

GEOLOGICAL WELLSITE REPORT

Devon et al Kotaneelee L-38, L-38/ST1, L-38A, L-38A/ST3

300L386010124000/02/03

Prepared For: Mark Marshall, Devon Canada Corporation

By: Peter Wasylyk, March 23, 2005

TABLE OF CONTENTS

WELL SUMMARY	3
DAILY SUMMARY	4
CASING SUMMARY	24
GEOLOGICAL SUMMARY	24
FORMATION TOPS	29
SAMPLE DESCRIPTIONS	30
BIT RECORD TABLE	123
PLAN VIEW OF WELL PATHS	126
DIRECTIONAL SURVEY DATA	127

WELL SUMMARY

WELL NAME: Devon et al Kotaneelee L-38, L-38/ST1, L-38A, L-38A/ST1

UWI: 300L386010124000/02/03

SURFACE COORD: 60 07 32.4" N 124 07 23.6"W

BOTTOM HOLE COORD: 1085.78m North and 226.75m West of surface location

WELL LICENSE: # 1117 AFE: # 03271041

ELEVATIONS: Ground: 803.65m KB 810.4m

OPERATOR: Devon Canada Corporation

DRILL CONTRACTOR: Akita Drilling Inc., Rig # 58

WELLSITE SUPERVISION: Engineer: Dennis Tokar
Geologist: Peter Wasyluk

WELL SPUDDED: 17:45 hrs; 08 - 22 - 2004

DRILLING COMPLETED: 14:00 hrs; 03 - 05 - 2005

BOTTOM HOLE FORM: Nahanni

TOTAL DEPTH: Driller: 4065m MD; 3755.3m TVD;
Logger: 4053.5m MD; 3745.8m TVD;

BIT SIZES: Surface: 444.5mm; Intermediate: 311; Downhole: 216mm; Downhole: 156mm

CASING SIZES: Surface: 339.7mm; Intermediate: 244.5mm; Liner: 177.8mm

CORES CUT: None

LOGS RUN: Run #1: UBI/PPC/AIT/EMS. Interval: 3314.5m - 921m
Run #1: DSI/GPIT/CNL-LDT. Interval: 3314m - 22m
Run #2: OBMI/DSI/GPIT/EMS/GR/TTC. Interval: 3908m - 3311m
Run #2: PEX. Interval: 3802m - 3311m
Run #3: UBI/AIT. Interval: 4053.5m - 3951.5m
Run #3: DSI/GPIT/CNL-LDT. Interval: 4053.5m - 3951.5m

RIG RELEASE: NA

WELL STATUS: Potential Nahanni Gas Well

SAMPLE REQUIREMENTS: Company: 22m - 1502m; 1150m - 4543m; 3345m - 4175m; 3970m - 4065m
Government: 22m - 1502m; 1150m - 4543m; 3345m - 4175m; 970m - 4065m

DAILY SUMMARY

(Reports as at 24:00 hrs.)

08-22-2004

Depth: 0m; Progress: 0m; Status: Prepare to spud

- Wait on orders, prepare to spud.
- Spud @ 17:45 hrs, Drill 444.5mm hole from 22 to 27 meters, circulate and condition mud (1.75 hrs.).
- Drill 444.5mm hole from 27 to 43 meters.

08-23-2004

Depth: 43m; Progress: 21m; Status: Drilling

- Drill 444.5mm hole and survey from 43 to 93 meters.
- Pull out of hole, change bit and pick up directional tools (VertiTrack), run in hole, wash to bottom (91 to 93m).
- Drill 444.5mm hole and survey from 93 to 111 meters.

08-24-2004

Depth: 111m; Progress: 68m; Status: Drilling

- Drill 444.5mm hole and survey from 111 to 195 meters.

08-25-2004

Depth: 195m; Progress: 84m; Status: Drilling

- Drill 444.5mm hole and survey from 195 to 219 meters, Work tight hole, circulate and condition mud (2.5 hrs.).
- Trip for bit, make up new bit and run in hole, ream to bottom from 185 to 219 meters.
- Drill 444.5mm hole and survey from 219 to 241 meters.
-

08-26-2004

Depth: 241m; Progress: 46m; Status: Drilling

- Drill 444.5mm hole and survey from 241 to 273 meters, pump high viscosity sweep.
- Trip for bit, run in hole and ream under gauge hole from 259 to 264 meters.
- Drill 444.5mm hole and survey from 273 to 278 meters.

08-27-2004

Depth: 273m; Progress: 32m; Status: Drilling

- Drill 444.5mm hole and survey from 278 to 308 meters, work pipe on connections, Pump sweep to clean hole.
- Trip for bit, run in hole and wash to bottom from 268 to 308 meters.
- Drill 444.5mm hole and survey from 308 to 328 meters.

08-28-2004

Depth: 328m; Progress: 55m; Status: Drilling

- Drill 444.5mm hole and survey from 328 to 380 meters, ream 370 to 380 meters.
- Circulate and clean hole, pump high vis sweep, pull out for new bit, Run in with bit #6 (Smith 4J3S).

08-29-2004

Depth: 380m; Progress: 52m; Status: Run in with new bit

- Run in hole with new bit, ream from 345 to 380 meters.
- Drill 444.5mm hole and survey from 380 to 454 meters.

08-30-2004

Depth: 454m; Progress: 74m; Status: Drilling

- Drill 444.5mm hole and survey from 454 to 471 meters.
- Circulate and condition hole, pump high vis sweep, pull out for new bit.
- Run in hole with bit #7 (Hughes HT30GC), ream from 429 to 471 meters.
- Drill 444.5mm hole and survey from 471 to 493 meters.

08-31-2004

Depth: 493m; Progress: 39m; Status: Drilling
- Drill 444.5mm hole and survey from 493 to 515 meters.
- Circulate and condition hole, pump high vis sweep, trip out for new bit.
- Run in hole with bit #8 (Smith M57DODC), ream from 467 to 515 meters.
- Drill 444.5mm hole and survey from 515 to 525 meters.

09-01-2004

Depth: 525m; Progress: 32m; Status: Drilling
- Drill 444.5mm hole and survey from 525 to 587 meters.

09-02-2004

Depth: 587m; Progress: 62m; Status: Drilling
- Drill 444.5mm hole and survey from 587 to 661 meters.

09-03-2004

Depth: 661m; Progress: 74m; Status: Drilling
- Drill 444.5mm hole and survey from 661 to 714 meters, Circulate and condition hole prior to trip.
- Trip out for new bit and holed out directional tools.
- Change out directional tools and run in with new bit #9 (Hughes MXDP 55DX).

09-04-2004

Depth: 714m; Progress: 53m; Status: Run in hole with new bit
- Run in hole to 149 meters, break circulation and wash to 157 meters, Ream tight hole from 157 to 714 meters.
- Drill 444.5mm hole and survey from 714 to 749 meters.

09-05-2004

Depth: 749m; Progress: 35m; Status: Drilling
- Drill 444.5mm hole and survey from 749 to 821 meters.

09-06-2004

Depth: 821m; Progress: 72m; Status: Drilling
- Drill 444.5mm hole and survey from 821 to 857 meters, Circulate hole clean, trip out for new bit.
- Run in with bit #10 (Smith 57JSDL) to 116 meters, break circulation, ream from 114 to 130 meters.

09-07-2004

Depth: 857m; Progress: 36m; Status: Run in hole with bit#10
- Run in hole from 411 to 450 meters, ream tight spot from 450 to 470 meters, run in hole to 580 meters.
- Ream and wash from 580 to 857 meters, Drill 444.5mm hole from 857 to 899 meters.

09-08-2004

Depth: 899m; Progress: 42m; Status: Drilling
- Drill 444.5mm hole from 899 to 919 meters, circulate with pump #2, work on pump #1.
- Pull out of hole, change out module on pump #1, Run in hole with bit #11rr (Hughes HT30GC).

09-09-2004

Depth: 919m; Progress: 20m; Status: Run in hole with bit #11rr
- Run in hole to 780 meters, wash from 780 to 899 meters, Circulate with pump #2, change head in pump #1.
- Ream to bottom from 898 meters, Drill 444.5mm hole from 919 to 922 meters TD.
- Circulate, pump sweeps, work pipe, trip out of hole to run surface casing.
- Lay down VertiTrack, rig to run surface casing, Run 339.7mm surface casing.

09-10-2004

Depth: 922m; Progress: 3m; Status: Run 339.7mm surface casing

- Run 339.7mm surface casing, landed at 920.71 meters, Circulate casing, rig out Tesco casing running tool.
- Run in hole with inner string for packoff, rig out lay down truck, Continue to run in hole with inner string.
- Rig up cement head, circulate and condition mud, Cement casing.

09-11-2004

Depth: 922m; Progress: 0m; Status: Cement casing

- Cement casing, plug down @ 00:15 hrs.
- Hold pressure on cement, displace casing to water, rig out cementers and cement head.
- Trip inner string out of hole, Nipple down diverter stack, cut casing and conductor.
- Install casing bowl and nipple up BOP.

09-12-2004

Depth: 922m; Progress: 0m; Status: Nipple up BOP

- Nipple up BOP and pressure test, Set wear bushing and run in hole.

09-13-2004

Depth: 922m; Progress: 10m; Status: Run in hole with bit #12

- RIH and tag float collar at 907 m, Circulate and displace hole to Amodril 1400.
- Drill float collar and shoe, Drill from 922 m to 926 m, Circulate and condition.
- Run leak off test and POH, PU BHA with VertiTrac and NB #13.
- Surface test VertiTrac and RIH, Drill from 926 m to 936 m.

09-14-2004

Depth: 936m; Progress: 58m; Status: Drilling 311 mm hole.

- Drill and survey from 936 m to 983 m, Work on and install shale slide, Drill and survey from 983 m to 994 m.
-

09-15-2004

Depth: 994m; Progress: 74m; Status: Drilling 311 mm hole.

- Drill and survey from 994 m to 1068 m.

09-16-2004

Depth: 1068m; Progress: 114m; Status: Drilling 311 mm hole.

- Drill and survey from 1068 m to 1182 m.

09-17-2004

Depth: 1068m; Progress: 45m; Status: Drilling 311 mm hole.

- Drill and survey from 1182 m to 1227 m, Circulate and rotate to condition hole.
- POH for NB #14, PU bit and move shock sub up one collar, RIH.

09-19-2004

Depth: 1227m; Progress: 129m; Status: Drilling 311 mm hole.

- RIH, Drill and survey from 1227 m to 1244 m, Reduce FOB to 20,000 due to building angle.
- Change shaker screens, Drill and survey from 1244 m to 1356 m.

09-20-2004

Depth: 1356m; Progress: 146m; Status: Drilling 311 mm hole.

- Drill and survey from 1356 m to 1502 m, Circulate and condition for trip, Pump out 4 singles due to tight hole.
- Work tight hole, mix gel and raise MW to 920, Pump out to 1026m POH, Lay down VertiTrac and BHA.
- RIH slick to bridge at 1350 m, Wash from 1350 m to bottom, Circulate and condition hole and mud.

09-21-2004

Depth: 1502m; Progress: 0m; Status: Circulating and mix mud.

- Circulate and raise MW to 920, Pump out to casing shoe (921 meters), finish pulling out of hole.
- Lay down 21 drill collars and pick up directional tools, Run in with bit # 15 (Smith F27PS) to 186 meters.
- Repair rig (1.5 hrs.), change starter from #1 motor to #2 motor, then #1 to #3 motor.
- Pick up 30 joints of HWDP, slip and cut drilling line.
- Trip in hole, wash from 1350 to 1450 meters, ream from 1450 to 1498 meters, Work tight hole.

09-22-2004

Depth: 1502m; Progress: 0m; Status: Work tight hole.

- Attempt to free stuck pipe.

09-23-2004

Depth: 1502m; Progress: 0m; Status: Attempt to free stuck pipe.

- Attempt to free stuck, wait on Schlumberger and fishing tools, Rig in wireline truck and run free-point survey.
- Run in with string shot and back off pipe at 1439 meters.

09-24-2004

Depth: 1502m; Progress: 0m; Status: Pull wireline.

- Pull wireline and rig out Schlumberger
- Pull up to 1414 meters and break circulation, circulate and condition mud, wash down from 1414 to 1427 m.
- Circulate and condition mud, trip out of hole.
- Make up fishing tools and run in hole to 744 meters with bit #16 (Hughes J40BY).

09-25-2004

Depth: 1502m; Progress: 1502m; Status: Run in hole with fishing tools.

- Run in hole with fishing tools, bridge off at 1375 meters, Wash down from 1375 to top of fish at 1439 meters.
- Circulate bottoms up, attempt to latch on to fish, Pull up to 1421 meters, attempt to pump, pressured up.
- Trip out of hole and clean plugged drill pipe and collars.
- Make up new bit and run in hole, wash down from 1371 meters to top of fish.
- Circulate and condition mud above fish (1.5 hrs.), pull one stand and rack it back.
- Attempt to pull second stand, pipe is stuck, attempt to circulate, work stuck pipe.
- Jar on stuck pipe (to 23:15 hrs.), rig in wireline.

09-26-2004

Depth: 1502m; Progress: 0m; Status: Rig in wireline.

- Trouble shoot wireline tools, rig out wireline, Work stuck pipe (10:15 hrs.).
- Rig in wireline and run in with string shot, set charge and back-off, pull out wireline and rig out.
- Circulate and condition mud (2.5 hrs.), trip out of hole and lay down fishing tools.
- Run in hole open-ended to run cement plug, Circulate and condition mud.

09-27-2004

Depth: 1502m; Progress: 0m; Status: Circulate and condition mud.

- Circulate and condition mud, Rig in cements and run cement plug from top of fish to 1300 meters.
- Pull up from 1300 meters to 985 meters, circulate bottoms up and pull out of hole.
- Make up BHA and run in hole with Bit #17 (Hughes XV), pick up 3 collars and 24 drill pipe.
- Run in to 935 meters, break circulation, circulate (0.75 hrs.), wash down to 1120 meters.
- Circulate (2.75 hrs.), wash down to 1147 meters, circulate, wait on cement (4.75 hrs.).

09-28-2004

Depth: 1502m; Progress: 0m; Status: Wait on cement.

- Wait on cement to 00:15 hrs, wash down to 1195 meters, circulate bottoms up.
- Wash down to 1222 meters, circulate bottoms up and condition mud (8.25 hrs.).
- Trip out of hole and lay down BHA, Run in hole open-ended to 1222 meters to run second cement plug.
- Rig up cementers and cement plug.

09-29-2004

Depth: 1502m; Progress: 0m; Status: Cement second plug.

- Cement plug, plug down @ 00:30 hrs., Pull 11 stands and circulate hole clean, return 4m3 of pre-flush.
- Trip out of hole and pick up BHA, Run in hole to 820 meters and wait on cement (7.5 hrs.).
- Run in hole and tag cement at 1059 meters.
- Tear top drive electrical cable, trip out to casing shoe and wait on parts

09-30-2004

Depth: 1502m; Progress: 0m; Status: Wait on electrical cable for top drive.

- Replace top drive power cord
- Trip in to plug and tag it @ 1059 meters, Drill cement from 1059 to 1123 meters, circulate up sample.
- Pull out of hole, make up directional assembly and run in hole (survey on the way in).

10-01-2004

Depth: 1502m; Progress: 0m; Status: Run in hole with directional assembly.

- Drill cement from 1123 to 1150 meters, Note: START SIDETRACK @ 1150 meters.
- Time-drill 311mm hole from 1150 to 1157.5 meters.

10-02-2004

Depth: 1157.5m; Progress: 7.5m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1157.5 to 1160.7 meters, circulate bottoms up.
- Trip out of hole to change bend on mud motor, set new angle to 2.0 deg.
- Pick up Bit#20 (Reed TD53AM), run in hole, build trough with motor (0.75 hrs.).
- Time-drill 311mm hole and survey from 1160.7 to 1163.2 meters.

10-03-2004

Depth: 1163.2m; Progress: 5.7m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1163.2 to 1165.7 meters.
- Lost ledge, restart time drill, drill 311mm hole and survey from 1165.7 to 1168.5 meters.
- Circulate bottoms up, trip out of hole, make up new bend on mud motor, run in hole

10-04-2004

Depth: 1168.5m; Progress: 5.3m; Status: Run in hole

- Run in hole, attempt to fill hole, MWD screen fell in pipe, pull out 3 stands and recover screen.
- Run in to bottom, no fill, break circulation, drill 311mm hole and survey from 1168.5 to 1196.5 meters.

10-05-2004

Depth: 1196.5m; Progress: 28m; Status: Drill 311mm hole

- Drill 311mm hole from 1196.5 to 1197.7 meters, circulate bottoms up.
- Pull out of hole, pulled tight at 1161 meters, work pipe, circulate bottoms up, pump pill.
- Trip out of hole, make up bit #21 (Hughes MXDP5SR), and run in hole to 1143 meters.
- Ream to bottom, pump super sweep, drill 311mm hole and survey from 1197.7 to 1202 meters.

10-06-2004

Depth: 1202m; Progress: 5.5m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1202 to 1225 meters.

10-07-2004

Depth: 1225m; Progress: 23m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1225 to 1235 meters, circulate bottoms up, prepare to trip.
- Pop stand, clean oil spray on rig floor (3.0 hrs.), pump out 3 stands to 1139 meters.
- Pull out of hole, lay down mud motor and pick up a new one.

10-08-2004

- Depth: 1235m; Progress: 10m; Status: Pick up new mud motor
- Pick up new mud motor, make up Bit #23 (Smith F40DPS), run in hole.
 - Wash and ream to bottom from 1220 meters, drill 311mm hole and survey from 1235 to 1251 meters.

10-09-2004

- Depth: 1251m; Progress: 16m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1251 to 1302 meters.

10-10-2004

- Depth: 1302m; Progress: 51m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1251 to 1362 meters.

10-11-2004

- Depth: 1362m; Progress: 60m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1362 to 1400 meters, circulate bottoms up.
 - Pull out to 1160 meters, ream through sidetrack from 1160 to 1169 meters.

10-12-2004

- Depth: 1400m; Progress: 38m; Status: Ream through sidetrack
- Ream through sidetrack from 1169 to 1200 meters.
 - Pull out of hole, make up Bit#23 (Hughes ATJ44CDXP), add a second shock sub to string.
 - Run in hole, wash to bottom from 1366 meters, drill 311mm hole and survey from 1400 to 1440 meters.

10-13-2004

- Depth: 1440m; Progress: 40m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1440 to 1532 meters.

10-14-2004

- Depth: 1532m; Progress: 95m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1532 to 1624 meters.

10-15-2004

- Depth: 1624m; Progress: 92m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1624 to 1664 meters, circulate bottoms up, trip for bit.
 - Inspect directional BHA, make up new bit #24 (Reed TD53AM), run in hole.
 - Wash to bottom from 1633 meters, Drill 311mm hole from 1664 to 1667 meters.

10-16-2004

- Depth: 1667m; Progress: 43m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1667 to 1777 meters.

10-17-2004

- Depth: 1777m; Progress: 110m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1777 to 1891 meters.

10-18-2004

- Depth: 1891m; Progress: 114m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 1891 to 1909 meters, circulate bottoms up, trip out of hole.
 - Lay down MWD tools and motor, pull wear bushing, set test plug, pressure test BOP, set wear bushing.
 - Pick up new BHA and make up bit #25 (Security FM28451), run in hole.
 - Bridge off at: 1204m, 1248m, 1270m and 1517 meters.

10-19-2004

Depth: 1909m; Progress: 18m; Status: Ream and wash to bottom

- Ream and wash to bottom from 1529 to 1583 meters, run in hole to 1875 meters.
- Wash down from 1875 to 1909 meters, no fill.
- Drill 311mm hole from 1909 to 1916 meters, circulate bottoms up, trip for bit.
- Weld on stand pipe, change out directional tools, make up new bit# 26 (Smith F47MOD).
- Run in hole

10-20-2004

Depth: 1916m; Progress: 7m; Status: Run in hole with new bit

- Run in hole with new bit.
- Drill 311mm hole and survey from 1916 to 1953.5 meters.

10-21-2004

Depth: 1953.5m; Progress: 44.5m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1953.5 to 1959 meters.
- Circulate bottoms up, trip for bit, make up Bit#27 (Reed TD53A), run in hole.
- Wash to bottom from 1942 meters, Drill 311mm hole and survey from 1959 to 1983 meters.

10-22-2004

Depth: 1983m; Progress: 29.5m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 1983 to 2062 meters.

10-23-2004

Depth: 2062m; Progress: 79m; Status: Drill 311mm hole

- Circulate with pump #1 and change head on pump #2 (1.0 hrs.).
- Drill 311mm hole and survey from 2062 to 2139 meters.

10-24-2004

Depth: 2139m; Progress: 77m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2139 to 2213 meters.

10-25-2004

Depth: 2213m; Progress: 74m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2213 to 2244 meters.
- Circulate bottoms up, pull out of hole, change out directional BHA, pick up Gamma tool.
- Make up bit #28 (Security ES365).

10-26-2004

Depth: 2244m; Progress: 31m; Status: Make up new bit

- Run in hole, slip and cut drilling line, circulate and wash to bottom from 2228 meters (no fill).
- Drill 311mm hole and survey from 2244 to 2283 meters.

10-27-2004

Depth: 2283m; Progress: 39m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2283 to 2328 meters.

10-28-2004

Depth: 2328m; Progress: 45m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2328 to 2351 meters.
- Circulate with pump #2 and change head and liner on pump #1, circulate bottoms up.
- Pull out of hole for new bit, lay down 2 shock subs, inspect directional BHA.
- Make up new bit #29 (Reed TD53AM), run in hole.

10-29-2004

Depth: 2351m; Progress: 23m; Status: Run in hole with new bit

- Run in hole with new bit, wash to bottom from 2335 meters.
- Drill 311mm hole and survey from 2351 to 2404 meters.

10-30-2004

Depth: 2404m; Progress: 53m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2404 to 2470 meters.

10-31-2004

Depth: 2470m; Progress: 66; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2470 to 2570 meters.

11-01-2004

Depth: 2570m; Progress: 100m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2570 to 2642 meters.

11-02-2004

Depth: 2642m; Progress: 72m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2642 to 2651 meters, circulate bottoms up, flow check.
- Pull out of hole for new bit, change out mud motor, inspect directional assembly.
- Make up Bit #30 (Reed TD52D), run in hole, slip and cut drilling line.
- Change heads and liners on pump #1 and #2, run in hole.
- Drill 311mm hole from 2651 to 2655 meters.
- Shut in well, check shut-in pressure, circulate bottoms up through choke.

11-03-2004

Depth: 2655m; Progress: 13m; Status: Circulate gas out of hole through choke

- Circulate through choke, monitor gas, drill 311mm hole and survey from 2655 to 2674 meters.
- Circulate up gas and pump sweep, drill to 2677 meters, circulate up gas.
- Drill to 2681 meters, circulate up gas, drill to 2685 meters, circulate up gas.
- Drill 311mm hole and survey from 2685 meters to 2712 meters.

11-04-2004

Depth: 2712m; Progress: 57m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2712 to 2735 meters, change 2" nipple to pressure gauge on pump #1.
- Drill to 2744 meters, change cap gasket and retainer on pump #1.
- Drill 311mm hole and survey from 2735 to 2759 meters.

11-05-2004

Depth: 2759m; Progress: 47m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2759 to 2784 meter, change middle module on pump #1.
- Circulate out gas, drill 311mm hole and survey from 2784 to 2790 meters.

11-06-2004

Depth: 2790m; Progress: 31m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2790 to 2805 meters, work on pump #2.
- Drill 311mm hole and survey from 2805 to 2812 meters, work on pump #2.
- Drill 311mm hole and survey from 2812 to 2832 meters.

11-07-2004

Depth: 2832m; Progress: 42m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2832 to 2881 meters.

11-08-2004

Depth: 2881m; Progress: 49m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2881 to 2894 meters, circulate bottoms up, pump sweep.
- Pump out 5 stands, flow check, pull out to 2420 meters, circulate and pump pill, pull out of hole.
- Change out mud motor, inspect directional BHA, make up new bit #31 (Security EBXS30S).
- Run in hole to 2887 meters.

11-09-2004

Depth: 2894m; Progress: 13m; Status: Run in hole with new bit

- Wash to bottom from 2894 meters, drill 311mm hole to 2895.5 meters.
- Shut in well, circulate gas through choke, flare gas (2.75 hrs.).
- Drill 311mm hole and survey from 2895.5 to 2929 meters.

11-10-2004

Depth: 2929m; Progress: 35m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2929 to 2955 meters.

11-11-2004

Depth: 2955m; Progress: 26m; Status: Drill 311mm hole

- Drill 311mm hole to 2956 meters, circulate bottoms up, change wash pipe (1.25 hrs.).
- Circulate 10 stands out of hole, pump pill, pull out for new bit.
- Inspect directional BHA, make up Bit #32 (Reed TD53A), run in hole.
- Wash to bottom from 2906 meters, drill 311mm hole to 2957 meters.
- Shut in well, circulate through choke, flare gas (3.25 hrs.), drill 311mm hole to 2958 meters.

11-12-2004

Depth: 2958m; Progress: 3m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 2958 to 2976 meters.
- Replace union on popvalve line and repair popvalve on pump #2 (2.0 hrs.).
- Drill 311mm hole and survey from 2076 to 3011 meters.

11-13-2004

Depth: 3011m; Progress: 53m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 3011 to 3076 meters.

11-14-2004

Depth: 3076m; Progress: 65m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 3076 to 3133 meters.

11-15-2004

Depth: 3133m; Progress: 57m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 3133 to 3172 meters.

11-16-2004

Depth: 3172m; Progress: 39m; Status: Drill 311mm hole

- Drill 311mm hole and survey from 3172 to 3187 meters.
- Circulate bottoms up, flow check, pump out to 2916 meters, flow check.
- Pull out of hole, make up bit # 33 (Reed HP51A), run in hole.

11-17-2004

Depth: 3187m; Progress: 15m; Status: Run in hole with new bit

- Slip and cut drilling line, run in hole, wash to bottom from 3145 meters.
- Drill to 3188 meters, circulate through choke and flare gas (1.75 hrs.).
- Circulate with pump #2 while changing module on pump #1 (3.25 hrs.).
- Drill 311mm hole and survey from 3188 to 3204 meters.

11-18-2004

Depth: 3204m; Progress: 17m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 3204 to 3229 meters.

11-19-2004

Depth: 3229m; Progress: 25m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 3229 to 3263 meters.

11-20-2004

Depth: 3263m; Progress: 34m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 3263 to 3295 meters.

11-21-2004

Depth: 3295m; Progress: 32m; Status: Drill 311mm hole
- Drill 311mm hole and survey from 3295 to 3303 meters, change washed seat and valve in pump #2 (0.75 hrs.).
- Drill 311mm hole and survey from 3303 to 3314 meters, circulate bottoms up, wiper trip 10 stands.
- Circulate hole clean, circulate through choke (flare gas), circulate hole clean.

11-22-2004

Depth: 3314m; Progress: 19m; Status: Circulate hole clean
- Circulate and clean hole, pull out of hole, lay down directional tools, rig service.
- Rig in Schlumberger for open hole logging, Run#1: 2-OBMI (offset), GPIT, Gamma; casing test tool.
- Caliper will not close, troubleshoot tool (2.25 hrs), run in to 3315 meters and log hole.
- Make up tools for run #2: DSI, GPIT, Gamma, UBI, PPC: casing test tools.
- Rig out UBI, PPC due to power problems (2.25 hrs.).

11-23-2004

Depth: 3314m; Progress: 0m; Status: Log with Schlumberger
- Change out UBI and PPC, run in hole and log up from 3315 meters.
- Rig out run #2 and rig up run #3: CNL-LDT, AIT, EMS, run in hole and log up from 3315 meters.
- Rig out run #3 and rig up run #4.

11-24-2004

Depth: 3314m; Progress: 0m; Status: Log with Schlumberger
- Rig up run #4: CBT, Gamma, Cal; run in to bottom of surface casing and log to surface.
- Rig up run #4 and rig up run #5: UBI, run in hole, bridge off at 1160 meters.
- Rig out run #5 and rig up run #6: UBI, run in hole, bridge off at 1169 meters, rig out Schlumberger.
- Make up bit # 34RR (Hughes XV) and run in hole, circulate bottoms up, shut in well, circulate through choke.

11-25-2004

Depth: 3314m; Progress: 0m; Status: Circulate through choke and flare gas
- Circulate through choke and flare gas (4.5 hrs.), pull out of hole, lay down collars.
- Pull wear bushing, change upper pipe rams, install test plug and pressure test BOP.
- Rig up Tesco casing running tool, rig up lay down truck, run 244.5mm intermediate casing.

11-26-2004

Depth: 3314m; Progress: 0m; Status: Run 244.5mm intermediate casing
- Run 244.5 mm intermediate casing, circulate casing, circulate through choke and flare gas (3 hrs.).

11-27-2004

Depth: 3314m; Progress: 0m; Status: Circulate casing
- Circulate casing, rig up cementers, cement casing, plug down @ 08:30 hrs.
- Flush stack, rig out cementers, rig out Tesco running tool, lift BOP and set casing slips.
- Cut casing and install bit guide, nipple up BOP, pressure test BOP.

11-28-2004

Depth: 3314m; Progress: 0m; Status: Pressure test BOP

- Pressure test BOP, make up BHA and make up Bit #35 (Hughes XV), slip and cut drilling line.
- Run in hole and tag cement at 3271 meters, drill out cement and float collar.

11-29-2004

Depth: 3314m; Progress: 0m; Status: Drill out cement

- Drill out cement and shoe, drill 216mm hole from 3314 to 3315 meters, pull out of hole.
- Pick up mud motor and directional tools, make up bit # 36 (Reed TD53A), test MWD tool and run in hole.
- Drill 216mm hole from 3315 to 3334 meters.

11-30-2004

Depth: 3334m; Progress: 20m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3334 to 3404 meters.

12-01-2004

Depth: 3404m; Progress: 70m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3404 to 3458 meters.

12-02-2004

Depth: 3458m; Progress: 54m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3458 to 3478 meters.
- Circulate bottoms up, pull out of hole, inspect BHA, make up bit # 37 (Smith F130 OD), run in hole.

12-03-2004

Depth: 3478m; Progress: 20m; Status: Run in hole with new bit

- Run in hole, slip and cut drilling line, repair s-pipe on topdrive (3.5hrs.), run in hole, wash to bottom.
- Drill 216mm hole from 3478 to 3478.8 meters, shut in well, circulate through choke(0.5 hrs.).
- Drill 216mm hole and survey from 3478.8 to 3505 meters.

12-04-2004

Depth: 3505m; Progress: 27m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3505 to 3560 meters.

12-05-2004

Depth: 3560m; Progress: 55m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3560 to 3586 meters.
- Circulate bottoms up, make up BHA, make up new bit # 38 (Hughes HX-S30), run in hole.

12-06-2004

Depth: 3586m; Progress: 26m; Status: Run in hole with new bit

- Drill 216mm hole and survey from 3586 to 3623.6 meters, circulate bottoms up, pull out of hole.

12-07-2004

Depth: 3623.6m; Progress: 39.6m; Status: Pull out of hole for new BHA

- Pull out of hole, change out BHA, make up Bit # 39 (Smith FI-30), run in hole, slip and cut drilling line.
- Ream dog-leg from 3576 to 3602 meters, wash to bottom.
- Drill 216mm hole and survey from 3623.6 to 3638 meters.

12-08-2004

Depth: 3638m; Progress: 14.4m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3638 to 3702 meters.

12-09-2004

Depth: 3702m; Progress: 64m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3702 to 3750 meters.

12-10-2004

Depth: 3750m; Progress: 48m; Status: Drill 216mm hole

- Drill 216mm hole from 3750 to 3755 meters, trip for bit, inspect BHA.
- Make up bit #40 (Hughes HX-S30), run in hole, wash to bottom from 3736 meters, circulate out trip gas.
- Drill 216mm hole and survey from 3755 to 3761 meters.

12-11-2004

Depth: 3761m; Progress: 11m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3761 to 3804 meters.

12-12-2004

Depth: 3804m; Progress: 43m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3804 to 3847 meters.

12-13-2004

Depth: 3847m; Progress: 36.5m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3847 to 3883.5 meters.

12-14-2004

Depth: 3883.5m; Progress: 22.5m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3883.5 to 3906 meters, Circulate bottoms up, POH with flow checks.
- Pick up NB #41 and mud motor, Service MWD, RIH.

12-15-2004

Depth: 3906m; Progress: 25m; Status: RIH with NB #41.

- RIH, Test MWD, RIH, Drill 216mm hole and survey from 3906 to 3931 meters.

12-16-2004

Depth: 3931m; Progress: 28m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3931 to 3959 meters.

12-17-2004

Depth: 3959m; Progress: 35m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3959 to 3994 meters.

12-18-2004

Depth: 3994m; Progress: 10m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3994 to 4006 meters, circulate bottoms up, pull out of hole.
- Pick up new bit #42 and inspect MWD tools, run in hole.

12-19-2004

Depth: 4006m; Progress: 40m; Status: Drill 216mm hole

- RIH, Test MWD, RIH, Drill 216mm hole and survey from 4006 to 4046 meters.

12-20-2004

Depth: 4046m; Progress: 40m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4046 to 4113 meters.

12-21-2004

Depth: 4113m; Progress: 67m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4113 to 4124 meters, circulate bottoms up, wiper trip 30 stands.
- Circulate and condition hole, hoist to log.

12-22-2004

Depth: 4124m; Progress: 11m; Status: Hoist to log

- Continue out of hole, Rig up Schlumberger, run in with run #1, OBMI/SONIC/GPIT/EMS/GR/TTC.
- Bridge off at 3960 meters, run one repeat section, tool failure, pull out of hole, lay down EMS.
- Run in hole to 3908 meters, log up to casing, rig to run TLC(OBMI/GPIT/GR/TTC), run in hole with drill pipe.

12-23-2004

Depth: 4124m; Progress: 0m; Status: Logging with Schlumberger

- Run in hole to 3263 meters, rig up side door sub, run in wireline, latch on to tools, electrical failure.
- Unlatch from logging tools, remove side door sub, pull wireline, rebuild head, run in hole with wireline.
- Latch on to tools, check OK, run in hole, tools unlatched, pull back to side door sub and attempt to latch.
- Tools check OK, run in hole with drill pipe to bottom, log up, unlatch and retrieve latching tool.
- Remove side door sub.

12-24-2004

Depth: 4124m; Progress: 0m; Status: Logging with Schlumberger

- Hoist logging tools, rig up loggers, run in hole with PEX to 3802 meters, log up to casing at 3311 meters.
- Rig up and run cement bond log from 3311 to surface, rig out Schlumberger, pick up directional tools.
- Make up new bit#43 (Reed TD61) and prepare to run in hole to drill ahead.

12-25-2004

Depth: 4124m; Progress: 0m; Status: Logging with Schlumberger

- Finish making up BHA, run in hole, wash to bottom from 4104 meters.
- Drill 216mm hole and survey from 4124 to 4137 meters.

12-26-2004

Depth: 4137m; Progress: 13m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4137 to 4167 meters, circulate, wiper trip 5 stands.
- Circulate 5 stands off bottom and raise mud weight from 1220 to 1290kg/m3.

12-27-2004

Depth: 4167m; Progress: 30m; Status: Drill 216mm hole

- Wash and ream 52 meters to bottom, drill 216 mm hole and survey from 4167 to 4206 meters.

12-28-2004

Depth: 4206m; Progress: 41m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4206 to 4216 meters, circulate bottoms up.
- Trip for bit, pull out to 2511 meters, wait on weather.

12-29-2004

Depth: 4206m; Progress: 0m; Status: Wait on weather

- Monitor hole through trip tank, wait on crew to arrive, weather problems.
- Pull out of hole, break off bit, lay down BHA, pick up new BHA and Bit#44 (Smith F140).
- Run in hole to 781 meters, slip and cut drilling line, run in to 4200 meters.
- Wash to bottom from 4200 meters, drill 216mm hole and survey from 4217 to 4226 meters.

12-30-2004

Depth: 4226m; Progress: 20m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4226 to 4253 meters.

12-31-2004

Depth: 4253m; Progress: 27m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 4253 to 4276 meters, circulate bottoms up, trip out for new bit.
- Break off bit, change out BHA, make up new Bit#45 (Hughes MX30GDX).

01-01-2005

Depth: 4276m; Progress: 23m; Status: Make up BHA
- Make up new BHA and run in hole to 4257 meters, break circulation and wash to bottom.
- Circulate bottoms up trip gas, drill 216mm hole and survey to 4286 meters.
- Attempt to get signal from MWD tool, circulate bottoms up, pull out of hole, pump out 5 stands.
- Drift S-135 drill pipe while pulling out of hole.

01-02-2005

Depth: 4286m; Progress: 10m; Status: Pull out of hole for MWD tools
- Finish out of hole, change out MWD tools, run in hole to 3334 meters, slip and cut drilling line.
- Test MWD tools, no signal, pull out of hole, trouble shoot MWD tools and surface test same, run in hole.

01-03-2005

Depth: 4286m; Progress: 0m; Status: Run in hole
- Run in hole to 3337 meters, check MWD tool for signal, none found, run in to 3480, check tools for signal.
- Run in hole to 4255 meters and wash to bottom, drill 216mm hole and survey from 4286 to 4309 meters.

01-04-2005

Depth: 4309m; Progress: 23m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4309 to 4337 meters, circulate bottom hole sample.
- Pull out to 3300 meters, wait on weather conditions.

01-05-2005

Depth: 4337m; Progress: 29m; Status: Pull out of hole
- Pull out of hole, swap MWD tools, test tools, make up Bit#46 (Hughes HX-S30D), run in hole to 3365 meters.
- Wash down gamma from 4278 to 4337 meters, drill 216mm hole and survey from 4337 to 4346 meters.

01-06-2005

Depth: 4346m; Progress: 9m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4346 to 4383 meters.

01-07-2005

Depth: 4383m; Progress: 37m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4383 to 4426 meters, circulate bottoms up, pump out 5 stands.
- Slip and cut drilling line, continue to pull out of hole.

01-08-2005

Depth: 4426m; Progress: 43m; Status: Pull out of hole
- Pull out of hole, inspect directional BHA and make up bit#47 (Smith ER70330DPS).
- Run in hole to 4382 meters, wash to bottom, drill 216mm hole from 4426 to 4441 meters.

01-09-2005

Depth: 4441m; Progress: 15m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4441 to 4470 meters.

01-10-2005

Depth: 4470m; Progress: 29m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4470 to 4487 meters, circulate bottoms up, pump out 5 stands.
- Pull out of hole, inspect directional BHA, make up bit#48 (Hughes HR-S38C), run in hole.

01-11-2005

Depth: 4487m; Progress: 17m; Status: Run in hole with new bit
- Run in hole to 3337 meters, circulate bottoms up, change water hose on draw works (0.75 hrs.).
- Run in hole to 4469 meters, wash to bottom, drill 216mm hole and survey from 4487 to 4502 meters.

01-12-2005

Depth: 4502m; Progress: 15m; Status: Drill 216mm hole
- Drill 216mm hole and survey from 4502 to 4527 meters.

01-13-2005

Depth: 4527m; Progress: 25m; Status: Drill 216 mm hole
- Drill 216mm hole and survey from 4527 to 4543 meters TD, circulate bottoms up, pump out 5 stands.
- Pull out of hole to 3256 meters, slip and cut drilling line, pull out of hole.

END OF L-38 SIDETRACK 1

01-14-2005

Depth: 4543m; Progress: 16m; Status: Pull out of hole
- Pull out of hole, lay down 11 stands of E-2 drill pipe, run in hole open-ended to 4175 meters.
- Change wash pipe, circulate and condition mud (6.5 hrs.).

01-15-2005

Depth: 4543m; Progress: 0m; Status: Circulate and condition mud
- Circulate (9.5hrs.), pick up drill pipe and run in to 4524 meters, circulate (6.5hrs.).
- Pump water spacer, displace hole with 2100kg/m³ mud, pull 13 stands.
- Rig up cementers and pump first plug, pull 6 stands, reverse circulate.

01-16-2005

Depth: 4543m; Progress: 0m; Status: Run cement plugs
- Pump water spacer and displace with drilling mud, pull out 18 stands.
- Rig up cementers and pump second plug to 3250 meters, pull out 9 stands, circulate (3.25hrs.).
- Pull out of hole to 2300 meters, run in 12 stands of E-2 drill pipe and lay down, pull out of hole.
- Wait on pressure tester (5.75hrs.), run in hole.

01-17-2005

Depth: 3250m; Progress: 0m; Status: Run in hole
- Run in hole, tag soft cement @ 3198.5 meters, wash down to 3216 meters, circulate (3.25hrs.).
- Wash down to 3250 meters, drill cement from 3250 to 3300 meters, circulate bottoms up.
- Pressure test casing, drill cement from 3300 to 3335 meters, circulate and work pipe (4.5hrs.).
- Slip and cut drilling line, circulate (1.75 hrs.).

01-18-2005

Depth: 3335m; Progress: 85m; Status: Circulate
- Circulate (6 hrs.), pull out of hole, wait on pressure test truck (6 hrs.), rig in Falcon pressure testing truck.
- Pressure test BOP.

01-19-2005

Depth: 3335m; Progress: 0m; Status: Pressure test BOP
- Pressure test BOP, pick up directional tools and make up Bit#49 (Hughes GT-S1), run in hole to 3311 meters.
- Break circulation and wash down to 3345 meters, time drill and attempt to sidetrack from 3345 to 3348.8. meters

START NEW LEG L-38A

01-20-2005

Depth: 3348.8m; Progress: 13.8m; Status: Time drill to sidetrack well
- Time drill 3348.8 to 3357 meters, sidetrack not successful, pump pill and pull out of hole.

01-21-2005

Depth: 3357m; Progress: 8.2m; Status: Pull out of hole

- Pull out of hole, break off bit and lay down mud motor, pick up new directional BHA.
- Make up Bit# 50 (Reed TD51A), run in hole to bottom, time drill 216mm hole from 3357 to 3362.5 meters.

01-22-2005

Depth: 3362.5m; Progress: 5.5m; Status: Time drill to sidetrack well

- Time drill 216mm hole from 3362.5 to 3370 meters.

01-23-2005

Depth: 3370m; Progress: 7.5m; Status: Time drill to sidetrack well

- Time drill 216mm hole from 3370 to 3372.1 meters, circulate bottoms up, pull out of hole.
- Replace broken bolts on top-drive grabber, replace grabber dies and saver sub on top-drive.
- Make up new bit #51 (Hughes D411ST), reset motor to 2.1 degrees, run in hole.

01-24-2005

Depth: 3372m; Progress: 2m; Status: Run in hole to sidetrack

- Run in hole to 3331 meters, slip and cut drilling line, run in to 3372 meters.
- Time drill 216mm hole from 3372.1 to 3380 meters.

01-25-2005

Depth: 3380m; Progress: 8m; Status: Time drill to sidetrack well.

- Time drill 216mm hole from 3380 to 3391 meters, circulate bottoms up, pull out of hole.
- Set motor at 1.6 degrees, make up new bit #52 (Smith MF5H), run in hole.

01-26-2005

Depth: 3391m; Progress: 11m; Status: Run in hole

- Run in hole to 3378 meters, wash to 3391 meters, drill 216mm hole and survey from 3391 to 3437 meters.

01-27-2005

Depth: 3437m; Progress: 46m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3437 to 3482 meters.

01-28-2005

Depth: 3482m; Progress: 45m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3482 to 3514 meters.

01-29-2005

Depth: 3514m; Progress: 32m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3514 to 3535 meters, circulate bottoms up, pull out of hole.

01-30-2005

Depth: 3535m; Progress: 21m; Status: Trip for bit

- Finish pulling out of hole, change out mud motor and set at 1.6 degrees, make up bit #53 (Reed TD61A).
- Run in hole, drill 216mm hole and survey from 3535 to 3560 meters.

01-31-2005

Depth: 3560m; Progress: 25m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3560 to 3610 meters.

02-01-2005

Depth: 3610m; Progress: 50m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3610 to 3648 meters.

02-02-2005

Depth: 3648m; Progress: 38m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3648 to 3675 meters, circulate bottoms up, trip for bit.

02-03-2005

Depth: 3675m; Progress: 27m; Status: Pull out of hole

- Finish out of hole, inspect directional BHA, make up Bit#54 (Hughes HCM404-PDC).
- Run in hole, bridge off at 3578 meters, wash and ream to bottom.
- Drill 216mm hole and survey from 3675 to 3719 meters

02-04-2005

Depth: 3719m; Progress: 44m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3719 to 3766 meters

02-05-2005

Depth: 3766m; Progress: 47m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3766 to 3770 meters, circulate bottoms up, pull out of hole.
- Inspect directional BHA, make up bit #55 (Reed TD62A), break circulation @ 3723 meters, wash to bottom.
- Circulate out trip gas, drill 216mm hole and survey from 3770 to 3779 meters.

02-06-2005

Depth: 3779m; Progress: 13m; Status: Drilling 216mm hole

- Drill 216mm hole and survey from 3779 to 3809 meters.

02-07-2005

Depth: 3809m; Progress: 30m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3809 to 3846 meters.

02-08-2005

Depth: 3846m; Progress: 37m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3846 to 3889 meters.

02-09-2005

Depth: 3889m; Progress: 43m; Status: Drill 216mm hole

- Drill 216mm hole and survey from 3889 to 3906 meters, circulate bottoms up, pull out of hole.
- Slip and cut drilling line, finish out of hole, change out directional BHA.
- Make up new bit#56 (Smith MF5H0DPS), run in hole.

02-10-2005

Depth: 3906m; Progress: 17m; Status: Run in hole with new bit

- Run in hole to 3886 meters, wash to bottom, drill 216mm hole and survey from 3906 to 3953 meters.

02-11-2005

Depth: 3953m; Progress: 47m; Status: Drilling 216mm hole

- Drill 216mm hole and survey from 3953 to 3959 meters, circulate bottoms up, wiper trip to 3310 meters.
- Circulate and condition mud, pull out of hole to run casing, lay down E2 drill pipe and heavy weight drill pipe.
- Break off bit, lay down directional tools, rig up to run casing.

02-12-2005

Depth: 3959m; Progress: 6m; Status: Rig to run casing

- Rig to run 177.8mm liner, install shoe, float and landing collar, run casing.
- Rig out lay down truck and power tongs, run in hole with 177.8mm liner to 3282 meters, circulate.
- Run in hole to 3924 meters, circulate, rig in cement head, pump setting ball.

02-13-2005

Depth: 3959m; Progress: 0m; Status: Pump down setting ball

- Pump down setting ball, rig in cement head and cement lines, cement casing, plug down at 02:00 hrs.
- Set liner hanger, pull out of hole 10 stands, circulate, pull out to 1724 meters, slip and cut drilling line.
- Pull out of hole, lay down casing hanging tool, change bottom pipe rams, rig in pressure tester, test BOP.

02-14-2005

Depth: 3959m; Progress: 0m; Status: Pressure test BOP

- Pressure test BOP, clean mud tanks, trip in hole with 216mm bit, tag cement at 3020 meters, clean mud tanks.

02-15-2005

Depth: 3959m; Progress: 0m; Status: Clean mud tanks

- Clean mud tanks, pump high vis spacer and displace to fresh base oil.
- Wash down to top of liner at 3103.7 meters, circulate and condition mud, pull out of hole.
- Change out elevators and pick up 4" drill pipe.

02-16-2005

Depth: 3959m; Progress: 0m; Status: Pick up 4" drill pipe

- Pick up 4" drill pipe, run in hole with 127mm drill pipe to top of liner, drill out drillable liner hanger.
- Run in hole and tag cement at 3755 meters, wash down to 3950.5 meters, drill out shoe, circulate, pull out of hole.

02-17-2005

Depth: 3959m; Progress: 0m; Status: Pull out of hole

- Pull out of hole, pick up directional tools, surface test MWD, run in hole to 3936 meters.
- Slip and cut drilling line, change water line on draw works drum, run in to bottom, drill 156mm hole and survey to 3967 meters.

02-18-2005

Depth: 3967m; Progress: 8m; Status: Drilling 156mm hole

- Drill 156mm hole and survey to 3991 meters, MWD tools not working, pull out of hole.
- Change out MWD tools and make up bit#57 (Reed SL62AP), surface test tools, run in hole.

02-19-2005

Depth: 3991m; Progress: 24m; Status: Run in hole

- Run in hole, break circulation at 3957 meters, wash down to 3994 meters.
- Drill 156mm hole from 3994 to 4013 meters, attempt to survey, MWD tools not working, circulate bottoms up.
- Pull out of hole, change out MWD tools, surface test, make up bit #58 (Reed SL61AP), run in hole.

02-20-2005

Depth: 4013m; Progress: 22m; Status: Run in hole

- Run in hole to 3022 meters, test MWD tools, run in to 3961 meters, slip and cut drill line.
- Circulate to cool down MWD tools, attempt to survey, tools not working, trip out of hole for new MWD tools.

02-21-2005

Depth: 4013m; Progress: 0m; Status: Change out MWD tools

- Change out MWD tools and surface test, make up Bit #59 (Varel ETD55) and run in hole to 3000 meters.
- Test MWD tools, tools not working, trip out of hole, change out MWD tools and surface test, run in hole.

02-22-2005

Depth: 4013m; Progress: 0m; Status: Run in hole

- Run in hole to 3056 meters, circulate to cool tool, test tool (ok), run in to 3402 meters, circulate.
- Run in to 3966 meters, circulate, wash to bottom, drill 156mm hole and survey from 4013 to 4079 meters.
- Circulate bottoms up, trip for bit, pull out of hole.

02-23-2005

Depth: 4079m; Progress: 66m; Status: Trip out of hole for new bit
- Pull out of hole to 3500 meters, circulate, pull out of hole, inspect directional assembly.
- Set angle on motor to 1.15 degrees, run in hole to 3000 meters, circulate, run in to 3350 meters, circulate.
- Run in to 3637 meters, circulate, run in to 3959 meters, circulate to cool tool, wash to bottom.
- Drill 156mm hole and survey from 4079 to 4093 meters.

02-24-2005

Depth: 4093m; Progress: 14m; Status: Drill 156mm hole
- Drill 156mm hole from 4093 to 4099 meters, attempt to survey, tools not working, bit not drilling.
- Circulate bottoms up, trip for new bit and MWD tools, inspect directional BHA.
- Make up bit #61 (Varel ETD55XG), run in hole, circulate to cool tool at 3050 and 3350 meters.

02-25-2005

Depth: 4099m; Progress: 6m; Status: Run in hole to drill ahead
- Run in hole, circulate to cool tool at 3500m, 3750m & 3960 meters, wash to bottom.
- Drill 156mm hole and survey from 4099 to 4112 meters, pull up to 4080 meters, circulate, run back to bottom.
- Drill 156mm hole and survey from 4112 to 4156 meters.

02-26-2005

Depth: 4156m; Progress: 57m; Status: Drilling 156mm hole
- Drill 156mm hole and survey from 4156 to 4175 meters, circulate bottoms up, pull out of hole.
- Break off bit and lay down directional equipment, wait on packer and whip-stock (6.5 hrs.).

02-27-2005

Depth: 4175m; Progress: 19m; Status: Wait on packer and whip-stock.
- Wait on packer and whip-stock (3.75 hrs.), make up packer and run in hole.
- Try to inflate and set packer, no luck, pull out of hole.

02-28-2005

Depth: 4175m; Progress: 0m; Status: Pull out of hole with packer
- Pull out of hole with packer, packer is left downhole, pick up directional tools and run in hole.
- Circulate to cool tool at 2000m and 3072 meters, trip in to 3960 meters, circulate to cool tool.
- Build trough for sidetrack, time drill from 3961.5 to 3961.9 meters

Start new leg: L-38A/ST3

03-01-2005

Depth: 3962m; Progress: 1m; Status: Time drill to kick-off
- Time drill from 3961.9 to 3963.5 meters, build trough for sidetrack, time drill from 3963.5 to 3964.1 meters.
- Work trough, time drill from 3962 to 3962.5 meters, work trough, time drill from 3962.4 to 3963.6 meters.
- Trip out of hole.

03-02-2005

Depth: 3962m; Progress: 0m; Status: Trip out of hole for sidetrack bit
- Trip out of hole for sidetrack bit, inspect BHA, make up bit, run in hole, time drill from 3962.4 to 3970 meters.
- Pull out of hole.

03-03-2005

Depth: 3970m; Progress: 8m; Status: Trip for bit
- Pull out of hole, make up bit #64 (Varel CH44MRS), inspect directional BHA, run in hole.
- Drill 156mm hole and survey from 3970 to 4021 meters.

03-04-2005

Depth: 4021m; Progress: 51m; Status: Drill 156mm hole

- Drill 156mm hole and survey from 4021 to 4026 meters, lost circulation, mix LCM (5.0 hrs.).
- Trip out for bit, inspect directional BHA, lay down mud motor, make up bit #65 (Varel ETD44).
- Run in hole, circulate to cool tool at 3072 meters.

03-05-2005

Depth: 4026m; Progress: 5m; Status: Run in hole with new bit

- Run in hole to 3959 meters, circulate, wash to bottom, record gamma readings.
- Drill 156mm hole from 4026 to 4065 meters, circulate bottoms up, spot LCM pill, pull out of hole to 3967m.
- Plugged MWD tool, shut in well and monitor pressure.

03-06-2005

Depth: 4065m; Progress: 39m; Status: Well shut in

- Well shut in to 14:15 hrs., pump LCM pill through kill line, pull out of hole, rig out catch trays and flow nipple.

03-07-2005

Depth: 4065m; Progress: 0m; Status: Rig in Schlumberger

- Rig in lubricator and Schlumberger wireline, run in hole with OBMI, bridge at 4024 meters, log up.
- Pull out of hole, rig out OBMI and rig up CBT/USET, run in hole and log with Schlumberger.
- Finish logging, rig out lubricator, pick up bit and run in hole for clean-out trip.

03-08-2005

Depth: 4065m; Progress: 0m; Status: Run in hole for clean-out trip

- Run in hole to 2000 meters, circulate hole clean, run in to 3092 meters, circulate hole clean.
- Wash to bottom, 5m of fill on bottom, circulate bottoms up, pump high vis sweep, trip out of hole.
- Rig up lubricator, pick up UBI and run in hole with Schlumberger wireline.

03-09-2005

Depth: 4065m; Progress: 0m; Status: Run in hole with UBI

- Run in hole with UBI, rig out tools and rig up DSI/GPIT, run in hole and log up to 3100 meters.
- Rig out DSI, rig up and run CNL-LDT, rig out and rig up and run AIT.

03-10-2005

Depth: 4065m; Progress: 0m; Status: Rig out AIT

- Rig out AIT, rig out lubricator, turn well over to completions at 03:30 hrs.
- Potential Nahanni Gas Well.

CASING SUMMARY

Surface Casing

Ran 76 joints of 339.7mm, 107.15kg/m, L-80 range 3, BC, new surface casing. Landed at 920.7m. Cemented by Sanjel with 110 tonnes of 0:1:0 class "G" + 0.5 % CFR + 0.4% LTR . Plug down at 00:15 hrs; 09 - 11 - 2004; with 8.5m³ cement returns to surface.

Intermediate Casing

Ran 241 joints of 244.5mm, 79.62kg/m, L-80, LT & C, Range 111 Summit casing. Cemented by Sanjel, lead with 49.4 tonnes of Thixlite HT + 0.5% CFL-3 + 0.55% LTR + 3% LCC-1, tailed with 76 tonnes Thermal 40 + 0.9% CFL-4 + 1% LCC-1 + 2% SPC-11 + 0.2% LTR. Landed at 3311.0m. Plug down at 08:30 hrs; 11 - 27 - 2004; with good cement returns to surface.

Liner Casing

Ran 65 joints (with top of liner at 3105.6 meters) of 177.8mm, 43.16kg/m, L-80, LT&C and 2 CRA joints of 177.8mm 43.16 kg/m, L-80, LT&C Summit liner casing. Hang with Import Tool ZXP packer and Hydraulic liner hanger. Cemented by Sanjel with 22 tonnes of Thermal 40 + 0.7% HTR + 0.9% CFL4 + 1.0% CFR + 0.2% SPCII + 1.0% LCC1. Landed at 3953m. Plug down at 02:10 hrs; 02 - 13 - 2005; with no cement returns to surface.

GEOLOGICAL SUMMARY

Purpose of Well

The Kotaneelee Field is located approximately 30 km southwest of Ft. Liard, N.W.T., and is producing from the Devonian Nahanni Formation from two wells, I48 and B38. The B38 well is experiencing severe and increasing water production and it is anticipated that the well will cease producing in a matter of months. The I48 well has also recently commenced producing water with an associated decline in gas rate; however, it is expected to continue producing for several years. The overall result is declining gas production from the Kotaneelee Field. Devon Canada has proposed to drill 302/I48 (bottom hole I49) to reverse the trend. The Nahanni has a sour component to the gas.

There are potential secondary zones for hydrocarbons as identified on the prognosis. They include the Lower Flett, First Black, Exshaw, and Devonian (Muskwa) zones.

Geological Impact on the Release Rate

The Nahanni reservoir at Kotaneelee is considered a fractured, low porosity, high-pressured reservoir. Regardless of the thick gas column (approximately 900m), conventional vertical wells such as I48 and B38 are potentially coning water due to the limited reservoir exposure of the vertical wells as a result of their high drawdowns. It is anticipated that horizontal wells, located near the crest of the Kotaneelee structure, should yield highly productive wells at much lower drawdowns, thereby mitigating water coning/production.

To arrest declining gas production from the Kotaneelee Gas Field, the Kotaneelee 302/I48 horizontal well will be drilled from a surface location near the producing I48 well targeting the gas bearing Middle Devonian Nahanni dolomite reservoir approximately 1 km north-northwest out from the surface location, and landing at bottom hole location I49. After limited penetration of the Nahanni reservoir, intermediate logs will be run, followed by intermediate casing. Drilling operations will then conclude with drilling an approximately 900 m long near-horizontal leg in the upper Nahanni to ensure gas production, and test the lateral limits of the Nahanni reservoir. The plan is to complete the horizontal leg open hole.

Drilling Summary

Surface Hole (444.5mm): Devon Kotaneelee L-38 was spudded on August 22, 2004. A regular rotary assembly was used to drill 444.5mm hole from 22 meters (conductor set at 22 meters) to 93 meters. In order to keep the hole vertical a VertiTrack directional assembly was picked up and used to drill 444.5mm hole from 93 meters to 922 meters (surface casing point). Gel-Chem drilling mud was used to drill surface hole with a maximum mud weight of 1220 kg/m³ and a total of 10 bits were

used. 339.7mm surface casing was set at 920.7 meters with plug down @ 00:15 hrs., Sept. 11, 2004. A logging waiver was granted. No open-hole logs were run over this interval.

Intermediate Hole (311mm): Drilling 311mm intermediate hole began on Sept. 14, 2004. The mud system was changed at this point from a Gel-Chem system to a VersaClean (oil based) system. VersaClean was used to drill to TD. A Baker-Hughes VertiTrack drilling assembly was used to keep the hole straight from 922 to 1502 meters (kick-off point). While drilling with a mud weight of 860kg/m³, severely fractured shales were encountered from 1345 to 1400 meters and from 1445 to 1480 meters. At this point the mud weight was raised from 860 kg/m³ to 1050kg/m³. After tripping for a directional assembly at 1502 meters, hole problems resulted in the directional assembly becoming stuck. The pipe had to be “backed-off” at 1439 meters. An unsuccessful attempt was made to fish the tools. A clean out trip was run with the result being the bit was stuck in the hole. Once again the pipe had to be “backed-off” and at this point it was decided that the hole was lost and cement plugs were run back to surface casing.

Sidetrack One was started on October 01, 2004 at 1150 meters. 311mm hole was directionally drilled to a maximum angle of 26 degrees, from 1150 (kick-off point) to 3314 meters (intermediate casing point) without any major problems. Schlumberger was used to run open hole logs from TD to surface. 244.5mm intermediate casing was set at 3311meters on Nov. 27, 2005.

Intermediate Hole (216mm): Drilling 216mm intermediate hole began on November 29, 2004 and was drilled directionally from 3314 to 4124meters to a maximum angle of 60.4 degrees. At this time it was decided to run open-hole logs even though the Nahanni formation had not been penetrated. After logging it was decided to drill ahead. The Nahanni was never encountered and this leg of the hole was ended at a depth of 4543m (3853.5mTVD) at an average angle of 60 degrees. A decision was made to plug back to just below intermediate casing (3345 meters). Sidetrack 3 was started on January 20, 2005. The hole was drilled to 3959 meters at maximum angle of 45 degrees, encountering the Nahanni formation at 3942m (3660mTVD). A liner casing string was set at 3953 meters on Feb. 13, 2005.

Main hole (156mm): Main hole was drilled from 3959 through the Nahanni, building angle to 73 degrees. Unfortunately the hole once again intersected the Muskwa formation at 4083m (3729.5mTVD). It was decided to abandon this leg of the well after drilling 92 meters of Muskwa Formation.

Side-track 3 was started on March 03, 2005. After kicking off it was decided to drop angle to 34 degrees to try to keep from intersecting the Muskwa formation for the third time. Drilling continued to 4023 meters, at which time permeability and lost circulation was encountered. A decision was made to drill ahead with losses. The well was drilled to a TD of 4065 meters on March 05, 2005. Open-hole logs were run and an open-hole completion of the well was started.

Geology

The **Fantastique** Formation was picked from logs at 114m (+696.9mss) and from samples at 113.5 (+696.9mss). The formation consisted of chert which was described as being light to medium gray to white (20%), massive angular fragments, speckled, slightly fossiliferous, tight to poor (3%) pin point porosity, with trace to common black heavy oil shows, no visible fluorescence and a fast massive yellow white cut. This was interbedded with more chert, described as being, light gray to medium brown (80%), earthy to micritic texture, very bituminous in part, argillaceous, fossiliferous with trace to common glauconite, very hard, very slightly dolomitic with tight to very poor pin point and intercrystalline porosity and no shows. There were no significant gas shows over this interval.

The **Kindle** Formation was picked from logs at 291m (+519.4mss) and from samples at 291m (+519.4mss). The formation consisted mainly of shale with interbedded chert and dolomite. The shale was described as being: black, blocky, very siliceous, hard, slightly bituminous with trace disseminated pyrite. The chert was described as being: black to brownish black to medium gray, cryptocrystalline to very finely crystalline to massive, very fossiliferous, pyrite lined vugs with tight to poor (6%) pin point, intercrystalline and fenestral type porosity, trace to common black bitumen, common bright yellow fluorescence and a fast massive to bright yellow ribbon cut. The dolomite was described as being: dark grayish brown, microcrystalline, very hard, silty, trace white calcite crystals and calcite filled fractures, grading in part to dolomitic siltstone, very argillaceous, tight with no shows. There were no significant gas shows over this interval.

The **Mattson** Formation was picked from logs at 305m (+505mss) and from samples at 304m (+506.4mss). The formation consisted of mainly sandstone interbedded with shale and siltstone with minor amounts of limestone, dolomite and chert. The sandstone was described as being: light brownish gray, quartzite, trace glauconite, very fine to fine (lower) grained, well sorted, subrounded, moderately hard to very hard, calcite cement, tight to fair (12%) intergranular porosity with a common

bright yellow fluorescence and a slow to moderate massive bright milky yellow cut. The siltstone was described as being: brownish black, quartzose, silt to very fine (lower) grained, occasionally grading to very fine grained sandstone, very argillaceous, very bituminous, calcite and dolomite cement, tight with bitumen staining throughout and trace to common white sparry calcite filled fractures. The shale was described as being: black, blocky, siliceous, moderately to very hard, silty in part, sandy in part with trace calcite filled fractures. The limestone was white to buff to light grayish brown, micritic, chalky to microcrystalline, soft to moderately hard, sandy and silty in part, slightly argillaceous, sly bituminous, tight with no shows. The dolomite was described as: medium to dark brownish gray, microcrystalline, very hard, silty, tight, pyrobituminous with trace chert, light gray, massive, angular fragments. The chert was described as being: light to medium gray, massive angular fragments, speckled in part, very hard, sandy in part (clear quartz grains in matrix), tight, no shows. There were no significant gas shows over this interval.

The **Lower Mattson** Formation was picked from logs at 939m (-128.6mss) and from samples at 939m (-128.6mss). The formation consisted of mainly shale with minor interbedded sandstone and limestone; The shale was described as dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle. The sandstone was described as being: light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows. The limestone was described as being: white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, argillaceous in part, lime mudstone, appears recrystallized in part with occasional clear to light gray calcite veins, slightly dolomitic in part, tight with no shows. The shale was extremely fractured (slickensides) from 1340 to 1400 meters and again from 1470 to 1495 meters. No significant gas shows were noted.

The **Golata** Formation was picked from log at 1539mMD, 1525.2mTVD (-714.8mss) and from samples at 1537.5mMD, 1523.9mTVD (-713.5mss). Samples were described as being shale, dark gray to occasionally dark greyish brown, blocky to subfissile, slightly silty, easily hydrated (swelling shales), poorly to moderately indurated, slightly to moderately calcareous, common disseminated pyrite, trace healed fractures filled with calcite. No significant gas readings were recorded over this interval.

The **Upper Flett** Formation was picked from logs at 1866mMD, 1817.0mTVD (-1006.6mss) and from samples at 1880m 1829.6m, TVD (-1019.2mss). The upper half of the Upper Flett was described as interbedded limestone and shale grading to interbedded limestone and calcareous marlstone. The limestone was described as being: black to brownish black, cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone, medium to dark gray to buff, micritic, chalky, occasionally microcrystalline, moderately hard, silty, tight, no shows, with common microfossils. The shale/marlstone was described as being: dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone. The lower half of the Upper Flett formation was described as being Shale: dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%) with trace limestone, dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, very dolomitic, grading to limy dolomite in part, slightly pyritic, slightly silty, tight, no shows. An interval over the lower portion of the Lower Flett from 2145 to 2178 meters was very fractured (healed fractures as well as calcite, dolomite and pyrite spar were noted in samples) and gas reading of four to five times background were noted (580 units over a background of 120 units).

The **Lower Flett** Formation was picked from logs at 2176mMD, 2093.7mTVD (-1283.3mss) and from samples at 2177mMD, 2095.6mTVD (-1284.2mss). The formation consisted of interbedded limestone, calcareous marlstone and shale. Samples were described as Limestone: buff (mottled) to light to medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite. Marlstone: white to buff to dark gray, chalky, argillaceous, calcareous, soft, tight, no shows. The Shale was described as being: dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite. The Lower Flett produced a good gas show. Gas readings at 2362.5m reached a high of 6901 units over a background of 170 units. There was a noted increase in torque and pump pressure, but no increase in fractures was noted in samples. This appears to be a relatively thin (0.5 – 1m) fractured interval with high pressure low volume. After penetrating the interval gas reading fell back to a more normal background.

The **Banff** Formation was picked from logs at 2483mMD, 2367.4mTVD (-1557.0mss) and from samples at 2493.5m MD, 2376.9mTVD (-1566.5mss). The formation consisted of mainly shale which was described as being dark brownish gray (poorly indurated) to occasionally black (moderately to well indurated), blocky to subfissile, easily hydrated, very calcareous, grading to less calcareous, kaolinitic, common disseminated pyrite, trace milky white calcite sparite, trace to common healed fractures, trace slickensides. At 2493.5meters it was noted that the Shales became: black, occasionally dark brownish gray, poorly to moderately indurated, blocky to subfissile, easily hydrated in part, very calcareous, grading to less calcareous, kaolinitic, common disseminated pyrite, common milky white calcite sparite, common to abundant healed fractures, common to abundant slickensides and were interbedded with marlstone (up to 20%), black to occasionally buff to medium to dark gray, poorly indurated, very argillaceous, tight, no shows. A significant gas show was associated with the change in sample descriptions. Readings reached a maximum of 8074 units over a background of 175 units. A second gas show was encountered at 2651m and was also associated with fractured shales, with readings going up to the gas detectors maximum of 10,000 units over a background of 1,200 units. This show continued to produce large quantities of gas, with high amounts of trip gases that had to be flared on each trip. The gas continued to be a problem until intermediate casing was set at 3311 meters. Samples were described as shale: dark gray to black, blocky to subfissile, poorly to moderately indurated, slightly calcareous grading to marlstone (10%) in part, slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite. The gas noted in the Banff Formation was significant and will be looked at once the Nahanni has been depleted.

The **First Black** Formation was picked from logs at 3291mMD, 3089.5mTVD (-2279.1mss) and from samples at 3287m MD; 3085.9m TVD (-2275.5mss). Samples were described as being Shale: black, subfissile to blocky, moderately indurated, brittle to firm, trace siliceous (very hard, silicified shale), slight to moderate bituminous, moderately carbonaceous with carbonaceous fragments, minor pyrite, weak calcareous, interbedded with shale (15-20%) black to dark gray brown, soft, bentonitic, kaolinitic in part, trace to common pyrite, blocky, easily hydrated. A third gas show associated with fractures in the shale was noted at 3338m with max readings of 4558 units over a background of 225 units. This show continued to produce connection gases, survey gases and trip gases until a liner was run over the lower portion of the hole at 3953 meters.

The **Exshaw** Formation was intersected in the L-38/ST1 leg of the well and the top was picked from logs at 3377mMD, 3166.6mTVD (-2356.2mss). The **Exshaw** Formation was also intersected in the L-38A leg of the well and the top was picked from logs at 3378mMD, 3167.6mTVD (-2357.1mss). This formation was not easily recognizable from the First Black above and the Devonian Formation below. There were no gas shows.

The **Devonian** Formation was intersected in the L-38/ST1 leg of the well and the top was picked from logs at 3379.5mMD, 3168.9mTVD (-2358.5mss). The **Devonian** Formation was also intersected in the L-38A leg of the well and the top was picked from logs at 3380mMD, 3169.4mTVD (-2358.9mss). Samples were described as being Shale: black, blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, carbonaceous, interbedded with shale, brownish black to black, amorphous, bituminous, soft to moderately hard, samples are very pyritic with abundant disseminated pyrite and pyrite lenses, common to abundant fractures parallel and perpendicular to bedding, common to abundant clear quartz, white calcite and pyrite sparite. No significant gas shows were noted.

The **Besa River** Formation was intersected in the L-38/ST1 leg of the well and the top was picked from logs at 3470mMD, 3250.5mTVD (-2440.1mss). The **Besa River** Formation was also intersected in the L-38A leg of the well and the top was picked from logs at 3469mMD, 3250.1mTVD (-2439.6mss). Samples were described as being Shale: medium to dark gray, rare black shale fragments, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, dolomitic in part, common disseminated pyrite, trace calcite sparite, trace calcite filled fractures, interbedded with or becoming shale, dark gray to brownish black, amorphous, soft to moderately hard, occasionally subfissile to blocky, bituminous in part, easily hydrated in part, bentonitic in part, slightly carbonaceous, very slightly dolomitic, and with rare very siliceous black, blocky shale. Grading to Shale: black to medium gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, interbedded with shale black, blocky to subfissile, very siliceous in part, soft (bentonitic) in part, poorly to well indurated, common disseminated pyrite, trace quartz sparite, trace quartz and pyrite filled fractures, also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows. No significant gas shows were noted over this interval.

The **Muskwa** Formation was intersected in the L-38/ST1 leg of the well and the top was picked from logs at 3801mMD, 3508.0mTVD (-2697.6mss). The **Muskwa** Formation was also intersected in the L-38A leg of the well and the top was picked from logs at 3747mMD, 3502.8mTVD (-2692.3mss). Samples were described as being Shale: black to brownish black, amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous,

bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, trace pyrite sparite interbedded with minor amounts of shale, black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with minor amounts of dolomite, black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows. No significant gas shows were noted over this interval.

The **Nahanni** Formation was intersected in the L-38A leg of the well and the top was picked from logs at 3947.5mMD, 3664.2mTVD (-2853.8mss) and from samples at 3942mMD, 3660.2mTVD (-2849.8mss). The Nahanni was described as a dolomite mainly matrix dolomite, mottled (black and white) to occasionally dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), very poor (1%) fracture porosity, no shows, abundant dolomite filled fractures, 10 to 15% loose white dolomite sparite and rare to 1% clear quartz sparite, trace pyrite sparite. The L-38A leg of the well drilled 141 meters of Nahanni without encountering any significant permeability. The well then faulted back into the Muskwa at 4083 meters. A third leg (L-38/ST3) was started at 3975 meters and was turned slightly more to the east and downwards on a more vertical trajectory. Approximately 50 meters of Nahanni was drilled before lost circulation was encountered at 4025 meters, rendering samples very poor with a very large percentage of LCM. An additional 40 meters of Nahanni was drilled with loses of up to 15m³ per hour. It was decided to terminate the well at 4065 meters in the Nahanni Formation due to unacceptable loses. Lost circulation appears to be a result of extreme fracturing which was noted in offset wells and is also responsible for the gas production from the Nahanni Formation. Gas readings were very low, with no significant increases on connections, surveys or trips.

On March 10, 2005 the well was turned over to production, with the objective being to produce gas from the fractures in the Nahanni Formation.

FORMATION TOPS

<u>FORMATION</u>	<u>PROGNOSED(m)</u>		<u>SAMPLE(m)</u>			<u>LOG TOPS(m)</u>		
	<u>MD</u>	<u>TVD</u>	<u>MD</u>	<u>TVD</u>	<u>SS</u>	<u>MD</u>	<u>TVD</u>	<u>SS</u>
L-38								
Fantasque	-	-	113.5	113.5	+696.9	114	114	+696.4
Kindle	-	-	291	291	+519.4	291	291	+519.4
Mattson	-	-	304	304	+506.4	305	305	+505.4
Lower Mattson	931	931	939	939	-128.6	939	939	-128.6
Total Depth	N/A	N/A	1502	1502	-691.6	N/A	N/A	N/A
L-38/ST1								
Golata	1504	1477	1537.5	1523.9	-713.5	1539	1525.2	-714.8
Upper Flett	1724	1687	1880	1829.6	-1019.2	1866	1817.0	-1006.6
Lower Flett	2186	2086	2177	2094.6	-1284.2	2176	2093.7	-1283.3
Banff	2467	2328	2493.5	2376.9	-1566.5	2483	2367.4	-1557.0
Lower Banff Marker	N/A	N/A	3157	2970.1	-2159.7	3161	2973.6	-2163.2
First Black	3308	3054	3287	3085.9	-2275.5	3291	3089.5	2279.1
Exshaw	3377	3145	3376.6	3166.3	-2355.9	3377	3166.6	-2356.2
Devonian	3383	3149	3378.8	3168.3	-2357.9	3379.5	3168.9	-2358.5
Besa River	3441	3198	3471	3251.4	-2441.0	3470	3250.5	-2440.1
Muskwa	3724	3470	3799.5	3507.1	-2696.7	3801	3508.0	-2697.6
Otter Park	N/A	N/A	3822.5	3519.6	-2709.2	3823	3519.9	-2709.5
Otter Park Marker	N/A	N/A	4045	3620.9	-2810.5	4048	3622.2	-2811.8
Evie	N/A	N/A	4232	3700.8	-2890.4	4234	3701.6	-2891.2
Evie (OT)	N/A	N/A	4249	3708.3	-2897.9	4247	3707.4	-2897.0
Otter Park Marker (OT)	N/A	N/A	4421	3791.4	-2891.0	4421	3791.4	-2981
Total Depth (Otter Park OT)	N/A	N/A	4543	3853.1	-3043.1	N/A	N/A	N/A
L-38A								
Exshaw	3377	3113	3375	3164.8	-2354.4	3378	3167.6	-2357.1
Devonian	3383	3118	3377	3166.7	-2356.3	3380	3169.4	-2358.9
Besa River	3441	3168	3466	3247.3	-2436.9	3469	3250.1	-2439.6
Muskwa	3724	3412	3742	3498.2	-2687.8	3747	3502.8	-2692.3
Otter Park	N/A	N/A	3755	3510.1	-2699.7	3759	3513.7	-2703.2
Mid Otter Park Marker	N/A	N/A	3832	3576.6	-2766.2	3835	3579.0	-2768.5
Evie	N/A	N/A	3907	3634.3	-2823.9	3904	3632.0	-2821.6
Nahanni	3943	3510	3942	3660.2	-2849.8	3947.5	3664.2	-2853.8
Muskwa	N/A	N/A	4083.5	3729.6	-2912.2	4083	3729.5	-2919.1
Total Depth (Otter Park)	N/A	N/A	4175	3765.0	-2954.5	N/A	N/A	N/A
L-38A/ST3								
Nahanni	3943	3510	3942	3660.2	-2849.8	3947.5	3664.2	-2853.8
Total Depth (Nahanni)	N/A	N/A	4065	3755.3	-2944.9	4053.5	3745.8	-2935.4

Note: OT= interpreted overturned section

SAMPLE DESCRIPTIONS

25.00 to 35.00 (10.00)	100% Cement	
35.00 to 40.00 (5.00)	80% Cement 20% Overburden	overburden consisting of reddish brown clays, silt and sand grains and milled up boulders with variable sized rock fragments and grains consisting of angular quartzitic sandstone fragments (70%), light to medium gray to greenish gray, silt to very fine grained, subangular, very hard, well sorted, calcareous cement, tight, no shows, micaceous, common variable colored lithic grains, with rounded shale fragments and pebbles (30%), reddish brown to dark gray, blocky, micromicaceous, slightly calcareous, easily hydrated.
40.00 to 55.00 (15.00)	100% Overburden	overburden consisting of reddish brown clays, silt and sand grains and milled up boulders with variable sized rock fragments and grains consisting of angular quartzitic sandstone fragments (70%), light to medium gray to greenish gray, silt to very fine grained, subangular, very hard, well sorted, calcareous cement, tight, no shows, micaceous, common variable colored lithic grains, with rounded shale fragments and pebbles (30%), reddish brown to dark gray, blocky, micromicaceous, slightly calcareous, easily hydrated.
55.00 to 75.00 (20.00)	100% Overburden	overburden consisting of reddish brown clays, silt and sand grains and milled up boulders with variable sized rock fragments and grains consisting of shale fragments and pebbles (80%), reddish brown to dark gray, blocky, micromicaceous, slightly calcareous, easily hydrated also with angular quartzitic sandstone fragments (20%), light to medium gray to greenish gray, silt to very fine grained, subangular, very hard, well sorted, calcareous cement, tight, no shows, micaceous, common variable colored lithic grains.
75.00 to 110.00 (35.00)	100% Overburden	overburden consisting of reddish brown clays, silt and sand grains and milled up boulders with variable sized rock fragments and grains consisting of shale fragments and pebbles (20%), reddish brown to dark gray, blocky, micromicaceous, slightly calcareous, easily hydrated also with angular quartzitic sandstone fragments (80%), light to medium gray to greenish gray, silt to very fine grained, subangular, very hard, well sorted, calcareous cement, tight, no shows, micaceous, common variable colored lithic grains.

Fantasque: 113.5 MD, 113.5 TVD, +696.9 SSL

110.00 to 115.00 (5.00)	50% Chert	light gray to medium brown, earthy to micritic texture, very bituminous in part, trace to common glauconite, very hard, slightly dolomitic, trace dolomite filled fractures, tight to very poor (2%) pin point porosity, no shows, interbedded with chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight, no shows.
	50% Overburden	overburden consisting of reddish brown clays, silt and sand grains and milled up boulders with variable sized rock fragments and grains consisting of shale fragments and pebbles (20%), reddish brown to dark gray, blocky, micromicaceous, slightly calcareous, easily hydrated also with angular quartzitic sandstone

fragments (80%), light to medium gray to greenish gray, silt to very fine grained, subangular, very hard, well sorted, calcareous cement, tight, no shows, micaceous, common variable colored lithic grains.

115.00 to 125.00 (10.00)	100% Chert light gray to medium brown, earthy to micritic texture, very bituminous in part, trace to common glauconite, very hard, slightly dolomitic, trace dolomite filled fractures, tight to very poor (2%) pin point porosity, no shows, interbedded with chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight, no shows.
125.00 to 150.00 (25.00)	100% Chert medium to dark grayish brown grading to brownish gray, blocky, very hard, dolomitic in part, fossiliferous, appears micritic in part with an earthy texture, crystalline in part, very bituminous, trace glauconite, trace pin point porosity, no shows.
150.00 to 155.00 (5.00)	100% Chert as above, grading to very glauconitic (thinly bedded with up to 80% glauconite), grading to light gray to medium brown, earthy to micritic texture, very bituminous in part, common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows.
155.00 to 160.00	100% Chert light gray to medium brown, earthy to micritic texture, very bituminous in part, trace to common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, interbedded with chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight to very poor pin point porosity, no shows.
160.00 to 165.00	100% Chert light gray to medium brown, earthy to micritic texture, very bituminous in part, fossiliferous, argillaceous, trace to common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, with trace chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight to very poor pin point porosity, no shows, also with trace chert, dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows.
165.00 to 175.00 (10.00)	100% Chert light gray to medium brown (50%), earthy to micritic texture, very bituminous in part, argillaceous, trace to common glauconite, very hard, fossiliferous, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, with trace chert (50%), dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows, also with trace chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight to very poor pin point porosity, no shows.
175.00 to 200.00 (25.00)	100% Chert light gray to medium brown (90%), earthy to micritic texture, very bituminous in part, fossiliferous, argillaceous, trace to common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, with trace chert (10%), dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows, also with trace chert, light gray to white, massive angular fragments, speckled, fossiliferous, trace bitumen, tight to very poor pin point porosity, no shows.

200.00 to 210.00 (10.00)	100% Chert light to medium gray to white (20%), massive angular fragments, speckled, slightly fossiliferous, tight to poor (3%) pin point porosity, trace to common black heavy oil shows, no visible fluorescence, fast massive yellow white cut, interbedded with chert, light gray to medium brown (80%), earthy to micritic texture, very bituminous in part, argillaceous, fossiliferous, trace to common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, also with trace chert, dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows.
210.00 to 235.00 (25.00)	100% Chert light to medium gray to white (20%), massive angular fragments, speckled, slightly fossiliferous, tight to poor (3%) pin point porosity, trace black heavy oil shows, no visible fluorescence, fast massive yellow white cut, interbedded with chert, light gray to medium brown (80%), earthy to micritic texture, very bituminous in part, argillaceous, fossiliferous, trace to common glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, also with trace chert, dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows.
235.00 to 252.50 (17.50)	100% Chert light to medium gray to bluish gray (50%), massive angular fragments, speckled, slightly fossiliferous, tight to poor (3%) pin point porosity, trace to common black heavy oil shows, no visible fluorescence, fast massive yellow white cut, interbedded with chert, light gray to light brown to medium brown (40%), earthy to micritic texture, slightly bituminous in part, argillaceous, fossiliferous, trace to glauconite, very hard, very slightly dolomitic, tight to very poor pin point and intercrystalline porosity, no shows, also with chert (10%), dark gray brown to black, cryptocrystalline, very hard, trace glauconite, tight, no shows.
252.50 to 260.00 (7.50)	20% Shale black, blocky, very siliceous, hard, slightly bituminous. Chert dark grayish brown, cryptocrystalline, occasional massive angular fragments, very hard, argillaceous trace pyrite, tight, no shows.
260.00 to 285.00 (25.00)	100% Shale black, blocky, very siliceous, hard, trace disseminated pyrite, slightly bituminous, with trace chert, light gray to light blue gray, speckled, trace disseminated pyrite, very hard fossiliferous, tight to poor pin point porosity, no shows.
285.00 to 290.00 (5.00)	80% Chert black to brownish black to medium gray, cryptocrystalline to very finely crystalline to massive, very fossiliferous, pyrite lined vugs, tight to poor (6%) pin point, intercrystalline and fenestral type porosity, trace to common black bitumen, common bright yellow fluorescence, fast massive to bright yellow ribbon cut. 20% Shale black, blocky, very siliceous, hard, trace disseminated pyrite.

Kindle: 291.0 MD, 291.0 TVD, +519.4 SSL

290.00 to 295.00	80% Dolomite dark grayish brown, microcrystalline, very hard, silty, trace white calcite crystals and calcite filled fractures, grading in part to dolomitic siltstone, very argillaceous, tight, no shows.
------------------	---

	15%	Chert as above.
	5%	Shale as above.
295.00 to 300.00	100%	Shale black, blocky, slightly micaceous, very siliceous, hard, trace white calcite crystals and calcite filled fractures, trace disseminated pyrite with trace chert, as above.

Mattson: 304.0 MD, 304.0 TVD, +506.4 SSL

300.00 to 305.00	60%	Shale black, blocky, slightly micaceous, very siliceous, hard, trace white calcite crystals and calcite filled fractures, trace disseminated pyrite.
	30%	Sandstone medium grayish brown to medium gray to light gray, quartzite, common glauconite grains, silt to very fine grained, subrounded, well sorted, moderately hard to very hard, argillaceous, well cemented with calcite, trace calcite filled fractures, tight to very poor intergranular and fracture porosity, trace black bitumen, no visible fluorescence, slow bright yellow ribbon cut.
	10%	Dolomite dark grayish brown, microcrystalline, very hard, silty, trace white calcite crystals and calcite filled fractures, grading in part to dolomitic siltstone, very argillaceous, tight, no shows.
305.00 to 310.00	60%	Sandstone light to medium gray to occasionally medium brownish gray, quartzite, common glauconite grains, silt to very fine grained, subrounded, well sorted, moderately hard to very hard, argillaceous, well cemented with calcite, trace calcite filled fractures, tight to very poor intergranular and fracture porosity, trace black bitumen, no visible fluorescence, slow bright yellow ribbon cut.
	30%	Shale black, blocky, slightly micaceous, very siliceous, hard, trace white calcite crystals and calcite filled fractures, trace disseminated pyrite, with trace chert, black to brownish black to medium gray, cryptocrystalline to very finely crystalline to massive, very fossiliferous, pyrite lined vugs, tight to poor (6%) pin point, intercrystalline and fenestral type porosity, trace to common black bitumen, common bright yellow fluorescence, fast massive to bright yellow ribbon cut.
	10%	Dolomite dark grayish brown, microcrystalline, very hard, silty, trace white calcite crystals and calcite filled fractures, grading in part to dolomitic siltstone, very argillaceous, tight, no shows.
310.00 to 330.00 (20.00)	100%	Sandstone light brownish gray, quartzite, trace black carbonaceous grains, silt to very fine grained, subrounded, well sorted, moderately to very hard, slightly argillaceous, tight to very poor (<5%) intergranular porosity, trace bitumen stain, trace dull yellow fluorescence, trace very slow bright yellow ribbon cut.
330.00 to 335.00 (5.00)	90%	Sandstone light brownish gray, quartzite, trace black carbonaceous grains, silt to very fine grained, subrounded, well sorted, moderately to very hard, slightly argillaceous, tight to very poor (<5%) intergranular porosity, trace bitumen stain, trace dull yellow fluorescence, trace very slow bright yellow ribbon cut.

	10%	Chert light to medium gray to medium brown, cryptocrystalline, massive angular fragments, very hard, tight to poor (5%) pin point and fracture porosity, common dark brown heavy oil stain, common yellow fluorescence, moderate to fast massive bright yellow cut.
335.00 to 340.00	70%	Sandstone light brownish gray, quartzite, trace black carbonaceous grains, silt to very fine grained, subrounded, well sorted, moderately to very hard, slightly argillaceous, tight to very poor (<5%) intergranular porosity, trace bitumen stain, trace dull yellow fluorescence, trace very slow bright yellow ribbon cut.
	30%	Chert light to medium gray to medium brown, cryptocrystalline, massive angular fragments, very hard, tight to poor (5%) pin point and fracture porosity, common dark brown heavy oil stain, common yellow fluorescence, moderate to fast massive bright yellow cut.
340.00 to 345.00	100%	Sandstone light brownish gray (80%), quartzite, trace glauconite, very fine to fine (lower) grained, well sorted, subrounded, moderately hard to very hard, calcite cement, tight to fair (12%) intergranular porosity, no shows, with sandstone (20%), medium gray, quartzite, silt to very fine (lower) grained, subrounded, well sorted, very hard, calcite cement, slightly dolomitic, tight, abundant black bitumen specks also with trace chert, as above.
345.00 to 350.00	100%	Sandstone light brownish gray, quartzite, trace glauconite, very fine to fine (lower) grained, well sorted, subrounded, moderately hard to very hard, calcite cement, tight to fair (12%) intergranular porosity, common bright yellow fluorescence, slow to moderate massive bright milky yellow cut, with sandstone (trace) medium gray, quartzite, silt to very fine (lower) grained, subrounded, well sorted, very hard, calcite cement, slightly dolomitic, tight, abundant black bitumen specks, trace chalky white bentonite grains.
350.00 to 365.00 (15.00)	100%	Sandstone light brownish gray, quartzite, trace glauconite, very fine to fine (lower) grained, well sorted, subrounded, moderately hard to very hard, calcite cement, tight to fair (12%) intergranular porosity, common bright yellow fluorescence, slow to moderate massive bright milky yellow cut with up to 10% white bentonite grains also with trace sandstone, medium gray, quartzite, silt to very fine (lower) grained, subrounded, well sorted, very hard, calcite cement, slightly dolomitic, tight, abundant black bitumen specks
365.00 to 380.00	100%	Sandstone light to medium brownish gray, quartzite, trace glauconite, very fine to fine (lower) grained, well sorted, subrounded, moderately hard to very hard, calcite cement, tight to fair (12%) intergranular porosity, common bright yellow fluorescence, slow to moderate massive bright milky yellow cut, also with trace sandstone (10%), medium to dark gray, quartzite, silt to very fine (lower) grained, subrounded, well sorted, very hard, argillaceous, calcite cement, slightly dolomitic, tight, abundant black bitumen specks.
380.00 to 385.00 (5.00)	100%	Sandstone light gray to light -m brownish gray, quartzose, trace glauconite, trace dark lithic grains, trace disseminated pyrite, silt to very fine green, subrounded, well sorted, friable to moderately hard, calcite with minor argillaceous cement, mainly tight, occasional poor to fine (5-9%) intergranular porosity, trace black bitumen stain, scattered dull yellow fluorescence, slow massive milky yellow white cut.

385.00 to 390.00	70% Siltstone medium to dark brownish gray, quartzose, very argillaceous, moderately hard to very hard, calcite and argillaceous cement, tight, no shows.
	30% Sandstone as above, grading to siltstone.
390.00 to 395.00	50% Siltstone as above.
	30% Sandstone as above, becoming medium brown (5%), quartzite, very fine grained, very hard, very well cemented with silica, 5% fracture porosity, common dark brown oil stain, no visible fluorescence, instant massive milky white cut.
	20% Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part.
395.00 to 400.00	80% Sandstone medium brown, < 5% as above, becoming light to medium brownish gray, quartzose, trace dark lithic grains, silt to very fine grained, subrounded, friable to moderately hard, mainly calcite cement, minor argillaceous and silica cement, poor (5%) to good (15%) intergranular porosity, common scattered dull yellow fluorescence, trace lower to medium brown oil stain, moderate to fast massive milky white cut.
	20% Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part.
400.00 to 405.00	90% Sandstone light to medium brownish gray, as above.
	10% Siltstone dark gray to dark brownish gray, quartzose, very argillaceous, very hard, calcite cement, tight, no shows.
405.00 to 415.00 (10.00)	100% Sandstone light to medium brownish gray, quartzose, trace dark lithic grains, silt to very fine grained, subrounded, friable to moderately hard, mainly calcite cement, minor argillaceous and silica cement, poor (5%) to good (15%) intergranular porosity, common scattered dull yellow fluorescence, trace lower to medium brown oil stain, moderate to fast massive milky white cut, with trace shale and trace siltstone, as above.
415.00 to 420.00 (5.00)	60% Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
	40% Sandstone light to medium brownish gray, quartzose, trace dark lithic grains, silt to very fine to occasionally fine (lower) grained, subrounded, friable to moderately hard, mainly calcite cement, minor argillaceous and silica cement, poor (5%) to good (15%) intergranular porosity, common scattered dull yellow fluorescence, trace lower to medium brown oil stain, moderate to fast massive milky white cut, trace white calcite crystals.
420.00 to 430.00 (10.00)	80% Sandstone medium brownish gray, quartzose, silt to fine (upper) grained, subrounded to rounded, moderately sorted, moderately hard to friable, very well cemented with calcite, tight to fine (8%) intergranular porosity, trace to common medium brown oil stain, trace dull yellow fluorescence, moderate to fast massive milky white cut, trace black lithic grains.

	20%	Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
430.00 to 435.00 (5.00)	70%	Sandstone as above.
	30%	Shale as above.
435.00 to 440.00	80%	Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
	20%	Sandstone medium brownish gray, quartzose, silt to fine (upper) grained, subrounded to rounded, moderately sorted, moderately hard to friable, very well cemented with calcite, tight to fine (8%) intergranular porosity, trace to common medium brown oil stain, trace dull yellow fluorescence, moderate to fast massive milky white cut, trace black lithic grains, grading to siltstone, medium to dark gray to medium to dark gray brown, quartzose, very hard, very well cemented with calcite, tight, no shows, trace sparry calcite lining fractures.
440.00 to 445.00	70%	Sandstone as above, becoming light to medium brownish gray, quartzose, trace to common dark lithic grains, silt to very fine grained, subrounded, well sorted, friable to moderately hard, well cemented with calcite, tight to poor (5%) intergranular porosity, rare dull yellow fluorescence, rare very slow milky yellow white ribbon cut, trace to common sparry calcite filled fractures.
	30%	Shale as above.
445.00 to 455.00 (10.00)	90%	Sandstone light to medium brownish gray, quartzose, trace to common dark lithic grains, silt to very fine grained, subrounded, well sorted, friable to moderately hard, well cemented with calcite, tight to poor (5%) intergranular porosity, rare dull yellow fluorescence, rare very slow milky yellow white ribbon cut.
	10%	Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
455.00 to 465.00	100%	Sandstone light gray to light brownish gray to occasionally medium brownish gray to occasionally light brown, quartzose, very fine to fine (upper) grained, silty in part, subrounded, moderately well sorted, friable to moderately hard, well cemented with calcite in part, tight to good (15%) intergranular porosity, abundant bright yellow fluorescence, fast bright milky yellow white fibrous cut, trace calcite filled fractures.
465.00 to 480.00 (15.00)	100%	Sandstone light gray to light brownish gray to occasionally medium brownish gray to occasionally light brown, quartzose, silt to very fine to fine (upper) grained, subrounded, moderately to well sorted, friable to moderately hard, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight to good (15%) intergranular and fracture porosity, rare light brown oil stain, rare bright yellow fluorescence, fast bright milky yellow white fibrous cut, trace white calcite crystals and sparry calcite

		filled fractures.
480.00 to 485.00 (5.00)	70%	Sandstone as above, becoming increasingly argillaceous with medium to coarse grained black shale clasts.
	30%	Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
485.00 to 490.00	80%	Sandstone light gray to medium brownish gray as above, grading to dark gray, quartzose, silt to very fine grained, very argillaceous, subrounded, poorly sorted, friable to moderately hard, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight to poor (5%) intergranular and fracture porosity, no shows, trace white calcite crystals and sparry calcite filled fractures.
	20%	Shale as above.
490.00 to 495.00	90%	Sandstone light gray to light brownish gray to occasionally medium brownish gray to occasionally light brown, dark good (very argillaceous) in part, quartzose, silt to very fine to fine (upper) grained, subrounded, moderately to well sorted, friable to moderately hard, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight to good (15%) intergranular and fracture porosity, rare light brown oil stain, rare bright yellow fluorescence, fast bright milky yellow white fibrous cut, trace white calcite crystals and sparry calcite filled fractures.
	10%	Shale black, blocky, siliceous, moderately to very hard, silty in part, sandy in part, trace calcite filled fractures.
495.00 to 500.00	100%	Sandstone light gray to light brownish gray to occasionally medium brownish gray to occasionally light brown, dark good (very argillaceous) in part, quartzose, trace dark lithic grains, silt to very fine to fine (upper) grained, subrounded, moderately to well sorted, friable to moderately hard, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight to good (15%) intergranular and fracture porosity, rare light brown oil stain, rare bright yellow fluorescence, fast bright milky yellow white fibrous cut, trace white calcite crystals and sparry calcite filled fractures, also with minor shale, as above.
500.00 to 515.00 (15.00)	100%	Sandstone light gray to light brownish gray to occasionally medium brownish gray to occasionally light brown, quartzose, trace dark lithic grains, silt to medium (upper) grained, subrounded, poorly to moderately, friable to moderately hard, unconsolidated in part, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight to good (15%) intergranular and fracture porosity, rare light brown oil stain, rare bright yellow fluorescence, fast bright milky yellow white fibrous cut, trace to 5% white calcite crystals and sparry calcite filled fractures, trace pyrite.
515.00 to 530.00 (15.00)	100%	Sandstone as above, becoming increasingly argillaceous towards the bottom of the interval with minor medium gray to light greenish gray sandy shale, trace pyrite.
530.00 to 535.00 (5.00)	80%	Siltstone medium to dark brownish gray, occasionally light gray, quartzose, trace pyrite, sandy

			in part, calcite and argillaceous cement, slightly dolomitic, tight, no shows with trace medium greenish gray shale.
	20%	Sandstone	light to medium brownish gray, quartzose (clear and opaque grains), trace dark lithic grains, silt to coarse (lower) grained, subrounded, poorly to moderately, friable to moderately hard, well cemented with calcite in part, minor argillaceous, dolomitic and kaolinitic cement, tight, no shows.
535.00 to 540.00	70%	Sandstone	as above.
	30%	Siltstone	as above.
540.00 to 550.00 (10.00)	100%	Siltstone	brownish black, quartzose, silt to very fine (lower) grained, occasionally grading to very fine grained sandstone, very argillaceous, very bituminous, calcite and dolomite cement, tight, bitumen staining throughout, trace to common white sparry calcite filled fractures.
550.00 to 560.00	80%	Siltstone	as above.
	20%	Sandstone	light to medium brownish gray, quartzose (clear and opaque grains), trace dark lithic grains, silt to fine (lower) grained, subrounded, poorly to moderately sorted, friable to moderately hard, well cemented with calcite and dolomite, common argillaceous cement, tight to poor (7%) intergranular and fracture porosity, trace medium brown oil stain, no visible fluorescence, slow milky white ribbon cut, trace to common white sparry calcite filled fractures and loose coarsely crystalline calcite crystals.
	5%	Chert	light to medium gray, massive angular fragments, speckled in part, very hard, sandy in part (clear quartz grains in matrix), tight, no shows.
560.00 to 570.00	60%	Siltstone	brownish black, quartzose, silt to very fine (lower) grained, occasionally grading to very fine grained sandstone, very argillaceous, very bituminous, calcite and dolomite cement, tight, bitumen staining throughout, trace to common white sparry calcite filled fractures.
	40%	Sandstone	as above.
570.00 to 575.00 (5.00)	50%	Limestone	white to buff to light grayish brown, micritic, chalky to microcrystalline, soft to moderately hard, sandy and silty in part, slightly argillaceous, sly bituminous, tight, no shows.
	30%	Sandstone	light to medium brownish gray, quartzose (clear and opaque grains), trace dark lithic grains, silt to fine (upper) grained, subrounded, moderately sorted, friable to moderately hard, well cemented with calcite and dolomite, common argillaceous cement, tight to poor (7%) intergranular and fracture porosity, trace medium brown oil stain, no visible fluorescence, fast massive milky white cut.
	20%	Chert	light to medium gray, massive angular fragments, speckled in part, very hard, sandy in part (clear quartz grains in matrix), tight, no shows.
575.00 to 585.00	80%	Sandstone	

(10.00)		as above.
	15%	Limestone as above.
	5%	Chert as above.
585.00 to 590.00 (5.00)	70%	Sandstone light to medium brownish gray, quartzose (clear and opaque grains), trace dark lithic grains, silt to fine (upper) grained, subrounded, moderately sorted, friable to moderately hard, well cemented with calcite and dolomite, increasing argillaceous cement, tight to poor (7%) intergranular and fracture porosity, trace medium brown oil stain, no visible fluorescence, fast massive milky white cut.
	25%	Limestone medium grayish brown to white to buff, micritic, chalky to microcrystalline, soft to moderately hard, sandy and silty in part, increasingly argillaceous, sly bituminous, tight, no shows.
	5%	Chert light to medium gray, massive angular fragments, speckled in part, very hard, sandy in part (clear quartz grains in matrix), tight, no shows.
590.00 to 600.00 (10.00)	60%	Siltstone medium grayish brown, quartzose, sandy, very argillaceous, bituminous, moderately hard, dolomitic, grading to silty dolomite, tight, common medium brown bitumen stain, dull yellow fluorescence throughout.
	35%	Sandstone medium grayish brown, quartzose (clear and opaque grains), trace dark lithic grains, silt to fine (upper) grained, subrounded, moderately sorted, friable to moderately hard, well cemented with calcite and dolomite, very argillaceous, tight to poor (7%) intergranular and fracture porosity, trace medium brown oil stain, dull yellow fluorescence throughout, fast massive milky white cut.
	5%	Chert light to medium gray, massive angular fragments, speckled in part, very hard, sandy in part (clear quartz grains in matrix), tight, no shows.
600.00 to 605.00 (5.00)	70%	Siltstone grading in part to silty dolomite, dark brownish gray, occasionally light gray, quartzose, very argillaceous, very dolomitic, tight, pyrobituminous, trace disseminated pyrite.
	30%	Sandstone light to medium grayish brown, quartzose (mainly clear grains), trace dark lithic grains, silt to medium (lower) grained, rounded to subrounded, poor sorted, moderately hard, very calcareous, slightly argillaceous, tight to poor (5%) intergranular porosity, no visible fluorescence, slow massive milky white cut.
605.00 to 610.00	70%	Siltstone as above.
	30%	Sandstone as above with trace, dolomite cement, occasionally good (15%) porosity, trace light brown oil stain, trace chert, white to light gray, massive, angular fragments.
610.00 to 615.00	50%	Dolomite medium to dark brownish gray, microcrystalline, very hard, silty, tight, pyrobituminous with trace chert, light gray, massive, angular fragments.
	50%	Sandstone light to medium grayish brown, quartzose (mainly clear grains), trace dark lithic

			grains, silt to medium (lower) grained, rounded to subrounded, poor sorted, moderately hard, very calcareous, minor dolomite cement, slightly argillaceous, tight to occasionally good (15%) intergranular porosity, no visible fluorescence, slow massive milky white cut, trace white calcite crystals.
615.00 to 620.00	80%	Sandstone	medium gray to medium brownish gray, quartzose, silt to fine (upper) grained, subrounded to rounded, poorly to moderately sorted, moderately hard, very argillaceous, dolomite and calcite cement, tight to poor (5%) intergranular porosity, no visible fluorescence, slow milky white massive cut.
	20%	Siltstone	medium gray to medium brownish gray, quartzose, very hard, very dolomitic, tight, pyrobituminous.
620.00 to 625.00	70%	Limestone	black to dark gray, microcrystalline to micritic, very argillaceous, sandy, silty, slightly dolomitic, very hard, tight, pyrobituminous, no visible fluorescence, very slow dull yellow ribbon cut, trace white calcite crystals, also with chert (trace), light gray, massive, angular fragments.
	30%	Sandstone	light grayish brown to medium gray, quartzose, silt to fine (upper) grained, subrounded to rounded, poorly to moderately sorted, very hard, very argillaceous, calcareous cement, tight, pyrobituminous, no visible fluorescence, slow milky white massive cut.
625.00 to 630.00	60%	Sandstone	light to medium grayish brown, as above, silt to fine grained, argillaceous, silty, very calcareous, very dolomitic, trace disseminated pyrite, tight to poor (7%) intergranular porosity, common to abundant dull yellow fluorescence, slow massive milky white cut.
	40%	Limestone	dark brownish gray to black, microcrystalline to micritic, occasionally chalky, trace white to light brown calcite crystals, silty, sandy, very hard, tight, pyrobituminous with trace light gray chert (fossiliferous).
630.00 to 640.00 (10.00)	80%	Sandstone	as above, becoming very fine to medium (lower) grained with fair to good (15%) intergranular porosity, trace black bitumen stain, common to abundant yellow fluorescence, slow massive milky white cut.
	20%	Limestone	as above, pyrobituminous, trace to 5% chert, light gray, massive, angular fragments.
640.00 to 650.00	100%	Sandstone	light grayish brown, quartzose, trace to common dark to occasionally variable colored lithic grains, silt to medium (lower) grained, subrounded to rounded, poorly sorted, occasionally well sorted, silica and dolomite cement, moderately hard to friable, occasionally very hard, tight to good (15%) intergranular porosity, common black pyrobitumen specks, common to abundant yellow fluorescence, slow massive milky white cut, trace light gray to white chert fragments also with minor white to buff, coarse crystalline dolomite filled fractures.
650.00 to 655.00 (5.00)	100%	Sandstone	white to light gray to light grayish brown, quartzose, trace to common dark to occasionally variable colored lithic grains, silt to fine grained, subrounded to rounded, poorly sorted, occasionally well sorted, dolomite cement, moderately hard to friable, occasionally very hard, tight to excellent (25%) intergranular porosity,

common black pyrobitumen specks, trace light gray to white chert fragments.

655.00 to 660.00	70% Sandstone as above.
	30% Limestone buff to dark grayish brown, cryptocrystalline to microcrystalline, micritic in part, very hard, argillaceous, silty in part, tight, pyrobituminous in part with trace to common light to medium gray chert fragments.
660.00 to 665.00	50% Sandstone white to light gray to light grayish brown, quartzose, trace to common dark to occasionally variable colored lithic grains, silt to fine grained, subrounded to rounded, poorly sorted, occasionally well sorted, dolomite cement, moderately hard to friable, occasionally very hard, tight to good (15%) intergranular porosity, common black pyrobitumen specks, trace to common medium brown oil stain, common dull yellow fluorescence, moderate massive milky white cut, trace light gray to white chert fragments.
	40% Limestone medium brown to dark brownish gray, cryptocrystalline to microcrystalline, micritic in part, very argillaceous in part, silty, sandy, very hard, tight, pyrobituminous.
	10% Dolomite light to medium brown, cryptocrystalline to medium crystalline, very hard, tight, no shows.
665.00 to 670.00	100% Sandstone white to light gray to light grayish brown, quartzose, trace to common dark to occasionally variable colored lithic grains, silt to fine grained, subrounded to rounded, poorly sorted, occasionally well sorted, dolomite cement, moderately hard to friable, occasionally very hard, tight to good (15%) intergranular porosity, common black pyrobitumen specks, trace to common medium brown oil stain, common dull yellow fluorescence, moderate massive milky white cut, trace light gray to white chert fragments, also with dolomite (up to 5%), as above and trace shale, black, blocky, bituminous, very hard.
670.00 to 680.00 (10.00)	100% Sandstone white, quartzose, very fine to fine (upper) grained, well sorted, subrounded to rounded, moderately hard, mainly silica cement, minor dolomite cement, minor white kaolinite grains and cement, very poor (3%) to fair (12%) intergranular porosity, trace to common black pyrobitumen with trace dolomite, dark grayish brown, cryptocrystalline to coarsely crystalline, very hard, very slightly calcareous, tight, no shows.
680.00 to 685.00 (5.00)	90% Sandstone as above, very fine to medium grained, trace medium brown oil stain, with trace shale, black, blocky, very hard, bituminous, also with trace chert, light to medium gray, fossiliferous, massive, angular fragments.
	10% Dolomite dark grayish brown, cryptocrystalline to coarsely crystalline, very hard, very slightly calcareous, tight, no shows.
685.00 to 700.00 (15.00)	90% Sandstone white, quartzose, very fine to coarse grained, well sorted, subrounded to rounded, moderately hard, mainly silica cement, minor dolomite cement, minor white kaolinite grains and cement, excellent (20%) intergranular porosity, no shows.
	10% Dolomite

dark grayish brown, cryptocrystalline to coarsely crystalline, very hard, very slightly calcareous, tight, no shows.

700.00 to 710.00 (10.00)	100% Sandstone white, quartzose, very fine to medium (lower) grained, well sorted, subrounded to rounded, moderately hard, mainly silica cement, minor dolomite cement, minor white kaolinite grains and cement, tight to fair (12%) intergranular porosity, no shows.
710.00 to 725.00 (15.00)	100% Sandstone white, quartzose (clear grains), common black lithic grains, silt to fine (lower) grained, well sorted, rounded to subrounded, moderately hard to hard, silica cement, slightly kaolinitic, tight to poor (7%) intergranular porosity, trace black pyrobitumen specks with siltstone (trace), light green, friable, silty, sandy, kaolinitic, tight, no shows, also with shale (trace), black, black to subfissile, bituminous, hard, siliceous, and with dolomite (trace), dark grayish brown to occasionally buff, cryptocrystalline to coarsely crystalline, very hard, very slightly calcareous, fossiliferous in part, tight, no shows.
725.00 to 730.00 (5.00)	80% Sandstone as above, becoming increasingly silty and argillaceous, dolomitic in part. 15% Siltstone dark gray to black, argillaceous, sandy (clear quartz grains) in part, bituminous, hard, dolomitic cement, tight, no shows. 5% Shale black, black to subfissile, bituminous, moderately hard to hard, siliceous.
730.00 to 735.00	80% Sandstone light brown to light gray to occasionally white, quartzose (clear grains), common black lithic grains, silt to fine (lower) grained, moderately to well sorted, rounded to subrounded, moderately hard to hard, dolomite cement, slightly kaolinitic, argillaceous, tight to fair (12%) intergranular porosity, trace to common light brown oil stain, common to abundant dull yellow fluorescence, fast massive milky white cut, trace black pyrobitumen specks. 15% Siltstone as above. 5% Shale as above.
735.00 to 740.00	100% Sandstone as above, with trace siltstone and shale, as above.
740.00 to 745.00	80% Sandstone medium gray, quartzose (clear grains), common black lithic grains, silt to fine (lower) grained, moderately to well sorted, rounded to subrounded, moderately hard to hard, dolomite cement, slightly kaolinitic, argillaceous, tight to poor (5%) intergranular porosity, trace black pyrobitumen specks. 20% Shale black, black to subfissile, bituminous, very silty in part, sandy in part, moderately hard to hard, siliceous.
745.00 to 750.00	80% Sandstone light to medium gray, quartzose (clear grains), common dark lithic grains and clasts, silt to medium grained, moderately, rounded to subrounded, moderately hard to hard, slightly siliceous, minor argillaceous cement, tight to excellent (25%) intergranular porosity, abundant black pyrobitumen specks, interbedded with sandstone, medium gray, quartzose, very fine to medium grained, poorly sorted, very argillaceous, very silty, dolomitic, tight to poor (5%) intergranular porosity, no shows, also with dolomite (trace), dark grayish brown to occasionally buff, cryptocrystalline to coarsely

		crystalline, very hard, very slightly calcareous, fossiliferous in part, tight, no shows.
	20%	Shale black, black to subfissile, bituminous, very silty in part, sandy in part, moderately hard to hard, siliceous.
750.00 to 760.00 (10.00)	100%	Sandstone light gray (20%), quartzose, common dark lithic grains and clasts, very fine to coarse grained, rounded to subrounded, friable, light argillaceous and silica cement, poorly sorted, excellent (20%) intergranular porosity, abundant black pyrobitumen specks with sandstone (80%), buff, quartzose, silt to medium (lower) grained, poorly sorted, moderately hard, well cemented with dolomite and argillaceous matter, tight to poor (5%) intergranular porosity, trace light brown oil stain, common yellow fluorescence, fast massive milky white cut, also with dolomite (trace), dark grayish brown to occasionally buff, cryptocrystalline to coarsely crystalline, very hard, very slightly calcareous, fossiliferous in part, tight, no shows.
760.00 to 770.00	100%	Sandstone buff to light to medium brownish gray, quartzose (clear to translucent), trace dark lithic grains, very fine to medium (lower) grained with common coarse grains, rounded to subrounded, moderately sorted, friable in part to moderately hard, dolomite cement, tight to good (15%) intergranular porosity, light to medium brown residual oil stain throughout, black pyrobitumen specks throughout, common dull yellow fluorescence, instantaneous massive to streaming bright yellow white milky cut, trace to common white kaolinite grains, trace black shale.
770.00 to 780.00	100%	Sandstone buff to light to medium brownish gray, quartzose (clear to translucent), trace dark lithic grains, very fine to fine grained, rounded to subrounded, moderately sorted, friable in part to moderately hard, dolomite cement, tight to poor (7%) intergranular porosity, rare light to medium brown residual oil stain, common black pyrobitumen specks, rare shows, trace to common white kaolinite grains, trace black shale.
780.00 to 790.00	45%	Sandstone as above, occasional fine (9%) intergranular porosity.
	30%	Dolomite black to brownish black, microcrystalline, very fossiliferous, pyrobituminous, very hard, silty, argillaceous, tight, no shows, with dolomite (10%), buff, medium to coarse crystalline, occasionally cryptocrystalline, tight to poor (3%) fracture and pin point porosity, trace black dead oil staining, also with common chert fragments, light to medium gray, massive, angular, pyritic.
	25%	Shale black, blocky to subfissile, bituminous, common disseminated pyrite, moderately hard, slightly silty in part.
790.00 to 800.00	90%	Sandstone light to medium brownish gray, quartzose (clear to translucent), trace dark lithic grains, very fine to fine (upper) grained, rounded to subrounded, moderately sorted, friable in part to moderately hard, dolomite cement, tight to fair (12%) intergranular porosity, rare to common light to medium brown residual oil stain, common black pyrobitumen specks, rare shows, trace to common white kaolinite grains.
	5%	Dolomite as above.
	5%	Shale as above.

800.00 to 810.00	100%	Sandstone light to brownish gray, quartzose (clear to translucent), trace dark lithic grains, very fine to medium grained, rounded to subrounded, moderately sorted, friable in part to moderately hard, dolomite cement, tight to good (15%) intergranular porosity, rare medium brown residual oil stain, trace to common black pyrobitumen specks, trace to common dull yellow fluorescence, fast massive to streaming bright milky white cut, trace to common white kaolinite grains, trace black shale.
810.00 to 840.00 (30.00)	100%	Sandstone light brownish gray, quartzose (clear to translucent), trace dark lithic grains, silt to fine grained, rounded to subrounded, moderately sorted, friable in part to moderately hard, dolomite cement, tight to fair (9%) intergranular porosity, rare medium brown residual oil stain, trace to common black pyrobitumen specks, rare dull yellow fluorescence, fast massive to streaming bright milky white cut, trace to common white kaolinite grains, trace black shale.
840.00 to 860.00 (20.00)	100%	Sandstone medium brownish gray, quartzose (clear to translucent), trace dark lithic grains, silt to fine grained, rounded to subrounded, moderately sorted, friable in part to moderately hard, argillaceous in part, dolomite cement, tight to fair (9%) to occasionally good (15%) intergranular porosity, rare to common light to medium brown oil stain, common black pyrobitumen specks, rare to common dull yellow fluorescence, fast massive to streaming bright milky white cut, trace to common white kaolinite grains, trace to common black shale, blocky to subfissile, slightly bituminous.
860.00 to 875.00 (15.00)	90%	Sandstone medium brownish gray to light gray, quartzose (clear to translucent), trace dark lithic grains, silt to fine grained, subangular to subrounded, moderately sorted, friable in part to moderately hard, argillaceous in part, calcite cement, tight to fair (9%) intergranular porosity, rare light to medium brown oil stain, common black pyrobitumen specks, rare to common dull yellow fluorescence, fast massive to streaming bright milky white cut, trace to common white kaolinite grains.
	10%	Shale black, blocky to subfissile, bituminous, common disseminated pyrite, moderately hard, slightly silty in part.
875.00 to 905.00 (30.00)	90%	Sandstone medium brownish gray to light gray to medium to dark gray, quartzose (clear to translucent), trace dark lithic grains, silt to fine grained, grading to sandy siltstone in part, subangular to subrounded, poorly sorted, moderately hard to hard, very argillaceous in part, calcite cement with minor dolomite cement, tight to fair (9%) intergranular porosity, rare light to medium brown oil stain, common black pyrobitumen specks, rare to common dull yellow fluorescence, slow bright milky white ribbon cut, trace to common white kaolinite grains.
	10%	Shale black, blocky to subfissile, bituminous, common disseminated pyrite, moderately hard, slightly silty in part grading to argillaceous siltstone in part.

Lower Mattson: 939.0 MD, 939.0 TVD, -128.6 SSL

905.00 to 910.00 (5.00)	90%	Sandstone medium brownish gray to light gray to medium to dark gray, quartzose (clear to translucent), trace dark lithic grains, silt to fine grained, grading to sandy siltstone in part, subangular to subrounded, poorly sorted, moderately hard to
----------------------------	-----	--

hard, very argillaceous in part, calcite cement with minor dolomite cement, tight to good (20%) intergranular porosity, rare to common light to medium brown oil stain, common black pyrobitumen specks, rare to common dull yellow fluorescence, slow bright milky white ribbon cut, trace to common white kaolinite grains.

	10%	Shale black, blocky to subfissile, bituminous, common disseminated pyrite, moderately hard, slightly silty in part grading to argillaceous siltstone in part.
910.00 to 922.00	100%	Sandstone as above (30%) becoming white, quartzose, silt to medium grained, poorly to moderately sorted, moderately hard, subangular to subrounded, well cemented with calcite, minor dolomite cement, fair (9%) intergranular porosity, no shows.
922.00 to 925.00 (3.00)	100%	Cement very poor sample, cement with sandstone (5%), coarse grained quartz grains (rounded to subrounded) in a dark gray argillaceous matrix, tight, no shows.
925.00 to 930.00 (5.00)	100%	Sandstone light to medium brownish gray, occasionally white, quartzose, silt to fine grained with common loose coarse grained quartz grains, subrounded to rounded, moderately sorted, hard, dolomite and silica cement, minor argillaceous cement, tight, common black bitumen stain throughout.
930.00 to 935.00	60%	Shale brownish black, blocky to subfissile, moderately hard, occasionally calcareous, silty in part.
	40%	Sandstone as above.
935.00 to 940.00	80%	Sandstone light gray, silt to very fine grained, subangular to subrounded, moderately to well sorted, hard, dolomite cement, tight, no shows, trace to common disseminated pyrite, occasional loose coarse grained quartz grains.
	20%	Shale dark gray, blocky to subfissile, moderately indurated, silty, trace disseminated pyrite.
940.00 to 950.00 (10.00)	70%	Shale dark gray to brownish black, blocky to subfissile, slightly silty, trace disseminated pyrite, bituminous.
	30%	Sandstone dark grayish brown, quartzose, silt to very fine grained, very argillaceous, hard, dolomite cement, slightly calcareous, tight, no shows.
950.00 to 960.00	90%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated pyrite, occasional sandstone stringers, bituminous, brittle.
	10%	Sandstone dark grayish brown, quartzose, silt to very fine grained, very argillaceous, hard, dolomite cement, slightly calcareous, tight, no shows.
960.00 to 970.00	80%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, occasional sandstone stringers, bituminous, brittle.
	20%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, silty in part, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
970.00 to 980.00	70%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, occasional sandstone stringers, bituminous, brittle.
	30%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.

980.00 to 990.00	90%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, occasional sandstone stringers, bituminous, brittle.
	10%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
990.00 to 1,000.00	70%	Shale as above but with occasional Crinoid fragments.
	30%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,000.00 to 1,010.00	95%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, occasional sandstone stringers, bituminous, brittle. Please note: fine white grains are undissolved CaCl mud additive.
	5%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,010.00 to 1,015.00 (5.00)		No Sample Sample not caught.
1,015.00 to 1,020.00	95%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare brown microcrystalline dolomite stringers, occasional sandstone stringers, bituminous, brittle.
	5%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,020.00 to 1,030.00 (10.00)	95%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare brown microcrystalline dolomite stringers, occasional sandstone stringers, bituminous, brittle.
	5%	Sandstone white to light gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, slightly silty, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,030.00 to 1,040.00	70%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare brown microcrystalline dolomite stringers, very common limestone stringers, occasional sandstone stringers, bituminous, brittle.
	25%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, chalky in minor part, argillaceous in part, lime mudstone, occasional clear to light gray calcite veins, slightly dolomitic, firm to brittle, dense, no shows.
	5%	Sandstone gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, silty grading to sandy siltstone, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,040.00 to 1,050.00	80%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare brown microcrystalline dolomite stringers, very common limestone stringers, occasional sandstone stringers, bituminous, brittle.
	15%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, chalky in minor part, argillaceous in part, lime mudstone, occasional clear to light gray calcite veins, slightly dolomitic, firm to brittle, dense, no shows.

	5%	Sandstone gray to light brownish gray, quartzose, very fine grained, well sorted, subangular to angular, silty grading to sandy siltstone, friable, argillaceous matrix, siliceous and minor calcareous cement, tight to poor (1%) intergranular porosity, no shows.
1,050.00 to 1,060.00	100%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,060.00 to 1,070.00	100%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,070.00 to 1,080.00	100%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,080.00 to 1,090.00	100%	Shale dark gray to brownish black, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,090.00 to 1,100.00	100%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,100.00 to 1,105.00 (5.00)	90%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
	10%	Limestone
1,105.00 to 1,110.00	55%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, chalky in minor part, argillaceous in part, lime mudstone, occasional clear to light gray calcite veins, common Crinoid fragments, slightly dolomitic in minor part, firm to brittle, dense, no shows.
	45%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers, occasional sandstone and siltstone stringers, brittle.
1,110.00 to 1,115.00	55%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, chalky in minor part, argillaceous in part, lime mudstone, occasional clear to light gray calcite veins, common Crinoid fragments, slightly dolomitic in minor part, firm to brittle, dense, no shows.
	25%	Sandstone light gray to very light brownish gray, quartzose, very fine grained, well sorted, subrounded to angular, silty, friable, argillaceous matrix, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
	20%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, locally common limestone stringers,

occasional sandstone and siltstone stringers, brittle.

1,115.00 to 1,120.00	60%	Sandstone light gray to light brownish gray, quartzose, very fine grained, well sorted, subrounded to angular, silty, friable, argillaceous matrix, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
	40%	Shale as above with very common white kaolin?
1,120.00 to 1,125.00	55%	Sandstone light gray to light brownish gray, quartzose, very fine grained, well sorted, subrounded to angular, silty, friable, argillaceous matrix, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
	30%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, occasional limestone stringers, common white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	10%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, chalky in minor part, argillaceous in part, lime mudstone, occasional clear to light gray calcite veins, common Crinoid fragments, slightly dolomitic in minor part, firm to brittle, dense, no shows.
	5%	Siltstone light gray to gray, quartzose, blocky, friable, argillaceous matrix, siliceous cement, tight, no shows.
1,125.00 to 1,135.00 (10.00)	90%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, occasional limestone stringers, common white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	10%	Sandstone light gray to light brownish gray, quartzose, very fine grained, well sorted, subrounded to angular, silty, friable, argillaceous matrix, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
1,135.00 to 1,145.00	100%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,145.00 to 1,150.00 (5.00)	100%	Shale dark gray to brownish black mottled with white in part, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, rare brown microcrystalline dolomite stringers, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,150.00 to 1,155.00		No Sample Sample was not caught.
1,155.00 to 1,165.00 (10.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,165.00 to 1,175.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,175.00 to 1,185.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers,

1,185.00 to 1,190.00 (5.00)	100%	occasional sandstone and siltstone stringers, brittle. Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,190.00 to 1,195.00	65%	Shale as above with rare Pelecypods.
	20%	Sandstone light gray to light brownish gray, quartzose, very fine grained, well sorted, subrounded to angular, silty, friable, argillaceous matrix, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
	15%	Limestone white to light brown to gray, mottled in part, microcrystalline to very fine crystalline, semi translucent in part, argillaceous in part, lime mudstone, appears recrystallized in part. occasional clear to light gray calcite veins, slightly dolomitic in minor part, firm to brittle, dense, no shows.
1,195.00 to 1,205.00 (10.00)	90%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
	10%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,205.00 to 1,210.00 (5.00)	95%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
	5%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,210.00 to 1,215.00	80%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
	20%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,215.00 to 1,220.00	60%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	40%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.

1,220.00 to 1,227.00 (7.00)	75%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	25%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,227.00 to 1,240.00 (13.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,240.00 to 1,245.00 (5.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,245.00 to 1,250.00	75%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
	25%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,250.00 to 1,255.00	60%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	40%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,255.00 to 1,265.00 (10.00)	85%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	15%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,265.00 to 1,275.00	95%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	5%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.

1,270.00 to 1,275.00 (5.00)	75%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	25%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,275.00 to 1,285.00 (10.00)	95%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	5%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,285.00 to 1,290.00 (5.00)	95%	Shale as above with occasional limestone stringers.
	5%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,290.00 to 1,295.00	80%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	20%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,295.00 to 1,300.00	95%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
	5%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,300.00 to 1,305.00	90%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
	10%	Sandstone light gray to light brownish gray to rarely dark gray, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, locally common white kaolin? stringers with carbonaceous laminae, slightly silty in part, friable to brittle, argillaceous matrix in part, siliceous and minor local pyritic cement, tight to poor (1%) intergranular porosity, no shows.
1,305.00 to 1,310.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional

white kaolin stringers, occasional sandstone and siltstone stringers, brittle.

1,310.00 to 1,320.00 (10.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,320.00 to 1,330.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,330.00 to 1,340.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,340.00 to 1,350.00	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,350.00 to 1,360.00	100%	Shale as above with common very carbonaceous to argillaceous coal laminae.
1,360.00 to 1,370.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, rare Crinoid fragments, occasional very fine grained sandstone stringers, rare limestone stringers, very common carbonaceous to argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,370.00 to 1,380.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, rare Crinoid fragments, occasional very fine grained sandstone stringers, rare limestone stringers, very common carbonaceous to argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,380.00 to 1,390.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, rare Crinoid fragments, occasional very fine grained sandstone stringers, rare limestone stringers, very common carbonaceous to argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,390.00 to 1,395.00 (5.00)	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, rare Crinoid fragments, occasional very fine grained sandstone stringers, rare limestone stringers, very common carbonaceous to argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,395.00 to 1,400.00	85%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, rare Crinoid fragments, occasional very fine grained sandstone stringers, rare limestone stringers, very common carbonaceous to argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
	15%	Sandstone light gray to light brownish, quartzose, very fine grained, well sorted, subrounded to angular, appears vitreous in part, silty in part, friable to brittle, argillaceous matrix in part, siliceous cement, tight to poor (1%) intergranular porosity, no shows.
1,400.00 to 1,410.00 (10.00)	100%	Shale brown to dark brownish gray to black, mottled with white in minor part, blocky to tabular, subfissile to fissile, mainly earthy, micromicaceous in part, occasional white kaolin? stringers, slightly pyritic, rare sandstone stringers, firm to brittle.

1,410.00 to 1,420.00 100% **Shale** brown to dark brownish gray to black, mottled with white in minor part, blocky to tabular, subfissile to fissile, mainly earthy, micromicaceous in part, occasional white kaolin? stringers, slightly pyritic, rare sandstone stringers, firm to brittle.

1,420.00 to 1,425.00 (5.00)	100%	Shale brown to dark brownish gray to black, mottled with white in minor part, blocky to tabular, subfissile to fissile, mainly earthy, micromicaceous in part, occasional white kaolin? stringers, slightly pyritic, rare sandstone stringers, firm to brittle.
1,425.00 to 1,440.00 (15.00)	80%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part, slightly pyritic, brittle to hard.
	20%	Shale medium gray brown to dark brownish gray to black, mottled with white in minor part, blocky to tabular, subfissile to fissile, mainly earthy, micromicaceous in part, occasional white kaolin? stringers, slightly pyritic, rare sandstone stringers, firm to brittle.
1,440.00 to 1,450.00 (10.00)	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part, slightly pyritic, brittle to hard.
1,450.00 to 1,460.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part with occasional argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,460.00 to 1,470.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part with occasional argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,470.00 to 1,480.00	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part with occasional argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,480.00 to 1,485.00 (5.00)		No Sample Sample was not caught.
1,485.00 to 1,495.00 (10.00)	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part with occasional argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.
1,495.00 to 1,502.00 (7.00)	100%	Shale dark gray to black, tabular to blocky, fissile to subfissile, earthy to resinous, micromicaceous, occasional very fine grained sandstone stringers, rare siltstone stringers, carbonaceous in part with occasional argillaceous coal stringers and or laminae, slightly pyritic, brittle to hard.

Total Depth: 1,502.0 MD, 1,502.0 TVD, -691.6 SSL

End L-38

Run cement plug and plug back from 1502 to 1056 meters. Polish plug to 1150 and attempt to kick-off. Time drill from 1150 to 1160.7 meters. First attempt to kick off failed. Pull out of hole and set new angle on mud motor. Run in hole and attempt to kick-off a second time at 1160.7 meters. Second attempt successful. Time drill to 1168 meters.

Begin L-38/ST1

1,160.00 to 1,165.00 (10.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,165.00 to 1,170.00 (5.00)	100%	Shale dark gray to dark brownish gray to brownish black, blocky, subfissile, slightly silty, carbonaceous in part, trace disseminated and occasional pyrite grains, rare Crinoid fragments, occasional limestone stringers, occasional white kaolin stringers, occasional sandstone and siltstone stringers, brittle.
1,170.00 to 1,180.00 (10.00)	100%	Shale black to brownish black to dark gray, blocky, fissile in part, occasionally very silty, very bituminous, soft, easily hydrated, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers.
1,180.00 to 1,190.00 (10.00)	100%	Shale black to brownish black to dark gray, blocky, fissile in part, occasionally very silty, very bituminous, soft, easily hydrated, carbonaceous in part, trace disseminated and occasional pyrite grains, occasional white kaolin stringers also with minor sandstone, light gray, quartzose, very fine grained.
1,190.00 to 1,195.00 (5.00)	50%	Shale black to brownish black to dark gray, blocky, fissile in part, occasionally very silty, very bituminous, soft, easily hydrated, carbonaceous in part, very slightly dolomitic, trace disseminated and occasional pyrite grains, occasional white kaolin stringers.
	50%	Sandstone white, clear and opaque quartzose grains, quartzose, silt to very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
1,195.00 to 1,200.00 (5.00)	50%	Sandstone light to medium brown, quartzite, very fine grained, well sorted, subangular to subrounded, very hard, silica cement, tight, common black bitumen stain, very rare pyrobituminous, trace to common disseminated pyrite.
	30%	Shale black to brownish black to dark gray, blocky, fissile in part, occasionally very silty, very bituminous, soft, easily hydrated, carbonaceous in part, very slightly dolomitic, trace disseminated and occasional pyrite grains, occasional white kaolin stringers.
	20%	Siltstone medium to dark gray, quartzose, argillaceous, trace to common dark lithic grains, very siliceous, kaolinitic in part, tight, no shows.
1,200.00 to 1,205.00 (5.00)	100%	Sandstone light to medium brown, quartzite, trace white lithic matter, trace dark lithic grains, very fine grained, well sorted, subangular to subrounded, very hard, silica cement, tight, common bitumen throughout, rare pyrobitumen filled fractures, trace to common disseminated pyrite mixed with pyrobitumen in fractures.

1,205.00 to 1,210.00 (5.00)	100%	Sandstone as above, becoming very argillaceous, slightly calcareous, dolomite and silica cement, becoming silty with interbedded very kaolinitic siltstone, very bituminous, soft, common disseminated pyrite in bitumen, common pyrobitumen flakes, also with minor shale, black, blocky to subfissile, very bituminous, large mica flakes.
1,210.00 to 1,215.00 (5.00)	50%	Sandstone light to medium brown, quartzite, trace white lithic matter, trace dark lithic grains, very fine grained, well sorted, subangular to subrounded, very hard, silica cement, tight, common bitumen throughout, rare pyrobitumen filled fractures, trace to common disseminated pyrite mixed with pyrobitumen in fractures.
	50%	Siltstone dark brown to brownish black, argillaceous grading to very silty shale, very bituminous, soft (friable) in part grading to hard, poorly cemented, tight, common pyrite bitumen flakes, trace to common disseminated pyrite.
1,215.00 to 1,220.00 (5.00)	60%	Sandstone as above.
	40%	Siltstone as above.
1,220.00 to 1,225.00 (5.00)	80%	Siltstone dark brown to brownish black, argillaceous grading to very silty shale, very bituminous, soft (friable) in part grading to hard, poorly cemented, tight, common pyrite bitumen flakes, trace to common disseminated pyrite.
	20%	Sandstone light to medium brown, quartzite, trace white lithic matter, trace dark lithic grains, very fine grained, well sorted, subangular to subrounded, very hard, silica cement, tight, common bitumen throughout, rare pyrobitumen filled fractures, trace to common disseminated pyrite mixed with pyrobitumen in fractures.
1,225.00 to 1,235.00 (10.00)	100%	Shale siltstone grading to shale, black to brownish black, blocky to subfissile, very bituminous, very kaolinitic matrix, calcareous in part, minor dolomite cement, very pyritic in part with disseminated pyrite and pyrite filled fractures, silty, occasionally grading to siltstone, shale occasionally becoming very hard, micromicaceous, common to abundant pyrobitumen flakes.
1,235.00 to 1,240.00 (5.00)	85%	Shale black to brownish black, blocky to subfissile, very bituminous, very kaolinitic matrix, calcareous in part, minor dolomite cement, very pyritic in part with disseminated pyrite and pyrite filled fractures, silty, occasionally grading to siltstone, shale occasionally becoming very hard, micromicaceous, common to abundant pyrobitumen flakes.
	15%	Sandstone light gray, quartzose, very fine grained, subrounded to subangular, well sorted, moderately to very hard, silica and calcite cement, slightly dolomitic, minor kaolinite in matrix, tight to very poor (3%) intergranular porosity, common bitumen stain.
1,240.00 to 1,245.00 (5.00)	65%	Shale dark brownish gray to dark gray, blocky to subfissile, soft to moderately hard, very bituminous, very silty in part, kaolinitic in part, very pyritic (disseminated

		pyrite), with trace shale, light brownish gray, blocky, very fossiliferous (crinoids).
	35%	Sandstone light to medium gray brown, as above, silty, grading to siltstone in part, slightly argillaceous, mainly dolomite and silica cement, minor calcite cement, tight, common bitumen stain, common disseminated pyrite.
1,245.00 to 1,250.00 (5.00)	100%	Sandstone light gray, quartzose, very fine grained, subrounded to subangular, well sorted, moderately to very hard, silica and calcite cement, slightly dolomitic, minor kaolinite in matrix, tight to very poor (3%) intergranular porosity, common bitumen stain, grading to or interbedded with siltstone in part, common disseminated pyrite and pyrobitumen lined fractures.
1,250.00 to 1,255.00 (5.00)	70%	Sandstone as above.
	30%	Shale dark gray to dark brown, occasionally black, blocky to subfissile, soft to moderately hard, very bituminous, silty, minor calcite filled fractures.
1,255.00 to 1,260.00 (5.00)	80%	Shale dark brownish gray, blocky, subfissile, easily hydrated, poorly indurated to well indurated, minor calcite filled fractures, trace to common disseminated pyrite, trace pyrobitumen flakes, kaolinitic in part, silty in part grading to very argillaceous siltstone.
	20%	Siltstone light gray, quartzose, moderately to very hard, silica and calcite cement, slightly dolomitic, minor kaolinite in matrix, tight, common bitumen stain, grading to or interbedded with silty shale, common disseminated pyrite and pyrobitumen lined fractures.
1,260.00 to 1,265.00 (5.00)	100%	Shale dark brownish gray, blocky, soft to moderately indurated, easily hydrated, bituminous, very silty, disseminated pyrite throughout, grading in part to siltstone (10-20%), light to medium gray, quartzose, argillaceous, slightly calcareous, slightly dolomitic, kaolinitic, tight, trace to common bitumen stain, common disseminated pyrite.
1,265.00 to 1,270.00 (5.00)	100%	Shale dark brownish gray, blocky, soft to moderately indurated, easily hydrated, bituminous, very silty, disseminated pyrite throughout
1,270.00 to 1,275.00 (5.00)	80%	Shale dark brownish gray, blocky, soft to moderately indurated, easily hydrated, bituminous, very silty, disseminated pyrite throughout, minor kaolinite laminations, trace calcite filled fractures.
	20%	Siltstone light to dark gray, quartzose, very argillaceous, moderately hard, dolomitic, slightly calcareous, kaolinitic, trace disseminated pyrite, trace to common pyrobitumen flakes, trace calcareous fossil fragments.
1,275.00 to 1,280.00 (5.00)	60%	Shale dark brownish gray, blocky, soft to moderately indurated, easily hydrated, bituminous, very silty, disseminated pyrite throughout, minor kaolinite laminations, trace calcite filled fractures.

	40%	Siltstone light to dark gray, quartzose, occasionally grading to very fine grained sandstone, very argillaceous, moderately hard, dolomitic, slightly calcareous, kaolinitic, trace disseminated pyrite, trace to common pyrobitumen flakes, trace calcareous fossil fragments.
1,280.00 to 1,285.00 (5.00)	75%	Shale dark gray (note colour change), blocky, poorly to moderately indurated, silty, easily hydrated, common disseminated pyrite, slightly dolomitic, trace white calcite crystals.
	15%	Siltstone medium to dark gray, quartzose, argillaceous, moderately hard, very kaolinitic, dolomitic, slightly calcareous, tight, trace pyrite, trace pyrobitumen flakes.
	10%	Sandstone light to medium gray, quartzose, silt to very fine grained, subrounded to subangular, well sorted, moderately hard to hard, dolomite and calcite cement, slightly kaolinitic, tight, no shows.
1,285.00 to 1,295.00 (10.00)	50%	Shale as above, becoming dark gray to black to brownish black, very silty, grading to argillaceous siltstone, common pyrobitumen flakes.
	40%	Siltstone medium to dark gray, quartzose, argillaceous, moderately hard, very kaolinitic, dolomitic, slightly calcareous, tight, trace pyrite, trace pyrobitumen flakes.
	10%	Sandstone light to medium gray, quartzose, silt to very fine grained, subrounded to subangular, well sorted, moderately hard to hard, dolomite and calcite cement, slightly kaolinitic, tight, no shows.
1,295.00 to 1,300.00 (5.00)	85%	Shale dark gray to brownish black, blocky, poorly to moderately indurated, bituminous, slightly silty.
	15%	Sandstone light to medium gray, quartzose, silt to very fine grained, subrounded to subangular, well sorted, moderately hard to hard, dolomite and calcite cement, slightly kaolinitic, tight, no shows.
1,300.00 to 1,310.00 (10.00)	100%	Shale dark gray to dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, kaolinitic in part, trace white calcite crystals.
1,310.00 to 1,315.00 (5.00)	100%	Shale dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, kaolinitic in part, trace white calcite crystals, trace disseminated pyrite, trace carbonaceous laminations, trace to common pyrobitumen specks, bituminous, slightly dolomitic, with minor siltstone laminations (up to 10%), medium to dark gray, quartzose, argillaceous, moderately hard, very kaolinitic, dolomitic, slightly calcareous, tight, trace pyrite, trace pyrobitumen flakes, grading occasionally to very fine grained sandstone.
1,315.00 to 1,320.00 (5.00)	100%	Shale dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, kaolinitic in part, trace white calcite crystals, trace disseminated pyrite, bituminous, slightly dolomitic, also with trace siltstone, as above.

1,320.00 to 1,330.00 (10.00)	100% Shale dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, kaolinitic in part, trace white calcite crystals, trace disseminated pyrite, bituminous, slightly dolomitic.
1,325.00 to 1,335.00 (10.00)	100% Shale dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, kaolinitic in part, trace white calcite crystals, common disseminated pyrite, bituminous, slightly dolomitic.
1,335.00 to 1,345.00 (10.00)	100% Shale dark brownish gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, silty, increasing kaolinite in part, trace white calcite crystals, trace disseminated pyrite, bituminous, slightly dolomitic.
1,345.00 to 1,370.00 (25.00)	100% Shale black, blocky to subfissile, easily hydrated, poorly to moderately indurated, trace to common carbonaceous flakes, slightly silty, slightly dolomitic, rare kaolinite laminations, trace calcite filled fractures, trace loose white calcite crystals.
1,370.00 to 1,385.00 (15.00)	100% Shale dark gray to black (50%), blocky to subfissile, well indurated, slightly micromicaceous, slightly silty, common disseminated pyrite, trace pyrite nodules, trace pyrite lined fractures, common slickenside, trace calcite lined fractures, trace loose calcite crystals interbedded with shale, dark brownish gray (50%), blocky to subfissile, easily hydrated, poorly to moderately indurated.
1,385.00 to 1,390.00 (5.00)	80% Shale dark gray to black (50%), blocky to subfissile, well indurated, slightly micromicaceous, slightly silty, common disseminated pyrite, trace pyrite nodules, trace pyrite lined fractures, common slickenside, trace calcite lined fractures, trace loose calcite crystals interbedded with shale, dark brownish gray (50%), blocky to subfissile, easily hydrated, poorly to moderately indurated. 20% Siltstone medium brownish gray, quartzose, argillaceous, very kaolinitic, slightly calcareous, moderately hard, tight, no shows, common pyrobitumen stain or flakes, trace disseminated pyrite.
1,390.00 to 1,400.00 (10.00)	100% Shale dark gray (50%), blocky to subfissile, well indurated, slightly micromicaceous, slightly silty, common disseminated pyrite, trace pyrite nodules, trace pyrite lined fractures, common slickenside, interbedded with shale, dark brownish gray (50%), blocky to subfissile, easily hydrated, poorly to moderately indurated.
1,400.00 to 1,405.00 (5.00)	80% Shale dark gray to brownish gray (30%), blocky to subfissile, slightly silty, moderately indurated, trace pyrite filled fractures, trace pyrite nodules, interbedded with shale(70%), black to brownish gray, blocky, easily hydrated, poorly indurated. 20% Sandstone light to medium gray, quartzose, silt to very fine grained, subrounded to subangular, well sorted, hard, very argillaceous in part, very silty in part occasionally grading to argillaceous siltstone, calcite cement, slightly dolomitic, kaolinitic in part, tight, no shows

1,405.00 to 1,415.00 (10.00)	100% Shale dark gray (30%), blocky to subfissile, slightly silty, moderately indurated, rare pyrite, interbedded with shale(70%), dark gray to black, blocky, easily hydrated, poorly indurated, with minor interbedded siltstone and sandstone (<5%), as above.
1,415.00 to 1,420.00 (5.00)	No Sample
1,420.00 to 1,430.00 (10.00)	100% Shale dark gray (30%), blocky to subfissile, slightly silty, moderately indurated, rare pyrite, trace calcite crystals, trace calcite veining, interbedded with shale(70%), dark gray to black, blocky, easily hydrated, poorly indurated, with minor interbedded siltstone and sandstone (<5%), light to medium gray, quartzose, silt to very fine grained, subrounded to subangular, well sorted, hard, very argillaceous in part, very silty in part occasionally grading to argillaceous siltstone, calcite cement, slightly dolomitic, kaolinitic in part, tight, no shows
1,430.00 to 1,445.00 (15.00)	100% Shale dark gray (30%), blocky to subfissile, slightly silty, moderately indurated, trace to common pyrite filled fractures and pyrite nodules, interbedded with shale(70%), dark gray to black, blocky, easily hydrated, poorly indurated.
1,445.00 to 1,470.00 (25.00)	100% Shale dark gray (30%), blocky to subfissile, slightly silty, moderately indurated, trace pyrite filled fractures and pyrite nodules, interbedded with shale(70%), dark gray to black, blocky, easily hydrated, poorly indurated.
1,470.00 to 1,500.00 (30.00)	100% Shale dark gray to dark brownish gray (70%), blocky to subfissile, slightly silty, moderately indurated, trace to common pyrite filled fractures and pyrite nodules, slickensided, interbedded with shale(30%), dark gray to black, blocky, easily hydrated, poorly indurated.
1,500.00 to 1,505.00 (5.00)	100% Shale dark gray to occasionally dark grayish brown, blocky to subfissile, slightly silty, moderately to well indurated, minor pyrite lined fractures, common slickenside, minor loose calcite crystals and pyrite nodules, interbedded with shale (30%), dark gray, blocky, easily hydrated, poorly indurated.
1,505.00 to 1,510.00 (5.00)	100% Shale as above, with minor dolomite (<5%), dark brownish gray, cryptocrystalline, very argillaceous, very hard, tight, no shows.
1,510.00 to 1,515.00 (5.00)	100% Shale dark gray to occasionally dark grayish brown, blocky to subfissile, slightly silty, moderately to well indurated, minor pyrite lined fractures, common slickenside, minor loose calcite crystals and pyrite nodules, interbedded with shale (30%), dark gray, blocky, easily hydrated, poorly indurated.
1,515.00 to 1,525.00 (10.00)	70% Sandstone medium to dark gray, quartzose, silt to fine grained, occasionally grading to very sandy shale, subrounded to angular, moderately to well sorted, hard, very argillaceous in part, dolomite and silica cement, trace kaolinite matrix, tight, no shows, trace disseminated pyrite, trace pyrobitumen stain.

	30%	Shale as above.
1,525.00 to 1,530.00 (5.00)	60%	Shale dark gray to occasionally dark grayish brown, blocky to subfissile, slightly silty, moderately to well indurated, minor pyrite lined fractures, common slickenside, minor loose calcite crystals and pyrite nodules, interbedded with shale (30%), dark gray, blocky, easily hydrated, poorly indurated.
	40%	Sandstone light to medium to dark gray, quartzose, silt to fine grained, occasionally grading to very sandy shale, subrounded to angular, moderately to well sorted, hard, very argillaceous in part, dolomite and silica cement, trace kaolinite matrix, tight, no shows, trace disseminated pyrite, trace pyrobitumen stain.
	10%	Chert light gray, mottled, massive angular fragments, trace disseminated pyrite.
1,530.00 to 1,535.00 (5.00)	80%	Chert white to light gray to medium brownish gray, massive angular fragments, blocky, mottled, in part, trace to common disseminated pyrite, minor brecciation (siliceous shale fragments), tight, no shows.
	20%	Shale dark grayish brown, blocky, moderately indurated, micromicaceous, slightly silty, common disseminated pyrite, trace pyrobitumen flakes.

Golata: 1,537.5 MD, 1,523.9 TVD, -713.5 SSL

1,535.00 to 1,540.00 (5.00)	70%	Chert white to light gray to medium brownish gray, massive angular fragments, blocky, mottled, in part, trace to common disseminated pyrite, minor brecciation (siliceous shale fragments), tight, no shows.
	30%	Shale dark grayish brown, blocky, poorly to moderately indurated, easily hydrated, micromicaceous, slightly silty, slightly dolomitic, common disseminated pyrite, trace pyrobitumen flakes.
1,540.00 to 1,545.00 (5.00)	90%	Shale dark grayish brown, becoming dark gray to black, blocky, poorly indurated, easily hydrated, micromicaceous, slightly silty, slightly dolomitic, common disseminated pyrite, trace pyrobitumen flakes.
	10%	Chert white to light gray to medium brownish gray, massive angular fragments, blocky, mottled, in part, trace to common disseminated pyrite, tight, no shows.
1,545.00 to 1,550.00 (5.00)	100%	Shale dark gray to black, blocky, poorly indurated, micromicaceous, easily hydrated, slightly silty, slightly dolomitic, common disseminated pyrite, trace pyrobitumen flakes with trace chert as above.
1,550.00 to 1,575.00 (25.00)	100%	Shale dark gray to black, blocky, poorly indurated, easily hydrated, micromicaceous, slightly silty, slightly dolomitic, common disseminated pyrite, trace pyrobitumen flakes.
1,575.00 to 1,580.00 (5.00)	90%	Shale dark gray to black, blocky, poorly indurated, micromicaceous, easily hydrated,

		slightly silty, slightly dolomitic, common disseminated pyrite, trace pyrobitumen flakes, interbedded with chert (trace), white to light gray to medium brownish gray, massive angular fragments, blocky, mottled, in part, trace to common disseminated pyrite, tight, no shows.
	10%	Sandstone dark gray, occasionally light gray, quartzose, silt to fine grained, very silty in part, very argillaceous in part, subrounded to subangular, poorly sorted, moderately hard to hard, slightly dolomitic, kaolinitic in part, tight, no shows.
1,580.00 to 1,585.00 (5.00)	100%	Shale dark gray, blocky, subfissile in part, poorly indurated, easily hydrated, silty and sandy in part, kaolinitic in part, slickensided, trace calcite lined fractures with calcareous marl, medium brown to buff, silty, very argillaceous, soft, tight, no shows.
1,585.00 to 1,605.00 (20.00)	100%	Shale dark gray, blocky, subfissile in part, poorly indurated, easily hydrated, silty and sandy in part, kaolinitic in part, slickensided, trace calcite lined fractures, trace pyrite lined fractures, trace pyrite nodules.
1,605.00 to 1,610.00 (5.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, trace loose pyrite and pyrite lined fractures, slickensided, crenulated, trace brecciated shale.
1,610.00 to 1,615.00 (5.00)	100%	Shale dark gray to black, blocky - subfissile, poorly indurated, easily hydrated, silty, trace loose pyrite and pyrite lined fractures, slickensided, crenulated, trace brecciated shale.
1,615.00 to 1,620.00 (5.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, trace loose pyrite and pyrite lined fractures, trace white calcite lined fractures, slickensided, crenulated, trace brecciated shale.
1,620.00 to 1,630.00 (10.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, trace disseminated pyrite, slickensided, crenulated, trace brecciated shale with minor (trace) dolomite, dark brown, cryptocrystalline, very hard, very argillaceous, tight, no shows..
1,630.00 to 1,640.00 (10.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, trace disseminated pyrite, slickensided, crenulated, trace brecciated shale, with minor (5%) marl, medium to dark brown, soft, argillaceous, calcareous, tight, no shows.
1,640.00 to 1,645.00 (5.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, trace to common disseminated pyrite, slickensided, brecciated, with trace calcareous marlstone, medium to dark brown, soft, very argillaceous, tight, no shows also with dolomite (trace), dark brownish black, cryptocrystalline, very argillaceous, very hard, tight, no shows.
1,645.00 to 1,650.00 (5.00)	100%	Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty,

common disseminated pyrite, slickensided, brecciated, trace white calcite sparite, with trace dolomitic marlstone, medium to dark brown, soft, very argillaceous, tight, no shows also with dolomite (trace), dark brownish black, cryptocrystalline, very argillaceous, very hard, tight, no shows, and with siltstone (trace), light gray to salt and pepper, quartzose, common dark lithic grains, hard, siliceous, slightly dolomitic, tight, no shows.

1,650.00 to 1,655.00 (5.00)	100% Shale as above, trace euhedral calcite crystals, very poor fracture porosity.
1,655.00 to 1,665.00 (10.00)	100% Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, common disseminated pyrite, slickensided, brecciated, trace white calcite sparite, with dolomite (trace), dark brownish black, cryptocrystalline, very argillaceous, very hard, tight, no shows.
1,665.00 to 1,685.00 (20.00)	90% Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, silty, calcareous grading to calcareous marlstone in part, common disseminated pyrite, slickensided, brecciated, trace calcite lined fractures, trace white calcite sparite, trace bitumen, with marlstone (up to 10%), buff to dark brown, soft, poorly indurated, very argillaceous, very calcareous, tight, no shows 10% Dolomite Brownish black, cryptocrystalline, very argillaceous, very hard, tight, no shows.
1,685.00 to 1,690.00 (5.00)	100% Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, swelling shales, silty, calcareous grading to calcareous marlstone in part, dolomitic in part, common to abundant disseminated pyrite, slickensided, trace calcite lined fractures, trace white calcite sparite, trace bitumen, with marlstone (up to 5%), buff to dark brown, soft, poorly indurated, very argillaceous, very calcareous, tight, no shows also with dolomite (up to 10%), dark grayish brown, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,690.00 to 1,695.00 (5.00)	100% Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, swelling shales, silty, calcareous grading to calcareous marlstone in part, dolomitic in part, common to abundant disseminated pyrite, slickensided, trace calcite lined fractures, trace white calcite sparite, trace bitumen, with marlstone (up to 10%), buff to dark brown, soft, poorly indurated, very argillaceous, very calcareous, tight, no shows also with dolomite (up to 10%), dark grayish brown, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,695.00 to 1,720.00 (25.00)	100% Shale dark gray to black, blocky to subfissile, poorly indurated, easily hydrated, swelling shales, silty, calcareous grading to calcareous marlstone in part, dolomitic in part, common to abundant disseminated pyrite, slickensided, trace calcite lined fractures, trace white calcite sparite, trace bitumen, with marlstone (up to 10%), buff to dark brown, soft, poorly indurated, very argillaceous, very calcareous, tight, no shows also with dolomite (trace), dark grayish brown, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,720.00 to 1,750.00 (30.00)	100% Shale dark gray to black, blocky to subfissile, poorly to well indurated, easily hydrated (40%), swelling shales, silty, dolomitic in part, calcareous in part,

trace to common disseminated pyrite, slickensided, abundant dolomite lined fractures, trace to common white coarse crystalline dolomite sparite, also with dolomite (up to 10%), dark grayish brown, cryptocrystalline, argillaceous, very hard, tight, no shows.

1,750.00 to 1,760.00 (10.00)	100% Shale dark gray to black, blocky to subfissile, poorly to well indurated, easily hydrated (40%), swelling shales, silty, dolomitic in part, calcareous in part, trace to common disseminated pyrite, slickensided, abundant dolomite lined fractures, trace to common white coarse crystalline dolomite sparite, also with dolomite (up to 10%), dark grayish brown, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,760.00 to 1,775.00 (15.00)	100% Shale as above, becoming slightly calcareous with decreasing fractures.
1,775.00 to 1,795.00 (20.00)	100% Shale dark gray to black, blocky to subfissile, poorly to well indurated, easily hydrated (40%), swelling shales, slightly silty, becoming very calcareous in part, dolomitic in part, trace disseminated pyrite, no fracturing present.
1,795.00 to 1,800.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, with trace siltstone, medium gray, quartzose, trace glauconite, common disseminated pyrite, hard, silica cement, tight, no shows.
1,800.00 to 1,805.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, trace healed fractures filled with traces of medium to coarse dolomite crystals and clear gypsum grains, with trace dolomite, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,805.00 to 1,810.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, with trace dolomite, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,810.00 to 1,815.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, trace healed fractures filled with dolomite and pyrite, interbedded with trace dolomite, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows also with trace limestone, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,815.00 to 1,820.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, trace healed fractures filled with dolomite and pyrite, interbedded with dolomite (up to 5%), dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows also with trace limestone, dark gray, cryptocrystalline, carbonaceous flakes, argillaceous, dolomitic. very hard, tight, no shows.

1,820.00 to 1,825.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, trace healed fractures filled with calcite, interbedded with trace dolomite, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,825.00 to 1,830.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, very calcareous, common disseminated pyrite, interbedded with trace dolomite, dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.
1,830.00 to 1,840.00 (10.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, slightly to moderately calcareous, common disseminated pyrite.
1,840.00 to 1,845.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, slightly to moderately calcareous, common disseminated pyrite, trace healed fractures filled with calcite, trace slickenside.
1,845.00 to 1,850.00 (5.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, slightly to moderately calcareous, common disseminated pyrite, trace healed fractures filled with calcite.
1,850.00 to 1,870.00 (20.00)	100% Shale dark gray, blocky to subfissile, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, slightly to moderately calcareous, common disseminated pyrite, trace healed fractures filled with calcite.
1,870.00 to 1,875.00 (5.00)	100% Shale dark grayish brown to dark gray, blocky to subfissile, slightly bituminous, slightly silty, easily hydrated, swelling shales, poorly to moderately indurated, moderately calcareous, common disseminated pyrite.
1,875.00 to 1,880.00 (5.00)	100% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, common disseminated pyrite, interbedded with dolomite (trace), dark brownish gray, cryptocrystalline, argillaceous, very hard, tight, no shows.

Upper Flett: 1,880.0 MD, 1,829.6 TVD, -1,019.2 SSL

1,880.00 to 1,885.00 (5.00)	80% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, common disseminated pyrite, trace healed calcite filled fractures.
	20% Limestone medium brownish gray, micritic, occasionally microcrystalline, very argillaceous, easily hydrated in part, poorly - moderately indurated, tight, no shows, trace disseminated pyrite.

1,885.00 to 1,890.00 (5.00)	70% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, becoming dolomitic in part, common disseminated pyrite.
	20% Limestone medium brownish gray, micritic, occasionally microcrystalline, very argillaceous, easily hydrated in part, poorly - moderately indurated, tight, no shows, trace disseminated pyrite.
	10% Dolomite medium - dark grayish brown, cryptocrystalline, micritic in part, very argillaceous, hard, tight, no shows.
1,890.00 to 1,895.00 (5.00)	75% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, slightly dolomitic, common disseminated pyrite, trace healed calcite filled fractures.
	25% Limestone light brownish gray - buff - medium - dark grayish brown, micritic - microcrystalline, very argillaceous, poorly - moderately indurated, slightly dolomitic, tight, no shows.
1,895.00 to 1,900.00 (5.00)	85% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, slightly dolomitic, common disseminated pyrite, trace healed calcite filled fractures.
	15% Limestone light brownish gray - buff - medium - dark grayish brown, micritic - microcrystalline, very argillaceous, poorly - moderately indurated, slightly dolomitic, tight, no shows.
1,900.00 to 1,905.00 (5.00)	90% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous, slightly dolomitic, common disseminated pyrite.
	10% Limestone light brownish gray - buff - medium - dark grayish brown, micritic - microcrystalline, very argillaceous, poorly - moderately indurated, slightly dolomitic, tight, no shows.
1,905.00 to 1,910.00 (5.00)	80% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous grading to very argillaceous marlstone, slightly dolomitic, common disseminated pyrite.
	20% Limestone light brownish gray - buff - medium - dark grayish brown, micritic - microcrystalline, very argillaceous, poorly - moderately indurated, slightly dolomitic, tight, no shows.
1,910.00 to 1,915.00 (5.00)	65% Shale dark gray to dark grayish brown, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, silty in part, very calcareous grading to very argillaceous marlstone, slightly dolomitic, common

disseminated pyrite.

	25%	Limestone light brownish gray to buff to medium to dark grayish brown to black, micritic to microcrystalline, very argillaceous, poorly to moderately indurated, slightly dolomitic, grading to very dolomitic in part (dolomitic limestone to limy dolomite), tight, no shows.
	10%	Chert light to medium gray to black, tripolitic, massive, silicified limestone, mottled in part, sandy in part (clear quartz grains), tight, no shows.
1,915.00 to 1,920.00 (5.00)	50%	Limestone mainly medium to dark brownish gray, occasionally white to buff, micritic to microcrystalline, occasionally fine to medium grained, very argillaceous, very kaolinitic in part, moderately hard, dolomitic in part grading to limy dolomite in part, tight, no shows, microfossils, common disseminated pyrite and pyrite coated grains.
	50%	Shale dark gray, blocky to subfissile, poor indurated and easily hydrated in part (very kaolinitic), becoming increasingly less kaolinitic, moderately indurated, slightly silty, calcareous in part, dolomitic in part, common carbonaceous or pyrobitumen flakes, common disseminated pyrite, trace calcite filled healed fractures, trace slickensides.
1,920.00 to 1,925.00 (5.00)	80%	Limestone black to brownish black (35%), cryptocrystalline to microcrystalline, pyrobituminous, dolomitic, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone (65%), light gray to buff, micritic, chalky, microcrystalline, moderately hard, slightly dolomitic, silty, tight, no shows, microfossils, trace healed fractures lined with calcite.
	20%	Shale dark gray, blocky to subfissile, poor indurated and easily hydrated in part (very kaolinitic), becoming less kaolinitic, moderately indurated, slightly silty, calcareous in part, dolomitic in part, common carbonaceous or pyrobitumen flakes, common disseminated pyrite, trace calcite filled healed fractures.
1,925.00 to 1,935.00 (10.00)	100%	Limestone black to brownish black (35%), cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, dolomitic grading to limy dolomite in part, siliceous in part, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone (65%), light gray to buff, micritic, chalky, microcrystalline, moderately hard, slightly dolomitic, silty, tight, no shows, common pyrite, microfossils.
1,935.00 to 1,940.00 (5.00)	100%	Limestone black to brownish black (35%), cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, dolomitic, siliceous in part, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone (65%), light gray to buff, micritic, chalky, microcrystalline, moderately hard, slightly dolomitic, silty, tight, no shows, microfossils, trace healed fractures lined with dolomite.
1,940.00 to 1,945.00 (5.00)	100%	Limestone black to brownish black (35%), cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, dolomitic, siliceous in part, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone (65%), medium to dark gray to buff, micritic, chalky, microcrystalline, moderately hard,

slightly dolomitic, silty, tight, no shows, microfossils.

1,945.00 to 1,950.00 (5.00)	100% Limestone black to brownish black (35%), cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, very hard, silty, tight, no shows, common disseminated pyrite, interbedded with limestone (65%), medium to dark gray to buff, micritic, chalky, occasionally microcrystalline, moderately hard, silty, tight, no shows, microfossils.
1,950.00 to 1,970.00 (20.00)	70% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, common disseminated pyrite, pyrobituminous flakes, calcareous grading to marlstone (40%) in part. 30% Limestone medium to dark gray to buff, micritic, chalky, occasionally microcrystalline, moderately hard, silty, tight, no shows, microfossils interbedded with limestone, black to brownish black, cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, very hard, silty, tight, no shows, common disseminated pyrite.
1,970.00 to 1,975.00 (5.00)	80% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone (60%). 20% Limestone black to brownish black, cryptocrystalline to microcrystalline, pyrobituminous, argillaceous, very hard, silty, tight, no shows, common disseminated pyrite.
1,975.00 to 1,980.00 (5.00)	100% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone (60%).
1,980.00 to 1,985.00 (5.00)	100% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone (40%).
1,985.00 to 1,990.00 (5.00)	100% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone (20%) with trace limestone, black, cryptocrystalline, very hard, slightly dolomitic, tight, no shows, pyrobituminous.
1,990.00 to 1,995.00 (5.00)	100% Shale dark gray to dark brownish gray, blocky to subfissile, very argillaceous, poorly to moderately indurated, trace disseminated pyrite, calcareous grading to marlstone (10-20%).
1,995.00 to 2,015.00 (20.00)	100% Shale dark gray to occasionally black, blocky to subfissile, common disseminated pyrite, silty, poorly to moderately indurated, easily hydrated swelling shales, kaolinitic, calcareous, occasionally grading to argillaceous marlstone (10%) in part.
2,015.00 to 2,030.00 (15.00)	100% Shale dark gray to occasionally black, blocky to subfissile, common disseminated

pyrite, silty, poorly to moderately indurated, easily hydrated swelling shales, kaolinitic, calcareous, occasionally grading to argillaceous marlstone (10%) in part.

2,030.00 to 2,045.00 (15.00)	90% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%).
	10% Limestone dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, very dolomitic, grading to limy dolomite in part, slightly pyritic, slightly silty, tight, no shows.
2,045.00 to 2,050.00 (5.00)	100% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%) with trace limestone, dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, very dolomitic, grading to limy dolomite in part, slightly pyritic, slightly silty, tight, no shows.
2,050.00 to 2,070.00 (20.00)	100% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%) with trace limestone, dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, very dolomitic, grading to limy dolomite in part, slightly pyritic, slightly silty, tight, no shows.
2,070.00 to 2,075.00 (5.00)	100% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to buff colored (in part) marlstone (10%) with dolomite (up to 10%), dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, calcareous, slightly pyritic, slightly silty, tight, no shows.
2,075.00 to 2,100.00 (25.00)	100% Shale dark gray, occasionally light gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%) with dolomite (up to 10%), dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, calcareous, slightly pyritic, slightly silty, tight, no shows.
2,100.00 to 2,120.00 (20.00)	100% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, grading in part to marlstone (10%) with dolomite (up to 10%), dark gray to black, occasionally buff, cryptocrystalline to micritic, pyrobituminous, very hard, calcareous, slightly pyritic, slightly silty, tight, no shows.
2,120.00 to 2,125.00 (5.00)	100% Shale dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite,

trace calcite filled healed fractures.

2,125.00 to 2,130.00 (5.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures interbedded with marlstone (up to 20%) buff to white, kaolinitic, poorly indurated, very argillaceous, tight, no shows.
2,130.00 to 2,145.00 (15.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
2,145.00 to 2,150.00 (5.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures interbedded with marlstone (up to 20%) buff to white, kaolinitic, poorly indurated, very argillaceous, tight, no shows.
2,150.00 to 2,155.00 (5.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, trace dolomite sparite, trace pyrite nodules, interbedded with marlstone (trace) buff to white, kaolinitic, poorly indurated, very argillaceous, tight, no shows.
2,155.00 to 2,160.00 (5.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures, trace euhedral dolomite sparite, trace fracture porosity.
2,160.00 to 2,170.00 (10.00)	100% Shale	dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
2,170.00 to 2,175.00 (5.00)	100% Shale	dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.

Lower Flett: 2,177.0 MD, 2,094.6 TVD, -1,284.2 SSL

2,175.00 to 2,190.00 (15.00)	80% Shale	dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
	20% Limestone	dark gray to black to occasionally buff, micritic to cryptocrystalline, argillaceous, bituminous, dolomitic, very hard to occasionally moderately hard, tight, trace microfossil, trace fracture porosity.
2,190.00 to 2,195.00 (5.00)	50% Shale	dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.

	50%	Limestone dark gray to black (50%), micritic, very argillaceous, dolomitic, microfossils, tight, no shows with limestone, buff (50%), light to medium gray, micritic to microcrystalline, slightly argillaceous, tight, no shows.
2,195.00 to 2,200.00 (5.00)	80%	Limestone buff to medium to dark gray, micritic to microcrystalline, very argillaceous in part, dolomitic, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.
	20%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
2,200.00 to 2,205.00 (5.00)	80%	Limestone buff to medium to dark gray, micritic to microcrystalline, very argillaceous in part, dolomitic, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils grading to marlstone in part, white to buff to dark gray, soft, kaolinitic, argillaceous, tight, no shows.
	20%	Shale dark gray to occasionally brownish black, blocky to subfissile, well to moderately indurated, calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
2,205.00 to 2,215.00 (10.00)	40%	Marlstone calcareous white to buff to dark gray, chalky, argillaceous, calcareous, soft, tight, no shows.
	40%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, very calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
	20%	Limestone buff to medium to dark gray to black, micritic to microcrystalline, very argillaceous in part, dolomitic, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.
2,215.00 to 2,220.00 (5.00)	50%	Marlstone calcareous white to buff to dark gray, chalky, argillaceous, calcareous, soft, tight, no shows.
	25%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, very calcareous, dolomitic, common disseminated pyrite, trace calcite filled healed fractures.
	25%	Limestone buff to medium to dark gray to black, micritic to microcrystalline, very argillaceous in part, dolomitic, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.
2,220.00 to 2,225.00 (5.00)	40%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, swelling shales, kaolinitic, very calcareous, dolomitic, common disseminated pyrite.
	40%	Limestone buff to medium to dark gray to black, mainly micritic, cryptocrystalline to very fine crystalline in part, very argillaceous in part, dolomitic, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.

	20%	Marlstone calcareous white to buff to dark gray, chalky, argillaceous, calcareous, soft, tight, no shows.
2,225.00 to 2,230.00 (5.00)	70%	Limestone buff to medium to dark gray to black, mainly micritic, cryptocrystalline to very fine crystalline in part, very argillaceous in part, dolomitic, grading to calcareous marlstone in part, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.
	30%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly swelling shale, kaolinitic, very calcareous, dolomitic, common disseminated pyrite.
2,230.00 to 2,245.00 (15.00)	80%	Limestone buff to medium to dark gray to black, mainly micritic, cryptocrystalline to very fine crystalline in part, very argillaceous in part, dolomitic, grading to calcareous marlstone in part, tight, no shows, common pyrite, trace healed fractures filled with calcite, trace to common microfossils.
	20%	Shale dark gray to occasionally brownish black, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly swelling shale, kaolinitic, very calcareous, dolomitic, common disseminated pyrite.
2,245.00 to 2,250.00 (5.00)	80%	Limestone buff (mottled) to light to medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	20%	Shale dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace to common disseminated pyrite.
2,250.00 to 2,255.00 (5.00)	90%	Limestone buff (mottled) to light to medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	10%	Shale dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace to common disseminated pyrite.
2,255.00 to 2,265.00 (10.00)	40%	Shale dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace to common disseminated pyrite.
	30%	Limestone medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, becoming very argillaceous, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	30%	Marlstone calcareous

			white, soft, chalky, tight, no shows.
2,265.00 to 2,270.00 (5.00)	50%	Shale	dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace slickenside, trace to common disseminated pyrite.
	30%	Limestone	medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, becoming very argillaceous, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	20%	Marlstone calcareous	white, soft, chalky, tight, no shows.
2,270.00 to 2,275.00 (5.00)	60%	Limestone	medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, becoming very argillaceous, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	30%	Shale	dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace slickenside, trace to common disseminated pyrite.
	10%	Chert	mottled to medium gray, massive angular fragments, slightly calcareous and dolomitic, common disseminated pyrite, tight, no shows.
2,275.00 to 2,290.00 (15.00)	70%	Limestone	medium to dark gray to brownish black, micritic, cryptocrystalline, dolomitic grading to limy dolomite in part, silty, moderately to very hard, becoming very argillaceous, tight, trace very poor fracture porosity, common pyrobitumen throughout, common disseminated pyrite.
	30%	Shale	dark gray to brownish black, blocky to subfissile, poorly to moderately indurated, calcareous, dolomitic in part, easily hydrated in part, slightly kaolinitic, trace slickenside, trace to common disseminated pyrite.
2,290.00 to 2,300.00 (10.00)	70%	Shale	dark gray to dark brownish gray, blocky to subfissile, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.
	20%	Limestone	black to dark gray, micritic to cryptocrystalline, very hard, very silty in part (grading to siltstone), dolomitic, tight, no shows, common to abundant disseminated pyrite, with minor chert, mottled, massive angular fragments, very hard, common microfossils.
	10%	Siltstone	medium to dark brownish gray, quartzose, very hard, calcareous in part, dolomitic in part, tight, no shows.
2,300.00 to 2,305.00 (5.00)	50%	Shale	dark gray to dark brownish gray, blocky to subfissile, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.
	20%	Marlstone calcareous	buff to light to medium gray, very argillaceous, soft, tight, no shows.

	20%	Limestone black to dark gray, micritic to cryptocrystalline, very hard, very silty in part (grading to siltstone), dolomitic, tight, no shows, common to abundant disseminated pyrite, with minor chert, mottled, massive angular fragments, very hard, common microfossils.
	10%	Siltstone medium to dark brownish gray, quartzose, very hard, calcareous in part, dolomitic in part, tight, no shows, grading in part to very fine grained sandstone (white to light gray, slightly dolomitic).
2,305.00 to 2,310.00 (5.00)	80%	Shale dark gray to dark brownish gray, blocky to subfissile, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite with trace siltstone, medium to dark brownish gray, quartzose, very hard, calcareous in part, dolomitic in part, tight, no shows, grading in part to very fine grained sandstone (white to light gray, slightly dolomitic).
	20%	Limestone black to dark gray, micritic to cryptocrystalline, very hard, very silty in part (grading to siltstone), dolomitic, tight, no shows, common to abundant disseminated pyrite, with minor chert, mottled, massive angular fragments, very hard, common microfossils.
2,310.00 to 2,320.00 (10.00)	100%	Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.
2,320.00 to 2,325.00 (5.00)	100%	Shale dark gray to dark brownish gray, blocky to subfissile, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite with trace siltstone, medium to dark brownish gray, quartzose, very hard, calcareous in part, dolomitic in part, tight, no shows, grading in part to very fine grained sandstone (white to light gray, slightly dolomitic).
2,325.00 to 2,330.00 (5.00)	95%	Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.
	5%	Siltstone medium to dark brownish gray, quartzose, sandy in part, very hard, calcareous in part, dolomitic in part, tight, no shows.
2,330.00 to 2,335.00 (5.00)	55%	Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.
	40%	Limestone medium gray to medium brownish gray, micritic, very argillaceous, grading to marlstone in part, poorly to moderately indurated, common disseminated pyrite, tight, no shows.
	5%	Siltstone medium to dark brownish gray, quartzose, sandy in part, very hard, calcareous in part, dolomitic in part, tight, no shows.

2,335.00 to 2,340.00 (5.00)	50%	<p>Limestone medium to dark gray to dark brownish gray, mainly micritic, occasionally cryptocrystalline (brownish black), very argillaceous, dolomitic, bituminous in part, tight, no shows, common to abundant disseminated pyrite, common microfossils.</p>
	30%	<p>Marlstone calcareous medium gray to medium brownish gray, chalky, soft, very argillaceous, tight, no shows.</p>
	20%	<p>Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.</p>
2,340.00 to 2,345.00 (5.00)	55%	<p>Limestone medium to dark gray to dark brownish gray, mainly micritic, occasionally cryptocrystalline (brownish black), very argillaceous, dolomitic, bituminous in part, tight, no shows, common to abundant disseminated pyrite, common microfossils.</p>
	35%	<p>Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite.</p>
	10%	<p>Marlstone calcareous medium gray to medium brownish gray, chalky, soft, very argillaceous, tight, no shows.</p>
2,345.00 to 2,350.00 (5.00)	50%	<p>Limestone medium to dark gray to dark brownish gray, mainly micritic, occasionally cryptocrystalline (brownish black), very argillaceous, dolomitic, bituminous in part, tight, no shows, common to abundant disseminated pyrite, common microfossils.</p>
	30%	<p>Shale dark gray to dark brownish gray, blocky to subfissile, bituminous, poorly indurated, easily hydrated in part, dolomitic in part, common to abundant disseminated pyrite, common healed calcareous filled fractures, common calcite sparite.</p>
	20%	<p>Marlstone calcareous medium gray to medium brownish gray, chalky, soft, very argillaceous, tight, no shows.</p>
2,350.00 to 2,355.00 (5.00)	60%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	20%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite, trace slickensides.</p>
	20%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.</p>
2,355.00 to 2,360.00 (5.00)	70%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	20%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite, common slickensides.</p>
	10%	<p>Marlstone calcareous</p>

mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.

2,360.00 to 2,365.00 (5.00)	50%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite, trace slickensides.</p>
	30%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	20%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.</p>
2,365.00 to 2,370.00 (5.00)	50%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite, trace slickensides.</p>
	30%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.</p>
	20%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
2,370.00 to 2,375.00 (5.00)	40%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.</p>
	40%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	20%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.</p>
2,375.00 to 2,380.00 (5.00)	60%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	20%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.</p>
	20%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.</p>
2,380.00 to 2,385.00 (5.00)	40%	<p>Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.</p>
	35%	<p>Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.</p>
	25%	<p>Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous,</p>

2,385.00 to 2,390.00 (5.00)	50%	bituminous, tight, no shows. Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.
	30%	Limestone medium to dark brownish gray, occasionally buff, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, trace healed fractures filled with calcite, trace calcite sparite, no shows, common microfossils, common disseminated pyrite.
	20%	Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.
2,390.00 to 2,395.00 (5.00)	50%	Limestone medium to dark brownish gray to buff, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.
	30%	Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.
	20%	Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.
2,395.00 to 2,400.00 (5.00)	40%	Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.
	40%	Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, trace healed fractures filled with calcite, trace calcite sparite, no shows, common microfossils, common disseminated pyrite.
	20%	Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.
2,400.00 to 2,405.00 (5.00)	70%	Shale dark gray to medium brownish gray, blocky to subfissile, poorly indurated in part, bituminous in part, calcareous, slightly dolomitic, common disseminated pyrite.
	20%	Marlstone calcareous mottled to buff to white to light gray, poorly indurated, chalky, argillaceous, bituminous, tight, no shows.
	10%	Limestone medium to dark brownish gray, microcrystalline, occasionally cryptocrystalline, slightly silty, bituminous, argillaceous, dolomitic, moderately hard to very hard, trace fracture porosity, no shows, common microfossils, common disseminated pyrite.
2,405.00 to 2,425.00 (20.00)	100%	Shale dark gray to dark brownish gray, blocky to subfissile, easily hydrated, poorly indurated, very calcareous, grading to very argillaceous marlstone, kaolinitic in part, common disseminated pyrite trace milky white calcite sparite, trace healed fractures with trace limestone, dark gray to black, micritic to cryptocrystalline, very argillaceous, bituminous, very hard, tight, no shows.

2,425.00 to 2,450.00 (25.00)	100% Shale dark gray to dark brownish gray, blocky to subfissile, easily hydrated, poorly indurated, very calcareous, grading to very argillaceous marlstone (up to 75%), kaolinitic, common disseminated pyrite trace milky white calcite sparite, trace healed fractures.
2,450.00 to 2,480.00 (30.00)	100% Shale dark brownish gray (poorly indurated) to occasionally black (moderately to well indurated), blocky to subfissile, easily hydrated, very calcareous, grading to very argillaceous marlstone (up to 75%), kaolinitic, common disseminated pyrite trace milky white calcite sparite, trace healed fractures.
2,480.00 to 2,490.00 (10.00)	100% Shale dark brownish gray (poorly indurated) to occasionally black (moderately to well indurated), blocky to subfissile, easily hydrated, very calcareous, grading to less calcareous, kaolinitic, common disseminated pyrite, trace milky white calcite sparite, trace to common healed fractures, trace slickensides.

Banff: 2,493.5 MD, 2,376.9 TVD, -1,566.5 SSL

2,490.00 to 2,500.00 (10.00)	100% Shale mainly black, occasionally dark brownish gray, poorly to moderately indurated, blocky to subfissile, easily hydrated in part, very calcareous, grading to less calcareous, kaolinitic, common disseminated pyrite, common milky white calcite sparite, common to abundant healed fractures, common to abundant slickensides with marlstone (up to 20%), black to occasionally buff to medium to dark gray, poorly indurated, very argillaceous, tight, no shows.
2,500.00 to 2,515.00 (15.00)	100% Shale mainly black, occasionally dark brownish gray, poorly to moderately indurated, blocky to subfissile, easily hydrated in part, calcareous, grading to less calcareous, kaolinitic, common disseminated pyrite, common milky white calcite sparite, common to abundant healed fractures, trace slickensides.
2,515.00 to 2,520.00 (5.00)	100% Shale black, moderately indurated, blocky to subfissile, slightly carbonaceous, calcareous, grading to less calcareous, trace to common disseminated pyrite, trace milky white calcite sparite, common healed fractures, trace slickensides with trace limestone, buff, micritic, moderately hard, slightly kaolinitic, very argillaceous, tight, no shows.
2,520.00 to 2,530.00 (10.00)	100% Shale black, moderately indurated, blocky to subfissile, slightly carbonaceous, calcareous, grading to less calcareous, trace to common disseminated pyrite, trace milky white calcite sparite, common healed fractures, trace slickensides.
2,530.00 to 2,540.00 (10.00)	100% Shale black to occasionally dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace pyrite nodules, trace fractures filled with calcite and pyrite, trace calcite sparite.
2,540.00 to 2,545.00 (5.00)	100% Shale black to occasionally dark gray, blocky to fissile in part, slightly calcareous grading to marlstone (10%), carbonaceous in part, bituminous in part, moderately

to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace pyrite nodules, trace fractures filled with calcite and pyrite, trace calcite sparite.

2,545.00 to 2,550.00 (5.00)	100% Shale black to occasionally dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace pyrite nodules, trace fractures filled with calcite and pyrite, trace calcite sparite.
2,550.00 to 2,570.00 (20.00)	100% Shale dark gray to occasionally black, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with calcite and pyrite, trace calcite sparite, trace slickensides.
2,570.00 to 2,590.00 (20.00)	100% Shale dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with calcite and pyrite, trace calcite sparite, common slickensides.
2,590.00 to 2,595.00 (5.00)	100% Shale dark gray, blocky to fissile in part, slightly calcareous grading to marlstone (10%), carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with calcite and pyrite, trace calcite sparite, common slickensides.
2,595.00 to 2,605.00 (10.00)	100% Shale dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with calcite and pyrite, trace calcite sparite, common slickensides.
2,605.00 to 2,620.00 (15.00)	100% Shale dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with chlorite and pyrite, trace calcite sparite, common slickensides.
2,620.00 to 2,635.00 (15.00)	100% Shale dark gray to occasionally black, blocky to fissile in part, slightly calcareous grading to marlstone (10%), carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, common to abundant disseminated pyrite, trace fractures filled with chlorite and pyrite, trace calcite sparite, common slickensides.
2,635.00 to 2,645.00 (10.00)	100% Shale black to occasionally dark gray to dark brownish gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, trace disseminated pyrite, trace fractures filled with chlorite and pyrite, trace calcite sparite, trace slickensides.

2,645.00 to 2,655.00 (10.00)	100% Shale dark brownish gray to black to dark gray, blocky to fissile in part, slightly calcareous, carbonaceous in part, bituminous in part, moderately to poorly indurated, easily hydrated in part, kaolinitic in part, trace disseminated pyrite, trace fractures filled with chlorite and pyrite, trace calcite sparite, trace slickensides.
2,655.00 to 2,660.00 (5.00)	100% Shale dark gray to black, blocky to subfissile, poorly to moderately indurated, slightly calcareous, slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with siltstone (trace), light gray to light brownish gray, quartzose, slightly argillaceous. moderately hard, slightly dolomitic, tight, no shows.
2,660.00 to 2,665.00 (5.00)	100% Shale dark gray to black, blocky to subfissile, poorly to moderately indurated, slightly calcareous grading to marlstone (10%) in part, slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with siltstone (trace), light gray to light brownish gray, quartzose, slightly argillaceous. moderately hard, slightly dolomitic, tight, no shows.
2,665.00 to 2,670.00 (5.00)	100% Shale dark gray to black to medium gray brown, blocky to subfissile, poorly to moderately indurated, slightly calcareous grading to marlstone in part (5%), slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows.
2,670.00 to 2,675.00 (5.00)	100% Shale dark gray to black to medium gray brown, blocky to subfissile, poorly to moderately indurated, slightly calcareous, slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows.
2,675.00 to 2,680.00 (5.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, slightly calcareous grading to marlstone in part (10%), slightly silty, slightly kaolinitic, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows.
2,680.00 to 2,690.00 (10.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, very slightly calcareous, slightly kaolinitic, slightly silty, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite.
2,690.00 to 2,695.00 (5.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, slightly calcareous grading to marlstone in part (10%), slightly silty, slightly kaolinitic, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite and pyrite, also with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows.

2,695.00 to 2,715.00 (20.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite, also with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows.
2,715.00 to 2,720.00 (5.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, trace fractures lined with calcite and pyrite, trace loose calcite, with limestone (trace to 5%), brownish black, cryptocrystalline to microcrystalline, very hard, argillaceous, pyrobituminous, dolomitic, tight, no shows with sandstone (trace), white, quartzose, very fine grained, subrounded, well sorted, moderately hard, dolomite cement, tight to poor intergranular porosity, no shows.
2,720.00 to 2,725.00 (5.00)	100% Shale medium to dark gray to black, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, with siltstone (trace), white to light gray to medium brownish gray, quartzose, occasionally very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,725.00 to 2,730.00 (5.00)	100% Shale medium to dark gray to black, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, trace euhedral clear quartz crystals, with siltstone (trace), white to light gray to medium brownish gray, quartzose, occasionally very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,730.00 to 2,735.00 (5.00)	100% Shale light to medium to dark gray, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, with siltstone (trace), white to light gray to medium brownish gray, quartzose, occasionally very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,735.00 to 2,740.00 (5.00)	100% Shale light to medium to dark gray, blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, trace euhedral calcite crystals, with siltstone (trace), white to light gray to medium brownish gray, quartzose, occasionally very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,740.00 to 2,745.00 (5.00)	100% Shale light to medium to dark gray (50%) to black (50%), blocky to subfissile, poorly to moderately indurated, dolomitic, very slightly calcareous, slightly silty, slightly kaolinitic, common disseminated pyrite, trace calcite and dolomite crystals, trace to common healed fractures, with siltstone (trace), white to light gray to medium brownish gray, quartzose, occasionally very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.

2,745.00 to 2,750.00 (5.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, very slightly calcareous, slightly silty, kaolinitic, common disseminated pyrite.
2,750.00 to 2,765.00 (15.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, moderately calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite, with sandstone (trace), white to light gray, quartzose, very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,765.00 to 2,770.00 (5.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic grading to marlstone in part, moderately calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite, trace dolomite filled healed fractures and sparite, trace loose euhedral clear quartz crystals.
2,770.00 to 2,775.00 (5.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic grading to marlstone in part, moderately calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite.
2,775.00 to 2,780.00 (5.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, moderately calcareous grading to marlstone in part, slightly silty, kaolinitic, trace to common disseminated pyrite, trace loose pyrite nodules.
2,780.00 to 2,785.00 (5.00)	100% Shale light to medium gray (80%) to black (20%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic grading to marlstone in part, slightly calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite with sandstone (trace), light gray, quartzose, very fine grained, subrounded, well sorted, very hard, silica cement, tight, no shows.
2,785.00 to 2,790.00 (5.00)	100% Shale light to medium gray (90%) to black (10%), blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic grading to marlstone in part, slightly calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite.
2,790.00 to 2,795.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic grading to marlstone in part, slightly calcareous, slightly silty, kaolinitic, trace to common disseminated pyrite.
2,795.00 to 2,800.00 (5.00)	100% Shale light to medium gray (90%) to black (10%), blocky to subfissile, poorly to moderately indurated, easily hydrated, mainly dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace pyrite nodules.

2,800.00 to 2,815.00 (15.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, mainly dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
2,815.00 to 2,820.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, mainly dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace loose pyrite.
2,820.00 to 2,835.00 (15.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, mainly dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace to common euhedral clear quartz and white dolomite crystals.
2,835.00 to 2,840.00 (5.00)	100% Shale light gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic.
2,840.00 to 2,845.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace to common euhedral clear quartz crystals, trace loose pyrite.
2,845.00 to 2,850.00 (5.00)	100% shale light gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic.
2,850.00 to 2,855.00 (5.00)	100% Shale light gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic, trace euhedral clear quartz crystals.
2,855.00 to 2,880.00 (25.00)	100% Shale light gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic.
2,880.00 to 2,895.00 (15.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic.
2,895.00 to 2,900.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace to 10%), dark gray to black.
2,900.00 to 2,910.00 (10.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace), dark gray to black.
2,910.00 to 2,920.00 (10.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace

2,920.00 to 2,925.00 (5.00)	100% Shale to 10%), dark gray to black. light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace), dark gray to black.
2,925.00 to 2,930.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace to 10%), dark gray to black also with limestone (trace), black, cryptocrystalline to microcrystalline, argillaceous, very hard, dolomitic, tight, pyrobituminous.
2,930.00 to 2,945.00 (15.00)	100% Shale mainly medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic.
2,945.00 to 2,955.00 (10.00)	100% Shale mainly medium gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic with shale (trace to 10%), dark gray to black.
2,955.00 to 2,960.00 (5.00)	100% Shale dark gray to black (50%) to medium gray (50%), blocky to subfissile, poorly to moderately indurated, easily hydrated, dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
2,960.00 to 2,965.00 (5.00)	100% Shale medium to dark gray to occasionally black, blocky to subfissile, poorly to moderately indurated, easily hydrated, dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with siltstone (trace), medium to dark gray, quartzose, very argillaceous, tight, no shows.
2,965.00 to 2,980.00 (15.00)	100% Shale medium to dark gray, blocky to subfissile, poorly to moderately indurated, easily hydrated, dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
2,980.00 to 2,995.00 (15.00)	100% Shale medium to dark gray, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, dolomitic, slightly calcareous, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
2,995.00 to 3,015.00 (20.00)	100% Shale light gray, occasionally medium to dark gray to black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,015.00 to 3,020.00 (5.00)	100% Shale light gray, occasionally medium to dark gray to black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with trace siltstone, medium gray brown, quartzose, argillaceous, dolomite cement, very hard, tight, no shows.

3,020.00 to 3,025.00 (5.00)	100% Shale light gray, occasionally medium to dark gray to black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, slightly dolomitic, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, rare rounded dolomite nodules, very hard.
3,025.00 to 3,040.00 (15.00)	100% Shale light gray, occasionally medium to dark gray to black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,040.00 to 3,060.00 (20.00)	100% Shale medium gray, rare black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,060.00 to 3,075.00 (15.00)	100% Shale medium gray, rare black, blocky to subfissile, waxy, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,075.00 to 3,080.00 (5.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace medium gray dolomite nodules, trace dolomite filled healed fractures.
3,080.00 to 3,085.00 (5.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace dolomite, dark gray, microcrystalline, very argillaceous, hard, tight, no shows, trace dolomite filled healed fractures.
3,085.00 to 3,090.00 (5.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace loose dolomite sparite.
3,090.00 to 3,095.00 (5.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace siltstone, medium gray, quartzose, very calcareous, very argillaceous, poorly indurated, tight, no shows, also with trace medium gray dolomite nodules.
3,095.00 to 3,100.00 (5.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, also with dolomite (trace), medium gray, microcrystalline to micritic, moderately hard, calcareous, argillaceous, pyritic, tight, no shows.

3,100.00 to 3,105.00 (5.00)	100% Shale medium to dark gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,105.00 to 3,110.00 (5.00)	100% Shale light to medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,110.00 to 3,120.00 (10.00)	100% Shale medium gray, rare dark gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately dolomitic (dolomitic marlstone in part), calcareous in part, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,120.00 to 3,125.00 (5.00)	100% Shale medium gray, up to 10% black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, dolomitic (dolomitic marlstone in part), increasingly calcareous in part, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,125.00 to 3,130.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace calcite and pyrite filled fractures.
3,130.00 to 3,135.00 (5.00)	100% Shale light to medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,135.00 to 3,140.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,140.00 to 3,145.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace calcite filled fractures, trace rounded dolomite nodules.
3,145.00 to 3,150.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace medium gray rounded dolomite nodules.
3,150.00 to 3,155.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, trace limestone, black, microcrystalline to cryptocrystalline, very hard, very argillaceous, slightly dolomitic, tight, no shows.

Lower Banff Marker: 3,157.0 MD, 2,970.1 TVD, -2,159.7 SSL

3,155.00 to 3,160.00 (5.00)	100% Shale medium to dark gray, occasionally black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,160.00 to 3,170.00 (10.00)	100% Shale medium gray (40%) to dark gray to black (60%), blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, moderately to very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite.
3,170.00 to 3,180.00 (10.00)	100% Shale dark gray to black, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, becoming dolomitic in part, slightly silty, slightly kaolinitic, trace disseminated pyrite, trace pyrite nodules.
3,180.00 to 3,190.00 (10.00)	100% Shale medium gray (70%), blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with shale (30%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with limestone (up to 10%), medium gray, micritic, moderately hard, very argillaceous, tight, no shows.
3,190.00 to 3,195.00 (5.00)	100% Shale medium gray (85%), blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with shale (15%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with limestone (up to 10%), medium gray, micritic, moderately hard, very argillaceous, tight, no shows.
3,195.00 to 3,200.00 (5.00)	100% Shale medium gray (90%), blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous with calcareous marlstone, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with shale (10%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with limestone (up to 10%), medium gray, micritic, moderately hard, very argillaceous, tight, no shows.
3,200.00 to 3,220.00 (20.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous in part grading to calcareous marlstone, becoming slightly dolomitic in part, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite with shale (up to 10%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with varying amounts of limestone, medium gray, micritic, poorly indurated to moderately hard, very argillaceous, tight, no shows and with dolomite (trace), medium gray, microcrystalline, moderately hard, argillaceous, tight, no shows.
3,220.00 to 3,230.00 (10.00)	100% Shale medium gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated in part, very calcareous in part grading to calcareous

marlstone, becoming slightly dolomitic in part, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, with varying amounts of limestone, medium gray, micritic, poorly indurated to moderately hard, very argillaceous, tight, no shows and with dolomite (trace), medium gray, microcrystalline, moderately hard, argillaceous, tight, no shows.

3,230.00 to 3,240.00 (10.00)	100% Shale medium dark gray, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated in part, very calcareous in part grading to calcareous marlstone, becoming slightly dolomitic in part, slightly silty, kaolinitic, bentonitic, trace disseminated pyrite, with varying amounts of limestone, medium gray, micritic, poorly indurated to moderately hard, very argillaceous, tight, no shows and 10% black shale.
3,240.00 to 3,250.00 (10.00)	100% Shale medium gray tan (85%), blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous with calcareous marlstone, slightly silty to sandy, kaolinitic, bentonitic, trace disseminated pyrite with shale (15%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with limestone (up to 10%), medium gray, micritic, moderately hard, very argillaceous, tight, no shows.
3,250.00 to 3,255.00 (5.00)	100% Shale medium gray tan (65%), blocky to subfissile, waxy in part, poorly to moderately indurated, trace very siliceous (very hard, silicified shale), easily hydrated, very calcareous with calcareous marlstone, slightly silty to sandy, kaolinitic, bentonitic, trace disseminated pyrite with shale (35%) dark gray to black, subfissile, moderately indurated, slightly bituminous also with limestone (up to 10%), medium gray, micritic, moderately hard, very argillaceous, tight, no shows.
3,255.00 to 3,265.00 (10.00)	100% Shale (60%) black to dark gray, subfissile, moderately indurated, trace very siliceous (very hard, silicified shale), slightly bituminous also with shale (40%) medium gray tan, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, very calcareous with calcareous marlstone, slightly silty to sandy, kaolinitic, bentonitic, trace disseminated pyrite with up to 5% translucent dolomite rhombs (mud additives)
3,265.00 to 3,275.00 (10.00)	100% Shale black to dark gray, subfissile to blocky, moderately indurated, soft to brittle, trace very siliceous (very hard, silicified shale), slight to moderate bituminous, slightly breccia in part, also with shale (5%) medium gray tan, blocky to subfissile, waxy in part, poorly to moderately indurated, easily hydrated, weak calcareous with minor calcareous marlstone, slightly silty to sandy, kaolinitic, bentonitic, trace to common disseminated pyrite with up to 5% translucent dolomite rhombs (mud additives)
3,275.00 to 3,280.00 (5.00)	100% Shale black to dark gray, subfissile to blocky, moderately indurated, soft to brittle, trace very siliceous (very hard, silicified shale), slightly bituminous, breccia in part, crenulated in part, carbonaceous stringers grading to coal, black, shaley; also with shale (15%) medium gray tan, blocky to subfissile, poorly to moderately indurated, easily hydrated, weak calcareous, slightly silty to sandy, kaolinitic with kaolin infilling fracture, bentonitic, trace to common disseminated pyrite with up to 1% translucent dolomite rhombs (mud additives)

3,280.00 to 3,285.00 100% **Shale**
(5.00) black to dark gray, subfissile to blocky, moderately indurated, soft to brittle, trace very siliceous (very hard, silicified shale), slight to moderate bituminous, breccia in part, crenulated in part, kaolinitic with kaolin infilling fracture, carbonaceous stringers grading to coal also with common interstitial kaolin and pyrite, easily hydrated, weak calcareous, bentonitic in part, trace to common disseminated pyrite; minor translucent dolomite rhombs (mud additives)

First Black: 3,287.0 MD, 3,085.9 TVD, -2,275.5 SSL

3,285.00 to 3,295.00 100% **Shale**
(10.00) black, subfissile to blocky, moderately indurated, brittle to firm, trace very siliceous (very hard, silicified shale), slight to moderate bituminous, crenulated in part, slight to moderately carbonaceous with carbonaceous fragments, minor pyrite, weak calcareous, also with shale black to dark gray brown, soft, bentonitic, trace to common pyrite, blocky, easily hydrated (slight decrease in the bentonitic shales)

3,295.00 to 3,300.00 100% **Shale**
(5.00) black, subfissile to blocky, moderately indurated, brittle to firm, trace siliceous (very hard, silicified shale), slight to moderate bituminous, moderately carbonaceous with carbonaceous fragments, minor pyrite, weak calcareous, also with shale (15-20%) black to dark gray brown, soft, bentonitic, kaolinitic in part, trace to common pyrite, blocky, easily hydrated; minor Siderite stringers brown, hard, massive, shaley.

3,300.00 to 3,305.00 100% **Shale**
(5.00) black, subfissile to blocky, moderately indurated, brittle to firm, trace siliceous (very hard, silicified shale), slight to moderate bituminous, moderately carbonaceous with carbonaceous fragments, minor pyrite, weak calcareous, also with shale (15-20%) black to dark gray brown, soft, bentonitic, kaolinitic in part, trace to common pyrite, blocky, easily hydrated; with minor Sandstone: translucent quartz, fine to medium grain, stringer to loose, shale coated, no shows, no porosity.

3,305.00 to 3,314.00 100% **Shale**
(9.00) black, subfissile to blocky, moderately indurated, brittle to firm, trace siliceous (very hard, silicified shale), slight to moderate bituminous, moderately carbonaceous with carbonaceous fragments, minor pyrite, weak calcareous, also with shale (40%) black to dark gray brown, soft, bentonitic, kaolinitic in part, common pyrite, blocky, easily hydrated.

3,314.00 to 3,320.00 100% **Shale**
(6.00) black, blocky, massive, poorly to moderately indurated, trace siliceous (very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, slightly dolomitic, slightly bentonite, trace rounded light brown dolomite nodules.

3,320.00 to 3,325.00 100% **Shale**
(5.00) black, blocky, massive, poorly to moderately indurated, very siliceous (10%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, slightly dolomitic, slightly bentonite, trace rounded loose opaque quartz grains.

3,325.00 to 3,330.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (10 to 20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, slightly dolomitic, slightly bentonite, with trace sandstone, light to medium gray, quartzose, very fine to fine grained, subrounded to subangular, well sorted, hard, siliceous, argillaceous, tight, no shows, trace black bitumen specks also with trace chert, yellow, massive angular fragment.
3,330.00 to 3,335.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (10-20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, slightly dolomitic, slightly bentonite.
3,335.00 to 3,340.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (10-20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, slightly dolomitic, slightly bentonite, trace medium brown siliceous siltstone, trace medium brown micritic limestone.
3,340.00 to 3,345.00 (5.00)	100% Shale black (trace light gray), blocky, massive, poorly to moderately indurated, very siliceous (10 to 20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace micromicaceous, trace disseminated pyrite, trace pyrite lined fractures, slightly dolomitic, slightly bentonite, easily hydrated in part.
3,345.00 to 3,350.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (10-20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, slightly bentonitic, easily hydrated in part.
3,350.00 to 3,355.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (20-30%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, slightly bentonite, easily hydrated in part with trace sandstone, white quartzose, very fine to fine (lower) grained, subangular, well sorted, moderately hard, silica cement, tight to poor (5%) intergranular porosity, no shows.
3,355.00 to 3,360.00 (5.00)	100% Shale black, blocky, massive, poorly to moderately indurated, very siliceous (10-20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous with chert, trace, light brown speckled fragments, also with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.
3,360.00 to 3,370.00 (10.00)	100% Shale black, blocky, massive, poorly to moderately indurated in part, very siliceous in part (60-100%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace to common disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, easily hydrated in part with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.

Exshaw: 3,376.6 MD, 3,166.3 TVD, -2,355.9 SSL

Devonian: 3,378.8 MD, 3,168.3 TVD, -2,357.9 SSL

3,370.00 to 3,390.00 (20.00)	100% Shale black, blocky, moderately indurated in part, very siliceous in part (30-80%, very hard, silicified shale), carbonaceous, trace to common disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.
3,390.00 to 3,395.00 (5.00)	100% Shale black to brownish black, blocky, moderately indurated in part, very siliceous in part (80%, very hard, silicified shale), carbonaceous, trace to common disseminated pyrite, common to abundant calcite filled and quartz lined fractures, very slightly dolomitic, slightly calcareous with dolomite, trace to 5%, medium brown, microcrystalline, argillaceous, hard, tight, no shows.
3,395.00 to 3,405.00 (10.00)	100% Shale black, blocky, very siliceous in part (80-100%, very hard, silicified shale), moderately indurated in part, carbonaceous, trace to common disseminated pyrite, very slightly dolomitic, slightly calcareous, trace calcite filled fractures with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.
3,405.00 to 3,415.00 (10.00)	100% Shale black, blocky, very siliceous in part (60-90%, very hard, silicified shale), moderately indurated in part, carbonaceous, trace to common disseminated pyrite, trace calcite filled fractures, very slightly dolomitic, slightly calcareous.
3,415.00 to 3,420.00 (5.00)	100% Shale black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (40%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic.
3,420.00 to 3,435.00 (15.00)	100% Shale black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (30-40%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic, trace white bentonite.
3,435.00 to 3,440.00 (5.00)	100% Shale black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (30%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic, moderately bentonitic, with trace dolomite, light to medium gray, microcrystalline to very fine crystalline, argillaceous, slightly calcareous, tight, no shows.
3,440.00 to 3,450.00 (10.00)	100% Shale black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (40%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic, moderately bentonitic, with dolomite (up to 10%), light to medium gray, microcrystalline to very fine crystalline, argillaceous, slightly calcareous, tight, no shows.
3,450.00 to 3,460.00 (10.00)	100% Shale black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (10-20%, very hard, silicified shale), carbonaceous, common to

abundant disseminated pyrite, very slightly dolomitic, moderately bentonitic with thin white bentonite laminations, calcareous in part, easily hydrated in part, with dolomite (up to 5%), light to medium gray, microcrystalline to very fine crystalline, argillaceous, slightly calcareous, tight, no shows.

3,460.00 to 3,470.00 (10.00) 100% **Shale**
 black, blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (15-20%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic, moderately bentonitic with trace medium gray bentonite grains, also with thin white bentonite laminations, calcareous in part, easily hydrated in part, and with dolomite, trace, light to medium gray, microcrystalline to very fine crystalline, argillaceous, slightly calcareous, tight, no shows.

Besa River: 3,471.0 MD, 3,251.4 TVD, -2,441.0 SSL

3,470.00 to 3,475.00 (5.00) 100% **Shale**
 black (60%), blocky, occasionally subfissile, moderately indurated in part, very siliceous in part (15%, very hard, silicified shale), carbonaceous, common to abundant disseminated pyrite, very slightly dolomitic, moderately bentonitic with shale (40%), medium gray, earthy, occasionally blocky, very soft, bentonitic, kaolinitic, with dolomite, trace, light to medium gray, microcrystalline to very fine crystalline, argillaceous, slightly calcareous, tight, no shows.

3,475.00 to 3,490.00 (15.00) 100% **Shale**
 medium gray, earthy, massive, occasionally blocky, poorly indurated, silty, bentonitic, common disseminated pyrite, with shale, trace, black, blocky, moderately indurated, carbonaceous, common disseminated pyrite.

3,490.00 to 3,495.00 (5.00) 100% **Shale**
 medium gray, earthy, massive, occasionally blocky, poorly indurated, silty, bentonitic, easily hydrated, common disseminated pyrite, slightly dolomitic with shale (15%), black, blocky, moderately indurated, carbonaceous, common disseminated pyrite.

3,495.00 to 3,500.00 (5.00) 100% **Shale**
 medium gray, earthy, massive, occasionally blocky, poorly indurated, silty, bentonitic, easily hydrated, common disseminated pyrite, with shale (15%), black, blocky, moderately indurated, carbonaceous, common disseminated pyrite, also with trace dolomite nodules, medium gray brown.

3,500.00 to 3,505.00 (5.00) 100% **Shale**
 dark gray, rare medium gray, earthy, massive, occasionally blocky, poorly indurated, silty with trace thin siltstone laminations (dark gray, quartzose, dolomitic, moderately hard), bentonitic, easily hydrated, common disseminated pyrite, slightly dolomitic with shale (5%), black, blocky, moderately indurated, carbonaceous, common disseminated pyrite.

3,505.00 to 3,510.00 (5.00) 100% **Shale**
 dark gray, rare medium gray, earthy, massive, occasionally blocky, poorly indurated, silty with trace thin siltstone laminations (dark gray, quartzose, dolomitic, moderately hard), bentonitic, common disseminated pyrite, slightly dolomitic with shale (5%), black, blocky, moderately indurated, carbonaceous, common disseminated pyrite.

3,510.00 to 3,520.00 (10.00)	100% Shale dark gray, rare medium gray, earthy, massive, occasionally blocky, poorly indurated, silty with trace thin siltstone laminations (dark gray, quartzose, dolomitic, moderately hard), bentonitic, common disseminated pyrite, slightly dolomitic.
3,520.00 to 3,530.00 (10.00)	100% Shale medium to dark gray, rare black, earthy, massive, occasionally blocky, poorly indurated, silty with trace thin siltstone laminations (light gray, quartzose, dolomitic, moderately hard, pyrobitumen stain), bentonitic, common disseminated pyrite, slightly dolomitic with shale (5%), black, blocky, moderately indurated, carbonaceous, common disseminated pyrite.
3,530.00 to 3,535.00 (5.00)	100% Shale dark gray to occasionally black, earthy, subfissile to blocky, poorly to moderately indurated, disseminated pyrite throughout, slightly bentonitic.
3,535.00 to 3,540.00 (5.00)	100% Shale dark gray to black, earthy, subfissile to blocky, poorly to moderately indurated, disseminated pyrite throughout, slightly bentonitic.
3,540.00 to 3,545.00 (5.00)	100% Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, disseminated pyrite throughout, slightly bentonitic, slightly dolomitic with trace siltstone, light gray, quartzose, argillaceous, moderately hard, dolomitic, tight, no shows.
3,545.00 to 3,550.00 (5.00)	100% Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, disseminated pyrite throughout, slightly bentonitic, slightly dolomitic with trace sandstone, black, quartzose, very fine grained, subangular, well sorted, argillaceous, very hard, dolomitic, tight, no shows.
3,550.00 to 3,565.00 (15.00)	100% Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, kaolinitic in part, disseminated pyrite throughout, slightly bentonitic, decreasing dolomitic.
3,565.00 to 3,570.00 (5.00)	95% Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, kaolinitic in part, abundant disseminated pyrite throughout with thin pyrite laminations, slightly bentonitic, slightly dolomitic with dolomite, (trace to 5%), 5% Chert black, microcrystalline, pyrobituminous, very hard, tight, no shows.
3,570.00 to 3,575.00 (5.00)	100% Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, kaolinitic in part, abundant disseminated pyrite throughout with thin pyrite laminations, slightly bentonitic, slightly dolomitic with dolomite, (trace), black, microcrystalline, pyrobituminous, very hard, tight, no shows.

3,575.00 to 3,585.00 (10.00)	90%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, kaolinitic in part, abundant disseminated pyrite throughout with thin pyrite laminations, slightly bentonitic, slightly dolomitic.
	10%	Chert black, silicified shale, blocky, very hard, tight, no shows.
3,585.00 to 3,590.00 (5.00)	80%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly dolomitic.
	20%	Chert black, silicified shale, blocky, very hard, tight, no shows, trace dolomite lined fractures
3,590.00 to 3,595.00 (5.00)	60%	Chert black, silicified shale, blocky, very hard, tight, no shows, trace quartz lined fractures, trace loose quartz grains.
	20%	Dolomite speckled, large blocky fragments, mainly black with white dolomite grains, very fine grained, very argillaceous, moderately hard, tight, no shows, pyrobituminous.
	20%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly dolomitic.
3,595.00 to 3,600.00 (5.00)	60%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly dolomitic with shale (20%), dark brown, bituminous, earthy, poorly indurated.
	30%	Chert black, silicified shale, blocky, very hard, tight, no shows, trace dolomite lined fractures.
	10%	Dolomite speckled, large blocky fragments, mainly black with white dolomite grains, very fine grained, very argillaceous, moderately hard, tight, no shows, pyrobituminous.
3,600.00 to 3,605.00 (5.00)	60%	Chert black, silicified shale, blocky, very hard, tight, no shows, trace quartz lined fractures.
	40%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly dolomitic with dolomite (<5%), as above.
3,605.00 to 3,610.00 (5.00)	75%	Shale black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, siliceous.
	20%	Chert black, silicified shale, blocky, very hard, tight, no shows, trace quartz and

			dolomite lined fractures.
	5%	Dolomite	medium gray, microcrystalline, very argillaceous, moderately hard, tight, no shows.
3,610.00 to 3,615.00 (5.00)	65%	Shale	black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly siliceous.
	30%	Chert	black, silicified shale, blocky, very hard, tight, no shows.
	5%	Dolomite	medium gray, microcrystalline, very argillaceous, moderately hard, tight, no shows.
3,615.00 to 3,620.00 (5.00)	70%	Shale	black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly siliceous.
	30%	Chert	black, silicified shale, blocky, very hard, tight, no shows.
3,620.00 to 3,625.00 (5.00)	80%	Shale	black, occasionally dark gray to brownish black, subfissile to blocky, earthy in part, carbonaceous in part, poorly to moderately indurated, slightly silty, slightly kaolinitic, abundant disseminated pyrite throughout with thin pyrite laminations, slightly siliceous.
	20%	Chert	black, silicified shale, blocky, very hard, tight, no shows.
3,625.00 to 3,630.00 (5.00)	60%	Shale	black, occasionally brownish black, blocky to earthy, poorly to moderately indurated, occasionally well indurated, kaolinitic in part, bituminous in part, carbonaceous in part, slightly silty in part, occasionally very dolomitic, occasionally very siliceous, common disseminated pyrite.
	40%	Chert	black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
3,630.00 to 3,635.00 (5.00)	60%	Shale	black, occasionally brownish black, blocky to earthy, poorly to moderately indurated, occasionally well indurated, kaolinitic in part, bituminous in part, carbonaceous in part, slightly silty in part, occasionally very dolomitic, occasionally very siliceous, common disseminated pyrite, with shale (<5%), medium gray, very soft, kaolinitic.
	35%	Chert	as above.
	5%	Dolomite	black, microcrystalline, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,635.00 to 3,645.00 (10.00)	60%	Shale	black, occasionally brownish black, blocky to earthy, poorly to moderately indurated, occasionally well indurated, kaolinitic in part, bituminous in part, carbonaceous in part, slightly silty in part, occasionally very dolomitic, occasionally very siliceous, common disseminated pyrite.

3,645.00 to 3,650.00 (5.00)	40%	Chert black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
	70%	Shale black, occasionally brownish black, blocky to earthy, poorly to moderately indurated, occasionally well indurated, increasing kaolinite, bituminous in part, carbonaceous in part, slightly silty in part, occasionally very dolomitic, occasionally very siliceous, common disseminated pyrite.
	20%	Chert black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
	10%	Dolomite black to medium to dark gray, microcrystalline, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,650.00 to 3,655.00 (5.00)	65%	Shale medium gray, earthy, occasionally blocky, bentonitic, kaolinitic, dolomitic, disseminated pyrite.
	20%	Dolomite black to medium to dark gray, microcrystalline, argillaceous, moderately hard, pyrobituminous, tight, no shows.
	10%	Siltstone medium gray, quartzose, argillaceous, very hard, very siliceous, tight, no shows.
	5%	Chert black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
3,655.00 to 3,660.00 (5.00)	100%	Shale medium gray, earthy, occasionally blocky, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with siltstone (up to 5%), medium gray, quartzose, argillaceous, very hard, very siliceous, tight, no shows also with chert (up to 5%), black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
3,660.00 to 3,665.00 (5.00)	100%	Shale medium gray, earthy, occasionally blocky, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with dolomite (up to 5%) black to medium to dark gray, microcrystalline, argillaceous, moderately hard, pyrobituminous, tight, no shows, also with chert (up to 5%), black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
3,665.00 to 3,670.00 (5.00)	100%	Shale medium gray, earthy, occasionally blocky, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with siltstone (up to 15%), medium gray, quartzose, argillaceous, very hard, very siliceous, tight, no shows.
3,670.00 to 3,695.00 (25.00)	80%	Shale medium gray, earthy, occasionally blocky, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with chert (up to 5%), black, blocky, silicified shale, brittle fracture, very hard, common disseminated pyrite.
	20%	Dolomite black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,695.00 to 3,705.00 (10.00)	100%	Shale medium gray, occasionally black, earthy, occasionally blocky to subfissile, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite

with dolomite (up to 10%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.

3,705.00 to 3,715.00 (10.00)	100% Shale medium gray to dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with shale (trace), black, blocky, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,715.00 to 3,725.00 (10.00)	100% Shale medium to mainly dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, dolomitic, disseminated pyrite with shale (trace), black, blocky, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,725.00 to 3,740.00 (15.00)	100% Shale medium to dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, slightly dolomitic, trace floating chert grains (black, coarse grained, subrounded), trace to common disseminated pyrite with shale (trace), black, blocky, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,740.00 to 3,755.00 (15.00)	100% Shale medium to mainly dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, increasingly dolomitic, disseminated pyrite with chert (trace), black, blocky, silicified shale, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,755.00 to 3,765.00 (10.00)	100% Shale medium to mainly dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, slightly dolomitic, disseminated pyrite with chert (trace), black, silicified shale, blocky, very siliceous with dolomite (trace), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,765.00 to 3,775.00 (10.00)	100% Shale medium to dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, slightly dolomitic, trace to common disseminated pyrite becoming fissile in part and increasing well indurated in part with chert (trace), black, silicified shale, blocky, very siliceous with dolomite (trace), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,775.00 to 3,795.00 (20.00)	100% Shale medium to dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, slightly dolomitic, trace to common disseminated pyrite becoming fissile in part and increasing well indurated in part with chert (trace to 5%), black, silicified shale, blocky, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.

Muskwa: 3,799.50 MD, 3,507.1 TVD, -2,696.7 SSL

3,795.00 to 3,800.00 (5.00)	100% Shale medium to dark gray, earthy (marlstone), occasionally blocky to subfissile, soft, bentonitic, easily hydrated in part, kaolinitic, very slightly dolomitic, trace to common disseminated pyrite becoming fissile in part and increasing well indurated in part, shale becoming black (10%), fissile, moderately indurated, pyritic with chert (trace), black, silicified shale, blocky, very siliceous with dolomite (trace to 5%), black to medium to dark gray, microcrystalline, very silty, argillaceous, moderately hard, pyrobituminous, tight, no shows.
3,800.00 to 3,810.00 (10.00)	100% Shale black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, pyritic, poor to moderately indurated, occasionally well indurated, occasionally becoming medium to dark gray, earthy, poorly indurated, bentonitic, kaolinitic, also with dolomite (trace to 5%), medium gray to occasionally dark gray, microcrystalline to cryptocrystalline, very hard, argillaceous, tight, no shows.
3,810.00 to 3,815.00 (5.00)	100% Shale black to brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic becoming black (up to 20%), blocky, very hard, siliceous to silicified shale (chert), with shale (trace), medium gray, fissile, waxy, soft, bentonitic, also with dolomite (trace to 5%), medium gray to occasionally dark gray, microcrystalline to cryptocrystalline, very hard, argillaceous, tight, no shows.
3,815.00 to 3,820.00 (5.00)	100% Shale black to brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic becoming black (up to 5%), blocky, very hard, siliceous to silicified shale (chert), with dolomite (trace to 5%), medium gray to occasionally dark gray, microcrystalline to cryptocrystalline, very hard, argillaceous, tight, no shows.
3,820.00 to 3,825.00 (5.00)	100% Shale black to brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic becoming black (up to 25%), blocky, very hard, siliceous to silicified shale (chert), with dolomite (trace to 5%), medium gray to occasionally dark gray, microcrystalline to cryptocrystalline, fossiliferous in part, pyritic, very hard, argillaceous, tight, no shows.

Otter Park: 3,822.5MD, 3,519.6 TVD, -2,709.2 SSL

3,825.00 to 3,840.00 (15.00)	100% Shale black to occasionally brownish black, blocky to fissile, occasionally earthy (soft), slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic with shale, black (up to 25%), blocky, very hard, siliceous to silicified shale (chert).
3,840.00 to 3,850.00 (10.00)	100% Shale black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to

moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 25%), blocky, very hard, siliceous to silicified shale (chert), with dolomite (trace), medium gray to occasionally dark gray, microcrystalline to cryptocrystalline, pyritic, very hard, argillaceous, tight, no shows.

3,850.00 to 3,865.00 (15.00)	100% Shale	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 25%), blocky, very hard, siliceous to silicified shale (chert).
3,865.00 to 3,870.00	100% Shale	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale (chert), also with sandstone, trace, white, quartzose, silt to very fine grained, subrounded, well sorted, very hard, dolomitic, tight, no shows.
3,870.00 to 3,875.00	80% Shale 20% Limestone	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale (chert), also with dolomite, trace, black, microcrystalline, very hard, argillaceous, pyrobitumen, tight, no shows. white to black (mottled), micritic, very argillaceous, pyrobituminous, soft, tight, no shows.
3,875.00 to 3,880.00	100% Shale	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale (chert), also with dolomite, trace, black, microcrystalline, very hard, argillaceous, pyrobituminous, tight, no shows.
3,880.00 to 3,885.00	80% Shale 20% Dolomite	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale (chert). black, microcrystalline, very hard, argillaceous, pyrobituminous, tight, no shows.
3,885.00 to 3,890.00	100% Shale	black to occasionally brownish black, blocky to fissile, occasionally earthy, slightly siliceous, slightly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale (chert), also with dolomite, trace, black, microcrystalline, very hard, argillaceous, pyrobituminous, tight, no shows.
3,890.00 to 3,895.00	100% Shale	black to occasionally brownish black, blocky, subfissile to moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale.
3,895.00 to 3,900.00	100% Shale	black to occasionally brownish black, blocky, subfissile to moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale.

3,900.00 to 3,905.00	100%	Shale black to occasionally brownish black, blocky, subfissile to moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, slightly dolomitic, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale.
3,905.00 to 3,910.00	100%	Shale black to occasionally brownish black, blocky, subfissile to moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, with shale, black (up to 10%), blocky, very hard, siliceous to silicified shale.
3,910.00 to 3,915.00	100%	Shale black to occasionally brownish black, blocky, subfissile to moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, with shale, black (up to 5%), blocky, very hard, siliceous to silicified shale.
3,915.00 to 3,920.00	100%	Shale black to occasionally brownish black, amorphous to blocky in minor part, subfissile to rarely moderately fissile with irregular cleavage, occasionally earthy, slightly siliceous, commonly carbonaceous, slightly bituminous, pyritic, poor to moderately indurated, occasionally well indurated, with shale, black (up to 5%), blocky, very hard, siliceous to silicified shale.
3,920.00 to 3,925.00	100%	Shale brownish black to black, amorphous to blocky, subfissile to occasionally moderately fissile with irregular cleavage in minor part, occasionally earthy, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,925.00 to 3,930.00	100%	Shale dark brownish gray to black, amorphous to blocky, subfissile to occasionally moderately fissile with irregular cleavage in minor part, occasionally earthy, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,930.00 to 3,935.00	100%	Shale dark brownish gray to black, blocky to amorphous, subfissile to occasionally moderately fissile with irregular cleavage in minor part, occasionally earthy, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,935.00 to 3,940.00	100%	Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,940.00 to 3,945.00	100%	Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,945.00 to 3,950.00	100%	Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,950.00 to 3,955.00	100%	Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately

3,955.00 to 3,960.00	100%	indurated, firm to brittle. Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,960.00 to 3,965.00	100%	Shale dark brownish gray to black, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, occasionally earthy, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,965.00 to 3,970.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,970.00 to 3,975.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,975.00 to 3,980.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,980.00 to 3,985.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in minor part, subfissile to occasionally moderately fissile with irregular cleavage, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to moderately indurated, firm to brittle.
3,985.00 to 3,990.00	100%	Shale as above but becoming more tabular and fissility increasing.
3,990.00 to 3,995.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
3,995.00 to 4,000.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
4,000.00 to 4,006.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
4,006.00 to 4,010.00	100%	Shale dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
4,010.00 to 4,015.00	100%	Shale as above with rare clear calcite veins.

- 4,015.00 to 4,020.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,020.00 to 4,025.00 100% **Shale** as above but mainly dark brownish gray and amorphous with occasional clear to white calcite patches and or veins.
- 4,025.00 to 4,030.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,030.00 to 4,035.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,035.00 to 4,040.00 100% **Shale** dark brownish gray to black, mainly earthy, amorphous to blocky, subfissile to occasionally moderately fissile with irregular cleavage, slickenside, commonly carbonaceous, slightly bituminous, pyritic, poorly indurated, firm to brittle.
- 4,040.00 to 4,045.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.

Otter Park Marker: 4,045.0 MD, 3,620.9 TVD, -2,810.5 SSL

- 4,045.00 to 4,050.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to amorphous to tabular in part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,050.00 to 4,055.00 100% **Shale** as above with rare clear quartz veins? also shale which is black, blocky subfissile, siliceous, very hard.
- 4,055.00 to 4,060.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,060.00 to 4,065.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, poorly to well indurated, firm to brittle.
- 4,065.00 to 4,070.00 100% **Shale** as above well rare white limestone stringers.
- 4,070.00 to 4,075.00 100% **Shale** dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to

fissile, slightly micromicaceous, slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, moderately to well indurated, firm to brittle.

- | | | |
|----------------------|------|--|
| 4,075.00 to 4,080.00 | 100% | Shale dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, well indurated, firm to brittle. |
| 4,080.00 to 4,085.00 | 100% | Shale dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, well indurated, firm to brittle. |
| 4,085.00 to 4,090.00 | 100% | Shale dark brownish gray to black, earthy to resinous, blocky to tabular to amorphous in minor part, subfissile to occasionally moderately fissile with irregular cleavage to fissile, slightly micromicaceous, slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, pyritic, well indurated, firm to brittle. |
| 4,090.00 to 4,095.00 | 100% | Shale black, resinous to greasy, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage to fissile, micromicaceous, common slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. |
| 4,095.00 to 4,100.00 | 100% | Shale black, resinous to greasy, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage to fissile, micromicaceous, common slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. |
| 4,100.00 to 4,105.00 | 100% | Shale black, earthy, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage, micromicaceous, occasional slickenside, rare white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, slightly pyritic, moderately well to well indurated, firm to brittle. |
| 4,105.00 to 4,110.00 | 100% | Shale black, resinous to greasy, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage to fissile, micromicaceous, siliceous, common slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. |
| 4,110.00 to 4,115.00 | 100% | Shale black, resinous to greasy, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage to fissile, micromicaceous, siliceous, common slickenside, occasional white limestone stringers, rare white calcite patches and or veins, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. |
| 4,115.00 to 4,120.00 | 100% | Shale black to dark gray, resinous, blocky to tabular, subfissile to occasionally moderately fissile with irregular cleavage to fissile, micromicaceous, siliceous, common slickenside, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. |
| 4,120.00 to 4,124.00 | 100% | Shale black to dark gray, resinous, blocky to tabular, subfissile to occasionally |

moderately fissile with irregular cleavage to fissile, micromicaceous, siliceous, common slickenside, commonly carbonaceous, slightly bituminous, slightly pyritic, well indurated, firm to hard. Note very fine chips.

4,124.00 to 4,142.50 (18.50)	100% Shale black (30%), amorphous, soft, bituminous, common disseminated pyrite, slightly dolomitic, easily hydrated, with shale (70%), black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, common to abundant disseminated pyrite, well indurated (very hard). common slickenside, common fractures lined with dolomite and rare quartz, common dolomite, pyrite and rare quartz sparite, also with siltstone (trace), light to medium gray, quartzose, dolomitic, argillaceous, bituminous, tight, no shows.
4,142.50 to 4,162.50 (20.00)	100% Shale black (30%), amorphous, soft, bituminous, common disseminated pyrite, slightly dolomitic, easily hydrated, with shale (70%), black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, common to abundant disseminated pyrite, well indurated (very hard), decreasing slickenside, fractures and sparite.
4,162.50 to 4,175.00 (12.50)	100% Shale shale, black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, trace bentonite, common to abundant disseminated pyrite, well indurated (very hard), trace slickensides, black, amorphous, soft, bituminous, common disseminated pyrite, slightly dolomitic, easily hydrated, with dolomite (trace), black, microcrystalline, argillaceous, bituminous, tight, no shows.
4,175.00 to 4,185.00 (10.00)	100% Shale black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace slickensides, trace fractures healed with calcite, with shale (up to 20%), black, amorphous, soft, bituminous, common disseminated pyrite, trace bentonite, slightly dolomitic, easily hydrated.
4,185.00 to 4,190.00 (5.00)	100% Shale black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace slickensides, trace fractures healed with calcite, with shale (up to 20%), black, amorphous, soft, bituminous, common disseminated pyrite, trace bentonite, slightly dolomitic, easily hydrated also with siltstone (trace), light gray to light gray brown, quartzose, dolomitic, hard, tight, no shows.
4,190.00 to 4,200.00 (10.00)	100% Shale up to 80%, black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, with shale, black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace fractures healed with calcite.
4,200.00 to 4,202.50 (2.50)	100% Shale up to 30%, black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, with shale (up to 70%), black,

blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace fractures healed with calcite, also with abundant buff colored bentonite grains.

4,202.50 to 4,205.00 (2.50)	100% Shale	black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), with shale (up to 30%), black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, trace fractures healed with calcite, also with common to abundant loose quartzose grains (fine grained, subangular), trace buff colored rounded dolomite grains.
4,205.00 to 4,210.00 (5.00)	100% Shale	black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), with shale (up to 30%), black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, trace fractures healed with calcite,
4,210.00 to 4,216.80 (6.80)	100% Shale	black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard) interbedded with shale (up to 30%), black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, trace fractures healed with calcite, trace to common bentonite grains, trace pyrite sparite.
4,216.80 to 4,222.50 (5.70)	100% Shale	black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, trace conchoidal fracture, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard) interbedded with shale (20-40%), black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, trace fractures healed with calcite, pyrite and quartz, trace pyrite sparite.
4,222.50 to 4,230.00 (7.50)	100% Shale	black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, trace conchoidal fracture, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard) interbedded with shale (up to 70%), black, amorphous, soft, bituminous, common disseminated pyrite, very calcareous, slightly dolomitic, easily hydrated, trace fractures healed with calcite, trace pyrite sparite, trace light brown bentonite grains.

Evie: 4,232.0 MD, 3,700.8 TVD, -2,890.4 SSL

4,230.00 to 4,245.00 (15.00)	100% Shale	black, amorphous, occasionally blocky, soft, poorly indurated, micromicaceous, bituminous, very calcareous in part, dolomitic in part, no visible fractures, trace pyrite sparite.
---------------------------------	-------------------	--

Evie (Over Turned): 4,249.0 MD, 3,708.3 TVD, -2,897.9 SSL

4,245.00 to 4,260.00 (15.00)	100% Shale black, amorphous, poorly indurated, soft, bituminous, very calcareous, slightly dolomitic, micromicaceous in part, trace disseminated pyrite, interbedded with shale, black (up to 30%), blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, trace conchoidal fracture, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace calcite lined fractures, trace pyrite sparite also with trace limestone, medium gray, microcrystalline, hard, tight, no shows.
4,260.00 to 4,262.50 (2.50)	100% Shale black, blocky, subfissile in part with irregular cleavage, micromicaceous in part, very siliceous, trace conchoidal fracture, carbonaceous, slightly dolomitic, common to abundant disseminated pyrite, well indurated (very hard), trace calcite lined fractures, trace pyrite sparite, with trace siltstone, light gray, moderately hard, slightly dolomitic, argillaceous, tight, no shows.
4,262.50 to 4,265.00 (2.50)	100% Shale as above, with up to 20% shale, black, amorphous, poorly indurated, soft, bituminous, very calcareous, slightly dolomitic, micromicaceous in part, trace disseminated pyrite
4,265.00 to 4,270.00 (5.00)	100% Shale as above, trace reddish brown siderite grains.
4,270.00 to 4,276.00 (6.00)	100% Shale black, amorphous, poorly indurated, soft, very bituminous, very calcareous, slightly dolomitic, micromicaceous in part, interbedded with shale, black (up to 40%), blocky, subfissile in part with irregular cleavage, micromicaceous in part, moderately siliceous, trace conchoidal fracture, carbonaceous, slightly dolomitic, trace to common disseminated pyrite, well indurated (very hard), trace calcite lined fractures, trace pyrite sparite.
4,276.00 to 4,286.00 (10.00)	100% shale black, blocky, becoming fissile in part (splintery) with occasional irregular cleavage, micromicaceous in part, dolomitic, calcareous, slightly siliceous, trace conchoidal fracture, carbonaceous, trace to common disseminated pyrite, well indurated (very hard), trace calcite and dolomite lined fractures, trace pyrite, calcite and dolomite, sparite, with decreasing soft bituminous shale.
4,286.00 to 4,292.50 (6.50)	100% Shale black, blocky, becoming fissile in part (splintery) with occasional irregular cleavage, micromicaceous in part, dolomitic, calcareous, slightly siliceous, slightly carbonaceous, moderately to well indurated, trace to common disseminated pyrite, trace calcite and pyrite lined fractures, trace pyrite, calcite and dolomite, sparite, with interbedded soft bituminous shale (10 to 20%), also with rare medium grayish brown shale.
4,292.50 to 4,312.50 (20.00)	100% Shale black, blocky, becoming fissile in part, micromicaceous in part, dolomitic, calcareous, slightly siliceous, slightly carbonaceous, moderately to well indurated, silty, trace disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite, with minor interbedded soft bituminous shale, also with light to medium gray shale.

4,312.50 to 4,326.00 (13.50)	100% Shale black, blocky, becoming fissile in part, micromicaceous in part, dolomitic, calcareous, trace calcareous white specks, slightly siliceous, slightly carbonaceous, moderately to well indurated, silty, trace disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite, with minor interbedded soft bituminous shale, also with light to medium gray shale. up to 10% black, very hard, siliceous shale.
4,326.00 to 4,332.50 (6.50)	100% Shale black, becoming dark gray in part, blocky, subfissile in part, micromicaceous in part, dolomitic, calcareous, trace calcareous white specks, increasingly siliceous, slightly carbonaceous, moderately to well indurated, silty, irregular cleavage, common disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite.
4,332.50 to 4,350.00 (17.50)	100% Shale black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, dolomitic, increasingly calcareous, trace calcareous white specks, increasingly siliceous, slightly carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite.
4,350.00 to 4,362.50 (12.50)	100% Shale black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, dolomitic, increasingly calcareous, trace calcareous white specks, slightly siliceous, slightly carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite, 10-20% black, bituminous, soft, shale.
4,362.50 to 4,370.00 (7.50)	100% Shale black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, less dolomitic, less calcareous, trace calcareous white specks, increasingly siliceous, slightly carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite, up to 10% black, bituminous, soft, shale.
4,370.00 to 4,372.50 (2.50)	100% Shale as above, noticeable increase in healed fractures.
4,372.50 to 4,390.00 (17.50)	100% Shale black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, less dolomitic, less calcareous, trace calcareous white specks, increasingly siliceous, slightly carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace pyrite and calcite sparite, up to 10% black, bituminous, soft, shale.
4,390.00 to 4,405.00 (15.00)	100% Shale black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, slightly dolomitic, increasingly siliceous, carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace calcite and pyrite sparite, up to 10% black, bituminous, soft, shale also with rare dolomite, black, cryptocrystalline to microcrystalline, very carbonaceous, tight, no shows.

4,405.00 to 4,412.50 (7.50) 100% **Shale**
black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, slightly dolomitic, increasingly siliceous, carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace calcite and pyrite sparite, up to 10% black, bituminous, soft, shale also with rare dolomite increasing to 15%, black, cryptocrystalline to microcrystalline, very carbonaceous, tight, no shows.

4,412.50 to 4,415.00 (2.50) 100% **Shale**
black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, slightly dolomitic, increasingly siliceous, carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace calcite and pyrite sparite, up to 10% black, bituminous, soft, shale also with rare dolomite, black, cryptocrystalline to microcrystalline, very carbonaceous, tight, no shows.

4,415.00 to 4,422.50 (7.50) 100% **Shale**
black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, slightly dolomitic, increasingly siliceous, carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace to common calcite lined fractures, trace to common calcite and pyrite sparite with dolomite (10-20%), black, cryptocrystalline to microcrystalline, very carbonaceous, argillaceous, tight, no shows.

Otter Park Marker (Over Turned): 4,421.0 MD, 3,791.4 TVD, -2,891.0 SSL

4,422.50 to 4,426.00 (3.50) 100% **Shale**
black, blocky, subfissile in part, irregular cleavage, micromicaceous in part, slightly dolomitic, increasingly siliceous, carbonaceous, moderately to well indurated, silty, common disseminated pyrite, trace to common calcite lined fractures, trace to common calcite and pyrite sparite, trace quartz sparite, with dolomite (10-20%), black, cryptocrystalline to microcrystalline, very carbonaceous, argillaceous, tight, no shows.

4,426.00 to 4,435.00 (9.00) 100% **Shale**
black, blocky, irregular cleavage, occasionally subfissile in part, occasionally micromicaceous, very siliceous, interbedded with very slightly dolomitic shale, carbonaceous, well indurated, very hard, occasionally moderately indurated, silty, common disseminated pyrite, trace to common calcite lined fractures, trace to common calcite and pyrite sparite, interbedded with dolomite (5%), grading to rare, black, cryptocrystalline to microcrystalline, very carbonaceous, argillaceous, tight, no shows.

4,435.00 to 4,445.00 (10.00) 100% **Shale**
black to brownish black (30%), amorphous, soft, dolomitic in part, very bituminous, interbedded with shale, black (70%), blocky, irregular cleavage, occasionally subfissile in part, occasionally micromicaceous, very siliceous, interbedded with very slightly dolomitic shale, carbonaceous, well indurated, very hard, occasionally moderately indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace calcite and pyrite sparite, interbedded with dolomite (rare), black, cryptocrystalline to microcrystalline, very carbonaceous, argillaceous, tight, no shows.

4,445.00 to 4,455.00 (10.00)	100% Shale black to brownish black (70%), amorphous, soft, dolomitic in part, very bituminous, interbedded with shale, black (30%), blocky, irregular cleavage, occasionally subfissile in part, occasionally micromicaceous, very siliceous, interbedded with very slightly dolomitic shale, carbonaceous, well indurated, very hard, occasionally moderately indurated, silty, common disseminated pyrite, trace calcite lined fractures, trace calcite and pyrite sparite, interbedded with dolomite (rare), black, cryptocrystalline to microcrystalline, very carbonaceous, argillaceous, tight, no shows.
4,455.00 to 4,462.50 (7.50)	100% Shale black to brownish black (70%), amorphous, soft, dolomitic in part, very bituminous, interbedded with shale, black (30%), blocky, irregular cleavage, occasionally subfissile in part, occasionally micromicaceous, very siliceous, interbedded with very slightly dolomitic shale, carbonaceous, well indurated, very hard, occasionally moderately indurated, silty, common disseminated pyrite.
4,462.50 to 4,487.00 (24.50)	100% Shale black, amorphous, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, bituminous, slightly silty.
4,487.00 to 4,490.00 (3.00)	100% Shale as above, grading to shale, black, blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic, common to abundant disseminated pyrite, common calcite lined and filled fractures, common calcite sparite, trace pyrite sparite.
4,490.00 to 4,500.00 (10.00)	100% Shale grading back to shale, black to brownish black, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty, interbedded with shale (30%), black, blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic, trace disseminated pyrite, trace calcite lined and filled fractures, trace calcite sparite, trace pyrite sparite.
4,500.00 to 4,507.50 (7.50)	100% Shale black, blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic, trace disseminated pyrite, trace calcite lined and filled fractures, trace calcite sparite, trace pyrite sparite interbedded with shale (40%), black to brownish black, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty.
4,507.50 to 4,517.50 (10.00)	100% Shale black to brownish black, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty interbedded with shale, black (20-30%), blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic, trace disseminated pyrite, trace calcite lined and filled fractures, trace calcite sparite, trace pyrite sparite.
4,517.50 to 4,520.00 (2.50)	100% Shale black to brownish black, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty interbedded with shale, black (50%), blocky, irregular fracture,

subfissile in part, hard (well indurated), siliceous, very slightly dolomitic ,trace disseminated pyrite, trace calcite lined and filled fractures, trace calcite sparite, trace pyrite sparite.

4,520.00 to 4,532.50 (12.50) 100% **Shale**
black to dark gray, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty interbedded with shale, black (20-30%), blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic ,trace disseminated pyrite, trace calcite sparite, trace pyrite sparite.

4,532.50 to 4,543.00 (10.50) 100% **Shale**
black to dark gray, amorphous, bituminous appearance, occasionally blocky, occasionally subfissile, soft (poorly indurated), very slightly dolomitic in part, slightly silty interbedded with shale, black (20-30%), blocky, irregular fracture, subfissile in part, hard (well indurated), siliceous, very slightly dolomitic ,trace disseminated pyrite, trace pyrite sparite.

Total Depth (Otter Park Over Turned): 4,543.0 MD, 3,853.1 TVD, -3,043.1 SSL

End L-38 /ST1

L-38/ST1 was drilled to a total depth of 4543mMD without encountering the Nahanni formation. The well was plugged back to intermediate casing point of 3311 meters. The cement was drilled to a depth of 3345 meters at which time Side Track 2 was started.

Begin Devon et al Kotaneelee L-38A

3,345.00 to 3,360.00 (15.00) 90% **Cement**
10% **Shale**
black (trace light gray), blocky, massive, poorly to moderately indurated, very siliceous (10 to 20%, very hard, silicified shale), slightly bituminous, slightly carbonaceous, trace micromicaceous, trace disseminated pyrite, trace pyrite lined fractures, slightly dolomitic, slightly bentonite, easily hydrated in part.

Exshaw: 3,375.0 MD, 3,164.8 TVD, -2,354.4 SSL

Devonian: 3,377.0 MD, 3,166.7 TVD, -2,356.3 SSL

3,360.00 to 3,380.00 (20.00) 80% **Cement**
20% **Shale**
black, blocky, massive, very siliceous in part (60-100%, very hard, silicified shale), poorly to moderately indurated in part, slightly bituminous, slightly carbonaceous, trace to common disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, easily hydrated in part with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.

3,380.00 to 3,383.00 (3.00) 70% **Shale**
black, blocky, massive, very siliceous in part (60-100%, very hard, silicified shale), poorly to moderately indurated in part, slightly bituminous, slightly carbonaceous, trace to common disseminated pyrite, trace pyrite lined fractures, very slightly dolomitic, non calcareous, easily hydrated in part with dolomite, trace, medium brown, microcrystalline, argillaceous, hard, tight, no shows.

	30%	Cement	
3,383.00 to 3,391.00 (8.00)	100%	Shale black to brownish black, blocky, moderately indurated in part, very siliceous in part (80%, very hard, silicified shale), carbonaceous, trace to common disseminated pyrite, common to abundant calcite filled and quartz lined fractures, very slightly dolomitic, slightly calcareous, with dolomite (trace to 5%), medium brown, microcrystalline, argillaceous, hard, tight, no shows.	
3,391.00 to 3,400.00 (9.00)	100%	Shale black (70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, carbonaceous, interbedded with shale (30%), brownish black to black, amorphous, bituminous, soft to moderately hard, sample is very pyritic with abundant disseminated pyrite and pyrite lenses, common to abundant fractures parallel and perpendicular to bedding, common to abundant clear quartz, white calcite and pyrite sparite.	
3,400.00 to 3,420.00 (20.00)	100%	Shale black (70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, carbonaceous, interbedded with shale (30%), brownish black to black, amorphous, bituminous, soft to moderately hard, with decreasing pyrite and fractures and sparite in sample.	
3,420.00 to 3,440.00 (20.00)	100%	Shale black (60-70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, micromicaceous in part, carbonaceous, interbedded with shale (30-40%), brownish black to black, amorphous, bituminous, soft to moderately hard, trace to common disseminated pyrite and pyrite laminations in sample, trace to common white calcite sparite, trace calcite filled fractures, also with trace dolomite, black to mottled black, microcrystalline to very finely crystalline, pyrobituminous, argillaceous, tight, no shows.	
3,440.00 to 3,445.00 (5.00)	100%	Shale black (60-70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, micromicaceous in part, carbonaceous, interbedded with shale (30-40%), brownish black to black, amorphous, bituminous, soft to moderately hard, trace to common disseminated pyrite and pyrite laminations in sample, trace to common white calcite sparite, trace calcite filled fractures, also with dolomite (up to 10%), black to mottled black, microcrystalline to very finely crystalline, pyrobituminous, argillaceous, tight, no shows.	
3,445.00 to 3,450.00 (5.00)	80%	Shale black (60-70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, micromicaceous in part, carbonaceous, interbedded with shale (30-40%), brownish black to black, amorphous, bituminous, soft to moderately hard, trace to common disseminated pyrite and pyrite laminations in sample, trace to common white calcite sparite, trace calcite filled fractures.	
	20%	Dolomite black, occasionally mottled, microcrystalline to very fine crystalline, pyrobituminous, argillaceous, hard, tight, no shows.	

3,450.00 to 3,455.00 (5.00) 100% **Shale**
 black (60-70%), blocky to occasionally subfissile with occasional irregular fractures, very hard, silicified, slightly dolomitic, micromicaceous in part, carbonaceous, interbedded with shale (30-40%), brownish black to black, amorphous, bituminous, soft to moderately hard, trace to common disseminated pyrite and pyrite laminations in sample, trace white calcite sparite, also with dolomite (up to 5%), black to mottled black, microcrystalline to very finely crystalline, pyrobituminous, argillaceous, tight, no shows.

3,455.00 to 3,465.00 (10.00) 100% **Shale**
 brownish black, amorphous in part, blocky to subfissile in part, bituminous, soft to very hard, siliceous in part, micromicaceous in part, slightly carbonaceous, trace disseminated pyrite and pyrite laminations in sample, trace white calcite sparite, with dolomite (up to 5%), black to mottled black, microcrystalline to very finely crystalline, pyrobituminous, argillaceous, hard, tight, no shows.

Besa River: 3,466.0 MD, 3,247.3 TVD, -2,436.9 SSL

3,465.00 to 3,470.00 (5.00) 80% **Shale black**
 brownish black, amorphous in part, blocky to subfissile in part, bituminous, soft to very hard, siliceous in part, micromicaceous in part, slightly carbonaceous, trace disseminated pyrite and pyrite laminations in sample, trace white calcite sparite, with dolomite (up to 5%), black to mottled black, microcrystalline to very finely crystalline, pyrobituminous, argillaceous, hard, tight, no shows.
 20% **Shale**
 medium to dark gray, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, slightly dolomitic, common disseminated pyrite.

3,470.00 to 3,480.00 (10.00) 70% **Shale**
 as above.
 30% **Shale black**
 as above.

3,480.00 to 3,485.00 (5.00) 100% **Shale**
 medium to dark gray, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, slightly dolomitic, common disseminated pyrite.

3,485.00 to 3,495.00 (10.00) 100% **Shale**
 medium to dark gray, rare black shale fragments, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, dolomitic in part, common disseminated pyrite, trace calcite sparite, trace calcite filled fractures.

3,495.00 to 3,505.00 (10.00) 100% **Shale**
 medium to dark gray, rare black shale fragments, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, very slightly dolomitic, common disseminated pyrite.

3,505.00 to 3,525.00 (20.00) 100% **Shale**
 mainly dark gray, rare black shale fragments, amorphous, soft to moderately hard, easily hydrated in part, bentonitic in part, very slightly dolomitic, common disseminated pyrite, trace pyrite sparite.

3,525.00 to 3,535.00 (10.00) 100% **Shale**
 black to dark gray, amorphous, soft to moderately hard, occasionally subfissile to blocky, bituminous in part, easily hydrated in part, bentonitic in part, very slightly dolomitic, common disseminated pyrite.

3,535.00 to 3,545.00 (10.00)	100%	Shale dark gray to brownish gray to brownish black, amorphous, soft to moderately hard, occasionally subfissile to blocky, bituminous in part, easily hydrated in part, bentonitic in part, very slightly dolomitic, common disseminated pyrite with dolomite (trace), dark gray to black, microcrystalline to very finely crystalline, argillaceous, pyrobituminous, tight, no shows.
3,545.00 to 3,555.00 (10.00)	100%	Shale dark gray to brownish gray to brownish black, amorphous, soft to moderately hard, occasionally subfissile to blocky, bituminous in part, easily hydrated in part, bentonitic in part, slightly carbonaceous, very slightly dolomitic, common disseminated pyrite, trace pyrite lenses.
3,555.00 to 3,565.00 (10.00)	100%	Shale dark gray to brownish black, amorphous, soft to moderately hard, occasionally subfissile to blocky, bituminous in part, easily hydrated in part, bentonitic in part, slightly carbonaceous, very slightly dolomitic, rare very siliceous, black, blocky shale, common disseminated pyrite, trace white calcite sparite
3,565.00 to 3,575.00 (10.00)	100%	Shale black (55%), blocky, very siliceous, very hard, grading to chert in part, interbedded with shale (45%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite.
3,575.00 to 3,580.00 (5.00)	80%	Shale black (55%), blocky, very siliceous, very hard, grading to chert in part, interbedded with shale (45%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, hard, argillaceous, pyrobituminous, tight, no shows
	20%	Chert black, blocky fragments, trace conchoidal fractures, mainly brittle fracture, very siliceous, very hard, trace to common disseminated pyrite, trace quartz lined and filled fractures, trace clear quartz sparite.
3,580.00 to 3,585.00 (5.00)	50%	Shale as above.
	50%	Chert as above.
3,585.00 to 3,590.00 (5.00)	20%	Chert black, blocky fragments, trace conchoidal fractures, mainly brittle fracture, very siliceous, very hard, trace to common disseminated pyrite, trace quartz lined and filled fractures, trace clear quartz sparite.
3,590.00 to 3,610.00 (20.00)	80%	Shale black (60%), blocky, very siliceous, very hard, interbedded with shale (40%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with dolomite (trace to 10%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.

	20%	Chert black, blocky fragments, trace conchoidal fractures, mainly brittle fracture, very siliceous, very hard, trace to common disseminated pyrite, trace quartz lined and filled fractures, trace clear quartz sparite.
3,610.00 to 3,615.00 (5.00)	90%	Shale black (40%), blocky, very siliceous, very hard, interbedded with shale (60%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with dolomite (trace), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.
	10%	Chert black, blocky fragments, trace conchoidal fractures, mainly brittle fracture, very siliceous, very hard, trace to common disseminated pyrite.
3,615.00 to 3,635.00 (20.00)	80%	Shale black (30%), blocky, very siliceous, very hard, interbedded with shale (70%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with shale (10%), medium gray to dark brownish gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, and with dolomite (trace), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.
	20%	Chert black, blocky fragments, trace conchoidal fractures, mainly brittle fracture, very siliceous, very hard, trace to common disseminated pyrite.
3,635.00 to 3,645.00 (10.00)	100%	Shale medium gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, interbedded with shale black (20%), blocky, very siliceous, very hard and shale (20%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.
3,645.00 to 3,655.00 (10.00)	100%	Shale medium gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, interbedded with shale black (5%), blocky, very siliceous, very hard and shale (5%), black to brownish black, blocky to amorphous to subfissile, soft to hard, bituminous in part, carbonaceous in part, slightly dolomitic, slightly bentonitic, easily hydrated in part, common disseminated pyrite also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.
3,655.00 to 3,675.00 (20.00)	100%	Shale medium gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, interbedded with shale black (5%), blocky, very siliceous, very hard also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows.

3,675.00 to 3,680.00 (5.00) 100% **Shale**
medium gray, amorphous, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, common disseminated pyrite, interbedded with shale black (40%), blocky to subfissile, very siliceous in part, soft (bentonitic) in part, poorly to well indurated, common disseminated pyrite, trace quartz sparite, trace quartz and pyrite filled fractures, also with dolomite (trace to 5%), black, microcrystalline to very fine crystalline, argillaceous, pyrobituminous, hard, tight, no shows, and with siltstone (trace), buff, moderately hard, sideritic.

3,685.00 to 3,695.00 (10.00) 100% **Shale**
medium gray, blocky to subfissile, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, water sensitive (15%), common disseminated pyrite, interbedded with shale black (15%), blocky to subfissile, very siliceous in part, well indurated, common disseminated pyrite, also with siltstone (trace to 15%), buff, moderately hard, sideritic.

3,695.00 to 3,705.00 (10.00) 100% **Shale**
medium gray, blocky to subfissile, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, water sensitive (15%), common disseminated pyrite, interbedded with shale black (15%), blocky to subfissile, very siliceous in part, well indurated, common disseminated pyrite, also with siltstone (trace), buff, moderately hard, sideritic also with dolomite (trace) black, microcrystalline, hard, argillaceous, pyrobituminous, tight, no shows.

3,705.00 to 3,730.00 (25.00) 100% **Shale**
medium gray, grading to medium to dark gray towards the bottom, blocky to subfissile, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, water sensitive (15%), common disseminated pyrite, interbedded with shale black (5-10%), blocky to subfissile, very siliceous in part, well indurated, common disseminated pyrite, trace pyrite lined fractures, trace pyrite sparite.

Muskwa: 3,742.0 MD, 3,498.2 TVD, -2,687.8 SSL

3,730.00 to 3,745.00 (15.00) 100% **Shale**
medium gray to medium to dark gray towards the bottom, blocky to subfissile, soft to moderately indurated, very slightly dolomitic, kaolinitic, very slightly bentonitic, water sensitive (15%), common disseminated pyrite, interbedded with shale black (5-15%), blocky to subfissile, very siliceous in part, well indurated, common disseminated pyrite.

3,745.00 to 3,750.00 (5.00) 100% **Shale**
black to occasionally brownish black, fissile to occasionally blocky, amorphous in part, bituminous, bentonitic, moderately indurated, common to abundant disseminated pyrite, trace pyrite and calcite lined fractures, with minor shale (10%), medium to dark gray, as above.

Otter Park: 3,755.0 MD, 3,510.1 TVD, -2,699.7 SSL

3,750.00 to 3,765.00 (15.00) 100% **Shale**
black to brownish black, fissile, occasionally blocky, slightly dolomitic, bentonitic, slightly carbonaceous, slightly bituminous, abundant disseminated pyrite, common pyrite laminations, trace quartz and pyrite filled fractures, trace pyrite and quartz sparite, interbedded with shale (10-15%), black, blocky, very hard, siliceous to silicified shale (chert).

3,765.00 to 3,770.00 (5.00)	100% Shale black to brownish black, fissile, occasionally blocky, slightly dolomitic, bentonitic, slightly carbonaceous, slightly bituminous, abundant disseminated pyrite, common pyrite laminations, trace calcite filled fractures, trace siderite spherules.
3,770.00 to 3,780.00 (10.00)	100% Shale black to brownish black (85%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, trace calcite filled fractures, with shale (15%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite.
3,780.00 to 3,790.00 (10.00)	100% Shale black to brownish black (90%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, with shale (5%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with dolomite (5%), black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows, trace medium gray brown siderite spherules.
3,790.00 to 3,810.00 (20.00)	100% Shale black to brownish black (85%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, with shale (10%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with dolomite (5%), black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows.
3,810.00 to 3,820.00 (10.00)	100% Shale black to brownish black (85%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, trace pyrite sparite with shale (10%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with dolomite (5%), black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows.
3,820.00 to 3,825.00 (5.00)	100% Shale black to brownish black (85%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite laminations, with shale (10%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with dolomite (5%), black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows.

Mid Otter Park Marker: 3,832.0 MD, 3,576.6 TVD, -2,766.2 SSL

3,825.00 to 3,840.00 (15.00)	100% Shale black to brownish black (50%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, common pyrite
---------------------------------	--

laminations, trace pyrite sparite with shale (50%). black, blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite also with dolomite (up to 5%), black, microcrystalline to fine very crystalline, very hard, argillaceous, pyrobituminous, no shows.

3,840.00 to 3,860.00 (20.00)	100% Shale black (70%), blocky, irregular fractures, siliceous, very hard, carbonaceous, pyrobituminous, abundant disseminated pyrite, trace to common calcite and pyrite filled fractures, trace to common calcite and pyrite sparite, with shale, black to brownish black (30%), amorphous, fissile, occasionally blocky, slightly dolomitic, bentonitic, water sensitive in part, slightly carbonaceous, bituminous to pyrobituminous, abundant disseminated pyrite, also with limestone (trace), white to light gray, microcrystalline, pyrobituminous in part, slightly argillaceous, tight, no shows.
3,860.00 to 3,880.00 (20.00)	100% Shale black, blocky, irregular fractures, dolomite and siliceous, very hard, occasionally moderately hard, carbonaceous, pyrobituminous, abundant disseminated pyrite, trace pyrite sparite with dolomite (trace), black, microcrystalline, hard, argillaceous, pyrobituminous, tight, no shows.
3,880.00 to 3,890.00 (10.00)	100% Shale black, blocky, irregular fractures, dolomite and siliceous, very hard, occasionally moderately hard, carbonaceous, pyrobituminous, abundant disseminated pyrite, trace pyrite sparite interbedded with shale (30%), black to brownish black in part, amorphous to blocky to fissile in part, poorly to moderately indurated, bituminous, slightly bentonitic, slightly calcareous and dolomitic, common disseminated pyrite, also with dolomite (trace), black, microcrystalline, hard, argillaceous, pyrobituminous, tight, no shows.

Evie: 3,907.0 MD, 3,634.3 TVD, -2,823.9 SSL

3,890.00 to 3,910.00 (20.00)	100% Shale black, blocky, irregular fractures, dolomite and siliceous, occasionally slightly calcareous, hard to very hard, occasionally moderately hard, carbonaceous, pyrobituminous, common calcite filled fractures, common calcite sparite, abundant disseminated pyrite, trace pyrite sparite, interbedded with shale (5-10%), black to brownish black in part, amorphous to blocky to fissile in part, poorly to moderately indurated, bituminous, slightly bentonitic, slightly calcareous and dolomitic, common disseminated pyrite, also with dolomite (trace), black, microcrystalline, hard, argillaceous, pyrobituminous, tight, no shows.
3,910.00 to 3,922.50 (12.50)	100% Shale black, blocky, irregular fractures, siliceous, occasionally grading to chert, occasionally slightly dolomitic, very hard, pyrobituminous, common to abundant white dolomite filled fractures, common white dolomite sparite, trace calcite sparite, abundant disseminated pyrite, interbedded with dolomite (5%), light gray to black, microcrystalline to fine crystalline, hard, pyrobituminous, tight, no shows.
3,922.50 to 3,927.50 (5.00)	100% Shale black, blocky, irregular fractures, siliceous, occasionally grading to chert, occasionally slightly dolomitic, very hard, pyrobituminous, common white dolomite and clear quartz filled fractures, common white dolomite sparite, trace calcite sparite, abundant disseminated pyrite, interbedded with shale

(up to 10%), black to brownish black, pyrobituminous, amorphous to fissile, poorly to moderately indurated, common disseminated pyrite.

3,927.50 to 3,940.00 (12.50) 100% **Shale**
black, blocky, irregular fractures, siliceous, occasionally grading to chert, occasionally slightly dolomitic, very hard, pyrobituminous, common white dolomite and clear quartz filled fractures, common white dolomite sparite, trace white chalky calcite sparite, abundant disseminated pyrite, interbedded with shale (up to 15%), black to brownish black, pyrobituminous, amorphous to fissile, poorly to moderately indurated, common disseminated pyrite, also with dolomite (trace), white to light gray, finely crystalline, pyrobituminous, argillaceous, tight, no shows.

Nahanni: 3,942.0 MD, 3,660.2 TVD, -2,849.8 SSL

3,940.00 to 3,945.00 (5.00) 90% **Shale**
black (50%), blocky, irregular fractures, siliceous, occasionally grading to chert, occasionally slightly dolomitic, very hard, pyrobituminous, common white dolomite and clear quartz filled fractures, common white dolomite sparite, disseminated pyrite, interbedded with shale (50%), black to brownish black, pyrobituminous, amorphous to fissile, poorly to moderately indurated, common disseminated pyrite, also with limestone (10%), white, chalky, soft, pyrobituminous in part, argillaceous.

10% **Dolomite**
mottled (black and white) to dark gray, finely crystalline, hard, pyrobituminous, argillaceous in part, tight, no shows.

3,945.00 to 3,950.00 (5.00) 70% **Dolomite**
mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous, argillaceous in part, tight, no shows.

20% **Limestone**
white, chalky, soft, pyrobituminous in part, tight, no shows.

10% **Shale**
as above.

3,950.00 to 3,955.00 (5.00) 90% **Dolomite**
mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen and argillaceous matter), argillaceous in part, poor (3%) fracture porosity, no shows, common to abundant dolomite filled fractures, common loose white dolomite sparite and clear quartz sparite.

5% **Limestone**
as above.

5% **Shale**
as above.

3,955.00 to 3,959.00 (4.00) 100% **Dolomite**
mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen and argillaceous matter), argillaceous in part, poor (3%) fracture porosity, no shows, common to abundant dolomite filled fractures, common loose white dolomite sparite and clear quartz sparite.

3,959.00 to 3,965.00 (6.00) 100% **Cement**

3,965.00 to 3,975.00 (10.00)	100% Dolomite mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), poor (3%) fracture porosity, no shows, abundant dolomite filled fractures, 20% loose white dolomite sparite and 5% clear quartz sparite, trace pyrite sparite also with pyrobitumen grains (5%), black, lustrous, conchoidal fracture.
3,975.00 to 3,985.00 (10.00)	100% Dolomite mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), trace poor (3%) fracture porosity, no shows, common to abundant dolomite filled fractures, 15% loose white dolomite sparite and <5% clear quartz sparite also with pyrobitumen grains (<5% grading to trace), black to brownish black, lustrous, conchoidal fracture.
3,985.00 to 3,990.00 (5.00)	100% Dolomite mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), trace poor (3%) fracture porosity, no shows, common to abundant dolomite filled fractures, 10% loose white dolomite sparite and <5% clear quartz sparite, trace disseminated pyrite.
3,990.00 to 4,000.00 (10.00)	100% Dolomite black to mottled (black and white) to dark gray, fine to coarse crystalline, hard, increasing pyrobituminous (intercrystalline porosity filled with pyrobitumen), trace fracture porosity, no shows, common to abundant dolomite filled fractures, 10 to 15% loose white dolomite sparite (coarse crystalline) and trace clear quartz sparite (coarse crystalline).
4,000.00 to 4,013.00 (13.00)	100% Dolomite black to mottled (black and white) to dark gray, fine to coarse crystalline, hard, increasing pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, 5% loose white dolomite sparite (coarse crystalline) and 1% clear quartz sparite (coarse crystalline).
4,013.00 to 4,020.00 (7.00)	100% Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, 5% loose white dolomite sparite (coarse crystalline) and 1% clear quartz sparite (coarse crystalline), trace to common disseminated pyrite.
4,020.00 to 4,050.00 (30.00)	100% Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, 5% loose white dolomite sparite (fine to medium to occasionally coarse crystalline) and 1% clear quartz sparite (fine to medium to occasionally coarse crystalline), trace to common disseminated pyrite Note very poor sample quality to chip samples are pulverized to fine to medium grained in size.
4,050.00 to 4,079.00 (29.00)	100% Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, up to 20% loose white dolomite sparite (fine to medium to occasionally coarse crystalline) and 1% clear quartz sparite (fine to medium to occasionally coarse crystalline).

crystalline), trace to common disseminated pyrite with dolomite (tr-5%), black, microcrystalline, argillaceous. hard, pyrobituminous, tight, no shows.

Muskwa: 4,083.5 MD, 3,729.6 TVD, -2,912.2 SSL

4,079.00 to 4,085.00 (6.00)	100%	Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, up to 10% loose white dolomite sparite (fine to medium to occasionally coarse crystalline) and trace clear quartz sparite (fine to medium to occasionally coarse crystalline), trace to common disseminated pyrite with dolomite (trace), black, microcrystalline, argillaceous. hard, pyrobituminous, tight, no shows also with shale (trace), brownish black, amorphous, moderately indurated bituminous.
4,085.00 to 4,099.00 (14.00)	100%	Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, up to 5% loose white dolomite sparite (fine to medium to occasionally coarse crystalline), trace to common disseminated pyrite with dolomite (trace to common), black, microcrystalline, argillaceous. hard, pyrobituminous, tight, no shows also with shale (trace to common), brownish black, amorphous, moderately indurated bituminous.
4,099.00 to 4,100.00 (1.00)	80%	Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, up to 5% loose white dolomite sparite (fine to medium to occasionally coarse crystalline), trace to common disseminated pyrite with dolomite (trace to common), black, microcrystalline, argillaceous. hard, pyrobituminous, tight, no shows, trace white chalky limestone.
	20%	Shale black, blocky, ire fracture, very siliceous (grading to chert in part), very hard, trace slickensides, trace white calcite crystal filled fractures, trace disseminated pyrite.
4,100.00 to 4,105.00 (5.00)	50%	Dolomite black to mottled (black and white) to dark gray, fine to medium to occasionally coarse crystalline, hard, very pyrobituminous (intercrystalline porosity filled with pyrobitumen), tight, no shows, trace to common dolomite filled fractures, up to 5% loose white dolomite sparite (fine to medium to occasionally coarse crystalline), trace quartz sparite with one terminated quartz crystal, trace to common disseminated pyrite with dolomite (trace to common), black, microcrystalline, argillaceous. hard, pyrobituminous, tight, no shows, trace white chalky limestone.
	50%	Shale black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace disseminated pyrite.
4,105.00 to 4,110.00 (5.00)	100%	Shale black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace disseminated pyrite with shale (tr-5%), dark gray, fissile, calcareous, dolomitic, moderately hard, interbedded with dolomite (10%), black to occasionally mottled, microcrystalline to fine

crystalline, slightly argillaceous, pyrobituminous, tight, no shows, with trace to common dolomite and quartz filled fractures and sparite.

4,110.00 to 4,115.00 (5.00)	100% Shale	black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace disseminated pyrite with shale (tr-5%), dark gray, fissile, calcareous, dolomitic, moderately hard, also with shale (5%), brownish black, amorphous, poorly indurated, bituminous, interbedded with limestone (10%), black to occasionally mottled, microcrystalline to fine crystalline, slightly argillaceous, dolomitic, pyrobituminous, tight, no shows, with trace to common dolomite and quartz filled fractures and sparite.
4,115.00 to 4,145.00 (30.00)	100% Shale	black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace to common white dolomite and quartz sparite, trace clear quartz sparite, trace calcite filled fractures, trace calcite sparite, trace slickensides, trace disseminated pyrite and pyrite laminations interbedded with limestone (up to 15%), mottled black and gray to medium gray, microcrystalline to micritic, moderately hard, argillaceous, dolomitic, tight, no shows.
4,145.00 to 4,165.00 (20.00)	100% Shale	black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace to common white dolomite sparite, rare clear quartz sparite, trace calcite filled fractures, trace calcite sparite, trace slickensides, trace disseminated pyrite and pyrite laminations interbedded with limestone (5-10%), mottled black and gray to medium gray, microcrystalline to micritic, moderately hard, argillaceous, dolomitic, tight, no shows, trace white chalky limestone.
4,165.00 to 4,175.00 (10.00)	100% Shale	black, blocky, irregular fracture, very siliceous (grading to chert in part), very hard, 5-10% quartz and dolomite filled fractures, trace to common white dolomite sparite, rare clear quartz sparite, trace calcite filled fractures, trace calcite sparite, common disseminated pyrite and pyrite laminations interbedded with dolomite (<5%), mottled black and gray to medium gray, microcrystalline to very fine crystalline, moderately hard, argillaceous, calcareous, tight, no shows, trace pyrite sparite.

Total Depth (Otter Park): 4,175.0 MD, 3,765.0 TVD, -2,954.5 SSL

End of Descriptions for L-38A

L-38A was drilled to a depth of 4175mMD. 151.5 meters of Nahanni was drilled without intersecting any permeability before faulting back into the Muskwa. A decision was made to side track the well and L-38A/ST3 was started.

Begin sample descriptions for L-38A/ST3

Nahanni: 3,942.0 MD, 3,660.2 TVD, -2,849.8 SSL

3,959.00 to 3,965.00 (6.00)	100% Cement
--------------------------------	--------------------

3,965.00 to 3,970.00 (5.00)	100% Dolomite mottled (black and white) to dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), poor (3%) fracture porosity, no shows, abundant dolomite filled fractures, 20% loose white dolomite sparite and 5% clear quartz sparite, trace pyrite sparite also with pyrobitumen grains (5%), black, lustrous, conchoidal fracture.
3,970.00 to 3,990.00 (20.00)	100% Dolomite mottled (medium to dark gray and white) to occasionally black, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), poor (3%) grading to very poor fracture porosity, no shows, abundant dolomite filled fractures, 20% loose white dolomite sparite and 5% grading to 1% clear quartz sparite, trace pyrite sparite also with pyrobitumen sparite (<5% grading to 1%), black, lustrous, conchoidal fracture, also with trace to common white chalky limestone.
3,990.00 to 4,000.00 (10.00)	100% Dolomite mottled (medium to dark gray and white) to increasingly black, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), very poor (1%) fracture porosity, no shows, abundant dolomite filled fractures, 15% loose white dolomite sparite and 1% clear quartz sparite, trace pyrite sparite also with trace to common white chalky limestone.
4,000.00 to 4,010.00 (10.00)	100% Dolomite mainly matrix dolomite, mottled (black and white) to occasionally dark gray, fine to coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), very poor (1%) fracture porosity, no shows, abundant dolomite filled fractures, 10 to 15% loose white dolomite sparite and rare to 1% clear quartz sparite, trace pyrite sparite.
4,010.00 to 4,020.00 (10.00)	100% Dolomite mainly matrix dolomite, mottled (black and white) to occasionally dark gray, microcrystalline to medium crystalline to occasionally coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), very poor (1%) fracture porosity, no shows, abundant dolomite filled fractures, 10 % loose white dolomite sparite, trace to common disseminated pyrite.
4,020.00 to 4,026.00 (6.00)	No Sample Lost Circulation
4,026.00 to 4,032.50 (6.50)	100% Dolomite 95% LCM (mainly cal-carb, white, clear, buff, medium to coarse grained limestone) with dolomite (5%), mainly matrix dolomite, mottled (black and white) to occasionally dark gray, microcrystalline to medium crystalline to occasionally coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), fine (3-5%) fracture porosity inferred from penetration, torque and lost circulation, no shows, abundant dolomite filled fractures, 10 % loose white dolomite sparite, trace clear quartz sparite, trace disseminated pyrite, trace black pyrobitumen grains.
4,032.50 to 4,040.00 (7.50)	100% Dolomite 80% LCM (mainly cal-carb, white, clear, buff, medium to coarse grained limestone) with dolomite (20%), mainly matrix dolomite, mottled (black and white) to occasionally dark gray, microcrystalline to medium crystalline to occasionally coarse crystalline, hard, pyrobituminous (intercrystalline porosity

filled with pyrobitumen), fine(3-5%) fracture porosity inferred from penetration, torque and lost circulation, no shows, abundant dolomite filled fractures, 10 % loose white dolomite sparite, trace disseminated pyrite.

4,040.00 to 4,050.00 (10.00) 100% **Dolomite**
60% LCM (mainly cal-carb, white, clear, buff, medium to coarse grained limestone) with dolomite (40%), mainly matrix dolomite, mottled (black and white) to occasionally dark gray, microcrystalline to medium crystalline to occasionally coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), fine (3 to 5%) fracture porosity inferred from torque, penetration and lost circulation, no shows, abundant dolomite filled fractures, up to 15 % loose white dolomite sparite, trace disseminated pyrite.

4,050.00 to 4,065.00 (15.00) 100% **Dolomite**
50% LCM (mainly cal-carb, white, clear, buff, medium to coarse grained limestone) with dolomite (50%), mainly matrix dolomite, mottled (black and white) to occasionally dark gray, microcrystalline to medium crystalline to occasionally coarse crystalline, hard, pyrobituminous (intercrystalline porosity filled with pyrobitumen), fine (3-5%) fracture porosity inferred from penetration, torque and lost circulation, no shows, abundant dolomite filled fractures, 10 % loose white dolomite sparite, trace disseminated pyrite.

Total Depth (Nahanni): 4,065 MD, 3755.3 TVD, -2,944.9 SSL