Geological Report

on

West Chance H-28

300/H-28-6610-13730/0

Well Reached Total Depth on
Mar 29, 2013 @ 00:15

for

Northern Cross (Yukon) Limited

Well License # : 1135

Prepared For: B. McDOWELL
NORTHERN CROSS YUKON LTD

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Keitech Consultants Ltd. (P10492)

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NCY West Chance H-28 is an exploratory well drilled to evaluate several Mesozoic conventional targets, and several other Paleozoic conventional and unconventional targets for oil, gas and shale gas production potential. It is the third well, drilled and operated by Northern Cross Yukon, in the 2012-2013 drilling season. The well is located in the Eagle Plain area of the north central Yukon Territory. The Eagle Plain is an intermontane compressional basin bounded on the east by the Richardson Mountains, and on the north, west and south by the Keele, Nahoni and Taiga ranges respectively, of the Ogilvie Mountains. The basin covers an area of approximately 20,608km2, and is bisected by the Arctic Circle. The area is characterized by lightly forested low rolling hills with elevations ranging between 400 and 800 metres, and can be accessed year round by the Dempster highway, which exists as a high grade roadbed, consisting either of compacted sandstone, limestone or shale quarried from numerous pits located close to the roadway. As such, the road can have challenging conditions over the seasons in any particular year. Dawson City is located approximately 5 hours by road to the southwest, Whitehorse is 11 hours to the south, and Inuvik is approximately 6-7 hours to the northeast, however to travel to Inuvik by road, there are two ferry crossings over each of the Peel and Mackenzie Rivers that only operate in the summer and fall. To cross in the winter requires the rivers freeze over, and an ice road be established. Most personnel working on the project not travelling by road, were flown into Inuvik by charter on jets from Edmonton, then chartered from Inuvik to the project by Twin Otter aircraft. Commercial air travel is also available into Inuvik Monday through Friday each week. Twin Otters landed on the Dempster highway, opposite the approach to the projects main camp site.

The West Chance H-28 well was spudded January 11th, 2013, and was drilled to a depth of 3024mMD, reached 78 days later on March 29th, 2013. A major delay in the operation occurred prior to spud, when after moving the rig from the A-25 site to the H-28 site and setting up the rig, the substructure apparatus and supporting I-beams became irreparably bent and twisted when attempting to raise the substructure to its" operating position. During the lifting operation, the I-beams and supporting ties suddenly failed. Once failed, the rig listed and required support from below, using joints of 7 inch (177.8mm) casing, cut to length, and placed under the rig as a temporary measure before fabricating and installing new legs and supporting braces to the substructure. Approximately 14 days were lost as a result of the bent and twisted substructure, which ultimately prevented this well from being drilled to the planned total depth as the permit to drill on this winter-only location expired April 15th, 2013. Several other delays occurred over the course of drilling the H-28 well which prolonged the operation, but none as serious and time consuming as the damaged substructure.

Surface hole was drilled to 406mMD in 43.75 hours rotating (~4 days operating), then open hole logged. Six days were required to prepare the hole for logging, to run and cement surface casing, and to prepare the operation for the next phase of drilling.

Intermediate hole was drilled to 1526mKB, relatively quickly and without incident, in 87.5 hours rotating utilizing two tricone bits. The average rate of penetration for both bit runs was 12.8 metres/hour. To alleviate any hole deviation, and to minimize hole erosion, the Baker TruTrack drilling assembly was utilized over the entire intermediate hole section. This assembly does not require the drill string to rotate above the mud motor, and keeps the hole drilling in the direction desired with extreme accuracy. In this case, the hole was kept to as near vertical as possible. No mechanical delays of any consequence were experienced over intermediate hole. Tight hole conditions were first encountered while tripping for Bit #2, however hole conditions did not seriously hamper operations until intermediate casing depth was reached at 1526 metres, and the hole was being conditioned for open hole logging. The better part of four days were required to condition the hole for logging, where pipe became stuck on the initial wiper trip, and the well packed-off on another wiper trip. Mud weight and viscosity was

raised, and the hole was worked until the string could be tripped in and out unimpeded before open hole logging was attempted. Bad hole conditions can be attributed to sloughing shales and minor coals, where these lithologies are falling into the hole in "slugs" due to a prominent open jointing in the rock fabric creating an unstable wellbore.

Traces of hydrocarbons are seen to occur in somewhat porous sandstones within the Cretaceous Burnthill Creek (641-643m), Fishing Branch (998-1023m) and the Orange Marker (1206.5-1208m) formations, and within a chert pebble conglomerate belonging to the Permian Jungle Creek formation (1520-1526m), with the best show occurring in the Jungle Creek. The Jungle Creek occurs at the Cretaceous-Permian boundary, which may have been a "bald high" in late Permian time, as Permian conglomerates are in sharp contact with overlying Cretaceous shales. This unconformable contact may yield significant hydrocarbon-bearing reservoirs elsewhere in this basin, and is a bona fide exploration target.

Intermediate hole was logged successfully, and casing was run and cemented to total depth at 1526m, and the operation proceeded to the 222mm hole phase which includes the primary zones of interest in Carboniferous Hart River and Ford Lake, and Devonian Ogilvie formations. Drilling operations slowed considerably over the 222mm phase of the hole, mostly a function of the hardness of the formations, particularly in the cherty carbonate facies of the Hart River, but also in part due downhole tool failures, and to problems associated with drilling the Imperial section with PDC bits. On two occasions, PDC bits were run in the Imperial section and failed to make any progress due to bit-balling issues. One PDC bit run (Bit #16) was relatively successful, drilling 159m in 15.5 hours, for an average ROP of 10.26m/hr, however this bit was also pulled due to balling.

One core was taken over the Hart River Shale section, recovering only 8.8 metres as the bit was scrubbed drilling very hard cherty and silicified lithologies, and another planned core over the Ford Lake "Hot Shale"was abandoned due to logistical issues. The Ford Lake "Hot Shale" is an anomalously radioactive, highly organic shale, and is the prime candidate for shale gas production in this area of the basin. Intensive sampling of cuttings and cuttings gas, and numerous sidewall cores were taken over this section which should yield critical information on the potential of this zone to produce hydrocarbons.

The Imperial section immediately underlies the Ford Lake "Hot Shale", and persists to the total depth at which this well was drilled (3024m), consisting predominantly of shale, with occasional sandy intervals, and common silty partings. A total of 796m of the Imperial was drilled here, with no precise estimate of where the underlying Canol would occur. The Imperial is a fragile shale, with common sheared intervals, and prominent jointing, similar to the Cretaceous section. This phase of the hole was also drilled vertically with the Baker TruTrack system to eliminate hole deviation, and reduce hole erosion, particularly over the Imperial section. During the sample evaluation, a shear-zone was interpreted to occur between ~2430-2490m. After penetration the interval from ~2430-2440m was consistently troublesome when tripping through this zone, or when attempting to open hole log past this depth. In fact no open hole logging tools were successfully dropped past 2436m.

Drilling continued until shortly after midnight on March 29th, 2013, when this hole was suspended due to the approaching warmer weather, and the pending expiration of the drilling permit. A 177.8mm liner was run with the aid of a sacrificial mud motor and tricone drill bit as a precaution in an attempt to get the liner to bottom, however, the maximum liner depth reached before progress was impeded was 2882m, 142 metres off bottom. This hole was planned to drill to test the potential for unconventional

production from the Devonian Canol formation, and potential conventional oil production from the Devonian Ogilvie formation, and is currently suspended.

Well Summary

Storage Units: Metric

Well Information

Operator:	**Northern Cross (Yukon) Limited**
Well Name:	**West Chance H-28**
Location:	**300/H-28-6610-13730/0**
UWI:	NCY W Chance H-28
Pool:	
Field:	Permit 0016
State / Province:	Yukon Territory
Country:	Canada
License Number:	1135
Well Status:	**Currently suspended.**

Surface Co-ordinates

Hole Type: Vertical **Fault Indicator:**

Latitude: 66.072982 **Longitude:** 137.340564

UTM Northing: 7336214.66 **UTM Easting:** 384033.44

N / S :

E / W :

Int. Casing Co-ordinates

Latitude: **Longitude:**

N / S :

E / W :

Bottom Hole Co-ordinates

Latitude: 66.072982 **Longitude:** 137.340564

N / S :

E / W :

Elevations

		Reference:	MSL
Ground Elevation:	461.80	**Kelly Bushing to Ground:**	8.36
Kelly Bushing Elevation:	470.16	**Cut (-):**	
Casing Flange Elevation:		**Fill (+):**	0.30

Total Depth

	Measured Depth	**True Vertical Depth**
Total Depth Driller (Tally) :	3,024.80	3,024.62
Total Depth Driller (Strap or SLM):		
Total Depth Logger:		

Miscellaneous Depths

Plugback Depth:	**Water Depth Reference:**
Sidetrack Depth:	**Water Depth:**

Well Summary

Drilling Contractor:	Patterson-UTI Drilling Canada Ltd.	**Spud Date:**	Jan 11, 2013 @ 18:30
Rig Release Date:		**Total Depth Date:**	Mar 29, 2013 @ 00:15

Cores

#	Formation	Interval		Cut	Recovered	%
1	Hart River Shale	2,057.00	2,065.80	8.80	8.80	100.00

Well Summary

Storage Units: Metric

Casing Summary

Casing Type	Casing Size	Landed Depth	Hole Size
Conductor	508.0	31.70	762.0
Surface	339.7	404.40	444.5
Intermediate	244.5	1,526.00	311.0
Liner	177.8	2,882.37	222.0

Logging Summary

Company	Engineer	Total Depth (MD)	Logging tools
Schlumberger	Michel Lapointe	406.00	AIT-CNL-LDT-HNGS (Array Induction Tool-Compensated Neutron Log-Litho Density Tool-Spectral Gamma Ray)
			DSI-GR-GPIT (Dipole Sonic Imager-Gamma Ray-
		1,526.00	AIT-CNL-LDT-GR-Cal Array Induction Tool - Compensated Neutron Tool - Litho Density Tool - Gamma Ray - Caliper
			DSI-PPC-GR-GPIT Dipole Sonic Imager - Power Positioning Caliper - Gamma Ray - General Purpose Inclinometry Tool
		2,515.00	Mechanical Sidewall Coring Tool.
			FMI-GPIT-PPC2 (x2)-Sonic Scanner
			ADT-NEXT-CMR Array Dielectric Tool-Stringray-Compensated Magnetic Resonnance
			PEX (AIT-CNL-LDT-GR-SP with DSI, HRLA, HGNS, GPIT, PPC-2) Platform Express (Array Induction, Compensated Neutron, Litho Density, Gamma Ray, Spontaneous Potential with Dipole Sonic Imager, Laterlog, Spectral GR, Global positioning tool, 4-arm caliper.
	Edmund Brobbey	3,024.00	AIT-DSI-GPIT-HGNS-PPC-2
			AIT-DSI-GPIT-HGNS-PPC-2

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jan 12, 13	127.00		9.50		00:00-24:00Hrs; Jan 11, 2013 Rig to spud. Pick up 45 jts DP and rack stands in derrick. Make up bit and BHA. Pre-spud safety meeting. P/U 2 DCs. Start circulating. Rotate to warm top drive. Adjust elevators. Tag cement @ 22.4m. Trouble shoot pumps (1.75hrs). Spud in @ 18:30Hrs; Jan 11, 2013. Drill & survey 444.5mm hole f/22-54mKB.
Jan 13, 13	309.00	182.00	16.50	11.03	00:00-24:00Hrs; Jan 12, 2013 Drill & survey 444.5mm hole f/127-255mKB.
Jan 14, 13	406.00	97.00	17.50	5.54	00:00-24:00Hrs; Jan 13, 2013 Drill & survey 444.5mm hole f/255-379mKB.
Jan 15, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 14, 2013 Drill 444.5mm hole f/379-386mKB. Rig repairs - change seal in standpipe (1/2hr). Drill survey 444.5mm hole f/386-406mKB. Circulate hole clean. POOH to log - pull tight @ 340mKB. Work tight hole and back ream to 303mKB. Trip in hole. Condition mud and circulate - raise viscosity. Back ream out of hole to 200mKB. Reposition DCs in bird bath and re-adjust kelly hose. Back ream f/200-143mKB.
Jan 16, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 15, 2013 Back ream f/143-86mKB. Level rig (4.5hrs). Continue back reaming f/86-0m. Trip in hole - wash f/370-406mKB. Circulate and condition mud and hole. Trip out of hole to 304m and run back in. Pump out 6 stands HWDP. Circulate hole clean. Trip out of hole with DCs. Rig in Schlumberger and run open hole logs.
Jan 17, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 16, 2013 Log with Schlumberger. Rig out loggers. Rig to run 339.7mm surface casing. Cross thread shoe track and second joint. Laydown and P/U new shoe track. Run 33 joints of 339.7mm casing. Rig to and run 5" DP inner string for cementing. Head up and circulate and condition mud for cement job.
Jan 18, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 17, 2013 Mix and pump cement. Rig out cementers. Trip out of hole. WOC - Clean mud tanks, prepare to nipple down diverter, position manifold shack. P/T manifold valves. Rig-in flare and degasser lines & HCR line.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jan 19, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 18, 2013 Nipple down diverter. Cut conductor. Rig-in Weatherford screw-on bowl. L/D HWDP. Install speed head. P/U Landing base. Nipple up BOPs.
Jan 20, 13	406.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 19, 2013 Continue to nipple up BOP. P/T. Change out IBOP valve on top drive. Set wear bushing. P/U directional tools. Make up BHA.
Jan 21, 13	570.00	164.00	9.75	16.82	00:00-24:00Hrs; Jan 20, 2013 Make up BHA. Work on top drive unit (repair hydraulic lines and lube pump lines). Test tools. Slip & cut. Make up BHA. Trip in hole with HWDP. Drill out float, cement and shoe. Drill 311mm hole f/406-410mMD. Perform FLOT. Drill and survey 311mm hole f/410-472mMD.
Jan 22, 13	865.00	295.00	16.25	18.15	00:00-24:00Hrs; Jan 21, 2013 Drill and survey 311mm hole f/472-788mMD.
Jan 23, 13	1,023.00	158.00	13.50	11.70	00:00-24:00Hrs; Jan 22, 2013 Check pump #2 suction/discharge - clean screens. Transfer mud in active to suction tank to build volume (0.5hrs). Drill and survey 311mm hole f/788-1019mMD with Baker TruTrack.
Jan 24, 13	1,023.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 23, 2013 Drill and survey 311mm hole f/1019-1023mMD. Circulate bottoms up. Trip out of hole - work tight spot @ 965m. Pump sweep. Work tight spot @ 942mMD. Work on top drive. Trip out of hole - pump out stands. Pump pill. POOH. Handle directional tools. Change bit. Trip in hole to 252m. Rig repairs (Top Drive Service Loop).
Jan 25, 13	1,260.00	237.00	18.00	13.17	00:00-24:00Hrs; Jan 24, 2013 Rig repairs (Top Drive Service Loop). RIH to 651m. Blow/check surface equipment. Fill pipe. Test TruTrack tool. Trip in hole - wash in. Confirm depth correction. Pattern bit. Drill and survey 311mm hole f/1033-1192mMD.
Jan 26, 13	1,445.00	185.00	20.00	9.25	00:00-24:00Hrs; Jan 25, 2013 Drill and survey 311mm hole f/1192-1392mMD.
Jan 27, 13	1,526.00	81.00	10.75	7.53	00:00-24:00Hrs; Jan 26, 2013 Drill and survey 311mm hole f/1392-1445mMD.
Jan 28, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 27, 2013 Drill and survey 311mm hole f/1445-1526mMD. Circulate bottoms up - condition hole. Break off tight working single. Attempt to work pipe free - jar string. Regain circulation, and free up pipe. Circulate and condition hole and mud.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jan 29, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 28, 2013 Circulate and condition mud - raise viscosity. Hoist - pump out stands to 1060m. Circulate bottoms up. Attempt to pull out without pump. Work tight hole @ 1060m. Trip out - pump out stands to casing shoe. Blow out surface equipment. Fill trip tank. POOH - L/D 8" collars. Rig repairs (Forum Catwalk hydraulics 3.25hrs). Handle directional tools. Break bit. Make up new bit. Trip in hole to 389m. Slip & cut 19m drill line. RIH - encounter bridge @ 424m. Wash through and circulate bottoms up. RIH to 760m. Wash through bridge. Wash stands to 1200m.
Jan 30, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 29, 2013 Pull tight hole @1212m - pack-off. Work pipe and regain circulation (4hrs). Condition mud and circulate hole clean. Trip in hole - wash to 1448m.
Jan 31, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 30, 2013 P/U singles & wash to bottom f/1448-1526m. Condition mud and circulate hole clean. W/T f/1526-1284m - ream out - circulate hole clean. Ream to bottom. Condition mud and circulate - raise density to 1250Kg/m3. Trip out of hole - back ream f/1350-398m. Circulate hole clean. Mix pill, and blow out circulating equipment. POOH. Rig in and log with Schlumberger.
Feb 1, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Jan 31, 2013 Rig out Loggers. Remove wear bushing. Rig to, and run 244.5mm casing. M/U landing joint and mandrel. Wash down casing. Circulate hole clean and condition mud.
Feb 2, 13	1,526.00	0.00	0.00	0.00	00:00-24:00Hrs; Feb 1, 2013 Circulate casing and condition mud - lower vis to 50sec/l. Rig up Cementers - trouble-shoot Haliburton cement head (1.25hrs). Cement casing. Rig out cementers. Rig in Weatherford pack-off tool. P/T manifold and BOPs. RIH / 7" collars.
Feb 3, 13	1,596.00	70.00	17.50	4.00	00:00-24:00Hrs; Feb 2, 2013 P/U directional tools. M/U BHA. RIH to float @ 1491mMD. Circulate bottoms up. P/T casing. Drill out float, cement and shoe. Drill 222mm hole f/1526-1530mMD. Circulate bottoms up. Pull back into casing. Perform FLOT. Drill and survey 222mm hole f/1530-1566mMD

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Feb 4, 13	1,625.00	29.00	11.00	2.64	00:00-24:00Hrs; Feb 3, 2013 Drill and survey 222mm hole f/1566-1625mMD. Circulate bottoms up. Pump pill. POOH.
Feb 5, 13	1,680.00	55.00	18.50	2.97	00:00-24:00Hrs; Feb 4, 2013 Finish out of hole. Handle directional tools. Change bit. RIH / Bit #6 - pulse test directional tools @ 850m. RIH to 1512m. Slip & cut 12m drilling line. RIH & tag bottom - reduced pump strokes. Circulate bottoms up. Drill and survey 222mm hole f/1625-1661m.
Feb 6, 13	1,696.00	16.00	5.75	2.78	00:00-24:00Hrs; Feb 5, 2013 Drill and survey 222mm hole f/1661-1695m. Trouble shoot directional tools - circulate hole clean. Pump pill. POOH f/1695-611m. Rig repairs - adjust brakes (1hr). Safety Stand Down Mtg (1hr). POOH. L/D directional tools. Change bit. P/U directional tools.
Feb 7, 13	1,730.00	34.00	10.25	3.32	00:00-24:00Hrs; Feb 6, 2013 RIH with Bit #7 to 841mMD. Slip & cut 12m drilling line. RIH f/841-1695mMD. Pattern bit. Drill and survey 222mm hole f/1695-1717mMD. Circulate bottoms up. POOH. Handle directional tools. Change bit. RIH / Bit #8.
Feb 8, 13	1,745.00	15.00	7.25	2.07	00:00-24:00Hrs; Feb 7, 2013 RIH from 859-1717 m (MD), dir drill 222mm hole F/1717-1734m. Circ bottoms up, POOH for bit #9 change out bit & Tru Trak Trip in hole to 350m, held Bop drill & man down drill, Pulse test, Trip in hole fill pipe & pulse test at 851m, Trip in hole to 1225m.
Feb 9, 13	1,782.00	37.00	22.00	1.68	00:00-24:00Hrs; Feb 8, 2013 RIH from 1225-1511 m (MD), Slip and cut 14 meters of drill line, RIH from 1511-1705 m (MD), wash from 1705-1734 m (MD), dir drill 222 mm hole from 1734-1771 m (MD).
Feb 10, 13	1,815.00	33.00	22.25	1.48	00:00-24:00Hrs; Feb 9, 2013 Dir drill 222 mm hole from 1771-1804 m (MD).
Feb 11, 13	1,832.00	17.00	9.50	1.79	00:00-24:00Hrs; Feb 10, 2013 Dir drill 222 mm hole from 1804-1818 m (MD), circulate bottoms up, POOH, change out bit, inspect dir equipment, RIH, pulse test, pattern bit.
Feb 12, 13	1,871.00	39.00	21.00	1.86	00:00-24:00Hrs; Feb 11, 2013 Dir drill 222 mm hole from 1818-1853 m (MD). circ samples up, dir drill 222 mm hole from 1853-1858 m (MD).

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Feb 13, 13	1,912.00	41.00	21.75	1.89	00:00-24:00Hrs; Feb 12, 2013 Dir drill 222 mm hole from 1858-1890 m (MD). circulate bottoms up, dir drill 222 mm hole from 1890-1899 m (MD).
Feb 14, 13	1,929.00	17.00	9.25	1.84	00:00-24:00Hrs; Feb 13, 2013 Dir drill 222 mm hole from 1899-1918 m (MD), circ bottom hole sample, POOH, change out bit, check dir tools, P/U bit 11, RIH, fill pipe and pulse test @ 350 m (MD), slip and cut.
Feb 15, 13	1,965.00	36.00	21.75	1.66	00:00-24:00Hrs; Feb 14, 2013 Slip and cut, RIH, wash from 1894-1918 m (MD), three meters of fill on bottom of hole, flow check, pulse test, pattern bit, dir drill 222 mm hole from 1918-1955 m (MD).
Feb 16, 13	1,982.00	17.00	11.25	1.51	00:00-24:00Hrs; Feb 15, 2013 Dir drill 222 mm hole from 1955-1982 m (MD). circ bottoms up, POOH for dir tools and bit.
Feb 17, 13	2,012.00	30.00	7.50	4.00	00:00-24:00Hrs; Feb 16, 2013 POOH wet, Lay down directional tools, mud motor, P/U same, scribe motor, check filter sub and float, RIH, pulse test, flow check @ 554 m (MD), RIH to 1510 M(MD), wash to bottom, pattern bit, dir drill 222 mm hole from 1982-1996 m (MD), circulate samples up, dir drill 222 mm hole from 1996-1997 m (MD).
Feb 18, 13	2,036.00	24.00	23.00	1.04	00:00-24:00Hrs; Feb 17, 2013 Dir drill 222 mm hole from 2002-2028 m (MD).
Feb 19, 13	2,047.00	11.00	8.00	1.38	00:00-24:00Hrs; Feb 18, 2013 Dir drill 222 mm hole from 2028-2037.5 m (MD), circ hole clean, POOH for bit, M/U Smith bit, RIH to 190 m (MD), pulse test, RIH to 995 m (MD), slip and cut, RIH to 1941 m (MD).
Feb 20, 13	2,057.00	10.00	7.00	1.43	00:00-24:00Hrs; Feb 19, 2013 RIH to bottom, pattern bit & dir drill 222 mm hole from 2037.5- 2057 m (MD). circ hole clean, POOH for core barrel.
Feb 21, 13	2,056.80	-0.20	4.60	-0.04	00:00-24:00Hrs; Feb 20, 2013 M/U core barrels, RIH and slip and cut line at 1040 m (MD), RIH, circ bottoms up, drop ball and pump to bottom, core from 2057-2065.8 m (MD), circ bottoms up, POOH.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Feb 22, 13	2,095.00	38.20	17.50	2.18	00:00-24:00Hrs; Feb 21, 2013 POOH. Recover Core #1 (100% Rec). L/D core barrels. Make up BHA and Bit #15. RIH to 554m. F/T TruTrak tools. Blow out surface equipment. RIH. Log gamma from 2045-2054m. Drill and survey 222mm hole f/2066-2085m.
Feb 23, 13	2,133.00	38.00	20.75	1.83	00:00-24:00Hrs; Feb 22, 2013 Drill and survey 222mm hole f/2085-2123m.
Feb 24, 13	2,169.00	36.00	21.25	1.69	00:00-24:00Hrs; Feb 23, 2013 Drill and survey 222mm hole f/2123-2152m. Trouble shoot travelling blocks (1.25hrs). Drill ahead f/2152-2159m.
Feb 25, 13	2,210.00	41.00	16.75	2.45	00:00-24:00Hrs; Feb 24, 2013 Drill and survey 222mm hole f/2159-2206m.
Feb 26, 13	2,270.00	60.00	5.75	10.43	00:00-24:00Hrs; Feb 25, 2013 Drill 222mm hole f/2206-2210m. Circulate hole clean. Trip out 5 stands. Pump pill. Blow out surface equipment. POOH. Handle directional tools. Break bit. Change out TruTrac and scribe MWD tools. Trip in hole to 1040m. Pulse test tools. Slip & cut 30m drill line. Continue to trip in hole. Ream f/1677-1770m. Trip in to 1963m. Wash to bottom. Downlink to Tru-Trak (1.25hrs).
Feb 27, 13	2,369.00	99.00	9.75	10.15	00:00-24:00Hrs; Feb 26, 2013 Drill and survey 222mm hole f/2210-2369m. Circulate hole clean. Trip out 5 stands. Pump pill. Blow out surface equipment. POOH.
Feb 28, 13	2,375.00	6.00	9.00	0.67	00:00-24:00Hrs; Feb 27, 2013 Continue to POOH. Drain TruTrak. Break bit. P/U new TruTrak and M/U Bit #17. RIH w/ 3 stands HWDP and BHA. Fill pipe. Test tools. Blow out surface equipment. RIH to 1138m. Slip & cut 15m drill line. Trip in hole (ream at 1764, 1794 & 2000m). Wash last stand to bottom (2.7m fill) Pattern bit. Drill 222mm hole f/2369-2371m - very slow progress. Work string & attempt to drill off squat (.75hrs). Drill ahead f/2372-2374m
Mar 1, 13	2,375.00	0.00	0.00	0.00	00:00-24:00Hrs; Feb 28, 2013 Drill ahead f/2374-2375m - slow progress. Work stalled motor, pump sweeps, condition hole. Trip out 5 stands. Pump pill. Blow out surface equipment. POOH. Drain motor. Break bit. M/U Bit #18 and RIH to 1499m (test tools @ surface). Slip & cut 8m drill line. Continue to RIH to 1702m. Break circulation. Trouble shoot directional tool. Circulate hole clean. Mix and pump pill. Blow out surface equipment. POOH.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Mar 2, 13	2,435.00	60.00	17.75	3.38	00:00-24:00Hrs; Mar 1, 2013 POOH. Handle directional tools. Drain motor. Break bit. Change out TruTrak. M/U Monel and scribe tools. RIH (test tools at 19, 553 & 1097m). Ream and clean f/2334-2375m (2m fill). Drill and survey 222mm hole f/2375-2410m.
Mar 3, 13	2,455.00	20.00	7.50	2.67	00:00-24:00Hrs; Mar 2, 2013 Drill and survey 222mm hole f/2410-2455m. Circulate bottoms up. Pump pill. POOH.
Mar 4, 13	2,456.00	1.00	0.75	1.33	00:00-24:00Hrs; Mar 3, 2013 Handle directional tools. Drain motor. Change bit. RIH w/ Bit #19 - test tools @ surface. RIH to 544m. Test tools. Blow down surface equipment. Continue to RIH (test tools @ 1003m, 1491 & 1923m). Slip and cut 14m drill line. RIH. Wash f/2411-2455m - bridges @ 2429-32 & 2445m. 2.5m fill. Attempt to drill ahead with PDC bit, pump 2 sweeps - no progress. Mix and pump pill. POOH.
Mar 5, 13	2,515.00	59.00	15.25	3.87	00:00-24:00Hrs; Mar 4, 2013 Continue to POOH. Handle directional tools. Drain motor. Change bit. Check float and filter sub. Shallow pulse test tool. RIH w/ Bit #20 - flow check, pulse test tool and blow down @ 544, 1031, 1581 & 2122m. Wash f/2412-2456m. Drill and survey 222mm hole f/2456-2498m.
Mar 6, 13	2,515.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 5, 2013 Drill and survey 222mm hole f/2498-2515m. Circulate bottoms up. Perform 5 stand wiper trip. Wash in f/2409-2515m (Ream through bridge f/2431-34m - 1.5m fill on bottom). Perform second wiper trip f/2515-2381m. Wash in f/2430 to bottom (tight @ 2431-36m; 2m fill on bottom). Circulate hole clean. Spot weighted high vis pill on bottom. POOH. Rack monels. Drain motor. Break bit & L/D mud motor. Pull wear bushing. Rig in Schlumberger.
Mar 7, 13	2,515.00	0.00	0.00	0.00	00:00-08:00Hrs; Mar 7, 2013 Log with Schlumberger (Run 3.1: PEX w/ HRLA, HNGS, GPIT & PPC-2; Run 3.2: ADT-Stringray-CMR)
Mar 8, 13	2,515.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 7, 2013 Log hole with FMI-Sonic scanner PPC-2 tool, P/U tools, and run casing integrity tools, run side wall tools.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Mar 9, 13	2,515.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 8, 2013 Continue cutting side wall cores, rig out coring tools and recover cores, pressure test. set wear bushing, P/U dir tools, make up bit 21, scribe motor, M/U float and screen subs, shallow test tool, RIH and pulse test @ 545, 1030, 1520 and 2035 m (MD), ream and clean hole from 2411-2509 m (MD.
Mar 10, 13	2,560.00	45.00	11.25	4.00	00:00-24:00Hrs; Mar 9, 2013 Ream and clean hole from 2509-2515 m (MD), seven meters of fill on bottom, pattern bit, troubleshoot MWD tools, POOH to 1363 m (MD), checking for washed out pipe on the way out, L/D two washed out pipe joints, RIH, ream and clean from 2363-2515 m (MD), tight at 2430-2440, 2501 and 2511 m (MD), with three meters of fill. Dir drill 222 mm hole from 2515-2535 m (MD).
Mar 11, 13	2,632.00	72.00	21.50	3.35	00:00-24:00Hrs; Mar 10, 2013 Dir drill 222 mm hole from 2535-2609 m (MD).
Mar 12, 13	2,652.80	20.80	9.00	2.31	00:00-24:00Hrs; Mar 11, 2013 Dir drill 222 mm hole from 2609-2652.8 m (MD), circ bottoms up, pull nine stands wet, flow check @2397 m (MD), pump pill, blow out surface equipment, and continue to pull out of the hole to 1327 m (MD).
Mar 13, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 12, 2013 Continue to pull out of the hole, flow checks @ 583 and 271 m (MD), switch out SCR, L/D jars, switch out True track tools, jars, P/U bit 22, RIH, fill pipe every 500 m, slip and cut drill line at 1280 m (MD), RIH to 2400 m (MD), wash to 2430 m (MD), ream from 2430 - 2515, back ream to 2496 m (MD), wash and ream to 2515 m (MD), hole sloughed in @ around midnight.
Mar 14, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 13, 2013 Work and jar stuck pipe at 2515 m (MD) without circulation, regained abiltiy to circulate at 2510 m (MD), circ and clean hole, hole sloughed in a second time at a bit depth of approximately 1510 m (MD), with loss of ability to circulate, jarred stuck pipe, to 2502 m (MD) with limited ability to circulate hole, continue to jar , establish circulation and condition hole clean, back ream from 2500-2390 m (MD), POOH.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Mar 15, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 14, 2013 POOH from 1847-31 m (MD), flow check @ 1348, 546 and 299 m (MD), L/D dir tools & monels, L/D True Track dir tools, M/U slick BHA, RIH, slip and cut drill line, fill pipe and wash into the hole from 2400-2480 m (MD), circulate and condition hole and mud, working pipe between 2470 and 2480 m (MD), bringing up density to 1500 kg/m3. POOH to 2400 m (MD, pulled tight @ 2458, 2449 and 2425 m (MD), ream and clean from 2400-2428 m (MD), ream bridge at 2425 m (MD) multiple times.
Mar 16, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 15, 2013 Ream and clean from 2418-2436 m (MD), POOH. with flow checks @ 1352 and 876 m (MD), repair SCR, POOH, with flow checks @ 529, 277 and 0 m (MD), M/U bit sub, P/U five collars, RIH to 681 m (MD), fill pipe, flow check and blow out circulating equipment.
Mar 17, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 16, 2013 Continue tripping in hole. Ream / Wash into hole F/2334-2473m. Pump a high vis sweep (13 m3) with 20L of cavings seen at shaker. POOH to 2422m, ream back into hole to 2448m and pump high vis / 1510 kg/m3 sweep (14 m3) with 15L of cavings seen. Wash into hole to 2514m and hole started to packoff. Pump out of hole to 2420m (>1 bucket of cavings seen at shaker ~0.5cm hard, angular shale with sheared sides). Wash / Ream to 2514m
Mar 18, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 17, 2013 Ream and clean from 2514-2525 m (MD), pump sweeps, work pipe and condition hole, attempt to pull from 2525 - 2503 m (MD) without pumping, wash to 2525, pump sweep, attempt to POOH to 2403 m (MD) without pumping, POOH to 2359 m (MD).
Mar 19, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 18, 2013 Continue to POOH, M/U bit, & P/U 15 four inch drill pipe, RIH, to 1506 m (MD), fill pipe and flow check @1305 m (MD), slip and cut drill line, RIH, wash in from 2430-2525 m (MD), wiper to 2400 m (MD), wash back to 2525 m (MD), condition mud & pump high vis sweep, pump 15 m3 cement plug, POOH to 2060 m (MD).

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Mar 20, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 19, 2013 POOH, M/U bit 26, RIH / 7 inch drill collars, RIH with flow checks, tag cement @ 2430 m (MD), drill out cement plug from 2430-2522 m (MD).
Mar 21, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 20, 2013 Drill out cement plug from 2522-2525 m (MD), ream and clean from 2525-2570 m (MD). pump sweep, circulate and condition hole, wiper trip to 2410 m (MD). wash back into hole pumping high vis sweeps @ 2440 m (MD), ream and clean from 2453-2652 m (MD), circulate hole clean, POOH.
Mar 22, 13	2,652.80	0.00	0.00	0.00	00:00-24:00Hrs; Mar 21, 2013 Trip out of hole from 2484-2370m. Pump pill and blow out circulating equipment. POOH. Make up cement stinger consisting of: 156mm bit, bit sub, 5 stands 4" DP, X/O and float sub, and trip in hole to 1315m. Slip & cut 24m drill line. POOH. L/D Stinger BHA. Make up Reamer BHA c/w 222mm bit, near bit reamer & 2 string roller reamers and RIH.
Mar 23, 13	2,677.00	24.20	7.00	3.46	00:00-24:00Hrs; Mar 22, 2013 Continue to RIH with reamer assembly. Break circulation @ 2406m. Wash and ream f/2406-2432m. Work hard ledge at 2429-2432m. Ream and clean to bottom (4m fill). Drill 222mm hole f/2652-2655m.
Mar 24, 13	2,727.00	50.00	17.00	2.94	00:00-24:00Hrs; Mar 23, 2013 Drill 222mm hole f/2655-2721m.
Mar 25, 13	2,727.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 24, 2013 Drill 222mm hole f/2721-2727m. Circulate bottoms up. Spot slug on bottom. Trip out of hole - pump out to 2308m. Pump sweep @ ~2500m. Pump pill, blow out surface equipment. POOH. L/D reamers. P/U and M/U directional BHA and Bit #29. RIH - pulse test tool.
Mar 26, 13	2,794.00	67.00	11.25	5.96	00:00-24:00Hrs; Mar 25, 2013 Rig repairs (Doghouse power, 0.5hrs). RIH f/1005-1520m. Slip & cut 19m drill line. RIH f/1520-2300m. Wash in hole f/2300-2440m. Wash and ream to bottom (log Gamma f/2600-TD @ 30m/hr; 5m fill). Drill and survey 222mm f/2727-2755m.
Mar 27, 13	2,865.00	71.00	18.50	3.84	00:00-24:00Hrs; Mar 26, 2013 Change head in Pump #1. Drill and survey 222mm hole f/2755-2851m.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Mar 28, 13	2,967.00	102.00	21.25	4.80	00:00-24:00Hrs; Mar 27, 2013 Drill and survey 222mm hole f/2851-2931m.
Mar 29, 13	3,024.00	57.00	14.25	4.00	00:00-24:00Hrs; Mar 28, 2013 Drill and survey 222mm hole f/2931-3023m.
Mar 30, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 29, 2013 Drill 222mm hole f/3023-3024m. Circulate bottoms up and condition hole. Wiper trip 26 stands to 2300m. Circulate bottoms up. Wash in the hole f/2300m. Ream f/2917-2928m. Pump out of the hole f/2928-2418m. Pump pill. Blow out surface equipment. POOH.
Mar 31, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 30, 2013 Continue to POOH. L/D Monels, directional tools and mud motor. Break Bit. Change drilling line - prepare and slip new spool of drill line onto drum. P/U and M/U reamer assembly. RIH to 2397m. Ream and cleam hole f/2397-3023m.
Apr 1, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Mar 31, 2013 Ream and cleam hole f/3023-3024m (.25hrs). Circulate and condition hole. Trip out of hole - pump out f/3024-2397m. Pump pill. Blow out surface equipment. L/D 2 singles. POOH. Rig in Schlumberger. Bridge at 2401m - work bridge. Tools passed through after ~3/4hr then bridged @ 2436m. Attempt to work through that bridge - no progress. Log out with GPIT and PPC-2 to obtain cement volume since logging run 3. Rig out loggers.
Apr 2, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Apr 1, 2013 P/U and M/U reamer assembly and RIH to 1544m. Slip and cut 16m drill line. RIH to 2403m. Break circulation. Ream and wash in f/2405-2662m. Taking weight 2434-2460 & 2560-2662m. Ream and pump sweeps to clean hole. Trip out of hole with pumps @ 1.5m3/min f/2662-2374m. Circulate hole clean. POOH.
Apr 3, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Apr 2, 2013 Continue to POOH. Rig up Schlumberger. Run AIT-HGNS-DSI-GPIT-PPC-2 into hole. Bridge @ 2436m. Hoist tool string and L/D same. Rig out Schlumberger. RIH with reamer assembly. Ream and clean f/2406-3024m. Work through bridge @ 2440m. Wash through 12.5m fill on bottom. Circulate hole clean. Pump out stands f/3024-2680m.

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Apr 4, 13	3,024.00	0.00	0.00	0.00	00:00-24:00Hrs; Apr 3, 2013 Pump out stands f/2680-2393m. Circulate bottoms up. Pump pill. Blow out top drive. POOH. L/D D/P. Pull out of hole laying down D/P to 1002m. RIH to 1635m. Slip and cut 16m drill line. POOH and L/D D/P, HWDP and BHA. Pull wear bushing. Rig to and run 177.8mm casing with bit and sacrificial mud motor. Run 177.8mm casing.

Casing Data Summary

Storage Units: Metric

Casing Type: Conductor

Casing Size:	508.0	**Hole Size:**	762.0
Casing Landed @:	31.70	**Total Joints:**	3
Casing Date:		**Plug Down Date:**	

# of Joints / Length / O.D. / Weight: Ran 3 joints; ~33m; 508.0mm; 154.8Kg/m; X40 casing. Welded joints.

Cementing Details: Mix and pump ~ 5 Tonnes ArcticCem cement @ 1880Kg/m3.

Remarks: Hole was augered, and conductor barrel was preset with welded joints prior to moving the drilling rig onto location.

Casing Type: Surface

Casing Size:	339.7	**Hole Size:**	444.5
Casing Landed @:	404.40	**Total Joints:**	33
Casing Date:	Jan 16, 2013 @ 18:00	**Plug Down Date:**	Jan 17, 2013 @ 04:30

# of Joints / Length / O.D. / Weight: Ran 33 joints; 396.03m; plus casing shoe and float collar (total length 406m) 339.7mm; 101.2Kg/m; K-55, BT&C

Cementing Details: Preflush with...
Lead in with 23 Tonnes ArcticCem @ 1880Kg/m3
Tail in with 27 Tonnes HalCem "G" @ 1895 Kg/m3

Remarks:

Casing Type: Intermediate

Casing Size:	244.5	**Hole Size:**	311.0
Casing Landed @:	1,526.00	**Total Joints:**	111
Casing Date:	Jan 31, 2013 @ 18:00	**Plug Down Date:**	Feb 1, 2013 @ 04:15

# of Joints / Length / O.D. / Weight: Ran 111 joints; 244.5mm; 59.53Kg/m; L-80; LT&C new casing.

Cementing Details: Preflush casing.
Lead in with 60 Tonnes (64.7m3) of HalCem "G" @ 1665Kg/m3. Tail in with 6.6 Tonnes (5.0m3) HalCem "G" @ 1895Kg/m3.

Remarks: Casing landed with mandrel.
Full returns throughout the cement job. 4m3 good cement returns.

Casing Type: Liner

Casing Size:	177.8	**Hole Size:**	222.0
Casing Landed @:	2,882.37	**Total Joints:**	209
Casing Date:	Apr 5, 2013 @ 12:15	**Plug Down Date:**	Apr 5, 2013 @ 23:45

Casing Data Summary

Storage Units: Metric

# of Joints / Length / O.D. / Weight:	Ran 209 joints; 43.157Kg/m, L-80 casing.
Cementing Details:	Preflush with 3m3 water. LEAD: Mix and pump 37.9 Tonnes (39.4m3) Halchem "G" with 0.5% Halad 567 + 1.12% Gel + 3% HR-5; TAIL: 8.6 Tonnes (5m3) Halchem "G" with 0.5% Halad 567 + 0.3% HR-5.
Remarks:	Pump and displace with 54m3 water. Bump plug and PT casing to 23MPa for 10 minutes. Floats held.

Bit Record Table (IADC Grading System)

Storage Units: Metric

**** For more detailed Bit Information refer to Bit Record ****

Bit #	Make	Type	Size	Depth In	Depth Out	Made	Hours	Avg. P.R.	I.A.D.C. Bit Condition								
									I	O	MDC	Loc	B	G	ODC	RP1	RP2
1A	Varel	HRO4JMI	444.5	32.0	406.0	374.0	43.75	8.55	1	1	FC	A	1	I	WT	TD	
2	Hughes	GX-18DX	311.0	406.0	1,032.5	626.5	38.50	16.27	5	8	BT	A	E	10	FC	PR	
3	Security	EQH20D2	311.0	1,032.5	1,526.0	493.5	49.00	10.07	3	8	BT	G	F	2	FC	TD	
5	Security	EQH44D2	222.0	1,526.0	1,625.0	99.0	28.50	3.47	6	8	BT	A	E	I	CT	PR	
6	Smith	FHI450DI	222.0	1,625.0	1,695.0	70.0	25.00	2.80	2	6	BT	G	E	I	ER	DTF	
7	Hughes	VGD-44G	222.0	1,695.0	1,717.0	22.0	7.75	2.84	6	8	CT	H	E	I	BT	TQ	
8	Smith	FHI50	222.0	1,717.0	1,734.7	17.7	4.50	3.93	5	8	CT	A	E		BT	PR	
9	Smith	FH1550D	222.0	1,734.7	1,818.0	83.3	51.00	1.63	4	5	FC	A	E	I	BT	HR	
10	Smith	FH155OD	222.0	1,818.0	1,918.0	100.0	54.50	1.83	5	5	BT	A	E	I	FC	HR	
11	Halliburt	QH55D2F	222.0	1,918.0	1,982.0	64.0	38.60	1.66	3	6	BT	G	E	I	ER	DMF	
12	Hughes	EP6676	222.0	1,982.0	2,037.0	55.0	43.00	1.28	4	4	FC	A	E	I	BT	PR	
13	Smith	FH1550D	222.0	2,037.0	2,057.0	20.0	13.80	1.45	2	2	BT	A	E	I	WT	CP	
14C	Quest	DC813	222.0	2,057.0	2,066.0	9.0	4.60	1.96	0	2	CC	S	X	I	WT	PR	
15	Smith	FHi50OD	222.0	2,066.0	2,210.0	144.0	77.50	1.86	2	2	BT	A	E	I	WT	PR	
16	Smith	MDSi613	222.0	2,210.0	2,369.0	159.0	15.50	10.26	0	1	CT	S	X	I	NO	DMF	
17	Smith	MDSi613	222.0	2,369.0	2,375.0	6.0	9.00	0.67	0	1	CT	G	X	I	PN	PR	
18	Halliburt	EQH40D2	222.0	2,375.0	2,455.0	80.0	25.75	3.11	6	4	BT	M	E	I	FC	PR	
19	Smith	MDSi613U	222.0	2,455.0	2,456.0	1.0	0.75	1.33	1	1	PN	A	X	I	BU	PR	
20	Smith	FHi35	222.0	2,456.0	2,515.0	59.0	16.25	3.63	2	2	CT	N	E	I	NO	DTF	
21	Halliburt	EQH22D2	222.0	2,515.0	2,652.8	137.8	42.00	3.28	7	3	BT	M	E	I	JD	PR	
28	Halliburt	EQH26D2	222.0	2,652.0	2,727.0	75.0	24.50	3.06	3	1	JD	M	E	I	CT	BHA	
29	Halliburt	FX54R	222.0	2,727.0	3,024.0	297.0	64.25	4.62	1	4	BC	S	X	I	PN	TD	

Total Rotating Hours: 678.00

Core Report

Storage Units: Metric

Date: February 20, 2013
Core #: 1
Formations Cored: **Hart River Shale**

Cored Interval
From: 2,057.00 **To:** 2,065.80
Cut: 8.80 **Recovered:** 8.80 100.00 %
Core Diameter: 101.6

Coring Company: Corpro/ Terra-Tek
Service Representative: S. McBurney(Core Hand), C.Peters (Terra Tek)

Core Bit Information
Bit Make: Quest **Bit Type:** DC813
Bit Size (OD): 222.0 **Serial #:** 1012
Original Hole Size: 222.0

Remarks: Coring Times (Minutes per 0.2 meters)

2057.0-2057.2 m: 7.34 min
2057.2-2057.4 m: 4.90 min
2057.4-2057.6 m: 4.24 min
2057.6-2057.8 m: 4.32 min
2057.8-2058.0 m: 4.24 min

2058.0-2058.2 m: 5.88 min
2058.2-2058.4 m: 4.88 min
2058.4-2058.6 m: 3.94 min
2058.6-2058.8 m: 2.44 min
2058.8-2059.0 m: 2.02 min

2059.0-2059.2 m: 2.24 min
2059.2-2059.4 m: 2.98 min
2059.4-2059.6 m: 3.98 min
2059.6-2059.8 m: 4.61 min
2059.8-2060.0 m: 5.32 min

2060.0-2060.2 m: 4.82 min
2060.2-2060.4 m: 3.22 min
2060.4-2060.6 m: 5.16 min
2060.6-2060.8 m: 5.06 min
2060.8-2061.0 m: 2.74 min

2061.0-2061.2 m: 2.44 min
2061.2-2061.4 m: 3.26 min
2061.4-2061.6 m: 4.42 min
2061.6-2061.8 m: 3.66 min
2061.8-2062.0 m: 2.26 min

2062.0-2062.2 m: 1.22 min
2062.2-2062.4 m: 4.74 min
2062.4-2062.6 m: 6.68 min
2062.6-2062.8 m: 5.52 min
2062.8-2063.0 m: 3.72 min

2063.0-2063.2 m: 2.08 min
2063.2-2063.4 m : 2.32 min
2063.4-2063.6 m: 1.82 min
2063.6-2063.8 m: 2.44 min
2063.8-2064.0 m: 2.30 min

2064.0-2064.2 m: 4.76 min
2064.2-2064.4 m: 4.48 min
2064.4-2064.6 m: 8.58 min
2064.6-2064.8 m: 5.01 min
2064.8-2065.0 m: 9.58 min

2065.0-2065.2 m: 10 min
2065.2-2065.4 m: 13 min
2065.4-2065.6 m: 17 min
2065.6-2065,8 m: 36 min

Desorbtion tests were preformed between 1) 2061.5 to approximately 2061.8 m (MD) and 2) between 2064.5 and approximately 2064.8 m (MD). Each interval tested is one foot in length.

Eight-point six meters of core was cut and nine-point-one meters was reported to be recovered. The core likely shifted in the core barrel.

Detailed Core Descriptions

2,057.00 to 2,057.00 (0.00)	**CALCAREOUS MARLSTONE** dark brown to black, massive, no visible fractures, commonly with medium to dark brown shaly laminations, slightly pyritic, grading in part to argillaceous limestone, very hard, rare carbonaceous material, trace silt and sand grains, poor very slow & faint yellow green blooming cut fluorescence.
2,058.50 to 2,058.50 (0.00)	**MARLSTONE** dark brown, very hard, calcareous, grading in part to calcareous shale, slightly silty & sandy, pyritic, slightly carbonaceous, moderate rapid, yellow green blooming cut
2,060.00 to 2,060.00 (0.00)	**SHALE** dark reddish brown, very hard, brittle, non fissile, very calcareous, silty, pyritic, occasional vertical fractures, weak, slow yellow green blooming cut
2,061.50 to 2,061.50 (0.00)	**SHALE** dark reddish brown, dark gray brown, blocky, very hard, non fissile, siliceous, calcareous, commonly silty & sandy, pyritic, weak rapid yellow green blooming cut
2,063.00 to 2,063.00 (0.00)	**SHALE & INTERLAMINATED SANDSTONE** dark brown, dark brown gray, hard, non fissile, siliceous, calcareous, pyritic, silty & sandy, with irregular very fine silty to fine lower calcareous, quartzose sandstone & sandy siltstone laminae, good rapid yellow green blooming cut
2,064.50 to 2,064.50 (0.00)	**SHALE** dark brown gray, grading to black, hard, non fissile, questionable slickenside, calcareous, slightly siliceous, slightly silty & sandy, pyritic, weak slow yellow green blooming cut

2,065.80 to 2,065.80 (0.00)	**MARLSTONE** medium brown gray, medium yellow brown, no visible laminae, massive, very hard, commonly with light brown argillaceous matrix, grading in part to argillaceous limestone, commonly with dark brown carbonaceous or argillaceous specks, tight, weak slow yellow green blooming cut

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 1
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Trevor Wall

Engineer: Michel Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 2.200 °
Hole Size: 444.5

Total Lost Time: 0.00
Loggers' Total Down Time: 0.00
Total Job Time (From Rig up to Rig down): 9.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	400.90	400.88
Casing Depth Logger	31.70	31.70
Total Depth Driller (Tally)	406.00	405.98
Total Depth Driller (Strap or SLM)		

General Remarks: Tools operated normally, and date is reliable. Tool response is affected by hole conditions.

Logging Run #: 1
Date: Jan 15, 2013

Drilling Fluid Data

Drilling Fluid Type: Gel-Polymer
Fluid Density: 1130.0 **Viscosity:** 126 **pH:** 9.0 **Fluid Loss:** 7.5

Mud Resistivity (Rm): 1.150 @ 23.3 º
Mud Resistivity (Rm) @ BHT: 0.830 @ 41.0 º
Mud Filtrate Resistivity (Rmf): 0.990 @ 23.3 º
Mud Cake Resistivity (Rmc): 1.030 @ 23.3 º

Maximum Temperature: 41.0 º
Source (Rmf): Flowline
Source (Rmc): Calculated

Logging Run Information

Date on Bottom: Jan 15, 2013
Total Depth Logger: 400.90 (MD) 400.90 (TVD)

Logging Tools: DSI-GR-GPIT (Dipole Sonic Imager-Gamma Ray-

Remarks: Tools operated within acceptable parameters. Data is reliable.

Hole Conditions: Fair. Shales are prone to erosion, being frequently washed out.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jan 16, 2013

Drilling Fluid Data

Drilling Fluid Type: Gel Polymer

Fluid Density:	1130.0	**Viscosity:**	126	**pH:**	9.0	**Fluid Loss:**	7.5

Mud Resistivity (Rm):	1.150	@	23.3 º		
Mud Resistivity (Rm) @ BHT:	0.900	@	36.0 º	**Maximum Temperature:**	23.3 º
Mud Filtrate Resistivity (Rmf):	0.990	@	23.3 º	**Source (Rmf):**	Flowline
Mud Cake Resistivity (Rmc):	1.030	@	23.3 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: Jan 16, 2013
Total Depth Logger: 399.30 (MD) 399.30 (TVD)

Logging Tools: AIT-CNL-LDT-HNGS (Array Induction Tool-Compensated Neutron Log-Litho Density Tool-Spectral Gamma Ray)

Remarks: Data is reliable where hole conditions permit adequate pad contact. Density data is poor in areas of washed-out hole.

Hole Conditions:

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 2
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Trevor Wall

Engineer: Michel Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 1.200 º
Hole Size: 311.0

Total Lost Time: 0.00
Loggers' Total Down Time: 0.00
Total Job Time (From Rig up to Rig down): 14.25

	Measured Depth	True Vertical Depth
Casing Depth Driller	404.60	404.58
Casing Depth Logger	405.00	404.98
Total Depth Driller (Tally)	1,526.00	1,525.95
Total Depth Driller (Strap or SLM)		

General Remarks: Logging job completed in 2 runs. Job time includes rig-up and rig-down.

Logging Run #: 1
Date: Jan 30, 2013

Drilling Fluid Data

Drilling Fluid Type: KCl Polymer
Fluid Density: 1250.0 **Viscosity:** 95 **pH:** 10.0 **Fluid Loss:** 3.2

Mud Resistivity (Rm): 0.250 @ 11.8 º
Mud Resistivity (Rm) @ BHT: 0.130 @ 40.0 º
Mud Filtrate Resistivity (Rmf): 0.190 @ 11.8 º
Mud Cake Resistivity (Rmc): 0.260 @ 11.8 º

Maximum Temperature: 40.0 º
Source (Rmf): Flowline
Source (Rmc): Calculated

Logging Run Information

Date on Bottom: Jan 30, 2013
Total Depth Logger: 1,519.00 (MD) 1,518.87 (TVD)

Logging Tools: DSI-PPC-GR-GPIT
Dipole Sonic Imager - Power Positioning Caliper - Gamma Ray - General Purpose Inclinometry Tool

Remarks: Tools performed within normal operating parameters. No problems.

Hole Conditions: Rugose hole over shale sections affects log quality.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jan 30, 2013

Drilling Fluid Data

Drilling Fluid Type: KCl Polymer

Fluid Density:	1250.0	**Viscosity:**	95	**pH:**	10.0	**Fluid Loss:**	3.2

Mud Resistivity (Rm):	0.250	@	11.8 º		
Mud Resistivity (Rm) @ BHT:	0.130	@	41.0 º	**Maximum Temperature:**	41.0 º
Mud Filtrate Resistivity (Rmf):	0.190	@	11.8 º	**Source (Rmf):**	Flowline
Mud Cake Resistivity (Rmc):	0.260	@	11.8 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: Jan 30, 2013
Total Depth Logger: 1,517.80 (MD) 1,517.67 (TVD)

Logging Tools: AIT-CNL-LDT-GR-Cal
Array Induction Tool - Compensated Neutron Tool - Litho Density Tool - Gamma Ray - Caliper

Remarks: Tools operated normally. Data is reliable. Mud is very conductive.

Hole Conditions: Rugose hole over shale sections adversely affects log quality.

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 3
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Trevor Wall

Engineer: Michel Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 0.200 °
Hole Size: 222.0

Total Lost Time:
Loggers' Total Down Time:
Total Job Time (From Rig up to Rig down):

	Measured Depth	True Vertical Depth
Casing Depth Driller	1,526.00	1,525.95
Casing Depth Logger	1,524.00	1,523.95
Total Depth Driller (Tally)	2,515.00	2,514.94
Total Depth Driller (Strap or SLM)		

General Remarks: Logging tools bridged at 2432.2m. No clean ouit trips were attempted. Mud properties remain the same for all logging runs.

Logging Run #: 1
Date: Mar 6, 2013

Drilling Fluid Data

Drilling Fluid Type:	KCl Polymer						
Fluid Density:	1375.0	**Viscosity:**	63	**pH:**	9.5	**Fluid Loss:**	6.0

Mud Resistivity (Rm):	0.120	@	12.1 º		
Mud Resistivity (Rm) @ BHT:	0.050	@	57.2 º	**Maximum Temperature:**	57.2 º
Mud Filtrate Resistivity (Rmf):	0.070	@	12.1 º	**Source (Rmf):**	Calculated
Mud Cake Resistivity (Rmc):	0.180	@	12.1 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom:	Mar 6, 2013	
Total Depth Logger:	2,432.20 (MD)	2,432.16 (TVD)

Logging Tools: PEX (AIT-CNL-LDT-GR-SP with DSI, HRLA, HGNS, GPIT, PPC-2)
Platform Express (Array Induction, Compensated Neutron, Litho Density, Gamma Ray, Spontaneous Potential with Dipole Sonic Imager, Laterlog, Spectral GR, Global positioning tool, 4-arm caliper.

Remarks: All tools run in combination.
Total tool length = 36.9 metres
All data are reliable, but is some cases subject to hole conditions.

Hole Conditions: Rugose hole over some sections, particularly in fractured Limestones and chert sections of the Hart River.

Logging Run #: 2
Date: Mar 6, 2013

Drilling Fluid Data

Drilling Fluid Type: KCl Polymer

Fluid Density:	1375.0	**Viscosity:**	63	**pH:**	9.5	**Fluid Loss:**	6.0

Mud Resistivity (Rm):	0.120	@	12.1 º		
Mud Resistivity (Rm) @ BHT:	0.050	@	57.2 º	**Maximum Temperature:**	º
Mud Filtrate Resistivity (Rmf):	0.070	@	12.1 º	**Source (Rmf):**	Calculated
Mud Cake Resistivity (Rmc):	0.180	@	12.1 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: Mar 6, 2013
Total Depth Logger: (MD) (TVD)

Logging Tools: ADT-NEXT-CMR
Array Dielectric Tool-Stringray-Compensated Magnetic Resonnance

Remarks:

Hole Conditions:

Logging Run #: 3
Date: Mar 7, 2013

Drilling Fluid Data

Drilling Fluid Type: KCl Polymer

Fluid Density:	1375.0	**Viscosity:**	63	**pH:**	9.5	**Fluid Loss:**	6.0

Mud Resistivity (Rm):	0.120	@	12.1 º		
Mud Resistivity (Rm) @ BHT:	0.050	@	57.2 º	**Maximum Temperature:**	58.9 º
Mud Filtrate Resistivity (Rmf):	0.070	@	12.1 º	**Source (Rmf):**	Flow line
Mud Cake Resistivity (Rmc):	0.180	@	12.1 º	**Source (Rmc):**	Flow Line

Logging Run Information

Date on Bottom: Mar 7, 2013
Total Depth Logger: 2,034.00 (MD) 2,033.87 (TVD)

Logging Tools: FMI-GPIT-PPC2 (x2)-Sonic Scanner

Remarks: None

Hole Conditions: Good.

Logging Run #: 4
Date: Mar 7, 2013

Drilling Fluid Data

Drilling Fluid Type: KCL Polymer

Fluid Density:	1375.0	**Viscosity:**	63	**pH:**	9.5	**Fluid Loss:**	6.0

Mud Resistivity (Rm):	0.120	@	12.1 º		
Mud Resistivity (Rm) @ BHT:	0.050	@	57.2 º	**Maximum Temperature:**	34.0 º
Mud Filtrate Resistivity (Rmf):	0.070	@	12.1 º	**Source (Rmf):**	Flow line
Mud Cake Resistivity (Rmc):	0.180	@	12.1 º	**Source (Rmc):**	Flow line

Logging Run Information

Date on Bottom: Mar 7, 2013
Total Depth Logger: 2,351.70 (MD) 2,351.57 (TVD)

Logging Tools: Mechanical Sidewall Coring Tool.

Remarks: Ten samples were utilized for desorption testing and were not described. In all 50 cores were cut.

Hole Conditions: Good, a single core at 2081.7 m (MD) could not be recovered.. Samples were taken between 2351.7 and 1534.2 m (MD).

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 4
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Trevor Wall

Engineer: Edmund Brobbey
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No

Maximum Deviation: 2.200 °
Hole Size: 222.0

Total Lost Time: 1.50
Loggers' Total Down Time:
Total Job Time (From Rig up to Rig down): 7.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	1,526.00	1,525.95
Casing Depth Logger	1,524.00	1,523.95
Total Depth Driller (Tally)	3,024.00	3,023.82
Total Depth Driller (Strap or SLM)		

General Remarks: Lost time is due to time spent working to get past bridges encountered at 2401 and 2436m. After a clean-out trip, logging was attempted again with a similar result. Tools bridged at 2436m, and no further open hole logging was attempted for this phase of the hole.

Logging Run #: 1
Date: Mar 31, 2013

Drilling Fluid Data

Drilling Fluid Type: PHPA KCl Polymer

Fluid Density:	1515.0	**Viscosity:**	97	**pH:**	9.2	**Fluid Loss:**	5.0

Mud Resistivity (Rm):	0.110	@	25.8 º		
Mud Resistivity (Rm) @ BHT:	0.070	@	58.8 º	**Maximum Temperature:**	58.8 º
Mud Filtrate Resistivity (Rmf):	0.080	@	27.1 º	**Source (Rmf):**	Pressed
Mud Cake Resistivity (Rmc):	0.130	@	24.0 º	**Source (Rmc):**	Calculated

Logging Run Information

Date on Bottom: Mar 31, 2013
Total Depth Logger: 2,436.00 (MD) 2,435.94 (TVD)

Logging Tools: AIT-DSI-GPIT-HGNS-PPC-2

Remarks: Logging tools bridged at 2436m. Logged out with GPIT-PPC-2 only to create CVL to compare with run #3.

Hole Conditions: Sloughing shales in the Imperial section.
Severe bridging at 2432-2436m on trips with drillstring.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Apr 2, 2013

Drilling Fluid Data

Drilling Fluid Type: PHPA KCl Polymer

Fluid Density:	1520.0	**Viscosity:**	89	**pH:**	9.0	**Fluid Loss:**	4.0

Mud Resistivity (Rm):	@	º			
Mud Resistivity (Rm) @ BHT:	@	º	**Maximum Temperature:**	º	
Mud Filtrate Resistivity (Rmf):	@	º	**Source (Rmf):**		
Mud Cake Resistivity (Rmc):	@	º	**Source (Rmc):**		

Logging Run Information

Date on Bottom: Apr 2, 2013
Total Depth Logger: (MD) (TVD)

Logging Tools: AIT-DSI-GPIT-HGNS-PPC-2

Remarks: Tools bridged at 2436m. No further attempts to log well were undertaken prior to running 177.8mm casing.

Hole Conditions: Sloughing shales in the Imperial section.
Severe bridging at 2432-2436m on trips with drillstring.

Deviation / Directional Survey Report

Directional Drilling Company:	Baker Hughes
Directional Drillers:	Logan/Sean/Dave
Measured While Drilling (MWD) Hands:	Kevin/Drew/Bill/Alex
Survey Type:	magnetic
Survey Mode:	MWD
Survey Date:	Jan 20, 2013
Survey Calculation Method:	minimum curvature
Target Azimuth:	0.00 °
Dog Leg Severity Characteristic:	30.00

Survey Tie-In Information

Tie-In Co-Ordinates

Latitude: 66.072982
Longitude: 137.340564
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.00

Kick-Off (Whipstock) Information

Kick-Off Co-Ordinates

Latitude:
Longitude:
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity

Remarks:

Survey Points

Storage Units: Metric

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
0.00		0.000	96.20				
8.36	8.36	0.000	96.20	0.00	0.00	0.00	0.00
412.10	412.08	1.100	96.20	-0.42	3.85	-0.42	0.08
430.90	430.87	0.700	302.60	-0.38	3.94	-0.38	2.80
449.80	449.77	0.500	120.70	-0.36	3.91	-0.36	1.90
468.60	468.57	0.200	71.20	-0.39	4.01	-0.39	0.64
487.20	487.17	0.300	158.80	-0.42	4.06	-0.42	0.57
506.00	505.97	0.500	54.50	-0.42	4.14	-0.42	1.03
524.90	524.87	0.200	90.90	-0.37	4.24	-0.37	0.57
543.80	543.77	0.100	248.40	-0.38	4.26	-0.38	0.47
562.60	562.57	0.100	235.10	-0.40	4.23	-0.40	0.04
581.50	581.47	0.200	103.70	-0.41	4.25	-0.41	0.44
600.10	600.07	0.500	70.00	-0.39	4.36	-0.39	0.57
618.90	618.87	0.200	108.70	-0.37	4.47	-0.37	0.58
647.00	646.97	0.600	297.20	-0.32	4.38	-0.32	0.85
675.40	675.37	0.500	69.60	-0.21	4.37	-0.21	1.06
704.50	704.47	0.200	260.60	-0.18	4.44	-0.18	0.72
733.30	733.27	0.100	279.20	-0.18	4.36	-0.18	0.11
762.30	762.27	0.400	175.50	-0.28	4.34	-0.28	0.45
791.30	791.27	0.400	336.50	-0.29	4.31	-0.29	0.82
819.10	819.07	0.500	221.20	-0.29	4.19	-0.29	0.82
848.10	848.07	0.100	113.30	-0.39	4.13	-0.39	0.56
876.80	876.77	0.400	321.90	-0.32	4.09	-0.32	0.51
905.00	904.97	0.600	48.40	-0.15	4.14	-0.15	0.75
933.60	933.57	0.200	5.80	0.00	4.26	0.00	0.50
962.40	962.37	0.400	279.10	0.07	4.17	0.07	0.45
991.00	990.97	0.300	153.20	0.02	4.10	0.02	0.66
1,020.00	1,019.97	0.200	176.90	-0.10	4.14	-0.10	0.15
1,049.00	1,048.97	0.300	60.20	-0.12	4.21	-0.12	0.44
1,078.10	1,078.07	0.500	58.80	-0.01	4.38	-0.01	0.21
1,096.60	1,096.57	0.500	39.40	0.09	4.50	0.09	0.27
1,115.30	1,115.26	0.800	58.10	0.22	4.67	0.22	0.58

1,134.80	1,134.76	0.800	69.40	0.34	4.91	0.34	0.24
1,154.20	1,154.16	1.300	51.70	0.53	5.21	0.53	0.91
1,172.80	1,172.76	1.000	44.20	0.78	5.49	0.78	0.54
1,191.80	1,191.75	0.500	45.90	0.95	5.66	0.95	0.79
1,211.10	1,211.05	0.300	111.20	0.99	5.77	0.99	0.72
1,230.20	1,230.15	0.500	67.60	1.01	5.89	1.01	0.55
1,248.60	1,248.55	0.400	33.80	1.09	6.00	1.09	0.45
1,267.50	1,267.45	0.100	101.10	1.14	6.06	1.14	0.59
1,286.60	1,286.55	0.400	339.10	1.20	6.05	1.20	0.72
1,305.40	1,305.35	0.300	38.90	1.30	6.06	1.30	0.57
1,324.50	1,324.45	0.200	110.70	1.33	6.12	1.33	0.48
1,343.30	1,343.25	0.100	135.70	1.30	6.16	1.30	0.19
1,362.70	1,362.65	0.500	53.00	1.34	6.24	1.34	0.77
1,382.20	1,382.15	0.400	49.50	1.44	6.36	1.44	0.16
1,400.90	1,400.85	0.200	87.40	1.48	6.44	1.48	0.44
1,420.30	1,420.25	0.200	21.80	1.52	6.49	1.52	0.34
1,440.00	1,439.95	0.200	187.90	1.51	6.50	1.51	0.60
1,459.30	1,459.25	0.100	279.40	1.48	6.47	1.48	0.35
1,478.50	1,478.45	0.600	7.90	1.58	6.47	1.58	0.95
1,497.90	1,497.85	0.700	5.50	1.80	6.50	1.80	0.16
1,542.90	1,542.85	0.200	181.50	2.00	6.52	2.00	0.60
1,581.60	1,581.55	0.300	315.90	2.00	6.45	2.00	0.36
1,630.10	1,630.05	0.200	321.10	2.16	6.31	2.16	0.06
1,669.10	1,669.05	0.300	207.10	2.12	6.22	2.12	0.33
1,708.10	1,708.05	0.400	212.70	1.92	6.10	1.92	0.08
1,745.80	1,745.75	0.100	86.30	1.81	6.06	1.81	0.37
1,783.00	1,782.95	0.100	165.60	1.78	6.10	1.78	0.10
1,812.20	1,812.15	0.300	249.10	1.73	6.04	1.73	0.31
1,850.60	1,850.55	0.200	170.60	1.63	5.95	1.63	0.25
1,888.80	1,888.74	0.400	313.30	1.65	5.87	1.65	0.45
1,926.80	1,926.74	0.100	303.10	1.76	5.74	1.76	0.24
1,965.20	1,965.14	0.400	252.20	1.74	5.59	1.74	0.27
2,002.90	2,002.84	0.000	96.70	1.70	5.46	1.70	0.32
2,041.10	2,041.04	0.100	45.90	1.72	5.49	1.72	0.08
2,069.70	2,069.64	0.200	210.90	1.69	5.48	1.69	0.31

2,108.20	2,108.14	0.400	268.70	1.63	5.31	1.63	0.26
2,146.20	2,146.14	0.100	83.90	1.63	5.21	1.63	0.39
2,184.40	2,184.34	0.100	32.70	1.67	5.26	1.67	0.07
2,221.80	2,221.74	0.300	9.40	1.79	5.29	1.79	0.17
2,260.60	2,260.54	0.400	35.80	2.00	5.39	2.00	0.14
2,318.10	2,318.04	0.300	13.60	2.31	5.54	2.31	0.09
2,356.50	2,356.44	0.100	55.30	2.43	5.59	2.43	0.18
2,394.80	2,394.74	0.300	53.80	2.50	5.70	2.50	0.16
2,452.20	2,452.14	0.100	68.10	2.61	5.87	2.61	0.11
2,509.00	2,508.94	1.000	21.10	3.09	6.09	3.09	0.49
2,566.90	2,566.83	0.200	120.90	3.51	6.36	3.51	0.55
2,624.30	2,624.23	0.100	42.90	3.50	6.48	3.50	0.11
2,652.20	2,652.13	0.500	306.90	3.59	6.40	3.59	0.56
2,680.90	2,680.83	0.600	326.20	3.79	6.22	3.79	0.22
2,709.50	2,709.43	0.400	45.20	3.98	6.21	3.98	0.69
2,738.20	2,738.13	0.400	32.90	4.14	6.33	4.14	0.09
2,757.20	2,757.13	0.500	35.50	4.26	6.42	4.26	0.16
2,776.40	2,776.33	0.600	24.50	4.42	6.51	4.42	0.23
2,795.70	2,795.63	1.400	44.70	4.68	6.71	4.68	1.34
2,815.00	2,814.92	1.200	47.20	4.99	7.03	4.99	0.32
2,834.10	2,834.02	1.600	64.00	5.24	7.41	5.24	0.89
2,853.30	2,853.21	1.700	45.10	5.56	7.86	5.56	0.86
2,872.40	2,872.30	1.500	52.70	5.91	8.26	5.91	0.46
2,891.30	2,891.19	1.700	56.50	6.21	8.69	6.21	0.36
2,910.60	2,910.48	1.800	50.90	6.56	9.16	6.56	0.31
2,930.10	2,929.98	1.600	57.10	6.90	9.63	6.90	0.42
2,948.90	2,948.77	2.100	53.70	7.25	10.13	7.25	0.82
2,968.40	2,968.25	2.100	53.80	7.67	10.70	7.67	0.01
2,987.60	2,987.44	2.200	53.70	8.10	11.28	8.10	0.16
3,006.90	3,006.73	1.800	58.80	8.47	11.84	8.47	0.68

Deviation / Directional Survey Report

Directional Drilling Company:
Directional Drillers:
Measured While Drilling (MWD) Hands:
Survey Type: drift
Survey Mode: single shot
Survey Date: Jan 21, 2013
Survey Calculation Method: minimum curvature
Target Azimuth: 0.00 °
Dog Leg Severity Characteristic: 30.00

Survey Tie-In Information

Tie-In Co-Ordinates
Latitude: 66.072982
Longitude: 137.340564
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
0.00	0.00	0.000	96.20	0.00	0.00	0.00	0.00

Kick-Off (Whipstock) Information

Kick-Off Co-Ordinates
Latitude:
Longitude:
N / S:
E / W:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity

Remarks:

Measured Depth	T.V.D.	Drift Angle (º)	Azimuth (º)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
39.00	0.00	0.250	0.00	0.00	0.00	0.00	0.00
51.28		0.500					
57.91		0.500					
68.29		0.500					
88.00		0.250					
105.22		0.750					
114.13		0.750					
126.00		1.000					
162.00		0.500					
181.21		0.750					
199.80		1.250					
214.99		0.750					
232.83		1.750					
251.70		1.250					
309.00		2.250					
329.00		2.000					
344.00		1.000					
364.36		1.500					
400.00		2.000					

Drilling Fluid Summary

Storage Units: Metric

Drilling Fluid Type:	Gel/Chem - Polymer	**From:**	32	**To:**	406
Drilling Fluid Type:	KCL/Ultradrill	**From:**	406	**To:**	1,420
Drilling Fluid Type:	KCL/Ultradrill	**From:**	1,420	**To:**	2,653

Formation Top Summary

Storage Units: Metric

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

***** All Depths measured from Kelly Bushing Elevation *****

Group *Formation* Member	Prognosis (TVD)	Sample Top (MD)	Sample Top (TVD)	Log Top (MD)	Log Top (TVD)	Subsea	Thickness
EAGLE PLAIN ***Burnthill Creek***						0.00	943.60
EAGLE PLAIN ***Fishing Branch***		943.60	943.57	943.60	943.57	-473.41	93.00
EAGLE PLAIN ***Parkin*** Upper Parkin		1039.20	1039.17	1039.20	1039.17	-569.01	167.40
EAGLE PLAIN ***Parkin*** Orange Marker	1114.00	1204.00	1203.95	1204.00	1203.95	-733.79	85.00
Whitestone River	1189.00	1289.00	1288.95	1289.00	1288.95	-818.79	152.00
L Cretaceous Mkr	1487.00	1441.00	1440.95	1441.00	1440.95	-970.79	77.20
PERMIAN ***Jungle Creek***		1518.20	1518.15	1518.20	1518.15	-1047.99	19.20
CARBONIFEROUS ***Hart River***	1487.00	1537.40	1537.35	1537.40	1537.35	-1067.19	24.70
Hart River D Sands		1562.10	1562.05	1562.10	1562.05	-1091.89	73.00
Hart River C Sands		1635.10	1635.05	1635.10	1635.05	-1164.89	422.90
Hart River Shale	1645.00	2058.00	2057.94	2058.00	2057.94	-1587.78	36.00
Hart River B Sand	2021.00	2094.00	2093.94	2094.00	2093.94	-1623.78	76.30
Ford Lake	2276.00	2170.30	2170.24	2170.30	2170.24	-1700.08	12.20

Formation Top Summary

Storage Units: Metric

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

***** All Depths measured from Kelly Bushing Elevation *****

Group *Formation* Member	Prognosis (TVD)	Sample Top (MD)	Sample Top (TVD)	Log Top (MD)	Log Top (TVD)	Subsea	Thickness
Ford Lake Hot Shale		2182.50	2182.44	2182.50	2182.44	-1712.28	21.50
Ford Lake Base Hot Shale		2204.00	2203.94	2204.00	2203.94	-1733.78	24.00
Imperial		2228.00	2227.94	2228.00	2227.94	-1757.78	81.20
Imperial Tuttle		2309.20	2309.14	2309.00	2308.94	-1838.78	
Total Depth		3024.80	3024.62			-2554.46	

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group: EAGLE PLAIN
Formation: Burnthill Creek
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: upper
Period: Cretaceous
Stage: santonian
Age (Approx): 84 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top				943.60
Log Top				

Evaluation:

The H-28 well encountered a thick section of deltaic and shallow marine interbedded sandstones, siltstones, shale and minor thin coal seams from surface to the top of the Fishing Branch, picked here at 943.6m. Because the geologic section in this basin remains poorly defined, it is not clear where the top of the Burnthill Creek occurs, but stratigraphically it would overly the Fishing Branch. This interval (32-943m) is probably better loosely defined as the "Upper Cretaceous Section". The section from the Fishing Branch to the Whitestone River is better defined, and has tops picked that are based on characteristic log signatures and lithologic assemblages, and are described following this evaluation.

The conductor pipe was set and cemented at 31.7mKB in bedrock, and drilling progressed rapidly and without problems for surface hole, drilled to ~406mKB. Samples were collected at 5 metre intervals, and a full suite of geophysical logs were run over this section, which should aid in better defining the stratigraphy in this basin. The first thin coal seam was logged to occur at 385mKB.

Drilling continued in these Upper Cretaceous lithologies in the 311mm hole, again with a rigorous sampling program, and obtaining a full suite of geophysical logs which should greatly improve the understanding of the lithological and stratigraphic relationships of this interval. Most sandstone intervals were tight, with a silty and argillaceous matrix, and no significant gas shows were seen to occur over this interval.

Conclusion:

With the exception of 3 intervals, all sandstones in this section had a silty and argillaceous matrix, and restricted porosity. One sandstone at ~641-648.5m was seen to be porous, and did have a weak gas show in the top 2m peaking at 97u (~3x background). Otherwise, this Upper Cretaceous Section and the Burnthill Creek does not show evidence of containing significant hydrocarbons at this location.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group: EAGLE PLAIN
Formation: Fishing Branch
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: upper
Period: Cretaceous
Stage: turonian
Age (Approx): 90 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	943.60	943.57	-473.41	93.00
Log Top	943.60	943.57	-473.41	

Evaluation:

The Fishing Branch is a complex sequence of interbedded lower shoreface sandstones and siltstones, interrupted by variable thicknesses of carbonaceous shale and silty shale. The sequence is shalier at the base, and sandier towards to the top. Sandstones are typically moderate to poorly sorted carbonaceous quartz litharenites, and locally may contain minor chert clasts. They commonly have traces of glauconite, and are cemented with silica and traces of calcite and locally with trace to minor black pyrobitumen cement. Sample porosity appears restricted, but locally was estimated to be 4-7%, while density porosity over the cleaner sandstones is commonly in the 10-12% range. The presence of bitumen cement is suspected to give spurious density porosity readings. Where sandstones are cemented with bitumen, they display a slow hazy dead oil cut.

One significant gas show was recorded to occur at ~986m, and is accompanied by a curious spike in both the sonic, and the density-neutron data. Gas at this depth increased roughly 6-fold to 187u, but was only a very brief show. Otherwise, gas readings over the Fishing Branch are generally quite subdued. Other gas peaks occur at 964.5, 979.9, 986.7, 998.1, 1003.7, 1012.9, 1016.9 and at 1023.6 meters (MD) with values of 86, 78, 187, 74, 109, 89, 90 and 135 units over an ~40 unit background respectively.

Conclusion:

The Fishing Branch is a sequence of interbedded lower shoreface marine sandstones, interbedded with carbonaceous shales and silty shales. Sample porosity appears restricted, however the logs would indicate porosities in the cleaner sandstones are commonly in the 10-12% range. The presence of pyrobitumen cement appears to give an elevated density porosity for these sandstones.

One gas show at 986m may be attributed to either a thin porous sandstone capped by impermeable shale, or perhaps a fracture, given the curious sonic response at this depth.

The Fishing Branch appears to have once contained hydrocarbons, but they have since migrated through the formation at this location, leaving only minor pyrobitumen cement, and there is no potential for production at this location from this interval.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group: EAGLE PLAIN
Formation: Parkin
Member: Upper Parkin
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: upper
Period: Cretaceous
Stage:
Age (Approx): 95 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1039.20	1039.17	-569.01	167.40
Log Top	1039.20	1039.17	-569.01	

Evaluation:

The Upper Parkin is a thick sequence of monotonous brown to grayish brown carbonaceous shale, with occasional to common siltstone laminations. The shales are believed to be relatively low in total organic carbon, and are not overly gassy.

Looking at the caliper over this section, the hole is decidedly elliptical, and is likely a function of a prominent jointing pattern seen in this region of the Eagle Plain Basin. Hole erosion did not hamper drilling, logging, or casing operations at this location however.

Conclusion:

The Upper Parkin is a monotonous section of carbonaceous shale, with occasional silty partings. The shales are thought to have moderate to low TOC, and have no potential for either conventional or unconventional hydrocarbon production at this location.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group: EAGLE PLAIN
Formation: Parkin
Member: Orange Marker
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: upper
Period: Cretaceous
Stage: cenomanian
Age (Approx): 96 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1204.00	1203.95	-733.79	85.00
Log Top	1204.00	1203.95	-733.79	

Evaluation:

The Orange Marker occurs as a 5 metre thick sequence of upper shoreface conglomeratic and glauconitic chert litharenite and quartz arenite. The conglomeratic lithologies are tightly cemented with silica. The quartz arenite is also cemented with silica, but displays close to 8% intergranular porosity, and shows evidence of containing hydrocarbons, with light amber oil staining, and a slow weak fluorescing cut. A gas show peaking at 151 units over a background of 40 units was recorded while penetrating the quartz arenite.

The Orange marker is overlain by 3 metres of siltstone and minor fine grained sandstone, and in turn overlies ~80 metres of sandy and glauconitic siltstone and minor shale, that at A-25 was included in the Whitestone River formation. No gas shows were seen over these intervals.

Conclusion:

The Orange Marker appears to be an excellent geologic marker in this region of the basin, albeit, there are significant variations in thickness from penetration to penetration. For example at A-25, the Orange Marker is much more prominent, reaching a thickness of 13 metres, and is coarser grained overall. At this location, the Orange marker did show evidence of containing hydrocarbons in a thin porous quartzose sandstone underlying approximately 3 metres of chert pebble conglomerate. Regionally, there may be the potential for a significant pinch-out type trap at this stratigraphic level, where the quartzose sandstone thickens, and there is good 3-way closure. Although there is evidence for hydrocarbons within the quartzose sandstone here, this location does not appear to have potential for production.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Whitestone River
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: lower
Period: Cretaceous
Stage: albian
Age (Approx): 105 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1289.00	1288.95	-818.79	152.00
Log Top	1289.00	1288.95	-818.79	

Evaluation:

The Whitestone River is picked here at 1289 metres where the lithology grades from sandy siltstone to a thick sequence of calcareous shale with occasional silty partings. The shale itself is a medium gray to grayish brown colour, and is only slightly carbonaceous. There are 80 metres of sandy siltstone immediately underlying the Orange Marker here that are included with the Middle Parkin, but at A-25, this interval is included with the Whitestone River. This is just one more example where the stratigraphic relationships and boundaries need to be further examined and defined in this underexplored basin.

Drilling progressed rapidly and without problems through the Whitestone River section, and logging and casing operations were not negatively affected, however there is a pronounced ellipsoidal geometry to the hole over this interval, probably a function of the prominent jointing seen in this region of the basin.

Conclusion:

The stratigraphic relationships and boundaries require further study in this basin, so correlation between wells is more consistent.

The Whitestone River is a low TOC shale, and has no hydrocarbon production potential.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: L Cretaceous Mkr
Member:
Boundary Type: conformable
Fault Type:

Era: mesozoic
Series: lower
Period: Cretaceous
Stage: albian
Age (Approx): 133 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1441.00	1440.95	-970.79	77.20
Log Top	1441.00	1440.95	-970.79	

Evaluation:

The Lower Cretaceous Marker represents a facies change in the lower Whitestone River where basinal shales with occasional silty partings pass conformably into overlying blocky lower shoreface glauconite siltstones and sandy siltstones. These blocky siltstones have a sharp upper contact with a continuation of the Whitestone River basinal shales which are genetically similar to the lowermost sequence. Fossil bivalves were noted to occur at the top of the Lower Cretaceous Marker. No gas shows or porosity were seen to occur over the Lower Cretaceous Marker.

Conclusion:

The Lower Cretaceous Marker is a mappable unit within the Eagle Plain Basin, and may be useful in correlating stratigraphic sections. No porosity or hydrocarbon shows were seen to occur over the Lower Cretaceous Marker.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group: PERMIAN **Era:** paleozoic
Formation: Jungle Creek **Series:** early
Member: **Period:** Permian
Boundary Type: unconformable **Stage:** sakmarian
Fault Type: **Age (Approx):** 283 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1518.20	1518.15	-1047.99	19.20
Log Top	1518.20	1518.15	-1047.99	

Evaluation:

The Jungle Creek is represented within drill cuttings and within geophysical logs between 1518.2 and 1537.4 meters (MD). It consists of interbedded sandstone and conglomerate. 244.5 millimeter (OD) intermediate casing is set at 1524 meters (MD) (two meters deeper than hole measured depth). A single side wall core was cut at 1534.2 meters (MD).

Gas levels rose during the penetration of this interval and significant gas shows are as follows: 1) 1521-1522.9 meters (MD): 85-264 units over a 40 unit background; 2) 1522.9-1529 meters (MD): 80-190 units over a 20 unit background; 3) 1530.7 meters (MD): 150 units over a 20 units background , and 4) 1532.2-1533.6 meters (MD): 57 units over a 20 unit background.

Conglomerate between 1518.2 and 1526 meters (MD) is as follows: as chert peble conglomerate, : medium to dark brown to grayish brown, predominately with medium to dark grayish brown chert pebbles, granules, and very coarse grains in silty to upper fine grained sandy matrix, subrounded to rounded, poorly sorted, silica + pyrite + locally minor pyrobitumen cement, questionable porosity, chert grains are pulverized to shards, matrix commonly has light amber oil staining, spotty dull yellow fluorescence, immediate blooming cut, minor streaming cut.

Sandstone between 1526 and 1531 meters (MD) is as follows: conglomeratic, medium brown, grayish brown, variously gray and occasional with white chert granules & small pebbles in poorly sorted silty to coarse grained sandy matrix with common reddish brown ferruginous staining, subrounded, silica + chert + patchy poor, + trace calcite cement, scattered minor black pyrobitumen cement, predominately tight, locally weak intergranular porosity (0-6%), spotty dull yellow fluorescence, fair streaming cut, poor show, occasional medium to dark brown silty argillaceous partings

Conglomerate between 1531 and 1538.2 meters (MD) is as follows: predominately with variably gray chert, minor white & brown chert pebbles granules & very coarse grained clasts, medium brownish gray silty to upper medium grained sandy matrix, minor black pyrite bitumen cement coating grains, patchy massive pyrite, silica cement, subrounded, poorly sorted, occasional moderately sorted quartzose fine grained sandstone with prominent silica overgrowths and common black pyrobitumen cement, occluded porosity (estimated 6-9%), strong petroliferous odor, spotty dull yellow fluorescence, fair streaming cut, dead oil show.

The sidewall core recovered at 1534.2 meters (MD) is as follows: represented by a single off white, light gray quartz arenite boulder and minor conglomeratic sandstone matrix as follows: predominately salt and pepper with gray chert, minor white & brown fine upper to very coarse upper chert grains pebbles, granules & minor quartz grains, siliceous, poorly sorted, with abundant 1-12% black pyrobitumen filled intergranular porosity, slightly pyritic, petroliferous odor, slow weak yellow green blooming cut fluorescence in powdered sample.

Geophysical logs are good only below 1530 meters (MD) and porosity logs indicate the presence of porosiies ranging between 6 and 14% with some neutron and density porosity crossover suggesting the presence of gas.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Conclusion:

The Jungle Creek is likely gas productive.

Group: CARBONIFEROUS
Formation: Hart River
Member:
Boundary Type: unconformable
Fault Type:

Era: paleozoic
Series: upper
Period: Mississippian
Stage: serpukhovian
Age (Approx): 322 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1537.40	1537.35	-1067.19	24.70
Log Top	1537.40	1537.35	-1067.19	

Evaluation:

The Hart River is a complex sequence of clastics, carbonates and highly organic shales, deposited over a range of facies, with multiple sequence boundaries separating the various sequences.

Conclusion:

Specific sections of the Hart River formation are described below.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: D Sands
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Mississippian
Stage: serpukhovian
Age (Approx): 323 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1562.10	1562.05	-1091.89	73.00
Log Top	1562.10	1562.05	-1091.89	

Evaluation:

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

The Hart River "D" sands are represented in drill cutings and within geophysical logs between 1562.1 and 1635.1 meters (MD). The member consists of sandstone, interbedded with minor limestone and shale. Sidewall cores were recovered at 1634.5, 1609, 1607 and at 1571.8 meters (MD).

A single interval located between 1568.8 and 1580 metres (MD) generated significant gas. Here, gas levels ranged between 32 and 90 units over a 20 unit background. Sandstone associated with this interval is as follows: light amber brown, light gray, medium brownish gray, quartzose with minor chert with common to abundant white siliceous lithics, upper very fine to lower coarse upper, becoming conglomeratic basally, subrounded, poor to moderately sorted, siliceous, calcareous. Porosity and shows are as follows: 1) 2568.8-1570 meters (MD): variable porosity, predominately 3-8%, locally 8-12%, light amber hydrocarbon staining throughout, yellow fluorescence throughout, slow streaming cut, poor oil show; 2) 1570-1577.5 meters (MD), with occluding porosity, common to abundant yellow fluorescence, weak streaming cut, poor oil show; 3) 1577.5- 1580 meters (MD): tight to very poor porosity, trace light amber hydrocarbon staining, spotty yellow fluorescence with weak streaming cut, questionable show, tight.

Core recovered from 1571.8 meters (MD) is as follows: gray, salt and pepper with scattered white, medium brown, or gray, rare black or green chert grains, angular to subrounded, fine to medium grained, rare floating very coarse lower chert grains, poor to moderately sorted, calcareous, siliceous, minor pyrite cement, grains in part crush to a fine powder and diagenetically altered, locally kaolinitic, rare patchy clay matrix, spotty amber hydrocarbon staining with moderate, rapid yellow green blooming cut fluorescence, very little visible intergranular in core, rare black bitumen, matrix porosity? Geophysical logs between 1562 and 1580 meters (MD) indicate the presence of porosity ranging between 3 and 13 percent.

Further analysis of the geophysical logs show that between 1608 and 1619 meters (MD) porosities range between 3 and 14%, Sandstone in this intervals is as follows: light to medium grayish brown, white, light gray, light yelish brown, quartz, minor, locally variable gray chert & common to abundant white siliceous clasts, predominately upper very fine to upper very coarse grained, subrounded, poor to moderately sorted, siliceous, calcareous. Porosity and shows are as follows: 1) 1607.5-1610 meters (MD):, trace to minor black pyrobitumen cement, occasional silica overgrowths, 6-9% intergranular porosity, yellow fluorescence throughout, moderate streaming & weak blooming cut, fair dead oil show; 2) 1610-1615 meters (MD): minor pyrobitumen cement, dull yellow fluorescence, moderately slow streaming cut, dead oil show, 3) 1615-1617.5 meters (MD): patchy light amber hydrocarbon staining & dull yellow fluorescence, weak streaming dead oil cut.

Sandstone recovered in side wall core at 1609.0 meters (MD) is as follows: light grayish brown, salt and pepper with gray, gray brown & white chert grains, grains commonly crush to a fine powder, diagenetically altered, white chert in part as siliceous clasts (of kaolin?), predominately upper very fine to lower medium grained, subrounded, moderately sorted, siliceous, calcareous, trace to minor black pyrobitumen cement, occasional silica overgrowths, 6-9% bitumen plugged intergranular porosity, yellow fluorescence throughout, moderate yellow green blooming cut, no visible intergranular porosity.

Sidewall Cores cut in unconventional reservoir were taken at 1634.5 and 1607 meters (MD) and are as follows: 1) 1607 meters (MD):dark brown, dark brown gray, calcareous, firm, commonly with scattered crinoid ossicles & occasional brachiopod fragments, slightly silty & sandy, pyritic, powdered sample with moderate yellow green blooming cut fluorescence. 2) 1634.5 meters (MD) medium to dark brown, firm, slightly silty & sandy, calcareous, no visible fractures, no cut fluorescence.

Conclusion:

The Hart River "D" Sands displays good, largely bitumen and locally clay plugged intergranular porosity. It also contains hydrocarbons. Further evaluation is needed in order to deterrmine if the interval is economically viable.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: C Sands
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Mississippian
Stage: serpukhovian
Age (Approx): 324 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1635.10	1635.05	-1164.89	422.90
Log Top	1635.10	1635.05	-1164.89	

Evaluation:

The Hart River "C" Sand is represented in drill cuttings and within geophysical logs between 1635.1 and 2058 meters (MD). Between 1635.1 and 1683 meters (MD), the interval consists predominantly of sandstone with minor limestone and shale. Below this interval it consists primarily of interbedded chert and limestone with minor shale and sandstone beds. Sidewall cores were recovered from 1) 1655, 1663.5, 1671.5, 1690.9, 1824 and 1882.7 meters (MD). The second and third cores were cut in conventional reservoirs.

Sidewall cores cut in unconventional reservoir are as follows: 1) 1655 meters (MD): shale: medium to dark brown, calcareous, siliceous, firm, commonly silty & sandy, no cut fluorescence; 2) 1690.9 meters (MD): shale: dark brown, firm, sub fissile, calcareous, slightly pyritic, commonly silty or sandy, no cut fluorescence; 3) 1824 meters (MD): shale: dark brown to black, sub platy, very calcareous & very firm, slightly silty & sandy, micromicaceous, non fissile, slow weak yellow green blooming cut fluorescence; 4) 1882.7 meters (MD): shale: dark brown, calcareous, slightly fissile, hard, slightly silty & sandy, rare pyrite, predominately as clay shale, very slow, weak, yellow green blooming cut fluorescence.

There were no significant gas shows recorded above 1683 meters (MD). Numerous significant gas shows occur below 1683 meters (MD) and are attributable to the presence of fractures within limestones and chert.

Geophysical logs. indicate the presence of porosity in the following intervals: 1) 1635.1-1655 meters (MD) with most porosity ranging between 3 and 15% with 18-21 % located at 1641 meters (MD); 2) between 1658 and 1661 meters (MD) with porosities ranging between 3 and 8%; 3) between 1670 and 1682 meters (MD) with porosities ranging between 3 and 15%. Porosity estimates from logs are poorer below 1690 meters (MD) due to hole washout.

Sandstones associated with these intervlas are as follows: 1) 1635 to 1637.5 meters (MD): light to medium brownish gray, translucent & semi opaque quartz, and common gray & brown chert, fine to lower coarse grained, subrounded, moderate to poorly sorted, minor primary silica cement, abundant secondary calcite cement occluded porosity, trace spotty interstitial bitumen cement, tight to weak porosity (0-6%), patchy yellow fluorescence, fair streaming cut, questionable show. 2) 1637.5. to 1642.5 meters (MD) light to medium grayish brown, translucent & semi opaque quartz, minor gray & brown chert, abundant white chert, predominately fine grained, 10-15% medium to lower coarse grained, moderate sorting, subrounded to sbangular, commonly with silica overgrowths, silica cement, trace secondary calcite cement, fair intergranular porosity (8-12%), dark pyrobitumen occluded porosity throughout, yellow fluorescence, strong petroliferous odor, fair moderately fast blooming & streaming cut, fair show, 3) 1642.5 to 1650 meters (MD): light to medium grayish brown, quartz with abundant gray white, & occasional brown chert, predominately upper very fine to upper fine grained, minor medium to lower coarse grained, subrounded to subangular, moderately well sorted, primary silica cement, abundant secondary calcite cement, common to abundant dark brown to black pyrobitumen cement, moderately well indurated, friable in part, poor to locally fair porosity (3-10%), yellow fluorescence throughout, fair blooming and moderate streaming cut, fair show, no gas; 4) 1650 to 1655 meters (MD) light to medium gray, very fine to fine grained, minor lower medium grained, quartz & gray chert, subrounded, moderate to poorly sorted, primary silica + abundant secondary calcite cement, predominately tight (0-4% porosity), trace interstitial pyrobitumen, spotty yellow fluorescence, slow streaming cut, very poor to questionable show; 5) 1655 to 1660 meters (MD): white to very light tan or yellowish white, very fine grained, silty in part, subrounded, moderate sorted, silica cement, extremely calcareous, dissolved grains leave a framework of quartz & minor gray chert with minor interstitial pyrobitumen cement, spotty dull fluorescence, trace cut, no show, 6) 1660 to 1662.5 meters (MD): light brown, very fine grained, minor lower fine grained, quartzose, subrounded to rounded, moderately well sorted, primary silica + secondary calcite cement, patchy minor pyrobitumen cement, poor porosity (3-7%), bright yellow fluorescence throughout, fair moderately fast blooming & streaming cut; 7) 1670 to 1680 meters MD): light to medium grayish brown, quartz & abundant gray & occasionally brown chert, very fine to very coarse grained, predominately poorly sorted, interbedded moderate to well sorted fine to lower medium grained sandstone, subrounded to subangular, moderate to well

indurated, primary silica cement, common pyrobitumen cement, abundant secondary calcite cement, poor intergranular porosity (~2-6%), patchy yellow fluorescence, moderate streaming dead oil cut.

Sandstone recovered within sidewall cores from 1663.5 and 1671.5 meters (MD) are as follows: 1) 1663.5 meters (MD): Sandstone: white with thick laminations of very light tan or yellowish white argillaceous sandstone, very fine grained, silty, subrounded, well to moderate sorted, calcareous, siliceous, dissolved grains leave a framework of quartz & minor gray chert with minor interstitial pyrobitumen cement & reveal a white argillaceous matrix (kaolin?), spotty dull fluorescence, trace cut, no show, kaolin matrix porosity?; 2) 1671.5 meters (MD): light to medium grayish brown, salt and pepper, fine to lower medium, occasionally upper medium grained, commonly with gray, white or brown chert grains, poor to moderately sorted, siliceous, calcareous, slightly pyritic, locally with light brown or off white argillaceous matrix, commonly with 1-12 % pyrobitumen plugged intergranular porosity, diagenetically altered & grains crush to a fine powder, feldspathic?, rare poor visible intergranular porosity, rapid milky yellow green blooming cut fluorescence.

Conclusion:

The C Sands are porous and contain hydrocarbons which largely occludes the pore spaces. Poor gas shows were generated and the interval may not be economically viable. Further evaluation is required.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Hart River
Member: B Sand
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Mississippian
Stage: serpukhovian
Age (Approx): Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2094.00	2093.94	-1623.78	76.30
Log Top	2094.00	2093.94	-1623.78	

Evaluation:

The Hart River "B" and "A" Sands are poorly developed, tight and non productive here. No significant gas shows are associated with both of these zones of interest.

Sandstone located between 2094 and 2096 meters (MD is as follows: medium to dark gray, dark brown in part, quartz & common gray chert, predominately lower fine to lower medium grained, occasional upper medium clasts, moderate to poorly sorted, subrounded, primary silica cement, abundant secondary calcite cement occludes porosity completely, well indurated, tight, no visible show, trace pyrite.

A deeper sandstone equivalent to the "A" Sand is as follows: medium to dark gray, dark brown in part, quartz & common gray chert, predominately lower fine to lower medium grained, occasional upper medium clasts, moderate to poorly sorted, subrounded, primary silica cement, abundant secondary calcite cement occluded porosity completely, well indurated, tight, no visible show, trace pyrite.

Sidewall cores were cut at 2144.9, 2145.1, 2145.2, 2151.9 and at 2152.1 meters (MD). Cores are as follows: 2144.9 meters (MD): shale: dark brown, calcareous, as clay shale, silt & sand grains, sub fissile, slightly pyritic or micromicaceous, no cut fluorescence; 2) 2145.1 meteres (MD) shale: dark brown, massive, as clay shale, micromicaceous, with disseminated fine pyrite, rare silt & sand grains, calcareous, no cut fluorescence; 3) 2145.2 meters (MD): shale: dark brown, massive, commonly slightly silty, sandy, slightly pyritic, micromicaceous, hard, calcareous, no cut fluorescence; 4) 2151.9 meters (MD): shale: dark brown, hard, sub fissile, calcareous, commonly silty & or with very fine lower quartz grains, grading to very argillaceous, medium brown, sandy siltstone, slightly pyritic, tight, no cut fluorescence; 5) shale: 2152.1 meters (MD): shale: dark brown, hard, sub fissile, calcareous, commonly silty & or with very fine lower quartz grains, grading to very argillaceous, medium brown, sandy siltstone, slightly pyritic, tight, no cut fluorescence.

Conclusion:

The Hart River "B" and "A" Sand is not productive here. Unconventional cores did not generate a cut fluorescence.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Ford Lake
Member:
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: middle
Period: Mississippian
Stage: visean
Age (Approx): 338 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2170.30	2170.24	-1700.08	12.20
Log Top	2170.30	2170.24	-1700.08	

Evaluation:

The Ford Lake is divided here into three sections. This is the first and it is represented within drill cuttings and within geophysical logs between 2170.3 and 2182.5. meters (MD). The interval consists of interbedded shale and limestone. No side wall cores were cut.

Background gas levels ranged between 49 and 60 units with a single significant gas peak between 2178 and 2181 meters (MD) of 137 units over a 50 unit background is present.

Shale is as follows: dark grayish brown to black, subfissile, calcareous, bituminous, silty, very fine grained sandy in part, moderately firm & brittle, no visible fluorescence, bituminous in part, weak slow hazy cut, trace pyrite. Limestone is as follows: light to dark grayish brown, cryptocrystalline, silty & argillaceous, occasional siltstone and sandstone stringers, sandstone stringers grade to very coarse grained & are poorly sorted with abundant dark gray chert & are tightly cemented with calcite, scattered brachiopods, occasional bioclastic beds, interbedded dark carbonaceous shale, locally cherty with 2-4% dark brown chert, slightly bituminous, slow blooming cut, rare calcite filled fractures.

Conclusion:

More information is required in order to evaluate this zone.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Ford Lake
Member: Hot Shale
Boundary Type: unconformable
Fault Type:

Era: paleozoic
Series: middle
Period: Mississippian
Stage: visean
Age (Approx): 339 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2182.50	2182.44	-1712.28	21.50
Log Top	2182.50	2182.44	-1712.28	

Evaluation:

The Ford Lake "Hot Shale Zone" is represented within geophysical logs and drill cuttings between 2182.5 and 2204 meters (MD). The unit consists of radioactive shale which liberated gas ranging between 59 and 167 units.

Sidewall cores were recovered at 2184.4, 2184.6, 2192.4, 2192.6, 2192.7, 2199.9, and at 2200.1 meters (MD). The descriptions are as follows: 1) 2184.4 meters (MD): shale: dark brown, as clay shale, medium hard, fissile in part, commonly with accicular or needle shaped randomly orientated very fine pyrite crystals, predominately non calcareous, slightly bituminous with very slow, weak yellow green, blue blooming cut fluorescence; 2) 2184.6 meters (MD): shale: dark brown, medium hard, sub fissile, non calcareous, commonly with floating very fine quartz grains, commonly pyritic (botryoidal & accicular), with questionable rare phosphate pellets, bituminous with very slow yellow green, poor in part blue blooming cut fluorescence; 3) 2192.4 meters (MD): shale: dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, greasy, pyritic, carbonaceous, bioturbated with rare pyrite tubes or sand filled trace fossils, bituminous, moderate milky yellow green blooming cut fluorescence; 4) 2192.6 meters (MD): shale: dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, non calcareous, core easily scratched, greasy, pyritic, carbonaceous,commonly with floating angular to subrounded, predominately fine lower quartz grains, bituminous, moderate milky yellow green blooming cut fluorescence; 5) 2192.7 meters (MD): shale: dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, non calcareous, core easily scratched, greasy, pyritic, carbonaceous, commonly with floating angular to subrounded, predominately fine lower quartz grains, in part bioturbated, bituminous, moderate milky yellow green blooming cut fluorescence; 6) 2199.9 meters (MD): shale: dark gray brown, dark brown, sub fissile, soft to commonly hard or firm, brittle in part, pyritic, greasy, occasionally slightly silty & sandy,core predominately massive, rare sand filled trace fossils, bituminous, powdered fragments with rapid yellow green blooming cut fluorescence, 7) 2200.1 meters (MD): shale: dark brown, dark brown gray, commonly soft, sub fissile to brittle, micromicaceous to greasy, commonly with disseminated very fine or occasionally needle like pyrite crystals, rare silty & sand grains, bioturbated, powdered sample with rapid, moderate yellow green blooming cut fluorescence.

Conclusion:

The Ford Lake liberated good gas shows. The desorbtion results will provide the final word on the potential of this zone.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Ford Lake
Member: Base Hot Shale
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: middle
Period: Mississippian
Stage: visean
Age (Approx): 340 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2204.00	2203.94	-1733.78	24.00
Log Top	2204.00	2203.94	-1733.78	

Evaluation:

This is the basal most zone of the Ford Lake and it is represented within drill cuttings and within geophysical logs between 2204 and 2228 meters (MD). Background gas levels ranged between 46 and 67 units with two significant gas peaks located between 2211.8 and 2216 meters (MD) and between 2218 and 2221 meters (MD) of 153 units and 117 units over a 55 unit background, respectively.

Sidewall cores were cut at 2207.4, 2207.6, 2207.7 and 2216.4, 2216.6 and 2216.7 meters (MD).The core descriptions are as follows: 1) 2207.4 meters (MD): shale: medium to dark gray brown, slightly pyritic, predominately as clay shale, locally silty & sandy, with light gray, calcareous, very fine gently inclined silty to very fine grained tight, sandstone laminae, trace calcareous cement, slow poor faint yellow green blooming cut fluorescence; 2) 2207.6 meters (MD): shale: medium to dark gray brown, slightly pyritic, predominately as clay shale, locally silty & sandy, with light gray, calcareous, very fine gently inclined silty to very fine grained tight, sandstone laminae, trace calcareous cement, slow poor faint yellow green blooming cut fluorescence. 3) 2207.7 meters (MD) : shale: dark brown, as clay shale, slightly pyrc, core is massive, spotty calcareous cement, soft to hard & sub fissile to brittle, carbonaceous, bituminous, with weak, slow, poor yellow green blooming cut fluorescence. 4) 2216.4 meters (MD): shale: dark brown, hard, calcareous, pyritic, slightly silty & sandy, bedded with brachiopod, locally cherty, sandy, very pyritic, marly tight shale, bituminous, slow yellow green poor blooming cut fluorescence. 5) 2216.6 meters (MD) shale: dark brown, sub fissile,commonly with floating fine quartz grains or silty, pyritic, non calcareous, occasional carbonaceous flakes, sub fissile to firm & brittle, core commonly with very fine silty to fine grained, tight, calcareous, quartzose, silty very fine grained, wavy sandstone laminae, weak slow poor yellow green blooming cut fluorescence. 6) 2216.7 meters (MD): shale: medium to dark gray brown, commonly with elongated or stretched pyrite crystals & in part sheared, commonly very finely interlaminated with discontinuous ribbon like quartzose siltstone & sandstone laminae, slightly carbonaceous or bituminous, non calcareous, slow poor faint cut fluorescence.

Conclusion:

Desorbtion tests will be the ultimate "determiner" with regard to the productivity of this interval.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Imperial
Member:
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Devonian
Stage: famennian
Age (Approx): 365 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2228.00	2227.94	-1757.78	81.20
Log Top	2228.00	2227.94	-1757.78	

Evaluation:

The Imperial is a very thick section of basinal carbonaceous shales with occasional interbedded blocky sandstones. The most prominent of these blocky sandstones is referred to as the Tuttle member, and is described in more detail below.

The Imperial is greater than 796m in thickness at this location, and was greater than 1019m in apparent thickness at the A-25 location, drilled in the latter half of 2012. At neither location was the Imperial fully penetrated to reach the underlying Canol formation, so true thicknesses of this section are yet to be determined. The Imperial shales do change in character over the sequence, with some sections having common sandy or silty partings, some sections showing silicification, and some sections having greater (or lesser) amounts of total organic carbon and pyrite. There are also some sections of the Imperial in this well that show a high degree of shearing and ductile deformation, and other sections which do not display shearing, but may have high angle jointing. This formation presents challenges for efficiently drilling the section, as the heterogeneity of the lithology, both in mechanical and chemical terms makes bit selection difficult. Another significant challenge occurs where the hole abruptly passes from soft incompetent shale, to hard, brittle and competent sandstone. Invariably this scenario creates bridges and ledges which make it difficult to pass drill strings, logging tools, or casing strings past these interfaces. In addition, the fragile and wettable nature of these shales makes them prone to sloughing. If they fail suddenly, it can lead to packing off the drill string, and stuck pipe situations. Drilling this section with an oil-based mud may alleviate some of these potential hole problems.

Conclusion:

The Imperial is a very thick sequence of dark carbonaceous basinal shale, that is locally pyritic, locally siliceous, and has minor interbedded sandstone, siltstone, and locally has thin argillaceous limestone partings. Porous sandstones typically have anomalous cuttings gas, but do not appear to have good potential for hydrocarbon production.

Imperial shales are typically anomalously gassy at H-28, but are not overly gassy, and do not appear to be a good candidate for shale gas production. Likewise, the Tuttle member and other sandstone members within the Imperial have restricted porosity, and do not appear to have potential for hydrocarbon production.

The Imperial shales are fractured, jointed, and sheared. They are also fissile, and somewhat wettable. Mechanically these shales create the perfect storm for any drilling program, and are particularly challenging when attempting to drill this section with a water based mud system.

Kelly Bushing Elevation: 470.16 **Casing Flange Elevation:**
Ground Elevation: 461.80

All Depths Measured from Kelly Bushing Elevation

Group:
Formation: Imperial
Member: Tuttle
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: upper
Period: Devonian
Stage: famennian
Age (Approx): 366 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2309.20	2309.14	-1838.98	
Log Top	2309.00	2308.94	-1838.78	

Evaluation:

The Tuttle member of the Imperial formation occurs as a blocky granular sandstone where clasts are predominately medium grayish brown, off white, light brown & gray chert with occasional quartz in a poorly sorted argillaceous, tight silty & sandy matrix, with sand clasts to lower medium grained and scattered massive pyrite cement. Clasts are subrounded and very poorly sorted. The Tuttle showed no porosity, and no evidence of containing hydrocarbons at this location. Granular sandstones are interbedded with minor argillaceous siltstone & silty shale.

Conclusion:

The Tuttle member occurs as a tight, poorly sorted granular sandstone. No porosity or hydrocarbon show was detected in the sample evaluation study.

32.00 to 40.00 (8.00)	85%	**SANDSTONE** medium gray, very fine to fine grained, minor interbedded lower to upper fine grained, silty & argillaceous throughout, very slightly calcareous, predominately quartzose, abundant dark lithics, rare glauconite grain, occasional carbonaceous fragments, weak silica cement with argillaceous matrix, weak to moderate induration, tight to very poor porosity, no visible show
	15%	**SHALE** medium gray, pale greenish gray, subfissile, non calcareous, locally silty to sandy, rare plant remains
40.00 to 45.00 (5.00)	70%	**SHALE** predominately light to medium greenish gray, medium to dark brownish gray in part, subfissile, non calcareous, commonly silty, grading to shaly siltstone, rare plant fragments
	30%	**SILTSTONE** medium gray, pale greenish gray, grading to very fine grained sandstone in part, argillaceous matrix, non to very slightly calcareous, scattered plant fragments, rare coaly laminae
45.00 to 60.00 (15.00)	70%	**SHALE** medium greenish gray, medium brown to purple gray, non to subfissile, slightly waxy in part, non calcareous, brown shale is slightly carbonaceous
	20%	**SILTSTONE** medium gray, brownish gray, sandy in part, non to very slightly calcareous, trace carbonaceous matter
	10%	**SANDSTONE** medium gray, brownish gray, very fine grained to lower fine grained in part, silty argillaceous matrix, grading to sandy siltstone, subrounded, poorly sorted, non to very slightly calcareous, weak silica cement with argillaceous matrix, moderately well indurated, tight, occasional thin bed with common minute carbonaceous matter
60.00 to 70.00 (10.00)	85%	**SHALE** predominately medium gray to greenish gray, minor purple to brownish gray, non to subfissile, waxy in part as above, silty & sandy laminations, non calcareous, dark shale is slightly carbonaceous, non calcareous
	10%	**SILTSTONE** medium gray to brownish gray, sandy in part, non calcareous, thin laminae
	5%	**SANDSTONE** medium gray, brownish gray, very fine grained, locally grading to lower fine grained, silty argillaceous matrix, non calcareous, trace minute carbonaceous matter, rare coaly laminae, non calcareous, subrounded, poorly sorted, tight

70.00 to 75.00 (5.00)	70%	**SANDSTONE** medium to dark gray to brownish gray, quartz, chert, dark lithics & common carbonized fragments, predominately very fine grained, occasional thin beds grading to fine grained, silty argillaceous matrix, non calcareous, moderate indurated, friable in part, tight to very poor porosity, no visible show, scattered plant fragments, rare coaly laminae
	30%	**SHALE** medium greenish gray and brownish gray, non to subfissile, slightly waxy, non calcareous, commonly silty & or sandy, carbonaceous in part
75.00 to 90.00 (15.00)	85%	**SHALE** medium to dark brownish gray, non to subfissile, silty throughout, grading shaly siltstone in part, increasingly carbonaceous, rare coaly laminae, sandy stringers, non to very slightly calcareous in part
	15%	**SANDSTONE** medium to dark grayish brown to brownish gray, predominately very fine grained, 3-5% lower fine grained, silty and argillaceous matrix, non to very slightly calcareous, subrounded to subangular , poorly sorted, moderately indurated, tight
90.00 to 95.00 (5.00)	85%	**SHALE** predominately medium to dark brownish gray, light to medium greenish gray in part, non calcareous, non to subfissile, silty & sandy in part, occasional sandy stringers, carbonaceous in part, occasional carbonized plant fragments
	10%	**SILTSTONE** medium to dark brownish gray, sandy in, non calcareous, carbonaceous in part
	5%	**SANDSTONE** medium gray, very fine to locally fine grained, silty & argillaceous matrix, subangular to subrounded, non calcareous, moderately well indurated, tight, common minute carbonized plant fragments throughout
95.00 to 100.00 (5.00)	65%	**SILTSTONE** light fleshy brown, quartzose, sandy, non calcareous
	35%	**SHALE** light greenish gray, medium grayish brown in part, non to subfissile, silty & sandy throughout, slightly waxy, moderate to well compacted, non calcareous
100.00 to 105.00 (5.00)	40%	**SHALE** medium to dark grayish brown, subfissile, silty, carbonaceous in part, non calcareous, occasional mica flake
	40%	**SANDSTONE** dark grayish brown, quartz, chert, lithics, and common to abundant black carbonaceous matter, very fine to fine grained, silty & argillaceous matrix, subrounded to subangular, poorly sorted, moderate induration, friable in part, tight to very poor porosity, no visible show

100.00 to 105.00 (5.00)	20%	**SILTSTONE** predominately medium to dark gray to brownish gray, light gray in part, sandy in part, non calcareous, carbonaceous in part
105.00 to 110.00 (5.00)	70%	**SHALE** predominately light gray to pale grayish green, light to medium brown, minor dark grayish brown as above, subfissile to non fissile, slightly waxy, non calcareous, silty throughout
	30%	**SANDSTONE** pale grayish green, light brown, light gray, quartzose, very fine grained, silty & argillaceous, non calcareous, weak to moderate induration, tight
110.00 to 115.00 (5.00)	100%	**SHALE** light to medium grayish brown, pale tan gray, non fissile, light colored very fine to fine grained oval pellets? in slightly darker matrix, waxy, commonly limonitic and sideritic to ferruginous, non calcareous, silty in part, rare carbonized plant remains
115.00 to 125.00 (10.00)	80%	**SHALE** predominately light to medium grayish tan to brown, non fissile, silty in part, non calcareous, commonly having bioturbated appearance with lighter colored pellets? in darker matrix, sandy stringers, becoming medium dark brown and carbonaceous
	10%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous, subrounded to subangular, poorly sorted, becoming carbonaceous, non calcareous, tight
	10%	**SILTSTONE** light to medium grayish brown, sandy in part, non calcareous, trace carbonaceous matter
125.00 to 130.00 (5.00)	60%	**SHALE** medium to dark grayish brown, subfissile, silty, carbonaceous in part, non calcareous
	40%	**SILTSTONE** dark grayish brown, sandy in part, grading to very fine grained sandstone, carbonaceous, non calcareous, plant remains, rare pyrite, micromicaceous
130.00 to 145.00 (15.00)	70%	**SHALE** mottled & interbedded pale grayish green & grayish brown, brown shale is slightly carbonaceous, silty, non calcareous, waxy in part, sandy laminations
	30%	**SANDSTONE** light to medium grayish brown, quartz & abundant dark lithics, very fine grained, silty & argillaceous, grading to sandy siltstone in part, subangular, poorly sorted, thin beds, tight

145.00 to 160.00 (15.00)	75%	**SHALE** mottled & interbedded pale grayish green & medium to dark brown as above, subfissile to non fissile, non calcareous, silty in part, well compacted, firm
	25%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous, grading to sandy siltstone,, subangular, poorly sorted, tight, carbonaceous in part, non calcareous
160.00 to 165.00 (5.00)	60%	**SHALE** predominately light to medium pale grayish green, medium to dark brownish gray in part, non fissile, small trace pyrite, trace carbonaceous matter, non calcareous
	40%	**SANDSTONE** medium gray to grayish brown, quartz, chert & abundant dark lithics in brown silty and argillaceous matrix, subrounded to subangular, poorly sorted, moderately well indurated, non calcareous, tight, rare glauconite grain
165.00 to 185.00 (20.00)	70%	**SHALE** pale green, light to medium grayish brown, non fissile, waxy in part, silty in part, non calcareous, breaks readily when immersed in Hydrochloric
	20%	**SANDSTONE** medium to dark grayish brown, very fine grained, dark brown silty & argillaceous matrix, subangular to subrounded, poorly sorted, moderately indurated, tight
	10%	**SILTSTONE** medium to dark grayish brown, sandy in part, non calcareous, slightly carbonaceous
185.00 to 190.00 (5.00)	70%	**SHALE** dark brown, subfissile, non calcareous, silty in part, slightly carbonaceous, sandy stringers throughout
	20%	**SANDSTONE** medium to dark gray to grayish brown, very fine to lf grained, silty & argillaceous matrix, occasional carbonized plant fragments, subrounded, poorly sorted, non calcareous, moderately well indurated, friable in part, tight
	10%	**SILTSTONE** medium to dark gray to grayish brown, occasionally light gray, sandy in part, non calcareous, slightly carbonaceous in part, occasional plant remains, shaly
190.00 to 215.00 (25.00)	50%	**SHALE** medium to dark brownish gray, subfissile, non calcareous, slightly carbonaceous, small trace pyrite, well compacted, moderately firm

190.00 to 215.00 (25.00)	35%	**SANDSTONE** medium to dark grayish brown, quartz, dark lithics, and carbonaceous fragments, very fine to locally fine grained, silty & argillaceous matrix, subrounded, poorly sorted, silica cement, non to very slightly calcareous, moderately well indurated, tight
	15%	**SILTSTONE** medium to dark grayish brown, carbonaceous in part, non calcareous, sandy in part, trace pyrite
215.00 to 220.00 (5.00)	85%	**SHALE** light to medium grayish brown, in part dark brownish gray as above, subfissile, light colored shale appears pelletoidal or bioturbated, non to very slightly calcareous, silty & sandy stringers, silty in part, well compacted, moderately firm
	10%	**SANDSTONE** light to medium grayish brown, quartz, chert, lithics & common black carbonaceous fragments in a dark brown silty & argillaceous matrix, non to very slightly calcareous, silica cement, moderately well indurated, tight, trace pyrite
	5%	**SILTSTONE** as above
220.00 to 225.00 (5.00)	90%	**SANDSTONE** medium gray to grayish brown, quartz, chert, lithics, and abundant black carbonaceous fragments, dark brown silty matrix, very fine to lower fine grained, trace upper fine grained, subrounded, poor to moderate sorting, moderate induration, moderately friable, tight to very weak porosity
	10%	**SHALE** as above
225.00 to 230.00 (5.00)	80%	**SHALE** medium to dark brown, subfissile, silty in part, non to very slightly calcareous, small trace pyrite, carbonaceous in part, bioturbated
	20%	**SANDSTONE** as above, trace pyrite, occasional carbonized plant fragments
230.00 to 235.00 (5.00)	40%	**SANDSTONE** medium to dark grayish brown, quartz, chert & lithics in dark brown silty matrix, non to very slightly calcareous, carbonaceous in part, subrounded to subangular, poorly sorted, friable in part, tight
	35%	**SILTSTONE** medium to dark brown to grayish brown, sandy, carbonaceous in part, non to very slightly calcareous
	25%	**SHALE** mottled light to medium grayish brown, subfissile, silty in part, non calcareous, bioturbated with pelletoidal appearance, well compacted, moderately firm

235.00 to 240.00 (5.00)	95%	**SANDSTONE** medium gray to brownish gray, salt and pepper, predominately fine grained, silty to very fine grained matrix, quartz, chert, lithics & abundant dark brown to black carbonaceous fragments, subangular, moderately sorted, silica + minor calcite cement, poor porosity (3-6%), no visible show, friable in part
	5%	**SHALE** as above
240.00 to 245.00 (5.00)	85%	**SHALE** light gray, pale greenish gray, light to dark brown in part, subfissile, non calcareous, silty in part, scattered yellow pellets, bioturbated in part
	15%	**SANDSTONE** medium gray to brownish gray, as above, abundant dark brown to black carbonaceous fragments, very poor porosity
245.00 to 250.00 (5.00)	40%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous matrix, subrounded to subangular, poorly sorted, non calcareous, carbonaceous, trace pyrite, tight
	30%	**SHALE** dark grayish brown, subfissile, silty, non calcareous, carbonaceous in part
	30%	**SILTSTONE** ddk grayish brown, sandy in part, non calcareous, carbonaceous
250.00 to 265.00 (15.00)	85%	**SHALE** predominately medium to dark grayish brown, subfissile, non calcareous, slightly carbonaceous, becoming increasingly light grayish brown to light gray, bioturbated in part, silty, sandy laminations
	15%	**SANDSTONE** medium to dark grayish brown, predominately very fine grained, occasional lower fine grained laminations, dark brown silty & argillaceous matrix, non calcareous, subrounded, poorly sorted, moderately well indurated, tight, carbonaceous in part
265.00 to 270.00 (5.00)	40%	**SANDSTONE** medium to dark brown to grayish brown, quartz, chert, lithics & common to abundant black carbonaceous fragments in dark brown silty carbonaceous matrix, predominately very fine grained, minor fine grained, subrounded, poorly sorted, non calcareous, moderate induration, friable in part, tight
	40%	**SILTSTONE** dark brown, sandy in part, non calcareous, carbonaceous, trace pyrite, very finely laminated
	20%	**SHALE** medium to dark grayish brown, light to medium gray, subfissile, silty, scattered pellets, carbonaceous in part, non calcareous

270.00 to 285.00 (15.00)	90%	**SHALE** predominately medium to dark brown, locally light to medium grayish brown, subfissile, locally silty, bioturbated in part, occasional pellets, trace pyrite, sandy laminations
	10%	**SANDSTONE** medium to dark brown, very fine grained, locally grading to lower fine grained, dark brown silty argillaceous & carbonaceous matrix, trace pyrite, subrounded, poorly sorted, moderate induration, tight, thin laminations
285.00 to 295.00 (10.00)	75%	**SHALE** as above, increasing silty & sandy laminations, commonly light colored in 295 sample
	15%	**SANDSTONE** light to medium gray to grayish brown, very fine to lower fine grained, silty & argillaceous in part, quartz, light colored chert and common dark lithics, trace carbonaceous matter, subrounded, moderate to poorly sorted, non calcareous, trace to minor pyrite, moderate induration, tight
	10%	**SILTSTONE** dark brown, coarse, sandy in part, carbonaceous in part, slightly calcareous
295.00 to 300.00 (5.00)	90%	**SHALE** medium to dark brown, subfissile, silty laminae, carbonaceous in part, scattered carbonized minute plant fragments
	10%	**SILTSTONE** as above
300.00 to 305.00 (5.00)	60%	**SHALE** predominately light to medium grayish tan, medium to dark brown in part, subfissile, non calcareous, bioturbated in part, silty ipscat minute carbonaceous fragments
	25%	**SANDSTONE** medium to dark grayish brown, very fine grained, dark brown silty & argillaceous matrix, subangular to subrounded, poorly sorted, locally slightly calcareous, carbonaceous in part, moderately well indurated, friable in part, tight
	15%	**SILTSTONE** dark grayish brown, non to slightly calcareous, carbonaceous in part, locally sandy, occasional plant fragments
305.00 to 310.00 (5.00)	80%	**SANDSTONE** medium to dark grayish brown, quartz lithics and abundant black carbonaceous fragments in dark brown silty carbonaceous matrix, very fine to lower fine grained, silty argillaceous matrix, subangular to subrounded, poorly sorted, trace to minor pyrite cement, non to spotty calcareous content, moderate induration, tight

305.00 to 310.00 (5.00)	20%	**SHALE** medium to dark brown to grayish brown, subfissile, carbonaceous, silty, non calcareous
310.00 to 315.00 (5.00)	60%	**SHALE** medium to dark grayish brown, subfissile, silty in part, non calcareous, carbonaceous
	25%	**SANDSTONE** as above, increasingly very fine grained, carbonaceous, tight
	15%	**SILTSTONE** dark brown to grayish brown, sandy in part, carbonaceous, non calcareous
315.00 to 320.00 (5.00)	50%	**SANDSTONE** medium to dark grayish brown, quartz, lithics, chert, and dark carbonaceous fragments in a medium to dark silty carbonaceous matrix, subrounded to subangular, poorly sorted, moderate induration, trace pyrite, tight
	30%	**SILTSTONE** as above
	20%	**SHALE** as above
320.00 to 335.00 (15.00)	75%	**SHALE** dark gray to dark grayish brown, subfissile, silty laminae, plant remains, non calcareous, well compacted, firm, brittle, occasional coal stringers
	10%	**SANDSTONE** medium to dark grayish brown, salt and pepper, very fine grained, subangular, poorly sorted, plant fragments, tight
	10%	**SILTSTONE** medium to dark gray to grayish brown, sandy in part, carbonaceous, non calcareous
	5%	**COAL** dull to moderately vitreous, coaly shale laminae throughout, argillaceous in part, thin stringers
335.00 to 340.00 (5.00)	100%	**SHALE** predominately medium to dark grayish brown, light brownish gray in part, subfissile, non calcareous, silty in part, carbonaceous in part, non calcareous, bioturbated
340.00 to 345.00 (5.00)	80%	**SHALE** medium to dark grayish brown, subfissile, non calcareous, carbonaceous in part, occasional very thin coal beds or laminae, silty & sandy laminae, plant remains

340.00 to 345.00 (5.00)	10%	**SILTSTONE** medium to dark brown, sandy in part, carbonaceous, trace poorly, plant remains
	10%	**SANDSTONE** as above, very fine grained, carbonaceous in part, tight
345.00 to 350.00 (5.00)	80%	**SHALE** predominately medium to dark brown to grayish brown, light gray in part, subfissile, non calcareous, carbonaceous, plant remains, silty laminae, occasional thin coal stringer, trace pyrite
	10%	**SILTSTONE** as above
	5%	**SANDSTONE** medium gray to grayish brown, very fine grained, silty & argillaceous, subangular, poorly sorted, carbonaceous, thin beds
	5%	**COAL** dull to moderately vitreous, shaly or silty laminae, occasional pyritic laminae, brittle
350.00 to 355.00 (5.00)	60%	**SHALE** medium to dark brown to grayish brown, subfissile, silty in part, carbonaceous, non calcareous, trace pyrite, plant remains
	25%	**SANDSTONE** medium grayish brown, very fine grained, silty in part, subangular, poorly sorted, dark silty carbonaceous matrix, non calcareous, tight, thin beds
	15%	**SILTSTONE** medium to dark brown, carbonaceous, non calcareous, plant remains, trace pyrite
355.00 to 360.00 (5.00)	85%	**SHALE** as above
	10%	**SILTSTONE** as above, sandy in part, locally grading to very fine grained sandstone, carbonaceous
	5%	**SANDSTONE** as above, thin laminae
360.00 to 365.00 (5.00)	50%	**SHALE** medium to dark brown to grayish brown, subfissile, non calcareous, silty laminae, carbonaceous, rare pyritic pellet

360.00 to 365.00 (5.00)	35%	**SANDSTONE** medium brown to grayish brown, quartz, lithics, & abundant black carbonaceous fragments, medium to dark brown silty matrix, very fine to lower fine grained, subrounded to subangular, poorly sorted, non calcareous, moderately well indurated, tight, plant fragments
	15%	**SILTSTONE** medium to dark grayish brown, non calcareous, carbonaceous, plant remains
365.00 to 370.00 (5.00)	60%	**SHALE** medium to dark brown to grayish brown, subfissile, non calcareous, silty laminae, carbonaceous
	25%	**SILTSTONE** sandstone, sandy in part, carbonaceous
	15%	**SANDSTONE** medium brown to grayish brown, quartz, lithics, & abundant black carbonaceous fragments, medium to dark brown silty matrix, increasingly very fine grained, minor lower fine grained, subrounded to subangular, poorly sorted, non calcareous, moderately well indurated, tight, plant fragments
370.00 to 375.00 (5.00)	80%	**SHALE** medium to dark brown to grayish brown, subfissile, silty in part, carbonaceous, silty laminae, occasional sandy stringer, trace coal
	15%	**SILTSTONE** medium to dark grayish brown, sandy in part, carbonaceous, trace pyrite
	5%	**SANDSTONE** medium gray to grayish brown, very fine grained, silty & argillaceous in part, subangular, poorly sorted, thin laminations, tight, carbonaceous
375.00 to 385.00 (10.00)	60%	**SHALE** as above, occasional argillaceous coal laminae, 2-3% coal
	25%	**SANDSTONE** light to medium grayish brown, very fine to fine grained, subangular, moderately sorted, slightly calcareous, silica + minor calcite cement, moderately well indurated, tight, occasional carbonaceous fragments
	15%	**SILTSTONE** medium to dark grayish brown, sandy in part, slightly calcareous, carbonaceous
385.00 to 395.00 (10.00)	55%	**SHALE** medium to dark brown, light grayish brown in part, subfissile, carbonaceous, slightly calcareous, silty in part
	25%	**SILTSTONE** dark grayish brown, sandy in part, slightly calcareous, carbonaceous, plant remains

385.00 to 395.00 (10.00)	15%	**SANDSTONE** medium grayish brown, quartz & abundant dark lithics, very fine to lower fine grained, subangular, silica + calcite cement, moderately well indurated, tight, carbonaceous fragments
	5%	**COAL** moderately vitreous, pyritic, brittle, thin stringers
395.00 to 400.00 (5.00)	50%	**SHALE** medium to dark brown to grayish brown, subfissile, silty in part, carbonaceous, slightly calcareous
	30%	**SILTSTONE** dark grayish brown, sandy in part, locally grading to very fine grained sandstone, calcareous, carbonaceous, trace pyrite
	20%	**SANDSTONE** medium to dark grayish brown, silty & argillaceous throughout, carbonaceous in part, increasingly calcareous, tight
400.00 to 406.00 (6.00)	80%	**SHALE** predominately medium to dark brown as above, in part light to medium grayish tan, subfissile, bioturbated in part, scattered pellets, trace coal
	20%	**SILTSTONE** as above
406.00 to 410.00 (4.00)	90%	**SHALE** medium to dark grayish brown, light to medium gray in part, subfissile, locally silty, slightly calcareous
	10%	**SILTSTONE** medium to dark grayish brown, sandy in part, slightly calcareous, trace carbonaceous matter, trace pyrite
410.00 to 420.00 (10.00)	70%	**SILTSTONE** medium to dark grayish brown, sandy in part, slightly calcareous, small trace pyrite, trace carbonaceous matter
	15%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous matrix, slightly calcareous, carbonaceous in part, thin laminations, tight
	15%	**SHALE** as above
420.00 to 430.00 (10.00)	65%	**SHALE** as above, bioturbated in part
	25%	**SILTSTONE** as above

420.00 to 430.00 (10.00)	10%	**SANDSTONE** as above, small trace pyrite, trace carbonaceous matter, tight
430.00 to 435.00 (5.00)	87%	**SHALE** medium to dark grayish brown, subfissile, carbonaceous, occasional coal laminae
	10%	**SILTSTONE** medium gray to grayish brown, sandy in part, locally grading very fine grained silty sandstone, carbonaceous in part, very slightly calcareous, trace pyrite
	3%	**COAL** brittle, jointed, vitreous, minor pyrite
435.00 to 440.00 (5.00)	50%	**SHALE** medium to dark brown to grayish brown, subfissile, non calcareous, carbonaceous, trace pyrite, plant remains
	50%	**SILTSTONE** medium to dark grayish brown, sandy, grading to very fine grained sandstone, argillaceous, carbonaceous, non to very slightly calcareous, small trace pyrite
440.00 to 445.00 (5.00)	75%	**SHALE** in part medium to dark brown as above, light to medium gray, subfissile, silty, non calcareous, bioturbated in part
	25%	**SILTSTONE** as above
445.00 to 460.00 (15.00)	80%	**SHALE** predominately medium to dark brown to gray brown, light to medium gray in part, subfissile, non calcareous, carbonaceous in part, locally silty, rare pyrite nodules, occasional silty stringers
	20%	**SILTSTONE** medium grayish brown, sandy, in part, grading to very fine grained silty & argillaceous sandstone, non calcareous, carbonaceous, trace pyrite, plant remains
460.00 to 470.00 (10.00)	90%	**SHALE** medium to dark grayish brown, subfissile, non calcareous, locally silty, trace pyrite, rare fish scales, plant remains, silty laminae
	10%	**SILTSTONE** as above, locally grading to very fine grained sandstone
470.00 to 475.00 (5.00)	50%	**SHALE** as above
	30%	**SILTSTONE** dark grayish brown, sandy, non calcareous, carbonaceous, small trace pyrite, plant remains

470.00 to 475.00 (5.00)	20%	**SANDSTONE** medium to dark grayish brown, very fine grained, dark brown silty & argillaceous matrix, subangular, poorly sorted, non calcareous, carbonaceous, tight
475.00 to 480.00 (5.00)	60%	**SANDSTONE** dark grayish brown, quartz, dark lithics, minor chert & carbonaceous fragments in dark silty & argillaceous matrix, very fine to lower fine grained, subrounded to subangular, poorly sorted, moderate to well indurated, tight, slightly calcareous, small trace pyrite
	20%	**SILTSTONE** as above, icrly sandy, carbonaceous in part
	20%	**SHALE** light to medium gray, medium to dark grayish brown, subfissile, silty in part, non calcareous, carbonaceous in part, bioturbated in part
480.00 to 490.00 (10.00)	85%	**SHALE** medium to dark grayish brown, subfissile, silty in part, occasional siltstone laminations, rare shell fragments, carbonaceous in part, non calcareous, plant rmns
	15%	**SILTSTONE** dark grayish brown, sandy in part, carbonaceous in part, plant remains, thin laminae
490.00 to 495.00 (5.00)	50%	**SHALE** as above
	30%	**SILTSTONE** as above
	20%	**SANDSTONE** medium to dark grayish brown, very fine to lower fine grained, dark brown silty & argillaceous matrix, carbonaceous, non calcareous, subrounded to subangular, poorly sorted, tight, trace pyrite
495.00 to 500.00 (5.00)	50%	**SHALE** medium to dark brown to grayish brown, subfissile, silty in part, non calcareous, carbonaceous in part, rare shell fragments
	30%	**SILTSTONE** light to medium gray, medium to dark grayish brown in part, sandy in part, trace carbonaceous matter, non calcareous
	20%	**SANDSTONE** light to medium gray, predominately very fine grained, 10-15% lower fine grained, silty argillaceous matrix, non calcareous, subrounded to subangular, poorly sorted, moderate induration, tight

500.00 to 510.00 (10.00)	60%	**SHALE** medium gray, medium to dark grayish brown, subfissile, non calcareous, carbonaceous in part, occasional coaly laminae, plant remains, silty laminae
	25%	**SILTSTONE** medium to dark grayish brown, sandy in part, carbonaceous, non calcareous
	15%	**SANDSTONE** medium grayish brown, very fine grained, silty & argillaceous, subangular, poorly sorted, carbonaceous in part, thin beds, tight
510.00 to 520.00 (10.00)	50%	**SHALE** light to medium gray, medium brown in part, subfissile, silty in part, scattered plant remains, non calcareous
	35%	**SILTSTONE** medium to dark gray to brownish gray, becoming light gray, sandy in part, non calcareous, carbonaceous in part
	15%	**SANDSTONE** medium to dark gray to bnsh gray, very fine grained, silty & argillaceous throughout, non calcareous, scattered carbonaceous fragments, tight, grading to sandy siltstone
520.00 to 540.00 (20.00)	85%	**SHALE** light to medium gray, medium to dark brown, brown color apparent when immersed in mineral oil, subfissile, silty laminae, carbonaceous in part, non calcareous
	15%	**SILTSTONE** medium to dark grayish brown, sandy in part, non calcareous, carbonaceous in part
540.00 to 565.00 (25.00)	80%	**SHALE** light to medium gray, medium brown, subfissile, silty in part, occasional siltstone laminations, decreasing carbonaceous content, non calcareous, bioturbated in part, rare shell fragments
	20%	**SILTSTONE** medium to dark grayish brown, sandy in part, occasional very fine grained sandy laminae, scattered carbonized plant fragments, non calcareous
565.00 to 580.00 (15.00)	90%	**SHALE** medium brown, light to medium gray, subfissile, occasional silty laminae, non calcareous, carbonaceous in part, scattered plant remains, bioturbated in part
	10%	**SILTSTONE** medium to dark grayish brown, trace to minor finely disseminated minute carbonaceous matter, non calcareous, locally sandy

580.00 to 595.00 (15.00)	100%	**SHALE** medium gray dry, medium brown immersed in mineral oil, subfissile, increasingly carbonaceous, trace coal in 585 sample, plant remains, non calcareous, occasional silty laminations, small trace pyrite
595.00 to 605.00 (10.00)	90%	**SHALE** as above
	10%	**SILTSTONE** dark grayish brown, non calcareous, carbonaceous, sandy in part
605.00 to 615.00 (10.00)	85%	**SANDSTONE** medium gray, predominately very fine grained, locally grading to lower fine grained, dark grayish brown silty & argillaceous matrix, subrounded to subangular, poorly sorted, non calcareous, minute carbonaceous fragments throughout, moderate induration, tight, shale partings
	15%	**SHALE** medium brown, subfissile, locally silty, non calcareous, plant remains
615.00 to 620.00 (5.00)	70%	**SHALE** predominately medium brown, subfissile, carbonaceous in part, sandy stringers, plant remains, in part light to medium gray & light tan, bioturbated, non calcareous
	20%	**SANDSTONE** medium gray brown, very fine to lower fine grained, 3 to 5% upper fine grained, dark silty & argillaceous matrix, subrounded to subangular, poorly sorted, weak silica cement, moderate induration, tight, carbonaceous in part, non calcareous
	10%	**SILTSTONE** medium brown, non calcareous, carbonaceous, locally sandy in part
620.00 to 625.00 (5.00)		**No Sample** sample missed
625.00 to 630.00 (5.00)	100%	**SHALE** medium to dark gray dry, medium to dark brown in mineral oil, subfissile, non calcareous, amber fossiliferous laminae, small trace vitreous coal, thin bed with orange white specks, carbonaceous, small trace pyrite, occasional silty laminae
630.00 to 635.00 (5.00)	90%	**SANDSTONE** medium gray to brownish gray, quartz, lithics & common carbonaceous fragments, predominately upper fine grained, silty very fine grained matrix, subangular, moderate sorting, silica cement, amber to light orange silty fossiliferous bed, scattered calcareous shell fragments, silica cement, moderate induration, friable in part, weak intergranular porosity (4-7%), no visible show
	10%	**SHALE** medium brown, grayish brown, subfissile, silty in part, carbonaceous, non calcareous

635.00 to 640.00 (5.00)	80%	**SHALE** predominately light to medium gray, subfissile, silty in part, bioturbated, medium to dark brown in part, subfissile, non calcareous, carbonaceous
	20%	**SANDSTONE** as above, silty matrix, siliceous cement, increasingly tight, scattered black carbonaceous fragments
640.00 to 655.00 (15.00)	70%	**SHALE** predominately medium to dark brown to grayish brown, subfissile, silty stringers, carbonaceous in part, non calcareous, light gray to grayish tan in part, silty, non calcareous, bioturbated
	20%	**SILTSTONE** medium to dark grayish brown, non calcareous, carbonaceous, sandy in part, plant remains, occasional shell fragments
	10%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous matrix, subangular, poorly sorted, thin beds, tight, plant remains
655.00 to 660.00 (5.00)	40%	**SHALE** predominately medium brown, subfissile, locally silty, non calcareous, carbonaceous in part, occasional light gray to grayish tan shale stringers as above
	40%	**SILTSTONE** as above, scattered plant remains, trace pyrite
	20%	**SANDSTONE** as above, dark argillaceous silty carbonaceous matrix, tight
660.00 to 675.00 (15.00)	80%	**SHALE** predominately medium brown, as above, increasingly carbonaceous, silty laminations throughout, non calcareous
	20%	**SILTSTONE** medium to dark brown to grayish brown, non calcareous, carbonaceous in part, sandy laminations
675.00 to 685.00 (10.00)	70%	**SHALE** predominately medium to dark grayish brown to brown, subfissile, non calcareous, carbonaceous in part, interbedded light to medium tan to grayish tan, subfissile, non calcareous, silty, bioturbated shale
	20%	**SILTSTONE** as above
	10%	**SANDSTONE** medium to dark grayish brown, very fine grained, silty & argillaceous throughout, non calcareous, carbonaceous, tight, thin beds

685.00 to 695.00 (10.00)	60%	**SANDSTONE** dark brown to grayish brown, very fine grained, silty & argillaceous matrix, subrounded to subangular, poorly sorted, non calcareous, carbonaceous, moderately indurated, tight,
	25%	**SILTSTONE** medium to dark grayish brown, sandy in part, carbonaceous in part, non calcareous
	15%	**SHALE** as above
695.00 to 710.00 (15.00)	75%	**SHALE** medium brown, minor interbedded medium gray to grayish brown, subfissile, non calcareous, carbonaceous in part, silty silty partings, plant remains, rare coaly laminae
	25%	**SILTSTONE** light to medium grayish brown, locally sandy, non calcareous, carbonaceous in part, thin beds, small trace pyrite, plant remains
710.00 to 715.00 (5.00)	50%	**SHALE** medium brown to grayish brown in part, subfissile, non calcareous, carbonaceous in part, interbedded siltstone, well compacted, moderately firm & brittle
	50%	**SILTSTONE** medium gray, quartzose, very slightly calcareous, trace minute carbonaceous matter throughout
715.00 to 730.00 (15.00)	85%	**SHALE** medium to dark brown to gray brown, subfissile, non calcareous, occasional silty laminations, increasingly carbonaceous, locally bioturbated, scattered plant remains, trace vitreous coal in 730 sample
	15%	**SILTSTONE** light to medium grayish brown, sandy in part, non calcareous, carbonaceous in part, thin beds & laminations
730.00 to 735.00 (5.00)	70%	**SHALE** light to medium gray, grading to very fine siltstone in part, quartzose, non calcareous, bioturbated in part, interbedded medium to dark brown, subfissile, silty laminae, carbonaceous in part
	30%	**SILTSTONE** as above, occasional pyritized & carbonized plant remains, sandy in part
735.00 to 745.00 (10.00)	98%	**SHALE** medium to dark brown to slightly grayish brown, subfissile, non calcareous, increasingly carbonaceous, plant remains, silty laminae, occasional thin pyritic coal stringers

735.00 to 745.00 (10.00)	2%	**COAL** moderately vitreous, pyritic, brittle, thin stringers
745.00 to 760.00 (15.00)	70%	**SHALE** predominately medium brown, minor light gray as above, subfissile, non calcareous, carbonaceous in part, minor interbedded siltstone, occasional argillaceous sandy parting, plant remains, well compacted, moderately firm
	20%	**SILTSTONE** medium gray to brownish gray, sandy in part, carbonaceous in part, non calcareous
	10%	**SANDSTONE** medium grayish brown, very fine grained, silty & argillaceous throughout, subangular, poorly sorted, carbonaceous in part, tight, thin beds
760.00 to 765.00 (5.00)	65%	**SHALE** medium gray, grayish brown, subfissile, non calcareous, interbedded siltstone
	35%	**SILTSTONE** light yellow tan to gray, quartzose, sandy in part, slightly argillaceous, scattered shell fragments
765.00 to 790.00 (25.00)	80%	**SHALE** medium to dark brown, locally dark grayish brown, subfissile, non calcareous, silty stringers, carbonaceous, well compacted, moderately firm, scattered carbonized plant remains
	20%	**SILTSTONE** medium to dark brown, grayish brown in part, sandy in part, rare glauconite grain, non calcareous, carbonaceous
790.00 to 825.00 (35.00)	85%	**SHALE** medium br to grayish brown, subfissile, non calcareous, locally silty, occasional light gray quartzose silty laminations, carbonaceous in part, siltstone partings, scattered carbonized plant remains
	15%	**SILTSTONE** medium grayish brown, non calcareous, minute carbonaceous matter common throughout, locally grading to very fine grained sandstone, thin stringers
825.00 to 845.00 (20.00)	75%	**SHALE** medium to dark gray dry, medium to dark brown in mineral oil, subfissile, silty laminations throughout, non calcareous, carbonaceous in part, occasional plant remains, rare thin laminae with abundant pellets, well compacted, firm, moderately brittle, softens in H2O
	25%	**SILTSTONE** medium to dark grayish brown, non calcareous, very fine silt in brown argillaceous & carbonaceous matrix, rarely sandy,

845.00 to 855.00 (10.00)	85%	**SHALE** as above, bioturbated in part, slight increase in carbonaceous content, plant remains
	15%	**SILTSTONE** as above, commonly light grayish tan, quartzose, trace minute carbonaceous matter throughout, non calcareous, scattered plant remains
855.00 to 865.00 (10.00)	50%	**SHALE** medium brown to grayish brown, subfissile, silty in part, carbonaceous, non calcareous, interbedded carbonaceous siltstone
	50%	**SILTSTONE** light to dark brown, light grayish white & quartzose in part, non calcareous, carbonaceous in part, rare scattered shell fragments, carbonized plant remains
865.00 to 870.00 (5.00)	100%	**SHALE** medium to dark brown to grayish brown, subfissile to subblocky, occasional silty laminae, carbonaceous in part, non calcareous, well compacted, firm
870.00 to 890.00 (20.00)	65%	**SHALE** medium to dark brown, subfissile, interbedded siltstone, carbonaceous, non calcareous
	35%	**SILTSTONE** medium to dark grayish brown, very fine to coarse silt, locally sandy, locally white to light tan & quartzose, carbonaceous, non calcareous, small trace pyrite
890.00 to 925.00 (35.00)	75%	**SHALE** medium to dark brown, subfissile, non calcareous, carbonaceous, occasional thin coal laminae, scattered carbonized & pyritic plant remains, interbedded carbonaceous siltstone
	25%	**SILTSTONE** medium to dark grayish brown, non calcareous, rare sandy laminae, carbonaceous, small trace pyrite, plant remains, micromicaceous
925.00 to 930.00 (5.00)	50%	**SILTSTONE** medium to dark brown to gray brown, minor light grayish white quartzose siltstone, non calcareous, carbonaceous, fine to coarse silt in brown argillaceous & carbonaceous matrix, locally sandy, small trace pyrite
	48%	**SHALE** medium brown, subfissile, silty in part, non cal;cs, plant rmns, coaly laminae, thin coal seam
	2%	**COAL** black, moderately vitreous to vitreous, pyritic, thin seam
930.00 to 935.00 (5.00)	40%	**SILTSTONE** medium to dark brown, sandy in part, non calcareous, carbonaceous in part

930.00 to 935.00 (5.00)	30%	**SANDSTONE** medium brownish gray, lf to uf grained, quartz with minor dark lithics and common scattered black carbonaceous fragments, subangular, silica overgrowths, moderate sorting, silica cement, trace secondary calcite cement, tight to locally poor intergranular porosity (2-5%), no visible show
	30%	**SHALE** medium brown, subfissile, non calcareous, carbonaceous
935.00 to 940.00 (5.00)	70%	**SANDSTONE** light to medium yellow brown to grayish brown, quartzose with minor lithics & gray chert, scattered carbonaceous fragments, trace to minor dark brown to black interstitial bitumen cement, very fine to fine grained, subangular, moderate to poorly sorted, silica + trace secondary calcite cement, well indurated tight to very poor porosity (<4%), no visible fluorescence, slow weak dead oil cut, yellowish white calcareous laminae with shell debris, rare glauconite
	30%	**SHALE** medium to dark gray to brown, subfissile, non calcareous, locally silty, carbonaceous in part

Fishing Branch: 943.60 MD, 943.57 TVD, -473.41 SSL

940.00 to 950.00 (10.00)	60%	**SHALE** medium brown, subfissile to subblocky, non calcareous, carbonaceous in part
	40%	**SILTSTONE** light to medium brown, sandy, grading to very fine grained silty sandstone, brown argillaceous matrix, carbonaceous, non calcareous, small trace glauconite
950.00 to 960.00 (10.00)	65%	**SANDSTONE** light to brown to grayish brown, quartz, lithics, minor chert carbonaceous fragments, common dark brown to black pyrobitumen cement, very fine to lower fine grained, silty in part, subangular, moderate to poorly sorted, silica + trace secondary calcite cement, tight, to locally very weak porosity, no visible fluorescence, slow hazy dead oil cut, interbedded silty shale
	35%	**SILTY SHALE** medium brown, medium gray in part, subfissile to subblocky, silty, grading to shaly siltstone, bioturbated, carbonaceous in part, small trace pyrite, non calcareous
960.00 to 970.00 (10.00)	70%	**SANDSTONE** light to medium brown to yellowish brown, very fine to lower fine grained, silty carbonaceous matrix, subangular, poor to moderate sorting, silica cement, well indurated, tight, trace pyrobitumen, no visible fluorescence, trace slow faint cut
	15%	**SILTSTONE** medium brown, sandy in part, non calcareous, carbonaceous in part, shaly, plant remains

960.00 to 970.00 (10.00)	15%	**SHALE** medium brown, grayish brown, subfissile, non calcareous, carbonaceous in part, locally silty
970.00 to 975.00 (5.00)	70%	**SANDSTONE** light yellowish brown to yellowish white, quartzose with minor dark lithics, small trace glauconite, upper very fine grained, locally grading to lower fine grained, subrounded to subangular, silica overgrowths, predominately tight, locally with 4-7% intergranular porosity, trace to minor interstitial bitumen cement, no visible fluorescence, slow faint cut, questionable show
	20%	**SHALE** light to medium brown, medium gray in part, subfissile, non calcareous, bioturbated in part, locally silty
	10%	**SILTSTONE** medium brown, sandy in part, non calcareous, carbonaceous
975.00 to 980.00 (5.00)	80%	**SHALE** medium brown, subfissile, non calcareous, carbonaceous, sandy & silty laminae
	10%	**SILTSTONE** as above
	10%	**SANDSTONE** medium brown, very fine grained, silty & argillaceous, subangular, poorly sorted, thin beds, trace interstitial pyrobitumen, no visible fluorescence, tight
980.00 to 990.00 (10.00)	75%	**SANDSTONE** light to medium brown, grayish brown, predominately very fine grained, 7-10% lower fine grained, silty & argillaceous matrix, subangular, poorly sorted, moderately well indurated, small trace glauconite, silica cement, predominately tight, locally w/ very weak porosity (<6%), trace pyrobitumen cement, no visible fluorescence, slow faint cut
	15%	**SILTSTONE** light to medium brown, non calcareous, carbonaceous in part, laminations, plant remains
	10%	**SHALE** medium brown, subfissile, non calcareous, carbonaceous, silty in part
990.00 to 1,000.00 (10.00)	80%	**SANDY SILTSTONE** medium brown, sandy throughout, grading to very fine grained sandstone, argillaceous matrix, non calcareous, well indurated, hard, carbonaceous
	20%	**SHALE** as above
1,000.00 to 1,015.00 (15.00)	40%	**SHALE** medium to dark brown, subfissile, locally silty, carbonaceous, non calcareous

1,000.00 to 1,015.00 (15.00)	40%	**SILTY SANDSTONE** light to medium brown, very fine grained, silty, grading to coarse siltstone, subangular to subrounded, moderate to poorly sorted, silica cement, well indurated, predominately tight, locally with weak porosity, no visible fluorescence, trace slow faint cut
	20%	**SILTSTONE** medium brown, sandy in part, carbonaceous, non calcareous
1,015.00 to 1,023.00 (8.00)	80%	**SILTSTONE** medium brown, non calcareous, locally sandy, carbonaceous, scattered carbonized plant remains
	20%	**SHALE** medium to dark brown to grayish brown, silty in part, carbonaceous, non calcareous
1,023.00 to 1,033.00 (10.00)		**DEPTH CORRECTION** An error was made in the pipe tally at the time the surface casing shoe was drilled out. All samples described between 406 and 1023mMD are actually located ~10 metres deeper. All sample vials labelled in this interval are likewise ~10 metres deeper than the label shows.
1,033.00 to 1,035.00 (2.00)	70%	**SHALE** medium brown, grayish brown in part, subfissile, non calcareous, carbonaceous
	30%	**SILTSTONE** predominately medium to dark brown, slightly sandy with small trace glauconite, non calcareous, carbonaceous, minor white to light gray of very light tan & quartzose,

Parkin, Upper Parkin: 1,039.20 MD, 1,039.17 TVD, -569.01 SSL

1,035.00 to 1,040.00 (5.00)	85%	**SHALE** as above
	15%	**SILTSTONE** as above
1,040.00 to 1,070.00 (30.00)	100%	**SHALE** medium to dark brown to grayish brown, subfissile, silty laminae, carbonaceous in part, non to very slightly calcareous, well compacted, moderately firm
1,070.00 to 1,100.00 (30.00)	100%	**SHALE** dark brown to grayish brown, subfissile, non calcareous, increasingly carbonaceous, common silty laminae, well compacted
1,100.00 to 1,140.00 (40.00)	100%	**SHALE** medium to dark gray dry, medium to dark brown immersed in mineral oil, subfissile, non calcareous, carbonaceous, occasional silty laminae

1,140.00 to 1,170.00 (30.00) 100% **SHALE**
medium to dark gray dry, medium to dark brown immersed in mineral oil, subfissile, non calcareous, carbonaceous, occasional silty laminae, well compacted, moderately firm

1,170.00 to 1,200.00 (30.00) 100% **SHALE**
medium to dark brown in mineral oil. subfissile, non calcareous, trace pyt, silty in part, occasional silty laminae, carbonaceous in part

Parkin, Orange Marker: 1,204.00 MD, 1,203.95 TVD, -733.79 SSL

1,200.00 to 1,205.00 (5.00) 85% **SHALE**
medium brown, subfissile, silty, trace pyrite, carbonaceous, non calcareous

15% **SILTSTONE**
medium brown, non calcareous, sandy, trace to minor bright green glauconite, carbonaceous in part, pyritic

1,205.00 to 1,210.00 (5.00) 60% **SANDSTONE**
light brown, light to medium gray, very fine to very coarse grained, conglomeratic in part, abundant dark gray to black & brown chert in a predominately quartzose matrix with common bright green glauconite grains, subrounded, predy poorly sorted & tightly cemented with silica + minor secondary calcite, thin quartzose bed with weak intergranular porosity (<8%) & light amber hydrocarbon staining, no visible fluorescence, faint very slow cut, very poor show

25% **SHALE**
medium brown to grayish brown, subfissile to subblocky, silty, non calcareous

15% **SILTSTONE**
light to medium grayish brown, sandy in part, non to very slightly calcareous

1,210.00 to 1,215.00 (5.00) 70% **SILTSTONE**
medium grayish brown, sandy, trace glauconite, pyritic, slightly calcareous, carbonaceous in part

30% **SHALE**
medium brown, subfissile, silty in part, non calcareous, carbonaceous, trace pyrite, cavings in part

1,215.00 to 1,245.00 (30.00) 100% **SILTSTONE**
medium grayish brown, sandy, slightly calcareous, rare glauconitic laminae, trace to minor pyrite, moderately hard, firm, no visible deformation

1,245.00 to 1,265.00 (20.00) 100% **SILTSTONE**
medium gray to brnsg gray, increasingly sandy, locally grading to very fine grained silty sandstone, trace glauconite, slightly calcareous, increasingly pyritic, hard, firm

1,265.00 to 1,285.00 (20.00) 60% **SILTSTONE**
medium gray to brownish gray, sandy in part, slightly calcareous, carbonaceous in part, trace pyrite

40% **SHALE**
medium gray, subfissile, silty, non to very slightly calcareous, carbonaceous in part

Whitestone River: 1,289.00 MD, 1,288.95 TVD, -818.79 SSL

1,285.00 to 1,300.00 (15.00) 100% **SHALE**
medium gray to brownish gray, subfissile, non to very slightly calcareous, silty in part, silty laminae, plant remains, scattered trace pyrite

1,300.00 to 1,340.00 (40.00) 100% **SHALE**
medium gray, brownish gray, subfissile, very slightly calcareous in part, silty in part, slightly carbonaceous, trace pyrite, well compacted, moderately firm, silty laminae

1,340.00 to 1,380.00 (40.00) 100% **SHALE**
medium gray to brownish gray, subfissile, very slightly calcareous, silty in part, small trace pyrite, slightly carbonaceous, well compacted, moderately firm

1,380.00 to 1,420.00 (40.00) 100% **SHALE**
medium gray, medium grayish brown in part, locally becoming dark gray, subfissile, very slightly calcareous, rare shell fragments, small trace pyrite, silty in part, occasional siltstone laminations with small trace glauconite

1,420.00 to 1,435.00 (15.00) 100% **SHALE**
medium to dark gray, brownish gray in part, subfissile, very slightly calcareous, trace to locally common pyrite, silty in part, rare silty laminations, slightly carbonaceous

1,435.00 to 1,440.00 (5.00) 85% **SHALE**
medium gray,subfissile, very slightly calcareous, small trace pyrite, slightly carbonaceous, well compacted, locally silty

15% **SILTSTONE**
medium gray, slightly calcareous, small trace glauconite, ~2% white to yellowish white cryptocrystalline calcite (shell fragments?), trace pyrite, sandy in part

L Cretaceous Mkr: 1,441.00 MD, 1,440.95 TVD, -970.79 SSL

1,440.00 to 1,460.00 (20.00) 80% **SILTSTONE**
medium gray, sandy, locally grading to very fine grained silty & argillaceous sandstone, minor to common glauconite, minor to common pyrite, slightly calcareous, trace carbonaceous matter, silty shale laminae

20% **SHALE**
medium gray, subfissile, silty, very slightly calcareous, trace glauconite, trace pyrite

1,460.00 to 1,475.00 (15.00) 80% **SILTSTONE**
medium gray to brownish gray, sandy in part, locally grading to very fine grained sandstone, slightly calcareous, trace pyrite, trace glauconite

20% **SHALE**
medium to dark gray, brownish gray, subfissile, silty, very slightly calcareous, trace carbonaceous matter, trace pyrite

1,475.00 to 1,495.00 (20.00) 70% **SILTY SHALE**
medium to dark brownish gray, subfissile, silty throughout with silty laminations, occasional very fine grained sandy stringer, very slightly calcareous, trace pyrite, trace glauconite

30% **SILTSTONE**
medium brownish gray, sandy, occasional very fine grained sandy laminations with trace glauconite, slightly calcareous, trace pyrite, trace glauconite

1,495.00 to 1,510.00 (15.00) 100% **SHALE**
medium grayish brown, subfissile, commonly silty, pyritic, common to abundant finely disseminated pyrite throughout, very slightly calcareous, calcareous laminae, pyritic silty laminae with trace glauconite

1,510.00 to 1,515.00 (5.00) 95% **SHALE**
medium gray brown, subfissile to fissile, non calcareous, trace finely disseminated pyrite, well compacted, brittle in mineral oil, becoming soft in water, glauconitic sandy stringer

5% **SANDSTONE**
light to medium gray, very fine grained, silty & argillaceous in part, abundant bright green glauconite, pyritic, rare chert shard

Jungle Creek: 1,518.20 MD, 1,518.15 TVD, -1,047.99 SSL

1,515.00 to 1,520.00 (5.00) 100% **CHERT PEBBLE CONGLOMERATE**
medium to dark brown to grayish brown, predominately medium to dark grayish brown chert pebbles, granules, and very coarse grains in silty to upper fine grained matrix, subrounded to rounded, poorly sorted, silica + pyrite + locally minor pyrobitumen cement, questionable porosity, chert grains are pulverized to shards, matrix commonly has light amber oil staining, spot dull yell fluorescence, immediate blooming cut, minor streaming cut

1,520.00 to 1,526.00 (6.00) 80% **SANDSTONE**
medium to dark brown, patchy very dark brown pyrobitumen cement imparts color, very fine to upper medium grained, subrounded to subangular, silica overgrowths, predominately poorly sorted, in part moderately well sorted fine to medium grained, silica + abundant vdk brown to black pyrobitumen cement, poor to locally fair intergranular porosity (3-10%), spot yellow fluorescence fluorescence, fair moderately fast blooming cut, abundant rusty red oxidized discoloration in silty to very fine grained sandstone

20% **CHERT PEBBLE CONGLOMERATE**
as above

1,526.00 to 1,530.00 100% (4.00) **CONGLOMERATIC SANDSTONE**
medium brown, grayish brown, variously gray and occasional white chert granules & small pebbles in poorly sorted silty to coarse grained matrix with common reddish brown ferruginous staining, subrounded, silica + chert + patchy poor[yr, + trace calcite cement, scattered minor black pyrobitumen cement, predominately tight, locally weak intergranular porosity (0-6%), spotty dull yellow fluorescence, fair streaming cut, poor show, occasional medium to dark brown silty argillaceous partings

1,530.00 to 1,535.00 100% (5.00) **CONGLOMERATE**
predominately variously gray chert, minor white & brown chert pebbles granules & very coarse grained clasts, medium brownish gray silty to upper medium grained matrix, minor black pyrite bitumen cement coating grains, patchy massive pyrite, silica cement, subrounded, poorly sorted, occasional moderate to sorted quartzose fine grained sandstone with prominent silica overgrowths and common black pyrobitumen cement occluding porosity (estimated 6-9%), strong petroliferous odor, spotty dull yellow fluorescence, fair streaming cut, dead oil show

Hart River: 1,537.40 MD, 1,537.35 TVD, -1,067.19 SSL

1,535.00 to 1,547.50 100% (12.50) **LIMESTONE**
medium to dark grayish brown, cryptocrystalline, argillaceous, fragmental, white coarsely crystalline calcite commonly replaces fossil fragments, trace pyrite, trace to minor chert, scattered brachiopod shls, occasional crinoid ossicle, dense, tight

1,547.50 to 1,552.50 100% (5.00) **LIMESTONE**
medium to dark grayish brown, increasingly fossiliferous, creamy white coarsely crystalline calcite preserves brachiopods, crinoids and fossil fragments, dark argillaceous wackestone matrix, predominately tight, locally weak pin point porosity, spotty dull yellow fluorescence, fair streaming cut, occasional shaly parting

1,552.50 to 1,560.00 100% (7.50) **LIMESTONE**
medium to dark gray to brownish gray, common creamy white coarsely crystalline fossil fragments (predominately brachiopods & crinoids) in a very dark argillaceous & silty cryptocrystalline matrix, calcite preserved abundant microfossils, occasional dark gray shaly parting, dense, tight, no show

Hart River, D Sands: 1,562.10 MD, 1,562.05 TVD, -1,091.89 SSL

1,560.00 to 1,565.00 100% (5.00) **SANDSTONE**
light to medium gray, quartzose, very fine grained, coarse silty matrix, subrounded to subangular, moderately sorted, calcite cement, tight, no show

1,565.00 to 1,567.50 90% (2.50) **SANDSTONE**
predominately medium gray, dark gray in part, predominately very fine grained, 5-7% fine grained, silty & argillaceous matrix, subrounded to subangular, moid to poorly sorted, calcite cement, no visible show

1,565.00 to 1,567.50 (2.50)	10%	**SHALE** dark gray, subblocky, silty & sandy in part, calcareous, carbonaceous in part
1,567.50 to 1,570.00 (2.50)	100%	**SANDSTONE** light amber brown, quartzose with minor chert & common to abundant white siliceous lithics, upper very fine to lower medium grained, 5-7% upper medium grained, subrounded, moderately sorted, silica cement & abundant calcite cement, variable porosity, predominately 3-8%, locally 8-12%, light amber hydrocarbon staining throughout, yellow fluorescence throughout, slow streaming cut, poor oil show
1,570.00 to 1,577.50 (7.50)	100%	**SANDSTONE** medium brownish gray, quartz & abundant gray chert, common white siliceous lithics, upper fine to lower very coarse grained, subrounded, moderate to poorly sorted, primary minor silica cement with abundant secondary calcite cement occluding porosity, common to abundant yellow fluorescence, weak streaming cut, poor oil show
1,577.50 to 1,580.00 (2.50)	85%	**SANDSTONE** predominately light gray to light brownish gray, quartz & common gray chert, lower fine to very coarse grained, scattered granules, subrounded to rounded, poorly sorted, calcite cement, tight to very poor porosity, trace light amber hydrocarbon staining, spotty yellow fluorescence with weak streaming cut, questionable show, in part medium to very dark gray, very fine grained, calcite cement, tight
	15%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, silty in part, fossiliferous, scattered brachiopods & crinoids, argillaceous, dense, tight
1,580.00 to 1,592.50 (12.50)	80%	**SANDSTONE** prtedly medium to dark dark grayish brown, very fine grained, locally grading to fine grained, silty in part, subangular, moderate to poorly sorted, calcareous cement, slightly bituminous, tight, occasional sandy shale partings
	15%	**LIMESTONE** medium to dark grayish brown, patchy light gray to off white, crppxl, silty & sandy in part, scattered fossil fragments (brachiopods, crinoids), dense, tight
	5%	**SHALE** very dark gray, blocky, silty & sandy, very calcareous
1,592.50 to 1,602.50 (10.00)	100%	**SANDSTONE** light to medium gray, predominately light to medium gray chert, white chert, & brown chert, with minor clear quartz, upper fine to lower very coarse grained, subrounded to rounded, poorly sorted, intbdd medium grayish brown very fine to fine grained sandstone, abundant secondary calcite cement + minor primary silica cement, tight to poor porosity (2-7%), common yellow fluorescence, moderately fast streaming cut, dead oil
1,602.50 to 1,607.50 (5.00)	45%	**SHALE** medium to dark grayish brown, subblocky, silty & sandy in part, calcareous, scattered brachiopod fragments

1,602.50 to 1,607.50 (5.00)	40%	**SANDSTONE** dark grayish brown, very fine grained, silty & argillaceous matrix, subrounded, poorly sorted, xtrem calcareous
	15%	**LIMESTONE** medium grayish brown, cryptocrystalline, silty & argillaceous, sandy in part, fossiliferous, (brachiopods, crinoids), dense, tight
1,607.50 to 1,610.00 (2.50)	100%	**SANDSTONE** light grayish brown, quartz, minor gray chert & common to abundant white siliceous clasts, predominately upper very fine to upper fine grained, 5-8% lower medium grained, subrounded, moderately sorted, minor primary silica cement with abundant secondary calcite cement, trace to minor black pyrobitumen cement, occasional silica overgrowths, 6-9% intergranular porosity, yellow fluorescence throughout, moderate streaming & weak blooming cut, fair dead oil show
1,610.00 to 1,615.00 (5.00)	100%	**SANDSTONE** light to medium gray to brownish gray, quartz, common to abundant gray chert, and common to abundant white opaque siliceous clasts, upper very fine to upper very coarse grained, subrounded, poorly sorted, calcite + minor silica cement, minor pyrobitumen cement, dull yellow fluorescence, moderately slow streaming cut, dead oil show, white siliceous clasts commonly have microfracture cemented with silica,
1,615.00 to 1,617.50 (2.50)	75%	**SANDSTONE** white to light gray, light yellowish brown, quartz with common variously gray chert, very fine to lower fine grained, subrounded, moderate sorting, calcite cement throughout, tight, patchy light amber hydrocarbon staining & dull yellow fluorescence, weak streaming dead oil cut
	25%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, sandy, floating very fine to lower fine grained sand clasts throughout, trace to minor chert nodules, cryptocrystalline, argillaceous in part, dense, tight, hard
1,617.50 to 1,625.00 (7.50)	100%	**LIMESTONE** medium to very dark grayish brown, cryptocrystalline, sandy, argillaceous in part, scattered brachiopod fragments, rare brown sht nodule, dense, tight, hard
1,625.00 to 1,630.00 (5.00)	100%	**LIMESTONE** medium to dark grayish brown, crxpl, argillaceous, sandy in part, occasional very fine grained sandy stringers, dense, tight, scattered brachiopod fragments
1,630.00 to 1,633.00 (3.00)	60%	**LIMESTONE** as above, increasingly argillaceous, sandy in part, rare fossil fragments
	40%	**SHALE** dark grayish brown, blocky, calcareous, silty, carbonaceous in part

Hart River, C Sands: 1,635.10 MD, 1,635.05 TVD, -1,164.89 SSL

1,633.00 to 1,637.50 100% **SANDSTONE**
(4.50) light to medium gray brownish gray, translucent & semi opaque quartz, and common gray & brown chert, fine to lower coarse grained, subrounded, moderate to poorly sorted, minor primary silica cement, abundant secondary calcite cement occludes porosity, trace spotty interstitial bitumen cement, tight to weak porosity (0-6%), patchy yellow fluorescence, fair streaming cut, questionable show

1,637.50 to 1,642.50 100% **SANDSTONE**
(5.00) light to medium grayish brown, translucent & semi opaque[quartz, minor gray & brown chert, abundant white chert, predominately fine grained, 10-15% medium to lower coarse grained, moderate sorting, subrounded to sband, common silica overgrowths, silica cement, trace secondary calcite cement, fair intergranular porosity (8-12%), dark pyrobitumen occludes porosity throughout, yellow fluorescence, strong petroliferous odor, fair moderately fast blooming & streaming cut, fair show, no gas show, fining down with increasing calcite cement

1,642.50 to 1,650.00 100% **SANDSTONE**
(7.50) light to medium grayish brown, quartz with abundant gray white, & occasional brown chert, predominately upper very fine to upper fine grained, minor medium to lower coarse grained, subrounded to subangular, moderately well sorted, primary silica cement, abundant secondary calcite cement, common to abundant dark brown to black pyrobitumen cement, moderately well indurated, friable in part, poor to locally fair porosity (3-10%), yellow fluorescence throughout, fair blooming and moderate streaming cut, fair show, no gas

1,650.00 to 1,655.00 75% **SHALE**
(5.00) dark grayish brown, blocky, silty, very fine sand throughout, calcareous, trace pyrite, very firm, brittle, carbonaceous in part

25% **SANDSTONE**
light to medium gray, vf- fine grained, minor lower medium grained, quartz & gray chert, subrounded, moderate to poorly sorted, primary silica + abundant secondary calcite cement, predominately tight (0-4% porosity), trace interstitial pyrobitumen, spotty yellow fluorescence, slow streaming cut, very poor to questionable show

1,655.00 to 1,660.00 50% **SANDSTONE**
(5.00) white to very light tan or yellowish white, very fine grained, silty in part, subrounded, moderate sorted, silica cement, extremely calcareous, dissolved grains leave a framework of quartz & minor gray chert with minor interstitial pyrobitumen cement, spotty dull fluorescence, trace cut, no show

30% **CHERTY SILTSTONE**
white to off white, very light gray, quartz silt cemented with white chert,, slightly calcareous, hard, brittle

20% **SHALE**
as above

1,660.00 to 1,662.50 (2.50) 80% **SANDSTONE**
light brown, very fine grained, minor lower fine grained, quartzose, subrounded to rounded, moderately well sorted, primary silica + secondary calcite cement, patchy minor pyrobitumen cement, poor porosity (3-7%), bright yellow fluorescence throughout, fair moderately fast blooming & streaming cut

20% **CHERTY SILTSTONE**
as above

1,662.50 to 1,670.00 (7.50) 85% **SANDSTONE**
medium gray to grayish brown, predominately upper very fine to upper fine grained, 3-5% medium to lower coarse grained, subrounded, moderate to well sorted, primary silica + bitumen cement, minor secondary calcite cement, silica overgrowths, poor intergranular porosity (3-5%), spotty dull yellow fluorescence, slow streaming dead oil cut

15% **LIMESTONE**
medium to dark grayish brown, cryptocrystalline, cherty, sandy in part, dense, tight, thin beds

1,670.00 to 1,680.00 (10.00) 100% **SANDSTONE**
light to medium grayish brown, quartz & abundant gray & occasionally brown chert, very fine to very coarse grained, predominately poorly sorted, interbedded moderate to well sorted fine to lower medium grained sandstone, subrounded to subangular, moderate to well indurated, primary silica cement, common pyrobitumen cement, abundant secondary calcite cement, poor intergranular porosity (~2-6%), patchy yellow fluorescence, moderate streaming dead oil cut

1,680.00 to 1,690.00 (10.00) 80% **LIMESTONE**
mottled or interbedded light tan to light yellowish brown & medium to dark grayish brown, cryptocrystalline, argillaceous in part, locally silty to very fine grained sandy in part, fossiliferous, scattered brachiopods, shell fragments, 2-3% chert in 1690 sample, dense tight

20% **SHALE**
dark grayish brown, subblocky, silty in part, calcareous, carbonaceous in part

1,690.00 to 1,695.00 (5.00) 45% **LIMESTONE**
white, off white, medium grayish brown in part, commonly sandy, scattered fossil fragments, cherty, dense tight

40% **CHERT**
predominately light to medium yellowish brown to grayish tan, occasional dark brown, silty inclusions throughout, occasionally seen with pyrite along rim contact with limestone, as nodules & irregular beds

15% **SANDSTONE**
light tan to light grayish brown, very fine grained, coarse silt in part, subrounded, moderate sorting, calcite cement throughout, grading to sandy limestone in part, thin beds, tight

1,695.00 to 1,700.00 (5.00)	50%	**CHERT** predominately light yellowish brown, minor medium to dark brown, silty & organic inclusions, massive, bedded, hard, brittle
	50%	**LIMESTONE** light to medium yellowish brown to grayish brown, occasional dark grayish brown argillaceous bed, cryptocrystalline to microcrystalline subhedral, occasional silty bed, rare fossil fragment, dense, tight, interbedded chert
1,700.00 to 1,710.00 (10.00)	85%	**LIMESTONE** light to medium yellowish brown, cryptocrystalline to very finely microcrystalline subhedral, clean, local slightly silty, rare argillaceous stringer, rare fossil fragment, chert stringers, occasional calcite druse in rare microfracture, dense, tight
	15%	**CHERT** predominately light to medium yellowish brown to grayish brown, minor mottled dark brown, silty & organic inclusions as above, bedded, fractured to jointed in part
1,710.00 to 1,717.00 (7.00)	70%	**LIMESTONE** light to medium yellow brown, minor interbedded dark grayish brown, slightly argillaceous in part, cryptocrystalline to very finely microcrystalline subhedral as above, silty in part, dense, tight, interbedded massive chert
	30%	**CHERT** mottled light to occasionally very dark yellowish brown to grayish brown, massive, bedded, very hard, brittle, organic inclusions, silty in part
1,717.00 to 1,735.00 (18.00)	70%	**LIMESTONE** light to medium yellowish brown, argillaceous in part, occasional dark brown argillaceous stringer, cryptocrystalline to very finely microcrystalline subhedral, scattered shell fragments, locally silty, dense, tight, interbedded massive chert, possible chert nodules
	30%	**CHERT** mottled light to dark grayish brown, massive, trace calcite, silty in part, organic inclusions, bedded & possible nodules, common fractures
1,735.00 to 1,745.00 (10.00)	65%	**LIMESTONE** light to medium yellowish brown, off white, chalky & argillaceous in part, cryptocrystalline to very finely microcrystalline subhedral, locally silty, sandy, dense, tight, interbedded massive chert, possible chert nodules
	35%	**CHERT** mottled light to dark grayish brown, off white, yellow brown, massive, trace calcite, silty in part, occasional organic & argillaceous inclusions, as chert bedded & in part as possible nodules, common fractures

1,745.00 to 1,755.00 (10.00)	65%	**LIMESTONE** off white, gray brown, light brown, cryptocrystalline to very finely crystalline, chalky in part, as mudstone, peloidal wackestone, slightly silty, cherty, sandy or argillaceous, tight, rare stylolites, rare shale fragments, rare open & healed fractures, slightly bituminous.
	35%	**CHERT** off white, light yellow brown, commonly mottled, slightly calcareous, massive, translucent, occasional clay, hydrocarbon or spicule inclusions, rare open and healed fractures, tight
1,755.00 to 1,760.00 (5.00)	70%	**LIMESTONE** off white, light to occasionally medium brown gray, cryptocrystalline to lower fine crystalline, recrystallized, chalky, as peloidal mudstone to wackestone, slightly argillaceous & silty, locally cherty, rare dark brown shale partings, slightly bituminous.
	30%	**CHERT** off white, light to medium brown, mottled, translucent, commonly with organic or argillaceous inclusions, slightly calcareous, spicular, rare open and healed fractures.
1,760.00 to 1,765.00 (5.00)	60%	**LIMESTONE** off white, light to occasionally medium brown gray, rare dark brown marly fragments, cryptocrystalline to lower fine crystalline, recrystallized, chalky, as peloidal mudstone to wackestone, slightly argillaceous & silty, locally cherty. rare dark brown shale partings, slightly bituminous.
	40%	**CHERT** off white, predominately light to medium yellow brown, mottled, translucent, commonly with organic or argillaceous inclusions, rare pyrite, slightly calcareous, spicular, rare open and healed fractures.
1,765.00 to 1,775.00 (10.00)	75%	**CHERT** predominately yellow brown, light gray, occasionally off white, dark gray or black, translucent, occasionally with organic of argillaceous inclusions, slightly calcareous, rare spicules, occasional fragments with healed or open fractures, tight.
	25%	**LIMESTONE** off white, mottled yellow brown, gray brown, cryptocrystalline to very fine crystalline, recrystallized, chalky, friable in part, as mudstone, slightly silty, sandy or argillaceous, tight, slightly bituminous.
1,775.00 to 1,785.00 (10.00)	65%	**LIMESTONE** off white, light gray brown, light yellow brown, mottled, cryptocrystalline to very fine crystalline, recrystallized, chalky in part, as mudstone, slightly silty, sandy, tight, 7-8% medium brown calcareous shale, argillaceous limestone or marlstone fragments, slightly bituminous.

1,775.00 to 1,785.00 (10.00) 35% **CHERT**
yellow brown, light gray, occasionally off white, dark gray or dark brown, mottled, translucent, commonly with organic or argillaceous inclusions, slightly calcareous, rare spicules, occasional fragments with healed or open fractures, tight.

1,785.00 to 1,790.00 (5.00) 60% **LIMESTONE**
off white, cream, occasionally medium to dark brown gray, cryptocrystalline to very fine crystalline, recrystallized, commonly chalky textured, as mudstone, gray brown fragments commonly argillaceous, locally marly, rare dark brown shale laminae or partings, rare fractures, rare stylolites, tight, slightly bituminous.

40% **CHERT**
light to medium yellow brown, light to dark gray, off white, translucent, commonly with argillaceous or black hydrocarbon inclusions, rare fractures, spicular in part, tight.

1,790.00 to 1,795.00 (5.00) 65% **LIMESTONE**
off white, cream, commonly light gray brown & mottled, cryptocrystalline to very fine crystalline, recrystallized & in part chalky, commonly argillaceous, slightly silty & sandy, rare dark brown marly fragments, tight, slightly bituminous.

35% **CHERT**
light to medium yellow brown, light to medium brown gray, off white, translucent, calcareous, commonly with argillaceous or hydrocarbon inclusions, with occasional open & healed fractures, tight.

1,795.00 to 1,805.00 (10.00) 60% **LIMESTONE**
off white, cream, gray brown, commonly mottled, recrystallized, cryptocrystalline to lower fine crystalline, as mudstone, chalky textured in part, 3-4% dark brown cryptocrystalline marly limestone fragments, silty, sandy or argillaceous, tight, slightly bituminous.

40% **CHERT**
light to medium yellow brown, occasionally dark brown, off white, light gray, as platy to occasionally blocky fragments, translucent, mottled, commonly with argillaceous or hydrocarbon inclusions, rare pyrite or spicules, occasional open & healed fractures.

1,805.00 to 1,810.00 (5.00) 65% **LIMESTONE**
off white, cream, commonly light to medium brown gray & more argillaceous, commonly mottled, cryptocrystalline to very fine crystalline, recrystallized & in part chalky textured, commonly with medium brown clay, locally grading to marlstone, slightly silty, tight, no visible fractures, trace medium brown gray, blocky, micromicaceous, greasy shale fragments.

35% **CHERT**
light to medium yellow brown, dark brown, occasionally light gray, off white, translucent, commonly with clay or hydrocarbon inclusions, rare spicules, commonly tight, rare open & healed fractures, as massive beds or laminae.

1,810.00 to 1,815.00 (5.00) 100% **LIMESTONE**
light to medium brown gray, commonly mottled, cryptocrystalline to microcrystalline, locally very fine crystalline, chalky in part, commonly with medium brown argillaceous cement & grading in part to calcareous marlstone, rare calcite filled fractures, 6% off white, dark brown, translucent, locally fracture & spicular chert fragments, trace dark gray brown soft bituminous shale fragments.

1,815.00 to 1,820.00 (5.00) 100% **LIMESTONE**
light to medium brown gray, occasionally dark brown, cryptocrystalline to occasionally lower fine crystalline, as mudstone, commonly with medium brown argillaceous cement & grading to calcareous marlstone, rare fractures, tight, 3-4% as translucent chert fragments, trace calcareous dark brownish gray shale, bituminous.

1,820.00 to 1,825.00 (5.00) 60% **LIMESTONE**
light to medium brown, occasionally off white, mottled in part, cryptocrystalline to lower fine crystalline, commonly argillaceous & marly, rare white calcite lined fractures, tight, slightly bituminous, trace chert fragments.

40% **SHALE**
dark brown to black, sub platy, very calcareous & very firm, slightly silty & sandy, micromicaceous, non fissile, slow weak yellow green blooming cut fllor.

1,825.00 to 1,830.00 (5.00) 90% **LIMESTONE**
light brown gray, off white, commonly mottled, chalky textured in part, cryptocrystalline to microcrystalline, as mudstone, rare medium brown cryptocrystalline fragments, commonly argillaceous & grading to calcareous mudstone, tight, no visible fractures.

10% **SHALE**
dark brown, black, subblocky, firm, very calcareous, non fissile, slightly silty & sandy.

1,830.00 to 1,835.00 (5.00) 85% **LIMESTONE**
off white, light to medium brown gray, mottled, cryptocrystalline to very fine crystalline, chalky textured in part, 10-15% medium brown, dark brown & predominately cryptocrystalline, as mudstone, commonly argillaceous & locally marly, tight, rare fractures.

15% **CHERT**
off white, medium brown, locally cherty, translucent, locally spicular, tight, minor black, firm, non fissile, very calcareous shale fragments.

1,835.00 to 1,840.00 (5.00) 60% **LIMESTONE**
off white, light to medium brown gray, mottled, cryptocrystalline to lower finely crystalline, chalky textured in part, as mudstone, commonly argillaceous, locally marly, rare calcite healed fractures, tight.

40% **CHERT**
medium brown, opaque, calcareous, blocky, dense & tight, rare pyrite.

1,840.00 to 1,845.00 (5.00) 60% **LIMESTONE**
predominately off white to medium brown & mottled, cryptocrystalline to lower fine crystalline, commonly chalky textured & recrystallized, occasionally medium brown, cryptocrystalline & dense, as mudstone, commonly slightly argillaceous, locally marly, rare fractures with calcite druse, rare dark brown platy calcareous shale fragments.

40% **CHERT**
medium to dark brown, trace off white fragments, cryptocrystalline, calcareous, locally argillaceous, predominately opaque, dense & tight.

1,845.00 to 1,850.00 (5.00) 60% **LIMESTONE**
off white, light to medium brown gray, commonly mottled, in part medium brown, cryptocrystalline to occasionally lower fine crystalline, recrystallized or in part chert replaced, as mudstone, argillaceous, locally marly, rare fractures, rare calcite druse as fracture fill or possible vug linings, slightly bituminous.

40% **CHERT**
medium to dark brown, opaque and as replaced limestone, occasionally argillaceous, rare light gray or off white translucent spicular chert fragments, tight.

1,850.00 to 1,855.00 (5.00) 70% **LIMESTONE**
off white, light to medium brown, mottled, in part medium brown gray, cryptocrystalline to occasionally lower fine crystalline, in part recrystallized & chalky, as mudstone, commonly argillaceous, locally cherty and marly, rare calcite filled fractures, rare fragments with calcite druse & possible vug lining, slightly bituminous.

30% **CHERT**
medium to dark brown, opaque, platy to blocky, calcareous, commonly argillaceous & as replaced limestone, rare medium brown spicular chert fragments.

1,855.00 to 1,865.00 (10.00) 65% **LIMESTONE**
off white, light to medium brown gray, mottled, in part medium brown gray, medium brown, cryptocrystalline to occasionally lower fine crystalline, in part recrystallized & chalky, as mudstone, commonly argillaceous, locally cherty and marly, rare calcite filled fractures, slightly bituminous.

35% **CHERT**
medium to dark brown, opaque, platy to blocky, calcareous, commonly argillaceous & as replaced limestone, rare pyrite, rare off white or medium brown spicular chert fragments, tight.

1,865.00 to 1,870.00 (5.00) 70% **LIMESTONE**
predominately off white, speckled medium brown gray & mottled, occasionally medium brown, recrystallized in part, in part chalky textured, rare brachiopods, as mudstone, cherty, locally argillaceous & marly, rare fractures, tight, bituminous, rare stylolites, minor shale.

1,865.00 to 1,870.00 (5.00) 30% **CHERT**
medium gray brown, dark brown gray, dark brown, opague to translucent, occasionally spicular or banded, greasy to dull lustre, occasionally argillaceous, calcareous, rare open and healed fractures,

1,870.00 to 1,875.00 (5.00) 50% **CHERT**
medium brown, medium to dark gray, black, opaque, occasionally translucent, calcareous, locally argillaceous, rare fractures, in part spicular, predominately as replaced limestone, tight.

50% **LIMESTONE**
off white commonly with gray brown speckling, mottled, occasional medium brown fragments, cryptocrystalline to lower fine crystalline, recrystallized & chalky in part, as mudstone, commonly argillaceous & grading in part to calcareous marlstone, locally cherty, rare white calcite filled fractures, 3% black blocky very calcareous non fissile hard shale fragments.

1,875.00 to 1,880.00 (5.00) 70% **LIMESTONE**
off white commonly with gray brown speckling, mottled, occasional medium brown fragments, cryptocrystalline to lower fine crystalline, recrystallized & chalky in part, as mudstone, rare brachiopods, commonly argillaceous & grading in part to calcareous marlstone, locally cherty, rare white calcite filled fractures, 7% medium brown, black, blocky, very calcareous, non fissile, hard, occasionally slightly silty, sandy, pyritic or marly shale fragments with no cut fluorescence.

30% **CHERT**
medium brown, medium to dark gray, black, opaque, occasionally translucent, calcareous, locally argillaceous, rare fractures, in part spicular, predominately as replaced limestone, tight.

1,880.00 to 1,885.00 (5.00) 50% **CHERT**
medium to dark brown, occasionally light gray, translucent to opaque, spicular in part, locally with argillaceous or organic inclusions, occasional open and healed fractures, tight.

25% **LIMESTONE**
off white, cream & commonly with light to medium brown gray speckling, mottled, cryptocrystalline to very fine lower crystalline, recrystallized, chalky in part, as brachiopod mudstone, commonly argillaceous, locally marly, rare calcite healed fractures, tight, rare shale partings.

25% **SHALE**
medium to dark brown, black, commonly with off white calcareous & sand grain speckling, calcareous, commonly subblocky to blocky, hard, non fissile, commonly silty & sandy, pyritic, with slow weak yellow green flsh cut fluorescence, bituminous.

1,885.00 to 1,890.00 (5.00) 85% **CHERT**
medium to dark brown, gray, translucent, occasionally opaque, calcareous, locally argillaceous, fragments with occasional argillaceous inclusions, rare calcite lined fractures, predominately tight, no shows.

1,885.00 to 1,890.00 (5.00)	15%	**LIMESTONE** off white, speckled brown, mottled, cryptocrystalline to lower fine crystalline, chalky textured, mudstone, sllty, argillaceous or locally marly, rare fractures.
1,890.00 to 1,895.00 (5.00)	80%	**CHERT** medium to dark brown, occasionally gray, opaque to translucent, calcareous, occasionally with argillaceous inclusions, spicular in part, rare open and healed fractures, tight.
	20%	**LIMESTONE** off white, cream, commonly speckled light to medium brown gray, mottled, occasionally medium brown, medium brown gray, cryptocrystalline to occasionally lower fine crystalline, recrystallized & chalky, as mudstone, commonly argillaceous, locally marly, rare clay lined stylolites, tight.
1,895.00 to 1,900.00 (5.00)	80%	**CHERT** medium to dark brown, commonly gray, translucent, calcareous, occasionally with argillaceous inclusions, spicular in part, rare open and healed fractures, tight.
	20%	**LIMESTONE** offf white, cream commonly speckled light to medium brown gray, mottled, occasionally light brown, cryptocrystalline to occasionally lower fine crystalline, recrystallized & chalky, as mudstone, commonly argillaceous, locally marly, tight.
1,900.00 to 1,910.00 (10.00)	70%	**CHERT** gray, medium to dark brown, trace black, translucent to opaque, commonly with spherical & argillaceous inclusions, spicular in part, calcareous, occasional healed & open fractures, tight.
	30%	**LIMESTONE** off white, occasionally medium brown gray, commonly speckled brown & mottled, cryptocrystalline to lower fine crystalline, commonly recrystallized & chalky, as mudstone, commonly argillaceous or marly, tight, occasional calcite lined fractures.
1,910.00 to 1,915.00 (5.00)	80%	**CHERT** light gray, medium to dark brown, commonly translucent, calcareous, faint laminae, slightly argillaceous, occasionally calcite & silica lined fractures, rare open fractures, tight.
	20%	**LIMESTONE** off white, speckled brown & mottled, chalky textured & recrystallized, cryptocrystalline to lower fine crystalline, rare medium brown cryptocrystalline fragments, as mudstone, in part argillaceous or marly, tight.
1,915.00 to 1,920.00 (5.00)	60%	**CHERT** medium to dark brown, occasionally light gray, opaque to translucent, commonly argillaceous or with argillaceous inclusions, spicular in part, rare fractures, tight, trace dark brown to black, calcareous, shale.

1,915.00 to 1,920.00 (5.00) 40% **LIMESTONE**
off white mottled light to medium brown gray, commonly chalky textured & cryptocrystalline to lower fine crystalline, commonly argillaceous or marly, tight.

1,920.00 to 1,925.00 (5.00) 60% **CHERT**
medium to dark brown, occasionally gray or black, platy to blocky, opaque to translucent, occasionally with open & healed fragments, commonly with argillaceous inclusions, calcareous, no visible staining.

40% **LIMESTONE**
off white, mottled light to medium brown gray, commonly chalky textured & cryptocrystalline to lower fine crystalline, occasional medium brown, cryptocrystalline fragments, as mudstone, commonly argillaceous or marly, tight, rare druse lined fractures & possible druse lined vugs, no visible staining.

1,925.00 to 1,935.00 (10.00) 80% **CHERT**
medium to dark brown, yellow brown, gray, black, platy to blocky, opaque to translucent, commonly with argillaceous inclusions, calcareous, occasionally with calcite druse lined fractures with black pyrobitumen.

20% **LIMESTONE**
off white mottled light to medium brown gray, commonly chalky textured & cryptocrystalline to lower fine crystalline, friable in part, commonly argillaceous, bit-ground?, occasional medium brown, cryptocrystalline, occasionally cherty fragments, as mudstone, commonly argillaceous or marly, tight, rare fractures, trace dark brown to black, silty & sandy, calcareous shale fragments.

1,930.00 to 1,940.00 (10.00) 70% **CHERT**
medium to dark brown, yellow brown, gray, black, platy to blocky, opaque to translucent, cryptocrystalline, commonly with argillaceous inclusions, calcareous, occasional open & healed fractures, tight.

30% **LIMESTONE**
off white mottled light to medium brown gray, occasionally gray brown, medium brown, commonly chalky textured & cryptocrystalline to lower fine crystalline, friable in part, commonly argillaceous, marly, as mudstone, rare silt, tight, rare fractures, rare medium brown shale partings, trace medium to dark brown to black, silty & sandy (fine to rare lower medium) , calcareous shale fragments.

1,940.00 to 1,945.00 (5.00) 70% **CHERT**
medium to dark brown, gray, rare yellow brown or black, platy to blocky, opaque to translucent,, cryptocrystalline to very fine lower crystalline, commonly with argillaceous inclusions, calcareous, occasional open & healed fractures, tight.

15% **LIMESTONE**
off white mottled light to medium brown gray, occasionally gray brown, medium brown, commonly chalky textured & cryptocrystalline to lower fine crystalline, friable in part, commonly argillaceous, marly, as mudstone, rare silt, tight, rare fractures, trace calcareous shale fragments.

1,940.00 to 1,945.00 (5.00) 15% **SANDSTONE**
white, light gray, medium brown, consolidated, salt and pepper, fine to coarse lower grained, poor to moderately sorted, angular to subrounded, with < 40% brown, light gray, yellow brown chert grains, calcareous, siliceous, slightly pyritic & with patchy medium brown argillaceous cement, poor grain relief, tight, rare fragments with 1-6% black dead bitumen plugged intergranular porosity, no cut fluorescence, rare brown gray shale partings.

1,945.00 to 1,950.00 (5.00) 65% **CHERT**
medium to dark brown, gray, rare yellow brown or black, platy to blocky, opaque to translucent, commonly with argillaceous inclusions, calcareous, occasional open & healed fractures, rare fracture lined druse with pyrobitumen, generally tight.

20% **SANDSTONE**
white, light gray, rare light brown, consolidated, salt and pepper, fine to coarse lower grained, rare floating very coarse lower chert grains, poor to moderately sorted, angular to subrounded, with < 40% brown, light gray, yellow brown, green, chert grains, calcareous, siliceous, slightly kaolinitic, slightly pyritic & with patchy medium brown argillaceous cement, poor grain relief, tight, rare fragments with 1-6% black dead bitumen plugged intergranular porosity, no cut fluorescence.

15% **LIMESTONE**
off white mottled light to medium brown gray, occasionally gray brown, medium brown, commonly chalky textured & cryptocrystalline to microcrystalline, occasionally lower fine crystalline, friable in part, commonly argillaceous, marly, commonly silty & sandy, grading in part to calcareous, argillaceous siltstone, tight, rare fractures, trace calcareous shale fragments.

1,950.00 to 1,955.00 (5.00) 40% **SANDSTONE**
white, light gray, rare light brown, consolidated, salt and pepper, fine to coarse lower grained, rare floating very coarse lower chert grains, poor to moderately sorted, angular to subrounded, with < 40% brown, light to dark gray, yellow brown, green, chert grains, calcareous, slightly siliceous & pyritic, with patchy medium brown argillaceous cement, poor grain relief, tight, rare fragments with 1-9% black dead bitumen plugged intergranular porosity, argillaceous fragments with good bright yellow green streaming cut fluorescence.

35% **CHERT**
yellow brown, gray, olive, translucent to occasionally opaque, calcareous, in part as silicified sandstone, occasional healed fractures, commonly with argillaceous inclusions, tight.

20% **LIMESTONE**
off white, light to medium brown gray mottled, cryptocrystalline to very fine lower crystalline, chalky textured, argillaceous, marly, tight, occasionally silty or sandy.

5% **SHALE**
medium to dark brown, occasionally silty & sandy, calcareous, marly in part, commonly firm, non fissile, weak yellow green blooming cut fluorescence.

1,955.00 to 1,960.00 (5.00) 45% **CHERT**
medium to dark brown, gray, translucent, commonly with argillaceous inclusions, locally with open or healed fractures, calcareous, occasionally argillaceous, tight.

30% **LIMESTONE**
very light brown, off white, commonly speckled light to medium brown gray, mottled, cryptocrystalline to very fine lower crystalline, chalky textured in part & recrystallized, commonly argillaceous, silty, sandy & marly, grading in part to argillaceous, calcareous quartzose siltstone, tight.

20% **SANDSTONE**
off white, light gray, locally light to medium brown, consolidated, salt and pepper, friable in part, fine to coarse upper grained, angular to rounded, poor to moderately sorted, calcareous, patchy medium brown argillaceous cement, slightly siliceous or pyritic, rare 1-6% dead intergranular bitumen staining, no cut fluorescence.

5% **SHALE**
medium to dark brown, dark brown gray, platy to blocky, non fissile, commonly speckled with calcite crystals, locally siliceous or cherty, commonly slightly silty & sandy, weak to good yellow green bloming cut fluorescence.

1,960.00 to 1,965.00 (5.00) 80% **CHERT**
medium brown, medium brown gray, gray, calcareous, translucent to opaque, calcareous, rare calcite lined fractures.

20% **LIMESTONE**
very light brown, off white, commonly speckled light to medium brown gray, mottled, cryptocrystalline to very fine lower crystalline, chalky textured in part & recrystallized, commonly argillaceous & marly, cherty in part, tight, trace medium to dark brown, rare black, greasy in part, commonly silty, sandy, calcareous, shale fragments.

1,965.00 to 1,970.00 (5.00) 85% **CHERT**
off white, cream, light to dark brown, light gray, microcrystalline to cryptocrystalline, microcrystalline fragments silty, calcareous, siliceous, in part as silicified siltstone, translucent fragments commonly with argillaceous inclusions, in part as replaced limestone & in part spicular, occasional fractures, tight.

15% **LIMESTONE**
off white, very light brown & commonly with medium brown speckling & mottled, cryptocrystalline to very fine crystalline, 3% as consolidated, fine to medium grained, calcareous, salt and pepper sandstone fragments with spotty dead black bitumen & no cut fluorescence as above, trace dark brown to black silty, calcareous, silty & sandy shale fragments.

1,970.00 to 1,975.00 (5.00) 65% **CHERT PEBBLE SANDSTONE**
light gray, off white, salt and pepper, friable, fine to very coarse upper grained, rare dark gray chert granules, conglomeratic & matrix supported, with 40-80 % light to dark gray, light brown, rare light yellow brown chert grains, angular in part & predominately subangular to subrounded, poor to moderately sorted, occasional fragments with silty to very fine lower quartz matrix, calcareous, slightly siliceous & pyritic, patchy brown & white (kaolinitic?) argillaceous matrix, no visible porosity, scattered 1-7%, rare 9 % black bitumen plugged intergranular porosity, very slow, poor, yellow green weak blooming cut fluorescence.

35% **CHERT**
yellow brown, calcareous, microcrystalline, orange brown, calcareous & commonly argillaceous, (siliceous siltstone?), predominately light gray, medium to dark brown, translucent, cryptocrystalline, spicular in part & with medium brown argillaceous inclusions, rare fractures, 5% off white, cryptocrystalline to lower fine crystalline, argillaceous, tight mudstone limestone fragments.

1,975.00 to 1,980.00 (5.00) 60% **CHERT**
light gray, light brown, cryptocrystalline to lower fine crystalline, commonly with brown or off white argillaceous inclusions, spotty calcareous cement, spicular in part, commonly translucent, occasional healed and open fractures, tight.

40% **CHERT PEBBLE SANDSTONE**
light gray, off white, salt and pepper, friable & in part as unconsolidated grains, fine to very coarse upper grained, rare dark gray chert granules, conglomeratic & matrix supported, with 40-80 % light to dark gray, light brown, rare light yellow brown chert grains, angular & rounded in part & predominately subangular to subrounded, poor to moderately sorted, occasional fragments with silty to very fine lower quartz matrix, calcareous, slightly siliceous & pyritic, patchy brown argillaceous matrix, no visible porosity, scattered 1-7%, rare 9 % black bitumen plugged intergranular porosity, very slow, poor yellow green weak blooming cut fluorescence.

1,980.00 to 1,985.00 (5.00) 80% **CHERT**
medium brown, light gray, translucent, calcareous, commonly with argillaceous inclusions, slightly pyritic, occasional healed & open fractures, tight, 4% largely unconsolidated sandstone as above.

20% **LIMESTONE**
off white, light gray brown, commonly argillaceous, silty & grading to calcareous marlstone & calcareous, commonly argillaceous siltstone, & silty lower fine grained sandstone, tight, no shows.

1,985.00 to 1,990.00 (5.00) 70% **CHERT**
light gray, light to medium brown, trace black, translucent, occasionally opaque, rare pyrite, slightly calcareous, commonly with faint very fine lower grain ghosts, commonly with argillaceous inclusions, predominately cryptocrystalline, 3% medium to dark brown, silty, sandy, calcareous, hard, non fissile shale, very slow yellow green blooming cut fluorescence.

1,985.00 to 1,990.00 (5.00)	30%	**LIMESTONE** of white, brown gray, mottled, soft to hard & brittle, in part with white or light to medium brown argillaceous matrix & marly, commonly silty & sandy, locally cherty, in part grading to very argillaceous, tight, calcareous, silty sandstone & sandy argillaceous siltstone.
1,990.00 to 1,995.00 (5.00)	40%	**CHERT** medium brown, gray, yellow brown, translucent, rare opaque fragments, calcareous, commonly with argillaceous inclusions, rare spherical microfossils, occasionally fractured, occasionally fractured tight.
	40%	**LIMESTONE** off white, light brown speckled, mottled, chalky in part, argillaceous, occasionally silty & sandy, locally grading to calcareous marlstone & calcareous, commonly argillaceous siltstone, tight.
	20%	**SHALE** medium to dark brown, blocky, non fissile,occasionally with calcareous specks, locally fractured, , marly in part, commonly silty & sandy, weak, slow bloming cut fluorescence.
1,995.00 to 2,000.00 (5.00)	60%	**CHERT** light gray, medium brown, platy, occasionally blocky to splintery, translucent, occasionally fractures & with calcite infill, spicular in part, tight.
	20%	**LIMESTONE** off white, light brown, speckled light to medium brown, mottled, cryptocrystalline to microcrystalline, occasionally lower fine crystalline, commonly argillaceous & marly, slightly silty, cherty, grading in part to calcareous argillaceous siltstone, tight.
	20%	**SHALE** medium to dark brown, in part blocky, commonly with white or light brown clc specks, very firm & non fissile, calcareous, marly in part, commonly silty & occasional fine quartz grains, slightly cherty, , good very slow (5 minn) bright yellow green blooming cut fluorescence.
2,000.00 to 2,005.00 (5.00)	70%	**CHERT** medium brown, light gray, gray green, translucent, calcareous, cryptocrystalline, occasionally fractured, commonly with argillaceous inclusions, no shows.
	30%	**LIMESTONE** off white, light brown, commonly speckled or mottled yellow brown or light to medium gray brown, cryptocrystalline to microcrystalline, occasionally lower fine crystalline, recrystallized, chalky in part, commonly argillaceous, silty or sandy, commonly grading to calcareous marlstone,
2,005.00 to 2,010.00 (5.00)	70%	**CHERT** medium brown, light gray, gray green, translucent, calcareous, cryptocrystalline, occasionally fractured, commonly with argillaceous inclusions, no shows.

2,005.00 to 2,010.00 (5.00)	30%	**LIMESTONE** off white, light brown, commonly speckled or mottled yellow brown or light to medium gray brown, cryptocrystalline to microcrystalline, occasionally lower fine crystalline, recrystallized, chalky in part, commonly argillaceous, silty or sandy, commonly grading to calcareous marlstone, trace dark brown, blocky, calcareous, occasionally silty & sandy, marly in part, shale fragments.
2,010.00 to 2,015.00 (5.00)	75%	**CHERT** gray, medium to dark brown, yellow brown, black, calcareous, commonly with argillaceous inclusions, spicular in part, occasional fractures, tight.
	15%	**SHALE** medium to dark brown, commonly with calcite crystal specks or with floating sand grains, calcareous, sub platy to subblocky, commonly firm, non fissile, commonly silty & sandy, marly, or with off white. light brown clay patches, bituminous, with very weak, very slow yellow green blooming cut fluorescence.
	10%	**LIMESTONE** off white, speckled or mottled medium brown gray, cryptocrystalline to microcrystalline,argillaceous, marly, commonly silty & sandy, tight.
2,015.00 to 2,020.00 (5.00)	60%	**CHERT** medium to dark brown, occasionally light gray or yellow brown, opaque to translucent, calcareous, commonly with argillaceous inclusions, slightly pyritic, spicular in part, occasional open & healed fractures, slightly pyritic, tight.
	40%	**LIMESTONE** off white with dark brown mottling, occasionally dark brown, cryptocrystalline to fine lower crystalline, argillaceous, marly, slightly cherty, silty or sandy, tight.
2,020.00 to 2,025.00 (5.00)	50%	**CHERT** medium to dark brown, occasionally yellow brown, in part light gray, opaque to translucent, calcareous, rare fractures, spicular in part, commonly with argillaceous inclusions, trace pyrite, tight, in part as replaced marly limestone, tight.
	50%	**LIMESTONE** off white to dark brown gray, commonly mottled, locally off white & brown interlaminations, with off white or medium brown argillaceous cement, commonly silty & sandy, locally cherty, commonly grading to silty calcareous marlstone or rarely to argillaceous calcareous sandy siltstone, rare sandy shale fragments.
2,025.00 to 2,030.00 (5.00)	50%	**CHERT** light gray, medium yellow brown, medium to dark brown, occasionally orange brown, calcareous, in part as replaced limestone, cryptocrystalline to occasionally microcrystalline, occasional open & calcareous or silica healed fractures, slightly pyritic, locally argillaceous, tight.

2,025.00 to 2,030.00 (5.00) 50% **LIMESTONE**
off white to medium brown gray, commonly speckled & mottled, cryptocrystalline to fine crystalline, commonly argillaceous or marly, silty & sandy, locally chert replaced, grading to marlstone, rare calcareous shale, tight.

2,030.00 to 2,035.00 (5.00) 60% **LIMESTONE**
off white with light to medium brown mottling and grading to dark brown with white mottling, cryptocrystalline to lower fine crystalline, commonly slightly silty & occasionally sandy, commonly argillaceous & grading to marlstone, in part chert replaced, tight.

40% **CHERT**
dark brown, black, occasionally light gray or yellow brown, opaque to translucent, occasional argillaceous fragments, cryptocrystalline to occasionally microcrystalline, rare fragments with siliceous druse fracture fill, slightly pyritic, tight.

2,035.00 to 2,040.00 (5.00) 70% **CHERT**
medium to dark brown, occasionally light yellow brown, light gray, cryptocrystalline to rare microcrystalline, translucent, calcareous, commonly with medium brown argillaceous inclusions, slightly pyritic, rare fractures , tight.

30% **LIMESTONE**
off white or cream to medium brown gray & mottled, cryptocrystalline to lower fine crystalline, recrystallized & chalky in part, commonly with off white or medium brown argillaceous cement & in part marly, cherty, silty & sandy in part, tight.

2,040.00 to 2,045.00 (5.00) 55% **CHERT**
medium to dark brown, occasionally yellow brown or gray, cryptocrystalline, translucent, calcareous, commonly with argillaceous inclusions & minor fractures, tight.

45% **LIMESTONE**
off white, cream to dark brown gray, mottled, cryptocrystalline to microcrystalline, occasionally lower fine crystalline, commonly with off white o0r medium brown argillaceous cement & in part marly, slightly silty & sandy, tight, rare dark brown gray, blocky, cacs, silty, firm, shale fragments.

2,045.00 to 2,050.00 (5.00) 50% **CHERT**
medium to dark brown, occasionally yellow brown or gray, calcareous, translucent, occasional with open & silica or calcite healed fractures, commonly with medium brown irregular very wispy thin argillaceous inclusions, slightly pyritic, tight.

50% **LIMESTONE**
off white, cream grdt to medium brown gray, mottled, cryptocrystalline, in part mixcl or very fine lower crystalline, commonly with off to medium brown argillaceous matrix & commonly grading to marlstone, locally cherty, , slightly silty or sandy, rare calcite filled fractures, rare light to medium gray brown, trace black, slightly pyritic, in part non calcareous shale fragments.

2,050.00 to 2,052.50 (2.50) 60% **CHERT**
light to dark brown, occasionally yellow brown or light gray, translucent, spicular in part, commonly with abundant rounded lower fine grains, microfossils?, calcareous, slightly pyritic, commonly with very fine argillaceous inclusions, occasionally fractured, tight.

40% **LIMESTONE**
off white, crn, to medium dark brown & commonly mottled, cryptocrystalline to microcrystalline, occasionally lower fine crystalline, as mudstone, commonly with off white, or medium brown argillaceous cement, slightly silty & sandy, commonly grading to marlstone, rare shale.

2,052.50 to 2,055.00 (2.50) 90% **SHALE**
medium to dark brown gray, sub platy to subblocky, dull, trace pyrite, soft to firm, sub fissile, calcareous, occasional calcite lined fractures, slightly marly, silty & sandy, weak, slow (10 mins) yellow green blooming cut fluorescence.

10% **CHERT**
dark brown, medium brown, rare light gray fragments, opaque to rare translucent, rare spicules, occasional fractures, calcareous, tight.

2,055.00 to 2,057.50 (2.50) 100% **SHALE**
medium to dark brown, sub platy to subblocky, calcareous, firm, sub fissile, occasional white calcite lined fractures, slightly silty & sandy, slightly carbonaceous, slow yellow green blooming cut fluorescence, 10-15% as dark brown, black, occasionally light gray, occasionally fractured, calcareous, tight chert fragments.

Hart River Shale: 2,058.00 MD, 2,057.94 TVD, -1,587.78 SSL

2,057.50 to 2,066.00 (8.50) **CORED INTERVAL**
See Core Description for detailed lithology.

2,066.00 to 2,077.50 (11.50) 70% **LIMESTONE**
predominately medium to dark brownish gray, light to medium grayish brown in part, cryptocrystalline, silty & argillaceous, commonly cherty with medium brown spicular chert, chert lenses & beds, occasional dark shale partings, occasional drusy calcite lining fractures, no visible show

20% **CHERT**
medium to dark amber brown, opaque to semi opaque, spicular in part. silty & organic inclusions, hard, brittle, occasional calcite filled microfracture

10% **SHALE**
dark brownish gray to black, subblocky, calcareous, silty in part, slightly bituminous, no visible fluorescence, very slow faint cut

2,077.50 to 2,082.50 (5.00) 80% **SHALE**
dark grayish brown to black, subfissile to non fissile, very calcareous, silty in part, slightly bituminous, no visible fluorescence, small weak cut, pyritic

2,077.50 to 2,082.50 (5.00) 20% **LIMESTONE**
as above

2,082.50 to 2,090.00 (7.50) 60% **LIMESTONE**
off white to light tan, medium to dark grayish brown, cryptocrystalline, locally silty, argillaceous in part, rare shell fragments, locally cherty, dense, tight, rare calcite filled fracture

25% **SHALE**
dark grayish brown to black, subfissile, calcareous, silty in part, carbonaceous, trace pyrite

15% **CHERT**
as above

Hart River, B Sand: 2,094.00 MD, 2,093.94 TVD, -1,623.78 SSL

2,090.00 to 2,095.00 (5.00) 60% **LIMESTONE**
light to medium grayish brown, cryptocrystalline, silty & argillaceous in part, rare shell fragments, cherty, rare calcite cemented fracture, common fine to medium grained sand clasts, dense, tight, hard

20% **CHERT**
medium to dark grayish brown, opaque to semi opaque, silty inclusions, organic inclusions, rare silica cemented microfracture, hard, brittle

20% **SANDSTONE**
medium to dark gray, dark brown in part, quartz & common gray chert, predominately lower fine to lower medium grained, occasional upper medium clasts, moderate to poorly sorted, subrounded, primary silica cement, abundant secondary calcite cement occludes porosity completely, well indurated, tight, no visible show, trace pyrite

2,095.00 to 2,115.00 (20.00) 60% **LIMESTONE**
light to medium yellowish brown, grayish brown in part, cryptocrystalline, silty in part, dense, tight, cherty with interbedded massive chert

40% **CHERT**
medium to dark brown to grayish brown, silty, calcareous & organic icls, commonly slightly calcareous, bedded, massive, calcite lining open microfractures, very hard, brittle

2,115.00 to 2,120.00 (5.00) 45% **SHALE**
dark grayish brown, subfissile, moderately firm, moderately calcareous, somewhat fragile, slightly bituminous, no visible fluorescence, slow weak cut

35% **LIMESTONE**
light to medium grayish brown, locally dark grayish brown, cryptocrystalline, slightly argillaceous, silty in part, cherty, dense, tight, rare fracture

2,115.00 to 2,120.00 (5.00)	20%	**CHERT** medium to dark amber brown, semi opaque, silty & organic inclusions, thin beds
2,120.00 to 2,127.50 (7.50)	60%	**SHALE** dark gray to grayish brown, subfissile, calcareous, firm, silty in part, trace pyrite
	40%	**LIMESTONE** medium to dark brownish gray, cryptocrystalline, earthy, argillaceous, locally sandy, scattered fine to upper medium grained floating quartz or chert sand clasts, occasional thin fine bioclastic beds, interbedded calcareous shale, occasional poorly sorted sandstone stringer, tight, rare calcite cemented fracture
2,127.50 to 2,130.00 (2.50)	35%	**LIMESTONE** medium to dark grayish brown, cryptocrystalline, argillaceous, sandy in part, minute bioclastic matter common, cherty, dense, tight
	30%	**SANDSTONE** medium to dark gray, in part very fine to lower fine grained with a dark brownish gray argillaceous matrix, in part very fine to medium with trace lower coarse grained quartz & chert clasts with primary silica cement, & abundant secondary calcite cement occluding porosity, subrounded, poorly sorted, well indurated, tight
	30%	**SHALE** as above
	5%	**CHERT** medium to dark brown to grayish brown, banded with organic inclusions, replacement or thin irregular beds
2,130.00 to 2,132.50 (2.50)	80%	**SHALE** dark grayish brown to black, subfissile, moderately firm, slightly reactive in water, calcareous, slightly bituminous, no visible fluorescence, slow weak hazy cut
	10%	**SANDSTONE** light to medium gray to brownish gray, quartz & gray & brown chert in white calcite cement, lf to upper medium grained, subrounded, moderately sorted, well indurated, primary silica & abundant secondary calcite cement, tight
	5%	**CHERT** as above
	5%	**LIMESTONE** as above
2,132.50 to 2,142.50 (10.00)	55%	**LIMESTONE** medium to dark brown to grayish brown, argillaceous & silty in part, locally sandy with occasional sandstone stringers, locally bioclastic, occasional lower coarse to lower very coarse grained quartz & chert clasts, slightly bituminous, dense, tight, no visible fluorescence, slow streaming & hazy cut, dead oil

2,132.50 to 2,142.50 (10.00) 40% **SHALE**
dark grayish brown to black, subfissile, moderately firm, calcareous, bituminous in part, slow weak dead oil cut

5% **CHERT**
medium to dark brown, opaque to semi translucent, organic inclusions, calcareous inclusions, replacement

2,142.50 to 2,145.00 (2.50) 90% **SHALE**
very dark grayish brown to black, increasingly carbonaceous, bituminous in part, extremely calcite, subfissile to non fissile, trace pyrite, silty in part, occasional very fine grained sandy laminations, no visible fluorescence, slow blooming dead oil cut

10% **LIMESTONE**
as above

2,145.00 to 2,162.50 (17.50) 75% **LIMESTONE**
medium to dark gray to grayish brown, cryptocrystalline, argillaceous, silty in part, occasional sandy stringer, scattered brachiopods, occasional bioclastic thin bed, slightly bituminous, weak blooming cut, 2-3% scattered chert, dense, tight, rare calcite cemented microfracture

25% **SHALE**
dark grayish brown, subfissile to non fissile, calcareous, silty in part, slightly bituminous, weak blooming & streaming cut, small trace pyrite, rare calcite cemented fracture

2,162.50 to 2,170.00 (7.50) 70% **LIMESTONE**
light to dark grayish brown, cryptocrystalline, silty & argillaceous, occasional siltstone and sandstone stringers, sandstone stringers grade to very coarse grained & are poorly sorted with abundant dark gray chert & are tightly cemented with calcite, scattered brachiopods, occasional bioclastic beds, interbedded dark carbonaceous shale, locally cherty with 2-4% dark brown chert, slightly bituminous, slow blooming cut, rare calcite filled fracture

30% **SHALE**
dark grayish brown to black, subfissile, black shale is increasingly bituminous with greasy lustre & decreasingly calcareous, dark grayish brown shale is silty & poorly fissile & extremely calcareous as above, slow dead oil cut

Ford Lake: 2,170.30 MD, 2,170.24 TVD, -1,700.08 SSL

2,170.00 to 2,175.00 (5.00) 65% **SHALE**
dark grayish brown to black, subfissile, calcareous, bituminous, silty, very fine grained sandy in part, moderately firm & brittle, no visible fluorescence, bituminous in part, weak slow hazy cut, trace pyrite

35% **LIMESTONE**
light to dark grayish brown, cryptocrystalline, silty & argillaceous in part, bioclastic debris, rare brachiopod spine, 2-3% scattered brown chert, slightly bituminous, weak slow cut, dense, tight

2,175.00 to 2,180.00 70% **LIMESTONE**
(5.00) as above, scattered brachiopod fragments, slightly bituminous, no visible fluorescence, slow weak blooming cut, rare calcite filled fracture

30% **SHALE**
increasingly dark grayish brown to black, increasingly bituminous, silty to very fine grained sandy throughout, trace pyrite, subfissile, moderately firm, moderately brittle, calcareous

Ford Lake, Hot Shale: 2,182.50 MD, 2,182.44 TVD, -1,712.28 SSL

2,180.00 to 2,197.50 100% **SHALE**
(17.50) very dark brown to black, subfissile, silty in part, well compacted, moderately soft, moderately ductile, greasy, very slightly to non calcareous, bituminous, no visible fluorescence, slow hazy cut, trace pyrite

Ford Lake, Base Hot Shale: 2,204.00 MD, 2,203.94 TVD, -1,733.78 SSL

2,197.50 to 2,210.00 100% **SHALE**
(12.50) very dark gray to grayish brown, subfissile, moderately soft, rare wispy calcite veinlet, non calcareous with occasional limy argillaceous stringers, silty in part, siltstone to very fine grained argillaceous & calcareous sandstone stringers, pyritic, decreasing bituminous content, slow weak cut

Imperial: 2,228.00 MD, 2,227.94 TVD, -1,757.78 SSL

2,210.00 to 2,230.00 100% **SHALE**
(20.00) dark gray to dark brownish gray, subfissile, non calcareous, occasional silty stringers, carbonaceous in part, very slightly bituminous in part, slow faint cut.

2,230.00 to 2,250.00 100% **SHALE**
(20.00) dark gray to dark brownish gray, subfissile, non calcareous, occasional silty stringers, carbonaceous in part, rare limy stringers, pyritic,medium rare slickenside, occasional calcite filled fracture

2,250.00 to 2,270.00 100% **SHALE**
(20.00) medium brownish gray, locally dark gray, subfissile, non calcareous, small trace pyrite, carbonaceous in part, common carbonized plant remains, increasingly silty, silty & sandy laminae, occasional fine grained floating quartz grains, well compacted, firm, no visible fractures, minor high angle jointing

2,270.00 to 2,290.00 100% **SHALE**
(20.00) dark brownish gray, subfissile, non calcareous. locally silty, occasional siltstone and very fine grained quartzose sandstone laminations, micro laminae commonly hilighted with carbonaceous matter, scattered minor to common pyrite, weak jointing, well compacted, moderately firm, becoming soft when immersed in water

2,290.00 to 2,305.00 (15.00) 100% **SHALE**
dark gray to dark brownish gray, fissile to subfissile, non calcareous, carbonaceous, very fine carbonaceous micro laminae, silty & occasional sandy laminations, rare calcite filled micro veinlet, weak high angle jointing, moderately well compacted, moderately firm, does not swell but softens in water

Imperial, Tuttle: 2,309.20 MD, 2,309.14 TVD, -1,838.98 SSL

2,305.00 to 2,320.00 (15.00) 40% **SHALE**
medium to dark gray to brownish gray, fissile to subfissile, non calcareous, silty in part, carbonaceous, cavings in part, trace pyrite

30% **GRANULAR SANDSTONE**
medium grayish brown, off white, light brown & gray chert and occasional quartz granules & possible pebbles in a poorly sorted argillaceous, silty & sandy matrix with sand clasts to lower medium, subrounded, very poor sorting, tight, no visible show, interbedded argillaceous siltstone & silty shale, scattered massive pyrite

30% **SILTSTONE**
light to medium brown, quartzose, sandy, angular to subangular floating sand clasts to upper fine grained, trace minute carbonaceous matter, non calcareous

2,320.00 to 2,325.00 (5.00) 85% **SHALE**
dark grayish brown to dark gray, subfissile, silty in part, trace pyrite, non calcareous, floating fine to medium grained sand clasts, weak jointing

10% **Sandstone**
medium grayish brown, predominately very fine grained with floating fine grained clasts, silty argillaceous matrix, subrounded, poorly sorted, non calcareous, common minute carbonaceous matter throughout, moderate induration, tight, no visible show

5% **GRANULAR SANDSTONE**
as above, sandy and argillaceous matrix, tight, no visible show

2,325.00 to 2,340.00 (15.00) 95% **SHALE**
medium to dark grayish brown, subfissile, non to slightly calcareous, silty in part, occasional siltstone laminations, carbonaceous in part, trace scattered pyrite, occasional coarse grained poorly sorted sandstone partings, moderately soft, fragile

5% **SANDSTONE**
medium gray to brownish gray, medium to lower coarse grained gray & brown chert & quartz grains in medium brown silty argillaceous matrix, non calcareous, subrounded, poorly sorted, tight, thin beds & stringers

2,340.00 to 2,345.00 (5.00) 70% **SHALE**
dark gray to brownish gray, becoming very dark gray to black, increasingly carbonaceous, bituminous in part, subfissile, non calcareous

2,340.00 to 2,345.00 (5.00)	20%	**SANDSTONE** medium gray to brownish gray, upper coarse to upper very coarse grained rounded chert clasts in very fine grained silty & argillaceous matrix, non calcareous, predominately tight, contact gas show?, trace light brown hydrocarbon staining on occasional grain, weak cut, locally with abundant pyrite cement
	10%	**LIMESTONE** dark gray to grayish brown, cryptocrystalline, argillaceous, cherty, dense, tight
2,345.00 to 2,350.00 (5.00)	85%	**SHALE** very dark brownish gray to black, subfissile, earthy to slightly greasy lustre, non calcareous, bituminous, no visible fluorescence, slow hazy dead oil cut
	15%	**SANDSTONE** as above
2,350.00 to 2,360.00 (10.00)	90%	**SHALE** dark grayish brown to black, fissile to subfissile, non calcareous, bituminous in part, no visible fluorescence, slow hazy dead oil cut, moderately soft & fragile, occasional poorly sorted coarse grained sandstone stringers, rare dark argillaceous limestone stringers
	10%	**SANDSTONE** light to brownish medium gray, in part medium to coarse grained medium to dark gray rounded chert clasts in silty to very fine grained sandy matrix, in part subrounded to subangular and well sorted fine grained & quartzose with minor lithics, silica cement with trace to minor secondary calcite cement, well indurated, tight, no visible show
2,360.00 to 2,370.00 (10.00)	100%	**SHALE** dark gray to dark brownish gray, subfissile, non calcareous, carbonaceous in part, relatively soft, sheared in part, trace quartzose sandstone as above, trace pyrite, occasional pyritic silty laminations
2,370.00 to 2,375.00 (5.00)		**POOR SAMPLE** 50% SHALE: dark brownish gray to black, subfissile, non calcareous, carbonaceous, trace pyrite, soft, occasional slickenside; 35% LIMESTONE: dark grayish brown, yellowish brown, cryptocrystalline, argillaceous in part, dense, tight; CHERT: dark gray, black, brown; 15% CONTAMINATION: predominately G-Seal mud additive
2,375.00 to 2,380.00 (5.00)	100%	**SHALE** dark brownish gray to black in part, subfissile, non calcareous, trace pyrite, scattered pyrite nodule, soft, becoming very soft when immersed in water, jointed, occasional slickenside
2,380.00 to 2,385.00 (5.00)	85%	**SHALE** as above, rounded clasts, soft, occasional slickenside

2,380.00 to 2,385.00 (5.00)	15%	**SANDSTONE** off white, light to medium grayish brown, white & translucent quartz & common light lithics, lower fine to lower medium grained, minor upper medium grained, subrounded, moderate sorting, well indurated, silica cement, trace secondary calcite cement, tight
2,385.00 to 2,390.00 (5.00)	95%	**SHALE** dark brownish gray to black, subfissile, non calcareous, trace to minor scattered pyrite, soft rounded grains, becoming very soft in water, occasional slickenside, silty stringers, occasional thin hard sandstone stringer
	5%	**SANDSTONE** medium gray, very fine to upper medium grained, occasional floating coarse to very coarse grained clasts, subrounded, poorly sorted, silica cement, trace to calcite cement, well indurated, tight
2,390.00 to 2,400.00 (10.00)	70%	**SILTY SHALE** medium to dark gray, subfissile to non fissile, silty throughout, non calcareous, trace pyrite, soft, rounded shale grains, common carbonaceous plant remains
	30%	**SILTSTONE** medium to dark gray, relatively soft & fragile, rounded grains, non calcareous, argillaceous matrix, grading to silty shale, common carbonaceous plant remains, trace pyrite
2,400.00 to 2,415.00 (15.00)	100%	**SHALE** very dark brownish gray , increasingly black, subfissile, non calcareous, trace to minor pyrite, common slickenside, occasional sandy stringer, soft, fragile, becoming increasingly soft in water
2,415.00 to 2,425.00 (10.00)	100%	**SHALE** as above, scattered minor pyrite, occasional pyritic laminae, occasional silty stringer
2,425.00 to 2,430.00 (5.00)	50%	**SHALE** dark gray to black, subfissile, non calcareous, carbonaceous, common slickenside, soft
	35%	**SILTY SHALE** medium to dark gray, subfissile to non fissile, non calcareous, silty throughout, very fine grained sandy in part, carbonaceous
	15%	**SANDSTONE** medium gray, very fine to upper fine grained, trace medium grained, silty & argillaceous matrix, subrounded, poorly sorted, silica + trace secondary calcite cement, patchy pyrite cement, moderate to well indurated, common carbonaceous matter throughout, tight
2,430.00 to 2,440.00 (10.00)	100%	**SHALE** dark brownish gray to black in part, subfissile, non calcareous, trace to minor scattered pyrite, carbonaceous, well compacted, relatively soft, becoming very soft & fragile in water, moderate shear, occasional slickensided grain

2,440.00 to 2,455.00 (15.00)	100%	**SHALE** increasingly dark brownish gray to black in part, subfissile, non calcareous, carbonaceous, occasional silty laminae, abundant sheared grains, possible shear or fault zone (2448-2451m?), weak microfracture, soft, fragile
2,455.00 to 2,470.00 (15.00)	95%	**SHALE** dark brownish gray to black in part, fissile to subfissile, non calcareous, carbonaceous in part, occasional silty stringers, common sheared grains
	5%	**SILTSTONE** medium brownish gray, sandy in part, grading to very fine grained silty & argillaceous sandstone, non calcareous, pyritic, carbonaceous in part, moderate induration
2,470.00 to 2,485.00 (15.00)	100%	**SHALE** very dark brownish gray to black in part, sbis, locally fissile, occasional silty laminae, carbonaceous, pyritic laminae, trace to minor scattered pyrite, moderate compaction, soft, becoming very soft & fragile in water, common slickenside and/or sheared grain
2,485.00 to 2,500.00 (15.00)	100%	**SHALE** dark brownish gray, grading to black, subfissile to fissile, non calcareous, carbonaceous, common slickenside ~parallel to bedding, moderate shear, trace scattered pyrite, occasional pyritic silty laminations
2,500.00 to 2,515.00 (15.00)	100%	**SHALE** dark brownish gray to black, subfissile, non calcareous, carbonaceous, occasional pyritic laminae, trace disseminated pyrite, rare pyrite nodules, occasional silty to very fine grained sandy laminations, occasional to common sheared grains, soft, relatively fragile
2,515.00 to 2,520.00 (5.00)	100%	**SHALE** dark gray, dark gray brown, soft to firm, subfissile, micromicaceous, greasy, as clay shale, slightly pyrite, rare very fine pyrite laminae, commonly sheared & with abundant slickensides, post-trip sample, non calcareous.
2,520.00 to 2,525.00 (5.00)	100%	**SHALE** dark brown, grading to black, dark brown gray, subblocky to blocky, commonly firm, brittle, micromicaceous, occasionally greasy or dull, pyritic, occasional pyrite laminations, non calcareous, occasional slickenside surfaces.
2,525.00 to 2,530.00 (5.00)	100%	**SHALE** dark gray, grading to black, dark brown, dark brown gray, platy to blocky, commonly hard, sub to non fissile, greasy, dull, micromicaceous, slightly pyritic, predominately as clay shale, rare silt or sand grains, rare fragments becoming soft in water, occasional slickenside surfaces.
2,530.00 to 2,535.00 (5.00)	100%	**SHALE** dark gray, grading to black, dark brown, dark brown gray, platy to blocky, commonly hard, sub to non fissile, greasy, dull, micromicaceous, slightly pyritic, predominately as clay shale, occasional silty or sandy fragments, rare fragments becoming soft or splitting in water, occasional slickenside surfaces.

2,535.00 to 2,540.00 100% (5.00) **SHALE**
dark gray, dark brown, dark brown gray, grading to black, platy to blocky, commonly hard, sub to non fissile, greasy, dull, micromicaceous, slightly pyritic, predominately as clay shale, occasional silty & sandy fragments, 30% of fragments medium brown gray, soft, splitting in water, occasional slickenside surfaces.

2,540.00 to 2,545.00 100% (5.00) **SHALE**
dark gray, dark brown, dark brown gray, grading to black, platy to blocky, commonly hard, sub to non fissile, rare soft fragments, greasy, dull, micromicaceous, slightly pyritic, predominately as clay shale, occasional silty & sandy fragments, occasional fragments becoming soft or cracking in water, occasional slickenside surfaces.

2,545.00 to 2,550.00 100% (5.00) **SHALE**
dark gray, dark brown, dark brown gray, grading to black, 25% light to medium brown gray, platy to blocky, commonly hard, sub to non fissile, occasional soft fragments, greasy, dull, micromicaceous, slightly pyritic, predominately as clay shale, occasional silty & sandy fragments, bituminous, occasional fragments becoming soft or cracking in water, occasional slickenside surfaces.

2,550.00 to 2,555.00 100% (5.00) **SHALE**
dark gray, dark gray brown, dark brown, 35% medium brown gray, sub platy to subblocky, occasionally blocky, soft to hard, fissile to brittle, micromicaceous, dull, occasionally greasy, occasional slickenside surfaces, pyritic, occasional fragments cracking in water, predominately as clay shale, bituminous, <10% of fragments silty or sandy & grading in part to very argillaceous, locally carbonaceous, tight, silty very fine lower grained sandstone & sandy argillaceous, tight siltstone.

2,555.00 to 2,560.00 100% (5.00) **SHALE**
medium to dark gray, dark gray brown, dark brown, sub platy to subblocky, soft to hard, subfissile to occasionally brittle, micromicaceous, dull, occasionally greasy, occasional slickenside surfaces, pyritic, occasional fragments cracking in water, predominately as clay shale, occasionally slightly silty or sandy, non calcareous.

2,560.00 to 2,565.00 100% (5.00) **SHALE**
dark brown, dark brown gray, 20% of fragments medium gray brown, sub platy to commonly subblocky, soft to firm, subfissile to brittle, occasional pyrite laminae, predominately as clay shale, occasionally slightly silty or sandy, occasional fragments crack or soften in water, scattered slickensides.

2,565.00 to 2,570.00 100% (5.00) **SHALE**
dark brown, dark brown gray, medium to dark gray, sub platy to subblocky, soft to occasionally firm, fissile to subfissile, occasionally brittle, slightly pyritic, predominately as clay shale, occasional slightly silty or sandy fragments, fragments occasionally crack or soften in water, scattered slickensides.

2,570.00 to 2,575.00 100% (5.00) **SHALE**
dark brown, medium to dark brown gray, sub platy to subblocky, soft to firm, subfissile to fissile, occasionally brittle, trace disseminated & massive pyrite, predominately as clay shale, occasionally slightly silty or sandy fragments or rare sandy white argillaceous siltstone laminae, occasional fragments crack or soften in water, scattered slickensides.

2,575.00 to 2,580.00 100% (5.00) **SHALE**
dark brown, medium to dark brown gray, platy to blocky, soft to occasionally firm, subfissile to occasionally fissile, brittle, occasional disseminated very fine pyrite, pyrite laminae, pyrite nodules or botryoidal pyrite, predominately as clay shale, occasional slightly silty or sandy fragments, occasional fragments crack or soften in water, occasional slickensided surfaces.

2,580.00 to 2,585.00 100% (5.00) **SHALE**
dark brown, medium to dark brown gray, sub platy to sub blocky, soft to commonly firm, subfissile to commonly brittle, trace disseminated or massive pyrite, predominately as clay shale, occasional slightly silty or sandy fragments, occasional fragments crack or soften in water, occasional slickensided surfaces.

2,585.00 to 2,590.00 100% (5.00) **SHALE**
dark brown, medium to dark brown gray, sub platy to sub blocky, soft to commonly firm, sub fissile to commonly brittle, micromicaceous, dull, greasy, trace disseminated or massive pyrite, rare very fine pyrite laminae, predominately as clay shale, rare slightly silty or sandy fragments, occasional fragments crack or soften in water, scattered slickensided surfaces.

2,590.00 to 2,595.00 100% (5.00) **SHALE**
dark brown, dark brown gray, sub platy to blocky, soft to occasionally firm, sub fissile to fissile, occasionally brittle, micromicaceous, dull, waxy, trace disseminated or massive pyrite, rare very fine pyrite laminae, predominately as clay shale, rare slightly silty or sandy fragments, occasional fragments crack or soften in water, scattered slickensided surfaces.

2,595.00 to 2,600.00 100% (5.00) **SHALE**
dark gray, dark gray brown, platy to blocky, waxy, micromicaceous, dull, micromicaceous, soft to occasionally hard, fissile to occasionally brittle, pyritic, as clay shale, commonly cracking or becoming soft in water, slightly bituminous, non calcareous,

2,600.00 to 2,605.00 100% (5.00) **SHALE**
dark gray, dark gray brown, platy to blocky, waxy, micromicaceous, dull micromicaceous, soft to occasionally hard, siliceous in part?, fissile to occasionally brittle, pyritic, as clay shale, commonly cracking or becoming soft in water, slightly bituminous, non calcareous, occasional slickensided surfaces, trace dark brown chert fragments.

2,605.00 to 2,610.00 100% (5.00) **SHALE**
medium to dark gray, dark gray brown or dark brown, sub platy to blocky, micromicaceous, dull, occasionally waxy, commonly soft, subfissile to fissile, locally hard & brittle, siliceous?, predominately as clay shale, occasionally slightly silty & sandy, rare pyrite & slickesided surfaces.

2,610.00 to 2,615.00 100% (5.00) **SHALE**
medium to dark gray, dark brown gray, sub platy to subblocky, micromicaceous, dull, locally waxy, as clay shale, rare pyrite, commonly soft & sub fissile to fissile, commonly cracking in water, slightly carbonaceous, occasional slickenslide surfaces, rare siliceous druse lined fractures.

2,615.00 to 2,620.00 100% (5.00) **SHALE**
medium to dark gray, dark brown gray, sub platy to subblocky, micromicaceous, dull, locally waxy, soft to occasionally hard, commonly subfissile to fissile, as clay shale, locally slightly silty or sandy, rare pyrite, commonly cracking in water, slightly carbonaceous, rare slickenside surfaces, rare dark brown, cryptocrystalline to microcrystalline, locally fractured argillaceous, occasionally silty or sandy chert fragments.

2,620.00 to 2,625.00 100% (5.00) **SHALE**
medium to dark gray, dark brown, dark brown gray, platy to blocky, predominately soft, sub fissile to fissile, occasional hard & brittle fragments, micromicaceous, dull, occasionally waxy, predominately as clay shale, rare disseminated or massive pyrite, rare very fine pyrite laminae, rare silty or sandy fragments, occasional slickenside surfaces, trace medium to dark brown, cherty, argillaceous, siltstone to very fine lower ged sandstone fragments.

2,625.00 to 2,630.00 100% (5.00) **SHALE**
medium to dark gray, sub platy to blocky, micromicaceous, dull, commonly soft, subfissile to fissile, with occasional cracks when placed in water, slightly pyritic, as clay shale, 40% medium to dark brown, firm, brittle, with occasional slickensides, locally siliceous or cherty, rare medium brown argillaceous, commonly pyritic, locally silty or sandy chert fragments with euhedral silica quartz druse fracture linings.

2,630.00 to 2,635.00 100% (5.00) **SHALE**
medium to dark gray, sub platy to blocky, micromicaceous, dull, commonly soft, subfissile to fissile, with occasional cracks when placed in water, slightly pyritic, as clay shale, 20% medium to dark brown, firm, brittle, with occasional slickensides, rare pyrite laminae, rare medium to dark brown, rare black, argillaceous, commonly pyritic, locally silty or sandy, tight chert fragments.

2,635.00 to 2,640.00 100% (5.00) **SHALE**
medium to dark gray, sub platy to blocky, micromicaceous, dull, commonly soft, subfissile to fissile, with occasional cracks when placed in water, slightly pyritic, as clay shale, 35% medium to dark brown, firm, brittle, with occasional slickensides, rare medium to dark brown, cryptocrystalline to microcrystalline, argillaceous, silty in part, commonly pyritic, chert fragments with rare euhedral silica druse.

2,640.00 to 2,645.00 100% (5.00) **SHALE**
medium to dark gray, sub platy to blocky, micromicaceous, dull, commonly soft, subfissile to fissile, rare hard & non fissile fragments, with occasional cracks when placed in water, slightly pyritic, as clay shale, 15% medium to dark brown, firm, brittle, with rare slickensides, trace medium to dark brown, cryptocrystalline to microcrystalline, argillaceous, silty in part, tight chert fragments.

2,645.00 to 2,650.00 (5.00)	100%	**SHALE** medium to dark gray, sub platy to blocky, micromicaceous, dull, commonly soft, subfissile to fissile, rare hard & non fissile fragments, with fewer cracks when placed in water than above, slightly pyritic, as clay shale, ~15% medium to dark brown, firm, brittle, with rare slickensides, trace medium to dark brown, cryptocrystalline to microcrystalline, argillaceous, silty in part, tight chert fragments.
2,650.00 to 2,665.00 (15.00)	95%	**SHALE** very dark gray to brownish gray, subfissile, non calcareous, soft, fragile, delaminates in water, minor scattered pyrite, carbonaceous in part, occasional silty stringer, common slickenside
	5%	**CONTAMINATION** predominately CaCO3 mud additive, trace oil well cement
2,665.00 to 2,680.00 (15.00)	90%	**SHALE** very dark gray, dark grayish brown in part, subfissile, non calcareous, silty stringers, trace finely disseminated pyrite, occasional pyrite laminations, scattered small pyrite nodules, occasional slickenside, high angle jointing, moderately soft, fragile, carbonaceous in part
	10%	**SILTSTONE** light to medium gray, yellowish brown in part, argillaceous, commonly quartzose, common minute carbonized plant matter throughout, rare slickenside, occasional high angle joint, siliceous, trace calcite, hard, brittle, thin stringers
2,680.00 to 2,700.00 (20.00)	90%	**SHALE** dark gray, dark brownish gray in part, subfissile, non calcareous, moderately soft, fragile, delaminates and breaks apart in water, occasional silty stringer, trace pyrite, carbonaceous in part, occasional sheared grain, occasional high angle joint
	10%	**CONTAMINATION** predominately CaCO3 mud additive, trace cement
2,700.00 to 2,715.00 (15.00)	100%	**SHALE** very dark gray to black, dark grayish brown in part, subfissile, non calcareous, increasingly pyritic, common to abundant very finely disseminated pyrite throughout, pyritic laminae, increasingly carbonaceous, moderately soft, fragile, as above, decreasing sheared grains, occasional high angle joint, occasional siltstone laminations
2,715.00 to 2,730.00 (15.00)	100%	**SHALE** dark grayish brown, black, subfissile, non to very slightly calcareous, carbonaceous, common finely disseminated pyrite throughout, soft, fragile, occasional sheared grain, occasional silty laminae

2,730.00 to 2,745.00 100% (15.00)	**SHALE** predominately dark gray to black, subfissile, non to very slightly calcareous, carbonaceous, occasional slickenside, 20-30% interbedded & interlaminated medium brownish gray, subfissile, silty micromicaceous shale, common minute black carbonized plant rmns, trace to minor pyrite, occasional pyritic laminae
2,745.00 to 2,760.00 100% (15.00)	**SHALE** predominately medium brownish gray, subfissile, silty, pyritic, non to very slightly calcareous, firm, moderately hard & brittle, carbonaceous in part, 20-30% interlaminated & interbedded dark brownish gray to black, subfissile, non to very slightly calcareous soft carbonaceous shale, also with trace to minor pyrite, occasional slickenside, occasional siltstone laminations
2,760.00 to 2,770.00 100% (10.00)	**SHALE** medium brownish gray, 10-15% dark gray to black as above, subfissile, silty, pyritic, minor to common finely disseminated pyrite throughout, micromicaceous in part, non to very slightly calcareous, rock chips are stable in oil and water, but break down immediately in acid, common minute black carbonized matter throughout, silty stringers, occasional high angle joint
2,770.00 to 2,885.00 100% (115.00)	**SHALE** predominately medium gray to medium brownish gray, subfissile, non calcareous, minor to common finely disseminated pyrite throughout, moderately firm, brittle, trace carbonaceous matter, minor interbedded dark brownish gray to black carbonaceous shale, no apparent shear, occasional high angle joint
2,785.00 to 2,800.00 100% (15.00)	**SHALE** medium brownish gray silty pyritic shale with minor intbdd dark gray to black carbonaceous shale as above, common finely disseminated pyrite throughout, moderately firm, occasional high angle joint, trace calcareous matter
2,800.00 to 2,820.00 100% (20.00)	**SHALE** subequal medium grayish brown & interbedded dark brown to black, occasional light gray silty laminae, subfissile to subblocky, non calcareous, minor finely disseminated pyrite, decreasing silt content, increasingly carbonaceous, moderately firm, brittle, occasional high angle joint
2,820.00 to 2,840.00 100% (20.00)	**SHALE** subequal medium & interbedded dark grayish brown to brownish gray, subfissile, non calcareous, micromicaceous in part, medium gray shale is silty & moderately firm, dark shale is softer & carbonaceous, trace to minor finely disseminated pyrite, no shear evident, occasional high angle joint, silty laminae
2,840.00 to 2,850.00 100% (10.00)	**SHALE** predominately dark brownish gray to grayish brown, minor medium brownish gray, subfissile, decreasingly silty, silty micro laminae, non calcareous, increasingly carbonaceous, moderately soft, fragile, trace pyrite, rare calcite filled microfracture

2,850.00 to 2,855.00 (5.00)	85%	**SHALE** dark gray to dark brownish gray, subfissile, non calcareous, carbonaceous, moderately soft, fragile, becoming very fragile in water, trace to locally minor pyrite, occasional silty laminae
	15%	**CONTAMINATION** mud additives: predominately G-Seal well trace CaCO3 & walnut shell debris
2,855.00 to 2,865.00 (10.00)	100%	**SHALE** dark brownish gray, subfissile to sbbly, non to very slightly calcareous, moderately firm, silty in part, trace finely disseminated pyrite, micromicaceous in part, occasional silty laminae, carbonaceous, occasional jointing
2,865.00 to 2,890.00 (25.00)	100%	**SHALE** dark brownish gray with 20-30% interbedded medium gray, subfissile, non calcareous, minor disseminated pyrite, carbonaceous in part, silty in part, moderately firm, brittle, very finely micro laminated, weak jointing, no visible shear
2,890.00 to 2,895.00 (5.00)	100%	**SILTY SHALE** light to medium brownish gray, subfissile, silty throughout, very fine quartzose silt, non calcareous, trace to locally minor disseminated pyrite, moderately soft, fragile, becoming very soft in water, weak jointing
2,895.00 to 2,920.00 (25.00)	100%	**SHALE** interbedded & interlaminated light to medium brownish gray silty shale, & medium to dark brownish gray carbonaceous shale, subfissile, non calcareous, trace to minor finely disseminated pyrite, micromicaceous in part, moderately firm, moderately brittle, fragile, softens in water, weak jointing, no shear
2,920.00 to 2,945.00 (25.00)	100%	**SHALE** 30-35% medium brownish gray silty shale with 65-70% interbedded & interlaminated very dark grayish brown carbonaceous shale, subfissile to subblocky, non to very slightly calcareous in part, minor to locally common disseminated pyrite, occasional silty pyritic laminations, moderately soft, moderately fragile, no visible shear, occasional high angle joint
2,945.00 to 2,960.00 (15.00)	100%	**SHALE** predominately light to medium brownish gray, subfissile to subblocky, silty in part, minor very finely disseminated pyrite, rare pyrite micro spherules (pyritized pellets?), well compacted, moderately brittle, 20-25% interbedded & interlaminated dark carbonaceous shale, trace to minor disseminated pyrite, moderately soft, becoming very soft and fragile in water, occasional moderately hard silty laminations
2,960.00 to 2,975.00 (15.00)	100%	**SHALE** predominately medium brownish gray, ~30-35% dark grayish brown, subfissile, non calcareous, decreasing silt content, rare silty laminae, minor finely disseminated pyrite, rare pyritized pellets (spherules) as above, carbonaceous in part, moderately soft & fragile, becoming very soft in water, silty laminae are moderately hard & brittle

2,975.00 to 2,990.00 100% **SHALE**
(15.00) predominately light to medium brownish gray low total organic carbon shale, 10-15% dark grayish brown carbonaceous shale, non calcareous, locally silty, trace finely disseminated pyrite, micromicaceous in part, moderately soft, fragile as above, no visible shear, occasional high angle joint

2,990.00 to 3,000.00 100% **SHALE**
(10.00) predominately medium brownish gray, 20-25% dark brownish gray, subfissile, non calcareous, moderate to low total organic carbon, trace to minor disseminated pyrite, micromicaceous in part, silty in part, occasional siltstone stringers, well compacted, moderately soft, fragile

3,000.00 to 3,005.00 90% **SHALE**
(5.00) light to medium gray to brownish gray with low total organic carbon, ~10% dark brownish gray & carbonaceous in part, subfissile, non calcareous, trace pyrite, silty laminations, moderately soft & fragile as above

10% **SILTSTONE**
light to medium gray, slightly calcareous, sandy in part, locally grading to very fine grained sandstone, minor to common black minute carbonized plant matter throughout, thin beds, trace pyrite, micromicaceous in part

3,005.00 to 3,020.00 80% **SHALE**
(15.00) predominately medium gray, locally dark grayish brown with increasing total organic carbon content, subfissile, non calcareous, trace disseminated pyrite, locally silty, micromicaceous in part, moderately soft & fragile

10% **SILTSTONE**
medium gray, sandy in part, very slightly calcareous, trace carbonaceous matter, trace pyrite

10% **SANDSTONE**
light to medium gray, very fine grained, silty & argillaceous in part, 3-5% lower fine grained clasts, subrounded to subangular, poorly sorted, very slightly calcareous, clay matrix, trace pyrite, trace mica, moderate induration, moderately brittle, tight, trace to minor carbonaceous matter

Total Depth: 3,024.80 MD, 3,024.62 TVD, -2,554.46 SSL

3,020.00 to 3,025.00 40% **SANDSTONE**
(5.00) light to medium gray, very fine grained, silty & argillaceous matrix, occasional stringer grading to lower fine grained, subrounded to subangular, moderate induration, friable to brittle in part, slightly calcareous, trace carbonaceous matter, trace mica, tight, silty and shaly laminations

30% **SHALE**
medium gray, subfissile, non calcareous, silty in part, interlaminated very fine grained sandstone, and sandy siltstone, low total organic carbon, trace pyrite, trace mica, moderately soft, fragile as above

20% **SILTSTONE**
as above

3,020.00 to 3,025.00 10% (5.00)	**CONTAMINATION** predominately G-Stop

Sidewall Cores

Storage Units: Metric

Date		**Service Company**	Schlumberger
Run No.	1	**Tool Type**	Mechanical
Top Depth	1,534.20	**Cores Requested**	50
Base Depth	2,351.50	**Cores Obtained**	50
Geologist	H. Gluth	**Cores Lost**	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
1	2,351.70	**SHALE**
100	2,349.93	medium to dark brown gray, as clay shale, pyritic, micromicaceous, slightly silty & sandy, soft to hard, fissile to brittle, non calcareous, carbonaceous, bituminous, very slow weak poor milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
2	2,351.60	**SHALE**
100	2,349.83	medium to dark brown gray, as clay shale, pyritic, micromicaceous, slightly silty & sandy, soft to hard, fissile to brittle, non calcareous, carbonaceous, bituminous, very slow weak poor milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
4	2,351.40	**SHALE**
100	2,349.63	medium to dark brown gray, as clay shale, pyritic, micromicaceous, trace silt & sand grains, soft to hard, fissile to brittle, non calcareous, core with partings orientated at an inclination of approximately 30 degrees, bituminous, very slow weak milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
5	2,316.00	**Granular SANDSTONE**
100	2,314.23	medium grayish brown, off white, light brown, gray chert and occasional quartz granules in a poorly sorted argillaceous, silty & medium grained, sandy matrix, angular to subrounded, very poorly sorting, both matrix & clast supported conglomeratic sandstone, spotty calcareous cement, tight, no visible show, interbedded argillaceous siltstone & silty shale, scattered massive pyrite.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
6	2,216.70	**SHALE**
100	2,214.93	medium to dark gray brown, commonly with elongated or stretched pyrite crystals & in part sheared, commonly very finely interlaminated with discontinuous ribbon like quartzose siltstone & sandstone laminae, slightly carbonaceous or bituminous, non calcareous, slow poor faint cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
7	2,216.60	**SHALE**
100	2,214.83	dark brown, sub fissile,commonly with floating fine quartz grains or silty, pyritic, non calcareous, occasional carbonaceous flakes, sub fissile to firm & brittle, core commonly with very fine silty to fine grained, tight, calcareous, quartzose, silty very fine grained, wavy sandstone laminae, weak slow poor yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
9	2,216.40	**SHALE**
100	2,214.63	dark brown, hard, calcareous, pyritic, slightly silty & sandy, bedded with brachiopod, locally cherty, sandy, very pyritic, marly tight shale, bituminous, slow yellow green poor blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
10	2,207.70	**SHALE**
100	2,205.93	dark brown, as clay shale, slightly pyrc, core is massive, spotty calcareous cement, soft to hard & sub fissile to brittle, carbonaceous, bituminous, with weak, slow, poor yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
11	2,207.60	**SHALE**
100	2,205.83	medium to dark gray brown, slightly pyritic, predominately as clay shale, locally silty & sandy, with light gray, calcareous, very fine gently inclined silty to very fine grained tight, sandstone laminae, trace calcareous cement, slow poor faint yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
13	2,207.40	**SHALE**
100	2,205.63	medium to dark gray brown, slightly pyritic, predominately as clay shale, locally silty & sandy, with light gray, calcareous, very fine gently inclined silty to very fine grained tight, sandstone laminae, trace calcareous cement, slow poor faint yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
14	2,200.10	**SHALE**
100	2,198.33	dark brown, dark brown gray, commonly soft, sub fissile to brittle, micromicaceous to greasy, commonly with disseminated very fine or occasionally needle like pyrite crystals, rare silty & sand grains, bioturbated, powdered sample with rapid, moderate yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

16	2,199.90	**SHALE**
100	2,198.13	dark gray brown, dark brown, sub fissile, soft to commonly hard or firm, brittle in part, pyritic, greasy, occasionally slightly silty & sandy,core predominately massive, rare sand filled trace fossils, bituminous, powdered fragments with rapid yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
17	2,192.70	**SHALE**
100	2,190.93	dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, non calcareous, core easily scratched, greasy, pyritic, carbonaceous, commonly with floating angular to subrounded, predominately fine lower quartz grains, in part bioturbated, bituminous, moderate milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
18	2,192.60	**SHALE**
100	2,190.83	dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, non calcareous, core easily scratched, greasy, pyritic, carbonaceous,commonly with floating angular to subrounded, predominately fine lower quartz grains, bituminous, moderate milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
20	2,192.40	**SHALE**
100	2,190.63	dark brown, black, massive, sub fissile, soft, fissile to firm & brittle, greasy, pyritic, carbonaceous, bioturbated with rare pyrite tubes or sand filled trace fossils, bituminous, moderate milky yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
21	2,184.60	**SHALE**
100	2,182.83	dark brown, medium hard, sub fissile, non calcareous, commonly with floating very fine quartz grains, commonly pyritic (botryoidal & accicular), with questionable rare phosphate pellets, bituminous with very slow yellow green, poor in part blue blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
23	2,184.40	**SHALE**
100	2,182.63	dark brown, as clay shale, medium hard, fissile in part, commonly with accicular or needle shaped randomly orientated very fine pyrite crystals, predominately non calcareous, slightly bituminous with very slow, weak yellow green, blue blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

24	2,152.10	**SHALE**
100	2,150.33	dark brown, hard, sub fissile, calcareous, commonly silty & or very fine lower quartz grains, grading to very argillaceous, medium brown, sandy siltstone, slightly pyritic, tight, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
26	2,151.90	**SHALE**
100	2,150.13	dark brown, hard, sub fissile, calcareous, commonly silty & or very fine lower quartz grains, grading to very argillaceous, medium brown, sandy siltstone, slightly pyritic, tight, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
27	2,145.20	**SHALE**
100	2,143.43	dark brown, massive, commonly slightly silty, sandy, slightly pyritic, micromicaceous, hard, calcareous, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
28	2,145.10	**SHALE**
100	2,143.33	dark brown, massive, as clay shale, micromicaceous, with disseminated fine pyrite, rare silt & sand grains, calcareous, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
30	2,144.90	**SHALE**
100	2,143.13	dark brown, calcareous, as clay shale, silt & sand grains, sub fissile, slightly pyritic or micromicaceous, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
31	2,084.70	**SHALE**
100	2,082.93	dark brown, sub fissile. calcareous, with scattered brachiopod fragments, predominately as clay shale, rare silt & sand grains, rare pyrite, very weak, very slow & poor yellow blooming cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
32	2,084.60	**SHALE**
40	2,082.83	medium to dark brown, sub fissile, calcareous, slightly pyritic, rare silt & sand grains, commonly with scattered brachiopod shells, very weak, vk slow yellow green blooming cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**

34	2,084.40	**SHALE**
100	2,082.63	dark brown, calcareous, slightly fissile, hard, slightly silty & sandy, rare pyrite, predominately as clay shale, very weak, slow yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
36	2,081.60	**SHALE**
100	2,079.83	dark brown, calcareous, slightly fissile, occasional silt and sand grains, rare pyrite, predominately as clay shale, rare calcite filled fractures at 60 degrees to vertical, very weak, very slow (10 minutes) yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
38	2,081.40	**SHALE**
100	2,079.63	dark brown, calcareous, slightly fissile, hard, predominately as clay shale, bioturbated with silt & sand filled trace fossils, very weak, slow (10 minutes) yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
39	2,081.30	**SHALE**
100	2,079.53	dark brown, calcareous, slightly fissile, hard, rare silt and sand grains, predominately as clay shale, very slow, weak, yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
40	1,882.70	**SHALE**
100	1,880.93	dark brown, calcareous, slightly fissile, hard, slightly silty & sandy, rare pyrite, predominately as clay shale, very slow, weak, yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
41	1,824.00	**SHALE**
100	1,822.47	dark brown to black, sub platy, very calcareous & very firm, slightly silty & sandy, micromicaceous, non fissile, slow weak yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
42	1,690.90	**SHALE**
100	1,689.37	dark brown, firm, sub fissile, calcareous, slightly pyritic, commonly silty or sandy, no cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description

43	1,671.50	**SANDSTONE**
100	1,669.97	light to medium grayish brown, salt and pepper, fine to lower medium, occasionally upper medium grained, commonly with gray, white or brown chert grains, poor to moderately sorted, siliceous, calcareous, slightly pyritic, locally with light brown or off white argillaceous matrix, commonly with 1-12 % pyrobitumen plugged intergranular porosity, diagenetically altered & grains crush to a fine powder, feldspathic?, rare poor visible intergranular porosity, rapid milky yellow green blooming cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
44	1,663.50	**SANDSTONE**
100	1,661.97	white with thick laminations of very light tan or yellowish white argillaceous sandstone, very fine grained, silty, subrounded, well to moderate sorted, calcareous, siliceous, dissolved grains leave a framework of quartz & minor gray chert with minor interstitial pyrobitumen cement & reveal a white argillaceous matrix (kaolin?), spotty dull fluorescence, trace cut, no show, kaolin matrix porosity?

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
45	1,655.00	**SHALE**
100	1,653.47	medium to dark brown, calcareous, siliceous, firm, commonly silty & sandy, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
46	1,634.20	**SHALE**
100	1,633.40	medium to dark brown, firm, slightly silty & sandy, calcareous, no visible fractures, no cut fluorescence.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
47	1,609.00	**SANDSTONE**
100	1,607.47	light grayish brown, salt and pepper with gray, gray brown & white chert grains, grains commonly crush to a fine powder, diagenetically altered, white chert in part as siliceous clasts (of kaolin?), predominately upper very fine to lower medium grained, subrounded, moderately sorted, siliceous, calcareous, trace to minor black pyrobitumen cement, occasional silica overgrowths, 6-9% bitumen plugged intergranular porosity, yellow fluorescence throughout, moderate yellow green blooming cut, no visible intergranular porosity.

Core No.	**Depth (MD)**	**Rock Type**
% Recovery	**Depth (TVD)**	**Description**
48	1,607.00	**SHALE**
100	1,605.47	dark brown, dark brown gray, calcareous, firm, commonly with scattered crinoid ossicles & occasional brachiopod fragments, slightly silty & sandy, pyritic, powdered sample with moderate yellow green blooming cut fluorescence.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
49	1,571.80	**SANDSTONE**
100	1,570.27	gray, salt and pepper with scattered white, medium brown, or gray, rare black or green chert grains, angular to subrounded, fine to medium grained, rare floating very coarse lower chert grains, poor to moderately sorted, calcareous, siliceous, minor pyrite cement, grains in part crush to a fine powder and diageneticaly altered, locally kaolinitic, rare patchy clay matrix, spotty amber hydrocarbon staining with moderate, rapid yellow green blooming cut fluorescence, very little visible intergranular in core, rare black bitumen, matrix porosity?

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
50	1,561.00	**SHALE**
100	1,559.47	medium to predominately dark brown, massive core of shale, rare brachiopod shell fragments, commonly firm & sub fissile or brittle, calcareous, powdered fragments with moderate, rapid yellow green blooming cut fluorescence, slightly pyritic, silty & sandy.

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
51	1,534.20	**CONGLOMERATE**
100	1,532.67	The core is represented by a single off white, light gray quartz arenite boulder and minor conglomeratic sandstone matrix as follows: predominately salt and pepper with gray chert, minor white & brown fine upper to very coarse upper chert grains pebbles, granules & minor quartz grains, siliceous, poorly sorted, with abundant 1-12% black pyrobitumen filled intergranular porosity, slightly pyritic, petroliferous odor, slow weak yellow green blooming cut fluorescence in powdered sample.