

Geotechnical Investigation Report 23-31 Dover Road, Rose Bay NSW

Prepared for: DOVER STREET (ROSE BAY) DEVELOPMENTS Pty Ltd

Reference: P3496_02 Rev1

Date: 17 September 2025

Morrow Geotechnics Pty Ltd

2/5-7 Malta Street, Fairfield East NSW 2165
79/6 Bellambi Lane, Bellambi NSW 2518
E: info@morrowgeo.com.au
P: 02 8599 7579

ABN 42 605 892 126

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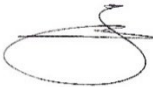
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Site Address	23-31 Dover Road, Rose Bay NSW
Report Prepared for	DOVER STREET (ROSE BAY) DEVELOPMENTS Pty Ltd

Document status, review and details:

Rev	Prepared	Reviewed	Details	Date
0	MJ	AM		4 July 2025
1	MJ	AM	Updated Report with latest architectural drawings (MHNDU(Rev P12–P15, dated 10 September 2025)	17 September 2025

Distribution of copies

Revision	Electronic	Paper	Issued to
Rev0	1	-	DOVER STREET (ROSE BAY) DEVELOPMENTS Pty Ltd
Rev1	1	-	DOVER STREET (ROSE BAY) DEVELOPMENTS Pty Ltd

	Full Name & Title	Signature
Author	Mahmoud Jangidaryan Geotechnical Engineer	
Reviewer	Alan Morrow Principal Geotechnical Engineer	



PROJECT DETAILS

PROJECT NAME

Application number	SSD 86017721
Address of subject land	23-31 Dover Road, Rose Bay NSW
Legal Description	Lot 1 in DP105598, Lot 13 in DP663078, Lots 10, 11 & 12 in DP 4244

APPLICANT DETAILS

Applicant name	DOVER STREET (ROSE BAY) DEVELOPMENTS Pty Ltd
Applicant address	Level 5, 30-36 Bay Street, DOUBLE BAY NSW 2028

REPORT DETAILS

Name of report this declaration relates	Geotechnical investigation report for 23-31 Dover Road, Rose Bay NSW
Report reference no.	P3496_02 Rev1
Report date	17/09/2025
Company name (inc. ABN / ACN)	Morrow Geotechnics Pty Ltd
Author name	Alan Morrow
Author qualifications	BE, BSc, MIEAust, CPEng, NER
Author address	2/5-7 Malta Street, Fairfield East NSW

DECLARATION BY CONSULTANT

Name	Alan Morrow
Registration no.	2474672
Organisation registered with	Engineers Australia

Declaration	The undersigned declares that the Geotechnical Investigation Report: • has been prepared in accordance with the following policy, guidelines, or legislative requirements: - SEARS Environmental Assessment Requirements (Item 12) • contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the Geotechnical Report relates; • does not contain information that is false or misleading; • identifies and addresses the relevant Planning Secretary's environmental assessment requirements (SEARs) for the project; • identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments to which the Geotechnical Report relates; • contains a consolidated summary of the proposed or necessary mitigation measures
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Signature



17/09/2025

1. Introduction

This report has been prepared to support a State Significant Development Application (SSDA) SSD 86017721 for the site at 23-31 Dover Road, Rose Bay (the site).

The Minister for Planning, or their delegate, is the consent authority for the SSDA and this application is lodged with the NSW Department of Planning, Housing and Infrastructure (DPHI) for assessment.

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 13 June 2025 (SSD-86017721). Specifically, this report has been prepared to respond to the following SEARs:

This report has been prepared to meet the general requirements of Woollahra Municipal Council Attachment 6 "Guidelines for Preparation of Geotechnical and Hydrogeological Reports".

SEARS Compliance Requirements are presented below:

Item	SEARS Requirement	Relevant Section of Report
12	Ground and Groundwater Conditions • Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion. • Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	The site is not in an area of riparian lands and further assessment is not required. Groundwater Impact Assessment based on groundwater results presented in this report. Acid sulfate soil assessed by others and reviewed by Morrow Geotechnics. The site is not in a mapped area of high salinity potential and further assessment is not required.

1.1 Project Description

The application seeks development consent for an SSDA which will facilitate the redevelopment of the site for a residential flat building using the in-fill affordable housing and mid-rise housing controls in accordance with the recently introduced provisions under the State Environmental Planning Policy (Housing) 2021 (Housing SEPP). The project seeks consent for:

- Demolition of existing buildings on site and tree removal.
- Construction of a residential flat building comprising two levels of basement car parking, eight storeys of residential dwellings, communal open space and associated landscaping. The building will include:
 - 15% affordable housing operated and used by a CHP for a period of 15 years.
 - 49 residential dwellings including 1, 2, 3 and 4 bedroom typology.
 - Vehicular access from Dover Road and provision for parking of 60 resident vehicles, 6 visitor vehicles, 7 motorcycles and 5 visitor bicycle racks.
- Communal open space at ground level, storage areas, utilities (including plant rooms, substation and stormwater systems) and associated service provision. Refer to Architectural Plans prepared by MHNDU(Rev P12–P15, dated 10 September 2025) appended to the Environmental Impact Statement.

1.2 The Site

The Site The site is located at 23-31 Dover Road, Rose Bay. The site occupies five lots legally described as Lots 10/A in DP4244, Lot 11/A in DP4244, Lot 12/A in DP4244, Lot 13 in DP663078 and Lot 1 in DP105598. The site area is 2657sqm.

The site is located to the immediate east of the Rose Bay town centre in the Woollahra local government area (LGA). The Rose Bay town centre is identified as a Low-Mid Rise Centre under the Housing SEPP.

Existing development on the site includes:

- A single storey building with a large gable roof, housing the Rose Bay Family Medical Centre at 23 Dover Road. The zoning of this property is still residential.
- Two-storey rendered houses with pitched tiled roofs at 25 & 27 Dover Road
- A single storey rendered house with a pitched tiled roof at 29 Dover Road.
- A two-storey rendered dual occupancy with a pitched metal roof at 31 Dover Road.

All five lots have vehicular access from Dover Road, leading to garages. Pedestrian access is also available from Dover Road through gates in the front fences.

1.3 Investigation Intent

The intent of the investigation is to provide geotechnical advice and recommendations specific to the ground conditions observed at site for the proposed development. These recommendations include:

- Expected subsurface conditions;
- Lot classification in accordance with AS2870 and geotechnical parameters for foundation design;
- Excavation support options, including lateral earth pressures and pile design parameters;
- Advice on possible seepage water associated with construction;
- Earthquake site classification in accordance with AS1170.4; and
- Geotechnical construction considerations.

1.4 Published Geological Mapping

Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130) indicate that the site is located in (Qd (Qhd/Qpd)) Quaternary Holocene deposits which are typically comprised of medium to fine-grained "marine" sand with podsols.

1.5 Published Soil Landscapes

The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 (1st Edition) indicates that the aeolian landscape at the site likely comprises the Tuggerah Landscape. This landscape type typically includes gently undulating to rolling coastal dunefields. It generally comprises deep (> 2 m) podsols on dunes and podsol/humus podsol intergrades on swales. These soils are noted to present extreme wind erosion hazard, non-cohesive, highly permeable soils, localised flooding and permanently high-water tables.

2. Observations

2.1 Investigation Methods

Fieldwork was undertaken by Morrow Geotechnics on 1 & 2 May 2025. Work carried out as part of this investigation includes:

- Review of publicly available information from previous reports in the project area, published geological and soil mapping and government agency websites;
- Site walkover inspection by an experienced Geotechnical Engineer to assess topographical features, condition of surrounding structures and site conditions;
- Drilling of three boreholes (BH101 to BH103) in total. Boreholes were drilled using a track-mounted drill rig with solid flight augers equipped with a tungsten-carbide (TC) bit up to the depth of 6.0 mBGL, the boreholes were then extended using the wash-boring technique to final depths ranging from 10.15 m to 16.1 mBGL. Borehole locations are shown on **Figure 1**, and the borehole logs are attached to this report;
- Standard Penetration Tests (SPT) were undertaken during drilling at regular intervals of 1.5m in accordance with Australian Standard AS 1289.6.3.1-2004 to provide an assessment of soil strength; and
- Groundwater observations within boreholes during drilling and installation of three groundwater monitoring wells within all three boreholes immediately following drilling.

2.2 Subsurface Conditions

The stratigraphy at the site is characterised by fill/topsoil and natural sand overlying Sandstone bedrock. Observations taken during the investigation have been used to produce a stratigraphic model of the site. The observed stratigraphy has been divided into four geotechnical units.

A summary of the subsurface conditions across the site, interpreted from the investigation results, is presented in **Table 1** and **Table 2** below. More detailed descriptions of subsurface conditions at the test locations are available in the borehole logs presented in **Appendix A**. The details of the method of soil and rock classification, explanatory notes and abbreviations adopted in the borehole logs are also presented in **Appendix A**.

Table 1 Summary of Inferred Subsurface Conditions

Unit	Material	Generalised Description
1	Fill/Topsoil	FILL: Silty to gravelly SAND, loose, fine grained, fine to coarse sized gravel, with construction waste. Unit 1 is inferred to be uncontrolled and poorly compacted.
2	Very Loose Sand	Marine/Aeolian Sand, very loose, poorly graded, fine grained, pale grey, brown, dry to moist.
3	Loose Sand	Marine Sand, loose, poorly graded, fine grained, with trace of low plasticity clays at some bands, pale grey, brown, pale orange, pale yellow, moist.
4	Medium Dense Sand	Marine Sand, medium dense, poorly graded, fine grained, with trace of low plasticity clays at some bands, pale grey, brown, pale orange, pale yellow, moist to wet.
5	Sandstone Bedrock	SANDSTONE, highly weathered, very low strength, fine to medium grained, inferred to grade stronger with depth.

Table 2 Summary of Inferred Subsurface Conditions

Unit	Material	Approx. Depth Range of Unit ¹ mBGL (RL mAHD)		
		BH1	BH2	BH3
1	Fill/Topsoil	0.0 to 0.4 (9.5 to 9.1)	0.0 to 0.3 (7.2 to 6.9)	0.0 to 0.4 (6.0 to 5.6)
2	Very Loose Sand	0.4 to 1.5 (9.1 to 8.0)	0.3 to 1.5 (6.9 to 5.7)	0.4 to 1.5 (5.6 to 4.5)
3	Loose Sand	1.5 to 2.5 (8.0 to 7.0)	1.5 to 3.0 (5.7 to 4.2)	1.5 to 3.0 (4.5 to 3.0)
4	Medium Dense Sand	2.5 to 16.1 (7.0 to -6.6)	3.0 to 10.15 (4.2 to -2.95)	3.0 to 10.3 (3.0 to -4.3)
5	Sandstone Bedrock	16.1 + (sub -6.6)	-	-

Notes:

1 Depth ranges shown are based on material observed within test locations and will vary across the site.

2.3 Groundwater Observations

Standpipe piezometers were installed within the boreholes as part of the geotechnical investigation with well details found in **Table 3** below. The monitoring well was constructed using 50mm diameter screw threaded PVC casing, sections of which were machine slotted. The annulus between the casing and borehole was backfilled using a 2 mm filter gravel pack to above the top of the screen. A bentonite plug with a minimum thickness of 0.5m was then installed above the gravel pack, the remaining annulus was backfilled with drill cuttings. The well was finished with a cement plug and a gatic cover.

Table 3 Piezometer Details

Piezometer	BH1	BH2	BH5
Top of Piezometer approx. RL (mAHD)	9.5	7.2	6.0
Piezometer Depth (m)	15.1	10.15	10.3
Bentonite Plug Depth (mBGL)	2.9 to 3.5	3.0 to 3.5	2.2 to 2.9
Screen Depth (mBGL)	4.1 to 15.1	4.15 to 10.15	4.3 to 10.3
Base of Piezometer RL (mAHD)	-5.6	-2.95	-4.3
Groundwater Depth (6 May 2025) mBGL (RL mAHD)	6.40 (RL 3.10)	4.21 (RL 2.99)	2.74 (RL 3.26)

3. Discussions and Recommendations

3.1 Foundation Design

The parameters given in **Table 4** may be used for the design of pad footings and bored piles. Morrow Geotechnics recommends that a Preliminary Geotechnical Strength Reduction Factor (GSRF) of 0.4 is used for the design of piles in accordance with AS 2159:2009 if no allowance is made for pile testing during construction. Should pile testing be nominated, the GSRF may be reviewed and a value of 0.55 to 0.65 may be expected.

Selection of footing types and founding depth will need to consider the risk of adverse differential ground movements within the foundation footprint and between high level and deeper footings. Unless an allowance for such movement is included in the design of the proposed development, we recommend that all new structures found on natural materials with comparable end bearing capacities and elastic moduli.

Ultimate geotechnical strengths are provided for use in limit state design. Allowable bearing pressures are provided for serviceability checks. These values have been determined to limit settlements to an acceptable level for conventional building structures, typically less than 1% of the minimum footing dimension.

Table 4 Pad Footing and Pile Design Parameters

Material		Unit 1 Fill / TS	Unit 2 Very Loose Sand	Unit 3 Loose Sand	Unit 4 Medium Dense Sand	Unit 5 Sandstone Bedrock
Allowable Bearing Pressure (kPa)		N/A	N/A	70	150	1000
Ultimate Vertical End Bearing Pressure (kPa)		N/A	N/A	210	450	3000
Elastic Modulus (MPa)		5	10	15	30	100
Allowable Shaft Adhesion (kPa)	In Compression	0	8	10	12	100
	In Tension	0	4	5	6	50
Susceptibility to Liquefaction during an Earthquake		Medium	Medium	Medium	Low	Low

Notes:

- Side adhesion values given assume there is intimate contact between the pile and foundation material. Design engineer to check both 'piston' pull-out and 'cone' pull-out mechanics in accordance with AS4678-2002 Earth Retaining Structures.
- Susceptibility to liquefaction during an earthquake is based on the following definition:
 Low - Medium to very dense sands, stiff to hard clays, and rock
 Medium - Loose to medium dense sands, soft to firm clays, or uncontrolled fill below the water table
 High - Very loose sands or very soft clays below the water table

To adopt these parameters we have assumed that the bases of all pile excavations are cleaned of loose debris and water and inspected by a suitably qualified Geotechnical Engineer prior to pile construction to verify that ground conditions meet design assumptions. Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water prior to pouring concrete, or alternatively a tremmie system could be used.

3.2 AS1170 Earthquake Site Risk Classification

Assessment of the material encountered during the investigation in accordance with the guidelines provided in AS1170.4-2007 indicates an earthquake subsoil class of Class C_e – Shallow Soil for the site.

3.3 Excavation Retention

Where sufficient space for batters is not available a shoring system should be installed prior to excavation. Shoring systems in sand generally comprise anchored soldier pile walls with piles socketing below bulk excavation level (BEL). Geotechnical parameters for input to shoring design have been provided in **Table 5** below.

Table 5 Shoring Design Parameters

		Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Material		Fill / TS	Very Loose Sand	Loose Sand	Medium Dense Sand	Sandstone Bedrock
Unit Weight (kN/m ³)		17	17	17	24	24
Earth Pressure Coefficients	At Rest, K _o	0.53	0.58	0.53	0.47	0.44
	Passive, K _p	2.77	2.50	2.77	3.25	3.55
	Active, K _a	0.36	0.40	0.36	0.30	0.28
Drained Cohesion, c' (kPa)		0	0	0	0	50
Friction Angle, φ' (°)		28	25	28	32	34
Elastic Modulus (MPa)		5	10	15	30	100
Poisson's Ratio		0.30	0.30	0.30	0.30	0.25

Notes:

- 1 Unit Weight is based on visual assessment only and may vary by ±10%.
- 2 Earth pressures are provided on the assumption that the ground behind the retaining wall is flat and drained.

In addition, design of retaining walls should consider the following:

- Appropriate surcharge loading from construction equipment, vehicular traffic and neighbouring structures at finished surface level should be considered in the retention design. Surcharge loads on retention structures may be calculated using a rectangular stress block with an earth pressure coefficient of 0.5 applied to surcharge loads at ground surface level.
- Anchor design should ignore the contribution of any bonded length within a wedge which extends upwards at 45° from the top of Unit 6 to account for a failure wedge forming behind the shoring system.

3.4 Excavation Vibration Considerations

Where vibration intensive works such as driving of sheet piles or vibratory compaction are proposed contractors should make an assessment of the potential impact of their works on the basis of the borehole logs, core photographs and point load data. Monitoring of construction induced vibration must be undertaken at the commencement of such activities at the nearest

vibration receptor in consultation with the project superintendent and geotechnical engineer. Locations of the vibration monitors are shown on **Figure 1** below.



Figure 1: Location of vibration monitoring points

- Vibration Monitor Location

Vibration monitors are to be placed within the site boundaries directly adjacent to the north-western and south-eastern boundaries. Vibration monitors are to be set up for continuous monitoring and with visual and audible alarms for exceedances of the nominated vibration threshold.

Trials must take place at the commencement of works to ensure that the contractor's proposed methodology can be achieved within the nominated vibration thresholds. It is recommended that vibration monitors are placed prior to the early works contractor mobilising to site by a registered acoustic consultant. On the basis of trials at the commencement of works a construction methodology may be proposed to limit peak particle velocities (ppv) to acceptable levels. In the absence of ppv guidelines from affected asset owners, Morrow Geotechnics recommends the following limits be placed on vibrations:

- **5 mm/s** for residential structures.

The initial trial is to be carried out in the presence of the project geotechnical and structural engineers. The initial trial is to comprise bucket excavation of soil.

A second trial is to be conducted prior to the commencement of pile driving if sheet piling is adopted. The second trial is to be carried out in the presence of the project geotechnical and structural engineers.

If vibration levels are exceeded during construction it is necessary to cease work and alert the project geotechnical and structural engineers to determine a suitable plan for safe continuation of construction activities.

3.5 Soil and Rock Excavatability

The expected ability of equipment to excavate the soil and rock encountered at the site is summarised in **Table 7**. This assessment is based on available site investigation data and guidance on the assessment of excavatability of rock by Pettifer and Fookes (1994). The presence of medium to high strength bands in lower strength rock and the discontinuity spacing may influence the excavatability of the rock mass.

Table 6 Soil and Rock Excavatability

Unit	Material	Excavatability
1	Fill/Topsoil	Easy digging by 20t Excavator
2	Very Loose Sand	
3	Loose Sand	
4	Medium Dense Sand	
5	Sandstone Bedrock	Hard Ripping by 20t Excavator with hydraulic hammering required where medium strength sandstone is encountered in Unit 5.

The excavation methodology may also be affected by the following factors:

- Scale and geometry of the excavation;
- Availability of suitable construction equipment;
- Potential reuse of material on site; and
- Acceptable excavation methods, noise, ground vibration and other environmental criteria.

4. ADDITIONAL GEOTECHNICAL INPUT

Further input from a geotechnical professional during design and construction is advised in order to ensure a cost-effective design which can be constructed safely and efficiently. Areas for geotechnical input should include:

- All excavated material transported off site should be classified in accordance with NSW EPA 2014 - Waste Classification Guideline Part 1; Classifying Waste.

- A suitably qualified geotechnical engineer is to assess the condition of exposed material at foundation or subgrade level to assess the ability of the prepared surface to act as a foundation or as a subgrade.
- Observation of the material within pile excavations should be undertaken at the start of piling works to confirm that material across the site is in accordance with the geotechnical model presented in this report.
- Regular inspections of battered and unsupported excavations, where proposed, to confirm geotechnical conditions and to assess the suitability of design assumptions and to provide further advice with regards to excavation retention/ support and proposed construction methodologies, if required.

5. CONCLUSION

Based on the findings of geotechnical investigations at the site it can be concluded that the proposed development will not adversely impact land stability, groundwater flow or present structural risk to adjoining structures provided that the recommendations of this report are incorporated into design and construction of the proposed works.

This report meets the requirements of Woollahra Municipal Council Attachment 6 “*Guidelines for Preparation of Geotechnical and Hydrogeological Reports*”.

6. STATEMENT OF LIMITATIONS

The adopted investigation scope was limited by the investigation intent and the presence of structures onsite at the time of the investigation. Further geotechnical inspections should be carried out during construction to confirm the geotechnical model provided in this report.

Your attention is drawn to the document “Important Information”, which is included in **Appendix B** of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Morrow Geotechnics, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

7. REFERENCES

AS1726:1993, *Geotechnical Site Investigations*, Standards Australia.

AS2159:2009, *Piling – Design and Installation*, Standards Australia.

AS2870:2011, *Residential Slabs and Footings*, Standards Australia.

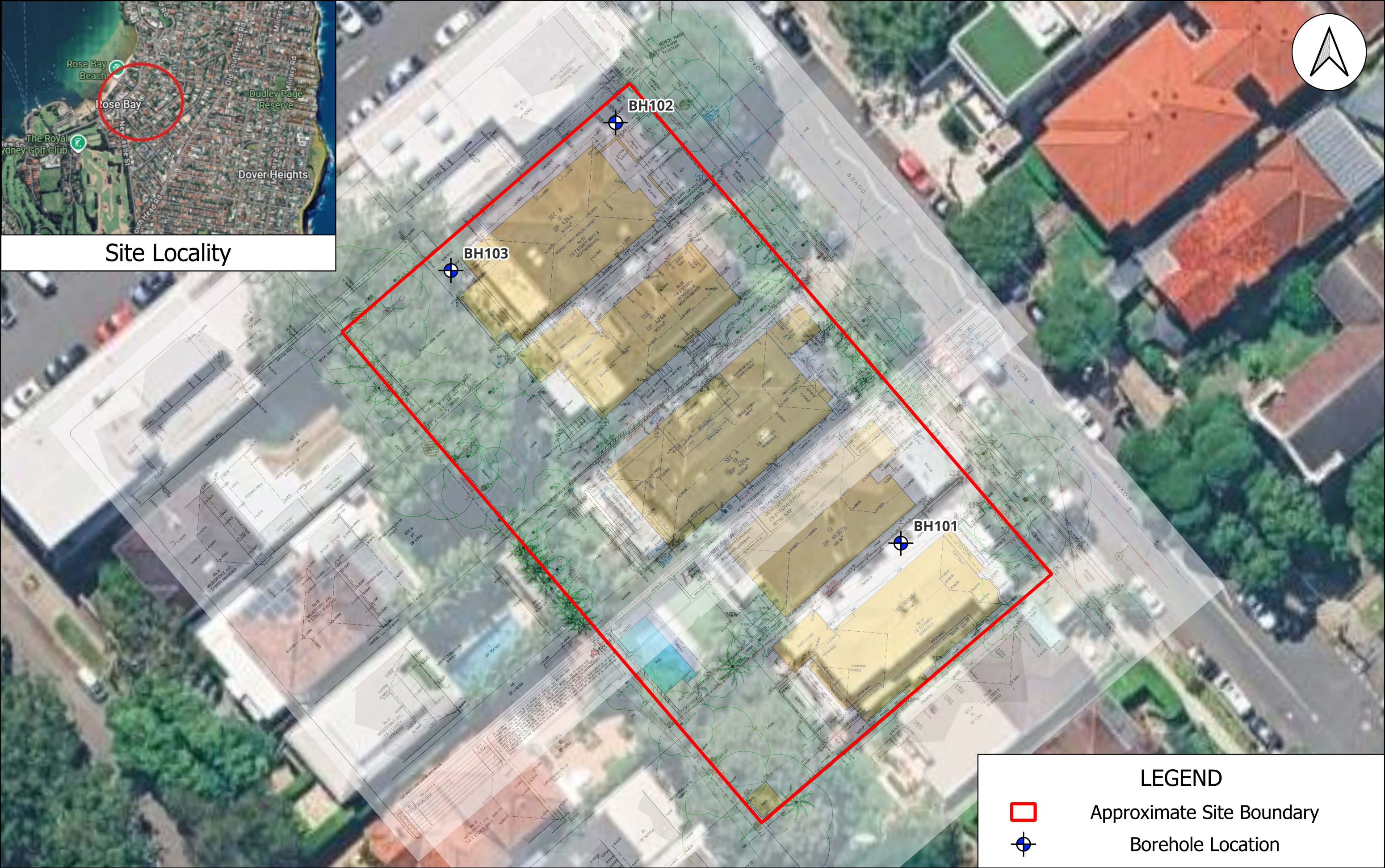
Chapman, G.A. and Murphy, C.L. (1989), Soil Landscapes of the Sydney 1:100000 sheet. Soil Conservation Services of NSW, Sydney.

NSW Department of Mineral Resources (1985) Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1). Geological Survey of New South Wales, Department of Mineral Resources.

Pells (2004) Substance and Mass Properties for the Design of Engineering Structures in the Hawkesbury Sandstone, Australian Geomechanics Journal, Vol 39 No 3



Site Locality



LEGEND

 Approximate Site Boundary

 Borehole Location

Dover Street Developments Pty Ltd

Geotechnical Investigation

21-31 Dover Road, Rose Bay NSW

Borehole Location Plan

1

Project: P3496

Revision: 0

NOTE:

1. Drawing projection in GDA2020 / MGA zone 56, adapted from aerial imagery from "SIX Maps", accessed 16/09/2025.

2. Elevation data sourced from ELVIS - Elevation and Depth - Foundation Spatial Data Framework, accessed 16/09/2025, provided by Geoscience Australia and NSW Government – Spatial Services.

0

10

20

30

40 m



morrow

Morrow Geotechnics Pty Ltd ABN 42 605 892 126

2/5-7 Malta Street, Fairfield East NSW 2165

79/6 Bellambi Lane, Bellambi NSW 2518

E: info@morrowgeo.com.au

P: 02 8599 7579

DRAWN BY:

OAP

Approved:

RM

Date:

16/09/2025

Drawing:

1

Project: P3496

Revision: 0

APPENDIX A
BOREHOLE LOGS AND EXPLANATORY NOTES

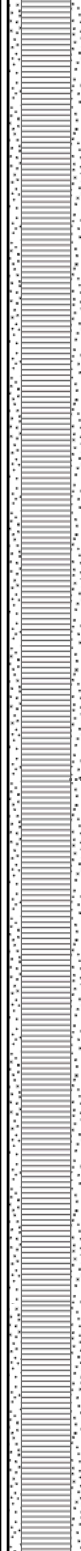
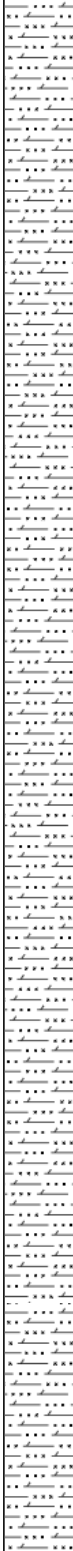
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Easting : 340063.81	Driller Supplier : BG Drilling	Client : Fortis
Northing : 6250803.34	Logged By : Mahmoud Jangidaryan	Project : Rose Bay
RL : 9.50(m)	Reviewed By : Rhiannon McKeon	Location : 23-31 Dover Road, Rose Bay NSW
Total Depth : 16.1 m	Date : 02/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing		Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT	Elevation Depth (m)								
				9.4 0.1		Non-Soil	CCT	Non-Soil - Concrete	0.1			
				9.1 0.4		FILL	FILL	SILTY GRAVELLY SAND loose to medium dense, fine grained, fine to medium sized gravel, with construction waste.	0.4	L-MD		
				1.1,2 (N=3)		Marine	SP	SAND very loose, poorly graded, fine grained, pale grey, moist.	1	VL		M
				8.0 1.5					1.5			
				2.3,3 (N=6)				As above, but: loose.	2	L		
				7.0 2.5		Marine	SP	As above, but: medium dense, brown grey, moist.	2.5			
				3.6,6 (N=12)					3	MD		M
				5.0 4.5					4			
				6.9,11 (N=20)		Marine	SP	As above, but: pale orange pale yellow.	4.5	MD		M

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
Easting : 340063.81	Driller Supplier : BG Drilling	Client : Fortis
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Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
				3.5		Marine	SP	As above, but: pale orange pale yellow.	6	MD		M
			7, 10, 11 (N=21)	6				SAND medium dense, poorly graded, fine grained, pale orange pale yellow, moist, trace low plasticity clay.	6			
			8, 14, 19 (N=33)						7			
			4, 4, 5 (N=9)			Marine	SP		8	MD		M
									9			

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
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Total Depth : 16.1 m	Date : 02/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
			7,11,15 (N=26)			Marine	SP	SAND medium dense, poorly graded, fine grained, pale orange pale yellow, moist, trace low plasticity clay.	11	MD		M
			11,14,20 (N=34)						12			
		50mm PVC Slotted							13			
									14			

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
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Drilling Method	Water	Well Diagram	Testing		Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT	Elevation								
				Depth (m)								
				-5.5					15			
		 50mm PVC Slotted	4,6,12 (N=18)	15		Residual	CI	SANDY CLAY very stiff, medium plasticity, fine grained sand, pale orange pale yellow dark red, w > pl.		VSt		w > PL
				-6.4					15.9			
			16/50mm (N=0)	15.9		Rock	SST	Rock; SANDSTONE highly weathered, very low strength, pale orange pale yellow, fine to medium grained, generally massive.	16	VLS	HW	
								BH101 Reached Target Depth at 16.1m				

UTM : 56H
 Easting : 340033.03
 Northing : 6250847.66
 RL : 7.2(m)
 Total Depth : 10.15 m

Driller Rig : Christie Rig
 Driller Supplier : BG Drilling
 Logged By : Mahmoud Jangidaryan
 Reviewed By : Rhiannon McKeon
 Date : 01/05/2025

Job Number : P3496
 Client : Fortis
 Project : Rose Bay
 Location : 23-31 Dover Road, Rose Bay NSW
 Loc Comment :

Drilling Method	Water	Well Diagram	Testing SPT	Elevation Depth (m)	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
				7.1		Non-Soil	CCT	Non-Soil - Concrete	0.13			
				0.13		FILL	FILL	GRAVELLY SAND loose, poorly graded, fine grained, fine sized gravel, trace.	0.3	L		
				6.9				SAND very loose, poorly graded, pale grey with brown, With trace of coffee rocks.		VL		
				0.3		Aeolian	SP					
				5.7				SAND loose, poorly graded, fine grained, pale grey white, dry.	1.5			
				1.5		Marine	SP		2	L		D
				4.2				As above, but: medium dense, pale orange yellow, moist.	3			
				3		Marine	SP			MD		M
				2.7				As above, but: wet, trace low plasticity clay.	4.5			
				4.5		Marine	SP			MD		W

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
Easting : 340033.03	Driller Supplier : BG Drilling	Client : Fortis
Northing : 6250847.66	Logged By : Mahmoud Jangidaryan	Project : Rose Bay
RL : 7.2(m)	Reviewed By : Rhiannon McKeon	Location : 23-31 Dover Road, Rose Bay NSW
Total Depth : 10.15 m	Date : 01/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation Depth (m)	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
						Marine	SP	As above, but: wet, trace low plasticity clay.				
			5,8,11 (N=19)						6	MD		W
									7			
		50mm PVC Slotted		-0.3 7.5		Marine	SP	As above, but: pale yellow.	7.5			
			8,11,13 (N=24)									
									8	MD		W
				-1.8 9		Marine	SP	As above, but: brown grey.	9			
			9,11,14 (N=25)									

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
Easting : 340033.03	Driller Supplier : BG Drilling	Client : Fortis
Northing : 6250847.66	Logged By : Mahmoud Jangidaryan	Project : Rose Bay
RL : 7.2(m)	Reviewed By : Rhiannon McKeon	Location : 23-31 Dover Road, Rose Bay NSW
Total Depth : 10.15 m	Date : 01/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
 Shore		 50mm PVC Slotted				Marine	SP	As above, but: brown grey.		MD		W
								BH102 Reached Target Depth at 10.15m				

Job Number : P3496
Client : Fortis
Project : Rose Bay
Location : 23-31 Dover Road, Rose Bay NSW
Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT	Depth (m)								
ADT Washbore		C 50mm PVC Solid 50mm PVC Slotted		5.9	Non-Soil	CCT	Non-Soil - Concrete	0.11				
			0.11	FILL	FILL	CLAYEY GRAVELLY SAND loose, fine grained, fine sized gravel, low plasticity clay.	L					
			5.6			SAND very loose, poorly graded, fine grained, pale grey.						
	1.1,2 (N=3)		0.4	Aeolian	SP		VL					
			4.5			SAND very loose, poorly graded, fine grained, pale grey brown, moist, Trace indurated sands.						
	2.3,2 (N=5)		1.5	Marine	SP		VL		M			
			3.0			SAND loose, poorly graded, fine grained, pale orange pale yellow, with trace of clays at some bands.						
	4.5,5 (N=10)		3	Marine	SP		L					

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
Easting : 340016.97	Driller Supplier : BG Drilling	Client : Fortis
Northing : 6250833.45	Logged By : Mahmoud Jangidaryan	Project : Rose Bay
RL : 6.0(m)	Reviewed By : Rhiannon McKeon	Location : 23-31 Dover Road, Rose Bay NSW
Total Depth : 10.3 m	Date : 01/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
				0.0		Marine	SP	SAND loose, poorly graded, fine grained, pale orange pale yellow, with trace of clays at some bands.		L		
			8,9,10 (N=19)	6				As above, but: medium dense.	6			
									7			
			7,9,12 (N=21)			Marine	SP		8	MD		
									9			
			7,12,16 (N=28)									

UTM : 56H	Driller Rig : Christie Rig	Job Number : P3496
Easting : 340016.97	Driller Supplier : BG Drilling	Client : Fortis
Northing : 6250833.45	Logged By : Mahmoud Jangidaryan	Project : Rose Bay
RL : 6.0(m)	Reviewed By : Rhiannon McKeon	Location : 23-31 Dover Road, Rose Bay NSW
Total Depth : 10.3 m	Date : 01/05/2025	Loc Comment :

Drilling Method	Water	Well Diagram	Testing	Elevation	Graphic Log	Material Type	Classification Code	Material Description	Depth (m)	Consistency	Weathering	Moisture
			SPT									
 Washbore		 50mm PVC Slotted				Marine	SP	As above, but: medium dense.		MD		
								BH103 Reached Target Depth at 10.3m				

GENERAL

Information obtained from site investigations is recorded on log sheets. The "Cored Drill Hole Log" presents data from an operation where a core barrel has been used to recover material - commonly rock. The "Non-Core Drill Hole - Geological Log" presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 1993 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

DRILLING

Drilling & Casing

ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
WB	Wash-bore drilling
RR	Rock Roller
NMLC	NMLC core barrel
NQ	NQ core barrel
HMLC	HMLC core barrel
HQ	HQ core barrel

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

VE	Very Easy
E	Easy
M	Medium
H	High
VH	Very High

Groundwater Levels

Date of measurement is shown.

Standing water level measured in completed boreholeLevel taken during or immediately after drilling

D	Disturbed
B	Bulk
U	Undisturbed
SPT	Standard Penetration Test
N	Result of SPT (sample taken)
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test

EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

MATERIAL DESCRIPTION - SOIL

Classification Symbol - In accordance with the Unified Classification System (AS 1726-1993, Appendix A, Table A1)

Material Description - In accordance with AS 1726-1993, Appendix A2.3

Moisture Condition

D	Dry, looks and feels dry
M	Moist, No free water on remoulding
W	Wet, free water on remoulding

Consistency - In accordance with AS 1726-1993, Appendix A2.5

VS	Very Soft	< 12.5 kPa
S	Soft	12.5 – 25 kPa
F	Firm	25 – 50 kPa
St	Stiff	50 – 100 kPa
VSt	Very Stiff	100 – 200 kPa
H	Hard	> 200 kPa

Strength figures quoted are the approximate range of undrained shear strength for each class.

Density Index. (%) is estimated or is based on SPT results.

VL	Very Loose	< 15 %
L	Loose	15 – 35 %
MD	Medium Dense	35 – 65 %
D	Dense	65 – 85 %
VD	Very Dense	> 85 %

MATERIAL DESCRIPTION -ROCK

Material Description

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-1993, Appendix A3.1-A3.3 and Tables A6a, A6b and A7.

Core Loss

Is shown at the bottom of the run unless otherwise indicated.

Bedding

Thinly Laminated	< 6 mm
Laminated	6 - 20
Very Thinly Bedded	20 - 60
Thinly Bedded	60 - 200
Medium Bedded	200 – 600
Thickly Bedded	600 – 2000
Very Thickly Bedded	> 2000

Weathering - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties.

Fresh (F)	Rock substance unaffected by weathering
Slightly Weathered(SW)	Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable.
Moderately Weathered (MW)	Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable.
Highly Weathered(HW)	Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained.
Extremely Weathered (EW)	Rock texture evident but material has soil properties and can be remoulded.

Strength - The following terms are used to described rock strength:

Rock Strength Class	Abbreviation	Point Load Strength Index, Is(50) (MPa)
Extremely Low	EL	< 0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	≥ 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

Diametral Point Load Test

Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

MATERIALS STRUCTURE/FRACTURES

ROCK

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Visual Log - A diagrammatic plot of defects showing type, spacing and orientation in relation to core axis.

Defects		Defects open in-situ or clay sealed Defects closed in-situ Breaks through rock substance
	----- _____	

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-1993, Appendix A Table A10, notes and Figure A2.

Orientation - angle relative to the plane normal to the core axis.

Type	BP JT SM FZ SZ VN FL CL DL HB DB	Bedding Parting Joint Seam Fracture Zone Shear Zone Vein Foliation Cleavage Drill Lift Handling Break Drilling Break
Infilling	CN X Clay KT CA Fe QZ MS MU	Clean Carbonaceous Clay Chlorite Calcite Iron Oxide Quartz Secondary Mineral Unidentified Mineral
Shape	PR CU UN ST IR DIS	Planar Curved Undulose Stepped Irregular Discontinuous
Roughness	POL SL S RF VR	Polished Slickensided Smooth Rough Very Rough

SOIL

Structures - Fissuring and other defects are described in accordance with AS 1726-1993, Appendix A2.6, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

APPENDIX B

SITE SPECIFIC RISK ASSESMENT MATRIX

Risk Matrix	
Loss	
1	Could cause very major damage >\$500K
2	Could cause major damage \$100K - \$500K
3	Could cause moderate damage \$50K - \$100K
4	Could cause damage \$5K-\$50K
5	Couldn't cause damage or <5K damage

				LIKELIHOOD				
		OHS	ENVIRONMENT	A Almost Certain	B Likely	C Possible	D Unlikely	E Rare
CONSEQUENCE	1 Catastrophic	Fatality	Long term, widespread permanent damage	1 - High	2 - High	4 - High	7 - Med	11 - Med
	2 Major	Extensive injury (LTI)	Major effect/off site release	3 - High	5 - High	8 - Me d	12 - Med	16 - Low
	3 Moderate	Alternative Duties Incident (ADI)	Moderate effect / off site emission	6 - High	9 - Med	13 - Med	17 - Low	20 - Low
	4 Minor	Medical Treatment Incident (MTI)	Minor off site impact	10 - Med	14 - Med	18 - Low	21 - Low	23 - Low
	5 Negligible	First Aid or Non treatment Incident (FAI & NTI)	No offsite impact	15- Med	19 - Low	22 - Low	24 - Low	25 - Low

Description of Work: INSTALLATION OF SHORING AND SITE DEWATERING	Consequence			Likelihood				
		OHS	Environmental	Almost certain	Likely	Possible	Unlikely	Rare
		1 – Catastrophic/fatality	Long term, widespread permanent damage	1 -H	2- H	4- H	7- M	11-M
		2 – Major/permanent disability –(LTI)	Major effect/off site release	3- H	5- H	8- M	12-M	16-L
		3 – Moderate/Temp. disability (ADI)	Moderate effect / off site emission	6 - H	9 -M	13- M	17-L	20-L
		4 – Minor / Medical Treatment (MTI)	Minor off site impact	10- M	14-M	18-L	21-L	23-L
		5 – Negligible/First Aid	No offsite impact	15- M	19-L	22-L	24-L	25-L
Potential Hazards (source of harm)		Risks (what could happen)	Potential Risk		Control Method / PPE	Residual Risk		
			Risk Number	Risk (H, M, L)		Risk Number	Risk (H, M, L)	
General hazards to site personnel		Slips, trips and falls Moving plant and equipment Heavy lifting	9	M	These hazards should be controlled by normal site safety procedures adopted by the contractor (such as Safety Management Plans and Safe Work Method Statements.	17	L	

Description of Work: INSTALLATION OF SHORING AND SITE DEWATERING	Consequence			Likelihood				
		OHS	Environmental	Almost certain	Likely	Possible	Unlikely	Rare
		1 – Catastrophic/fatality	Long term, widespread permanent damage	1 -H	2- H	4- H	7- M	11-M
		2 – Major/permanent disability –(LTI)	Major effect/off site release	3- H	5- H	8- M	12-M	16-L
		3 – Moderate/Temp. disability (ADI)	Moderate effect / off site emission	6 - H	9 -M	13- M	17-L	20-L
		4 – Minor / Medical Treatment (MTI)	Minor off site impact	10- M	14-M	18-L	21-L	23-L
		5 – Negligible/First Aid	No offsite impact	15- M	19-L	22-L	24-L	25-L
Potential Hazards (source of harm)		Risks (what could happen)	Potential Risk		Control Method / PPE	Residual Risk		
			Risk Number	Risk (H, M, L)		Risk Number	Risk (H, M, L)	
Access/egress from excavation		Fall from height	4	H	Barriers should be constructed at the crest of the wall(s) to prevent personnel from falling. Provide suitable access/egress to the excavation including provision of an emergency winch or similar for a stretcher lift.	16	L	
Overexcavation		Wall collapse due to excavation at the toe	8	M	Retained height of the soldier pile wall without temporary support should not exceed those indicated on the design drawings. Temporary anchors or bracing to be provided in accordance with the requirements of this design report and drawings.	16	L	
Excessive Loading		Wall collapse due to excess surcharge at the crest	8	M	The owner/builder of the wall should familiarise themselves with the surcharge restrictions or design allowances on the wall.	17	L	
Inadequate Design		Wall collapse due to structural inadequacy	4	H	Provide appropriate type of shoring and temporary ground anchor designed to Australian Standards. Provide recommended construction sequence and specification. Peer review of shoring design.	20	L	

Description of Work: INSTALLATION OF SHORING AND SITE DEWATERING	Consequence			Likelihood				
		OHS	Environmental	Almost certain	Likely	Possible	Unlikely	Rare
		1 – Catastrophic/fatality	Long term, widespread permanent damage	1 -H	2- H	4- H	7- M	11-M
		2 – Major/permanent disability –(LTI)	Major effect/off site release	3- H	5- H	8- M	12-M	16-L
		3 – Moderate/Temp. disability (ADI)	Moderate effect / off site emission	6 - H	9 -M	13- M	17-L	20-L
		4 – Minor / Medical Treatment (MTI)	Minor off site impact	10- M	14-M	18-L	21-L	23-L
		5 – Negligible/First Aid	No offsite impact	15- M	19-L	22-L	24-L	25-L
Potential Hazards (source of harm)		Risks (what could happen)	Potential Risk		Control Method / PPE	Residual Risk		
			Risk Number	Risk (H, M, L)		Risk Number	Risk (H, M, L)	
Neighbouring Structures within Zone of Influence		Destabilise/Undermine Neighbouring Buildings	12	M	Shoring design to include surcharge loadings from neighbouring structures.	20	L	
Piling Rig Operation		Collapse of plant during construction	12	M	A safe working platform for plant should be designed and constructed in accordance with BRE guidelines for Working Platforms for Tracked Plant if required.	16	L	
Piling Rig Operation		Underground/Overhead Services Strike	9	M	All services are to be identified/exposed and diverted as necessary to allow the piling works to be completed safely.	21	L	

Description of Work: INSTALLATION OF SHORING AND SITE DEWATERING	Consequence			Likelihood				
		OHS	Environmental	Almost certain	Likely	Possible	Unlikely	Rare
		1 – Catastrophic/fatality	Long term, widespread permanent damage	1 -H	2- H	4- H	7- M	11-M
		2 – Major/permanent disability –(LTI)	Major effect/off site release	3- H	5- H	8- M	12-M	16-L
		3 – Moderate/Temp. disability (ADI)	Moderate effect / off site emission	6 - H	9 -M	13- M	17-L	20-L
		4 – Minor / Medical Treatment (MTI)	Minor off site impact	10- M	14-M	18-L	21-L	23-L
		5 – Negligible/First Aid	No offsite impact	15- M	19-L	22-L	24-L	25-L
Potential Hazards (source of harm)		Risks (what could happen)	Potential Risk		Control Method / PPE	Residual Risk		
			Risk Number	Risk (H, M, L)		Risk Number	Risk (H, M, L)	
Piling Rig Operation		Back injury Minor cuts, scratches, splinters etc Collision with other workers Crushing injury	4	H	Rig operation under subcontractors SWMS Operators instruction manual to be consulted prior to use Inspection of equipment prior to use Only trained operators to use rig	11	M	
Poor Quality Ground Conditions		Inadequate toe support for wall or excess soil pressure on wall leading to collapse	8	M	Geotechnical inspection during piling to ensure the assumptions of the geotechnical design are achieved in pile sockets.	17	L	

APPENDIX C

IMPORTANT INFORMATION

This Document has been provided by Morrow Geotechnics Pty Ltd subject to the following limitations:

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Conditions may exist which were undetectable given the limited nature of the enquiry Morrow Geotechnics was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required. No geotechnical investigation can provide a full understanding of all possible subsurface details and anomalies at a site.

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Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that Morrow Geotechnics be notified of any variations and be provided with an opportunity to review the recommendations of this report.

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