

Proposed Redevelopment Preliminary Geotechnical Investigation Report

182-186 Gertrude St North Gosford

80021082

Prepared for
Lindfield Group Pty Ltd

24 July 2022



now



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Gosford

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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.

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Appendix A SITE PLAN

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1 Introduction

As requested, a senior geotechnical engineer from Cardno attended site on the 13th July 2022. The purpose of this investigation was to assess the site's surface and subsurface conditions in order to provide recommendations from a geotechnical viewpoint for the design and construction of the proposed new residential apartment development. The results of the investigation are detailed below.

1.1 Available Information

At the time of preparing this report, the following info are made available for review:

- Architecture plans, prepared by Texco Design, dated 7/04/2022, rev D, showing the proposed building and basement footprints.

1.2 Proposed Development

At the time of preparing this report, we understand that the proposed residential redevelopment includes:

- The demolition of the existing three (3) dwellings at 182, 184, and 186 Gertrude St, North Gosford.
- Construction of proposed seven storey apartments with basements. Based on the information provided, it is anticipated that the proposed basement excavation will be up to 13m deep.

2 Findings of Investigation

2.1 Geological Condition

Reference to the Geological Map of Gosford to Lake Macquarie (1:100,000) indicates that the site is underlain of Terrigal Formation (Rnt) which comprises interbedded laminite, shale and quartz, to lithic-quartz sandstone.

Geological plan of the site is shown in Appendix A.

2.2 Fieldwork

Fieldwork for the geotechnical investigation was carried out on 13th July 2022 and comprised the following:

- A detailed walkover inspection of the site and surrounds.
- Drilling of a total of four (6) boreholes (HA1 to HA6 inclusive) across the site, using manual hand auger equipment taken to target depths of about 1m.
- In-situ testing using a Dynamic Cone Penetrometer (DCP) was conducted across the site. Six (6) DCP tests were undertaken up to 2.5m depth to weathered sandstone / siltstone bedrock refusal.

The approximate borehole and DCP test locations are shown on the enclosed Borehole and DCP test location plan referenced as Figure 1 in Appendix A.

2.3 Site Description

The following site observation were made:

- The site is rectangular in shape, and is currently occupied by three (3) dwellings. The buildings are currently occupied and appears to be in a moderate condition.
- The site is bounded by Gertrude St to the east and residential properties on the other sides. No basements were observed on the adjoining properties Nos 178 and 188-198 Gertrude St.
- Site slopes down from east to west, with surveyed RL at the east approximately 40.42 m slopping towards the west to approximate RL of 32.27 m, at a degree of about 10 degrees.

2.4 Surface Condition

Based on the observations from the geotechnical investigation, the sub surface profile within the footprint of the proposed development can be generalised as follows:

- Topsoil Sandy Clay and Clayey Sand, fine to medium grained, low to medium plasticity clay, dark brown, 0.1m thick, grass covered, overlying,
- Fill Sandy Clay and Clayey Sand, fine to medium grained Sand, low to medium plasticity, dark brown with gravel, 0.2-0.5m thick across the site, overlying,
- Silty Clay, medium to high plasticity, brown, with sand and gravel, overlying weathered siltstone / sandstone bedrock.

Based on findings of investigation, weathered siltstone bedrock is expected at depths of 0.5-1.5m at the eastern half of site, and 1.5-2.5m at the western half of the site.

The encountered subsurface materials and their relative strengths have been recorded and logged as Engineering Log of Boreholes in accordance with AS 1726:2017 Geotechnical Site Investigation and on a Penetration Resistance of Soil Test Sheet. These have been enclosed in Appendix B.

A typical Gosford station area borehole based on past experience is shown below:



2.5 Groundwater Condition

Groundwater table or seepage was not encountered in any of the boreholes during drilling to shallow depths of not more than about 1m below existing ground surface levels. Based on the findings, surrounding landform, and past nearby project experience, it is anticipated the proposed 13m basement earthwork is unlikely to intersect with the groundwater table at the subject site. However, it is possible that localised seepage may occur within interface of soils and rocks and fractures and defects of rock when an intense and prolonged rainfall occurs during excavation.

3 Comments and Recommendations

3.1 General

It is understood that the proposed development comprises of demolishing the existing dwellings across three (3) sites and constructing new seven storey apartment with basements. Excavation will include cutting into the existing slope of up to 13m, and general site levelling.

3.2 Excavation Condition

We expect overburden soils comprising topsoil, sand fill, and weathered siltstone / sandstone in the upper 2m section to be readily excavated by conventional earthworks equipment such as excavators. Ripping or hammering will be required for any deeper bulk excavation into the less weathered siltstone / sandstone materials. Therefore, the induced vibration level control will be required to avoid impacting the adjacent properties.

Induced vibrations in structures adjacent to the excavation should not exceed a Peak Particle Velocity (PPV) of 10mm/sec for brick or unreinforced structures in good condition.

To ensure vibration levels remain within acceptable levels and minimise the potential effects of vibration, excavation into medium or higher strength siltstone / sandstone across the site should be complemented with saw cutting or other appropriate methods prior to excavation. Rock saw cutting should be carried out using an excavator mounted rock saw, or the like, so as to minimise transmission of vibrations to any adjoining properties.

If vibrations in adjacent structures exceed the values recommended above or appear excessive during construction, excavation should cease and the project Geotechnical Engineer should be contacted immediately for appropriate reviews so that counter measures/actions can be taken.

We recommend that dilapidation surveys of the adjacent structures be carried out prior to earthwork commencement.

We recommend that inspections be carried out by a Geotechnical Consultant at every 1.5m deep intervals during excavation to assess excavation stability.

3.3 Site Classification

Based on the results of this investigation, we consider that the subsurface conditions comprise topsoil overlying most sand and rock. A site classification of "Class A – Most sand and rock sites with little or no ground movement from moisture changes" can be adopted (if applicable) for footings constructed in accordance with AS2870-2011.

3.4 Groundwater Conditions

It is anticipated the proposed earthwork will not intersect with the groundwater table. However, localised seepage may occur within interface of soils and rocks and fractures and defects of rock when an intense and prolonged rainfall occurs during basement excavation. It is anticipated the potential to occur large amount of inflow through soils, interface of soils and rocks, and through joints within shale is minor during basement excavation. The conventional pump and sump method is considered manageable of such inflow water.

We also recommend the following control measures during design and construction:

- Strip drains, weepholes, subsoil drains, drainage materials should be included in the design of shoring and retaining walls.
- Collection trenches or pipes and pits connected to the building stormwater system. A stormwater storage tank and pump system may be required.
- The basement walls and slabs should be designed to withstand hydrostatic pressures taking into consideration the potential for seepage.
- Seepage or subsurface runoff inside the excavated foundation pits or pile holes should be removed prior to pouring of concrete.

3.5 Temporary Batter Slopes

Considering the proposed offset distance and depths of bedrock, piled retaining structure is recommended prior to basement excavation, temporary batter slopes may not be appropriated.

3.6 Retaining Structures

Shoring and support basement excavation and control lateral ground movement are recommended. The options include the following:

- Soldier pile wall shoring system; or
- Contiguous or semi-contiguous cast in-situ reinforced concrete piles embedded into underlying Class III Sandstone or better rock, and gaps between the piles should be covered with reinforced shotcrete or reinforced concrete panels.

Temporary anchorage or other temporary tie-back system may be required to be installed prior to excavation to reduce the potential effects of ground movement on adjoining properties. Typically, anchors are to be installed at regular intervals along the shoring wall. However, installation of anchors beyond the property boundaries will be subject to approval by owners of adjoining properties or public assets. If installation of temporary anchors is not feasible, it is necessary to consider other options to control lateral ground movement. These options include the following:

- Temporary solutions such as installation of props associated with staged excavation; or
- Staged excavations and creating temporary partial berms in front of walls.

It is recommended that monitoring of ground movement (settlement and deflection) should be carried out during excavation.

During basement excavation, observations and recording on conditions of exposed faces should be carried out by the project Geotechnical Engineer, so that loose materials or weak

The retaining wall should be designed and constructed in accordance with AS4678 Earth- Retaining Structures.

The recommended preliminary parameters for design of retaining structures are presented in Tables 3-1 and 3-2 below. The coefficients provided are based on drained conditions. Rock classification and depths are to be determined in future study.

Table 3-1 Preliminary Geotechnical Design Parameters for Retaining Walls

Geotechnical Unit	Unit Weight (kN/m ³)	Effective Cohesion c' (kPa)	Angle of Effective Internal Friction ϕ' (degree)	Modulus of Elasticity E_s (h) (MPa)	Poisson Ratio ν
Fill (Unit 1)	17	2	27	8	0.35
Residual Soils (Unit 2)	18	5	28	20	0.35
Class V Siltstone / Sandstone (Unit 3a)	22	50	28	100	0.35
Class IV/III Siltstone / Sandstone (Unit 3b)	24	200	32	500	0.20

Table 3-2 Preliminary Coefficients of Lateral Earth Pressure

Geotechnical Unit	Coefficient of Active Lateral Earth Pressure (Ka)	Coefficient of Lateral Earth Pressure at Rest (Ko)	Coefficient of Passive Lateral Earth Pressure (Kp)
-------------------	---	--	--

Fill (Unit 1)	0.38	0.55	2.7
Residual Soils (Unit 2)	0.36	0.53	2.8
Class V Siltstone / Sandstone (Unit 3a)	0.36	0.53	2.8
Class IV/III Siltstone / Sandstone (Unit 3b)	0.31	0.47	3.3

The foregoing coefficients assume that the ground level behind the retaining structures is horizontal and the retained material is effectively drained. Adequate surface and sub-surface drainage is to be provided behind retaining walls.

Surcharge loading from neighbouring structures should also be taken into account in the design of retaining structures should it be within the zone of influence of the excavation. The zone of influence of the excavation is defined as a plane projected at 45 degrees from horizontal from the toe of the excavation face upwards into the excavation face towards the ground surface.

For design of temporary ground anchors, the allowable bond stress of 20kPa, 50kPa, and 200kPa, can be adopted within Residual Soils (Unit 2), Class V Siltstone / Sandstone (Unit 3a), and Class IV/III Siltstone / Sandstone (Unit 3b) respectively. The following is recommended as a guidance for anchor design:

- Anchor bond length of at least 3m behind the “active” zone of the excavation;
- Overall stability of anchor system and interaction is satisfactory; and
- The anchors are proof loaded to at least 1.3 times the design working load before locking off at working load.
- Deflection to be monitored within the TfNSW limit.

3.7 Structural Footings

It is anticipated that the proposed bulk earthwork basement is likely to be founded predominantly in Class IV / III Siltstone / Sandstone (Units 3b) bedrock.

It is assessed that a foundation system consisting of cast-in-situ reinforced concrete shallow foundations, such as pad or strip footings under columns and walls, would be applicable for the proposed development at this site.

Installation of piles is expected to be required for excavation shoring walls and in case of large axial loads on columns and walls and exceeding the bearing pressure of the bearing stratum. Other cases where piles may be required include the need to increase the stiffness of the founding rock, or increase the resistance against lateral seismic loads. Piles are expected to be socketed into underlying rock better than Class III/IV Siltstone Sandstone (Unit 3b). Bored piles would be applicable for this site.

The geotechnical capacities and parameters recommended for design of shallow and piled foundations are provided in Table 3-3 below:

Table 3-3 Preliminary Geotechnical Foundation Design Capacities and Parameters

Geotechnical Unit	Allowable End Bearing Pressure kPa¹	Allowable Shaft Adhesion Compression² kPa	Modulus of Elasticity $E_{s,v}$ (MPa)
Fill (Unit 1)	N/A ³	N/A ³	N/A ³
Residual Soils (Unit 2)	N/A ³	20	25
Class V Siltstone / Sandstone (Unit 3a)⁴	600 (shallow footing)	40	150
Class IV/III Siltstone / Sandstone (Unit 3b)⁴	2500 (shallow footing) 3000 (piles)	150	600

Notes:

- 1 With a minimum embedment depth of 0.8m for piled foundations and 0.5m for shallow foundations.
- 2 Shaft Adhesion applicable to piles only.
- 3 N/A, Not Applicable or being excavated or not recommended for the proposed development.
- 4 The actual depth of underlying Class V Sandstone to Class III Sandstone should be confirmed during construction.

To minimise the potential effects of differential settlement under the buildings loads, it is recommended all foundations of the proposed building should be founded on consistent materials of similar properties or rock of similar class.

Shaft adhesion may be applied to socketed piles adopted for foundations if socket shaft lengths conform to appropriate classes of sandstone and accepted levels of shaft sidewall cleanliness and roughness. The rock socket sidewalls should be free of soil and/or crushed rock to the extent that natural rock is exposed over at least 80% of the socket sidewall. Shaft adhesion should be reduced or ignored within socket lengths that are smeared and fail to satisfy cleanliness requirements. Additional attention to cleanliness of socket sidewalls may be required where presence of clay seams and weathered sandstone bands is evident over socket lengths.

Any water, debris, loose and wet materials should be wholly removed from excavated footing areas prior to pouring of concrete.

We recommend that footing inspections be carried out by a Geotechnical Engineer / consultant during footing excavation to confirm appropriate founding materials, that the recommended serviceability bearing pressures could be met and to ensure that all soft and wet materials have been removed from the foundation footprint prior to concrete placement.

3.8 Future Assessment

It is considered that the subject site is suitable for the proposed residential development. In order to inform for the detailed design assessment, it is recommended that supplementary geotechnical assessment to be carried out, including:

- Additional cored borehole across the site, to at least 5m below the proposed design bulk excavation level for rock classification;
- Installation of groundwater monitoring wells. Testing of groundwater seepage water aggressivity and rates.
- Prior to construction commencement, numerical modelling of the eastern shoring wall adjacent to Gertrude St (TfNSW asset) and southern shoring wall adjacent to the adjoining property, to assess the likely amount of excavation-induced ground movement as a result of the proposed excavation. Preparation of monitoring plan; and
- Waste classification of all material to be excavated and transported off site.

4 Limitation

Assessment of the sub-surface profile at the site and the recommendations presented in this report are based on information from six (6) boreholes, drilled at locations considered representative across the site, and DCP testing at six (6) locations. Based on the results of the investigation and subsurface variability, there is a possibility that actual geotechnical conditions across the site could differ from the inferred geotechnical model presented in this report.

This report contains geotechnical parameters to be used as input for the structural design of footings and retaining walls. On-going geotechnical input is required to ensure recommendations provided in this report are followed and that actual ground conditions reflect those indicated in this report. In the absence of adequate information about the siting, extent and depth of the proposed earthwork, it is mandatory that a review of the recommendations as presented in this report, are carried out upon finalisation of the earthwork design, prior to any excavations.


APPENDIX


A

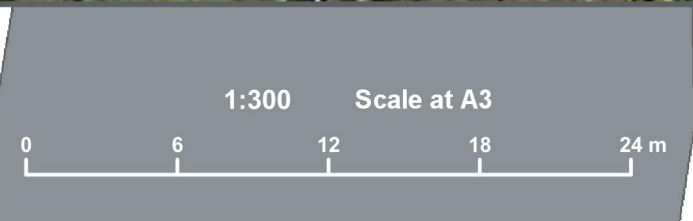
SITE PLAN



Legend

 Subject Site

 Investigation Locations



182,184,186 Gertrude Street, North Gosford


Geotechnical Investigation - Site Plan

 now 


Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2022-7-14 | Project: 80022000
Coordinate System: MGA Zone 56
Aerial imagery supplied by Metromap (2022)



Legend

 Subject Site

Gosford-Lake Macquarie 1:100 000 Geological Map


 Terrigal Formation (Rnt)



1:1000 Scale at A3

0 20 40 60 80 m

182,184,186 Gertrude St, North Gosford, NSW

Geological Plan



Map Produced by Cardno NSW/ACT Pty Ltd (SYD)
Date: 2022-7-14| Project: 80022000
Coordinate System: MGA Zone 56
Aerial imagery supplied by Metromap (2021)

APPENDIX

B

BOREHOLE LOGS

PENETRATION RESISTANCE OF SOIL TEST FIELD SHEET



Project:

Proposed Redevelopment

Project No.

80021088

Testing Type

Dynamic Cone Penetrometer (DCP)

x

Client:

Test By:

AT

Location:

182,184,186 Gertrude St, North Gosford

Date:

13/07/2022

Location:

Refer to Site Plan

Sheet:

1

DCP No.	DCP1	DCP2	DCP3	DCP4	DCP5		DCP6												
Penetration (mm)	Number of Blows per 150 mm Penetration					Penetration (mm)	Number of Blows per 150 mm Penetration					Penetration (mm)	Number of Blows per 150 mm Penetration						
150	1	0	3	1	1	150	1					150							
300	2	1	4	1	2	300	1					300							
450	4	3	5	3	3	450	3					450							
600	6	3	6	3	3	600	3					600							
750	10	7	12	6	8	750	6					750							
900	13	7	25	8	8	900	8					900							
1050	16	12	R	12	12	1050	10					1050							
1200	25	17		19	19	1200	17					1200							
1350	R	19		33	25	1350	25					1350							
1500		16		R	R	1500	R					1500							
1650		19				1650						1650							
1800		22				1800						1800							
1950		18				1950						1950							
2100		20				2100						2100							
2250		26				2250						2250							
2400		34				2400						2400							
2550		R				2550						2550							
2700						2700						2700							
2850						2850						2850							
3000						3000						3000							
3150						3150						3150							
3300						3300						3300							
3450						3450						3450							
3600						3600						3600							

Test Procedure: AS 1289.6.3.2

Comments: R - Refusal H - High Resistance \ Unable to Penetrate

EXCAVATION - GEOLOGICAL LOG

PIT NO : HA1

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346203.310, N: 6301115.880 (56 MGA94)

SURFACE ELEVATION : 39.400 (AHD)

EQUIPMENT TYPE : Hand Auger

METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL									
VE PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
	STABLE			0.0			SANDY CLAY: dark brown, low to medium plasticity, fine to medium grained sand, with fine to medium grained gravel, with rootlets					TOPSOIL	
				0.10m			FILL: SANDY CLAY: dark brown, low to medium plasticity, fine to medium grained sand, with fine to medium grained gravel	M				FILL	
				0.30m			SILTY CLAY: brown, pale brown, medium to high plasticity, with fine to medium grained sand	M	St			RESIDUAL SOIL	
				0.50m			Sandy SILT: pale brown-orange, fine to medium grained sand, with low plasticity silt, inferred as very low strength highly weathered siltstone					WEATHERED ROCK	
				1.00m			EXCAVATION HA1 TERMINATED AT 1.00 m Target depth						
				1.50m									
				2.00m									
				2.50m									
				3.00m									

PHOTOGRAPHS
NOTES☐ YES☒ NO

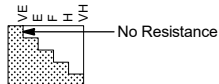
METHOD

N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT

T Timbering

PENETRATION



WATER

10 Oct., 73 Water
Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS

U50 - Undisturbed Sample
50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak,
R-Remoulded (uncorrected kPa)
PBT - Plate Bearing TestCLASSIFICATION SYMBOLS &
SOIL DESCRIPTION
Based on Unified
Classification System

MOISTURE

D - Dry
M - Moist
W - WetCONSISTENCY/
RELATIVE DENSITYVS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very DenseSee Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD



EXCAVATION - GEOLOGICAL LOG

PIT NO : HA2

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346168.830, N: 6301121.370 (56 MGA94)

SURFACE ELEVATION : 33.800 (AHD)

EQUIPMENT TYPE : Hand Auger

METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL									
VE PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
VE E F H	STABLE	Not Encountered		0.0			SANDY CLAY: dark brown, low to medium plasticity, fine to medium grained sand, with fine to medium grained gravel, with rootlets FILL: SANDY CLAY: dark brown, low to medium plasticity, fine to medium grained sand, with fine to medium grained gravel	M		100 200 300 400	5 10 15 20 25	TOPSOIL	
				0.10m								FILL	
				0.5									
				0.60m		CI-CH	SILTY CLAY: brown, pale brown, medium to high plasticity, with fine to medium grained sand	M	VSt			RESIDUAL SOIL	
				1.0			EXCAVATION HA2 TERMINATED AT 1.00 m Target depth						
				1.5									
				2.0									
				2.5									
				3.0									

PHOTOGRAPHS
NOTES ☐ YES ☒ NO

METHOD	PENETRATION	SAMPLES & FIELD TESTS	CLASSIFICATION SYMBOLS & SOIL DESCRIPTION Based on Unified Classification System	CONSISTENCY/RELATIVE DENSITY
N Natural Exposure E Existing Excavation BH Backhoe Bucket B Bulldozer Blade R Ripper	VE E F H No Resistance	U50 - Undisturbed Sample 50 mm diameter D - Disturbed Sample B - Bulk Disturbed Sample MC - Moisture Content HP - Hand Penetrometer (UCS kPa) VS - Vane Shear; P-Peak, R-Remoulded (uncorrected kPa) PBT - Plate Bearing Test	MOISTURE D - Dry M - Moist W - Wet	VS - Very Soft S - Soft F - Firm St - Stiff VSt - Very Stiff H - Hard VL - Very Loose L - Loose MD - Medium Dense D - Dense VD - Very Dense

10 Oct., 73 Water
Level on Date shown
water inflow
water outflow

See Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD



EXCAVATION - GEOLOGICAL LOG

PIT NO : HA3

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346202.060, N: 6301091.120 (56 MGA94)

SURFACE ELEVATION : 38.300 (AHD)

EQUIPMENT TYPE : Hand Auger

METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL									
VE PENETRATION F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
	STABLE			0.0			SILTY CLAYEY SAND: dark brown, fine to medium grained sand, low to medium plasticity clay, with fine to medium grained gravel, with rootlets					TOPSOIL	
				0.10m			FILL: SILTY CLAYEY SAND: dark brown, fine to medium grained sand, fine to medium grained clay	M				FILL	
				0.30m			SILTY CLAY: brown, medium to high plasticity, with fine to medium grained sand	M	St			RESIDUAL SOIL	
				0.5		CI-CH		M					
				0.60m			SILTY CLAY: pale brown, yellow, mottled red, medium to high plasticity	M	VSt to H				
				1.0		CI-CH		M					
				1.00m			EXCAVATION HA3 TERMINATED AT 1.00 m Target depth						
				1.5									
				2.0									
				2.5									
				3.0									

PHOTOGRAPHS
NOTES

☐ YES ☒ NO

METHOD

N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT

T Timbering

PENETRATION

VE WH VH

No Resistance

WATER

10 Oct., 73 Water
Level on Date shown

water inflow

water outflow

SAMPLES & FIELD TESTS

U50 - Undisturbed Sample
50 mm diameter

D - Disturbed Sample

B - Bulk Disturbed Sample

MC - Moisture Content

HP - Hand Penetrometer (UCS kPa)

VS - Vane Shear; P-Peak,
R-Remoulded (uncorrected kPa)

PBT - Plate Bearing Test

**CLASSIFICATION SYMBOLS &
SOIL DESCRIPTION**
Based on Unified
Classification System

MOISTURE

D - Dry
M - Moist
W - Wet

**CONSISTENCY/
RELATIVE DENSITY**

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

See Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD



EXCAVATION - GEOLOGICAL LOG

PIT NO : HA4

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346164.590, N: 6301094.110 (56 MGA94)

SURFACE ELEVATION : 32.800 (AHD)

EQUIPMENT TYPE : Hand Auger

METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL									
VE PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
VE F H	STABLE			0.0			SILTY CLAYEY SAND: dark brown, fine to medium grained sand, low to medium plasticity clay, with fine to medium grained gravel, with rootlets FILL: SILTY CLAYEY SAND: dark brown, fine to medium grained sand, fine to medium grained clay	M		100 200 300 400	5 10 15 20 25	TOPSOIL	
				0.10m								FILL	
				0.5									
				0.60m			SILTY CLAY: brown, medium to high plasticity, with fine to medium grained sand	M	VSt			RESIDUAL SOIL	
				1.0			EXCAVATION HA4 TERMINATED AT 1.00 m Target depth						
				1.5									
				2.0									
				2.5									
				3.0									

PHOTOGRAPHS
NOTES☐ YES☒ NO

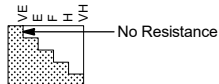
METHOD

N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT

T Timbering

PENETRATION



WATER

10 Oct., 73 Water
Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS

U50 - Undisturbed Sample
50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak,
R-Remoulded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS &
SOIL DESCRIPTION
Based on Unified
Classification System

MOISTURE

D - Dry
M - Moist
W - Wet

CONSISTENCY/
RELATIVE DENSITY

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S - Soft
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St - Stiff
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H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

See Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD



EXCAVATION - GEOLOGICAL LOG

PIT NO : HA5

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346196.790, N: 6301106.610 (56 MGA94)

SURFACE ELEVATION : 38.200 (AHD)

EQUIPMENT TYPE : Hand Auger

METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL									
VE PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
VE F H	STABLE			0.0			SILTY CLAYEY SAND: dark brown, fine to medium grained sand, low to medium plasticity clay, with fine to medium grained gravel, with rootlets FILL: SILTY CLAYEY SAND: dark brown, fine to medium grained sand, fine to medium grained clay			100 200 300 400	5 10 15 20 25	TOPSOIL	
				0.10m								1	
				0.5				M				2	
				0.60m								3	
				0.60m			SILTY CLAY: brown, medium to high plasticity, with fine to medium grained sand					3	
				1.0				M	VSt			8	
				1.00m			EXCAVATION HA5 TERMINATED AT 1.00 m Target depth					8	
				1.5								12	
				2.0								19	
				2.5								25	
				3.0								H	

PHOTOGRAPHS
NOTES☐ YES☒ NO

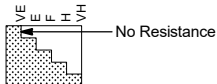
METHOD

N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT

T Timbering

PENETRATION



WATER

10 Oct., 73 Water
Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS

U50 - Undisturbed Sample
50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak,
R-Remoulded (uncorrected kPa)
PBT - Plate Bearing TestCLASSIFICATION SYMBOLS &
SOIL DESCRIPTION
Based on Unified
Classification System

MOISTURE

D - Dry
M - Moist
W - WetCONSISTENCY/
RELATIVE DENSITYVS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very DenseSee Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD



EXCAVATION - GEOLOGICAL LOG

PIT NO : HA6

FILE / JOB NO :

SHEET : 1 OF 1

PROJECT : 182,184,186 Gertrude St, North Gosford
LOCATION : North Gosford

POSITION : E: 346170.690, N: 6301106.510 (56 MGA94)

SURFACE ELEVATION : 34.700 (AHD)

EQUIPMENT TYPE : Hand Auger


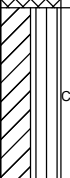
METHOD : Hand Auger

DATE EXCAVATED : 13/7/22

LOGGED BY : AT

CHECKED BY : TH

EXCAVATION DIMENSIONS :

DRILLING				MATERIAL										
VE PENETRATION F H		SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETRO- METER	DCP TEST (AS 1289.6.3.2-1997) Blows/150 mm	STRUCTURE & Other Observations	
		STABLE	Not Encountered		0.0			SILTY CLAYEY SAND: dark brown, fine to medium grained sand, low to medium plasticity clay, with fine to medium grained gravel, with rootlets FILL: SILTY CLAYEY SAND: dark brown, fine to medium grained sand, fine to medium grained clay	M		100 200 300 400	5 10 15 20 25	TOPSOIL	
					0.10m								1	FILL
					0.5								1	
					0.60m		CI-CH	SILTY CLAY: brown, medium to high plasticity, with fine to medium grained sand	M	VSt			3	
					1.0			EXCAVATION HA6 TERMINATED AT 1.00 m Target depth					3	
													6	RESIDUAL SOIL
													8	
													10	
													17	
													25	
												H		

PHOTOGRAPHS
NOTES

☐ YES

☒ NO

METHOD

N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT

T Timbering

PENETRATION

VE
w u i VH
No Resistance

WATER

10 Oct., 73 Water
Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS

U50 - Undisturbed Sample
50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak,
R-Remoulded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION

Based on Unified
Classification System

MOISTURE

D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS - Very Soft
S - Soft
F - Firm
St - Stiff
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VL - Very Loose
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MD - Medium Dense
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See Explanatory Notes for
details of abbreviations
& basis of descriptions.

CARDNO NSW/ACT PTY LTD

Cardno

About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

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