DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

ENVIRONMENT AND RESOURCE DIVISION

CONSTRUCTION SAND RESOURCES

MASLIN BEACH

HD. WILLUNGA, Co. ADELAIDE

by

J.G. OLLIVER
SENIOR GEOLOGIST

and

J.A. REED
GEOLOGIST

Rept.Bk.No. 75/140
G.S. No. 5672
D.M. No. 165/74

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Plate 1 Construction Sand Resources, Maslin Beach

General view easterly with ABM Noarlunga Pit in foreground. Monier's pit in centre, and in background - RMC Pedlar Creek pit on left and Christies pit on right.

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ABSTRACT

Maslin Beach is the only major sand producing area south of Adelaide.

Since the start of mining in 1928 to the end of 1974, 10.5 million tonnes of construction sand have been produced.

A total of 21.3 million cubic metres of sand in situ has been proved by drilling. This should yield 36.5 million tonnes of washed sand. Geological extrapolation into areas as yet untested by drilling to bedrock suggests that the Extractive Industry Zone contains 106 million cubic metres or 184 million tonnes of washed sand with a further 74 million cubic metres or 126 million tonnes of washed sand in Sections 369, 370, 159, 160 and 161, Hd. Willunga, south of the Extractive Industry Zone. These reserves, totalling 310 million tonnes are classified as possible.

Ten exploration holes totalling 970 m are required to confirm the geological assumptions.

When the limits of workable sand are defined the Extractive Industry Zone should be extended to ensure availability of this resource.

INTRODUCTION

Crushed aggregate, sand and clay are essential raw materials for urban development. Being non-renewable resources, large reserves are required to provide for long term needs.

Mineral deposits are particularly vulnerable to sterilisation by the inadvertent use of land for purposes which preclude the eventual establishment of extractive operations. Identification and securing of deposits of these essential materials is vital at an early stage in the transformation of rural land to urban use.

The sand deposits at Maslin Beach are one of the three major sources of construction sand in metropolitan Adelaide. Although a large part of the resources was zoned Extractive Industry following a report by Pain and Hiern (1972), there was no calculation of reserves.

Many holes have been drilled since the investigation of Olliver and Weir (1967). All available data have been incorporated in this report to define the geological limits of the sand resource and to estimate total reserves.

The co-operation of Ready Mixed Concrete (S.A.) Pty. Ltd., Concrete Industries (Monier) Ltd., Christies Sands Pty Ltd. and Pioneer Concrete Pty. Ltd., in providing drillhole data and samples is acknowledged.

LOCATION

The area under review comprises approximately 800 ha extending east and west of the Main South Road to Myponga, 46 km south of Adelaide. Twenty six sections viz. MS 1293, MS 1294, 133, 139-143, 149-153, 159-163, 359, 362-364, 366, 367, 369 and 370, Hd. Willunga, Co. Adelaide are involved. The new

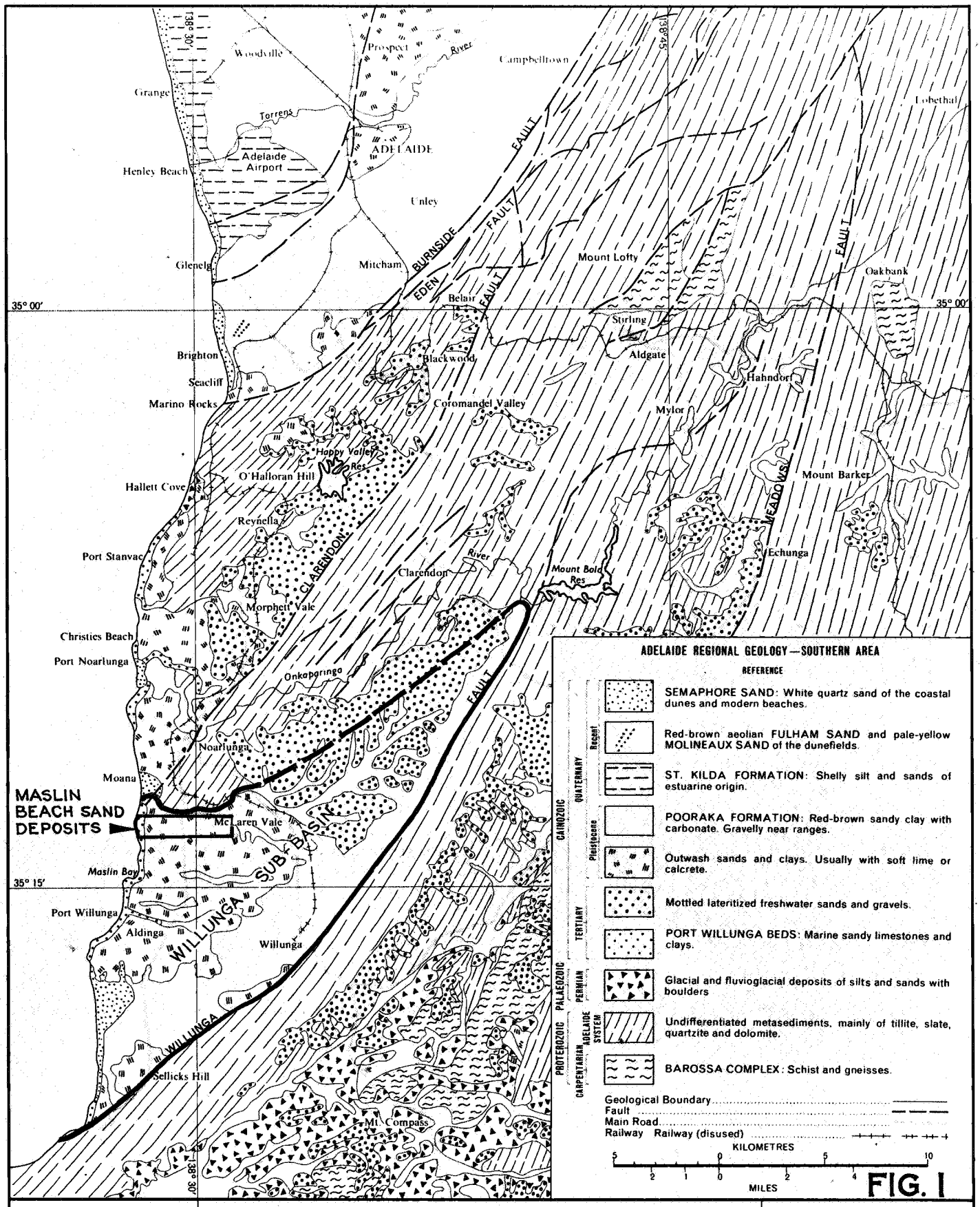


FIG. 1

ENGINEERING GEOLOGY SECTION	**DEPARTMENT OF MINES—SOUTH AUSTRALIA**	Scale: 1:250,000
Compiled: J.G.O.	**CONSTRUCTION SAND RESOURCES MASLIN BEACH** LOCATION AND REGIONAL GEOLOGY	Date: August 1975
Drn. A.F. | Ckd.		Drg. No. **S11872**
Geology from Adelaide and Barker 1:250,000 Geological Atlas Series		

PF No S9993 GH

highway to Victor Harbor marks the eastern boundary of the Extractive Industry Zone and represents the eastern limit of this investigation (see Figs. 2 and 3).

Construction sand has been proved to extend from Maslin Beach on the coast, eastwards for 5 km to the outskirts of McLaren Vale (see Plate 1).

Residential subdivisions at Seaford are now only 5 km north of the operating sand pits.

MINERAL TENURE AND ZONING

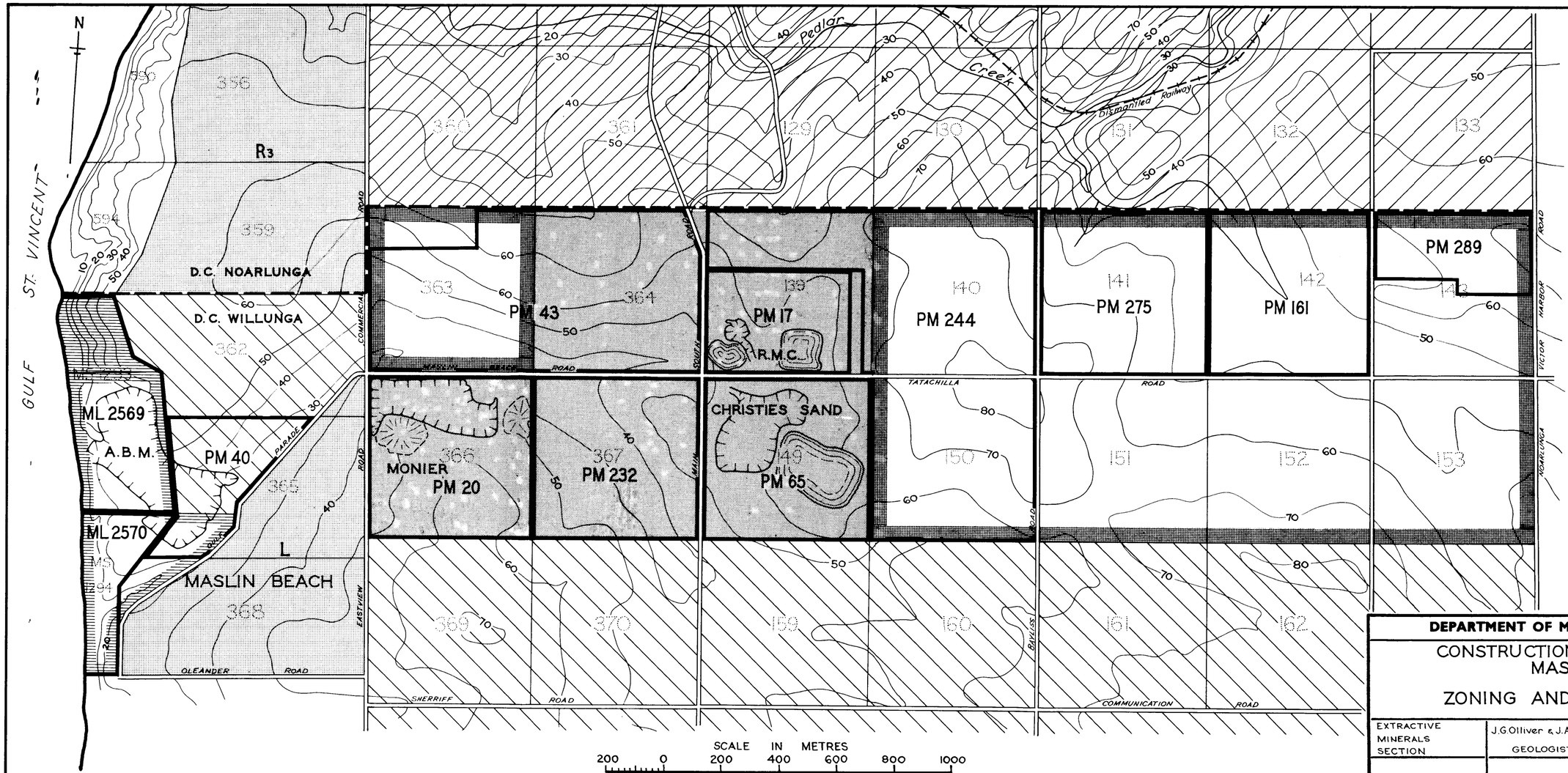
All sections are freehold land. Under the repealed Mining Act, minerals were alienated from the Crown. Ten Private Mines were declared under the Mining Act 1971-1975. Minerals on all remaining properties are now reserved to the Crown. However, as sand is classed as an extractive mineral, only the freehold owner may obtain mining title for sand.

A royalty of 5 cents per tonne on all sand produced is paid into the Extractive Areas Rehabilitation Fund . Grants from this fund are used for restoration of worked out areas.

Two mineral leases and ten Private Mines are current as detailed in Table 1 and shown on Figure 2.

Fourteen sections, as outlined on Fig. 2, are zoned Extractive Industry in Supplementary Development Plan No. 4 of the District Council of Willunga which was authorised on 12th July, 1973. The eastern eight sections and section 363 are not to be subject to operation prior to 1981.

The eastern eight sections are also subject to the Restriction or Prohibition of Surface Mining Operations Regulations, under the Mines and Works Inspection Act, 1920-1970 (see Appendix A). The restriction of operations on section 363 is not



LEGEND

- Sand deposits
- Pit area
- Slime dam
- Overburden heap
- 60 Surface contour in metres
- 140 Section number, Hd Willunga
- District council boundary
- PM40 Private Mine

ZONES

D.C. Noarlunga
- Residential 3 ..... R3
- Rural A .....
- Rural B .....

D.C. Willunga
- Living L
- Extractive Industrial .....
- Extractive Industrial - not To be subject To operation prior to 1981* .....
- Rural .....
- Open space, existing .....
- Open space, proposed .....

* Sections 140, 141, 142, 143, 150, 151, 152, 153, subject to "The Restriction or Prohibition of Surface Mining Operations Regulations."

FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CONSTRUCTION SAND RESOURCES MASLIN BEACH

ZONING AND MINERAL TENURE

EXTRACTIVE MINERALS SECTION	J.G.Olliver & J.A.Reed GEOLOGISTS	Compiled J.G.O.	Scale: 1:10000
			Date: August 1975
Director of Mines		Drn. A.F. Ckd.	Drg. No. 75-837

200—4.70 A2482

warranted as a small pit already exists near the centre of the section.

The sections surrounding the Extractive Industry Zone are zoned rural in both Noarlunga and Willunga District Council areas. Residential and living areas adjoin to the west.

Land use is detailed on Fig. 3. Apart from the sand pits, cereal crops and grazing are the main uses although vineyards and almond orchards predominate east of Bayliss Road. Ten homes have been built on sections, 133, 143, 151 and 152 in recent years.

TABLE 1

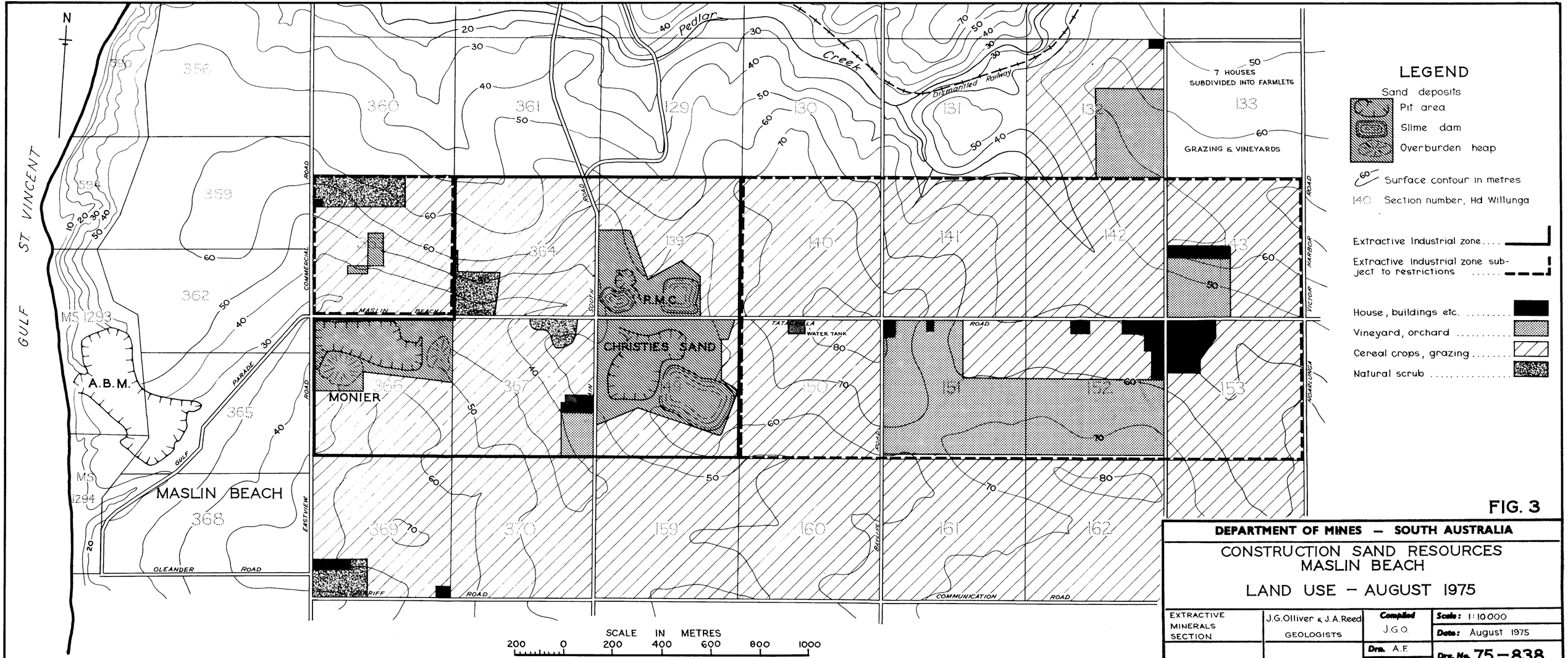
MINING TENEMENTS, MASLIN BEACH

(1) Mineral Leases

No.	Holder	Section	Area(ha)	Originally granted	Expires
ML2569	Australian Blue Metal Ltd.	MS 1293	16.2	1-4-28	31.3.80
ML2570	" "	MS 1294	6.5	"	"

(2) Private Mines

No.	Holder	Section	Area(ha)	Proclaimed	Operator
17	Ready Mixed Concrete(SA)Pty.Ltd.	Pt.139	18.5	9-11-72	RMC
20	C. Dyson	366	32.4	9-11-72	Monier
40	Australian Blue Metal Ltd.	Pt.365	14.4	22-2 -73	RMC
43	Concrete Industries(Monier)Ltd.	Pt.363, 364	60.4	22-2- 73	Monier
65	Christies Sands Pty. Ltd.	149	32.3	15-3- 73	Christies
161	Pioneer Concrete (SA) Pty. Ltd.	142	31.7	9-8- 73	Pioneer
232	A.W. Sherriff	367	32.4	16-5- 74	Christies



LEGEND

- Sand deposits
- Pit area
- Slime dam
- Overburden heap
- Surface contour in metres
- Section number, Hd Willunga
- Extractive Industrial zone
- Extractive Industrial zone subject to restrictions
- House, buildings etc.
- Vineyard, orchard
- Cereal crops, grazing
- Natural scrub

FIG. 3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CONSTRUCTION SAND RESOURCES MASLIN BEACH

LAND USE — AUGUST 1975

EXTRACTIVE MINERALS SECTION	J.G. Olliver & J.A. Reed GEOLOGISTS	Compiled J.G.O.	Scale: 1:10000
			Date: August 1975
Director of Mines		Drn. A.F. Chd. A.F.	Drg. No. 75-838

290—4,78 A3482

Private Mines Continued

244	A.I. & L.A.E. Martin	Pt.139, 140,150	78.7	8-8-74	RMC
275	A.I. & L.A.E. Martin	Pt.141	30.8	1-5-75	RMC
289	A.M. & L.J. Chaplin	Pt.143	12	14-8-75	-

PRODUCTION

Sand mining began in the coastal cliffs at Maslin Beach in 1928 (Ward 1928a, and 1928b) and until 1960 this was the only pit in the area (Cornelius, 1929 and Miles, 1944), The operating company, A.B.M. Noarlunga Sand Co., is now a wholly owned subsidiary of Ready Mixed Concrete (S.A.) Pty.Ltd. There are no washing facilities on site; all production has been unscreened or dry screened sand.

Alberts' Sand Pit Pty.Ltd was founded in 1960 on Section 366, following a scout drilling programme in 1959 (Olliver, 1961a). Output was restricted to dry screened products until installation, in 1972, of washing equipment purchased on the closure of W. Duhne and Sons Pty. Ltd., at Highbury.

With the retirement of Mr. J. Albert in September, 1973, the pit was acquired by Concrete Industries (Monier) Pty.Ltd.

In 1961-62, Twin Power Excavations obtained filling sand from Section 139 for the foundation pads of the storage tanks at Pt. Stanvac oil refinery. This pit remained dormant until reopened in 1969 by International Sand Supply Pty. Ltd., Unisan Pty. Ltd. became the operating company in 1972 only to go into liquidation later in the year. Ready Mixed Concrete(S.A.) Pty. Ltd. acquired the deposit in 1973

Christies Sands Pty. Ltd's, pit was opened in September, 1961 by D.R. Rosewall. The washing plant was installed in October, 1964.

Production of sand from the four pits is detailed in Table 2, and compared with other areas supplying metropolitan Adelaide in Table 3 and Fig. 4.

TABLE 2

PRODUCTION OF SAND AND GRAVEL, MASLIN BEACH

	ABM NOARLUNGA	ALBERTS' now MONIER SANDS	CHRISTIES	UNISAN now RMC-PEDLAR CREEK	TOTAL
(in tons)					
1922-59	5 000 000(est)	-	-	-	5 000 000
1960	114 903	56 846	-	-	171 749
1961	130 245	78 450	5 000	-	213 695
1962	135 912	64 668	24 000	-	224 580
1963	162 541	80 687	20 000	-	263 228
1964	165 443	116 025	24 116	-	305 584
1965	141 523	110 740	105 464	-	357 727
1966	192 500	76 914	83 877	-	353 291
1967	172 350	54 689	85 618	-	312 657
1968	136 150	57 548	104 136	-	297 834
1969	146 130	58 189	122 817	56 983	384 119
1970	162 800	60 944	122 219	49 118	385 081
1971	205 439	62 811	103 638	57 683	429 571
1972	189 160	62 028	130 255	43 606	425 049
TOTAL TONS	7 055 096	940 539	921 140	207 390	9 124 165

Cont.....

TABLE 2 (continued)

	ABM NOARLUNGA	ALBERTS' now MONIER SANDS	CHRISTIES	UNISAN now RMC-PEDLAR CREEK	TOTAL
QUIVALENT TONNES	7 167 978	955 588	935 878	210 708	9 270 152
in tonnes)					
1973	172 345	102 833	163 560	67 734	506 472
1974	215 230	200 477	187 078	93 864	696 649
TOTAL	7 555 553	1 258 898	1 286 516	372 306	10 473 273

In Table 3, natural sand is defined as unconsolidated sediment of aeolian, lacustrine or fluviatile origin. Production figures quoted include coarse grained material or gravel.

Quarry sand is defined as the fine grained byproduct derived from crushing and screening of quartzite at hard rock quarries to produce coarse aggregate.

"Elsewhere" comprises Golden Grove, Highbury, Tea Tree Gully, Gawler, Rowland Flat and One Tree Hill. The proportion of the various totals represented by Maslin Beach are listed in Table 4.

TABLE 3

PRODUCTION OF SAND AND GRAVEL, ADELAIDE

	MILLIONS OF TONNES					
	1969	1970	1971	1972	1973	1974
Maslin Beach	0.390	0.391	0.436	0.430	0.506	0.697
Elsewhere	0.960	0.957	0.900	0.935	1.655	1.103
Total Natural Sand	1.350	1.348	1.336	1.365	2.161	1.800
*Quarry Sand	0.070	0.114	0.102	0.074	0.102	0.068
Total Construction Sand	1.420	1.462	1.438	1.439	2.263	1.868
Filling Sand	0.250	0.201	0.131	0.161	0.111	0.093
Total Sand	1.670	1.663	1.569	1.600	2.374	1.961

*Quarry sand herein does not include the considerable output from Stonyfell and Eagle quarries, as this sand has not been separated from coarse aggregate in returns to the Department of Mines.

TABLE 4

PERCENTAGE REPRESENTED BY MASLIN BEACH OF METROPOLITAN PRODUCTION

	Natural Sand	Total Construction Sand	Total Sand
1969	29	27	23
1970	29	27	24
1971	33	30	28
1972	32	30	27
1973	23	22	21
1974	39	37	36

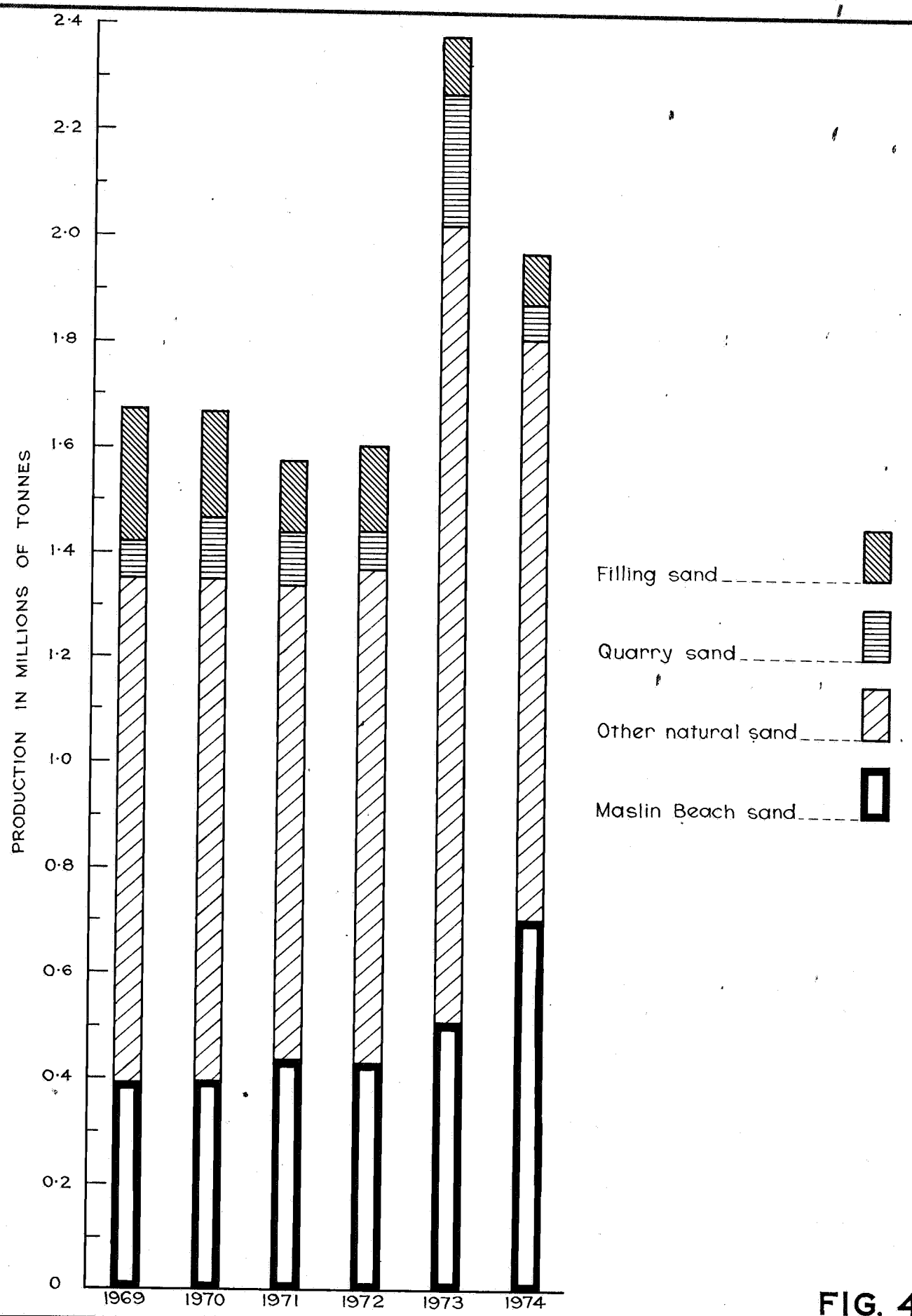


FIG. 4

Industrial Minerals Section	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale :
Compiled : J.G.O	SAND PRODUCTION METROPOLITAN ADELAIDE	Date : Aug 1975
Drn. A.F. | Ckd A.F.		Drg. No. S11881

750—8.74 F332 O

At Maslin Beach, both washed and unwashed sand is produced for use as concrete fine aggregate, mortar and plastering. At one stage, foundry sand was supplied to Chrysler Aust. Ltd. from Christies Sand Pit. However, the size grading of this material was too variable. A classification plant is required to produce consistent graded sands for special uses.

With the loss of the fine sand deposits at Royal Park due to residential development and the near depletion of similar deposits at Happy Valley, fine sand lenses within the North Maslin Sand and relatively clean layers of fine sand in the overburden must be considered for filling purposes.

GEOLOGICAL SETTING

The Maslin Beach sand deposits are located along the northern margin of the Willunga Sub-basin, a tectonic valley developed in Adelaidean sediments of Precambrian age. The sub-basin occupies a northeast-southwest depression of approximately 160 square kilometres, bounded south easterly by the Willunga Fault and westerly by Gulf St. Vincent (see Fig.1). Orientation is due to later Tertiary fault movements which tilted the sub-basin to the south-east at a low angle.

To the north, Precambrian bedrock represented by slates and quartzites of Marinoan age, crops out in the coastal cliffs north of ABM Noarlunga pit and along Pedlar Creek.

Permian and Tertiary sediments fill the sub-basin to a recorded maximum of 330 m in Borehole QA 16, at Aldinga Beach, 6 km southwest of Maslin Beach (J. Waterhouse pers. comm). The western half of the sub-basin is covered surficially by soil

and Quaternary units; Tertiary sediments being exposed only in coastal cliffs, road cuttings, stream channels and sand pits. Lateritised freshwater Tertiary sediments crop out in the eastern portion (see Fig. 1).

Construction sand is won from the basal Tertiary North Maslin Sand of Middle Eocene age. This non-marine unit has been deposited unconformably on an undulating surface of Precambrian rocks, or in some areas Permian fluvioglacial clays and sands. The basal sand and overlying dominantly marine Tertiary sediments (as detailed in Table 5 from Reynolds, 1953) dip gently to the south-east. The marine units are richly fossiliferous, particularly the Blanche Point Transitional Marl and Tortachilla Limestone.

TABLE 5

STRATIGRAPHIC TABLE, WILLUNGA SUB-BASIN

Quaternary	Sands, clays, scree, outwash and alluvium.
? Plio-Pleistocene:	Carisbrooke Sand. Varicoloured quartz sand, unfossiliferous, very fine to medium grained, gravelly at base, slightly clayey. Probably fluviatile.
Pliocene:	Hallett Cove Sandstone - Limestone and sands with some clays.
Late Eocene - Oligocene:	Port Willunga Beds - Bryozoal calcarenites, impure limestones, sands, silts and clays.
Late Eocene:	Chinaman's Gully Beds - Gravels to silts, with red, yellow, brown and green clayey beds.
	Blanche Point Soft Marl - Mottled soft spicular clay and claystone, glauconitic, with nodules of chertstone.

	Blanche Point Banded Marl - Bands of hard grey, white, brown chertstones, marlstone and limestone alternate with soft clay and marl.
	Blanche Point Transitional Marl - Soft mottled marly sand and marl, glauconitic in parts.
	Tortachilla Limestone - Pale brown limestone, glauconitic limestone, ferruginous limestone, and yellow, brown and olive clay or marl.
? Late Eocene:	South Maslin Sand - yellow and brown ferruginous quartz sand, clayey in parts, with polished limonite grains.
Middle Eocene:	North Maslin Sand - Varicoloured fine to coarse grained quartz sand, unfossiliferous.
	unconformity
Permian:	Fine sands, silts and clays.

The North Maslin Sands are varicoloured, cross-bedded quartz sands. Grain size and clay content vary rapidly, both vertically and laterally. Grain size generally increases with depth, culminating in basal gravels containing quartz cobbles up to 20 cm in diameter. Grains vary from angular to subrounded. Mica flakes are widespread.

Occasional seams of laminated silts and clays occur. A lens of black clay rich in spores and pollen was exposed at ABM Noarlunga Sand Pit (Lange, 1970 and McGowran et al., 1970). A comparable but younger grey clay with black lignitic bands was encountered in drill holes B2/73 and B3/73 (Lindsay and Harris, 1974 and Olliver, 1974).

Within the central part of the Willunga Sub-basin, the North Maslin Sands comprise clayey and silty sands with

lignites and carbonaceous beds as distinct from the relatively clean coarse sand facies in the Maslin Beach area.

RESULTS OF DRILLING

During 1959 - 1965, 228 holes were completed by the Department of Mines, using either the Landrover mounted Proline or the Gemco machine augers. Most of these holes were ineffective due to the limited capacity of the drilling rig and its inability to penetrate hard layers in the overburden. Approximately half the holes either failed to reach North Maslin Sand or to reach the base of the sand. Also during this period many holes were drilled by private rigs but no records or samples were kept.

During 1972 - 1975, a further 122 holes were drilled; 92 shallow holes by private rigs and 30 holes using Departmental rigs. Only 22 of the former reached the base of the North Maslin Sand compared with 20 of the latter. Deep drilling to bedrock was accomplished successfully using a Mayhew rotary rig with mud circulation.

Drillhole locations are shown in Appendix B and Fig. 5. Materials encountered are summarised in Appendix C and on geological sections in Fig. 5 and Fig. 6. The subdivision of the overburden into stratigraphic units is beyond the scope of this report; reference should be made to Lindsay and Harris (1974) and Olliver and Reed (in press).

The north-south sections (Fig. 6) show bedrock outcropping in the north and sloping gently southwards. Maximum thickness of construction sand was 57 m in drillhole A11/72 (see section D-D'). The thickness of overburden increases

progressively southwards in all sections.

Difficulty has been experienced in distinguishing between the upper fine grained and clayey North Maslin Sands, reworked North Maslin Sands and South Maslin Sands (as recorded by Brown, 1960) from old bore logs.

Water table which is not recorded in Appendix C may pose a problem when quarrying nears bedrock.

RESERVES

Reserves of construction sand and overburden proved by drilling are listed in Table 6, together with total potential sand in each section based on the geological sections in Fig. 6. The expected yield of washed product assuming all fines passing 75 microns are removed is based on,

density of sand in situ ..... 1.9 tonnes/c.m.
average content passing 75 microns. 14 percent by weight
moisture content of washed product. 5 percent by weight

Tonnes of washed product are obtained by multiplying the volume of sand in situ by a factor of 1.7.

Fine sand has been included with construction sand. These figures are classed as geological reserves. Extractable reserves will be less and will depend on pit design, mining techniques, environmental considerations and water table.

TABLE 6

RESERVES OF CONSTRUCTION SAND (millions)

(1) Extractive Industry Zone free of restrictive regulations

Section	Proved c.m.	Possible c.m.	Total Potential c.m.	Yield Tonnes	Overburden c.m.	References
Pt. 365	almost worked out-assume nil					
366	4.0	7.0	11	25*	4	Olliver, 1973
364	3.4	2.6	6	10	1	Johns, 1965a
367	0.5	9.5	10	17	3	Olliver, 1961b
139	1.4	0.6	2	3	1	Olliver, 1963a
149	-	7.0	7	12	7	-
TOTAL	9.3	26.7	36	67	16	

* includes dumps of overburden

(2) Extractive Industry Zone subject to restrictive regulations

Section	Proved c.m.	Possible c.m.	Total Potential c.m.	Yield Tonnes	Overburden c.m.	References
363	2.9	4.1	7	12	1	Johns, 1965b
140	1.8	0.2	2	3	2	RMC
150	2.7	6.3	9	15	11	RMC
141	1.0	3.0	4	7	3	RMC
151	-	12.0	12	20	11	-
142	3.6	0.4	4	6	3	Olliver & Reed, 1975
152	-	12.0	12	20	11	-
143	-	9.0	9	15	4	Olliver 1975 Reed, 1974
153	-	11.0	11	19	11	-
OTAL	12.0	58.0	70	117	57	

(3) Outside Extractive Industry Zone.

Section	Proved c.m.	Possible c.m.	Total Potential c.m.	Yield Tonnes	Overburden c.m.	References
369	-	23	23	39	10	-
370	-	16	16	27	10	-
159	-	10	10	17	13	-
160	-	10	10	17	16	-
161	-	15	15	26	19	-
TOTAL	nil	74	74	126	68	-

Total proved sand in situ is therfore 21.3 million cubic metres equivalent to 36.5 million tonnes of washed product, all within the Extractive Industry Zone.

Sections 132, 133, 162 and 163 are not included in Table 6 (3) for the following reasons:-

Section 132 - reserves too small and probably sand is too fine grained (Olliver, 1962a).

Section 133 - proved reserves of 170 000 cubic metres are too fine grained for construction purposes (Olliver, 1963c).

Section 162, 163 - overburden probably too thick, await results of exploratory drilling.

PROPOSED DRILLING PROGRAMME

A drilling programme of ten holes as detailed in Table 7 at sites shown on Fig. 5 is recommended to determine the thickness of construction sand and overburden, particularly south of the operating pits. All holes have been sited in road reserves.

The Mayhew rig using mud circulation should be used as the deepest hole is expected to be 130 m.

TABLE 7

PROPOSED DRILLHOLES

Hole No.	Geological Section	Target Depth (m)
MS1	D-D'	130
MS2	D-D'	100
MS3	E-E'	110
MS4	F-F'	60
MS5	F-F'	90
MS6	G-G'	90
MS7	H-H'	110
MS8	H-H'	90
MS9	H-H'	60
MS10	J-J'	130
		970

CONCLUSIONS

The sand deposits at Maslin Beach are the only major developed source of construction sand south of Adelaide. Output from the 4 operating pits has totalled 10.5 million tonnes since the start of mining in 1928. Annual production is expected to exceed 1 million tonnes in 1976. In 1974, Maslin Beach provided 37% of the construction sand requirements of metropolitan Adelaide.

Sand is won from the North Maslin Sand , a non-marine sedimentary unit of Middle Eocene age, which was deposited unconformably on an undulating surface of Permian and Precambrian strata.

Since 1959, 21.3 million cubic metres of construction sand or 36.5 million tonnes of washed product have been proved by drilling. Estimates of total potential sand within the area investigated are tabled below.

Zone	Sand In Situ Million c.m.	Expected Yield of Washed Sand Million Tonnes
Extractive Industry - no restrictive regulations	36	67
Extractive Industry - restrictive regulations	70	117
Rural	74	126
	180	310

A drilling programme of 10 holes to a maximum expected depth of 130 m and totalling 970 m is proposed. The Extractive Industry Zone should then be extended to include sections containing workable deposits of construction sand.

J.G. OLLIVER
Senior Geologist.

JGO:JAR/JG

J.A. REED
Geologists

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APPENDIX A.

EXTRACT FROM SOUTH AUSTRALIAN GOVERNMENT GAZETTE

JULY 5, 1973

REGULATIONS UNDER THE MINES AND WORKS INSPECTION ACT, 1920-1970

Regulations under the Mines and Works Inspection Act, 1920-1970

At the Executive Council Office, at Adelaide, this 5th day of July, 1973

BY virtue of the provisions of the Mines and Works Inspection Act, 1920-1970, and all other enabling powers, I, the Governor of the State of South Australia, with the advice and consent of the Executive Council, hereby make the following regulations.

M. L. OLIPHANT, Governor

Regulations under the Mines and Works Inspection Act, 1920-1970

1. These regulations may be cited as "The Restriction or Prohibition of Surface Mining Operations Regulations".

2. These regulations shall apply to the area or areas of the State specified in the schedule hereto.

3. (1) No person shall, in an area to which these regulations apply, commence or extend any mining operation, or any operation or practice incidental thereto, which interferes with the surface of any land, without the written consent of the Minister being first obtained.

(2) Subject to Regulation 4 of these regulations, the Minister may grant his consent either unconditionally or subject to such conditions as he thinks fit, or may refuse his consent.

(3) Subregulations (1) and (2) of this regulation shall not apply to mines lawfully existing at the time these regulations come into operation and which are being worked in conformity with the requirements of the Mines and Works Inspection Act, 1920-1970, and all regulations made thereunder.

4. The Minister may refuse his consent or impose conditions upon his consent if such refusal or conditions are necessary or desirable:—

(*a*) to reduce or prevent any impairment of the amenity of any area or place by mining operations or practices, or

(*b*) in order to ensure or encourage the orderly mining of mineral deposits in such a manner or in such stages that the amenity of any area or place is either preserved or the impairment thereof is reduced as much as is reasonably possible.

5. (1) Any person who commences or extends any mining operation, or any operation or practice incidental thereto, in contravention of Regulation 3 of these regulations shall be guilty of an offence against these regulations.

(2) Any person who conducts any mining operation or any operation or practice incidental thereto in contravention of Regulation 3 of these regulations shall be guilty of an offence against these regulations for each day upon which such mining operation or operation or practice incidental thereto is conducted.

(3) Any person guilty of an offence against these regulations shall be liable to a penalty not exceeding, for a first offence, $40.00 and for a subsequent offence, $200.00.

THE SCHEDULE

1. Sections 140, 141, 142, 143, 150, 151, 152 and 153 of the Hundred of Willunga.

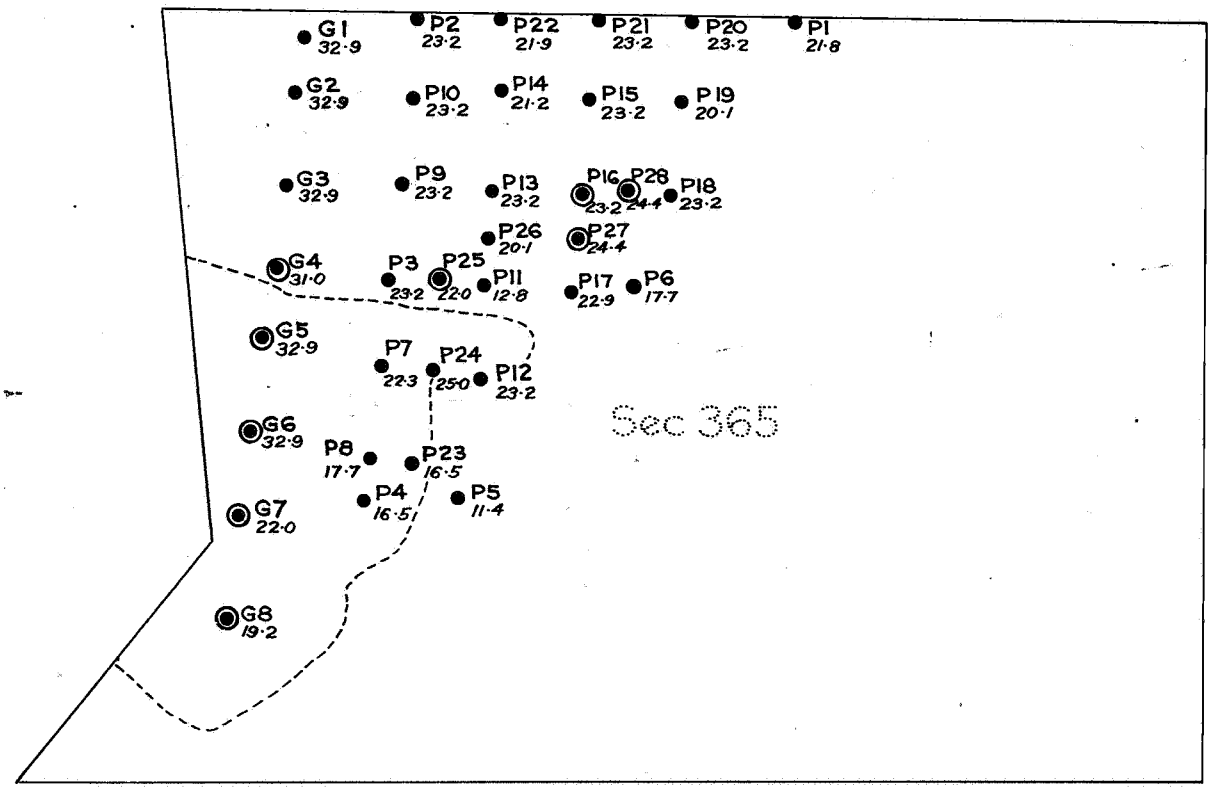
2. The Hills Face Zone as defined by the Metropolitan Development Hills Face Zone Planning Regulations, 1971, which were made on the 16th day of December, 1971, and published in the *Government Gazette* on the same day at page 2513.

And the Honourable the Minister of Development and Mines is to give the necessary directions herein accordingly.

S.P.O., 93/1972 K. FLEMING, Acting Clerk of the Council

APPENDIX B

LOCATION OF DRILLHOLES



REFERENCE FOR PLANS IN THIS APPENDIX

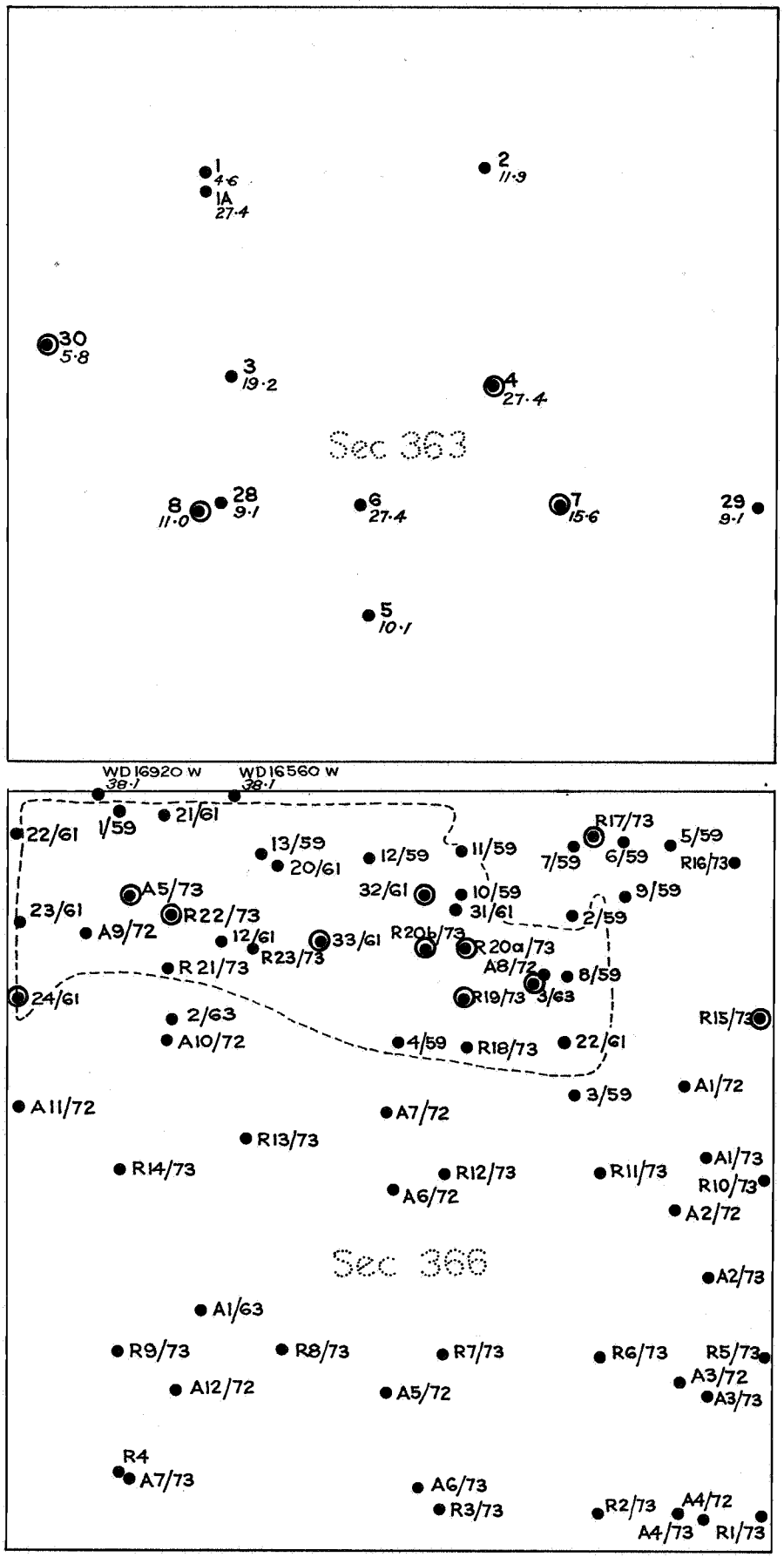
Outline of pit area

G7 22·0 Drillhole position and number
Depth in metres

O Bedrock intersected

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	Drn. J.R.	MASLIN BEACH SAND DEPOSITS	SCALE: 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11873
	Ckd.	SECTION 365 HD. WILLUNGA	
	Exd.		DATE: Aug. 1975

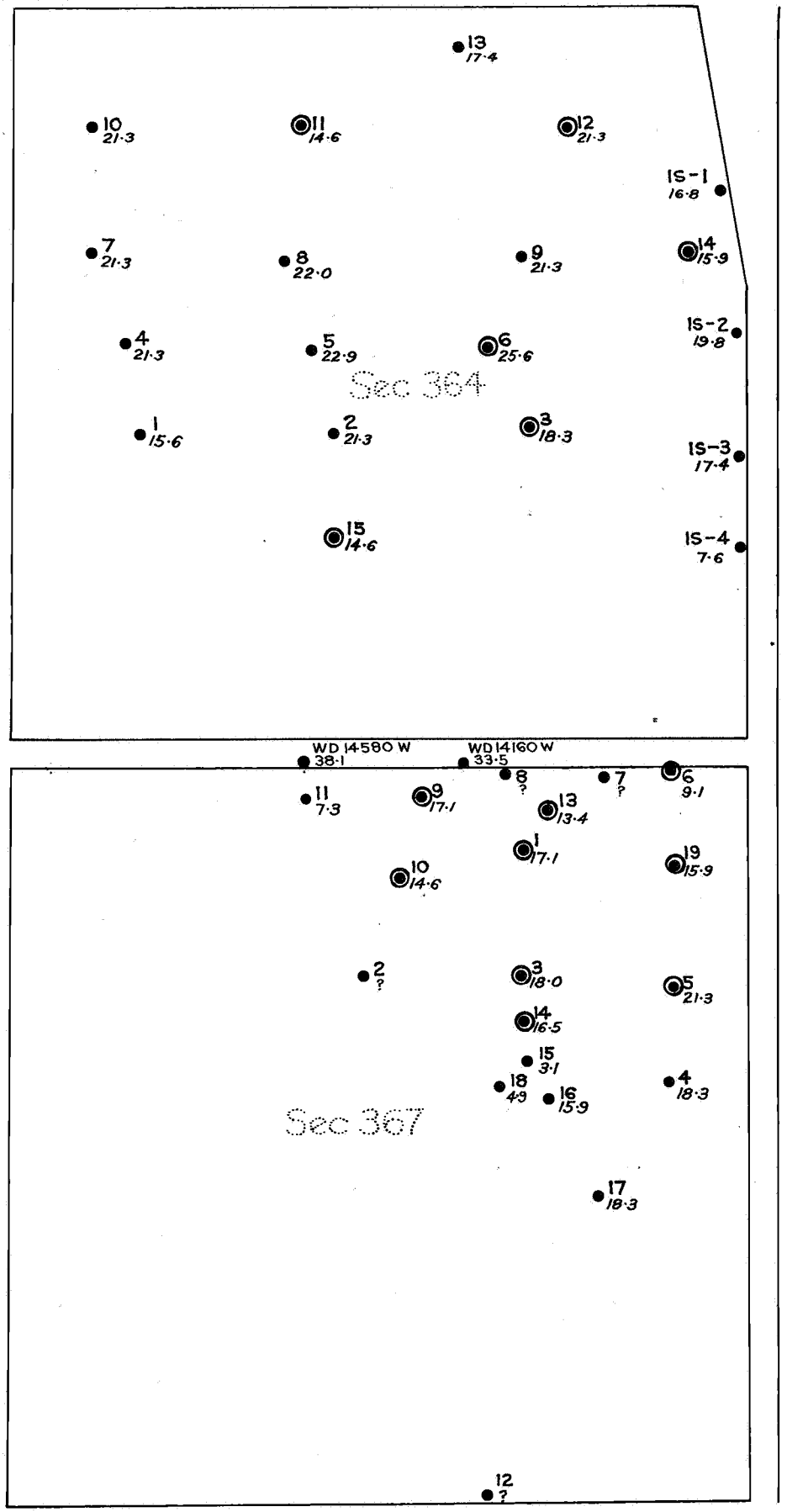


For depths of drillholes in Sec. 366 see tables, Appendix E.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	**Drn.** J.R.	MASLIN BEACH SAND DEPOSITS	**SCALE:** 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11874
	Ckd.	SECTIONS 363, 366. HD. WILLUNGA	**DATE:** Aug 1975
	Exd.		

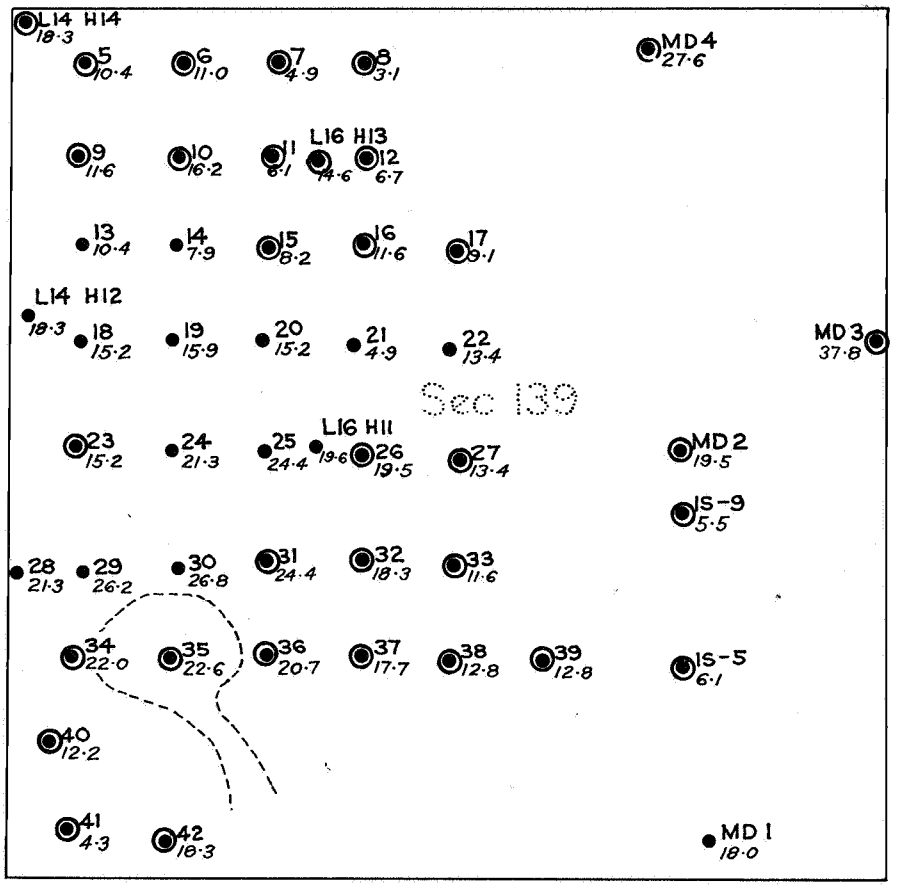
500—2 69 665

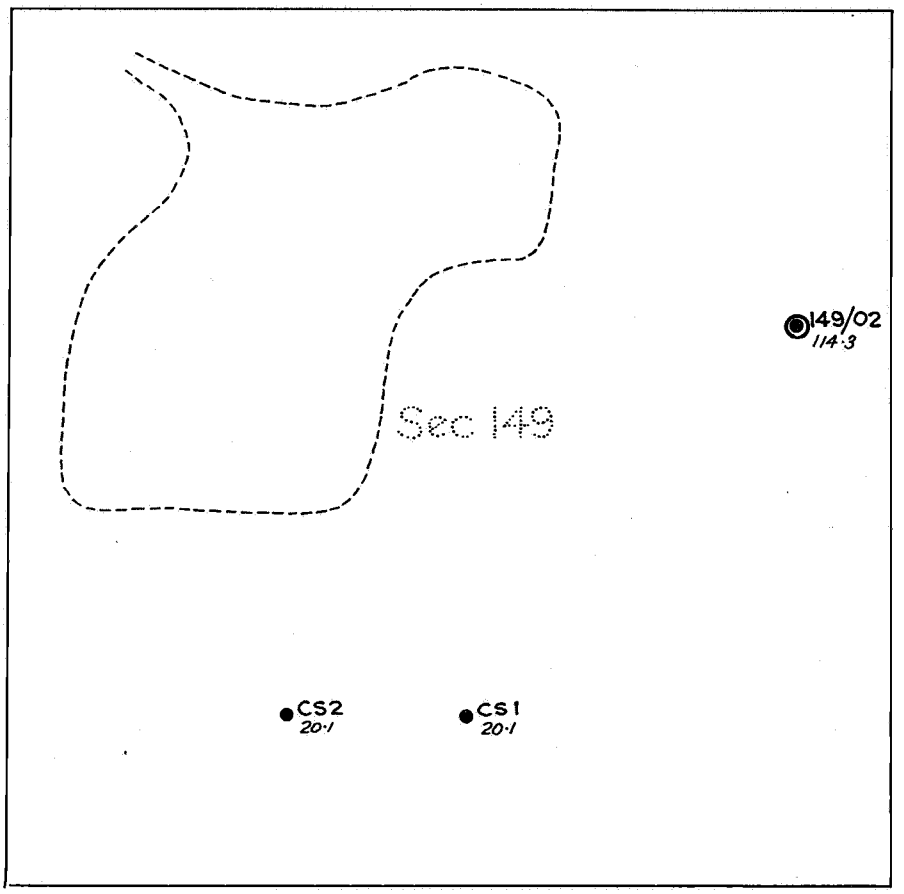


DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	Drn. J.R.	MASLIN BEACH SAND DEPOSITS	SCALE: 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11875
	Ckd.	SECTIONS 364, 367. HD. WILLUNGA	DATE: Aug 1975
	Exd.		

500–2,69 665

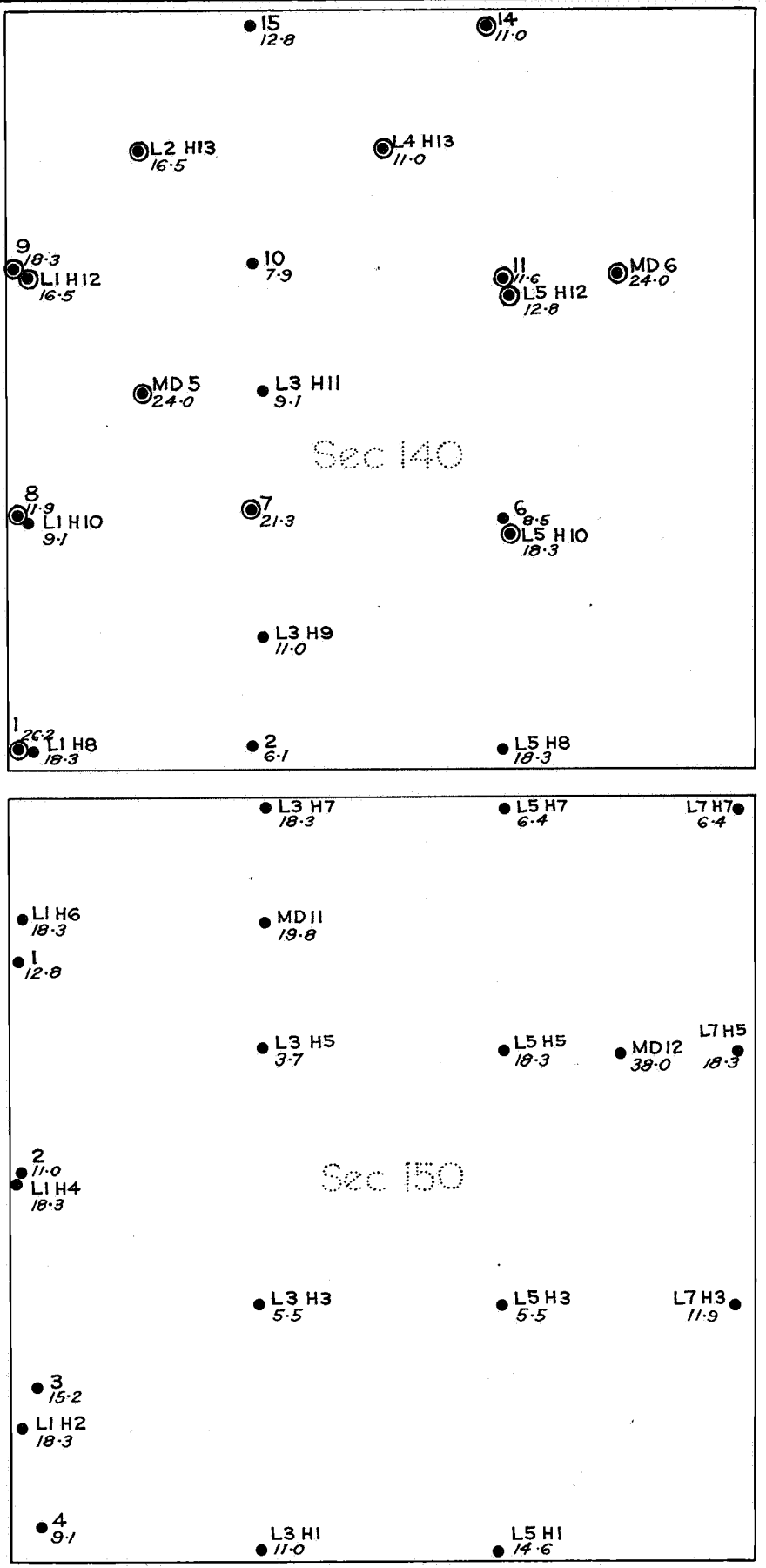




DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	Drn. J.R.	MASLIN BEACH SAND DEPOSITS	SCALE: 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11876
	Ckd.	SECTIONS 139, 149. HD. WILLUNGA	
	Exd.		DATE: Aug 1975

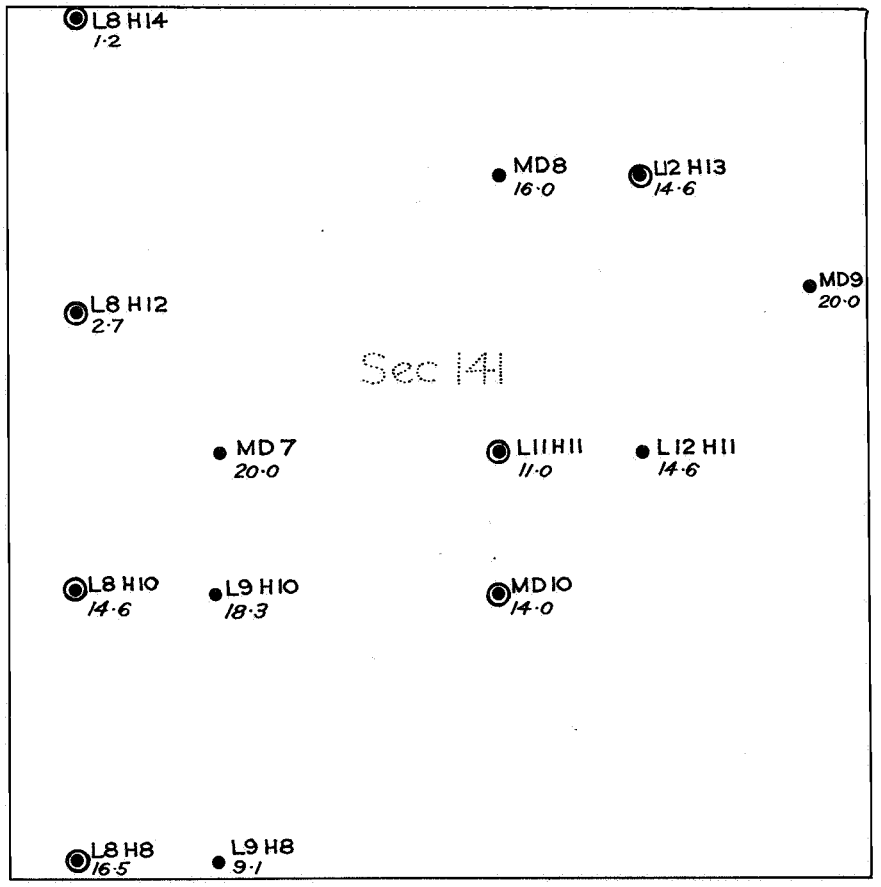
500—2.69 865

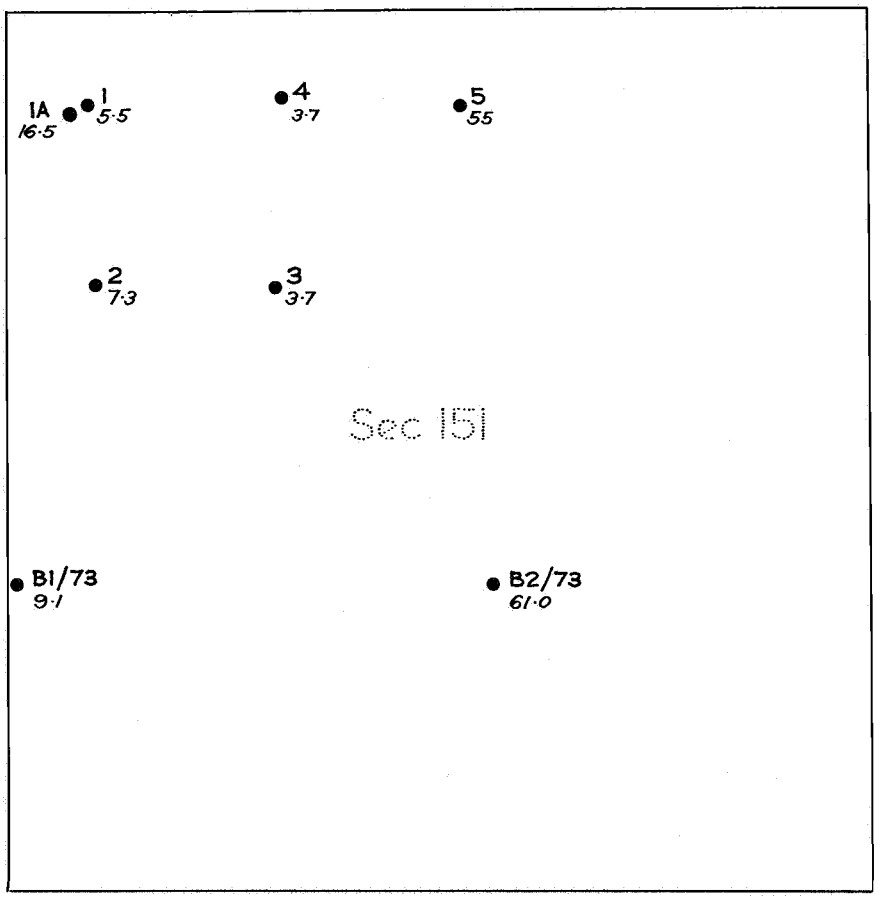


DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	**Drn.** J.R.	MASLIN BEACH SAND DEPOSITS	**SCALE:** 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11877
	Ckd.	SECTIONS 140, 150. HD. WILLUNGA	**DATE:** Aug 1975
	Exd.		

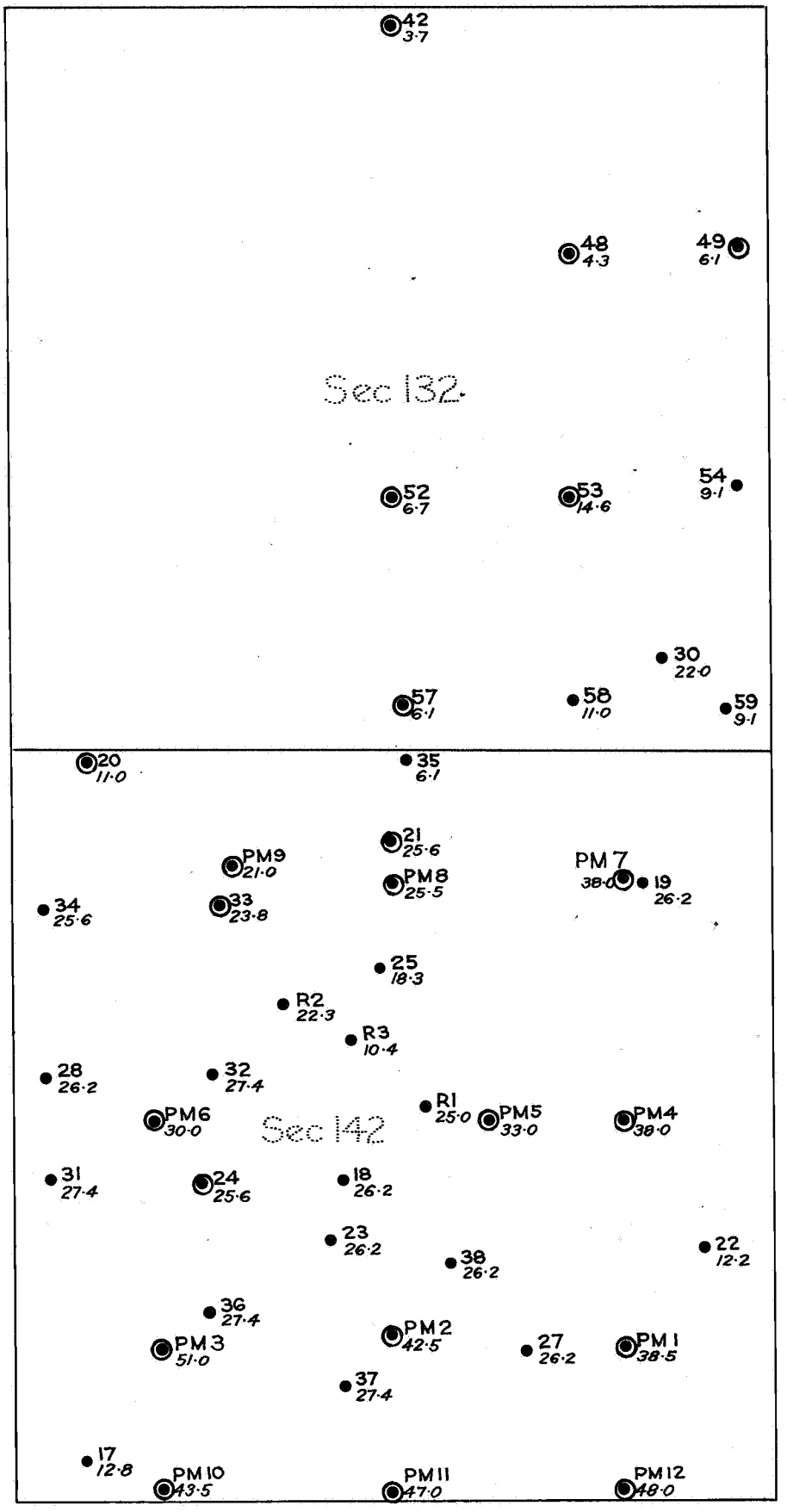
500—2,69 665





DEPARTMENT OF MINES — SOUTH AUSTRALIA

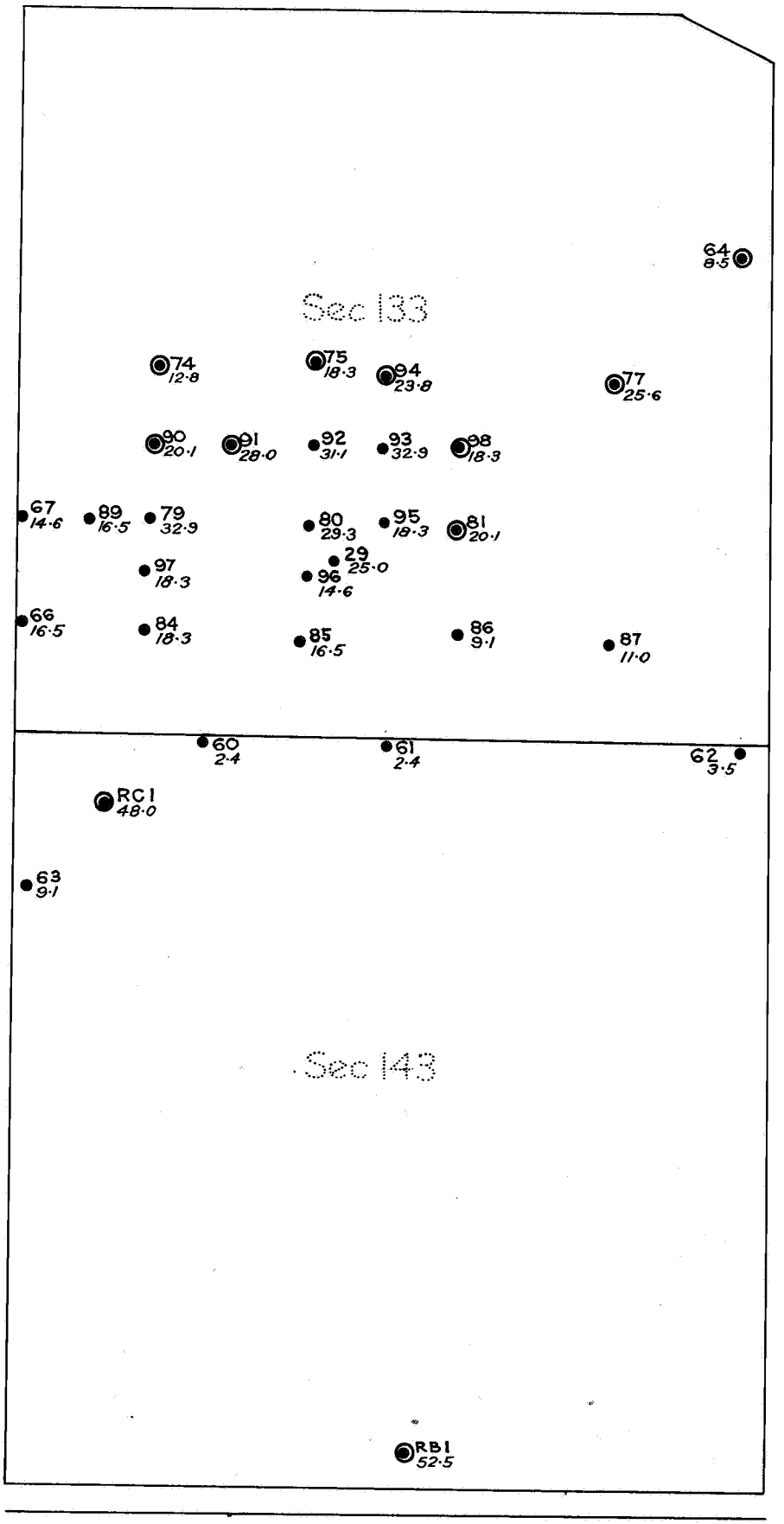
EXTRACTIVE MINERALS SECTION	Drn. J.R. Tcd. A.F. Ckd. Exd.	MASLIN BEACH SAND DEPOSITS LOCATION OF DRILLHOLES SECTIONS 141, 151. HD. WILLUNGA	SCALE: 1:5000 S11878 DATE: Aug 1975



DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	**Drn.** J.R.	MASLIN BEACH SAND DEPOSITS	**SCALE:** 1:5000
	Tcd. A.F.	LOCATION OF DRILLHOLES	S11879
	Ckd.	SECTIONS 132, 142. HD. WILLUNGA	**DATE:** Aug 1975
	Exd.		

500—2.69 665



DEPARTMENT OF MINES — SOUTH AUSTRALIA

EXTRACTIVE MINERALS SECTION	**Drn.** J.R. **Tcd.** A.F. **Ckd.** **Exd.**	MASLIN BEACH SAND DEPOSITS LOCATION OF DRILLHOLES SECTIONS 133, 143. HD. WILLUNGA	**SCALE:** 1:5000 S11880 **DATE:** Aug 1975

500—2 69 665

APPENDIX C

SUMMARY OF DRILLHOLE DATA

Hole No.	Overburden	Fine Sand	Waste	Construction Sand	Bedrock
SECTION 365 (Johns, 1962)					
P1	0-8.5	-	-	8.5-21.8	-
P2	0-23.2	-	-	-	-
P3	0-3.1	-	-	3.1-23.2	-
P4	0-12.2	-	-	12.2-16.5	-
P5	0-11.4	-	-	-	-
P6	0-9.8	-	-	9.8-17.7	-
P7	0-4.3	-	-	4.3-22.3	-
P8	0-5.5	-	-	5.5-17.7	-
P9	0-6.1	6.1-8.5	-	8.5-23.2	-
P10	0-3.7	3.7-6.1	6.1-11.6	11.6-23.2	-
P11	0-12.8	-	-	-	-
P12	0-12.8	12.8-14.6	14.6-17.7	17.7-23.2	-
P13	0-1.8	-	-	1.8-23.2	-
P14	0-6.1	-	-	6.1-21.2	-
P15	0-2.4	-	-	2.4-23.2	-
P16	0-4.3	-	-	4.3-22.6	22.6-23.2
P17	0-13.4	-	-	13.4-22.9	-
P18	0-16.5	16.5-23.2	-	-	-
P19	0-10.4	-	-	10.4-20.1	-
P20	0-2.4	-	-	2.4-7.9	-
	-	-	7.9-11.6	11.6-23.2	-
P21	0-3.1	-	-	3.1-23.2	-
P22	0-1.8	1.8-6.1	6.1-10.4	10.4-21.9	-
P23	0-11.0	-	-	11.0-12.2	-
	-	-	12.2-13.4	13.4-16.5	-
P24	0-5.5	-	-	5.5-25.0	-
P25	0-4.3	-	-	4.3-21.3	21.3-22.0
P26	0-4.9	-	-	4.9-20.1	
P27	0-11.0	-	-	11.0-22.0	22.0-24.4
P28	0-11.0	-	-	11.0-18.9	18.9-24.4

SECTION 365 (Olliver, 1963b)

G1	0-22.0	-	-	22.0-32.9	-
G2	0-21.0	-	-	21.0-32.9	-
G3	0-18.3	-	-	18.3-32.9	-
G4	0-8.2	-	-	8.2-31.1	31.0
G5	0-5.5	-	-	5.5-32.0	32.0-32.9
G6	0-4.3	-	-	4.3-32.6	32.6-32.9
G7	0-3.7	-	-	3.7-21.3	21.3-22.0
G8	0-3.7	-	-	3.7-18.3	18.3-19.2

SECTION 360 (Olliver, 1961b)

27/61	0-0.6	-	-	-	0.6

SECTION 363 (Olliver, 1961b)

28	0-9.1	-	-	-	-
29	0-9.1	-	-	-	-
30	0-5.8	-	-	-	5.8

(Johns, 1965b)

1	0-4.6	-	-	-	-
1A	0-8.2	8.2-10.1	10.1-11.9	11.9-27.4	-
2	0-2.7	-	-	2.7-11.9	-
3	0-0.9	-	-	0.9-19.2	-
4	0-0.9	-	-	0.9-22.9	22.9-27.4
5	0-8.2	-	-	8.2-10.1	-
6	0-4.6	4.6-10.1	-	10.1-27.4	-
7	0-1.2	-	-	1.2-12.8	12.8-15.6
8	0-11.0	-	-	-	11.0
9	0-5.0	-	-	5.0-33.5	33.5-45.7

The location of hole No. 9 is not known but is assumed to be in the northwestern corner near No. 1.

SECTION 366 (Olliver, 1961a)

A1/59	0-2.4	-	-	2.4-12.2	-
A2/59	0-2.4	-	-	2.4-12.2	-
A3/59	0-2.4	-	-	2.4-12.2	-
A4/59	0-2.4	-	-	2.4-12.2	-
A5/59	0-2.4	-	-	-	-
A6/59	0-1.8	-	-	1.8-5.5	-
A7/59	0-1.8	-	-	1.8-5.5	-
A8/59	0-2.4	-	-	2.4-5.5	-
A9/59	0-3.1	-	-	3.1-3.7	-
A10/59	0-1.2	-	-	1.2-10.4	-
A11/59	0-2.4	-	-	2.4-5.5	-
A12/59	0-2.4	-	-	2.4-4.9	-
A13/59	0-1.2	-	-	1.2-6.7	-

(Olliver, 1961b)

20/61	0-5.5	5.5-6.7	-	6.7-10.4	-
21/61	0-12.8	-	-	12.8-14.6	-
22/61	0-3.7	-	-	3.7-16.5	-
23/61	0-4.9	-	-	4.9-14.6	-
24/61	0-4.3	-	-	4.3-12.2	12.2-14.6
31/61	0-4.6	-	-	-	-
32/61	-	-	-	0-5.5	5.5-11.0
33/61	0-2.4	2.4-3.7	3.7-7.3	7.3-22.0	22.0-24.4

(Olliver, 1965a)

1/63	0-22.0	-	-	22.0-32.9	-
2/63	0-12.8	-	-	12.8-32.9	-
3/63	-	0-5.5	-	5.5-16.5	16.5-17.4

(Olliver, 1973)

A1/72	0-20.1	-	-	20.1-32.9	-
A2/72	0-18.3	-	-	18.3-32.9	-
A3/72	0-18.9	-	-	18.9-32.9	-
A4/72	0-19.5	-	-	19.5-32.9	-
A5/72	0-18.9	-	-	18.9-32.9	-
A6/72	0-18.3	-	-	18.3-32.9	-
A7/72	0-14.6	-	-	14.6-32.9	-
A8/72	0-14.6	-	-	14.6-32.9	-

A9/72	0-14.6	-	-	14.6-32.9	-
A10/72	0-14.6	-	-	14.6-32.9	-
A11/72	0-12.8	-	-	12.8-69.8	-
A12/72	0-21.9	-	-	21.9-28.3	-
	-	-	28.3-29.3	29.3-32.9	-
A1/73	0-13.7	13.7-19.8	-	19.8-39.6	-
A2/73	0-4.6	4.6-12.2	-	12.2-39.6	-
A3/73	0-21.3	-	-	21.3-39.6	-
A4/73	0-15.2	-	-	15.2-39.6	-
A5/73	-	-	-	0 -12.2	12.2-13.7
A6/73	0-13.7	-	-	13.7-30.5	-
A7/73	0-10.7	-	-	10.7-22.9	-
R1/73 to R14/73	0-20.1	-	-	-	-
R15/73	0-3.7	-	-	3.7-11.9	11.9-14.6
R16/73	0-5.5	-	-	5.5-11.0	-
R17/73	0-4.3	-	-	4.3-11.6	11.6-13.7
R18/73	0-9.8	-	-	9.8-18.3	-
R19/73	-	-	-	0-12.8	12.8-14.6
R20a/73	-	-	-	0-2.7	2.7
R20b/73	-	-	-	0-2.1	2.1-5.5
R21/73	-	-	-	0-18.3	-
R22/73	-	-	-	0-12.8	12.8-14.3
R23/73	-	-	-	0-20.1	-

SECTION 364 (Johns, 1965a)

1	0-4.5	-	-	4.6-15.6	-
2	0-2.7	-	-	2.7-21.3	-
3	0-2.7	-	-	2.7-16.5	16.5-18.3
4	0-7.3	-	-	7.3-21.3	-
5	0-3.7	-	-	3.7-22.9	-
6	0-1.8	-	-	1.8-23.8	23.8-25.6
7	0-1.8	-	-	1.8-21.3	-
8	0-2.7	-	-	2.7-22.0	-
9	0-1.8	-	-	1.8-21.3	-
10	0-1.8	-	-	1.8-21.3	-
11	0-3.7	-	-	3.7-12.8	12.8-14.6
12	0-2.7	-	-	2.7-20.1	20.1-21.3

13	0-3.7	-	-	3.7-17.4	-
14	0-4.6	-	-	4.6-14.6	14.6-15.9
15	0-2.7	-	-	2.7-9.5	9.5-14.6
IS1	0-1.5	-	-	1.5-4.6	-
	-	4.6-6.1	-	6.1-16.8	-
IS2	0-1.5	1.5-6.1	-	6.1-19.8	-
IS3	0-0.9	-	-	0.9-6.4	-
	-	6.4-9.1	-	9.1-17.4	-
IS4	0-1.5	-	-	1.5-7.6	-

SECTION 367 (Olliver, 1961b)

1	0-2.4	-	-	2.4-6.1	-
	-	6.1-8.5	-	8.5-17.1	?17.1
2	Unknown	-	-	-	-
3	0-2.4	-	-	2.4-8.5	-
		8.5-12.2	-	12.2-18.0	?18.0
4	0-9.8	-	-	9.8-18.3	-
5	0-11.0	-	-	11.0-17.1	-
	-	-	17.1-20.1	-	20.1-21.3
6	0-2.4	-	-	2.4-6.1	6.1-9.1
7	Unknown	-	-	-	-
8	Unknown	-	-	-	-
9	0-1.8	-	-	1.8-15.9	?15.9-17.1
10	0-1.8	-	-	1.8-14.0	?14.0-14.6
11	0-2.4	-	-	2.4-7.3	-
12	Unknown	-	-	-	-
13	0-2.4	-	-	2.4-13.4	?13.4
14	0-7.9	7.9-10.4	-	10.4-16.5	?16.5
15	0-2.4	-	-	2.4-3.1	-
16	0-2.4	-	-	2.4-11.6	-
	-	-	11.6-12.8	12.8-15.9	-
17	0-5.5	-	-	5.5-18.3	-
18	0-3.7	-	-	3.7-4.9	-
19	0-1.8	-	-	1.8-15.2	15.2-15.9

SECTION 139 (Olliver, 1963a)

5	0-2.4	-	-	2.5-9.8	9.8-10.4
6	0-1.8	-	-	1.8-6.1	6.1-11.0
7	0-2.4	-	-	-	2.4-4.9
8	0-1.8	-	-	-	1.8-3.1
9	0-11.0	-	-	11.0-11.6	11.6
10	0-4.9	-	-	4.9-16.2	16.2
11	0-1.8	-	-	1.8-4.3	4.3-6.1
12	0-2.4	-	-	-	2.4-6.7
13	0-7.3	-	-	7.3-10.4	-
14	0-3.1	-	-	3.1-7.9	-
15	0-4.9	-	-	4.9-8.2	8.2
16	0-3.1	-	-	3.1-11.6	11.6
17	0-3.1	-	-	3.1-7.9	7.9-9.1
18	0-3.7	-	-	3.7-15.2	-
19	0-4.3	-	-	4.3-15.9	-
20	0-4.9	-	-	4.9-15.2	-
21	0-4.3	-	-	-	4.3-4.9
22	0-6.7	-	-	6.7-12.2	12.2-13.4
23	0-2.4	-	-	2.4-14.6	14.6-15.2
24	0-2.4	-	-	2.4-21.3	-
25	0-7.3	-	-	7.3-24.4	-
26	0-3.1	-	-	3.1-19.5	?19.5
27	0-4.3	-	-	4.3-11.6	11.6-13.4
28	0-3.1	-	-	3.1-5.5	-
	-	-	5.5-8.5	8.5-21.3	-
29	0-1.8	-	-	1.8-26.2	-
30	0-2.4	-	-	2.4-26.8	-
31	0-1.2	-	-	1.2-23.2	23.2-24.4
32	0-4.3	-	-	4.3-16.5	16.5-18.3
33	0-4.3	-	-	4.3-9.8	9.8-11.6
34	0-1.8	-	-	1.8-18.9	18.9-22.0
35	0-3.1	-	-	3.1-20.7	20.7-22.6
36	0-4.9	-	-	4.8-19.5	19.5-20.7
37	0-3.1	-	-	3.1-17.1	17.1-17.7
38	0-6.1	-	-	6.1-11.6	11.6-12.8
39	0-2.4	-	-	2.4-10.4	10.4-12.8

40	-	-	-	0-9.1	9.1-12.2
41	-	-	-	0-3.1	3.1-4.3
42	0-2.4	-	-	2.4-15.2	15.2-18.3

Supplied by RMC

MD1	0-4.0	4.0-14.0	-	14.0-18.0	-
MD2	0-4.0	-	-	4.0-11.0	11.0-19.5
MD3	0-6.0	-	-	-	6.0-37.8
MD4	0-1.0	-	-	-	1.0-27.6
IS5	0-1.5	-	-	-	1.5-6.1
IS9	0-1.8	-	-	-	1.8-5.5
IS15	0-1.5	-	-	-	-
L14H12	0-3.7	3.7-7.9	-	7.9-18.3	-
L14H14	0-1.8	-	-	-	1.8-18.3
L16H11	0-3.7	3.7-5.5	5.5-7.3	-	-
	-	7.3-11.0	-	11.0-14.6	-
L16 H13	0-1.8	1.8-5.5	-	-	5.5-14.6

SECTION 149 (Not reported)

149/02	0-25.0	-	-	25.0-38.1	38.1-114.3
CS1	0-4.6	4.6-20.1	-	-	-
CS2	0-2.7	2.7-20.1	-	-	-

SECTION 140 (Olliver,1961c)

1	0-1.2	1.2-14.0	14.0-25.0	-	25.0-26.2
2	0-6.1	-	-	-	-
6	0-8.5	-	-	-	-
7	0-17.7	-	-	-	17.7-21.3
8	0-11.0	-	-	-	11.0-11.9
9	0-6.7	-	-	-	6.7-18.3
10	0-4.9	-	-	4.9-7.9	-
11	0-11.0	-	-	-	11.0-11.6
14	0-1.8	-	-	-	1.8-11.0
15	0-1.2	-	-	1.2-12.8	-

Supplied by RMC

MD5	0-2.0	2.0-8.0	-	-	8.0-24.0
MD6	0-2.0	-	-	-	2.0-24.0
L1H8	0-1.8	1.8-18.3	-	-	-
L1H10	0-3.7	3.7-9.1	-	-	-
L1H12	0-2.7	-	-	-	2.7-16.5
L2H13	0-1.8	1.8-11.0	-	-	11.0-18.3
L3H9	0-1.8	1.8-7.3	-	7.3-11.0	-
L3H11	0-1.8	-	-	1.8-9.1	-
L4H13	0-1.8	1.8-9.1	-	-	?9.1-11.0
L5H8	0-1.8	1.8-18.3	-	-	-
L5H10	0-1.8	1.8-3.7	3.7-7.3	-	-
	-	7.3-14.6	14.6-16.5	-	16.5-18.3
L5H12	0-9.1	-	-	-	9.1-12.8

SECTION 150 (Olliver, 1963a)

1	0-4.3	4.3-12.8	-	-	-
2	0-2.4	2.4-9.8	9.8-11.0	-	-
3	0-1.8	1.8-8.5	8.5-12.8	-	-
	-	12.8-15.2	-	-	-
4	0-9.1	-	-	-	-

Supplied by RMC

MD11	0-2.0	2.0-19.8	-	-	-
MD12	0-2.0	2.0-22.0	22.0-28.0	-	-
	-	28.0-38.0	-	-	-
L1H2	0-1.8	1.8-12.8	12.8-14.6	-	-
	-	14.6-18.3	-	-	-
L1H4	0-1.8	1.8-18.3	-	-	-
L1H6	0-5.5	5.5-18.3	-	-	-
L3H1	0-11.0	-	-	-	-
L3H3	0-3.7	3.7-5.5	-	-	-
L3H5	-	0-3.7	-	-	-
L3H7	0-1.8	1.8-9.1	-	9.1-14.6	-
	-	14.6-18.3	-	-	-
L5H1	0-14.6	-	-	-	-
L5H3	0-1.8	-	1.8-5.5	-	-
L5H5	0-7.3	7.3-18.3	-	-	-

L5H7	0-1.8	1.8-6.4	-	-	-
L7H3	0-1.8	-	-	1.8-11.9	-
L7H5	0-1.8	1.8-18.3	-	-	-
L7H7	0-1.8	1.8-6.4	-	-	-

SECTION 141 (Supplied by RMC)

MD7	0-6.0	6.0-20.0	-	-	-
MD8	0-2.0	2.0-4.0	4.0-7.0	-	-
	-	7.0-12.0	-	12.0-16.0	-
MD9	0-11.5	-	-	11.5-20.0	-
MD10	0-2.0	-	-	-	2.0-14.0
L8H8	0-1.8	1.8-14.6	-	-	14.6-16.5
L8H10	0-3.7	3.7-12.8	-	-	12.8-14.6
L8H12	0-1.8	-	-	-	1.8-2.7
L8H14	-	-	-	-	0-1.2
L9H8	0-1.8	1.8-9.1	-	-	-
L9H10	0-1.8	1.8-18.3	-	-	-
L11H11	0-2.7	2.7-7.3	-	-	7.3-11.0
L12H11	0-3.7	3.7-5.5	5.5-12.8	12.8-14.6	-
L12H13	0-5.5	-	-	-	5.5-14.6

SECTION 151 (Olliver, 1965b)

1	0-5.5	-	-	-	-
1A	0-1.8	1.8-14.6	14.6-16.5	-	-
2	0-1.8	1.8-7.3	-	-	-
3	0-3.7	-	-	-	-
4	0-3.7	-	-	-	-
5	0-5.5	-	-	-	-

(Olliver, 1974 and Lindsay & Harris, 1974)

B1/73	0-9.1	-	-	-	-
B2/73	0-3.1	3.1-16.8	16.8-48.8	-	-
	-	48.8-61.0	-	-	-

SECTION 132 (Olliver, 1961c)

30	0-22.0	-	-	-	-
	(Olliver, 1962a)				
42	0-3.1	-	-	-	3.1-3.7
48	0-4.3	-	-	-	4.3
49	0-6.1	-	-	-	6.1
52	0-3.7	3.7-6.7	-	-	6.7
53	0-3.7	3.7-12.2	-	-	12.2-14.6
54	0-9.1	-	-	-	-
57	0-5.5	-	-	-	5.5-6.1
58	0-9.8	-	-	9.8-11.0	-
59	0-9.1	-	-	-	-

SECTION 142 (Olliver, 1961 c)

17	0-12.8	-	-	-	-
18	0-3.7	-	-	3.7-12.2	-
	-	-	12.2-15.2	15.2-26.2	-
19	0-7.9	7.9-15.2	-	15.2-26.2	-
20	0-1.2	-	-	-	1.2-11.0
21	0-7.3	-	-	7.3-20.7	20.7-25.6
22	0-12.2	-	-	-	-
23	0-10.4	-	-	10.4-26.2	-
24	0-11.6	-	-	11.6-25.0	25.0-25.6
25	0-4.9	-	-	4.9-18.3	-
27	0-7.3	7.3-14.0	14.0-17.7	17.7-26.2	-
28	0-6.1	-	-	6.1-26.2	-
R1	0-25.0	-	-	-	-
R2	0-1.0	-	-	1.0-22.3	-
R3	0-1.0	-	-	1.0-10.4	-
	(Olliver, 1961 d)				
31	0-4.9	-	-	4.9-27.4	-
32	0-7.3	-	-	7.3-27.4	-
33	0-3.7	-	-	3.7-17.7	17.7-23.8
34	0-17.1	-	-	17.1-25.6	-

35	0-6.1	-	-	-	-
36	0-13.4	13.4-20.7	-	20.7-27.4	-
37	0-11.6	11.6-15.2	15.2-23.2	23.2-27.4	-
38	0-4.3	-	-	4.3-11.0	-
	-	-	11.0-14.0	-	-
	-	14.0-16.5	16.5-18.9	18.9-26.2	-

(Olliver & Reed, 1975)

PM1	0-4.5	4.5-10.5	10.5-12.0	12.0-29.0	29.0-38.5
PM2	0-7.5	-	-	7.5-10.5	-
	-	10.5-19.5	-	19.5-30.0	30.0-42.5
PM3	0-9.0	-	-	9.0-35.0	35.0-51.0
PM4	0-9.0	9.0-16.5	16.5-22.5	22.5-30.0	30.0-38.0
PM5	0-4.0	4.0-7.5	7.5-9.0	-	-
	-	9.0-15.0	-	15.0-24.0	24.0-33.0
PM6	0-6.0	-	-	6.0-20.0	20.0-30.0
PM7	0-6.0	6.0-13.5	13.5-15.0	15.0-30.0	30.0-38.0
PM8	0-3.0	-	-	3.0-16.5	16.5-25.5
PM9	0-3.0	-	-	3.0-11.0	11.0-21.0
PM10	0-24.0	-	-	24.0-36.0	36.0-43.5
PM11	0-15.0	15.0-25.5	-	25.5-39.0	39.0-47.0
PM12	0-28.5	-	-	28.5-41.0	41.0-48.0

SECTION 152 (Olliver, 1974 and Lindsay & Harris, 1974)

B3/73	0-35.0	35.0-40.0	-	-	-

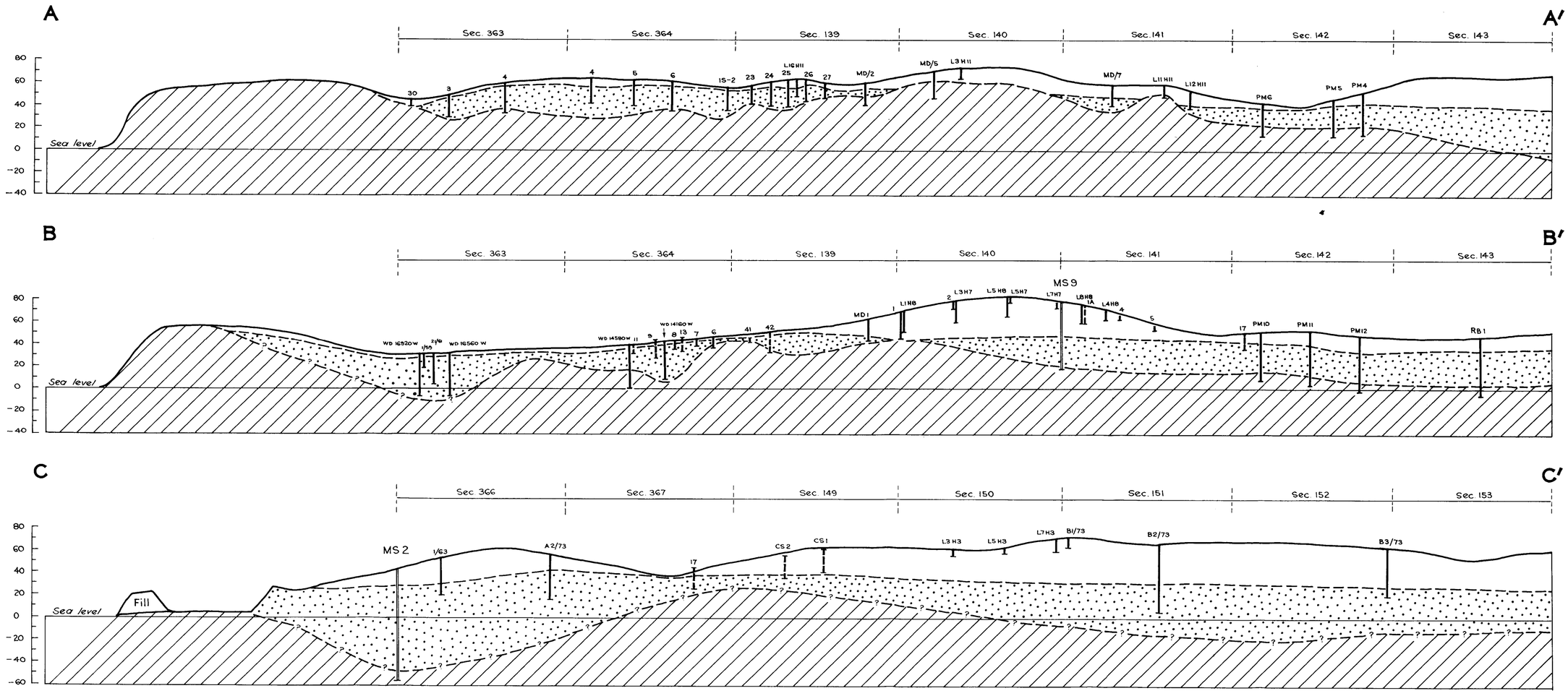
SECTION 133 (Olliver, 1961c)

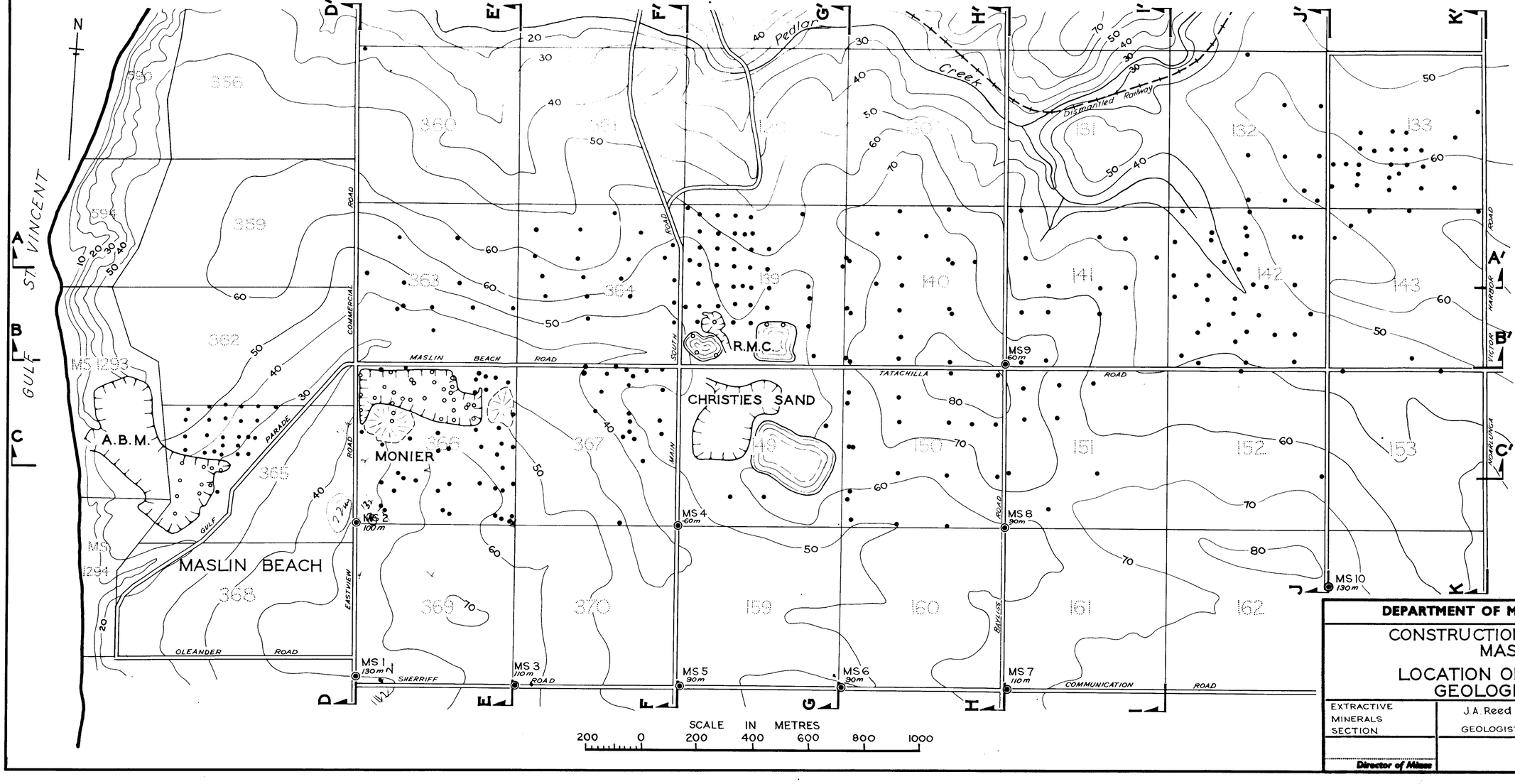
29	0-25.0	-	-	-	-
		(Olliver, 1962a)			
64	0-7.9	-	-	-	7.9-8.5
		(Olliver, 1963c)			
66	0-16.5	-	-	-	-
67	0-14.6	-	-	-	-
74	0-12.5	-	-	-	12.5-12.8
75	0-7.3	7.3-9.1	-	9.1-11.9	11.9-18.3
77	0-4.2	4.2-6.1	6.1-14.6	-	14.6-25.6

79	0-5.5	-	-	5.5-9.1	-
	-	9.1-27.4	-	27.4-32.9	-
80	0-11.0	11.0-29.3	-	-	-
81	0-3.7	3.7-8.2	8.2-13.7	-	13.7-20.1
84	0-18.3	-	-	-	-
85	0-5.5	-	-	5.5-6.4	-
	-	-	6.4-16.5	-	-
86	0-9.1	-	-	-	-
87	0-11.0	-	-	-	-
89	0-11.0	11.0-16.5	-	-	-
90	0-7.3	7.3-18.8	-	-	18.9-20.1
91	0-5.5	5.5-20.1	-	20.1-28.0	28.0
92	0-5.5	5.5-20.1	-	20.1-31.1	-
93	0-5.5	-	-	5.5-9.1	-
	-	9.1-22.0	-	22.0-32.9	-
94	0-9.1	-	-	9.1-11.0	-
	-	11.0-16.5	-	16.5-21.0	21.0-23.8
95	0-18.3	-	-	-	-
96	0-14.6	-	-	-	-
97	0-18.3	-	-	-	-
98	0-12.8	12.8-14.6	-	14.6-17.1	17.1-18.3
	SECTION 143	(Olliver, 1962 a)			
60	0-2.4	-	-	-	-
61	0-2.4	-	-	-	-
62	0-3.5	-	-	-	-
63	0-9.1	-	-	-	-
		(Reed, 1974)			
RB1	0-15.0	15.0-25.5	-	25.5-43.5	43.5-52.5
		(Olliver, 1975)			
RC1	0-11.0	11.0-24.0	-	24.0-39.5	39.5-48.0

SEISMIC SHOTHOLES

WD14160W	Sand to 33.5m
WD14580W	Base of sand at 22.9 m
WD16560W	Sand to 38.1 m
WD16920W	Sand to 38.1 m

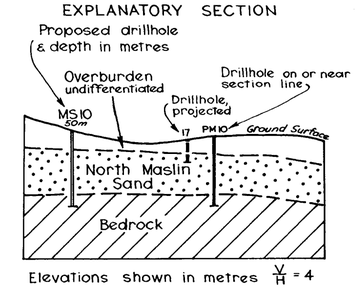




LEGEND

- Sand deposits
- Pit area
- Slime dam
- Overburden heap
- Drillhole location See appendix B
- 60 Surface contour in metres
- 140 Section number, Hd Willunga
- MS 4 60m Proposed drillhole, depth in metres (To be drilled in road reserve.)

EXPLANATORY SECTION



Elevations shown in metres V/H = 4

For sections D-D' to K-K' see fig 6.

FIG. 5

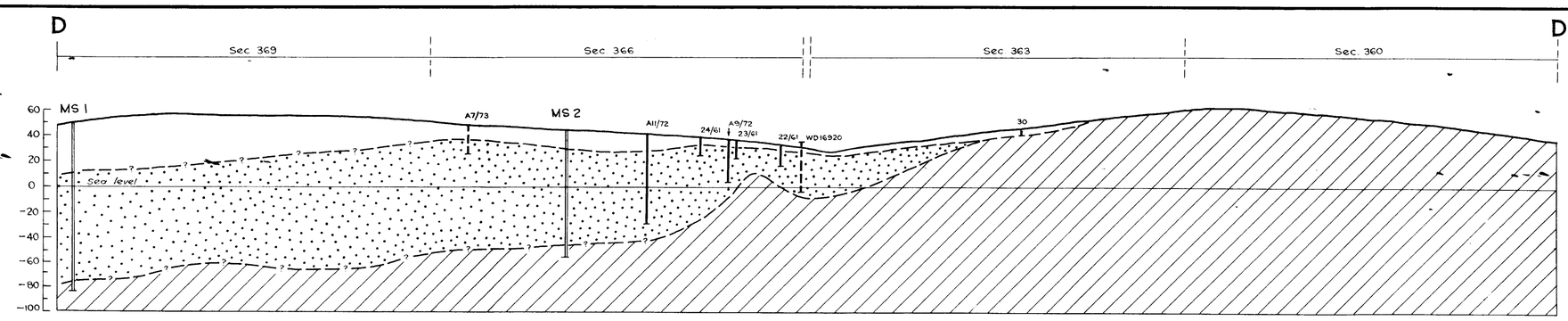
DEPARTMENT OF MINES — SOUTH AUSTRALIA

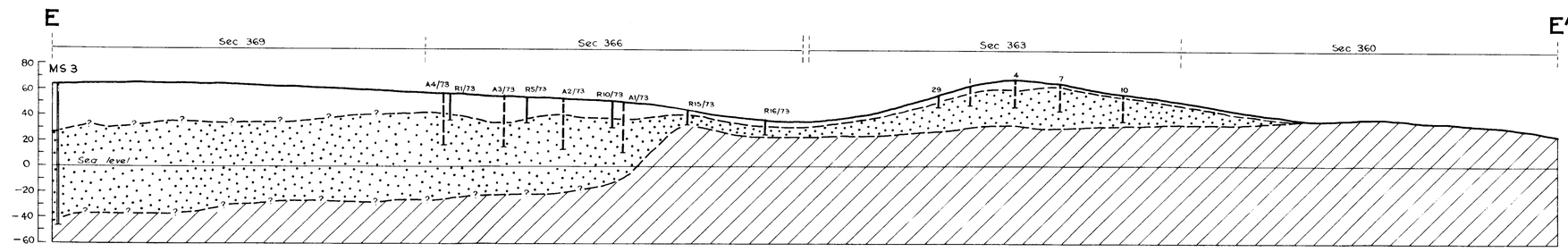
CONSTRUCTION SAND RESOURCES MASLIN BEACH

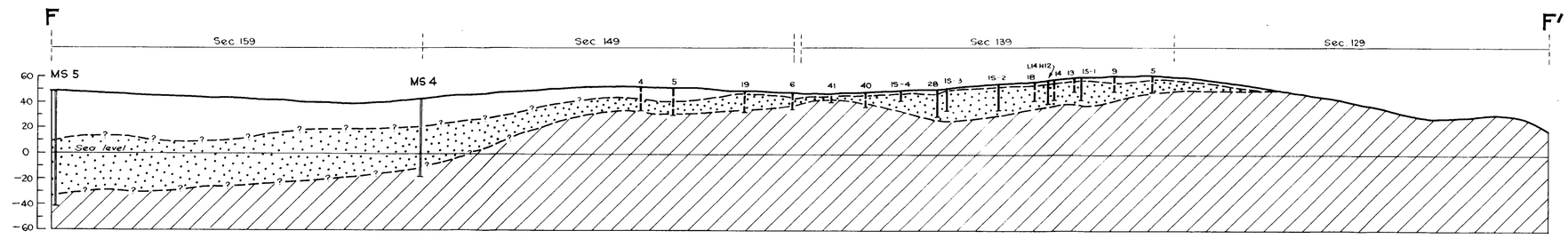
LOCATION OF DRILLHOLES AND GEOLOGICAL SECTIONS

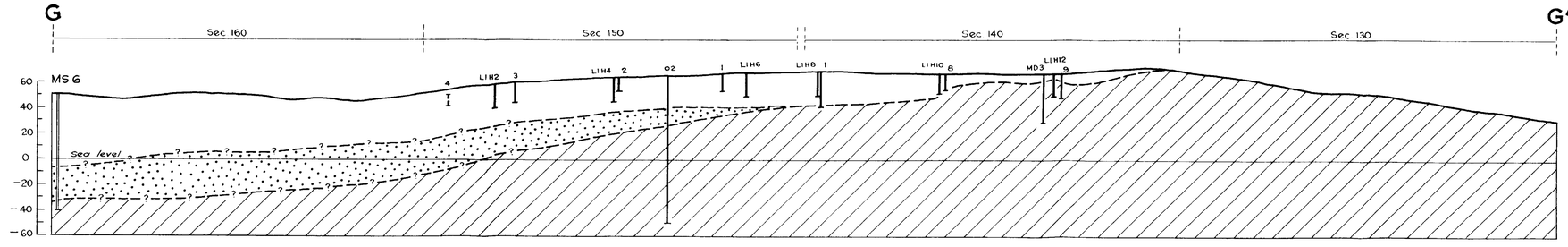
EXTRACTIVE MINERALS SECTION	J.A. Reed GEOLOGIST	Compiled J.A. Reed	Scale: 1:10000
			Date: August 1975
Director of Mines		Drn. A.F. Ckd. A.F.	Drg. No. 75-839

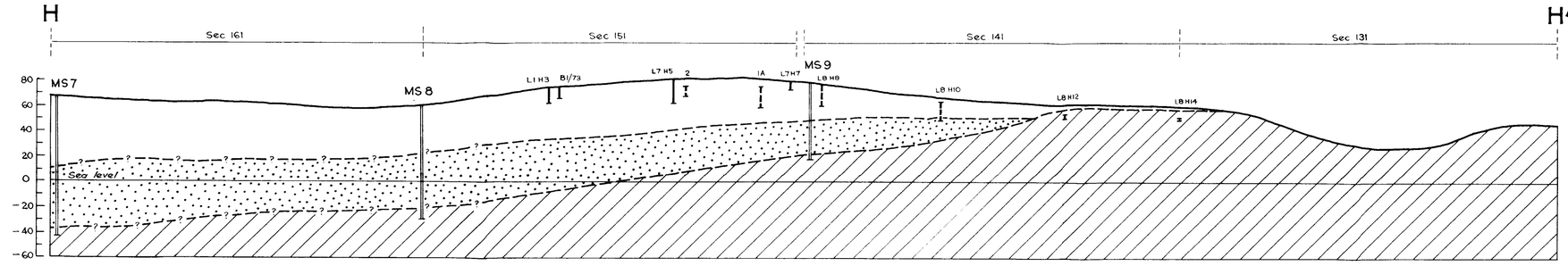
200—4.76 A3482

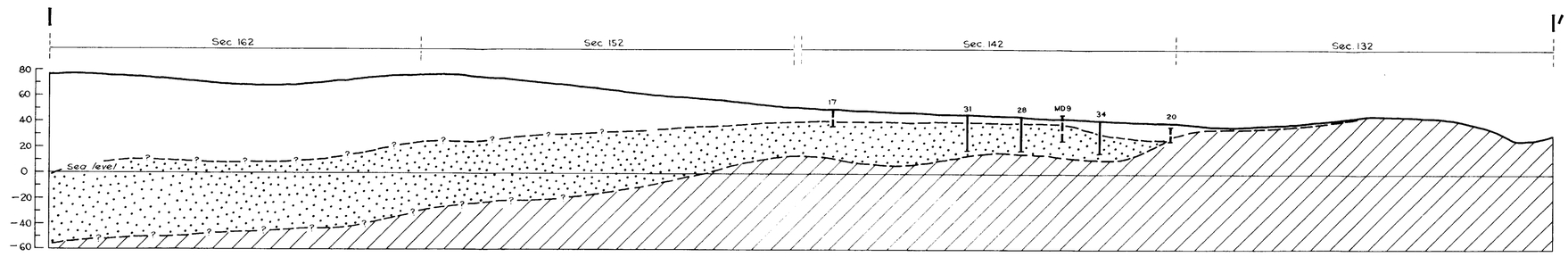


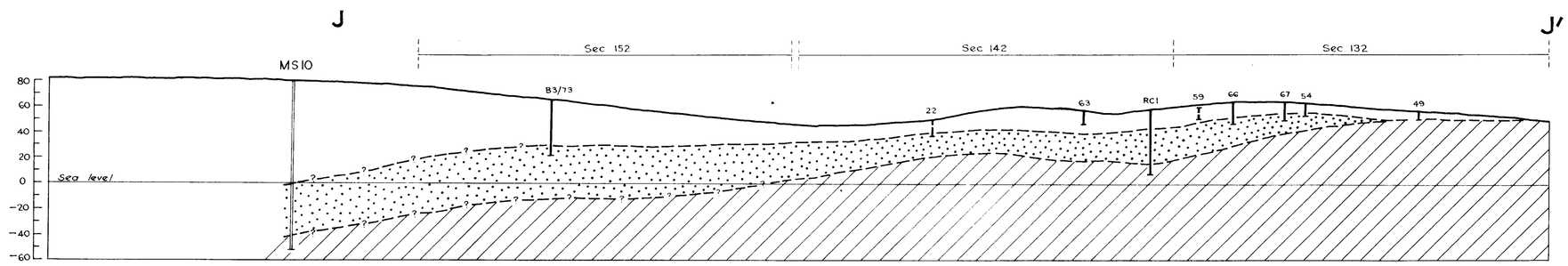


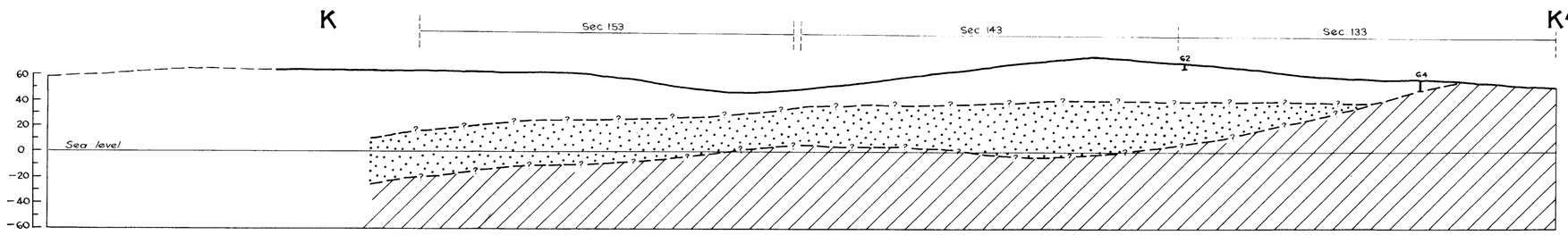












For explanation of symbols see Explanatory Section fig 5.

HORIZONTAL SCALE

METRES 100 0 100 200 300 400 500 METRES

Elevations shown in metres
Datum: Mean sea level

$\frac{V}{H} = 2$

FIG. 6

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CONSTRUCTION SAND RESOURCES MASLIN BEACH

GEOLOGICAL SECTIONS

EXTRACTIVE MINERALS SECTION	J.G.Olliver & J.A.Reed GEOLOGISTS	*Compiled* J.G.O J.A.R	*Scale:* H 1:5000 V 1:2500
			Date: August 1975
Director of Mines		*Drn.* A.F. *Ckd.* A.F.	*Drg. No.* 75-840