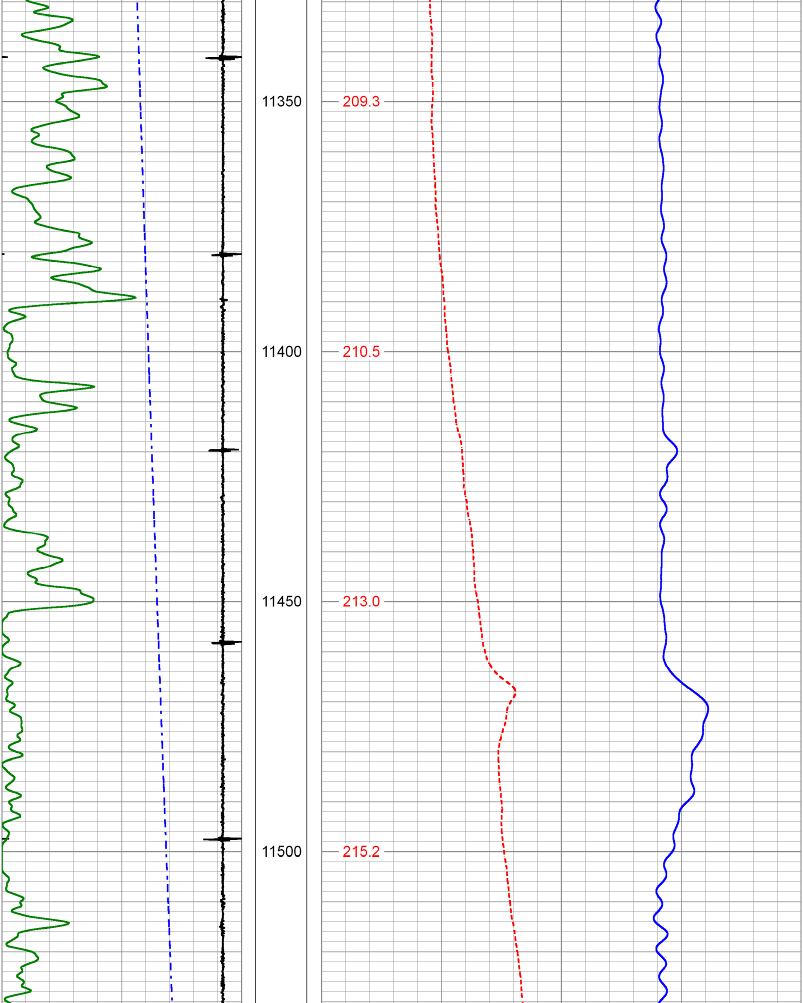
## 80 FPM Up Immediately After SI Pumps

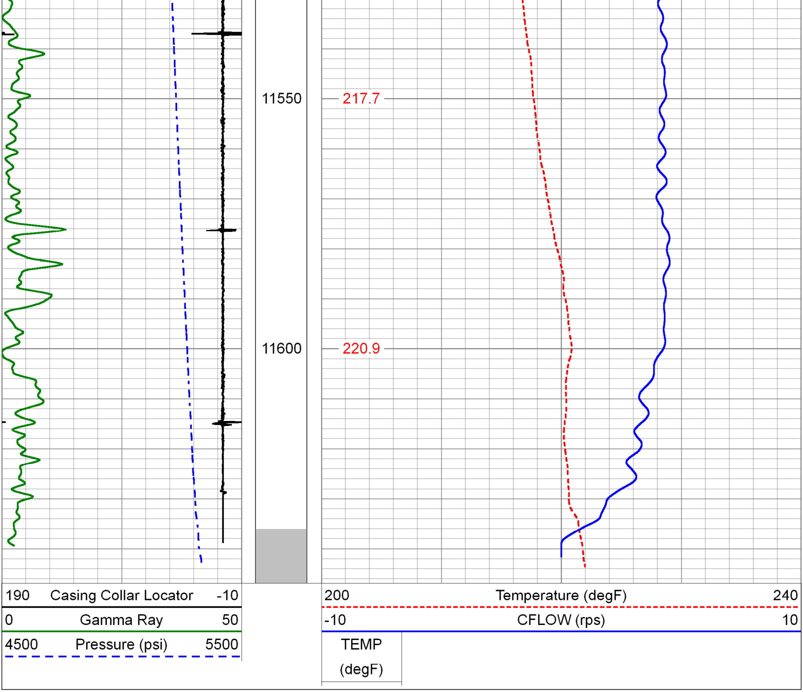
| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | UP_80_XFLOW.4 |
| Presentation Format | lee_pl_jz |
| Dataset Creation | Tue Jan 31 11:29:40 2017 |
| Charted by | Depth in Feet scaled 1:240 |











Company:
Well:
File: C:\ProgramData\Warrior\Data\Expedition Water Service\Expedition Water Solutions EWS 3 SpinTe
Dataset: field/well/run1/_tracer_/_shottabl_/2
Reference Rate: 2683.5 b/d

## VELOCITY RESULTS

| # | Depth (ft) | Time | D Space (ft) | D Time (sec) | Csg ID (in) | Flow (b/d) | Flow (%) | Delta (%) | Comm |
|---|---|---|---|---|---|---|---|---|---|
| 5 | 10860.10 | 16:09:37 | 11.33 | 5.00 | 4.00 | 2683.54 | 100.00 | | Lyon |
| 4 | 10920.00 | 16:07:12 | 11.33 | 8.70 | 4.00 | 1542.26 | 57.47 | 42.53 | Temp Infl |
| 7 | 11114.00 | 16:15:16 | 11.33 | 11.60 | 4.00 | 1156.70 | 43.10 | 14.37 | Spinner Int |
| 3 | 11394.00 | 16:02:48 | 11.33 | 15.60 | 4.00 | 860.11 | 32.05 | 11.05 | Wolfca |
| 2 | 11520.00 | 16:00:25 | 11.33 | 15.10 | 4.00 | 888.59 | 33.11 | -1.06 | Amaz |
| 1 | 11600.00 | 15:58:29 | 11.33 | 22.30 | 4.00 | 601.69 | 22.42 | 10.69 | Council C |

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# Tracer Composite

Flow annotated from Velocity Shot Table

| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | _compos3_ |
| Presentation Format | trccomp |
| Dataset Creation | Wed Feb 01 16:46:49 2017 |
| Charted by | Depth in Feet scaled 1:240 |

9 CCL -1

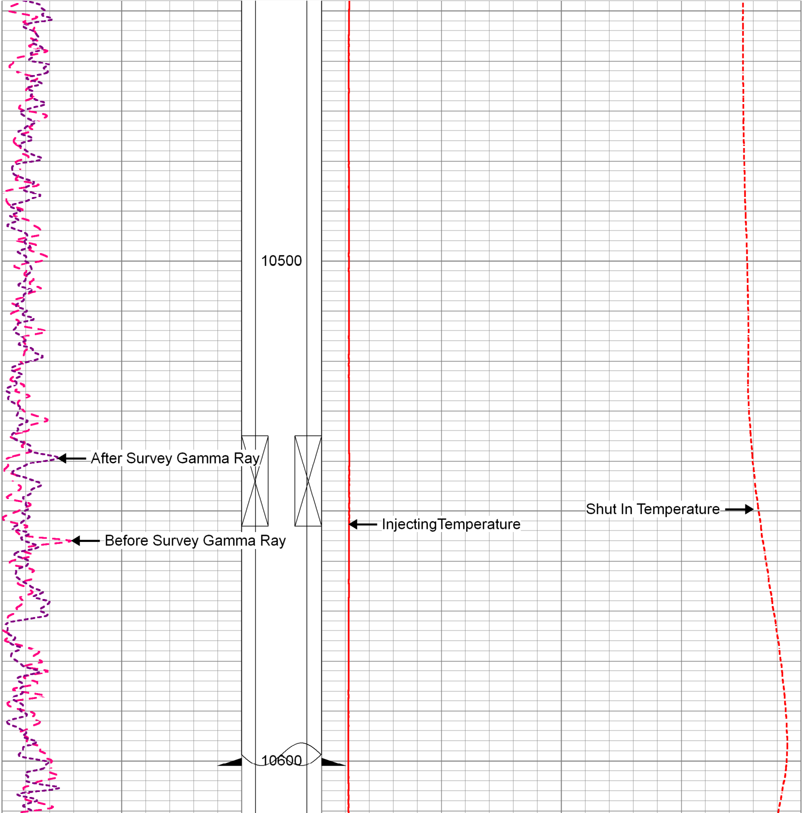
Before Survey Gamma Ray
0 (GAPI) 50

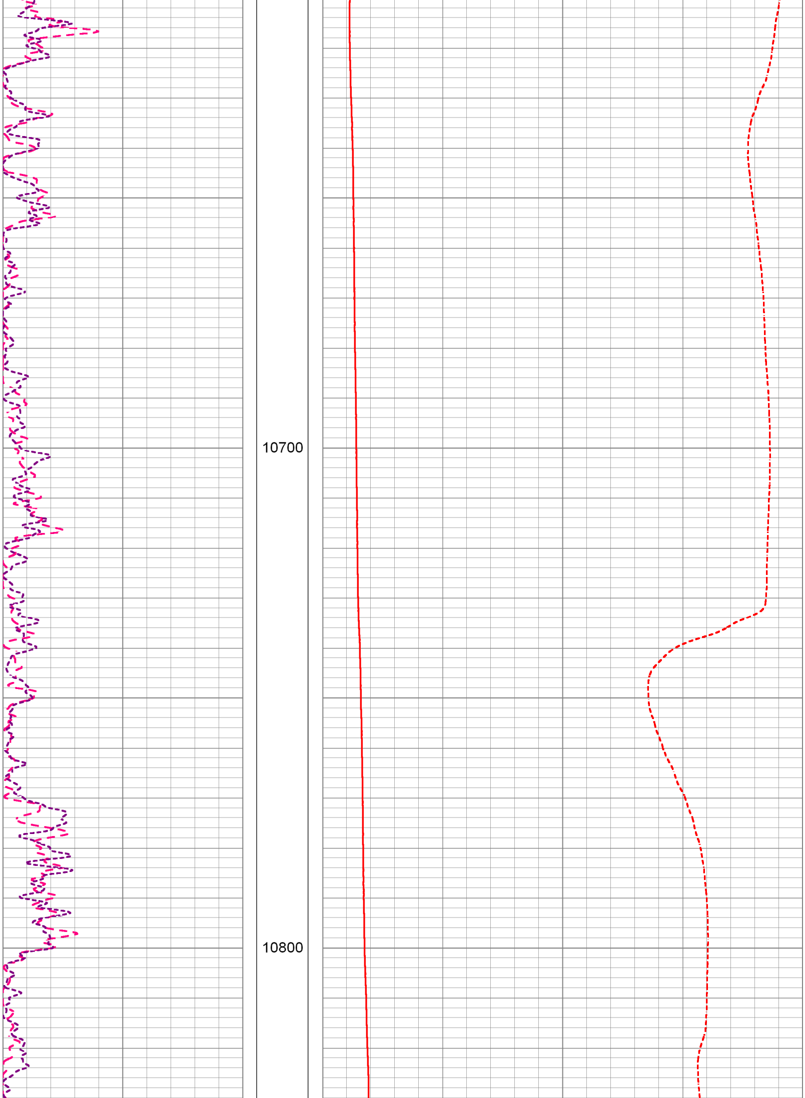
After Survey Gamma Ray
0 (GAPI) 50

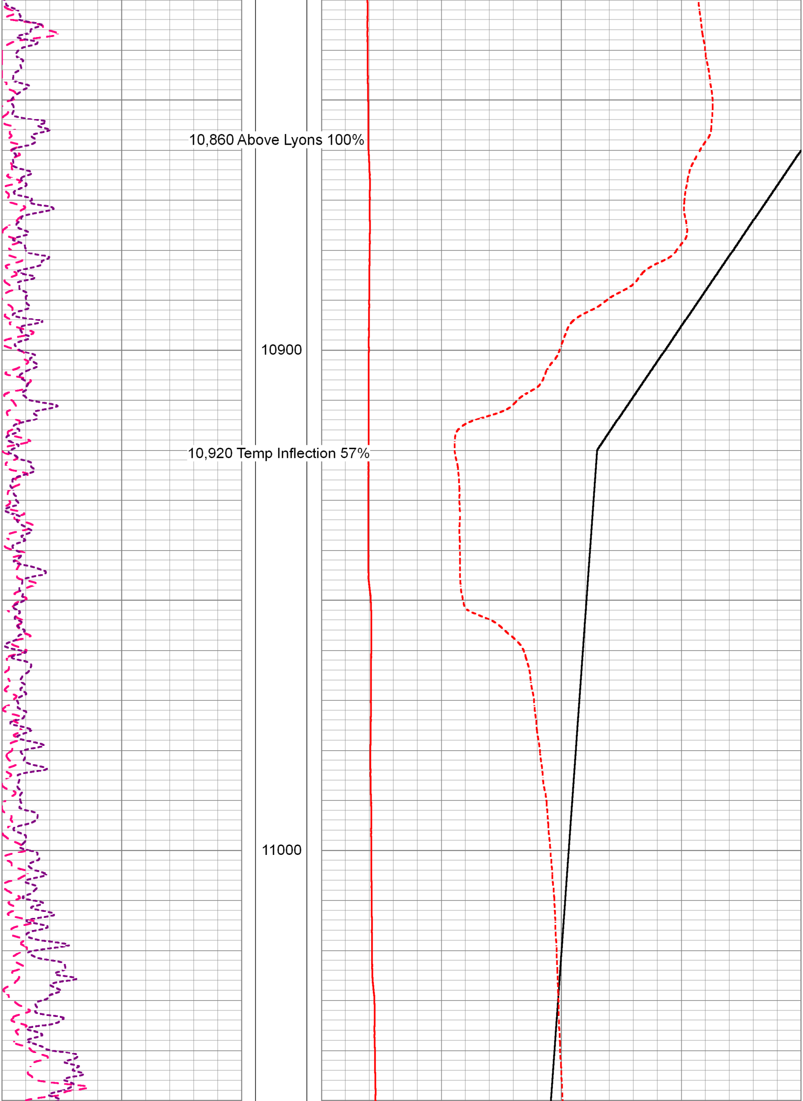
0 Percent of Flow (%) 100

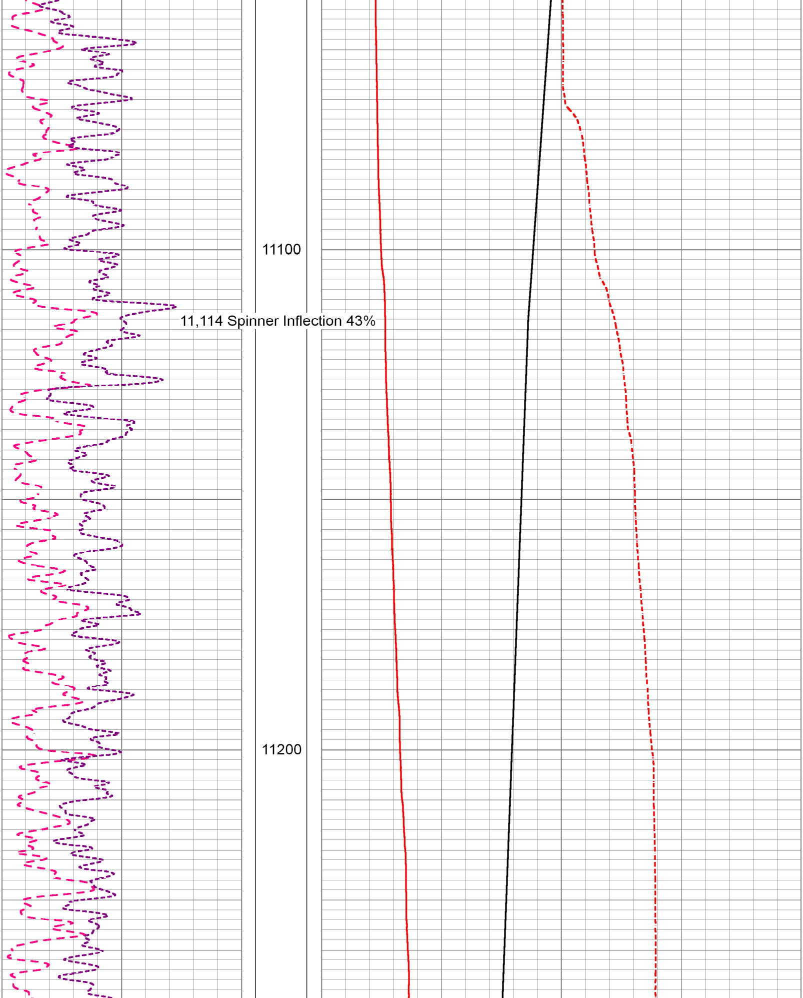
200 Shut In Temperature (degF) 280

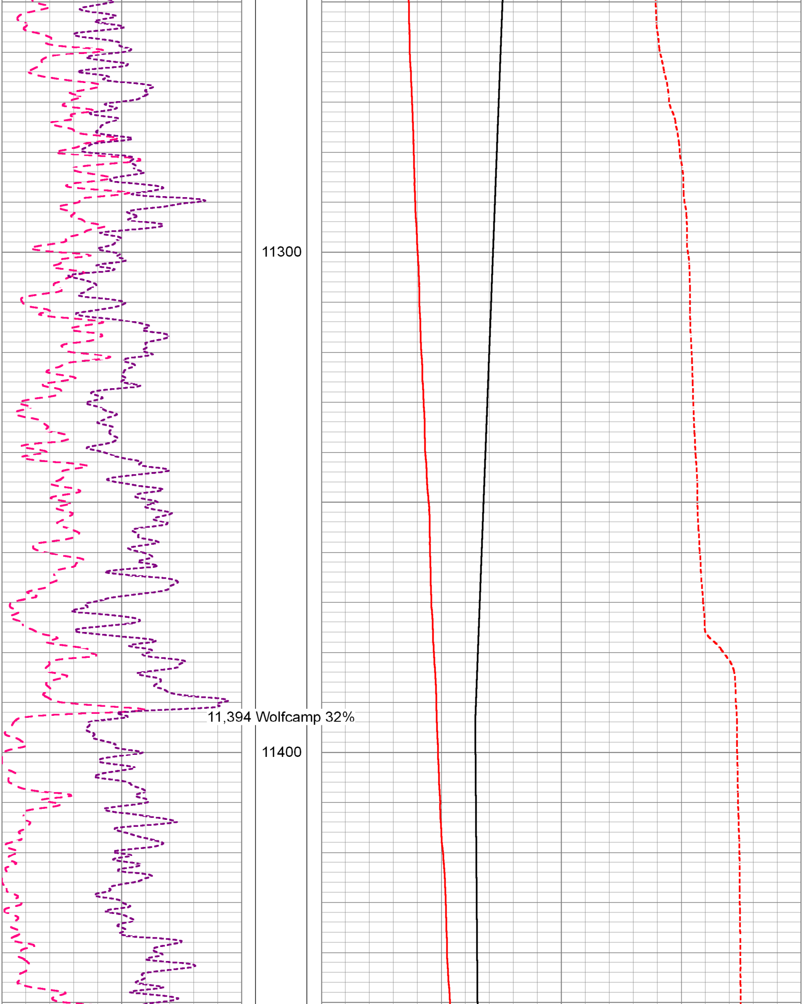
200 InjectingTemperature (degF) 280

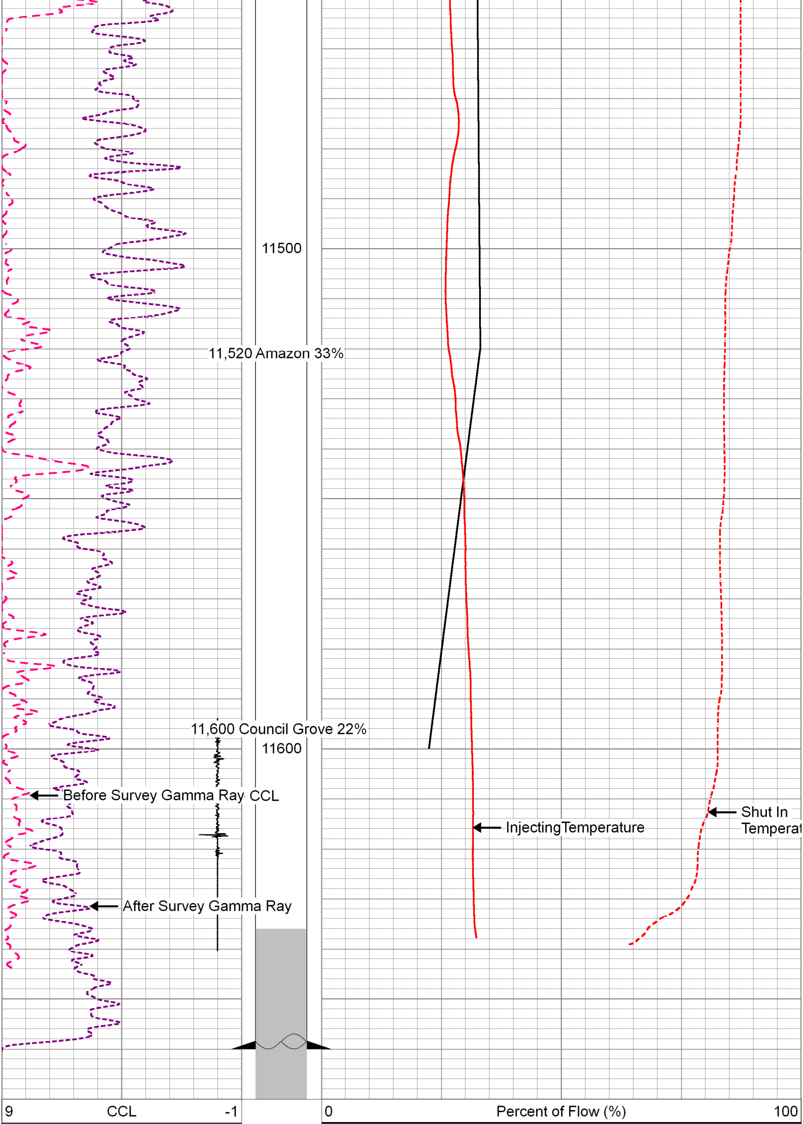












Before Survey Gamma Ray

0 (GAPI) 50

After Survey Gamma Ray

0 (GAPI) 50

200 Shut In Temperature (degF) 280

200 InjectingTemperature (degF) 280

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# 10,520 Ft.

Packer Check 20 min.
No Channeling Detected.

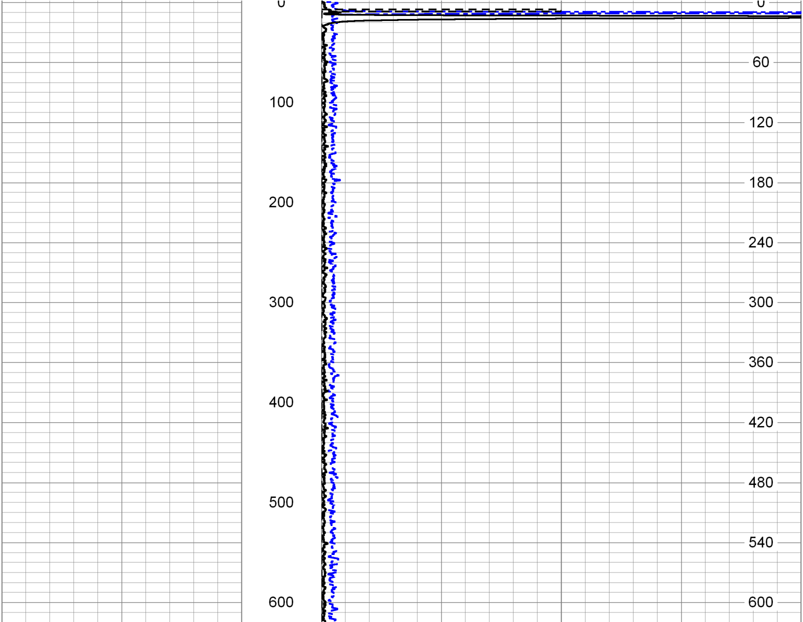
| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | RAT_10520_PKR |
| Presentation Format | tracer2 |
| Dataset Creation | Sun Jan 29 16:46:58 2017 |
| Charted by | Time scaled 36/hour |

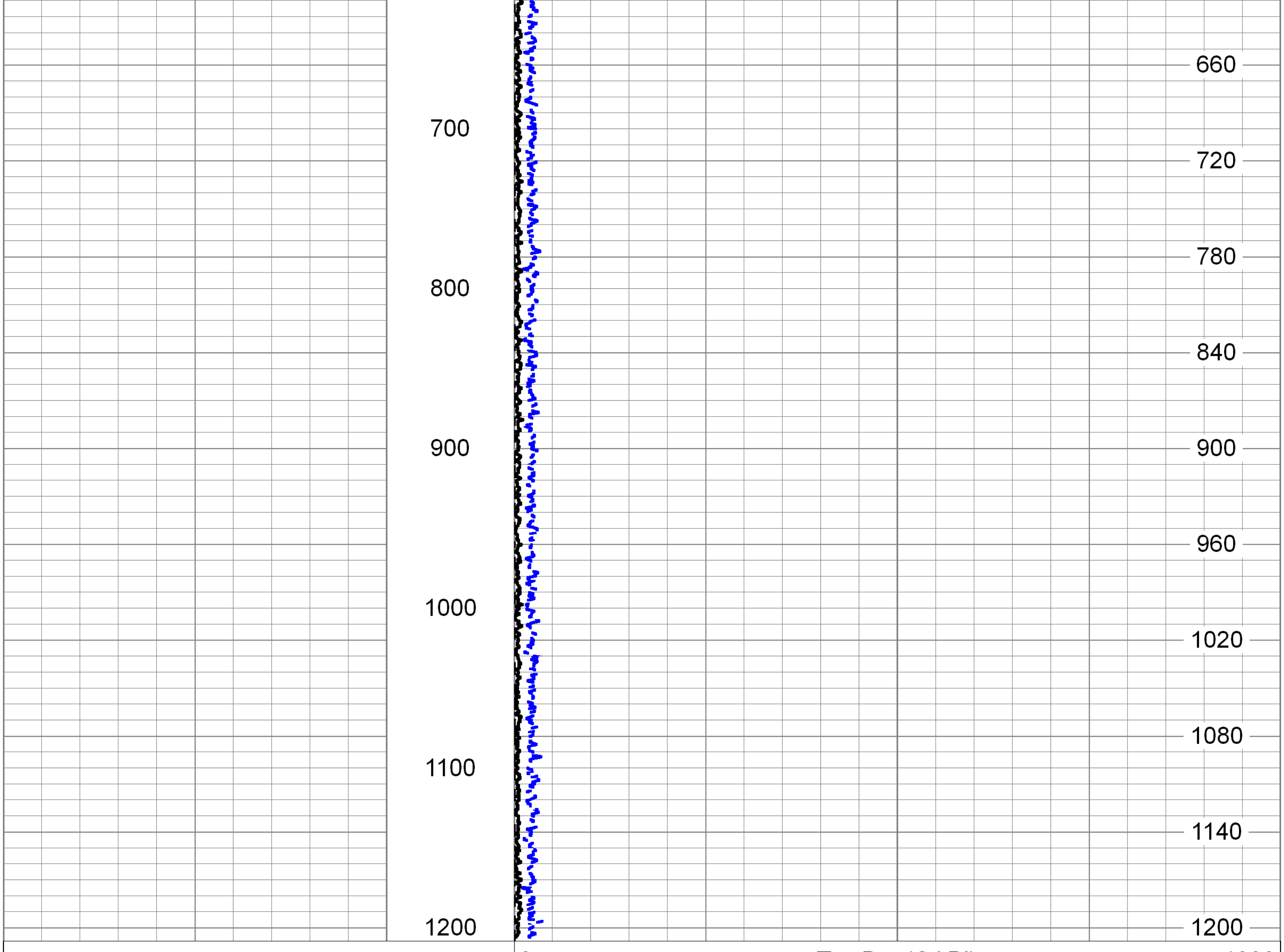
0 Top Det (GAPI) 1000

0 Bottom Det (GAPI) 1000

0 EJECT 1

ELTIM (sec)





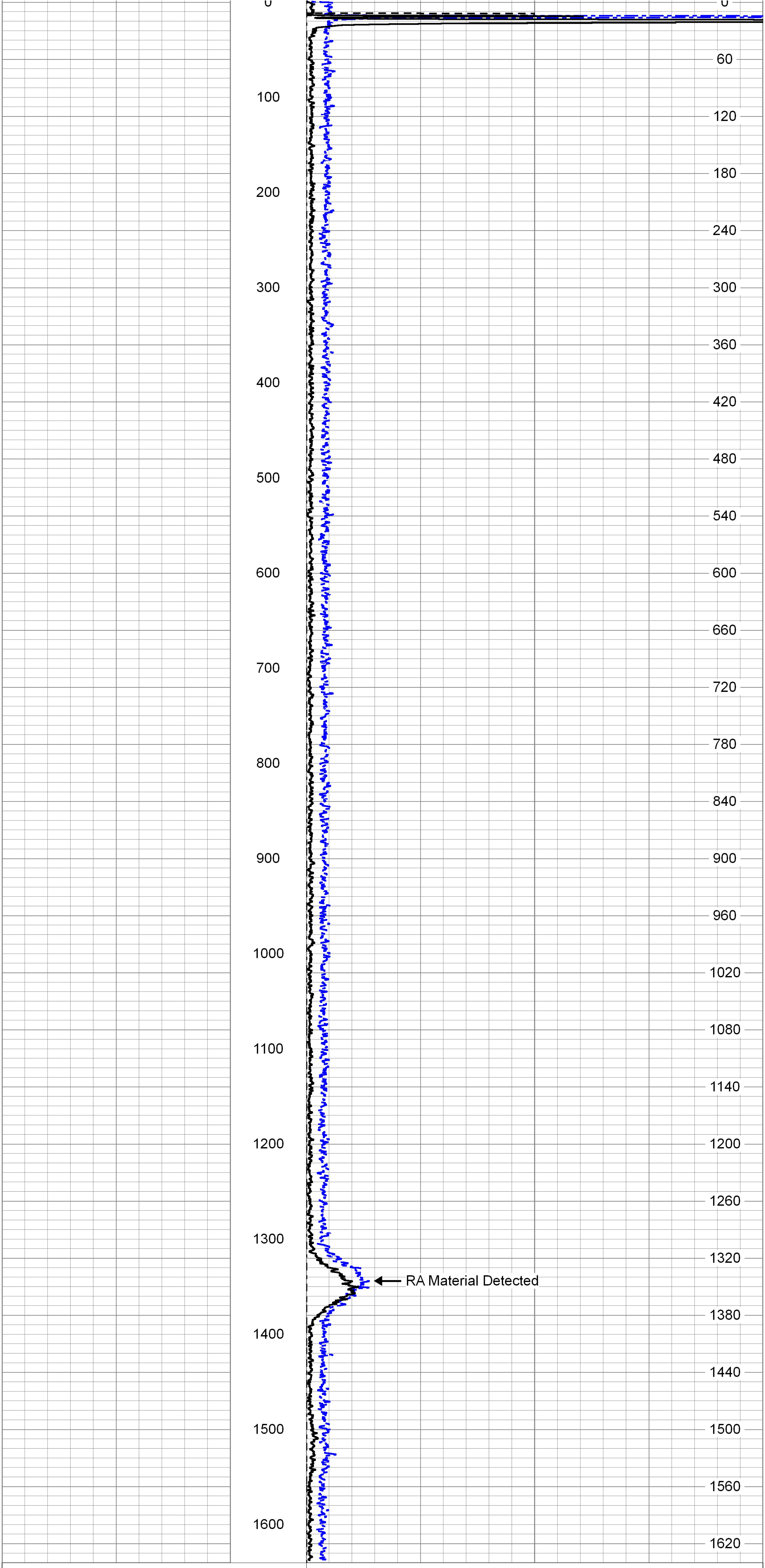
0 Top Det (GAPI) 1000
0 Bottom Det (GAPI) 1000
0 EJECT 1
ELTIM
(sec)

## 10,845 ft. Channel Check at ECP

RA Material detected at 1350 sec.

| | |
|---|---|
| Database File | expedition water service\expedition water solutions ews 3 spintemppressrat 20170129.db |
| Dataset Pathname | RAT_10845_CHAN |
| Presentation Format | tracer2 |
| Dataset Creation | Sun Jan 29 16:17:07 2017 |
| Charted by | Time scaled 36/hour |

0 Top Det (GAPI) 1000
0 Bottom Det (GAPI) 1000
0 EJECT 1
ELTIM
(sec)



0 Top Det (GAPI) 1000
0 Bottom Det (GAPI) 1000
0 EJECT 1
ELTIM
(sec)

| | |
|---|---|
| Company | EXPEDITION WATER SOLUTIONS |
| Well | EWS #3A |
| Field | WATTENBERG |
| County | WELD |
| State | COLORADO |