

Geological Report

on

NCY McParlon A-25 300/ A25 66-10 137-15/0

**Well Reached Total Depth on
Sep 19, 2012 @ 22:15**

for

NORTHERN CROSS (YUKON) LIMITED

Well License # : 1130

Prepared For: D.Stachiw, B.McDowell, P.Moignard
NORTHERN CROSS (YUKON) LTD

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NCY McParlon A-25 is a wildcat 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. 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 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. Twin Otters landed on the Dempster highway, opposite the approach to the projects main camp site.

The McParlon A-25 well was spudded July 2nd, 2012, and was drilled to a depth of 3132mMD, reached 80 days later on September 19th, 2012. After reaching 3132mMD the bit was pulled after 80.5 hours rotating, and it was decided to run open-hole logs. On the first attempt to log this section of the hole, tools bridged at 2218mMD where coincidentally the top of the first blocky coarse grained sandstone of the Tuttle member occurs. Tuttle sandstones, are tightly cemented with silica, and are very hard and resistant to erosion, with overlying relatively fragile Imperial shale. This sets up ideal conditions for the formation of ledges at the top of these sandstones, and also effectively creates a bottleneck situation where over-gauge shales are juxtaposed against in-gauge very hard sandstones. Bottlenecks become sites where caved material will collect and form bridges. In addition to ledges, logging tools have the added disadvantage of having to navigate past bridges. Ledges are particularly troublesome when the hole is deviated from the vertical, as logging tools will naturally fall with gravity but skid along the low side of the hole, making it more likely that they will encounter ledges. A full suite of logs was acquired, in addition to several speciality runs between the intermediate casing shoe and the top of the Tuttle member sandstones, but logging tools never investigated this hole lower than 2218mMD.

Despite several attempts to stabilize this hole, and fix known trouble spots with cement plugs, this hole was deemed unusable, and on October 13th, 2012, 24 days after drilling to 3132mMD, a cement plug was run, and the well was subsequently sidetracked at 2113mMD. This abstract, and the contents of this report are specific to the original A-25 well. The A-25 sidetrack will be addressed in a separate report.

Several delays occurred over the course of drilling the original A-25 well which prolonged the operation. Firstly while drilling surface hole, there were minor start-up problems with the electrical system to the top drive, and a minor problem with the SCR. Surface hole was drilled to 377mMD, then open hole logged. On attempting to log surface hole, tools bridged off, requiring a clean-out trip. 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 1197mMD requiring two drill bits and ~8 days operating. A bit trip at

881mMD and at ICP, both required extensive back-reaming to condition the hole before operations could continue. Conditioning the hole for logging was particularly time consuming, requiring almost 5 days. Hole-stability issues were problematic over Cretaceous shale and coal sections, mostly as a result of prominent jointing in the rocks, occurring at a high angle to bedding, where the rock breaks readily along these joint planes. This rock fabric also made directional drilling challenging, where the bit would trend left despite steering aggressively to the right. Logs and casing were then run without incident, however on cementing the casing, cement returns were not by-passed and instead were circulated back into the mud system, creating extensive contamination and cementing off the mud tanks and surface equipment. Approximately 3 days were required to clean the mud tanks and surface equipment, and to strip back contaminated mud, and mix and prepare a new mud system. Cement was also recirculated back down the casing while displacing the cement to bump the plug. This cement set-up within the casing and required an additional 24 hours to both drill out, and then to run a casing scraper.

Once cement was cleaned from surface equipment and the casing, drilling the 222mm phase of the hole commenced. Five drill bits were required to drill from 1197-2050mMD where it was attempted to cut and recover an 18 metre core in the base of the Hart River, with the expectation that the core interval could transition into the underlying Ford Lake. Unfortunately the core was started in highly siliceous rocks, and the core bit was scrubbed after cutting only 1.5 metres of section.

Hole problems did not really manifest themselves in the 222mm phase of the operation until the Imperial was penetrated. This formation consists largely of structurally unstable, and slightly wettable shales. Shales display high angle jointing, fracturing, and shearing. Poor mechanical integrity and the fissile and slightly wettable nature of these shales make this section extremely fragile, and prone to excessive caving. After penetrating the Imperial, tripping in and out of the hole became time consuming, requiring back-reaming, circulating, conditioning mud, and washing and reaming into the hole. There were also several instances where the drillstring became stuck, and the hole packed off, either due to a sudden failure of sections of the borehole wall, or the accumulation of mud-rings, where native clays, dehydrated mud, and rock debris formed extensive sticky plugs, impeding circulation, and making for tight hole conditions.

Traces of hydrocarbons were noted throughout the section, in all phases of the hole. Porous sandstones typically had pyrobitumen cement, and were often anomalously gassy, however, with only a few exceptions, porosity was restricted, and shows did not appear economically significant. Several gas-charged fractures were encountered while drilling the Blackie carbonate section (1365, 1402 & 1604mMD). The fracture encountered at 1604mMD resulted in a gas kick that required circulating and flaring off the gas. This fracture continued to produce gas into the wellbore until the mud weight was increased to 1150Kg/m³. Shales were carbonaceous throughout, but most shales were either not gassy, or only marginally gassy and did not appear to have good potential for shale gas production. Extensive sampling was conducted over this entire drilled section, and 50 sidewall cores were cut and recovered between 2096-1440mMD, and will undoubtedly be integral to determining the shale gas potential of these rocks in this region of the basin. The primary conventional target in the Ogilvie carbonate was not reached in this hole, and will be evaluated in the A-25 sidetrack, and in subsequent holes later in the drilling program.

Well Summary

Storage Units: Metric

Well Information

Operator: NORTHERN CROSS (YUKON) LIMITED
Well Name: NCY McParlon A-25
Location: 300/ A25 66-10 137-15/0
UWI: NCY McParlon A-25
Pool: N/A
Field: UNDEFINED
State / Province: Yukon Territory
Country: Canada
License Number: 1130
Well Status: Sidetracked @ 2113mMD.

Surface Co-ordinates	Hole Type: Deviated	Fault Indicator:
	Latitude: 66.040930	Longitude: 137.185758
	UTM Northing: 7329565.45	UTM Easting: 395189.91

N / S : 158.5 meters West of the East Boundary of Unit A.
E / W : 296.3 meters North of the South Boundary of Unit A.

Int. Casing Co-ordinates	Latitude:	Longitude:
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N / S : 339.89 meters West of the East Boundary of Unit A.
E / W : 378.44 meters North of the South Boundary of Unit A.

Bottom Hole Co-ordinates	Latitude:	Longitude:
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N / S : @ 3079.48m stn: 138.42m north of well centre
E / W : @ 3079.48m stn: 191.90m west of well centre

Elevations	Ground Elevation: 616.80	Kelly Bushing to Ground: 8.35	Reference: MSL
	Kelly Bushing Elevation: 625.15	Cut (-): 0.00	
	Casing Flange Elevation:	Fill (+):	

Total Depth	Measured Depth	True Vertical Depth
Total Depth Driller (Tally) :	3,132.00	3,089.01
Total Depth Driller (Strap or SLM):	3,132.00	3,089.01
Total Depth Logger:		

Miscellaneous Depths

Plugback Depth:		Water Depth Reference:
Sidetrack Depth: 2,113.00		Water Depth:

Well Summary

Drilling Contractor: Patterson Drilling Rig #3.	Spud Date: Jul 2, 2012 @ 20:30
Rig Release Date:	Total Depth Date: Sep 19, 2012 @ 22:15

Cores	#	Formation	Interval	Cut	Recovered	%
	1	Hart River	2,050.00 2,051.50	1.50	1.08	72.00

NORTHERN CROSS (YUKON) LIMITED
UWI NCY McParlon A-25

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Well Summary

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Casing Summary

Casing Type	Casing Size	Landed Depth	Hole Size
Conductor	508.0	28.20	
Surface	339.7	374.60	444.5
Intermediate	244.5	1,193.82	311.0

Logging Summary

Company	Engineer	Total Depth (MD)	Logging tools
Schlumberger	Michel Lapointe	477.00	Ran neutron, density, sonic, resistivity, gamma and sp tool from 0 - 377 meters (MD) Platform express (Pex).
Schlumberger Wireline Services		1,197.00	PEX-AIT-HGNS-PSS (Platform Express-Array Induction-Spectral Gamma-4 Arm Caliper) DSI-PSS (Dipole Sonic Imager; 4-Arm Caliper)
Schlumberger	Justin Easton	1,175.00	Ran an ultrasonic Imager log from 1175 to surface.
	Michel Lapointe	3,132.00	PEX-HNGS-PPC-TLD2 (Platform Express-Spectral Gamma-Power positioning Caliper-Dual Density AIT-DSI-GPIT-PPC X2 (Array Induction-Dipole Sonic-General purpose inclinometry tool-Power positioning caliper X2) PPC tool is a 4 arm caliper. 2 PPC components were run offset 45 degrees to one another.
		2,199.00	USIT Ultra Sonic Imaging Tool (Casing Drillwear log.) MSCT Sidewall Coring Tool MDT Modulated Dynamic Tester Stringray-CMR-ADT (Stringray-Combinable Magnetic Resonance-Dielectric Tool) FMI-GPIT-PPC X2 (Formation Imager-General purpose inclinometry tool-Power positioning caliper X2) PPC tool is a 4 arm caliper. 2 PPC components were run offset 45 degrees to one another.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jun 28, 12	0.00		0.00	0.00	
Jun 29, 12	0.00	0.00	0.00	0.00	June 28th: 00:00- 00: 24 Hrs: Install Flow line, tongs, mouse hole, pails, P/U elevators, P/U subs, drill pipe collar slips, rig in diverter hoses, top drive generator, install BOP valves, rig in mud pumps, charge accumulator and precharge bottles and return pump on flare stack.
Jun 30, 12	0.00	0.00	0.00	0.00	June 29th: 00:00 - 00: 24 Hrs: Rig up diverter, rig up floor, preform accumulator function check, held diverter drill, rig in top drive, replace new regulators on propane bottles for flare stack.
Jul 1, 12	0.00	0.00	0.00	0.00	June 30th: 00:00-24:00 Hrs: Build Gel Chem mud system, construct enviro barrier for cement, rig in survey line, catch tray, work on top drive generator, calibrate Pason sensors, slip and cut, calibrate and reset tac crown, prepare for spud, hook up choke lines to manifold shack, hook up degasser tank.
Jul 2, 12	0.00	0.00	2.00	0.00	Jul 1st: 00:00-24:00 Hrs: Safety meeting with crews use of incinerator, wait on services, mix mud, repair agitator in pre-mix tank, install safety chains on degasser lines, slip and cut drilling line, repair damaged electrical cords, wait on services and orders, held diverter drill, orientate crews on the operation of the top drive, wait on services.
Jul 3, 12	37.00	37.00	2.00	18.50	Jul 2nd, 00:00-00:24 Hrs: held diverter drill, wait on services, remove spinning chain, fix lease road, move cement line up on "V" door, service orientation for top drive, P/U landing sub and monel, bit and M/U BHA, held pre spud safety meeting, service flare ignitor, unload casing, held diverter drill, drill out cement in conductor pipe, troubleshoot SCR problems, break off collars, POOH, remove jets from bit, lay down MWD tool.
Jul 4, 12	118.00	81.00	9.25	8.76	Jul 3rd: 00:00-24:00 Hrs: RIH, P/U surveying tool, drill out cement from 22-28.2 meters (MD), drill 444.5 mm hole from 28.2-37 meters (MD), spud @ 20:20 hrs, July 2nd, 2012, drill 444.5 mm hole from 37-63 m (MD), POOH, RIH. P/U two collars, drill 444.5 mm hole from 62-74 m (MD).

Daily Drilling Summary

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Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jul 5, 12	179.00	61.00	12.50	4.88	Jul 4th 00:00-24:00 Hrs: Drill 444.5 mm hole from 74-155 m (MD), POOH, L/D mudmotor, clean bit, RIH.
Jul 6, 12	253.00	74.00	19.00	3.89	Jul 5th 00:00-00:24 Hrs: RIH, circ LCM from hole. Drill 444.5 mm hole from 155-237 m (MD).
Jul 7, 12	340.00	87.00	17.00	5.12	Jul 6th: 00:00-24:00 Hrs: Drill 444.5 mm hole from 237-277 m (MD), jack and level rig, drill 444.5 mm hole from 277-297 m (MD).
Jul 8, 12	377.00	37.00	6.50	5.69	Jul 7th, 00:00-24:00 Hrs: Drill 444.5 mm hole from 297-377 m (MD), POOH, safety meeting with Schlumberger, preform logging run #1.
Jul 9, 12	377.00	0.00	0.00	0.00	Jul 8th, 00:00-24:00 Hrs: RIH hit filter cake ring at 181 m (MD), POOH, remove bowstring off resistivity tool, RIH, bridge off at 180 m (MD), POOH, pick up drill pipe, RIH, wash and ream to bottom. Circ & cond hole, POOH, log / Schlumberger run 1 and run 2.
Jul 10, 12	377.00	0.00	0.00	0.00	Jul 9th, 00:00-24:00 Hrs: Rig out loggers, RIH to bottom, cond & circ mud, POOH, L/D BHA, rig in tongs, run 339.7 mm (OD) surface casing, circ and condition mud, run 37.5 inch drill pipe cement stringer, rig in import tool circulating equipment, circ casing.
Jul 11, 12	377.00	0.00	0.00	0.00	Jul 10th, 00:00-24:00 Hrs: Circ casing, rig in cementers, cement casing, trip stringer from hole, wait on cement, remove landing joint, remove diverter, cut conductor barrel, set up degasser and gut lines, screw in landing joint, set slips and pull with 10,000 tension, P/U 24.5 mm cement stringer, RIH and tag at 27 m (MD), safety meeting with Halliburton cementers, rig in cementers for a top down cement job, pump cement.
Jul 12, 12	377.00	0.00	0.00	0.00	Jul 11th, 00:00-24:00 Hrs: Wait on cement, safety meeting with Halliburton, cement casing from top down, wait on cement, pull landing joint, screw on casing bowl, P/U and nipple up BOP, M/U lower spool, lower pipe rams, upper spool, blind rams, and upper pipe rams, nipple up pipe rams, change out short pipe studs on lower pipe rams, P/U annular.

Daily Drilling Summary

Storage Units:

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Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jul 13, 12	377.00	0.00	0.00	0.00	July 12; 00:00-24:00Hrs: Prepare rig to drill-out: Pick up and install annular, flow nipple, flow line, hole-fill hose, kill valves, choke line & valves, flare lines, degasser and bouey lines. Rig in kill lines. Change lower pipe rams to VBR rams. Hook up BOP lines. Pressure test.
Jul 14, 12	394.00	17.00	0.50	34.00	July 13; 00:00-24:00Hrs: Pressure test. Remove flowline. Install wear bushing and catch-can. Pre drill-out inspection and safety meeting. RIH with slick BHA. Drill out float, cement and shoe. BOP drill. Drill 311mm hole f/377-379mMD. Perform FIT. Man-down drill. POOH. P/U Directional Tools. M/U Bit.
Jul 15, 12	564.00	170.00	18.00	9.44	July 14; 00:00-24:00Hrs: Install MWD. RIH. Displace hole to new mud. Drill and survey 311mm hole f/379-451mMD. Man-down drill. Drill and survey 311mm hole f/451-511mMD.
Jul 16, 12	724.00	160.00	19.00	8.42	July 15; 00:00-24:00Hrs: Drill and survey 311mm hole f/511-668mMD.
Jul 17, 12	881.00	157.00	17.00	9.24	July 16; 00:00-24:00Hrs: Drill and survey 311mm directional hole f/668-862mMD.
Jul 18, 12	897.00	16.00	2.00	8.00	July 17; 00:00-24:00Hrs: Drill and survey 311mm directional hole f/862-881mMD. Circulate and condition hole for trip. Back ream out of hole f/881-120mMD. Pull free from mudring @ 120mMD. POOH. Handle directional tools. Break bit. M/U new bit RIH. Test tool. RIH to 355mMD. Slip & cut.
Jul 19, 12	1,023.00	126.00	18.50	6.81	July 18; 00:00-24:00Hrs: Slip & cut 11m drill line. Trip in hole - wash down f/ 404-441, 603-608 & 834-881mMD. Drill and survey 311mm directional hole f/881-983mMD.
Jul 20, 12	1,135.00	112.00	18.50	6.05	July 19; 00:00-24:00Hrs: Drill and survey 311mm directional hole f/983-1111mMD.
Jul 21, 12	1,197.00	62.00	12.00	5.17	July 20; 00:00-24:00Hrs: Drill and survey 311mm directional hole f/1111-1176mMD. Rig repair (change gasket on standpipe). Drill and survey ahead f/1176-1197mMD.

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Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jul 22, 12	1,197.00	0.00	0.00	0.00	July 21; 00:00-24:00Hrs: Circulate and condition hole. POOH - pump and back ream out f/1197-477mMD. Purge and clean mud ring from hole - pump water & TKPP sweep. Finish out of hole. Lay down directional tools. Break bit. P/U & M/U reamer assembly. RIH. Ream and wash f/377-712mMD. POOH f/712-456mMD.
Jul 23, 12	1,197.00	0.00	0.00	0.00	July 22; 00:00-24:00Hrs: Condition hole for logging - Continue to POOH f/456-371mMD. Trip in hole f/371-712mMD. Ream and wash f/712-1197mMD. Trip out of hole - backream f/1197-597mMD.
Jul 24, 12	1,197.00	0.00	0.00	0.00	July 23; 00:00-24:00Hrs: Continue to backream out of hole f/597-374mMD. POOH. L/D reamer & M/U bit & RIH slick. Slip & cut 21m drill line. Trip in hole f/347-1198mMD. Attempt to POOH - pull 25DaN over. Work hole. Circulate and work pipe on bottom. Pump high vis sweeps and condition mud and hole. Trip out of hole.f/1198-801mMD.
Jul 25, 12	1,197.00	0.00	0.00	0.00	July 24; 00:00-24:00Hrs: Trip out of hole f/801-733mMD. Circulate and clean hole. Trip out of hole f/733-450mMD. Circulate and clean hole. Trip out of hole f/450-404mMD. Circulate and clean hole. Trip out of hole f/404-375mMD. Circulate and clean hole. Trip out of hole f/375-365mMD. Flow check. RIH - ream bridges @ 450-452, & 518-520mMD. Trip in - ream and clean to bottom. Circulate and condition mud. POOH - Back ream out f/1197-403mMD. Circulate hole, condition & work pipe f/377-543mMD.
Jul 26, 12	1,197.00	0.00	0.00	0.00	July 25; 00:00-24:00Hrs: Circulate hole, condition & work pipe f/543-800mMD. RIH - ream through bridge @ 1081-1085.7mMD. Wash to bottom - 8m fill. Circulate and clean hole. POOH. Rig in Schlumberger and run open hole logs.
Jul 27, 12	1,197.00	0.00	0.00	0.00	July 26; 00:00-24:00Hrs: Continue to log with Schlumberger. Rig down Loggers. RIH - L/D 8" DCs. Make up bit and RIH to 1082mMD. Ream 3 stands, & P/U 3 singles and ream and wash to bottom. Condition mud and circulate. Back ream out of hole f/1197-367mMD. Circulate bottoms up and work pipe. RIH.

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Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Jul 28, 12	1,197.00	0.00	0.00	0.00	July 27; 00:00-24:00Hrs: POOH. Break bit. Remove flow-T. Remove and clean wear bushing. Install flow-T and flowline. P/U & rig in power tong equipment. Run 244.5mm casing. Casing landed @ 1193.82mMD @18:30hrs. Condition mud and circulate casing. Cement casing.
Jul 29, 12	1,197.00	0.00	0.00	0.00	July 28; 00:00-24:00Hrs: Cement casing. Rig out cementers. Back off and L/D landing joint. Remove flow-T and flowline, and run pack-off assembly. Seat tool and shear off. Remove lower casing bowl valves & install blind and vent. P/T. L/D DP & continue to P/T. Clean mud tanks. Strip & mix mud.
Jul 30, 12	1,197.00	0.00	0.00	0.00	July 29; 00:00-24:00Hrs: Clean mud system. Strip back mud.
Jul 31, 12	1,197.00	0.00	0.00	0.00	July 30; 00:00-24:00Hrs: Clean mud system. Strip back mud.
Aug 1, 12	1,197.00	0.00	0.00	0.00	July 31; 00:00-24:00Hrs: Clean pre-mix tanks. Strip back mud. Clean rig of mixing solids from tanks and centrifuge underflow, pressure test top of casing and landing hanger to 21000 KPa. Perform accumulator function test, P/U BHA and drill out cement from 30-146 meters (MD).
Aug 2, 12	1,197.00	0.00	0.00	0.00	Aug 1st; 00:00-24:00 hrs: Drill out cement from 324 - 600 meters (MD), drill out softer cement and wash to bottom of casing from 600 meters (MD) to the float collar at 1180.27 meters (MD), circ & cond mud, POOH for casing scraper.
Aug 3, 12	1,197.00	0.00	0.00	0.00	August 2; 00:00-24:00Hrs: POOH, Cut drill line, P/U casing scraper assembly, RIH & clean casing, cond & circ bottoms up, POOH, rig in loggers, perform two casing log runs, P test casing, fill casing with water, close blind rams, test casing to 25MPa, hold for 15 minutes, condition mud and premix to polymer, function blind rams.
Aug 4, 12	1,281.00	84.00	12.75	6.59	Aug 3rd, 00:00-24:00 Hrs RIH / 222 mm bit and reamer assembly, drill out cement and shoe, drill 222 mm hole from 1197 to 1201 meters (MD), circ hole clean. Perform leak off test. Displace water with polymer mud, Drill 222 mm hole from 1201 - 1225 meters (MD), troubleshoot gamma tool. Drill 222 mm hole from 1225-1233 meters (MD).

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Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Aug 5, 12	1,385.00	104.00	25.00	4.16	Aug 4th; 00:00-24:00 Hrs: Drill 222 mm hole from 1233-1290 m (MD), circ bottoms up & check for corepoint, drill 222 mm hole from 1290-1360 m (MD).
Aug 6, 12	1,405.00	20.00	14.00	1.43	Aug 5th, 00:00-24:00 Hrs: Drill 222 mm hole from 1360-1364 m (MD), circ bottoms up, drill 222 mm hole from 1364-1402 m (MD), circ bottoms up, drill 222 mm hole from 1402 - 1405 m (MD), POOH for dir tools.
Aug 7, 12	1,447.00	42.00	13.00	3.23	Aug 6th, 00:00-24:00 Hrs: POOH, L/D bit reamer, P/U Smith bit, build BHA, RIH, pulse test, preform check shots, RIH, pattern bit, drill 222 mm hole from 1405-1447 m (MD), circ bottoms up, POOH for bit.
Aug 8, 12	1,508.00	61.00	20.00	3.05	Aug 7th, 00:00-24:00 Hrs: POOH, change out bit, RIH, pattern bit, dir drill 222 mm hole from 1447-1486 m (MD).
Aug 9, 12	1,592.00	84.00	20.25	4.15	Aug 8th, 00:00-24:00 Hrs: Dir drill 222 mm hole from 1486--1508 m (MD), circ bottom hole spl, dir drill 222 mm hole from 1508-1564 m (MD).
Aug 10, 12	1,606.00	14.00	5.75	2.43	Aug 9th; 00:00-24:00Hrs: Drill & survey 222mm directional hole f/1564-1578m MD. Circulate bottom hole sample. Drill and survey ahead f/1578-1603.9mMD - high torque. P/U and circulate GTS in 30min. Shut in well. Monitor and circulate through degasser - 1.5m flare. Circulate 1.5 btms up. Open annular. Flow check. Circulate and raise mud density - produced gas dropping from max 7530u to ~250u. Drill ahead f/1603.9-1606mMD. Circulate btms up. POOH w/ flow checks. Lay down jars and pony DC. Handle directional tools - switch out MWD.
Aug 11, 12	1,659.00	53.00	9.25	5.73	Aug 10; 00:00-24:00Hrs: M/U Bit #6. Switch out 1 DC P/U new jars and pony HWDP. Shallow test MWD. Slip & cut 16m drill line. RIH. Wash last stand to btm. Circulate btms up - 924u Trip Gas (TG). Pump pill. POOH to csg. Work on and blow out lower kill line. RIH. Drill and survey 222mm hole f/1606-1658mMD.
Aug 12, 12	1,735.00	76.00	17.50	4.34	Aug 11; 00:00-24:00Hrs: Drill 222mm hole f/1658-1659mMD. Circulate bottoms up. Pump pill. POOH. Change out MWD tools. M/U Bit #7. RIH. Wash from 1636-1659mMD - flush junk. Pattern bit. Drill and survey 222mm hole f/1659-1704mMD.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Aug 13, 12	1,823.00	88.00	20.75	4.24	Aug 12th; 00:00-24:00Hrs: Drill and survey 222mm hole f/1704-1795mMD.
Aug 14, 12	1,905.00	82.00	17.50	4.69	Aug 13th; 00:00-24:00Hrs: Drill and survey 222mm hole f/1795-1840mMD. PVT gain. P/U off bottom - shut in and circulate through manifold. Open annular and resume conventional circulation - gas peaked @ 268u. Drill ahead f/1840-1842mMD. Circulate btms up - no appreciable gas. Drill and survey ahead f/1842-1877mMD.
Aug 15, 12	1,962.00	57.00	15.50	3.68	Aug 14th; 00:00-24:00Hrs: Drill 222mm hole f/1877-1880mMD. Circulate btms up after drilling break. Drill and survey ahead f/1880-1925mMD. Circulate btm hole sample. Drill ahead to 1927.8mMD. Circulate sample. Drill and survey 222mm hole f/1927.8-1946mMD.
Aug 16, 12	1,985.00	23.00	7.00	3.29	Aug 15th; 00:00-24:00Hrs: Drill and survey 222mm hole f/1946-1962mMD. Circulate btms up. Pump pill. POOH. P/U mud motor. M/U Bit #8. RIH to 1112mMD. Slip & cut 15m drill line. RIH - wash and ream in last 2 stands. Circulate 2 btms up (TG = 424u).
Aug 17, 12	2,034.00	49.00	19.50	2.51	Aug 16th; 00:00-24:00Hrs: Drill and survey 222mm hole f/1962-2015mMD. Circulate btm hole sample. Drill ahead f/2015-2019mMD.
Aug 18, 12	2,050.00	16.00	7.00	2.29	Aug 17th; 00:00-24:00Hrs: Drill and survey 222mm hole f/2019-2050mMD. Circulate bottoms up. POOH. L/D directional tools. P/U and M/U coring BHA.
Aug 19, 12	2,060.00	10.00	7.00	1.43	Aug 18th; 00:00-24:00Hrs: Continue to M/U coring BHA. RIH. P/U 3 singles. Wash in f/2022-2050mMD. Circulate bottoms up. Drop ball. Cut core #1 f/2050.0-2051.5mMD. POOH and recover core (Rec 1.08m). L/D coring BHA. M/U Bit #9 and RIH.
Aug 20, 12	2,070.00	10.00	4.75	2.11	Aug 19th; 00:00-24:00Hrs: Finish in hole. Wash in f/2029-2051mMD. Circulate bottoms up (TG = 879u). Drill and survey 222mm hole f/2051.5-2060mMD. Shut in and monitor well. Drill ahead f/2060-2070mMD. Work stuck pipe. Jars fired - Pull free. POOH. L/D directional tools. M/U magnet sub and assembly. P/U 10 stands DP & RIH.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Aug 21, 12	2,070.00	0.00	0.00	0.00	Aug 20th; 00:00-24:00Hrs: RIH w/ Magnet. L/D 28 singles "E" DP. RIH. L/D 6 singles "GG" DP. RIH. Circ btms up (TG = 1221u). Work magnet. POOH. Recover junk (2 cones + several inserts). L/D magnet. M/U mill. RIH. Circulate btms up (TG =161u). Mill junk on bottom.
Aug 22, 12	2,111.00	41.00	10.50	3.90	Aug 21st; 00:00-24:00Hrs: Circulate 2 btms up. Pump pill. POOH. L/D mill and junk sub. Make up Bit #10 and directional BHA & RIH to 1093mMD. Slip & cut 17m drill line. Man down drill. RIH f/1093-2040mMD. Ream and clean to btm. Drill and survey 222mm hole f/2070-2098mMD
Aug 23, 12	2,173.00	62.00	19.25	3.22	Aug 22nd; 00:00-24:00Hrs: Drill and survey 222mm hole f/2094-2099.6mMD. Circulate btms up. Drill ahead to 2100.0mMD. Circulate btms up. Drill and survey ahead f/2100-2152mMD.
Aug 24, 12	2,201.00	28.00	7.00	4.00	Aug 23rd, 00:00-24:00 Hrs: Dir drill 222 mm hole from 2152-2201 m (MD), circulate and condition mud, POOH, lay down mudmotor, held safety meeting prior to picking up DST.
Aug 25, 12	2,207.00	6.00	3.00	2.00	August 24th: 00:24:00 Hrs: Pick up DST tools, RIH to 1600 m (MD), drill stem test 1604 m (MD) interval, POOH and lay down DST tools, P/U bit, dir tools, RIH.
Aug 26, 12	2,401.00	194.00	19.75	9.82	Aug 25th 00:00-24:00 Hrs: RIH, wash from 2160 to bottom, dir drill 222 mm hole from 2401-2348 m (MD).
Aug 27, 12	2,435.00	34.00	4.50	7.56	Aug 26 00:00-24:00 Hrs: Drill 222 mm hole from 2348-2435 m (MD). POOH due to excessive torque. Circ, POOH to 2267 m (MD) and backream out to 2050 m (MD).
Aug 28, 12	2,442.00	7.00	3.75	1.87	Aug 27th 00:00-00:24 Hrs: POOH, L/D slant roller reamer, P/U vertical roller reamer and bit #12, RIH, wash from 2425 to bottom. Dir drill 222 mm hole from 2435-2442 m (MD), POOH, backream from 2432-1200 m (MD), L/D roller reamer and make up bit 13.
Aug 29, 12	2,552.00	110.00	19.50	5.64	Aug 28th: 00:00-24:00 Hrs: RIH, wash through bridges at 2222, 2230, 2237, 2427, 2430 and 2434 m (MD). Dir drill 222 mm hole from 2442-2527 m (MD).

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Aug 30, 12	2,582.00	30.00	7.00	4.29	Aug 30th 00:00-24:00 Hrs: Dir drill 222 mm hole from 2527-2572 m (MD), circ & cond mud, Dir drill 222 mm hole from 2572-2582 m (MD), backream out of hole.
Aug 31, 12	2,582.00	0.00	0.00	0.00	Aug 30th, 00:00-24:00 Hrs: Backream out of hole to 2179 m (MD), POOH, change out bit, dial up motor to 1.5 degrees, RIH, slip and cut, check torque and drag every 250 meters, Hit bridges @ 2432, 2460 and 2472 m (MD), ream bridges and work tight hole.
Sep 1, 12	2,582.00	0.00	0.00	0.00	Aug 31st: 00:00-24:00 Hrs: Ream and work tight hole, POOH from 2530 m (MD), lay down mudmotor, safety meeting with Schlumberger, log casing, safety meeting with pressure tester, pull wear bushing, rig in pressure tester, pressure test BOP, set wear bushing and install flow T, P/U dir tools, M/U bit and scribe motor.
Sep 2, 12	2,582.00	0.00	0.00	0.00	Sep 1, 00:00-24:00 Hrs: RIH, slip and cut drill line (14 meters of line), RIH, wash and ream from 2474-2556 m (MD).
Sep 3, 12	2,596.00	14.00	5.00	2.80	Sep 2, 00:00-24:00 Hrs: Ream 222 mm hole from 2556-2582 m (MD), Wiper and back ream from 2582-2067 m (MD) with tight spots at 2565, 2562, 2546, 2528.5, 2483-2481, and 2308 m (MD), RIH and ream from 2067-2567 m (MD) with bridges at 2308, 2215, 2385, 2479, 2482 and 2537.5 m (MD).
Sep 4, 12	2,632.00	36.00	10.25	3.51	Sep 3rd, 00:00-24:00 Hrs: Ream from 2567-2582 m (MD). Dir drill 222 mm hole from 2582-2632 m (MD), circ bottoms up, backream from 2632-2000 m (MD).
Sep 5, 12	2,632.00	0.00	0.00	0.00	Sep 4th, 00:00-24:00 Hrs: Backream from 2632-2010 m (MD), pump pill, POOH and L/D dir BHA, P/U mill tooth bit, near bit reamer, slant roller reamers,, RIH, slip and cut drill line, install non rotating casing protectors from 913-1190 m (MD) and two per single between 567 - 904 m (MD), RIH to 1950 m (MD).
Sep 6, 12	2,632.00	0.00	0.00	0.00	Sep 5th, 00:00-24:00 Hrs: Ream from 2065-2578 m (MD), wiper to 1425 m (MD), move pipe, swap non rotating sleeves, RIH & ream from 2470-2605 m (MD).

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Sep 7, 12	2,645.00	13.00	6.00	2.17	Sep 7th, 00:00-24:00 Hrs: Ream from 2605-2632 m (MD), circ hole clean, POOH. P/U insert bit, near bit and slant reamers, RIH, slip and cut drill line. Ream from 2473-2600 m (MD).
Sep 8, 12	2,694.00	49.00	21.25	2.31	Sep 7th; 00:00-24:00 Hrs: Ream and clean hole f/2600-2632mMD. Drill and survey 222mm hole f/2632-2677mMD.
Sep 9, 12	2,714.00	20.00	8.00	2.50	Sep 8th; 00:00-24:00hrs: Drill and survey 222mm hole f/2677-2714mMD. POOH wet f/2714-2392mMD. Pump pill. POOH f/2392-315mMD. F/T BOPs - Okay.
Sep 10, 12	2,760.00	46.00	14.50	3.17	Sep 9th; 00:00-24:00hrs: Finish out of hole. P/U mud motor. M/U Bit #17. Scribe motor. RIH. Wash and ream to bottom f/2470-2714mMD. Drill and survey 222mm hole f/2714-2733mMD.
Sep 11, 12	2,825.00	65.00	20.75	3.13	Sep 10th; 00:00-24:00hrs: Drill and survey 222mm hole f/2733-2802mMD.
Sep 12, 12	2,902.00	77.00	20.50	3.76	Sep 11th; 00:00-24:00hrs: Drill and survey 222mm hole f/2802-2875mMD.
Sep 13, 12	2,921.00	19.00	7.25	2.62	Sep 12th; 00:00-24:00hrs: Drill and survey 222mm hole f/2875-2921mMD. Circulate bottoms up. POOH - Backream f/2921-2431mMD.
Sep 14, 12	2,921.00	0.00	0.00	0.00	Sep 13th; 00:00-24:00hrs: POOH. Handle directional tools. Change out mud motor. M/U Bit # 18. RIH to 1189mMD. Slip & cut 29m drill line. RIH to 2302mMD. Wash and ream f/ 2302-2513mMD.
Sep 15, 12	2,935.00	14.00	5.25	2.67	Sep 14th; 00:00-24:00hrs: Wash and ream f/ 2513-2921mMD. Work tight spots. Pump high vis sweep. Weight up mud system to 1350Kg/m3.
Sep 16, 12	2,980.00	45.00	19.00	2.37	Sep 15th; 00:00-24:00hrs: Drill 222mm hole f/2921-2964mMD.
Sep 17, 12	3,035.00	55.00	19.75	2.78	Sep 16th; 00:00-24:00hrs: Drill and survey 222mm hole f/2964-3016mMD - work drill string ~each 5m to aid in cleaning the hole and reduce drag.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Sep 18, 12	3,056.00	21.00	8.25	2.55	Sep 17th; 00:00-24:00hrs: Drill 222mm hole f/3016-3053mMD - work drill string ~each 5m to aid in cleaning the hole and reduce drag. Wiper trip f/3053-2452mMD - pump out. Ream and clean f/2452-2603mMD. Circulate bottoms up - work pipe. Ream and clean f/2603-2701mMD.
Sep 19, 12	3,108.00	52.00	20.50	2.54	Sep 18th; 00:00-24:00hrs: Ream and clean f/2701-3053mMD. Drill and survey 222mm hole f/3053-3091mMD.
Sep 20, 12	3,132.00	24.00	10.75	2.23	Sep 19th; 00:00-24:00hrs: Drill and survey 222mm hole f/3091-3132mMD - work drill string frequently in attempts to reduce hole and drag. Circulate bottoms up and condition mud - work pipe.
Sep 21, 12	3,132.00	0.00	0.00	0.00	Sep 20th; 00:00-24:00hrs: Continue to circulate and condition mud. Hoist - pump out stands f/3132-2730mMD & 2521-2392mMD - spot polymer beads. POOH - pump pills. Lay down 2 bent singles. Handle directional tools - Lay down MWD. Rig in and log with Schlumberger.
Sep 22, 12	3,132.00	0.00	0.00	0.00	Sep 21st; 00:00-24:00hrs: Log with Schlumberger. Rig out Loggers. M/U BHA. L/D reamers. RIH to 1187mMD. Slip & cut 26m drill line. RIH to 2164mMD. Circulate and wash in f/2164-2223mMD - Tag bridge. Work tight hole f/2223-2250mMD. Circulate hole clean. Wash in f/2246-2421mMD. Work tight spots and ledges @ 2234, 2395, 2404, & 2410mMD.
Sep 23, 12	3,132.00	0.00	0.00	0.00	Sep 22nd; 00:00-24:00hrs: Wash in f/2421-2492mMD. Work tight spots @ 2421, 2490, & 2492mMD. Circulate and condition hole and mud. POOH f/2450-2105mMD. RIH - encounter bridge @ 2024mMD. Ream 2220-2249mMD. Circulate and condition mud. POOH to 1185mMD. Circulate bottoms up. RIH to 2214mMD - tag bridge. Ream 2224-2260mMD. Wash in f/2260-2362mMD. Work tight spots and circulate hole.
Sep 24, 12	3,132.00	0.00	0.00	0.00	Sep 23rd; 00:00-24:00hrs: Wash in f/2362-2492mMD. Work tight spots and circulate hole clean. Ream f/2492-2505mMD. Top Drive failure - circulate and work drill string.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Sep 25, 12	3,132.00	0.00	0.00	0.00	Sep 24th; 00:00-24:00hrs: Top Drive failure - circulate and work drill string. WO parts and repairs. Repair Top Drive. Work tight hole f/2482-2492mMD.
Sep 26, 12	3,132.00	0.00	0.00	0.00	Sep 25th; 00:00-24:00hrs: Ream & work tight hole f/2492-2504mMD. Pump pill. POOH. Change bit and burn sub and grabber dies.. P/U mud motor. M/U bit #20. RIH to 1092mMD. Slip and cut 15m drill line. Trip in hole - encounter bridge @ 1271mMD. Ream and clean f/1271-1320mMD.
Sep 27, 12	3,132.00	0.00	0.00	0.00	Sep 26th; 00:00-24:00hrs: Trip in hole f/1320-2242mMD. Ream and clean f/2242-2310mMD. Circulate and clean hole. POOH to 2242mMD. Ream and clean f/2242-2499mMD. Condition mud and circulate. Ream and clean f/2482-2474mMD. Trip out of hole. Pump stands out f/2288-2269mMD. POOH. Pump pill @ 2212mMD.
Sep 28, 12	3,132.00	0.00	0.00	0.00	Sep 27th; 00:00-24:00hrs: POOH. Tight spot @ 1882mMD. Back ream and clean hole f/1882-1866mMD. POOH. L/D BHA. RIH w/ slick BHA and Bit #21. Ream and clean hole f/2245-2270mMD. Condition mud and circulate hole clean. Spot high vis pill. POOH.
Sep 29, 12	3,132.00	0.00	0.00	0.00	Sep 28th; 00:00-24:00hrs: POOH - pull tight at 1236mMD. Back ream and clean hole f/1255-1230mMD. Rig in Schlumberger. Bridge with logging tools @ 1265mMD. Retrieve tools. Rig out Loggers. RIH to 767mMD. Slip & cut 18m drill line. Continue in hole to 1290mMD. Ream and clean f/1290-1430mMD.
Sep 30, 12	3,132.00	0.00	0.00	0.00	Sep 29th; 00:00-24:00hrs: Ream and clean f/1426-1569mMD - work tight hole @ 1480mMD. Backream f/1569-1193mMD - work tight hole @ 1220mMD. Ream and clean f/1193-2199mMD. Condition mud and circulate - Raise vis, lower density. Trip out of hole - pump pill @ 2056mMD. Backream f/1823-1796MD. POOH to 1494mMD - pulling tight.
Oct 1, 12	3,132.00	0.00	0.00	0.00	Sep 30th; 00:00-24:00hrs: POOH. Back ream tight spots (1508-1480, 1444-1366 & 1332-1319). POOH to 1188mMD. RIH to 2206mMD. Circulate and clean hole. POOH to log. Rig in and log with Schlumberger.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Oct 2, 12	3,132.00	0.00	0.00	0.00	Oct 1st: 00:00-24:00hrs: Log with Schlumberger
Oct 3, 12	3,132.00	0.00	0.00	0.00	Oct 2nd: 00:00-24:00hrs: Log with Schlumberger (MDT).
Oct 4, 12	3,132.00	0.00	0.00	0.00	Oct 3rd: 00:00-24:00hrs: Log with Schlumberger (Runs 4.4 MSCT & 4.5 USIT). Pull wear bushing. P/T BOP system.
Oct 5, 12	3,132.00	0.00	0.00	0.00	Oct 4th 00:00-24:00 hrs Pressure test blind rams, preform accumulator function test, install wear bushing, M/U BHA, RIH to 500 m (MD), blow out lines & break circulation, break circulation at 1000, 1500 and 2000 m (MD), RIH to 2180 m (MD), wash & ream to 2220 m (MD), wiper trip four stands of pipe using pumps.
Oct 6, 12	3,132.00	0.00	0.00	0.00	Oct 5th, 00:00-24:00 hrs Clean and ream from 2110 -2211 m (MD), wiper 5 stands, circ hole clean, POOH, rig in cement stringer, RIH to 2213 m (MD).
Oct 7, 12	3,132.00	0.00	0.00	0.00	Oct 6th; 00:00-24:00 hrs Circ hole clean, wiper trip 10 stands, circ and cond mud, held safety meeting with Halliburton, rigged in cementers, cemented plug #1 with 5.4 tonnes of Class "G" cement, plug down @ 09:57 hrs. Pulled 10 stands, broke circ, pulled four stands, circulated hole clean, POOH, P/U monel, MWD tools, service the same, picked up BHA, RIH back to intermediate casing, slip and cut drill line, RIH to 1434 m (MD).
Oct 8, 12	3,132.00	0.00	0.00	0.00	Oct 7th 00:00-24:00 hrs RIH to 2161 m (MD), circ & wash to 2168 m (MD), drill cement plug from 2168-2220 m (MD), clean hole from 2220 - 2307 m (MD), wiper to 2167 m (MD), clean back down to 2307 m (MD), circulate hole clean, POOH.
Oct 9, 12	3,132.00	0.00	0.00	0.00	Oct 8th: 00:00-0024 hrs; POOH, L/D BHA, RIH open ended, work tight spots @ 2242, 2258 and 2268 m (MD).

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Oct 10, 12	3,132.00	0.00	0.00	0.00	Oct 9th: 00:00-24:00 Hrs. Wash through tight spots @ 2242, 2258 and 2268 m (MD), could not get past 2268 m (MD). Held safety meeting with Halliburton, rig in cementers, lay cement plug from 2220 - 2268 m (MD) (with 1.1% gel + 0.5% Hallad + 1% HR-5 + 0.1% CFR-3 + 2% Econolite). Plug down @ 05:48 Hrs. POOH, change out BHA, RIH, wash through tight spots at 2057, 2077, 2108, 2146, 2161 and 2235 m (MD). Drill cement from 2239-2268 m (MD).
Oct 11, 12	3,132.00	0.00	0.00	0.00	Oct 10th: 00:00-24:00 Hrs. Clean hole from 2268 - 2374 m (MD with tight spots @ 2394- 2304, 2320-2324 m (MD). Wiper trip to 2160 m (MD), Circ bottoms up, circ back into hole from 2300 mKB to 2374 m (MD) / tight spots at 2307 & 2371 - 2374 m (MD), clean from 2374- 2418 m (MD) / tight spots @ 2380-2386 m (MD) & between 2402 and 2304 m (MD),
Oct 12, 12	3,132.00	0.00	0.00	0.00	Oct 11: 00:00-24:00 Hrs Ream & clean from 2418-2486 m (MD), tight spots at 2455, 2466, 2452, 2480 and 2486 m (MD), work tight hole @ 2486 m (MD), jar on stuck pipe @ 2486 m (MD), wash out of hole to 2286 m (MD), H2S drill, rig service, pre-tour safety meeting, wash from 2286-2142 m (MD), circ hole clean, RIH to 2247 m (MD), ream and clean from 2247-2277 m (MD), rig service lower pipe rams.
Oct 13, 12	3,132.00	0.00	0.00	0.00	Oct 12: 00:00-24:00 Hrs Ream & clean from 2277-2375 m (MD), circ hole clean, ream and clean to 2445 m (MD), circ hole clean, wiper to 1597 m (MD), circ through tight spots @ 2056, 2011. 1925, and 1871 m (MD), RIH to 2227 m (MD), circ hole clean, POOH and at 1650 m (MD) at midnight.
Oct 14, 12	3,132.00	0.00	0.00	0.00	Oct 13: 00:00-24:00 Hrs POOH, change BHA, RIH to bottom of intermediate casing, slip and cut drilling line, finish tripping into hole to 2202 m (MD), circulate hole clean, rig in cementers, cement with 16 tonnes of "G" 0-1-0 with 0.5% Hallad, 1.0% CFC-3 + 0.4% HR-5, plug down @ 17:28 hrs, pull out of plug, broke circulation, trip out to 1758 m (MD), circulate hole clean, POOH and @ 900 m (MD) at midnight.

Daily Drilling Summary

Storage Units:

Metric

Date	Depth	Progress	Rotating Hours	Avg. P.R.	Daily Operational Summary
Oct 15, 12	2,113.00	-1,019.00	0.00	0.00	Oct 14: 00:00-24:00 Hrs POOH, RIH to polish plug, drift 13 stands of pipe to remove cement, wash from 2000-2107 m (MD), tagged whipstock @ 2108 m (MD), polish plug from 2108-2113 m (MD), POOH, P/U dir tools.
Oct 16, 12	2,120.00	7.00	9.25	0.76	Oct 15th: 00:00-24:00 Hrs Dir work, set bend angle to 2.12 degrees, RIH to 1195 m (MD), flow check @ 420 m (MD), flow check and check MWD @ 1195 m (MD), slip and cut drill line, RIH, clean to 2113 m (MD), pre tour safety meeting, troubleshoot dir tools, time drill from 2113-2117 m (MD).

Casing Data Summary

Storage Units:

Metric

Casing Type: Conductor

Casing Size: 508.0
Casing Landed @: 28.20
Casing Date:

Hole Size:
Total Joints:
Plug Down Date:

of Joints / Length / O.D. / Weight:

Cementing Details:

Remarks: A surface aquifer at approximately 20 meters depth was encountered.

Casing Type: Surface

Casing Size: 339.7
Casing Landed @: 374.60
Casing Date: Jul 9, 2012 @ 12:30

Hole Size: 444.5
Total Joints: 29
Plug Down Date: Jul 10, 2012 @ 03:00

of Joints / Length / O.D. / Weight: Ran 29 joints of K-55, 339.7 m (OD), 315.3 mm (ID), 101.2 kg/m, Summit surface casing, landed at 374.6 meters (MD).

Cementing Details: Cemented with 16.9 cubic meters of Arctic-Cem (1870 kg lead F/(0-200 M) W/).27% PFR-1 followed by 11 cubic meters (14.5 tonnes) of Halchem G tail cement (1895 kg) with five cubic meters returned to surface. The surface sunk down 27 meters and had to be top filled twice to complete the cementing job.

Remarks: Cement was lost between 40 and 50 meters (MD).

Casing Type: Intermediate

Casing Size: 244.5
Casing Landed @: 1,193.82
Casing Date: Jul 27, 2012 @ 18:30

Hole Size: 311.0
Total Joints: 87
Plug Down Date: Jul 28, 2012 @ 01:45

of Joints / Length / O.D. / Weight: Ran 87 joints; 244.5mm; 59.53Kg/m; L-80; LT&C new casing.

Cementing Details: Preflush 3m3 fresh water. Pump 4m3 (1.3T) Extendacem 1400 + 0.5% Halad 344 scavenger @ 1250Kg/m3
LEAD #1: 19.9m3 (10.3T) Extendacem 1400 + 0.5% Halad @ 1400 Kg/m3.
LEAD #2: 40.8m3 (40T) Halcem "G" + 0.5% Halad 567 + 1.6% + Halgel + CaCl2 + 4% Econolite @ 1250Kg/m3.
TAIL: 33.4m3 (44T) Halcem "G" + 0.5% Halad + 0.2% HR-4 @ 1895Kg/m3.

Remarks: Drop plug and displace with 46.8m3 drilling mud @ 1250Kg/m3. Bump plug and hold for 15 minutes. Bleed off - floats held. ~40m3 mud-contaminated cement returns.

Bit Record

Pump Data

Pump #1	Model: IDECO	Size: T-1000	Type: triplex
	Pump Rod Diameter: 114	Liner Size: 178.0	Stroke Length: 254
	Efficiency Rating (%): 97		

Pump #2	Model: IDECO	Size: T-1000	Type: triplex
	Pump Rod Diameter: 114	Liner Size: 178.0	Stroke Length: 254
	Efficiency Rating (%): 97		

Bit Data

Storage Units: Metric

Bit #:	1A	Make: Security	Type: IS 11 TGP	IADC Series / Type: 1 / 1
Serial #:	0020210	Size: 444.5	Jets / Nozzles: 32.00 / 32.00 / 32.00 /	T.F.A.: 412.70
Depth In:	28.20	Depth Out: 63.00	Made: 34.80	Rotating Hours: 12.25
		Average Drill Rate: 2.84	Total Rotating Hours: 12.25	

Bit Grade / Condition I.A.D.C.: 1 / 1 / NO / A / E / I / WT / BHA / T / B / G: / /

Remarks:

Formations Drilled: Burnthill Creek

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	3,000 /	3,000	R.P.M.:	50 /	50
Pump 1 S.P.M. / Volume:	100 /	2	Pump 2 S.P.M. / Volume:	100 /	2
S.P.P.:	7,200 /		Fluid Density:	1,030 /	1,090
Drift Angle:	0.000 /	1.000	Funnel Viscosity:	95 /	110

Annular Velocity Bottoms Up	Drill Collars: Depth:	HeavyWeight Drill Pipe: Theoretical:	Drill Pipe: Actual:
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Bit #:	2A	Make: Smith	Type: 15JSC	IADC Series / Type: 44 / 5
Serial #:	NCO471	Size: 444.5	Jets / Nozzles: 38.10 / 25.40 / /	T.F.A.: 926.90
Depth In:	63.00	Depth Out: 377.00	Made: 314.00	Rotating Hours: 52.00
		Average Drill Rate: 6.04	Total Rotating Hours: 64.25	

Bit Grade / Condition I.A.D.C.: 2 / 2 / SS / A / E / 1 / FC / TD / T / B / G: / /

Remarks:

Formations Drilled: Burnthill Creek, Fishing Branch, Upper Parkin

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	6,000 /	17,000	R.P.M.:	160 /	180
Pump 1 S.P.M. / Volume:	100 /	2	Pump 2 S.P.M. / Volume:	100 /	2
S.P.P.:	7,200 /		Fluid Density:	1,030 /	1,090
Drift Angle:	0.000 /	1.000	Funnel Viscosity:	95 /	110

Annular Velocity Bottoms Up	Drill Collars: Depth:	HeavyWeight Drill Pipe: Theoretical:	Drill Pipe: Actual:
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Bit Data

Storage Units: Metric

Bit #: 1 Make: Varel Type: 14JMRSV IADC Series / Type: 43 / 7
 Serial #: 1306664 Size: 311.0 Jets / Nozzles: 22.20 / 22.20 / 22.20 / 14.30 T.F.A.: 321.80
 Depth In: 377.00 Depth Out: 881.00 Made: 504.00 Rotating Hours: 56.00
 Average Drill Rate: 9.00 Total Rotating Hours: 120.25

Bit Grade / Condition I.A.D.C.: 2 / 2 / WT / A / F / 4 / NO / TQ / T / B / G: / /

Remarks: 1 Bearing completely worn
 Formations Drilled: Upper Parkin, Middle Parkin SS (Orange Mkr), Whitestone River

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	5,000 /	22,500	R.P.M.:	50 /	172
Pump 1 S.P.M. / Volume:	120 /	1	Pump 2 S.P.M. / Volume:	120 /	1
S.P.P.:	120 /	120	Fluid Density:	1,010 /	1,130
Drift Angle:	/		Funnel Viscosity:	45 /	60

Annular Velocity Bottoms Up Drill Collars: Depth: HeavyWeight Drill Pipe: Theoretical: Drill Pipe: Actual:

Bit #: 2 Make: Smith Type: 23BODVC IADC Series / Type: 51 / 7
 Serial #: PS6378 Size: 311.0 Jets / Nozzles: 19.10 / 19.10 / 19.10 / 25.40 T.F.A.: 366.20
 Depth In: 881.00 Depth Out: 1,197.00 Made: 316.00 Rotating Hours: 48.50
 Average Drill Rate: 6.52 Total Rotating Hours: 168.75

Bit Grade / Condition I.A.D.C.: 2 / 3 / BT / S / E / 1 / FC / TD / T / B / G: / /

Remarks:
 Formations Drilled: Whitestone River, PreCretaceous Unc, Jungle Creek, Ettrain

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	5,000 /	26,000	R.P.M.:	117 /	197
Pump 1 S.P.M. / Volume:	100 /	1	Pump 2 S.P.M. / Volume:	100 /	1
S.P.P.:	12,600 /	13,210	Fluid Density:	1,130 /	1,160
Drift Angle:	/		Funnel Viscosity:	43 /	48

Annular Velocity Bottoms Up Drill Collars: Depth: HeavyWeight Drill Pipe: Theoretical: Drill Pipe: Actual:

Bit #: 3RR Make: Smith Type: 121B OD1 IADC Series / Type: 5 / 1
 Serial #: PX4870 Size: 222.0 Jets / Nozzles: 15.90 / 15.90 / 15.90 / T.F.A.: 595.60
 Depth In: 1,197.00 Depth Out: 1,405.00 Made: 208.00 Rotating Hours: 39.00
 Average Drill Rate: 5.33 Total Rotating Hours: 207.75

Bit Grade / Condition I.A.D.C.: 8 / 4 / BT / A / E / 1 / WT / BHA / T / B / G: / /

Remarks:
 Formations Drilled: Ettrain, Blackie, Hart River

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	12 /	22	R.P.M.:	50 /	70
Pump 1 S.P.M. / Volume:	85 /	2	Pump 2 S.P.M. / Volume:	85 /	2
S.P.P.:	3,415 /	4,300	Fluid Density:	1,040 /	1,130
Drift Angle:	13.500 /	14.500	Funnel Viscosity:	43 /	59

Annular Velocity Bottoms Up Drill Collars: Depth: HeavyWeight Drill Pipe: Theoretical: Drill Pipe: Actual:

Bit Data

Storage Units: Metric

Bit #: 4 **Make:** Smith **Type:** FH135 **IADC Series / Type:** /
Serial #: PS6169 **Size:** 222.0 **Jets / Nozzles:** 15.90 / 15.90 / 15.90 / **T.F.A.:** 595.60
Depth In: 1,405.00 **Depth Out:** 1,447.00 **Made:** 42.00 **Rotating Hours:** 13.00
Average Drill Rate: 3.23 **Total Rotating Hours:** 220.75

Bit Grade / Condition I.A.D.C.: 8 / 5 / BT / A / E / I / JD / PR / **T / B / G:** / /

Remarks:

Formations Drilled: Blackie

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	16 /	17	R.P.M.:	20 /	50
Pump 1 S.P.M. / Volume:	70 /	2	Pump 2 S.P.M. / Volume:	70 /	2
S.P.P.:	5,990 /	6,330	Fluid Density:	1,150 /	1,150
Drift Angle:	/		Funnel Viscosity:	43 /	47

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit #: 5 **Make:** Hughes **Type:**X-45CDX2 **IADC Series / Type:** 62 / 7
Serial #: 5210371 **Size:** 222.0 **Jets / Nozzles:** 15.90 / / / **T.F.A.:** 595.60
Depth In: 1,447.00 **Depth Out:** 1,606.00 **Made:** 159.00 **Rotating Hours:** 43.50
Average Drill Rate: 3.66 **Total Rotating Hours:** 264.25

Bit Grade / Condition I.A.D.C.: 2 / 3 / WT / A / E / 1 / CT / TQ / **T / B / G:** / /

Remarks:

Formations Drilled: Blackie

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	17 /	20	R.P.M.:	18 /	23
Pump 1 S.P.M. / Volume:	/		Pump 2 S.P.M. / Volume:	/	
S.P.P.:	6,700 /	7,900	Fluid Density:	1,100 /	1,150
Drift Angle:	/		Funnel Viscosity:	40 /	45

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit #: 6 **Make:** Security **Type:**QH-34D2R **IADC Series / Type:** 54 / 7
Serial #: 11548155 **Size:** 222.0 **Jets / Nozzles:** 12.70 / / / **T.F.A.:** 380.00
Depth In: 1,606.00 **Depth Out:** 1,659.00 **Made:** 53.00 **Rotating Hours:** 9.25
Average Drill Rate: 5.73 **Total Rotating Hours:** 273.50

Bit Grade / Condition I.A.D.C.: 6 / 8 / BT / A / E / I / LT / PR / **T / B / G:** / /

Remarks:

Formations Drilled:

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	23 /	23	R.P.M.:	20 /	25
Pump 1 S.P.M. / Volume:	130 /		Pump 2 S.P.M. / Volume:	70 /	
S.P.P.:	5,000 /	7,920	Fluid Density:	1,130 /	1,140
Drift Angle:	/		Funnel Viscosity:	42 /	46

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit Data

Storage Units: Metric

Bit #: 7 **Make:** Smith **Type:** FHi40 **IADC Series / Type:** 61 / 7
Serial #: PS9225 **Size:** 222.0 **Jets / Nozzles:** 14.30 / / / **T.F.A.:** 481.80
Depth In: 1,659.00 **Depth Out:** 1,962.00 **Made:** 303.00 **Rotating Hours:** 70.00
Average Drill Rate: 4.33 **Total Rotating Hours:** 343.50
Bit Grade / Condition I.A.D.C.: 5 / 8 / BT / M / E / 3 / CT / TQ / **T / B / G:** / /

Remarks:**Formations Drilled:****Drilling Parameters**

	Min	Max		Min	Max
Force on Bit:	21 /	23	R.P.M.:	20 /	20
Pump 1 S.P.M. / Volume:	130 /		Pump 2 S.P.M. / Volume:	70 /	
S.P.P.:	6,640 /	7,900	Fluid Density:	1,100 /	1,160
Drift Angle:	/		Funnel Viscosity:	43 /	70

Annular Velocity
Bottoms Up

Drill Collars:
Depth:

HeavyWeight Drill Pipe:
Theoretical:

Drill Pipe:
Actual:

Bit #: 8 **Make:** Smith **Type:** FHi45 **IADC Series / Type:** 61 / 7
Serial #: PX5296 **Size:** 222.0 **Jets / Nozzles:** 14.30 / / / **T.F.A.:** 481.80
Depth In: 1,962.00 **Depth Out:** 2,050.00 **Made:** 88.00 **Rotating Hours:** 33.00
Average Drill Rate: 2.67 **Total Rotating Hours:** 376.50
Bit Grade / Condition I.A.D.C.: 2 / 4 / FC / A / E / I / CT / CP / **T / B / G:** / /

Remarks:**Formations Drilled:****Drilling Parameters**

	Min	Max		Min	Max
Force on Bit:	21 /	23	R.P.M.:	20 /	20
Pump 1 S.P.M. / Volume:	/		Pump 2 S.P.M. / Volume:	/	
S.P.P.:	7,200 /	7,200	Fluid Density:	1,120 /	1,130
Drift Angle:	/		Funnel Viscosity:	42 /	45

Annular Velocity
Bottoms Up

Drill Collars:
Depth:

HeavyWeight Drill Pipe:
Theoretical:

Drill Pipe:
Actual:

Bit #: 1C **Make:** Quest **Type:** DC813L **IADC Series / Type:** /
Serial #: 1012 **Size:** 222.0 **Jets / Nozzles:** 11.10 / / / **T.F.A.:** 775.50
Depth In: 2,050.00 **Depth Out:** 2,051.50 **Made:** 1.50 **Rotating Hours:** 4.00
Average Drill Rate: 0.38 **Total Rotating Hours:** 380.50
Bit Grade / Condition I.A.D.C.: 8 / 3 / CC / N / X / I / FC / PR / **T / B / G:** / /

Remarks:**Formations Drilled:****Drilling Parameters**

	Min	Max		Min	Max
Force on Bit:	10 /	10	R.P.M.:	5,800 /	5,800
Pump 1 S.P.M. / Volume:	/		Pump 2 S.P.M. / Volume:	/	
S.P.P.:	1,130 /	1,130	Fluid Density:	1,130 /	1,130
Drift Angle:	/		Funnel Viscosity:	44 /	44

Annular Velocity
Bottoms Up

Drill Collars:
Depth:

HeavyWeight Drill Pipe:
Theoretical:

Drill Pipe:
Actual:

Bit Data

Storage Units: Metric

Bit #: 12 **Make:** Smith **Type:** S1613UBP **IADC Series / Type:** /
Serial #: JF5461 **Size:** 222.0 **Jets / Nozzles:** 11.10 / 11.10 / 11.10 / 11.10 **T.F.A.:** 774.10
Depth In: 2,435.00 **Depth Out:** 2,442.00 **Made:** 7.00 **Rotating Hours:** 3.50
Average Drill Rate: 2.00 **Total Rotating Hours:** 452.75

Bit Grade / Condition **I.A.D.C.:** 4 / 2 / BT / M / E / I / CT / PP / **T / B / G:** / /

Remarks:

Formations Drilled: Imperial

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	17 /	17	R.P.M.:	35 /	35
Pump 1 S.P.M. / Volume:	77 /	1	Pump 2 S.P.M. / Volume:	77 /	1
S.P.P.:	1,100 /	1,100	Fluid Density:	1,150 /	1,150
Drift Angle:	/		Funnel Viscosity:	50 /	50

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit #: 13 **Make:** Security **Type:** QH34D2R **IADC Series / Type:** 5 / 4
Serial #: 11254360 **Size:** 222.0 **Jets / Nozzles:** 11.10 / / / **T.F.A.:** 483.80
Depth In: 2,442.00 **Depth Out:** 2,582.00 **Made:** 140.00 **Rotating Hours:** 24.00
Average Drill Rate: 5.83 **Total Rotating Hours:** 476.75

Bit Grade / Condition **I.A.D.C.:** 4 / 2 / BT / M / E / I / CT / PR / **T / B / G:** / /

Remarks:

Formations Drilled: Imperial

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	23 /	23	R.P.M.:	35 /	40
Pump 1 S.P.M. / Volume:	77 /	1	Pump 2 S.P.M. / Volume:	77 /	1
S.P.P.:	13,500 /	14,000	Fluid Density:	1,160 /	1,220
Drift Angle:	/		Funnel Viscosity:	48 /	57

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit #: 14 **Make:** Smith **Type:** ii450D1PS **IADC Series / Type:** 61 / 7
Serial #: PX650 **Size:** 222.0 **Jets / Nozzles:** 12.70 / / / **T.F.A.:** 380.00
Depth In: 2,582.00 **Depth Out:** 2,632.00 **Made:** 50.00 **Rotating Hours:** 15.50
Average Drill Rate: 3.23 **Total Rotating Hours:** 492.25

Bit Grade / Condition **I.A.D.C.:** 1 / 1 / CT / B / E / I / WT / TQ / **T / B / G:** / /

Remarks:

Formations Drilled: Imperial

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	21 /	22	R.P.M.:	35 /	40
Pump 1 S.P.M. / Volume:	/		Pump 2 S.P.M. / Volume:	/	
S.P.P.:	13,400 /	13,650	Fluid Density:	1,270 /	1,280
Drift Angle:	/		Funnel Viscosity:	85 /	98

Annular Velocity **Drill Collars:** **HeavyWeight Drill Pipe:** **Drill Pipe:**
Bottoms Up **Depth:** **Theoretical:** **Actual:**

Bit Data

Storage Units:

Metric

Bit #: 18 **Make:** Smith **Type:** i450D1PS **IADC Series / Type:** 61 / 7
Serial #: PX6964 **Size:** 222.0 **Jets / Nozzles:** 12.70 / 12.70 / 12.70 / **T.F.A.:** 380.00
Depth In: 2,922.00 **Depth Out:** 3,132.00 **Made:** 210.00 **Rotating Hours:** 80.50
Average Drill Rate: 2.61 **Total Rotating Hours:** 668.50

Bit Grade / Condition I.A.D.C.: 3 / 2 / WT / A / E / I / BT / HR / T / B / G: / /

Remarks:

Formations Drilled:

Drilling Parameters

	Min	Max		Min	Max
Force on Bit:	/		R.P.M.:	/	
Pump 1 S.P.M. / Volume:	/		Pump 2 S.P.M. / Volume:	/	
S.P.P.:	/		Fluid Density:	/	
Drift Angle:	/		Funnel Viscosity:	/	

Annular Velocity
Bottoms Up

Drill Collars:
Depth:

HeavyWeight Drill Pipe:
Theoretical:

Drill Pipe:
Actual:

Wireline Logging Summary

Storage Units:

Metric

Logging Suite Number: 1
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: H. Gluth

Engineer: Michel Lapointe
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No
Maximum Deviation: 1.000 °
Hole Size: 444.5

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

	Measured Depth	True Vertical Depth
Casing Depth Driller	28.20	28.20
Casing Depth Logger	28.00	28.00
Total Depth Driller (Tally)	477.00	476.83
Total Depth Driller (Strap or SLM)		

General Remarks: The loggers began running their tools down hole @ 21:15 hrs, July 7th, tested their tools, and had to replace a failed density tool. After running into the hole, a bridge was hit at 180-181 m (MD), the well was logged out, and at surface a bowstring was removed off the resistivity tool and re-entry attempted but failed.. A clean out trip was then preformed. and at 16:00 hrs, July 8, 2012, a second attempt was made and the logs made it to bottom. Two logging runs were made due to the large diameter of the hole.

Wireline Logging Summary

Storage Units:

Metric

Logging Run #: 1
Date: Jul 7, 2012

Drilling Fluid Data

Drilling Fluid Type: Gel Chemical
Fluid Density: 1190.0 **Viscosity:** 125 **pH:** 8.0 **Fluid Loss:** 8.5

Mud Resistivity (Rm): 2.390 @ 26.9 °
Mud Resistivity (Rm) @ BHT: 2.790 @ 20.0 ° **Maximum Temperature:** 26.9 °
Mud Filtrate Resistivity (Rmf): 2.130 @ 26.9 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.990 @ 26.9 ° **Source (Rmc):** Flowline

Logging Run Information

Date on Bottom:
Total Depth Logger: (MD) (TVD)

Logging Tools: Platform express (Pex).

Remarks: The crews were bridged off at 181 meters (MD).

Hole Conditions: Poor, a wiper trip was not made prior to logging.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jul 8, 2012

Drilling Fluid Data

Drilling Fluid Type: Gel Chemical
Fluid Density: 1200.0 **Viscosity:** 85 **pH:** 8.5 **Fluid Loss:** 8.0

Mud Resistivity (Rm): 1.920 @ 23.4 °
Mud Resistivity (Rm) @ BHT: 1.430 @ 39.0 ° **Maximum Temperature:** 39.0 °
Mud Filtrate Resistivity (Rmf): 1.690 @ 23.4 ° **Source (Rmf):** Flow Line
Mud Cake Resistivity (Rmc): 1.640 @ 23.4 ° **Source (Rmc):** Flowline

Logging Run Information

Date on Bottom: Jul 8, 2012
Total Depth Logger: 370.30 (MD) 370.30 (TVD)

Logging Tools: Ran neutron, density, sonic, resistivity, gamma and sp tool from 0 - 377 meters (MD)

Remarks: Good crews.

Hole Conditions: Shales were badly washed out between 25 and 50 meters (MD).

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 2A
Wireline Logging Company: Schlumberger Wireline Services **Engineer:** Michel Lapointe
District: Grande Prairie **Unit Number:** 2034
Witness: Trevor Wall

Was Pressure Control Equipment Utilized: No **Maximum Deviation:** 18.900 °
Was the Logging Job Mechanically Assisted: No **Hole Size:** 311.0

Total Lost Time: 0.00
Loggers' Total Down Time: 0.00
Total Job Time (From Rig up to Rig down): 15.75

	Measured Depth	True Vertical Depth
Casing Depth Driller	374.60	374.59
Casing Depth Logger	375.00	374.99
Total Depth Driller (Tally)	1,197.00	1,168.28
Total Depth Driller (Strap or SLM)		

General Remarks: Job was completed in two separate runs.
Extremely rugose hole in Cretaceous section.
Begin rig in Run #1: 14:15Hrs July 25, 2012
Logging Tool on Bottom: 16:55Hrs
Logging Tool at surface: 18:30Hrs
Rig Down Tools: 19:15Hrs

Begin rig in Run #2: 19:30Hrs
Logging Tool on Bottom: 22:24Hrs
Logging Tool at surface: 12:20Hrs July 26, 2012
Rig Down Tools: 02:00Hrs

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: Jul 25, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer-Gel
Fluid Density: 1280.0 **Viscosity:** 130 **pH:** 9.0 **Fluid Loss:** 6.5

Mud Resistivity (Rm): 1.250 @ 17.0 °
Mud Resistivity (Rm) @ BHT: 0.790 @ 40.0 ° **Maximum Temperature:** 40.0 °
Mud Filtrate Resistivity (Rmf): 0.900 @ 17.0 ° **Source (Rmf):** Calculated
Mud Cake Resistivity (Rmc): 1.490 @ 17.0 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Jul 25, 2012
Total Depth Logger: 1,199.00 (MD) 1,170.15 (TVD)

Logging Tools: DSI-PSS (Dipole Sonic Imager; 4-Arm Caliper)

Remarks: Tools operated normally. Data is reliable.
Geologic, gas, and ROP data on the Geologic Striplog over intermediate hole has been shifted down to correlate with open hole logging data.

Hole Conditions: Sloughing shales and caved coals over Cretaceous section.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Jul 25, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer-Gel
Fluid Density: 1280.0 **Viscosity:** 130 **pH:** 9.0 **Fluid Loss:** 6.5

Mud Resistivity (Rm): 1.250 @ 17.0 °
Mud Resistivity (Rm) @ BHT: 0.790 @ 40.0 ° **Maximum Temperature:** 40.0 °
Mud Filtrate Resistivity (Rmf): 0.900 @ 17.0 ° **Source (Rmf):** Calculated
Mud Cake Resistivity (Rmc): 1.490 @ 17.0 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Jul 25, 2012
Total Depth Logger: 1,199.00 (MD) 1,170.15 (TVD)

Logging Tools: PEX-AIT-HGNS-PSS (Platform Express-Array Induction-Spectral Gamma-4 Arm Caliper)

Remarks: Barite corrected logs were processed on location.

Hole Conditions: Extremely rugose hole in shale sections adversely affects log response.

Wireline Logging Summary

Storage Units:

Metric

Logging Suite Number: 2B
Wireline Logging Company: Schlumberger
District: Grande Prairie
Witness: Harry Gluth

Engineer: Justin Easton
Unit Number: 2034

Was Pressure Control Equipment Utilized: No
Was the Logging Job Mechanically Assisted: No
Maximum Deviation: 18.900 °
Hole Size: 311.0

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

	Measured Depth	True Vertical Depth
Casing Depth Driller	1,197.00	1,168.28
Casing Depth Logger		
Total Depth Driller (Tally)	1,175.00	1,146.94
Total Depth Driller (Strap or SLM)		

General Remarks: Loggers flew from Grande Prairie, Alberta to Whitehorse, Yukon Territory, and drove to location. They arrived at 2 AM, August 2, 2012. Two runs were made in order vary the movement of debris and fluids trapped between the wellbore and intermediate casing. Loggers had the rig from 12:15 until 19:45 hrs.

Wireline Logging Summary

Storage Units:

Metric

Logging Run #: 1
Date: Aug 2, 2012

Drilling Fluid Data

Drilling Fluid Type: Gel Chem

Fluid Density: 1010.0

Viscosity:

pH:

Fluid Loss:

Mud Resistivity (Rm): @ °

Mud Resistivity (Rm) @ BHT: @ °

Mud Filtrate Resistivity (Rmf): @ °

Mud Cake Resistivity (Rmc): @ °

Maximum Temperature: 29.0 °

Source (Rmf):

Source (Rmc):

Logging Run Information

Date on Bottom: Aug 2, 2012

Total Depth Logger: 1,175.00 (MD) 1,146.94 (TVD)

Logging Tools: Ran an ultrasonic Imager log from 1175 to surface.

Remarks: The cement bond is poor above 600 meters (MD). A second run was made in order to confirm the movement of trapped air and debris.

Hole Conditions: Good.

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 **Maximum Deviation:** 9.000 °
Was the Logging Job Mechanically Assisted: No **Hole Size:** 222.0

Total Lost Time: 0.00
Loggers' Total Down Time: 0.00
Total Job Time (From Rig up to Rig down): 15.50

	Measured Depth	True Vertical Depth
Casing Depth Driller	1,194.00	1,165.36
Casing Depth Logger	1,196.00	1,167.30
Total Depth Driller (Tally)	3,132.00	3,089.01
Total Depth Driller (Strap or SLM)		

General Remarks: Job was completed in two separate runs.
Logging tools on both runs bridged off at 2218mMD.
Begin rig in Run #1: 15:45Hrs Sept 20, 2012
Logging Tool on Bottom: 17:28Hrs
Logging Tool at surface: 24:00Hrs
Rig Down Tools: 00:45Hrs Sept 21, 2012

Begin rig in Run #2: 01:00Hrs Sept 21, 2012
Logging Tool on Bottom: 02:38Hrs
Logging Tool at surface: 06:20Hrs
Rig Down Tools: 07:15Hrs

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: Sep 20, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1405.0 **Viscosity:** 75 **pH:** 9.5 **Fluid Loss:** 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.410 @ 55.5 ° **Maximum Temperature:** 55.5 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Sep 20, 2012
Total Depth Logger: 2,218.30 (MD) 2,178.63 (TVD)

Logging Tools: AIT-DSI-GPIT-PPC X2 (Array Induction-Dipole Sonic-General purpose inclinometry tool-Power positioning caliper X2)
PPC tool is a 4 arm caliper. 2 PPC components were run offset 45 degrees to one another.

Remarks: All date is reliable.

Hole Conditions: Hole shows erosion over some intervals, however it is largely in gauge.

Wireline Logging Summary

Storage Units:

Metric

Logging Run #: 2
Date: Sep 21, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1405.0 **Viscosity:** 75 **pH:** 9.5 **Fluid Loss:** 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.410 @ 56.7 ° **Maximum Temperature:** 56.7 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Sep 21, 2012
Total Depth Logger: 2,218.30 (MD) 2,178.63 (TVD)

Logging Tools: PEX-HNGS-PPC-TLD2 (Platform Express-Spectral Gamma-Power positioning Caliper-Dual Density)

Remarks: Density data is adversely affected in rugose hole.

Hole Conditions: As run 3.1

Wireline Logging Summary

Storage Units: Metric

Logging Suite Number: 4
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: 17.400 °
Hole Size: 222.0

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

	Measured Depth	True Vertical Depth
Casing Depth Driller	2,181.30	2,141.75
Casing Depth Logger	1,196.00	1,167.30
Total Depth Driller (Tally)	2,199.00	2,159.39
Total Depth Driller (Strap or SLM)		

General Remarks: Job was completed in four separate runs.
Hole was cleaned and conditioned to 2199mMD only.
Logging tools bridged at 2181.3mMD.
Begin rig in Run #1: 14:00Hrs Sept 30, 2012
Logging Tool on Bottom: 15:00Hrs
Logging Tool at surface: 18:30Hrs
Rig Down Tools: 19:00Hrs Sept 30, 2012

Begin rig in Run #2: 20:00Hrs Sept 30, 2012
Logging Tool on Bottom: 22:15Hrs
Logging Tool at surface: 06:20Hrs Oct 1, 2012
Rig Down Tools: 07:15Hrs

Begin rig in Run #3: 09:00Hrs Oct 1, 2012
Logging Tool on Bottom: 11:15Hrs
Logging Tool at surface: 23:00Hrs Oct 2, 2012
Rig Down Tools: 24:00Hrs

Begin rig in Run #4: 00:00Hrs Oct 3, 2012
Logging Tool on Bottom: 02:15Hrs
Logging Tool at surface: 13:00Hrs Oct 3, 2012
Rig Down Tools: 13:30Hrs

Begin rig in Run #5: 13:30Hrs Oct 3, 2012
Logging Tool on Bottom: 14:30Hrs
Logging Tool at surface: 15:45Hrs Oct 3, 2012
Rig Down Tools: 16:15Hrs

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 1
Date: Sep 30, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1380.0 Viscosity: 121 pH: 10.0 Fluid Loss: 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.450 @ 49.0 ° Maximum Temperature: 49.0 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° Source (Rmf): Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° Source (Rmc): Calculated

Logging Run Information

Date on Bottom: Sep 30, 2012
Total Depth Logger: 2,181.30 (MD) 2,141.75 (TVD)

Logging Tools: FMI-GPIT-PPC X2 (Formation Imager-General purpose inclinometry tool-Power positioning caliper X2)
PPC tool is a 4 arm caliper. 2 PPC components were run offset 45 degrees to one another.

Remarks: All tools calibrated and run in combination. Data appears reliable.

Hole Conditions: Hole is washed and elliptical from ICP to ~1348mMD, in gauge from 1348-1799mMD, mostly in-gauge with occasional elliptical zones to 2104mMD, then overgauge from 2104-2170mMD where data ends.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 2
Date: Sep 30, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1380.0 **Viscosity:** 121 **pH:** 10.0 **Fluid Loss:** 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.450 @ 49.0 ° **Maximum Temperature:** 49.0 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Sep 30, 2012
Total Depth Logger: 2,181.30 (MD) 2,141.75 (TVD)

Logging Tools: Stringray-CMR-ADT
(Stingray-Combinable Magnetic Resonance- Dielectric Tool)

Remarks: CMR data is merged with AIT data from run 3.2 for presentation purposes.
All data has been depth tied to previous runs.

Hole Conditions: See comments in run 4.1 above.

Wireline Logging Summary

Storage Units:

Metric

Logging Run #: 3
Date: Oct 1, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1380.0 **Viscosity:** 121 **pH:** 10.0 **Fluid Loss:** 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.450 @ 49.0 ° **Maximum Temperature:** 49.0 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Oct 3, 2012
Total Depth Logger: 2,181.30 (MD) 2,141.75 (TVD)

Logging Tools: MDT
Modulated Dynamic Tester

Remarks: Tool functioned faultlessly. All data is reliable. 4 fluid samples taken for 2 separate zones.

Hole Conditions: See comments in Run 4.1 above.

Wireline Logging Summary

Storage Units:

Metric

Logging Run #: 4
Date: Oct 2, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1380.0 **Viscosity:** 121 **pH:** 10.0 **Fluid Loss:** 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.450 @ 49.0 ° **Maximum Temperature:** 49.0 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° **Source (Rmf):** Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° **Source (Rmc):** Calculated

Logging Run Information

Date on Bottom: Oct 2, 2012
Total Depth Logger: 2,181.30 (MD) 2,141.75 (TVD)

Logging Tools: MSCT
Sidewall Coring Tool

Remarks: 51 sidewall cores cut and recovered. 100% recovery.

Hole Conditions: See comments in run 4.1 abaoove.

Wireline Logging Summary

Storage Units: Metric

Logging Run #: 5
Date: Oct 3, 2012

Drilling Fluid Data

Drilling Fluid Type: Polymer
Fluid Density: 1380.0 Viscosity: 121 pH: 10.0 Fluid Loss: 5.0

Mud Resistivity (Rm): 0.810 @ 17.8 °
Mud Resistivity (Rm) @ BHT: 0.450 @ 49.0 ° Maximum Temperature: 49.0 °
Mud Filtrate Resistivity (Rmf): 0.460 @ 17.8 ° Source (Rmf): Flowline
Mud Cake Resistivity (Rmc): 1.390 @ 17.8 ° Source (Rmc): Calculated

Logging Run Information

Date on Bottom: Oct 3, 2012
Total Depth Logger: 2,181.30 (MD) 2,141.75 (TVD)

Logging Tools: USIT
Ultra Sonic Imaging Tool
(Casing Drillwear log.)

Remarks: Data is reliable.

Hole Conditions: See comments in run 4.1 above.

Drill Stem Test Report

Storage Units:

Metric

Time and Gas Flow Rates m3/Day

10:25:55	0
10:25:10	0
10:25:25	41.21
10:25:40	0
10:26:10	23.89
10:26:25	9.78
10:26:40	0
10:26:55	0
10:27:10	10.95
10:27:25	0
10:27:40	0
10:27:55	3.11
10:28:11	0
10:28:25	09.76
10:28:41	9.78
10:28:56	0
10:29:11	10.17
10:29:26	0
10:29:41	0

Shut-in 1	11,238.0	17,871.0	21.00	The packer failed at the end of the test.
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Recovery: Recovered 1.79 m3 of fluid in the annulus of 368 meters of drill pipe. The resistivity of the mud was measured at .67 ohm/m at 25 C and the top middle and bottom of the liquid sample showed similar resistivities of .66, .61 and .60 ohm/m respectively. The fluid was gasified and lacked any H2S gas.

Analyses: Collected liquid samples were shipped to Core lab in Calgary.

Remarks: Only the initial flow and a portion of the initial shut in was performed. Gas flow rates were measured at approximately 9.78 cubic meters of gas per day.

Deviation / Directional Survey Report

Directional Drilling Company: Ark Directional Services
Directional Drillers: Andy Edwards/ Wayne Rosendahl/ Mike Mikus
Measured While Drilling (MWD) Hands: Denis Mifflin
Survey Type: magnetic
Survey Mode: MWD
Survey Date: Jun 29, 2012
Survey Calculation Method: minimum curvature
Target Azimuth: 300.27 °
Dog Leg Severity Characteristic: 30.00

Survey Tie-In Information

Tie-In Co-Ordinates

Latitude: 66.040930
Longitude: 137.185758
N / S: 158.5 meters West of the East Boundary of Unit A.
E / W: 296.3 meters North of the South Boundary of Unit A.

Measured Depth	T.V.D.	Drift Angle (°)	Azimuth (°)	+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: 66.49301
Longitude: 137.1857526
N / S: 7329565.45
E / W: 395189.91

Measured Depth	T.V.D.	Drift Angle (°)	Azimuth (°)	+N / -S Distance	+E / -W Distance	Vertical Section	DogLeg Severity
404.00	404.00	1.100	220.00	-2.87	-0.24	-1.18	1.70

Remarks: EM Pulse Tool.

Survey Points

Storage Units: Metric

Measured Depth	T.V.D.	Drift Angle (°)	Azimuth (°)	+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
391.99	391.98	0.790	184.50	-2.69	-0.21	-1.17	0.06
401.49	401.48	1.190	215.87	-2.84	-0.27	-1.19	2.08
410.79	410.77	1.010	235.87	-2.96	-0.40	-1.15	1.36
420.12	420.10	1.490	259.60	-3.03	-0.59	-1.02	2.24
429.58	429.56	1.890	278.89	-3.03	-0.86	-0.78	2.19
439.02	438.99	2.680	286.89	-2.94	-1.23	-0.42	2.70
448.48	448.44	3.600	294.27	-2.76	-1.71	0.09	3.18
457.80	457.73	4.700	299.50	-2.45	-2.31	0.76	3.74
467.15	467.04	5.710	305.56	-1.99	-3.02	1.61	3.69
476.48	476.32	6.900	304.86	-1.40	-3.86	2.63	3.83
485.79	485.54	8.310	308.38	-0.66	-4.84	3.85	4.78
495.10	494.74	9.320	310.09	0.24	-5.95	5.26	3.36
504.21	503.72	10.110	308.20	1.21	-7.14	6.78	2.81
513.86	513.20	11.600	310.57	2.37	-8.54	8.57	4.83
523.33	522.46	12.610	309.78	3.65	-10.06	10.53	3.24
532.47	531.35	14.190	309.96	5.01	-11.69	12.62	5.19
541.89	540.46	15.290	307.37	6.50	-13.56	14.99	4.08
551.39	549.60	16.300	306.40	8.05	-15.63	17.56	3.30
561.03	558.85	16.700	305.78	9.67	-17.84	20.28	1.36
570.73	568.13	17.090	305.70	11.31	-20.13	23.09	1.21
580.44	577.40	17.490	306.80	13.02	-22.46	25.96	1.60
590.26	586.76	17.710	304.29	14.74	-24.87	28.91	2.41
599.81	595.85	17.890	302.18	16.34	-27.31	31.83	2.10
609.44	605.01	18.020	301.70	17.91	-29.83	34.79	0.61
618.87	613.97	18.410	302.58	19.48	-32.33	37.74	1.52
628.38	622.99	18.500	302.58	21.10	-34.86	40.75	0.28
637.47	631.62	18.280	302.58	22.65	-37.28	43.61	0.73
646.20	639.91	18.300	300.30	24.08	-39.62	46.35	2.46
655.00	648.25	18.700	299.90	25.48	-42.03	49.14	1.43
664.86	657.58	18.980	298.97	27.04	-44.81	52.33	1.25
674.15	666.38	18.410	298.67	28.48	-47.42	55.31	1.87

683.70	675.45	18.110	298.58	29.91	-50.04	58.30	0.95
693.07	684.37	17.800	300.29	31.33	-52.56	61.18	1.96
702.71	693.55	17.400	297.87	32.75	-55.10	64.10	2.59
712.30	702.71	17.180	294.97	34.01	-57.66	66.94	2.78
721.73	711.72	17.310	298.58	35.27	-60.15	69.73	3.43
731.36	720.91	17.310	300.68	36.69	-62.64	72.59	1.95
740.46	729.61	17.010	301.26	38.07	-64.94	75.28	1.14
750.32	739.05	16.390	299.37	39.50	-67.39	78.11	2.51
759.66	748.02	16.080	301.70	40.83	-69.64	80.72	2.32
768.92	756.92	15.690	298.80	42.11	-71.82	83.26	2.86
780.44	768.02	15.690	299.59	43.63	-74.54	86.37	0.56
790.14	777.34	16.390	301.26	44.98	-76.85	89.05	2.59
799.83	786.63	16.610	298.09	46.34	-79.25	91.80	2.87
808.83	795.26	16.300	297.96	47.54	-81.50	94.35	1.04
818.09	804.16	15.820	299.59	48.78	-83.74	96.91	2.13
828.20	813.91	14.810	297.48	50.05	-86.09	99.58	3.42
836.80	822.22	14.810	297.57	51.07	-88.04	101.77	0.08
846.60	831.68	15.510	298.49	52.27	-90.30	104.34	2.27
854.80	839.58	15.910	297.48	53.31	-92.26	106.55	1.77
865.90	850.25	16.080	294.27	54.65	-95.01	109.60	2.43
872.16	856.26	15.910	294.44	55.36	-96.58	111.32	0.85
882.97	866.66	15.820	292.50	56.54	-99.29	114.25	1.49
891.65	875.01	16.000	291.01	57.42	-101.50	116.61	1.54
901.19	884.17	16.440	288.20	58.31	-104.01	119.22	2.83
910.85	893.43	16.790	285.65	59.11	-106.65	121.91	2.51
920.36	902.53	16.960	282.57	59.79	-109.33	124.56	2.87
930.20	911.95	16.610	282.48	60.40	-112.10	127.27	1.07
939.93	921.27	16.610	282.31	61.00	-114.82	129.91	0.15
949.70	930.64	16.520	281.78	61.58	-117.54	132.56	0.54
958.10	938.70	16.000	281.78	62.06	-119.85	134.79	1.86
967.30	947.56	15.470	282.04	62.58	-122.29	137.16	1.74
977.00	956.91	15.470	282.04	63.12	-124.82	139.62	0.00
986.40	965.96	15.910	282.66	63.66	-127.30	142.03	1.50
996.00	975.17	16.440	283.10	64.26	-129.91	144.59	1.70
1,005.85	984.61	16.880	281.96	64.87	-132.66	147.28	1.67

1,015.11	993.46	17.310	282.84	65.45	-135.32	149.87	1.63
1,024.49	1,002.42	17.310	283.36	66.09	-138.04	152.53	0.49
1,034.08	1,011.57	17.310	281.69	66.70	-140.83	155.25	1.55
1,043.07	1,020.15	17.490	282.31	67.26	-143.46	157.80	0.86
1,053.06	1,029.68	17.400	281.78	67.89	-146.39	160.65	0.55
1,063.08	1,039.25	17.230	282.13	68.51	-149.30	163.48	0.60
1,072.70	1,048.44	16.960	281.78	69.09	-152.07	166.16	0.90
1,081.70	1,057.05	16.880	283.10	69.66	-154.63	168.66	1.31
1,091.30	1,066.25	16.520	287.49	70.38	-157.29	171.32	4.10
1,101.00	1,075.56	15.910	291.10	71.28	-159.84	173.98	3.64
1,111.00	1,085.19	15.560	294.26	72.32	-162.34	176.66	2.78
1,120.81	1,094.64	15.470	296.93	73.45	-164.71	179.28	2.20
1,130.18	1,103.68	15.290	299.10	74.62	-166.90	181.76	1.93
1,139.72	1,112.88	15.210	299.27	75.84	-169.09	184.27	0.29
1,149.56	1,122.37	15.380	298.04	77.09	-171.37	186.87	1.12
1,159.04	1,131.51	15.290	297.60	78.26	-173.59	189.37	0.47
1,168.23	1,140.39	14.770	296.28	79.34	-175.71	191.75	2.03
1,178.00	1,149.84	14.500	296.37	80.43	-177.93	194.21	0.83
1,181.50	1,153.23	14.240	295.23	80.81	-178.71	195.08	3.29
1,202.29	1,173.41	13.710	298.84	83.09	-183.18	200.09	1.47
1,211.63	1,182.48	13.710	299.19	84.16	-185.11	202.30	0.27
1,221.80	1,192.37	13.540	298.67	85.32	-187.21	204.70	0.62
1,230.33	1,200.66	13.360	301.13	86.31	-188.93	206.68	2.11
1,239.95	1,210.02	13.620	302.36	87.49	-190.84	208.92	1.21
1,249.71	1,219.50	13.620	303.50	88.74	-192.77	211.22	0.83
1,258.91	1,228.44	13.540	304.29	89.95	-194.56	213.37	0.66
1,268.60	1,237.86	13.710	304.47	91.23	-196.45	215.65	0.54
1,279.13	1,248.09	13.620	305.26	92.66	-198.49	218.13	0.59
1,288.21	1,256.92	13.620	305.17	93.89	-200.23	220.26	0.07
1,297.76	1,266.20	13.620	306.05	95.20	-202.06	222.50	0.65
1,307.65	1,275.81	13.710	307.19	96.59	-203.94	224.82	0.86
1,317.43	1,285.31	13.800	307.81	98.01	-205.78	227.13	0.53
1,326.74	1,294.35	13.890	308.25	99.38	-207.54	229.34	0.45
1,336.16	1,303.50	13.800	308.51	100.78	-209.30	231.57	0.35
1,345.36	1,312.44	13.540	309.30	102.15	-211.00	233.72	1.04

1,355.01	1,321.81	13.710	309.65	103.59	-212.75	235.96	0.59
1,364.58	1,331.11	13.970	310.00	105.06	-214.51	238.22	0.86
1,373.61	1,339.86	14.240	309.83	106.47	-216.20	240.39	0.91
1,384.01	1,349.94	14.500	310.27	108.13	-218.17	242.93	0.81
1,392.91	1,358.54	15.210	310.17	109.60	-219.91	245.18	2.39
1,402.69	1,367.98	15.290	310.43	111.27	-221.88	247.71	0.32
1,412.43	1,377.37	15.290	314.56	113.00	-223.77	250.22	3.35
1,422.36	1,386.96	14.770	317.64	114.85	-225.55	252.70	2.88
1,431.84	1,396.15	13.970	318.96	116.61	-227.12	254.94	2.74
1,441.97	1,405.99	13.180	320.80	118.43	-228.65	257.18	2.67
1,451.89	1,415.66	12.480	319.66	120.12	-230.06	259.25	2.25
1,461.34	1,424.91	11.690	320.45	121.64	-231.33	261.11	2.56
1,469.94	1,433.34	11.070	321.33	122.95	-232.40	262.70	2.25
1,479.54	1,442.76	10.630	321.68	124.37	-233.53	264.38	1.39
1,488.51	1,451.59	10.020	321.86	125.63	-234.52	265.88	2.04
1,497.99	1,460.93	9.490	322.91	126.90	-235.50	267.36	1.77
1,507.28	1,470.10	9.140	319.05	128.07	-236.45	268.77	2.31
1,517.12	1,479.82	8.530	320.36	129.22	-237.43	270.19	1.96
1,527.14	1,489.74	7.820	316.67	130.29	-238.37	271.55	2.64
1,536.24	1,498.76	7.470	316.59	131.17	-239.20	272.71	1.15
1,546.94	1,509.37	7.120	318.17	132.17	-240.12	274.01	1.13
1,555.64	1,518.01	6.770	321.60	132.98	-240.80	275.00	1.87
1,565.34	1,527.65	6.420	323.00	133.86	-241.48	276.03	1.19
1,575.48	1,537.73	5.980	320.98	134.72	-242.15	277.05	1.45
1,585.16	1,547.36	5.540	318.96	135.46	-242.78	277.96	1.50
1,594.66	1,556.81	5.540	321.77	136.17	-243.36	278.82	0.86
1,604.42	1,566.53	5.270	319.66	136.88	-243.94	279.68	1.03
1,613.94	1,576.01	5.360	321.07	137.56	-244.51	280.51	0.50
1,623.44	1,585.47	5.270	322.91	138.25	-245.05	281.33	0.61
1,632.74	1,594.73	4.920	323.35	138.91	-245.54	282.09	1.14
1,642.64	1,604.59	4.920	325.20	139.60	-246.04	282.87	0.48
1,652.37	1,614.29	4.480	327.84	140.27	-246.48	283.58	1.51
1,661.65	1,623.55	4.220	328.89	140.87	-246.85	284.20	0.88
1,671.14	1,633.01	4.130	334.25	141.47	-247.18	284.79	1.27
1,680.24	1,642.09	3.690	341.90	142.05	-247.41	285.28	2.25

1,691.34	1,653.17	3.340	355.43	142.71	-247.55	285.73	2.43
1,699.74	1,661.55	3.160	3.87	143.18	-247.55	285.98	1.82
1,709.17	1,670.97	2.990	6.77	143.69	-247.51	286.19	0.73
1,718.65	1,680.44	2.990	9.41	144.18	-247.44	286.38	0.44
1,728.03	1,689.81	3.080	23.29	144.65	-247.30	286.49	2.36
1,737.54	1,699.30	3.340	38.06	145.10	-247.02	286.49	2.73
1,747.16	1,708.90	3.780	48.69	145.53	-246.61	286.35	2.47
1,757.23	1,718.95	4.480	56.78	145.97	-246.04	286.07	2.71
1,766.64	1,728.32	4.830	59.59	146.37	-245.39	285.71	1.33
1,776.08	1,737.73	4.920	56.34	146.80	-244.71	285.34	0.92
1,784.87	1,746.49	5.100	54.85	147.23	-244.07	285.01	0.76
1,794.48	1,756.06	5.190	55.64	147.72	-243.37	284.65	0.36
1,803.98	1,765.52	5.360	56.69	148.21	-242.64	284.27	0.62
1,814.07	1,775.56	5.270	57.66	148.71	-241.85	283.84	0.38
1,823.76	1,785.22	4.660	56.08	149.17	-241.15	283.47	1.94
1,833.11	1,794.54	4.570	58.89	149.58	-240.52	283.12	0.78
1,843.28	1,804.67	4.830	59.07	150.00	-239.80	282.72	0.77
1,852.74	1,814.10	4.830	57.13	150.43	-239.13	282.35	0.52
1,862.34	1,823.67	4.920	56.25	150.87	-238.45	281.99	0.37
1,872.14	1,833.43	4.830	54.23	151.35	-237.76	281.64	0.59
1,881.84	1,843.09	4.920	55.64	151.82	-237.09	281.29	0.46
1,891.24	1,852.46	5.010	54.06	152.29	-236.42	280.95	0.52
1,900.09	1,861.27	5.190	55.46	152.74	-235.78	280.63	0.74
1,909.35	1,870.50	5.360	58.89	153.20	-235.06	280.24	1.16
1,918.73	1,879.83	5.360	59.68	153.65	-234.31	279.82	0.24
1,928.18	1,889.24	5.360	61.18	154.09	-233.54	279.37	0.44
1,937.20	1,898.22	5.360	60.74	154.50	-232.81	278.94	0.14
1,946.82	1,907.80	5.270	60.21	154.94	-232.03	278.50	0.32
1,957.34	1,918.27	5.800	59.77	155.44	-231.15	277.99	1.52
1,967.23	1,928.11	6.240	56.69	155.99	-230.27	277.51	1.66
1,977.03	1,937.85	5.980	54.41	156.58	-229.41	277.06	1.09
1,986.36	1,947.14	5.630	53.44	157.14	-228.65	276.68	1.17
1,996.23	1,956.96	5.010	50.54	157.70	-227.93	276.34	2.05
2,005.65	1,966.35	4.570	48.61	158.21	-227.33	276.08	1.49
2,014.83	1,975.50	4.130	46.67	158.68	-226.81	275.87	1.52

2,025.21	1,985.86	4.040	45.88	159.19	-226.28	275.67	0.31
2,034.77	1,995.40	3.690	48.34	159.63	-225.81	275.48	1.22
2,044.24	2,004.85	3.430	52.21	160.00	-225.36	275.28	1.12
2,053.65	2,014.24	3.160	54.58	160.32	-224.92	275.07	0.96
2,064.84	2,025.42	2.990	54.23	160.67	-224.43	274.83	0.46
2,074.14	2,034.70	2.990	53.35	160.96	-224.04	274.63	0.15
2,083.60	2,044.15	3.160	54.14	161.26	-223.63	274.43	0.56
2,093.25	2,053.79	2.990	54.93	161.56	-223.21	274.22	0.54
2,103.39	2,063.91	2.720	59.33	161.84	-222.79	273.99	1.03
2,111.71	2,072.22	2.200	64.87	162.00	-222.47	273.80	2.06
2,122.62	2,083.13	2.290	69.00	162.17	-222.08	273.55	0.51
2,132.17	2,092.67	1.570	80.86	162.26	-221.77	273.33	2.57
2,141.74	2,102.24	0.970	135.53	162.22	-221.59	273.15	4.02
2,151.43	2,111.93	1.760	191.17	162.02	-221.56	273.02	4.50
2,161.07	2,121.56	2.900	199.78	161.64	-221.67	272.93	3.70
2,170.01	2,130.48	3.690	206.19	161.17	-221.87	272.87	2.92
2,180.65	2,141.10	4.390	203.91	160.49	-222.19	272.80	2.02
2,189.63	2,150.05	4.660	204.09	159.85	-222.48	272.72	0.90
2,198.74	2,159.13	4.570	207.69	159.19	-222.80	272.66	1.00
2,209.00	2,169.36	4.660	214.63	158.48	-223.22	272.68	1.65
2,217.41	2,177.74	4.830	214.90	157.91	-223.62	272.73	0.61
2,227.97	2,188.26	4.920	214.98	157.18	-224.13	272.80	0.26
2,237.82	2,198.07	4.820	219.91	156.51	-224.64	272.91	1.31
2,247.33	2,207.55	5.190	221.49	155.88	-225.18	273.06	1.25
2,257.04	2,217.22	5.100	224.39	155.25	-225.78	273.25	0.85
2,266.44	2,226.58	4.570	226.67	154.69	-226.34	273.46	1.80
2,274.95	2,235.07	4.660	225.79	154.22	-226.84	273.65	0.40
2,285.50	2,245.58	4.310	228.69	153.66	-227.44	273.89	1.19
2,295.02	2,255.08	4.040	223.86	153.18	-227.94	274.08	1.40
2,315.69	2,275.70	3.520	225.97	152.21	-228.90	274.42	0.78
2,334.59	2,294.58	2.020	234.58	151.62	-229.59	274.71	2.46
2,354.49	2,314.48	0.880	263.59	151.40	-230.03	274.98	1.99
2,382.47	2,342.45	1.140	6.24	151.65	-230.21	275.27	1.70
2,400.61	2,360.58	2.640	21.36	152.22	-230.04	275.40	2.59
2,420.10	2,380.04	3.600	26.55	153.18	-229.60	275.51	1.54

2,436.53	2,396.43	4.480	24.09	154.23	-229.11	275.62	1.64
2,455.94	2,415.79	4.310	53.53	155.35	-228.21	275.41	3.46
2,475.23	2,435.01	5.100	78.75	155.95	-226.79	274.48	3.41
2,494.61	2,454.32	4.920	91.50	156.10	-225.11	273.11	1.74
2,512.87	2,472.49	6.330	110.57	155.73	-223.39	271.43	3.82
2,531.76	2,491.26	6.940	111.10	154.95	-221.35	269.28	0.97
2,550.07	2,509.43	7.120	99.85	154.36	-219.20	267.12	2.27
2,569.84	2,529.05	7.030	98.44	153.97	-216.80	264.85	0.30
2,585.14	2,544.24	7.030	94.84	153.75	-214.94	263.13	0.86
2,606.20	2,565.12	7.820	90.71	153.63	-212.22	260.72	1.36
2,628.32	2,586.99	9.230	88.16	153.66	-208.94	257.91	1.98
2,637.96	2,596.51	9.400	88.16	153.71	-207.38	256.59	0.53
2,646.66	2,605.09	9.320	89.30	153.75	-205.97	255.39	0.70
2,656.12	2,614.43	9.320	93.08	153.71	-204.44	254.05	1.94
2,664.82	2,623.01	9.400	93.17	153.64	-203.02	252.79	0.28
2,674.92	2,632.98	9.400	94.75	153.52	-201.38	251.31	0.77
2,685.01	2,642.93	9.230	96.68	153.36	-199.75	249.82	1.06
2,694.25	2,652.05	9.140	98.88	153.16	-198.29	248.46	1.18
2,704.70	2,662.38	8.700	102.84	152.86	-196.70	246.93	2.17
2,713.88	2,671.46	8.260	110.48	152.47	-195.41	245.62	3.95
2,732.28	2,689.70	6.680	125.25	151.39	-193.29	243.25	4.03
2,751.42	2,708.75	4.570	136.50	150.20	-191.86	241.41	3.72
2,770.78	2,728.07	2.810	151.35	149.22	-191.10	240.27	3.08
2,789.78	2,747.05	2.720	186.24	148.36	-190.93	239.68	2.62
2,809.17	2,766.41	3.690	204.61	147.34	-191.24	239.43	2.17
2,819.76	2,776.98	3.520	201.89	146.73	-191.50	239.35	0.68
2,828.87	2,786.07	3.430	207.95	146.23	-191.73	239.30	1.24
2,847.58	2,804.75	3.160	209.53	145.28	-192.25	239.27	0.46
2,867.28	2,824.43	2.290	212.08	144.48	-192.73	239.28	1.34
2,886.13	2,843.27	1.490	195.38	143.92	-192.99	239.23	1.53
2,905.47	2,862.60	0.970	161.46	143.52	-193.01	239.04	1.35
2,925.86	2,882.99	1.410	132.81	143.19	-192.77	238.66	1.07
2,944.36	2,901.48	2.020	130.87	142.82	-192.35	238.12	0.99
2,964.86	2,921.96	2.460	144.14	142.23	-191.82	237.36	0.99
2,983.33	2,940.41	2.990	155.66	141.47	-191.39	236.61	1.23

3,001.42	2,958.48	3.160	174.91	140.54	-191.15	235.93	1.73
3,020.32	2,977.35	2.720	199.34	139.60	-191.25	235.55	2.09
3,039.36	2,996.38	2.020	223.25	138.93	-191.63	235.54	1.89
3,058.60	3,015.61	0.700	213.31	138.59	-191.93	235.62	2.08
3,079.48	3,036.49	0.620	118.66	138.42	-191.90	235.51	1.40

Drilling Fluid Summary

Storage Units: Metric

Drilling Fluid Type: Gel Chemical	From: 0	To: 377
Drilling Fluid Type: Polymer PHPA	From: 377	To: 3,132

Formation Top Summary

Storage Units:

Metric

Kelly Bushing Elevation:
Ground Elevation:

625.15
616.80

Casing Flange Elevation:

**** 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 <i>Burnthill Creek</i>		28.80	28.80	28.80	28.80	596.35	224.00
EAGLE PLAIN <i>Fishing Branch</i>		252.80	252.79	252.80	252.79	372.36	70.80
EAGLE PLAIN <i>Parkin</i> Upper Parkin		323.60	323.59	323.60	323.59	301.56	456.20
EAGLE PLAIN <i>Parkin</i> Orange Marker	837.00	779.80	767.40	779.80	767.40	-142.25	14.20
<i>Whitestone River</i>		794.00	781.04	795.20	782.19	-157.04	215.50
<i>PreCretaceous Unc</i>	1041.00	1003.00	981.88	1011.40	989.91	-364.76	71.50
PERMIAN <i>Jungle Creek</i>		1081.00	1056.38	1082.00	1057.34	-432.19	101.00
CARBONIFEROUS <i>Etrain</i>		1182.00	1153.72	1179.40	1151.20	-526.05	32.50
CARBONIFEROUS <i>Blackie</i>	1275.00	1209.20	1180.15	1211.90	1182.74	-557.59	476.40
<i>Hart River</i>	1658.00	1688.20	1650.04	1688.30	1650.14	-1024.99	75.80
<i>Hart River</i> CD Sands	1775.00	1764.00	1725.70	1763.40	1725.09	-1099.94	77.20
<i>Hart River</i> Hart River Shale	1830.00	1841.20	1802.60	1841.60	1803.00	-1177.85	21.60
<i>Hart River</i> AB Sands	1915.00	1862.80	1824.13	1862.80	1824.13	-1198.98	216.10

Formation Top Summary

Storage Units:

Metric

Kelly Bushing Elevation:
Ground Elevation:

625.15
616.80

Casing Flange Elevation:

**** 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
<i>Ford Lake</i>	2013.00	2078.90	2039.46	2078.80	2039.36	-1414.21	34.10
<i>Imperial</i>	2083.51	2113.00	2073.51	2113.00	2073.51	-1448.36	68.50
<i>Imperial Tuttle Member</i>		2181.50	2141.95	2180.00	2140.45	-1515.30	

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

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	28.80	28.80	596.35	224.00
Log Top	28.80	28.80	596.35	

Evaluation:

The Burnthill Creek Formation is represented within geophysical logs and samples, between 28.2 and 252.8mMD. The interval consists of interbedded siltstone, sandstone, shale, and minor coal. Sandstones in this interval are very porous between 170-180, 200-210 and 225-235mMD.

In drill cuttings these sandstones occur as unconsolidated, subangular to subrounded, occasionally angular, fine lower to upper medium, occasionally coarse upper quartz and varicolored chert grains. Between 175 and 180mMD chert granules are present and here are in part, present as conglomeratic matrix supported sandstone. Consolidated fragments are salt and pepper, light gray, light gray brown, friable, with 20-50% chert grains, are poor to moderately sorted, locally well sorted, siliceous, slightly dolomitic, pyritic, kaolinitic, locally sideritic, and locally are characterized with a light gray, off white, or medium brown argillaceous matrix. Coal grains or pyritic worm burrows are locally present also.

Porosity and shows are as follows; 1) between 170 and 180 meters (MD): 12-20% coal, black bitumen and kaolin plugged intergranular porosity, rare 10-12% visible intergranular porosity, very slow yellow green flash cut fluorescence. 2) between 200-210 meters (MD): with 25% maximum kaolin plugged intergranular porosity, slow yellow green flash cut fluorescence, and 3) between 225-235 meters (MD): < 25% coal, bitumen and kaolin plugged intergranular porosity, slow yellow green flash cut fluorescence.

Conclusion:

Porous sands within the Burnthill Creek show evidence of containing hydrocarbons, and show anomalous resistivity, but have a weak gas response while drilling at this location. These sands may have potential for hydrocarbon production at deeper depths in this basin, where natural hydrocarbon traps are present.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

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

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

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	252.80	252.79	372.36	70.80
Log Top	252.80	252.79	372.36	

Evaluation:

The Fishing Branch Formation is represented by interbedded sandstone, shale, siltstone and minor coal. It occurs both within drill cuttings and within geophysical logs, between 252.8 and 323.6mMD. Sandstones between 255 and 266mMD, and between 299 and 323.6mMD, display visible porosity in cuttings, show a poor gas response, contain residual hydrocarbons and are clearly water wet.

Sandstones occur predominately as unconsolidated, very fine upper to upper medium, locally coarse lower, subangular to subrounded, locally angular, quartz & variously colored chert grains. Sandstone between 298 and 300 mMD, contains floating chert granules. Consolidated fragments are salt and pepper, light gray, light brown, or off white, poor to moderately sorted, slightly dolomitic, siliceous or kaolinitic, locally sideritic, contain 20-50% chert grains, and locally contain coal.

Between 255 and 266 mMD sandstone displays traces of visible, black bitumen and kaolin plugged porosity ranging between 9 and 12%, and typically generated a slow, faint to good yellow green flash cut fluorescence. Geophysical logs do not confirm this porosity with separation between the neutron and density porosity curves approaching 9-12%. Between 298 and 323.6 mMD, drill cuttings display 6-12% visible and locally contain an abundance of kaolin & bitumen. Geophysical logs indicate the presence of porosity both visible and matrix reaching a maximum of approximately 25% between 318 and 321 mMD.

Conclusion:

The Fishing Branch Formation is water saturated.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

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: cenomanian
Age (Approx): 95 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	323.60	323.59	301.56	456.20
Log Top	323.60	323.59	301.56	

Evaluation:

The Upper Parkin is a sequence of deltaic to shallow marine carbonaceous shales, glauconitic sandstone, siltstone, and minor coal. The section from 323.6 to ~677mMD is distinctly more deltaic to lower shoreface, with an abundance of quartz litharenite or quartzose sandstone that is typically carbonaceous, and commonly glauconitic. Many of these sandstones also show patchy residual hydrocarbon staining, but have no visible fluorescence, give a weak dead oil cut, and have poor gas response on penetration. Thin coal seams and laminations are present to a depth of approximately 610mMD over this interval.

From ~677-780mMD the section is a monotonous dark gray slightly carbonaceous marine shale, with occasional medium to dark grayish brown laminations or thin beds that are slightly sideritic.

The shales and the coal display prominent jointing at a high angle to bedding, seen in the shale cuttings, and in large cavings in both the coal and shale on a bit trip at 881mMD, and on conditioning the hole for wireline logging at 1197mMD. The shale and coal over this section is particularly fragile, mostly as a result of this high angle jointing, where the rock appears to break more readily along joint planes, than bedding planes.

Conclusion:

There are several quartzose sandstones within a deltaic to lower shoreface sequence in the lower section of the Parkin from 538 to 672mMD. Many of these sandstones show a light amber residual oil staining, and give a weak cut fluorescence. Sandstones are typically very fine grained, with some beds grading to lower fine grained, and are cemented with silica & minor, to trace secondary calcite cement. Porosity is variable, and locally is seen on logs to be greater than 15% (545-548mMD). No significant gas shows occurred over these sandstones, and oil shows were judged to be "dead".

There are also several thin sandstones in the upper section of the Parkin. Porosity within these sandstones is either entirely occluded or very restricted, and none appear to have potential for economic hydrocarbon production.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

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

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

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	779.80	767.40	-142.25	14.20
Log Top	779.80	767.40	-142.25	

Evaluation:

The Middle Parkin "Orange Marker" (NCY nomenclature) occurs as a massive chert pebble conglomerate, described as medium to dark gray with a patchy greenish yellow & green matrix. Grains are predominately black, gray & brown chert with minor quartz & siliceous clasts in a poorly sorted dark siliceous, glauconitic & sideritic matrix. Clasts are well rounded & polished and mostly occur as coarse granules to pebbles. The conglomerate appears tight to having questionable porosity in samples, with a trace of residual hydrocarbon but no visible fluorescence, and gives a weak hazy cut. This was deemed as a very poor to questionable dead oil show during the sample evaluation. Open hole logs verify that this conglomerate is indeed tightly cemented, with negligible porosity.

The conglomerate rests on ~3 metres of very poorly sorted, very fine grained argillaceous and glauconitic sandstone and minor shale.

Conclusion:

The "Orange Marker" occurs as a massive chert pebble conglomerate, and is a very good stratigraphic marker in this region of the Eagle Plain Basin. The conglomerate is tightly cemented with silica, and although there is a trace of residual hydrocarbon, porosity is negligible, and no potential for hydrocarbon production exists over this section at this location.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

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

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

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	794.00	781.04	-155.89	215.50
Log Top	795.20	782.19	-157.04	

Evaluation:

The Whitestone River is a sequence of lower ramp marine shale with minor interbedded siltstone and sandy laminations, overlain by a sequence of upper ramp lithologies, dominated by siltstone, with minor interbedded very fine grained argillaceous sandstone and shale. Shales have a strong jointed fabric, and are characteristically slightly calcareous, carbonaceous in part, locally pyritic, and have silty and sandy laminations. Plant remains, and pelecypod fragments are seen throughout the section. Traces of glauconite can be seen throughout the section, but is more apparent in silts and sands below 850mMD.

Conclusion:

The Whitestone river is a sequence of marine shales and very fine grained clastics, where the lower half of the section is interpreted to have been deposited in a deep ramp, and the upper half of the section in middle and upper ramp depositional environments.

No hydrocarbon potential exists within the Whitestone River formation.

Group:
Formation: PreCretaceous Unc
Member:
Boundary Type: unconformable
Fault Type:

Era: paleozoic
Series: lower
Period: Cretaceous
Stage: albian
Age (Approx): 135 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1003.00	981.88	-356.73	71.50
Log Top	1011.40	989.91	-364.76	

Evaluation:

There is no definitive log pick for the Pre-Cretaceous Unconformity here. Lithology across the unconformity does have a different character above and below this pick however, with shales above the unconformity being somewhat carbonaceous, with scattered plant remains and having thin interbeds of glauconitic siltstone, and shales below the unconformity having thin beds of argillaceous limestone.

Conclusion:

The Pre-Cretaceous Unconformity is picked where shales change their character from a shallow marine influence above, to a deep marine influence below. The first carbonate bed is picked as the unconformity itself. A chert grained lag or storm deposit does appear to occur at 1018.5mMD, and may also be picked as the unconformity.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

Group: PERMIAN
Formation: Jungle Creek
Member:
Boundary Type: unconformable
Fault Type:

Era: paleozoic
Series: early
Period: Permian
Stage: Sakmarian
Age (Approx): 283 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1081.00	1056.38	-431.23	101.00
Log Top	1082.00	1057.34	-432.19	

Evaluation:

The Permian Jungle Creek is a complex sequence of interbedded sandstone, conglomerate, siltstone and shale. The sequence unconformable overlies the Carboniferous Ettrain formation. The lower ~52 metres of the Jungle Creek is dominated by shale, thin conspicuously glauconitic sandstone and conglomeritic beds, one massive 4 metre thick chert pebble conglomerate, and numerous thin pelecypod-rich siltstones, and poorly sorted sandstones. This lower sequence is overlain by ~45 metres of mostly massive chert pebble conglomerate and blocky fine grained sandstones with occasional shale partings. This upper part of the section is represented by at least 5 sequences of deposition, where there is a general trend for fining upwards, deposited in upper and lower shoreface depositional settings.

Logs reveal that blocky sandstones and conglomerates generally have fair to good intergranular porosity, and samples show traces of faint light amber oil staining, localized traces of interstitial bitumen, and typically give a faint yellowish green, moderately fast streaming or blooming fluorescing cut. Cuttings gas is slightly elevated over sandstones and conglomerates from 1088-1108mMD, and 1159-1162mMD, but did not appear overly significant. The Density-Neutron response shows a weak gas effect, and resistivity is anomalously high.

Conclusion:

The Jungle Creek is a complex sequence of upper and lower shoreface deposits, and frequently has abundant glauconite. Conglomerates and well sorted fine grained sandstones throughout the section typically have fair to good porosity, and show evidence of containing hydrocarbons, but shows were weak, and these porous beds do not appear to have potential for economic hydrocarbon production at this location.

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 625.15 Casing Flange Elevation:
Ground Elevation: 616.80

All Depths Measured from Kelly Bushing Elevation

Group: CARBONIFEROUS **Era:** paleozoic
Formation: Ettrain **Series:** middle
Member: **Period:** Pennsylvanian
Boundary Type: unconformable **Stage:** moscovian
Fault Type: **Age (Approx):** 310 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1182.00	1153.72	-528.57	32.50
Log Top	1179.40	1151.20	-526.05	

Evaluation:

The Ettrain formation is a sequence of middle to upper ramp argillaceous Brachiopod Wackestones and minor interbedded calcareous shale. Limestones become increasingly clean towards the top of the formation. Fossil content (brachiopod shell fragments & spines, occasional crinoid debris) appears greater in the upper 12 metres, and diminishes in the lower, more argillaceous section. The lower section also appears cherty, with common spicules. The Ettrain limestones are cryptocrystalline, dense and tight throughout.

Conclusion:

The Ettrain is a sequence of middle to upper ramp Brachiopod-Crinoid Wackestones and Cherty argillaceous limestones. The section has no porosity, and no hydrocarbon potential in this area of the basin, but may be a useful seismic marker due to its' juxtaposition with lithologies having dramatically different mechanic properties.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

Group: CARBONIFEROUS
Formation: Blackie
Member:
Boundary Type: conformable
Fault Type:

Era: paleozoic
Series: lower
Period: Pennsylvanian
Stage: bashkirian
Age (Approx): 312 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1209.20	1180.15	-555.00	476.40
Log Top	1211.90	1182.74	-557.59	

Evaluation:

The Blackie formation has a thick sequence (~327 metres true thickness) of middle to lower ramp argillaceous nodular crinoid-brachiopod wackestones, which are locally conspicuously cherty, containing up to 5-8% dark chert, overlain by ~111 metres of open marine dark calcareous shale with minor interbedded sandstone, siltstone and argillaceous mudstone and wackestone. Intermediate casing was run after the well was drilled to 1197mMD in anticipation of cutting and recovering a core over the top of the Blackie which occurs approximately 15 metres lower at 1211.9mMD. After Blackie shales were penetrated and evaluated, coring over the top of the Blackie was not conducted due to the low gas content in those shales.

The lower Blackie carbonates are typically very brittle, and had several gas shows, which are all believed to originate from gas-charged fractures. Fracture related gas shows were seen at 1365, 1402, 1579 and 1604mMD. The most significant show was at 1604mMD where a gas kick was flared at surface, producing a 1.5-2 metre flare. The sample evaluation suggests the fracture at 1604mMD is within a brachiopod wackestone. A sidewall core at 1616mMD was described as a crinoid wackestone. A DST over the fracture was inconclusive as the packers failed midway through the first shut-in period. Preliminary flow rates were approximately 9.75m³/day, and fluid samples taken from the drill string did not show any evidence of containing H₂S.

Another sidewall core, taken at 1440mMD was also described as a crinoid wackestone. This sample showed evidence of an open fracture, and had visible light brown low gravity oil within a crinoid fragment, suggesting that these rocks are indeed in the oil window.

Conclusion:

The Blackie shale section is somewhat anomalously gassy between 1230-1267mMD, but overall appears to be a poor candidate for shale gas production at this location. The underlying Blackie carbonate section, between 1357-1687mMD (1323-1650mTVD), has numerous gas-charged fractures. One fracture at 1604mMD produced gas into the wellbore on connections and trips until the mud weight was increased to 1150Kg/m³. A DST over this fracture indicated it would flow at ~10m³/day, and that the gas is not sour. Sidewall coring recovered argillaceous limestones and crinoid wackestones over the lower Blackie, and one core had a trace of low gravity brown oil within a crinoid fragment, suggesting the hydrocarbon maturation of these rocks is somewhere within the oil window.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

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

Era: paleozoic
Series: upper
Period: Mississippian
Stage: serpukhovian
Age (Approx): 320 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1688.20	1650.04	-1024.89	75.80
Log Top	1688.30	1650.14	-1024.99	

Evaluation:

The Hart River is a very complex sequence of interbedded clastics and carbonates that are grossly divided into four separate sequences representing lithologies accumulating in high stand, and low stand depositional settings. Low stand deposition is characterized by blocky prograding sandstone sequences, and high stands by carbonates, chert, shale and minor thin sandstones. Shales in the Hart River are calcareous, and typically anomalously radioactive. Abundant white specks are commonly seen in Hart River shales, and were thought to be phosphatic. Geochemical and petrological analysis is required to ascertain what these white specks are composed of, and what is giving these shales the very high gamma readings that are seen. Several shale sidewall core samples were taken from the Hart River. All sidewalls taken from shale sections were calcareous and typically silty, and all had a strong petroliferous to miasmatic odor, suggesting that these rocks have a relatively high organic component.

Low stands are subdivided into four gross sequences, where sandstones become the dominant lithology, named A, B, C and D in ascending order. A and B sandstones are massive blocky quartz-chert arenites to sublitharenites, and both have similar cementing agents, with primary silica, and secondary calcite and pyrobitumen cement. Sorting and porosity is better in the B sands, than the A sands at this location, presumably a function of the position within the low stand facies where the sands accumulated. Traces of hydrocarbons are seen throughout both these blocky sandstones, with one significant show in the A sand at 1926mMD, where cutting gas was briefly measured at 1564u. This show may have originated from a very thin porous bed, or like the shows in the Blackie carbonate, from a fracture. Gas values in the B sand were slightly elevated, but were not significant, and the B sand appears water saturated on logs.

C sands are thin and dispersed in a dominantly carbonate sequence over 23 metres from 1814-1837mMD, and are typically poorly sorted and tightly cemented.

D sands are coarse grained, poorly sorted, tightly cemented and relatively thick and massive. D sands are interbedded with thin bedded argillaceous limestones and dark gray to black shales.

No gas or hydrocarbon shows were seen to occur over the C & D sand sequences.

Conclusion:

Porosity within the Hart River sand sequences is restricted to the A and B sands only. B sands show the best porosity but appear water saturated on logs. One significant gas show in the A sand at 1926mMD was very brief, and either originates in a very thin bed, or a high angle fracture. Sandstones within the C and D sequences are tightly cemented, did not show evidence of containing hydrocarbons, and therefore have no potential for hydrocarbon production at this location.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

Group: Era: paleozoic
Formation: Hart River **Series:** upper
Member: CD Sands **Period:** Mississippian
Boundary Type: conformable **Stage:** serpukhovian
Fault Type: **Age (Approx):** 322 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1764.00	1725.70	-1100.55	77.20
Log Top	1763.40	1725.09	-1099.94	

Evaluation:

See Evaluation and Conclusion for Hart River above.

Conclusion:

Group: Era: paleozoic
Formation: Hart River **Series:** upper
Member: Hart River Shale **Period:** Mississippian
Boundary Type: conformable **Stage:** serpukhovian
Fault Type: **Age (Approx):** 323 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1841.20	1802.60	-1177.45	21.60
Log Top	1841.60	1803.00	-1177.85	

Evaluation:

The Hart River Shale occurs between 1841.6 and 1862.8 meters (MD) on geophysical logs. Sidewall cores were cut at 1857.9, 1857.8, 1857.7, 1851.2, 1851.1, 1851.0, 1850.9, 1844.1, 1844 and 1843.9 meters (MD). Background gas levels on penetrating this interval were low, averaging 35 units, with one gas show occurring at 1862 meters (MD), peaking at only 85 units.

In drill cuttings the Hart River Shale is described as medium to dark grayish brown to black, subfissile to subblocky, calcareous, carbonaceous, locally silty and/or sandy, with calcite cemented microfractures. The shale appeared phosphatic, and has minor limestone and cherty lower very fine to coarse grained sandstone partings. Sidewall core samples characteristically display a strong petroliferous odor.

Conclusion:

The Hart River Shale is a 21 metre thick sequence of anomalously radioactive shale, which may be phosphatic in nature, interbedded with thin beds of argillaceous limestone, and minor thin bedded cherty sandstone. Cuttings gas was low while penetrating this zone. The sidewall cores recovered over the Hart River Shale will no doubt add to the level understanding on the geochemistry and petrology of this sequence.

Formation Evaluations

Storage Units: Metric

Kelly Bushing Elevation: 625.15 Casing Flange Elevation:
Ground Elevation: 616.80

All Depths Measured from Kelly Bushing Elevation

Group: **Era:** paleozoic
Formation: Hart River **Series:** upper
Member: AB Sands **Period:** Mississippian
Boundary Type: conformable **Stage:** serpukhovian
Fault Type: **Age (Approx):** 325 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	1862.80	1824.13	-1198.98	216.10
Log Top	1862.80	1824.13	-1198.98	

Evaluation:

See Evaluation and Conclusion for Hart River above.

Conclusion:

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

Group: Ford Lake
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	2078.90	2039.46	-1414.31	34.10
Log Top	2078.80	2039.36	-1414.21	

Evaluation:

The Ford Lake is very similar lithologically to the Hart River Shale insofar as both sequences consist mostly of anomalously radioactive shale with subordinate thin bedded argillaceous limestone and minor sandstone. Additionally both sequences appear very stable, and nonreactive as evidenced by the caliper data over these intervals. Both sequences also show increased resistivity, and will react with a strong solvent to bleed out residual hydrocarbon residue, but neither fluoresce before being subjected to the solvent. Cuttings gas background levels are slightly elevated over the Ford Lake, but the gas content appears too low for a viable shale gas play in this formation in this region of the basin. Several sidewall cores were cut and recovered over the Ford Lake, and several of these underwent desorption analysis. The quantitative aspects of the desorption results are beyond the scope of this evaluation, however all Ford Lake samples were witnessed producing gas on desorption.

Conclusion:

The Ford Lake sequence looks uncannily similar to the lithologies seen in the Hart River Shale section. These two sections are obviously genetically similar, and may well be members within the same depositional system, and thus could be considered as part of the same formation. Both Ford Lake and the Hart River Shale are Mississippian, however the Ford Lake is believed to be approximately 15 million years older than the Hart River Shale.

Cuttings gas was low, however the Ford Lake samples did react with solvent (tetrachloroethylene) to give a slow cut, and leave a dark amber brown residual ring on the thumb plate. The section has anomalous radioactivity and resistivity, is nonreactive and very stable, and did show evidence of containing gas where sidewall cores were desorbed. Further evaluation, including geochemistry and pyrolysis will be useful in fully realizing the potential of this section for shale gas production within this region of the basin.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

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

Era: paleozoic
Series: late
Period: Devonian
Stage: Famennian
Age (Approx): 365 Million years.

	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2113.00	2073.51	-1448.36	68.50
Log Top	2113.00	2073.51	-1448.36	

Evaluation:

The Imperial is a very thick section (>1019m) of dark gray, or dark brownish gray, to locally black, carbonaceous, and largely non calcareous pyritic shale, frequently interbedded with poorly sorted and often very coarse grained to granular sandstones. Some intervals within the Imperial may also have thin argillaceous limestone partings. Coarse grained, poorly sorted blocky sandstones are particularly conspicuous between 2219-2272mMD, and are subdivided here as the Tuttle member. Shales can be locally siliceous or cherty and brittle, but are mostly relatively soft where not inundated with pyrite, are typically well compacted, and are seen to have a prominent jointed fabric. Shales are also commonly seen to have a sheared appearance, where grains are described as having slickensides. Overall, these shales are not particularly reactive, but will imbibe trace amounts of water, causing them to become somewhat wet, and therefore will swell slightly with time when drilled with a water based drilling fluid. This section is particularly unstable owing largely to the deformation, but also in part due to the inherent fragility of a fissile and slightly wettable shale.

The sandstones are typically extremely competent, being very well indurated, and tightly cemented with silica as the primary cementing agent. Several sandstones are seen to have intergranular porosity, and where porous invariably have anomalous cuttings gas (see: 2220-2223; 2269-2271; 2552; 2568-2571mMD). Where competent sandstones are in direct contact with fragile shales, ledges naturally form, and create bottlenecks where bridges are more prone to form when material caves back into the open hole. Both ledges and bridges can adversely affect open hole logging operations, particularly where the hole is deviated from vertical.

Imperial shales are carbonaceous to a degree, but for the most part are not overly gassy with the exception of the interval from 2716-2816mMD where cuttings gas increased from a background of 60 units to an average of 200+ units, peaking at 418 units. This interval was noticeably darker, becoming black, and would give a slow weak hazy cut when immersed in a strong solvent. Fractures and slickensides were also coincidentally more prominent over this interval.

Conclusion:

The Imperial is a very thick sequence of dark carbonaceous 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.

Shales are not overly gassy with the exception of the interval from 2716-2816mMD.

The Imperial shales are fractured, jointed, and sheared. The shales 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.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

<p>Group: Formation: Imperial Member: Tuttle Member Boundary Type: conformable Fault Type:</p>	<p>Era: paleozoic Series: upper Period: Devonian Stage: famennian Age (Approx): Million years.</p>
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	Measured Depth	True Vertical Depth	Subsea	Thickness
Sample Top	2181.50	2141.95	-1516.80	
Log Top	2180.00	2140.45	-1515.30	

Evaluation:

The Tuttle Member, as defined here, is located between 2180 and approximately 2270 meters (MD). The interval is represented by interbedded sandstone and shale. Significant gas shows (twice the background), occur between 2218 and 2221 meters (MD), and between 2262.5 and 2271 meters (MD). Liberated gas reached 127 units over a 35 unit background and 212 units over a 60 unit background, respectively.

Sandstone between 2218 and 2221 meters (MD) is as follows: Defined as a chert pebble sandstone: consolidated, off white, light brown, angular to subrounded, very fine upper to upper medium grained, occasionally coarse grained, rare chert granules & locally conglomeratic, poor to moderately sorted, abundant white, occasional gray, brown, dark gray chert grains, calcareous, dolomitic, siliceous, pyritic, locally with medium brown argillaceous cement, spotty 1-9% black dead bitumen plugged intergranular porosity, no cut fluorescence.

Sandstone between 2269 and 2272 meters (MD) is as follows: consolidated, salt and pepper, with abundant white, occasionally light to dark gray, trace black chert grains, very fine upper to coarse lower grained, occasionally coarse upper very coarse upper grained, angular to subrounded, moderately sorted, siliceous, calcareous, dolomitic, slightly pyritic, with silica overgrowths, slightly bituminous, grains pitted, occasional 6-9% visible intergranular porosity, no cut fluorescence.

Other salient sandstone intervals within the Tuttle Member occur between 1) 2226 and 2230 meters (MD); 2) 2239 and 2240 meters (MD), and 3) between 2243 and 2245 meters (MD).

Sandstone between 2226 and 2230 meters (MD) is as follows: occurs as a chert pebble sandstone: consolidated, off white, light brown, angular to subrounded, very fine lower to coarse lower, occasionally coarse upper to very coarse upper grained, rare chert granules & locally conglomeratic, poor to moderately sorted, abundant white, gray, brown, dark gray chert grains, calcareous, dolomitic, siliceous, pyritic, occasional fragments with brown argillaceous cement, grains commonly pitted, spotty 1-10, trace 13 % black dead bitumen plugged intergranular porosity, no cut fluorescence.

Sandstone between 2239 and 2240 meters (MD) is as follows: consolidated, salt and pepper, off white, light brown, commonly black & bitumen stained, fine to lower medium grained, occasionally with floating coarse quartz & chert grains, abundant white, occasionally gray, chert grains, poor to moderately sorted, siliceous, calcareous, dolomitic, pyritic, with 10-18% black, in part dead bitumen plugged intergranular porosity & rare bitumen fracture fill, trace 9% visible intergranular porosity, weak milky white flash cut fluorescence.

Sandstone between 2243 and 2245 metes (MD) is as follows: Defined as a chert pebble sandstone: consolidated, light brown, fine lower to very coarse upper, rare granules, subangular to subrounded, angular in part, poor to moderately sorted, conglomeratic & as a matrix supported conglomeratic sandstone, calcareous, dolomitic, siliceous, commonly with white, brown, gray chert grains, pyritic, spotty 6-9% black dead bitumen plugged intergranular porosity, no cut fluorescence.

Formation Evaluations

Storage Units:

Metric

Kelly Bushing Elevation: 625.15
Ground Elevation: 616.80

Casing Flange Elevation:

All Depths Measured from Kelly Bushing Elevation

Conclusion:

The Tuttle as defined here contains hydrocarbons.

Sample Descriptions

Storage Units: Metric

Burnthill Creek: 28.80 MD, 28.80 TVD, 596.35 SSL

28.20 to 30.00 (1.80)	100%	SANDSTONE light gray, consolidated, salt and pepper, silty to fine upper grained, subangular to subrounded, angular in part, moderately sorted, with 40-50 % chert grains, calcareous, carbonaceous, slightly micaceous, argillaceous, trace poor visible intergranular porosity, no cut fluorescence.
30.00 to 35.00 (5.00)	75%	SHALE medium gray, medium brown gray, subblocky, micromicaceous, slightly montmorillonitic, slightly silty, carbonaceous or calcareous.
	25%	SANDSTONE consolidated, salt and pepper, light gray, silty to very fine lower grained, locally with floating very fine upper quartz grains or very fine upper grained, commonly grading to sandy siltstone, commonly with gray brown argillaceous cement, micaceous, carbonaceous, slightly calcareous, tight, no shows.
35.00 to 40.00 (5.00)	50%	SHALE medium brown, medium gray, light gray, locally ferruginous, commonly silty, sandy, occasionally slightly montmorillonitic, rare carbonaceous flakes.
	50%	SANDSTONE 10-15% of fragments as unconsolidated, subangular to subrounded, fine upper to occasionally lower medium quartz grains, consolidated fragments: light gray, salt and pepper, very fine lower to very fine upper, occasionally fine lower to fine upper grained, subangular to subrounded, moderately to well sorted, argillaceous, slightly calcareous, commonly carbonaceous, slightly micaceous or sideritic, consolidated fragments tight, trace poor visible intergranular porosity, predominately tight, unconsolidated grain porosity?, trace black vitreous COAL.
40.00 to 45.00 (5.00)	100%	SHALE light brown, light brown gray, slightly hematitic or ferruginous, slightly montmorillonitic, micromicaceous, locally silty & sandy, 6% black vitreous COAL, trace light gray, silty to fine grained, tight, salt and pepper sandstone fragments.
45.00 to 50.00 (5.00)	75%	SANDSTONE consolidated, salt and pepper, light gray, predominately silty to very fine upper grained, occasional fine upper to lower medium to fine lower grained fragments, subangular to subrounded, moderately to occasionally well sorted, calcareous, argillaceous, locally with limonite or goethite, siderite or rare hematitic cement, micaceous, tight, trace poor visible intergranular porosity, trace COAL.
	25%	SHALE medium brown gray, light gray, occasionally with ferruginous cement, ferruginous nodules, slightly montmorillonitic, occasionally silty or sandy, slightly calcareous.

Sample Descriptions

Storage Units: Metric

50.00 to 55.00 (5.00)	75%	SANDSTONE light gray, rare fragments with yellow to orange limonite? argillaceous cement, salt and pepper, predominately silty to very fine lower grained, locally very fine upper grained, subangular to subrounded, slightly calcareous & dolomitic, argillaceous, micaceous, carbonaceous, tight, rare fragments with abundant very fine carbonaceous or coaly laminae, trace COAL.
	25%	SHALE light gray, medium brown gray, ironstone concretions, goethite, limontie staining, micromicaceous, commonly slightly silty.
55.00 to 60.00 (5.00)	70%	SANDSTONE consolidated, salt and pepper, predominately silty to very fine upper grained, < 20% of fragments fine lower or rarely fine upper grained, moderately sorted, subangular to subrounded, angular in part, dolomitic, trace calcite, commonly argillaceous, carbonaceous, micaceous, occasional carbonaceous partings, tight, no shows.
	40%	SHALE light gray, medium brown, medium brown gray, subblocky, commonly silty, sandy or carbonaceous, occasional ironstone fragments.
60.00 to 65.00 (5.00)	50%	SANDSTONE consolidated, light gray, salt and pepper, silty to very fine upper grained, locally fine lower or very fine lower grained, subangular to subrounded, moderately sorted, dolomitic, slightly calcareous, commonly with gray argillaceous cement, micaceous, carbonaceous, no visible intergranular porosity, no cut fluorescence, locally with ferruginous cement.
	25%	SHALE gray, light gray brown, occasionally dark brown & very coaly or carbonaceous, commonly silty & sandy.
	25%	COAL post-trip sample, black, locally pyritic, vitreous, brittle.
65.00 to 70.00 (5.00)	85%	SANDSTONE consolidated, light gray, salt and pepper, predominately silty to very fine upper grained, occasionally fine lower grained, rare fine upper grained fragments, predominately moderately sorted, silty, argillaceous, dolomitic, commonly brittle & friable, carbonaceous, micaceous, tight, no cut fluorescence, trace COAL.
	15%	SHALE light brown, light brown gray, medium brown, occasional ferruginous nodules, slightly silty & sandy.
70.00 to 75.00 (5.00)	55%	SANDSTONE consolidated, salt and pepper, subangular to subrounded, angular in part, silty to very fine lower grained, grading in part to sandy siltstone, occasional fine lower grained fragments, predominately moderately sorted, argillaceous, dolomitic, carbonaceous, micaceous, tight, no shows.

Sample Descriptions

Storage Units: Metric

70.00 to 75.00 (5.00)	45%	SHALE medium gray brown, subblocky, micromicaceous, slightly montmorillonitic, commonly silty & sandy, rare ironstone, grading in part to argillaceous sandy siltstone.
75.00 to 80.00 (5.00)	70%	SANDSTONE light gray, salt and pepper, angular to subrounded, silty to very fine upper grained, rare fine lower grained fragments, moderately sorted, argillaceous, carbonaceous, dolomitic, very poor grain relief, micaceous, 6% as fractured siderite nodules or ferruginous nodules, tight, no shows,
	30%	SHALE light brown, light to medium brown gray, sub platy to blocky, montmorillonitic, occasionally silty & sandy, micromicaceous, rare carbonaceous flakes.
80.00 to 85.00 (5.00)	100%	SHALE light gray, medium brown, commonly medium to dark gray, sub platy to blocky, micromicaceous, occasionally silty & sandy, 5% as fractured ironstone or siderite nodules, with <10% as light gray, consolidated, salt and pepper, dolomitic, argillaceous, tight, sandy siltstone & silty to very fine lower grained salt and pepper sandstone fragments.
85.00 to 90.00 (5.00)	70%	SHALE medium brown, medium brown gray, sub platy to blocky, micromicaceous, commonly slightly silty, sandy or carbonaceous, slightly dolomitic or calcareous, 5% as fractured siderite & ironstone nodules.
	20%	SANDSTONE light gray, consolidated, salt and pepper, silty to very fine lower, locally very fine upper grained or with floating very fine upper quartz & chert grains, moderately sorted, dolomitic, slightly calcareous, argillaceous, carbonaceous, micaceous, tight.
	10%	SILTSTONE light gray, sandy, salt and pepper, dolomitic, slightly carbonaceous, micaceous, soft, grading in part to silty shale, tight no shows.
90.00 to 95.00 (5.00)	70%	SHALE light gray, predominately light to medium brown, sub blocky to blocky, micromicaceous, slightly silty, sandy, abundant fractured siderite & ironstone fragments, dolomitic.
	30%	SILTSTONE consolidated, salt and pepper, sandy & in part grading to silty to very fine lower grained, dolomitic, tight sandstone, with <10% as silty to very fine lower, occasionally very fine upper grained, consolidated, salt and pepper, argillaceous, dolomitic, carbonaceous, micaceous, tight, sandstone fragments.
95.00 to 100.00 (5.00)	70%	SHALE light gray, light to medium gray brown, sub platy to blocky, commonly silty, slightly sandy, carbonaceous, slightly montmorillonitic, with 15% of fragments as fractured siderite & ironstone nodules, slightly dolomitic.

Sample Descriptions

Storage Units: Metric

95.00 to 100.00 (5.00)	30%	SANDSTONE consolidated, salt and pepper, silty to very fine lower, occasionally very fine upper grained, subangular to subrounded, angular in part, moderately sorted, argillaceous, dolomitic, carbonaceous, micaceous, tight, no shows, 3% COAL, grading in part to sandy siltstone.
100.00 to 105.00 (5.00)	75%	SHALE light to medium gray, commonly silty, slightly carbonaceous, 5% as fractured siderite & ironstone nodules, slightly montmorillonitic.
	25%	SANDSTONE consolidated, salt and pepper, silty to very fine lower, occasionally very fine upper grained, grading in part to sandy siltstone, subangular to subrounded, angular in part, moderately sorted, argillaceous, dolomitic, micaceous, carbonaceous, tight, no shows, 3% COAL.
105.00 to 110.00 (5.00)	85%	SHALE light to medium gray, sub platy to blocky, micromicaceous, commonly silty, slightly carbonaceous, rare very carbonaceous & dark brown blocky shale fragments, 3-4% as fractured siderite & ironstone nodules.
	15%	SILTSTONE light gray, salt and pepper, argillaceous, dolomitic, commonly sandy & locally grading to silty to very fine lower grained, tight, sandstone, slightly carbonaceous & micaceous.
110.00 to 115.00 (5.00)	100%	SHALE light gray, commonly medium gray, medium gray brown, sub platy to blocky, micromicaceous, commonly silty, 3% as fractured siderite or ironstone nodules, 10% of fragments very silty & grading to argillaceous siltstone, rare consolidated, salt and pepper, silty to very fine upper, rare very fine upper grained, moderately sorted, argillaceous, tight, salt and pepper sandstone fragments.
115.00 to 120.00 (5.00)	80%	SHALE medium gray, medium brown gray, sub platy to subblocky, micromicaceous, commonly silty, slightly carbonaceous, with abundant fractured siderite & ironstone nodules.
	20%	SANDSTONE consolidated, salt and pepper, light gray, off white, light gray brown, predominately silty to very fine upper grained, with < 5% of fragments fine lower to fine upper grained, subangular to subrounded, angular in part, moderately sorted, with < 35% chert grains, dolomitic, commonly friable, micaceous, argillaceous, carbonaceous, fine upper fragments with traces of poor intergranular porosity, no cut fluorescence, matrix porosity?

Sample Descriptions

Storage Units: Metric

120.00 to 125.00 (5.00)	100%	SHALE medium gray (dry), medium brown gray, medium brown (wet), sub platy to occasionally blocky, micromicaceous, commonly silty, locally carbonaceous, rare montmorillonitic fragments, 6% as light brown, fractured ironstone nodules, trace light gray, very fine lower to fine lower grained, moderately sorted, predominately subangular to subrounded, micaceous, tight, carbonaceous sandstone fragments.
125.00 to 130.00 (5.00)	100%	SHALE 10% off white, montmorillonitic, predominately medium gray (dry) or medium brown gray (wet), commonly silty, sub platy to subblocky, micromicaceous, dolomitic.
130.00 to 135.00 (5.00)	100%	SHALE medium brown gray (wet), medium gray (dry), micromicaceous, slightly silty & slightly montmorillonitic, occasional coal partings, with 15-20% as black, vitreous, locally pyritic COAL.
135.00 to 140.00 (5.00)	80%	SHALE medium gray, micromicaceous, slightly silty & slightly montmorillonitic, occasional coal partings, with 15-20% as black vitreous, locally pyritic COAL.
	20%	SILTSTONE light gray, consolidated, salt and pepper, argillaceous, sandy, grading in part to very fine lower grained sandstone, dolomitic, argillaceous, micaceous, trace very fine lower to very fine upper grained, subangular to subrounded, moderately to well sorted, tight sandstone fragments, abundant LCM in sample.
140.00 to 145.00 (5.00)	80%	SHALE light to medium gray, sub platy to subblocky, micromicaceous, light gray fragments commonly montmorillonitic, slightly carbonaceous, & silty, medium gray or medium gray fragments commonly silty, trace fractured siderite nodules.
	20%	SILTSTONE consolidated, light gray, medium gray, sandy in part & grading to silty & argillaceous very fine lower grained sandstone, dolomitic, carbonaceous, micaceous, tight.
145.00 to 150.00 (5.00)	75%	SHALE medium brown, occasionally light gray, commonly silty, micromicaceous, slightly carbonaceous.
	25%	SANDSTONE consolidated, light gray, salt and pepper, predominately silty to very fine lower grained, locally very fine upper to rare fine lower grained, moderately to rare well sorted, subangular to subrounded, dolomitic, commonly silty, argillaceous, carbonaceous, tight, grading in part to sandy siltstone, no shows.

Sample Descriptions

Storage Units: Metric

150.00 to 155.00 (5.00)	75%	SHALE medium brown, medium brown gray, predominately medium gray, sub platy to blocky, micromicaceous, trace very fine carbonaceous flakes, commonly silty, rare montmorillonitic fragments.
	25%	SANDSTONE consolidated, salt and pepper, light gray, light gray brown, very fine lower to very fine upper grained, rare fine lower to fine upper grained fragments, subangular to subrounded, commonly silty, well to predominately moderately sorted, dolomitic, argillaceous, carbonaceous, micaceous, tight, no shows.
155.00 to 160.00 (5.00)	90%	SHALE light gray, predominately medium brown (wet), sub platy to blocky, micromicaceous, slightly silty, rare slightly montmorillonitic fragments, scattered fractured siderite nodules.
	10%	SANDSTONE consolidated, salt and pepper, light gray, light gray brown, subangular to subrounded, silty to very fine upper grained, moderately sorted, carbonaceous, dolomitic, argillaceous, micaceous, tight, no shows, post-trip sample.
160.00 to 165.00 (5.00)	80%	SANDSTONE light brown, consolidated, salt and pepper, silty to very fine upper grained, moderately sorted, subangular to subrounded, dolomitic, commonly with gray to gray brown argillaceous cement, with light & dark mica flakes, slightly carbonaceous & sideritic, tight, no shows.
	20%	SHALE light gray, light gray green (wet), sub platy, silty, micromicaceous, slightly montmorillonitic.
165.00 to 170.00 (5.00)	100%	SANDSTONE predominately as unconsolidated fine lower to upper medium, rare coarse lower, subangular quartz & white, black, gray, rare green chert grains, consolidated fragments salt and pepper, light gray, very fine upper to upper medium grained, poor to moderately sorted, friable, dolomitic, slightly siliceous, locally with light brown argillaceous cement, trace glauconite, rare COAL grains, slightly kaolinitic & sideritic, trace 1-4% intergranular porosity, kaolin matrix porosity?, unconsolidated grain porosity? very slow green flash cut fluorescence.
170.00 to 175.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, angular to subrounded, fine lower to upper medium, rare coarse lower quartz & black, white, occasionally yellow or brown chert grains, consolidated fragments salt and pepper, light gray, light gray brown, poor to moderately sorted, with 50% or more chert grains, slightly dolomitic & siliceous, friable to firm, patchy off white or light brown intergranular kaolin, trace intergranular bitumen, occasional fragments with 1 to rare 10% visible intergranular porosity, slightly sideritic, kaolin matrix porosity?, very slow good green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

175.00 to 180.00 (5.00)	100%	SANDSTONE predominately as unconsolidated fine lower to upper medium, occasionally coarse lower quartz & chert grains & rare brown chert granules, conglomeratic in part & matrix supported, consolidated fragments salt and pepper, light gray, light gray brown, fine lower to upper medium grained, angular to subrounded, with 20-45% chert grains, moderately to locally well sorted, rare pyritic worm burrows, rare coal grains, rare pyrite, commonly friable, slightly siliceous, dolomitic, fine grained fragments with light gray predominately medium brown argillaceous cement, rare kaolin, medium grained fragments with rare 1-12% black bitumen plugged intergranular porosity, slightly sideritic, occasional 10-12% visible intergranular porosity, 12-20% coal plugged intergranular & kaolin plugged matrix porosity?, unconsolidated grain porosity?, very slow good green flash cut fluorescence.
180.00 to 185.00 (5.00)	100%	SHALE medium brown, sub blocky, montmorillonitic, micromicaceous, slightly carbonaceous, rare silt, with <6% light gray, very argillaceous, tight siltstone & silty to very fine upper grained sandstone fragments.
185.00 to 190.00 (5.00)	100%	SHALE medium brown, medium brown gray, medium gray (wet), sub platy micromicaceous, slightly silty & slightly montmorillonitic, 7% light gray, silty to very fine lower grained, consolidated, salt and pepper, argillaceous, dolomitic, micaceous, tight sandstone fragments.
190.00 to 195.00 (5.00)	100%	SHALE medium gray (dry), light to medium brown, medium brown gray (wet), montmorillonitic, micromicaceous, trace light brown, light gray, sandy siltstone & silty sandstone fragments.
195.00 to 200.00 (5.00)	90%	SANDSTONE 10% as light to medium brown, consolidated, salt and pepper, silty to very fine lower, grading to very fine upper grained, locally with floating medium quartz & chert grains, poor to moderately sorted, dolomitic, micaceous, friable sandstone commonly with light gray brown argillaceous cement, with trace poor visible intergranular porosity, locally with white intergranular kaolin, predominately as unconsolidated fine lower to upper medium, trace very coarse upper quartz & varicolored chert grains, subangular to subrounded, rare white kaolin rims, slightly sideritic, rare black bitumen or carbonaceous rims, trace massive pyrite, 6% kaolin plugged porosity, unconsolidated grain porosity?, slow green flash cut fluorescence.
	10%	SHALE medium brown, sub platy to blocky, commonly silty & sandy, micromicaceous, slightly carbonaceous.
200.00 to 205.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, fine lower to coarse upper, subangular to subrounded, quartz & white, black, brown, rare green chert grains, consolidated fragments slightly dolomitic, slightly sideritic, slightly siliceous, locally pyritic, kaolinitic, scattered 6, occasional 9-12% visible & kaolin plugged intergranular porosity, very slow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

205.00 to 210.00 (5.00)	100%	SANDSTONE as unconsolidated, subangular to subrounded, fine lower to medium, trace coarse lower quartz & varicolored chert grains, grain commonly with very fine druse, consolidated fragments, light gray, salt and pepper, with abundant chert grains, dolomitic, friable, slightly siliceous, slightly kaolinitic, sideritic, occasional 6-10 % visible intergranular porosity, kaolin & black bitumen plugged intergranular porosity?, occasional fragments with 25 % kaolin plugged intergranular porosity? unconsolidated grain porosity?, slow yellow green flash cut fluorescence, trace COAL.
210.00 to 215.00 (5.00)	80%	SANDSTONE predominately as unconsolidated, subangular to subrounded, fine lower to coarse lower quartz & varicolored chert grains, consolidated fragments salt and pepper, light gray, light gray brown, predominately fine lower to fine upper, locally lower medium grained or with floating coarse lower chert grains, slightly dolomitic, friable, carbonaceous, commonly silty or with light gray brown argillaceous cement, slightly siliceous, poor to moderately sorted, slightly kaolinitic, scattered 1-9% visible intergranular porosity, very slow green flash cut fluorescence.
	20%	SHALE medium brown, medium brown gray, sub platy to subblocky, micromicaceous, commonly silty.
215.00 to 220.00 (5.00)	70%	SHALE medium brown, occasionally light brown, sub platy to blocky, micromicaceous, commonly slightly silty, sandy or montmorillonitic.
	30%	SANDSTONE consolidated, salt and pepper, light gray, light brown, subangular to subrounded, silty to very fine lower grained, locally very fine upper grained, well to moderately sorted, commonly with light brown argillaceous cement, slightly micaceous, dolomitic, carbonaceous, tight. 10% black COAL.
220.00 to 225.00 (5.00)	85%	SANDSTONE light gray, light gray brown, consolidated, salt and pepper, with < 25% chert & carbonaceous grains, silty to very fine upper grained, occasionally fine lower grained, subangular to subrounded, moderately sorted, slightly dolomitic, silty, carbonaceous, micaceous, bituminous or tarry & with. slow green flash cut fluorescence, occasional fragments with very fine coaly laminae, slightly kaolinitic, no visible porosity, 35% as unconsolidated, subangular to subrounded, fine upper to lower medium quartz & chert grains, unconsolidated grain porosity? questionable sample quality
	15%	SHALE medium brown, sub blocky, commonly silty, grading to argillaceous siltstone, carbonaceous, micromicaceous.

Sample Descriptions

Storage Units: Metric

225.00 to 230.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, subangular to subrounded, occasionally angular, fine upper to upper medium quartz & varicolored chert grains, consolidated fragments salt and pepper, light gray, light gray brown , with 20-40% chert grains, silty to upper medium grained, poor to moderately sorted, slightly dolomitic, siliceous, friable, slightly micaceous, slightly kaolinitic, carbonaceous, slightly bituminous or tarry, abundant kaolin plugged, coal & minor bitumen plugged porosity, occasional 10% visible intergranular porosity, slow weak green flash cut fluorescence.
230.00 to 235.00 (5.00)	85%	SANDSTONE 50-60% of sample as unconsolidated, subangular to subrounded, fine upper to upper medium, rare coarse lower, quartz & varicolored chert grains, consolidated, fragments light gray, light gray brown, salt and pepper, slightly dolomitic & sideritic, very fine upper to medium grained, poor to moderately sorted, kaolinitic, carbonaceous, siliceous, rare massive pyrite, feldspathic?, locally with coal grains or with rare faint coaly laminations, occasional 1-9% visible intergranular porosity, kaolin matrix porosity?, with minor black bitumen or tar plugged intergranular porosity, slow yellow green flash cut fluorescence, 15% log porosity?
	15%	SHALE medium gray, medium brown (wet), light to medium gray (dry), sub platy to blocky, micromicaceous, slightly montmorillonitic, silty, slightly carbonaceous.
235.00 to 240.00 (5.00)	100%	SHALE medium brown, medium brown gray, medium gray (wet), medium to dark gray (dry), sub platy to subblocky, micromicaceous, commonly silty, grading in part to very argillaceous siltstone, slightly montmorillonitic, trace fractured siderite nodules, occasional carbonaceous partings, slightly montmorillonitic, 4% as fractured siderite nodules, trace COAL.
240.00 to 245.00 (5.00)	100%	SHALE 20% very light gray to white, sub platy, montmorillonitic, silty, micromicaceous, predominately medium brown, sub platy to occasionally blocky, micromicaceous, montmorillonitic, carbonaceous, 10% as fractured siderite nodules, minor limestone mud additive, slightly dolomitic.
245.00 to 250.00 (5.00)	100%	SHALE predominately medium brown, (wet) sub platy to subblocky, micromicaceous, silty, rare montmorillonitic fragments, 25% very light gray, more montmorillonitic, micromicaceous, slightly silty, 3% fractured siderite nodules, trace light brown gray, argillaceous, consolidated, salt and pepper, sandy siltstone fragments.

Fishing Branch: 252.80 MD, 252.79 TVD, 372.36 SSL

250.00 to 255.00 (5.00)	100%	SHALE 40% off white gray, commonly with abundant rounded fine upper to lower medium siderite nodules, montmorillonitic, slightly silty, predominately medium brown, sideritic, silty, 7% light gray, off white, silty to very fine lower grained, commonly friable sandstone & sandy siltstone fragments.
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Sample Descriptions

Storage Units: Metric

255.00 to 260.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, fine upper to upper medium, occasionally very fine lower to fine lower, rare coarse lower, subangular to subrounded, quartz & varicolored chert grains, consolidated fragments light gray, slightly dolomitic, with 40% dark chert grains & carbonaceous grains & flakes, friable, slightly siliceous, kaolinitic, feldspathic? illitic?, grains crush to a fine powder, occasional fragments with 12% black bitumen filled intergranular porosity, occasional 9% visible intergranular porosity, kaolin matrix porosity?, slow, good green flash cut fluorescence.
260.00 to 265.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, very fine upper to lower medium, rare upper medium, subangular to subrounded, quartz & varicolored chert grains, consolidated fragments off white, light gray, with up to 50% chert grains, predominately very fine upper to lower medium grained, with rare floating upper medium chert grains, moderately sorted, fragments crush to a fine powder, feldspathic?, commonly kaolinitic, slightly siliceous, slightly dolomitic, commonly carbonaceous, or bituminous, rare mica flakes, scattered 1-9% visible & kaolin plugged intergranular porosity, bitumen plugged intergranular porosity?, slow moderate green flash cut fluorescence.
265.00 to 270.00 (5.00)	60%	SHALE medium brown, sub platy to subblocky, micromicaceous, montmorillonitic, commonly silty & sandy, locally sideritic, micaceous, trace massive pyrite.
	40%	SANDSTONE predominately as unconsolidated very fine upper to lower medium, subangular to subrounded, quartz & varicolored chert grains, consolidated fragments salt and pepper, off white, light gray, with 40-50% chert grains, friable, locally with coal grains, very fine upper to lower medium, occasionally upper medium grained, moderately sorted, grains commonly with very fine druse, trace dolomite, commonly slightly siliceous & kaolinitic, feldspathic?, occasional 9% kaolin plugged & visible intergranular porosity, weak, faint slow green flash cut fluorescence, rare disseminated & massive pyrite.
270.00 to 275.00 (5.00)	70%	SHALE medium brown (wet), sub platy to subblocky, montmorillonitic, micromicaceous, trace fractured siderite nodules.
	30%	SANDSTONE light to medium gray, silty to very fine lower grained, moderately sorted, argillaceous, micaceous, carbonaceous, very poor grain relief, tight, no shows.
275.00 to 280.00 (5.00)	50%	SIDERITE as predominately lower medium, rounded nodules eroded from shale, occasional fragments of larger concretions, argillaceous, locally carbonaceous.
	25%	SHALE medium brown, sub platy to subblocky, micromicaceous, commonly silty.

Sample Descriptions

Storage Units: Metric

275.00 to 280.00 (5.00)	25%	SANDSTONE consolidated, light gray, gray brown, silty to very fine lower grained, salt and pepper & with < 15% chert grains, subangular to subrounded, slightly carbonaceous, sideritic, commonly with light gray argillaceous cement, micaceous, grading to silty sandy shale, tight, no shows.
280.00 to 285.00 (5.00)	100%	SHALE medium brown, light to medium brown gray, very montmorillonitic, micromicaceous, predominately as clay minerals, little silt, trace carbonaceous flakes, occasional coal laminae, trace COAL, locally with lower medium rounded siderite grains, 7% as gray brown, very argillaceous, micaceous, silty to very fine lower grained, tight sandstone fragments.
285.00 to 290.00 (5.00)	100%	SHALE 10-15% very light brown, very montmorillonitic, micromicaceous, trace silt, predominately medium brown, sub platy to blocky, commonly silty, 25% as fractured siderite nodules, slightly carbonaceous, rare medium gray, very argillaceous, silty to very fine lower grained, quartzose to salt and pepper, micaceous, tight sandstone & sandy siltstone fragments.
290.00 to 295.00 (5.00)	85%	SHALE 7% very light brown, sub platy, slightly montmorillonitic, silty or carbonaceous, predominately medium brown gray, sub platy to subblocky, micromicaceous, occasionally silty or sandy, occasional fine rounded, clustered siderite grains or more massive fractured siderite nodules.
	15%	SANDSTONE consolidated, light to medium brown gray, salt and pepper with < 10% chert grains, silty to very fine lower grained, grading to sandy siltstone, moderately sorted, angular to subrounded, carbonaceous, trace dolomitic cement, slightly sideritic, commonly with medium brown argillaceous cement, micaceous, tight.
295.00 to 300.00 (5.00)	100%	SHALE medium brown, sub platy to subblocky, micromicaceous, silty, micromicaceous, trace disseminated very fine carbonaceous flakes.
	90%	SANDSTONE predominately as unconsolidated, fine lower to upper medium, trace coarse lower, subangular to subrounded, occasionally angular, quartz & varicolored chert grains, consolidated fragments salt and pepper, with commonly 40 to 50% chert grains, commonly off white, light gray, light brown, poor to moderately sorted, dolomitic, sideritic, slightly siliceous, commonly with medium brown oil? stained argillaceous cement, slightly bituminous, 6-9% visible intergranular porosity, kaolin matrix porosity?, rapid milky yellow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

300.00 to 305.00 (5.00)	100%	SANDSTONE predominately as unconsolidated subangular to subrounded, occasionally angular, fine lower to upper medium, occasional coarse lower, trace coarse upper, quartz & varicolored chert grains, consolidated fragments light gray, occasionally light brown & very kaolinitic, poor to moderately sorted, with 40-50% chert grains, dolomitic, siliceous, sideritic, slightly carbonaceous, friable to occasionally firm, trace 3-5% visible intergranular porosity, spotty light brown oil stained kaolinitic clay matrix, kaolin matrix plugged porosity?, spotty bright rapid yellow green flash cut fluorescence.
305.00 to 310.00 (5.00)	90%	SANDSTONE predominately as unconsolidated, subangular to subrounded, occasionally angular, fine lower to upper medium, occasional coarse lower quartz & varicolored chert grains, consolidated fragments light gray, occasionally light brown & very kaolinitic, poor to moderately sorted, with 40-50% chert grains, dolomitic, sideritic, carbonaceous, with occasional COAL grains, COAL partings or very fine COAL laminae, siliceous, friable to occasionally firm, rare 12-15% visible intergranular porosity, spotty light brown bitumen stained kaolinitic clay matrix, kaolin matrix plugged porosity?, slow, bright milky yellow green flash cut fluorescence.
	10%	SHALE medium brown, sub platy to blocky, micromicaceous, commonly silty, slightly carbonaceous, grading in part to very argillaceous siltstone.
310.00 to 315.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, subangular to subrounded, occasionally angular, fine lower to upper medium, occasional coarse lower, quartz & varicolored chert grains, consolidated fragments light gray, off white, with commonly < 35% chert grains, poor to moderately sorted, dolomitic, siliceous, slightly sideritic, carbonaceous & with occasional carbonaceous grains, friable to occasionally firm, medium grained fragments with traces of 6-9% visible intergranular porosity, spotty light brown oil stained kaolinitic clay matrix, kaolin matrix plugged porosity?, spotty bright rapid yellow green flash cut fluorescence, 10% as fractured siderite nodules.
315.00 to 320.00 (5.00)	100%	SANDSTONE predominately as unconsolidated, subangular to subrounded, occasionally angular, fine lower to upper medium, occasional coarse lower, quartz & varicolored chert grains, trace dark chert granules, locally as matrix supported conglomeratic sandstone, consolidated fragments light gray, off white, poor to moderately sorted, with 30-50% chert grains, dolomitic, siliceous, sideritic, slightly carbonaceous, friable, occasional coaly parting or coaly grains, scattered 3-6, rare 12% visible intergranular porosity, occasional very carbonaceous or coaly fragments, slightly bituminous, kaolin matrix plugged porosity?, slow bright green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

Parkin, Upper Parkin: 323.60 MD, 323.59 TVD, 301.56 SSL

320.00 to 325.00 (5.00)	85%	SANDSTONE predominately as unconsolidated, subangular to subrounded, occasionally angular, fine lower to upper medium, occasional to rare coarse lower, quartz & varicolored chert grains, consolidated fragments light gray ,off white, commonly light brown & with abundant bitumen stained kaolinitic matrix, commonly very fine upper to fine upper grained, with floating medium to coarse lower quartz & chert grains, rare fine upper to medium grained fragments, poor to moderately sorted, with 20-50% chert grains, dolomitic, siliceous, sideritic, slightly carbonaceous, friable, occasional coaly partings or coal grains, consolidated fragments commonly tight, occasional 6-12 %visible intergranular porosity, slightly bituminous, kaolin matrix plugged porosity?, slow moderate green flash cut fluorescence.
	15%	SHALE medium brown, sub platy to blocky, silty, montmorillonitic, micromicaceous.
325.00 to 330.00 (5.00)	75%	SHALE medium brown, sub platy to blocky, micromicaceous, slightly montmorillonitic, commonly silty, trace fractured siderite nodules.
	25%	SILTSTONE consolidated, medium brown, sandy, slightly sideritic, grading to silty, sandy shale, commonly with scattered very fine lower quartz grains, slightly carbonaceous, tight, slightly dolomitic.
330.00 to 335.00 (5.00)	100%	SHALE (wet) light brown, sub platy to subblocky, very montmorillonitic, slightly silty, carbonaceous, micromicaceous, predominately medium brown, sub platy to blocky, montmorillonitic, trace fractured siderite nodules, rare very fine coal laminae.
335.00 to 340.00 (5.00)	80%	SHALE very light gray white, sub platy to subblocky, micromicaceous, montmorillonitic, trace silt, predominately medium brown, sub platy to blocky, micromicaceous, locally silty or sandy, carbonaceous.
	20%	SIDERITE as fine to medium, rounded grains or mainly as fractured larger nodules, cryptocrystalline, argillaceous, locally silty & sandy.
340.00 to 345.00 (5.00)	100%	SHALE 20% off white, predominately medium brown, montmorillonitic, micromicaceous, trace silt & sand grains, 3% fractured siderite nodules.
345.00 to 350.00 (5.00)	100%	SHALE 10-15% light gray, off white, predominately medium brown, sub platy to subblocky, micromicaceous, montmorillonitic, trace silt & sand grains, occasional carbonaceous flakes, trace COAL.

Sample Descriptions

Storage Units: Metric

350.00 to 355.00 (5.00)	100%	SHALE medium brown, 15% light gray, montmorillonitic, sub platy to blocky, micromicaceous, commonly slightly silty & with disseminated very fine carbonaceous flakes, 8% as fractured siderite nodules, trace COAL., 8% as unconsolidated fine upper to upper medium quartz & varicolored chert grains as probable carryover.
355.00 to 360.00 (5.00)	100%	SHALE medium brown, sub platy to blocky, rare light gray, montmorillonitic, occasionally silty & sandy, 3% fractured siderite nodules, 3% COAL.
360.00 to 365.00 (5.00)	100%	SHALE (wet) medium brown, sub platy to blocky, micromicaceous, occasional very fine disseminated carbonaceous flakes, slightly montmorillonitic, occasional fragments with abundant coaly laminae, 7% off white, white gray, sub platy to blocky, silty, sandy, 3% as fractured siderite nodules, 4% black, locally pyritic COAL.
365.00 to 370.00 (5.00)	100%	SHALE medium brown gray, sub platy to blocky, micromicaceous, slightly montmorillonitic, commonly silty & sandy, locally with carbonaceous flakes, commonly light brown, sub platy to blocky, commonly silty & sandy, grading in part to light to medium brown, very argillaceous, predominately quartzose sandstone & siltstone, slightly sideritic, trace COAL.
370.00 to 375.00 (5.00)	100%	SHALE medium brown, sub platy to subblocky, micromicaceous, carbonaceous, slightly montmorillonitic, occasional silty fragments, 15% off white, white gray, sub platy to subblocky, montmorillonitic, soft, slightly silty, micromicaceous, trace fractured siderite nodules, 7% medium brown, quartzose to salt and pepper, silty to very fine lower grained, tight, very sideritic sandstone fragments, 10-15% as black, dark gray, locally argillaceous, COAL.
375.00 to 377.00 (2.00)	100%	SILTSTONE medium brown, well consolidated, grading to very silty to very fine lower grained sandstone, slightly dolomitic, sideritic, very micaceous, carbonaceous, minor dark chert, rare black or dark gray & very carbonaceous fragments, dense & tight, 5% as fractured siderite nodules, 5% medium to dark brown shale, 4% COAL.
377.00 to 380.00 (3.00)	80%	SHALE dark gray, subfissile, non calcareous, occasional silty laminations, carbs, plant remains, well compacted
	10%	CEMENT & CONTAMINATION oilwell cement
	10%	SILTSTONE medium to dark gray, sandy in part, non calcareous, carbonaceous in part

Sample Descriptions

Storage Units: Metric

380.00 to 385.00 (5.00)	80%	SHALE increasingly dark gray, grading to black, increasingly carbonaceous, coal laminae, subfissile, non calcareous, occasional plant remains, silty laminations, firm, well compacted
	10%	COAL bright vitreous lustre, clean, thin stringers & laminae
	10%	SILTSTONE predominately light gray, occasionally brown, locally sandy, non calcareous
385.00 to 390.00 (5.00)	60%	SHALE medium to dark gray, subfissile to subblocky, decreasing carbonaceous, increasingly silty with common silty to sandy laminations, well compacted, firm, non calcareous, jointing common
	20%	SILTSTONE medium gray to brownish gray, sandy in part, trace glauconite, common carbonaceous matter, non calcareous
	15%	SANDSTONE light to medium gray, predominately quartz with common lithics, feldspar & carbonaceous rock fragments, trace glauconite, lower to very fine grained, silty & argillaceous in part, subangular to subrounded, poorly sorted, silica cement, non calcareous, well indurated, tight, no visible show
	5%	COAL as above
390.00 to 395.00 (5.00)	80%	SHALE medium gray, brownish gray, subfissile to subblocky, non to very slightly calcareous, occasional silty laminations, carbonaceous in part, scattered plant remains, jointing
	15%	SILTSTONE light to medium gray, brownish gray, sandy in part, carbonaceous in part, non calcareous, small trace glauconite
	5%	SANDSTONE medium gray, yellowish gray, very fine grained, silty in part, subrounded, poorly sorted, silica cement, tight, argillaceous in part, carbonaceous, non to locally slightly calcareous, trace glauconite
395.00 to 405.00 (10.00)	85%	SHALE medium to dark gray to brownish gray, subfissile, non to very slightly calcareous, silty laminae, rare sandy laminations, carbonaceous in part
	10%	SILTSTONE medium to dark gray, sandy in part, very slightly calcareous, carbonaceous, plant remains

Sample Descriptions

Storage Units: Metric

395.00 to 405.00 (10.00)	5%	SANDSTONE medium to dark gray, very fine grained, silty & argillaceous, trace calcareous matter, trace glauconite, subangular, poorly sorted, silica cement, well indurated, tight, carbonaceous
405.00 to 410.00 (5.00)	70%	SHALE dark gray, subfissile, carbonaceous, black carbonized plant remains common throughout, non calcareous
	15%	SILTSTONE medium to dark gray, light grayish yellow in part, locally sandy, non calcareous, carbonaceous in part, rare preserved burrow
	15%	SANDSTONE light to medium gray to yellowish gray, quartzose, very fine grained, grading to coarse siltstone, occasional lower fine grained argillaceous laminations, subrounded, moderately sorted, silica cement, small trace secondary calcite, small trace glauconite, well indurated, tight
410.00 to 415.00 (5.00)	70%	SHALE as above
	25%	SILTSTONE medium to dark brownish gray, sandy in part, carbonaceous, non calcareous
	5%	SANDSTONE light to medium yellowish gray, yellowish brown, very fine grained, quartz with common lithics & common to abundant carbonaceous matter, subrounded to subangular, poorly sorted, well indurated, tight, trace glauconite
415.00 to 420.00 (5.00)	60%	SHALE medium to dark gray, subfissile, silty, carbonaceous, non calcareous
	20%	SILTSTONE medium to dark gray to brownish gray, sandy in part, non to very slightly calcareous, trace glauconite, carbonaceous in part
	20%	SANDSTONE as above, common plant remains, well indurated, tight, trace glauconite
420.00 to 435.00 (15.00)	100%	SHALE medium to dark gray, grayish brown in part, subfissile, non calcareous, common plant rmns, rare silty laminae, occasional high angle jointing
435.00 to 445.00 (10.00)	95%	SHALE medium to dark gray to brownish gray, subfissile, non calcareous, carbonaceous in part, rare silty laminae, plant remains
	5%	COAL vitreous to dull lustre, argillaceous in part, thin stringers

Sample Descriptions

Storage Units: Metric

445.00 to 450.00 (5.00)	75%	SHALE medium to dark gray, dark brownish gray in part, subfissile, non calcareous, carbonaceous, common carbonized plant remains, sandy & silty stringers
	15%	SILTSTONE medium to dark gray, medium yellowish brown to yellowish gray in part, sandy in part, non calcareous, locally carbonaceous
	10%	SANDSTONE light to medium yellowish gray to yellowish brown, quartz with common chert & abundant light to dark lithics, trace glauconite, predominately very fine to lower fine grained, locally grading to upper fine grained, subangular to subrounded, poorly sorted, silica cement, small trace secondary calcite cement, well indurated, tight, carbonaceous fragments
450.00 to 455.00 (5.00)	65%	SHALE dark gray, subfissile, non calcareous, carbonaceous, plant remains, silty stringers
	25%	COAL moderately vitreous lustre, argillaceous in part, brittle, occasional floating sand & silt grains, scattered pyrite bleb
	10%	SILTSTONE as above, trace very fine grained carbonaceous sandstone
455.00 to 470.00 (15.00)	75%	SHALE predominately dark gray, locally medium to dark grayish brown, fissile to subfissile, non calcareous, carbonaceous, plant remains, silty stringers, jointing common
	15%	SILTSTONE medium to dark gray to brownish gray, sandy in part, non calcareous, carbonaceous, trace glauconite
	10%	SANDSTONE light to medium brownish gray, light yellowish brown in part, very fine grained, silty & argillaceous in part, quartz with minor chert & common to abundant lithics, common carbonaceous fragments, subrounded, poorly sorted, silica cement, well indurated tight
470.00 to 475.00 (5.00)	65%	SHALE medium to dark gray, subfissile, non calcareous, carbonaceous, locally silty
	20%	SANDSTONE light to medium yellowish brown to yellowish gray, very fine grained, quartz with common lithics, trace to minor chert, trace glauconite, common carbonized plant remains, very fine to lower fine grained, silty in part, subrounded, poorly sorted, silica cement, well indurated, tight, no visible show
	15%	SILTSTONE as above

Sample Descriptions

Storage Units: Metric

475.00 to 490.00 (15.00)	85%	SHALE dark gray, subfissile, minor medium to dark grayish brown blocky shale, non calcareous, occasional silty stringers, trace coal, carbonaceous, plant remains
	15%	SILTSTONE medium to dark gray, yellowish brown, sandy in part, occasional sandy laminations, non calcareous, carbonaceous, plant remains
490.00 to 505.00 (15.00)	75%	SHALE dark gray, occasional black coaly stringers, subfissile, non calcareous, carbonaceous, silty & sandy stringers, trace pyritic coal, jointing common
	15%	SILTSTONE medium to dark gray, brownish gray, sandy in part, carbonaceous, slightly calcareous
	10%	SANDSTONE light to medium gray, brownish gray, quartz with common lithics & carbonaceous fragments, very fine grained, silty in part, subrounded, poorly sorted, silica + minor calcite cement, well indurated, tight, carbonaceous
505.00 to 515.00 (10.00)	70%	SHALE dark gray, dark brownish gray, subfissile, carbonaceous, non calcareous
	30%	SILTSTONE medium to dark grayish brown, coarse, sandy in part, carbonaceous, trace pyrite, slightly calcareous, occasional sandy laminations
515.00 to 530.00 (15.00)	80%	SHALE increasingly dark gray & carbonaceous, subfissile, non calcareous, common plant remains, trace pyritic coal, silty stringers, jointing common
	20%	SILTSTONE medium to dark grayish brown, fine to coarse occasional very fine grained sandy laminae, carbonaceous, slightly calcareous, plant remains
530.00 to 540.00 (10.00)	75%	SHALE dark gray, subfissile to subblocky, carbonaceous, locally silty, non calcareous, plant remains
	15%	SILTSTONE light to medium yellowish brown to grayish brown, locally sandy, carbonaceous, slightly calcareous
	10%	SANDSTONE light to medium yellowish brown, medium to dark gray in part, very fine grained, grading to coarse siltstone, subrounded, moderately sorted, silica + trace secondary calcite cement, well indurated, tight to very weak porosity (0-3%), trace light amber residual oil staining, very weak slow hazy dead oil cut

Sample Descriptions

Storage Units: Metric

540.00 to 545.00 (5.00)	70%	SANDSTONE light to medium gray, brownish gray, salt and pepper, quartz, minor chert & abundant dark lithics, predominately very fine to lower fine grained, 3-5% upper fine grained, subangular to subrounded, moderate to poorly sorted, coarsening down, silica + minor secondary calcite cement, poor porosity (3-6%), common patchy light amber residual oil staining, patchy black bitumen cement, no visible fluorescence, slow weak hazy dead oil cut, small trace glauconite
	20%	SHALE dark gray, subfissile, non calcareous, carbonaceous
	10%	SILTSTONE light to medium yellowish brown, medium to dark grayish brown, sandy in part, slightly bituminous, slightly calcareous, carbonaceous in part, tight
545.00 to 555.00 (10.00)	40%	SANDSTONE light to medium brownish gray, salt and pepper, very fine to upper fine grained, 2-3% lower medium grained, quartz, chert & abundant dark lithics, subangular to subrounded, moderate to poorly sorted, silica + minor secondary calcite cement, patchy black bitumen cement, 4-8% porosity, common light amber residual oil staining, no visible fluorescence, weak slow hazy dead oil cut, rare bright grain glauconite grain
	35%	SHALE as above, trace coal
	25%	SILTSTONE medium gray to yellowish gray, sandy in part, slightly calcareous, slightly bituminous, tight, slow weak hazy dead oil cut
555.00 to 570.00 (15.00)	80%	SHALE medium to dark gray, dark brownish gray in part, subfissile, silty in part, carbonaceous, non calcareous, common jointing
	20%	SILTSTONE medium to dark grayish brown, yellowish brown, fine to coarse, slightly calcareous, slightly bituminous, locally grading to very fine grained sandstone
570.00 to 575.00 (5.00)	65%	SHALE predominately dark gray, medium grayish brown in part, subfissile, locally silty, carbonaceous, non calcareous
	20%	SANDSTONE light to medium yellowish gray to yellowish brown, quartzose with minor lithics, carbonaceous fragments, small trace glauconite, very fine grained, grading to coarse siltstone, subrounded to subangular, moderately sorted, silica + trace to minor secondary calcite cement, well indurated, tight, no visible fluorescence, weak hazy dead oil cut
	15%	SILTSTONE as above

Sample Descriptions

Storage Units: Metric

575.00 to 595.00 (20.00)	45%	SHALE dark gray, subfissile, non calcareous, locally silty, carbonaceous
	35%	SANDSTONE light to medium yellowish brown, quartzose with minor lithics, small trace glauconite, very fine grained, coarse silt in part, subrounded, moderately well sorted, silica + minor secondary calcite cement, moderately well indurated, friable in part, tight to poor porosity (0-5%), light amber residual oil stg common throughout, slow weak blooming dead oil cut
	20%	SILTSTONE medium to dark grayish brown to brownish gray, sandy in part, slightly bituminous, slightly calcareous, carbonaceous in part
595.00 to 610.00 (15.00)	80%	SHALE dark gray, locally very dark gray & increasingly carbonaceous, occasional coaly laminae, plant remains, silty stringers, occasional jointing
	10%	SILTSTONE medium to dark yellowish brown, sandy in part, slightly bituminous, slightly calcareous
	10%	SANDSTONE light yellowish brown, quartzose, very fine grained, rare lower fine grained laminations, trace to minor lithics, small trace glauconite, subrounded, moderately sorted, silica + trace secondary calcite cement, weak residual oil staining, weak dead oil cut, tight
610.00 to 625.00 (15.00)	60%	SANDSTONE light yellowish brown, quartzose with minor lithics, trace glauconite, common carbonaceous fragments, very fine to lower fine grained, silty in part, subrounded, moderate sorted, silica cement, well indurated, tight to very poor porosity (0-4%), patchy light brown residual oil staining, no visible fluorescence, very slow weak dead oil cut
	25%	SHALE dark gray, subfissile, silty in part, carbonaceous, non calcareous
	15%	SILTSTONE medium to dark yellowish brown, sandy in part, carbonaceous, non calcareous
625.00 to 640.00 (15.00)	65%	SANDSTONE light to medium yellowish gray, quartzose with common lithics & black carbonaceous fragments, very fine grained, coarse silt in part, subrounded, moderately sorted, well indurated, tight, trace bitumen cement, patchy faint residual hydrocarbon staining, no visible fluorescence, slow weak hazy dead oil cut, small trace glauconite
	20%	SHALE dark gray, fissile to subfissile, locally silty, carbonaceous

Sample Descriptions

Storage Units: Metric

625.00 to 640.00 (15.00)	15%	SILTSTONE medium to dark gray, grayish brown, sandy in part, very slightly calcareous, slightly bituminous
640.00 to 650.00 (10.00)	40%	SHALE dark gray to dark brownish gray, subfissile, locally silty, carbonaceous, non calcareous
	30%	SILTSTONE medium gray to grayish brown, sandy, argillaceous, slightly bituminous, slightly calcareous, carbonaceous in part
	30%	SANDSTONE light to medium yellowish gray, occasionally yellowish white, quartzose with minor to common lithics & carbonaceous fragments, small trace glauconite as above, subrounded, moderately sorted, silica + trace secondary calcite cement, trace patchy bitumen cement, well indurated, tight to very poor porosity (0-3%), no visible fluorescence, weak slow hazy dead oil cut
650.00 to 655.00 (5.00)	70%	SHALE dark gray to very dark gray, subfissile, locally silty with trace glauconite, carbonaceous, locally pyritic, non calcareous, well compacted, firm
	20%	SANDSTONE light yellowish brown to yellowish gray, quartzose, minor lithics & trace glauconite as above, very fine grained, subrounded, moderately sorted, silica + trace calcite cement, tight, trace light amber oil staining as above, weak hazy dead oil cut
	10%	SILTSTONE as above, trace glauconite
655.00 to 660.00 (5.00)	85%	SHALE as above, very dark gray, carbonaceous
	10%	SILTSTONE as above
	5%	SANDSTONE as above
660.00 to 670.00 (10.00)	100%	SHALE dark gray, dark brownish gray, subfissile, non calcareous, occasional silty stringers, carbonaceous
670.00 to 675.00 (5.00)	80%	SHALE dark gray, subfissile, carbonaceous, locally silty
	20%	SANDSTONE light yellowish brown, quartzose with trace to minor lithics, occasional carbonaceous fragments, trace to minor patchy black bitumen cement, poor to very poor porosity (2-5%), dull yellow fluorescence, slow blooming cut, poor to questionable show

Sample Descriptions

Storage Units: Metric

675.00 to 690.00 (15.00)	85%	SHALE dark gray to very dark gray, subfissile, occasional silty & sandy laminations, carbonaceous, non calcareous, common jointing
	10%	SILTSTONE medium to dark grayish brown, sandy in part, non calcareous
	5%	SANDSTONE light to medium yellowish brown, quartzose with minor lithics, trace glauconite, trace carbonaceous matter, silica + trace bitumen cement, well indurated, tight, weak dead oil cut
690.00 to 710.00 (20.00)	100%	SHALE dark to very dark gray, becoming black, subfissile to fissile, locally silty in part, non calcareous, occasional silty laminations
710.00 to 740.00 (30.00)	100%	SHALE predominately dark to very dark gray, becoming black, fissile to subfissile, occasional thin medium to dark grayish brown blocky stringers, non calcareous, carbonaceous in part, common jointing
740.00 to 770.00 (30.00)	100%	SHALE predominately dark to very dark gray, becoming black, fissile to subfissile, occasional thin medium to dark grayish brown blocky stringers, non calcareous, carbonaceous in part, common jointing

Parkin, Orange Marker: 779.80 MD, 767.40 TVD, -142.25 SSL

770.00 to 780.00 (10.00)	100%	SHALE very dark gray to black, subfissile to fissile, non calcareous, carbonaceous
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Whitestone River: 794.00 MD, 781.04 TVD, -155.89 SSL

780.00 to 795.00 (15.00)	90%	CHERT PEBBLE CONGLOMERATE medium to dark gray, patchy greenish yellow & green matrix, predominately black, gray & brown chert with minor quartz & siliceous clasts in a poorly sorted dark siliceous glauconitic & sideritic matrix, coarse granules to pebbles, well rounded & polished clasts, questionable porosity, no visible fluorescence, trace residual hydrocarbon, weak hazy cut
	10%	SHALE dark gray, subfissile to subblocky, non calcareous, carbonaceous
795.00 to 805.00 (10.00)	50%	SHALE as above
	35%	SANDSTONE dark gray to black, very fine grained, silty argillaceous matrix, common to abundant glauconite throughout, siliceous, slightly calcareous, well indurated, tight, no visible show

Sample Descriptions

Storage Units: Metric

795.00 to 805.00 (10.00)	15%	CHERT PEBBLE CONGLOMERATE as above
805.00 to 820.00 (15.00)	70%	SILTSTONE dark gray to black, sandy in part, grading to very fine grained silty argillaceous sandstone, dark gray argillaceous matrix, locally pyritic, calcareous, slightly bituminous, no visible fluorescence, weak cut, occasional fine grained argillaceous sandy laminations, 5 to 10% conglomeratic debris
	30%	SHALE dark gray to black, subfissile to subblocky, non calcareous, carbonaceous, firm
820.00 to 835.00 (15.00)	75%	SILTSTONE dark gray to black, sandy in part, non to slightly calcareous, dark argillaceous matrix, plant fragments, sandy laminations
	25%	SHALE dark gray to black, subblocky, silty, non calcareous, carbonaceous
835.00 to 850.00 (15.00)	70%	SILTSTONE dark gray to dark brownish gray, sandy in part, carbonaceous, slightly calcareous, trace pyrite, trace glauconite
	30%	SHALE dark gray to dark brownish gray, subblocky, non calcareous, carbonaceous, silty in part
850.00 to 860.00 (10.00)	60%	SILTSTONE dark gray, sandy, very slightly calcareous, scattered medium dark yellowish brown pelecypod fragments
	40%	SHALE dark gray, subfissile, silty, non calcareous, carbonaceous
860.00 to 880.00 (20.00)	50%	SILTSTONE dark gray to dark brownish gray, sandy, slightly calcareous, carbonaceous, glauconitic, scattered pelecypod fragments
	25%	SANDSTONE medium to dark gray, dark greenish gray, very fine grained, silty & argillaceous matrix, subangular to subrounded, poorly sorted, pyritic, well indurated, hard, silica + pyrite cement, tight, common to abundant glauconitic + pyrite cement, patchy massive pyrite
	25%	SHALE dark gray to dark brownish gray, blocky, non calcareous, silty in part, well compacted, firm
880.00 to 900.00 (20.00)	60%	SHALE dark gray, fissile to subfissile, non calcareous, silty in part, slightly carbonaceous, local total organic carbon, commonly with jointing at high angle to bedding

Sample Descriptions

Storage Units: Metric

880.00 to 900.00 (20.00)	40%	SILTSTONE medium to dark gray, slightly greenish gray, sandy in part, non to very slightly calcareous, glauconitic, occasional sandy laminations, dark gray argillaceous matrix, trace pyrite
900.00 to 920.00 (20.00)	90%	SHALE increasingly dark gray, fissile to subfissile, predominately non calcareous, occasional laminae are slightly calcareous, silty in part, occasional silty laminations, occasional plant remains, increasing total organic carbon, trace scattered pyrite nodules, jointing common
	10%	SILTSTONE dark gray, non to slightly calcareous, trace glauconite, carbonaceous in part, dark gray matrix, thin laminations
920.00 to 940.00 (20.00)	100%	SHALE dark gray, fissile to subfissile, non calcareous, silty in part, carbonaceous in part, jointing common, scattered pelecypod fragments, occasional light to medium yellowish brown slightly calcareous blocky laminations, rare pyrite
940.00 to 960.00 (20.00)	100%	SHALE dark gray, fissile to subfissile, silty in part, non calcareous, rare silty glauconitic stringer, occasional pelecypod fragments, occasional light to medium yellowish brown slightly calcareous blocky stringers, slightly dolomitic.
960.00 to 980.00 (20.00)	100%	SHALE dark gray, subfissile, non calcareous, carbonaceous in part, trace pyrite, occasional silty laminations, scattered pelecypod fragments, occasional light to medium yellowish brown slightly calcareous blocky laminations as above, trace dolomite cement.
980.00 to 990.00 (10.00)	100%	SHALE dark gray, subfissile, non calcareous, occasional silty laminae, rare pelecypod fragments, common jointing, small trace pyrite, trace dolomite.
990.00 to 995.00 (5.00)	85%	SHALE dark gray, fissile to subfissile, slightly calcareous, slightly dolomitic, occasional silty laminations with trace glauconite, small trace pyrite, carbonaceous, plant remains
	15%	COAL dull, brittle, locally silty, occasional glassy inclusions, lignite mud additive?
PreCretaceous Unc: 1,003.00 MD, 981.88 TVD, -356.73 SSL		
995.00 to 1,010.00 (15.00)	100%	SHALE dark gray, fissile to subfissile, silty in part, carbonaceous, plant remains, trace pyrite, jointing common, occasional light to medium yellowish brown blocky calcareous laminations
1,010.00 to 1,020.00 (10.00)	95%	SHALE dark gray, subfissile, slightly calcareous, silty in part, carbonaceous in part

Sample Descriptions

Storage Units: Metric

1,010.00 to 1,020.00 (10.00)	5%	LIMESTONE light to medium yellowish brown, medium gray, blocky, argillaceous, cryptocrystalline, pyritic, rare shell fragments
1,020.00 to 1,030.00 (10.00)	75%	SHALE dark gray, dark greenish gray in part, subfissile, slightly calcareous, silty, trace pyrite
	25%	LIMESTONE medium to dark brownish gray, light yellowish brown in part, argillaceous, dense, tight, common yellowish amber glassy fossil fragments, thin bedded, trace pyrite, trace coarse grained dark chert in dark gray argillaceous slightly calcite matrix
1,030.00 to 1,040.00 (10.00)	90%	SHALE dark gray, subfissile, slightly calcareous, silty in part, occasional thin limy stringers
	10%	LIMESTONE medium to dark gray to dark brownish gray, cryptocrystalline, argillaceous, dense, tight, rare fossil fragments, thin beds
1,040.00 to 1,055.00 (15.00)	90%	SHALE dark gray, subfissile, slightly calcareous, occasional limestone stringers, locally silty, trace pyrite
	10%	LIMESTONE medium to dark yellowish brown to brownish gray, blocky, cryptocrystalline, argillaceous, dense, tight, locally pyritic, cherty, trace to minor gray chert fragments
1,055.00 to 1,075.00 (20.00)	85%	SHALE dark gray, subfissile, slightly calcareous, locally silty with trace glauconite, trace pyrite, carbonaceous in part
	15%	LIMESTONE medium to dark gray to grayish brown, occasional light yellowish brown fossil fragments, locally pyritic, tight

Jungle Creek: 1,081.00 MD, 1,056.38 TVD, -431.23 SSL

1,075.00 to 1,085.00 (10.00)	85%	SHALE dark gray, subfissile, slightly calcareous, locally silty with trace glauconite, trace pyrite, carbonaceous in part
	10%	LIMESTONE medium to dark grayish brown, common light to medium amber colored glassy fossil fragments, argillaceous, tight

Sample Descriptions

Storage Units: Metric

1,075.00 to 1,085.00 5% (10.00)	SANDSTONE light to medium yellowish brown, very fine grained, silty in part, subrounded, poorly sorted, silica + trace to minor calcite cement, minor glauconite, well indurated, hard, tight
1,085.00 to 1,100.00 50% (15.00)	SHALE dark gray, subfissile, non calcareous, silty, pyritic, carbonaceous in part
50%	SANDSTONE white to light yellowish brown, light gray in part, quartzose with common white interstitial kaolinitic cement, predominately upper very fine to lower fine grained, subrounded, moderate to well sorted, silica + kaolin + 2-4% bitumen cement, silica overgrowths, poor to locally fair intergranular porosity (6-12%), minor very fine to silty grains, locally pebbly with 2-3% coarse dark chert granules with silica + pyrite cement, spotty faint light amber residual oil staining, spotty dull yellow fluorescence, moderately fast streaming cut
1,100.00 to 1,110.00 50% (10.00)	CHERT PEBBLE CONGLOMERATE medium to dark gray, salt and pepper in part, predominately dark gray, dark brown & grayish brown chert, minor light yellowish brown siliceous clasts & quartz, silty to lower medium grained sandy matrix, silica + pyrite + trace bitumen cement, silica overgrowths, pyrite fills chaotic microfractures, patchy weak to locally fair porosity (3-9%), trace faint yellowish green fluorescence, moderately fast blooming & streaming cut
40%	PEBBLE SANDSTONE light to medium gray to slightly brownish gray, quartz with common to abundant gray & brown chert clasts, occasional floating granules to small pebbles, trace glauconite, trace pyrite, subrounded, moderate to poorly sorted, silica cement, patchy white kaolinitic cement, minor to locally common interstitial bitumen cement, poor porosity (3-6%), spotty dull fluorescence, weak cut
10%	SHALE medium to dark gray, non very slightly calcareous, silty, locally pyritic
1,110.00 to 1,115.00 100% (5.00)	CHERT PEBBLE CONGLOMERATE medium brown to grayish brown, predominately light brown, yellowish brown & light to medium grayish brown chert, common dark gray chert, very fine to medium grained sandy matrix, subrounded to rounded, poorly sorted, silica + trace to minor pyrite cement, tight to poor porosity (0-6%), occasional euhedral quartz crystals, trace glauconite, trace bitumen, spotty very dull yellowish green fluorescence, weak hazy cut
1,115.00 to 1,120.00 75% (5.00)	CHERT PEBBLE CONGLOMERATE off white, light brown & dark gray chert pebbles in a medium gray salt and pepper lower fine to upper medium grained sandy matrix, subrounded, poorly sorted, silica cement, well indurated, poor to locally fair intergranular porosity (4-10%), trace interstitial bitumen, trace faint dull yellowish green fluorescence, weak hazy cut, trace glauconite
15%	SILTSTONE medium grayish brown, sandy, pyritic, non calcareous, locally grading to very fine grained argillaceous sandstone

Sample Descriptions

Storage Units: Metric

1,115.00 to 1,120.00 (5.00)	10%	SHALE medium to dark gray, blocky to subfissile, non calcareous, silty in part
1,120.00 to 1,125.00 (5.00)	70%	CHERT PEBBLE CONGLOMERATE dark gray, abundant dark gray to black chert throughout, medium gray argillaceous silty to upper fine grained sandy matrix, silica + minor pyrite cement, small trace bitumen, tight to poor porosity, no visible show
	15%	SHALE as above
	15%	SILTSTONE medium brownish gray, sandy, non calcareous, trace pyrite, trace glauconite
1,125.00 to 1,130.00 (5.00)	30%	SILTSTONE light to medium grayish brown, sandy in part, non calcareous, trace pyrite, occasional inoceramus fragment preserved with aragonite
	30%	SANDSTONE medium gray to grayish brown, quartz with common gray chert & minor to common bright green glauconite, pyritic, very fine to upper fine grained, silty & argillaceous, subrounded, poorly sorted, silica cement, tight, no visible show
	20%	CHERT PEBBLE CONGLOMERATE as above, patchy massive pyrite
	20%	SHALE dark gray, sbbly to subfissile, slightly calcareous, silty in part
1,130.00 to 1,140.00 (10.00)	40%	SILTSTONE medium brownish gray, coarse sandy in part, calcareous, trace glauconite
	30%	SHALE medium to dark gray, fissile to subfissile, slightly calcareous, silty, pyritic
	20%	CAVING predominately chert pebble shards, sandstone, minor coal & shale
	10%	SANDSTONE medium grayish brown, very fine grained, silty & argillaceous, common bright green glauconite, subangular to subrounded, poorly sorted, calcite cement, tight, no visible show
1,140.00 to 1,155.00 (15.00)	60%	SHALE dark gray to brownish gray, fissile to subfissile, silty in part, calcareous, occasional inoceramus fragments
	25%	SILTSTONE medium to dark gray to grayish brown, sandy in part, calcareous, pyritic, occasional inoceramus fragments preserved with aragonite
	15%	CAVING chert pebble fragments & dark gray shale

Sample Descriptions

Storage Units: Metric

1,155.00 to 1,160.00 (5.00)	70%	SHALE medium to dark gray to grayish brown, sbbly, silty, calcareous, trace pyrite, minor minute black carbonaceous matter throughout
	15%	SILTSTONE as above
	15%	SANDSTONE medium yellowish brown to brownish gray, very fine grained, silty & argillaceous, subrounded, poorly sorted, calcite cement, tight, common aragonite fossil fragments (inoceramus), trace glauconite, locally with massive pyrite cement
1,160.00 to 1,165.00 (5.00)	45%	CHERT PEBBLE CONGLOMERATE dark gray, abundant dark gray & brown chert & minor quartz, granules to pebbles, fine to lower medium grained sandy matrix, subrounded, poorly sorted, silica + minor pyrite cement, trace glauconite, poor to locally fair porosity, no visible show
	25%	SILTSTONE light to medium brownish gray, sandy, calcareous
	20%	SANDSTONE light to medium grayish brown, very fine to fine grained, silty & argillaceous in part, subrounded, poorly sorted, calcareous cement, well indurated, common to abundant bright green glauconite, tight, no visible show
	10%	SHALE medium to dark gray, grayish brown, silty in part, calcareous, pyritic
1,165.00 to 1,170.00 (5.00)	40%	SHALE medium to dark gray, grayish brown, silty in part, calcareous, pyritic
	30%	CHERT PEBBLE CONGLOMERATE dark gray, abundant dark gray & brown chert & minor quartz, granules to pebbles, fine to lower medium grained sandy matrix, subrounded, poorly sorted, silica + minor pyrite cement, trace glauconite, poor to locally fair porosity, no visible show
	15%	SILTSTONE light to medium brownish gray, sandy, calcareous
	15%	SANDSTONE light to medium grayish brown, very fine to fine grained, silty & argillaceous in part, subrounded, poorly sorted, calcareous cement, well indurated, common to abundant bright green glauconite, tight, no visible show
1,170.00 to 1,180.00 (10.00)	70%	SHALE dark grayish brown, subfissile to subblocky, silty, trace glauconite, trace pyrite, calcareous
	20%	SILTSTONE medium to dark brownish gray, sandy, calcareous, trace glauconite

Sample Descriptions

Storage Units: Metric

1,170.00 to 1,180.00 10% **PEBBLE SANDSTONE**
(10.00) light to medium yellowish brown, salt and pepper, upper fine to medium grained, common to abundant dark gray chert granules to pebbles, subrounded, poorly sorted, silica + calcite cement + pyrite cement, no visible show

Ettrain: 1,182.00 MD, 1,153.72 TVD, -528.57 SSL

1,180.00 to 1,185.00 50% **LIMESTONE**
(5.00) in part light yellowish brown to yellowish white & relatively clean, in part dark grayish brown & argillaceous throughout, cryptocrystalline, fossiliferous (brachiopod shell fragments & spines, occasional crinoid debris), dense, tight, Brachiopod Wackestone

50% **SHALE**
dark brownish gray, sbbly, silty in part, calcareous

1,185.00 to 1,197.00 70% **LIMESTONE**
(12.00) predominately dark grayish brown to brownish gray, 10% light to medium yellowish brown, fossiliferous, scattered brachiopods, rare crinoid fragments, dense, tight, Brachiopod Wackestone, cherty, common spicules

30% **SHALE**
dark gray to brownish gray, subblocky, calcareous, interbedded argillaceous limestone

1,197.00 to 1,200.00 100% **SHALE**
(3.00) medium brown, sub platy to blocky, micromicaceous, slightly pyritic, occasional glauconite grains or carbonaceous flakes, commonly slightly silty or sandy, rare cherty fragments, calcareous, rare mica flakes, no cut fluorescence, 15% cement fragments.

1,200.00 to 1,205.00 80% **SHALE**
(5.00) medium brown, sub platy to blocky, calcareous, slightly dolomitic, commonly silty, sandy, trace glauconite grains & carbonaceous flakes, pyritic, occasional fragments with brachiopod or crinoid fragments, abundant cement in sample

20% **LIMESTONE**
light brown, off white, commonly mottled, commonly with medium brown argillaceous matrix or with shale or marly partings, in part chert replaced, argillaceous, crinoid, brachiopod wackestone to packstone rare mudstone, occasional glauconite grains, locally friable or chalky, rare sand grains, tight, no shows, abundant cement in sample.

Blackie: 1,209.20 MD, 1,180.15 TVD, -555.00 SSL

1,205.00 to 1,210.00 75% **SHALE**
(5.00) medium brown, sub platy to blocky, micromicaceous, pyritic, calcareous, slightly carbonaceous, rare glauconite grains, brittle, no cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 1,205.00 to 1,210.00 25% **LIMESTONE**
(5.00) off white, light brown, commonly mottled with medium brown argillaceous matrix, commonly chalky & friable, as crinoid, brachiopod mudstone to packstone, rare Syringopora bafflestone, in part chert replaced, rare glauconite grains, tight, no cut fluorescence.
- 1,210.00 to 1,215.00 100% **SHALE**
(5.00) medium brown, platy to occasionally blocky, micromicaceous, calcareous, trace disseminated & massive pyrite, fractures?, rare botryoidal pyrite, occasional crinoid & brachiopod fragments, slightly carbonaceous, soft to firm, fissile in part, 7& as off white, light brown, occasionally orange brown, crinoid, brachiopod, mudstone to wackestone, rare packstone limestone, fragments commonly with medium brown argillaceous matrix, tight, no shows, slightly glauconitic.
- 1,215.00 to 1,220.00 100% **SHALE**
(5.00) medium brown, sub platy to occasionally blocky, micromicaceous, trace disseminated or pyrite occurs in thin line bands, fractures?, occasionally silty & sandy, rare glauconite grains, calcareous, slow yellow green flash cut fluorescence, 8% as off white, light to medium brown, in part chalky white crinoid, brachiopod wackestone, rare packstone fragments, slow milky yellow green flash cut fluorescence, adding Soltex asphaltene mud additive.
- 1,220.00 to 1,230.00 100% **SHALE**
(10.00) medium brown, occasional dark brown fragments, platy to occasionally blocky, soft to firm, occasional fragments with glauconite grains, calcareous, occasional carbonaceous grains, flakes, crinoids or brachiopod fragments, rare off white, light to medium brown, mottled, argillaceous, crinoid brachiopod mudstone to wackestone fragments, rare shale fragments with very fine coaly laminae, occasional marly fragments, slow milky yellow green flash cut fluorescence, added Soltex asphaltene mud additive, pyrite filled fractures?
- 1,230.00 to 1,235.00 90% **SHALE**
(5.00) medium brown, sub platy to blocky, pyritic, predominately as clay shale, rare silt & sand, calcareous, occasional brachiopod & crinoid fragments. slow yellow green flash cut fluorescence, Soltex mud additive?
- 10% **LIMESTONE**
off white, light to medium brown, mottled, as crinoid, brachiopod mudstone to wackestone, rare packstone, slightly cherty, chalky, rare fragments with poor moldic bitumen plugged intergranular porosity, bright yellow green flash cut fluorescence, Soltex mud additive?
- 1,235.00 to 1,245.00 100% **SHALE**
(10.00) medium brown, occasionally dark brown, platy to occasionally blocky, pyritic, calcareous, occasional brachiopod & crinoid clasts, rare carbonaceous grains or glauconite, slow yellow green flash cut fluorescence (Soltex mud additive?).
- 1,245.00 to 1,260.00 100% **SHALE**
(15.00) medium brown, occasionally dark brown, platy to occasionally blocky, pyritic, calcareous, occasional brachiopod & crinoid clasts, rare carbonaceous grains or glauconite, slow yellow green flash cut fluorescence (Soltex Mud additive?).

Sample Descriptions

Storage Units: Metric

- 1,260.00 to 1,270.00 100% **SHALE**
(10.00) medium brown, sub platy to blocky, calcareous, occasionally very pyritic, with pyritic laminae (facs?), & commonly with disseminated very fine pyritic specks, calcareous, slightly carbonaceous, slightly silty & sandy, occasional brachiopod or crinoid fossils, rare glauconite, slow yellow green milky flash cut fluorescence (Soltex mud additive?)
- 1,270.00 to 1,280.00 100% **SHALE**
(10.00) medium brown, platy to occasionally blocky, pyritic, micaceous, calcareous, locally slightly silty or sandy, rare carbonaceous flakes, rare crinoid & brachiopod fossils, slow yellow green flash cut fluorescence (Soltex mud additive?)
- 1,280.00 to 1,285.00 100% **SHALE**
(5.00) medium brown, sub platy to occasionally blocky, pyritic, calcareous, less silty & sandy than above, rare brachiopod & crinoid fossils, milky yellow green slash cut fluorescence, (Soltex mud additive?)
- 1,285.00 to 1,290.00 100% **SHALE**
(5.00) light to medium brown, rare dark brown fragments, sub platy to blocky, calcareous, pyritic, commonly silty & sandy, occasional fragments grading to very argillaceous, light to medium brown, angular to subrounded, calcareous, silty to very fine lower grained, tight, quartzose sandstone.
- 1,290.00 to 1,295.00 100% **SHALE**
(5.00) medium brown, sub platy to blocky, micromicaceous, pyritic, rare pyrite fracture fills, calcareous, commonly silty & sandy, occasional brachiopod & crinoid fossils, , slightly carbonaceous, slow yellow green, milky flash cut fluorescence, (Soltex mud additive?)
- 1,295.00 to 1,300.00 100% **SHALE**
(5.00) medium brown, rare dark brown fragments, sub platy to occasionally blocky, micromicaceous, calcareous, slightly pyritic, 25% of fragments silty & sandy, slow yellow green milky flash cut fluorescence (Soltex mud additive?)
- 1,300.00 to 1,305.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to blocky, calcareous, trace carbonaceous flakes, rare massive pyrite fragments as possible fracture fills, rare crinoid & brachiopod fossil fragments, slow yellow green flash cut fluorescence (Soltex mud additive?), rare light gray, off white, salt and pepper, subangular to subrounded, siliceous, calcareous, silty to very fine lower grained, tight sandstone fragments with 10-15% chert grains.
- 1,305.00 to 1,310.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to blocky, calcareous, slightly carbonaceous, occasional brachiopod or crinoid fossils, locally with very fine pyrite laminae & as probable fracture fill, slightly marly, slightly silty & sandy, slow yellow green flash cut fluorescence, (Soltex mud additive?) slightly silty & sandy, 3-5% light gray, off white, salt and pepper, consolidated, silty to very fine lower grained, subangular to subrounded, calcareous, siliceous, locally argillaceous or pyritic, tight, moderately to well sorted, sandstone fragments.

Sample Descriptions

Storage Units: Metric

- 1,310.00 to 1,315.00 100% **SHALE**
(5.00) medium to dark brown, platy to occasionally blocky, micromicaceous, 7% as pyrite fragments, fracture fill?, trace disseminated very fine carbonaceous flakes, calcareous, 15-20% of fragments slightly silty & sandy, slow yellow green flash cut fluorescence.
- 1,315.00 to 1,320.00 100% **SHALE**
(5.00) medium brown, sub platy to blocky, calcareous, occasional pyrite filled fractures, 15-20% of fragments silty & sandy, rare very fine disseminated carbonaceous flakes, rare crinoid or brachiopod fossils, slow yellow green flash cut fluorescence (Soltex mud additive?)
- 1,320.00 to 1,325.00 100% **SHALE**
(5.00) medium brown, sub platy to occasionally blocky, calcareous, pyritic, occasional brachiopod & crinoid fossil fragments, occasional silty or sandy fragments, slow moderate yellow green flash cut fluorescence (Soltex mud additive?), rare off white, light brown, commonly chalky, brachiopod, crinoid mudstone to wackestone fragments.
- 1,325.00 to 1,330.00 60% **SHALE**
(5.00) gray brown, medium brown, 7% light gray, sub platy to occasionally blocky, pyritic, calcareous, slightly carbonaceous, occasionally silty & sandy, slow yellow green flash cut fluorescence (Soltex mud additive?)
- 40% **LIMESTONE**
white, light to medium brown, mottled, sandy, marly, argillaceous, glauconitic, as crinoid, brachiopod mudstone to wackestone, chalky in part, grading to calcareous, fossiliferous, argillaceous, silty to fine lower grained, glauconitic, tight sandstone & sandy, fossiliferous marlstone.
- 1,330.00 to 1,335.00 100% **SHALE**
(5.00) medium brown, 6% light gray, sub platy to occasionally blocky, calcareous, pyritic, rare pyrite filled fractures, 30% of fragments silty & sandy, grading to argillaceous, calcareous, sandy, tight siltstone & silty sandstone, bulk sample with milky yellow green flash cut fluorescence, (Soltex mud additive?)
- 1,335.00 to 1,340.00 70% **SHALE**
(5.00) medium brown, 4% light gray, sub platy to occasionally blocky, calcareous, commonly slightly silty & sandy, pyritic, milky yellow green flash cut fluorescence.
- 30% **LIMESTONE**
light to medium brown, off white occasionally mottled, chalky in part, commonly with medium brown argillaceous cement & marly, occasionally sandy & grading to silty to very fine lower grained, tight, calcareous, quartzose, argillaceous, angular to subrounded sandstone, limestone as crinoid, brachiopod mudstone to wackestone.

Sample Descriptions

Storage Units: Metric

- 1,340.00 to 1,345.00 100% **SHALE**
(5.00) medium brown, sub platy to occasionally blocky, calcareous, pyritic, < 25% of fragments silty & sandy, occasional crinoid & brachiopod fossils, slightly marly, milky yellow green flash cut fluorescence (Soltex mud additive?), 7% light gray, light to medium brown, argillaceous, locally silty or sandy, marly, crinoid, brachiopod wackestone, mudstone fragments.
- 1,345.00 to 1,350.00 60% **SHALE**
(5.00) medium brown, sub platy to blocky, calcareous, commonly silty, pyritic, rare glauconite, yellow green flash cut fluorescence (Soltex mud additive?).
- 40% **LIMESTONE**
light to medium brown, occasionally light gray, off white, argillaceous & grading to calcareous marlstone, as marly, locally sandy, silty, argillaceous, brachiopod, crinoid mudstone, rare wackestone, tight, chalky in part. Trace light gray, light brown, consolidated, salt and pepper, subangular to subrounded, angular in part, calcareous, quartzose to salt and pepper, argillaceous, fine grained, moderately to well sorted, tight sandstone fragments.
- 1,350.00 to 1,355.00 70% **SHALE**
(5.00) medium brown, rare light gray shale fragments, sub platy to subblocky, calcareous, pyritic, yellow green flash cut fluorescence (Soltex mud additive?).
- 30% **SANDSTONE**
consolidated, salt and pepper, off white, light gray, fine to lower medium grained, with 20-35% black, gray, light brown chert grains, siliceous & locally with silica overgrowths, subangular to subrounded, rounded in part, locally with light gray or light brown argillaceous cement, tight, no shows.
- 1,355.00 to 1,360.00 80% **LIMESTONE**
(5.00) light to medium brown, occasionally off white & chalky in part, cryptocrystalline to microcrystalline, argillaceous & grading to calcareous marlstone, as mudstone, tight, slightly pyritic, locally silty or sandy, rare glauconite grains, tight, no shows, 20% of fragments sandy, grading to argillaceous, very calcareous, tight, predominately quartzose, argillaceous, tight sandstone.
- 20% **SHALE**
medium to dark brown, sub platy to blocky, calcareous, slightly pyritic, marly in part, occasional limestone partings.
- 1,360.00 to 1,365.00 100% **LIMESTONE**
(5.00) light to medium brown, cryptocrystalline to occasionally microcrystalline, as crinoid, brachiopod mudstone, commonly argillaceous & marly, grading in part to marlstone, occasional fragments with 9% visible vug porosity with bright rapid yellow green flash cut fluorescence (Soltex mud additive?).
- 1,365.00 to 1,370.00 100% **LIMESTONE**
(5.00) light to medium brown, cryptocrystalline, as mudstone, rare brachiopod & crinoid fossil fragments, rare pyrite, commonly argillaceous & marly, dense & tight.

Sample Descriptions

Storage Units: Metric

- 1,370.00 to 1,375.00 100% **LIMESTONE**
(5.00) light to predominately medium brown, 10-15% off white & chalky, cryptocrystalline, as rare crinoid, brachiopod mudstone, commonly with light to medium brown argillaceous cement & grading to calcareous, tight marlstone, tight, no shows, rare pyrite.
- 1,375.00 to 1,380.00 100% **LIMESTONE**
(5.00) 30% off fragments off white, cryptocrystalline to microcrystalline, chalky & friable in part, commonly with off white argillaceous matrix & marly, predominately medium brown, cryptocrystalline, commonly with medium brown argillaceous cement, limestone marly & grading to calcareous marlstone, as argillaceous, crinoid, brachiopod mudstone, tight, no shows.
- 1,380.00 to 1,385.00 100% **LIMESTONE**
(5.00) 20% off fragments off white, predominately medium brown, cryptocrystalline to microcrystalline, chalky & friable in part, commonly with off white or medium brown argillaceous matrix & marly, grading to calcareous marlstone, as argillaceous, crinoid, brachiopod mudstone, tight, no shows.
- 1,385.00 to 1,390.00 100% **LIMESTONE**
(5.00) off white, light to medium brown, mottled, cryptocrystalline to occasionally microcrystalline, chalky in part, trace pyrite, cherty, commonly with brown argillaceous matrix & grading to calcareous marlstone, as rare crinoid, brachiopod mudstone, slightly sandy, silty, dense & tight.
- 1,390.00 to 1,395.00 100% **LIMESTONE**
(5.00) 25% off white, predominately medium brown, cryptocrystalline to microcrystalline, commonly with off white or medium brown argillaceous cement & locally grading to marlstone, commonly chert replaced, as rare crinoid, brachiopod mudstone, slightly pyritic, tight.
- 1,395.00 to 1,400.00 100% **LIMESTONE**
(5.00) 30% of fragments off white, cherty, commonly with off white argillaceous cement, grading in part to cherty, calcareous marlstone, tight, 30% medium brown, commonly chert replaced, with medium brown argillaceous cement, trace pyrite, 25% light gray, predominately chert replaced, 15% off white, mottled, as mudstone, rare brachiopod & crinoid fragments, tight.
- 1,400.00 to 1,405.00 100% **LIMESTONE**
(5.00) 30% off white, predominately medium brown, mottled in part, as crinoid, brachiopod mudstone, commonly chert replaced, locally argillaceous, rare fractures, 1-2% of fragments as clear or amber colored calcite sparite, locally euhedral and as vug or fracture fill, rare calcite lined fractures, , most fragments give a bright yellow green flash cut fluorescence, petroleum odor (Soltex mud additive?)
- 1,405.00 to 1,410.00 100% **LIMESTONE**
(5.00) off white & brown, mottled, commonly argillaceous, slightly silty & sandy, occasionally hard & cherty or occasionally marly, cryptocrystalline to microcrystalline, as argillaceous mudstone, 50% of fragments medium brown, cryptocrystalline, well indurated, with more chert than above, locally with medium brown argillaceous cement, as mudstone, rare brachiopod & crinoid fossils,

Sample Descriptions

Storage Units: Metric

- 1,410.00 to 1,415.00 100% **LIMESTONE**
(5.00) off white, predominately light to medium brown, cryptocrystalline to occasionally microcrystalline, very cherty, locally with light brown argillaceous cement, chert commonly light to medium brown, rare gray, as mudstone, rare crinoid & brachiopod fossil fragments, tight.
- 1,415.00 to 1,420.00 100% **LIMESTONE**
(5.00) 25% off white, chalky, cryptocrystalline to microcrystalline, predominately medium brown, cryptocrystalline, as mudstone, rare brachiopod & crinoid fossil fragments, very cherty, locally argillaceous, rare chert fragments with 9 % black bitumen filled moldic porosity, predominately tight, samples contaminated with Soltex mud additive.
- 1,420.00 to 1,425.00 100% **LIMESTONE**
(5.00) 20% off white, chalky in part, slightly argillaceous or cherty, predominately light to medium brown, cryptocrystalline, rare pyrite, commonly chert replaced, as mudstone, rare medium brown shale partings, tight.
- 1,425.00 to 1,430.00 100% **LIMESTONE**
(5.00) off white, light brown, mottled. predominately medium to dark brown, cryptocrystalline to occasionally microcrystalline, commonly argillaceous, marly, cherty, trace disseminated pyrite, grading in part to calcareous cherty marlstone, tight.
- 1,430.00 to 1,435.00 100% **LIMESTONE**
(5.00) 40% off white, light brown, mottled, predominately medium brown, commonly argillaceous, cherty, slightly pyritic, occasionally fragments very argillaceous & grading to calcareous marlstone, commonly cherty, as mudstone, tight.
- 1,435.00 to 1,440.00 100% **LIMESTONE**
(5.00) 30% light brown, chalky in part, predominately medium brown, cryptocrystalline, as mudstone, commonly argillaceous, cherty & grading to calcareous marlstone, tight, no shows.
- 1,440.00 to 1,445.00 100% **LIMESTONE**
(5.00) 25% off white, brown, mottled, chalky in part, predominately medium brown, cryptocrystalline, dense, well indurated, commonly cherty, argillaceous, as mudstone limestone, grading to calcareous marlstone, slightly pyritic, tight.
- 1,445.00 to 1,450.00 100% **MARLSTONE**
(5.00) light gray brown, predominately medium to dark brown, cryptocrystalline, very calcareous, commonly silty, rare crinoid or brachiopod fossil fragments, slightly carbonaceous, fragments in part grading to argillaceous mudstone limestone, rare pyrite & chert, dense & tight.
- 1,450.00 to 1,455.00 100% **LIMESTONE**
(5.00) 40% light brown,, off white, mottled, slightly pyritic, as crinoid, brachiopod mudstone, commonly argillaceous, occasionally silty & sandy, predominately medium to dark brown, cryptocrystalline, argillaceous, silty, sandy, slightly cherty, grading to calcareous marlstone, dense & tight.

Sample Descriptions

Storage Units: Metric

- 1,455.00 to 1,460.00 100% **MARLSTONE**
(5.00) 25% light gray brown, predominately medium to dark brown, argillaceous, calcareous, slightly silty, carbonaceous or pyritic, grading in part to argillaceous mudstone limestone, rare crinoid & brachiopod shell frags, dense & tight.
- 1,460.00 to 1,465.00 100% **MARLSTONE**
(5.00) medium to dark brown, sub platy to blocky, slightly pyritic, grading in part to argillaceous, mudstone limestone, commonly slightly silty or sandy, dense & tight.
- 20% **LIMESTONE**
light brown, light gray brown, off white, commonly mottled, argillaceous, as crinoid, brachiopod mudstone, silty, sandy, chalky in part, grading to marlstone, dense & tight.
- 1,465.00 to 1,470.00 60% **LIMESTONE**
(5.00) light gray brown, off white, brown, mottled, commonly argillaceous, grading in part to calcareous, marlstone, as argillaceous mudstone limestone, slightly pyritic, chalky in part, slightly carbonaceous, sandy or cherty, dense & tight.
- 40% **MARLSTONE**
medium to dark brown, blocky, firm, very calcareous, slightly pyritic, silty, sandy or cherty, dense & tight.
- 1,470.00 to 1,475.00 70% **MARLSTONE**
(5.00) medium to dark brown, sub platy to blocky, very calcareous, locally cherty, slightly carbonaceous, silty or sandy, grading in part to argillaceous limestone, dense & tight.
- 30% **LIMESTONE**
off white, light gray brown, light brown, mottled, commonly with light brown or off white clay, marly, as mudstone, slightly pyritic, tight.
- 1,475.00 to 1,480.00 60% **LIMESTONE**
(5.00) light gray brown, cryptocrystalline, commonly with light gray, light brown argillaceous matrix, rare crinoids, spicules, brachiopods, silty & sandy in part, as mudstone, grading to marlstone., dense & tight.
- 60% **MARLSTONE**
medium brown, cryptocrystalline, calcareous, very firm, commonly with dark brown argillaceous matrix, rare floating crinoids, slightly silty, sandy, pyritic, slightly carbonaceous, grading in part to argillaceous limestone, dense & tight.
- 1,480.00 to 1,485.00 100% **LIMESTONE**
(5.00) light brown gray, commonly medium to dark brown, cryptocrystalline, argillaceous & commonly grading to calcareous marlstone, in part chert replaced, slightly carbonaceous & silty, rare calcite lined fractures, as argillaceous, marly mudstone, rare pyrite, dense & tight.

Sample Descriptions

Storage Units: Metric

- 1,485.00 to 1,490.00 100% **LIMESTONE**
(5.00) light gray brown, medium to dark brown, cryptocrystalline, rare microcrystalline fragments, slightly chalky, as mudstone, commonly argillaceous & grading to marlstone, slightly silty & carbonaceous, rare chert in acid residue, dense & tight.
- 1,490.00 to 1,495.00 100% **LIMESTONE**
(5.00) 40% light brown, off white, chalky in part, predominately medium to dark brown, cryptocrystalline, commonly argillaceous, slightly silty & pyritic, spicular, predominately as mudstone, rare clear calcite sparite & euhedral sparite lined fracture fills & rare microcrystalline calcite healed fractures, yellow green flash cut fluorescence (Soltex still contaminates samples)
- 1,495.00 to 1,500.00 100% **LIMESTONE**
(5.00) 50% light gray brown, chtky in part, 50% medium to dark brown, cryptocrystalline to rare microcrystalline, as mudstone, argillaceous, grading in part to marlstone, occasional spicules, slightly carbonaceous, tight.
- 1,500.00 to 1,505.00 100% **LIMESTONE**
(5.00) light gray brown, light brown, chalky in part, mottled, argillaceous, as crinoid mudstone, grading to marlstone, slightly silty & sandy, tight, 40% medium to dark brown, blocky, cryptocrystalline, very argillaceous, rare crinoids, commonly grading to marlstone, slightly silty & sandy, rare pyrite lined fractures.
- 1,505.00 to 1,510.00 60% **LIMESTONE**
(5.00) light brown, chalky & mottled in, commonly argillaceous, with light brown argillaceous matrix, grading to calcareous marlstone, slightly silty, rare pyrite, as argillaceous, marly, mudstone limestone, tight, no shows
- 40% **MARLSTONE**
medium to dark brown, slightly pyritic, cryptocrystalline, cherty in part, commonly with dark brown argillaceous matrix, slightly silty, cherty, locally grading to argillaceous mudstone limestone, dense & tight.
- 1,510.00 to 1,515.00 50% **LIMESTONE**
(5.00) light gray brown, light gray, off white, mottled, cryptocrystalline, commonly with light gray, light brown argillaceous acid residue, marly, grading to marlstone, as mudstone, dense & tight.
- 50% **MARLSTONE**
medium to dark brown, cryptocrystalline to occasionally microcrystalline, slightly pyritic, calcareous, slightly silty, locally grading to argillaceous mudstone limestone.
- 1,515.00 to 1,520.00 60% **MARLSTONE**
(5.00) medium brown, cryptocrystalline to microcrystalline, slightly silty & sandy, slightly carbonaceous, cherty in part, calcareous, dense & tight.

Sample Descriptions

Storage Units: Metric

1,515.00 to 1,520.00 (5.00)	40%	LIMESTONE light gray brown, light brown, off white, mottled in part & chalky, cryptocrystalline, as argillaceous, marly limestone, slightly silty, trace pyrite, rare clear calcite sparite & rare euhedral sparite with black, dead bitumen, slow yellow green flash cut fluorescence, (Soltex mud additive?).
1,520.00 to 1,525.00 (5.00)	100%	LIMESTONE 60% off white, light brown, mottled, chalky, cherty, argillaceous, as argillaceous mudstone, 40% medium brown & predominately as argillaceous chert or calcareous, marlstone, dense & tight.
1,525.00 to 1,530.00 (5.00)	65%	LIMESTONE off white, very light brown, mottled, chalky, cherty & argillaceous, grading in part to marlstone, occasional sparite lined fractures with abundant black, bitumen lined clear coarse sparite calcite crystals as fracture fills with abundant black tarry to vitreous & dead & hard bitumen, slow yellow green flash cut fluorescence, Soltex still contaminating samples, 40% of fragment as dark gray marlstone & translucent, spicular chert.
1,530.00 to 1,535.00 (5.00)	100%	LIMESTONE 50% off white, light brown, mottled, argillaceous, slightly pyritic, marly, cryptocrystalline to occasionally very fine lower crystalline, as mudstone, grading to marlstone, dense & tight, 40% as medium to dark brown, cryptocrystalline, as calcareous, locally cherty, slightly silty, slightly carbonaceous, marlstone, dense & tight.
1,535.00 to 1,540.00 (5.00)	60%	LIMESTONE off white, light brown, mottled, argillaceous, cryptocrystalline to microcrystalline, chalky in part, commonly argillaceous & grading to calcareous marlstone, as argillaceous, marly mudstone limestone, tight, no shows.
	40%	MARLSTONE medium to dark brown, cryptocrystalline, slightly silty, sandy, rare carbonaceous flakes, locally cherty, calcareous, dense & tight.
1,540.00 to 1,545.00 (5.00)	60%	LIMESTONE off white, light brown, light gray brown, mottled, chalky textured in part, commonly argillaceous, slightly silty, sandy, spicular, as argillaceous, marly mudstone limestone, grading to calcareous, marlstone, dense & tight.
	40%	MARLSTONE medium to dark gray, blocky, calcareous, slightly pyritic, locally slightly cherty, dense & tight.
1,545.00 to 1,550.00 (5.00)	75%	MARLSTONE medium to predominately dark brown, sub platy to blocky, cryptocrystalline, slightly silty, carbonaceous, dense & tight.
	25%	LIMESTONE light brown, light gray brown, off white, chalky in part, argillaceous & marly, slightly silty & carbonaceous, trace pyrite, dense & tight, grading in part to marlstone.

Sample Descriptions

Storage Units: Metric

1,550.00 to 1,555.00 (5.00)	70%	MARLSTONE medium to dark brown, cryptocrystalline to microcrystalline, silty, grading to calcareous shale.
	30%	LIMESTONE light gray brown, light brown, off white, chalky & mottled textured, commonly argillaceous & marly, as argillaceous limestone, grading to calcareous marlstone, slightly silty & carbonaceous, tight.
1,555.00 to 1,560.00 (5.00)	75%	SHALE medium to dark brown, sub platy to blocky, calcareous, grading in part to calcareous limestone, trace silt & carbonaceous flakes.
	25%	MARLSTONE light gray brown, medium chalky, mottled in part, calcareous, slightly silty, sandy, pyritic or carbonaceous, dense & tight.
1,560.00 to 1,565.00 (5.00)	75%	SHALE medium to dark brown, calcareous, slightly silty, locally grading to marlstone.
	25%	MARLSTONE light gray brown, off white, chalky textured, calcareous, slightly silty & sandy, friable in part.
1,565.00 to 1,570.00 (5.00)	75%	SHALE medium brown, calcareous, firm, non fissile, locally cherty or grading to calcareous marlstone.
	30%	MARLSTONE light gray brown, off white, chalky & mottled textured, calcareous, slightly carbonaceous, spicular, rare pyrite, tight.
1,570.00 to 1,575.00 (5.00)	50%	LIMESTONE off white, light gray, light to medium brown, mottled, chalky textured in part, argillaceous, locally grading to calcareous marlstone, slightly silty, tight.
	50%	MARLSTONE medium to dark brown, platy to blocky, calcareous, grading to calcareous shale, slightly silty, dense & tight.
1,575.00 to 1,580.00 (5.00)	60%	MARLSTONE medium to dark brown, cryptocrystalline, calcareous, grading in part to shale, locally cherty, silty, dense & tight.
	40%	LIMESTONE off white, light gray, light to medium brown, chalky textured, mottled, argillaceous & commonly grading to calcareous marlstone, trace silt, rare bitumen lined sparite fracture fill fragments.
1,580.00 to 1,585.00 (5.00)	60%	SHALE medium to dark brown, sub platy to blocky, very calcareous, slightly silty, grading in part to calcareous marlstone.

Sample Descriptions

Storage Units: Metric

1,580.00 to 1,585.00 40% (5.00)	MARLSTONE light gray brown, light to medium brown, off white, mottled, chalky textured, calcareous, occasionally grading to argillaceous mudstone limestone, trace silt, rare pyrite, tight.
1,585.00 to 1,590.00 60% (5.00)	MARLSTONE off white, light brown, light brown gray, mottled, chalky textured in part, calcareous, slightly silty, chjty, grading in part to argillaceous mudstone limestone.
40%	SHALE medium to dark brown, calcareous, mrlsy, grading to calcareous, marlstone, spicular, slightly silty, trace pyrite.
1,590.00 to 1,595.00 100% (5.00)	MARLSTONE 50% of fragments off white, light gray brown, light brown, mottled, commonly chalky textured, calcareous, <30% of fragments grading to argillaceous mudstone limestone, slightly silty, spicular with light brown argillaceous matrix, 40% of fragments medium to dark brown, as calcareous chert, locally as marlstone or shale, dense & tight.
1,595.00 to 1,600.00 100% (5.00)	MARLSTONE 50% of fragments off white, light gray brown, light brown, mottled, commonly chalky textured, calcareous, in part grdt to argillaceous mudstone limestone, slightly silty, spicular & commonly with light brown argillaceous matrix, 50% of fragments medium to dark brown, silty, locally cherty, grading to silty, calcareous, very calcareous shale, tight
1,600.00 to 1,606.00 90% (6.00)	LIMESTONE dark grayish brown to yellowish brown, cryptocrystalline, slightly argillaceous in part, occasional calcareous shale partings, scattered to locally common brachiopod fragments, cherty siliceous framework, tight muddy matrix, occasional calcite filled fracture with trace to minor pyrobitumen, local fracture porosity, sparry calcite + bitumen cement has yellow fluorescence & gives a slow blooming cut.
10%	SHALE dark gray, blocky, calcareous, trace minute carbonaceous matter throughout, minor finely disseminated pyrite, thin laminations
1,606.00 to 1,615.00 75% (9.00)	LIMESTONE dark grayish brown cherty matrix with common light to medium yellowish brown to yellowish gray fossiliferous limestone, skeletal in part, scattered brachiopods, cryptocrystalline, argillaceous in part, dense, tight, trace pyrite, rare calcite filled fracture, no visible show
25%	SHALE dark gray to black, subfissile to blocky, calcareous, carbonaceous in part
1,615.00 to 1,625.00 90% (10.00)	LIMESTONE predominately medium yellowish brown to yellowish gray, dark grayish brown & cherty in part, cryptocrystalline, slightly argillaceous, scattered brachiopods, skeletal in part, dense, tight, occasional calcite cemented fracture

Sample Descriptions

Storage Units: Metric

1,615.00 to 1,625.00 (10.00)	10%	SHALE dark gray to black, subfissile to subblocky, calcareous, thin laminations
1,625.00 to 1,635.00 (10.00)	85%	LIMESTONE as above, occasional calcite cemented fracture with trace pyrobitumen, dark cherty matrix, scattered brachiopods, dense, tight
	15%	SHALE dark gray to black, blocky, calcareous, carbonaceous in part
1,635.00 to 1,647.50 (12.50)	100%	LIMESTONE predominately light to medium yellowish brown to yellowish gray, dark grayish brown in part, cryptocrystalline, slightly argillaceous, 5-8% dark brown chert, nodular, scattered brachiopods, dense, tight, occasional calcite cemented fracture, trace calcite druse, occasional calcareous shale laminations, no visible show
1,647.50 to 1,660.00 (12.50)	85%	LIMESTONE light to medium yellowish brown, to grayish brown nodules in dark grayish brown muddy matrix, cryptocrystalline, argillaceous in part, common calcareous shale partings, cherty, 3-5% dark grayish brown chert nodules, scattered brachiopods, dense, tight, Cherty Nodular Brachiopod Wackestone
	15%	SHALE dark gray to black, subblocky to blocky, calcareous, thin beds
1,660.00 to 1,665.00 (5.00)	95%	LIMESTONE light to medium grayish brown, cryptocrystalline, cherty, 15-20% cherty framework & occasional dark chert nodules, fragmental, locally sandy, sandy stringers, dense, tight, occasional calcite cemented microfracture, trace pyrite
	5%	SHALE as above
1,665.00 to 1,670.00 (5.00)	80%	LIMESTONE medium to dark grayish brown, cryptocrystalline, increasingly argillaceous, cherty framework, locally sandy, fragmental in part, common brachiopod fragments, dense, tight, occasional calcite cemented microfracture
	20%	SHALE dark gray, dark brownish gray, blocky, slightly carbonaceous, calcareous
1,670.00 to 1,685.00 (15.00)	100%	LIMESTONE medium brownish gray nodules in dark grayish brown muddy matrix, common brachiopods, argillaceous, occasional dark gray to black argillaceous parting, dense, tight, minor finely disseminated pyrite, silty in part, Nodular Brachiopod Wackestone

Hart River: 1,688.20 MD, 1,650.04 TVD, -1,024.89 SSL

1,685.00 to 1,690.00 (5.00)	60%	LIMESTONE as above
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Sample Descriptions

Storage Units: Metric

1,685.00 to 1,690.00 (5.00)	40%	SHALE dark gray to black, subblocky to subfissile, phosphatic, common white specks, carbonaceous in part, no visible show
1,690.00 to 1,697.50 (7.50)	90%	SHALE dark gray to black, subfissile to subblocky, extremely calcareous, occasional calcite rods, abundant white specks throughout, phosphatic, locally silty, carbonaceous in part, no visible show
	10%	LIMESTONE medium to dark grayish brown to brownish gray, cryptocrystalline, argillaceous, rare fossil fragments, dense, tight
1,697.50 to 1,705.00 (7.50)	60%	LIMESTONE medium to dark yellowish brown to grayish brown, cryptocrystalline, argillaceous, scattered shell fragments, dense, tight, locally sandy, brittle, Sandy Wackestone
	25%	SANDSTONE medium gray, light, medium & dark gray chert, common to abundant grayish brown chert, minor quartz, fine to very coarse grained, subrounded, poorly sorted, calcite cement, well indurated, brittle, tight, no visible show
	15%	SHALE dark gray to black, subfissile to subblocky, calcareous, phosphatic, carbonaceous in part, silty in part
1,705.00 to 1,715.00 (10.00)	75%	LIMESTONE medium to dark gray to grayish brown, cryptocrystalline, argillaceous, locally sandy, scattered brachiopods, hard, brittle, dense, tight, dark muddy matrix, Brachiopod Wackestone
	25%	SHALE dark gray to black, subfissile, calcareous, carbonaceous in part, slightly phosphatic
1,715.00 to 1,722.50 (7.50)	80%	SHALE dark gray to black, subfissile to subblocky, extremely calcareous, phosphatic, carbonaceous in part, silty to very fine grained sandy, abundant white specks throughout, no visible fluorescence
	20%	LIMESTONE medium to dark gray to brownish gray, cryptocrystalline, argillaceous, scattered fossil fragments, dense, tight
1,722.50 to 1,735.00 (12.50)	75%	SHALE dark gray to black, subblocky, silty to sandy, calcareous, carbonaceous in part, phosphatic, abundant white phosphatic specks throughout
	25%	LIMESTONE dark grayish brown, cryptocrystalline, argillaceous, phosphatic, trace to minor chert, scattered nodules, dense, tight

Sample Descriptions

Storage Units: Metric

1,735.00 to 1,745.00 (10.00)	70%	LIMESTONE medium to dark grayish brown, cryptocrystalline to very finely microcrystalline subhedral, locally silty, phosphatic in part, scattered dark brown chert nodules, occasional fossil fragments, dense, tight
	30%	SHALE dark gray to black, subblocky, silty in part, phosphatic, calcareous, carbonaceous
1,745.00 to 1,750.00 (5.00)	60%	SHALE as above
	40%	LIMESTONE as above
1,750.00 to 1,760.00 (10.00)	100%	SHALE dark grayish brown to black, subfissile to subblocky, calcareous, carbonaceous, silty to sandy, phosphatic, locally with white crystalline rods, occasional dark grayish brown limestone stringers

Hart River, CD Sands: 1,764.00 MD, 1,725.70 TVD, -1,100.55 SSL

1,760.00 to 1,765.00 (5.00)	70%	LIMESTONE medium to dark grayish brown, cryptocrystalline, sandy, very fine to upper fine grained quartz & chert clasts common throughout, argillaceous, dense, tight, Sandy Limestone
	30%	SHALE as above
1,765.00 to 1,770.00 (5.00)	50%	LIMESTONE as above, occasional brachiopod fragment
	40%	SANDSTONE medium yellowish brown, very fine to fine grained, locally grading to medium grained, subrounded, poorly sorted, calcite cement, grading to sandy limestone in part, well indurated, tight, subequal quartz & gray chert
	10%	SHALE dark brownish gray to black, subblocky, calcareous, carbonaceous, phosphatic in part, silty to sandy
1,770.00 to 1,775.00 (5.00)	65%	SHALE as above
	20%	SANDSTONE light to medium yellowish brown, predominately quartz with common light chert, very fine to fine grained, minor medium grained, subrounded, moderately sorted, calcite cement, tight, no visible show

Sample Descriptions

Storage Units: Metric

1,770.00 to 1,775.00 (5.00)	15%	LIMESTONE dark grayish brown, cryptocrystalline, argillaceous, locally sandy, rare fossil fragments, dense, tight
1,775.00 to 1,777.50 (2.50)	50%	SANDSTONE light yellowish white to grayish white, light to medium yellowish brown, predominately very fine to fine grained, locally medium to lower coarse grained, subrounded, moderate to poorly sorted, calcite cement, well indurated, tight, no visible show
	35%	SHALE dark gray to black, subblocky, silty, calcareous, phosphatic, carbonaceous in part
	15%	LIMESTONE as above
1,777.50 to 1,780.00 (2.50)	100%	SANDSTONE light gray, light yellowish gray, very fine to fine grained, 7-10% medium to lower coarse grained cherty sandstone, 40-50% chert, subrounded, poorly sorted, calcite cement, well indurated, tight, no show, minor shale & limestone as above
1,780.00 to 1,785.00 (5.00)	100%	SANDSTONE medium gray, salt and pepper, fine to very coarse upper grained, predominately variously gray chert with minor quartz, subrounded to rounded, poorly sorted, calcite cement, well indurated, tight
1,785.00 to 1,790.00 (5.00)	50%	SANDSTONE light to medium gray, brownish gray in part, 70-80% variously gray & occasionally brown chert, 20-30% quartz, very fine to lower coarse grained, subrounded to rounded, poorly sorted, brittle, hard, well indurated, calcite cement, tight, no visible show
	30%	LIMESTONE light to dark yellowish brown, cryptocrystalline, argillaceous in part, silty, locally sandy, glassy, well indurated, hard, brittle, rare shell fragments
	20%	SHALE dark brownish gray to black, subblocky, calcareous, phosphatic in part, carbonaceous, silty
1,790.00 to 1,800.00 (10.00)	85%	SANDSTONE light to medium gray, 85-90% chert, 10-15% quartz, upper fine to upper very coarse grained, subrounded to rounded, poorly sorted, calcite cement, well indurated, tight, occasional grains show trace to minor interstitial pyrobitumen cement, trace weak dull yellow fluorescence, slow streaming dead oil cut
	15%	LIMESTONE light yellowish brown, cryptocrystalline, argillaceous, platy, fossiliferous, common shell fragments, tight

Sample Descriptions

Storage Units: Metric

1,800.00 to 1,805.00 (5.00)	65%	LIMESTONE predominately light to medium yellowish brown, locally dark grayish brown, cryptocrystalline, argillaceous in part, glassy, brittle, scattered shell fragments, occasional calcite cemented microfracture, tight
	20%	SHALE dark grayish brown to black, subfissile to subblocky, calcareous, carbonaceous, silty, phosphatic
	15%	SANDSTONE as above
1,805.00 to 1,810.00 (5.00)	65%	SHALE as above
	30%	LIMESTONE light to dark yellowish brown to grayish brown, cryptocrystalline, argillaceous, glassy in part, dense, tight, increasing shell fragments, occasional calcite cemented microfractures
	5%	SANDSTONE as above
1,810.00 to 1,815.00 (5.00)	50%	LIMESTONE predominately light to medium yellowish brown & fossiliferous, common to abundant dark grayish brown & glassy, cryptocrystalline, argillaceous in part, silty in part, rare microfractures with calcite cement, trace chert, tight
	40%	SHALE dark grayish brown to black, subblocky, calcareous, phosphatic, carbonaceous in part
	10%	SANDSTONE medium yellowish gray, very fine to coarse grained chert & trace to minor quartz, calcite cement, subrounded, poorly sorted, well indurated, tight, no visible show
1,815.00 to 1,820.00 (5.00)	85%	LIMESTONE as above, increasingly cherty, 5-7% dark brown chert, dense, tight, occasional microfracture
	10%	SHALE as above
	5%	SANDSTONE light yellowish brown, medium to coarse grained chert in fine grained quartz rich matrix, calcite cement, subrounded, poorly sorted, well indurated, tight, thin stringers
1,820.00 to 1,835.00 (15.00)	75%	LIMESTONE light to medium yellowish brown, locally dark grayish brown, cryptocrystalline, locally sandy, sandy partings, fossiliferous (shell fragments), cherty, common medium to dark brown chert nodules or stringers, very sandy f/1825-1830mMD

Sample Descriptions

Storage Units: Metric

1,820.00 to 1,835.00 25% **SANDSTONE**
(15.00) 15%: light to medium yellowish brown, predominately chert with minor quartz, very fine to upper fine grained, light yellowish brown limestone matrix, grading to sandy limestone; 10%: light to medium gray, predominately variously gray chert with common quartz, fine to upper medium grained, subrounded, poorly sorted, calcite cement, well indurated, tight

1,835.00 to 1,840.00 70% **SANDSTONE**
(5.00) light to medium gray to yellowish gray, 60-70% gray & brown chert, 30-40% quartz, predominately upper very fine to upper medium grained, 5-7% coarse to very coarse grained, subrounded to rounded, poorly sorted, calcite cement, tight

30% **LIMESTONE**
subequal light to medium yellowish brown fossiliferous & fragmental limestone (shell fragments) & dark grayish brown glassy limestone, cryptocrystalline, argillaceous, silty & sandy in part, fine to coarse grained sandy stringers, cherty, ~5% dark brown chert (nodules or stringers), dense, tight

Hart River, Hart River Shale: 1,841.20 MD, 1,802.60 TVD, -1,177.45 SSL

1,840.00 to 1,842.50 80% **LIMESTONE**
(2.50) as above, increasingly dark grayish brown, increasingly cherty (10-15% chert), trace spicular chert, dense, tight, rare brachiopod fragments

20% **SHALE**
dark brownish gray to black, subblocky, calcareous, carbonaceous in part, phosphatic

1,842.50 to 1,845.00 100% **SHALE**
(2.50) medium to dark grayish brown, black, subfissile to subblocky, silty to sandy in part, rare calcite cemented irregular microfracture, phosphatic, minor limestone & cherty coarse grained sandstone as above

1,845.00 to 1,855.00 100% **SHALE**
(10.00) increasingly dark grayish brown to black, subfissile to subblocky, silty in part, occasional dark grayish brown limestone stringer, calcareous, phosphatic, rare microfracture, no visible fluorescence

1,855.00 to 1,860.00 85% **SHALE**
(5.00) dark grayish brown to black, increasingly silty, calcareous, phosphatic, trace dark cherty limestone, occasional sandstone stringers

15% **SANDSTONE**
light yellowish white, light to medium yellowish brown

Hart River, AB Sands: 1,862.80 MD, 1,824.13 TVD, -1,198.98 SSL

1,860.00 to 1,865.00 75% **SHALE**
(5.00) dark grayish brown to black, subfissile to subblocky, silty, calcareous, carbonaceous in part, hard, brittle, phosphatic

Sample Descriptions

Storage Units: Metric

1,860.00 to 1,865.00 (5.00)	25%	SANDSTONE light to medium gray, yellowish gray in part, quartz & abundant light to medium gray chert in white calcite cement, common white subangular brittle clasts (feldspar?), lower fine to upper medium grained, subrounded to subangular, moderate to poorly sorted, silica + calcite + black interstitial bitumen cement, poor intergranular porosity (6-8%), no visible fluorescence, slow streaming dead oil cut
1,865.00 to 1,877.50 (12.50)	90%	SANDSTONE light to medium gray, 20-25% gray chert, 10-15% white angular fragments, 60-70% quartz, predominately upper fine to upper medium grained, 5-7% coarse grained, subrounded to angular, silica + calcite + trace to minor pyrobitumen cement, 6-8% porosity, no visible fluorescence, weak streaming dead oil cut
	10%	SHALE medium to dark brownish gray, calcareous, silty, carbonaceous in part
1,877.50 to 1,890.00 (12.50)	100%	SANDSTONE light gray, light yellowish brown, quartz, chert & abundant white brittle clasts, fine to upper medium grained, subrounded, silica overgrowths, silica + calcite + trace to minor patchy pyrobitumen cement, variable porosity (6-12%), common yellow fluorescence, weak slow blooming cut, questionable show
1,890.00 to 1,895.00 (5.00)	90%	SANDSTONE as above
	10%	SHALE dark grayish brown to black, subblocky to subfissile, silty, calcareous, carbonaceous in part, greasy, firm, brittle
1,895.00 to 1,910.00 (15.00)	60%	SANDSTONE light gray, quartz & abundant light to medium gray chert, very fine to medium grained, subrounded to rounded, poorly sorted, predominately tightly cemented with calcite, occasional grain has minor interstitial pyrobitumen with poor porosity, no visible fluorescence
	20%	LIMESTONE light to medium yellowish brown, cryptocrystalline, slightly argillaceous, silty, fossiliferous (shell fragments), phosphatic in part
	20%	SHALE as above, increasingly silty to very fine grained sandy, phosphatic
1,910.00 to 1,922.50 (12.50)	70%	SANDSTONE light to medium gray, brownish gray, 30-40% gray & occasionally brown chert, very fine to upper medium grained, 4-5% lower coarse grained, subrounded to subangular, poorly sorted, calcite + silica cement, predominately tight, locally with weak intergranular porosity & trace black pyrobitumen cement, no visible fluorescence

Sample Descriptions

Storage Units: Metric

1,910.00 to 1,922.50 (12.50)	20%	LIMESTONE predominately light to medium yellowish brown, dark grayish brown in part, cryptocrystalline, argillaceous, scattered shell fragments, scattered dark brown chert, dense, tight
	10%	SHALE dark grayish brown to black, subblocky, silty, calcareous, carbonaceous in part, phosphatic in part
1,922.50 to 1,925.00 (2.50)	100%	SANDSTONE medium gray, salt and pepper, very fine to lower coarse grained, predominately variously gray chert, 20-30% quartz, subrounded, poorly sorted, silica + calcite + 5-7% pyrobitumen cement, well indurated, poor to locally fair porosity (7-12%), no visible fluorescence, slow streaming dead oil cut
1,925.00 to 1,930.00 (5.00)	100%	SANDSTONE as above, increasing calcite cement, 8-10% porosity, abundant pyrobitumen cement, spotty dull yellow fluorescence, slow streaming dead oil cut
1,930.00 to 1,940.00 (10.00)	100%	SANDSTONE light gray to light yellowish gray, 35-40% variously gray & occasional brown chert, common white brittle feldspar clasts, silica overgrowths, very fine to lower medium grained, 3-5% lower coarse grained, subrounded, poorly sorted, moderate to well indurated, friable in part, poor to locally fair porosity (3-10%), trace interstitial pyrobitumen, no visible show, occasional yellowish white fossiliferous limestone stringers (coquina)
1,940.00 to 1,945.00 (5.00)	65%	SANDSTONE light to medium gray, quartz & 35-40% variable gray chert, predominately very fine to upper medium grained, occasional lower to upper very coarse grained, rounded to subangular, poorly sorted, well indurated, silica + calcite + locally trace pyrobitumen cement, 0-4% porosity, no visible fluorescence
	25%	LIMESTONE predominately dark grayish brown, cryptocrystalline, glassy, cherty, light to medium yellowish brown in part, cryptocrystalline, slightly argillaceous, fossiliferous, shell fragments, silty in part, tight
	10%	SHALE dark brown to black, subfissile, silty to sandy in part, greasy, calcareous, phosphatic, carbonaceous in part
1,945.00 to 1,955.00 (10.00)	40%	SHALE medium to dark grayish brown to black, subfissile to subblocky, calcareous, hard, brittle, phosphatic, carbonaceous in part, silty
	30%	LIMESTONE medium to dark yellowish brown to grayish brown, cryptocrystalline, argillaceous in part, silty to sandy, cherty, fragmental, dense, tight
	30%	SANDSTONE as above, finer grained overall, increasingly well indurated, tightly cemented, small trace pyrobitumen, no visible show

Sample Descriptions

Storage Units: Metric

1,955.00 to 1,965.00 (10.00)	70%	LIMESTONE light yellowish white, light to medium yellowish gray, cryptocrystalline to very finely microcrystalline, fragmental, interbedded massive chert, occasional sandy partings, dense, tight
	30%	CHERT light to medium yellowish brown, medium to dark grayish brown, minute fossiliferous matter & brown organic matter as inclusions throughout, bedded
1,965.00 to 1,972.50 (7.50)	70%	LIMESTONE light to medium yellowish brown to yellowish gray, cryptocrystalline to very finely microcrystalline, sandy in part, fragmental, shell debris, occasional fine grained sandstone laminations, dense, tight, interbedded chert
	30%	CHERT medium to dark brown, light to medium grayish brown, micro fossiliferous & brown organic inclusions, bedded, increasingly abundant dark brown chert in 1972.5m sample
1,972.50 to 1,975.00 (2.50)	50%	LIMESTONE medium to dark grayish brown, cryptocrystalline, argillaceous, rare brachiopod fragments, dense, tight
	45%	SHALE dark brownish gray to black, subfissile, calcareous, silty in part, carbonaceous in part
	5%	CHERT predominately dark brown, brown organic inclusions throughout
1,975.00 to 1,985.00 (10.00)	50%	LIMESTONE light yellowish white, light to medium yellowish gray, locally dark grayish brown, cryptocrystalline to very finely microcrystalline, argillaceous in part, common shell fragments, silty & sandy in part
	40%	CHERT light to very dark brown, bedded, microfossils, dark brown organic inclusions throughout
	10%	SHALE as above
1,985.00 to 1,990.00 (5.00)	50%	LIMESTONE light to medium yellowish brown, yellowish gray, commonly medium to dark grayish brown, cryptocrystalline to very finely microcrystalline, silty & sandy in part, dense, tight
	30%	CHERT medium to very dark brown, microfossils & organic inclusions, bedded
	20%	SHALE dark gray to black, subfissile, silty, calcareous, carbonaceous, greasy

Sample Descriptions

Storage Units: Metric

1,990.00 to 1,995.00 (5.00)	50%	LIMESTONE as above, increasingly medium to dark grayish brown, occasional sandy stringer, rare brachiopod fragments, dense, tight, occasional chert beds
	40%	SHALE dark gray to black, medium to dark grayish brown in part, subfissile to subblocky, calcareous, silty in part, phosphatic, slightly bituminous, very weak faint hazy cut
	10%	CHERT light to dark brown, inclusions, thin beds
1,995.00 to 2,000.00 (5.00)	75%	SANDSTONE light to medium gray, yellowish gray, very fine to medium grained, quartz with abundant gray & brown chert throughout, subrounded to subangular, poorly sorted, silica + secondary calcite cement, well indurated, predominately tight, spotty very weak ingran porosity é trace to minor interstitial pyrobitumen, no visible fluorescence
	15%	LIMESTONE yellowish white, light to medium yellowish brown, dark grayish brown in part, cryptocrystalline to very finely microcrystalline, fragmental, shell fragments, sandy in part
	10%	CHERT variously gray, brown, thin beds, organic inclusions
2,000.00 to 2,005.00 (5.00)	60%	SANDSTONE light to medium gray, brownish gray, subequal quartz & gray to blueish gray chert, very fine to very coarse lower grained, subrounded, poorly sorted, silica + light yellowish brown calcite cement, trace interstitial pyrobitumen cement, friable in part, poor to fair porosity (8-12%), no visible fluorescence, spotty slow streaming dead oil cut, no show
	30%	LIMESTONE light to dark yellowish brown, cryptocrystalline to very finely microcrystalline, glassy, common shell debris, argillaceous in part, dense, tight
	10%	CHERT light to dark brown, organic inclusions, thin beds
2,005.00 to 2,007.50 (2.50)	40%	SHALE dark grayish brown to black, subfissile, calcareous, silty, phosphatic, greasy
	40%	SANDSTONE light to medium gray, chert & quartz, very fine to medium grained, well indurated, silica + secondary calcite cement, tight, no visible show
	20%	LIMESTONE medium to dark brown to grayish brown, cryptocrystalline, glassy, occasional shell fragments

Sample Descriptions

Storage Units: Metric

2,007.50 to 2,012.50 (5.00)	60%	LIMESTONE light to medium yellowish brown to yellowish white, minor very dark brown, cryptocrystalline to very finely microcrystalline, locally sandy, fragmental, tight
	20%	CHERT brown, occasionally gray, fossiliferous in part, organic inclusions, bedded
	20%	SANDSTONE as above
2,012.50 to 2,015.00 (2.50)	100%	SANDSTONE light to medium brownish gray, quartz & abundant gray chert, predominately upper medium to upper coarse grained, very fine to fine grained matrix, rounded to well rounded, moderately sorted, silica + yellowish brown calcite cement, friable, predominately loose, fair to good intergranular porosity (12-18%), no visible fluorescence, rare grain é weak hazy cut, no show
2,015.00 to 2,020.00 (5.00)	60%	SANDSTONE as above
	20%	LIMESTONE light to medium yellowish brown, dark brown in part, cryptocrystalline to very finely microcrystalline, sandy in part, common shell debris, dark brown limestone is slightly argillaceous & glassy, hard, dense, tight
	10%	SHALE dark grayish brown to black, subfissile, calcareous, silty, phosphatic, greasy
	10%	CHERT brown, occasionally gray, fossiliferous in part, organic inclusions, bedded
2,020.00 to 2,022.50 (2.50)	60%	LIMESTONE light to medium yellowish brown, medium to dark brown, cryptocrystalline, argillaceous in part, sandy, common sandy stringers, interbedded chert, fragmental in part
	40%	CHERT dark brown, massive, bedded, organic inclusions
2,022.50 to 2,027.50 (5.00)	60%	LIMESTONE predominately light yellowish white, medium to dark brownish gray, cryptocrystalline to very finely microcrystalline, fragmental, interbedded chert, locally sandy, tight
	30%	CHERT light to dark brown, grayish brown in part, microfossils & organic inclusions, massive, bedded
	10%	SHALE dark brownish gray to black, subfissile, calcareous, greasy, silty in part

Sample Descriptions

Storage Units: Metric

2,027.50 to 2,030.00 (2.50)	50%	CHERT light to dark brown, grayish brown in part, microfossils & organic inclusions, massive, bedded
	40%	LIMESTONE predominately light yellowish white, medium to dark brownish gray, cryptocrystalline to very finely microcrystalline, fragmental, interbedded chert, locally sandy, tight
	10%	SHALE dark brownish gray to black, subfissile, calcareous, greasy, silty in part
2,030.00 to 2,035.00 (5.00)	70%	LIMESTONE predominately medium to dark grayish brown, minor light yellowish gray, cryptocrystalline, increasingly argillaceous, fine grained sandy laminations, occasional brachiopods, occasional calcite cemented microfractures, dense, tight
	20%	SHALE dark brown gray to black, subfissile, calcareous, well indurated, frn, brittle
	10%	CHERT medium to dark brown, microfossils & organic inclusions, thin beds
2,035.00 to 2,040.00 (5.00)	50%	LIMESTONE light to medium yellowish brown, dark grayish brown, cryptocrystalline, argillaceous in part, locally sandy, occasional brachiopod fragments, chert lenses
	30%	SHALE dark grayish brown to black, subfissile to subblocky, calcareous, silty, slightly bituminous, slow weak hazy cut
	20%	CHERT dark brown, microfossils & organic inclusions, thin bds & lenses
2,040.00 to 2,042.50 (2.50)	85%	SHALE very dark brown to black, subfissile, calcareous, greasy, bituminous in part, silty, no visible fluorescence, slow blooming cut, dark orange brown residue ring
	10%	LIMESTONE medium to dark grayish brown, cryptocrystalline, argillaceous in part, dense, tight, locally sandy
	5%	CHERT brown, light gray, thin lenses
2,042.50 to 2,045.00 (2.50)	70%	SHALE as above, slow blooming cut
	15%	CHERT as above

Sample Descriptions

Storage Units: Metric

2,042.50 to 2,045.00 (2.50)	15%	LIMESTONE as above, increasing sandy laminations, cherty in part
2,044.00 to 2,047.50 (3.50)	40%	LIMESTONE light to dark yellowish brown, very finely microcrystalline, sandy & argillaceous in part, occasional very fine to upper fine grained sandy laminations, fragmental, dense, tight
	40%	SHALE as above, increasingly silty, weak blooming cut
	20%	CHERT light to medium dark brown, grayish brown in part, microfossils & organic inclusions, thin beds
2,047.50 to 2,050.00 (2.50)	55%	LIMESTONE as above
	35%	CHERT as above
	10%	SHALE as above
2,050.00 to 2,051.50 (1.50)		CORED INTERVAL see Core Description for lithologic detail
2,051.50 to 2,055.00 (3.50)	50%	SANDSTONE light to medium gray, quartz & chert, very fine to lower medium grained, subrounded, poorly sorted, well indurated, silica + trace pyrobitumen + calcite cement, tight, hard, no visible show
	25%	LIMESTONE light yellowish brown & very dark grayish brown, cryptocrystalline, argillaceous in part, local sandy, interbedded sandstone, scattered fossil fragments, dense, hard, tight
	15%	CHERT light to very dark brown to grayish brown, massive, microfossils & organic inclusions, bedded
	10%	SHALE dark gray to black, subblocky, silty in part, very slightly bituminous, no visible fluorescence, trace weak slow hazy cut
2,055.00 to 2,057.50 (2.50)	50%	SANDSTONE as above
	40%	CHERT as above, commonly sandy
	10%	LIMESTONE as above

Sample Descriptions

Storage Units: Metric

2,057.50 to 2,060.00 (2.50)	50%	LIMESTONE predominately light yellowish white, medium yellowish brown, dark grayish brown in part, cryptocrystalline to microcrystalline, interbedded sandstone, shell fragments, dense, tight
	30%	SANDSTONE light to medium gray, brownish gray, quartz & chert, very fine to lower medium grained, subrounded, poorly sorted, silica + calcite cement, well indurated, tight
	20%	CHERT light gray, medium to dark grayish brown, massive, bedded, microfossils & organic inclusions
2,060.00 to 2,065.00 (5.00)	40%	CHERT as above, increasingly dark grayish brown, massive
	40%	LIMESTONE as above, sandy stringers
	10%	SANDSTONE as above, thin stringers
2,065.00 to 2,070.00 (5.00)	70%	CHERT medium to dark grayish brown, massive, microfossils
	30%	LIMESTONE light medium yellowish brown, yellowish white, locally very dark grayish brown, cryptocrystalline, slightly argillaceous, sandy in part, shell fragments (brachiopods, occasional crinoids), dense, tight, trace pyrite
2,070.00 to 2,072.50 (2.50)	80%	CHERT light to medium brown, grayish brown fine grained sand clasts, microfossils & organic inclusions, bedded, occasional high angle fracture
	20%	LIMESTONE yellowish white to light yellowish brown, cryptocrystalline to very finely microcrystalline, occasional shell fragments, local sandy, dense, tight
2,072.50 to 2,077.50 (5.00)	80%	CHERT predely very dark brown to very dark grayish brown, microfossils & organic inclusions
	20%	LIMESTONE as above, increasingly sandy, occasional sandstone stringer
2,077.50 to 2,080.00 (2.50)	30%	CHERT as above
	30%	SHALE dark brownish gray to black, subfissile, calcareous, silty in part, commonly greasy, slightly bituminous, slow streaming dead oil cut

Sample Descriptions

Storage Units: Metric

Ford Lake: 2,078.90 MD, 2,039.46 TVD, -1,414.31 SSL

2,077.50 to 2,080.00 (2.50)	30%	SANDSTONE yellowish white, light to dark gray, predominately quartz with minor to common chert, very fine to upper fine grained, silica + secondary calcite cement, minor interstitial bitumen cemented over with calcite, very well indurated, tight, trace faint yellow fluorescence, no show
	10%	LIMESTONE as above
2,080.00 to 2,082.50 (2.50)	50%	SHALE dark brownish gray to black, common white specks, subfissile, calcareous, silty, slightly bituminous, trace pyrite
	20%	CHERT medium to very dark brown, occasionally light to medium gray, inclusions throughout, bedded
	20%	LIMESTONE medium to dark grayish brown, cryptocrystalline, argillaceous, rare fossil fragments, silty in part, tight
	10%	SANDSTONE as above, occasional medium to very coarse grained clasts
2,082.50 to 2,085.00 (2.50)	85%	SHALE dark grayish brown to black, subfissile to subblocky, calcareous, silty, firm, moderately brittle, slightly bituminous, no visible fluorescence, slow streaming cut, fair brown residue, occasional limestone & sandstone partings, rare slickenside, rare fracture
	5%	CHERT very dark grayish brown, bedded, inclusions
	5%	LIMESTONE light yellowish brown, medium to dark brownish gray, cryptocrystalline, silty & sandy in part, occasional sandy stringers, shell fragments, tight, thin beds
	5%	SANDSTONE medium to dark good, very fine to fine grained, calcareous, well indurated, tight, thin beds
2,085.00 to 2,087.50 (2.50)	80%	SHALE as above
	10%	SANDSTONE medium to dark good, very fine to fine grained, calcareous, well indurated, tight, thin beds
	5%	LIMESTONE as above

Sample Descriptions

Storage Units: Metric

2,085.00 to 2,087.50 5% (2.50)	CHERT as above
2,087.50 to 2,090.00 80% (2.50)	SHALE dark grayish brown to black, subfissile, silty, occasional very fine to fine grained sandy laminae, trace pyrite, calcareous, slightly bituminous, slow weak streaming dead oil cut, occasional dark gray argillaceous limestone stringer, rare slickenside
20%	SANDSTONE light to medium grayish brown, predominately quartz with minor chert, very fine to fine grained, silica + calcite cement, well indurated, thin beds, tight, no visible show
2,090.00 to 2,095.00 100% (5.00)	SHALE dark grayish brown to black, subfissile, increasingly bituminous, greasy lustre throughout, silty in part, occasional chert & limestone stringer, occasional sandy parting, no visible fluorescence, slow weak strmg cut, rare slickenside
2,095.00 to 2,100.00 80% (5.00)	SHALE as above
15%	SANDSTONE medium to dark gray, quartz & common gray chert, very fine to upper fine grained, occasionally lower medium grained, subrounded to subangular, poorly sorted, silica + calcite cement, trace pyrobitumen, well indurated, tight, no visible show
5%	CHERT medium to dark gray, brown in part, thin beds, inclusions, rare pyrite cemented microfracture
2,100.00 to 2,105.00 65% (5.00)	SHALE very dark grayish brown to black, subfissile, silty, locally sandy, calcareous, slightly bituminous, pyritic (2-5% pyrite), commonly greasy, slow weak streaming cut, fair dark amber brown residue
20%	SANDSTONE as above, increasingly upper fine to lower medium grained, poorly sorted, well indurated, tightly cemented, no visible show
10%	LIMESTONE predominately light to medium grayish brown to yellowish brown, dark grayish brown in part, cryptocrystalline, argillaceous in part, locally sandy, scattered fossil fragments, dense, tight
5%	CHERT as above

Sample Descriptions

Storage Units: Metric

Imperial: 2,113.00 MD, 2,073.51 TVD, -1,448.36 SSL

2,105.00 to 2,117.50 (12.50)	90%	SHALE very dark grayish brown to black, non to slightly calcareous, subfissile, silty, pyritic, greasy to earthy lustre, slightly bituminous, weak streaming cut
	5%	CHERT medium to dark brown to grayish brown, thin beds, inclusions
	5%	LIMESTONE as above
2,117.50 to 2,125.00 (7.50)	85%	SHALE black, very dark brown, fissile to subfissile, silty in part, non calcareous, occasional silt to fine grained sandy parting, trace chert, trace pyrite, moderately firm, moderately brittle
	15%	CONTAMINATION white mud additive coated with medium orange brown rhind. Lime product.
2,125.00 to 2,130.00 (5.00)	75%	SHALE dark gray to black, subfissile, non calcareous, greasy, slightly bituminous, slow weak streaming cut, trace pyrite, silty laminations
	10%	LIMESTONE light to medium yellowish brown, cryptocrystalline to very finely microcrystalline, thin beds, interbedded sandstone, scattered pyrite, tight
	10%	SANDSTONE medium to dark gray, very fine grained, silty in part, subrounded, poorly sorted, calcite cement, minor bitumen cement, well indurated, tight
	5%	CHERT medium to dark gray, grayish brown, thin beds, inclusions
2,130.00 to 2,135.00 (5.00)	65%	SHALE as above
	15%	LIMESTONE as above
	15%	CHERT as above
	5%	SANDSTONE as above
2,135.00 to 2,145.00 (10.00)	60%	SHALE dark grayish brown to black, subfissile, locally silty, occasional pyritic sandy stringers, greasy, slightly bituminous, very weak slow streaming cut

Sample Descriptions

Storage Units: Metric

2,135.00 to 2,145.00 (10.00)	20%	LIMESTONE light to medium yellowish brown, dark grayish brown in part, cryptocrystalline to very finely microcrystalline, locally sandy, occasional fossil fragments, trace pyrite
	10%	SANDSTONE medium to dark gray, very fine to fine grained, rare medium to coarse grained clasts, subrounded, poorly sorted, silica + calcite cement, locally with abundant pyrite cement, well indurated, tight
	10%	CHERT light to medium grayish brown, occasionally very dark brown, inclusions, thin beds
2,145.00 to 2,150.00 (5.00)	45%	SHALE as above
	25%	LIMESTONE as above, increasingly dark gray to grayish brown, argillaceous in part
	15%	CHERT as above
	15%	SANDSTONE as above, increasing massive pyrite, occasional massive pyrite stringer, well indurated, tight
2,150.00 to 2,165.00 (15.00)	75%	SHALE very dark gray to black, subfissile, non calcareous, greasy, slightly bituminous, very weak slow streaming cut as above
	15%	LIMESTONE medium to dark yellowish brown, cryptocrystalline, argillaceous in part, dense, tight, rare brachiopod fragments
	10%	SANDSTONE light to medium gray, very fine to fine grained, quartzose with trace chert, subangular to subrounded, moderate to poorly sorted, calcite cement, well indurated, tight, locally abundant pyrite cement
2,165.00 to 2,180.00 (15.00)	80%	SHALE very dark gray to black, subfissile to subblocky, silty, non calcareous, greasy, slightly bituminous, sandy laminations, rare ostracods, rare fracture
	20%	SANDSTONE medium to dark gray, very fine to fine grained, silty & argillaceous in part, subrounded to subangular, poorly sorted, calcite cement, locally with abundant pyrite cement, tight

Sample Descriptions

Storage Units: Metric

Imperial, Tuttle Member: 2,181.50 MD, 2,141.95 TVD, -1,516.80 SSL

- 2,180.00 to 2,185.00 100% **CHERT PEBBLE SANDSTONE**
(5.00) off white, light gray, occasionally medium brown, consolidated, salt and pepper, fine to medium grained, occasionally coarse grained or conglomeratic & matrix supported, with 30-70% light chert grains, subangular to rounded, moderately to well sorted, commonly with silica overgrowths, calcareous, slightly dolomitic, locally pyritic, traces of 6-8% dead bitumen plugged porosity, poor effective porosity, no cut fluorescence with <10% medium brown, bituminous, blocky, silty, pyritic shale fragments.
- 2,185.00 to 2,190.00 90% **SHALE**
(5.00) medium to dark gray, occasionally medium brown gray, sub platy to blocky, pyritic, bituminous & with slow yellow green flash cut fluorescence, slightly carbonaceous, abundant fractured siderite nodules.
- 10% **SANDSTONE**
light gray, off white, salt and pepper, fine to upper medium grained, moderately to well sorted, subangular to subrounded, calcareous, well consolidated, dolomitic, siliceous, slightly pyritic, tight.
- 2,190.00 to 2,195.00 75% **SHALE**
(5.00) medium to dark brown, medium to dark gray brown, rare black fragments, sub platy to blocky, slightly pyritic, slightly carbonaceous, silty or sandy, bituminous & with slow yellow green flash cut fluorescence, 10% as fractured siderite nodules.
- 25% **SANDSTONE**
commonly as unconsolidated, subangular to subrounded, fine lower to fine upper, occasionally lower medium quartz & chert grains, consolidated fragments light gray, off white, subangular to subrounded, moderately to well sorted, calcareous, siliceous, slightly dolomitic, locally upper medium grained, tight, no shows.
- 2,195.00 to 2,200.00 90% **SHALE**
(5.00) medium brown, medium gray, < 10% dark brown or dark brown gray, sub platy to blocky, micromicaceous, pyritic, soft, slightly carbonaceous or silty, bituminous.
- 10% **SANDSTONE**
light gray, off white, consolidated, salt and pepper, fine to lower medium grained, subangular to subrounded, calcareous, dolomitic, siliceous, pyritic, with <35% chert grains, tight.

Sample Descriptions

Storage Units: Metric

- 2,200.00 to 2,205.00 100% **SHALE**
(5.00) post-trip sample, commonly medium gray, platy, micromicaceous, pyritic, slightly carbonaceous & silty, soft to hard, 40% medium to dark brown, occasionally pyritic, silty, trace light to medium brown cryptocrystalline limestone & fractured siderite nodules, bituminous, with slow yellow green flash cut fluorescence, 6% off white, light gray, siliceous, salt and pepper, fine to occasionally lower medium grained, calcareous, slightly dolomitic, sandstone fragments with occasional 1-8% dead black bitumen plugged intergranular porosity, no cut fluorescence, poor effective porosity.
- 2,205.00 to 2,210.00 100% **SHALE**
(5.00) medium gray, 30% dark gray to black, micromicaceous, slightly carbonaceous, locally sideritic, bituminous & with slow yellow green flash cut fluorescence, 3-4% as cryptocrystalline to microcrystalline, locally silty, sandy fractured siderite nodules & sideritic limestone, 3% as light gray, fine grained, quartzose to salt and pepper, calcareous, tight, subangular to subrounded, slightly dolomitic, tight sandstone fragments, rare massive pyrite fragments.
- 2,210.00 to 2,215.00 100% **SHALE**
(5.00) medium gray, 25% dark gray black, platy to occasionally subblocky, micromicaceous, pyritic, slightly calcareous, bituminous, with slow yellow green flash cut fluorescence, 3% medium brown, fractured siderite fragments.
- 2,215.00 to 2,220.00 90% **SHALE**
(5.00) 50% medium gray, 50% dark gray, dark brown, platy to occasionally subblocky, micromicaceous, pyritic, slightly carbonaceous, bituminous, with slow yellow green flash cut fluorescence, 6% as medium brown, cryptocrystalline to microcrystalline, occasionally silty or sandy, slightly calcareous, fractured siderite nodules.
- 10% **CHERT PEBBLE SANDSTONE**
consolidated, off white, light brown, angular to subrounded, very fine upper to upper medium grained, occasionally coarse grained, rare chert granules & locally conglomeratic, poor to moderately sorted, abundant white, occasional gray, brown, dark gray chert grains, calcareous, dolomitic, siliceous, pyritic, locally with medium brown argillaceous cement, spotty 1-9% black dead bitumen plugged intergranular porosity, no cut fluorescence.
- 2,220.00 to 2,225.00 85% **CHERT PEBBLE SANDSTONE**
(5.00) consolidated, off white, light brown, angular to subrounded, very fine upper to upper medium, occasionally coarse grained, rare chert granules & locally conglomeratic, poor to moderately sorted, abundant white, gray, brown, dark gray chert grains, calcareous, dolomitic, siliceous, pyritic, locally with medium brown argillaceous cement, spotty 1-9% black dead bitumen plugged intergranular porosity, no cut fluorescence.
- 15% **SHALE**
medium brown, medium to dark gray, sub platy to occasionally subblocky, micromicaceous, slightly pyritic, locally silty & sandy, bituminous, with slow yellow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,225.00 to 2,230.00 85%
(5.00) **CHERT PEBBLE SANDSTONE**
consolidated, off white, light brown, angular to subrounded, very fine lower to coarse lower, occasionally coarse upper to very coarse upper grained, rare chert granules & locally conglomeratic, poor to moderately sorted, abundant white, gray, brown, dark gray chert grains, calcareous, dolomitic, siliceous, pyritic, occasional fragments with brown argillaceous cement, grains commonly pitted, spotty 1-10, trace 13 % black dead bitumen plugged intergranular porosity, no cut fluorescence.
- 15% **SHALE**
medium brown, sub platy to subblocky, micromicaceous, slightly carbonaceous, pyritic, rare silt & sand, trace fractured siderite nodules, bituminous, with slow yellow green flash cut fluorescence.
- 2,230.00 to 2,235.00 100%
(5.00) **SHALE**
medium brown, medium gray, 15% dark brown, platy to occasionally subblocky, micromicaceous, pyritic, slightly carbonaceous, bituminous, with slow yellow green flash cut fluorescence, 10% as medium brown, fractured siderite nodules.
- 2,235.00 to 2,240.00 85%
(5.00) **SHALE**
light to medium brown, sub platy, micromicaceous, pyritic, bituminous, with slow yellow green flash cut fluorescence.
- 15% **SANDSTONE**
consolidated, salt and pepper, off white, light brown, commonly black & bitumen stained, fine to lower medium grained, occasionally with floating coarse quartz & chert grains, abundant white, occasionally gray, chert grains, poor to moderately sorted, siliceous, calcareous, dolomitic, pyritic, with 10-18% black, in part dead bitumen plugged intergranular porosity & rare bitumen fracture fill, trace 9% visible intergranular porosity, weak milky white flash cut fluorescence.
- 2,240.00 to 2,245.00 70%
(5.00) **CHERT PEBBLE SANDSTONE**
consolidated, light brown, fine lower to very coarse upper, rare granules, subangular to subrounded, angular in part, poor to moderately sorted, conglomeratic & as a matrix supported conglomeratic sandstone, calcareous, dolomitic, siliceous, commonly with white, brown, gray chert grains, pyritic, spotty 6-9% black dead bitumen plugged intergranular porosity, no cut fluorescence.
- 30% **SHALE**
light gray brown, medium brown, sub platy to occasionally subblocky, pyritic, occasionally silty, sandy or carbonaceous, bituminous, with slow yellow green flash cut fluorescence.
- 2,245.00 to 2,250.00 85%
(5.00) **SHALE**
medium brown, sub platy to subblocky, micromicaceous, pyritic, slightly silty & sandy, rare COAL, bituminous, with slow yellow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

2,245.00 to 2,250.00 (5.00)	15%	CHERT PEBBLE SANDSTONE predominately as unconsolidated, subangular to subrounded, locally rounded or angular, fine to very coarse upper chert & quartz grains & rare granules, consolidated fragments fine to lower medium grained, poor to moderately sorted, with light brown, off white, gray chert grains, siliceous, calcareous, locally with medium brown argillaceous cement, slightly dolomitic & pyritic, predominately tight, rare black dead intergranular bitumen, no cut fluorescence.
2,250.00 to 2,255.00 (5.00)	85%	SHALE medium gray brown, occasionally dark brown, sub platy to subblocky, pyritic, slightly carbonaceous, predominately as clay shale, bituminous, with slow yellow green flash cut fluorescence.
	15%	CHERT PEBBLE SANDSTONE predominately as unconsolidated, subangular to subrounded, locally rounded, fine upper to very coarse upper chert & quartz grains & rare granules, consolidated fragments fine to lower medium grained, angular to subrounded, with light brown, off white, gray chert grains, siliceous, calcareous, locally with medium brown argillaceous cement, slightly dolomitic, & pyritic, predominately tight, rare black dead intergranular bitumen, no cut fluorescence.
2,255.00 to 2,260.00 (5.00)	100%	SHALE medium to occasionally dark brown, sub platy to subblocky, micromicaceous, pyritic, trace calcite, bituminous, with slow yellow green flash cut fluorescence, 3% fine to medium grained, salt and pepper sandstone as above as carry over.
2,260.00 to 2,265.00 (5.00)	100%	SHALE medium brown, sub platy to subblocky, micromicaceous, slightly pyritic, predominately as clay shale, bituminous, with slow yellow green flash cut fluorescence, occasional fractured medium brown siderite nodules, 7% fine to lower medium, rare upper medium, subangular to subrounded, poor to moderately sorted, siliceous, calcareous, dolomitic, slightly pyritic, tight salt and pepper sandstone fragments with abundant light brown, occasionally white chert grains.
2,265.00 to 2,270.00 (5.00)	70%	SANDSTONE consolidated, salt and pepper, with abundant white, occasionally light to dark gray, trace black chert grains, very fine upper to coarse lower grained, occasionally coarse upper to very coarse upper grained, angular to subrounded, moderately sorted, siliceous, calcareous, dolomitic, slightly pyritic, with silica overgrowths, slightly bituminous, grains pitted, occasional 6-9% visible intergranular porosity, no cut fluorescence.
	30%	SHALE medium brown, sub platy to subblocky, micromicaceous, pyritic, predominately as clay shale, bituminous, with slow yellow green flash cut fluorescence.
2,270.00 to 2,275.00 (5.00)	100%	SHALE medium brown, 20% dark brown, sub platy to subblocky, micromicaceous, pyritic, slightly carbonaceous, bituminous, with slow yellow green flash cut fluorescence, rare silt, predominately as clay shale.

Sample Descriptions

Storage Units: Metric

- 2,275.00 to 2,280.00 100% **SHALE**
(5.00) medium brown, sub platy to subblocky, micromicaceous, rare silt, predominately as clay shale, slightly carbonaceous, pyritic, bituminous, with slow yellow green flash cut fluorescence.
- 2,280.00 to 2,285.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to subblocky, pyritic, micromicaceous, bituminous, with slow yellow green flash cut fluorescence, 3% argillaceous, fractured siderite nodules, rare pyrite lined fractures, trace fine to medium grained, salt and pepper, siliceous, calcareous, dolomitic, tight sandstone fragments as probable carry over.
- 2,285.00 to 2,290.00 100% **SHALE**
(5.00) medium to dark brown gray, greasy, sub platy to subblocky, micromicaceous, pyritic, rare fractures, bituminous, with slow yellow green flash cut fluorescence, 7% as argillaceous, locally silty, sandy, calcareous, fractured siderite nodules, rare massive pyrite fragments, rare coaly partings, slightly carbonaceous, rare fractures.
- 2,290.00 to 2,295.00 100% **SHALE**
(5.00) medium to occasionally dark brown, sub platy to subblocky, micromicaceous, pyritic, slightly carbonaceous, predominately as clay shale, bituminous, with slow yellow green flash cut fluorescence, slightly montmorillonitic, rare fractured siderite nodules or calcareous fragments.
- 2,295.00 to 2,300.00 100% **SHALE**
(5.00) medium gray, 40% dark gray, sub platy to blocky, micromicaceous, occasionally pyritic, bituminous, with slow yellow green flash cut fluorescence, 10-15% as cryptocrystalline to microcrystalline, sideritic, argillaceous, tight limestone fragments.
- 2,300.00 to 2,305.00 100% **SHALE**
(5.00) medium to predominately dark gray, platy, micromicaceous, slightly pyritic, greasy to dul lustre, sub platy to occasionally blocky, brittle to subfissile, no visible fractures 1-2% of fragments as massive pyrite, fractures?, 6-7% as medium brown, occasionally silty or sandy, calcareous, fractured siderite fragments, trace fine to medium grained, consolidated, salt and pepper, angular to subrounded, siliceous, calcareous, dolomitic, tight, sandstone
- 2,305.00 to 2,310.00 100% **SHALE**
(5.00) medium to dark gray, sub platy to subblocky, micromicaceous, in part blocky, greasy, slightly carbonaceous, as clay shale, firm, brittle, subfissile, 1-2% of fragments as massive pyrite, 6-7% of fragments as medium brown fractured siderite nodules, or argillaceous, sideritic, tight limestone fragments.
- 2,310.00 to 2,315.00 100% **SHALE**
(5.00) medium to dark gray, dark brown, sub platy, micmicca, slightly pyritic & carbonaceous, dull to greasy in part, slightly pyritic, as clay shale, commonly firm, subfissile, 6% of fragments as fractured siderite nodules or argillaceous, sideritic, calcareous, mudstone limestone fragments, milky yellow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,315.00 to 2,320.00 100% **SHALE**
(5.00) medium to dark gray, dark brown, micromicaceous, dull to greasy in part, slightly pyritic, bituminous, predominately as clay shale, rare pyrite laminae as probable fracture fills, slightly montmorillonitic, 6-7% of fragments as fractured siderite nodules or as sideritic, tight, mudstone limestone fragments, slightly carbonaceous, rare silt & sand grains, milky yellow green flash cut fluorescence.
- 2,320.00 to 2,325.00 100% **SHALE**
(5.00) medium to dark gray, dark brown, platy to subblocky, micromicaceous, occasional greasy & very carbonaceous fragments, rare slightly montmorillonitic fragments, predominately as clay shale, rare silt & sand grains, pyritic, questionable pyrite lined fractures, bituminous, yellow green slow flash cut fluorescence, 3% of fragments as massive pyrite, 4% as medium brown, fractured, locally calcareous siderite nodules, rare sandstone cavings.
- 2,325.00 to 2,330.00 100% **SHALE**
(5.00) medium to dark gray, dark brown, sub platy to subblocky, micromicaceous, dull to greasy, slightly carbonaceous, brittle, subfis, rare slightly montmorillonitic fragments & rare carbonaceous partings, predominately as clay shale, rare silt & sand grains, bituminous, with slow yellow green flash cut fluorescence, 3% as massive pyrite, shale pyritic, trace fractured siderite nodules, fractures?, rare fine to medium grained salt and pepper sandstone fragments as probable carry over, sample quality good.
- 2,330.00 to 2,335.00 100% **SHALE**
(5.00) **SHALE:** medium to dark gray, dark brown, platy to occasionally subblocky, slightly carbonaceous, pyritic, micromicaceous, dull to greasy, predominately as clay shale, slightly silty & sandy, trace massive pyrite fragments, brittle, subfis, 5% of fragments calcareous, grading to calcareous marlstone, rare limestone, milky yellow green flash cut fluorescence.
- 2,335.00 to 2,340.00 100% **SHALE**
(5.00) medium to dark gray, platy to occasionally subblocky, micromicaceous, dull, greasy, firm, brittle, subfis, bituminous, commonly pyritic, 3% of fragments as massive pyrite, fracture fill?, trace silt & sand grains, slightly carbonaceous, trace light gray, medium brown, fine to lower medium grained, calcareous, siliceous, tight, salt and pepper sandstone fragments, shale with milky yellow green flash cut fluorescence.
- 2,340.00 to 2,345.00 100% **SHALE**
(5.00) medium gray, 20% of fragments dark gray, platy to occasionally subblocky, micromicaceous, greasy to dull, pyritic, slightly montmorillonitic, 6% of fragments as massive pyrite, fracture fill?, trace fractured siderite nodules, 4% of fragments calcareous & grading to calcareous marlstone or rare argillaceous, mudstone limestone, shale with slow weak, yellow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,345.00 to 2,350.00 100% **SHALE**
(5.00) medium brown, medium brown gray, platy to occasionally subblocky, soft, slightly montmorillonitic, fissile to subfissile, micromicaceous, greasy, dull, slightly carbonaceous, occasional pyritic fragments, bituminous, rare silty or sandy fragments & locally grading to silty to very fine lower grained, tight, salt and pepper sandstone or sandy siltstone, trace fractured siderite nodules, 6% of fags calcareous or marly, shale with milky yellow green flash cut fluorescence.
- 2,350.00 to 2,355.00 100% **SHALE**
(5.00) medium brown, medium brown gray, platy to occasionally subblocky, soft, slightly montmorillonitic, fissile to subfissile, greasy, dull, micromicaceous, slightly carbonaceous, occasional pyritic fragments, rare silty or sandy fragments & locally grading to silty to very fine lower grained, tight, salt and pepper sandstone or sandy siltstone, trace fractured siderite nodules, 6% of fags calcareous or marly, shale with milky yellow green flash cut
- 2,355.00 to 2,360.00 100% **SHALE**
(5.00) medium gray, 25% of fragments dark gray or dark gray brown, platy to occasionally subblocky, micromicaceous, greasy to dull, firm, brittle to subfissile, bituminous, with slow yellow green flash cut fluorescence, predominately as clay shale, rare silt & sand grains, slightly montmorillonitic, rare fractured siderite nodules, rare calcareous or marly fragments.
- 2,360.00 to 2,365.00 100% **SHALE**
(5.00) light to medium gray, 40% dark gray, dark gray brown, platy to occasionally subblocky, predominately as clay shale, micromicaceous, greasy to dull, no visible fractures, firm, brittle to subfissile, bituminous, with slow yellow green flash cut fluorescence, rare massive pyrite, rare marly or calcareous fragments, trace fractured siderite nodules.
- 2,365.00 to 2,370.00 100% **SHALE**
(5.00) medium gray, 20% dark gray or dark gray brown, platy to subblocky, micromicaceous, greasy, dull, 7-8% of shale fragments with massive pyrite, slightly carbonaceous, rare montmorillonitic fragments or silty or sandy fragments, bituminous, as clay shale, no visible fractures, firm, brittle to subfissile, slow yellow green flash cut fluorescence.
- 2,370.00 to 2,375.00 100% **SHALE**
(5.00) medium gray, 35% of fragments dark gray, dark gray brown, platy to subblocky, micromicaceous, dull, greasy, 7% of fragments with massive pyrite, predominately as clay shale, rare silty & sandy fragments, bituminous, slow yellow green flash cut fluorescence, 5% of fragments calcareous, marly.
- 2,375.00 to 2,380.00 100% **SHALE**
(5.00) medium gray, 30% of fragments dark gray or dark gray brown, platy to subblocky, micromicaceous, slightly carbonaceous, predominately as clay shale, rare silty & sandy fragments, rare montmorillonitic fragments, rare fragments with floating medium or coarse chert grains, 7% of fragments with massive pyrite, rare predominately fine grained, argillaceous, angular to subrounded, calcareous, sideritic, tight, salt and pepper sandstone fragments, trace fractured siderite nodules, rare carbonaceous flakes, 4% of fragments calcareous, marly.

Sample Descriptions

Storage Units: Metric

- 2,380.00 to 2,385.00 100% **SHALE**
(5.00) light gray, 35% medium brown, platy, micromicaceous, dull, greasy, firm, brittle to subfissile, rare chert, occasionally subblocky, rare slightly montmorillonitic fragments, bituminous, < 5% of fragments sandy or silty & grading to poorly sorted, argillaceous, light gray, light brown, quartzose to salt and pepper, calcareous, silty to very fine upper grained, tight, sandstone, 3% of fragments calcareous or marly, shale with weak milky yellow green flash cut fluorescence, rare massive pyrite fragments.
- 2,385.00 to 2,390.00 100% **SHALE**
(5.00) medium gray, medium brown, platy to subblocky, greasy, dull, bituminous, 6% of fragments with massive pyrite, predominately as clay shale, rare silty & sandy fragments, occasional fragments with coaly grains, bituminous & with slow yellow green flash cut fluorescence, trace light gray, light brown, quartzose to salt and pepper, fine to rare lower medium grained, siliceous, calcareous, argillaceous, tight sandstone fragments.
- 2,390.00 to 2,395.00 100% **SHALE**
(5.00) medium to dark brown, sub platy to occasionally subblocky, predominately as clay shale, 5 % of fragments with massive pyrite, as clay shale, trace fractured siderite nodules, dull, greasy, micromicaceous, bituminous, with slow yellow green flash cut fluorescence, trace argillaceous, medium brown gray, silty to predominately very fine lower grained, tight, siliceous, slightly calcareous sandstone fragments.
- 2,395.00 to 2,400.00 100% **SHALE**
(5.00) light gray brown, 25% medium to occasionally dark brown, platy to occasionally subblocky, micromicaceous, greasy, dull, micromicaceous, slightly carbonaceous, rare silty fragments, predominately as clay shale, trace massive pyrite fragments & rare fractured siderite nodules, firm to occasionally hard, brittle to subfissile, bituminous, with slow yellow green flash cut fluorescence, trace silty to very fine upper grained, tight, argillaceous, siliceous, slightly calcareous, salt and pepper sandstone fragments.
- 2,400.00 to 2,405.00 100% **SHALE**
(5.00) 40% light gray, 60% medium to occasionally dark brown, platy to occasionally subblocky, micromicaceous, greasy, dull, predominately as clay shale, rare silty & sandy fragments, bituminous, with slow yellow green flash cut fluorescence, 3% as light gray, silty to very fine lower grained, predominately quartzose, non calcareous, slightly siliceous, argillaceous, occasionally pyritic, sandstone & sandy siltstone fragments.
- 2,405.00 to 2,410.00 90% **SHALE**
(5.00) light to medium gray, 20% dark gray, dark brown, platy to occasionally subblocky, micromicaceous, greasy, dull, pyritic, trace calcite lined fractures, bituminous, with yellow green slow flash cut fluorescence, 3% as fractured siderite nodules, predominately as clay shale, 20% of fragments silty or sandy fragments, weak milky yellow green flash cut fluorescence.
- 10% **SANDSTONE**
off white, light gray, very light brown, consolidated, quartzose, silty to very fine lower grained, non calcareous, friable, commonly with medium brown argillaceous cement, rare chert grains, micaceous, no cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,410.00 to 2,415.00 85%
(5.00) **SHALE**
medium gray, 30% dark brown, dark gray, platy to occasionally subblocky, pyritic, as clay shale, micromicaceous, greasy, dull, slightly montmorillonitic, firm, brittle to subfissile, rare curved shale foliation or partings & calcite lined fractures, moderate slow milky yellow green flash cut fluorescence.
- 10% **SANDSTONE**
consolidated, quartzose, silty to fine grained, rare floating lower medium quartz grains, subangular to subrounded, moderately to well sorted, siliceous, with silica overgrowths, commonly with medium brown argillaceous cement, slightly sideritic, rare pyrite, tight, no cut fluorescence.
- 2,415.00 to 2,420.00 90%
(5.00) **SHALE**
light brown, 60% dark brown, platy to occasionally subblocky, micromicaceous, 3-4% as massive pyrite, predominately as clay shale, 2% as fractured, occasionally silty or sandy siderite nodules, slow milky yellow green flash cut fluorescence, rare white calcite lined fractures, curved shale & questionable slickeslide.
- 10% **SANDSTONE**
consolidated, light gray, off white, light brown, fine to occasionally lower medium grained, quartzose to salt and pepper, friable to commonly firm, siliceous, sideritic, rare calcareous fragments, subangular to subrounded, commonly with medium brown argillaceous cement, slightly pyritic, tight, no shows.
- 2,420.00 to 2,425.00 100%
(5.00) **SHALE**
light gray, 50% dark gray or black, more organic than above, platy to occasionally subblocky, micromicaceous, carbonaceous, as clay shale, rare silty & sandy fragments, bituminous, slow yellow green flash cut fluorescence, 6% as fractured, occasionally silty or sandy siderite nodules, rare montmorillonitic fragments, 4% of fragments with abundant massive pyrite, 3% as consolidated, salt and pepper, silty to fine, occasionally lower medium grained, siliceous, argillaceous, subangular to subrounded, sandstone fragments with rare traces of intergranular bitumen.
- 2,425.00 to 2,430.00 100%
(5.00) **SHALE**
medium gray, 25% dark gray or black, platy to occasionally subblocky, micromicaceous, pyritic, soft, subfissile, rare montmorillonitic fragments, slightly carbonaceous, rare massive pyrite fragments, rare carbonaceous flakes, rare silty & sandy fragments, shales with occasional curved foliation or partings, 3% as fractured siderite nodules.
- 2,430.00 to 2,435.00 100%
(5.00) **SHALE**
dark gray, dark brown, blocky, platy to occasionally subblocky, micromicaceous, greasy, dull, 7-8% as fractured siderite nodules, bituminous & with slow yellow green flash cut fluorescence, 4% of fragments as massive pyrite, rare fine grained, poor to moderately sorted, siliceous, argillaceous, tight salt and pepper & quartzose sandstone fragments, many fragments with curved foliation or partings.

Sample Descriptions

Storage Units: Metric

- 2,435.00 to 2,440.00 100% **SHALE**
(5.00) Post-trip sample, medium gray brown, 35% dark gray, dark brown, platy, soft to occasionally firm, subfissile, micromicaceous, dull to greasy, 3% of fragments as massive pyrite, as clay shale, rare silt & sand, bituminous, with yellow green slow flash cut fluorescence, shale fragments occasionally curved, trace fractured siderite nodules, trace silty to very fine lower grained, argillaceous, tight sandstone fragments with rare medium, grained, predominately siliceous slightly bitumenous sandstone fragments as probable carryover.
- 2,440.00 to 2,445.00 100% **SHALE**
(5.00) post-trip sample, 25% medium gray, 75% dark gray to black, platy to occasionally subblocky, micromicaceous, greasy, dull, splintery in part, soft to firm, subfissile, slightly pyritic, carbonaceous, bituminous, yellow green slow flash cut fluorescence, rare sandy fragments with light gray, silty to very fine lower grained, tight, predominately quartzose, silty sandstone & sandy siltstone fragments., rare pyrite or calcite lined fractures.
- 2,445.00 to 2,450.00 100% **SHALE**
(5.00) 40% medium gray, 60% dark gray, black, platy to subblocky, micromicaceous, dull, greasy, pyritic, occasional carbonaceous flakes or rare very thin carbonaceous partings, predominately as clay shale, non calcareous, rare calcite lined fractures, commonly soft, slightly brittle, bituminous, with slow yellow green flash cut fluorescence, 10-15% of fragments silty or sandy, locally grading to argillaceous, light brown gray, silty to very fine lower grained, tight quartzose, very poorly sorted tight sandstone & sandy siltstone, 7% of fragments with massive pyrite, bituminous, milky yellow green flash cut fluorescence.
- 2,450.00 to 2,455.00 100% **SHALE**
(5.00) 40% medium gray, 60% dark gray, black, platy to subblocky, micromicaceous, greasy, dull, occasional curved shale fragments, pyritic, occasional carbonaceous flakes or rare very thin carbonaceous partings, predominately as clay shale, soft to medium hard, subfissile, 10-15% of fragments silty or sandy, locally grading to argillaceous, light brown gray, silty to very fine lower grained, tight quartzose, very poorly sorted tight sandstone & sandy siltstone, 7% of fragments with massive pyrite.
- 2,455.00 to 2,460.00 100% **SHALE**
(5.00) medium gray, medium brown, 25% dark gray to black, splintery, sub platy to subblocky, micromicaceous, greasy in part, dull, predominately as clay shale, firm to hard, brittle to subfissile, occasional curved shale fragments, bituminous, with yellow green flash cut fluorescence, 3% of fragments with massive pyrite, commonly with trace disseminated pyrite, 4-5% of fragments as sandy fractured siderite nodules, rare silty to very fine lower grained, quartzose, locally sideritic or argillaceous, poor to well sorted, tight, silty sandstone or sandy siltstone fragments.

Sample Descriptions

Storage Units: Metric

- 2,460.00 to 2,465.00 85% **SHALE**
(5.00) medium gray, 20% dark brown brown or dark gray, platy to subblocky, micromicaceous, greasy, dull, firm to hard, brittle to subfissile, bituminous, with yellow green flash cut fluorescence, occasionally slightly silty & sandy, slightly carbonaceous, with massive pyrite, rare slightly montmorillonitic fragments, 20% or calcarb mud additive.
- 15% **SANDSTONE**
consolidated, off white, very light brown, silty to very fine lower grained, rare fine upper grained fragments, quartzose, rare dark chert grains, blocky, spotty calcareous cement, commonly siliceous, with siliceous overgrowths, slightly carbonaceous, argillaceous, micaceous, dense & tight, no shows.
- 2,465.00 to 2,470.00 100% **SHALE**
(5.00) medium brown gray, medium gray, medium brown, splintery, platy to subblocky, micromicaceous, greasy, dull, predominately as clay shale, occasional silty or sandy fragments, firm to brittle, occasionally subfissile, occasional fragments with curved foliation or rare calcite lined fractures, bituminous, with slow yellow green flash cut fluorescence, 3-5% as fractured siderite nodules.
- 2,470.00 to 2,475.00 100% **SHALE**
(5.00) medium to dark gray brown, platy to blocky, micromicaceous, dull, greasy, predominately as clay shale, greasy in part, firm, brittle, occasionally subfissile, bituminous, with slow yellow green flash cut fluorescence, 4% as fractured siderite nodules, pyritic, rare light gray, silty to very fine upper grained, siliceous, argillaceous, locally calcareous, tight, quartzose sandstone & sandy siltstone fragments.
- 2,475.00 to 2,480.00 100% **SHALE**
(5.00) medium gray, 40% dark brown, black, platy to occasionally blocky, micromicaceous, greasy, dull, firm, occasionally siliceous & very hard, occasional shale fragments with curved foliation, rare calcite lined fractures, bituminous, with slow yellow green flash cut fluorescence, pyritic, 6% as fractured siderite nodules, 3% light gray, off white, predominately quartzose, silty to very fine lower grained, argillaceous, calcareous, siliceous, poor to well sorted, tight, sandstone fragments, 3% coarse crystalline calcite fragments as mud additive, scattered massive pyrite fragments.
- 2,480.00 to 2,485.00 100% **SHALE**
(5.00) medium to dark gray, platy, splintery to blocky, greasy, dull, micromicaceous, slightly pyritic, as clay shale, 10-15% as fractured siderite nodules, abundant limestone mud additive, rare very carbonaceous fragments, occasionally siliceous hard & brittle fragments occasional fragments with curved foliation, rare calcite lined fractures with euhedral calcite crystals as fracture fills, bituminous, milky yellow green flash cut fluorescence, trace dark chert,
- 2,485.00 to 2,490.00 100% **SHALE**
(5.00) medium gray, 40% dark gray, blocky, platy, occasionally subblocky, micromicaceous, pyritic, rare silty or sandy fragments, predominately as clay shale, 5% as fractured siderite nodules, rare sideritic, cryptocrystalline fragments of chert or hard siliceous shale fragments.

Sample Descriptions

Storage Units: Metric

- 2,490.00 to 2,495.00 100% **SHALE**
(5.00) medium gray, 50% dark gray, platy to occasionally subblocky, occasionally slightly silty, predominately as clay shale, siliceous, rare slickenslide, hard, brittle, non fissile, micromicaceous, greasy, bituminous, pyritic, 3% as fractured, occasionally siliceous siderite nodules & siliceous shale fragments, milky yellow green flash cut fluorescence.
- 2,495.00 to 2,500.00 100% **SHALE**
(5.00) medium gray, 40% dark gray, blocky, platy, occasionally subblocky, micromicaceous, greasy, dull, pyritic, rare silty or sandy fragments, occasionally siliceous, brittle, firm, cherty, predominately as clay shale, 5% as fractured siderite, nodules, occasional cryptocrystalline fragments of chert or hard silica shale fragments, bituminous, slow yellow green flash cut fluorescence, rare slickensides, curved shale fragments or questionable calcite lined fractures
- 2,500.00 to 2,505.00 100% **SHALE**
(5.00) medium gray, 50% dark gray, dark gray brown, platy to occasionally subblocky, micromicaceous, greasy in part, dull, rare waxy fragments, pyritic, commonly brittle, hard, in part siliceous, as clay shale, rare silty & sandy fragments, 2% as fractured siderite nodules, 2% off white, light gray brown, silty to very fine lower, rare fine lower grained, quartzose, slightly carbonaceous, argillaceous, siliceous, silty sandstone & sandy siltstone fragments, shale bituminous & with yellow green flash cut fluorescence & locally with curved foliation, rare calcite lined fractures.
- 2,505.00 to 2,510.00 100% **SHALE**
(5.00) medium gray, 50% dark gray, dark gray brown, platy to occasionally subblocky, micromicaceous, greasy in part, dull, rare waxy fragments, firm, brittle to subfissile, pyritic, as clay shale, rare silty & sandy fragments, 2% as fractured siderite nodules, 2% off white, light gray brown, silty to very fine lower, rare very fine upper grained, quartzose, slightly carbonaceous, argillaceous, siliceous, silty sandstone & sandy siltstone fragments, shale bituminous & with yellow green flash cut fluorescence, rare fractures, occasional very siliceous fragments.
- 2,510.00 to 2,515.00 100% **SHALE**
(5.00) medium gray, 70% dark gray, platy, occasionally subblocky, as clay shale, micromicaceous, greasy, dull, rare waxy fragments, rare silty or sandy fragments, pyritic, bituminous, with yellow green slow flash cut fluorescence, rare calcite lined fractures & curved shale fragments, 3% as fractured siderite nodules.
- 2,515.00 to 2,520.00 100% **SHALE**
(5.00) medium gray, 30% dark gray, sub platy to subblocky, micromicaceous, dull, greasy, bituminous, predominately as clay shale, with milky yellow green flash cut fluorescence, rare curved shale fragments & with questionable pyrite lined fractures, 4% as off white, light gray, gray brown, silty to occasional very fine lower grained, argillaceous, calcareous, siliceous, slightly carbonaceous, tight, quartzose sandstone & sandy siltstone.

Sample Descriptions

Storage Units: Metric

- 2,520.00 to 2,525.00 80%
(5.00) **SHALE**
medium gray, 70% dark gray, black, dark brown, platy to subblocky, micromicaceous, greasy, pyritic, predominately as clay shale, slightly bituminous & with milky yellow green flash cut fluorescence, commonly very siliceous, hard, brittle.
- 20% **SANDSTONE**
consolidated, off white, quartzose to salt and pepper, with < 20% chert grains, silty to fine upper grained, subangular to subrounded, calcareous, argillaceous, siliceous, pyritic, slightly carbonaceous, moderately sorted, tight, no shows.
- 2,525.00 to 2,530.00 85%
(5.00) **SHALE**
medium gray, 70% dark gray, platy to subblocky, micromicaceous, dull, greasy, as clay shale, pyritic, bituminous, rare silty & sandy fragments, commonly hard, siliceous, brittle, rare curved curved fragments, slow milky yellow green flash cut fluorescence.
- 15% **SANDSTONE**
consolidated, off white, gray brown, light brown, quartzose to salt and pepper, with < 20% chert grains, silty to fine upper grained, rare lower medium grained fragments or fragments with floating medium quartz & chert grains, subangular to subrounded, angular in part, slightly calcareous, argillaceous, siliceous, pyritic, slightly carbonaceous, moderately sorted, tight, no shows.
- 2,530.00 to 2,535.00 90%
(5.00) **SHALE**
medium gray, 70% dark gray, platy, occasionally subblocky, micromicaceous, greasy, dull, waxy in part, pyritic, bituminous, with yellow green flash cut fluorescence, firm, siliceous, hard, occasionally firm, brittle to subfissile, rare curved shale fragments, siliceous, rare questionable fractures.
- 10% **SANDSTONE**
light gray, light gray brown, light brown, silty to very fine lower grained, rare fine lower to medium grained fragments, subangular to subrounded, angular in part, quartzose to occasionally salt and pepper, rare chert granules, argillaceous, siliceous, slightly carbonaceous, tight, no shows, in part as sandy siltstone.
- 2,535.00 to 2,540.00 85%
(5.00) **SHALE**
medium gray, 30% dark gray, platy to occasionally subblocky, micromicaceous, bituminous, greasy in part, occasional waxy fragments, pyritic, carbonaceous, slightly silty, trace fractured siderite nodules, milky yellow green flash cut fluorescence, rare slickenslides, rare questionable calcite lined fractures, occasional curved shale fragments, commonly firm, brittle, rare subfissile fragments, as clay shale.
- 15% **SILTSTONE**
off white, light gray, light gray brown, quartzose, sandy, commonly grading to siltstone, very fine lower grained, sandstone, siliceous, argillaceous, slightly calcareous & pyritic, slightly carbonaceous, tight, no shows.

Sample Descriptions

Storage Units: Metric

- 2,540.00 to 2,545.00 75%
(5.00) **SHALE**
medium gray, predominately dark gray or dark brown, sub platy to subblocky, micromicaceous, greasy in part, rare waxy fragments, pyritic, locally silty & sandy, predominately as clay shale, bituminous, locally silty & hard & grading to argillaceous chert, milky yellow green flash cut fluorescence.
- 25% **SANDSTONE**
light gray, off white, light gray brown, quartzose to salt and pepper, with < 20% chert grains, silty to very fine lower grained, locally with floating very fine upper to fine upper quartz grains, subangular to subrounded, angular in part, argillaceous, siliceous, slightly carbonaceous & pyritic, locally micaceous, tight, no shows.
- 2,545.00 to 2,550.00 80%
(5.00) **SHALE**
medium gray, 50% dark gray, platy to occasionally subblocky, micromicaceous, greasy, occasional waxy fragments, pyritic, rare silty & sandy fragments, bituminous, yellow green milky flash cut fluorescence, firm, brittle, occasional curved shale fragments, rare questionable slickenslide, no visible fractures.
- 20% **SANDSTONE**
consolidated, light brown, light gray, off white, quartzose to salt and pepper, silty to fine, rare lower medium to coarse lower grained fragments, subangular to subrounded, occasionally angular, with < 30% light chert grains, very siliceous & commonly with silica overgrowths, sideritic, or with medium brown argillaceous cement, slightly calcareous, pyritic, slightly carbonaceous, rare fragments with 6% dead black intergranular bitumen, weak yellow green flash cut fluorescence, poor reservoir.
- 2,550.00 to 2,555.00 80%
(5.00) **SHALE**
medium gray, 20% dark gray, blocky, micromicaceous, greasy, platy to occasionally subblocky, pyritic, as clay shale, siliceous, rare dark chert fragments, occasional curved shale fragments, occasional fractures, 15% as fractured siderite nodules. bituminous, no cut fluorescence.
- 20% **SANDSTONE**
consolidated, quartzose to salt and pepper, with < 25% light chert grains, light brown, sideritic brown, light gray, off white, silty to fine grained, subangular to subrounded, angular in part, poor to moderately sorted, quartzose to salt and pepper, slightly calcareous, dolomitic, sideritic, commonly siliceous or with medium brown argillaceous cement, carbonaceous, pyritic, tight, slightly bituminous, no cut fluorescence.
- 2,555.00 to 2,560.00 15%
(5.00) **SANDSTONE**
consolidated, quartzose, light gray, light brown, off white, silty to very fine lower grained, occasional fragments with floating fine upper to lower medium quartz grains, rare medium brown, sideritic chert granules, moderately sorted, siliceous, slightly calcareous, or dolomitic, rare pyrite, commonly argillaceous, or carbonaceous, tight, no shows.

Sample Descriptions

Storage Units: Metric

- 2,560.00 to 2,565.00 85%
(5.00) **SHALE**
medium to dark brown, occasionally medium gray, platy to subblocky, micromicaceous, greasy, pyritic, slightly montmorillonitic, slightly carbonaceous, locally silty, predominately as clay shale, milky yellow green flash cut fluorescence, rare fractures & occasional curved shale fragments.
- 15% **SANDSTONE**
off white, light gray, light brown, silty to very fine lower grained, occasionally very fine upper grained, subangular to subrounded, siliceous, argillaceous, quartzose to salt and pepper, with < 10-15% chert or carbonaceous grains, siliceous & with silica overgrowths, locally argillaceous, micromicaceous, slightly dolomitic, pyritic, tight, no shows.
- 2,565.00 to 2,570.00 80%
(5.00) **SHALE**
medium gray, 80% dark gray, platy, micromicaceous, greasy, occasionally waxy, very carbonaceous, firm, brittle to subfissile, locally siliceous, occasional curved shale fragments, bituminous, milky yellow green flash cut fluorescence.
- 20% **SANDSTONE**
consolidated, salt and pepper, very hard, light gray, light to medium brown, fine to upper medium grained, rare coarse grained fragments or chert granules & in part as matrix supported conglomeratic sandstone, angular to subrounded, poor to moderately sorted, siliceous & commonly with silica overgrowths, patchy medium brown argillaceous cement, slightly calcareous, dolomitic or sideritic, with 30-50% chert grains, slightly pyritic, rare fragments with 6-8% black dead intergranular bitumen, predominately tight, very poor reservoir, no cut fluorescence.
- 2,570.00 to 2,575.00 90%
(5.00) **SHALE**
medium gray, 80% dark gray or black, platy, occasionally blocky, micromicaceous, dull, greasy, occasionally waxy, pyritic, slightly carbonaceous, firm to hard, occasional shale fragments with curved foliation, locally siliceous, bituminous, milky yellow green flash cut fluorescence.
- 10% **SANDSTONE**
consolidated, off white, light brown, light gray brown, light gray, medium brown, silty to very fine upper grained, rare fine upper grained fragments, commonly quartzose, subangular to subrounded, occasionally angular, siliceous & hard with silica overgrowths, slightly argillaceous, calcareous, dolomitic, pyritic, commonly argillaceous, trace black intergranular dead bitumen, no cut fluorescence, very poor reservoir.
- 2,575.00 to 2,580.00 90%
(5.00) **SHALE**
light gray, predominately medium brown, platy, occasionally splintery or subblocky, micromicaceous, dull to greasy, < 15% of fragments waxy, pyritic, slightly carbonaceous, bituminous, milky yellow green flash cut fluorescence, rare curved shale fragments.

Sample Descriptions

Storage Units: Metric

- 2,575.00 to 2,580.00 10% **SANDSTONE**
(5.00) consolidated, off white, light gray, light to medium brown, silty to fine upper grained, rare fragments with floating lower medium to coarse quartz or chert grains, siliceous, commonly with light gray or medium brown argillaceous cement, calcareous, dolomitic, pyritic, slightly carbonaceous, rare fragments with 1-8% dead black bitumen plugged intergranular porosity, no cut fluorescence.
- 2,580.00 to 2,585.00 100% **SHALE**
(5.00) Post-trip sample, medium to dark gray, platy, occasionally subblocky, micromicaceous, greasy, occasionally waxy, soft to medium hard, predominately as clay shale, rare silty & sandy fragments, 2% light gray, light brown, silty to very fine lower, rare very fine upper to lower medium grained, silty, in part, moderately sorted, subangular to subrounded, commonly very siliceous, slightly carbonaceous, locally sideritic, quartzose to salt and pepper sandstone, rare 6-8% black dead bitumen plugged intergranular porosity, with poor effective porosity, no cut fluorescence.
- 2,585.00 to 2,590.00 100% **SHALE**
(5.00) medium to dark gray, platy to occasionally blocky, soft to firm, micromicaceous, greasy, dull, occasionally waxy, as clay shale, rare silty or sandy fragments, brittle in part, in part subfissile, pyritic, non calcareous, rare brown, cryptocrystalline, sideritic, slightly siliceous & hard shale fragments, rare slickenslides, trace light gray, light gray brown, silty to very fine lower grained, argillaceous, siliceous, tight sandstone fragments.
- 2,590.00 to 2,595.00 100% **SHALE**
(5.00) medium to dark gray, platy occasionally blocky, as clay shale, < 10% of fragments slightly silty or sandy, pyritic, firm, subfissile, bituminous, trace dark brown cryptocrystalline chert fragments with abundant euhedral quartz druse, trace light brown, light gray, silty to very fine upper grained, very siliceous, well indurated, slightly argillaceous, tight, slightly carbonaceous, sandstone fragments.
- 2,595.00 to 2,600.00 100% **SHALE**
(5.00) medium to dark gray, subblocky, micromicaceous, commonly firm & semi fissile, occasional silty, slightly montmorillonitic, occasional very silty & brittle shale fragments, trace light gray, quartzose, slightly carbonaceous, argillaceous, slightly siliceous, tight silty to very fine lower silty sandstone & sandy tight siltstone fragments, trace dark brown chert fragments.
- 2,600.00 to 2,605.00 100% **SHALE**
(5.00) medium to dark gray, 10% black & very carbonaceous, occasionally platy, predominately subblocky, commonly soft, subfissile, occasionally fissile, locally slightly montmorillonitic, very brittle, pyritic, micromicaceous, greasy in part, 5% light gray, light brown, quartzose to salt and pepper, silty to very fine upper grained, argillaceous, slightly carbonaceous, locally with silica overgrowths, slightly carbonaceous, friable to well indurated, tight sandstone fragments, no cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,605.00 to 2,610.00 100% **SHALE**
(5.00) medium to dark gray, sub platy to blocky, micromicaceous, greasy in part, slightly montmorillonitic, pyritic, predominately as clay shale, rare silty or sandy fragments, trace light gray, argillaceous, siliceous, quartzose, slightly pyritic, slightly carbonaceous, poor to moderately sorted, tight, silty to upper medium grained, tight, sandstone & sandy siltstone fragments, with rare dark chert grains, no cut fluorescence.
- 2,610.00 to 2,615.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, pyritic, predominately as clay shale, < 10% of fragments silty, sandy, trace fractured siderite nodules, trace medium brown chert, trace medium brown, gray brown, cherty siderite fragments, trace light gray, consolidated, blocky, silty to very fine lower grained, tight, argillaceous, siliceous, sandstone & sandy siltstone fragments, no cut fluorescence.
- 2,615.00 to 2,620.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, slightly montmorillonitic, greasy in part, pyritic, predominately as clay shale, 7% light gray, gray brown, light brown, silty to very fine lower grained, occasionally very fine upper grained, subangular to subrounded, moderately sorted, siliceous, argillaceous, well indurated, carbonaceous, tight quartzose to salt and pepper., slightly pyritic sandstone fragments with trace dead black intergranular bitumen, poor grain relief, no cut fluorescence, no visible intergranular porosity.
- 2,620.00 to 2,625.00 85% **SHALE**
(5.00) medium to dark gray, sub platy to blocky, micromicaceous, pyritic, greasy in part, predominately as clay shale, rare silty & sandy fragments, in part as cavings. weak green, milky slow flash cut, bituminous in part.
- 15% **SANDSTONE**
consolidated, light brown, light gray, quartzose to salt and pepper, locally with 20-30% chert grains, silty to fine grained, rare medium to coarse grains or chert granules, poor to moderately sorted, siliceous & commonly with silica overgrowths, commonly with gray or medium brown argillaceous cement, occasionally calcareous, slightly pyritic, with 6-10% black bitumen plugged intergranular porosity, no cut fluorescence.
- 2,625.00 to 2,630.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, greasy in part, rare silty & sandy fragments, predominately as clay shale, pyritic, brittle to subfissile, 4% light gray, argillaceous, siliceous, blocky, slightly carbonaceous, pyritic, non calcareous, tight, siltstone fragments in part grading to silty to very fine lower grained, tight, quartzose sandstone, shale with weak, slow yellow green flash cut fluorescence.
- 2,630.00 to 2,635.00 100% **SHALE**
(5.00) Post-trip sample, medium to dark gray, platy to occasionally blocky, micromicaceous, firm, in part sub fissile, as clay shale, carbonaceous, rare silt & sand grains, bituminous. 1% as massive pyrite fragments, trace lm brown, slightly calcareous fractured siderite nodules, trace light gray, very fine, siliceous, tight, salt and pepper, siltstone fragments, bulk sample with weak, very slow green flash cut fluorescence.

Sample Descriptions

Storage Units: Metric

- 2,635.00 to 2,640.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, greasy in part, predominately as clay shale, rare silty or sandy fragments, pyritic, medium hard, slightly fissile, bituminous, with very slow green flash cut fluorescence, 7% light gray, consolidated, salt and pepper, light gray, light brown, light gray brown, silty to very fine lower, occasionally very fine upper grained, subangular to subrounded, siliceous, & occasionally with silica overgrowths commonly argillaceous & with light gray argillaceous matrix, slightly calcareous, with < 10-20% chert grains & as sandy siltstone & silty tight sandstone, no shows.
- 2,640.00 to 2,645.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, greasy in part, pyritic, medium hard, subfissile in part, 2-3% as fractured, locally silty or sandy siderite nodules, trace medium brown chert, 1% consolidated, quartzose to salt and pepper, predominately silty to very fine upper grained, subangular to subrounded, siliceous, argillaceous, slightly pyritic tight sandstone fragments, trace medium grained, siliceous, salt and pepper sandstone fragments with 6-8% dead black bitumen plugged porosity, as cavings?, bulk sample with no cut fluorescence.
- 2,645.00 to 2,650.00 100% **SHALE**
(5.00) medium to dark gray, platy to blocky, micromicaceous, pyritic, medium hard, sub fissile in part, as clay shale, rare silty & sandy fragments, 1-2% as light gray, silty to very fine upper grained, subangular to subrounded, quartzose to salt and pepper, moderately sorted, siliceous, slightly pyritic, tight sandstone fragments grading in part to sandy, siltstone, tight, trace light gray, salt and pepper, very fine lower to fine upper grained fragments with floating coarse lower quartz & chert grains, siliceous, with 1-12% black dead, bitumen plugged intergranular porosity, as thins stringers,?, cavings?, no cut fluorescence.
- 2,650.00 to 2,665.00 100% **SHALE**
(15.00) dark gray to black, fissile to subfissile, non calcareous, pyritic, occasional silty slightly calcareous & pyritic laminations, occasional cherty pyritic stringers, well compacted, hard, siliceous in part, brittle, occasional calcite cemented microfracture, occasional pyritized plant stems or burrows?
- 2,665.00 to 2,680.00 100% **SHALE**
(15.00) very dark gray to black, fissile to subfissile, non calcareous, pyritic, pyrite nodules & micro laminae, carbonaceous, occasional silty to very fine grained sandy laminations, well compacted, brittle, trace brown chert
- 2,680.00 to 2,695.00 90% **SHALE**
(15.00) dark gray to black, fissile to subfissile, non calcareous, carbonaceous, pyritic, silty stringers, well compacted, firm, brittle, trace brown chert
- 10% **SILTSTONE**
medium to dark yellowish brown to yellowish gray, quartzose, calcareous, pyritic, locally grading to very fine grained sandstone
- 2,695.00 to 2,700.00 70% **SHALE**
(5.00) very dark gray to black, fissile to subfissile, non calcareous, pyritic, occasional cherty limestone stringers, well compacted, firm, carbonaceous

Sample Descriptions

Storage Units: Metric

2,695.00 to 2,700.00 (5.00)	15%	SANDSTONE light to medium yellowish brown to yellowish gray, very fine to upper medium grained, rare upper coarse grained clasts, quartz with minor chert & white feldspars, subrounded to rounded, poorly sorted, predominately tight, locally with 8-10% intergranular porosity, locally with common interstitial black pyrobitumen cement, weak slow dead streaming cut
	10%	LIMESTONE medium to dark grayish brown, cryptocrystalline, slightly argillaceous, cherty in part, blocky, dense, tight, hard
	5%	CHERT medium to dark yellowish brown to yellowish gray, thin stringers, organic inclusions
2,700.00 to 2,705.00 (5.00)	90%	SHALE black, fissile to subfissile, non calcareous, occasional siltstone & limestone stringers, carbonaceous, well compacted, firm
	5%	LIMESTONE as above, occasional fossil fragments (crinoids, brachiopods), thin stringers, trace brown chert
	5%	SILTSTONE dark gray to dark brownish gray, calcareous, locally sandy, pyritic, thin stringers
2,705.00 to 2,710.00 (5.00)	75%	SHALE very dark gray to black, fissile to subfissile, non calcareous, carbonaceous, locally pyritic
	15%	LIMESTONE light to dark yellowish brown, cryptocrystalline, blocky, glassy, slightly argillaceous in part, dense, tight, rare fossil fragments, trace brown chert
	10%	SANDSTONE light to medium gray, yellowish gray, very fine to fine grained, quartzose with trace chert, subrounded to subangular, moderate to poorly sorted, silica + abundant secondary calcite cement, common pyrite cement, locally with minor to common black pyrobitumen cement, faint slow streaming dead oil cut, well indurated, tight
2,710.00 to 2,730.00 (20.00)	90%	SHALE black, subfissile to fissile, non calcareous, pyritic, scattered massive pyrite, occasional pyrite cemented fractures, carbonaceous, occasional slickenside, well compacted, firm
	10%	SILTSTONE medium to dark grayish brown, quartzose, calcareous, micromicaceous, sandy in part, trace pyrite

Sample Descriptions

Storage Units: Metric

- 2,730.00 to 2,750.00 100% **SHALE**
(20.00) very dark grayish brown to black, subfissile to fissile, pyritic, well compacted, firm, moderately brittle, common slickenside, slightly greasy lustre, increasingly carbonaceous, no visible fluorescence, rare cut with cut fluorescence, occasional silty laminations
- 2,750.00 to 2,770.00 100% **SHALE**
(20.00) very dark gray to black, fissile to subfissile, occasional dark grayish brown blocky laminae, pyritic, occasional aragonitic fossil fragments, slightly greasy lustre, common slickenside, occasional silty laminations, occasional calcite cemented microfracture, well compacted, moderately firm, no visible fluorescence, slow weak hazy dead oil cut
- 2,770.00 to 2,790.00 90% **SHALE**
(20.00) as above, very slow weak hazy cut, increasingly common silty laminae
- 10% **SILTSTONE**
dark grayish brown, very fine silt with argillaceous matrix, carbonaceous in part, trace pyrite, slightly calcareous, thin laminae
- 2,790.00 to 2,800.00 100% **SHALE**
(10.00) very dark gray to black, fissile to subfissile, non calcareous, increasingly carbonaceous, slightly greasy lustre in part, pyritic, common slickenside, occasional silty laminae, no visible fluorescence, slow weak hazy cut
- 2,800.00 to 2,820.00 100% **SHALE**
(20.00) very dark gray to black, subfissile to fissile, occasional dark grayish brown blocky laminae, pyritic, carbonaceous, occasional dark grayish brown silty laminations, common slickenside with greasy lustre, no fluorescence, very slow faint cut
- 2,820.00 to 2,840.00 100% **SHALE**
(20.00) predominately dark gray, locally black, subfissile to fissile, carbonaceous, decreasing total organic carbon, non calcareous, well compacted, moderately firm, pyritic, common finely disseminated pyrite, trace massive pyrite, occasional slickenside, occasional silty laminae, no visible fluorescence
- 2,840.00 to 2,860.00 100% **SHALE**
(20.00) predominately dark gray to dark brownish gray, locally black, subfissile to fissile, non calcareous, carbonaceous, moderately well compacted, moderately soft, decreasing pyrite content, trace scattered massive pyrite, occasional slickenside, no visible show
- 2,860.00 to 2,880.00 100% **SHALE**
(20.00) predominately dark gray to dark brownish gray, locally black, occasional dark grayish brown calcareous silty laminations, subfissile to fissile, non calcareous, carbonaceous, moderately well compacted, moderately soft, decreasing pyrite content, trace scattered massive pyrite, rare slickenside, no visible show

Sample Descriptions

Storage Units: Metric

2,880.00 to 2,900.00 (20.00)	100%	SHALE predominately dark gray to dark brownish gray, locally black, subfissile, non calcareous, carbonaceous, silty in part, occasional silty laminations, trace massive pyrite, trace disseminated pyrite, micromicaceous, non visible show, occasional slickenside
2,900.00 to 2,910.00 (10.00)	85%	SHALE predominately dark gray to dark brownish gray, locally black, subfissile, non calcareous, carbonaceous in part, increasingly silty, trace pyrite, micromicaceous, rare slickenside, no visible fluorescence
	15%	SILTSTONE medium to dark grayish brown, fine to coarse silt, argillaceous matrix, slightly calcareous in part, slightly carbonaceous, pyritic, micromicaceous
2,910.00 to 2,915.00 (5.00)	85%	SHALE as above
	10%	SILTSTONE as above, sandy in part
	5%	SANDSTONE medium grayish brown, quartz & common chert, very fine to lower coarse grained, silty matrix, subrounded, poorly sorted, silica + minor calcite cement, well indurated tight, very hard, no visible show
2,915.00 to 2,922.00 (7.00)	50%	SHALE dark gray to black, subfissile, non calcareous, carbonaceous, locally silty, well compacted, firm, occasional slickenside
	35%	SANDSTONE light to medium grayish brown, predominately quartz with trace chert, very fine to upper fine grained, locally with silty matrix, subrounded, moderately sorted, silica + trace calcite cement, trace bright green glauconite grain, well indurated, tight, trace brown hydrocarbon residue, no visible fluorescence, very slow & very faint weak hazy cut, no show
	15%	SILTSTONE light to medium grayish brown, quartzose, sandy in part, slightly calcareous, well indurated, hard
2,922.00 to 2,930.00 (8.00)	95%	SHALE predominately dark gray to black, subfissile to fissile, non calcareous, carbonaceous, well compacted, moderately firm, brittle in part, occasional dark brown siliceous laminae, locally pyritic, minor massive pyrite, occasional slickenside, cavings in part
	5%	SANDSTONE light to medium grayish brown, predominately quartz with trace chert, very fine to upper fine grained, locally with silty matrix, subrounded, moderately sorted, silica + trace calcite cement, trace bright green glauconite grain, well indurated, tight, trace brown hydrocarbon residue, no visible fluorescence, very slow & very faint weak hazy cut, no show

Sample Descriptions

Storage Units: Metric

2,930.00 to 2,945.00 (15.00)	90%	SHALE dark gray to brownish gray, locally black, subfissile, non calcareous, decreasing carbonaceous content, pyritic, firm, brittle, common to abundant massive, dis & patchy pyrite throughout, occasional silty stringer, occasional poorly sorted sandstone laminations, rare to occasional slickenside
	5%	SILTSTONE medium gray, sandy in part, slightly calcareous to dolomitic, pyritic, well indurated
	5%	SANDSTONE medium gray, quartz, chert & common dark lithics, very fine to upper fine grained, rare medium grained clasts, silty argillaceous matrix, silica + trace dolomitic cement, well indurated, hard, minor disseminated pyrite cement, tight
2,945.00 to 2,955.00 (10.00)	90%	SHALE dark gray, dark grayish brown, minor bk, subfissile to subblocky, non calcareous, carbonaceous in part, well compacted, firm, brittle, pyritic, silty laminations
	10%	SILTSTONE medium to dark gray, dark brownish gray, slightly dolomitic in part, rare brachiopod fragment, sandy in part, well indurated, hard, trace pyrite
2,955.00 to 2,960.00 (5.00)	95%	SHALE dark gray to black, subfissile, increasingly carbonaceous, non calcareous, pyritic, occasional silty laminations, occasional slickenside
	5%	SILTSTONE as above
2,960.00 to 2,975.00 (15.00)	100%	SHALE predominately black, dark gray to dark grayish brown in part, subfissile, non calcareous, carbonaceous, moderately high total organic carbon, locally pyritic, occasional silty laminations, rare poorly sorted sandstone stringer, well compacted, firm, common slickenside
2,975.00 to 2,990.00 (15.00)	90%	SHALE dark gray to black, dark grayish brown in part, subfissile to fissile, non calcareous, carbonaceous, pyritic, patchy massive pyrite, moderate to well compacted, common slickenside, occasional sandstone & siltstone stringers, cavings in part
	5%	SILTSTONE medium gray, sandy, slightly calcareous, thin laminations, minor pyrite
	5%	SANDSTONE light to medium gray, brownish gray, very fine to fine grained, silty argillaceous matrix, subrounded, poorly sorted, silica + minor dolomitic to calcareous cement, patchy minor pyrite cement, well indurated tight, thin stringers

Sample Descriptions

Storage Units: Metric

2,990.00 to 3,005.00 (15.00)	90%	SHALE predominately black, dark grayish brown in part, subfissile to fissile, non calcareous, carbonaceous, occasional silty laminae, locally pyritic, occasional slickenside
	10%	SANDSTONE as above, quartz & common dark lithics, trace carbonaceous matter, well indurated, tight, thin stringers, minor pyrite
3,005.00 to 3,015.00 (10.00)	90%	SHALE predominately black, dark grayish brown in part, fissile to subfissile, non calcareous, carbonaceous, moderate to well compacted, moderately firm, common slickenside, brittle in part, minor pyrite, occasional sandy stringer, no visible fluorescence, very faint & very slow cut fluorescence
	10%	SANDSTONE light to medium gray, brownish gray, quartz & minor dark lithics, very fine to fine grained, occasional medium to lower coarse grained stringer, silty & argillaceous, subrounded, poorly sorted, silica + calcite cement, trace pyrite, well indurated, tight
3,010.00 to 3,020.00 (10.00)	90%	SHALE subequal black & dark brownish gray, subfissile to fissile, non calcareous, carbonaceous in part, pyritic, rare aragonitic fossil fragments, occasional sandy stringer
	10%	SANDSTONE medium brownish gray, very fine to fine grained, occasional medium grained floating clasts, silty matrix, subrounded, poorly sorted, silica + calcite cement, tight, well indurated
3,015.00 to 3,020.00 (5.00)	85%	SHALE as above
	10%	SANDSTONE as above
	5%	SILTSTONE medium to dark gray, medium brown, quartzose, argillaceous in part, sandy, thin laminations, slightly calcareous
3,020.00 to 3,025.00 (5.00)	70%	SHALE dark gray to black, dark grayish brown in part, subfissile, non calcareous, carbonaceous in part, minor patchy & disseminated pyrite, moderate to well compacted, occasional slickenside
	20%	SANDSTONE light to medium gray to brownish gray, quartzose with minor dark lithics, very fine to upper fine grained, rare medium grained clasts, rounded to subrounded, moderate to poorly sorted, silica + minor calcite cement, well indurated, tight

Sample Descriptions

Storage Units: Metric

3,020.00 to 3,025.00 (5.00)	5%	LIMESTONE medium to dark hgy to brown, cryptocrystalline, argillaceous, blocky, dense, tight, thin stringer
	5%	SILTSTONE as above
3,025.00 to 3,030.00 (5.00)	85%	SHALE predominately dark gray, black in part, subfissile, calcareous, silty & sandy laminations, moderate to well compacted, decreasing carbonaceous content, firm, occasional slickenside
	10%	SANDSTONE as above
	5%	SILTSTONE as above
3,030.00 to 3,035.00 (5.00)	85%	SHALE subequal dark gray to grayish brown & black, subfissile to fissile, non calcareous, carbonaceous, minor disseminated & patchy pyrite, sandy laminations as above, occasional to common slickenside, occasional silty laminations
	15%	SANDSTONE light to medium gray to brownish gray, quartzose with minor dark lithics, very fine to fine grained, silty in part, subrounded, moderate sorting, silica + minor calcite cement, well indurated, tight, patchy black bitumen cement, no visible show
3,035.00 to 3,045.00 (10.00)	90%	SHALE predominately black, dark brownish gray in part, subfissile to fissile, increasingly carbonaceous, non calcareous, minor patchy pyrite, pyrite laminae, very fine grained sandy to silty laminations, common slickenside
	10%	SANDSTONE as above
3,045.00 to 3,065.00 (20.00)	100%	SHALE predominately black, very dark grayish brown in part, subfissile to fissile, non calcareous, carbonaceous, minor patchy pyrite, moderately well compacted, firm, common slickenside, occasional silty laminae, rare microfossil fragments, rare aragonitic fossil remains
3,065.00 to 3,080.00 (15.00)	95%	SHALE subequal dark gray to dark brownish gray & black, subfissile to fissile, non calcareous, decreasing carbonaceous, occasional silty laminae, trace to minor scattered pyrite, moderately well compacted, firm, sandy stringers, occasional slickenside

Sample Descriptions

Storage Units: Metric

3,065.00 to 3,080.00 5% (15.00)	SANDSTONE light to medium gray to brownish gray, very fine to upper fine grained, occasional lower to upper medium grained clasts, silty matrix, subangular, poorly sorted, silica + minor calcite cement, rare grain with trace to minor pyrite bitumen cement, well indurated, tight
3,080.00 to 3,085.00 80% (5.00)	SHALE as above, rare calcite filled microfracture, occasional slickenside
20%	SANDSTONE as above, predominately very fine to fine grained, silty in part, moderately sorted, well indurated, tight, no visible fluorescence, trace faint very slow cut, no show, trace pyrite
3,085.00 to 3,095.00 85% (10.00)	SHALE subequal very dark gray to grayish brown & black, fissile to subfissile, non calcareous, carbonaceous, well compacted, firm, minor pyrite, sandy stringers, silty laminae, rare slickenside
10%	SANDSTONE light to medium gray to brownish gray, very fine to fine grained, silty matrix, subrounded to subangular, moderate to poorly sorted, silica + calcite + trace to minor pyrite cement, well indurated, tight, trace interstitial pyrobitumen, no show
5%	SILTSTONE medium to dark gray, sandy in part, slightly calcareous, carbonaceous in part, thin laminations
3,095.00 to 3,110.00 90% (15.00)	SHALE predominately dark gray to brownish gray, commonly black, subfissile, pyritic, carbonaceous in part, moderately well compacted, moderately firm, occasional slickenside, sandy stringers
10%	SANDSTONE as above, common floating lower medium grained clasts, poorly sorted, well indurated, tight, thin stringers
3,110.00 to 3,120.00 90% (10.00)	SHALE predominately dark gray to grayish brown, subfissile to subblocky, well compacted, firm, non calcareous, decreasing carbonaceous content, well compacted, firm, pyritic, occasional slickenside
10%	SANDSTONE medium brownish gray, very fine to fine grained, occasional medium grained floating clasts, silty matrix, subrounded, poorly sorted, silica + calcite cement, well indurated, tight
3,120.00 to 3,132.00 65% (12.00)	SHALE predominately dark gray to grayish brown, black in part, subfissile to subblocky, well compacted, firm, silty in part, decreasing carbonaceous content, rare slickenside

Sample Descriptions

Storage Units: Metric

-
- 3,120.00 to 3,132.00 25% **SANDSTONE**
(12.00) as above, occasional medium to coarse grained quartz & light gray chert well rounded loose clasts
- 10% **SILTSTONE**
medium to dark grayish brown, sandy in part, slightly calcareous, carbonaceous in part, trace to minor disseminated pyrite

Sidewall Cores

Storage Units: Metric

Date		Service Company	Schlumberger
Run No.	1	Tool Type	MDT - Modulated Dynamic Tester
Top Depth	1,440.00	Cores Requested	51
Base Depth	2,096.10	Cores Obtained	51
Geologist	Trevor Wall	Cores Lost	0

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
1	2,096.10	SHALE
100	2,056.63	SHALE: black, silty, calcareous, firm, no fractures, finely disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
2	2,096.00	SHALE
100	2,056.53	SHALE: black, silty, calcareous, firm, no fractures, finely disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
3	2,095.90	SHALE
100	2,056.43	SHALE: black, silty, calcareous, firm, no fractures, finely disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
4	2,095.80	SHALE
100	2,056.33	black, silty, calcareous, firm, no fractures, finely disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
5	2,092.30	SHALE
100	2,052.84	black, silty, calcareous, firm, no fractures, finely disseminated pyrite

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
6	2,092.20	SHALE
100	2,052.74	black, silty, calcareous, firm, no fractures, finely disseminated pyrite

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

7	2,092.20	SHALE
100	2,052.74	dark gray to black, silty, calcareous, firm, one open fracture

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
8	2,092.00	SANDSTONE
100	2,052.54	light -m gray, interbedded dark gray SILTSTONE, calcareous, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
9	2,085.20	SANDSTONE
100	2,045.75	light to medium gray, interbedded dark gray SILTSTONE, calcareous, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
10	2,085.10	SANDSTONE
100	2,045.65	light to medium gray, interbedded dark gray SILTSTONE, calcareous, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
11	2,085.00	SANDSTONE
100	2,045.55	light to medium gray, interbedded dark gray SILTSTONE, calcareous, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
12	2,084.90	SHALE
100	2,045.45	black, blocky, calcareous, firm, hard, silty in part, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
13	1,934.90	SHALE
100	1,895.93	black, blocky, calcareous, firm, hard, silty in part, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
14	1,934.80	SHALE
100	1,895.83	black, blocky, calcareous, firm, hard, silty in part, no fractures

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

15	1,934.70	SANDSTONE
100	1,895.73	medium gray coarse to very coarse grained, abundant chert, petroliferous odor, no fractures

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
16	1,928.80	SANDSTONE
100	1,889.86	medium to dark gray, abundant black pyrobitumen cement, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
17	1,887.50	SANDSTONE
100	1,848.73	medium gray, fine to very coarse grained, petroliferous odor, light amber oil stain

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
18	1,879.50	SANDSTONE
100	1,840.76	medium gray, fine to very coarse grained, petroliferous odor, light amber oil stain

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
19	1,857.90	SHALE
100	1,819.24	no data

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
20	1,857.80	
100	1,819.14	

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
21	1,857.70	SANDSTONE
100	1,819.04	dark gray vfg, silty, calcareous, tight, microfracture, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
22	1,851.10	SHALE
100	1,812.47	dark gray, silty, calcareous, tight, firm, hard, petroliferous odor

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

23	1,851.10	SHALE
100	1,812.47	dark gray, silty, calcareous, tight, firm, hard, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
24	1,851.00	SHALE
100	1,812.37	dark gray, silty, calcareous, tight, firm, hard, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
25	1,850.90	SHALE
100	1,812.27	dark gray silty to sandy, calcareous, tight, firm, hard, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
26	1,844.10	SHALE
100	1,805.49	dark gray silty to sandy, calcareous, tight, firm, hard, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
27	1,844.00	SHALE
100	1,805.39	dark gray silty to sandy, calcareous, tight, firm, hard, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
28	1,843.90	SILTSTONE
100	1,805.29	dark gray shly, hard, calcareous, petroliferous odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
29	1,796.70	SANDSTONE
100	1,758.27	light to medium gray, bedded, strong petroliferous odor, calcite cement, tight

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
30	1,754.10	SANDSTONE
100	1,715.83	light to medium gray, bedded, strong petroliferous odor, calcite cement, tight

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

31	1,754.00	SANDSTONE
100	1,715.73	light to medium gray, bedded, strong petroliferous odor, calcite cement, tight

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
32	1,753.90	SHALE
100	1,715.63	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
33	1,729.20	SHALE
100	1,690.98	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
34	1,729.10	SHALE
100	1,690.88	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
35	1,725.10	SHALE
100	1,686.88	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
36	1,725.00	SHALE
100	1,686.78	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
37	1,720.10	SHALE
100	1,681.89	black, silty to sandy, very strong odor, calcareous, firm

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
38	1,720.00	SHALE
	1,681.79	black, silty to sandy, very strong odor, calcareous, firm

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

39	1,719.90 1,681.69	LIMESTONE dark brownish gray, silty, shell fragment, strong odor, hard
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Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
40	1,696.50	SHALE
100	1,658.32	very dark gray non calcareous pyritic, blocky, firm, moderate odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
41	1,696.40	SHALE
100	1,658.22	very dark gray, non calcareous pyritic, blocky, firm, moderate odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
42	1,696.30	SHALE
100	1,658.12	very dark gray non calcareous pyritic, blocky, firm, moderate odor

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
43	1,616.10	LIMESTONE
100	1,578.16	Crinoid Wackestone: dark brownish gray argillaceous limestone, moderate odor, tight, rare crinoid fragment

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
44	1,616.00	LIMESTONE
100	1,578.06	Crinoid Wackestone: dark brownish gray argillaceous limestone, moderate odor, tight, rare crinoid fragment

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
45	1,615.90	LIMESTONE
	1,577.96	Crinoid Wackestone: dark brownish gray argillaceous limestone, moderate odor, tight, rare crinoid fragment

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
46	1,514.90	ARGILLACEOUS LIMESTONE
100	1,477.63	medium grayish brown, slight odor, tight, massive, occasional fossil

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
47	1,514.90	ARGILLACEOUS LIMESTONE
100	1,477.63	medium grayish brown, slight odor, tight, massive, occasional fossil

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
48	1,514.70	ARGILLACEOUS LIMESTONE
100	1,477.43	medium grayish brown, slight odor, tight, massive, occasional fossil

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
49	1,440.20	ARGILLACEOUS LIMESTONE
100	1,404.27	medium grayish brown, slight odor, tight, massive, occasional fossil

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
50	1,440.10	ARGILLACEOUS LIMESTONE
100	1,404.17	medium grayish brown, slight odor, tight, massive, occasional fossil

Core No.	Depth (MD)	Rock Type
% Recovery	Depth (TVD)	Description
51	1,440.00	LIMESTONE
100	1,404.08	Crinoid Wackestone: dark gray argillaceous limestone, open fracture with trace brown oil on crinoid fragments

MDT

Storage Units: Metric

Seq.	Depth	TVD	SSL	HP(Before)	HP(After)	Form. Prs.	EFW	Temp	MDCP	Formation	Comment
1											
1	2017.50	1978.16	-1353.00	27681.000		17350.000	1.3800	49.0	0.0400	Hart River A	Formation pressure was measured at 18,112KPa on first test, and 17,350KPa on second test. Interval possibly supercharged. Formation pressure is therefore likely less than 17,350KPa
2	2002.00	1962.71	-1338.00		27345.000		1.3800	49.0		Hart River A	Formation is too tight to obtain a stabilized pressure.
3	1934.20	1895.23	-1270.00		26418.000	17783.000	1.3800	49.0	0.4000	Hart River A1	Obtained 2 450ml fluid samples.
4	1930.50	1891.55	-1266.00		26391.000	17861.300	1.3800			Hart River A1	Two pretest conducted. Data repeated and is reliable.
5	1887.50	1848.73	-1224.00		25748.000	17358.000	1.3800			Hart River B	Formation pressure based on second pretest. Did not move enough fluid on first pretest to obtain valid pressure.
6	1879.50	1840.76	-1216.00		25580.000	17457.000	1.3800			Hart River B	2 450ml fluid samples obtained. First sample taken after 80 litres were pumped in 190minutes. Second sample taken after 90 litres pumped in 220 minutes.