



APPENDIX 20

Geotechnical Investigation Report : WGA



Turner & Townsend Project Management Pty Ltd

Proposed Southern Barossa Winery and Tourist Accommodation

GEOTECHNICAL INVESTIGATION REPORT

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1 INTRODUCTION

A geotechnical investigation has been undertaken by Wallbridge Gilbert Aztec (WGA) for the proposed Southern Barossa Winery and Tourist Accommodation development at Hoffnungsthal Road, near Williamstown.

It is understood that the proposed development comprises a multi-level hotel with associated car parking and a new winery. Due to the topography of the site appreciable bulk earthworks will be required to form a level building platform.

A concept layout plan of the proposed development is shown in Figure 1 and Figure 2.

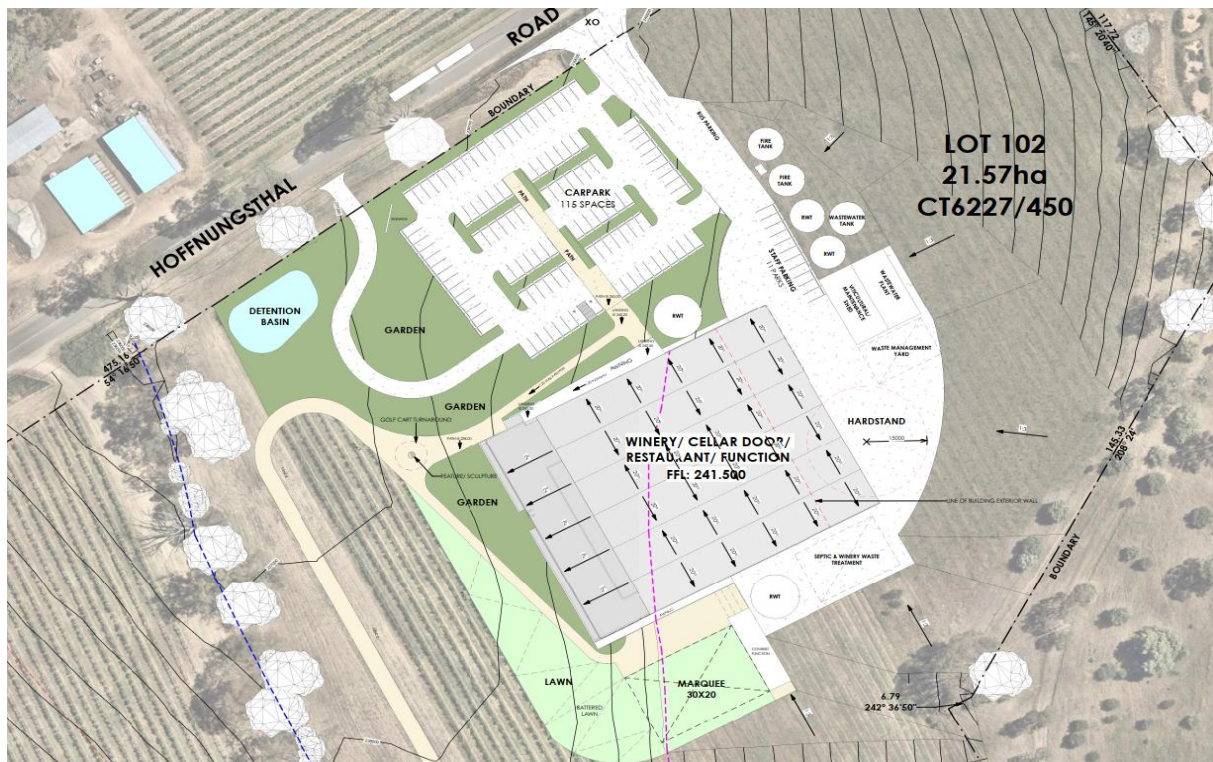


Figure 1: Proposed Development (Car Park and Winery)

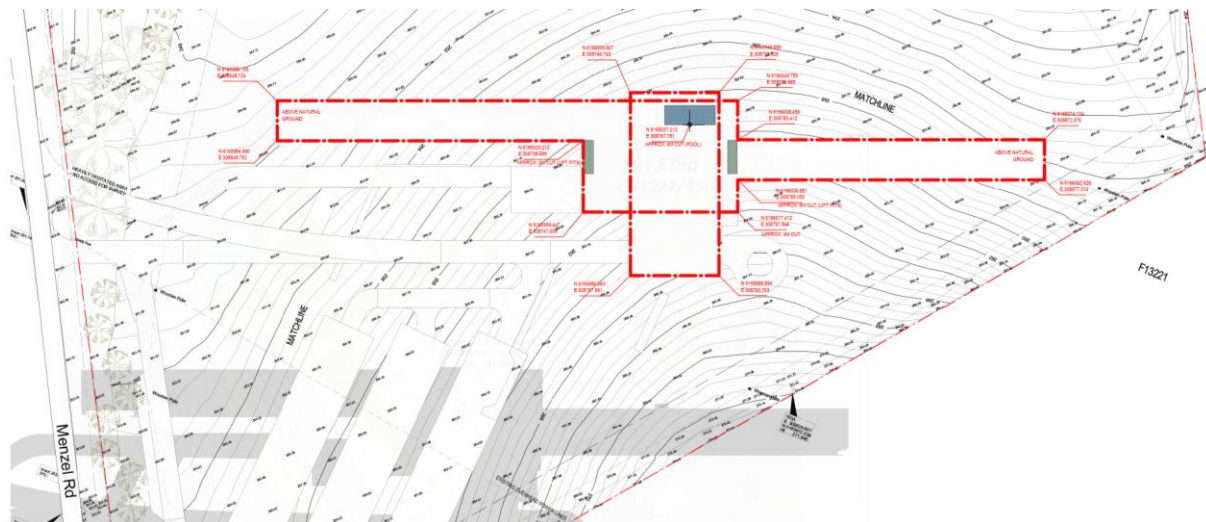


Figure 2: Proposed Development (Hotel)

The geotechnical investigation was commissioned by Turner & Townsend Project Management Pty Ltd. The scope and extent of the geotechnical investigation were broadly consistent with a proposal prepared by WGA dated 17 April 2025 and subsequent amendments by email.

It is envisaged that the proposed buildings would be supported by near surface spread footings or bored piles depending on the extent of site earthworks.

This report outlines the geotechnical investigation undertaken and summarises the subsurface conditions encountered. Recommendations relating to the design of footings, pavements and associated earthworks are presented in Section 4.

The results of a previous preliminary geotechnical investigation (Reference 1) conducted by FMG at the site have been referred to in the preparation of the report recommendations.

2 OUTLINE OF THE INVESTIGATION

2.1 Field Work

The field work for the geotechnical investigation was undertaken between 11 June and 26 June 2025, and comprised:

- Drilling three boreholes (denoted BH1 to BH3) within the proposed winery car park to a depth of about 1.5 m;
- Drilling six boreholes (denoted BH4 to BH9) within the footprint of the proposed winery to depths of up to about 4 m;
- Drilling six boreholes (denoted BH10 to BH15) using solid auger drilling and HQ diamond coring methods to depths ranging from about 8 m to 10 m. Standard Penetration Tests (SPTs) were undertaken at selected depths in soil strength materials. Boreholes BH10 to BH12 were drilled within the footprint of the proposed hotel, whilst boreholes BH13 to BH15 were drilled within the footprint of the proposed winery;
- Excavating eight test pits (denoted TP1 to TP8) across the hotel site using either a 28 t or 13 t excavator to depths ranging from about 1.6 m to 3 m.

The shallow boreholes (BH1 to BH9) were drilled using portable drilling equipment, which involved advancing push tubes with a hand operated jackhammer. The deeper boreholes were drilled using a track mounted Boart Longyear LX6 drilling rig using diamond coring techniques in rock and a solid auger in soil strength materials.

The test pits were excavated with a 28 tonne CAT excavator (fitted with a 950 mm wide toothed bucket and single tyne ripper), or a 13 tonne Hitachi excavator (fitted with a 500 mm wide toothed bucket).

The boreholes and test pits were positioned to provide a broad coverage of the proposed development area subject to restrictions imposed by existing site features. The locations of the boreholes and test pits are shown approximately on Figure A1 and A2 in Appendix A. The boreholes were positioned on site using a handheld GPS unit (accuracy about ± 5 m).

The subsurface profile encountered in the boreholes is described on the borehole logs contained in Appendix B. The logs are accompanied by two explanation sheets that outline the terms and symbols used in their preparation.

Photographs of the core recovered from boreholes BH10 to BH15 and the sides of the test pits are presented in Appendix B.

The results of the SPTs are shown graphically on Figure A3 in Appendix A.

2.2 Laboratory Testing

The scope of geotechnical laboratory testing undertaken comprised:

- Atterberg limits and particle size distribution tests (six soil samples);
- Four-Day Soaked CBR tests (two soil samples);
- Point Load Strength Index (10 rock samples);
- Durability suite (pH, sulphate, chloride and electrical conductivity, five soil samples).

The results of the Atterberg limits and particle size distribution tests were used to calculate an estimated CBR value based on a test procedure adopted by the Department for Infrastructure and Transport (DIT).

The estimated CBR value is considered to be empirically equivalent to a laboratory four day soaked CBR test in which the sample has been conditioned to the optimum moisture content and compacted to a dry density ratio of 95% based on Modified compactive effort (AS 1289 5.2.1).

The geotechnical testing was undertaken at the NATA registered Adelaide laboratory of Coffey Testing in accordance with the relevant sections of AS 1289 *“Methods of Testing Soils for Engineering Purposes”*.

The chemical durability suite was undertaken at the NATA registered laboratory of ALS Laboratory in their Melbourne laboratory.

The laboratory test results are provided in Appendix C.

3 SITE CONDITIONS

3.1 General

The proposed Southern Barossa Winery and Tourist Accommodation development is located at Lot 102 Hoffnungsthal Road, near Williamstown SA and covers an area of approximately 22 hectares.

The site is bounded by Menzel Road to the west, Hoffnungsthal Road to the north and vacant agricultural land to the east.

The site location is shown in Figure 3.



Figure 3: Site Location

The proposed development comprises an on-grade car park and a winery within the north-eastern portion of the site and a multi-storey hotel with an on-grade car park in the south, as shown in Figure 4.

Development



Figure 4: Site Layout

The site currently comprises agricultural land which includes vineyards and vacant paddocks. The perimeter of the site was mainly delineated by post and wire fences.

Two unnamed watercourses were present on site and appeared to be running from a higher elevation in the south towards the centre of the project area, merging into one watercourse toward north. The watercourses were dry during the investigation.

3.1.1 Proposed Winery Building and Car Park

At the time of the investigation the proposed car park and winery site was undeveloped, covered with short grass, and separated into two paddocks by a post and wire fence. A vineyard was present on the western side of the site.

The overall topography of the site generally sloped down towards the north-west. The surface of the site was undulating with evidence of recent disturbance possibly associated with the clearance of a former vineyard.

Numerous trees of varying sizes were present along the eastern boundary and across the site.

Photographs of the typical site conditions during the investigation are presented in Figure 4 and Figure 5.



Figure 4: Typical Site Conditions of the Proposed Car Park and Winery (Facing North-West)



Figure 5: Typical Site Conditions (Facing South-East)

3.1.2 Proposed Hotel Building

The site is bounded by Menzel Road to the west. The proposed hotel building is situated across the hillslope in the southern part of the project site.

The site was formerly a vineyard which had recently been removed. As a result of the disturbance the ground surface was uneven.

The overall topography of the site generally slopes down towards the north with the highest elevation near the southern boundary.

Numerous trees of varying sizes were present along watercourses on the site.

Photographs of the typical site conditions are presented in Figure 6 and Figure 7.



Figure 6: Typical Site Condition (Facing North)



Figure 7: Typical Site Condition (Facing South-East)

3.2 Regional Geology

The Geological Survey of South Australia (1:250,00 scale Adelaide Map Sheet) indicates that the site is underlain at shallow depth by undifferentiated Quaternary aged sediments (Q) and Woolshed Flat Shale (Ndw).

The Woolshed Flat Shale mainly comprises black shale, dolomitic siltstone, dolomite and grey laminated siltstone.

Local variants of Woolshed Flat Shale include fine to medium grained, interbedded sandstone (Ndw₁); blue-grey, flaggy, silty dolomite, and local grey stromatolitic dolomite (Ndw₂); garnet-bearing Schist (Ndw₃); muscovite-rich Schist (Ndw₄) and black carbonaceous Shale (Ndw₅).

Pockets of Tertiary aged sediments (T) occur near to the site. The Tertiary aged sediments typically comprise variably cemented sand with pockets of rock strength material in places.

It is also expected that Quaternary aged alluvium is likely present, particularly near the watercourses, which typically comprise interbedded clays and sands.

An excerpt from the Geological Map is presented in Figure 8.

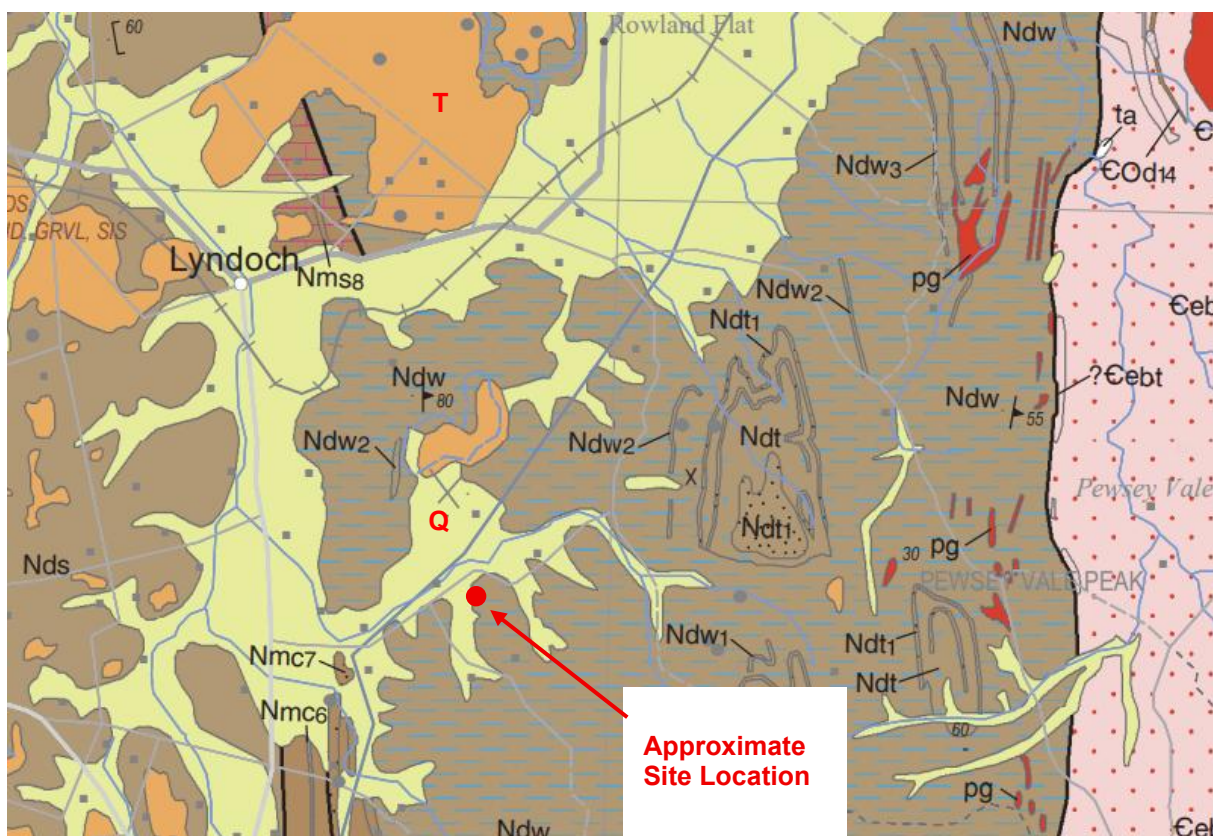


Figure 8: Excerpt from Geological Map

The South Australian Regional Information Gateway (SARIG) indicates that the regional groundwater level is anticipated between depths of about 5 m and 10 m.

3.2.1 Previous Investigations

A preliminary geotechnical investigation was performed by FMG at the site (Reference 1).

Reference 1 indicates that nine boreholes (denoted BH01 to BH09) were drilled within the footprint of the proposed car park and winery generally to a depth of 3 m, as shown in Figure 9.



Figure 9: Previous Boreholes - FMG

Topsoil (clayey silty sand, with rootlets) was encountered in each borehole in Reference 1 to depths ranging from 0.15 m to 0.7 m. The topsoil was underlain by Quaternary aged alluvium to depths ranging from 1.4 m to at least 3 m (borehole termination depth). The alluvium mainly comprised red brown, orange brown and grey brown silty sandy clay of medium to high plasticity and very stiff to hard consistency.

At four borehole locations, the alluvium was underlain by residual soil/weathered bedrock. The residual soil typically recovered as grey, red brown, orange brown clayey sandy silt of low plasticity, with weathered rock fragments. Push tube refusal was encountered in one borehole location at a depth of 3.7 m.

Reference 1 also indicates that 9 boreholes (denoted BH10 to BH18) were drilled within the footprint of the proposed hotel site, as shown in Figure 9. Push tube refusal was encountered in each borehole, typically at depths ranging from 1.0 m to 1.5 m, although up to 3.7 m depth in BH10.

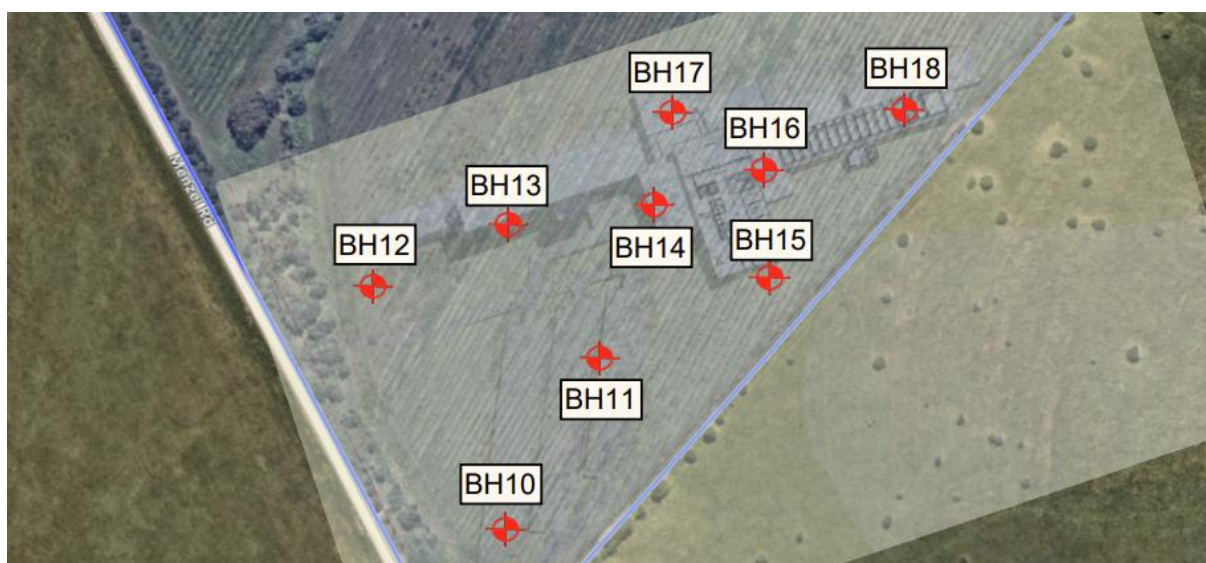


Figure 10: Previous Boreholes - FMG

The subsurface profile encountered comprised clayey silty sand with rootlets (topsoil) up to about 300 mm thick, overlying red brown and brown clay of high plasticity to depths of up to 1.3 m (locally 3.6 m). The clays were underlain by variably weathered bedrock at depths ranging from 0.3 m to 3.6 m. The bedrock was described as being extremely and highly weathered and was recovered as schist and shale fragments up to 50 mm in size. Push tube refusal was encountered in these materials.

3.3 Subsurface Conditions

Descriptions of the materials encountered in the boreholes drilled during the geotechnical investigation are summarised on the engineering logs contained in Appendix B.

3.3.1 Proposed Winery Building and Car Park

Nine boreholes (denoted BH1 to BH9) were drilled to depths of about 1.5 m to 4 m and three diamond cored boreholes (denoted as BH13 to BH15) were drilled to depths of 8 m to 10 m.

The natural soil profile encountered at the locations investigated was broadly consistent with the regional geology outlined in Section 3.2. Push tube refusal was met on weathered bedrock at depths of about 3 m (BH7) and 1.6 m (BH8).

The soil profile broadly comprised:

- **Topsoil:** dark brown clayey sand/sand with a varying portion of root fibres, ranging from about 0.15 m to 0.7 m thick;
- **B-Horizon:** red brown to dark brown, dark red brown clay of medium to high plasticity, highly fissured and blocky structure, moisture content typically close-to plastic limit, very stiff to hard consistency;
- **Quaternary alluvium:** pale brown to pale yellow brown sandy clay of low to medium plasticity, with a varying portion of fine to medium grained sand and fine grained, subrounded to rounded gravel. Locally highly calcareous in BH6 with calcareous gravel. Moisture content typically less than the plastic limit. Hard consistency, or locally friable where sandier, with SPT N-values of 9 and 18 were recorded;
- **Coarser grained alluvium:** comprising pale brown to pale yellow brown sandy clay/clayey sand of low plasticity, becoming sandier with depth tending to sand in BH6. Moisture content typically less than the plastic limit or dry;
- **Residual Soil:** typically comprised red brown mottled grey, yellow brown clay of high plasticity, moisture content less than the plastic limit, hard consistency with pocket penetrometer readings of over 600 kPa;
- **Weathered Bedrock:** push tube and SPT refusal was typically encountered in extremely weathered bedrock which typically comprised medium to high plasticity sandy clay with siltstone fragments of varying size. Becoming highly to moderately weathered siltstone, with interbedded schist, with local extremely weathered zones. The siltstone was predominately grey to dark grey, mottled brown and medium to high strength, locally of low strength. The rock was typically highly fractured with a fracture spacing of 30 mm to 100 mm, locally up to 300 mm. The defects were primarily bedding with a dip angle of about 20 degrees. Tending to moderately and slightly weathered and of high and very high strength below a depth of 7.5 m in BH13.

The depth range of the various layers is summarised in Table 1. A plan showing indicative relative level of bedrock at the hotel building site is presented in Appendix A.

Groundwater was not encountered in the shallow boreholes over the depth range investigated. The groundwater level was not able to be assessed in the deeper boreholes due to the use of water in the drilling process.

Seasonal variations in groundwater level may occur, with perched groundwater possibly present in sandier soils during winter.

The moisture content of the soil was typically higher in the upper 0.4 m, possibly due to recent rainfall.

3.3.2 Proposed Hotel

Eight test pits (denoted TP1 to TP8) were excavated within the footprint of the proposed hotel to depths ranging from 1.6 m to 3 m below the surface level with three diamond cored boreholes (denoted BH10 and BH12) drilled to a depth of 10 m.

Bedrock was encountered in 6 of the test pits and refusal of either the single tyne ripper or toothed bucket was met in each pit at varying depths, as summarised in Table 2.

The natural soil profile encountered at the test pits and borehole locations were broadly consistent with the regional geology, and typically comprised:

- **Topsoil/A-horizon:** dark brown clayey sand with a varying portion of roots and rootlets, ranging from about 0.15 m to 0.4 m thick;
- **B-horizon:** encountered to depths ranging from 0.6 m to 1.3 m in four test pits. Typically comprised red brown, dark grey to black clay of high plasticity, fissured. Moisture content generally less than the plastic limit. Hard consistency; overlying
- **Alluvium:** encountered in two test pits and BH12, adjacent to the western watercourse. Typically comprised red brown, pale brown to brown sandy clay/clay of high plasticity, extending to the termination depth of the test pit and about 7.5 m depth at BH12. Moisture content typically less than the plastic limit. Mainly hard consistency, with SPT N-values ranging from 20 to 32;
- **Weathered bedrock:** encountered at depths ranging from about 0.5 m to 7.7 m, not encountered at TP4 and TP5. Typically, fine-medium grained siltstone with interbedded schist. The upper portion of the weathered bedrock to depths of up to about 1.1 m comprised residual soil and extremely weathered rock, with fragments of less weathered rock of varying size. SPT met refusal in BH12.

Becoming highly to moderately weathered at depth, grey to dark grey, stained red brown, brown, thinly laminated. Typically, of medium to high strength, locally of low strength. The rock was typically highly fractured with a fracture spacing of 30 mm to 100 mm, locally up to 300 mm. The defects were primarily bedding. The exposed rock face in the test pit indicated a predominant dip angle of about 30 to 60 degrees and a dip direction of about 280 degrees (westerly, although locally varying).

Bucket, and or ripper refusal, was met in the less weathered rock at depths ranging from about 1.7 m to 2.5 m.

The depth range of the various layers is summarised in Table 2. A plan showing indicative relative level of bedrock at the hotel building site is presented in Appendix A.

Groundwater was not encountered in the test pits over the depth ranges investigated. The groundwater level was not able to be assessed in the deeper boreholes due to the use of water in the drilling process.

Seasonal variations in groundwater level may occur, with perched groundwater possibly present in more permeable zones during winter.

Table 1: Summary of the Subsurface Profile Encountered Within the Proposed Winery Car Park and Building (Depth to Base of Unit)

BOREHOLE	WINERY CAR PARK			WINERY BUILDING								
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	BH9	BH13*	BH14*	BH15*
Topsoil	0.3	0.7	0.3	0.3	0.15	0.3	0.3	0.15	0.5	Not able to differentiate due to auger drilling method used		
B-Horizon	1.5 (TD)	0.7	1.2	1.1	1	0.9	0.9	1.55	1.2			
Alluvium	NE	1.5 (TD)	1.5 (TD)	3.1	3.1	2.2	2.4	NE	NE			
Coarse Grained Alluvium	NE	NE	NE	4.0 (TD)	4.0 (TD)	4.0 (TD)	NE	NE	NE			
Residual Soil	NE	NE	NE	NE	NE	NE	2.8	NE	3.8	4.8	2.0	2.5
Extremely Weathered Bedrock	NE	NE	NE	NE	NE	NE	3.0 (R)	1.6 (R)	4.0 (TD)			
Weathered Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	NE	9.9 (TD)	8.1 (TD)	9.7 (TD)

Note: NE – Not Encountered; R – Refusal; TD – Target Depth; * - Cored Borehole

Table 2: Summary of the Subsurface Profile Encountered Within the Proposed Hotel Building (Depth to Base of Unit, m)

BOREHOLE	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	BH10*	BH11*	BH12*
Topsoil	0.15	0.4	0.3	0.4	0.2	0.25	0.25	0.2	Not able to differentiate due to auger drilling method used		
B-Horizon	NE	NE	0.6	1.3	1	NE	0.6	NE			
Alluvium	NE	NE	NE	3.0 (TD)	3.0 (TD)	NE	NE	NE			
RS to XW Bedrock	0.5	1.0	0.9	NE	NE	1.0	1.1	NE	2.6	0.5	7.7
Weathered Bedrock	1.7 m Ripper refusal, 28t	1.8 m Ripper refusal, 28t	2.5m Ripper refusal, 28t	NE	NE	2.2 m Bucket refusal, 13t	2.3 m Bucket refusal, 13t	1.6 m Bucket refusal, 13t	10.1 (TD)	10.0 (TD)	11.5 (TD)

Note: NE – Not Encountered; TD – Target Depth; RS – Residual Soil; XW – Extremely Weathered; HW – Highly Weathered; MW – Moderately Weathered; * - Cored Borehole

3.4 Laboratory Test Results

The results of the laboratory testing are presented in Table 3 to Table 6.

Table 3: Summary of Laboratory Testing Results (Proposed Winery Car Park and Building)

BOREHOLE	DEPTH RANGE (m)	ATTERBERG LIMITS			PARTICLE SIZE (% PASSING SIEVE)			ESTIMATED CBR (%)
		LL (%)	PI (%)	LS (%)	2.36 mm	0.425 mm	0.075 mm	
BH1	0.5 to 0.7	42	23	12.5	99	95	79	6
BH3	0.7 to 0.9	58	36	12.5	100	98	85	4.5
BH4	3.5 to 3.7	25	8	5.5	98	86	53	-
BH5	2.8 to 3.0	30	13	9.0	100	96	62	-
BH7	2.6 to 2.8	50	29	14.0	100	97	78	-
BH9	1.7 to 1.9	33	16	10.5	99	95	72	-

Note: - = Not Tested; LL = Liquid Limit; PI = Plasticity Index; LS = Linear Shrinkage

Table 4: Summary of Soaked CBR Test Results (Proposed Hotel Building)

TEST PIT	DEPTH RANGE (m)	MAXIMUM DRY DENSITY (t/m ³)	OPTIMUM MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	SOAKED CBR (%)
TP3	0.4 to 0.6	1.47	29.5	21.8	4.0
TP5	0.5 to 1.0	1.61	20.5	13.1	4.0

Note: - = Not Tested; LL = Liquid Limit; PI = Plasticity Index; LS = Linear Shrinkage

Table 5: Summary of Point Load Strength Index Test Results

TEST PIT	DEPTH (m)	TEST TYPE	POINT LOAD, P(kN)	Is(50) (MPa)	UCS* (MPa)	ROCK STRENGTH
TP1	1.5 to 1.7	Irregular	6.11	4.1	82	Very High
TP6	2.0 to 2.2	Irregular	0.61	0.31	6.2	Medium
TP7	2.3 to 2.3	Irregular	1.83	0.61	12.2	Medium
TP8	1.6 to 1.6	Irregular	3.81	4.0	80	Very High
BH10	8.0 to 8.1	Diametral & Axial	1.16 & 1.70	0.37 & 0.53	10.6	Medium
BH11	2.75 to 2.85	Diametral & Axial	1.36 & 2.86	0.43 & 0.92	18.4	Medium
BH11	8.55 to 8.75	Diametral & Axial	7.92 & 6.34	2.7 & 1.6	32	High
BH12	7.8 to 7.95	Diametral & Axial	0.68 & 2.29	0.21 & 0.97	19.4	Medium
BH12	10.05 to 10.15	Diametral & Axial	4.23 & 6.89	1.4 & 2.6	52	High
BH14	5.5 to 5.65	Diametral & Axial	0.75 & 1.54	0.24 & 0.71	14.2	Medium

Note: * using a correlation of UCS = 20 Is(50), in accordance with AS1726:2017

Table 6: Summary of Laboratory Testing – Durability

BOREHOLE	DEPTH (m)	pH (UNITS)	CHLORIDE (mg/kg)	SULPHATE (mg/kg)	EC(1:5) (uS/cm)
BH12	6.0 to 6.3	8.2	130	90	288
BH12	4.5 to 4.8	8.2	60	180	261
BH13	3.0 to 3.3	7.9	10	20	52
BH10	0.5 to 0.7	7.5	60	310	266
BH10	1.5 to 1.7	8.1	30	250	261

4 GEOTECHNICAL ASSESSMENT

4.1 General

It is envisaged that the proposed winery will be supported by a stiffened raft footing with integral pads beneath concentrated loads or spread footings. Fill up to about 2.5 m deep is expected on the western side and a cut ranging from about 1.5 m to 2.5 m are envisaged on the eastern side. Cut depths of up to about 6 m are envisaged on the eastern side of the adjacent hardstand.

The hotel will be supported on rock by a combination of bored piles and spread footings. Fill up to about 1.6 m deep is expected at the eastern and western ends, with a cut in the central section ranging from about 2 m to 3.6 m.

Based on the results of the investigation, the key geotechnical issues which may impact on the proposed development are:

- The medium and high plasticity clays have the potential to undergo relatively large shrink-swell movements with changes in soil moisture content;
- The presence of rock strength material at varying depths across the site which will impact on excavatability.

Recommendations are provided in the following sections for the design of footings, pavements and bulk earthworks.

4.2 Site Characteristics

4.2.1 Shrink-Swell Movements - Proposed Winery

Based on a visual-tactile assessment and limited laboratory testing, the clays encountered in the boreholes are judged to be moderately to highly reactive with respect to shrink-swell movements caused by changes in soil moisture content. Shrink-swell indices for the medium and high plasticity clays are estimated to typically range from about 1.5% to 3%.

Based on the recommended soil suction change profile for Adelaide reported in AS 2870-2011 a characteristic surface movement (y_s) ranging from about 30 mm to 45 mm would be expected for the soil profile encountered in the boreholes, assuming that the site remains at the current ground surface level.

In accordance with AS 2870-2011, a site classification of Class H1-D (highly reactive clay site with deep moisture changes, which may experience high ground movements resulting from moisture changes) is considered appropriate for a site which experiences normal soil moisture conditions, as outlined in AS 2870-2011.

Where controlled fill is placed on the building area and is more than 0.4 m deep, the overall site classification would be Class P (filled site).

The predicted y_s value assumes that the site generally remains at the current surface level and any additional fill placed is non-reactive. Where design site levels vary by more than about 0.3 m from the existing ground surface level, a further assessment of shrink-swell movements should be undertaken. This is particularly relevant where:

- Site won clays are used to elevate the site as compacted clays less than five years old are considered to be in an uncracked condition and therefore are potentially more reactive;
- Excavations are undertaken such that the weathered bedrock (BH8) occurs at a shallower depth, thereby reducing the potential shrink-swell movements.

For example, if 1 m depth of cut was performed, the resulting y_s values at the new surface level could vary from about 45 mm (BH9) to about 20 mm (BH8), based largely on the varying depth to bedrock.

Should future moisture content changes in soil exceed the normally expected changes reported in AS 2870-2011 (abnormal moisture conditions) a larger y_s value may occur. Such changes could occur adjacent to leaking water services or where the soils are desiccated by trees.

Where the effects of trees need to be considered in the footing design, an additional maximum potential surface movement as a result of trees (y_{tmax}) has been estimated to be about 15 mm for a single tree and 20 mm for a group of trees based on the guidelines of Appendix H in AS 2870-2011. The assessment assumes that the tree is located a distance of 0.5 times its height away from the proposed building.

4.2.2 Shrink-Swell Movements - Proposed Hotel

Extremely weathered to highly weathered bedrock was typically encountered at a shallow depth within the proposed hotel site. The weathered bedrock is considered to be essentially non-reactive with respect to shrink-swell movements caused by changes in soil moisture content.

Clay was encountered at two test pits and one borehole location within the proposed hotel site, extending to a depth of over 3 m. the clays is considered to be moderately to highly reactive with respect to shrink-swell movements caused by changes in soil moisture content, with shrink-swell indices estimated to typically range from about 1.5% to 3%.

Based on the recommended soil suction change profile for Adelaide reported in AS 2870-2011 a characteristic surface movement (y_s) ranging from less than 10 mm to 45 mm would be expected for the soil profile encountered in the boreholes, assuming that the site remains at the current ground surface level.

In accordance with AS 2870-2011, the site classification would range from:

- Class A (most sand and rock sites with little or no ground movement from moisture changes);
- Class H1-D (highly reactive clay site with deep moisture changes, which may experience high ground movements resulting from moisture changes) for TP4, TP5 and BH12.

Where controlled fill is placed on the building area and is more than 0.4 m deep, the overall site classification would be Class P (filled site).

The site classifications are appropriate for a site which experiences normal soil moisture conditions, as outlined in AS 2870-2011.

As noted previously:

- Where design site levels vary by more than about 0.3 m from the existing ground surface level, a further assessment of shrink-swell movements should be undertaken;
- Where the effects of trees need to be considered in the footing design, the shrink-swell movements would need to be increased.

For example, if 1 m depth of cut was performed, the resulting y_s values at the new surface level could vary from about 55 mm (BH12, due to the presence of uncracked clay at shallower depth following the 1 m deep cut) to 0 mm (BH11, due to the presence of bedrock).

4.2.3 Earthquake Site Classification

Weathered bedrock is typically expected at a depth of less than 3 m.

A site sub-soil class of B_e (Rock Site) is typically expected for the site in accordance with AS 1170.4-2007 "Structural design actions Part 4: *Earthquake actions in Australia*".

In areas where deeper fill is proposed or the depth to bedrock is greater, a site sub-soil class of C_e (Shallow Soil Site) would be appropriate.

The natural soils and weathered rock are not considered to be vulnerable to liquefaction during an earthquake with an annual probability of exceedance of about 1 in 500 (10% chance of being exceeded in a 50-year period).

4.2.4 Durability

The results of the laboratory chemical tests (Table 6) indicate that the natural soils are typically slightly alkaline with relatively low concentrations of sulphates and chlorides.

An exposure classification of “Non-aggressive” is considered appropriate for buried concrete above the groundwater table and “Mild” for buried concrete below the groundwater table, in accordance with the guidelines of Table 6.4.2(C) in AS 2159-2009 “*Piling - Design and Installation*”.

4.3 Footing Design - Winery

4.3.1 General

Depending on the applied structural loads and flexibility of the superstructure, suitable footing options for the proposed winery include a stiffened raft footing or spread footings with a structurally independent concrete floor.

4.3.2 Stiffened Raft Footing

A stiffened raft footing with integral pads beneath the concentrated loads could be considered for the proposed winery building.

For preliminary design it is recommended that a stiffened raft footing system be designed based upon the recommendations of AS 2870 “*Residential Slabs and Footings*” assuming a site classification of Class H1-D and a y_s value of 45 mm. The y_s values would need to be re-assessed based on the extent of cut or fill and the nature of the fill materials used.

A minimum swell stiffness (k) of 1000 kPa/m is recommended for the raft design.

Footing beams should be founded in natural soils, weathered bedrock or controlled fill at a minimum depth of 0.6 m. Such footings may be proportioned based on a maximum allowable bearing pressure of 150 kPa for the natural soils and extremely weathered rock or 100 kPa for controlled fill.

Footings must not be founded in uncontrolled fill, softened or disturbed natural soils, organic or sandy topsoil. Should such materials be encountered at the design founding level, footing excavations must be deepened or mass concrete piers provided.

It is recommended that the base of all footings be observed by a suitably experienced Engineer to confirm that the foundation materials have geotechnical properties consistent with the design assumptions. Where materials are encountered which are weaker than assumed in the design analyses the footing would need to be founded deeper or the allowable bearing pressure reduced.

4.3.3 Spread Footings

Spread footings (such as pad footings for point loads and strip footings for line loads) may be used wherever the flexibility of the supported structure can accommodate both the load-induced total and differential settlements and the potential reactive soil movements.

In order to reduce the potential for differential settlement it is recommended that strip footings are placed in a grillage pattern.

The allowable bearing pressure for shallow spread footings depends on factors such as:

- The founding depth of the spread footing below the ground surface and for granular foundation strata, the minimum plan dimension of the footing;
- The length to breadth ratio of the footing;
- Any inclined or eccentric loads applied to the footing; and
- The settlement sensitivity of the supported structure.

Depending on the extent of cut and fill at a particular location, spread footings could be founded on alluvial clay, sand/clayey sand, weathered rock or controlled fill.

It is recommended that concentrically loaded spread footings founded in natural clay of very stiff consistency (with an undrained shear strength of at least 125 kPa) or extremely weathered rock be proportioned based on the following maximum allowable bearing pressures, assuming a minimum footing embedment of 0.8 m:

- Strip Footing: 225 kPa;
- Rectangular Pad ($L/B = 2$): 240 kPa;
- Square Pad: 250 kPa.

A similar bearing pressure may be adopted for medium dense clayey sand and sand, provided a minimum footing width of 1 m is adopted.

Strip and pad footings founded in engineered fill may be proportioned based on an allowable bearing capacity of 100 kPa.

A higher bearing pressure of around 400 kPa may be used where the footings are founded on highly weathered rock (rock strength materials). This would need to be confirmed during construction.

In assessing the allowable bearing pressure, a factor of safety of around three has been adopted. The ultimate geotechnical capacity (failure load, $R_{d,ug}$) may be estimated as three times the recommended maximum allowable bearing pressure. It is recommended that a geotechnical strength reduction factor (ϕ_g) of 0.4 be applied to the ultimate geotechnical capacity to determine the design geotechnical strength ($R_{d,g}$).

Under short term transient loads (such as earthquake or wind loading) the maximum allowable bearing pressure may be increased by 25%.

Lower bearing pressures may need to be adopted for eccentrically loaded footings and further advice must be sought for such cases.

The elastic (immediate) settlement of square or rectangular spread footings (length to breadth ratio of 2 or less) up to about 2 m wide is unlikely to exceed about 20 mm, when uniformly loaded to the maximum recommended allowable bearing pressure.

Differential elastic settlement resulting from soil variability beneath footings of similar size and bearing pressure is likely to be of the order of 10 mm.

The long-term load-induced settlement of a spread footing is not expected to exceed the immediate settlement by more than about 25%, provided that abnormal soil moisture conditions do not develop in the future. Future saturation of the foundation soils could result in a marked increase in footing settlement.

Spread footings must not be founded on uncontrolled fill, topsoil, or softened/disturbed natural soils.

It is recommended that the base of all footings be observed by a suitably experienced Engineer to confirm that the foundation materials have geotechnical properties consistent with the design assumptions. Where materials are encountered which are weaker than assumed in the design analyses the footing would need to be founded deeper or the allowable bearing pressure reduced.

Care should be taken to prevent water from ponding in the base of any footing excavation during construction.

It is recommended that the base of footing excavations be covered with a blinding layer of lean mix concrete to assist in reducing moisture content variations during construction.

4.4 Footing Design - Hotel

4.4.1 General

The central portion of the hotel is expected to be excavated into the bedrock. It is recommended that all footings extend into the rock, in order to ensure a consistent founding strength and stiffness. Separate ancillary structures may be supported on the natural clay or engineered fill, provided such structures can move independently of the hotel building without causing damage.

As such, it is envisaged that the proposed hotel will be supported by spread footings or bored piles that extend into bedrock. Bored piles are expected in the western and eastern portion of the building where significant fill will be required to achieve the final finish level.

4.4.2 Spread Footings

Depending on the extent of cut and fill at a particular location, spread footings could be founded on alluvial clay, variably weathered rock or controlled fill.

The following maximum allowable bearing pressures are recommended for the likely range of founding materials expected over the site:

- Alluvial or residual clay: Refer to Section 4.3.3;
- Controlled fill: 100 kPa;
- Extremely and highly weathered rock: 400 kPa;
- Highly and moderately weathered rock of at least medium strength: 700 kPa.

In assessing the allowable bearing pressure, a factor of safety of around three has been adopted. The ultimate geotechnical capacity (failure load, $R_{d,ug}$) may be estimated as three times the recommended maximum allowable bearing pressure. It is recommended that a geotechnical strength reduction factor (ϕ_g) of 0.4 be applied to the ultimate geotechnical capacity to determine the design geotechnical strength ($R_{d,g}$).

Under short term transient loads (such as earthquake or wind loading) the maximum allowable bearing pressure may be increased by 25%.

The elastic settlement of footings founded on rock is unlikely to exceed 10 mm.

Recommendations relating to footing inspections and blinding are presented in Section 4.3.3.

4.4.3 Bored Piles

Design Parameters

It is recommended that bored piles be founded in weathered bedrock. In order to optimise the axial capacity it is recommended that piles be founded in the stronger, less weathered rock which was encountered at depths ranging from less than 1 m to 7.5 m below the current ground level.

Such piles would be essentially end bearing piles, unless a rock socket is formed at the base.

It is recommended that bored piles subject to axial loads be proportioned based on the geotechnical parameters presented in Table 7. Some conservatism has been incorporated into the selection of the geotechnical parameters given the varying weathering profiles observed.

Table 7: Summary of Design Parameters for Bored Piles

TYPICAL EXTENT ⁽¹⁾	GENERALISED SOIL/ROCK TYPE	TYPICAL SPT N-VALUE	UNDRAINED SHEAR STRENGTH, c_u (kPa)	AVERAGE ULTIMATE SHAFT RESISTANCE (kPa)	ULTIMATE BASE RESISTANCE (MPa)
Varies up to 1.5	Fill, topsoil and pile cap	-	Neglect for the purposes of pile design		
Maximum depth 7.5 m	Clay, very stiff	15	150	75 ⁽²⁾	Not suitable
Up to about 1 m thick	Extremely and highly weathered rock of low strength	>40	Average UCS >1.5 MPa, with locally stronger bands	150	3 ⁽³⁾
-	Highly and moderately weathered rock of at least medium strength	>50	Average UCS >8 MPa	350 ⁽⁵⁾	9 ⁽⁴⁾
Notes: ⁽¹⁾ Depth ranges are approximate only and will vary over the site. ⁽²⁾ Shaft resistance must be neglected over the depth of the pile cap and any uncontrolled fill. ⁽³⁾ Assumes a founding depth to base diameter ratio of at least 4. ⁽⁴⁾ Assumes piles are socketed at least 1 pile diameter into the stronger rock. ⁽⁵⁾ Assumes a socket roughness class of R2 or better (grooves 1 mm to 4 mm deep, at least 2 mm wide and at spacings of 200 mm or less).					

Where piles are arranged in closely spaced groups, such that the spacing to shaft diameter ratio is less than 2.5, a reduction in the above parameters may be necessary. Pile groups would need to be assessed individually based on the size of the group and the pile spacing.

In accordance with the guidelines of AS 2159-2009 “*Piling - Design and Installation*” a geotechnical strength reduction factor, ϕ_g , must be applied to the ultimate geotechnical parameters presented in Table 7 to determine the design geotechnical strength, $R_{d,g}$, which must then be equal to or exceed the design action effect, E_d .

In the absence of any pile load testing during construction, a geotechnical strength reduction factor, ϕ_g , of 0.4 is recommended.

The elastic settlement of a single bored pile at the design serviceability load ($0.75 R_{d,g}$) is unlikely to exceed 10 mm, provided the pile is designed in accordance with the above recommendations and the base diameter is less than 2 m. Settlement of a group of piles would be expected to be larger than for a single pile and would need to be assessed as part of the detailed design phase.

In order to assess the short-term lateral capacity of a bored pile and pile cap it is recommended that an ultimate lateral soil resistance (P_y) of 900 kPa be adopted in the clays below a depth of 1.5 pile diameters. The soil resistance to a depth of 1.5 pile diameters should be neglected.

Construction Issues

In order to penetrate the variably weathered rock strength materials to the required founding depth, large piling rigs fitted with a tungsten tipped core barrel are expected to be required. Drilling production rates are likely to vary depending on the degree of weathering, strength and nature of the defects.

The adoption of the recommended end bearing pressure assumes that adequate cleaning of the bored pile bases is carried out prior to concreting. In this regard, it is essential that the base of each pile is free of loose or softened soil or other debris over at least 80% of the base area. In most instances this will require specialist cleaning methods to be adopted.

The pile shaft must also be essentially free of loose spoil or smeared/remoulded soil.

It is recommended that the base of all bored piles be carefully observed by a suitably experienced Engineer to confirm that the foundation materials have geotechnical properties consistent with the design assumptions and to check base and shaft cleanliness. Where materials are encountered which are weaker than assumed in the design analyses, the pile would need to be founded deeper or the allowable bearing pressure reduced.

4.5 Retaining Wall Design

Whilst basement levels are not proposed for the hotel or winery buildings, due to the slope of the site, benching for the buildings may result in retaining walls up to about 3 m high. Such walls are anticipated to retain a mixture of natural clay and rock. Low-height retaining walls may also be required on engineered fill batters for landscaping or similar.

Permanent retaining walls may be designed based on the long-term parameters presented in Table 8. Note that these parameters assume a horizontal slope behind the top of the retaining wall, no propping of the retaining wall, and ignore any friction between the retained soil and the back of the wall.

Further advice should be sought for sloping backfill, if required.

Table 8: Long-term Retaining Wall Design Parameters

MATERIAL	ESTIMATED AVERAGE PEAK STRENGTH PARAMETERS	BULK UNIT WEIGHT	EARTH PRESSURE COEFFICIENTS
	c' (kPa), ϕ' (°)	γ (kN/m ³)	K_a , K_0 , K_p
Engineered Fill	2, 30 ⁽¹⁾	19	0.33, 1.0, 3.0
Natural clay	5, 25	19	0.4, 1.2, 2.5
Extremely and highly weathered rock of low strength	10, 35	20	0.27, 1.0, 3.7
Highly and moderately weathered rock of at least medium strength	20, 45 ⁽²⁾	22	0.15, 1.0, 6 ⁽³⁾
Where: c' = long term apparent cohesion, ϕ' = long term angle of internal friction K_a , K_0 , K_p = coefficients of active, at-rest and passive earth pressure, assuming a horizontal surface above the wall and ignoring wall friction			
Notes: ⁽¹⁾ Assumes the engineered fill comprises highly and moderately weathered rock, suitably processed to provide a reasonably well-graded material with only a minor clay component. ⁽²⁾ Assumes the more competent rock will behave like a dense, clayey gravel for the purposes of estimating earth pressures on retaining walls. Note that Mohr-Coulomb shear strength parameters of about $c = 300$ kPa and $f = 30^\circ$ are suggested by the Hoek-Brown failure criterion, assuming a UCS of 6 MPa, GSI = 60% and $m_i = 7$. These alternative parameters may be adopted for stability assessments, if required. ⁽³⁾ Passive resistance in rock may be governed by failure along defects in the rock, especially at shallow depth.			

Where the retaining walls have significant compacted backfill placed after construction, it is expected that the compaction induced pressures will be much greater than the active or at-rest earth pressures.

The load on the retaining wall due to compaction equipment may be estimated from Figure J5 in AS 4678-2002 *“Earth Retaining Structures”*. For select free-draining granular backfill, an active coefficient, k_a , of 0.33 and an at rest coefficient, k_o , of 0.7 are recommended together with a bulk density of 21 kN/m³.

The compaction equipment used to compact backfill behind the wall must be carefully selected and preferably light-weight compaction equipment should be used.

All retaining walls should be designed in accordance with the recommendations of AS 4678-2002 *“Earth Retaining Structures”*.

In addition to the design earth pressures retaining walls would need to consider the following as appropriate:

- Unintended over-excavation in front of the retaining wall, thereby reducing the available passive resistance;
- An unbalanced hydrostatic pressure;
- Traffic loadings at the crest;
- Surcharge loadings at the crest (e.g. construction materials or footings of adjacent buildings).

4.6 Pavement Design

The laboratory soaked CBR tests and laboratory Estimated CBR values indicated CBR values of between 4% and 6% in the natural subgrade soils.

Based on the laboratory test results and our previous experience with similar soils, it is recommended that flexible pavements constructed on natural clays of medium and high plasticity be designed based on a subgrade CBR value of 4%.

Lower CBR values may be present locally where the subgrade soils are wetter or weaker and such areas would need to be identified during construction. Should such condition encountered, remedial works will be required, which would typically involve over-excavation and replacement of the upper 200 mm the subgrade or the placement of a geogrid on the subgrade.

For the design of concrete pavements, an average long-term Young's modulus of 18 MPa is recommended for the natural soils.

Where pavements and floor slabs in cut are founded on weathered rock a higher CBR value may be used. For preliminary design a CBR value of 10% and an average long-term Young's modulus of 30 MPa is recommended. These values would need to be confirmed during construction following completion of the bulk earthworks.

Pavements may also be founded on engineered fill, derived from site-won crushed rock, providing that the rock is suitably processed in accordance with Section 4.7.2 and is compacted to a dry density ratio of at least 98% based on Standard compaction. A preliminary design CBR value of 7% and a long-term Young's modulus of 25 MPa is suggested for engineered fill derived from site-won crushed rock. These preliminary design values would need to be reassessed during the earthworks, based on the quality of the engineered fill actually produced from the crushed rock.

The recommended design CBR values assume that:

- All highly organic soils, any uncontrolled fill and any softened natural soils are stripped and the upper 0.2 m of underlying natural subgrade is compacted to achieve a dry density ratio of at least 98% based on Standard compaction (AS 1289 5.1.1); and
- The pavement is adequately drained to prevent saturation of the pavement materials and underlying subgrade.

In addition to the design traffic loading, the long-term pavement performance must also consider:

- The effects of shrink-swell movements due to moisture content changes in the reactive subgrade soils (refer to Section 4.2.2). Such movements may adversely affect the riding quality and surface drainage and may result in cracking of any asphalt seal; and
- Differential subgrade movement at the transition between areas cut into rock and areas underlain by reactive clay. The use of geosynthetic reinforcing comprising both a paving fabric at the asphaltic concrete level and a geogrid at the base of the structural pavement (top of subgrade) should help to reduce reflective cracking at these locations.

4.7 Site Earthworks

4.7.1 Site Preparation

It is recommended that all uncontrolled fill, organic topsoil or softened/disturbed natural soils be stripped from the proposed building and pavement areas. A depth of stripping of up to about 0.4 m is expected, although locally deeper pockets of organic soils and disturbed soils may be encountered in places. The depth of stripping must be checked during the site earthworks.

Following stripping of unsuitable materials, it is recommended that the exposed natural soils be proof rolled with a vibrating pad foot roller of at least 8 tonnes static or fully loaded tandem axle truck to identify any soft, wet or weak areas which may require remedial works. The proof rolled surface shall be observed by a suitably experienced Engineer.

Proof rolling may be omitted where the subgrade comprises rock strength material.

4.7.2 Reuse of Site Won Material

The existing topsoil, with an appreciable proportion of organic material, is not suitable for re-use as controlled fill. The existing topsoil should only be used for landscaping.

The natural clays of medium and high plasticity are not ideally suited for re-use as controlled fill. In particular:

- The clays are expected to be difficult to moisture condition and compact, particularly where the moisture content varies markedly from the optimum moisture content;
- The clays are highly reactive and the shrink-swell potential is exacerbated in a fill as the clay is considered to be in an uncracked condition, in accordance with AS 280-2011.

The highly and moderately weathered rock would be suitable for use as engineered fill beneath pavements. Prior to compaction, the materials will need to be processed (screened and/or crushed) to provide a reasonably well graded material with a maximum particle size of nominally 100 mm (or no greater than 2/3 of the thickness of the compacted layer) and no more than 20% retained on the 37.5 mm sieve. A specification for the crushed rock should target the DIT specification for Type A fill.

The defect spacing varies in the rock mass so excavated block sizes will vary. It is noted that the test pits indicated rock fragments up to about 0.4 m in dimension in the more weathered rock. Consideration could be given to using a grid roller to compact the fill in order to break-down the larger particles.

The controlled fill should preferably comprise an imported quarry product or Type A fill meeting DIT specifications with a CBR value of at least 15%.

4.7.3 Controlled Fill

Prior to compaction, the controlled fill shall be moisture conditioned to within 2% of the optimum moisture content and compacted in layers not exceeding 250 mm in loose thickness to achieve a dry density ratio of at least 98% based on Standard compaction (AS 1289 5.1.1).

It is recommended that the controlled fill be placed under Level 1 overview, as outlined in AS 3798 *"Guidelines on earthworks for commercial and residential developments"*.

4.7.4 Excavatability

The soil strength materials (alluvium, residual soils and extremely weathered rock) encountered in the boreholes and test pits are expected to be excavatable using conventional earthmoving equipment, such as excavators larger than about 13 t.

Slower production rates would be expected where the clays are desiccated and within the residual soils/extremely weathered rock which contains fragments of less weathered rock. In such conditions larger machinery, such as a 20 t excavator, would be required.

Excavation of rock strength materials would be more difficult and hard rock excavation techniques would be required. The following excavation characteristics are expected based on our assessment of the test pit excavations and the typical rock characteristics:

- Where highly weathered, highly fractured and of low strength, the rock is expected to be rippable with a large bulldozer (CAT D9 or larger) or able to be excavated with a large excavator (30 t or larger) fitted with a rock bucket. A rock breaker or single tyne ripper may be required in less weathered zones, particularly around the perimeter of excavations.
- Moderately weathered rock of high and very high strength with a relatively wide defect spacing will require hard to very hard ripping with a CATD9 (or similar) bulldozer. Such materials are expected below the depth where refusal of the single tyne ripper occurred in the test pits. Production rates are likely to vary markedly depending on the rock characteristics such as the spacing, orientation and persistence of defects and rock strength.
Alternative extraction techniques such as a rock-breaker mounted on a large excavator (50 t or larger) should be considered.
The excavation of moderately weathered rock of high and very high strength in confined excavations (such as footing excavations and services trenches) is expected to be problematic.

Table 9 summarises the excavation conditions expected in areas of deeper cut.

Table 9: Summary of Likely Excavation Characteristics

BOREHOLE	DEPTH (m)	MATERIAL	TYPICAL EXCAVATABILITY CHARACTERISTICS
Winery (cuts up to about 6 m deep)			
BH13	0 to 4.7	Mainly soil strength	Bucket
	>4.7	Highly and moderately weathered rock, grading moderately to slightly weathered below 7.5 m	Rippable to 7 m Very hard ripping below 7 m
BH14	0 to 2.4	Mainly soil strength	Bucket
	>2.4	Highly and moderately weathered rock	Rippable to 3.3 m Hard ripping below
BH15	0 to 2.5	Mainly soil strength	Bucket
	>2.5	Highly and moderately weathered rock	Rippable to 5.6 m Hard ripping below
Hotel (cuts up to about 4 m deep, near BH11)			
BH10	0 to 2.6	Mainly soil strength	Bucket
	>2.6	Highly and moderately weathered rock	Rippable to 4 m Hard ripping below
BH11	0 to 0.5	Mainly soil strength	Bucket
	>0.5	Highly and moderately weathered rock	Rippable to 2.3 m Hard to very hard ripping below
BH12	0 to 7.7	Mainly soil strength	Bucket
	>7.7	Highly and moderately weathered rock	Rippable (locally hard ripping)

It is emphasised that the above rippability assessment is approximate only. Subsurface conditions are likely to vary from that shown in the boreholes logs and this will impact on the viability of ripping and the production rates.

4.7.5 Batter Slopes

All excavations deeper than 1.5 m must be appropriately battered and benched in accordance with WHS regulations and SafeWork SA guidelines prior to personnel entering. Proprietary continuous shoring is recommended in trenches deeper than 1.5 m.

The following batter slopes recommended for short-term excavations up to about 3 m deep where no groundwater seepage is encountered:

- Topsoil and natural sand/clayey sand: 1.75H:1V (or flatter);
- Natural clays of very stiff or hard consistency: 1H:1V (or flatter);
- Rock strength materials*: 0.5H:1V (or flatter).

Note: * Batter slopes would be governed by the orientation and persistence of defects in the exposed rock. The stability of cuttings in rock will need to be assessed during construction based on the orientation, persistence and condition of discontinuities in the rock mass. Batter slopes may need to be varied locally to reflect either more favourable or less favourably orientated discontinuities. Assuming a broadly westerly dip, slope stability would be less favourable on the eastern cut batters.

Flatter batter slopes would be required where groundwater seepage is encountered.

The proximity of stockpiles, cranes and delivery vehicles to the excavations would also need to be considered in the selection of temporary batter slopes.

The following long-term batter slopes are recommended:

- Soil strength materials: of 3H:1V (or flatter);
- Weathered rock: 1.5H:1V to 0.5H:1V* (or flatter);
- Controlled fill: 2H:1V (or flatter), assuming that the fill comprises adequately compacted site won crushed rock. Flatter slopes would apply for clay fill.

*Note: the appropriate batter slope in rock strength materials will depend on the degree of weathering, and the defects within the rock, which will need to be assessed during excavation. The potential for future instability in steep batters should be considered.

Batter slopes in weathered rock will need to be cleaned to remove all loose fragments and potentially unstable zones.

Batters in soil strength materials must be vegetated to reduce the potential for scour or erosion, or anti-erosion mats provided. Stormwater must not be allowed to flow down fill batters unless specifically constructed erosion protection measures are installed.

Where the fill is placed on natural slopes steeper than 8H:1V, the fill would need to be keyed into the slope by the provision of a series of horizontal benches (terraces) excavated into the hillslope.

Adequate surface drainage must also be provided to prevent saturation of the fill during construction.

4.7.6 Dewatering

Groundwater is not expected in the upper 3 m and therefore dewatering of shallow excavations is not expected to be generally required.

Locally perched groundwater could occur during extended wet periods and if encountered such groundwater would typically be controlled using sumps and pumps.

4.7.7 Drainage and Soil Erosion

In general site drainage must be designed to prevent surface run-off ponding on or adjacent to pavements or buildings. The ponding of water along or adjacent to pavements may cause premature failure.

Drainage could be achieved by grading the ground surface away from footings and across pavements and providing swales or surface V-drains to direct surface water to suitable disposal areas.

Concentrated surface flows should be avoided where possible. Where unavoidable, erosion protection works (such as stone pitching) must be provided.

Care will therefore need to be taken to prevent erosion, particularly where the vegetation cover is disturbed (or not established on new cuts or fills) or where concentrated surface flows exist.

Disturbed surfaces should be promptly covered with topsoil and seeded to promote vegetation growth or proprietary anti-erosion mats provided.

4.7.8 Trafficability

Trafficability of the clays is likely to become poor when wetted. Contractors should make allowance for poor trafficability, compaction difficulties and program delays when earthworks are conducted in the winter months. It is considered desirable to conduct the earthworks in the drier months rather than winter.

The provision of a working platform of imported quarry material on top of the natural soil would be expected to assist trafficability during construction. Alternatively lime stabilisation of the upper 150 mm of subgrade could be considered.

4.7.9 Moisture Control

Care must be undertaken during construction to prevent desiccation or moisture ingress to the foundation soils during construction.

4.8 Landscaping and Site Maintenance

It is recommended that the landscaping, drainage and future maintenance of the site be in accordance with the recommendations of AS 2870-2011. In particular, the following should be noted:

- Appropriate perimeter paving must be provided around the structures;
- Stormwater and surface run-off must not be allowed to pond adjacent to footings. Roof stormwater should be piped to the street;
- New trees and shrubs should be carefully selected and located to minimise desiccation effects; and
- All underground service connections to the structure should be made flexible in order to accommodate the expected shrink-swell movements in the soils.

4.9 Safety in Design

This report presents factual information about the subsurface conditions at the site and an assessment of how these conditions might impact on the design and construction of the proposed development from a geotechnical perspective. At the time of reporting the design and documentation of the proposed development had not been finalised and as a result Safety in Design issues have not been considered in this report. It is the responsibility of the designer to use the information contained herein to prepare a Safety in Design Report which is appropriate for the proposed development.

Specific input on geotechnical issues for the Safety in Design report can be provided as part of the detailed design phase if required.

5 LIMITATIONS

The recommendations contained within this report have been based on the subsurface conditions encountered in a limited number of boreholes and the judgement and opinion of WGA. To the best of our knowledge, the subsurface conditions described in this report provide a reasonable interpretation of the typical subsurface conditions likely to be encountered at the site.

It must be accepted that variations in subsurface conditions are likely to occur at this site and such variations may impact on the design recommendations provided. Under no circumstances can it be assumed that this report represents the actual subsurface conditions at all locations over the site.

Yours sincerely,



Brenton Harris
for
WALLBRIDGE GILBERT AZTEC

APPENDIX A

FIGURES





Legend:

-  - Test Pit Location
-  - Borehole Location



Source: Google Earth Pro.
Dated March 2024.

Drawn by	ZY
Approved	RWG
Date	11/06/2025
Dimensions	NTS
Original	-

WGA

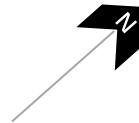
Client:	TURNER & TOWNSEND PROJECT MANAGEMENT		
Project:	SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION WILLIAMSTOWN SA		
Title:	BOREHOLE LOCATION PLAN		
Project No.:	WGA242303	Ref.	FIGURE A1



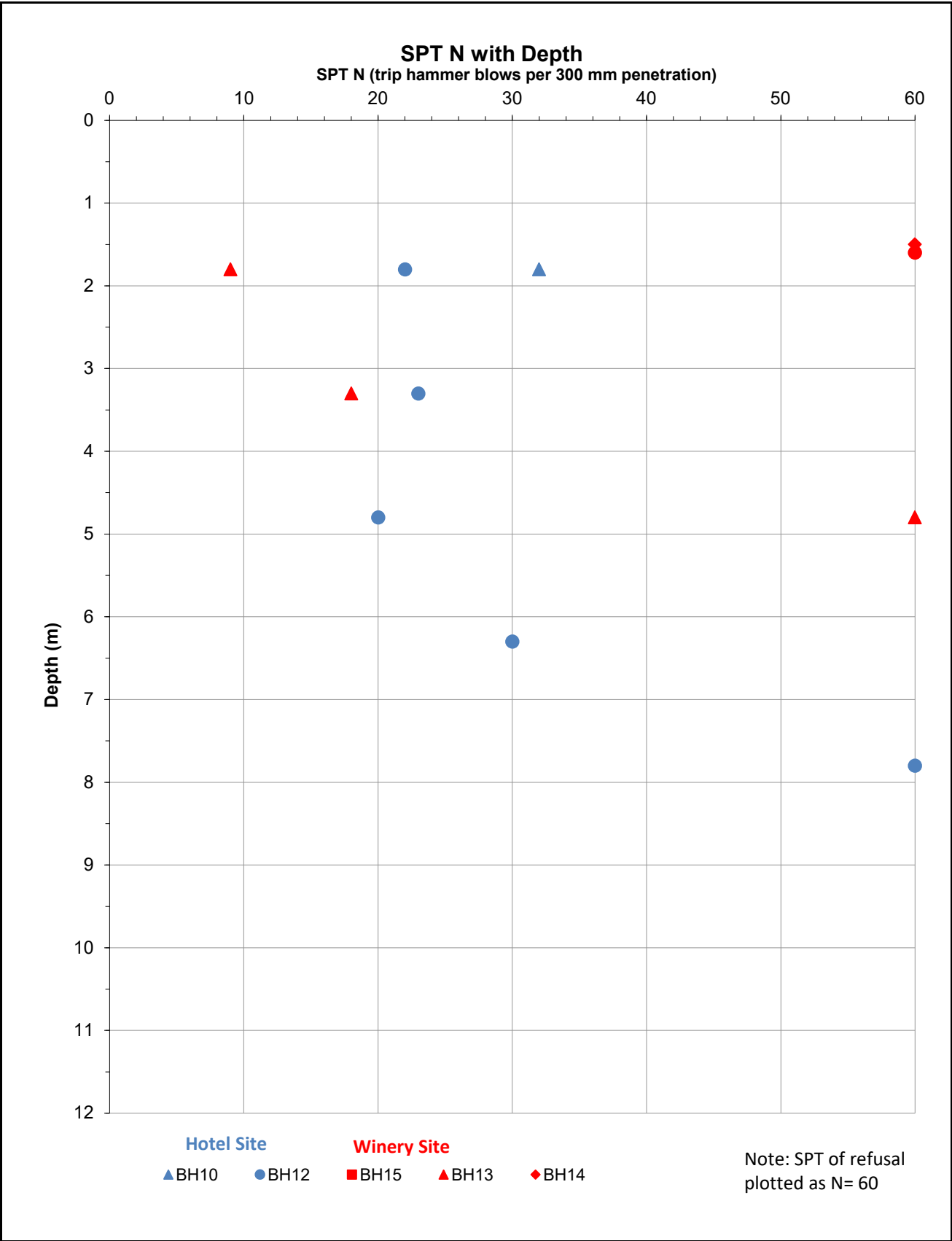
Legend:

-  - Test Pit Location
-  - Borehole Location

Source: Google Earth Pro.
Dated March 2024.

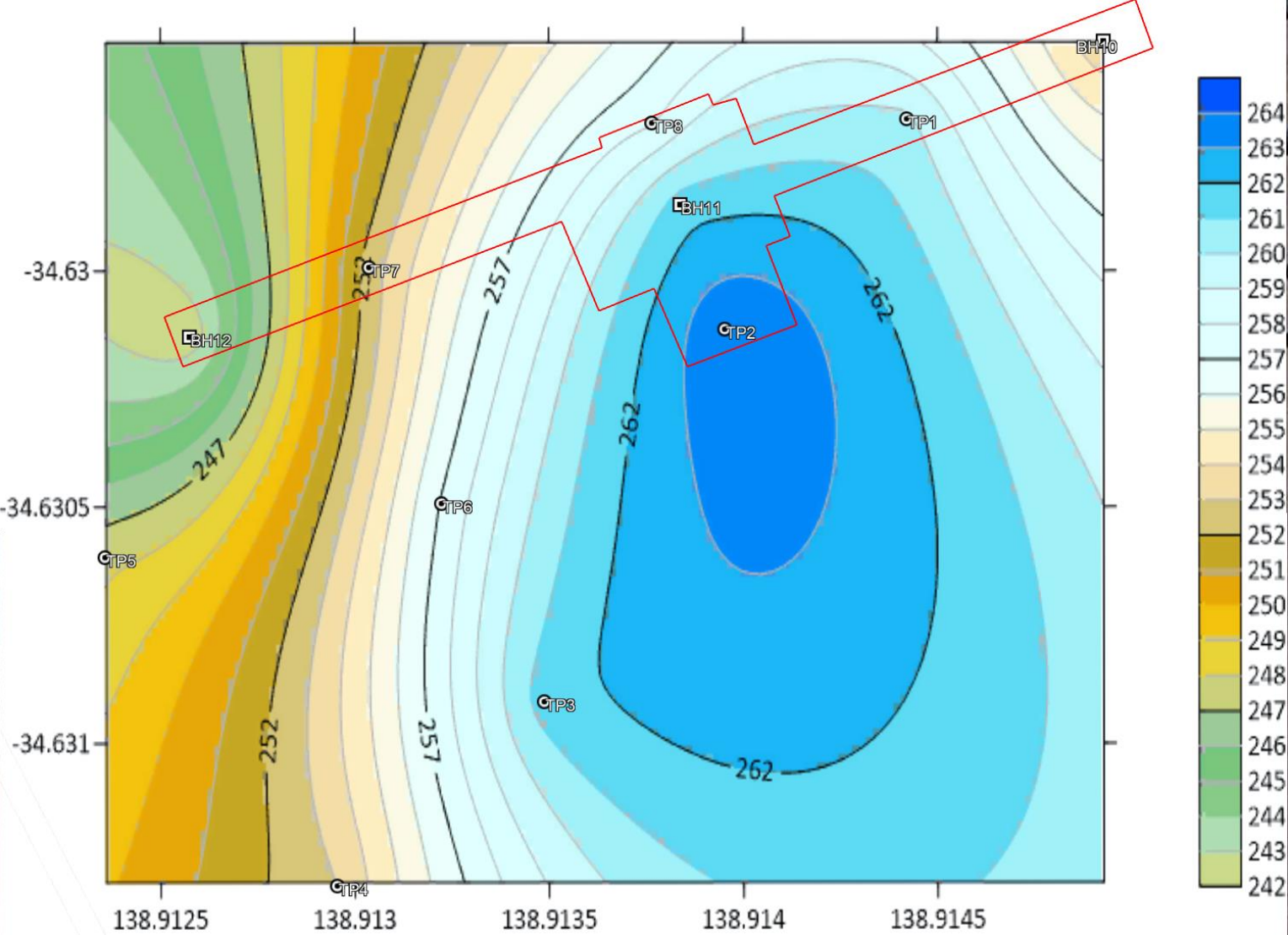


Drawn by	ZY					Client:	TURNER & TOWNSEND PROJECT MANAGEMENT		
Approved	RWG					Project:	SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION WILLIAMSTOWN SA		
Date	30/06/2025					Title:	BOREHOLE AND TEST PIT LOCATION PLAN		
Dimensions	NTS					Project No.:	WGA242303	Ref.	FIGURE A2
Original	-								



Prepared by	ZY	WGA	TOWNSEND AND TURNER SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION WILLIAMSTOWN SUMMARY OF STANDARD PENETRATION TESTING	
Checked by	RWG			
Date	18/04/24			
Date tested	15/04/24			
Original Size	A4		WGA242303	FIGURE A3

Indicative RL of Bedrock

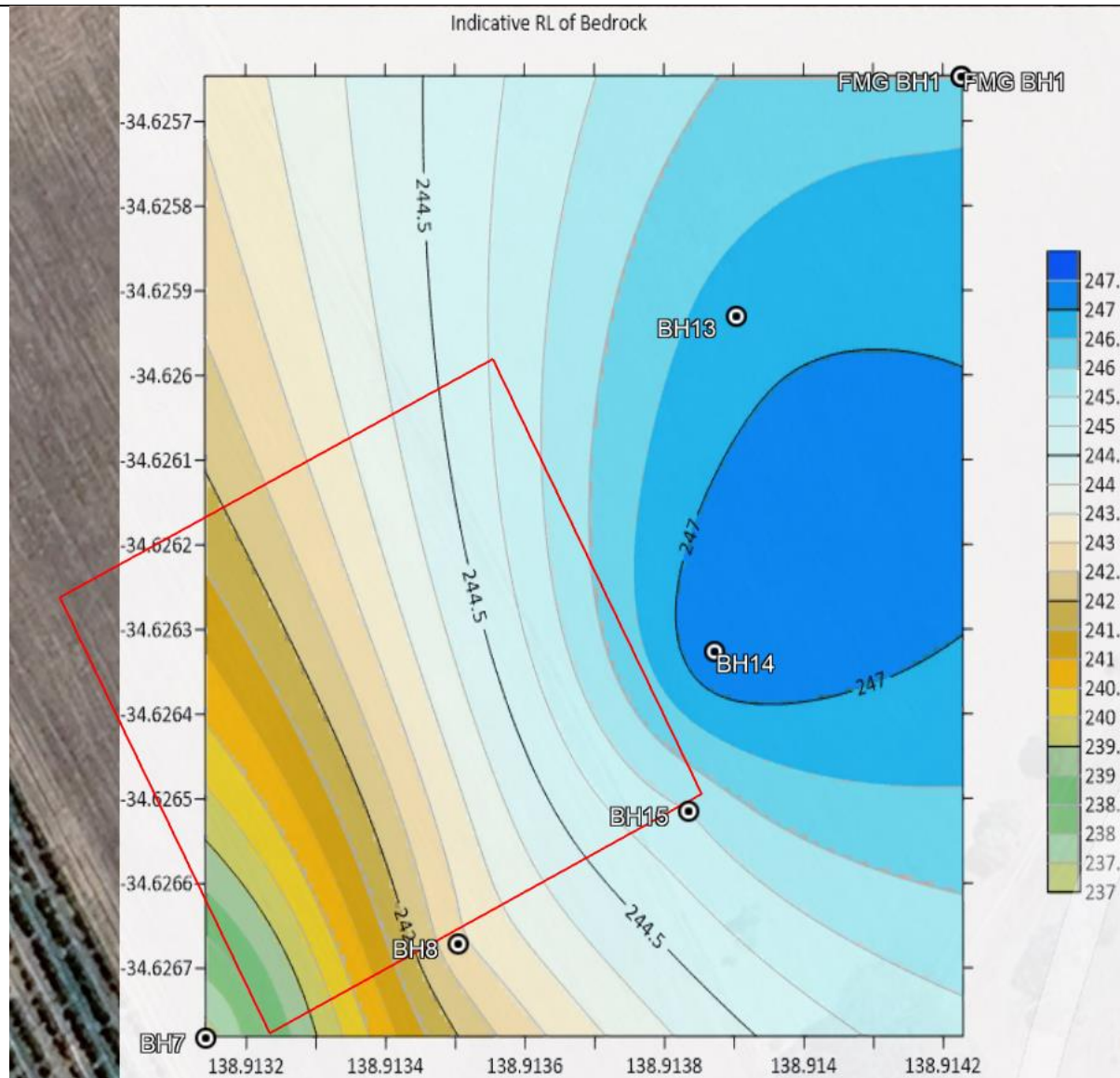


Source: Google Earth Pro.
Dated March 2024.

Drawn by	ZY
Approved	BJH
Date	30/06/2025
Dimensions	NTS
Original	-

WGA

Client:	TURNER & TOWNSEND PROJECT MANAGEMENT		
Project:	SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION WILLIAMSTOWN, SA		
Title:	INFERRED BEDROCK ELEVATION - HOTEL		
Project No.:	WGA242303	Ref.	FIGURE A4



Source: Google Earth Pro.
Dated March 2024.

Drawn by	ZY	WGA	Client:	TURNER & TOWNSEND PROJECT MANAGEMENT		
Approved	BJH		Project:	SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION WILLIAMSTOWN, SA		
Date	30/06/2025		Title:	INFERRED BEDROCK ELEVATION- WINERY		
Dimensions	NTS		Project No.:	WGA242303	Ref.	FIGURE A5
Original	-					

APPENDIX B

RESULTS OF THE FIELD INVESTIGATION





60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 11/06/2025

Date Logged: 11/06/2025

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 1

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, brown to dark brown, with low plasticity fines, trace fine root fibres	M			Topsoil - A-horizon
0.3						
0.5	CH	CLAY, high plasticity, red brown to dark red brown, trace sand, fissured, blocky structure	<Wp	H	>600	Alluvium
					>600	
					>600	
1.0					>600	
					>600	
		From 1.3 m, became mottled white and sandier			>600	
1.5					>600	
		Borehole terminated at 1.5 m (target depth)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



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Date Drilled: 11/06/2025

Date Logged: 11/06/2025

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 2

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, dark brown, with low plasticity fines, with rootlets and organic matters	M			Topsoil
0.35						
	SP	SAND, fine to medium grained, pale brown to pale yellow brown, trace fines, trace organic matters	D-M			A-horizon
0.5						
0.7						
	CL	Sandy CLAY, medium to high plasticity, pale orange brown mottled red brown, fine to medium grained	<Wp	H-Fb	350	Alluvium
1.0						
1.1					600	
	CH	CLAY, high plasticity, red brown to dark red brown, trace sand, fissured, blocky structure	<Wp	H	>600	
					>600	
1.5					>600	
		Borehole terminated at 1.5 m (target depth)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



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Date Drilled: 11/06/2025

Date Logged: 11/06/2025

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 3

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SC	Clayey SAND, fine to medium grained, brown, low plasticity, with rootlets and organic matters	M			Topsoil
0.3						
	CH	CLAY, high plasticity, red brown to dark red brown, trace sand, fissured, blocky structure	<Wp	Fb		B-horizon
0.5						
		0.35 m - 0.65 m, highly fissured		H-Fb		
					>600	
1.0						
					>600	
1.2						
	CH	CLAY, high plasticity, dark red brown to grey brown mottled white, with fine to medium grained sand	<Wp	H	>600	Alluvium
1.5					>600	
		Borehole terminated at 1.5 m (target depth)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 4

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, brown to dark brown, with low plasticity fines, trace fine root fibres	M			Topsoil
0.3						
	CH	CLAY, high plasticity, red brown with pale orange brown, with fine to medium grained sand, fissured, blocky	<Wp	H-Fb	>600	B-horizon
0.5						
					>600	
1.0					>600	
1.1						
	CL	Sandy CLAY, medium plasticity, pale brown to pale yellow brown, fine to medium grained, trace fine root fibres	<Wp	Fb		Alluvium
1.5				H-Fb	550	
2.0						
2.1						
	CL/CH	CLAY, medium to high plasticity, red brown to brown, with fine to medium grained sand, trace fine root fibres	<Wp	H	>600	
					>600	
2.5					>600	
					>600	
					>600	
3.0					>600	

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 4

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff

USCS: Unified Soil Classification System ↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
3.1	CL/CH	CLAY, as above	<Wp	H	>600	
	CL/SC	Sandy CLAY/clayey SAND, low to medium plasticity, pale brown to brown, fine to medium grained, becoming sandier with depth	<Wp/D	Fb	250	Coarser grained alluvium
3.5				Vst		From 3.1 m, moisture content increased
3.7						
	SC	Clayey SAND, fine to medium grained, pale brown to pale yellow brown, low plasticity	D	MD		
4.0						
		Borehole terminated at 4.0 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 5

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.15	SP	SAND, fine to medium grained, dark brown, with low plasticity fines, trace rootlets	M			Topsoil / disturbed
	CH	CLAY, high plasticity, red brown, trace sand, fissured, blocky structure	≈Wp	Vst	380	B-horizon
0.5			<Wp	H	>600	
					>600	
					>600	
1.0	CL	Sandy CLAY, medium plasticity, pale brown to pale yellow brown, fine to medium grained	<Wp	Fb		Alluvium
1.5				Vst	310	
					280	
				Fb		
2.0				Vst	380	
2.4						
2.5	CL	Sandy CLAY, medium plasticity, pale brown to pale orange brown, fine to medium grained, becoming sandier with depth	<wp	Vst	410	
3.0					310	
					330	

Depth to Groundwater: None Observed

Trees at Site: Yes



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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 5

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System ↓GW = Groundwater		

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
3.1	CL	Sandy CLAY, as above	<Wp	H	450	
	CL/SC	Sandy CLAY/clayey SAND, low to medium plasticity, yellow brown to brown, fine to medium grained	<Wp/D	Fb		Coarser gained alluvium
3.5		3.5 m - 3.7 m, became clayey sand				
4.0				H	>600	
		Borehole terminated at 4.0 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 6

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, dark brown, with low plasticity fines, with fine root fibres and organic matters	M			Topsoil
0.3						
	CH	CLAY, high plasticity, red brown to dark red brown, trace sand, fissured, blocky structure	<Wp	H	>600	B-horizon
0.5					>600	
					>600	
0.9						
1.0	CL	Sandy CLAY, low to medium plasticity, pale brown mottled white, fine to medium grained, trace gravels, slightly calcareous	<Wp	Fb		Calcareous
1.25						
	CL/SC	Sandy CLAY/clayey SAND, low plasticity, pale brown, fine to medium grained	<Wp/D	Fb		Alluvium
1.5						
2.0						
2.2						
	SC	Clayey SAND, fine to medium grained, brown to red brown speckled black, grey, low plasticity, with fine grained, subrounded to rounded gravels	D			Coarse gained alluvium
2.4						
2.5						
	SC	Clayey SAND, fine to medium grained, orange brown to brown, low plasticity	D			
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



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Telephone 08 8223 7433
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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 6

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System ↓GW = Groundwater		

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
3.1	SC	Clayey SAND, as above	D			
	SP	SAND, fine to medium grained, brown, with low plasticity fines	D			
3.5						
3.7						
	CL/SC	Sandy CLAY/clayey SAND, low plasticity, pale orange brown, fine to	<Wp/D	Fb		
4.0		medium grained				
		Borehole terminated at 4.0 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2025

Date Logged: 11/06/2025

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 7

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, dark brown, with low plasticity fines, trace fine root fibres and organic matter	M			Topsoil
0.3						
	CH	CLAY, high plasticity, dark brown to dark red brown, trace sand, fissured, blocky structure	<Wp	H	>600	B-horizon
0.5					>600	
					>600	
0.9						
1.0	CL	Sandy CLAY, medium plasticity, pale brown to pale yellow brown, fine to medium grained	<Wp	Fb		Alluvium
				H	>600	
1.5					>600	
1.7						
	CL/SC	Sandy CLAY/clayey SAND, low plasticity, pale orange brown, fine to medium grained	<Wp/D	Fb		Coarser grained alluvium
2.0						
2.4						
2.5	CH	CLAY, high plasticity, red brown mottled grey and yellow, trace sand At 2.4 m, highly weathered schist fragment recovered	<Wp	H	>600	Residual clay
					>600	
2.8		Extremely weathered schist recovered as silty SAND, fine to medium			>600	
	SP	grained, pale yellow to pale yellow brown, low plasticity, trace schist fragment	D			Extremely to highly
3.0		Borehole terminated at 3.0 m (push tube refusal)				weathered bedrock

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2025

Date Logged: 11/06/2025

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 8

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SC	Clayey SAND, fine to medium grained, dark brown, low plasticity, with fine root fibres	M			Topsoil
0.15	CH	CLAY, high plasticity, red brown to dark red brown, trace sand, fissured, blocky structure	<Wp	H	430	B-horizon
0.5					600	
					510	
		0.75 m - 1.55 m, highly fissured		H		
1.0						
1.5		At 1.55 m, extremely to highly weathered schist fragment recovered				
1.6		as gravels, rock fabric observed				Extremely to highly weathered bedrock
		Borehole terminated at 1.6 m (push tube refusal)				
2.0						
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
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Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 9

Page 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System		↓GW = Groundwater

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
	SP	SAND, fine to medium grained, dark brown, with low plasticity fines, with fine root fibres and organic matter	M			Topsoil
			D-M			
0.5						
	CH	CLAY, high plasticity, red brown to pale red brown, trace sand, fissured	<Wp	H	>600	B-horizon
					>600	
1.0					>600	
1.2					>600	
	CL/CH	Sandy CLAY, medium to high plasticity, pale yellow brown mottled red brown, fine to medium grained	<Wp	H	>600	Alluvium
1.5						
	CL	Sandy CLAY, medium plasticity, pale yellow brown mottled black, fine to medium grained, trace fine grained, subrounded to rounded gravels, becoming sandier with depth	<Wp	Vst	600	
					450	
2.0					420	
2.2					300	
	CL/SC	Sandy CLAY/clayey SAND, low plasticity, brown to red brown mottled yellow brown, grey brown, fine to medium grained	<Wp/D	Fb		Coarser grained alluvium
2.5						
3.0						

Depth to Groundwater: None Observed

Trees at Site: Yes



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 11/06/2025

Date Logged: 11/06/2024

Logged by: ZY

Drilling Method: Push Tube

Drill Rig/Mount: Portable

Borehole No.

BH 9

Page 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm Fb - Friable
Wp - Plastic Limit		St - Stiff
USCS: Unified Soil Classification System ↓GW = Groundwater		

Project Number: WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
3.1	CL/SC	Sandy CLAY/clayey SAND, as above	<Wp/D	Fb		
	CH	CLAY, high plasticity, red brown with grey, with fine to medium grained sand	<Wp	H	420	Residual clay
					400	
3.5					410	
3.8						
4.0		Extremely weathered schist recovered as sandy CLAY, medium to high plasticity, pale red brown to orange brown, with grey, fine to medium grained	<Wp	Vst	280	Extremely weathered bedrock - moisture content increased
		Borehole terminated at 4.0 m (target depth)				
4.5						
5.0						
5.5						
6.0						

Depth to Groundwater: None Observed

Trees at Site: Yes

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 23/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 24/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308865.0 m E 6166064.0 m N MGA2020-54		Checked By: BJH	

Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°		RL Surface: No survey	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°		Datum: AHD Operator: BN	

Drilling Information						Rock Substance						Rock Mass Defects										
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling									
										VL	L	M	H	VH	EH	30	100	300	1000	3000	Particular	General
									Continued from non-cored borehole sheet													
							0.5		CH: Topsoil (Clayey SAND) over clay, high plasticity, red brown, trace sand, <Wp.													
							1.0															
							1.5		CL: low to medium plasticity, pale grey mottled yellow brown, with fine to medium grained sand, rock fabric observed, very stiff.													
							2.0		CL: Sandy CLAY, medium plasticity, pale grey brown, mottled red brown, fine to medium grained, trace rock fragments <Wp.	XW												
			100	0	0		2.5															
							3.0		SILTSTONE: fine to medium grained, dark grey, mottled grey and brown, thinly laminated.	XW HW											2xPT, 15°, Sand, CO, IR, RO	
							3.5														PT, 70°, CO, IR, RO	
			90	77	0																FZ, recovered gravels	
																					5xPT, 15°, Sand, CO, IR, RO	

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel		Water Level (Date) Inflow Partial Loss Complete Loss		Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High		Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil		Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break		Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open	
Graphic Log/Core Loss Core recovered (hatching indicates material) Core loss		Support T - Timbering		Defect Roughness RO - Rough SO - Smooth SL - Slickened						Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved	

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 23/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 24/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308865.0 m E 6166064.0 m N MGA2020-54		Checked By: BJH	

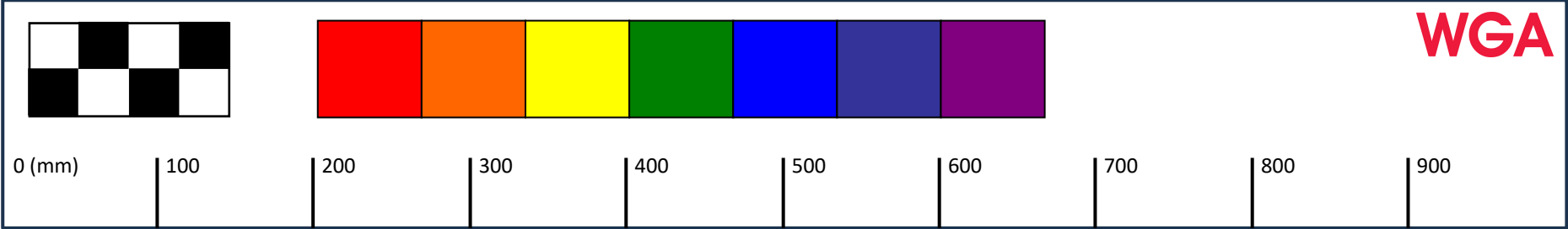
Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°		RL Surface: No survey	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°		Datum: AHD Operator: BN	

Drilling Information						Rock Substance				Rock Mass Defects										
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling							
										VL	M	H	EH	30	100	300	1000	3000	Particular	General
			90	77	0				SILTSTONE: fine to medium grained, dark grey, mottled grey and brown, thinly laminated. (continued)										JT, 45°, Clay, VN, IR, RO	
			82	77	23		4.5												PT, 85°, Sand, CO, IR, RO	
							5.0												JT, 45°, Sand, VN, IR, RO	
			88	70	0		5.5												8xPT, 30°, Sand and clay, VN, IR, RO	
							6.0												JT, 40°, Sand, CO, IR, RO PT, 30°, Sand, CO, IR, RO	
							6.5												5xPT, 25°, Clay, CO, IR, RO	
			90	87	10		7.0												PT, 80°, Clay, CO, IR, RO JT, 45°, Clay, CO, IR, RO	
							7.5												5xPT, 15°, Clay, CO/VN, IR, RO JT, 70°, Clay, CO, IR, RO JT, 60°, Clay, VN, IR, RO	
			89	78	0														5xPT, 15°, Clay, VN, IR, RO JT, 60°, Clay, VN, IR, RO	
																			2xPT, 15°, Sand, CO, IR, RO JT, 65°, Sand, CO, IR, RO JT, 45°, Clay, CO, IR, RO	
																			7xPT, 15°, Clay, CO, IR, RO	

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel		Water Level (Date) Inflow Partial Loss Complete Loss		Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High		Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil		Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break		Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open	
Graphic Log/Core Loss Core recovered (hatching indicates material) Core loss		Support T - Timbering		Defect Roughness RO - Rough SO - Smooth SL - Slickened				Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved			

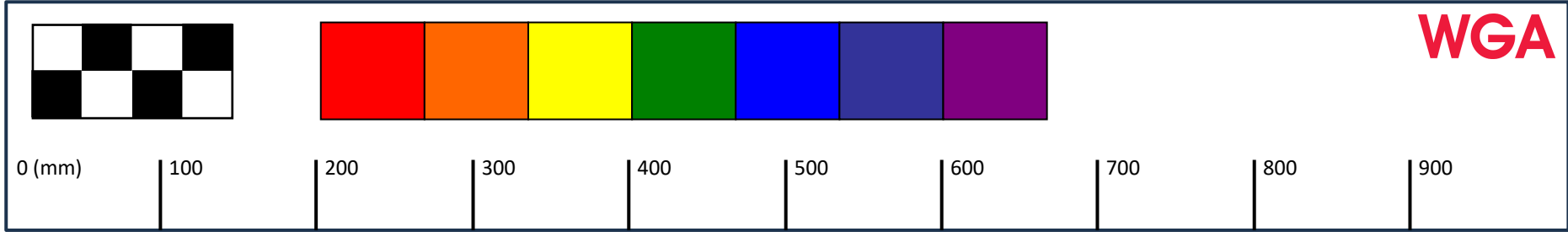
Project No.: WGA242303

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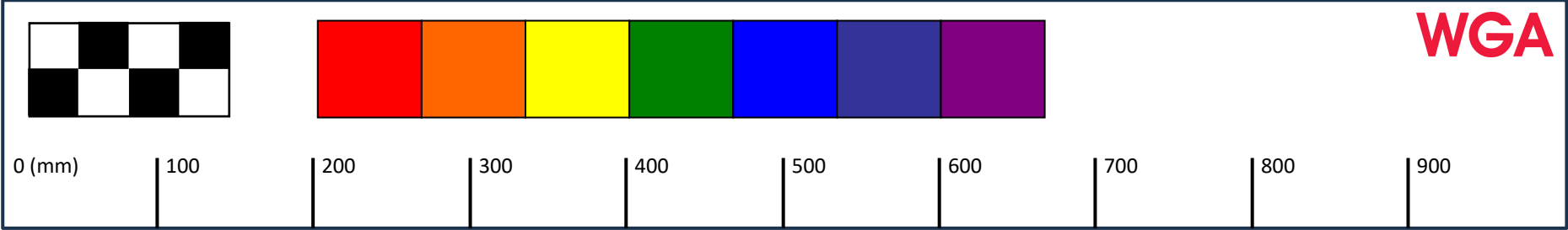


WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH10
Project:	Proposed Southern Barossa Hotel Development	Date:	23/06/2025 – 24/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	1/3
Job No:	WGA242303	Depth:	0.0 m – 4.0 m



Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH10
Project:	Proposed Southern Barossa Hotel Development	Date:	23/06/2025 – 24/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	2/3
Job No:	WGA242303	Depth:	4.0 m – 8.0 m



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH10
Project:	Proposed Southern Barossa Hotel Development	Date:	23/06/2025 – 24/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	3/3
Job No:	WGA242303	Depth:	8.0 m – 10.1 m

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 24/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 24/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308766.0 m E 6166024.0 m N MGA2020-54		Checked By: BJH	

Drill Model and Mounting: Boart Longyear LX6 track mounted	Inclination: -90°	RL Surface: No survey
Barrel Type and Length: HQ 1.5 m	Bearing: 090°	Datum: AHD Operator: BN

Drilling Information				Rock Substance				Rock Mass Defects						
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling	
												Particular	General	
									Continued from non-cored borehole sheet	VL				
							0.5		Topsoil (Clayey SAND) over mixture of rock fragments and clay, high plasticity, red brown, with fine to medium grained sand.	RS XW				
							1.0		SILTSTONE: fine to medium grained, grey-dark grey, thinly laminated, with schist interbedded.	XW HW				JT, 30°, Clay, VN, UN, RO
							1.5		Gravelly CLAY, medium plasticity, pale grey brown to pale brown, fine to coarse grained, subangular to subrounded, with fine to coarse grained sand, <Wp.	XW				JT, 45°, Sand, CO, UN, RO
							2.0		SILTSTONE: fine to medium grained, grey-dark grey, thinly laminated, with schist interbedded.	HW MW				7xPT, 15°, Sand, CO, IR, RO
							2.5		NO CORE 0.20m (2.10-2.30)					FZ, recovered as clayey GRAVEL
							3.0		SILTSTONE: fine to medium grained, grey-dark grey, thinly laminated, with schist interbedded.	HW MW				5xPT, 15°, Clay, VN, IR, RO
							3.5							PT, 15°, Sand, CO, IR, RO
							4.0							JT, 70°, Clay, VN, IR, RO
							4.5							2xPT, 15°, Sand, CO, IR, RO
							5.0							
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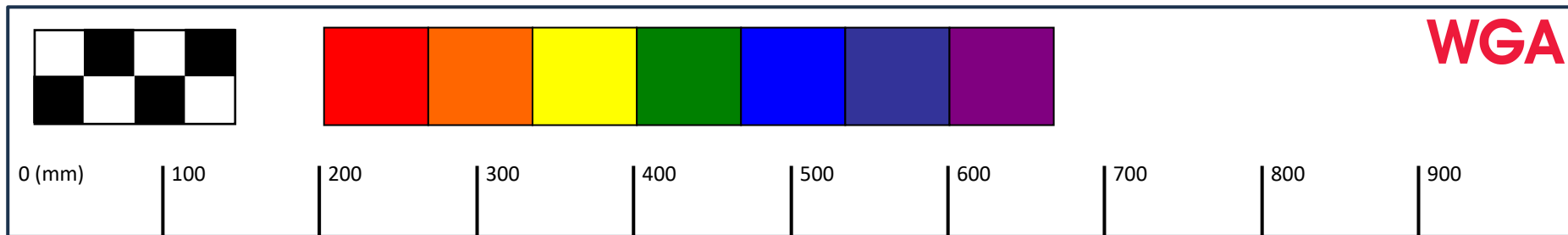
Engineering Log - Cored Borehole

Project No.: WGA242303

Client:		Turner & Townsend Project Management Pty Ltd				Commenced:		24/06/2025						
Project Name:		Proposed Southern Barossa Hotel				Completed:		24/06/2025						
Hole Location:		Lyndoch, SA				Logged By:		ZY						
Hole Position:		308766.0 m E 6166024.0 m N MGA2020-54				Checked By:		BJH						
Drill Model and Mounting:		Boart Longyear LX6 track mount		tthclination:		-90°		RL Surface: No survey						
Barrel Type and Length:		HQ 1.5 m		Bearing:		090°		Datum: AHD Operator: BN						
Drilling Information		Rock Substance					Rock Mass Defects							
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20-1 ₅₀₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling	
										VL L M H VH EH		30 100 300 1000 3000	Particular	General
HQ3								x x						

Project No.: WGA242303

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WGA

Client: Turner & Townsend Project Management Pty Ltd

Project: Proposed Southern Barossa Hotel Development

Title: CORE PHOTOGRAPHS

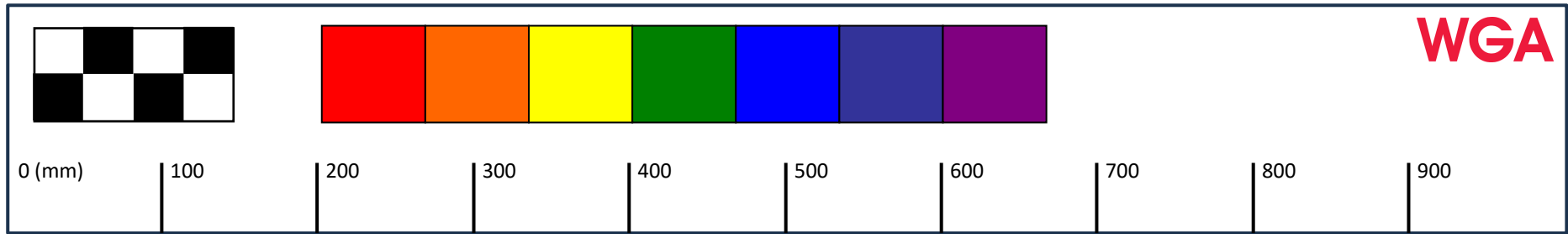
Job No: WGA242303

Borehole ID: BH11

Date: 24/06/2025

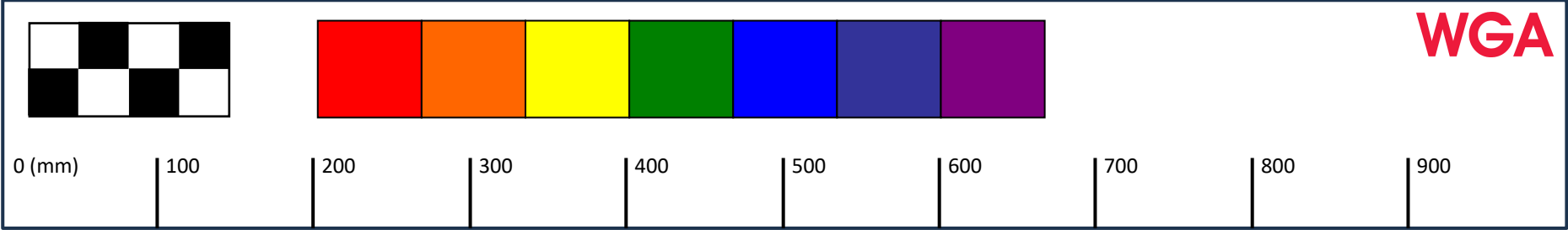
Box No: 1/3

Depth: 0.0 m – 4.0 m



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH11
Project:	Proposed Southern Barossa Hotel Development	Date:	24/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	2/3
Job No:	WGA242303	Depth:	4.0 m – 8.0 m



	Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH11
	Project:	Proposed Southern Barossa Hotel Development	Date:	24/06/2025
	Title:	CORE PHOTOGRAPHS	Box No:	3/3
	Job No:	WGA242303	Depth:	8.0 m – 10.0 m

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 25/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 25/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308651.0 m E 6165991.0 m N MGA2020-54		Checked By: BJH	
Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°	
RL Surface: No survey		Datum: AHD	
Operator: BN			

Drilling Information				Rock Substance				Rock Mass Defects												
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling							
										VL	LM	HM	EH	30	100	300	1000	3000	Particular	General
ADV							0.5		Continued from non-cored borehole sheet											
							1.0		Topsoil (Clayey SAND) over clay, high plasticity, brown mottled white, trace sand, trace calcareous nodules, <Wp, very stiff.											
							2.0		CL: Sandy CLAY, medium plasticity, pale brown to brown, fine to medium grained, <Wp, very stiff.											
							3.5		CL: Sandy CLAY, medium plasticity, pale brown, mottled red brown, grey, fine to medium grained, <Wp, stiff-very stiff.											

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel	Water Level (Date) Inflow Partial Loss Complete Loss	Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil	Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break	Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open
Graphic Log/Core Loss Core recovered (hatching indicates material) Core loss	Support T - Timbering	Defect Roughness RO - Rough SO - Smooth SL - Slickened			Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 25/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 25/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308651.0 m E 6165991.0 m N MGA2020-54		Checked By: BJH	

Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°		RL Surface: No survey	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°		Datum: AHD Operator: BN	

Drilling Information						Rock Substance						Rock Mass Defects					
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling				
										VL L M H VH EH		30 100 300 1000 3000	Particular	General			
							4.5		CL: Sandy CLAY, medium plasticity, pale brown, mottled red brown, grey, fine to medium grained, <Wp, stiff-very stiff.(continued)								
							5.0		CL CH: Sandy silty CLAY, medium to high plasticity, pale brown with red brown, speckled black, fine to medium grained, with silts, <Wp, very stiff.								
							5.5										
							6.0										
							6.5										
							7.0										
							7.5		NO CORE 0.20m (7.50-7.70)								
									SCHIST: fine to coarse grained, dark grey-black mottled grey, massive, with interbedded siltstone.	HW MW HW							

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel		Water Level (Date) Inflow Partial Loss Complete Loss		Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High		Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil		Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break		Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open	
Graphic Log/Core Loss Core recovered (hatching indicates material) Core loss		Support T - Timbering		Defect Roughness RO - Rough SO - Smooth SL - Slickened				Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved			

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd
 Project Name: Proposed Southern Barossa Hotel
 Hole Location: Lyndoch, SA
 Hole Position: 308651.0 m E 6165991.0 m N MGA2020-54

Commenced: 25/06/2025
 Completed: 25/06/2025
 Logged By: ZY
 Checked By: BJH

Drill Model and Mounting: Boart Longyear LX6 track mounted inclination: -90°
 Barrel Type and Length: HQ 1.5 m Bearing: 090°
 RL Surface: No survey
 Datum: AHD Operator: BN

Drilling Information							Rock Substance							Rock Mass Defects										
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20·L ₅₀ ● - Axial ○ - Diametral ■ - UCS					Average Defect Spacing (mm)				Defect Description thickness, type, inclination, planarity, roughness, coating/infilling				
											VL	L	M	H	VH	EH	30	100	300	1000	3000	Particular	General	
HQ3	HWT		83	54	0		8.5		SCHIST: fine to coarse grained, dark grey-black mottled grey, massive, with interbedded siltstone.(continued)	MW												8xPT, 15°, Clay, VN, IR, RO		
								HW															JT, 30°, Sand, CO, IR, RO PT, 15°, Sand, VN, IR, RO PT, 70°, Sand, CO, IR, RO	
							9.0			MW													PT, 70°, Sand, CO, IR, RO	
								HW																
								HW - MW															2xPT, 15°, Clay, CO, IR, RO	
							9.5			MW														
										HW													5xPT, 15°, Clay, CO, IR, RO	
			91	88	21		10.0																PT, 15°, Clay, CO, IR, RO PT, 30°, Sand and Clay, VN, IR, RO	
																							JT, 30°, Sand, CO, IR, RO JT, 20°, Sand, CO, IR, RO	
							10.5				HW - MW													
																						FZ, multiple fractures FZ, recovered as rock fragments		
			79	7	0		11.0			HW													7xPT, 20°, Silty clay with gravels, VN, IR, RO	
							11.5		Hole Terminated at 11.50 m Target depth															

Method

AS - Auger Screwing
WB - Washbore
NMLC - NMLC Core Barrel
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel

Graphic Log/Core Loss

Core recovered (hatching indicates material)

Core loss

Water

Level (Date)

Inflow

Partial Loss

Complete Loss

Support

T

Timbering

Strength

VL

Very Low

L

Low

M

Medium

H

High

VH

Very High

EH

Extremely High

Defect Roughness

RO

Rough

SO

Smooth

SL

Slickened

Weathering

FR

Fresh

SW

Slightly Weathered

DW

Distinctly Weathered

XW

Extremely Weathered

RS

Residual Soil

Defects

JT

Joint

PT

Parting

SM

Seam

SZ

Sheared Zone

CS

Crushed Seam

XW

Extremely Weathered

RS

Residual Soil

FZ

Fractured Zone

DB

Drill Break

Defect Coating

CN

Clean

SN

Stained

VN

Veneer

CO

Coating

OP

Open

Defect Shape

PL

Planar

UN

Undulating

ST

Stepped

IR

Irregular

CU

Curved

Method
 AS - Auger Screwing
 WB - Washbore
 NMLC - NMLC Core Barrel
 HQ3 - HQ3 Core Barrel
 NQ3 - NQ3 Core Barrel

Water
 ☒ Level (Date)
 ▽ Inflow
 ▽ Partial Loss
 ▲ Complete Loss

Strength
 VL - Very Low
 L - Low
 M - Medium
 H - High
 VH - Very High
 EH - Extremely High

Weathering
 FR - Fresh
 SW - Slightly Weathered
 DW - Distinctly Weathered
 XW - Extremely Weathered
 RS - Residual Soil

Defects
 JT - Joint
 PT - Parting
 SM - Seam
 SZ - Sheared Zone
 CS - Crushed Seam
 XW - Extremely Weathered
 RS - Residual Soil
 FZ - Fractured Zone
 DB - Drill Break

Defect Coating
 CN - Clean
 SN - Stained
 VN - Veneer
 CO - Coating
 OP - Open

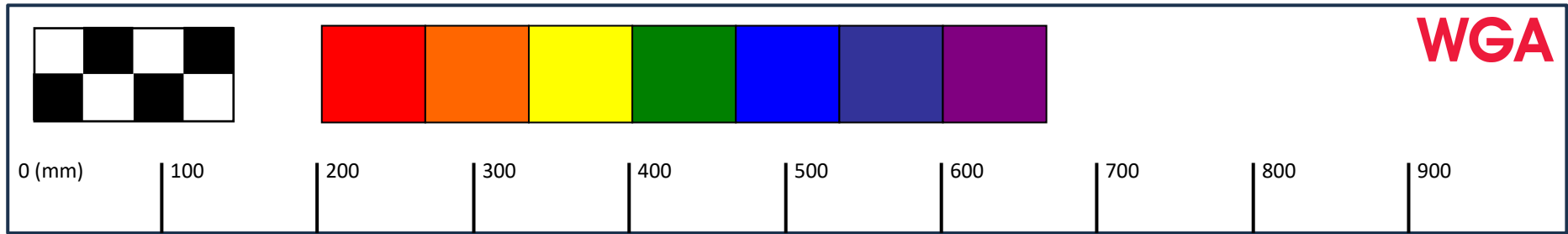
Defect Shape
 PL - Planar
 UN - Undulating
 ST - Stepped
 IR - Irregular
 CU - Curved

Graphic Log/Core Loss

Core recovered (hatching indicates material)
 Core loss

Support
 T - Timbering

Defect Roughness
 RO - Rough
 SO - Smooth
 SL - Slickened



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH12
Project:	Proposed Southern Barossa Hotel Development	Date:	25/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	1/1
Job No:	WGA242303	Depth:	7.5 m – 11.5 m

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 25/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 25/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308763.0 m E 6166460.0 m N MGA2020-54		Checked By: BJH	

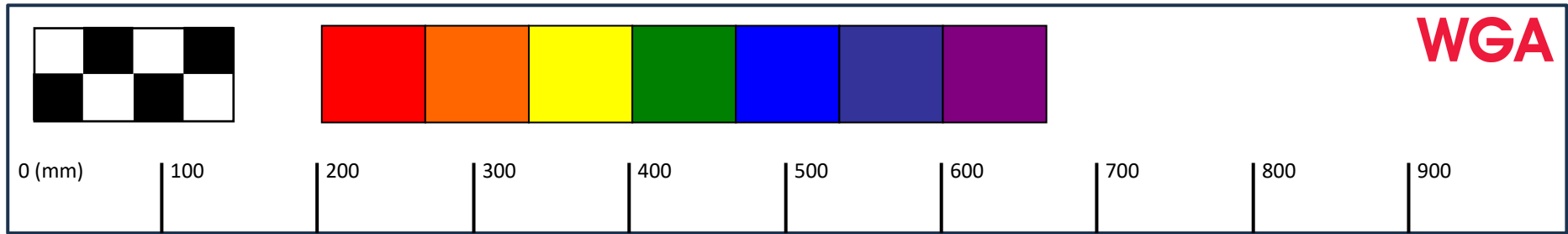
Drill Model and Mounting: Boart Longyear LX6 track mounted	Inclination: -90°	RL Surface: No survey
Barrel Type and Length: HQ 1.5 m	Bearing: 090°	Datum: AHD Operator: BN

Drilling Information						Rock Substance						Rock Mass Defects												
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS = I _{avg} ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling											
										VL	L	M	H	VH	EH	30	100	300	1000	3000	Particular	General		
Continued from non-cored borehole sheet																								
Topsoil (Clayey SAND) over clay, high plasticity, red brown to brown, trace sand, <Wp, firm.																								
CL CH: Sandy CLAY, medium to high plasticity, brown to red brown, fine to medium grained, <Wp, stiff.																								
Silty SAND, fine to medium grained, pale grey brown, low plasticity, with rock fragments, dry-moist.										RS XW														

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel		Water ☒ Level (Date) ▽ Inflow ▽ Partial Loss ▲ Complete Loss		Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High		Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil		Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break		Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved	
Graphic Log/Core Loss [Hatching] Core recovered (hatching indicates material) [X] Core loss		Support T - Timbering		Defect Roughness RO - Rough SO - Smooth SL - Slickened							

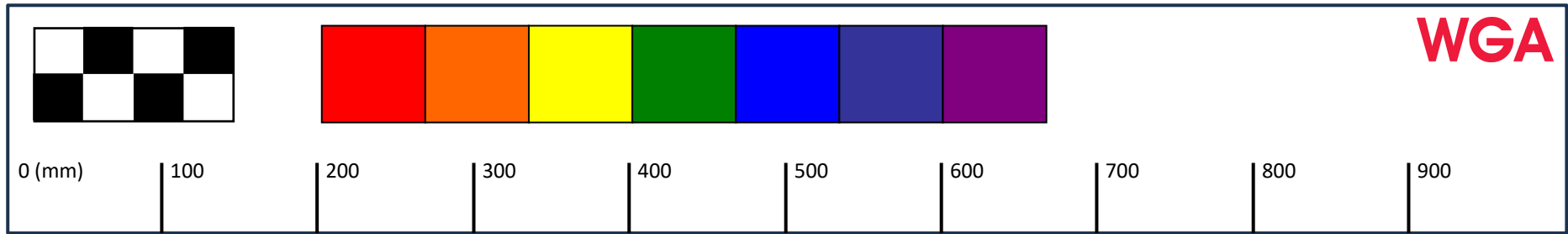
Project No.: WGA242303

WGA 2.01.0 LIB GLB Log IS AU CORED BORE HOLE 1 SOUTHERN BAROSSA PROJECT - GINT.GPJ <<DrawingFile>> 7/7/2025 14:12 10.03.00.09 Datgel Lab and In Situ Tool - DGD [Lib: WGA 2.01.0 2022-06-20 Pri: WGA 2.01.0 2022-06-20]



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH13
Project:	Proposed Southern Barossa Hotel Development	Date:	25/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	1/2
Job No:	WGA242303	Depth:	4.0 m – 8.0 m



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH13
Project:	Proposed Southern Barossa Hotel Development	Date:	25/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	2/2
Job No:	WGA242303	Depth:	8.0 m – 10.0 m

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 25/06/2025													
Project Name: Proposed Southern Barossa Hotel		Completed: 26/06/2025													
Hole Location: Lyndoch, SA		Logged By: ZY													
Hole Position: 308761.0 m E 6166416.0 m N MGA2020-54		Checked By: BJH													
Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°													
Barrel Type and Length: HQ 1.5 m		Bearing: 090°													
		RL Surface: No survey													
		Datum: AHD Operator: BN													
Drilling Information		Rock Substance		Rock Mass Defects											
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling		
									Continued from non-cored borehole sheet		VL L M H VH EH	100 300 1000 3000	Particular	General	
ADV							0.5		Topsoil (Clayey SAND) over clay, high plasticity, brown, trace sand, <Wp.						
							1.0								
							1.5		CL CH: Sandy silty CLAY, medium to high plasticity, pale brown to pale grey, fine to medium grained, with silt.	RS XW RS					
				50	37	0	2.0		Sandy CLAY, medium plasticity, red brown to brown, fine to coarse grained, becoming clayey sand with depth.	XW					
							2.5		SILTSTONE: fine to coarse grained, dark grey-grey, thinly laminated to massive, with interbedded schist.	XW HW XW					
							3.0			XW HW MW					
							3.5			MW					
							4.0			HW					
							4.5			MW					
	HQ3	HWT		89	76	26			5.0						
							5.5								
							6.0								
							6.5								
							7.0								
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							8.0								
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			89	86	51		10.0								
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Project No.: WGA242303

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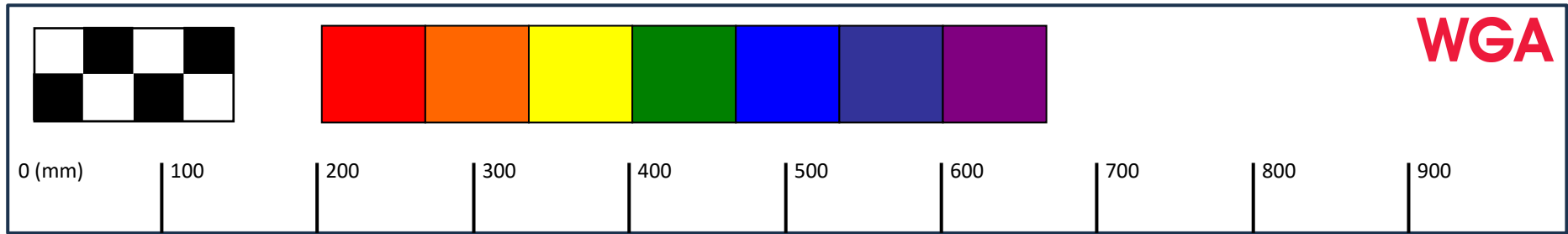
Engineering Log - Cored Borehole

Project No.: WGA242303

Client:		Turner & Townsend Project Management Pty Ltd		Commenced:		25/06/2025	
Project Name:		Proposed Southern Barossa Hotel		Completed:		26/06/2025	
Hole Location:		Lyndoch, SA		Logged By:		ZY	
Hole Position:		308761.0 m E 6166416.0 m N MGA2020-54		Checked By:		BJH	
Drill Model and Mounting:		Boart Longyear LX6 track mounted		Inclination:		-90°	
Barrel Type and Length:		HQ 1.5 m		Bearing:		090°	
				RL Surface:		No survey	
				Datum:		AHD	
				Operator:		BN	

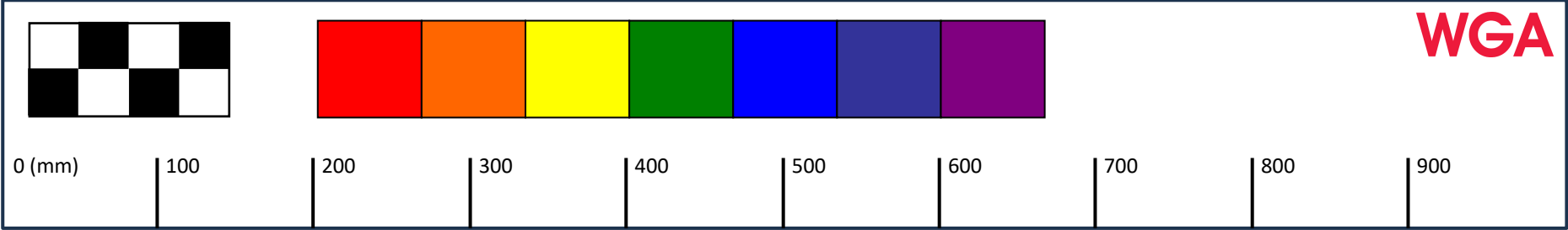
Drilling Information						Rock Substance						Rock Mass Defects										
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=20 L ₅₀ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling									
										VL	L	M	H	VH	EH	30	100	300	1000	3000	Particular	General
			82	74	32			x x x	Hole Terminated at 8.10 m												3xPT, 45°, Silt, CO, IR, RO	
							8.5															
							9.0															
							9.5															
							10.0															
							10.5															
							11.0															
							11.5															

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel	Water Level (Date) Inflow Partial Loss Complete Loss	Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil	Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break	Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open
Graphic Log/Core Loss Core recovered (hatching indicates material) Core loss	Support T - Timbering	Defect Roughness RO - Rough SO - Smooth SL - Slickened			Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	BH14
Project:	Proposed Southern Barossa Hotel Development	Date:	25/06/2025 to 26/06/2025
Title:	CORE PHOTOGRAPHS	Box No:	1/2
Job No:	WGA242303	Depth:	1.0 m – 5.0 m



WGA

Client: Turner & Townsend Project Management Pty Ltd

Project: Proposed Southern Barossa Hotel Development

Title: CORE PHOTOGRAPHS

Job No: WGA242303

Borehole ID: BH14

Date: 25/06/2025 to 26/06/2025

Box No: 2/2

Depth: 5.0 m – 8.1 m

Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 26/06/2025	
Project Name: Proposed Southern Barossa Hotel		Completed: 26/06/2025	
Hole Location: Lyndoch, SA		Logged By: ZY	
Hole Position: 308758.0 m E 6166395.0 m N MGA2020-54		Checked By: BJH	
Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°	
RL Surface: No survey		Datum: AHD	
Operator: BN			

Drilling Information				Rock Substance				Rock Mass Defects														
Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS = I _{avg} ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling									
										VL	LM	HM	VH	EH	30	100	300	1000	3000	Particular	General	
ADV							0.5		Topsoil (Clayey SAND) over sandy clay medium plasticity, pale yellow brown, fine to medium grained, <Wp.													
							1.0		CL: Sandy silty CLAY, low plasticity, pale grey brown to pale yellow brown, fine to medium grained, with silts, trace rock fragments.													
							1.5		CL: Sandy silty CLAY, low plasticity, pale grey brown to pale yellow brown, fine to medium grained, with silts, trace rock fragments.													
							2.0		NO CORE 0.50m (2.00-2.50)													
							2.5		SCHIST: fine to coarse grained, dark grey-grey mottled brown, massive, with interbedded siltstone, dry.													
HQ3	HWT		64	21	0		3.0		Sandy CLAY, medium plasticity, dark grey brown mottled brown, fine to coarse grained, trace rock fragments.													
							3.5		SCHIST: fine to coarse grained, dark grey-grey mottled brown, massive, with interbedded siltstone, dry.													
							4.0		NO CORE 0.30m (3.50-3.80)													
							4.5		CL SC: Sandy CLAY/clayey SAND, medium plasticity, pale brown to pale yellow brown, fine to medium grained, with rock fragments.													
							5.0		CL SC: Sandy CLAY/clayey SAND, medium plasticity, pale brown to pale yellow brown, fine to medium grained, with rock fragments.													

Method AS - Auger Screwing WB - Washbore NMLC - NMLC Core Barrel HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel	Water Level (Date) Inflow Partial Loss Complete Loss	Strength VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High	Weathering FR - Fresh SW - Slightly Weathered DW - Distinctly Weathered XW - Extremely Weathered RS - Residual Soil	Defects JT - Joint PT - Parting SM - Seam SZ - Sheared Zone CS - Crushed Seam XW - Extremely Weathered RS - Residual Soil FZ - Fractured Zone DB - Drill Break	Defect Coating CN - Clean SN - Stained VN - Veneer CO - Coating OP - Open
Graphic Log/Core Loss 	Support T - Timbering	Defect Roughness RO - Rough SO - Smooth SL - Slickened	Defect Shape PL - Planar UN - Undulating ST - Stepped IR - Irregular CU - Curved		

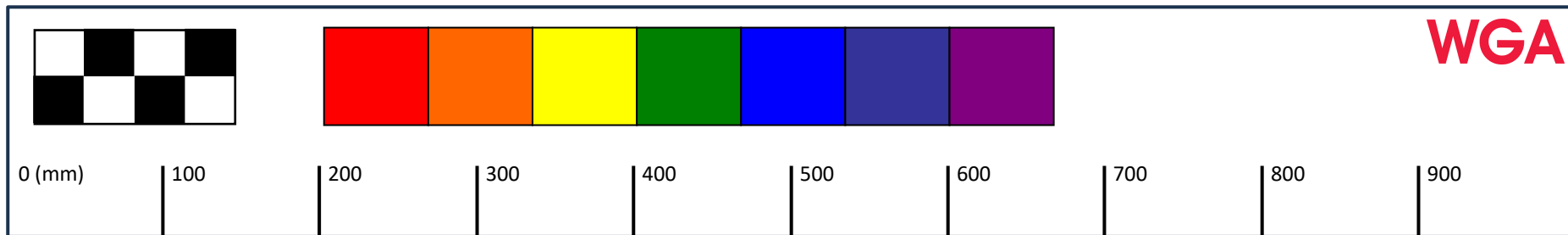
Engineering Log - Cored Borehole

Project No.: WGA242303

Client: Turner & Townsend Project Management Pty Ltd		Commenced: 26/06/2025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Project Name: Proposed Southern Barossa Hotel		Completed: 26/06/2025																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Hole Location: Lyndoch, SA		Logged By: ZY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Hole Position: 308758.0 m E 6166395.0 m N MGA2020-54		Checked By: BJH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Drill Model and Mounting: Boart Longyear LX6 track mounted		Inclination: -90°																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Barrel Type and Length: HQ 1.5 m		Bearing: 090°																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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Method	Support	Water	TCR (%)	SCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS= $\frac{1}{2} \sigma_{1-3}$ ● - Axial ○ - Diametral ■ - UCS	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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HQ3	HWT		62	28	0		4.5		CL: Sandy CLAY, medium plasticity, pale grey brown to grey brown, fine to medium grained, with interbedded schist.	XW																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

Project No.: WGA242303

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WGA

Client: Turner & Townsend Project Management Pty Ltd

Project: Proposed Southern Barossa Hotel Development

Title: CORE PHOTOGRAPHS

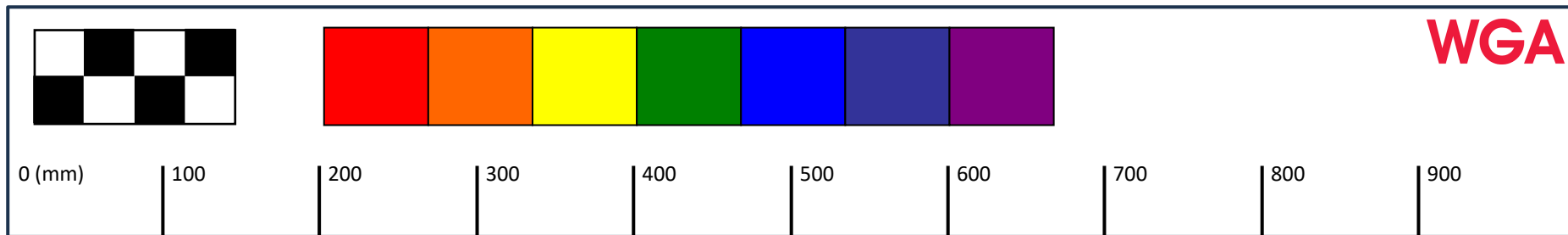
Job No: WGA242303

Borehole ID: BH15

Date: 26/06/2025

Box No: 1/2

Depth: 2.0 m – 6.0 m



WGA

Client: Turner & Townsend Project Management Pty Ltd

Project: Proposed Southern Barossa Hotel Development

Title: CORE PHOTOGRAPHS

Job No: WGA242303

Borehole ID: BH15

Date: 26/06/2025

Box No: 2/2

Depth: 6.0 m – 9.7 m



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: CAT 28T

Bucket Size: 950 mm

Test Pit No.

TP 1

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
0.15	SP	Clayey SAND, fine to medium grained, dark brown to brown, low plasticity, with rootlets, trace rock fragments	D - M			Topsoil			
		Mixture of soil and rock, highly to moderately weathered siltstone, fine grained, grey mottled, red brown, thinly bedded, high strength, with clayey sand, dip direction: 120° N, dip angle: 45°	D			Weathered bedrock			
0.5		Moderately weathered siltstone, fine grained, grey, thinly bedded	D			0.2 m - 0.5 m, 10-30 mm fracture spacing			
1.0		Dip direction: 280°N, dip angle: 60° Fracture spacing (0.7 m -1.2 m): 30 mm-100 mm Fracture spacing 1 m - 2 m -1.7 m: 10mm -30 mm Maximum block size: 400 mm x 300 mm x 150 mm Strength: high to very high strength				1.5 m - 1.7 m, ripper used			
1.5									
1.7		Test pit terminated at 1.7 m (refusal)							
2.0									
2.5									
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP1
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	1.7m (Refusal)
Job No:	WGA242303		



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: Cat 28t

Bucket Size: 950 mm

Test Pit No.

TP 2

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SC	Clayey SAND, fine to medium grained, dark brown, low plasticity with rootlets, trace gravel	D-M			Topsoil			
0.4									
0.5	CL	Extremely weathered schist, recovered as sandy silt, low to medium plasticity, brown mottled grey brown and white, fine to medium grained, trace rock fragments, rock fabric observed	<WP	Fb		extremely weathered bedrock			
1.0									
		Highly weathered schist/siltstone recovered silty gravel/cobble fine to coarse grained, subangular to angular, pale yellow brown with grey, low plasticity, with fine to medium grained sand	D						
1.5		Fracture spacing: 10 mm-30mm Dip direction: 280° N, dip angle: 45° Maximum block size: 300 mm x 200 mm x 70 mm strength: very high				At 1.5 m , ripper used From 1.7 m, became			
1.8		Strength: very high				highly to moderately			
2.0		Test pit terminated at 1.8 m (refusal)				moderately weathered			
2.5									
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client: **Turner & Townsend Project Management Pty Ltd**

Project: **Proposed Southern Barossa Hotel Development**

Title: **TEST PIT PHOTOGRAPHS**

Job No: **WGA242303**

Borehole ID: **TP2**

Date: **18/06/2025**

Termination Depth: **1.8m (Refusal)**



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: Cat 28t

Bucket Size: 950 mm

Test Pit No.

TP 3

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SP	SAND, fine to medium grained, brown to dark brown, with low plasticity fines, with root fibres	D-M			Topsoil			
0.3									
	CH	CLAY, high plasticity, red brown mottled pale yellow, trace rock fragments, trace rootlets, fissured	<Wp	H		B- Horizon			
0.5									
0.6					>600				
	CH	CLAY, high plasticity, red brown with yellow brown, with rock fragments	<Wp	H		Residual soil			
					550				
0.9									
1.0		High weathered siltstone recovered as mixture of soil and gravel	D			Weathered bedrock			
1.1		cobble. Fine to coarse grained, subangular to angular, grey with yellow brown, with low plasticity fines, fine to medium grained sand							
		Highly weathered siltstone, fine grained, thinly bedded	D						
1.5									
		Dip direction: 80° N, 120° N, dip angle: 45°-60°							
		Dip direction 200°N, dip angle: 60°							
2.0		Fracture spacing: 10 mm -30mm (0.9 m -1.4 m)							
		Fracture spacing: 30 mm -100 mm (1.4 m-2.5 m)							
		Maximum block size: 200 mm x 250 mm x 100 mm				At 2.1 m, ripper used			
		Strength: high to very high							
2.5									
		Test pit terminated at 2.5 m (refusal)							
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP3
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	2.5m (Refusal)
Job No:	WGA242303		



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025
Date Logged: 18/06/2025
Logged by: ZY
Excavator: Cat 28t
Bucket Size: 950 mm

Test Pit No.
TP 4

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. **WGA242303**

Location: **PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION**

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SC	Clayey SAND, fine to medium grained, brown to dark brown, low plasticity, with rootlets, trace gravels	M			Topsoil			
0.4									
0.5	GP	Clayey GRAVEL, fine to medium grained, subrounded to rounded, pale yellow, low plasticity, with fine to medium grained sand	D						
0.6									
	CH	CLAY, high plasticity, red brown, with fine to medium grained sand, fissured	<Wp	H	>600	B-Horizon			
					>600				
1.0					>600				
					>600				
1.3					>600				
	CH	Sandy CLAY, high plasticity, yellow brown to brown, fine to medium grained	<Wp	H		Alluvium			
1.5					600				
					600				
2.0									
2.5					600				
3.0		Test pit terminated at 3.0 m (target depth)							

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP4
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	3m (Target Depth)
Job No:	WGA242303		



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: Cat 25t

Bucket Size: 950 mm

Test Pit No.

TP 5

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))
0.2	SC	Clayey SAND, fine to medium grained, dark grey to black, low plasticity, with rootlets	M			Topsoil
0.5	CH	CLAY, high plasticity, dark grey to black, with fine to medium grained sand, fissured	<Wp	H	>600	B-Horizon
					>600	
					>600	
1.0					>600	
	CH	CLAY, high plasticity, red brown to brown with yellow brown, with fine to medium grained sand	<Wp	H		Alluvium
					>600	
1.5						
					>600	
2.0						
					>600	
2.5						
					>600	
3.0		Test pit terminated at 3.0 m (target depth)				

Depth to Groundwater: Not Encountered

Trees at Site: Yes



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP5
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	3m (Target Depth)
Job No:	WGA242303		



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: Hitachi 13t

Bucket Size: 550mm

Test Pit No.

TP 6

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. **WGA242303**

Location: **PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION**

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SC	Clayey SAND, fine to medium grained, dark brown, low plasticity, with rootlets, trace rock fragments	M			Topsoil			
0.25									
	SC	Mixture of siltstone fragment and clayey sand, fine to medium grained, dark brown, low plasticity	D-M						
0.5									
0.6									
		Extremely weathered siltstone recovered as silty sandy gravel, fine to coarse grained, subangular to angular, grey mottled red brown, yellow brown, low plasticity, fine to medium grained sand, with trace of high plasticity clay (residual soil).	D			Weathered bedrock			
1.0									
		Extremely weathered to highly weathered siltstone recovered as silty sandy gravel, fine to coarse grained, subangular to angular, grey to dark grey, stained red brown, low plasticity, fine to medium grained, trace high plasticity clay	D						
1.5									
		Dip direction: 280° N, dip angle: 30°							
		Fracture spacing: 10 mm - 30 mm							
		Strength: Low							
		Max Block size: 150 mm x 230 mm x 300 mm							
2.0									
2.2									
		Test pit terminated at 2.2 m (refusal)							
2.5									
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP6
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	2.2m (Refusal)
Job No:	WGA242303		



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: ZY

Excavator: Hitachi 13t

Bucket Size: 500 mm

Test Pit No.

TP 7

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SC	Clayey SAND, fine to medium grained, dark brown, low plasticity, with rootlets, trace gravels	M			Topsoil			
0.25									
	CH	CLAY, high plasticity, red brown, trace sand, fissured	<WP	H	>600	B-Horizon			
0.5									
0.6					>600				
	CH	Sandy silty CLAY, high plasticity, dark grey brown to dark red brown with yellow, fine to medium grained, low plasticity silt, with rock fragments	<WP	H	>600	Possibly residual soil to extremely weathered siltstone			
1.0									
1.1									
		Highly weathered siltstone recovered as silty sandy gravel, fine to coarse grained, subangular to angular, brown, grey with yellow, low plasticity, fine to medium grained sand	D			Weathered bedrock			
1.5									
		Fracture spacing: 0 mm - 30 mm (1.1 m -1.3 m)							
		Fracture spacing: 30 mm - 100 mm (1.3 m - 2.3 m)							
		Rock strength: Low to medium							
		Maximum block size: 150 mm x 150 mm x 50 mm							
2.0		Dip direction: 260°N, dip angle 45°							
2.3									
		Test pit terminated at 2.3 m (refusal)							
2.5									
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP7
	Project:		Date:
	TEST PIT PHOTOGRAPHS		18/06/2025
	Job No:		Termination Depth:
	WGA242303		2.3m (Refusal)



60 Wyatt Street, Adelaide
South Australia 5000
Telephone 08 8223 7433
Email adelaide@wga.com.au

Date Drilled: 18/06/2025

Date Logged: 18/06/2025

Logged by: LP

Excavator: Hitachi 13t

Bucket Size: 500 mm

Test Pit No.

TP 8

Legend:

Moisture Condition	Density Index - Granular	Consistency - Cohesive	
D - Dry	VL/L - Very Loose/Loose	VS - Very Soft	Vst-Very Stiff
M - Moist	MD- Medium Dense	S - Soft	H - Hard
W - Wet	D/VD- Dense/Very Dense	F - Firm	Fb - Friable
Wp - Plastic Limit		St - Stiff	
USCS: Unified Soil Classification System		↓GW = Groundwater	

Project No. WGA242303

Location: PROPOSED SOUTHERN BAROSSA WINERY AND TOURIST ACCOMMODATION

		Composition of soil	Condition of soil			Structure and additional observations			
Depth below surface (m)	USCS Symbol	Soil Description (type, plasticity, grading, colour, secondary and minor components)	Moisture Condition	Consistency or Density Index	Hand Penetrometer Reading (kPa)	(e.g. soil origin, defects, cementing, likely I_{pt} (%))	Excavatability		
							L	M	H
	SP	SAND, fine to medium grained, dark brown, with low plasticity	D			Topsoil			
0.2		fines, with rootlets, trace rock fragments							
		Moderately weathered siltstone recovered as sandy silty gravel,	D			Weathered bedrock			
		fine to coarse grained, subangular to angular, grey, stained red							
0.5		brown, fine to medium grained, low plasticity silts, with cobble							
		size rock fragments							
		(Moderately weathered siltstone, fine grained, grey stained red							
		brown, thinly bedded)							
1.0		Dip direction: 85°N, dip angle: 45°							
		Fracture spacing: 0 mm - 30 mm (0.2 mm - 0.5 mm)							
		Fracture spacing: 30 mm - 100mm (0.5 mm - 1 m)							
		Max block size: 150 mm x 300 mm x 150mm							
		Strength: medium to high strength							
1.5		From 1m , moderately to slightly weathered, became							
1.6		grey to dark grey							
		Test pit terminated at 1.6 m (refusal)							
2.0									
2.5									
3.0									

Depth to Groundwater: Not Encountered

Trees at Site: No



WGA

Client:	Turner & Townsend Project Management Pty Ltd	Borehole ID:	TP8
Project:	Proposed Southern Barossa Hotel Development	Date:	18/06/2025
Title:	TEST PIT PHOTOGRAPHS	Termination Depth:	1.6m (Refusal)
Job No:	WGA242303		

DESCRIPTION AND CLASSIFICATION OF SOILS⁽¹⁾ FOR ENGINEERING PURPOSES EXPLANATION SHEET TO ACCOMPANY ENGINEERING LOGS (SHEET 1)

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in general accordance with the Unified Soil Classification (UCS) as shown in Table 1 on Sheet 2 using visual-tactile methods.

PARTICLE SIZES

NAME	FRACTION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6.7 mm to 20 mm
	fine	2.36 mm to 6.7 mm
Sand	coarse	600 µm to 2.36 mm
	medium	210 µm to 600 µm
	fine	75 µm to 210 µm

MOISTURE CONDITION

Dry Looks and feels dry. Cohesive soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet Similar to moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH Su (kPa)	FIELD ASSESSMENT
Very Soft	≤12	A finger can be pushed well into the soil with little effort.
Soft	12 to 25	A finger can be pushed into the soil to about 25 mm depth.
Firm	25 to 50	The soil can be indented about 5 mm with the thumb.
Stiff	50 to 100	The surface of the soil can be indented with the thumb.
Very Stiff	100 to 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	Not able to be measured	Crumbles or powders when scraped by thumbnail.

The undrained shear strength is assessed in the field using a pocket or hand penetrometer (PP). The undrained shear strength is approximately one half of the hand penetrometer reading.

DENSITY INDEX OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 to 35
Medium Dense	35 to 65
Dense	65 to 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	FIELD ASSESSMENT	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye.	Coarse grained soils: ≤5% Fine grained soils: ≤15%
With some	Presence easily detected by feel or eye.	Coarse grained soils: >5 to ≤12% Fine grained soils: >15 to ≤30%

SOIL STRUCTURE

INCLUSIONS		CEMENTING	
Layers	Continuous across exposure or sample.	Weakly Cemented	Easily broken up by hand in air or water.
Lenses	Discontinuous layers of lenticular shape.	Moderately Cemented	Effort is required to break up the soil by hand in air or water.
Pockets	Irregular inclusions of different material.		

SOIL ORIGIN

MATERIALS WEATHERED IN-SITU

Extremely weathered material	Structure and fabric of parent rock visible.
Residual soil	Structure and fabric of parent rock not visible.

TRANSPORTED SOILS

Aeolian	Deposited by wind.
Alluvial	Deposited by streams and rivers.
Colluvial	Deposited on slopes (transported downslope by gravity)
Fill	Placed by man. Fill may be markedly more variable between tested locations than naturally occurring soils.
Marine	Deposited in ocean basins, bays, beaches and estuaries.

Note: (1) materials found in the ground are generally described as a soil if the material can be remoulded or disintegrated by hand in the field condition or in water. Other materials are described using rock description terms.

Table 1: SOIL CLASSIFICATION AND FIELD IDENTIFICATION AND DESCRIPTION (SHEET 2)

FIELD IDENTIFICATION PROCEDURES (excluding particles larger than 60 mm and basing fractions on estimated mass)					USC	PRIMARY NAME
COARSE GRAINED SOILS More than 65% of material less than 63 mm is larger than 0.075 mm	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.		GW	GRAVEL
			Predominantly one size or a range of sizes with more intermediate sizes missing.		GP	GRAVEL
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)		GM	SILTY GRAVEL
			Plastic fines (for identification procedures see CL below)		GC	CLAYEY GRAVEL
	SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Well graded. Wide range in grain sizes and substantial amounts of all intermediate sizes.		SW	SAND
			Poorly graded. Predominantly one size or a range of sizes with some intermediate sizes missing		SP	SAND
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML Below)		SM	SILTY SAND
			Plastic fines (for identification procedures see CL below)		SC	CLAYEY SAND
IDENTIFICATION PROCEDURES ON PARTICLES <0.2 mm						
FINE GRAINED SOILS More than 35% of material less than 63 mm is smaller than 0.075 mm	SILTS & CLAYS Liquid limit less than or equal to 50	DRY STRENGTH	DILATANCY	TOUGHNESS		
		None to low	Quick to slow	None	ML	SILT
		Medium to high	None	Medium	CL	CLAY
		Low to medium	Slow to very slow	Low	OL	ORGANIC SILT
	SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium	MH	SILT
		High	None	High	CH	CLAY
		Medium to high	None	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS		Identified by colour, odour, spongy feel and frequently by fibrous texture.			Pt	PEAT
* Low plasticity – Liquid Limit W _L Less than 35 % * Medium plasticity - W _L between 35% and 50%						

APPENDIX C

LABORATORY TEST RESULTS



Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272A
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 18/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH1 , Depth: 0.5-0.7m



Adelaide Laboratory
Unit 2, 30-34 Ragless Street St Marys SA 5042
Phone: 04 3978 6290
Email: Franco.Harkins@coffeytesting.com



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Approved Signatory: Franco Harkins
General Manager - WA/SA
Laboratory Accreditation Number: 431

Atterberg Limit (DPTI (SA) TP143 & TP141)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	42		
Plastic Limit (%)	19		
Plasticity Index (%)	23		

Linear Shrinkage (DPTI (SA) TP143)		Min	Max
Linear Shrinkage (%)	12.5		
Cracking Crumbling Curling	None		

Particle Size Distribution (DPTI (SA) TP134)					
Sieve	Passed %	Passing Limits	Retained %	Retained Limits	
4.75 mm	100		0		
2.36 mm	99		1		
1.18 mm	98		1		
0.6 mm	96		2		
0.425 mm	95		1		
0.3 mm	94		1		
0.15 mm	91		3		
0.075 mm	79		12		

Estimation of CBR from Classification Test (DPTI (SA) TP133)		Min	Max
Lab-estimated CBR (%)	6		

Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272B
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 18/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH3 , Depth: 0.7-0.9m



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Laboratory Accreditation Number: 431

Atterberg Limit (DPTI (SA) TP143 & TP141)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	58		
Plastic Limit (%)	22		
Plasticity Index (%)	36		

Linear Shrinkage (DPTI (SA) TP143)		Min	Max
Linear Shrinkage (%)	12.5		
Cracking Crumbling Curling	Curling		

Particle Size Distribution (DPTI (SA) TP134)					
Sieve	Passed %	Passing Limits	Retained %	Retained Limits	
4.75 mm	100		0		
2.36 mm	100		0		
1.18 mm	99		1		
0.6 mm	99		1		
0.425 mm	98		0		
0.3 mm	98		1		
0.15 mm	96		2		
0.075 mm	85		10		

Estimation of CBR from Classification Test (DPTI (SA) TP133)		Min	Max
Lab-estimated CBR (%)	4.5		

Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
 60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272C
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 17/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH7 , Depth: 2.6-2.8m



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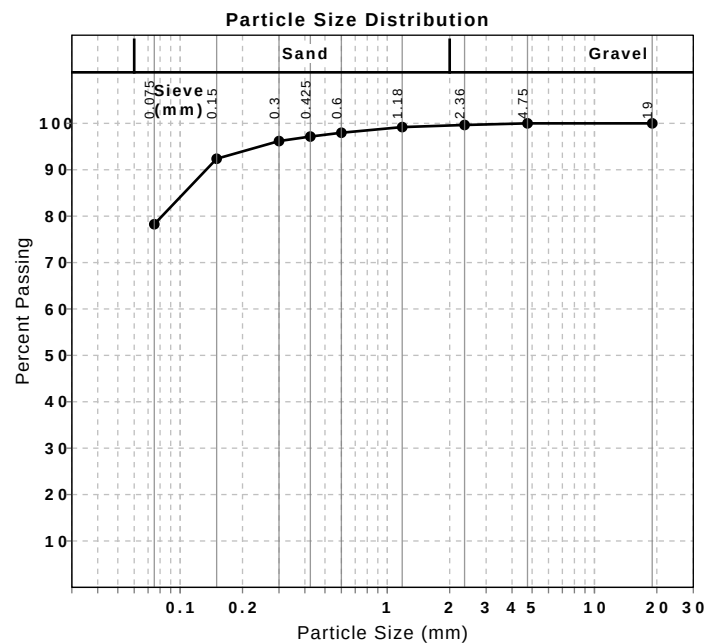
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Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
19 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	99		0	
0.6 mm	98		1	
0.425 mm	97		1	
0.3 mm	96		1	
0.15 mm	92		4	
0.075 mm	78		14	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)			Min	Max
Sample History	Air Dried			
Preparation Method	Dry Sieve			
Liquid Limit (%)	50			
Plastic Limit (%)	21			
Plasticity Index (%)	29			

Linear Shrinkage (AS1289 3.4.1)			Min	Max
Moisture Condition Determined By	AS 1289.3.1.2			
Linear Shrinkage (%)	14.0			
Cracking Crumbling Curling	None			



Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272D
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 18/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH5 , Depth: 2.8-3.0m



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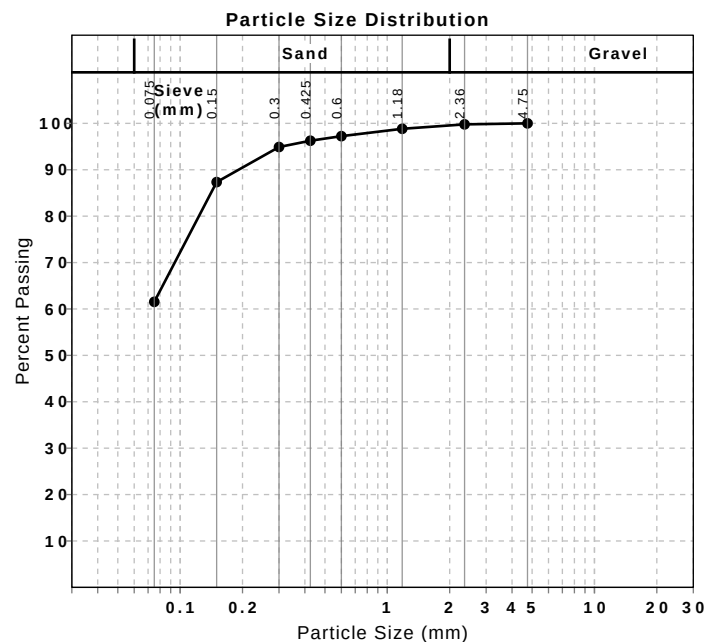
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Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	99		1	
0.6 mm	97		2	
0.425 mm	96		1	
0.3 mm	95		1	
0.15 mm	87		8	
0.075 mm	62		26	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)			Min	Max
Sample History	Air Dried			
Preparation Method	Dry Sieve			
Liquid Limit (%)	30			
Plastic Limit (%)	17			
Plasticity Index (%)	13			

Linear Shrinkage (AS1289 3.4.1)			Min	Max
Moisture Condition Determined By	AS 1289.3.1.2			
Linear Shrinkage (%)	9.0			
Cracking Crumbling Curling	None			



Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272E
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 18/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH9 , Depth: 1.7-1.9m



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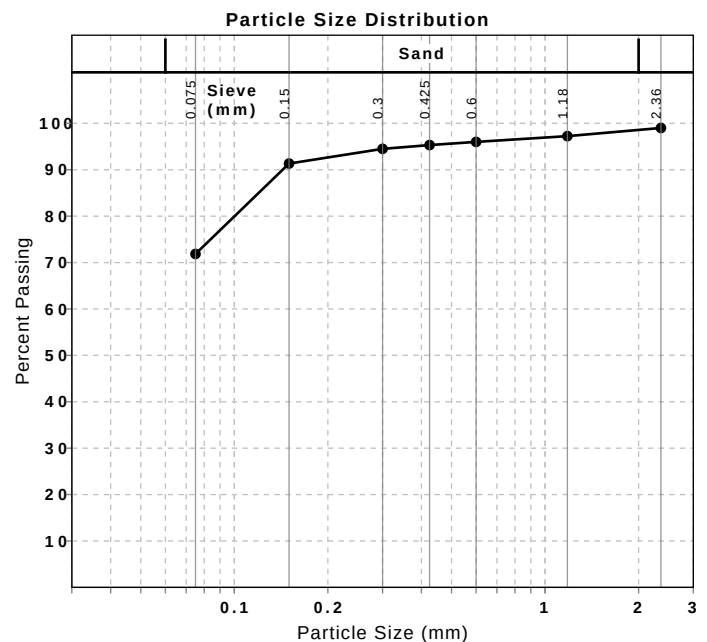
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Laboratory Accreditation Number: 431

Particle Size Distribution (AS1289 3.6.1)					
Sieve	Passed %	Passing Limits		Retained %	Retained Limits
2.36 mm	99			1	
1.18 mm	97			2	
0.6 mm	96			1	
0.425 mm	95			1	
0.3 mm	95			1	
0.15 mm	91			3	
0.075 mm	72			19	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)				Min	Max
Sample History		Air Dried			
Preparation Method		Dry Sieve			
Liquid Limit (%)		33			
Plastic Limit (%)		17			
Plasticity Index (%)		16			

Linear Shrinkage (AS1289 3.4.1)				Min	Max
Moisture Condition Determined By		AS 1289.3.1.2			
Linear Shrinkage (%)		10.5			
Cracking Crumbling Curling		None			



Material Test Report

Report Number: ADEL0215-1
Issue Number: 1
Date Issued: 18/06/2025
Client: Wallbridge Gilbert Aztec
 60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0215
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2272
Sample Number: ADEL2272F
Date Sampled: 11/06/2025
Dates Tested: 12/06/2025 - 18/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: BH4 , Depth: 3.5-3.7m



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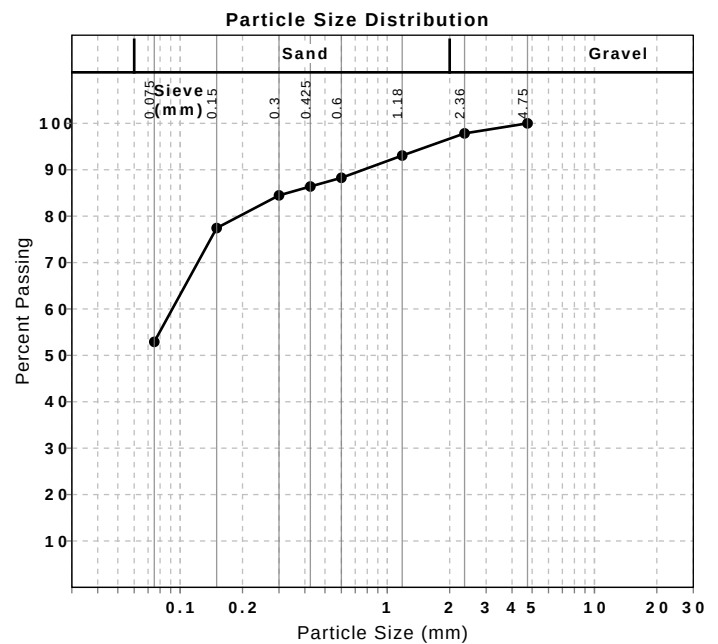
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 Laboratory Accreditation Number: 431

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
4.75 mm	100		0	
2.36 mm	98		2	
1.18 mm	93		5	
0.6 mm	88		5	
0.425 mm	86		2	
0.3 mm	84		2	
0.15 mm	77		7	
0.075 mm	53		25	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	25		
Plastic Limit (%)	17		
Plasticity Index (%)	8		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1 / AS 1289.3.1.2 / AS 1289.3.9.1 / AS 1289.3.9.2		
Linear Shrinkage (%)	5.5		
Cracking Crumbling Curling	None		



Material Test Report

Report Number: ADEL0223-1
Issue Number: 1
Date Issued: 03/07/2025
Client: Wallbridge Gilbert Aztec
 60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0223
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2310
Sample Number: ADEL2310A
Date Sampled: 19/06/2025
Dates Tested: 19/06/2025 - 30/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: TP3 , Depth: 0.4-0.6m



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 Email: Franco.Harkins@coffeytesting.com



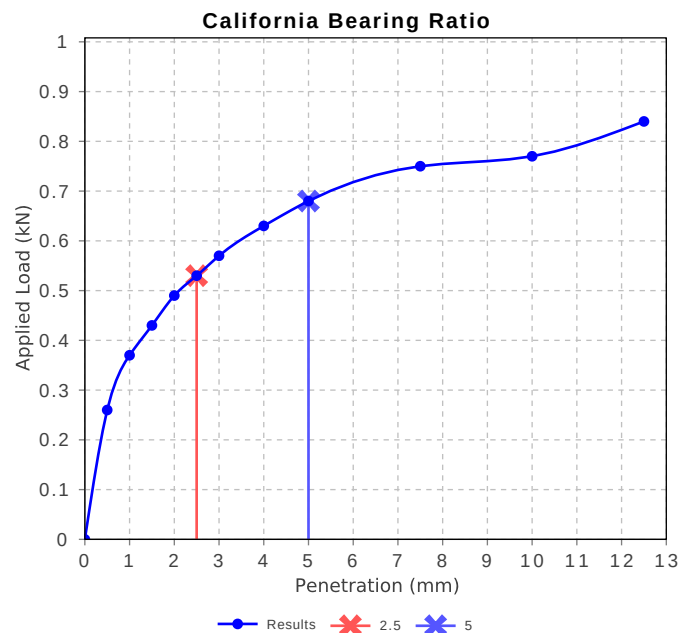
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Approved Signatory: Franco Harkins
 General Manager - WA/SAVIC
 Laboratory Accreditation Number: 431

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	4.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual		
Maximum Dry Density (t/m ³)	1.47		
Optimum Moisture Content (%)	29.5		
Laboratory Density Ratio (%)	98.5		
Laboratory Moisture Ratio (%)	100.0		
Moisture Content at Placement (%)	29.4		
Moisture Content Top 30mm (%)	36.7		
Mass Surcharge (kg)	4.5kg		
Soaking Period (days)	4		
Curing Hours (h)	145		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		

Dry Density - Moisture Relationship (AS 1289 5.1.1 & 2.1.1)		Min	Max
Mould Type	1 LITRE MOULD A		
Compaction	Standard		
Maximum Dry Density (t/m ³)	1.47		
Optimum Moisture Content (%)	29.5		
Oversize Sieve (mm)	19		
Oversize Material Wet (%)	0		
Method used to Determine Plasticity	Visual		
Curing Hours (h)	4		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	21.8



Material Test Report

Report Number: ADEL0223-1
Issue Number: 1
Date Issued: 03/07/2025
Client: Wallbridge Gilbert Aztec
 60 Wyatt Street, Adelaide SA 5000
Contact: Zhuoying Yang
Project Number: ADEL0223
Project Name: Proposed Southern Barossa Hotel
Project Location: Lyndoch, SA
Client Reference: WGA242303
Work Request: 2310
Sample Number: ADEL2310B
Date Sampled: 19/06/2025
Dates Tested: 19/06/2025 - 30/06/2025
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: TP5 , Depth: 0.5-1.0m



Adelaide Laboratory
 Unit 2, 30-34 Ragless Street St Marys SA 5042
 Phone: 04 3978 6290
 Email: Franco.Harkins@coffeytesting.com



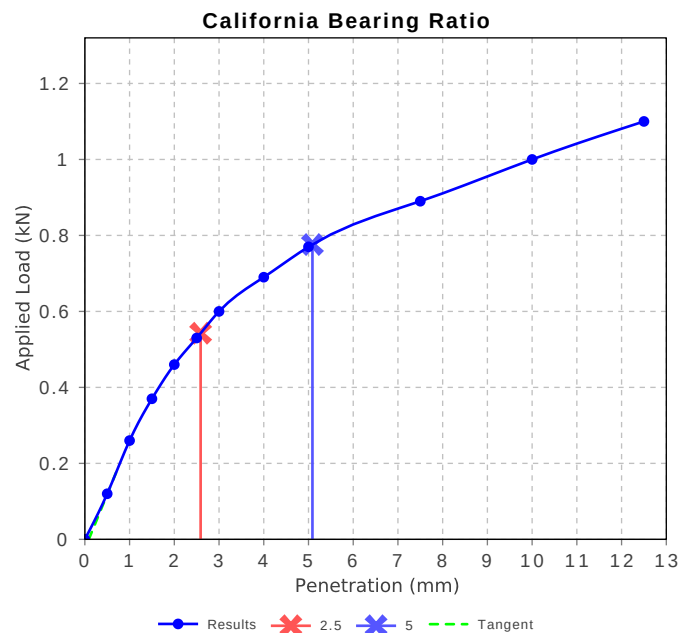
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Approved Signatory: Franco Harkins
 General Manager - WA/SAVIC
 Laboratory Accreditation Number: 431

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	4.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity			
Maximum Dry Density (t/m ³)	1.61		
Optimum Moisture Content (%)	20.5		
Laboratory Density Ratio (%)	98.5		
Laboratory Moisture Ratio (%)	100.5		
Moisture Content at Placement (%)	20.4		
Moisture Content Top 30mm (%)	23.9		
Mass Surcharge (kg)	4.5kg		
Soaking Period (days)	4		
Curing Hours (h)	146.1		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		

Dry Density - Moisture Relationship (AS 1289 5.1.1 & 2.1.1)		Min	Max
Mould Type	1 LITRE MOULD A		
Compaction	Standard		
Maximum Dry Density (t/m ³)	1.61		
Optimum Moisture Content (%)	20.5		
Oversize Sieve (mm)	19		
Oversize Material Wet (%)	0		
Method used to Determine Plasticity			
Curing Hours (h)	2.4		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	13.1



Rock Strength Report

Report No: RS:ADEL25S-00004

Issue No: 1

Client: Wallbridge Gilbert Aztec
60 Wyatt Street
Adelaide SA 5000

Principal:

Project No.: TESTADEL01035AA

Project Name: Proposed Southern Barossa Hotel

Lot No.: **TRN:**



Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates



Approved Signatory: Jhorden Minutillo
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 25/06/2025

Sample Details

Sample ID: ADEL25S-00004

Field ID: 00001

Date Sampled: 19/06/2025

Date Submitted:

Date Tested: 25/06/2025

Project Location: Lyndoch, SA

Sample Location:

Test Method: AS 4133.4.1

Sampling Method: Submitted by client*

Material:

Source:

Specification:

General Details

Test Machine:

Moisture Condition: Natural

Storage History: As Recived

Loading Rate:

Irregular/Block					Orientation 1				Orientation 2				Ia(50) MPa
Sample ID	Rock Type	Location	Sample Dimensions	Depth	P kN	Is MPa	Is(50) MPa	Failure Mode	P kN	Is MPa	Is(50) MPa	Failure Mode	
ADEL2310C	sandstone	TP1 1.5-1.7m	107.9 x 49.2 x 35.1 mm	from 1.50 to 1.70 m	6.11	4.7	4.1	valid					
ADEL2310D	sandstone	TP6 2.0-2.2m	94.4 x 96.2 x 38.6 mm	from 2.00 to 2.20 m	0.61	0.34	0.31	valid					
ADEL2310E	sandstone	TP7 2.3-2.3m	127.2 x 66.2 x 59.3 mm	from 2.30 to 2.30 m	1.83	0.58	0.61	valid					
ADEL2310F	sandstone	TP8 1.6-1.6m	78.1 x 63.6 x 25.7 mm	from 1.60 to 1.60 m	3.81	5.3	4.0	valid					

Comments

Substance = Valid Break



CERTIFICATE OF ANALYSIS

Work Order : **EM2511796**
Client : **WGASA Pty Ltd**
Contact : **Z YANG**
Address : **60 WYATT ST**
ADELAIDE SOUTH AUSTRALIA, AUSTRALIA 5000
Telephone : ----
Project : **WGA242303**
Order number : ----
C-O-C number : ----
Sampler : ----
Site : **Lyndoch, SA**
Quote number : **EN/222**
No. of samples received : **5**
No. of samples analysed : **5**

Page : 1 of 3
Laboratory : Environmental Division Melbourne
Contact : Customer Services EM
Address : 4 Westall Rd Springvale VIC Australia 3171
Telephone : +61-3-8549 9600
Date Samples Received : 01-Jul-2025 11:10
Date Analysis Commenced : 02-Jul-2025
Issue Date : 07-Jul-2025 15:10



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- Corrosion assessment for Concrete and Steel piles in soil per Australian Standard AS2159-2009 uses a combination of soil and groundwater data (Tables 6.4.2 C & 6.5.2 C). In the absence of groundwater data, assessment has been made against soil criteria only. Refer to AS2159-2009 section 6.4 for further interpretation of corrosion assessment. ALS is not NATA accredited for Corrosion Assessment comments
- EA167: Soil Condition A – High permeability soils (e.g. sands and gravels) which are in groundwater
- EA167: Soil Condition B – Low permeability soils (e.g. silts and clays) or all soils above groundwater
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH12_6-6.3	BH12_4.5-4.8	BH13_3.0-3.3	BH10_0.5-0.7	BH10_1.5-1.7
Sampling date / time					30-Jun-2025 00:00	30-Jun-2025 00:00	30-Jun-2025 00:00	30-Jun-2025 00:00	30-Jun-2025 00:00
Compound	CAS Number	LOR	Unit		EM2511796-001	EM2511796-002	EM2511796-003	EM2511796-004	EM2511796-005
				Result	Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		8.2	8.2	7.9	7.5	8.1
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		288	261	52	266	261
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		9.9	7.1	12.2	21.0	17.5
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		3470	3830	19200	3760	3830
EA167: Corrosion Classification (per AS2159-2009)									
Ø Exposure Classification - Concrete Piles Soil Condition A	----	-	-		Mild	Mild	Mild	Mild	Mild
Ø Exposure Classification - Concrete Piles Soil Condition B	----	-	-		Non Aggressive	Non Aggressive	Non Aggressive	Non Aggressive	Non Aggressive
Ø Exposure Classification - Steel Piles Soil Condition A	----	-	-		Mild	Mild	Non Aggressive	Mild	Mild
Ø Exposure Classification - Steel Piles Soil Condition B	----	-	-		Non Aggressive	Non Aggressive	Non Aggressive	Non Aggressive	Non Aggressive
ED040S: Soluble Major Anions									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		90	180	20	310	250
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		130	60	10	60	30



QUALITY CONTROL REPORT

Work Order	: EM2511796	Page	: 1 of 3
Client	: WGASA Pty Ltd	Laboratory	: Environmental Division Melbourne
Contact	: Z YANG	Contact	: Customer Services EM
Address	: 60 WYATT ST ADELAIDE SOUTH AUSTRALIA, AUSTRALIA 5000	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: ----	Telephone	: +61-3-8549 9600
Project	: WGA242303	Date Samples Received	: 01-Jul-2025
Order number	: ----	Date Analysis Commenced	: 02-Jul-2025
C-O-C number	: ----	Issue Date	: 07-Jul-2025
Sampler	: ----		
Site	: Lyndoch, SA		
Quote number	: EN/222		
No. of samples received	: 5		
No. of samples analysed	: 5		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Eric Chau	Metals Team Leader	Melbourne Inorganics, Springvale, VIC



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC
 * = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA002: pH 1:5 (Soils) (QC Lot: 6694001)									
EM2511796-001	BH12_6-6.3	EA002: pH Value	----	0.1	pH Unit	8.2	8.2	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 6694002)									
EM2511796-001	BH12_6-6.3	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	288	270	6.6	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 6695531)									
EM2511510-002	Anonymous	EA055: Moisture Content	----	0.1 (1.0)*	%	23.5	23.9	2.0	0% - 20%
EM2511670-002	Anonymous	EA055: Moisture Content	----	0.1 (1.0)*	%	10.6	11.4	7.4	0% - 50%
ED040S: Soluble Major Anions (QC Lot: 6693997)									
EM2511580-001	Anonymous	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	40	40	0.0	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 6693998)									
EM2511580-001	Anonymous	ED045G: Chloride	16887-00-6	10	mg/kg	120	120	0.0	0% - 50%



Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Acceptable Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA002: pH 1:5 (Soils) (QCLot: 6694001)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	101	98.8	101
				----	7 pH Unit	100	99.3	101
EA010: Conductivity (1:5) (QCLot: 6694002)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1413 µS/cm	99.8	94.5	105
ED040S: Soluble Major Anions (QCLot: 6693997)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	----	----	----	----
ED045G: Chloride by Discrete Analyser (QCLot: 6693998)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	103	85.5	120
				<10	5000 mg/kg	109	85.5	120

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 6693998)							
EM2511796-001	BH12_6-6.3	ED045G: Chloride	16887-00-6	2000 mg/kg	120	93.0	125



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM2511796	Page	: 1 of 5
Client	: WGASA Pty Ltd	Laboratory	: Environmental Division Melbourne
Contact	: Z YANG	Telephone	: +61-3-8549 9600
Project	: WGA242303	Date Samples Received	: 01-Jul-2025
Site	: Lyndoch, SA	Issue Date	: 07-Jul-2025
Sampler	: ----	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, where applicable to the methodology, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.



Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis
EA002: pH 1:5 (Soils)						
Snap Lock Bag BH12_6-6.3, BH13_3.0-3.3, BH10_1.5-1.7	BH12_4.5-4.8, BH10_0.5-0.7,	----	----	----	04-Jul-2025	03-Jul-2025
						1

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for **VOC in soils** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)								
Snap Lock Bag (EA002) BH12_6-6.3, BH12_4.5-4.8, BH13_3.0-3.3, BH10_0.5-0.7, BH10_1.5-1.7		30-Jun-2025	03-Jul-2025	07-Jul-2025	✔	04-Jul-2025	03-Jul-2025	✘
EA010: Conductivity (1:5)								
Snap Lock Bag (EA010) BH12_6-6.3, BH12_4.5-4.8, BH13_3.0-3.3, BH10_0.5-0.7, BH10_1.5-1.7		30-Jun-2025	03-Jul-2025	07-Jul-2025	✔	04-Jul-2025	31-Jul-2025	✔
EA055: Moisture Content (Dried @ 105-110°C)								
Snap Lock Bag (EA055) BH12_6-6.3, BH12_4.5-4.8, BH13_3.0-3.3, BH10_0.5-0.7, BH10_1.5-1.7		30-Jun-2025	----	----	----	03-Jul-2025	14-Jul-2025	✔
ED040S: Soluble Major Anions								
Snap Lock Bag (ED040S) BH12_6-6.3, BH12_4.5-4.8, BH13_3.0-3.3, BH10_0.5-0.7, BH10_1.5-1.7		30-Jun-2025	03-Jul-2025	28-Jul-2025	✔	03-Jul-2025	31-Jul-2025	✔



Matrix: SOIL

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride by Discrete Analyser								
Snap Lock Bag (ED045G)								
BH12_6-6.3,	BH12_4.5-4.8,	30-Jun-2025	03-Jul-2025	28-Jul-2025	✔	04-Jul-2025	31-Jul-2025	✔
BH13_3.0-3.3,	BH10_0.5-0.7,							
BH10_1.5-1.7								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	6	33.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	5	40.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Resistivity (1:5)	EA080	SOIL	In house: Calculated from Electrical Conductivity
Corrosion Classification for Steel and Concrete Piles	* EA167	SOIL	In house: Exposure classification is determined according to Australian Standard AS2159-2009.
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500 Cl - G. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Rock Strength Report

Report No: RS:ADEL25S-00016

Issue No: 1

Client: Wallbridge Gilbert Aztec
60 Wyatt Street
Adelaide SA 5000

Principal:

Project No.: TESTADEL01046AA

Project Name: Proposed Southern Barossa Hotel

Lot No.: **TRN:**



Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates

Approved Signatory: Jhorden Minutillo
(Laboratory Manager)
NATA Accredited Laboratory Number:431
Date of Issue: 7/07/2025

Sample Details

Sample ID: ADEL25S-00016

Field ID: 00001

Date Sampled: 30/06/2025

Date Submitted: 1/07/2025

Date Tested: 7/07/2025

Project Location: Lyndoch, SA

Sample Location: Point Loads

Test Method: AS 4133.4.1

Sampling Method: Submitted by client*

Material: Rock

Source: Bore Hole

Specification:

General Details

Test Machine: 1251(B)

Moisture Condition: Natural

Storage History: As Recived

Loading Rate:

Core Specimen

Sample ID	Rock Type	Location	Sample Dimensions	Depth	Diametral				Axial				
					P kN	Is MPa	Is(50) MPa	Failure Mode	P kN	Is MPa	Is(50) MPa	Failure Mode	Ia(50) MPa
ADEL2342A		BH11	210.0 x 60.8 x 60.8 mm	from 8.55 to 7.75 m	7.92	2.6	2.7	parallel	6.34	1.4	1.6	substance	0.59
ADEL2342B		BH12	119.0 x 61.0 x 61.0 mm	from 10.05 to 10.15 m	4.23	1.3	1.4	parallel	6.89	2.5	2.6	substance	1.9
ADEL2342C		BH10	126.2 x 60.7 x 60.7 mm	from 8.00 to 8.10 m	1.16	0.34	0.37	parallel	1.70	0.49	0.53	substance	1.4
ADEL2342D		BH11	122.2 x 60.9 x 60.9 mm	from 2.75 to 2.85 m	1.36	0.40	0.43	parallel	2.86	0.86	0.92	substance	2.1
ADEL2342E		BH12	137.2 x 60.6 x 60.6 mm	from 2.80 to 2.95 m	0.68	0.20	0.21	parallel	2.29	0.99	0.97	substance	4.6
ADEL2342F		BH14	142.8 x 60.8 x 60.8 mm	from 5.50 to 5.65 m	0.75	0.22	0.24	parallel	1.54	0.74	0.71	substance	3.0

Comments

Substance = Valid Break



GUIDE TO INTERPRETING YOUR WGA GEOTECHNICAL REPORT

This geotechnical report has been prepared by an experienced WGA Engineer. These notes have been prepared by WGA to assist the Client interpret and understand the report limitations.

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and WGA. In some circumstances, the scope of the services may have been altered by a range of factors such as time, budget and access restrictions.

GEOTECHNICAL INVESTIGATIONS

Geotechnical engineering is based extensively on professional judgment and opinion. It is far less precise than other engineering disciplines.

Geotechnical engineering reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client for the purposes indicated in the agreed scope of services. Use by any other persons for any purpose, or by the Client for a different purpose, may result in problems.

For example, a report prepared for a consulting civil engineer may not be adequate for a construction contractor or even another consulting engineer.

This report must not be used for any project other than that originally specified at the time the report was prepared, without seeking additional geotechnical advice.

PROJECT-SPECIFIC FACTORS

This report is based on a subsurface investigation designed to meet the requirements of a specific project. The subsurface investigation was formulated based on factors which include the nature of the development, its size and configuration, the location of any existing development on the site, and the location of access roads and parking areas. Unless further geotechnical advice is obtained in writing, this

report may not provide appropriate recommendations if:

- the nature of the proposed development is changed; or
- the size, configuration, location or orientation of the proposed development is modified.

The report findings cannot be applied to any other sites, including adjacent sites.

SUBSURFACE CONDITIONS

Subsurface conditions are created by natural processes and the activity of man and may, therefore, be modified by changing natural forces or man-made influences. For example, water levels can vary with time and fill may be placed on a site. The report is based on conditions which existed at the time of subsurface exploration.

Construction operations at, or adjacent to, the site and natural events such as floods or groundwater fluctuations may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. WGA should be kept informed of any such events and should be consulted to determine if additional investigations are necessary

THIRD PARTY INTERPRETATION OF FINDINGS

WGA should be retained to assist other design professionals in the interpretation of relevant geotechnical findings, and to review the adequacy of plans and specifications relative to geotechnical issues. Costly problems can occur when other design professionals develop plans based on misinterpretations of a geotechnical report.

ENGINEERING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT

The report presents the findings of the geotechnical investigation and must not be copied or altered in any way.



Engineering logs and cross-sections are developed by geotechnical engineers based upon their interpretation of field logs and laboratory testing of samples. These logs and figures should not be redrawn for inclusion in other documents or separated from the report in any way.

To reduce the likelihood of misinterpretation, contractors should be given access to the complete geotechnical report prepared or authorised for use. The following publication should be referenced for further information.

Guidelines for the Provision of Geotechnical Information in construction Contracts (Engineers Australia, National Headquarters, Canberra 1987).

RELIANCE ON SUPPLIED DATA

In preparing the report, WGA may have relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations. Unless otherwise stated in the report, WGA has not verified the accuracy or completeness of such data. WGA will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misinterpreted or otherwise not fully disclosed to WGA.

LIMITATIONS OF SITE INVESTIGATIONS

In making an assessment of a site from a limited number of boreholes or test pits it is inevitable that variations will occur between test locations. Subsurface exploration identifies specific subsurface conditions only at those points from which samples have been taken. The likelihood that subsurface variations will not be detected can be reduced by increasing the frequency of test locations, although this has cost implications. The investigation program undertaken is a professional estimate of a reasonable scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geotechnical model and an engineering opinion is formed about overall subsurface conditions and their likely behaviour with regard to the proposed development.

Despite subsurface exploration, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface conditions and anomalies.

The engineering logs are the subjective interpretation of the subsurface conditions encountered at a particular location, made by experienced personnel. The interpretation may be limited by the method of investigation, and cannot always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigations, however, such methods are limited by depth and site disturbance restrictions.

The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained from the subsurface exploration. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, the services of WGA should be retained through design and construction stages, to identify variances, conduct additional tests if required and recommend solutions to any problems encountered on site.



FOR FURTHER INFORMATION CONTACT:

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