DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 83/63
ALLEN'S SAND QUARRY
(Section 715, Hd. Blanche)
RESULTS OF AUGER DRILLING,
1981-82.
(PM.233, I.A. & C.H. Allen)

GEOLOGICAL SURVEY

by

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DEPARTMENT OF MINES AND ENERGY
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ALLEN'S SAND QUARRY
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(PM 233, I.A. & C.H. Allen)

ABSTRACT

Allen's sand quarry, 10 km northwest of Mount Gambier was investigated by drilling in February 1981 during reconnaissance for construction sand in lower South East, South Australia.

The quarry has been an important source of construction sand for Mount Gambier and produced between 60 000 and 100 000 tonnes from early 1940's until 1974.

Gently domed coarse sand, silt and clay of Middle Eocene age is overlain unconformably by thin ferruginous Compton Conglomerate and massive bryozoal Gambier Limestone of Oligocene to Miocene age.

Allen's sand quarry is the only exposure of Early Tertiary sediments in the South Australian portion of the Otway Basin and preservation of a representative section is essential.

Eighteen auger drillholes have outlined probable reserves of 80 000 tonnes of construction sand below 57 000 tonnes of overburden.

Sand as mined contains more than 10 percent fines and will need to be washed to meet concrete sand specifications.

Further drilling is required to prove sand reserves and assist quarry development.

As a result of these investigations, quarry operations recommenced in early 1982.

INTRODUCTION

Investigation of construction sand resources in the lower South East was initiated by a request from Rocky Camp Sand Supplies Pty. Ltd. seeking assistance to locate additional sources of coarse sand for their concrete batching plant at Millicent.

Before mid 1960's, Allen's sand quarry was a major supplier of construction sand for Mount Gambier but increasing overburden thickness and excessive fines content caused operations to cease in 1974.

The partly rehabilitated quarry was inspected with P.C. Smith (Geologist, Mount Gambier Office) on 7 October 1980 and after discussion with landowner I.A. Allen, the quarry was included in a reconnaissance drilling programme for construction sand.

In February 1981, 15 auger holes were drilled using a Diahatsu-mounted hydraulic auger operated by M.W. Flintoft (Field Assistant, Mineral Resources Section). Hole locations and quarry faces were stadia surveyed by P.P. Crettenden (Field Assistant, Mineral Resources Section).

The small auger rig was limited by hard limestone overburden and restricted depth capacity. However, results indicated that a limited quantity of construction sand could be obtained after washing.

Rocky Camp Sand Supplies Pty. Ltd. entered into an agreement with the landowner and mining recommenced in early 1982. Sand dug by front-end loader is road transported to Rocky Camp 6 km east of Millicent for screening, washing and blending with finer grained dune sand before carting to Millicent for use in concrete.

In November 1982, recent quarry operations were surveyed by P.P. Crettenden and 3 hand auger holes were sunk to provide additional data for geological cross sections.

PREVIOUS WORK

Allen's sand quarry (formerly Knight's Quarry) is referred to in Sprigg (1952) and was inspected in 1955 during an investigation of economic potential of Eocene clay in the Mount Gambier area (Kingsbury, 1955).

The geology of the quarry is discussed in Ludbrook (1956 and 1961) with photographs of quarry operations in 1956 (reproduced herein as Plates 1 and 2). Compton Conglomerate (Ludbrook, 1957), Knight Formation (Harris, 1966) and equivalent Tartwaup Formation (Ludbrook, 1969) are described from their designated type section in the quarry (Plate 2).

In 1966, samples of sand and conglomerate collected by K. Rochow (then Geologist, Petroleum Section) were examined by Australian Mineral Development Laboratories (AMDEL) for heavy minerals and phosphate (Scott and Trueman, 1966).

Ceramic tests on clay collected by M.N. Hiern (Supervising Geologist, Mineral Resources Section) are reported in Lennox (1969).

A fault on the southwestern boundary of the deposit mapped by Sprigg, Cochrane and Solomon (1951) is disputed by Waterhouse (1973).

Preservation of Allen's sand quarry as a geological monument is recommended by Mooney (1976).

LOCATION ACCESS AND LAND USE

The quarry is 10 km northwest of the City of Mount Gambier on section 715, hundred Blanche, county Grey in District Council of Mount Gambier, part of the South East Planning Area.

Access from Mount Gambier is 7 km northwest along the main Mount Gambier - Millicent road (National Highway 1) then 3 km north along Stony Flat Road. The quarry is accessible from Stony Flat or Vause roads (Figs. 1 and 2).

The area investigated in this report covers approximately 12 ha of sloping land varying from 65 m elevation in the northeast to 50 m in the southwest. Land use is primarily grazing for dairy cattle with some planting of cereal crops.

Past sand quarry operations have been mostly rehabilitated and the land returned to pasture. A 7 m deep limestone quarry for road rubble is 350 m west of the sand quarry (Fig. 2).

HISTORY, MINERAL TENURE AND PRODUCTION

Before 1973, mining on section 715 was conducted under private agreement with the landowner, minerals being alienated from the Crown. Few records of early quarry operations exist but sand mining probably commenced in early 1940's.

Sand produced in the late 1950's was used for construction purposes by Engineering and Water Supply Department (Ludbrook, 1961).

Until the mid 1960's, the quarry was a major source of concrete sand for Mount Gambier, supplemented by finer grained sand from dunes close to the city and from Wepar sand deposit near Tarpeena (Keeling, 1982). Since the mid 1960's, significant quantities of sand have been supplied from Comaum northeast of Penola and from deposits in Victoria, supplemented by crusher fines from Mount Schank basalt quarry.

In September 1973, I.A., S.L. and C.H. Allen applied for a Private Mine covering both sand and limestone quarries.

Private Mine 233 of 120 ha (see Fig. 2) was proclaimed on 20 June 1974. Sand mining ceased in the same year due to increasing overburden thickness and unacceptably high fines content.

Past production is estimated from the geological plan (Fig. 4) to have totalled between 60 000 and 100 000 tonnes.

In early 1982, Rocky Camp Sand Supplies Pty. Ltd. recommenced sand mining and 1 921 tonnes were produced during 1982.

REGIONAL GEOLOGY

Regional geology of the South East is discussed in Sprigg (1952), Ludbrook (1961), Wopfner and Douglas (1971) and Firman (1973). Geological setting is presented in Figures 1 and 2.

The area is part of the Otway Basin comprising a thick sequence of Cretaceous and Tertiary terrestrial and marine sediments.

Coarse sand, silt and clay exposed in quarry faces are terrestrial and marginal marine deposits of Middle Eocene age subsequently buried beneath bryzoal Gambier Limestone during marine transgression in Oligocene to Miocene times. The base of Gambier Limestone is marked by a thin limonite cemented sand, Compton Conglomerate, which overlies Eocene sand and clay with angular unconformity.

Gambier Limestone is in turn overlain by stranded calcareous beach dunes of Bridgewater Formation of Pleistocene age.

Fine grained Molineaux Sand of Holocene age is widespread as a thin veneer on older sediments or as dunes.

Stratigraphy

The only exposure of Early Tertiary sediments in the South Australian portion of the Otway Basin is at Allen's sand quarry where 5 m of weathered silty clay and sand are overlain unconformably by Gambier Limestone. Age and stratigraphic position of the quarry section are based on extrapolation from nearby wells, drilled for coal and petroleum, where up to 300 m of Eocene sediments have been intersected.

The lack of data on Early Tertiary sediments in the South Australian portion of the Otway Basin contrasts with extensive exposures in Victoria which have been studied in detail for the past 30 years. Attempts to correlate across the border are reflected in the changing stratigraphic nomenclature summarised in Table 1.

Sprigg (1952) named the Early Tertiary clay and sand sequence 'Knight sands and clays'. The sequence was renamed Knight Group by Sprigg and Boutakoff (1953) and incorporated Bahgallah and Dartmoor Formations of Western Victoria. The quarry section was equated with the upper part of Dartmoor Formation.

In 1956, the quarry was sampled and described by N.H. Ludbrook (then Palaeontologist, Department of Mines) during a field conference with Frome-Broken Hill Co. Pty. Ltd. (Ludbrook, 1956). Subsequently, thin limonite and calcite cemented sand at the base of Glenelg Group was named Compton Conglomerate (Ludbrook, 1957). The stratigraphy and description of the quarry type section of Compton Conglomerate and Knight Group were published in Ludbrook (1961).

Carbonaceous clay from upper Knight Group intersected in coal exploration wells CG7 and CG8 (Fig. 3), 8 km west of Allen's sand quarry was found to be Middle Eocene age. By extrapolation, Harris (1966) defined Knight Formation of Middle Eocene age designating Allen's sand quarry (then Knight's quarry) as the type section.

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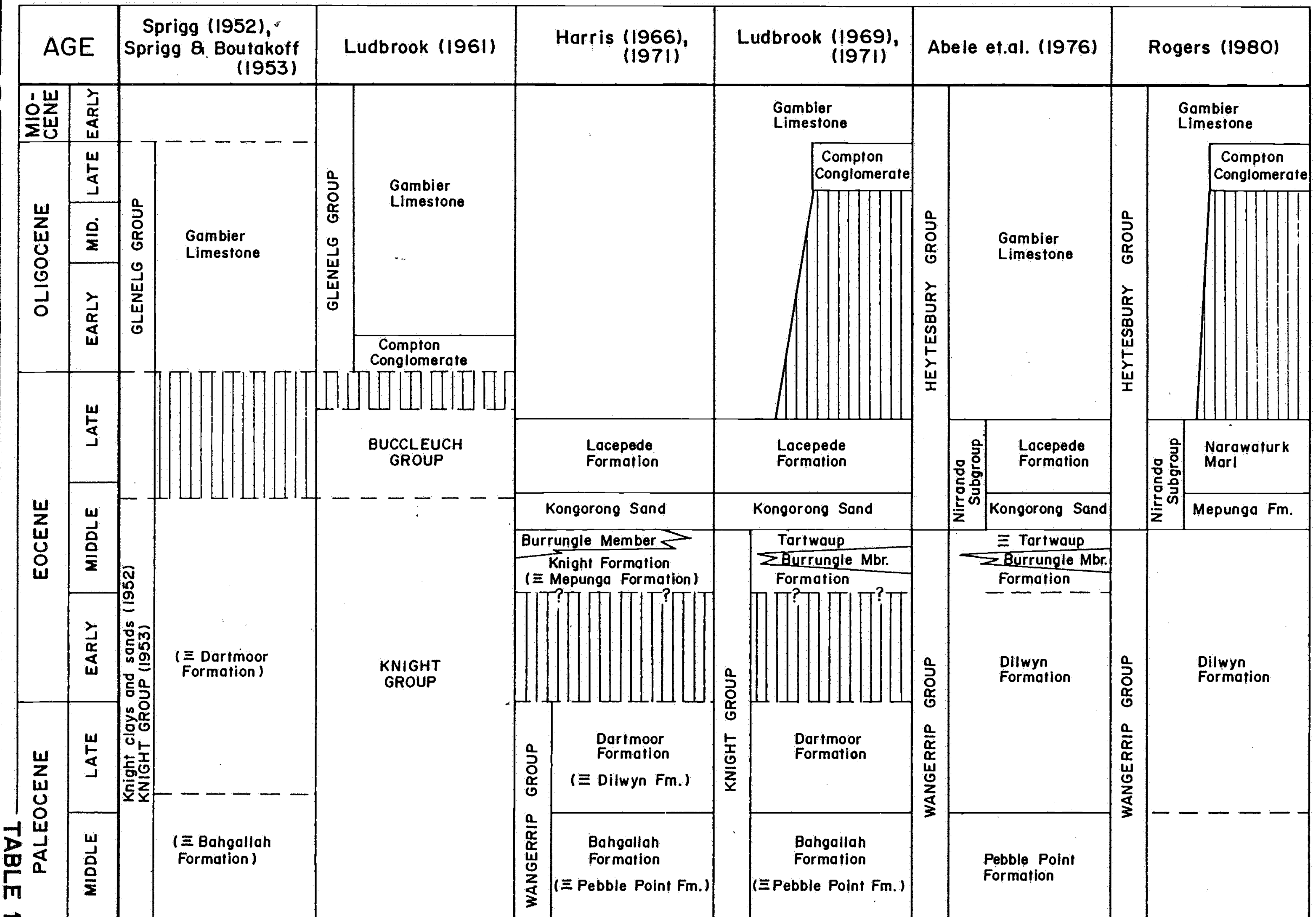
TABLE 1



LOWER TERTIARY STRATIGRAPHY

OTWAY BASIN

SOUTH AUSTRALIA

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

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Harris also defined an upper clay unit Burrungle Member within Knight Formation and subsequently redefined Dartmoor Formation as being of Late Paleocene age (Harris, 1966 and 1971).

Ludbrook (1969), argued for retention of Knight Group, rejecting Knight Formation in favour of Tartwaup Formation for the Middle Eocene unit. Burrungle Member was retained as carbonaceous marginal marine clay within Tartwaup Formation.

Both arguments are presented in Wopfner and Douglas (1971).

Rogers (1980) adopted Victorian correlations by Abele et. al. (1976) and equated Tartwaup Formation with upper Dilwyn Formation in Wangerrip Group. Harris (1980) supports this correlation. Dilwyn Formation is predominantly clay and silt with fine grained sand and in type section is Palaeocene to Early Eocene age (Abele et. al., 1976).

While use of Wangerrip Group for Knight Group may be accepted generally, the name Tartwaup Formation is retained in this report for coarse sand, gravel and silty clay of Middle Eocene age.

Structure

Outcrop of Tartwaup Formation at Allen's quarry has been attributed to faulting (Sprigg, 1952), the quarry being on the upthrown side of Tartwaup Fault.

Tartwaup Fault or Gambier Lineament (Rogers, 1980) is traced from The Bluff 22 km northwest of Mount Gambier east-southeast into western Victoria (Fig. 1) and its presence, at least at depth is supported by seismic data (Cadart et. al., 1974).

Waterhouse (1973) questioned the fault theory arguing that angular unconformity between Gambier Limestone and Tartwaup Formation can account for Gambier Limestone being at lower elevation immediately south of the quarry.

Structure contours for the top of Wangerrip Group (Fig. 3) show an irregular surface of highs and lows which may result from either erosion or gentle folding.

In the quarry area (Fig. 2), the postulated fault trace is marked by a northwest-southeast trending erosion channel infilled with fine grained Molineaux Sand. Similar channels and hollows northeast and northwest of the quarry appear to be solution features in Gambier Limestone which in some cases are elongate along the Gambier Limestone - Tartwaup Formation contact.

The following suggest that outcrop of Tartwaup Formation at Allen's sand quarry is related to a northwesterly trending structural high, not a fault.

- In the southeastern corner of section 715, Gambier Limestone is continuous across the proposed fault without any obvious disruption or recyrstallisation.
- The angular unconformity between Tartwaup Formation and Gambier Limestone is exposed in the southeastern corner of the quarry where yellow, red and white banded silty clay dips 10 degrees east-southeasterly overlain by apparently flat-lying limestone.
- Absence of Late Eocene, Nirranda Subgroup (Rogers, 1980) overlying Tartwaup Formation.
- Gambier Limestone at Allen's sand quarry is younger than limestone overlying Tartwaup Formation in deeper parts of the Otway Basin (Ludbrook, 1969).

Following deposition, Tartwaup Formation was uplifted, probably by gentle folding or doming in Late Eocene to Early Oligocene times and subjected to erosion before marine transgression and deposition in Middle to Late Oligocene times. Subsequent erosion of the thin cap of Gambier Limestone has exposed Tartwaup Formation.

SITE GEOLOGY

Geology of the deposit is summarised on geological plan (Fig. 4) and sections (Fig. 5).

Coarse sand, clay and silt of Tartwaup Formation is exposed only in quarry faces, the original outcrop having been mined and rehabilitated.

Gambier Limestone is widespread cropping out as massive bryzoal limestone or covered by thin red or dark brown clay soil.

Fine grained yellow to pale brown Molineaux Sand fills erosion channels and forms a high dune 500 m west of the quarry (Fig. 2).

The stratigraphic relationship between Tertiary units is exposed in an abandoned cut at the southeastern end of the quarry (Plate 5). The type section measured by Ludbrook in 1956 at the northwestern end of this cut (Plate 2) is today partly obscured by 4 to 5 m of fill. A more complete section can be seen near drillhole ASQ 16 (Fig. 4).

A composite section from ASQ 16 and quarry face (Fig. 6) described in Table 2 differs from the original type section in that Compton Conglomerate is only 0.2 m thick and silty clay overlying coarse sand has increased from 1 m to 4 m thick.

Table 2: Composite geological section

UNIT (thickness)	Depth (m)	Description
TOPSOIL (0.8 m)	0 - 0.8	Dark red-brown clay soil, slightly sandy.
GAMBIER LIMESTONE (5.3 m)	0.8 - 4.6	White to pale yellow calcarenite mainly broken bryzoal fragments. Patches and bands of recrystallised limestone to 10 cm thick.
	4.6 - 6.1	Massive pale yellow to brown limestone composed of coarse shell and bryzoal fragments.
COMPTON CONGLOMERATE (0.2 m)	6.1 - 6.3	Fine to coarse grained sand yellow-brown, subangular to subrounded cemented by limonite and carbonate.
TARTWAUP FORMATION (10.4 m^+)	6.3 - 7.7	White, yellow, red and brown banded silty clay, semi-plastic with limonite nodules and thin bands at 6.5 to 6.8 m.
	7.7 - 11.4	Clayey fill with limestone fragments.
	11.4 - 16.4	Mottled yellow, red and white clayey silt, micaceous with coarse sand interbeds to 1 m thick. Grey carbonaceous silt between 13.2 to 14.2 m.

Five metres of coarse sand and gravel are exposed in workings north of the measured section (Plate 4). A channel sample from the quarry face contained 20 percent subrounded, medium to fine white quartz gravel. Sand size fraction was mostly clay coated white or smoky quartz, angular to subrounded and commmonly fractured. Mica, feldspar and opaques are present in minor amounts and trace amounts of tourmaline, zircon and rutile were reported by Scott and Trueman (1966).

Weathered blocks of Gambier Limestone overlie sand in the southern part of recent workings (Plate 6).

A small abandoned quarry at the western end of the rehabilitated area (Fig. 4) exposes:-

0-2 m	Gambier Limestone
2-2.4 m	Compton Conglomerate
2.4-4.4 m	Tartwaup Formation comprising 0.5 m of yellow and red-brown silty clay overlying 1.5 m of coarse sand. Sand, is slightly gravelly with variable clay content and shows small scale cross bedding.

Overall structure is a gentle anticline or dome with sand intertonguing with silty clay in the southeast and clay content increasing to the east.

Rapidly thickening overburden in most directions restricts quarry development to a northeasterly extension (Fig. 4).

DRILLING

From 25 February to 27 February 1981, 15 holes (ASQ1 to ASQ15) totalling 85 m were drilled using a Diahatsu-mounted hydraulic auger with flights 75 mm diameter and 1.5 m length.

On 23 November 1982, 3 holes (ASQ16 to ASQ18) totalling 17.6 m were drilled by hand auger with lightweight aluminium extensions.

Hole locations are plotted on Figure 4 and drillhole logs are given in Appendix C.

Logging samples were collected for each 1 m of drilling and bulk samples of approximately 1 kg were taken when drilling in sand.

Drillhole samples were logged consistent with terminology used in Pain (1976), as summarised in Appendix A. Representative logging samples were retained and stored at Glenside Core Library Complex.

Auger drilling was only partly successful in defining sand reserves. The rig was not capable of penetrating Gambier Limestone in 6 holes (ASQ5, 8, 11, 12, 13 and 14) and ASQ10 jammed in clayey sand.

Depth of drilling was limited to 9 m and drillholes ASQ1 and ASQ2 failed to penetrate the full thickness of coarse sand.

A more powerful rig with depth capacity of 15 m is required for follow-up work.

Useful sand was intersected in 4 holes, ASQ1, ASQ2, ASQ4 and ASQ18.

Results of drilling are summarised in Table 3.

Table 3: Summary of drillhole data.

Hole No.	Depth (m)	Cons. Sand Intersection From	To	Thickness	FM	Fines (%)	Comment
ASQ1	9.0	5.5 7.0	7.0 9.0	1.5 2.0	2.68 3.16	22.0 11.9	Base of sand not penetrated.
ASQ2	9.0	4.0 5.0 7.0	5.0 7.0 9.0	1.0 2.0 2.0	2.94 3.12 3.15	8.3 7.4 11.2	Base of sand not penetrated.
ASQ3	9.0	5.5	8.0	2.5	2.78	23.0	Moderately clayey sand.
ASQ4	9.0	3.0	8.0	5.0	2.94	16.4	Slightly clayey sand.
ASQ5	4.5	-	-	-	-	-	Limestone - hard drilling.
ASQ6	9.0	-	-	-	-	-	Fine dune sand.
ASQ7	9.0	-	-	-	-	-	Fine dune sand.
ASQ8	5.0	-	-	-	-	-	Limestone - hard drilling.
ASQ9	9.0	-	-	-	-	-	Fine dune sand.
ASQ10	4.0	1.6	3.0	1.4	2.93	20.8	Auger stuck in clay.
ASQ11	0.4	-	-	-	-	-	Limestone - hard drilling.
ASQ12	1.8	-	-	-	-	-	Limestone - hard drilling.
ASQ13	5.2	-	-	-	-	-	Limestone - hard drilling.
ASQ14	2.1	-	-	-	-	-	Limestone - hard drilling.
ASQ15	8.0	6.0	8.0	2.0	2.20	39.0	Very clayey sand.
ASQ16	6.6	1.8 2.9 6.0	2.2 3.1 6.4	0.4 0.2 0.4	not not not	tested tested tested	Thin coarse sand lenses.
ASQ17	4.0	0 2.5	0.5 3.8	0.5 1.3	3.07 2.57	7.6 15.4	Thin clayey sand.
ASQ18	7.0	2.2 5.0	5.0 7.0	2.8 2.0	3.25 2.97	4.6 5.6	Clean construction sand.

LABORATORY TESTING

Sand

Fourteen bulk sand samples were sieved using procedures described in Australian Standard (AS) 1141-1974 and the results are shown as graphical plots in Appendix D.

The size grading limits for natural fine aggregates are defined by AS 1465-1974 which is shown as a broad envelope on graphs in Appendix D.

Concrete sand specification occupies a restricted range within the general specification AS 1465-1974.

Size grading for a sample is represented conveniently by Fineness Modulus (FM), the derivation of which is described in Appendix B. The finest sand which meets specification AS 1465-1974 has FM 1.35 and the coarsest FM 4.00. For concrete sand, FM should lie between 2.20 and 3.45.

FM is calculated on a 'fines free' basis (i.e. silt and clay content are ignored) and it is therefore necessary to quote fines content in conjunction with FM.

Although the permissible amount of fines recommended in AS 1465-1974 is 5 percent, sand with up to 30 percent fines is treated in modern washing plants.

FM and fines content for samples tested are summarised in Table 2 and are recorded against the drillhole logs in Appendix C and on graphical plots in Appendix D.

All samples tested have FM values within specification for concrete sand but fines content is variable. Best intersection of 4.8 m in ASQ18 averaged FM 3.13 with fines content 5.0 percent.

Other sand intersections have higher fines content and would require washing.

After washing and removal of medium to coarse gravel, the pale yellow, subangular to subrounded well-graded sand is suitable for concrete.

Clay

Four metres of finely bedded silty clay overlie coarse sand in the southeastern part of the quarry. The clay is pale yellow to white with yellow, brown and red oxidised bands. Limonite, as nodules and thin veins is common near the contact of clay with Compton Conglomerate, and rare crystallised carbonate concretions up to 20 mm across are seen in outcrop.

A sample of clay collected by M.N. Hiern in 1969 was tested at AMDEL and the results (Lennox, 1969) are summarised in Table 3.

Silt content is high (45 percent quartz) with low alumina (11.8 percent) and appreciable amounts of iron (3.30 percent Fe_2O_3) and titanium (1.15 percent). The clay fraction is composed of approximately equal amounts of kaolin and illite with 10 to 20 percent montmorillonite.

Firing produced a hard, light red fired product at 1050°C with a low fired shrinkage (1.7 percent). Fired specimens show white inclusions (probably calcium carbonate) and surface spalling was noticeable after samples had been standing.

The presence of carbonate is highly detrimental to brickmaking and the clay is unsuitable for this purpose.

Table 4: Ceramic tests - sample A590/69

DRYING AND FIRING PROPERTIES

Temperature °C	% Total Shrinkage	% Absorption	Relative Hardness	Colour
105	3.9	-	-	-
800	3.5	15.6	soft	light red
850	3.4	15.4	soft	light red
900	3.7	14.7	soft	light red
950	4.3	14.5	soft	light red
1000	4.4	14.2	harder	light red
1050	4.6	13.7	hard	light red
1100	5.2	12.1	hard	light red
1150	6.0	10.8	hard	brown
1200	6.8	8.4	hard	red

SIZING ANALYSIS%		CHEMICAL ANALYSIS%		MINERALOGICAL COMPOSITION%	
Screening					
Grit		SiO_2	76.0		
+53 micron (300#)	32.9	Al_2O_3	11.8	Quartz	45
		Fe_2O_3	3.30		
Sedimentation		FeO	0.22	Minus 2 micron fraction	
Wt % finer than		MgO	0.35		
50 micron	100	CaO	1.15	Quartz	10
25 "	64	MnO	0.01	Montmorillonite	10-20
20 "	55	Na_2O	1.52	Illite	30-40
15 "	44	K_2O	0.09	Kaolin	30-40
10 "	32	TiO_2	1.15		
8 "	28	SO_3	0.02		
7 "	25	Cl	0.20		
6 "	22	CO_2	0.66		
5 "	19	H_2O^+	3.80		
4 "	16	H_2O^-	0.60		
3 "	12				
2 "	8				
1 "	4				

RESERVES

Construction sand intersected during drilling is restricted to a northeasterly extension of existing workings.

Probable reserves calculated for the area outlined on plan (Fig. 4) and sections (Fig. 5) were based on the following:-

average construction sand thickness	- 5 m
average overburden thickness	- 3 m
specific gravity of sand	- 1.6
specific gravity of overburden	- 1.9

80 000 tonnes of construction sand averaging 10 to 15 percent fines content are available below 57 000 tonnes of fine sand and clay overburden.

A further 12 holes drilled on a 30 x 30 m grid to a depth of 10 to 15 m are required to prove reserves and plan quarry operations.

SUMMARY AND RECOMMENDATIONS

Allen's Sand Quarry, 10 km northwest of Mount Gambier was drilled during reconnaissance survey for construction sand in lower South East, South Australia.

Gently domed sand, clay and silt of Middle Eocene age is overlain by bryzoal Gambier Limestone.

The quarry is the type section for Middle Eocene Tartwaup Formation and overlying Compton Conglomerate at the base of Gambier Limestone.

Auger drilling has outlined probable reserves of 80 000 tonnes of construction sand averaging 10 to 15 percent fines content beneath 57 000 tonnes of overburden.

Silty clay overburden is not suitable for brickmaking.

Rocky Camp Sand Supplies Pty. Ltd. recommenced quarry operations in early 1982 and 1 921 tonnes were produced by the end of the year.

The following are recommended:-

... Probable sand reserves in the area outlined on Figure 4 be proved by drilling a further 12 holes on a 30 x 30 m grid to a depth of 10 to 15 m. Using drillhole data, plan quarry operations to minimise overall fines content of future output.

... Area shown in Figure 4 which includes the type section measured by Ludbrook in 1956 be preserved and not disturbed by quarry operations.

... Further exploratory holes be drilled north of previous workings to test sand at depth and below thin Gambier Limestone overburden.

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APPENDIX A

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

CLASSIFICATION AND DESCRIPTION OF SAND AND GRAVEL

In laboratory analysis, material passing 200 mesh BSS sieve (0.075 mm) is designated 'fines'. No attempt is made to determine the relative proportions of silt and clay in this fraction.

Sand and gravel with less than 30% fines are potentially usable, and are subdivided below as shown on figure A1.

- moderately silty - total fines 20-30% and silt is dominant fines component
- moderately clayey - total fines 20-30% and clay is dominant fines component
- slightly silty - total fines 10-20% (silt dominant)
- slightly clayey - total fines 10-20% (clay dominant)

Many different classifications exist of grain size of sediments, some of which are illustrated on figure A2. Mesh sizes used to specify grading of fine aggregate in A.S. 1465 approximate the Wentworth size classification. Consequently, a classification similar to Wentworth but based on A.S. 1465 size gradings has been used throughout this report (see general classification, Fig. A2).

'Fines', Sand and Gravel size fractions are defined thus:-

- 'Fines' (Silt and clay); minus 200 mesh BSS (-0.075 mm)
- Sand; plus 200 minus 7 mesh BSS (+0.075 mm - 2.36 mm).
- Gravel; plus 7 mesh BSS (+2.36 mm)

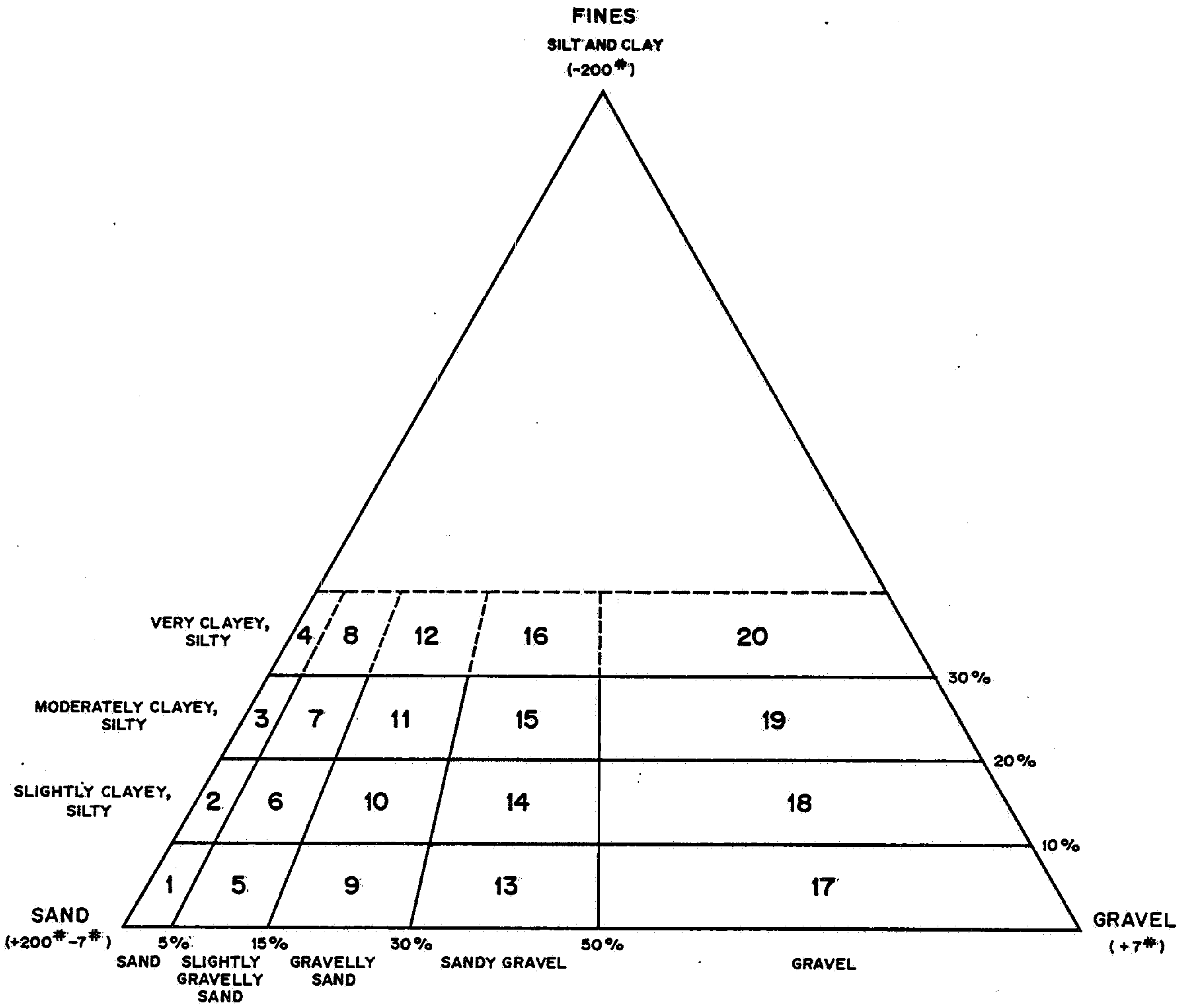
Where sediments are too thinly bedded to log each bed individually, the relative proportions are described using words 'and' or, 'with', as below. The same terminology is used to describe relative abundance of mineral constituents (e.g. smoky quartz, mica).

Sand and clay - approximate equal proportions with neither constituent less than about 25%

Sand with clay - sand is dominant, and clay comprises 5 to 25%

Sand with some clay - clay bands are apparent but less than 5% of the intersection.

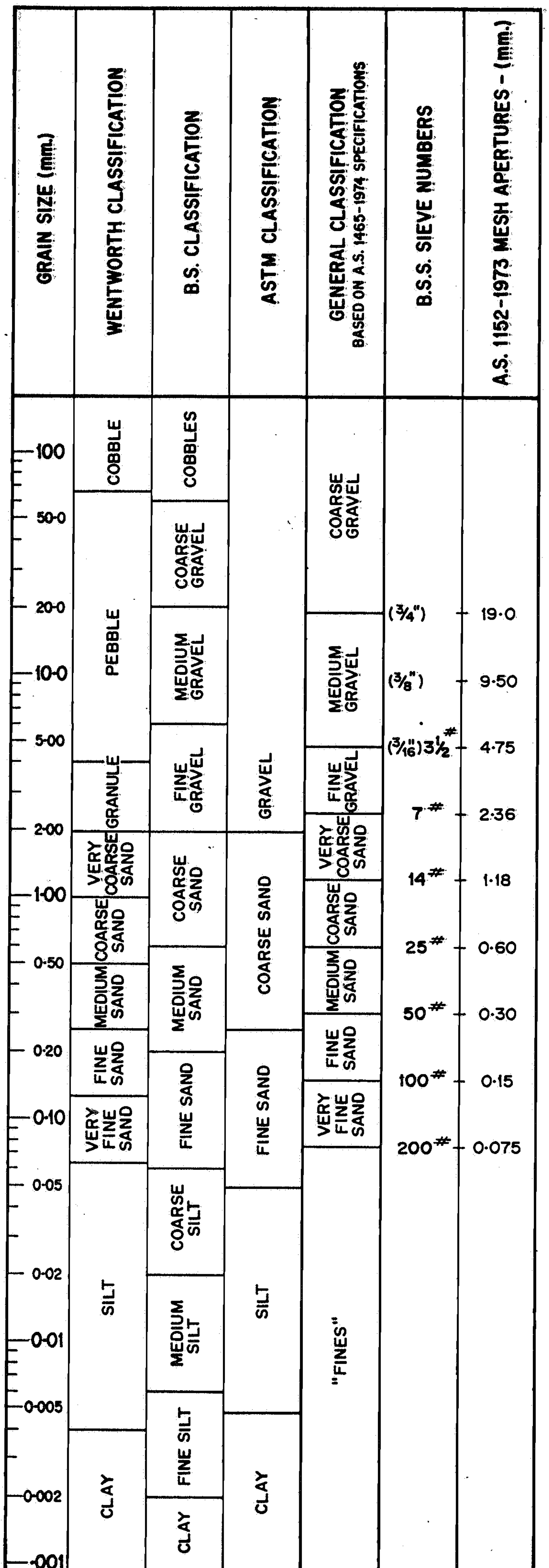
Rare constituents are referred to as 'trace'.



1 SAND	5 SAND, SL.GRAVELLY	9 SAND, GRAVELLY	13 GRAVEL, SANDY	17 GRAVEL
2 SAND, SL.CLAYEY/SL.SILTY	6 SAND, SL.GRAVELLY SL.CLAYEY/SL.SILTY	10 SAND, GRAVELLY SL.CLAYEY/SL.SILTY	14 GRAVEL, SANDY SL.CLAYEY/SL.SILTY	18 GRAVEL, SL.CLAYEY/SL.SILTY
3 SAND M.CLAYEY/M.SILTY	7 SAND, SL.GRAVELLY M.CLAYEY/M.SILTY	11 SAND, GRAVELLY M.CLAYEY/M.SILTY	15 GRAVEL, SANDY M.CLAYEY/M.SILTY	19 GRAVEL, M.CLAYEY/M.SILTY
4 SAND V.CLAYEY/V.SILTY	8 SAND, SL.GRAVELLY V.CLAYEY/V.SILTY	12 SAND, GRAVELLY V.CLAYEY/V.SILTY	16 GRAVEL, SANDY V.CLAYEY/V.SILTY	20 GRAVEL, V.CLAYEY/V.SILTY

Fig. A1

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE.
COMPILED: A.M. PAIN	**CLASSIFICATION OF SAND AND GRAVEL**	DATE: MAY '76
DRN: R.G. CKD.		PLAN NUMBER: S 12234



AUSTRALIAN STANDARD 1152-1973		BRITISH STANDARD 410-1969		U.S. STANDARD (1924), AND ASTM (E11-61) DESIGNATION			U.S. TYLER (1910)	
DESIGNATION	SIEVE APERTURE mm.	MESH Nº	SIEVE APERTURE mm.	MESH Nº	ASTM DESIGNATION microns	SIEVE APERTURE mm.	MESH Nº	SIEVE APERTURE mm.
19·0mm	19·0	(3/4")	19·0					
16·0 "	16·0		16·0					
13·2 "	13·2		13·2					
11·2 "	11·2		11·2					
9·50 "	9·50	(3/8")	9·50					
8·00 "	8·00		8·00				2·5	7·925
6·70 "	6·70		6·70				3	6·680
5·60 "	5·60	3	5·60	3·5	5,660	5·66	3·5	5·613
4·75 "	4·75	(3/16")3½	4·75	4	4,760	4·76	4	4·699
4·00 "	4·00	4	4·00	5	4,000	4·00	5	3·962
3·35 "	3·35	5	3·35	6	3,360	3·36	6	3·327
2·80 "	2·80	6	2·80	7	2,830	2·83	7	2·794
2·36 "	2·36	7	2·36	8	2,380	2·38	8	2·362
2·00 "	2·00	8	2·00	10	2,000	2·00	9	1·981
1·70 "	1·70	10	1·70	12	1,680	1·68	10	1·651
1·40 "	1·40	12	1·40	14	1,410	1·41	12	1·397
1·18 "	1·18	14	1·18	16	1,190	1·19	14	1·168
1·00 "	1·00	16	1·00	18	1,000	1·00	16	0·991
850µm	0·850	18	0·850	20	841	0·841	20	0·833
710 "	0·710	22	0·710	25	707	0·707	24	0·701
600 "	0·600	25	0·600	30	595	0·595	28	0·589
500 "	0·500	30	0·500	35	500	0·500	32	0·495
425 "	0·425	36	0·425	40	420	0·420	35	0·417
355 "	0·355	44	0·355	45	354	0·354	42	0·351
300 "	0·300	52	0·300	50	297	0·297	48	0·295
250 "	0·250	60	0·250	60	250	0·250	60	0·246
212 "	0·212	72	0·212	70	210	0·210	65	0·208
180 "	0·180	85	0·180	80	177	0·177	80	0·175
150 "	0·150	100	0·150	100	149	0·149	100	0·147
125 "	0·125	120	0·125	120	125	0·125	115	0·124
106 "	0·106	150	0·106	140	105	0·105	150	0·104
90 "	0·090	170	0·090	170	88	0·088	170	0·089
75 "	0·075	200	0·075	200	74	0·074	200	0·074
63 "	0·063	240	0·063	230	63	0·063	250	0·061
53 "	0·053	300	0·053	270	53	0·053	270	0·053
45 "	0·045	350	0·045	325	44	0·044	325	0·043
38 "	0·038	400	0·038	400	37	0·037	400	0·038

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

PARTICLE SIZE CLASSIFICATIONS AND EQUIVALENT SIEVE SIZES

Fig. A2

S-11511

APPENDIX B

DETERMINATION OF FINENESS MODULUS

1. Particle size distribution is determined according to the procedure described in A.S. 1141-1974, sections 11 and 12. Sieves are chosen such that each has nominal aperture double that of the preceding one:-

Aperture(mm)	0.075	0.15	0.30	0.60	1.18	2.36	4.75	9.5	19.0
B.S.S. mesh	200	100	50	25	14	7	3.5"	3/8"	3/4"

2. The production of material finer than 0.075 mm (200 mesh BSS) is designated as 'fines'.

3. The cumulative amount of sand retained on each of the nominated sieves is recalculated as a percentage of the material coarser than 0.075 mm (200 mesh).

4. Cumulative percentages calculated in 3 (above) retained on 100 mesh BSS and coarser sieves are summed and divided by 100 to give Fineness Modulus.

<u>Example:</u> Total weight of sample 200 gms.

BSS mesh	Nominal Aperture (mm)	Cum. Wt. Retained (gm)	Cum. % Retained	Cum. % of +200 mesh fraction retained	
3/8"	9.50	0.00	0.00	0.00)	
3.5"	4.75	0.56	0.28	0.29)	
7	2.36	4.36	2.19	2.26)	
14	1.18	13.34	6.70	6.91)	Sum = 166.5
25	0.60	35.71	17.93	18.50)	
52	0.30	85.67	43.03	44.39)	
100	0.15	181.65	91.23	94.12)	
200	0.075	192.99	96.93	100.00	

Fines = 100.00 − 96.93 = 3.07%

$$FM = \frac{166.5}{100} = 1.67$$

APPENDIX C

Logs of Drillholes

Note:

VF	- very fine grained
F	- fine grained
M	- medium grained
C	- coarse grained
VC	- very coarse grained.

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ1	0	2	SAND (VF-F) subangular to subrounded light brown to dark brown.			
	2	3	SAND (VF-F) slightly SILTY, slightly CLAYEY subrounded to rounded. CLAY increasing below 2.7 m.			
	3	5.5	CLAY moderately SANDY (VF-F) orange brown, plastic.			
	5.5	7	SAND (F, C-VC) moderately CLAYEY subrounded to rounded, orange brown.	5.5 - 7 m	2.68	22.0
	7	9	SAND (F-VC) slightly CLAYEY, slightly GRAVELLY (F) subrounded to rounded, brown [water cut at 8.0 m].	7 - 9 m	3.16	11.9
			E.O.H. 9.0 m Logged J.L.K. 25 Feb. 1981			
ASQ2	0	3	SAND (VF-F) minor coarse grains, slightly SILTY, subrounded grey to brown.			
	3	4	SAND (VF-VC) subangular to rounded, brown.			
	4	5	SAND (F, C-VC), slightly GRAVELLY (F)	4 - 5 m	2.94	8.3
	5	7	SAND (F-VC), slightly GRAVELLY (F) subrounded to rounded, orange brown.	5 - 7 m	3.12	7.4

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ2	7	9	SAND (F-VC), slightly GRAVELLY (F), slightly CLAYEY. [Water cut at 8.5 m].	7 - 9 m	3.15	11.2
			E.O.H. 9.0 m Logged J.L.K. 25 Feb. 1981			
ASQ3	0	1	SAND (VF-F) minor coarse grains, rounded, brown.			
	1	2	SAND (VF-F) slightly CLAYEY, orange brown.			
	2	4	CLAY moderately to slightly SANDY (VF-C) at top, red brown to yellow brown, moderately plastic.			
	4	5.5	CLAY moderately to very SANDY (F-C), orange brown.			
	5.5	8	SAND (F-VC) moderately CLAYEY, orange brown.	5.5 - 8 m	2.78	23.0
	8	9	CLAY moderately to very SANDY (M-VC) subrounded to rounded.			
			E.O.H. 9.0 m Logged J.L.K. 25 Feb. 1981			
ASQ4	0	1.5	SAND (VF-F) slightly CLAYEY, organic matter, dark brown.			
	1.5	3	CLAY slightly to very SANDY (VF-VC) plastic, yellow brown to orange brown.			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ4	3	8	SAND (F-VC), slightly CLAYEY minor GRAVEL (F) subangular to subrounded orange-brown. [Water cut at 7.8 m]	3 - 8 m	2.94	16.4
	8	9	CLAY very SANDY (F-C) subrounded to rounded, yellow brown.			
	E.O.H. 9.0 m		Logged J.L.K. 26 Feb. 1981			
ASQ5	0	1	SAND (VF-F) moderately CLAYEY, black.			
	1	3	CLAY very SANDY (VF-F) moderately plastic, black.			
	3	4.5	CLAY plastic with fragments of bryzoal LIMESTONE. Hard drilling at 4.5 m (LIMESTONE).			
	E.O.H. 4.5 m		Logged J.L.K. 26 Feb. 1981			
ASQ6	0	1	SAND (VF-F) slightly SILTY, light brown with minor ironstone pebbles to 10 mm diam.			
	1	2	SAND (VF-F) clean, yellow subangular to subrounded.			
	2	7	SAND (VF-F), slightly SILTY light to dark brown with a trace of coarse sand.			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ6	7	9	SAND (VF-F) slightly CLAYEY orange brown to orange.			
			E.O.H. 9.0 m Logged J.L.K. 26 Feb. 1981			
ASQ7	0	1	SAND (VF-F) slightly SILTY grey.			
	1	3	SAND (VF-F) white, subrounded to rounded. [Water cut at 3.0 m]			
	3	8	SAND (VF-F) light brown.			
	8	9	SAND (VF-F) slightly CLAYEY with CLAY slightly SANDY (VF-M), plastic red brown.			
			E.O.H. 9.0 m Logged J.L.K. 26 Feb. 1981			
ASQ8	0	1	SAND (VF-F,C) slightly SILTY, light brown.			
	1	3.5	SAND (VF-F) moderately CLAYEY light brown to orange brown.			
	3.5	4.8	CLAY red brown, plastic.			
	4.8	5.0	LIMESTONE white, hard drilling.			
			E.O.H. 50 m Logged J.L.K. 26 Feb. 1981			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ9	0	1	SAND (VF-F) slightly SILTY, grey with 5 to 10 percent coarse sand, rounded.			
	1	3	SAND (VF-F), clean, white.			
	3	9	SAND (VF-F), slightly CLAYEY, brown. [Water cut at 5.5 m].			
			E.O.H. 9.0 m Logged J.L.K. 26 Feb. 1981			
ASQ10	0	1.6	SAND (VF-F) moderately SILTY with minor GRAVEL (F-M) ironstone and quartz. Gravel well rounded.			
	1.6	3	SAND (M-VC) slightly to moderately CLAYEY, minor GRAVEL (F), subangular to subrounded, orange.	1.6 - 3 m	2.93	20.8
	3	4	CLAY moderately to very SANDY (M-VC) becoming less sandy with depth, orange.			
			E.O.H. 4.0 m Logged J.L.K. 27 Feb. 1981			
ASQ11	0	0.4	SAND (VF-F) moderately SILTY, slightly CLAYEY, red brown, over LIMESTONE, hard drilling.			
			E.O.H. 0.4 m Logged J.L.K. 27 Feb. 1981.			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ12	0	1	SAND (VF-F) slightly SILTY, light brown.			
	1	1.8	SAND (VF-F) moderately to very CLAYEY, orange brown over LIMESTONE.			
			E.O.H. 1.8 m Logged J.L.K. 27 Feb. 1981			
ASQ13	0	1	SAND (VF-F) moderately SILTY with CLAY, orange.			
	1	5	CLAY, plastic, calcareous, orange with bryzoal fragments.			
	5	5.2	LIMESTONE very CLAYEY, pale yellow plastic. Hard drilling at 5.2 m.			
			E.O.H. 5.2 m Logged J.L.K. 27 Feb. 1981			
ASQ14	0	1	SAND (VF-F) moderately SILTY, brown.			
	1	1.9	SAND (VF-F) very CLAYEY, brown.			
	1.9	2.1	CLAY yellow brown to orange brown, plastic, calcareous, over LIMESTONE, hard drilling.			
			E.O.H. 2.1 m Logged J.L.K. 27 Feb. 1981.			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ15	0	1.5	SAND (VF-F) moderately SILTY grey to light brown.			
	1.5	5	SAND (VF-F) moderately to very CLAYEY grey to brown.			
	5	6	CLAY plastic, orange brown.			
	6	8	SAND (F-VC) very CLAYEY subangular to rounded, orange.	6 - 8 m	2.20	39.0
			E.O.H. 8.0 m Logged J.L.K. 27 Feb. 1981.			
ASQ16	0	1.3	FILL - Clay moderately sandy with fragments of limestone and occassional quartz gravel - yellow brown to reddish brown.			
	1.3	1.8	SILT moderately CLAYEY white and yellow layers.			
	1.8	2.2	SAND (C-VC) slightly to modrrately CLAYEY, slightly SILTY with minor gravel, yellow.			
	2.2	2.9	SILT moderately CLAYEY slightly SANDY (VF-F), micaceous, mottled yellow, red and white. Minor fine gravel between 2.7 and 2.9 m.			

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ16	2.9	3.1	SAND (M-VC) predominantly clear quartz subangular to subrounded with some smoky and opaque white quartz, minor gravel (F).			
	3.1	4.0	SILT slightly CLAYEY grey-brown with yellow, brown and red patches. Carbonaceous at 4.0 m.			
	4.0	4.15	SILT slightly CLAYEY, black, carbonaceous, finely bedded with yellow-brown oxidised patches.			
	4.15	6.0	SILT moderately CLAYEY yellow to orange-brown, micaceous with carbonaceous patches. Thin sandy layers 10 to 20 mm thick.			
	6.0	6.4	SAND (F-C) subrounded to angular with thin clay layers. Minor opaque grains.			
	6.4	6.6	SAND (VF-F) micaceous, pale yellow.			
		E.O.H. 6.6 m	Logged J.L.K. 23 Nov. 1982			
ASQ17	0	0.5	SAND (F-VC) slightly GRAVELLY (F) orange-brown, subrounded clear and smoky quartz.	0 - 0.5	3.07	7.6

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ17	0.5	2.5	SILT, slightly SANDY (VF), slightly CLAYEY, micaceous, mottled yellow-brown and white with occassional red bands.			
	2.5	3.9	SAND (F-VC) slightly SILTY minor GRAVEL (P) subangular to subrounded, yellow. Minor opaques.	2.5 - 3.9	2.57	15.4
	3.9	4.0	CLAY moderately plastic, moderately SILTY, orange-brown.			
		E.O.H. 4.0 m.	Logged J.L.K. 23 Nov. 1982			
ASQ18	0	0.8	SAND (VF-F), brown.			
	0.8	1.2	SAND (VF-M) slightly SILTY with rounded ironstone gravel and sand patches weakly cemented by iron.			
	1.2	1.7	CLAY yellow-brown to pale grey, moderately plastic, minor carbonate.			
	1.7	2.2	CLAY moderately to very SILTY mottled white, red and yellow, micaceous, minor quartz gravel.	2.2 - 5.0	3.24	4.6

SOUTH EAST CONSTRUCTION SAND SURVEY
LOG OF AUGER DRILL HOLES

Allen's Sand Quarry
(Hd: Blanche Sec. 715)

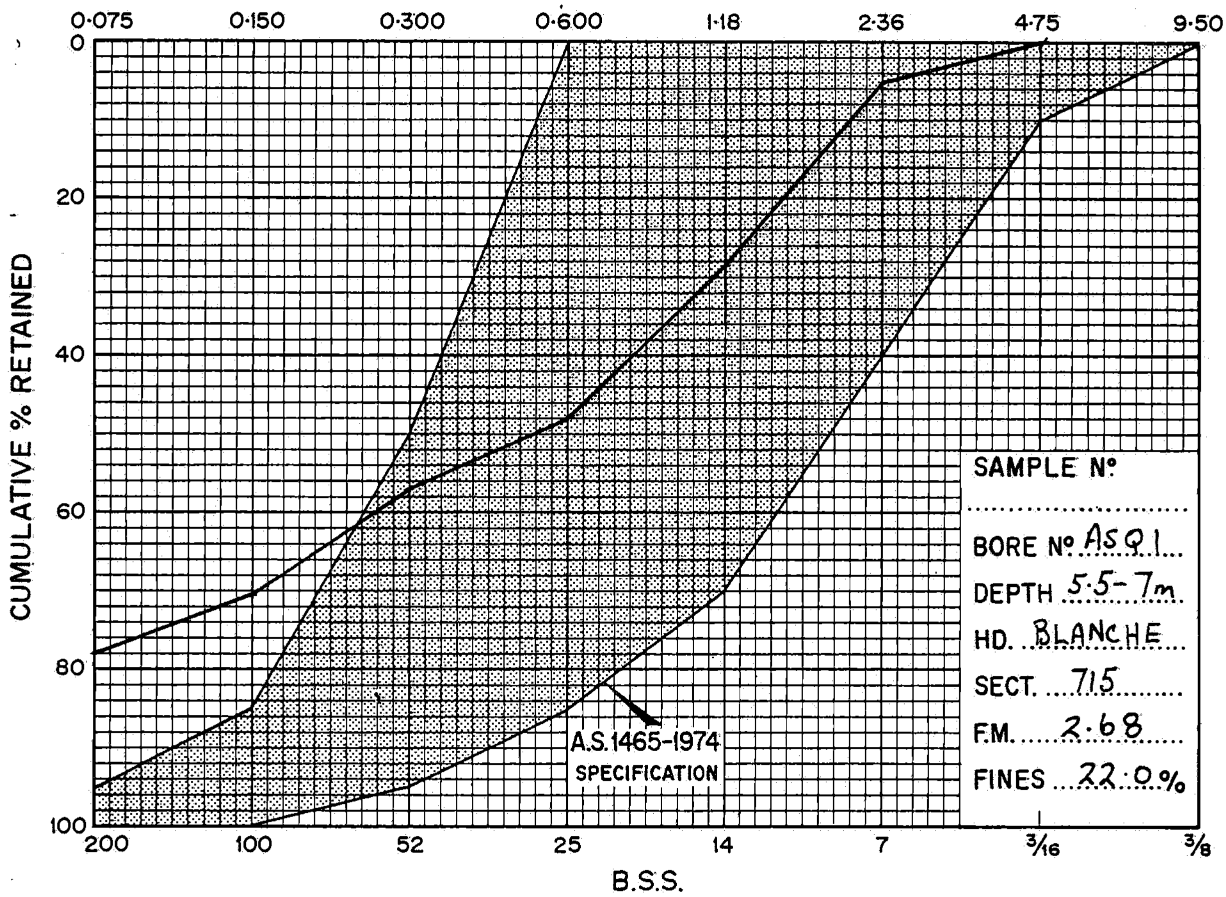
Hole No.	From	To (m)	Description	Sample Interval	F.M.	Fines (%)
ASQ18	2.2	7.0	SAND (F-VC) slightly GRAVELLY (F), pale yellow to pale brown, relatively clean. Thin clay lens at 6.8 m.	5.0 - 7.0	2.97	5.6

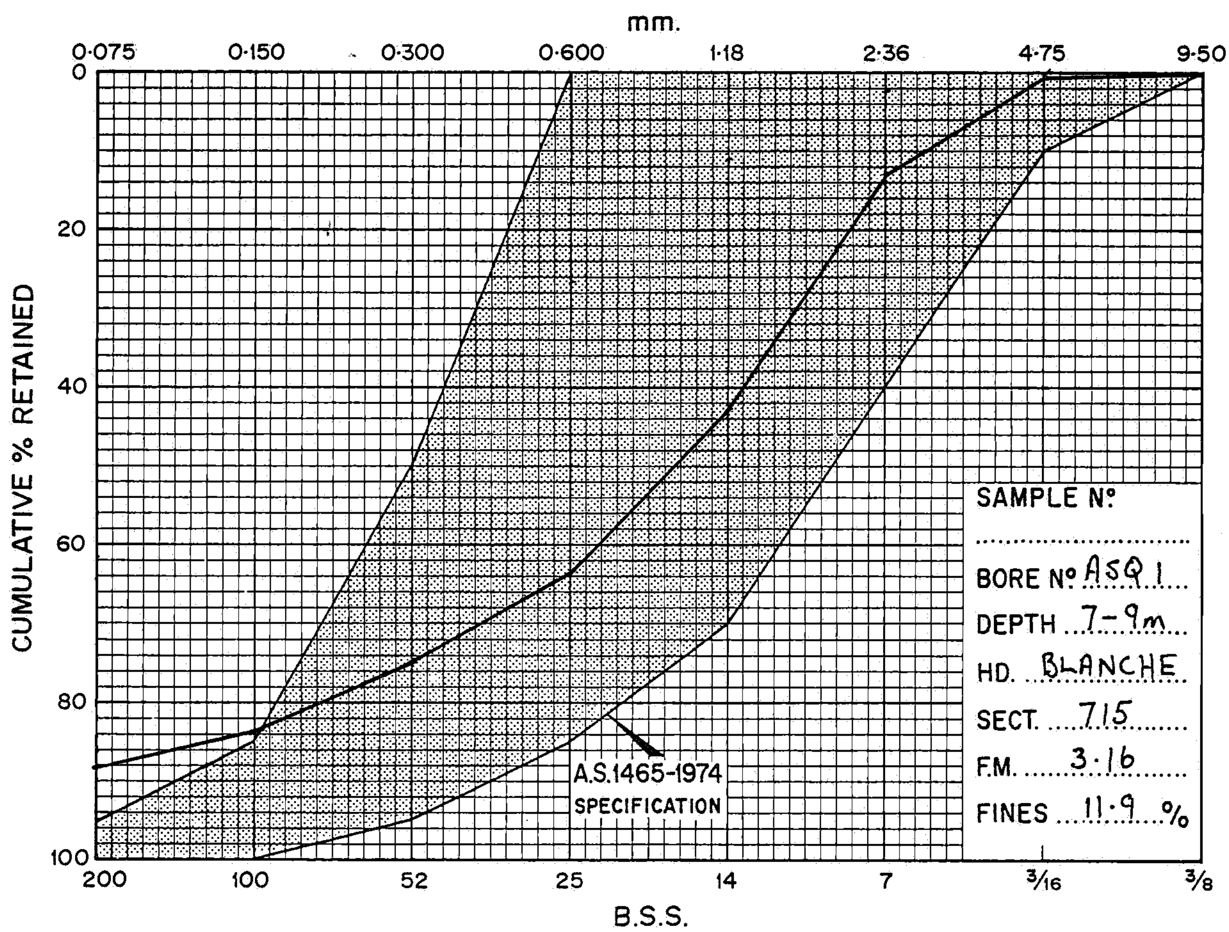
E.O.H. 7.0 m. Logged J.L.K. 23 Nov. 1982

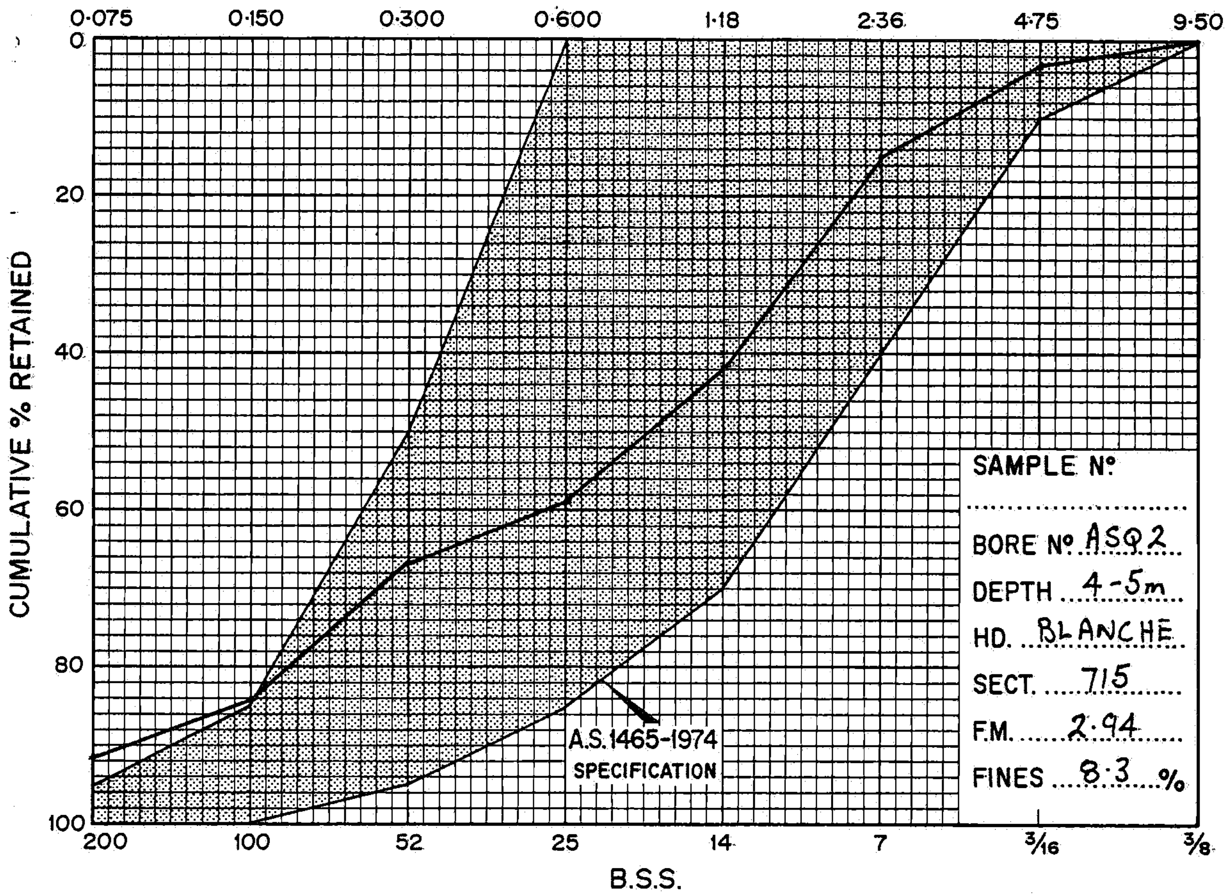
APPENDIX D

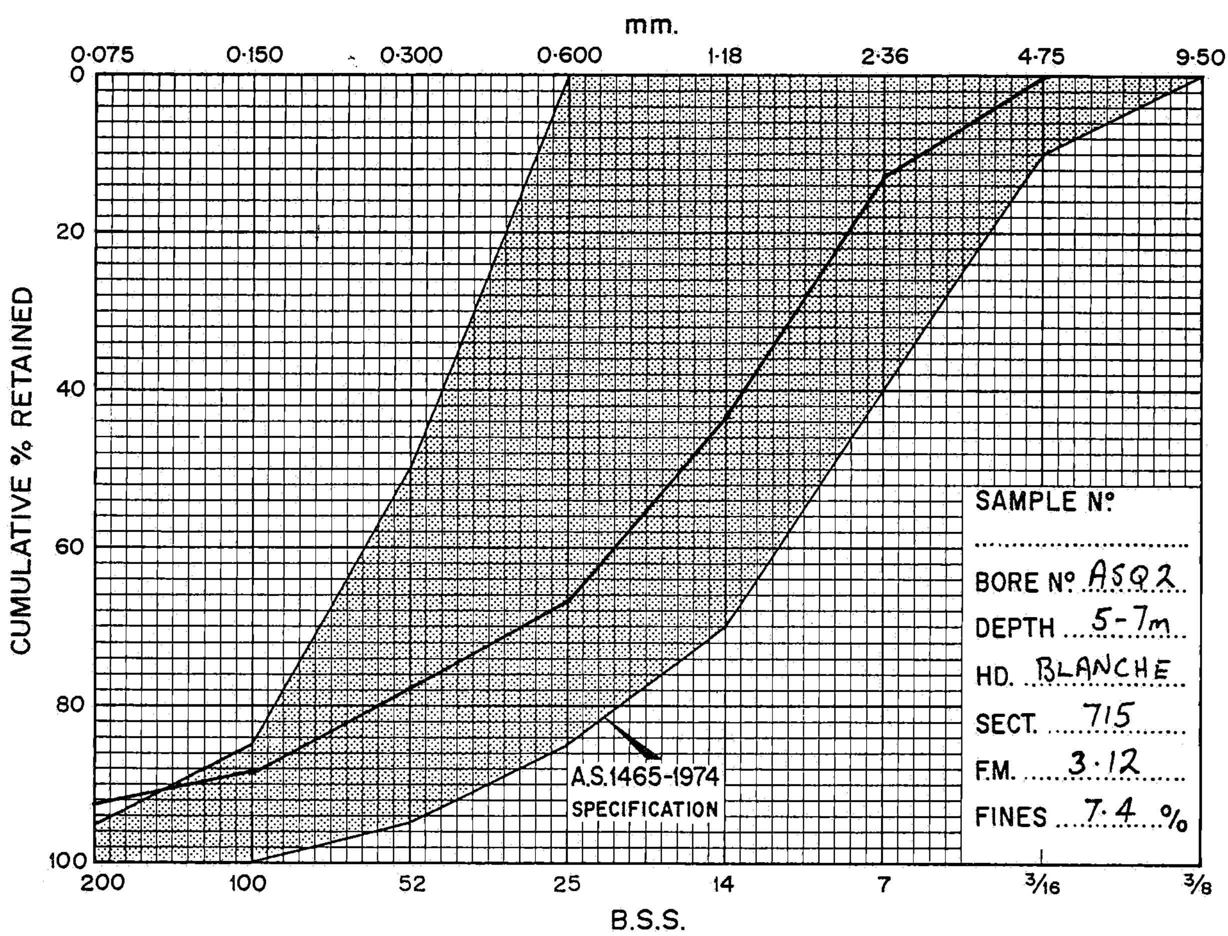
Sand Sizing Analyses

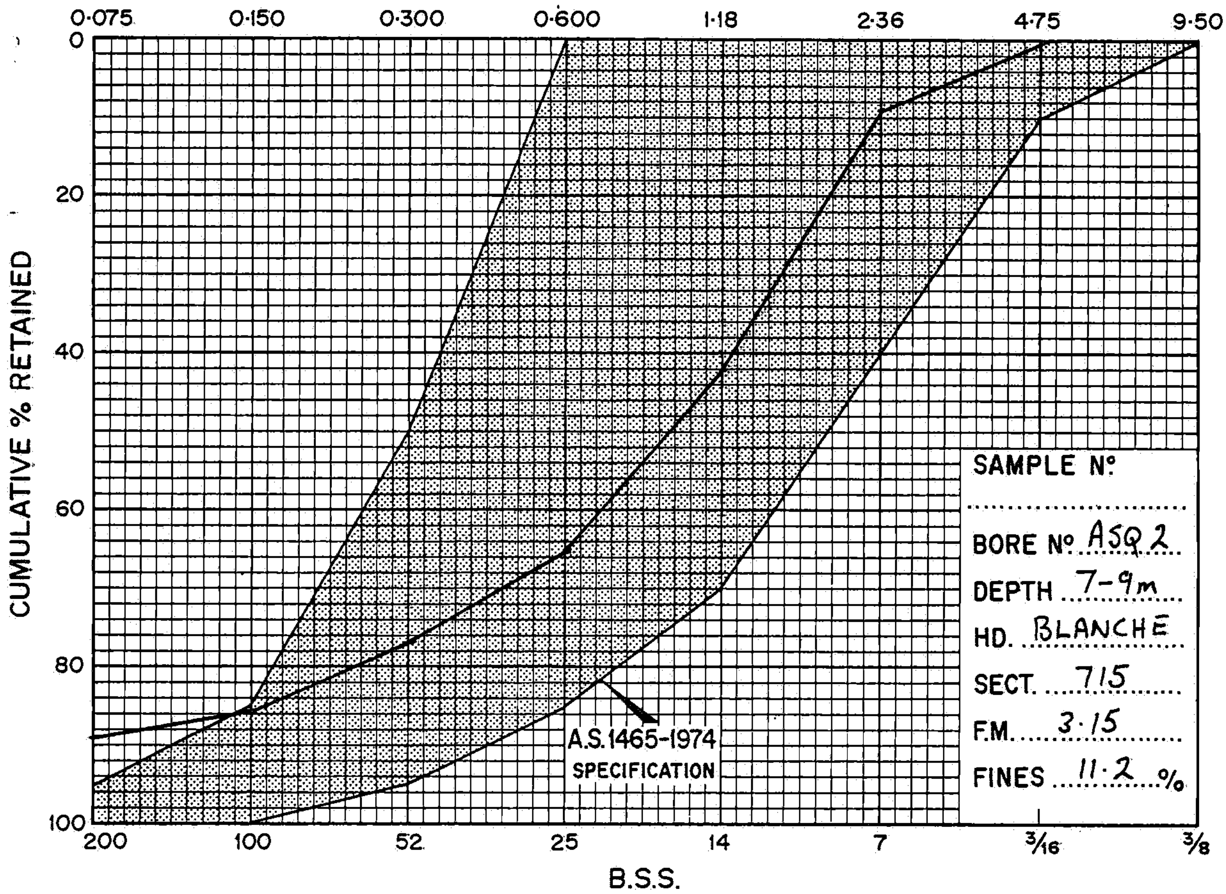
- Graphical Plots.


0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
BORE Nº ASQ 1
DEPTH 5·5-7m
HD. BLANCHE
SECT. 715
F.M. 2·68
FINES 22·0 %


mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
BORE Nº ASQ 1
DEPTH 7-9m
HD. BLANCHE
SECT. 715
F.M. 3·16
FINES 11·9 %


0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
BORE Nº ASQ2
DEPTH 4-5m
HD. BLANCHE
SECT. 715
F.M. 2·94
FINES 8·3 %


mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
BORE Nº ASQ2
DEPTH 5-7m
HD. BLANCHE
SECT. 715
F.M. 3·12
FINES 7·4 %


0·075
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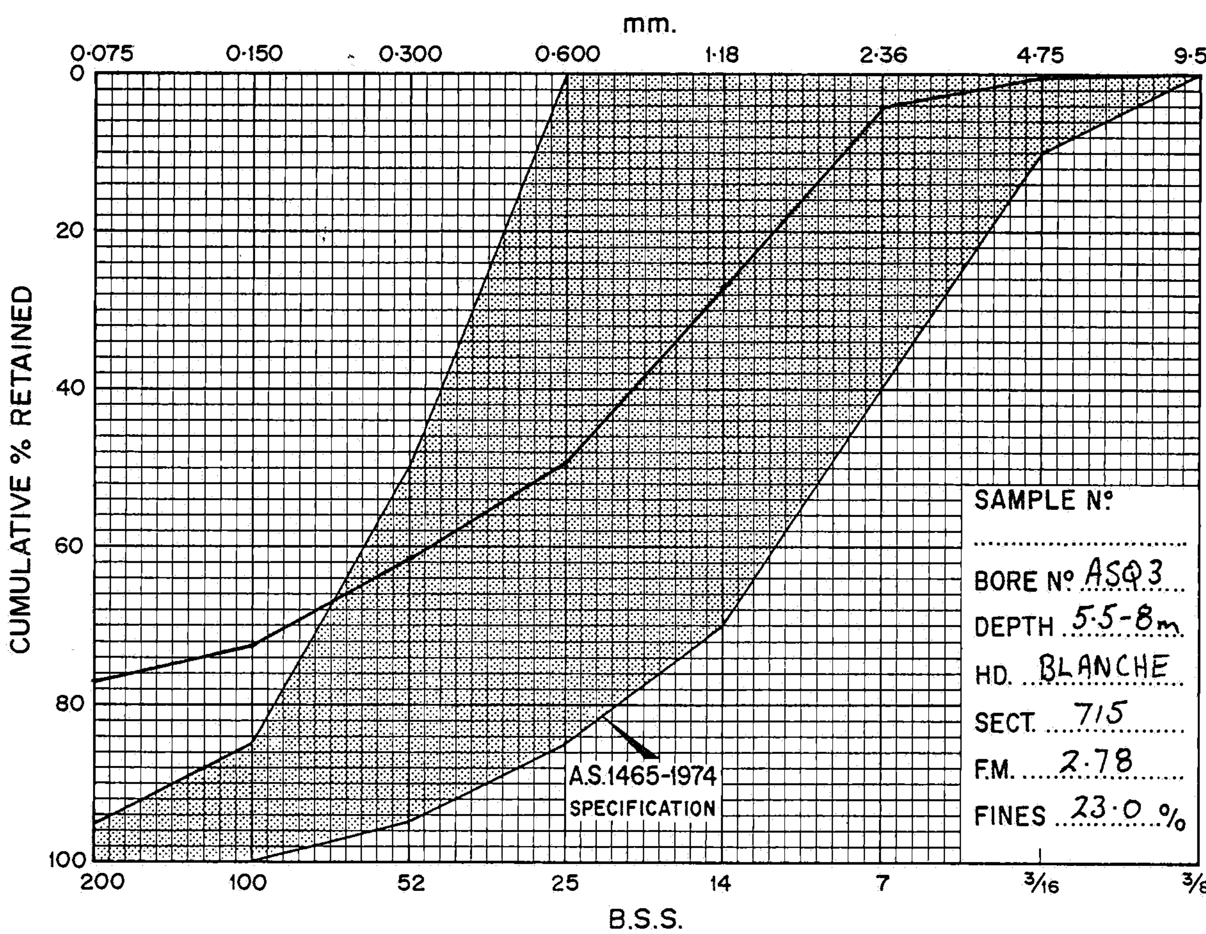
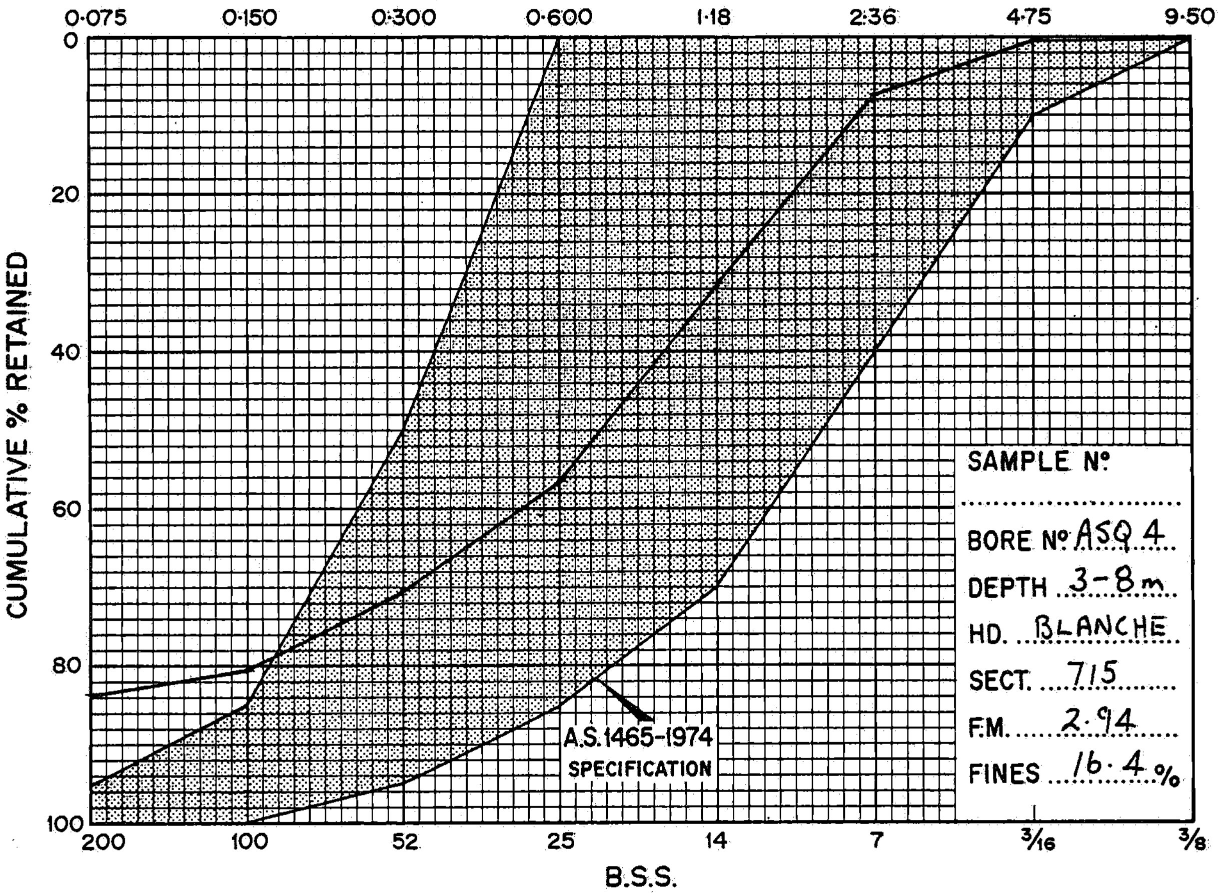
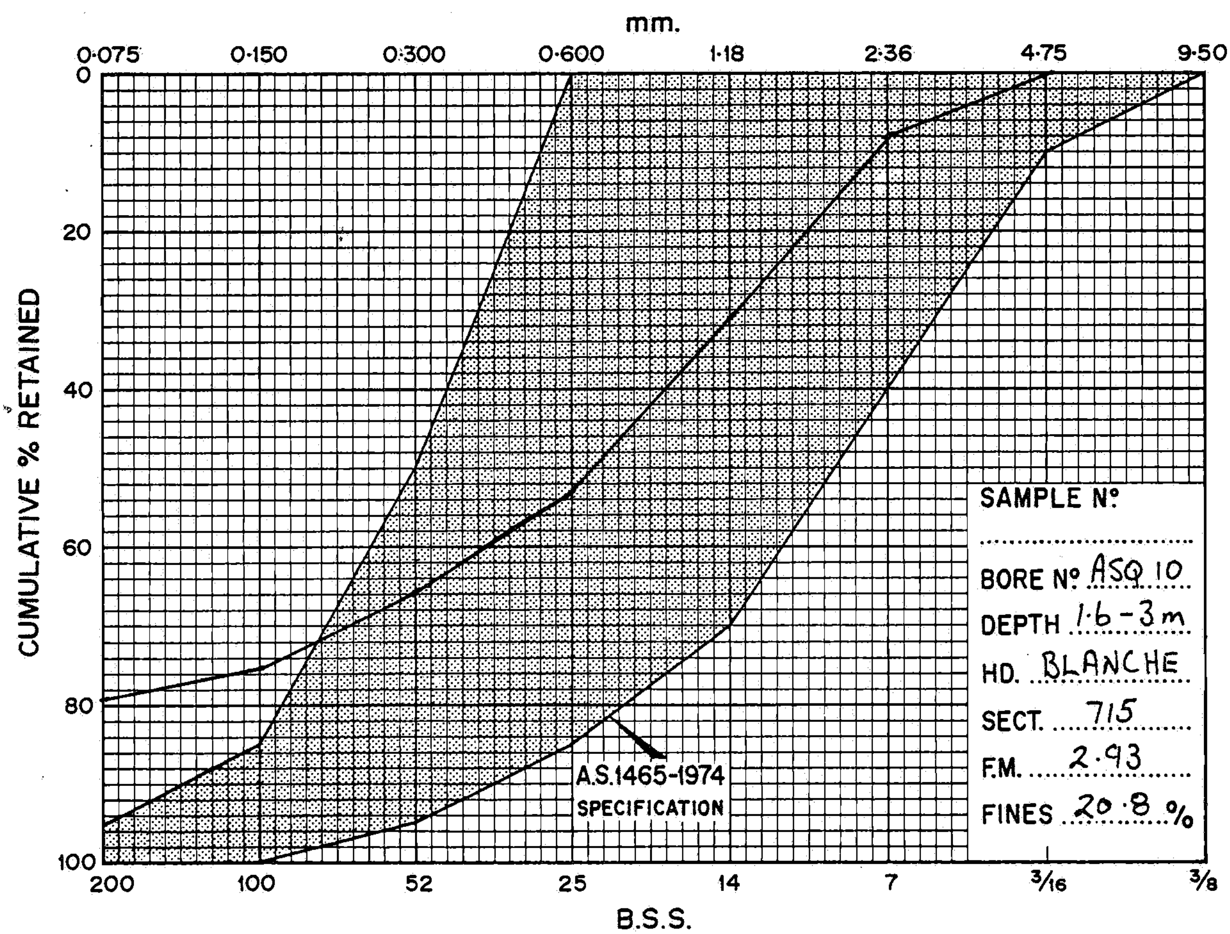
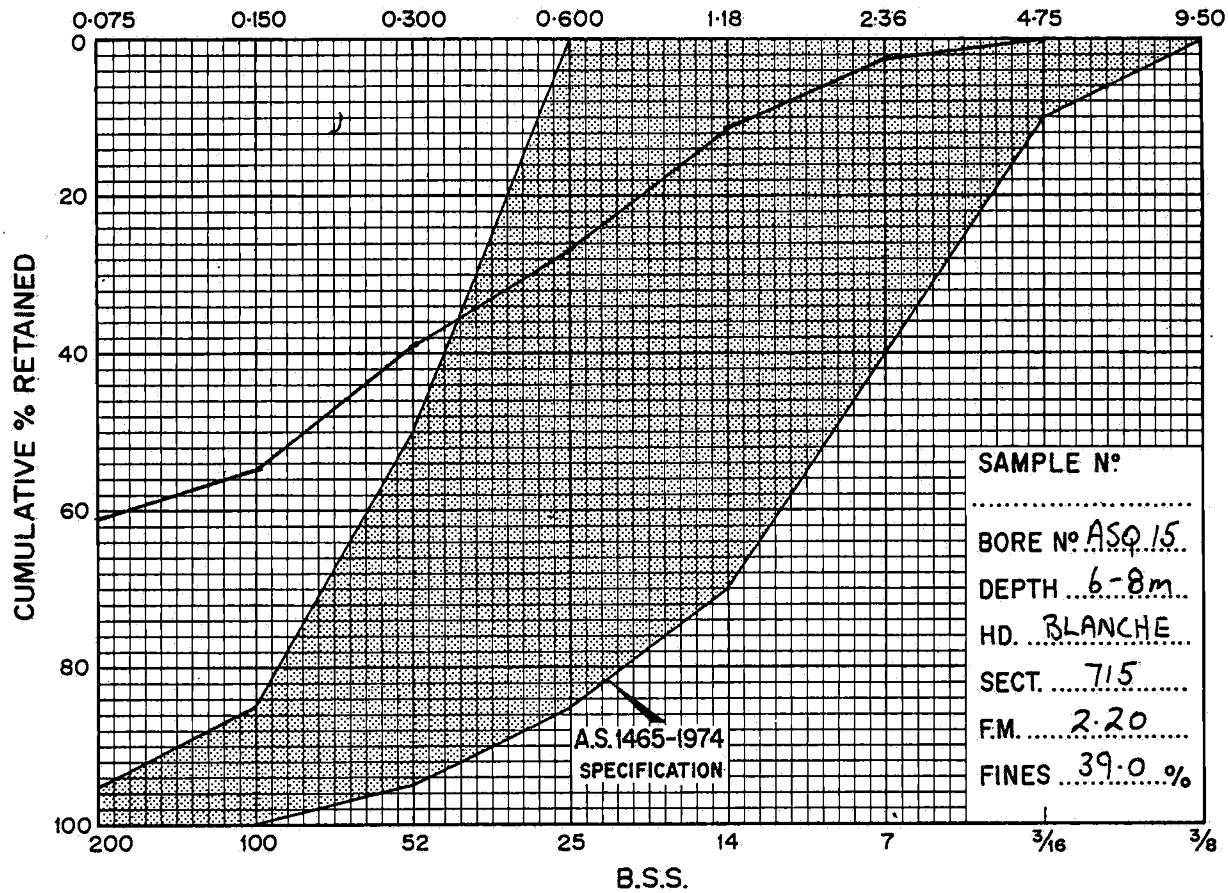
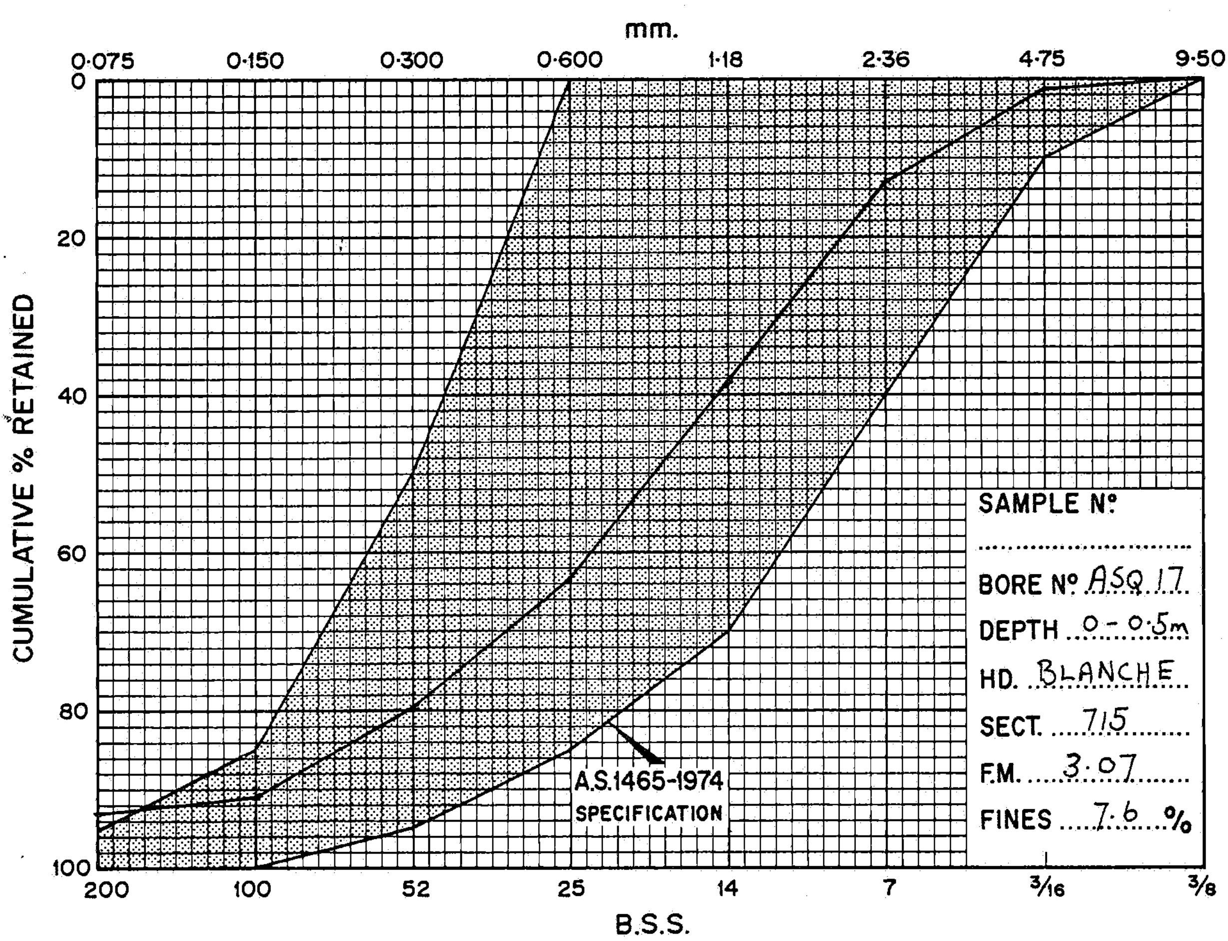
1·18
2·36
4·75
9·50
CUMULATIVE % RETAINED
0
20
40
60
80
100
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE N°
BORE N° ASQ 2
DEPTH 7-9m
HD. BLANCHE
SECT. 715
F.M. 3·15
FINES 11·2 %

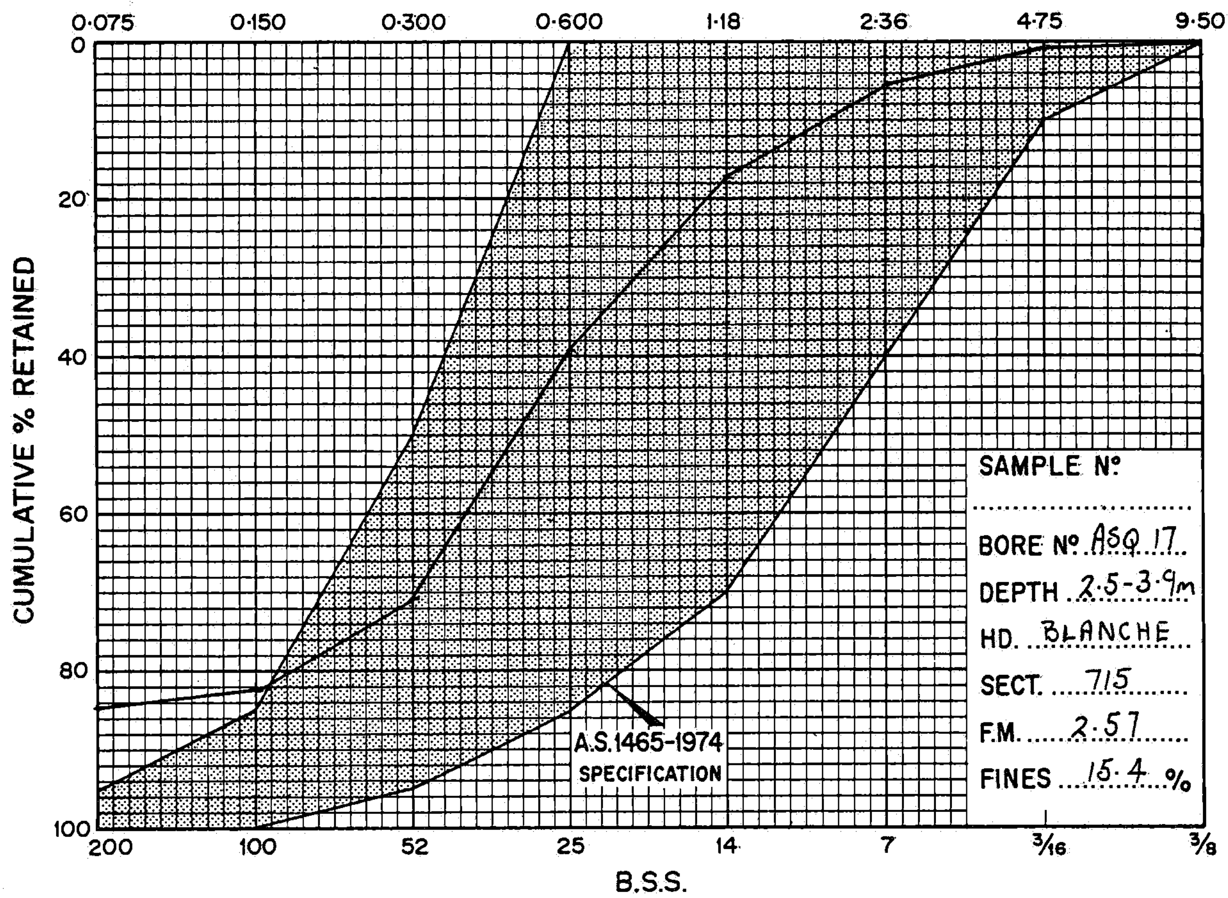

mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
CUMULATIVE % RETAINED
0
20
40
60
80
100
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE N°
BORE N° ASQ 3
DEPTH 5·5-8m
HD. BLANCHE
SECT. 715
F.M. 2·78
FINES 23·0 %

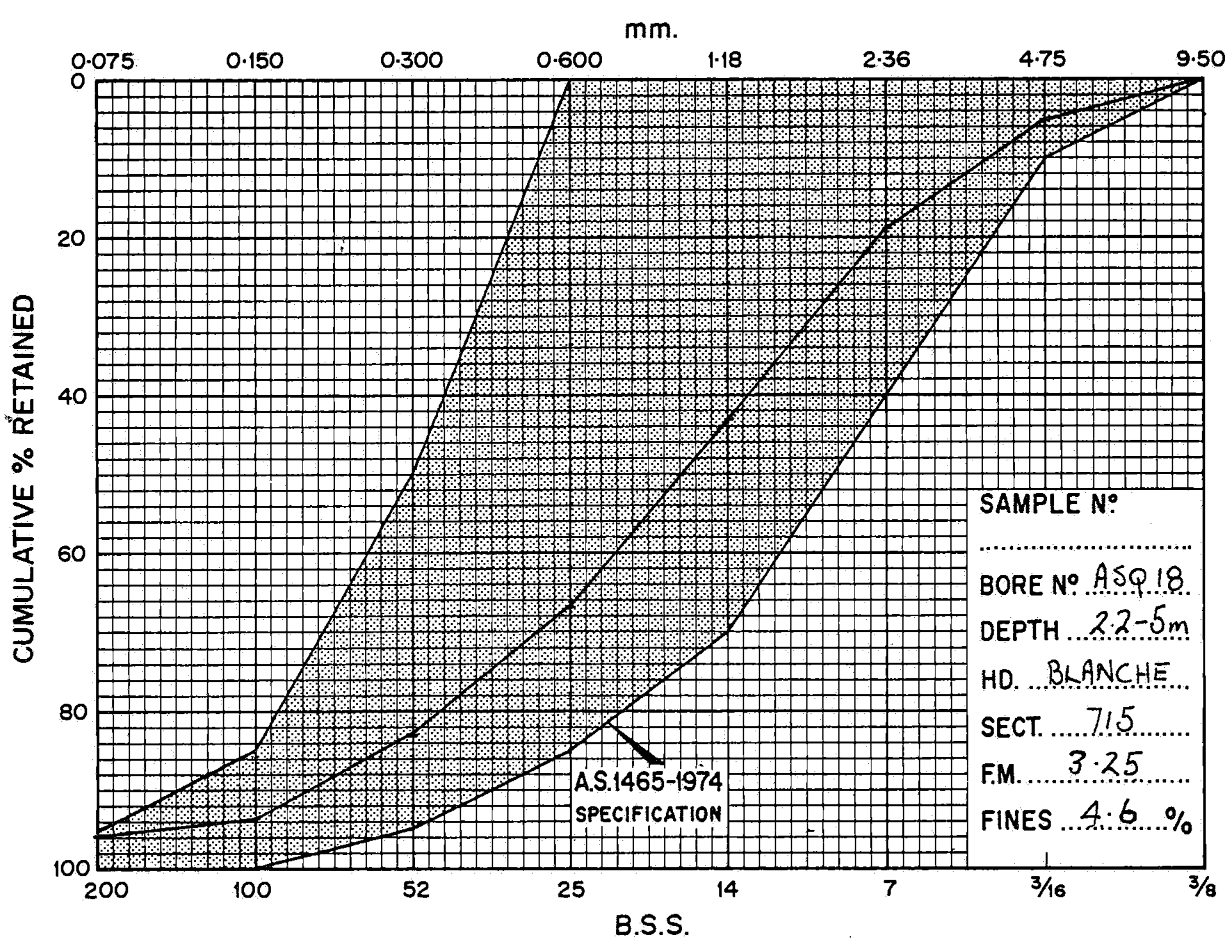

0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
SAMPLE Nº
BORE Nº ASQ 4
DEPTH 3-8m
HD. BLANCHE
SECT. 715
F.M. 2·94
FINES 16·4 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.

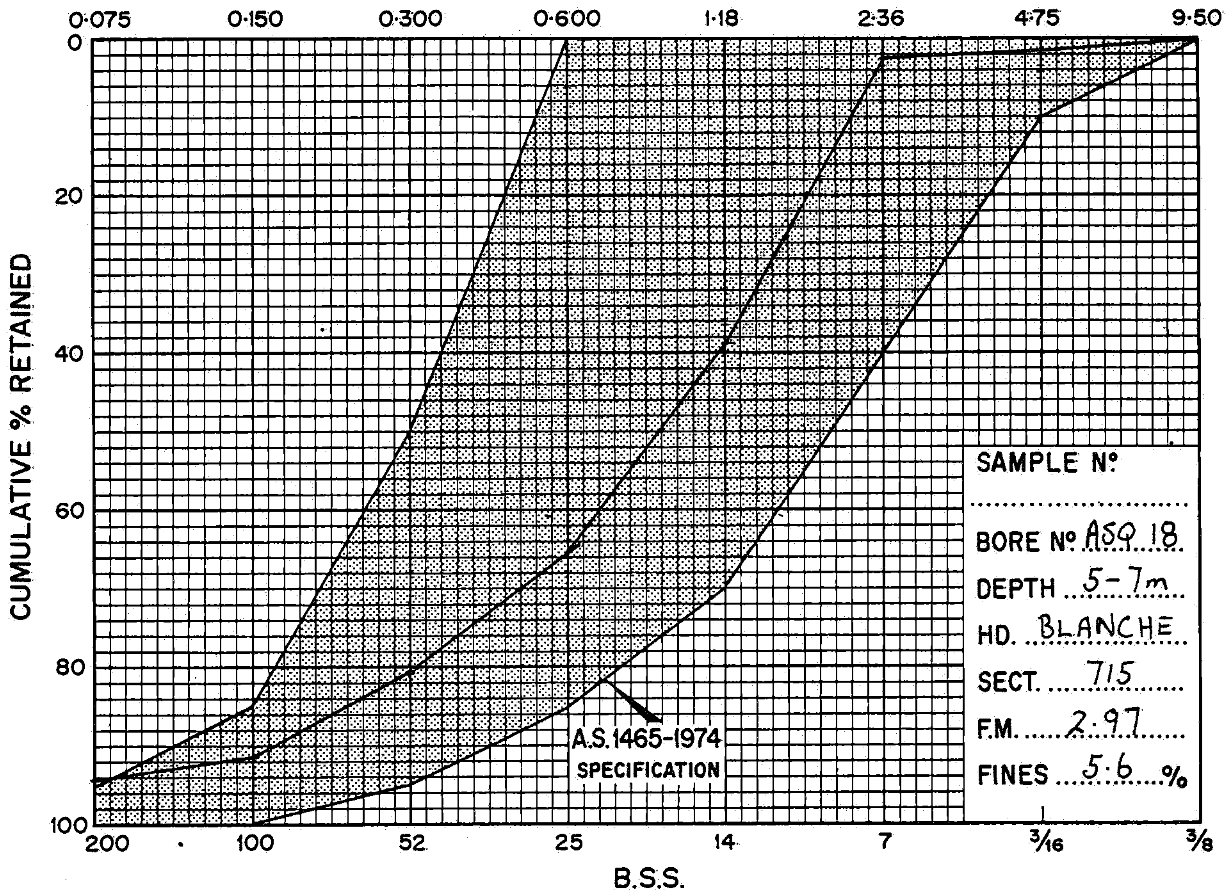

mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
SAMPLE Nº
BORE Nº ASQ 10
DEPTH 1·6-3m
HD. BLANCHE
SECT. 715
F.M. 2·93
FINES 20·8 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.

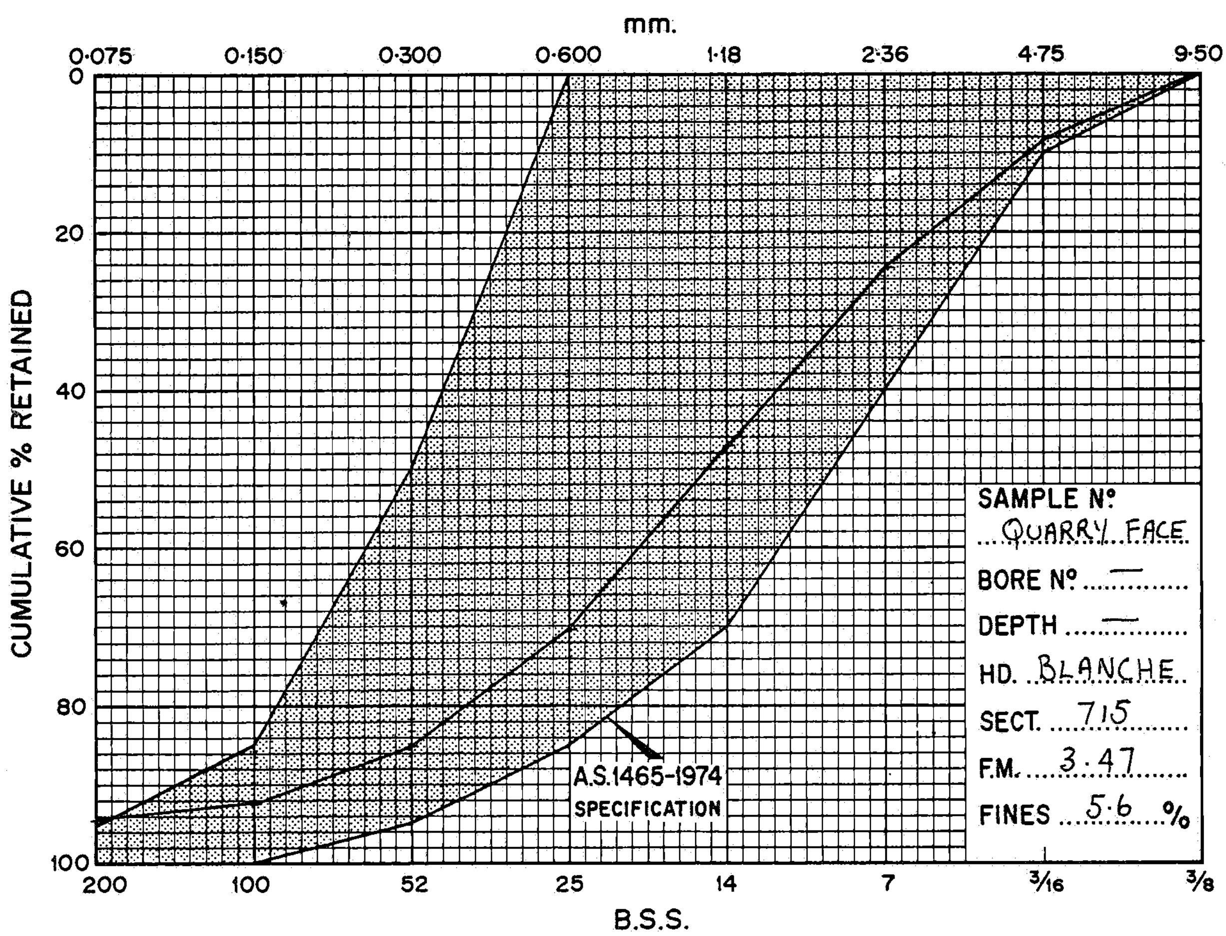

0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
CUMULATIVE % RETAINED
0
20
40
60
80
100
SAMPLE Nº
BORE Nº ASQ 15
DEPTH 6-8m
HD. BLANCHE
SECT. 715
F.M. 2·20
FINES 39·0 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.


mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
CUMULATIVE % RETAINED
0
20
40
60
80
100
SAMPLE Nº
BORE Nº ASQ 17
DEPTH 0-0·5m
HD. BLANCHE
SECT. 715
F.M. 3·07
FINES 7·6 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.


0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
SAMPLE Nº
BORE Nº ASQ 17
DEPTH 2·5-3·9m
HD. BLANCHE
SECT. 715
F.M. 2·57
FINES 15·4 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.


mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
SAMPLE Nº
BORE Nº ASQ 18
DEPTH 2·2-5m
HD. BLANCHE
SECT. 715
F.M. 3·25
FINES 4·6 %
A.S.1465-1974
SPECIFICATION
200
100
52
25
14
7
3/16
3/8
B.S.S.


0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
BORE Nº ASQ 18
DEPTH 5-7m
HD. BLANCHE
SECT. 715
F.M. 2·97
FINES 5·6 %


mm.
0·075
0·150
0·300
0·600
1·18
2·36
4·75
9·50
0
20
40
60
80
100
CUMULATIVE % RETAINED
200
100
52
25
14
7
3/16
3/8
B.S.S.
A.S.1465-1974
SPECIFICATION
SAMPLE Nº
QUARRY FACE
BORE Nº —
DEPTH —
HD. BLANCHE
SECT. 715
F.M. 3·47
FINES 5·6 %

PLATES

PLATE 1. Quarry operations 1956, view looking south. Face at right exposes 3 m of coarse sand which was dug by face shovel. Photo by N.H. Ludbrook. N24461

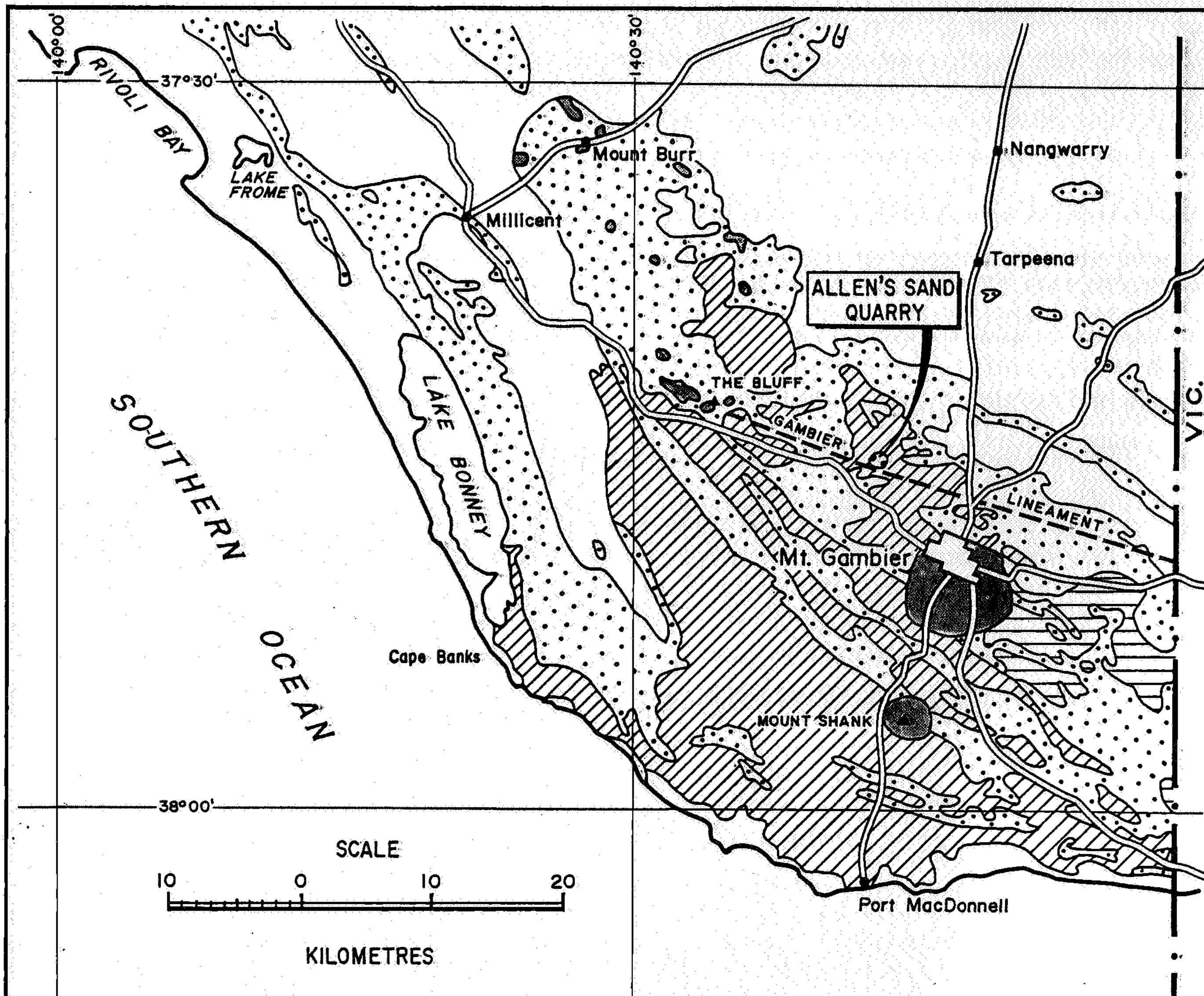
PLATE 2. Abandoned southeastern quarry cut. P.R. Kenley sampling coarse sand near type section measured by N.H. Ludbrook. The 7 m quarry face exposes 3.8 m Gambier Limestone with 0.5 m Compton Conglomerate at base overlying 4 m of silty clay and coarse sand.
Photo by N.H. Ludbrook in 1956. N24460

PLATE 3. Reopened quarry, March 1982, view looking north. Remains of early face shovel in centre foreground below current workings.
Trans. No. 23717

PLATE 4. Quarry excavations, March 1982. Working face exposes 3 m of coarse sand and gravel below 1.5 to 2 m of fine sand and weathered Gambier Limestone overburden. View looking north in direction of future quarry development.
Trans. No.23718

PLATE 5. Southeastern quarry to be preserved as representative section of Compton Conglomerate and Tartwaup Formation. View looking east, October 1980.
Trans. No. 23720

PLATE 6. Weathered block of Gambier Limestone in overburden at southern end of current workings, March 1982.
Trans. No. 23719



REFERENCE

Quaternary		Undifferentiated deposits.
		Bridgewater Formation : calcarenite, stranded dune and beach deposits
		Whalers Bluff Formation : sandy limestone
		Volcanics
Tertiary		Gambier Limestone : pale bryzoal limestone
		Tartwaup Formation : coarse sand, clay and silt

(Geology after Rogers, 1980)

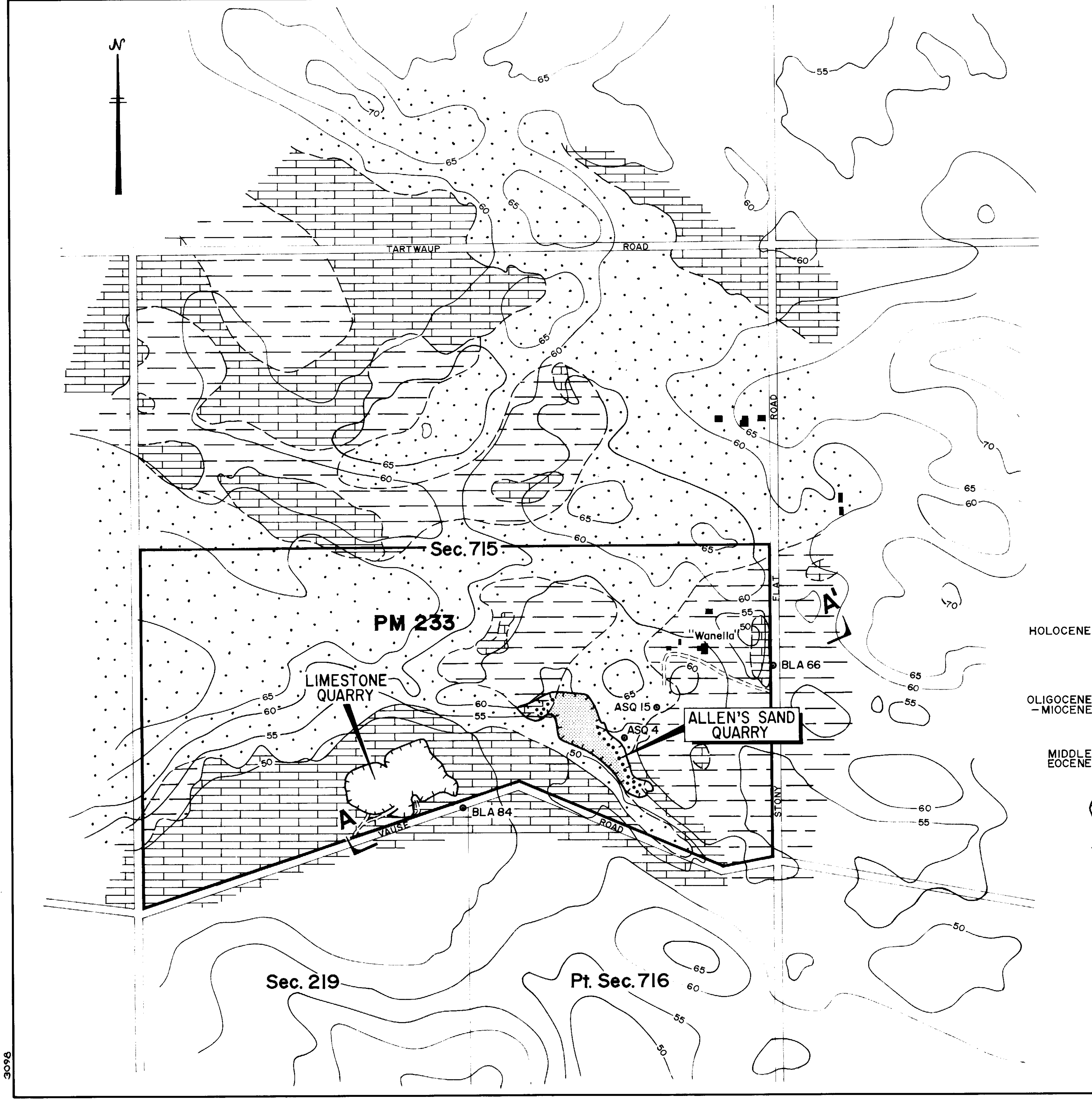
FIG. 1

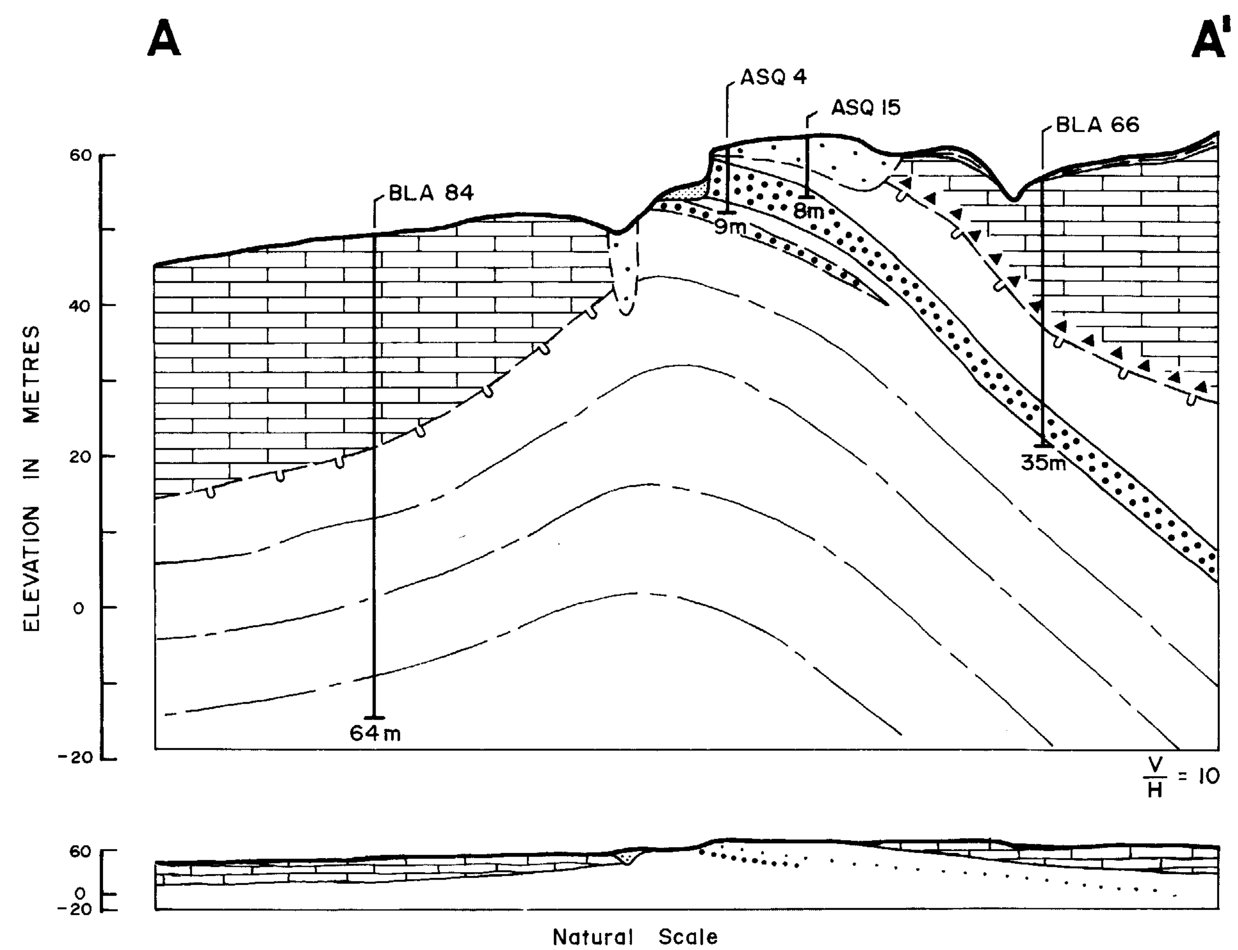
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

ALLEN'S SAND QUARRY
SECTION 715, HD. BLANCHE
LOCATION AND REGIONAL GEOLOGY

COMPILED J. Keeling	C.D.O. DATE
DRAWN M.F.L.	SCALE 1:500 000
DATE 9-3-83	PLAN NUMBER S16638
CHECKED	

3096





REFERENCE

HOLOCENE
- CLAY : Dark brown to red-brown soil profile developed primarily on Gambier Limestone
- MOLINEAUX SAND : Pale yellow, fine grained dune sand

OLIGOCENE – MIOCENE
- GAMBIER LIMESTONE : Pale bryzoal limestone. COMPTON CONGLOMERATE at base

MIDDLE EOCENE
- WANGERRIP GROUP
  TARTWAUP FORMATION : Silty clay, coarse sand and gravel

Quarry

Area of rehabilitation

Geological boundary;
Observed
Inferred

Unconformity
Inferred bedding trend

BLA 66 Drillhole location and number (on plan)

ASQ 4, 9m Drillhole location, number and depth of hole (on section)

Buildings

60 Topographic contour (5m interval, datum M.S.L.)

Location of section

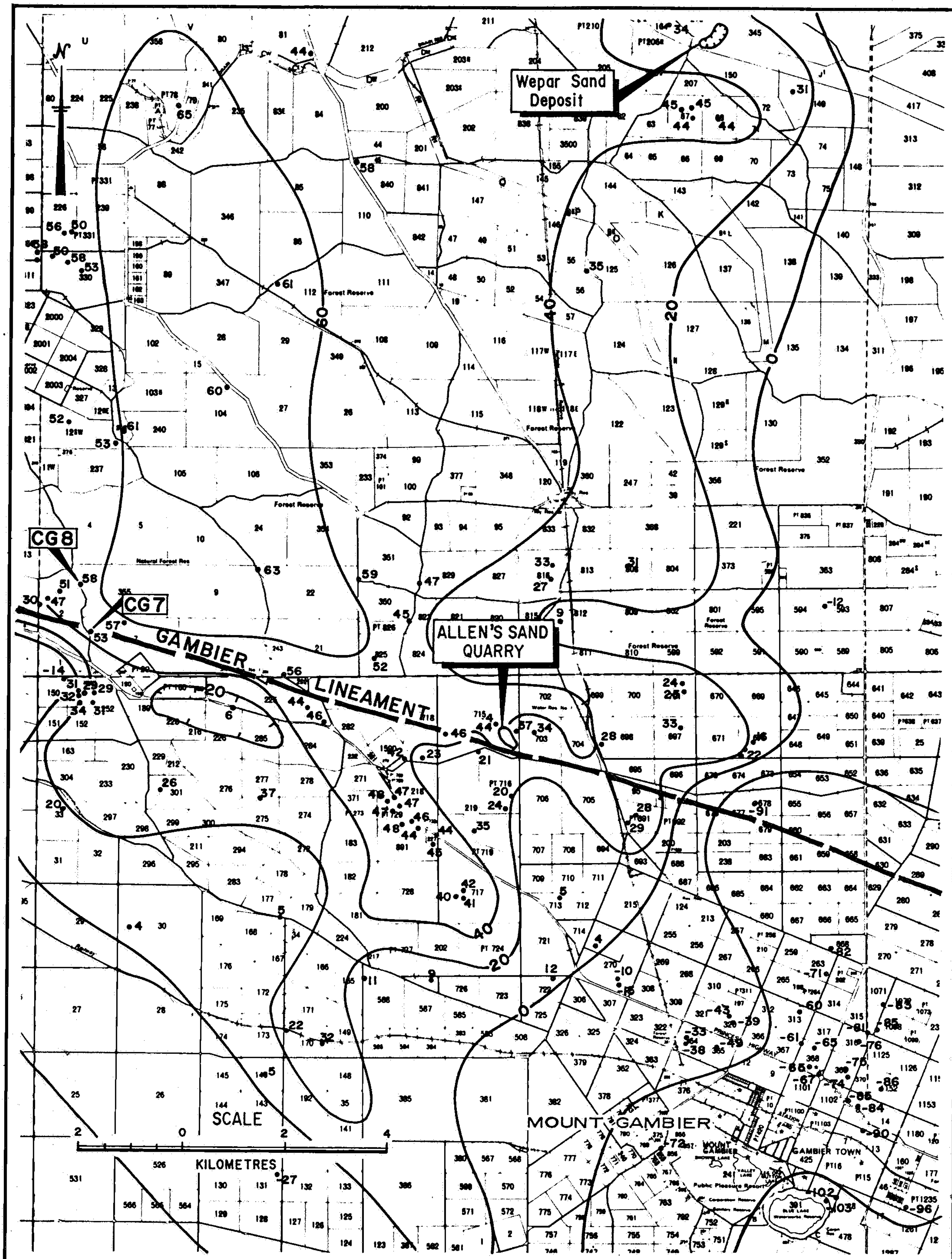
SCALE

200 0 200 400 600 800

METRES

FIG.2

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J. Keeling	4-5-83 DATE
ALLEN'S SAND QUARRY	DRAWN M.F.L.	SCALE 1:10 000
SECTION 715, HD. BLANCHE	DATE 14-3-83	PLAN NUMBER 83-130
GEOLOGICAL PLAN AND SECTION	CHECKED	



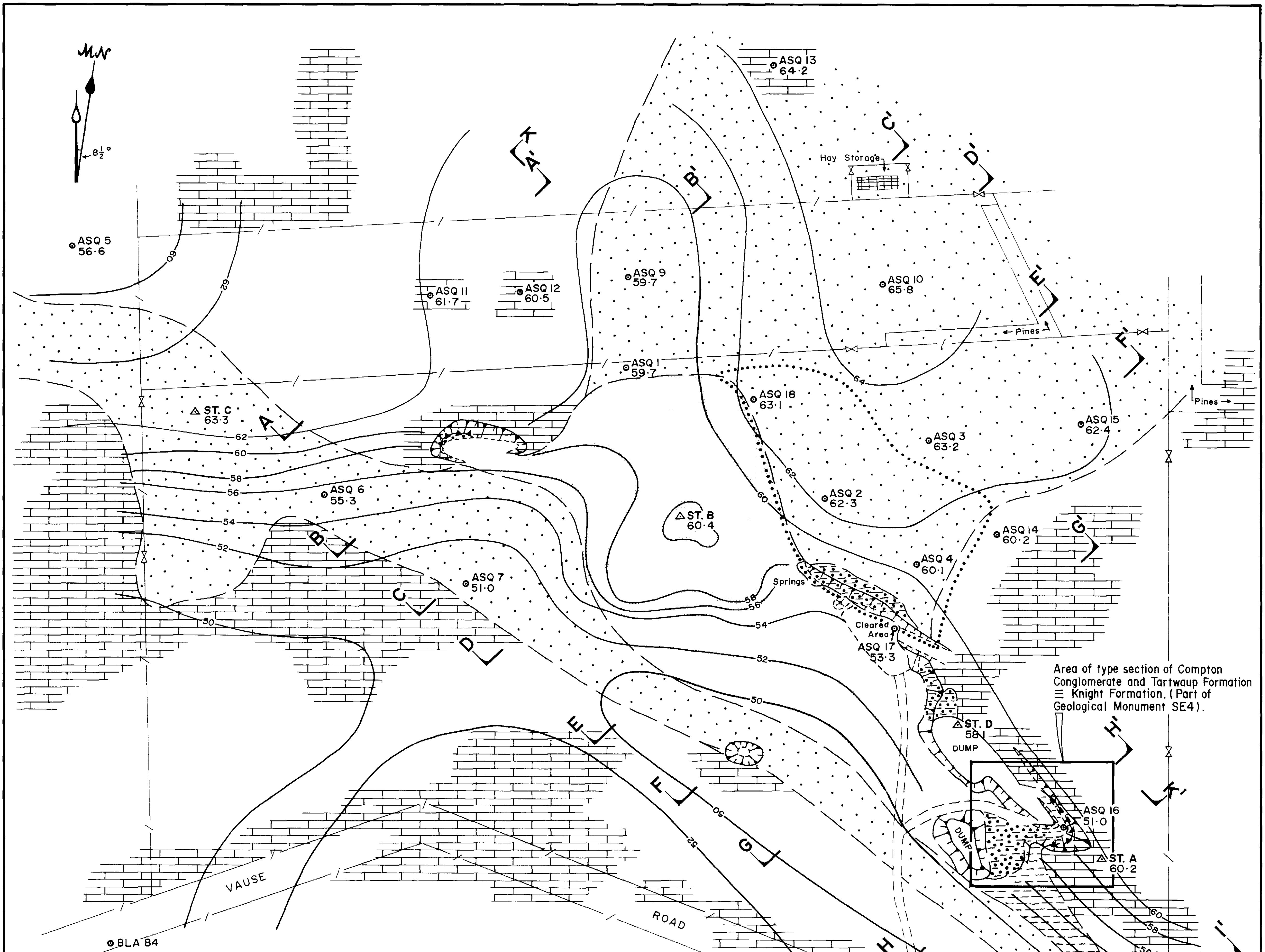
•23 Location of well intersecting Wangerrip Group, with height of top of said group relative to mean sea level (in metres).

—40— Contour of top of Wangerrip Group (datum M.S.L.).

FIG. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J. Keeling	C.D.O. DATE 4·8·83
ALLEN'S SAND QUARRY	DRAWN M.F.L.	SCALE 1 : 100 000
SECTION 715, HD. BLANCHE	DATE 15 – 3 – 83	PLAN NUMBER
STRUCTURE CONTOURS TOP WANGERRIP GROUP	CHECKED	S16639

3098



REFERENCE

HOLOCENE	CLAY : Dark brown to red brown soil developed primarily on Gambier Limestone	
	MOLINEAUX SAND : Pale yellow, fine to very fine grained dune sand	
OLIGOCENE – MIOCENE	GAMBIER LIMESTONE : Pale bryzoal limestone. COMPTON CONGLOMERATE : Basal conglomerate of ferruginised sandstone in part cemented by limestone	
MIDDLE EOCENE	WANGERRIP GROUP TARTWAUP FORMATION : Oxidised silty clay and carbonaceous silt Poorly sorted, fine to coarse grained sand and gravel, slightly to very clayey	

Area previously mined but now rehabilitated.

Face of quarry or dump

Boundary of area used in reserve calculations

Approximate geological boundary

Location of section. (See Fig.5, plan 83-132)

ST. B 60·4 — Survey station with elevation (in metres)

ASQ 16 63·2 — Auger drillhole location, number and elevation (in metres)

52 — Topographic contour (2m interval; datum M.S.L.)

Fence, gate

Track

SCALE

40 0 100 200

METRES

FIG.4

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J. Keeling	MR 4·8·83 CDO DATE
ALLEN'S SAND QUARRY SECTION 715, HD. BLANCHE GEOLOGICAL PLAN SHOWING DRILL HOLE AND SECTION LOCATIONS	DRAWN M.F.L.	SCALE 1 : 2 000
	DATE 18 – 3 – 83	PLAN NUMBER
	CHECKED	83-131

3098

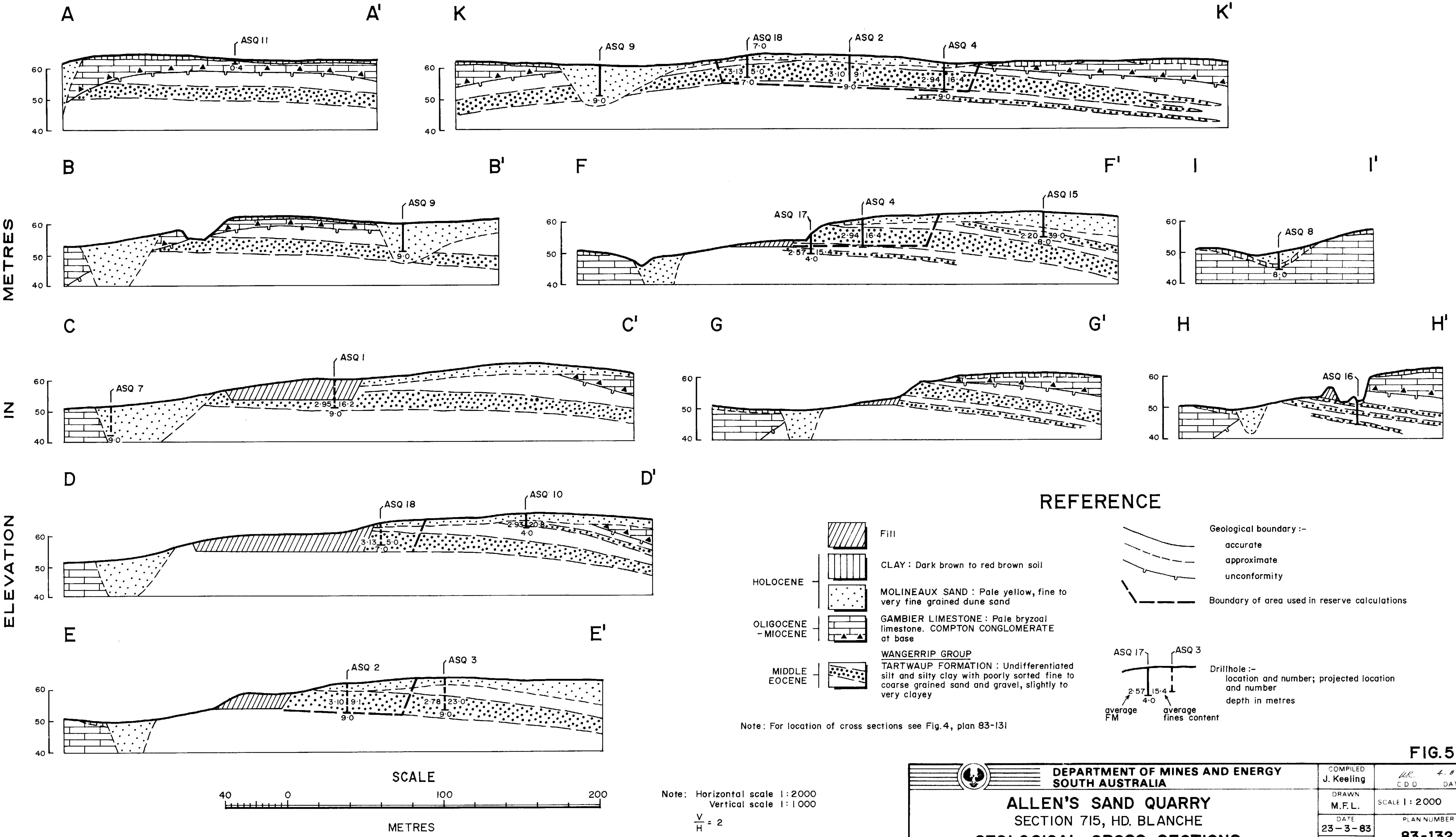
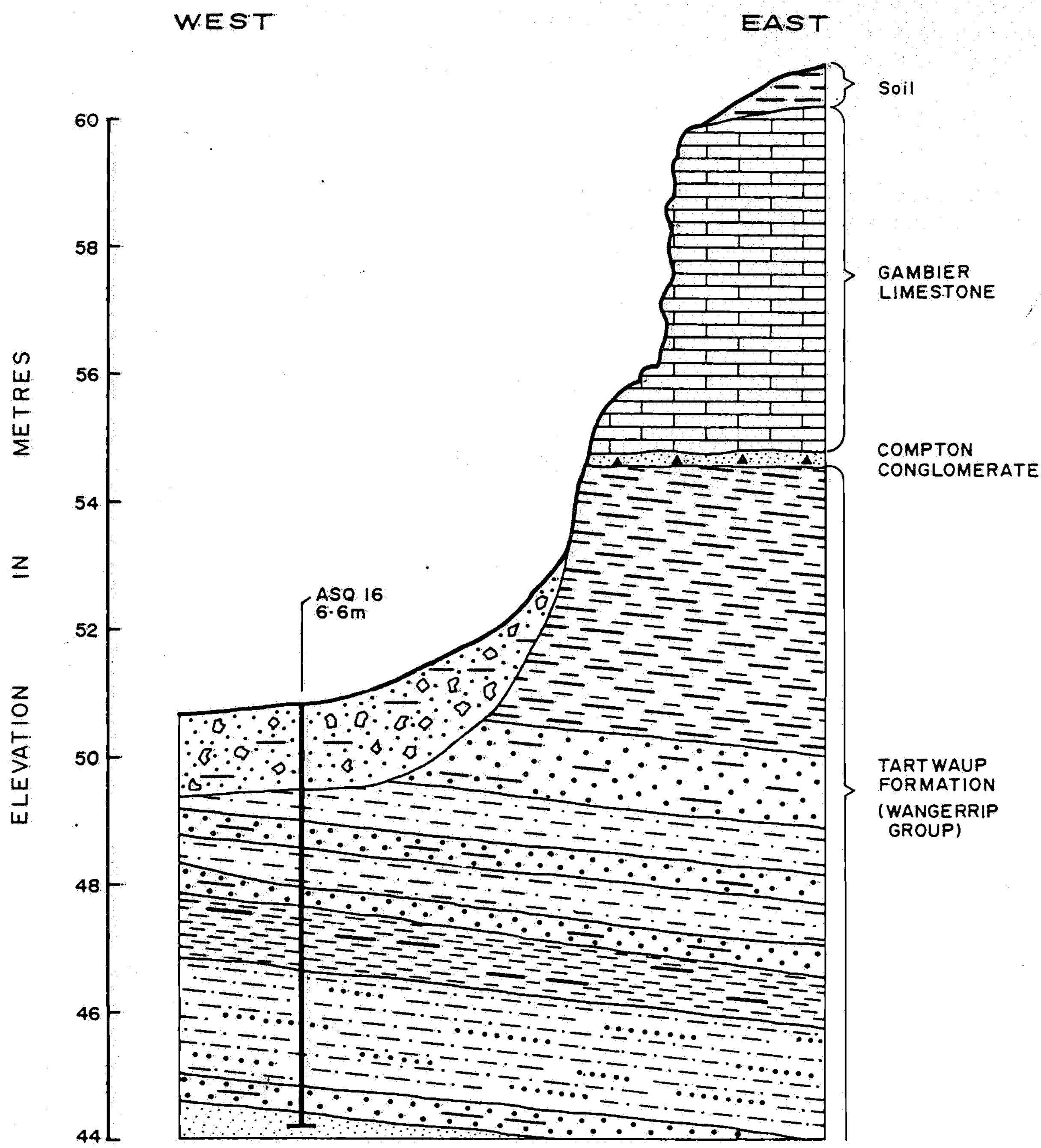


FIG. 5

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED J. Keeling	4. 8. 83	CDO DATE
ALLEN'S SAND QUARRY	DRAWN M.F.L.	SCALE 1 : 2000	
SECTION 715, HD. BLANCHE	DATE 23-3-83	PLAN NUMBER	
GEOLOGICAL CROSS SECTIONS	CHECKED	83-132	

3098



REFERENCE

- FILL : Clay and sand with limestone fragments
- SOIL : Dark red-brown clay, slightly sandy
- LIMESTONE : Massive pale yellow to white calcarenite, predominantly shell and bryzoal fragments
- SAND : Yellow-brown, fine to very coarse sand cemented by limonite and carbonate
- CLAY : Very silty, banded white, yellow and red
- SAND : Fine to very coarse, slightly clayey, slightly gravelly
- SILT : Moderately clayey, micaceous, yellow, brown and red
- SILT : Slightly clayey, carbonaceous, light grey to black
- SAND : Fine grained, micaceous, pale yellow

SCALE
0 2 4 $\frac{V}{H} = 1$
METRES

FIG. 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

ALLEN'S SAND QUARRY
SECTION 715, HD. BLANCHE
COMPOSITE QUARRY SECTION

COMPILED J. Keeling	C.D.O. DATE	
DRAWN M.F.L.	SCALE 1 : 100	
DATE 25-3-83	PLAN NUMBER S16640	
CHECKED		