

WCR (VOL. 1)
BLACKBACK-1
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ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

W994

PETROLEUM DIVISION

WELL COMPLETION REPORT

MSB
K. J. J. J.

BLACKBACK 1

VOLUME 1 23 JAN 1990

BASIC DATA

GIPPSLAND BASIN

VICTORIA

ESSO AUSTRALIA LIMITED

COMPILED BY:

A. CLARE

OCTOBER 1989

BLACKBACK-1
WELL COMPLETION REPORT
VOLUME 1: BASIC DATA

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04890121

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1. WELL DATA RECORD

BLACKBACK-1

LOCATION : Latitude : 38⁰33'03.53" S
Longitude : 148⁰33'42.12" E
X = 636088.2m E
Y = 5731868.0m N
Map Projection: UTM Zone 55
Geographical Location: Bass Strait,
Victoria
Field: BLACKBACK

PERMIT : Vic/P24

ELEVATION : 21m

WATER DEPTH : 418m

TOTAL DEPTH : 3400m MD - Blackback-1
3047m MD - Blackback-1 ST1
4401m MD - Blackback-1 ST2

PLUG BACK TYPE : Cement Plug

REASONS FOR
PLUGGING BACK : Abandonment

MOVE IN : 20/03/89 0715 hours

SPUDED : 25/03/89 1615 hours

REACHED T.D. : 28/04/89 1630 hours - Blackback-1
22/05/89 1015 hours - Blackback-1 ST1
28/06/89 1530 hours - Blackback-1 ST2

RIG RELEASED : 23/07/89 0545 hours

OPERATOR : Esso Australia Resources Limited

PERMITTEE OR LICENCEE : Esso/BHP Petroleum (Victoria) Pty. Ltd.

ESSO INTEREST : 50%

OTHER INTEREST : 50%

CONTRACTOR : South Seas Drilling Company

RIG NAME : Southern Cross

EQUIPMENT TYPE : Semi-submersible

TOTAL RIG DAYS : 125.34 (includes production test)

DRILLING AFE NO. : 239005 (Segment 35)

TYPE COMPLETION : Plugged and abandoned

WELL CLASSIFICATION : Before Drilling: Wildcat
After Drilling: Plugged and abandoned

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BLACKBACK-1 FINAL WELL REPORT

Operations Summary

1. MOVING/MOORING

After bolstering the No. 1 anchor at the Conger-1 location, the Southern Cross was towed by the MV Lady Penelope to the Blackback-1 location. The rig arrived in the proximity of the location at 0715 hours March 20, 1989, thus completing the 26nm tow in 9.75 hours at an average speed of 2.7 kts.

Due to the water depth at the location (400m prognosed), it was not deemed feasible to use marker buoys to spot the well and primary anchor locations. Therefore, the positioning vessel MV Flinders Tide was stationed in front of the target location, on a bearing of 210°, and used to guide the rig onto location as well as spot anchor positions. Prior to moving onto location, however, the MV Lady Caroline engaged the aft tow bridle in order to assist the Lady Penelope in maintaining the rig position and heading until the aft primary anchors (Nos. 1 and 8) were run.

As the two vessels held the rig on location, the MV Eastern Tide ran anchor No. 1. The MV Lady Diana then ran anchors Nos. 8 and 5. After anchor No. 8 was set, the Lady Caroline released the aft tow bridle and ran anchor No. 4. While the Lady Diana was running anchor No. 6, the Lady Penelope released the forward tow bridle and ran anchor No. 2. After the Eastern Tide set anchor No. 3, operations were suspended for 10.75 hours due to weather (45 kt winds, 4m swell). The Eastern Tide then ran anchor No. 7, thus completing the anchor running operation in 33 hours.

Because of the water depth at the location, the maximum amounts of 2" chain (+2850ft) and 2 1/2" wire (+2500ft) available for each mooring leg were run. Also, because of the steeply sloping seafloor, an additional 450ft of 2" chain was added at the anchors of the port primary mooring legs (Nos. 1 and 4) since these anchors were in significantly deeper water than the well location. Consequently, because of water depth variations, pendant line lengths were optimized as much as practical to suit water depth. Each pendant line was also fitted with an Esso supplied 45 ton swivel assembly between the first and second 500ft pendant wire from the anchor end. This was designed to eliminate pendant fouling problems as experienced on 26 of the 40 anchors recovered during this drilling campaign with the Southern Cross. Esso supplied 14MT marker buoys were also deployed on three of the four deepwater moorings (Nos. 1, 2 and 3). Because of deck space limitations on the anchor handling vessels, a standard SSDC 9MT marker buoy was deployed on deepwater mooring No. 4. For additional information regarding mooring/pendant components refer to Section G.2.a, "Mooring Pattern".

After all of the anchors had been set, an attempt was made to load test the anchors to 250 kips. However, under a tension of 220 kips, chain No. 2 parted in a common link located about 980 ft from the chain locker end (see EFR No.1).

While waiting on daylight for a workboat to attempt to recover the anchor, the remaining anchors (except for No.6) were load tested to 250 kips. Also, maintenance/modifications which had been underway to prepare the rig for drilling in deepwater were completed (i.e., 6 joints of buoyant riser redressed, blue pod hose replaced, Hydril GL annulars changed to deepwater hook up).

The next morning the Eastern Tide made an attempt to recover the anchor. However, after recovering the anchor to the stern roller, the 250ft pendant line adjacent to the anchor broke and dropped the anchor and chain back to the seafloor (see EFR No. 2). Because of the difficulties in grappling and recovering chain in this water depth ($\pm 550\text{m}$), no recovery attempt was made. A spare anchor and extra chain were then loaded out from Barry's Beach Marine Terminal (BBMT) and dispatched to the rig. The Flinders Tide was able to locate the anchor and chain approximately 1700m from the well location on a bearing of 105° . Permission was subsequently requested and granted by the Department of Industry, Technology and Resources (DITR) to leave the anchor and chain on the seafloor.

After receiving and assembling the spare anchor, the Lady Diana recovered the No. 2 chain end from the rig and connected the replacement chain. As the rig began winching the chain into the locker, the chain began slipping into the water off of the workboat. The chain gained momentum and dumped into the water, stripping the control wire off of the workboat's winch. The chain also became tangled into knots, requiring 3 sections of chain to be cut out and Kenter links installed (see EFR No. 3). The anchor and chain were then passed to the Eastern Tide, the anchor was deployed and anchor Nos. 2 and 6 were successfully load tested to 250 kips.. Total non-productive time spent to redeploy the anchor was 53 hours.

The rig was moved towards the called location and ballasted down. The TGB was then run to within $\pm 60\text{m}$ of bottom and the mooring lines were pretensioned to 140 kips. Four unsuccessful attempts were then made to land the TGB on level seafloor. On each attempt the bullseye showed an inclination of over 5° port. Therefore, the TGB was POOH and modified by attaching a scrap piece of 20" casing horizontally to the underside of the port lip. The TGB was then rerun and landed at a seafloor depth of 439m RKB, with an inclination of $3\frac{1}{2}^\circ$ starboard (Note: Based on the observed bullseye reading, the seafloor slope at the location was calculated to be 6° port). The rig position was then determined to be 4.7m on a bearing of 304.7° from the called location.

2. DRILLING OPERATIONS

a) 26" Hole/20" Casing

After setting the TGB, the 26" bit/26" hole opener BHA was made up and stabbed into the TGB. Due to the sloping seafloor, the MWD tool was included in the BHA to monitor hole inclination while drilling to ensure that as straight a hole as possible was drilled. The bit was set down on bottom and two surveys were taken, showing inclinations of 4.0° and 4.7° , respectively. Blackback-1 was then spudded at 1515 hours March 25, 1989. The 26" hole was drilled from 439m to 569m, at an average ROP of 19.3 mph, using seawater and high viscosity gel slugs to clean the hole. At TD a MWD survey showed 0.40° of hole inclination and the hole was swept with a 100 bbl high viscosity pill. A Totco was dropped and the bit was POOH to the seafloor. The Totco was recovered (0.25°) and the bit was RIH. No drag or fill was encountered, 150 bbls of high viscosity mud was spotted in the hole at TD, then the drillstring was pulled up to spot a second high viscosity pill near the seafloor. However, the bit was inadvertently POOH before spotting the pill. Therefore, the guide frame and subsea TV were run and the bit was stabbed back into the TGB (see EFR No. 4). A 150 bbl high viscosity pill was then spotted at 482m and the drillstring was POOH to run casing.

Eight joints of 20", 94 ppf, X-56, JV casing, plus a crossover joint (129 ppf, JV x CC) and the 24" pile joint/18³/₄" CIW WS-I wellhead assembly were then run, with the 20" shoe at 564m. The RCV 150 vehicle had previously been removed from the rig and placed on the Flinders Tide to perform pipeline inspections. Therefore, the RCV was deployed from the Flinders Tide and used to monitor the stabbing of the casing into the TGB and the landing of the PGB on the TGB. The casing was cemented to the seafloor, using a drillpipe stinger, with a lead slurry of 750sx of Class "G" cement plus 2.2% prehydrated gel and a tail slurry of 750sx of Class "G" neat cement.

After mating the LMRP to the BOP stack, two joints of marine riser were made up and the BOP stack was lowered into the water. However, the accumulator pressure and power supply line pressure were found to be decreasing. The BOP was recovered to the spider deck and the lower annular open pod control valve was observed to be leaking. The annular regulator pilot was bled off and the leak was no longer observed (see EFR No.6). Therefore, the BOP stack was rerun using 20 x 50ft non-buoyant riser joints, 6 x 50ft buoyant joints, 1 x 5ft pup joint and the slip joint. Due to weight considerations, an additional riser joint was used as a landing joint. After latching the BOP, performing an overpull test to 50 kips and testing the shear rams, wellhead connector and casing to 500psi, the landing joint was laid down.

b) 17¹/₂" Hole/13³/₈" Casing

A 17¹/₂" bit and pendulum BHA were then picked up and RIH to the TOC. Based on calculated displacement, the TOC was expected at ±554m (i.e., about 10m above the casing shoe); however, the actual TOC was encountered at 539m, indicating a back flow of about 18bbl through the float shoe. Assuming gauge hole, this would equate to a cement drop of about 20m in the annulus.

After two hours spent drilling out cement and the 20" casing shoe, the 17¹/₂" hole was drilled from 569m to 1265m, at an average ROP of 24.9 mph, using a seawater/gel mud system. While drilling this section, formation gas units increased from zero to a maximum of 138 units after a wiper trip from 805m. Background gas also increased from zero to 60-70 units at 805-1100m, then fell back to about 10 units for the remainder of the section. After reaching TD, a 50bbl high viscosity sweep was pumped, a Totco was dropped and a wiper trip was run to the 20" casing shoe. Maximum drag of 70 kips was

encountered while POOH, the Totco was recovered (0.50°) and the bit was RIH. No drag on fill was encountered and the hole was circulated clean. The drillstring was then POOH and the BHC/GR/CAL log was run.

The wearbushing was pulled and 68 joints of 13³/₈", K-55, BTC casing, plus the casing hanger pup joint (68ppf, K-55) were run and landed with the shoe at 1250m. The first 30 joints of casing run were 54.5 ppf joints, with the remaining joints being 68 ppf. The casing was cemented in place with 1000sx of Class "G" neat cement. The estimated TOC was calculated to be at 834m based on an average hole diameter of 18" as per the caliper log. The top plug was bumped and the pressure was increased to 1500psi to test the casing. The 13³/₈" seal assembly was then set and tested, along with the BOP stack, to 200/3000psi. A Phase I PIT was run against the shear rams to 1500psi and the choke manifold was tested to 200/5000psi.

c) 12 1/4" Hole/9 5/8" Casing

An HP11J bit and pendulum BHA were then RIH to the TOC at 1224m. After drilling cement to 1226m, operations were suspended for 1 hour while observing weather conditions (50 kt winds/33ft combined seas @090°). The float collar and cement were then drilled to 1229m, when operations were again suspended due to weather. While observing conditions, the No. 2 anchor chain parted at 1045 hours April 1, 1989. The riser angle immediately exceeded 6°; therefore, it was necessary to hang off on the upper pipe rams, shear the drillpipe, and release the LMRP. All non-essential personnel were then evacuated from the rig by helicopter.

Weather conditions and anchor tensions were observed until about 1630 hours April 1, when the MV Bonavista, which had been dispatched from the DB101 derrick barge, arrived at the rig. Because of high tensions on anchor lines Nos. 1 and 8 (230 kips and 170 kips, respectively), the Bonavista was hooked up to the aft tow bridle. This resulted in a decrease in tension in line No. 1 to about 150 kips, while the tension in line No. 8 dropped to about 140 kips.

At about 0700 hours April 2, weather conditions had improved sufficiently to disengage the Bonavista from the tow bridle and release the vessel back to the DB101. However, because of the improved weather, the Lady Diana, which had arrived at the rig at 2330 hours April 1, was also called away to assist the Maersk Giant jack-up rig in moving from the Barracouta Platform to the Fortescue Platform. At this time, while waiting on workboat assistance, the sheared drillpipe was POOH.

The Lady Caroline arrived at the rig at about 1945 hours April 2 and was put on the aft tow bridle due to another increase in weather (35 kt winds/30ft combined seas @050°). The weather again subsided and the vessel was released from the tow bridle at 1617 hours April 3 to also assist with the Maersk Giant move. At this time, the Lady Penelope arrived at the rig and took a standby position.

By 0315 hours April 4, the weather had improved sufficiently to ballast the rig up to 21ft. An inspection was then made of the BOP stack, with the RCV deployed from the Flinders Tide, to verify that no anchor lines were in the immediate vicinity of the BOP and to ensure that the guidelines were free. An attempt was made to move the rig back over the wellhead by tensioning up on anchor No. 1. However, because the line tension increased from 160 kips to 200 kips after pulling in about 1ft of line, the Lady Penelope was hooked up to the aft tow bridle and moved the rig into position. The anchor lines were then adjusted and the tow bridle was recovered. Also, because there was not enough wire on the No. 6 winch drum to permit slacking off without exceeding SSDC's drum wrap safety factor, the Lady Penelope recovered the No. 6 anchor and moved it about 85m closer to the rig.

As the rig hauled in its section of the broken No. 2 chain, the Lady Penelope recovered the No. 2 buoy and pendants. The Lady Penelope then towed its section of chain to shallower water prior to recovering the anchor and chain to her deck. When the Lady Penelope returned with the chain, the rig was ballasted down to 40ft and the chain was inspected. It was discovered that the chain had parted eight links in from what was believed to be the changeover Kenter link. This led to the theory that the ±850ft of supposedly unused locker chain was defective. Therefore, the MV Lady Gay was dispatched from BBMT with 15 x 90ft shots of Esso owned chain to replace the locker chain. During this time the Lady Caroline's tow wire failed on the Maersk Giant move and the Lady Penelope was called away to assist the move. Prior to departing, the Lady Penelope received 2 x 250ft pendant wires from the rig, then the chain was moved to shallower water near the Kingfish "B" Platform and wet stowed.

After waiting 15.25 hours, the Lady Gay arrived at the rig and offloaded the Esso chain for inspection. However, it was discovered that this chain was Grade 2 and was not suitable for use as mooring chain. Therefore, the locker chain was flaked out on deck and inspected. At this time an unlogged Kenter link was discovered ± 50 ft from the broken link. This suggested that the failure had not been in the locker chain as originally suspected, but in a short section of chain which was installed between the dormant locker chain and the primary service chain. No additional Kenter links were discovered and the chain appeared undamaged. Therefore, the short section of chain was removed and the chain was rerun into the locker.

By 2200 hours April 6, the rig was ready to rerun the chain; however, no workboats were available due to the Maersk Giant move. The MV Senorita picked up the wet stowed chain and arrived at the rig at 1615 hours April 7. The chain was then reconnected and hauled into the locker; however, it was necessary to wait for the Lady Penelope to arrive because the pendants required to run the anchor (± 2250 ft) were on her work drum.

The Lady Penelope arrived at the rig at 1930 hours April 7 and began redeploying the anchor. While lowering the anchor to bottom, however, the pendants parted when the open socket between the third and fourth pendant wires lost its pin. The anchor and three pendants were dropped to bottom and consequently, the buoy could not be deployed. Anchors Nos. 2 and 6 were then load tested to 250 kips, the rig was ballasted down to drilling draft (48ft) and the rig was repositioned over the wellhead. The LMRP was then landed and latched. A 50 kip overpull test was performed and the choke and kill lines were tested to 1000psi.

After nipping up the diverter, a fishing assembly was made up and RIH. The shear rams were opened and the riser was circulated with mud through the choke line. The fish was tagged and milled on for one hour with no progress. The fishing assembly was then POOH, 3 x 8" drill collars were picked up to provide additional weight, and the assembly was rerun. After milling for 0.75 hours, the fish was engaged. The fish was POOH and the fishing assembly was laid down. The bit was then pulled above the seafloor, circulation was established to ensure that the bit nozzles were clear and the shear rams were tested to 200/1500 psi. The BOP stack was also tested to 200/1500 psi after RIH with the bit to 716m. The bit was then RIH to 1229m to continue drilling out cement, thus ending the NPT at 0100 hours April 9, 1989. Total time spent due to the No. 2 chain failure was 7.59 days.

The remaining cement and float collar/float shoe were drilled out and 3m of hole was drilled to 1268m, where a Phase II PIT was conducted to leakoff at 14.3 ppg EMW. The 12 $\frac{1}{4}$ " hole was then drilled from 1268m to 1941m in one bit run, at an average ROP of 13.2 mph, using a seawater/gel mud system. Lithology in this section was limestone and background gas units were generally low, decreasing from about 17 units to 6 units over the section. The majority of this section below 1807m was drilled using just one mud pump due to various pump problems (see EFR's Nos. 7, 8 and 9). After drilling to 1941m, the bit run was terminated due to a decrease in penetration rate. Prior to POOH, however, the mud in the hole was displaced in two stages with a 9.0 ppg seawater/polymer mud. The program had called for the mud to be conditioned prior to beginning the planned directional portion of the well at ± 2200 m. However, due to problems experienced with the build up of low gravity solids on Conger-1, it was decided to displace the mud in the hole with a clean, low solids mud. The displacement was done at this time due to operational constraints imposed by the large marine riser volume requiring that the displacement be done on a trip. Upon POOH with the bit, maximum drag of 120 kips was encountered at 1300-1390m and the bit was found to be 3/16" undergauge.

A 12¹/₄" HTC B9M+ PDC bit was then made up below a 9¹/₂" Nortrak steerable motor and RIH. It was planned to use the PDC/steerable motor system to drill in the rotary mode to the planned kickoff point at 2217m, then orient the assembly and build at a rate of 2°/30m to a final angle of 35°. It was also hoped that the bit would drill to the Top of Latrobe objective at 2825m MD (2779m TVD) in one bit run.

Upon RIH with the B9M+, tight hole was encountered at 1886m. After spending one hour reaming to bottom, three runs with the B9M+ were required to drill the 12¹/₄" hole from 1941m to 2198m. The first two runs were terminated at depths of 2068m and 2150m, respectively, due to failures of two separate Teleco RGD MWD tools (see EFR's Nos. 10 and 11). Although the causes of the failures appeared to be different, both tools were pulled due to the inability to provide tool face orientation when attempting to steer the Nortrak assembly (i.e., when in the non-rotating mode). Tool face orientation was needed at this time to bring the hole back to vertical since inclination had gradually built to 4.9° on an azimuth of 299°, while it was desired to kick off on an azimuth of 134°. The third B9M+ run was made using a Smith MWD tool. However, this run was terminated after drilling only 48m due to the inability to drop angle or change the azimuth because of the high left hand reactive torque (180-360°) associated with the PDC bit. In its three runs the bit drilled 257m, at an average ROP of 8.2 mph, and was graded as 10% worn. While drilling this section of Gippsland Limestone, the desander and desilter were run continuously to maintain the lowest possible mud weight (±9.0 ppg) and solids content (±5%).

After laying down the B9M+, an HP11J bit was RIH on the Nortrak assembly with the Smith MWD tool. The Nortrak was oriented 180° away from the high side of the hole and the kick off portion of the well was begun at 2198m MD. Drilling in the oriented mode continued until 2251m MD, where the well was brought back to vertical. Oriented drilling then progressed on an azimuth of ±138° to 2301m MD, at a rate of build of ±2.5°/30m, where the bit was POOH on hours. A rate of build greater than the originally planned rate of 2°/30m was used because the well could not be brought back to vertical until 34m below the planned kick off point. This rate of build was designed to allow an angle of 35° to be achieved ±100m before entering the Top of Latrobe objective. The maximum dogleg calculated in this interval was 3.66°/30m.

A new HP11J bit was picked up and RIH on the Nortrak assembly. Because the previous HP11J bit had been graded as only 3-3-1 after being run for 21.50 hours at ±160 RPM on the Nortrak motor, it was not deemed necessary to limit this bit run to a specified number of hours. Therefore, drilling resumed and the interval 2301-2561m MD was drilled in 44.75 hours at an average ROP of 5.8 mph. This interval was drilled in the oriented mode except for two singles which were rotated. A significant ROP increase was noted while rotating; however, the hole inclination failed to build as desired. The rate of build continued at 2.5°/30m while in the oriented mode, with an angle of 24.9° built by the end of the bit run. Lithology in this section graded from the Gippsland Limestone to the claystone/siltstone formations of the Lakes Entrance, which was picked at 2418m MD (2415m TVD) or about 8m low to prognosis. After penetrating the Lakes Entrance, the average ROP increased from about 5mph to 7mph.

Another HP11J bit was then RIH on the Nortrak assembly and drilled the interval 2561-2837m MD at an average ROP of 8.8 mph. This section was drilled in the oriented mode to 2686m MD, where rotation was alternated with oriented drilling as required. By 2701m MD (2668m TVD) an angle of 35° at an azimuth of 130° had been achieved, thus concluding the build portion of the well. Also, while drilling at 2600m MD, the mud weight was increased to 10.0 ppg to help provide hole stability in the Lakes Entrance. While weighting up, the desander and desilter were run intermittently (2 hours on, 2 hours off) to avoid discharging excessive amounts of barite. However, the solids content and mud viscosity began increasing over this section due to the active clays being drilled.

Because the previous two HP11J's had been graded 4-8-1/16", a HP13G was picked up and RIH on the Nortrak assembly. A 12" stabilizer was also picked up and placed between two stands of 8" drill collars in the upper portion of the BHA to reduce the contact area between the collars and the borehole wall. After reaming tight hole at 2717-2731m MD and 2775-2837m MD, the interval 2837-2903m MD was drilled in the rotating mode at an average ROP of 4.2 mph. The bit run was terminated after circulating up 175 units of gas from a drilling break at 2899-2903m MD in order to core. Sandstone was discovered in the bottoms up sample and the Top of Latrobe was picked at 2900m MD (2826m TVD) or about 47m low to prognosis.

A 12¹/₄" core bit and core barrel, with a 12" near bit stabilizer and 9⁷/₈" upper stabilizers, were then picked up. The assembly was RIH and Core No. 1 was cut from 2903m MD to 2921m MD at an average ROP of 1.4 mph. High torque was experienced while coring and difficulties were encountered trying to recommence after the connection at 2914m MD. Core recovery was 67% and the core bit was graded as 5% worn. The core was composed of glauconitic sandstone with a strong hydrocarbon odor; however, because of poor rock properties, another core was not warranted.

Prior to coring, the hole inclination had gradually increased to about 37°. However, because it was believed that the coring assembly would have a strong dropping tendency, a rotary building assembly, with a 9⁷/₈" stabilizer located 8.74m above the bit, was picked up. The BHA was RIH with a HP51A bit and the Smith MWD tool to 2338m MD, where a bridge was tagged. After reaming to 2352m MD the assembly was RIH and three singles were drilled to 2953m MD at an average ROP of 7.5 mph. At this point, surveys showed that the coring assembly had held angle, while the rotary assembly was building at a rate of about 1.8°/30m. Therefore, due to the excessive build rate, the bit was POOH and the 9⁷/₈" stabilizer was replaced with a 12" stabilizer. While drilling this section, a maximum gas peak of 401 units was recorded at 2930m MD.

The new BHA and a HP51A bit were then RIH to 2244m MD, where a tight spot was tagged. After reaming the interval 2244-2267m MD, the bit was RIH to TD and used to drill to 3131m MD at an average ROP of 7.4 mph. Trip gas of 390 units was recorded on this run, with maximum gas peaks of 56 units and 75 units recorded at 2960m MD and 3075m MD, respectively.

Because the previous BHA continued to build angle at a rate of about $0.2^\circ/30\text{m}$, reaching a maximum angle of 40.8° at the end of the bit run, a new BHA was built to hold angle. Previous experience from production drilling in Bass Strait, coupled with predictions from the EPR Rate of Build (ROB) program, dictated that the first string stabilizer be separated from the near bit stabilizer by about 15ft. However, since the 15ft NMDC pup joint which was on rental had previously been sent to the Maersk Giant, an assembly consisting of a 10ft DC pup and a $9\frac{7}{8}$ " stabilizer was made up to provide the required spacing. The Smith MWD tool was also laid down and a Teleco RGD MWD tool was picked back up so that the objective intervals could be logged.

After RIH with the new BHA and a HP51A bit to 2902m MD, the kelly was picked up and the interval 2890-2949m MD was logged with the MWD tool. While logging, trip gas of 890 units, containing 1.0% CO_2 was recorded. It was believed that the gas had been swabbed in from 2906m MD, where 50 kips drag had been experienced on the previous trip out. On bottoms up, the mud was gas cut from 10.0 to 9.0 ppg and showed signs of carbonate contamination. The bit was then RIH to bottom at 3131m MD, where a six stand trip was required to recover the Teleco mud screens inadvertently left in the pipe. While POOH, 100 kips of drag was recorded at 3131-3100m MD and the kelly was picked up to ream a tight spot at 3071m MD. After recovering the screens, the bit was RIH and the interval 3131-3283m MD was drilled at an average ROP of 5.2 mph. High torque was noted throughout this section, requiring drilling to be interrupted frequently due to rotary stalling. Drag of up to 100 kips was also recorded at 3138-3118m MD while POOH for a wiper trip from 3230m MD. After drilling to 3283m MD, the Top of the Coastal Plain sediments had been confirmed and the bit run was terminated to log and set $9\frac{5}{8}$ " casing. Prior to POOH, a wiper trip was run from TD to above the KOP at 2198m and the mud was conditioned. The hole angle at the end of this bit run had decreased slightly to 40.5° , indicating a slight drop rate of $0.06^\circ/30\text{m}$ for the BHA.

Schlumberger was rigged up and electric logs were run as follows:

- Run No. 1 - DLL/MSFL/LDL/CNL/SP/GR/CAL
- Run No. 2 - BHC/GR/CAL
- Run No. 3 - RFT/GR (18 pressure pretests attempted)

While running the RFT pretests, the hole became sticky and the tool was briefly stuck on several occasions. Therefore, the RFT was POOH, Schlumberger was rigged down and a bit was RIH for a wiper trip. Tight hole was encountered at 3254m MD while RIH; therefore, the kelly was picked up and the interval 3254-3283m MD was reamed. On bottoms up, 375 units of trip gas containing 3% CO_2 was recorded. The hole was then circulated and the mud was treated for carbonate contamination. While circulating and working the junk sub, however, the pipe became stuck with the bit at 3263m MD. Full circulation was maintained and the drilling jars in the string were working, indicating that the stuck point was in the BHA below the jars. Although there was only one drill collar below the jars, which was separated by two stabilizers, the logs showed that the drill collar was across a permeable sand. Therefore, because of the ± 885 psi differential between the 10.0 ppg mud weight and the formation pressure (8.33 ppg EMW from the RFT's), it was believed that the string was differentially stuck.

After jarring and working the pipe without success, 115 bbls of diesel were pumped, followed by a 60 bbl 9.5 ppg EZ spot pill. The pill was allowed to soak and rotation was regained. Once regaining rotation, the pipe could be moved down. However, it was necessary to back ream to allow upward movement, indicating that the string may have been both mechanically and differentially stuck. Three singles were then pulled with the kelly and the interval 3235-3283m MD was reamed prior to making a wiper trip to the 13³/₈" casing shoe. After reaming a bridge at 3005-3020m MD upon RIH, the bit was RIH to TD and the hole was conditioned prior to POOH.

After POOH it had been planned to continue with the logging program. However, the Schlumberger operators had left the rig two days previous for a stop work meeting and had voted to go on strike. Since the Exploration Department vetoed running casing at this time because the SHDT and CST's had not been run, it was decided to resume drilling.

After testing the BOP stack, a new BHA and a HP51A were RIH and the interval 3283-3400m MD was drilled at an average ROP of 6.4 mph. At this time, the Schlumberger strike had ended and the operators had returned to the rig. Therefore, the bit run was terminated in order to resume logging. While drilling this section, 50 kips of drag was experienced on each connection, with a maximum drag of 100 kips recorded on the trip out of the hole. The hole angle at the end of this bit run had dropped to 38.2°, equating to a drop rate of 0.66°/30m for the BHA. Also, mud properties continued to show a decline because of the effects of CO₂ contamination from the Latrobe formation coupled with the high active solids in the mud from the Lakes Entrance formation. An analysis performed by EPR at this time also showed that the barite being used contained some siderite contamination. This provided 15,000mg/l of soluble carbonates, whereas EPR generally recommends carbonate levels less than 3,000mg/l for barite used in seawater muds.

Schlumberger was then rigged up and the RFT tool was RIH. Tight hole was encountered at 2600m MD and the tool was unable to pass 2690m MD. Therefore, the RFT was POOH and a wiper trip was run. While reaming at 2600-2693m MD a large amount of claystone cuttings were observed over the shakers. At this time, it was believed that the Lakes Entrance formation, which had been open for about 18 days, was beginning to collapse. Because the hole was also packing off, the mud weight was increased in stages to 11.0 ppg. Drag of up to 100 kips was encountered while reaming; however, after the mud weight increase, a maximum drag of only 30 kips was recorded while POOH from 2802m MD to change the bit.

After RIH with a new bit, reaming in singles began from 2794m MD to 3139m MD. A trip gas of 47 units, containing 0.5% CO₂, was recorded from bottoms up, with a corresponding decrease in mud properties. While attempting to RIH with a stand after reaming to 3139m MD, the pipe became stuck with the bit at 3163m MD. Full circulation was maintained; however, the drilling jars in the string were not firing. Because of the ±1300 psi differential between the mud weight and the formation pressure, it was believed that the string was differentially stuck across the Top of Latrobe sandstone (topped @2900m MD). A diesel/EZ spot pill was then spotted to attempt to free the string. This was not successful; therefore, a free point was run indicating the string was stuck below 2881m MD.

A string shot was then run to 2881m MD and the pipe was backed off and POOH, leaving the bit, BHA, and 29 joints of HWDP in the hole. A fishing assembly was then RIH. The fish was engaged at 2878m MD and jarred on without success, while maintaining full circulation. A free point was then rerun, indicating that the string was stuck below 2895m MD. At this time, in an attempt to free a shorter section of the drillstring, a Pengo explosive cutter was run inside the string and the HWDP was severed at 2955m MD. Attempts to free this section of the string by jarring and spotting diesel were also unsuccessful; therefore, it was decided to plugback and sidetrack around the fish.

A 50 sx cement plug (P & A Plug No. 1) was then spotted across the severed HWDP to cement the fish in the hole and a string shot was run to attempt to backoff at 2879m MD. However, due to mud entry into the firing head, the shot did not fire (see EFR No. 12). A second string shot was run; however, because the cement plug was beginning to set up, the shot could not get below 2870m MD. Therefore, the shot was fired and the pipe was backed off and POOH, leaving the bit, BHA and 30 joints of HWDP in the hole. Open ended drillpipe was then RIH to the top of the fish at 2870m MD and a 100m balanced cement plug (P & A Plug No. 2) was set to seal off the Top of Latrobe using 650 sx of Class "G" cement with 0.4% HR6L retarder mixed in freshwater. After laying down excess drillpipe, the plug was tagged at 2777m MD. The pipe was then POOH to 2550m MD and a 125m balanced cement plug (Sidetrack Plug No.1) was set using 450 sx of Class "G" neat cement mixed in freshwater.

After laying down excess drillpipe, a HP11J bit was RIH on the Nortrak assembly with the Teleco MWD tool. The TOC was tagged at 2441m MD (Hole Angle = 16°) and the plug was dressed to 2448m MD. The Nortrak was oriented and the sidetrack portion of the hole was begun. Due to low ROP (2.3 mph average), the bit was POOH at 2462m MD and the Nortrak dump valve was found to be malfunctioning. A new Nortrak and HP11J bit were then picked up and RIH to continue the sidetrack. As drilling began, the mud was diluted with seawater to reduce the mud weight to ± 9.9 ppg and cut the MBT to 13 ppb. Then, at about 2525m MD, when ROP, surveys and cuttings indicated 100% formation was being drilled, the old mud was diluted with 20% KCL mud in a 1:1 ratio to form a 10.0 ppg, $\pm 10\%$ KCL mud system. This mud system was designed to maintain acceptable properties while in the presence of contaminants (eg: CO₂) in the Top of Latrobe while inhibiting dispersion of the Lakes Entrance clays. After drilling to 2599m MD, at an average ROP of 5.0 mph, the HP11J was POOH on hours (27.25). Hole angle at the end of this run was 24.5°.

Two runs with S11J bits were then required to sidetrack the 12¹/₄" hole to 2909m MD, where the bit was POOH to cut a planned core in the lower half of the Top of Latrobe reservoir. Average ROP for these two runs was 8.2 mph and a significant improvement in cuttings appearance was noted, coupled with less tendency for mud weight increases and less caustic consumption, indicating that the clays were being inhibited by the KCL. The Top of Latrobe was intersected at 2888m MD (2824m TVD) in the sidetrack hole or about 2m higher in TVD than in the original hole. At the Top of Latrobe, the wellbores were separated by ± 40 m. Maximum gas recorded in this interval was 145 units at 2898m MD and the hole angle at the end of this run had built to 42.6°.

A 12¹/₄" core bit and core barrel, with a 12" near bit stabilizer and 9⁷/₈" upper stabilizers, were then picked up. The assembly was RIH and Core No. 2 was cut from 2909m MD to 2927m MD at an average ROP of 1.4 mph. Core recovery was 86% and the core bit was graded as 10% worn.

A rotary hole/drop BHA was then built, with a 12³/₁₆" stabilizer located 8.89m above the bit, and a HP51A bit was RIH. After drilling to 3047m MD, at an average ROP of 5.6 mph, the bit run was terminated to log and set 9⁵/₈" casing. The hole/casing setting depth was designed to allow the Top of Latrobe reservoir to be cased off for production testing, while allowing for provision for 50m of liner lap if required to production test the lower objective. The hole angle at the end of this bit run had decreased slightly to 41.6°, indicating a drop rate of 0.31°/30m for the BHA.

Schlumberger was rigged up and electric logs were run as follows:

- Run No. 1 - DLL/MSFL/LDL/CNL/SP/GR/CAL (2 runs required)
- Run No. 2 - RFT/GR (3 samples attempted / 3 seal failures)
- Run No. 3 - SHDT/GR
- Run No. 4 - SAT (Shot 7 levels, caliper malfunction)
- Run No. 5 - WST (Shot 14 levels)
- Run No. 6 - CST/GR (30 Shot, 25 Recovered, 5 Lost in Hole)

While logging, 6.75 hours of NPT were required to fix a hydraulic leak in the Schlumberger unit (see EFR No. 13). Additionally, 15.75 hours of NPT were spent unsuccessfully attempting to take RFT samples due to packer failures across tight formations and 6.25 hours were lost due to a malfunction of the SAT tool. The caliper log also showed some improvement in hole condition over the original hole. The Top of Latrobe appeared in gauge or slightly undergauge in both holes; however, the maximum washout in the Lakes Entrance in the sidetrack hole was about 15" compared to +22" in the original hole.

After logging, a bit and junk sub were RIH and 3m of new hole was drilled to 3050m MD while milling up sidewall core bullets. While circulating and conditioning the mud, the hole packed off and the string was hydraulically pumped out of hole until the mud pump pop off valve activated at 3400 psi. After regaining circulation, with the bit at 3034m MD, it was discovered that the string was stuck. It was believed that a segment of Lakes Entrance shale, which had been open for about 8 days in the sidetrack hole, had collapsed and packed off around the drillstring and that the string became differentially stuck due to an effective differential pressure against the formation of over 4000 psi prior to the pop off activating. The string could not be freed by jarring/spotting Pipelax; therefore, a string shot was run and the pipe was backed off at 3019m MD and POOH, leaving the bit, junk sub, near bit stabilizer, 1 x 8" DC and a string stabilizer in the hole. Two runs with the string shot were required to backoff as the first shot became stuck in the drillpipe float valve while attempting to correlate. Because the top of the fish was sufficiently deep enough, it was decided to set 9⁵/₈" casing shallower than planned and to sidetrack around the fish below the casing shoe. This meant that if it were necessary to set a liner, the liner lap would need to cover the Top of Latrobe reservoir, requiring perforations to be made through two strings of pipe for production testing.

The wearbushing was pulled and 211 joints of 9⁵/₈", 47 ppf, N-80, BTC casing, plus the casing hanger pup joint were run and landed with the shoe at 2952m MD. Due to weight limitations and concern over potential drag in the directional hole, an additional 37 joints of casing were used as a landing string. The casing was cemented in place with 800 sx of Class "G" cement with 1.19% HR6L retarder mixed with freshwater. The estimated TOC was calculated to be at 2450m MD based on the caliper log. The top plug was bumped and the pressure was increased to 1500 psi to test the casing. The landing string was then laid down and the 9⁵/₈" seal assembly was set and tested, along with the BOP stack, to 200/3500 psi. A Phase I PIT was run against the shear rams to 3500 psi and the choke manifold was tested to 200/5000 psi.

d) 8 1/2" Hole

A S13G bit and slick BHA were then RIH to the TOC at 2923m MD. After drilling cement and the float shoe, the rathole was cleaned out to 2965m MD and the mud weight was reduced to 9.5 ppg while the KCL concentration was reduced to 7%. A Phase II PIT was then conducted to leakoff at 13.3 ppg EMW. The remainder of the rathole was cleaned out to the top of the fish and the bit was POOH.

Open ended drillpipe was then RIH to the top of the fish at 3019m MD and a densified (16.5 ppg), balanced cement plug (Sidetrack Plug No. 2) was set using 180 sx of Class "G" cement with 5.9% CFR2L friction reducer mixed with freshwater.

After laying down 8" drill collars, a S11J bit was RIH on a 6³/₄" Nortrak assembly with the Teleco MWD tool. The TOC was tagged at 2915m MD and the plug was dressed to the 9⁵/₈" casing shoe at 2952m MD. The Nortrak was oriented and the sidetrack was begun. After drilling to 3035m MD, at an average ROP of 10.4 mph, the bit was POOH due to an increase in torque and graded 6-8-1/8" after only 8 hours. While kicking off, the maximum deviation (43.5°) measured in the well was recorded at 2967m MD. At the top of the fish, the wellbores were separated by ± 6m.

An Eastman Christensen R437 PDC bit was then made up on the Nortrak assembly and RIH. After drilling through sandstone with siltstone interbeds down to 3212m MD, at an average ROP of 5.6 mph, the bit was POOH due to a decrease in ROP to less than 0.5 mph. From logs in the original hole, a sandstone with hard dolomitic cement was interpreted at this depth and high torque generated while drilling this formation periodically stalled the Nortrak motor. Rotation was alternated with oriented drilling as required and the hole angle dropped to 38.4° by the end of the run. The hard cement also destroyed the bit, with the bit graded as 100% worn and 1/4" undergauge after 31.50 hours.

The Nortrak was laid down and a full gauge rotary BHA was picked up and RIH with a HP51A bit. While RIH, the bit became briefly stuck at 2970m MD and was jarred free.

A total of 29.75 hours were then spent reaming in singles with the full gauge assembly from 2952m MD to 3212m MD. New hole was drilled to 3214m MD, then the bit was POOH and replaced with a new HP51A. Normal drag was experienced while tripping and drilling proceeded to 3319m MD, at an average ROP of 5.4 mph, where another trip was made. While drilling this section, the MWD tool experienced intermittent failures.

After changing out the MWD tool, a R437 PDC bit was run on the rotary assembly. The bit had an excellent run, drilling from 3319m MD to 3702m MD in 68 hours at an average ROP of 5.6 mph. Lithology in this section was predominantly sandstone with interbedded siltstones and some coal. Samples were circulated up and small shows were noted on two occasions. Maximum gas recorded was 61 units from a coal at 3534m MD. Drag of 30-40 kips was encountered while POOH and the bit was graded as 95% worn and 1/16" undergauge.

During this bit run, after reaching a depth of 3390m MD (3210m TVD), NPT associated with the sidetracking operations ended. In total 24.65 days were spent sidetracking, with 21.25 days attributed to Sidetrack No. 1 and 3.40 additional days required for Sidetrack No.2.

Three bit runs (2 x HP51A's, 1 x HP53A) were then required to drill to 3904m MD (3625m TVD), at an average ROP of 2.9 mph, where it was decided to TD the well approximately 146m TVD short of the programmed total depth (3771m TVD). While drilling this section, dolomitic cement in the sandstones made drilling slow and produced high torque which occasionally stalled the rotary. Hole angle also decreased over the 8 1/2" hole interval, dropping to 35.8° and KCL concentration was gradually allowed to drop back to about 4%.

Schlumberger was rigged up and electric logs were run as follows:

- Run No. 1 - DLL/MSFL/LDL/CNL/SP/GR/CAL (2 runs required)
- Run No. 2 - BHC/GR/CAL
- Run No. 3 - SHDT/GR
- Run No. 4 - CCL/GR (For production test correlation, tool malfunction)
- Run No. 5 - WST (Shot 8 levels with boomer deployed by boat over sonde)
- Run No. 6 - RFT/GR (17 successful pressure pretests in 2 runs, 8 samples attempted / 4 seal failures)

While RIH for Log No. 1, the sonde became stuck over the interval 3762.5-3791m MD. After unsuccessful attempts to free the tool, the wireline was cut and the fish was retrieved by stripping over the line. A wiper trip was then run and the mud weight was reduced from 9.4 ppg to 9.2 ppg since it was believed that the tool had been differentially stuck. Total NPT attributed to this incident was 48.75 hours. Additionally, 18.50 hours of NPT were spent unsuccessfully attempting to take RFT samples due to packer failures across tight formations, 4.75 hours of NPT resulted from a failure of a HP pressure gauge and 1.75 hours were lost due to a malfunction of the CCL tool.

Based on encouraging indications on the logs, it was decided to drill ahead. Therefore, a HP53A bit was picked up and RIH on a rotary BHA. However, because the MWD tool had been sent in to shore when it was believed that the well had reached TD, it was not available for inclusion in the string. After drilling to 3989m MD, at an average ROP of 2.7 mph, the bit run was terminated due to an increase in torque. The bit was POOH and found to be 1/4" undergauge after being run for 31.50 hours.

In an attempt to obtain longer bit life and to reduce torque associated with bits wearing on the gauge, 2 x Smith F27DL bits, with diamond enhanced gauge protection, were obtained and used for the next two bit runs. The first F27DL drilled to 4106m MD at a ROP just slightly better than the previous HP53A (3.0 vs 2.7 mph). Prior to this run, the MWD tool was returned to the rig and was included in the string. This bit was pulled as a precaution after 39 hours and was graded 3-3-I. The second F27DL drilled to 4289m MD at an overall average ROP of 3.7 mph. However, after a porosity reversal at about 4150m MD, the average ROP increased from about 2.5 mph to 5.5 mph. This bit was pulled after 49.75 hours and was graded 4-4-I. Because the diamond enhanced gauge protection prevented gauge erosion, torque was less than on previous runs since the near bit stabilizer was not drilling/opening hole. On the second F27DL run, samples were circulated up from drilling breaks on three occasions; however, no shows were observed. Maximum gas recorded in this hole section was 43 units from 4124m MD.

As no more F27DL's were available, a HP53A was picked up and used to drill to the final TD of the well at 4401m MD (4043m TVD), at an average ROP of 7.0 mph. At this depth, torque increased dramatically and it was not possible to rotate the string after a connection. A possible explanation of the torque increase could result from the "S" shape of the well, as the hole angle had steadily dropped from a maximum of 43.5° at 2967m MD to 28.7° at TD. After circulating and conditioning the mud, the bit was POOH to run logs. Overpull of up to 190 kips was recorded while POOH and the bit was found to be 1/16" undergauge after being run for 16 hours.

Schlumberger was rigged up and electric logs were run as follows:

- Run No. 1 - DLL/MSFL/LDL/CNL/SP/GR/CAL
- Run No. 2 - BHC/GR/CAL
- Run No. 3 - RFT/GR (11 pressure pretests, 1 sample taken, 1 sample aborted, 1 tool malfunction)
- Run No. 4 - SHDT/GR
- Run No. 5 - CST/GR (90 Shot, 66 Recovered, 18 Lost in Hole)

3. PRODUCTION TESTING

a) Open Hole Plugback

After completing final logs, a 7 stand 3 1/2" tubing stinger was picked up and RIH on drillpipe to 4205m MD. A 145m balanced cement plug (P & A Plug No. 3) was then set from 4205m MD to 4060m MD, to seal off a hydrocarbon zone, using 163 sx of Class "G" cement with 1.0% HR6L retarder mixed in freshwater. The stinger was pulled up to 3850m MD and a 100m balanced cement plug (P & A Plug No. 4) was set from 3850m MD to 3750m MD, to seal off a hydrocarbon zone, using 112sx of Class "G" cement with 0.6% HR6L retarder mixed in freshwater. The stinger was then pulled up to 3580m MD and a 160m balanced cement plug (P & A Plug No. 5) was set to seal off a hydrocarbon zone, using 185 sx of Class "G" cement with 0.5% HR6L retarder mixed in freshwater. After laying down drillpipe, the plug was tagged at 3427m MD with 15 kips and the stinger/drillpipe string was POOH.

Schlumberger was rigged up and a gauge ring/junk basket was run to 2945m MD. An EZSV cement retainer (P & A Plug No. 6) was then set at 2940m MD and a star stinger was RIH on drillpipe. After establishing an injection rate (2 bpm @ 2000 psi), 85 sx of Class "G" cement with 0.36% HR6L retarder mixed in freshwater (P & A Plug No.7) was squeezed below the EZSV (final rate = 2 bpm @ 1800 psi). The stinger was pulled out of the EZSV and the retainer was tested to 3500 psi.

b) Production Test No 1.

Operations for Production Test No. 1 began at 2200 hours July 2, 1989 after testing the EZSV. The BOP stack was then tested and a 90 bbl balanced 6% KCL (8.8 ppg) brine pill was spotted, as a perforating fluid, from 2940m MD to 2570m MD. The tubing stinger was then POOH and the Otis Subsea Test Tree (SSTT) and Subsea Lubricator Valve (SSLV) were brought up to the rig floor for necessary pretest preparations to be made.

After completing pretest preparations (preassemblies, pressure testing, etc.), Schlumberger was rigged up and a 9⁵/₈" Size 194-32, Baker Model "D" packer was set at 2873m MD. A lower test string assembly, consisting of a Baker Model G-22 locator seal assembly, bundle carrier, and Schlumberger "MUST" downhole shut-in valve, was then made up and RIH on 3¹/₂" 12.95 ppf, L-80, PH-6 tubing. Two GRC 700 electronic pressure gauges and one Amerada gauge were installed in the bundle carrier prior to running. The seal assembly was stabbed into the packer, the annulus was tested to 200/1500 psi, then the tubing was tested to 200/3500 psi.

After obtaining space out measurements, 15 stands of tubing were then POOH and the SSTT and SSLV were RIH on tubing with necessary pup joints to provide the required space out. The Otis Surface Test Tree (STT) was picked up and the fluted hanger was landed on the wearbushing.

After pressure testing the surface and downhole equipment, the tubing was displaced with 69 bbls of diesel to provide a \pm 650 psi underbalance for perforating. The seal assembly was then stung back into the packer and, after retesting the annulus to 200/1500 psi, the pressure was bled back to \pm 300 psi and monitored throughout the test.

Schlumberger was rigged up and the lubricator was tested to 200/3500 psi. A 17m long 2¹/₈" 0° phasing, 6 spf, Enerjet perforating gun was then picked up and stabbed into the lubricator. However, due to vessel motion (1.1m heave, 2° roll) and weather (35 kt winds), the monocable was kinked while attempting to reconnect the lubricator.

Therefore, due to problems associated with the long 17m gun, an 8.5m gun was made up and RIH after the monocable was reterminated. As two runs would now be required to perforate the Test No.1 zone, the gun was placed across the upper part of the zone (2891-2899.5m MD) and fired at 1000 hours July 5, 1989 with the well open on a 1/4" choke. No pressure build up occurred during a 10 minute shut-in; therefore, it was believed that the gun up did not fire. Some drag was encountered when pulling the gun up through the mule shoe and the gun became stuck inside the lower test string at 2858.4 - 2871.9m MD. The gun was apparently stuck across the "MUST" valve and/on the bundle carrier, which both had ID's of 2.25". Attempts to work the gun free were unsuccessful; therefore, the monocable was pulled out of the weak point. Schlumberger was rigged down and Otis was rigged up. A blind box was then run and the fish was tagged. After hitting down five times, the fish fell free. The blind box was RIH to 2930m MD to ensure there were no further obstructions, then the tool was POOH and Otis was rigged down.

Schlumberger was rigged back up and another 8.5m long perforating gun was RIH. At this time, it was unknown if the first gun had fired on if the formation was tight; therefore, the second gun was placed across the lower part of the zone (2899.5-2908m MD) and fired at 0203 hours July 6, 1989. To reduce the possibility of flowing any debris up across the "MUST"/bundle carrier, the well was perforated against a closed choke and monitored for 10 minutes. The surface pressure built up to about 500 psi during this period, then the gun was pulled up to 2800m MD to place it above the "MUST"/bundle carrier prior to conducting a 5 minute clean up flow period (flowrate = \pm 300 bpd). The well was then shut back in while POOH with the perforating gun.

After retrieving the spent perforating gun, on which all the shots had fired, a 65 minute initial flow period was conducted. The well was then shut in for the initial build up period. During this time, the "MUST" actuator/HP gauge assembly was rigged up and RIH on monocable. The actuator was latched into the "MUST" valve assembly and the HP gauge was allowed to temperature stabilize. After a total shut in period of about 4 hours, the well was opened for the major flow period at 0942 hours July 6, 1989. Prior to surfacing formation fluids, methanol injection was begun into the SSTT to inhibit hydrate formation. During this flow period, the well produced at a final rate of 841 STB/D of 52° API oil and 1.3 MSCF/D of gas, with a GOR of 1600 SCF/STB.

The "MUST" actuator was then cycled 11 times to attempt to close the flapper valve and initiate the downhole shut in. However, the tool could not be closed and the well was shut in at the choke manifold at 2303 hours July 6, 1989, after a major flow period of 13.35 hours. During the shut in period, the marine riser was circulated with mud which was heated by the production testing heater in an attempt to inhibit hydrate formation. The heater was able to raise the mud temperature by 7.3°C, from 8.3°C to 15.6°C. By 1620 hours July 7, 1989, after a major build up period of 17.28 hours, sufficient data was obtained to terminate the test. The "MUST" actuator was then cycled 17 times at a line pull of \pm 2500 lbs to attempt to disengage from the valve assembly. This proved unsuccessful; therefore, the monocable was pulled out of the weak point with \pm 3200 lbs pull and the cable was POOH.

Because the "MUST" actuator could not be pulled with the monocable, a tubing trip would be required to retrieve the actuator and allow additional perforations to be added for Test No. 1A. Therefore, the seal assembly was unstung from the packer and an attempt was made to kill the well by reverse circulating. This proved unsuccessful, however, as the tubing appeared plugged by either the "MUST" valve or by a hydrate/wax plug. To determine the location of the plug the tubing contents were flared while observing the annulus for pressure communication. After flaring for one hour, it was believed that the blockage was downhole and not near the seafloor as would be expected for a hydrate/wax plug. Therefore, it was believed that the "MUST" valve was the cause of the problem. Halliburton was then rigged up and 47 bbls of freshwater were pumped down the tubing before a pressure response was noted. An additional 3 bbl were then pumped to establish pressure communication with the annulus, indicating that the "MUST" flapper valve was being pumped open from above. As tubing pressure was bled off, the annulus pressure also decreased. This led to the belief that the flapper valve may have been pumped closed when trying to reverse, but was now free. Therefore, a second attempt was made to reverse circulate. This again proved unsuccessful as the flapper appeared to close; therefore, the seal assembly was stung back into the packer and the remaining formation fluid in the tubing plus the freshwater were bullheaded into the formation with 9.2 ppg mud. An initial pressure of 3500 psi was required to pump into the formation, with a final injection rate of 2 bpm @ 2175 psi.

After unstinging from the packer and confirming that the well was dead, three conventional circulations were made coming up through the choke to reduce the gas units from offscale ($\pm 10,000$ units) to about 150 units. The annular cavity was then flushed (3000 units maximum gas), the annular was opened and the riser was circulated (1000 units maximum gas). The tubing string was then POOH to the SSTT, which was unlatched for servicing in the rotary table. Problems relatching the head due to a frozen latching mechanism then resulted in 2.75 hours of NPT (see EFR No. 16) before the head could be relatched and the remaining tubing string POOH. The seal assembly was then laid down and redressed, the "MUST" valve assembly and actuator were laid down and the pressure gauges in the bundle carrier were retrieved.

At this time, it was discovered that the equilization shaft of the "MUST" actuator was bent (see EFR No. 17) and that one of the GRC pressure gauges did not record any data, while the other GRC stopped working while POOH. From the GRC/Amerada pressure data, it also appeared that the first perforating gun did not fire.

c) Production Test No. 1A

Operations for Production Test No. 1A began at 0215 hours July 9, 1989 after POOH with the tubing string. The seal assembly was redressed and a new "MUST" valve was made up. Two GRC gauges and two Ameradas were installed in the bundle carrier and the assembly was RIH. The GRC's which had failed previously were rerun because no backups were available. The SSTT, which had been redressed, was then picked up and the latch mechanism was functioned. The SSTT was RIH, along with the SSLV, and the STT was picked up.

After stinging into the packer and landing the fluted hanger on the wearbushing, the surface equipment was pressure tested. The tubing was then picked up and displaced with 69 bbls of diesel. The seal assembly was stung back into the packer and, after retesting the annulus, the pressure was bled back to ± 300 psi and monitored throughout the test. Schlumberger was then rigged up and the lubricator was tested, thus ending the NPT associated with the tubing trip. In total, 52.50 hours of NPT resulted from this trip caused by the "MUST" tool failure.

An 8m long Enerjet perforating gun was then RIH to perforate the Test No. 1A zone at 2910-2918m MD. However, while attempting to place the gun across the zone, the previously unfired gun from Test No. 1 was tagged at 2917m MD. To avoid the possibility of sticking the new gun, the perforation interval was revised slightly to 2908.8-2916.8m MD and the gun was fired at 2338 hours July 9, 1989 against a closed choke. The surface pressure built up to about 570 psi over a 10 minute period, then the gun was pulled up to 2800m MD and a 5 minute clean up flow period was conducted (flowrate = ± 685 bpd). The well was then shut back in while POOH with the perforating gun.

After retrieving the spent perforating gun, on which all the shots had fired, an 8.5m gun was made up to attempt to perforate the upper part of the Test No. 1 zone (2891-2899.5m MD). However, while RIH, the gun became stuck inside the lower test string (across the "MUST" valve and/or bundle carrier) at 2856.8-2870.5m MD. Attempts to work the gun free while pulling tension and flowing the well were unsuccessful; therefore, the monocable was pulled out of the weak point. Schlumberger was rigged down and Otis was rigged up to attempt to fish the gun. However, due to inclement weather, Otis was rigged down prior to RIH and preparations were made to kill the well.

The seal assembly was unstung from the packer and 4-1/4 hours were spent reverse circulating the tubing to reduce the gas units from offscale to 200 units. While reversing, the stuck perforating gun apparently was freed and circulated to surface, as rattling could be heard in the tubing above the rotary. While rigging up Schlumberger's tool catcher above the SSTT to attempt to retrieve the gun, however, increasing weather (50-55 kt winds, 5m swells @ 180°) required the seal assembly to be stung back into the packer, the upper pipe rams to be closed and the SSTT to be unlatched at 2030 hours July 10, 1989 as the lower ball joint angle reached 3.5°. (NOTE: Because of the space out of the SSTT in the BOP stack, the shear rams could not be closed above the unlatch point.) While observing the lower ball joint angle, displacement of the riser to seawater was begun. However, after displacing only 94 bbls, the ball joint angle reached 5.5° and the LMRP was unlatched at 2100 hours. Due to anchor tensions on Nos. 3 and 4 of ±170 kips, these lines were slacked off and the rig was moved about 20m north of the location after slacking off the guidelines. Operations were then suspended for 28.75 hours while observing weather conditions. During this time, guideline No. 1 parted.

By 0200 hours July 12, 1989, the weather had abated sufficiently (30-35 kt winds) to allow the upper test string to be POOH. The perforating gun which had been circulated to the surface was found trapped across the SSLV and was successfully recovered and the SSLV and SSTT were redressed and tested. An electrical problem with the RCV, which had been reinstalled on the rig, then resulted in 6.50 hours of NPT (see EFR No.18). A total of 7.50 hours were then spent untangling guideline Nos.3 and 4 and a visual inspection of the LMRP and BOP stack were performed with the RCV.

After moving the rig back over the wellhead, the LMRP was relatched and the choke and kill lines were tested to 200/3500 psi. At this time, an annular pressure of 900 psi was observed below the closed pipe rams. A modified 9⁵/₈" centralizer was then attached to the SSTT and the upper test string was RIH. Prior to attempting to relatch, however, the No. 5 MRT line parted, requiring 2.75 hours to repair. A further 2.75 hours and about 7 attempts were then required before the SSTT could be relatched. After latching the SSTT, the riser was filled with mud, the surface equipment was tested and the annulus pressure was bled to zero by bleeding off 1¹/₂ bbls through the choke. The choke and kill lines were then displaced with mud and the BOP stack was swept with mud below the closed rams (300 units maximum gas). The annulus was tested and the SSTT was opened. Otis was rigged up, an "N" test plug was run and landed in the "RN" ripple and the tubing was tested to 200/3500 psi. Otis was rigged down and 15 bbls of fluid was reversed out of the tubing to ensure that no seawater was in the string. The tubing was then displaced with 69 bbls of diesel and the seal assembly was stung back into the packer, thus ending the NPT associated with the unlatch operation. In total, 87.50 hours (3.65 days) of NPT resulted from this weather related incident.

Because the Reservoir Department still desired perforations across the upper part of the Test No.1 zone, Schlumberger was rigged up and the lubricator was tested. However, in order to eliminate the previous problem with a 2¹/₈" gun hanging up in the 2¹/₄" ID "MUST"/bundle carrier, a 6m long 1¹¹/₁₆", 0° phasing, 4 spf Enerjet perforating gun was made up. The gun was RIH and the interval 2891-2897m MD was perforated, with the well open on a 1/4" choke to introduce a differential into the wellbore, at 1103 hours July 14, 1989. After a 10 minute shut in period, the surface pressure built up to about 560 psi. The gun was then pulled up to 2800m MD and a 5 minute clean up flow period was conducted (flowrate = ± 150 bpd). The well was then shut in while the perforating gun was POOH.

After retrieving the spent perforating gun, on which all the shots had fired, a 67 minute flow period was conducted to clean the well up prior to running the "MUST" actuator/HP gauge assembly. The well was shut in for 2.75 hours while rigging up and RIH with the "MUST" assembly, then the well was opened for the major flow period at 1730 hours July 14, 1989. Prior to surfacing formation fluid, glycol injection was begun into the SSTT to inhibit hydrate formation. During this 13.82 hour flow period, the well produced at a final rate of 1509 STB/D of 52.4° API oil and 1.9 MSCF/D of gas, with a GOR of 1257 SCF/STB.

The "MUST" actuator was then cycled to attempt to close the flapper valve and initiate the downhole shut in. Although the tool appeared to close, a pressure build up was noted at the choke manifold, which had been closed just after closing the "MUST". Therefore, in order to eliminate any interference in the build up data which could be caused by a leak through the "MUST" valve, the "MUST" was opened and a surface shut in was initiated. During this period, the marine riser was circulated with heated mud as done for Test No.1. By 0200 hours July 16, 1989, after a major build up period of 16.68 hours, sufficient data was obtained to terminate the test. The "MUST" actuator was then cycled 23 times at a line pull of 1500 lbs, 20 times at 2500 lbs and finally, twice at 3000 lbs prior to coming free. The assembly was then POOH, making three gradient stops, and laid down.

The well was then killed by bullheading the tubing fluid into the formation with 10 lbs of freshwater followed by 90 bbls of 9.2 ppg mud. An initial pressure of 3350 psi was required to pump into the formation, with a final injection rate of 3 bpm @ 2200 psi. After unstinging from the packer and confirming that the well was dead, two reverse circulations were made, followed by one conventional circulation. Maximum gas was 2000 units on bottoms up and was circulated down to 20 units. The bottoms up mud also appeared black; however, the mud did not show any deterioration in primary mud properties other than a pH reduction to 7.5. No oil or soluble sulphides were measured in the mud. The tubing string was then POOH and laid down. At this time, it was discovered that the "MUST" valve was packed with mud solids (see EFR No. 19) and that one GRC gauge worked for the entire test, while the other GRC worked intermittently. Also, both Ameradas failed, one due to a clock problem and one due to a hole in the bellows.

d) Test Zone Abandonment

After laying down the test string, a 6 stand 3¹/₂" tubing stinger was RIH on drillpipe to the top of the Model "D" packer at 2873m MD. The mud was circulated bottoms up and a 115m balanced cement plug (P & A Plug No.8) was set above the packer, using 185 sx of Class "G" cement with 5.25% Halad 322L water loss additive mixed in freshwater. The stinger was pulled above the plug and 11¹/₄ bbls of slurry were squeezed into the perforations at a final squeeze pressure of 3500 psi. A total of 3¹/₂ bbls were then bled back, resulting in an estimated TOC at 2800m MD. The pipe was then reversed out and the string was POOH.

Schlumberger was rigged up and a 9⁵/₈" EZSV bridge plug (P & A Plug No.9) was set at 2771m MD. The plug was then tested to 3500 psi, thus ending production testing operations at 2230 hours July 17, 1989. In total, 14.63 days were required to conduct the two tests. Non productive time during testing was 7.43 days or 50.8 %, mainly resulting from the "MUST" tool failure and weather.

D) PLUG AND ABANDONMENT

After testing the EZSV, a Pengo cutter was RIH and an attempt was made to cut the 9⁵/₈" casing at 700m. However, after retrieving the wearbushing and RIH with a spear, the casing could not be pulled free with 250 kips overpull. Therefore, a second Pengo cutter was RIH and fired at 697m. A spear was run and the casing was pulled free with 30 kips overpull. A total of 21 joints plus a stub of 9⁵/₈" casing were then pulled and laid down.

Open ended drillpipe was then RIH and a 100m balanced cement plug (P & A Plug No.10) was set across the 9⁵/₈" stub, from 750m to 650m, using 235sx of Class "G" neat cement mixed in seawater. The drillpipe was pulled above the plug and 10 bbls of slurry were squeezed away at a rate of 3 bpm @ 350 psi. A total of 3¹/₂ bbls were then bled back, resulting in an estimated TOC at 638m. The drillpipe was then POOH and the plug was pressure tested to 1500 psi.

Schlumberger was rigged up and a 13³/₈" EZSV bridge plug (P & A Plug No.11) was set at 628m. A Pengo cutter was then run and the casing was cut at 530m. A spear was run and the casing was pulled free with 20 kips overpull. A total of 8 joints plus a stub of 13³/₈" casing were then pulled and laid down.

Open ended drillpipe was then RIH and a 100m balanced cement plug (P & A Plug No. 12) was set across the 13³/₈" stub, from 570m to 470m, using 440 sx of Class "G" neat cement mixed with seawater. The pipe was pulled up to 470m and the hole was circulated clean with seawater. Excess drillpipe was then laid down and the plug was pressure tested to 500 psi.

After pinning the inner barrel of the slip joint closed, the diverter was rigged down and a joint of riser was picked up to pull the BOP stack. The wellhead connector was unlatched and the BOP and riser were pulled and secured in 22.25 hours.

A 3.9 kg shaped explosive charge was then RIH to 450m and the 20" casing was explosively cut ± 1m below the pile joint assembly "CC" connector. The pile joint, PGB and TGB were then pulled free with 150 kips overpull and laid out.

E) PULLING ANCHORS

After the rig was deballasted from drilling draft (48 ft) to transit draft (21 ft), the MV's Torungen Supplier, Lady Penelope and Senorita retrieved the eight anchors in 38.75 hours. Included in this time was 1.50 hours of NPT lost when a 500 ft pendant line broke when attempting to recover anchor No.4 and 7.75 hours of NPT spent stripping over and recovering anchor No.2, which had been deployed without a buoy. While recovering the anchors, the pendants were removed, except for Nos.2 and 4, and replaced with 250 ft lengths. The extra 450 ft of chain on anchor No.1 was also removed. Under tow by the Lady Penelope, the rig departed for the Sweetlips-1 well location at 0545 hours July 23, 1989.

While deballasting/pulling anchors, a seabed survey of the well location was conducted using the RCV 150 vehicle.

ESSO AUSTRALIA LTD.
BLACKBACK-1 FINAL WELL REPORT
CASING DATA

OD (In.)	WEIGHT (LB/FT)	GRADE	CONNECTION	LENGTH (M)	SHOE DEPTH (mMD-RKB)	CENTRALIZER POSITION	REMARKS
20	94	X-56	JV	14.26	564	NONE	FLOAT SHOE JOINT
20	94	X-56	JV	89.94		NONE	7 INTERMEDIATE JOINTS
20	129	X-52	JV x CC	11.87		NONE	CROSSOVER JOINT
24	670	—	CC	10.88		NONE	PILE JOINT: EP9
				=====			
				126.95			
13-3/8	54.5	K-55	BTC	12.02	1250	1 W/ STOP RING	FLOAT SHOE JOINT
	54.5	K-55	BTC	11.95		1 ACROSS COLLAR	FLOAT JOINT
	54.5	K-55	BTC	11.69		1 W/ STOP RING	FLOAT COLLAR JOINT
	54.5	K-55	BTC	319.61		1 ACROSS FIRST FIVE COLLARS	27 INTERMEDIATE JOINTS
	68	K-55	BTC	450.14		NONE	38 INTERMEDIATE JOINTS
	68	K-55	BTC	5.50		NONE	CASING HANGER PUP JOINT
				=====			
				810.91			-CSG HANGER: EHW 37 -SEAL ASSY: ESW 36

ESSO AUSTRALIA LTD.
 BLACKBACK-1 FINAL WELL REPORT
 CASING DATA

OD (In.)	WEIGHT (LB/FT)	GRADE	CONNECTION	LENGTH (M)	SHOE DEPTH (mMD-RKB)	CENTRALIZER POSITION	REMARKS
9-5/8	47	N-80	BTC	12.57	2952	NONE	FLOAT SHOE JOINT
	47	N-80	BTC	11.94		1 ACROSS COLLAR	FLOAT JOINT
	47	N-80	BTC	12.52		NONE	FLOAT COLLAR JOINT
	47	N-80	BTC	23.98		1 ACROSS COLLARS	2 INTERMEDIATE JOINTS
	47	N-80	BTC	3.14		1 ACROSS COLLAR	PUP JT @ 2888-2891mMD
	47	N-80	BTC	2446.98		1 ACROSS FIRST NINE COLLARS	204 INTERMEDIATE JOINTS
	47	N-80	BTC	3.00		NONE	CASING HANGER PUP JOINT
				=====			-CSG HANGER: EHW 92
				2514.13			-SEAL ASSY: ESW 91

ESSO AUSTRALIA LTD.
BLACKBACK-1 FINAL WELL REPORT
CEMENT DATA

DATE (1989)	TYPE JOB	INTERVAL (mMD-RKB)	TYPE CEMENT	VOLUME (SX)	SLURRY WEIGHT (PPG)	ADDITIVES	MIX WATER	REMARKS
26-Mar	20" PRIMARY LEAD		CLASS "G"	750	13.2	2.2% PHG	FW	CEMENT THROUGH DP STINGER. CMT VOLUME CALCULATED TO PROVIDE 250% EXCESS ABOVE GAUGE HOLE VOLUME WITH TOC @ SEAFLOOR.
		564-439						
26-Mar	20" PRIMARY TAIL		CLASS "G"	750	15.8	---	SW	
31-Mar	13-3/8" PRIMARY	1250-834	CLASS "G"	1000	15.8	---	SW	CMT VOLUME BASED ON 18" AVG. HOLE DIAMETER PER THE CALIPER LOG. BUMPED PLUG W/ 1500 PSI.
11-May	P & A PLUG No.1	2955-2935	CLASS "G"	50	15.8	1.0% HR6L	FW	SPOT PLUG ACROSS SEVERED HWDP TO CEMENT FISH IN HOLE.
12-May	P & A PLUG No.2	2870-2777	CLASS "G"	650	15.8	0.4% HR6L	FW	SET PLUG ABOVE TOP OF FISH @ 2870mMD TO SEAL TOP OF LATROBE @ 2900mMD, TAGGED WITH 20 KIPS.
12-May	SIDETRACK PLUG No.1	2550-2441	CLASS "G"	450	15.8	---	FW	SET SIDETRACK PLUG, TAGGED W/ 20 KIPS @ 2441mMD, DRESS TO 2448mMD, BEGIN KICKOFF WITH NORTRAK.
27-May	9-5/8" PRIMARY	2952-2540	CLASS "G"	800	15.8	1.19% HR6L	FW	CMT VOLUME BASED ON 13.75" AVG. HOLE DIAMETER PER THE CALIPER LOG. BUMPED PLUG W/ 1500 PSI.
29-May	SIDETRACK PLUG No.2	3019-2915	CLASS "G"	180	16.5	5.9% CFR2L	FW	SET DENSIFIED SIDETRACK PLUG, TAGGED WITH 30 KIPS @ 2915mMD, DRILL CSG SHOE @ 2952mMD, BEGIN KICKOFF WITH NORTRAK.

ESSO AUSTRALIA LTD.
BLACKBACK-1 FINAL WELL REPORT
CEMENT DATA

DATE (1989)	TYPE JOB	INTERVAL (mMD-RKB)	TYPE CEMENT	VOLUME (SX)	SLURRY WEIGHT (PPG)	ADDITIVES	MIX WATER	REMARKS
01-Jul	P & A PLUG No.3	4205-4060	CLASS "G"	163	15.8	1.0% HR6L	FW	SET ACROSS HYDROCARBON INTERVALS IN 8.50" HOLE PRIOR TO PROD TEST.
01-Jul	P & A PLUG No.4	3850-3750	CLASS "G"	112	15.8	0.6% HR6L	FW	SET ACROSS HYDROCARBON INTERVALS IN 8.50" HOLE PRIOR TO PROD TEST.
01-Jul	P & A PLUG No.5	3580-3427	CLASS "G"	185	15.8	0.5% HR6L	FW	SET ACROSS HYDROCARBON INTERVALS IN 8.50" HOLE PRIOR TO PROD TEST. TAGGED WITH 15 KIPS.
02-Jul	P & A PLUG No.7	2940-3002	CLASS "G"	85	15.8	0.36% HR6L	FW	SQUEEZE BELOW 9-5/8" EZSV CEMENT RET. (P&A PLUG No.6) @ 2940mMD.
17-Jul	P & A PLUG No.8	2905-2800	CLASS "G"	185	15.8	5.25% HALAD 322L	FW	SET BALANCED PLUG ABOVE MODEL "D" PKR @ 2873mMD. SQUEEZE 11.25 BBL BELOW PACKER, FINAL SQUEEZE PRES. =3500 PSI, BLED BACK 3.50 BBL.
18-Jul	P & A PLUG No.10	750-638	CLASS "G"	235	15.8	---	SW	SET BALANCED PLUG ACROSS 9-5/8" CASING STUB @ 697m. SQUEEZE 10 BBL, FINAL SQUEEZE PRES. = 350 PSI, BLED BACK 3.50 BBL. TESTED TO 1500 PSI.
19-Jul	P & A PLUG No.12	570-470	CLASS "G"	440	15.8	---	SW	SET ACROSS 13-3/8" CASING STUB @ 530m. TESTED TO 500 PSI.

5. SAMPLES, CONVENTIONAL CORES, SIDEWALL CORES

BLACKBACK-1

INTERVAL (m)

TYPE

BLACKBACK-1

1265.0-3400m

Cutting samples - 4 sets of washed and oven dried and 1 set of bagged air dried cuttings.

Samples from 1265.0-2010.0m at 30m intervals.

Samples from 2010.0-2680.0m at 10m intervals.

Samples from 2680.0-3400.0m at 5m intervals.

1265.0-3400.0m

Unwashed composite tinned samples for geochemistry collected at 30m/15m intervals.

2903.0-2921.0m

Core #1 (Aluminium Sleeved). Recovery of 12.0m and chip sampling at every 1.4m from 2903.0m to 2921.0m.

BLACKBACK-1 ST1

2441.0-3047.0

Cutting samples - 4 sets of washed and oven dried and 1 set of bagged air dried cuttings.

Samples from 2441.0-2800.0m at 10m intervals.

Samples from 2800.0-3047.0m at 5m intervals.

2441.0-3047.0

Unwashed composite tinned samples for geochemistry collected at 30m/15m intervals.

2906.8-2927.0

Core #2 (Aluminium Sleeved). Recovery of 15.9m and chip sampling at every 1.4m from 2906.8m to 2927.0m.

2827.9-2995.1

CST, 30 Shot, Recovered and Brought 25.

BLACKBACK-1 ST2

2952.0-4401.0

Cutting samples - 4 sets of washed and oven dried and 1 set of bagged air dried cuttings.

Samples from 2952.0-4401.0m at 5m intervals.

2952.0-4401.0

Unwashed composite tinned samples for geochemistry collected at 30m/15m intervals.

3008.0-4374.0

CST, 90 Shot, Recovered and Brought 65.

6. WIRELINE LOGS AND SURVEYS
BLACKBACK-1

<u>TYPE AND SCALE</u>		<u>FROM</u>	<u>TO</u>
<u>BLACKBACK-1</u>			
<u>SUITE 1 (TD=1263.5mMD & TVD)</u>			
BHC-CAL-GR-AMS	1:200/1:500	400.0	1265
<u>SUITE 2 (TD=3281mMD, 3117.4mTVD)</u>			
BHC-GR-CAL	1:200/1:500	1250.0	3278.5
LDL-CNL-GR-AMS	1:200/1:500	2850.0	3269.5
DLL-MSFL-GR-SP	1:200/1:500	1250.0	3275.0
RFT-HP-GR	(18 pretest/ no sample runs)	2903.5	3200.4
<u>BLACKBACK-1 ST1</u>			
<u>SUITE 3 (TD=3005.5mMD, 2910.9mTVD)</u>			
LDL-CNL-GR-AMS	1:200/1:500	2800.0	3001.0
DLL-MSFL-GR-SP	1:200/1:500	2800.0	3001.0
SHDT-GR	1:200/1:500	2700.0	3001.0
RFT-HP-GR	(16 pretest/ 5 sample runs)	2895.0	2925.5
WSS	16 levels	1250.0	2980.0
CST-GR (30 Shots)	(Recovered and brought 25)	2827.9	2995.1
<u>BLACKBACK-1 ST2</u>			
<u>SUITE 4 (TD=3901mMD, 3621.8mTVD)</u>			
BHC-GR-CAL	1:200/1:500	2950.0	3898.5
LDL-CNL-GR-AMS	1:200/1:500	2950.0	3891.0
DLL-MSFL-GR-SP	1:200/1:500	2950.0	3896.5
SHDT-GR	1:200/1:500	2950.0	3900.0
RFT-HP-GR	(29 pretest/28 sample runs)	3440.0	3805.5
WSS	10 levels	2875.0	3885.0
<u>SUITE 5 (TD=4399mMD, 4041mTVD)</u>			
BHC-GR-CAL	1:200/1:500	3850.0	4397.0
LDL-CNL-GR-AMS	1:200/1:500	3850.0	4389.0
DLL-MSFL-GR-SP	1:200/1:500	3850.0	4394.5
SHDT-GR	1:200/1:500	3850.0	4398.5
RFT-HP-GR	(11 pretest/1 sample runs)	4020.0	4175.0
CST-GR (90 Shots)	(Recovered and brought 65)	4374.0	3008.0

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME - BLACKBACK-1

BLACKBACK-1 : SUITE 2

<u>TEST & SEAT NO.</u>	<u>DEPTH (METRES) K.B.</u>	<u>CHAMBER</u>	<u>RECOVERY (LITRES)</u>				<u>FORMATION WATER</u>	<u>MUD FILTRATE</u>	<u>HEWLETT-PACKARD FORMATION PRESSURE</u>		<u>HEWLETT-PACKARD HYDROSTATIC PRESSURE</u>		<u>REMARKS</u>
			<u>OIL</u>	<u>COND.</u>	<u>GAS</u>				<u>MPaa</u>	<u>Psia</u>	<u>MPaa</u>	<u>Psia</u>	
		Litres	Litres	Litres	m ³	Litres	Litres						
1/1	2903.5	Pretest						27.68	4015.43	33.51	4860.80	GOOD TEST	
1/2	2910.3	Pretest						27.73	4022.51	33.56	4870.90	TIGHT	
1/3	2914.0	Pretest						27.74	4024.30	33.62	4876.12	GOOD TEST	
1/4	2920.0	Pretest						27.74	4024.64	33.67	4884.50	GOOD TEST	
1/5	2924.4	Pretest						27.77	4027.84	33.72	4890.65	GOOD TEST	
1/6	2927.3	Pretest						27.78	4029.57	33.74	4894.60	GOOD TEST	
1/7	2934.0	Pretest						27.82	4034.83	33.80	4903.50	GOOD TEST	
1/8	2947.0	Pretest						27.92	4049.20	33.93	4921.00	GOOD TEST	
1/9	2958.6	Pretest						28.00	4061.71	34.03	4936.40	GOOD TEST	
1/10	3010.5	Pretest						-	-	-	-	SEAL FAILURE	
1/11	3011.0	Pretest						-	-	34.51	5006.25	SEAL FAILURE	
1/12	3011.5	Pretest						-	-	34.51	5006.78	SEAL FAILURE	
1/13	3010.0	Pretest						-	-	34.50	5004.59	SEAL FAILURE	
1/14	3200.4	Pretest						30.23	4384.51	36.26	5259.50	GOOD TEST	
1/15	3065.4	Pretest						-	-	-	-	STUCK TOOL - ABORT	
1/16	3050.3	Pretest						28.71	4164.54	34.87	5057.90	GOOD TEST	
1/17	3010.4	Pretest						28.40	4118.95	34.50	5004.50	POOR HYDROSTATIC	
1/18	3065.4	Pretest						-	-	-	-	SEAL FAILURE	

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME -BLACKBACK-1

BLACKBACK-1 ST1 :SUITE 3

TEST & SEAT NO.	DEPTH (METRES) K.B.	CHAMBER Litres	OIL Litres	RECOVERY (LITRES)		FORMATION WATER Litres	MUD FILTRATE Litres	HEWLETT-PACKARD FORMATION PRESSURE		HEWLETT-PACKARD HYDROSTATIC PRESSURE		REMARKS
				COND. Litres	GAS m ³			MPaa	Psia	MPaa	Psia	
1/1	2925.5	Pretest						27.80	4032.20	34.38	4987.30	VERY POOR PERMEABILITY
1/2	2922.0	Sample						27.80	4029.80	34.35	4982.50	SEAL FAILURE
1/3	2922.0	Sample						27.80	4029.70	34.35	4982.30	SEAL FAILURE
1/4	2922.0	Pretest						-	-	34.35	4982.40	SEAL FAILURE
1/5	2922.0	Pretest						-	-	34.35	4983.00	SEAL FAILURE
1/6	2911.8	Pretest						-	-	34.26	4970.80	SEAL FAILURE
1/7	2911.8	Pretest						-	-	34.26	4970.60	NO SEAL OBTAINED
1/8	2910.0	Sample						27.73	4022.12	34.23	4966.50	SEAL FAILURE
1/9	2910.0	Pretest						-	-	34.25	4967.50	NO SEAL OBTAINED
1/10	2910.2	Pretest						-	-	34.24	4967.30	NO SEAL OBTAINED
1/11	2925.5	Pretest						-	-	34.38	4987.10	NO SEAL OBTAINED
1/12	1179.0	Pretest						-	-	14.62	2120.50	NO SEAL OBTAINED
2/13	2925.5	Sample						28.44	4125.00	34.39	4989.00	VERY POOR PERMEABILITY
2/14	2925.7	Pretest						27.80	4032.20	34.39	4989.10	VERY POOR PERMEABILITY
2/15	2925.8	Pretest						28.16	4085.00	34.40	4989.30	VERY POOR PERMEABILITY
2/16	2910.0	Pretest						27.80	4031.00	34.26	4969.00	VERY POOR PERMEABILITY
2/17	2910.2	Sample						27.80	4031.20	34.26	4969.30	SEAL FAILURE
2/18	2910.3	Pretest						-	-	34.26	4970.00	NO SEAL OBTAINED
2/19	2894.8	Pretest						26.83	3892.10	34.13	4950.10	NO PERMEABILITY
2/20	2895.0	Pretest						-	-	34.28	4972.10	SEAL FAILURE
2/21	2909.8	Pretest						-	-	34.26	4969.20	SEAL FAILURE
3/22	2910.0	Sample						27.73	4023.30	34.25	4968.50	SEAL FAILURE
3/23	2910.1	Pretest						-	-	34.26	4969.50	PLUGGED
3/24	2909.9	Pretest						-	-	34.25	4968.50	PLUGGED

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME -BLACKBACK-1

BLACKBACK-1 ST2 : SUITE 4

TEST & SEAT NO.	DEPTH (METRES) K.B.	CHAMBER	OIL	RECOVERY (LITRES)		FORMATION WATER	MUD FILTRATE	HEWLETT-PACKARD FORMATION PRESSURE		HEWLETT-PACKARD HYDROSTATIC PRESSURE		REMARKS
				COND.	GAS			MPaa	Psia	MPaa	Psia	
		Litres	Litres	Litres	m ³	Litres	Litres					
1/1	3440.0	Pretest						32.25	4677.62	35.65	5171.00	GOOD TEST
1/2	3450.0	Pretest						32.31	4686.90	35.85	5199.50	GOOD TEST
1/3	3469.5	Pretest						32.49	4712.58	36.02	5225.40	GOOD TEST
1/4	3488.5	Pretest						-	-	36.20	5251.17	TIGHT - ABORT
1/5	3489.0	Pretest						32.68	4740.55	36.19	5249.90	GOOD TEST
1/6	3499.5	Pretest						-	-	36.29	5264.50	TIGHT - ABORT
1/7	3499.7	Pretest						-	-	36.29	5263.80	TIGHT - ABORT
1/8	3509.5	Pretest						32.84	4763.00	36.37	5275.30	GOOD TEST
1/9	3516.0	Pretest						32.90	4771.90	36.43	5284.20	GOOD TEST
1/10	3527.0	Pretest						-	-	36.52	5296.90	SEAL FAILURE
1/11	3528.2	Pretest						33.01	4788.60	36.53	5298.50	SL. SUPERCHARGED
1/12	3530.5	Pretest						33.00	4786.80	36.54	5299.95	VERY GOOD TEST
1/13	3538.5	Pretest						-	-	36.61	5310.50	LEAKING SEAL
1/14	3538.7	Pretest						33.07	4796.4	36.61	5310.80	GOOD TEST
1/15	3544.0	Pretest						-	-	36.66	5317.97	TIGHT - ABORT
1/16	3544.3	Pretest						33.11	4802.94	36.66	5317.30	GOOD TEST
1/17	3556.5	Pretest						33.19	4814.55	36.77	5333.15	GOOD TEST
1/18	3564.0	Pretest						33.31	4831.77	36.84	5343.44	GOOD TEST
1/19	3567.0	Pretest						-	-	36.86	5346.09	SEAL FAILURE
1/20	3566.6	Pretest						33.31	4831.05	36.84	5344.12	GOOD TEST
1/21	3574.5	Pretest						33.35	4836.97	36.93	5356.68	GOOD TEST
1/22	3598.0	Pretest						33.53	4863.81	37.14	5386.81	GOOD TEST
1/23	3614.7	Pretest						-	-	37.28	5407.32	LOST SEAL
1/24	3614.8	Pretest						-	-	37.27	5406.10	LOST SEAL

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME -BLACKBACK-1

BLACKBACK-1 ST2 : SUITE 4

TEST & SEAT NO.	DEPTH (METRES) K.B.	CHAMBER Litres	OIL Litres	RECOVERY (LITRES)		FORMATION WATER Litres	MUD FILTRATE Litres	HEWLETT-PACKARD FORMATION PRESSURE		HEWLETT-PACKARD HYDROSTATIC PRESSURE		REMARKS
				COND. Litres	GAS m ³			MPaa	Psia	MPaa	Psia	
1/25	3614.5	Pretest						-	-	37.27	5406.76	LOST SEAL
1/26	3631.0	Pretest						33.81	4904.10	37.41	5426.95	GOOD TEST
1/27	3614.9	Pretest						-	-	37.27	5405.75	LOST SEAL
1/28	3564.0	Pretest						-	-	36.84	5343.65	TIGHT - ABORT
1/29	3564.2	Pretest						33.31	4831.40	36.83	5341.81	GOOD TEST
2/30	3805.5	22.7 3.8	8.0	-	2.962	0.14	0.36	35.20	5106.39	38.97	5652.93	GOOD TEST - SAMPLE 1
3/31	3574.5	22.7 3.8	14.0	(P R E S E R V E D)	2.404	TR	TR	33.34	4836.26	36.90	5353.18	GOOD TEST - SAMPLE 2
4/32	3566.6	Pretest						-	-	36.85	5345.30	SEAL FAILURE
4/33	3566.4	Pretest						-	-	36.85	5343.50	SEAL FAILURE
4/34	3566.8	22.7 3.8	-	1.2	8.110	-	8.5	33.32	4832.76	36.85	5345.78	GOOD TEST - SAMPLE 3
5/35	3530.5	Pretest						-	-	36.58	5305.80	SEAL FAILURE
5/36	3530.3	Pretest						-	-	36.58	5305.10	SEAL FAILURE
5/37	3530.0	Pretest						33.02	4789.90	36.51	5296.30	VERY SLOW BUILD UP
5/38	3529.5	Pretest						-	-	36.52	5296.70	SEAL FAILURE
5/39	3530.0	Pretest						-	-	36.51	5296.50	SEAL FAILURE
5/40	3530.0	Pretest						-	-	36.51	5295.20	SEAL FAILURE
5/41	3530.4	Pretest						-	-	36.53	5298.50	SEAL FAILURE
5/42	3528.3	Pretest						-	-	36.51	5296.00	SEAL FAILURE
5/43	3469.5	Pretest						-	-	35.98	5219.90	SEAL FAILURE
6/44	3530.5	Pretest						33.05	4793.40	36.55	5302.00	LOST SEAL
6/45	3530.5	Pretest						33.07	4796.90	36.59	5306.80	LOST SEAL
6/46	3530.3	Pretest						-	-	36.53	5298.10	SEAL FAILURE
7/47	3530.5	Pretest						-	-	36.52	5297.40	SEAL FAILURE

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME -BLACKBACK-1

BLACKBACK-1 ST2 : SUITE 4

<u>TEST & SEAT NO.</u>	<u>DEPTH (METRES) K.B.</u>	<u>CHAMBER</u>	<u>OIL</u>	<u>RECOVERY (LITRES)</u>		<u>FORMATION WATER</u>	<u>MUD FILTRATE</u>	<u>HEWLETT-PACKARD FORMATION PRESSURE</u>		<u>HEWLETT-PACKARD HYDROSTATIC PRESSURE</u>		<u>REMARKS</u>
				<u>COND.</u>	<u>GAS</u>			<u>MPaa</u>	<u>Psia</u>	<u>MPaa</u>	<u>Psia</u>	
				Litres	m ³	Litres	Litres					
7/48	3528.3	Pretest						-	-	36.62	5311.20	SEAL FAILURE
7/49	3469.5	Pretest						-	-	36.12	5239.10	SEAL FAILURE
8/50	3530.4	22.7	0.05	-	0.453	-	20.1	32.84	4763.70	36.41	5281.70	GOOD TEST - SAMPLE 4
		3.8	0.10	-	0.445	-	1.8					
9/51	3556.5	Pretest						-	-	36.69	5322.70	SEAL FAILURE
9/52	3557.0	Pretest						-	-	36.68	5320.70	SEAL FAILURE
9/53	3556.7	Pretest						33.13	4805.70	36.71	5324.70	LOST SEAL
9/54	3556.7	Pretest						33.15	4808.70	36.72	5325.70	LOST SEAL
9/55	3489.0	Pretest						-	-	36.11	5237.70	SEAL FAILURE
9/56	3488.8	Pretest						-	-	36.12	5238.70	SEAL FAILURE
9/57	3489.2	Pretest						-	-	36.12	5239.70	SEAL FAILURE

7. SUMMARY OF WIRELINE FORMATION TEST PROGRAMME -BLACKBACK-1

BLACKBACK-1 ST2 : SUITE 5

TEST & SEAT NO.	DEPTH (METRES) K.B.	CHAMBER Litres	OIL Litres	RECOVERY (LITRES)		FORMATION WATER Litres	MUD FILTRATE Litres	HEWLETT-PACKARD FORMATION PRESSURE		HEWLETT-PACKARD HYDROSTATIC PRESSURE		REMARKS
				COND. Litres	GAS m ³			MPaa	Psia	MPaa	Psia	
1/1	4020.0	Pretest						36.23	5255.89	40.28	5843.29	GOOD TEST
1/2	4028.0	Pretest						36.99	5365.38	40.36	5853.78	GOOD TEST
1/3	4065.0	Pretest						37.30	5410.59	40.68	5900.55	GOOD TEST
1/4	4073.0	Pretest						37.37	5419.96	40.75	5910.71	GOOD TEST
1/5	4120.0	Pretest						37.81	5484.67	41.18	5972.72	GOOD TEST
1/6	4124.5	Pretest						37.83	5486.15	41.21	5977.99	GOOD TEST
1/7	4152.5	Pretest						38.05	5518.89	41.47	6015.54	GOOD TEST
1/8	4155.0	Pretest						38.06	5520.77	41.49	6018.23	GOOD TEST
1/9	4157.5	Pretest						38.08	5523.81	41.51	6021.60	GOOD TEST
1/10	4162.5	Pretest						38.12	5529.58	41.56	6028.08	GOOD TEST
1/11	4175.0	Pretest						38.22	5544.47	41.67	6044.41	GOOD TEST
2/12	4120.0	22.7 3.8	1.2	-	5.035	6.3	-	37.81	5483.92	41.19	5974.08	GOOD TEST - SAMPLE 1

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8. TEMPERATURE RECORD - BLACKBACK-1

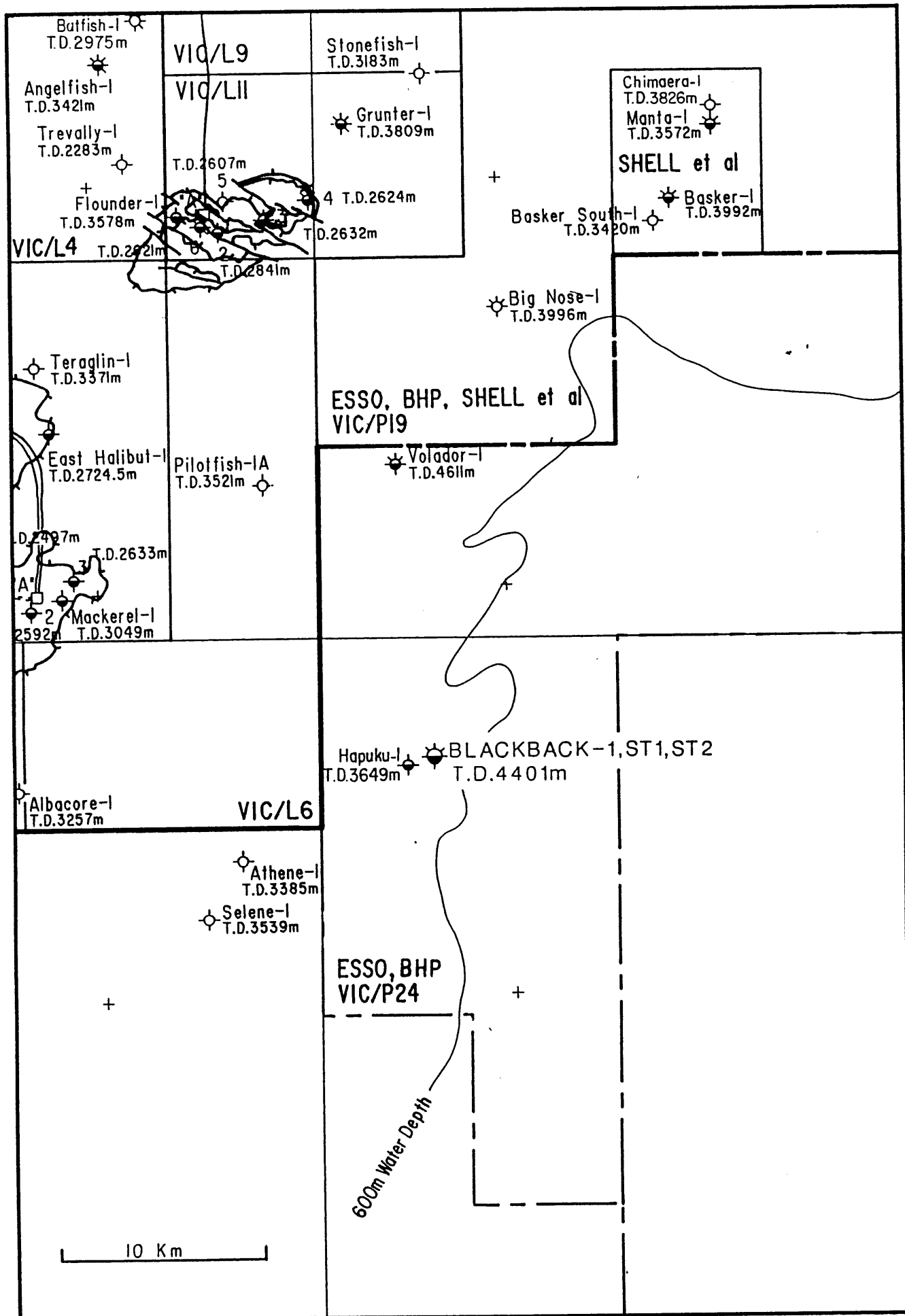
LOGGING RUN	THERMOMETER DEPTH (m)	MAX. RECORDED TEMPERATURE (°C)	CIRCULATION TIME (t _k) (hours)	TIME AFTER CIRCULATION STOPPED (t)	HORNER TEMPERATURE (°C)	GEOHERMAL GRADIENT (C°/km)
<u>BLACKBACK-1</u>						
<u>Suite 1</u>						
BHC-CAL-GR	1254.65	45	-	6hrs 35mins		
<u>Suite 2</u>						
DLL-MSFL-LDL-CNL-GR-SP	3241.31	66	0hrs 15mins	11hrs 0mins		
BHC-GR-CAL	3260.57	70		18hrs 30mins	75.3	24.19
RFT-HP-GR	3191.36	70	-	27hrs 30mins		
<u>BLACKBACK-1 ST1</u>						
<u>Suite 3</u>						
DLL-MSFL-LDL-CNL-GR-SP	2972.81	64	2hrs 0mins	20hrs 0mins		
RFT-HP-GR	2916.46	64	-	26hrs 30mins		
SHDT	2991.45	71	-	40hrs 45mins	78.1	27.30
WSS	3000.00	71	-	44hrs 30mins		
CST's	2995.00	71	-	54hrs 0mins		
<u>BLACKBACK-1 ST2</u>						
<u>Suite 4</u>						
DLL-MSFL-LDL-CNL-GR-SP	3868.31	81	0hrs 23mins	8hrs 33mins		
BHC-GR-CAL	3873.11	86		13hrs 55mins		
RFT-HP-GR	3891.96	83	-	11hrs 15mins	92.7	25.81
SHDT	3885.95	87	-	18hrs 20mins		
WSS	3885.00	89	-	26hrs 45mins		
<u>Suite 5</u>						
DLL-MSFL-LDL-CNL-GR-SP	4366.38	90	2hrs 0mins	15hrs 19mins		
BHC-GR-CAL	4384.05	95		18hrs 19mins		
RFT-HP-GR	4165.96	95.6	-	28hrs 30mins	102.8	25.61
SHDT	4387.45	100	-	43hrs 55mins		
CST's	4374.00	100	-	48hrs 30mins		

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FIGURES

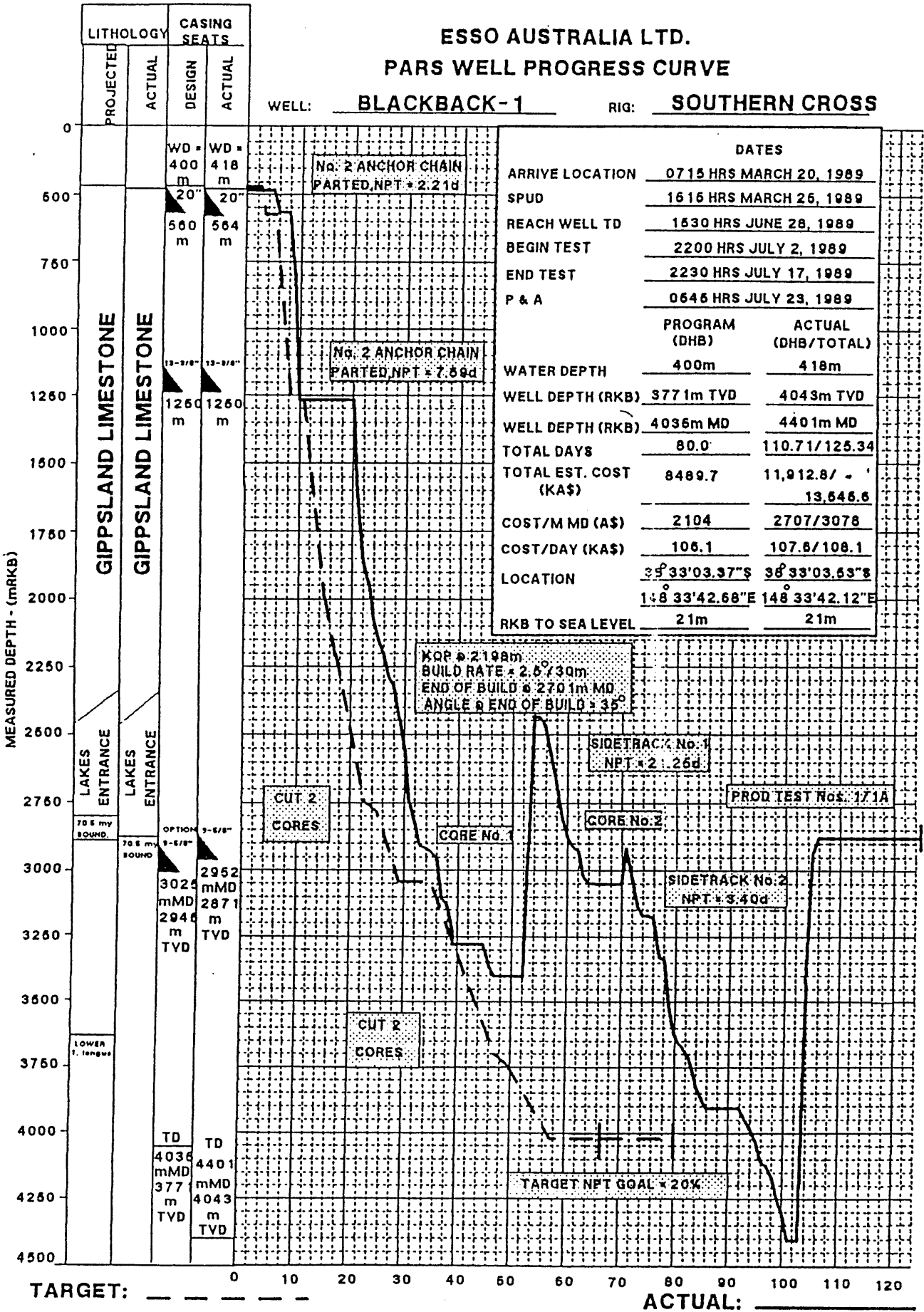


BLACKBACK - 1 LOCALITY MAP



ESSO AUSTRALIA LTD.
PARS WELL PROGRESS CURVE

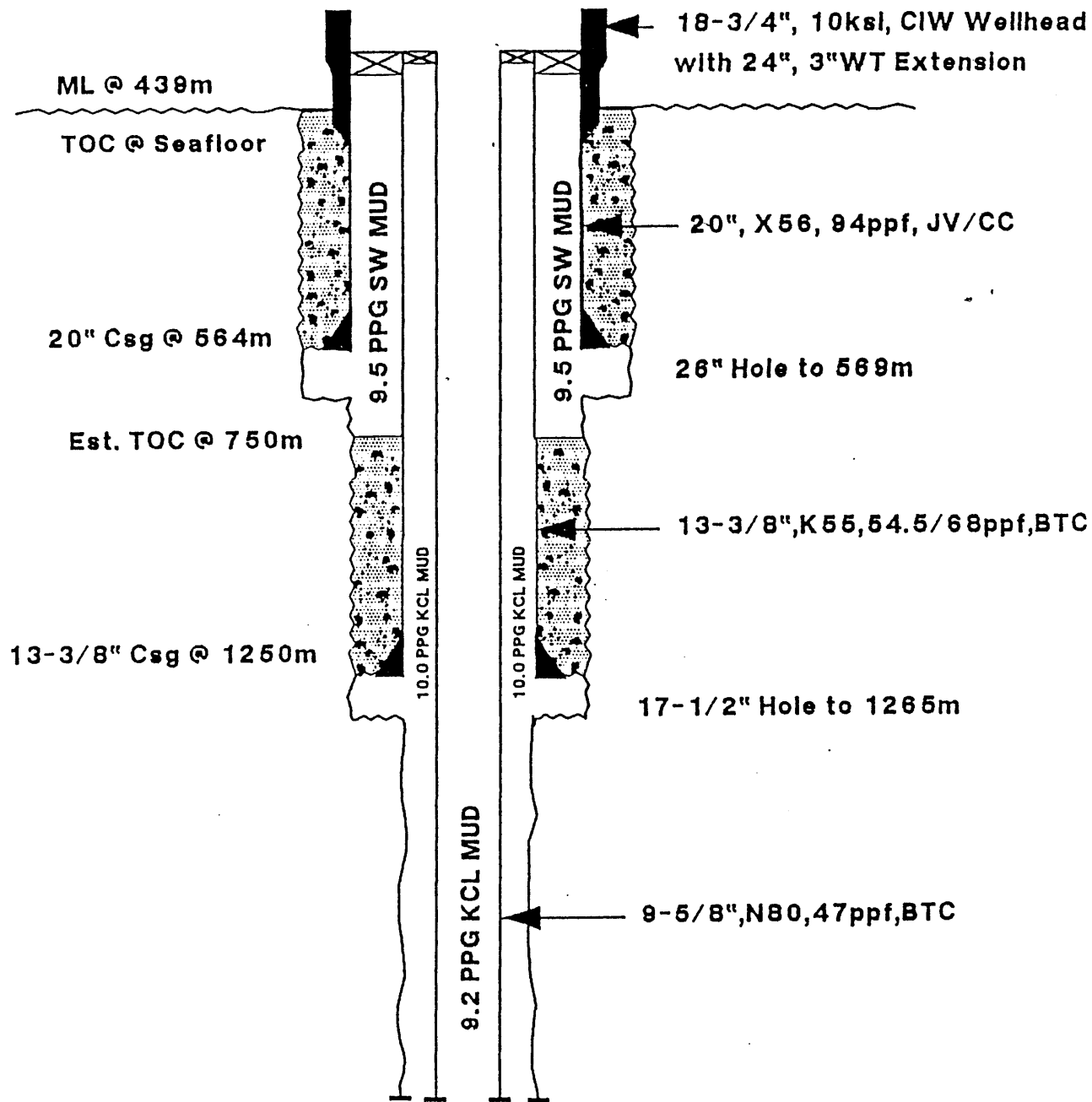
WELL: BLACKBACK-1 RIG: SOUTHERN CROSS



ESSO AUSTRALIA LTD. BLACKBACK-1 FINAL WELL REPORT UPPER WELLBORE SCHEMATIC

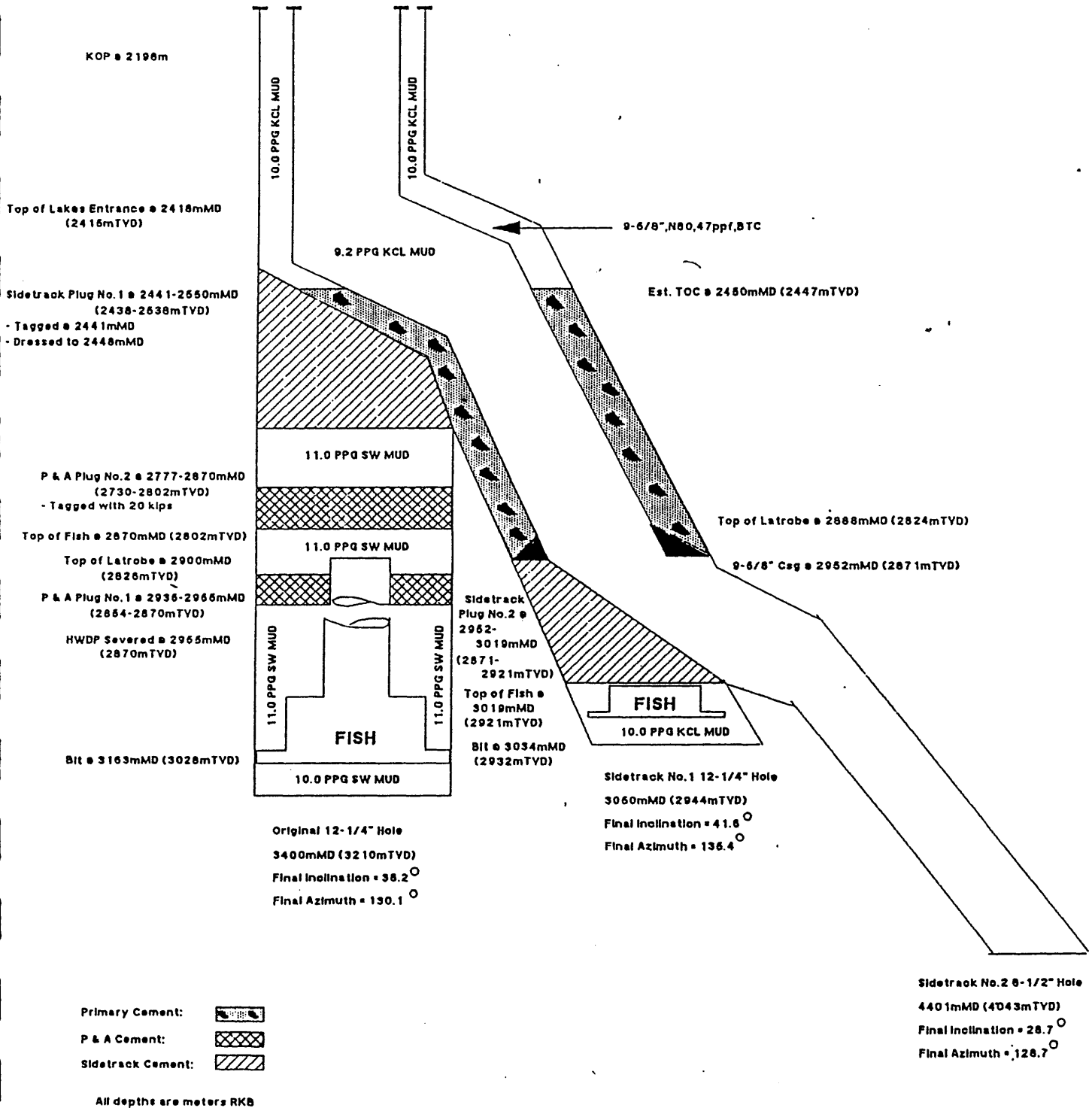
RKB

MSL @ 21m



All depths are meters RKB

ESSO AUSTRALIA LTD. BLACKBACK-1 FINAL WELL REPORT LOWER WELLBORE SCHEMATIC

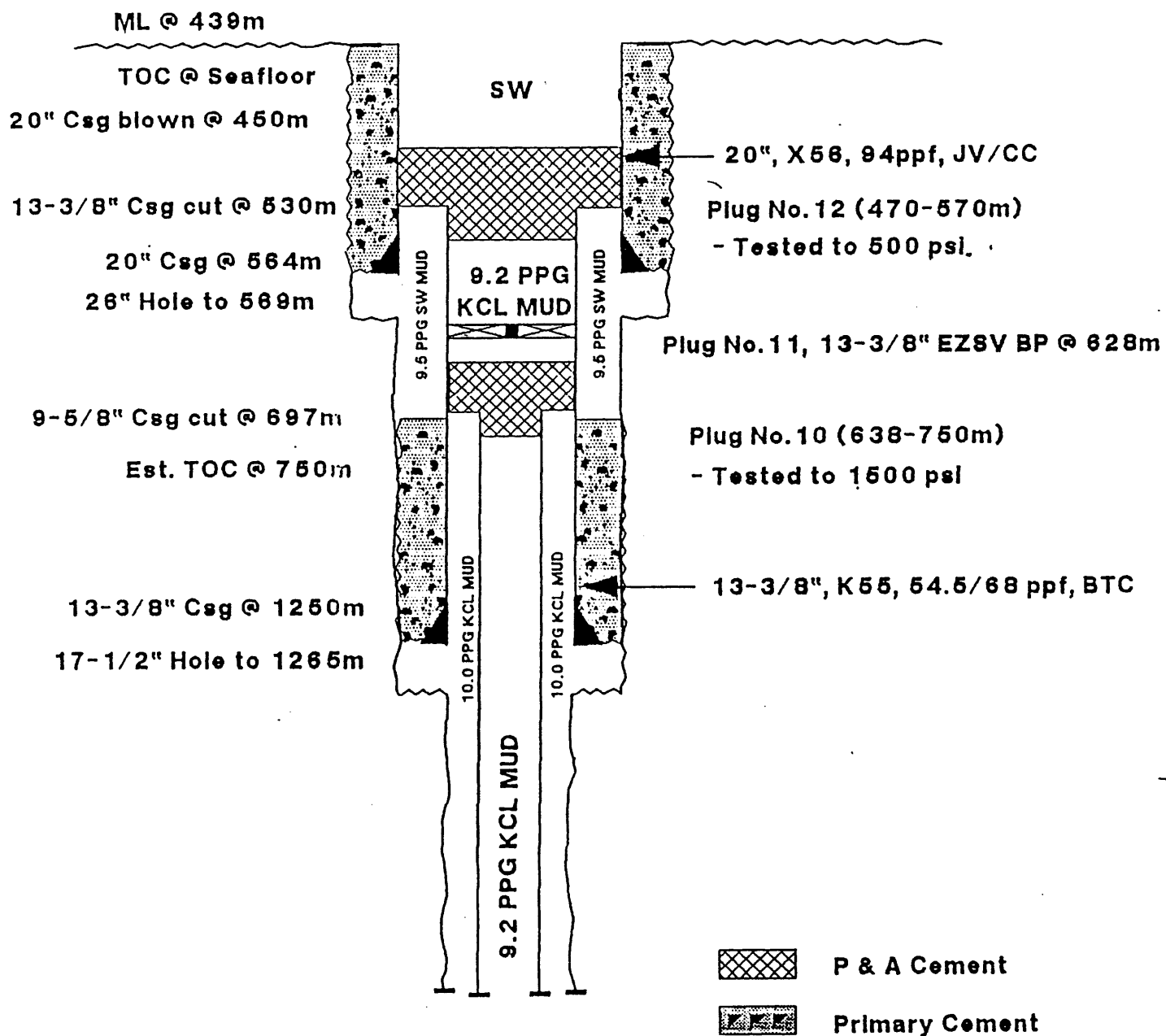


All depths are meters RKB

ESSO AUSTRALIA LTD. BLACKBACK-1 FINAL WELL REPORT UPPER WELLBORE ABANDONMENT SCHEMATIC

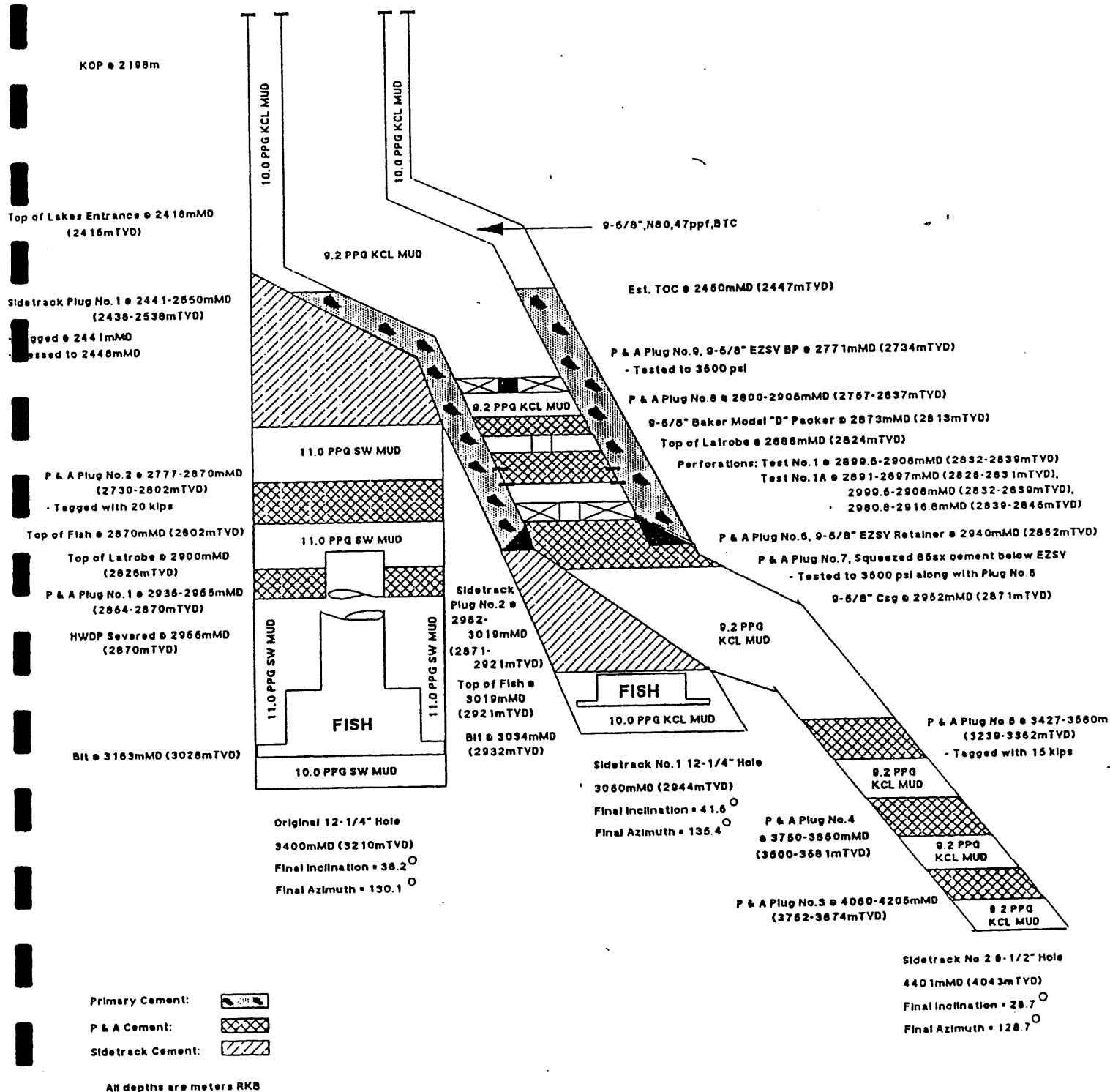
RKB

MSL @ 21m

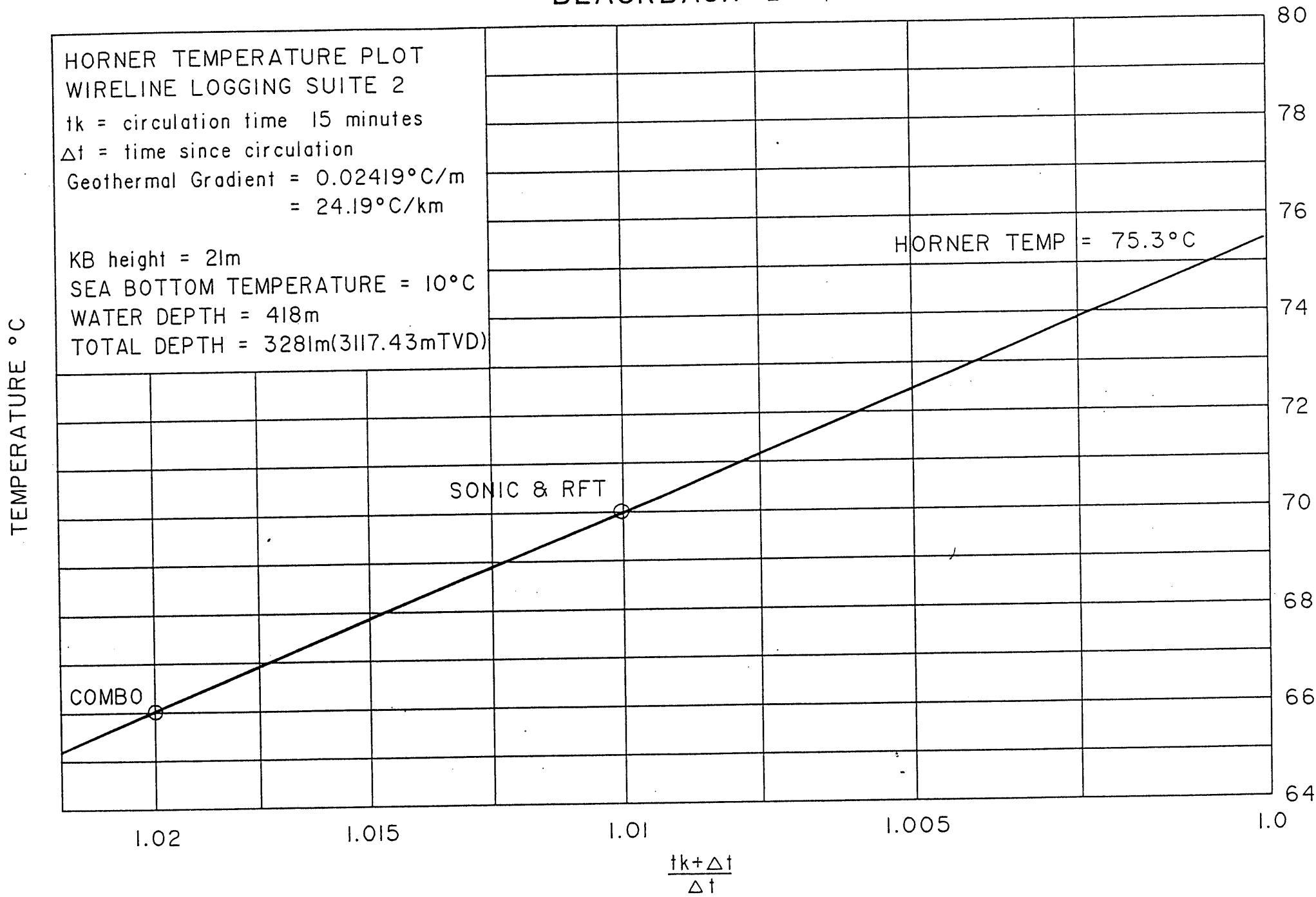


All depths are meters RKB

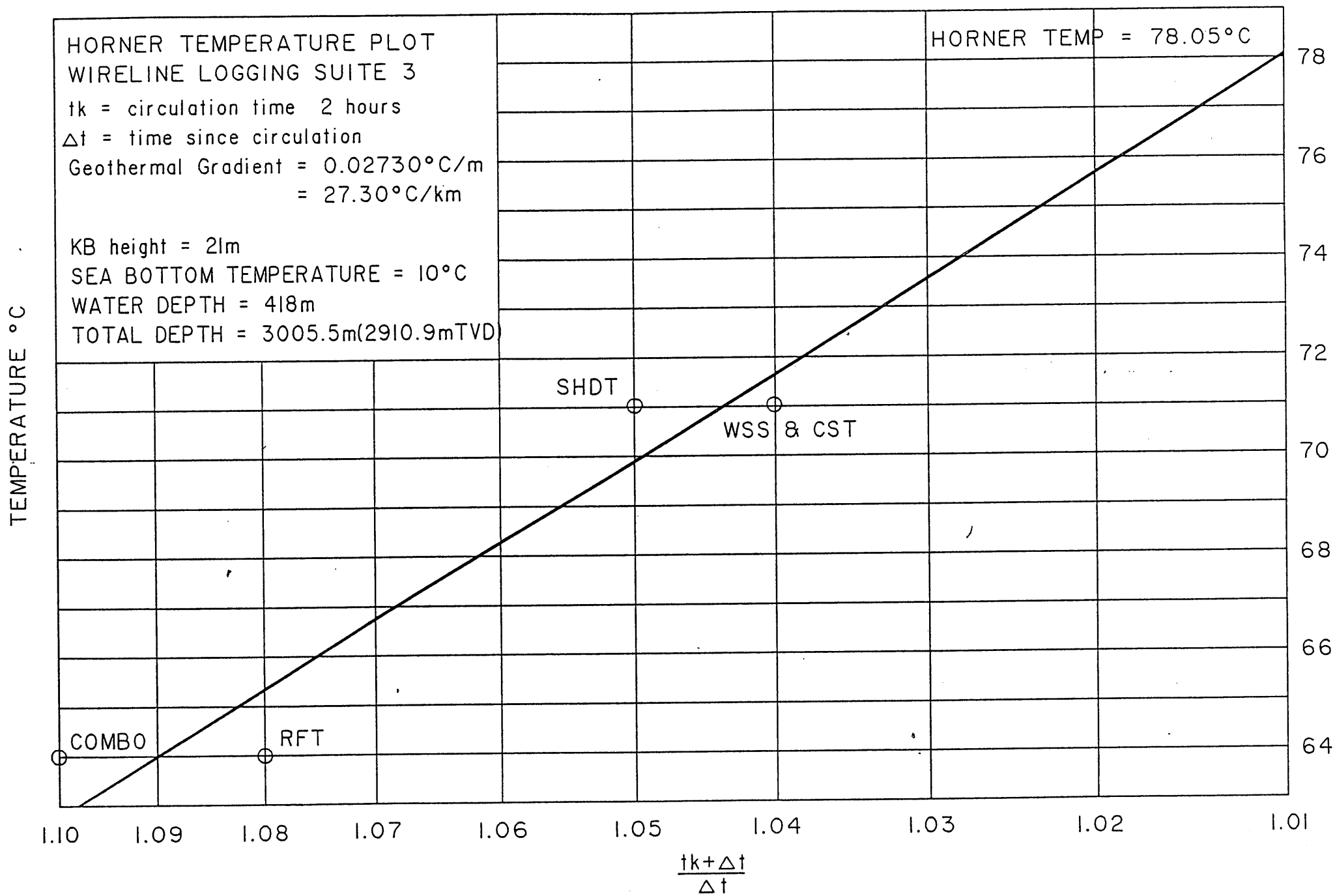
ESSO AUSTRALIA LTD. BLACKBACK-1 FINAL WELL REPORT LOWER WELLBORE ABANDONMENT SCHEMATIC



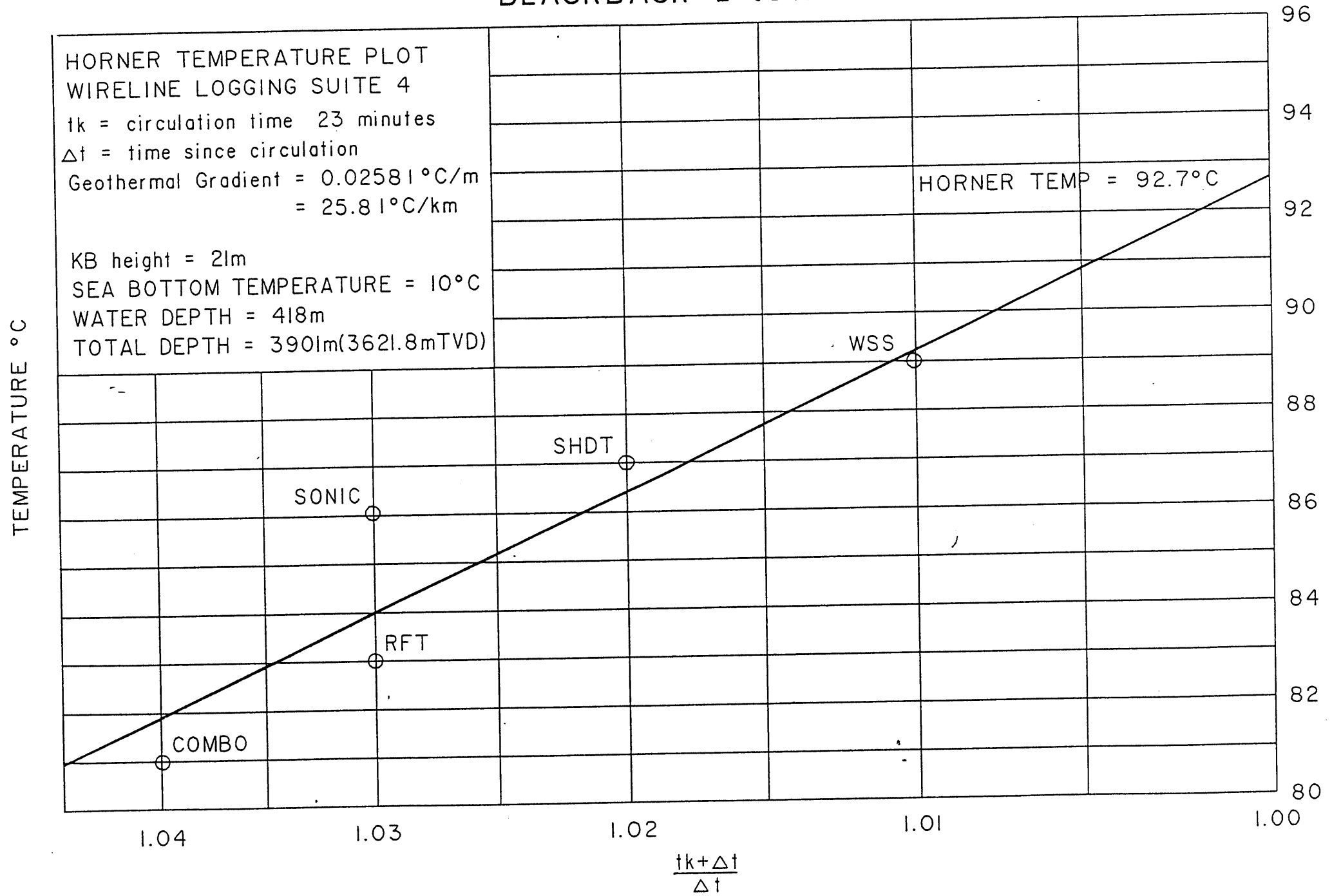
BLACKBACK-1



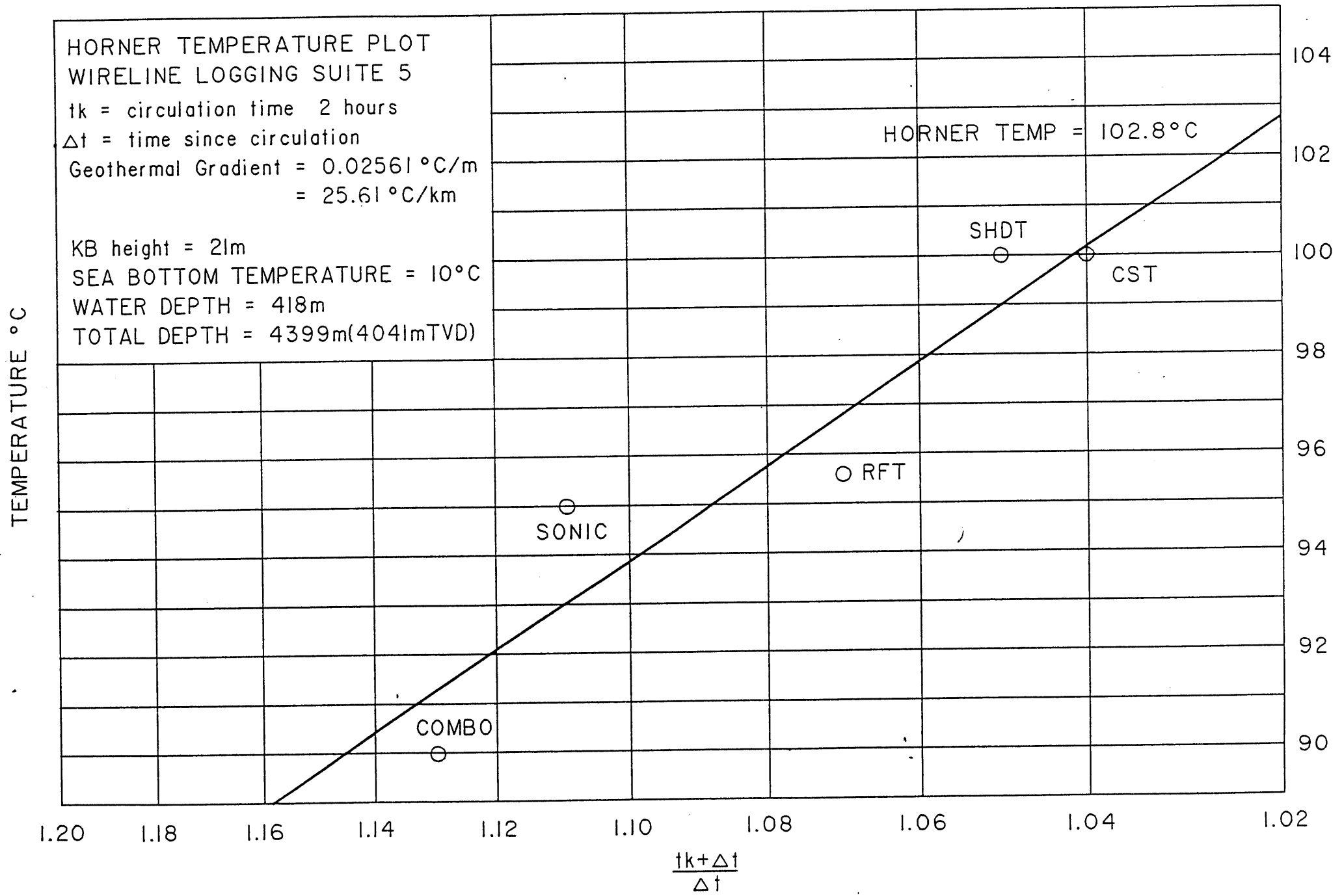
BLACKBACK-1 (ST1)



BLACKBACK-1 (ST2)



BLACKBACK-1 (ST2)



**APPENDIX
1**

BLACKBACK-1

Lithology Descriptions

<u>Depth</u>	<u>%</u>	<u>Description</u>
1265 - 1290	100	<u>LIMESTONE</u> : Medium to light grey, calcilutite to calcarenite (=mudstone to wackestone), medium to fine well sorted, rounded, firm, common forams, and bryozoans, poor inferred porosity, no fluorescence.
1290 - 1320	100	<u>LIMESTONE</u> : Light grey, dominantly calcitic, trace dolomitic, calcilutite to calcarenite (calcarenite medium to coarse grains, well sorted, moderately well rounded, calcareous cement and matrix, firm to moderately hard), (=mudstone to Wackestone), firm, common fossils (common forams, trace bryozoans), poor inferred porosity, no fluorescence.
1320 - 1350	100	<u>LIMESTONE</u> : As above, common forams, poor inferred porosity, no fluorescence.
1350 - 1380	100	<u>LIMESTONE</u> : As above, abundant forams, trace bryozoans and fragments, poor inferred porosity, no fluorescence.
1380 - 1410	100	<u>LIMESTONE</u> : As above, soft to firm, trace forams, poor inferred porosity, no fluorescence.
	Tr	<u>LIMESTONE</u> : (ii) Medium to dark grey, calcareous, calcilutite (=mudstone), firm, no observable fossils, very poor inferred porosity, no fluorescence.
1410 - 1440	80	<u>LIMESTONE</u> : (i) As above, common forams, poor inferred porosity, no fluorescence.
	20	<u>LIMESTONE</u> : (ii) As above, firm, very poor inferred porosity, no fluorescence.
1440 - 1470	100	<u>LIMESTONE</u> : (i) As above, common forams, trace (few grains) quartz, poor inferred porosity, no fluorescence (very minor trace dolomitic mineral fluorescence).
	Tr	<u>LIMESTONE</u> : (ii) As above, firm to soft, very poor inferred porosity, no fluorescence.
1470 - 1500	95	<u>LIMESTONE</u> : (i) Light grey, calcareous, trace dolomite, calcilutite to calcisiltite (=mudstone), firm, no observable fossils, very poor inferred porosity, no fluorescence.
	5	(ii) Medium grey, calcareous, trace dolomite, calcilutite to calcisiltite (=mudstone), no observable fossils, very poor inferred porosity, no fluorescence.
1500 - 1530	100	<u>LIMESTONE</u> : (i) Light grey, calcareous, trace dolomite, calcilutite to calcisiltite (=mudstone), soft, trace to common forams, trace sponge spicules, trace fossil debris, very poor porosity, no fluorescence (very minor trace mineral fluorescence).
1530 - 1560	100	<u>LIMESTONE</u> : Light grey, calcareous, trace dolomite, calcilutite to calcisiltite

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		(=mudstone), trace calcarenite (medium to very fine, moderately sorted, moderately to well rounded), (=Wackestone), soft, sticky, common forams, trace fossil fragments (trace sponge spicules), very poor inferred porosity, no fluorescence (very minor trace mineral fluorescence).
1560 - 1590	100	<u>LIMESTONE</u> : Light grey, calcareous, trace dolomite, calcilutite to calcisiltite (=mudstone), no observed calcarenite, soft, very sticky, common to abundant forams and fossil fragments (sponge spicules), very poor inferred porosity, no fluorescence (trace mineral fluorescence).
1590 - 1620	100	<u>LIMESTONE</u> : As above, trace to common fossil fragments (forams, bryozoans, sponge spicules), very poor inferred porosity, no fluorescence).
1620 - 1650	100 Tr	<u>LIMESTONE</u> : (i) As above, trace fossil fragments (forams, sponge spicules), very poor inferred porosity, no fluorescence. <u>LIMESTONE</u> : (ii) Medium grey, calcareous limestone, trace dolomite, trace to common calcilutite (=mudstone) laminae, no observable fossils, very poor inferred porosity.
1650 - 1680	90 10	<u>LIMESTONE</u> : As above, trace fossils (forams), very poor inferred porosity, no fluorescence. <u>CLAYSTONE</u> : Light grey to light brown grey (occasionally cream), calcareous, trace siltstone size particles, trace fossil fragments, firm, blocky.
1680 - 1710	80 20	<u>LIMESTONE</u> : As above, light grey to pale brown/grey, as above, soft, sticky, very poor inferred porosity, no fluorescence. <u>CLAYSTONE</u> : Light grey to pale brown, as above, soft, blocky.
1710 - 1740	90 10	<u>LIMESTONE</u> : As above, common forams, very poor inferred porosity, no fluorescence. <u>CLAYSTONE</u> : As above, soft, blocky.
1740 - 1770	90 10	<u>LIMESTONE</u> : As above, trace forams, very poor inferred porosity, no fluorescence. <u>CLAYSTONE</u> : As above, trace to common siltstone sized particles, trace calcarenite grains, soft, sticky, blocky.
1770 - 1800	100 Tr	<u>LIMESTONE</u> : As above, trace to common forams, very poor inferred porosity, no fluorescence. <u>CLAYSTONE</u> : As above, very strong swelling clays, soft, sticky, blocky.
1800 - 1830	100	<u>LIMESTONE</u> : Medium to predominantly light grey, occasionally very pale grey to brown, calcareous limestone, very minor trace dolomite, no observable structure,

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		calcilutite to calcisiltite (=mudstone), trace carbonaceous debris, very rare very fine quartz grains, common forams, very poor inferred porosity, no fluorescence.
1830 - 1860	100	<u>LIMESTONE</u> : As above, trace carbonaceous debris, trace to common forams, very poor inferred porosity.
1860 - 1890	100	<u>LIMESTONE</u> : Light grey/brown, calcareous limestone, calcilutite to calcisiltite (=mudstone), trace carbonaceous debris, trace very fine quartz grains, trace forams, trace argillaceous debris, very poor inferred porosity, no fluorescence.
1890 - 1920	100	<u>LIMESTONE</u> : As above, rare to trace forams, trace argillaceous material, very poor inferred porosity, no fluorescence.
		<BIT CHANGE AT 1941M, PDC BIT (HUGHES 89M+)>
1920 - 1950	100	<u>LIMESTONE</u> : As above, trace forams, trace argillaceous material, very poor inferred porosity, no fluorescence, trace mineral fluorescence.
1950 - 1980	100	<u>LIMESTONE</u> : As above, trace argillaceous debris, much finer more powdery cuttings due to PDC bit, very poor inferred porosity, no fluorescence.
1980 - 2010	100	<u>LIMESTONE</u> : As above, trace forams, trace to common argillaceous material, trace carbonaceous debris, soft, sticky, very poor inferred porosity, no fluorescence.
2010 - 2020	100	<u>LIMESTONE</u> : As above, trace very fine discontinuous laminae, soft to firm, sticky, very poor inferred porosity, no fluorescence.
2020 - 2030	100	<u>LIMESTONE</u> : As above, trace forams, trace argillaceous material, soft to firm, very poor inferred porosity, no fluorescence.
2030 - 2040	100	<u>LIMESTONE</u> : Light to medium grey, occasionally pale grey/brown, calcareous limestone, no observable structure, calcisiltite to calcilutite (=mudstone), occasionally calcarenite (very fine, well sorted, well rounded, calcareous cement, trace argillaceous matrix), trace forams, trace crystalline calcite, very poor inferred porosity, no fluorescence.
2040 - 2050	100	<u>LIMESTONE</u> : As above, no forams or fossils observable, very poor inferred porosity, no fluorescence.
2050 - 2070	100	<u>LIMESTONE</u> : Light grey/brown, calcareous limestone, trace dolomite, mottled/speckled appearance, calcisiltite, trace calcarenite

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		(fine to very fine, moderately to well sorted, subrounded to rounded), trace carbonaceous material, trace argillaceous matrix, trace to common forams, soft, blocky, very poor inferred porosity, no fluorescence.
2070 - 2080	100	<u>LIMESTONE</u> : As above, trace calcarenite (as above), trace carbonaceous material, trace argillaceous matrix, trace forams, very poor inferred porosity, no fluorescence.
2080 - 2090	100	<u>LIMESTONE</u> : As above, occasionally off white to very pale grey/brown, as above, very poor inferred porosity, no fluorescence.
2090 - 2100	100	<u>LIMESTONE</u> : As above, very poor inferred porosity, no fluorescence.
2100 - 2110	100	<u>LIMESTONE</u> : As above, very poor inferred porosity, no fluorescence.
2110 - 2120	100	<u>LIMESTONE</u> : As above, soft to firm, very poor inferred porosity, no fluorescence.
2120 - 2130	100	<u>LIMESTONE</u> : As above, trace broken foram fragments, soft to firm, very poor inferred porosity, no fluorescence.
2130 - 2140	100	<u>LIMESTONE</u> : Light to medium grey, calcareous limestone, mottled/speckled, calcisiltite, trace to common calcarenite (very fine to fine, moderately to well sorted, subrounded to rounded), trace carbonaceous material, rare very fine glauconite, trace argillaceous matrix, no observable fossils, soft, blocky, sticky, very poor inferred porosity, no fluorescence.
2140 - 2150	100	<u>LIMESTONE</u> : As above, no observable fossils, soft, sticky, blocky, very poor inferred porosity, no fluorescence.
2150 - 2160	100	<u>LIMESTONE</u> : As above, sticky, blocky, very poor inferred porosity, no fluorescence.
2160 - 2170	100	<u>LIMESTONE</u> : As above, sticky, blocky, very poor inferred porosity, no fluorescence.
2170 - 2180	100	<u>LIMESTONE</u> : Light to medium grey, calcareous limestone, mottled, calcisiltite to calcarenite, (very fine to fine, moderately to well sorted, subrounded), rare carbonaceous material, rare glauconite, trace argillaceous matrix, no observable fossils, soft, blocky, very poor inferred porosity, no fluorescence.
2180 - 2190	100	<u>LIMESTONE</u> : Light to medium grey, calcareous limestone, mottled, predominantly calcisiltite, common calcarenite (very fine to fine, moderately sorted, subrounded), rare carbonaceous debris, trace argillaceous

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		matrix, trace forams, soft, slightly sticky, blocky, very poor inferred porosity, no fluorescence.
2190 - 2200	100	<u>LIMESTONE</u> : As above, soft to firm, blocky, very poor inferred porosity, no fluorescence.
2200 - 2210	100	<u>LIMESTONE</u> : As above, trace forams, soft to firm, slightly sticky, blocky, very poor inferred porosity, no fluorescence.
2210 - 2220	100	<u>LIMESTONE</u> : As above, trace forams, trace to rare carbonaceous debris, soft to firm, blocky, very poor inferred porosity, no fluorescence.
2220 - 2230	100	<u>LIMESTONE</u> : As above, trace forams, predominantly calcarenite (as above,), trace carbonaceous debris, soft to firm, sticky, very poor inferred porosity, no fluorescence.
2230 - 2240	100	<u>LIMESTONE</u> : Light to predominantly medium grey, calcareous, trace dolomite, slightly mottled, calcisiltite to calcarenite (as above), trace calcilutite, rare carbonaceous debris, trace argillaceous matrix, no observable fossils, soft to firm, occasionally hard, slightly sticky, blocky, poor inferred porosity, no fluorescence.
2240 - 2250	100	<u>LIMESTONE</u> : Medium grey to medium grey/brown, as above, trace forams, firm, slightly sticky, blocky, very poor inferred porosity, no fluorescence.
2250 - 2260	100	<u>LIMESTONE</u> : As above, trace forams, trace pyrite, trace calcite, trace very fine glauconite, firm to occasionally hard, blocky, very poor inferred porosity, no fluorescence.
2260 - 2270	100	<u>LIMESTONE</u> : Medium grey to medium grey/brown, calcareous, trace dolomite, slightly mottled, calcisiltite to calcarenite (as above), trace to common calcilutite, rare carbonaceous debris, trace calcite, very rare quartz grains, trace glauconite, trace to common argillaceous matrix, no observable fossils, firm to occasionally hard (medium grey/brown cavings), blocky, very poor inferred porosity, no fluorescence.
2270 - 2280	100	<u>LIMESTONE</u> : As above, no observable fossils, trace calcite, trace medium to dark green, flaky glauconite, firm to hard, occasionally soft, sticky, blocky, very poor inferred porosity, no fluorescence.
2280 - 2290	100	<u>LIMESTONE</u> : As above, rare calcareous forams, rare very fine glauconite, firm to hard, occasionally very argillaceous, soft and sticky, blocky.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		<BIT TRIP>
2290 - 2300	100	<u>LIMESTONE</u> : As above, trace forams, rare quartz grains, rare flaky glauconite, firm to hard, blocky, very poor inferred porosity, no fluorescence (high proportion of mixed cavings from bit trip).
2300 - 2310	100	<u>LIMESTONE</u> : Medium to pale brown/grey, calcareous limestone, slightly mottled, calcarenite to trace calcisiltite, fine, moderately sorted, subrounded, common argillaceous matrix, trace forams, rare glauconite (flaky), hard, blocky, very poor inferred porosity, no fluorescence. (abundant cavings associated with sample)
2310 - 2320	100	<u>LIMESTONE</u> : Light to medium brown/grey, mottled, calcarenite to calcisiltite, fine to medium calcareous grains in slightly swelling argillaceous matrix, rare calcareous forams, blocky, firm to moderately hard, no visual porosity, no fluorescence.
2320 - 2330	100	<u>LIMESTONE</u> : Mottle light to medium brown grey, as above, no visual porosity, no fluorescence.
2330 - 2340	100	<u>LIMESTONE</u> : As above.
2340 - 2350	100	<u>LIMESTONE</u> : As above, trace calcareous forams.
2350 - 2360	100	<u>LIMESTONE</u> : As above, trace spherical calcareous forams.
2360 - 2370	100	<u>LIMESTONE</u> : As above.
2370 - 2380	100	<u>LIMESTONE</u> : Mottled, light to medium brown grey, calcarenite as above, trace spherical calcareous forams increase in abundant.
2380 - 2390	100	<u>LIMESTONE</u> : As above, trace forams.
2390 - 2400	100	<u>LIMESTONE</u> : As above, trace spherical and other various calcareous forams.
2400 - 2410	100	<u>LIMESTONE</u> : Medium grey to brown, calcareous limestone, mottled, calcisiltite to calcarenite (fine, moderately sorted, subrounded, common argillaceous swelling matrix), calcareous cement, trace forams, rare glauconite (flaky), firm to hard, blocky, very poor inferred porosity, no fluorescence.
2410 - 2420	100	<u>LIMESTONE</u> : Medium to light grey, occasionally grey/brown, calcareous limestone, mottled, calcisiltite to calcilutite, occasionally calcarenite (as above, decreased abundance), common strong swelling clay matrix, trace forams, no

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		observable glauconite, firm to soft, occasionally hard, blocky, very poor inferred porosity, no fluorescence.
2420 - 2430	90	<u>LIMESTONE</u> : Medium to light grey, as above, trace forams, blocky, slightly sticky, strong swelling clays, soft to firm, very poor inferred porosity, no fluorescence.
	10	<u>LIMESTONE</u> : Medium grey/brown, calcilutite, calcarenite (as above), trace forams, trace sponge spicules, firm to hard, blocky, very poor inferred porosity, no fluorescence.
2430 - 2440	50	<u>LIMESTONE</u> : Medium to light brown grey, calcarenite, grading to calcisiltite, as above.
	50	<u>CLAYSTONE</u> : Very calcareous, common and varied calcareous forams, slightly sticky, homogeneous, blocky to amorphous, soft to firm.
2440 - 2450	60	<u>CLAYSTONE</u> : Very calcareous, as above, trace spherical calcareous forams.
	40	<u>LIMESTONE</u> : Calcarenite, as above, probably cavings.
2450 - 2460	80	<u>CLAYSTONE</u> : As above, common and varied calcareous forams.
	20	<u>LIMESTONE</u> : As above.
2460 - 2470	80	<u>CLAYSTONE</u> : As above, trace to common spherical calcareous forams, very rare spherical pyritized forams.
	20	<u>LIMESTONE</u> : As above.
2470 - 2480	80	<u>CLAYSTONE</u> : Very calcareous, as above, trace spherical calcareous and dark grey to black pyritized forams, rare shell fragments.
	20	<u>LIMESTONE</u> : Calcarenite, as above, probably cavings.
2480 - 2490	80	<u>CLAYSTONE</u> : As above, trace spherical calcareous and pyritized forams.
	20	<u>LIMESTONE</u> : As above.
2490 - 2500	80	<u>CLAYSTONE</u> : As above, rare pyritized worm burrow, rare shell fragments.
	20	<u>LIMESTONE</u> : As above.
2500 - 2510	100	<u>CLAYSTONE</u> : Light grey, occasionally medium grey, very calcareous, common forams, trace pyrite and pyritized forams, trace sponge spicules, trace fossil fragments, soft, slightly sticky, blocky to amorphous.
	Tr	<u>LIMESTONE</u> : As above (cavings).
2510 - 2520	100	<u>CLAYSTONE</u> : As above, common forams, trace pyrite (increased abundance), trace glauconite with associated rare pyritized sponge spicules, soft, slightly sticky, blocky.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2520 - 2530	100	<u>CLAYSTONE</u> : As above, common forams, trace pyrite, rare glauconite (flaky), soft, slightly sticky, blocky.
2530 - 2540	100	<u>CLAYSTONE</u> : As above, common forams, trace pyrite (aggregates), no observable glauconite, soft, slightly sticky, blocky.
2540 - 2550	-	Not circulated to surface.
2550 - 2560	100	<u>CLAYSTONE</u> : Light to medium grey, very calcareous, abundant forams and trace to common fossil fragments, trace pyrite, soft, slightly sticky, blocky.
2560 - 2570	100	<u>CLAYSTONE</u> : As above, becoming more medium grey, abundant forams, trace sponge spicules, common fossil fragments, trace to common pyrite, soft, sticky, blocky.
2570 - 2580	100	<u>CLAYSTONE</u> : Light to predominantly medium grey, abundant and varied calcareous forams, nodular pyrite, blocky to fissile, firm to hard.
2580 - 2590	100	<u>CLAYSTONE</u> : As above, rare elongate spalled cuttings (very slightly overpressured), trace glauconite, micromicaceous.
2590 - 2600	100	<u>CLAYSTONE</u> : As above, blocky to subfissile, micromicaceous, firm.
2600 - 2610	100	<u>CLAYSTONE</u> : As above, plus pale green glauconitic, blocky to subfissile, trace pyrite, firm to moderately hard.
2610 - 2620	100	<u>CLAYSTONE</u> : As above, common to abundant forams, trace pyrite, trace fossil fragments, soft to hard, sticky, subfissile.
2620 - 2630	100	<u>CLAYSTONE</u> : As above, common forams, trace pyrite, firm to hard.
2630 - 2640	100	<u>CLAYSTONE</u> : Light to medium grey, very calcareous, trace dolomite, common forams, trace pyrite, trace to rare glauconite (mid green, flaky), soft to firm sticky, blocky.
2640 - 2650	100	<u>CLAYSTONE</u> : Light to medium grey, occasionally medium grey/green, very calcareous, common forams, trace pyrite (large nodules), trace glauconite (slightly nodular), soft to firm, slightly sticky, blocky.
2650 - 2660	100	<u>CLAYSTONE</u> : As above, trace grey/green claystone (glauconitic), trace pyrite, common forams, soft to firm, sticky, blocky.
2660 - 2670	100	<u>CLAYSTONE</u> : (i) 90%, as above, common forams, trace to common pyrite, soft to occasionally moderately hard, blocky.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2670 - 2680	100	(ii) 10%, as above, green tinge, trace glauconite, trace forams, trace pyrite, firm to hard, splintery. <u>CLAYSTONE</u> : (i) 100%, as above, common forams, trace pyrite, blocky. (ii) (trace) As above, trace glauconite, trace pyrite, splintery.
2680 - 2685	100	<u>CLAYSTONE</u> : (i) Medium grey, very calcareous, predominantly argillaceous, trace pyrite (occasionally nodular), common to abundant forams, trace to rare glauconite, firm, blocky.
2685 - 2690	100	<u>CLAYSTONE</u> : (i) 95%, as above, common forams, trace pyrite, blocky. (ii) 5%, as above, trace glauconite, firm, blocky.
2690 - 2695	100	<u>CLAYSTONE</u> : (i) 90%, as above. (ii) 10%, as above.
2695 - 2700	100	<u>CLAYSTONE</u> : (i) 80%, as above, common forams, trace to common pyrite, firm to hard, blocky. (ii) 20%, as above, grey to green colour, trace glauconite, trace forams, trace disseminated pyrite, splintery to blocky, firm.
2700 - 2705	100	<u>CLAYSTONE</u> : (i) 90%, as above, common forams, trace pyrite altered to orangey brown limonite, firm, blocky. (ii) 10%, as above, grey to green colour, trace glauconite, trace forams, splintery to possible spalled cuttings, blocky, firm.
2705 - 2710	100	<u>CLAYSTONE</u> : (i) 90%, medium grey, very calcareous, common forams, trace pyrite, very rare quartz grains, firm, blocky, trace (1-2%) dull orange mineral fluorescence. (ii) 10%, as above, grey/green, trace glauconite, trace pyrite, splintery to blocky.
2710 - 2715	100	<u>CLAYSTONE</u> : (i) 100%, medium grey, occasionally grey to brown, common forams, trace pyrite, rare subrounded quartz grains (clean, coarse), firm, blocky. (ii) Trace, as above, trace glauconite.
2715 - 2720	100	<u>CLAYSTONE</u> : (i) 100%, as above, occasionally grey to brown, common forams, trace pyrite, rare quartz grains, firm, blocky. (ii) Trace, as above.
2720 - 2725	100	<u>CLAYSTONE</u> : (i) 100%, medium grey, occasionally grey to brown, very calcareous, trace to common forams, trace pyrite, trace micromicaceous, trace to rare quartz grains, rare carbonaceous debris, firm, blocky. (ii) Trace, medium grey to green, trace glauconite.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2725 - 2730	100	<u>CLAYSTONE</u> : (i) 100%, as above, trace to rare quartz grains, rare carbonaceous debris, firm, blocky. (ii) Trace, as above, trace glauconite, trace pyrite.
2730 - 2735	100	<u>CLAYSTONE</u> : As above, trace to rare quartz grains, rare carbonaceous material, trace pyrite associated with calcite cement, firm, blocky.
2735 - 2740	100	<u>CLAYSTONE</u> : Medium grey, occasional tinge of grey/brown, very calcareous, common forams, common pyrite (pyrite fragments show calcite veining and recrystallized pyrite fracture fill), trace quartz grains (coarse, bit fractured, orange to pink tinge), blocky, firm to hard).
2740 - 2745	100	<u>CLAYSTONE</u> : As above, occasionally slightly silty, trace pyrite, common forams, blocky, firm.
2745 - 2750	100	<u>CLAYSTONE</u> : As above, trace carbonaceous debris, trace pyrite, common forams, trace orange to pink quartz grains (very well rounded, medium), blocky, firm.
2750 - 2755	100	<u>CLAYSTONE</u> : As above, trace carbonaceous, trace pyrite, common forams, trace quartz grains, blocky, firm.
2755 - 2760	100	<u>CLAYSTONE</u> : As above, trace siltstone size particles, firm, blocky.
2760 - 2765	100	<u>CLAYSTONE</u> : As above, trace quartz grains (as above), trace pyrite, firm, blocky.
2765 - 2770	100	<u>CLAYSTONE</u> : As above, trace glauconite, trace quartz grains, trace pyrite, trace carbonaceous material, firm, blocky.
2770 - 2775	100	<u>CLAYSTONE</u> : As above, trace quartz grains (orange tinged grains), trace pyrite, trace carbonaceous, trace glauconite, firm, blocky.
2775 - 2780	100	<u>CLAYSTONE</u> : As above, common forams, no quartz grains, firm to blocky, trace spalled claystone fragments, trace disseminated pyrite in medium grey to green firm to hard claystone, trace carbonaceous debris.
2780 - 2785	100	<u>CLAYSTONE</u> : As above, trace disseminated pyrite, common pyrite (pyrite fragments show calcitic veining and secondary pyrite fracture fill), trace carbonaceous debris, firm, blocky, common forams.
2785 - 2790	100	<u>CLAYSTONE</u> : As above, common pyrite (disseminated and fragments), trace quartz grains, common forams, sponge spicules, firm to blocky.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2790 - 2795	100	<u>CLAYSTONE</u> : As above, grey to green claystone (blocky and flaky but firm to hard) , abundant blocky and disseminated pyrite (also associated with calcite infilling fractures in pyrite fragments), calcite fragments, common forams, sponge spicules, shell fragments, trace carbonaceous debris and medium grey claystone, occasionally grey to brown, very calcareous.
2795 - 2800	100	<u>CLAYSTONE</u> : As above, trace pyrite, common forams, blocky firm, trace carbonaceous debris.
2800 - 2805	100	<u>CLAYSTONE</u> : As above, trace pyrite, common forams, trace carbonaceous debris, blocky to flaky, firm.
2805 - 2810	100	<u>CLAYSTONE</u> : As above, trace pyrite, common forams, (occasionally black due to oxidised pyrite), trace carbonaceous debris, sponge spicules.
2810 - 2815	100	<u>CLAYSTONE</u> : (i) Medium grey, occasionally grey to brown, very calcareous, trace common forams, trace pyrite, trace carbonaceous debris, blocky to flaky. (ii) Medium grey green claystone, trace pyrite, firm to blocky, trace forams, pyrite in 2 forms (i) blocky whole grains (ii) blocky aggregates/clusters of small grains
2815 - 2820	100	<u>CLAYSTONE</u> : As above, trace carbonaceous debris (a) disseminated throughout softer, light grey green claystone, and (b) in fine laminae form but discontinuous, trace common forams, sponge spicules (trace), various forams.
2820 - 2825	100	<u>CLAYSTONE</u> : Medium grey, trace grey to brown, very calcareous, common forams, trace Fe stained quartz grains, trace pyrite, trace glauconite, firm, blocky.
2825 - 2830	100	<u>CLAYSTONE</u> : Light grey, trace grey to brown, very calcareous, trace pyrite (pyritized sponge spicules), trace quartz grains (slight orange tinge), trace glauconite, firm, blocky.
2830 - 2835	100	<u>CLAYSTONE</u> : Light to medium grey, occasionally grey to brown, very calcareous, trace peletal glauconite, rare quartz grains (well rounded, bit fractured medium to fine), trace pyrite (disseminated), common forams, moderately firm, blocky.
2835 - 2840	100	<u>CLAYSTONE</u> : As above, rare glauconite, rare pyrite, common forams, firm, blocky (high proportion of cavings).

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2840 - 2845	100	<u>CLAYSTONE</u> : As above, trace glauconite (medium to dark green), common forams, firm, blocky.
2845 - 2850	100	<u>CLAYSTONE</u> : As above, trace glauconite, trace quartz grains, (rounded to subrounded, bit fractured, medium to coarse), trace dolomite and fine sand aggregates, trace to common forams, trace pyrite, firm, blocky.
2850 - 2855	100	<u>CLAYSTONE</u> : As above, rare glauconite, trace to rare quartz grains (as above), trace dolomite and dolomitic cement, trace to common forams, trace pyrite, firm, blocky.
2855 - 2860	100	<u>CLAYSTONE</u> : Medium grey, occasionally grey to green, very calcareous, common forams, trace pyrite, rare quartz grains (as above, trace orange tinge), trace dolomite, firm, blocky.
2860 - 2865	100	<u>CLAYSTONE</u> : As above, trace quartz grains (as above), trace forams, trace dolomite in aggregates, firm, blocky.
2865 - 2870	100	<u>CLAYSTONE</u> : As above, trace quartz grains, trace dolomite in minor aggregates, firm, blocky, (very minor increase in abundance of quartz grains, but still a trace).
2870 - 2875	100	<u>CLAYSTONE</u> : As above, trace quartz grains, trace dolomitic cemented quartz grain aggregates (very fine), trace to common forams, trace pyrite, firm, blocky.
2875 - 2880	100	<u>CLAYSTONE</u> : Medium grey, occasionally light grey, very calcareous, trace to common forams, trace pyrite, trace quartz grains ((i) medium to coarse, slight orange tarnish, rounded, (ii) very fine, well rounded, associated with dolomitic cement), firm, blocky, trace dull orange, dolomite mineral fluorescence (abundant quartz grains increasing).
2880 - 2885	100	<u>CLAYSTONE</u> : As above, trace dolomitic cemented quartz aggregates (very fine, buff to cream, tight), trace pyrite, trace dark green peletal glauconite, firm, blocky.
2885 - 2890	100	<u>CLAYSTONE</u> : As above, trace glauconite, firm, blocky.
	Tr	<u>SANDSTONE</u> : Buff to clear, tight to moderate, fine to very fine grained, well sorted, subrounded, strong dolomitic cement, hard, very poor inferred porosity.
2890 - 2895	100	<u>CLAYSTONE</u> : As above, trace glauconite, trace pyrite, trace to common forams.
	Tr	<u>SANDSTONE</u> : Loose quartz grains, Fe stained very fine, occasionally medium to coarse grained, subangular to rounded, trace dolomite cement.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2895 - 2900	95 5	<u>CLAYSTONE</u> : As above. <u>SANDSTONE</u> : Light grey to light brown, slight orange tarnish, very fine grained, well sorted, rounded to well rounded, clean and loose, common peletal glauconite, trace dolomitic cemented aggregates, very good inferred porosity, slight trace dull orange dolomite mineral fluorescence.

Core No 1:2903 to 2921m, Rec 12m (66.7%)

Chip Sample Descriptions

2903.0	100	<u>SANDSTONE</u> : Medium brown, clear to translucent, very fine to fine grained, rare disseminated medium grains, moderate to well sorted, angular to rounded, abundant brown (oil stained) argillaceous matrix, matrix supported, weak calcareous cement, abundant, carbonaceous flakes, micaceous, abundant glauconite pellets, no visual porosity, no fluorescence, no cut, trace dull film residue.
2904.07	100	<u>SANDSTONE</u> : Medium brown to buff, clear to cream, fine grained, occasional medium grains, moderately sorted, subangular to subrounded, abundant brown argillaceous matrix and associated common to abundant carbonaceous flakes, trace to common calcareous cement, common dolomitic cement, hard, abundant glauconite pellets, trace micro-micaceous, trace to common disseminated pyrite, no visual porosity, trace, very patchy, dull, yellow fluorescence, slow streaming cut, moderately bright yellow crush cut, thin film residue.
2904.98	100	<u>SANDSTONE</u> : Buff to medium brown, clear to light brown, moderately consolidated, occasionally slightly loose, fine to medium grained, occasionally coarse to very coarse, moderate to poorly sorted, subangular to subrounded, common argillaceous matrix, matrix supported, common moderate to strong dolomitic cement (trace sideritic cement), abundant glauconite, abundant to common micromica (occasional mica flakes), trace pyrite, poor inferred porosity, strong hydrocarbon odour. No visible fluorescence, instant, milky yellow, streaming cut, thick film residue.
2905.56	100	<u>SANDSTONE</u> : Medium brown, clear to light brown (oil stained) very fine to fine, disseminated medium to coarse grains, poorly to moderately sorted, angular to subrounded, abundant brown argillaceous matrix (strongly swelling), matrix supported, very weak calcareous cement, abundant glauconite, abundant micromica and mica flakes, common to abundant carbonaceous matter, oil stained, strong hydrocarbon odour, no to very poor

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		visual porosity, no visual fluorescence, slow, pale yellow/green streaming cut, thin film residue.
2905.79	100	<u>SANDSTONE</u> : Medium brown to light grey, as above, poorly sorted, moderately swelling brown argillaceous matrix, weak calcareous cement, poor visual porosity, strong hydrocarbon odour, no visible fluorescence, instant moderately bright green/yellow streaming cut, thick film residue.
2907.20	100	<u>SANDSTONE</u> : Medium brown, as above, trace calcareous cement, slightly swelling argillaceous matrix, poor visual porosity, strong hydrocarbon odour, no visible fluorescence, fast pale yellow/green streaming cut, thin film residue.
2908.60	100	<u>SANDSTONE</u> : Medium brown, as above, strong calcareous cement, slightly swelling argillaceous matrix, very poor visual porosity, strong hydrocarbon odour, no visible fluorescence, very slow streaming cut, strong bright yellow crush cut, thick film residue.
2910.00	100	<u>SANDSTONE</u> : Medium to dark brown, as above, very oil stained, strongly swelling argillaceous matrix, weak calcareous cement, strong hydrocarbon odour, very poor visual porosity, no visible fluorescence, slow streaming cut, strong yellow crush cut, thick film residue.
2911.41	100	<u>SANDSTONE</u> : Medium to dark brown, clear to light brown, fine with disseminated medium to coarse grains, poorly sorted, angular to subrounded, abundant argillaceous matrix (strongly swelling), trace to common carbonaceous flecks in matrix, no observable calcareous cement, rare siliceous cement, (trace overgrowths), firm aggregates, abundant glauconite, trace to common micromica, Trace pyrite, poor inferred porosity, no visual fluorescence, very slow streaming yellow cut, strong yellow crush cut thick yellow film residue.
2912.82	100	<u>SANDSTONE</u> : Medium brown, clear to light brown (slightly orange brown), moderately loose, fine to medium grained, occasionally coarse, moderate to poorly sorted, subangular to subrounded, no observable cement, abundant argillaceous matrix, common to trace carbonaceous flecks in matrix, firm to moderately hard aggregates, abundant glauconite, trace micromica, no observable pyrite, moderate to poor visual porosity, no visual fluorescence, very slow cut, moderate crush cut, thin film residue.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2914.23	100	<u>SANDSTONE</u> : Medium brown, occasionally dark brown, grains clear to off white, moderately tight, medium, occasionally coarse to very coarse grained, poorly sorted, angular to subrounded, no calcareous cement, trace dolomite cement (very minor), abundant argillaceous matrix, firm to hard aggregates, trace carbonaceous debris, abundant glauconite, trace micromica, poor inferred porosity, no visual fluorescence, strong crush cut, thick film residue.
2915.0	100	<u>SANDSTONE</u> : Medium to light brown, grains clear to buff, fine grained, well sorted, angular to subrounded, moderate calcareous cement, common brown argillaceous matrix, moderately swelling, abundant peletal and micaceous glauconite, abundant micromica, strong hydrocarbon odour, poor to fair visual porosity, no visual fluorescence, instant creamy yellow streaming cut, thick film residue.
2915.0 - 2921.0		No Sample

CUTTINGS DESCRIPTIONS

2921.0 - 2925	60	<u>CLAYSTONE</u> : Light to medium grey, very calcareous, common forams (cavings).
	40	<u>SANDSTONE</u> : Clear to translucent, very fine to medium grained, moderately sorted, angular to subrounded, loose and clean, trace glauconite pellets, common mica flakes, assumed claystone matrix washing out at shakers, poor inferred porosity, no fluorescence.
2925 - 2930	60	<u>CLAYSTONE</u> : As above.
	40	<u>SANDSTONE</u> : As above, very fine to coarse grained, rare pyrite nodules, poorly sorted.
	Tr	<u>SILTSTONE</u> : Light brown to buff, arenaceous and argillaceous matrix, grading to very fine sandstone, as above.
2930 - 2935	70	<u>SANDSTONE</u> : As above.
	30	<u>CLAYSTONE</u> : As above.
	Tr	<u>SILTSTONE</u> : As above, waxy micaceous texture.
2935 - 2940	70	<u>CLAYSTONE</u> : As above.
	30	<u>SANDSTONE</u> : As above.
2940 - 2945	70	<u>SANDSTONE</u> : As above, becoming fine to medium grained (reworked beach grains), poorly sorted, angular to well rounded, loose and clean, inferred argillaceous matrix, common to abundant glauconite pellets, trace mica, trace lithics, poor to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Brown to buff, arenaceous with argillaceous matrix, abundant glauconite, abundant mica, brown waxy (kerogenous)

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		texture, grades to very fine sandstone, as above, no fluorescence.
	30	<u>CLAYSTONE</u> : As above, cavings.
2945 - 2950	70	<u>SANDSTONE</u> : As above, fine to coarse grained, loose, inferred argillaceous matrix, no fluorescence.
	30	<u>CLAYSTONE</u> : Cavings, as above.
	Tr	<u>SILTSTONE</u> : Light grey to medium brown, as above.
2950 - 2954	80	<u>SANDSTONE</u> : As above, fine to medium grained, moderately sorted, predominantly rounded, loose and clean, poor to fair inferred porosity, no fluorescence.
	20	<u>CLAYSTONE</u> : As above.
	Tr	<u>SILTSTONE</u> : Waxy, medium brown, as above.
2954 - 2960	80	<u>SANDSTONE</u> : As above, rare dolomitic cemented aggregates, trace to common well rounded lithics (quartzite and chlorite schist), trace pyrite, poor inferred porosity, no fluorescence.
	20	<u>CLAYSTONE</u> : As above, cavings.
2960 - 2965	70	<u>SANDSTONE</u> : As above, becoming medium to coarse grained, well rounded, subspherical (beach sand), fair inferred porosity, no fluorescence.
	30	<u>CLAYSTONE</u> : Cavings, as above.
2965 - 2970	80	<u>SANDSTONE</u> : Light grey, clear to translucent, occasionally medium grey and pink grains, moderately sorted, angular to well rounded, loose and clean, rare dolomitic cemented aggregates with glauconite/mica/pyrite matrix, common glauconite pellets, trace to common crystalline pyrite, common lithics (well rounded), good inferred porosity, no fluorescence.
	20	<u>CLAYSTONE</u> : Cavings, as above.
	Tr	<u>SILTSTONE</u> : Medium brown to buff, arenaceous, waxy lustre, glauconite pellets, blocky to sucrosic, hard (cavings).
2970 - 2975	80	<u>SANDSTONE</u> : As above, increased bit fractured angular grains, good to very good inferred porosity, no fluorescence.
	20	<u>CLAYSTONE</u> : As above, cavings.
	Tr	<u>SILTSTONE</u> : As above.
2975 - 2980	90	<u>SANDSTONE</u> : As above, predominantly fine to medium grained, trace quartz overgrowths, (becoming more fluvial), good inferred porosity, no fluorescence.
	10	<u>CLAYSTONE</u> : As above, cavings.
	Tr	<u>SILTSTONE</u> : As above.
2980 - 2985	90	<u>SANDSTONE</u> : As above, predominantly medium grained, good to very good inferred porosity, no fluorescence.
	10	<u>CLAYSTONE</u> : As above, cavings.

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	<u>SILTSTONE</u> : As above.
2985 - 2990	90	<u>SANDSTONE</u> : As above, predominantly medium grained, good to very good inferred porosity, no fluorescence.
	10	<u>CLAYSTONE</u> : As above, cavings.
	Tr	<u>SILTSTONE</u> : As above.
2990 - 2995	95	<u>SANDSTONE</u> : As above, predominantly medium grained, subangular to subrounded (reworked fluvial), occasionally coarse rounded grains (beach), very good inferred porosity, no fluorescence.
	5	<u>CLAYSTONE</u> : As above, cavings.
2995 - 3000	Tr	<u>SILTSTONE</u> : As above.
	100	<u>SANDSTONE</u> : As above, medium to coarse grained, loose and clean, common to abundant glauconite and pyrite, very good inferred porosity, no fluorescence.
3000 - 3005	100	<u>SANDSTONE</u> : As above, medium to coarse grained, loose and clean, common to abundant glauconite and pyrite, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
	Tr	<u>SILTSTONE</u> : As above.
3005 - 3010	100	<u>SANDSTONE</u> : As above, light grey, clear to translucent, fine to coarse, predominantly medium grained, moderately sorted, subangular to well rounded, loose and clean, abundant glauconite pellets, common crystalline and nodular pyrite, trace to common lithics, trace mica, very good inferred porosity, no fluorescence.
3010 - 3015	100	<u>SANDSTONE</u> : As above, trace pyrite cemented aggregates, very good inferred porosity, no fluorescence.
3015 - 3020	100	<u>SANDSTONE</u> : As above, predominantly medium grained (reworked fluvial), very good inferred porosity, no fluorescence.
3020 - 3025	100	<u>SANDSTONE</u> : As above, medium to coarse grained, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3025 - 3030	100	<u>SANDSTONE</u> : As above, medium to coarse grained, trace calcareous cement, very good inferred porosity, no fluorescence (strong hydrocarbon bubble reaction to HCl. Oily scum and lustre; Not in 3020 sample) (No mud additives).
	Tr	<u>SILTSTONE</u> : Brown to buff, arenaceous, micromicaceous, blocky to subfissile, firm.
3030 - 3035	100	<u>SANDSTONE</u> : As above, predominantly coarse grained, well rounded, loose and clean, very good inferred porosity, no fluorescence (no oil reaction).

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3035 - 3040	100	<u>SANDSTONE</u> : As above, common bit fractured shards, trace calcareous cement, loose and clean, very good visual porosity, no fluorescence (no hydrocarbon bubble reaction).
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3040 - 3045	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence (slight oil reactions; changed to fresh 10% HCl - same reaction).
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3045 - 3050	100	<u>SANDSTONE</u> : As above, light grey, clear to translucent, common medium grey, pale green, pale orange grains, fine to coarse, predominantly coarse grained, poorly to moderately sorted, angular to well rounded, loose and clean, rare dolomitic cement aggregates, common well rounded quartz and quartzite lithic grains, rare schistose lithics, trace glauconite, trace pyrite cemented fine grained aggregates, trace mica, very good inferred porosity, no fluorescence (no oil reaction).
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3050 - 3055	100	<u>SANDSTONE</u> : As above, predominantly coarse grained, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3055 - 3060	100	<u>SANDSTONE</u> : As above, medium to coarse grained, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3060 - 3065	90	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	10	<u>CLAYSTONE</u> : As above, cavings.
3065 - 3070	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3070 - 3075	100	<u>SANDSTONE</u> : As above, rare bitumen staining, very good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3075 - 3080	100	<u>SANDSTONE</u> : (1) 70%, as above, (2) 30%, light grey, clear to translucent, very fine grained, grading to arenaceous siltstone, well sorted, subangular to subrounded, moderate to strong calcareous cement, trace white argillaceous matrix, trace very fine glauconite, hard to very hard, no visual porosity.

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	FLU: 30%, dull, spotty, yellow, weak crush cut, thin ring residue (fast streaming cut in chlor/HCl). <u>CLAYSTONE</u> : As above, cavings.
3080 - 3085	100	<u>SANDSTONE</u> : (1) 10%, as above. (2) 90%, as above, very fine to fine grained, very poor to no visual porosity. FLU: 90%, moderately bright, spotty, yellow, weak pale yellow crush cut, thin ring residue.
3085 - 3090	100	<u>SANDSTONE</u> : (1) 20%, as above, coarse grained, well rounded (cavings). (2) 80%, as above, trace brown kerogenous matter. FLU: 80%, as above, weak crush cut, thin ring residue.
3090 - 3095	90	<u>SANDSTONE</u> : (1) 10%, as above. (2) 80%, as above. FLU: 70%, as above, weak crush cut, thin ring residue.
	10	<u>SILTSTONE</u> : Light grey, arenaceous, grading to very fine sandstone, as above (2).
3095 - 3100	100	<u>SANDSTONE</u> : (2) 40%, as above. FLU: 30%, as above, weak crush cut, thin ring residue. (1) 10%, as above. <u>SANDSTONE</u> : (3) Light grey, clear to translucent, medium to coarse, predominantly medium grained, moderately sorted, subangular to subrounded, clean and loose, good inferred porosity, no fluorescence.
3100 - 3105	100	<u>SANDSTONE</u> : (1 and 3 combined) 60%, medium to coarse grained, subangular to well rounded, good inferred porosity, no fluorescence (mostly cavings). <u>SANDSTONE</u> : (2) as above, no visual porosity. FLU: 20%, as above, very weak crush cut, thin ring residue.
3105 - 3110	100	<u>SANDSTONE</u> : (1) 75%, as above, no fluorescence. (2) 25%, as above, no visual porosity. FLU: 20%, as above.
3110 - 3115	100	<u>SANDSTONE</u> : (1) 80%, as above, no fluorescence. (2) 20%, as above, smaller aggregates, no visual porosity. FLU: 10%.
3115 - 3120	100	<u>SANDSTONE</u> : (1) 85%, as above, increased bit fracturing, inferred increased siliceous cement, rare quartz overgrowths, good inferred porosity, no fluorescence. (2) 15%, as above, small aggregates, very fine grained, decreasing glauconite, no visual porosity.

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		FLU: 10%, as above, weak crush cut, thin ring residue.
3120 - 3125	100	<u>SANDSTONE</u> : (1) 85%, as above, no fluorescence. (2) 15%, as above. FLU: 5%, as above.
3125 - 3130	100	<u>SANDSTONE</u> : (1) 90%, as above, predominantly medium grained, angular to subrounded, loose and clean, good visual porosity, no fluorescence. (2) 10%, very small aggregates. FLU: 5%, as above.
3132 BOTTOMS UP	100	<u>SANDSTONE</u> : (1) 90%, becoming fine to medium grained, angular to subangular, moderately sorted, inferred siliceous cement, fair inferred porosity, no fluorescence. (2) <u>SANDSTONE</u> : 10%, as above. FLU: 5%, as above.
3132 - 3140	80	<u>SANDSTONE</u> : 90%, light grey, clear to translucent, fine to very coarse, predominantly medium grained, abundant bit fractured grains, poorly to moderately sorted, subangular to well rounded, loose and clean, trace pyrite, trace glauconite, trace mica, common lithic grains, good inferred porosity, no fluorescence. <u>SANDSTONE</u> : (2) 5%, as above. FLU: Trace, as above (cavings).
	20	<u>CLAYSTONE</u> : Cavings (after trip).
3140 - 3145	80	<u>SANDSTONE</u> : As above, predominantly medium grained, abundant mica, good inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : (2), as above, very small, very fine grained aggregates, probably cavings. FLU: Trace, as above, weak crush cut, trace residue.
	20	<u>CLAYSTONE</u> : As above, cavings.
3145 - 3150	95	<u>SANDSTONE</u> : As above, predominantly medium grained, subangular to rounded, predominantly rounded, abundant pyrite (mostly cavings), loose, good inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : (2), as above. FLU: Trace, as above.
	5	<u>CLAYSTONE</u> : Cavings.
3150 - 3155	100	<u>SANDSTONE</u> : As above, predominantly medium angular (bit fractured) grains, increasing siliceous cement, good inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : (2) As above.
	Tr	FLU: As above.
	Tr	<u>CLAYSTONE</u> : Cavings.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3155 - 3160	100	<u>SANDSTONE</u> : As above, common coarse well rounded grains, loose and clean, good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : Cavings.
3160 - 3165	100	<u>SANDSTONE</u> : As above, good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3165 - 3170	100	<u>SANDSTONE</u> : As above, predominantly medium, common bit fractured shards, good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3170 - 3175	100	<u>SANDSTONE</u> : As above, good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3175 - 3180	100	<u>SANDSTONE</u> : As above, predominantly coarse grained, good inferred porosity, no fluorescence.
3180 - 3185	90	<u>SANDSTONE</u> : As above, predominantly coarse grained, abundant bit fractured grains, good inferred porosity, no fluorescence.
	10	<u>CLAYSTONE</u> : As above, cavings.
3185 - 3190	100	<u>SANDSTONE</u> : As above, predominantly coarse grained, well rounded, bit fractured grains, good inferred porosity, no fluorescence.
	Tr	<u>CLAYSTONE</u> : As above, cavings.
3190 - 3195	100	<u>SANDSTONE</u> : As above, good inferred porosity, trace quartz overgrowths, no fluorescence.
3195 - 3200	100	<u>SANDSTONE</u> : As above, common pyrite, good inferred porosity, no fluorescence.
3200 - 3205	100	<u>SANDSTONE</u> : As above, predominantly medium grained, angular to rounded, poor to moderately sorted, loose and clean, trace mica, good inferred porosity, no fluorescence.
3205 - 3210	100	<u>SANDSTONE</u> : Light grey, clear to translucent, fine to coarse, predominantly coarse grained, common bit fractured shards, poor to moderately sorted, common fine to coarse grain aggregates with strong dolomitic (anhydrite) cement, predominantly loose and clean, common mica, trace pyrite, very hard aggregates, with poor to very poor visual porosity, trace bright yellow mineral fluorescence, no cut.
3210 - 3215	100	<u>SANDSTONE</u> : As above, abundant bit fractured grain aggregates with strong dolomite/anhydrite cement, abundant bright yellow mineral fluorescence, very weak crush cut, thin ring residue (trace hydrocarbons locked in cemented aggregates).

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3215 - 3220	100	<u>SANDSTONE</u> : As above, predominant bit fractured, dolomitic (anhydrite) cemented aggregates, no visual porosity, bright yellow mineral (dolomite) fluorescence, very weak crush cut, thin ring residue.
3220 - 3225	100	<u>SANDSTONE</u> : As above, coarse to very coarse grained, strong dolomitic (anhydrite) cement, abundant mineral fluorescence, no visual porosity, very weak crush cut, thin ring residue.
3225 - 3230	100	<u>SANDSTONE</u> : As above, no visual porosity, abundant bright yellow mineral fluorescence, weak crush cut, thin ring residue.
3230 - 3235	100	<u>SANDSTONE</u> : As above, no visual porosity, abundant mineral fluorescence, very weak crush cut, thin ring residue.
3235 - 3240	100	<u>SANDSTONE</u> : As above, no visual porosity, abundant mineral fluorescence, very weak crush cut, thin ring residue.
3240 - 3245	100	<u>SANDSTONE</u> : As above, no visual porosity, common mineral fluorescence (dolomite/anhydrite), very weak crush cut, thin ring residue.
3245 - 3250	100	<u>SANDSTONE</u> : As above, common very fine adhered pyrite, predominantly very coarse bit fractured grains, and grain aggregates with strong dolomite/anhydrite cement, no visual porosity, abundant bright yellow/orange mineral fluorescence, weak crush cut, thin ring residue.
3250 - 3255	100	<u>SANDSTONE</u> : Light grey, clear to translucent, medium to very coarse grained, bit fractured shards, poorly sorted, subrounded to well rounded, strong dolomitic cement, clean, trace pyrite, common quartz overgrowths, very poor inferred porosity, abundant to common bright amber/yellow mineral fluorescence, very weak crush cut, thin ring residue.
3255 - 3260	100	<u>SANDSTONE</u> : Light grey, as above, common lithic grains, fluorescence as above, weak crush cut, thin ring residue.
	Tr	<u>SILTSTONE</u> : Light grey to medium brown, arenaceous to argillaceous (interlaminated), carbonaceous (kerogenous), trace micromica, sucrosic to blocky, firm.
3260 - 3265	100	<u>SANDSTONE</u> : As above, trace black magnetic metallic grains, rare coal fragments, fluorescence as above, very weak crush cut, thin ring residue.
	Tr	<u>SILTSTONE</u> : As above.
3265 - 3270	90	<u>SANDSTONE</u> : As above, common dolomitic cemented fine grained aggregates, common

BLACKBACK-1

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		lithics (dark grey well rounded quartz grains), rare well rounded woody coal fragments, fluorescence as above, very weak crush cut, thin ring residue.
	10	<u>SILTSTONE</u> : As above, more arenaceous, abundant lithics, sucrosic, friable to hard (dolomitic cement) (may form fine grained matrix to loose coarse grains in sandstone above).
3270 - 3275	90	<u>SANDSTONE</u> : As above, medium to coarse grained, strong dolomitic cement, abundant dark grey quartz lithics. FLU: As above, very weak crush cut, thin ring residue.
	10	<u>SILTSTONE</u> : Predominantly arenaceous, as above, very calcareous to dolomitic.
3275 - 3280	85	<u>SANDSTONE</u> : As above, fine to coarse, predominantly medium grained, moderately sorted, subangular to subrounded, predominantly loose, common dolomitic cemented aggregates, trace argillaceous matrix, abundant lithics, trace mica, rare pyrite, aggregates are friable to very hard, very poor to poor visual porosity, common to abundant amber yellow mineral fluorescence, very weak crush cut, thin ring residue.
	15	<u>SILTSTONE</u> : As above, arenaceous with medium grey argillaceous matrix.
3280 - 3283	85	<u>SANDSTONE</u> : As above, common quartz overgrowths, abundant lithics, abundant dolomitic cemented aggregates, common mineral fluorescence, weak crush cut, thin ring residue.
	15	<u>SILTSTONE</u> : As above, plus interlaminated brown carbonaceous, micromicaceous.
3283 - 3285		Pull out of hole for intermediate logging suite.
3285 - 3290	80	<u>CAVINGS</u> : Marine calcareous claystones, as above.
	15	<u>SANDSTONE</u> : Light grey, clear to translucent, coarse to very coarse grained, moderately sorted, well rounded, frosted, loose, clean (cavings), no fluorescence, rare aggregates with strong dolomitic cement, trace mineral fluorescence.
	5	<u>SILTSTONE</u> : Light brown, argillaceous/carbonaceous interlaminated with light grey arenaceous, micromicaceous, sucrosic to subfissile, firm to hard.
	Rare	<u>ANHYDRITE</u> : Clear to white (selenitic) perfect basal cleavage, abundant very finely disseminated pyrite (brassy to black).
3290 - 3295	80	<u>CAVINGS</u> : As above.
	10	<u>SANDSTONE</u> : As above.
	10	<u>SILTSTONE</u> : As above, very micaceous in parts.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3295 - 3300	70	<u>CAVINGS</u> : As above.
	20	<u>SANDSTONE</u> : As above, common grey well rounded quartz grains, common coarse grained aggregates with strong dolomitic cement, trace mineral fluorescence, very weak crush cut, thin ring residue.
	10	<u>SILTSTONE</u> : As above, becoming more carbonaceous, rare coal fragments.
	Tr	<u>COAL</u> : Dark grey to black, very silty, earthy to subvitreous, blocky, moderately hard.
3300 - 3320	60	<u>CAVINGS</u> : As above.
	25	<u>SANDSTONE</u> : As above, trace mineral fluorescence, very weak crush to no cut, thin ring residue.
	15	<u>SILTSTONE</u> : As above, abundant waxy mica.
	Tr	<u>COAL</u> : Black, bituminous, vitreous, conchoidal fracture, brittle, hard.
	Rare	<u>ANHYDRITE</u> : As above, rare pink grains.
3320 - 3325	30	<u>CAVINGS</u> :
	40	<u>SANDSTONE</u> : Translucent to clear, commonly white to light grey, predominantly medium to coarse, rare coarse to very coarse grained, poor to moderately sorted, subrounded to rounded, clean, loose, fair to good inferred porosity, minor white to light grey, very fine to fine well cemented grain aggregates with dolomitic cement, minor white argillaceous matrix, hard to very hard, brittle, tight visual porosity, trace dull yellow mineral fluorescence.
	25	<u>SILTSTONE</u> : As above, becoming light to medium grey/brown, very micromica, trace carbonaceous flecks, firm to moderately hard, subfissile.
	15	<u>COAL</u> : As above.
3325 - 3330	20	<u>CAVINGS</u> : As above.
	70	<u>SANDSTONE</u> : Clear to translucent grains, rarely milky white and grey, coarse to very coarse, grading to medium in parts, moderately sorted, grains are generally very well rounded, commonly fractured, grain surfaces are frosted, weak siliceous to no cement, clean, predominantly loose, trace pyrite coating on some grains, good inferred porosity, trace dull orange mineral fluorescence, no show.
	10	<u>SILTSTONE</u> : As above.
3330 - 3335	10	<u>CAVINGS</u> : As above.
	70	<u>SANDSTONE</u> : As above, predominantly coarse grains.
	15	<u>COAL</u> : As above.
	5	<u>SILTSTONE</u> : As above.
3335 - 3340	60	<u>SANDSTONE</u> : As above, predominantly coarse, well rounded, loose.
	20	<u>COAL</u> : As above, common lignitic, woody textured inclusions, trace honey brown amber.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3340 - 3345	10	<u>SILTSTONE</u> : As above, very micromicaceous, waxy kerogenous texture.
	10	<u>CAVINGS</u> : As above.
	70	<u>SANDSTONE</u> : As above, medium to coarse grained, subangular to subrounded, loose and clean, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : As above, plus brown to buff, micromica, with carbonaceous laminae and abundant plant detritus, subfissile, firm.
3345 - 3350	Tr	<u>COAL</u> : As above.
	70	<u>SANDSTONE</u> : As above, medium to coarse, predominantly medium grained, subangular to subrounded, loose and clean, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : As above, grading to lignitic coal in parts.
	10	<u>CAVINGS</u> : As above.
3350 - 3355	Tr	<u>COAL</u> : As above.
	80	<u>SANDSTONE</u> : Translucent to occasionally clear, light grey to white, coarse to very coarse grained, occasionally medium, poorly sorted, original grain surfaces indicate subrounded to rounded nature, grains are predominantly bit fractured, weak to no siliceous cement, clean, loose, good to very good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium to dark brown, very carbonaceous, as above.
	Tr	<u>COAL</u> : As above.
3355 - 3360	80	<u>SANDSTONE</u> : As above.
	10	<u>SILTSTONE</u> : Medium to dark brown, medium grey/brown, moderately argillaceous, very lightly arenaceous, very micromicaceous, abundant carbonaceous specks and thin laminae, common plant remains and woody coal fragments, moderately hard, subfissile.
	10	<u>COAL</u> : As above.
3360 - 3365	50	<u>SANDSTONE</u> : Medium to very coarse grained, predominantly coarse, poorly sorted, subrounded to rounded, loose, clean, grading to pebbly in parts, good inferred porosity, no fluorescence.
	40	<u>COAL</u> : As above, commonly very silty, dull and brittle, grading to carbonaceous siltstone.
	10	<u>SILTSTONE</u> : As above, also very dark grey/black, grading to coal.
	3365 - 3370	90
3365 - 3370	5	<u>SILTSTONE</u> : As above, occasionally becoming very argillaceous grading to medium grey claystone.
	5	<u>COAL</u> : As above.

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3370 - 3375	95	<u>SANDSTONE</u> : Translucent to clear, medium to very coarse, predominantly coarse grained, moderately sorted, subangular to subrounded, common well rounded grains, loose and clean, no cement/matrix, good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3375 - 3380	90	<u>SANDSTONE</u> : As above.
	10	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3380 - 3385	95	<u>SANDSTONE</u> : Translucent to clear, occasionally light grey, medium to very coarse, predominantly coarse grained, poor to moderately sorted, as above.
	5	<u>SILTSTONE</u> : As above
	Tr	<u>COAL</u> : As above
3385 - 3390	70	<u>SANDSTONE</u> : Translucent to occasionally clear, light grey and milky white, medium to coarse, commonly very coarse grained, moderately sorted, subrounded to rounded, no cement or matrix visible, loose and clean frosted grains, good inferred porosity, no fluorescence.
	20	<u>COAL</u> : Black to very grey/black, moderately silty, subvitreous to vitreous lustre, subconchoidal to fissile fracture trace pyrite, woody texture in part, brittle, hard.
	10	<u>SILTSTONE</u> : Medium to dark brown, moderately argillaceous, moderate to very micromicaceous, trace to very carbonaceous with common thin coal laminae and fragments, moderately hard to firm, blocky.
3390 - 3395		Logged after trip
	80	<u>SANDSTONE</u> : As above, good to very good inferred porosity, no fluorescence.
	10	<u>COAL</u> : As above.
3395 - 3400	10	<u>SILTSTONE</u> : As above.
	60	<u>SANDSTONE</u> : Generally as above, commonly very coarse to coarse and pebbly well rounded quartz grains, overall poor to moderately sorted, subrounded, good to very good inferred porosity, no fluorescence.
	30	<u>COAL</u> : As above.
	10	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST1)

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<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
<u>START OF SIDETRACK ONE (ST1)</u>		
2450 - 2460	100	<u>CLAYSTONE</u> : Medium to light grey, very calcareous, common forams, trace fossil fragments, trace pyrite (very minor), soft to firm, slightly sticky, blocky.
	Tr	<u>LIMESTONE</u> : Medium to light grey, calcisiltite to calcilutite, trace to common forams, firm to hard, blocky, very poor inferred porosity. (percentages for lithology only, cement % excluded).
2460 - 2470	100	<u>CLAYSTONE</u> : As above, common forams, soft to firm, sticky, blocky.
2470 - 2480	100	<u>CLAYSTONE</u> : As above, trace fossil fragments.
	Tr	<u>LIMESTONE</u> : As above.
2480 - 2490	100	<u>CLAYSTONE</u> : As above, trace pyrite, very rare flaky glauconite, soft, sticky.
2490 - 2500	100	<u>CLAYSTONE</u> : As above, common forams, soft to firm, sticky, blocky.
2500 - 2510	100	<u>CLAYSTONE</u> : As above, common assorted forams.
2510 - 2520	100	<u>CLAYSTONE</u> : As above, trace pyrite (minor aggregates).
2520 - 2530	100	<u>CLAYSTONE</u> : Light to medium grey, very calcareous, abundant forams, trace to rare flaky glauconite, soft, sticky, blocky.
2530 - 2540	100	<u>CLAYSTONE</u> : As above, common foram.
2540 - 2550	100	<u>CLAYSTONE</u> : As above, trace fossil fragments (sponge spicules), soft, sticky, blocky.
2550 - 2560	100	<u>CLAYSTONE</u> : As above, trace pyrite.
2560 - 2570	100	<u>CLAYSTONE</u> : As above, common forams, trace pyrite, trace fossil fragments.
2570 - 2580	100	<u>CLAYSTONE</u> : As above, abundant forams, trace fossil fragments, soft to firm, slightly sticky, blocky.
2580 - 2590	100	<u>CLAYSTONE</u> : As above, common forams.
	Tr	<u>SILTSTONE</u> : Medium grey, calcareous to argillaceous, common forams, blocky.
2590 - 2600	95	<u>CLAYSTONE</u> : Medium grey, occasionally light grey and blue/green to grey, very calcareous, moderately swelling clays, abundant forams, trace fossil fragments, trace pyrite, rare bit fractured quartz grains (clear, moderately rounded), trace calcareous, soft to firm, sticky, blocky.
	5	<u>SILTSTONE</u> : Medium grey, occasionally light to medium brown, very calcareous, trace glauconite (flaky), firm to moderately hard, blocky.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2710 - 2720	60	<u>CLAYSTONE</u> : As above, trace to rare quartz grains, trace fossil fragments, common forams, firm, blocky.
	40	<u>SILTSTONE</u> : Medium grey, occasionally grey to brown, very calcareous, trace pyrite, trace fossil fragments, common forams, firm, blocky.
2720 - 2730	70	<u>CLAYSTONE</u> : As above, trace quartz grains (clear, loose, medium to coarse, well rounded), trace pyrite, common forams, firm, slightly sticky, moderate swelling clays, blocky.
	30	<u>SILTSTONE</u> : As above, common forams, firm, blocky.
2730 - 2740	40	<u>CLAYSTONE</u> : As above, rare quartz grains, trace pyrite.
	60	<u>SILTSTONE</u> : As above, trace forams, trace pyrite, firm to moderately hard, blocky.
2740 - 2750	70	<u>SILTSTONE</u> : As above, occasional sand sized calcareous grains, trace pyrite, moderately hard, blocky.
	30	<u>CLAYSTONE</u> : As above, rare to very rare quartz grains, trace pyrite, blocky.
2750 - 2760	80	<u>SILTSTONE</u> : As above, occasional sand sized grains, trace pyrite, trace quartz grains, rare peletal glauconite, trace forams, firm to moderately hard, sticky, blocky.
	20	<u>CLAYSTONE</u> : As above, trace pyrite, blocky.
2760 - 2770	60	<u>SILTSTONE</u> : As above, trace pyrite, common forams, moderately hard, blocky.
	40	<u>CLAYSTONE</u> : As above.
2770 - 2780	60	<u>SILTSTONE</u> : Medium to light grey, occasionally green to black to grey, very calcareous, argillaceous matrix, trace to common calcareous grains (occasionally sand sized), trace pyrite, trace quartz grains, common forams, firm to moderately hard, slightly sticky, blocky.
	40	<u>CLAYSTONE</u> : Medium to light grey, occasionally dark grey, very calcareous, trace pyrite, common forams, trace fossil fragments, firm, slightly sticky, blocky.
2780 - 2790	80	<u>SILTSTONE</u> : As above, trace pyrite, slightly calcareous, common forams, firm, blocky.
	20	<u>CLAYSTONE</u> : As above, firm, blocky.
2790 - 2800	60	<u>SILTSTONE</u> : As above, trace micromica, common forams, firm, blocky.
	40	<u>CLAYSTONE</u> : As above, grading in part to siltstone, firm, blocky.
2800 - 2805	50	<u>SILTSTONE</u> : As above, trace micromica, trace forams, grading in part to claystone, firm, blocky.
	50	<u>CLAYSTONE</u> : As above, trace pyrite.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2805 - 2810	50	<u>SILTSTONE</u> : As above, trace forams, trace fossil fragments, slightly calcareous, firm, slightly sticky, blocky.
	50	<u>CLAYSTONE</u> : As above, trace pyrite, firm, sticky, blocky, occasional blade like cuttings.
2810 - 2815	60	<u>SILTSTONE</u> : As above, grading to calcarenite in part (tight, fine to occasionally medium, moderately sorted, moderately rounded), trace medium to coarse mica flakes, common forams, firm to moderately hard, blocky.
	40	<u>CLAYSTONE</u> : As above, occasionally pale grey to green, trace micromica, trace pyrite, firm, slightly sticky, blocky.
2815 - 2820	50	<u>SILTSTONE</u> : As above, rare quartz grains (slightly orange tarnished, loose, clean, medium to fine, moderately rounded), very rare glauconite pellets.
	50	<u>CLAYSTONE</u> : As above, trace micromica, trace pyrite.
2820 - 2825	70	<u>CLAYSTONE</u> : As above, trace micromica, trace pyrite, rare calcite, firm, sticky, blocky.
	30	<u>SILTSTONE</u> : As above, trace pyrite, trace calcarenite (as above), trace to common forams, firm, blocky.
2825 - 2830	60	<u>CLAYSTONE</u> : As above, trace pyrite, trace micromica, firm, slightly sticky, blocky.
	40	<u>SILTSTONE</u> : As above, occasionally grading to calcarenite in parts, common forams, trace pyrite, firm, blocky.
2830 - 2835	70	<u>CLAYSTONE</u> : Medium grey, occasionally dark grey and green/grey, very calcareous, trace white coarse grains of fossil fragments, trace forams, trace pyrite, very rare clean, loose, medium quartz grains, trace to rare flaky glauconite, firm, moderately swelling clay, blocky.
	30	<u>SILTSTONE</u> : Medium to occasionally light grey, grading in parts to calcarenite, very calcareous, trace (crystalline) calcite, trace forams, trace pyrite, firm to occasionally moderately hard, blocky.
2835 - 2840	60	<u>CLAYSTONE</u> : As above, no observable quartz, rare forams, firm, slightly sticky, blocky.
	40	<u>SILTSTONE</u> : As above, trace pyrite, firm, blocky.
2840 - 2845	60	<u>CLAYSTONE</u> : As above, no observable quartz, common micromica, firm, slightly sticky, blocky.
	40	<u>SILTSTONE</u> : As above, occasionally medium brown grey and grading in part of calcarenite, very argillaceous in part, moderately swelling clays, blocky.

BLACKBACK-1 (ST1)

DEPTH	%	LITHOLOGY
2845 - 2850	60	<u>CLAYSTONE</u> : As above, common micromica, firm, blocky.
	40	<u>SILTSTONE</u> : As above, trace to common medium grey to brown siltstone, blocky.
2850 - 2855	70	<u>CLAYSTONE</u> : As above, common green to grey claystone, common micromica, firm, blocky.
	30	<u>SILTSTONE</u> : As above, occasionally grey/brown to brown in parts, trace fossil fragments, blocky.
2855 - 2860	50	<u>SILTSTONE</u> : Medium grey to brown grey, occasionally light to medium brown, very calcareous, calcareous foram and fossil fragments, trace pyrite, trace micromica, firm, blocky.
	50	<u>CLAYSTONE</u> : As above, strong swelling clays, firm, slightly sticky, blocky.
2860 - 2865	50	<u>SILTSTONE</u> : As above, trace quartz grains (clean, loose, coarse, subangular to subrounded), rare peletal glauconite, trace micromica, firm, blocky.
	50	<u>CLAYSTONE</u> : As above, common grey to green, trace peletal and flaky glauconite, trace pyrite, strong swelling clays, firm to occasionally soft, sticky, blocky.
2865 - 2870	50	<u>SILTSTONE</u> : As above, increasing brown in colour, trace quartz grains (as above), trace to common peletal and fine disseminated glauconite, trace micromica, firm, blocky.
	50	<u>CLAYSTONE</u> : As above, increasing green to grey, trace forams, strong swelling clays, trace glauconite flecks, firm, blocky.
2870 - 2875	60	<u>SILTSTONE</u> : Medium to light grey to brown, occasionally medium brown, very calcareous, very argillaceous, trace to common very fine disseminated quartz grains (clean, loose, medium, moderately rounded), trace peletal glauconite, firm, blocky.
	40	<u>CLAYSTONE</u> : Medium grey to grey green, very calcareous, strong swelling clays, trace flaky glauconite, trace to common micromica, trace pyrite, firm, sticky, blocky.
2875 - 2880	50	<u>SILTSTONE</u> : As above, trace peletal glauconite, trace quartz grains (as above), firm, blocky.
	50	<u>CLAYSTONE</u> : As above, common disseminated very fine flakes of glauconite, trace pyrite, strongly swelling, firm, sticky, blocky.
2880 - 2885	60	<u>SILTSTONE</u> : As above, trace glauconite, trace quartz grains, firm, blocky.
	40	<u>CLAYSTONE</u> : As above, firm, sticky.
2885 - 2890	80	<u>SILTSTONE</u> : Grey to brown, occasionally light brown and occasionally green brown, grading in parts to very fine sandstone (very fine, moderately sorted, subangular to subrounded),

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		trace mica, trace pyrite, common peletal glauconite, firm, blocky.
	20	<u>CLAYSTONE</u> : As above, occasionally green to grey, trace forams (often green in colour, glauconitized), trace pyrite, trace fossil fragments, blocky (cavings).
	Tr	<u>SANDSTONE</u> : Clear to beige, off white to buff tarnish on grains, loose, fine to predominantly medium grained, poorly sorted, subangular to subrounded, no observable cement, moderate inferred porosity, no fluorescence.
2890 - 2895	80	<u>SILTSTONE</u> : As above, abundant glauconite, trace to common quartz grains (as above), trace coarse muscovite mica, firm, blocky.
	20	<u>CLAYSTONE</u> : As above, common fossil fragments and forams, firm, blocky (cavings).
2895 - 2900	80	<u>SILTSTONE</u> : As above, abundant glauconite, trace to common quartz grains, common muscovite grains, firm, blocky.
	20	<u>CLAYSTONE</u> : As above, common fossil fragments and forams.
	Tr	<u>SANDSTONE</u> : As above, subrounded, trace pyrite, moderate to good inferred porosity, no fluorescence.
2900 - 2905	50	<u>SANDSTONE</u> : White to buff, grains off white to beige tarnish, loose, moderately clean, medium to fine grained, moderately sorted, subangular to subrounded, no observable cement, trace of green glauconite staining on some grains, trace coarse mica flakes, good inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : As above, abundant glauconite, firm, blocky.
	10	<u>CLAYSTONE</u> : As above, cavings.
<u>SIDETRACK 1 CORE 1</u>		
2905 - 2909	40	<u>SANDSTONE</u> : White to off white, off white to light buff, loose and generally clean, medium to coarse grained, moderately to poorly sorted, subangular to angular, trace argillaceous matrix, common glauconite (peletal), trace pyrite, moderate to good inferred porosity, no fluorescence.
	30	<u>SILTSTONE</u> : Medium grey, very calcareous, argillaceous matrix, slightly arenaceous in parts, trace to rare glauconite, trace forams, trace pyrite, blocky, (cavings).
	20	<u>CLAYSTONE</u> : Medium grey, very calcareous, trace micromica, trace fossil fragments, trace forams, trace pyrite, firm, slightly sticky, blocky (cavings).
	10	<u>SILTSTONE</u> : Medium brown to grey, argillaceous to arenaceous, slightly calcareous, common glauconite (peletal), grading in parts to very fine sandstone with

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		argillaceous matrix, common disseminated very fine quartz grains, blocky.
2909 - 2910	40	<u>SANDSTONE</u> : As above, coarse to medium, occasionally fine grained, subangular, poorly sorted, trace pyrite, common peletal glauconite, moderate to good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium brown to grey, as above, grading to very fine sandstone with strong argillaceous matrix, firm to moderately hard, blocky.
	20	<u>SILTSTONE</u> : Medium grey, very calcareous, as above, (cavings).
	20	<u>CLAYSTONE</u> : As above, (cavings)
2910 - 2911	20	<u>SANDSTONE</u> : As above, common green stained grains, poorly sorted, trace pyrite, common peletal glauconite, moderate to good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium brown to grey, occasionally pale brown, as above, moderately hard, blocky.
	40	<u>SILTSTONE</u> : Medium brown to grey, occasionally pale brown, as above, moderately hard, blocky.
	20	<u>CLAYSTONE</u> : As above, (cavings).
2911 - 2912	20	<u>SANDSTONE</u> : As above, poorly sorted, trace pyrite, common glauconite, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium brown to grey, as above, moderately hard, common glauconite, blocky.
	40	<u>SILTSTONE</u> : Grey to grey/brown, very calcareous, as above, blocky, (cavings).
	20	<u>CLAYSTONE</u> : As above, (cavings).
2912 - 2913	20	<u>SANDSTONE</u> : As above, predominantly medium to coarse grained, poorly sorted, common glauconite, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium brown to grey, as above.
	40	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	20	<u>CLAYSTONE</u> : As above, (cavings).
2913 - 2914	20	<u>SANDSTONE</u> : White to off white, off white to buff, loose an moderately clean, medium to coarse grained, poorly sorted, subangular, trace argillaceous matrix, trace pyrite, common glauconite (peletal), moderate to good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium brown to beige, argillaceous to arenaceous, grading in parts to fine sandstone, trace to common glauconite, trace mica, argillaceous matrix, firm to moderately hard, blocky.
	40	<u>SILTSTONE</u> : Medium grey, very calcareous, as above, (cavings).
	30	<u>CLAYSTONE</u> : As above, (cavings).
2914 - 2915	30	<u>SANDSTONE</u> : As above, moderate to good inferred porosity, no fluorescence.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	10	<u>SILTSTONE</u> : Medium brown to beige, as above.
	40	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	20	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2915 - 2916	30	<u>SANDSTONE</u> : As above, moderate inferred porosity, no fluorescence.
	15	<u>SILTSTONE</u> : Medium brown, as above.
	45	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	10	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2916 - 2917	40	<u>SANDSTONE</u> : As above, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium brown, trace pyrite, common fine peletal glauconite, moderately hard, blocky.
	30	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	10	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2917 - 2918	10	<u>SANDSTONE</u> : White to off white, 'off white to pale brown, loose and clean, medium to coarse grained, poorly sorted, subangular to occasionally subrounded, no observable matrix or cement, common peletal glauconite, moderate to good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium brown, arenaceous to argillaceous, common glauconite pellets, common disseminated fine to medium quartz grains, moderately hard, blocky.
	60	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	20	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2918 - 2919	15	<u>SANDSTONE</u> : As above, medium to coarse grained, poorly sorted, subangular (bit fractured grains), common peletal glauconite, moderate inferred porosity, no fluorescence.
	25	<u>SILTSTONE</u> : Medium brown, disseminated medium to coarse quartz grains, as above.
	50	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	10	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2919 - 2920	10	<u>SANDSTONE</u> : White to off white, grains clear to pale buff, loose and moderately clean, medium to coarse, occasionally fine grained, poorly sorted, subangular, common peletal glauconite, trace muscovite mica, good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium brown, arenaceous to argillaceous, grading in parts to fine sandstone (argillaceous), disseminated coarse to medium quartz grains, common peletal glauconite, firm to moderately hard, blocky.
	50	<u>SILTSTONE</u> : Medium grey, as above, trace forams, (cavings).
	30	<u>CLAYSTONE</u> : Medium grey, as above, trace forams, trace pyrite, (cavings).
2920 - 2921	5	<u>SANDSTONE</u> : As above, trace pyrite, trace muscovite mica, good inferred porosity, no fluorescence.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	10	<u>SILTSTONE</u> : Medium brown, as above, common peletal glauconite, common disseminated quartz grains, moderately hard, blocky.
	70	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	15	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2921 - 2922	10	<u>SANDSTONE</u> : As above, trace green glauconitic staining on grains, trace pyrite, common peletal glauconite, trace muscovite mica, good inferred porosity, blocky.
	10	<u>SILTSTONE</u> : Medium brown, as above, disseminated quartz grains, common glauconite, trace micromica, firm to moderately hard, blocky.
	60	<u>SILTSTONE</u> : Medium grey, as above, (cavings).
	20	<u>CLAYSTONE</u> : Medium grey, as above, (cavings).
2922 - 2930	10	<u>CLAYSTONE</u> : Green to grey, calcareous, firm, well sorted forams, glauconite: N.B. 70% of Sample Cavings.
	80	<u>SILTSTONE</u> : Green to grey, calcareous, forams, fossil fragments, quartz.
	10	<u>SANDSTONE</u> : Translucent, fine to medium grained, angular to subrounded, loose, clean, glauconite (pellets), mica flakes, brown argillaceous matrix, trace lithics.
2930 - 2935	70	<u>SANDSTONE</u> : Clear to translucent, fine to medium grained, quartz, angular to subrounded, loose, clean, peletal glauconite, mica flakes, trace brown argillaceous matrix, trace lithics, no visible fluorescence.
	30	<u>SILTSTONE</u> : Brown, occasional light brown fragments, firm, blocky, glauconite, trace pyrite, trace mica.
2935 - 2940	80	<u>SANDSTONE</u> : As above, no visible fluorescence.
	20	<u>SILTSTONE</u> : As above.
2940 - 2945	80	<u>SANDSTONE</u> : As above.
	20	<u>SILTSTONE</u> : As above.
2945 - 2950	80	<u>SANDSTONE</u> : Clear to white, as above, very slight fluorescence.
	20	<u>SILTSTONE</u> : Grey to brown, occasionally light brown, arenaceous, very fine, moderately sorted, subangular to subrounded grains, trace mica, trace pyrite, firm, blocky.
2950 - 2955	80	<u>SANDSTONE</u> : As above.
	20	<u>SILTSTONE</u> : As above.
2955 - 2960	80	<u>SANDSTONE</u> : Clear to translucent, fine to coarse grained, quartz, angular to subrounded, loose, clean, peletal glauconite, mica flakes, trace brown argillaceous lithic fragments, no visual fluorescence, trace dolomitic cemented aggregates.
	20	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2600 - 2610	95	<u>CLAYSTONE</u> : As above, common quartz grains (clear to off white, loose, medium to coarse, well rounded, trace pyrite cement), soft to firm, sticky, blocky.
	5	<u>SILTSTONE</u> : As above, trace glauconite (flaky), trace pyrite, trace pyrite replacing fossil fragments, moderately hard, blocky.
2610 - 2620	90	<u>CLAYSTONE</u> : As above, abundant forams, trace quartz grains (as above), soft to firm, blocky.
	10	<u>SILTSTONE</u> : As above, common pyrite, trace fossil fragments, moderately hard, blocky.
2620 - 2630	90	<u>CLAYSTONE</u> : As above, common pyrite, trace to rare quartz grains (as above), firm, blocky.
	10	<u>SILTSTONE</u> : As above, common pyrite, moderately hard, blocky.
2630 - 2640	100	<u>CLAYSTONE</u> : As above, trace pyrite, common forams, trace to common fossil fragments, moderately hard to firm, blocky, slightly sticky.
2640 - 2650	90	<u>CLAYSTONE</u> : Medium grey, very calcareous, moderate swelling clays, common forams, trace fossil fragments, trace pyrite, rare quartz grains (as above, bit fractured), firm, slightly sticky, blocky.
	10	<u>SILTSTONE</u> : Medium to light grey, very calcareous, trace pyrite, trace forams, firm, slightly sticky, blocky.
2650 - 2660	95	<u>CLAYSTONE</u> : As above, trace pyrite, firm, sticky, blocky.
	5	<u>SILTSTONE</u> : As above, firm, blocky.
2660 - 2670	90	<u>CLAYSTONE</u> : As above, trace pyrite, <u>no</u> observable quartz grains, firm, blocky.
	10	<u>SILTSTONE</u> : As above.
2670 - 2680	95	<u>CLAYSTONE</u> : As above, occasionally dark grey, common forams, firm, slightly sticky, blocky.
	5	<u>SILTSTONE</u> : As above.
2680 - 2690	95	<u>CLAYSTONE</u> : As above, trace to rare well rounded clear quartz grains, firm, sticky, strong swelling clays, blocky.
	5	<u>SILTSTONE</u> : As above, trace pyrite, trace to common forams, trace fossil fragments, firm, blocky.
2690 - 2700	80	<u>CLAYSTONE</u> : As above, common forams, trace quartz grains (as above), firm, sticky, blocky.
	20	<u>SILTSTONE</u> : As above, occasionally grey to brown, trace pyrite, firm, blocky.
2700 - 2710	80	<u>CLAYSTONE</u> : As above, trace pyrite, trace fossil fragments, common forams, trace quartz grains (as above), firm, sticky, blocky.
	20	<u>SILTSTONE</u> : As above, blocky.

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
2960 - 2965	70	<u>SANDSTONE</u> : Translucent to buff, medium to coarse grained, as above, trace pyrite.
	30	<u>SILTSTONE</u> : As above.
2965 - 2970	90	<u>SANDSTONE</u> : White to off white, clear to very slight orange tarnish on grains, generally loose and clean, fine to very coarse, predominantly coarse grained, very poorly sorted, subangular to subrounded, trace to rare siliceous cement, trace pyrite, trace glauconite (peletal) and trace green glauconite coating on some grains, very good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium brown to occasionally dark brown, predominantly arenaceous and minor argillaceous, trace siliceous cement, very strong argillaceous matrix and very glauconitic, common fine disseminated quartz grains (occasionally medium grain size), common glauconite, moderately hard, blocky.
2970 - 2975	95	<u>SANDSTONE</u> : As above, very fine to very coarse grained (occasional bit fractured grains), very poorly sorted, predominantly subrounded, trace pyrite, trace muscovite mica, excellent inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, abundant glauconite (medium to fine petal), common pyrite cement, moderate argillaceous matrix, common fine to medium disseminated quartz grains, moderately hard, blocky.
2975 - 2980	100	<u>SANDSTONE</u> : As above, predominantly medium grained, poorly sorted, subangular to subrounded, trace pyrite, trace muscovite mica, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, common pyrite, abundant glauconite, common disseminated quartz grains, moderately hard, blocky.
2980 - 2985	100	<u>SANDSTONE</u> : As above, trace siliceous cement, trace argillaceous matrix, trace pyrite, trace glauconite, trace muscovite mica, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, very argillaceous matrix, common pyrite, common to abundant glauconite, moderately hard to hard, blocky.
2985 - 2990	95	<u>SANDSTONE</u> : As above, trace siliceous cement, no observable argillaceous matrix, trace pyrite (rare pyrite aggregates with medium to coarse quartz and petal glauconite), trace muscovite mica, very good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, common pyrite, abundant glauconite, hard, blocky.
2990 - 2995	100	<u>SANDSTONE</u> : As above, trace siliceous cement, trace to common pyrite, trace glauconite,

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	trace muscovite mica, very good inferred porosity, no fluorescence. <u>SILTSTONE</u> : As above, common pyrite, hard, blocky.
2995 - 3000	100	<u>SANDSTONE</u> : Clear to off white, grains clear to occasionally buff, fine to very coarse, predominantly medium grained, generally clean and moderately loose, very poorly sorted, subangular to subrounded, trace to common pyrite cemented aggregates, aggregates very hard, common pyrite, trace muscovite mica, trace glauconite, moderate to good inferred porosity, no fluorescence.
3000 - 3005	100	<u>SANDSTONE</u> : As above, common pyrite, trace glauconite, trace coarse muscovite mica, good to very good inferred porosity, trace to rare weak yellow to white fluorescence, very dull yellow to white crush cut, very thin dull yellow white film residue.
3005 - 3010	95	<u>SANDSTONE</u> : (i) As above, common pyrite, trace glauconite, trace muscovite mica, very good inferred porosity, trace dull yellow to white fluorescence, very dull yellow to white crush cut, very thin dull yellow to white film residue.
	5	<u>SANDSTONE</u> : (ii) White to off white, clear to off white, tight, fine to medium, occasionally coarse grained, subangular to subrounded, strong calcareous cement, trace siliceous cement, trace dolomitic cement, hard aggregates, very poor inferred porosity, very dull yellow white fluorescence (5%), very dull yellow white crush cut, very dull thin yellow white film residue.
3010 - 3015	90	<u>SANDSTONE</u> : (i) As above, trace pyrite, trace muscovite, very good inferred porosity, trace dull yellow to white fluorescence, very dull yellow to white crush cut, very dull thin yellow film residue.
	10	<u>SANDSTONE</u> : (ii) As above, strong calcareous cement, trace siliceous cement, hard, very poor inferred porosity, very dull yellow fluorescence (5%), very dull yellow white crush cut, dull thin yellow film residue.
3015 - 3020	90	<u>SANDSTONE</u> : (i) As above, trace muscovite, very good inferred porosity, no observable fluorescence.
	10	<u>SANDSTONE</u> : (ii) As above, strong calcareous cement, trace pyrite, hard, poor inferred porosity, very dull yellow fluorescence (10%), moderately bright yellow white crush cut, thin yellow film residue.
3020 - 3025	80	<u>SANDSTONE</u> : (i) As above, very good inferred porosity, no fluorescence.
	20	<u>SANDSTONE</u> : (ii) As above, very poor inferred porosity, dull yellow white fluorescence

BLACKBACK-1 (ST1)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		(20%), dull to moderately bright yellow white crush cut, moderately bright thin film residue.
3025 - 3030	70	<u>SANDSTONE</u> : (i) As above, very good inferred porosity, no fluorescence.
	30	<u>SANDSTONE</u> : (ii) As above, moderate to poor inferred porosity, dull to moderately bright fluorescence (30%), moderately bright yellow white crush cut, moderately bright yellow white thin film residue.
3030 - 3035	95	<u>SANDSTONE</u> : (i) Clear to opaque, clear to buff grains, loose, clean, fine to coarse grained, well sorted (medium grains), subangular to subrounded, common pyrite, trace aggregates (very hard), trace mica, trace glauconite, moderate inferred porosity, trace fluorescence (weak yellow to white).
	5	<u>SANDSTONE</u> : (ii) White to buff, tight, fine to medium plus occasionally coarse grained, subangular to subrounded, calcareous cement (strong), trace dolomitic cement, trace siliceous cement, trace hard aggregates, poor inferred porosity, trace dull fluorescence (weak yellow to white).
3035 - 3040	95	<u>SANDSTONE</u> : (i) As above, no visible fluorescence.
	5	(ii) As above, trace dull yellow to white fluorescence, dull to moderately bright crush cut.
3040 - 3045	95	<u>SANDSTONE</u> : (i) As above.
	5	<u>SANDSTONE</u> : As above.
3045 - 3047	45	<u>SANDSTONE</u> : (i) Clear to off white, clear to buff, loose and clean, fine to very coarse grained, poorly sorted, subangular to subrounded, common pyrite, trace very coarse muscovite mica, good inferred porosity, trace dull yellow fluorescence, moderately bright yellow crush cut, moderate to dull yellow, patchy, thin film residue.
	5	<u>SANDSTONE</u> : (ii) White to off white, clear to off white, fine to medium grained, subangular to subrounded, poorly sorted, strong calcareous cement, aggregates hard to very hard, very poor inferred porosity, very dull yellow fluorescence, dull yellow crush cut, dull to moderately bright yellow thin patchy film residue.
	50	<u>CLAYSTONE</u> : Medium grey, very calcareous, strongly swelling clays, trace glauconite, common micromica, firm to moderately hard, blocky.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
<u>START OF SIDETRACK TWO (ST2)</u>		
2955	100	<u>CEMENT</u>
2955 - 2960	100	<u>CEMENT</u>
2960 - 2965	100 Tr	<u>CEMENT</u> <u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and clean, medium to coarse, occasionally fine grained, poorly sorted, subangular to subrounded, trace to very rare peletal glauconite, very good inferred porosity, no fluorescence.
2965 - 2970	95 5	<u>CEMENT</u> <u>SANDSTONE</u> : As above, trace to occasional common glauconite (glauconite occasionally coating quartz grains), trace pyrite, very good inferred porosity, no fluorescence.
2970 - 2975	80 20	<u>CEMENT</u> <u>SANDSTONE</u> : As above, common glauconite, very good inferred porosity, no fluorescence.
2975 - 2980	80 20 Tr	<u>SANDSTONE</u> : As above, common glauconite, trace pyrite, very good inferred porosity, no fluorescence. <u>CEMENT</u> <u>SILTSTONE</u> : Medium brown, predominantly arenaceous and minor argillaceous, argillaceous matrix, trace pyrite, trace disseminated quartz grains, trace glauconite, moderately hard, blocky.
2980 - 2985	90 5 5	<u>SANDSTONE</u> : As above, trace glauconite, trace pyrite, trace muscovite mica, very good inferred porosity, no fluorescence. <u>SILTSTONE</u> : As above, trace glauconite, trace micromica, moderately hard, blocky. <u>CEMENT</u>
2985 - 2990	95 5 Tr	<u>SANDSTONE</u> : As above, trace muscovite mica, very good inferred porosity, no fluorescence. <u>SILTSTONE</u> : As above, trace micromica, trace pyrite, moderately hard, blocky. <u>CEMENT</u>
2990 - 2995	100 Tr Tr	<u>SANDSTONE</u> : As above, trace muscovite mica, trace to occasionally common pyrite, very good inferred porosity, no fluorescence. <u>SILTSTONE</u> : As above, common to occasionally abundant pyrite, moderately hard, blocky. <u>CEMENT</u>
2995 - 3000	100	<u>SANDSTONE</u> : Clear to off white, clear to occasionally buff, loose and clean, medium to coarse grained, poorly sorted, subrounded, trace glauconite, trace pyrite, very good inferred porosity, no fluorescence.
3000 - 3005	Tr 100	<u>SANDSTONE</u> : As above. <u>SANDSTONE</u> : Clear to off white, clear to occasionally buff, loose and generally clean, medium to coarse, abundant bit fractured

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		grains, poorly sorted, subangular to subrounded, trace glauconite, trace pyrite, trace muscovite mica, trace siliceous cement, quartz overgrowths, very good inferred porosity, fluorescence: trace dull yellow, very weak yellow crush cut, very pale film residue, trace dull orange mineral fluorescence.
	Tr	<u>SILTSTONE</u> : Medium brown, arenaceous, strong argillaceous matrix, trace pyrite cement (intergranular pyrite), common disseminated coarse quartz grains, common glauconite pellets, common pyrite, hard, blocky.
3005 - 3010	100	<u>SANDSTONE</u> : As above, abundant pyrite, trace buff cement (trace dolomite), very good inferred porosity, 5 to 15% dull yellow fluorescence, weak dull yellow crush cut, thin dull yellow film residue.. ' .
3010 - 3015	100	<u>SANDSTONE</u> : As above, abundant pyrite, common white to occasional buff cement (calcareous), moderately bright yellow crush cut, thin moderately bright yellow film residue.
3015 - 3020	90	<u>SANDSTONE</u> : (i) As above, abundant pyrite, good inferred porosity, trace dull yellow fluorescence, dull yellow crush cut, thin dull yellow film residue.
	10	<u>SANDSTONE</u> : (ii) White to off white, clear to off white, fine to coarse, predominantly coarse grained, subangular to subrounded, common to abundant calcareous and dolomitic cement, rare argillaceous matrix, moderately hard aggregates, trace pyrite, very poor inferred porosity, 10% yellow fluorescence, weak yellow crush cut, thin moderately bright yellow film residue.
3020 - 3025	90	<u>SANDSTONE</u> : (i) as above, trace pyrite, trace muscovite mica, very good inferred porosity, trace dull yellow fluorescence, dull yellow crush cut, thin dull yellow film residue.
	10	<u>SANDSTONE</u> : (i) As above, strong predominantly dolomitic and minor calcitic cement (white to off white) and associated rock flour, hard, very poor inferred porosity, trace dull yellow fluorescence, weak yellow crush cut, thin dull yellow film residue.
3025 - 3030	100	<u>SANDSTONE</u> : (i) (90%) Clear to off white, clear to translucent, loose and clean, medium to very coarse grained (common bit fractured grains), angular to subrounded, very poorly sorted, trace pyrite, trace muscovite mica, very good inferred porosity, 10% moderately bright yellow fluorescence, very weak dull yellow crush cut, dull thin yellow film residue.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		(ii) (10%) Clear to off white, clear to occasionally buff, tight, medium to coarse, subangular to subrounded, poorly sorted, common calcareous and trace dolomitic cement, trace muscovite mica, trace pyrite, very poor inferred porosity, no fluorescence.
3030 - 3035	100	<u>SANDSTONE</u> : (i) (100%) As above, trace to common pyrite, trace glauconite, very good inferred porosity, 20% dull yellow fluorescence, dull to moderately bright yellow crush cut, dull to moderately bright thick film residue. (ii) (Tr) As above, no fluorescence.
3035 - 3040	100	<u>SANDSTONE</u> : (i) (100%) As above, excellent inferred porosity, 5% dull yellow fluorescence, dull to moderately bright yellow crush cut, dull to moderately bright thick film residue. (ii) (Tr) As above, no fluorescence.
3040 - 3045	100	<u>SANDSTONE</u> : (i) (95%) As above, excellent inferred porosity, no fluorescence. (ii) (5%) As above, abundant dolomitic cement (5%), moderately bright yellow green fluorescence, weak diffuse slow yellow cut, bright yellow crush cut, thick yellow film residue.
3045 - 3050	100	<u>SANDSTONE</u> : (i) (95%) As above, excellent inferred porosity, no fluorescence. (ii) (5%) As above, trace moderately bright yellow fluorescence, weak diffuse slow streaming cut, bright yellow crush cut, thick yellow film residue.
3050 - 3055	100	<u>SANDSTONE</u> : (i) (100%) As above, excellent inferred porosity, no fluorescence. (ii) (5%) As above, tight, very poor inferred porosity, (Tr-5%) yellow moderately bright fluorescence, moderately bright yellow crush cut, thin yellow film residue.
3055 - 3060	100	<u>SANDSTONE</u> : (i) (100%) As above, trace pyrite, trace muscovite, excellent inferred porosity, no fluorescence.
3060 - 3065	100	<u>SANDSTONE</u> : (i) Clear to off white, clear to translucent, loose and clean, medium to very coarse grained, very poorly sorted, subangular to subrounded, trace pyrite, trace muscovite mica, excellent inferred porosity, no fluorescence.
3065 - 3070	100	<u>SANDSTONE</u> : White to off white, translucent to milky and occasional clear grains, medium to predominantly very coarse grained, common very coarse angular bit fractured grains, moderately sorted, subrounded, no visible cement or matrix, minor muscovite mica flakes, trace pyrite, very good inferred porosity, trace dull to moderately bright

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		yellow patchy fluorescence, no cut, weak diffuse crush cut, thin ring residue, (mineral fluorescence).
3070 - 3075	100	<u>SANDSTONE</u> : As above, moderately to well sorted, minor smokey quartz grains, subrounded to rounded, very good to excellent inferred porosity, no fluorescence.
3075 - 3080	100	<u>SANDSTONE</u> : (i) (80%) Clear to translucent grains, medium to very coarse grained, common bit fractured grains, original grain surfaces are smooth and rounded to subrounded, no visible cement or matrix, loose, trace pyrite and muscovite, very good to good inferred porosity, no fluorescence. (ii) (20%) Off white, very fine to medium grained, moderate to poorly sorted, subangular to subrounded, well cemented with dolomitic and siliceous cement, no matrix, minor mica flakes, trace glauconite and pyrite, hard to very hard, brittle, poor visual porosity, trace fluorescence as above.
3080 - 3085	100	<u>SANDSTONE</u> : (i) (90%) Translucent to clear, medium to very coarse grained, grading to pebbly size, poorly sorted, angular to subrounded, generally grains are bit fractured, no cement or matrix, loose and clean, very good to excellent inferred porosity, no fluorescence. (ii) (10%) As above.
3085 - 3090	100	<u>SANDSTONE</u> : Clear to translucent, light grey, smokey, fine to very coarse, predominantly coarse to very coarse grained, poorly sorted, angular to subangular, predominantly bit fractured with some grain surfaces being smooth and rounded, weak to moderate siliceous and dolomitic cement, generally loose, no visible matrix, minor aggregates are hard and brittle, trace pyrite, trace muscovite mica, fair to good inferred porosity. FLUOR: (20%) Moderately bright to bright blue white and moderately bright yellow, patchy to solid in part, blue white fluorescence gives a slow blooming cut, moderately fast to instant crush cut, thin milky ring residue.
3090 - 3095	100	<u>SANDSTONE</u> : Light grey to off white, clear to translucent, medium to very coarse, predominantly medium grained, poorly sorted, angular to subrounded, (predominantly bit fractured shards and not representative), weak calcareous and dolomitic cemented rare aggregates, generally loose, no matrix, trace pyrite, rare glauconite, fair inferred porosity. FLUOR: (10-15%) As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3095 - 3100	95	<u>SANDSTONE</u> : As above, becoming predominantly very coarse to coarse angular bit fractured grains, good inferred porosity. FLUOR: (Tr-5%) As above.
	5	<u>CLAYSTONE</u> : Medium to dark grey, dark grey/brown, silty, dispersive, soft.
3100 - 3105	70	<u>SANDSTONE</u> : (i) (50%) Translucent to clear, as above, medium to very coarse grained. (ii) (20%) Light grey/brown to off white, fine to medium, occasionally very fine grained, moderately sorted, subangular to subrounded, weak to moderate calcareous cement, trace light to medium grey argillaceous/silty matrix, trace glauconite, rare pyrite disseminated in matrix, moderately hard, brittle, tight to very poor visual porosity. FLUOR: (Tr-5%) As above.
	30	<u>SILTSTONE</u> : Mottled, light to medium grey/brown, moderately argillaceous and arenaceous, abundant muscovite mica flakes, rare carbonaceous flakes, trace lithic fragments, firm to moderately hard subfissile.
3105 - 3110	100	<u>SANDSTONE</u> : (i) (100%) White, translucent to clear, medium to very coarse grained, angular bit fractured fragments, predominantly very coarse, original grains grading to pebbly in size, grains are subangular to subrounded with predominantly angular fractured fragments, poorly sorted, no visible cement or matrix, clean and loose, trace pyrite on some grains, good to excellent inferred porosity. FLUOR: (5-10%) Dull to moderately bright yellow and moderately bright blue/white fluorescence, no to very weak blooming cut, diffuse moderately fast crush cut, thin ring residue.
3110 - 3115	100	<u>SANDSTONE</u> : As above, predominantly coarse to medium grained, good to very good inferred porosity. FLUOR: (20%) As above with trace brown staining on some grains.
3115 - 3120	100	<u>SANDSTONE</u> : As above, medium to coarse grained, occasionally grading to very coarse, medium grains are well rounded to rounded, moderately sorted, very good inferred porosity. FLUOR: (20%) As above.
	Tr	<u>SILTSTONE</u> : Medium to dark grey, very arenaceous, grading to very fine sandstone, moderately argillaceous, firm, blocky.
3120 - 3125	100	<u>SANDSTONE</u> : Translucent to occasionally clear, common dark grey smokey quartz grains, coarse to very coarse, grading to medium grained, predominant bit fractured angular

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		<p>fragments, poor to very poorly sorted, angular to subrounded fragments, minor aggregates are weakly cemented with a siliceous cement and have no visible matrix, generally loose and clean, aggregates are firm and friable, fair to good inferred porosity.</p> <p>FLUOR: (20%) Moderately bright yellow/white fluorescence, patchy, weak slow streaming cut, moderately fast milky white crush cut, thin ring residue fluorescence in medium to coarse weakly cemented aggregates.</p>
3125 - 3130	90	<p><u>SANDSTONE</u>: As above, predominantly very coarse to pebbly fractured grained, very poorly sorted, rare fine to medium cemented aggregates as above, fair to good inferred porosity.</p> <p>FLUOR: (5-10%) As above, decreasing with depth.</p>
	10	<p><u>SILTSTONE</u>: As above.</p>
3130 - 3135	90	<p><u>SANDSTONE</u>: White, translucent to clear, fine to very coarse, predominantly medium to coarse grained, very poorly sorted, fine to medium grains are subrounded to rounded, coarse to very coarse grains are fractured and angular, minor weakly cemented aggregates with siliceous and calcareous cements, no visible matrix, trace pyrite coating on grains, good inferred porosity.</p> <p>FLUOR: (Tr-5%) As above.</p>
	10	<p><u>SILTSTONE</u>: Medium grey/brown, medium brown, moderately argillaceous, slightly arenaceous, common micromicaceous flakes, trace carbonaceous flakes, slightly swelling, firm to moderately hard, subfissile to blocky.</p>
3135 - 3140	100	<p><u>SANDSTONE</u>: Translucent to clear, coarse to very coarse, minor medium grained, moderately sorted, subrounded to rounded, no cement or matrix visible, loose and clean, good to very good inferred porosity.</p> <p>FLUOR: (Tr) As above.</p>
3140 - 3145	80	<p><u>SANDSTONE</u>: As above, no fluorescence.</p>
	20	<p><u>SILTSTONE</u>: As above.</p>
3145 - 3150	95	<p><u>SANDSTONE</u>: Light grey to white, translucent to clear, common smokey quartz grains, predominantly coarse to very coarse grained, minor medium grain, generally as above, good inferred porosity, no fluorescence.</p>
	5	<p><u>SILTSTONE</u>: As above.</p>
3150 - 3155	70	<p><u>SANDSTONE</u>: As above.</p>
	30	<p><u>SILTSTONE</u>: As above, very micromicaceous, soft, dispersive.</p>
3155 - 3160	60	<p><u>SANDSTONE</u>: As above.</p>
	40	<p><u>SILTSTONE</u>: As above, very dispersive.</p>

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3160 - 3165	60	<u>SILTSTONE/CLAYSTONE</u> : Medium grey/brown, very argillaceous, moderately arenaceous, abundant micromicaceous flakes, trace carbonaceous specks, very soft, dispersive and soluble.
	40	<u>SANDSTONE</u> : Clear to translucent, medium to very coarse, angular bit fractured quartz grains, as above, no fluorescence.
3165 - 3170	80	<u>SANDSTONE</u> : Clear to translucent, predominantly very coarse, grading in parts from medium to very coarse grained, moderately well sorted, subrounded to subangular, no cement or matrix visible, clean and loose, excellent to very good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : As above.
3170 - 3175	60	<u>SANDSTONE</u> : As above, with common pyritic coating on grains, no fluorescence.
	40	<u>SILTSTONE</u> : As above.
3175 - 3180	60	<u>SANDSTONE</u> : Translucent to clear, common dark grey smokey quartz grains, coarse to very coarse grained, occasionally medium, poor to moderately sorted, medium grains are shattered angular fragments, inferred original grains grade up to pebbly size, no visible cement or matrix, minor pyrite as disseminated grains and as a grain coating, grains are loose, fair inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : Medium grey, moderate to very argillaceous, slightly arenaceous, common micromicaceous flakes, soft to firm, dispersive in parts, blocky in parts.
3180 - 3185	60	<u>SILTSTONE</u> : As above with minor glauconite, siltstone becoming very arenaceous with common very fine to fine quartz grains, trace disseminated pyrite, soft, dispersive.
	40	<u>SANDSTONE</u> : As above.
3185 - 3190	90	<u>SANDSTONE</u> : Translucent to clear, fine to coarse, predominantly medium with minor very coarse quartz grain, poorly sorted, fine to medium grains are well rounded, medium to very coarse grains are fractured argillaceous fragments, no cement or matrix, trace pyrite, trace glauconite on some grains, predominantly loose, fair to good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above.
3190 - 3195	100	<u>SANDSTONE</u> : Clear to occasionally translucent, medium to coarse, rare fine and very coarse grained, moderately well to well sorted, subrounded to rounded, trace calcareous cement on grains, no visible matrix, very clean, predominantly loose, very good inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3195 - 3200	100	<u>SANDSTONE</u> : As above, becoming coarser grained, poorly to moderately sorted, increasing proportion of coarse to very coarse angular fracture fragments, very good inferred porosity. FLUOR: (5%) Dull yellow, patchy, no cut, (dolomitic mineral fluorescence which reacts slowly with 10% HCl acid).
3200 - 3205	100	<u>SANDSTONE</u> : As above. FLUOR: (5-10%) As above.
3205 - 3210	100	<u>SANDSTONE</u> : Translucent to clear, medium to very coarse, poorly sorted, angular to subrounded, medium grains are commonly subrounded to rounded, weak to moderately calcareous/dolomitic cement, no visible matrix, aggregates are rare and are very hard to hard, generally loose fractured quartz grains, poor inferred porosity, trace pyrite, rare mica flakes. FLUOR: (5-10%) As above (mineral fluorescence)
3210 - 3215	90	<u>SANDSTONE</u> : Translucent to clear, light grey sandstone, medium to coarse grained, grading to very coarse in parts, majority of grains are fractured angular shards of original grains, poorly sorted, angular to subrounded, occasionally rounded medium grains, trace calcareous cement on some grains, no aggregates present, clean with no matrix, loose grains, trace pyrite (disseminated nodular, cement on some grains) trace dark green glauconite (<1%), poor inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium grey/brown, moderately argillaceous, slightly to very arenaceous, grading in part to very fine dirty sandstone, trace carbonaceous specks, moderately micromicaceous, firm to soft, blocky to subfissile.
3215 - 3220	95	<u>SANDSTONE</u> : As above, predominantly medium grained, minor coarse to very coarse angular fractured grains, medium grains are subrounded to rounded, no cement or matrix, good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above.
3220 - 3225	100	<u>SANDSTONE</u> : As above, medium to very coarse, predominantly medium to coarse grained, good inferred porosity, no fluorescence.
3225 - 3230	95	<u>SANDSTONE</u> : As above, becoming coarser with depth, predominantly coarse grading medium to very coarse and occasionally pebbly, original grain surfaces indicate grains are well rounded with no cement, clean, good to very good inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	5	<u>SILTSTONE</u> : As above, predominantly medium grey.
3230 - 3235	100	<u>SANDSTONE</u> : Translucent to clear, common smokey grey grains, white to light grey sandstone, coarse to very coarse grained, grading in parts to medium, trace calcareous/dolomitic cement on some grains, poorly sorted, subangular to angular fractured shards, inferred original grains are very coarse to pebbly, rounded to subrounded, very good inferred porosity. No fluorescence.
3235 - 3240	90	<u>SANDSTONE</u> : Translucent to milky, occasionally clear, common smokey grey quartz grains, grading fine to very coarse, predominantly medium to coarse grained, very poorly sorted, fine to medium grains are subrounded to rounded, coarser grains are bit fractured angular shards with occasional remnant rounded grain surfaces, minor moderately strong to strong calcareous cement, no matrix, common pyrite, pyrite inclusions in some grains, trace muscovite mica flakes, abundant white rock flour aggregates, poor visual porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium to dark grey, medium grey/brown, moderately to very argillaceous, slightly arenaceous, rare carbonaceous flakes, moderately micromicaceous, firm to soft, blocky.
3240 - 3245	95	<u>SANDSTONE</u> : (i) (90%) As above. (ii) (15%) Light grey to medium grey, very fine to fine, rarely medium grained, poorly sorted, subangular to subrounded, strong dolomitic and calcareous cement, no visible matrix, common pyrite, very hard grain aggregates, tight visual porosity. FLUOR: (15%) Dull patchy yellow orange, no cut or crush cut, no residue ring.
	5	<u>SILTSTONE</u> : As above.
3245 - 3250	80	<u>SANDSTONE</u> : (i) (70%) As above, with common pyrite. (ii) (10%) Very fine to fine grained, tight, trace dull yellow orange mineral fluorescence.
	20	<u>SILTSTONE</u> : As above.
3250 - 3255	80	<u>SANDSTONE</u> : Light grey, clear to translucent, minor smokey grains, fine to very coarse, predominantly medium grained, very poorly sorted, angular to subangular fractured grains, fine to medium grains are moderately to strongly cemented with calcareous/dolomitic cement, minor light grey to off white argillaceous/siliceous matrix, aggregates are moderately hard to hard and brittle, generally loose and shattered, poor

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		visual and inferred porosity, trace mineral fluorescence as above.
	20	<u>SILTSTONE</u> : Mottled light to medium grey/brown, very argillaceous, slightly arenaceous, abundant muscovite flakes, common carbonaceous specks, trace lithic fragments, very slightly calcareous in parts, firm to soft, blocky.
3255 - 3260	90	<u>SANDSTONE</u> : As above, becoming predominantly medium to coarse grained, moderately sorted, loose shattered quartz grains, angular to subangular with occasionally rounded grain surfaces, minor fine to medium cemented grain aggregates (approximately 10%) as above, poor to fair inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above.
3260 - 3265	90	<u>SANDSTONE</u> : As above, increasing grain size with depth, predominantly coarse to very coarse grained, commonly well rounded with no visible cement, minor fine to medium grained cemented dirty sandstone as above, good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above.
3265 - 3270	95	<u>SANDSTONE</u> : As above, common pyrite, good inferred porosity.
	5	<u>SILTSTONE</u> : As above.
3270 - 3275	85	<u>SANDSTONE</u> : 2 types (i) (70%) Translucent to clear, occasionally smokey and milky white, medium to very coarse grains, common bit fractured grains which are angular shattered shards of very coarse to rounded quartz pebbles, poor to moderately sorted, no visible cement or matrix, loose and clean, common pyrite cement coating grains, good inferred porosity, no fluorescence. (ii) (15%) Dirty mottled light grey/white, very fine to fine grained, with rare medium grains, poor to moderately sorted, subangular to subrounded, moderately strong calcareous/dolomitic cement, minor white silica/argillaceous matrix, trace glauconite, minor pyrite, moderately hard to hard aggregates, trace dull yellow/orange mineral fluorescence.
	15	<u>SILTSTONE</u> : Medium grey/brown, very argillaceous, moderately arenaceous occasionally grading to very fine grained dirty sandstone as above, trace carbonaceous specks, moderately micromicaceous, rare glauconite and common pyrite, moderately firm to soft, blocky.
3275 - 3280	80	<u>SANDSTONE</u> : 2 types (ii) (60%) As above, trace dull yellow/orange mineral fluorescence. (i) (20%) As above, coarse to very coarse angular bit fractured quartz grains.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	20	<u>SILTSTONE</u> : As above, grading to very fine argillaceous sandstone.
3280 - 3285	70	<u>SANDSTONE</u> : 2 types (ii) (60%) As above, well cemented with calcareous and dolomitic cement, common pyrite, trace silica/argillaceous matrix, rare glauconite grains, trace muscovite mica flakes, trace dull to moderately bright yellow mineral fluorescence. (i) (10%) Coarse to very coarse angular bit fractured quartz grains, as above.
	30	<u>SILTSTONE</u> : As above.
3285 - 3290	80	<u>SANDSTONE</u> : 2 types (i) (50%) Medium to very coarse as above. (ii) (30%) As above.
	20	<u>SILTSTONE</u> : As above.
3290 - 3295	85	<u>SANDSTONE</u> : 2 types (i) Clear to translucent, occasionally milky white, medium to coarse, rare very coarse, moderately sorted, subangular to subrounded, common angular bit fractured grains, generally no cement visible, clean with no matrix, loose, minor pyrite coating, fair to good inferred porosity, no fluorescence. (ii) (10%) As above, fine to medium grained cemented aggregates, tight visual porosity, trace dull to moderately bright yellow mineral fluorescence.
	15	<u>SILTSTONE</u> : As above.
3295 - 3300	80	<u>SANDSTONE</u> : (i) (70%) As above. (ii) (10%) As above.
	20	<u>SILTSTONE</u> : Medium grey to medium brown, moderate to very argillaceous, slightly arenaceous, common carbonaceous flakes and detritus, moderately micromicaceous, firm to soft, blocky.
	Tr	<u>COAL</u> : Black, dull to subvitreous lustre, slightly silty, brittle, moderately hard.
3300 - 3305	90	<u>SANDSTONE</u> : Light grey to off white, with clear to translucent grains, fine to coarse, predominantly medium grained, poorly sorted, subangular to subrounded with occasional rounded grains, moderate calcareous/dolomitic cement, trace siliceous/argillaceous matrix generally clean and loose with aggregates being hard to very hard, minor pyrite, trace mica (muscovite flakes), minor carbonaceous/coaly detrital fragments, poor inferred/visual porosity, trace dull yellow mineral fluorescence.
	10	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3305 - 3310	60	<u>SANDSTONE</u> : As above, moderately argillaceous matrix, predominantly fine to medium grained, cemented aggregates, poor visual/inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	40	<u>SILTSTONE/CLAYSTONE</u> : Light to medium grey/brown, very argillaceous grading to claystone, slightly arenaceous, abundant carbonaceous fragments and microlaminae, abundant micromicaceous flakes, trace lithic fragments, soft, firm, blocky, very slightly silty.
	Tr	<u>COAL</u> : As above, increasing with depth.
3310 - 3315	50	<u>SANDSTONE</u> : 2 types (i) (20%) Translucent to clear, medium to very coarse grained, angular fractured grains, inferred rounded to subrounded, poorly sorted, no cement/matrix, loose, fair to good inferred porosity, no fluorescence. (ii) (30%) Off white to light grey/brown, very fine to fine grained, moderately well sorted, subangular to subrounded, weak siliceous cement, moderate white argillaceous/silty matrix, trace carbonaceous specks, common mica flakes, aggregates are moderately hard, brittle to friable, trace lithic fragments, tight to very poor visual porosity, no fluorescence.
	30	<u>SILTSTONE</u> : Light grey to medium grey and brown, very argillaceous, slightly to very arenaceous, grading in part to very fine sandstone. (ii) As above, abundant micromicaceous flakes, common carbonaceous and coaly fragments, soft to firm, slightly dispersive, blocky.
	10	<u>CLAYSTONE</u> : Tan to light brown/grey, silty, common carbonaceous specks, very soft and dispersive, slight sticky.
	10	<u>COAL</u> : Black, very woody and fibrous texture in parts, occasionally dull to subvitreous, splintery to subconchoidal fracture, brittle, moderately hard.
3315 - 3320	75	<u>SANDSTONE</u> : Type (i) as above with trace type (ii).
L.A.T.	25	<u>SILTSTONE</u> : As above.
	Tr	<u>CLAYSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3320 - 3325	95	<u>SANDSTONE</u> : Clear to translucent, rare milky white grains, medium to coarse, minor fine to very coarse grained, moderately well sorted, subrounded to rounded, occasionally subangular, no cement or matrix, very clean loose quartz grains, trace pyrite, fair to good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above.
3325 - 3330	85	<u>SANDSTONE</u> : As above becoming slightly coarser grained.
	10	<u>COAL</u> : As above.
	5	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3330 - 3335	50	<u>SANDSTONE</u> : As above, medium to very coarse grained, fair to good inferred porosity, no fluorescence.
	45	<u>SILTSTONE</u> : Medium to dark grey/brown, occasionally light grey, moderate to very argillaceous, slightly arenaceous, very carbonaceous with common microlaminae and coaly fragments, very slightly micromicaceous, firm to moderately hard, blocky.
	5	<u>COAL</u> : As above.
3335 - 3340	60	<u>SILTSTONE</u> : As above.
	40	<u>SANDSTONE</u> : As above, common very coarse to pebbly grains, very pyritic.
	Tr	<u>COAL</u> : As above.
3340 - 3345	60	<u>SANDSTONE</u> : Translucent to clear, fine to very coarse, predominantly medium, poorly sorted, subangular to angular bit fractured quartz grains, subrounded to occasionally round medium and inferred coarse grains, trace weak to moderate calcareous/siliceous cemented fine grains, generally no cement visible on medium to coarse grains, no matrix, loose, aggregates are moderately hard to hard, fair inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : As above.
3345 - 3350	75	<u>SANDSTONE</u> : As above.
	20	<u>SILTSTONE</u> : As above.
	5	<u>COAL</u> : As above.
3350 - 3355	85	<u>SANDSTONE</u> : Translucent to clear, medium to coarse, occasionally very coarse, predominantly medium grained, poorly sorted, subangular to subrounded, occasionally rounded, grains are generally loose and clean with minor weakly silica cemented aggregates, trace argillaceous matrix, fair inferred porosity, no fluorescence.
	10	<u>COAL</u> : Black, dull to subvitreous lustre, slightly silty in parts, uneven fracture, brittle, moderately hard.
	5	<u>SILTSTONE</u> : As above.
3355 - 3360	60	<u>SANDSTONE</u> : As above, no fluorescence.
	40	<u>COAL</u> : As above.
	Tr	<u>SILTSTONE</u> : As above.
3360 - 3365	70	<u>SANDSTONE</u> : Translucent to clear, occasionally white, light grey aggregates, predominantly medium, occasionally coarse to very coarse grained, moderately sorted, subrounded, weak siliceous cement in parts, trace light grey argillaceous matrix, generally loose clean grains, trace pyrite, minor muscovite mica flakes, fair inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium to dark brown, medium grey/brown, moderately argillaceous, very

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		slightly arenaceous, abundant carbonaceous laminations and fragments, commonly micromicaceous, grading in parts to claystone, rare lithic fragments, firm to soft, blocky to subfissile. <u>COAL</u> : As above.
3365 - 3370	85	<u>SANDSTONE</u> : As above, fair inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above, becoming very carbonaceous in parts and grading to carbonaceous siltstone.
	5	<u>COAL</u> : As above.
3370 - 3375	95	<u>SANDSTONE</u> : As above, predominantly medium to coarse grained, moderately sorted, fair to good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3375 - 3380	85	<u>SANDSTONE</u> : As above, also very fine to medium, predominantly fine grained, moderately well sorted, subangular to subrounded, well cemented with siliceous cement, trace white argillaceous matrix, trace pyrite, moderately hard to hard grain aggregates, poor to tight visual porosity, no fluorescence.
	15	<u>SILTSTONE</u> : As above becoming slightly arenaceous.
	Tr	<u>COAL</u> : As above.
3380 - 3385	50	<u>SANDSTONE</u> : Translucent to clear, occasionally milky white, medium to occasionally coarse and very coarse grained, poorly sorted, subangular, minor moderately strong to strong siliceous cemented aggregates with trace to minor white argillaceous matrix, predominantly loose grains, common muscovite mica, trace pyrite, poor to fair visual/inferred porosity, no fluorescence.
	50	<u>SILTSTONE</u> : Light to medium grey/brown, medium to dark brown, moderate to very argillaceous, slightly arenaceous, light grey siltstone becoming very arenaceous grading in part to very fine dirty sandstone, abundant carbonaceous and micromicaceous flakes, firm to soft, blocky.
	Tr	<u>COAL</u> : As above.
3385 - 3390	85	<u>SANDSTONE</u> : As above, predominantly medium to coarse, commonly very angular grains, predominantly loose, fair to good inferred porosity, no fluorescence.
	15	<u>SILTSTONE</u> : As above.
3390 - 3395	40	<u>SANDSTONE</u> : As above.
	40	<u>COAL</u> : Black, subvitreous lustre, very silty in parts, uneven fracture, hard to moderately hard, brittle.
	20	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3395 - 3400	75	<u>SANDSTONE</u> : Translucent to clear, medium to very coarse and pebbly, predominantly medium grained, poorly sorted, common bit fractured grains, generally subrounded to subangular, minor aggregates inferred weak to moderate siliceous cement, trace quartz overgrowths, trace white argillaceous matrix, predominantly loose with minor aggregates being hard to firm, brittle, fair inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : As above.
	5	<u>COAL</u> : As above.
3400 - 3405	60	<u>SILTSTONE</u> : As above, becoming predominantly medium grey/brown.
	40	<u>SANDSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3405 - 3410	50	<u>SANDSTONE</u> : Translucent to clear grains, light grey sandstone, fine to predominantly medium with commonly coarse to very coarse loose quartz grains, very poorly sorted, subangular to subrounded, aggregates are weak to moderately cemented with siliceous cement, trace white argillaceous matrix, predominant grains are loose, trace pyrite, fair inferred porosity, no fluorescence.
	50	<u>SILTSTONE</u> : Mottled medium to dark grey/brown, dark brown, moderately argillaceous and arenaceous, common carbonaceous specks and fragments, trace lithic fragments, moderately micromicaceous, firm to moderately hard, crumbly, blocky.
3410 - 3415	70	<u>SILTSTONE</u> : As above.
	30	<u>SANDSTONE</u> : As above, very poorly sorted, cemented with siliceous cement, poor to fair inferred/visual porosity, no fluorescence.
3415 - 3420	50	<u>SILTSTONE</u> : As above.
	45	<u>SANDSTONE</u> : As above.
	5	<u>COAL</u> : As above.
3420 - 3425	60	<u>SANDSTONE</u> : As above, predominantly medium, grading to very coarse grained, no fluorescence.
	40	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3425 - 3430	60	<u>SANDSTONE</u> : Predominantly medium with common coarse to very coarse angular fractured grains, medium grains are subrounded to rounded, poor to moderately sorted, predominantly loose with minor weak siliceous cement, fair inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : Medium grey/brown, moderately argillaceous, slightly arenaceous as above.
3430 - 3435	70	<u>SILTSTONE</u> : As above.
	30	<u>SANDSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3435 - 3440	90	<u>SILTSTONE</u> : As above, becoming very argillaceous grading in parts to claystone, slightly dispersive and soluble.
	10	<u>SANDSTONE</u> : As above.
3440 - 3445	80	<u>SANDSTONE</u> : Translucent to clear, medium to coarse, rare very coarse grained, moderately sorted, subangular to subrounded, common bit fractured grains, trace weak silica cement, clean with no matrix, loose, trace pyrite coating on some grains, good inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Medium to dark grey, moderate to very argillaceous, grading to claystone in parts, trace carbonaceous specks, slightly micromicaceous, slightly arenaceous, firm to moderately hard, subfissile.
3445 - 3450	60	<u>SANDSTONE</u> : Generally as above becoming slightly coarser grained, predominantly medium to coarse angular grains, minor quartz overgrowths, fair to good inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : As above.
3450 - 3455	60	<u>SANDSTONE</u> : As above, medium to very coarse, predominantly coarse, majority of grains are bit fractured, inferred subrounded grains, weak to moderately silica cement in parts, clean with no matrix, fair inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : Medium to dark grey as above.
3455 - 3460	90	<u>SANDSTONE</u> : Predominantly medium, minor coarse to very coarse grained, moderately well sorted, subangular to predominantly subrounded, weak silica cement, clean with no matrix, trace pyrite, fair inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above, becoming arenaceous with depth.
3460 - 3465	80	<u>SANDSTONE</u> : As above, becoming slightly coarser grained.
	15	<u>SILTSTONE</u> : As above, also medium brown with common carbonaceous specks and laminations, grading in part to carbonaceous siltstone, firm to moderately hard, brittle.
	5	<u>COAL</u> : Black, very silty, dull, uneven fracture, brittle, moderately hard.
3465 - 3470	90	<u>SANDSTONE</u> : Predominantly medium to coarse, occasionally very coarse, generally as above, fair inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above.
3470 - 3475	75	<u>SANDSTONE</u> : Translucent to clear grains, white to light grey sandstone, fine to medium grained, occasionally coarse to very coarse grained, poorly sorted, subangular to subrounded, weak silica cement, trace white to light grey argillaceous matrix, trace

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	20	pyrite, loose, with occasional moderately hard fine grained aggregates, poor inferred porosity, no fluorescence. <u>SILTSTONE</u> : Medium to dark grey/brown, moderate to very argillaceous, slightly arenaceous, common carbonaceous fragments and microlaminae, micromicaceous, slightly pyritic in parts, grading to claystone in parts, firm to moderately hard, blocky.
	5	<u>COAL</u> : As above.
3475 - 3480	65	<u>SANDSTONE</u> : As above, with minor very fine to fine grained aggregates with moderate sorting, subrounded, weak to moderate silica cement, trace light grey argillaceous matrix, moderately hard, friable, poor to tight visual porosity, no fluorescence.
	30	<u>SILTSTONE</u> : As above.
	5	<u>COAL</u> : As above.
3480 - 3485	30	<u>SANDSTONE</u> : As above.
	45	<u>SILTSTONE</u> : As above, becoming medium to dark brown, very carbonaceous in parts and grading to carbonaceous siltstone/coal.
	25	<u>COAL</u> : Black, very silty, well laminated, dull, uneven fracture, moderately hard, brittle to splintery.
3485 - 3490	80	<u>SILTSTONE</u> : As above, becoming very argillaceous grading to claystone, specks are becoming very sticky, very carbonaceous grading to coal/carbonaceous siltstone, very slightly arenaceous, soft, blocky to crumbly.
	10	<u>COAL</u> : As above, very silty and laminated.
	10	<u>SANDSTONE</u> : As above.
3490 - 3495	80	<u>SILTSTONE</u> : As above.
	20	<u>SANDSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3495 - 3500	70	<u>SILTSTONE</u> : Medium to dark grey/brown, dark brown, moderate to very argillaceous, moderately arenaceous, common carbonaceous specks and laminations, moderately micromicaceous, slightly pyritic, becoming slightly sticky in parts, moderately hard to firm, blocky to rarely subfissile.
	30	<u>SANDSTONE</u> : Translucent to clear, common milky white quartz grains, predominantly medium to coarse, with minor very coarse angular grains, moderately sorted, subangular, common bit fractured grains, weak siliceous cement in parts, clean with no matrix, very poor to poor inferred porosity, no fluorescence.
	Tr	<u>COAL</u> : As above.
3500 - 3505	80	<u>SILTSTONE</u> : Generally as above, becoming predominantly dark grey, firm to moderately hard, blocky.
	20	<u>SANDSTONE</u> : As above, poor inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3505 - 3510	90	<u>SILTSTONE</u> : Mottled light grey/brown to medium grey, moderately argillaceous becoming moderate to very arenaceous with common very fine sand grains, very micromicaceous, moderately carbonaceous with coaly fragments and laminations, grading in parts to very fine grained sandstone, firm to moderately hard, blocky.
	10	<u>SANDSTONE</u> : As above.
3510 - 3515	80	<u>SILTSTONE</u> : As above, becoming dispersive and sticky in parts, increasingly argillaceous.
	10	<u>SANDSTONE</u> : As above, poor inferred porosity, no fluorescence.
	10	<u>COAL</u> : Black, very silty, dull to subvitreous lustre, grading to carbonaceous siltstone, uneven fracture, moderately hard to firm, brittle.
3515 - 3520	60	<u>SILTSTONE</u> : Medium grey/brown, medium brown, moderately argillaceous and arenaceous, minor carbonaceous specks and laminae, slightly micromicaceous, interlaminated with and grading to very fine grained sandstone in parts, moderately hard, subfissile.
	35	<u>SANDSTONE</u> : Medium to coarse, occasionally very coarse grained, as above with fair to poor inferred porosity, no fluorescence, also minor (10%) light grey to off white, very fine to fine grained, moderately sorted, subangular to subrounded, weak to moderate dolomitic cement, trace argillaceous matrix, minor altered feldspars, trace lithics, grading in parts to arenaceous siltstone, moderately hard, friable, tight visual porosity.
		<u>FLUOR</u> : (Tr-5%) Dull yellow mineral fluorescence with trace very weak yellow crush cut, trace ring residue.
	5	<u>COAL</u> : As above.
3520 - 3525	70	<u>SILTSTONE</u> : As above, becoming predominantly medium brown, slightly arenaceous, very micromicaceous, soft to firm, subfissile.
	25	<u>SANDSTONE</u> : (15%) Medium to coarse loose grains with poor to fair inferred porosity, no fluorescence, (10%) very fine to fine sandstone as above, trace fluorescence as above.
	5	<u>COAL</u> : As above.
3525 - 3530	60	<u>SILTSTONE</u> : Medium to dark grey/brown, light grey, moderately argillaceous, becoming increasingly arenaceous with depth, grading to very fine sandstone, moderately carbonaceous, abundant micromicaceous flakes, firm to moderately hard, blocky to subfissile.
	30	<u>SANDSTONE</u> : (5%) Medium to coarse, angular to subrounded loose quartz grains, no cement or matrix, fair inferred porosity, no fluorescence, (25%) light grey, very fine to

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		fine, moderately well sorted, subangular to subrounded, weak to moderately calcareous/dolomitic cement, trace white argillaceous matrix, moderately hard, friable, tight to very poor visual porosity, trace dull yellow mineral fluorescence.
	10	<u>COAL</u> : As above, very silty, grading to carbonaceous siltstone.
3530 - 3535	50	<u>SANDSTONE</u> : White to light grey, very fine to fine, as above, tight visual porosity, grading to very dirty arenaceous siltstone. 5% mineral fluorescence as above.
	40	<u>SILTSTONE</u> : As above, becoming increasingly arenaceous with depth.
	10	<u>COAL</u> : As above.
3535 - 3540	60	<u>SILTSTONE</u> : As above.
	30	<u>SANDSTONE</u> : As above, tight visual porosity, trace fluorescence as above.
	10	<u>COAL</u> : As above.
3540 - 3545	60	<u>SILTSTONE</u> : Medium to dark brown, medium grey/brown, very argillaceous, slightly to moderately arenaceous, abundant carbonaceous microlaminae and fragments, well laminated, micromicaceous, moderately hard, fissile to blocky, occasionally splintery.
	30	<u>SANDSTONE</u> : Translucent to clear grains, white to light grey sandstone, predominantly very fine to fine, occasionally medium grained, moderately sorted, subangular to subrounded, weak calcareous cement, trace argillaceous matrix, minor aggregates are moderately hard and friable, tight to poor visual/inferred porosity, trace dull yellow mineral fluorescence.
	10	<u>COAL</u> : As above, bleeding gas.
3545 - 3550	50	<u>SANDSTONE</u> : As above, reducing calcareous cement, weak siliceous cement in parts, minor medium to coarse loose angular grains, tight to poor inferred porosity, no fluorescence.
	40	<u>SILTSTONE</u> : As above.
	10	<u>COAL</u> : As above.
3550 - 3555	40	<u>SILTSTONE</u> : Medium grey and brown, light grey, moderate to very argillaceous, slightly arenaceous, moderately to very carbonaceous, grading to carbonaceous siltstone, moderately micromicaceous, well laminated, firm to moderately hard, subfissile.
	40	<u>SANDSTONE</u> : Light grey to off white, mottled, very fine to fine, occasionally medium grained, moderately sorted, subangular, weak calcareous/dolomitic cement, minor argillaceous matrix, moderately hard, friable, poor to tight visual porosity, trace dull yellow patchy mineral fluorescence.
	20	<u>COAL</u> : Black, very silty, laminated, grading to carbonaceous siltstone in parts, splintery

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		to blocky, with uneven fracture, moderately hard.
3555 - 3560	60	<u>SILTSTONE</u> : Medium to dark grey/brown, very argillaceous as above.
	40	<u>SANDSTONE</u> : As above, with minor (<5%) medium to coarse loose angular to subrounded quartz grains, predominantly very fine to fine, cemented grain aggregates, with a poor to tight visual porosity, trace mineral fluorescence.
	Tr	<u>COAL</u> : As above.
3560 - 3565	50	<u>SANDSTONE</u> : As above.
	30	<u>COAL</u> : Black, subvitreous lustre, slightly silty, subconchoidal to uneven fracture, hard, brittle.
	20	<u>SILTSTONE</u> : As above.
3565 - 3570	70	<u>SILTSTONE</u> : Light to medium grey and brown, moderate to very argillaceous, slightly arenaceous, common micromicaceous flakes, minor carbonaceous specks, trace carbonaceous laminae, very slightly swelling, firm, blocky.
	30	<u>SANDSTONE</u> : Light grey, translucent to clear, predominantly very fine to fine grained, with minor loose medium to coarse angular grains, very fine to fine grained is moderately well sorted, subangular to subrounded, minor strong dolomitic/siliceous cement, minor white argillaceous matrix, very hard to hard, brittle, tight visual porosity, trace to 5% very dull yellow fluorescence, with very weak yellow milky crush cut, trace ring residue.
	Tr	<u>COAL</u> : As above.
3570 - 3575	70	<u>SILTSTONE</u> : Predominantly medium to dark grey, argillaceous as above.
	30	<u>SANDSTONE</u> : As above with common (10%) medium to coarse loose quartz grains, poor inferred porosity, trace fluorescence as above.
3575 - 3580	70	<u>SANDSTONE</u> : Translucent to clear, medium to coarse, predominantly medium grained, minor very coarse angular grains, moderately sorted, subangular to subrounded, minor strong dolomite cemented medium grained aggregates, with trace to no matrix, predominantly loose, minor aggregates are very hard to hard and brittle, trace pyrite, fair to good inferred porosity.
		<u>FLUOR</u> : (10%) Dull to very dull, yellow fluorescence, with no to very weak slow streaming cut, slow weak milky yellow crush cut, thin pale ring residue.
	30	<u>SILTSTONE</u> : Medium to dark grey, moderately argillaceous as above.
3580 - 3585	80	<u>SANDSTONE</u> : As above, becoming slightly coarser grained, predominantly coarse, grading medium to very coarse, good inferred porosity, 30% fluorescence as above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	20	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
3585 - 3590	90	<p><u>SANDSTONE</u>: 2 types:</p> <p>(i) (60%) Translucent to clear, medium to very coarse grained, predominantly coarse, grains are predominantly bit fractured, medium grains are subrounded, generally no cement or matrix, loose, fair to good inferred porosity, no fluorescence.</p> <p>(ii) (30%) Light grey to off white, mottled, very fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, well cemented with dolomite cement, trace light grey argillaceous matrix, aggregates are hard to very hard, brittle, trace altered feldspars, tight visual porosity.</p> <p>FLUOR: (30%) Dull to very dull patchy yellow fluorescence, occasionally slow weak yellow streaming cut, slightly milky yellow crush cut, thin ring residue (approximately 15% mineral dolomite fluorescence 15% residual hydrocarbon fluorescence).</p>
	10	<u>SILTSTONE</u> : As above.
3590 - 3595	95	<p><u>SANDSTONE</u>: 2 types:</p> <p>(i) (70%) Medium to coarse grained, occasionally very coarse angular grains, poorly sorted, subangular, no cement or matrix visible, loose and clean, good inferred porosity, no fluorescence.</p> <p>(ii) (25%) Very fine to medium dolomite cemented aggregates as above, tight visual porosity, 30% fluorescence as above.</p>
	5	<u>SILTSTONE</u> : Medium to dark grey, moderately argillaceous, slightly arenaceous, moderately carbonaceous, trace pyrite, firm to moderately hard, blocky.
3595 - 3600	100	<p><u>SANDSTONE</u>: 2 types:</p> <p>(i) (70%) Clear to translucent, common milky white grains, grading medium to very coarse, predominantly coarse to very coarse, grains are generally fractured angular shards, inferred original grains are subrounded to rounded, trace siliceous cement indicated by minor quartz overgrowths, clean with no visible matrix, good inferred porosity, no fluorescence.</p> <p>(ii) (30%) Light grey to translucent, occasionally white, fine to medium grained, poor to moderately sorted, subangular to subrounded, very strong dolomitic cement, trace white to light grey argillaceous matrix, very hard to hard, tight porosity.</p> <p>FLUOR: (10%-15%) As above.</p>
	Tr	<u>SILTSTONE</u> : As above.
3600 - 3605	70	<u>SANDSTONE</u> : Clear, translucent, milky white, occasionally light grey, medium to very coarse, predominantly medium to coarse

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		grained, moderately sorted, inferred subangular to subrounded (bit fractured), inferred moderate siliceous cement in parts, rare quartz overgrowths, trace to common dolomitic cement, generally loose, clean, good inferred porosity.
	20	FLUOR: (10%-15%) Mineral fluorescence. <u>SILTSTONE</u> : Medium to dark brown, grey brown, slightly arenaceous in parts, micromicaceous in parts, carbonaceous specks and laminae, firm to moderately hard, subblocky to subfissile.
	10	<u>COAL</u> : Black, vitreous lustre, conchoidal fracture, silty in parts, hard, brittle.
3605 - 3610	85	<u>SANDSTONE</u> : As above, predominantly coarse to very coarse grained, poorly sorted, angular to subangular fractured quartz grains, fair to good inferred porosity. FLUOR: (20%) Dull to moderately bright yellow patchy, slow to occasionally fast yellow streaming cut, moderate yellow milky crush cut, thin ring residue. (Brown oil staining noted in tight cemented aggregates).
	15	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
	*	Sample becoming very clayey to wash, suspect higher siltstone/claystone percentage than observed in washed sample.
3610 - 3615	60	<u>SILTSTONE</u> : Medium brown, medium to dark grey/brown, becoming very argillaceous grading to claystone, moderately micromicaceous, trace carbonaceous specks and laminae, firm to moderately hard, subfissile to fissile.
	40	<u>SANDSTONE</u> : Translucent to clear, milky white in parts, medium to very coarse, predominantly coarse grained, subangular to subrounded medium grains, angular to subangular coarse to very coarse grains, minor strong dolomite cemented aggregates, no matrix, aggregates are very hard to hard, brittle, trace pyrite, aggregates are tight, poor porosity overall. FLUOR: (5%-10%) Fluorescence as above in very tight cemented aggregates.
	*	As above.
3615 - 3620	50	<u>SILTSTONE</u> : As above.
	50	<u>SANDSTONE</u> : As above, becoming predominantly medium grained, increasing cemented grain aggregates.
	*	Washing out a significant quantity of claystone from sample.
3620 - 3625	70	<u>SANDSTONE</u> : Translucent to clear, fine to coarse, predominantly medium, rarely very coarse grained, poorly sorted, subrounded to subangular, minor fine to medium grained dolomite cemented aggregates with trace white argillaceous matrix, generally loose and

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		clean grains, trace quartz overgrowths, aggregates are very hard to hard with a tight visual porosity, medium to very coarse grains have an inferred fair to good porosity. FLUOR: (Tr-5%) As above.
	30	<u>SILTSTONE</u> : Medium grey, very argillaceous, slightly arenaceous, trace carbonaceous specks, minor micromicaceous flakes, grading to claystone in parts, firm, fissile to subfissile. (Unwashed sample is very clayey, majority being washed out).
3625 - 3630	80	<u>SANDSTONE</u> : As above with common fine to medium dolomite cemented aggregates, no matrix, predominantly medium to very coarse loose quartz grains, fair to good inferred porosity. FLUOR: (10%) Dull yellow mineral fluorescence.
	10	<u>SILTSTONE</u> : As above.
	10	<u>COAL</u> : Black, subvitreous lustre, subconchoidal fracture, moderately hard, brittle.
3630 - 3635	80	<u>SANDSTONE</u> : As above, poor to fair inferred porosity. FLUOR: (10%) Mineral fluorescence, as above.
	20	<u>SILTSTONE</u> : As above.
3635 - 3640	70	<u>SANDSTONE</u> : Translucent to clear, light grey to white, very fine to medium, predominantly medium grained, rare coarse grains, moderately sorted, subrounded to subangular, generally loose with minor very strong dolomitic cemented aggregates, aggregates have trace white argillaceous matrix, trace quartz overgrowths on medium to coarse grain, aggregates are very hard to hard, with a tight visual porosity, poor inferred porosity overall. FLUOR: (5%) Dull yellow mineral fluorescence.
	30	<u>SILTSTONE</u> : Medium to dark grey brown, very argillaceous, slightly arenaceous, slightly carbonaceous with specks and thin laminae, grading to claystone, soft, slightly sticky, blocky.
3640 - 3645	80	<u>SANDSTONE</u> : Becoming slightly coarser grained, predominantly medium to coarse, grading fine to very coarse, poorly sorted, trace mineral fluorescence as above.
	10	<u>SILTSTONE</u> : As above.
	10	<u>COAL</u> : As above.
3645 - 3650	60	<u>SANDSTONE</u> : Fine to medium, predominantly medium grained, occasionally coarse to very coarse loose grains, sandstone generally as above, fair inferred porosity, trace dull mineral fluorescence.
	40	<u>SILTSTONE</u> : Very argillaceous, grading to claystone, as above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3650 - 3655	80	<u>SANDSTONE</u> : As above, fair inferred porosity, trace dull yellow mineral fluorescence as above.
	20	<u>SILTSTONE</u> : Medium to dark grey/brown as above.
3655 - 3660	85	<u>SANDSTONE</u> : Clear, translucent, light grey, medium to very coarse, dominantly coarse grained, moderately sorted, inferred subrounded to subangular, bit fractured, rare quartz overgrowths, clean, loose, good inferred porosity, trace mineral fluorescence.
	15	<u>SILTSTONE</u> : Medium to occasionally dark grey brown, arenaceous, micromicaceous, pyritic, soft to firm, occasionally moderately hard, subblocky to blocky.
3660 - 3665	60	<u>SILTSTONE</u> : Medium brown to grey'brown, arenaceous, slightly micromicaceous, carbonaceous specks and laminae, soft to firm, occasionally moderately hard, subblocky.
	40	<u>SANDSTONE</u> : Clear, translucent, occasionally light grey, medium to very coarse, predominantly coarse to very coarse grained, moderately sorted, inferred subangular to subrounded (bit fractured), clean, loose, very good inferred porosity. <u>FLUOR</u> : (Tr-15%) Mineral fluorescence.
3665 - 3670	80	<u>SANDSTONE</u> : Clear, translucent, rare milky white, rare light grey, coarse to predominantly medium, occasionally very coarse, moderately to well sorted, subangular to predominantly subrounded (bit fractured), inferred moderate siliceous cement, occasionally dolomitic/calcareous cement, clean, loose, good inferred porosity. <u>FLUOR</u> : (Tr-10%) Dolomitic mineral fluorescence.
	20	<u>SILTSTONE</u> : Medium to dark grey brown, black, grey, arenaceous in parts, common micromicaceous, carbonaceous, soft to firm, blocky.
3670 - 3675	95	<u>SANDSTONE</u> : Clear, translucent, occasionally milky white, occasionally light grey, medium to very coarse grained, predominantly coarse to very coarse, subangular to predominantly subrounded, occasionally rounded, occasionally bit fractured, clean, loose, very good inferred porosity. <u>FLUOR</u> : (Tr-5%) Dolomitic mineral fluorescence.
	5	<u>SILTSTONE</u> : As above.
3675 - 3680	90	<u>SANDSTONE</u> : As above, minor pyrite in parts, trace mineral fluorescence as above.
	10	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3680 - 3685	90	<u>SANDSTONE</u> : Clear, translucent, light grey, occasionally milky white, medium to very coarse, predominantly coarse grained, moderately well sorted, subrounded to predominantly subangular, common bit fractured, trace strong siliceous cement inferred, clean, loose, minor pyrite, very good visual porosity, trace mineral fluorescence.
	10	<u>SILTSTONE</u> : Medium to dark grey to grey brown, argillaceous, slightly arenaceous, micromicaceous, carbonaceous with coaly laminations, subfissile, soft to occasionally moderately hard.
3685 - 3690	90	<u>SANDSTONE</u> : As above, medium to coarse, occasionally very coarse grained, common pyrite, good porosity, trace mineral fluorescence.
	10	<u>SILTSTONE</u> : As above.
3690 - 3695	90	<u>SANDSTONE</u> : Translucent to clear, medium to very coarse, occasionally fine grained, poorly sorted, common angular bit fractured grains, generally subangular to subrounded, minor strongly cemented medium to fine grained aggregates with dolomite and silica cement, clean with no matrix, aggregates are very hard to hard, tight porosity in aggregates, generally fair to good porosity. FLUOR: (10%) Dull yellow mineral fluorescence.
	10	<u>SILTSTONE</u> : As above.
3695 - 3700	95	<u>SANDSTONE</u> : As above. FLUOR: (5%) As above.
	5	<u>SILTSTONE</u> : As above.
3700 - 3705	90	<u>SANDSTONE</u> : Translucent to clear, occasionally milky, predominantly medium to coarse, occasionally fine and very coarse grained, poorly to moderately sorted, subangular to subrounded, common angular fractured grains, moderately strong dolomite and silica cemented grain aggregates, predominantly loose and clean, aggregates are very hard to hard and brittle with a tight visual porosity, fair porosity overall, trace dull yellow mineral fluorescence.
	5	<u>SILTSTONE</u> : Medium to dark grey, moderately argillaceous, slightly arenaceous, very carbonaceous grading to carbonaceous siltstone, firm to moderately hard, blocky.
	5	<u>COAL</u> : (Possible cavings) Black, vitreous occasionally subvitreous lustre, slightly silty in parts, generally subconchoidal fracture, hard, brittle.
3705 - 3710	90	<u>SANDSTONE</u> : As above, with increasing cemented aggregates, tight to poor visual porosity, trace mineral fluorescence.
	10	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3710 - 3715	90	<u>SANDSTONE</u> : (i) (70%) Translucent, clear, light grey, milky white, medium to coarse grained, occasionally very coarse, moderate to well sorted, angular to subrounded, bit fractured in parts, trace dolomitic cement, loose, generally clean, occasionally pyrite cement, fair to good inferred porosity. (ii) (30%) Translucent, clear, light grey, medium to predominantly fine, occasionally very fine, poorly sorted, moderate siliceous cement, dolomitic cement, common white argillaceous matrix, carbonaceous specks, trace pyrite inclusions, moderately hard to hard, very poor visual porosity, 10% mineral fluorescence.
	10	<u>SILTSTONE</u> : Medium to dark grey, grey brown, arenaceous, slightly micromicaceous, carbonaceous, trace pyrite, moderately hard, blocky to subblocky.
3715 - 3720	95	<u>SANDSTONE</u> : (i) (75%) As above. (ii) (20%) As above.
	5	<u>SILTSTONE</u> : As above, very carbonaceous, grading to carbonaceous siltstone.
3720 - 3725	95	<u>SANDSTONE</u> : (i) (80%) As above. (ii) (20%) As above, trace mineral fluorescence, as above.
	5	<u>SILTSTONE</u> : As above.
3725 - 3730	95	<u>SANDSTONE</u> : (i) (90%) Clear, translucent, light grey, medium to very coarse, predominantly coarse grained, well sorted, subrounded to predominantly subangular, trace pyrite, clean, loose, fair visual porosity. (ii) (10%) As above, trace mineral fluorescence.
	5	<u>SILTSTONE</u> : Dark grey to grey brown, argillaceous, slightly micromicaceous, very carbonaceous to coaly, hard, brittle, subfissile.
3730 - 3735	100	<u>SANDSTONE</u> : (i) (95%) As above, trace pyrite. (ii) (5%) As above.
3735 - 3740	100	<u>SANDSTONE</u> : (i) As above.
3740 - 3745	90	<u>SANDSTONE</u> : Clear, translucent, light grey, medium to coarse, occasionally very coarse grained, moderately sorted, subangular to subrounded, occasionally strong siliceous cement, trace dolomitic cement, occasional silica overgrowths, common evidence of quartz recrystallisation, loose, clean, trace pyrite, fair to good inferred porosity, trace to 10% dull gold fluorescence with weak cut, good crush cut, moderate residue ring (possible cavings).
	10	<u>SILTSTONE</u> : Medium to predominantly dark grey, grey brown, arenaceous, trace micromicaceous, carbonaceous specks, moderately hard, subfissile to subblocky.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3745 - 3750	95	<u>SANDSTONE</u> : As above, fair inferred porosity, trace dull mineral fluorescence.
	5	<u>SILTSTONE</u> : As above.
3750 - 3755	100	<u>SANDSTONE</u> : Clear, translucent, light grey, medium to very coarse, predominantly coarse grained, moderately to well sorted, subrounded, trace dolomitic cement, trace pyrite cement, recrystallised quartz grains, loose, clean, fair inferred porosity, trace very dull mineral fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
3755 - 3760	100	<u>SANDSTONE</u> : (i) (90%) Clear, translucent to white, frosted, coarse to predominantly medium, occasionally very coarse grained, well sorted, subrounded, trace dolomitic cement, minor pyrite cement, recrystallised quartz grains, loose, trace white argillaceous matrix, poor to fair inferred porosity.
		(ii) (10%) Clear, translucent, fine to medium grained, well sorted, subangular, moderately strong siliceous cement, trace dolomitic cement, common white argillaceous matrix, moderately hard, poor visual porosity.
3760 - 3765	100	<u>SANDSTONE</u> : (i) (80%) As above. (ii) (20%) As above.
3765 - 3770	100	<u>SANDSTONE</u> : (i) (70%) As above. (ii) (30%) As above.
3770 - 3775	95	<u>SANDSTONE</u> : (i) (70%) As above, predominantly medium grained, calcareous cement in parts. (ii) (30%) Clear, translucent, light grey, fine to medium grained, well sorted, subrounded, abundant calcareous cement, common strong siliceous cement, common white argillaceous matrix, calcareous veins, pyrite, moderately hard, very poor visual porosity, 20% very dull orange mineral fluorescence, trace milky yellow fluorescence with weak cut, thin residue ring, (in tight aggregates).
	5	<u>SILTSTONE</u> : Dark grey black to grey brown, slightly arenaceous in parts, carbonaceous, slightly calcareous, soft to firm, slightly blocky.
3775 - 3780	95	<u>SANDSTONE</u> : (i) (20%) As above. (ii) (80%) As above, 20% dull orange mineral fluorescence, 10% dull cream to yellow patchy to spotted fluorescence, weak cut, moderate crush cut, thin residue ring.
	5	<u>SILTSTONE</u> : As above.
3780 - 3785	100	<u>SANDSTONE</u> : (i) (70%) Predominantly medium grained, occasional quartz overgrowths, fair inferred porosity. (ii) (30%) As above, with strong dolomite/calcareous cement, trace

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		argillaceous matrix, tight, 5% dull yellow mineral fluorescence, no cut, no residue.
3785 - 3790	95	<u>SANDSTONE</u> : Translucent to clear, occasionally white and smokey grey, medium to predominantly coarse, occasionally very coarse grained, poorly sorted, subangular, minor aggregates are well cemented with dolomite and trace silica cement, trace white argillaceous matrix, trace pyrite cement coating some grains, aggregates are hard to very hard, brittle, generally loose, fair inferred porosity, tight visual porosity, trace dull mineral fluorescence as above.
	5	<u>SILTSTONE</u> : Dark grey/black, dark grey/brown, slightly argillaceous, slightly arenaceous, moderately carbonaceous, firm to moderately hard, blocky.
3790 - 3795	95	<u>SANDSTONE</u> : As above, minor quartz overgrowths, poor to tight visual/inferred porosity, trace mineral fluorescence.
	5	<u>SILTSTONE</u> : As above.
3795 - 3800	100	<u>SANDSTONE</u> : Translucent to white, clear, minor brown staining (possibly bitumen staining) predominantly medium to coarse grained, grading fine to very coarse in parts, common aggregates with moderate to strong silica/dolomite cement, minor quartz overgrowths, trace white to light brown argillaceous matrix, trace pyrite cement, aggregates are very hard, predominantly loose fractured grains, poor inferred, tight visual porosity, trace dull yellow/orange mineral fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
3800 - 3805	100	<u>SANDSTONE</u> : As above.
	Tr	<u>SILTSTONE</u> : As above.
3805 - 3810	85	<u>SANDSTONE</u> : Predominantly medium occasionally fine and coarse grained, moderately sorted, subangular to subrounded, minor aggregates (20%) are very well cemented with dolomite and trace silica cement, trace white argillaceous matrix, trace pyrite, aggregates are very hard to hard and brittle, trace muscovite mica flakes, predominantly loose grains, poor to tight inferred/visual porosity, 5% mineral fluorescence.
	10	<u>COAL</u> : Black, very silty, shiny to subvitreous lustre, uneven to subconchoidal fracture, hard, brittle.
	5	<u>SILTSTONE</u> : As above.
3810 - 3815	8	<u>SANDSTONE</u> : As above.
	10	<u>SILTSTONE</u> : As above.
	5	<u>COAL</u> : As above.
3815 - 3820	85	<u>SANDSTONE</u> : As above, (30% aggregate).
	10	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	5	<u>COAL</u> : As above.
3820 - 3825	90	<u>SANDSTONE</u> : Translucent to clear, medium to coarse, rarely fine grained, moderately to well sorted, subrounded, minor bit fractured grains, moderately strong silica and dolomite cement on aggregates (->30%), trace white argillaceous matrix, trace muscovite mica, trace pyrite cement and disseminated nodules, minor quartz overgrowths, aggregates are hard to very hard, generally loose grains and fractured shards, tight to poor visual porosity, no fluorescence.
	5	<u>SILTSTONE</u> : Very dark grey/black, dark grey, very argillaceous, moderately carbonaceous grading to carbonaceous siltstone, firm to moderately hard, subfissile to blocky.
	5	<u>COAL</u> : As above, possibly cavings.
3825 - 3830 (L.A.T)	85	<u>SANDSTONE</u> : Clear, translucent, light grey, fine to very coarse, predominantly medium to coarse grained, moderately well sorted, subrounded to angular, bit fractured in parts, moderately strong dolomitic cement, quartz recrystallisation in parts, trace white argillaceous matrix, predominantly fair inferred porosity, trace dull mineral fluorescence.
	15	<u>SILTSTONE</u> : Dark grey, black, slightly arenaceous, slightly carbonaceous, moderately hard, subfissile.
3830 - 3835	80	<u>SANDSTONE</u> : As above, common pyrite.
	15	<u>SILTSTONE</u> : As above.
	5	<u>COAL</u> : Black, vitreous lustre, subconchoidal to conchoidal fracture, silty, hard, brittle, blocky.
3835 - 3840	95	<u>SANDSTONE</u> : Clear, translucent, light grey, fine to coarse, predominantly medium grained, well sorted, subangular to angular, dolomitic cement in parts, strong siliceous cement in parts, common quartz overgrowths, trace argillaceous matrix in parts, hard in aggregates (20 to 40%), common pyrite cement and inclusions, poor inferred porosity, 10% dull mineral fluorescence.
	5	<u>SILTSTONE</u> : As above.
3840 - 3845	100	<u>SANDSTONE</u> : As above.
	Tr	<u>SILTSTONE</u> : As above.
3845 - 3850	95	<u>SANDSTONE</u> : As above, 50% aggregates, predominantly moderate dolomitic cement, very poor to tight inferred porosity.
	5	<u>SILTSTONE</u> : As above.
3850 - 3855	100	<u>SANDSTONE</u> : Clear, translucent, light grey, fine to coarse, predominantly medium to fine, rarely very coarse grained, subangular to angular, poorly sorted, moderate siliceous

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	cement with common weak dolomitic cement, common pyrite, common quartz overgrowths, trace argillaceous matrix, 60 to 70% aggregates, moderately hard to hard, very poor to tight inferred porosity. <u>SILTSTONE</u> : As above.
3855 - 3860	95	<u>SANDSTONE</u> : As above, 90% aggregate, no visual porosity.
	5	<u>SILTSTONE</u> : As above.
3860 - 3865	100	<u>SANDSTONE</u> : As above.
3865 - 3870	100	<u>SANDSTONE</u> : Light grey to white, minor clear to translucent grains, predominantly fine to medium grained aggregates, minor medium to coarse loose grains, well sorted, subangular to subrounded, moderate strong dolomitic and siliceous cemented grain aggregates, trace white to light grey silica and argillaceous matrix, trace pyrite matrix, rare altered feldspar grains, trace coal fragments, aggregates are moderately hard to hard, friable, tight to very poor visual porosity, trace dull yellow/orange mineral fluorescence, no cut, no residue ring.
3870 - 3875	100	<u>SANDSTONE</u> : As above, 90% fine to medium grained aggregates, 10% medium to coarse loose fractured quartz grains, tight to very poor visual porosity, trace dull yellow/orange mineral fluorescence.
3875 - 3880	100	<u>SANDSTONE</u> : As above, trace brown (bitumen) staining on some grains, trace dull orange mineral fluorescence.
3880 - 3885	100	<u>SANDSTONE</u> : As above, with slightly increasing white argillaceous matrix, tight to very poor visual porosity, trace mineral fluorescence.
3885 - 3890	100	<u>SANDSTONE</u> : As above, 60% very fine to medium grained aggregates, 40% medium to coarse loose quartz grains, tight to very poor visual porosity, trace mineral fluorescence as above.
3890 - 3895	100	<u>SANDSTONE</u> : Translucent to clear grains, white to light grey sandstone aggregates, fine to coarse, predominantly medium grained, poor to moderately sorted, subangular to subrounded grains in aggregates, medium to coarse loose grains are angular and fractured, strong siliceous and moderately strong dolomitic cement, common quartz overgrowths, fine to medium grained aggregates have trace white argillaceous matrix and are moderately hard to hard, with a tight visual porosity, minor loose grains, trace pyrite cement, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3895 - 3900	100	<u>SANDSTONE</u> : As above, becoming predominantly medium to coarse loose shattered grains, occasionally very coarse, strong siliceous cement with common quartz overgrowths, clean with no matrix, poor inferred porosity, no fluorescence.
3900 - 3904	100	<u>SANDSTONE</u> : As above, 50% fine to medium grained aggregates, as above, 50% medium to coarse loose quartz grains, angular with common quartz overgrowth surfaces, poor visual/inferred porosity, no fluorescence.
T.D. 3904m MD @ 1000 hours 13/06/89 Deepend well after logging		
3905 - 3910	90	<u>SANDSTONE</u> : Translucent to clear, light grey to white sandstone, medium to coarse, occasionally very coarse grained, poorly sorted, angular to subrounded, predominantly bit fractured grains, predominantly loose shattered grains, 20% aggregates which have moderately strong silica/dolomitic cement, trace white argillaceous matrix, aggregates are hard to moderately hard, brittle, trace pyritic cement, trace muscovite mica flakes, poor to fair inferred, tight to poor visual porosity, trace dull yellow/orange mineral fluorescence, no cut, no crush cut, no residue ring.
	5	<u>SILTSTONE</u> : Medium to dark grey, dark brown, moderate to very argillaceous, slightly arenaceous, trace carbonaceous specks, firm, subfissile to blocky.
	5	<u>COAL/CARBONACEOUS SILTSTONE</u> : Black, shiny to dull (with increasing siltiness), uneven to subconchoidal fracture, moderately hard, brittle.
3910 - 3915	95	<u>SANDSTONE</u> : As above, becoming slightly coarser grained with depth, predominantly coarse, grading from medium to very coarse grained, fair to good inferred/fair visual porosity, trace dull yellow mineral fluorescence, as above.
	5	<u>SILTSTONE</u> : As above.
3915 - 3920	100	<u>SANDSTONE</u> : Translucent to clear grains, occasionally smokey grey quartz grains, fine to very coarse grained, predominantly fractured shards, inferred subrounded to rounded grains, moderate to poorly sorted, grains are predominantly loose with minor well cemented aggregates having a strong siliceous and dolomitic cement, trace argillaceous matrix, poor visual/inferred porosity, no fluorescence.
3920 - 3925	100	<u>SANDSTONE</u> : As above, becoming coarse to very coarse grained, poor to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3925 - 3930	100	<u>SANDSTONE</u> : Clear to translucent, as above coarse to very coarse, occasionally medium grained, moderately sorted, inferred subrounded, minor aggregates are well cemented with a siliceous and dolomitic cement, trace argillaceous matrix, trace pyrite, fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
3930 - 3935	100	<u>SANDSTONE</u> : Clear to predominantly translucent, fine to very coarse grained, predominantly medium, grading poor to moderately sorted, inferred subrounded to subangular grains, coarse grains are generally angular and fractured, cementing as above, trace pyrite inclusions in quartz grains, poor to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
3935 - 3940	100	<u>SANDSTONE</u> : As above, common smokey grey to dark grey quartz grains, predominantly medium to coarse grained, common coarse and pebbly fractured quartz grains, inferred poor to moderately sorted, inferred subrounded to subangular grains, minor well cemented grained aggregates with siliceous and dolomitic cement, no matrix, generally loose and clean grains, trace disseminated pyrite nodules, trace quartz overgrowths, fair to poor inferred porosity, no fluorescence.
3940 - 3945	95	<u>SANDSTONE</u> : 2 types: (i) (40%) Clear to translucent, medium to predominantly very coarse grained, poorly sorted, as above. (ii) (55%) Light grey to off white sandstone, clear to translucent grains, fine to medium grained, moderately to well sorted, subangular to subrounded, very well cemented with siliceous and dolomitic cement, generally clean with only trace white argillaceous matrix, aggregates are very hard to hard, brittle, trace pyrite, tight to very poor visual porosity, trace dull yellow/orange mineral fluorescence with no cut or residue.
	5	<u>SILTSTONE</u> : Dark grey/black, dark brown, slightly arenaceous and argillaceous mineral carbonaceous specks, has a silicified appearance, hard, subfissile.
3945 - 3950	100	<u>SANDSTONE</u> : 2 types: (i) (70%) Translucent to milky, clear to light grey/smokey grey, coarse to very coarse angular bit fractured grains as above, poorly sorted, inferred subangular to subrounded grains, as above, poor inferred porosity, no fluorescence. (ii) (30%) As above, very well cemented, hard to very hard, brittle, tight to very poor visual porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	<u>SILTSTONE</u> : As above.
3950 - 3955	95	<u>SANDSTONE</u> : 2 types: (i) (80%) As above, coarse to very coarse grained, predominantly smokey grey to translucent grains, very poorly sorted, bit fractured angular shards, loose grains predominantly common quartz overgrowths, indicating weak to moderately silica cement, fair to poor inferred porosity, no fluorescence. (ii) (15%) As above, fine to medium aggregates, well cemented, hard to very hard, tight visual porosity, trace dull yellow/orange mineral fluorescence.
	5	<u>SILTSTONE</u> : Very dark grey and brown, dark grey/black, moderately argillaceous, moderately arenaceous with minor very fine sand grains, trace carbonaceous specks, micromica in parts, well laminated, moderately hard, subfissile.
3955 - 3960	95	<u>SANDSTONE</u> : 2 types: (i) (50%) As above, becoming slightly finer grained, predominantly medium to coarse grained, moderately sorted, subangular to subrounded, moderate siliceous cement indicated by common quartz overgrowths, no matrix visible, predominantly loose clean quartz grains, fair to good inferred porosity, no fluorescence. (ii) (45%) Fine to medium grained cemented aggregates, as above, trace dull yellow orange mineral fluorescence, as above.
	5	<u>SILTSTONE</u> : As above.
3960 - 3965	95	<u>SANDSTONE</u> : 2 types: (i) (55%) Translucent to clear, medium to coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, inferred subrounded, weak to moderate siliceous cement inferred from minor quartz overgrowths, generally clean with no matrix, common pyrite inclusions in quartz grains, trace pyrite cement, poor inferred porosity, no fluorescence. (ii) (40%) Light grey, off white, predominantly fine to occasionally medium grained, moderately well sorted, subrounded, moderately strong dolomitic and siliceous cement, minor off white argillaceous matrix, trace muscovite mica flakes, rare lithic fragments, moderately hard to hard, brittle, trace pyrite, trace dull yellow mineral fluorescence.
	5	<u>SILTSTONE</u> : As above.
3965 - 3970	100	<u>SANDSTONE</u> : 2 types: (i) (65%) Medium to very coarse, loose, as above.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		(ii) (35%) Light grey of off white, fine to medium cemented aggregates, tight to very poor visual porosity, no fluorescence.
3970 - 3975	95	<u>SANDSTONE</u> : 2 types: (i) (50%) Translucent to white, occasionally clear, medium to very coarse grained, poor to moderately sorted, inferred subrounded to subangular, grains are predominantly bit fractured and angular, moderate silica cement, loose, no matrix, poor to fair inferred porosity. (ii) (50%) Light grey of off white, fine to medium grained aggregates as above, tight to very poor visual porosity, no fluorescence.
	5	<u>SILTSTONE</u> : Dark grey to dark grey/brown, slightly argillaceous and arenaceous, trace carbonaceous specks, slightly micromicaceous, trace pyrite, moderately hard, subfissile.
3975 - 3980	100	<u>SANDSTONE</u> : Translucent to clear, occasionally light grey and smokey, predominantly medium to coarse, occasionally very coarse grained, poor to moderately sorted, subangular to subrounded, common argillaceous bit fractured quartz grains, trace silica and dolomite cements, common quartz overgrowths, no visible matrix, trace pyrite, clean, loose, fair to poor inferred porosity, no fluorescence.
3980 - 3985	100	<u>SANDSTONE</u> : Translucent to clear and milky white, minor smokey grey grains, medium to very coarse grains, predominantly coarse as above, moderately strong silica cement with quartz overgrowths as above, poor to fair inferred porosity, no fluorescence.
3985 - 3990	95	<u>SANDSTONE</u> : Translucent to off white, clear to white, generally loose and clean grains, medium to very coarse grained, very poorly sorted, subangular to subrounded, trace siliceous overgrowths and cement, trace pyrite cement, trace to common frosting and occasional gently curved pitting (large, suggestive of pressure solution), good inferred porosity, trace dull yellow fluorescence, no cut, weak yellow crush cut, thin weak yellow film residue.
	5	<u>COAL</u> : Black to brown/black, dull to occasionally vitreous, trace silty laminae, trace brown sideritic cleat fill (cavings).
3990 - 3995	100	<u>SANDSTONE</u> : Translucent to off white, clear to white, loose and clean, medium to very coarse, moderate to very poorly sorted, subangular to subrounded, trace siliceous cement and overgrowths, trace dolomitic cement, poor inferred porosity, no fluorescence.
	Tr	<u>COAL</u> : As above, cavings.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
3995 - 4000	100	<u>SANDSTONE</u> : As above, trace pyrite, fair to poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Brown, arenaceous to argillaceous, trace very fine sandstone grains, common micromica, trace to common pyrite, blocky, hard.
4000 - 4005	100	<u>SANDSTONE</u> : As above, trace to common siliceous and dolomitic cement, trace to very rare pyrite, abundant fractured grains, fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, arenaceous to argillaceous, common micromica, trace pyrite, blocky, hard.
	Tr	<u>COAL</u> : As above, waxy, hard.
4005 - 4010	100	<u>SANDSTONE</u> : As above, trace to common siliceous cement, trace dolomitic cement, trace to common quartz overgrowths, common to abundant bit fractured grains, moderate to poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, common micromica, blocky, hard.
	Tr	<u>COAL</u> : As above, waxy to subvitreous, hard.
4010 - 4015	90	<u>SANDSTONE</u> : As above, predominantly very coarse, trace to common siliceous cement, abundant grains, moderately to poor inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, trace very fine sandstone grains, trace carbonaceous flecks.
	5	<u>COAL</u> : As above, predominantly waxy, occasionally subvitreous, brittle.
4015 - 4020	95	<u>SANDSTONE</u> : As above, common siliceous cement, common quartz overgrowths, moderate to poor inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, common to abundant carbonaceous flecks, hard.
4020 - 4025	100	<u>SANDSTONE</u> : Translucent to off white, clear to white, loose and clean, medium to very coarse grained, moderate to poorly sorted, subangular to subrounded, abundant bit fractured grains, trace to common siliceous cement, trace dolomitic cement, very hard, trace pyrite, moderate to poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Medium brown, arenaceous to argillaceous, common carbonaceous flecks, hard, blocky.
4025 - 4030	100	<u>SANDSTONE</u> : As above, common dolomitic cement, very hard aggregates, trace pyrite, moderate to very poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, hard, blocky.
4030 - 4035	100	<u>SANDSTONE</u> : Translucent to very pale grey, clear to off white, clean and moderately loose, medium to very coarse grained, poorly sorted, subangular, abundant bit fractured grains, trace siliceous cement, common to

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		abundant dolomitic cement, very hard aggregates, trace pyrite, poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, common carbonaceous laminae, common pyrite laminae, blocky, trace fossil plant fragments.
4035 - 4040	100	<u>SANDSTONE</u> : (i) (70%) White to off white, occasionally pale grey, clear to off white, medium to coarse, occasionally fine grained, very poorly sorted, subangular to occasionally rounded, trace to common siliceous cement, common to abundant dolomitic cement, very hard aggregates, trace pyrite, very rare mica (muscovite), very poor inferred porosity, no fluorescence. (ii) (30%) Light grey to off white, clear to off white, clean and moderately loose, medium to very coarse, predominantly coarse grained, very poorly sorted, subangular, common bit fractured grains, trace siliceous cement, moderate inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace to common carbonaceous flecks, blocky.
4040 - 4045	100	<u>SANDSTONE</u> : (i) (50%) As above, trace pyrite, very poor inferred porosity, no fluorescence. (ii) (50%) As above, trace coarse muscovite mica, moderate to good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace pyrite, trace to common micromica, blocky.
4045 - 4050	100	<u>SANDSTONE</u> : (i) (50%) As above, very poor inferred porosity, no fluorescence. (ii) (50%) As above, moderate to good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace micromica, blocky.
4050 - 4055	100	<u>SANDSTONE</u> : (i) (60%) White to off white, occasionally pale grey, translucent to off white, medium to coarse grained, predominantly medium, poorly sorted, subangular, trace siliceous cement, common to abundant dolomitic cement, very hard aggregates, trace pyrite, very poor inferred porosity, no fluorescence. (ii) (40%) Clear to off white, translucent to off white, clean and loose, medium to very coarse, poorly sorted, subangular, abundant bit fractured grains, no observable cement, good to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Medium to occasionally light brown, argillaceous to arenaceous, trace to common argillaceous matrix, trace pyrite, trace to common carbonaceous flecks, hard, blocky.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
4055 - 4060	100	<u>SANDSTONE</u> : (i) (60%) As above, very poor inferred porosity, no fluorescence. (ii) (40%) As above, good to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, very carbonaceous, trace pyrite, hard, blocky.
4060 - 4065	100	<u>SANDSTONE</u> : (i) (50%) As above, very poor inferred porosity, no fluorescence. (ii) (50%) As above, good to fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace micromica, hard, blocky.
4065 - 4070	100	<u>SANDSTONE</u> : (i) (50%) As above, very poor inferred porosity, no fluorescence. (ii) (50%) As above, fair to very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace pyrite, hard, blocky.
	Tr	<u>COAL</u> : As above, trace silty laminae, hard, blocky.
4070 - 4075	100	<u>SANDSTONE</u> : (i) (40%) As above, very poor inferred porosity, trace pyrite, trace to maximum of 5% dolomitic mineral fluorescence, no hydrocarbon fluorescence. (ii) (60%) As above, fair inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace pyrite, trace carbonaceous flecks, blocky.
4075 - 4080	100	<u>SANDSTONE</u> : (i) (60%) As above, very poor inferred porosity, trace pyrite, trace dolomitic mineral fluorescence. (ii) (40%) As above, fair inferred porosity, abundant bit fractured grains, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace carbonaceous laminae, blocky.
	Tr	<u>COAL</u> : Black to very dark brown, silty, trace pyrite, trace argillaceous matrix in thin silty laminae, waxy, blocky, hard.
4080 - 4085	100	<u>SANDSTONE</u> : (i) (60%) White to occasionally pale grey, clear to off white, fine to medium, occasionally very coarse grained, poorly sorted, subangular to subrounded, strong dolomitic cement, trace siliceous cement and quartz overgrowths, rare carbonaceous siltstone fragments in matrix, very hard, trace pyrite, trace muscovite mica, very poor inferred porosity, no hydrocarbon fluorescence, trace dull orange mineral fluorescence. (ii) (40%) White to off white, clear to off white, loose and clean, medium to coarse, occasionally very coarse grained, poorly sorted, subangular to subrounded, no observable cement, trace quartz overgrowths, fair to good inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	<u>SILTSTONE</u> : Medium brown to occasionally dark brown, arenaceous to argillaceous, common carbonaceous flecks and discontinuous fine laminae, trace pyrite, hard, blocky.
4085 - 4090	95	<u>SANDSTONE</u> : (i) (60%) As above, trace pyrite, very strong dolomitic cement, very poor inferred porosity, no hydrocarbon fluorescence, trace to 5% dolomitic mineral fluorescence (orange). (ii) (35%) As above, trace coarse muscovite mica, good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, trace pyrite, hard, blocky.
4090 - 4095	90	<u>SANDSTONE</u> : (i) (60%) As above, trace to occasionally pyrite in aggregates, very strong dolomitic cement, very hard, very poor inferred porosity, no hydrocarbon fluorescence, trace to 5% dull orange mineral fluorescence.
	10	(ii) (30%) As above, good inferred porosity, no fluorescence. <u>SILTSTONE</u> : As above, abundant carbonaceous flecks, blocky, hard.
		< 4097 CHANGE IN LITHOLOGY >
4095 - 4100	90	<u>SANDSTONE</u> : (i) (90%) White to predominantly pale grey, clear to pale grey, fine to medium, predominantly medium grained, moderate to poorly sorted, subangular to subrounded, strong dolomitic cement, common calcareous cement, argillaceous to siliceous matrix, very hard, trace pyrite, trace micromica, very poor inferred porosity, trace dull orange mineral fluorescence. (ii) (Tr) As above, good inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : Medium brown to pale brown/grey, argillaceous to arenaceous, trace to common calcareous cement, argillaceous matrix, trace pyrite, trace micromica, hard, blocky.
4100 - 4105	50	<u>SANDSTONE</u> : (i) White to pale grey, clear to off white, tight, fine to medium grained, moderate to poorly sorted, subangular to subrounded, strong dolomitic cement, trace calcareous cement, trace to occasionally common argillaceous matrix, very hard, trace pyrite, trace muscovite mica, very poor inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : (ii) Clear to off white, translucent to white, loose and clean, medium to very coarse grained, moderate to poorly sorted, subangular, no cement, trace quartz overgrowths, moderate inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	50	<u>SILTSTONE</u> : Medium brown, occasionally pale brown, argillaceous to arenaceous, trace dolomitic cement, argillaceous matrix, trace pyrite, common carbonaceous flecks, trace to common disseminated fine quartz grains, trace micromica, hard, blocky.
	Tr	<u>COAL</u> : Black to dark brown, waxy to dull, trace pyrite, trace to common silty laminae, blocky, hard.
4105 - 4110	80	<u>SILTSTONE</u> : As above, common carbonaceous flecks and laminae, common fine quartz grains, trace micromica, hard, blocky.
	20	<u>SANDSTONE</u> : (i) As above, strong dolomitic cement, trace muscovite mica, very poor inferred porosity, no fluorescence.
	Tr	<u>COAL</u> : As above, waxy to dull, occasionally subvitreous, blocky, hard.
4110 - 4115	60	<u>SILTSTONE</u> : As above, common carbonaceous flecks, common disseminated fine quartz grains, trace micromica, hard, blocky.
	40	<u>SANDSTONE</u> : As above, strong dolomitic cement, trace siliceous cement and quartz overgrowths, common pyrite cement, trace argillaceous matrix, trace coal fragments in matrix.
	Tr	<u>COAL</u> : As above, blocky, hard.
4115 - 4120	60	<u>SILTSTONE</u> : As above, common carbonaceous flecks, trace to common disseminated fine quartz grains, hard, blocky.
	40	<u>SANDSTONE</u> : (i) As above, strong dolomitic cement, strong silica cement, common quartz overgrowths, very poor inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : (ii) White to off white, clear to white, loose and clean, coarse grained, very poorly sorted, subangular to angular, common bit fractured grains, trace pyrite, moderate to good inferred porosity, no fluorescence.
4120 - 4125	80	<u>SANDSTONE</u> : White to off white, clear to white, loose and clean, medium to coarse grained, poorly sorted, subrounded, trace silica cement, trace muscovite mica, very rare pyrite, predominantly very clear, good to very good inferred porosity, trace dull orange mineral fluorescence (cavings).
	20	<u>SILTSTONE</u> : As above, common carbonaceous flecks, blocky, hard.
4125 - 4130	95	<u>SANDSTONE</u> : White to off white, clear to translucent, loose and clean, medium to very coarse grained, moderate to poorly sorted, subangular to subrounded, trace silica cement, trace muscovite mica, good to very good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : Medium to dark brown, argillaceous to arenaceous, common argillaceous matrix, trace pyrite, trace micromica, blocky, hard.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
4130 - 4135	95	<u>SANDSTONE</u> : (i) (65%) White to off white, clear to translucent, loose and clean, medium to coarse grained, poorly sorted, subangular, trace silica cement, trace quartz overgrowths, good inferred porosity, trace dull yellow green fluorescence, very weak yellow/green crush cut, very faint film residue. (ii) (30%) White to off white, clear to off white, fine to medium, occasionally coarse grained, poorly sorted, subangular to subrounded, strong dolomitic cement, trace silica cement, trace quartz overgrowths, hard, very poor inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : ~ As above, blocky, hard.
4135 - 4140	85	<u>SANDSTONE</u> : (i) (20%) As above, good inferred porosity, trace dull yellow green fluorescence, weak yellow/green crush cut. (ii) (65%) As above, very poor inferred porosity, no fluorescence.
	15	<u>SILTSTONE</u> : As above, blocky, hard.
4140 - 4145	60	<u>SILTSTONE</u> : Medium brown, occasionally grey brown, arenaceous to argillaceous, trace dolomitic cement, abundant argillaceous matrix, trace to common pyrite, trace micromica, trace to common disseminated fine quartz grains, hard, blocky (grading in parts to medium brown and grey brown claystone).
	40	<u>SANDSTONE</u> : (i) (5%) As above, very good inferred porosity, no fluorescence. (ii) (35%) As above, abundant dolomitic cement, very poor inferred porosity, trace dull orange mineral fluorescence.
4145 - 4150	90	<u>SILTSTONE</u> : As above, trace to common associated claystone, hard, blocky.
	10	<u>SANDSTONE</u> : (i) (3%) As above, very good inferred porosity, trace dull yellow to green fluorescence, very weak yellow to green crush cut, very faint dull yellow green film residue. (ii) (7%) As above, very poor inferred porosity, trace dull orange mineral fluorescence.
4150 - 4155	90	<u>SANDSTONE</u> : (i) (20%) White to off white, clear to off white, fine to medium grained, poorly sorted, subangular to subrounded, strong dolomitic cement, trace siliceous cement, trace argillaceous matrix, trace pyrite, very hard, very poor inferred porosity, trace dull orange mineral fluorescence. (ii) (70%) White to off white, clear to off white, loose and clean, medium to coarse grained, subangular to subrounded, poorly sorted, trace pyrite, good inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	10	<u>SILTSTONE</u> : As above, blocky, hard.
4155 - 4160	90	<u>SANDSTONE</u> : (ii) Clear to off white, clear to translucent, loose and clean, medium to coarse, occasionally very coarse grained, moderate to poorly sorted, subangular, trace mica, very good inferred porosity, trace dull yellow/green fluorescence, very weak yellow/green crush cut, no observable residue.
	10	<u>SILTSTONE</u> : Medium to dark brown, arenaceous to argillaceous, strong argillaceous matrix, trace to common carbonaceous flecks, common disseminated fine quartz grains, trace pyrite, trace micromica, hard, blocky.
	Tr	<u>SANDSTONE</u> : (i) White to pale grey, clear to off white, predominantly fine to occasionally medium grained, moderate to poorly sorted, subangular to subrounded, trace pyrite, very poor inferred porosity, trace dull orange mineral fluorescence.
4160 - 4165	100	<u>SANDSTONE</u> : (ii) As above, clean and loose, medium to coarse grained, moderately sorted, subangular to subrounded, very good to excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace pyrite, common carbonaceous flecks, hard, blocky.
4165 - 4170	100	<u>SANDSTONE</u> : As above, clean and loose, medium to coarse grained, moderate to well sorted, subangular to subrounded, very good to excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace pyrite, trace micromica, hard, blocky.
4170 - 4175	100	<u>SANDSTONE</u> : As above, loose, medium to coarse, occasionally very coarse grained, moderate to poorly sorted, subangular to subrounded, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, common carbonaceous flecks, common fine disseminated quartz grains, hard, blocky.
4175 - 4180	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	Tr	<u>SANDSTONE</u> : White to buff/pale grey, clear to off white, predominantly fine to occasionally medium grained, poorly sorted, subangular to subrounded, strong dolomitic cement, trace pyrite, very poor inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, blocky, hard.
4180 - 4185	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, common carbonaceous flecks, blocky, hard.
4185 - 4190	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
	Tr	<u>SILTSTONE</u> : As above.
4190 - 4195	100	<u>SANDSTONE</u> : As above.
	Tr	<u>SILTSTONE</u> : As above.
4195 - 4200	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
4200 - 4205	100	<u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and clean, medium to coarse, occasionally very coarse grained, poorly sorted, subangular to occasionally subrounded, trace pyrite, excellent inferred porosity, no fluorescence.
4205 - 4210	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4210 - 4215	100	<u>SANDSTONE</u> : As above, common bit fractured grains, poorly sorted, subangular, very good inferred porosity.
4215 - 4220	100	<u>SANDSTONE</u> : Clear to off white, clear to white, loose and clean, medium to coarse, occasionally very coarse grained, poorly sorted, subangular to subrounded, common bit fractured grains, trace pyrite, trace muscovite mica, very good inferred porosity, no fluorescence.
4220 - 4225	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Dark brown, arenaceous to argillaceous, common carbonaceous material, common coal interlaminae (COAL: waxy to subvitreous, pyritic), trace pyrite, trace to common disseminated fine quartz grains, blocky, hard.
4225 - 4230	100	<u>SANDSTONE</u> : As above, subangular to subrounded, common bit fractured grains, trace pyrite, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>COAL</u> : Black to very dark brown, waxy to occasionally subvitreous, common disseminated and banded very fine pyrite, trace sideritic cleat fill, hard, blocky.
4230 - 4235	100	<u>SANDSTONE</u> : As above, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>COAL</u> : As above, occasionally common silty laminae, hard, blocky.
	Tr	<u>SILTSTONE</u> : Dark brown, arenaceous to argillaceous, common carbonaceous component to matrix, trace pyrite, common disseminated fine quartz grains, slight trace dolomitic cement, hard, blocky.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
4235 - 4240	100	<u>SANDSTONE</u> : As above, subangular to subrounded, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
	Tr	<u>COAL</u> : As above.
4240 - 4245	100	<u>SANDSTONE</u> : As above, no fluorescence.
4245 - 4250	100	<u>SANDSTONE</u> : As above, common bit fractured grains, trace pyrite, very good inferred porosity, no fluorescence.
4250 - 4255	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4255 - 4260	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4260 - 4265	100	<u>SANDSTONE</u> : As above, trace pyrite, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace micromica, hard, blocky.
4265 - 4270	100	<u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and clean, medium to very coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, common bit fractured grains, trace pyrite, very rare coarse muscovite mica, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Dark brown, occasionally brown to black, very carbonaceous, common medium brown silty laminae, waxy to occasionally subvitreous carbonaceous flecks, very rare plant fragments, trace pyrite, blocky, hard.
4270 - 7275	100	<u>SANDSTONE</u> : As above, trace dolomitic cement, trace silica cement, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, blocky, hard.
4275 - 4280	100	<u>SANDSTONE</u> : As above, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, hard, blocky.
4280 - 4285	100	<u>SANDSTONE</u> : As above, trace quartz overgrowths, trace muscovite mica, very good inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, trace disseminated fine quartz grains (subangular to subrounded), hard, blocky.
4285 - 4290	95	<u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and generally clean, medium to very coarse, predominantly coarse grained, moderate to poorly sorted, subangular, common to abundant bit fractured grains, trace pyrite, very good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : Dark brown to dark grey/brown, arenaceous to argillaceous, abundant

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
		carbonaceous flecks, grading in parts to silty sandstone, trace pyrite, trace plant fragments, blocky, hard.
4290 - 4295	95	<u>SANDSTONE</u> : As above, subangular to subrounded, trace quartz overgrowths, very good inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, blocky, hard.
4295 - 4300	95	<u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and clean, medium to coarse grained, poorly sorted, subangular to subrounded, trace pyrite, trace muscovite mica, excellent inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : Dark brown, arenaceous to argillaceous, abundant carbonaceous debris, trace pyrite, trace plant fragments, blocky, hard.
4300 - 4305	95	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, blocky, hard.
4305 - 4310	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, very carbonaceous, hard, blocky.
4310 - 4315	100	<u>SANDSTONE</u> : As above, common bit fractured grains, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, hard, blocky.
4315 - 4320	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above, hard, blocky.
4320 - 4325	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : As above.
4325 - 4330	100	<u>SANDSTONE</u> : As above, subangular to subrounded, increasing proportion subrounded, rare pyrite, excellent inferred porosity, no fluorescence.
4330 - 4335	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4335 - 4340	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4340 - 4345	100	<u>SANDSTONE</u> : As above, medium to coarse, occasionally fine grained, poorly sorted, subangular to subrounded, increasing proportion of subrounded, excellent inferred porosity, no fluorescence.
4345 - 4350	100	<u>SANDSTONE</u> : As above, fine to coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, excellent inferred porosity, no fluorescence.

BLACKBACK-1 (ST2)

<u>DEPTH</u>	<u>%</u>	<u>LITHOLOGY</u>
4350 - 4355	100	<u>SANDSTONE</u> : As above, subangular to subrounded, increasing proportion subrounded, excellent inferred porosity, no fluorescence.
4355 - 4360	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4360 - 4365	100	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
4365 - 4370	100	<u>SANDSTONE</u> : Clear to off white, clear to translucent, loose and clean, fine to coarse, predominantly medium grained, poorly sorted, subangular to subrounded, common bit fractured grains, trace pyrite, trace muscovite mica, excellent inferred porosity, no fluorescence.
	Tr	<u>SILTSTONE</u> : Dark brown, arenaceous to argillaceous, abundant carbonaceous debris, trace pyrite, trace to common fine quartz grains (disseminated), hard, blocky.
4370 - 4375	90	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above, grading in parts to claystone, hard, blocky.
	Tr	<u>COAL</u> : Black to brown/black, very silty, abundant pyrite, dull to subvitreous, blocky, brittle, laminated, hard.
4375 - 4380	90	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	10	<u>SILTSTONE</u> : As above, hard, blocky.
	Tr	<u>COAL</u> : As above, dull to subvitreous, blocky, brittle, laminated, hard.
4380 - 4385	80	<u>SANDSTONE</u> : Clear to off white, clear to translucent, occasionally white, loose and clean, fine to coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, abundant bit fractured grains, trace pyrite, trace muscovite mica, excellent inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : Dark brown, arenaceous to argillaceous, argillaceous matrix, abundant carbonaceous content, trace to common pyrite, common carbonaceous fragments, common disseminated fine quartz grains, hard, blocky.
4385 - 4390	80	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	20	<u>SILTSTONE</u> : As above, hard, blocky.
4390 - 4395	95	<u>SANDSTONE</u> : As above, excellent inferred porosity, no fluorescence.
	5	<u>SILTSTONE</u> : As above, hard, blocky.
4395 - 4400	100	<u>SANDSTONE</u> : Clear to off white, clear to translucent, occasionally white, loose and clean, fine to coarse, predominantly coarse

BLACKBACK-1 (ST2)

DEPTH

%

LITHOLOGY

grained, poorly sorted, subangular to subrounded, predominantly subangular and common bit fractured grains, trace pyrite, trace muscovite mica, trace quartz overgrowths on grains, excellent inferred porosity, no fluorescence.

Tr

SILTSTONE: Dark brown to brown/black, arenaceous to argillaceous, common carbonaceous content, trace pyrite, trace micromica, trace to common disseminated fine quartz grains, hard, blocky.

Tr

COAL: Black to very dark brown/black, very silty, abundant pyrite, dull to subvitreous, blocky, brittle, laminated, hard.

APPENDIX

2

Core No. 1

Well : Blackback-1

Interval Cored : 2903.0-2921.0

Cut : 18.0m

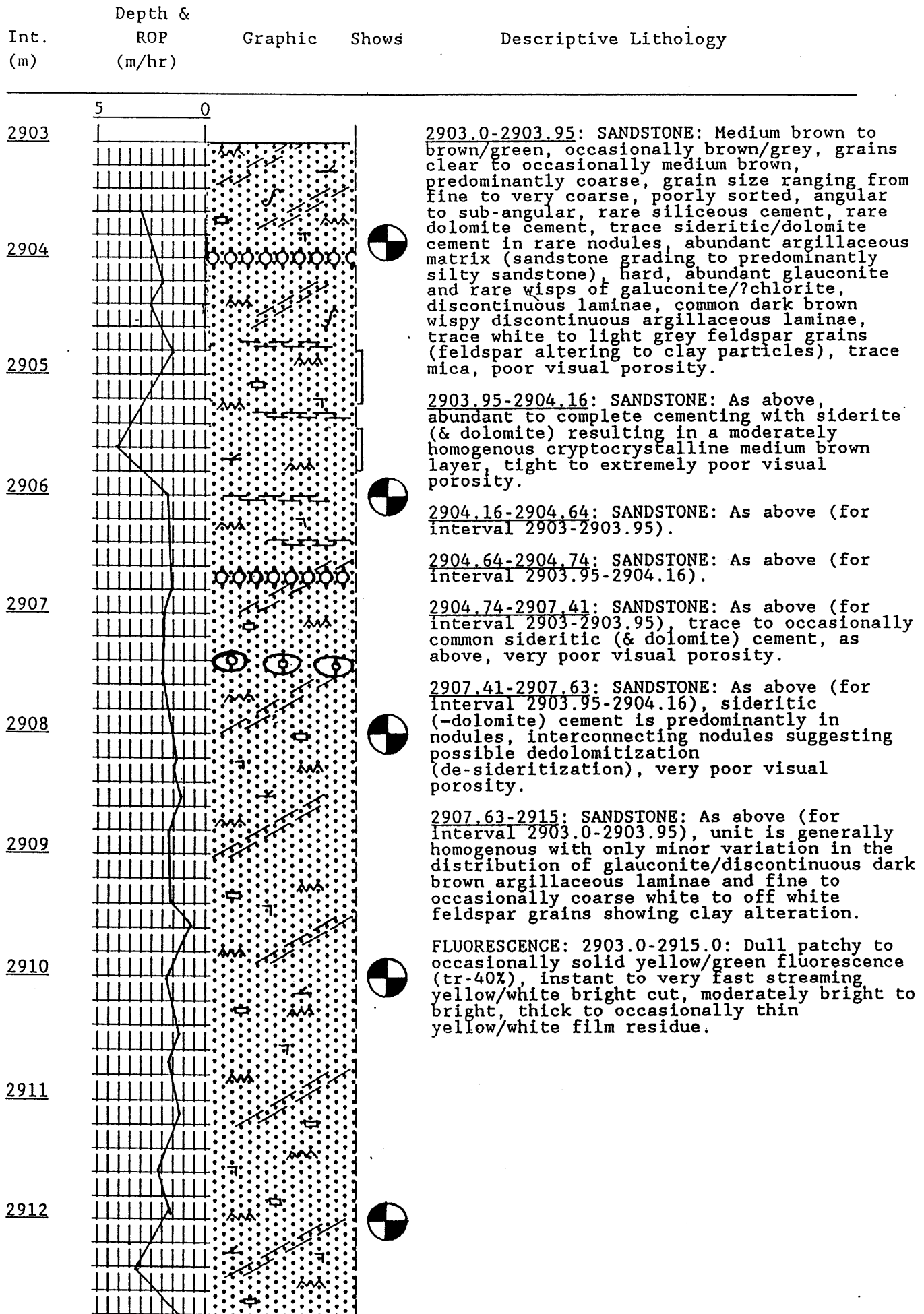
Recovered : 12m (66.7%)

Bit Type : 12 1/4" R476

Bit Size : 12 1/4"

Described by : A Clare

Date : 23/04/89



Core No. 1

Well

: Blackback-1

Interval Cored : 2903.0-2921.0

Cut : 18.0m

Recovered : 12m (66.7%)

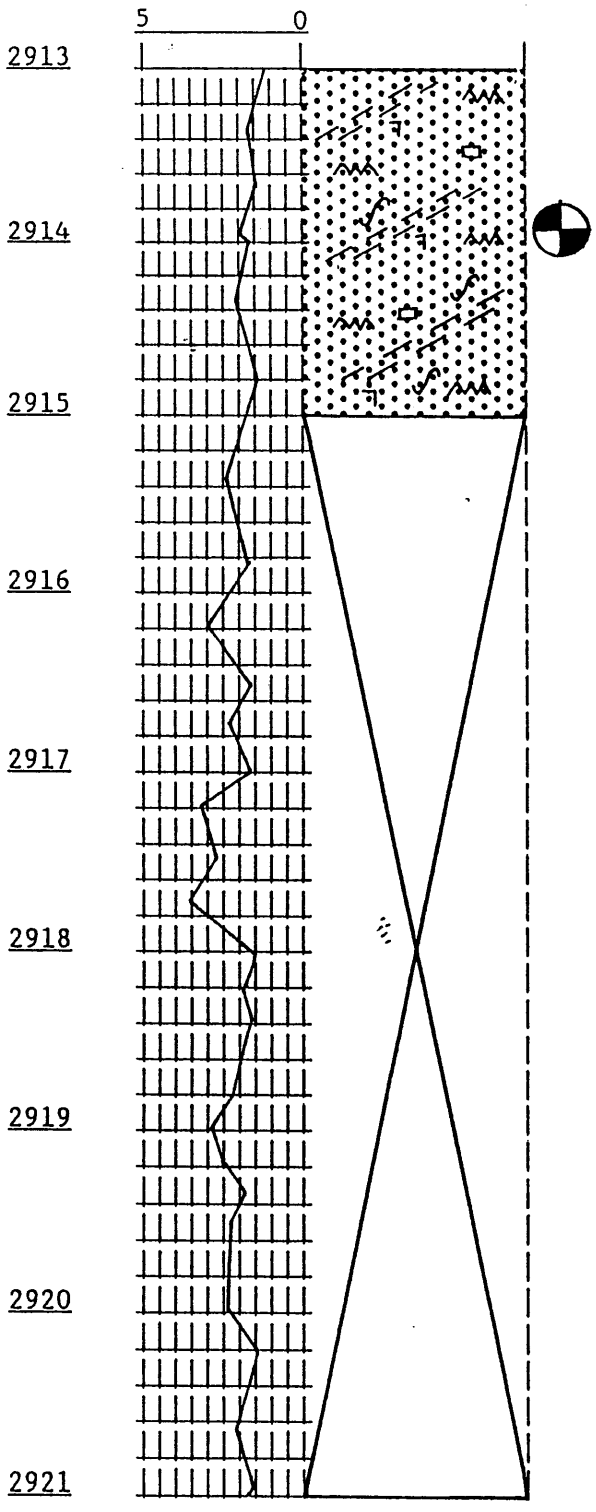
Bit Type : 12 1/4" R476

Bit Size : 12 1/4"

Described by : A Clare

Date : 23/04/89

Int. (m)	Depth & ROP (m/hr)	Graphic Shows	Descriptive Lithology
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COREDESC:1

Core No. 2

Well : Blackback-1 ST1

Interval Cored : 2908.6-2927.0

Cut : 18.4m

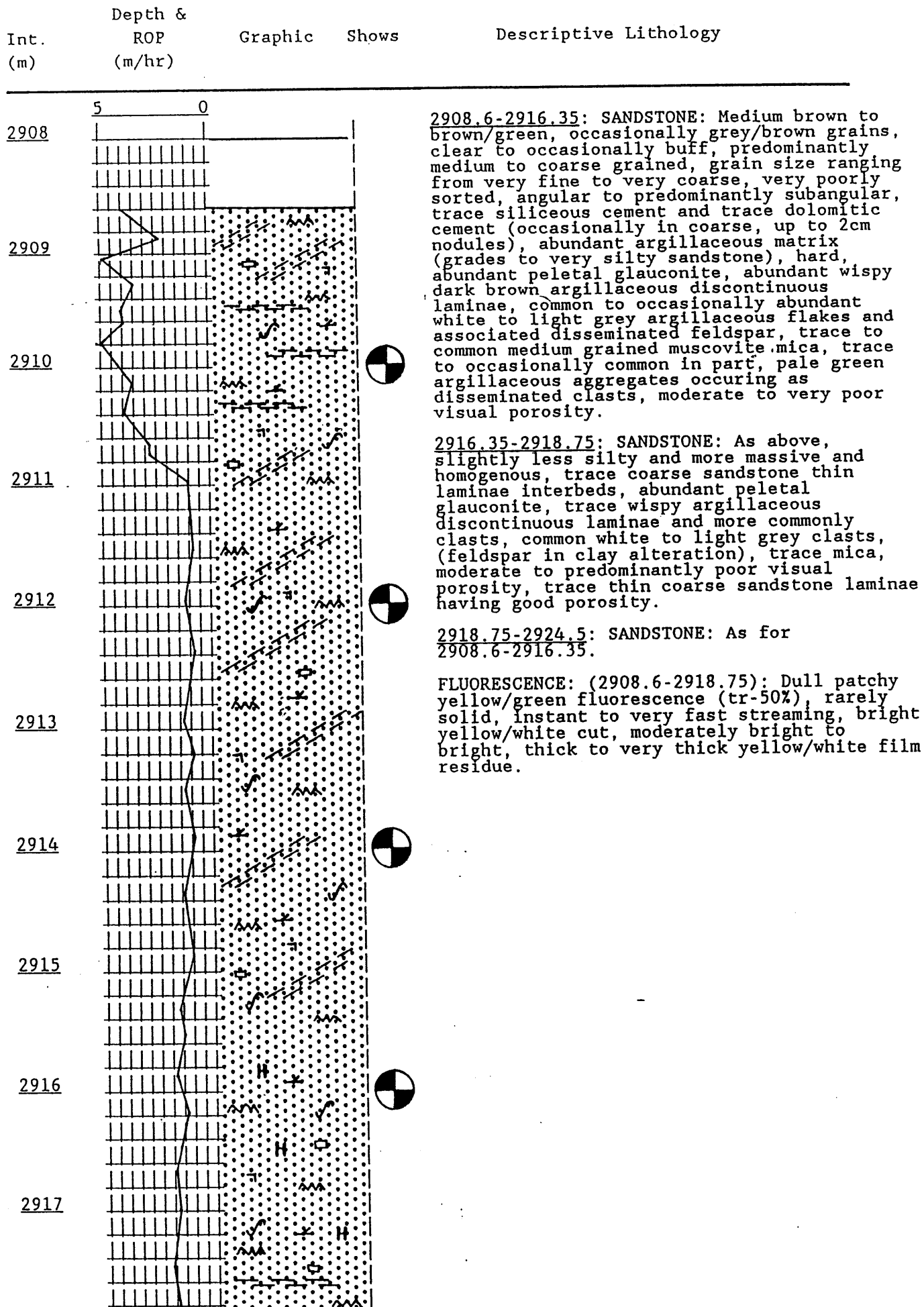
Bit Type : 12 1/4" R476

Described by : A Clare

Recovered : 15.9m (86.4%)

Bit Size : 12 1/4"

Date : 20/05/89



Core No. 2

Well : Blackback-1 ST1

Interval Cored : 2908.6-2927.0

Recovered : 15.9m (86.4%)

Cut : 18.4m

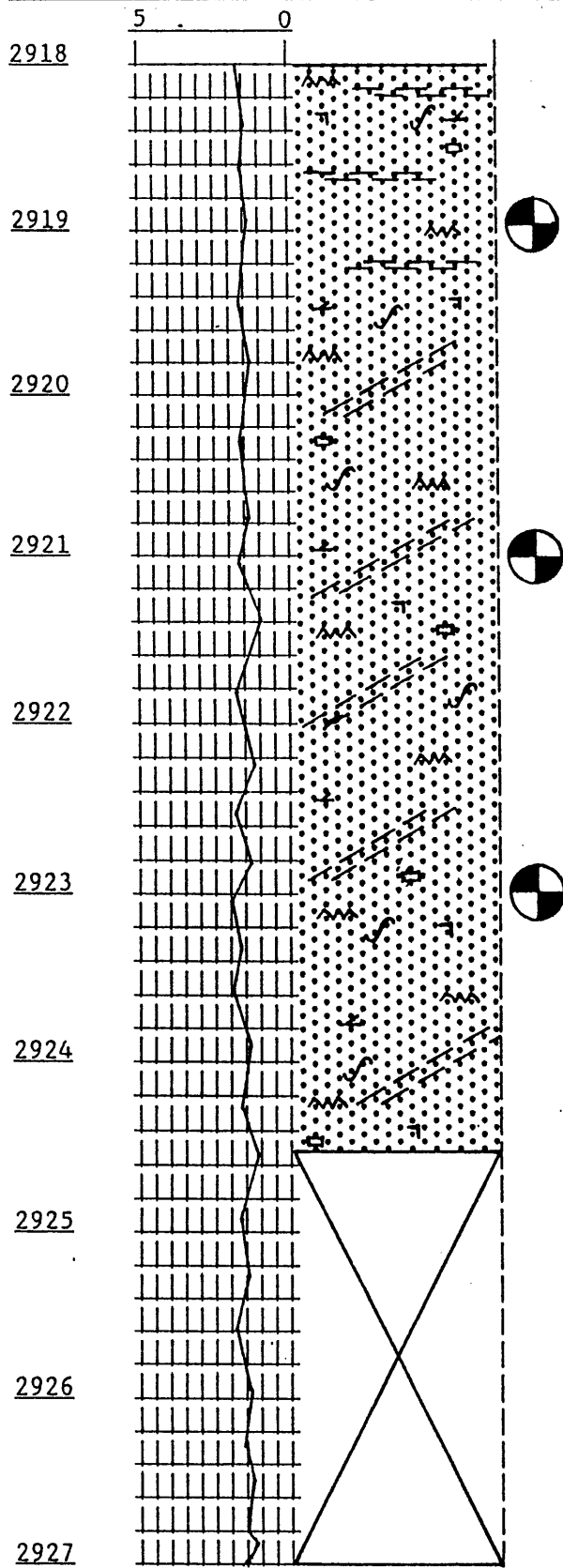
Bit Size : 12 1/4"

Bit Type : 12 1/4" R476

Date : 20/05/89

Described by : A Clare

Int. (m)	Depth & ROP (m/hr)	Graphic Shows	Descriptive Lithology
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APPENDIX
3

BLACKBACK-1 (ST1)

SIDEWALL CORE DESCRIPTIONS

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: TG/C1/C2/C3/C4/C5 ppm)
1	2995.08	20	<p><u>SANDSTONE</u>: White grey to green grey, off white to occasionally green stained grains, predominantly off white, well consolidated, fine to very coarse, predominantly fine grained, moderately sorted, disseminated coarse grains occur in a moderately sorted fine grained matrix, subangular to subrounded (coarse grains rounded), predominantly arenaceous and slightly argillaceous matrix, moderate swelling clays, moderately hard, abundant glauconite, common disseminated intergranular pyrite, trace calcareous cement, very poor inferred porosity. FLU: No fluorescence. GAS: 438/97.8/45.5/40.5/24/6.4</p>
2	2993.08	25	<p><u>SANDSTONE</u>: Medium green to occasionally dark green, off white to pale grey quartz grains, moderately tight, fine to coarse, predominantly medium grained, very poorly sorted, subangular to subrounded, trace calcareous cement, trace argillaceous matrix, predominantly arenaceous (silty) matrix, moderately hard, abundant glauconite (40%), trace anhydrite cement, trace pyrite cement, trace muscovite mica, very poor inferred porosity. FLU: No fluorescence. GAS: 202/76.8/23.8/16.1/4.8/2.1</p>
3	2991.05	27	<p><u>SANDSTONE</u>: Buff to brown green, grains off white to buff, moderately tight to tight, fine to coarse, predominantly medium grained, very poorly sorted, subangular to subrounded, trace siliceous cement, trace anhydrite cement, trace pyrite cement, trace to common argillaceous matrix, common arenaceous matrix, moderately hard, abundant glauconite (30%), trace muscovite mica, very poor inferred porosity. FLU: No fluorescence. GAS: 198/35.9/18.8/15.4/14.4/4.2</p>
4	2987.26	25	<p><u>SANDSTONE</u>: Off white to pale green/white, grains clear to very pale green, moderately tight, fine to coarse, predominantly medium grained, very poorly sorted, subangular to subrounded, predominantly subangular, trace siliceous cement, arenaceous (silty) matrix, trace pyrite, trace muscovite, abundant glauconite (=>20%), poor inferred porosity. FLU: No fluorescence. GAS: 316/48.9/17.8/28.1/28.8/6.4</p>
5	2984.4	30	<p><u>SANDSTONE</u>: Pale to medium brown to green, grains clear to buff, very tight, fine to very coarse, predominantly coarse grained, poorly sorted, angular to subangular, trace siliceous cement, common to abundant argillaceous matrix (yellow to brown in colour), argillaceous matrix has strong swelling clays, moderately hard, trace pyrite, trace muscovite, abundant glauconite (10%), very poor inferred porosity. FLU: No fluorescence. GAS: 163/57.1/19.8/13.8/3.6/2.1</p>

BLACKBACK-1 (ST1)SIDEWALL CORE DESCRIPTIONS

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: TG/C1/C2/C3/C4/C5 ppm)
6	2980.03	17	<u>SANDSTONE</u> : Green to grey, clear to opaque, loose, very coarse grained, poorly sorted, subangular to subrounded, calcareous cement (moderate), hard, brown arenaceous matrix, glauconite, trace pyrite, mica, brown argillaceous lithic clasts, fair porosity, no fluorescence, swelling clay in argillaceous lithic clasts. GAS: 36/4.9/2.0/4.1/3.6/Tr
7	2970.95	0	NO RECOVERY/MISSING BULLET
8	2972.01	0	NO RECOVERY/MISSING BULLET
9	2967.57	17	<u>SANDSTONE</u> : Green to grey, clear to milky, loose, coarse to medium grained, poorly sorted, subangular to subrounded, weak calcareous cement, glauconite, brown arenaceous matrix, swelling clay, trace pyrite, mica, fair visual porosity. FLU: No fluorescence GAS: 987/132/81.2/105.3/75.6/14.8
10	2965.08	30	<u>SILTSTONE</u> : Green/grey to brown, cloudy, friable, fine to very fine grained, poorly sorted, subangular to subrounded, coarse quartz grains (20%), glauconite, trace pyrite, mica, fossil fragments, swelling clay, poor visual porosity. FLU: No fluorescence. GAS: 3011/355.3/240.6/290/260.4/52.7
11	2959.51	40	<u>SANDSTONE</u> : Green to grey, clear to opaque, friable, coarse to very fine grained, poorly sorted, subangular to subrounded, weak calcareous cement, brown arenaceous matrix, glauconite, trace pyrite, mica, fossil fragments in matrix, poor porosity. FLU: Very dull crush cut. GAS: 20020/127.1/179.2/1208.2/2525.8/1161.4
12	2951.94	20	<u>SANDSTONE</u> : Green to grey, clear to opaque, friable, coarse to fine grained, poorly sorted, subangular to subrounded, weak calcareous cement, glauconite, brown arenaceous matrix, fossil fragments in matrix, poor porosity. FLU: Weak crush cut, pale yellow, patchy residue. GAS: 24527/57.1/138.6/1283.9/2952/1206.6
13	2946.19	30	<u>SANDSTONE</u> : Green to grey, clear to opaque, friable, very fine to coarse grained, poorly sorted, subangular to subrounded, glauconite, pyrite, brown arenaceous matrix (20%), calcareous cement, poor porosity. FLU: No fluorescence. GAS: 6601/241.24/366.3/201.69/725.7/424
14	2940.02	35	<u>SANDSTONE</u> : Green grey, clear to opaque, friable, fine to coarse grained (discrete very coarse quartz grains), poorly sorted, subangular to subrounded, glauconite, quartz, brown arenaceous matrix, trace pyrite, calcareous cement, poor porosity. FLU: No fluorescence. GAS: 624/3.2/1/24.3/65/57.2

BLACKBACK-1 (ST1)SIDEWALL CORE DESCRIPTIONS

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: TG/C1/C2/C3/C4/C5 ppm)
15	2935.97	20	<u>SANDSTONE</u> : Pale brown grey, grains clear to buff, moderate consol, fine to coarse, predominantly medium grained, poorly sorted, subangular to subrounded, trace siliceous cement, strong arenaceous matrix, trace argillaceous matrix (moderate swelling clays), moderately hard, common glauconite, trace muscovite mica, rare pyrite, poor inferred porosity. FLU: Trace, patchy dull yellow white, dull moderately fast streaming cut, very thin dull patchy film residue. GAS: 20226/139/309.4/1275.7/2221/1351.5
16	2932.0	-	NO RECOVERY/MISSING BULLET
17	2903.93	30	<u>SANDSTONE</u> : Pale brown green, grains off white to buff, very tight, fine to coarse, predominantly medium grained, poorly sorted, subangular to subrounded, trace siliceous cement (and associated overgrowths), trace calcareous cement (very minor), strong arenaceous matrix, minor argillaceous matrix, moderate to weak swelling clays, moderately hard, common glauconite, no observable pyrite, trace muscovite mica, extremely poor inferred porosity. FLU: Trace, patchy dull yellow green, moderately fast, moderately bright yellow streaming cut, bright yellow crush cut, bright yellow moderately thick film residue. GAS: 102128/33/643/6440/11376/7197
18	2897.06	25	<u>SILTSTONE GRADING IN PART TO SANDSTONE</u> : Medium brown, grains off white to dark buff, moderately tight, fine to silty, moderate to well sorted, subangular to subrounded, trace siliceous cement, strong argillaceous matrix, moderately swelling clays, moderately hard, common glauconite, trace coarse disseminated quartz grains, trace muscovite mica, very poor inferred porosity. FLU: No fluorescence. GAS: 9159/8.1/46/494.1/1078/653
19	2891.52	-	NO RECOVERY/MISSING BULLET
20	2889.04	-	NO RECOVERY/MISSING BULLET
21	2887.40	25	<u>SANDSTONE</u> : Green to grey, clear to opaque, friable, very fine to coarse grained, poorly sorted, subangular to subrounded, quartz, glauconite, brown arenaceous matrix (20%), fossil fragments in matrix, calcareous cement, poor porosity. FLU: Weak crush cut, patchy residue. GAS: 61055/228.2/762/3827.2/6576/4303.6
22	2884.0	15	<u>CLAYSTONE</u> : Brown, firm, abundant forams, glauconite, trace pyrite, mica, fossil fragments, sticky, blocky, ?micritic mud. GAS: 3889/154.5/207/445.5/337/127.2
23	2877.07	30	<u>CLAYSTONE</u> : Brown, as above. GAS: 1736/167/167/194.2/118/36

BLACKBACK-1 (ST1)SIDEWALL CORE DESCRIPTIONS

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: TG/C1/C2/C3/C4/C5 ppm)
24	2869.98	15	<u>CLAYSTONE</u> : Grey to brown, as above. GAS: 642/110.8/72/64.8/35/10.6
25	2861.94	25	<u>CLAYSTONE</u> : Brown, as above, trace glauconite, mica, fossil fragments. GAS: 509/114.1/46/46.1/28/10.6
26	2856.04	30	<u>CLAYSTONE</u> : Medium grey, predominantly argillaceous, trace silty arenaceous and very calcareous, common forams, trace micromica, trace very fine disseminated glauconite (flaky), moderately hard, blocky. GAS: 405/179.3/35/24.3/17/3
27	2851.50	25	<u>CLAYSTONE</u> : Medium grey, very calcareous, common forams, trace fossil fragments, very fine flecks of glauconite, trace micromica, moderately hard, blocky. GAS: 1035/212/99/78.5/71/21.2
28	2840.95	40	<u>CLAYSTONE</u> : Medium grey, very calcareous, common forams, abundant micromica, moderately hard, blocky. GAS: 612/118.9/69/59.9/36/6.3
29	2837.98	20	<u>CLAYSTONE</u> : Brown, firm, abundant forams, fossil fragments, trace mica, sticky, blocky, rare fine grained glauconite pellets. GAS: 1167/407.5/154/81/39/10.6
30	2827.90	35	<u>CLAYSTONE</u> : Medium grey, very calcareous, common forams, abundant micromica, trace fossil fragments, moderately hard, blocky. GAS: 820/407.5/81/48.6/21/4.2

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
1	4374	10	<u>SANDSTONE</u> : Medium to dark brown, clear to medium brown, fine to very fine, occasionally medium grained, moderately well sorted, subangular to subrounded, trace siliceous cement, abundant argillaceous matrix, trace to occasional common pyrite (disseminated to patchy), trace carbonaceous flakes, trace micromica, very hard, very poor inferred porosity, no fluorescence. GAS: 19.7/20/13/Tr/-
2	4364	-	MISSING - RWI
3	4315	10	<u>SANDSTONE</u> : Off white to pale grey, occasionally pale grey to brown, clear to off white, very fine to medium, predominantly medium grained, moderately to poorly sorted, predominantly subangular, occasionally subrounded, trace siliceous cement, trace quartz overgrowths on grains, very fine white to pale grey arenaceous and minor argillaceous matrix, trace pyrite (very minor), trace carbonaceous flakes, trace micromica, firm to moderately hard, moderate inferred porosity, no fluorescence. GAS: 26.6/49/40/14/Tr
4	4271	5	<u>SILTSTONE</u> : Medium brown to medium grey brown, predominantly arenaceous and minor argillaceous, grading in parts to very fine sandstone, common argillaceous matrix, trace to occasional common carbonaceous flakes, trace micromica, common very fine continuous laminae with occasional carbonaceous flakes concentrated in laminae planes, firm, blocky, no fluorescence. GAS: 79.8/58/34/9/-
5	4267.5	-	EMPTY
6	4223	-	MISSING - RWI
7	4221.2	-	MISSING - RWI
8	4170	5	<u>SANDSTONE</u> : Off white to pale grey, occasionally pale grey to brown, clear to pale grey, fine to medium, predominantly medium grained, moderately sorted, subangular to subrounded, predominantly subangular, trace siliceous cement, abundant pale grey arenaceous matrix and trace to common pale grey argillaceous matrix, trace carbonaceous flakes, trace micromica, firm, poor inferred porosity, no fluorescence, no cut or crush cut. GAS: 14/8/12/Tr/-
9	4153	-	EMPTY AND BROKEN
10	4143	-	EMPTY - Trace mud filtrate.

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
11	4112	15	<u>SILTSTONE</u> : Medium brown to medium grey brown, arenaceous and argillaceous, predominantly arenaceous, abundant argillaceous matrix, trace to common disseminated fine quartz grains, common disseminated carbonaceous flakes associated with common discontinuous laminae, trace micromica, rare fossil plant fragments, blocky, firm, very poor inferred porosity, no fluorescence. GAS: 505/279/95/23/-
12	4095	25	<u>SILTSTONE</u> : Medium to dark brown/grey, arenaceous to argillaceous, predominantly arenaceous, abundant argillaceous matrix, common disseminated fine quartz grains, trace carbonaceous flakes occurring in very fine discontinuous laminae, trace muscovite mica (minor oxidising associated), blocky, firm, very poor to nil inferred porosity, no fluorescence. GAS: 20/100/64/19/-
13	4060	-	MISSING - RWI
14	4020	10	<u>SANDSTONE</u> : Off white to pale grey, clear to off white, fine to very coarse, predominantly coarse grained, very poorly sorted, angular to subangular, trace siliceous cement, trace quartz overgrowths, trace white to pale grey arenaceous matrix, trace micromica, fine to moderately hard, very good inferred porosity, no fluorescence, no cut. GAS: 691/705/294/211/33
15	3966	15	<u>SANDSTONE</u> : White to pale grey, clear to off white, very fine to coarse, predominantly fine grained, poorly sorted, angular to subangular, trace to common siliceous cement, trace dolomitic cement, trace argillaceous matrix (very minor), trace micromica, trace disseminated patches pyrite, hard, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: 40/25/14/Tr/-
16	3948	-	MISSING- RWI
17	3905	10	<u>SILTSTONE</u> : Pale to medium brown to medium grey brown, predominantly arenaceous and minor argillaceous, common disseminated fine quartz grains, grading in parts to very fine sandstone, trace carbonaceous flakes, trace micromica, very poor inferred porosity, no fluorescence. GAS: 8/18/102/80/Tr
18	3857	-	EMPTY AND BROKEN - Mud sample
19	3814.5	-	MISSING - RWI

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
20	3802.5	25	<u>SILTSTONE</u> : Brown to grey/brown, predominantly argillaceous, abundant arenaceous matrix, trace to common micromica, trace carbonaceous debris, blocky, hard, no fluorescence. GAS: 665/401/265/849/204
21	3788.5	-	EMPTY / BROKEN
22	3766.5	-	MISSING - RWI
23	3728	-	MISSING - RWI
24	3674.5	15	<u>SANDSTONE</u> : Brown to dark brown, occasional patches pale grey and patches black (carbonaceous), clear to black, very fine to fine grained, moderately well sorted, subangular to subrounded, predominantly subrounded, abundantly argillaceous and carbonaceous matrix, trace laminations, disseminated patches of clean and very carbonaceous sandstone, trace micromica, firm, moderate to poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: 212/708/292/332/75
25	3660.5	20	<u>SILTSTONE</u> : Brown to grey/brown, argillaceous with minor arenaceous matrix, trace micromica, trace to common carbonaceous flakes, common good laminae continuous, good platy cleavage, blocky, hard, no fluorescence. GAS: 1596/1107/306/159/20
26	3643	20	<u>SANDSTONE</u> : White to pale grey, clear to off white, fine to very coarse, predominantly coarse grained, very poorly sorted, subangular to subrounded, trace quartz overgrowths, soft to firm, friable, excellent inferred porosity, 10% dull yellow to white fluorescence, patchy, no cut, dull yellow white, crush cut, thin dull yellow film residue. GAS: 99/143/368/563/223
27	3625	-	<u>SANDSTONE</u> : White, pale grey, clear to off white, very fine to fine, grading in parts to siltstone, moderate to well sorted, subangular to subrounded, trace quartz overgrowths on larger grains, arenaceous matrix, trace muscovite mica, trace carbonaceous flakes, firm to moderately hard, moderate to inferred porosity, 80% solid to patchy moderately bright yellow green fluorescence, no cut, weak yellow green, crush cut, thin moderately bright yellow to green film residue. GAS: 27/32/20/23/Tr
28	3605.5	-	MISSING - RWI
29	3589	-	MISSING - RWB
30	3574.5	-	MISSING - RWI
31	3570.5	25	<u>SILTSTONE</u> : Medium brown/grey, arenaceous to argillaceous, common medium to occasionally very coarse muscovite mica flakes, trace disseminated very fine sand grains, trace carbonaceous flakes, firm, blocky, no fluorescence. GAS: 1306/1025/306/84/Tr

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
32	3565.5	30	<u>SANDSTONE</u> : Off white to pale grey, clear to off white, very fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, trace siliceous cement, trace pale grey arenaceous matrix, trace micromica, firm, good inferred porosity, no fluorescence, dull yellow slow streaming cut, dull yellow crush cut, dull yellow thin film residue. GAS: 599/1845/469/1421/139
33	3556.5	25	<u>SANDSTONE</u> : Off white to pale grey, white to occasionally dark grey, fine to coarse, predominantly medium grained, moderately to poorly sorted, subangular to subrounded, trace siliceous cement, trace dolomitic cement, trace pale grey arenaceous matrix, trace micromica, trace carbonaceous flakes, poor inferred porosity, 80% solid moderately bright yellow green fluorescence, moderately bright yellow green slow pluming cut, moderately bright yellow green crush cut, moderately bright thin film residue. GAS: 67/61/273/848/781
34	3553.5	10	<u>SANDSTONE</u> : Pale grey to occasionally medium grey, clear to pale grey, fine to coarse, predominantly fine grained, moderately sorted, subangular to subrounded, predominantly subangular, common arenaceous matrix, trace to common carbonaceous flakes, disseminated and in discontinuous laminae, trace mica, firm, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: 14/9/7/22/-
35	3544	30	<u>SANDSTONE</u> : Pale grey, clear to pale grey, fine to coarse, predominantly fine grained, moderately to well sorted, subangular to subrounded, common arenaceous matrix, common carbonaceous flakes associated with fine discontinuous laminae, firm, poor to moderate inferred porosity, moderately bright yellow to white fluorescence, no cut, dull yellow white crush cut, dull yellow to white thin film residue. GAS: 27/25/87/278/251
36	3535	30	<u>SILTSTONE</u> : Medium to dark brown, arenaceous to argillaceous, grading in parts to claystone, common carbonaceous flakes, common fine carbonaceous laminae (COAL: Black, clean, vitreous, subconchoidal, brittle, laminated), moderately hard, blocky, no fluorescence. GAS: 1143/738/470/408/176
37	3529	25	<u>SANDSTONE</u> : White to pale grey, clear to pale grey, fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, occasionally angular, common arenaceous pale grey matrix, trace carbonaceous flakes associated with carbonaceous laminae, trace micromica, trace quartz overgrowths, firm, moderate inferred porosity, no fluorescence, no cut, no crush cut. GAS: 1715/1033/612/1686/752
38	3516	-	MISSING - RWI
39	3497.5	-	MISSING - RWI

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
40	3489		<u>SANDSTONE</u> : Off white to pale grey, clear to pale grey, fine to very coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, clean and loose, trace carbonaceous flakes, trace micromica, firm to loose, good to excellent inferred porosity, bright yellow fluorescence, very fast to instant streaming cut, thick bright yellow to white film residue. GAS: 2859/1681/897/2533/1172
41	3484	30	<u>SANDSTONE</u> : Pale grey to grey/brown, off white to pale grey, very fine to fine grained, grading in parts to siltstone, moderate to well sorted, subangular to subrounded, abundant arenaceous and argillaceous matrix, trace micromica, trace carbonaceous flakes, trace disseminated medium to occasionally coarse quartz grains, hard, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: 2859/1722/816/818/-
42	3478.5	30	<u>SILTSTONE</u> : Dark brown, argillaceous to carbonaceous, grading in parts to claystone, abundant carbonaceous debris, common continuous carbonaceous laminae (COAL: Black, clean, vitreous to subvitreous, conchoidal, hard, laminated), firm, subfissile, no fluorescence. GAS: 13965/5658/1560/403/140
43	3463	-	MISSING - RWI
44	3448	30	<u>SANDSTONE</u> : Medium to pale grey, clear to pale grey, very fine to fine, predominantly fine grained, moderate to well sorted, subangular to subrounded, abundant arenaceous matrix, common argillaceous matrix associated with siltstone laminae (<u>SILTSTONE</u> : Dark brown, argillaceous grading in parts to claystone, trace micromica, trace carbonaceous flakes, blocky, hard), trace muscovite mica, trace discontinuous carbonaceous laminae, hard to firm in parts, poor inferred porosity, trace 5% patchy laminae of moderately bright yellow fluorescence, weak very slow pluming cut, weak yellow crush cut, very thin dull yellow film residue. GAS: 133/246/119/77/10
45	3427	30	<u>SILTSTONE</u> : Dark brown, argillaceous, common carbonaceous flakes, trace micromica, firm, subfissile, strong swelling clays, no fluorescence. GAS: 931/738/442/178/28
46	3400.5	15	<u>SANDSTONE</u> : Off white to medium light grey, clear to off white, very fine to medium, predominantly fine grained, moderate to well sorted, subangular to subrounded, abundant arenaceous matrix, grading in parts to siltstone, trace very coarse quartz grains, trace fine discontinuous laminae of coal, (COAL: Black, clean, vitreous, conchoidal, brittle, laminae), trace muscovite mica, firm to hard, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: 93/205/163/131/20
47	3377.5	-	MISSING - RWI

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
48	3357.5	35	<u>COAL</u> : Black to dark brown, generally clean with interlaminae of silty coal, dull to vitreous, uneven to conchoidal, brittle to firm, laminated, no fluorescence. GAS: 27930/17720/2312/499/140
49	3332.5	30	<u>SANDSTONE</u> : Medium to light grey, clear to light grey, fine, moderately sorted, subangular to subrounded, abundant arenaceous matrix, grading in parts to siltstone, common disseminated medium to coarse quartz grains, common silty laminae and associated carbonaceous flakes, trace micromica, firm, poor inferred porosity, trace to 10% dull yellow fluorescence, no cut, very weak yellow crush cut, thin dull yellow film residue. GAS: 66/237/258/161/92
50	3260	-	MISSING - RWI
51	3280.5	-	ONLY MUD FILTRATE GAS: Tr/Tr/Tr/Tr/Tr
52	3236	40	<u>SANDSTONE</u> : Pale grey, clear to pale grey, fine to coarse, predominantly medium grained, trace arenaceous matrix, trace siliceous cement, trace dolomitic cement, trace pyrite, trace muscovite mica, firm, good inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/Tr/Tr/Tr/-
53	3180	20	<u>SILTSTONE</u> : Medium grey to brown, arenaceous to argillaceous, abundant argillaceous matrix, common disseminated medium to very coarse quartz grains, trace biotite mica, trace muscovite mica, grades in parts to fine sandstone, blocky to subfissile, firm, no fluorescence. GAS: 80/221/299/736/18
54	3142	25	<u>SANDSTONE</u> : Light grey/brown to grey, clear to light grey, very fine to fine, occasionally medium grained, moderately sorted, subangular to subrounded, common arenaceous matrix, grades in parts to siltstone, trace micromica, trace glauconite, trace carbonaceous flakes, firm to moderately hard, very poor inferred porosity, 5 to 10% moderately bright yellow fluorescence, dull yellow slow pluming cut, dull yellow crush cut, dull to moderately bright yellow thin film residue. GAS: 15/20/74/272/20
55	3113	15	<u>SANDSTONE</u> : Light brown/grey to light grey, clear to light grey, very fine to medium, predominantly very fine grained, poorly sorted, subangular to subrounded, common arenaceous matrix, grading in parts to siltstone, trace to common muscovite mica, trace carbonaceous flakes, firm, very poor inferred porosity. GAS: 27/41/210/193/74

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 1

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
56	3095	35	<u>SILTSTONE</u> : Medium grey/brown, arenaceous to argillaceous, abundant argillaceous matrix, trace micromica, trace very fine continuous light and dark laminae, blocky, firm to moderately hard, no fluorescence. GAS: 1277/1009/1768/1170/279
57	3082	40	<u>SANDSTONE</u> : Light grey/brown to off white, clear to light grey, very fine to medium, occasionally very coarse, poorly sorted, subangular to subrounded, trace arenaceous matrix, trace to common glauconite, trace micromica, firm, moderate to good inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/Tr/Tr/Tr/-
58	3045	-	MISSING - RWI
59	3020	30	<u>SANDSTONE</u> : Off white to very light grey, clear to off white, very fine to medium, predominantly fine grained, moderately sorted, angular to subangular, occasionally subrounded, trace arenaceous matrix, trace glauconite, trace carbonaceous flakes, trace bio mica, moderately hard, very good inferred porosity, trace to 5% moderately bright yellow to white fluorescence, weak yellow pluming cut, weak yellow crush cut, thin yellow film residue. GAS: 17/16/30/74/150
60	3008	-	MISFIRE

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 2

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
61	4364	25	<u>SANDSTONE</u> : Off white to light grey, clear to light grey, very fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, trace arenaceous matrix, trace argillaceous matrix, trace to common bio mica, trace muscovite mica, firm to soft, moderate inferred porosity, no fluorescence, no cut, no crush cut. GAS: 106/173/122/58/10
62	4315	25	<u>SANDSTONE</u> : Off white to light grey, occasionally light grey to brown, clear to off white, fine to medium, occasionally coarse, poorly sorted, subangular to subrounded, occasionally angular, trace siliceous cement, trace quartz overgrowths, trace arenaceous matrix, trace pyrite, trace carbonaceous flakes, trace micromica, firm to friable, good inferred porosity, no fluorescence, no cut, no crush cut. GAS: 106/33/17/6/Tr
63	4271	25	<u>SILTSTONE</u> : Medium brown/grey, arenaceous and minor argillaceous, grading in parts to very fine sandstone, common argillaceous matrix, trace carbonaceous flakes, trace micromica, trace pyrite, common fine continuous laminae associated with pale grey sandstone and carbonaceous flakes, firm, blocky, no fluorescence. GAS: 332/820/449/46/135/56
64	4267.5	30	<u>SANDSTONE</u> : Off white to pale grey, clear to off white, very fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, trace siliceous cement, trace dolomitic cement, trace muscovite and bio mica, trace carbonaceous debris, moderately hard, moderate to poor visual porosity, no fluorescence, no cut, no crush cut. GAS: 40/33/21/23/Tr
65	4223	30	<u>SILTSTONE</u> : Medium brown to grey, occasionally dark brown (bands), arenaceous and argillaceous, abundant argillaceous matrix, common carbonaceous flakes, common fine carbonaceous continuous laminae, moderately hard, blocky, no fluorescence. GAS: 1796/1550/1333/416/98
66	4221.5 (Broken bullet)	40	<u>SILTSTONE</u> : Medium to dark brown, occasionally brown/black, arenaceous to argillaceous to carbonaceous, abundant argillaceous matrix, abundant carbonaceous content, trace micromica, well laminated, good parting/cleavage, hard, blocky, no fluorescence. GAS: 19950/3690/1280/281/56
67	4170	30	<u>SANDSTONE</u> : Pale grey, clear to pale grey, very fine to medium, predominantly fine grained, moderately sorted, subangular to subrounded, occasionally angular, trace arenaceous matrix, trace micromica, trace carbonaceous flakes, moderately hard, moderate to good inferred porosity, no fluorescence, no cut, no crush cut. GAS: 1197/246/109/28/-

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 2

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
68	4135.5	40	<u>SANDSTONE</u> : Off white to pale grey, clear to off white, fine to very coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, predominantly subangular, trace arenaceous matrix, trace quartz overgrowths, trace carbonaceous flakes, trace dolomitic cement, trace siliceous cement, moderately hard, moderate to good inferred porosity, bright yellow to green fluorescence (solid, 90%), moderately bright yellow with fast streaming cut, bright yellow white crush cut, moderately bright thick yellow film residue. GAS: 65/38/140/228/250
69	4143	25	<u>SILTSTONE</u> : Dark brown, occasionally dark grey brown, arenaceous to argillaceous to carbonaceous, abundant argillaceous matrix and carbonaceous flakes, common micromica, common to abundant fine disseminated quartz grains (grading in parts to very fine sandstone), moderately hard, blocky, no fluorescence. GAS: 151/435/302/128/50
70	4112	30	<u>SILTSTONE</u> : Dark brown, arenaceous, abundant argillaceous and carbonaceous matrix, abundant micromica flakes, common disseminated fine quartz grains, moderately hard to firm, blocky, no fluorescence. GAS: 400/605/376/109/42
71	4060	-	MISSING - RWI
72	4020	25	<u>SANDSTONE</u> : Off white to pale grey, clear to pale grey, fine to very coarse, predominantly coarse grained, poorly sorted, angular to subrounded, predominantly angular, trace to common arenaceous matrix, common to abundant dolomitic cement, trace quartz overgrowths, trace muscovite mica, very rare carbonaceous flakes, very poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/6/-/Tr/Tr
73	3949	35	<u>SANDSTONE</u> : (40%) White to very pale grey, clear to off white, fine to coarse, predominantly fine grained, moderately sorted, subangular to subrounded, abundant calcareous cement, trace dolomitic cement, common calcareous to dolomitic matrix, trace argillaceous matrix, trace micromica, firm, very poor inferred porosity, no fluorescence, no cut, no crush cut. <u>SILTSTONE</u> : (60%) Dark brown, arenaceous to argillaceous, abundant argillaceous matrix, trace micromica, common disseminated quartz grains, common carbonaceous flakes, blocky, hard, no fluorescence. GAS: 61/246/270/186/87
74	3905	20	<u>SANDSTONE</u> : Off white to pale grey/brown, clear to beige, fine to very coarse, predominantly medium poorly sorted, subangular to subrounded, trace arenaceous matrix, trace siliceous and dolomitic cement, trace micromica, firm to moderately hard, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/10/8/18/-

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 2

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
75	3857	20	<u>SANDSTONE</u> : Off white to pale grey, clear to pale grey, fine to coarse, predominantly medium grained, poorly sorted, subangular to subrounded, occasionally angular, trace arenaceous matrix, trace siliceous cement, trace dolomitic cement, trace muscovite mica, moderately hard, poor visual porosity, no fluorescence, no cut, no crush cut. GAS: Tr/3/2/Tr/Tr
76	3814.5	30	<u>SANDSTONE</u> : Off white to pale grey, clear to pale grey, very fine to medium, predominantly very fine grained, moderately well sorted, subangular to subrounded, occasionally angular, common to abundant arenaceous matrix, trace siliceous cement, trace to very rare muscovite mica, trace disseminated coarse quartz grains, moderately hard, very poor visual porosity, trace to 10% dull yellow to green fluorescence, very slow pluming cut, weak dull yellow green crush cut, dull thin yellow to white film residue. GAS:
77	3788.5	25	<u>SANDSTONE</u> : Off white to pale grey/brown, clear to pale grey, very fine to very coarse, predominantly very fine grained, poorly sorted, subangular to subrounded, abundant arenaceous matrix, abundant calcareous and dolomitic cement, trace argillaceous matrix, trace pyrite, moderately hard, very poor inferred porosity, trace dull yellow to green fluorescence, trace dull yellow green crush cut, very thin dull yellow film residue. GAS: Tr/Tr/5/Tr/Tr
78	3766.5	30	<u>SILTSTONE</u> : Off white to pale grey brown, arenaceous, minor argillaceous matrix, grading in parts to very fine sandstone, trace pyrite, trace micromica, hard blocky, no fluorescence. GAS: Tr/Tr/6/Tr/Tr
79	3728	35	<u>SILTSTONE</u> : Off white to very pale grey, arenaceous, minor argillaceous matrix, trace calcareous and dolomitic cement, grading in parts to very fine sandstone, trace to common disseminated medium to very coarse sandstone grains, trace micromica, trace carbonaceous flakes, hard, blocky, no fluorescence. GAS: Tr/18/125/181/-
80	3606.5	35	<u>SILTSTONE</u> : (60%) Medium to dark brown, arenaceous and argillaceous, abundant carbonaceous debris interlaminated with sandstone and siltstone, trace pyrite, trace micromica, sub-blocky, firm, no fluorescence. <u>SANDSTONE</u> : (50%) Light grey, clear to light grey, very fine to medium, predominantly very fine grained, moderately sorted, subangular to subrounded, trace dolomitic and siliceous cement, trace arenaceous matrix, trace pyrite, firm, poor visual porosity, no fluorescence, no cut, no crush cut (strongly interbedded with siltstone). GAS: 54/315/406/182/62

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 2

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
81	3589	30	<u>SANDSTONE</u> : Off white to light grey, clear to light grey, very fine to medium, predominantly fine grained, moderately sorted, angular to subrounded, trace to common dolomitic and calcareous cement, common arenaceous matrix, trace micromica, firm, very poor inferred porosity, 50% moderately bright patchy yellow green fluorescence, no cut, dull yellow to green crush cut, thin dull yellow film residue. GAS: Tr/Tr/10/Tr/-
82	3074.5	40	<u>SANDSTONE</u> : Off white to trace buff/grey, clear to off white, very fine to very coarse, predominantly coarse grained, very poorly sorted, subangular to subrounded, predominantly subrounded, common arenaceous matrix, no observable cement, firm, very good inferred porosity, 100% bright yellow green fluorescence, instant bright yellow green cut, thick bright yellow green film residue. GAS: 12/113/749/1573/2375
83	3516	30	<u>SANDSTONE</u> : Off white to pale buff/grey, clear to off white, fine to coarse, predominantly coarse grained, poorly sorted, subangular to subrounded, trace micromica, firm to friable, very good inferred porosity, bright yellow green patchy 80% fluorescence, instant bright yellow green cut, thick moderately bright yellow green film residue. GAS: Tr/25/88/234/312
84	3479.5	15	<u>SILTSTONE</u> : Dark brown, occasionally medium brown, arenaceous and argillaceous, abundant argillaceous matrix, common carbonaceous flakes, common disseminated fine quartz, trace micromica, blocky, firm, no fluorescence. GAS: 22/69/104/81/12
85	3463	35	<u>CLAYSTONE</u> : Dark brown, argillaceous, trace arenaceous matrix, common carbonaceous debris, minor discontinuous coal laminae (black, clean, vitreous, dull, subconchoidal, brittle, laminae), blocky, hard, no fluorescence. GAS: 216/567/406/140/47
86	3377.5	20	<u>SANDSTONE</u> : Off white to pale buff/grey, clear to buff, very fine to fine grained, moderately to well sorted, subangular to subrounded, common arenaceous matrix, trace siliceous cement, trace micromica, grading in parts to siltstone, firm, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/19/52/33/?
87	3280.5	30	<u>SANDSTONE</u> : Off white to medium grey, clear to grey, very fine to medium grained, well sorted, subangular to subrounded, predominantly subrounded, common arenaceous matrix, common muscovite mica, grading in parts to siltstone, firm, poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tr/16/42/27/5

BLACKBACK-1 (ST2)SIDEWALL CORE DESCRIPTIONS

Gun No. 2

<u>NO.</u>	<u>Depth</u> (m)	<u>Rec.</u> (mm)	<u>Description</u> (GAS: C1/C2/C3/C4/C5 ppm)
88	3260	40	<u>SILTSTONE</u> : Medium brown to buff, arenaceous and abundant argillaceous matrix, trace carbonaceous flakes, trace micromica, common disseminated medium to very coarse well rounded quartz grains, blocky, firm, no fluorescence.
89	3045	45	<u>SANDSTONE</u> : Buff to medium brown, clear to dark brown, fine to very coarse, predominantly fined grained, well sorted, subrounded, common arenaceous matrix, trace siliceous cement, trace micromica, abundant coarse peletal to flaky glauconite, firm, very poor inferred porosity, no fluorescence, no cut, no crush cut. GAS: Tt/Tr/15/38/Tr
90	3008	50	<u>SANDSTONE</u> : Off white to buff, clear to buff, fine to medium, occasionally coarser grained, moderately sorted, subangular to subrounded, trace to common arenaceous matrix, trace argillaceous matrix, common muscovite mica, trace glauconite, trace pyrite, firm to moderately hard, moderate inferred porosity, no fluorescence, no cut, no crush cut. GAS: -/-/Tr/5/-

APPENDIX

4

THE SCHLUMBERGER REPORT

SONIC CALIBRATION

AND GEOGRAM

PROCESSING REPORT

BLACKBACK
~~HARLEQUIN~~ No. 1

HAS BEEN DISTRIBUTED SEPARATELY

MISSING 27/5/99

Blackback-1

APPENDIX 5

RFT SAMPLE TEST REPORT

WELL : BLACKBACK-1 (ST2)

OBSERVER : A. CLARE

DATE : 30/6/89

RUN NO. : 2

	CHAMBER 1 (6 gal.)	CHAMBER 2 (1 gal.)
SEAT NO.	2-12	2-12
DEPTH	4120 mMD (3780 mTVDss)	4120 mMD (3780 mTVDss)
A. RECORDING TIMES		
Tool Set	03:56 hrs	03:56 hrs
Pretest Duration	4 mins	-
Chamber Open	04:00 hrs	04:10 hrs
Chamber Full	04:09 hrs	04:13 hrs
Fill Time	9 mins	3 mins
Finish Build Up	04:10 hrs	04:14 hrs
Build Up Time	1 mins	1 mins
Tool Retract	- hrs	04:15 hrs
Total Time	- mins	19 mins
B. SAMPLE PRESSURE		
Init. Hydrostatic	5973.9 psia	- psia
Init. Form'n Press.(Pretest)	5485.3 psia	- psia
Init. Flowing Press.	5447.8 psia	5460.6 psia
Final Flowing Press.	5450.54 psia	5461.14 psia
Final Form'n Press.	5483.94 psia	5483.95 psia
Final Hydrostatic	- psia	5974.3 psia
C. TEMPERATURE		
Max. Rec. Temp.	93.7 deg C	93.7 deg C
D. SAMPLE RECOVERY		
Surface Pressure	2845 psia	psia
Amt Gas	177.9 cu ft	cu ft
Amt Condensate	1.2 lit	lit
Amt Water (Total)	0.63 lit	lit
Amt Others	lit	lit
E. SAMPLE PROPERTIES		
Gas Composition		
C1	553,613 ppm	ppm
C2	63,960 ppm	ppm
C3	19,487 ppm	ppm
C4	7,453 ppm	ppm
C5	921 ppm	ppm
C6+	Tr ppm	ppm
CO2/H2S	0.6/Tr % /ppm	% /ppm
Oil Properties	52 deg API @ 15.5deg C	deg API@ deg C
Colour	Honey Yellow	
Fluorescence	Very Bright Blue-White	
GOR	23,571	
Pour Point		
Water Properties		
Resistivity	0.414 ohm-m @ 17.5 deg C	ohm-m @ deg C
NaCl Equivalent	16,500 ppm	ppm
Cl-titrated	10,000 ppm	ppm
Tritium	1921 DPM	DPM
pH	8.0	
Est. Water Type		
F. MUD FILTRATE PROPERTIES		
Resistivity	0.214 ohm-m @ 15.5 deg C	0.214ohm-m @ 15.5 deg C
NaCl Equivalent	37,180 ppm	37,180 ppm
Cl-titrated	17,500 ppm	17,500 ppm
pH	10.2	10.2
Tritium (in Mud)	3100 DPM	3100 DPM
G. GENERAL CALIBRATION		
Mud Weight	9.2 ppG	9.2 ppG
Serial No. (Preserved)	-	RFS AD 1129
Choke Size/Probe Type	2 x 0.02/Martineau	1 x 0.02/Martineau
REMARKS	Tritium Value @ 4120m while drilling = 2966DPM	Sample Preserved for PVT Analysis

08900124/1

RFT SAMPLE TEST REPORT

WELL : BLACKBACK-1 (ST2)

OBSERVER : G.SMITH/M.BUCKNILL DATE : 18/6/89

RUN NO. : 2

	CHAMBER 1 (22.4 lit.)	CHAMBER 2 (3.8 lit.)
SEAT NO.	2-30	2-30
DEPTH	3805.5 mMD (3523 mTVDss)	3805.5 mMD (3523 mTVDss)
A. RECORDING TIMES		
Tool Set	01:56 hrs	- hrs
Pretest Duration	5 mins	-
Chamber Open	02:01 hrs	02:19 hrs
Chamber Full	02:13 hrs	02:21 hrs
Fill Time	12 mins	2 mins
Finish Build Up	02:15 hrs	02:22 hrs
Build Up Time	2 mins	1 mins
Tool Retract	- hrs	02:29 hrs
Total Time	- mins	33 mins
B. SAMPLE PRESSURE		
Init. Hydrostatic	5652.5 psia	- psia
Init. Form'n Press. (Pretest)	5106.4 psia	- psia
Init. Flowing Press.	Not Seen psia	5085.1 psia
Final Flowing Press.	5083.6 psia	5090.1 psia
Final Form'n Press.	5106.2 psia	5106.8 psia
Final Hydrostatic	- psia	5651.8 psia
C. TEMPERATURE		
Max. Rec. Temp.	87.8 deg C	87.8 deg C
D. SAMPLE RECOVERY		
Surface Pressure	1990 psia	psia
Amt Gas	104.6 cu ft	cu ft
Amt Oil	8.0 (Emulsion) lit	lit
Amt Water (Total)	0.5 lit	lit
Amt Others	- lit	lit
E. SAMPLE PROPERTIES		
Gas Composition		
C1	771,000 ppm	ppm
C2	103,000 ppm	ppm
C3	29,000 ppm	ppm
C4	3,900 ppm	ppm
C5	108 ppm	ppm
C6+	- ppm	ppm
CO2/H2S	Nil/20 % /ppm	% /ppm
Oil Properties	53 deg API @ 15.5 deg C	deg API @ deg C
Colour	Translucent Light Brown	
Fluorescence	Bright Cream - Off White	
GOR	2079	
Pour Point	-	
Water Properties		
Resistivity	0.2 ohm-m @ 19.4 deg C	ohm-m @ deg C
NaCl Equivalent	35,860 ppm	ppm
Cl-titrated	20,500 ppm	ppm
Tritium	1805 DPM	DPM
pH	8.4	
Est. Water Type	Filtrate	
F. MUD FILTRATE PROPERTIES		
Resistivity	0.144 ohm-m @ 18.3 deg C	ohm-m @ deg C
NaCl Equivalent	53,850 ppm	ppm
Cl-titrated	22,000 ppm	ppm
pH	10.0	
Tritium (in Mud)	2440 DPM	DPM
G. GENERAL CALIBRATION		
Mud Weight	9.2 ppg	ppg
Serial No. (Preserved)		1114 RFS-AD
Choke Size/Probe Type	2 x 0.02	2 x 0.02
REMARKS		Preserved for PVT Analysis

RFT SAMPLE TEST REPORT

WELL : BLACKBACK-1 (ST2)

OBSERVER : G. SMITH/M. BUCKNILL DATE : 18/6/89

RUN NO. : 3

	CHAMBER 1 (22.7 lit.)	CHAMBER 2 (3.8 lit.)
SEAT NO.	3-31	3-31
DEPTH	3574.5 mMD (3336 mTVDss)	3574.5 mMD (3336 mTVDss)
A. RECORDING TIMES		
Tool Set	06:15 hrs	- hrs
Pretest Duration	4 mins	-
Chamber Open	06:19 hrs	06:33 hrs
Chamber Full	06:29 hrs	06:35 hrs
Fill Time	10 mins	2 mins
Finish Build Up	06:30 hrs	06:35 hrs
Build Up Time	1 mins	0.3 mins
Tool Retract	- hrs	06:37 hrs
Total Time	- mins	22 mins
B. SAMPLE PRESSURE		
Init. Hydrostatic	5354.4 psia	- psia
Init. Form'n Press. (Pretest)	4836.2 psia	- psia
Init. Flowing Press.	Not Seen psia	Not Seen psia
Final Flowing Press.	4821 psia	4822 psia
Final Form'n Press.	4835.4 psia	4835.4 psia
Final Hydrostatic	- psia	5353 psia
C. TEMPERATURE		
Max. Rec. Temp.	80.8 deg C	80.8 deg C
D. SAMPLE RECOVERY		
Surface Pressure	2450 psia	psia
Amt Gas	84.9 cu ft	cu ft
Amt Oil	14 lit	lit
Amt Water (Total)	Tr lit	lit
Amt Others	- lit	lit
E. SAMPLE PROPERTIES		
Gas Composition		
C1	7,332,000 ppm	ppm
C2	378,000 ppm	ppm
C3	54,000 ppm	ppm
C4	8,832 ppm	ppm
C5	240 ppm	ppm
C6+	- ppm	ppm
CO2/H2S	6 /Nil % /ppm	% /ppm
Oil Properties	41 deg API @ 15.5 deg C	deg API @ deg C
Colour	Lht Yellow Brown Waxy Crude	
Fluorescence	Bright Yellow White	
GOR	963	
Pour Point	-	
Water Properties		
Resistivity	ohm-m @ deg C	ohm-m @ deg C
NaCl Equivalent	ppm	ppm
Cl-titrated	ppm	ppm
Tritium	DPM	DPM
pH		
Est. Water Type		
F. MUD FILTRATE PROPERTIES		
Resistivity	0.144 ohm-m @ 18.3 deg C	ohm-m @ deg C
NaCl Equivalent	53,850 ppm	ppm
Cl-titrated	22,000 ppm	ppm
pH	10.0	
Tritium (in Mud)	2440 DPM	DPM
G. GENERAL CALIBRATION		
Mud Weight	9.2 ppg	9.38 ppg
Serial No. (Preserved)		1286 RFS-AD
Choke Size/Probe Type	2 x 0.02"	2 x 0.02"
REMARKS		Preserved for PVT Analysis

RFT SAMPLE TEST REPORT

WELL : BLACKBACK-1 (ST2)

OBSERVER : G.SMITH

DATE : 19/6/89

RUN NO. :

	CHAMBER 1 (22.7 lit.)	CHAMBER 2 (3.78 lit.)
SEAT NO.	8-50	8-50
DEPTH	3530.4 mMD (3300 mTVDss)	3530.4 mMD (3300 mTVDss)
A. RECORDING TIMES		
Tool Set	06:46 hrs	- hrs
Pretest Duration	3 mins	-
Chamber Open	06:49 hrs	07:49 hrs
Chamber Full	07:49 hrs	08:57 hrs
Fill Time	60 mins	8 mins
Finish Build Up	- hrs	- hrs
Build Up Time	- mins	- mins
Tool Retract	- hrs	08:18 hrs
Total Time	- mins	92 mins
B. SAMPLE PRESSURE		
Init. Hydrostatic	5273 psig	- psig
Init. Form'n Press. (Pretest)	4761 psig	- psig
Init. Flowing Press.	15 psig	1243 psig
Final Flowing Press.	4369 psig	4300 psig
Final Form'n Press.	4663 psig	4563 psig
Final Hydrostatic	- psig	5267 psig
C. TEMPERATURE		
Max. Rec. Temp.	82.7 deg C	82.7 deg C
D. SAMPLE RECOVERY		
Surface Pressure	1700 psia	2250 psia
Amt Gas	16.0 cu ft	15.7 cu ft
Amt Oil	0.05 lit	0.1 lit
Amt Water (Total)	20.1 lit	1.8 lit
Amt Others	- lit	- lit
E. SAMPLE PROPERTIES		
Gas Composition		
C1	3,854,000 ppm	7,538,000 ppm
C2	1,209,600 ppm	1,350,000 ppm
C3	414,000 ppm	351,000 ppm
C4	8,082 ppm	67,380 ppm
C5	3,132 ppm	1,440 ppm
C6+	Tr ppm	Tr ppm
CO2/H2S	8 /Nil % /ppm	9 /Nil % /ppm
Oil Properties	deg API @ deg C	46 deg API @ 15.5 deg C
Colour	Honey Coloured	Dark Green
Fluorescence	Bright Yellow Cream	Bright Blue White
GOR	50,880	24,963
Pour Point		
Water Properties		
Resistivity	ohm-m @ deg C	ohm-m @ deg C
NaCl Equivalent	ppm	ppm
Cl-titrated	24,000 ppm	24,000 ppm
Tritium	2559 DPM	2316 DPM
pH	7.0	6.8
Est. Water Type	Filtrate 3%KCl	Filtrate 3%KCl
F. MUD FILTRATE PROPERTIES		
Resistivity	0.144 ohm-m @ 18.6 deg C	0.144 ohm-m @ 18.6 deg C
NaCl Equivalent	53,850 ppm	53,850 ppm
Cl-titrated	22,000 ppm	22,000 ppm
pH	10.0	10.0
Tritium (in Mud)	3120 DPM	3120 DPM
G. GENERAL CALIBRATION		
Mud Weight	9.2 ppG	9.2 ppG
Serial No. (Preserved)		
Choke Size/Probe Type	5 x 0.02"/Martineau	5 x 0.02"/Martineau
REMARKS		

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RFT SAMPLE TEST REPORT

WELL : BLACKBACK-1 (ST2)

OBSERVER : M.BUCKNILL/G.SMITH DATE : 18/6/89

RUN NO. : 4

	CHAMBER 1 (22.7 lit.)	CHAMBER 2 (3.8 lit.)
SEAT NO.	4-34	4-34
DEPTH	3566.8 mMD (3330 mTVDss)	3566.8 mMD (3330 mTVDss)
A. RECORDING TIMES		
Tool Set	10:21 hrs	- hrs
Pretest Duration	2	-
Chamber Open	10:23 hrs	10:40 hrs
Chamber Full	10:36 hrs	10:43 hrs
Fill Time	13 mins	3 mins
Finish Build Up	10:40 hrs	10:44 hrs
Build Up Time	4 mins	1 mins
Tool Retract	- hrs	10:45 hrs
Total Time	- mins	24 mins
B. SAMPLE PRESSURE		
Init. Hydrostatic	5330.9 psia	- psia
Init. Form'n Press.(Pretest)	4832.8 psia	- psia
Init. Flowing Press.	Not Seen psia	Not Seen psia
Final Flowing Press.	4796.8 psia	4795.3 psia
Final Form'n Press.	4832 psia	4837 psia
Final Hydrostatic	- psia	5345.3 psia
C. TEMPERATURE		
Max. Rec. Temp.	84.5 deg C	84.5 deg C
D. SAMPLE RECOVERY		
Surface Pressure	2350 psia	- psia
Amt Gas	87.3 cu ft	- cu ft
Amt Condensate	1.2 lit	- lit
Amt Water (Total)	8.5 lit	- lit
Amt Others	- lit	- lit
E. SAMPLE PROPERTIES		
Gas Composition		
C1	7,708,000 ppm	ppm
C2	982,800 ppm	ppm
C3	432,000 ppm	ppm
C4	163,440 ppm	ppm
C5	15,480 ppm	ppm
C6+	ppm	ppm
CO2/H2S	7/3 % /ppm	% /ppm
Oil Properties	52 deg API @ 15.6deg C	deg API@ deg C
Colour	Dark Green	
Fluorescence	Very Bright Blue White	
GOR	9915	
Pour Point		
Water Properties		
Resistivity	0.19 ohm-m @ deg C	ohm-m @ deg C
NaCl Equivalent	ppm	ppm
Cl-titrated	28,500 ppm	ppm
Tritium	2545 DPM	DPM
pH	7.5	
Est. Water Type	Filtrate	
F. MUD FILTRATE PROPERTIES		
Resistivity	0.144 ohm-m @ 18.3 deg C	ohm-m @ deg C
NaCl Equivalent	53,850 ppm	53,850 ppm
Cl-titrated	22,000 ppm	22,000 ppm
pH	10.0	
Tritium (in Mud)	2867 DPM	DPM
G. GENERAL CALIBRATION		
Mud Weight	9.2 ppg	ppg
Serial No. (Preserved)		
Choke Size/Probe Type	2 x 0.02"	2 x 0.02"
REMARKS		Preserved for PVT Analysis