SDA 958

DEVILFISH-1
WELL COMPLETION REPORT
GIPPSLAND BASIN
VIC/P21

VOLUME 1
BASIC DATA

SOUTHERN TEAM/PETROLEUM
ENGINEERING/DRILLING
OPERATIONS

July 1990

Keywords: Exploration, reservoir, seal, source, stratigraphy, structure, hydrocarbons, petrophysics, palynology, palaeontology, geochemistry, synthetic seismogram.

THE SHELL COMPANY OF AUSTRALIA LIMITED
1 SPRING STREET, MELBOURNE, VIC. 3000

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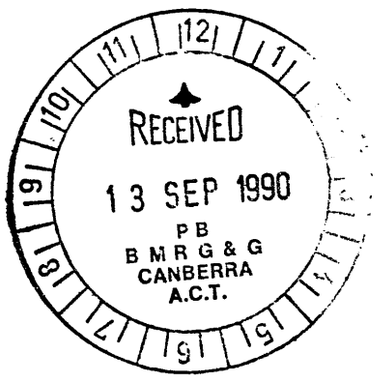

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1. INTRODUCTION

Devilfish-1 was drilled by the semi-submersible drilling unit the "Zapata Arctic". Operations commenced on 9 April, 1990 when the rig was handed over at the conclusion of the Petrofina well, Archer-1. The rig proceeded under tow, assisting with its own power, to the Devilfish-A location and Devilfish-1 was spudded on 10 April, 1990. The total depth of 2058m was reached after a total of 10.7 days drilling. The only drilling problem encountered was the drill string being stuck for 3.5 hours at 300m during the drilling of the 8 1/2" pilot hole. Rough weather caused 5.3 days lost time during anchor handling at the end of the well.

No significant hydrocarbon shows were encountered. Log analysis showed the objective Latrobe Group to be entirely water bearing. The Golden Beach Group was not intersected.

The well was plugged and abandoned and the Zapata Arctic released on 1 May, 1990. The total time taken to complete the well was 22.3 days, 2.5 days more than programmed.

2. WELL DATA

Note: All Depths in this report are metres below drill floor (bdf) unless stated otherwise.

Well :	Devilfish-1
Well Type :	Exploration
Permit:	VIC/P21
Operator :	The Shell Company of Australia Ltd (50%)
Joint Venture Partners:	Western Mining Corporation (25%) TCPL Resources Ltd. (25%)
Location :	Latitude 38 ^{o} 47'58.21" S Longitude 147 ^{o} 55'10.54" E
	Grid Reference AGD66 East 579854.6m North 5705055.9m
Drilling Contractor :	Zapata Off-Shore Company.
Drilling Unit :	Zapata Arctic (Semi-Submersible)
Permanent Datum :	Mean Sea Level (msl)
Drill Floor Elevation :	28.4m above msl
Water Depth :	74m below msl
Total Depth :	2058.0m bdf
Geothermal Gradient :	4.8 ^{o}C/100m
Start of Operations :	1100 hours 9 April, 1990
Spudded :	2300 hours 10 April, 1990
Drilling Completed :	1600 hours 21 April, 1990
Rig Released :	1700 hours 1 May, 1990
Total Days :	22.25 (start operations to rig release)
Total Cost :	A$ 4.6 million
Final Well Status:	Plugged and Abandoned

2. WELL DATA (Cont'd.)

Hole size and depth :	36"	to 142m
	26"	to 400m
	12 1/4"	to 1100m
	8 1/2"	to 2058m
Wellhead :	18 3/4" Vetco SG5, top at 99m bdf	
Casing Summary :	30"	to 137.5m
	20"	to 391m
	9 5/8"	to 1088.6m

Wireline Logging :

Suite 1

DLL-AS-LDL-GR-AMS-CAL (GR to seabed)	891 - 390m Tool hung up at 893m

Suite 2

a) DLL-AS-MFSL-LDL-CNL-NGS-CAL-AMS	2038 - 1091m (CNL-MSFL-NGS to 1590m
b) FMS-GR	2031-1590m,GR to 850m
c) CST-GR	Shot 30, Recovered 27 2 Lost, 1 Empty
d) WST	2025-527m, 50 Levels

Wireline Logging Contractor : Schlumberger Seaco Inc.

Production Testing : None Performed

Contractor : Schlumberger Seaco Inc. (Flopetrol)

Abandonment Plugs :

Plug 1a	2000 - 1866m
Plug 1b	1860 - 1733m
Plug 1c	1720 - 1579m
Plug 2	1140 - 990m
Plug 3 EZSV BP	950m
Plug 4	150m to Seabed

3. DRILLING OPERATIONS

3.1 Site Survey

Associated Surveys International Pty. Ltd. performed a bathymetric and side scan sonar site investigation at the Devilfish-A location. This was carried out over 12/13 January, 1990, aboard the survey vessel "M.V. Wongara". The site surveyed was an area of 2,400 meters square centred on lat 38°47'57.9"S, long 147° 55'10.7"E, using three Syledis stations for position determination. The sea floor topography from echo sounding and side scanning sonar was used to determine the nature of the sea floor and to identify any sea floor features.

The bathymetric survey indicated a gently undulating sea floor sloping slightly to the north-west. Water depths range from 70.4m in the south-west to 74.1m in the north-west, with 73.1m at the Devilfish-A location. The sea floor has a uniform texture of medium grained sand with minor coarse sand and shell gravel. No obstructions which would affect the positioning or anchoring of the drilling unit were observed.

3.2 Rig Navigation & Positioning

Racal Surveys (Australia) was contracted to position the "Zapata Arctic" on location at Devilfish-A using a four station Syledis Positioning System interfaced to a HP9826 microcomputer using Racal's General Navigation System software. Final position was determined by differential G.P.S. Satellite Positioning.

The final location results were :

	Easting	Northing	Latitude	Longitude
Syledis	579871.6	5705051.5	38°47'58.35"S	147°55' 11.25"E
G.P.S.	579854.6	5705055.9	38°47'58.21"S	147°55' 10.54"E

The G.P.S. position was taken as the correct final position. This was 10.4m at 202° from the intended location.

Final determination of the position was delayed until 0915 hours on 12 April because seabed currents created difficulties in stabbing the 30" casing into the newly drilled hole requiring the rig to be repositioned. The satellite window for positioning was only 3hrs each morning and the positioning crew had to be held over an additional day to recalculate the rig position after the move to enable stabbing the casing.

3.3 Drilling Operations Summary

Rig Move

The semi-submersible drilling unit "Zapata Arctic" was released from Petrofina's Archer-1 location at 1100 hours on 9 April, 1990. It proceeded under tow, assisting with its own power, from Archer-1 to the Devilfish-A location, a distance of 34 kilometres taking 3.75 hours. After setting primary anchors the marine crews took a 10 hour rest period. A further delay was experienced after recommencing anchor handling due to the flukes of one anchor fouling its chain. The anchors were all set, a pre-spud safety meeting was held, the emergency shut down and generator system was tested and the rig ballasted down to its drilling draft by 1800 hours on 10 April. The BOP's were function tested while the anchors were being pre-tensioned prior to spud.

36" hole for 30" casing

A 36" bit was used to drill this phase. The sea-bed was tagged at 102m and Devilfish-1 spudded at 2300 hours on 10 April, 1990. The 36" hole was drilled to a depth of 142m in 5 hours. Initial difficulty was experienced in spudding due to the bit walking across the seabed before starting to drill. This resulted in the hole not being directly below the rig. The hole was displaced with Hi-vis mud prior to pulling out to run casing.

Three joints of Grade X-52, 30" casing with a combination of Vetco ATD and ST-2 couplings were made up to the PGB and run to seabed. Poor visibility, strong currents and the offset location of the hole prevented stabbing the casing. It was finally stabbed in after moving the rig 3m to position the casing above the hole. The shoe was set and cemented at 137.5m. Cementation details can be found in Section 5. Good returns of cement were observed with the ROV after 100% of the theoretical cement volume was pumped.

26" hole for 20" casing

The cement and 30" casing shoe were drilled out with a 26" bit, then an 8 1/2" bit was run and a pilot hole was drilled to 400m. At 310m the drill string became stuck during a survey requiring 3 1/2 hours to work and wash it free as it was not possible to engage the kelly bushings to rotate the string. The two main factors which contributed to the string becoming stuck were;

1. insufficient volume and frequency of hi-vis sweeps to fully clean the hole

2. the survey was taken with the bit so close to the bottom it was not possible to work the pipe downwards

The pilot hole took a total of 11 drilling hours. The 26" bit was rerun and the hole opened to a depth of 400m in 15 1/2 hours.

After displacing the hole with high viscosity mud, 24 joints of X-56 20" casing with Vetco LS connections and a Vetco 18 3/4" SG5 wellhead housing were run to 391m and cemented. Good returns were observed throughout with the ROV, cement was again observed after the theoretical volume had been pumped.

The riser and BOP's were run and landed and the casing tested to 6900 kPa. The BOP,surface lines and kelly were then tested and all found to be satisfactory.

12 1/4" hole for 9 5/8" casing

A 13 3/8" casing string was unneccesary due to the shallow nature of this well. The original intention was to omit the 30" and use a 20" conductor but it was felt that the combined loading from the heavy BOP stack (104 MPa) and the severe weather conditions that can be experienced in Bass Strait would overload a 13 3/8" wellhead. Consequently the 13 3/8" string was omitted.

A 17 1/2" bit was used to clean out the 20" casing and drill the 20" shoe track and new formation to 408m. Here a formation intake test established a formation strength gradient of 12.86 kPa/m. Next a 12 1/4" PDC bit, Bit #6, was run with a stiff BHA and drilled to 1100m in 33 1/2 drilling hours. (Drilling time includes connection time but not circulation, survey or trip time.) No hole problems were encountered during the drilling, wiper trip at 848m or bit trip at 1100m and the drilling of this interval was free of complications. During logging the Schlumberger Super-Combo tool hung up at 893m requiring 670 kg overpull to free it, so the interval was logged from 891m up. Due to the uniform, well documented nature of the Gippsland Limestone and the ability to log it with a Gamma Ray Log through the 9 5/8" casing, the decision was made not to make a wiper trip and rerun logs but to run casing. No resistance was encountered while running casing.

83 joints of N-80 grade, 47 lb/ft, 9 5/8" casing with buttress couplings were run to 1088.6m. The casing was cemented and the calculated top of cement was 241m, 150m inside the 20" casing. After displacement the plug was bumped and the casing tested to 27600 kPa. Due to the delayed delivery of a part for the Schlumberger gyroscopic survey tool, which was on an Esso workboat, the gyroscopic deviation survey of the 9 5/8" casing was not run until the BOPs and surface equipment had been pressure tested on all functions, the casing shoe drilled out and a formation intake test performed.

8 1/2" hole

An 8 1/2" tricone bit and junk sub were run on a slick assembly to drill out the 9 5/8" shoe, clean the rat hole and drill to 1105m for the formation intake test. A formation fracture gradient of 19.25 kPa/m and fracture propagation gradient of 15.88 kPa/m were established for the Gippsland Limestone. After Schlumberger ran a gyro deviation survey in the 9 5/8" casing, Bit #8 was run. This PDC bit drilled to the well T.D. at 2058m in 55 drilling hours without complications. No hole problems were experienced during the wiper trip at 1613m but up to 44500 daN overpull was required to pull back to 1670m during the wiper trip to the shoe at T.D. The hole gave no problems during the bit trip at T.D. Schlumberger's logging run was

extended by one hour due to a failure in the WST but was eventually completed successfully.

3.4 Abandonment

On evaluation of wireline logs it was decided to plug and abandon Devilfish-1. Cement plug details are presented in Figure 3 and Section 5. Plug 1 was set from 2000m to 1579m in 3 stages. After tagging Plug 1, Plug 2 was set from 1140m to 990m, across the 9 5/8" casing shoe. Plug 2 was tagged then Schlumberger ran a gauge ring and junk basket prior to setting an EZSV bridge plug, Plug 3, at 950m. The bridge plug was tested to 10350 kPa then the 9 5/8" casing was cut at 150m using a mechanical casing cutter and three and a half joints retrieved with a casing spear. The BOPs and riser were pulled and a mechanical casing cutter used to cut the 20" and 30" casings at 107m. These casings were cut and pulled on the first attempt, which could in part be attributed to the greasing of the top joint of 30" casing prior to running it. Plug #4 was set from 150m to 102m (seabed) then a seabed survey was conducted by the ROV. Anchor handling was prolonged by 5.3 days due to bad weather. At 1700 hours on 1 May, 1990, 6.33 days after the setting of the final cement plug, the last anchor was racked and the "Zapata Arctic" released from Devilfish-1.

4. CASING RECORD

SIZE (inches)	WEIGHT (lbs/ft)	GRADE	COUPLING	LENGTH (m)	SHOE (m)	NO. JOINTS	REMARKS
30	310 (1" W.T.)	X-52	ST-2	37.45	137.5	3	Plus PGB and 30" wellhead
20	106.5	X-56	LS	292.30	391.1	23	Plus 18 3/4" SG5 wellhead
9 5/8	47	N-80	BTC	989.22	1088.6	83	Plus pup jt and csg hanger

5. CEMENTING SUMMARY

JOB	SACKS	TONS	MIXWATER	SLURRY WEIGHT (SG)	VOLUME OF SLURRY (cubic m)	TOC (m)	REMARKS
30"	954	40.7	S/W mixed with 1% $CaCl_2$ (BWOC)	1.90	31.10	Seabed	200% excess
20"							
LEAD	891	38.0	S/W mixed with 2% $CaCl_2$ (BWOC) plus 3.9% Econolite (BWOW)	1.58	46.84	See notes	150% excess on theoretical hole volume
TAIL	1847	78.8	S/W neat	1.90	60.24	See notes	150% excess on theoretical hole volume
9 5/8"							
LEAD	814	34.7	S/W mixed with 3.9% Econolite (BWOW)	1.58	42.70	990	20% excess on caliper
TAIL	166	7.10	S/W neat	1.90	5.40	241	20% excess on caliper

NOTE: For the 20" cementation returns of cement to seabed were observed after pumping the approximate hole volume. It is felt that the volume of cement pumped was excessive and that 100% excess on the lead slurry and 50% excess on the tail would have been sufficient. No cement was found in the 20"-30" annulus after cutting casing on abandonment probably as a result of the excessive head from the tail slurry causing slumping.

6. FORMATION EVALUATION

6.1 Mudlogging Services (Appendix 1)

Geoservices carried out real time evaluation and description of formations during drilling using their computerised Advanced Logging System. Gas was extracted from the mud and its relative concentration measured. It was also analysed by a Flame Ionisation Detector (FID) chromatograph which could detect concentrations of gas above 0.001%. Cuttings were routinely examined in a fluoroscope for direct and cut hydrocarbon shows. Detailed records and interpretations of overpressure parameters were kept. This data was then transmitted to Shell's Melbourne office for further examination. Cuttings samples were caught, washed, dried, bagged and distributed as follows:

6 sets of washed and air dried samples;

- 2 sets to Shell
- 1 set to WMC
- 1 set to BMR
- 1 set to DIEP

1 set of unwashed and air dried samples for Shell
1 set of Samplex trays for Shell

6.2 Wireline Logging

Schlumberger ran logs in the 12 1/4" and 8 1/2" phases for definitive formation evaluation. The results of these are discussed in following sections. The logging programme provided for CSTs and RFTs in 8 1/2" hole depending on evaluation of data already collected. Of these only CSTs were run.

A Super Combo configuration of logging tools was run in both phases considerably reducing the logging time.

6.3 Sidewall Core Samples (Appendix 2)

A total of 30 sidewall cores were attempted in Devilfish-1. 27 cores were recovered, 2 bullets were lost and 1 bullet was empty.

6.4 Velocity Survey (Appendix 3)

A velocity survey was carried out at TD. A total of 50 levels were shot.

7. TOTCO DEVIATION RECORD

SURVEY NO	DEPTH (m)	INCLINATION (deg)	TVD (m)	MAX HORIZONTAL DISPLACEMENT m	DOG LEG (deg/10m)
1	142	0.50	142.00	0.62	0.04
2	400	0.50	399.99	2.87	0.00
3	706	0.00	705.99	4.21	0.02
4	848	0.25	847.99	4.52	0.02
5	1100	1.00	1099.97	7.27	0.03
6	1256	0.50	1255.92	9.31	0.03
7	1400	0.25	1399.96	10.25	0.02
8	1607	0.25	1606.96	11.15	0.00
9	2051	2.00	2050.86	19.75	0.04

Appendix 1

Lithological Descriptions

APPENDIX 1

LITHOLOGICAL DESCRIPTIONS

All depths are quoted below derrick floor, which is 28.4m above Mean Sea Level and 738m above the sea bed. Drill cuttings were collected at 3m intervals, where drilling rates permitted. No returns were collected above 405m.

DEPTH	% LITHOLOGY	DESCRIPTION
405-414m	100%	CALCARENITE: wh-off wh, (ye) gy, Foss, (srt), abd Foram, com Cor frag, tr Diat, tr biotur Peld Struc, rr Chlor, uncons, no Fluor.
414-423m	100%	CALCARENITE : lt gy - off wh, f-med,srt, (sph), brit, calc cmt, com macro & micro Foss Frag, mass, (por), tr yel Min Fluor.
423-486m	100%	CALCARENITE: lt - med gy, f - med, (srt), (rnd), (sph), frm, calc cmt, abd arg mtx, tr macro and micro Foss Frag, mass, (por).
486-504m	100%	CALCARENITE : lt gy, vf - med, srt, (rnd), (sph), brit, mod calc Cmt, carb frag, abd mtx, micro & macro Foss, mass, (por)
504-522m	100%	CALCARENITE: lt gy, vf-med, srt (rnd) (sph), frm, calc Cmt, abd arg mtrx, com carb Frags, micro & macro Foss, tr Pyr Nod, tr buff micrxln Lst, mass, (por).
522-567m	100%	CALCARENITE: lt gy, vf-med, srt, (rnd), (sph), frm, calc cmt, abd arg mtrx, com micro & macro Foss Frags, carb Frags, tr Glc, mass, (por).
567-603m	100%	CALCARENITE: lt gy, f, srt, (rnd), (sph), frm, calc Cmt Foss Frag, com carb Frag, rr Glc, mass, (por), tr dull yel, Min Fluor.
603-657m	90%	CALCARENITE: lt gy, f, srt, (rnd) rnd, (sph), frm, Calc cmt, abd gn mtx, com Foss Frag, carb Frag, mass, tr dull yel Min Fluor.
	10%	CALCILUTITE: off wh - pale gy, f, srt, (rnd), (sph), frm, arg, calc cmt, com Foss Frag, no fluor.

657-675m	80%	CALCARENITE: pale gy - (wh) gy, crs xln, srt, (rnd)-rnd, (sph), frm-hd, cons, calc cmt, com macro-Foss frag, no fluor.
	20%	CALCILUTITE: as above
675-684M	70%	CALCILUTITE: pale gy - (wh) gy, micrxln, srt, rnd, (sph), frm, cons, calc cmt, micr-Foss Frag, no fluor.
	30%	CALCARENITE: pale gy - (wh) gy, crs xln, srt, (rnd)- rnd, (sph), frm, cons, calc cmt, com macro-Foss frag, no Fluor.
684-702m	70%	CALCARENITE : as above
	30%	CLACILUTITE: pale gy - (wh) gy, med micrxln, srt, (rnd)-(ang), (sph), sft-(hd), arg Mtx, com micro-Foss frag, tr carb frag, tr Ech spine, (por), tr (wh) ye Min Fluor.
702-711m	40%	CALCARENITE: as above
	60%	CALCILUTITE: as above
	Tr	MARL: v lt gy, vf, sft, stky, tr carb frag, (por), tr dull ye min Fluor.
711-720m	20%	CALCARENITE: as above
	60%	CALCILUTITE: as above
	20%	MARL: as above
720-729m	20%	CALCARENITE: pale gy - (wh) gy, suc, crs nln, srt, (rnd), (sph), frm, cons, calc cmt, com macro-Foss frag, tr min Fluor.
	40%	CALCILUTITE: (wh) gy, micrxln, srt, (rnd) - (ang), (sph), sft-(hd), arg mtx, tr carb frag, (por), tr ye Min Fluor.
	40%	MARL: lt (gn) gy, vf, amr, stky, tr carb frag, no Fluor.
729-747m	Tr	CALCARENITE: as above
	30%	CALCILUTITE: as above
	70%	MARL: as above
747-756m	20%	CALCILUTITE: as above
	80%	MARL: as above
756-765m	20%	CALCILUTITE: as above
	80%	MARL: as above
756-774m	20%	CALCILUTITE: as above
	80%	MARL: as above

774-801m	10%	CALCILUTITE: (wh) gy, micrxln, srt, (rnd)-(ang), (sph), sft-(hd), arg mtx, tr carb frag, (por), no Fluor.
	90%	MARL: lt (gn) gy, vf, amr, stky, tr carb frag, no fluor
810-828m	20%	CALCILUTITE: as above
	80%	MARL: as above
828-846m	30%	CALCILUTITE: (wh) gy, micrxln, srt, (rnd)-(ang), (sph) sft-(hd), arg mtrx tr micro Foss, tr carb frag, tr min Fluor.
	70%	MARL: lt (gn) gy, vf, amr, stky, tr carb frag, no fluor.
→ 846-855m	10%	CALCARENITE: lt-med gy, vf-med, (srt), (ang)-(rnd), (sph), frm, tr Pyr Nod, tr micro Foram, tr min fluor.
	20%	CALCILUTITE: as above
	70%	MARL: as above
855-873m	30%	CALCARENITE: as above
	10%	CALCILUTITE: as above
	60%	MARL: as above
873-882m	10%	CALCARENITE: as above
	20%	CALCILUTITE : (wh) gy, vf-med, srt, (ang)-(rnd), (sph), sft-(hd), arg mtx arg, tr micro Foss.
	70%	MARL: lt (gn) gy, vf, amr, stky, no fluor.
→ 882-900m	80%	MARL: lt (gn) gy, vf, amr, stky, no fluor.
	20%	CALCILUTITE: as above
900-918m	90%	MARL: as above
	10%	CALCILUTITE: as above
→ 918-945m	100%	MARL: lt (gn) gy, vf, amr, stky, no Fluor.
→ 954-963m	90%	MARL: as above
	10%	CALCAREOUS CLAYSTONE : (O/V) gy, amr, sft-v sft, stky, tr carb frag, no Fluor.
963-972m	80%	MARL: as above
	20%	CALCAREOUS CLAYSTONE: as above
972-981m	70%	MARL: as above
	30%	CALCAREOUS CLAYSTONE : as above
981-990M	60%	MARL: as above
	40%	CALCAREOUS CLAYSTONE: as above

990-1017M	50%	MARL: as above
	50%	CALCAREOUS CLAYSTONE: as above
1017-1062m	40%	MARL: lt (gn) gy, vf, amr, stky, no Fluor.
	60%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, v sft, stky, tr carb frag, tr Pyr, no Fluor.
1062-1110m	30%	MARL: lt (gn) gy, vf, amr, stky, no Fluor
	70%	CALCAREOUS CLAYSTONE : (O/V) gy, amr, v sft, stky, tr Foss, tr carb frag, tr Pyr, no Fluor.
1110-1122m	20%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft, stky, tr micro Foss, tr Pyr Nod, tr carb frag, tr Glc, no fluor
	80%	MARL: lt (gn) gy, vf, amr, stky, no fluor.
1122-1134m	100%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft, stky, tr micro Foss, tr Pyr Nod, com Glc, no Fluor
1134-1179m	100%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft-v sft, stky, tr micro Foss, Glc com, tr Pyr Nod, no fluor.
1179-1224m	90%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft-v sft, stky, tr Pyr, com Foram, com Glc.tr yel min Fluor.
	10%	MARL: lt (gn) gy, vf, amr, stky, com Foram.
1224-1251m	100%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft-v sft, stky, tr Pyr, com Foram, com Glc, tr yel min Fluor.
1251-1260m	100%	CALCAREOUS CLAYSTONE: as above
	Tr	SHALE: med gy, brit-hd, (fis)-fis, tr Pyr.
1260-1269m	90%	CALCAREOUS CLAYSTONE : as above
	10%	SHALE: med gy, brit-hd, (fis)-fis, tr Pyr
1260-1269m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: med gy, brit-hd, (fis)-fis, Mic, tr Pyr
1269-1273m	90%	CALCAREOUS CLAYSTONE: (O/V), gy, amr, sft-v. sft, tr Pyr, com Foram, com Glc, tr yel min Fluor.
	10%	SHALE: med gy, brit-hd, Mic (fis)-fis, tr Pyr.

1273-1287m	80%	CALCAREOUS CLAYSTONE: as above
	20%	SHALE: as above
1287-1293m	70%	CALCAREOUS CLAYSTONE: as above
	30%	SHALE: med gy, hd, (fis)-(blky), Mic, tr Pyr.
1293-1299m	70%	CALCAREOUS CLAYSTONE: (O/V) gy, amr, sft-v sft, stky, abd Foram, com Mol, com Biv, com Glc, tr yel min Fluor.
	30%	SHALE: as above
1299-1305m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1305-1317m	100%	CALCAREOUS CLAYSTONE: as above
	Tr	SHALE: as above
1317-1323m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1323-1332m	80%	CALCAREOUS CLAYSTONE: as above
	20%	SHALE: as above
1332-1359m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1359-1395m	80%	CALCAREOUS CLAYSTONE: (olv) gy, amr, sft-v. sft, stky tr Glc, com Micr foss, tr Pyr Nod, tr pale yel fluor
	20%	SHALE: med (gn) gy, hd, (fis)-(blky), mic-mic tr Pyr.
1395-1431m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1431-1440m	100%	CALCAREOUS CLAYSTONE: (S), (olv) gy, amr, sft-v. sft, stky, tr Pyr Nod Forams, Biv, tr Glc, tr pale yel min Fluor.
1440-1458m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1458-1467m	100%	CALCAREOUS CLAYSTONE
	Tr	SHALE: as above
1467-1465m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SHALE: as above
1485-1557m	100%	CALCAREOUS CLAYSTONE: (S), (olv) gy, amr, sft-v. sft, stky, Pyr Nod, com Foram, tr Glc, tr pale yel min Fluor
	Tr	SHALE: as above
1557-1593m	100%	CALCAREOUS CLAYSTONE: (olv) gy, amr, sft-v sft, stky, Pyr Nod, com Foram, tr Glc, tr yel min Fluor

1593-1608m	100%	CALCAREOUS CLAYSTONE: (olv) gy, amr, sft - v sft, stky, tr Pyr, com Foram, com Mol, com Biv, tr-com Glc, tr pale yel min Fluor.
1608-1617m	100%	CALCAREOUS CLAYSTONE: (olv) gy, amr, sft-v. sft, stky, tr Pyr, com Foram, tr Mol, tr Biv, tr-com Glc, tr yel min Fluor.
→ 1617-1620m	80%	CALCAREOUS CLAYSTONE: (s), lt gy, tr Pyr, Foram, tr Biv, Glc, (disp), sft, stky, tr yel min fluor
	20%	SILTSTONE: buff, (carb frag), lam frm.
1626-1629m	90%	CALCAREOUS CLAYSTONE: as above
	10%	SILTSTONE: as above
1629-1635m	70%	CALCAREOUS CLAYSTONE: as above
	30%	SILTSTONE : (S), lt gy-buff, (Glc), (Pyr), lam, frm-hd
	Tr	SANDSTONE : lt gy-wh, v f, calc cmt, (Glc), hd
→ 1635-1638m	30%	CALCAREOUS CLAYSTONE: as above, 30% SILSTONE: as above
	30%	SANDSTONE: gy, vf, arg, calc cmt, (Glc), hd
	10%	Loose qtz grains, m, rnd, sph-elong, uncons.
1638-1641m	30%	CLAYSTONE: as above
	20%	SILTSTONE: as above
	50%	SANDSTONE : (red)-brn-orng, m, (srt)-srt, rnd, spb, por, qz uncons, no flu.
1641-1644m	10%	CALCAREOUS CLAYSTONE: as above
	10%	SILTSTONE: as above
	80%	SANDSTONE: as above
→ 1644-1647m	90%	SANDSTONE: buff-orng, m-crs, srt, rnd, sph, qz, uncons, por, no flu.
	10%	SILTSTONE: as above
→ 1647-1665m	100%	SANDSTONE: trnsp-wh, crs-v crs, srt, rnd, sph, qz, uncons, por, no flu.
1665-1680m	100%	SANDSTONE: trnsp, crs-m, srt, rnd-rnd, sph, Qz, uncons, por, no flu.
1680-1683m	100%	SANDSTONE: trnsp, m-crs, srt, rnd, Sph-(spb), Qz, uncons, por, no flu.
1683-1698m	100%	SANDSTONE: trnsp, crs-m, srt, rnd, sph-(sph), Qz, uncons, por, no flu.

1698-1704m	100%	SANDSTONE: trnsp, m, srt, rnd, sph, Qz, uncons, por, no flu.
1704-1722m	100%	SANDSTONE: trnsp, m-crs, srt, rnd, sph, Qz, uncons, por, no flu.
1722-1728m	100%	SANDSTONE: trnsp, f-crs, (srt), (rnd)-rnd, sph, Qz, uncons, por, no flu.
1728-1758m	100%	SANDSTONE: trnsp, m-f, srt, rnd-(rnd), (sph)-sph, Qz, uncons, por, no flu.
1758-1761m	100%	SANDSTONE: trnsp, f, srt, md-(rnd), sph, Qz, uncons, por, no flu.
1761-1767m	100%	SANDSTONE: trnsp, f-vf, srt, (rnd), sph, Qz, tr Lit, uncons, por, no flu.
1767-1770m	100%	SANDSTONE : trnsp, f-vf, srt, (rnd), sph, Qz, tr Lit, tr arg mtx, uncons, por, no flu.
1770-1773m	80%	SILTSTONE: s, (red) brn, Pyr, disp, sft.
	20%	SANDSTONE: as above
1773-1782m	20%	SANDSTONE: (orng) brn, f-crs, (srt) rnd, sph, Qz, Pyr, uncons, no flu.
	80%	SILTSTONE: as above
1782-1788m	100%	SANDSTONE: wh-buff, m, srt, (rnd)-(ang), (sph), Qz, Lit, tr Pyr, uncons, por, no flu.
1788-1791m	100%	SANDSTONE: wh-trnsp, m-f, srt, (ang), (sph), Qz, tr Lit, uncons, por, no flu.
1791-1794m	90%	SANDSTONE: wh, m, srt, (ang)-(rnd), (sph), Qz, Pyr, tr Lit, uncons, por, no flu.
	10%	SILTSTONE: lt brn-buff, carb lam, lam, frm-hd.
	100%	SANDSTONE: wh, f-m (srt), (ang), (sph), Qz, Pyr, tr Lit, uncons, por, no flu.
1797-1800m	Tr	COAL: (slty), dk brn-blk, (Mic), lam hd
	90%	SANDSTONE: as above
	10%	SILTSTONE: as above

1803-1806m	80%	SANDSTONE: as above
	20%	SILTSTONE: as above
	Tr	COAL: as above
1806-1812m	90%	SANDSTONE: as above
	10%	COAL: as above
	Tr	SILTSTONE: as above
1812-1815m	100%	SANDSTONE: cl, lt gy, f-crs, (srt), (rnd)-(ang), (sph), Qz, Pyr, tr Lit, arg mtx, uncons, (por), no flu.
	Tr	SILTSTONE: as above
	Tr	COAL: as above
1815-1818m	80%	SANDSTONE: as above
	10%	SILTSTONE: buff, (carb frag), (Mic), frm-hd
	10%	COAL: dk brn, (Mic), lam, vit, blky, hd.
1818-1821m	100%	SANDSTONE: cl, lt gy, f-m, (srt), (rnd), (sph), Qz, tr Pyr, tr Lit, arg mtx, uncons, (por), no flu.
	Tr	SILTSTONE: as above
	Tr	COAL: as above
1821-1836m	90%	SANDSTONE: as above
	10%	SILTSTONE: as above
	Tr	COAL: as above
1836-1839m	80%	SANDSTONE: lt gy, m, srt, (rnd)-rnd, Qz, tr Lit, Pyr, uncons, por, no flu.
	20%	SILTSTONE : as above
	Tr	COAL : as above
1839-1842m	100%	SANDSTONE: as above
	Tr	SILTSTONE: as above
	Tr	COAL : as above
1842-1845m	90%	SANDSTONE: as above
	10%	SILTSTONE: as above
	Tr	COAL: as above
1845-1848m	80%	SANDSTONE: cl, gy, f-crs, (srt), (rnd)-(ang), Qz, Lit, Pyr, uncons (por), no flu.
	20%	SILTSTONE: as above
1848-1851m	90%	SANDSTONE: lt gy, f-m, (srt), (rnd), (sph), Qz, tr lit, uncons, por, no flu.
	10%	SILTSTONE: brn-buff, carb frag, lam, frm-hd

1851-1854m	80%	SANDSTONE: (cl) as above
	10%	SILTSTONE: as above
	10%	COAL: (slty), dk, brn, lam, (vit), fis, frm
1854-1857m	90%	SANDSTONE: lt gy-wh, f-vf, srt, (rnd), sph, Qz, tr lit, uncons por, no flu
	10%	SILTSTONE: as above
	Tr	COAL: as above
1857-1869m	100%	SANDSTONE: trnsp-wh, m, srt, (rnd)-rnd, sph, Qz, uncons, por, no flu.
1869-1872m	90%	SANDSTONE: transp-wh, f-m, srt, (rnd), sph, Qz, tr Pyr, tr Lit, uncons, por, no flu.
	10%	SILTSTONE: as above
1872-1875m	100%	SANDSTONE: as above
	Tr	SILTSTONE: as above
1875-1878m	100%	SANDSTONE: trnsp-wh, m, (srt), (rnd), (sph), Qz, Pyr, tr Lit, uncons, por, no flu.
	Tr	SILTSTONE: as above
1878-1881m	90%	SANDSTONE: as above
	10%	SILTSTONE, buff, carb frag, lam, frm
1881-1884m	80%	SANDSTONE: as above
	20%	SILTSTONE: as above
	Tr	COAL: as above
1884-1887m	90%	SANDSTONE: as above
	10%	SILTSTONE: as above
	Tr	COAL: as above
1887-1890m	100%	SANDSTONE: trnsp-wh, f, srt, rnd, sph, Qz, tr Lit, uncons, por, no flu.
1890-1896m	100%	SANDSTONE: trnsp-wh, f-vf, srt, rnd, sph, Qz, tr Lit, uncons, por, no flu.
1896-1899m	100%	SANDSTONE: trnsp, f-m, srt, rnd, sph, Qz, tr Lit, uncons, por, no flu.
1899-1902m	90%	SANDSTONE: as above
	10%	COAL: (slty), dk brn-blk, (vit), blky, hd
	Tr	SILTSTONE: as above

1902-1905m	70%	SANDSTONE: as above
	20%	COAL: as above
	10%	SILTSTONE, brn, carb, lam, (Mic) frm
1905-1908m	90%	SANDSTONE: trnsp f-m, srt, (rnd)-(ang), (sph) Qz, tr Lit, uncons, por, no flu
	10%	COAL: as above
	Tr	SILTSTONE: as above
1908-1911m	80%	SANDSTONE: as above
	10%	COAL: as above
	10%	SILTSTONE: as above
1911-1914m	90%	SANDSTONE: as above
	Tr	COAL: as above
	10%	SILTSTONE: as above
1914-1917m	90%	SANDSTONE: trnsp, m-f, (srt), (ang)-(rnd), (sph), Qz, uncons, (por), no flu.
	Tr	COAL : as above
	10%	SILTSTONE: as above
1917-1923m	80%	SANDSTONE: cl, lt gy, f-crs, (srt), (rnd)-(ang), (sph), Qz, tr Lit, uncons, por, no flu.
	20%	SILTSTONE: as above
	Tr	COAL: as above
1923-1929	90%	SANDSTONE: trnsp, m-crs, (srt), (rnd), (sph), Qz, tr lit, uncons, por, no flu
	10%	SILTSTONE: as above
	Tr	COAL: as above
1929-1932m	90%	SANDSTONE: Clx, lt gy-wh, f-crs, (srt), ang-(rnd), (elong), Qz, tr Lit, tr Pyr, uncons, por, no flu
	10%	SILTSTONE: as above
	Tr	COAL: as above
1932-1935m	100%	SANDSTONE: cl, gy, vf-f, srt, (rnd), (spl), Qz, tr Lit, uncons, (por), no flu.
	Tr	SILTSTONE: as above
	Tr	COAL: as above
1935-1941m	90%	SANDSTONE: as above
	10%	SILTSTONE: as above
	Tr	COAL: as above
1941-1947m	90%	SANDSTONE: lt gy, m-f, (srt)-srt, (ang), (sph), Qz, uncons, (por), no flu.
	10%	SILTSTONE: as above
	Tr	COAL: as above

1947-1950m	60%	SANDSTONE: as above
	10%	SILTSTONE: dk brn-buff, carb lam, (Mic), frm-hrd
	10%	COAL : dk brn, slty, frm
	20%	CLAYSTONE:: lt gy-gy, (fis), frm
1950-1953m	40%	SILTSTONE: as above
	10%	COAL: blk, vit, (fis)
	10%	CLAYSTONE: as above
	40%	SANDSTONE: cl, gy, f-m, (srt), (ang), (sph), Qz, tr Lit, uncons, (por) no flu.
1953-1956m	60%	COAL: (slty) brn, vit, conch, hd.
	40%	SANDSTONE : as above
	Tr	SILTSTONE: as above
1956-1959m	40%	COAL: as above
	60%	SANDSTONE: lt gy, f, (srt), (ang), (sph), Qz, tr Lit, uncons (por), no flu
	Tr	SILTSTONE : as above
1959-1962m	100%	SANDSTONE: trnsp, f, srt, (rnd)-rnd, sph, Qz, uncons, por, no flu.
1962-1969m	100%	SANDSTONE : trnsp, f-m, srt, (rnd)-(ang), sph, Qz, uncons, por, no flu.
	Tr	SILTSTONE: as above
1968-1971m	100%	SANDSTONE: cl, lt gy, f-vf, srt, (ang)-(rnd), sph, Qz, tr Lit, uncons, por, no flu.
1971-1974m	100%	SANDSTONE: (cl), gy, f, (srt), (ang), (sph), Qz, Pyr, uncons, (por) no flu.
	Tr	SILTSTONE: as above
1974-1977m		SANDSTONE: (cl), lt gy, f-m, (srt), ang-(ang), (sph)-(elong), Qz, tr Pyr, tr Lit, uncons, (por), no flu.
	Tr	SILTSTONE: as above
	Tr	COAL: as above
1977-1980m	90%	SANDSTONE : as above
	10%	SILTSTONE: buff-brn, carb frag, (Mic), frm-hd
	Tr	COAL: as above
1980-1983m	60%	SANDSTONE: cl, gy, f-m, (srt), ang-(ang), (sph), Qz, tr Pyr, tr Lit, arg mtx, disagg, (por)-non por, no flu.
	20%	CLAYSTONE : lt gy, sft, disp.
	20%	SILTSTONE : as above

1983-1986m	40%	SANDSTONE: as above
	50%	CLAYSTONE: as above
	10%	SILTSTONE: as above
1986-1989m	30%	SANDSTONE: as above
	60%	CLAYSTONE: as above
	10%	SILTSTONE: as above
1989-1992m	60%	SANDSTONE: cl, gy, f-m, (srt), (ang)-(rnd), (sph), Qz, Pyr, tr Lit, arg mtx, dissagg (por), no flu.
	30%	CLAYSTONE: as above
	10%	SILTSTONE: as above
1992-1995M	10%	CLAYSTONE : lt gy, sft, disp.
	70%	SANDSTONE: (cl), gy, f, (srt), (ang), (sph), Qz, Pyr, uncons, (por), no Fluor.
	20%	SILTSTONE: buff-brn, carb frag, (Mic), frm-hd.
1995-1998m	80%	SANDSTONE: (cl), gy, f, (srt), (ang), (sph), Qz, Pyr, uncons, (por), no Fluor.
	20%	SILTSTONE : buff-brn, com carb frag, (Mic), frm-hd.
	Tr	COAL: (slt) blk-dk brn, brit.
1998-2001m	90%	SANDSTONE : as above
	10%	SILTSTONE : as above
2001-2004m	90%	SANDSTONE : (cl), gy, f, (srt), (ang), (sph), Qz, Pyr, uncons, (por), no Fluor
	10%	SILTSTONE : as above
2004-2007m	90%	SANDSTONE: (cl) gy-trnsp, (srt), ang, (sph), Qz, Pyr, uncons, (por), no Fluor.
	10%	SILTSTONE : buff-brn, com carb frag, (Mic), frm-hd
2007-2010m	90%	SANDSTONE : gy, f, (srt), (ang), (sph), Qz, Pyr, uncons, (por), no Fluor.
	10%	SILTSTONE : as above
2010-2016m	80%	SANDSTONE: trnsp, gy, f-med, (srt), (ang), (sph), Qz, tr Pyr, uncons, (por), no Fluor.
	20%	SILTSTONE: as above
2016-2019m	20%	CLAYSTONE: lt gy, amr, sft, disp.
	10%	SILTSTONE: as above
	70%	SANDSTONE : (cl) trnsp, (gy) gn, f-med, (srt), (ang), (sph), Qz, abd Pyr, Sch, Phy, Biot, uncons, (por), no Fluor.

2019-2025m	20%	CLAYSTONE: as above
	60%	SANDSTONE: as above
	20%	SILTSTONE: as above
	Tr	COAL: (slty), blk-dk brn, (vit), brit, (slty)
2025-2028m	30%	CLAYSTONE: lt gy, amr, sft, disp.
	50%	SANDSTONE: (cl) trnsp gy, f-med, (srt), ang, (sph), Qz, abd Pyr, tr Biot, tr lt grn Aggr Sch, uncons, (por), no Fluor.
	20%	SILTSTONE: buff-brn, com carb frag, (Mic), frm-hd.
	Tr	COAL: (slty) blk-dk brn, (vit), brit, (slty)
2028-2031m	30%	CLAYSTONE: as above
	40%	SANDSTONE: as above
	30%	SILTSTONE: as above
	Tr	COAL: as above
2031-2034m	30%	CLAYSTONE: as above
	30%	SANDSTONE: as above
	40%	SILTSTONE: as above
	Tr	COAL: as above
2034-2043m	30%	CLAYSTONE: as above
	20%	SANDSTONE: as above
	50%	SILTSTONE: as above
2043-2046m	30%	CLAYSTONE: lt gy, amr, sft, disp.
	30%	SANDSTONE: (cl) trnsp, gy, f-med, (srt), (ang), sph, Qz, abd Pyr, Glc, tr Biot, tr grn Sch, pred uncons, acc aggs, cl mtx, (por), no Fluor.
	40%	SILTSTONE: buff-brn, com carb frag, (Mic), frm-hd.
	Tr	COAL: blk-dk brn, (vit), brit.
2046-2055m	30%	CLAYSTONE: lt gy, amr, sft, disp.
	40%	SANDSTONE : (cly) transp, gy, f-med, (srt), (ang), (sph), Qz, abd Pyr, tr Biot, tr lt gn Sch, pred uncons, acc aggs, wh mtx, (por), no Fluor.
	30%	SILTSTONE: buff-lt brn, com carb lam, frm.
	Tr	COAL: blk-dk brn, (vit), brit.
2055-2058m	30%	CLAYSTONE: as above
	30%	SANDSTONE: as above
	40%	SILTSTONE: as above
	Tr	COAL: as above

Appendix 2

Sidewall Core Descriptions

SIDEWALL SAMPLE DESCRIPTION

WELL: DEVILFISH-1

DEPTH OF HOLE: 2058m RUN NO: 1 FIRED: 30 REC: 27 DESCRIPTION BY: L. BROWN DATE: 23/4 PAGE 1 OF 3

SHOT NO.	DEPTH (mRT)	RECOVERY (mm)	LITHOLOGICAL DESCRIPTION																			HYDROCARBON INDICATIONS							
			MAIN ROCK TYPE	COLOUR	QUALIFIER		QUALIFIER		GRAINSIZE		SORTING	ROUNDNESS	HARDNESS	ACCESSORIES	MATRIX		CEMENT		POROSITY		SED. STRUCTURE	REMARKS	NATURAL FLUOR			CUT FLUOR			SOLVENT CUT	REMARKS (Residue, oil staining, acetone)
					TYPE	%	TYPE	%	RANGE	DOM.					TYPE	%	TYPE	%	TYPE	%			DISTRIB.	INTENS.	COLOUR	RATE TYPE	INTENS.	COLOUR		
1	2035	16	Sst	lt gy	Qz	40	Lit	60	f-m	f	(srt)	(ang)	frm	Phy	Cl	30			(por)-nonpor			carb lam, dk gy-blk								
2	2020	15	Sst	lt gy-(gn)gy	Qz	40	Lit	60	f		(srt)	(ang)	frm	Phy, Sch	Cl	30			(por)-nonpor			tr carb frag								
3	2008	20	Cl	v dk gy															nonpor			abd carb mat								
4	2002.5	18	Cl	dk gy															nonpor			com carb mat								
5	1983	18	Cl	dk gy										tr crs Qz grn					nonpor			carb mat								
6	1975	21	Sst	lt gy-(gn)gy	Qz	50	Lit	50	f-m	f	(srt)	ang	frm-sft	Phy, Sch	Cl	40			nonpor			tr carb frag								
7	1967.5	19	Sst	lt gy	Qz	80	Lit	20	f-m	f	srt	(ang)	frm		Cl	20			(por)-nonpor			tr coaly mat, occ crs-pbl Qz grn								
8	1955	25+	Co	blk																		vit, blky, fri								
9	1949.5	22	Cl	lt-dk gy															nonpor			com carb mat								
10	1931.5	23	Sst	lt gy	Qz	80	Lit	20	f		(srt)	(ang)	frm		Cl	40			(por)-nonpor			tr coaly mat								
11	1928	23	Sst	lt-dk gy	Qz	90	Lit	10	f-crs	m	(srt)	ang	frm		Cl	40			(por)-nonpor			tr coaly mat								
12	1918.5	5	Cl?																			dom mudcake								
13	1906.7	22	Sst	(orng) bm-gy	Qz	90	Lit	10	f-m	m	srt	(rnd)	frm-fri		Cl	20			(por)-por											
14	1904.2	18	Slt	(orng)-brn									frm	20% Co	Cl	30			nonpor			Coaly strks, blk, vit, fri								

SIDEWALL SAMPLE DESCRIPTION

WELL: DEVILFISH - 1

DEPTH OF HOLE: 2058 RUN NO: 1 FIRED: 30 REC: 27 DESCRIPTION BY: L. BROWN DATE: 23/4 PAGE 2 OF 3

SHOT NO.	DEPTH (mRT)	RECOVERY (mm)	LITHOLOGICAL DESCRIPTION																			HYDROCARBON INDICATIONS								
			MAIN ROCK TYPE	COLOUR	QUALIFIER		QUALIFIER		GRAINSIZE		SORTING	ROUNDNESS	HARDNESS	ACCESSORIES	MATRIX		CEMENT		POROSITY		SED. STRUCTURE	REMARKS	NATURAL FLUOR			CUT FLUOR			SOLVENT CUT	REMARKS (Residue, oil staining, acetone)
					TYPE	%	TYPE	%	RANGE	DOM.					TYPE	%	TYPE	%	TYPE	%			DISTRIB.	INTENS.	COLOUR	RATE TYPE	INTENS.	COLOUR		
15	1895	19	Sst	lt-dk gy	Qz	80	Lit	20	f-m	f	srt-(sbrt)	(rnd)	frm		Cl	20			(por)			tr carb frag								
16	1882.5	24	Sst	dk orng-brn	Qz	80	Lit	20	f-crs	m	(srt)	(rnd)	frm-fri		Cl	30			(por)-nonpor			occ crs-pbl Qz grn, tr carb frag								
17	1855	16	Cl	lt gy									frm-sft						nonpor		(lam)									
18	1853	35+	Co	blk																		vit, blky, fri								
19	1847	—																				MISSING								
20	1834	22	Cl	lt-dk gy									frm						nonpor			(slt)								
21	1814.5	30	Cl	dk brn									frm						nonpor		(lam)	(slt), tr carb frag								
22	1812	20	Sst	lt-gy	Qz	100			vf-f	vf	srt	(rnd)	frm		Cl	10			(por)		lam	tr carb frag, lam								
23	1798	—																				EMPTY								
24	1783	27	Sst	(orng) brn	Qz	90	Lit	10	f-m	f	(srt)	(rnd)	frm-fri		Cl	40			nonpor (por)											
25	1775	21	Sst	(red) brn	Qz	90	Lit	10	f		(srt)	(rnd)	fri		Cl	40			nonpor (por)											
26	1650	25	Sst	(orng)-brn	Qz	100			m-crs	m	(srt)	rnd	frm		Cl	30			por											
27	1642	5	Cl	lt gy									sft-disp									abd Qz pbl grns								
28	1550	—																				MISSING								

SIDEWALL SAMPLE DESCRIPTION

WELL: DEVILFISH-1

DEPTH OF HOLE: 2058 RUN NO: 1 FIRED: 30 REC: 27 DESCRIPTION BY: L. BROWN DATE: 23/4 PAGE 3 OF 3

SHOT NO.	DEPTH (mRT)	RECOVERY (mm)	LITHOLOGICAL DESCRIPTION																			HYDROCARBON INDICATIONS							
			MAIN ROCK TYPE	COLOUR	QUALIFIER TYPE	QUALIFIER %	QUALIFIER TYPE	QUALIFIER %	GRAINSIZE RANGE	GRAINSIZE DOM.	SORTING	ROUNDNESS	HARDNESS	ACCESSORIES	MATRIX TYPE	MATRIX %	CEMENT TYPE	CEMENT %	POROSITY TYPE	POROSITY %	SED. STRUCTURE	REMARKS	NATURAL FLUOR DISTRIB.	NATURAL FLUOR INTENS.	NATURAL FLUOR COLOUR	CUT FLUOR RATE TYPE	CUT FLUOR INTENS.	CUT FLUOR COLOUR	SOLVENT CUT	REMARKS (Residue, oil staining, acetone)
29	1450	32	Cl	lt gy									frm	Calc					non	por		argillaceous								
30	1300	38	Cl	lt gy									frm	Calc					non	por		argillaceous								

Appendix 3

Velocity Survey Report

Schlumberger

SHELL AUSTRALIA

VSP PROCESSING REPORT

DEVILFISH #1

FIELD	:	WILDCAT
COUNTRY	:	AUSTRALIA
COORDINATES	:	038° 47' 58.21" S 147° 55' 10.54" E
DATE OF SURVEY	:	22-APR-1990
DATE OF PROCESSING	:	2-MAY-1990
REFERENCE NO.	:	VSP : 56577
INTERVAL	:	2025.0 M - 527.0 M

Contents

List of Tables

1. Introduction

A vertical seismic profile was recorded with the well seismic tool in the Devilfish #1 well.

The data was processed using the conventional zero offset vertical incidence processing chain . The final presentation includes displays indicationg the effectiveness of the processing after each stage. All plots are at a scale of 10 cm/sec.

2. Data Acquisition

The data was acquired over the logging suite using the well seismic tool (WST). A 200 cu inch air gun without waveshaping kit was used as the source. The gun was suspended from the rig with a deck crane. Recording was made on the Schlumberger Cyber Service Unit (CSU) using LIS format at a tape density of 800 BPI.

Table 1: Survey Parameters

Elevation KB	28.4 metres AMSL
Elevation DF	28.0 metres AMSL
Elevation GL	-102.0 metres AMSL
Total Depth	2025.0 metres below KB
Energy Source	Airgun
Source Offset	60.0metres
Source Depth	10.0 metres below MSL
Reference Sensor	Hydrophone
Hydrophone Offset	60.0 metres
Hydrophone Depth	15.0 metres below MSL
Source/Hydrophone Azimuth	200 deg

3. VSP Processing

3.1 Stacking

A median stack was performed on the vertical component data. The surface sensor (hydrophone) breaks are used as the zero time for stacking. The break time of each trace is recomputed after stacking.

The data quality is good with the vertical component stacks displaying a consistent signature and a high signal to noise ratio. The frequency content of the data is quite high as indicated by the 3-dimensional frequency plot (no. 10).

There is significant tube energy in the stacked data which can be velocity filtered by subsequent processing.

3.2 Spherical Divergence Correction and Bandpass Filter

A bandpass filter of 5-90 hertz bandwidth was applied. No time varying gain function was applied due to the tube wave energy.

Trace equalisation was applied by normalising the RMS amplitude of the first break to correct for transmission losses of the direct wave. A normalisation window of 100 millisecs was used. (see Plot 2)

3.3 Velocity Filter and Tube Wave Subtraction

The downgoing coherent energy is estimated using a seven level median velocity filter. The filter array is moved down one level after each computation and the process is repeated level by level over the entire dataset. As a result, the deepest and shallowest levels are lost because of edge effects.

The residual wavefield is obtained by subtracting the downgoing coherent energy from the total wavefield. The residual wavefield has some compressional events though is dominated by the tube energy. A 7 level median filter is applied along the tube arrival. The residual wavefield (with tube wave subtraction) is displayed in plot 3, panel 3.

The upgoing wavefield (after tube wave subtraction- panel 4, plot 3) is enhanced by applying a median stack of the upgoing aligned traces using a 5 level filter.

3.4 Predictive Deconvolution

The assumption is made that the downgoing energy at a given level is convolved with the earth reflectivity sequence below that level. The deconvolution operator is designed on the downgoing trace, the operator is applied to both the downgoing and upgoing traces at the same level.

The result of predictive deconvolution on the residual wavefield is shown on plot 4 . An

operator of 1000 msec length and prediction distance equal to the 2^{nd} zero crossing was computed. The deconvolution is applied before any coherency enhancement in order to collapse the multiple sequence of shear arrivals, diffractions or out of plane reflections.

3.5 Waveshaping Deconvolution

The waveshaping deconvolution operator is a double sided operator and is designed trace by trace opening 20 ms before the first break with a window length of 1000 ms. The desired outputs were chosen to be zero phase with a band width of 8-60 Hz. Once the design is made upon the downgoing wavefield, it is applied to the downgoing and subtracted wavefield at the same level. The upgoing compressional wavefield is enhanced in the same manner to before.

The result of waveshaping deconvolution on the residual wavefield is shown on plot 5. The deconvolution is applied before any coherency enhancement in order to collapse the multiple sequence of shear arrivals, diffractions or out of plane reflections.

A corridor stack is computed on the data after waveshaping deconvolution and predictive deconvolution by defining a timing window 100 msec wide along the time depth curve and stacking the data onto a single trace. This trace under normal circumstances should satisfy the assumption of one dimensionality and provide the best seismic representation of the borehole. These are displayed on plots 6 and 7.

3.6 VSP Acoustic Impedance Inversion

The zero phase waveshaping should permit a better interpretation of acoustic contrast, hence the data used for the inversion has been taken from the VSP after zero phase waveshaping deconvolution.

The inversion technique is based on entropy minimisation of the reflection coefficient series. In other words, the algorithm chooses the sparsest sequences of reflection coefficients as the preferred solution. The low frequency trend is extracted from the time depth curve such that the inversion technique is achieved without any input from the logged data.

The acoustic impedance inversion is obtained without any input from the logged data. The quality of the inversion can be assessed by the similarity of the match between the logged impedance and inverted impedance.

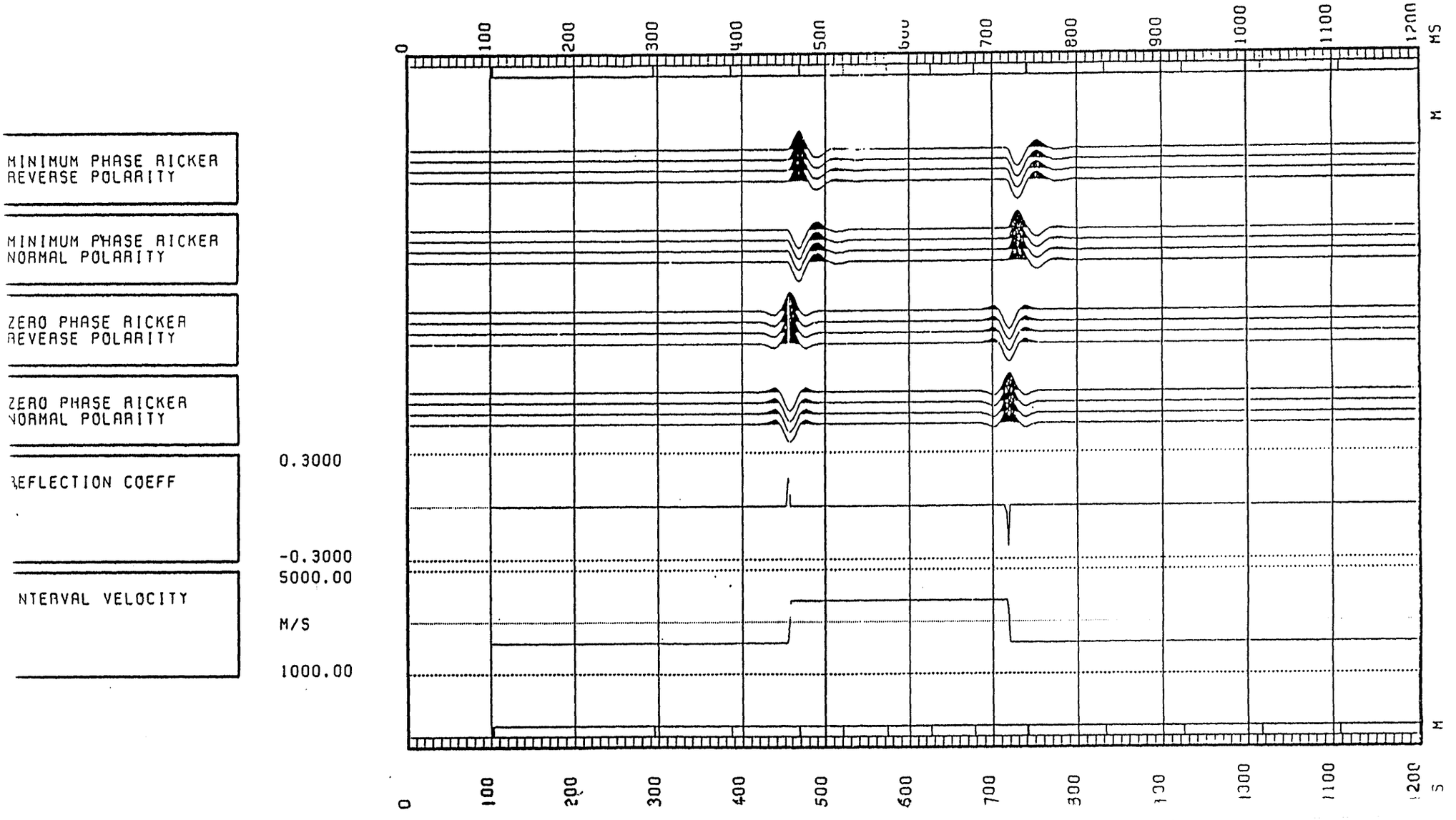
Composite displays of VSP, inverted impedance, logged impedance and synthetic seismograms are shown on plots 8 and 9. These plots depict the excellent tie between the synthetic and vsp data.

VSP PLOTS

Plot 1	Stacked Data
Plot 2	Amplitude Recovery
Plot 3	Velocity Filter and Tube wave Subt.
Plot 4	Predictive Deconvolution
Plot 5	Waveshaping Deconvolution Zero Phase
Plot 6	Predictive and Corridor
Plot 7	Waveshaping and Corridor
Plot 8	Vsp and Geogram composite- normal polarity 10 cm/sec
Plot 9	Vsp and Geogram composite- reverse polarity 10 cm/sec
Plot 10	Power spectrum of geophone signal

SCHLUMBERGER (SEG-1976) WAVELET POLARITY CONVENTION

Figure 1



PE905929

This is an enclosure indicator page.
The enclosure PE905929 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905929 has the following characteristics:

ITEM_BARCODE	= PE905929
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 1, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905930

This is an enclosure indicator page.
The enclosure PE905930 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905930 has the following characteristics:

ITEM_BARCODE	= PE905930
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 2, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905931

This is an enclosure indicator page.
The enclosure PE905931 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905931 has the following characteristics:

ITEM_BARCODE	= PE905931
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 3, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905932

This is an enclosure indicator page.
The enclosure PE905932 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905932 has the following characteristics:

ITEM_BARCODE	= PE905932
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 4, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905933

This is an enclosure indicator page.
The enclosure PE905933 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905933 has the following characteristics:

ITEM_BARCODE	= PE905933
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 5, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905934

This is an enclosure indicator page.
The enclosure PE905934 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905934 has the following characteristics:

ITEM_BARCODE	= PE905934
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 6, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905935

This is an enclosure indicator page.
The enclosure PE905935 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905935 has the following characteristics:

ITEM_BARCODE	= PE905935
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 7, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905936

This is an enclosure indicator page.
The enclosure PE905936 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905936 has the following characteristics:

ITEM_BARCODE	= PE905936
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 8, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905937

This is an enclosure indicator page.
The enclosure PE905937 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905937 has the following characteristics:

ITEM_BARCODE	= PE905937
CONTAINER_BARCODE	= PE905927
NAME	= Vertical Seismic Profile
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Vertical Seismic Profile, Plot 9, (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	= 2/05/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

PE905938

This is an enclosure indicator page.
The enclosure PE905938 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905938 has the following characteristics:

ITEM_BARCODE	= PE905938
CONTAINER_BARCODE	= PE905927
NAME	= DISPL*, VSP Power Spectrum
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= DISPL*, VSP Power Spectrum (enclosure from WCR vol.1 appendix 3--Velocity Survey) for Devilfish-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)

Figures

Figures

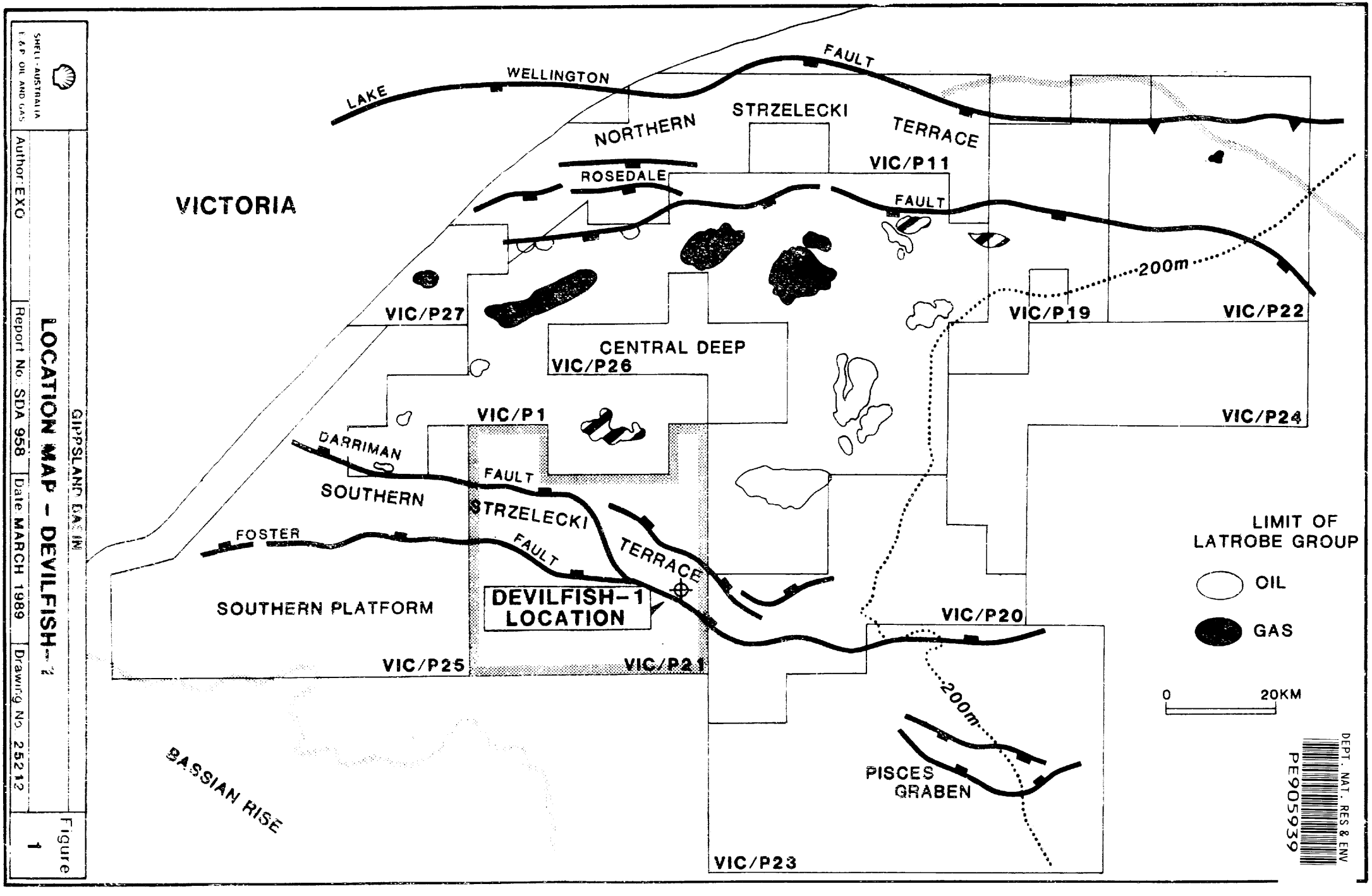
PE905939

This is an enclosure indicator page.
The enclosure PE905939 is enclosed within the container PE905927 at this location in this document.

The enclosure PE905939 has the following characteristics:

ITEM_BARCODE	= PE905939
CONTAINER_BARCODE	= PE905927
NAME	= Location Map
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= MAP
DESCRIPTION	= Location Map (figure1 from WCR vol.1) for Devilfish-1
REMARKS	=
DATE_CREATED	= 31/03/89
DATE_RECEIVED	= 13/09/90
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)



SHELL AUSTRALIA E&P OIL AND GAS

Author: EXO

Report No: SDA 958

Date: MARCH 1989

Drawing No: 25212

GIPPSLAND BASIN

LOCATION MAP – DEVILFISH-1

Figure 1

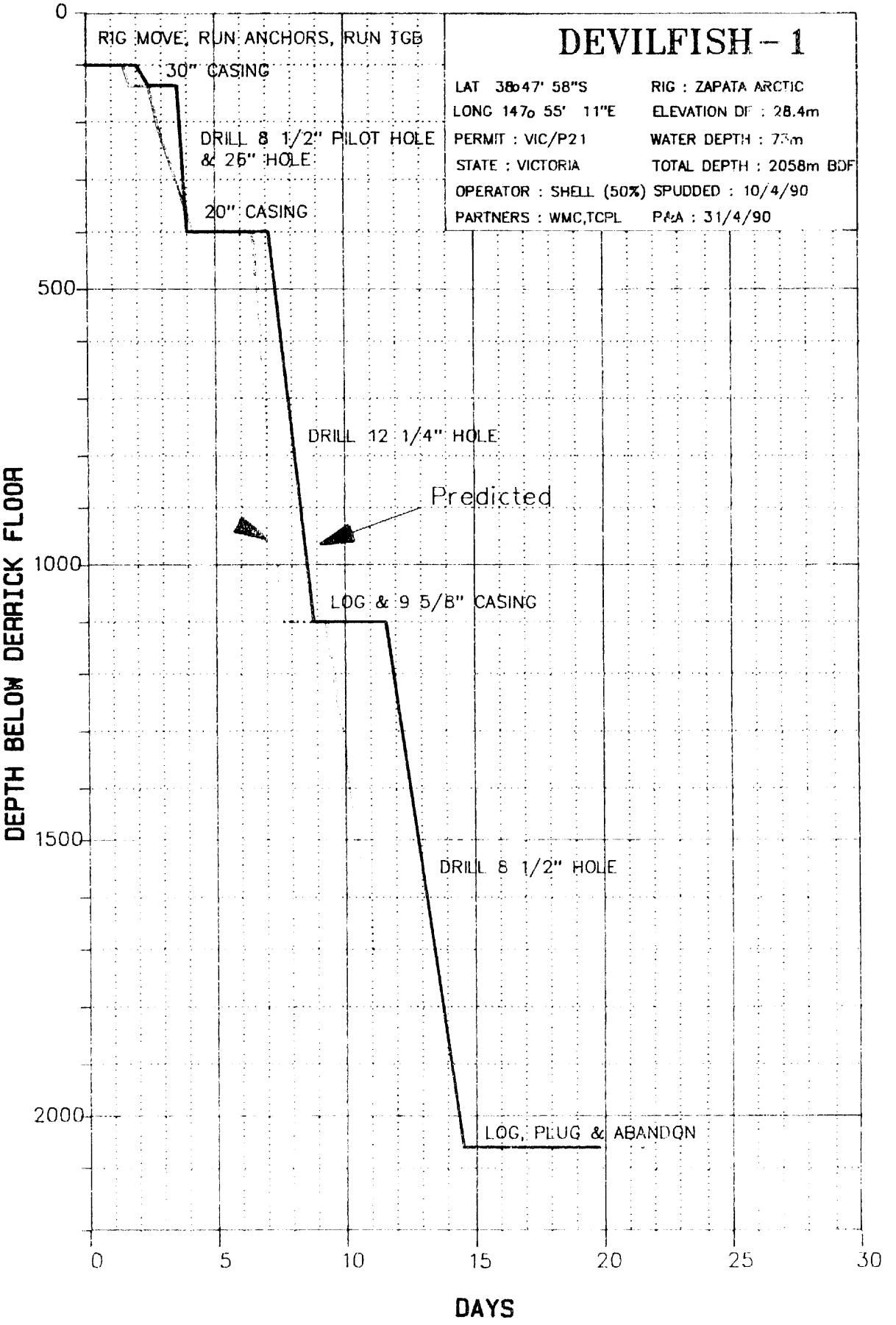
PE905940

This is an enclosure indicator page.
The enclosure PE905940 is enclosed within the container PE905927 at this location in this document.

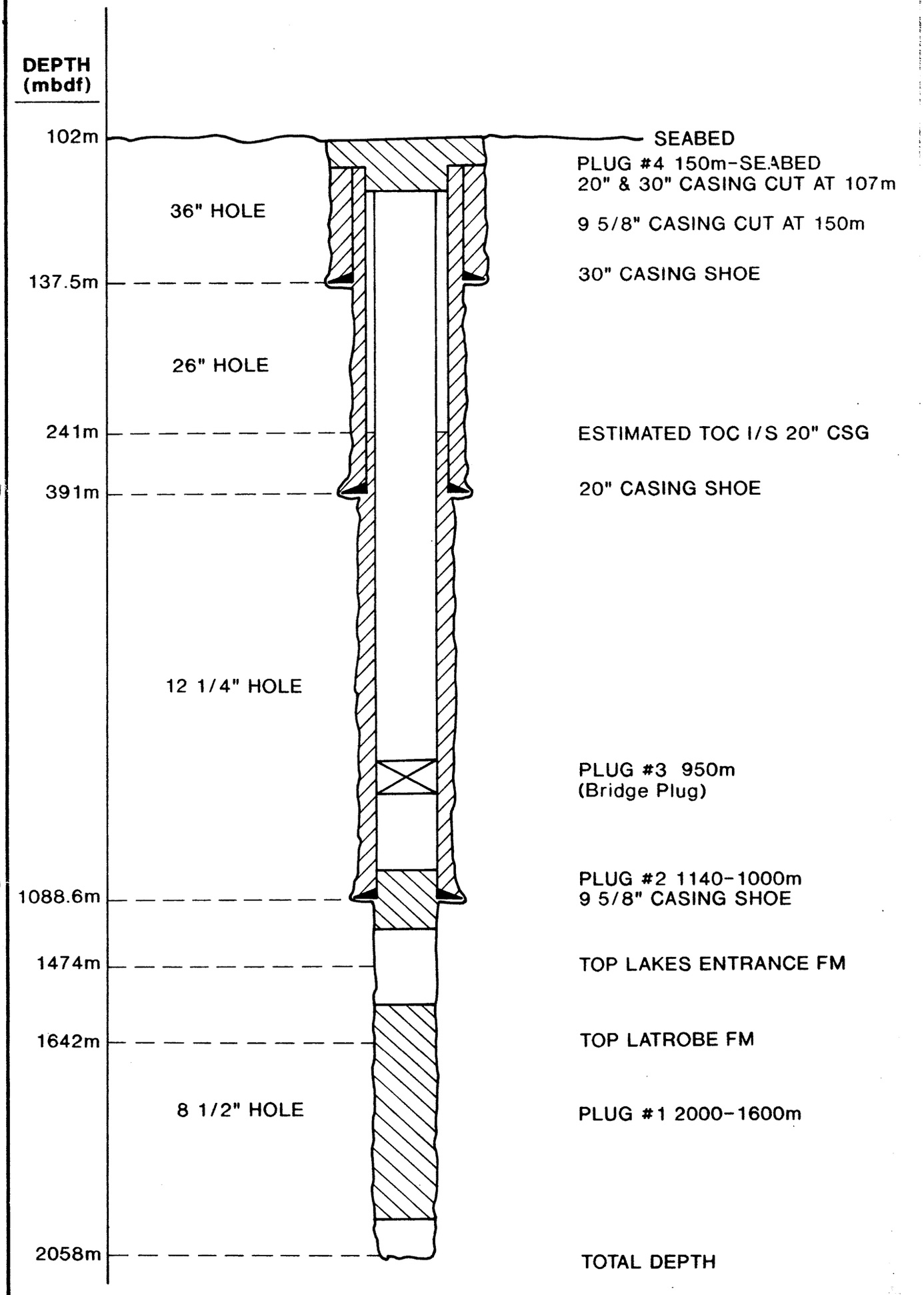
The enclosure PE905940 has the following characteristics:

ITEM_BARCODE	= PE905940
CONTAINER_BARCODE	= PE905927
NAME	= Time Depth Curve
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Predicted vs. Actual Time Depth Curve (figure2 from WCR vol.1) for Devilfish-1
REMARKS	=
DATE_CREATED	= 30/06/90
DATE_RECEIVED	= 13/09/90
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)



SHELL AUSTRALIA E & P OIL AND GAS	GIPPSLAND BASIN DEVILFISH–1 – TIME–DEPTH CURVE				Figure 2
	Author EXO	Report No SDA 956	Date JUNE 1990	Drawing No. 26188	



SHELL-AUSTRALIA E & P. OIL AND GAS	GIPPSLAND BASIN				Figure 3
	DEVILFISH-1 P & A WELLBORE STATUS				
	Author: EEO/21	Report No.: SDA 958	Date: JULY 1990	Drawing No.: 26257	

Enclosures

Enclosures

PE604489

This is an enclosure indicator page.
The enclosure PE604489 is enclosed within the container PE905927 at this location in this document.

The enclosure PE604489 has the following characteristics:

ITEM_BARCODE	= PE604489
CONTAINER_BARCODE	= PE905927
NAME	= Master Log
BASIN	= GIPPSLAND BASIN
PERMIT	= VIC/P21
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Master Log/ Mud Log (enclosure from WCR vol.1) for Devilfish-1
REMARKS	=
DATE_CREATED	= 21/04/90
DATE_RECEIVED	=
W_NO	= W1026
WELL_NAME	= DEVILFISH-1
CONTRACTOR	= GEOSERVICES
CLIENT_OP_CO	= SHELL AUSTRALIA

(Inserted by DNRE - Vic Govt Mines Dept)