



**Essential
Petroleum
Resources
Limited**

PEP 151

ONSHORE OTWAY BASIN, VICTORIA

WELL COMPLETION REPORT

Pritchard 1

December 2008

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1 SUMMARY

Pritchard 1 was drilled as an oil and gas exploration well. The well is located approximately 11 km south of the Dartmoor township, and 2 km southeast of the exploration well Henke – 1 (Figure 1).

The primary target of the well was oil below the Pember Mudstone seal in the Pebble Point Formation and/or the Timboon Sandstone (Figure 2). Secondary targets were recognised in sand/shale pairs interpreted from seismic data and tentatively ascribed to the Nullawarre Greensand equivalent and the Flaxman Formation. These lower zones were considered a secondary target as the distribution of seals and reservoirs in this section was uncertain. The overall structure at base Tertiary is created by a combination of transpression along the Tartwarp fault, and syn-depositional thickening of the Wangerrip Group south of the Tartwarp fault. Four way dip closure is created by post Dilwyn Formation east-west compression.

Pritchard 1 was drilled in March – April 2006. The well was drilled to the primary target in 8½” hole. No testing was carried out. The Pebble Point Formation was poorly developed as expected. The Timboon Sandstone was well developed and was intersected 11 m high to the adjacent Henke-1 well.

The well was deepened to intersect the Nullawarre and Flaxman Formation targets. The deeper part of the well encountered a thick sand-prone deltaic sequence and was terminated within this sequence. Subsequent palynological examination showed the well terminated in the Morum Formation, an age equivalent of the lowermost Belfast Mudstone Unit A or Banoon Member of the Port Campbell Embayment. No oil shows were recorded.

The well was terminated when a determination was made that the capacity of the rig brake could be exceeded by any further drilling. The upper levels of the section of interest had been intersected and mud gas readings remained low in the sand intervals. Sand to shale ratios were high throughout the Belfast Formation section suggesting that seal was poor in the section penetrated. It was decided that the additional engineering required to safely deepen the well was not justified by results to date.

The well was logged and a velocity survey was carried out. The velocity survey confirmed that the well had penetrated the top of the secondary target and that further drilling would have been purely speculative.

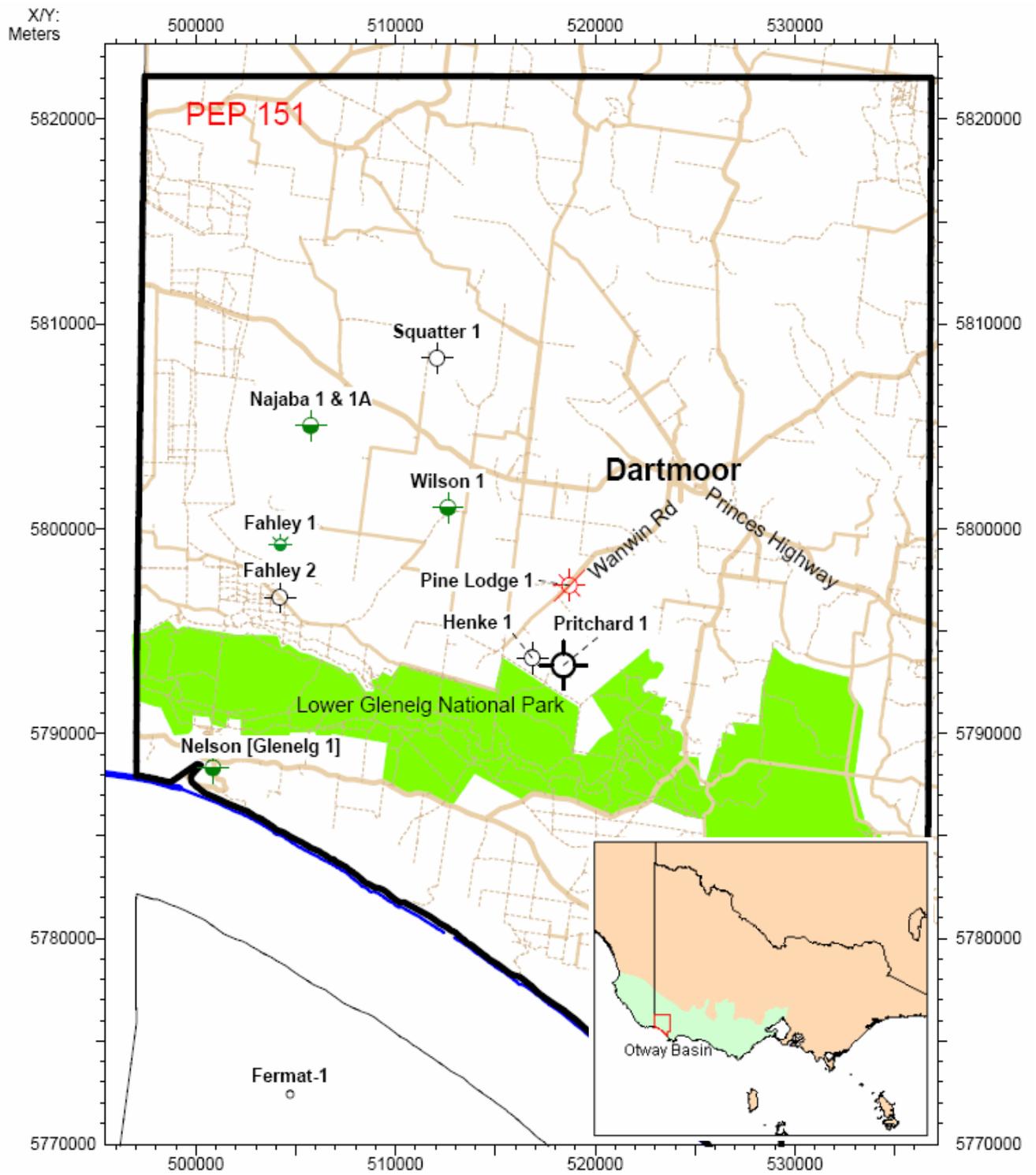


Figure 1: Pritchard 1 Location Map

Figure 2: Regional Stratigraphy

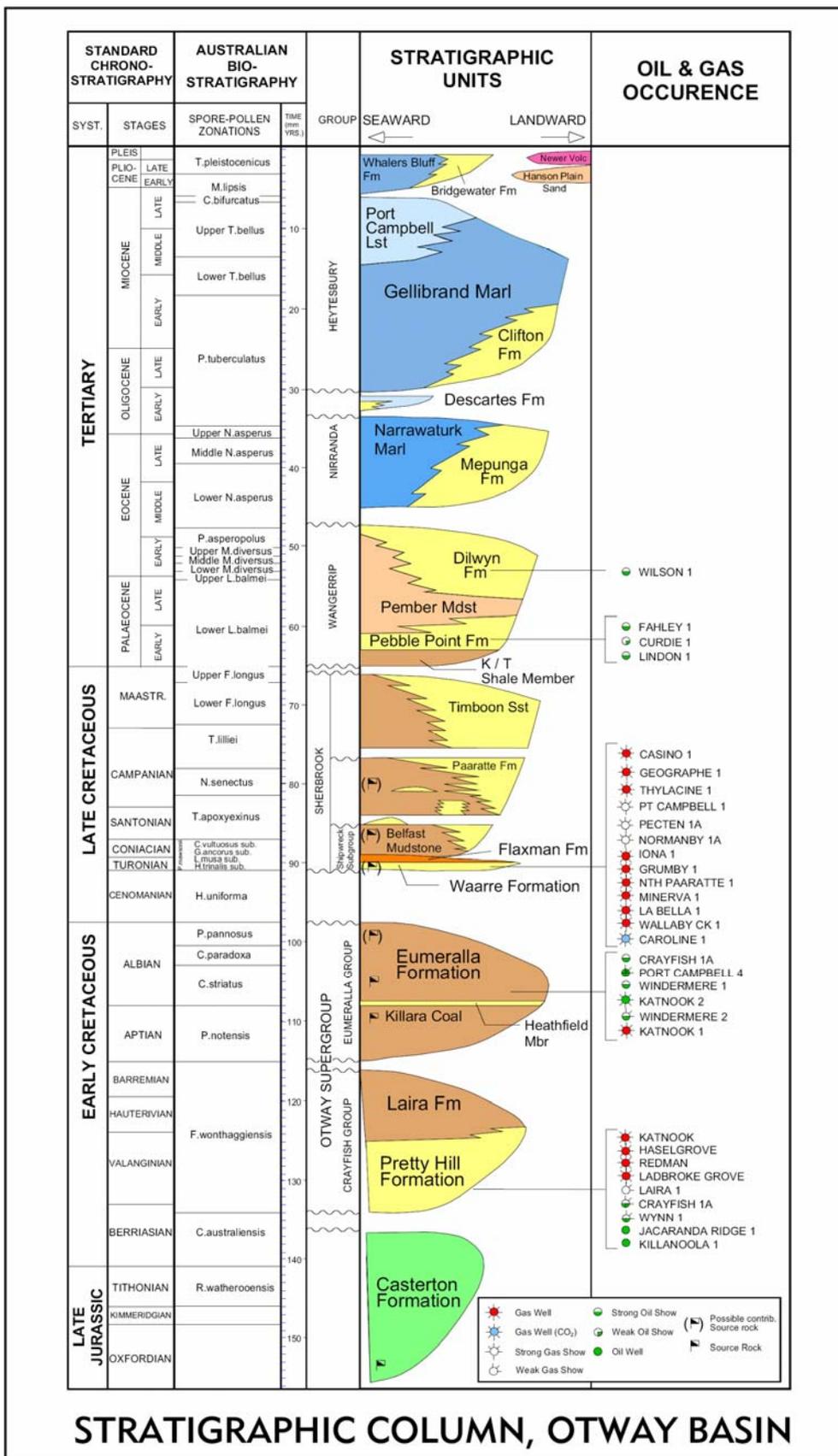


Figure 3: Top Pebble Point Time Structure Map showing location of dip line WGD85-352 through Pritchard 1

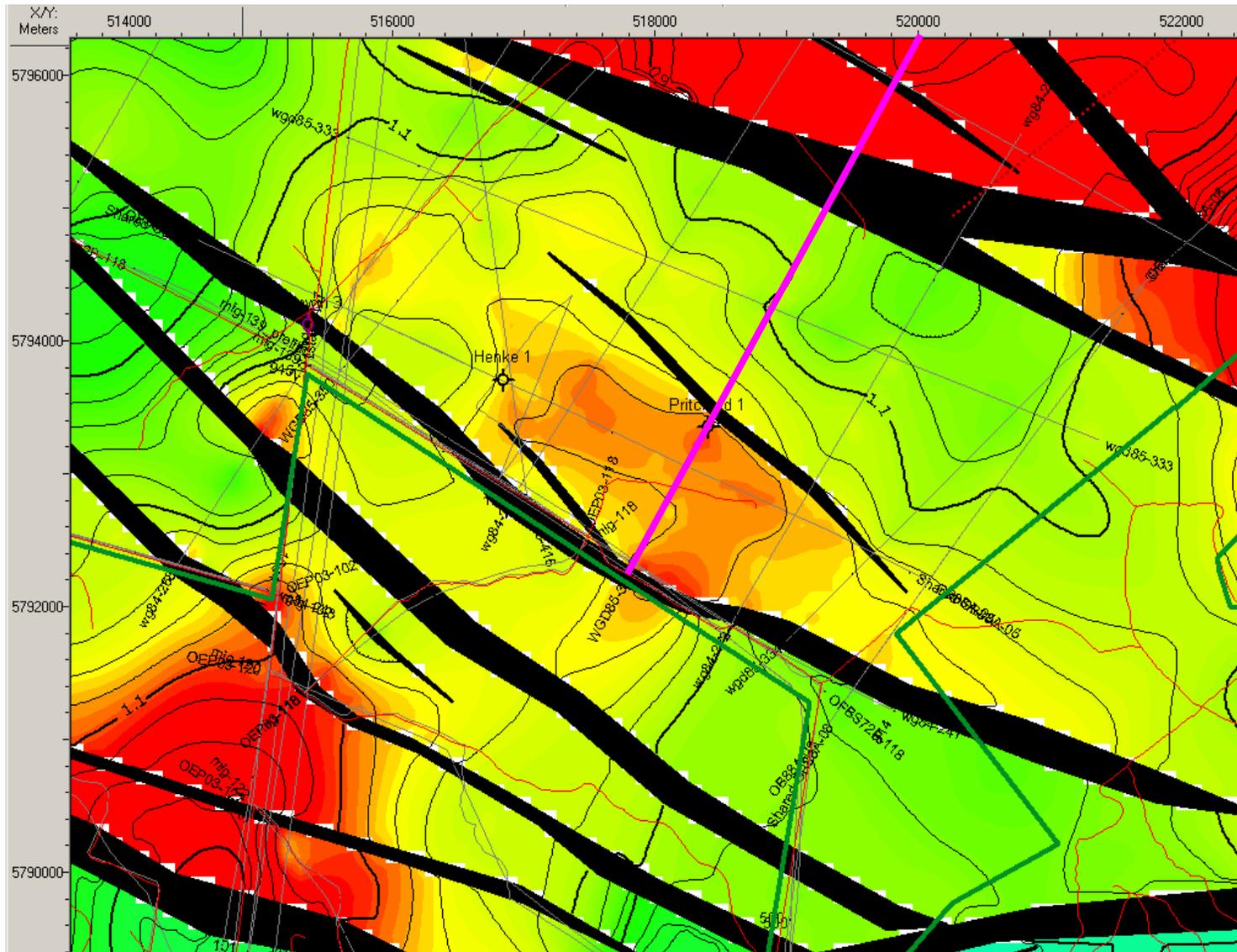
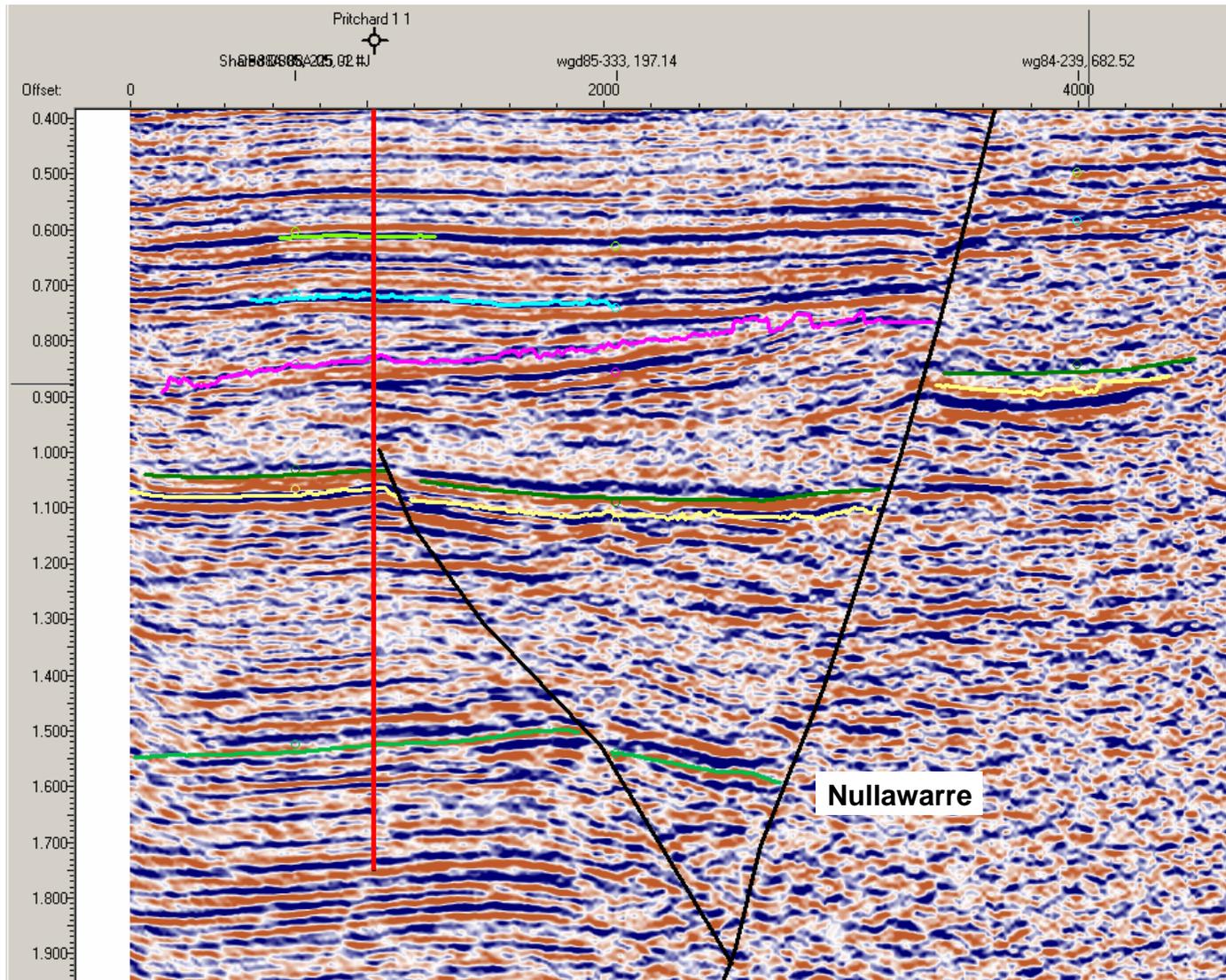


Figure 4: Seismic Line WGD85-352 (Dip Line) showing Pritchard 1



2 WELL HISTORY

2.1 GENERAL DATA

General well data are given in Table 1. Location is shown in Figure 1. The surveyor's report is shown in Appendix 1.

Table 1: General Well Data

Well name:	Pritchard 1	
Classification:	Exploration	
Permit operator:	Essential Petroleum Resources Limited	
Well operator:	Essential Petroleum Resources Limited Level 2, 226 Albert Rd South Melbourne, Victoria 3205	
Participants:	Essential Petroleum Resources Limited Level 2, 226 Albert Road South Melbourne, Victoria 3205	50%
	Bass Strait Oil Company Ltd Level 25, 500 Collins Street, Melbourne, Victoria 3000	25%
	IOR Energy Pty Ltd 39 Byron Street, Brisbane, Queensland 4171	25%
Basin:	Otway Basin, onshore western Victoria	
Lease:	PEP 151	
Seismic location:	WGD352, SP 116.	
Coordinates:	Latitude 38° 00' 26.48", Longitude 141° 12' 34.56"	
Datum GDA-94	Easting 518,400.60m, Northing 5,793,347.88m, MGA Zone 54	
Elevation:	Ground Level (GL): 36.75 metres AHD Rotary Table (RT): 41.05 metres AHD (All depths relate to RT unless otherwise stated)	
Property owner:	Great Southern Plantations	
Nearest town:	The township of Dartmoor, approximately 11 km south of the well.	
Nearest well:	Henke 1	
Measured depth:	2543.0 m (Driller)	
	2530.0 m (Logger)	
Spud date:	19:00:00 on 27/03/2006.	
TD reached:	07:00:00 on 12/04/2006.	
Days to Drill:	19.75 days	
Drill rig released:	12:00 on 16/04/2006	
Well status:	Plugged and abandoned, no shows.	

2.2 CONTRACTORS

Table 2: List of Contractors

Service	Contractor
Operator	Essential Petroleum Resources Limited
Drilling Manager	Kelly Down Consultants Pty Ltd
Environmental Site Assessment	Bremner Corporation Pty Ltd & Enesar Consulting Pty. Ltd.
Precollar Drilling	Paul Mahony
Drilling Services & Rig	Hunt Energy & Mineral Co. Australia Pty Ltd (Hemco): Rig 2
Location Survey	Berry & Whyte Surveyors Pty Ltd
Site Construction	Bob Gleed, Gambier Earth Movers
Water Well	Grant Smith, Dartmoor
Cementing	Halliburton
Mud System	RMN Fluids / AMC
Mud Logging	Colin Higgins & Associates
Electric Logging	Schlumberger
Drilling Tools	Transco Oilfield
Casing	Marubeni
Wellhead Equipment	Wood Group Pressure Control
Waste Disposal	Cleanaway
Accommodation	Rig camp at Pritchard 1 location
Communications	South West Communications

3 ENGINEERING DATA

3.1 WELL STATUS

After logging the well was plugged and abandoned on 16/04/06.

3.2 OPERATIONAL SUMMARY

Pritchard 1 was drilled as an exploration well in the Otway Basin. The well spudded at 17:00 hrs on the 27th March 2006. A Conductor had been pre-set to 43m. 12 ¼" surface hole was drilled to 836m and 9 5/8" casing set at 831m. 8 ½" production hole was drilled to 2543m and wireline logs were run and the well evaluated. The well was plugged and abandoned and the rig was released at 12:00 hrs on the 16th April 2006. Pritchard 1 was drilled, evaluated and abandoned in 19.75 days.

3.2.1 Logistics and Planning

Kelly Down Consultants Pty Ltd managed the drilling on behalf of Essential Petroleum Resources Limited and the PEP151 Joint Venture. Supply and service contractors are listed in Table 2.

3.2.2 Site Preparation

The site was cleared of plantation red gum. The site contained soft sand, which required sheeting to a depth of 200 mm of local limestone. Black polythene liners were used for the sump and for the water dam. Water was supplied from an existing surface water bore on an adjacent property. A 20" precollar was drilled to 43 m RT with a water rig. Conductor casing (16") was set and cemented.

3.2.3 Mobilisation and Pre Spud

Hunt Energy and Mineral Co. Rig 2 was mobilized to the Pritchard location from the Sale area of Victoria and rigged up. A Conductor had been pre-set to 43m.

3.2.4 12 ¼" Hole Section and Surface Casing Surface to 831.6m.

A new Varel 12 ¼" bit (IADC 117) was made up with a stiff BHA and run in the hole. Surface hole was drilled to 836m with a wiper trip at 581m without incident. At section TD the hole was circulated clean, wiper trip made and the bit pulled to surface. The survey at section TD was 1 degree. The 12.25" BHA was laid out. The bit drilled 836m in 57 hours at an average rate of penetration of 13.9m/hr and was graded C-1-WT-TD. This section was drilled using a Gel spud mud and native clays.

Casing running equipment was rigged up and 66 joints (plus the landing joint) of 9 5/8" 36ppf, J55, BTC casing run in the hole. The hole was circulated clean while reciprocating the pipe. The casing was cemented with 5bbl water ahead, pressure test lines, 174 bbl Class A lead cement at 12.5 ppg followed by 55 bbl class A tail cement at 15.8 ppg. The cement was displaced by Halliburton, and completed with the rig pumps due to a blown Halliburton Line. Floats Held.

After waiting on cement, the landing joint was backed out, the 11" 3000psi casing head installed and the BOP's nipped up and tested to 300 psi low and 2000 psi high pressure.

3.2.5 Production Hole and Evaluation.

A new Varel tricone bit, (IADC 117) was picked up with a packed BHA and run in the hole and the cement and the shoe track were drilled out. The rat hole was cleaned out and new hole drilled to 841m. The hole was circulated clean and a FIT giving a formation fracture gradient of 9.8 ppg EMW at the shoe.

After the FIT, drilling proceeded with surveys to 1281m. A washout developed and was laid out 13 joints from surface. Drilling continued to 1395m where a bit trip was made, encountering some tight hole from 1194 – 1119m and 1062 – 1005m.

A re-run PDC bit was run the hole and drilled to 2098m. A wiper trip was made, and nine drill collars laid out to reduce the string weight. There was some differential pipe sticking apparent at 2047m – but the pipe came free after 40bbl water circulated around.

Drilling continued with samples circulated as requested to TD at 2543m. The well was terminated short of the ultimate TD as the brake capacity of the rig was nearing its safe working limit. The geological requirements were satisfied by drilling into the top of the target stratigraphy.

Schlumberger logged the well and after evaluation a decision made to P&A the well.

3.2.6 Plugging and Rig Release

On completion of logging, the drill collars and excess drill pipe was run in hole and laid out.

Plug #1 was run from 2060 – 2000m, 20.7 bbl Cement @ 15.8ppg

Plug #2 was run from 1375 – 1275m, 34.5 bbl Cement @ 15.8ppg

Plug #3 was run from 900 – 750m, 43 bbl Cement @ 15.8ppg (tagged at 856m)

Plug #4 was run from 856 – 815m and tagged.

BOP's were flushed and laid down, bradenhead removed, and mud tanks dumped and cleaned.

The abandonment schematic is shown in Figure 5.

The rig was released at 12:00 hrs on the 16th April, 2006

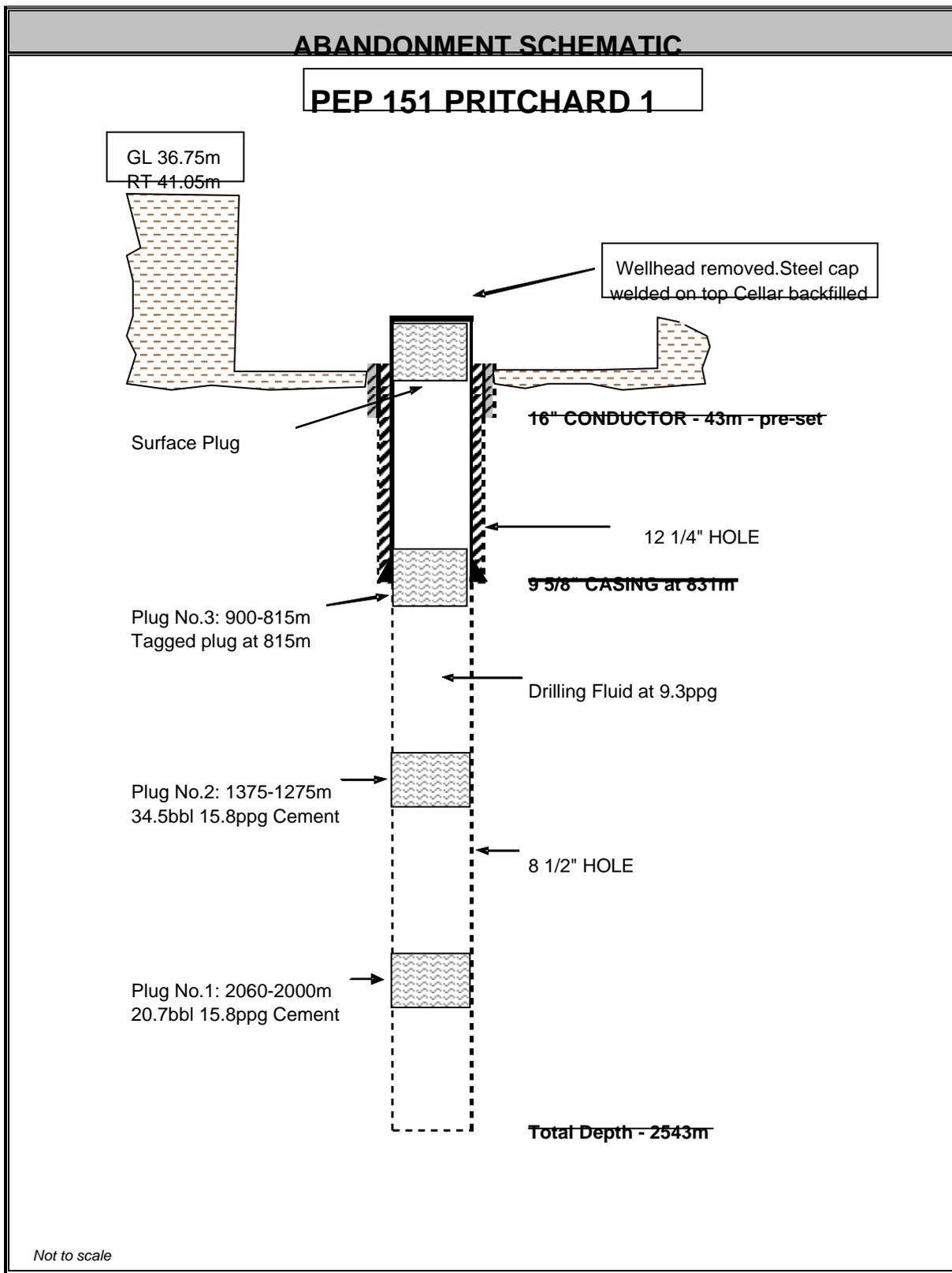


Figure 5: Pritchard 1 Abandonment Schematic

3.3 DAILY OPERATIONS

3.3.1 Daily Drilling Reports

The details of the daily activities during rig up and drilling operations for the Pritchard 1 well are presented in the Daily Drilling reports in Appendix 2.

3.3.2 Time Performance

The time – depth curve for Pritchard 1 is presented in Figure 6 and a time breakdown is presented in Table 3.

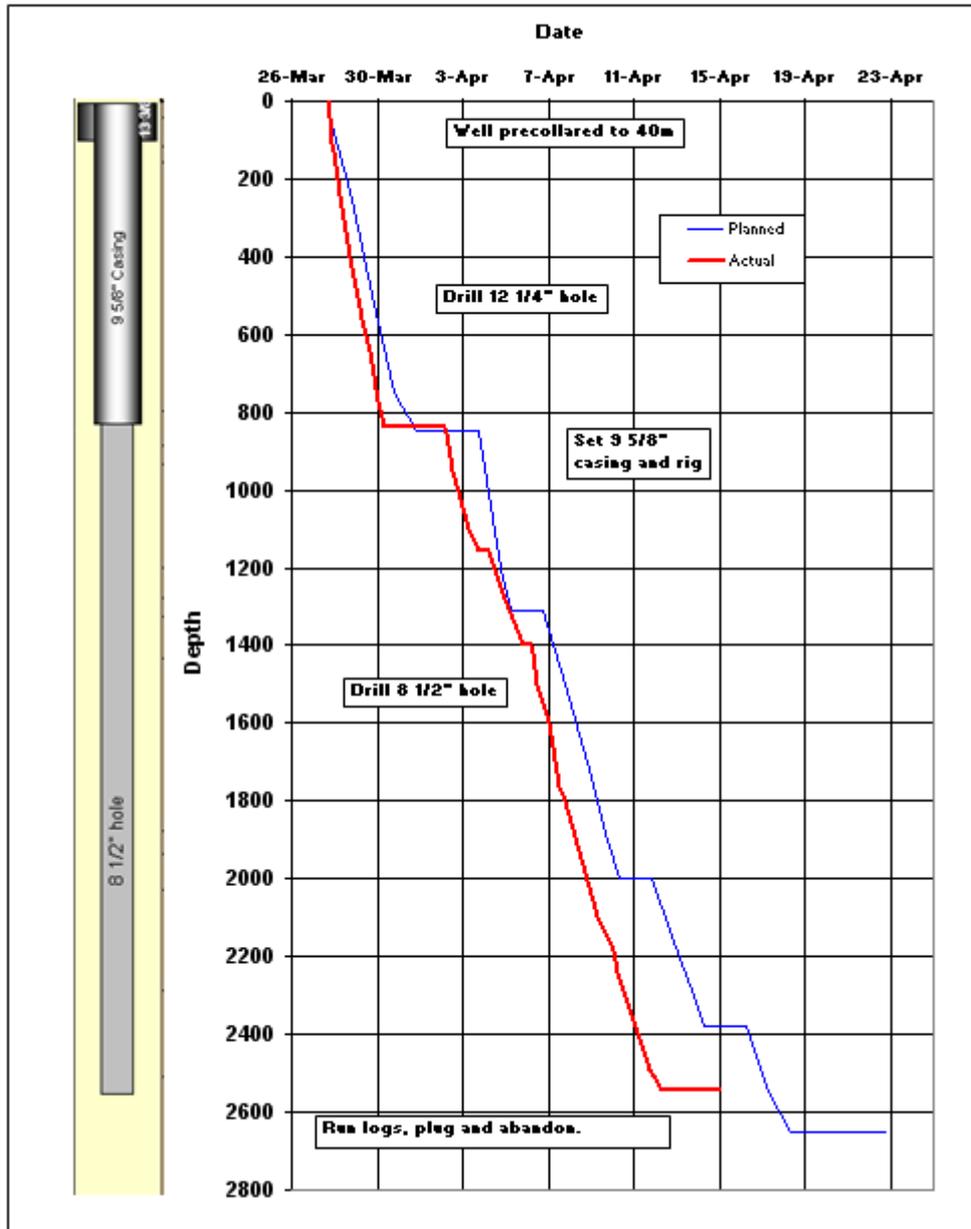


Figure 6: Pritchard 1 Time – Depth Curve

Table 3: Completion time summary

OPERATION	HOURS	%
Drill Actual	209.0	55.66
Trip	52.0	13.85
Wiper Trip	10.5	2.80
Survey	2.5	0.67
Circ/Cond	10.5	2.80
Handle BHA	6.0	1.60
Case/Cement	24.5	6.52
Wellhead	8.0	2.13
BOPS	19.5	5.19
Lot	1.0	0.27
Coring	0.0	0.00
Logging	16.0	4.26
Ream/Wash	2.5	0.67
Rig Repair	0.0	0.00
Wait - Other	0.0	0.00
Rig Service	0.5	0.13
Slip/Cut Line	6.5	1.73
Other	6.5	1.73
COMPLETION	0.0	0.00
	375.5	100.0

3.3.3 Surveys

Deviation measured in the well did not exceed 2.25 degrees.

Table 4: Deviation Surveys

Survey No.	Depth (mKB)	Hole Size (in)	Deviation (deg)	Azimuth (deg)	Survey Type
1	154	12 ¼"	1.00		Totco
2	826	12 ¼"	1.00		Totco
3	1185	8 ½"	1.25		Totco
3	1497	8 ½"	1.50		Totco
4	1768	8 ½"	2.25		Totco

3.4 BHA and BIT summaries

Table 5: Bit Record

Bit No	in	mm	Jets	Make	Type	IADC code	In (mRT)	Out (mRT)	Made Hrs	Cond	Reason Pulled	
	20"	445	The Conductor hole was drilled with a precollar rig to 43 m				GL	43	38			Casing point
1rr	12 1/4	311	18-18-18	CH1GMS	M22	1-1-7	43	836	793	57	C-I-WT-TD	Casing point
2rr	8 1/2	216	12-12-12	CH1GMS		1-1-7	836	1158	1063	39.5	8.6.WT.A.E..I.ER	Programmed bit change
3rr	8 1/2	216	14-14-15	CH1GMS		1-1-7	1158	1395			6 5 WT.A.E2.ER PR	Programmed bit change
4rr	8 1/2	216	5 x12	DBS	PDC	FS2565	1395	2098				Washed jt instring
5rr	8 1/2	216	5 x12	DBS	PDC	FS2565	2098	2543	1148	97		TD

Table 6: BHA Record

BHA No.	Bit No.	Hole Size	BHA Description	Depth in (m)	Depth out (m)
1	1	12 ¼"	12 ¼" Bit Near Bit Stabilizer 1 x 8" Drill Collar 12 ¼" Stabiliser 1 x 8" Drill Collar Cross-over 7 x 6 ½" Drill collars Drilling Jars 2 x 6 ½" Drill collars	43	836
2	2 & 3	8 ½"	8 ½" Bit 8 ½" NB Stabiliser 1 x 6 ½" Drill collar 8 ½" Stabiliser 2 x 6 ½" Drill collar 8 ½" Stabiliser 10 x 6 ½" Drill collars Drilling Jars 2 x 6 ½" Drill collars 4 x HWDP	836	1395
3	4	8 ½"	8 ½" Bit Bit Sub 1 x 6 ½" Drill collar 8 ½" Stabiliser 12 x 6 ½" Drill collars Drilling Jars 2 x 6 ½" Drill collars 4 x HWDP	1395	2098
4	4RR	8 ½"	8 ½" Bit Bit Sub 1 x 6 ½" Drill collar 8 ½" Stabiliser 4 x 6 ½" Drill collars Drilling Jars 1 x 6 ½" Drill collars 4 x HWDP	2098	2543

3.5 CASING AND CEMENTING SUMMARY

The casing record is summarised in Table 7 and the Casing and Cementing Report and Casing Tally Sheet is presented in Appendix 3.

Table 7: Casing Record

Hole Size	Hole Depth	Csg Size	Shoe Depth	Type	Cementing	Comment
20"	43 m	16"	40.3	68 ppf K55 BTC	To surface	
12 1/4	836.0 m	9 5/8"	831.6	36/47 ppf K55BTC	To surface	FIT with 8.6 ppg mud (EMW 1.17 SG ,9.8 ppg)

3.6 DRILLING FLUIDS

Drilling fluid details are summarised in the Operational summaries (Section 3.2). The drilling fluid contractor's mud recap is provided in Appendix 4. Drilling fluid chemistry was effective throughout the well.

4 FORMATION SAMPLING AND TESTING

4.1 CUTTINGS

Cuttings were collected at 10 metre intervals to a depth of 1000 mRT and at 3 metre intervals from 1000 mRT to TD. Detailed cuttings descriptions are presented in Appendix 5.

4.2 CORES

No sidewall or conventional cores were cut.

4.3 TESTING

No testing was carried out.

4.4 MUD LOGGING

Colin Higgins & Associates provided mudlogging services. Depth, penetration rate, mud gas, pump rate and mud volume data as well as mud chromatographic analysis was recorded from 40m RT to total depth. Rate of penetration, weight on bit, total gas and chromatography were recorded and plotted on the Formation Evaluation Log (Mud Log) and are presented in Enclosure 1.

4.5 WIRELINE LOGGING

Wireline logging was carried out using a Schlumberger MAXIS unit. The logging suite consisted of two logging runs. A composite log is provided in Enclosure 2. Individual Logs are presented in Enclosure 3. Details of the log depth intervals for each log run are presented in Table 8.

Table 8: Wireline Logging

Run	Depth (mRT)	Log	Top Log Interval	Bottom Log Interval	BHT Deg. C
1	2530	GR	surface	2516.0	84
		SP	831.6	2510.0	
		HALS	831.6	2526.0	
		PEX	831.6	2522.0	
		MCFL	831.6	2516.0	
		BHC	831.6	2522.0	
2	2530	CSAT	40.0	2530.0	n/r

4.6 VELOCITY SURVEY

A velocity survey was carried out by Schlumberger using explosives. The results are shown in Table 9.

NOTE: Results are given in two-way time.

SRD Depth from Schlumberger Zero was 40.75m.

True Vertical Time Correction with Surface Velocity of 1339.30m/sec.

Table 9: Velocity Survey Results

Stack Number	Raw Depth (m)	Raw Trans Time (ms)	True Vert Depth from SRD (m)	Corrected Trans Time Two-way (ms)	Average velocity (m/s)
22	40.00	51.13	0.00	0.00	1339.30
21	189.90	111.13	147.60	158.47	1732.13
20	300.00	164.98	257.70	270.54	1812.8
19	550.00	277.78	507.70	499.48	1966.68
18	697.00	335.82	654.70	616.41	2062.39
17	850.00	394.37	807.70	734.03	2142.99
16	1009.90	456.25	967.60	858.15	2202.08
15	1179.90	508.47	1137.60	962.90	2309.72
14	1268.00	538.88	1225.70	1023.83	2342.67
13	1316.00	556.75	1273.70	1059.61	2353.62
12	1333.00	564.40	1290.70	1074.93	2351.81
11	1365.00	572.11	1322.70	1090.40	2375.97
10	1500.00	609.48	1457.70	1165.26	2451.62
9	1750.00	685.37	1707.70	1317.22	2544.65
8	1900.00	727.91	1857.70	1402.37	2601.91
7	2030.10	767.01	1987.80	1480.62	2638.81
6	2099.90	783.24	2057.60	1513.12	2673.21
5	2250.0	824.45	2207.70	1595.60	2721.57
4	2385.00	846.98	2342.70	1640.71	2808.50
3	2530.00	893.46	2487.70	1733.71	2824.64

4.7 PETROPHYSICAL ANALYSIS

A petrophysical analysis of the wireline logs is presented in Appendix 6 and a summary of the results is given below:

The purpose of this study was to examine the reservoir characteristics of the various sands encountered in the Pritchard 1 well. The wireline logs were quantitatively interpreted over the interval 850-2530m.

Pritchard 1, drilled by Essential Petroleum Resources Ltd. to a depth of 2543m, is located in PEP 151, Otway Basin, Victoria. No significant hydrocarbons were encountered during drilling and no drill stem tests were carried out. After wireline logging, Pritchard 1 was plugged and abandoned as a dry well on 15th April 2006.

The Pebble Point Formation contains argillaceous sandstones with a high percentage of glauconite. A total of 0.6m of net sand is interpreted in the Pebble Point with an average porosity of 10.0%. Minor hydrocarbon saturations are determined, however these are not considered to be significant.

The Paaratte Formation consists of 391.4m of net sand in a 646.1m gross interval. The sands are clearly water saturated with excellent reservoir properties. Calculated porosities are up to 28% in thick massive sands, with the permeability expected to be very high.

The Nullawarre Greensand Equivalent consists of coarsening upward sandstone with porosities ranging from 10% at the base to 22% near the top. A total of 29.7m of net sand is interpreted with an average porosity of 16.1% and is interpreted to be entirely water saturated.

A large sand package was interested over the interval 2101-2500m, which is termed the "Pritchard Delta". A total of 254.6m of net sand is interpreted with excellent reservoir properties, however is entirely water saturated. Calculated porosities range from 10% up to 28% in thick massive sands, with the permeability expected to be very high.

4.8 PALYNOLOGICAL ANALYSIS

A palynological analysis on samples from Pritchard 1 is presented in Appendix 7 and a summary of the results is given below:

Palynological analyses have been performed on twenty-two cuttings samples between 960 and 2541m from the Pritchard-1 exploration well and the final results are summarised in Table 1. The recovered spore-pollen assemblages form an incomplete succession from the uppermost *Phyllocladidites mawsonii* Zone to lowermost *Malvacipollis diversus* Zone representing an age range from possible latest Turonian to Early Eocene. The low diversity and moderately abundant microplankton in the assemblages are even more incomplete with only selected Late Cretaceous and Early Paleogene zones represented in the succession.

5 GEOLOGY

5.1 STRATIGRAPHY

The stratigraphic section penetrated in Pritchard 1 is shown in Table 10 below. Formation tops were picked by reference to Henke 1 and Pine Lodge 1.

Table 10: Stratigraphic Table

Formation Tops			
	Ground level m AHD		36.75
	Datum (RT) m		41.05
	air gap m		4.3
Formation	wireline depth (mRT)	Elevation (mAHD)	thickness (m)
Alluvium	4.3	36.75	13.4
Pt Campbell Lst	17.7	23.35	66.3
Dilwyn Formation	84	-42.95	806
Pember Mudstone	890	-848.95	425.5
Pebble Point Formation	1315.5	-1274.45	7
Massacre Shale	1322.5	-1281.45	10
Timboon Formation	1332.5	-1291.45	183.5
Paarrate Formation	1516	-1474.95	145.5
Skull Ck Mudstone	1661.5	-1620.45	7.5
Nullawarre Greensand	1669	-1627.95	36.5
Mt Salt Fm (Belfast Mdst)	1705.5	-1664.45	540
(Belfast B equiv)	2245.5	-2204.45	102.5
Morum Fm (Belfast A equiv)	2348	-2306.95	195
TD	2543	-2501.95	

5.2 LITHOLOGY

The full cutting descriptions are provided in Appendix 5 and summarised by interval on the Composite Well Log. Formations encountered in Pritchard-1 are described below.

Quaternary sediments

Fine well sorted aeolian sand was encountered from surface to 6.6 m. Grey sticky clay was encountered from 6.6 m to 10.5 m.

Heytesbury Group, Late Eocene to Pliocene

Port Campbell Limestone (17.7–84.m)

The Heytesbury Group is represented by a thin veneer of Port Campbell Limestone. The Port Campbell Limestone consists of a white to pale yellow and light grey medium grained fossiliferous calcarenite, variably cemented. Large fragments of bryozoans are present. At Pritchard-1 the section is relatively thin. The lower section of the formation which is dominated by marl is not present at this location.

Nirranda Group, Middle Eocene to Early Oligocene

The Nirranda Group is absent at this location

Wangerrip Group, Palaeocene to Middle Eocene

Dilwyn Formation 84.0 – 890.0m)

At the top of the Dilwyn Formation the sandstone is mottled reddish brown, orange, pink, fine to coarse grained, with a dense argillaceous matrix and ferruginised calcareous cement. Iron staining and cementation decreases over approximately 20 m from the top of the formation.

The main body of the formation is predominantly sandstone, interbedded with minor mudstone in successive coarsening-upwards cycles. The sandstone is clear, white, or light brown, fine to very coarse grained occasionally granular, moderately to poorly sorted, with angular to subangular loose clean grains, and traces of calcite cement, clear quartz overgrowths, trace lithic grains and coarse mica. The visual porosity is predominantly very good. The mudstone is very dark grey to greyish brown, soft to very hard/calcareous, with individual pyritic bands.

Pember Mudstone (890.0 – 1315.5m)

The boundary between the Dilwyn Formation and the Pember Mudstone is problematical. There is an interfingering prograding relationship between coarsening upwards sandstone units lithologically similar to the Dilwyn Formation, and mudstone units with Pember Mudstone affinities. The top of the Pember Mudstone is placed at the base of massive sandstones however a lower pick is possible at 1047 m where mudstone becomes dominant, and the intervening interval is best considered as Pember / Dilwyn progrades. The interval of progrades in Pritchard is more mud-dominated than the equivalent section in Henke-1 but a good correlation can be established.

A mid-Pember sands were prognosed based on seismic, and were intersected at 1007 and 1147 m. Poosity in the sands was good but no hydrocarbon shows were encountered

The Pember Mudstone and the Dilwyn Formation formed within the major period of subsidence and infilling of the Portland Trough.

The Pember Mudstone consists of medium to dark greyish brown silty claystone, occasionally very dark grey & very dark brown, soft amorphous to firm subfissile when calcareous, trace to common loose well rounded quartz grains occurring as laminae. There are occasional pyrite aggregates. Sandstone occurs as thin laminations: light brown, very fine grained, with light grey, sucrosic, calcareous siltstone.

A distinctive unit at the base of the Pember Mudstone contains silty claystone which is medium brownish grey to very dark grey and brown, occasionally yellowish grey/dolomitic, subfissile to splintery and which grades to carbonaceous shale. There are occasional fine laminations of sandstone green to black, carbonaceous, glauconitic in part, with trace crinoid stems.

Pebble Point Formation (1315.5 – 1322.5m)

The Pebble Point Formation is very thin, and is recognised on the basis of strongly cemented glauconitic / chamositic material giving a strong fast break on the sonic log, and on paynological dating of the distinctive Massacre Shale below.

The rock intersected is glauconitic sandstone: brown, dark green to black, predominantly fine to medium but occasionally very coarse grained, with angular, irregular quartz grains. The grains are poorly sorted, predominantly loose with traces of mud matrix, pyrite and silica cements. Quartz grains form 30 - 70% of rock but the visual porosity is poor due to the matrix. The quartzose Pebble Point Formation sandstone intersected at Pine Lodge-1 was

absent at his location. Quartz sand preservation in the Pebble point appears to be restricted to the proximal northern side of The Tartwaup Fault, immediately to the north of the well.

Sherbrook Group, Late Cretaceous

In the upper part of the Sherbrook Group a reasonable correlation exists with the Port Cambell Embayment. The Massacre Shale, Timboon Sandstone and Paaratte Formations are clearly recognisable. The lower section is less clearly comparable with Port Campbell. This is not surprising given the distance from the Port Campbell Embayment and the variability of this section geographically. The section at Pritchard is more similar to that intersected in the Gambier Embayment. Use of an extended Paaratte Formation and the Mount Salt Formation are more useful names for the sand dominated section in the lower part of the well. Given however that the original prognosis was made using the Victorian Otway Basin stratigraphy those names have been retained and used as equivalents. The palynology report (Appendix 7) provides a comparative stratigraphy and expands on some of the issues mentioned here.

This similarity to the Gambier Embayment provides support for the division at the Discovery Bay High of the Late Cretaceous Otway Basin into a Morum and Nelson Subbasins based on independent sand supply and the relative deposition rates through the early part of the late Cretaceous.

Massacre Shale (1322.5 – 1332.5m)

The Massacre Shale is recognised by the characteristically very high gamma ray signature. Lithologically the formation is composed of glauconitic mudstone: black, soft to hard, contains up to 30% glauconite and ?chamosite pellets. The Massacre Shale is a thin transgressive event at the Cretaceous – Tertiary boundary that is recognised across the Otway Basin. The Massacre Shale and the thin overlying Pebble Point Formation are deposited in a period of very slow sediment accumulation with minimal clastic input resulting in a condensed section.

Timboon Sandstone (1332.5 – 1516.0m)

The Timboon Sandstone is predominantly sandstone interbedded with minor shale. The sandstone is described as being white to grey, fine to coarse, poorly sorted, abundant shattered grained. From palynological evidence the uppermost part of the Timboon may be missing. The uppermost part of the formation as drilled is characterised by a high sonic velocity and strong cementation of the sand. From the neutron and density logs some porosity is apparent from a depth of approximately 1340 m, approximately 10m higher than in Henke-1. Below the cemented zone the sandstone is clear to light grey, fine to coarse, rounded to angular, fractured but predominantly clean with a fair to good visual porosity. While porosity has been limited by the diagenetic processes a greater interval of reasonable porosity was intersected in Pritchard-1 than in the adjacent Henke-1 well in which the upper Timboon contained a 40m thick shale unit.

Paaratte Formation (1516.0 – 1661.5m)

The Paaratte Formation consists of interbedded sands, siltstone and claystone. The top of the formation is picked where finer grained interbeds and sandstone are present in equal volumes, in contrast to the sand-dominated Timboon Sandstone above.

. An extended Paaratte Formation used in the sense of the Gambier Embayment could be interpreted to extend to 1994 m, and the Mount Salt Formation extend from that depth to TD.

Skull Creek Mudstone (equivalent) (1661.5 – 1669.0 m)

The Skull Creek Formation was prognosed and originally interpreted from wireline logs as being substantially deeper in the well, however on the basis of palynology the equivalent age material occurs higher. The Skull Creek Mudstone is picked as a particularly high gamma section separating the silt and claystone dominated lower Paaratte Formation from the sandier Nullawarre Formation equivalent below. The material in the interval is described as siltstone and silty claystone laminated on millimetre scale between medium grey, speckled, dark grey carbonaceous, and pale grey /quartzose, occasional carbonaceous laminations.

Nullawarre Greensand equivalent (1669– 1705.5 m)

In the Nullawarre Greensand, sandstone is interbedded with silty claystone, silty sandstone and siltstone. The sandstone is translucent, greenish grey, well sorted very fine to medium grained, quartzose but with trace glauconite, grey smoky quartz and lithics. The grains are predominantly loose with traces of an argillaceous and in places calcareous matrix adhering. Siltstone is of two types: very light greenish grey, trace very fine glauconite; and greyish brown, trace fine carbonaceous material, grading to silty claystone. Both siltstones are finely sandy, speckled, soft to hard, calcareous in part with traces of marine fossils. Silty claystone: medium to dark greyish brown, fossiliferous, very glauconitic in part, pyritic in part. Sandstones within the Nullawarre Formation appear to be highly cemented however thin intervals with fair porosity remain.

Belfast Mudstone equivalent (1705.5 – 2543.0m TD)

The Belfast Mudstone equivalent consists of alternating sandstones and shales interbedded on a 5 – 30 m interval. As discussed above the section is similar to the Mount Salt Formation. In the upper part of the formation the sandstone was white to light grey, fine to medium grained, predominantly well sorted, angular to subrounded with clay matrix washing out. Minor silica and rare pyrite cements were noted along with trace lithics and glauconite. visual porosity was fair to occasionally good. Siltstone and silty claystone were laminated on millimetre scale between medium grey, speckled, dark grey carbonaceous, and pale grey /quartzose. From 1980 – 2101 m there is a change from thinly bedded predominately sandy facies to large-scale coarsening upwards cycles comprising massive subfissile mudstone at the bases and white to light brown coarse porous sandstone at the sharp tops.

At 2101 m a change in sandstone character occurs. At the sharp top of a thick coarsening upwards unit the sandstone becomes very pale green, very fine to occasionally very coarse poorly sorted at top grading downward to well sorted predominantly fine grained through the body of the unit. Grains are predominantly subangular but with common very angular irregular grains, and trace very well rounded grains. There is high sphericity. The sand is quartzose, with clear, white, yellow, rare pink quartz grains grains, and a distinctive trace of ?chlorite grains. A ?chlorite clay matrix adheres to many grains giving an overall pale green colour to the sample. Porosity is generally poor, but is very good at the top of the cycle from 2108 - 2119 m. There are trace marine fossils associated with rare claystone interbeds.

Throughout the lower part of the Belfast Formation equivalent it remained dominated by large coarsening-upward deltaic cycles. Shales increase in prevalence toward the base of the section however the shale sand ratio always exceeds 50% indicating that the sealing potential remains low in the section penetrated. A 35 metre and a 20 metre thick shale were penetrated at 2435 m and 2504 m. Background gas rose through the shales but decreased again in the underlying sandstones suggesting the section was not prospective.

Subsequent palynological study indicates the well penetrated to the base of the Belfast Formation but did not penetrate the Flaxman Formation. From the velocity survey the well penetrated into but did not drill out the base of the target stratigraphy.

5.3 Hydrocarbon indications

No significant hydrocarbons were intersected in the well. Yellow to white fluorescence was detected from an organic resin (amber) that occurred in trace amounts from the Pember Mudstone to TD. The substance was examined in detail. It is a translucent orange – brown solid with a soapy texture occurring as discrete particles and irregular laminations in fine grained carbonaceous sediment. The material dissolves in the cutting agent with a bright greenish yellow solvent fluorescence which could easily be mistaken for hydrocarbon fluorescence in a bulk sample. The description is similar to that recorded as hydrocarbon fluorescence in the nearby Henke-1 well.

Background gas remained low throughout the drilled section with the exception of shales in the Belfast Formation which showed background gas up to 2700 ppm. Interbedded sands within this section had a low gas background.

Table 11: Reservoir Quality and Hydrocarbon Indications

Formation	Interval (m RT)	Drill Porosity	Drill HC (maximum)	Petrophysical analysis
Dilwyn	84-890	very good	Nil -100 ppm	N/A
Pember Mudstone	890 - 1313	“Mid Pember” sands fair to very good	Nil in sandstone 220 ppm in basal carb shales	N/A
Pebble Point Fm & massacre Shale	1313 - 1333	Very poor	65 ppm	N/A
Timboon Sandstone	1333 - 1516	Very good, (poor at top)	20 ppm	Sw 100% Øeff 25%
Paaratte Fm	1516 - 1662	Interbedded nil to good	20 ppm	Sw 100% Øeff nil to 25%
Skull Ck	1662 - 1670	nil	25 ppm	SW 100%
Nullawarre Greensand	1670-1706	fair	80 ppm	SW 100% 10 – 25% Øeff
Belfast Mudstone	1706 – 1872	Nil to poor	80 ppm	SW 100% 10 – 25% Øeff
Belfast Mudstone	1872 - 2543 m TD	Interbedded sand and minor shale. Nil to fair, occ good	2700 ppm (in shale)	SW 100% 10 – 22% Øeff

5.4 CONTRIBUTION TO GEOLOGICAL KNOWLEDGE

1. The Timboon Sandstone primary target of the well was intersected higher than in the adjacent Henke-1 well but no shows were observed. The structural closure appears robust. Hydrocarbon migration into the structure appears not to have taken place suggesting that the location was inopportune with respect to either the timing or the migration path of generated hydrocarbons.
2. Mid Pember sands anticipated from seismic interpretation were encountered with good porosity but without hydrocarbon shows
3. With adequate reservoir and sealing formations present and in a structurally elevated position the most likely reason for failure of the well in the Tertiary section is that hydrocarbon charge did not occur. The structure is a relatively late feature. It is likely that closure was not present during hydrocarbon generation and that the structure once formed was not in the path of subsequent remigration.
4. Seismic interpretation of the lower Sherbrook Group suggested that possible hydrocarbons existed in Sand /shale pairs in the Flaxman Formation. While the well was not drilled to the full depth of this interval sufficient section was intersected to determine that no significant hydrocarbons were present.
5. The extent of significant deltaic sands within the Belfast Formation support regional models that sand supply into the Morum Subbasin are significantly greater through the lower Sherbrook group than is the case in the Nelson Sub Basin to the east. The sand prone section is analogous to the Mount Salt Formation describe in the Gambier Embayment.
6. Despite being the age equivalent of the lowermost Belfast Formation the sand/shale ratio at the base of the section penetrated remained greater than 50%. It is possible that the sealing potential for the Belfast / Mt Salt Formation is poor in this area.
7. A significant onset of new sand supply to the basin is recorded in the well as a pale greenish-grey medium to coarse sandstone at 2100 m MD. The colour is from staining of quartz grains and could be derived from remobilisation of volcanoclastic Eumeralla Fm in the basin hinterland.

Appendix 1: Location Survey

Appendix 2: Daily Drilling Reports

Appendix 3: Casing and Cement

Appendix 4: Mud Recap

Appendix 5: Cuttings Description

Appendix 6: Petrophysical Report

Appendix 7: Palynological Report

Enclosure 1: Mudlog

Enclosure 2: Composite Log

Enclosure 3: Wireline Logs