Natural Resources and Environment

WELL SUMMARY

LAKES ENTRANCE OIL SHAFT (W434)

Folio No.	Referred to	Date	Bring up / Put away / Initials	Folio No.	Referred to	Date	Clearing Officer's initials

FILE COVER INSTRUCTIONS FOR ACTION OFFICERS

1. FOLIO NUMBERS: Each subject paper attached to a file is to be given a consecutive number by the attaching officer. Papers must not be removed from or attached to a file without approval.
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3. BRING UP MARKINGS: When action on a file is required at a later date the officer will initial Column (4) and on the next vacant line, enter the relevant folio number in Column (1), then write "B/U" followed by the action officer's name in Column (2) and the date the file is required in Column (3).
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LOCATION

LAKES ENTRANCE DEVELOPMENT-1 (W434)

Well Summary Report

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Enclosures

Lithological Log
Locality Map
Structure Map of Oilfield

PE904187

This is an enclosure indicator page.
The enclosure PE904187 is enclosed within the container PE906145 at this location in this document.

The enclosure PE904187 has the following characteristics:

ITEM_BARCODE	= PE904187
CONTAINER_BARCODE	= PE906145
NAME	= well card
BASIN	= GIPPSLAND
PERMIT	=
TYPE	= WELL
SUBTYPE	= WELL_CARD
DESCRIPTION	= well card Lakes Entrance Oil Shaft-1
REMARKS	=
DATE_CREATED	= 30/11/1945
DATE_RECEIVED	=
W_NO	= W434
WELL_NAME	= Lakes Entrance Oil Shaft-1
CONTRACTOR	= Later Lakes Oil Ltd
CLIENT_OP_CO	= Later Lakes Oil Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

LITHOLOGY

AND HYDROCARBON SHOWS

LAKES ENTRANCE OIL SHAFT.

Notes taken from H.J. Cook's reports to Controller of Minerals Production. (H.J. Cook was appointed Supervisor of Lakes Entrance Oil project as from 7th. September, 1942)

Lithological Aspects:

Shaft sinking commenced on 10th. September, 1942.

160'	Sinking through marl. It is moist but makes practically no water.
208'	Start of systematic sampling so that each sample covers 4 feet of shaft wall vertically.
220'	(about) 1st. occurrence, in odd patches of polyzoal limestone. Then patches increased in frequency until at present (254') the formation is wholly polyzoal. There are, however, persistent thin bands of marl right throughout the whole mass.
253'	A small fissure where water is coming in crystal clear in runnels about as thick as one's thumb.
228' - 268'	Pure polyzoal limestone.
268' - 288'	Heaviest water bearing ground.
308'	The compact polyzoal limestone has disappeared and at 308' in a mixture of marl and sporadic make of limestone. No sharp line of demarcation level at top and bottom of limestone. No new water encountered after 288'.
312'	In marl and polyzoal mixed together.
314'	Passed out of polyzoal limestone into marl. This passage quite marked as polyzoal is lighter in colour than the marl. The marl itself is largely made up of lime replacements of polyzoal and consequently is very gritty. I believe that the so called marl in which we are sinking is very largely polyzoal limestone discoloured with marl.
308' - 314'	Small expossure of polyzoal limestone.
314' - 348'	Dark grey marl very like the country met above the polyzoal limestone.
400'	Country unchanged - a strong compact shelly marl, dark grey in colour.
314' - 468'	In marl with shell fragments and polyzoal remains, the only noticeable differences being in the amount and coarseness of the limey fragments.
470'	Coherent polyzoal limestone is making its appearence, this is not the pure white porous type of limestone encountered higher up, but is much greyer and carries enough marl to make it almost impervious.

461' - 466'	In this interval somewhere an unusual number of limestone concretions which are commonly spherical and vary in size from a cricket ball to a football.
468' - 508'	In mainly dark grey marl with several small bands (abour 8") of polyzoal limestone. In addition there are small patches of lighter coloured polyzoal limestone showing in places. The concretionary isolated boulders of sand limestone (~~400'~~) which put in an appearance at about 400' are still present.
535'	Shaft water began showing an inky discolouration and a search of material excavated showed small makes of black soft mineral which was determined at the Bairnsdale School of Mines as pyrites.
560'	Mixed polyzoal and marl. H_2S met with.
566' - 570'	Fretting ground.
588'	H_2S still encountered.
548' - 576'	In this lift some caving ground present as friable country about 2' thick and charged with H_2S gas.
596' - 601'	3 soft bands present with plentiful H_2S gas and several bands of water.
576' - 612' At 580'	Bad ground encountered with plentiful H_2S gas. Then there was 22' of green polyzoal limestone broken by 2 bands of soft gassey (H_2S) ground. Then 6' of pure white polyzoal followed by dry green marl without water. There were several water bands in the polyzoal.
612' - 616'	Methane encountered as gas bubbles. This existence disappeared in 5 days. H_2S also has died down.
0' - 616'	2 Main water horizons. 240' - 313' in polyzoal and 590' - 612' in polyzoal, most from 602' and not from the green glauconitic polyzoal above it.
616' - 633'	Country shown much variety, there was a continuation for 1 foot of the friable ground before encountered, then about 6 feet of stron polyzoal followed by 5' of very green marl, then a layer of mixed polyzoal and green marl whilst in the bottom (633') is grey marl.
636' - 642'	grey marl.
642' - 656'	Green blocky marl with traces of oil on cleavages.
below 656'	Band ofpolyzoal succeeded by green marl again.

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666' Floor of shaft rose 12"-15" and cracked, water came in and rose 10' in 15 minutes.

680' Very hard band

682' Water band. Water is coming in from 15" of very porous coral rock or polyzoal which needed explosives. Below this is polyzoal limestone with increasing proportion of light green marl. Water bubbles freely with gas.

708' Dark grey marl heavily charged with the calcareous remains of polyzoal. Soft.

712' - 740' Dark grey soft marl.

740' - about 750' Polyzoal limestone slowly merging into a pale green marl-polyzoal mixture

about 752' Small water band with a little gas.

752' - 756' Soft greenish clayey marl.
Bottom rises at 1" per hour.

760' a 9" band of strong polyzoal - broken.

776' " " " " - "

792' Muddy marl and broken polyzoal began to rise through the break in the centre of the shaft bottom.

784' - 796' Alternating bands of polyzoal limestone about 8" thick and narrower bands of very soft clayey marl. (Test bore in shaft bottom is 816'. Augered to 26'6").

816' - 820' Alternating bands of soft polyzoal limestone and layers of soft muddy marl. These bands are from 4" to 8" thick.
Gas present in meagre quantities.

852' - 880' Fewer distinct polyzoal layers in the marl

880' - 907' No polyzoal bands and entirely compact dark grey marl fossils present.

900' Rock temperature 82° showing a gradient of 3°F. per 100 ft.

910' Hard bands of polyzoal were met.

954' Signs that the change into the micaceous series is approaching. There are occassional brown layers showing mica. A gradual change.

995' Still definite marl bands in the micaceous

1021' Hard band 6"-10" thick and thins out to nothing as it approaches the east side of shaft.

about 1023' A single large boulder about 14" thick.

1038' Hard boulder

1046' " " (4) It was about 10" thick and composed of very compact tough limestone.

1046' Oily films plentiful

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1060' 5th hard band. The band or bouler 20"-24" thick and nowhere less than 20". Slightly domed in centre.
1076' Hard band consists of boulders and is 10" thick.
1093' Hard band 10" thick.
1101' " " 6" thick
1121' " "
1164' " " 6" ")
1173' " " 4" ") Cores from hole spudded at 1173'3" i.e. shaft
1185' " " " ") bottom.
1200' Glauconite struck)
Concreted shaft to 1156'.
1143' Hard band 6" thick and not continuous across shaft.
1152' A long branch-like piece of hard limestone 6 feet long and up to 8" diameter.
Shaft extended from 1156' by a 5' x 4' winze
1182-3 Sand band. No gas. Band irregular and tough 4" - 9" thick.
1197'6" Ground dry and tight no glauconite visible.
Driving Nth. and Sth. commenced at 1204'
Top of glauconite expected between 1198'-1199'.

North face of drive.
Drive 7' high - 6' wide.

At 5' in : Face of drive homogeneous glauconite, no sign of bedding on banding or any system of cleavages. Oil in showing in the face as isolated uncorrelated spots some 6 or 7 in all, from which oily gas bubbles exude. These very slowly drip down the face making an oil stained area. The oily bubbles come from restricted areas of not more than 1 or 2 square inches. Face appears all sandy glauconite. Rock face temperature 86°F.

At 7' in : Number of oily spots increased to 17. Many of these spots failed to reappear when cleaned off. Face appears, especially its upper part, to be part of the Micaceous well coloured with glauconite. There were 2 persistent drops of water in this face.

At 8' in : Face showed considerably more oil. Heads started to appear.

At 10'in : Heads well developed, the pin points of oil had disappeared and oil was showing only on the cleavages of the heads.

At.12'in : The face showed a very big increase in oil almost sufficient for measurement; here again the oil was on the cleavage of heads only.

At 11' in : A blocky lump of stone, about 30 lb. lying between 2 heads was taken to the surface. In situ this was very oily. The expose area of this lump was alive with gassy oil bubbles and before long the stone was as wet with oil as if it had been dipped in oil. After about an hour the bubbles ceased but the stone was still oily.

PILOT
~~HOLE~~ BORE.

(For Lakes Entrance Oil Shaft)

1st. hole abandoned at about 350'
2nd. hole located 16' back.
Spudded. 24th. March, 1943.
8" casing cemented at 319'
6" " " " 974'
5" " " " 1196'6"

Notes on Lithologaixes taken from H. Cook's Report.

470'	-	480'	More polyzoal in the marl
480'	-	505'	Polyzoal limestone
505'	-	510'	Passed out of polyzoal limestone and into marl
		515'	Very sticky formation
591'	-	592'3"	Hard limey band
592'3"	-	595'	White marl (not polyzoal)
595'	-	598'6"	Green sticky marl
598'6"	-	605'	Whiter with much grit, probably polyzoal limestone
605'	-	635'	Bright green clay or very clayey marl
		690'	Compact sticky marl
		755'	Sticky marl
		778'	" "
		828'	Close grained marl
		880'	Dry marl
		954'	Brown micaceous clay - first appearance
		960'	" " " - quite definite
		1001'	Micaceous clay
		1138'	Micaceous series with plentiful iron pyrites in nodules ranging from minute particles to pieces as big as hen's egg.
1180'	-	1184'	Mud coming into hole.
		1186'	Miss I. Crespin found signs of glauconite sandstone
		1187'6"	Well marked signs of glauconitic sandstone
1192'	-	1193'3"	Micaceous mud
1193'3"	-	1194'3"	Consolidated mud and sand
1194'3"	-	1196'	Much glauconitic sand and some consolidated to definite glauconitic sandstone.
1204'5"	-	1206'5"	Core showed 2 sand layers between fragmented brittle glauconite.

PILOT BORE

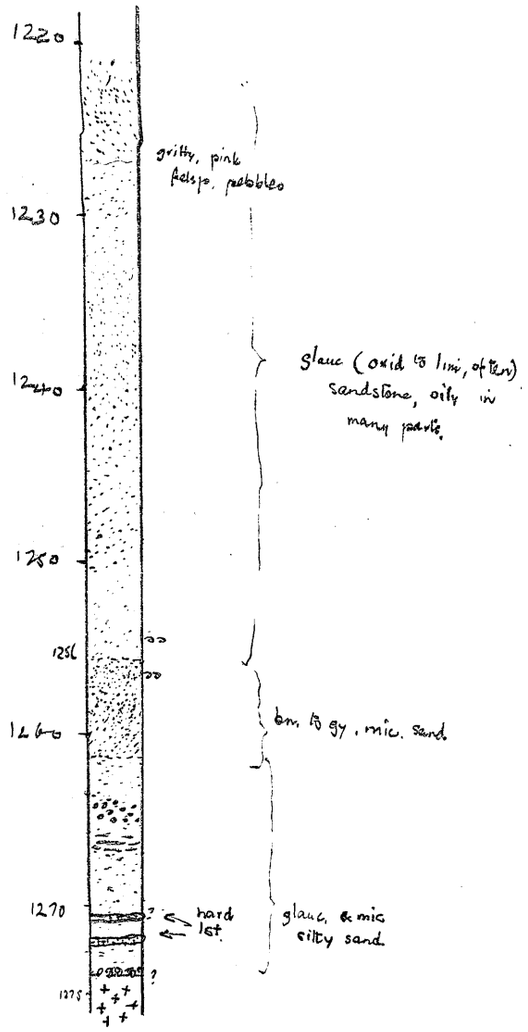
Oil and Gas shows recorded by H. Cook.

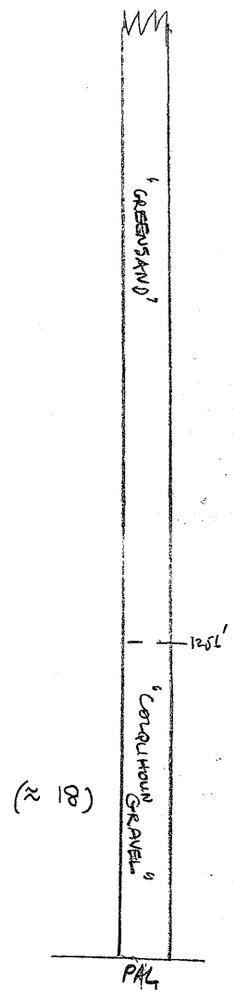
560' - 590'		Small make of H_2S gas which all dissolves in water which makes from 550'-570'.
	682'	Signs of gas, very strong at 688' i.e. when the bailer is brought to the surface the gas bubbles out of the water very freely and burns with a non-luminous flame. (Gas mentioned sporadically in reports on to 909')
	909'	Gas is very plentiful and now bubbles up against the water. This gas sampled by Mr. Hadden during week ending 5th. November, 1943.
	974'	No gas after cementing casing.
	1043'	Definite though not heavy showing of gas
	1138'	Gas evident but not in very marked quantity
1158' - 1166'		Gas more active
	1187'6"	Faint showings of oil
Core 1192' - 1196'6"		Definite signs of oil
1196' - 1219'		Hole cored, bailed and rise tests conducted gave maximum of 49·6 pints per day of dry oil.

Oil as bailed was oil/water mixture
38·5% oil 61·5% water.

LAKES ENTRANCE
OIL SHAFT (Pilot Bore)

Bdy of mic, marl, & glauc. sst at 1200 ft,





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LAKES ENTRANCE OIL SHAFT.
PILOT BORE : GRANITIC CORES.

1320 : granodiorite
– 1313·5 : weathered.
1313·5 – 1311·5 : fragments of granite + dark green grey? shale in a green clayey matrix (not glauconite).
1311·5 – 1305 : As above ; pieces of dk. grey green fine-grained basic rock.
The green chloritic matrix is due to the weathering of this green basic rock.
1305 – 1294·5 : mottled white + green weathering product soft
? Has granitic texture. Contains green (not chloritised) micas.

1290·5 – 1292 : Some parts are v. green
1289·5 – 1290·5 : weathered granite. Quartz developed a resistant gravelly texture

1288·5 – 1289·5 green material.
1288·5 – 1287·5 granite + some piece + dark green basic material (v. hard + f. grd.
1287·5 green material + granite remnants.

1284·5 – 1283 : V. rich in gn. micas, etc. Friable & wet.
1283 – 1278·5 : Soft gn. material.
1278·5 – 1277·5 : Dk. gn. basic material + granite chips.
1276 – 1276·5 : Weathered grnd.
1276 : Rel. fresh granite with pink felspars (?)

1272·5 – 1269·5 Grn. granitic material (? glauconitic) + pyrite oxidised yellow (fr. sulph) brn (lim)
1270·5 – 1272·5 : includes hard ~~dark~~ grey crystalline rock.
1269·5 : Sample.

Lakes Entrance Oil Shaft : Pilot Bore

1223·5 - 1224·5 : dark bn. sandstone, oily. Some rounded quartz grit.

~~Faintly~~ Blue-greenish lens in centre

1224·5 - 1225·5 : (a) Hard bluish green sandstone, sec: ~~quartzitic~~ grit (quartz + polished dark bn. pellets). Brown ground rims of core presumably due to oxid'n. Some mica.

(b) ~~Soft~~ friable med. to coarse bn. gn. sand, oily.

1225·5 - 1226·5: (a) As above, more greenish, rounded quartz grit more common. Harder in parts & includes small rounded pebbles of pink felspar.

(b) Hard blue-gn. sandst. Traces of whitish shell material.

1226·5 - 1227·5: (a) Rel soft gn. bn sand, some rounded coarser grs.

(b) V. soft gnish sand, medium, also some harder lumps. (oily) Clean quartz sand is v. common.

1227 - 1227·5 : As for (b). Abundant clean quartz sand, also lumps ~~incorporating~~ of black oily Sandy clay.

1227·5 - 1228 : Soft brownish green glauconitic sand (stone), oil-free.

[GAP]

1254'6" - 1255'6" : As above, faint mica traces, rare fine shell fragments.

1255·5 - 1256·5 : As above, more micaceous, shelly pieces more common. Core of brownish grey sl. ~~calc~~ calcareous micaceous sand.

1256·5 - 1257·5 : Bn. gn. sl. micaceous sand, appears to contain foraminifera.

1257·5 - 1258·5 : As above, brown (pres due to oxid'n), a rather silty sand. No appr shell material. Rel. common traces of yellowish sulphurous material.

1258·5 - 1259·5 : As above. As well as yellow mat'l are also grains of a greyish material.

1259·5 - 1261·5 : As above. Some cores are greenish.

1261·5 - 1263·5 : Coarse glauc. silty sand, sl. micaceous, oily in parts. Also some of bn. sand.

1263·5 - 1265·5 : Bn. sand, some gs. grit.

1265·5 - 1267·5 : Brown silty sand grades into a black sandy clay. (oily odour).

1267·5 - 1269·5 : Partly bn + partly gn. (glauc.) mic. silty sand.

1269·5 - 1271·5: Loose materials includes silty sand, brn & grn; also core of hard limestone, some minute casts + moulds of molluscs. V. fine granular glauc. grits rock grish tinges in parts.

1271·5 - 1272·5: Cores of limestone, as above; loose material of glauc silty sand.

1273·5 - 1275·5: Dark green granitic material with pink felspars. Loose material is predominantly of chips of quartz + felspar.

Extract from forthcoming report -

DRILL CORES FROM THE SHAFT BORE, LAKES ENTRANCE.

Report No. 1945/72.

CONCLUSIONS.

The report has dealt with the examination of diamond drill cores from the bottom of the Shaft at Lakes Entrance, and includes the results of petrological examination, examination under ultra-violet light and determination of oil, water and gas saturation. The drill hole penetrated 19 feet 2 inches in glauconitic sandstone with a core recovery of 82 per cent, consisting mainly of unbroken lengths of core. It is believed that the 18 per cent not recovered probably did not include any significant proportion of oil-bearing glauconitic sandstone.

The oil fluoresced under ultra-violet light and this method was used to determine in detail the distribution of oil in the cores. The examination allowed the division of the glauconitic sandstone section into five oil-bearing zones of which the bottom two zones, i.e. zones 4 and 5 were insignificant and were excluded from the calculations of total oil content. The upper three zones (zones 1, 2 and 3) were the main oil-bearing ones and occurred in the top 12 feet of glauconitic sandstone. Evidence has been gathered on the distribution of oil in several additional bores in an area surrounding the shaft and indicated that the occurrence of oil in the top 12 feet of glauconitic sandstone was a feature common to all of them. It was found that there was a close parallel between the oil zones as indicated by bailing tests in the Pilot Bore with those in the Shaft Bore 100 ft. distant from it.

The evidence showed that oil from other bores referred to above also occurs fairly generally in the lower portion of the glauconitic sandstone, but neither the Pilot nor the Shaft Bore intersected this portion which has therefore been excluded from any conclusions regarding the oil content of the reservoir.

Two kinds of oil distribution were noted; one in which oil occurred almost entirely throughout the cores and the other in which the oil occurred as irregular patches throughout the cores. The cores in which the patches exceeded 50 per cent of the volume of the cores were included in the oil zones.

The aggregate thickness of oil-bearing zones included in the calculation of total oil content per acre was 3¼ inches, comprising 1¼, 12 and 8 inches in zones 1, 2 and 3 respectively.

Petrological work indicated that oil-bearing glauconitic sandstone contains less glauconitic mud matrix than barren or 'normal' sandstone. Because of this it is believed that the permeability of oil-bearing glauconitic sandstone is considerably higher than that of normal glauconitic sandstone and this belief is supported by a critical examination of the results of permeability tests on samples from No. 10 Bore. It appears that the sandstone as a whole is not an oil reservoir, but contains a series of thin stratigraphical traps. The horizontal extent of any one trap has not been determined, but it is thought that they occur as a series of lenses. They occur at fairly definite horizons and form the oil zones already described.

Saturation and porosity tests were made on all sections of the core which the ultra-violet light examination had shown to contain appreciable quantities of oil, and on eleven samples of barren sandstone. The porosities ranged from 27.4 to 49.6 per cent, oil saturations from 0 to 12.2 per cent, water saturations from 63.5 to 99 per cent and gas saturations from 1 to 26.6 per

cent. The porosities were determined on dry samples, and it is believed that they are greater than the actual porosities of the reservoir rocks in situ. Planar water would have been driven off from the dry samples but would be present in the reservoir rocks and consequently the volume of interstices available to oil and true interstitial water has been reduced by the swelling of the clay and clay-like minerals in the glauconitic mud. This swelling is due to planar water in these minerals.

Tests were made at the Pilot and Imray Bores to determine the quantity of gas yielded by each and the results indicated gas/oil ratios of 4 and 70 respectively; these ratios, however, must be regarded as approximate and subject to large error. It is believed that the gas produced was substantially methane and that therefore the gas in the cores was methane and was originally in solution in the oil.

Tests were made to determine whether any of the drilling water had entered the cores. An indicator chemical, namely glucose, was added to the drilling water and six core samples were analysed for glucose. No glucose was found in the cores and it has been concluded that none of the drilling fluid entered them.

A test was made on a sample of glauconitic sandstone to determine the water lost at various temperatures between 14 C.° and 110°C.°, and it was concluded from the results that none of the water collected during the saturation tests was water of crystallisation. The water collected included true interstitial water and planar water. There appears to be no means of determining by direct measurment the quantity of the latter in a sample.

Tests were made to determine the quantity of water lost by evaporation during the time the samples were exposed prior to their saturations being determined and in determining the final figures for oil, gas and water saturations, allowance was made for the space in the samples occupied by air which has replaced evaporated water.

It has been assumed that the space in the cores occupied by gas other than the air mentioned above was formerly occupied by oil which it has replaced.

The total oil saturation in situ was calculated by assuming that the total oil saturation was the sum of the oil saturation found experimentally and the corrected gas saturation. Weighted averages of total and residual or measured oil saturations were calculated for each of the three oil zones by weighting the individual samples in accordance with their lengths. These averages for zones 1, 2 and 3 were 15.7, 14.6 and 16.4 per cent respectively for the total oil saturations and 5.2, 7.1 and 6.75 per cent respectively for residual oil saturation. It has been concluded that these figures for total and residual oil saturations are not inconsistent with the experimental results of Leverett and Lewis on the flow of gas-oil-water mixtures through permeable media if due allowance is made for the low permeability of the glauconitic sandstone and the effect of planar water on the porosities and saturations. On the basis of the above figures the oil contents per acre for the three zones combined are estimated at -

(1)	Total oil content	1400 barrels per acre.
(2)	Oil content from residual saturations	560 " " "

(A barrel contains 35 imperial gallons)

It is concluded that through lack of appropriate data there is no reliable way in which the area of reservoir rocks likely to be drained by any well or series of wells in a field such as Lakes Entrance can be estimated nor is there any satisfactory basis for estimating the quantity of oil which might be recovered from such

an area. However, it is possible to estimate the total oil present in a given area around the shaft, and to make an approximate estimation, based on the factors influencing recovery, of the proportion of this oil which might be recovered by horizontal drilling. Factors influencing ultimate recovery are -

(1) Those dependent on reservoir conditions -

(a) The oil occurs in three thin zones separated by layers of impermeable sandstone.

(b) Of the 34 inches included in the three zones, only 10 inches were composed entirely of oil-bearing sandstone and it is believed that most of the oil produced in the Pilot Bore came from zones of sandstone entirely oil-bearing, the permeability of sandstone corresponding to the remaining 24 inches being too low to allow any appreciable flow into the hole.

(c) There may be no great horizontal continuity in any individual oil zone.

(d) High viscosity of the oil and low permeability of the oil zone.

(e) The motive force causing the oil to flow. It is generally conceded that if the oil is flowing under gas drive the ultimate recovery under the most favourable conditions is 25 to 30 per cent, and that with carefully controlled water drive, which includes artesian and expansive water drive, the most favourable recovery may be 60 to 70 per cent.

(f) A rapid decline in the rate of production such as that determined for the Pilot Bore (40 to 27 pints per day in 340 days) usually indicates low ultimate recovery.

(2) Those dependent on recovery from horizontal drill holes -

(a) Any single hole could tap only one of the three zones because of the impermeable sandstones between them.

(b) It will be very difficult, if not impossible, to keep a horizontal drill hole within any one of the thin oil-bearing zones.

(c) The number and distribution of the horizontal drill holes.

(d) The unknown influence of fracturing the sandstone by exploding charges in the bore holes.

Taking all these factors into consideration it has been estimated that if water drive is the motive force, the recovery would not exceed 15 to 20 per cent and if gas-expansion drive is the motive force the recovery would be considerably less than this and probably not greater than 5 to 10 per cent.

Finally it is concluded that the volume of oil present in the three oil zones in a circular area 2,000 feet diameter would be approximately 100,000 barrels of which a maximum of 20,000 barrels might be recovered. These figures refer to the top 19 feet of the glauconitic sandstone.

It is known from other bores that oil occurs in the lower portion of the glauconitic sandstone. This portion was not, however, intersected in the Pilot and Shaft bores and therefore no attempt has been made to estimate the oil content. Even if the total oil content could be estimated, it would be inadvisable to attempt to estimate the possible recovery because of the engineering difficulties associated with the sinking of the shaft to a sufficient depth to recover such oil by horizontal holes. The possibility of recovering any of this oil from horizontal holes in the upper portion of the sandstone would depend upon the fracturings by explosive charges and, as already stated above, the possible effect of such charges is not known.

(R. F. Thyer)
Geophysicist.

(L. C. Noakes)
Geologist

CANBERRA.
16th October, 1945.

PALYNOLOGY

AND

PALAEONTOLOGY

COPY W434 B.M.R. Report No.1947/69

A SUMMARY OF THE STRATIGRAPHY AND PALAEONTOLOGY OF THE LAKES ENTRANCE OIL SHAFT, GIPPSLAND, VICTORIA

by I. Crespin

The Lakes Entrance Oil Shaft is situated in allotment 1 Parish of Colquhoun, about 2 miles north-east of Lakes Entrance township, and at an elevation of 90 feet above sea level. The Shaft was sunk with the object of developing, by means of low pressure mining methods, the oil-bearing beds known to exist in the lower portion of the Tertiary basin in the Lakes Entrance area. It is a circular construction with a diameter of 10 feet at the surface. It is concreted down to the depth of 1,156 ft; a smaller timbered shaft carried it down to 1,204 ft, and a winze, 3 ft by 4 ft, was used down to 1,212 ft when operations were suspended as it was considered that this depth was the margin of safety allowed above the underlying artesian waters.

It is estimated that, during mining operations, approximately 12,000 tons of Tertiary sediments were excavated. Consequently a unique opportunity was afforded the palaeontologist and geologist to study the stratigraphic sequence of Tertiary beds in the Lakes Entrance area. The author was fortunate enough to pay frequent visits to the scene of operations where she made extensive collections of fossiliferous material. From time to time she observed the various stratigraphic stages and substages of the Tertiary sequence in situ on the walls of the Shaft. The brown, Micaceous marls and fine sandstones and the glauconitic sandstone of the Janjukian Stage have not yet been found exposed elsewhere in the Gippsland area.

SCOPE OF INVESTIGATION

The methods used in collecting the samples for micro-palaeontological examination and for studying the lithologic sequence were:

1. A sample of sediment averaging 4 lb. in weight was taken by the miners at every 4 ft from below the depth of 200 ft. Unfortunately, systematic sampling was not undertaken from the surface down to the depth of 200 ft. These samples were bagged and labelled to await the arrival of the author who divided each sample, one portion being brought to Canberra, the other being retained at the Shaft. Approximately 300 samples have been subjected to micro-palaeontological examination.

2. Samples taken over a wider interval and representing each change in lithology were laid out on the ground in proper sequence, thus giving an excellent view of the character of the sediments through which the Shaft passed.

3. The bulk of the 12,000 tons of sediments excavated was dumped from platforms 30 ft high and 80 ft long, which stretched across the valley west of the Shaft. Many excellently preserved megafossils were collected from these dumps. Because of the frequent visits of the author, it was possible to know the limiting depths to within a few feet of the material exposed at the time. Also the miners and other members of the staff were on constant watch for fossils in situ, and were instrumental in obtaining many beautiful specimens (Crespin 1945, 1946). Samples of sediments and fossils were also collected from the kibbles as they came up from underground. Exact depths could be assigned to these.

STRATIGRAPHIC NOTES

An important result of the palaeontological investigation of the sediments from the Shaft is that it confirms the stratigraphic sequence of the marine Tertiary deposits in Gippsland

as recently put forward (Crespin, 1943). There is little variation in the thicknesses of the Stages and Substages in the Shaft compared with those based on small cores from bores in the vicinity. The characteristic lithology of the sediments of each Stage is also confirmed.

Furthermore, the investigation of such large quantities of material revealed the extended stratigraphic range of fossils, both micro and mega-forms, previously regarded as restricted. Such a result is inevitable when it is considered that the range of certain species in the Victorian Tertiaries has been based on material collected from surface sections which are limited in vertical extent and from small bore cores.

A short account of the Stages and Substages with their characteristic lithology and fossils as developed in the Shaft is given below:

The stratigraphic sequence of the beds is as follows:

Recent to Pleistocene	Post Kalimnan	0 - 10 ft
Lower Pliocene	Kalimnan Stage	10 - 150 ft
Upper Miocene	Mitchellian Stage	150 - 208 ft
Middle Miocene	Balcombian Stage	208 - 952 ft
	i. Fairnsdale Substage	208 - 524 ft
	ii. Batesford Substage	524 - 728 ft
	iii. Longford Substage	728 - 952 ft
	Janjukian Stage	952 - 1,212 ft.
	i. Micaceous Marls and sandstones	952 - 1,197 ft.
	ii. Glauconitic sandstone	1,197 - 1,212 ft. (base of Shaft)

Recent to Pleistocene (Post Kalimnan)

Ten feet of sands referable to the above age cover the marine Tertiaries at the Shaft. The rostrum of a beaked whale (Mesoplodon longirostris) was discovered at the base of this bed, but Glaessner (1945) suggested that it had been weathered out of the upper Kalimnan (Lower Pleistocene) which directly underlies these sands.

Lower Pliocene (Kalimnan Stage)

Unfortunately, no systematic collection of samples was made from the beds referable to the Kalimnan Stage, but the official log book showed that rich fossiliferous sediments occurred from 10 feet down to 150 feet. Material collected from the dump shortly after this depth had been passed, tended to confirm this.

The fossiliferous sandstone of the upper bed at Jenny's Point was not recorded in the Shaft, which passed directly from the Post-Kalimnan sands into the lower fossiliferous horizon of that locality. The first fossilliferous beds exposed were ochreous sandstone which extended down to 50 feet. These overlay greenish grey sandy marls in which glauconite was common and mega-fossils fairly abundant. Many large mollusc shells were collected including Eucrassatella kingicnoides, Venericardia gippslandica, Panopea Kalimnae, Chlamys

antiaustralis, Turritella conspicabilis, Fulgoraria fulvetroides and Bathytoma pritchardi. The microfaunal assemblage was typical of the Kalimnan elsewhere.

Upper Miocene (Mitchellian Stage)

At 150 ft the Shaft passed into the Mitchellian Stage which persisted down to 208 ft. The upper portion of the Stage consisted of greenish grey marl with Balcombian species becoming common and with decomposed remains of molluscan shells chiefly referable to Kalimnan species. With progress downward the glauconite content gradually disappeared and Kalimnan molluscan species gave way to forms more characteristic of the upper part of the Miocene, such as Pteria (Malleagrina) crassicardia and Lima (Limatula) jeffreysiana. The foraminifera exhibited a similar [illegible] Plio-Miocene assemblage.

Middle Miocene

Balcombian Stage

The Shaft afforded an excellent opportunity to study the Balcombian Stage as developed in Gippsland. It passed through 744 ft of sediments, from 208 ft down to 952 ft. The sediments consisted of bryozoal li[illegible]stones, marly limestones and bryozoal marls, characteristic of the Gippsland Limestone ("Polyzoal Series"). The stratigraphic sequence of substages of the Balcombian described in Section 5 of the Bulletin (Crespin, 1943) has been substantiated by further evidence derived from the study of large quantities of sediments from the Shaft. The characteristic foraminiferal assemblage for the Balcombian was persistent throughout the 744 ft of sediments. New species have been found in the three substages which may prove of zonal value when the investigation of samples is finalised.

i. Bairnsdale Substage. This typical substage of the Gippsland Tertiaries was well developed. It extended from 208 ft down to 524 ft, and consisted of bryozoal limestones, frequently hard, and bryozoal marly limestones. The rich shelly horizon found at the top of the Substage at the type locality at Pound Swamp, Bairnsdale, at Toorloo Arm, Princes Highway and elsewhere east of Lakes Entrance, was encountered at 320 ft. Fossils such as Clypeaster gippslandicus, Stethothyris insolita, Austrotina bassi, Spondylus baileyanus, Linnites corioensis and Serripecten yabliensis were common. Specimens of the last named species together with the varietal form semilaevis were frequently present throughout the Substage. A band of large valves of Ostrea were exposed at 372 ft. Typical Balcombian species of foraminifera were recorded. Operculina victoriensis, as usual, made its first appearance, in downward sequence, towards the base of the Substage, at 472 ft. However, except for two occurrences, at 264 and 272 ft respectively, Amphistegina was not found elsewhere in the Bairnsdale Substage.

ii. Batesford Substage. The Shaft passed through the Batesford Substage from 524 ft down to 728 ft. The passage from the Bairnsdale into the Batesford could only be determined by the foraminiferal content. The lithology of the sediments in the Substage was white to grey, bryozoal limestone and marly limestone interbedded with bryozoal marls often green in colour and roughly bedded. The first typical Batesford Substage foraminifera to appear was Hofkerina semiornata at 524 ft. The first record of Lepidocyclina was at 580 ft and the last one at 684 ft. Cycloclypeus was not as abundant as anticipated, the only records being at 660 and 670 ft. Other species characteristic of the Batesford assemblage were usually present.

Bryozoa was abundant, but not well preserved in the marls. Amongst the larger fossils were Stethothyris insolita (common at 660 feet), Briscopsis arcuori (at 660 feet) and Nautilus cf. geelongensis (660 feet).

iii. Longford Substage. The Shaft penetrated the Longford Substage at 728 feet and continued in it down to 952 feet. The sediments were represented by bryozoal marls chiefly grey in colour. But at 852 to 860 feet a greenish, glauconitic, shelly, bryozoal limestone was exposed. It contained numerous specimens of echinoids (chiefly broken), Stethothyris, Limatula, and Serripecten. This glauconitic bed passed down into grey bryozoal marls in which the bryozoa completely dominated the fauna. Towards the base of the Substage fragile molluscan shells began to appear. Batesford foraminifera such as Hofkerina semiornata, Gypsina howchini and Planorbulinella plana, were present in the upper portion of the Substage, but gradually disappeared as the lower limit was approached.

Janjukian Stage

Sediments referable to this Stage occurred from 952 feet down to the base of the Shaft at 1,212 feet. The two characteristic lithological units were represented:

i. Micaceous marls and fine grained calcareous sandstones.
ii. Glauconitic sandstone.

i. The micaceous marls and fine grained calcareous sandstones extended from 952 feet down to 1,197 feet. The top portion of this lithological unit was represented by brown micaceous marls which passed downwards into brown, fine grained calcareous sandstone. Towards the base of this unit glauconite became increasingly common and foraminifera and mollusca scarcer. The zonal foraminifera, Cyclicaudia incisa, Lamarckina glencoensis and Vaginulina gippslandica were recorded and were associated with numerous smaller forms, including species which are of zonal importance in the overlaying Balcombian. Small molluscan shells were common but the larger forms were distributed more sparingly, and were usually found in thin bands. The shells were fragile and consequently were difficult to collect intact. Amongst the commoner forms were Volutispina anticingulata, Turritella aldingae (very common), Limopsis chapmani (very common) and Venericardia janjukiensis. A well preserved specimen of Carcharodon megalodon was collected at 1,018 feet and remains of a crab, recently described as Harpactocarcinus victoriensis, at 1,000 feet, (Grospin, 1946).

A prominent feature of this lithologic unit was the occurrence of hard bands of brown, calcareous sandstone. Similar bands had been encountered in all bores in Section 1, that had penetrated the Janjukian, but little was known of their mode of occurrence. The diameter of the Shaft was such that it permitted the study of the bands in situ. They proved to be "floaters" ranging up to 6 feet in length and varying in thickness from 2 inches up to 12 inches. Fourteen of these lenticular shaped floaters were encountered in the Shaft between the depths of 1,020 feet and 1,182 feet. The rock was richly fossiliferous, but the hard nature of the rock made extraction of the fossils difficult.

ii. The Shaft passed into the glauconitic sandstone at 1,197 feet. The thickness of this lithological unit was not proved as sinking operations were discontinued at 1,212 feet. The topmost samples consisted of fine angular, quartz grains with numerous ovoid pellets of brown and green glauconite. A few foraminifera such as Anomalina grosseru-

gosa, Eponides scabriculus and Elphidium crassatum were noted. The typical glauconitic sandstone was reached at 1,198 feet. This rock was very fossiliferous. Many large specimens of mollusca were present, Venericardia janjukiensis a small species of Ostrea and Turritella aldingae being particularly abundant. Cyclammina was recorded amongst the foraminifera.

The glauconitic sandstone was oil-bearing, but the quantity of oil available was not large enough to warrant the continuance of mining operations.

REFERENCES

Crespin, I., 1943 - The Stratigraphy of the Tertiary Marine Rocks in Gippsland, Victoria. Bur. Min. Res. Bull. No.9. Pal. Ser. No.4. (Mimeographed).

Crespin, I., 1946 - A Fossil Crab from the Lakes Entrance Oil Shaft, Gippsland, Victoria. Proc. Roy. Soc. Vic. 59.

Crespin, I., 1947 - Some Tertiary Pelecypoda from the Lakes Entrance Oil Shaft, Gippsland, Victoria. Proc. Roy. Soc. Vic. 60.

Glaessner, M.F., 1945 - A Fossil Beaked Whale from Lakes Entrance, Victoria. Proc. Roy. Soc. Vic. 58, (1-2) n.s. P.25.

CANBERRA
17th October, 1947.

I. Crespin
Commonwealth Palaeontologist.

1985/86

ASSESSMENT

Bruce Thompson

LAKES ENTRANCE OIL SHAFT

VISIT REPORT 21 MARCH 1986

PURPOSE:

The purpose of visiting the Lakes Entrance Oil Shaft was to determine -

(i) whether the shaft has historical significance which would warrant its preservation; or

(ii) if there were any physical impediments or environmental concerns with the filling of the shaft above the cap.

SHAFT DESCRIPTION:

The shaft is located on private property in the yard of an apparently disused garage/panel beating workshop.

The shaft is around 3m across and is surrounded by solid concrete foundations. It is capped at 3m below ground surface. Above the cap lies 1.2 metres of (rain) water. A 6" pipe, going through the cap, was found to be dry to a depth of 10m below ground surface.

In the shaft above the cap is a variety of steel junk.

HISTORICAL SIGNIFICANCE:

In its current state the shaft has minimal historical value and does not warrant preservation. It is most doubtful that costly restoration could be justified.

INFILLING:

The shaft is largely open at the surface and does present some hazard. Provided that the cap is solid, infilling should not be unduly difficult as :

(a) the shaft has solid concrete foundations;

(b) there is a good access, via a track to the yard;

(c) there are no impediments such as trees;

(d) the surrounding area is flat;

(e) there are no obvious environmental implications.

24/3/86

RECOMMENDATION:

The shaft should be infilled, after testing of the cap.

Phil Roberts
MINING POLICY UNIT

25/3/86

Department of Minerals and Energy

DRILLING REQUISITION

OIL & GAS. RECLAMATION. S302 COMP. 2107 ITEM No.

RECEIVED - 6 MAR 1986 DRILL ADMIN SECT 196 TUR... PT. MELB.

Project: LAKES ENTRANCE OIL SHAFT	Project No
Project Officer: B R THOMPSON	Section: OIL & GAS DIVISION
Telephone No: Ext 6539275	

Reason for ~~drilling~~ infill shaft.

To investigate the possibility of infilling the top sump of the shaft with earth spoil. Provided that the concrete capping of the shaft is sufficiently strong this could be accomplished using the Department's equipment. It should be filled under the supervision of the Mining Division inspectors.

~~Drilling~~ on behalf of: Oil & Gas Division	Funded by

No. of holes	Av. depth	Total metreage	Rig type

Location (parish, allotment etc, plan attached): Colquhoun	Land Tenure: Private - Roy Kent (Owner) Permission to drill Obtained from Required from

Geological Summary (include details of formation tops, mineral intersections, sampling requirements etc)

The shaft is concrete lined and 7 ft diameter to a depth of 1198 ft deep. It is capped by a concrete layer at about 12 ft from the surface. There are a number of holes (7) in this capping into the water filled shaft, these may need capping. The strength and security of the capping cannot be guaranteed.

Completion requirements

Signed B.R. Thompson ..... 28/2/1986 Project Officer

Recommendation

Section Head B.R. Thompson ..... 28/4/1986 A/ Director R.J. Hudson 28/4/1986

Drilling report

Drilling Engineer ..... / /19

Approved on following terms and conditions

Secretary 3/3/1986

Drilling Branch to Record

Plant No ..... Costing Card ..... Advise Applicant .....

cc. B. Drew.

MR. MORGANS.

Accompanied by MR W. HALL MINES inspector TARRAGON, I visited the LAKES ENTRANCE OIL SHAFT on 20-9-85.

PHOTO 1

Shows SITE GENERALLY.

NOTE Photos 2-5 used by R. Bleist as 1-4 in her fieldreport 9/12/85.

PHOTO 2

shows top of SHAFT

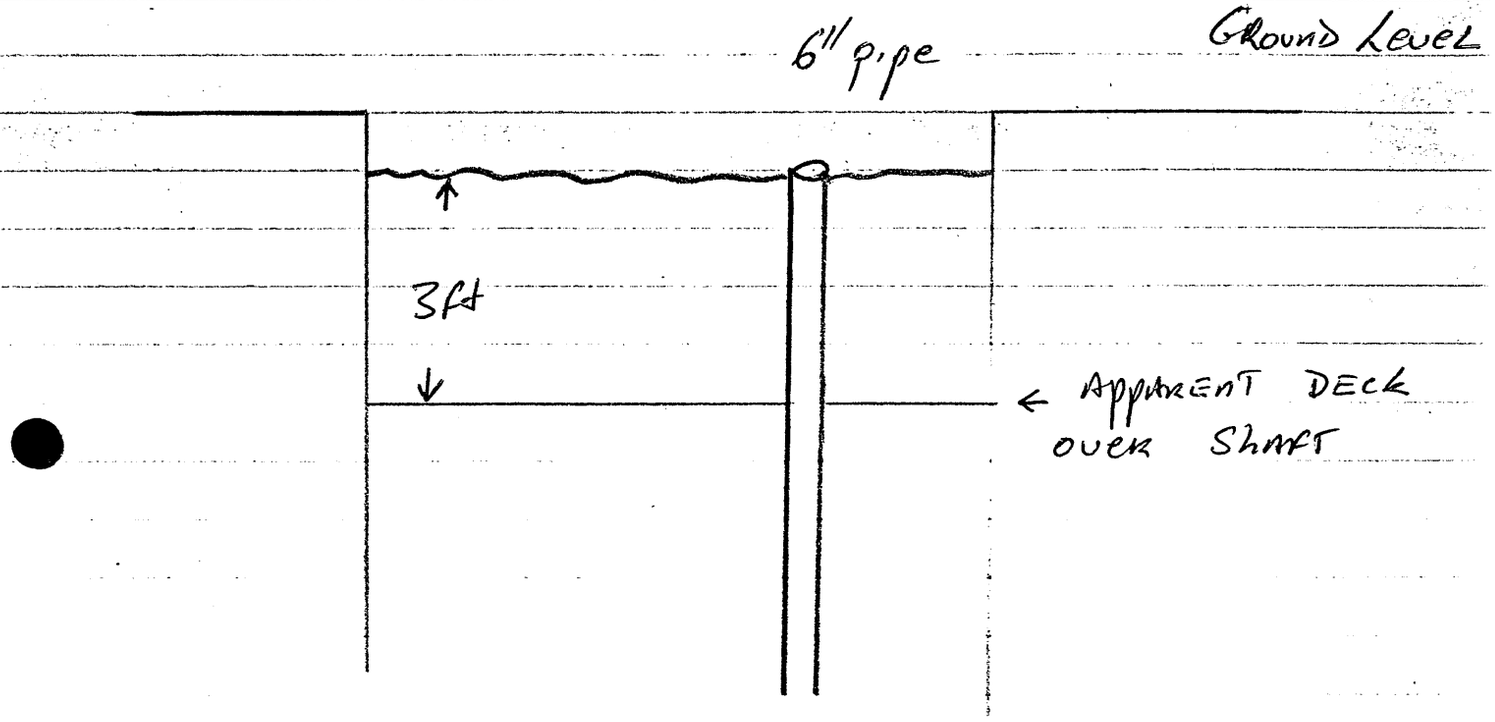
PHOTO 3 shows water in shaft (3ft) and 6" Pipe (vent)

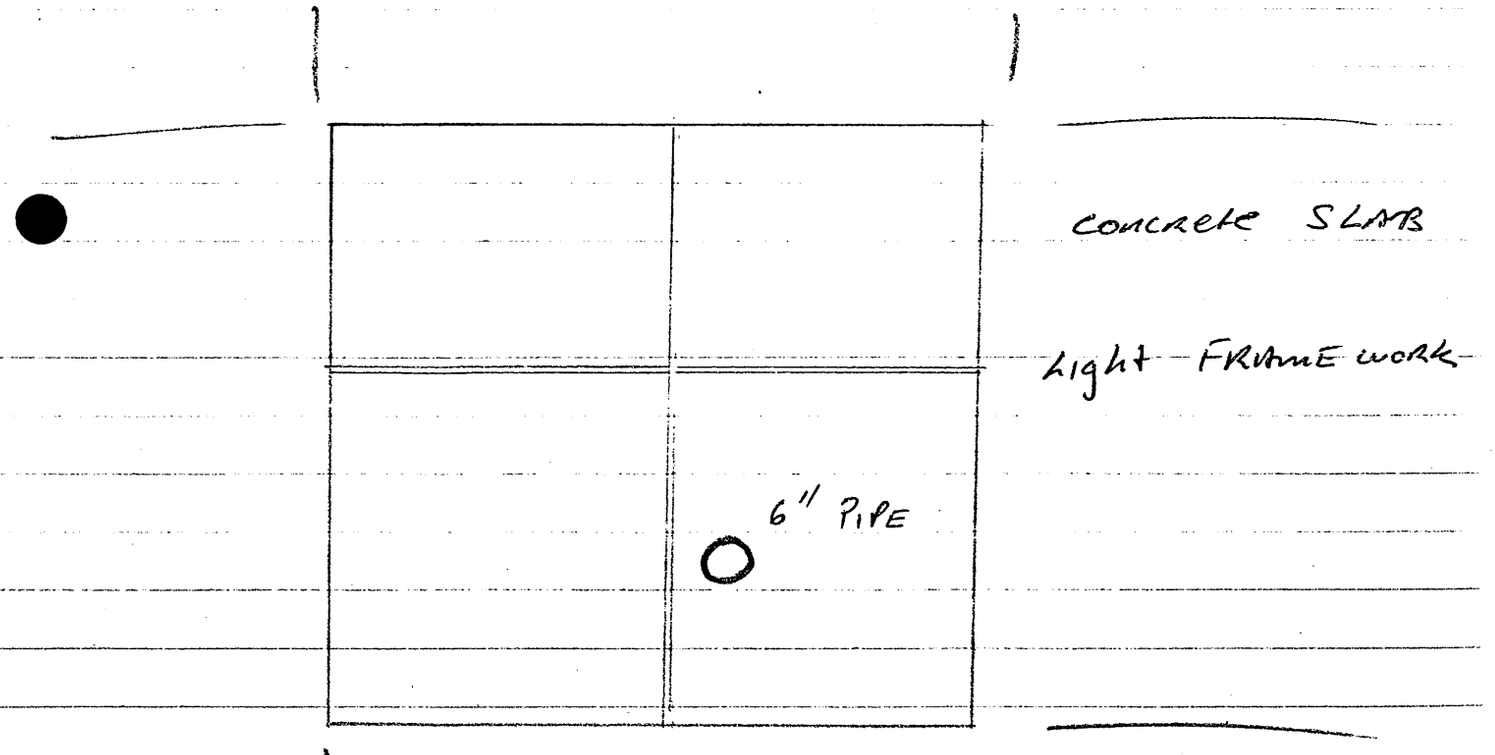
PHOTO 4+5 show tripod and 6" casing on hillside approx 600m from shaft.

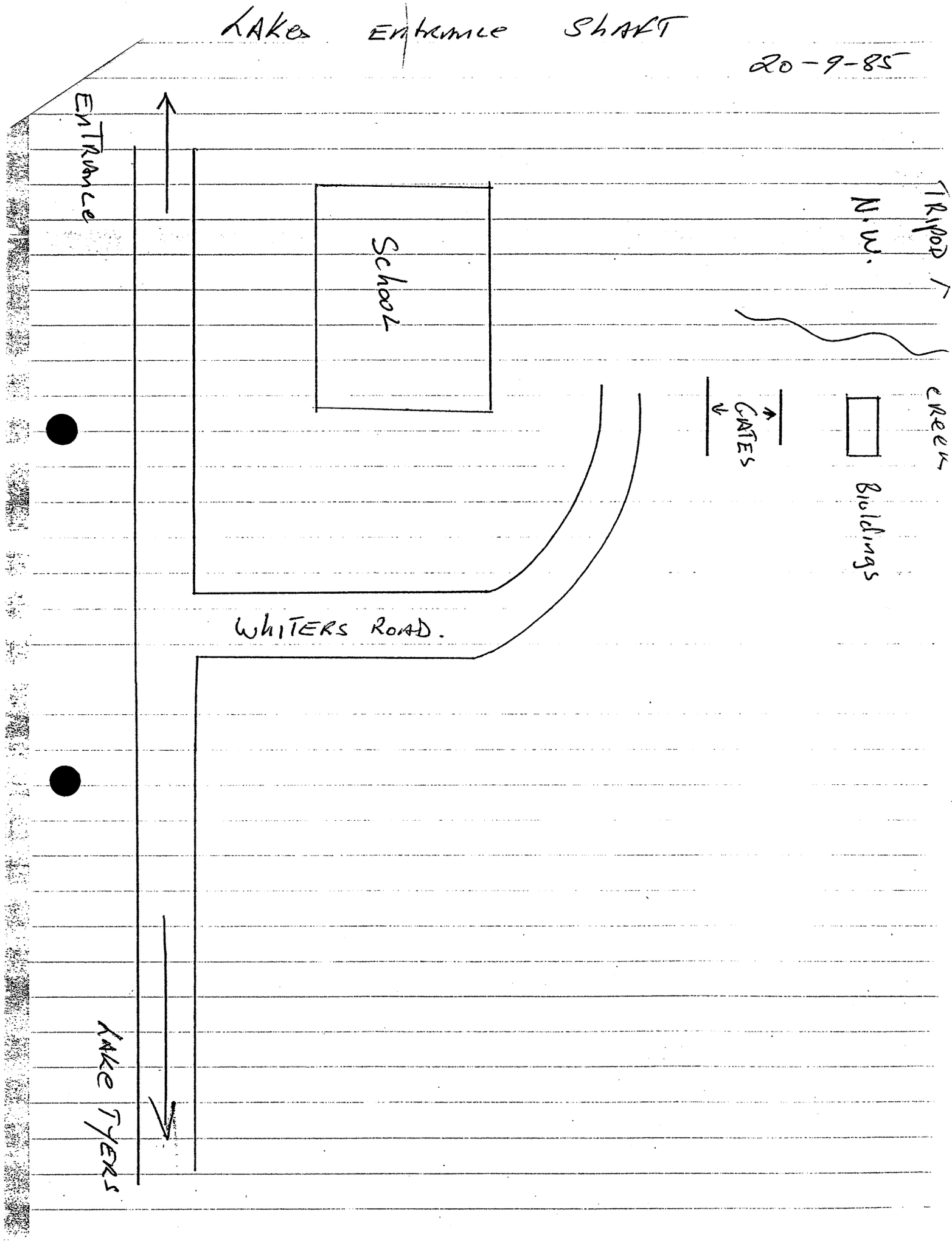
It would appear that a DECKING has been placed over the shaft approx 7' from surface the water is 3ft deep.
Soundings showed that the pipe appears DRY, and the water is probably RAIN water SEE sample, there was OIL on the water but I believe it to be "sump oil" as the area appears to have been used as an automotive WRECKING yard.

NOTE there are 2 bolts missing from the flange photo 5 which leads me to believe, there is NO pressure in the 6" casing.
MR W. HALL is to send you a REPORT

D. RADFORD.

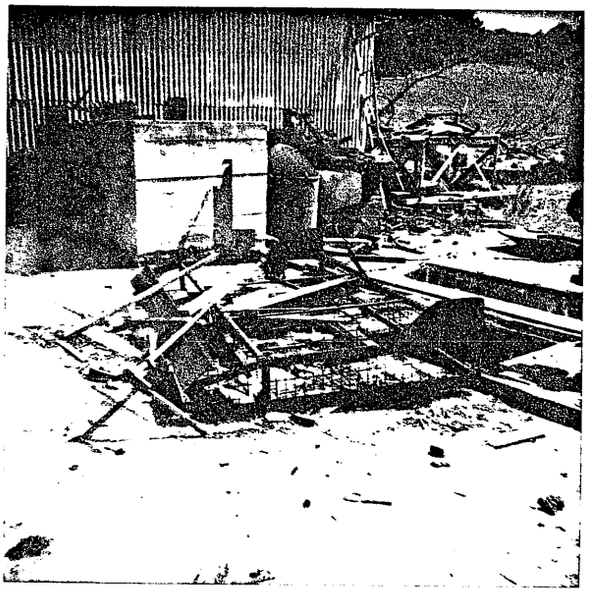

6" pipe
Ground Level
3ft
← Apparent Deck over Shaft


concrete slab
light framework
6" Pipe


LAKE ENTRANCE SHAFT
20-9-85
ENTRANCE
School
TRIPOD
N. W.
CREEK
GATES
Buildings
WHITERS ROAD.
LAKE TYERS

1

2



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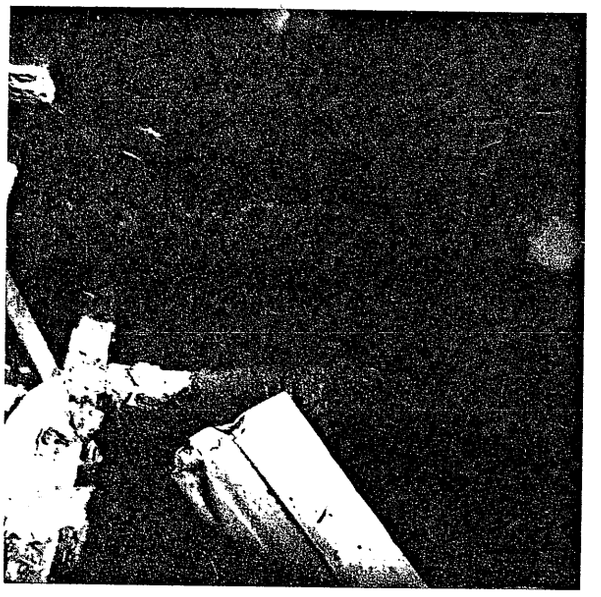

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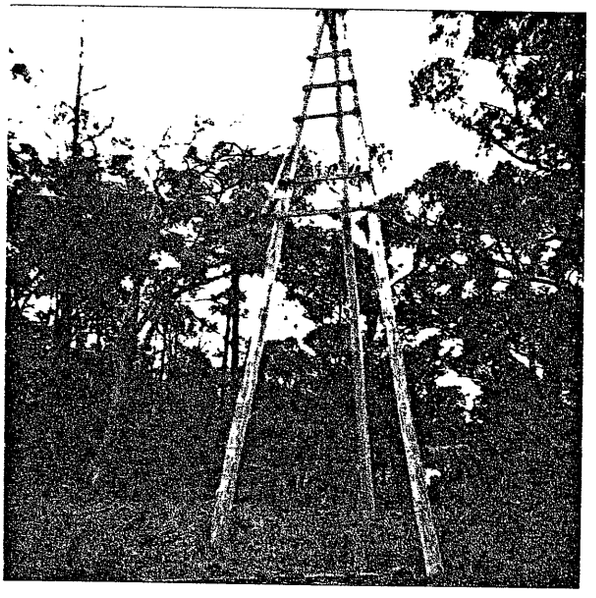


3

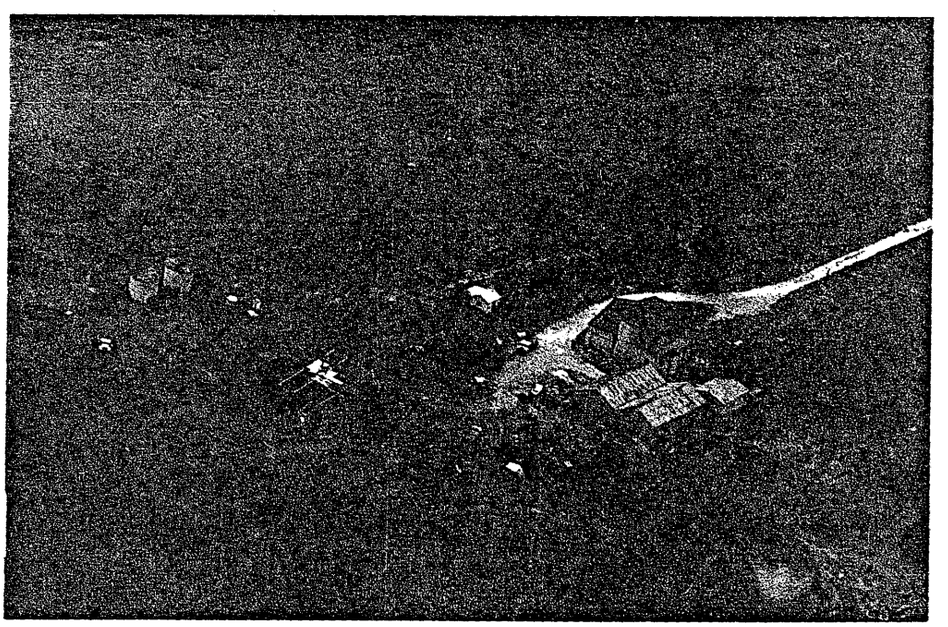
4

ATTACHMENT No 4

5

6

ATTACHMENT No 5



ATTACHMENT NO.

PRE - DEVELOPMENT REPORTS

(C O P Y)

COMMONWEALTH OF AUSTRALIA.

Prime Minister,
Canberra.
20th June, 1941.

D. 376/1/4

Dear Sir,

I desire to refer to your letter of 24th May, 1941, regarding the Commonwealth Government's proposal to obtain an independent report on the possibilities of securing commercial production of oil from the Lakes Entrance area.

At the request of the Commonwealth Government, the Australian Minister in Washington discussed with the Director of the United States Bureau of Mines the possibility of securing the services of an expert to undertake the investigation. As a result, Mr. Leo Ranney, President and Chief Engineer of the Ranney Oil Mining Company, was selected to undertake the investigation. Mr. Ranney has had wide experience in the methods adopted in low pressure fields and is reported as being one of the very few who have had experience in horizontal drilling.

Mr. Ranney, who has intimated his willingness to undertake the investigation, advised that he desired that Mr. Charles Fairbank a Canadian petroleum engineer come with him. Mr. Ranney believes that a joint opinion is essential. Mr. Fairbank is a member of the Ontario Parliament.

Mr. Ranney has asked for an inclusive fee of 100 dollars per day to cover remuneration of himself and Mr. Fairbank, in addition to travelling expenses, fares and living expenses. Travelling by air both ways, Mr. Ranney expects to be absent from the United States for only thirty days. If necessary, he states, Mr. Fairbank could extend his stay in which case remuneration at the rate of 500 dollars per month, plus living expenses, would be payable.

The Commonwealth Government is meeting the full cost of the fees and expenses incurred in the visit to Lakes Entrance of Messrs. Ranney and Fairbank. Arrangements are being made for them to leave Los Angeles on 28th June.

Your Government's willingness to co-operate in the investigation is very much appreciated.

Yours faithfully,

(SGD.:) T. J. COLLINS,

for Prime Minister.

The Honorable
the Acting Premier of Victoria,
MELBOURNE.

MAIN POINTS OF THE REPORT ON LAKES ENTRANCE OIL FIELD BY MESSRS. LEO RANNEY AND C. O. FAIRBANK.

(1) Characteristics of the Oil.

The oil is of asphaltic base and contains gas oil (light fuel oil) 15%, lubricating oil 72% and bitumen 13%. It does not contain motor spirit or kerosene.

The lubricating oil must be refined to make it completely satisfactory for continuous use.

(2) Development

The field is considered susceptible of profitable development under normal circumstances, while under existing emergency conditions it is recommended that the field be developed immediately. The suggested method is:-

> The installation referred to comprises a circular, vertical shaft of 8 feet inside diameter, lined with a concrete wall 1 foot thick extending down to the oil-bearing horizon and ending in a circular chamber approximately 25 feet in diameter, from which horizontal wells are drilled to great length in the oil-bearing formation. This method is more fully described and illustrated in the attached publication issued by the Illinois-Indiana Petroleum Association.
>
> The location selected for the shaft is between the Imray (No. 26) and Foster (No. 31) wells at a site disclosed to Dr. Raggatt.

The estimated cost of this development is £100,000. This figure includes drilling to a depth of 20,000ft. The total drilling necessary will be 50,000 ft. but it is anticipated that the oil produced from 20,000 ft. of hole will pay for the rest of the development.

(3) Probable Recovery

The proposed installation will tap an area of 400 acres from which it is estimated a total of 1,160,000 barrels of oil (40,600,000 gls.) The investigators consider that the money received from 100,000 barrels will return the initial investment and the receipts from 115,000 barrels would cover the entire cost of fully developing the 400 acres.

(4) Suggested Policy of Development.

(a) The management of the development to be vested in one person.

(b) The vertical shaft to be sunk by an Australian contractor but an American contractor to be engaged to drill the horizontal wells possibly on a cost plus 10% basis.

(c) The drilling and subsequent development and operation to be under the supervision of either one or both of Messrs. Ranney and Fairbank.

(d) A royalty of 2% of the selling price or value of the oil to be charged to the operating Company and paid into a fund to assist in carrying out a Commonwealth Geological Survey.

(e) The licence to use the Ranney method to provide for proper control by the Commonwealth over future development and exploration.

(5) Suggested Action for Development (step by step)

(1) Grant rights to use and sub-licence the Ranney method;

(2) Complete the set up of organisation to operate the property;

(3) Arrange purchase of drilling machinery etc. and secure priorities in manufacture and delivery of same in U.S.A.

(4) Arrange for sinking of shaft, excavation of work chamber and installation of shaft equipment;

(5) Arrange for an American Company to undertake drilling;

(6) Arrange for Mr. Ranney to return to Australia to supervise completion of the work chamber and commencement of horizontal drilling.

Notes:

(a) Perhaps Mr. Fairbank could be asked to accept the position of Supervising and Consulting Engineer to the Commonwealth for the purpose of 5(3) above. This would simplify the work from our point of view and ensure that it is done efficiently.

(b) A proposal has been made that a Company with a nominal capital of £2,000,000 be formed with the Commonwealth holding 51% of the shares to take over leases, rights, plant and machinery and goodwil of Austral Oil Syndicate, a Company now operating the area (estimated to be valued at £124,000) and to then operate the project. The consideration to Austral Oil Syndicate should be by way of an issue of shares to that value.

The proposed Company to have a Chairman, appointed by the Commonwealth and a Board of Directors with half representing the Commonwealth's share holding and half representing ordinary shareholders.

This is along the lines of the Commonwealth Oil Refineries Ltd. and Amalgamated Wireless Ltd.

3/9/41

All Communications should
be addressed
SECRETARY FOR MINES.
Telephones: CXKCXXXXXX F0234
WJP:EAH

- V -

MINES DEPARTMENT,
TREASURY GARDENS,
MELBOURNE. C.2.

12th August, 1941.

MEMORANDUM FOR THE HONORABLE THE MINISTER:

Messrs. Ranney & Fairbank, the two oil experts brought from America by the Commonwealth Government, have reported that, in their opinion, oil can be commercially produced at Lakes Entrance. They estimate that, by means of a concrete shaft and horizontal bores in the oil-bearing rock at the bottom of the shaft, 1,160,000 barrels of oil (40,600,000 gallons) can be obtained from a selected area of 400 acres, at a cost equivalent to the value of 115,000 barrels.

The area selected as the site for the proposed shaft is held under a petroleum prospecting licence by the Austral Oil Drilling Syndicate N.L. The Company is not itself able to meet the cost of carrying out the proposed work (£100,000), and has suggested to the Commonwealth Government that a new company with a capital of £500,000 be formed.

A copy of the Austral Company's proposals has now been received from the Minister of Supply for consideration and advice as to what the Victorian Government is prepared to do.

The Austral Oil Drilling Syndicate has submitted to the Minister of Supply two schemes for the provision of the finance to carry out Messrs. Ranney & Fairbank's proposals. The first of these is that the Commonwealth Government shall take sufficient shares to hold a controlling interest in the company to be formed. The Commonwealth Government may offer portion of its interest to the Government of Victoria.

The second scheme provides for the formation of a company, also with a capital of £500,000, to acquire the assets of Austral Oil Drilling Syndicate. Neither the Commonwealth Government nor the State Government would hold shares in the Company, but it is proposed that the Company should borrow £150,000 from the Government or Governments to carry out Messrs. Ranney & Fairbank's programme. The loan would be secured by debentures constituting a first charge on the Company's assets and would be repaid by a royalty on the oil sold.

With regard to the first proposal, the view has been verbally expressed by the Minister for Mines (Mr. Hogan) at a conference with the Minister of Supply that the State Government would not be prepared to take shares in the company.

The second proposal, viz. that financial assistance should be provided by loan from the State and Commonwealth Governments, requires Cabinet consideration. The Austral Company suggests a total loan of £150,000. This amount is more than Messrs. Ranney & Fairbank's estimate (£100,000) to cover the whole cost of carrying out their scheme without raising any money from shareholders.

It will be some time before the new company can be registered and the necessary capital for operations raised. In the meantime the Austral Company has suggested an advance of £50,000 from the Commonwealth Government so that there will be no delay in proceeding with the work.

At the conference with the Minister of Supply, it was suggested that the Commonwealth should provide two-thirds and the State one-third of any assistance given from public funds, on the £1 for £1 basis with the Company, with a limit of £50,000, the whole amount of £100,000 to be expended on developmental work.

It is now suggested that the Commonwealth might be informed that the State is prepared to provide £16,667 of a loan of £50,000, under the following conditions :-

(1) The advance to be made to the Austral Company on a £1 for £1 basis with the Company.

(2) The period of the advance to be three years.

(3) The Company to give security to the Commonwealth and State over its assets for the repayment of the loan.

(4) The advance to be free of interest.

(5) The advance to be repaid before any profits are distributed, with repayments divided in the proportion of two-thirds to the Commonwealth and one-third to the State.

(6) The advance to be only for a programme mutually approved by the Minister of Mines and the Minister of Supply to carry out the developmental scheme recommended by Messrs. Ranney & Fairbank.

(7) No part of the advance nor of the Company's contribution to be used for the payment of directors' fees, office expenditure, advertising, or for any purpose other than the actual developmental work on the field.

(8) The State to have an opportunity of expressing its views to the Commonwealth Government on any proposed agreement with the Austral Co. in relation to the terms of the advance.

(9) The Commonwealth Government to deal with the Austral Oil Drilling Syndicate in all matters relating to the loan.

On the formation of the new company it would be required to take over the Austral Company's liability to the Crown in respect of the advance before it was permitted to commence operations. Any agreement made with the Austral Co. or any other company will not absolve any company from the necessity of complying with the provisions of the Mines Acts (including the Mines (Petroleum) Acts).

Part of the area on which the proposed operations are to be carried out is held under a petroleum mineral lease by Midwest Oil Company N.L., with which the Austral Company has an agreement. Before any financial assistance is given by the State, it will be necessary for the Austral Company to obtain a title under the Mines (Petroleum) Acts to the whole of the area.

Secretary.

Cabinet Decision

Advance of £16,667 approved subject to conditions set out in above Memorandum

E. J. Hogan 19/8/41

Copy.

JOHN A. LAING,
Capel Court,
375 Collins Street,
MELBOURNE.

2nd September, 1943.

The Controller of Minerals Production,
Department of Supply and Shipping,
409 Collins Street,
MELBOURNE C.1.

Dear Sir,

LAKES ENTRANCE OIL PROJECT.

Following several discussions with Mr. H. J. Cook I now have pleasure in submitting hereunder my report on the design and construction of a Working Chamber at the base of the shaft now being sunk in connection with the above work.

The chief features affecting the construction of a working chamber include:

(1) Its position at the base of a shaft of 12 feet overall diameter and 1200 feet deep

(2) Its inside diameter of 30 feet

(3) The desirability of sinking the chamber as far as is considered safe into the stratum of oil bearing glauconite from which the oil is to be recovered and which is some 35 feet thick and lying in a plane approximately horizontal in one direction and dipping about 1 in 30 in a direction at right angles

(4) The underside of the glauconite is subjected to a hydrostatic pressure of approximately 600 lb. per sq. inch

(5) The stratum of glauconite is impervious under this heavy pressure; it is probably jointed in vertical planes of little shear strength at intervals of about 30'

(6) The bores show that the material beneath the glauconite is very fine grained

(7) One piece of glauconite core material tested for compression strength showed that a crushing strength of 1350 lb. per sq. inch could be expected under normal conditions

(8) No. 10 Bore is considered as being typical of the glauconite deposit and this discloses that it is made up of a series of harder and softer layers in which are interspersed throughout the whole depth some 14 or more layers of still softer material about 1 inch in thickness.

In addition to the foregoing information Mr. Cook supplied me with complete data obtained from No. 10 Bore and together we visited the Geological Museum where Mr. Saragwanath and other officers of this Department kindly made available for our inspection samples of the material obtained from this bore and also showed us samples of the material underlying the glauconite.

The glauconite is at present impervious and the problem is to construct the floor of the working chamber within such limits of area and penetration into the glauconite that there is no possibility of an upward fracture of the stratum when the stabilising weight of the overburden is removed in the process of making space for the working chamber. In addition, it is equally important to ensure that such movement of the glauconite stratum as must inevitably take place must be so inappreciable as not in any way interfere with its present impervious nature.

As already indicated, the glauconite overburden is 1200' deep. This will transmit a downward load on the top of the glauconite of at least 60 tons per square foot. The net upward pressure of the water is 36.5 tons per square foot, consequently the overburden is more than ample to resist the water pressure.

Immediately however the overburden is removed to make room for the Chamber, the water pressure becomes unbalanced and over an area of 30 feet diameter

it amounts to a total upward force of 26,000 tons.

This huge force must be diverted or spread diagonally to the underside of the walls of the working chamber which must now provide the necessary stabilising force. This diversion of the net upward force must be accomplished by one of the following means: (1) by virtue of the natural strength of the stratum of glauconite, (2) by this strength augmented in some manner or (3) by modifying the design of the working chamber in such a manner that the amount of upward force of the water to be spread diagonally through the glauconite is greatly reduced.

I understand that a proposal coming under heading (2) has been made. In this the material underlying the glauconite vertically under the chamber is impregnated and hardened with cement grout or solidified with chemical solution. This will increase the resistance of the glauconite to the heavy water pressure tending to cause upward movement when the stabilising overburden already referred to has been removed.

To enable this proposal to become effective it would be necessary to treat a volume of material in the shape of an inverted dome at least 10 feet thick at the centre and approximately 40 feet in diameter. This hardened material would also have to be rendered impervious and made integral with the glauconite, otherwise the water would still reach the underside of the glauconite and exert exactly the same pressure as if the hardened material did not exist.

In my opinion it would be impossible to ensure any degree of impermeability to material treated in the manner proposed, and it is certain that after the process was completed, full hydrostatic pressure would be applied to the underside of the glaudonite. Under the circumstances it is difficult to see what advantage could be gained by this method of treatment because the original conditions are entirely reproduced. In any event it would be a most serious and costly problem: owing to the fine close grained nature of the underlying material it would be most difficult to penetrate it to any depth.

Neither does it appear to me to be a feasible proposal to attempt to construct a floor of reinforced concrete or structural steel on top of the glauconite capable of resisting a force of 26,000 tons.

In view of these conclusions I am suggesting a modification of the design of the working chamber as indicated on the attached blue print. The general diameter of the working chamber is maintained at 50', but a number of buttressing walls are introduced and these will have the effect of reducing the floor span from 50' to 20' and in this way the total upward force of water to be resisted and spread diagonally by the stratum of glauconite is also reduced from 26,000 tons to 11,500 tons. This reduction in upward force and span will enable the glauconite to be penetrated to a depth of at least 6 feet.

The proposal has the further advantage that the method of construction is safe in that the work is carried out in 12 self-contained sections, each section being completed and made safe before another section is commenced.

The method of procedure proposed when the shaft is completed to the level F - F shown on the drawing is as follows:

A winze is put in, in a direction corresponding to the sloping wall of the chamber and carried down to the glauconite and a further 6' into the stratum. The excavation must be wide enough to permit of a floor section of approximately 6' x 7'10" to 5'3" being put in and concrete wall carried up as shown in Sectional Plan E-E and half Section D-D. The concrete work is carried up as indicated at other Half Section in drawing, care being taken to ensure that the concrete is stepped back and left horizontal on top and that it is well packed in, leaving no cavities. In this way the concrete is carried up to meet the base of the shaft, the upper portion being one of the sections shown as Sectional Plan C-C.

When the first section is completed, another section is commenced beside the first by excavating as before: down to the glauconite and 6' into it. Concreting of this section can then be commenced and completed as in the former case and so on, until the whole work of 12 sections is complete. The central hill left is then excavated and an inverted dome of concrete laid to strengthen the floor. The final construction is shown in Section A-A.

There remains the question of the intrusion of the buttress walls into

the chamber. As pointed out, the full clear diameter of 50' is still available and I am suggesting that the matter be gone into to ascertain if there are any vital objections to the design. If there are none I believe it is the safest method to adopt. The sizes of concrete shown on the drawing are approximate only and have been left to be finally determined if and when the proposal meets with approval.

Yours faithfully,

(Sgd.) JOHN A. LAING.

COPY.

DEPARTMENT OF SUPPLY AND SHIPPING,

Mineral Resources Survey.

CANBERRA, 17th October, 1945.

MEMORANDUM FOR :-

The Secretary,
Department of Supply and Shipping.
MELBOURNE, VICTORIA.

LAKES ENTRANCE PROJECT.

Following completion of their investigations of the cores recovered from the bore in the Lakes Entrance shaft, Messrs. Thyer and Noakes have completed the draft of a report. This draft has been discussed with the authors by Messrs. Nye, Temple Watts and myself. The authors' conclusions following this discussion are set out in the attached statement. Their full report will be forwarded as soon as possible.

The following comments are based largely on reports by Messrs. Thyer and Noakes on the Shaft bore, the Pilot bore, and their observations of the Imray bore.

1. The Ranney-Fairbank report recommended the sinking of a vertical shaft at Lakes Entrance and the development of a tract of 400 acres around the shaft by Ranneywells. Horizontal wells approximately 2,000 ft. long were proposed.

2. Evidence from vertical wells suggests that the whole of the area within the tract is oil-bearing.

3. In the Pilot and Shaft bores the oil occurs in three thin zones separated by layers of impermeable sandstone. In the Pilot bore, of 34 inches included in the three zones, only 10 inches were composed entirely of oil-bearing sandstone and it is believed that most of the oil produced came from this 10 inches. The permeability of the remaining 24 inches of sandstone appears too low to allow any appreciable flow into the hole.

4. Evidence from other bores indicates that oil also occurs in the lower part of the glauconitic sandstone. This oil zone has not been penetrated by the Pilot, Shaft and Imray bores and is not taken into account in the following estimates. For various reasons it is considered virtually non-recoverable under present circumstances.

5. The estimates given below, presuppose that the shaft can be carried to a depth which will allow the drilling of controlled horizontal holes in the main oil zone. If this is not possible recoveries will be less than stated hereunder.

6. There seems little doubt that horizontal holes could be drilled with fair control and without great difficulty up to 1,000 ft. in length but the evidence available indicates that the drilling of longer holes under control is difficult and therefore relatively costly.

7. Ranney and Fairbank estimated that 2,900 barrels per acre would be recoverable and that a total quantity of 1,160,000 barrels could be recovered from the tract (400 acres) which they recommended should be developed.

8. If the results obtained from the Pilot, Injury and Shaft bores are fairly applicable to the whole area, an estimate of total oil content of 1,400 barrels per acre is considered reasonable. It is considered that not more than and probably less than 20% of the oil contained in an area of 2,000 ft. diameter can be recovered. Similarly it is considered that not more than and probably less than 15% of the oil contained in an area of 4,000 ft. diameter can be recovered, i.e. the estimated recovery per acre will be from 240 to 280 barrels. This means that there would be a total oil content of 100,000 barrels of oil within an area of 70 acres (1,000 ft. radius) and 560,000 barrels within an area of 400 acres (2,350 ft. radius). The estimated recovery from the smaller tract of 70 acres is 20,000 barrels and from the larger of 400 acres, 84,000 barrels.

9. It has been estimated that oil from the shaft could be sold for 6d. per gallon, or let us say £1 per barrel. Thus the estimated recoverable oil will be worth from £20,000 to £60,000 according to the size of the tract which can be developed. Admitting that there is still not sufficient evidence upon which to base accurate estimates, the figures given above are likely to be of the right order. They would need to be considerably in error to make any significant difference to the economics of the project.

10. As approximately £140,000 has been expended on the project and further expenditure will be required to reach the producing stage, it is concluded that the project must be uneconomic.

11. Thus if work is continued by the Commonwealth, it will be primarily to obtain information on the field and on the technique and efficiency of horizontal wells. It is generally conceded that the method of producing oil by horizontal drilling has possibilities, but there is little reliable data available. If it were found practicable to drill a trial horizontal hole in one of the oil zones, the evidence obtained would be valuable to the petroleum industry. Consideration might be given to this suggestion but it is realised that the cost might be out of proportion to the value of the information obtained.

Reliable data on the occurrence of oil in the lower part of the glauconitic sandstone would be useful and could be obtained cheaply by deepening the Pilot bore.

(sgd) (W. G. WOOLLEY)
Director.

Encl.

PRODUCTION HISTORY

LAKES ENTRANCE OIL SHAFT

OIL PRODUCTION 1947 – 1951 W434

YEAR	GALLONS	VALUE £
1947	– *	–
1948	30,000	750
1949	34,410	1,004
1950	40,000	2,000
1951	68,180	3,409
	172,590	7,163

* Total production to 1947 (all sources / Lakes Entrance)

115,283 — 2,769

Total production to 1951 (all sources, Lakes Entrance)

287,873 — 9,932

Note. Data from Mines Department Annual Reports 1947–1952

LAKES ENTRANCE OIL SHAFT.

Reports of Oil and Gas contained in H.Cook's weekly reports.

Just above 560'	H_2S gas evident.
± 560' - 576'	H_2S gas in the ground. Not much in evidence.
About 616'	Methane by test.
About 636' - 665'	Several showings of gas. On occasions bubbling continuously for some hours only from water in bottom.
682'	15" of very porous coral rock with water charged with gas.
752'	Small band of water with a little gas.
756' - 763'	Contains two gas shows. Oil films seen on ground excavated.
820' - 844'	Gas evident.
907'	" " "
Just below 1021'	" " "
1046'	Oil films showing in shaft plentifully.
1197'	Oil present.

(From this point on oil present and tests made by measuring amounts from pits and horizontal drill holes.)

LAKES ENTRANCE OIL SHAFT.

W434

Copied from Department of Mines Annual Reports.

For 1946. "During the year Austral Oil Drilling Syndicate took over the oil Shaft at Lakes Entrance from the Commonwealth and State Governments, and is engaged in carrying out the work of deepening the large shaft, and the construction of a drilling and work chamber above the glauconite, at the 1198 foot level."
G. Hadden - Chief Mining Inspector.

For 1947. "During 1947, the task of completing the work chamber of the Lakes Oil Limited shaft at Lakes Entrance was finalized. This drilling and work chamber is 20 feet in diameter and has the necessary piping let into the concrete walls and fitted with stop works and stuffing glands through which the horizontal boring will be carried out.

This precaution will allow any artesian water under pressure to be shut off from the shaft should it be inadvertently drilled into."
G. Hadden - Chief Mining Inspector.

For 1948. "Having completed the work chamber and sump, exploratory drilling has been carried out from the drilling platform. The holes drilled vary in length up to 200 feet and are mostly 1½" in diameter. During the boring, cores have been taken and analyses carried out at the Company's laboratory at the works. Pressure gradients have also been recorded, showing pressures within the glauconite of up to 520 lb. per square inch.

Rate of yield of fluid obtained is also noted. Three treatment tanks of 2,500 gallons capacity and one of 1,000 gallons have been erected where the separation of the oil and water is effected. The first of a series of 20,000 gallon storage tanks has just been completed. Experiments have been carried out to improve the ventilation of the shaft bottom where the humidity is high. A feature of interest is the use of oil from the shaft as a fuel for the boilers which are used for steam generation. Up to the present approximately 30,000 gallons of oil have been produced.
G. Hadden - Chief Mining Inspector

W434

For 1949. "At the Lakes Entrance Oil Shaft, operations by Lakes Oil Ltd., testing operations were carried out from 15 exploration holes drilled from the work chamber 1196 feet below the surface. The exploration holes extend nearly horizontally for distances of up to 200 feet, and the dry oil recovered from fluid pumped or bailed from the sump to the separators amounted to 34,410 gallons. This should be regarded as a yield from tests only and not an annual out put.

In December the first of the holes drilled by the directional drilling method was held within the glauconite for a distance of 702 feet, producing an average of 77% dry oil".

G. Brown - Secretary for Mines.

"Operations were continuous for the year, work being mainly concentrated on the drilling of new holes and the deepening of existing ones.

In order to facilitate the transfer of fluid to the surface a new 40h.p. three-throw pump with a capacity of 4,000 gallons per hour against a head of 1,200 feet has been installed in the shaft bottom. This pump will deliver from the work chamber to storage tanks on the surface. Grouting of the walls of the shaft was carried out to prevent the seepage of moisture, and this has had a beneficial effect on the humidity of the air in the work chamber."

G. Hadden - Chief Mining Inspector.

For 1950. "At Lakes Entrance the pumping of crude oil was continued by Lakes Oil Ltd. from the work chamber at 1198 feet below the surface, where bores have been drilled radially into the oil-bearing strata. Production was not on a continuous basis, but comprised tests during which certain bores would be turned on, measured for flow during fixed periods and then turned off again. Altogether 40,000 gallons of crude oil were recovered from these tests". - R. Neal - Secretary for Mines.

From 1951. "Oil production in Victoria ceased towards the end of the year when Lakes Oil Ltd. suspended operations at Lakes Entrance Shaft after 10 years of work. From the begining of 1951 until the time of closing, 68,180 gallons of crude oil had been obtained from tests".

R. Neal - Secretary for Mines.

Statistics for 1951

Crude Oil 68,180 gallons produced in 1951

287,873 gallons produced up to 31/12/1951.

Oil Shaft – Lake Entrance

From Document-on File No. 300 "Natural Gas Bairnsdale"

Lake Oil Ltd. bought a concrete shaft 1150 feet deep & 10 feet in diameter from the Commonwealth Government. The Commonwealth Government constructed the shaft, but it was subsequently abandoned by them.

Lake Oil deepened the shaft by about 50 feet to a total depth of 1200 feet, and built on to the bottom of it a work chamber, an oil store room, and a room which contains ventilation equipment. They proceeded with horizontal drilling and encountered many difficulties.

On 20 Feb 1951 Lake Oil Ltd. were getting about between 6 & 7 barrels per day from the shaft, but pumping difficulties & the question of separation of oil & water were under investigation by the company.

The oil contains no gas dissolved in it, but contains about 20% diesel fuel, 60% kerosene oil, & 20% bitumen.

On 25 Feb 1951 the oil was being sold to gas fuel oil to local users some of which goes to 2 butter factories at Bairnsdale, and large quantities are used in the production of milk. Recently the Vacuum Company send it to Altona.

About 6 Feb 1950. Shaft oil tanks average of approx 190-200 gallons of oil per day.

Letter 25 Sept 1951 by Lake Oil Ltd.

The total footage of open hole still producing oil

"D" Hole	6146 feet
"A", "B" & "C" Hole.	1600 feet
	7,746 feet.

Because of high pressure water breaking through in some holes, probably 1,200 feet of hole which were producing good quantities of oil had to be entirely abandoned. e.g. D14 was producing at rate of 113 gals oil per day prior to water breaking through.

cd PTO

D12 is a typical hole. On test on 13 Sept 1951, with hole throttle fully open for 1 hour, it was yielding 278 gallons / Total fluid in 5 minutes, oil content just over 6 gallons. The rate / flow / fluid is beyond the capacity of the country pump.

Typical cases where holes have not been drilled to bottom are eg.

D2 8 to 44 gals. oil per day then 3 to 27 gals water. The percentage / oil to total fluid ranged from 39% to 60%.

D22 produces 2 to 5 gals oil per day.
Oil to water = approx 60%.

Table as at 8th Sept 1951. All holes except experimental holes.

Bore	Total length.	Length open.	Below	Remarks.
D2	1047'	88'	959'	End / both Bores in
Branch	202'		202'	Glauconite.
D6	1006'	77'	929'	End / both Bores in
Branch.	73'		73'	Sand Glauconite
D10	186'	89'	97'	End / bore in Glauconite.
D12	980'	124'	856'	End / bore in Glauconite
Branch.	194'		194'	" " " to underside / Glauconite, Producing.
D13	717	90'	627'	Both bores cemented off,
D14	703	96'	607'	total loss.
D16	262'	132'	130'	Bore to underside / Glauconite, producing.
D18	416'	121'	295'	End / Bore in Glauconite.
D20	190'	82'	108'	End / bore to underside / " , in water.
D22	411'	77'	334'	" " " in "
D24	1008'	69'	939'	" " " " "
D26	506'	76'	430'	" " " " "
Branch	69'		69'	" " " " "

Contd.

Water: Govt. Colquhoun No 1.
(Ref. Folio 300. Memo Dated 20/1/1950. J.J. Brown to Manuka).
Analysis made on 22 March 1929.

Calcium carbonate	1·5	grains per gallon. (× 10/7 → p.p.m. 100,000.)
Magnesium "	2·1	" " "
" Sulphate	nil.	" " "
Sodium Carbonate	48·3	" " "
" Chloride	45·0	" " "
Total	96·9	" " "

D28	336'	79'	257'	End of Bore in Glauconite.
Brand.	101'		101'	" " " " "
A3	121'	36'	85'	" " " (Sandrock) "
A5	106'	25'	81'	" " " " " "
Tot	8634'	1261'	7373'.	

7373' less D13, D14 cemented off = 6146' Total footage of open hole.

Production. (net oil containing not more than ¼% Water).
Total to 11 Sept-1951 = 145,364 gallons.

April.	19·6 Tons.
May	19·7 "
Jun.	17·6 "
July	14·8 "
Aug.	24·4 "
Sept-6 11th.	20 "

P.T.O.

Conference 8th Oct 1951. Statistics.

Total production to 11th Sept 1951 145,364 gallons.

Production for April 4520 gallons.
May 4540 "
June 4050 "
July 3400 "
Aug. 5660 "
to Sept 11th 4670 "

Water content less than 0.25% cut.

2 Types of drilling for shaft.
- Horizontal short holes.
- Longer directionally drilled "D" holes.

A B & C holes are short horizontal holes.
D " go over 1000'.
48 8" pump holes in bore for shaft.

D holes are 2½" diam. A B & C are 1½" diam.

Sept bypass on 9390 gall wet cut & analysis showed the content 18% for crude.

Drilling for shaft did started 1948 & pump hole were entirely satisfactory inside the 200 foot diam around shaft.

"D" 10 started Nov 1949
"D" 6 " Jan 1950
"D" 12 " April 1950.

} from memory for Mr. Demaine.

D12. yield April 1950 54-4 pumped.
Dec 1950 - water distance 994 feet. 16,000 pumped / 24 hours.

B2 at 56' (after holes) → 9-10 pumped per 24 hours.
83.7' → 129 " " 24 "
91.5' → 278 " " " "
and at this

RANNEY WELL NO. 1 - 5.5 FEET.

Date 1945	Standing Time	Total Fluid	Free Water	Wet Oil	% Water	Dry Oil	Dry Oil per 24 hours.	Total Water per 24 hours	Dry Oil per foot	Water per foot	Dry Oil per 1000 ft. of hole	Total Water per 1000' of hole	Water/Oil Ratio
	Hours	Pints	Pints	Pints		Pints	Pints	Pints	Pints	Pints	Gallons	Gallons	
Nov. 3	16	2.4	-	2.4	40.0	1.44	2.16	1.44	.386	.262	48	32.8	0.685
4	24	4.35	-	4.35	54.0	2.0	2.0	2.35	.357	.428	44.6	53.5	1.20
5	24	2.875	-	2.875	52.0	1.38	1.38	1.5	.251	.273	31.4	34.1	1.18
6	24	2.45	1.075	1.375	19.0	1.115	1.115	1.335	.203	.243	25.4	30.4	1.20
7	25½	2.8	1.25	1.55	12.0	1.365	1.28	1.35	.233	.246	29.1	30.8	1.06
8	22½	2.375	1.05	1.325	7.0	1.23	1.31	1.22	.238	.222	29.7	28.0	0.945
9	25	2.45	1.15	1.30	8.0	1.195	1.15	1.205	.207	.219	25.9	27.4	1.06
10	23	1.55	0.55	1.00	10.0	0.90	0.94	0.68	.171	.124	21.4	15.5	0.725
11	24	1.6	0.60	1.00	4.0	0.96	0.96	0.64	.1745	.116	21.75	14.5	0.67
12	26	1.27	0.375	0.90	14.0	0.775	0.715	0.457	.130	.083	16.3	10.4	0.64

RANNEY WELL NO. 2. 32 feet.

North End.

Date 1945	Standing time Hours	Total Fluid Pints	Free Water Pints	Wet Oil Pints	% of Water in Oil	Dry Oil Pints	Dry Oil in 24 hrs. Pints	Total Water per 24 hrs. Pints	Dry Oil per foot Pints	Total Water per ft. Pints	Dry Oil for 24 hrs. per 1000' of hole Gallons	Water per 24 hrs. per 1000' of hole Gallons	Water/Oil Ratio
Nov.													
8	16	18.15	12.	6.15	10.0	5.53	8.29	18.92	.259	.592	32.4	74	2.28
9	24	30.45	15.	15.45	14.0	13.3	13.3	17.15	.416	.536	52.0	67	1.29
10	24	31.2	16.2	15.0	19.0	12.15	12.15	19.05	.380	.595	47.5	74.4	1.56
11	24	30.4	16.0	14.4	19.0	11.65	11.65	18.75	.364	.586	45.5	73.2	1.61
12	25½	27.85	14.5	13.35	18.5	10.89	10.24	15.95	.320	.498	40.0	62.2	1.56
13	22½	21.45	13.15	8.3	19.0	6.73	7.17	15.70	.224	.492	28.0	61.5	2.2
14	24	25.1	14.8	10.3	15.0	8.74	8.74	16.36	.273	.512	34.1	64.0	1.875
15	24	24.65	12.75	11.9	19.0	9.64	9.64	15.01	.301	.469	37.6	58.6	1.56
16	24	26.15	14.8	11.35	16.0	9.52	9.52	16.63	.297	.520	37.1	65.0	1.75
17	24	24.55	14.55	10.0	17.0	8.30	8.30	16.25	.259	.507	32.4	63.4	1.95
18	24	25.4	15.0	10.4	18.0	8.52	8.52	16.88	.266	.527	33.25	65.9	1.98
19	24	22.1	12.1	10.0	13.0	8.70	8.70	13.40	.272	.418	34.0	52.25	1.54
20	24	24.9	15.1	9.8	15.0	8.33	8.33	16.57	.260	.517	32.5	64.6	1.99
21	24	21.0	11.8	9.2	15.0	7.82	7.82	13.18	.244	.413	30.5	51.6	1.69
22	24	24.25	15.1	9.15	10.0	8.23	8.23	16.02	.256	.500	32.0	62.5	1.95
23	24	22.2	13.8	8.4	6.0	7.90	7.90	14.30	.247	.447	30.8	55.9	1.82
24	24	21.15	12.9	8.25	12.0	7.26	7.26	13.89	.227	.434	28.4	54.2	1.93
25	24	22.4	14.0	8.4	10.0	7.56	7.56	14.84	.236	.464	29.5	58.0	1.97
26	24	23.05	14.0	9.05	8.0	8.33	8.33	14.72	.260	.460	32.5	57.5	1.77
27	24	22.7	14.2	8.5	14.0	7.31	7.31	15.39	.228	.482	28.5	60.2	2.27
28	24	20.6	12.6	8.0	11.0	7.12	7.12	13.48	.223	.421	27.8	52.7	1.89
29	24	22.2	13.6	8.6	10.0	7.74	7.74	14.46	.242	.452	30.2	56.5	1.87
30	24	18.7	10.7	8.0	10.0	7.20	7.20	11.50	.225	.359	28.1	44.9	1.60
Dec. 1	24	19.3	11.1	8.2	7.5	7.6	7.6	11.7	.237	.366	29.69	45.7	1.54
2	24	22.1	14.3	7.8	9.5	7.1	7.1	15.0	.222	.469	27.8	58.6	2.1
3	24	21.1	13.8	7.3	10.0	6.6	6.6	14.5	.206	.454	25.8	56.7	2.2
4	24	22.9	14.6	8.3	7.0	7.7	7.7	15.2	.241	.475	30.1	59.4	1.97
5	24	19.2	13.4	5.8	6.0	5.45	5.45	13.75	.170	.430	21.3	53.7	2.52

RANNEY WELL NO. 4 - NORTH FACE. 35'

Date 1945	Standing time	Total Fluid	Free Water	Wet Oil	% Water	Dry Oil	Dry Oil per 24 hours	Total Water per 24 hours.	Dry Oil per foot per day	Dry Oil per 1000 ft. hole per day.	Water per foot	Water per 1000' hole	Water/ Oil Ratio.
	Hours	Pints	Pints	Pints		Pints	Pints	Pints	Pints	Gallons	Pints	Gallons	
Nov.		No production for approx. 2 days - Production figures from 3rd day.											
17	24	8.65	5.4	3.25	5.5	3.07	3.07	5.58	.088	11.0	.160	20.	1.82
18	24	9.30	6.2	3.10	9.0	2.82	2.82	6.48	.08	10.0	.185	23.	2.30
19	24	10.3	6.3	4.0	7.0	3.72	3.72	6.58	.106	13.25	.188	23.5	1.77
20	24	3.4	1.6	1.8	15.0	1.53	1.53	1.87	.044	5.5	.053	6.6	1.2
21	24	9.5	5.8	3.7	11.0	3.29	3.29	6.21	.094	11.54	.177	22.1	1.92
22	24	9.75	6.25	3.5	4.0	3.36	3.36	6.39	.096	12.0	.194	24.2	2.02
23	24	9.0	5.4	3.6	5.0	3.42	3.42	5.58	.099	12.25	.159	19.9	1.63
24	24	9.3	6.2	3.1	3.0	3.01	3.01	6.29	.086	10.75	.179	22.4	2.22
25	24	8.7	5.2	3.7	3.0	3.6	3.6	5.1	.103	12.8	.146	18.2	1.42
26	24	9.3	5.4	3.9	4.0	3.7	3.7	5.6	.106	13.2	.160	20.	1.51
27	24	8.2	4.6	3.6	8.0	3.3	3.3	4.9	.094	11.75	.140	17.5	1.49
28	24	8.2	5.4	2.8	6.0	2.63	2.63	5.57	.075	9.39	.159	19.9	2.12
29	24	8.5	5.4	3.1	5.0	2.94	2.94	5.56	.084	10.5	.159	19.1	1.89
30	24	9.4	4.9	4.5	6.0	4.23	4.23	5.17	.121	15.11	.148	18.46	1.22
Dec.													
1	24	8.5	5.2	3.3	3.0	3.2	3.2	5.3	.091	11.43	.151	18.93	1.66
2	24	8.0	5.0	3.0	4.5	2.9	2.9	5.1	.083	10.36	.146	18.3	1.76
3	24	7.5	4.7	2.8	8.0	2.6	2.6	4.9	.074	9.25	.140	17.5	1.89
4	24	8.3	5.0	3.3	6.5	3.1	3.1	5.2	.088	11.0	.148	18.5	1.68
5	24	7.5	4.6	2.9	7.0	2.7	2.7	4.8	.077	9.6	.137	17.2	1.78

RANNEY WELL NO. 3 SOUTH FACE 38 feet.

Date 1945	Standing Time	Total Fluid	Free Water	Wet Oil	% Water in oil	Dry Oil	Dry oil per 24 hours	Total Water	Total Water per 24 hrs.	Dry oil per foot per 24 hours	Oil per 1000 ft. of hole per 24 hours.	Water per foot per 24 hours.	Water per 1000 ft. of hole per 24 hours.	Water/ Oil Ratio.
	Hours	Pints	Pints	Pints		Pints	Pints	Pints	Pints	Pints	Gallons	Pints	Gallons	
Nov.	Well did not produce for 26 hours - Next 24 hrs. production discarded - Production figures commenced on third day.													
15	24	20.75	11.65	9.1	23.0	7.02	17.02	13.73	13.73	.185	23.1	.362	45.25	1.96
16	24	23.20	14.55	8.65	9.0	7.86	17.86	15.34	15.34	.207	25.9	.404	50.5	1.95
17	24	21.7	13.10	8.6	9.0	7.83	17.83	13.87	13.87	.206	25.75	.365	45.6	1.77
18	24	20.45	11.05	9.4	11.0	8.36	8.36	12.09	12.09	.220	27.5	.318	39.75	1.45
19	24	21.65	13.0	8.65	11.0	7.70	7.70	13.95	13.95	.203	25.4	.367	45.9	1.82
20	24	20.5	11.0	9.5	11.0	8.45	8.45	12.05	12.05	.222	27.75	.317	39.6	1.43
21	24	19.4	9.9	9.5	12.0	8.36	8.36	11.04	11.04	.220	27.5	.290	36.2	1.28
22	24	19.1	9.6	9.5	11.0	8.45	8.45	10.65	10.65	.222	27.75	.280	35.0	1.27
23	24	17.8	9.2	8.6	9.0	7.82	7.82	9.98	9.98	.206	25.75	.262	32.75	1.27
24	24	17.6	7.7	9.9	7.0	9.20	9.20	8.40	8.40	.242	30.25	.222	27.75	0.92
25	24	19.6	10.1	9.5	10.0	8.55	8.55	11.05	11.05	.225	28.1	.291	36.4	1.29
26	24	18.8	10.2	8.6	4.0	8.26	8.26	10.54	10.54	.217	27.2	.277	34.7	1.28
27	24	18.7	10.3	8.4	11.0	7.5	7.5	11.2	11.2	.197	24.6	.295	36.8	1.49
28	24	17.6	9.0	8.6	6.0	8.08	8.08	9.52	9.52	.212	26.58	.251	31.3	1.18
29	24	18.3	10.3	8.0	4.0	7.68	7.68	10.62	10.62	.202	25.26	.280	34.9	1.38
30	24	16.0	9.4	6.6	6.0	6.2	6.2	9.8	9.8	.163	20.39	.258	32.2	1.58
Dec.														
1	8	7.1	4.0	3.1	4.0	2.98	8.93	4.12	12.37	.235	29.37	.326	40.7	1.39
2	Production tests interrupted by driving in South Face.													

RANNEY WELL NO. 5 - DRILLED EAST 25' LONG IN TOP ZONE.

HOLE WAS COMPLETED 2.30 p.m. - 30.11.45

UP TO DECEMBER 5TH THIS HOLD DID NOT PRODUCE ANY OIL

XXX

→ POT HOLE IN ZONE 3.

XXX

Date 1945	Standing Time Hours	Total Fluid Pints	Free Water Pints	Wet Oil Pints	% Water	Dry Oil Pints	Dry Oil per 24 hours. Pints	Total Water 24 hours Pints	Water/Oil Ratio
Nov. 17	24	42.9	3.75	39.15	7	36.35	36.35	6.55	.18
18	24	36.45	2.45	34.0	3	33.0	33.0	3.45	.105
19	24	36.05	2.5	33.55	4.5	32.1	32.1	3.95	.123
20	24	37.25	2.35	34.9	4.5	33.3	33.3	3.95	.119
21	24	39.3	2.0	37.3	11.0	33.2	33.2	6.1	.187) x
22	24	38.0	2.0	36.0	10.0	32.4	32.4	5.6	.173)
23	Mishap with pump, hole flooded								
24	24	38.5	3.6	34.9	12.0	30.7	30.7	7.8	.254
26	24	37.2	3.9	33.3	12.0	29.3	29.3	7.9	.269
27	24	35.6	2.2	33.4	22.0	26.1	26.1	9.5	.368
28	24	33.6	2.8	30.8	12.0	27.1	27.1	6.5	.240
29	24	34.2	2.2	32.0	11.0	28.5	28.5	5.7	.200
30	24	34.6	2.6	32.0	6.0	30.1	30.1	4.5	.149
Dec. 1	24	32.7	2.8	29.9	5.5	28.3	28.3	4.4	.184
2	24	31.8	3.2	28.6	6.0	26.9	26.9	4.9	.182
3	24	35.1	3.4	31.7	7.0	29.5	29.5	5.6	.190
4	24	29.6	2.9	26.7	6.0	25.1	25.1	4.5	.180
5	24	33.0	3.2	29.8	5.0	28.3	28.3	4.7	.166

Oil and H_2O leaking in from drive floor) x

at Cooks Reports

SHAFT BORE.

	excavated	concreted.	
2 - 11 - 42	88′	87′	
23 - 11 - 42	160′	148′	≈2050 gals. H_2O.
14 - 1 - 43	254′	228′	
	over 6 days, water lie.		117 → 500
1 - 2 - 43	≈270′	≈268′	
	500 → 700 gals/hr.		
11 - 3 - 43			
~~11~~ - 3 - 43	≈290′	≈288′	
22 - 3 - 43	308′		
17 - 6 - 43	335′		
24 - 6 - 43	348′	348′	
5 - 7 - 43	390′		
[redacted] - 7 - 43		388′	
15 - 7 - 43	400′		
23 - 7 - 43	428′		
7 - 8 - 43	470′	468′	
3 - 9 - 43	568′		
25 - 9 - 43	548′		
1 - 10 - 43	560′		
8 - 10 - 43	576′		
25 - 10 - 43	601′		
29 - 10 - 43	612′		
5 - 11 - 43	616′		
13 - 11 - 43		616′	

sample of water

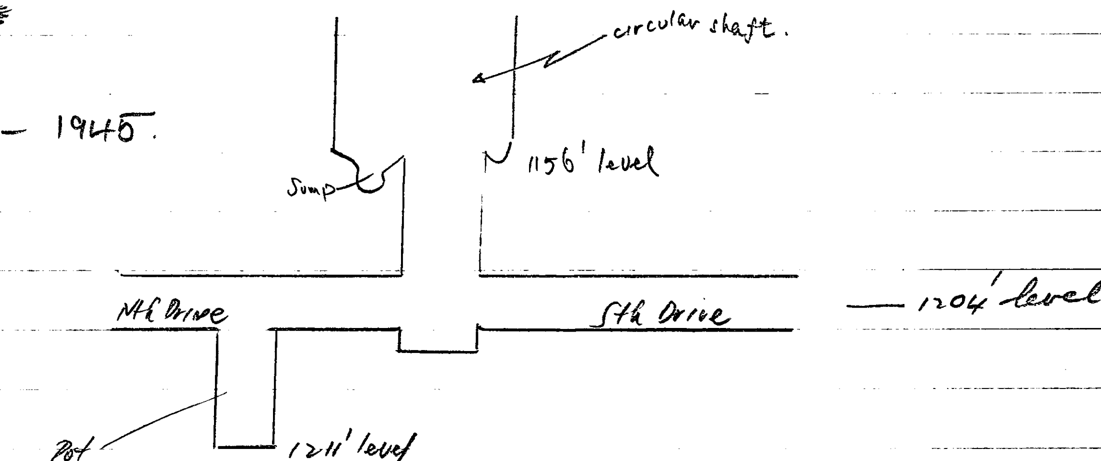
	300′	600′
$CaCO_3$		1.5
$MgCO_3$		1.5
Na_2CO_3		6.5
Na_2SO_4		7.0
NaCl	34.0	29.5
$NaHCO_3$		23.0
SiO_2	2.0	
$Ca(HCO_3)_2$	30.0	
$Mg(HCO_3)_2$	1.0	
$MgSO_4$	28.0	
$MgCl_2$	4.5	
HCl	2.5	

	excavated	cemented.	
18-1-44	636'		
21-1-44		636'	
3-2-44	665'		gas showings.
6-3-44	676'		
13-3-44		676'	
	660' pump plat count.		
	680'		
	682' water band.		
8-5-44	690'		
15-5-44	708'		
22-5-44	712'	712	
19-6-44	756'	756'	
12-7-44	763'		
24-7-44	784'		
31-7-44	784'	784	
5-8-44	788'		
13-8-44	792'		
21-8-44	816'	816	
7-9-44	820'		
18-9-44	852'		
9-10-44	880'	836'	
23-10-44	907'	+	
30-10-44	916'	916'	
15-	900 pump plat count.		
1-45	934'		
22-1-45	940'	940'	
5-2-45	964'	956'	
19-2-45	980'		
19-2-45	985'		
26-2-45	995'		
27-2-45	996'	~~996'~~	
2-3-45		996'	
12-3-45	1012'		
19-3-45	1021'	1021'	
23-3-45	1024'		
29-3-45	1033'		
27-3-45	1036'		
3~~0~~-4-45	1046'	oil film.	
4-4-45	1048'	1048'	
9-4-45	1053'		

Date.	excavated	cemented.
16-4-1945	1064'	1064'
23-4-1945	1076'	
30-4-1945	1080'	1080'
7-5-1945	1092'	
14-5-1945	1103'	
21-5-1945	1108'	
30-5-1945	1116'	1116'
11-6-45	drilling { 1117'3"	1117'3"
25-6-45	drilling { 1158'3"	
2-7-45	drilling { 1220' ½" * — glauconite struck at 1200'.	
30-7-45	SINKING ↓ 1131'	
13-8-45	1140'	1140'
20-8-45	1156'	1156'
1-10-45	1182'	
8-10-45	1189'	
15-10-45	1197'6"	

See *

11-11-1945.



	Hours Prodn	Yield Wet oil	% Koai oil	Dry oil	Dry oil / ft in 24 hrs
3-11-45	16	2 pts 8 ozs	40	2.16	0.386 pts
4-11-1945	24	4 .. 7 ..	54	2.0	0.357 pts

Date Nov 1945	Standing hrs	Total Fluid	Free Water	Wet oil	Dry oil	Dry oil / ft 24 hrs.	Prodn. Dry oil 1000' hole 24 hrs gals.
8	16	18.15	12	6.15	5.53	0.259	32.4
9	24	30.45	15	15.45	13.3	0.416	52.0
10	24	31.2	16.2	15.0	12.15	0.380	47.5
11	24	30.4	16.0	14.4	11.65	0.364	45.5

Date Nov 1965	Yield dry oil in 24 hr. lbs.	Yield dry oil / ft. of hole in 24 hrs. pints.	Estimated yield for hole 1000' long. Dry gallons / 24 hr.
3	2.16	0.386	48
4	2.0	0.357	44.6
5	1.38	0.251	31.4
6	1.115	0.203	25.4
7	1.28	0.233	29.1
8	1.31	0.238	29.7
9	1.15	0.207	25.9
10	0.94	0.171	21.4
11	0.96	0.174	21.7

SHAFT STRUCTURE

DATA GATHERING

Each file, well card and map were scrutinized. A great amount of discrepancies exist throughout the records. The exact location, the well depth, the ground elevation, the amount of oil recovered, the casing records and plugging or cementing status were all inaccurately recorded or never reported.

After several weeks of reconciliating numerous pieces of information we were ready to walk-the-ground.

FIELD SURVEY

The only unquestionable piece of information we had was the location of the Lakes Entrance oil shaft. Therefore we took the shaft as our starting point and pace the ground, endeavouring to find the wells as per the recorded distances and directions. (See Attachment No. 2)

2 December 1985

LAKES ENTRANCE OIL SHAFT (No. 47 on attached list).

Upon arrival on site we examined the shaft and as per Mr Radford's report on 20 September 1985, "It would appear that a decking has been placed over the shaft approximately 7' from the surface. The water is 3' deep." (See photographs No. 1 and 2). We collected oil sample from within the 6" pipe opened at water level.
but it could be pump oil from surrounding field

PILOT BORE (No. 40)

As planned, we walked in the direction of the closest well.

- Located 100' due north of the shaft.
- Oil and water is flowing onto the ground out of a bent 5" pipe.
- We sampled the liquid coming out of the well.

UNNAMED WELL

In an effort to locate the Fosters Bore, we stumbled on to a 10" hole opened with a cement surround.

- Located approximately 290' ESE from the shaft.
- Appears to be a cemented hole from which the casing has been pulled out.
- The well and the surrounding area are dry.

SEEPAGE

As we were walking in the direction of the Midwest 2 well we came across an oil seepage.

- Located on the western flank of the dam (see attachment No. 3) approximately 100' directly north of the broken bridge.
- Seepage is abundant.
- No well is recorded beneath that location.

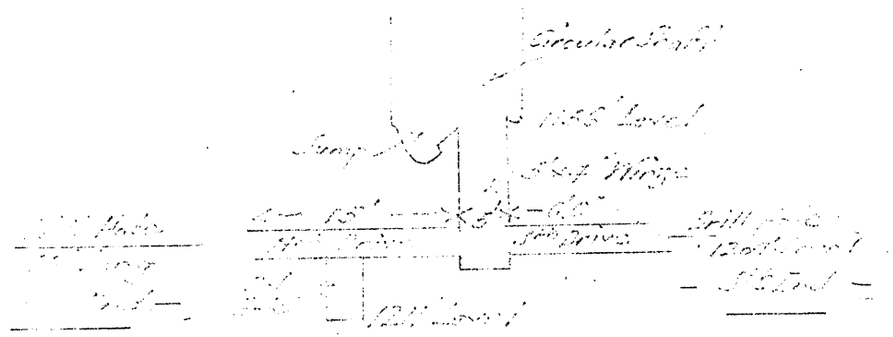
Ex. H.J. Cook's Report No 153.

Lekoa Estates,
11th November, 1945.

The Controller of Minerals Production,
Department of Supply and Shipping,
PRETORIA.

Dear Sir,

The following sketch shows the position in the [illegible] at this date:-



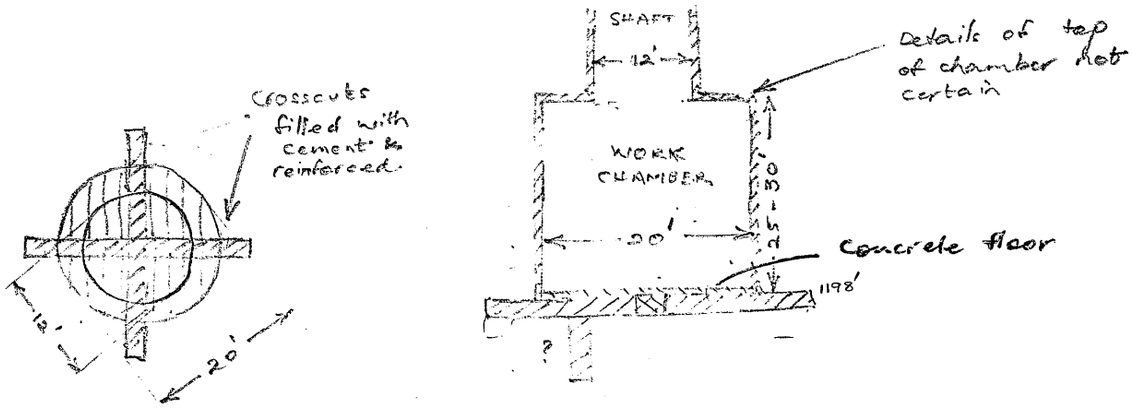
Lakes Entrance Oil Shaft

Data supplied by Mr G. Hadden 12.7.66.

Austral / Lakes asked to deepen shaft to within about 12' of the water

Department agreed.

Work chamber was constructed — 20' in diameter



Numerous slanting / radial holes were drilled from the work chamber About 40? in number

Only 1 or 2 of the drill holes penetrated to the artesian water and these were promptly plugged with cement grout.

Collar pipes / inserts for the proposed drill holes were cemented into the lining of the work chamber with valves / control attached to each pipe.

All drill holes flowed a fair amount of water and some oil, especially when valves were first opened. All still producing when operations closed down.

Mr G. Hadden supervised the final plugging of all the drill holes (with cement grout) before operations finally ceased and the shaft was closed. Mr L.S. McEachern visited the shaft in the closing stages and was one of the last two or three to go down the shaft.

Mr Hadden considered the sides of the work chamber were vertical for 25 – 30' but was unable to recollect the construction of the top of the chamber. ie. the slope (if any) of the roof etc.

The work for Austral Oil was managed by Mr (Al)bert Clark (Bert) who is now a Director of Golden Plateau (Queensland) & lives in Lakes Entrance.

Production of oil was found to be from very tiny bands of glauconitic sand which were separated by a foot or two of impervious clays.

Underground water was encountered during shaft sinking at about 5 separate horizons – each of which was sealed off as sinking proceeded.

The water quality of these was stated to vary, and one was regarded as practically "pure" drinking water. This water was actually used in their boilers.

The concrete lining developed small leaks from time to time due to ground water corrosion of the concrete

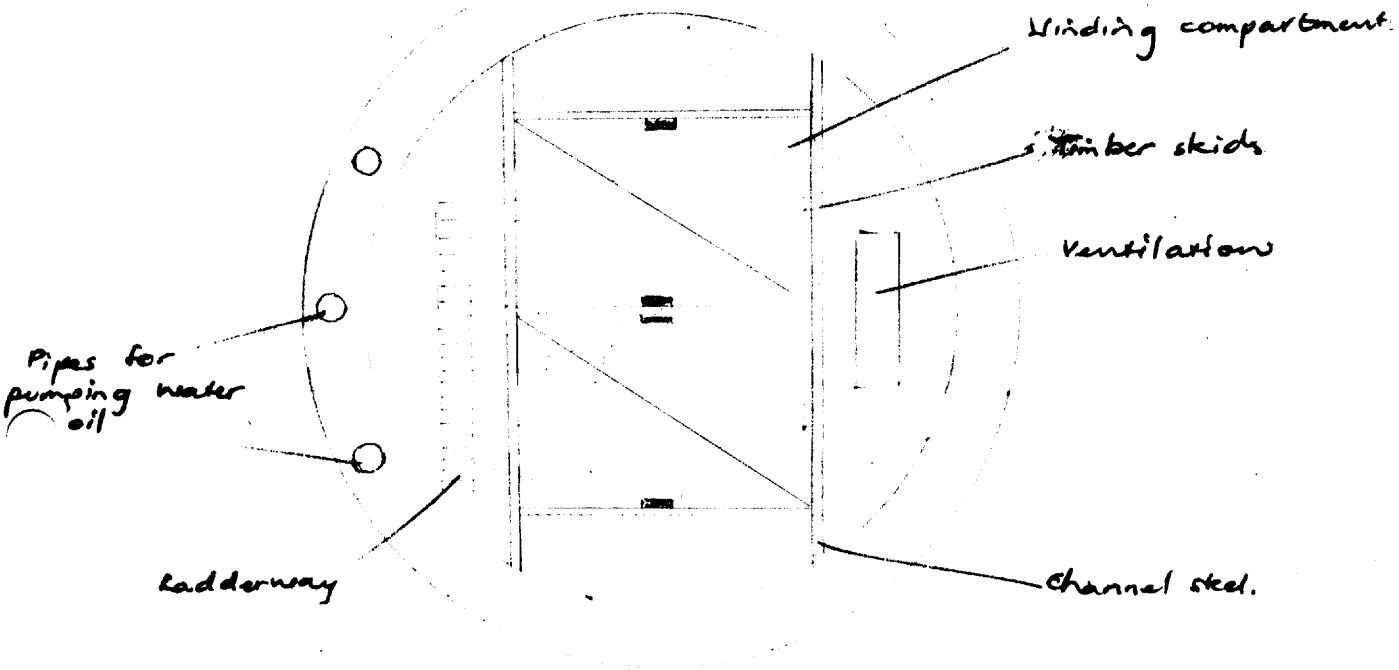
The pump pipes & ventilation pipes were built into the concrete & the shaft was regarded as an outstanding construction job by Mr Hadden.

When Mr Hadden last saw the shaft it was reasonably dry but Mr Mc Eachern stated independently that pumping of water from sumps was a fairly continuous operation

Mr Mc Eachern affirmed that the water was all coming from a high level – definitely not the [Colquhoun Gravel] artesian sands. This is supported by Dr Thomas and Mr Hadden.

The steel skids for moving drills were left Underground.

Mr Hadden is of the opinion that there is a concrete cover down the shaft [This seems very unlikely P.R.K.]



Sketch from memory (Mr G. Hadden 12.7.66)

Mr Hadden regards the shaft as unique in the world.

Following dates from Mr Hadden's diary :—

Visited Lakes Entrance

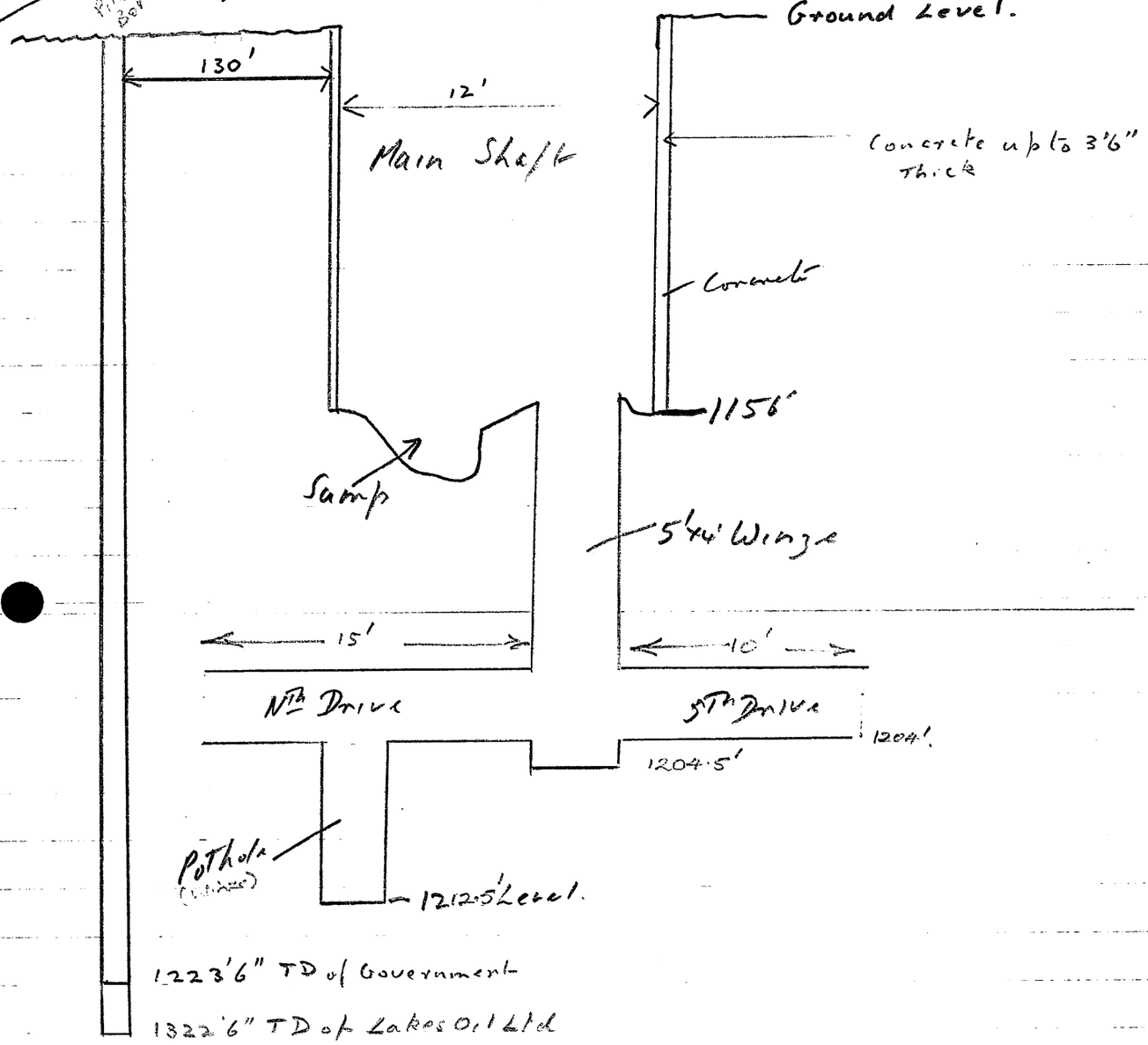
Sept 3rd, 1951 – Discussed closing down of operations

Nov. 10th, 1951 – Inspected with Mr R.K. Neal. Sec.

Dec 17th, 1951 – Last visit. Holes being plugged.

Mr A. Clark had left for Golden Plateau Mine in Queensland at this stage and the work was finalized under his second in charge.

Fig 1. CONDITION OF SHAFT AT TIME of COMPLETION of Government operations.



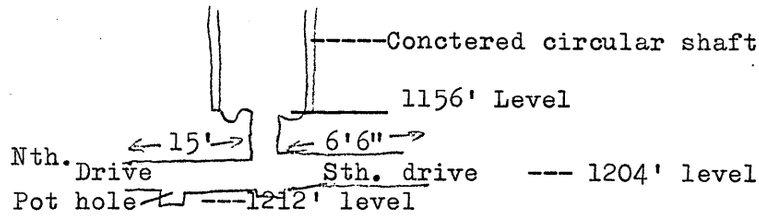
show aquifer

LAKES ENTRANCE OIL SHAFT.

Lakes Oil Ltd. bought a concrete shaft 1150 feet deep by 10 feet in diameter from the Commonwealth Government. The Commonwealth Government constructed the shaft, but it was susequently abondoned by them.

At 11:11:45

W434



Lakes Oil Ltd. deepened the shaft by about 50 feet to a total depth of 1200 feet, and built on the bottom of it a work chamber, an oil store, and a room which contained ventilation equipment. They proceeded with horizontal drilling and encountered many difficulties.

On 2oth.Feb.,1951 Lakes Oil Ltd. produced between 6 & & barrels of oil per day from the shaft, but pumping difficulties and the question of separation of oil and water ~~ex~~ were under investigation by the company.

The oil contained no free petrol in it, but contains about 20% diesel fuel, 60% lubricating oil and 20% bitumen.

On 25th.Feb.,1951 the oil was being sold as a fuel oil to local users, some of which goes to 2 butter factories at Bairnsdale, and larger quantities are used in the production of ink. Occaisionally the Vacuum Company sends it to Altona.

About 6th. Feb.,1950 shaft gave an average of approximately 190-200 galls oil / day

---

From the project supervisor's report (Cook)

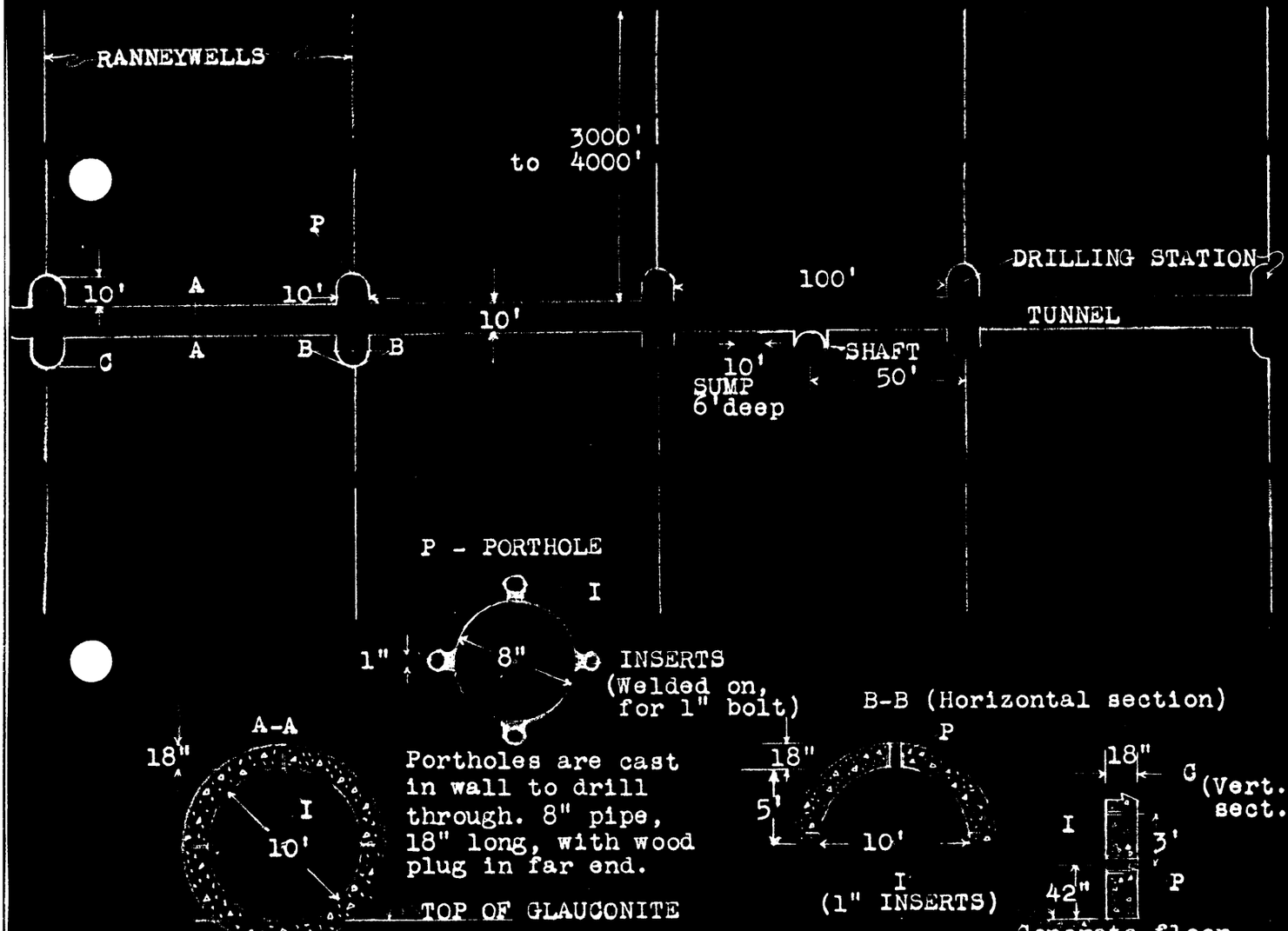
Shaft sumk to 1197'6" on 15:10:45 and cemented to 1156'
Winze from 1156'-1197'6"
Driving started at 1204'
North from 15'
South from 10'

Horizontal drilling

Ranney well No.1.	N drive a distance of 9'	H.H. 5'6"	in NW direction	
" " " 2.	N drive at face(15')	H.H. 32'	slight downward slope	
" " " 3.	S drive	H.H. 38'		
" " " 4.	N drive	2nd.H.H. 35'	N.E ly direction	
" " " 5.	N drive at distance &	25'	N.E.	

LAKES ENTRANCE OIL FIELD OPERATIONS - RANNEYWELLS PROJECT - Oct. 22, 1943.
LAKES ENTRANCE, AUSTRALIA

A simplified method of drilling horizontal wells made possible by improvements in drilling equipment. This makes it possible to eliminate the large work chamber at the bottom of the shaft - a desirable advantage, because of the great upward pressure against the glauconite. For the work chamber we substitute a tunnel running exactly up and down dip. All wells are turned down into the glauconite, then leveled off and continued level for 3000' to 4000' feet. The tunnel may be extended out under the ocean, if desired.



Portholes are cast in wall to drill through. 8" pipe, 18" long, with wood plug in far end.

If steel forms are used in building shaft, they may be usable in tunnels for placing the concrete lining. If water is found above the glauconite, the tunnel walls should be 2' thick, or well reinforced. 1" inserts are placed in top and sides of tunnel every 10'. Top of wood floor in drilling station is 1' above top of concrete and 30" below center line of porthole. Inserts cast in tunnel wall are to support pipes, including large exhaust ventilator pipes. A pump carried at lower end of tunnel delivers seeping water to sump from which it is lifted to surface. This method will permit operation of more than one drill at any time. At the start wells will be drilled 200' apart - later the intermediate locations may be drilled if 100-foot spacing is found to be best. Each hole will be cased with 100' of casing, grouted in. Portholes may be covered with steel plates until required for new wells. Occasional weep pipes should be cast in tunnel wall - these to be 2", threaded to receive cap or valve. Old vertical wells in path of tunnel to be sealed with concrete. Leo Ranney, Franklin, Penna.

SHAFT REPORTS

AND EVALUATIONS

COPY FOR MR. BROWN

(COPY)

RANNEY WELLS. 225 Bush Street,
San Francisco 4.

ENGINEERS, LIMITED.

October 7, 1944.

A. V. Smith, Esq.,
Secretary,
Department of Supply and Shipping,
Commonwealth of Australia,
125 Swanston Street,
MELBOURNE. C.1.

Dear Mr. Smith:

Lakes Entrance Ranneywell Project.

Today, through the kindness of Mr. A. S. Watt of the Australian Legation, I am in receipt of your letter of September 15th and Cook reports #87, 97, 98 and 99, for all of which I thank you. Your letter of July 22nd and the accompanying letter from Dr. Raggatt and the report on Glen Davis and the summary from Mr. Cook were all helpful. I am glad to note that from now a copy of the weekly report on Lakes Entrance will be forwarded.

Before beginning the Lakes Entrance discussion, may I ask you to have Dr. Raggatt tell me the operating pressure maintained in the Balmain workings, and the total daily production of gas. I understand that an airtight seal is being constructed in each shaft, so that vacuum can be applied. I did not receive Dr. Raggatt's letters of last February 4th and 14th.

With the information received today in hand, I am in a much better position to discuss Lakes Entrance. I note that the pilot bore hole has been cased on top of the glauconite, and that it is now making some oil; also that the hole will be cored 2 feet at a time down into the glauconite and careful analyses of the core and tests of production will be made. You have the thickness of the glauconite in the logs of wells drilled on all sides of the shaft. Extreme care should be taken not to drill clear through the glauconite. We are not so much interested in the bottom 3' to 5' of the glauconite, since our wells will be in the top.

I am much interested to know the character of the mud seams spaced in the glauconite. Does the mud run into the hole? Can it be bailed out? By carefully checking the depth with the length of core recovered, you will be able to tell whether the mud lenses squeeze out so that the substrata of glauconite are pressed together - such action would give us, in places, a lesser vertical diameter for the horizontal wells. If this is found to be the condition, we must prepare for it in designing the drilling tools. The cores that I studied were old and dry, but my impression was that the mud lenses were small in lateral extent, varied in thickness from 1/128" to 1" and in texture the mud was really a shale that would not run and would be for practical purposes about uncompressible. We must expect that the horizontal wells will cut across many of these small lenses, so I should greatly appreciate a most careful and minute survey, under Dr. Raggatt's direction, of the cores in the top 20 feet of the glauconite. I shall be much interested in the rate at which the fluid level rises in the test bore, the pressures that build up, the quantity of gas produced and the oil-water ratio - this last observation may not be entirely dependable, since if there is water in the formation above the glauconite, some water may pass around your seal.

I have no log of the test bore above 1192' - will you please send one? In sinking the test bore the last 100' were tests made to learn the quantity of water being produced by the formation? That is very important now and will be more and more so as work progresses. In most of the well logs (none of which I have since the fire) a 3-foot layer of hard limestone was shown about 50 feet

above the glauconite (I am not sure of these figures). It was my thought that we might be able to make some use of this hard rock, as a roof for the work chambers, for instance. Did the test bore encounter this limestone stratum?

Apparently Mr. Cook has been having a lot of fun sinking the shaft - well, sometimes it is tough, this shaft sinking, as we have found out in putting down more than 100 of them in all kinds of ground. Sometimes you just have to "slug it out" by old-time methods that are well-tried and established. But I do that only when I have to.

To date I have no set of working blue prints of the shaft - I understand that the plans we drew up were modified in some details to facilitate the sinking. How thick are the concrete walls? Are they reinforced vertically and horizontally. Your inside diameter is now 10 feet?

Of course I do not know how soft the ground is at 800' to 1200'. In some cases where soft ground was encountered we set up for the caisson type of sinking - built the concrete caisson under the concrete walls already in place and jacked the caisson down, utilizing the wall above in placing the jacks. My impression is that the ground is too firm for that treatment. You apparently have the good old "heaving ground" that none of us like. It is not gas or water pressure that causes this heaving - it is only the weight of the cover that causes the ground to flow until an equilibrium is struck. Assuming that the caisson type of operation just wouldn't work there, let's go to another.

Grouting ahead is one of the most satisfactory ways to get through a run of bad ground - no doubt you have used it many times. For the Lakes Entrance shaft it would be especially desirable because of what we have to do when we get to the bottom. There used to be a theory that it was necessary to have a hard rock with cracks in it to do successful pregrouting - but practice has upset that theory. Mr. Cook reports that in a 3" test hole in the bottom of the shaft at 816' the mud rose 15' when the auger was withdrawn. Then you have really soft ground that will take grout or thin concrete, if enough pressure is applied - the displaced mud would go somewhere, and we don't care where - it will flow one way as well as the opposite way.

A column of grout or slurry to the surface would weigh about 1 pound per square inch per foot - from 20% to 25% more than the column of earth. If no grout pump is available anywhere in Australia, you have an air compressor to put additional pressure on the column. If the ground is bad where we shall drive the tunnel from which to drill the horizontal wells, we may have to pre-grout along ahead of the tunnel.

If pregrouting is employed, it will not be necessary to stay 100' above the glauconite to do our drilling - of course that could be done, but a lot of glauconite would be untapped, and difficulties of operating would be added up against us, not only in drilling the Ranneywells but in operating them - and they will be operated for 100 years. Since the whole field will be operated from one hoisting shaft, it is worth some trouble to have it right. The field may produce a billion barrels of oil (1,000 million), if it really extends out under the Tasman Sea for any considerable distance.

In grouting ahead of the shaft excavation probably it would be wise to use at least 6 grout pipes spaced near the circumference, and since the bores will not stay open, the pipes would have to be perforated to allow the grout to pass out. In this country the most common cause of failure in pregrout jobs is trying to grout through too long a hole, especially where the ground is not uniform - then the grout is not distributed. There your grouting would have to be done quite a distance ahead - you might even have to build a temporary concrete floor in the shaft to get started with a grout job.

Once you have learned the ground, from a grouting standpoint, the job will go easily and the shaft will be much stronger than it would be without the grout. Unless the ground just above the glauconite is very peculiar, it could be grouted and the shaft could be carried almost down to the glauconite. A study of the cores that you will soon be taking will tell you a lot about the strength of the glauconite - so, much of the planning will have to be based on those studies.

From indications revealed by the pilot bore, it would seem almost certain that the tunnel tangent to the bottom of the shaft and the drill stations along the tunnel will all have to be pregrout jobs. From Mr. Cook's remarks I assume that the last 100' of the test bore was in ground that could not be cored, otherwise you would have cored it, since that information would be of untold value to us.

When considering the tunnel and drill chambers, one item is of great importance to us - how much water there is in the formation overlying the glauconite? How freely does it flow? Would it bail down easily in the pilot test bore? Mr. Cook's statement that the end of the casing resting on top of the glauconite receives 20 times as much water as oil may indicate that some water is coming from above - the oil-water ratio is quite different from ratios observed in the hole that was bailed dry while I was there. As I recall, we found a column of oil about 1000' high in the casing, underlain by about 135' of water. That particular bore was about the only one that had not been drilled clear through the glauconite and into the water sand below. Of course none of them should have been drilled clear through.

While I think of it - I do not know whether anything is being planned in connection with the old vertical wells on the property. Eventually we might find some use for them, or we may not - time will tell. Meanwhile they may not be doing much harm, since the glauconite is not very permeable and not much liquid has been taken out of it. Whether the bottom water is now rising up into the old bores and passing out into the glauconite may be questionable, since theoretically the pressure within the glauconite has not changed much since the wells were drilled, and the rock is too tight for gravity separation and a resultant water flooding of the sand.

Will you please extend my greetings to Mr. Beasley, Mr. Newman and Dr. Raggatt? It was a pleasure to meet Mr. Beasley in Washington - though utterly exhausted, he expressed a keen interest in this project.

With best personal regards,

Yours very truly,

Leo Ranney.

cc's:
Dr. H. G. Raggatt
H. J. Cook
C. O. Fairbank
A. B. Swinerton.

LAKES ENTRANCE OIL SHAFT...

Notes Taken from Progress Reports of the Project.

5th April 1945.

2. Rannay (12-11-43) dewatering scheme.
10' diameter tunnels (14' dian excavatn) in place of 25' diameter work chamber..
(35' .. excavation).
However Co. Experience shows that these expensive to build & maintain
7. Suggest to Rannay - 10' drain. transf. to Lge.
10. water/oil ratio esp. Imray well where after produn. of only abt. 2,000 gallons of oil ratio change. 1941 1 water to 4.536 oil.
1945 1 water to 3.866 oil.
1945 1 .. .. 3.0 oil (latest).

10th April 1945

1. Rate of Sinking 6-1-1945 916 ft.
29.3.1945 1036 ft.
2. Occurrence of natural oil.
oil film at 830 ft. } no. drop of oil.
.. .. .. 1015 ft. }
5. Oil yield of various wells.
no work on Fosters, Mid West, Government No 10, Macks Imray well - 27.2.1945 Fluid level from surface 43 ft.
column of oil 978 ..
.. .. water 253 ..
1274 ..
oil measured in Tanks on surface
↳ = 1042 gallons.
one day yield 31 pints. oil ~ 5% water
8½ .. water

6th July 1945

coring to 1220 ft. - 20 ft. into g/aeonite.
agreed to go 40 ft more
Core recovery in g/aeonite 93% - Land S.S.
oil occurrences show at 14 points distrib fairly evenly from top to bottom of the 20 ft.. Gas forced oil to extrude at each of these points. aggreg thickness of oil bearing strata in 20 feet is abt. 5 ft.

24th July 1945.

Rest. on S.S. 1" diam 1½" ht.

sample.	Compr. St. lb/sq. in.
1211 -> 1212	1190
1218 -> 1219	1360
1217'	1430.

Sample	Shear strength lb/sq. in.
12 11' – 12 12'	310
12 18' – 12 19'	390
12 17'	240.

25 July 1945. Hvdspeth advises to make variation in lb. of sample.

compression	3/4"	1"	1 1/4".
Shear	1/2"	3/4"	1".

8th October 1945.

1. March 1940 completion of Pilot Station Bore
2. 14th May 1940 " " Nungurner "

poor lithological recovery.
no. trace of oil.

3. ~~September~~ Tyne 1940 completion of Maringio Creek Bore

4. Lake Tyrrell Bore – completed 17 September 1940.

19th October 1943. South Aust. Oil Coy. – 5 bottles of refined Lubricating oil
Kerosene . .

18th April 1945. Yields from the Pilot and Tyrrell bores are, on the whole, somewhat lower than the yield from many other bores in the vicinity, but unfortunately we cannot say whether. these yields also, as reported, represent approx. water free oil.

Report No 1945/25.
MINERAL RESOURCES.
SURVEY.

Sections which yielded oil are represented by cores 5, 6, 7, 11, 12, 13 and 14. Amnt. to 93 inches. out of a total of 274 inches drilled – unlikely Remaining 181 inches oil bearing – baling tests show that it did not contribute any oil to total oil yield for the bores.

Tests on selected portions of cores (core 23). showed of 93" oil yielding section – not all was oil bearing.
Laboratory test on samples up. 51".
Remaining 42" – 10" lost in coring.
32" rejected because
visual observation showed no oil..
Visual inspection showed that oil was present in the sand & fine angular fragments. Solid portions had a superficial oil appearance. The oil appeared as

a thin coating on the fragment. (1/8" → film).

Comparison made between the apparent oil saturation of the oil-coated fragment and the saturation of adjacent fragments from which the oil coating had been scraped. It was found that the failure to remove the oil coating resulted in an apparent oil saturation of approx 8 %, whereas the removal of the coating reduced this figure to approx. 1 %.

Saturation must have been high.

In nearly every sample tested the liquid content was found to be sufficient to fill the pore space completely..

Apparatus for the Measurement of oil & water Saturation

Remarks.

Zone of order 2 → 14 % - no real significance.

0 % - these appear in sections which generally yielded oil.

5 % - came from a section of glauconite which yielded no oil..

Conclusion

Substantial part of the glauconitic S.S. is not oil bearing.

Oil Pilot Zone Results.

21/5/43. Letter from [redacted] Ltd. Toronto. Frank Connor. TORONTO.

Drum of oil from Lakes Entrance field. sent to Bureau of Mines, Oklahoma.

S.G.		0.961
API Grav.		15.70.
Flash Point (Cleveland open cup)		275 °F
Color.		Dark-Brownish Black
Odor		Pleasant. Mild Cedar
Say bolt Universal Visc.	@ 100°F	473 sec.
	130°F	190 "
	210°F	55 "
Kinematic Viscosity	@ 100°F	101.4
	~~130°F~~	87
	210°F	
Viscosity Index (ASTM)		48
Pour Test (ASTM)		Minus 5°F
Solidifying Pt.		Minus 10°F
Conradson carbon Residue		3.67 %
ash		2.05 %

BS and water (Astm) 0.3 %
Total Sulphur 0.32 %

Corrosion

Polished Copper Strip: 24 hr. @ 212°F Nil (No stain).
Further pages of Results. * see bottom of page 7.

10-7-1945 1. agreed that there is a certain "Minimum Residual oil saturation" in a sand which represents oil which cannot be recovered by normal methods.

US Bureau of Mines suggest 15% as an average for this figure. However figure usually 10% → 20% of pore space.

2. "Minimum Residual saturation" determined by lab. analysis

3. Recoverable oil saturation may be taken as the difference between 100 and the sum of the "Minimum Residual oil saturation" plus interstitial water.

eg Residual saturation 15%
Interstitial water 20%
Recoverable oil saturation 65%

ie 81% of oil in place is recoverable.

4. Shrinkage factor due to gas being released from oil at the lower pressure at the ground level. 10→30%

(won't operate to extent at Lakes Entrance)

5., 6., 7., 8., 9. Bulk of L.E oil confined to rel. narrow zone and the horiz. wells can be kept therein of porosity and permeability normal to the. Bedding planes are not markedly less than // to it. then yield from horiz. wells will probably be "many times greater than from vertical wells".

3. Yield per area of surface exposed in a horiz. well would not be less than from the equiv. surface area of oil yielding sand in a vertical well..

3-11-1944 Baggatt → Smith ... Method of coring used - Baker core barrel on percussion rig - ∴ difficult to get precise information about the "mud seams"

30-5-1945. Boyle Bros. → Supervisor ... from bottom of shaft.
dealing with hole complications.
1. high H_2O pressure - vol?
2. Methane gas - vol? pres?
3. Swelling ground..

4. gas & water pressure difficult to control.
5. Danger to drill rich.
6. no information as to gas & water likely to be met.

these reasons, the hole should be drilled from ground level using columns of 3" ordinary black pipe..

10-7-43 Cook → Barragwanath.
358' sample enclosed - 1st other than polycoal.
found to be hard L.S.

17- Oct 1945

Memorandum for the Sec.
- Lakes Entrance Project.

Following investigation of recovered cores from Lakes Entrance Shaft.

Shaft Core : Pilot Core : Imray Bore :

1. Ramney - Fairbank report sinking of a vertical shaft at L.E and develop. Kraut 400 acres
Horizontal wells approx. 2000 feet long proposed..
2. Evidence suggests Kraut oil-bearing..
3. Pilot & Shaft bores - oil in 3 thin zones sep. by layers of impermeable S.S.
Pilot bore - 34" sat. in 3 zones - only 10" were comp. entirely of oil-bearing S.S. most oil from this 10".
permeability of sem 24" too low to allow flow.
4. oil app. in two glauconitic S.S.
oil zone not penetrated by the Pilot, Shaft & Imray bores
5. Recovery will be less unless horizontal holes are drilled from bottom of Shaft. (than belowstated values)
6. horiz holes drilled with fair control & w/o great difficulty up to 1000 feet.
longer holes are difficult & costly.
7. Ramney & Fairbank — est Kraut 2000 barrels/acre would be recoverable
total quantity of 1,160,000 barrels could be recovered from the Kraut (400 acres)
8. H-bores (P., S., I.,) results correct & applicable to whole area then not more total oil content 1400 barrels/acre.
≤ 20% of oil in 2000 ft drain area recoverable..
≤ 15% .. .. .. 4000 .. ..
i.e 210 → 280 barrels recovery / acre.
oil content 100,000 barrels / in 70 acres (1000 ft rad)
" " 560,000 " " 400 " 2350 "

smaller tract — 70 acres 20,000 barrels
Ger " 400 " 84,000 "

9. Kraft oil sold 6/gallon. ≈ £1 (or $2) per barrel)
∴ total £20,000 → £60,000

10. as ≈ £140,000 has been expended & further expenditure will be required. ∴ uneconomic project.

11.
Commonwealth if it continues would primarily obtain information on field.

Report No 1945/72 Drill cores from the Kraft Bore, Lakes Entrance

Drill hole penetrated 19' 2" into glauconitic S.S. (82% rec). 18% not rec. did not have sig proportion of oil-bearing glauconitic S.S.

Main oil bearing zones occ. in top 12' of glauconitic S.S.

Other bores show oil in lower portion of glauconitic S.S. but neither Pilot or Kraft Bore intersected this portion which has ∴ been excluded from calc.

2 kinds of distribution noted.
① — oil occ. evd. thro core
② " " irreg. patches throughout core (≥ 50% oil inc.)

Aggr thickness of oil bearing zones inc calcn of total oil/acre
34" — 14" + 12" + 8" going down zones respectively.

Oil bearing glauc. S.S. contains less glauc. than barren S.S.
∴ perm. of oil bearing glauc S.S is greater than that of normal S-S

porosity 27.4 → 49.6 % (det on dry samples).
oil satun. 0 → 12.2 %
H_2O " 63.5 → 99 %
gas " 1 → 26.6 %
— Pilot & Tarpaulin Bores — det the gas quantity: ratio of gas/oil were 4 and 70 respectively. (approx).
glauc. S.S dest — do det. water lost 6ex.
14°C } water was interstitial & planar water
and 100°C } no water of crystallizn.

Total oil saturation:— going down into glauc. SS.
15.7% 14.6%/16.4% = residual oil saturation.

Oil content/acre for zones going down were

1. Total oil content 1400 ~~gallons~~ barrels/acre
2. Oil content from residual saturations 560 . . . . .

(1 barrel ≡ 35 imp. gals)

~~Var~~ (a) oil appears in 3 Kap Zones (thin & sep by impern SS).

(b) of 34" net in 3 zones – only 10" were comp of entirely of oil bearing S.S.

perm of remaining 24" too low to allow any appreciable flow.

(c) horiz contin. ?

(d) High viscosity of oil and low perm. of oil zone.

(e) oil flooding under gas recovery 25% → 30%
" " " 40 " 60% → 70%

(f).

? depend on recovery from horiz holes.

? a single hole can tap only 3 Zones

(a) difficult to keep drill hole in thin oil bearing Zones.

(b) no. & distrib. of horiz drill holes.

(c) fracturing ? as SS by exploding charges. ?

Taking all into consideration water drive recovery 15 → 20%
gas " " 5 → 10%

Recovery 2000 acre area → 100,000 barrels of the top 19' of glauc. S.S.

Thyer – Geophysicist
Canberra, 6 Oct 1945.

20th Sept 1944 A V Smith (Sec) → Gregg
Chairman of Dir. Austral Oil.
shaft covered to 816' and clean to 818'.
oil bearing SS. met at 1196' 6" – indic. of oil
5" casing. ½ gal oil/day.

(shown page 4) The utilisation of Australian crude oil in the manufacture of lubricating Greases.

Methods
- Fibre or Sponge Grease.
- Cup grease
- High temp Grease
- Al Stearate base grease.

over → page 8.

Ca Soap cold Lext axle grease type
Na - - - - - - - - -

Description of simple type of Grease mixing Equipment.

1945. Rannay Well No 1 — 55 feet.
2 — 32 ..
3 — 38 ..
4 — 35 ..
5 — 45 ..

Date? Summary of position at Lakes Entrance.

"There is no chance of a successful outcome at LE."
"In view of above the proper course is to cease all expenditure at LE and recover as much as possible of what has been spent".

8 March 1944 Palmer (sec) of Giggs Oil → Shareholders —
Horizontal drilling method extract from mag.. para drilling enables the drill to proceed 4km oil bearing sand st. for more than 50% of the time covered is the vertical method means that 90% of the time is spent drilling thru barren sand.

6 Jan 1939 Giggs. oil. - Mr Lightner waxed with Austral oil. Had cemented 2, 4, 6, 7, 8 & Houghton's bores. Repressuring system..
Try and treatment - Run a 2" pipe down a 6" dam casing & pump 7 → 2000 gallon hydrochloric acid which dissolves HCO_3 &. Lab in sand and enables the oil to pass through the glauconite. This method is cheap & could be used first.

4th Jan 1946 Austral oil → Dept of Shipping & Supply.
Whole of LE maintained by Dept.
But note that the workings are becoming flooded..
Reply — from Dept → Austral oil.
Mr Cook says that the bore head water caused adverse effect the glauconite. - Mr Cook states water can be pumped out

Shaft taken to depth of 1156 ft and dewatering costs £100 pr week and is being kept dewatered.

23 Jan 1943. Geo Brown → H T Cook.

(Except Imray bore) - all bores went thru to artesian water struck immed. following the east of the Glamorgan S.S.

glamo bottom would be where the artesian waterstrata

Imray bore. - penetration of S.S. from.
1253 feet to 1273 feet.

25 [redacted]. 1943. H T Cook → controller of Mines Perth.

Cook studied log of Imray bore - this bore had casing connected into glamorgan stop. - hole free of water & gas.

glamorgan drilled to 25' but cost 9/6" closed. at one stage is bore was left standing for 699 consec. days & oil rose to within 109' of surface.

bottom of bore was 1274'9" & head 165'9"

taking → 1100 gals of oil + 100 gals water.

then 5 gal oil & 1 gas water daily.

Introduction - pamphlet.

MINING OIL IN THE PECHELBRONN FIELD
ALSACE FRANCE.

~~Introduction~~.

MINING . . . . . GERMANY.

detail on Texas-o-like additive

Methods of testing Crude oil Emulsions.
For selection of Best Demulsifying Agent.
from Texolite Co—.

The following extracts are from a folder labled.

OIL - LAKES ENTRANCE —

Generalized Section based on estimated composite logs
LAKES ENTRANCE OIL PROJECT — J. A. PEMBERTON

0 → 50 feet	50 feet	oxidized surface material
50 → 245 feet	195 feet	dark gray marl
245 → 315 feet	70 feet	Polyzoal l.s. porous and saturated with artesian water.
315 → 960 feet	645 "	Stratified l.s. and marly sometimes mingled together.
960 → 1195 —	235 "	Occasional clays & marls. with 1 l.s. beds up to 22" in thickness each.
1195 → 1231 " —	36 '	Glauconitic oil bearing l.s.
1231 → 1321 " —	90 "	Basal l.s. porous and carrying high head fresh water.
1321 → ?	?	~~Basement~~ complex - granite or schist.

oil Itself is 40° gravity. S.G 0.96
asphaltic base crude oil devoid of gasoline or kerosene. 30% is gas oil remainder consists of heavy lube stock and petroleum residue. —

10 cores of interval 22'5" Set the depths 1,196'3" and 1,219 feet that only 93" yielded any oil at all and that "oil bearing strata constitute little more than 2%".

80.5% prodn in Pilot Bore came from a zone 45" in thickness lying Set 1,204'5" and 1208'2".

19.5% oil came from remainder of diff. Set 93' and 45".

Le Max. thickness of glauconitic l.s. (oil bearing) = 26'.

Rate of Prodn.
Tests of rate over period - 4 months.
Same oil recov. Set 1,196'3" → 1200'2"
Such of .. .. - 1204'5" → 1208'2"
water and oil .. below prior 1204'5". 46% → 54% oil

Rate ∴ 39.75 pints/day ⟶ 52.3 pints/day.

Pilot core was not baled for 64 days and in that time 501'10" fluid has risen.

∴ vol = 3,131 pints or 49 pints/day.

decline 55 → 36 pints/day.

Detailed Data then tabulated..

18 gallons of oil obtained for some time.

analysis of Data.

1. No geological formation which could be a source

2. No evidence of existence of a structure to trap oil.

3. 80% of oil comes from Area of 24".

4. Porosity of glauconitic sand is high and permeability good.

5. Rate of prodn low.

6. decline in prodn - indic. limited supply.

7. Results are typical.

8. Commercial oil to exist.

1. Gr quantity in rock of suitable porosity permeability.

2. Force present.

3. A. compr. gas.

B. Gr vol of water.

C. structural gravity force.

In L.E. only B. is present.

9. ordinary core holes in ground.. but at Lakes Entrance has fails to produce oil.. The only favourable condition (viz. vol of water) in ineffective due to low permeability..

10. In oil wells usually the oil is obtained to 50%, and rest left as uneconomical.

Conclusion

Doomed to failure. J.R. Henderson.

Followed by Hendersons credentials..

H.J. Cook. - Diary of trip to U.S.

Oil index = porosity of sand x Saturation of sand.

26-7-1945 Lenahan & Cook.

overburden needed to hold the sand down when grout is being pumped into it.

Equipment required for "chemical grouting" 3.A

(i) a standard Halliburton cementing unit either truck mounted or skid mounted.

(ii) a Standing gun perforating unit,

pump unit cost.

x $12,000 if skid mntd.

$10,000. truck mtd. + truck cost.

Gun perforating unit $5,000

Technical supervision would be required for this task.

For Cabinet. Lakes Entrance Oil Project.

INFORMATION ON THE PROCESS OF OPERATIONS.

1. quantities of oil available.

2. Physical difficulties of hazards in carrying out shaft sinking and excavating of chamber in preparation for horizontal drilling.

3. DOUBTS AS TO THE EFFICIENCY OF THE RANNEY HORIZONTAL DRILLING PROCESS BECAUSE OF UNSATISFACTORY REPLIES RECEIVED FROM MR. RANNEY IN RESPONSE TO ENQUIRIES MADE OF HIM.

& doubts of our ability to obtain horiz drilling equipment from U.S.A.

REPORT OF VISIT TO LAKES ENTRANCE ON 9TH AUGUST, 1942.

Proceeded by car on 9th August to Lakes Entrance. On arrival at 3.30 p.m. picked up Clarke and went round the field and found that Snider's foreman, George Stewart, had been paid off on the previous Friday.

BUILDINGS: Boiler house was being completed. Cement store had been constructed and flooring was being put down. Most of the material for this cement store came from Austral's stock, the old dehydrator shed from Mac's being used. Men's change and shower room had been practically completed. The lavatory block was marked out on the site. The flooring of the main engine room was completed with the exception of the cement covers for trenches regarding which instructions were given for their manufacture on the site.

SHAFT SITE: The apron had been poured and work was in progress for the sky shaft.

PLANT: The electric compressor had been connected up to the air receiver, had been run and tested and was working quite satisfactorily. Guides had been fitted on the valve stems of the diesel set which was running quite satisfactorily. Fuel and other gauges were being checked. Guard rails round V belts on compressor were being installed. The steam compressor erection had been completed, but little further work had been done on the steam winding engine.

BLACKSMITH'S SHOP was busy on iron work for sky shaft etc.

FENCING: All fencing posts had been cut and delivered, post holes had been sunk and posts were set ready for barbed wire which is on order and gates are in process of manufacture.

PIPE LINE FOR WATER SUPPLY: Pipe line had been completed and electric power poles had been cut and were being erected in readiness for the line.

ELECTRICIAN: The electric lighting installation within the power house and on the poppet legs had been completed so far as is possible. Conduits had been run in the apron for cement mixer and electric supply for the shaft. Overhead mains had been run from the power house and blacksmith's shop to Pilot Well derrick and to offices. New set of relay coils for contractors on the electric winder had been installed and were checked over. Electric limits had been installed on the winding engine.

A.R.P. LIGHTING installation was completed and on Wednesday night, the local Constable, as chief Air Raid Warden, came and inspected the installation and all necessary arrangements were discussed with him as to control of lights in the event of emergency. There is very little glare visible from the entrance to the Golf Links when all lights are on. The top of the poppet head had a certain amount of glow which was reflected from the concrete apron. This is going to be coloured down with either paint or oil to prevent reflection.

AIR LINES ETC. The air line ring had been completely connected to the air receiver thus making it possible to operate the steam engine in the blacksmith's shop, the pump from the dam or the drilling engine on the Pilot Well from the air supply. All valves and controls were checked over; certain small leaks in the air line were detected and these will be attended to on receipt of the electric welder.

FUEL TANKS: These are being completed.

PILOT WELL: On Tuesday morning, a start was made on the chemical test on the Pilot Well. The 8" casing had been cemented for a distance of approximately 6 ft. down from the surface, a pipe being run through the cementing with a valve on the top end. The casing had been lifted approximately 10 ft. above the point where the bottom of the Polyzoal meets the marl. Bailing tests had been taken on two occasions prior to Tuesday, and by bail at the rate of 1200 gallons per hour, the water was reduced to 160 ft. from the surface. It could not be reduced below that level when bailing at the maximum rate (12000 gals. per hr).

4½ cwt. of Sodium Silicate was mixed with 135 gallons of water and the well was bailed down to the 160 ft. level and the 168 gals. of Sodium Silicate solution was poured into the well. This was followed by pouring in two gallons of water. In the meantime, 2 cwt. of Calcium Chloride was dissolved in 160 gals. of water. The tank was then connected on to the feed pump and the Calcium Chloride solution was pumped into the well and followed by 200 gallons of water, very little pressure being recorded on the valve. The lower valve on the cement was left open until the water was showing on the outside of the casing when it was closed. The Sodium Silicate was put inside the casing at 3.45 p.m. on Tuesday, 11th August. The Calcium Chloride was put in at 4.25 p.m. The feed pump was kept in operation after putting the 200 gals. of water on top of the Calcium Chloride and after about ½ an hr. the pressure rose to 30 lbs. to the sq. in. inside the casing. We kept the speed of the feed pump at just sufficient a rate to maintain a constant 30 lbs. per sq. in. pressure, the volume of water required to be pumped into the well to maintain that pressure being in the region of 100 gals per hr. The pressure on the valve inside the casing showed at 23 lbs. to the sq. in. This pumping was maintained right through the night until 6.30 a.m. on Wednesday 12th August, when the pumping had to stop due to shortage of water, but by 8 a.m. they had the water again and the pump was operated to maintain the pressure at the 30 lbs. per sq. in. until 7.30 a.m. on Thursday, 17th August.

The well was allowed to stand and by 11 a.m. the fluid had risen back to the old mark at 57 ft. below the surface. (It might have risen to this point earlier). About 10 a.m. on the 13th August, we ran the 2" bailer to the bottom of the bore to obtain a sample from the base of thw well. This did not appear to have any grit on it but seemed to be a fairly consolidated sample of the reaction that had taken place with the chemicals and possibly the Polyzoal. Water was bailed from different levels inside the casing and the water was perfectly clear down to a depth of 175 ft. and from there on it became gradually more milky until at the base of the well, a sample was obtained and marked to be given to Mr. Anderson.

At 11.25 a.m. a bailing test was carried out and it was found possible by bailing at the rate of 1200 gals. per hr. to get the level of fluid in the well down to 200 ft. which was a better result than has ever been obtained on the well. It was decided to allow the well to stand until Monday, 24th August when a bailing test was to be repeated to ascertain the conditions that may then be attainable.

On Monday, 10th August, the Hon. T. Paterson visited Lakes Entrance and made an inspection of the works and stayed at Lakes Entrance on Monday night and again visited the works on Tuesday morning, leaving by train that day for Melbourne.

Mr. Snider arrived on Tuesday afternoon and witnessed the tests and generally checked over everything on the field.

We left the field at 12.30 p.m. on 13th August to return to Melbourne that night.

(Signed) C.S. DEMAINE

Recs 28/11

Agenda No.....

Copy No.....

7/11/45

FOR CABINET.

LAKES ENTRANCE OIL PROJECT.

(a) Mr. Cook's Report.

The Commonwealth's participation in the Lakes Entrance Oil Project began in May, 1942, when leases held at Lakes Entrance by the Austral Oil Drilling Syndicate, N.L., were resumed under the National Security (Minerals) Regulations. This action was taken as part of the Government's policy of promoting the search for natural oil in Australia as an urgent defence measure, and was based on a favourable report from two American oil experts selected by the U.S. Bureau of Mines for the purpose, Messrs. Ranney and Fairbank, who personally examined the area. The Syndicate had indicated that it was unable to provide the funds necessary to carry the project to completion. So far actual expenditure on the project amounts to £140,461, of which the Commonwealth's share is £105,346 and that of the Government of Victoria £35,115.

2. With a view to obtaining a clearer assessment of the possibilities of the Lakes Entrance Oil Project it was decided to send the Supervisor of the Project, Mr. H.J. Cook, to U.S.A., and he left Australia for this purpose by air on 16th May and returned at the end of July. Dr. Raggatt, the Director of the Commonwealth Mineral Resources Survey was in U.S.A. at the same time as Mr. Cook and co-operated with him in certain of his investigations. Dr. Raggatt returned to Australia at the end of September and has now submitted a separate report which is dealt with later in this memorandum.

3. We were prompted to take this action because of information which had been acquired in the process of operations concerning -

(1) quantities of oil available;

(2) the physical difficulties and hazards in carrying out shaft sinking and excavating of chamber in preparation for horizontal drilling;

(3) doubts as to the efficacy of the Ranney horizontal drilling process because of unsatisfactory replies received from Mr. Ranney in response to enquiries made of him; and

(4) doubts of our ability to obtain horizontal drilling equipment from U.S.A.

4. Mr. Cook has now submitted his report which indicates that he consulted a leading oil Geologist, in the person of Mr. J.R. Pemberton, on the possibilities of recovering oil in commercial quantities, and other authorities in U.S.A. on shaft sinking problems as well as conducting investigations into the Ranney process of horizontal drilling. The results of Mr. Cook's investigations might be epitomised as follows:-

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(1) <u>According to Mr. Pemberton the Lakes Entrance Oil Project is doomed to failure under any system of production because oil is not available in commercial quantities</u>.

(2) No satisfactory method of horizontal drill hole survey has yet been developed, and

(3) No sure and safe method has yet been adopted which would enable the sinking of the shaft sufficiently far to permit horizontal drilling operations to be carried out.

5. In view of this Mr. Cook recommends the adoption of one of two courses. These are -

(1) to cease operations and liquidate the venture; or

(2) to cease operations and let the project stand with a view to operations being resumed at some later date if, and when, horizontal drilling methods are perfected and shaft sinking technique is developed to a stage where the dangerous and difficult problems associated with the venture can be coped with.

6. Copies of Messrs. Cook's and Pemberton's reports, together with the comments of the Executive Committee which controls the enterprise are attached hereto.

(b) <u>Dr. Raggatt's Report</u>.

7. A copy of Dr. Raggatt's report is attached hereto. In effect, Dr. Raggatt states that if it is possible to obtain oil from an area of 70 acres by horizontal drilling the estimated recovery would be 20,000 barrels, and if oil could be drawn from 400 acres the estimated recovery would be 84,000 barrels. The estimated value of this oil would be £20,000 and £60,000 respectively.

8. Dr. Raggatt adds that as approximately £140,000 has been expended on the project, and further expenditure will be required to reach the producing stage it is concluded that the project must be uneconomic. Dr. Raggatt concludes by saying that if work is continued by the Commonwealth it will be primarily to obtain information on the field and on the technique and efficiency of horizontal wells. This would be valuable to the petroleum industry.

<u>NOTE</u>: Even if horizontal drilling could be carried out over a limited area (1,000 ft. radius from the shaft) and there is a serious doubt about this, these operations would occupy a long period involving additional expenditure for drilling and the heavy maintenance costs during the whole period over which the possible 20,000 barrels of oil are being recovered. This expenditure would be far greater than the value of the oil.

(c) <u>Brief Review of the Project</u>.

9. On the basis of the Ranney estimate of expenditure of £100,000, funds totalling £150,000 were provided initially for this project, three-quarters of the amount by the Commonwealth and one-quarter by the Victorian Government. This amount was considered to be insufficient and

/in August,

in August, 1944, Cabinet approved of an additional £50,000 on the basis of the State increasing its provision on a pro rata basis.

10. In February, 1945, Cabinet directed that although no additional expenditure was to be incurred by the Commonwealth by way of assistance to private Companies engaged in the search for natural oil in Australia an exception was to be made in the case of specified undertakings, including the Lakes Entrance Oil Project, for which additional funds would be provided to complete operations.

11. Under the Ranney specifications vertical drilling methods were discarded in favour of a new method of horizontal drilling, and it was estimated that with a shaft at 1,200 feet in depth and 50,000 feet of horizontal drilling around the base of the shaft a yield of 40 million gallons of oil could be obtained from the project within five (5) years; the project becoming revenue earning after 20,000 feet of drilling.

12. The shaft has now been taken down to a depth of 1,156 feet. Technical opinion, including amongst others the Chief Inspector of Mines of Victoria, was strongly opposed to the taking of the shaft to any greater depth because of the fear that high water pressure (amounting to 600 lbs. to the square inch) would endanger life. Arrangements were, therefore, made for the construction of a shaft 5' x 4' from the 1,156 ft. level and this shaft has now been taken down to a depth of 1,204 ft. 6 ins., or approximately 4 ft. in the oil sands. Driving is now being carried out. Any future decision regarding the main shaft which is 10 ft. in diameter is to be made in the light of results of this work.

13. Endeavours have been made from time to time to reach an arrangement with the Austral Oil Drilling Syndicate under which the Syndicate would accept an equity equivalent to 35,000 £1. shares in the project, with no provision for increasing that equity in the event of further capital beyond £150,000 being required to complete the project. These negotiations have not met with any success; the Syndicate having rejected the offer and has lodged a substantial claim with the Compensation Board (Minerals). This claim was set down for hearing on 4th September, but it has been mutually agreed to defer the case for an indefinite period.

(d) <u>The Position of the Governments</u>.

14. It will be noted that this project was resumed under the National Security (Minerals) Regulations which will now lapse within a relatively short space of time. Unless, therefore, some stabilised arrangement is made with the Syndicate to carry on the project on a partnership or other basis the position will shortly arise where the Syndicate will be able to resume possession of the property, and derive any advantages from Government development, including plant and equipment, unless this is removed before legislation lapses.

15. Counsel's opinion has been obtained, copy of which is attached, which deals with various courses of action open to the Governments in connection with this project. In the light of information now available to us,

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which was not available when Counsel's opinion was given, as Mr. Cook and Dr. Raggatt had then not visited U.S.A., it would not appear that the proposals discussed by Counsel need be dealt with in detail.

16. In brief, the courses of action discussed by Counsel are the return of the project to the Syndicate on the understanding that the Syndicate is to repay all expenditure incurred by the Governments; the conclusion of a partnership agreement with the Syndicate; the return of the project to the Syndicate on the Syndicate's undertaking to repay Government expenditure as a first charge against 50% of the profits, and the compulsory acquisition of the project by the Commonwealth under defence powers.

17. It is clear that the Commonwealth should not compulsorily acquire the project, and in the light of Mr. Cook's and Dr. Raggatt's reports a partnership agreement would not merit consideration. The alternative to these proposals is the handing back of the project to the Syndicate on a basis to be determined.

18. In any further negotiations with the Syndicate we should inform the Syndicate fully of the results of investigations carried out by Mr. Cook and Dr. Raggatt in U.S.A., and, if we accept the views of Mr. Cook, the maximum return which the Governments might expect would be the value of realisable plant and equipment.

19. The Syndicate has no money and it may ask for a loan to enable operations to be continued, thus enabling personnel to be kept together pending the raising of capital. If the Commonwealth were to advance money for this purpose, or authorise the raising of capital such action would be tantamount to an expression of some confidence in the future of the project. If we accept technical opinion outlined herein we would not be justified in either lending the Company money or authorising a capital issue. The alternative, therefore, would be to arrange for the Disposals Commission to liquidate the venture to the best advantage.

SUBMISSION.

In view of the foregoing it is submitted:-

(1) as to whether the Commonwealth should decide to cease operations and liquidate the venture;

and

(2) if the decision in respect of (1) is in the affirmative, whether the Victorian Government should be so informed, and be asked to co-operate with the Commonwealth Government in discussions with the Syndicate with a view to ascertaining whether the Syndicate has any proposals to make before liquidation arrangements are put in train; such proposals, if they are made, to be dealt with by the Treasurer and myself on behalf of the Commonwealth Government;

(3) as to whether money should be advanced to the Syndicate pending the raising of capital and whether any proposal by the Syndicate to raise capital should be approved.

(W. P. ASHLEY)
Minister for Supply and Shipping.

7th November, 1945.

(COPY)

R A N N E Y W E L L S

Morro Bay, California,
December 26, 1944.

A. V. Smith, Esq.,
Secretary,
Dept. of Supply and Shipping,
125 Swanston Street,
Melbourne,
AUSTRALIA.

Dear Mr. Smith,

Thanks for your letter of November 21st and the enclosed reports No. 106 and 107 of Mr. H. J. Cook, together with his letter of the 17th. To date blue prints of the shaft at Lakes Entrance and of the Balmain workings showing the location of the seals have not arrived. The Lakes Entrance situation looks considerably better, judging by Mr. Cook's reports. The following is for Mr. Cook:

Pregrouting. Apparently the ground farther up the shaft, where you tried to pregrout, would not flow and therefore could not be displaced by the grout. Just plain mud can be displaced if enough pressure is placed on the grout. If very high pressures were to be used, you would have to build a temporary concrete bottom in the shaft and anchor it to the side walls. Best results are obtained, in an excavation as large as 14' in diameter, when the grouting pipes are placed not over 4' apart along the circumference and each pipe is perforated opposite the area to be frouted. Such things as the thickness of the temporary shaft bottom, the size, length and spacing of grout pipes, the spacing, number and size of the perforations in the grout pipes to be applied - all these depend upon the nature of the ground and the quantity of water present.

Escape from pregrouting. Your latest report stresses the absence of any large quantity of water, both in the glauconite and in the 200' above - which may obviate the necessity of pregrouting. The test bore indicates that the bottom pressure may build up to 600 #psi - with sufficient confinement, 1 gallon of water per day would cause such a pressure, but remove the water and the pressure is gone. From your latest report it seems probable that you can easily remove the water and soft mud (if any) ahead of the excavation by means of perforated pipes, for relief, inserted to the most favorable depths. Eventually these relief holes (or hole) would extend about 2/3 of the way through the glauconite. With the pressure so relieved, there should be little danger of the hard bands breaking off as sinking progresses.

If the pressure is relieved in the glauconite and in the layers above, probably it will be unnecessary to produce a stable (solidified) block of ground above the glauconite, since with intermediate pressure relieved the entire thickness of glauconite will behave as a block, such as it is, without rupturing from the top, layer by layer, as you feared. If the softer bands in the glauconite would flow, I would like to see them pregrouted, but this may not be possible. I feel rather confident that by relieving the pressure the shaft can be carried down very close to the top of the glauconite - then a heavily reinforced bottom should be built in the shaft. Unfortunately, I do not know the exact nature of the ground for the 2 feet just above the glauconite.

I note that you are not greatly worried about driving the tunnel. We can probably relieve the pressure there also by drilling a horizontal bore along under the tunnel path, if necessary, in the top of the glauconite. This hole would not be lost, since it would be operated as an oil well.

If necessary, though it would be greatly undesirable, the tunnels could be slightly inclined, downward from the shaft bottom, until they approach the glauconite, then continued parallel to the glauconite. However, this slope would be a great inconvenience for the next 50 or 75 years - so I hope the shaft can be carried right down to the glauconite, which should be possible if the pressure is relieved.

As regards the Franklin operation, and your questions about it:

1. Average production in the Franklin Heavy Field in 1941 was 1/6 of a barrel per day. However, a very few wells made 1 barrel daily - without these the average was 1/10 of a barrel daily.

2. As yet we have no decline curve on the Franklin horizontal wells. As to production per foot of hole before shooting and its application to Lakes Entrance, several things should be borne in mind: more than half the core at Franklin was unproductive; there is no pressure left in the rock, while you have 600 #psi; the oil is 45% lubricating oil and contains neither gasoline nor kerosene, though the gravity is higher than yours; earth temperature is 50°F, while yours is 105°, which reduces the viscosity of your oil below that in Franklin; production from the horizontal wells of the Venango installation before shotting was about 5 gallons per day per 100' of productive hole.

3. Effect of shooting. All the vertical wells in the field were shot before commercial production was obtainable. Decline curves on these wells fell from about 10 bpd when the field was virgin down to the present levels, during a period of 80 years. There was no important quantity of gas when the field was first developed - sometimes enough to run an engine a few days. After shooting, the horizontal wells made about 20 gallons per productive 100', without the application of vacuum.

4. The application of vacuum increased production, after shooting, to about 50 gallons per productive 100'. All the old vertical wells on the lease have been under 26 points of vacuum for many years - without it, there would be practically no production.

5. The oil sand. The top 12' to 15' of the sand is barren. The next 19' to 20' (the substratum being worked) varies in saturation from 5% to 29%, without much uniformity or correlation. (Oil saturation means the percentage of pore space filled with oil). Total oil content of the 20' being worked averages about 6,000 barrels per acre. The bottom 12' to 15' of the sand is very porous and pebbly and is filled with salt water. These particular unfavourable factors do not exist at Lakes Entrance.

6. The old vertical wells produce 45 bbls. of water to 1 of oil. Our ratio is 10 to 15 bbls. of water to 1 of oil. At first the horizontal wells produced a small percentage of emulsion - but it was concluded that this was caused by pumping. The vertical wells in the field produced some emulsion when new, which the drillers accounted for by the presence of fresh drill water in the sand about the holes. The emulsion breaks down readily by the application of heat and a small quantity of Treatolite.

Non-correlating barren levels in the glauconite should not be disconcerting - a few feet away from the test the saturation may be excellent on the same level. Results in the test bore indicate a very productive installation.

Yours very truly

(Sgd.) Leo Ranney

C O P Y. for Mr. Baragwanath.

Mines Department,

Mining Inspector's Office,
80 Bent Street,
WONTHAGGI.

6th February, 1945.

REPORT OF INSPECTION OF THE LAKES ENTRANCE OIL SHAFT, MADE ON THURSDAY, THE 1st OF FEBRUARY, 1945.

Surface Plant and Equipment,

This is all in good order. During the time while shaft sinking was held up just before Christmas, advantage was taken of it to overhaul all the surface equipment and to carry out any work that was found necessary.

Shaft,

Sinking had been carried down to 964 feet, and preparations were being made to commence concreting a 24' lift. The ground being sunk through at present is some of the best that I have seen in the shaft, being dry and with very little Gas showing. From the point of view of the heavy artesian water that is known to exist immediately below the Oil sands, I would welcome some very much harder ground for the next 250 feet in order to impose a safety zone between the shaft bottom and this water. As this lift will complete a distance of 44 feet sunk since starting again after Christmas, I think the time has come when a definite decision should be made as to how near the shaft bottom should be taken to the artesian water, and what method is to be adopted (if any) to strengthen the strata between this point and the water. This is rendered more urgent by the fact that there is little or no data available as to the mechanical strength of the stata being sunk through, which visually, appears to possess none, and also by the known fact that at approx 600', water which would have about one half the hydrostatic head of that at 1200', broke up through approx 17' of considerably stronger ground than we are in at present. From the point of view of safety for the men engaged in the sinking, I would welcome an early decision on this matter.

Explosives,

The Explosives that were condemned by the Explosives Inspector were destroyed by him and his Assistant, and the Magazine is now empty.

Yours faithfully,

(Signed:) G.HADDEN.

Inspector of Mines.

Secretary For Mines.
Treasury Gardens.
MELBOURNE.

COMMONWEALTH OF AUSTRALIA

Department of Supply & Shipping.

Mineral Resources Survey,
Census Building,
City, Canberra.

19th January, 1945.

Mr. A. C. Smith,
Executive Officer, Minerals,
Department of Supply & Shipping,
409 Collins Street,
MELBOURNE C.1. Vic.

I refer to your memorandum M6/3 of 17th January.

I think it is a bit premature to discuss the evidence available from the pilot bore at Lakes Entrance and am only offering this comment because you have requested me to do so. I would much prefer to talk than to write about these things as verbal discussion brings out points which may be missed in writing, and the written word can be misunderstood.

Mr. Cook's conclusion that the evidence of the pilot bore indicates that the amount of oil present in the glauconitic sandstone is 1/10th of that estimated by Ranney is not soundly based. There are four factors which have to be multiplied together to make an estimate of the probable oil recovery. These are thickness, porosity, saturation and recovery. Mr. Cook deals with only one of these factors 'thickness' and takes no cognisance of the other three. It will be clear that if one or more of the other three factors is higher than Ranney assumed, this will tend to offset any error in the figure taken for thickness. For instance if the saturation and recovery factors only were each three time that assumed by Ranney — and this is not possible — the error due to a wrong assumption as to thickness of oil sand would be nearly offset. (3 x 3 = 9).

In this connection it should be remembered that <u>these factors are not yet known for the actual oil zones</u> as Thyer did not find any oil in the cores he examined.

(Incidentally it is considered that the total thickness of the oil mud veins is considerably more than 6". In saying this we do not confine the term 'oil mud vein' rigidly but interpret it to mean oil saturated layers.)

Personally I have never set much store on a calculation of the oil content of the reservoir based on assumptions similar to those made by Ranney. As Mr. Cook points out it is very doubtful whether Mr. Ranney himself placed much reliance on an estimate of this kind.

The statement by Ranney and Fairbank which is quoted hereunder is the one I think of which most notice should be taken.

> * It has been our experience that where vertical wells are capable of producing in excess of five gallons of oil a day from a sand of this thickness (30 feet), the field is susceptible to development by secondary methods. It has also been our experience that when a column of oil will rise more than 500 feet in a standing well in a sand of this thickness the field may be profitably developed by secondary methods of recovery."

The pilot bore has demonstrated that a yield of oil approaching five gallons is being obtained from a thickness of strata of somewhere about 3 feet. It would seem fair to assume that if Ranney and Fairbank had found that a field which produced upwards of five gallons

of oil from a thickness of 30 feet was susceptible to development by secondary methods, that it would be profitable to develop a sand with about the same yield from a considerably reduced thickness.

A great deal of thought is being given in this Branch to interpretation of the evidence available from Lakes Entrance. A start has been made with our analysis of the cores from the pilot bore and this work will be kept going without interruption. When these results are available we will present a report which it is suggested will provide a good basis for discussion.

(Sgd) H. G. RAGGATT
Director.

LAKES ENTRANCE OIL DEPARTMENTAL EXECUTIVE.

MINUTES OF MEETING OF LAKES ENTRANCE OIL DEPARTMENTAL EXECUTIVE COMMITTEE HELD IN MELBOURNE ON 26TH JANUARY, 1945.

Present:	MR. J. MALCOLM NEWMAN,	Controller of Minerals Production (Chairman).
	MR. GEORGE BROWN,	Secretary, Department of Mines, Victoria.
	MR. A. C. SMITH,	Executive Officer - Minerals, Department of Supply and Shipping.
In Attendance:	MR. H. J. COOK,	Supervisor, Lakes Entrance Oil Project.
	MR. W. BARAGWANATH,	Consultant to the Department of Mines of Victoria.
	DR. H. G. RAGGATT,	Director, Commonwealth Mineral Resources Survey.

(1) MINUTES - The minutes of the previous meeting held on 29th November, 1944 were confirmed.

(2) ACCOUNTS - Accounts as per Schedules 28 & 29, copies of which are attached, covering total expenditure amounting to £49 and £641 respectively were passed for payment.

(3) MR. COOK'S VIEWS ON THE POSSIBILITIES OF OIL PRODUCTION AT LAKES ENTRANCE - The meeting had been specially convened for the purpose of considering views which had been expressed by Mr. H. J. Cook, the Supervisor, on the possibilities of oil production at Lakes Entrance following results which had recently been obtained from the pilot bore. The views expressed by Mr. Cook were -

"The Ranney estimate of oil production at Lakes Entrance was based on assumptions now known to be unfounded and the actual production will probably be less than one tenth part of the estimate.

"I make this statement because Ranney estimated production from 30' of oil bearing sandstone. The fact is probably less than 3', or less than one tenth. Alternatively, Ranney estimated oil production on 6' of oil mud veins. The probability is less than as many inches. These remarks are based on observations of our Pilot Bore Hole and on investigations carried out on cores from No. 10 Bore Hole. They are not intended in any way as a criticism or reflection on Ranney who bluntly stated in his report that he had not the data on which to base an estimate and that he was forced to make assumptions. It would not be right for me to modify the principle involved in Ranney's calculation of oil production, but I think it is perfectly correct to modify it as regards the amount of country from which oil is to be drained".

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The Committee had before it the formal comments of Mr. Beragowanath and Dr. Raggatt in connection with this matter and copies of memoranda prepared by these Officers, dated 18th and 19th January, 1945 are attached hereto.

Considerable discussion ensued; it was realised that the views expressed by Mr. Cook were of the utmost importance and might influence future policy in connection with this development. For this reason the Committee desired to be in a position to present the Minister for Supply and Shipping, and the Minister for Mines of Victoria, with a considered opinion for guidance and decision. After hearing further views expressed by Dr. Raggatt and Messrs. Beragowanath and Cook the Committee decided that the following statement represented its views on the matter so far as they could be expressed at the present juncture:—

"Results to date of the pilot bore which has been sunk alongside the shaft at Lakes Entrance confirm information from certain other bores in the locality on which a careful check was kept during drilling. The information available from the pilot bore is no more precise than has been obtained previously, but is, in general, similar. Insofar as the pilot bore may be considered typical of the area, it is now confirmed that the oil bearing layers are restricted in thickness and that both assumptions of Mr. Kenney as to thickness are high; consequently the probability is that the total quantity of oil available may be less than he estimated. It must be borne in mind, however, that there are other factors which should be ascertained before a final check on probable oil content can be made. These factors are saturation and probable recovery. Analysis of the cores is now going forward and should be completed in about a month when a further memorandum will be submitted.

"A qualifying factor is that owing to the necessity of making all possible tests of the pilot bore whilst it is free of water, drilling has been stopped some 10 feet short of the full thickness of the glauconitic sandstone in which the oil bearing bands occur. From the evidence of surrounding bores there is good reason to believe that there is an oil bearing zone at or near the bottom of the glauconitic sandstone which has not been tested by the pilot bore.

"Obviously it would not be wise to make a final assumption as to the possibilities of the Lakes Entrance oil sand on the results of this one bore and it is, therefore, considered that a further bore should be put down in the vicinity of the shaft.

"At the same time the Murray bore should be bailed dry and the amounts of oil and water present therein accurately determined. Thereafter bailing operations should be continued to determine the normal rate of yield in this bore at the present time for comparison with pilot bore results."

The meeting terminated at 1 p.m.

CONFIRMED

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(Chairman)

SUMMARY OF

POSITION AT LAKES ENTRANCE.

1. The report prepared by oil geologist Pemberton of Los Angeles is unequivocal in its finding.

It states clearly what has been hinted by so many of the men whom we have contacted that there is no chance of a successful outcome at Lakes Entrance.

There is no doubt that the step of consulting approved geologists should have preceded all other activities at Lakes Entrance and, in fact, it was thought this had been covered when Ranney was called in, more especially as he was recommended by the U.S. Bureau of Mines. Instead of putting ourselves in the hands of a consultant we fell into the hands of a promoter.

In view of the above the proper course is to cease all expenditure at Lakes Entrance and recover as much as possible of what has been spent.

2. If, for any reason, it be decided to disregard the foregoing recommendation then the following steps are necessary.

(a) To find the experts who can do controlled horizontal drilling. Dr. Raggatt has information that this was actually done as a special secret war activity.

When the procedure is released for public use and the equipment made available it can be said that there is a solution to this problem, which we found to be still in the air after inspecting Ranney's operations in America.

(b) No satisfactory method of survey of horizontal drill holes has yet been developed. When it is developed and tested it will be time to start drilling and not before.

(c) To sink the shaft sufficiently far to enable horinzontal drilling to be done is dependent on finding a method of consolidating the water bearing ground below the oil sand. Enquiries in America have tended only to confirm that grouting in sand is a specialist's

-/job

job and that the outcome is most uncertain.

All enquiries showed that the Halliburton Oil Well Cementing Company were the likeliest people to be able to do this.

Halliburtons themselves are not keen on the job and do not guarantee success.

3. We are not ready to proceed with any one of the steps set out in para 2 above and if we do undertake them we shall be pioneering each one of them with inadequate resources and experience. Finally -

4. I recommend that the Lakes Entrance Project be abandoned and all possible assets be recovered.

If the above, for any reasons, be found to be not acceptable then the plant should be closed down and the project be allowed to rest until the problems set out in para 2 have been solved elsewhere on properties where the chances of success warrant the expenditure of sufficient money to solve them.

In the meantime the property at Lakes Entrance will not deteriorate as it might well do with inexpert efforts to push the project to finality now.

LAKES ENTRANCE OIL SHAFT.

Copied from Department of Mines Annual Reports.

For 1946. "During the year Austral Oil Drilling Syndicate took over the oil Shaft at Lakes Entrance from the Commonwealth and State Governments, and is engaged in carrying out the work of deepening the large shaft, and the construction of a drilling and work chamber above the glauconite, at the 1198 foot level."
G. Hadden - Chief Mining Inspector.

For 1947. "During 1947, the task of completing the work chamber of the Lakes Oil Limited shaft at Lakes Entrance was finalized. This drilling and work chamber is 20 feet in diameter and has the necessary piping let into the concrete walls and fitted with stop works and stuffing glands through which the horizontal boring will be carried out.

This precaution will allow any artesian water under pressure to be shut off from the shaft should it be inadvertently drilled into."
G. Hadden - Chief Mining Inspector.

For 1948. "Having completed the work chamber and sump, exploratory drilling has been carried out from the drilling platform. The holes drilled vary in length up to 200 feet and are mostly 1½" in diameter. During the boring, cores have been taken and analyses carried out at the Company's laboratory at the works. Pressure gradients have also been recorded, showing pressures within the glauconite of up to 520 lb. per square inch.

Rate of yield of fluid obtained is also noted. Three treatment tanks of 2,500 gallons capacity and one of 1,000 gallons have been erected where the separation of the oil and water is effected. The first of a series of 20,000 gallon storage tanks has just been completed. Experiments have been carried out to improve the ventilation of the shaft bottom where the humidity is high. A feature of interest is the use of oil from the shaft as a fuel for the boilers which are used for steam generation. Up to the present approximately 30,000 gallons of oil have been produced.
G. Hadden - Chief Mining Inspector

For 1949. "At the Lakes Entrance Oil Shaft, operations by Lakes Oil Ltd., testing operations were carried out from 15 exploration holes drilled from the work chamber 1196 feet below the surface. The exploration holes extend nearly horizontally for distances of up to 200 feet, and the dry oil recovered from fluid pumped or bailed from the sump to the separators amounted to 34,410 gallons. This should be regarded as a yield from tests only and not an annual out put.

In December the first of the holes drilled by the directional drilling method was held within the glauconite for a distance of 702 feet, producing an average of 77% dry oil".
G. Brown - Secretary for Mines.

"Operations were continuous for the year, work being mainly concentrated on the drilling of new holes and the deepening of existing ones.

In order to facilitate the transfer of fluid to the surface a new 40h.p. three-throw pump with a capacity of 4,000 gallons per hour against a head of 1,200 feet has been installed in the shaft bottom. This pump will deliver from the work chamber to storage tanks on the surface. Grouting of the walls of the shaft was carried out to prevent the seepage of moisture, and this has had a beneficial effect on the humidity of the air in the work chamber."
G. Hadden - Chief Mining Inspector.

For 1950. "At Lakes Entrance the pumping of crude oil was continued by Lakes Oil Ltd. from the work chamber at 1198 feet below the surface, where bores have been drilled radially into the oil-bearing strata. Production was not on a continuous basis, but comprised tests during which certain bores would be turned on, measured for flow during fixed periods and then turned off again. Altogether 40,000 gallons of crude oil were recovered from these tests". - R. Neal - Secretary for Mines.

From 1951. "Oil production in Victoria ceased towards the end of the year when Lakes Oil Ltd. suspended operations at Lakes Entrance Shaft after 10 years of work. From the begining of 1951 until the time of closing, 68,180 gallons of crude oil had been obtained from tests".
R. Neal - Secretary for Mines.

Statistics for 1951

Crude Oil 68,180 gallons produced in 1951
287,873 gallons produced up to 31/12/1951.

LAKES ENTRANCE OIL SHAFT.

Reports of Oil and Gas contained in H.Cook's weekly reports.

Just above 560'	H_2S gas evident.
± 560' - 576'	H_2S gas in the ground. Not much in evidence.
About 616'	Methane by test.
About 636' - 665'	Several showings of gas. On occasions bubbling continuously for some hours only from water in bottom.
682'	15" of very porous coral rock with water charged with gas.
752'	Small band of water with a little gas.
756' - 763'	Contains two gas shows. Oil films seen on ground excavated.
820' - 844'	Gas evident.
907'	" " "
Just below 1021'	" " "
1046'	Oil films showing in shaft plentifully.
1197'	Oil present.

(From this point on oil present and tests made by measuring amounts from pits and horizontal drill holes.)

COPY FOR MR. GEO. BROWN

COPY

J. R. PEMBERTON
Petroleum Geologist and Engineer.
714 West Olympic Boulevard,
LOS ANGELES 15

LAKES ENTRANCE OIL PROJECT.

DEPARTMENT OF SUPPLY & SHIPPING.

COMMONWEALTH OF AUSTRALIA.

INTRODUCTION

Commonwealth of Australia has in process of development a project to produce oil known as the Lakes Entrance Oil Project on the seacoast of Victoria about 200 miles east of Melbourne. An area of some 5,000 acres in extent, of which approximately 1,100 are considered to be more favorable, has been the scene in the past of the drilling of approximately 30 bore holes, most of which have been drilled within the past 20 years.

The development has not been commercially successful although it is reported that there has been produced about 100,000 gallons of oil.

The emergency brought on by the World War, coupled with the fact that Australia has no commercial oil production, has caused the Australian Government to consider and put into effect any method by which oil in commercial quantities could be recovered from this area. Following a study of all known methods of extracting oil from the ground it was decided to endeavour to put into effect the recovery system known as the Leo Ranney process. Difficulties encountered in sinking the shaft necessary to put into effect the Ranney process, coupled with some uncertainties as to many of the necessary mechanical details yet to be undertaken, has caused the Commonwealth to seek all possible information likely to be of help in reaching correct decisions and in completion of the work.

GEOLOGY

Based upon surface exposures and logs of the many wells which have been drilled in the area it is known that the

sedimentary section consists of marls, glauconitic sandstones and sandy clays with several thin strata of hard limestone. This section rests on a crystalline basement of granite and is approximately 1,300 feet in thickness. The strata dips south at extremely low angles said to be at the rate of 3½ feet per hundred feet.

A generalized section based upon extremely accurate logs of some of the bore holes, drillers records of the early wells, and the record of formations passed through in the sinking of a shaft for the Ranney process to a depth of 1,120 feet indicated that the following is the sequence of strata underlying the area:

0-50 feet	50 feet	Oxidized surface material
50-245 "	195 "	Dark gray marl
245-315 "	70 "	Polyzoal limestone, porous and saturated with artesian water.
315-960 "	645 "	Stratified limestones and marl, sometimes mingled together.
960-1195 "	235 "	Micaceous clays and marls with 11 limestone beds up to 22 inches in thickness each.
1195-1231 "	36 "	Glauconitic oil bearing sandstone.
1231-1321 "	90 "	Basal sandstone, porous and carrying high head fresh water.
1321- ?	?	Basement complex - granite or schist.

This section is highly fossiliferous and, as previously stated, is entirely of Miocene sediments.

All of the wells which have been drilled passed through the glauconitic oil sand and bottomed in the water carrying basal sandstone with the exception of the last two which have been drilled, known as the "Pilot Bore" and "Imray" bore hole. In addition, several of the wells drilled deep enough to encounter the granite underlying the basal sandstone. In general the logs of all of the wells drilled agree essentially with the underground section as outlined.

OCCURRENCE OF PETROLEUM

The records of all the wells drilled indicate that the petroleum occurs in the glauconitic sandstone which, as

outlined above, is approximately 36 feet in thickness. This particular zone has been intensively studied by the technical staff of the Department of Supply & Shipping and two reports covering the result of the study are at hand, the first being by L. C. Noakes, geologist, entitled "Preliminary Report on the Examination of Cores From the Pilot Bore, Lakes Entrance Victoria" under date of April 5, 1945. The second report at hand is by R. F. Thyer, geophysicist, and entitled "Preliminary Report on Results of Tests of Oil and Water Saturation Pilot Bore, Lakes Entrance, Victoria". These reports are extremely well made, in great detail and present all factual matter that could be asked for with respect to the physical characteristics of core samples which were obtained in the Pilot Bore from the glauconitic sandstone. In addition the report by Mr. Noakes includes extremely detailed data upon the rate of production of oil and water from the Pilot bore as drilling and coring progressed.

The oil itself is 15.6 PAI gravity - S. G. 0.96. It is an asphaltic base crude oil devoid of gasoline or kerosene. Distillation tests indicate 30% is gas oil and the remainder consists of heavy lube stock and petroleum residue. The oil is accompanied by fresh water. An anaylisis of the water which occurs in the basal sandstone shows it to contain 9 grains per gallon of sodium carbonate, 29 grains per gallon of sodium bicarbonate, and 60 grains per gallon of salt. In this respect the water is a good quality of fresh water.

In the report by Mr. Noakes it is stated that in the total thickness embraced in the 10 cores which were examined covering the interval 22 feet and 9 inches between the depths 1,196 feet 3 inches and 1,219 feet that only 93 inches yielded any oil at all and that "oil bearing strata constitutes little more than 24 inches". In the tabulation of production data in Mr. Noakes report it is shown that 80.5% of the production in the Pilot bore came from a zone 45 inches in thickness lying between 1,204 feet 5 inches and 1,208 feet 2 inches. 19.5% of the oil came from the remainder of the difference between the 93 inches and the 45 inches.

In the report by Mr. Thyer he states "we arrived at a tentative figure of 26 inches for the maximum thickness of oil bearing glauconitic sandstone". Thus both Messrs. Noakes and Thyer, using different methods of determination, arrive at practically the same conclusion; namely, that the bulk of the oil which has been obtained comes from a strata approximately 24 to 26 inches in thickness.

RATE OF PRODUCTION.

The tests of rate of production by Mr. Noakes covering a period of about 4 months between September 1944 and February 1945 include data based upon a complete bailing of the hole each day as drilling progressed. Following the drilling or coring of each section, 13 in number, the well was bailed of fluid and determinations made as to the amount of water and oil entering the bore, the percentage of emulsion, and the percentage of clean oil to total fluid. The report shows that while some oil was obtained in the interval from 1,196 feet 3 inches to 1,200 feet 2 inches that the bulk of the oil was obtained, as previously stated, between 1,204 feet 5 inches and 1,208 feet 2 inches from core sections number 6 and 7. Whereas water and oil, varying in amounts from 45.1 pints per day to 89.8 pints per day consisting nearly entirely of water, was obtained prior to reaching below 1,204 feet 5 inches, the production thereafter ranged from 60.1 pints to 77.55 pints of fluid of which from 46 to 54% was oil. Following the taking of core number 7 at 1,208 feet 2 inches, coring and the taking of daily bailing tests continued to 1,219 feet. No increased daily production of either water or oil was obtained and the inference therefore is that the greater part of this production came from the interval taken in by cores 6 and 7. Approximately 3 months elapsed between the taking of core 6 and core 13 but in this time production of net oil declined from 39.75 pints per day to 32.3 pints per day. Bailing of the hole to the last drop of oil obtainable in a bailer was performed each day and the fluids both of oil and water that came into the bore hole were bailed and thus indicate the total production of the well. The fluid consisted of free water and an emulsion of oil and water and there was no unemulsified oil produced. The water contained in the emulsion ranged from 13.25% to as high as 51%.

An extract from a report by W. Rae as of May 7, 1945 indicates that between the period April 27 and May 5, 1945 the production of oil in the Pilot bore ranged from 29 pints to 31.7 pints per day. The report from Mr. Rae includes similar data on the Imray well and the production ranged from 28.2 pints per day to 30.9 pints per day of clean oil.

Between the period February 13, 1945 to April 18,1945, or 64 days, the Pilot bore was not bailed but during this period readings were obtained nearly every day as to the height of the fluid in the hole. At the end of 64 days the fluid had risen 507 feet 10 inches. The hole was cased with

pipe of 4-3/4 inches inside diameter. The volume of the fluid produced was therefore 3,131 pints or an average of 49 pints a day. An examination of the height of fluid at the end of each week indicated the rise for that period. In the beginning the fluid entering was about 55 pints per day but at the end of the period the fluid had declined to 36 pints per day. This indicates, of course, that the fluid continued to enter the bore hole after the cessation of bailing in February, 1945 at approximately the same rate determined during the daily bailing tests but as time went on the production diminished due to back pressure in the bottom of the hole caused by the mounting column of fluid.

The detailed data covering the above is as follows:

	Fluid Rise	Rise During Period	Pints	Pints Per Day
1st 10 days	94'5"	94'5"	584	58.4
2nd " "	191'0"	96'5"	595	59.5
3rd " "	272'3"	81'3"	502	50.2
4th " "	348'4"	76'1"	469	46.9
5th " "	420'1"	71'6"	441	44.1
6th " "	484'4"	64'3"	396	39.6
Last 4 "	507'8"	23'4"	144	36.0
		507'7"	3131	49

It has been reported that in one bore hole which was drilled through the glauconitic oil sand and into the Basal artesian water sand that a yield of 78 gallons of oil was obtained for some time. This yield, higher than that reported in either the Pilot Bore or the Imray Bore, was accompanied by a large volume of water, so much greater than the volume commonly produced from the glauconitic sand, as to lead to the conclusion that both the water and the oil came from the Basal Sand.

The casual occurrence of small quantities of oil in the Basal Sand may be classed as accidental. It is significant that there is no record of the persistance of flows of oil in such volume. The presence of such large volumes of water accompanying the oil precludes the possibility of successfully attempting to develop oil production from the Basal Sand by any known method.

ANALYSIS OF DATA

1. There is a complete lack of evidence of any kind whatsoever of the existence of any geologic formation within

the area or adjacent thereto which could be the source of petroleum in any commercial quantity. The presence of petroleum in the limited quantity already found is, of course, an indication that a source of petroleum does exist but from the manner and all circumstances connected with the occurence of petroleum in these rocks it is more likely that the source of the petroleum may be found in minute organic remains within the marls or limestones themselves occuring above the glauconitic sandstone than from any other distant and hypothetical source formation.

2. There is no evidence of the existence of any structural or stratigraphic trap suitable for the accumulation of petroleum in commercial quantities should it be present; in other words, the extremely gentle gradient at which the rocks lie is too slight to permit gravity to effect the separation between the water and oil and cause the oil to stratify itself in a pool overlying a pool of water.

3. Based upon the records of 30 wells it is known that petroleum occurs in extremely minute quantities from a commercial point of view and is restricted to a horizon of about 93 inches in thickness but that about 80% of the production comes from a zone 24 to 26 inches in thickness or less.

4. While the effective porosity of the glauconitic sand is high the permeability is extremely low. The oil occurs with fresh water and has not been separated so that both fluids enter the bore hole together and the oil is generally emulsified with the water. Gas in the volume necessary to drive oil to the bore hole through the rock is lacking. The oil saturation is of so low an order that it is surprising that any oil at all enters the bore hole. It seems probable that the oil which is produced comes from an extremely thin layer of higher permeability and oil saturation than the average. Such layers are undoubtedly of small extent, otherwise more oil would be produced and the rate of production would be better maintained

5. The rate of production is extremely low and of the order of from 40 to 60 pints of total fluid per day. The fact that in the Pilot bore during a period of 64 days the fluid rose only 507 feet 10 inches in an indication of the extreme resistance within the rock to the passage of fluid through it

6. The indicated rate of decline in production of fluid is a further proof of the limited volume available within

the reservoir. At the end of the bailing tests covering 84 days the production in Pilot Bore was 7.5 pints per day less than at the commencement of the test. This emphasizes the adverse effect of low permeability, low saturation and limited source.

7. The officials of the Victorian Geological Survey state that production results from Pilot Bore and Imray Bore are similar to those obtained previously and may be regarded as typical.

8. The essential conditions necessary to cause a commercial oil field to exist are

1. Large quantities of oil collected in a reservoir composed of rocks of suitable porosity and permeability to permit free movement of the fluids.

2. An existent force present which will force the oil to the bore hole. This force can be either in the form

   A. Highly compressed gas associated with the oil to the bore hole, or

   B. A large volume of water under high pressure surrounding the oil pool which drives the oil before it to the bore hole, or

   C. In the absence of either A or B a structural condition which will permit the force of gravity alone to cause the oil to drain from the rock into the bore hole in seeking a lower level.

In the Lakes Entrance Oil Project only one, viz "B" of these essential conditions is known to occur. This condition is however rendered ineffective by the extremely low permeability of the reservoir rock. The field is therefore from every standpoint a non-commercial pool.

9. In extracting oil from the ground it is customery to drill bore holes into the pool. This has been tried in this project with no commercial success attending the effort. The reason for the failure is that, first, there is no oil pool of consequence present and, second, the driving force of the water which is present is rendered ineffective by the low permeability.

If the permeability were high a quick flush production of some of the limited oil present would be expected and to be followed by a complete drowning out of the well by water. No other successful methods for producing oil in an oil pool have ever been adopted. In a few rare instances slightly sloping tunnels have been driven into sides of hills in which the rocks carry in fractures and crevices some liquid petroleum and limited water which then seeps into the tunnel and flows to the mouth. Such tunnels are few in existence and of scant commercial importance. They have been, however, the source of some petroleum which could not have been obtained by bore holes driven directly from the surface vertically downward to penetrate these rocks.

10. Oil wells do not extract all of the oil present in a reservoir except in certain outstanding oil pools wherein extremely high porosity and permeability exists and a perfectly effective water drive is in existence around the perimeter of the pool. Only a few pools of such character are known in the world. In the normal oil pool where the oil occurs in porous sandstone or other rock a large percentage of the recoverable oil, perhaps as high as 50% in some cases, remains in the reservoir after the wells have reached their economic limit. To obtain this remaining oil many methods have been proposed and put into effect. These are commonly called "Secondary Recovery" method. In pools lacking an effective water drive and in which the original oil moved through the rock to the bore solely due to the expansive force of the gas contained in the oil it was found by repressuring the field after all the wells had declined to a low rate of production by the injection of large quantities of gas into the top of the structure a considerable part of the residual oil would be forced to the bore holes occupying the lower levels of the pool and around its perimeter. In this type of field it was also found that water could sometimes be injected into the reservoir rock which was formerly saturated with oil and the water would drive the oil upward to the wells located on the high portions of the structure. The artifical water drive has been very successful in some oil pools. Neither of these methods is applicable to the Lakes Entrance Project solely because of the low permeability of the rock and the paucity of oil.

The Ranney method of secondary recovery of oil and which could be applied to primary production of oil in a virgin oil field has been proposed by its sponsor Leo Ranney.

To warrant the use of the Ranney method it is obvious that an adequate supply of recoverable oil must be present otherwise the project is doomed to failure. In my view the Ranney process is sound in principle and should not be

condemed out-of-hand simply because to date there are no successful applications in effect. It is obvious that in the drilling of small holes laterally into an oil bearing formation that control of the hole particularly in the vertical plane is an essential.

In the Lakes Entrance Oil Project an entirely insufficient quantity of oil exists to warrant the installation of the Ranney method of oil production or, for that matter any other method. As a consequence no advice on methods of oil production can be offered.

BASIS OF REPORT AND SOURCE OF INFORMATION

Statements of fact, etc., concerning the Lakes Entrance Oil Project on which this report is based have been obtained from Australian Mineral Resources reports and by questions directly addressed to Mr. H. J. Cook, Supervisor of the Project, in Los Angeles at the time of writing.

CONCLUSION

The Lakes Entrance Project is doomed to failure regardless of what type of development is applied simply for the reason that an entirely insufficient and inadequate supply of oil exists within the area to warrant consideration.

X

(sgd.) J. R. Pemberton

Los Angeles,
California,
July 5, 1945

PE603530

This is an enclosure indicator page.
The enclosure PE603530 is enclosed within the container PE906145 at this location in this document.

The enclosure PE603530 has the following characteristics:

ITEM_BARCODE	= PE603530
CONTAINER_BARCODE	= PE906145
NAME	= Lithological Log and Summary
BASIN	= GIPPSLAND
PERMIT	= PPL139
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Lithological Log and Drill Summary data for Lakes Entrance Oil Shaft-1
REMARKS	=
DATE_CREATED	= 03/07/1945
DATE_RECEIVED	=
W_NO	= W434
WELL_NAME	= LAKES ENTRANCE OIL SHAFT-1
CONTRACTOR	=
CLIENT_OP_CO	= AUSTRAL OIL DRILLING SYNDICATE

(Inserted by DNRE - Vic Govt Mines Dept)

PE906146

This is an enclosure indicator page.
The enclosure PE906146 is enclosed within the container PE906145 at this location in this document.

The enclosure PE906146 has the following characteristics:

ITEM_BARCODE	= PE906146
CONTAINER_BARCODE	= PE906145
NAME	= Locality Map
BASIN	= GIPPSLAND
PERMIT	= PPL139
TYPE	= GENERAL
SUBTYPE	= PROSPECT_MAP
DESCRIPTION	= Locality Map for Lake Entrance Oil Shaft-1
REMARKS	=
DATE_CREATED	= 07/01/1986
DATE_RECEIVED	=
W_NO	= W434
WELL_NAME	= LAKES ENTRANCE OIL SHAFT-1
CONTRACTOR	=
CLIENT_OP_CO	= AUSTRAL OIL DRILLING SYNDICATE

(Inserted by DNRE - Vic Govt Mines Dept)

PE906147

This is an enclosure indicator page.
The enclosure PE906147 is enclosed within the container PE906145 at this location in this document.

The enclosure PE906147 has the following characteristics:

ITEM_BARCODE	= PE906147
CONTAINER_BARCODE	= PE906145
NAME	= Structure Map
BASIN	= GIPPSLAND
PERMIT	= PPL139
TYPE	= SEISMIC
SUBTYPE	= HRZN_CONTR_MAP
DESCRIPTION	= Structure Map of Lakes Entrance Oil Field and Drill Locality Plan
REMARKS	=
DATE_CREATED	= 15/08/1940
DATE_RECEIVED	=
W_NO	= W434
WELL_NAME	= LAKES ENTRANCE OIL SHAFT-1
CONTRACTOR	=
CLIENT_OP_CO	= AUSTRAL OIL DRILLING SYNDICATE

(Inserted by DNRE - Vic Govt Mines Dept)