

CONTENTS ENVELOPE 735DM598/66

TENEMENT: S.M.L. 116 and 122

TENEMENT HOLDER: PENINSULAR PROSPECTING AND MINING PTY. LTD.

REPORTS:

- Peninsular Prospecting and Mining Pty. Ltd., 1966
Quarterly Report, Special Mining Lease No. 116
Period ending December 16th, 1966 (pgs.2-3)
- Dickinson, S.B., 1967. Exploration Programme at
Lake MacDonnell, South Australia, August 1966
to March, 1967. No Plans. (pgs.4-72)
- Dickinson, S.B., 1967. Quarterly Report on S.M.L.'s 116
and 122 for the period ended September 16th 1967.
No Plans. (pgs.73-76)
- Peninsular Prospecting and Mining Pty. Ltd., 1967.
Quarterly Report on S.M.L. 116 to December 16th,
1967. No Plans. (pgs.77-78)
- Peninsular Prospecting and Mining Pty. Ltd., 1968.
Quarterly Report on S.M.L. 116 to March 16th, 1968.
No Plans. (pg. 79)

Peninsula Prospecting and Mining Pty. Limited

002

Quarterly Report Special Mining Lease No.116 and No.122
Period Ending December 16th, 1966

An investigational programme was prepared and submitted to the Mines Department involving the drilling of 31 holes on gypsum, 11 holes on lime sand. Later on this programme was supplemented by a proposal to drill 4 holes for the testing of the deeper formations, underlying the gypsum deposits, for salt brines (potash) and phosphate.

The programme was approved by the Mines Department and arrangements were made to hire specialised drilling equipment and experienced drilling personnel from the Department with supervision of the work by the Company.

As at December 16th, 1966; fourteen holes on gypsum were completed, total footage 381 ft.6 in., and four holes on lime sand, total footage 335 ft. 14 samples of gypsum and 24 samples of lime sand were sent for analyses.

During this period a study was commenced into the possible markets for gypsum on a large scale in Australia and in the South Pacific Area generally. A major part of this study comprised the possible use of gypsum as a substitute for sulphur in the manufacture of fertilizers, in particular ammonium sulphate, which is produced extensively from gypsum in countries where the gypsum factory delivered cost is low. This study is still in progress.

Total expenditure incurred for the period is estimated at \$5,000 including the mobilization expenses for the drilling, drill progress payments and the costs of the commercial studies, planning work and field supervision.

The programme and investigations are common to both these mining leases.

Noted
mg

Quarterly Report Special Mining Leases Nos. 116 & 122
Period Ending March 16th, 1967

Following a brief Xmas holiday break the drilling programme on the leases was resumed on January 23rd and on March 10th, 1967, the drilling and field sampling work was completed. An additional 13 bores were sunk on the gypsum deposits, three bores were drilled in search of enriched potash brines and phosphate, and one additional bore on lime sand was completed.

The completed programme thus involved the following:-

	<u>No. of Bores</u>	<u>Total Footage</u>	<u>No. of Samples</u>
Gypsum bores	27	564 ft.	44
Lime Sand Bores	5	407 ft.	30
Potash brine and phosphate exploration bores	3	477 ft.	29
Total	35	1448 ft.	103

All the samples are now with the A.M.D.L. Laboratories for analysis and all results are expected to be to hand by April 30th.

On receipt of the analytical data a full report will be prepared on the potential of the prospecting authorities with respect to quantity and quality of the gypsum, lime sand and salt brines revealed by the drilling.

Further enquiry was made on markets and uses for gypsum, salt and lime sand.

Preliminary discussions were held with the General Manager of the South Australian Harbour Board on the possibilities of accommodating large ships in the area.

The expenditure incurred to March 16th, 1967, is estimated at \$12,000.

*Noted
S.M.P.*

EXPLORATION PROGRAMME AT LAKE MACDONNELL,
SOUTH AUSTRALIA, AUGUST 1966 TO MARCH 1967

004

Introduction

Prospecting rights in the form of Special Mining Leases for gypsum, salt, limesand, potash and phosphates, were granted to Peninsular Prospecting and Mining Pty. Limited at Lake MacDonnell, South Australia, on August 18th 1966, with respect to an area of 18 square miles in SML 116 and on September 1st, 1966 with respect to an area of 35 square miles in SML 122, a total of 53 square miles.

These leases are of 12 months' duration and carry expenditure covenants involving a minimum expenditure of \$4,000 on the large lease, SML 116 and \$10,000 on the smaller lease, SML 122.

The Mines Department, for this expenditure, required the company to carry out field studies comprising drilling and sampling of the minerals thereon and economic studies in respect to markets, transport and development planning.

This report covers the results of the field exploration work. The actual field work, drilling and sampling, commenced November 20th, 1966, and was completed on March 10th, 1967, a period of 16 weeks.

The programme carried out comprised the following:-

DRILLING

A. <u>Percussion Drilling</u>	Lime Sand	5 boreholes	407 feet
	Potash brine and Phosphate		
	Exploration bores	3 boreholes	477 feet
	Total	8 boreholes	984 feet
B. <u>Rotary Drilling</u>	Gypsum	27 boreholes	564 feet
	Grand Total =	35 boreholes	1448 feet

SAMPLING

Gypsum	44 samples
Lime Sand	28 samples
Brine Samples	29 samples
Total =	101 samples

ORGANISATION

The work was carried out under the direction of S. B. Dickinson. The Department of Mines provided equipment and experienced personnel for the drilling (4 men plus supervisory staff and 2 plants).

Enlarged aerial photographs were used to assist in the location of drilling sites which were selected to conform as closely as possible with the grid previously used by the Mines Department in earlier exploration programmes. A hand prismatic compass and pacing were used to finally locate the sites on the ground, the measurement being made from previously pegged drill sites on recognizable features on the aerial photos. The accuracy of location would be of the order of plus or minus 2%.

The drilling operations were carried out without a hitch and no praise is too high for the employees of the Mines Department who spared no effort to get reliable samples and to contribute to the efficient nature of the work.

All the samples were delivered to the Mines Department Depot in Adelaide where they were carefully examined and logged and representative samples of the material of possible economic worth were sent to the Australian Mineral Development Laboratories for chemical analysis. The drilling samples are preserved at the Mines Department Depot for future reference.

Drill logs, assay certificates and maps showing the results of the exploration work are attached.

DRILLING

The drilling of the gypsum was carried out with a diamond drilling plant mounted on a trailer which was drawn by a Bombardier or Truck, depending on access conditions. An auger or sample tube was used to penetrate and sample the soft or weathered near surface gypsum. The underlying rock gypsum was then cored with an NX diamond bit after the insertion of casing through the soft overlying weathered gypsum and soil.

The lime sands were sampled by means of a light percussion drill with a 3 inch diameter sample tube.

The deeper drilling for brines and the testing of the underlying Tertiary sediments for possible phosphate beds was undertaken with a heavier percussion drill using casing throughout to permit brine samples to be taken at ten feet intervals, with a minimum of contamination from brines contained in overlying beds.

DRILLING RESULTS

Gypsum

The results have proved a reserve of high quality crystalline (rock) gypsum of 125 million tons, averaging 7 feet in thickness (range 2 ft.6 ins. to 19 feet) over an area of 6.5 square miles. The rock gypsum is overlain by flour and semi-consolidated crystalline and sandy gypsum averaging about 3 ft.6 ins. in thickness. In the 6.5 square miles area, the estimated tonnage of unconsolidated gypsum is 62.5 million tons with an equivalent tonnage of at least 62.5 million tons in surrounding areas, particularly in the Lake Bell area where only a limited area of crystalline rock gypsum was located. These calculations take into account the results of earlier drilling by the Mines Department.

The total proven reserves of gypsum are accordingly estimated at 250 million tons.

The quality of the 125 million tons of crystalline rock gypsum is extremely high grade on world commercial standards. The gypsum content for the total tonnage would be in excess of 95% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$, with chemically precipitated lime comprising the main other ingredient, less than 5% CaCO_3 and silica or acid insolubles less than 0.2%.

A large proportion of the proven reserves has a chemical composition in excess of 98% $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ with CaCO_3 less than 1.0% and silica less than 0.2%.

The flour and sandy gypsum generally found overlying the rock gypsum is an inferior quality gypsum with a higher lime content to that in the rock gypsum, but still with a low silica content. The average composition is of the order of 85% CaSO_4 , $2\text{H}_2\text{O}$, 14% CaCO_3 , and silica less than 0.5%.

No beneficiation tests have been done on this lower grade flour and sandy gypsum but similar material elsewhere has responded to up-grading tests by simple log-washing techniques.

LIME SAND

The drilling of about 5 square miles of sand dunes, bordering the coast on the western side of Lake MacDonnell, has revealed the presence of about 250 million cubic yards of fine calcareous sand in loose sand dunes ranging up to 120 feet in height above normal ground level.

Samples taken from 5 drill holes show a uniform composition in CaO ranging from 47.90% to 50.20%, average 48.9%, in MgO from 2.80% to 4.70%, average 3.40%, in SiO_2 from 2.80% to 5.65%, average 4.51%, and in SO_3 from 0.26% to 0.45%, average 0.36%. *Offin Bay angle Cao 51.3*

The total volume of sands on the leases, on the basis of the dunes averaging 50 feet in height over the whole area, is estimated at 500 million cubic yards, or say 650 million tons.

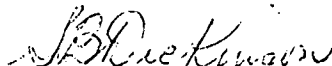
SALT

The three boreholes drilled have shown the presence of brines ranging from 12100 grains per gallon to 2760 grains per gallon of total salts, average 6193 grains per gallon in the gypsum and the porous lime sand and dune limestone beds underlying the gypsum. The water table ranges from 2 feet to 4 ft.6 ins. below surface in these bores. The thickness of the porous beds would be of the order of 100 feet. These beds afford a large reservoir for stored brines which by solar evaporation could produce considerable tonnages of salt.

The area unlain by these brines on the leases would be of the order of 15 square miles. In places, notably at the Red and Blue Lakes, there is a continuous flow of concentrated brine into Lake MacDonnell at the rate of 30,000 to 40,000 gallons per hour. It is estimated that if Lake MacDonnell is developed for salt production by solar evaporation, an annual production of 500,000 tons of salt per annum could be achieved.

COSTS

The exploration work described herein has been carried out at a field cost of approximately \$16,000 comprising drilling, assaying and supervision expenses.



S. B. Dickinson
Projects Development Manager

26th May, 1967.

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 3 (gypsum) Location A 12 W edge Lake MacDonnell S.
Date Started 4/12/66 Water Table below surface.....
Date Finished 5/12/66 Height above Datum.....
Depth 27 ft. 6 ins......
Valued Depth No gypsum in bore......
General Comments Casing pushed down from 10' to 25' shows absence of
commercial gypsum......

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 4 (gypsum).....Location. B 12 W. Lake MacDonnell. SA.....
Date Started...6/12/66.....Water Table below surface.....
Date Finished...6/12/66.....Height above Datum.....
Depth.....35ft......
Valued Depth.....No gypsum in bore......
General Comments...Casing easily dropped to 15 feet indicating no.....
gypsum above dune limestone......

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 5 (gypsum) ... Location ... DD 8 W. Lake MacDonnell S.A.
Date Started ... 7/12/66 ... Water Table below surface ...
Date Finished ... 7/12/66 ... Height above Datum ...
Depth ... 23 ft ...
Valued Depth ... 0-10' Sandy gypsum (Low grade) 10'-16' & 6 ft Cryst. gypsum ...
General Comments ...

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 7 (gypsum).....Location.....AA7W. Lake MacDonnell. SA.
Date Started...9/12/66.....Water Table below surface.....
Date Finished...9/12/66.....Height above Datum.....
Depth.....30ft.....
Valued Depth.....No cryst gypsum......
General Comments...0'-5' not analysed as high lime content visible.

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 8 (gypsum) Location AA 8W, Lake MacDonnell. SA
Date Started ~~10/12/66~~ 10/12/66 Water Table below surface
Date Finished 10/12/66 Height above Datum
Depth 22 ft
Valued Depth No. Cryst. gypsum
General Comments No sandy gypsum chiefly fine sand at or near
..... surface

[illegible]

018

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 11 (gypsum) Location BB 7W. Lake MacDonnell S.A.
Date Started 13/12/66 Water Table below surface
Date Finished 13/12/66 Height above Datum
Depth 28 ft 6 ins
Valued Depth Crystalline gypsum 10'-15' 5 ft thickness
General Comments Overburden high in CaCO_3 . See Bore No 9 A7W for
..... similar white lime (?) bed below gypsum horizon also No 7 A A 7W.

[illegible]

BOREHOLE RECORD SHEET.

Borehole No. 12 (gypsum).....Location.....G2E. Lake MacDonnell. S.A.
Date Started.....14/12/66.....Water Table below surface.....
Date Finished.....14/12/66.....Height above Datum.....
Depth.....20 ft 3 ins.....
Valued Depth.....Uncol. sandy + cryst gypsum 0-5 ft; Cryst. gypsum 5-9' 4 ft
General Comments.....From surface to 9'-0" could probably be
.....worked as cryst. gypsum......

[illegible]

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 14 (gypsum).....Location.....H2W. Lake MacDonnell. S.A.
Date Started...16/12/67.....Water Table below surface.....
Date Finished...16/12/67.....Height above Datum.....
Depth.....29 ft.....
Valued Depth.....No. cryst gypsum.....
General Comments.....0 - 8ft 8ft. Gypseous sand.

[illegible]

[illegible]

[illegible]

[illegible]

Borehole No. 18 (gypsum).....Location.....I¹E^X Lake MacDonnell. S.A......

Date Started. 25/1/67.....Water Table below surface.....

Date Finished. 25/1/67.....Height above Datum.....

Depth.....18 ft 10 ins.....

Valued Depth.. Flour Gypsum 0-7 ft Rock gypsum 5'-14' - 9 ft thickness.....

General Comments.....

Depth		Stratigraphic Details	Sample No.	CaSO ₄ 2H ₂ O	CaCO ₃	Acet Insol.
From	To					
0	4'-10"	Sample Tube.				
0	2'-8"	Fine flour gypsum (fine flaking)	IIE ①	82.6	16.2	0.24
2'-8"	4'-10"	ditto	IIE ②	82.6	17.4	0.39
4'-10"	9'-0"	Rock gypsum.	IIE ③	99.0	1.14	0.16
9'-0"	13'-10"	Rock gypsum.	IIE ④	94.7	5.10	0.2
4'-10"	13'-10"	Core cuttings sample.	IIE ⑤	87.5	11.4	0.41
13'-10"	18'-10"	Dark grey lime sand with some gypsum flakes.				
Average						
4'-10"	13'-10"					
avg 5	14'	Average IIE ② ④ ⑤		97.2	2.9	0.17

[illegible]

028

[illegible]

BOREHOLE RECORD SHEET

Borehole No. 21 (gypsum) Location L. 2 E Lake MacDonald S.A.
Date Started 27/1/67 Water Table below surface
Date Finished 22/1/67 Height above Datum
Depth 19 ft 6 ins
Valued Depth 0-14'6" Sandy gypsum - no crystalline gypsum
General Comments

Depth		Stratigraphic Details	Sample No.	CaSO ₄ %	CaCO ₃	Acid Insol.
From	To					
0	14' 6"	Sample tube.				
0	4' 0"	Sandy gypsum, discoloured.	L2E (1)	84.3	12.1	0.23
4' 0"	7' 0"	ditto with much organic discoloration.	L2E (2)	91.4	4.2	0.23
7' 0"	11' 6"	ditto with some coarse green clay & lime sand with gypsum lumps.	L2E (3)	86.8	9.35	0.18
11' 6"	14' 6"	green clay & lime sand.				
14' 6"	19' 6"	Light grey lime sand semiconsolidated.				
Average (weighted)						
0	11' 6"	Sandy gypsum. L2E (1) (2) + (3).		87.1	9.0	0.22

General Comments.....

[illegible]

[illegible]

[illegible]

[illegible]

General Comments.....

[illegible]

[illegible][illegible]

Borehole No. AA 14 W Location. Lake MacDonnell S.A.

Date Started... 3/12/66 Water Table below surface... 87 ft

Date Finished... 6/12/66 Height above Datum.....

Depth.....97 ft.....

Valued Depth.....

General Comments. Water sample taken when water cut at 88 ft. Sand still present at 97'.

[illegible]

[illegible]

038

Borehole No. 30 (lime sand) Location AA18W. Lake McDonnell. SA.
Date Started 8/12/66 Water Table below surface
Date Finished 13/12/66 Height above Datum
Depth 54 ft
Valued Depth
General Comments No water cut.

[illegible]

BOREHOLE RECORD SHEET*

Borehole No. 31 (limestone).....Location.....Bluff Lake MacDonnell SA
Date Started..14/12/67.....Water Table below surface.....
Date Finished..16/12/67.....Height above Datum.....
Depth.....107 ft.....
Valued Depth.....
General Comments...Bore bottomed on Sandstone No water cut
.....
.....

[illegible]

BOREHOLE RECORD SHEET*

040

Borehole No. 32 (limestone) Location B16W Lake MacDonnell

Date Started... 8/3/67.....Water Table below surface.....

Date Finished... 10/3/67 Height above Datum.....

Depth.....72 ft.....

Valued Depth.....

General Comments.....

[illegible]

Borehole No. 33 (Brines) No. 1 Location Abt. 20 on N-S line Lake McDowell, S.A.
 Date Started 30/1/67 Water Table below surface 4'-6"
 Date Finished 14/2/67 Height above Datum.....
 Depth 250ft
 Valued Depth.....
 General Comments 8" casing to 30' 2", 6" casing to 194' 2", 5" casing thereafter.
Porous limestone beds bottom at 120ft.

Depth		Stratigraphic Details	Sample No.	Water Level	Total Salts	Sodium Chloride	K.Cl
From	To						
0'-0"	6'-6"	Gypsum sand + crystal.			grains per gallon	grains per gallon	grains per gallon
	6'-0"	Sample of Brine		4'-6"	6305	4872	128
6'-6"	14'-0"	Coarse sand + gravel grey mottled colour.					
	14'-0"	Sample of Brine		4'-6"	6790	5269	139
14'-0"	22'-0"	Fine grained sand with shell fragments					
22'-0"	23'-0"	Band of nodular travertine fragments up to 1 1/2" dia. in mottled grey sand.					
23'-0"	35'-0"	Even grained calc. sand mottled grey.					
	25'-0"	Sample of Brine.		4'-6"	6946	5394	143
35'-0"	75'-0"	Off-white fine grained sand. calc.					
	45'-0"	Sample of Brine.		4'-6"	7244	5642	149
	65'-0"	ditto.		4'-6"	7420	5783	153
75'-0"	105'-0"	Yellow brown sand calc with selenite cryst.					
	85'-0"	Sample of Brine		4'-6"	7557	5889	154
	105'-0"	ditto.		4'-6"	7875	6162	160
105'-0"	119'-0"	Fine grained sand (siliceous) with gypsum grains, deep yellow brown colour.					
119'-0"	120'-0"	Coarse grained sand. siliceous white colour.					
120'-0"	250'-0"	Decomposed granitic or gneissic bedrock.					
	125'-0"	Sample of brine.		4'-6"	7867	6164	162
	145'-0"	ditto		35'-0"	10067	7768	198
	165'-0"	ditto		48'-0"	11412	9064	223
	185'-0"	ditto		51'-0"	10042	7948	202
	205'-0"	ditto		56'-0"	15854	13298	317
	225'-0"	"		160'-0"	17441	14150	336
	245'-0"	"		230'-0"	17876	14533	336

BOREHOLE RECORD SHEET

042

Borehole No. 34 (brines) ^{No. 2.} Location near B.W. Coombe Well Lake MacDonnell SA

Date Started... 12/2/67.....Water Table below surface.... 2' 6".....

Date Finished..27/2/67.....Height above Datum.....

Depth.....150 ft.....

Valued Depth.....

General Comments. Porous limestone beds bottom at 144 feet with brines of high salt content at depth.

[illegible]

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

AN2148/67

12th April, 1967

Your reference:

3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	3430	Calcium bicarbonate	12	Total	1178
Sulphate, SO ₄	558	Calcium sulphate	326	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	1166
Nitrate, NO ₃	trace	Magnesium bicarbonate	-	Due to calcium	252
Sodium, Na	1917	Magnesium sulphate	411	Due to magnesium	926
Potassium, K	67	Magnesium chloride	556	Due to iron	
Calcium, Ca	101	Sodium bicarbonate	-		
Magnesium, Mg	225	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	4872	Remarks: Fe 0.03 g/g	
Iron, Fe		Sodium nitrate	-	Br 11 g/g	
pH		Potassium chloride	128		
Total	6305	Iron Bicarbonate			
	14.41 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
 Water Cut 5'
 Water Level 4'6"
 Address..... Supply -
 Depth Hole 6'
 Hundred Lake MacDonnell Date Collected 30/1/67
 Section.....
 Sample collected by A. Marochi

Y.A. Young
 P. A. YOUNG
 Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	3720	Calcium bicarbonate	13	Total	1255
Sulphate, SO ₄	572	Calcium sulphate	319	Temporary	13
Bicarbonate, HCO ₃	8	Calcium chloride	-	Permanent	1242
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	247
Sodium, Na	2073	Magnesium sulphate	435	Due to magnesium	1008
Potassium, K	73	Magnesium chloride	615	Due to iron	
Calcium, Ca	99	Sodium bicarbonate	-		
Magnesium, Mg	245	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	5269	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	139	Br 13 g/g	
	6790	Iron Bicarbonate			
Total	15.52 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... 5'
..... Water Cut
..... 4'6"
Address..... Water Level
..... Supply
..... 14'
Hundred Lake MacDonnell Depth Hole
Section..... Date Collected
Sample collected by A. Marochi

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

AN2148/67

12th April, 1967

Your reference:

3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	3810	Calcium bicarbonate	12	Total	1280
Sulphate, SO ₄	582	Calcium sulphate	319	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	1268
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	247
Sodium, Na	2122	Magnesium sulphate	447	Due to magnesium	1033
Potassium, K	75	Magnesium chloride	631	Due to iron	
Calcium, Ca	99	Sodium bicarbonate	-		
Magnesium, Mg	251	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	5394	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	143	Br 13 g/g	
	6946	Iron Bicarbonate			
Total	15.88 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
Address..... Water Level 4'6"
..... Supply -
Hundred..... Depth Hole 25'
Section..... Date Collected.....
Sample collected by.....

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	3980	Calcium bicarbonate	10	Total	1322
Sulphate, SO ₄	601	Calcium sulphate	313	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	1312
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	240
Sodium, Na	2220	Magnesium sulphate	476	Due to magnesium	1082
Potassium, K	78	Magnesium chloride	654	Due to iron	
Calcium, Ca	96	Sodium bicarbonate	-		
Magnesium, Mg	263	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	5642	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	149	Br 13 g/g	
Total	7244	Iron Bicarbonate			
	16.56 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
..... Water Level 4'6"
Address..... Supply -
.....
Hundred Lake MacDonnell Depth Hole 45'
Section..... Date Collected 1/2/67
Sample collected by.....

[Signature]
P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

AN2148/67

12th April, 1967

Your reference:
3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	4080	Calcium bicarbonate	12	Total	1355
Sulphate, SO ₄	611	Calcium sulphate	309	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	1343
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	240
Sodium, Na	2275	Magnesium sulphate	493	Due to magnesium	1115
Potassium, K	80	Magnesium chloride	670	Due to iron	
Calcium, Ca	96	Sodium bicarbonate	-		
Magnesium, Mg	271	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	5783	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	153	Br	14 g/g
		Iron Bicarbonate			
Total	7420				
	16.96 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
..... Water Level 4'6"
Address..... Supply -
..... Depth Hole 65'
Section..... Date Collected 1/2/67
Sample collected by.....

P. A. Young
P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA
TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

12th April, 1967

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	4150	Calcium bicarbonate	12	Total	1380
Sulphate, SO ₄	628	Calcium sulphate	316	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	1368
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	244
Sodium, Na	2317	Magnesium sulphate	508	Due to magnesium	1136
Potassium, K	81	Magnesium chloride	678	Due to iron	
Calcium, Ca	98	Sodium bicarbonate	-		
Magnesium, Mg	276	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	5889	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	154	Br 14 g/g	
Total	7557	Iron Bicarbonate			
	17.27	oz/gallon			
Suspended matter					
Organic matter					

NAME..... Hole No. 1
Water Cut. 5'
Address..... Water Level 4'6"
Supply -
Hundred..... Depth Hole 85'
Section..... Date Collected 1/2/67
Sample collected by.....

P. A. Young
P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA
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Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

12th April, 1967

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	4350	Calcium bicarbonate	12	Total	1421
Sulphate, SO ₄	625	Calcium sulphate	326	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	1409
Nitrate, NO ₃	111	Magnesium bicarbonate	-	Due to calcium	252
Sodium, Na	2424	Magnesium sulphate	495	Due to magnesium	1169
Potassium, K	84	Magnesium chloride	720	Due to iron	
Calcium, Ca	101	Sodium bicarbonate	-		
Magnesium, Mg	284	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	6162		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	160		
		Iron Bicarbonate			
Total	7875	oz/gallon			
	18.00				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g
Br 15 g/g

NAME..... Hole No. 1
..... Water Cut 5'
..... Water Level 4'6"
Address..... Supply -
..... Depth Hole 105'
Hundred..... Date Collected 2/2/67
Section.....
Sample collected by A. Marochi

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	4350	Calcium bicarbonate	10	Total	1411
Sulphate, SO ₄	620	Calcium sulphate	316	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	1401
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	242
Sodium, Na	2425	Magnesium sulphate	498	Due to magnesium	1169
Potassium, K	85	Magnesium chloride	717	Due to iron	
Calcium, Ca	97	Sodium bicarbonate	-		
Magnesium, Mg	284	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	6164	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	162	Br	15 g/g
Total	7867	Iron Bicarbonate			
	17.98 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
..... 4'6"
Address..... Water Level -
..... Supply 125'
Hundred..... Depth Hole 4/2/67
Section..... Date Collected
Sample collected by A. Marochi

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

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Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	5630	Calcium bicarbonate	10	Total	1761
Sulphate, SO ₄	728	Calcium sulphate	299	Temporary	10
Carbonate, HCO ₃	6	Calcium chloride	-	Permanent	1751
Nitrate, NO ₃	111	Magnesium bicarbonate	-	Due to calcium	230
Sodium, Na	3135	Magnesium sulphate	648	Due to magnesium	1531
Potassium, K	104	Magnesium chloride	944	Due to iron	
Calcium, Ca	92	Sodium bicarbonate	-		
Magnesium, Mg	372	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	7968	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	198	Br 18 g/g	
	10067	Iron Bicarbonate			
Total	23.01 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
..... Water Level 35'
Address..... Supply -
..... Depth Hole 145'
Section..... Date Collected 6/2/67
Sample collected by A. Marochi

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA
TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

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Your reference:
3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

12th April, 1967

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	6420	Calcium bicarbonate	10	Total	1983
Sulphate, SO ₄	788	Calcium sulphate	272	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	1973
Nitrate, NO ₃	Nil	Magnesium bicarbonate	-	Due to calcium	210
Sodium, Na	3566	Magnesium sulphate	747	Due to magnesium	1773
Potassium, K	117	Magnesium chloride	1096	Due to iron	
Calcium, Ca	84	Sodium bicarbonate	-		
Magnesium, Mg	431	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	9064	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	223	Br	21 g/g
		Iron Bicarbonate			
Total	11412				
	26.08 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
..... Water Level 40'
Address..... Supply.....
..... Depth Hole 165'
Section..... Date Collected 7/2/67
Sample collected by A. Marochi

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791862 · TELEGRAMS 'AMDEL' ADELAIDE

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12th April, 1967

Your reference:
3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	5620	Calcium bicarbonate	10	Total	1753
Sulphate, SO ₄	721	Calcium sulphate	299	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	1743
Nitrate, NO ₃	Nil	Magnesium bicarbonate	-	Due to calcium	230
Sodium, Na	3127	Magnesium sulphate	639	Due to magnesium	1523
Potassium, K	106	Magnesium chloride	944	Due to iron	
Calcium, Ca	92	Sodium bicarbonate	-		
Magnesium, Mg	370	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	7948	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	202	Br	13 g/g
	10042	Iron Bicarbonate			
Total	22.95 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
Water Cut 5'
Address..... Water Level 51'
Supply -
Hundred Lake MacDonnell Depth Hole 185'
Section..... Date Collected 9/2/67
Sample collected by.....

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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12th April, 1967

Your reference:
3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	GRAINS PER GALLON	ASSUMED COMPOSITION OF SALTS	GRAINS PER GALLON	HARDNESS (as Calcium Carbonate)	GRAINS PER GALLON
Chloride, Cl	9000	Calcium bicarbonate	8	Total	2072
Sulphate, SO ₄	925	Calcium sulphate	200	Temporary	8
Bicarbonate, HCO ₃	5	Calcium chloride	-	Permanent	2064
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	155
Sodium, Na	5230	Magnesium sulphate	982	Due to magnesium	1917
Potassium, K	166	Magnesium chloride	1049	Due to iron	
Calcium, Ca	62	Sodium bicarbonate	-		
Magnesium, Mg	466	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	13298	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	317	Br 29 g/g	
	15854	Iron Bicarbonate			
Total	36.24 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1
..... Water Cut 5'
Address..... Water Level 56'
..... Supply -
Hundred..... Depth Hole 205'
Section..... Date Collected 10/2/67
Sample collected by.....

P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

AN2148/67

12th April, 1967

Your reference:
3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER 10000 grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER 10000 grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER 10000 grains/gallon
Chloride, Cl	10000	Calcium bicarbonate	10	Total	2813
Sulphate, SO ₄	985	Calcium sulphate	163	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	2803
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	130
Sodium, Na	5570	Magnesium sulphate	1090	Due to magnesium	2683
Potassium, K	176	Magnesium chloride	1692	Due to iron	
Calcium, Ca	52	Sodium bicarbonate	-		
Magnesium, Mg	652	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	14150	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	336	Br. 33 g/g	
	17441	Iron Bicarbonate			
Total	39.87 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 1

Water Cut.....

Address..... Water Level 160'

Supply.....

Hundred Lake MacDonnell Depth Hole 225'

Section..... Date Collected 11/2/67

Sample collected by.....

A. Young
A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Your reference:

3/267/0

Mr. S.B. Dickinson,
Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

12th April, 1967

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	10250	Calcium bicarbonate	8	Total	2862
Sulphate, SO ₄	1010	Calcium sulphate	156	Temporary	8
Bicarbonate, HCO ₃	5	Calcium chloride	-	Permanent	2854
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	122
Sodium, Na	5720	Magnesium sulphate	1128	Due to magnesium	2740
Potassium, K	176	Magnesium chloride	1715	Due to iron	
Calcium, Ca	49	Sodium bicarbonate	-		
Magnesium, Mg	666	Sodium sulphate	-		
Silica, SiO ₂		Sodium chloride	14533	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	336	Br	33 g/g
Total	17876	Iron Bicarbonate			
	40.86 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No.....
 Water Cut..... 230'
 Address..... Water Level.....
 Supply..... 245'
 Hundred..... Depth Hole.....
 Section..... Date Collected..... 11/2/67
 Sample collected by..... A. Marochi

P. A. Young
P. A. YOUNG
Director.

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

Report Completed
AN2393/67

19th April, 1967

Your reference:

3/267/0

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARS PER MILLION grains/gallon
Chloride, Cl	2580	Calcium bicarbonate	12	Total	961
Sulphate, SO ₄	505	Calcium sulphate	289	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	949
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	224
Sodium, Na	1446	Magnesium sulphate	377	Due to magnesium	737
Potassium, K	55	Magnesium chloride	404	Due to iron	
Calcium, Ca	90	Sodium bicarbonate	-		
Magnesium, Mg	179	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	3675	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	105	Br	9 g/g
		Iron Bicarbonate			
Total	4862 11.11 oz/gallon				
Suspended matter					
Organic matter					

NAME _____ Hole No. 2

Water Cut _____

Address _____ Water Level _____

Supply _____

Hundred _____ Depth Hole 6'

Section _____ Date Collected _____

Sample collected by A. Marochi

AMD
P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Report Completed

Your reference:

3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	XXXX PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	XXXX PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	XXXX PARTS PER MILLION grains/gallon
Chloride, Cl	2020	Calcium bicarbonate	12	Total	800
Sulphate, SO ₄	445	Calcium sulphate	289	Temporary	788
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	12
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	224
Sodium, Na	1136	Magnesium sulphate	302	Due to magnesium	576
Potassium, K	43	Magnesium chloride	309	Due to iron	
Calcium, Ca	90	Sodium bicarbonate	-		
Magnesium, Mg	140	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	2887	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe < 0.01 g/g	
pH		Potassium chloride	82	Br 7 g/g	
Total	3881	Iron Bicarbonate			
	8.87 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. **2**

..... Water Cut.....

Address..... Water Level.....

..... Supply.....

Hundred..... Depth Hole **14'**

Section..... Date Collected.....

Sample collected by **A. Marochi**

P. A. Young
P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



060

CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

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Report Completed
AN2393/67

Your reference:

3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARIS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARIS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARIS PER MILLION grains/gallon
Chloride, Cl	1550	Calcium bicarbonate	13	Total	534
Sulphate, SO ₄	246	Calcium sulphate	122	Temporary	13
Bicarbonate, HCO ₃	8	Calcium chloride	-	Permanent	521
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	102
Sodium, Na	862	Magnesium sulphate	200	Due to magnesium	432
Potassium, K	34	Magnesium chloride	255	Due to iron	
Calcium, Ca	41	Sodium bicarbonate	-		
Magnesium, Mg	105	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	2191		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	65		
	2846	Iron Bicarbonate			
Total	6.51 oz/gallon				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g
Br 6 g/g

NAME Hole No.
..... Water Cut
Address Water Level
..... Supply
..... Depth Hole
Hundred
Section Date Collected
Sample collected by A. Marochi

P. A. Young
P. A. YOUNG
Director



061

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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AN2393/67

Your reference:

3/267/0

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

19th April, 1967

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	1520	Calcium bicarbonate	13	Total	503
Sulphate, SO ₄	218	Calcium sulphate	102	Temporary	13
Bicarbonate, HCO ₃	8	Calcium chloride	-	Permanent	490
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	87
Sodium, Na	846	Magnesium sulphate	183	Due to magnesium	416
Potassium, K	32	Magnesium chloride	251	Due to iron	
Calcium, Ca	35	Sodium bicarbonate	-		
Magnesium, Mg	101	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	2150		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	61		
		Iron Bicarbonate			
Total	2760				
	6.31 oz/gallon				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g
Br 5 g/g

2

NAME Hole No.

Water Cut

Address Water Level

Supply

Hundred Depth Hole 45'

Section Date Collected

Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	1780	Calcium bicarbonate	12	Total	582
Sulphate, SO ₄	265	Calcium sulphate	109	Temporary	12
Bicarbonate, HCO ₃	7	Calcium chloride	-	Permanent	570
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	92
Sodium, Na	994	Magnesium sulphate	236	Due to magnesium	490
Potassium, K	39	Magnesium chloride	278	Due to iron	
Calcium, Ca	37	Sodium bicarbonate	-		
Magnesium, Mg	119	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	2532	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	74	Br	6 g/g
	3241	Iron Bicarbonate			
Total	7.41 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 2

..... Water Cut 2' 6"

Address..... Water Level 4'

..... Supply -

Hundred..... Depth Hole 65'

Section..... Date Collected 20/2/67

Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 : TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

Report Completed**AN2393/67**

Your reference:

3/267/0**19th April, 1967**

**Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.**

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	3110	Calcium bicarbonate	10	Total	1026
Sulphate, SO ₄	476	Calcium sulphate	217	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	1016
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	170
Sodium, Na	1742	Magnesium sulphate	405	Due to magnesium	856
Potassium, K	63	Magnesium chloride	494	Due to iron	
Calcium, Ca	68	Sodium bicarbonate	-		
Magnesium, Mg	208	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	4427		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	120		
	5673	Iron Bicarbonate			
Total	12.97 oz/gallon				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g

Br 11 g/g

NAME..... Hole No. 2
Water Cut 2'6"
Address..... Water Level 4'
Supply -
Hundred..... Depth Hole 85'
Section..... Date Collected 21/2/67
Sample collected by **A. Marochi**

P. A. Young
P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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AN2393/67

19th April, 1967

Your reference:

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

3/267/0

	PPM PER MILLION	ASSUMED COMPOSITION OF SALTS	PPM PER MILLION	HARDNESS (as Calcium Carbonate)	PPM PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	4000	Calcium bicarbonate	8	Total	1310
Sulphate, SO ₄	597	Calcium sulphate	289	Temporary	8
Carbonate, HCO ₃	5	Calcium chloride	-	Permanent	1302
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	220
Sodium, Na	2232	Magnesium sulphate	492	Due to magnesium	1090
Potassium, K	83	Magnesium chloride	650	Due to iron	
Calcium, Ca	88	Sodium bicarbonate	-		
Magnesium, Mg	265	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	5673		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	158		
		Iron Bicarbonate			
Total	7270				
	16.62 oz/gallon				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01g/g

Br 139 g/g

NAME..... Hole No. 2

Water Cut. 2'6"

Address..... Water Level. 4'

Supply.....

Hundred..... Depth Hole. 105'

Section..... Date Collected. 22/2/67

Sample collected by. A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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Report Completed**AN2393/67**

Your reference: -

3/267/0

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

19th April, 1967

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	5650	Calcium bicarbonate	13	Total	1765
Sulphate, SO ₄	736	Calcium sulphate	262	Temporary	13
Bicarbonate, HCO ₃	8	Calcium chloride	-	Permanent	1752
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	205
Sodium, Na	3145	Magnesium sulphate	691	Due to magnesium	1560
Potassium, K	115	Magnesium chloride	936	Due to iron	
Calcium, Ca	82	Sodium bicarbonate	-		
Magnesium, Mg	379	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	7994		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	219		
		Iron Bicarbonate			
Total	10115				
	23.12 oz/gallon				
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g
 Br 19 g/g

NAME Hole No. 2
 Water Cut 2'6"
 Address Water Level 8'
 Supply -
 Hundred Depth Hole 125'
 Section Date Collected 23/2/67
 Sample collected by A. Marochi

P. A. Young
P. A. YOUNG
 Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



066

CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

Report Completed

AN2393/67

Your reference: -

3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	XXXXX PARTS PER XXXXX MILLION	ASSUMED COMPOSITION OF SALTS	XXXXX PARTS PER XXXXX MILLION	HARDNESS (as Calcium Carbonate)	XXXXX PARTS PER XXXXX MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	6800	Calcium bicarbonate	10	Total	2099
Sulphate, SO ₄	841	Calcium sulphate	272	Temporary	10
Bicarbonate, HCO ₃	6	Calcium chloride	-	Permanent	2089
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	210
Sodium, Na	3771	Magnesium sulphate	813	Due to magnesium	1889
Potassium, K	139	Magnesium chloride	1155	Due to iron	
Calcium, Ca	84	Sodium bicarbonate	-		
Magnesium, Mg	459	Sodium Sulphate	9585	Remarks:	
Silica, SiO ₂		Sodium chloride	-	Fe	< 0.01 g/g
Iron, Fe		Sodium nitrate	265	Br	22 g/g
pH		Potassium chloride			
	12100	Iron Bicarbonate			
Total	27.66	oz/gallon			
Suspended matter					
Organic matter					

NAME..... Hole No. 2
Water Cut 2'6"
Address..... Water Level 46'
Supply.....
Hundred..... Depth Hole 150'
Section..... Date Collected 25/2/67
Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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Report Completed
AN2393/67

19th April, 1967

Your reference:
3/267/0Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	2190	Calcium bicarbonate	18	Total	818
Sulphate, SO ₄	424	Calcium sulphate	306	Temporary	18
Bicarbonate, HCO ₃	11	Calcium chloride	-	Permanent	800
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	242
Sodium, Na	1227	Magnesium sulphate	261	Due to magnesium	576
Potassium, K	48	Magnesium chloride	341	Due to iron	
Calcium, Ca	97	Sodium bicarbonate	-		
Magnesium, Mg	140	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	3119	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	0.02 g/g
pH		Potassium chloride	92	Br	8 g/g
	4137	Iron Bicarbonate			
Total	9.46 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 3
..... 2'
..... Water Cut
Address..... Water Level 2'
..... Supply
.....
Hundred..... Depth Hole 6'
Section..... Date Collected 1/3/67
Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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Report Completed

AN2393/67

Your reference:

3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	3590	Calcium bicarbonate	15	Total	1233
Sulphate, SO ₄	576	Calcium sulphate	313	Temporary	15
Bicarbonate, HCO ₃	9	Calcium chloride	-	Permanent	1218
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	245
Sodium, Na	2002	Magnesium sulphate	445	Due to magnesium	988
Potassium, K	73	Magnesium chloride	587	Due to iron	
Calcium, Ca	98	Sodium bicarbonate	-		
Magnesium, Mg	240	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	5089		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	139		
	6588	Iron Bicarbonate			
Total	15.06	oz/gallon			
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g

Br 12 g/g

NAME..... Hole No. 3
..... Water Cut 2'
..... Water Level 2'
Address..... Supply -
..... Depth Hole 14'
Hundred..... Date Collected 1/3/67
Section.....
Sample collected by A. Marochi

W. A. Young
P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

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3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	4010	Calcium bicarbonate	13	Total	1267
Sulphate, SO ₄	535	Calcium sulphate	234	Temporary	13
Bicarbonate, HCO ₃	8	Calcium chloride	-	Permanent	1254
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	185
Sodium, Na	2232	Magnesium sulphate	464	Due to magnesium	1082
Potassium, K	83	Magnesium chloride	662	Due to iron	
Calcium, Ca	74	Sodium bicarbonate	-		
Magnesium, Mg	263	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	5674	Remarks:	
Iron, Fe		Sodium nitrate	-	Fe	< 0.01 g/g
pH		Potassium chloride	158	Br	13 g/g
Total	7205	Iron Bicarbonate			
	16.47 oz/gallon				
Suspended matter					
Organic matter					

NAME..... Hole No. 3
..... Water Cut 2'
..... Water Level 4'
Address..... Supply -
..... Depth Hole 26'
Hundred..... Date Collected 1/3/67
Section.....
Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

TELEPHONE 791662 - TELEGRAMS 'AMDEL' ADELAIDE

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19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	4090	Calcium bicarbonate	13	Total	1270
	525	Calcium sulphate	228	Temporary	13
Sulphate, SO ₄	8	Calcium chloride	-	Permanent	1257
Bicarbonate, HCO ₃	N11	Magnesium bicarbonate	-	Due to calcium	180
Nitrate, NO ₃	2277	Magnesium sulphate	456	Due to magnesium	1090
Sodium, Na	83	Magnesium chloride	678	Due to iron	
Potassium, K	72	Sodium bicarbonate	-		
Calcium, Ca	265	Sodium Sulphate	-		
Magnesium, Mg		Sodium chloride	5787	Remarks:	
Silica, SiO ₂		Sodium nitrate	-	Fe	< 0.01 g/g
Iron, Fe		Potassium chloride	158	Br	14 g/g
pH		Iron Bicarbonate			
Total	7320				
	16.73 oz/gallon				
Suspended matter					
Organic matter					

NAME _____ Hole No. **3**

Water Cut _____

Address _____ Water Level _____

Supply _____

Hundred **Lake Beel** Depth Hole **45'**

Section _____ Date Collected _____

Sample collected by **A. Marochi**

P. A. Young
P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

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Your reference:

3/267/0

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

19th April, 1967

	PARTS PER MILLION	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION
	grains/gallon		grains/gallon		grains/gallon
Chloride, Cl	4350	Calcium bicarbonate	12	Total	1370
Sulphate, SO ₄	588	Calcium sulphate	268	Temporary	12
Carbonate, HCO ₃	7	Calcium chloride	-	Permanent	1358
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	210
Sodium, Na	2426	Magnesium sulphate	500	Due to magnesium	1160
Potassium, K	90	Magnesium chloride	709	Due to iron	
Calcium, Ca	84	Sodium bicarbonate	-		
Magnesium, Mg	282	Sodium Sulphate	6166		
Silica, SiO ₂		Sodium chloride	-		
Iron, Fe		Sodium nitrate	172		
pH		Potassium chloride			
	7827	Iron Bicarbonate			
Total	17.89	oz/gallon			
Suspended matter					
Organic matter					

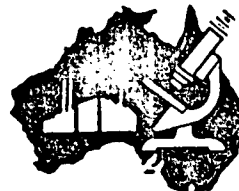
Remarks:

Fe < 0.01 g/g
Br 15 g/g

NAME..... Hole No. 3
..... Water Cut 2'
..... Water Level 2'
Address..... Supply -
..... Depth Hole 65'
Hundred..... Date Collected 3/3/67
Section.....
Sample collected by A. Marochi

P. A. YOUNG
Director

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES



CONYNGHAM STREET - FREWVILLE - SOUTH AUSTRALIA

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Your reference:

3/267/0

19th April, 1967

Projects Development Manager,
Clutha Development Pty Ltd,
GPO Box 3996,
SYDNEY, N.S.W.

	PARTS PER MILLION grains/gallon	ASSUMED COMPOSITION OF SALTS	PARTS PER MILLION grains/gallon	HARDNESS (as Calcium Carbonate)	PARTS PER MILLION grains/gallon
Chloride, Cl	5070	Calcium bicarbonate	10	Total	1583
Sulphate, SO ₄	661	Calcium sulphate	282	Temporary	10
Carbonate, HCO ₃	6	Calcium chloride	-	Permanent	1573
Nitrate, NO ₃	N11	Magnesium bicarbonate	-	Due to calcium	217
Sodium, Na	2821	Magnesium sulphate	579	Due to magnesium	1366
Potassium, K	104	Magnesium chloride	842	Due to iron	
Calcium, Ca	87	Sodium bicarbonate	-		
Magnesium, Mg	332	Sodium Sulphate	-		
Silica, SiO ₂		Sodium chloride	7170		
Iron, Fe		Sodium nitrate	-		
pH		Potassium chloride	198		
Total	9081 20.76 oz/gallon	Iron Bicarbonate			
Suspended matter					
Organic matter					

Remarks:

Fe < 0.01 g/g
Br 17 g/g

NAME..... Hole No. 3
Water Cut 2'
Address..... Water Level 2'
Supply -
Lake Bepl
Hundred..... Depth Hole 77'
Section..... Date Collected 4/3/67
Sample collected by A. Marochi

P. A. YOUNG
Director

PENINSULA PROSPECTING AND MINING PROPRIETARY LIMITEDQuarterly report on SML's 116 and 122 for the period ended
September 16th 1967

With the establishment of the proven reserves of gypsum, lime sand, and concentrated brines on SML's 116 and 122 during the period ended June 16th 1967, the investigational work has been directed to the following matters which are briefly reported as follows:-

1. A review has been made of the brine analyses of the samples taken in the three bores drilled through the gypsum deposits to bedrock. Table 1 attached, compares the concentrations of Cl, K, Mg and Br with the Na concentrations at various depths of the bores. It is of interest that the Na/Cl ratio is quite constant with depth for the three bores (and the same is true of the Na/Mg and Na/Br) but that the Na/K ratio in No. 1 is somewhat greater than in Nos. 2 & 3, and actually shows an increase between 125 feet and 145 feet, and that this increase is maintained at the greater depths even as the concentration of the No. 1 brine is more than doubled from 125 feet to 245 feet. This apparent slight depletion of K is difficult to interpret except in so far as the notable increase in concentration corresponds to a change from the porous limestone beds to the weathered granite bedrock in which the contained brines would have less freedom of movement and some of the K content might be chemically deposited in this bedrock environment.

In respect of computing an average composition for the brine underlying the gypsum, it is to be noted that there are anomalies in respect of Brine Bore No. 2 that make any arithmetic or even weighted average suspect, without a much larger number of bores being drilled and sampled in a similar manner to that for Nos. 2 & 3. Table 2 compares the three brine bores with Port Le Hunte seawater at the various sampling depths; Brine Bore No. 2 seems to exhibit somewhat anomalous behaviour through the first half of its depth, approaching the composition of seawater at 25-45 feet, and then increasing in concentration. This might suggest an incursion of seawater or more probably fresh water from some local drainage at this point.

An interesting consideration is the increase in brine concentration with depth in all three bores (noting the exception of the anomaly at certain depths in No. 2 Bore). The concentration increases markedly with depth. The ratios of the components to those of seawater certainly suggests that the concentration of seawater produced the brines.

In considering salt production by solar evaporation we have sought advices from an overseas consultant and are also continuing our studies on the surface areas required for specific tonnages in respect of utilizing the underground brines and the natural inflow of brines as either the main source or as a supplementary source for salt production by solar evaporation.

2. Gypsum

Our studies are being continued to define overseas markets for gypsum and also to ascertain the improvements necessary at Thevenard or at a new port site to permit a much greater market potential to be achieved. This study is presently concerned with the assessment of the characteristics of ports in the Pacific area where gypsum is presently being supplied from ex-Australian sources.

The use of the sulphate radical in gypsum is being considered both for sulphuric acid production and for use as a reactant in the form of those compounds to which calcium sulphate may be readily processed.

These possibilities include the production of ammonium sulphate from gypsum, ammonia, and carbon dioxide with the product, ammonium sulphate as a market product. The production of ammonium sulphate from gypsum for use in the production of sulphuric acid is also being investigated through consultants overseas.

The world shortage of elemental sulphur has resulted in increased cost of elemental sulphur, and therefore increased cost of sulphuric acid. A continuation of this trend seems inevitable, on our information for 2 or 3 years, and more if no spectacular discoveries are made. This situation will result in a favourable competitive position for sulphuric acid produced through other routes than elemental sulphur.

Our enquiries accordingly are covering the possible uses of gypsum in the chemical field and these are integrated particularly with transportation and fuel availability.

3. The lime sand utilization study has not been commenced.

We would propose to supply reports as they are completed.

The expenditure on investigational work for the period may be itemized as follows:-

Salaries	\$2050
Travelling Expenses and Sundries	<u>255</u>
Total -	<u>\$2305</u>

Excluding Head Office expenses.

S. B. Dickinson

S. B. Dickinson
2nd November, 1967

Table No. 1

Depth (feet)			Brine Bore No. 1				Brine Bore No. 2				Brine Bore No. 3			
No 1	No 2	No 3	Na Cl	Na K	Na Mg	Na Br	Na Cl	Na K	Na Mg	Na Br	Na Cl	Na K	Na Mg	Na Br
6	6	6	0.559	28.61	8.52	174	0.561	26.29	8.08	161	0.560	25.56	8.76	153
14	14	14	0.557	28.40	8.46	159	0.562	26.42	8.11	162	0.558	27.42	8.34	167
25	25	25	0.557	28.29	8.45	163	0.556	25.35	8.21	144	0.557	26.89	8.49	172
45	45	45	0.558	28.46	8.44	171	0.557	26.44	8.38	169	0.557	27.43	8.59	163
65	65	65	0.558	28.44	8.40	163	0.558	25.49	8.35	166	0.558	26.96	8.60	162
85	85	77	0.558	28.60	8.40	166	0.560	27.65	8.38	158	0.556	27.13	8.50	166
105	105		0.557	28.86	8.54	162	0.558	26.89	8.42	(160)? 16✓				
125	125		0.557	28.53	8.54	162	0.557	27.35	8.30	166				
145	150		0.557	30.14	8.43	174	0.555	27.13	8.22	171				
165			0.556	30.48	8.27	170								
185			0.556	29.50	8.45	295								
205			0.581	31.51	11.22	180								
225			0.557	31.65	8.54	169								
245			0.558	32.50	8.59	173								

Wt. ratio of the Na component
to Cl, K, Mg, and Br, respectively

Wt. ratio of the Na component
to Cl, K, Mg, and Br, respectively

Table No. 2.

			Brine Bore No. 1				Brine Bore No. 2				Brine Bore No. 3			
			Na	K	Mg	Cl	Na	K	Mg	Cl	Na	K	Mg	Cl
			Na sw	K sw	Mg sw	Cl sw	Na sw	K sw	Mg sw	Cl sw	Na sw	K sw	Mg sw	Cl sw
6	6	6	2.372	2.326	2.322	2.404	1.789	1.910	1.847	1.808	1.518	1.667	1.445	1.53
14	14	14	2.565	2.535	2.528	2.607	1.405	1.493	1.445	1.416	2.477	2.535	2.477	2.51
25	25	25	2.625	2.604	2.590	2.670	1.066	1.181	1.084	1.086	2.761	2.882	2.714	2.81
45	45	45	2.747	2.708	2.714	2.789	1.047	1.111	1.042	1.065	2.817	2.882	2.735	2.86
65	65	65	2.815	2.778	2.797	2.859	1.230	1.354	1.228	1.247	3.000	3.125	2.910	3.04
85	85	77	2.867	2.812	2.848	2.908	2.155	2.187	2.147	2.179	3.490	3.611	3.426	3.55
105	105		3.000	2.917	2.931	3.048	2.761	2.882	2.735	2.803				
125	125		3.000	2.951	2.931	3.048	3.891	3.993	3.911	3.959				
145	150		3.879	3.611	3.839	3.945	4.665	4.826	4.737	4.765				
165			4.412	4.062	4.448	4.499	(Note accuracy)							
185			3.869	3.681	3.818	3.938								
205			6.470	5.764	4.809	6.307								
225			6.891	6.111	6.729	7.008								
245			7.077	6.111	6.873	7.183								

Wt ratio of the Na, K, Mg & Cl
components of the brines to the
respective components in Port Le
Hunte sea water

Table No. 3. (The elements of Table 1, rearranged)

Depth (feet)			Wt ratio: $\frac{Na}{Cl}$			Wt ratio: $\frac{Na}{K}$			Wt ratio: $\frac{Na}{Mg}$			Wt ratio: $\frac{Na}{B}$		
No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3
6	6	6	0.559	0.561	0.560	28.61	26.29	25.56	8.52	8.08	8.76	174	161	15
14	14	14	0.567	0.562	0.558	28.40	26.42	27.42	8.46	8.11	8.34	159	162	16
25	25	25	0.557	0.556	0.557	28.29	25.35	26.89	8.45	8.21	8.49	163	144	17
45	45	45	0.558	0.557	0.557	28.46	26.44	27.43	8.44	8.38	8.59	171	169	16
65	65	65	0.558	0.558	0.558	28.44	25.49	26.96	8.40	8.35	8.60	163	166	16
85	85	77	0.558	0.560	0.556	28.60	27.65	27.13	8.40	8.38	8.50	166	158	16
105	105		0.557	0.558		28.86	26.89		8.54	8.42		162	16	
125	125		0.557	0.557		28.53	27.35		8.54	8.30		162	166	
145	150		0.557	0.555		30.14	27.13		8.43	8.22		174	171	
165			0.556			30.48			8.27			170		
185			0.556			29.50			8.45			295		
205			0.581			31.51			11.22			180		
225			0.557			31.65			8.54			169		
245			0.558			32.50			8.59			173		

Table No. 4. (The elements of Table 2, rearranged)

Depth (feet)			Wt ratio: $\frac{Na}{Na_{SW}}$			Wt ratio: $\frac{K}{K_{SW}}$			Wt ratio: $\frac{Mg}{Mg_{SW}}$			Wt ratio: $\frac{Cl}{Cl_{SW}}$		
No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3	No 1	No 2	No 3
6	6	6	2.372	1.789	1.518	2.326	1.910	1.667	2.322	1.847	1.445	2.04	1.808	1.53
14	14	14	2.565	1.405	2.477	2.535	1.493	2.535	2.528	1.445	2.477	2.07	1.416	2.52
25	25	25	2.625	1.066	2.761	2.604	1.181	2.882	2.590	1.084	2.714	2.70	1.083	2.81
45	45	45	2.747	1.047	2.817	2.708	1.111	2.882	2.714	1.042	2.735	2.29	1.005	2.81
65	65	65	2.815	1.230	3.000	2.778	1.354	3.125	2.797	1.228	2.910	2.59	1.217	3.04
85	85	77	2.867	2.155	3.490	2.812	2.187	3.611	2.848	2.147	3.426	2.08	2.179	3.55
105	105		3.000	2.761		2.917	2.882		2.931	2.735		3.048	2.803	
125	125		3.000	3.891		2.951	3.993		2.931	3.991		3.048	3.959	
145	150		3.879	4.665		3.611	4.826		3.839	4.737		3.945	4.765	
165			4.412			4.062			4.448			4.499		
185			3.869			3.681			3.818			3.938		
205			6.470			5.764			4.809			6.307		
225			6.891			6.111			6.729			7.008		
245			7.077			6.111			6.873			7.183		

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Quarterly Report on S.M.L.116 to December 16th, 1967

During the period ended December 16th, 1967, the investigational work of the company has comprised the assembly of information relating to the chemical uses for gypsum which, towards the end of the period, was devoted almost entirely to the process proposed by Dr. Coghill for producing sulphur from gypsum via hydrogen sulphide, the latter being a product of microbial action.

It is generally recognized that all the possibilities of the use of the sulphate radicle of gypsum must be given full consideration and study. In addition to the work that has already been done on ammonium sulphate from gypsum, and on sulphuric acid and cement from gypsum, following essentially proven processes that have been adopted commercially, his new concept was considered to be worthy of detailed investigation.

Enquiries to date, from an extensive literature search, have indicated that some thought has been given to the production of hydrogen sulphide from gypsum over the past years. There are some thirty to forty U.S. Patents pertaining to the reduction of sulphate to calcium sulphide as well as extensive patent information relating to the improvements and modifications of the Claus process which is applied to the production of the elemental sulphur.

We have had some preliminary discussions with the AMDEL Laboratories and have generally reached agreement that the study of the production of elemental sulphur from gypsum needs to take the widest possible course, and tentative plans have been made to pursue a preliminary investigation of the merits of Dr. Coghill's process but also to study the broader picture as to what reducing agent or agents may be favourable for the reduction of sulphate to sulphide.

In general, it is recognized that this reduction involves the transfer of eight electrons per atom of sulphur (sulphate or sulphide) if elemental hydrogen was the reductant of choice, and a reaction path was provided by means of a suitable "catalyst", i.e. the provision of a minimum of eight parts of elemental hydrogen per 32 parts of sulphur (25 tons of elemental hydrogen per 100 tons of sulphur) would constitute a process requirement. During the next period it is hoped to carry these studies further with practical laboratory information.

2.

This investigational work on chemical uses for gypsum is closely correlated with the market studies and port site studies that are being undertaken for both S.M.L.116 and S.M.L.122.

The investigational expenses for the period are itemized as follows:-

Salaries and wages	\$550
Travelling expenses and sundries	<u>\$275</u>
Total =	<u>\$825</u>

Excluding Administration expenses.

Quarterly Report on SML.116 to March 16th, 1968

During the period ended March 16th 1968, the investigational work of the Company has been related to the processing of gypsum for chemical uses.

This work has followed two main lines of enquiry, namely the utilization of gypsum for the manufacture of sulphuric acid by the cement-sulphuric process and for the manufacture of ammonium sulphate by the double decomposition process.

Preliminary feasibility studies have been made on the economics of both these processes and the possibilities of integrating one or both of these processes into chemical complexes have also been studied.

The Company has had the advice of overseas consultants on the latest development with respect to these processes and has had discussions with a potential consumer of large quantities of sulphuric acid for fertilizer manufacture. This consumer sees the desirability of using indigenous materials as a source of sulphur and in collaboration with the Company is considering the establishment of a plant to process 500,000 tons of gypsum annually. This investigation is still in progress.

Further to the report of the previous quarter (ended December 1967) a decision was taken to fully investigate the process proposed by Dr. Coghill for the production of sulphur from gypsum. The AMDEL Organisation has been authorised to proceed with a recommended programme of investigation with all findings being available to the Department on request.

The investigational expenses for the period are itemized as follows:-

Salaries and Wages	\$1050
Travelling Expenses and Sundries	\$ 215
Total =	<u>\$1265</u>