

# Robert L. Milford

PETROLEUM GEOLOGIST  
Wichita, Kansas

## GEOLOGIST'S REPORT

DRILLING TIME AND SAMPLE LOG

OPERATOR **Murfin Drilling Company, Inc.**

LEASE **Haller #1-7**

LOC SPOT **65 E of W2 SW SW**

LOC FOOTAGE **660' FSL 395' FWL**

SEC. **7** TWP. **2S** R. **34W**

COUNTY **Rawlins** STATE **Kansas**

DATE **15-153-2182-00-00**

CONTRACTOR **Murfin Drilling Co., Inc.** RIG NO. **7**

DRILLING STARTED **11-27-2016** COMPLETED **11-26-2016**

MUD DISPLACED **3,990** MUD TYPE **Chemical**

DRILLING TIME KEPT FROM **3,600** TO RTD

SAMPLES SAVED FROM **3,720** TO RTD

SAMPLES EXAMINED FROM **3,720** TO RTD

GEOLOGICAL SUPERVISION FROM **3,720** TO RTD

MEASUREMENTS

CASING RECORD

ELEVATIONS

KB **3,123'**

GL **3,118'**

FORMATION NAME

LOG DATE/TIME

SAMPLE DATE/TIME

TOP

LOG

FORMATION NAME

TOP

DATE	7:00 AM DEPTH	REMARKS
11-17-16	0'	Spud @ 6:00 pm. Plug down @ 11:30 pm. Dev.: 0.75' @ 232'
11-18-16	232'	Cut 232' in last 24 hrs. Drilled out plug @ 7:30 am w/ PDC bit. Dev.: 0.25' @ 1520'
11-19-16	2,800'	Cut 2,568' in last 24 hrs; 21.75 hrs drlg. Bit trip @ 3500' (ran button bit)
11-20-16	3,745'	Cut 945' in last 24 hrs; 18.25 hrs drlg. DST #1 @ 3859'
11-21-16	3,905'	Cut 160' in last 24 hrs; 5.5 hrs drlg. DST #2 @ 3944'
11-22-16	4,040'	Cut 135' in last 24 hrs; 6.75 hrs drlg. DST #4 @ 4107'
11-23-16	4,107'	Cut 67' in last 24 hrs; 2.75 hrs drlg. DST #5 @ 4150'
11-24-16	4,180'	Cut 73' in last 24 hrs; 3.75 hrs drlg. DST #6 @ 4234'
11-25-16	4,285'	Cut 105' in last 24 hrs; 5.5 hrs drlg. DST #7 @ 4285'
11-26-16	4,495'	Cut 210' in last 24 hrs; 9.75 hrs drlg. RTD 4735' @ 7:13 pm
11-27-16	4,735'	Cut 240' in last 24 hrs; 11.75 hrs drlg. Ran production casing.

**Remarks**

The electric log measurements correlate from even to 1' higher to the drilling measurements.

Formation tops and lithology on this report have been corrected to the electric log.

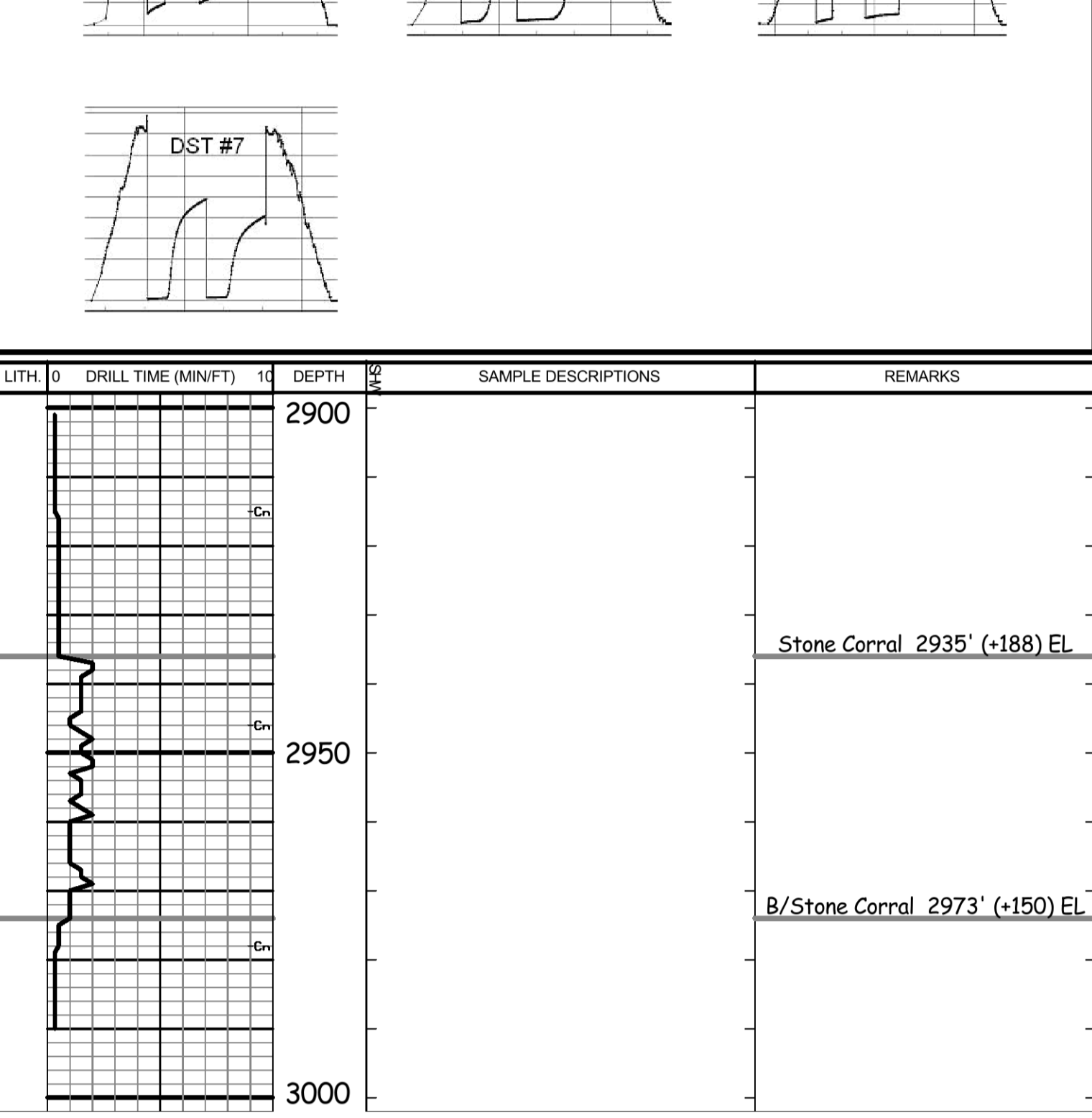
The drilling samples were deposited at the Kansas Geological Survey office in Wichita.

Respectfully submitted,

Robert L. Milford

### Drill Stem Test Charts

Drill Stem Test by **Trilobite Testing, Inc.**



LITH	DRILL TIME (MIN/FT)	DEPTH	SAMPLE DESCRIPTIONS	REMARKS
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Stone Corral 2935' (+188) EL

B/Stone Corral 2973' (+150) EL

Drill time was started with samples at 3720' but after SFO at 3760'. I had rig go back and record drill time starting at 3600'

Mud displaced from 3390' to 3422'

Call depth 3420' @ 2:26 pm on 11-19-16

Bit trip at 3500' - Replace PDC bit with button bit.

Pipe Strap @ 3500': Strap long 1.33'

Straight Hole Survey @ 3500': 0.5° Dev.

3600'

3650'

3700'

3750'

3800'

3850'

3900'

3950'

4000'

4050'

4100'

4150'

4200'

4250'

4300'

4350'

4400'

4450'

4500'

4550'

4600'

4650'

4700'

4750'

LS: crm-gry, fxlh, fos in prt, sub chky-prtly dns, pr por, NS

Sh: red-brn (some soft & gummy), lt-med gry

LS: crm-lt gry, fxlh, fos in prt, some shly (red-brn, mottled), sub chky-prtly dns, pr por, NS

LS: crm-gry, fxlh, fos in prt, sub chky-prtly dns, pr por, scat med-drk brn patchy-sub sat stn, S-FSFO (pp-small beads, some bleeding), no odor

Sh: red-brn (some soft & gummy), gry

LS: crm-gry, fxlh, fos in prt, sub chky-prtly dns, pr w/ tr fr fos por, scat drk-brn blk patchy-sub sat stn, S-FSFO (some thk-hvy oil), no odor

Sh: red-brn (some silty), some gry

LS: crm, fxlh, fos in prt, sub chky-prtly dns, pr w/ tr fr intrprtcl por, scat blk w/ some brn patchy-sat stn, FSFO (some thk-hvy, some bleeding), no odor

Sh: red-brn (some sdy, some soft & gummy), some gry & gm, intermixed w/ some Shly LS: crm w/ mottled red-brn, fxlh, sub chky-prtly dns, pr por, NS

LS: crm-lt gry, fxlh, fos in prt, sli pyr, sub chky-prtly dns w/ some chky, pr por, scat blk spdt-patchy stn (some tarry), NSFO, no odor

Sh: red-brn, some gry (some sdy) & gry

LS: crm-lt gry, fxlh, ool-fos in prt, sub chky-prtly dns, pr w/ tr fr intrprtcl por, scat blk w/ some brn patchy-sat stn, FSFO (some thk-hvy), no odor

Sh: red-brn w/ tr Sd: crm, fn-vry fn grain, pr vis por, drk-brn blk sat stn, NSFO, no odor

LS: crm-lt gry, fxlh, fos in prt, sub chky-prtly dns, pr por, scat blk spdt-patchy stn (some tarry), NSFO, no odor

Sdy LS: crm, fxlh, fn-vry fn grain sd, pr por, scat brn blk patchy-sub sat stn, NSFO, no odor

Sh: red-brn (some sdy), w/ tr Sd: lt gry, fn-vry fn grain, calc, pr vis por, NS

LS: crm-lt gry, fxlh, sli fos, sli shly (red-brn, mottled), sub chky-prtly dns, pr por, tr brn-blk spdt-patchy dead stn, NSFO, no odor

LS: lt gry-tan, fxlh, sli shly, sub chky-prtly dns, pr por, NS, intermixed w/ some Calc Sh: lt gry-maroon

Calc Sh: lt gry-maroon, intermixed w/ some LS: A.A., pr por, NS

Calc Sh w/ some LS: A.A.

LS: crm-lt gry, fxlh, fos-ool in prt, sub chky-prtly dns, pr w/ some fr intrprtcl por, scat med-drk brn & blk patchy-sub sat stn, FSFO, sli odor

LS: wh-lt gry, fxlh, sli fos, sub chky-prtly dns w/ some chky-vry chky, pr por, scat blk (some tarry) spdt-patchy stn, NSFO, no odor

LS: crm-lt gry, fxlh, sub chky-prtly dns, pr por, NS

LS: A.A. w/ some LS: tan-brn, fxlh, sli chty (tan), prtly dns, pr por, NS

LS: tan-brn, fxlh, prtly dns, pr por, NS

Sh: Blk Carb & drk gry w/ some Calc Sh-Shly LS: drk gry

LS: tan-brn, fxlh, fos in prt, sli pyr, prtly dns, pr w/ tr fr fos por, scat drk-brn blk patchy-sub sat stn, S-FSFO, frnt odor on brk

Sd: crm-lt gry, fn-vry fn grain, calc, sli pyr, pr w/ some fr por, fr amtnt lt-vry lt brn sub-sat stn, S-FSFO beads w/ gm amtnt lt brn filmy-filky oil, no odor

Sh: red-brn (some soft & gummy), some gry

Sh: A.A.

LS: crm-tan, fxlh, prtly dns w/ some chky, pr por, intrprtcl ool-fos in prt, sub chky-prtly dns, pr fr amtnt lt-vry lt brn sub-sat stn, S-FSFO, frnt odor

LS: crm-tan, fxlh, sli fos, sub chky-prtly dns, pr por, scat drk-brn blk patchy-sub sat stn, S-FSFO, frnt odor

Sd: crm-lt gry, fn-vry fn grain, calc, soft-brITTLE, pr vis por, gd amtnt lt-vry lt brn sub-sat stn, S-FSFO (pin-point small beads), no odor

Sh: red-brn (some silty), some soft & gummy), some gry & gm

Sh: A.A.

LS: crm, fxlh, fos in prt, sub chky-prtly dns, pr w/ trace Sd: lt gry, fn-vry fn grain, sil, some brittle, pr vis por, NS

LS: wh-crm, fxlh, sli fos, pr fos w/ tr vug por, fr amtnt brn patchy stn, S-FSFO, no odor

Sh: gm (some calc) & red-brn

LS: crm, fxlh, fos in prt, sub chky-prtly dns, pr w/ some fr fos por, scat lt-drk brn patchy-sub sat w/ tr sat stn, FSFO, no odor

Sh: red-brn (some sdy), some gry-gm

Sh: red-brn (some soft & gummy), some gry & gm w/ trace Sd: lt gry, fn-vry fn grain, sil, some brittle, pr vis por, NS

LS: A.A., fxlh, prtly dns, SSFO, no odor

Shy LS: gry, chty, chky-prtly dns, pr por, NS

Sh: lt-med gry (some calc) & red-brn

LS: tan-brn, fxlh, fos, prtly dns, pr por, scat lt-drk brn patchy-sub sat stn, S-FSFO, no odor

Sh: lt-med gry (some calc), some red-brn

Sh: red-brn, lt-med gry

LS: crm-lt tan, fxlh, fos in prt, sli pyr, sub chky-prtly dns, pr w/ some fr fos-pin point, scat lt w/ some med brn patchy w/ some sat stn, S-FSFO, no odor

Sh: gm & red-brn

LS: crm-lt gry, fxlh, sub chky-prtly dns, pr w/ tr fr fos por, scat brn-blk patchy stn, SSFO, no odor

Sh: red-brn (some sdy, some soft & gummy), gm

Sh: red-brn (some silty), some gry-gm

LS: crm, fxlh, fos in prt, sub chky-prtly dns w/ some chky, pr por, scat lt-med brn patchy-sub sat stn, S-FSFO, frnt odor

LS: crm, fxlh, sli fos, sub chky-prtly dns, pr por, scat lt-med brn patchy stn, SSFO, no odor

Sh: gry-gm (some soft & gummy), tr red-brn

Sh: red-brn (some soft & gummy), some gry-gm, intermixed w/ small amt of Sd: lt gry, fn-vry fn grain, calc, fri-semi brittle, pr vis por, NS

Sh: red-brn, some gry

LS: wh-crm, fxlh, fos in prt, sub chky-prtly dns w/ some chky-vry chky, pr w/ tr fr fos por, vry pcs lt-med brn patchy-sub sat stn, S-FSFO (few ps w/ FSFO), no odor

Sh: red-brn (some soft & gummy), gm, some gry

LS: crm-tan, fxlh, fos in prt, some shly (red-brn, mottled), sub chky-prtly dns w/ some chky, pr w/ tr fr fos-pin point por, NS

Sh: red-brn, gm, some gry

LS: crm-lt gry, fxlh, fos in prt, sub chky-prtly dns, pr por, NS

Sh: A.A.

Sh: red-brn (some soft & gummy, some sdy), some gry & gm

LS: crm-tan, fxlh, sub chky-prtly dns w/ some chky, pr por, NS

Sh: red-brn, some gry & gm

Sh: red-brn (some sdy), some gry & gm

LS: crm-gry, fxlh, sub chky-prtly dns, pr por, NS

Calc Sh: med gry, w/ some Sh: red-brn, gry & gm

Sh: red-brn, some gry & gm

Sh: red-brn (some sdy, some soft & gummy), some gry

Sh: red-brn (mstly sdy, some soft & gummy), some gry & gm

LS: crm-tan, fxlh, some shly, sub chky-prtly dns w/ some chky, pr por, NS

Calc Sh: lt-med gry, w/ some Sh: red-brn, some gry

Calc Sh & Sh: A.A.

Sh: red-brn, some gry

LS: crm-lt gry, fxlh, fos in prt, some sdy (vry fn grain sd), sub chky-prtly dns, pr por, NS

LS: crm, fxlh, fos in prt, sub chky-prtly dns w/ some chky, pr por, NS

LS: lt gry-tan, fxlh, sli shly in prt, sub chky-prtly dns, pr por, NS, w/ some Calc Sh: med gry

Calc Sh: med gry w/ some Sh: med-drk gry

LS: crm, fxlh, fos in prt, sli chty (tan-ang), sub chky-prtly dns w/ some chky, pr por, NS

LS: crm-tan, fxlh, sli chty (tan-ang), sub chky-prtly dns w/ some chky, pr por, NS

LS: gry-tan, fxlh, vry sli chty (tan-ang), sub chky-prtly dns, pr por, NS

LS: tan-gry w/ some crm, fxlh, some sli shly, tr cht (tan-ang), sub chky-prtly dns, pr por, NS

Sh: Blk Carb (small amt) & Sh: lt-med gry (some calc)

LS: crm-tan, fxlh, fos in prt, sub chky-prtly dns w/ some chky, pr por, NS

Sh: lt-med gry (some soft & gummy), red-brn, gm, intermixed w/ tr Sd: gry, fn-vry fn grain, calc, semi brittle, pr vis por, NS, no fluor, no cut, no odor

LS: crm-tan, fxlh, fos in prt, sub chky-prtly dns, pr por, NS

LS: crm-tan, fxlh, fos in prt, sub chky-prtly dns, pr por, NS

Sh: red-brn (some soft & gummy), some gm & lt gry (soft & gummy)

LS: crm-tan, fxlh, fos in prt, sub chky-prtly dns, pr por, NS

Sh: red-brn (some sdy), gm, gry, tr yell, intermixed w/ small amt Sd: crm, fn-med grain, some calc, fri-semi brittle, pr vis por, NS, & loose crs grains, clr, sub ang-sub rnd, NS

Sh: red-brn (some soft & gummy), some gry & gm, intermixed w/ small amt Sd: gry-brn, fn-med grain, calc, shly, semi brittle, pr vis por, NS

Sh: red-brn, some gry & gm (some sdy), w/ small amtnt Sd: crm, fn-med grain, calc, some shly, semi fri-brITTLE, pr vis por, NS

Sh: red-brn (some sdy), some gm & gry, tr yell, w/ incrs amt Sd: A.A., pr vis por, NS

Sh: A.A. w/ incrs amt Sd: crm, fn-med, fr-med, some crs grains, sil, some shly (red-brn), semi fri-brITTLE, pr-fr por, NS

Sh: red-brn, some gry & gm, w/ Sd: crm, fr-crs grain, some shly (red-brn & gm), sil, fri-brITTLE, pr-fr por, NS, no fluor, no cut, no odor

Sh: A.A., w/ incrs amt Sd: A.A., pr-fr por, NS, & some loose crs grains, clr, sub rnd-sub ang, NS

Sh: red-brn & gry, some yell & gm, w/ dcns amt of Sd: clusters & loose grains A.A., pr-fr por, NS

Sh: A.A. w/ incrs Sd: crm, fr-crs grain, sil, some shly (red-brn), semi fri-brITTLE, pr-fr por, NS

Sh & Sd: A.A. w/ vry scat pcs Cht: crm-ang, fresh & weathered, NS (4640'-50' drly smpl)

Chert: wh-crm w/ some org, mstly weathered w/ some fresh, weathered por, NS, trace of questionable earthy brn spdt stn, no fluor, no cut, no odor

LS: tan w/ some crm, fxlh, sli chty (tan), sub chky-prtly dns, pr por, NS (trace questionable brn-blk spotted stn, no fluor, no cut, no odor)

LS: A.A. w/ incrs crm, pr por, NS

LS: A.A. w/ some LS: crm, fxlh, ool (small), sli chty (cm), sub chky-prtly dns w/ some chky-vry chky, pr-fr intrprt por, NS

LS: wh-crm, fxlh, ool (small), chky-prtly dns w/ some vry chky, pr-fr w/ some gm intrprt por, NS

LS: A.A.

LS: A.A. w/ some med size ool, pr-fr w/ some fld, prtly dns, pr por, NS

LS: crm-tan, fxlh, sli chty, prtly dns, pr por, NS

Ran 16 stand short trip @ 4735' after CFS

R.T.D. 4735' (-1612)

L.T.D. 4737' (-1614)

Straight Hole Survey @ 4735': 1° Dev.

Morgan Mud check @ 3765': 61 Vis, 8.7 Wt, 5.6 WL, 600 ppm Chl, 4# LCM

DST #1 3746'-3859' Stotler-Topeka IF: blow built to 5" ISI: no blow back Rec: 300' TOTAL FLUID: 113' Mud w/ Oil Specks (100% M) 62' WCM w/ SO (10% W, 90% M) 125' WCM w/ SO (45% W, 55% M) Chl ppm: 40,000 DST: 600 Mud IFF: 122-141#/30" ISIP: 940#/60" FFP: 145-161#/60" FSIP: 902#/90"

Note: Tool opened on bridge 21' off brn. Slid to bottom and lost at least 30' of mud from annulus. After reaching bottom, bled off blow from lost mud. Packer held.

Topeka 3818' (-695) EL

Morgan Mud check @ 4040': 59 Vis, 9.0 Wt, 5.6 WL, 700 ppm Chl, 4# LCM (7:45 am, while TTH for DST #3)

Ran 5 stand short trip prior to DST #3

DST #4 4035'-4107' LKC 'A' 'Sd' - 'D' Prime zones IF: BOB in 8" ISI: surface blow FF: BOB in 13" ISI: no blow back Rec: 225' GIP & 784' TOTAL FLUID: 183' Mud w/ oil spks (11% O, 47% W, 95% M) 282' WCM w/ SO (45% W, 55% M) 313' WCM w/ SO (75% W, 25% M) Chl ppm: 70,000 DST: 700 Mud IFF: 128-237#/30" ISIP: 1160#/60" FFP: 242-385#/60" FSIP: 1151#/90"

Note: Tool opened on bridge 10' off brn. Slid to bottom and lost at least 20' of mud from annulus. After reaching bottom, bled off blow from lost mud.

Morgan Mud check @ 4107': 55 Vis, 9.0 Wt, 5.6 WL, 800 ppm Chl, 3# LCM (7:30 am, while TOH w/ DST #4)

DST #5 4102'-4150' LKC 'G' 'zn IF: blow built to 4" ISI: surface blow FF: blow built to 7.5" ISI: surface blow Rec: 175' GIP & 75' TOTAL FLUID: 15' CO (100% O) 60' OCM (25% O, 75% M) Oil Gravity 36° API IFF: 21-38#/30" ISIP: 1167#/60" FFP: 48-67#/60" FSIP: 1157#/90"

Ran 5 stand short trip prior to DST #5

Morgan Mud check @ 4185': 60 Vis, 9.0 Wt, 6.0 WL, 1,400 ppm Chl, 4# LCM

DST #6 4145'-4234' LKC 'G' Prime - 'I' zones IF: blow built to 5" ISI: no blow back FF: blow built to 7.5" ISI: no blow back Rec: 222' TOTAL FLUID: 97' OCM (5% O, 95% M) 125' WCM w/ SO (30% W, 70% M) Chl ppm: 60,000 DST: 1,400 Mud IFF: 23-72#/30" ISIP: 1263#/60" FFP: 78-125#/60" FSIP: 1246#/90"

Stark 4230' (-1107) EL

Straight Hole Survey @ 4234': 0.75° Dev.

DST #7 4228'-4285' LKC 'K' 'L' zns IF: blow built to 1.75" ISI: surface blow FF: blow built to 0.5" ISI: surface blow Rec: 15' Mud w/ oil specks (100% M) IFF: 21-30#/30" ISIP: 1214#/60" FFP: 31-38#/30" FSIP: 1013#/60"

B/KC 4275' (-1152) EL

Morgan Mud check @ 4285': 58 Vis, 9.2 Wt, 6.0 WL, 1,500 ppm Chl, 4# LCM (7:45 am, while TOH for DST #7)

Heebner 3970' (-847) EL

DST #2 3884'-3944' Oread Rec: blow built to 0.25" FF: no blow Rec: 65' Mud (100% M) IFF: 52-55#/30" ISIP: 1105#/60" FFP: 56-58#/30" FSIP: 985#/60"

Note: tool slid 10' to bottom after tool opened. Lost 5' of mud from annulus. Bled off blow from mud.

Oread 3925' (-802) EL

Morgan Mud check @ 3928': 57 Vis, 9.0 Wt, 6.0 WL, 700 ppm Chl, 4# LCM

Ran 5 stand short trip prior to DST #2

4400'

4450'

4500'

4550'

4600'

4650'

4700'

4750'

Fort Scott 4397' (-1274) EL

Morgan Mud check @ 4510': 83 Vis, 9.3 Wt, 6.4 WL, 1,600 ppm Chl, 4# LCM

4400'

4450'

4500'

4550'

4600'

4650'

4700'

4750'

Oakley 4473' (-1350) EL