Report on Preliminary Geotechnical Investigation

259 Windermere Road, Windermere NSW

81022070

Prepared for Newpro27 Pty Ltd

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Cardno is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

Table of Contents

1	Introdu	uction	1
2	Previo	ous Investigation	2
3	Site Id	lentification	3
4	Investi	igation Methodology	4
	4.1	Subsurface Investigation	4
	4.2	Laboratory Testing	4
5	Investi	igation Findings	5
	5.1	Published Data	5
	5.2	Subsurface Conditions	5
	5.3	Laboratory Results	5
6	Geote	chnical Comment and Recommendation	7
	6.1	Earthworks	7
	6.2	Basin Construction	8
7	Paver	nent Thickness Design	11
	7.1	Design Parameters	11
	7.2	Pavement Design	12
	7.3	Construction Notes	13
8	Limitat	tions	17
9	Refere	ences	18

Appendices

Appendix A	Figures
Appendix B	Engineering Logs
Appendix C	Laboratory Test Results
Appendix D	48 Windermere Road Investigaiton Plans and Logs

Tables

Table 5-1	Summary of Shrink Swell Test Results	6
Table 5-2	Summary of CBR Test Results	6
Table 5-3	Summary of Emerson Class Test Results	6
Table 5-4	Summary of Atterberg Limits Test Results	6
Table 5-5	Summary of Permeability Test Results	6
Table 6-1	Embankment Material Specification	9
Table 7-1	Design Traffic Loading (Roads 2, 3, 11-14)	11
Table 7-2	Pavement Thickness Design for Road 2, 11-14 (DESA = 2x10 ⁵)	12
Table 7-3	Pavement Thickness Design for Road 3 (DESA = 2x10 ⁶)	13

Table 7-4 Material Specification and Compaction Requirements

14

1 Introduction

This report presents the findings of a preliminary geotechnical investigation undertaken by Cardno, now Stantec Australia Pty Ltd (Stantec) for the proposed residential development located at 259 Windermere Road, Windermere NSW (the site). The investigation was commissioned by Mr Tom Goold of Newpro27 Pty Ltd via email confirmation. The current subject site is a proposed extension to the existing DA approved 48 Windermere Road development and the report has been prepared as a preliminary concept report to inform likely design issues based on the abutting development.

Stantec have been provided with the following design plans:

- Concept design plans titled "Proposed Subdivision 259 Windermere Road, Lochinvar Lot Layout Plan", referenced 21460DA, revision 7, dated 27/07/2022.
- Civil design plans titled "Proposed Subdivision 259 Windermere Road Development Application Plans, referenced 21460C, revision 2, dated October 2022 [1].

Based on the supplied plans, the proposed residential development comprises the following:

- > The creation of 96 residential allotments (Lot 101-196).
- > Construction of utilities and ancillary infrastructure (sewer, electrical services etc.).
- > Internal subdivision pavements (Road 2, Road 3, Road 11-14) and associated stormwater infrastructure.
- > Construction of a basin in the south-east portion of the site, to be connected to the proposed basin associated with the 48 Windermere Road residential subdivision.
- > Widening of Windermere Road.

The geotechnical investigation was undertaken in conjunction with a Preliminary Site Investigation (PSI) undertaken by Stantec prepared under cover "Report on Preliminary Site Investigation – 259 Windermere Road, Windermere NSW", referenced 81022070-001, dated 7/10/2022 [2].

The purpose of this investigation was to obtain preliminary geotechnical information on subsurface conditions as a basis for the following comments and recommendations:

- > Advice and recommendations for basin construction.
- > Comment on earthwork conditions and suitability of site won material for reuse.
- > Recommendations for earthworks procedures and guidelines.
- > Retaining wall design parameters.
- > Requirements for de-commissioning of existing dam farms.
- > Comment on founding conditions and footing design recommendations.
- > Pavement design for the proposed internal roads.

Relevant data from a geotechnical investigation undertaken by Stantec to the south of the subject site has been included within this report. The report was prepared under cover "Report on Geotechnical Investigation – 48 Windermere Road, Lochinvar NSW", referenced 81021034-002.5", dated 29/11/2022 [3].

2 **Previous Investigation**

Stantec have previously undertaken geotechnical report for the proposed residential development to the south to provide geotechnical comment and recommendation. The investigation was reported under cover "Report on Geotechnical Investigation – 48 Windermere Road, Lochinvar NSW", referenced 81021034-002.5", dated 29/11/2022 [3].

The investigation comprised the excavation of 30 test pits within the proposed pavement and residential allotments with a 3.5t excavator fitted with a 450 mm tooth bucket, with dynamic cone penetrometer (DCP) testing was undertaken at test pit locations. Subsurface conditions encountered during the investigation comprised:

- > FILL: Silty CLAY / Sandy GRAVEL to depths in the range of 0-0.3 m BGL. Filling was typically associated with existing farm dams, existing access tracks/horse training tracks, and previous structures noted across the site.
- > ALLUVIAL: Silty CLAY of low plasticity with varying fractions of gravel and sand were towards the eastern boundary of the site, associated with Lochinvar Creek.
- > COLLUVIUM: Silty CLAY of varying plasticity encountered at depths of 0.10-0.45 m BGL. Colluvium soils were observed to have a moisture content greater than plastic limit and were of stiff consistency.
- RESIDUAL: Silty CLAYs of pale to reddish brown colour were encountered to depths of 0.6 to 2.0 m BGL. Residual clays were typically of medium to high plasticity and ranged from firm to hard consistency. Moisture was observed to range from above to below plastic limit across the site.
- EXTREMELY WEATHERED MATERIAL (EWM): Silty / Sandy CLAY and Clayey SAND of brown yellow, pale brown mottled red and reddish brown, encountered to depths of 1.3 to 2.0 m BGL. EWM was typically of medium plasticity clays and fine to coarse sand, and of generally hard consistency or dense density. Moisture was observed to be below the plastic limit or dry to moist.
- > WEATHERED ROCK: SANDSTONE, fine to medium grained and reddish brown in colour, encountered in one test pit at a depth of 0.9 m BGL.

Laboratory testing undertaken on recovered samples comprised CBR, shrink swell, Emerson Class, Atterberg limits, and permeability testing. Laboratory testing previously undertaken has been included within this report.

Site plan and logs from the previous report have been included in Appendix D.

3 Site Identification

The site is a rectangular parcel of land identified as a portion of 259 Windermere Road, Windermere NSW, situated within the southern portion of Lot 1902 DP1112961. The subject site is highlighted in Figure 1 attached in Appendix A, and is bounded by:

- > The remaining portion of 259 Windermere Road to the north.
- > Rural residential property to the south, DA approved residential development.
- > Lochinvar Creek along the eastern boundary of the site, with residential properties further to the east.
- > Windermere Road long the western boundary with rural residential properties further to the west.

Topographically the site is located within gently sloping, undulating terrain. The local topography is characterised by gentle slopes falling from the northwest corner of the site to the south-east. Drainage is expected to comprise surface runoff towards Lochinvar Creek towards the east of the Site.

Vegetation generally comprises open pasture with a concentration of mature trees along the eastern boundary, associated with Lochinvar Creek.

The following features were observed at the time of site investigation:

- > An overland flow path was noted running from the northwest portion of the site through the middle of the site to a dam on the adjacent property to the south.
- > The southwest corner of the site had been stripped with a gravel hard stand formed.
- Rutting was noted during tracking of a 5t excavator during the investigation works due to softening of surficial soils from sustained periods of rain in the lead up to the investigation.
- > Surficial topsoil was noted to be virtually saturated during the investigation.

4 Investigation Methodology

4.1 Subsurface Investigation

As part of the PSI investigation [2] intrusive investigation was undertaken on 13th April 2022 by Stantec, and comprised the following:

- > A site walkover and visual inspection by a geotechnical consultant from Stantec including logging of significant site features.
- Excavation of seven (7) test pits (TP001-TP007) targeted within proposed pavements and residential lots with a 5t excavator fitted with 450 mm toothed bucket. Test pits were advanced to a maximum depth of 2.0 m below ground level (BGL).
- > All test pits were backfilled with excavated spoil on completion.
- > Dynamic Cone Penetrometer (DCP) testing was undertaken at each test pit to assess subsurface strength properties.
- > Bulk, disturbed and thin walled (U50 tubes) samples were taken for subsequent laboratory assessment.

Field investigation including logging of subsurface profiles and collection of samples was carried out a geotechnical consultant from Stantec. Test pits were located using site boundaries and features. The location of the test pits are shown on Figure 1, attached in Appendix A. Subsurface conditions are summarised below and detailed in the engineering logs attached in Appendix B with explanatory notes.

It should be noted that access to the eastern portion of the site was restricted due to an exclusion zone associated with Aboriginal Heritage Potential Archaeological Deposits (PADs) in the area. As such, no sampling or excavation was undertaken within the nominated exclusion zone, however the area was still subject to inspection.

4.2 Laboratory Testing

While no specific geotechnical laboratory testing was undertaken during the current assessment, testing from previous investigation to the south has been adopted for the purpose of this report. Results are considered relevant based on the test pitting and classification of the encountered subsurface profile. Testing on selected samples recovered during the geotechnical investigation for 48 Windermere Road [3] comprised the following:

- > Two (2) California Bearing Ratio (CBR) tests to assess proposed subgrade strength.
- > Five (5) Shrink Swell tests to measure soil volume change over an extreme soil moisture content range.
- > Two (2) Emerson Class tests to measure soil dispersion.
- > One (1) Atterberg Limits test to assist in material classification.
- > One (1) Permeability test to determine site soil permeability.

The previous geotechnical laboratory testing was conducted at NATA accredited construction materials testing laboratory. Results of laboratory testing are detailed in the report sheets attached in Appendix C and summarised in Section 5.3 below.

5 Investigation Findings

5.1 Published Data

5.1.1 Regional Geology

Reference to the NSW Seamless Geology dataset [4] indicates that the Site is underlain by the Lochinvar Formation of the Dalwood Group (**Pdal**) known to comprise of Early Permian deposits of basalt, siltstone, sandstone and residual soils derived from the weathering of these deposits.

5.1.2 Acid Sulfate Soils

Review of the Maitland Local Environmental Plan (LEP) 2011 Acid Sulfate Soils Risk Map indicates the Site is situated within Class 5 Acid Sulfate Soils. Class 5 indicates that *"works within 500 metres of adjacent Class 1, 2, 3, or 4 land that is below 5 metres AHD and by which the water table is likely to be lowered below 1 metres AHD on adjacent Class 1, 2, 3 or 4 land, present an environmental risk*

Further review of the NSW Government Planning, Industry & Environment eSPADE v2.2 mapping system (eSPADE) [5] indicates that the Site not situated within an area of known occurrence.

5.1.3 Soil Landscape Maps

A review of eSPADE [5] indicates that the investigation site is situated within the Lochinvar (NKB-1v) soil landscape – comprising in situ weathered parent rock and derived alluvium from the Lochinvar formation. These rocks comprise siltstone, sandstone, basalt and tuff. The mapping indicates site soil salinity is low to moderate with localised salinity hazards.

5.2 Subsurface Conditions

The subsurface conditions encountered across the site have been characterised and summarised as follows:

- > TOPSOIL: Clayey/Sandy SILT was encountered in all test pits, except for TP006. The depth of topsoil ranged from 0.1 -0.15 m below ground level (BGL).
- COLLUVIAL: Clayey SAND/ Silty, Sandy CLAY and Gravelly, Sandy SILT were encountered in TP001, TP003-TP007, to depths in the range of 0.25–0.9 m BGL. The colluvial soils encountered ranged in plasticity from medium to high, with fine to coarse grained sand and traces of fine to coarse gravel. Granular colluvial soils were observed to be wet, with cohesive soils of moisture content greater than plastic limit and were of very loose to loose density and soft to firm consistency respectively.
- > RESIDUAL: Sandy/Silty CLAY were encountered in all test pits to depths ranging from 1.0 m to investigation limits of 2.0 m BGL. Residual clays were typically of medium to high plasticity and ranged from firm to hard consistency. Residual clays had observed moisture content ranging from equal to greater than plastic limit. Varying fractions of sand and gravel were encountered in the residual soils.
- EXTREMELY WEATHERED MATERIAL (EWM): Clayey SAND of brown and grey mottled yellow colour were encountered in TP001, TP003 and TP005 to depths of 1.4 m to investigation limits of 2 m BGL. The Sand was typically fine to coarse grained and was generally dense to very dense. Moisture was observed to be moist to dry.

Groundwater was not observed at the time of the investigation; however, inflow was noted from ponded water due to recent inclement weather. It should be noted that groundwater is likely to fluctuate with variations in climatic and site conditions particularly after sustained periods of inclement weather.

Test pit logs attached in Appendix B should be referenced for full details of the subsurface profile encountered.

5.3 Laboratory Results

The results of the geotechnical testing undertaken during the previous 48 Windermere Road investigation [3] has been summarised below, with the laboratory report sheets attached in Appendix C.

5.3.1 Shrink Swell Testing

The results of the laboratory shrink swell tests undertaken on the adjacent site are summarised below in Table 5-1 with the test report sheets attached in Appendix C.

Table 5-1 Summary of Shrink Swell Test Results

Pit ID	Depth (m)	Sample Type	Soil Type	Swelling Strain (Esw %)	Shrinkage Strain (Esh %)	Shrink/Swell Index (Iss %)
TP002	0.35-0.58	U50	CLAY: brown	1.2	11.2	6.6
TP004	1.60-1.85	U50	Silty CLAY: pale grey	5.7	2.9	3.2
TP011	1.50-1.63	U50	Silty CLAY: red-brown	4.0	2.8	2.7
TP026	0.95-1.35	U50	CLAY: pale brown	0.4	7.0	4.0
TP030	0.20-0.40	U50	Silty CLAY: reddish brown	0.7	6.1	3.6

Notes to table:

U50: Testing undertaken on thin walled 50mm diameter tube

5.3.2 **California Bearing Ratio Test Results**

The results of the standard compaction CBR testing undertaken on the adjacent site are summarised below in Table 5-2 with the laboratory report sheets attached in Appendix C.

Table 5-2 Summary of CBR Test Results

Pit ID	Depth (m)	Material Description	W (%)	SOMC (%)	SMDD (%)	Swell (%)	CBR (%)
TP003	0.3-0.5	CLAY: pale brown	29.0	26.5	1.53	2.0	3.0
TP010	0.5-0.6	CLAY: brown	24.9	26.0	1.56	1.0	4.0

Notes to table:

W: Field Moisture Content

SOMC: Standard Optimum Moisture Content

SMDD: Standard Maximum Dry Density

5.3.3 **Emerson Class Test Results**

The result of the Emerson Class test undertaken on a representative sample of the water quality basin material is summarised below in Table 5-3 with the laboratory report sheets attached in Appendix C.

Table 5-3 Summary of Emerson Class Test Results

Hole ID	Depth (m)	Soil Type	Emerson Class	Notes
TP015	0.9-1.1	CLAY: brown	6	No Dispersion
TP016	0.8-0.9	Silty CLAY: dark brown	6	No Dispersion

5.3.4 Atterberg Limits Test Results

The results of the laboratory Atterberg Limits tests undertaken on cohesive soils on the adjacent site are summarised below in Table 5-4 with the test report sheets attached in Appendix C.

Table 5-4 Summary of Allerberg Limits Test Results	Table 5-4	Summary of Atterberg	Limits Test Results
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Test Pit ID	Depth (m)	Sample Type	Soil Type	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
TP015	0.9-1.1	D	CLAY: brown	85	23	62

Notes to table: D: Testing on disturbed sample

Permeability Test Results 5.3.5

The results of the permeability test undertaken on a selected samples from the adjacent site are summarised below in Table 5-5.

Table 5-5 Summary of Permeability Test Results

Pit ID	Depth (m)	Soil Type	Sample Compaction (%)	Coefficient of Permeability (m/sec)
TP015	0.9-1.1	CLAY: Brown	99.0	1×10 ¹⁰

6 Geotechnical Comment and Recommendation

6.1 Earthworks

Based on the supplied civil plans [1], earthworks for the proposed development are to comprise excavations and filling ranging up to approximately 1.0 m. Filling is predominately associated with filing of the existing gully line through Lots 161-169 and the southern portion of Road 2, and the eastern boundary of Road 11, associated with the Lochinvar Creek embankment. Deeper cuts and fill in the order of 2.5 m are proposed associated with the proposed basin in the southeast portion of the site.

It should be noted localised softening and rutting of surficial soils was noted at the time of investigation due to inclement weather in the lead up to the investigation. Trafficability issues may be encountered due to saturation of topsoil and colluvial soils following periods of inclement weather and should be considered during construction. Groundwater was noted encountered during the investigation however seepage was noted in TP006 associated with saturated colluvial soils.

6.1.1 Excavations

Considering the proposed depth of excavations and the site investigation findings, excavations into the topsoil, colluvial and residual soils are expected to be readily undertaken using conventional earthmoving equipment. Given refusal was encountered during the investigation on extremely/very weathered SANDSTONE with a 5t excavator, for any excavations that exceed the depth of investigation, assistance by hydraulic rock hammers may be required.

Particular allowance should be made for confined trenching into the rock profile, such as sewer and stormwater excavations, and in deeper cuts associated with the proposed basin.

Excavations or trenches in the residual stiff or better soils and the weathered rock profile would be expected to stand close to vertical in the short-term. Where personnel are to enter excavations, options for short-term excavations include benching or battering back of the excavations at 1H:1V or the support of excavations within the residual soil and extremely weathered rock profile. Short-term excavations within the more competent rock may be battered at steeper than 1H:1V and may not require support, however this would be subject to specific geotechnical assessment.

6.1.2 Filling

Earthworks for the development are expected to comprise minor cut and fill. Fill should be placed and compacted in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments* [6].

It is expected that construction of fill platforms during bulk earthworks, which would be suitable to support structural loads associated with residential developments would include the following:

- > Removal of any existing fill, topsoil, slopewash or deleterious materials from the areas where fill is to be placed. Any unsuitable material including foreign matter must be removed from the fill areas.
- > The fill materials must be free of vegetation including tree stumps, roots, root fibres or other organic matter. Silts or material with high silt portions must be blended with other site soils to be used as fill.
- > Fill should not comprise material with particle sizes of greater than 100mm or 2/3 of the compacted layer thickness.
- > Benching of the slopes where fill is to be placed with slopes steeper than 8H:1V will be required.
- Placement of fill in uniform horizontal layers with compaction of each layer to a minimum dry density ratio of 95% standard Compaction (AS 1289-5.5.1) at moisture contents in the order of 85-115% of SOMC or ±2% but generally as close to SOMC as practical. Over compaction should be avoided.
- > Within the road alignments, subgrade formation moisture specification will need to be maintain at -2 to 0% of OMC.
- Prior to filling works in existing dam footprints, the decommissioning methodology below must be undertaken.

Filling materials are expected to comprise clays and extremely weathered rock won during bulk earthworks. Where possible, highly plastic surficial site won clays are proposed to be used as filling should be placed as deep as possible to reduce negative impacts on site classifications. It is suggested that where possible this

material is used where filling >1.0m is required, where the top portion of lot & pavement fill consists of less reactive material such as site won weathered rock.

All fill should be battered at a slope of 2H:1V or preferably flatter and temporary erosion control should be provided. To prevent erosion in the long term, provision of protection by vegetation and with the provision of adequate drainage is also required. Where a batter of 2H:1V is not possible, the fill should be supported by an engineer designed and suitably constructed retaining walls.

Fill materials are expected to comprise of the following:

- Site won alluvial, colluvial, residual & extremely weathered clay materials: Generally, soils excavated on site with the exception of topsoil and soils of high silt content are considered suitable for reuse as engineering fill. Sandy colluvial soils may require blending with cohesive soils prior to reuse.
- > Where excavations extend into the weathered rock profile, site won ripped sandstone / siltstone would be considered suitable for the development. Generally, all site won ripped rock would be suitable for re-use following reconditions and grading for particle size requirements.

6.1.3 Existing Overland Flow Path

Filling of the existing gully traversing from the western to the southeast portion of the site is proposed as part of the bulk earthworks. As the gully has been subject to overland flows, additional stripping may be required to remove silt build-up and material with elevated moisture. Earthworks for the existing drainage line would comprise the following:

- > Removal of any topsoil, slop-wash / colluvium, over-wet, organic, or deleterious materials from the areas where fill is to be placed.
- > Stripping of all sediment and moisture impacted material.
- Inspection of all stripped surfaces should be undertaken by an experienced geotechnical consultant to confirm removal of all deleterious material and suitable foundation materials prior to placement of fill. Filling is to be undertaken as detailed in Section 6.1.2 above.
- > Consideration should be made to diverting surface flows during earthworks within the existing drainage line.

6.2 Basin Construction

Based on the provided civil design plans [1], a stormwater detention basin is proposed to be constructed in the southeast corner of the development. The basin is to be constructed such that it forms a larger basin with the proposed basin for the 48 Windermere Road residential development.

6.2.1 Proposed Earthworks

The existing basin in the northeast of the 48 Windermere Road development is to be augmented with additional wall support in the form of filling proposed around the dam to form a permanent basin. The basin is then proposed to be extended to the north during the 259 Windermere Road development. Earthworks for the proposed basin extension comprises excavations ranging up to 2.5 m BGL to form the western and northern walls, and impoundment area, with filling in the order of 2.5 m proposed to form the eastern wall. Filling is proposed to be placed to extend the existing Lochinvar Creek embankment along the eastern boundary of the Site.

Filling works associated with the eastern wall will required benching into the existing embankment slopes such that additional fill is keyed into the natural soil profile. Appropriate sediment and erosion control should be provided prior to earthworks to protect Lochinvar Creek.

No test pitting was undertaken within the proposed basin extension due to Potential Archaeological Deposits (PADs) being present in the area. Based on test pitting undertaken during the previous 48 Windemere investigation [3], founding conditions for the walls and impoundment area are expected to comprise firm to stiff alluvial & residual Silty CLAY profiles. Alluvial clays encountered from approximately 0.55-0.75 m below ground levels were consistent in strength with underlying residual clay. This indicates that additional excavation may be required however the stiff alluvial Silty CLAY will be acceptable as a foundation for the basin. This will be subject to inspections by a suitably qualified geotechnical consultant.

6.2.2 Embankment Requirements

Table 6-1 below provides general material requirements and compaction specifications for the construction of a zoned embankment for temporary and permanent basins.

Table 6-1 Embankment Material Specification

Specifications	Zone 1 – Clay Core Material	Zone 2 – Embankment Fill
Material Property		
Material Description	CLAY, sandy/silty CLAY	s with minor gravel content
Plasticity Index	10	-50%
Permeability	< 10 ⁻⁹ m/s	N/A
Emerson Class	Minimum Class 4	Minimum Class 2
Maximum particle Size	50mm	200mm or 2/3 of the compacted layer
Percentage Fine Content (Material Passing 0.075mm)	> 25%	> 20%
Compaction Requirements		
Compaction (Standard Relative Density AS1289 5.7.1)	Minimum 98%	Minimum 95%
Moisture Content	-1 to +2 of SOMC	-1 to +2 of SOMC
Notes to table:		

SOMC: Standard Optimum Moisture Content N/A: Not applicable

Subsurface profiles encountered during the investigation comprise Silty SAND overlying highly plastic clay, overlying medium plastic clays then grading to weathered rock. Based on testing undertaken, it is considered the highly plastic surficial clays may require amelioration prior to use in basin wall construction.

It is expected the foundation for the clay core would comprise alluvial and residual soils. Stiff alluvial and residual clays are expected to be suitable for clay core foundation, however, will be subject to inspection during construction. All batter slopes within the impoundment area should be 1V:5H or flatter.

6.2.3 Embankment Foundation Treatment

Based on the subsurface conditions encountered during the previous investigation [3] and earthworks shown in the provided civil design plans [1], embankment foundation conditions are expected to comprise residual & alluvial clays for the basin walls, and a combination of residual/alluvial soil and weathered rock for the impoundment area.

The following general foundation preparation requirements must be adopted:

- > Removal of all uncontrolled filling or topsoil material.
- Static proof-rolling of the exposed foundation area under the embankment with a heavy (minimum 10 tonne) roller. Soft or weak areas detected during the proof rolling shall be excavated and replaced with compacted fill comprising low permeability clay meeting the requirements of Zone 1 material.
- > Protection of the prepared foundation to prevent excessive wetting or drying prior to placement of embankment fill material. Trafficking of the exposed foundation should be limited (or avoided where possible) to prevent permanent deformation.
- > Embankment clay core to have a minimum 500 mm key below the invert of the basin.
- Inspection of clay or controlled filling foundation and key by an experienced geotechnical consultant to assess potential defects and potential seepage.
- > Where weathered rock is encountered within the impoundment area, ripping and recompacting or the application of a clay liner may be required. This would be subject to inspection by a suitably qualified geotechnical consultant.

6.2.4 Keyway Construction

The basin will consist of a keyway location subject to founding conditions during construction. The basin walls are likely to be founded in stiff alluvial / residual clay/extremely weathered rock. The location of the keyway subject to inspection by a suitably qualified geotechnical consultant. Keyway construction is to comply with material specifications as per Table 6-2 and general filling methodology outlined in Section 6.1.2.

6.2.5 Stormwater Outlets and Seepage Collars

A seepage collar will be required to be constructed along stormwater pipes proposed to traverse the basin embankment to increase the length of the percolation path and reduce the risk of piping developing around the stormwater pipes.

Seepage collars are generally made of concrete with a required width depending on pipe diameter but are typically three times the pipe diameter.

6.2.6 Surface Erosion Control

Topsoil shall be spread over the exposed surfaces of the embankment to a depth of at least 150mm and sown with pasture grass to establish a good cover as soon as practical.

Large vegetation shall not be allowed to become established on or near the embankment. Tree roots (especially eucalyptus tree roots) can cause the core to crack and encourage piping development, resulting in the failure of the dam wall.

All trees and shrubs shall be restricted to a minimum distance of 1.5 times the height of the tree away from the embankment of the dam.

Rock rip rap scour protection shall be included for erosion control at all inlet and outlet points including emergency spillways.

6.2.7 Embankment Construction and Upstream Batters

Following the preparation of the embankment foundations, formation of the embankment must be undertaken from foundation to the crown using the compaction requirements specified in Table 6-1. Compaction of the embankment material must be undertaken using pad foot rollers.

Upstream batters of the basin should be graded at 5H:1V or flatter. Emergency spillways are to be included in the construction of the basins as per the provided drawings

7 Pavement Thickness Design

Pavement thickness design has been undertaken based on the findings of the geotechnical investigation and MCC requirements. The following guidelines have been adopted for the design of the internal roads:

- Pavement thicknesses for flexible pavements in accordance with mechanistic procedure presented in Austroads Guide to Pavement Technology, Part 2: Pavement Structural Design [7].
- > Maitland City Council (MCC) Manual of Engineering Standards, Chapter 5: Road Pavement Design [8].

7.1 Design Parameters

7.1.1 Design Traffic Loading

Design traffic loading for the internal roads has been adopted from MCC Engineering Manual, Chapter 4: Road Design [9] and Chapter 5: Pavement Design [8] based on the road type designations specified by lot serviceability. Pavement design traffic loading has also been cross referenced with requirements for the proposed adjoining development to the south. Table 7-1 below provides a summary of the proposed internal road traffic loading.

Table 7-1	Design Traff	ic Loading	(Roads 2	, 3,	11-14)
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Road	Road Designation	Design Equivalent Standard Axles (DESA)
Road 2, Road 11-14	Local – Secondary	2 × 10 ⁵
Road 3	Collector – Primary (Bus Route)	2 × 10 ⁶

Where the road designation differs from those presented in Table 7-1 above, additional consultation with Stantec would be required.

7.1.2 Design Subgrade

Based on the supplied plans [3], earthworks comprise cut and fill in the order of 1.0 m across the proposed pavements, with the majority of the proposed fill associated with the filling of the existing gully line. Filling is also proposed along the northeast boundary of Road 11.

It should be noted colluvial soils will likely be encountered at proposed subgrade level. Colluvial soils may require excavation and replacement subject to inspection by a suitably qualified geotechnical consultant. Colluvial soils were generally wet at the time of investigation and as such, allowance should be made for excavation and moisture conditioning.

Subgrade conditions along the proposed internal roads are expected to generally comprise a mixture of residual clays, extremely weathered rock and site won fill. The road alignment should be considered during the bulk earthworks, with better quality material placed in proposed road alignments. Additional fill subgrade may be required in portions of road and where over excavation takes place and as such, the design subgrade CBR would be dependent on the material being utilised.

The results of the CBR tests undertaken during the previous investigation [3] on potential subgrade material indicate that CBR values for residual silty clay soils encountered within the test pits produced CBR values between 3-4%. A design CBR of 3% for residual soils and general fill has been adopted to accommodate for the use of site won residual clays.

It is understood that it is MCC's preference that a 300 mm select layer is adopted to reduce the effect of reactive subgrades on pavement performance. Allowance for a minimum 300 mm select layer with CBR≥15% can increase overall CBR value to 8%, which has been adopted for the pavement design. Proposed imported select material will need to be confirmed for its quality by a suitably qualified geotechnical consultant.

With reference to above, the following design CBR's have been adopted for design:

> CBR = 8%: Residual clays & General fill with 300 mm of select fill.

Confirmatory CBR testing shall be undertaken during construction to confirm design assumptions.

7.1.3 Reactivity

The subsurface conditions encountered in the test pits across the site generally comprised of topsoil / colluvium overlying natural clays of generally higher plasticity and moisture before grading to less plastic clays and weathered rock with depth. Based on swell values from CBR testing, clays are moderately expansive.

Where pavement is founded on highly plastic soils, significant loss of pavement shape and potential damage to pavements due to volume change can occur as a result of moisture variations. Where expansive soils are encountered at subgrade, potential for volume change should be minimised by adopting some, or all, of the strategies outlined in clause 5.3.5 of Austroads [7]. The specific considerations in relation to expansive soils should include, but not be limited to:

- > Specification of a moisture content range which is maintained for preparation of the subgrade until subbase is placed.
- > The need for subsoil drainage to not be located in the expansive soils.
- > The need for a low permeability lower subbase / select layer.
- > Recommendation for sealed shoulders and impermeable verge material.
- > Recommend appropriate construction techniques.
- > Reduction of the volume expansion potential of the expansive soils by lime stabilisation.

Assessment of the subgrade materials is to be undertaken during the construction phase by an on-site experienced geotechnical consultant/engineer. Where expansive exposed subgrade is identified, suitable measures should be undertaken to mitigate the potential for volume change including those abovementioned. It is understood that over excavation and placement of a 300 mm low reactive select fill layer is a preference of Maitland City Council. This has been adopted in pavement design below.

Due to experience in nearby projects, this may need to be augmented pending inspection by a suitably qualified geotechnical consultant and the use of additional select or site won fill may be required. It should also be ensured that any reactive clays utilised as fill are placed lower where possible in road alignments.

7.2 Pavement Design

Based on the results of the test pitting and CBR testing, flexible unbound granular pavement would be the most cost-effective option for the construction of the internal roads. Pavement design thicknesses calculated for internal pavements are summarised below.

	Thickness	Recommended Material Type ⁽¹⁾				
Wearing Course ⁽²⁾	30mm	AC10				
Base Course ⁽³⁾	160mm	DGB20, GMB20, NGB20-2c				
Subbase Course	125mm ⁽⁴⁾	DGS20/40, GMS40, NGS20/40				
Select Material	Min 300mm	CBR ≥ 15%				
Total Thickness ⁽⁵⁾	615mm ⁽⁶⁾	Total Thickness				
Select Material	SELECT FILL overlying Silty CLAY	Select Material				
Subgrade CBR	3%	Subgrade CBR				
Design traffic	2 × 10 ⁵	DESA				
Design Life	30 ye	ears				
Notes to table:	n material specifications					

Table 7-2Pavement Thickness Design for Road 2, 11-14 (DESA = 2x10⁵)

(1) Refer to Section 7.3.2 for material specifications.

(2) 10 mm Primer Seal required.

(3) 160mm basecourse has been selected for tie in with 190mm kerb and gutter. Minimum 140mm base material as per Figure 8.4 of Austroads [7] has been neglected for constructability purposes.

(4) Minimum subbase thickness of 125mm as per MCC Guidelines.

(5) Include 300 mm select layer as per MCC requirements.

(6) Minimum pavement thickness of 300mm as per MCC Guidelines has been increased to 315mm to facilitate tie in with 190mm kerb and gutter.

Table 7-3 Pavement Thickness Design for Road 3 (DESA = 2x10⁶)

	Thickness	Recommended Material Type ⁽¹⁾
Wearing Course ⁽²⁾	40mm	AC10
Base Course (3)	150mm	DGB20, GMB20
Subbase Course	130mm	DGS20/40, GMS40
Select Material	Min 300mm	CBR ≥ 15%
Total Thickness (4)	620mm	Total Thickness
Subgrade Material	SELECT FILL overlying Silty CLAY	Subgrade Material
Subgrade CBR	3%	Subgrade CBR
Design traffic	2 × 10 ⁶ DE	SA
Design Life	30 years	3

Notes to table:

(1) Refer to Section 7.3.2 for material specifications.

(2) 10 mm primer seal required.

(3) 150mm basecourse has been selected for tie in with 190mm kerb and gutter. Minimum 145mm base material as per Figure 8.4 of Austroads [7] has been neglected for constructability purposes.

(4) Includes 300 mm select layer as per MCC requirements.

Select material thicknesses in above tables are minimum only and previous experience in the area indicates additional site won or select fill may be required, subject to inspection by a suitably qualified geotechnical engineer.

During boxing out of subgrade levels, where thin clay layers are present in locations such as transitions between bedrock and subgrade fill, over-excavation may be required to remove these thin layers and replacement with select material would be required.

Inspection of the finished subgrade by a geotechnical engineer during boxing is required to assess subgrade conditions, over-excavation and select subgrade quality.

MCC Pavement Design Specifications [8] Chapter 5.1 states that AC wearing course for flexible pavements may be included in total pavement thickness, and have been undertaken by reducing the subbase thickness where possible to limit pavement depths. Where additional pavements are required to facilitate a bus route, Stantec should be notified and amendments to design may be required.

7.3 Construction Notes

7.3.1 Subgrade Preparation

Where construction of a new pavement is proposed, subgrade preparation should be in general accordance with the relevant council construction specifications and the following procedures.

- Excavation to design subgrade level, with the stockpiling of the excavated material for reuse (if acceptable) following the reconditioning. Material to be removed offsite for disposal or recycling where not required or not acceptable as fill.
- Excavation of loose and oversize filling and elimination of abrupt changes between subgrade conditions, such from rock to soil, and from granular fill to fine grained natural soils.
- Identification of the need for removal and replacement of any potential higher reactive clays and replacement with site won or select fill. Depth of replacement would be subject to visual inspection by suitably qualified geotechnical consultant.
- > All subgrade surfaces in cut shall be ripped, loosened and compacted to a minimum depth of 150mm below the design subgrade, including up to 150mm behind the back of the kerb.
- > Fill material to be used as subgrade shall conform to the appropriate specifications as detailed in this report and MCC Specifications.
- Static proof-rolling of the exposed subgrade using a heavy (minimum 10 tonne) roller under the direction of an experienced geotechnical consultant.

- 🗘 Cardno 🔤 🕥 Stantec
- > Loose or yielding areas should be excavated and replaced with compacted select fill or suitable subgrade replacement comprising of material of similar consistency to the subgrade.
- Where filling or subgrade replacement is required, the materials employed should be free of organics or other deleterious material and could compromise the existing site-won ripped sandstone material or stockpile. The material should also have a maximum particle size of 100mm or one third of the layer thickness, with a soaked CBR > 15%.
- Compaction of the subgrade, filling or select should be to a minimum 100% of SMDD (or 70% Density Index for non-cohesive materials) in layers of not greater than 250mm loose thickness. Moisture contents should be within 70% to 90% of SOMC.

Following satisfactory preparation of the subgrade, the pavement should be placed in accordance with the requirements of the appropriate section of this report, depending on the proposed pavement type.

7.3.2 Specification and Compaction Requirements

Pavement materials and compaction requirements for the new pavement construction should conform to Maitland City Council specifications and the following requirements.

Pavement Course	Material Specification	Compaction Requirements
Road 2, Road 11-14		
Base Course High quality crushed rock	Material complying with RMS QA Specifications 3051 Category D [10]	Min 98% Modified (AS 1289 5.2.1)
Subbase Subbase quality crushed rock	Material complying with RMS QA Specifications 3051 Category D [10]	Min 95% Modified (AS 1289 5.2.1)
Road 3		
Base Course High quality crushed rock	Material complying with RMS QA Specifications 3051 Category C [10]	Min 98% Modified (AS 1289 5.2.1)
Subbase Subbase quality crushed rock	Material complying with RMS QA Specifications 3051 Category C [10]	Min 95% Modified (AS 1289 5.2.1)
All Pavements		
Select Crushed rock or gravel, generally consistent with a subbase type material	CBR ≥ 15%	Min 100% Standard (AS 1289 5.1.1)
Subgrade or replacement	Minimum CBR 3%	Min 100% Standard (AS 1289 5.1.1)

Table 7-4 Material Specification and Compaction Requirements

All granular pavement material quality should be in general accordance with RMS QA Specification 3051 [10].

Minimum testing on all potential imported pavement materials should be to RMS QA Specification 3051 [10] including a four-day soaked CBR, Atterberg Limits, Particle Size Distribution analysis and Wet/Dry strength determination. Pre-treatment of material prior to testing would be advisable for materials subject to breakdown.

7.3.3 Wearing Course

Wearing courses should be in accordance with Maitland City Council specifications with consideration to RMS QA Specifications R116 [11] and Austroads AGPT04B-07 Guide to Pavement Technology, Part 4B: Asphalt [12].

The design and construction of wearing courses should be in in consultation with the preferred supplier considering traffic volume and type. All pavement surfaces should be primed, or primer sealed prior to the application of bituminous spayed seal.

7.3.4 Drainage

The moisture regime associated with a pavement has a major influence on the performance considering the stiffness/strength of the pavement materials is dependent on the moisture content of the material used. Accordingly, to protect the pavement materials from wetting up and softening, particular care would be required to provide a waterproof seal for the pavement materials, together with adequate surface and sub-surface drainage of the pavement and adjacent areas.

Owing to the potential for cracking along the interface where new pavements are joined to existing pavements, it is suggested that an intra-pavement drain should be provided at the interface between any section of new and existing pavements.

Based on observation of the present geotechnical conditions, it is recommended that subsoil drainage be installed at subgrade level on both sides of the road. Detailing of subsoil drainage should be in accordance with Austroads 2017 [7] taking into consideration the presence of moderately expansive soils. The subgrade should be constructed with sufficient cross fall (in general 3%) to assist in reducing retention time for moisture entering the pavement. The subsoil drains should be located below or behind the kerb to intercept any moisture ingress from outside and within the roadway. The drains will require flush-out points and regular maintenance to ensure their correct operation, and detailing should consider the presence of moderately expansive soils where encountered. Provision of adequate cross fall to direct runoff from the pavement to drainage lines should be achieved as a result of reconstruction and possibly rehabilitation.

The pavement thickness designs presented above assume drained pavement conditions. The selection, construction and maintenance of appropriate drainage mechanisms would be required for adequate performance. The selection of appropriate construction materials that are relatively insensitive to moisture change is also essential in area subject to periodic inundation, even if for a relatively short period of time.

7.3.5 Pavement Compaction

Difficulty obtaining specified compaction requirements can be expected in areas of low strength subgrade which are evident in areas where the road is to be constructed in fill and firm clays near surface are expected and subgrade replacement is not undertaken. Vibratory compaction can lead to potential problems with the development of excess pore pressures and permanent deformation of the subgrade. Large capacity oscillating rollers are better suited to deep lift compaction. Static or low amplitude rolling may be appropriate in conjunction with thinner layers in poor subgrade areas.

It is essential to ensure that compaction is achieved though the full thickness of any pavement layers. A rough interface and bond is required between all pavement layers, generally achieved through scarification of the first layer prior to placement and compaction of the second and subsequent pavement layers.

7.3.6 Pavement Interface and Tie-in

The proposed development is to be constructed such that pavements tie in with the 48 Windermere Road development to the south. Where new pavement construction abuts an existing pavement, care should be exercised to bench into the base course layer for a minimum of 0.5m for the entire pavement width.

Adequate compaction of the subgrade and pavements in this area is essential to maximise performance of the pavement. It is noted that where variable pavements are abutted, the potential for localised failure is generally greater. Consideration should be given to sealing any cracks that may develop between existing and new pavements. The use of a strain alleviating membranes at the interface may also be appropriate. It may also be prudent to install intra-pavement drainage at subgrade level at interfaces of variable existing and new pavements.

7.3.7 Inspections

The subgrade will require inspection by an experienced geotechnical consultant after boxing out or filling to design subgrade level. The purpose of inspections is to confirm design parameters, assess the suitability of the subgrade to support the pavement, and delineate areas which may require subgrade replacement or remedial treatment prior to construction.

7.3.8 References

All works and materials used in construction should be designed and constructed in accordance with Maitland City Council Specifications or as specified in this report. Where discrepancies may occur, clarification should be sought from Council.

Earthworks and testing should generally be undertaken in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments* [6] where not otherwise specified.

8 Limitations

Stantec have performed investigation and consulting services for this project in general accordance with current professional and industry standards. The extent of testing was limited to discrete test locations and variations in ground conditions can occur between test locations that cannot be inferred or predicted.

A geotechnical consultant or qualified engineer shall provide inspections during construction to confirm assumed conditions in this assessment. If subsurface conditions encountered during construction differ from those given in this report, further advice shall be sought without delay.

Stantec, or any other reputable consultant, cannot provide unqualified warranties nor does it assume any liability for the site conditions not observed or accessible during the investigations. Site conditions may also change subsequent to the investigations and assessment due to ongoing use.

This report and associated documentation was undertaken for the specific purpose described in the report and shall not be relied on for other purposes. This report was prepared solely for the use by Newpro27 Pty Ltd and Maitland City Council. Any reliance assumed by other parties on this report shall be at such parties own risk.

9 References

- [1] GCA Engineering Solutions, "Proposed Subdivision 259 Winderemere Road Development Application Plans 21460C, Revision 2," October 2022.
- [2] Cardno, now Stantec Australia Pty Ltd, "Report on Preliminary Site Investigation 259 Windermere Road, Windermere NSW," October 2022.
- [3] Cardno, now Stanec Australia Pty Ltd, "Report on Geotechnical Investigation 48 Windermere Road, Lochinvar NSW," November 2022.
- [4] NSW Department of Planning, Industry & Environment, "MinView," 2019. [Online]. Available: https://minview.geoscience.nsw.gov.au/. [Accessed August 2020].
- [5] NSW office of Environment and Heritage, "eSPADE v2.2," 2022.
- [6] Australian Standard AS3798-2007, "Guidelines on Earthworks for Commercial and Residential Structures," Standards Australia, 2007.
- [7] Austroads AGPT02-17, "Guide to Pavement Technology Part 2: Pavement Structural Design," Austroads Ltd, 2017.
- [8] Maitland City Council, "Manual of Engineering Standards: Chapter 5 Pavement Design," Maitland City Council, 2014.
- [9] Maitland City Council, "Manual of Engineering Standards; Chatper 4 Road Design," Maitland City Council, 2014.
- [10] RMS QA Specification 3051 (Ed 6 Rev 2), "Granular Base and Subbase Materials for Surfaced Road Pavements," Roads and Maritime Services, April 2011.
- [11] RMS QA Specification R116 (Ed 8 Rev 2), "Heavy Duty Dense Graded Asphalt," Roads and Maritime Services, January 2012.
- [12] Austroads AGPT04B-07, Guide to Pavement Technology Part 4B: Asphalt, Austroads Ltd, May 2007.

APPENDIX



FIGURES



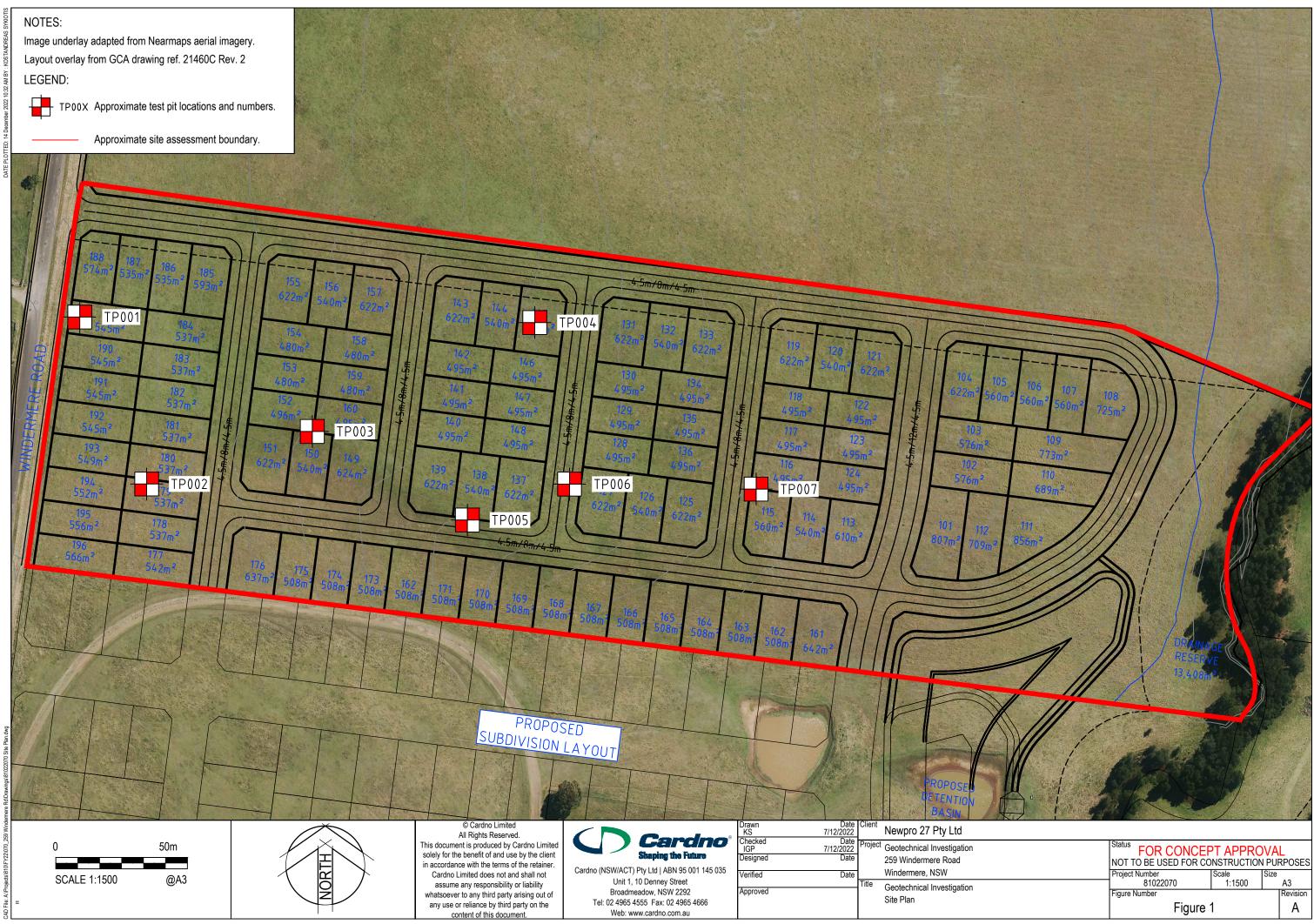


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	E	Stable	Not Encountered			- 0.5				Sandy CLAY; medium plasticity, gre yellow, fine to medium sand	y mottled	M (>PL)	St	RESIDUAL SOIL	- - -
						- 1.0				Clayey SAND; fine to medium grain mottled yellow, with fine to medium ((Sandstone fragments)				EXTREMELY	EATHERED
V	F					-			1.30m			М	н		
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									Silty Sandy CLAY; medium plasticity, brown, fine to coarse grained sand, trace fine to medium gravel 0.30m	M (>PL)	s	COLLUVIUM
E	:	Stable	Not Encountered	B 0.30 - 0.40 m ES 0.30 - 0.40 m		- 0.5			Sandy CLAY; medium to high plasticity, brown mottled yellow, fine to coarse sand, trace fine to medium gravel	M (>PL)	F to St	RESIDUAL SOIL
1						-2.0			Silty CLAY; medium plasticity, grey mottled orange, trace fine to medium sand, trace fine to medium gravel Z.00m TERMINATED AT 2.00 m Target depth	M (¤ PL)	н	
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				ES 0.40 - 0.50 m		-				e to coarse grainec e gravel	d, light brown,	w	L	COLLUVIUM	
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		SI	Not			1.0			1.00m			M (>PL)	St		
F-	τ					-			mottled yellow, wi (Sandstone fragm	e to medium graine th fine to medium g nents)	ed, grey gravel	м	н	EXTREMELY W	VEATHERED
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			-			1.20m	Sandy CLAY: medium plasticity, brown mo yellow, fine to medium sand	ttied			-
Surface Water	90 - 1.00 m		-			1.20m	Sandy CLAY: medium plasticity, brown mo yellow, fine to medium sand	ttied		RESIDUAL SOIL	-
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ō			-					M (>F	L) F		
			-			1 1	Sandy CLAY: medium to high plasticity, bro	own		_	
			- 1.5			2.00m	mottled yellow, fine to medium sand		L) VSt to H	4	
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r bucket ger e ling ier	VE VI E EI F FI H H VH VI WATER	/ery Easy (No Easy Firm Hard /ery Hard (Re R 7 Water Le 7 Water Le	^{efusal)} evel on		SI H D P M PI I P	SPT - S IP - I DCP - I PSP - I PSP - I PBT - I MP - I PID - I	Standard Penetration Test B Hand/Pocket Penetrometer D Dynamic Cone Penetrometer U Perth Sand Penetrometer U Moisture Content MC Plate Bearing Test D Borehole Impression Test M Photoionisation Detector W	 Bulk distur Disturbed Environme Thin wall t DISTURE Dry Moist 	sample intal sample ube 'undisti	e VS S urbed' St VSt H	L CONSISTENCY - Very Soft - Soft - Firm - Stiff - Very Stiff - Hard ATIVE DENSITY - Very Loose - Loose - Medium Dense
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				0.05 m			للبر علير علير علير علير ع يلبر علير علير علير علير ع		TOPSOIL: Sandy SILT; low plasticity, dark brown, fine to medium grained sand, with rootlet 0.10m	w	s	TOPSOIL	
				ES 0.10 - 0.20 m					Gravelly, Sandy SILT; low plasticity, brown/grey, fine to coarse grained sand, fine gravel	w	s	COLLUVIUM	
				ES 0.30 - 0.35 m		-			0.30m			RESIDUAL SOIL	
- purum toothed pricket	E-F	Stable	Not Encountered	ES 0.30 - 0.35 m		- - 0.5 - - - - - - - - - - - - - - - - - - -			Sandy CLAY; medium to high plasticity, brown motted yellow, fine to coarse grained sand, trace fine gravel	M (>PL)	VSt to H	RESIDUAL SUL	· · · ·
¥.						-			2.00m TERMINATED AT 2.00 m Target depth			5011	CONSISTENCY
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Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. Material descriptions are deduced from field observation or engineering examination, and may be appended or confirmed by in situ or laboratory testing. The information is dependent on the scope of investigation, the extent of sampling and testing, and the inherent variability of the conditions encountered.

Subsurface investigation may be conducted by one or a combination of the following methods.

Method	Method					
Test Pitting: excavation/trench						
BH	Backhoe bucket					
EX	Excavator bucket					
R	Ripper					
Н	Hydraulic Hammer					
Х	Existing excavation					
Ν	Natural exposure					
Manual drilling: hand operated tools						
HA	Hand Auger					
Continuous sample drilling						
PT	Push tube					
PS	Percussion sampling					
SON	Sonic drilling					
Hammer drilling						
AH	Air hammer					
AT	Air track					
Spiral flight auge	er drilling					
AS	Auger screwing					
AD/V	Continuous flight auger: V-bit					
AD/T	Continuous spiral flight auger: TC-Bit					
HFA	Continuous hollow flight auger					
Rotary non-core	drilling					
WB	Washbore drilling					
RR	Rock roller					
Rotary core drill	ing					
PQ	85mm core (wire line core barrel)					
HQ	63.5mm core (wire line core barrel)					
NMLC	51.94mm core (conventional core barrel)					
NQ	47.6mm core (wire line core barrel)					
DT	Diatube (concrete coring)					

Sampling is conducted to facilitate further assessment of selected materials encountered.

Sampling method Soil sampling В Bulk disturbed sample D Disturbed sample С Core sample ES Environmental soil sample SPT Standard Penetration Test sample U Thin wall tube 'undisturbed' sample Water sampling WS Environmental water sample

Field testing may be conducted as a means of assessment of the in situ conditions of materials.

|--|

	-						
SPT	Standard Penetration Test						
HP/PP	Hand/Po	Hand/Pocket Penetrometer					
Dynamic Penetrometers (blows per noted increment)							
	DCP	Dynamic Cone Penetrometer					
	PSP	Perth Sand Penetrometer					
MC	Moisture	Moisture Content					
VS	Vane Shear						
PBT	Plate Bearing Test						
IMP	Borehole Impression Test						
PID	Photo Ior	nization Detector					

If encountered, refusal (R), virtual refusal (VR) or hammer bouncing (HB) of penetrometers may be noted.

The quality of the rock can be assessed by the degree of natural defects/fractures and the following.

Rock quality description					
TCR	Total Core Recovery (%)				
	(length of core recovered divided by the length of core run)				
RQD	Rock Quality Designation (%)				
	(sum of axial lengths of core greater than 100mm long divided by the length of core run)				

Notes on groundwater conditions encountered may include.

Groundwater	
Not Encountered	Excavation is dry in the short term
Not Observed	Water level observation not possible
Seepage	Water seeping into hole
Inflow	Water flowing/flooding into hole

Perched groundwater may result in a misleading indication of the depth to the true water table. Groundwater levels are also likely to fluctuate with variations in climatic and site conditions.

Notes on the stability of excavations may include.

Excavation conditions						
Stable	No obvious/gross short term instability noted					
Spalling	Material falling into excavation (minor/major)					
Unstable	Collapse of the majority, or one or more face of the excavation					



Explanatory Notes: General Soil Description

The methods of description and classification of soils used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, a material is described as a soil if it can be remoulded by hand in its field condition or in water. The dominant component is shown in upper case, with secondary components in lower case. In general descriptions cover: soil type, plasticity or particle size/shape, colour, strength or density, moisture and inclusions.

In general, soil types are classified according to the dominant particle on the basis of the following particle sizes.

Soil Classific	ation	Particle Size (mm)
CLAY		< 0.002
SILT		0.002 0.075
SAND	fine	0.075 to 0.21
	medium	0.21 to 0.6
	coarse	0.6 to 2.36
GRAVEL	fine	2.36 to 6.7
	medium	6.7 to 19
	coarse	19 to 63
COBBLES		63 to 200
BOULDERS		> 200

Soil types may be qualified by the presence of minor components on the basis of field examination methods and/or the soil grading.

Terminology	In coarse	In fine soils		
reminology	% fines	% coarse	% coarse	
Trace	≤5	≤15	≤15	
With	>5, ≤12	>15, ≤30	>15, ≤30	

The strength of cohesive soils is classified by engineering assessment or field/lab testing as follows.

Strength	Symbol	Undrained shear strength
Very Soft	VS	≤12kPa
Soft	S	12kPa to ≤25kPa
Firm	F	25kPa to ≤50kPa
Stiff	St	50kPa to ≤100kPa
Very Stiff	VSt	100kPa to ≤200kPa
Hard	Н	>200kPa

Cohesionless soils are classified on the basis of relative density as follows.

Relative Density	Symbol	Density Index
Very Loose	VL	<15%
Loose	L	15% to ≤35%
Medium Dense	MD	35% to ≤65%
Dense	D	65% to ≤85%
Very Dense	VD	>85%

The plasticity of cohesive soils is defined by the Liquid Limit (LL) as follows.

Plasticity	Silt LL	Clay LL
Low plasticity	≤ 35%	≤ 35%
Medium plasticity	N/A	> 35% ≤ 50%
High plasticity	> 50%	> 50%

The moisture condition of soil (w) is described by appearance and feel and may be described in relation to the Plastic Limit (PL), Liquid Limit (LL) or Optimum Moisture Content (OMC).

WOISIU	re condition and description
Dry	Cohesive soils: hard, friable, dry of plastic limit. Granular soils: cohesionless and free-running
Moist	Cool feel and darkened colour: Cohesive soils can be moulded. Granular soils tend to cohere
Wet	Cool feel and darkened colour: Cohesive soils usually weakened and free water forms when handling. Granular soils tend to cohere

The structure of the soil may be described as follows.

Zoning	Description
Layer	Continuous across exposure or sample
Lens	Discontinuous layer (lenticular shape)
Pocket	Irregular inclusion of different material

The structure of soil layers may include: defects such as softened zones, fissures, cracks, joints and root-holes; and coarse grained soils may be described as strongly or weakly cemented.

The soil origin may also be noted if possible to deduce.

Soil origin and description		
Fill	Anthropogenic deposits or disturbed material	
Topsoil	Zone of soil affected by roots and root fibres	
Peat	Significantly organic soils	
Colluvial	Transported down slopes by gravity/water	
Aeolian	Transported and deposited by wind	
Alluvial	Deposited by rivers	
Estuarine	Deposited in coastal estuaries	
Lacustrine	Deposited in freshwater lakes	
Marine	Deposits in marine environments	
Residual soil	Soil formed by in situ weathering of rock, with no structure/fabric of parent rock evident	
Extremely weathered material	Formed by in situ weathering of geological formations, with the structure/fabric of parent rock intact but with soil strength properties	

The origin of the soil generally cannot be deduced solely on the appearance of the material and the inference may be supplemented by further geological evidence or other field observation. Where there is doubt, the terms 'possibly' or 'probably' may be used



Explanatory Notes: General Rock Description

The methods of description and classification of rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, if a material cannot be remoulded by hand in its field condition or in water, it is described as a rock. In general, descriptions cover: rock type, grain size, structure, colour, degree of weathering, strength, minor components or inclusions, and where applicable, the defect types, shape, roughness and coating/infill.

Rock types are generally described according to the predominant grain or crystal size, and in groups for each rock type as follows.

Rock type	Groups
Sedimentary	Deposited, carbonate (porous or non), volcanic ejection
Igneous	Felsic (much quartz, pale), Intermediate, or mafic (little quartz, dark)
Metamorphic	Foliated or non-foliated
Duricrust	Cementing minerology (iron oxides or hydroxides, silica, calcium carbonate, gypsum)

Reference should be made to AS1726 for details of the rock types and methods of classification.

The classification of rock weathering is described based on definitions in AS1726 and summarised as follows.

Term and symbol		Definition	
Residual Soil	RS	Soil developed on rock with the mass structure and substance of the parent rock no longer evident	
Extremely weathered	XW	Weathered to such an extent that the rock has 'soil-like' properties. Mass structure and substance still evident	
Distinctly weathered	DW	The strength is usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores. May be distinguished into MW (Moderately Weathered) and HW (Highly Weathered).	
Slightly weathered	SW	Slightly discoloured; little or no change of strength from fresh rock	
Fresh Rock	FR	The rock shows no sign of decomposition or staining	

The rock material strength can be defined based on the point load index as follows.

Term and symbo	bl	Point Load Index I₅50 (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	Μ	0.3 to 1.0
High	Н	1.0 to 3
Very High	VH	3 to 10
Extremely High	EH	> 10

It is important to note that the rock material strength as above is distinct from the rock mass strength which can be significantly weaker due to the effect of defects. A preliminary assessment of rock strength may be made using the field guide detailed in AS1726, and this is conducted in the absence of point load testing.

The defect spacing measured normal to defects of the same set or bedding, is described as follows.

Definition	Defect Spacing (mm)
Thinly laminated	< 6
Laminated	6 to 20
Very thinly bedded	20 to 60
Thinly bedded	60 to 200
Medium bedded	200 to 600
Thickly bedded	600 to 2000
Very thickly bedded	> 2000

Terms for describing rock and defects are as follows.

Defect Terms			
Joint	JT	Sheared zone	SZ
Bedding Parting	BP	Seam	SM
Foliation	FL	Vein	VN
Cleavage	CL	Drill Lift	DL
Crushed Seam	CS	Handling Break	HB
Fracture Zone	FZ	Drilling Break	DB

The shape and roughness of defects in the rock mass are described using the following terms.

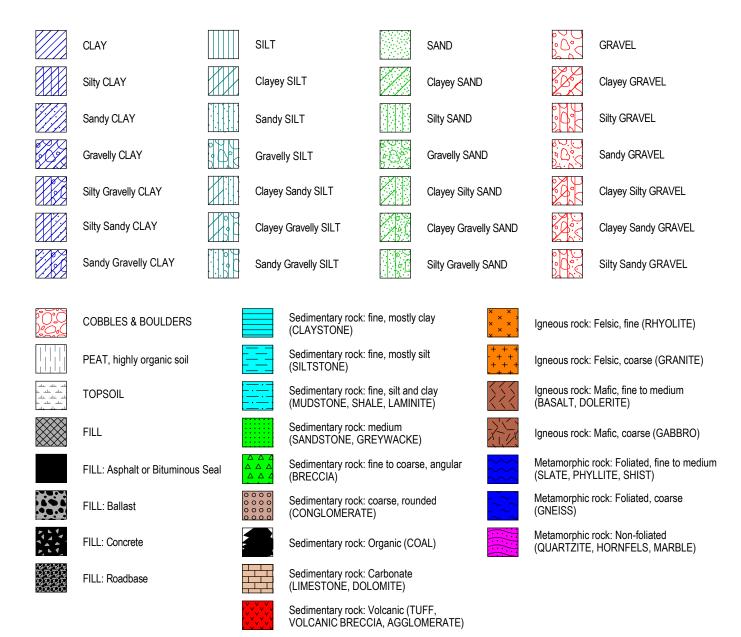
Planarity		Roughness	
Planar	PR	Very Rough	VR
Curved	CU	Rough	RF
Undulose	UN	Smooth	S
Irregular	IR	Slickensided	SL
Stepped	ST	Polished	POL
Discontinuous	DIS		

The coating or infill associated with defects in the rock mass are described as follows.

Infill and Coating		
Clean	CN	
Stained	SN	
Carbonaceous	Х	
Minerals	MU	Unidentified mineral
	MS	Secondary mineral
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
Veneer	VNR	Thin or patchy coating
Coating	СТ	Infill up to 1mm



Graphic Symbols Index



APPENDIX



LABORATORY TEST RESULTS



Report Number:	PRJ360637-1
Issue Number:	1
Date Issued:	13/10/2020
Client:	Cardno NSW
	Unit 1, 10 Denny Street, Broadmeadow NSW 2292
Contact:	lan Piper
Project Number:	PRJ360637
Project Name:	Materials Testing
Project Location:	S#152064 48 Windermere Rd, Lochinvar, Nsw, 2321
Work Request:	656
Sample Number:	SO20-656F
Date Sampled:	23/09/2020
Dates Tested:	23/09/2020 - 29/09/2020
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP003, Depth: 0.3 - 0.5
Material:	Silty CLAY, pale brown

California Bearing Ratio (AS 1289 6.1.1 & 2	.1.1)	Min	Max
CBR taken at	2.5 mm		_
CBR %	3.0		
Method of Compactive Effort	Star	dard	
Method used to Determine MDD	AS 1289 5	.1.1 & 2	2.1.1
Method used to Determine Plasticity	vis	ual	
Maximum Dry Density (t/m ³)	1.53		
Optimum Moisture Content (%)	26.5		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m ³)	1.50		
Field Moisture Content (%)	29.0		
Moisture Content at Placement (%)	26.4		
Moisture Content Top 30mm (%)	33.5		
Moisture Content Rest of Sample (%)	28.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	102		-
Swell (%)	2.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

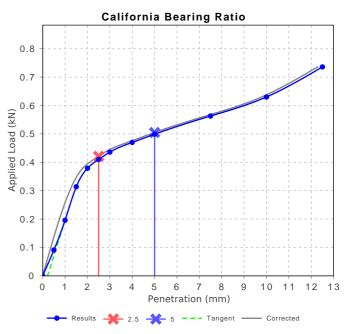


Intrax Consulting Engineers Pty Ltd Branch Site of Deer Park Laboratory Site no. 23209 Morisset Laboratory Unit 2, 50 Alliance Avenue Morisset NSW 2264 Phone: 0477 6611 753 Email: steve.waugh@intrax.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED

Approved Signatory: Steve Waugh Laboratory Manager NATA Accredited Laboratory Number: 19862



Report Number:	PRJ360637-1
Issue Number:	1
Date Issued:	13/10/2020
Client:	Cardno NSW
	Unit 1, 10 Denny Street, Broadmeadow NSW 2292
Contact:	lan Piper
Project Number:	PRJ360637
Project Name:	Materials Testing
Project Location:	S#152064 48 Windermere Rd, Lochinvar, Nsw, 2321
Work Request:	656
Sample Number:	SO20-656G
Date Sampled:	23/09/2020
Dates Tested:	23/09/2020 - 29/09/2020
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP010, Depth: 0.5 - 0.6
Material:	Silty CLAY, brown

California Bearing Ratio (AS 1289 6.1.1 & 2	2.1.1)	Min	Max
CBR taken at	2.5 mm		
CBR %	4.0		
Method of Compactive Effort	Star	ndard	
Method used to Determine MDD	AS 1289 5	.1.1 & :	2.1.1
Method used to Determine Plasticity	vis	ual	
Maximum Dry Density (t/m ³)	1.56		
Optimum Moisture Content (%)	26.0		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	97.5		
Dry Density after Soaking (t/m ³)	1.54		
Field Moisture Content (%)	24.9		
Moisture Content at Placement (%)	ture Content at Placement (%) 25.4		
Moisture Content Top 30mm (%)	30.1		
Moisture Content Rest of Sample (%)	27.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	101		_
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

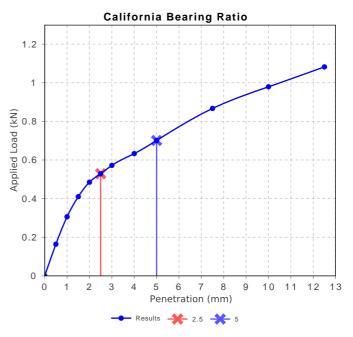


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Report Number: PRJ360637-1

Report Number:	PRJ360637-1
Issue Number:	1
Date Issued:	13/10/2020
Client:	Cardno NSW
	Unit 1, 10 Denny Street, Broadmeadow NSW 2292
Contact:	lan Piper
Project Number:	PRJ360637
Project Name:	Materials Testing
Project Location:	S#152064 48 Windermere Rd, Lochinvar, Nsw, 2321
Work Request:	656
Sample Number:	SO20-656H
Date Sampled:	23/09/2020
Dates Tested:	23/09/2020 - 06/10/2020
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP015, Depth: 0.9 - 1.1
Material:	Silty CLAY, brown

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max		
Sample History	Oven Dried				
Preparation Method	Dry Sieve				
Liquid Limit (%)	85				
Plastic Limit (%)	23				
Plasticity Index (%)	62				
Linear Shrinkage (AS1289 3.4.1)	Min	Max			
Moisture Condition Determined By	AS 1289.3.1.2				
Linear Shrinkage (%)	21.5				
Cracking Crumbling Curling	Curling	1			
Emerson Class Number of a Soil (A	Emerson Class Number of a Soil (AS 1289 3.8.1) Min Max				
Emerson Class	6				
Soil Description					
Nature of Water	Distilled				
Temperature of Water (°C)	21				



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Report Number:	PRJ360637-1
Issue Number:	1
Date Issued:	13/10/2020
Client:	Cardno NSW
	Unit 1, 10 Denny Street, Broadmeadow NSW 2292
Contact:	lan Piper
Project Number:	PRJ360637
Project Name:	Materials Testing
Project Location:	S#152064 48 Windermere Rd, Lochinvar, Nsw, 2321
Work Request:	656
Sample Number:	SO20-656I
Date Sampled:	23/09/2020
Dates Tested:	23/09/2020 - 06/10/2020
Sampling Method:	Sampled by Client - Tested as Received
	The results apply to the sample as received
Site Selection:	Selected by Client
Sample Location:	TP016, Depth: 0.8 - 0.9
Material:	Silty CLAY, dark brown



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Emerson Class Number of a Soil (AS 1289 3.8.1)			Max
Emerson Class	6		
Soil Description			
Nature of Water	distilled		
Temperature of Water (°C)	21		

Report Number:	PRJ360637-1
Issue Number:	1
Date Issued:	13/10/2020
Client:	Cardno NSW
	Unit 1, 10 Denny Street, Broadmeadow NSW 2292
Contact:	lan Piper
Project Number:	PRJ360637
Project Name:	Materials Testing
Project Location:	S#152064 48 Windermere Rd, Lochinvar, Nsw, 2321
Work Request:	656
Dates Tested:	22/09/2020 - 30/09/2020



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Approved Signatory: Steve Waugh Laboratory Manager NATA Accredited Laboratory Number: 19862

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	SO20-656A	SO20-656B	SO20-656C	SO20-656D	SO20-656E
Date Sampled	21/09/2020	21/09/2020	21/09/2020	21/09/2020	21/09/2020
Date Tested	23/09/2020	22/09/2020	28/09/2020	28/09/2020	30/09/2020
Material Source	insitu	insitu	insitu	insitu	insitu
Sample Location	TP002 (0.35-0.58m)	TP004 (1.6-1.85m)	TP011 (1.5-1.63m)	TP026 (0.95-1.35m)	TP030 (0.2 - 0.4m)
Inert Material Estimate (%)	0	5	0	2	0
Pocket Penetrometer before (kPa)	**	**	**	**	**
Pocket Penetrometer after (kPa)	**	**	**	**	**
Shrinkage Moisture Content (%)	37.7	22.5	19.0	29.2	32.1
Shrinkage (%)	11.2	2.9	2.8	7.0	6.1
Swell Moisture Content Before (%)	37.1	27.6	17.9	30.1	26.6
Swell Moisture Content After (%)	39.3	34.2	23.0	30.8	29.5
Swell (%)	1.2	5.7	4.0	0.4	0.7
Shrink Swell Index Iss (%)	6.6	3.2	2.7	4.0	3.6
Visual Description	Silty CLAY, brown	Silty CLAY, pale grey mottled brown	Sandy CLAY, red- brown	Silty CLAY, pale brown	Refer to Client Borehole logs
Cracking	SC	MC	MC	MC	MC
Crumbling	**	**	**	**	**
Remarks	**	**	**	**	**

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.

Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.

NATA Accreditation does not cover the performance of pocket penetrometer readings.



Sydney Laboratory Unit 5/43 Herbert St Artarmon NSW 2064 email: artarmon@ghd.com.au web: www.ghd.com.au/ghdgeotechnics Tel: (02) 9462 4860 Fax:(02) 9462 4710

Materi	al To	est Report	Report No: SYD2002387 Issue No: 1
Client: Project:	U2, 5	Consulting Engineers Pty Ltd 0 Alliance Ave set NSW 2264 4258	Accredited for compliance with ISO / IEC 17025 - Testing
Sample D)etails		No: 679 Date of Issue: 13/10/2020 THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL
GHD Sampl	e No	SYD20-0441-01	
Client Samp Date Sampl		SO20-656H 16/09/2020	
Sampled By		Supplied by Client	
Location		S#152064	
Client Loca	tion	48 Winderemere Rd Lochinvar, NSW	
BH / TP No.		TP015	
Depth (m)		0.9 - 1.1m	
Soil Descrip	otion	CLAY with sand; brown	

Test Results

Description	Method	Result	Limits
Standard MDD (t/m ³)	AS 1289.5.1.1 - 2017	1.51	
Standard OMC (%)		29.0	
Retained Sieve (mm)		19	
Oversize Material (%)		0	
Curing Time (h)		72	
Date Tested		1/10/2020	
Coef of Permeability (m/s)	AS 1289.6.7.3	1 E-10	
Mean Stress Level (kPa)		30	
Permeant Used		Syd tap water	
Length (mm)		76.4	
Diameter (mm)		63.6	
Length/Diameter Ratio		1.20	
Laboratory Moisture Ratio (%)		101.0	
Laboratory Density Ratio (%)		99.0	
CompactiveEffort		Standard	
Method of Compaction		Remoulded	
Surcharge Applied (kg)		0.0	
Pressure Applied (kPa)		10	
Oversize Sieve (mm)		9.5	
Percentage Oversize (%)		0.0	
Moisture Content (%)		35.3	
Date Tested		2/10/2020	

Comments





48 WINDERMERE ROAD INVESTIGAITON PLANS AND LOGS



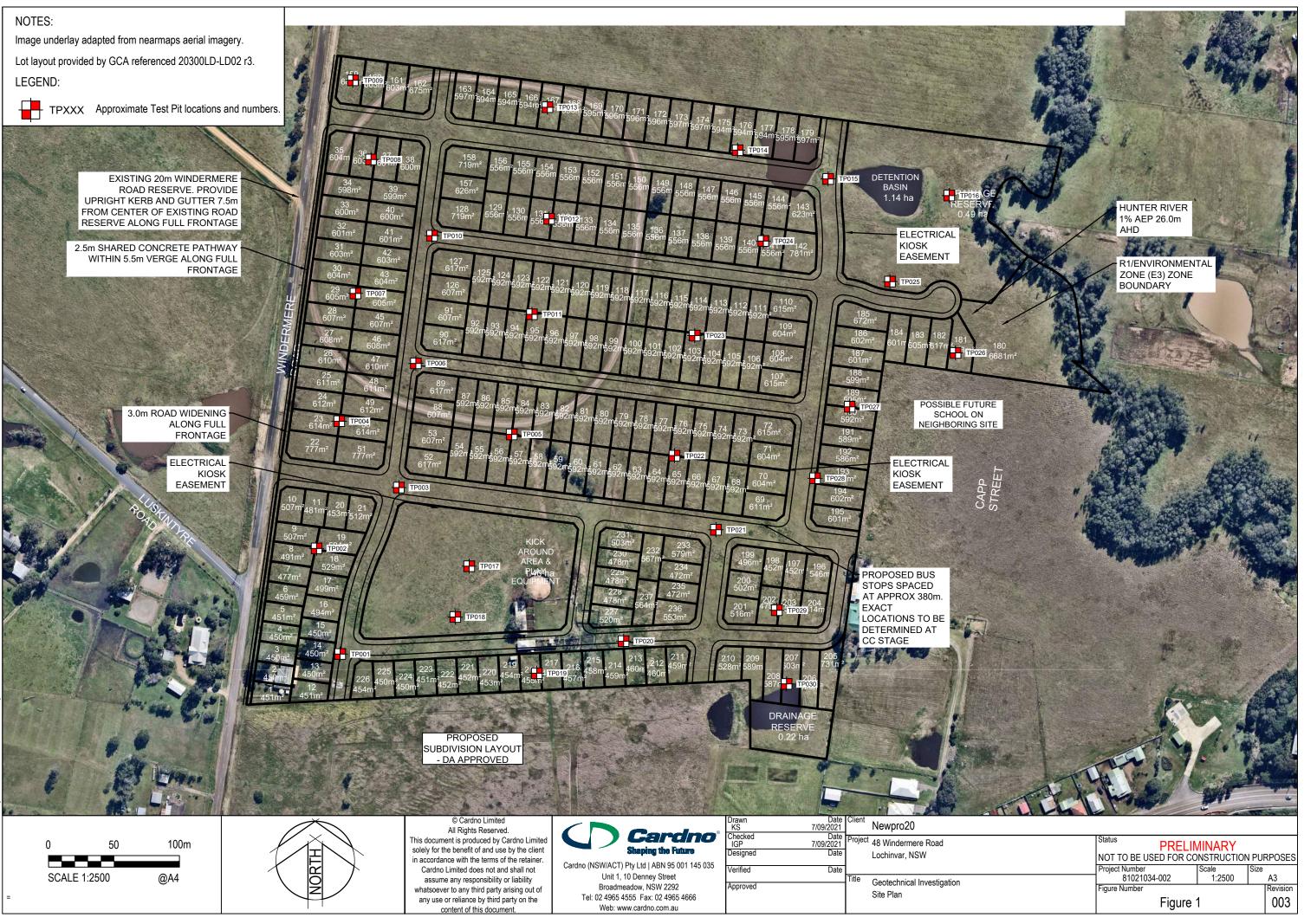
48 Windermere Road Geotechnical Investigation

APPENDIX



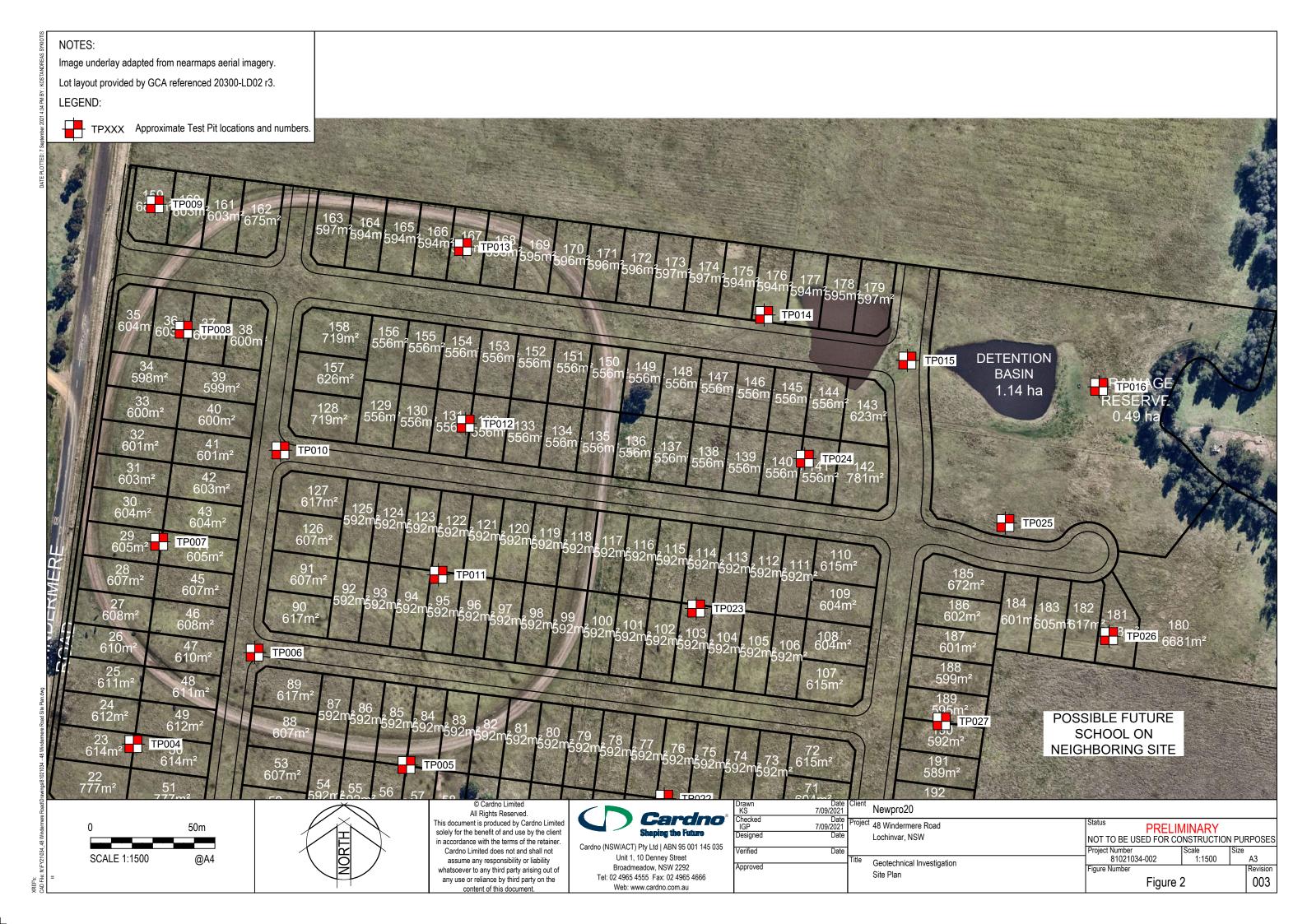
FIGURES

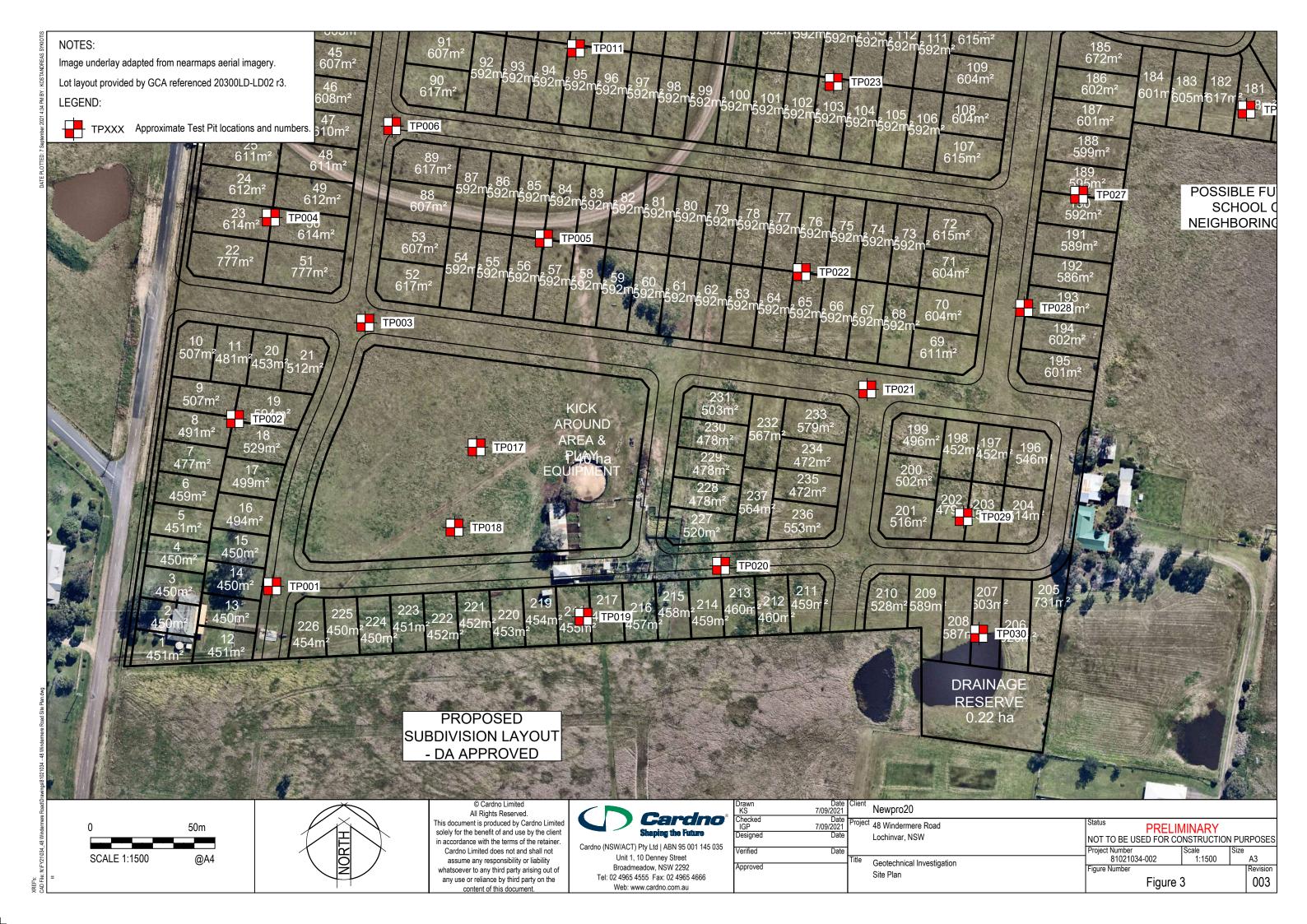
Cardno[®]



DATE PLOTTED: 7 Septe

Jermere Road/Drawings/81021034 - 48 Windermere Ros





48 Windermere Road Geotechnical Investigation

APPENDIX



ENGINEERING LOGS



C	>	Ca	ara	Ino								ΤE	ST PIT LOG SHEET
Client Proje Locat	ct:	C	Seote	ro20 echnical Inves indermere Ro			/ar N	SW		Job No: 81021034		Η	ole No: TP001 Sheet: 1 of
				site map	,					Angle from Horizontal: 90°		Surfac	e Elevation:
				tonne Excav	ator					Excavation Method:			
Exca	vatio	on D	imen	isions:								Contra	ctor: ARSK
Date	Exc	avat	ed: 1	6/9/20						Logged By: KS		Check	ed By: JG
Exca	avatio	on		Sampling &	Testing					Material Description	n		
Method	Resistance	Stability	Water	Sample or Field Test	DC (blc 150 1	ows er mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
1								للبر علير علير علير علير علير علير علير علير علير علير علير - علير علير		TOPSOIL: Silty CLAY, medium plasticity, dark brown, with fine to coarse grained sand	M(-DI)		TOPSOIL
										25m Silty CLAY: medium to high plasticity, dark brown	M (<pl)< td=""><td></td><td>RESIDUAL SOIL</td></pl)<>		RESIDUAL SOIL
							- 0.5				M (= PL)) St	
			Groundwater Not Encountered							55m Silty CLAY: medium to high plasticity, red-brown, with fine to coarse grained sand, with cemented			-
EX-		Stable	Groundwater N		R 	 				sand gravel	M (<pl)< td=""><td>н</td><td></td></pl)<>	н	
						ii-	- 1.0			Sitly CLAY: medium to high plasticity, pale brown mottled red, with fine to coarse grained sand, with cemented sand gravel	M (<pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
										10m			_
						1 1 1	-1.5—			Clayey SAND: brown-yellow, fine to coarse grained sand, with fine coarsed gravel	M (<pl)< td=""><td>D</td><td></td></pl)<>	D	
							-2.0			TERMINATED AT 1.50 m Target depth			
METH EX R HA PT SON AH PS AS AD/V AD/T HFA WB RR	Exc Rip Har Pus Sor Air Sol Sol Sol Hol Wa	per nd aug sh tub nic dril hamm cussic ort spii id fligh id fligh low flig	e er on sam al auge it auge ght auge ght auge	at VE E F H VH er ∇ r: V-Bit - r: TC-Bit - ger ↓	Easy Firm Hard Very Ha Very Ha Very Ha Very Ha Very Ha	ION asy (No R ard (Refu ater Lev own ter inflo ter outf	^{isal)} vel on ow		SF HF DC PS MC	 Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear, P=Peak, L 	Bulk disturb Disturbed si Environmen Thin wall tu RE Dry Moist	ample ital sampl be 'undis'	le S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense
Refer t	to expl	anatory	notes fo	or details of escriptions				CAR	L RDN	O (NSW/ACT) PTY LTD			VD - Very Dense

C	\square) C	arc	dno							ΤE	ST PIT LOG SHEET
Clie	ent: iect:			oro20 echnical Inv	estigation						Η	ole No: TP002
Loc	atio	n: 4	48 W	indermere F	Road, Lochi	nvar M	ISW		Job No: 81021034			Sheet: 1 of 1
				site map	water				Angle from Horizontal: 9	0°	Surfac	e Elevation:
				5 tonne Exca nsions:					Excavation Method:		Contra	ctor: ARSK
				16/9/20					Logged By: KS		Checke	ed By: JG
E	xcava	ition		Sampling	& Testing				Material D	escription		
Method	Resistance	Stability	Water	Sample o Field Tes	t 150 mm		Graphic Log	Classification	SOIL TYPE, plasticity or particle charac colour, secondary and minor compor ROCK TYPE, grain size and type, co fabric & texture, strength, weatherir defects and structure	lour, lour,	Consistency Relative Density	STRUCTURE & Other Observations
							لد علد علد علد علد ع لد علد علد علد علد ع		TOPSOIL: Silty CLAY, medium plasticity, brown, with fine to coarse grained sand	dark		TOPSOIL
						-	لد علد علد علد علد علد لد علد علد علد علد علد علد علد علد علد علد علد لد علد علد			M (<pl)< td=""><td></td><td></td></pl)<>		
				U50 0.35 - 0.58		-			0.30m CLAY: high plasticity, pale brown, with silt			RESIDUAL SOIL
			ncountered			- 0.5 -				M (>PL)	St	-
— EX —		Stable	Groundwater Not Encountered			-						
			U			- 1.0				M (<pl)< td=""><td>VSt</td><td>-</td></pl)<>	VSt	-
						-			1.20m			
									Clayey SAND: brown-yellow, fine to coars sand, with fine coarsed gravel	M (<pl)< td=""><td>D</td><td>EXTREMELY WEATHERED</td></pl)<>	D	EXTREMELY WEATHERED
					R 				1.50m TERMINATED AT 1.50 m Target depth			
						-						
						-						
						-2.0						-
						-						
ME EX HA PT SC AH PS	R H P DN S H A	D Excavato Ripper land aug Push tub Sonic dri bir hamm Percussio	ger e Iling ier	et f	PENETRATION /E Very Easy (N E Easy Firm H Hard /H Very Hard (R WATER		nce)	S H D P N	PT - Standard Penetration Test IP - Hand/Pocket Penetrometer OCP - Dynamic Cone Penetrometer SP - Perth Sand Penetrometer IC - Moisture Content PT - Plate Regime Test	SAMPLES B - Bulk disturb D - Disturbed s ES - Environmen U - Thin wall tu MOISTURE	ample tal sampl	e S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard
AS AD AD HF WE RF	5 S D/V S D/T S FA H B V	Short spi Solid flig	ral aug nt aug nt aug ght au e drilli	ger er: V-Bit er: TC-Bit iger	Water shown water in water c	nflow	i Date	IN P	MP - Borehole Impression Test ID - Photoionisation Detector S - Vane Shear; P=Peak, P=Peaclud (uncorrected kPa)	D - Dry M - Moist W - Wet PL - Plastic limit LL - Liquid limit w - Moisture co	ntent	RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
				for details of descriptions			CAF	DI	NO (NSW/ACT) PTY LT	D		

C		C	arc	Ino							ΤE	ST PIT LOG SHEET
Clier Proje Loca	ect:	0	Geoto	oro20 echnical Inves indermere Roa	tigation ad. Lochii	nvar N	ISW		Job No: 81021034		Η	ole No: TP003 Sheet: 1 of 2
				site map	.,				Angle from Horizontal: 90°		Surfac	e Elevation:
				5 tonne Excava	ator				Excavation Method:			
				nsions:							Contra	ctor: ARSK
Date	Exc	cavat	ed: 1	6/9/20					Logged By: KS		Check	ed By: JG
Exc	avati	ion		Sampling &	Testing				Material Description			
					DCP	Ē		_				
Method	Resistance	Stability	Water	Sample or Field Test	(blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						-	للد علد علد علد علد علد للد علد علد علد علد علد للد علد علد		TOPSOIL; Sandy CLAY, medium plasticity, dark brown, with fine to coarse grained sand	M (<pl)< td=""><td></td><td>TOPSOIL</td></pl)<>		TOPSOIL
				D 0.30 - 0.50 m					2.15m CLAY: high plasticity, pale brown, with silt		St	RESIDUAL SOIL
EX		Stable	Groundwater Not Encountered			-				M (>PL)		
			Ø			- 1.0			.30m		VSt	
						- 1.5			Clayey SAND; brown-yellow, fine to coarse grained sand, with fine coarsed gravel	M (<pl)< td=""><td>D</td><td>EXTREMELY WEATHERED</td></pl)<>	D	EXTREMELY WEATHERED
						- 2.0			TERMINATED AT 1.60 m Target depth			
EX R HA PT SON AH PS AS AD/V AD/T HFA WB RR	Rip Ha Pu So Air Pe Sh / So C So Ro Ro	cavator pper and aug ish tub nic dril hammercussic nort spin blid fligh blow fli ashbor pock rolle	ger e ling er on sam ral auge nt auge ght au e drillir er	et VE F H VH VH r: V-Bit er: TC-Bit ger	Very Easy (N Easy Firm Hard Very Hard (Re TER Water I shown water ir Water o	efusal) ∟evel on nflow	Date	SF HI DO PS MI PI IM PI VS	P Hand/Pocket Penetrometer D D Dir P Dynamic Cone Penetrometer ES - T P Perth Sand Penetrometer U - Th C Moisture Content MOISTURE T Plate Bearing Test D - Dr P Borehole Impression Test M M M Q Photoionisation Detector W W W Q Vane Shear; P=Peak, L - Lit	y pist	ample tal samp be 'undis	Ie S - Soft F - Firm

	aro	lno						TE	ST PIT LOG SHEET
Client: Project: Location:	Newp Geote	ro20 echnical Invest ndermere Roa	tigation					Н	ole No: TP004
Position: Re				1011		Job No: 81021034 Angle from Horizontal:	90°	Surfac	Sheet: 1 of 1 e Elevation:
		tonne Excava	ator			Excavation Method:		Garrao	
Excavation								Contra	actor: ARSK
Date Excava	ated: 1	6/9/20				Logged By: KS		Check	ed By: JG
Excavation		Sampling & 1	Testing				Description		
			DCP Ê		c .				
Method Resistance Stability	Water	Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12	Graphic Log	Classification	SOIL TYPE, plasticity or particle chars colour, secondary and minor comp ROCK TYPE, grain size and type, or fabric & texture, strength, weathe defects and structure	onents colour,	Condition Consistency Relative Density	STRUCTURE & Other Observations
1				بلد علد علد علد علد ع بلد علد علد علد علد علد علد علد علد		TOPSOIL; Sandy CLAY, medium plasti brown, with fine to coarse grained sand	city, dark M (<	PL)	TOPSOIL
EX - Stable	Groundwater Not Encountered				0.15	CLAY: high plasticity, pale brown, with s	M (<	PL) F to St	RESIDUAL SOIL
		U50 1.60 - 1.85 m	- 1.5 -		1.85	Clause CAND fine to second mained b		PL) St to VSI	t EXTREMELY WEATHERED
R Ripper HA Hand a PT Push tu SON Sonic d AH Air harr PS Percus AS Short s AD/V Solid fli AD/T Solid fli HFA Hollow	ibe Irilling imer sion sam piral aug ght auge ght auge flight aug ore drillin oller	et VE E F H VH VH er TC-Bit ger	IFTRATION Very Easy (No Resiste Easy Firm Hard (Refusal) TER Water Level o shown water inflow water outflow	n Date	SPT HP DCP PSP MC PBT IMP PID VS	 Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content 	D - Disturbe ES - Environn U - Thin wal MOISTURE D - Dry M - Moist V - Wet PL - Plastic lii LL - Liquid lir w - Moisture	nental samp I tube 'undis mit nit	Ie S - Soft F - Firm

Proj	nt: ect:	(Geoto	ro20 echnical Inves	tigation	_					H	ole No: TP00
	ation			indermere Roa	ad, Lochi	nvar l	ISW		Job No: 81021034			Sheet: 1 c e Elevation:
				site map 5 tonne Excava	tor				Angle from Horizontal: 90° Excavation Method:		Surrace	e Elevation:
				sions:					Excavation Method.		Contra	ctor: ARSK
				6/9/20					Logged By: KS			ed By: JG
	cavati			Sampling &	Testina				Material Descriptio			54 <u>5</u> <u>7</u> . 6 <u>6</u>
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm	(Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
	R			D 0.10 - 0.20 m		-	لير علم علم علم علم علم علم علم ع علم علم علم علم علم علم	Ö	TOPSOIL; Sitly CLAY, medium plasticity, dark brown, with fine to coarse grained sand	M (<pl)< td=""><td></td><td>TOPSOIL</td></pl)<>		TOPSOIL
			itered	D 0.40 - 0.50 m U50 0.65 - 1.02 m		- - - 0.5 -			0.20m CLAY: high plasticity, pale brown, with silt	M (>PL)	F	RESIDUAL SOIL
EX		Stable	Groundwater Not Encountered	D 1.10 - 1.20 m		- 1.0			1.10m Silty CLAY; medium to high plasticity, pale grey mottled red-yellow		VSt	EXTREMELY WEATHERED
v				B 1.60 - 1.80 m		- 1.5			1.80m	M (≈PL)	н	
						- - 2.0 - -			TERMINATED AT 1.80 m Target depth			
ME EX R HA PS AD/ AD/ HF/ WB R	Rip Ha Pu N So Air Pe Sh V So T So A Ho	per nd aug sh tub nic dril hamm cussic ort spi id fligh id fligh llow fli	e ling ler on sam ral aug nt auge nt auge ght au e drillir	et VE E F H VH er Sr: V-Bit sr: TC-Bit ger	JETRATION Very Easy (N Easy Firm Hard Very Hard (R TER Water Shown water in water of	efusal) Level or nflow		S F F M F	IP - Hand/Pocket Penetrometer D ES E ICP - Dynamic Cone Penetrometer U - ISP - Perth Sand Penetrometer U - IC - Moistrue Content MOISTUE IBT - Plate Bearing Test D - IP - Borehole Impression Test M - ID - Photoionisation Detector W - IS - Paradition (Penetrometer) - -	Bulk disturb Disturbed sa Environmen Thin wall tul RE Dry	ample tal sample be 'undist	e S - Soft F - Firm

Position: Refer to site map Angle from Horizontal: 90° Surface Elevation: Machine Type: 35 tonne Excevator Excevation Dimensions: Date Excevation Dimensions: Date Excevation Sample or Position Sample or	OG SHEET	ST PIT LO	TE								no	rd	Cé		C
Location: 48 Windermere Road, Lochinvar NSW Job No: 81021034 She Position: Refer to site map Angle from Horizontal: 90° Surface Elevation: Machine Type: 3.5 tone Excavator Excavation Method: Excavation Method: Excavation Dimensions: Contractor: ARSK Date Excavated: 16/9/20 Logged By: KS Checked By: JG Excavation Sample or Field Test per 150 mm 1 9	: TP006	ole No:	H							igation					
Machine Type: 3.5 tonne Excavator Excavation Method: Excavation Dimensions: Contractor: ARSK Date Excavated: 16/9/20 Logged By: KS Checked By: JG Excavation Sample or Field Test Sample or (blows per 150 mm) Soll TYPE: plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE; grain size and type, colour, fabric & texture, strength, weathering, defects and structure gray by gray by gra	Sheet: 1 of 1							ISW	nvar N		ndermere Road	3 Wi	: 4	atior	Loc
Excavation Dimensions: Contractor: ARSK Date Excavated: 16/9/20 Logged By: KS Checked By: JG Excavation Sampling & Testing Material Description 0<		e Elevation:	Surfac	5	: 90°	0					•				
Date Excavated: 16/9/20 Logged By: KS Checked By: JG Excavation Sampling & Testing Material Description Potigg of the gran size and type, colour, secondary and minor components relation to the properties of the size and type, colour, secondary and minor components ROCK TYPE, gran size and type, colour, return the size and		ctor: ARSK	Contra			Excavation method.				.01					
DOUTING Sample or Field Test DCP (blows per 150 mm) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) SOL TYPE, plasticity or particle characteristic, colour, secondary and minor components, ROCK TYPE, grain size and type, colour, fabric & terms, strength, weathering, defects and structure (i) (i) (i) (i) (i) (i) STRUCTU & Other Obset 0 (i) (i) (i) (i) (i) (i) (i) 1 3 6 12 (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i) (i)		ed By: JG	Checke	(Logged By: KS									
Image: constrained backgroup					al Description	Material Des				esting	Sampling & Te		on	cavati	E>
Image: Construction of the second			Consistency Relative Density	Moisture Condition	aracteristic, ponents , colour, nering,	colour, secondary and minor componen ROCK TYPE, grain size and type, color fabric & texture, strength, weathering	Classification	Graphic Log	<i>`</i>	(blows per 150 mm)		Water	Stability	Resistance	Method
Method Personal functional grant and served se		TOPSOIL		M (<pl)< td=""><td></td><td>TOPSOIL; Silty CLAY, medium plasticity, da</td><td>-</td><td>ىلىر غاير غاير بار ئار ر</td><td>! </td><td>1 3 6 12</td><td></td><td></td><td></td><td></td><td>A</td></pl)<>		TOPSOIL; Silty CLAY, medium plasticity, da	-	ىلىر غاير غاير بار ئار ر	! 	1 3 6 12					A
MCTHOO PENETRATION PELD TESTS Standard Penetration M (vPL) P V PENETRATION VS		RESIDUAL SOIL			/	· · ·				<u>8</u>					
Micro Provident Pr			F	M (>PL)					-						
METHOD PENETRATION Field Tests SAMPLES SAMPLES SOLUCION		-	F to St	M (>PL)		CLAY: high plasticity, pale brown, with silt			- - 0.5 -			ater Not Encountered	itable		EX
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METHOD PENETRATION PENETRATION FELD TESTS SAMPLES SOL CON- B SOL CON- B SOL CON- B METHOD PENETRATION VE_Very Law (b) Resistance) FM_ Head super- FM_ Head s															
Method Penetration Penetration Penetration Penetration Solution			н	M (<pl)< td=""><td>and, with</td><td>mottled red, fine to coarse grained sand, wit</td><td></td><td></td><td></td><td></td><td>D 1.00 - 1.10 m</td><td>-</td><td></td><td></td><td></td></pl)<>	and, with	mottled red, fine to coarse grained sand, wit					D 1.00 - 1.10 m	-			
METHOD PENETRATION FIELD TESTS SAMPLES SOLICON EX. Excavator bucket R. Ropper HA Hand auger PP Push lube Ver Very Early (No Resistance) F. Error PENETRATION FIELD TESTS SAMPLES B B Solic dompie U Solic Constraint	ATHERED	EXTREMELY WE	н	M (<pl)< td=""><td>oarse grained M (·</td><td>Clayey SAND; brown-yellow, fine to coarse sand, with fine coarsed gravel</td><td></td><td></td><td>+</td><td></td><td>B 1.20 - 1.30 m</td><td></td><td></td><td></td><td></td></pl)<>	oarse grained M (·	Clayey SAND; brown-yellow, fine to coarse sand, with fine coarsed gravel			+		B 1.20 - 1.30 m				
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SON Sonic drilling AH VH Very Hard (Refusal) PSP Perth Sand Penetrometer MOISTURE VSt V AH Air hammer PS Percussion sampler AS Short spiral auger MC - Moisture Content MOISTURE H - H <td>CONSISTENCY - Very Soft - Soft - Firm - Stiff - Very Sliff - Hard ATIVE DENSITY - Very Loose - Loose - Medium Dense - Dense - Very Dense</td> <td>le VS s turbed' St VSt H RELA VL L D</td> <td>ample tal sampl be 'undist</td> <td>urbed sa ironment wall tub st stic limit id limit</td> <td>B - Bulk dis D - Disturbe ES - Environ U - Thin wa MOISTURE D - Dry M - Moist W - Wet PL - Plastic I LL - Liquid Ii w - Moisture</td> <td>Standard Penetration Test B Hand/Pocket Penetrometer D Dynamic Cone Penetrometer Est Perth Sand Penetrometer U Moisture Content M Plate Bearing Test D Borehole Impression Test M Photoionisation Detector W Vane Shear; P=Peak, LL R=Resdual (uncorrected kPa) W</td> <td>S H □ P ≥ P ≦ P V</td> <td colspan="7">METHOD PENETRATION EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/T Solid flight auger: VC-Bit AFA Hollow flight auger WB Washbore drilling RR Rock roller</td> <td>EX R HA PT SC AD AD AD HF WE RF</td>	CONSISTENCY - Very Soft - Soft - Firm - Stiff - Very Sliff - Hard ATIVE DENSITY - Very Loose - Loose - Medium Dense - Dense - Very Dense	le VS s turbed' St VSt H RELA VL L D	ample tal sampl be 'undist	urbed sa ironment wall tub st stic limit id limit	B - Bulk dis D - Disturbe ES - Environ U - Thin wa MOISTURE D - Dry M - Moist W - Wet PL - Plastic I LL - Liquid Ii w - Moisture	Standard Penetration Test B Hand/Pocket Penetrometer D Dynamic Cone Penetrometer Est Perth Sand Penetrometer U Moisture Content M Plate Bearing Test D Borehole Impression Test M Photoionisation Detector W Vane Shear; P=Peak, LL R=Resdual (uncorrected kPa) W	S H □ P ≥ P ≦ P V	METHOD PENETRATION EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/T Solid flight auger: VC-Bit AFA Hollow flight auger WB Washbore drilling RR Rock roller							EX R HA PT SC AD AD AD HF WE RF

Location: 46 Windomser Road, Lochinvar NSW Job No: 81021034 5 Position: Refer to site map Machine Type: 3.5 tome Excavator Excavator Merizontal: 90* Surface Elevation: Excavation Minerations: Contractor: Contractor: ARSK. Date Excavator Surpling & Testing Material Description Tage Big Big Surpling & Testing Material Description Tage Big Big Surpling & Testing Material Description Tage Big Big<		ardno				T LOG SHEET
Position: Refer to site map Angle from Horizontal: 90° Surface Elevation: Machine Type: 3.5 tonne Excavator Excavation Method: Excavation Method: Excavation Dimensions: Contractor: ARSK Date Excavated: 169/920 Logged By: KS Checked By: JG Excavation Sample or Field Test OP 05 0 05 0 05 <t< th=""><th>Project:</th><th>Newpro20 Geotechnical 48 Winderme</th><th>Investigation re Road, Lochinvar N</th><th>SW</th><th>Hole I</th><th>No: TP007 Sheet: 1 of</th></t<>	Project:	Newpro20 Geotechnical 48 Winderme	Investigation re Road, Lochinvar N	SW	Hole I	No: TP007 Sheet: 1 of
Machine Type: 3.5 toone Excavator Excavation Method: Contractor: AR8K Date Excavation Dimensions: Logged By: K3 Checked By: J3 Encounter Sampling & Testing Mathinia Description Mathinia Description Encounter Sampling & Testing Sampling & Testing Mathinia Description Mathinia Description Image: Sampling & Testing Sampling & Testing Image: Sampling & Testing			,		Surface Elevat	
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Excavation Sample or Big 2 Comparing & Testing Big 2 Comparing big 2 Comparind big 2 Comparing big 2 Compa	xcavation D	Dimensions:			Contractor: A	RSK
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Z Z V F	Excavation	Sam	oling & Testing	Material Description		
Memory Memory Display Memory Display Possible Display Display <thdisplay< th=""> <thdisplay< th=""> <thdis< td=""><td>Method Resistance Stability</td><td>Samı Samı Field</td><td>,</td><td>SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure</td><td>Moisture Condition Consistency Relative Density</td><td>STRUCTURE A Other Observations</td></thdis<></thdisplay<></thdisplay<>	Method Resistance Stability	Samı Samı Field	,	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition Consistency Relative Density	STRUCTURE A Other Observations
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M M		Ţ		CLAY: high plasticity, pale brown, with silt	RESIDUA	IL SOIL
M(cPL) VSt to H Image: Standard Function Image: Standard Penetration Test Image: Standard Penetration Test R Report SAMPLES SAMPLES SOLC V Verticity Verticity (No Resistance) Verticity FIELD TESTS SAMPLES Source VS to H	Stable	Groundwater Not Encountered			M (>PL) St	
METHOD PENETRATION FIELD TESTS SAMPLES SOLCA VE<				Silty CLAY: medium to high plasticity, pale grey	M (<pl) h<="" td="" to="" vst=""><td></td></pl)>	
EX Excavator bucket VE Very Easy (No Resistance) SPT Standard Penetration Test B Bulk disturbed sample VS VS R Ripper F Fasy HP Hand/Pocket Penetrometer D D Disturbed sample S -	Y			TERMINATED AT 1.50 m		
HA Haind auger F Firm DCP - Dynamic Cone Penetrometer ES - Environmental sample F SON Sonic drilling H Hard DCP - Dynamic Cone Penetrometer U - Thin wall tube 'undisturbed' VS - SON Sonic drilling VH VeryHard (Refusal) MC - Moisture Content B MOISTURE VS - SP Percussion sampler XATER PBT - Plate Bearing Test D - Dry RELAT AD/T Solid flight auger: V-Bit Shown VI PID - Photoionisation Detector W - Wet MD/T Solid flight auger water untiflow VS - Vane Shear; P=Peak, PL - Plastic limit LL - Liquid limit WB Washbore drilling water outflow R=Resdual (uncorrected kPa) WL LL - Liquid limit	EX Excavato R Ripper HA Hand au PT Push tub SON Sonic dri AH Air hamn PS Percussi AD/V Solid flig AD/V Solid flig HFA Hollow fl WB Washbor	uger ibe rilling mer sion sampler piral auger ght auger: V-Bit ght auger: TC-Bit flight auger pre drilling	VE Very Easy (No Resistan E Easy F Firm H Hard VH Very Hard (Refusal) WATER Water Level on shown water inflow	SPT Standard Penetration Test B B HP Hand/Pocket Penetrometer D D Di DCP Dynamic Cone Penetrometer D - Di PSP Perth Sand Penetrometer U - Th MC Moisture Content MOISTURE PBT Plate Bearing Test D - Dr IMP Borehole Impression Test M M VS Vane Shear; P=Peak, PL - PL	ulk disturbed sample sturbed sample ivironmental sample ini wall tube 'undisturbed' y y oist et astic limit juid limit	S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - VL - Very Loose L - Loose MD - Medium Densee D - Dense

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Clie Pro	ent: ject:			ero20 echnical Inve	estigation						Η	ole No: TP008
	atio	n: 4	8 Wi	indermere R		nvar N	ISW		Job No: 81021034		0	Sheet: 1 of 1
				site map 5 tonne Exca	vator				Angle from Horizontal: 90° Excavation Method:		Surrac	e Elevation:
				isions:								ctor: ARSK
	-		ed: 1	6/9/20			1		Logged By: KS		Check	ed By: JG
E	xcava T	tion		Sampling	-	-			Material Descri	ption		
Method	Resistance	Stability	Water	Sample or Field Test		Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristi colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
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			Ū			- 1.0			.10m Silty CLAY: medium, reddish brown	M (<pl)< td=""><td></td><td>EXTREMELY WEATHERED</td></pl)<>		EXTREMELY WEATHERED
									TERMINATED AT 1.50 m Target depth			
EX Excavator bucket VE Very Easy (No Resistance) SP HA Hand auger F E Easy HP HA Hand auger F Firm DC SON Sonic drilling H Hard PS AH Air hammer WH Very Hard (Refusal) PS PS Percussion sampler AD/V Solid flight auger: TC-Bit MATER PB HFA Hollow flight auger: TC-Bit HHA Hollow flight auger Water inflow VS WB Washbore drilling RR Rock roller Water outflow VS								SF HF DC PS MC PE IM PI	P Hand/Pocket Penetrometer D P Dynamic Cone Penetrometer U P Perth Sand Penetrometer U C Moisture Content MOIS T Plate Bearing Test D P Borehole Impression Test M O Photoionisation Detector W Vane Shear, P=Peak, L	PLES - Bulk disturb - Disturbed s - Environmen - Thin wall tu TURE - Dry - Moist - Wet - Vet - Iciquid limit - Liquid limit - Moisture co	ample ital samp be 'undis	le F - Firm
Ref	fer to ex previatio	xplanatory ons and ba	notes f asis of d	or details of escriptions			CAF	DN	O (NSW/ACT) PTY LTD			

C)	Ca	arc	Ino							ΤE	ST PIT LOO	G SHEET
Client Proje				oro20 echnical Inves	tigation						H	ole No:	TP009
Locat	tion	: 4	8 W	indermere Roa		nvar N	ISW		Job No: 81021034				heet: 1 of 1
				site map 5 tonne Excava	ator				Angle from Horizontal: 90° Excavation Method:	;	Surfac	e Elevation:	
				sions:							Contra	ctor: ARSK	
Date	Exc	avat	ed: 1	6/9/20			1		Logged By: KS		Check	ed By: JG	
Exca	avatio	on		Sampling &	Testing				Material Description	1	1		
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUC & Other Obs	
				D 0.00 - 0.10 m	1 3 6 12		للد علد علد علد علد ع للد علد علد		TOPSOIL: Silty SAND: fine to coarse grained, dark brown	D		TOPSOIL	
EX		Stable	Groundwater Not Encountered	D 0.50 - 0.60 m		- 0.5			0.10m Silty CLAY: medium to high plasticity, reddish brown	M (>PL)	St	RESIDUAL SOIL	-
				D 1.00 - 1.10 m B 1.20 - 1.40 m		- 1.0			As above: with fine to coarse grained sand, with fine sub-angular gravel Clayey SAND: fine to coarse grained, reddish brown	M (<pl)< td=""><td>VSt</td><td>EXTREMELY WEATH</td><td>- - HERED -</td></pl)<>	VSt	EXTREMELY WEATH	- - HERED -
METH EX HA PT SON						- 1.5 - - 			TERMINATED AT 1.40 m Target depth				-
PS AS AD/V AD/T HFA WB RR	Exc Rip Har Sor Air Per Sol Sol Sol Hol Wa	lid fligh llow flig shbor ck rolle	ger e ling er on sam ral augo nt augo ght au ght au e drillin er	et VE E F H VH eter F: TC-Bit ger 1g –	Very Easy (No Easy Firm Hard Very Hard (Re TER Water L Shown water in water of	efusal) .evel or iflow	Date	SH DP P P P V	P Hand/Pocket Penetrometer D Display CP Dynamic Cone Penetrometer E E SP Perth Sand Penetrometer U Th C Moisture Content MOISTURE BT Plate Bearing Test D D ID Photoionisation Detector M Mk S Vane Shear; P=Peak, LL LL R=Resdual (uncorrected kPa) W W	/ bist	ample tal sampl be 'undis	le VS - S - turbed' St - VSt - H - RELATIV VL - L - MD - D -	NSISTENCY Very Soft Soft Firm Stiff Very Stiff Hard /E DENSITY Very Loose Loose Dense Dense Very Dense
				or details of escriptions			CAF	D	NO (NSW/ACT) PTY LTD				

Second 49 Windowner Road, Locking Mindowner Road, Loc			Ca	arc	dnoʻ							TE	ST PIT LC	OG SHEET
Catolini 48 Windommer Road, Luchinvar NSW Job No: 8102103 Sente: 1 of Surface Texture 10 Exhibit Crows along exaction Dimensione: Contractor: ARSK Executed: 169/20 Contractor: ARSK Sampling 1 Texture 199/20	Clien Proie	nt: act:				estigation						Η	ole No:	TP010
Echner Dyne: 3.5 tone Ecowator exervision Dimensions: Lecowator Method: te Ecowator Method: Service Market Berrico et al. (1997) Berrico et al. (1997) B	Loca	tion	1: 4	8 W	indermere F		nvar I	NSW						Sheet: 1 of 1
Canadian Dimensions: Contractor: Contractor:<												Surfac	e Elevation:	
Logged By: K8 Checked By: J6 Samethar Bigging Bigging Big						IVALOF				Excavation Method:		Contra	ctor: ARSK	
Note: Note: <th< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>Logged By: KS</th><th></th><th></th><th></th><th></th></th<>										Logged By: KS				
B B C C B Construction C <thc< th=""> <thc< th=""> <thc< th=""> <thc<< th=""><th>Exc</th><th>avati</th><th>on</th><th></th><th>Sampling</th><th>& Testing</th><th></th><th></th><th></th><th>Material Description</th><th>on</th><th></th><th>1</th><th></th></thc<<></thc<></thc<></thc<>	Exc	avati	on		Sampling	& Testing				Material Description	on		1	
Image: state in the s	Method	Resistance	Stability	Water		(blows per 150 mm	´	Graphic Log	Classification	colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering,	Moisture Condition	Consistency Relative Density		
g g 0.00-0.00 m g 0.00-0.00 m g 0.00-0.00 m g <td>•</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>: </td> <td>سلب سلب س</td> <td></td> <td></td> <td>k D</td> <td></td> <td>TOPSOIL</td> <td></td>	•						: 	سلب سلب س			k D		TOPSOIL	
ETHOD FELD TEST SAMPLES SOL CONSISTENCY N FELD TEST SPENDENDER B B B B B B B B B B B SOL CONSISTENCY N FELD TEST SP FELD TEST SP P B B B B B B B B B B B B SOL CONSISTENCY VS YS							-			0.10m			RESIDUAL SOIL	
ETHOD FELD TEST SAMPLES SOL CONSISTENCY N FELD TEST SPENDENDER B B B B B B B B B B B SOL CONSISTENCY N FELD TEST SP FELD TEST SP P B B B B B B B B B B B B SOL CONSISTENCY VS YS	-EX		stable	ater Not Encountered	B 0.50 - 0.60 n		- - 0.5			As above: colour change to reddish brown	M (= PL) St		
EHOD PENETRATION FILD TESTS SAMPLES SAMPLES SOL CONSISTENCY Image: Constraining and property of the statistical intermined regimes of the state of the	Image:													
ETHOD PENETRATION FELD TESTS SAMPLES SOL CONSISTENCY X Example bucket IIIII IIIII IIIII IIIIII IIIII IIIII IIIII IIIII IIIIII IIIIII IIIIII IIIII IIIIII IIIIII IIIIIII IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							-			Clayey SAND: fine to coarse grained, reddish brown	M (<pl)< td=""><td>D</td><td>EXTREMELY WEA</td><td>THERED</td></pl)<>	D	EXTREMELY WEA	THERED
Image: Second State St								<u> /:/:</u> /:/		TERMINATED AT 1.30 m				
Image: Second state of the second							-			rarget depth				
ETHOD PENETRATION FIELD TESTS Non-darger IIIIII IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							-15							
Image: Second Ducket Image: Second Ducket Image: Second Ducket Image: Second Ducket Second Ducket<							1.0							
IETHOD PENETRATION FIELD TESTS SAMPLES X Excavator bucket IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIII IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							-							
Image: Solid flight auger 10-000 Solid							-							
Image: Solution of the second state														
Image: Solution of the second state														
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Image: Image: Image: Top Solid Circling Result of Resistance) Field TESTS SAMPLES Solid Consistence) Image: Resolution of Resistance) Field TESTS SPT - Standard Penetration Test B - Bulk disturbed sample VS - Very Soft Image: Resolution of Resistance) Field TESTS SPT - Standard Penetration Test B - Bulk disturbed sample VS - Very Soft Image: Resolution of Resistance) Field TESTS SPT - Standard Penetration Test B - Bulk disturbed sample VS - Very Soft Image: Resolution of Resistance) Field TESTS SPT - Standard Penetrometer DCP - Dynamic Cone Penetrometer D - Disturbed sample VS - Very Soft Image: Solid flight auge: To-Bit Water Level on Date Moisture Content MOISTURE St - Stiff Image: Solid flight auge: To-Bit Water Level on Date Short spiral auge: To-Bit Water Inflow VS - Very Locose D - Dry Image: Resolution Water outflow Water outflow Vs - Vene Short spiral auge: To-Bit Moisture content Moisture content Image: Resolution Water outflow Water outflow Record Resolution Detector VS - Very Dense Very Dense Image: Resolution Water content Water outflow Record Resolut														
Image: Solution of the system of the syst														
IETHOD PENETRATION Soll CONSISTENCY X Excavator bucket FileD TESTS SAMPLES SOIL CONSISTENCY X Excavator bucket VE Very Easy (No Resistance) SPT - Standard Penetration Test B - Bulk disturbed sample VS - Very Soft A Hand auger FileD TESTS SPT - Standard Penetration Test D - Disturbed sample S - Soft F NS sonic drilling H Hand Very Hard (Refusal) WATER S Port - Moisture Content PSP - Perth Sand Penetrometer D - Dry Stort System Stort System S + Hard D/V Solid flight auger Water Level on Date shown Shown PBT - Plate Bearing Test D - Dry Moist VL - Very Loose L/F A Hollow flight auger r W ater inflow water outflow R=Resdual (uncorrected kPa) W - Wet PL - Plastic limit L - Loose MD - Medium Dense Water outflow R=Resdual (uncorrected kPa) W - Moisture content W - Very Dense VD - Very Dense							-							
IETHOD PENETRATION Soll CONSISTENCY X Excavator bucket No Spec Spec <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>F</td> <td></td> <td></td> <td></td> <td></td> <td> </td> <td></td> <td></td>							F							
IETHOD PENETRATION FIELD TESTS SAMPLES SOIL CONSISTENCY X Excavator bucket Ripper A Hand auger F - Hand/Pocket Penetrometer Disturbed sample VS - Very Soft A Hand auger H Hand PSP - Perthonetrometer Disturbed sample S Soft S S S Soft S S Soft S S Soft S S Soft S S S Soft S S S S S Soft S							Ļ							
X Excavator bucket VE Very Easy (No Resistance) SPT Standard Penetration Test B B Bulk disturbed sample S														
D/V Solid light auger: V-Bit FA Hollow flight auger /// Solid light auger V-Bit ////////////////////////////////////	EX R HA PT SON AH PS AS	Ex Rip Ha Pu So Air Pe Sh	oper nd aug sh tub nic dril hamm rcussio ort spi	jer e ling er on san ral aug	et r	/E Very Easy (N E Easy Firm H Hard /H Very Hard (F VATER Water	tefusal) Level or		S H D P N P	PT - Standard Penetration Test B - P - Hand/Pocket Penetrometer D - CP - Dynamic Cone Penetrometer U - SP - Perth Sand Penetrometer U - C - Moisture Content MOISTU BT - Plate Bearing Test D - MP - Borehole Impression Test M -	Bulk disturt Disturbed s Environmer Thin wall tu RE Dry Moist	ample Ital sampl	le VS S turbed' St VSt H RELA	 Very Soft Soft Firm Stiff Very Stiff Hard
The variance of the variance o	AD/V AD/T HFA WB RR	So Ho Wa	lid fligh llow fli ashbor	nt aug ght au e drilli	er: TC-Bit Iger	water i	nflow		P	ID - Photoionisation Detector W - S - Vane Shear; P=Peak, PL - B=Beadual (uncersorted kDo) LL -	Wet Plastic limit Liquid limit	ntent	L MD D	LooseMedium DenseDense
								CAF		NO (NSW/ACT) PTY LTD			I	

Location: Windemmer Read: Location: Same: 1 Same: 1 Position: Form Horizontal: 9° Surface Elevation: Reaching Type: 25 tome Elevation: Elecandition Method: Elecandition Method: Date Elevation: Elecandition Method: Checked By: J3 Checked By: J3 Date Elevation: Barrying & Testing Barrying & Te				dno								ST PIT LOG SHEE
Petition: Ender Der Stefer to elle map Angle from Horizontal: 90° Surface Elevation: Bachino Dyna Stores Sample of the Stores Contractor: ANSK Contractor: ANSK Bachino Dyna Stores Sample of the Stores Contractor: ANSK Contractor: ANSK Back Excandio: Sample of the Stores Contractor: ANSK Contractor: ANSK Back Excandio: Sample of the Stores Contractor: ANSK Contractor: ANSK Back Excandio: Sample of the Stores Sample of the Stores Contractor: ANSK Contractor: ANSK Back Excandio: Sample of the Stores	Project:	. (Geot	echnical Inv	vestigation						H	ole No: TP011
Machine Type: 3.5 tome Excavitor Excavitor Excavitor Excavitor Method Excavitor Interestion: Dete Excavitor 169/2 Excavitor Interestion: Dete Excavitation: Dete Excavitor Int					Road, Lochii	nvar r	1211			0	Surfac	Sheet: 1 of
Excervation Dimensions: USARSK Decked By: JG Data Excervator 199/20 Excervator Top Bill Bill Bill Bill Bill Bill Bill Bil				•	avator				-		ounac	
Excavelian Second Second Sec											Contra	ctor: ARSK
Bit	Date Ex	cavat	ed: 1	16/9/20					Logged By: KS		Check	ed By: JG
E E Image: Constraint Statute CO S Image: Constraint Statute	Excavat	tion		Sampling	g & Testing				Material Des	cription		
Note Note <th< td=""><td>Method Resistance</td><td>Stability</td><td>Water</td><td></td><td>or (blows per st 150 mm)</td><td>Depth (m)</td><td>Graphic Log</td><td>Classification</td><td>colour, secondary and minor componen ROCK TYPE, grain size and type, colou fabric & texture, strength, weathering,</td><td>ristic, uts arr, Oudițiion</td><td>Consistency Relative Density</td><td></td></th<>	Method Resistance	Stability	Water		or (blows per st 150 mm)	Depth (m)	Graphic Log	Classification	colour, secondary and minor componen ROCK TYPE, grain size and type, colou fabric & texture, strength, weathering,	ristic, uts arr, Oudițiion	Consistency Relative Density	
NEMO View of the second state of the	A				1 3 6 12			-	TOPSOIL; Sandy CLAY; low plasticity, brown	n, fine		TOPSOIL
Method R Point R							بليد عبليا عليا	0.	to medium grained sand	sand		RESIDUAL SOIL
MEHOD PENETRATION FELD TESTS SAMPLES SOL CONSISTENC V V Vy Eavy Read (Refutual) FFLD TESTS SAMPLES SOL CONSISTENC V V Vy Eavy Read (Refutual) FFLD TESTS SAMPLES B B BUL disturbed sample DO - Dry Ramic Cone Penetrometer PS Percossion sampler At Arhammer SOL CONSISTENC FS Penetration FFLD TESTS SAMPLES B B BUL disturbed sample DO - Dry Ramic Cone Penetrometer PS Percossion sampler At Arhammer SOL CONSISTENC FS Percontert PS Percossion sampler AS Short spiral augger - BAV FELD TESTS B - Bulk disturbed sample DO - Dry Ramic Cone Penetrometer PS Percossion sampler PS Percossion sampler AS Short spiral augger - BAV Solt CONSISTENC AV Water Level on Date Short spiral augger - ADV Water Level on Date Short spiral augger - AV Water Level on Date BaV D - Dry Mater Vy Low Level Content PL + Plate Bearing Test IMP - Boothole Impression Test Debuticementer Debutice Debuticer Mater V. Vy Low Level Vy - Vy Content	EX	Stable	Groundwater Not Encountered			- 1.0		1.3	sub-angular gravel, trace fine to coarse grain sand 30m Sandy CLAY; medium plasticity, red-brown, f	s fine, ned M (=PL		EXTREMELY WEATHERED
METHOD EX. Excavator bucket PENETRATION R Ripper Film H Hard auger Film PT Push tube Standard Penetration Test HA Hard auger PT Push tube SON Social criticity H Hard (Refusal) WATER Water Level on Date Short spiral auger Water Level on Date ADV Solid flight auger V-Bit Water Level on Date MATER Water Level on Date Short spiral auger Vature Content PS Percussion sampler ADV Solid flight auger V-Bit Water Level on Date MAY Short spiral auger ADV Solid flight auger Vature Content PS Percussion sampler ADV Solid flight auger Vature Content PS Parcussion sampler ADV Solid flight auger Vature Content PS Parcussion sampler ADV Solid flight auger Vature Content PS Parcussion sampler ADV Solid flight auger Vater Level on Date Sho	¥			U50 1.50 - 1.6	i 	-		1.	50m TERMINATED AT 1.50 m	M (<pl)< td=""><td>н</td><td></td></pl)<>	н	
EX Excavator bucket VE Very Easy (No Resistance) SPT ST Standard Penetration Test B						- 2.0						
AD/T Solid flight auger: TC-Bit FID Photoionisation Detector W Viet L - Loose HFA Holow flight auger: TC-Bit W Water inflow VS Vane Shear; P=Peak, PL Plastic limit MD - Medium Detector WB Washbore drilling W R=Resdual (uncorrected kPa) LL - Liquid limit D D = Dense	EX E: R R R PT P SON S: AH Ai PS P AD/V S: AD/V S: AD/V S: AD/T S: HFA H WB W	xcavato ipper and aug ush tub onic dril ir hamm ercussic hort spi olid fligl olid fligl ollow fli	ger lling her on san ral aug ht aug ght au ght au e drilli	et npler ger er: V-Bit er: TC-Bit ger	VE Very Easy (N E Easy F Firm H Hard VH Very Hard (Ro WATER WATER Shown water in	efusal) ₋evel or nflow		SPT HP DCF PSF MC PBT IMP PID	Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer Derth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, L	- Bulk disturt - Disturbed s - Environmer - Thin wall tu DISTURE - Dry - Moist - Wet - Plastic limit - Liquid limit	ample ital sampl be 'undis'	le S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense

C)		3-30-04	Ino								ST PIT LOG SHEET
Clien Proje	ect:	C	Geot	oro20 echnical Inves							H	ole No: TP012
Loca				indermere Roa	ad, Lochir	nvar N	ISW		Job No: 81021034		0	Sheet: 1 of 1
				site map 5 tonne Excava	tor				Angle from Horizontal: 90° Excavation Method:		Surfac	e Elevation:
				sions:					Excavation Method.		Contra	ctor: ARSK
				6/9/20					Logged By: KS			ed By: JG
	avati			Sampling &	Testing				Material Descripti			j :
					DCP	Ê		c				
Method	Resistance	Stability	Water	Sample or Field Test	(blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
1							لد علد علد علد علد ع لد علد علد		TOPSOIL; Sandy CLAY; low plasticity, brown, fine to medium grained sand	D		TOPSOIL
EX.		Stable	Groundwater Not Encountered			- - - - - - - - - - - - - - - - -			0.10m CLAY; high plasticity, brown, with silt	M (>PL	St	RESIDUAL SOIL
						- 1.5			As above, medium plasticity, colour change to pail grey mottled brown 1.50m Silty CLAY; medium plasticity, pale grey mottled brown, with fine gravels, rock structure present [Extremely Weathered Siltstone] 1.70m TERMINATED AT 1.70 m Target depth		VSt-H H	EXTREMELY WEATHERED
METI EX HA SON AH PS AS	Exe Rip Ha Pu: Soi Air Pei Shi	cavator pper nd aucu sh tub nic driit hamm rcussicia	jer e ling er on sam ral aug	et VE F H VH Ipler WA Ier V	I I I	efusal)		S H D P N P	CP - Dynamic Cone Penetrometer ES - U - SP - Perth Sand Penetrometer U - C - Moisture Content MOISTL BT - Plate Bearing Test D - M -	Bulk disturt Disturbed s Environmer Thin wall tu IRE Dry Moist	ample ital sampl	le S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY
AD/V AD/T HFA WB RR	Sol Ho Wa		nt auge ght au e drillir		✓ shown water in water of water of	flow		P V	ID - Photoionisation Detector S - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)	Wet Plastic limit Liquid limit Moisture co	ntent	VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
Refer abbrev	to exp	lanatory s and ba	notes f asis of d	or details of escriptions			CAF	I D	NO (NSW/ACT) PTY LTD			

		C	arc	Ino							ΤE	ST PIT LOG SHEET
Clier Proje Loca	ect:	(Geote	oro20 echnical Inve indermere R		nvar N	ISW		Job No: 81021034		Η	ole No: TP013 Sheet: 1 of 1
				site map	,		••••		Angle from Horizontal: 90°		Surfac	e Elevation:
				tonne Exca	vator				Excavation Method:		••••	
				isions:							Contra	ctor: ARSK
Date	Exc	avat	ed: 1	6/9/20					Logged By: KS		Check	ed By: JG
Exc	cavati	on		Sampling	& Testing				Material Descripti			
Method	Resistance	Stability	Water	Sample or Field Test		Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
					1 3 6 12		ىلىر خاند خاند خاند خاند خ	0	TOPSOIL; Sandy CLAY; low plasticity, brown, fine			TOPSOIL
						L			to medium grained sand .10m	D		
EX		Stable	Groundwater Not Encountered			- 0.5			.80m Silty CLAY; medium to high plasticity, red-brown, trace sub-rounded, fine gravels .30m Silty CLAY; medium plasticity, red-brown, trace fin to coarse gravel, rock structure present		St St - VSt	RESIDUAL SOIL
						- 1.5-		4	.50m TERMINATED AT 1.50 m Target depth			
MET EX R HA PT SOM AH AD//A AD//A HFA WB	Rip Ha Pu So Air Pe Sh V So T So A Ho		ger e ling er on sam ral aug nt auge nt auge ght aug	et v E F H V v er TC-Bit ger	PENETRATION // Very Easy (N // Easy // Firm	efusal) Level or hflow		SP HF DC PS MC	- Hand/Pocket Penetrometer P - Dynamic Cone Penetrometer P - Perth Sand Penetrometer - Moisture Content - Plate Bearing Test D - Dhotoionisation Detector - Vane Shear; P=Peak, D - Dhotoinisation Detector - Vane Shear; P=Peak, - D - Dhotoinisation Detector - D - D - D - D - D - D - D - D - D - D	Bulk disturb Disturbed sa Environmen Thin wall tu	ample tal sampl be 'undis	le S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense
RR Refe abbre	r to exp	ock rolle	notes f	or details of escriptions			CAR	RDN	O (NSW/ACT) PTY LTD			VD - Very Dense

C		C	arc	dno								TE	ST PIT LOG SHEET
Clie	ent: ject:	1		oro20 echnical lı	nvestia	ation						Η	ole No: TP014
Loc	atio	n: 4	48 W	indermere			nvar N	ISW		Job No: 81021034			Sheet: 1 of 1
-				site map						Angle from Horizontal: 90°		Surfac	e Elevation:
				5 tonne Ex nsions:	cavalo	r				Excavation Method:		Contra	ctor: ARSK
-				16/9/20						Logged By: KS			ed By: JG
E	xcavat	tion		Sampli	ng & Tes	ting				Material Description	on		
Method	Resistance	Stability	Water	Sample Field Te	est 1	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
				D 0.00 - 0.10		1 3 6 12		لد علد علد علد علد ع لد علد علد علد علد ع		TOPSOIL; Sandy CLAY; low plasticity, brown, fine to medium grained sand 0.10m	D		TOPSOIL
							-			Silty CLAY; low plasticity, dark brown	M (>PL)	St	Possibly COLLUVIUM
			untered	D 0.50 - 0.60	0 m		- 0.5 -			Silty CLAY; medium to high plasticity, dark brown, trace fine to coarse sand, trace fine gravel	M (>PL)	St	RESIDUAL SOIL
EX		Stable	Groundwater Not Encountered	D 1.00 - 1.10	0 m		- - 1.0			0.70m CLAY; high plasticity, brown, with silt	M (>PL)	St	
							-			1.10m Silty CLAY; medium to high plasticity, pale grey mottled brown	M (<pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
•				D 1.50 - 1.60			- 1.5			1.60m TERMINATED AT 1.60 m Target depth			
MI E2 R H4 PT SC A9 AL HFF WR R R R R	Ri A H	xcavato ipper and aug	ger	et	VE Ve E Ea F Fi	 	-	nce)	S H	P - Hand/Pocket Penetrometer D - ES -	Bulk disturb Disturbed s Environmen	ample tal sampl	le F - Firm
PT SC AF AS AS AE AE HF WI RF	ON S		lling her on san ral aug nt aug nt aug ght au e drilli	ger er: V-Bit er: TC-Bit iger		ard ery Hard (Re Water L shown water in water ou	evel or	Date	P M P	SP Perth Sand Penetrometer U C Moisture Content MOISTU BT Plate Bearing Test D IP Borehole Impression Test M D Photoionisation Detector W S Vane Shear; P=Peak, LL	Thin wall tu RE Dry Moist Wet Plastic limit Liquid limit Moisture co		turbed' St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
Re abl				for details of descriptions				CAF	RDI	NO (NSW/ACT) PTY LTD			

				dno'								ST PIT LOG SHEET
Clier Proje Loca	ect:	0	Geot	oro20 echnical Inves indermere Roa	tigation	ivar N	ISW		Job No: 81021034		Η	ole No: TP015 Sheet: 1 of 1
				site map					Angle from Horizontal: 90°		Surfac	e Elevation:
				5 tonne Excav	ator				Excavation Method:			
				nsions:							Contra	ctor: ARSK
Date	Exc	avat	ed: ′	16/9/20					Logged By: KS		Check	ed By: JG
Exc	avati	on		Sampling &	Testing				Material Description	n		
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
•					1 3 6 12		لىر غلىر غلىر غلىر غلىر غ		TOPSOIL; Sandy CLAY; low plasticity, brown, fine to medium grained sand	D		TOPSOIL
			Encountered			- - 0.5		0.10		M (>PL)	F	Possibly RESIDUAL SOIL
EX		Stable	Groundwater Not Encountered	B 0.90 - 1.10 m		- 1.0 - -		1.20	n Sandy CLAY; medium plasticty, brown, fine sand	M(PP)	St - VSt	EXTREMELY WEATHERED
•				B 1.40 - 1.60 m		- 1.5		1.60	n TERMINATED AT 1.60 m Target depth	M (=PL)	н	
						- - 2.0 - -						
MET EX R HA PS AH PS AD/T HFA WB RR	Rip Ha Pu Air Pel Sh Sol F Sol Ho Wa		ger e ling ier on san ral aug nt aug ght au ght au	et VE F H VH ger C F: V-Bit er: V-Bit er: TC-Bit ger	Very Hard (Re Very Hard (Re Very Hard (Re TER Water Li shown water int	^{fusal)} evel on flow		SPT HP DCP PSP MC PBT IMP PID	 Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, D - D Maintenance 	ulk disturb isturbed si nvironmen nin wall tu E ry oist	ample tal samp be 'undis	S - Soft le F - Firm
				for details of descriptions			CAF) (NSW/ACT) PTY LTD			1

C		C	arc	Ino						ΤE	ST PIT LOG SHEET
Clie	ent: ject:	l		oro20 echnical Inves	tigation					Н	ole No: TP016
	atio	n: 4	8 W	indermere Roa	ad, Lochinvar I	NSW		Job No: 81021034			Sheet: 1 of 1
				site map				Angle from Horizontal: 90°		Surfac	e Elevation:
				5 tonne Excava nsions:	ator			Excavation Method:		Contra	ctor: ARSK
				13/0/13.				Logged By: KS			ed By: JG
E	xcava	tion		Sampling &	Testing			Material Description	ı		•
	e				DCP Ê		uo	SOIL TYPE, plasticity or particle characteristic,		~	
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12	Graphic Log	Classification	colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						لير علم علم علير علم علم لير علم علم لير علم علم علير علم علم العلم علم علم		TOPSOIL; Silty SAND; fine to coarse, dark brown 0.15m	D		TOPSOIL
								Silty CLAY; low plasticity, dark brown, trace fine to coarse sand, trace fine sub-angular gravel	M (>PL)	F	ALLUVIUM
								0.55m	_		RESIDUAL SOIL
EX-		Stable	Groundwater Not Encountered	B 0.90 - 1.00 m				Silty CLAY; medium plasticity, dark brown mottled orange, trace fine to coarse sand, trace fine, sub-angular gravel			RESIDUAL SOIL
			Gro							St	-
X∃ MI E2 R HA PTS A4 PTS A5 PTS									M (>PL)		
					1.5						
					R			1.70m		н	
								TERMINATED AT 1.70 m Target depth			
ME E> R H/	R H	xcavato ipper and aug	jer	et VE E F	IETRATION Very Easy (No Resista Easy Firm	nce)	S H	P - Hand/Pocket Penetrometer D - D CP Dynamic Cope Penetrometer ES - E	ulk disturb isturbed sa nvironmen	ample tal sampl	le F - Firm
PT SC AF PS AS AL AL HF WI RF	0N S A A B S S S S S S S S S S S S S	ush tub onic dril ir hamm ercussic hort spi olid fligl olid fligl ollow fli /ashbor ock roll	ling er on sam ral aug nt auge nt auge ght au e drillir	ger er: V-Bit er: TC-Bit ger	Hard Very Hard (Refusal) TER Shown water inflow water outflow	n Date	P N P IN P	SP Perth Sand Penetrometer O I IC Moisture Content MOISTUR BT Plate Bearing Test D - IP Borehole Impression Test M M ID Photoionisation Detector W - S Vane Shear; P=Peak, PL -	hin wall tul F Ioist /et lastic limit quid limit loisture coi		turbed' St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense
Re abl	fer to ex previatio	planatory	notes f asis of d	or details of lescriptions		CAF		NO (NSW/ACT) PTY LTD			I

5) C	arc	Ino						ΤE	ST PIT LOG SHEET
Client: Project: Locatio	:	Newp Geote 48 W	echnical Inves	stigation ad, Lochinvar N	wa		Job No: 81021034		Η	ole No: TP017
			site map				Angle from Horizontal: 90°		Surfac	e Elevation:
			5 tonne Excav	ator			Excavation Method:		oundo	
Excava									Contra	ctor: ARSK
Date Ex	xcava	ated: 1	7/9/20				Logged By: KS		Check	ed By: JG
Excava	ation		Sampling &	Testing			Material Description	I		-
Method Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
	0,			1 3 6 12		Cla	defects and structure FILL; Silty CLAY; medium plasticity, brown, with fine,		ŏ	FILL
							sub-angular to sub-rounded gravel, with fine to coarse sand	M (<pl)< td=""><td></td><td></td></pl)<>		
							Sandy CLAY; medium plasticity, red-brown, fine to coarse sand, trace organics	M (<pl)< td=""><td>VSt</td><td>TOPSOIL 0.30 m: Former Topsoil</td></pl)<>	VSt	TOPSOIL 0.30 m: Former Topsoil
		Encountered					Sifty CLAY; medium to high plasticity, red-brow, trace fine to medium sand		VSt	RESIDUAL SOIL
EX	Stable	Groundwater Not Encountered						M (<pl)< td=""><td></td><td>-</td></pl)<>		-
									н	
							1.35m Sandy CLAY; low plasticity, reddish brown mottled grey, fine to coarse sand	M (<pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
•				 1.5-			1.50m TERMINATED AT 1.50 m			
							Target depth			
R F HA F PT F SON S AH A PS F AD/V S AD/T S AD/T S HFA F WB V	Excavat Ripper Hand au Push tu Sonic d Air ham Percuss Short su Solid fli Solid fli Hollow	ibe rilling mer sion sam piral aug ght aug ght aug flight au ore drillir	et VE F H VH VH er V-Bit er: V-Bit er: TC-Bit ger	NETRATION Very Easy (No Resistan Easy Firm Hard Very Hard (Refusal) ATER Water Level or shown water inflow water outflow		SI HI D ^Q PS	P Hand/Pocket Penetrometer D - D CP Dynamic Cone Penetrometer Es - T SP Perth Sand Penetrometer U - T GT Plate Bearing Test D - D IP Borehole Impression Test M M D - Photoionisation Detector W - W S Vane Shear, P=Peak, L - D	ulk disturb isturbed si nvironmen nin wall tu E ry oist	ample tal samp be 'undis	Ie S - Soft F - Firm
Refer to e abbreviatio	explanato ions and	ory notes f basis of d	or details of lescriptions		CAR		NO (NSW/ACT) PTY LTD			

			Car	dn	O'										TE	ST PIT LOG S	HEET
	ient ojec			vpro2	0 nical Inves	tinatio	n								H	ole No: TI	P018
Lo	cati	ion:	48	Winde	ermere Ro	ad, Lo	chinva	ar N	ISW			Job No: 81021034					:1 of 1
					e map nne Excav	-						Angle from Horizontal Excavation Method:	: 90°	5	Surfac	e Elevation:	
				ensio		ator						Excavation Method:			Contra	ctor: ARSK	
				: 17/9								Logged By: KS		(Checke	ed By: JG	
E	Exca	vation			Sampling &	Testing						Materia	al Description			1	
Method		Ctability	Water		Sample or Field Test	DC (blc 150 1	Ί	Depth (m)	Graphic Log	Classification	s	OIL TYPE, plasticity or particle cha colour, secondary and minor com ROCK TYPE, grain size and type fabric & texture, strength, weat defects and structure	ponents , colour,	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observat	
									بلتر عنات عالت عنات عالت عالت عنات عالت عالت عالت عالت عالت عالت عالت عالت ع			TOPSOIL; Clayey SAND; fine to coa	rse, brown	D		TOPSOIL	
EX		stahla Stahla	Gmundwater Not Encountered					0.5			0.15m	Silty CLAY; high plasticity, brown, trac coarse sand		M (<pl)< td=""><td>St</td><td>RESIDUAL SOIL</td><td>- - - - -</td></pl)<>	St	RESIDUAL SOIL	- - - - -
noto, Monuoling Loois				В 0	.90 - 1.10 m		 = = = =-'	1.0			0.80m	Sandy CLAY; low plasticity, yellow-br red, fine to coarse grained sand, with medium, sub-angular to sub-rounded	fine to	M (<pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td><td>-</td></pl)<>	н	EXTREMELY WEATHERED	-
											1.10m 1.20m	Clayey SAND; fine to coarse, yellow- red, with fine to medium sub-angular to gravel TERMINATED AT 1.20 m		D	D	-	
								2.0				Target depth					-
	A T ON H S	Excave Ripper Hand Push f Sonic Air har Percue Short Solid f	auger ube drilling spiral a ight au ight au flight ore dr	ampler auger uger: V- uger: T(auger	VE F H VH Bit -	Easy Firm Hard Very Ha Very Ha Very Ha Very Ha Very Ha	ION asy (No Re ard (Refusa ater Leve own ter inflow ter outflo	^{al)} el on w		Si H D P M P	P - CP - SP - IC - BT - MP - ID -	Standard Penetration Test Hand/Pocket Penetrometer Dynamic Cone Penetrometer	D - Dis ES - Env U - Thi MOISTURE D - Dry M - Moi W - We PL - Pla LL - Liqu	ist	imple tal sampl be 'undist	e S - Soft F - Firm St - Stiff VSt - Very H - Hard RELATIVE DE VL - Very L - Loos	Soft Stiff NSITY Loose e um Dense se
R	efer to obrevi	o explana ations an	ory not	es for det of descrip	ails of otions				CAR		10	(NSW/ACT) PTY I	_TD				

Cardno'			TEST PIT LOG SH	IEET
Client: Newpro20 Project: Geotechnical I	Investigation		Hole No: TP	019
	e Road, Lochinvar NS	Job No: 81021034	Sheet:	1 of 1
Position: Refer to site map		Angle from Horizontal: 90°	Surface Elevation:	
Machine Type: 3.5 tonne Excavation Dimensions:	xcavator	Excavation Method:	Contractor: ARSK	
Date Excavated: 17/9/20		Logged By: KS	Checked By: JG	
Excavation Sampli	ing & Testing	Material Description	on	
Method Resistance Vater Vater		SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	eutition autition Statester Autor	าร
▲		الله على TOPSOIL; Clayey SAND; fine to medium grained, الله على dark brown	D	
		0.15m Sitty CLAY; medium to high plasticity, dark brown	M (>PL) St	
EX		0.45m Silty CLAY; medium to high plasticity, red-brown, trace fine to coarse sand	M (=PL) VSt	
BOD BOD		0.75m Sandy CLAY; low plasticity, yellow-brown mottled red, fine to coarse grained sand, with fine to medium, sub-angular to sub-rounded gravel	M (<pl) h<="" td=""><td></td></pl)>	
	R	1.20m Clayey SAND; fine to coarse grained, red-brown mottled yellow, with fine to medium gravel 1.30m TERMINATED AT 1.30 m	D D	
		Target depth		
METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	Image: Image and the image	HP - Hand/Pocket Penetrometer D - DCP - Dynamic Cone Penetrometer U - PSP - Perth Sand Penetrometer U - MC - Moisture Content MOISTUI PBT - Plate Bearing Test D - IMP - Borehole Impression Test M - PID - Photoionisation Detector W - VS - Vane Shear; P=Peak, LL -	Bulk disturbed sample VS - Very Sc Disturbed sample S - Soft Environmental sample F - Firm Thin wall tube 'undisturbed' St - Stiff VSt - Very St	oft iff SITY pose n Dense
Refer to explanatory notes for details of abbreviations and basis of descriptions	C	ARDNO (NSW/ACT) PTY LTD		

Position: Refer to site map Angle from Horizonta: 90° Surface Elevation: Machine Type: 3.5 tonne Excavator Excavation Dimensions: Date Excavation Dimensions: Date Excavation: Type: 3.5 tonne Excavator Excavation Dimensions: Date Excavator Sample or Pand Test Date Scavator Sample or Pand Test Date Scavator Sample or Pand Test Date Scavator Date Scavat		ST PIT LOG												Ino			D	C
Position: Refer to site map Angle from Horizontal: 90° Surface Elevation: Machine: Type: 3.5 torme Excavator Eccavation Method: Contractor: ARSK Date Excavator: Sample or Paid Test Somple or Paid Test Som			Ho									gation	Investi	echnical	Geote	0	ect:	Pro
Machino Type: 5.5 toone Escavator Excavation Dimensions: Date Excavated: 17/820 Checked By: KS Checked By: KS Sample of Field Testing Field Tes	neet: 1 of		Surface	6		• 00°				1577	ivar N	I, LOCNIN						
Excertation Dimensions: Contractor: ARSK Date Excertation Date Excertation Sampling & Testing Samples of Field Test Samples of Sampl			Juilace	3		. 30	-					or	•	•				
Date Excevended: Sampling & Testing Testing gg		ctor: ARSK	Contrac	С														
Note Note <th< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th>ogged By: KS</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></th<>							ogged By: KS											
2 2 0 - 0 0 0 0 0 100 4 1 0 1 0 1 0 100 0		-				al Description						esting	pling & Te	Sampl		on	cavat	E
Image: Section of the sectio			Consistency Relative Density		Moisture Condition	ponents , colour,	, secondary and minor cor K TYPE, grain size and type ic & texture, strength, weat	S	assification	Graphic Log	Depth (m)	(blows per			Water	Stability	Resistance	Method
Image: State Store Image: State		TOPSOIL				lium grainad			Ū	للدر علد علد		1 3 6 12					ш	
No. No. Status CLAX: hip hashop, dark brown, table fine b. Resolution. 1 <td></td> <td></td> <td></td> <td></td> <td>D</td> <td>num grained,</td> <td>rown</td> <td>0.10m</td> <td>L</td> <td>ليليد ليليد لي ليد ليليد ليليد</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Ī</td>					D	num grained,	rown	0.10m	L	ليليد ليليد لي ليد ليليد ليليد								Ī
Note Image: Signed of the second system is and with the to come any state is and, with the to come any state is any st		RESIDUAL SOIL		'L)	M (>PL		s sand				-				red			
Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse, angular gravel D D Image: Clayer SAND; fine to coarse grained, red-brown motified yelow, with fine to coarse grained, red-	ERED	EXTREMELY WEATHE		'L)	M (<pl< td=""><td>own mottled</td><td>CLAY; low plasticity, yellow-b ne to coarse grained sand, wit</td><td>0.45m</td><td></td><td></td><td>- 0.5</td><td></td><td></td><td></td><td>Groundwater Not Encounter</td><td>Stable</td><td></td><td>EX</td></pl<>	own mottled	CLAY; low plasticity, yellow-b ne to coarse grained sand, wit	0.45m			- 0.5				Groundwater Not Encounter	Stable		EX
Image: Construction of the second			D		D			<u>1.00m</u>			- - 1.0							
								<u>1.20m</u>			- 15							¥
											-							
METHOD PENETRATION FIELD TESTS SAMPLES SOIL CONSIL EX Excavator bucket VE Very Easy (No Resistance) FIELD TESTS B B ulk disturbed sample VS Very HA Hand auger F Film HP Hand/Pocket Penetrometer D Disturbed sample VS Very SON Sonic drilling HH Hard Hard Head Film HP Hand/Pocket Penetrometer D Disturbed sample VS Very SON Sonic drilling HH Hard Head HP Hand/Pocket Penetrometer D D Thin wall tube 'undisturbed' VS Very SON Sonic drilling HH Hard Head Moist VS Very Very AD/T Solid flight auger: V-Bit Mater Level on Date MOY Mater Level on Date NM Moist VL Very Very <td< td=""><td>Very Soft Soft Firm Stiff Very Stiff Hard E DENSITY Very Loose Loose Medium Dense</td><td>e VS - V S - S purbed' St - S VSt - S VSt - V H - H RELATIVE VL - V L - L MD - M D - D</td><td>ample al sample be 'undistu</td><td>san enta tube it</td><td>sturbed s vironmer in wall tu v sist et astic limit juid limit</td><td>B - Bu D - Dis ES - En U - Thi MOISTURE D - Dry M - Mo W - We PL - Pla LL - Liq</td><td>Pocket Penetrometer nic Cone Penetrometer Sand Penetrometer ure Content Bearing Test ole Impression Test ionisation Detector Shear; P=Peak,</td><td>PT - P - CP - SP - IC - BT - MP - ID -</td><td>S ⊢ □ ₽ ₽ ₽</td><td></td><td>^{:fusal)} evel on flow</td><td>TRATION Very Easy (No Easy Firm Hard Very Hard (Re R Vater L shown water in</td><td>VE F H VH WATE</td><td>pler er er: V-Bit er: TC-Bit ger</td><td>ger ling ler on sam ral aug nt auge nt auge ght auge ght aug</td><td>oper ind aug ish tub nic dril hamm rcussic ort spii lid fligh lid fligh llow fli ashbor</td><td>E) Ri Ha Pu N So Ain Pe St So C T So A Ho S</td><td>EX PT SCH PS AD AD HF W</td></td<>	Very Soft Soft Firm Stiff Very Stiff Hard E DENSITY Very Loose Loose Medium Dense	e VS - V S - S purbed' St - S VSt - S VSt - V H - H RELATIVE VL - V L - L MD - M D - D	ample al sample be 'undistu	san enta tube it	sturbed s vironmer in wall tu v sist et astic limit juid limit	B - Bu D - Dis ES - En U - Thi MOISTURE D - Dry M - Mo W - We PL - Pla LL - Liq	Pocket Penetrometer nic Cone Penetrometer Sand Penetrometer ure Content Bearing Test ole Impression Test ionisation Detector Shear; P=Peak,	PT - P - CP - SP - IC - BT - MP - ID -	S ⊢ □ ₽ ₽ ₽		^{:fusal)} evel on flow	TRATION Very Easy (No Easy Firm Hard Very Hard (Re R Vater L shown water in	VE F H VH WATE	pler er er: V-Bit er: TC-Bit ger	ger ling ler on sam ral aug nt auge nt auge ght auge ght aug	oper ind aug ish tub nic dril hamm rcussic ort spii lid fligh lid fligh llow fli ashbor	E) Ri Ha Pu N So Ain Pe St So C T So A Ho S	EX PT SCH PS AD AD HF W

		>	Ca	arc	lnoʻ							ΤE	ST PIT L	OG SHEET
	ien oje				ro20 echnical In	vestigation						Η	ole No	: TP021
		tion			ndermere site map	Road, Lochi	nvar I	NSW		Job No: 81021034 Angle from Horizontal: 90°		foo	e Elevation:	Sheet: 1 of 1
_					tonne Exc	avator				Excavation Method:	•	Surrac		
Ex	cav	vatio	on D	imen	sions:								ctor: ARSK	
	_			ed: 1	7/9/20	n 9 Teating				Logged By: KS		Check	ed By: JG	
		avatio	ות		Sampini	g & Testing	Ê			Material Description				
Method		Resistance	Stability	Water	Sample of Field Test		Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density		UCTURE Observations
							_	لد علد علد علد علد ع لد علد علد علد علد ع لد علد علد	-	TOPSOIL: Sandy CLAY; low plasticity, dark brown, fine to coarse grained sand 0.13m	M (<pl)< td=""><td>St</td><td>TOPSOIL</td><td>-</td></pl)<>	St	TOPSOIL	-
EX			Stable	Groundwater Not Encountered			- 0.5			Sitty CLAY; medium to high plasticity, dark brown-red, trace fine to medium grained sand 0.30 m: as above, colour change to brown-red	M (>PL)	F	RESIDUAL SOIL	-
			St	Groundwa		R	- 1.0			0.70m Sandy CLAY; low plasticity, reddish brown, fine to coarse grained sand	M (= PL)	н	EXTREMELY WE	ATHERED -
00 Datgel AGS RIA, Ph							-			Clayey SAND: fine to coarse grained, reddish brown, with fine to coarse sub-angular to angular gravel I.30m TERMINATED AT 1.30 m	D to M	D	-	-
CARDNO 2016.LB-GLB LOG CARDNO NON-CORED 81021034 WINDERMERE RU, LOCHINVAN 21-30.GPJ <							- - 1.5 - - - - 2.0 - -			Target depth				
2.01.6 LIB.GLB LOG CARDNO NON-COR	L AETH X APTON VOITA VOITA VOITA VOITA	Exc Rip Har Pus Sor Air Sol Sol Sol Hol Wa	per nd aug sh tub nic dril hamm cussic ort spir id fligh id fligh low flig	e ling er on sam ral aug nt auge oft auge ght auge e drillin	pler er r: V-Bit r: TC-Bit ger	PENETRATION VE Very Easy (N E Easy F Firm H Hard VH Very Hard (R WATER WATER Water in water of	^{efusal)} _evel or nflow		SH DP P P	$\begin{array}{rcl} P & - & Hand/Pocket Penetrometer\\ CP & - & Dynamic Cone Penetrometer\\ SP & - & Perth Sand Penetrometer\\ C & - & Moisture Content\\ BT & - & Plate Bearing Test\\ IP & - & Borehole Impression Test\\ ID & - & Photoionisation Detector\\ S & - & Vane Shear, P=Peak,\\ P=Reducel (uncorrected IPa)\\ \end{array} \qquad \begin{array}{lllllllllllllllllllllllllllllllllll$	ulk disturb isturbed sa nvironmen nin wall tul E ry oist	ample tal sampl be 'undis	le VS S turbed' St VSt H	CONSISTENCY - Very Soft - Soft - Firm - Very Stiff - Very Stiff - Very Losse - Very Losse - Medium Dense - Dense - Very Dense
	Refer bbrev	to expl /iations	anatory and ba	notes f isis of d	or details of escriptions			CAF	, DI	NO (NSW/ACT) PTY LTD				

G		Car	rdn	10							TE	ST PIT LOG SHEET
Client Projec			wpro otecl	20 hnical Investi	igation						Η	ole No: TP022
Locati		48	Wind	dermere Road	d, Lochir	nvar N	NSW		Job No: 81021034			Sheet: 1 of
				te map					Angle from Horizontal: 90° Excavation Method:		Surfac	e Elevation:
Excav				onne Excavat	lor				Excavation Method:		Contra	ctor: ARSK
Date E									Logged By: KS			ed By: JG
Exca	vation			Sampling & Te	esting				Material Description			
Method	Kesistance	Motor	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
•							للد علد علد علد علد ع للد علد ع علد علد ع		TOPSOIL: Sandy CLAY: low plasticity, dark brown, fine to coarse grained sand	M (=PL)		TOPSOIL
									0.15m CLAY; high plasticity, brown, with silt	M (>PL)	F	RESIDUAL SOIL
EX		Stable Considents Not Encomposed				- 1.0			0.75m Silty CLAY; medium plasticity, reddish brown with black speckles, trace fine to coarse grained sand, trace fine, sub-angular gravel	M (>PL)	F	
						- 1.5			1.70m Silty CLAY; medium to high plasticity, pale grey mottled red brown	M (= PL)	н	EXTREMELY WEATHERED
*						-2.0-			2.00m TERMINATED AT 2.00 m Target depth			
						-						
METH EX R HA PT SON AH PS AS AD/V AD/T HFA WB RR	Excav Rippe Hand Push Sonic Air ha Percu Short Solid Solid Hollow	auger tube drilling ssion s spiral a flight a flight a w flight bore di	ample auger uger: \ uger: ٦ auger	r WATI	TRATION Very Easy (No Easy Firm Hard Very Hard (Re ER Water L shown water on	efusal) .evel or iflow		S H D M P	P Hand/Pocket Penetrometer D - Director CP Dynamic Cone Penetrometer ES - Ei SP Perth Sand Penetrometer U - Th C Moisture Content MOISTURI BT Plate Bearing Test D - Dir IP Borehole Impression Test M - M ID Photoionisation Detector W W V S Vane Shear, P=Peak, PL Peneducid (uncorrected MPa) LL - Lit	ulk disturb sturbed sa nvironmen nin wall tul y y oist	ample tal sampl be 'undis	Ie S - Soft F - Firm
		atory not nd basis					CAF		NO (NSW/ACT) PTY LTD			1

) C	ard	lnoʻ							TE	ST PIT LOG SHEET
Client: Project		Newp	ro20 echnical Invest	tigation						Н	ole No: TP023
Locatio	on:	48 Wi	ndermere Roa	id, Lochin	var N	ISW		Job No: 81021034			Sheet: 1 of 1
			site map	4.0.4				Angle from Horizontal: 90° Excavation Method:	;	Surface	e Elevation:
Excava			tonne Excava	llor				Excavation Method:		Contra	ctor: ARSK
Date E								Logged By: KS		Checke	ed By: JG
Excav	ation		Sampling & T	Festing				Material Description			1
Method Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						للد علد علد علد علد علد علد علد علد علد علد علد علد علد علد علد علد ع		TOPSOIL: Sandy CLAY; low plasticity, dark brown, fine to coarse grained sand 0.15m	D		TOPSOIL
					-			CLAY; high plasticity, brown, with silt	M (>PL)	F	RESIDUAL SOIL
		countered			- 0.5 - -			0.45m Silty CLAY; medium plasticity, reddish brown with black speckles, trace fine to coarse grained sand, trace fine, sub-angular gravel	M (>PL)	F	
EX	Stable	Groundwater Not Encountered			- - 1.0 - -			1.20m Sandy CLAY: low to medium plasticity, brown mottled yellow, fine to coarse grained sand		St - VSt VSt	EXTREMELY WEATHERED
					- - 1.5 - -				M (= PL)	Н	
_ Y					2.0 - - -	<u> </u>		2.00m TERMINATED AT 2.00 m Target depth			
R HA PT SON AH PS AD/V AD/T HFA WB	Excavato Ripper Hand au Push tub Sonic dri Air hamn Percussi Short sp Solid flig	ger lling ner on sam iral auge ht auge ht auge ight auge ight auge	et VE E F H VH VH er TC-Bit ger	Very Easy (No Easy Firm Hard Very Hard (Ref TER Water Lef shown water infl water ou	^{iusal)} evel on ilow		S H P M P I N P	$\begin{array}{rcl} P & - & Hand/Pocket Penetrometer \\ CP & - & Dynamic Cone Penetrometer \\ SP & - & Perth Sand Penetrometer \\ IC & - & Moisture Content \\ BT & - & Plate Bearing Test \\ ID & - & Photoionisation Detector \\ ID & - & Photoionisation Detector \\ S & - & Vane Shear; P=Peak, \\ PE-Pendural (Vanesmented VDe) \\ \end{array} \qquad \begin{array}{lllllllllllllllllllllllllllllllllll$	ulk disturb sturbed sa nvironmen nin wall tul Y oist	ample tal sample be 'undist	e S - Soft F - Firm
Refer to abbreviat	explanator tions and b	y notes fo asis of de	or details of escriptions			CAR	2 D	NO (NSW/ACT) PTY LTD			

) C	aro	lno						ΤE	ST PIT LOG SHEET
Client: Project:	. (Newp Geote	chnical Invest	tigation					Η	ole No: TP024
Locatio			ndermere Roa	d, Lochinvar	NSW		Job No: 81021034		0	Sheet: 1 of
			site map tonne Excava	tor			Angle from Horizontal: 90° Excavation Method:		Surrac	e Elevation:
Excavat							Excavation Method.		Contra	ctor: ARSK
Date Ex							Logged By: KS			ed By: JG
Excavat	tion		Sampling & T	Testing			Material Description			•
Method Resistance	Stability	Water	Sample or	DCP (blows per 150 mm) DCP	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour,	Moisture Condition	Consistency Relative Density	STRUCTURE
Resi	Ste	×	Field Test	150 mm) 1 3 6 12	لد علد علد	Class	fabric & texture, strength, weathering, defects and structure TOPSOIL: Sandy CLAY; low plasticity, dark brown,	Cor	Concert	& Other Observations
							fine to coarse grained sand	D	St	RESIDUAL SOIL
							Silty CLAY; medium plasticity, dark brown, trace fine to coarse grained sand, trace fine sub-rounded gravel	M (>PL)	St	
		untered					.45m CLAY; high plasticity, brown, with silt			
EX	Stable	Groundwater Not Encountered						M (>PL)	F	-
		0					0.90 m: as above, with fine to coarse grained sand	M (≈ PL)	St - VSt	
							40m			
v							Clayey SAND: fine to coarse grained, reddish brown, with fine to coarse sub-angular to angular gravel .60m	D to M	D	EXTREMELY WEATHERED
							TERMINATED AT 1.60 m Target depth			
				 -2.0 						
R Ri HA Ha PT Pi SON So AH Ai PS Pi AD/V So AD/V So HFA Ho WB W	xcavato ipper and au ush tub onic dri ir hamn ercussi hort spi olid flig	ger lling ner on sam ral aug ht auge ht auge ght auge ght aug	et VE E F H VH VH er TC-Bit ger	ETRATION Very Easy (No Resistz Easy Firm Hard Very Hard (Refusal)		SF HF DC PS MC	 Hand/Pocket Penetrometer Dynamic Cone Penetrometer Perth Sand Penetrometer Moisture Content Plate Bearing Test Borehole Impression Test Photoionisation Detector Vane Shear; P=Peak, Bereduci (uncorrected KPa) 	y pist	ample tal samp be 'undis	le S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard RELATIVE DENSITY VL - Very Loose L - Loose MD - Medium Densu D - Dense
Refer to ex	cplanator	/ notes fo	or details of escriptions		CAF	r DN	O (NSW/ACT) PTY LTD			VD - Very Dense

Cardno'			TES	ST PIT LOG SHEET
Client: Newpro20 Project: Geotechnical Ir	nvestigation		Ho	ole No: TP025
Location: 48 Windermere	Road, Lochinvar NSW	Job No: 81021034		Sheet: 1 of 1
Position: Refer to site map		Angle from Horizontal: 90°	Surface	Elevation:
Machine Type: 3.5 tonne Ex Excavation Dimensions:	Cavalor	Excavation Method:	Contrac	ctor: ARSK
Date Excavated: 17/9/20		Logged By: KS		ed By: JG
Excavation Samplir	ng & Testing	Material Description	ı	
Method Resistance Mater Water	(150 mm)	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition Consistency Relative Density	STRUCTURE & Other Observations
A	1 3 6 12	TOPSOIL: Sandy CLAY; low plasticity, dark brown in fine to coarse grained sand	M (<pl) f<="" td=""><td>TOPSOIL</td></pl)>	TOPSOIL
		0.15m Silty CLAY; medium plasticity, dark brown, trace fine to coarse grained sand 0.30 m: as above, colour change to brown	M (>PL) F	RESIDUAL SOIL
EX- Stable Groundwater Not Encountered		0.60m Sandy CLAY; low to medium plasticity, brown, fine to coarse grained sand	M (■PL) VSt	EXTREMELY WEATHERED
	 - 	1.00m Clayey SAND: fine to coarse grained, reddish brown, with fine to coarse sub-angular to angular gravel	D to M D	
		I.50m TERMINATED AT 1.50 m Target depth		
METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic forling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger	PENETRATION VE Very Easy (No Resistance) E Easy F Firm VH Very Hard (Refusal) WATER Shown water inflow	HP - Hand/Pocket Penetrometer D - D DCP - Dynamic Cone Penetrometer ES - E PSP - Perth Sand Penetrometer U - T MC - Moistrue Content MOISTUR PBT - Plate Bearing Test D - D IMP - - D - D PID - Photoionisation Detector W - W VS - Vane Shear: P=Peak. PL - P	ulk disturbed sample listurbed sample nivironmental sample hin wall tube 'undistu E Iry loist Vet lastic limit	S - Soft F - Firm
WB Washbore drilling RR Rock roller Refer to explanatory notes for details of abbreviations and basis of descriptions	water outflow	B=Resdual (uncorrected kPa)	iquid limit loisture content	D - Dense VD - Very Dense

Hole No: TP026 No: 81021034 Sheet: 1 of 1 a from Horizontal: 90° Surface Elevation: vation Method: Contractor: ARSK ed By: KS Checked By: JG Material Description plasticity or particle characteristic,
e from Horizontal: 90° Surface Elevation: vation Method: Contractor: ARSK ed By: KS Checked By: JG Material Description
vation Method: Contractor: ARSK ed By: KS Material Description
Contractor: ARSK ed By: KS Checked By: JG Material Description
ed By: KS Checked By: JG Material Description
plasticity or particle characteristic,
plasticity or particle characteristic, condary and minor components PE, grain size and type, colour, texture, strength, weathering, defects and structure
Clayey SAND; fine to coarse grained TOPSOIL
D MD
plasticity, brown, with silt, trace fine to ned sand
M (>PL)
medium to high plasticity, pale grey wn and black, trace fine to coarse id M (PL) H RESIDUAL SOIL -
ED AT 1.60 m h
SAMPLES SOIL CONSISTENCY Penetration Test ket Penetrometer B - Bulk disturbed sample VS - Very Soft Done Penetrometer - Disturbed sample S - Soft S - Soft Denetrometer - Thin wall tube 'undisturbed' F - Firm St - Stiff Vontent - Dry MOISTURE D - Dry RELATIVE DENSITY M - Moist V - Very Lorge - Very Lorge - Very Stiff

		0	1.00	Ino								ST PIT LOG SHEE
Clie Proj	ect:	(Vewp Geote	echnical Inves	tigation		1014/				H	ole No: TP02
Loca				ndermere Roa site map	ia, Lochi	nvar r	1511		Job No: 81021034 Angle from Horizontal: 90°		Surfac	Sheet: 1 of e Elevation:
				i tonne Excava	ator				Excavation Method:		Junac	
				sions:						(Contra	ctor: ARSK
Date	Ex	cavat	ed: 1	7/9/20					Logged By: KS		Checke	ed By: JG
Exe	cavat	tion		Sampling &	Testing				Material Description			1
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	 Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						-	لير علير علير علير علير علير علير علير علير علير علير علير علير علير ع		TOPSOIL: Clayey SAND; fine to coarse grained sand, dark brown	D	MD	TOPSOIL
			tered						0.20m Sitty CLAY; medium to high plasticity, brown, trace fine to coarse grained sand, trace fine, sub-angular gravel	M (>PL)	F - St	Possibly ALLUVIUM
EX		Stable	Groundwater Not Encountered						1.20m Silty CLAY; medium to high plasticity, pale grey mottled pale brown	M (>PL)	VSt	RESIDUAL SOIL
♥ MET EX	THOD	, xcavato		*	I I I I I I I I I I I I I I I I I I I	- 2.0-			2.00m TERMINATED AT 2.00 m Target depth ELD TESTS SAMPLES PT - Standard Penetration Test B - Bu	lk disturb	ed sampl	SOIL CONSISTENCY VS - Very Soft
EX R HA PT SOI AH PS AD/ AD/ HFA WB RR	Ri Hi Pi Si Pi Si Si Si Si Si W	ipper and aug ush tub onic dril ir hamm ercussio hort spi olid fligh	ger ling ler on sam ral aug nt auge nt auge ght auge ght aug	pler WA er St. V-Bit ger Jer	Very Easy (N Easy Firm Hard Very Hard (R TER Water I shown water in water o	^{efusal)} Level on nflow		H D P N P IN P	P - Hand/Pocket Penetrometer D - Dis CP Dynamic Cone Penetrometer U - Th SP - Perth Sand Penetrometer U - Th IC - Moisture Content MOISTURE BT - Plate Bearing Test D - Dr IP - Borehole Impression Test M - Moisture ID - Photoionisation Detector W - We S - Vane Shear; P=Peak, LL - Lit	sturbed sa vironmen in wall tul : y vist	ample tal sampl be 'undist	le F - Soft
				or details of escriptions			CAF		NO (NSW/ACT) PTY LTD			1

\Box	Carc	Ino							TE	ST PIT LOG SHEET
Client: Proiect:	Newp	oro20 echnical Invest	idation						H	ole No: TP028
Location:	48 W	indermere Roa		var N	ISW		Job No: 81021034			Sheet: 1 of 1
Position: R		•					Angle from Horizontal: 90°	:	Surface	e Elevation:
Excavation	-	5 tonne Excava nsions:	tor				Excavation Method:		Contra	ctor: ARSK
Date Excav							Logged By: KS			ed By: JG
Excavation		Sampling & 1	Testing				Material Description	_	_	
Method Resistance	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
^					للد علد علد علد علد عد علد علد عد علد علد عد علد علد علد علد علد علد		TOPSOIL: Sandy CLAY; low plasticity, dark brown, fine to coarse grained sand	D	St	TOPSOIL
	t Encountered			- - 0.5			9.15m Silty CLAY; medium to high plasticity, reddish brown, trace fine to coarse grained sand	M (>PL)	F	RESIDUAL SOIL
EX EX	Groundwater Not Encountered			-			0.60m Sandy CLAY; medium plasticity, reddish brown, fine to coarse grained sand 0.80m Clayey SAND: fine to coarse grained, reddish	M (mPL)	VSt	EXTREMELY WEATHERED
				- 			brown, with fine to coarse sub-angular to angular gravel	D to M	D	
				-			TERMINATED AT 1.20 m Target depth			
				- 1.5 - -						
				- - 2.0						
				-						
R Rippel HA Hand PT Push i SON Sonic AH Air hai PS Percu: AS Short AD/V Solid i AD/T Solid i	auger tube drilling mmer ssion sam spiral auge flight auge v flight au bore drillir	et VE E F H VH VH Per er: V-Bit er: TC-Bit ger	ETRATION Very Easy (No Easy Firm Hard Very Hard (Re TER Water L shown water in water ou	^{fusal)} evel on flow		SI HI D ⁽ P ⁽ M	P - Hand/Pocket Penetrometer D - Di CP - Dynamic Cone Penetrometer ES - Er CP - Perth Sand Penetrometer U - Th CP - Moisture Content MOISTURE TP - Barehole Impression Test D - Dr P - Borehole Impression Test M - Mu O - Photoionisation Detector W - W S - Vane Shear; P=Peak, PL - Pit	y pist	ample tal sample be 'undist	e S - Soft F - Firm
Refer to explana abbreviations an	tory notes f d basis of d	or details of lescriptions			CAR	<u>N</u> D	IO (NSW/ACT) PTY LTD			

		C	arc	Ino						TE	ST PIT LOG SHEET
Clie	ent: ject:			oro20 echnical Invest	igation					H	ole No: TP029
Loc	ation	n: 4	48 W	indermere Roa		NSW		Job No: 81021034			Sheet: 1 of 1
				site map	4			Angle from Horizontal: 90°		Surface	e Elevation:
				5 tonne Excava nsions:	tor			Excavation Method:		Contra	ctor: ARSK
-				7/9/20				Logged By: KS			ed By: JG
E)	kcavat	ion		Sampling & T	esting			Material Description			
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						ا اعتلم اعتلما مثلم اعتلم اع معلم اعتلم مثلم اعتلم اع مثلم اعتلم اع	- 	TOPSOIL: Silty SAND; fine to coarse grained, reddish brown	D	St	TOPSOIL
EX		Stable	Groundwater Not Encountered	U50 0.60 - 0.79 m D 0.70 - 0.80 m				0.15m Silty CLAY; medium to high plasticity, reddish brown, trace fine to coarse grained sand, trace fine, sub-angular to angular gravel	M (<pl)< td=""><td>St VSt - H</td><td>RESIDUAL SOIL -</td></pl)<>	St VSt - H	RESIDUAL SOIL -
								0.90m		Votern	
♥						:::::		0.95m SANDSTONE; fine to coarse grained, pale grey mottled black			WEATHERED ROCK
					- 1.0			TERMINATED AT 0.95 m Bucket refusal			-
ME EX R HAA PSC AD HFF R R R R R											
ME EX HA PT SC AH SC AD AD HF WE RR	Ri Ha DN So I Aii S St V/V So V/T So A Ho B W	cavator pper and aug ush tub pnic dril r hamm ercussion nort spir blid fligh	ger e lling her on sam ral aug nt aug ght au ght au	et VE E F H VH VH VH VH VH VH VH VH VH VH VH VH V	ETRATION Very Easy (No Resist Easy Firm Hard Very Hard (Refusal) ER Water Level of shown water inflow ◀ water outflow			IP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer VC - Moisture Content BT - Plate Bearing Test VIP - Borehole Impression Test VID - Photoionisation Detector VS - Vane Shear; P=Peak, D - Plate Perdual (upcorrected VPa)	turbed sa vironment n wall tub , ist	tal sample be 'undist	e S - Soft F - Firm
Ref abb	er to ex previation	planatory ns and ba	/ notes f asis of c	or details of escriptions		CA	RD	NO (NSW/ACT) PTY LTD			I

C	D	C	arc	Ino							ΤE	ST PIT LOG SHEET
Clie	ent: ject:			oro20 echnical Invest	igation						Η	ole No: TP030
	atio	n: 4	18 W	indermere Road	d, Lochi	nvar M	NSW		Job No: 81021034			Sheet: 1 of 1
-				site map					Angle from Horizontal: 90°	9	Surfac	e Elevation:
				5 tonne Excavat nsions:	or				Excavation Method:		Contra	ctor: ARSK
				17/9/20					Logged By: KS			ed By: JG
E>	kcavat	tion		Sampling & T	esting				Material Description			,
Method	Resistance	Stability	Water	Sample or Field Test	DCP (blows per 150 mm)	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
						-	لك على على على على على على على على على على على على على على على على على على ع		TOPSOIL: Sandy CLAY; low plasticity, reddish brown, fine to coarse grained sand	M (<pl)< td=""><td>St</td><td>TOPSOIL</td></pl)<>	St	TOPSOIL
			ered	U50 0.20 - 0.40 m		-			0.15m Silty CLAY; medium to high plasticity, reddish brown, trace fine to coarse grained sand 0.30 m: as above, with sand	M (<pl)< td=""><td>St</td><td>RESIDUAL SOIL</td></pl)<>	St	RESIDUAL SOIL
EX-		Stable	Groundwater Not Encountered		R	- 0.5			0.45m Sandy CLAY; medium plasticity, reddish brown mottled yellow, fine to coarse grained sand	M (<pl)< td=""><td>н</td><td>EXTREMELY WEATHERED</td></pl)<>	н	EXTREMELY WEATHERED
						- 1.0			1.00m Clayey SAND: fine to coarse grained, reddish brown, with fine to coarse sub-angular to angular gravel 1.20m TERMINATED AT 1.20 m Target depth	D to M	D	
ME EX R HAT PSC AD HFW R R R R ft abb						- 1.5			Target depth			
ME EX R HA PT SC AH SC AD AD HF WE RR	Ri Pi DN So I Ai S Pi S SI V/V So V/T So A Ho 3 W	xcavator ipper and aug ush tub onic dril r hamm ercussion hort spir olid fligh	ger e ling ler on sam ral aug nt aug nt aug ght au ght au	et VE F H VH VH er er: V-Bit er: TC-Bit ger	TRATION Very Easy (Ne Easy Firm Hard Very Hard (Re ER Water L shown water in ◀ water o	efusal) .evel or iflow		S H D P M I	P Hand/Pocket Penetrometer D Display CP Dynamic Cone Penetrometer ES En SP Perth Sand Penetrometer U Th IC Moisture Content MOISTURE BT Plate Bearing Test D Dr IP Borehole Impression Test M Mc ID Photoionisation Detector W W S Vane Shear; P=Peak, LL LL	/ bist	ample tal sampl be 'undis'	le F - Firm
Ref abb	er to ex previatio	planatory ns and ba	r notes f asis of c	or details of lescriptions			CAR		NO (NSW/ACT) PTY LTD			I



Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. Material descriptions are deduced from field observation or engineering examination, and may be appended or confirmed by in situ or laboratory testing. The information is dependent on the scope of investigation, the extent of sampling and testing, and the inherent variability of the conditions encountered.

Subsurface investigation may be conducted by one or a combination of the following methods.

Method								
Test Pitting: exc	Test Pitting: excavation/trench							
BH	Backhoe bucket							
EX	Excavator bucket							
R	Ripper							
Н	Hydraulic Hammer							
Х	Existing excavation							
Ν	Natural exposure							
Manual drilling:	hand operated tools							
HA	Hand Auger							
Continuous sam	nple drilling							
PT	Push tube							
PS	Percussion sampling							
SON	Sonic drilling							
Hammer drilling								
AH	Air hammer							
AT	Air track							
Spiral flight aug	er drilling							
AS	Auger screwing							
AD/V	Continuous flight auger: V-bit							
AD/T	Continuous spiral flight auger: TC-Bit							
HFA	Continuous hollow flight auger							
Rotary non-core	5							
WB	Washbore drilling							
RR	Rock roller							
Rotary core drilling								
PQ	85mm core (wire line core barrel)							
HQ	63.5mm core (wire line core barrel)							
NMLC	51.94mm core (conventional core barrel)							
NQ	47.6mm core (wire line core barrel)							
DT	Diatube (concrete coring)							

Sampling is conducted to facilitate further assessment of selected materials encountered.

Sampling method Soil sampling В Bulk disturbed sample D Disturbed sample С Core sample ES Environmental soil sample SPT Standard Penetration Test sample U Thin wall tube 'undisturbed' sample Water sampling WS Environmental water sample

Field testing may be conducted as a means of assessment of the in situ conditions of materials.

|--|

	-						
SPT	Standard	Standard Penetration Test					
HP/PP	Hand/Po	cket Penetrometer					
Dynamic F	Dynamic Penetrometers (blows per noted increment)						
DCP Dynamic Cone Penetrometer							
	PSP	Perth Sand Penetrometer					
MC	Moisture	Moisture Content					
VS	Vane Sh	Vane Shear					
PBT	Plate Bearing Test						
IMP	Borehole Impression Test						
PID	Photo Ionization Detector						

If encountered, refusal (R), virtual refusal (VR) or hammer bouncing (HB) of penetrometers may be noted.

The quality of the rock can be assessed by the degree of natural defects/fractures and the following.

Rock q	Rock quality description							
TCR	Total Core Recovery (%)							
	(length of core recovered divided by the length of core run)							
RQD	Rock Quality Designation (%)							
	(sum of axial lengths of core greater than 100mm long divided by the length of core run)							

Notes on groundwater conditions encountered may include.

Groundwater	
Not Encountered	Excavation is dry in the short term
Not Observed	Water level observation not possible
Seepage	Water seeping into hole
Inflow	Water flowing/flooding into hole

Perched groundwater may result in a misleading indication of the depth to the true water table. Groundwater levels are also likely to fluctuate with variations in climatic and site conditions.

Notes on the stability of excavations may include.

Excavation conditions							
Stable	No obvious/gross short term instability noted						
Spalling	Material falling into excavation (minor/major)						
Unstable	Collapse of the majority, or one or more face of the excavation						



Explanatory Notes: General Soil Description

The methods of description and classification of soils used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, a material is described as a soil if it can be remoulded by hand in its field condition or in water. The dominant component is shown in upper case, with secondary components in lower case. In general descriptions cover: soil type, plasticity or particle size/shape, colour, strength or density, moisture and inclusions.

In general, soil types are classified according to the dominant particle on the basis of the following particle sizes.

Soil Classification		Particle Size (mm)	
CLAY		< 0.002	
SILT		0.002 0.075	
SAND	fine	0.075 to 0.21	
	medium	0.21 to 0.6	
	coarse	0.6 to 2.36	
GRAVEL	fine	2.36 to 6.7	
	medium	6.7 to 19	
	coarse	19 to 63	
COBBLES		63 to 200	
BOULDERS		> 200	

Soil types may be qualified by the presence of minor components on the basis of field examination methods and/or the soil grading.

Terminology	In coarse grained soils In	In fine soils	
reminology	% fines	% coarse	% coarse
Trace	≤5	≤15	≤15
With	>5, ≤12	>15, ≤30	>15, ≤30

The strength of cohesive soils is classified by engineering assessment or field/lab testing as follows.

Strength	Symbol	Undrained shear strength
Very Soft	VS	≤12kPa
Soft	S	12kPa to ≤25kPa
Firm	F	25kPa to ≤50kPa
Stiff	St	50kPa to ≤100kPa
Very Stiff	VSt	100kPa to ≤200kPa
Hard	Н	>200kPa

Cohesionless soils are classified on the basis of relative density as follows.

Relative Density	Symbol	Density Index
Very Loose	VL	<15%
Loose	L	15% to ≤35%
Medium Dense	MD	35% to ≤65%
Dense	D	65% to ≤85%
Very Dense	VD	>85%

The plasticity of cohesive soils is defined by the Liquid Limit (LL) as follows.

Plasticity	Silt LL	Clay LL
Low plasticity	≤ 35%	≤ 35%
Medium plasticity	N/A	> 35% ≤ 50%
High plasticity	> 50%	> 50%

The moisture condition of soil (*w*) is described by appearance and feel and may be described in relation to the Plastic Limit (PL), Liquid Limit (LL) or Optimum Moisture Content (OMC).

Moistu	Moisture condition and description	
Dry	Cohesive soils: hard, friable, dry of plastic limit. Granular soils: cohesionless and free-running	
Moist	Cool feel and darkened colour: Cohesive soils can be moulded. Granular soils tend to cohere	
Wet	Cool feel and darkened colour: Cohesive soils usually weakened and free water forms when handling. Granular soils tend to cohere	

The structure of the soil may be described as follows.

Zoning	Description
Layer	Continuous across exposure or sample
Lens	Discontinuous layer (lenticular shape)
Pocket	Irregular inclusion of different material

The structure of soil layers may include: defects such as softened zones, fissures, cracks, joints and root-holes; and coarse grained soils may be described as strongly or weakly cemented.

The soil origin may also be noted if possible to deduce.

Soil origin a	nd description
Fill	Anthropogenic deposits or disturbed material
Topsoil	Zone of soil affected by roots and root fibres
Peat	Significantly organic soils
Colluvial	Transported down slopes by gravity/water
Aeolian	Transported and deposited by wind
Alluvial	Deposited by rivers
Estuarine	Deposited in coastal estuaries
Lacustrine	Deposited in freshwater lakes
Marine	Deposits in marine environments
Residual soil	Soil formed by in situ weathering of rock, with no structure/fabric of parent rock evident
Extremely weathered material	Formed by in situ weathering of geological formations, with the structure/fabric of parent rock intact but with soil strength properties

The origin of the soil generally cannot be deduced solely on the appearance of the material and the inference may be supplemented by further geological evidence or other field observation. Where there is doubt, the terms 'possibly' or 'probably' may be used



Explanatory Notes: General Rock Description

The methods of description and classification of rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, if a material cannot be remoulded by hand in its field condition or in water, it is described as a rock. In general, descriptions cover: rock type, grain size, structure, colour, degree of weathering, strength, minor components or inclusions, and where applicable, the defect types, shape, roughness and coating/infill.

Rock types are generally described according to the predominant grain or crystal size, and in groups for each rock type as follows.

Rock type	Groups
Sedimentary	Deposited, carbonate (porous or non), volcanic ejection
Igneous	Felsic (much quartz, pale), Intermediate, or mafic (little quartz, dark)
Metamorphic	Foliated or non-foliated
Duricrust	Cementing minerology (iron oxides or hydroxides, silica, calcium carbonate, gypsum)

Reference should be made to AS1726 for details of the rock types and methods of classification.

The classification of rock weathering is described based on definitions in AS1726 and summarised as follows.

Term and symbol		Definition
Residual Soil	RS	Soil developed on rock with the mass structure and substance of the parent rock no longer evident
Extremely weathered	XW	Weathered to such an extent that the rock has 'soil-like' properties. Mass structure and substance still evident
Distinctly weathered	DW	The strength is usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores. May be distinguished into MW (Moderately Weathered) and HW (Highly Weathered).
Slightly weathered	SW	Slightly discoloured; little or no change of strength from fresh rock
Fresh Rock	FR	The rock shows no sign of decomposition or staining

The rock material strength can be defined based on the point load index as follows.

Term and symbol		Point Load Index I₅50 (MPa)	
Very Low	VL	0.03 to 0.1	
Low	L	0.1 to 0.3	
Medium	Μ	0.3 to 1.0	
High	Н	1.0 to 3	
Very High	VH	3 to 10	
Extremely High	EH	> 10	

It is important to note that the rock material strength as above is distinct from the rock mass strength which can be significantly weaker due to the effect of defects. A preliminary assessment of rock strength may be made using the field guide detailed in AS1726, and this is conducted in the absence of point load testing.

The defect spacing measured normal to defects of the same set or bedding, is described as follows.

Definition	Defect Spacing (mm)	
Thinly laminated	< 6	
Laminated	6 to 20	
Very thinly bedded	20 to 60	
Thinly bedded	60 to 200	
Medium bedded	200 to 600	
Thickly bedded	600 to 2000	
Very thickly bedded	> 2000	

Terms for describing rock and defects are as follows.

Defect Terms			
Joint	JT	Sheared zone	SZ
Bedding Parting	BP	Seam	SM
Foliation	FL	Vein	VN
Cleavage	CL	Drill Lift	DL
Crushed Seam	CS	Handling Break	HB
Fracture Zone	FZ	Drilling Break	DB

The shape and roughness of defects in the rock mass are described using the following terms.

Planarity		Roughness	
Planar	PR	Very Rough	VR
Curved	CU	Rough	RF
Undulose	UN	Smooth	S
Irregular	IR	Slickensided	SL
Stepped	ST	Polished	POL
Discontinuous	DIS		

The coating or infill associated with defects in the rock mass are described as follows.

Infill and Coating	J	
Clean	CN	
Stained	SN	
Carbonaceous	Х	
Minerals	MU	Unidentified mineral
	MS	Secondary mineral
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
Veneer	VNR	Thin or patchy coating
Coating	СТ	Infill up to 1mm



Graphic Symbols Index

