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REPORT ON GEOTECHNICAL INVESTIGATION

PROPOSED EXTENSION TO SAND EXTRACTION OPERATION GRANTHAM PARK, BUNGENDORE

Prepared for
GRANTHAM PARK PTY LTD

PROJECT 46089
December 2006

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1. INTRODUCTION

This report presents the results of a geotechnical investigation undertaken at Grantham Park, Bungendore. The investigation examined sand reserves at a feasibility level, and the opportunities for extending the existing mining operation. The investigation was commissioned by the landholders, Grantham Park Pty Ltd.

Grantham Park is a large rural property of about 1200 hectares located on the southeastern shore of Lake George. In addition to cattle and sheep grazing, concessions have been granted to two operators to mine and extract sand from the property. One operation, at the northern end of the property, is continuous and well established with equipment for excavation, trucking, dredging, washing, screening, mixing and loading. The other operation, at the southern end of the property, is small scale and intermittent with equipment for excavation, trucking, dry screening and loading.

The investigation comprised the excavation of test pits, generally on a broad 500 m grid; the collection of samples for laboratory testing then engineering analysis and reporting. Details of the fieldwork and laboratory investigations undertaken are given within together with comments and recommendations relating to future sand mining at the site.

The site includes Lots 31 and 32 DP 634213 and Lot K DP 157545.

2. SITE DESCRIPTION AND REGIONAL GEOLOGY

The site is located on the southeastern end of Lake George. The terrain is generally flat at an elevation of about 680 m but rises in the southeastern part of the property to 710 m. The existing large-scale mining operation beside Butmaroo Creek provides a significant percentage of sand and gravel to Canberra from beach deposits on the margin of the lake.

Lake George was formed when faulting on the east side of the Lake George range interrupted the drainage pattern, which previously flowed through Gearys Gap, and formed a closed drainage basin. The lake is now an evaporating basin and the water level in the lake is influenced by climatic events. Currently the lake is dry. However in Recent geologic time the lake level has varied significantly resulting in extensive alluvial deposits around the lake margins and particularly at the northern and southern ends of the lake.

The 1:100,000 Canberra Geology Map (Reference 1) indicates the following rocks and materials occur at the site.

Recent Deposits - Quaternary

- Gravel, sand, silty clay and black organic clay alluvium (Qa)
- Clay, lacustrine and lagoonal pans (Ql)
- Coarse sand and gravel, strandline (Qbs)
- Fanglomerate and poorly cemented conglomerate, gravel and sand, colluvium (Qc)

Bedrock – Birkenburn Beds – Middle-Late Ordovician

- Interbedded sandstone, siltstone and shale (distal quartz turbidites) (Ob)
- Psammo peletic schist and peletic schist (Ob1)

(Note: Psammo indicates a fine grained rock with bedding planes or laminates less than 2 mm apart and peletic indicates a rock that is predominately composed of clay)

Mining evidence shows that the main source of construction sand is associated with strandline deposits, which are paleo-beach deposits that developed as sand spits along the shoreline and relate to the receding shore of the lake. The method of strandline formation generally results in a higher portion of sand and gravel than alluvium that has been deposited under quiescent conditions.

More detailed mapping (Reference 2) has identified three phases of strandline formation but within each phase there are many sub-phases that combine to form the strandline system.

Phase I is the oldest strandline and has been referred to as the "*Turalla Embankment*". It does not occur on the property. Phase II has been referred to as the "*Stonevilla (Older) Embankment*" and is presently the dominant source of construction sand in the area. Phase III, referred to as the "*Stonevilla (Younger) Embankment*" is the most recent and most clearly defined. It joins with the older Phase II at the southern end of the system and has been a significant source of sand in the past. Both Phase II and III strandline systems occur on the property.

The geological interpretation for the site is shown on Drawing 1 in Appendix A.

3. PREVIOUS INVESTIGATIONS

Douglas Partners has not been provided with details of previous investigations into sand and gravel resources at the site and have assumed no previous investigations have been undertaken.

Reference 2 notes 15 sand production sites at the south end of Lake George, however in 1995 only 4 were operating and only 3 pits were of significant size. The details are given in Table 1

Table 1 – Active Sand Mining Operations in 1995

Name	Description
Currandooley	Originally small scale in 1970, now a large operation by Canberra Sand and Gravel on the north side of site. Deposit is a Phase II strandline
Smiths	Large scale in 1970, operator Corkhill Brothers, now small scale at the south end of the property, described as 15 m of fine to coarse sand interbedded with clay. Deposit is a Phase I strandline
Bungendore sand/Mane Lodge	Large scale, operator was Monier Sands, now Readymix, described as 16 m of mixed sand and gravel with some clay layers. Deposit is a Phase II strandline with some aeolian. South of the property

Reference 3 includes details of drilling at Lake George. Drill hole C1, at the south end of the lake near the mouth of Turalla Creek found 65 m of alluvium and drill hole C294, which is northeast of Butmaroo Creek, found 37 m of alluvium. The drill logs did not describe the alluvium.

4. CURRENT SAND EXTRACTION OPERATION

Concessions to extract sand have been granted to two operators at the property. Canberra Sand and Gravel operate the northern pit, the Currandooley pit, which is the major mining operation at the site. Corkhill Brothers operate Smith's pit at the southern end of the property.

4.1 Canberra Sand and Gravel Pit

This site was originally the Curandooley pit, which was located on a low rise of coarse sand, a phase II strandline. The present operators commenced in 1982 and extended and deepened the pit to its current dimensions. The general extraction operation involves:

- Removal and disposal of topsoil and overburden by excavator and truck.
- Excavation of sand above the water table by large excavator and truck delivery to the washing and screening plant.
- Excavation of sand below the water table by dredge, which is pumped to the screening plant.

The water table is about 6 metres and the base of the pit, which is marked by a grey plastic clay layer, is about 13 m below the current ground surface.

Presently extraction is taking place on the western margin of the concession and is hampered by the high overburden ratio with 2-4 metres of overburden requiring removal before suitable material for washing and screening becomes available.

4.2 Corkhill Brothers Pit

This site was originally Smith's pit and mined the phase III strandline that runs approximately parallel to the lake edge. The pit appears to be intermittently worked and the excavations appear to be no more than about 2 metres deep. The general extraction operation involves:

- Light stripping to remove topsoil and overburden, this appears to be a dozer operation
- Excavation of generally clean sand with an excavator or scrapper
- Dry screening to correct the grading

During the fieldwork this pit was inactive. The operator appears to have removed the easily removeable near surface sands.

5. FIELD WORK

The field investigation comprised the excavation of fifteen test pits, (Pits TP1 to TP4, TP7 to TP10, TP13, and TP15 to TP20) with a Sumitomo SH350HD excavator.

5.1 Results

The test pit logs are given in Appendix A together with notes defining classification methods and descriptive terms.

All test pit sites were located by a GPS and the locations are shown on Drawing 2.

The test pits encountered alluvium, residual soil and weathered rock with the principal succession of strata is broadly summarised as follows:

Topsoil	Silty sand and sand, dark brown, light brown, grey and light grey, in places appears to be aeolian, 0.1 to 0.5 m thick encountered in all test pits except TP9, TP10, TP13, TP18 and TP20. Clay, brown, 0.2 m thick in TP13
Alluvium	Clay, sandy clay, clayey sand, sand and gravelly sand: All test pits except TP 13 and TP15 encountered alluvium. All test pits except TP13, TP15 and TP16 were terminated in alluvium at depths ranging form 5.0 to 7.0 m
Residual soil	Clay and sandy clay, brown, low and medium plasticity: In test pits T13 and T15
Weathered rock	Extremely weathered schist in test pits T13, T15 and T16 at depths of 0.7 m, 1.0 m and 5.5 m respectively

Seepage was encountered in test pits TP2, TP8, TP9, TP10, TP18 and TP20. The moisture condition of the soils ranged from dry to wet and trench collapses occurred in four excavations.

Groundwater conditions rarely remain constant and can change seasonally due to changes in rainfall, temperature and other factors. At this site the presence of alternating clay and sand layers could cause perched water tables to develop. All test pits were backfilled shortly following excavation, which precluded longer term monitoring of groundwater levels. The region is presently experiencing a prolonged drought and groundwater levels could be historically low.

6. LABORATORY TESTING

The laboratory test program comprised eighteen particle size distribution analyses on alluvial samples collected from the test pits. The results are given in Appendix B and summarised in Table 2. The grading results were used to confirm the field descriptions.

Table 2 – Summary of Particle Six Analysis

Test pit	Depth (m)	%passing 2.36 mm sieve	%passing 0.075 mm Sieve	Description
TP1	0.5 - 2.0	98	42	Clayey Sand (note 1)
TP1	4.0 - 5.5	88	10	Sand
TP2	3.5 - 5.5	98	23	Clayey Sand (note 1)
TP3	0.3 - 2.5	100	64	Sandy Clay (note 1)
TP3	2.5 - 3.0	88	33	Clayey Sand (note 1)
TP3	3.0 - 3.5	89	45	Clayey Sand (note 1)
TP4	1.5 - 4.0	97	60	Sandy Clay (note 1)
TP7	1.0 - 2.5	100	58	Sandy Clay (note 1)
TP7	2.5 - 3.0	99	7	Sand
TP8	2.5 - 4.5	99	25	Clayey Sand (note 1)
TP8	4.5 - 5.5	36	3	Sandy Gravel
TP9	1.5 - 2.2	100	28	Clayey Sand (note 1)
TP9	2.7 - 4.5	71	13	Clayey Sand (note 1)
TP10	0.5 - 3.0	97	31	Clayey Sand (note 1)
TP16	4.0 - 5.5	82	5	Gravelly Sand
TP18	3.0 - 4.0	96	36	Clayey Sand (note 1)
TP19	1.5 - 3.0	99	19	Clayey Sand (note 1)
TP20	0.0 - 3.5	98	24	Clayey Sand (note 1)

Note 1 – The field assessment described the fines as clayey. However, a full classification requires an Atterberg Limits test to determine if the fines are silty or clayey.

7. COMMENTS

The method of deposition of alluvial materials, whether in calm or fast flowing water, and the potential for re-working the deposit, whether by a change in lake level, wave action or a meandering stream, can result in highly variable sub-surface conditions. The current investigation has examined the alluvial soil profile on a broad basis to depths of 5 – 7 metres and the current major mining operation by Ready Mix and Canberra Sand and Gravel are removing sand to a depth of about 13-15 metres. There is poor information about the thickness

of the alluvium below these depths but two drill holes indicate the alluvium could be up to thirty metres thick in places.

The test pit program found that the alluvial soils at the site comprise a wide range of materials from clay to gravel. Generally the test pits have confirmed the geological interpretation however test pits TP13 and TP15 have shown that the rock unit Ob1 should extend further northwest than previously mapped. There where no excavations in the colluvial materials (Qc).

Sand extraction operations originally commenced on strandlines (Qbs), which are former beach deposits that where found to contain coarser grained and cleaner materials. However strandlines are surface features formed on the general alluvial deposit (Qa) and their thickness does not necessarily relate to the overall thickness of the alluvium at the site.

Within the topsoil layer aeolian sands, which are generally single sized fine or medium grained materials, were observed in a few test pits. The aeolian sand is thought to come from strandlines. For instance the Phase III strandline at the property has an asymetrical shape and flat crest that suggests a persistent westerly wind may have removed sand and deposited it further to the east. Although aeolian sand has been mined elsewhere there do no appear to be significant deposits on the property.

Canberra Sand and Gravel's dredging and washing operation appears to be able to process gravels, sands and clayey sands with up to about 30 percent fines. Clayey sands excavated above the water table can also be blended with a cleaner stream of material at the washing and screening plant however this requires double handling and is therefore less economic. Clays and sandy clays above the water table are wasted along with clayey sand with a high percentage of fines.

The investigation has generally examined the following four areas:

- West of the Currandooley pit
- East of the Currandooley pit
- Around Smith's pit
- Phase II strandline

7.1 West of the Currandooley pit

Four test pits, numbered TP1 to TP4 were excavated on the west side of the existing pit. The overburden depth, which includes materials described as clay, sandy clay and clayey sand with greater than 30 percent fines ranged from 2.0-5.0 m. Beneath the overburden was a mixture of clayey sand and sand with layers of clay. These findings are generally consistent with conditions being experienced by the operator along the western and northwestern margin of the pit. The test pits were located off the strandline and a higher overburden ratio and a greater percentage of fines was anticipated. An extension of the existing pit to the west does not appear favourable.

Test pit TP7, which is located near the southwest corner of the existing pit, found 2.5 m of overburden then generally clean sand to 6.5 m. The pit operator has reported better mining conditions in the southwest and southern part of the pit. This test pit is located within the strandline.

7.2 East of the Currandooley pit

Three test pits, numbered TP8 to TP10 were excavated on the east side of the existing pit. The overburden depth, which includes materials described as clay, sandy clay and clayey sand with greater than 30 percent fines ranged from 0.0-2.7 m. Beneath the overburden was a mixture of clayey sand and sand with occasional layers of clay. The sand materials exposed in the test pits were cleaner than expected as all excavations were located off the strandline.

7.3 Around Smith's pit

Four test pits, numbered TP17 to TP20 were excavated near and within the existing workings. Test pits TP18 to TP20 appeared to be within old workings and reference 2 indicates this was the site of a pit called Leonie. At test pit TP17 clean sand was present beneath a thin topsoil and this material would be suitable for dry screening. At test pit TP19 1.0 m of stripping would be needed to expose suitable material for washing while at the remaining sites no stripping is needed however the sand would require washing. The test pits were generally excavated within existing strandlines and this site appears suitable for further developed with a dredging operation similar to that operating at Currandooley.

7.4 Phase II Strandline

The mining history and current operations indicate the strandlines provide the lowest overburden ratios and the cleanest materials. Test pit TP7 was excavated within the strandline and is discussed above. The other excavations within the phase II strandline at the property include test pit TP16 and a silage pit between test pits TP16 and TP15. The silage pit is about 1.5 m deep and has exposed a medium and coarse grained sand beneath a thin topsoil. Test pit TP16 found 2.5 m of overburden then clayey sand, that is suitable for washing, and gravelly sand overlying weathered rock at 5.5 m. The limitation at this end of the strandline maybe the depth to rock although test pit TP18, which is on the same strandline system and further south, did not encounter rock but was terminated at 5.0 m.

8. CONCLUSIONS AND LIMITATIONS

Based on a consideration of the depositional and mining history at the site the most favourable operations are expected to be within the strandlines. At the Currandooley pit an extension to the south, which is along the strandline, should be successful. However the investigation has also found that an extension on the eastern side appears possible. Additional test pits would be needed to confirm these preliminary findings.

A deepening of Smiths pit would require adoption of a different mining operation as washing will be needed to remove the fines from the sand. Additional test pits would be needed to confirm these preliminary findings.

There is limited data on the depth of suitable alluvium and drilling to determine the depth would be beneficial in those areas that appear promising. Currently the large operators are excavating to depths of 13 to 15 m.

The report has been prepared for the exclusive use of Grantham Park Pty Ltd for the specific application to sand mining at the property. The investigation was at a feasibility level and test pits were broadly spaced to provide an overall appreciation of the sand resources at the site.

9. REFERENCES

1 1:100,000 Geologic Series, Map for Canberra, Bureau of Mineral Resources, 1992

2. Investigation of the Sand Resources of the Lake George Basin, 1995, Geological Survey of NSW, Report GS 1995/032

3. Geology of the Lake George Basin, NSW, Bureau of Mineral Resources, Australia, Record 1985/4

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Reviewed by

Michael J Thom for

Senior Geotechnical Engineer

Principal

APPENDIX A
Notes Relating to this Report
Test Pit Logs (Pits 1-4, 7-10, 13, 15-20)
Drawing 1- Geology
Drawing 2 – Site Plan

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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DESCRIPTION AND CLASSIFICATION OF ROCKS FOR ENGINEERING PURPOSES

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh Stained	Fs	Rock substance unaffected by weathering, but showing limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index ($I_{S(50)}$) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by Australian Standard 4133.4.1 - 1993.

Term	Symbol	Field Guide*	Point Load Index $I_{S(50)}$ MPa	Approx Unconfined Compressive Strength q_u ** MPa
Extremely low	EL	Easily remoulded by hand to a material with soil properties	<0.03	< 0.6
Very low	VL	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; too hard to cut a triaxial sample by hand. SPT will refuse. Pieces up to 3 cm thick can be broken by finger pressure.	0.03-0.1	0.6-2
Low	L	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long 40 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	0.1-0.3	2-6
Medium	M	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.	0.3-1.0	6-20
High	H	Can be slightly scratched with a knife. A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow, rock rings under hammer.	1 - 3	20-60
Very high	VH	Cannot be scratched with a knife. Hand specimen breaks with pick after more than one blow, rock rings under hammer.	3 - 10	60-200
Extremely high	EH	Specimen requires many blows with geological pick to break through intact material, rock rings under hammer.	>10	> 200

Note that these terms refer to strength of rock material and not to the strength of the rock mass, which may be considerably weaker due to rock defects.

* The field guide assessment of rock strength may be used for preliminary assessment or when point load testing is not able to be done.

** The approximate unconfined compressive strength (q_u) shown in the table is based on an assumed ratio to the point load index of 20:1. This ratio may vary widely.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks. The orientation of rock defects is measured as an angle relative to a plane perpendicular to the core axis. Note that where possible, recordings of the actual defect spacing or range of spacings is preferred to the general terms given below.

Term	Description
Fragmented	The core consists mainly of fragments with dimensions less than 20 mm.
Highly Fractured	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured	Core lengths are mainly 40 mm - 200 mm with occasional shorter and longer sections.
Slightly Fractured	Core lengths are generally 200 mm - 1000 mm with occasional shorter and longer sections.
Unbroken	The core does not contain any fracture.

ROCK QUALITY DESIGNATION (RQD)

This is defined as the ratio of sound (i.e. low strength or better) core in lengths of greater than 100 mm to the total length of the core, expressed in percent. If the core is broken by handling or by the drilling process (i.e. the fracture surfaces are fresh, irregular breaks rather than joint surfaces) the fresh broken pieces are fitted together and counted as one piece.

SEDIMENTARY ROCK TYPES

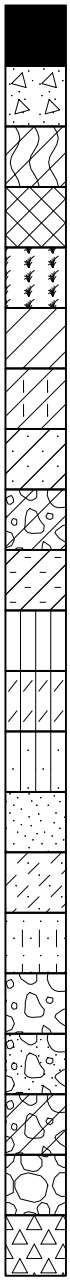
This classification system provides a standardised terminology for the engineering description of sandstone and shales, particularly in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Rock Type	Definition
Conglomerate	More than 50% of the rock consists of gravel-sized (greater than 2 mm) fragments
Sandstone:	More than 50% of the rock consists of sand-sized (0.06 to 2 mm) grains
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06 mm) granular particles and the rock is not laminated.
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated.
Shale:	More than 50% of the rock consists of silt or clay-sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, eg. clayey sandstone, sandy shale.

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

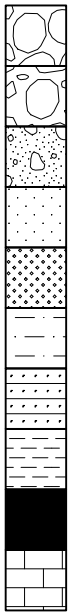
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

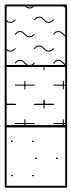
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

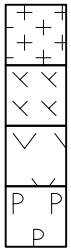


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 683 m
EASTING: 723485
NORTHING: 6103985
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
683	0	TOPSOIL - dark brown and grey fine and medium grained silty sand, excess low plasticity fines, roots, dry							
	0.5	CLAYEY SAND - light yellow brown fine to medium grained clayey sand, excess medium plasticity fines (approx 40%), moist (Alluvium)		D	0.5				
682	1								1
681	2								2
	2.0	CLAYEY SAND - light yellow brown fine to medium grained clayey sand, excess medium plasticity fines (approx 20%), moist (Alluvium)							
680	3								3
679	4								4
	4.0	SAND - white generally coarse grained sand, some fines and fine and medium sand, some gravel to 10mm, wet (Alluvium)		D	4.0				
678	5								5
	5.5	SANDY CLAY - yellow and white medium plasticity sandy clay, excess fine and medium grained, wet (Alluvium)							
677	6								6
	6.5	Pit discontinued at 6.5m (target depth reached)							
676	7								7

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 680 m
EASTING: 723250
NORTHING: 6103750
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
680	0.0	TOPSOIL - light grey fine and medium grained silty sand, excess low plasticity fines, roots, dry							
	0.3	SANDY CLAY - grey and light brown medium plasticity sandy clay, excess fine and medium grained, moist (Alluvium)							
679	1.0	CLAYEY SAND - light yellow brown fine and medium grained clayey sand, excess medium plasticity fines (approx 40%), moist (Alluvium)							
678	2								
677	3								
	3.5	CLAYEY SAND - white medium grained then coarse grained with increased depth, clayey sand, excess fines (approx 20%), moist (Alluvium)		D	3.5				
676	4								
675	5	- wet below 5.0m						▽	
	5.5	CLAY - grey and yellow medium plasticity clay, some sand, wet (Alluvium)							
674	6								
	6.0	SAND - white coarse grained sand, wet (Alluvium)							
	6.5	Pit discontinued at 6.5m (target depth reached)							
673	7								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Seepage at 5.3m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 680 m
EASTING: 723000
NORTHING: 6103500
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
680	0	TOPSOIL - light grey and brown fine and medium grained silty sand, excess low plasticity fines, roots, dry							
	0.3	SANDY CLAY - brown medium plasticity sandy clay, excess fine and medium sand, moist (Alluvium)		D	0.3				
679	1								1
678	2								2
	2.5	CLAYEY SAND - yellow brown fine and medium grained clayey sand, excess medium plasticity fines (approx 30%), some gravel, moist (Alluvium)		D	2.5				
677	3								3
	3.0	CLAYEY SAND - yellow brown medium and coarse grained clayey sand, excess medium plasticity fines (approx 45%), some gravel, moist (Alluvium)		D	3.0				
	3.5	CLAY - light brown medium plasticity clay, moist (Alluvium)							
676	4								4
	4.0	CLAYEY SAND - yellow brown medium and coarse grained clayey sand, excess medium plasticity fines (approx 30%), some gravel, moist (Alluvium)							
	4.5	CLAY - yellow brown medium plasticity clay, moist (Alluvium)							
675	5								5
	5.0	SAND - white and yellow coarse grained sand, some fines, some gravel, moist (Alluvium)							
	5.5	Pit discontinued at 5.5m (target depth reached)							
674	6								6
673	7								7

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 680 m
EASTING: 723000
NORTHING: 6104000
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
680	0	TOPSOIL - light brown and light grey fine and medium grained sand, roots, possibly aeolian							
	0.5	SANDY CLAY - yellow brown medium plasticity sandy clay, excess fine and medium sand, moist (Alluvium)							
679	1								1
	1.5	SANDY CLAY - light yellow brown medium plasticity sandy clay, excess fine sand, some medium and coarse, moist (Alluvium)		D	1.5				
678	2								2
677	3								3
676	4								4
	4.0	SAND - white medium grained sand, moist (Alluvium)							
675	5								5
	5.0	CLAY - grey medium and high plasticity clay, moist (Alluvium)							
	5.3	Pit discontinued at 5.3m (target depth reached)							
674	6								6
673	7								7

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 683 m
EASTING: 723000
NORTHING: 6103000
DIP/AZIMUTH: 90°/--

PIT No: 7
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
683	0	TOPSOIL - light brown and light grey fine and medium grained silty sand and sand, roots, possibly aeolian							
	0.5	SANDY CLAY - yellow brown medium plasticity sandy clay, excess fine and medium sand, moist (Alluvium)							
682	1 1.0	SANDY CLAY - yellow brown low and medium plasticity sandy clay, excess fine and medium sand, moist (Alluvium)		D	1.0				
681	2								
	2.5	SAND - yellow medium grained sand, moist (Alluvium)		D	2.5				
680	3 3.0	SAND - white medium and coarse grained sand, moist (Alluvium)							
679	4								
678	5								
677	6 6.0	SAND - yellow brown and light grey medium and coarse grained sand, moist (Alluvium)							
	6.5	CLAY - grey medium plasticity clay, moist (Alluvium)							
676	7 7.0	Pit discontinued at 7.0m (target depth reached)							

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 684 m
EASTING: 724250
NORTHING: 6102750
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
684	0.0	TOPSOIL - light grey and brown fine and medium grained silty sand, excess low plasticity fines, roots, dry							
	0.5	CLAY - yellow brown and light brown medium plasticity clay, some sand, moist (Alluvium)							
683	1								1
	1.3	SANDY CLAY - yellow brown medium plasticity sandy clay, excess fine and medium sand, moist (Alluvium)							
682	2								2
	2.0	CLAYEY SAND - yellow brown and grey fine and medium grained clayey sand, excess medium plasticity fines (approx 40%), moist (Alluvium)							
	2.5	CLAYEY SAND - white and grey fine to coarse grained clayey sand, excess medium plasticity fines (approx 25%), moist to wet, collapsing		D	2.5				
681	3								3
680	4								4
	4.5	SANDY GRAVEL - yellow sandy gravel, gravel to 30mm), excess fine to coarse sand, wet, collapsing (Alluvium)		D	4.5				
679	5								5
	5.5	Pit discontinued at 5.5m (target depth reached)							
678	6								6
677	7								7

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Rapid seepage at 4.5m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 684 m
EASTING: 724000
NORTHING: 6102500
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
684	0.0	CLAY - brown medium plasticty clay, roots to 0.2m, trace gravel to 20mm, some sand, dry (Alluvium)							
683	1.0	CLAYEY SAND - yellow brown fine and medium grained clayey sand, medium plasticity fines (approx 45%), moist (Alluvium)							
	1.5	CLAYEY SAND - white fine and medium grained clayey sand, medium plasticity fines (approx 30%), moist (Alluvium)		D	1.5				
682	2.2	CLAY - brown and grey low plasticity clay, some sand, moist (Alluvium)							
	2.7	CLAYEY SAND - yellow medium and coarse grained clayey sand, excess gravel to 30mm, excess fines (approx 15%), moist (Alluvium)		D	2.7				
681									
680									
	4.5	SANDY CLAY - grey medium plasticity sandy clay, excess fine grained sand, wet (Alluvium)							
679	5.0	SAND - yellow and grey coarse grained sand, some gravel to 20mm, wet, seepage, collapsing (Alluvium)						▷	
678	6.0	Pit discontinued at 6.0m (target depth reached)							
677	7.0								

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Seepage at 5.0m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 685 m
EASTING: 724500
NORTHING: 6102500
DIP/AZIMUTH: 90°/--

PIT No: 10
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
685	0	SAND - white fine and medium grained sand, roots at surface, dry (Alluvium)							
	0.5	CLAYEY SAND - yellow brown fine to coarse grained clayey sand, excess low and medium plasticity fines (approx 30%), moist		D	0.5				
684	1								
683	2								
682	3								
	3.0	SAND - white and yellow medium and coarse grained sand, some low and medium plasticity fines, becomes cleaner with depth, wet (Alluvium)							
681	4								
680	5								
	5.0	CLAY - light grey medium plasticity clay, wet (Alluvium)							
	5.5	CLAYEY GRAVEL - light grey angular fine and medium grained clayey gravel, excess low plasticity fines, some sand, wet, collapsing (Alluvium)						▷	
679	6								
	6.0	Pit discontinued at 6.0m (target depth reached)							
678	7								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Rapid seepage at 5.5m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 687 m
EASTING: 724000
NORTHING: 6102000
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
687	0.2	TOPSOIL - brown medium plasticity clay, dry, roots							
		CLAY - brown medium plasticity clay, dry (Residual)							
	0.7	SCHIST - extremely weathered schist, rock structure evident in-situ, dry to moist (excavates as clay)							
686	1.0	Pit discontinued at 1.0m (target depth reached)							
685									
684									
683									
682									
681									
680									

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 689 m
EASTING: 723000
NORTHING: 6101500
DIP/AZIMUTH: 90°/--

PIT No: 15
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
689	0.4	TOPSOIL - grey fine grained sand, roots, possibly aeolian							
		SANDY CLAY - brown low and medium plasticity sandy clay, excess fine and medium sand, moist (Residual)							
688	1.0	SCHIST - extremely weathered schist, rock structure evident in-situ, moist (excavates as clay)							
	1.4	Pit discontinued at 1.4m (target depth reached)							
687	2								
686	3								
685	4								
684	5								
683	6								
682	7								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧭ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 686 m
EASTING: 722500
NORTHING: 6102000
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
686	0.3	TOPSOIL - light brown and light grey fine and medium grained silty sand, excess low plasticity fines, roots, dry							
	0.5	CLAY - brown medium plasticity clay (Alluvium)							
685	1	SANDY CLAY - yellow brown medium plasticity sandy clay, excess fine and medium grained sand (Alluvium)							
684	2								
	2.5	CLAYEY SAND - yellow brown fine and medium grained clayey sand, excess low plasticity fines (approx 30%), moist (Alluvium)							
683	3								
682	4			D	4.0				
	4.0	GRAVELLY SAND - yellow brown fine to coarse grained gravelly sand, excess gravel to 25mm, some fines, moist (Alluvium)							
681	5								
	5.5	SCHIST - extremely weathered schist, rock structure evident in-situ, moist (excavates as clay)							
680	6								
	6.0	Pit discontinued at 6.0m (target depth reached)							
679	7								

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 684 m
EASTING: 722000
NORTHING: 6102000
DIP/AZIMUTH: 90°/--

PIT No: 17
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
684	0.1	TOPSOIL - grey sand, roots, dry							
		SAND - light yellow fine and medium grained sand, dry (Alluvium)							
683	1								1
	1.5	CLAYEY SAND - yellow brown fine to coarse grained clayey sand, excess medium plasticity fines (approx 30%), moist (Alluvium)							
682	2								2
681	3	3.0 SANDY CLAY - brown and grey medium plasticity sandy clay, excess fine to coarse sand, moist							3
680	4								4
679	5	5.0 Pit discontinued at 5.0m (target depth reached)							5
678	6								6
677	7								7

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 687 m
EASTING: 722000
NORTHING: 6101500
DIP/AZIMUTH: 90°/--

PIT No: 18
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
687	0.0	SAND - light grey fine grained sand, roots, dry, possibly aeolian							
	0.3	CLAYEY SAND - yellow brown fine and medium grained clayey sand, excess medium plasticity fines (approx 30%), dry (Alluvium)							
686	1.0	SANDY CLAY - yellow brown medium plasticity sandy clay, excess fine to coarse sand, moist (Alluvium)							
685	2.0	SAND - yellow brown fine to coarse grained sand, some fines, moist (Alluvium)							
684	3.0	CLAYEY SAND - light brown fine and medium clayey sand, excess medium plasticity fines (approx 40%), wet (Alluvium)		D	3.0				
683	4.0	SAND - yellow coarse grained sand, wet (Alluvium)						▷	
	4.5	SANDY CLAY - light grey fine and medium grained sandy clay, some coarse grained and some gravel to 10mm, wet (Alluvium)							
682	5.0	Pit discontinued at 5.0m (target depth reached)							
681	6								
680	7								

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Rapid seepage at 4.0m

REMARKS: Test pit at edge of old sand extraction pit

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧭ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 683 m
EASTING: 721500
NORTHING: 6101500
DIP/AZIMUTH: 90°/--

PIT No: 19
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
683	0	TOPSOIL - light grey fine and medium grained silty sand, excess low plasticity fines, roots, possible aeolian							
	0.5	CLAY - dark brown medium plasticity clay, dry (Alluvium)							
682	1	SAND - white and yellow medium and coarse grained sand, moist (Alluvium)							
	1.5	CLAYEY SAND - orange brown fine and medium grained clayey sand, excess fines (approx 20%), moist (Alluvium)		D	1.5				
681	2								
680	3	CLAY - grey medium plasticity clay (Alluvium)							
	3.5	GRAVEL - generally fine grained gravel, some coarse sand, some fines with depth, wet, collapsing (Alluvium)						▽	
679	4								
678	5	Pit discontinued at 5.0m (target depth reached)							
677	6								
676	7								

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Rapid seepage at 3.5m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Grantham Park Pty Ltd
PROJECT: Bungendore Sands Borrow Investigation
LOCATION: Bungendore

SURFACE LEVEL: 682 m
EASTING: 721500
NORTHING: 6102000
DIP/AZIMUTH: 90°/--

PIT No: 20
PROJECT No: 46089
DATE: 29 Oct 06
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
682	0	CLAYEY SAND - yellow brown fine to coarse grained clayey sand, fines (approx 25%), dry (Alluvium)		D	0.0				
681	1								1
680	2								2
679	3								3
	3.5	CLAY - light brown and grey medium plasticity clay, some sand, moist to wet (Alluvium)							
678	4								4
	4.5	SAND - yellow brown and grey medium plasticity sand, wet (Alluvium)							
677	5								5
	5.5	Pit discontinued at 5.5m (target depth reached - black clay at base of excavation)							
676	6								6
675	7								7

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: Case CX31B - 300mm bucket

LOGGED: B Mattick

WATER OBSERVATIONS: Seepage at 5.0m

REMARKS: Within old sand extraction pit

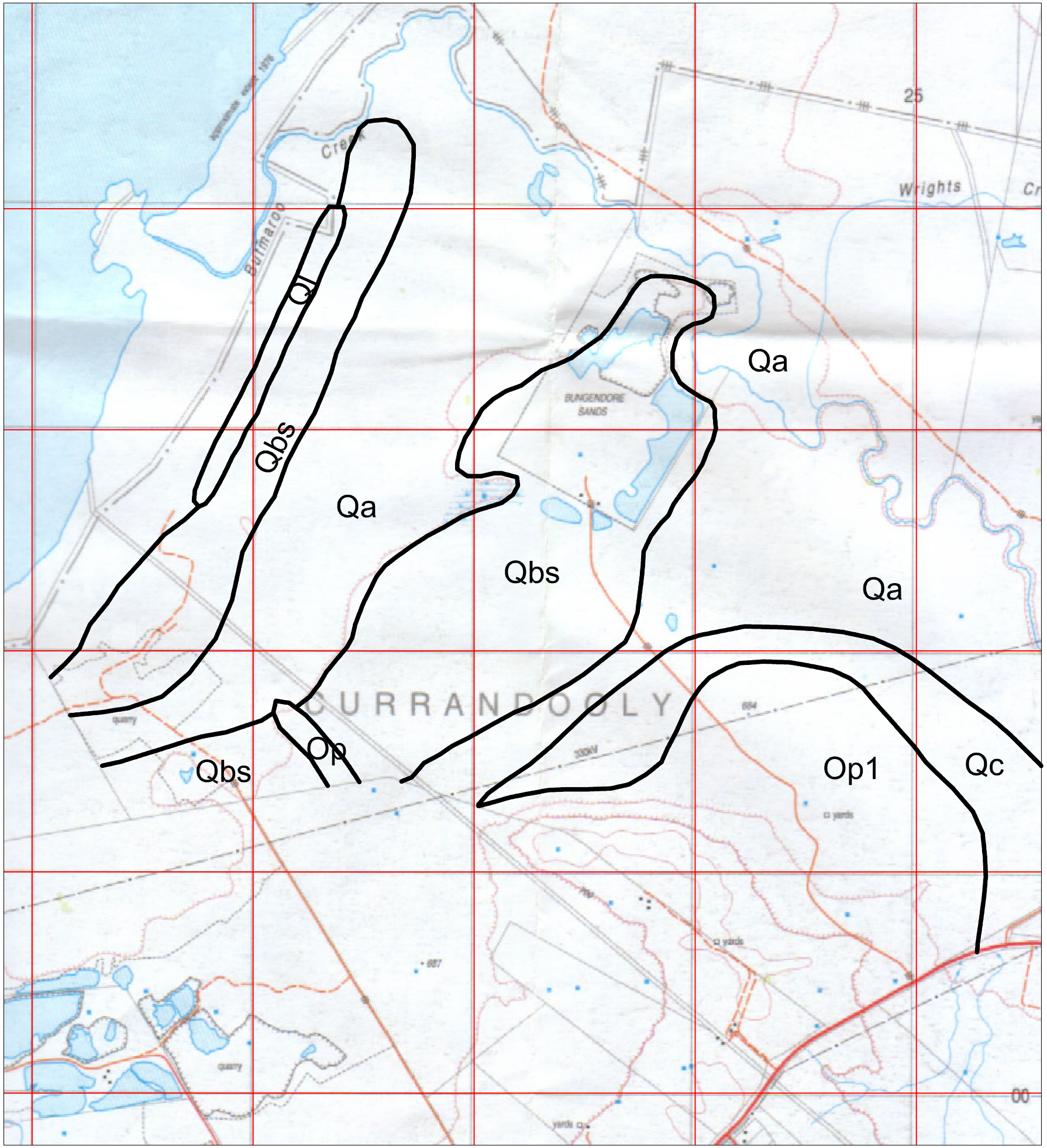
☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater



N

QUATERNARY

Qa	Gravel, sand, sily clay and black organic clay: alluvium
Ql	Clay, lacustrine and logoonal pans
Qbs	Coarse sand and gravel: strandline
Qc	Fanglomerate and poorly cemented conglomerate gravel and sand: colluvium

MIDDLE-LATE ORDOVICIAN

Op1	Psammitic schist, pelitic schist, quartzite and phyillite
Op	Interbedded sandstone, siltstone, shale and minor black shale, chert and impure calcareous sandstone (distal quartz turbidites)

NOTE
The geological interpretation is restricted to the site
Geological boundaries are approximate

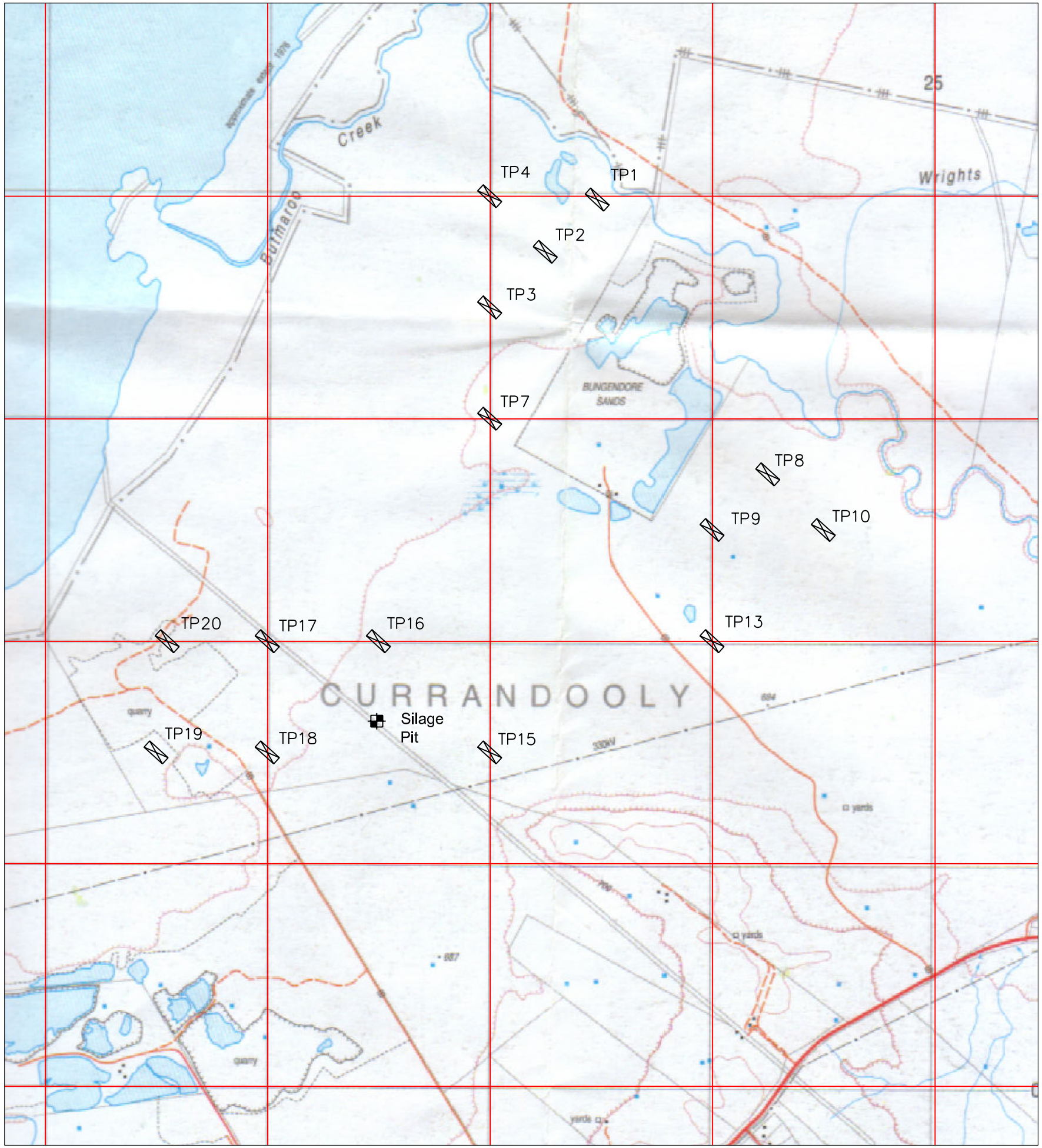
SCALE
0 500 1000 1500 2000m
1:20000

Douglas Partners
Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Canberra, Wyong, Campbelltown, Darwin, Townsville, Cairns, Wollongong

TITLE:
Surficial Geology
Proposed Sand Mine Extension
Grantham Park
BUNGENDORE

CLIENT: Grantham Park Pty Ltd			
DRAWN BY: BM	SCALE: As shown	PROJECT No: 46089	OFFICE: CANBERRA
APPROVED BY: *GMcI*		DATE: 16.11.2006	DRAWING No: 1



N

M.G.A. NORTH

LEGEND

TEST PIT LOCATION

SCALE

0 500 1000 1500 2000m

1:20000

Douglas Partners
Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Canberra, Wyong, Campbelltown, Darwin, Townsville, Cairns, Wollongong

TITLE:
Location of Test Pits
Proposed Sand Mine Extension
Grantham Park
BUNGENDORE

CLIENT: Grantham Park Pty Ltd			
DRAWN BY: BM	SCALE: As shown	PROJECT No: 46089	OFFICE: CANBERRA
APPROVED BY: *GMcI*		DATE: 16.11.2006	DRAWING No: 2

APPENDIX B

Laboratory Test Results

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

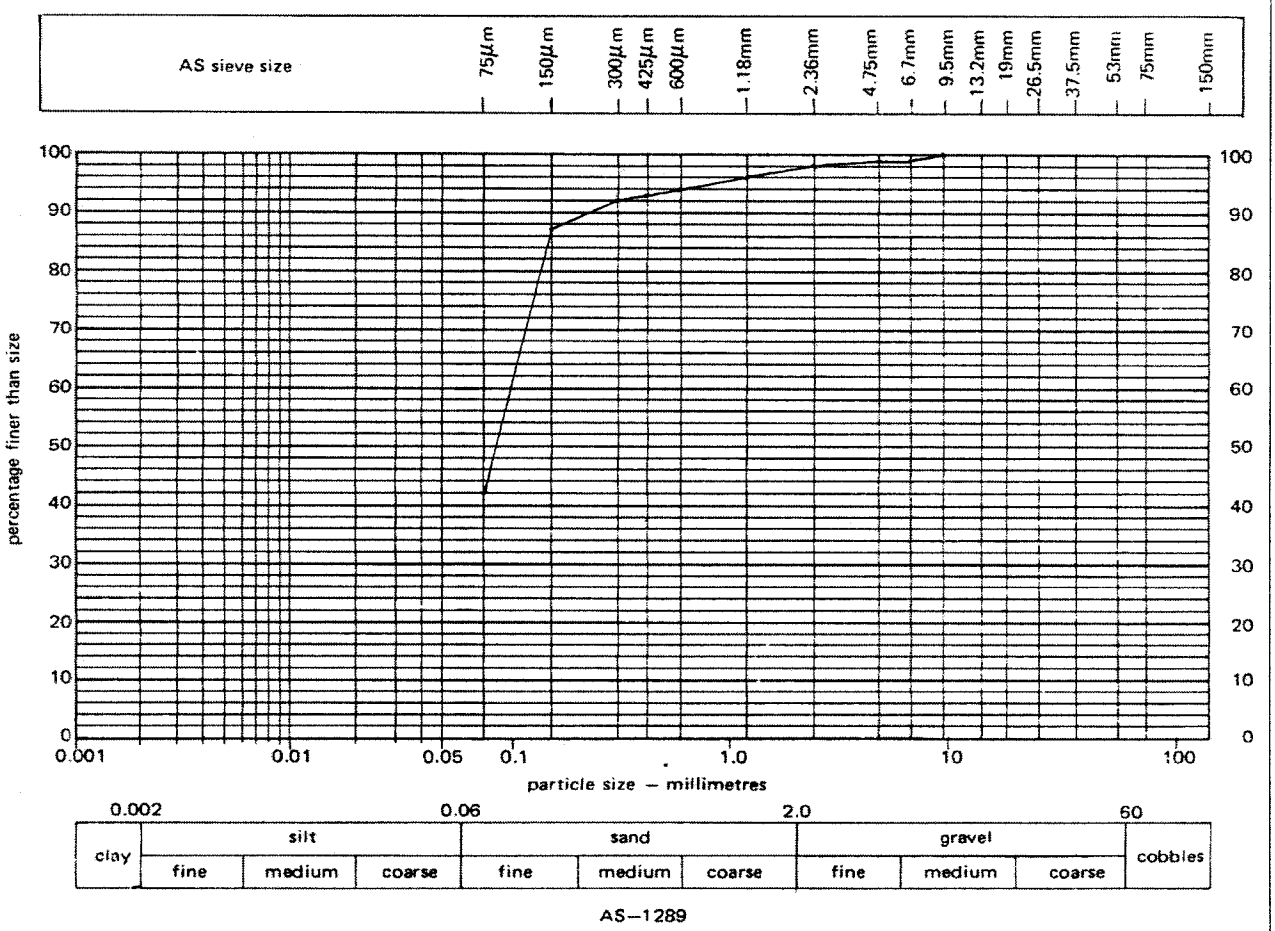
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S122** Client ID: TP1/D1, Depth: 0.5 - 2.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	-	-	-	100	99	99	98	96	94	93	92	87	42	-	-



AS–1289

Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1						
	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

G.W.Collins
03-11-06
Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT — Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd — Tested by.. A.V.

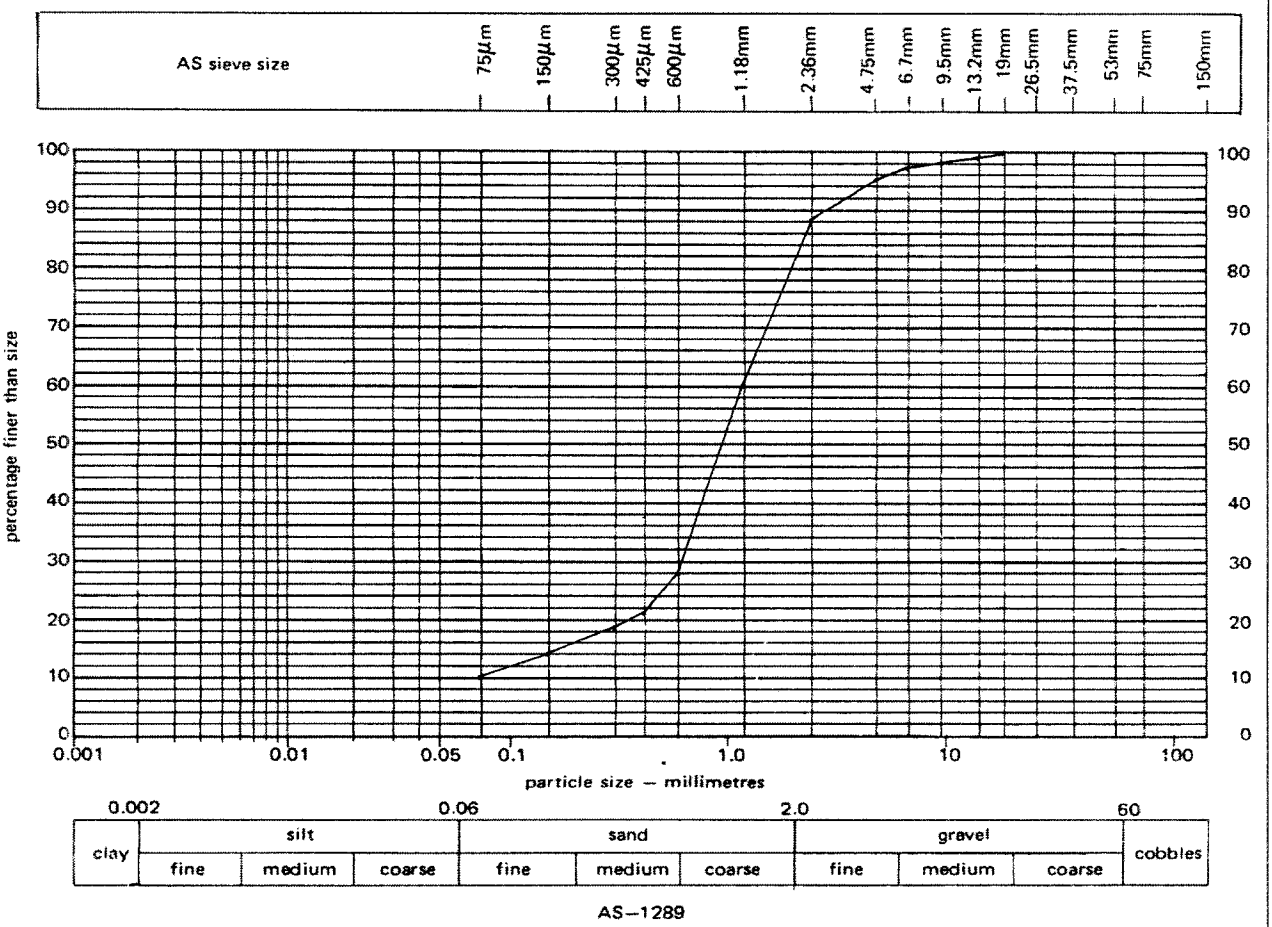
Project: ..... Grantham Park — Date..... 03.11.06

Location: .. BUNGENDORE, NSW — Checked.... G.C.

Sample Identification: **TS 018/S123** Client ID: TP1/D2, Depth: 4.0 - 5.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	100	99	98	97	95	88	60	28	21	18	14	10	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

Page 1 of 1

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G.W.Collins
03-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

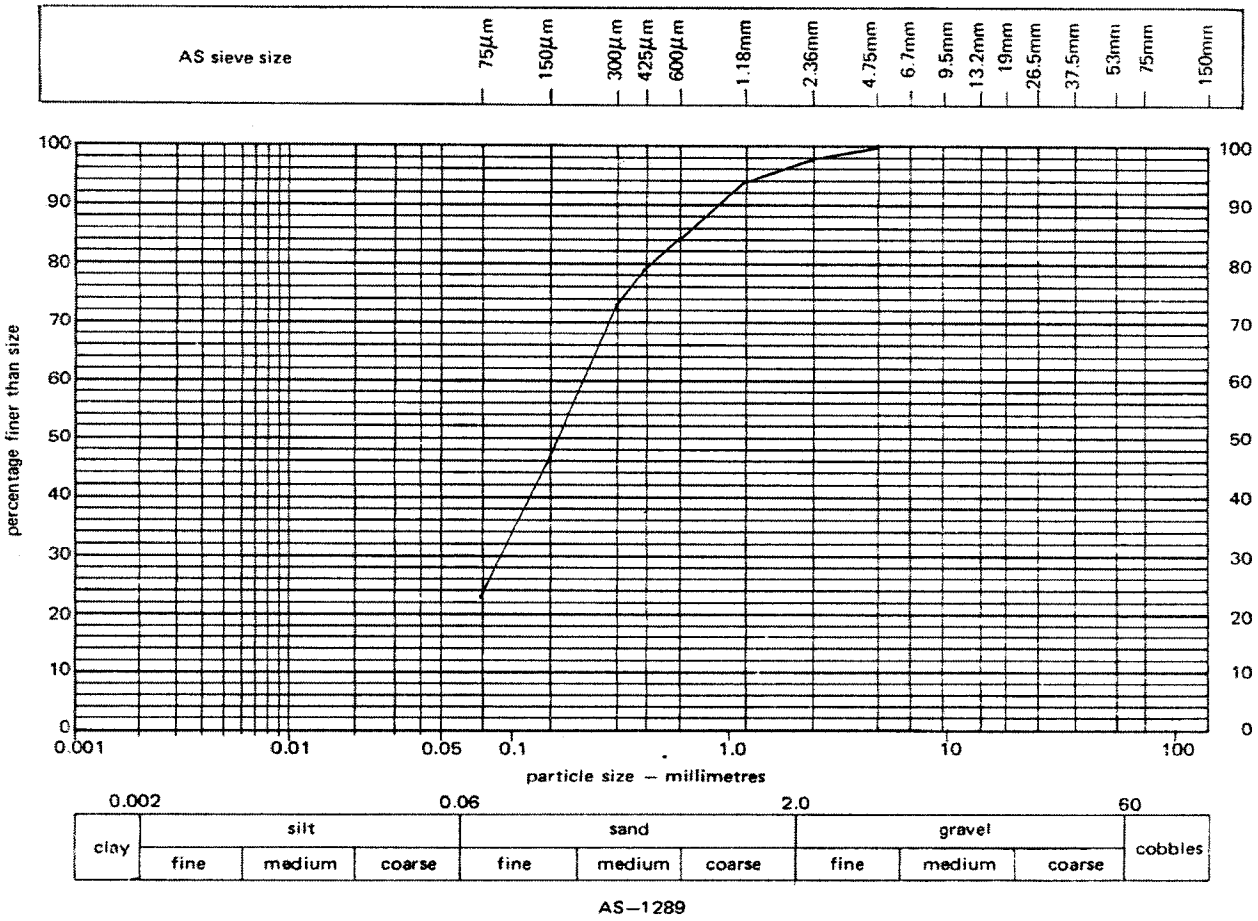
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S124** Client ID: TP2/D1, Depth: 3.5 - 5.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um					
Percent Passing	-	-	-	-	-	-	-	-	-	100	98	94	84	79	73	46	23	-	-					



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

G.W.Collins
23-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

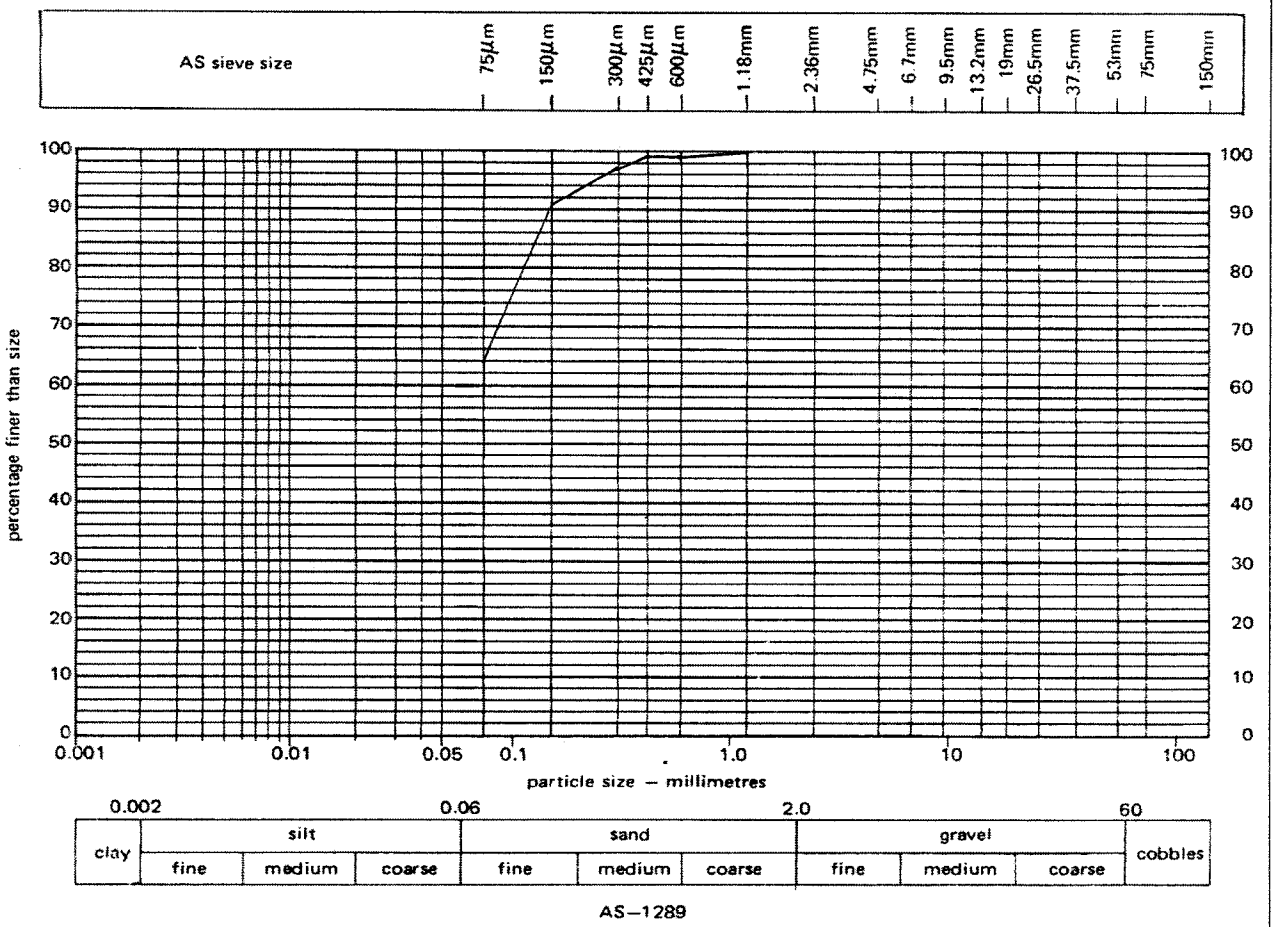
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S125** Client ID: TP3/D1, Depth: 0.3 - 2.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um					
Percent Passing	-	-	-	-	-	-	-	-	-	-	-	100	99	99	97	91	64	-	-					



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

Page 1 of 1

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G.W.Collins

03-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

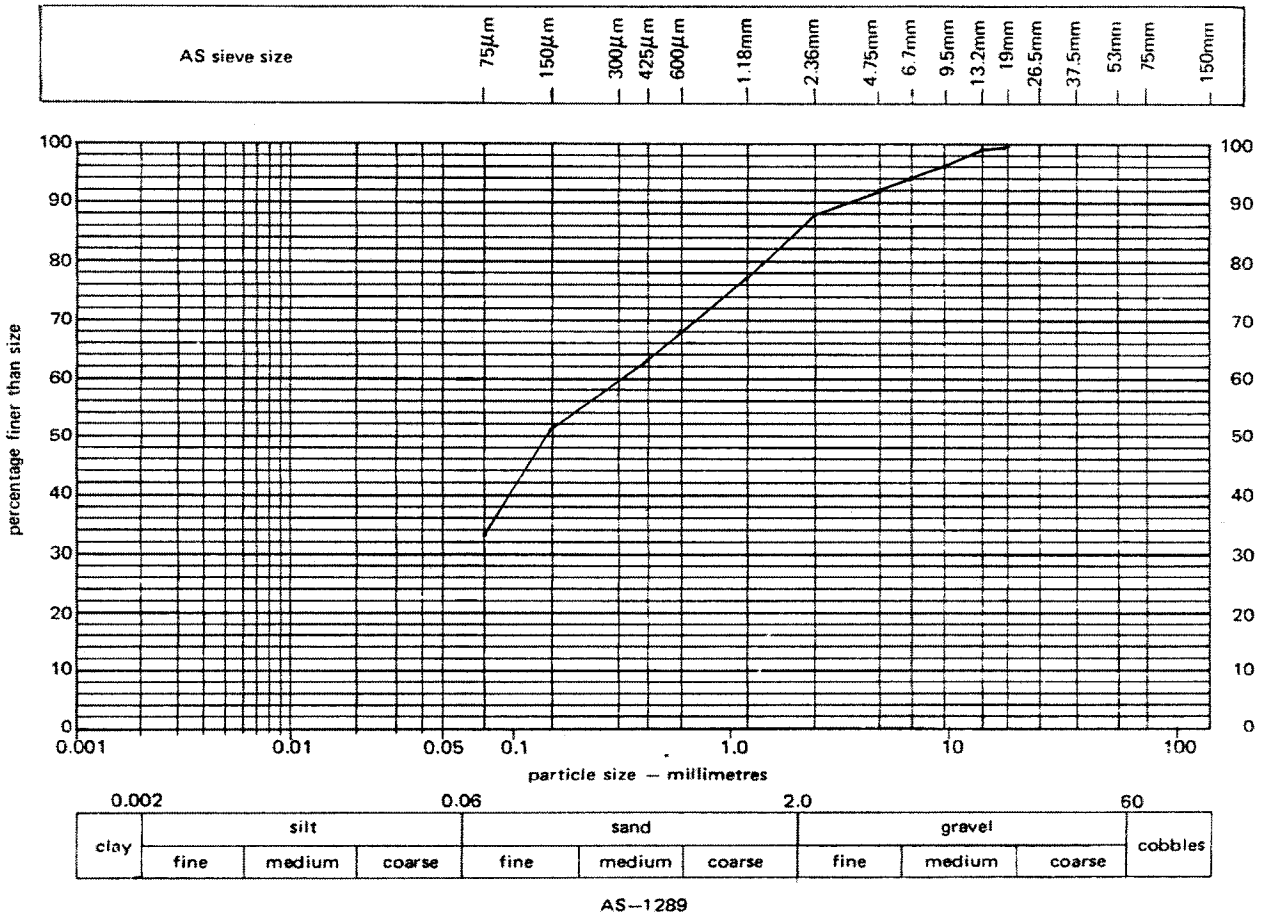
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S126** Client ID: TP3/D2, Depth: 2.5 - 3.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	100	99	96	94	92	88	77	68	63	57	51	33	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT — Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd — Tested by.. A.V.

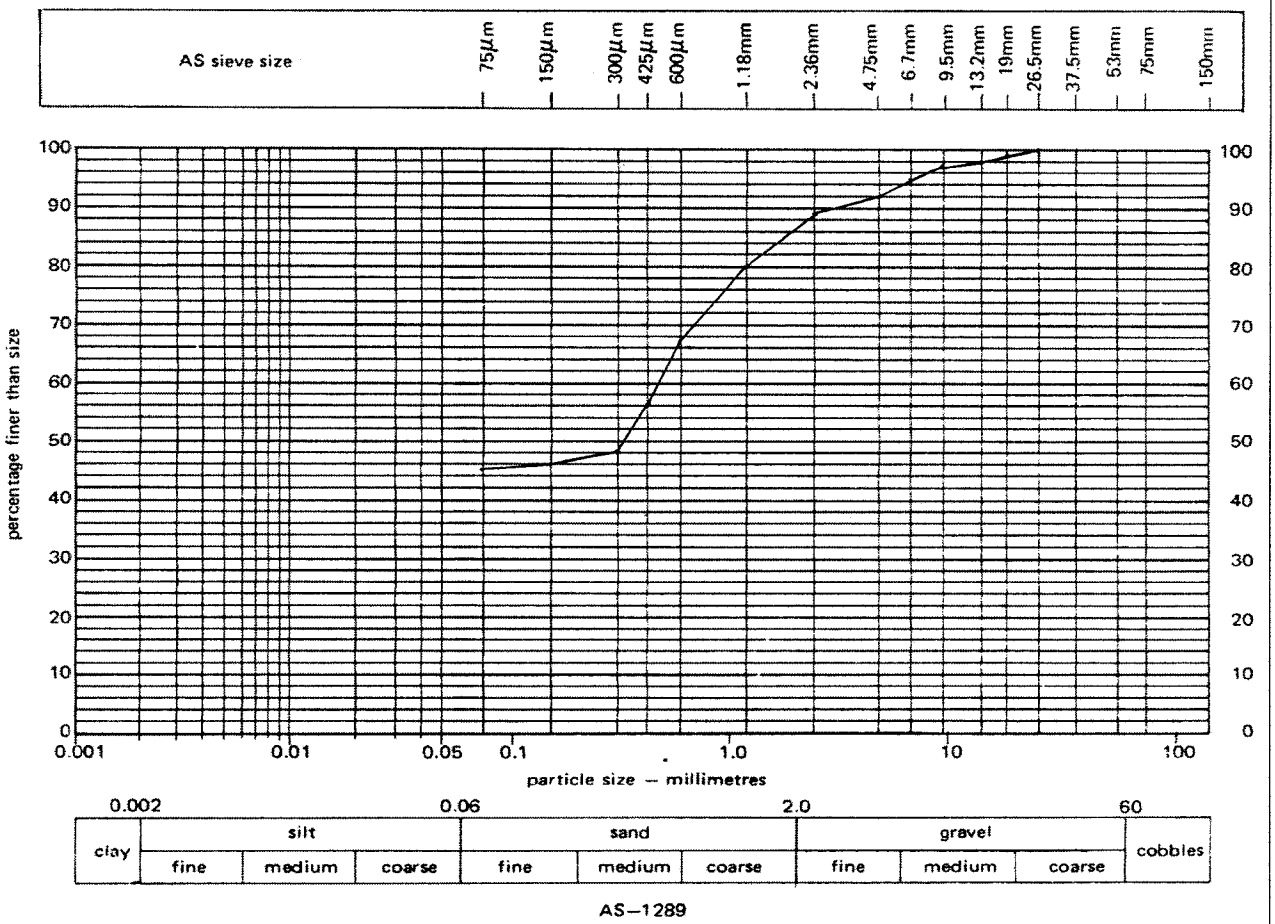
Project: ..... Grantham Park — Date..... 03.11.06

Location: .. BUNGENDORE, NSW — Checked.... G.C.

Sample Identification: **TS 018/S127** Client ID: TP3/D3, Depth: 3.0 - 3.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	100	99	98	97	95	92	89	80	67	56	48	46	45	-	-



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

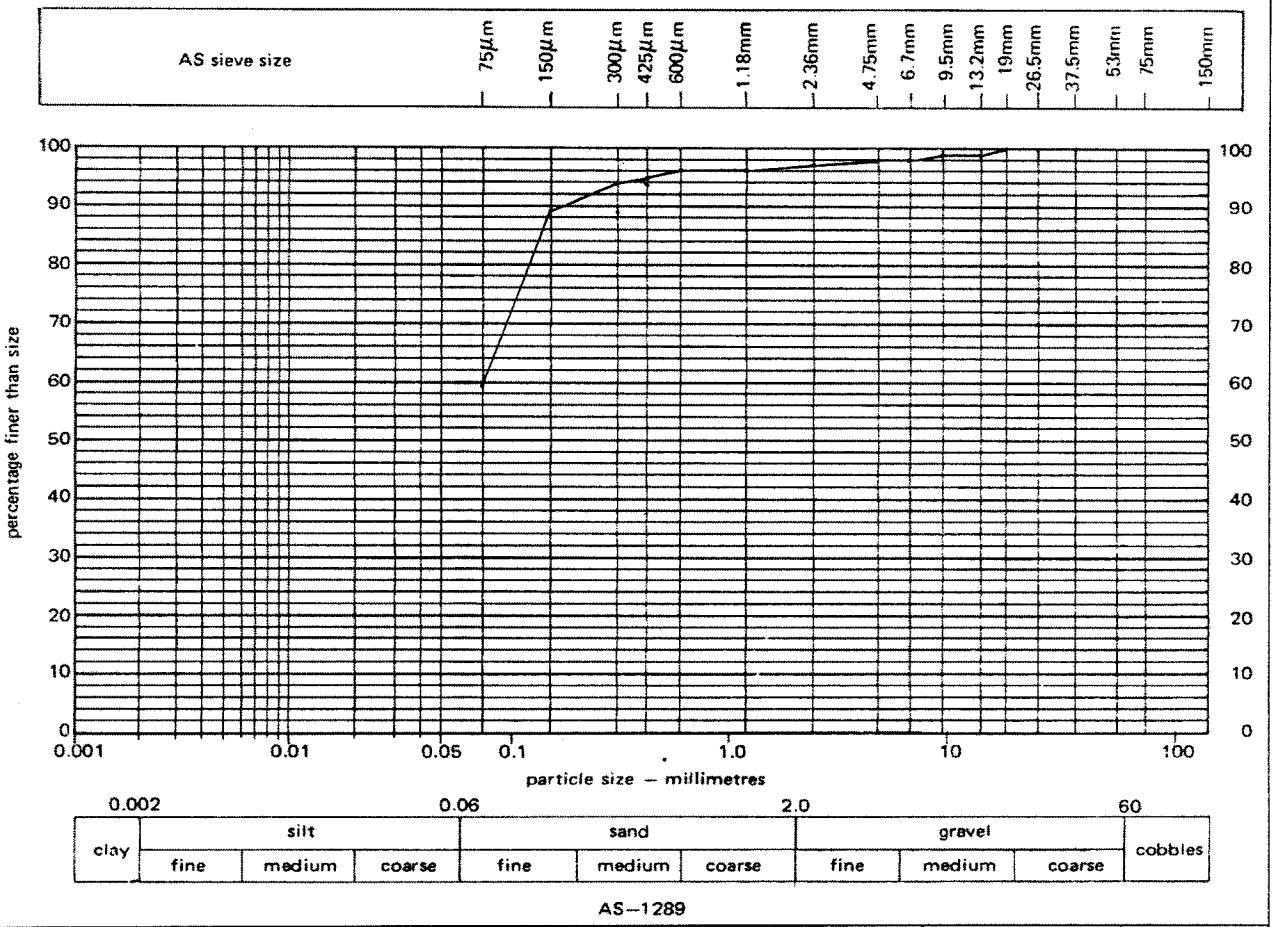
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S128** Client ID: TP4/D1, Depth: 1.5 - 4.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	100	99	99	98	98	97	96	96	95	94	89	60	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT — Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd — Tested by.. A.V.

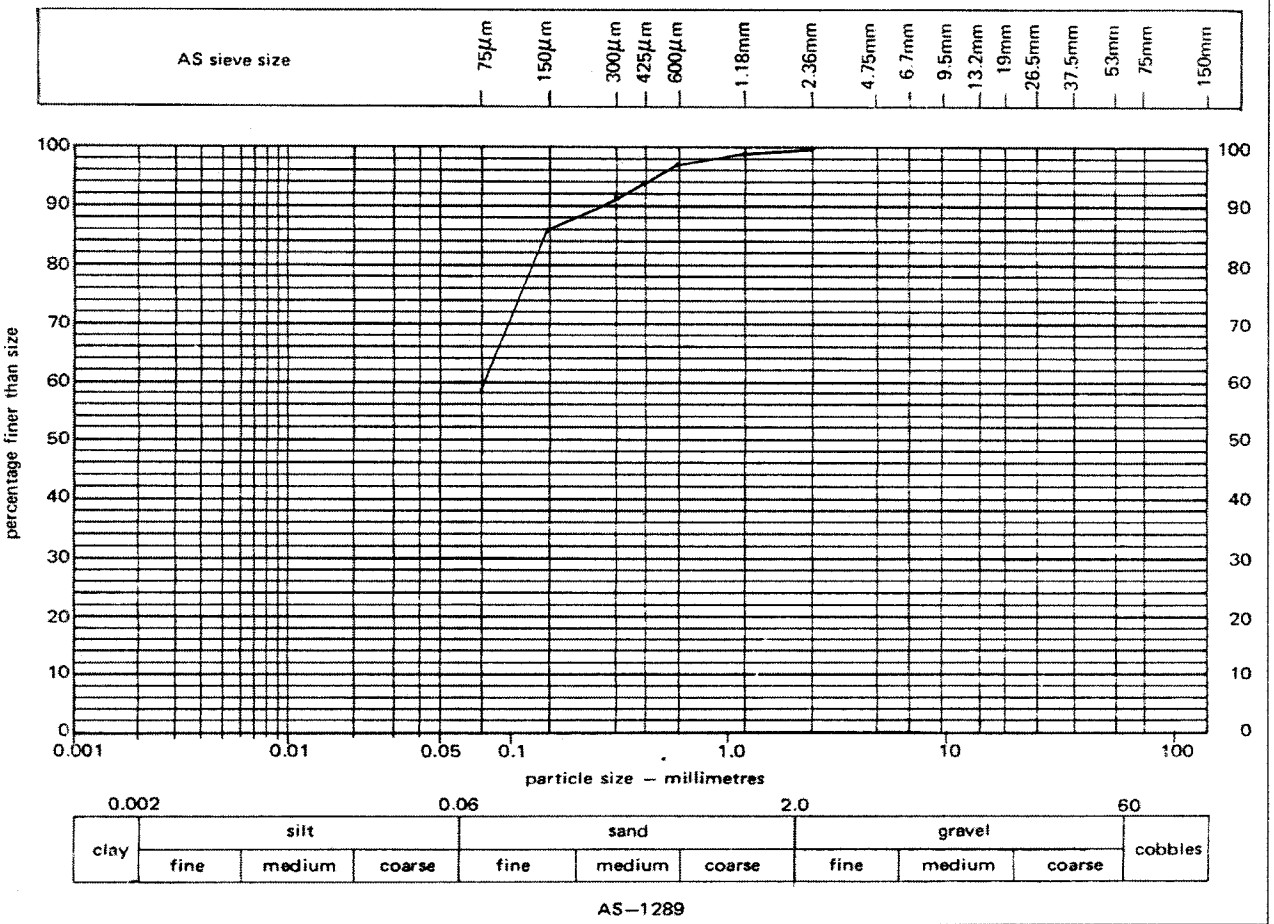
Project: ..... Grantham Park — Date..... 03.11.06

Location: .. BUNGENDORE, NSW — Checked.... G.C.

Sample Identification: **TS 018/S129** Client ID: TP7/D1, Depth: 1.0 - 2.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	-	-	-	-	-	-	100	99	97	94	91	86	58	-	-



AS–1289

Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1						
	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

03-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

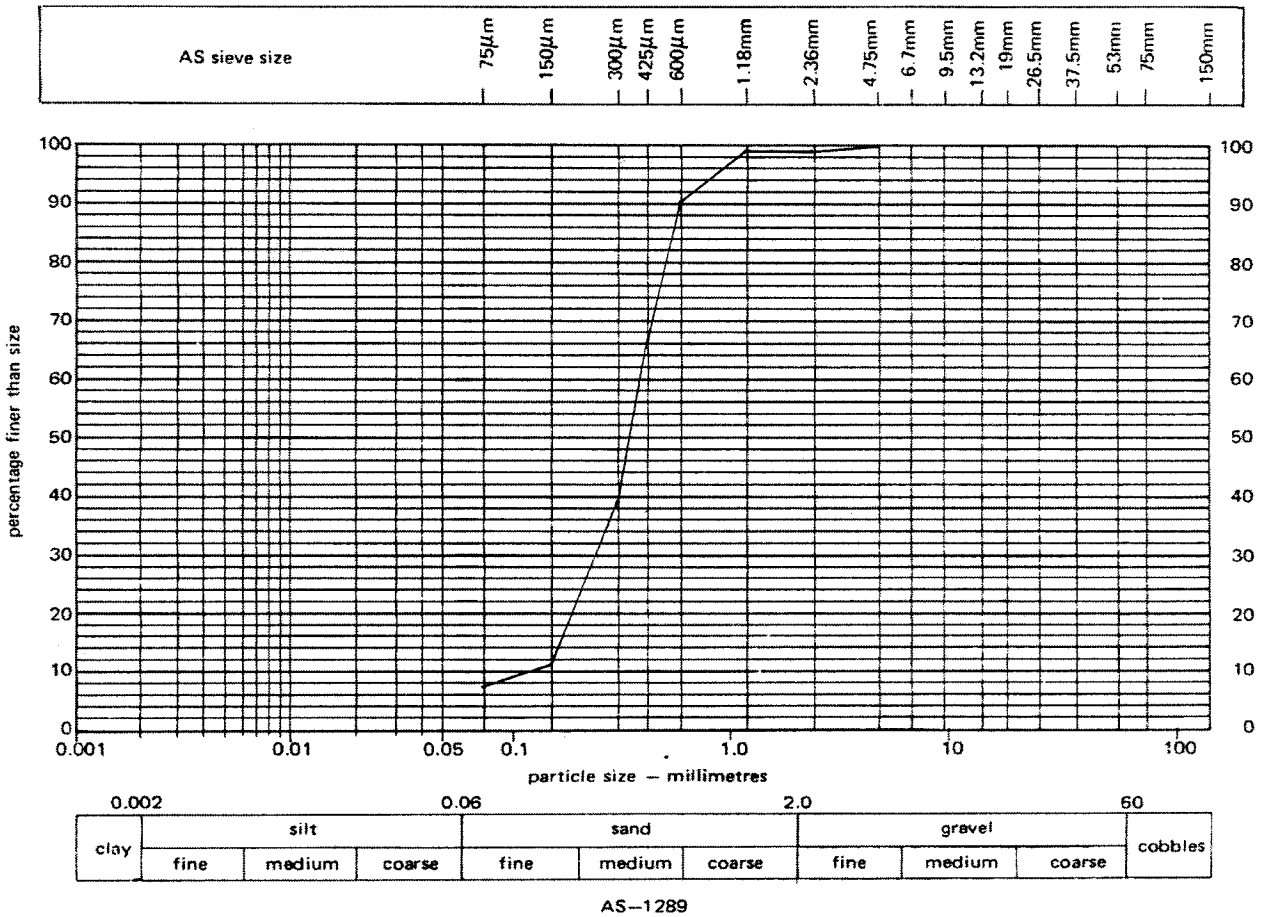
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S130** Client ID: TP7/D2, Depth: 2.5 - 3.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um					
Percent Passing	-	-	-	-	-	-	-	-	-	100	99	99	90	66	39	11	7	-	-					



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

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G.W.Collins
03-11-06

Approved Signatory/Date

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16 Kemble Court
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Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

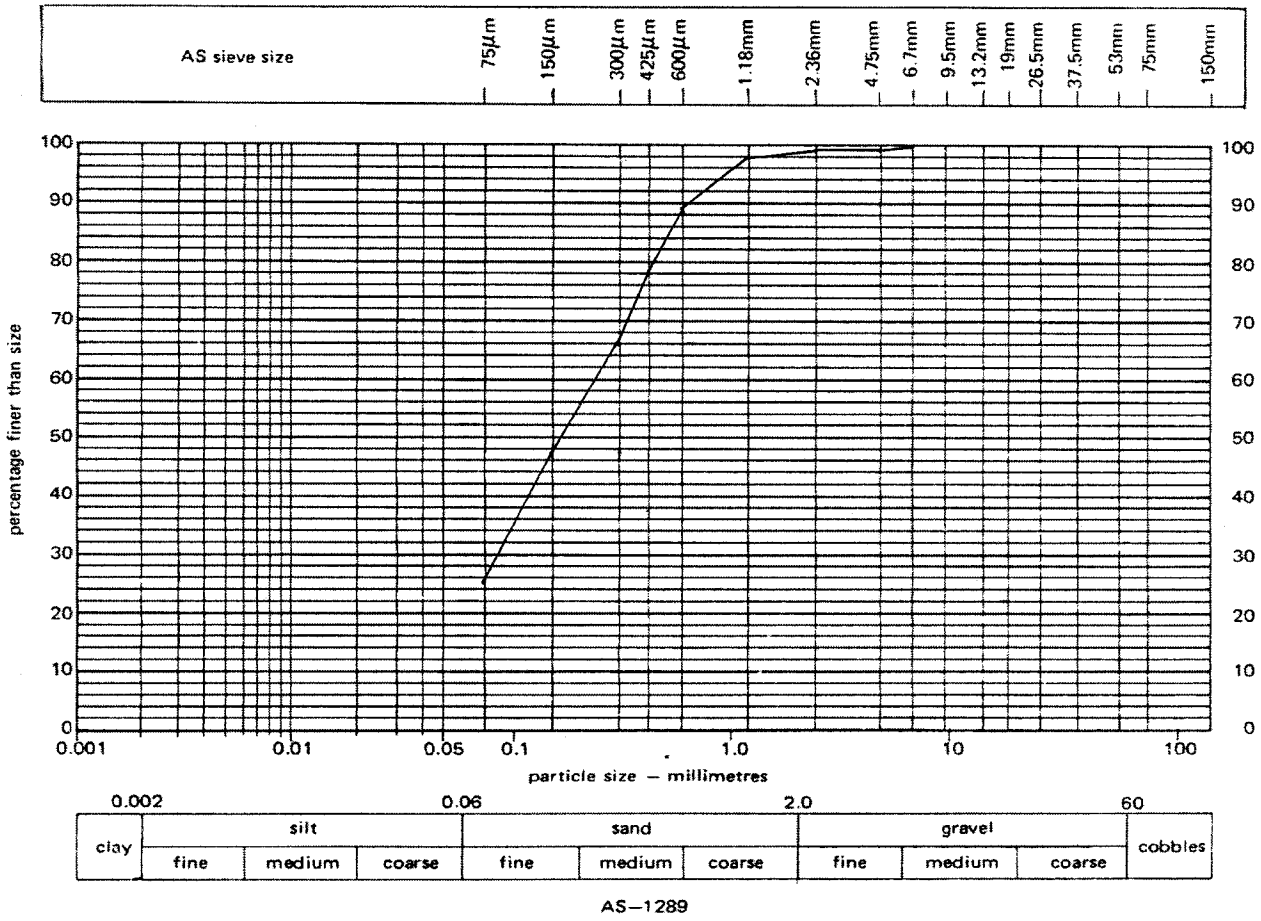
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S131** Client ID: TP8/D1, Depth: 2.5 - 4.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	-	-	-	100	99	99	98	89	78	66	47	25	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

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03-11-06

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TESTCRETE
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16 Kemble Court
MITCHELL ACT 2911
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Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

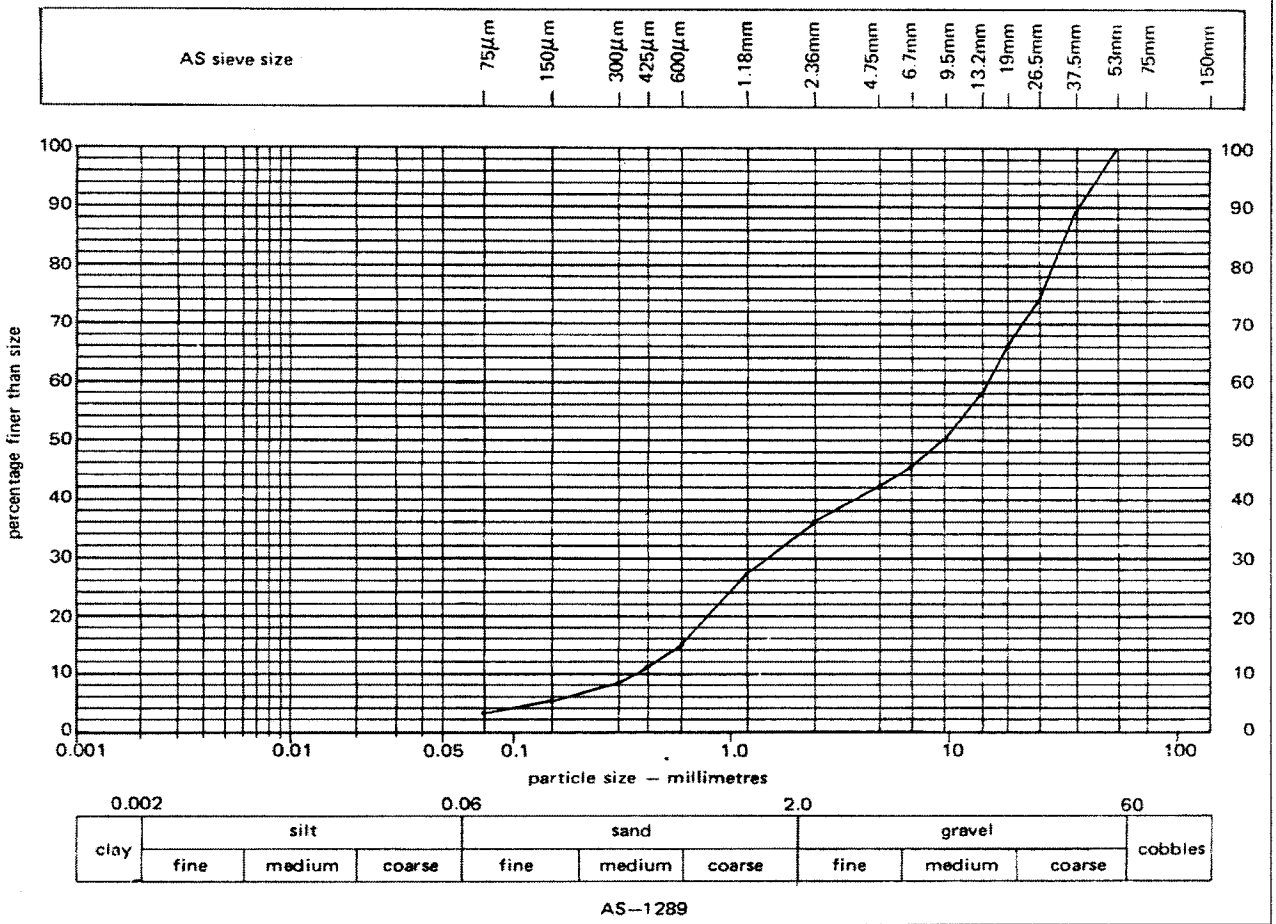
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S132** Client ID: TP8/D2, Depth: 4.5 - 5.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	100	89	74	66	58	50	45	42	36	27	15	11	8	5	3	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

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G.W.Collins
03-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

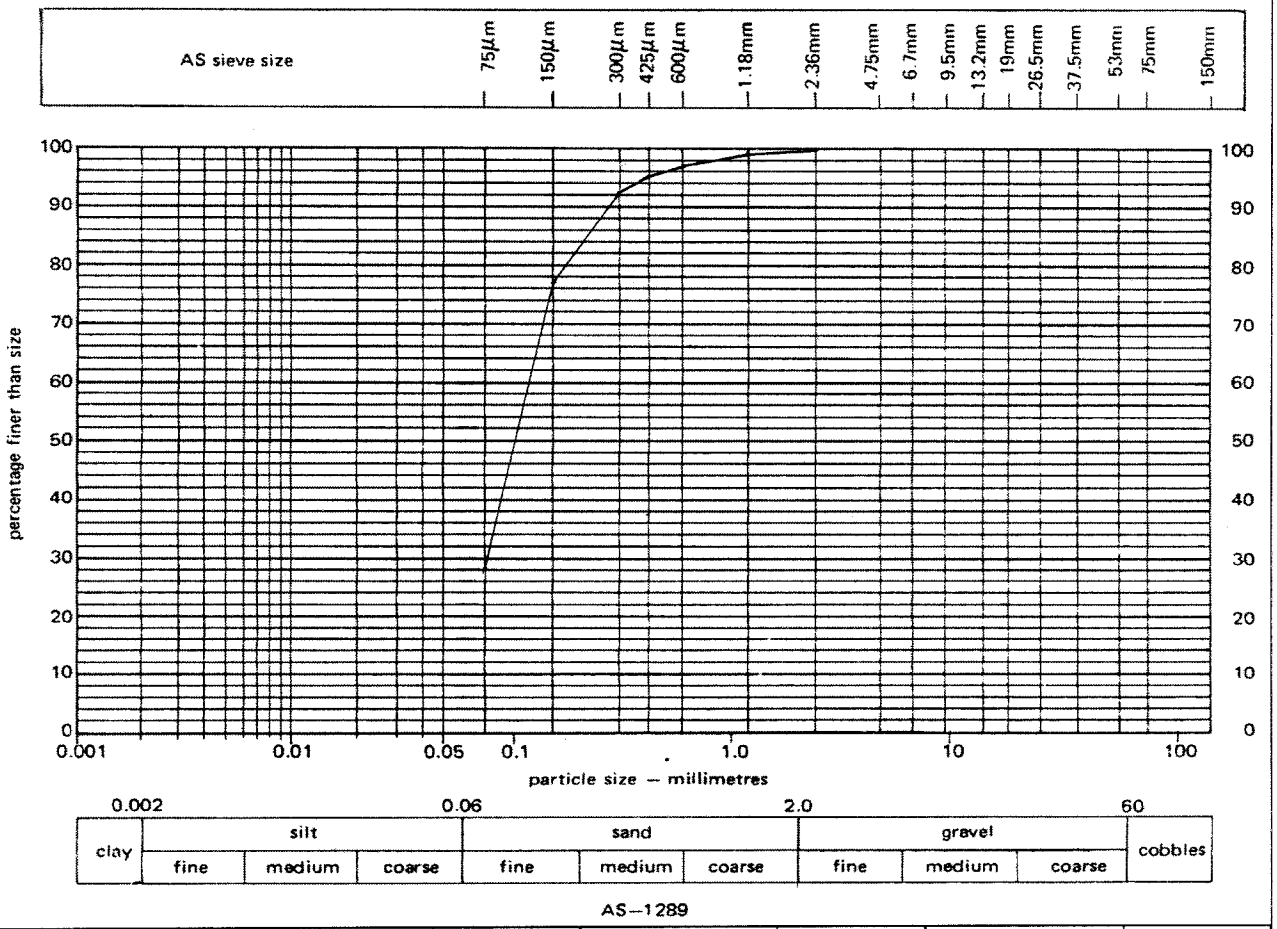
Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06
Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.
Project: ..... Grantham Park
Date..... 03.11.06
Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S133** Client ID: TP9/D1, Depth: 1.5 - 2.2m
Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	-	-	-	-	-	**100**	**99**	**97**	**95**	**92**	**77**	**28**	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

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G.W.Collins
03-11-06

Approved Signatory/Date

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LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
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ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT — Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd — Tested by.. A.V.

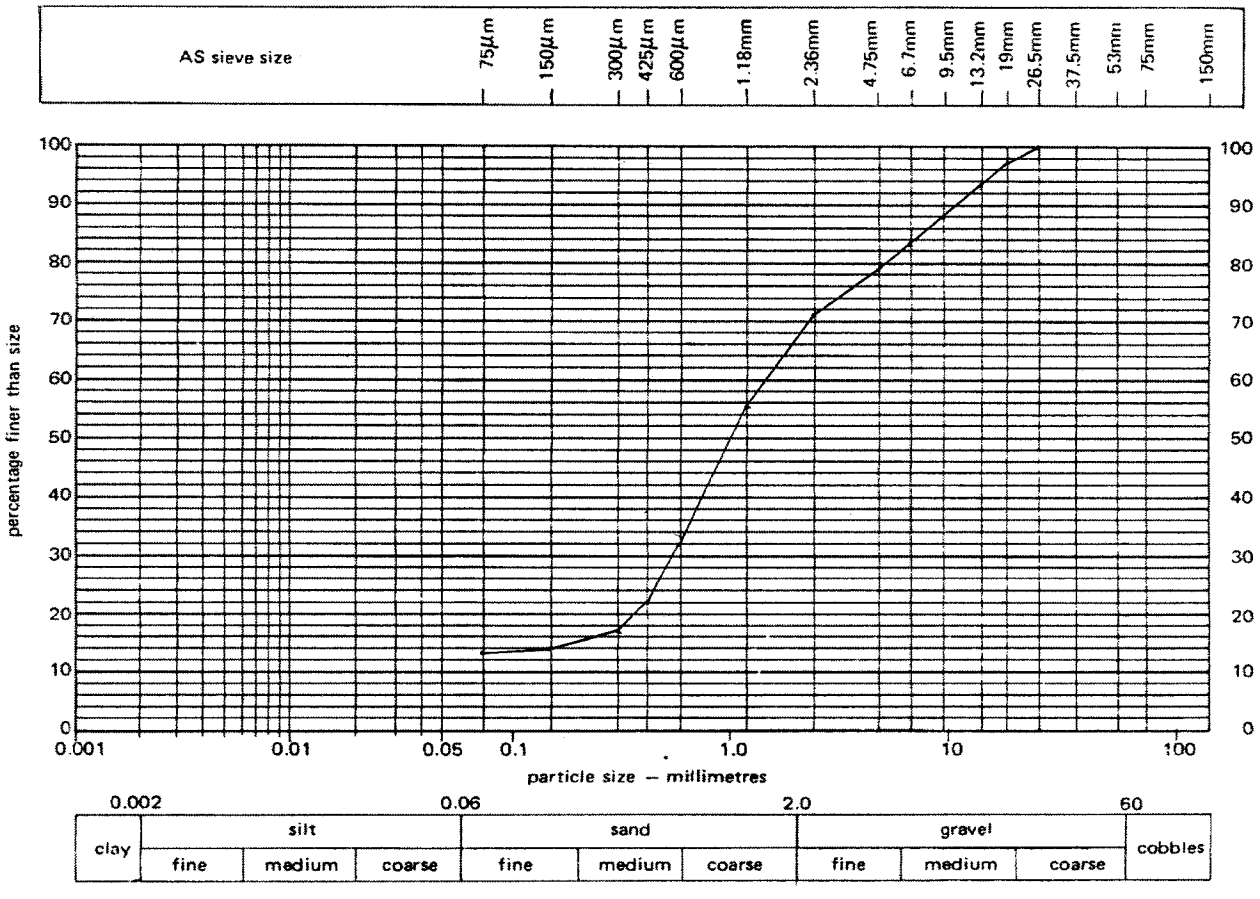
Project: ..... Grantham Park — Date..... 03.11.06

Location: .. BUNGENDORE, NSW — Checked.... G.C.

Sample Identification: **TS 018/S134** Client ID: TP9/D2, Depth: 2.7 - 4.5m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	100	97	93	88	83	79	71	55	32	22	17	14	13	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

G.W.Collins

23-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

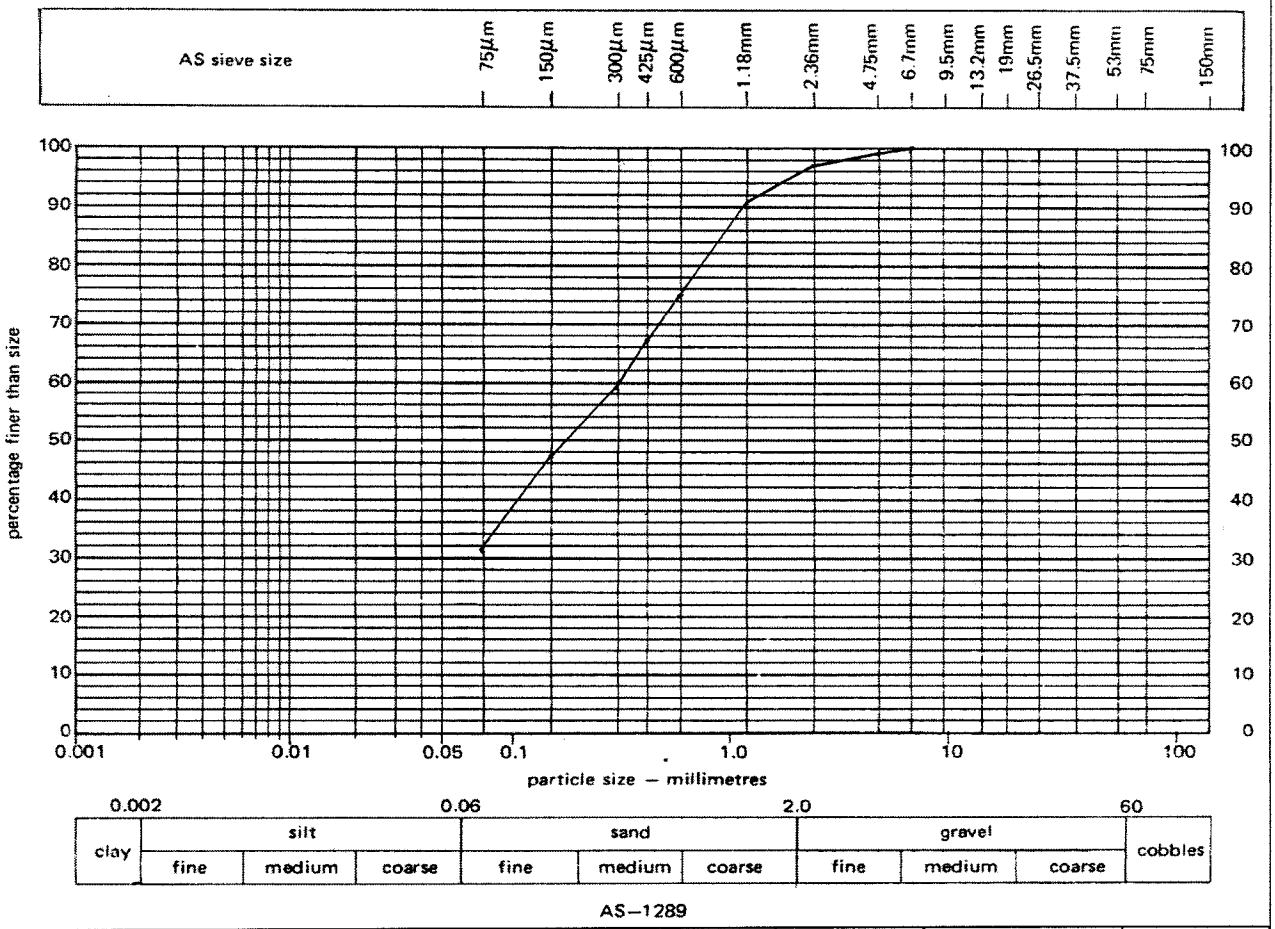
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S135** Client ID: TP10/D1, Depth: 0.5 - 3.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um						
Percent Passing	-	-	-	-	-	-	-	-	100	99	97	91	75	67	59	47	31	-	-						



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

Page 1 of 1

G W Collins
03-11-06

Approved Signatory/Date

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TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

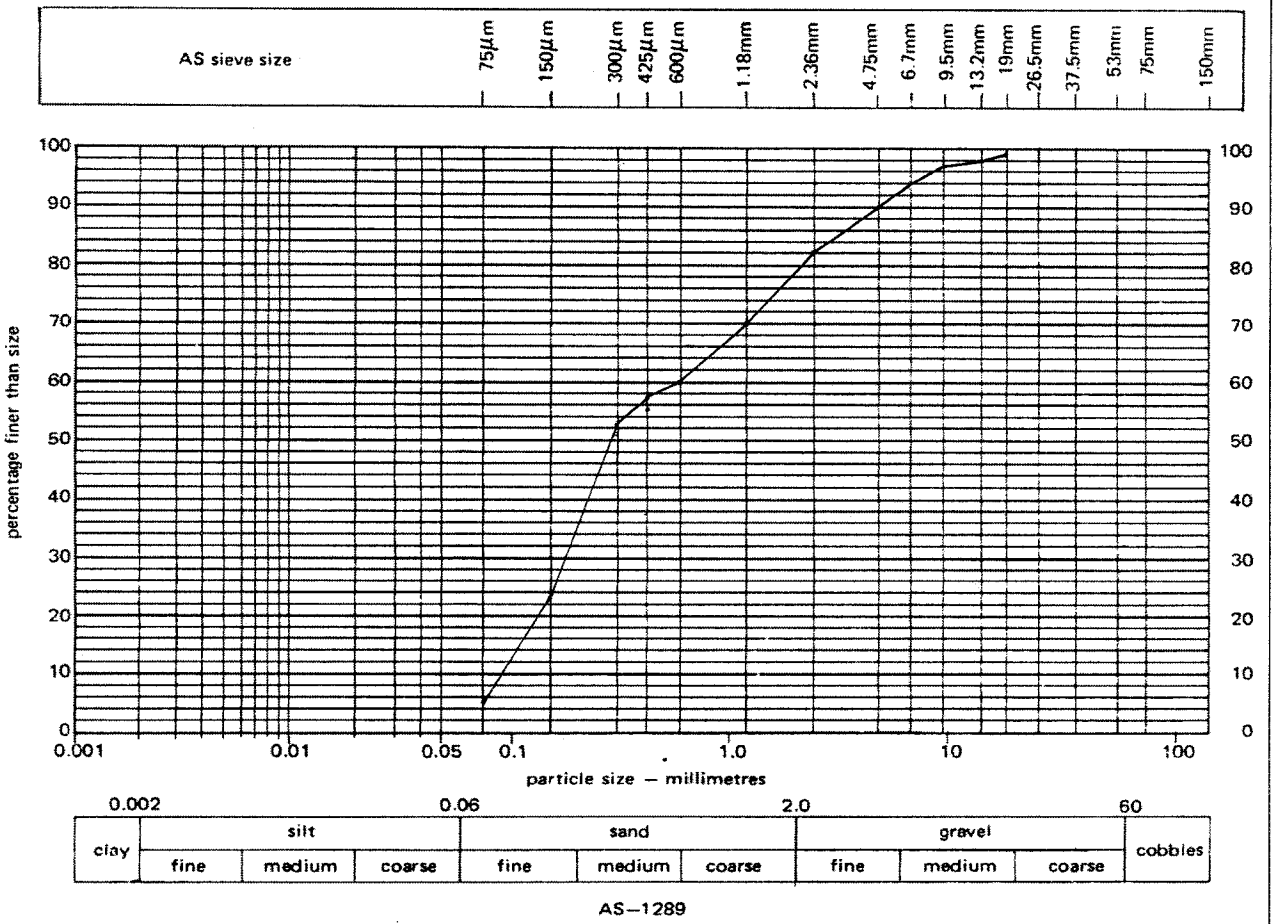
Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Principal: .. Douglas Partners Pty Ltd
Project: ..... Grantham Park
Location: .. BUNGENDORE, NSW

Date..... 31.10.06
Tested by.. A.V.
Date..... 03.11.06
Checked.... G.C.

Sample Identification: **TS 018/S136** Client ID: TP16/D1, Depth: 4.0 - 5.5m
Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	100	99	98	97	94	90	82	70	60	57	53	23	5	-	-



Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1						
	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

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TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

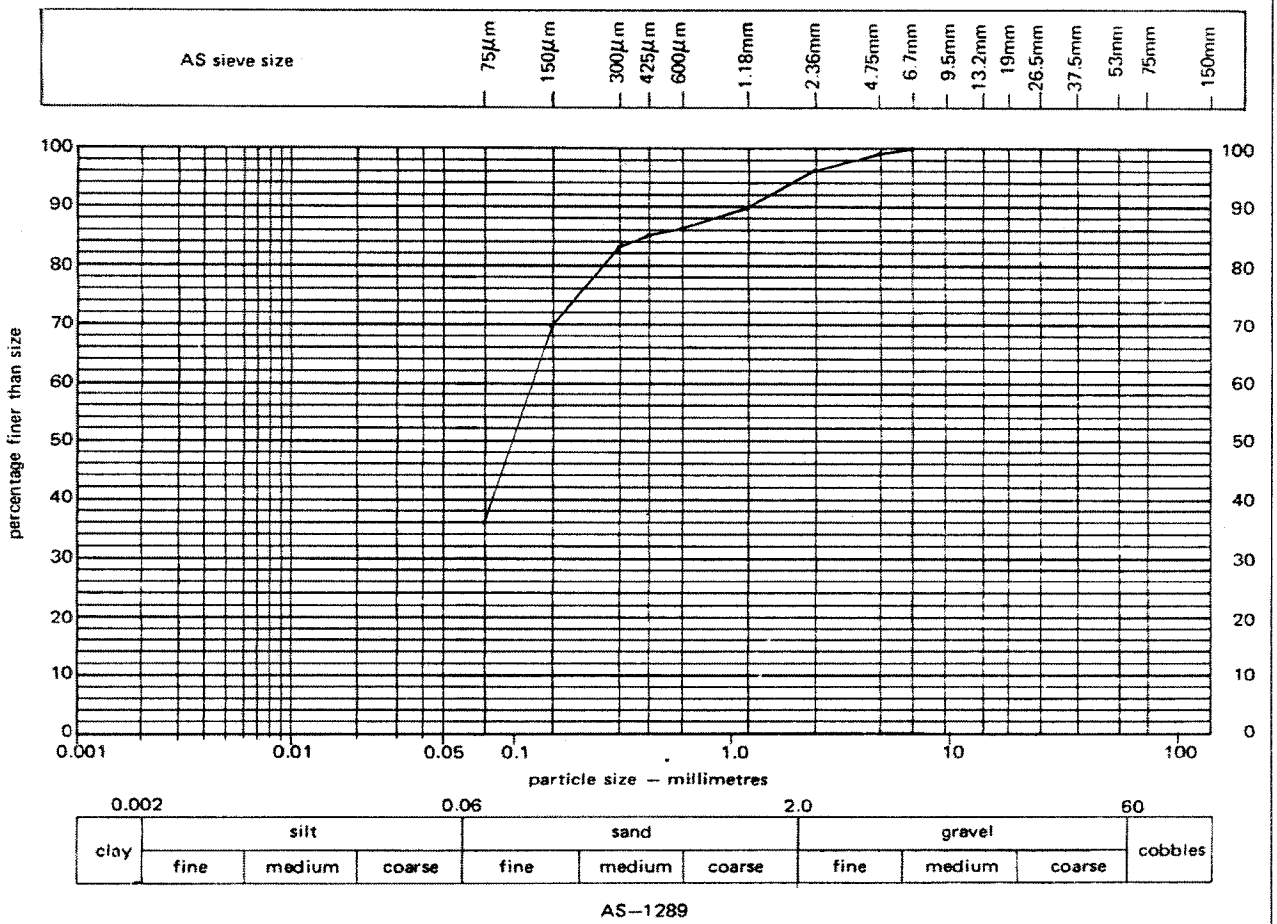
Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT — Date..... 31.10.06
Principal: .. Douglas Partners Pty Ltd — Tested by.. A.V.
Project: ..... Grantham Park — Date..... 03.11.06
Location: .. BUNGENDORE, NSW — Checked.... G.C.

Sample Identification: **TS 018/S137** Client ID: TP18/D1, Depth: 3.0 - 4.0m
Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	-	-	-	-	100	99	96	90	86	85	83	70	36	-	-



AS–1289

Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1						
	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

NATA

03-11-06

Approved Signatory/Date

TESTCRETE
LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
Telephone: 02 6241 1322
Fax: 02 6241 7593
ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06

Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.

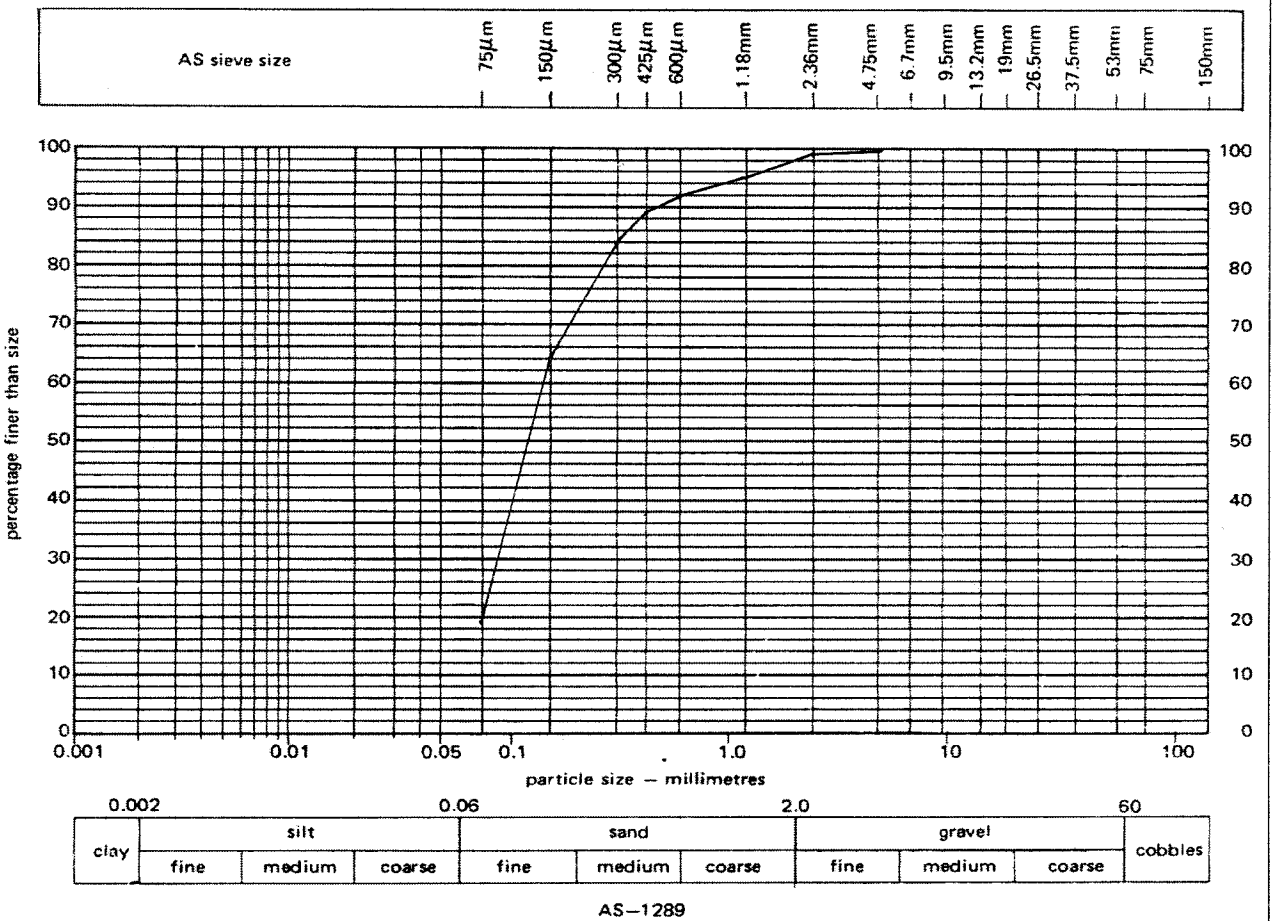
Project: ..... Grantham Park
Date..... 03.11.06

Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S138** Client ID: TP19/D1, Depth: 1.5 - 3.0m

Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	-	-	-	-	-	100	99	95	92	89	84	64	19	-	-



AS–1289

Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

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03-11-06

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LABORATORIES PTY. LIMITED.

16 Kemble Court
MITCHELL ACT 2911
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Fax: 02 6241 7593
ABN: 35 102 659 754

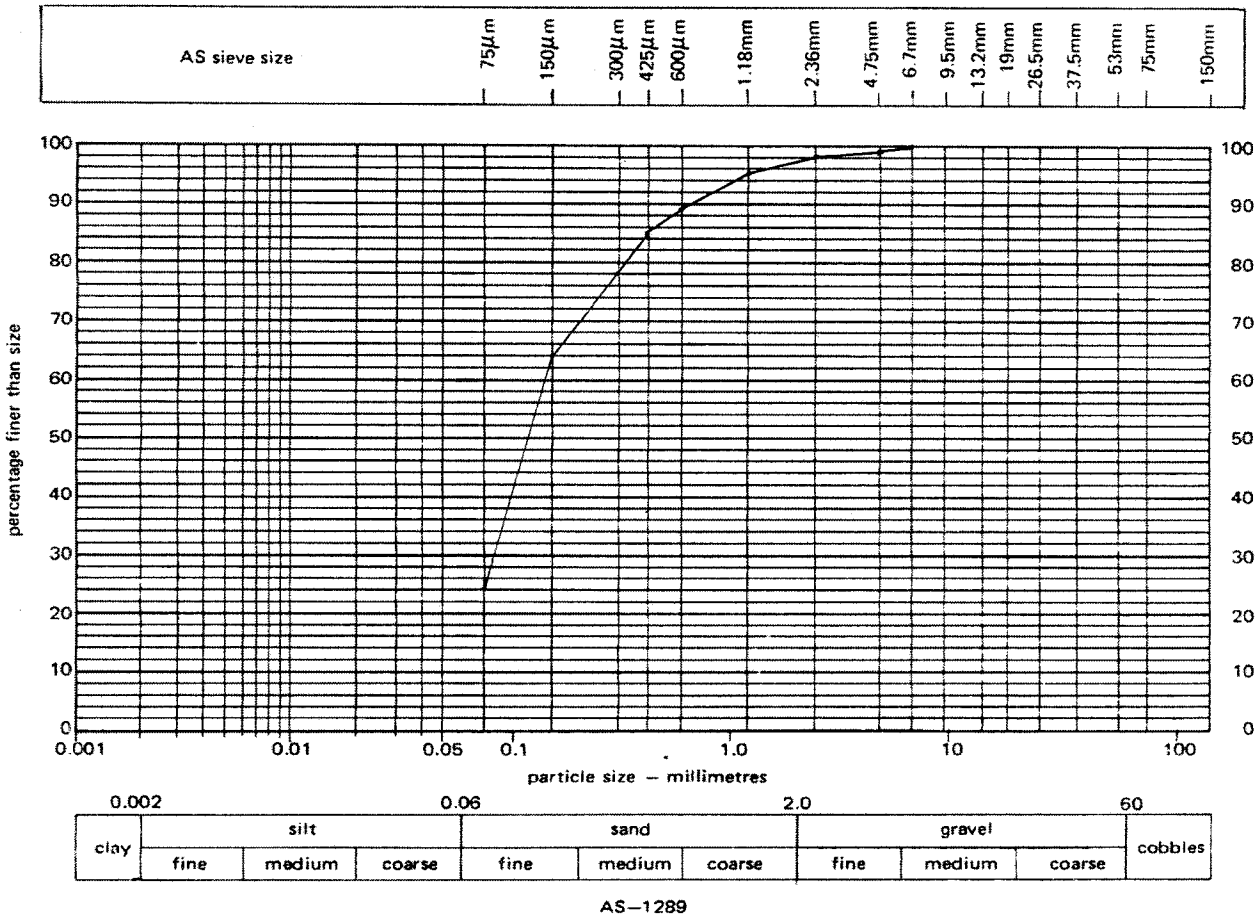
Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, WARAMANGA ACT
Date..... 31.10.06
Principal: .. Douglas Partners Pty Ltd
Tested by.. A.V.
Project: ..... Grantham Park
Date..... 03.11.06
Location: .. BUNGENDORE, NSW
Checked.... G.C.

Sample Identification: **TS 018/S139** Client ID: TP20/D1, Depth: 0.0 - 3.5m
Test Procedure: AS 1289 3.6.1 Sampled by Client submitted 30.10.06

AS Sieve size	150 mm	75 mm	53 mm	37.5 mm	26.5 mm	19.0 mm	13.2 mm	9.5 mm	6.7 mm	4.75 mm	2.36 mm	1.18 mm	600 um	425 um	300 um	150 um	75 um	13.2 um	0.02 um
Percent Passing	-	-	-	-	-	-	-	-	100	99	98	95	89	85	78	64	24	-	-



AS–1289

Atterberg Limits AS1289 3.1.1,3.2.1,3.3.1,3.4.1						
	Liquid Limit	- %	Plastic Limit	- %	Plasticity Index	- %
	Linear Shrinkage	- %				

Remarks:

Form No 1. R1289 3.6.1

G.W.Collins

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23-11-06

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