DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

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GEOLOGICAL INVESTIGATIONS IN 1984 FOR ROAD RUBBLE WITHIN DISTRICT COUNCIL OF TATIARA

GEOLOGICAL SURVEY

By

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ABSTRACT

In early 1983, District Council of Tatiara had 77 sites as sources of road rubble but this had risen to 82 by mid 1984.

Inspection of 57 Council road rubble pits and Highways Department borrow pits revealed that most pits are located on stranded coastal dunes of Pleistocene Bridgewater Formation. Material has also been won from interdunal lagoonal dolomite of Pleistocene Padthaway Formation. These materials are limited to the western portion of the council area.

To the east, Pleistocene sediments do not significantly onlap the uplifted Pinnaroo Block. Here Pliocene sands overlain by unconsolidated Holocene Molineaux Sand crop out. These are generally unsuitable for road rubble thus severely limiting the available options. Only five pits are located in the Pliocene Parilla Sand and Loxton Sands.

Thirty eight alternative potential sources are nominated for further testing.

INTRODUCTION

In November 1983, District Council of Tatiara requested geological assistance in locating sources of road rubble within the Council's 6 360 km^2 area (Fig. 1). In mid 1984, there were 82 operating pits (Appendix A), concentrated in the western portions where ridges of Bridgewater Formation are common (Fig. 2). New sources of road rubble were required in the eastern half i.e. in hundreds Beeamma, Cannawigara, Fisk, Geegeela, Makin, McCallum, Senior, Shaugh and Tatiara.

Several pits near Bordertown were inspected on 8 May 1984 by J.G. Olliver (Chief Geologist), L.C. Barnes (Principal Geologist), M.W. Flintoft (Field Assistant) and the author. M.W. Flintoft and the author inspected numerous existing pits and undertook exploration for new sources from 28 May to 1 June 1984.

Time did not permit documentation of every pit within the Council area. However, 29 current road rubble pits and another 29 abandoned pits, prospecting pits or Highways Department borrow pits were inspected, concentrating in and near those Hundreds where new sources were required; details are presented in Appendix B. About 36 areas and sites worthy of follow-up backhoe testing were identified and are described in Appendix C.

LOCATION AND ACCESS

District Council of Tatiara, part of the South East Planning Area, is the largest District Council in South Australia and borders Victoria (Fig. 1).

The sealed Duke's Highway to Melbourne passes diagonally across the Council area through Keith and Bordertown, the two largest towns. Numerous sealed and unsealed roads provide ready access throughout the area but 4-wheel drive vehicles are necessary to negotiate some tracks in the sandy north.

PHYSIOGRAPHY

Two distinct physiographic units are present:

- coastal plain to the west
- uplifted Pinnaroo Block to the east.

The two are separated by a fault scarp referred to as Kanawinka Lineament or Marmon Jabuk Scarp (Fig. 1). The scarp is most marked along West Naracoorte Range but decreases northwards and is barely noticeable near Keith.

The coastal plain unit is generally a flat surface with an elevation of 20-30 m AHD but is 60-70 m near Pigeon Flat which is interpreted as being on the uplifted eastern side of Marmon Jabuk Scarp. Large, broad, northwest-trending, stranded, coastal ridges are developed across the plains. The largest and highest of these are along Kanawinka Lineament in West Naracoorte Range, reaching 174 m at Sugarloaf Hill and 138 m at Willalooka. Further north near Keith, these ridges average only 70 m.

Resistant granite and rhyolite porphyry crop out as isolated high hills in the coastal plain unit, the most striking example is Mount Monster rising 60 m above surrounding plains.

Pinnaroo Block and its southern extensions are flat to very gently undulating plains which rise gradually to the northeast. These plains, consisting of deep clayey and very fine-grained sandy soils, are best developed around Bordertown and near Frances. Topographic heights are typically 90-100 m near Frances, 80-100 m east of Bordertown rising to 100-120 m in the northeast within hundred Senior. Maximum heights of about 150 m are reached along Lawloit Range in the extreme northeast, with Mount Shaugh the highest point at 182 m.

Throughout the northern area and in parts of the south between Sugarloaf Hill and Frances, young sand dunes, generally trending west-northwesterly, range up to 20 m above adjacent sand-blanketed interdunal flats.

GEOLOGY

The regional geology of the area is shown on Figure 3 and the following is summarised from Rochow (1969) and Rogers (1979 & 1980 a, b).

CAMBRIAN-ORDOVICIAN

Cambrian sediments equivalent to Kanmantoo Group, were metamorphosed, deformed and intruded by numerous granites during the Ordovician Delamerian Orogeny. Most intrusions are dated at 460-480 million years and consist of granite, adamellite, microgranite, dacite and porphyritic rhyolite. These form a buried basement ridge, Padthaway Ridge which is exposed as isolated granitic outcrops - at Mount Monster, 'Willalooka' and Jip Jip rocks.

TERTIARY

Padthaway Ridge acted as a basement high between areas of extensive Tertiary sedimentation in the Murray Basin to the north and Gambier Embayment of Otway Basin to the south, with the highest parts exposed as granite islands (Sprigg, 1952).

Within the Tatiara council area, only the youngest Tertiary sediments are exposed - Loxton Sands (Tpl) and overlying Parilla Sand (Tpp). These are only exposed on the uplifted Pinnaroo Block and are the main potential source for road rubble in

eastern and northern areas. To the west of Kanawinka Lineament and Marmon Jabuk scarp, Tertiary sediments have either been eroded or are buried under later Quaternary sediments.

Loxton Sands

This unit was subdivided into coastal and fluvial facies by Rogers (1979 and 1980 a).

The coastal facies consists of purplish-brown, medium-to-coarse grained, calcareous and shelly sandstone deposited in shallow marine, beach and coastal dune environments and crops out only in the far northern part of the council area adjacent to the Pinnaroo Road.

Fluvial facies of Loxton Sands consists of yellow-brown and red-brown, fine-to-coarse, micaceous quartz sand and gravel which are often ferruginised and occasionally silicified. Within the Council area, the only interpreted outcrop of fluvial sand and gravel is at Ridgway's pit east of Bordertown.

Parilla Sand

Overlying Loxton Sands and covering much of the Pinnaroo Block is fluvial-lacustrine Parilla Sand. This is pale yellow-brown, clayey, fine-to-medium, quartz sand but which in Lawloit Range is mottled red-brown, yellow-brown and pale grey, clayey, and unconsolidated and is only acceptable for road rubble if a feruginous duricrust has developed. Duricrust is referred to as Karoonda Surface and is lower Pleistocene fossil soil (Firman, 1979). Ferruginisation and duricrust are best developed in Lawloit Range and in a northwest-trending zone which includes Milne's, Noack's and Ridgway's pits.

PLEISTOCENE

Bridgewater Formation

During the Pleistocene in the southeast of South Australia, interglacial high sealevel stands on a gradually rising coastal shelf produced numerous stranded coastal ridges which generally increase in age northeastwards. Coastal dunes and beach sediments are referred to as Bridgewater Formation, of which only the lower member crops out in the council area and consist of pinkish-brown, fine-to-coarse, shelly, quartz calcarenite.

Bridgewater Formation dunes are predominantly restricted to along and west of Kanawinka Lineament and Marmon Jabuk Scarp, but

are still the major source of road rubble because of their wide distribution, carbonate content, low clay content and surface development of calcrete - Ripon Calcrete of Firman (1967). Unfortunately in eastern parts, dunes have formed predominantly from reworking of underlying Tertiary sand with only minor addition of shelly sand and are less suitable for use as road rubble.

Padthaway Formation.

Lagoonal sediments of Padthaway Formation were deposited between stranded Bridgewater Formation dunes and consist of white to pale grey, fine-grained dolomite and clay, as well as pale greenish-grey clayey quartz sand. Development of surface calcrete on the dolomite is referred to as Bakara Calcrete (Firman, 1973) with dolomite and calcrete suitable for use as road rubble providing that clay content is low. Lagoonal dolomite rarely exceeds one metre in thickness but can extend over large areas. The most easterly occurrence of lagoonal sediments is in an old embayment which almost reached Bordertown (Fig. 3).

On the Pinnaroo Block, Pleistocene sediments are mainly absent and instead, widespread ferruginous duricrust at the top of Parilla Sand marks fossil Karoonda Soil (Firman, 1979). Within the council area, ferruginisation is widespread but not duricrust development thus limiting use of Parilla Sand for road rubble.

HOLOCENE

Aridity with westerly winds during late Pleistocene and Holocene has produced extensive areas of sand sheets and east-southeast trending sand dunes of Molineaux Sand, usually pale coloured from dark yellow to the more typical pale-grey, fine-grained sand. Sand is loose and free-flowing when dry but dunes are fixed by vegetation.

Sand sheets and spreads are particularly well developed on the Pinnaroo Block where underlying Tertiary sand has been reworked. Bridgewater Formation west of the Kanawinka Lineament has also been reworked but the resultant sand dunes are not suitable for road rubble.

SOURCES OF ROAD RUBBLE

Only a few sources of road rubble are available on the uplifted Pinnaroo Block which consists mostly of Pliocene Parilla Sand with a covering of Molineaux Sand. On and to the west of Kanawinka Lineament, Pleistocene Bridgewater Formation and Padthaway Formation crop out extensively, Tertiary sediments are absent, and sites for road rubble are abundant.

Operating pits are listed in Appendix A, with descriptions of all pits inspected in Appendix B.

Fifty seven Council road rubble and Highways Department pits were inspected with host materials of:

Holocene	-	Molineaux Sand	1
Pleistocene	-	Padthaway Formation	5
	-	Bridgewater Formation	34
Tertiary	-	Parilla Sand	16
	-	Loxton Sands	1

Of the seventeen pits in Tertiary sediments, twelve are Highways Department borrow pits. Council has used only five, making Bridgewater Formation an even more important source for Council purposes than is apparent from the above data.

Unfortunately, Bridgewater Formation is limited in extent on the uplifted Pinnaroo Block and is concentrated along the western margin; the outlier of Bridgewater Formation near 'Wadlawarra' is a rare exception. Many of the stranded coastal dunes east of the fault zone have formed by reworking of underlying Tertiary sand with little addition of fresh calcareous, shelly sand and are now thin cappings over Parilla Sand. Bridgewater Formation provides suitable material from only the top 2-3 m; material from deeper in the dunes is unconsolidated and lacks sufficient carbonate for use as road rubble.

Lagoonal sediments of Pleistocene Padthaway Formation contain dolomite lenses which are also suitable for road rubble and have been worked extensively at Pigeon Flat and southwest of Cannawigara. In 1984, Highways Department crushed dolomite from near Cannawigara for use as base course on the Dukes Highway. The hard dolomite bed is 0.2 - 0.4 m thick and occurs near the

surface in the quarry area. Elsewhere dolomite beds may be thin, absent, or overlain by unconsolidated dolomitic sediments. The large embayment of Padthaway Formation not only extends as far east as Pigeon Flat, but also north beyond Cannawigara.

Tertiary sediments, which make up most of the Pinnaroo Block, are sources of only poor quality road rubble. Most of the very extensive Pliocene Parilla Sand is loose, friable, clay-rich and fine grained. Ferruginisation is widespread but developments of duricrust, ferruginous concretions or pisolites are rare. Material is then used as road rubble only if no carbonate-rich source is available. The only areas of ferruginisation with some cementation are in Lawloit Range and in a northwest-trending zone near Bordertown which includes Milne's, Noack's, and Ridgway's pits.

Pliocene Loxton Sands underlying Parilla Sand rarely crop out and are known only at two localities. Coastal facies sediments are exposed on the northern boundary of the Council area and have been quarried previously for road base for the Bordertown-Pinnaroo Road. As coastal facies sediments consist of calcareous shelly quartz sandstone with a capping of Bakara Calcrete, the occurrence has potential for providing carbonate-rich road rubble in the far northeast where such material is particularly rare. Fluvial facies of Loxton Sands crop out in only one locality 16 km east of Bordertown and consists of coarse-grained sand and clay which has been ferruginised and in part cemented. Clay content in exposed basal units is high; blending is required with coarse sand and gravel of upper units to provide acceptable material. Distribution is very limited and further occurrences are unlikely.

Holocene Molineaux Sand, as sand sheets and dunes, blankets the Pinnaroo Block particularly in the northeast and southeast. Sand is loose, friable and unsuitable for road rubble even where developed on Bridgewater Formation dunes.

CONCLUSIONS AND RECOMMENDATIONS

Potential sites for road rubble are tabulated in Appendix C, with locations shown on Figure 2. Appendix C also contains additional sites in Bridgewater Formation dunes but they are generally near existing pits or located just outside those hundreds where new sources are required.

Five main targets exist in the northern area. Bridgewater Formation calcarenite with surface calcrete capping should be used as much as possible from the existing pit at Wadlawarra, with exploratory backhoe trenching of interpreted Bridgewater Formation 3 km east of Dark Island Well (Site 17). Another potential source of road rubble containing carbonate is on the northern boundary of the Council immediately adjacent to the Bordertown - Pinnaroo Road; coastal facies of Pliocene Loxton Sands should be tested and is expected to yield a shelly quartz sand with a thin surface capping of calcrete (Site 9). Remaining two targets (Sites 10 & 11) consist of ferruginised Parilla Sand, with the most conveniently located deposit in hundred Fisk section 40 but material is only marginally suitable because of poor cementation. Material with greater ferruginisation and duricrust development probably occurs in the remote Lawloit Range and any backhoe testing in the extreme northeast should be restricted to Lawloit Range (Site 11) and the one outcrop of Loxton Sands (coastal facies) (Site 9).

Within the central part of the Council area, the only new sources worthy of testing are within Padthaway Formation. A previously unmapped extension of the large embayment of Padthaway Formation extends north of Cannawigara with prospects for lagoonal dolomite in hundred Cannawigara, sections 4, 42, 51 and 115 (Sites 6 & 7) with possible extensions further north along Canal Road in sections 5 and 6 (Site 8). Further lagoonal dolomite is available, if required, southwest of Cannawigara in hundred Cannawigara, sections 49, 59, 103-105 (Site 5) and in the area known as Big Stoney viz hundred Cannawigara, sections 249, 250, 283, 286, 287 and 290-293 (Site 31).

The only new sources of carbonate-rich road rubble in the south-southeastern portion of the council area are:

- west-northwest of Western Flat (Sites 2 & 4) on the same Bridgewater Formation dune on which Ritter's pit is located.

- near The Gap, West Naracoorte Range where Bridgewater Formation dunes crop out along and just outside the Council area (Site 13).

Bridgewater Formation should be used wherever possible but large reserves of ferruginised and strongly cemented Parilla Sand are available adjacent to the Bordertown-Naracoorte Road but within District Council of Naracoorte in hundred Hynam, section 450 (Site 12).

Coarse sand and gravel at Ridgway's pit in hundred Tatiara, section 341 should be used, if possible, as construction sand rather than as road rubble by the Council or Highways Department. However, washing to remove clay is required and the deposit is obscured on the eastern side by a thick dune of Molineaux Sand. Since inspection, the deposit has been pegged by the freehold landowner as Mineral Claim 1841.

White to pale grey clay was exposed by dam construction in hundred Senior, section 15 and should be checked for diatomite.

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APPENDIX A

OPERATING
ROAD RUBBLE PITS

IN

DISTRICT COUNCIL OF TATIARA

1983-1984

* Inspected

Hundred	section	Name
Beeamma	33	Fromm*
	40	Farmer*
	96	Young*
	104	Ritter
Cannawigara	-	-
Fisk	-	-
Geegeela	-	-
Glen Roy	340	Giles No. 1* (D.C. Naracoorte)
	340	Cherokee* (D.C. Naracoorte)
Lather	5,56	Hayes
	11	Sander
	19	Thompson
	21	B.M. Densley
	35	Brown
	43	Bell
	56	Carr
	60, 101	Patterson
	75	Cavanagh
	88	Lehmann
	89	Stopp
	90	Lehmann
Makin	14	Wadlawarra*
McCallum	-	-
Parsons	21	Virgo
	31	Stone Reserve
	63	Kallin
	92	East
	96	Stone Reserve*
	97	Vogelsang*
	108	Goodrich
	115	Giles No. 2*
	117	Goodrich*
	127	Cole*
Pendleton	13	Nunyara*
	16	Clark*
	111	Longmire
	113	Colbert No. 2*
	120	Meakins
Petherick	1	Waterview
	9	Wittalocka
	15	Didicoolum
	16	Moville
	24	Gip Gip Extension
	27	Wittacoola (Petherick)
	27	Wittacoola (Jip Jip)
Senior	88	Glengyle*
Shaugh	14	Hawick

hundred	section	Name
Stirling	24	Ovaflow
	64	Manser
	68	Richard
	86	Davidson
	92	Densley
	106	George
	118	Pengelly*
	134	Cook
	138	Makin
Stirling	144	Neave*
	391	G. Wheal
	395	S. Wheal
	456	MR 21-1
	456	MR 21-2
Tatiara	341	Ridgway*
	450,451	Milne*
	888	Noack*
Willalooka	27	Buckleboo
	28	Bassham
	38	Bruce
	64	Shearer chute
	66	Bond
	122	McMichael
Wirrega	17,18	P. Staude*
	34	Cannonball*
	62,66	Stone Reserve
	234	Hinge*
	246	Oborne
	352,436	Irwin
	375	Obst*
	438	Hunt
	453,454,603	Mock*
	470	N. Dinning
	523	Staude*
	533	Michell*
	535	Bennett*
	557	Duncan*
	564	Excell
	587	Hutching

APPENDIX B

ROAD RUBBLE PITS INSPECTED IN DISTRICT COUNCIL OF TATIARA:

- current road rubble pits
- abandoned road rubble pits
- prospecting pits
- Highways Department borrow pits

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
HUNDRED BEEAMMA						
6	un-named	Keppoch	N hill: 80x80x1 S hill: 60x60x1	Qpb / Tpp	Stockpiles 35x8x3 Essentially worked out	Capping of very poorly calcreted Qpb calcarenite over very fine-grained ferruginised clayey sand of Tpp (loose, friable). Material quality poor.
18	Stone reserve	Keppoch	150 x 100 x 1	Qpb / Tpp	Essentially worked out	Shallow scraping in thin capping of Qpb calcarenite overlying friable, clayey Parilla Sand. Friable mixed calcarenite and quartz sand; poor calcrete cementation.
22	un-named	Keppoch	200x150x1.5	Qpb / Tpp	Essentially worked out but may extend E 200m towards wind-mill.	Shallow scraping of hillcrest of calcreted Qpb calcarenite overlying soft, friable clayey sand of Tpp
33	Fromm	Keppoch	Several pits, largest of which is 50x40x3	Qpb	Large - extend E & W along the ridge.	Located on N side of E-W calcarenite dune. Platy calcrete bands 5-10 cm thick extend down to 2 m below surface. Remaining material not cemented and consists of mixed shell fragments and quartz sand.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
38	un-named	Keppoch	prospect only	ferrug. Tpp	Nil	Ferruginised Tpp boulders concentrated in 40 x 20 m area; passes down into friable sand. Previously prospected by backhoe. Inferior material quality.
40	Farmer	Keppoch	120x40x2.5	Qpb	Large - extend faces westwards and southwards. Stockpiles on site.	Located on N flank of high NW trending Qpb calcarenite of West Naracoorte Range
50	un-named	Keppoch	100x20x1	Qpb / Tpp	Limited ? 100x20x3	Qpb calcarenite, poorly cemented, friable and mixed with underlying clayey sand of Tpp. Material quality poor and hence reserves doubtful.
96	Young	Mundulla	50x40x1	Qpb	Essentially worked out. Higher hills 500m SW and 1 km NW probably contain large reserves, but are scrub covered.	Calcrete, less than 1 m thick, passes down into soft, friable, fine-grained, orange-brown and clayey sand and minor calcarenite. Clay-rich, friable and inferior quality.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
HUNDRED CANNAWIGARA						
51	Highways pit	Cannawigara	40x30x2	Qpl	Probably large, but lacks dolomite boulders and contains clay.	Fine white, powdery dolomite and clay; bouldery dolomite insignificant. At eastern margin of Qpl facies.
120	Meakins	Cannawigara	200x12x2 (locally 3 m deep)	Qpb	Large - extend S-SE along ridge towards 'Bella Vista'.	Calcrete on dune crest. May be able to deepen quarry and still retain same quality.
HUNDRED FISK						
8	un-named	Shaugh	2 small pits, largest of which is 45x45x1	Qhm / Tpp	Nil (of good-quality material)	Iron-stained very fine-grained clayey sand with minor pisolitic laterite as surface scree. Clay-rich and with no cementation hence material quality very poor.
9	un-named	Shaugh	40x30x1.5	Qhm / Tpp	Nil (of good-quality material)	Iron-stained orange-brown sand of Tpp which is very poorly cemented. Thin veneer of <1 m of Molineaux Sand. Material quality very poor.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
40	un-named Highways borrow pit	Shaugh	140x100x2 (max.)	Qhm / Tpp	Large - extend NW along the clearing in the scrub.	Iron-stained & weakly-cemented clayey sand of Tpp under <1m veneer offwhite Molineaux Sand. Material quality marginal.
HUNDRED GEEGEELA						
4	un-named Highways borrow pit	Frances	200x40x3.5	Tpp	Nil	1 m of soil cover over red, yellow, orange to off-white iregularly-mottled clayey sand. No iron-cemented boulders. Poorly lithified and clayey hence not suitable.
63	un-named Highways borrow pit	Frances	70x40x3	Tpp	Nil	Same as above for section 4; material not suitable for road rubble.
HUNDRED GLEN ROY						
298	un-named	Keppoch		Qpb / Tpp	Limited; no more than 100x50x2	Now used as rubbish dump. Only minor Qpb calcarenite remains, in isolated pockets, above clayey quartz sand.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
340	Giles No. 1	Keppoch	100x100x3 (max)	Qpb	Large; 100x80x2 readily available and can extend SW	Mostly a friable calcarenite but calcreted in places with blocks to 0.7 x 0.4 m.
	Cherokee			Qpb	Moderate - small ? 80x50x2	Covering of Molineaux Sand between the two deposits. Little worked with smaller and shallower workings than at Giles No. 1.
HUNDRED HYNAM						
449 450	un-named Highways borrow pit	Keppoch	7 pits scattered in scrub over a distance of 1 km. Pits to 250 m long; max depth of 1.5 m.	Tpp	Large	Located in D.C. Naracoorte. Extensive area of highly-ferruginised, very fine-grained, clayey sand. Numerous boulders of iron-cemented sand to 1 m across.
HUNDRED MAKIN						
14	Wadlawarra	Rescue	100x60x4 and 100x35x3	Qhm / Qpb	Large - extend SE towards low rise with prominent capping of calcrete.	N end of Qpb dune which extends S to 'Lucidon Park'. Stockpiled material in S (smaller) pit is friable carbonate-rich calcarenite with only minor calcrete boulders. Base of Qpb calcarenite not exposed in either pit.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
HUNDRED McCALLUM						
18	Highways rubble pit	McCallum	150x80x6	Qhm / Tpp	Unknown & untested - surrounding plain covered by veneer of Molineaux Sand	Ferruginised with dark red-black laterite nodules of 1-5 cm over red, yellow and white fine to to coarse-grained quartz sand with clay. No carbonate present. Irregular colour mottling extends to base of pit.
HUNDRED PARSONS						
96	Stone Reserve No. 1	Keppoch	140x80x5 (max)	Qpb	Large - extend face SE i.e. 150x100x5; as well as along the ridge.	Calcarenite exposed in face to 5m high; calcreted in top 2m with lower 3m well lithified but not calcreted. Lower portion mixed calcarenite and quartz-arenite. Yellow brown colour.
97	Vogelsang	Keppoch	45x20x1.5	Qpb	Essentially worked out; large reserves in high Qpb dune 1 km to the east.	Remnant calcreted blocks to 3x2x0.5m
115	Giles No. 2	Keppoch	140x120x2	Qpb	Moderate:- 120x90x3 under existing quarry. Can extend S across road.	Lightly to moderately calcreted calcarenite to at least 2.5 m deep on northern lower slopes. Only surface calcrete scraped off. Obtain reserves by deepening quarry.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
117	Goodrich	Keppoch		Qpb	Large	Bedded and calcreted to at least 3 m; minor orange-brown iron staining. Located on high NW-trending calcarenite dune.
118	un-nammed	Keppoch	130x40x1	Qpb / Tpp	Essentially worked out.	Thin capping (2-3m thick) of Qpb sandy calcarenite over friable quartz sand of Tpp.
127	Coles	Mundulla	100x80x4 (max) + extension 60x30x1.5	Qpb / ?Tpp	Large - extend quarry S towards nearby pit in sec 131	Calcarenite and calcrete for top 1-2 m passing down into mixed, lithified calcarenite and clayey quartz sand (gradational into Tpp). Numerous large near-surface calcrete blocks to 2.5 m long and 0.5 m thick.
HUNDRED PENDLETON						
13	Nunyara	Keith	120x80x4 (max)	Qpb	Large - extend face E-SE towards tanks.	West side of Qpb calcarenite dune. Poorly-consolidated, pale-brown calcarenite with only minor calcrete boulders.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
16	Clarke	Keith	80x70x2.5 (max)	Qpb	Limited - calcrete under cropped paddock to the east. Better alternative is poorly-developed calcrete on hill top 300-400 m to the north.	Thick, dark brown soil covering Qpb bouldery calcrete; large boulders to 2x1.5x0.5 m stockpiled in quarry floor. Friable, creamy yellow calcarenite below calcrete.
113	Colbert No. 2	Cannawigara	2 pits, largest is 200x70x2	Qpb	Large	Have mined surface calcrete in N-S Qpb calcarenite dune.
HUNDRED SENIOR						
88	Glengyle	Senior	130x70x5 (max)	Tpp	Moderate - extend E,N or S.	Iron-stained and weakly-consolidated sand with cemented lumps to 30 cm long. Sand is clayey and contains more clay than material in any other pit examined. Typical irregular red, yellow and white mottling present. Clay-rich along E face.
88	un-named	Senior	90x40x3 (max)	Tpp	Unknown - soil and Qhm covering	Adjacent to Emu Flat Road. Ferruginised clayey sand. Material quality probably inferior.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
HUNDRED SHAUGH						
12	Highways rubble pit.	Shaugh	200x40x6 (max)	Qhm / Tpp	Moderate - widen and extend further NW-N, as well as extension on E side of Pinnaroo Road.	Quarry extends NW-wards along dune crest of ferruginised med. to c.gr. clayey quartz sand of Tpp. Dune has 0.5 m covering of fine-grained Molineaux Sand
HUNDRED STIRLING						
118	Pengelly	Keith	120x45x2.5	Qpb	Large - extend uphill and/or NW and SE along the ridge.	Calcreted calcarenite on western side and base of Qpb dune. Yellow-brown to earthy colour. Qpl dolomite crops out immediately W of the quarry. Solution pipes 10-30 cm across and several metres deep exposed in calcarenite during quarrying.
144	Neave	Keith	100x90x4 (max)	Qhm / Qpb	Large - extend E-SE. Stockpiles on site.	Qpb calcarenite dune has a thin covering of Molineaux Sand. Quarry partly rehabilitated.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
HUNDRED TATIARA						
341	Ridgway	Tatiara	70x40x5 (max)	Qhm / Tpl	Unknown. Requires drilling as covered by thick dune of Qhm to the east.	Approx. 20 prospecting backhoe pits (backfilled) by Highways Department uphill to E and NE. Numerous iron-stained and iron-cemented boulders in scree amongst Qhm; Molineaux Sand appears to be several metres thick on adjacent hill top. Top 1.5 m consists of soil profile developed on fragmented iron-stained and cemented clayey sand; bedding disrupted. Sand is medium to coarse-grained. Next 1.5 m is coarse to gravelly channel sand with clay. Quartz grains are well rounded and range up to 10 mm across - construction-grade sand. Iron-cemented along bedding planes. Bottom 2 m consists of interbeds of clay and clayey sand. Material quality poor and requires blending with overlying coarse sands. Bedding subhorizontal.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
450 & 451	Milne	Tatiara	2 pits: 60x50x5 (max) & 50x40x3	Qhm / Tpp	Probably moderate but obscured by Molineaux Sand and contains clay-rich zones.	Overburden <1 m of off-white, fine-grained Molineaux Sand and red-brown clay (Tpp). Overlies ferruginised red, yellow and white semi-indurated sand but containing disseminated clay and clay-rich pockets. Pisolitic laterite also present.
888	Noack	Tatiara	60x30x3	Qhm / Tpp	Stockpiles in quarry: 25x15x2.5 Probably moderate to large - extend along ridge, but obscured by Qhm.	Ferruginised and nodular clayey sand of Tpp overlain by 0.5 m of off-white fine-grained Molineaux Sand (which is thicker on the S margin of the NW-trending dune). More uniform material quality and and with less clay than at Milne's pit in sections 450 & 451.
889	un-named	Tatiara	Backhoe trenching (prospecting) only.	Qhm / Tpp	Limited?	Iron-stained and iron-cemented boulders of Tpp clayey sand to 1 m across. Previously prospected by backhoe; backfilled and hence material quality unknown but presumed to be poor.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
997	Water Reserve No. 16. Highways borrow pit.	Tatiara	30x15x1.5	Tpp	100x100x1.5	Abundant bouldery and pisolitic laterite on surface with iron-cemented boulders to 45 cm. Recently tested by backhoe trenching by Highways Department. Trenches expose bright red and red-yellow, clayey, very fine-grained sand which is very friable at the base. Boulders may form gravel lag rather than be in-situ.
1003 & Pt. 335	Stone Reserve	Tatiara	45x20x2	Qhm / Tpp	Nil	Essentially a sand pit. Fine-grained, off-white Molineaux Sand over weakly iron-stained clayey sand (Tpp). Minor scattered iron-cemented boulders.
HUNDRED WIRREGA						
18 (+ 17, 58, 539)	P. Staude (Pigeon Flat)	Mundulla	300x70x1	Qpl	Stockpiles: 70x50x1.3	Workings formerly extended into sections 17, 58 and 539. Consolidated and cemented lagoonal white limestone with blocks in excess of 1 m. Passes down into a white calcareous clay. Good material quality but clay-rich with depth. Large blocks too hard to crush by rollers.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
34	Cannonball	Mundulla	120x120x1, rarely 2 m deep.	Qpb	Large - extend south-eastwards towards Cannon-ball Hill.	Calcreted earthy soil developed on top of Qpb calcarenite has been worked. Could probably scrape off another 1 m. Located on NW-trending Qpb calcarenite dune.
234	Hinge	Mundulla	130x60x2m (max)	Qpb	Moderate to large - extend face E (uphill)	Located on western and lower margin of Qpb calcarenite dune. Consists of calcreted calcarenite. Smaller pits adjacent to farmhouse have scraped calcreted surface only. Workings and any extensions are close to the farmhouse.
236	un-named	Mundulla	100x20x<1	Qpb	Moderate - 200x150x2 probably available	Abandoned and little worked previously. Shallow scrapings of surface calcrete over low rise of Qpb calcarenite.
375	Obst	Mundulla	140x65x2.5	Qpb	Stockpiles in quarry: 65x40x3 Large - extend W or E along the ridge.	Located on NE-flank of NW-trending Qpb calcarenite dune. Surface calcreted zone 2 m thick passes down to friable, bright orange-brown, very fine-grained, clayey sand and calcarenite. Stockpiled material good quality, but apparently with some white clay.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
454	Mock's	Mundulla	150x100x1.5	Qpl	Large	White dolomitic limestone and clay with red clay topsoil. Limestone reaches thickness of 1 m.
455	Highways quarry	Mundulla	Eventually 24 ha	Qpl	Large	Highways quarrying limestone/ dolomite bed 30-45 cm thick which is suitable for base course. Will mine about 24 ha yielding about 2 500 m^3/hectare.
480	N. Dinning	Mundulla	70x50x2.5 Second pit adjacent to fence: 50x30x2	Qpb	Limited - deepen and broaden quarry.	Calcreted calcarenite. Stockpiles consist of calcrete boulders in white powdery matrix.
523	Staude	Mundulla	50x50x2	Qpl	Stockpiles in quarry: 50x10x3. Probably large: part of the 'Big Stoney' field.	White to off-white dolomite and clay with dolomite and calcrete boulders.
533	Michell	Mundulla	45x20x1.5	Qpb / ?Tpp	Limited, but large reserves of Qpb calcarenite 1 km to south.	Shallow scraping in near-surface calcrete of Qpb. Below calcrete is lithified, bright orange-brown, clayey sand and minor calcarenite transitional into underlying Tpp; low carbonate content. Poor material quality.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
535	Bennett	Mundulla	4 pits	Qpb	Moderate - clear scrub and connect quarries.	Quarries close to farmhouse.
557	Duncan	Mundulla	80x80x3 (max)	Qpb / Tpp	Very limited - at most 50x40x2. Possible source at Woorlo Hill (not inspected)	Have worked 1.5m unit of soil and platy calcrete (Qpb) over orange-brown fine-grained clayey sand - probably Tpp. Material quality inferior as soil horizon is dominant in the Qpb calcarenite.
571 (west side)	D. Dinning	Mundulla	120x120x2 (max)	Qpb / ?Tpp	Essentially worked out. Alternatives are calcrete on hill 300 m S or higher Qpb calcarenites 1.5 km W and S.	Large scraping of thin calcreted calcarenite of Qpb overlying orange-brown, fine-grained, clayey quartz sand with only minor calcarenite - possibly Tpp. Small iron-cemented boulders present. Poor material quality.
571 (east side)	un-named	Mundulla	3 pits, largest of which is 70x40x2.5 (max)	Qpb	Large - extend uphill to the N and NW along ridge.	Workings have scraped off surface calcrete only - underlying material not tested.

Section	Name	1:50 000	Size of workings (metres)	Geol. formation	Reserves	Comments
612	Stone Reserve No. 7	Mundulla	200x150x1	Qpb	Essentially worked out unless another calcrete horizon is present at shallow depth.	Shallow scraping of surface calcrete over all of sec 612, exposing mixed orange-brown clayey sand and calcarenite (friable).
633	Stone Reserve No. 5	Mundulla		?Qhm	Nil	Originally contained calcrete, less than 1 m thick, over fine-grained, grey to off-white sand. Possibly Molineaux Sand. Now used only for sand.

APPENDIX C

POTENTIAL SOURCES OF ROAD RUBBLE FOR DISTRICT COUNCIL OF TATIARA

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED BEEAMMA					
1	10	Keppoch	Qpb / Tpp	Unknown but probably limited.	Abundant surface calcrete near tank and windmill in NE corner of section 10 - east of 'Clover Hills'. Road rubble pits nearby i.e. in sections 6, 18, 22 & 50 consist of thin capping of Qpb calcarenite and calcrete over very friable clayey quartz sand (Tpp), producing poor material quality and limited reserves.
2 3	31 83 84	Keppoch	Qpb / ?Tpp	Possibly large.	Not inspected but expected to consist of Qpb calcrete and mixed calcarenite and quartz sand to about 2 m thick in NW corner of section 31, N part of section 83 near existing small pit, and SW corner of section 84. Material quality probably similar to that from pit in section 104 (Ritter's).
4	4 20 104	Mundulla	Qpb / ?Tpp	Possibly large.	NW trending Bridgewater Formation dune extends from Ritter's pit in section 104, through the central portion of section 20 and W portion of section 4. Same ridge continues through to Obst's pit in Hd. Wirrega, sec. 375. Not inspected.

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED CANNAWIGARA					
5	49 58 103 104 105	Mundulla	Qpl	Large	Lagoonal limestone/dolomite has been worked in sections 49, 103 and 105 (Stone Reserve). Abundant dolomite float extends through to section 58 and shows that dolomite is extensive. Previous workings only 1-1.5 m deep. Material quality probably comparable to that from section 454 (Mock's) and section 455 (Highways base course operation), but may contain less bouldery dolomite as Qpl is thinning rapidly to NE.
6	42 51	Cannawigara	Qpl	Unknown	Highways road rubble pit in section 51 contains very few calcrete or dolomite boulders, but calcrete float more abundant on opposite side of Pinnaroo Road in section 42. NE limit of Qpl and hence dolomite is probably not more than 1 m thick, is poorly consolidated and may be mixed with clay.
7	4 115	Cannawigara	Qpl	Moderate?	Abundant calcreted dolomite float from Qpl along boundary of sections 4 and 115, with lesser float in section 4 immediately opposite entrance to 'Wichatay'. Material quality probably transitional between that from sec 454 (Mock's) and sec 51 (Highways pit). Probably not more than 1 m thick. Outcrop of Qpl is further NE than any marked on 1:250 000 geological map.
8	5 6	Cannawigara	Qhm / ?Qpl	Unknown	Site not inspected but could test for dolomite of Qpl facies by backhoe along Canal Road in area of sections 5 & 6. Possible extension of Qpl from that cropping out along Wagenknechts Road.

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED FISK					
9	37, 40	Quondong Bore	Tpl	Unknown	No additional sites located other than those outlined in Appendix B but best prospects are: - in two pits adjacent to the Pinnaroo Road which Rogers (1979) shows as Loxton Sands. Rogers (1984, pers. comm.) states that coastal facies is present, consisting of blocky surface calcrete and shelly sands up to 3 m deep. Located on boundary of sections 37 & 40 (out of hundreds) and on the boundary of District Councils of Tatiara and Pinnaroo. Good prospect; not inspected.
10	40	Shaugh	Tpp	Large	- weakly cemented Tpp but material quality marginal
11	3,4,6 7	Shaugh	Tpp	Large	- in a NW-trending zone which extends from Mount Shaugh (Hd Shaugh) through 'Kiara' in section 3, 4, 6 and 7 (not inspected). Zone forms Lawloit Range and apparently contains ferruginised and partly indurated Parilla Sand.
HUNDRED GEEGEELA					
					No additional sites to the two un-named Highways borrow pits in sections 4 and 63 (see Appendix B). Only source possible is ferruginised clayey quartz sand which is likely to be unconsolidated and clay-rich.
HUNDRED HYNAM					
12	450	Keppoch	Tpp	Large	District Council of Naracoorte. As discussed in Appendix B. Alternative sources, consisting of Qpb calcarenite, are located in Hd. Beeamma sections 39, 40 (Farmer) and 41 (Site 13).
13					

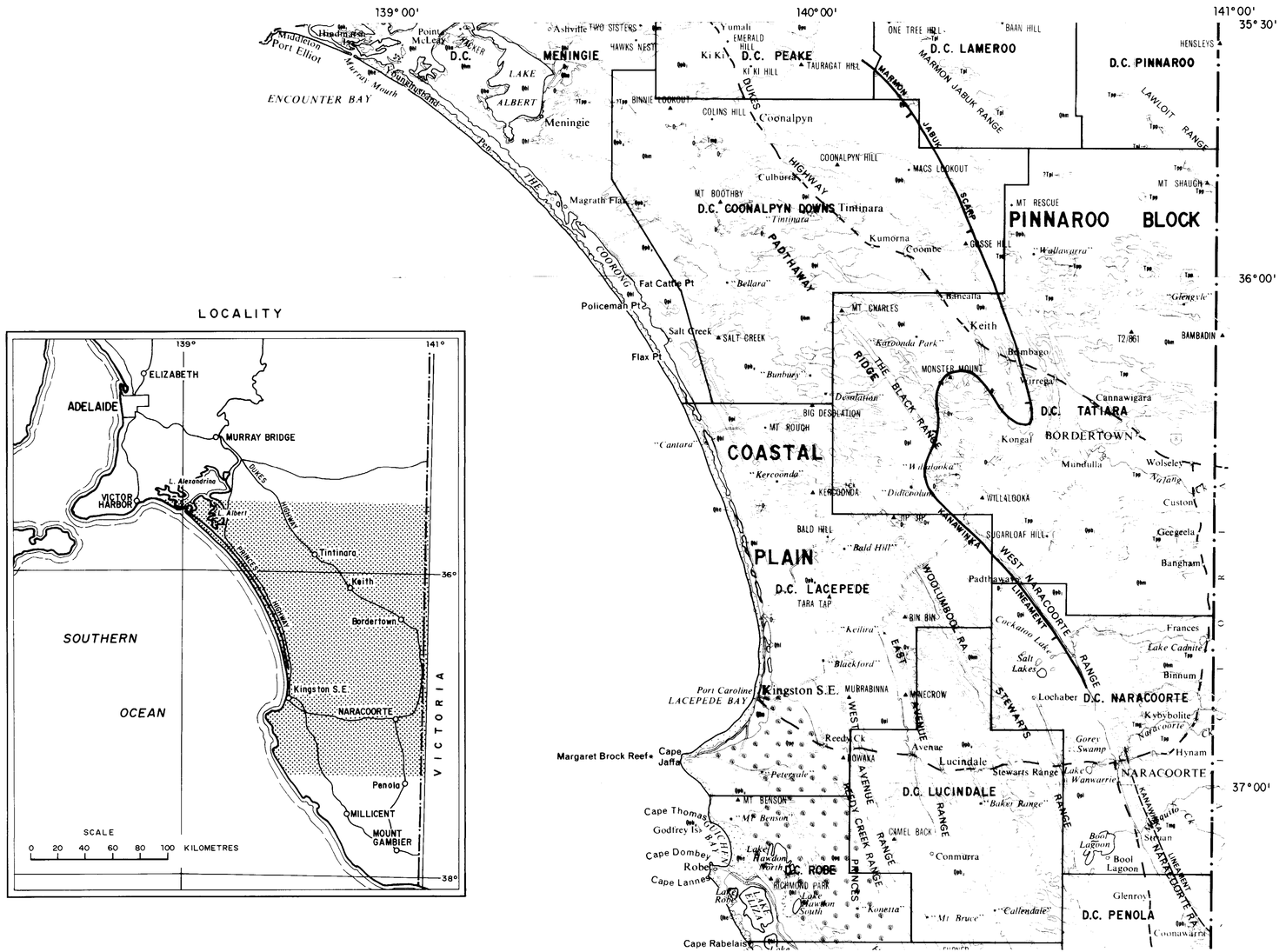
Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED MAKIN					
14 15 16 17 18					Main source is Qpb calcarenite in section 14 (Wadlawarra). Other possible but remote sources of Qpb are: - 2 km N-NE of Mount Rescue in sec 23 - 4 km NE of Mount Rescue in Bk 611 - 2 km N of 'Tamboore' in sec 23 - 3 km W of 'Kooleena' (in D.C. Coonalpyn Downs) - 5 km NW of 'Lucidon Park' (in D.C. Coonalpyn Downs). All sites were not inspected but have been photo-interpreted as Qpb outcrop by Rogers (1979). Sources of Qpb further east are most unlikely. Sources of ferruginised Tpp not located; blanket of Molineaux Sand is extensive.
19	5	Cannawigara	Qhm / Qpb	Unknown	Rochow (1969) showed NW-trending Qpb calcarenite dune underlying W-NW-trending Holocene Molineaux Sand dunes in section 5, 2 km E of Dark Island Well. Topographic trends suggest dune extends through to Hd Pendleton, sec 7. The same dune continues through Hd Pendleton, sec 96 to and beyond Hd Pendleton, sec 120 (Meakins). Northern portions of the dune are largely obscured by Molineaux Sand (Qhm) which would often reach several metres thick.

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED McCALLUM					
					No sources of ferruginised and indurated Parilla Sand (Tpp) located; Molineaux Sand covering is extensive. Hd. McCallum too far E for outcrop of Bridgewater Formation.
HUNDRED PENDLETON					
20	50	Cannawigara	Qpl	? Limited	Dolomite and calcrete float of Qpl in NW corner of section 50 at intersection of Wurlyana - Red Bluff Road and Wurlyana Road. Alternative and more reliable source would be from Meakins pit in section 120.
21	103 ?49	Cannawigara	Qpl	? Limited	Dolomite and calcrete float of Qpl along access track to 'Kellwood" from Wurlyana Road. Dolomite may also occur under soil and sand directly opposite in section 49.
22	60	Cannawigara	Qpb	Moderate	Abundant calcrete on Qpb dune crest in extreme NW corner of section 60 and only about 200-300 m S of the abandoned rubble pit alongside 'Bella Vista'.
23	6	Cannawigara	Qpb	Limited	The same dune as in sections 60 and 120 (Meakin's pit) extends SE and contains abundant surface calcrete 200-300 m east of 'Birrimba'.

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
24	59	Cannawigara	Qhm / ?Qpb	Unknown	The same dune also extends NE and is probably present at shallow depths in the NW corner of section 59. Site not inspected.
HUNDRED SENIOR					
25	65	Tatiara	Qhm / Tpp	?Nil	Backfilled prospecting pits on hill with tank in SE corner of sect 65. Ferruginised sand but clayey and non-indurated; material quality apparently unacceptable.
26					No sources of ferruginised and indurated Parilla Sand located. Best prospects would appear to be in a NW band through section 88 into section 90 - in the vicinity of present pits. Material in existing pits is poorly indurated and tends to be clay-rich.
HUNDRED SHAUGH					
11			Qhm / Tpp		No sources of ferruginised and indurated Parilla Sand found. Best prospects would appear to be in a NW-trending band of Tpp outcrop extending through Mount Shaugh (sec 5) up to 'Kiara' in Hd. Fisk. Not inspected. All of the favourable zone within Hd Shaugh forms part of Mount Shaugh Conservation Park.

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
HUNDRED TATIARA					
27	135 136 144 146	Mundulla	Qpl	Unknown	Rochow (1969) showed that Padthaway Formation extends further E from the large workings at in Hd Wirrega, section 18; dolomite within Padthaway Formation may exist under sections 135, 136, 144 and 146 (Hd Tatiara).
28	508 525	Tatiara	Qhm / Tpp	Nil	Highways borrow pits expose unconsolidated only weakly ferruginised fine-grained clayey sand - unsuitable material.
29	889	Tatiara	Tpp	? Limited	See Appendix B for additional comments.
30	997 (+443)	Tatiara	Tpp	100x100x1.5	Good prospect - see Appendix B for additional comments.
HUNDRED WIRREGA					
31	249 250 283 286 287 290- 293	Mundulla	Qpl	Large	Extensive area with abundant dolomite and calcrete float from Qpl - known as Big Stoney with calcrete and dolomite boulders harvested and stockpiled.
32	455- 457	Mundulla	Qpl	Large	Extension of dolomite from Padthaway Formation which is being worked in sec 454 (Mock's) and sec 455 (Highways).

Site No.	Section	1:50 000	Geol. formation	Available resource	Comments
33	471 479 484 485	Mundulla	Qhm / Qpb	Unknown	Low N-S trending Qpb dune with blanket of Molineaux Sand which may be up to 2 m thick; Qpb calcarenite may be poorly calcreted. Strongest calcrete development is on the S end in sec 234 (Hinge's) whereas calcrete development is poor on N end in sec 113 (hd Pendleton, Colbert No. 2 deposit).
34	562	Mundula	Qpb	Unknown	Not inspected. NW trending calcarenite of Qpb exposed in pits within sec 571 extend NW through sec 562 at 'Manuka Hill'. Probably not as well calcreted as in sec 571.
35	578 613	Mundulla	Qpb	? Large	Not inspected. NW trending calcarenite dune of Qpb.
36	533	Mundulla	Qpb	Large	Not inspected. High Bridgewater Formation dunes throughout all of sec 533; Michell's deposit is located on low rise slightly separated from the main dune. Material quality probably preferrable to that from W side of sec 571, 535 and 557.
37	376	Mundulla	Qpb	Moderate	Not inspected; Woorloo Hill. Apparently remnant of Qpb dune which extended through sections 372-376 and 557. Calcrete and calcarenite may form thin capping; larger reserves in the adjacent section 375 (Obst's pit).
38	100	Mundulla	Qpb	Moderate to Large	Not inspected. Apparently Qpb dune forming high hill to 117 m AHD on E side of sec 100. Probably strongly calcreted; scrub covered.



From Rogers, 1980

Fig. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

DISTRICT COUNCIL OF TATIARA – RUBBLE PITS

REGIONAL LOCALITY PLAN

COMPILED D.F.		DATE 8-11-84
DRAWN M.B.		SCALE 1:750 000
DATE August '84		PLAN NUMBER 84 – 326
CHECKED		

3626

140° 15'
140° 30'
140° 45'
35° 45'
36° 00'
36° 15'
36° 30'

LEWIS
COOMBE
ARCHIBALD
MOUNT RESCUE CONSERVATION PARK
MAKIN
McCALLUM
FISK
SHAUGH
MT. SHAUGH CONSERVATION PARK
LAFFER
STIRLING
PENDLETON
CANNAWIGARA
SENIOR
D. C. TATIARA
VICTORIA
STATE OF
PETHERICK
WILLALOOKA
WIRREGA
TATIARA
PEACOCK
MARCOLLAT
ROY
BEEAMMA
GEEGEELA

Hawick
Wadlawarra
Nunyara
Clark
Meakins
Longmire
Colbert No. 2
Mock's
N. Dinning
Irwin
Hunt
Hinge
Oborne
Staude
P. Staude
Cannonball
Stone Reserve
Excell
Hutching
D. Dinning
Duncan
Michell
Bennett
Obst
Kallin
Coles
Young
Ritter
Fromm
Milne
Noack
Ridgway
Glengyle
Cavanagh
Brown
Lehmann
Hayes
Bell
Carr
Lehmann
Sander
Stopp
Patterson
Thompson
B.M. Densley
Pengelly
George
Cook
Densley
Neave
Makin
Davidson
Richard
Manser
Oxaflow
S. Wheal
G. Wheal
Draper
MR 21 2
MR 21 1
Wittalocka
Moville
Shearer chute
Bruce
Bond
Bassham
Buckelboo
Mc Michael
Wittacoola (Jip Jip)
Wittacoola (Petherick)
Waterview
Didicoolum
Gip Gip Ext.
East
Goodrich
Vogelsang
Giles No. 2
Cherokee
Giles No. 1
Farmer
Stone Reserve

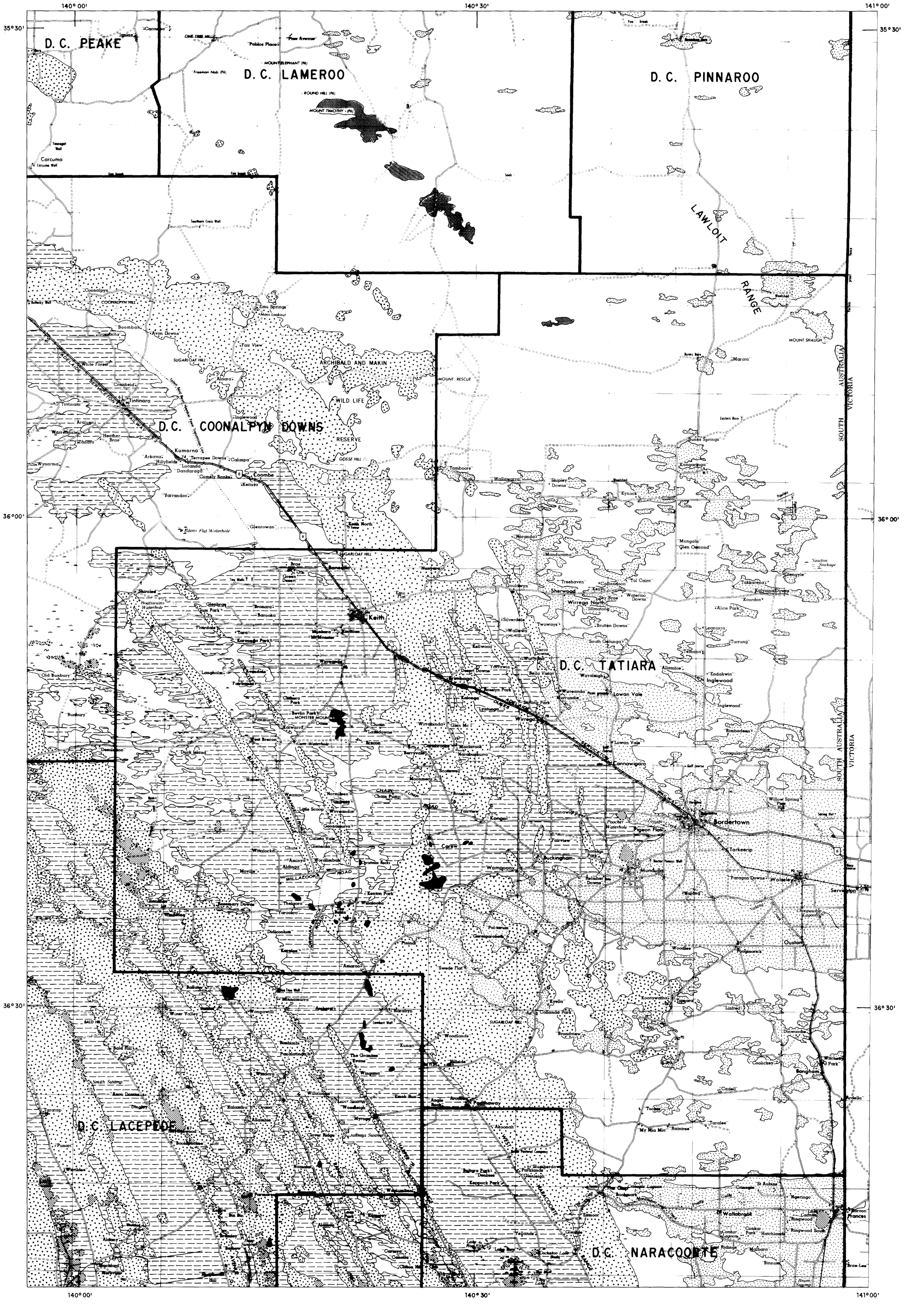
1 2 3 4 5 6 7 8 9 10 11 12 13 25 26 27 28 29 30 31 32 33 34 35 36 37 38

Fig. 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

DISTRICT COUNCIL OF TATIARA – RUBBLE PITS
LOCALITY PLAN
ROAD RUBBLE SOURCES

COMPILED D. F.	DATE 8.11.84
DRAWN M.B.	SCALE 1:100 000
DATE Aug '84	DRG. NUMBER 84-327
CHECKED	



QUATERNARY

HOLOCENE

MOLINEAUX SAND : Pale yellow, grey and light red-brown unconsolidated quartz sand of sand spreads, jumbled parabolic dunes and E - SE trending dunes.

PLEISTOCENE

PADTHAWAY FORMATION : Lagoonal white to pale grey fine-grained dolomite and pale greenish-grey clay and clayey quartz sand. BAKARA CALCRETE developed at top in places.

BRIDGEWATER FORMATION (LOWER MEMBER) : Stranded coastal dunes, beach ridges and beach deposits consisting of medium to coarse-grained calcarenite with varying proportions of clayey quartz sand. Aeolian dunes contain rounded shell fragments and eroded foraminifera whereas beach deposits contain more-intact molluscs and gastropods.

TERTIARY

PLIOCENE

PARILLA SAND : Fluvial-lacustrine pale yellow-brown, fine to medium-grained, clayey quartz sand. Mottled red-brown, yellow-brown and grey when ferruginised; hard, blocky, ferruginous duricrust of KAROONDA SOIL developed locally. Sand coarser in Lawloit Range. Often undifferentiated from underlying very-similar Loxton Sands (fluvial facies) - particularly on Naracoorte 1 : 250 000.

LOXTON SANDS : Fluvial facies : Yellow-brown and red-brown, fine to coarse clayey quartz sand and gravel. Hard, blocky ferruginous bands in places.
Coastal facies : Purplish-brown, medium to coarse, calcareous shelly, quartz sandstone; overlain by BAKARA CALCRETE.

PALAEOZOIC

ORDOVICIAN

GRANITE : Granite, microgranite, adamellite, dacite and rhyolite intruding Cambrian Kanmantoo Group (not exposed).

From Rochow (1969) and Rogers (1979)

Fig. 3

SCALE

0 5 10 15 20 25 KILOMETRES

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

DISTRICT COUNCIL OF TATIARA — RUBBLE PITS

REGIONAL GEOLOGY PLAN

COMPILED D. F.	8-11-84 SDO DATE
DRAWN M.B.	SCALE 1 : 250 000
DATE Aug '84	PLAN NUMBER 84 - 328
CHECKED	

3626