Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Sand Mine Expansion
Tarago Road, Lake George

Prepared for
Grantham Park Holdings Pty Ltd

Project 46089.01
September 2017

Douglas Partners
Geotechnics / Environment / Groundwater

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Geotechnical Investigation
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1. Introduction

This report presents the results of additional geotechnical investigation undertaken for a proposed sand mine expansion at Tarago Road, Lake George. The investigation was commissioned in an email dated 26 July 2017 by Mr Jim Osborne of Grantham Park Holdings Pty Ltd and was undertaken in accordance with Douglas Partners' email proposal dated 26 July 2017.

It is understood that the additional investigation has been requested to support a previous investigation prior to the client lodging a development application. It is further understood as part of that development application that the sand resource is required to be in excess of 5 million tonnes.

The aim of the investigation was to further assess the subsurface soil and groundwater conditions across the site in order to provide an estimate of the extent of the sand resource.

The investigation included the excavation of seven test pits and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

This report must be read in conjunction with the notes “About this Report” which are included in Appendix A.

2. Previous Investigation

The site has been the subject of a previous geotechnical investigation by Douglas Partners Pty Ltd (DP) with the results summarised in a report dated December 2006 (Project No 46089). The previous investigation examined sand reserves at a feasibility level, and the opportunities for extending the existing mining operation.

The report concluded that the most viable sand deposits were located within strandlines (ie: previous lake shore lines). The main sand mining operation, referred to as the Currandooley pit, could be extended to the south to extract additional resources. However the investigation has also found that an extension on the eastern side appears possible. Additional test pits were recommended to confirm these preliminary findings.

A site plan showing the previous test pit locations are presented in Drawing 1 (Appendix B) with the test pit logs included in Appendix C.

3. Site Description and Regional Geology

The site is located to the south east of the southernmost part of Lake George, to the north west, west and south west of the existing sand mining operation on the site. Figure 1 below shows the site locality.

Figure 1: Site Locality

At the time of the investigation, the site was lightly to moderately grassed.

Reference should be made to DP's 2006 report which provides a comprehensive description of the regional geology underlying the site.

4. Field Work Methods

The field investigation comprised the excavation of seven test pits (Pits 1 – 7). The test pits were excavated to 7.0 m depth using a Volvo 360A excavator fitted with a 1200 mm wide bucket. The test pits were logged on site by a senior geotechnical engineer who also undertook geotechnical sampling to assist with strata identification and for laboratory testing. The test pits were located on site using a handheld GPS unit which is accurate to approximately 5 m. The coordinates are provided on the each test pit log and the test locations are shown on Drawing 1 in Appendix B. The surface level shown on each test pit log was interpreted from Google Earth and very approximate and must not be relied on.

5. Field Work Results

Details of the subsurface conditions encountered in the current investigation are provided in the test pit logs in Appendix C together with explanatory notes defining classification methods and descriptive terms. The test pits encountered variable conditions underlying the site which are summarised in Table 1.

Table 1: Summary of Subsurface Conditions

Pit No	Subsurface Strata Thickness (m)			Groundwater Depth (m)
	Topsoil	Interbedded Clay/Sand/Gravel	Sand	
1	0 – 0.3	0.3 – 5.2	3.2 – 4.2 & 5.2 - >7.0	5.8
2	0 – 0.2	0.2 – 4.1	4.1 – 6.6	5.3
3	0 – 0.2	0.2 – 4.7	4.7 - >7.0*	5.3
4	0 – 0.25	0.25 – 3.4	3.4 - >7.0	4.5
5	0 – 0.2	0.2 – 1.4	1.4 – 4.0 & 4.6 – 6.7	3.7(1)
6	0 – 0.3	0.3 – 2.1	2.1 – 6.5	5.2
7	0 – 0.15	0.15 – 4.5	4.5 - >7.0*	4.8

Note: * Gravelly Sand
(1) Perched seepage

6. Laboratory Testing

Three (3) samples recovered from the test pits were tested in the laboratory for measurement of plasticity properties and particle size distribution. The detailed laboratory test report sheets are included in Appendix D with the results summarised in Table 2.

Table 2 - Results of Laboratory Testing

Pit No	Depth (m)	LL (%)	PI (%)	LS (%)	%Passing 2.36 mm Sieve	%Passing 0.075 mm Sieve	Material
4	3.8	18	3	0.5	98	21	Silty Sand
5	2.0	21	8	3.5	89	15	Sand
7	5.0	19	5	0.5	91	22	Silty Sand

where LL = Liquid limit PI = Plasticity index
LS = Linear shrinkage

The results indicate the fines portion of the samples tested were of low plasticity and the overall samples were predominantly sand with some silt.

7. Proposed Development

It is understood that the proposed development is to expand the existing sand mining operation. The proposed expansion is to be located to the north west, west and south west of the existing mining operation.

8. Comments

Based on the results of the current and previous field work, it is anticipated that the sand resource in the areas next to the existing mining operation would be in excess of 5 million tonnes of material mostly below the groundwater table. The area to the south/south west will most likely prove to be higher yielding with an approximate thickness of around 4 – 4.5 m within the investigated 7 m depth. The areas to the north west and west will contain interbedded alluvial soils where the sand is expected to be between 2.5 – 3 m in total thickness within the investigated depth of 7 m. The difference in the sand layer thickness across the site correlates with the geological mapping of the area (refer DP's previous report).

Drawing 1 which is included in Appendix B, details the values/methodology for establishing the mass of the sand resource. The study area was divided into 4 areas corresponding to different interpreted total sand thicknesses from the geological mapping of the area and the test pit information to date. Each area was then multiplied by the average interpreted sand thickness then added together to obtain an approximate volume (3.8 million m^3). Adopting a density value of 1.6 tonne per m^3, the mass of the sand interpreted within the study area was estimated to be over 6 million tonnes.

It is highly likely that additional sand deposits are located below the depth of this investigation, particularly in the south-western portions of the study area, and as such would only further add to the estimation of over 6 million tonnes.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Tarago Road, Lake George in accordance with DP's email proposal dated 26 July 2017 and acceptance received from Mr Jim Osborne dated 26 July 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Grantham Park Holdings Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

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Appendix A

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations 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.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report 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 or excavation. 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 and test pits 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 or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole 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; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements 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.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP 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 conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

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

About this Report

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, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

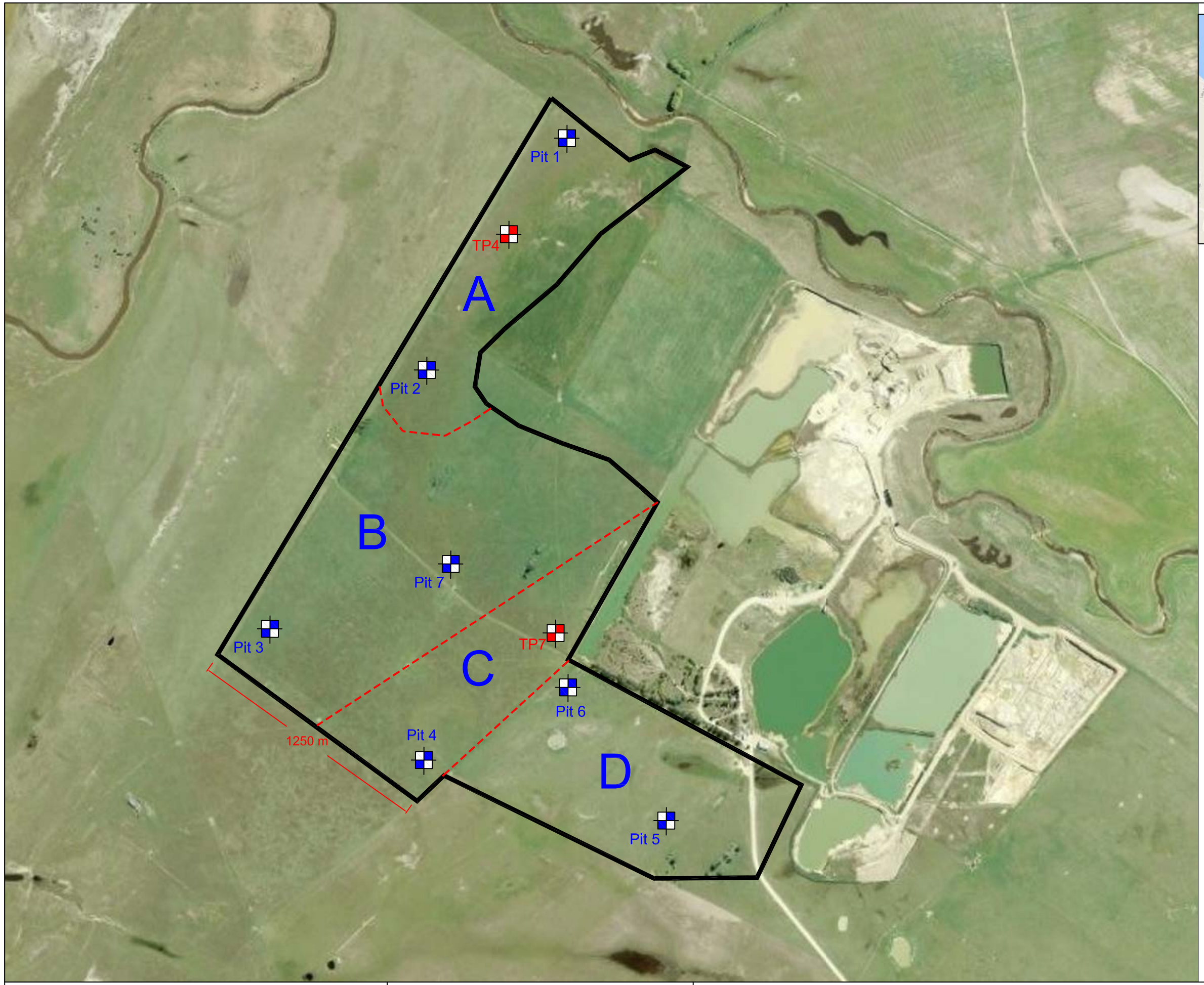
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

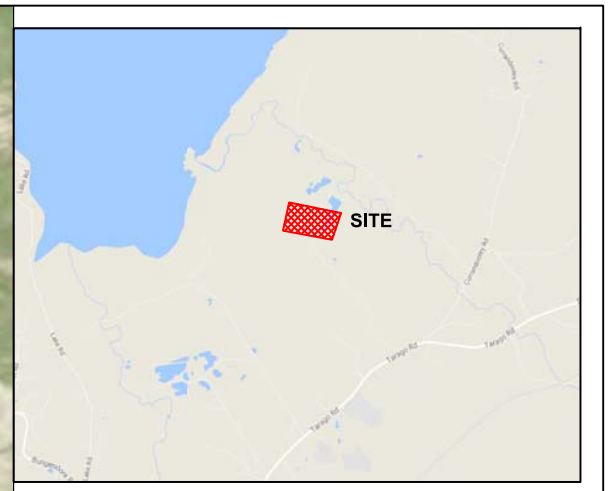
Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental 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.

Appendix B

Drawing 1





Locality Plan

Areas

A - 176,000 m2

B - 465,000 m2

C - 207,000 m2

D - 267,000 m2

Average Thickness of Sand

A - 2.5 m

B - 3 m

C - 4 m

D - 4.5 m

Total Volume of Sand (area x thickness)

3,864,500 m3

Density (estimated)

1.6 t/m3

Estimated Total Mass of

6,183,000 tonnes

Note: Estimates only to the depths investigated

LEGEND

- Site Boundary (Approximate)
- Test Pit Location (Approximate)
- Previous Test Pit Location (Approximate)

Note: Base drawing taken from SIXMaps

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Geotechnics / Environment / Groundwater

CLIENT: Grantham Park Holdings Pty Ltd		
OFFICE: Canberra	DRAWN BY: APH	
SCALE: As Shown	DATE: 11.09.2017	

TITLE: **Test Location Plan**
Proposed Sand Mine Expansion
Tarago Road, Lake George

N

PROJECT No:	46089.01
DRAWING No:	1
REVISION:	1

Appendix C

Explanatory Notes
Results of Field Work (Pits 1 – 7)

Sampling

Sampling is carried out during drilling or test pitting 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 it to obtain 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.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally 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 samples.

Continuous Spiral Flight Augers

The borehole 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 sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud 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 the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils 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 before the full penetration depth, 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 SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. 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 types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

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

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

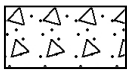
Symbols & Abbreviations

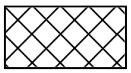
Graphic Symbols for Soil and Rock

General

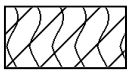

Asphalt

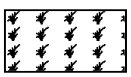

Road base

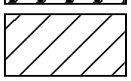

Concrete


Filling

Soils


Topsoil

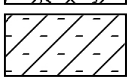

Peat


Clay


Silty clay

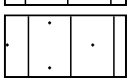

Sandy clay

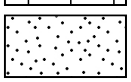

Gravelly clay

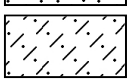

Shaly clay

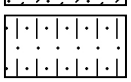

Silt


Clayey silt


Sandy silt

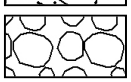

Sand


Clayey sand


Silty sand


Gravel

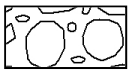

Sandy gravel


Cobbles, boulders

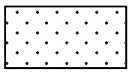

Talus

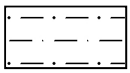
Sedimentary Rocks

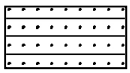

Boulder conglomerate

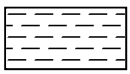

Conglomerate


Conglomeratic sandstone

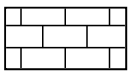

Sandstone


Siltstone

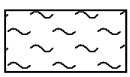

Laminite

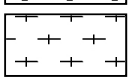

Mudstone, claystone, shale

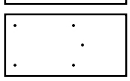

Coal


Limestone

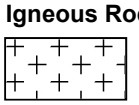
Metamorphic Rocks

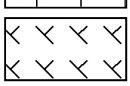

Slate, phyllite, schist

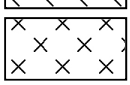

Gneiss

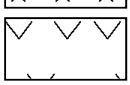

Quartzite

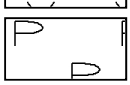
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 680 AHD
EASTING: 723135.73
NORTHING: 6104179.52

PIT No: 1
PROJECT No: 46089.01
DATE: 22/8/2017
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 - generally comprising moist, brown fine grained silty sand with abundant rootlets							
	0.3	SAND - loose, moist, light brown fine grained sand with some clay		D	0.5				
	0.75	CLAY - very stiff, moist, orange mottled grey medium to high plasticity clay, with some sand							
679	1								1
678	2			D	2.5				2
	2.0	SANDY CLAY/CLAYEY SAND - very stiff/medium dense, moist, orange and grey fine to medium grained sandy clay/clayey sand							
677	3								3
	3.0	SILTY SAND - loose to medium dense, moist, orange, fine to coarse grained silty sand with some fine to coarse grained gravel		D	3.5				
676	4								4
	4.2	CLAY - stiff, moist, grey mottled orange, low to medium plasticity clay with some silt and sand		D	4.5				
675	5								5
	5.2	SILTY SAND - loose to medium dense, wet, light grey, fine grained silty sand		D	5.5			▼	
	5.8	SILTY SAND - loose, saturated, light grey and orange, fine to coarse grained silty sand with some fine grained quartz gravel and some clay and clay pockets							
674	6			D	6.5				6
673	7								7
	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 5.8m

REMARKS: Collapsing conditions at 5.5m

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 681 AHD
EASTING: 722703.58
NORTHING: 6103585.42

PIT No: 2
PROJECT No: 46089.01
DATE: 22/8/2017
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)
681	0.2	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
		SAND - loose, moist, light brown fine grained sand with some clay							
	0.7	CLAY - very stiff, moist, orange mottled grey medium to high plasticity clay, with some sand		D	1.0				
680	1								1
	1.4	SANDY CLAY/CLAYEY SAND - very stiff/medium dense, moist, orange and grey fine to medium grained sandy clay/clayey sand		D	2.0				
679	2								2
678	3								3
677	4			D	4.0				4
	4.1	SAND - loose, moist to wet, light gre, fine grained sand, slightly silty		D	4.5				
	4.8	SAND - loose, wet to saturated, yellow brown fine to medium grained sand with trace of clay and silt		D	5.0				
676	5	- from 5.3m saturated						▼	5
675	6	- from 6.0m some coarse grained sand and fine grained gravel zones							6
	6.6	CLAY - firm, saturated grey clay		D	6.8				
674	7								7
	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 5.3m

REMARKS: Collapsing conditions at 5.0m

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 682 AHD
EASTING: 722355
NORTHING: 6102958.18

PIT No: 3
PROJECT No: 46089.01
DATE: 22/8/2017
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	0.2	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
	0.3	SAND/SILTY SAND - moist, light grey and grey fine grained sand/silty sand with some clay							
	0.8	CLAYEY SAND/SANDY CLAY - medium dense, very stiff moist, orange fine to coarse grained clayey sand/sandy clay							
681	1	CLAYEY SAND - medium dense, grey mottled orange fine to medium grained clayey sand		D	1.5				
	1.7	SANDY CLAY/CLAYEY SAND - very stiff/medium dense, moist orange and grey fine to medium grained sandy clay/clayey sand							
680	2			D	2.5				
679	3								
	3.5	GRAVELLY SANDY CLAY - very stiff, moist grey medium plasticity gravelly sandy clay, fine to coarse grained sand and fine to coarse grained quartz gravel		D	3.8				
678	4								
	4.7	SILTY SAND - loose, wet to saturated medium to coarse grained silty sand slightly gravelly		D	4.7				
677	5							▼	
676	6								
675	7								
	7.0	Pit discontinued at 7.0m - limit of reach							

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

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 5.3m

REMARKS: Collapsing conditions at 5.0m

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 681 AHD
EASTING: 722705.94
NORTHING: 6102631.48

PIT No: 4
PROJECT No: 46089.01
DATE: 22/8/2017
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)
681	0.25	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
	0.4	SAND/SILTY SAND - moist, light grey and grey fine grained sand/silty sand with some clay							
	0.75	CLAYEY SAND/SANDY CLAY - medium dense, very stiff moist, orange fine to coarse grained clayey sand/sandy clay							
680	1	CLAYEY SAND - medium dense, grey mottled orange fine to medium grained clayey sand		D	1.0				
	1.7	SANDY CLAY/CLAYEY SAND - very stiff/medium dense, moist orange and grey fine to medium grained sandy clay/clayey sand							
679	2			D	2.5				
678	3								
	3.4	SILTY SAND - loose, moist to wet, grey and orange fine to medium grained silty sand							
677	4			D	3.8				
	4.5	SAND - loose, wet, grey fine grained sand with some silt						▽	
676	5							▼	
	5.5	SAND - loose, saturated, grey and orange fine to coarse grained sand with some silt							
675	6								
	6.0	SAND - loose, saturated, grey fine grained sand, slightly silty							
674	7								
	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater seepage observed at 4.5m and free groundwater at 5.3m

REMARKS: Collapsing conditions at 4.5m

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 681 AHD
EASTING: 723302.62
NORTHING: 6102514.6

PIT No: 5
PROJECT No: 46089.01
DATE: 22/8/2017
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)
681	0.2	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
	0.4	SILTY SAND/SAND - loose to medium dense, moist, light brown/light grey fine grained sand							
	0.75	CLAYEY SAND - medium dense, moist, yellow and light grey brown fine graine clayey sand							
680	1	CLAYEY SAND - medium dense to dense, moist, fine to coarse grained slightly indurated clayey sand		D	0.9				
	1.1	SANDY CLAY - very stiff, moist, grey brown and yellow sandy clay							
	1.4	GRAVELLY SAND - loose to medium dense, moist, light brown fine to coarse grained gravelly sand, fine grained gravel							
	1.7								
679	2	SAND - medium dense, moist, yellow orange fine to coarse grained sand with some fine grained gravel and silt		D	2.0				
	2.3	SAND - loose to medium dense, light brown fine to meidum grained sand, with some clay and some sandy clay/clayey sand pockets							
678	3			D	3.0				
		- from 3.7m loose, wet						▽	
677	4								
	4.0	CLAY - firm to stiff, moist to wet grey clay							
	4.6	SILTY SAND - loose to medium dense, moist to wet, light brown fine to medium grained silty sand, slightly clayey with some grey clay pockets							
676	5			D	5.0				
675	6								
	6.7	SILTY CLAY - stiff, moist, orange and pale cream low plasticity silty clay with some sand							
674	7								
	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater seepage observed at 3.7m

REMARKS: Collapsing conditions from about 3.5m depth

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 681 AHD
EASTING: 723053.54
NORTHING: 6102790.03

PIT No: 6
PROJECT No: 46089.01
DATE: 22/8/2017
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)
681	0.3	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
		SAND - medium dense, moist, light brown and light grey fine grained sand, with trace of clay and silt							
680	0.9	CLAYEY SAND - medium dense, moist, grey mottled orange fine to meidum grained clayey sand		D	1.0				
	1.5	CLAYEY SAND - medium dense, moist, grey fine to coarse grained clayey sand		D	1.8				
679	2.1	SILTY SAND - medium dense, moist, light grey brown and orange fine to medium grained silty sand, slightly clayey and trace of quartz gravel							
678				D	3.0				
677		- from 4.0m wet, grey							
676		- from 5.2m saturated		D	5.0			▼	
	5.5	SILTY SAND - loose, saturated, grey and orange fine to coarse grained silty sand, with some clay							
675				D	6.0				
	6.5	SANDY CLAY/CLAYEY SAND - stiff/medium dense, moist to wet, grey mottled grey fine grained sandy clay/clayey sand		D	6.7				
674	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 5.2m

REMARKS: Collapsing conditions from about 4.0m depth

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Grantham Park Holdings Pty Ltd
PROJECT: Proposed Sand Mine Expansion
LOCATION: Tarago Road, Lake George

SURFACE LEVEL: 682 AHD
EASTING: 722819.52
NORTHING: 6103135.48

PIT No: 7
PROJECT No: 46089.01
DATE: 22/8/2017
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	0.15	TOPSOIL - generally comprising moist, brown fine grained silty sand with abundant rootlets							
		SAND - loose, moist, light brown fine grained sand with some clay							
	0.55	CLAY - very stiff, moist, orange mottled grey medium to high plasticity clay, with some sand							
681	1								1
	1.3	SANDY CLAY/CLAYEY SAND - very stiff/medium dense, moist, orange and grey fine to medium grained sandy clay/clayey sand		D	1.5				
680	2								2
679	3			D	3.0				3
	3.2	SAND - medium dense, moist, light yellow brown fine grained sand with some clay							
	3.5	SANDY CLAY/CLAYEY SAND - medium dense/very stiff, orange brown and grey, fine grained sandy clay/clayey sand							
678	4			D	4.0				4
	4.5	SILTY SAND - loose, saturated, grey and orange fine to coarse grained silty sand with fine to coarse grained quartz gravel and some clay pockets							
677	5			D	5.0			▼	5
676	6								6
675	7								7
	7.0	Pit discontinued at 7.0m - limit of reach							

RIG: Volvo 360A (36 tonne) excavator with 1200mm bucket fitted

LOGGED: Reid

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 4.8m

REMARKS: Collapsing conditions from 5.0m

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Appendix D

Results of Laboratory Testing (3 pages)

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

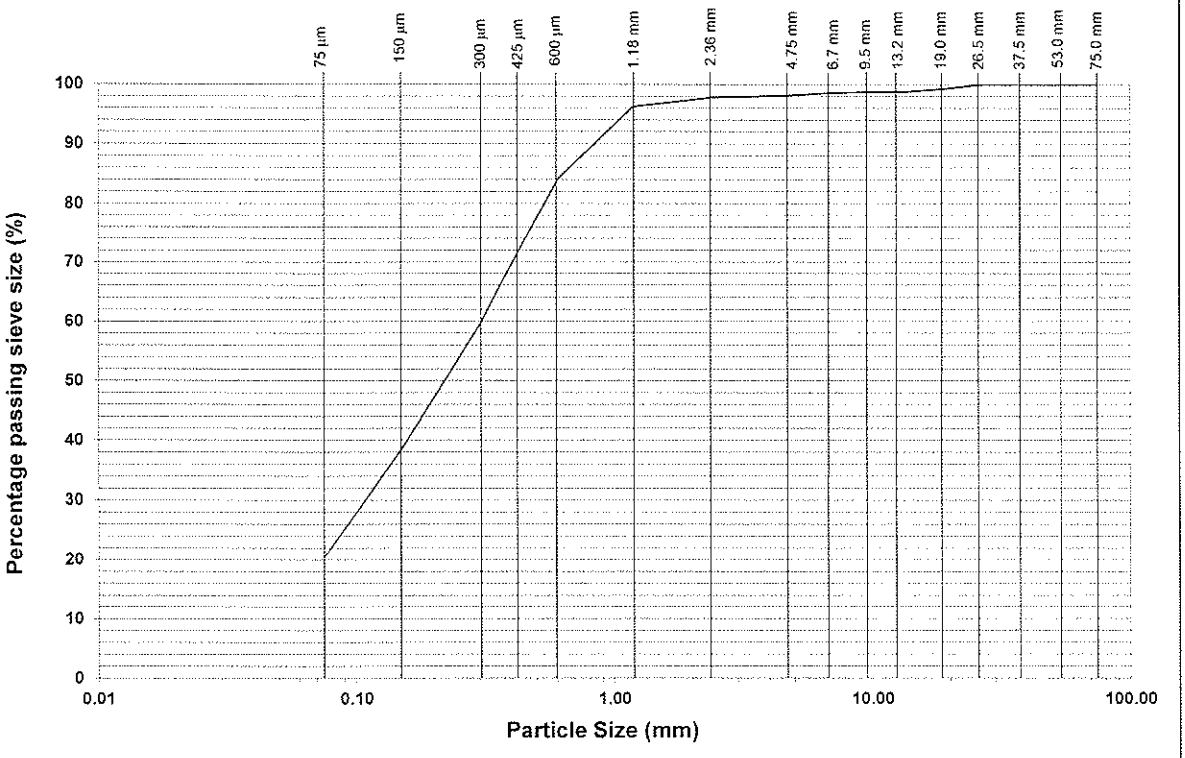
Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, HUME ACT
Date Tested... 29/08/2017
Principal: ..... Grantham Park Holdings Pty Ltd
Project: ..... Lake George Sand Quarry, Project # 46089.01
Location: ..... Tarago Road, LAKE GEORGE NSW

Sample Identification: **TS 018/S2924** Client ID: Pit 4, Depth 3.8 m

Test Procedure: AS 1289 3.6.1 Sampled by the Client and Submitted 24/08/2017 (Tested as Received)

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	99	99	98	98	96	84	72	59	39	21	-	-						



Atterberg Limits (Test procedure)	Liquid Limit AS 1289 3.1.1	18	%	Plastic Limit AS 1289 3.2.1	15	%	Plasticity Index AS 1289 3.3.1	3	%
	Linear Shrinkage AS 1289 3.4.1	0.5	%	-					

Remarks: Unless otherwise stated Atterberg Limits have been oven dried & dry sieved.
Linear Shrinkage moisture condition determined by AS1289 3.1.1

Authorised Signatory
G.W.Collins

NATA

NATA ACCREDITED LABORATORY Number 1742.
Accredited for compliance with ISO/IEC 17025.

Date of Issue: 1/09/2017

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, HUME ACT
Date Tested... 29/08/2017

Principal: ..... Grantham Park Holdings Pty Ltd

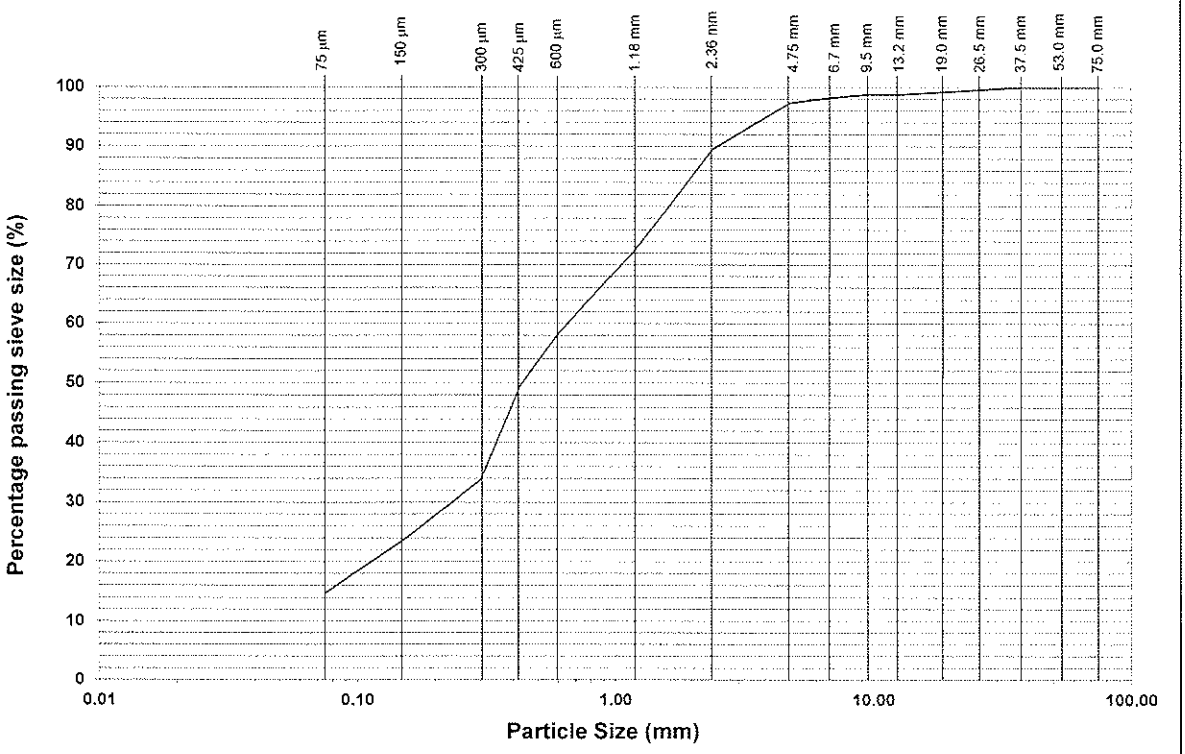
Project: ..... Lake George Sand Quarry, Project # 46089.01

Location: ..... Tarago Road, LAKE GEORGE NSW

Sample Identification: **TS 018/S2925** Client ID: Pit 5, Depth 2.0 m

Test Procedure: AS 1289 3.6.1 Sampled by the Client and Submitted 24/08/2017 (Tested as Received)

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	99	98	97	89	72	58	50	34	24	15	-	-



Atterberg Limits (Test procedure)						
	Liquid Limit AS 1289 3.1.1	21 %	Plastic Limit AS 1289 3.2.1	13 %	Plasticity Index AS 1289 3.3.1	8 %
	Linear Shrinkage AS 1289 3.4.1	3.5 %	-			

Remarks: Unless otherwise stated Atterberg Limits have been oven dried & dry sieved.
Linear Shrinkage moisture condition determined by AS1289 3.1.1

Authorised Signatory
G.W.Collins

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Date of Issue: 1/09/2017

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ABN: 35 102 659 754

Job No.
TS 018

Particle Size Distribution / Atterberg Limits

Client: ..... Douglas Partners Pty Ltd, HUME ACT
Date Tested... 29/08/2017

Principal: ..... Grantham Park Holdings Pty Ltd

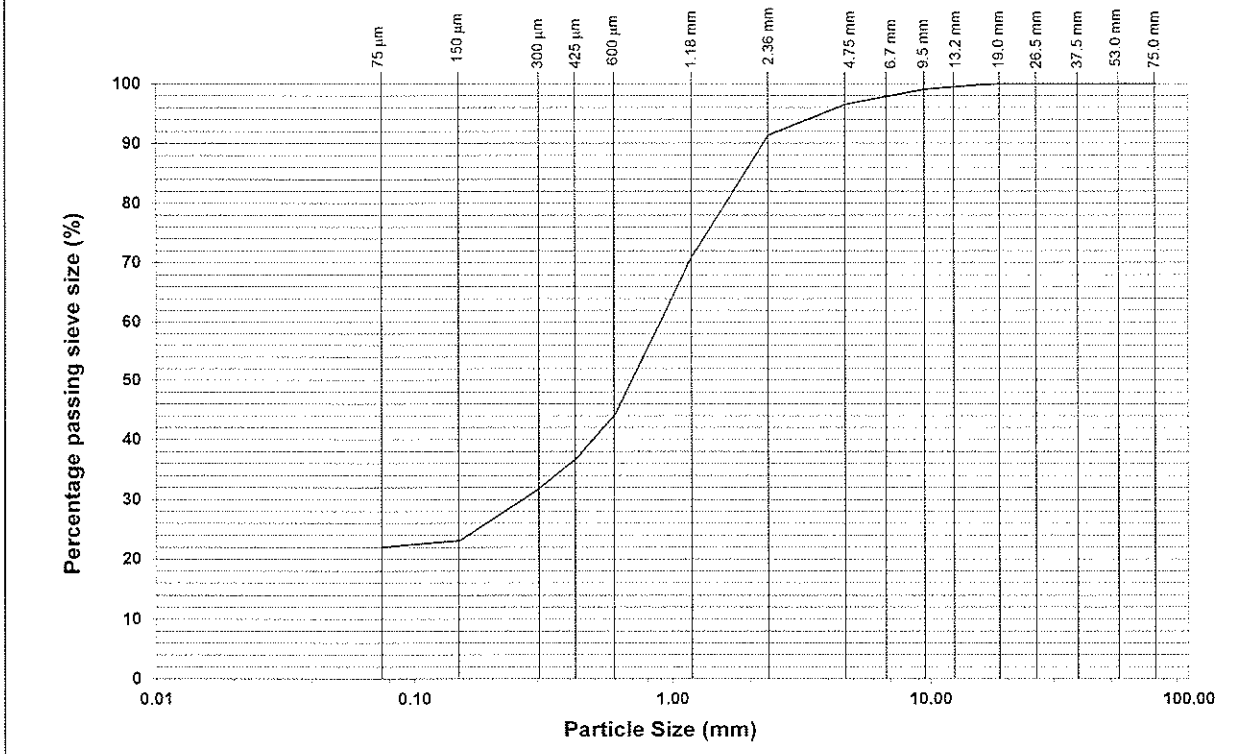
Project: ..... Lake George Sand Quarry, Project # 46089.01

Location: ..... Tarago Road, LAKE GEORGE NSW

Sample Identification: **TS 018/S2926** Client ID: Pit 7, Depth 5.0 m

Test Procedure: AS 1289 3.6.1 Sampled by the Client and Submitted 24/08/2017 (Tested as Received)

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	91	71	44	37	32	23	22	-	-



Atterberg Limits (Test procedure)						
	Liquid Limit AS 1289 3.1.1	19 %	Plastic Limit AS 1289 3.2.1	14 %	Plasticity Index AS 1289 3.3.1	5 %
	Linear Shrinkage AS 1289 3.4.1	0.5 %	-			

Remarks: Unless otherwise stated Atterberg Limits have been oven dried & dry sieved.
Linear Shrinkage moisture condition determined by AS1289 3.1.1

Authorised Signatory
G.W.Collins

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Date of Issue: 1/09/2017