



Qualtest Geotechnical & Laboratory
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Rock Excavatability Report Geotechnical Investigation Proposed Residential Development Monarch Glen, ROL4 Flagstone

March 31, 2025

Presented To

Mirvac C/- Charlie Resolved

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Qualtest Laboratory

Est. 1987

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**Geotechnical Investigation
Proposed Residential Development
Monarch Glen, ROL4, Flagstone**

Rock Excavatability Report

Report Ref. No.: 8062 – 24-231

March 31, 2025

MIRVAC

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1 Introduction

Qualtest Geotechnical & Laboratory (Qualtest) was engaged by Charlie Resolved on behalf of Mirvac (**The Client**) to undertake a geotechnical site investigation at the proposed residential development known as Monarch Glen, near Flagstone Queensland.

The Monarch Glen Residential development, which is a master-planned community set to include some 7,300 dwellings, schools, shops and parklands, is located on the allotment with the real property description Lot 3 on RP 45236.

To progress the multi-lot residential subdivisions, this geotechnical investigation report was requested to inform the excavatability of the bedrock to about 10m depth, as well as provide other relevant geotechnical information.

The fieldwork was undertaken between February 17 and 24, 2025. The works were generally carried out in accordance with our fee proposal with reference QGQ24-152–5560 Rev C, dated February 10, 2025.

Qualtest's commission also included geotechnical assessments targeting the following aspects of the development which are presented under separate covers:

- Proposed Bio Retention Basins; and
- Proposed Trunk Sewer Line.

This report presents the results of the geotechnical core drilling investigation conducted to assess the excavation conditions of the bedrock with respect to the proposed development.

The approximate geographical location of the investigated property is shown in red per *Figure 1*.



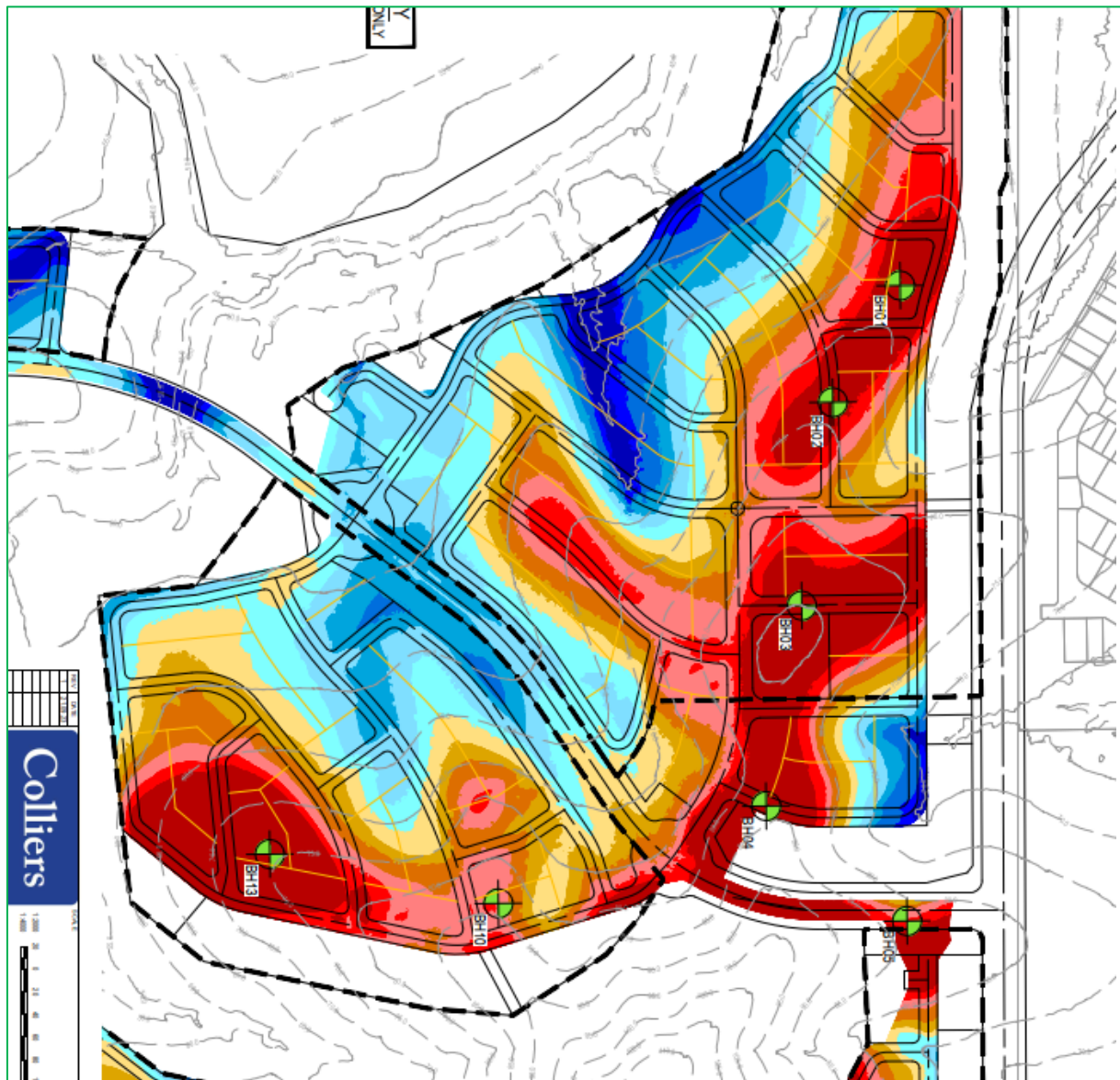
Figure 1: The Approximate Geographical Location of The Site Highlighted in Red

1.1 Proposed Development

It is understood that the site is proposed for a residential subdivision. Qualtest has not sighted detailed architectural/engineering drawings, however as is typical, it is expected that the development would include the following:

- Bulk earthworks to create relatively flat pads for the dwellings from cut and fill activities;
- Road and drainage works;
- Local recreational parks;
- Sewer/Water reticulation works;
- Retaining walls/structures;
- Stormwater networks;
- Water retention basins; and
- Soft and hard landscaping.

Figure 2 is an earthworks heat plan that shows the proposed layout for the future Monarch Glen subdivision.



1.2 Purpose

This report aims to present Mirvac and its partners with a geotechnical report addressing the scope of work per Section 1.3.

1.3 Scope of Work

Based on the geotechnical brief and subsequent correspondence with Charlie Resolved, the following scope of work was required:

- Drill seven (7) deep boreholes at Client-nominated locations across the site to 10m depths. Boreholes should be auger drilled to top of rock, and thereafter NLMC rock coring to nominated target depths;

Based on the above fieldwork, a geotechnical report is required to address the following :

- 1) A excavatability/rippability assessment, that includes the following
 - Depth to top of rock;
 - Rock type;
 - Rock defect – type and spacing;
 - Point load testing;
- 2) Other geotechnical advice on:
 - Excavation conditions for bulk earthworks cuts and trenching;
 - Suitability of site-won materials for use as structural fill and recommended material treatment including breakdown, crushing, etc.
 - Earthworks recommendations and material specifications;
 - Temporary safe batter/benching of the trenches;
 - Embedment recommendations for sewer and water services;
 - Preliminary subgrade CBR values;
 - Broadscale Site Classifications;
 - Broadscale Retaining Wall Design Parameters including angle of friction, cohesion, bulk Density and bearing pressures;
 - Erosion Hazard Assessment;
 - Log and visually classify the subsurface profile including;
 - Depth to Rock if encountered in the depth range of the test pits;
 - Groundwater levels if encountered; and
 - Break out particle size.

2 Methodology

2.1 Standards

This investigation has predominantly been undertaken in line with the following Australian Standards (AS):

- AS 1726:2017 – Geotechnical Site Investigations; and
- AS 4133.4.1-2007 – Methods of testing rocks for engineering purposes Rock strength tests - Determination of point load strength index;
- AS3798 – Guidelines on Earthworks for Commercial and Residential Developments;
- AS2870 – Residential Slabs and Footings; and

2.2 Literature Review

An initial literature review was undertaken before conducting the site investigation, covering the site's geology and geomorphology, a review of documents provided by Charlie Resolved/Mirvac, and a search for any other information that was publicly available.

2.2.1 Information Provided

The Client provided the following information to assist in preparing this report:

- Geotechnical Brief – Contained in an email received from Adam Porter, representing Charlie Resolved, dated 19/03/2024;
- Engineering Drawing – Constraints Map Working Plan, Homestead Drive, Flagstone - Prepared by Colliers Project No:22-0408-1002, undated; and
- Engineering Drawing – Constraints Map Sewer Plan, Homestead Drive, Flagstone - Prepared by Colliers Project No:22-0408-2000, undated.

2.2.2 Previous Reports

At the time of writing this report, Qualtest is unaware of any previous geotechnical report for the site.

2.2.3 Site Geology

The NationalMap Detailed Surface Geology map (1:100k) shows that the site is predominately underlain by the Gatton Sandstone (Jbmg) geological unit. This early Jurassic-era unit is reported to be an arenite-dominant unit containing Lithic Labile and feldspathic labile Sandstone.

An extract from the Detailed Surface Geology map showing the site is presented in *Figure 3*.

2.2.4 Site Description

The site is part of Mirvac's Monarch Glen development project, located near the suburb of Flagstone QLD within the Logan City Council area, approximately 38km from Brisbane's CBD.

At the time of the investigation, the site was generally noted to be well-vegetated by a dense forest with several tracks crisscrossing the area. The topography was generally recorded as gently to steeply sloping hills and valleys with occasional erosion gullies.

Photographs of the site showing the general conditions are provided in *Figures 4a & b*.

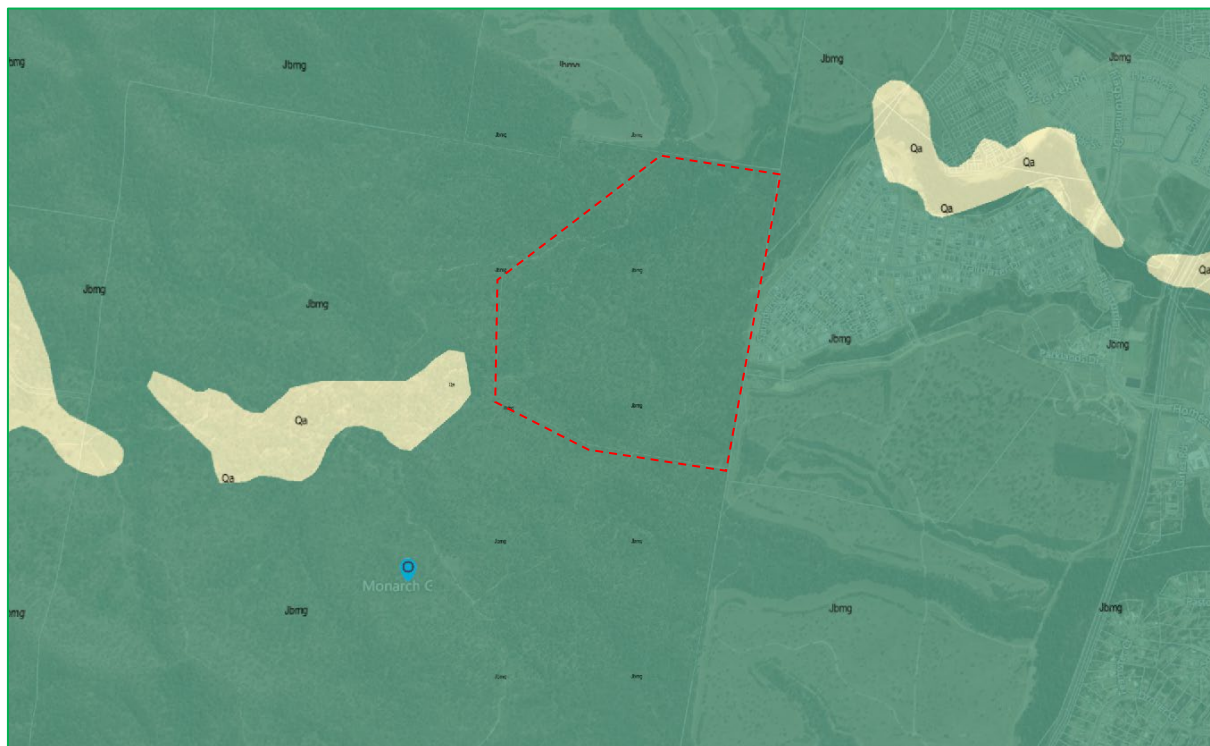


Figure 3: The Detailed Surface Geology of The Site – Approximate Site Boundaries Highlighted in Red





Figure 4a & b: Site Conditions on the Day of Investigation

2.3 Site Investigation

2.3.1 Geotechnical Investigation

The geotechnical investigation comprised a desktop study, fieldwork, and laboratory testing.

The Client engaged a contractor to set out the location of the boreholes, as well as to provide access tracks to each test location.

Seven (7) boreholes were drilled at Client-nominated locations across the site to a target depth of 10.0m. All boreholes were auger drilled to top of rock; thereafter NMLC rock coring technique was used to extend the boreholes to the termination depth.

The seven (7) geotechnical boreholes were designated – BH01 to BH07 and were drilled using a 12t Hydrapower Scout truck-mounted drill rig fitted with solid augers, wash-boring and rock coring capabilities. The boreholes were logged by Qualtest's Geotechnical Engineer per Australian Standard - AS1726-2017.

All boreholes were backfilled with spoil won from the drill cuttings.

Rock cores were boxed in core trays and photographed for future reference (Appendix A). The core trays were transported to Qualtest laboratory, where the rock cores were tested for strength using the point load test methods.

The location of the boreholes as drilled on the day of the investigation is illustrated in *Figure 5*, and the GPS locations are presented in *Table 1* which were acquired by a handheld GPS with an accuracy of about $\pm 4\text{m}$.



Figure 5: Site Plans Showing Test Locations

Table 1: Geographical Location of the Boreholes

BH ID	Zone	Easting (m)	Northing (m)	Drilled Depth (m)
BH01	56 J	493208	6924656	10.05
BH02	56 J	493137	6924566	10.15
BH03	56 J	493060	6924354	10.05
BH04	56 J	493000	6924117	10.00
BH05	56 J	493146	6924086	10.07
BH06	56 J	492714	6924142	10.06
BH07	56 J	492563	6924255	10.00

2.3.2 Subsurface Conditions

The detailed subsurface conditions encountered at the seven (7) boreholes are presented in the borehole logs attached as Appendix B.

In general, the typical subsurface profile consisted of silty sand as topsoil overlying a sandy clay residual layer, which in turn overlies a weathered rock. The depth to top of rock typically ranged between 0.4 to 0.8m. The rock has been described as sandstone and once encountered extended to the borehole termination depth.

The main layers in the subsurface profile are further described as follows:

Topsoil	Observed at all borehole locations and described as loose to medium dense silty sand. Typically, this layer extended down to a depth of between 0.1 to 0.3m bgl.
Residual Soils	Observed in all boreholes and described as stiff to very stiff sandy clay or medium dense clayey sand. The residual soil layer was generally found to be relatively thin, ranging in thickness from about 0.3m to 0.7m.
Weathered Sandstone Rock	Observed in all boreholes. Encountered as shallow as from about 0.3 bgl and extending to termination depths. The weathering of the rock generally decreased with increasing depth, with the rock becoming less weathered. The rock strength similarly varies with depth and has been recorded as very low to very high strength. The rock cores were slightly fractured to fractured, with defect spacings typically between 100mm and 1500mm.

2.3.3 Groundwater

Groundwater was not encountered in any of the seven (7) cored boreholes during the drilling operations. However, at depths greater than 1.5m, where auger drilling was replaced with NMLC water coring, Qualtest cannot ascertain the presence or otherwise of groundwater beyond such depth.

2.3.4 Geotechnical Model

A preliminary geotechnical model of the subsurface conditions encountered based on the boreholes is illustrated in *Table 2*.

Table 2: Preliminary Geotechnical Model Based on Borehole Profiles

BH ID	Topsoil (m)	Residual (m)	XW to HW Sandstone (m)	MW to Fresh Sandstone (m)
BH01	0.0 – 0.10	0.10 – 0.80	0.80 – 1.60	1.60 – 10.05
BH02	0.0 – 0.20	0.20 – 0.80	0.80 – 1.20	1.20 – 10.15
BH03	0.0 – 0.20	0.20 – 0.60	0.60 – 1.10	1.10 – 10.05
BH04	0.0 – 0.20	0.20 – 0.70	0.70 – 1.50	1.50 – 10.00
BH05	0.0 – 0.20	0.20 – 0.50	0.50 – 1.20	1.20 – 10.07
BH06	0.0 – 0.10	0.10 – 0.40	0.40 – 1.60	1.60 – 10.06
BH07	0.0 – 0.30	0.30 – 0.40	0.40 – 1.50	1.50 – 10.00
XW = extremely weathered, HW = highly weathered, MW = moderately weathered				

3 Laboratory Testing and Results

3.1 Point Load Test

Selected core samples were tested for strength using the Point Load Test (PLT) apparatus in accordance with Australian Standards (AS 4133.4.1-2007). Three axial and three diametric samples each were tested per borehole, making a total of 66 test samples.

The point load test (PLT) is an accepted rock mechanics testing procedure used to calculate a rock strength index. The rock strength determined by the PLT is an indication of intact rock strength and not necessarily the strength of the rock mass.

The PLT is an attractive alternative to the unconfined compressive strength (UCS) because it can provide similar data at a lower cost. The PLT has been used in geotechnical analysis for over thirty years (ISRM, 1985). The PLT involves compressing a rock sample between conical steel platens until failure occurs. The apparatus for this test consists of a rigid frame, two-point load platens, hydraulically activated ram, and a digital screen to record the failure pressure.

The International Society of Rock Mechanics (ISRM, 1985) has established the basic procedures for testing and calculation of the point load strength index. There are three basic types of point load tests: axial, diametral, and block or lump. This investigation carried out axial and diametral tests on core samples. In the axial test, the core is loaded parallel to the longitudinal axis of the core, and this test is most comparable to a UCS test.

The Point Load Test provides a Point Load Strength (Is) for different size samples, which is then corrected to a standard 50mm size equivalent, the Point Load Strength Index ($Is_{(50)}$), for comparison with other test results. A more conservative conversion factor of 22, as opposed to the traditional factor of 24, was used to convert ($Is_{(50)}$) to the unconfined compressive strength (UCS) of the rock.

The Point Load Strength Index laboratory test results are contained in *Appendix C* of this report and are summarised in *Table 3*.

Note: ST, SB, and P represent sample top, sample bottom, and maximum applied force at failure, respectively.

Table 3: Summary Results of Point Load Strength Index Test

Test #	BH ID	ST (m)	SB (SB)	Rock Type	Test Type	Ave. P Load (kN)	Ave. $Is_{(50)}$ MPa	UCS (MPa)
1	BH01	4.26	4.36	Sandstone	Diametral	2.74	1.10	24.11
2	BH01	4.33	4.36	Sandstone	Axial	4.19	2.06	45.43
3	BH01	4.67	4.78	Sandstone	Diametral	5.80	2.32	51.04
4	BH01	4.75	4.78	Sandstone	Axial	3.71	1.83	40.22
5	BH01	5.88	6.00	Sandstone	Diametral	1.95	0.78	17.16
6	BH01	5.96	6.00	Sandstone	Axial	3.01	1.19	26.11
7	BH01	6.90	7.00	Sandstone	Diametral	2.98	1.19	26.22
8	BH01	6.96	7.00	Sandstone	Axial	5.54	2.18	48.06
9	BH01	7.90	8.00	Sandstone	Diametral	2.94	1.18	25.87
10	BH01	7.96	8.00	Sandstone	Axial	2.99	1.18	25.94
11	BH01	8.00	8.10	Sandstone	Diametral	1.74	0.70	15.31
12	BH01	8.05	8.10	Sandstone	Axial	2.47	0.82	18.02
13	BH01	8.90	9.00	Sandstone	Diametral	2.50	1.00	22.00
14	BH01	8.96	9.00	Sandstone	Axial	4.79	1.89	41.55
15	BH01	10.13	10.23	Sandstone	Diametral	2.38	0.95	20.94
16	BH01	10.19	10.23	Sandstone	Axial	4.07	1.60	35.31
17	BH02	1.71	1.85	Sandstone	Diametral	3.92	1.57	34.50
18	BH02	1.82	1.85	Sandstone	Axial	6.13	3.02	66.46
19	BH02	2.00	2.10	Sandstone	Diametral	3.88	1.55	34.14
20	BH02	2.07	2.10	Sandstone	Axial	3.87	1.91	41.96
21	BH02	3.90	4.00	Sandstone	Diametral	2.34	0.94	20.59
22	BH02	3.96	4.00	Sandstone	Axial	3.25	1.28	28.19
23	BH02	4.90	5.00	Sandstone	Diametral	2.36	0.94	20.77
24	BH02	4.97	5.00	Sandstone	Axial	3.11	1.53	33.72
25	BH02	6.00	6.12	Sandstone	Diametral	5.43	2.17	47.78

Test #	BH ID	ST (m)	SB (SB)	Rock Type	Test Type	Ave. P Load (kN)	Ave. Is(50) MPa	UCS (MPa)
26	BH02	6.09	6.12	Sandstone	Axial	4.61	2.27	49.98
27	BH02	8.90	9.00	Sandstone	Diametral	6.19	2.48	54.47
28	BH02	8.96	9.00	Sandstone	Axial	9.01	3.55	78.16
29	BH02	10.00	10.15	Sandstone	Diametral	1.46	0.58	12.85
30	BH02	10.11	10.15	Sandstone	Axial	4.25	1.68	36.87
31	BH03	1.31	1.41	Sandstone	Diametral	1.37	0.55	12.06
32	BH03	1.38	1.41	Sandstone	Axial	0.87	0.43	9.43
33	BH03	2.30	2.40	Sandstone	Diametral	4.07	1.63	35.82
34	BH03	2.36	2.40	Sandstone	Axial	4.87	1.92	42.25
35	BH03	3.39	3.51	Sandstone	Diametral	5.83	2.33	51.30
36	BH03	3.47	3.51	Sandstone	Axial	5.45	2.15	47.28
37	BH03	4.40	4.51	Sandstone	Diametral	3.72	1.49	32.74
38	BH03	4.47	4.51	Sandstone	Axial	6.36	2.51	55.17
39	BH03	5.90	6.00	Sandstone	Diametral	2.87	1.15	25.26
40	BH03	5.96	6.00	Sandstone	Axial	4.05	1.60	35.13
41	BH03	8.87	9.00	Sandstone	Diametral	1.87	0.75	16.46
42	BH03	8.96	9.00	Sandstone	Axial	3.93	1.55	34.09
43	BH03	9.80	9.91	Sandstone	Diametral	2.21	0.88	19.45
44	BH03	9.87	9.91	Sandstone	Axial	5.65	2.23	49.02
45	BH04	3.79	3.92	Sandstone	Diametral	1.10	0.44	9.68
46	BH04	3.88	3.92	Sandstone	Axial	2.23	0.88	19.35
47	BH04	4.40	4.50	Sandstone	Diametral	4.14	1.66	36.43
48	BH04	4.46	4.50	Sandstone	Axial	6.48	2.56	56.22
49	BH04	7.00	7.10	Sandstone	Diametral	2.80	1.12	24.64
50	BH04	7.06	7.10	Sandstone	Axial	3.59	1.42	31.14
51	BH04	7.60	7.70	Sandstone	Diametral	3.34	1.34	29.39
52	BH04	7.66	7.70	Sandstone	Axial	4.24	1.67	36.78
53	BH04	8.00	8.12	Sandstone	Diametral	3.71	1.48	32.65
54	BH04	8.08	8.12	Sandstone	Axial	4.60	1.81	39.91
55	BH04	8.69	8.82	Sandstone	Diametral	5.00	2.00	44.00
56	BH04	8.78	8.82	Sandstone	Axial	6.84	2.70	59.34
57	BH04	9.32	9.42	Sandstone	Diametral	3.79	1.52	33.35
58	BH04	9.38	9.42	Sandstone	Axial	3.43	1.35	29.76
59	BH05	1.41	1.51	Sandstone	Diametral	6.08	2.43	42.94
60	BH05	1.48	1.51	Sandstone	Axial	6.68	3.29	88.14
61	BH05	5.90	6.00	Sandstone	Diametral	2.92	1.17	56.58
62	BH05	5.96	6.00	Sandstone	Axial	5.03	1.98	110.05
63	BH05	6.90	7.00	Sandstone	Diametral	4.16	1.66	32.38
64	BH05	6.96	7.00	Sandstone	Axial	5.65	2.23	69.32
65	BH05	8.60	8.70	Sandstone	Diametral	5.33	2.13	45.23
66	BH05	8.65	8.70	Sandstone	Axial	5.36	1.78	59.77
67	BH05	8.71	8.81	Sandstone	Diametral	3.78	1.51	35.38
68	BH05	8.78	8.81	Sandstone	Axial	8.05	3.97	49.28
69	BH05	9.00	9.10	Sandstone	Diametral	1.87	0.75	24.55
70	BH05	9.06	9.10	Sandstone	Axial	3.83	1.51	46.15
71	BH05	10.00	10.10	Sandstone	Diametral	1.15	0.46	46.38
72	BH05	10.06	10.10	Sandstone	Axial	3.41	1.34	72.00
73	BH06	4.89	5.00	Sandstone	Diametral	4.88	1.95	42.94
74	BH06	4.96	5.00	Sandstone	Axial	10.16	4.01	88.14
75	BH06	5.00	5.12	Sandstone	Diametral	6.43	2.57	56.58
76	BH06	5.09	5.12	Sandstone	Axial	10.15	5.00	110.05
77	BH06	5.88	6.00	Sandstone	Diametral	3.68	1.47	32.38
78	BH06	5.96	6.00	Sandstone	Axial	7.99	3.15	69.32
79	BH06	6.85	6.95	Sandstone	Diametral	5.14	2.06	45.23
80	BH06	6.91	6.95	Sandstone	Axial	6.89	2.72	59.77
81	BH06	7.90	8.00	Sandstone	Diametral	4.02	1.61	35.38
82	BH06	7.96	8.00	Sandstone	Axial	5.68	2.24	49.28

Test #	BH ID	ST (m)	SB (SB)	Rock Type	Test Type	Ave. P Load (kN)	Ave. Is(50) MPa	UCS (MPa)
83	BH06	8.21	8.34	Sandstone	Diametral	2.79	1.12	24.55
84	BH06	8.30	8.34	Sandstone	Axial	5.32	2.10	46.15
85	BH06	9.90	10.00	Sandstone	Diametral	5.27	2.11	46.38
86	BH06	9.96	10.00	Sandstone	Axial	8.30	3.27	72.00
87	BH07	3.85	3.98	Sandstone	Diametral	3.34	1.34	29.39
88	BH07	3.94	3.98	Sandstone	Axial	5.38	2.12	46.67
89	BH07	4.90	5.00	Sandstone	Diametral	2.00	0.80	17.60
90	BH07	4.96	5.00	Sandstone	Axial	3.28	1.29	28.45
91	BH07	5.90	6.00	Sandstone	Diametral	5.01	2.00	44.09
92	BH07	5.96	6.00	Sandstone	Axial	6.72	2.65	58.30
93	BH07	6.90	7.00	Sandstone	Diametral	4.71	1.88	41.45
94	BH07	6.96	7.00	Sandstone	Axial	6.31	2.49	54.74
95	BH07	7.90	8.00	Sandstone	Diametral	3.54	1.42	31.15
96	BH07	7.96	8.00	Sandstone	Axial	5.72	2.26	49.62
97	BH07	8.09	8.20	Sandstone	Diametral	2.74	1.10	24.11
98	BH07	8.16	8.20	Sandstone	Axial	4.07	1.60	35.31
99	BH07	9.65	9.81	Sandstone	Diametral	3.25	1.30	28.60
100	BH07	9.78	9.81	Sandstone	Axial	5.43	2.68	58.87

3.2 Point Load Strength vs Uniaxial Compressive Strength (UCS) Test

In this assessment, Point Load Strength Tests (axial and diametral) were carried out on 100 samples. While no UCS testing was conducted for this project, studies (for example Bieniawski, 1975; Broch and Franklin, 1972) that have been conducted on hard, strong rocks, have developed a relationship between UCS and the point load strength. This could be expressed as:

$$UCS = (k) I_{s(50)} = 24 I_{s(50)}$$

Where k is the "conversion factor." Subsequent studies found that K=24 was not as universal as had been hoped and that instead there appeared to be a broad range of conversion factors with most estimates between 16 and 24, with even lower values for some shales and mudstones.

Based on our experience with similar materials, and for the purposes of this investigation, a conversion factor (k) of 22 has been adopted. The converted values of UCS Vs depth have been plotted in *Figure 6*.

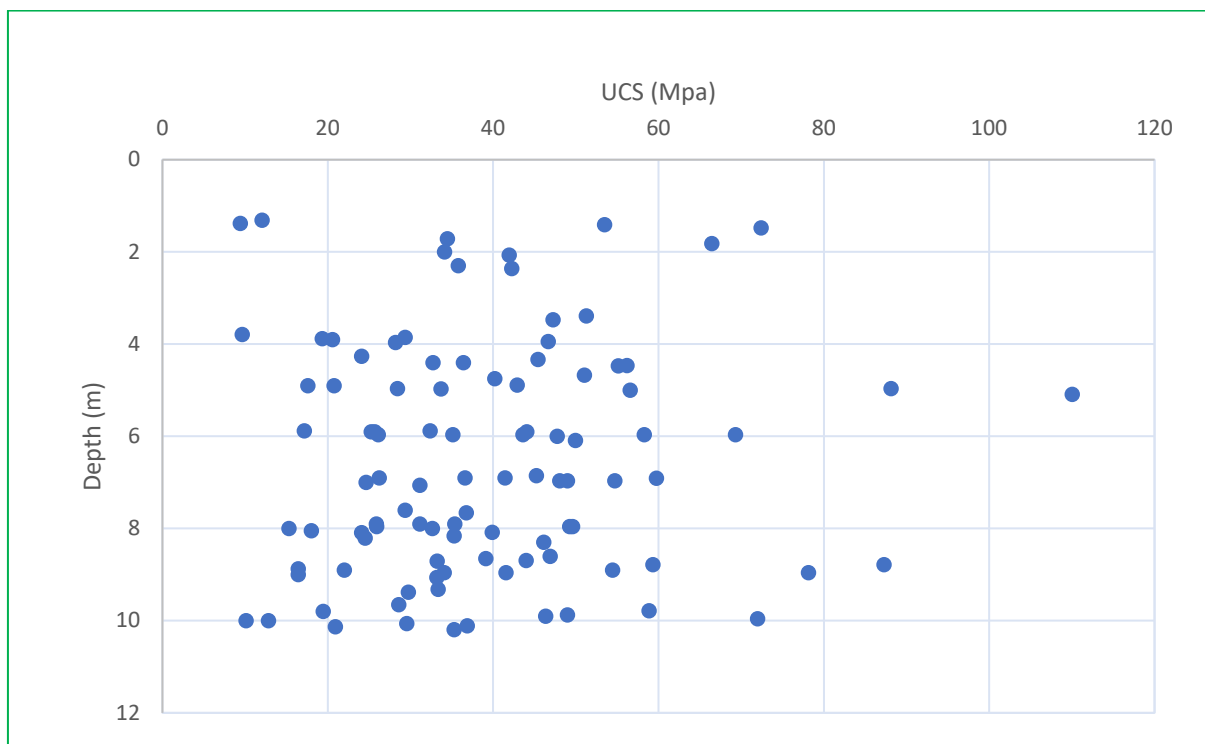


Figure 6: UCS Based on Point Load data) vs depth

4 Geotechnical Engineering Assessment

4.1 Depth to Rock/Thickness of Overburden

Depth to top of rock varied across the site – ranging from 0.4m to 1.10m. With increasing depths across the site, the 12t Hydrapower Scout truck-mounted rig refused by exhibiting very slow progress, indicative of the presence of at least moderately weathered rock.

The overburden thickness varies between 1.1 to about 1.6m, consisting of clayey sands/sandy clays of residual origin and extremely/highly weathered sandstone rock.

4.2 Rock Type/Strength

The bedrock encountered onsite was described as sedimentary Gatton sandstone formed during the Early Jurassic Age. The lithological summary consists of lithic labile and feldspathic labile sandstone.

The strength of the sandstone bedrock was described as low strength to high, with very high strength in accordance with the AS1726 per *Table 5*, based on UCS and $I_{s(50)}$ test results.

Table 4: Rock Material Strength Classification (after AS1726)

Term	Abbreviation	Uniaxial compressive strength (see Note 1 and Note 2) MPa	Guide to strength	
			Point load strength index $I_{s(50)}$ (see Note 3) MPa	Field assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	more than 200	more than 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

4.3 Excavatability Assessment

4.3.1 Franklin et al., (1971)

The excavatability of the encountered sandstone bedrock was assessed based on the method suggested by Franklin et al. (1971) with updates from Walton and Wong (1993). They proposed *Table 5* as appropriate for the excavatability assessment of rocks. They posited that "blast to loosen" can be approximately equated to "using a rock breaker". This assessment scheme was developed with point load test data.

Table 5: Excavatability Assessment (after Franklin, 1971)

Parameter	Easy Digging	Marginal Digging without Blasting	Using a Rock Breaker	Blast to Fracture
Strength, $I_s(50)$ (MPa)	< 0.1	< 0.3	> 0.3	
Discontinuity Spacing (m)	< 0.02	< 0.06	0.2 to 0.6	> 0.6
RQD (%)	< 10	< 90	> 90	

However, the assessment scheme by Franklin et al. (1971) does not provide an upper limit for the "Using a Rock Breaker"; hence, this does not provide a very useful assessment outcome as over 100% of the $I_s(50)$ strength determined were greater than 0.3MPa for the Gatton sandstone bedrock.

4.3.2 Bell (1992)

The excavatability of the encountered sandstone bedrock was also assessed based on the method suggested by Bell (1992). Bell proposed a relationship between unconfined compressive strength (UCS), joint spacing, and excavation characteristics. Bell (1992) posited *Table 6* for the excavatability characteristics based on rock hardness and strength.

Table 6: Excavation Characteristics (after Bell, 1992)

Rock Hardness Description	UCS (MPa)	Spacing of Joints (mm)	Excavation Characteristics
Very Soft	1.7 – 3.0	< 50	Easy Ripping
Soft	3.0 - 10	50 - 300	Hard Ripping
Hard	10 - 20	300 - 1000	Very Hard Ripping
Very Hard	20 - 70	1000 - 3000	Extremely Hard Ripping or Blasting
Extremely Hard	> 70	> 3000	Blasting
UCS = Unconfined compressive strength			

Using a conversion factor of 22, the $I_s(50)$ strength values were converted to UCS (MPa) for the sandstone bedrock. The estimated UCS values varied between 9.68 to 110.04 MPa (*Table 4* above), indicative of the presence of low to extremely high strength rock.

Based on Bell's classification scheme, bulk excavations within the planned depth range are likely to be within the limits of small to large earthworks plants, including Cat D6 to D11 dozers and 40t excavators, necessitated by the near flat joints and bedding planes.

4.3.3 Pettifer and Fookes (1994)

The excavability classification system suggested by Pettifer and Fookes (1994) was used in this investigation, with the $Is_{(50)}$ results superimposed on the chart per Figure 7 and has been based on the horizontal defect spacings as measured in the rock cores from each borehole.

The results indicate that the site will require traditional excavators, backhoes, and D11 or D9 with hydraulic breakers for effective excavability of the sandstone bedrock, depending on the degree of rock weathering.

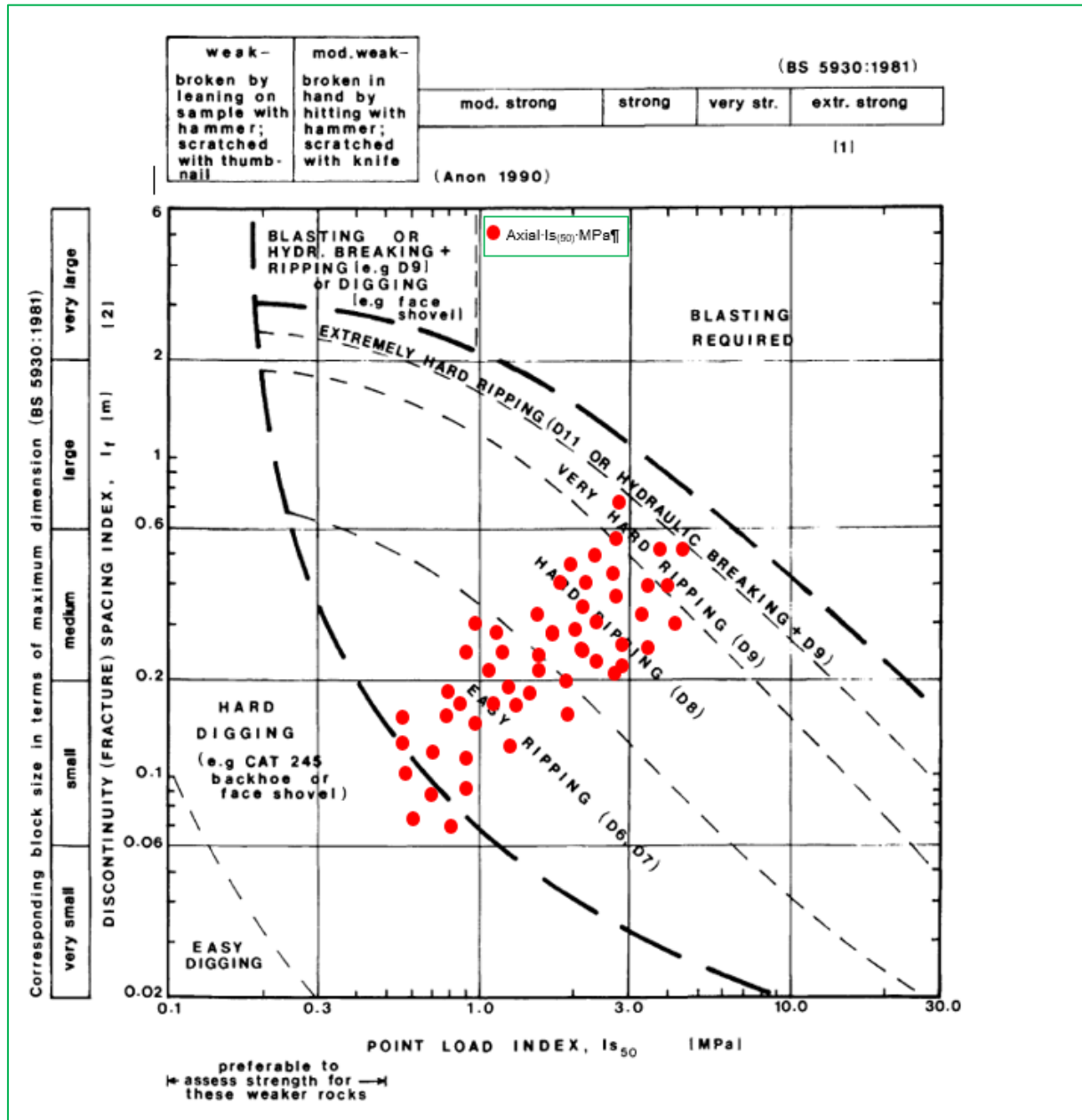


Figure 7: Excavability Evaluation of Encountered Sandstone Bedrock

5 Excavation Conditions

Excavation conditions have been categorised into the following:

- Topsoil and Residual Soils
- Extremely to Highly Weathered Sandstone Rock
- Moderately Weathered to Fresh Sandstone Rock.

5.1 Excavation Conditions - Topsoil and Residual Soils.

Excavation of the topsoil and residual soils to depths ranging from approximately 0.0 to generally 1.1m across the site will likely be within the limits of traditional small-sized excavators, e.g., 8t excavators fitted with general-purpose tooth buckets or backhoes in open trench conditions.

5.2 Excavation Conditions - Extremely to Highly Weathered Rock

Excavation of the extremely to highly weathered sandstone rock underneath the residual soils or topsoil to depths ranging between 0.7 to and 1.6m is likely to require tiger tooth buckets fitted to 14t excavator in open and trench conditions.

5.3 Excavation Conditions - Moderately Weathered to Fresh Rock

Excavation of the moderately weathered to fresh sandstone rock will require large excavators, e.g., 40t+ excavators fitted with ripper and hammer attachments in open and trench conditions, and large dozers, e.g., Cat D6 – 9 Dozers. However, taking into account the horizontal defect angles encountered, some sections may require a Cat D9 Dozer fitted with hydraulic breakers.

Break-out particle size using large dozers may correspond to the defect spacing of the rock. On this basis, break-out particles may range between 0.5m and 3.0m in size. Management of the particle size will be required following excavation if it is to be used as a backfill. Resizing of rock break-outs can be achieved through hammering and crushing. However, hammering and crushing are not likely to produce fines at a proportion that can be considered suitable for earthworks filling operations.

5.4 Depth/Thickness of Winnable Materials

Depth/thickness of winnable materials with traditional equipment such as backhoes and 8t excavator fitted with a toothed bucket will vary from 0.1 – 1.6m below ground surface.

5.5 Depth/Thickness of Rippable Materials

The majority of the sandstone rock falls within this category of excavatability. It is expected that from 1.1 to 10.0m bgl, the encountered rock can be ripped with Cat D6 – 9 Dozers.

5.6 Depth/Thickness of Blasting to Loosen

It is most likely that some sections of the rippable materials may require a Cat D9 Dozer fitted with hydraulic breakers to loosen the rock. The depth of these locations may vary across the site. For example, hydraulic rippability with a Cat D9 Dozer may be required in BH02 (1.0 – 10.0m bgl), BH05 (1.0 – 8.8m bgl), and BH06 (1.0 – 7.0m bgl).

On the basis of the analysed rock strength with depth and the fact that the site is remote, Qualtest suggests a blast-to-loosen technique as the most efficient for the sandstone bedrock.

6 Excavatability Discussions

In this investigation, axial and diametric testing of the sandstone rock core was conducted to estimate the excavatability of the parent bedrock. In the axial test, the core is loaded parallel to the longitudinal axis of the core, and this test is most comparable to a UCS test. Therefore, the excavatability of the sandstone bedrock was based on the axially loaded strength values.

The excavatability assessment concluded that the upper soils (topsoil/residual soils) could be excavated with traditional equipment such as backhoes and 8t excavators fitted with a toothed bucket. For the extremely to highly weathered sandstone rock, excavatability can be achieved with larger equipment such as a 14t excavator with toothed buckets. Cat D6 – 9 has been recommended for the moderately weathered sandstone to fresh rock onsite and with the use of D9 fitted with hydraulic breakers in some localities. However, for efficient excavatability conditions, Qualtest recommends the blasting technique.

It should be noted that boreholes were drilled about 50 to 150m apart, and the excavatability estimates are based only on materials encountered at the test locations. Therefore, excavatability conditions may prove more difficult or easier between borehole intervals.

This assessment must be considered a broad guide as many factors influence excavatability, including plant condition, operator expertise, etc. Intending contractors should inspect core samples prior to selecting their preferred excavation techniques for the project.

Generally, excavatability to nominated depths onsite will be achieved through hard digging to very hard ripping techniques. The difficulty in excavation could be associated with the near horizontal joints and bedding planes. An experienced equipment operator will ease the difficulty of excavating to the desired depth by appropriately positioning excavators or dozers in line with the dip direction if excavatability is to be achieved with excavators/dozers.

7 Other Geotechnical Advice

7.1 Allowable Bearing Pressures

Based on the encountered subsurface materials, Qualtest recommends the following allowable bearing pressures:

- Engineered Fill (Site Won) = 100kPa
- Residual Soils / XW / HW Rock = 250kPa
- Moderately Weathered (MW) Rock = 500kPa
- Slight Weathered (SW) to Fresh Rock = 1500kPa

7.2 Native soil Modulus

The native soil modulus is an elastic soil parameter and a measure of soil stiffness. It is defined as the ratio of the stress along an axis over the strain along that axis in the range of elastic soil behaviour.

Recommended values of modulus for the encountered materials are presented in *Table 7*. These recommendations have been based on an assessment of the material types (soil/rock) encountered as well as published correlations with SPT data.

Table 7: Recommended Native Modulus for Encountered Materials

Material	Young's (Native) Modulus (MPa)
Controlled Fill	2
Residual Soils/Extremely Weathered Rock (Stiff or Better)	10
≥ Moderately Weathered Rock	50

7.3 Temporary and Permanent Safe Batters

Temporary or short-term batters can be constructed to the gradients presented in *Table 8*. The short-term period is deemed to be no longer than 4 weeks, and following wet weather (rainfall), the short-term batter slopes would need to be reassessed for stability.

Temporary batters exceeding 3.0m in height will require horizontal benching at 3.0m vertical intervals. The benches should be at least 1.5m wide.

Further assessment of the batter angles may be required once the exact geometry and materials have been finalised.

Table 8: Recommendations for Cut and Fill Batters

Material	Short term	Long Term
Controlled Fill	18° (1V:3H)	14° (1V:4H)
Residual Soils/Extremely Weathered Rock (Stiff or Better)	27° (1V:2H)	18° (1V:3H)
≥ Moderately Weathered Rock	60° (1V:0.5H)	45° (1V:1H)

7.4 Effective Friction Angle and Cohesion

The internal friction angle of the existing materials with a plasticity index of about 19% was determined using graphical correlations proposed by Ladd et al. (1977) and Bjerrum and Simons (1960). As shown in *Table 9*, the cohesion values were then estimated based on the friction angles and guided by AS4678-2002.

Table 9: Recommended Geotechnical Material Design Parameters

Material	Geotechnical Design Parameters						
	Maximum Dry Density (t/m ³)	Bulk Density (t/m ³)	Drained Cohesion (kPa)	Angle of Friction (°)	ko	ka	kp
Residual Soils / XW / HW Sandstone (0.3 – 2m bgl)	1.8	1.9	5	28	0.53	0.36	2.77
≥ MW Sandstone or Better (>2.0m)	2.0	2.1	15	35	0.43	0.27	3.69

7.5 Bulking Factor

The bulking factor is the ratio or percentage of the volume change of excavated material to the volume of the original volume before excavation.

Bulking occurs when soil is excavated. One cubic metre of insitu material expands and does not always translate into one cubic metre of fill when placed and compacted on the site. Bulking can significantly affect the balance of cut and fill volumes and, hence, the cost of the earthworks.

Excavation increases the volume of material. It is, therefore, necessary to use a bulking factor to determine the volume of material that will be created by excavation. The bulking factor is defined as:

$$\text{Bulking Factor} = \frac{\text{Volume after Excavation}}{\text{Volume before Excavation}}$$

Based on experience, engineering judgement, laboratory demonstrations, and published typical values (Look, 2014), *Table 10* provides estimated bulking factors for the material types encountered on the site.

Table 10: Bulking Factors

Material	Bulking Factor for Transportation
Residual Clay / Extremely Weathered Sandstone	1.30
≥ Moderately Weathered Sandstone	1.60

Typical wastage of approximately 5% by volume may be adopted.

7.6 Earthwork Recommendations

All earthwork procedures should be carried out in a responsible manner in accordance with AS.3798-2007 “Guidelines on Earthworks for Commercial and Residential Developments”. The earthworks contractor should familiarise themselves with the site conditions.

Given the subsurface profile encountered on site and taking into consideration the proposed earthworks operations, the following geotechnical comments are provided:

7.6.1 Stripping Depths

Topsoil was encountered at all borehole/test pit locations. Based on the observed subsurface profile across the basins’ footprints, topsoil thickness is expected to vary from 0.1 to about 0.3m.

The topsoil should be removed and stockpiled for future use.

7.6.2 Reuse of Materials

Reuse of the site materials, including the existing fill is permitted, provided the materials are placed under a Level 1 supervision and testing program, and do not contain topsoil, organics and other deleterious materials.

However, the use of these site-won materials as fill (say dam embankment) may be placing dispersive soils and, therefore, treatment of the upper 0.3m layer should be considered.

7.6.3 Trafficability

At the time of the field investigation, trafficability was considered to be fair due to dry weather conditions. However, water-softened upper soils should be expected with persistent rain events, resulting in poor trafficability conditions following clearing and grubbing, including the unpaved access road leading to the site. Gravel surfacing of this road should be considered prior to the commencement of work.

Maintaining adequate drainage conditions is also essential. It should be ensured that runoff is diverted away from the construction areas to prevent the ponding of water.

7.6.4 Subgrade Preparation and Compaction Standards

All earthworks should be carried out by experienced contractors in general accordance with AS3798-2007 (Guidelines on Earthworks for Commercial and Residential Developments). Quality control of the Earthworks should be carried out under Level One Inspection and Testing as defined in AS3798 Section 8 by Qualtest Laboratory.

Materials won from cuts are suitable for use as controlled fill. Materials won from cuts are likely to be residual soils and weathered sandstone.

The following earthworks procedures can be considered by the Civil Engineer and Earthworks Contractor:

- Clearing, grubbing, and stripping should be carried out in stages to minimise exposure to the highly dispersive soils;
- Remove topsoil and stockpile for future use;
- All fill should be placed in thin layers (200mm max Loose) and compacted to a density ratio of 98% for basin embankments, Standard at moisture contents of OMC +/- 2%. However, for 5.0m fill depths (or greater), materials should be compacted at 100%. Each fill layer is to be keyed into existing slopes if applicable;
- Particular attention to the maximum particle size is required. Ideally, the maximum particle size should be limited to 150mm and be well-graded. Rock fragments unable to be broken down during placement and compaction are to be removed from the fill area;
- Testing of the placed and compacted fill should be carried out at frequencies defined in AS3798 Table 8.1 for Type 1 Earthworks; and
- The exposed base of the basins if within soil must be rolled to seal any cracks. If terminated on rock, a capping layer should be used on the rock surface.

7.7 Preliminary subgrade CBR values

No CBR testing was conducted as part of this investigation. Based on the materials encountered in the boreholes, it is likely that materials exposed at the subgrade level would include controlled fill, residual sandy clay or lay sand and weathered rock. To allow for variability in the site materials a preliminary CBR value of 3% can be adopted for preliminary pavement design.

It is recommended that CBR testing be commissioned at a later date to obtain site-specific information and therefore increase the reliability of the geotechnical data at hand.

7.8 Broadscale Site Classification

To determine the broadscale soil classification, a number of site features are considered, including the subsurface profile, the surface topography, existing vegetation, and the proposed development. Given the quantum of site modification planned, including the likely removal of existing shrubs/established trees, the site is assigned a broadscale **Class P** Site as per AS2870-2011, Clause 1.3.3 (b), (c), and (d).

Potential ground movement of between 0 to 40mm, corresponding to Class S to Class M movements, can be expected based on the materials likely to be exposed at the subgrade level. Again, site-specific testing would improve the reliability of these estimates.

The potential ground surface movements are subject to change when:

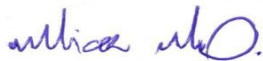
- Cut-to-fill or imported earthworks operations are carried out;
- Abnormal site soil moisture conditions are allowed to develop; and
- Tree planting is carried out, or existing trees are removed on or adjacent to the site

8 Disclaimer

This report has been prepared on behalf of and for the exclusive use of Mirvac and its partners per the scope of work outlined in Proposal QGQ24-152 – 5560 Rev C, dated February 10, 2025. This report is not intended for and should not be relied upon by any third party. In preparing this report, Qualtest relied upon information provided by Mirvac. This report, or sections from this report, should not be used as part of a specification for the project without review and agreement by Qualtest.

Interpretations and recommendations provided in the report are based on the ground conditions at the site, only at the specific test locations, and then only to the depths investigated and at the time the work was carried out. This is because ground conditions are subject to change from place to place and with time due to geological processes and/or because of human influences. The advice provided by Qualtest is based on the conditions encountered at the borehole locations and may not be applicable to other portions of the site.

Should you require further information regarding the above, please do not hesitate to contact this office.
Yours faithfully,



MICHAEL MORRISON

For and on behalf of

QUALTEST LABORATORY PTY LTD



DENNIS ALAZIGHA, RPEQ 22169

Appendix A: Core Photographs

Appendix B: Engineering Logs

Appendix C: Laboratory Test Certificates

9 References

AS 1726: 2017 – Geotechnical Site Investigations.

AS 4133.4.1-2007 – Methods of testing rocks for engineering purposes Rock strength tests – Determination of point load strength index.

Bell, F.G., (1992). "Open excavation in rock masses" Chapter 21 in Engineering in Rock Masses edited by FG Bell, Butterworth Heinemann.

Franklin, J.A., Broch, E., Walton, G., (1971). Logging the mechanical character of rock. Transactions of the Institut. Min. Metallurgy. 80: A1-9.

ISRM. International Society of Rock Mechanics Commission on Testing Methods, Suggested Method for Determining Point Load Strength, Int. J. Rock Mech. Min. Sci. and Geomech. Abstr. 22, 1985, p.51-60.

Pettifer, G.S., Fookes, P.G., (1994). A revision of the graphical method for assessing the excavability of rock. Q J Eng Geol 27:145–164.

Appendix A: Core Photographs

PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH01	CLIENT: Mirvac
DEPTH	1.6 – 10.05m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH02	CLIENT: Mirvac
DEPTH	1.2 – 10.15m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH03	CLIENT: Mirvac
DEPTH	1.1 – 10.05m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH04	CLIENT: Mirvac
DEPTH	1.5 – 10.01m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH05	CLIENT: Mirvac
DEPTH	1.2 – 10.07m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH06	CLIENT: Mirvac
DEPTH	1.6 – 10.06m	



PROJECT Geotechnical Site Investigation – Monarch Glen Development		
PROJECT No :	24 - 231	DATE: 21/02/25
BOREHOLE No:	BH07	CLIENT: Mirvac
DEPTH	1.5 – 10.0m	



Appendix B: Engineering Logs

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493208.54	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924655.70	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 21/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.1	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, grey, dry.	L-MD			
		0.8	Residual		SC		Clayey SAND: fine to medium grained, medium dense, brown, low to medium plasticity clay.	MD			
		1	Rock		SST	D	Silty SAND: fine to coarse grained, dense to very dense, brown.	D-VD			
		1.6					Commenced Coring at 1.6m		SPT Sample: no sample recovered	30/100mm, 0/mm, 0/mm (N=>50)	

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493208.54	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924655.70	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 21/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1											
							Commenced Coring at 1.6m									
NMLC	TCR = 100%	RQD = 22.56%			2		SANDSTONE: fine to medium grained, brown mottled grey, low strength.	HW								P BPI, PL, RO, STN, OP BPI, PL, RO, STN, OP BPI, PL, RO, STN, OP J, 2°, PL, RO, STN, OP J, CV, RO, STN, OP J, 5°, PL, RO, STN, OP J, 50°, UN, RO, VN, C BPI, PL, RO, STN, C J, 5°, PL, VN, C BPI, 2°, PL, RO, STN, C BPI, PL, RO, STN, C BPI, PL, RO, STN, C J, 40°, PL, RO, STN, C J, 60°, UN, RO, VN, J, 65°, UN, RO, STN, XWS
					3											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff Vst - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J
Easting (m) : 493208.54
Northing (m) : 6924655.70
Ground Elevation : Not Surveyed
Total Depth : 10.05 m BGL

Drill Rig : Hydrapower scout
Driller Supplier : Applied Geotech Drilling
Logged By : KD
Reviewed By : DA
Date : 21/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS				EHS

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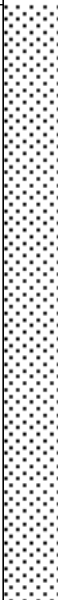
METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER Water Level on Date Water inflow Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J
Easting (m) : 493208.54
Northing (m) : 6924655.70
Ground Elevation : Not Surveyed
Total Depth : 10.05 m BGL

Drill Rig : Hydrapower scout
Driller Supplier : Applied Geotech Drilling
Logged By : KD
Reviewed By : DA
Date : 21/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		30	100
NMLC	TCR = 100%	RQD = 93.33%			9		SANDSTONE: fine to medium grained, grey, high strength, with minor coal seams .	SW-F									J, IR, RO, STN, C J, STP, RO, STN, OP J, 8°, PL, RO, STN, OP J, 8°, PL, RO, CT, I J, 5°, UN, VR, VN, I
					10		BH01 Terminated at 10.05m										

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493137.45	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924566.34	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.15 m BGL	Date : 21/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, grey, dry.	L-MD			
			Residual		CI	w < PL	Sandy CLAY: medium plasticity, stiff to very stiff, brown, medium grained sand, w < pl.	St-VSt			
		0.8									
		1	Rock		SST		Silty SAND: fine to medium grained, dense, brown.	D			
		1.1									
		1.2	Rock		SST		SANDSTONE: fine to medium grained, grey mottled brown, medium to high strength.	MS-HS			Auger refusal at 1.1
Commenced Coring at 1.2m											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J
Easting (m) : 493137.45
Northing (m) : 6924566.34
Ground Elevation : Not Surveyed
Total Depth : 10.15 m BGL

Drill Rig : Hydrapower scout
Driller Supplier : Applied Geotech Drilling
Logged By : KD
Reviewed By : DA
Date : 21/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1		Commenced Coring at 1.2m									
NMLC	TCR = 100%	RQD = 92.86%			2		SANDSTONE: fine to medium grained, grey mottled brown, medium to high strength.									
					3											

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER Water Level on Date Water inflow Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydrapower scout	Job Number : 24-231
Easting (m) : 493137.45	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924566.34	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.15 m BGL	Date : 21/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
↑ NMLC ↓	TCR = 100%	RQD = 90.61%			5		SANDSTONE: fine to medium grained, grey mottled brown, medium to high strength.									
					6											
					7											
	TCR = 100%	RQD = 88.24%														

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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UTM : 56J
Easting (m) : 493137.45
Northing (m) : 6924566.34
Ground Elevation : Not Surveyed
Total Depth : 10.15 m BGL

Drill Rig : Hydrapower scout
Driller Supplier : Applied Geotech Drilling
Logged By : KD
Reviewed By : DA
Date : 21/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC 	TCR = 100%	RQD = 88.24%			9 10		SANDSTONE: fine to medium grained, grey mottled brown, medium to high strength.							Run 3	J, 25°, UN, RO, STN, C J, 5°, CV, RO, STN, C J, 20°, STP, RO, CL, C IS, 80°, UN, RO, Quartz infill J, 15°, PL, RO, STN, OP	
							BH02 Terminated at 10.15m									

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493060.30	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924354.20	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 24/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, dark grey, dry, with rootlets.	MD			
		0.6	Residual		SC	D	Clayey SAND: fine to medium grained, medium dense, grey, dry, low plasticity clay.	MD			
		0.9	Rock		SST	D	Silty SAND: fine to medium grained, very dense, grey, dry.	VD			
		1.1	Rock		SST	D	As above but fine to medium grained, brown grey, low to medium strength, auger refusal.	LS-MS			
							Commenced Coring at 1.1m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket	VE Very Easy(No Resistance)	SPT - Standard Penetration Test	B - Bulk disturbed sample	VS - Very soft
R Ripper	E Easy	PP - Hand/Pocket Penetrometer	D - Disturbed sample	S - Soft
HA Hand auger	F Firm	DCP - Dynamic Cone Penetrometer	ES - Environmental sample	F - Firm
PT Push tube	H Hard	PSP - Perth Sand Penetrometer	U - Thin wall tube "undisturbed"	St - Stiff
SON Sonic drilling	VH Very Hard(Refusal)	MC - Moisture Content		Vst - Very stiff
AH Air hammer		PBT - Plate Bearing Test	MOISTURE	H - Hard
PS Percussion sampler	WATER	IMP - Borehole Impression Test	D - Dry	RELATIVE DENSITY
AS Short spiral auger	Water Level on Date	PID - Photo Ionisation Detector	M - Moist	VL - Very loose
AD/V Solid flight auger:V-Bit	Water inflow	VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	W - Wet	L - Loose
AD/T Solid flight auger:T-C-Bit	Water outflow		PL - plastic limit	MD - Medium dense
HFA Hollow flight auger			LL - liquid limit	D - Dense
WB Washbore drilling			W - Moisture content	VD - Very dense
RR Rock roller				

Qualtest

UTM : 56J
Easting (m) : 493060.30
Northing (m) : 6924354.20
Ground Elevation : Not Surveyed
Total Depth : 10.05 m BGL

Drill Rig : Hydropower Scout
Driller Supplier : Applied Geotech Drilling
Logged By : TS
Reviewed By : DA
Date : 24/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
↑ 																

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493060.30	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924354.20	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.05 m BGL	Date : 24/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 91%			9		As above but mottled grey orange brown.	MW-SW					Run 3	J, 40°, CV, RO J, 45°, CV, RO, STN, C J, 2°, PL, RO, VN, C J, 45°, CV, RO, CL, C J, PL, RO, CL, C J, 15°, CV, RO, STN, C J, 45°, CV, RO, STN, C J, 45°, CV, RO, CL, C J, PL, RO, CL, C J, 5°, PL, RO, CT, OP		

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493000.06	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924117.84	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 26/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, grey, dry.	MD			
		0.7	Residual		CI	w < PL	Sandy CLAY: medium plasticity, stiff to very stiff, pale brown mottled grey, fine to medium grained sand, w < pl.	St-VSt			
		1	Rock		SST	D	Silty SAND: fine to medium grained, dense to very dense, brown.	D-VD			
		1.3	Rock		SST		SANDSTONE: fine to medium grained, brown mottled grey, low strength.	LS			
		1.5					Commenced Coring at 1.5m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions



Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD		PENETRATION		FIELD TESTS		SAMPLES		SOIL CONSISTENCY	
EX	Excavator bucket	VE	Very Easy(No Resistance)	SPT	- Standard Penetration Test	B	- Bulk disturbed sample	VS	- Very soft
R	Ripper	E	Easy	PP	- Hand/Pocket Penetrometer	D	- Disturbed sample	S	- Soft
HA	Hand auger	F	Firm	DCP	- Dynamic Cone Penetrometer	ES	- Environmental sample	F	- Firm
PT	Push tube	H	Hard	PSP	- Perth Sand Penetrometer	U	- Thin wall tube "undisturbed"	St	- Stiff
SON	Sonic drilling	VH	Very Hard(Refusal)	MC	- Moisture Content			VSt	- Very stiff
AH	Air hammer							H	- Hard
PS	Percussion sampler	WATER		PBT	- Plate Bearing Test	MOISTURE		RELATIVE DENSITY	
AS	Short spiral auger		Water Level on Date	IMP	- Borehole Impression Test	D	- Dry	VL	- Very loose
AD/V	Solid flight auger:V-Bit		Water inflow	PID	- Photo Ionisation Detector	M	- Moist	L	- Loose
AD/T	Solid flight auger:TC-Bit		Water outflow	VS	- Vane Shear; P=Peak, R=residual (unconnected kPa)	W	- Wet	MD	- Medium dense
HFA	Hollow flight auger					PL	- plastic limit	D	- Dense
WB	Washbore drilling					LL	- liquid limit	VD	- Very dense
RR	Rock roller					W	- Moisture content		

Qualtest

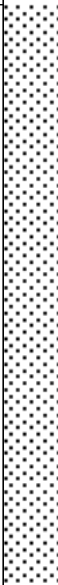


Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD		PENETRATION		FIELD TESTS		SAMPLES		SOIL CONSISTENCY	
EX	Excavator bucket	VE	Very Easy(No Resistance)	SPT	- Standard Penetration Test	B	- Bulk disturbed sample	VS	- Very soft
R	Ripper	E	Easy	PP	- Hand/Pocket Penetrometer	D	- Disturbed sample	S	- Soft
HA	Hand auger	F	Firm	DCP	- Dynamic Cone Penetrometer	ES	- Environmental sample	F	- Firm
PT	Push tube	H	Hard	PSP	- Perth Sand Penetrometer	U	- Thin wall tube "undisturbed"	St	- Stiff
SON	Sonic drilling	VH	Very Hard(Refusal)	MC	- Moisture Content			VSt	- Very stiff
AH	Air hammer							H	- Hard
PS	Percussion sampler	WATER		PBT	- Plate Bearing Test	MOISTURE		RELATIVE DENSITY	
AS	Short spiral auger		Water Level on Date	IMP	- Borehole Impression Test	D	- Dry	VL	- Very loose
AD/V	Solid flight auger:V-Bit		Water inflow	PID	- Photo Ionisation Detector	M	- Moist	L	- Loose
AD/T	Solid flight auger:TC-Bit		Water outflow	VS	- Vane Shear; P=Peak, R=residual (unconnected kPa)	W	- Wet	MD	- Medium dense
HFA	Hollow flight auger					PL	- plastic limit	D	- Dense
WB	Washbore drilling					LL	- liquid limit	VD	- Very dense
RR	Rock roller					W	- Moisture content		

Qualtest

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493000.06	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924117.84	Logged By : KD	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 26/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 91.06%			9		SANDSTONE: fine to medium grained, grey, high strength.	SW								Run 3 J, 15°, PL, RO, STN, C J, 2°, UN, RO, STN, C J, 10°, PL, RO, STN, OP J, 80°, PL, RO, CL, C J, 2°, PL, RO, VN, OP J, PL, RO, VN, OP J, 10°, PL, RO, VN, OP J, PL, RO, STN, OP
							BH04 Terminated at 10m									

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

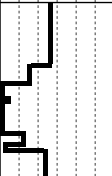
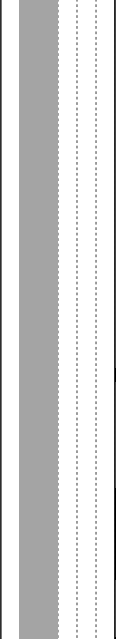
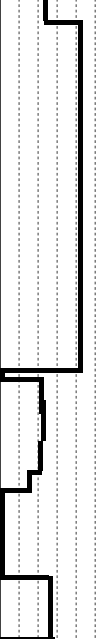
UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493146.40	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924086.80	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.07 m BGL	Date : 24/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.2	Topsoil		SM	D	Silty SAND: fine to medium grained, medium dense, dark grey, dry, with rootlets.	MD			
		0.5	Residual		SC	D	Clayey SAND: fine to medium grained, medium dense, grey, dry, low plasticity clay.	MD			
		1.2	Rock		SST	D	Clayey SAND: fine to medium grained, trace fine to medium sized gravel, very dense, grey, dry, low plasticity clay, rock chips included .	VD			
							Commenced Coring at 1.2m				

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493146.40	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924086.80	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.07 m BGL	Date : 24/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS				EHS

					1		Commenced Coring at 1.2m								
↑ NMLC ↓	TCR = 100%	RQD = 43%			2		SANDSTONE: fine grained, light grey mottled brown, very low to low strength.	HW-MW			Run 1	P J, PL, RO, CL, C IS, IR, SL, CT, I J, PL, RO, CL, OP J, IR, SL, STN, I XWS, PL, RO, CT, C FRZ, IR, RO J, 5°, CV, RO, CL, OP J, PL, RO, CL, OP			
	TCR = 100%	RQD = 44%			3		SANDSTONE: fine to medium grained, brown grey, low to medium strength.	HW-MW			Run 2	IS, IR, RO J, PL, RO, VN, C J, 15°, CV, RO, VN, C J, 10°, CV, RO, VN, C XWS, IR, SL IS, IR, RO, STN, OP			

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J
Easting (m) : 493146.40
Northing (m) : 6924086.80
Ground Elevation : Not Surveyed
Total Depth : 10.07 m BGL

Drill Rig : Hydropower Scout
Driller Supplier : Applied Geotech Drilling
Logged By : TS
Reviewed By : DA
Date : 24/02/2025

Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
↑ NMLC ↓	TCR = 100%	RQD = 44%			5		SANDSTONE: fine to medium grained, brown grey, low to medium strength.	HW-MW							Run 2	J, 10°, CV, RO, STN, C J, 10°, CV, RO, VN, C J, 45°, IR, RO, CL, OP J, PL, RO, CL, C J, 15°, CV, RO, CT, I
	TCR = 100%	RQD = 89%			6 <											

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	VS - Very soft S - Soft F - Firm St - Stiff Vst - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 493146.40	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924086.80	Logged By : TS	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : DA	Location : Wyatt Road, Undullah
Total Depth : 10.07 m BGL	Date : 24/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS				EHS
NMLC	TCR = 100%	RQD = 89%					SANDSTONE: fine to medium grained, grey mottled brown, low to medium strength.	MW								Run 3	XWS, IR, RO, STN, , IR, RO, CL, OP J, 15°, IR, RO, STN, OP
	TCR = 100%	RQD = 71%			9		SANDSTONE: fine to medium grained, grey, medium to high strength.	MW-SW								Run 4	J, 10°, PL, RO, CL, C J, 45°, PL, RO, CL, OP J, PL, RO, CL, C J, PL, RO, CL, C J, 10°, PL, RO, CL, OP J, 45°, PL, RO, CL, C
					10		BH05 Terminated at 10.07m (Target Depth)										

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
										SPT	
		0.1	Topsoil		SM	D	Silty SAND: fine to medium grained, loose, grey, dry.	L			
		0.4	Residual		SC	D	Clayey SAND: fine to coarse grained, medium dense, pale brown, dry, low plasticity clay.	MD			
		1	Rock		SST	D	SANDSTONE: fine to medium grained, pale brown, very low to low strength.	VLS-LS			
Washbore		1.6					Commenced Coring at 1.6m		SPT Sample:	30/100mm, 0/mm, 0/mm (N=>50)	

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger: V-Bit AD/T Solid flight auger: TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy (No Resistance) E Easy F Firm H Hard VH Very Hard (Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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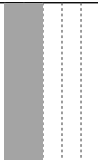
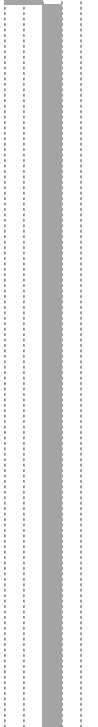
Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1											
							Commenced Coring at 1.6m									
NMLC	TCR = 100%	RQD = 74.58%			2		SANDSTONE: fine to coarse grained, brown mottled grey, low to medium strength.	HW-MW								Run 1
					3											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff Vst - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)					Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS	30	100	300	1000		
NMLC	TCR = 100%	RQD = 74.58%			5		SANDSTONE: fine to coarse grained, brown mottled grey, low to medium strength.	HW-MW			Run 1	J, 2°, UN, RO, CL, OP J, 2°, PL, RO, CL, OP BPI, PL, RO, STN, C J, 2°, STP, RO, STN, OP								
	TCR = 100%	RQD = 96%					6	SW					Run 2							
	TCR = 100%	RQD = 76.41%							7						Run 3					

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492714.90	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924142.48	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10.06 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS			
NMLC	TCR = 100%	RQD = 76.41%			9											

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/Density	Samples	Testing	Remarks
		0.3	Topsoil		SM	D	Silty SAND: fine to medium grained, loose to medium dense, pale brown, dry.	L-MD			
		0.4	Residual		SC	D	Clayey SAND: fine to coarse grained, medium dense, brown, dry, low to medium plasticity clay.	MD			
		1.1	Rock		SST	D	Silty SAND: fine to coarse grained, dense to very dense, pale brown.	D-VD			
		1.5	Rock		SST		SANDSTONE: fine to medium grained, brown mottled grey, medium strength.	MS			

Commenced Coring at 1.5m

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Refer to explanatory notes for details of abbreviations and basis of descriptions

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description type, inclination, planarity, roughness, coating, thickness
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		
					1											
							Commenced Coring at 1.5m									
NMLC	TCR = 100%	RQD = 50%			2		SANDSTONE: fine to medium grained, brown mottled grey, medium strength.									
					3		SANDSTONE: fine to medium grained, grey mottled brown, high strength.	SW								

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller		PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow		FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)		SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content		SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense	
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Job Number : 24-231
Client : Mirvac C
Project : Geotechnical Investigation Monarch Glen
Location : Wyatt Road, Undullah
Loc Comment :

METHOD	PENETRATION	FIELD TESTS	SAMPLES	SOIL CONSISTENCY
EX Excavator bucket	VE Very Easy(No Resistance)	SPT - Standard Penetration Test	B - Bulk disturbed sample	VS - Very soft
R Ripper	E Easy	PP - Hand/Pocket Penetrometer	D - Disturbed sample	S - Soft
HA Hand auger	F Firm	DCP - Dynamic Cone Penetrometer	ES - Environmental sample	F - Firm
PT Push tube	H Hard	PSP - Perth Sand Penetrometer	U - Thin wall tube "undisturbed"	St - Stiff
SON Sonic drilling	VH Very Hard(Refusal)	MC - Moisture Content		VS _t - Very stiff
AH Air hammer		PBT - Plate Bearing Test		H - Hard
PS Percussion sampler		IMP - Borehole Impression Test	MOISTURE	
AS Short spiral auger		PID - Photo Ionisation Detector	D - Dry	RELATIVE DENSITY
AD/V Solid flight auger:V-Bit	Water Level on Date	VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	M - Moist	VL - Very loose
AD/T Solid flight auger:TC-Bit	Water inflow		W - Wet	L - Loose
HFA Hollow flight auger	Water outflow		PL - plastic limit	MD - Medium dense
WB Washbore drilling			LL - liquid limit	D - Dense
RR Rock roller			W - Moisture content	VD - Very dense

Qualtest

UTM : 56J	Drill Rig : Hydropower Scout	Job Number : 24-231
Easting (m) : 492563.22	Driller Supplier : Applied Geotech Drilling	Client : Mirvac C
Northing (m) : 6924255.94	Logged By : DA	Project : Geotechnical Investigation Monarch Glen
Ground Elevation : Not Surveyed	Reviewed By : KD	Location : Wyatt Road, Undullah
Total Depth : 10 m BGL	Date : 20/02/2025	Loc Comment :

Coring			Water	Elevation (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength					Defect Spacing (mm)	Core Run	Defect Description	
Drilling Method	TCR (%)	RQD (%)							VLS	LS	MS	HS	VHS	EHS		30	100
NMLC	TCR = 100%	RQD = 82.33%			9		SANDSTONE: fine to medium grained, grey mottled brown, high strength.	SW									J, 2°, IR, RO, CL, , drill break? CS, 60°, PL, VR, CT, I J, IR, RO, CL, C, drill break? J, 2°, UN, RO, STN, C J, 2°, UN, RO, STN, C , 10°, IR, RO, STN, C
							BH07 Terminated at 10m										

METHOD EX Excavator bucket R Ripper HA Hand auger PT Push tube SON Sonic drilling AH Air hammer PS Percussion sampler AS Short spiral auger AD/V Solid flight auger:V-Bit AD/T Solid flight auger:TC-Bit HFA Hollow flight auger WB Washbore drilling RR Rock roller	PENETRATION VE Very Easy(No Resistance) E Easy F Firm H Hard VH Very Hard(Refusal) WATER  Water Level on Date  Water inflow  Water outflow	FIELD TESTS SPT - Standard Penetration Test PP - Hand/Pocket Penetrometer DCP - Dynamic Cone Penetrometer PSP - Perth Sand Penetrometer MC - Moisture Content PBT - Plate Bearing Test IMP - Borehole Impression Test PID - Photo Ionisation Detector VS - Vane Shear; P=Peak, R=residual (unconnected kPa)	SAMPLES B - Bulk disturbed sample D - Disturbed sample ES - Environmental sample U - Thin wall tube "undisturbed" MOISTURE D - Dry M - Moist W - Wet PL - plastic limit LL - liquid limit W - Moisture content	SOIL CONSISTENCY VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard RELATIVE DENSITY VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense
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Appendix C: Laboratory Test Certificates

POINT LOAD TEST RESULTS



TESTED BY: TS
CHECKED BY: DA

PROJECT #: 24-231
PROJECT: Mirvac Development
LOCATION: Flagstone QLD
SAMPLING TECHNIQUE: Rock Core

TEST DATE: 5/03/2025
SAMPLE DATE: February 20 - 26, 2025
STORAGE HISTORY: Fresh
MOISTURE CONDITION: Moist

Core Diameter	50	mm
Machine Callibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on)

TEST MACHINE: HMA Geotechnical PLT 6510
LAST CALLIBRATION DATE: 5/5/24
LOADING RATE:

Test #	Hole	Sample Top	Sample Bottom	Rock Type	Test Type	L Length (mm)	D Distance (mm)	W Width (mm)	Shape OK?	P Load (KN)	Adjusted P Load (KN)	mm (mm)	De (mm)	Is (MPa)	Corr. Fact.	Is(50) (MPa)	Empirical UCS (MPa)	Failure Type	Orient.of Weakness
1	BH01	4.26	4.36	SS	Diametral	100	50	n/a	OK	2.74	2.74	2500	50	1.10	1.00	1.10	24.11	P	
2	BH01	4.33	4.36	SS	Axial	n/a	30	50	OK	4.19	4.19	1910	44	2.19	0.94	2.06	45.43	S	
3	BH01	4.67	4.78	SS	Diametral	110	50	n/a	OK	5.80	5.80	2500	50	2.32	1.00	2.32	51.04	P	
4	BH01	4.75	4.78	SS	Axial	n/a	30	50	OK	3.71	3.71	1910	44	1.94	0.94	1.83	40.22	D	
5	BH01	5.88	6.00	SS	Diametral	100	50	n/a	OK	1.95	1.95	2500	50	0.78	1.00	0.78	17.16	P	
6	BH01	5.96	6.00	SS	Axial	n/a	40	50	OK	3.01	3.01	2546	50	1.18	1.00	1.19	26.11	S	
7	BH01	6.90	7.00	SS	Diametral	100	50	n/a	OK	2.98	2.98	2500	50	1.19	1.00	1.19	26.22	P	
8	BH01	6.96	7.00	SS	Axial	n/a	40	50	OK	5.54	5.54	2546	50	2.18	1.00	2.18	48.06	S	
9	BH01	7.90	8.00	SS	Diametral	100	50	n/a	OK	2.94	2.94	2500	50	1.18	1.00	1.18	25.87	P	
10	BH01	7.96	8.00	SS	Axial	n/a	40	50	OK	2.99	2.99	2546	50	1.17	1.00	1.18	25.94	S	
11	BH01	8.00	8.10	SS	Diametral	100	50	n/a	OK	1.74	1.74	2500	50	0.70	1.00	0.70	15.31	P	
12	BH01	8.05	8.10	SS	Axial	n/a	50	50	OK	2.47	2.47	3183	56	0.78	1.06	0.82	18.02	S	
13	BH01	9.00	9.10	SS	Diametral	100	50	n/a	OK	1.99	1.99	2500	50	0.80	1.00	0.80	17.51	P	
14	BH01	9.06	9.10	SS	Axial	n/a	40	50	OK	2.08	2.08	2546	50	0.82	1.00	0.82	18.04	S	

Tests undertaken in accordance with AS 4133.4.1 - 2007 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index

Core Diameter	50	mm
Machine Callibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on)

TEST MACHINE: HMA Geotechnical PLT 6510

LAST CALLIBRATION DATE: 5/5/24

LOADING RATE:

Core Diameter	50	mm
Machine Calibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on
TEST MACHINE: HMA Geotechnical PLT 6510		
LAST CALIBRATION DATE: 5/5/24		
LOADING RATE:		

Core Diameter	50	mm
Machine Callibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on)

TEST MACHINE: HMA Geotechnical PLT 6510

LAST CALLIBRATION DATE: 5/5/24

LOADING RATE:

POINT LOAD TEST RESULTS



TESTED BY: TS
CHECKED BY: DA

PROJECT #: 24-231
PROJECT: Mirvac Development
LOCATION: Flagstone QLD
SAMPLING TECHNIQUE: Rock Core

TEST DATE: 5/03/2025
SAMPLE DATE: February 20 - 26, 2025
STORAGE HISTORY: Fresh
MOISTURE CONDITION: Moist

Core Diameter	50	mm
Machine Callibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on)

TEST MACHINE: HMA Geotechnical PLT 6510
LAST CALLIBRATION DATE: 5/5/24
LOADING RATE:

Test #	Hole	Sample Top	Sample Bottom	Rock Type	Test Type	L Length (mm)	D Distance (mm)	W Width (mm)	Shape OK?	P Load (KN)	Adjusted P Load (KN)	mm (mm)	De (mm)	Is (MPa)	Corr. Fact.	Is(50) (MPa)	Empirical UCS (MPa)	Failure Type	Orient.of Weakness
1	BH05	1.41	1.51	SS	Diametral	100	50	n/a	OK	6.08	6.08	2500	50	2.43	1.00	2.43	53.50	P	
2	BH05	1.48	1.51	SS	Axial	n/a	30	50	OK	6.68	6.68	1910	44	3.50	0.94	3.29	72.42	S	
3	BH05	5.90	6.00	SS	Diametral	100	50	n/a	OK	2.92	2.92	2500	50	1.17	1.00	1.17	25.70	P	
4	BH05	5.96	6.00	SS	Axial	n/a	40	50	OK	5.03	5.03	2546	50	1.98	1.00	1.98	43.64	S	
5	BH05	6.90	7.00	SS	Diametral	100	50	n/a	OK	4.16	4.16	2500	50	1.66	1.00	1.66	36.61	P	
6	BH05	6.96	7.00	SS	Axial	n/a	40	50	OK	5.65	5.65	2546	50	2.22	1.00	2.23	49.02	P	
7	BH05	8.60	8.70	SS	Diametral	100	50	n/a	OK	5.33	5.33	2500	50	2.13	1.00	2.13	46.90	P	
8	BH05	8.65	8.70	SS	Axial	n/a	50	50	OK	5.36	5.36	3183	56	1.68	1.06	1.78	39.11	S	
9	BH05	8.71	8.81	SS	Diametral	100	50	n/a	OK	3.78	3.78	2500	50	1.51	1.00	1.51	33.26	P	
10	BH05	8.78	8.81	SS	Axial	n/a	30	50	OK	8.05	8.05	1910	44	4.21	0.94	3.97	87.28	S	
11	BH05	9.00	9.10	SS	Diametral	100	50	n/a	OK	1.87	1.87	2500	50	0.75	1.00	0.75	16.46	P	
12	BH05	9.06	9.10	SS	Axial	n/a	40	50	OK	3.83	3.83	2546	50	1.50	1.00	1.51	33.23	S	
13	BH05	10.00	10.10	SS	Diametral	100	50	n/a	OK	1.15	1.15	2500	50	0.46	1.00	0.46	10.12	P	
14	BH05	10.06	10.10	SS	Axial	n/a	40	50	OK	3.41	3.41	2546	50	1.34	1.00	1.34	29.58	S	

Tests undertaken in accordance with AS 4133.4.1 - 2007 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index

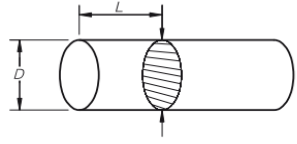
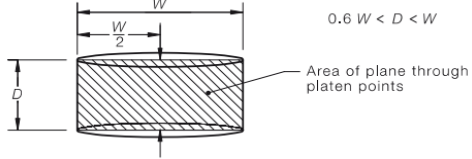
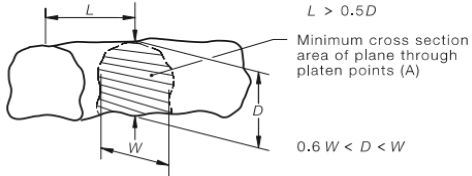
Core Diameter	50	mm
Machine Callibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on)

TEST MACHINE: HMA Geotechnical PLT 6510

LAST CALLIBRATION DATE: 5/5/24

LOADING RATE:

Core Diameter	50	mm
Machine Calibration Factor	100	%
Conversion From Is(50) to UCS	22	(can vary from 10 to 50 depending on
TEST MACHINE: HMA Geotechnical PLT 6510		
LAST CALIBRATION DATE: 5/5/24		
LOADING RATE:		

Shape of specimen	Direction of loading		Equivalent core diameter (D_e) mm
Cylindrical core	Diametral	 $L > 0.5D$	$D_e = D$
	Axial	 $0.6W < D < W$ Area of plane through platen points	$D_e = \sqrt{\frac{4A}{\pi}}$ $A = D \times W$
Other shapes		 $L > 0.5D$ Minimum cross section area of plane through platen points (A) $0.6W < D < W$	$D_e = \sqrt{\frac{4A}{\pi}}$

ROCK TYPE:

SS=Sandstone

SL=Siltstone

CY=Claystone

MD=Mudstone

CB=Carbonaceous

CG=Conglomerate

CO=Coal

IG=Igneous

IB=Interbedded (% 1st rock type:% 2nd rock type)

XW or EW = Extremely Weathered

SW = Slightly Weathered

DW or (HW & MW) = Distinctly

Weathered

FAILURE TYPE:

P = Failure parallel to bedding

D = Failure along defect (e.g. joint)

S = Failure through rock substance
(e.g. perpendicular to bedding)

BB = Bad break (should indicate that
result is greater than recorded value)