

GEOTECHNICAL INVESTIGATION REPORT

No. 167 Serpentine Road, Terrigal NSW 2260

**Prepared for
Malachite Holdings Pty Ltd Superannuation Fund**

**Reference No. G753-RevA
July 2025**

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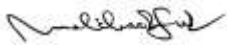
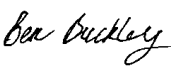
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—	Signature	Name	Date
Author		Lubos Melicharek	12/10/2024
Author		Ben Buckley	12/10/2024

TABLE OF CONTENTS

1.0 INTRODUCTION	5
2.0 AVAILABLE INFORMATION	6
3.0 FIELDWORK AND LABORATORY TESTING.....	7
4.0 GROUND CONDITIONS	7
4.1 Ground Profiles	7
4.2 Groundwater.....	9
4.3 Aggressivity and Salinity Tests	9
5.0 DISCUSSIONS AND RECOMMENDATIONS	10
5.1 Excavation Conditions and Permanent Batter Slopes	10
5.2 Dilapidation Survey	11
5.3 Retaining Walls	11
5.4 Foundations	12
5.5 Site Lot Classification	14
5.6 Site Earthquake Classification.....	14
5.7 Aggressivity and Salinity	15
5.8 Preliminary Pavement Design Parameters	15
5.9 Earthworks and Subgrade Preparation.....	15
6.0 CONCLUSIONS	16
7.0 LIMITATIONS	17
8.0 REFERENCES	17

LIST OF TABLES

Table 1: Summary of Details of the Site	5
Table 2: Summary of Ground Profile within the Boreholes BH1, TP9, TP11, TP26, TP27	8
Table 3: Summary of Ground Profile within the Boreholes BH2, BH3, TP1 to TP25	8
Table 4: Summary of Aggressivity Tests	9
Table 5: Summary of Soil Salinity Tests	10
Table 6: Retaining Walls Design Parameters	12
Table 7: Coefficient of Lateral Earth Pressure	12
Table 8: Foundation Design Parameters.....	13

APPENDICES

- Appendix A:** Site Plan
- Appendix B:** Borehole and Test Pit Logs
- Appendix C:** Laboratory CBR Test Results
- Appendix D:** Results of Aggressivity and Salinity Tests

1.0 INTRODUCTION

The purpose of Foundation Earth Sciences (“FES”) geotechnical investigation at the above site was to preliminary assess geotechnical surface and subsurface conditions together with DSI report E3266 prepared by FES. **This REVISION A contains SLOPES and COUNCIL comments with recommendations for proposed development.** Details of the site are below in Table 1.

Table 1: Summary of Details of the Site

Site	Details
Location	No. 167 Serpentine Road, Terrigal NSW
Lot/DP	Lot 2 in DP 746654
Local Council	Central Coast Council
Site Area	Approximately 1.827ha
Shape & Slope	Near rectangular size block of land sloping from the West to the East
Existing Structures	Two and single storey dwellings, shed, garden, grassed areas, with trees alongside the northern and western/southern boundaries
Close Watercourse	Erina Creek located approximately 2km distance to the West
Special Features	The site positioned near Central Coast Star of the Sea Primary School
Neighbouring Properties	East - Serpentine Road then residential properties West - Star of the Sea primary school South - Residential properties North - Residential properties
Geology Map	The Geological Map of Gosford-Lake Macquarie (Geological Series Sheet 9131, Scale 1:100,000, Edition 1, 1983), published by the Department of Trade & Investment Resources & Energy
Primary Geology	Rnt – Middle Triassic Age Terrigal Formation of Mesozoic Gosford Subgroup, described ‘Interbedded laminite, shale and fine to coarse grained quartz to quartz-lithic sandstone, minor red claystone’
Secondary Geology	Qa – Quaternary Cenozoic deposits, described ‘Gravel and sand’, located approximately 100m to the south-west of the site
Proposed Development	Re-development of the site into early learning centre including two outdoor areas, landscaping, carpark and driveways, main building.

2.0 AVAILABLE INFORMATION

Foundation Earth Sciences (“FES”) was appointed by Andrew Brand and Malachite Holdings Pty Ltd Superannuation Fund (“client”) to conduct combined Detailed Site Investigation (DSI) environmental and Geotechnical Investigation (GI) to assess the details and conditions of the property at No. 167 Serpentine Road, Terrigal NSW (“the site”).

The site is of an irregular shape and currently occupied by residential structures, vacant grassed areas, and parking spaces. The site, currently designated as Deferred Matter lands and zoned 7(c2) Scenic Protection Rural under Interim Development Order No. 122, is proposed for rezoning to C4 Environmental Living according to the Central Coast Local Environmental Plan 2022. The property is proposed to be re-developed into an early learning centre including multiple outdoor areas, landscaping, carpark and driveways, main stepped single/dual storey building. **The proposed development is designed with a total DEMOLITION of ALL EXISTING STRUCTURES** on site with subsequent construction of new building and carpark areas, with generally on-grade but some shallow cuts into the site slopes.

Following information was made available to Foundation ES (FES) during the preparation of this report:

- Survey Plan and “Record of Pre-Development Advice for No. 167 Serpentine Road, Terrigal NSW 2260” with proposed ‘Demolition and Construction of a Child Care Centre’ at Lot 2 in DP 746654, prepared by Central Coast Council, Document PDA/269/2023, Acting Section Manager / Development Advisory Services, prepared and dated 8th February 2024.
- **UPDATED - ARMADA Architects Plans / Drawings Project “Proposed Early Learning Centre – Serpentine Rd ELC – DA – RFI – FINAL”, Drawing Nos. A103-A552, dated 10th July 2025, Revision J [updated for Council Comments 26.6.2025].**
- ARMADA Architects concept drawings “240909_AA _SERPENTINE Site Concept”, DA Concept 4 Draft, Drawing Nos. 240909, dated 4.10.2024.
- DSI Report No. E3266, prepared by FES, dated November 2024.

3.0 FIELDWORK AND LABORATORY TESTING

Following scope of work were carried out during the investigation:

- Review of Before You Dig Australia (“BYDA”) plans and services locating.
- Field drilling/excavation of three (3) FES geo/enviro boreholes, identified as BH1 to BH3 and twenty-seven (27) test pits designated as TP1 to TP27 respectively.
- Installation of three (3) groundwater wells in drilled field boreholes further identified as GW1/BH1, GW2/BH2, GW3/BH3.
- Field sampling and chemical laboratory testing of Aggressivity and Salinity on the soil samples recovered from the borehole BH1 and BH2.
- California Bearing Ratio (“CBR”) testing on soil materials recovered from test pits designated as CBR1/TP26, CBR2/TP27.

The approximate locations of boreholes BH1 to BH3 and TP9, TP11, TP26, and TP27 field drilled completed including GW1-GW3, during site Geotechnical investigation by FES are shown in a “Site Plan” and attached as Appendix A.

The combined geotechnical and environmental investigation borehole logs finalised for BH1 to BH3 and TP1 to TP27 inclusive are attached and annexed as Appendix B.

The results of CBR Testing Appendix C, and Aggressivity and Salinity tests are annexed as Appendix D.

4.0 GROUND CONDITIONS

4.1 Ground Profiles

Ground profiles encountered within the geotechnical boreholes are summarised below in Table 2 and Table 3.

However, reference should be made to boreholes BH1 to BH3 and TP1 to TP27 inclusive final logs available and contained in FES geotechnical and DSI environmental reports for further details.

Table 2: Summary of Ground Profile within the Boreholes BH1, TP9, TP11, TP26, TP27

Unit	Details			
		BH1	TP9 & TP11	TP26 & TP27
Surface / Approximate: RL m [AHD]		44.50	57.45 -53.07	56.81 – 55.64
Fill	Silty Clay dark brown and brown, moist, organics	0.0 – 0.5	0.0 – 0.2	0.0 – 0.4
Residual Soil	CLAY, medium to high plasticity orange, CI-CH	0.5 – 1.6	0.2 – 0.7	0.4 – 2.2
Residual Soil	CLAY, high plasticity, red and pale brown, CH	1.6 – 6.0	-	-
[Class V ¹] Shale	SHALE, extremely weathered, grey and yellow, very low strength	-	-	-

Table 3: Summary of Ground Profile within the Boreholes BH2, BH3, TP1 to TP25

Unit	Details				
		BH2	TP1 – TP14	TP14 – TP25	BH3
Surface / Approximate: RL m [AHD]		44.5	52.0-45.0	45.0-36.0	38.0
Fill	Silty Clay dark brown and brown, moist, organics	0.0 – 0.2	0.0 – 0.6	0.0 – 0.7	0.0 – 0.8
Residual Soil	CLAY, medium to high plasticity orange, CI-CH	0.2 – 1.6	0.6 – 1.1	0.7 – 1.5	0.8 – 2.7
Residual Soil	CLAY, high plasticity, red and pale brown, CH	-	-	-	2.7– 4.6
[Class V ¹] Shale	SHALE, extremely weathered, grey and yellow, very low strength	1.6 – 3.0	1.0 – 1.2	-	4.6 – 5.0

Note: ¹ BEDROCK was assessed only as a GUIDE in accordance with the research paper of Pells P.J.N, Mostyn G. & Walker B.F. Foundations on Sandstone and Shale in the Sydney Region, AGS, December 1998. These CLASSES of bedrock are NOT applicable at the Central Coast region.

4.2 Groundwater

Groundwater seepage was observed during the auger drilling of the standpipes boreholes BH1 (GW1), BH3 (GW3) at the depths 2.0m, 3.3m respectively, below ground level ("BGL"). Measurements of groundwater levels were conducted in the installed standpipes GW1, GW2 and GW3 on the 22nd of October 2024. Seepage was found at the depth of 2.0m in GW1, and at the depth of 3.3m in GW3. However, GW2 no seepage was detected during measurement. It was assessed that seepage water inflows may possibly adversely affect the foundation piles excavations. Some pre-construction planned field visits to the site to conduct measurements of the potential seepage water levels may be conducted by FES or can be arranged by client prior to the demolition of the existing structures on this site. Further, it should be noted encountered water levels within the site may be subject to seasonal fluctuations, rainfall, prevailing weather conditions and future developments at neighbouring properties.

4.3 Aggressivity and Salinity Tests

Aggressivity and Salinity tests were carried out on recovered soils samples in accordance with Australian and NSW standards, guidelines, and regulations. Results of the Aggressivity tests and Salinity tests carried out are summarised in Table 4 and Table 5.

Table 4: Summary of Aggressivity Tests

Sample ID	Depth (m)	Soil Type	pH	Chloride (mg/kg)	Sulphate As SO ₄ (mg/kg)
BH1	1.5-1.6	CLAY	4.7	190	52
BH2	0.9-1.0	CLAY	4.6	<10	61
Piling - Design and Installation - AS2159-2009					
Reinforced Concrete Piles	<u>Clayey Soil</u>	<u>Sandy Soil</u>			
	Non	Mild	> 5.5		< 5,000
	Mild	Moderate	4.5 – 5.5		5,000-10,000
	Moderate	Severe	4.0 – 4.5		10,000-20,000
	Severe	Very Severe	< 4.0		> 20,000
Steel Piles	Non	Non	> 5.0	< 5,000	
	Non	Mild	4.0 – 5.0	5,000-20,000	
	Mild	Moderate	3.0 – 4.0	20,000-50,000	
	Moderate	Severe	< 3.0	> 50,000	

Table 5: Summary of Soil Salinity Tests

Sample ID	Depth (m)	Soil Type	Electrical Conductivity EC ($\mu\text{S}/\text{cm}$)	Factor	Saturated Extracted EC EC_e (dS/m)
BH1	1.5-1.6	CLAY	180	8	1.4
BH2	0.9-1.0	CLAY	46	8	0.4
Environmental Planning & Assessment Regulation 1994			Saline		> 4
Dryland Salinity (1993)			Non-Saline		< 2
			Slightly		2 – 4
			Moderately		4 – 8
			Very		8 – 16
			Highly		> 16

5.0 DISCUSSIONS AND RECOMMENDATIONS

5.1 Excavation Conditions and Permanent Batter Slopes

Earthworks and excavations across the site are expected to be generally removing the fill layer and upper layers of residual clay soils to the depth of up to 0.5m to 1m below ground level (“BGL”). There is planned ‘stepped’ construction at grade. **The final plans for the proposed earthworks, permanent batter slopes and supporting retaining walls will be finalised at CC stage of the project.** Permanent batter slopes shall be designed at maximum considered angles as per Council CWS Specification Design Guideline DG S.5.6, with FILL allowed to be maximum 1V:3H. Natural CLAYS can be allowed at steeper 1V:2H with condition that either fill or natural clays must be surface protected with EROSION countermeasures, such as shotcrete, turf vegetation etc. **If permanent slopes are designed steeper than above recommendations then BENCHING of the slopes is a viable alternative.** Benches must be at least 0.5m width and maximum height of the slopes not exceeding 2m vertical. RETAINING WALLS will be designed if permanent or temporary batter slopes are not achievable at the current design requirements. Area in between the batter slopes and proposed earth retaining structures shall be then backfilled with suitable materials. Drainage system must be installed as per structural design drawing prior to commencement of the backfilling.

The site excavations can be achieved using a conventional earthmoving equipment such as backhoes or tracked excavators with deeper cuts and re-grading of the exposed surface after removing of all unsuitable fill/topsoil material and clay debris across the site. Prior to commencement of excavations, all available data should be assessed, and client is advised to refer to all FES provided borehole logs. It is anticipated that prior to site earthworks and excavations an assessment will be carried out by a qualified excavation contractor to identify a suitable excavation method for removing all structures and unsuitable soils. The ground profiles summarised in Table 2 and Table 3 shall be used only for foundations design.

5.2 Dilapidation Survey

Dilapidation survey report on all neighbouring structures and Serpentine Road assessed pavement, potentially be affected by proposed development is recommended to be carried out by a qualified structural engineer prior to commencement of site works and construction.

5.3 Retaining Walls

Architectural prepared ARMADA drawings may at final CC stage indicate the retaining walls to be constructed if batter slopes proposed are not sufficient or not applicable at the western part of the site. It is possible then that detailed design may require retaining walls analysis.

If retaining structures are to be designed then they should withstand the applied lateral pressures of the soil and rock strata, the existing surcharges in their zone of influence, such as existing structures, construction related activities, and water pressures where exists. The pressure distribution The pressure distribution on cantilever retaining structures may be assumed triangular as follows:

$$\rho_h = \gamma k H + q k$$

Where:

ρ_h = Horizontal pressure (kN/m²)

γ = Wet density (kN/m³)

k = Coefficient of earth pressure (k_a or k_o)

H = Retained height (m)

q = Surcharge pressure behind retaining wall (kN/m²)

For the design of flexible retaining structures, where some lateral movement is acceptable, an active earth pressure coefficient is recommended. If critical to limit horizontal deformation of the retaining structure, use of an earth pressure coefficient at rest shall be considered. Recommended parameters for the design of retaining structures are in the Table 6.

Table 6: Retaining Walls Design Parameters

Ground Profile	Unit Weight (kN/m ³)	Effective Cohesion c' (kPa)	Angle of Friction ϕ (°)	Modulus of Elasticity E _{sh} (MPa)
Fill	18	0	26	8
Residual Soil	20	5	24	15
[Class V] Shale	22	10	28	75

Preliminary coefficients of lateral earth pressure for the encountered ground profile are provided in Table 7. These are based on horizontal ground and fully drained conditions.

Table 7: Coefficient of Lateral Earth Pressure

Ground Profile	Coefficient of Active Lateral Earth Pressure K _a	Coefficient of Active Lateral Earth Pressure at Rest K _o	Coefficient of Passive Lateral Earth Pressure K _p
Fill	0.39	0.56	2.56
Residual Soil	0.42	0.59	2.37
[Class V] Shale	0.36	0.53	2.77

5.4 Foundations

The foundation level of the proposed childcare building development is anticipated to be either on the surface high reactivity soils (slab on ground) or within the bedrock geology of extremely weathered very low strength Shale (piles drilled) at the depths of 1m to 5m.

It is recommended that detailed assessment of proposed foundation system will be carried out to assess the magnitude and distribution of settlement occurring under working load. Due to expected bearing pressures required and potential settlements, the footings for the proposed building are recommended to adopt pile foundations.

Piles will also serve the purpose to increase the resistance against the lateral seismic and wind loads. Piled foundations shall be then designed by structural engineer in accordance with Australian Standards AS 2870-2011 and AS 2159-2009, respectively.

It is recommended that all foundations are to be founded on the same stratum to minimise and avoid potential future differential settlements. Detail design of the foundation system shall be carried out by a structural engineer in accordance with AS 2870-2011.

It is further recommended to consider qualified geotechnical engineer inspected prepared footing excavations for the proposed building and other structures to confirm appropriate foundation material and to ensure the bearing pressures are satisfactory. Foundation excavations will have to be properly cleaned with all wet soils and debris be removed prior to the concrete placement. Verification of the capacity of the foundations will be required.

Table 8 provides design parameters recommended for shallow and pile foundations as described above.

Table 8: Foundation Design Parameters

Ground Profile	Allowable End Bearing Capacity (kPa)	Allowable Shaft Adhesion Compression (kPa)
Fill	N/A	N/A
Residual Soils	100	10
[Class V] Shale	700	70

Notes:

- With a minimum embedment depth of 0.5m for deep foundations and 0.4m for shallow foundations.

It is recommended to principal designer to consider if a modelling of proposed foundation system be carried out to determine the magnitude and distribution of settlement occurring under designed working loads, specifically in relation to the close vicinity of nearby structures and close roads pavements. Where additional bearing pressure is required or where potential excessive settlement may occur, preference should be given to adoption of pile foundation

socketing into stronger stratum of Shale (depth 5m and deeper). Piles will also be used to increase the resistance against the lateral seismic and wind loads. Shallow footings and pile foundations can be designed in accordance with AS 2870-2011 and AS 2159-2009, respectively. It is recommended that all foundations are to be founded on the same material to minimise and avoid potential future differential settlement. Detail design of the foundation system should be carried out by the structural engineer. A geotechnical engineer should inspect the foundation excavations to confirm appropriate foundation materials, and to ensure the serviceability bearing pressures can be achieved at the required strata. Foundation excavations shall be cleaned, all wet soil and rock spoils and debris to be removed prior to the concrete placement. Verification of the capacity of the shallow and pile foundations by inspections is required.

5.5 Site Lot Classification

Based on the site conditions and the soil profile, the site has been classified preliminary in accordance with AS 2870-2011 “Residential Slabs and Footings”:

- Lot classification **“Class H2”** Highly reactive clay site, which may experience high ground movement from moisture changes with characteristic surface movement y_s in the range 60mm to 75mm.

All relevant construction notes in AS 2870-2011 are applicable when constructing slab on ground for the proposed building. All fill and topsoil layers will have to be removed first.

5.6 Site Earthquake Classification

Based on the ground condition and details of the proposed development, in accordance with Australian Standard AS 1170.4-2007, the site can be classified as “Rock” (Class Be) for design of piled foundations (and possible retaining walls) embedded in the underlying bedrock. This is subject to foundation system of the development will be extended and socketed into the underlying bedrock geology. The Hazard Factor (Z) is 0.08.

5.7 Aggressivity and Salinity

Soil natural samples were tested for pH, Chloride and Sulphate for assessment of Aggressivity in accordance with Australian Standard AS 219-2009. Based on the ground profile and test results, site is assessed to be “Mild Aggressive” to reinforced concrete foundations and “Not Aggressive” to steel foundations. Assessment of the soil electrical conductivity was carried out to assess the salinity of the soil. It was assessed that site is “Non-Saline” in accordance with EPA regulation (1994) and Dryland Salinity (1993). It is recommended that the design and construction of proposed foundation system should incorporate aggressivity and salinity results of the soils as recommended above.

5.8 Preliminary Pavement Design Parameters

Results of CBR testing indicate that CBR values applicable to site residual silty clays of high reactivity is 5.0% and 1.5%. **It is therefore recommended a CBR value of 1.5% to be adopted for the site carpark and access road pavement thickness design.**

After preparation of the subgrade layers, it is advisable that in-situ CBR testing may be carried out prior to construction of proposed access road and carpark to confirm the design CBR recommended in this report and to avoid any issues that may result from potential variation in assessed strength of the prepared subgrade. Pavement thickness design should be complemented by the provision of adequate surface and subsurface drainage system and then shall be properly constructed in accordance with the Central Coast Council (Council) specifications.

5.9 Earthworks and Subgrade Preparation

Earthworks and subgrade preparation shall be carried out in accordance with Council specifications and Australian Standard AS 3798-2007. However, a general procedure is provided below for the development area:

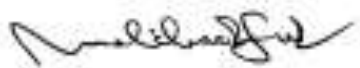
- Fill materials or topsoil or any unsuitable materials should be removed from the site.
- Excavated materials for reuse as engineering fill or remove to spoil should be stockpiled separately.
- Exposed surface after excavation should be treated to adjust its moisture condition to not to vary more than 2% from its Optimum Moisture Content ("OMC") and then compacted using at least 12t vibrating compacter to design density ratio.
- Exposed surface should be tested with appropriate density testing and proof rolling with a smooth drum roller of minimum 10t weight.
- Soft or loose areas should be excavated, treated with moisture and then recompacted or replaced with appropriate imported fill material. The materials should satisfy the Australian Standard AS 3798-2007.

6.0 CONCLUSIONS

This report presents the findings of the geotechnical investigation and recommendations for the proposed re-development at No. 167 Serpentine Road, Terrigal, NSW, referenced as project development application stage document. The geotechnical report considers the proposed development feasible in this site if the recommendations provided in this FES report are considered in design and construction of this development.

For and on behalf of Foundation Earth Sciences

Prepared by



Lubos Melicharek

Principal Geotechnical Engineer

CPEng and NER (Civil, Geotech Engineering)

Reviewed by



Ben Buckley

Director

7.0 LIMITATIONS

The assessment of the subsurface profile within the proposed development area and the recommendations presented in this report are based on limited information available to date. The recommendations and advice presented in this report on soil and rock conditions are to be considered limited as limited areas were assessed on site to date. Anecdotal site evidence and all information provided by client is assumed to be relevant and to the best of knowledge be appropriate for its interpretation. There is a potential that the actual geotechnical and groundwater conditions across the site may differ or vary from the inferred geotechnical assumptions and derivations on which our recommendations are presented in this report. In that case, Foundation Earth Sciences should be contacted for further advise and review of the information provided in this report. Foundation Earth Sciences does not accept any liabilities for the conditions not provided or not accessible during the preparation of this report.

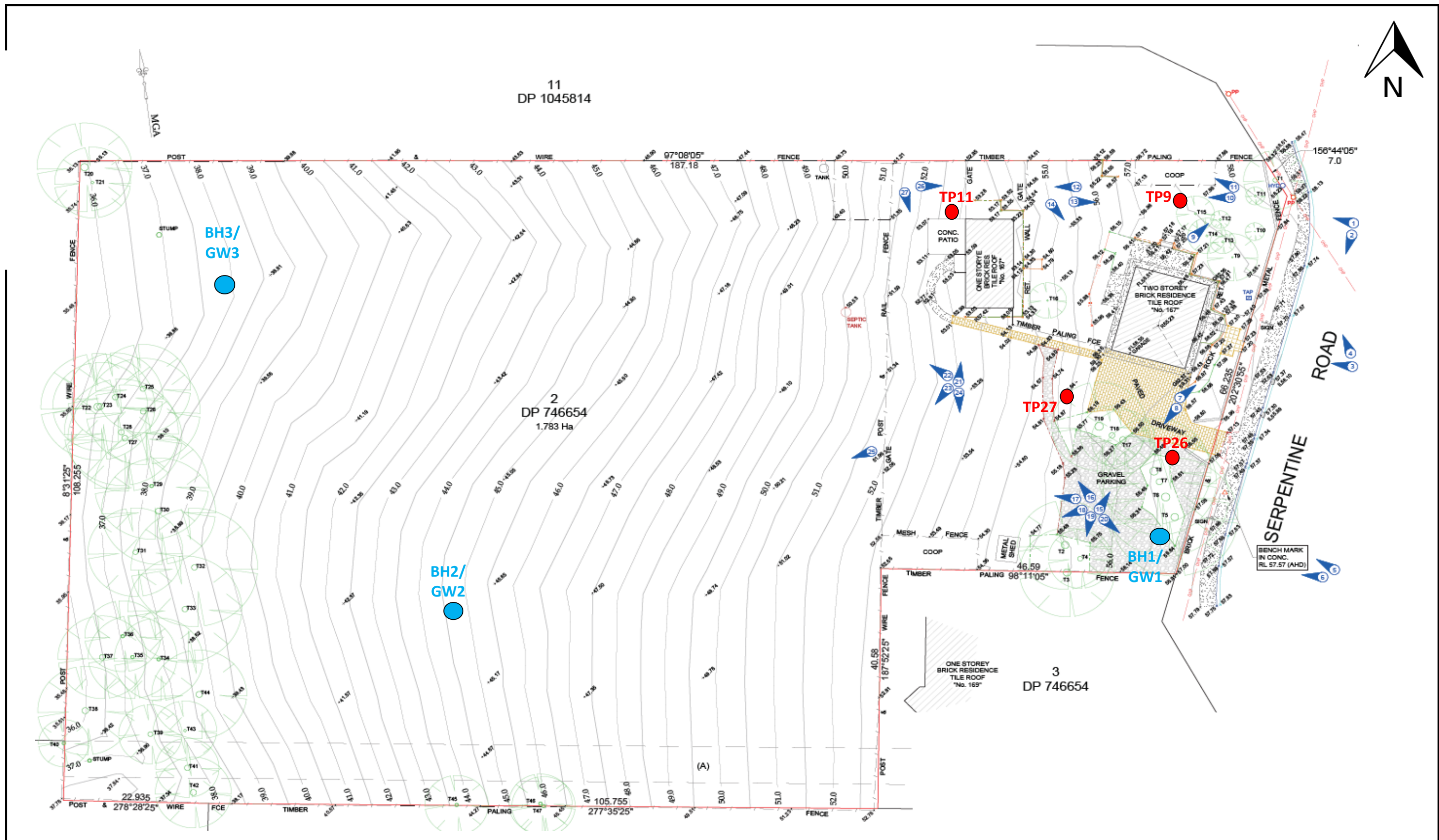
Any ensuring liability resulting from use of this report by third parties cannot be transferred to Foundation Earth Sciences.

8.0 REFERENCES

1. Australian Standard – AS 1726-1993 “Geotechnical Site Investigation”.
2. Australian Standard – AS 1170.4-2007 “Structural Design Actions – Part 4: Earthquake actions in Australia”.
3. Australian Standard – AS 2870-2011 “Residential slabs and footings”.
4. Australian Standard – AS 2159-2009 “Piling - Design and installation”.
5. Pells, P.J.N, Mostyn, E and Walker, B F – Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, Dec 1998.
6. Site Investigation for Urban Salinity, Department of Land and Water Conservation 2002.

Appendix A

Site Plan



Legend			DRAWN AB	Borehole Locations	
Site Boundary			FIGURE App A	Malachite Holdings Pty Ltd Superannuation Fund	
FES Geotechnical Investigation Approximate Locations			G753	167 Serpentine Road, Terrigal NSW	

Appendix B

Borehole and Test Pit Logs

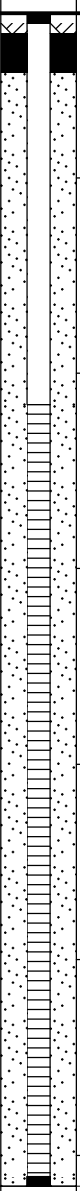
CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund **JOB NUMBER:** G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW **PROJECT:** GI / DSI

Date Started : 14/10/2024 **Completed :** 14/10/2024 **Logged By :** AB/HP **Checked By :** MS

Borehole Location : Refer to Site Plan **Surface RL :** 56.84 **Datum :** m AHD

Equipment : Masenza MI4 Drilling Rig **Borehole Size :** 100mm **Slope :** -90°

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT			56.3	0.50			FILL, Silty Clay, low plasticity, brown, with some organic matter and small rocks	M	[S]		Fill No staining & no fibro fragments observed	0.50
				1		CL-CH	CLAY, medium to high plasticity, orange/pale brown	M	[F]		Residual Soil	1
			55.2	1.60		CH	CLAY, high plasticity, orange/pale brown/red, with SHALE fragments and partial SHALE bands	M	[St]	1.5 - 1.6		1.60
				2								2
				3								3
			52.8	4.00		CH	CLAY interbedded with SHALE, red/orange some grey mottling	M	[vSt]			4
				5								5
				6								6
			50.8	6.00			Borehole BH1/GW1 terminated at 6.00m					6
				7								7

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund

JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW

PROJECT: GI / DSI

Date Started : 14/10/2024

Completed : 14/10/2024

Logged By : AB/HP

Checked By : MS

Borehole Location : Refer to Site Plan

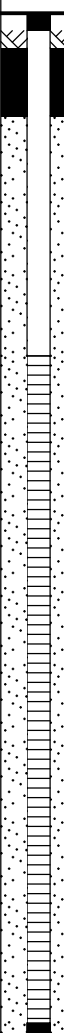
Surface RL : 44.50

Datum : m AHD

Equipment : Masenza MI4 Drilling Rig

Borehole Size : 100mm

Slope : -90°

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered		44.3	0.20			FILL, Silty Clay, low to medium plasticity, dark brown/brown, with some organic matter and trace of fine grained sand	M	[S]		Fill No staining & no fibro fragments observed	
						CL-CH	CLAY, medium to high plasticity, orange/brown	M	[S-F]		Residual Soil	0.5
				0.5								
				1.0						0.9 - 1.0		1.0
				1.5								1.5
			42.9	1.60			SHALE, extremely weathered, low strength, pale grey/pale yellow				SHALE	2.0
				2.0								
			42.3	2.20			SHALE, extremely to highly weathered, low to medium strenght, pale red/red					2.5
				2.5								
				3.0								3.0
			41.5	3.00			Borehole BH2/GW2 terminated at 3.00m					3.5
				3.5								
				4.0								4.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund

JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW

PROJECT: GI / DSI

Date Started : 14/10/2024

Completed : 14/10/2024

Logged By : AB/HP

Checked By : MS

Borehole Location : Refer to Site Plan

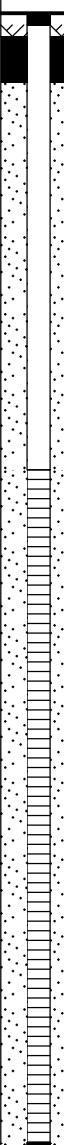
Surface RL : 38.0

Datum : m AHD

Equipment : Masenza MI4 Drilling Rig

Borehole Size : 100mm

Slope : -90°

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT			37.2	0.80			FILL, Silty Clay, medium plasticity, dark brown/orange, with organic matter	M	[S]	0.1 - 0.2	Fill No staining & no fibro fragments observed	
										SPT 2, 3, 4 N=7 SPT @ 0.5m	Residual Soil	1
										0.9 - 1.0		
			35.3	2.70		CL-CH	CLAY, medium to high plasticity, orange	M	[F]	SPT 3, 5, 8 N=13 SPT @ 2m		2
						CH	CLAY, high plasticity, orange/pale red, with some SHALE fragments	M	[F]	SPT 6, 8, 10 N=18 SPT @ 3m		3
												4
			33.4	4.60			SHALE, extremely weathered, low strength, pale red/orange				SHALE	5
			33.0	5.00			Borehole BH3/GW3 terminated at 5.00m					6

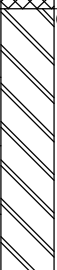
Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund **JOB NUMBER:** G753 / E3266
SITE ADDRESS: 167 Serpentine Road, Terrigal NSW **PROJECT:** GI / DSI
Date Started : 14/10/2024 **Completed :** 14/10/2024 **Logged By :** AB/HP **Checked By :** MS
Testpit Location : Refer to Site Plan **Surface RL :** 52.0 **Datum :** m AHD
Equipment : 5T Excavator **Testpit Size :** 450mm **Slope :** ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	51.4	0.5			FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter and some small - medium rocks/fragments	M	[S]		Fill	0.5
			0.60						0.1 - 0.2	No staining & no fibro fragments observed. D1/SS1	
			1.0		CL-CH	CLAY, medium to high plasticity, orange, some SHALE fragments	M	[F]		Residual Soil	1.0
			1.00			SHALE, extremely to highly weathered, low strength, red, with orange and grey laminations				SHALE	
		50.8	1.20			Testpit TP1 terminated at 1.20m					1.5
			1.5								2.0

Comments:

 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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund

JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW

PROJECT: GI / DSI

Date Started : 14/10/2024

Completed : 14/10/2024

Logged By : AB/HP

Checked By : MS

Testpit Location : Refer to Site Plan

Surface RL : 52.0

Datum : m AHD

Equipment : 5T Excavator

Testpit Size : 450mm

Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	51.4	0.5		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter and some small - medium rocks/fragments	M	[S]	0.0 - 0.1	Fill	0.5
			0.60			CLAY, medium to high plasticity, orange, some SHALE fragments	M	[F]		No staining & no fibro fragments observed. D2/SS2	
			1.0						0.7 - 0.8	Residual Soil	1.0
		50.9	1.10			Testpit TP2 terminated at 1.10m					1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 52.0 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered					FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter and some small - medium rocks/fragments	M	[S]		Fill	
									0.1 - 0.2	No staining & no fibro fragments observed	
		51.5	0.50								
			0.5								
					CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
		51.3	0.70								
									0.7 - 0.8		
						Testpit TP3 terminated at 0.70m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 50.50 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	50.3	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
E	Not Encountered	49.7	0.80			Testpit TP4 terminated at 0.80m				Residual Soil	1.0
E	Not Encountered		1.0								1.5
E	Not Encountered		1.5								2.0
E	Not Encountered		2.0								

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 50.25 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	50.1	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
		49.7	0.60			Testpit TP5 terminated at 0.60m				Residual Soil	1.0
			1.0								1.5
			1.5								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 51.0 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	50.8	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
		50.3	0.70			Testpit TP6 terminated at 0.70m				Residual Soil	2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund

JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW

PROJECT: GI / DSI

Date Started : 14/10/2024

Completed : 14/10/2024

Logged By : AB/HP

Checked By : MS

Testpit Location : Refer to Site Plan

Surface RL : 50.25

Datum : m AHD

Equipment : 5T Excavator

Testpit Size : 450mm

Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	50.0	0.30			FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
									0.2 - 0.3		
			0.5		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
		49.4	0.90			Testpit TP7 terminated at 0.90m					1.0
			1.0								
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 45.5 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	45.3	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
						CLAY, medium to high plasticity, orange			0.1 - 0.2	Residual Soil	
			0.5								0.5
		44.8	0.70			Testpit TP8 terminated at 0.70m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 57.45 Datum : m AHD

Equipment : Hand Auger Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
HA	Not Encountered	57.3	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, low to medium plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
			0.5							Residual Soil	
		56.9	0.60			Testpit TP9 terminated at 0.60m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 46.25 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	46.1	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
			0.5							Residual Soil	
		45.5	0.80			Testpit TP10 terminated at 0.80m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 53.07 Datum : m AHD

Equipment : Hand Auger Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
HA	Not Encountered	52.9	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
									0.1 - 0.2	No staining & no fibro fragments observed	
										Residual Soil	
									0.5 - 0.6		
		52.4	0.70			Testpit TP11 terminated at 0.70m					2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 47.50 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	47.3	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
			0.5							Residual Soil	
		46.8	0.70			Testpit TP12 terminated at 0.70m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 44.67 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	44.5	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
						CLAY, medium to high plasticity, orange			0.1 - 0.2	No staining & no fibro fragments observed	
			0.5							Residual Soil	1.0
		43.7	1.00			Testpit TP13 terminated at 1.00m					2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 45.0 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	44.8	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
						CLAY, medium to high plasticity, orange			0.1 - 0.2	Residual Soil	
			0.5								0.5
		44.3	0.70			Testpit TP14 terminated at 0.70m					
			1.0								1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 44.50 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	43.9	0.60		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill No staining & no fibro fragments observed	0.5
									0.1 - 0.2		
		43.4	1.10			CLAY, medium to high plasticity, orange	M	[F]	0.6 - 0.7	Residual Soil	1.0
						Testpit TP15 terminated at 1.10m					1.5
											2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 44.45 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	44.2	0.30		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
						0.2 - 0.3					
E	Not Encountered	44.2	0.30		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
E	Not Encountered	43.6	0.90			Testpit TP16 terminated at 0.90m					1.0
E	Not Encountered	43.6	0.90			Testpit TP16 terminated at 0.90m					1.5
E	Not Encountered	43.6	0.90			Testpit TP16 terminated at 0.90m					2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 42.0 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	41.7	0.30		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
						0.2 - 0.3					
											CLAY, medium to high plasticity, orange
		41.0	1.00			Testpit TP17 terminated at 1.00m					
			1.5								
			2.0								

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 39.5 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	39.3	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	
									0.1 - 0.2	No staining & no fibro fragments observed	
			0.5			CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	
									0.6 - 0.7		
		38.7	0.80			Testpit TP18 terminated at 0.80m					
			1.0								
			1.5								
			2.0								

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 39.5 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	39.2	0.30		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
									0.2 - 0.3	No staining & no fibro fragments observed	
						CLAY, medium to high plasticity, orange				Residual Soil	
		38.7	0.80			Testpit TP19 terminated at 0.80m					1.0
			1.0								1.5
			1.5								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 40.0 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	39.8	0.20		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	No staining & no fibro fragments observed
						CLAY, medium to high plasticity, orange			0.1 - 0.2	Residual Soil	
			0.5								0.5
			1.0								1.0
		39.0	1.00			Testpit TP20 terminated at 1.00m					
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 40.50 Datum : m AHD

Equipment : 5T Excavator Testpit Size : 450mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
E	Not Encountered	40.2	0.30			FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill No staining & no fibro fragments observed	
									0.2 - 0.3		
E	Not Encountered	39.8	0.70		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
			1.0			Testpit TP21 terminated at 0.70m					1.0
			1.5								1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 41.0 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 100mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	40.5	0.5			FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	
									0.1 - 0.2	No staining & no fibro fragments observed	
ADT	Not Encountered	39.5	0.50		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
									0.8 - 0.9		
ADT	Not Encountered	39.5	1.50			Testpit TP22 terminated at 1.50m					1.5
ADT	Not Encountered	39.5	2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 38.5 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 100mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	37.9	0.5			FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
			0.60						0.1 - 0.2	No staining & no fibro fragments observed	
			1.0		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	1.0
		37.0	1.50			Testpit TP23 terminated at 1.50m					1.5
			2.0								2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 37.5 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 100mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	36.8	0.70		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Fill	0.5
									0.1 - 0.2	No staining & no fibro fragments observed	
										Residual Soil	
		36.0	1.50			Testpit TP24 terminated at 1.50m					1.5
			2.0								2.0

Comments:

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

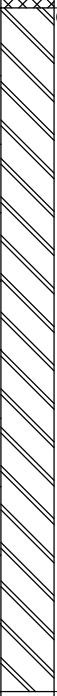
CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 36.0 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 100mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	35.5	0.50		CL-CH	FILL, Silty Clay, low - medium plasticity, dark brown/brown, with organic matter	M	[S]		Fill	0.5
									0.2 - 0.3	No staining & no fibro fragments observed	
ADT	Not Encountered	34.5	1.50		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	1.5
ADT	Not Encountered	34.5	1.50		CL-CH	Testpit TP25 terminated at 1.50m					2.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 56.81 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 200mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	56.4	0.40			FILL, Silty Clay, medium to high plasticity, dark brown/orange, with organic matter and small rocks	M	[S-F]		Fill	
			0.5		CL-CH	CLAY, medium to high plasticity, orange	M	[F]	SPT 4, 4, 4 N=8 SPT @ 0.5m	Residual Soil	0.5
			1.0								1.0
			1.5						1.2 - 1.5 CBR 1		1.5
			2.0						SPT 6, 8, 9 N=17 SPT @ 1.5m		2.0
		54.7	2.10			Testpit TP26 terminated at 2.10m					
			2.5								2.5
			3.0								3.0

Comments:

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

CLIENT NAME: Malachite Holdings Pty Ltd Superannuation Fund JOB NUMBER: G753 / E3266

SITE ADDRESS: 167 Serpentine Road, Terrigal NSW PROJECT: GI / DSI

Date Started : 14/10/2024 Completed : 14/10/2024 Logged By : AB/HP Checked By : MS

Testpit Location : Refer to Site Plan Surface RL : 55.64 Datum : m AHD

Equipment : Masenza MI4 Drilling Rig Testpit Size : 200mm Slope : ---

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
ADT	Not Encountered	55.3	0.30			FILL, Silty Clay, medium to high plasticity, dark brown/orange, with organic matter and small rocks	M	[S]		Fill No staining & no fibro fragments observed	
			0.5		CL-CH	CLAY, medium to high plasticity, orange	M	[F]		Residual Soil	0.5
			1.0								1.0
			1.5						1.5 - 2.0 CBR 2		1.5
			2.0								2.0
		53.4	2.20			Testpit TP27 terminated at 2.20m					
			2.5								2.5
			3.0								3.0

Comments:

D - Dry
M - Moist
W - Wet

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

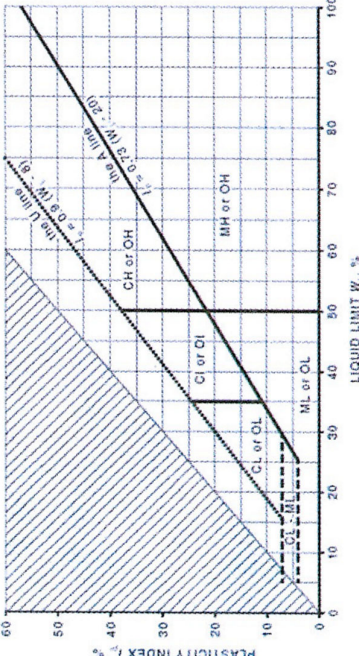
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

METHODS OF SOIL DESCRIPTION USED ON BOREHOLE LOGS

 FILL	 ORGANIC SOILS (OL, OH, Pt)	 CLAY (CL, CI, or CH)
 COUBLES or BOULDERS	 SILT (ML or MH)	 SAND (SP or SW)
 GRAVEL (GP or GW)	Combinations of these basic symbols may be sued to indicate mixed materials	

CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is broadly classified and described in borehole logs using the preferred method given in AS 1726:2017, section 6.1 soil descriptions and classification.

GROUP SYMBOLS				PARTICLE SIZE CHARACTERISTICS			
MAJOR DIVISIONS		SYMBOL	DESCRIPTION	Fraction	Components	Subdivision	Size mm
COARSE GRAINED SOILS More than 65% of the soil excluding oversize fraction is greater than 0.075mm	GRAVEL More than 50% of the coarse fraction is >2.36mm	GW	Well graded gravel and gravel-sand mixtures, little or no fines.	Oversize	BOULDERS		>200
					COBBLES		63-200
		GP	Poorly graded gravel and gravel-sand mixtures, little or no fines.		GRAVEL	Coarse	19-63
						Medium	6.7-19
						Fine	2.36-6.7
	SAND More than 50% of the coarse fraction is <2.36mm	GM	Silty gravel, gravel-sand-clay mixtures.		SAND	Coarse	0.6-2.36
						Medium	0.21-0.6
						Fine	0.075-0.21
		GC	Clayey gravel, gravel-sand-clay mixtures.		SILT		0.002-0.075
					CLAY		<0.002
FINE GRAINED SOILS More than 35% of the soil excluding oversize fraction is less than 0.075mm	Liquid limit less <50%	SW	Well graded sand and gravelly sand, little or no fines.	PLASTICITY PREOPERTIES 			
		SP	Poorly graded sand and gravelly sand, little or no fines.				
		SM	Silty sand, sand- silt mixtures.				
		SC	Clayey sand, sandy -clay mixtures.				
	Liquid limit > than 50%	ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands.				
		CL, CI	Inorganic slays of low to medium plasticity, gravelly clays, sandy clays, silty clays				
		OL	Organic silts and organic silty clays of low plasticity.				
		MH	Inorganic silts of high plasticity.				
		CH	Inorganic clays of high plasticity.				
		OH	Organic clays of medium to high plasticity.				
	Highly organic Soil	PT	Peat muck and other highly organic soils.				

ABBREVIATIONS AND DESCRIPTIONS FOR ROCK MATERIAL AND DEFECTS

MOISTURE CONDITION

Symbol	Term	Description
D	Dry	Non-cohesive and free running
M	Moist	Soils feel cool, darkened in colour. Soil tends to stick together.
W	Wet	Soils feel cool, darkened in colour. Soil tends to stick together, free water forms when handling.

Moisture content of cohesive soils shall be described in relation to plastic limit (PL) or liquid limit (LL) for soils with higher moisture content as follows: Moist, dry of plastic limit ($w < PL$); Moist, near plastic limit ($w = PL$); Moist, wet of plastic limit ($w < PL$); Wet, near liquid limit ($w = LL$), Wet, wet of liquid limit ($w > LL$),

CONSISTENCY				DENSITY			
Symbol	Term	Undrained Shear Strength (kPa)	SPT "N" #	Symbol	Term	Density Index %	SPT "N" #
VS	Very Soft	< 12	<2	VL	Very Loose	<15	0 to 4
S	Soft	>12 to <25	>2 to <4	L	Loose	>15 to <35	4 to 10
F	Firm	>25 to <50	>4 to <8	MD	Medium Density	>65 to <85	10 to 30
St	Stiff	>50 to <100	>8 to 15	D	Dense	>65 to <85	30 to 50
H	Hard	>200	>30				
Fr	Friable	-					

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material. #SPT correlations are not stated in AS1726:2017 and may be subject to corrections for overburden pressure and equipment type.

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION BY MASS
Trace	Presence just detectable by feel or eye but soil properties little or no difference to general properties of primary component	Coarse grained soils: <5% Fine grained soils: <15%
With	Presence easily detectable by feel or eye but soil properties little or no difference to general properties of primary component	Coarse grained soils: 5-12% Fine grained soils: 15-30%
Prefix	Presence easily detectable by feel or eye in conjunction with the general properties of primary component	Coarse grained soils: >12% Fine grained soils: >30%

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in borehole logs using the preferred method given in AS 1726:2017, section 6.2 Rock identification, descriptions, and classification.

ROCK MATERIAL DESCRIPTION

Layering		Structure	
Term	Description	Term	Spacing (mm)
Massive	No Layering apparent	Thinly Laminated	<6
		Laminated	6-20
Poorly Developed	Layering just visible; little effect on properties	Very thinly bedded	20-60
		Thinly bedded	60-200
Well Developed	Layering (bedding, foliation, cleavage) distinct; rock breaks more easily parallel to layering	Medium bedded	200-600
		Thickly bedded	600-2,000
		Very thickly bedded	>2,000

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT TYPES		
Defect Type	Abbr.	Description
Joint	JT	Surface of a fracture or parting, formed without displacement, across which the rock has little or no tensile strength. May be closed or filled by air, water, soil, or rock substance, which acts as cement.
Bedded Parting	BP	Surface of fracture or parting, across which the rock has little or no tensile strength, parallel or sub-parallel to layering/bedding. Bedding refers to the layering or stratification of a rock, indicating orientation during deposition, resulting in planar anisotropy in the rock material.
Foliation	FL	Repetitive planar structure parallel to the shear direction or perpendicular to the direction of higher pressure, especially in the metamorphic rock, e.g., schistosity (SH) and Gneissosity.
Contact	CO	The surface between two types or ages of rock.
Cleavage	CL	Cleavage planes appear as parallel, closely spaced, and planar surfaces resulting from mechanical fracturing of rock through deformation or metamorphism, independent of bedding.
Sheared Seam/ Zone (Fault)	SS/SZ	Seam or zone with roughly parallel almost planar boundaries of rock substance cut by closely spaced (often <50mm) parallel and usually smooth or slickensided joints or cleavage planes.
Crushed seam/ Zone (Fault)	CS/CZ	Seam or zone composed of disoriented usually angular fragments of the host rock substance, with rough parallel near-planar boundaries. The brecciated fragments may be of clay, silt, sand or gravel sizes or mixtures of these.
Decomposed seam/Zone	DS/DZ	Seam of soil substance, often with gradational boundaries, formed by weathering of the rock material in places.
Infilled Seam	IS	Seam of soil substance, usually clay or clayey, with very distinct roughly parallel boundaries, formed by soil migrating into joint or open cavity.
Schistosity	SH	The foliation in schist or other coarse grained crystalline rock due to the parallel arrangement of platy or prismatic mineral grains, such as mica.
Vein	VN	Distinct sheet-like body of minerals crystallised within rock through typically open-space filling or crack-seal growth.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT SHAPE AND ROUGHNESS					
Shape	Abbr.	Description	Roughness	Abbr.	Description
Planar	PI	Consistent Orientation	Polished	Pol	Shiny smooth surface
Curved	Cu	Gradual change in orientation	Slickensided	SL	Grooved or stained surface, usually polished
Undulating	Un	Wavy surface	Smooth	S	Smooth to touch. Few or no surface irregularities
Stepped	St	One or more well defined steps	Rough	RF	Many small surface irregularities, amplitude generally <1mm. Feels like fine to coarse sandpaper
Irregular	Ir	Many sharp changes in orientation	Very Rough	VR	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper.

Orientation: **Vertical Boreholes-** The dip (inclination from horizontal) of the defect.

Inclined Boreholes- The inclination is measured as the acute angle to the core axis.

ABBREVIATIONS AND DESCRIPTIONS FOR DEFECT COATING			DEFECT APERTURE		
Coating	Abbr.	Description	Aperture	Abbr.	Description
Clean	CN	No Visible coating or infilling	Closed	CL	Closed.
Stain	SN	No visible coating but surfaces are discoloured by staining, often limonite (orange-brown)	Open	O	Without any infill material
Veneer	VNR	A visible coating of soil or mineral substances, usually too thin to measure (<1mm); may be patchy	Infilled	-	Soil or rock i.e., clay, talc, pyrite, quartz, etc.

TERMS FOR ROCK MATERIAL STRENGTH AND WEATHERING

CLASSIFICATION AND INFERRED STRATIGRAPHY

Rock is broadly classified and described in borehole logs using the preferred method given in AS 1726:2017, section 6.2 Rock identification, descriptions, and classification.

ROCK MATERIAL STRENGTH CLASSIFICATION

Symbol	Term	Point Load Index Is (50) (MPa)#	Field Guide
VL	Very Low	0.03 To 0.01	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut triaxial sample by hand. Pieces up to 30mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with knife; indentations 1mm to 3mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 – 1	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
H	High	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken with a pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

#Rock Strength Test Results



Point Load Strength Index, Is (50) Axial Test (MPa)

Point Load Strength Index, Is (50), Diametral test (MPa)

Relationship between rock strength test result (Is (50)) and unconfined compressive strength (UCS) will vary with rock type and strength and should be determined on a site-specific basis. However, UCS is typically 20 x Is (50)

ROCK MATERIAL WEATHERING CLASSIFICATION

Symbol	Term	Field Guide
RS	Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric no longer evident; there is a large change in volume, but the soil has not been significantly transported.
XW	Extremely Weathered	Rock is weathered to such an extent that it has soil properties- i.e., it either disintegrates or can be remoulded, in water.
DW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to decomposition of weathered product in pores. In some environments it is convenient to subdivide into highly weathered and moderately weathered, with the degree of alteration typically less for MW
SW	Slightly Weathered	Rock slightly discoloured but shows little to no change of strength relative to fresh rock.
FR	Fresh	Rock shows no sign of decomposition or staining.

Appendix C

Laboratory CBR Test Results

California Bearing Ratio Determination Report

Project: G753: 167 SERPENTINE ROAD, TERRIGAL

Project No.: 32894

Client: Foundation Earth Sciences

Report No.: 24/3411

Address: PO Box 4405, East Gosford NSW 2250

Report Date: 29/10/2024

Test Method: AS1289.6.1.1,2.1.1

Page: 1 of 1

No. of Days Soaked: 4

Compactive Effort: STANDARD

Target Compaction (%): 100

Surcharge (Kg): 4.5

Sampling Procedure: AS 1289.1.2.1 Clause 6.5.3 - Power Auger Drilling (Not covered under NATA Scope of Accreditation)

STS / Sample No.	9234D-L/1	9234D-L/2				
Sample Location	TP26	TP27				
Material Description	Silty CLAY, red brown	Silty CLAY, red brown				
Depth of Sample (m)	1.2 - 1.5	1.5 - 2.0				
Sample Date	14/10/2024	14/10/2024				
Oversize on Wet Basis +19mm (%)	0.9	0.4				
Field Moisture Content (%)	25.0	24.0				
Optimum Moisture Content (%)	24.5	19.3				
Maximum Dry Density (t/m ³)	1.59	1.72				
Dry Density (t/m ³)	Before Soaking	1.59	1.72			
	After Soaking	1.57	1.65			
Relative Compaction (%)	Before Soaking	100	100			
	After Soaking	98.5	96			
Moisture Content (%)	Before Soaking	24.9	19.3			
	After Soaking	27.3	25.0			
Moisture Ratio Before Soaking (%)		101.5	100.0			
Moisture Content after test (%)	Top 30mm	28.9	29.9			
	Entire Depth	26.6	23.0			
Swell after Soaking (%)		1.4	4.2			
CBR Value (%)		5.0	1.5			
Penetration (mm)		2.5	2.5			

Remarks: +19mm material excluded from test

Approved Signatory.....

Technician: DN/FV

Mrigesh Tamang - Manager

Appendix D

Results of Aggressivity and Salinity Tests

CERTIFICATE OF ANALYSIS 364162

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Ben Buckley
Address	PO Box 4405, East Gosford, NSW, 2250

Sample Details

Your Reference	<u>G753 -Geotech. Invest. 167 Serpentine Rd, Terrigal</u>
Number of Samples	2 Soil
Date samples received	16/10/2024
Date completed instructions received	17/10/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	24/10/2024
Date of Issue	22/10/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Diego Bigolin, Inorganics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil			
Our Reference		364162-1	364162-2
Your Reference	UNITS	BH1	BH2
Depth		1.5-1.6	0.9-1
Date Sampled		14/10/2024	14/10/2024
Type of sample		Soil	Soil
Date prepared	-	21/10/2024	21/10/2024
Date analysed	-	21/10/2024	21/10/2024
pH 1:5 soil:water	pH Units	4.7	4.6
Electrical Conductivity 1:5 soil:water	µS/cm	180	46
Chloride, Cl 1:5 soil:water	mg/kg	190	<10
Sulphate, SO4 1:5 soil:water	mg/kg	52	61
Resistivity in soil*	ohm m	57	220

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/10/2024	[NT]	[NT]	[NT]	[NT]	21/10/2024	[NT]
Date analysed	-			21/10/2024	[NT]	[NT]	[NT]	[NT]	21/10/2024	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	102	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.