Geotechnical Investigation Report

RESIDENTIAL DEVELOPMENT

4-8 MARSHALL AVENUE, 1-5 CANBERRA AVENUE, & 2-8 HOLDSWORTH AVENUE, ST LEONARDS NSW

Prepared for:

EVERGREEN INVESTMENT HOLDINGS

Reference: P2160_02

16 February 2022

Morrow Geotechnics Pty Ltd | ABN 42 605 892 126
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1 PROJECT BACKGROUND

Morrow Geotechnics Pty Ltd has undertaken a Geotechnical Investigation to provide geotechnical advice and recommendations for proposed development at 4-8 Marshall Avenue, 1-5 Canberra Avenue & 2-8 Holdsworth Avenue NSW (the site).

A previous investigation for the site a Due Diligence for Purchase phase was carried out by Morrow Geotechnics, reference P2160_01 dated 9 March 2021. The previous geotechnical investigation provided preliminary information from five boreholes drilled around the site perimeter.

1.1 Proposed Development

Architectural Drawings for the proposed development have not been provided at the time of preparation of this report. From discussions with the client, Morrow Geotechnics understands that the proposed development will likely comprise the construction of three residential structures over four levels of basement parking. Excavation for the basement is expected to extend up to a depth of approximately 12.5 m below existing ground level (mBGL).

1.2 Investigation Intent

The purpose of this investigation is to provide further geotechnical advice and recommendations specific to the ground conditions observed at site for the proposed development. In particular, the centre of the site has been investigated through difficult access drilling rigs.

The recommendations of this report include:

- Foundation advice along with relevant geotechnical design parameters;
- Excavation and shoring advice along with relevant geotechnical design parameters;
- Approaches to minimise the impact of the proposed development through vibration, ground movement or groundwater drawdown;
- Other relevant geotechnical issues which may impact construction; and
- Recommendations for further geotechnical input.
- Commentary on geotechnical site suitability for the proposed works.

1.3 Published Geological Mapping

The Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sydney (DMR 1983) indicates the site overlies Ashfield Shale near the boundary with Hawkesbury Sandstone. Ashfield Shale generally comprises black to dark grey shale and laminite. Hawkesbury Sandstone generally comprise medium to coarse grained quartz sandstone, very minor shale and laminite lenses.

1.4 Published Soil Landscapes

The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 indicates that the residual landscape at the site likely comprises the Blacktown Landscape. This landscape type typically

includes undulating to rolling low hills on Wianamatta Group Shales with narrow ridges, hillcrests, valleys and slopes of 5 to 20 %. It generally comprises shallow to moderately deep (< 1.5 m) red and brown podzolic soils on crests and upper slopes. These soils are noted to present high soil erosion hazard, localised impermeable moderately reactive and highly plastic soil.

2 OBSERVATIONS

2.1 Investigation Methods

The original fieldwork for the site was undertaken by Morrow Geotechnics on 25 & 26 February and 1 March 2021. The additional round of borehole drilling was undertaken by Morrow Geotechnics on 3, 4 & 7 February 2022. 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 a Geotechnical Engineer to assess topographical features, condition of surrounding structures and site conditions;
- Dial Before You Dig (DBYD) services search of proposed borehole locations;
- Drilling of four additional boreholes. The boreholes (BH7, BH8, BH9 and BH10) were drilled by a track mounted drill rig using solid flight augers equipped with a tungsten-carbide bit (TC bit). The boreholes were extended beyond TC bit refusal by NMLC coring techniques to depths of between 14.40 and 15.20 mBGL. Rock core was boxed and photographed and point load tests were undertaken on selected core sample to assess rock strength. Borehole locations are shown on **Figure 1** and borehole logs are presented in **Appendix A**;
- Measurement of water levels within monitoring wells in BH1 and BH5 drilled as part of the previous investigation.

2.2 Subsurface Conditions

The stratigraphy at the site is characterised by residual soil overlying sandstone. The observed ground conditions have been divided into five geotechnical units. A summary of the subsurface conditions at the investigation locations is presented below in **Table 1**.

TABLE 1 SUMMARY OF INFERRED SUBSURFACE CONDITIONS

Unit		Generalised Description
1	**Fill**	Generally fine to medium grained sand with some silt, gravel, organic material present. Unit 1 is inferred to be uncontrolled and poorly compacted.
2	**Residual Soil**	Low to medium plasticity sandy clay. Stiff to hard consistency, grading to extremely weathered rock with depth.
3	**Class IV Sandstone**	Sandstone, highly weathered, very low to low strength.

4	**Class III Sandstone**	Sandstone, moderately weathered, medium to high strength. Defects within Unit 4 comprise bedding partings inclined to 30° and joints inclined up to 60°. Minor shale banding is present within Unit 4.
5	**Class II Sandstone**	Sandstone, slightly weathered to fresh, high strength. Defects within Unit 5 bedding partings inclined to 5° and joints inclined up to 90°.

Notes:

1 Depths shown are based on material observed within test locations and will vary across the site. More information on the material encountered at the test locations is shown on the Borehole logs in Appendix A.

TABLE 2 SUMMARY OF SUBSURFACE CONDITIONS AT INVESTIGATION LOCATIONS

Material	Unit 1 Fill	Unit 2 Residual Soil	Unit 3 Class IV Sandstone	Unit 4 Class III Sandstone	Unit 5 Class II Sandstone
BH1	0.0 to 0.35	0.35 to 0.8	0.8 to 2.7	2.7 to 4.8	4.8 to 14.52
BH3	0.0 to 0.15	-	0.15 to 7.2	-	7.2 to 14.63
BH4	0.0 to 0.7	0.7 to 2.8	2.8 to 4.0	4.0 to 8.0	8.0 to 14.50
BH5	0.0 to 0.1	-	0.1 to 5.6	5.6 to 7.8	7.8 to 14.79
BH6	0.0 to 0.4	0.4 to 2.3	2.3 to 2.6	2.6 to 6.25	6.25 to 14.39
BH7	0.0 to 0.5	0.5 to 1.6	1.6 to 4.4	4.4 to 7.3	7.3 to 14.40
BH8	0.0 to 0.2	0.2 to 2.6	2.6 to 4.45	4.45 to 8.05	8.05 to 14.41
BH9	0.0 to 1.0	1.0 to 3.2	3.2 to 4.9	4.9 to 6.55	6.55 to 15.20
BH10	0.0 to 0.6	0.6 to 3.5	3.5 to 5.3	5.3 to 6.0	6.0 to 14.72

2.3 Groundwater Observations

A groundwater monitoring event was carried out on 4 March 2021 and 3 February 2022. Water levels were recorded within the two monitoring wells installed in BH1 and BH5. Water level measurements were as follows:

- BH1:
  - 4 March 2021 - Water depth within monitoring well 13.57 mBGL ;
  - 3 February 2022 - Water depth within monitoring well 12.62 mBGL ;
- BH5:
  - 4 March 2021 - Water depth within monitoring well 4.42 mBGL.
  - 3 February 2022 - Water depth within monitoring well 6.06 mBGL.

The difference in water levels measured in the two monitoring wells indicates that the results are not indicative of a regional water table at the site. The water levels are inferred to represent free water within open joints in the sandstone rock mass. A regional groundwater table was not encountered at the site during either investigation.

2.4 Laboratory Test Results

Four soil samples were selected for laboratory testing. A summary of test results is provided in **Table 3**.

TABLE 3 SUMMARY OF CHEMICAL LABORATORY TEST RESULTS

Sample ID	BH7 SPT1	BH8 SPT1	BH9 SPT1	BH9 SPT2
Depth	0.5m	0.5m	0.5m	1.5m
pH	5.5	6.5	6.2	5.3
Conductivity (µS/cm)	46	19.4	74.3	120
Sulfate (mg/kg)	18.5	13.2	9.1	81
Chloride (mg/kg)	20.4	22.7	31.8	16

3 RECOMMENDATIONS

3.1 Excavation Retention

Units 1 to 3 material must be supported through adequate shoring during excavation. Units 4 and 5 Sandstone may be cut vertically without temporary support provided that geotechnical inspections are undertaken during construction to ensure that isolated blocks and wedges are not present within the rock cutting. If blocks and wedges are present isolated spot bolting, shotcreting or scaling of the rock face may be required as support. Allowance for shotcreting of Unit 4 Class III Sandstone should be included within the design drawings to be removed following geotechnical inspection if unnecessary for temporary excavation support.

Shoring systems in sandstone generally comprise anchored soldier pile walls with piles socketing below bulk excavation level (BEL). Piles can be terminated within Class III Sandstone or better material above BEL provided that toe anchors are installed for lateral pile restraint. For preliminary costing purposes a four level basement in sandstone may assume 450 to 600 mm diameter soldier piles at 2 m spacing with 2 rows of anchors.

Morrow Geotechnics understands that the finite element software packages will be used for design of shoring. Drained cohesion and friction angles for input to finite element analysis have been provided in **Table 4** below.

TABLE 4 EARTH PRESSURE PARAMETERS

Material		Unit 1 Fill	Unit 2 Residual Soil	Unit 3 Class IV Sandstone	Unit 4 Class III Sandstone	Unit 5 Class II Sandstone
Bulk Unit Weight (kN/m^3)		17	18	23	24	24
Saturated Bulk Unit Weight (kN/m^3)		18	19	23.5	24	24
Earth Pressure Coefficients	At Rest, K_o	0.53	0.58	0.43	0.43	0.38
	Passive, K_p	2.77	2.46	3.69	3.69	4.20
	Active, K_a	0.36	0.41	0.27	0.27	0.24
Drained Cohesion, c' (kPa)		0	7	50	300	750
Drained Friction Angle, ϕ' (°)		28	25	32	35	38
Elastic Modulus (MPa)		3	15	150	500	1000
Poisson's Ratio		0.30	0.30	0.22	0.20	0.20

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 t appropriate surcharge loading from construction equipment, vehicular traffic and neighbouring structures at finished surface level should be taken into account 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.

3.2 In Situ Rock Stresses

Due to the presence of high strength sandstone at relatively shallow depth the calculation of loading on shoring systems must take in situ stresses into consideration. No specific field testing has been carried out for the subject site in order to assess the in situ stress regime.

Numerous published papers exist which document the typical in situ horizontal stress values measured from projects elsewhere within the Sydney Basin. Papers by McQueen, 2004; Chan, Kotze and Stone, 2006; Chan and Stone, 2006; Macklin, McKay and Erskine, 2014; and 0liveira and Parker, 2014 have been reviewed and used to develop the in situ horizontal stress values to be adopted.

Based on published data, the orientation of the major in situ horizontal stress is typically in a NNE direction, while the minor in situ horizontal stress is in an ESE direction. In the absence of site specific testing of the stress field the principal stress direction should be taken as perpendicular to the alignment of the shoring wall under analysis. It should be noted that this is a conservative assumption which will result in higher stress relief and displacements than the actual conditions.

Bertuzzi (2014) reproduces the relationship shown in McQueen (2004) as

$$\sigma_H = 2.0\sigma_V + 2.5 \text{ MPa}$$

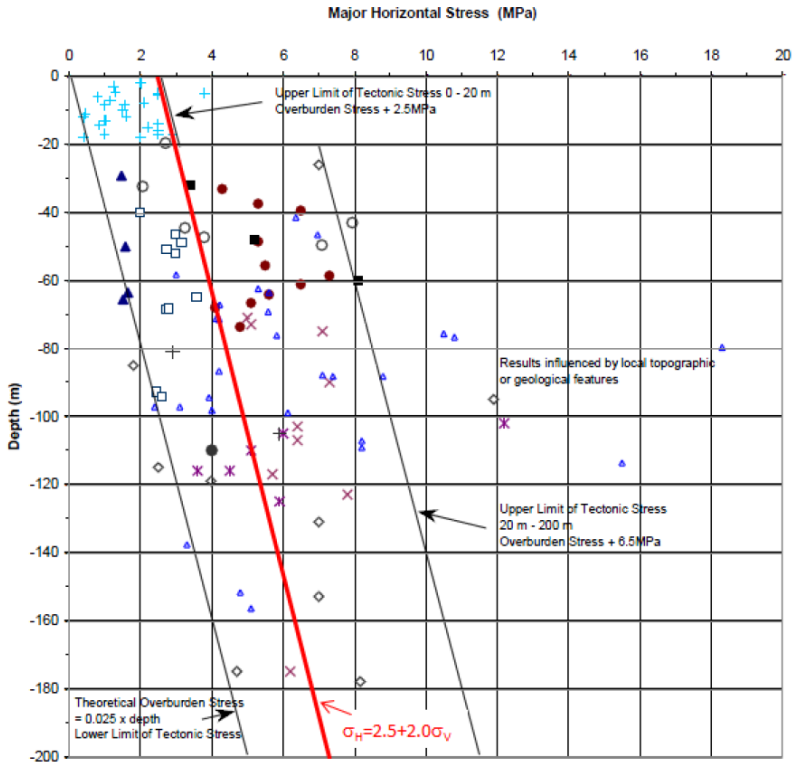

Figure 1: Plot of insitu stress to depth reproduced from McQueen (2004) and Bertuzzi (2014)

Bertuzzi's paper presents Sandstone and shale parameters for tunnel design. It is relevant to locked in stresses which can develop at depth, but not accurate for near surface effects. As can be seen from the

graph reproduced from Bertuzzi and McQueen, this overestimates the in-situ stress for shallow samples (<20 m depth) in 24 out of 25 tests. On average it produces values which are double those recorded from field testing. An upper limit of tectonic stress at σ_V + 2.5 MPa is suggested.

An in situ stress function of σ_V + 1.0 MPa encapsulates 15 of the 19 test results (approx. 80%) presented in the depth range relevant to excavation at the site. It is therefore considered a reasonable model of in situ stress conditions for modelling

The inputs to model in situ stresses for competent rock capable of maintaining locked in stress are presented in **Table 3**. These values may be used for direct input to finite element modelling software programs such as Plaxis or RS2.

TABLE 5 IN SITU STRESS RATIOS

Geotechnical Unit	Material	Typical Insitu Stress Conditions ($K_{0,x}$)
Unit 1	**Fill**	-
Unit 2	**Residual Soil**	-
Unit 3	**Class IV Sandstone**	-
Unit 4	**Class III Sandstone**	4.0
Unit 5	**Class II Sandstone**	6.0

3.3 Soil and Rock Excavatability

The expected ability of equipment to excavate the soil and rock encountered at the site is summarised in **Table 6**. 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**	Easy digging by 20t Excavator
2	**Residual Soil**	Easy digging by 20t Excavator
3	**Class IV Sandstone**	Moderate to hard ripping by 20t Excavator with hydraulic hammering required where medium strength sandstone is encountered within Unit 3
4	**Class III Sandstone**	Hydraulic hammering will be required in medium to high strength sandstone within Unit 4.
5	**Class II Sandstone**	Hydraulic hammering will be required in high strength sandstone within 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.

3.4 Excavation Vibration Considerations

As a guide, safe working distances for typical items of vibration intensive plant are listed in **Table 7**. The safe working distances are quoted for both "cosmetic" damage (refer British Standard BS 7385:1993) and human comfort (refer NSW Environmental Protection Agency Vibration Guideline). The safe working distances should be complied with at all times, unless otherwise mitigated to the satisfaction of the relevant stakeholders.

TABLE 7 RECOMMENDED SAFE WORKING DISTANCES FOR VIBRATION INTENSIVE PLANT

Plant Item	Description	Safe Working Distance	
		Cosmetic Damage (BS 7385:1993) [1]	Human Response (EPA Vibration Guideline)
Vibratory Roller	< 50 kN (typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (typically 2-4 tonnes)	6 m	20 m
	< 200 kN (typically 4-6 tonnes)	12 m	40 m
	< 300 kN (typically 7-13 tonnes)	15 m	100 m
	< 300 kN (typically 13-18 tonnes)	20 m	100 m
	< 300 kN (typically >18 tonnes)	25 m	100 m
Small Hydraulic Hammer	300 kg – 5 to 12 t excavator	2 m	7 m
Medium Hydraulic Hammer	900 kg – 12 to 18 t excavator	7 m	23 m
Large Hydraulic Hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Notes:

1 More stringent conditions may apply to heritage buildings or other sensitive structures.

The safe working distances in **Table 7** relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are permitted, as discussed in British Standard BS 6472-1:2008.

The safe working distances provided in **Table 7** are given for guidance only. Monitoring of vibration levels may be required to ensure vibrations levels remain below threshold values during the construction period. Monitoring thresholds should be set at a peak particle velocity (ppv) of 5 mm/sec to prevent structural

damage to neighbouring structures and infrastructure. Cosmetic damage to brittle elements of a structure such as tiling or plaster may occur at any vibration level. Where ppv thresholds are exceeded an alternative excavation methodology should be developed in collaboration with the geotechnical engineer to reduce the likelihood of vibration induced damage.

3.5 Groundwater Management

The wells installed as part of this investigation did not show a regional groundwater table. The proposed basement will not intersect the groundwater table and ongoing seepage will be minor. For excavations at the site it should be expected that minor seepage water from surface water infiltration will be encountered at the soil/rock interface and in joints and bedding partings within the bedrock. Seepage in sandstone bedrock may be assumed as typically flowing downwards toward local drainage lines or regional water table, along horizontal bedding planes and sub-vertical joints. The rock mass permeability will be governed by the joints, faults and bedding planes.

Given the observed relatively intact bedrock with tight defects across the site it is anticipated that the permeability of the sandstone will be relatively low and that seepage inflows will be controlled by sump and pump methods.

3.6 Foundation Design

The parameters given in **Table 8** 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.

Ultimate geotechnical strengths are provided for use in limit state design. Allowable bearing pressures are provide 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 8 PAD FOOTING AND PILE DESIGN PARAMETERS

Material		Unit 1 Fill	Unit 2 Residual Soil	Unit 3 Class IV Sandstone	Unit 4 Class III Sandstone	Unit 5 Class II Sandstone
Allowable Bearing Pressure (kPa)		0	200	1500	3500	6000
Ultimate Vertical End Bearing Pressure (kPa)		0	600	4500	10500	18000
Elastic Modulus (MPa)		3	15	150	400	1000
Ultimate Shaft Adhesion (kPa)	In Compression	0	50	250	800	1500
	In Tension	0	25	125	400	750
Susceptibility to Liquefaction during an Earthquake		Medium	Low	Low	Low	Low

Notes:

1 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.

2 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.

If Unit 5 Class II Sandstone parameters are relied on for footing design it will be necessary to carry out spoon testing on a minimum of 50% of the footings to confirm rock quality. Spoon tests should be carried out to a depth of at least two times the minimum footing width below the proposed footing level.

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.

3.7 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 B_e – Rock for the site; and
- a hazard factor (z) of 0.08 for Sydney.

3.8 Soil Aggressivity

Analysis of the pH, chloride & sulfate content and electrical conductivity of the soil against the guidelines provided in AS2159-2009 indicates:

- 'mildly aggressive' to buried concrete structural elements; and
- 'mildly aggressive' to buried steel structural elements.

Laboratory test certificates for aggressivity testing are included in **Appendix B**.

4 RECOMMENDATIONS FOR FURTHER GEOTECHNICAL SERVICES

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:

- 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.
- 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

Site conditions encountered in the investigation are generally consistent with regional Sydney Geology. The site is geotechnically suitable for development and excavation may be carried out safely provided that the recommendations of this report are implemented in design and construction of the works.

6 STATEMENT OF LIMITATIONS

The adopted investigation scope was limited by the investigation intent. Further geotechnical inspections should be carried out during construction to confirm both the geotechnical model and the design parameters 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.

AS3798:2007, *Guidelines on Earthworks for Commercial and Residential Developments*, Standards Australia.

NSW Department of Finance and Service, Spatial Information Viewer, maps.six.nsw.gov.au.

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

8 CLOSURE

Please do not hesitate to contact Morrow Geotechnics if you have any questions about the contents of this report.

For and on behalf of Morrow Geotechnics Pty Ltd,

Alan Morrow
Principal Geotechnical Engineer

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Drawn	AM
Approved	RM
Date	15/02/2022
Scale	NTS

Evergreen
4-8 Marshall Avenue, St Leonards NSW
Geotechnical Investigation
Proposed Borehole Location Plan

Figure: **1**

Project: P2160

Appendix A

Borehole Logs

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH1**
Hole Depth: **14.52 m**
Sheet: **1 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samples / Tests: SPT	Observations / Comments
							Surface: Lawn				
SFA					SM	Residual Soil	**Silty SAND**- dark brown, fine to medium grained, roots.	loose	m		
					CL	Residual Soil	**Sandy CLAY**- orange brown, fine to medium grained.	stiff	m	2 4 11 N=15	
		1.0				Bedrock	**SANDSTONE**- orange yellow, medium grained, extremely to highly weathered, estimated very low strength.				
		2.0				Bedrock	becoming highly to moderately weathered, estimated low strength.				
		3.0					*BH1 continued as cored hole from 2.5m*				
		4.0									
		5.0									
		6.0									

Moisture	
D	Dry
Dp	Damp
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet
Sd	Saturated

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES BH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:04 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH1**
Hole Depth: **14.52 m**
Sheet: **2 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Depth (m)	Material Description	Weathering	Estimated Strength (MPa)	$Is_{(50)}$ MPa	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm)	Defect Description (type, inclination, thickness, shape, roughness, coating)	Depth (m)	Casing & Core Lifts
NLMC	0.5										0.5	
	1.0										1.0	
	1.5										1.5	
	2.0										2.0	
	2.5										2.5	
	3.0	**Sandy CLAY** - orange grey, stiff, low plasticity, fine to medium grained.	RS		A=0.3						3.0	
	3.5	**SANDSTONE** - grey white orange and red, fine to medium grained.	XW-DW		A=0.47 D=0.3		54			SM, 0, clay 10mm SM, 0, clay 10mm SM, 0, clay 20mm SM, 0, clay 10mm Bd, 0, FE, RG SM, 0, clay, 70mm Bd, 3, FE, RG Bd, 2, FE, RG Bd, 2, FE, RG DB SM, 0, clay 10mm Bd, 2, FE, RG SM, 0, clay, 30mm SM, 0, clay, 30mm Bd, 5, FE, RG	3.5	3.5
	4.0	**SANDSTONE** - grey white orange and purple, medium to coarse grained, weak to moderate iron staining, trace carbonaceous laminations.									4.0	
	4.5	**Sandy CLAY** - orange grey, stiff, fine to medium grained.	RS		A=0.18						4.5	
	5.0	**SANDSTONE** - grey white orange and purple, medium to coarse grained, weak to moderate iron staining, trace carbonaceous laminations.	DW		A=1.24 D=1.23		84			Bd, 2, FE, RG Bd, 2, FE, RG	5.0	
	5.5	**SANDSTONE** - grey white some orange, medium to coarse grained, weak iron staining, trace carbonaceous laminations.	SW-FR							SM, 0, clay 10mm SM, 0, clay 10mm Bd, 10, FE, RG	5.5	
	6.0										6.0	

Material Type: Bedrock

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

Borehole Log Report

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Hole ID. **BH1**
Hole Depth: **14.52 m**
Sheet: **3 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Depth (m)	Material Description	Weathering	Estimated Strength (MPa)	$Is_{(50)}$ MPa	U.C.S. (Mpa)	RQD %	Core Photo	Defect Spacing (mm)	Defect Description (type, inclination, thickness, shape, roughness, coating)	Depth (m)	Casing & Core Lifts
NLMC	6.5	**SANDSTONE** - grey white some orange, medium to coarse grained, weak iron staining, trace carbonaceous laminations.	SW-FR		A=0.85 D=0.73		84			HB HB HB Bd, 5, clay infill 2mm	6.5	
	7.0				A=1.99 D=1.44					Bd, 5, clay infill 2mm SM, 0, clay 10mm	7.0	
	7.5										7.5	
	8.0				A=2.34 D=1.35					HB BD, 1, FE, RG BD, 1, FE, RG	8.0	
	8.5									BD, 1, FE, RG	8.5	8.5
	9.0	**SANDSTONE** - grey white, medium to coarse grained, trace carbonaceous laminations.	FR		A=0.16 D=0.21					DB SM, 0,clay, 30mm SM, 0, clay 10mm HB	9.0	
	9.5				A=1.25 D=1.22					HB HB	9.5	
	10.0						92			Bd, 5, clay infill 1mm	10.0	
	10.5				A=1.77 D=1.96					SM, 0, clay, 100mm	10.5	
	11.0										11.0	
	11.5				A=2.03 D=2.35		98			DB	11.5	11.5
	12.0										12.0	

Bedrock

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH1**
Hole Depth: **14.52 m**
Sheet: **4 of 4**

Project Name: **Geotechnical Assessment**
Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW**
Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling**
Date Started: **25-FEB-21**
Ground Level: ----------
Drill Method: **SFA/NLMC**
Date Completed: **25-FEB-21**
Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		12.5			Bedrock	**SANDSTONE** - grey white, medium to coarse grained, trace carbonaceous laminations.	FR		A=2.23 D=1.87		98			Bd, 0, FE, RG SM, 5, clay, 50mm	12.5	
		13.0													13.0	
		13.5							A=2.35 D=1.89						13.5	
		14.0													14.0	
		14.5							A=1.88 D=1.46						14.5	14.52
						Hole Terminated at 14.52 m Target depth achieved										
		15.0													15.0	
		15.5													15.5	
		16.0													16.0	
		16.5													16.5	
		17.0													17.0	
		17.5													17.5	
		18.0													18.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21**
Checked By: **Alan Morrow** Date: **07-MAR-21**


MORROW GEOTECHNICAL
JOB P2160
ST LEONARDS 25/2/2021
BH1
START CORING 2.50m
3
4
5
6
7
8
9
10
11
12
13
14
BH1 TERMINATED
AT 14.52m

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH3**
Hole Depth: **14.63 m**
Sheet: **1 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **01-MAR-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **01-MAR-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Observations / Comments
							Surface: Paver/Concrete slab	
SFA		1.0				Bedrock	**PAVER/CONCRETE**. **SANDSTONE with bands Sandy CLAY**- red yellow, extremely to highly weathered with bands residual sandy clay, estimated very low strength. becoming orange yellow. predominatly grey.	
		3.0 4.0 5.0 6.0					*BH3 continued as cored hole from 2.9m*	

Moisture	
D	Dry
Dp	Damp
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet
Sd	Saturated

Additional Comments

Logged By: **Matthew Kilham** Date: **01-Mar-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES BH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:04 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH3**
Hole Depth: **14.63 m**
Sheet: **2 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **01-MAR-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **01-MAR-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		3.0			Bedrock	**Sandy CLAY** - grey, low plasticity, fine to medium grained.	RS								3.0	
						SANDSTONE - white purple orange, medium to coarse grained, moderate iron staining.	XW-DW							SM, 0, clay, 40mm JT, 70, clay infill SM, 0, clay, 30mm SM, 0, clay, 10mm SM, 0, clay, 30mm SM, 0, clay, 60mm		
		4.0				**SANDSTONE** - grey white some orange, fine to medium grained.	DW		A=0.08 D=0.03		68			HB BD, 1, clay infill 1mm, SMTH BD, 9, clay infill 2mm, SMTH	4.0	
		5.0				**SANDSTONE** - grey and orange, fine to medium grained, weakly iron stained.	DW-SW		A=0.44 D=0.6 A=0.2 D=0.17					SM, 0, clay, 20mm BD, 5, clay infill 2mm, SMTH SM, 0, clay, 15mm SM, 0, clay, 80mm SM, 0, clay, 30mm BD, 4, clay infill 2mm, SMTH	5.0	
		6.0				**SANDSTONE** - light grey and grey, fine to medium grained, trace carbonaceous laminations.					90			DB BD, 3, clay infill 2mm, SMTH	6.0	5.64

Additional Comments

Logged By: **Matthew Kilham** Date: **01-Mar-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH3**
Hole Depth: **14.63 m**
Sheet: **3 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **01-MAR-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **01-MAR-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		6.5			Bedrock	**SANDSTONE** - light grey and grey, fine to medium grained, trace carbonaceous laminations.	DW-SW		A=0.73 D=0.28		90			BD, 3, clay infill 2mm, SMTH BD, 10, clay infill 2mm, SMTH BD, 8, clay infill 2mm, SMTH SM, 0, clay, 40mm SM, 0, clay, 5mm SM, 0, clay, 40mm HB	6.5	
		7.0							A=0.25					BD, 2 , FE, RG BD, 5 , FE, RG BD, 2 , FE, RG	7.0	
		7.5							A=1.7 D=1.46						7.5	
		8.0							A=1.9 D=1.72						8.0	
		8.5												HB HB DB	8.5	8.52
		9.0				**SANDSTONE** - grey white, medium to coarse grained, trace carbonaceous laminations.	FR		A=1.42 D=1.53		99			BD, 10 , FE, RG BD, 0 , FE, RG	9.0	
		9.5												BD, 1 , FE, RG	9.5	
		10.0							A=1.88 D=2.08					SM, 0, clay, 10mm	10.0	
		10.5													10.5	
		11.0							A=1.65 D=1.56					SM, 0, clay, 10mm BD, 1 , FE, RG BD, 0 , FE, RG BD, 0 , FE, RG	11.0	
		11.5													11.5	11.63
		12.0									100			DB BD, 3 , FE, RG	12.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **01-Mar-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:27 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH3**
Hole Depth: **14.63 m**
Sheet: **4 of 4**

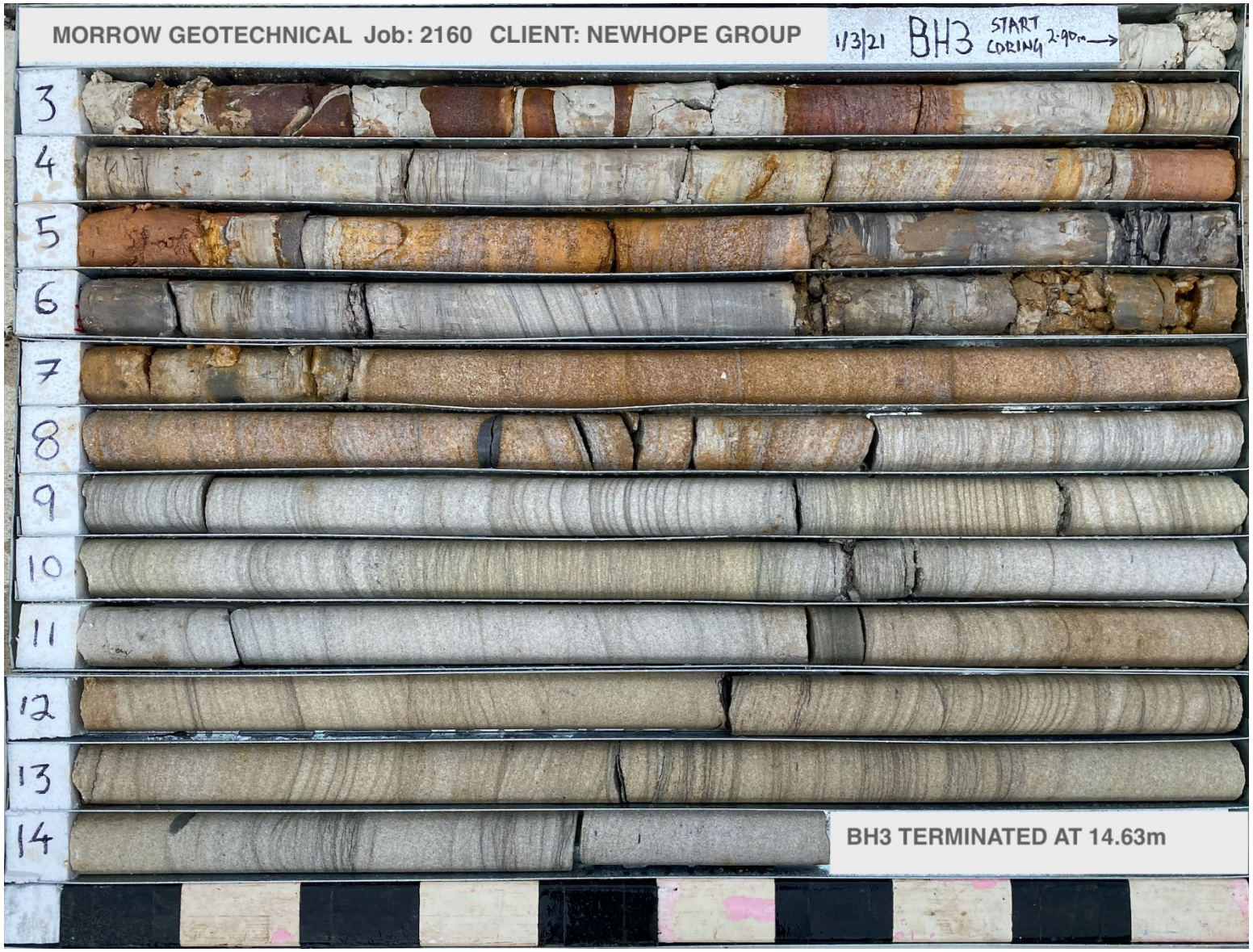
Project Name: **Geotechnical Assessment**
Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW**
Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling**
Date Started: **01-MAR-21**
Ground Level: ----------
Drill Method: **SFA/NLMC**
Date Completed: **01-MAR-21**
Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		12.5			Bedrock	**SANDSTONE** - grey white, medium to coarse grained, trace carbonaceous laminations.	FR		A=1.92 D=1.89		100			BD, 5 , FE, RG	12.5	
		13.0							A=2.51 D=2.04						13.0	
		13.5												BD, 5 , FE, RG	13.5	
		14.0							A=1.45 D=1.38						14.0	
		14.5												BD, 5 , FE, RG	14.5	14.63
		15.0				**Hole Terminated at 14.63 m** Target depth achieved									15.0	
		15.5													15.5	
		16.0													16.0	
		16.5													16.5	
		17.0													17.0	
		17.5													17.5	
		18.0													18.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **01-Mar-21**
Checked By: **Alan Morrow** Date: **07-MAR-21**


MORROW GEOTECHNICAL Job: 2160 CLIENT: NEWHOPE GROUP
1/3/21 BH3 START CORING 2:40pm
3
4
5
6
7
8
9
10
11
12
13
14
BH3 TERMINATED AT 14.63m

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH4**
Hole Depth: **14.50 m**
Sheet: **1 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samples / Tests: SPT	Observations / Comments
							Surface: Lawn				
SFA					CL		**FILL: Silty Sandy CLAY**- dark brown, low plasticity, fine to medium grained.	soft	m	1 1 2 N=3	
		1.0			CL	Residual Soil	**Sandy CLAY**- orange brown, low plasticity, fine to medium grained.	firm to stiff	m	2 4 3 N=7	
		3.0				Bedrock	**SANDSTONE bands Sandy CLAY**- grey purple, fine to coarse grained.				
							BH4 continued as cored hole from 3.05m				
		4.0									
		5.0									
		6.0									

Moisture	
D	Dry
Dp	Damp
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet
Sd	Saturated

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES BH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:05 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH4**
Hole Depth: **14.50 m**
Sheet: **2 of 4**

Project Name: **Geotechnical Assessment**
Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW**
Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling**
Date Started: **25-FEB-21**
Ground Level: ----------
Drill Method: **SFA/NLMC**
Date Completed: **25-FEB-21**
Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		0.5				**Sandy CLAY** - grey purple, low plasticity, fine to coarse grained.	RS								0.5	
		1.0													1.0	
		1.5													1.5	
		2.0													2.0	
		2.5													2.5	
		3.0													3.0	
		3.5			Bedrock	**SANDSTONE** - grey white, fine to coarse grained, trace carbonaceous laminations.	DW								3.5	
		4.0							A=0.8						4.0	
		4.5				**SANDSTONE** - purple, fine to coarse grained, moderate iron staining.					86			SM, 0, clay, 10mm BD, 0, FE, RG	4.5	
		5.0												ironstone band BD, 0, FE, RG	5.0	
		5.5				**SANDSTONE** - grey white, fine to coarse grained.	FR		A=1.14 D=1.57		94			DB	5.5	5.5
		6.0													6.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21**
Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:31 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH4**
Hole Depth: **14.50 m**
Sheet: **3 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating Specific / General	Depth (m)	Casing & Core Lifts
NLMC		6.5			Bedrock	**SANDSTONE** - grey white, fine to coarse grained.	FR		A=1.69 D=0.96		94			SM, 5, clay BD, 5, FE, RG	6.5	
		7.0							A=1.55 D=1.82						7.0	
		7.5				**SHALE** - dark brown.			A=0.12 D=0.08 A=0.16 D=0.11						7.5	
		8.0												SM, 0, clay, 40mm	8.0	
		8.5				**SANDSTONE** - grey white, fine to medium grained, trace carbonaceous laminations.			A=1.3 D=1.38					DB HB HB	8.5	8.5
		9.0							A=0.83 D=0.96						9.0	
		9.5				**9.60 t0 10.0m Shale clasts**.									9.5	
		10.0				medium to coarse grained.			A=0.93 D=0.66		97			HB HB HB HB HB	10.0	
		10.5												JT, 85, minor clay infill, RG BD, 4, RG	10.5	
		11.0							A=2.02 D=1.48					HB	11.0	
		11.5												SM, 3, clay, 3mm DB	11.5	11.5
		12.0									92			HB BD, 5, RG	12.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:31 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

Hole ID. **BH4**
Hole Depth: **14.50 m**
Sheet: **4 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **25-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		12.5			Bedrock	**SANDSTONE** - grey white, fine to medium grained, trace carbonaceous laminations.	FR		A=2.24 D=2.16		92			BD, 5, RG SM, 5, clay, 3mm BD, 5, RG HB HB	12.5	
		13.0							A=1.93 D=1.91						13.0	
		13.5												BD, 5, RG	13.5	
		14.0							A=2.57 D=2.34					HB	14.0	
		14.5													14.5	14.5
						Hole Terminated at 14.50 m Target depth achieved										
		15.0													15.0	
		15.5													15.5	
		16.0													16.0	
		16.5													16.5	
		17.0													17.0	
		17.5													17.5	
		18.0													18.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **25-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

MORROW GEOTECHNICAL Job:P2160 CLIENT: NEW HOPE GROUP **BH4** START CORING 3.05m

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH5**
Hole Depth: **14.79 m**
Sheet: **1 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Observations / Comments	Well Details	Well Construction
							Surface: Concrete			
SFA		0 1.0 2.0 3.0				Bedrock	**CONCRETE**. **SANDSTONE with clay seams**- grey orange, fine to coarse grained, extremely to highly weathered, estimated very low to low strength.	2.80m drilling becoming firm to hard	0.00 0.10 0.15 1.00	Bentonite Gravel Pack
		4.0 5.0 6.0					*BH5 continued as cored hole from 3m*			

Moisture	
D	Dry
Dp	Damp
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet
Sd	Saturated

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH5**
Hole Depth: **14.79 m**
Sheet: **2 of 4**

Project Name: **Geotechnical Assessment**
Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW**
Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling**
Date Started: **26-FEB-21**
Ground Level: ----------
Drill Method: **SFA/NLMC**
Date Completed: **25-FEB-21**
Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig**
Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Well Details	Depth (m)	Casing & Core Lifts
NLMC		0.5 1.0 1.5 2.0 2.5 3.0												0.00 0.10 0.15 1.00 3.00		0.5 1.0 1.5 2.0 2.5 3.0	
NLMC		3.5 4.0 4.5 5.0 5.5 6.0			Bedrock	**SANDSTONE** - grey white orange purple, fine to medium grained, weak to moderate iron staining.	DW		A=0.38 D=0.22 A=0.31 D=0.35		94 92			BD, 1, RG BD, 3, RG SM, 0, clay, 15mm BD, 1, RG BD, 15, RG BD, 10, RG BD, 5, RG SM, 0, clay 20mm SM, 0, clay 10mm SM, 0, clay 20mm BD, 3, RG HB BD, 1, SMTH BD, 1, SMTH SM, 0, clay 10mm DB BD, 10, RG BD, 3, RG		3.5 4.0 4.5 5.0 5.5 6.0	5.68
						SANDSTONE trace bands SILTSTONE - grey white orange, fine to medium grained, weak iron staining.	DW-SW		A=0.33 D=0.06							

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21**
Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:36 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH5**
Hole Depth: **14.79 m**
Sheet: **3 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa)	$Is_{(50)}$ MPa	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm)	Defect Description (type, inclination, thickness, shape, roughness, coating)	Well Details	Depth (m)	Casing & Core Lifts
NLMC		6.5–12.0			Bedrock	**SANDSTONE** - grey white orange, fine to coarse grained, weak iron staining, trace carbonaceous laminations.	DW-SW / SW-FR	EL 0.03, VL 0.1, L 0.3, M 1, H 3, VH 10, EH	A=1.71 D=1.47; A=2.3 D=0.46 A=2.02		92		20, 60, 200, 600, 2000	BD, 2, RG; BD, 0, RG; BD, 0, RG; SM, 0, clay 20mm; HB; BD, 1, RG; BD, 2, RG; BD, 5, RG; SM, 0, clay 5mm		6.5–12.0	
						SANDSTONE - grey white, fine to coarse grained, trace carbonaceous laminations.	FR		A=2.6 D=2.58; A=1.44 D=1.3; A=2.06 D=1.85		99			DB; 8.75; BD, 2, SMTH; BD, 1, RG; HB; BD, 3, RG			8.57
						SHALE/SILTSTONE - dark brown grey.	FR		A=0.4 D=0.43					BD, 1, SMTH; SM, 0, clay 10mm; BD, 10, SMTH; BD, 5, RG; BD, 5, SMTH			
						SANDSTONE - grey white, fine to coarse grained, weak iron staining, trace carbonaceous laminations.	SW-FR				98						11.73

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:36 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH5**
Hole Depth: **14.79 m**
Sheet: **4 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating Specific General	Well Details	Depth (m)	Casing & Core Lifts
NLMC		12.5			Bedrock	**SANDSTONE** - grey white, fine to coarse grained, weak iron staining, trace carbonaceous laminations.	SW-FR		A=2.56 D=2.71		98			BD, 5, RG SM, 0, clay 5mm SM, 0, clay 5mm		12.5	
		13.0							A=1.41 D=1.9					HB		13.0	
		13.5														13.5	
		14.0							A=1.68 D=1.52					HB HB		14.0	
		14.5												HB 14.75		14.5	14.79
		15.0				**Hole Terminated at 14.79 m** Target depth achieved										15.0	
		15.5														15.5	
		16.0														16.0	
		16.5														16.5	
		17.0														17.0	
		17.5														17.5	
		18.0														18.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**


MORROW GEOTECHNICAL JOB:P2160 26/2/21 CLIENT: NEW HOPE GROUP. BH5 START CORING 3.0m
3.0
4
5
6
7
8
9
10
11
12
13
14
←14.79
26/2/21
END
845

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

Hole ID. **BH6**
Hole Depth: **14.39 m**
Sheet: **1 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	USCS Symbol	Material Type	Material Description	Consistency / Density	Moisture	Samples / Tests: SPT	Observations / Comments
							Surface: Lawn				
SFA		0.0			ML		**TOPSOIL: Sandy SILT**- dark brown, trace fine Gravel, roots.		m to w		
					CH	Residual Soil	**Silty CLAY**- orange brown, medium to high plasticity. becoming orange mottled grey. becoming grey mottled red and orange.	stiff		3 5 6 N=11	
		1.0			CL	Residual Soil	**Sandy CLAY**- grey some red, low plasticity, fine to coarse grained.	stiff	m	4 5 7 N=12	
		2.0				Bedrock	**SANDSTONE**- orange grey, fine to coarse grained, extremely to highly weathered, estimated very low to low strength.				
							BH6 continued as cored hole from 2.6m				
		3.0									
		4.0									
		5.0									
		6.0									

Moisture	
D	Dry
Dp	Damp
SM	Slightly Moist
M	Moist
VM	Very Moist
W	Wet
Sd	Saturated

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES BH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:06 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

Hole ID. **BH6**
Hole Depth: **14.39 m**
Sheet: **2 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		0.5 1.0 1.5 2.0 2.5													0.5 1.0 1.5 2.0 2.5	
NLMC		3.0 3.5 4.0 4.5 5.0 5.5 6.0			Bedrock	**SANDSTONE** - purple grey, fine to coarse grained, weak to moderate iron staining, trace carbonaceous laminations.	DW-SW		A=2.16 D=1.99; A=1.18 D=1.36; A=1.49 D=1.36; A=0.65 D=0.6		100			BD, 10, RG; BD,15, RG; SM, 0, clay 20mm; SM, 0, clay 5mm; BD, 10, SMTH; BD, 8, SMTH; HB; BD,15, SMTH; BD, 3, RG; BD, 2, SMTH; BD, 2, SMTH; BD,15, SMTH; DB	3.0 3.5 4.0 4.5 5.0 5.5 6.0	5.43
						SANDSTONE - grey some orange, fine to medium grained, weak iron staining, trace carbonaceous laminations.	SW-FR				94			BD, 5, RG; BD, 5, RG; BD, 4, RG		

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH6**
Hole Depth: **14.39 m**
Sheet: **3 of 4**

Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Depth (m)	Material Description	Weathering	Estimated Strength (MPa)	$Is_{(50)}$ MPa	U.C.S. (Mpa)	RQD %	Defect Description (type, inclination, thickness, shape, roughness, coating)	Depth (m)	Casing & Core Lifts
NLMC	6.5	**SANDSTONE** - grey some orange, fine to medium grained, weak iron staining, trace carbonaceous laminations.	SW-FR		A=0.36 D=0.37			SM, 0, clay 30mm SM, 0, clay 20mm	6.5	
	7.0	**SANDSTONE** - grey, fine to coarse grained, trace carbonaceous laminations.	FR		A=1.36 D=1.21		94	SM, 0, clay 10mm SM, 0, clay 10mm BD, 2, SMTH HB BD, 10, SMTH	7.0	
	7.5							BD, 5, SMTH	7.5	
	8.0				A=1.65 D=1.9			BD, 10, RG SM, 0, clay 20mm	8.0	
	8.5							DB	8.5	8.42
	9.0				A=1.9 D=2.5			BD, 10, RG BD, 5, RG BD, 3, RG	9.0	
	9.5						93		9.5	
	10.0				A=2.28 D=2.14				10.0	
	10.5								10.5	
	11.0				A=2.17 D=2.08			BD, 3, RG	11.0	
	11.5							BD, 2, RG BD, 4, RG BD, 3, RG SM, 0, clay 10mm BD, 5, RG BD, 10, RG	11.5	11.47
	12.0						100	BD, 5, RG DB BD, 3, RG	12.0	

Bedrock

Rock Mass Defects — Core Photo — Defect Spacing (mm): 20, 60, 200, 600, 2000 — Defect Description: Specific / General

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**

GEE DAVIES CH LOG DRAFT LOGS ST LEONARDS.GPJ GEE.GDT 7-3-21 12:05:40 PM

Borehole Log Report

Morrow Geotechnics Pty Ltd
PO Box 4069
Carlton NSW 2218
M 0405 843 933

morrow

Hole ID. **BH6**
Hole Depth: **14.39 m**
Sheet: **4 of 4**

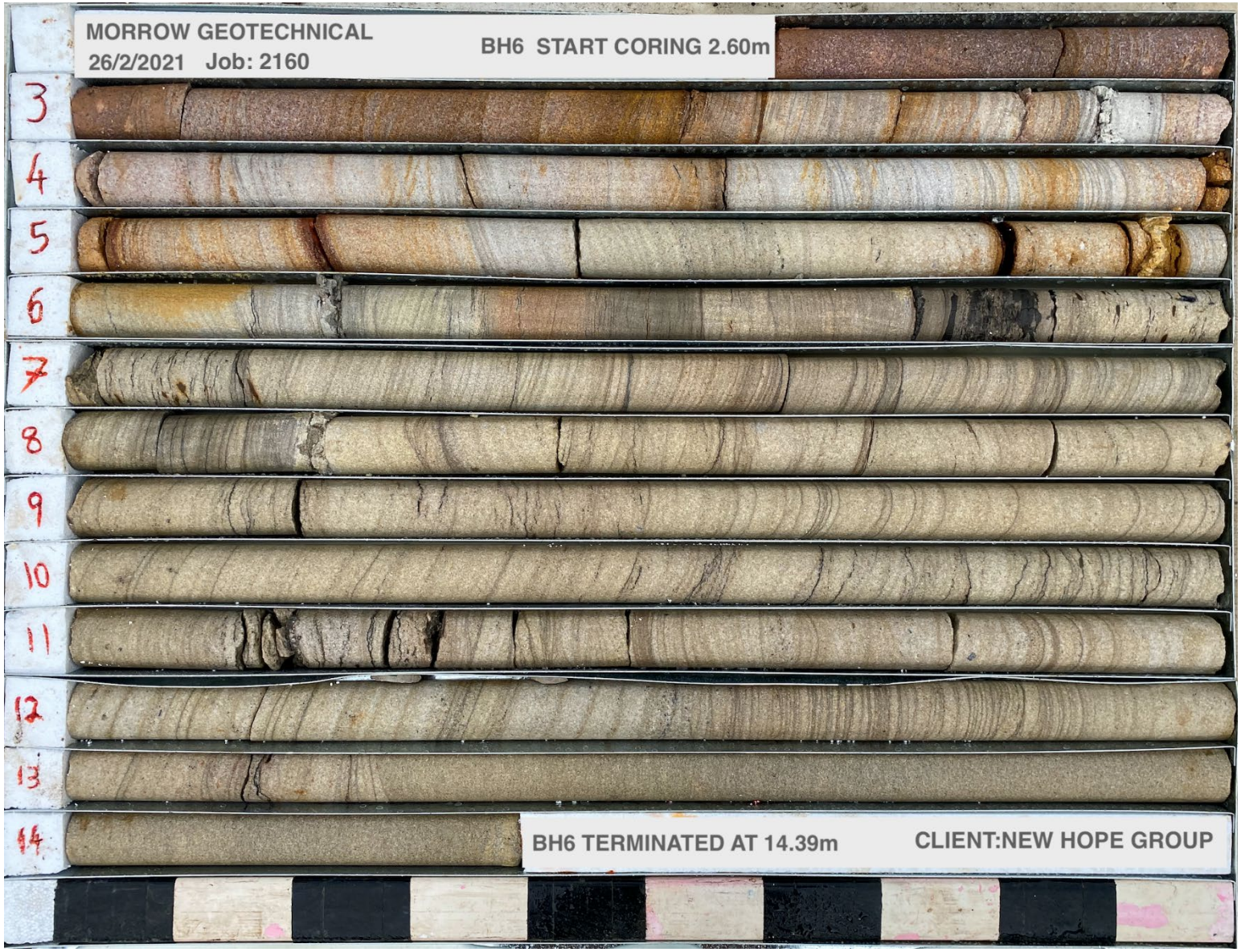
Project Name: **Geotechnical Assessment** Project Number: **P2160**
Location / Site: **4-8 Marshall Street, St Leonards NSW** Client: **Evergreen Investment Holdings**

Drilling Company: **BG Drilling** Date Started: **26-FEB-21** Ground Level: ----------
Drill Method: **SFA/NLMC** Date Completed: **25-FEB-21** Easting: ----------
Equipment: **Track mounted Hanjin Drill Rig** Northing: ----------

Method	Water Level	Depth (m)	RL (m)	Graphic Log	Material Type	Material Description	Weathering	Estimated Strength (MPa) EL 0.03 VL 0.1 L 0.3 M 1 H 3 VH 10 EH	$Is_{(50)}$ MPa D=diametral A=axial	U.C.S. (Mpa)	Rock Mass Defects: RQD %	Core Photo	Defect Spacing (mm) 20 60 200 600 2000	Defect Description type, inclination, thickness, shape, roughness, coating: Specific / General	Depth (m)	Casing & Core Lifts
NLMC		12.5 13.0 13.5 14.0			Bedrock	**SANDSTONE** - grey, fine to coarse grained, trace carbonaceous laminations.	FR		A=2.91 D=2.39 A=2 D=2.2 A=1.97 D=2.08		100			BD,15, RG BD,15, RG	12.5 13.0 13.5 14.0	14.39
		14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0				**Hole Terminated at 14.39 m** Target depth achieved									14.5 15.0 15.5 16.0 16.5 17.0 17.5 18.0	

Additional Comments

Logged By: **Matthew Kilham** Date: **26-Feb-21** Checked By: **Alan Morrow** Date: **07-MAR-21**


MORROW GEOTECHNICAL
26/2/2021 Job: 2160
BH6 START CORING 2.60m
3
4
5
6
7
8
9
10
11
12
13
14
BH6 TERMINATED AT 14.39m
CLIENT:NEW HOPE GROUP

Project No:	P2160	Contractor:	BG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	RM/FM
		Approved:	AM
Sheet: 1 of 4		Date:	3/02/2022

BH7

Drilling Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/ Density	Moisture	Additional Observations
ADT	L	GWNE	SPT 7-1 0.5-0.95 m 2,4,5 N= 9	ML	0.5	TOPSOIL: Sandy SILT, fine to medium grained, dark grey/brown, with rootlets	F	M< PL	TOPSOIL
				CL	1.0	Sandy CLAY, low plasticity, orange-grey fine to medium grained sand (RESIDUAL SOIL)	St		RESIDUAL SOIL
	M		SPT 7-2 1.5-1.95 m 8,12/120mm N= R	SC	1.5	Clayey SAND- fine to medium grained, orange/grey/red, low plasticity (RESIDUAL SOIL) AS ABOVE, with subangular to angular ironstone gravels from 1.4 m (RESIDUAL SOIL)			
				-	2.0	SANDSTONE, fine to medium grained, pale orange, highly weathered, very low strength, with some clay zones (WEATHERED ROCK)	-	-	WEATHERED ROCK
					2.5				
					3.0	Continued as cored hole from 3.0 m			
					3.5				
					4.0				
					4.5				
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				
					8.0				

Project No:	P2160	Contractor:	MG	morrow	
Client:	Evergreen Investment	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	RM/FM		
		Approved:	AM		
Sheet: 2 of 4		Date:	3/02/2022	BH7	

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.1 0.3 1 3 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 30 100 300 1000)	Defect Description
						0.5			
						1.0			
						1.5			
						2.0			
						2.5			
						3.0	Start Coring at 3.0 m		
NMLC	0% water loss	96%	29%		RS	3.0	Sandy CLAY- low to moderate plasticity, grey-orange, fine to medium grained sand		3.00-3.05, Core loss, 50 mm
					MW	3.1	SANDSTONE - fine to medium grained, grey-red-orange		3.16, B, 2°, Pl, Ro, Ct clay
					RS	3.2	Sandy CLAY- low to moderate plasticity, grey-orange, fine to medium grained sand		3.21, DB
					MW	3.4	SANDSTONE - fine to medium grained, grey-red-orange		3.40-3.70, core recovered as fragmented rock
					RS	3.5	Sandy CLAY- low to moderate plasticity, grey-orange, fine to medium grained sand		3.57, HB
					SW	3.6	SANDSTONE - fine to medium grained, grey-orange, moderate iron staining		3.62, B, 2°, Pl, Ro, Ct carbonaceous material 3.67, B, 4°, Un, Ro, Vnr carbonaceous material
						4.0			3.96, B, 4°, Un, Ro, Vnr carbonaceous material 4.00, HB 4.04, HB
					RS	4.2	Sandy CLAY- low to moderate plasticity, grey-orange, fine to medium grained sand		4.20-4.40, core recovered as fragmented rock
					SW	4.4	SANDSTONE - fine to medium grained, grey-orange, moderate iron staining		
		97%	85%			4.5	SANDSTONE- fine to medium grained, pale grey-orange, iron bandings with fine to medium angular iron gravels from 4.42-4.47 m		4.53, B, 2°, Pl, Ro, Cn 4.69, B, 2°, Pl, Ro, Cn
						5.0	CORELOSS		4.83-4.93, Core loss, 100mm thk
					SW	5.0	SANDSTONE- Fine to medium grained, pale grey orange, iron staining		5.16, B, 10°, Pl, Ro, Sn Fe 5.24-5.30, CZ, Sn Fe, 60mm thk
					HW	5.4			
					SW	5.5			5.63, B, 2°, Pl, Ro, Ct clay 5.74, B, 5°, Pl, Ro, Cn 5.84, B, 1°, Pl, Ro, Cn 5.91, B, 5°, Pl, Ro, Cn
					MW	6.0			6.00, HB 6.11, HB 6.28, J, 18°, Pl, Ro, Cn 6.36, HB
						6.5			6.53, HB 6.68, HB
					FR	7.0	SANDSTONE- Pale grey, carbonaceus laminations from 6.71m		6.9, HB 7.06, B, 0°, Pl, Sm, Cn 7.25, V, 10°, Pl, Sm, Cn
		96%	86%			7.5			
						8.0			7.90, HB

Project No:	P2160	Contractor:	MG	morrow	
Client:	EverGreen investment Holding	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM		
		Approved:	AM		
Sheet:		Date:	3/02/2022	BH7	

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.3 3; 0 0.1 1 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 100 1000; 30 300)	Defect Description
NMLC	GWNE	96%	86%		FR	8.5			
						9.0			9.16-9.52, B, 5°, Pl, Ro, Cn, 80mm sp
						9.5	SHALE- Fine grained, Dark gray, Flow bandings		
							SANDSTONE- Fine grained, pale grey, massive		
						10.0			10.21, HB 10.36, HB
		100%	98%			10.5	SANDSTONE- Fine to medium grained, pale grey,carbonaceous laminations from 10.66 m		10.67, HB 10.82, HB 10.90, HB
						11.0			
						11.5			11.81, HB 11.88, HB
						12.0			12.10, HB 12.18, HB 12.38, J, 30°, Pl, Ro, Cn
						12.5			
						13.0			12.90, HB 13.03, B, 10°, Pl, Ro, Cn 13.07, HB
						13.5			
			100%			14.0	Inclusion x1 coarse rounded quartz gravel		13.90, HB 13.98, HB 14.09, HB
						14.5	End of Borehole at 14.4m Reached Target depth		
						15.0			
						15.5			
						16.0			


MORROW GEOTECHNICAL
P2160 . ST LEONARDS 3/02/22 BH7
START LOGGING
3.0 m
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
CORE LOSS
EOH 14.40m

Project No:	P2160	Contractor:	MG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM
		Approved:	AM
Sheet:	1 of 3	Date:	7/02/2022

BH8

Drilling Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/ Density	Moisture	Additional Observations
ADT	L	GWNE	SPT8-1 0.5-0.95 m 3,5,8 N=13	ML	0.0	TOPSOIL - Sandy SILT, low plasticity, fine to medium grained sand, dark grey / brown, trace root fibres	-	M< PL	TOPSOIL
				CI-CH	0.5	Silty CLAY, medium to high plasticity, yellow/orange, fine to medium subangular to angular ironstone gravel (RESIDUAL SOIL)	St		RESIDUAL SOIL
					1.0				
	M		SPT8-2 1.5-1.95 m 5,12,12 N=24	-	1.5	SANDSTONE - fine to medium grained, red-purple, highly weathered, inferred extremely low strength (WEATHERED ROCK)	-	-	WEATHERED ROCK
					2.0	- becoming white / red / orange from 1.6m			
					2.5				
						Continued as Core Hole from 2.6m			
					3.0				
					3.5				
					4.0				
					4.5				
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				
					8.0				

Project No:	P2160	Contractor:	MG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM
		Approved:	AM
Sheet:	2 of 3	Date:	7/02/2022

morrow

BH8

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.3 3; 0 0.1 1 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 100 1000; 30 300)	Defect Description
						0.5			
						1.0			
						1.5			
						2.0			
						2.5	Start Coring at 2.6 m		
NMLC	GWNO				-		CORE LOSS, 110 mm thick		2.60-2.71, Core loss, 110mm thk
					RS		Silty CLAY, medium to high plasticity, grey / red		
		95%	80%		HW	3.0	SANDSTONE, fine to medium grained, red		2.81, B, 0°, Pl, Ro, Cn
									3.13-3.18, HBx3, 25mm sp
									3.42, HB
					EW	3.5			3.51, B, 0°, Pl, Ro, Cn
									3.75, B, 0°, Pl, Ro, Cn
					HW	4.0			3.91-4.00, HBx3, 45mm sp
									4.25, B, 0°, Un, Ro, Sn fe
									4.28, B, 0°, Pl, Sm, Ct clay
									4.32-4.37, DB, Core recovered as fragmented rock
						4.5	- becoming red / orange from 4.5 m		4.44, B, 0°, Pl, Ro, Cn
									4.75, HB
					M W	5.0			4.97-5.00, HBx2, 30mm sp
									5.13, HB
									5.35, B, 0°, Pl, Ro, Sn fe
									5.47, B, 0°, Pl, Ro, Sn fe
		100%	95%			5.5	SANDSTONE, fine to medium grained, grey, 10° cross beddings at 2-5mm spacing		5.53, HB
									5.80, HB
						6.0			6.00, HB
									6.30, J, 30°, Pl, Ro, Cn
						6.5			
					FR				6.76, J, 30°, Pl, Ro, Cn
									6.84, J, 30°, Pl, Ro, Cn
						7.0	SANDSTONE, fine to medium grained, pale grey, massive, some carbonaceous laminations		6.97-7.00, HBx2, 30mm sp
									7.10, HB
						7.5	SILTSTONE, dark grey, massive		7.50-7.63, DBx7, 20mm sp
		100%	100%						7.64, B, 0°, Pl, Ro, Cn
						8.0			7.95-7.99, Jx2, 35°, Pl, Sl, Cn, 40mm sp

Project No:	P2160	Contractor:	MG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM
		Approved:	AM
Sheet:	3 of 3	Date:	7/02/2022

morrow

BH8

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.3 3 / 0 0.1 1 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 100 1000 / 30 300)	Defect Description
NMLC	GWNO	85%	70%		FR	8.5	SANDSTONE, fine to medium grained, pale grey, massive		8.00, HB 8.05-8.08, Sm, clay, 30mm thk 8.12, HB, 0°, Pl, Ro, Cn 8.55, HB, 0°, Pl, Ro, Cn
						9.0			9.00, HB
						9.5			9.38, HB 9.57, B, 0°, Pl, Ro, Cn 9.59, HB 9.74, HB
					-	10.0	CORE LOSS, 50 mm thick		9.95-10.00, Core loss, 50mm thk
		95%	95%		FR	10.5	AS ABOVE, SANDSTONE, fine to medium grained, pale grey, massive, some shale inclusions		10.82, B, 0°, Pl, Ro, Cn 10.93-11.00, HBx2, 70mm sp 11.08-11.30, DBx4, 75mm sp
						11.0			
						11.5	- shale clasts, 5-20 mm thick from 11.1 to 11.5m		11.35, J, 45°, Pl, Ro, Cn 11.46, B, 0°, Pl, Sn, Ct clay
						12.0			11.70, B, 0°, Pl, Ro, Cn
						12.5			12.18, HB 12.52, HB
						13.0			12.80, HB 13.00, HB
		100%	100%			13.5			
						14.0			14.00, HB
						14.5	End of Hole at 14.41m		
						15.0			
						15.5			
						16.0			


MORRON GEOTECHNICS
P2160 - St Leonards
7/2/2022
BH8 -
CORING START → 2.6m
CORE LOSS
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
EOH 14.41

Project No:	P2160	Contractor:	BG	morrow	
Client:	Evergreen Investment	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	JA		
		Approved:	AM		
Sheet:	1 of 3	Date:	3/02/2022	BH9	

Drilling Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/ Density	Moisture	Additional Observations
ADT	L		SPT9-1 0.5-0.95 m 2,2,1 N=3	SM	0.5	TOPSOIL / FILL - Silty SAND fine to medium grained, low plasticity with course angular gravel(sandstone), grey		M	
					1.0	FILL - sandy clay, low plasticity, grey-brown, trace fine to medium angular gravel(charcoal), with rootlets			
			SPT9-2 1.5-1.95 m 4,5,6 N=11	CL-CI	1.5	Sandy CLAY medium to high plasticity, yellow-brown, fine to medium grained(Residual) yellow mottled orange from 1.6m		M< PL	
	H				2.0	SANDSTONE fine to medium grained orange-red with clay banding, inferred verry low to low strength, extremely weathered(Weathered Rock)			
					2.5				
					3.0	Continued as cored hole from 3.0m			
					3.5				
					4.0				
					4.5				
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				
					8.0				

Project No:	P2160	Contractor:	BG	morrow	
Client:	Evergreen Investment	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	JA		
		Approved:	AM		
Sheet: 2 of 3		Date:	3/02/2022	BH9	

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.3 3; 0 0.1 1 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 100 1000; 30 300)	Defect Description
						0.5			
						1.0			
						1.5			
						2.0			
						2.5			
						3.0			
NMLC	0% water loss	100%	25.00%		RS		Sandy CLAY l-m plasticity,orange- brown, fine to medium grain sand		3.33-3.56 clay seam
					HW		SANDSTONE fine to medium grained, orange-red, ironstone banding		
					RS	3.5	Sandy CLAY m-h plasticity,pale grey , fine to medium grain sand		
					MW		SANDSTONE fine to medium grained, pale grey-orange,patchy iron staining		
					RS		Sandy CLAY m-h plasticity,pale grey , fine to medium grain sand		
					XW	4.0	SANDSTONE fine to medium grained, orange-red, ironstone banding		4.0-4.1 core recovered as fragments
	0% water loss	85%	67%		HW		SANDSTONE fine to medium grained, orange-red, ironstone banding		4.12-BP-5°-PL-RF-Fe Sn 4.20-4.56 CLAY SEAM 4.22-BP-2°-PL-RF-Fe Sn
					SW	4.5	SANDSTONE fine to medium grained, grey-orange, carbonaceous laminations		4.32-HB 4.66-HB 4.65-HB
					SW	5.0	SANDSTONE fine grained, pale grey-red, ironstone banding		4.77-BP-2°-PL-RF-Fe Sn 4.80-BP-2°-PL-RF-Fe Sn 4.82- CLAY SEAM 4.93 - BP-5°-PL-RF-Fe Sn 4.98 - HB 5.00 - HB 5.18 - HB 5.26 - HB 5.58 - HB 5.72-5.73 - CLAY SEAM 5.74 - 5.77 - CLAY SEAM 5.76 -BP-2°-PL-RF-Fe Sn 5.98 - HB 5.99 - HB 6.88 - BP-5°-PL-RF-CN 6.96 - HB 7.42 - BP-1°-PL-RF-CN 7.76 - HB 7.96 - HB 7.99 - HB
					SW		SANDSTONE fine grained, pale grey, inclusion rounded quartz gravel		
					SW	5.5	SANDSTONE fine grained, pale grey		
					MW	6.0	SANDSTONE fine to medium grained, grey-orange, ironstone banding and staining SANDSTONE fine to medium grained, pale grey-orange, iron staining		
					MW	6.5	SANDSTONE fine to medium grained, pale grey- red-orange		
	0% water loss	100%	100%		FR	7.0	SANDSTONE fine to medium grained, pale grey, cross-bedding 5-15°, 5-10mm spacing		
					FR	7.5			
					FR	8.0			

Project No:	P2160	Contractor:	BG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	JA
		Approved:	AM
Sheet:	3 of 3	Date:	3/02/2022

BH9

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.1 0.3 1 3 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 30 100 300 1000)	Defect Description
NMLC		as above	as above			8.5	as above		8.08 - HB 8.90 - DB 8.99 - HB
	0% water loss	99%	92%		FR	9.0			8.90 - DB 8.99 - HB
						9.5			9.31 - BP-2°-PL-RF- CN
						10.0			9.7 - HB 9.99 - HB
					FR		SHALE dark grey		10.15 - BP-1°-PL-RF-CN
						10.5	SANDSTONE fine to medium grained, pale grey, cross-bedding 5-15°, 5-10mm spacing ends at 11.6m		10.17 - BP-1°-PL-RF-CN 10.27 - BP-1°-PL-RF-CN 10.38 - BP-1°-PL-RF-CN
						11.0			10.99 - HB 11.03 - HB 11.19 - BP-1°-PL-RF-CN
						11.5			11.39 - HB
	0% water loss	100%	100%		FR	12.0			11.85 - BP-2°-PL-RF-CN 11.99 - HB
						12.5			
						13.0			
						13.5	Carbonaceous Laminations at 13.7m, 10mm spacing		
						14.0			
						14.5			14.48 - BP-2°-PL-RF-Ct x
							Carbonaceous Laminations 10mm spacing at 14.6m		14.95 - BP-3°-PL-RF-CN 14.99 - HB
						15.0			15.00 - HB
						15.5	End of Hole at 15.2m Target Depth Reached		
						16.0			


MORROW GEOTECHNICS
P2160, ST LEONARDS
BH9
START CORING
3.0M
3·0
4·0
5·0
6·0
7·0
8·0
9·0
10·0
11·0
12·0
13·0
14·0

Project No:	P2160	Contractor:	BG	morrow	
Client:	Evergreen Investment	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM/JA		
		Approved:	RM		
Sheet: 1 of 4		Date:	4/02/2022	**BH10**	

Drilling Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/ Density	Moisture	Additional Observations
ADT	M	GWNE		SM	0.5	TOPSOIL/FILL - Silty SAND fine to medium grained, brown, low plastiticty silt	D	M	
	L			CI	1.0	Sandy CLAY - medium plasticity, orange-brown, fine to medium grained sand (RESIDUAL)	St	M< PL	
	M-H			-	1.5				
					2.0	SANDSTONE - fine to medium grained, white-orange, with clay banding, inferreed very low strength, extremely weathered (WEATHERED ROCK)	-	-	
					2.5				
					3.0	Continued as cored hole from 3.0 m			
					3.5				
					4.0				
					4.5				
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				
					8.0				

Project No:	P2160	Contractor:	BG	morrow	
Client:	Evergreen Investment	Drill Rig:	Christie Rig		
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM/JA		
		Approved:	RM		
Sheet:		Date:	7/02/2022	BH10	

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.3 3; 0 0.1 1 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 100 1000; 30 300)	Defect Description
						0.5			
						1.0			
						1.5			
						2.0			
						2.5			
						3.0	Start Coring 3.0m		
NMLC	50% Water Loss	100%	10%		RS	3.5	Sandy CLAY - low to medium plasticity, orange-grey, fine to medium grained sand		
					EW		SANDSTONE fine to medium grained, moderate iron staining		
					RS		Silty CLAY - low to medium plasticity, grey-red		
					HW	4.0	SANDSTONE fine to medium grained, grey, trace fine to medium sub-rounded gravels (ironstone)		4.00, HB 4.05-4.08, Sm, clay, 30mm thk 4.10, J, 2°, Pl, Ro, Sn Fe 4.39, B, 4°, Pl, Ro, Sn Fe
						4.5	SANDSTONE fine to medium grained, grey, very thinly bedded		4.50, HB 4.70, J, 2°, Pl, Ro, Sn Fe 4.72-4.74, CZ, 20mm thk
						5.0	LAMINITE fine grained, brown-grey		5.00, HB 5.05, B, 2°, Pl, Ro, Cn 5.11-5.19, J, 85°, Ir, Ro, Sn Fe 5.24, B, 2°, Pl, Ro, Sn Fe 5.25, B, 2°, Pl, Ro, Sn Fe 5.55, HB
							SANDSTONE fine to medium grained with heavy iron staining		
	50% Water Loss	100%	86%		SW	5.5	SANDSTONE fine to medium grained with carbonaceous laminations at 5°		5.81, B, 2°, Pl, Ro, Cn 5.87-5.88, Sm, clay, 10mm thk 5.99, B, 2°, Pl, Ro, Cn
						6.0	SANDSTONE fine to medium grained, massive with moderate iron staining		
					FR	6.5	SANDSTONE fine to medium grained with carbonaceous laminations at 5-10°		6.40, HB
						7.0			6.85, B, 4°, Pl, Ro, Cn 6.99, HB 7.00, HB
	50% Water Loss	100%	96%			7.5			7.60, DB 7.70-7.72, CZ, Ct clay, Sn Fe, 20mm thk 7.75, B, 4°, Pl, Ro, Sn Fe
						8.0	SANDSTONE fine to medium grained, pale orange, massive		8.00, HB

Project No:	P2160	Contractor:	BG
Client:	Evergreen Investment	Drill Rig:	Christie Rig
Project:	4-8 Marshall Street St Leonards NSW	Logged:	FM/JA
		Approved:	RM
Sheet:	3 of 4	Date:	7/02/2022

morrow

BH10

Drilling Method	Water	TCR	RQD (SCR)	Rock Strength (EL VL L M H VH EH; 0.03 0.1 0.3 1 3 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 30 100 300 1000)	Defect Description
NMLC	50% Water Loss	100%	96%			8.5	SANDSTONE fine to medium grained, pale grey, massive		8.00, HB
						9.0			8.96, B, 2°, Pl, Ro, Cn 8.99, HB
							SANDSTONE fine to medium grained with carbonaceous laminations at 5-10°		9.00, HB 9.11, HB 9.24, B, 2°, Pl, Ro, Cn 9.42, DB 9.56, B, 2°, Pl, Ro, Cn 9.60, B, 2°, Pl, Ro, Cn 9.63, B, 2°, St, Ro, Cn
						9.5			9.99, HB
						10.0			10,0, HB
						10.5			10.50, HB
	50% Water Loss	100%	100%		FR	11.0	SANDSTONE fine to medium grained, pale grey, massive		10.71, B, 2°, Pl, Ro, Cn 10.77, B, 2°, Pl, Ro, Cn
						11.5	carbonaceous laminations from 11.43-11.8m		11.90, HB
						12.0			12.00, HB 12.09, HB 12.17, HB
						12.5			12.44, B, 2°, Pl, Ro, Cn 12.55, B, 2°, Pl, Ro, Cn
							SANDSTONE fine to medium grained with carbonaceous laminations at 5-10°		12.60, DB
						13.0			
						13.5			13.61, DB
	50% Water Loss	100%	100%			14.0			14.10, J, 3°, Pl, Ro, Cn
						14.5			
						15.0	End of Borehole at 14.72m Reached Target Depth		
						15.5			
						16.0			


MORROW GEOTECHNICAL
P 2160 4/02/22 BH10
START CORING
3.0M
30
40
50
60
70
80
90
10.0
11.0
12.0
13.9
14.0
EOH 14.72m

POINT LOAD STRENGTH INDEX

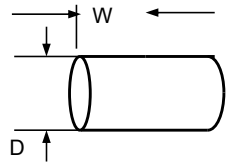
Project No.	P2160

Client:	Evergreen Investment Holdings	Date:	4-Mar-21
Project:	Geotechnical Investigation	Tested by:	MK
Location:	4-8 Marshall Avenue, St Leonards NSW	Data checked:	AM

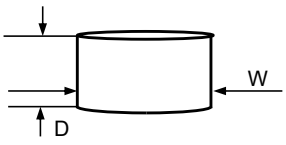
Test Machine:	GSA	Test Locality:	MHK	Core Size:	52	mm

Bore/TP	Depth (m)	Rock Type	Moisture Condition	Test Type	W (mm)	D (mm)	Load kN (P)	Failure Type	Point Load Strength Index $Is_{(50)}$ (MPa)	Strength Classification
BH01	2.72	SANDSTONE	F	A	52.0	41.0	0.81	1	0.30	M
BH01	3.41	SANDSTONE	F	D	50.0	50.0	0.76	2	0.30	M
BH01	3.41	SANDSTONE	F	A	52.0	41.0	1.24	1	0.47	M
BH01	4.53	SANDSTONE	F	A	52.0	35.0	0.42	1	0.18	L
BH01	5.07	SANDSTONE	F	D	50.0	49.0	2.99	1	1.23	H
BH01	5.07	SANDSTONE	F	A	52.0	46.0	3.60	1	1.24	H
BH01	6.05	SANDSTONE	F	D	50.0	50.0	1.82	2	0.73	M
BH01	6.05	SANDSTONE	F	A	52.0	47.0	2.53	1	0.85	M
BH01	7.05	SANDSTONE	F	D	50.0	48.0	3.38	2	1.44	H
BH01	7.05	SANDSTONE	F	A	52.0	41.0	5.31	1	1.99	H
BH01	7.95	SANDSTONE	F	D	50.0	50.0	3.38	1	1.35	H
BH01	7.95	SANDSTONE	F	A	52.0	40.0	6.11	1	2.34	H
BH01	8.57	SANDSTONE	F	D	50.0	50.0	0.52	2	0.21	L
BH01	8.57	SANDSTONE	F	A	52.0	48.0	0.48	1	0.16	L
BH01	9.05	SANDSTONE	F	D	50.0	50.0	3.06	1	1.22	H
BH01	9.05	SANDSTONE	F	A	52.0	39.0	3.20	1	1.25	H
BH01	10.05	SANDSTONE	F	D	50.0	48.0	4.61	1	1.96	H
BH01	10.05	SANDSTONE	F	A	52.0	43.0	4.90	1	1.77	H
BH01	11.05	SANDSTONE	F	D	50.0	48.0	5.51	1	2.35	H
BH01	11.05	SANDSTONE	F	A	52.0	45.0	5.82	1	2.03	H
BH01	12.29	SANDSTONE	F	D	50.0	48.0	4.39	1	1.87	H
BH01	12.29	SANDSTONE	F	A	52.0	45.0	6.40	1	2.23	H
BH01	13.50	SANDSTONE	F	D	50.0	49.0	4.59	2	1.89	H
BH01	13.50	SANDSTONE	F	A	52.0	43.0	6.49	1	2.35	H
BH01	14.50	SANDSTONE	F	D	50.0	49.0	3.53	2	1.46	H
BH01	14.50	SANDSTONE	F	A	52.0	46.0	5.48	1	1.88	H

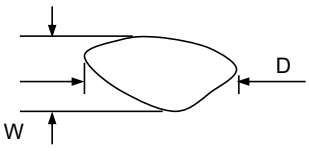
TEST TYPE :



W/D > 0.5
DIAMETRAL (D)



D/W = 0.3 - 1.0
AXIAL (A)



D/W = 0.3 - 1.0
IRREGULAR LUMP (I)

MOISTURE CONDITION :
Field (F), Saturated (S), Dry (D)

FAILURE TYPE :
1. Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2. Fracture along bedding.
3. Fracture influenced by pre-existing joint plane (J), microfracture (M), vein (V), chemical alteration (C).
4. Chip or partial fracture.

NOTES For specimens tested parallel to plane of weakness $D_e^2 = D^2$
For specimens tested perpendicular to plane of weakness $D_e^2 = 4WD/\pi$

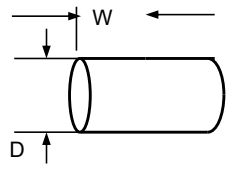
POINT LOAD STRENGTH INDEX

Project No.	P2160		
Client:	Evergreen Investment Holdings	Date:	4-Mar-21
Project:	Geotechnical Investigation	Tested by:	MK
Location:	4-8 Marshall Avenue, St Leonards NSW	Data checked:	AM

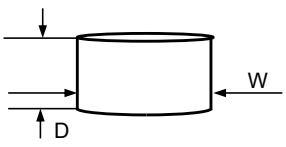
Test Machine:	GSA	Test Locality:	MHK	Core Size:	52	mm

Bore/TP	Depth (m)	Rock Type	Moisture Condition	Test Type	W (mm)	D (mm)	Load kN (P)	Failure Type	Point Load Strength Index $Is_{(50)}$ (MPa)	Strength Classification
BH03	4.31	SANDSTONE	F	D	50.0	51.0	0.09	2	0.03	VL
BH03	4.31	SANDSTONE	F	A	52.0	48.0	0.24	1	0.08	VL
BH03	4.70	SANDSTONE	F	D	50.0	48.0	1.40	2	0.60	M
BH03	4.70	SANDSTONE	F	A	52.0	45.0	1.25	1	0.44	M
BH03	5.40	SANDSTONE	F	D	50.0	50.0	0.43	1	0.17	L
BH03	5.40	SANDSTONE	F	A	52.0	44.0	0.57	1	0.20	L
BH03	6.27	SANDSTONE	F	D	50.0	50.0	0.70	2	0.28	L
BH03	6.27	SANDSTONE	F	A	52.0	45.0	2.09	1	0.73	M
BH03	7.05	SANDSTONE	F	A	52.0	45.0	0.71	1	0.25	L
BH03	7.53	SANDSTONE	F	D	50.0	49.0	3.53	1	1.46	H
BH03	7.53	SANDSTONE	F	A	52.0	41.0	4.53	1	1.70	H
BH03	8.05	SANDSTONE	F	D	50.0	48.0	4.04	1	1.72	H
BH03	8.05	SANDSTONE	F	A	52.0	45.0	5.43	1	1.90	H
BH03	9.05	SANDSTONE	F	D	50.0	49.0	3.70	2	1.53	H
BH03	9.05	SANDSTONE	F	A	52.0	46.0	4.14	1	1.42	H
BH03	10.05	SANDSTONE	F	D	50.0	48.0	4.87	1	2.08	H
BH03	10.05	SANDSTONE	F	A	52.0	44.0	5.28	1	1.88	H
BH03	11.05	SANDSTONE	F	D	50.0	48.0	3.67	1	1.56	H
BH03	11.05	SANDSTONE	F	A	52.0	41.0	4.41	1	1.65	H
BH03	12.05	SANDSTONE	F	D	50.0	48.0	4.43	1	1.89	H
BH03	12.05	SANDSTONE	F	A	52.0	46.0	5.59	1	1.92	H
BH03	13.05	SANDSTONE	F	D	50.0	49.0	4.94	1	2.04	H
BH03	13.05	SANDSTONE	F	A	52.0	45.0	7.18	1	2.51	H
BH03	14.05	SANDSTONE	F	D	50.0	49.0	3.34	1	1.38	H
BH03	14.05	SANDSTONE	F	A	52.0	45.0	4.16	1	1.45	H

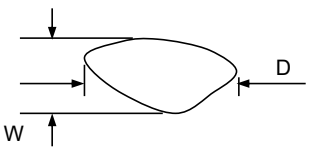
TEST TYPE :



W/D > 0.5
DIAMETRAL (D)



D/W = 0.3 - 1.0
AXIAL (A)



D/W = 0.3 - 1.0
IRREGULAR LUMP (I)

MOISTURE CONDITION :
Field (F), Saturated (S), Dry (D)

FAILURE TYPE :
1. Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2. Fracture along bedding.
3. Fracture influenced by pre-existing joint plane (J), microfracture (M), vein (V), chemical alteration (C).
4. Chip or partial fracture.

NOTES For specimens tested parallel to plane of weakness $D_e^2 = D^2$
For specimens tested perpendicular to plane of weakness $D_e^2 = 4WD/\pi$

POINT LOAD STRENGTH INDEX

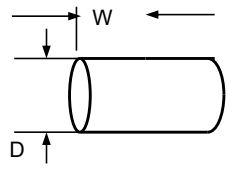
Project No.	P2160

Client:	Evergreen Investment Holdings	Date:	4-Mar-21
Project:	Geotechnical Investigation	Tested by:	MK
Location:	4-8 Marshall Avenue, St Leonards NSW	Data checked:	AM

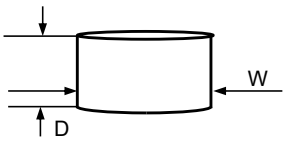
Test Machine:	GSA	Test Locality:	MHK	Core Size:	52	mm

Bore/TP	Depth (m)	Rock Type	Moisture Condition	Test Type	W (mm)	D (mm)	Load kN (P)	Failure Type	Point Load Strength Index $Is_{(50)}$ (MPa)	Strength Classification
BH04	4.00	SANDSTONE	F	A	52.0	41.0	2.12	1	0.80	M
BH04	5.12	SANDSTONE	F	D	50.0	48.0	3.68	1	1.57	H
BH04	5.12	SANDSTONE	F	A	52.0	46.0	3.31	1	1.14	H
BH04	6.25	SANDSTONE	F	D	50.0	50.0	2.41	2	0.96	M
BH04	6.25	SANDSTONE	F	A	52.0	45.0	4.84	1	1.69	H
BH04	7.10	SANDSTONE	F	D	50.0	50.0	4.54	2	1.82	H
BH04	7.10	SANDSTONE	F	A	52.0	37.0	3.81	1	1.55	H
BH04	7.34	SHALE/SILTSTONE	F	D	50.0	51.0	0.20	2	0.08	VL
BH04	7.34	SHALE/SILTSTONE	F	A	52.0	39.0	0.32	1	0.12	L
BH04	7.40	SHALE/SILTSTONE	F	D	50.0	50.0	0.27	2	0.11	L
BH04	7.40	SHALE/SILTSTONE	F	A	52.0	46.0	0.48	3	0.16	L
BH04	8.07	SANDSTONE	F	D	50.0	48.0	3.23	2	1.38	H
BH04	8.07	SANDSTONE	F	A	52.0	46.0	3.80	1	1.30	H
BH04	9.10	SANDSTONE	F	D	50.0	50.0	2.39	2	0.96	M
BH04	9.10	SANDSTONE	F	A	52.0	46.0	2.43	1	0.83	M
BH04	10.17	SANDSTONE	F	D	50.0	50.0	1.64	2	0.66	M
BH04	10.17	SANDSTONE	F	A	52.0	46.0	2.72	1	0.93	M
BH04	11.05	SANDSTONE	F	D	50.0	50.0	3.71	2	1.48	H
BH04	11.05	SANDSTONE	F	A	52.0	46.0	5.88	1	2.02	H
BH04	12.39	SANDSTONE	F	D	50.0	48.0	5.06	1	2.16	H
BH04	12.39	SANDSTONE	F	A	52.0	41.0	5.97	1	2.24	H
BH04	13.10	SANDSTONE	F	D	50.0	49.0	4.62	1	1.91	H
BH04	13.10	SANDSTONE	F	A	52.0	38.0	4.84	1	1.93	H
BH04	14.20	SANDSTONE	F	D	50.0	48.0	5.48	1	2.34	H
BH04	14.20	SANDSTONE	F	A	52.0	44.0	7.23	1	2.57	H

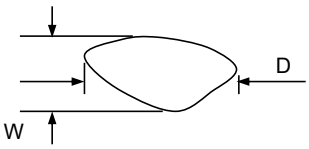
TEST TYPE :



W/D > 0.5
DIAMETRAL (D)



D/W = 0.3 - 1.0
AXIAL (A)



D/W = 0.3 - 1.0
IRREGULAR LUMP (I)

MOISTURE CONDITION :
Field (F), Saturated (S), Dry (D)

FAILURE TYPE :
1. Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2. Fracture along bedding.
3. Fracture influenced by pre-existing joint plane (J), microfracture (M), vein (V), chemical alteration (C).
4. Chip or partial fracture.

NOTES For specimens tested parallel to plane of weakness $D_e^2 = D^2$
For specimens tested perpendicular to plane of weakness $D_e^2 = 4WD/\pi$

POINT LOAD STRENGTH INDEX

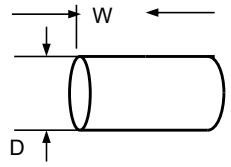
Project No.	P2160

Client:	Evergreen Investment Holdings	Date:	4-Mar-21
Project:	Geotechnical Investigation	Tested by:	MK
Location:	4-8 Marshall Avenue, St Leonards NSW	Data checked:	AM

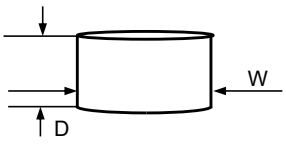
Test Machine:	GSA	Test Locality:	MHK	Core Size:	52	mm

Bore/TP	Depth (m)	Rock Type	Moisture Condition	Test Type	W (mm)	D (mm)	Load kN (P)	Failure Type	Point Load Strength Index $Is_{(50)}$ (MPa)	Strength Classification
BH05	3.37	SANDSTONE	F	D	50.0	50.0	0.54	2	0.22	L
BH05	3.37	SANDSTONE	F	A	52.0	47.0	1.14	1	0.38	M
BH05	4.38	SANDSTONE	F	D	50.0	50.0	0.88	2	0.35	M
BH05	4.38	SANDSTONE	F	A	52.0	41.0	0.82	1	0.31	M
BH05	5.18	SANDSTONE	F	D	50.0	51.0	0.16	2	0.06	VL
BH05	5.18	SANDSTONE	F	A	52.0	42.0	0.89	1	0.33	M
BH05	6.75	SANDSTONE	F	D	50.0	49.0	3.56	2	1.47	H
BH05	6.75	SANDSTONE	F	A	52.0	42.0	4.65	1	1.71	H
BH05	7.10	SANDSTONE	F	A	52.0	45.0	5.78	1	2.02	H
BH05	7.05	SANDSTONE	F	D	50.0	50.0	1.14	2	0.46	M
BH05	7.05	SANDSTONE	F	A	52.0	38.0	5.77	1	2.30	H
BH05	8.12	SANDSTONE	F	D	50.0	48.0	6.06	1	2.58	H
BH05	8.12	SANDSTONE	F	A	52.0	45.0	7.46	1	2.60	H
BH05	9.05	SANDSTONE	F	D	50.0	49.0	3.15	2	1.30	H
BH05	9.05	SANDSTONE	F	A	52.0	40.0	3.77	1	1.44	H
BH05	10.05	SANDSTONE	F	D	50.0	48.0	4.34	2	1.85	H
BH05	10.05	SANDSTONE	F	A	52.0	46.0	5.99	1	2.06	H
BH05	11.38	SILTSTONE	F	D	50.0	49.0	1.03	2	0.43	M
BH05	11.38	SILTSTONE	F	A	52.0	41.0	1.07	1	0.40	M
BH05	12.05	SANDSTONE	F	D	50.0	47.0	6.16	1	2.71	H
BH05	12.05	SANDSTONE	F	A	52.0	43.0	7.09	1	2.56	H
BH05	13.05	SANDSTONE	F	D	50.0	48.0	4.46	1	1.90	H
BH05	13.05	SANDSTONE	F	A	52.0	41.0	3.77	1	1.41	H
BH05	14.25	SANDSTONE	F	D	50.0	50.0	3.79	1	1.52	H
BH05	14.25	SANDSTONE	F	A	52.0	44.0	4.72	1	1.68	H

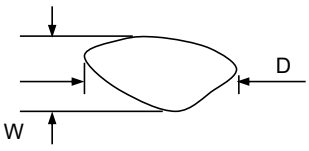
TEST TYPE :



W/D > 0.5
DIAMETRAL (D)



D/W = 0.3 - 1.0
AXIAL (A)



D/W = 0.3 - 1.0
IRREGULAR LUMP (I)

MOISTURE CONDITION :
Field (F), Saturated (S), Dry (D)

FAILURE TYPE :
1. Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2. Fracture along bedding.
3. Fracture influenced by pre-existing joint plane (J), microfracture (M), vein (V), chemical alteration (C).
4. Chip or partial fracture.

NOTES For specimens tested parallel to plane of weakness $D_e^2 = D^2$
For specimens tested perpendicular to plane of weakness $D_e^2 = 4WD/\pi$

POINT LOAD STRENGTH INDEX

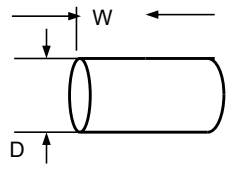
Project No.	P2160

Client:	Evergreen Investment Holdings	Date:	4-Mar-21
Project:	Geotechnical Investigation	Tested by:	MK
Location:	4-8 Marshall Avenue, St Leonards NSW	Data checked:	AM

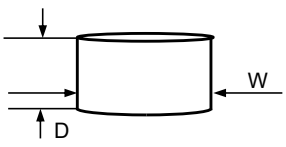
Test Machine:	GSA	Test Locality:	MHK	Core Size:	52	mm

Bore/TP	Depth (m)	Rock Type	Moisture Condition	Test Type	W (mm)	D (mm)	Load kN (P)	Failure Type	Point Load Strength Index $Is_{(50)}$ (MPa)	Strength Classification
BH06	2.70	SANDSTONE	F	D	50.0	48.0	4.68	2	1.99	H
BH06	2.70	SANDSTONE	F	A	52.0	45.0	6.20	1	2.16	H
BH06	3.05	SANDSTONE	F	D	50.0	49.0	3.30	2	1.36	H
BH06	3.05	SANDSTONE	F	A	52.0	46.0	3.43	1	1.18	H
BH06	4.07	SANDSTONE	F	D	50.0	48.0	3.19	2	1.36	H
BH06	4.07	SANDSTONE	F	A	52.0	46.0	4.35	1	1.49	H
BH06	5.07	SANDSTONE	F	D	50.0	50.0	1.49	2	0.60	M
BH06	5.07	SANDSTONE	F	A	52.0	40.0	1.71	1	0.65	M
BH06	6.05	SANDSTONE	F	D	50.0	50.0	0.92	2	0.37	M
BH06	6.05	SANDSTONE	F	A	52.0	46.0	1.04	1	0.36	M
BH06	7.07	SANDSTONE	F	D	50.0	49.0	2.92	2	1.21	H
BH06	7.07	SANDSTONE	F	A	52.0	42.0	3.69	1	1.36	H
BH06	8.05	SANDSTONE	F	D	50.0	48.0	4.45	2	1.90	H
BH06	8.05	SANDSTONE	F	A	52.0	43.0	4.56	1	1.65	H
BH06	9.15	SANDSTONE	F	D	50.0	48.0	5.87	1	2.50	H
BH06	9.15	SANDSTONE	F	A	52.0	40.0	4.97	1	1.90	H
BH06	10.05	SANDSTONE	F	D	50.0	48.0	5.02	1	2.14	H
BH06	10.05	SANDSTONE	F	A	52.0	39.0	5.84	1	2.28	H
BH06	11.05	SANDSTONE	F	D	50.0	48.0	4.88	1	2.08	H
BH06	11.05	SANDSTONE	F	A	52.0	41.0	5.77	1	2.17	H
BH06	12.05	SANDSTONE	F	D	50.0	48.0	5.61	1	2.39	H
BH06	12.05	SANDSTONE	F	A	52.0	40.0	7.60	1	2.91	H
BH06	13.05	SANDSTONE	F	D	50.0	48.0	5.16	1	2.20	H
BH06	13.05	SANDSTONE	F	A	52.0	43.0	5.54	1	2.00	H
BH06	14.05	SANDSTONE	F	D	50.0	49.0	5.05	1	2.08	H
BH06	14.05	SANDSTONE	F	A	52.0	45.0	5.63	1	1.97	H

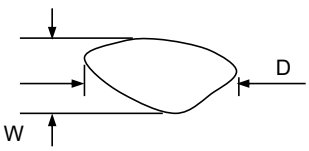
TEST TYPE :



W/D > 0.5
DIAMETRAL (D)



D/W = 0.3 - 1.0
AXIAL (A)



D/W = 0.3 - 1.0
IRREGULAR LUMP (I)

MOISTURE CONDITION :
Field (F), Saturated (S), Dry (D)

FAILURE TYPE :
1. Fracture through fabric of specimen oblique to bedding, not influenced by weak planes.
2. Fracture along bedding.
3. Fracture influenced by pre-existing joint plane (J), microfracture (M), vein (V), chemical alteration (C).
4. Chip or partial fracture.

NOTES For specimens tested parallel to plane of weakness $D_e^2 = D^2$
For specimens tested perpendicular to plane of weakness $D_e^2 = 4WD/\pi$

Soil and Rock Logging Explanatory Notes

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 borehole

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

IMPORTANT INFORMATION

morrow

Important Information

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

This Document has been prepared for the particular purpose outlined in Morrow Geotechnics' proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

The scope and the period of Morrow Geotechnics' Services are as described in Morrow Geotechnics' proposal, and are subject to restrictions and limitations. Morrow Geotechnics did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. The scope of services may have been limited by such factors as time, budget, site access or other site conditions. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Morrow Geotechnics in regards to it. Any advice given within this document is limited to geotechnical considerations only. Other constraints particular to the project, including but not limited to architectural, environment, heritage and planning matters may apply and should be assessed independently of this advice.

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.

In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Morrow Geotechnics' opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Morrow Geotechnics to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Morrow Geotechnics for incomplete or inaccurate data supplied by others.

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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