Qualtest Geotechnical & Laboratory
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Geotechnical Site Investigation
Proposed Residential Subdivision
#673 Silverwood Drive
Flagstone, QLD 4280

July 24, 2026

Presented To

Oris Accessories Pty Ltd,

Trustee for Chang Family Trust

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Oris Accessories Pty Ltd,
Trustee for Chang Family Trust
c/- JFP Urban Consultants

Geotechnical Site Investigation
Proposed Residential Subdivision
#673 Silverwood Drive, Flagstone
QLD 4280

Geotechnical Interpretative Report

Report Ref. No. 11507 Rev A – 26-258
July 24, 2026

Qualtest Laboratory
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Oris Accessories Pty Ltd,
Trustee For Chang Family Trust

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A	24/07/26	Kwaku Donkor – RPEQ 33046	Dennis Alazigha – RPEQ 22169	Issued to Client
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1 INTRODUCTION

This report presents the results of a broad-scale geotechnical site investigation undertaken at the site with street address #673 Silverwood Drive, Flagstone. The allotment is described as Lot 1 on RP45241 and covers a gross land area of approximately 33.0ha.

It is understood that the site is to be subdivided to create 527 Lots. As part of the development, civil infrastructure, including roadways, retention basin, public spaces/playground and sewer/water mains would be constructed.

The work was commissioned by Ms Isla Jenkins, representing JFP Urban Consultants, on behalf of Oris Accessories Pty Ltd, the Trustee for the Chang Family Trust (The Client), following the acceptance of our fee proposal QGQ26-216 – 11365, dated May 23, 2026. The commission entails onsite drilling of boreholes, laboratory testing of soil samples, geotechnical assessment, including global stability analysis of the proposed earth structures and reporting.

The fieldwork was undertaken on June 3, 2026. The approximate geographical location of the site is presented in *Figure 1.*

Figure 1: The Approximate Geographical Location of the Site (NearMap, June 2026).

1.1 Proposed Development

The available information indicates that a 527-lot residential subdivision is proposed for the site, including low to medium-density residential allotments.

Based on the proposed development plan, an excerpt of which is presented in *Figure 2*, it is expected that works will include the following:

- Bulk earthworks to create lots of various sizes;
- New pavements and associated drainage works;
- Cut/fill batters and retaining walls;
- Water and sewer reticulation works;
- Water retention basins;
- Soft & hard landscaping;
- Open spaces/playground; and
- Environmental reserves, etc.

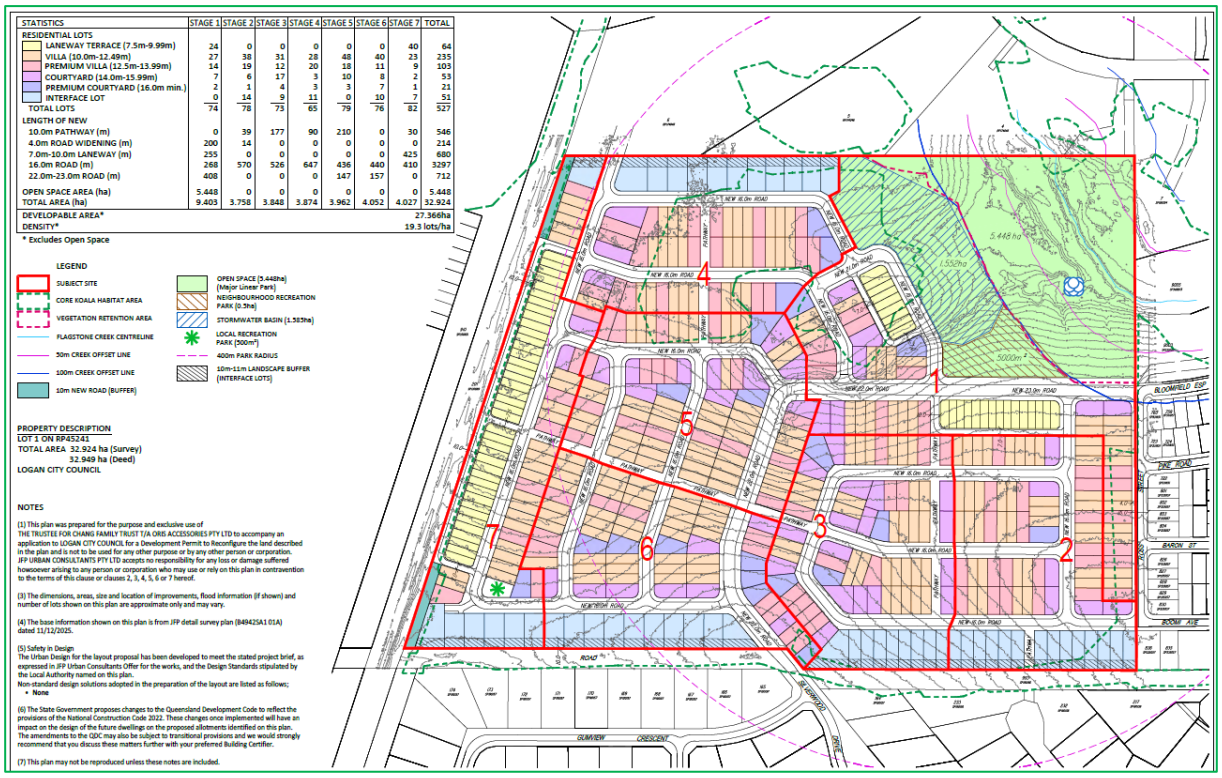

Figure 2: Excerpt of Reconfiguration Masterplan (Source: JFP Urban, 2026)

1.2 Purpose

This correspondence aims to present the client and its partners with a geotechnical interpretative report that would be relied upon for the following purposes:

1. To inform all phases of design, including Operational Works detailed design;
2. To accompany Development Application submissions, and
3. For incorporation into Civil tender documentation.

1.3 Scope of Work

The scope of work has been based on the client's geotechnical brief, which referenced an EDQ request for an Information (RFI) document. The main briefing points are presented below:

- Submit a preliminary geotechnical and earthworks stability assessment report, addressing retaining walls and batters adjoining the stormwater basin, including confirmation of long-term stability and erosion resistance. The design of the Page 3 of 5 Economic Development Queensland proposed retaining walls is to comply with the requirements of the Logan Planning Scheme Policy, Schedule 6, Section 3.3.6.2.
- Assess stability/slip circle analysis for the proposed tiered concrete sleeper retaining walls adjacent to the basin and supporting the new park area.
- Drill a few boreholes over the balance areas on the site (maybe 1 around the existing house area and another couple in the southern-western portions of the site, depending on access). These boreholes should provide some information on the existing site material, i.e. topsoil depth, depth to termination/rock, and parameters for retaining wall design.

In addition to the above, Qualtest will complete the following additional scope of work:

- Site description detailing the geology of the area in which the proposed development is situated.
- Aerial site plan detailing borehole locations.
- Description of the fieldwork investigations, including methodology.
- Geotechnical investigations of the site, including the drilling of a sufficient number of boreholes across the site, providing adequate site coverage and testing of soils to:

  - Identify the site soil profile(s), including depth to, and depth of, rock and rock quality (extent of weathering, etc.); and
  - Identify future site classifications based on existing site material properties.
- Borehole logs shall include standing groundwater levels, ground surface levels and depths of each soil regime.
- Carry out suitable laboratory testing and provide recommendations for: foundation design and soil foundation settlement estimates, retaining wall design and parameters, pavement design including CBR assessment, earthwork recommendations, and underground services embedment type recommendations.
- Preparation of a detailed geotechnical interpretative report which shall include the borehole logs, site soil test results and laboratory testing results, and which shall advise of, and on, the following:
  - Site soil classifications in accordance with requirements as described in the most current version of AS2870;
  - Recommended parameters for foundations and thrust blocks, including allowable bearing pressure;
  - Key soil regimes that need to be identified;
  - The presence and reactivity of encountered clays;
  - Excavatability of site material and plant required to perform cut operations of site material;
  - Suitability of material sourced from on-site cuttings to be used as structural fill;
  - Laboratory permeability test results of materials likely to form the basins/embankments;
  - Reuse of materials from on-site cuttings for basin/embankment constructions;
  - Maximum permissible temporary and permanent batter slopes based on site material;
  - Presence and extent of uncontrolled fill & associated treatment measures;
  - Trafficability;
  - Subgrade preparation and moisture/compaction standards;
  - Erosion potential of the soil, including Emerson Class and chemical laboratory testing;
    - Presence/absence of dispersive/migratory soils and basic treatment information and recommendations for embedment type;
  - Sewer and water pipe trench embedment support type through identification of migratory soils (grading analysis, Emerson Dispersion Index & chemical test results) and assessment of soil bearing pressure (<50kPa);
  - Identification of typical topsoil profile, including stripping depths.
  - Native soil modulus based on values presented in AS2566.
  - Permeability of in-situ materials based on visual descriptions of subsurface materials.
  - Recommendations for any areas of subgrade likely to require any special design considerations or modifications.
  - Recommended geotechnical parameters and bulking factors for earthworks operations (cut & fill).
  - Results of the stability analysis of the proposed retaining structures.
  - Soil aggressivity.
  - Comment on any geotechnical concerns for the site.

2 Methodology

2.1 Standards

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

- AS 1289 – Methods of testing soils for engineering purposes;
- AS 1289.6.3.2-1997 – Soil strength and consolidation tests – Determination of the penetration resistance of a soil – 9 kg dynamic cone penetrometer (DCP);
- AS3798 – Guidelines on Earthworks for Commercial and Residential Developments;
- AS2870 – Residential Slabs and Footings; and
- AS 1726:2017 – Geotechnical Site Investigations.

2.2 Literature Review

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

2.2.1 Information Provided

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

- A request for a proposal was received in an email from Isla Jenkins representing JFP Urban Consultants. The email contained the following:
    - Information Request and Public Notice of Development Application Document - Prepared by Economic Development Queensland (EDQ), Ref No: DEV-2026-FLA - 4642, dated 11 May 2026;
    - Civil Engineering Services Report - Prepared by JFP Urban Consultants, Proposed Development at 673 Silverwood Drive, Flagstone, Reference: B4942EA1 - DA1 - Engineering Report – Revision A, dated March 2026; and
    - Concept Engineering Drawings – Prepared by JFP Urban Consultants, Proposed Development at 673 Silverwood Drive, Flagstone, Reference: B4942EA1_DA, Dated 27/03/26.

2.2.2 Previous Reports

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

2.2.3 Site Geology

The online Queensland Globe Detailed Surface Geology maps (1:100K) show that the site is underlain by two geological formations; these are:

- ***The Gatton Sandstone (Jbmg) Geological Unit***. This unit is described as an Early Jurassic-aged, arenite-dominant formation, with a lithological summary of lithic labile and feldspathic labile sandstone. This unit covers the majority of the site, and
- ***The Qa-QLD (Qa) Geological Unit***. This unit covers a very small portion of the site at the north-east corner. The formation is Quaternary-aged with a lithological summary of flood-plain alluvial, including clay, silt, sand and gravel.

It is, therefore, expected that soils of residual origin will be encountered across the majority of the site, with weathered sandstone bedrock underneath the residual soils.

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

Figure 3: Excerpt of The Detailed Surface Geology Map, Site Boundaries Highlighted in Red

2.2.4 Site Description

The site at #673 Silverwood Drive, Flagstone, is located within the Logan City Council government area. In plan-view, the allotment is approximately rectangular in shape and is bordered on the western fringe by a rail line corridor. To the north, the site is bordered by acreage properties, while medium-density allotments exist to the south and east of the site. A drainage channel (Flagstone Creek) also cut across the north-eastern boundary.

On the day of the investigation, an abandoned dwelling was recorded in the northern half of the site. Also recorded in this area were a water dam, derelict shed structures, fence lines, above-ground water tanks, an onsite wastewater discharge area, and miscellaneous items.

The balance of the site was generally covered by dense woodland vegetation. However, gravel access tracks provided limited access around the perimeter of the site. In general, the site was found to be relatively flat, with gentle slopes falling towards the north-east, with steeper slopes towards the Flagstone Creek at the north-eastern corner of the allotment.

Photographs showing the typical site conditions taken on the day of the investigation are shown in *Figures 4a, b & c.*

a

b

Figures 4a, b & c: Selected Photographs of the Site Conditions

2.3 Site Investigation

2.3.1 Underground Services

The test locations were confirmed to be “free” from underground services before drilling commenced.

2.3.2 Geotechnical Investigation

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

In collaboration with the client, Qualtest nominated the location of the nine (9) boreholes distributed across the site. However, due to the thick onsite vegetation restricting access, the boreholes were drilled at previously cleared areas or along existing tracks.

The boreholes, designated QT1 to QT9, were drilled to a target depth of 3.0m bgl or early refusal on rock. All boreholes were drilled using a light-duty 4WD Ute-mounted Zenith Engineering drill rig fitted with a 100mm diameter solid flight auger and a Tungsten Carbide drill bit.

The fieldwork was supervised by a Qualtest Geotechnical Engineer, who logged boreholes per Australian Standard AS 1726-2017. For subsequent laboratory testing, soil samples were collected at various depths in the boreholes, and select materials were tested to address the scope of work.

The field engineer also acquired the coordinates of the test hole locations using a handheld GPS device with an accuracy of ±4m. These GPS coordinates are presented in *Table 1*.

Figure 5 shows the borehole locations as plotted on an aerial photograph of the site.

All boreholes were backfilled with spoil won from the drilling operations.

Table 1: GPS Location of Boreholes

BH ID	UTM Zone	Easting (m)	Northing (m)	Termination Depth (m)
QT1	56J	495988.376	6925758.862	3.0(TD)
QT2	56J	495911.338	6925767.255	3.0(TD)
QT3	56J	495743.834	6925873.427	3.0(TD)
QT4	56J	495590.114	6925718.735	3.0(TD)
QT5	56J	495745.062	6925461.245	0.75(R)
QT6	56J	495887.120	6925432.826	2.1(R)
QT7	56J	496078.042	6925388.027	1.2(R)
QT8	56J	496068.158	6925794.446	3.0(TD)
QT9	56J	496120.242	6925880.421	3.0(TD)
R = refusal on rock, TD = target depth				

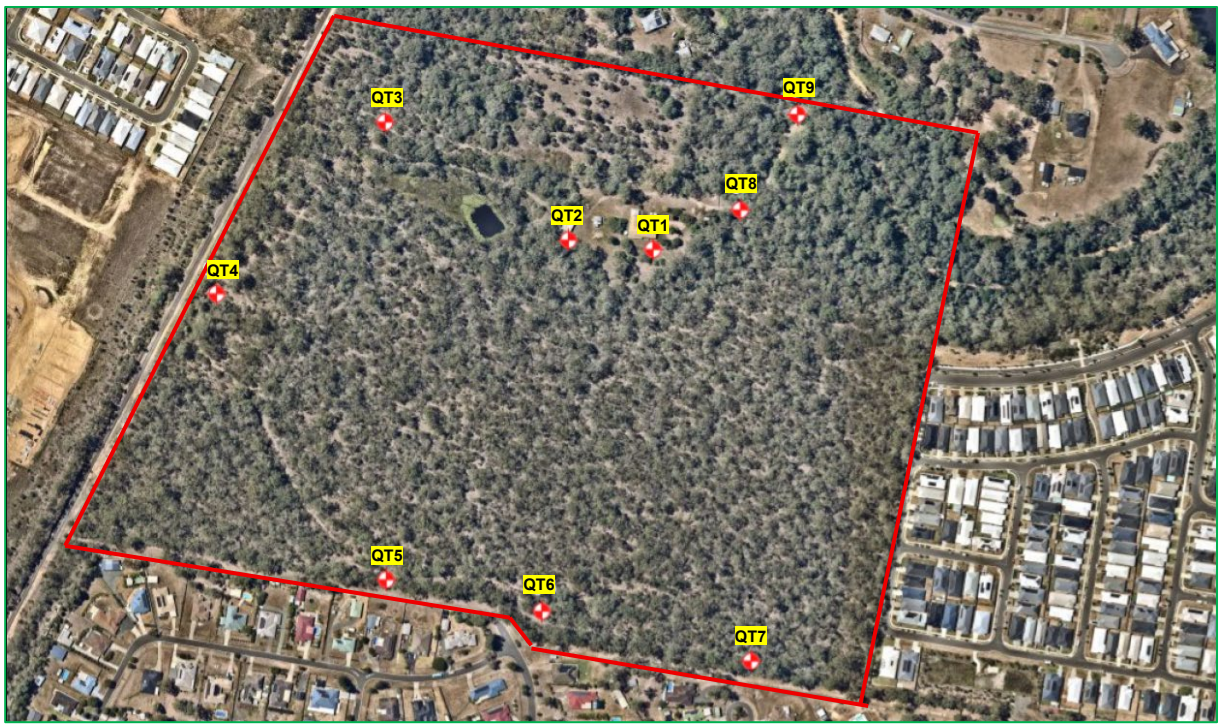

Figure 5: Plan Showing Approximate Location of Boreholes

2.3.2.1 DCP Testing

Dynamic cone penetrometer (DCP) testing was carried out at each borehole location prior to drilling. The results of the DCP testing are included in the borehole logs (*Appendix A*). In summary, the DCP tests were extended to varying depths ranging from about 0.7m to a maximum of 2.6m. The DCP blow counts ranged between 0 per 100mm penetration to refusal (hammer bouncing). In general, the upper units recorded the low DCP numbers, and blow counts increased with increasing depth.

However, it should be noted that the DCP testing technique may not be appropriate for the site profile, based on the presence of sand-based soils, which will return low blow counts, especially in loose sand.

2.3.2.2 Subsurface Conditions

The detailed subsurface conditions encountered at the test holes, together with the DCP test results, are presented in *Appendix A.* The boreholes encountered a variety of soil types depending on the location. At the borehole locations, topsoil, alluvial, residual, and weathered rock were recorded.

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

Topsoil	Topsoil was encountered at all borehole locations and was typically described as organic-rich silty sand, loose, extending to 0.1 to 0.3m in depth, underlain by:
Alluvial soils	Observed at QT1, QT2, QT3, QT8 and QT9 only. These holes were typically in the northern half of the site, within the influence of Flagstone Creek. The materials were described as very loose to loose silty sand and clayey sand extending to a maximum depth of 1.5m in QT9.
Residual Soils	Observed at all test locations underneath the topsoil or the alluvial soils. Extending to a maximum depth of 3.0m, these materials were logged as medium to high plasticity sandy clay/clay, stiff to very stiff consistency with dense silty/clayey sand interbeds. At some locations, these materials graded into weathered rock.
Weathered Rock	Observed at borehole QT5, QT6, QT7 and QT8 only. The rock was described as extremely to highly weathered sandstone that was recovered as clayey sand. The depth to rock varied from as shallow as 0.6m in QT5 to as deep as 1.9m in QT8. At Auger refusal depths, the rock materials are expected to be moderately weathered, with low to medium strength.

2.3.2.3 Groundwater

No groundwater was encountered in the boreholes at the time of the investigation. However, the ground profile is favourable for the development of perched water due to the loose relative density of the upper sand underlain by indurated clay/sand-based soils.

In addition, it is noted that groundwater conditions may change with time as it is influenced by climatic conditions, subsurface structure and material type.

2.3.2.4 Geotechnical Model

A preliminary geotechnical model of the subsurface conditions encountered based on the borehole/test pit data is illustrated in *Table 2*.

Table 2: Preliminary Geotechnical Model Based on Borehole Profiles

BH ID	Topsoil (m)	Alluvial (m)	Residual (m)	Weathered Rock (m)	Termination Depth (m)
QT1	0.0 – 0.3	0.3 – 1.2	1.2 – 3.0	NE	3.0$^{(TD)}$
QT2	0.0 – 0.3	0.3 – 1.1	1.1 – 3.0	NE	3.0$^{(TD)}$
QT3	0.0 – 0.1	0.1 – 0.6	0.6 – 3.0	NE	3.0$^{(TD)}$
QT4	0.0 – 0.3	NE	0.3 – 3.0	NE	3.0$^{(TD)}$
QT5	0.0 – 0.1	NE	0.1 – 0.6	0.6 – 0.75	0.75$^{(R)}$
QT6	0.0 – 0.3	NE	0.3 – 1.6	1.6 – 2.10	2.1$^{(R)}$
QT7	0.0 – 0.3	NE	0.3 – 1.0	1.0 – 1.20	1.2$^{(R)}$
QT8	0.0 – 0.2	0.2 – 1.1	1.1 – 1.9	1.9 – 3.00	3.0$^{(TD)}$
QT9	0.0 – 0.1	0.1 – 1.2	1.2 – 3.0	NE	3.0$^{(TD)}$
NE = not encountered; R = auger refusal depth, TD = Target Depth					

3 Laboratory Testing and Results

Selected soil samples were tested for geotechnical properties at Qualtest's NATA-accredited laboratory in Brisbane in accordance with relevant Australian Standards (AS). Tests outside the scope of Qualtest laboratory were outsourced.

The quantity and type of laboratory tests performed in this investigation are summarised in *Table 3*.

Table 3: Laboratory Testing Program

Laboratory Test	Quantity	Reference Standard
Atterberg Limits Test	3	AS1289.3.1.2, AS1289.3.2.1, AS1289.3.3.1, AS1289.3.4.1
Particle Size Distribution Test	3	AS1289.3.6.1
4-Day Soaked CBR Test	3	AS1289.6.1.1
Shrink-Swell Test	3	AS1289.7.1.1
Permeability Test	2	ASAS2159-2009
Soil Aggressivity Test	3	ALS Standards
Chemical Tests – Electrical Conductivity, Emerson Class Number, Cation Exchange Capacity, Exchangeable Sodium Percentage, pH	6	ALS Standards

The laboratory test certificates for the investigation are presented in *Appendix B*.

3.1 Particle Size Distribution

The behaviour of coarse-grained soils (sands and gravels) can be predicted by classifying the soil in terms of its particle size distribution (PSD). AS 1726-2017 denotes soils with fine contents (≤75 µm) greater than or equal to 35% will behave geomechanically as fine-grained soil and, therefore, are to be described as cohesive soils.

Three (3) soil samples recovered from across the site were tested for particle size distribution. The results of particle size distribution tests conducted on the selected samples are summarised in *Table 4*.

Table 4: Results of Particle Size Distribution Tests

Borehole ID	Sample Depth, m	Material Type	Gravel (%)	Sand (%)	Fines (%)
QT2	1.8 – 2.1	Silty Sand	0	85	15
QT3	0.9 – 1.2	Clay with sand	0	29	71
QT4	0.3 – 0.6	Sandy Clay	4	54	42

3.2 Shrink-Swell

The shrink-swell test is a simple test routinely employed in Australian geotechnical engineering practice to quantitatively assess the expansive potential of undisturbed or remoulded clay soils and to guide the design of footings on these soils. A fundamental rationale for using the shrink-swell test is that it evaluates the soil over both wetting (swell) and drying (shrink) phases. Hence, the result is independent of the initial moisture state of the soil sample and defines a unique soil class related to the fundamental properties of the soil.

Three (3) undisturbed soil samples (U50) recovered from selected boreholes across the site were subjected to shrink-swell testing. The test results are summarised in *Table 5*.

Table 5: Summary of Shrink-Swell Test Results

Borehole ID	Sample Depth, m	Shrinkage (%)	Swell (%)	Shrink-Swell Index (I_{ss}), %
QT3	0.6 – 0.80	2.2	8.3	3.5
QT4	0.6 – 0.72	1.5	10.3	3.7
QT7	0.6 – 0.80	0.8	12.3	3.9

3.3 Atterberg Limits

The behaviour of fine-grained soils (silts and clays) can be predicted by classifying the soil in terms of its plasticity. Plasticity is broadly described as either “High”, “Medium”, or “Low”.

Soils behave very differently depending on their moisture content. It can exist as either a solid at very low moisture content, a semi-solid, plastic, or liquid at ever-increasing moisture content. To determine plasticity, the moisture content is determined to define the boundaries between semi-solid, plastic, and liquid. The minimum moisture content at which the soil becomes plastic is known as the “Plastic Limit”, and the minimum moisture content at which the soil behaves as a liquid is known as the “Liquid Limit”. Collectively, these limits are known as the Atterberg Limits. Soils with liquid limits below 35% are described as Low plasticity, liquid limits between 35 and 50% are described as Medium plasticity and liquid limits above 50% are described as High plasticity.

The ‘Plasticity Index’ of soil is the range of moisture contents where the soil exhibits plastic behaviour. This is calculated by subtracting the Plastic Limit from the Liquid Limit of the soil. Soils with a plasticity Index greater than 25% are often referred to as high plasticity. The Atterberg limits of soil samples recovered from across the site were tested, including linear shrinkage. *Table 6* presents a summary of the Atterberg Limits test results.

Table 6: Results of the Atterberg Limit Test

BH ID	Sample Depth, m	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	WPI (%)
QT2	1.8 – 2.1	21	NO	NP	0.0	NO
QT3	0.9 – 1.2	41	21	20	12.0	1797
QT4	0.3 – 0.6	32	11	21	12.0	1644
WPI = Weighted Plasticity Index, NO = Not Obtainable, NP = Non-Plastic						

3.4 California Bearing Ratio (CBR)

Selected soil samples recovered from QT1, QT4 and QT7 were tested for 4-day soaked CBR using the test methods described in AS1289.6.1.1-2014. The samples were compacted using Standard compaction effort at optimum moisture content and soaked for four days under a 4.5kg surcharge. The tests were conducted at Qualtest’s NATA-accredited laboratory in Brisbane. A summary of the laboratory 4-day soaked CBR test results is presented in *Table 7*.

Table 7: Summary of Laboratory CBR Test Results

BH ID	Sample Depth, m	MDD (t/m^3)	OMC (%)	Swell (%)	CBR (%)
QT1	0.3 – 0.6	1.85	11.0	0.0	45
QT4	0.3 – 0.6	1.93	10.5	0.5	4.5
QT7	0.3 – 0.7	1.86	14.0	1.0	2.0

3.5 Soil Permeability

Soil permeability, also termed hydraulic conductivity, refers to the rate at which soil allows water to flow through it due to its grain structure and void spaces. Knowing how easily water can travel through soil structure is important for engineering purposes.

Several field and laboratory test methods exist to determine the permeability of soils. The two most common are “the constant head permeability method” and “the falling head permeability method”.

The falling head permeability test method was adopted to determine the coefficient of permeability (k) of soil samples recovered from QT2 and QT8 in the laboratory. The permeability test results (*Table 8*) are indicative of the presence of poorly drained soils.

Table 8: Summary of Laboratory Soil Permeability Test Results

BH ID	Sample Depth, m	Material Description	MDD (t/m^3)	OMC (%)	Coefficient of Permeability (k), m/s	Remarks
1	0.4 – 0.9	Sandy Clay	1.94	8.0	4×10^{-8}	WD-PD
QT8	0.4 – 0.8	Clayey Sand	1.82	10.0	3×10^{-7}	WD-PD
MDD = maximum dry density, OMC = optimum moisture content, WD-PD = well-drained to poorly drained						

3.6 Aggressivity

Sulfate, Chloride, pH, and resistivity in soil relate to the aggressivity of the site soils. Soil aggressivity tests are used to assess the durability of concrete/steel structures within the foundation materials. Three (3) soil samples were tested for soil aggressivity characteristics, including pH, moisture content, chloride, sulfate content, conductivity, and resistivity. The laboratory test result certificates are included in *Appendix B*, with a summary presented in *Table 9*.

Table 9: Summary of Aggressivity Test Results

Compound	QT1 (0.3 – 0.5m)	QT7 (1.5 – 1.8m)	QT9 (1.8 – 2.1m)
pH Value	5.4	5.7	6.4
Electrical Conductivity (uS/cm)	2	219	4
Moisture Content (%)	6.7	12.3	4.7
Resistivity (ohm-cm)	500,000	4570	250,000
Sulfate as SO_4^{2-} (mg/kg)	<10	40	<10
Chloride (mg/kg)	<10	250	<10

3.7 Chemical Testing

To characterise the dispersive state of the onsite soils, chemical testing of the selected soils was conducted.

The certificates of the chemical tests are attached in *Appendix B*, with a summary of the key indicators presented in *Table 10.*

The laboratory results indicate the presence of highly dispersive and sodic soils across multiple locations and depths.

Table 10: Summary of Chemical Testing Results

Sample	Depth (m)	Texture	pH	EC (uS/cm)	Emerson Class	ESP (%)	ECEC (meq/100g)	Ca/Mg Ratio
S22531A (QT1)	0.3-0.5	Clayey Fine Sand	7.5	3	3	NR	NR	NR
S22531B (QT2)	0.6-0.9	Sandy Loam	6.3	6	3	9.3	0.4	2.0
S22531C (QT4)	1.5-1.8	Clay Loam Sandy	5.6	249	1	3.7	0.8	2.5
S22531D (QT6)	0.3-0.5	Light Medium Clay	5.2	216	1	31.4	14.4	<0.1
S22531E (QT7)	0.2-0.5	Light Clay	5.3	182	1	26.6	12.9	<0.1
S22531F (QT9)	0.9-1.2	Loamy Sand	5.8	2	3	30.2	14.9	<0.1
EC = electrical conductivity, ESP = exchangeable sodium percentage, ECEC = effective cation exchange capacity, NR = not reported								

4 Geotechnical Engineering Assessment

4.1 Concept Geotechnical Risk and Management

The project's objective is to develop the site into a residential community that supports some 350 + new dwellings.

Infrastructure required to support this development includes roadways and associated drainage, water/sewer reticulation systems, stormwater networks and retained/unretained batters. All structures constructed on or within the ground have a geotechnical risk.

For this site, the main geotechnical risks that have been considered in the preparation of this report are:

- Dispersive soils - Risk of premature failure of built infrastructure, including road pavements, sidewalks, water and sewer networks, water dams, parks and other public structures.
- Perched water – The ground profile supports the development of perched water underneath built structures if the ground surface is not properly sealed or the upper sand-based soils are removed, mixed with clay-based soils and replaced.
- Low bearing capacity and shear strength of the upper sandy soils due to non-confinement.

  Highly reactive shrink -swell characteristics of site clays.
- Possible water-softened soils in the vicinity of Flagstone Creek and other gullies.
- Steep slopes define the banks of Flagstone Creek.
- Areas requiring deep fill over short distances.
- Shallow depth to Bedrock around QT5, which will present difficulty in excavatability.

Sections 4 and 5 of this report provide commentary, analysis and recommendations, including geotechnical parameters to reduce these geotechnical risks.

Notwithstanding the advice presented in this report, the geotechnical risk is actually managed through the implementation of sound construction/design techniques and procedures through all phases of the project.

Therefore, it is important that relevant stakeholders, including the civil designer, contractors and owners/users, are aware of possible geotechnical hazards onsite.

4.2 Bearing Capacity of Soils

The bearing capacity of the subsurface profiles encountered at the borehole locations was determined using DCP test data acquired during the June 3, 2026, investigation.

Campanella & Robertson (1983) developed a correlation between DCP blow counts and the bearing capacity of soils. This relation was adopted to derive the allowable bearing capacity of the subsurface profile with a safety factor of 4.0 for cohesive soils with a foundation factor Nc = 5.

The bearing capacity of the subsurface soils at the DCP test locations with depth is presented in *Figure 6*.

It can be seen from *Figure 6* that the upper soil layers in the majority of the boreholes (e.g., QT1, QT3, QT4, QT5, QT7, QT8 and QT9) have bearing capacities less than 100kPa. These low-capacity soils are the very loose to loose alluvial soils, and the water-softened upper clays extending down to a maximum of about 1.3m depth.

Without treatment, these sandy soils are not considered suitable to receive structural loads. It is recommended that such soils should be removed and replaced under a Level 1 testing program in areas of structural loading. Excavated soils should be treated prior to replacement. Treatment may include blending of the sand-based soils with clay soils to minimise the geotechnical risk of runoff infiltration.

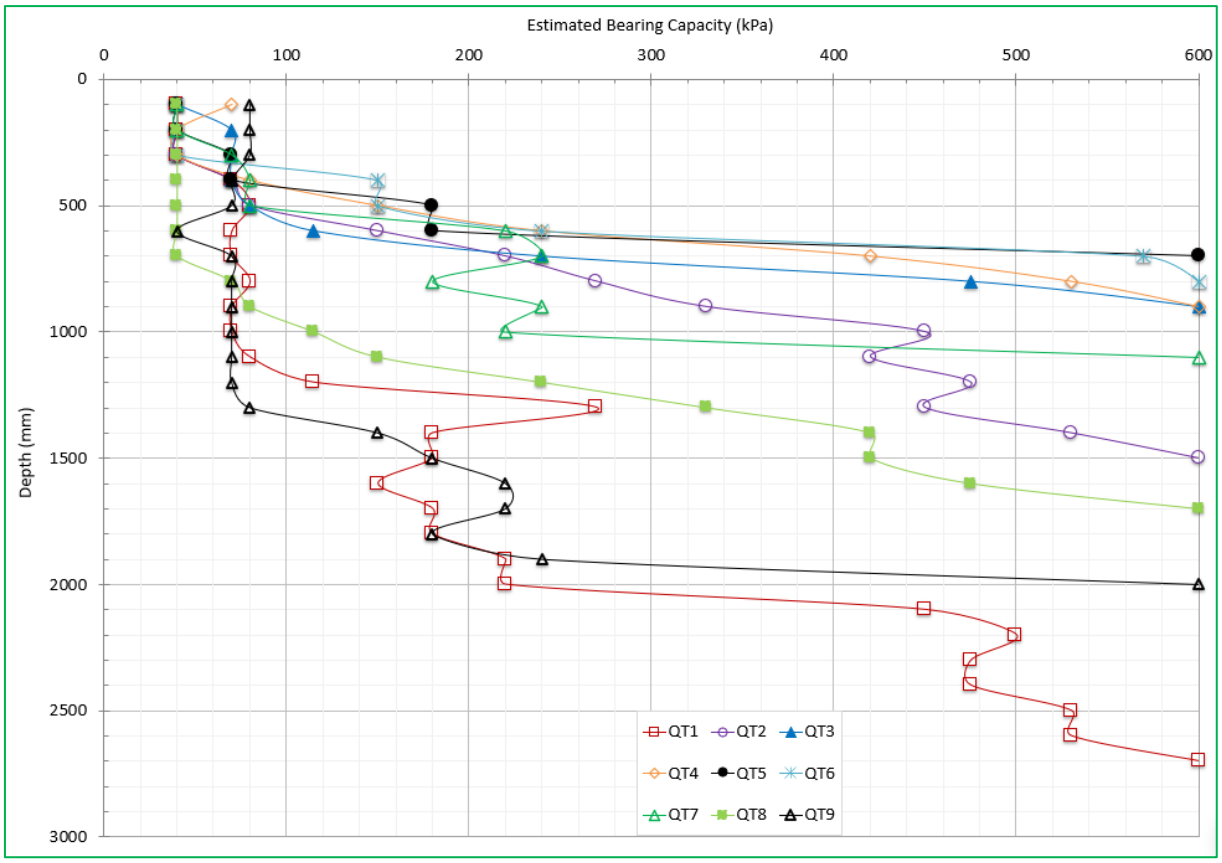

Figure 6: The Allowable Bearing Capacity of Soils with Depth; Derived from DCP Data

The recommended allowable bearing capacity of the main subsurface materials encountered at the site is presented in *Table 10.*

- *Uncontrolled fill/soft or loose soils = Not recommended (remove & replace)*
- *Controlled Fill (site won) = 100kPa*
- *Residual/alluvial soils stiff or better = 150 kPa*
- *Moderately reathered rock = 600 kPa*

4.3 Young's Modulus of Soils

Young's modulus is an elastic soil parameter and a measure of soil stiffness, and it is defined as the ratio of the stress along an axis to the strain along that axis in the range of elastic soil behaviour.

In this investigation, the soil Young's modulus (E), commonly referred to as soil elastic modulus, was calculated using correlation equations of DCP test data, as well as reference to literature, such as Look (2007) and the Australian Standard AS/NZS2566.1 (Buried Flexible Pipelines).

- Uncontrolled fill/Water-Softened Soils = not recommended (remove & replace)
- Controlled Fill (site won) = 3.5MPa
- Alluvial/Residual Soils (stiff to very stiff) = 8MPa
- Moderately Weathered Sandstone = 25MPa

4.4 Site Classification

To determine the broad-scale soil classification, a number of site features are considered, including the subsurface profile, the surface topography, existing vegetation, and the proposed development. Given that some soils in the upper horizons of the ground profile have a bearing capacity of less than 100kPa and the proposed removal of tree, the site is assigned a broadscale ***Class P*** per AS2870-2011.

The site was also classified based on characteristic surface movement (y_s) estimated in accordance with Clause 2.3 and applying Table 2.3 of AS2870-2011. The shrink-swell (I_{ss}), ranging from 3.5% to 3.9%,

obtained from laboratory testing, was used to calculate y_s. The change in suction was estimated from published literature as 1.2pF, and the design soil suction change (H_s) depth of 2.4m, with Hs crack of 50%.

Based on a worst-case clay profile, a potential ground surface movement of between 56 and 63mm can be expected at the site under normal moisture conditions and in the current state. This is consistent with site ***Class H1 to Class H2***.

The potential ground surface movements are subject to change when:

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

4.5 Shallow Footing Systems

Slab-on-ground, pad, and strip-type footings are considered appropriate for the site, provided the allowable bearing pressures presented in *Table 11* are adhered to.

Table 11: Preliminary Recommended Parameters for Foundation Design

Material		Allowable Bearing Pressure (kPa)	
		Slab on ground/Strip Footing	Pad Footings
Uncontrolled Fill / Water Softened Soils	Soft to Firm	NR	NR
Controlled Fill	≥Stiff	100	100
Residual/Alluvial Soils	Stiff to hard	150	150
MW or Better Rock	Low strength	600	600
NR: not recommended *MW = moderately weathered* *All founding materials should be verified by a suitably qualified person during construction.*			

Footing settlements are not expected to exceed 15mm, where footings are designed for the allowable bearing pressures in *Table 11.*

4.6 Thrust Block Design Parameters

Thrust blocks may be designed based on the allowable horizontal bearing capacities provided in *Table 12*.

Table 12: *Preliminary Parameters for Thrust Block Design*

Material		Allowable Horizontal Bearing Pressure (kPa)
Controlled Fill	Stiff or better	50
Residual Soil/alluvial soil	Stiff to Hard	75
MW of Better Rock	Low Strength	300
MW = moderately weathered		

4.7 Sediment and Erosion Control/Emerson Class

Based on the laboratory data, the site presents a high to very high risk of soil dispersion as discussed below:

Emerson Aggregate Test: Three samples (QT4, QT6, and QT7) recorded an Emerson Class Number of 1. This indicates strongly dispersive soil that slakes and disperses completely upon immersion in water without any mechanical remoulding. Samples with Emerson Class 1 are highly susceptible to severe gully and tunnel erosion. The remaining samples recorded an Emerson Class 3, indicating moderate dispersion potential after remoulding.

Exchangeable Sodium Percentage (ESP): Soil sodicity is a primary indicator of dispersion risk. Soils with an ESP greater than 6% are considered sodic, and those exceeding 15% are strongly sodic. Samples QT6 (31.4%), QT7 (26.6%), and QT9 (30.2%) are strongly sodic, confirming the severe chemical instability of the clay fractions onsite.

Electrical Conductivity (EC): The salinity levels across all samples are very low (ranging from 2 to 249 uS/cm). Low salinity exacerbates dispersion in sodic soils because there are insufficient dissolved salts in the soil solution to suppress the repulsive forces between sodium-saturated clay particles.

Acidity and Aluminium: Samples QT6 and QT7 are strongly acidic (pH 5.2 and 5.3) and show elevated exchange acidity and exchangeable aluminium (2.0 and 2.1 meq/100g, respectively). This acid-sodic condition requires careful selection of ameliorants, as traditional treatments like gypsum may need to be supplemented with lime to address the acidity and aluminium toxicity.

Calcium/Magnesium Ratio: A low exchangeable Calcium to Magnesium (Ca:Mg) ratio (less than 2:1) directly triggers and exacerbates soil dispersion, leading to severe structural collapse, hard-setting behaviour, and poor water infiltration. While sodium (Na^+) is traditionally recognised as the primary driver of sodicity, a high concentration of exchangeable magnesium (Mg^{2+}) mimics sodium by destabilising clay particles. This breaks up soil aggregates into individual clay platelets when wet. Samples QT6, QT7 and QT9 returned Ca:Mg ratio of less than 0.1, indicative of strong dispersivity.

Based on the above findings, Qualtest strongly recommends that a dispersive soil management plan be prepared for the site to manage the potential risks.

4.8 Sediment and Erosion Control/Emerson Class

The assessment evaluates the potential for chemical degradation of buried concrete and steel foundations due to aggressive soil conditions. Key chemical indicators tested include:

- **pH (1:5 soil-water extract)**: Indicates the acidity or alkalinity of the soil. Highly acidic soils (pH < 5.5) can degrade concrete and corrode steel.
- **Electrical Conductivity (EC)**: A measure of soil salinity.
- **Sulfate (SO_4^{2-})**: High concentrations can lead to sulfate attack on concrete, causing expansion and cracking.
- **Chloride (Cl^-)**: A primary catalyst for the corrosion of steel reinforcement and steel piles [2].
- **Soil Resistivity**: Low resistivity indicates higher moisture and ion content, facilitating electrochemical corrosion of steel.

The laboratory results were assessed against the criteria specified in AS 2159-2009, specifically:

- Table 6.4.2(C): Exposure Classification for Concrete Piles in Soil
- Table 6.5.2(C): Exposure Classification for Steel Piles in Soil

4.8.1 Soil Conditions

AS 2159-2009 differentiates exposure classifications based on the permeability of the soil and the presence of groundwater:

- **Soil Condition A**: High-permeability soils (e.g., sands and gravels) which are in groundwater.
- **Soil Condition B**: Low-permeability soils (e.g., silts and clays) or all soils above groundwater.

The classification has been made against both Soil Condition A and Soil Condition B, though considered to be **Soil Condition A**.

4.8.2 Aggressivity Assessment

The laboratory results were compared against the criteria set out in AS 2159-2009 to determine the exposure classifications for each sample location. The classification is governed by the most aggressive parameter.

4.8.2.1 Concrete Piles

According to AS 2159-2009 Table 6.4.2(C), concrete exposure classification is determined by soil pH and sulfate concentrations (*Table 13*).

- **QT1 (0.3–0.5m)**: The soil is slightly acidic with a pH of 5.4. While sulfate levels are negligible (<10mg/kg), the pH falls within the 4.5–5.5 range. This triggers a ***Moderate*** classification for Soil Condition A and a ***Mild*** classification for Soil Condition B.
- **QT7 (1.5–1.8m)**: The pH is 5.7, and sulfate concentration is 40mg/kg. Both parameters fall into the least aggressive category. This results in a ***Mild*** classification for Soil Condition A and ***Non-aggressive*** for Soil Condition B.
- **QT9 (1.8–2.1m)**: The pH is 6.4 and sulfate is <10mg/kg, resulting in a ***Mild*** classification for Soil Condition A and ***Non-aggressive*** for Soil Condition B.

4.8.2.2 Steel Piles

According to AS 2159-2009 Table 6.5.2(C), steel exposure classification is determined by soil pH, chloride concentrations, and soil resistivity (*Table 13*).

- **QT1 (0.3–0.5m)**: The pH is 5.4 (>5), chloride is <10mg/kg (<5,000mg/kg), and resistivity is 500,000 ohm.cm (>5,000 ohm.cm). This indicates a ***Non-aggressive*** classification for both Soil Conditions A and B.
- **QT7 (1.5–1.8m)**: The pH is 5.7 and chloride is 250mg/kg. However, the soil resistivity is relatively low at 4,570 ohm.cm. This falls into the 2,000–5,000 ohm.cm range, which triggers a ***Mild*** classification for Soil Condition A, while remaining ***Non-aggressive*** for Soil Condition B.
- **QT9 (1.8–2.1m)**: The pH is 6.4, chloride is <10mg/kg, and resistivity is 250,000 ohm.cm. This indicates a ***Non-aggressive*** classification for both Soil Conditions A and B.

Table 13: Summary of AS 2159-2009 Exposure Classifications

Structural Element	Soil Condition	QT1 (0.3–0.5 m)	QT7 (1.5–1.8 m)	QT9 (1.8–2.1 m)	Overall Site Classification
Concrete Piles	Condition A	Moderate	Mild	Mild	**Moderate**
	Condition B	Mild	Non-aggressive	Non-aggressive	**Mild**
Steel Piles	Condition A	Non-aggressive	Mild	Non-aggressive	**Mild**
	Condition B	Non-aggressive	Non-aggressive	Non-aggressive	**Non-aggressive**

4.8.2.3 Geotechnical Commentary

Based on the laboratory testing and assessment against AS 2159-2009, the overall site classifications are governed by the most aggressive conditions encountered across the tested profile.

1. **Concrete Structures**: The governing exposure classification is ***Moderate*** for Soil Condition A (high permeability soils in groundwater) and ***Mild*** for Soil Condition B (low permeability soils or soils above groundwater). This is primarily driven by the slightly acidic nature (pH 5.4) of the shallow soil at location QT1.
2. **Steel Structures**: The governing exposure classification is ***Mild*** for Soil Condition A and ***Non-aggressive*** for Soil Condition B. This is driven by the moderate soil resistivity (4,570 ohm.cm) encountered at depth in location QT7.

3. **General Chemistry**: The soils exhibit very low concentrations of soluble sulfates and chlorides across all tested depths, indicating a low risk of sulfate attack on concrete or chloride-induced corrosion of steel reinforcement.

Design Implications: Foundation designers should consider the site to be Soil Condition A, with anticipated groundwater levels. The concrete mix design, minimum cover to reinforcement, and steel corrosion allowances should be specified in accordance with the relevant exposure classification outlined in *Table 13*, complying with AS 2159-2009 and AS 3600-2018 (Concrete Structures).

4.9 Embedment Recommendations for Sewer and Water

Trench foundations at this site are likely to include controlled fill, alluvial/residual soils, and weathered bedrock. The Emerson Class for all samples tested returned values indicating strong dispersive soils. To allow for variability of materials onsite, the preliminary recommended trench embedment types are presented in *Table 14*.

Table 14: Recommended Trench Embedment Types

Material	Trench Embedment Type	Comments
Controlled Fill (site won)	Type 4 – Sewer, Type D – Water	Trench Foundation > 50 kPa
Residual / Alluvial Soils	Type 4 – Sewer, Type D – Water	Trench Foundation > 50 kPa
Sand-Based Soils	Type 7 – Sewer, Type G - Water	Trench Foundation > 50 kPa
≥ MW Sandstone	Type 3 – Sewer, Type C – Water	Trench Foundation > 50 kPa
MW = moderately weathered		

4.10 Pavement Design

Three (3) near-surface soil samples were collected and tested for 4-day soaked CBR to indicate the suitability of existing near-surface soils to act as subgrade support. The tests returned CBR values of 2.0%, 4.5% and 45% with a maximum CBR swell value of 1.0%.

The higher CBR results are for the sand-based soils, while the lower strength numbers correspond to the clay materials.

To allow for variability in the subsurface conditions onsite, a CBR design value of 2% may be adopted for preliminary design for the alluvial/residual clays. For sand-based soils, a pavement design CBR of 8.0% is recommended. Where moderately or better weathered rock is encountered, a design CBR of 20% can be adopted.

Proper preparation of the subgrade would be crucial in the long-term performance of the road pavements. Subgrades exposing with vey loose to loose silty sand upper units are likely to behave poorly, particularly after rainfall, where excess deformation and soil pumping are likely on loading.

It is therefore recommended that subgrade preparation should involve stripping the sands down to the competent clay/sandy clay/clayey sand soils.

Similarly, subgrade exposing high plasticity clay soils may require chemical stabilisation with lime or be capped with inert materials prior to pavement construction due to the very high reactive nature of the clays in some sections of the site.

4.11 Bulking Factors

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

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

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

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

Based on experience, engineering judgement, laboratory demonstrations, and published typical values (Look, 2014), *Table 15* provides estimated bulking/compaction factors for the material types encountered on the site.

Table 11: Bulking Factors

Material	Bulking Factor for Transportation
Alluvial / Residual Soils	1.35
≥ MW Sandstone	1.60

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

4.12 Geotechnical Strength Parameters

4.12.1 Bulk Density

The laboratory bulk density of the soils was determined for the materials and compared to published literature (e.g., AS 4678-2002, Cater and Bentley 1991).

Qualtest recommends that the following bulk densities be adopted for the materials:

- Controlled Fill (site won) = 18kN/m^3;
- Alluvial/Residual Soils = 19kN/m^3;
- Moderately to Slightly Weathered Sandstone = 21kN/m^3.

4.12.2 Effective Internal Friction Angle and Cohesion

The internal friction angle of the existing material with a plasticity index of 21% was determined using graphical correlations proposed by Ladd et al. (1977) and Bjerrum and Simons (1960).

Qualtest recommends that the following be adopted for the materials:

- ***Internal Friction Angle***
  - Controlled Fill (site won) = 26^o;
  - Alluvial/Residual Soils = 29^0;
  - ≥ Moderately Weathered Sandstone = 35^o.
- ***Effective Cohesion***
  - Controlled Fill - Clay (site won) = 1kPa;
  - Alluvial/Residual Soils = 3kPa;
  - ≥ Moderately Weathered Sandstone = 10kPa.

The material strength parameters summarised in *Table 16* are recommended for the design of the proposed structures (retaining wall, shallow foundations, batters, etc.).

Table 12: Strength Parameters of Encountered Materials at Borehole Locations

Origin	Description	Bulk density, γ (kN/m³)	Long-Term Friction Angle, (°)	K_o	K_a	K_p	Long-Term Cohesion, C' (kPa)
Controlled Fill	Stiff or better	18	26	0.56	0.39	2.56	1
Alluvial / Residual Soil	Stiff to Hard	19	29	0.52	0.35	2.88	3
≥ MW Rock	Medium Strength	21	35	0.43	0.27	3.69	10
MW = moderately weathered							

4.13 Retaining Wall Parameters

This Section provides advice and recommendations for free-headed and fixed-headed retaining walls that may be constructed as part of the proposed development.

Passive earth pressures for the site can be calculated by the Rankine (1857) method, which assumes no soil cohesion or wall soil friction.

The design of fixed or free-headed permanent retaining wall systems supporting fill or natural clay soil can be based on the lateral earth pressure distribution given as:

$$p_a = {}^1/_2\, k_a \gamma H^2 - 2cH + 2c^2/\gamma$$

In the above equation, H(m) is the height of the wall, γ (kN/m³) is the unit weight of the soil, k_a is the coefficient of active earth pressure, and c is the soil cohesion.

Retaining walls are to be designed with respect to internal stability properties such as sliding, overturning, and bearing capacity failure. The retaining walls are also to be assessed and designed for global stability. Internal and global stability design should be carried out in accordance with AS4678:2002 (Earth-Retaining Structures).

The preliminary design parameters for retaining walls onsite should be adopted as shown in *Table 15* above.

Subsoil drainage comprising free-draining granular material connected to slotted PVC pipes must be placed behind the permanent retaining walls to prevent the build-up of groundwater pressures behind the walls, and this must be discharged to the point of legal discharge.

4.14 Earthworks Recommendations

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

Given the subsurface profile encountered on site and taking into consideration the proposed earthworks operations, it is recommended that all earthwork operations be supervised under Level 1 engineering supervision and an engineering certification be provided by a registered professional engineer (RPEQ).

Earthworks recommendations are presented in the following subsections.

4.14.1 Existing Onsite Fill

No fill was observed in any of the boreholes drilled in this investigation. However, given that sections of the site have been previously developed, localised fill should be expected, particularly around the dwelling, dam and access tracks.

Any material assessed to be fill should be treated as uncontrolled and is not suitable to support structural loads.

4.14.2 Reuse of Materials

The alluvial, residual soils and weathered rock material can be reused as structural fill. However, these materials should be moisture conditioned to between +2 to -2% OMC and be placed in thin layers (200mm loose), with each layer compacted to at least 95% standard.

It is recommended that, where practical, any imported fill should comply with the following specifications:

- Max Particle Size = 150mm;
- Minimum soaked CBR = 7%; and
- Shrink Swell Index = 1.0% Max.

Testing of the placed and compacted fill should be carried out at frequencies defined in AS3798 *Table 8.1* for Level 1 Earthworks.

4.14.3 Excavation Conditions

Bulk excavation to a depth of 3.0m beneath the existing ground surface at the site will require the removal of loose sand, stiff to hard or dense to very dense alluvial/residual soils and extremely to moderately weathered sandstone bedrock.

Depth to top of rock varies across the site, with the shallowest at about 0.6m bgl at QT5. Refusal depth taken as the start of moderately weathered rock was recorded at depths ranging from 0.75 to 2.1m at QT5 and QT6, respectively.

Generally, it is expected that 8 to 14t+ excavators fitted with general-purpose/toothed buckets will be required to excavate the alluvial sands, residual soils and extremely to highly weathered sandstone materials to a depth of about the typical auger refusal depths.

Where excavations exceed auger refusal depths, a larger plant, such as a 30t+ excavator fitted with a toothed bucket, is recommended (probably Hydraulic hammer or ripper attachments). A D8 is regarded as having an equivalent capacity to rip high-strength rocks.

4.14.4 Trafficability

At the time of the field investigation, trafficability was considered to be good due to the dry weather conditions and the constructed access tracks.

Trafficability problems could arise for earthworks and construction machinery from:

- Softening of the upper-level soils during and after periods of rainfall. This is expected to occur in the very high reactive clay soils onsite and may require the installation of seepage cut-off drains should construction commence during or following an extended period of wet weather.
- Disturbance of the upper-level soil fabric with the removal of vegetation. Depressions could be formed, resulting in potential water traps, which could cause further softening of exposed soils.
- The likely zero shear strength of the upper unconfined sand-based soils. This will present trafficability constraints.

To improve the site's trafficability, it is recommended that the exposed surface be inspected and assessed following stripping, clearing, and grubbing. Areas that demonstrate excessive movement and/or do not improve sufficiently under proof rolling should be removed and replaced as required.

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

Potential trafficability problems with this site should not be underestimated. The site will quickly become non-trafficable if appropriate drainage control measures and construction practices appropriate for site conditions are not maintained.

If weather conditions and time constraints do not allow for site drains to effect sufficient site improvement to allow earthworks to proceed, then site trafficability may be improved by constructing haulage roads into and within the site. Imported materials could be used as a blanket course for the haulage roads.

The contractors should fully inform themselves of the ground conditions on site prior to the commencement of earthworks. This requirement should be explicit in any earthworks specifications or contract.

4.14.5 Subgrade Preparation and Compaction Standards

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

Materials won from cuts are suitable for use as controlled fill (except the black clay). Materials won from cuts are likely to be residual/alluvial soils and weathered sandstone.

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

- Remove all debris and vegetation, including grass and trees. Root bowls from trees are to be excavated and backfilled as required.
- Dewater farm dams and remove all wet soils and associated sediments to a surface capable of supporting filling operations.
- Remove topsoil (to stockpile) to depths exposing the underlying sand-based soils. The nominal thickness of topsoil to be removed ranges between 0.2m and 0.3m.
    - Localised deeper stripping requirements may be required along the overland flow/drainage path to remove wet soils and sediments.
    - Deeper stripping requirements may be required to remove the wet soils in the north-eastern portion of the site and areas that were not accessible at the time of the investigation.
- Following removal of debris, vegetation, and topsoil, the exposed surface should be proof rolled to identify any weak areas using a rubber-wheeled plant of at least 10 tonnes or a tracked plant of at least 20t. Identified weak areas should be repaired as required.
- Excavation of finger drains into the sand-based soils should be considered to drain groundwater perched at the interface of the sand-based soils and the clay-based soils. Finger drains should extend 300mm into the clay-based soils below the sand-based soils and drain to a designated sump or basin and then be removed by pumping. Draining of the perched water is likely to improve the bearing capacity of the sand-based soils. Compaction of the stripped surface is required following the draining of the sand-based soils.
- Sloping areas that are to be filled should be benched prior to fill placement.
- All fill required to raise the ground surface should be placed in thin layers (300mm max Loose) and compacted to a density ratio of at least 95% Standard at moisture contents of OMC +/- 2%. If the earthworks are to support industrial or commercial-sized buildings, then the fill will be required to be compacted to a density ratio of at least 98% Standard at moisture contents of OMC +/- 2%.
- Ideally, the sand-based soils in cut and fill areas should be capped with cohesive soils such as clayey sands and sandy clay. The thickness of the capping layer should be at least 400mm.
- When the sand-based soils are drained as well as confined by a capping layer of at least 400mm, bearing capacity improvements should be expected.
- If imported fill is required, it is recommended to be low reactivity and conform to the following imported fill specification:
    - Max Particle Size 150mm
    - Minimum soaked CBR 8%
    - Shrink Swell Index 1.0% Max.
- Testing of the placed and compacted fill should be carried out at frequencies defined in AS3798 Table 8.1 for Type 1 Earthworks.

Earthworks operations, including cutting, filling, and trenching, are expected to be within the limits of small tractors (e.g., Cat D6) and medium-sized excavators (20t Excavators).

4.14.6 Safe Batter Angles

Batters can be constructed to the following short- and long-term gradients presented in *Table 17*. The short-term is deemed to be no longer than a 2-week period, and following wet weather (rainfall), the short-term batter slopes would need to be assessed for stability.

Batters should be covered by topsoil, mulched, and vegetated to prevent drying and cracking. Further assessment of the batter angles may be required once the exact geometry and materials have been finalised. It is essential that permanent batter faces are suitably protected from erosion and scour by appropriate drainage. Temporary or permanent cuts and batters exceeding 1.5m in height should be inspected prior to allowing workers at the base.

Table 13: Recommendations for Cut and Fill Batters

Material	Short term	Long term
Controlled Fill	27° (1V:3H)	14° (1V:4H)
Residual Soils	27° (1V:3H)	14° (1V:4H)
Sand-Based Soils	27° (1V:3H)	14° (1V:4H)
Weathered Rock	45° (1V:1H)	27° (1V:2H)
Vertical faces of sand-based soils should be limited to 1.0m Max.		

Where temporary earthworks are required to tie in to existing stages of the development, it is recommended that battes are sloped back to the long-term batter angles presented in *Table 17 above*.

5 Global Stability Analysis

As part of the development, post and concrete sleeper retaining walls and batters have been proposed for construction onsite.

Global stability analyses have been conducted for the following design case scenarios.

The analysed cross-sections are presented in *Appendix C.*

- **Design Case 1: Cross Section A, Road 1**
  - Surcharge behind the Crest = 25kPa (Heavy Vehicale Surcharge)
  - Batter Type – Controlled Fill / Reidual Soils / Boulder Wall
  - Batter Height – 2.5m
  - Retaining – Controlled Fill and Residual Soils
  - Found on at Least Stiff Residual Soils.
- **Design Case 2: Cross Section B, Road 1**
  - Surcharge behind the Crest = 25kPa (Heavy Vehicale Surcharge)
  - Batter Type – Controlled Fill / Reidual Soils / Boulder Wall
  - Batter Height – 2.5m
  - Retaining – Controlled Fill and Residual Soils
  - Found on at Least Stiff Residual Soils.
- **Design Case 3: Cross Section C – Park**
  - Surcharge behind the Crest = 10kPa (Building Surcharge)
  - Retaining Wall Type – Three Tier Post & Concrete Sleeper Wall
  - Retaining Wall Height – 3.5m
  - Retaining – Controlled Fill
  - Foundation – Piered into Underlying Weathered Sandstone Rock.
- **Design Case 4: Cross Section D – Park**
  - Surcharge behind the Crest = 10kPa (Building Surcharge)
  - Retaining Wall Type – Four Tier Post & Concrete Sleeper Wall
  - Retaining Wall Height – 3.5m
  - Retaining – Controlled Fill
  - Foundation – Piered into Underlying Weathered Sandstone Rock.

5.1 Basis for Design

No specific design standard(s) are required to be used by Ipswich City Council to complete the geotechnical analysis. To progress the assessment, the Department of Transport and Main Roads ("TMR") Geotechnical Design Standard (2022) has been used as the basis of this analysis. This standard is widely accepted by government agencies when assessing slope stability and is considered to be appropriate for this analysis.

5.1.1 Design Methodology

The stability of the retaining walls and cut/fill batters has been assessed using a 2D limit equilibrium analysis. The design philosophy includes:

- Limit equilibrium methods of assessment have been used to assess global stability;
- The embankment material has been modelled using drained strength parameters
- Global stability assessment of unreinforced slopes and retaining walls has considered a minimum FOS for short-term conditions of 1.30, while the FoS for long-term stability was 1.50.

The factors of safety for the proposed slopes and retaining walls were assessed using the Morgenstern/ Price and Spencer methods, and the Circular Search Function were used to determine the Factor of Safety (FoS), with the lower FoS of the two adopted. The analysis was completed using the method of limit equilibrium analysis with the commercially available software package Slide2D Version 9.028 (by Rocscience).

The global stability of the retaining wall was assessed based on the Department of Transport and Main Roads ("TMR") Geotechnical Design Standard (2022) criteria per *Table 18*.

Table 18: Recommended Factor of Safety

Loading Condition	Recommended Minimum FoS	Reference
Static: Short Term	1.3	Geotechnical Design Standard (2022)
Static: everyday operating conditions – Long Term	1.5	Geotechnical Design Standard (2022)

Four (4) cross sections were used as the basis of the global stability analysis per Section 5.0 above.

5.1.2 Phreatic Surface

In this investigation, groundwater was not recorded at drilled locations to a depth of 3.0m. However, for this analysis, groundwater was assumed to exist at the fill-natural soils interface.

5.1.3 Design Assumptions

The following assumptions were made in the modelling/analysis of the retaining structure:

- Groundwater exists at the fill-natural soils interface;
- All earthworks will be carried out in accordance with AS3798 across the site;
- The piers for all retaining walls will be sufficiently socketed into the underlying at least very stiff to hard/dense to very dense soils or into weathered sandstone/siltstone;
- The adopted design parameters are conservative representations of current ground conditions; and
- An undrained strength of 1000 kPa is adopted for the reinforced sleepers and concrete piers.

5.1.4 Design Loads

The following loading conditions have been used as the basis of the stability assessment:

- A 10kPa uniformly distributed load has been positioned on all relatively flat areas to account for the proposed building/swimming pool load. A surcharge of 25kPa was adopted on roadways for possible garbage/maintenance trucks, etc.

5.2 Results of Stability Analyses

The results of the global stability analyses of the four (4) design cases under static loading conditions are presented in *Table 19*. Output from the analyses is shown in *Appendix D*.

All proposed structures are geotechnically stable in the long term.

Table 19: Stability Analysis Results for Static Loading Conditions

ID	Loading Condition	Required FoS	Achieved FoS	Remarks
Design Case 1	Static	1.50	2.42	Satisfactory Design
Design Case 2		1.50	2.77	Satisfactory Design
Design Case 3		1.50	1.74	Satisfactory Design
Design Case 4		1.50	1.85	Satisfactory Design

5.3 Stability Discussion

Following the stability analyses completed for the post & concrete sleeper retaining structures/batters proposed for construction at #673 Silverwood Drive, Flagstone, the long-term global factor of safety (FoS) is calculated to be greater than 1.5 for all design cases analysed.

It should be noted that the construction of the structures strictly complies with the drawings/models and materials used in the analysis. Deviation(s) from the models will render this report Invalid.

Retaining wall drainage is essential to building a good retaining wall. During the wall's construction, a drainage system must be built to drain water that is absorbed by the soil behind the wall. The weight of the earth or gravel behind the wall is an acting force that the retaining wall must withstand, and any water absorbed behind the wall adds compounding pressure that can result in shifting, bulging, or total collapse. For this reason, it is crucial that there is a passage for water to drain from and that the design of the wall can safely withstand the expected load.

It is recommended that vegetation be planted or the batter concreted to protect the near-surface from erosion, which, over time, could result in causing instability.

If the ground conditions modelled in this stability analysis and highlighted in the outputs are different at the time of construction, Qualtest should be informed so that an inspection and, if necessary, further analyses can be completed.

6 Conclusions

This geotechnical interpretative report is a product of a site investigation conducted at a parcel of land identified as #673 Silverwood Drive, Flagstone, QLD.

The site is underlain by the Gatton Sandstone (Jbmg) Geological Unit, with the north-eastern portion laced with Quaternary alluvial soils. The boreholes encountered a profile of very loose to loose clayey sand or alluvial/residual origins overlying dense to very dense clayey sand and medium to high plasticity residual sandy clays, which graded into weathered sandstone at some locations.

Based on shrink-swell test data, the clays have been found to have a potential ground movement of up to 40 to 75mm under normal moisture conditions. This corresponds to a *Class H1 - H2* site in accordance with AS2870-2011. The site, on a broadscale level, however, was assigned a *Class P* site due to localised low bearing capacity, planned tree removal, and expected fill heights.

Slab-on-ground, strip, and pad footings are considered appropriate for the site. Footings should be founded on an engineered capping layer and designed in accordance with the AS2870-11 requirement for a Class H2 site.

The excavatability assessment concluded that the upper soils (alluvial/residual soils) could be excavated with traditional equipment such as backhoes and 8t excavators fitted with a toothed bucket, including the extremely to highly weathered sandstone. A 30t+ excavator fitted with a general-purpose toothed bucket (or Cat D6 – D8) is recommended for the moderately weathered to fresh sandstone bedrock, without the requirement of hydraulic breakers or rock blasting.

Reuse of onsite soils is permitted, provided it is moisture-conditioned and free from deleterious materials or water-softened soils. However, for best practice, it is recommended that the sand horizon be removed, blended with clay and replaced. Similarly, the dispersive/expansive clays should be treated prior to reuse as subgrade, foundation, or fill materials.

The permanent batter angles should be less than or equal to the values presented in *Table 16.*

The Emerson Aggregate Class Number of the six (6) test soils returned three samples as 1 and three samples as 3, indicative of the presence of highly dispersive soils.

The Design Cases 1 to 4 global stability analysis has been completed to determine the long-term factor of safety of the retaining walls and fill/cut batters proposed for construction at the site. The Design Cases 1 to 4 returned safety factors greater than 1.5.

It is recommended that the construction of the retaining structures and batters strictly comply with the models/materials used in the analysis. Deviation(s) from the model/drawings will render this report Invalid.

If the ground conditions modelled in this stability analysis and highlighted in the outputs are different at the time of construction, Qualtest should be informed so an inspection can be completed and, if necessary, further analyses can be carried out.

The designer of the retaining walls must consider the effect of the reactive soils on the retaining walls, as the site has been assigned a *Class H2* clay site.

7 Disclaimer

This report has been prepared on behalf of and for the exclusive use of *JFP Urban Consultants, on behalf of Oris Accessories Pty Ltd, the Trustee for the Chang Family Trust (The Client)* and its design partners in accordance with the scope of work outlined in Proposal No: QGQ26-216–11365, dated May 23, 2026.

This report is not intended for and should not be relied upon by any third party. In preparing this report, Qualtest has necessarily relied upon information provided by *JFP Urban Consultants*. This report must be read in conjunction with the attached appendices and kept in its entirety without separating individual pages or sections. This report, or sections from this report, should not be used as part of a specification for a project without review and agreement by Qualtest.

Interpretations and recommendations provided in the report are based on the ground conditions at the site, only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. This is because ground conditions are subject to change from place to place and with time due to geological processes and/or because of human influences.

The advice provided by Qualtest is based on the conditions encountered onsite at the time of the investigation. If different ground conditions are encountered following the issuance of this report, Qualtest should be notified so that further advice can be provided.

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

Yours faithfully,

MICHAEL MORRISON **DENNIS ALAZIGHA,** *RPEQ 22169*

For and on behalf of
QUALTEST LABORATORY PTY LTD

Appendix A: Engineering Logs
Appendix B: Laboratory Test Certificates
Appendix C: Analysed Cross Sections
Appendix D: Stability Analysis Results for Proposed Retaining Walls and Batters

APPENDIX A

Engineering Logs

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Qualtest

2/40 Boyland Ave, Coopers Plains QLD 4108

Phone: (07) 3875 1898

Geotechnical Log - Borehole

QT1

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 495988.38	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925758.86	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.3	Topsoil		SM	M	Silty SAND: fine grained, brown, low plasticity silt, very loose, moist, with rootlets.	VL		1	
											1	
										D : 0.2 - 0.7 m	1	
								Clayey SAND: fine to medium grained, pale grey mottled brown, orange, low plasticity clay, loose, moist.			2	
											3	
											2	
											2	
				Alluvial					L		3	
											2	
			1.0								2	
											3	
			1.2								4	
								Clayey SAND: fine to medium grained, orange mottled grey, low plasticity clay, trace fine gravel, medium dense to dense, dry, crystal quartz inclusion.			9	
											6	
											6	
						SC			MD-D		5	
											6	
											6	
										D : 1.8 - 2.1 m	7	
			2.0								7	
											15	
			2.1	Residual			D					
								Clayey SAND: fine to medium grained, orange mottled red pale brown, low plasticity clay, trace fine gravel, very dense, dry, crystal quartz inclusion.			17	
											16	
											16	
											18	
									VD		18	
											20/80	
								QT1 Terminated at 3 m (Target Depth)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT2

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 495911.34	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925767.26	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.3	Topsoil				Silty SAND: fine to medium grained, pale brown grey, low plasticity silt, loose, moist, with rootlets.	L		1 1 1	
			0.7	Alluvial		SM	M	Silty SAND: fine to medium grained, pale brown, low plasticity silt, loose to medium dense, moist.	L-MD		2 3 5	
			1.0					Silty SAND: fine to medium grained, pale grey light brown, with fine to medium gravel, medium dense to dense, moist.	MD-D	D : 0.4 - 0.9 m	7 9 11 15 14	
			1.1					Clayey SAND: fine to medium grained, pale yellow orange, low plasticity clay, with silt, with fine to medium gravel, dense to very dense, dry.	D-VD		16 15 18 20/90	
			2.0	Residual		SC	D			D : 1.8 - 2.1 m		
			2.2					Clayey SAND: dense to very dense, fine to medium grained, pale grey mottled orange, low plasticity clay, trace fine gravel, dry.				
								QT2 Terminated at 3 m (Target Depth)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT3

UTM	: 56J	Drill Rig	: Zenith Engineering 4WD Drill Rig	Job Number	: 26-258
Easting (m)	: 495743.83	Driller Supplier	: Qualtest	Client	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925873.43	Logged By	: TS	Project	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	Reviewed By	: DA	Location	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	Date	: 03/06/2026	Loc Comment	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.1	Topsoil				Silty SAND: loose, fine to medium grained, grey brown, moist, with Rootlets.	L		1	
				Alluvial		SM	M	Silty SAND: fine to medium grained, grey, loose to medium dense, moist.	L-MD		2	
											2	
											2	
											3	
			0.6								4	
				Residual		CI	w ≈ PL	Sandy CLAY: medium plasticity, pale grey mottled orange brown, fine to medium grained sand, very stiff to hard, w = pl.	VSt-H	U50 : 0.6 - 0.8 m	8	
			0.8								16	
						CI-CH		Sandy CLAY: medium to high plasticity, pale brown mottled grey, fine to medium grained sand, hard, w < pl.	H		20/90	
			1.0							D : 0.9 - 1.2 m		
			1.2					CLAY: high plasticity, grey mottled light brown, trace fine to medium grained sand, very stiff to hard, w < pl.				
							w < PL					
			2.0			CH			VSt-H			
								QT3 Terminated at 3 m (Target Depth)				

Water

Weathering
- XW : Extremely weathered
- DW : Distinctly weathered
- HW : Highly weathered
- MW : Moderately weathered
- SW : Slightly weathered
- FR : Fresh

Altering
- XA : Extremely alterated
- DA : Distinctly alterated
- HA : Highly alterated
- MA : Moderately alterated
- SA : Slightly alterated

Consistency
- VS : Very soft
- S : Soft
- F : Firm
- St : Stiff
- VSt : Very stiff
- H : Hard
- FR : Friable

Moisture
- D : Dry
- M : Moist
- W : Wet

Density
- VL : Very loose
- L : Loose
- MD : Medium dense
- D : Dense
- VD : Very dense

Rock Strength
- VLS : Very low
- LS : Low
- MS : Medium
- HS : High
- VH : Very high
- XH : Extremely high

Tests&Results
- U50 : Undisturbed 50mm diam tube.
- D : Disturbed sample.
- SPT : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- PP : Hand penetrometer estimate of unconfined compressive strength, kPa.
- S : Vane shear value kPa.
- DCP : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT4

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 495590.11	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925718.74	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.3	Topsoil		SC	M	Clayey SAND: fine to medium grained, brown, low plasticity clay, very loose to loose, moist, with rootlets.	VL-L		2 1	
			0.6				w > PL	Sandy CLAY: medium to high plasticity, dark grey mottled brown, fine to medium grained sand, firm to stiff, w > pl.	F-St	D : 0.2 - 0.6 m	0 3 5 8	
			1.0	Residual		CI-CH	w < PL	Sandy CLAY: medium to high plasticity, pale grey mottled orange brown, fine to medium grained sand, hard, w < pl.	H	U50 : 0.6 - 0.72 m D : 1.5 - 1.8 m	14 18 20/90	
			1.8					As above, but: pale grey brown mottled orange, soft to firm.	S-F			
			2.0					QT4 Terminated at 3 m (Target Depth)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT5

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 495745.06	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925461.25	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 0.75 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.1	Topsoil		SM	M-D	Silty SAND: fine to medium grained, pale grey mottled brown, low plasticity silt, loose, moist to dry, with rootlets.	L		1	
				Residual		CI-CH	w > PL	Sandy CLAY: medium to high plasticity, pale grey mottled orange brown, fine to medium grained sand, firm to stiff, w > pl.	F-St		1	
											2	
											2	
			0.5								6	
						SC	M-D	Clayey SAND: fine to coarse grained, pale brown, low to medium plasticity clay, trace fine gravel, medium dense, moist to dry.	MD		6	
			0.6	Rock		SST	D	Clayey SAND: fine to coarse grained, pale brown mottled grey, low plasticity clay, very dense, (extremely to highly weathered sandstone).	VD		20/50	
								QT5 Refusal at 0.75 m (Max Tc)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT6

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 495887.12	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925432.83	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 2.1 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.3	Topsoil		SM	M	Silty SAND: fine to medium grained, pale brown, low plasticity silt, loose, moist, with rootlets.	L		1 1 1	
			0.6	Residual		CI-CH	w ≈ PL	Sandy CLAY: medium to high plasticity, pale grey mottled brown, fine to medium grained sand, stiff, w = pl.	St	D : 0.3 - 0.6 m	5 5 8	
			1.0				w < PL	Sandy CLAY: medium to high plasticity, pale brown mottled grey, fine to medium grained sand, hard, w < pl.	H		19 20/50	
			1.2					Sandy CLAY: medium to high plasticity, orange mottled grey brown, fine to coarse grained sand, hard, w < pl.				
			1.6	Rock		SST	D	Clayey SAND: fine to medium grained, yellow mottled grey brown, low plasticity clay, dense to very dense, (extremely to highly weathered sandstone).	D-VD	D : 1.6 - 1.8 m		
			2.0					QT6 Refusal at 2.1 m (Max Tc)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Phone: (07) 3875 1898

Geotechnical Log - Borehole

QT7

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 496078.04	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925388.03	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 1.2 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.3	Topsoil		SM	M-D	Silty SAND: fine to medium grained, pale brown, low plasticity silt, loose, moist to dry, with rootlets.	L		1 1 2	
				Residual		Cl-CH	w ≈ PL	Sandy CLAY: medium to high plasticity, pale grey mottled orange brown, fine to medium grained sand, stiff, w = pl.	St	D : 0.3 - 0.7 m U50 : 0.6 - 0.8 m	3 3 7 8 6 8 7	
			1.0 1	Rock		SST	D	Clayey SAND: fine to coarse grained, pale grey mottled orange, low plasticity clay, very dense, (extremely to highly weathered sandstone).	VD		20/75	
								QT7 Refusal at 1.2 m (Max Tc)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
- **S** : Soft
- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
- **FR** : Friable

Moisture

- **D** : Dry
- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT8

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 496068.16	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925794.45	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.2	Topsoil				Silty SAND: fine to medium grained, pale brown, low plasticity silt, very loose, moist, with rootlets.	VL		1	
											0	
				Alluvial		SM		Silty SAND: medium grained, pale brown, low plasticity silt, very loose to loose, moist.	VL-L		1	
			0.6								0	
											1	
											1	
								Silty SAND: medium grained, yellow brown, low plasticity silt, trace fine to medium gravel, loose to medium dense, moist.	L-MD		1	
											2	
											3	
			1.0				M				4	
			1.1								5	
				Residual		SC		Clayey SAND: medium grained, pale grey light brown, low plasticity clay, with fine to medium gravel, dense to very dense, moist.	D-VD		8	
											11	
											14	
											14	
											16	
										D : 1.5 - 1.8 m	20/90	
			1.9									
			2.0	Rock		SST	D	Gravelly clayey SAND: fine to medium grained, pale grey mottled orange, fine to medium grained gravel, low plasticity clay, dry, very dense, extremely weathered sandstone.	VD			
								QT8 Terminated at 3 m (Target Depth)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

- **VS** : Very soft
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- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
- **H** : Hard
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Moisture

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- **M** : Moist
- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
- **MD** : Medium dense
- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

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Geotechnical Log - Borehole

QT9

UTM	: 56J	**Drill Rig**	: Zenith Engineering 4WD Drill Rig	**Job Number**	: 26-258
Easting (m)	: 496120.24	**Driller Supplier**	: Qualtest	**Client**	: Oris Accessories CC- JFP Urban Consultants
Northing (m)	: 6925880.42	**Logged By**	: TS	**Project**	: GSI for proposed Residential development
Ground Elevation	: Not Surveyed	**Reviewed By**	: DA	**Location**	: 673 Silverwood Dr, Flagstone QLD 4280, Australia
Total Depth	: 3 m BGL	**Date**	: 03/06/2026	**Loc Comment**	:

Drilling Method	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Moisture	Material Description	Consistency/ Density	Samples	Testing: DCP	Remarks
Auger			0.2	Topsoil				Silty SAND: fine to medium grained, grey brown, low plasticity silt, loose, moist, with rootlets.	L		3	
			0.4	Alluvial		SM	M	Silty SAND: fine to medium grained, pale grey brown, low plasticity silt, very loose to loose, moist.	VL-L		3	
								As above, but: pale brown.			2	
											2	
											1	
											2	
											2	
											2	
			1.0							D : 0.9 - 1.2 m	2	
											2	
			1.2								2	
						SC		Clayey SAND: fine to medium grained, pale grey brown, low plasticity clay, with silt, loose to medium dense, moist.	L-MD		3	
			1.5								5	
											6	
							D	Clayey SAND: fine to medium grained, pale grey, low plasticity clay, medium dense to dense, dry.	MD-D		7	
											7	
											6	
			2.0								8	
										D : 1.8 - 2.1 m	20/70	
			2.2	Residual		CI	w < PL	Sandy CLAY: medium plasticity, grey mottled brown, fine to medium grained sand, hard, w < pl.	H			
								QT9 Terminated at 3 m (Target Depth)				

Water

Weathering

- **XW** : Extremely weathered
- **DW** : Distinctly weathered
- **HW** : Highly weathered
- **MW** : Moderately weathered
- **SW** : Slightly weathered
- **FR** : Fresh

Altering

- **XA** : Extremely alterated
- **DA** : Distinctly alterated
- **HA** : Highly alterated
- **MA** : Moderately alterated
- **SA** : Slightly alterated

Consistency

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- **F** : Firm
- **St** : Stiff
- **VSt** : Very stiff
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- **FR** : Friable

Moisture

- **D** : Dry
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- **W** : Wet

Density

- **VL** : Very loose
- **L** : Loose
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- **D** : Dense
- **VD** : Very dense

Rock Strength

- **VLS** : Very low
- **LS** : Low
- **MS** : Medium
- **HS** : High
- **VH** : Very high
- **XH** : Extremely high

Tests&Results

- **U50** : Undisturbed 50mm diam tube.
- **D** : Disturbed sample.
- **SPT** : Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.
- **PP** : Hand penetrometer estimate of unconfined compressive strength, kPa.
- **S** : Vane shear value kPa.
- **DCP** : Dynamic Cone Penetrometer test.

APPENDIX B

Laboratory Test Certificates

Qualtest Laboratory

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Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

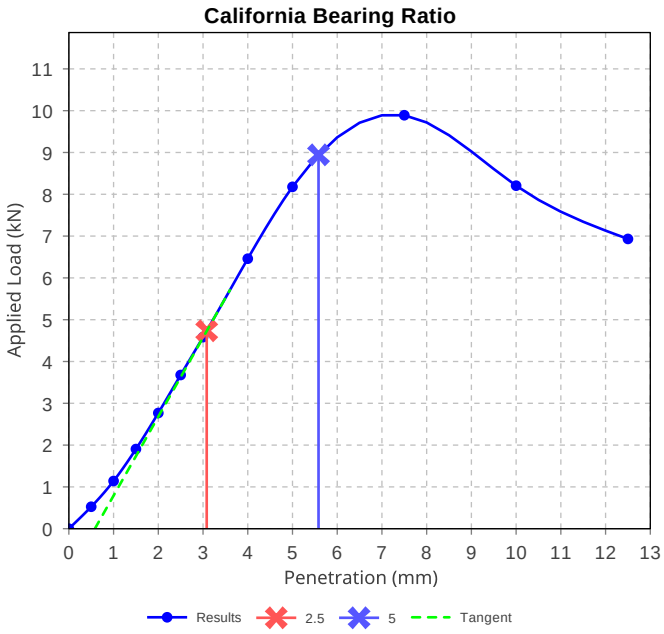
Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528A
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 16/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT1, Depth:** 0.3-0.6m

Qualtest Laboratory Pty Ltd
Brisbane Laboratory
2 / 40 Boyland Ave Cooper Plains QLD 4108
Phone: 0417 011 515
Email: rhys@qualtestgeo.com

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Rhys Mitchell
Field Technician
Laboratory Number: 2316

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**45**		
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)	1.85		
Optimum Moisture Content (%)	11.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	94.5		
Dry Density after Soaking (t/m^3)	1.86		
Field Moisture Content (%)	7.5		
Moisture Content at Placement (%)	10.6		
Moisture Content Top 30mm (%)	11.7		
Moisture Content Rest of Sample (%)	11.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	26.3		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528B
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 16/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT4, Depth:** 0.3-0.6m

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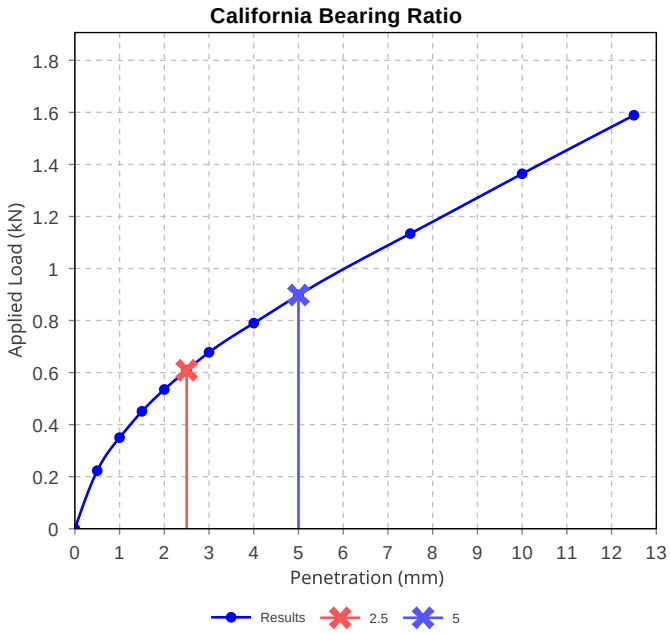
Approved Signatory: Rhys Mitchell
Field Technician
Laboratory Number: 2316

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.5**		
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)	1.93		
Optimum Moisture Content (%)	10.5		
Laboratory Density Ratio (%)	98.5		
Laboratory Moisture Ratio (%)	114.0		
Dry Density after Soaking (t/m^3)	1.89		
Field Moisture Content (%)	12.6		
Moisture Content at Placement (%)	12.1		
Moisture Content Top 30mm (%)	13.8		
Moisture Content Rest of Sample (%)	13.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	47.8		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528C
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 16/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT7, Depth: 0.3-0.7M**

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Brisbane Laboratory
2 / 40 Boyland Ave Cooper Plains QLD 4108
Phone: 0417 011 515
Email: rhys@qualtestgeo.com

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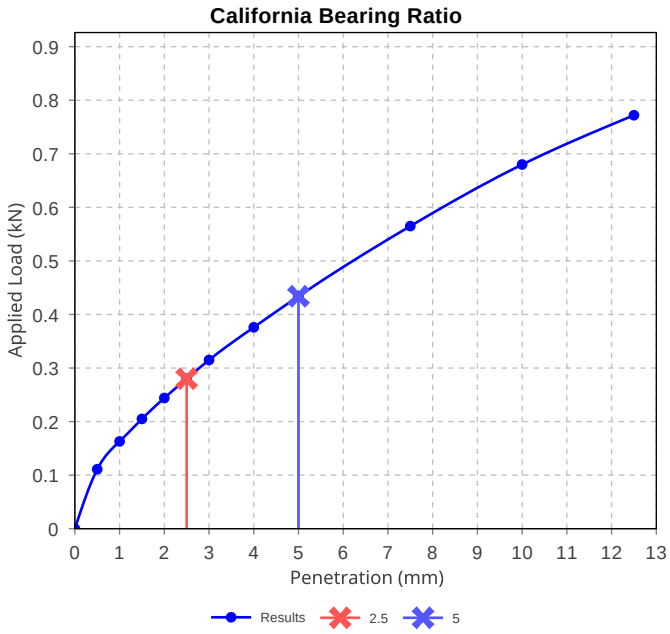
Approved Signatory: Rhys Mitchell
Field Technician
Laboratory Number: 2316

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**2.0**		
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)	1.86		
Optimum Moisture Content (%)	14.0		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	104.5		
Dry Density after Soaking (t/m^3)	1.83		
Field Moisture Content (%)	14.8		
Moisture Content at Placement (%)	14.7		
Moisture Content Top 30mm (%)	16.1		
Moisture Content Rest of Sample (%)	15.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours (h)	24		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.0		



Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528D
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 10/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT2, Depth: 1.8-2.1M**

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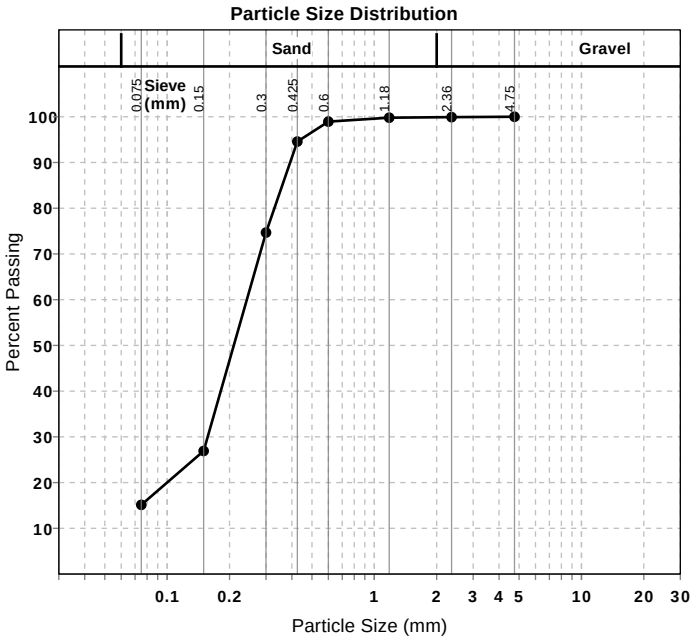
Approved Signatory: Rhys Mitchell
Field Technician

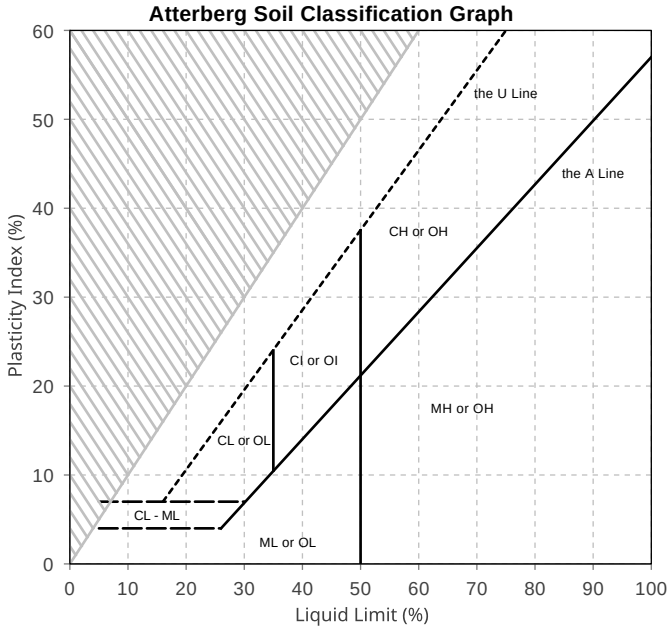
Laboratory Number: 2316

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	**100**			0		
0.6 mm	**99**			1		
0.425 mm	**95**			4		
0.3 mm	**75**			20		
0.15 mm	**27**			48		
0.075 mm	**15**			12		

Atterberg Limit (AS1289 3.9.2 & 3.2.1 & 3.3.2)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Retained 0.425 (%)	4		
Liquid Limit (%)	21		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		
Weighted Plasticity Index (%)			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**0.0**		
Cracking Crumbling Curling	None		





Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528E
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 11/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT3, Depth: 0.9-1.2M**

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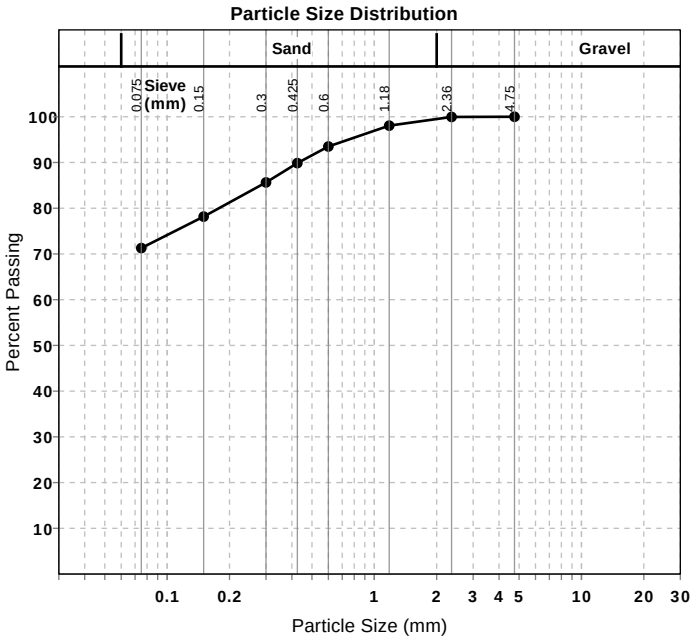
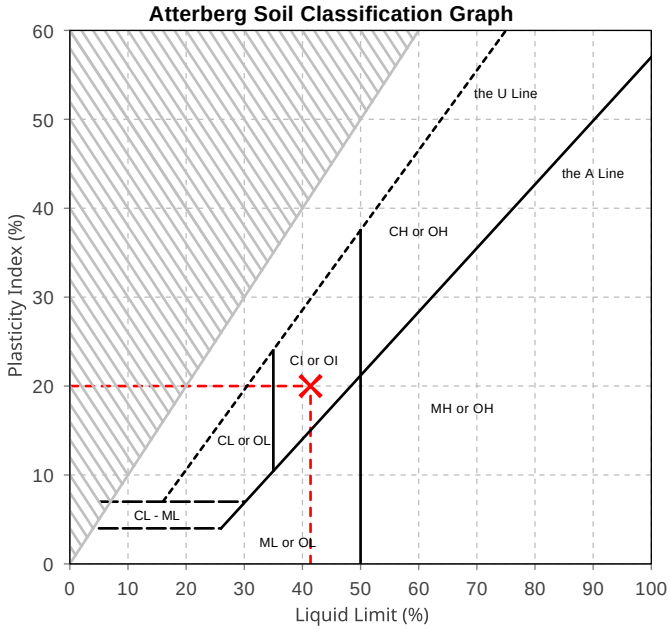
Approved Signatory: Rhys Mitchell
Field Technician
Laboratory Number: 2316

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	**98**			2		
0.6 mm	**93**			5		
0.425 mm	**90**			4		
0.3 mm	**86**			4		
0.15 mm	**78**			7		
0.075 mm	**71**			7		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	41		
Plastic Limit (%)	21		
Plasticity Index (%)	**20**		
Weighted Plasticity Index (%)	1797		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**12.0**		
Cracking Crumbling Curling	Curling		





Material Test Report

Report Number: **26-258E-1**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 22528
Sample Number: S22528F
Date Sampled: 03/06/2026
Dates Tested: 05/06/2026 - 11/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT4, Depth: 0.3-0.6M**

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Phone: 0417 011 515
Email: rhys@qualtestgeo.com

Accredited for compliance with ISO/IEC 17025 - Testing

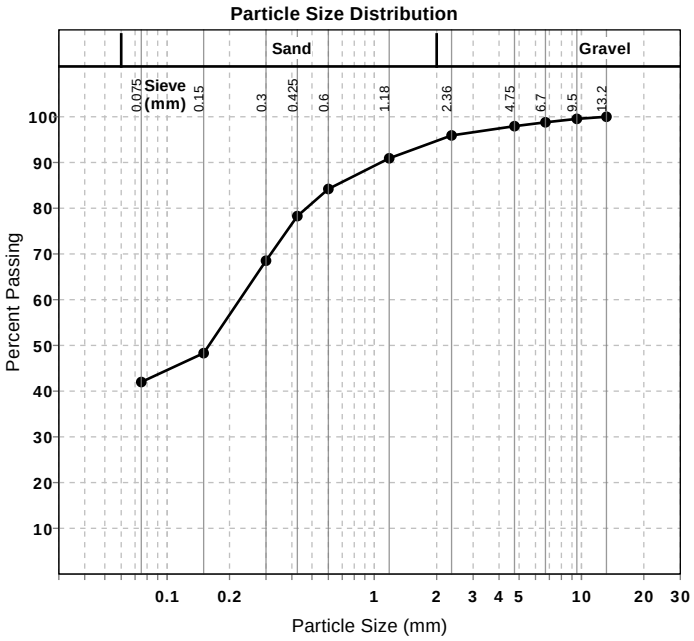
Approved Signatory: Rhys Mitchell
Field Technician

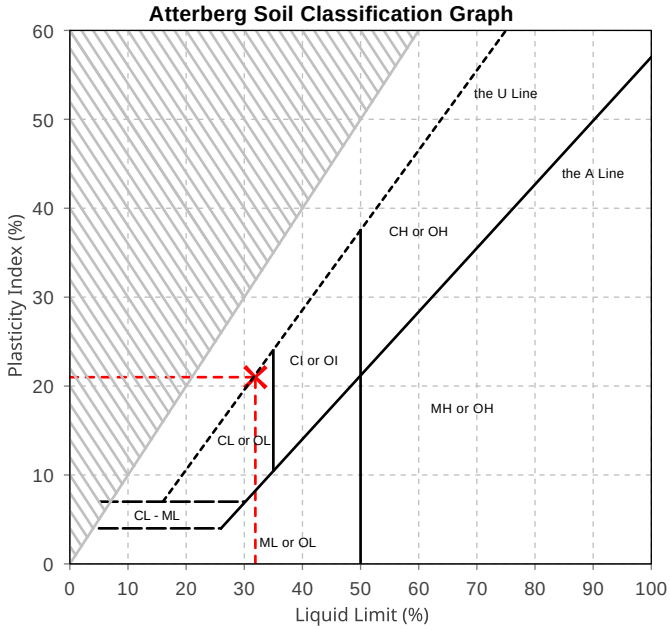
Laboratory Number: 2316

Particle Size Distribution (AS1289 3.6.1)						
Sieve	Passed %	Passing Limits		Retained %	Retained Limits	
13.2 mm	**100**			0		
9.5 mm	**100**			0		
6.7 mm	**99**			1		
4.75 mm	**98**			1		
2.36 mm	**96**			2		
1.18 mm	**91**			5		
0.6 mm	**84**			7		
0.425 mm	**78**			6		
0.3 mm	**69**			10		
0.15 mm	**48**			20		
0.075 mm	**42**			6		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	32		
Plastic Limit (%)	11		
Plasticity Index (%)	**21**		
Weighted Plasticity Index (%)	1644		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**12.0**		
Cracking Crumbling Curling	Curling		





Material Test Report

Report Number: **26-258E-2**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 5197
Sample Number: C5197A
Date Sampled: 05/06/2026
Dates Tested: 05/06/2026 - 08/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Site Selection: Selected by GTA
Sample Location: **QT3, Depth: 0.6-0.8M**
Material: Refer to Logs
Material Source: On-site

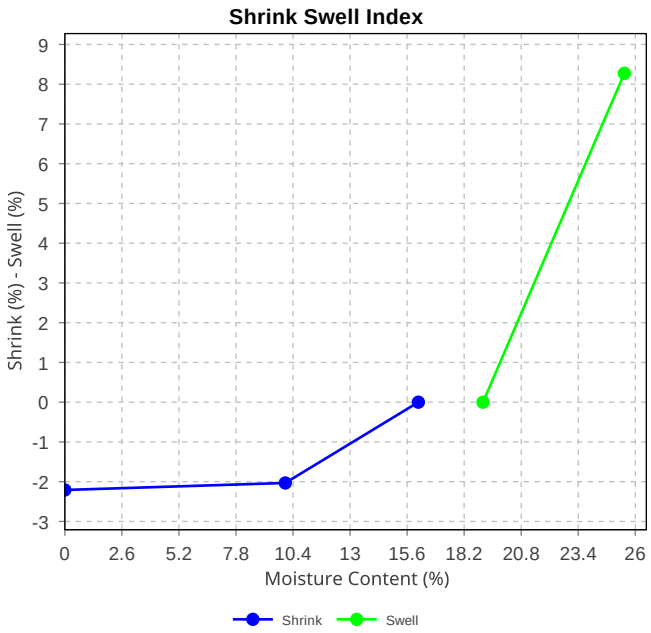
Qualtest Laboratory Pty Ltd
Caboolture Laboratory
3 / 64 Evans Drive Caboolture QLD 4510
Phone: 0417 011 515
Email: will@qualtestgeo.com

William Richards (Laboratory Manager)

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)		Min	Max
Iss (%)*	**3.5**		
Visual Description	Sandy Clay		
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.			

Core Shrinkage Test	
Total Shrinkage Strain (%)	**2.2**
Extent of Cracking	Minor
Extent of Crumbling	None
Moisture Content (%)	16.1
Initial Bulk Density (t/m^3)	2.028

Swell Test	
Initial Pocket Penetrometer (kPa)*	>600
Final Pocket Penetrometer (kPa)*	320
Initial Moisture Content (%)	19.1
Final Moisture Content (%)	25.5
Total Swell Strain (%)	**8.3**
Initial Bulk Density (t/m^3)	2.012
* scope of accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

Report Number: **26-258E-2**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 5197
Sample Number: C5197B
Date Sampled: 05/06/2026
Dates Tested: 05/06/2026 - 08/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Site Selection: Selected by GTA
Sample Location: **QT4, Depth: 0.6-0.72M**
Material: Refer to Logs
Material Source: On-site

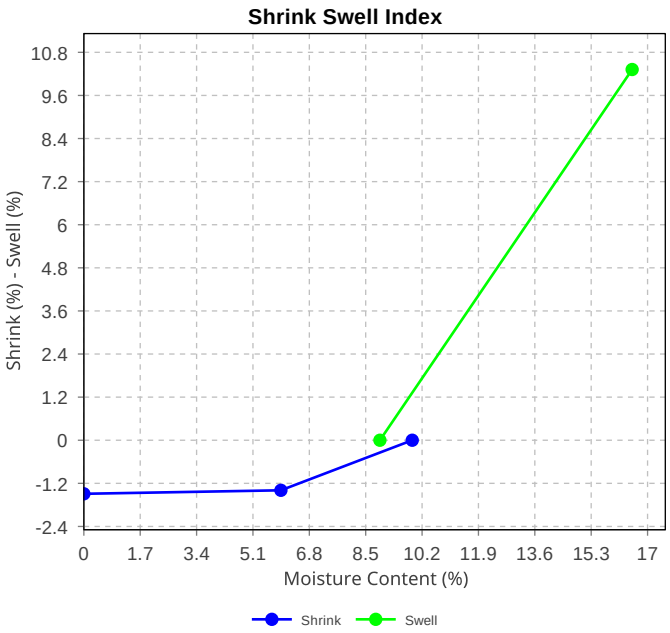
Qualtest Laboratory Pty Ltd
Caboolture Laboratory
3 / 64 Evans Drive Caboolture QLD 4510
Phone: 0417 011 515
Email: will@qualtestgeo.com

William Richards (Laboratory Manager)

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)		Min	Max
Iss (%)*	**3.7**		
Visual Description	Sandy Clay		
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.			

Core Shrinkage Test	
Total Shrinkage Strain (%)	**1.5**
Extent of Cracking	None
Extent of Crumbling	None
Moisture Content (%)	9.9
Initial Bulk Density (t/m^3)	2.143

Swell Test	
Initial Pocket Penetrometer (kPa)*	>600
Final Pocket Penetrometer (kPa)*	170
Initial Moisture Content (%)	8.9
Final Moisture Content (%)	16.5
Total Swell Strain (%)	**10.3**
Initial Bulk Density (t/m^3)	2.243
* scope of accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

Report Number: **26-258E-2**
Issue Number: 1
Date Issued: 17/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 5197
Sample Number: C5197C
Date Sampled: 05/06/2026
Dates Tested: 05/06/2026 - 08/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Site Selection: Selected by GTA
Sample Location: **QT7, Depth: 0.6-0.8M**
Material: Refer to Logs
Material Source: On-site

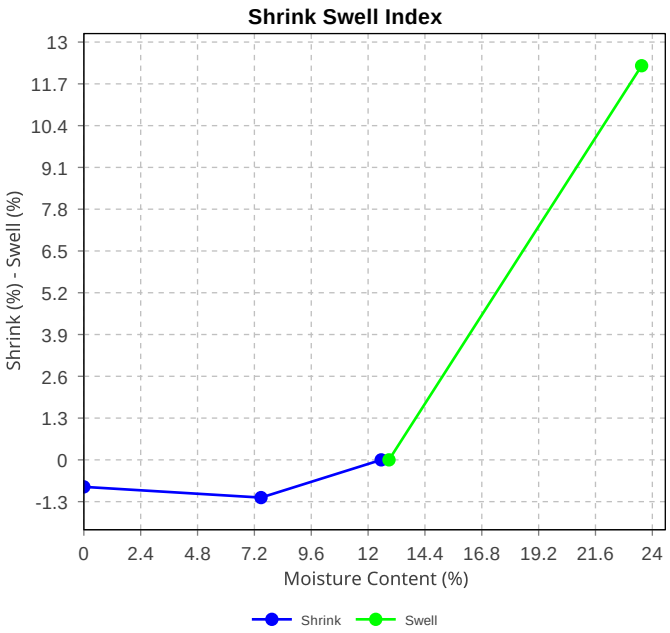
Qualtest Laboratory Pty Ltd
Caboolture Laboratory
3 / 64 Evans Drive Caboolture QLD 4510
Phone: 0417 011 515
Email: will@qualtestgeo.com

William Richards (Laboratory Manager)

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)		Min	Max
Iss (%)*	**3.9**		
Visual Description	Sandy Clay		
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.			

Core Shrinkage Test	
Total Shrinkage Strain (%)	**0.8**
Extent of Cracking	Severe
Extent of Crumbling	None
Moisture Content (%)	12.6
Initial Bulk Density (t/m^3)	2.081

Swell Test	
Initial Pocket Penetrometer (kPa)*	>600
Final Pocket Penetrometer (kPa)*	100
Initial Moisture Content (%)	12.9
Final Moisture Content (%)	23.5
Total Swell Strain (%)	**12.3**
Initial Bulk Density (t/m^3)	2.135
* scope of accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

Report Number: **26-258E-2**
Issue Number: 3 - *This version supersedes all previous issues*
Reissue Reason: *typo*
Date Issued: 22/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 5197
Sample Number: C5197D
Date Sampled: 08/06/2026
Dates Tested: 08/06/2026 - 17/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT2, Depth: 0.4 - 0.9m**
Material: Refer to Logs
Material Source: On-site

Constant Head Permeability (AS 1289 6.7.1 & 2.1.1)		Min	Max
Coefficient of Permeability (m/s)	**$2x10^{-6}$**		
Hydraulic Gradient	7.9		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.94		
Optimum Moisture Content (%)	8.0		
Field Moisture Content (%)	6.0		
Sieve for Oversize (mm)	19.0		
Oversize Material (%)	0.0		
Laboratory Density Ratio (%)	100.8		
Laboratory Moisture Ratio (%)	98.0		
Surcharges and Pressure Applied	2.46		

Qualtest Laboratory Pty Ltd
Caboolture Laboratory
3 / 64 Evans Drive Caboolture QLD 4510
Phone: 0417 011 515
Email: mick@qualtestgeo.com

David Taylor (Soil Technician)

Material Test Report

Report Number: **26-258E-2**
Issue Number: 3 - *This version supersedes all previous issues*
Reissue Reason: *typo*
Date Issued: 22/06/2026
Client: Oris Accessories Pty Ltd c/- JFP Urban Consultants

Contact: Isla Jenkins
Project Number: 26-258E
Project Name: GEOTECH INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
Project Location: 673 SILVERWOOD DRIVE, FLAGSTONE
Work Request: 5197
Sample Number: C5197E
Date Sampled: 08/06/2026
Dates Tested: 08/06/2026 - 12/06/2026
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: **QT8, Depth: 0.4 - 0.8m**
Material: Refer to Logs
Material Source: On-site

Constant Head Permeability (AS 1289 6.7.1 & 2.1.1)		Min	Max
Coefficient of Permeability (m/s)	**$1x10^{-6}$**		
Hydraulic Gradient	7.9		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.82		
Optimum Moisture Content (%)	10.0		
Field Moisture Content (%)	6.0		
Sieve for Oversize (mm)	19.0		
Oversize Material (%)	0.0		
Laboratory Density Ratio (%)	99.9		
Laboratory Moisture Ratio (%)	100.7		
Surcharges and Pressure Applied	2.46		

Qualtest Laboratory Pty Ltd
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3 / 64 Evans Drive Caboolture QLD 4510
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David Taylor (Soil Technician)

CERTIFICATE OF ANALYSIS

Work Order	: **EB2620567**	Page	: 1 of 4
Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Contact	: Customer Services EB
Address	: 2/40 BOYLAND AVENUE BRISBANE 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3552-8685
Project	: 26-258E	Date Samples Received	: 08-Jun-2026 08:10
Order number	: A 1042	Date Analysis Commenced	: 11-Jun-2026
C-O-C number	: ----	Issue Date	: 15-Jun-2026 17:34
Sampler	: ql-tani		
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE		
Quote number	: EN/333		
No. of samples received	: 6		
No. of samples analysed	: 6		

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*
Beatriz Brand	Senior Chemist	Brisbane Inorganics, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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.

- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Calcium/Magnesium Ratio results as required Calcium & Magnesium results are less than the limit of reporting.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio results as required Exchangeable Potassium results are less than the limit of reporting.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Echangeable Calcium, Magnesium, Potassium and Sodium Percent results as required results are less than the limit of reporting.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio result for some samples as required Exchangeable Magnesium and/or Potassium results are less than the limit of reporting.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Calcium/Magnesium Ratio result for some samples as required Exchangeable Calcium and/or Magnesium results are less than the limit of reporting.
- ED007 (Exchangeable Cations by ICP-AES): Unable to calculate Magnesium/Potassium Ratio for some samples as required Exchangeable Magnesium and/or Potassium results are less than the limit of reporting.
- ED007 (Exchangeable Cations): Unable to calculate Magnesium/Potassium Ratio result as required Exchangeable Potassium results are less than the limit of reporting.
- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	S22531A QT1, Depth: 0.3-0.5M	S22531B QT2, Depth: 0.6-0.9M	S22531C QT4, Depth: 1.5-1.8M	S22531D QT6, Depth: 0.3-0.5M	S22531E QT7, Depth: 0.2-0.5M
				Sampling date / time	05-Jun-2026 00:00	05-Jun-2026 00:00	05-Jun-2026 00:00	05-Jun-2026 00:00	05-Jun-2026 00:00
Compound	CAS Number	LOR	Unit		EB2620567-001	EB2620567-002	EB2620567-003	EB2620567-004	EB2620567-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		7.5	6.3	5.6	5.2	5.3
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		3	6	249	216	182
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		Gray (7.5YR 6/1)	Gray (7.5YR 6/1)	Light Gray (7.5YR 7/1)	Gray (7.5YR 6/1)	Pinkish Gray (7.5YR 6/2)
Texture	----	-	-		Clayey Fine Sand	Sandy Loam	Clay Loam Sandy	Light Medium Clay	Light Clay
Emerson Class Number	EC/TC	-	-		3	3	1	1	1
ED005: Exchange Acidity									
ø Exchange Acidity	----	0.1	meq/100g		----	----	<0.1	2.9	2.8
ø Exchangeable Aluminium	----	0.1	meq/100g		----	----	<0.1	2.0	2.1
ED006: Exchangeable Cations on Alkaline Soils									
ø Exchangeable Calcium	----	0.2	meq/100g		<0.2	----	----	----	----
ø Exchangeable Magnesium	----	0.2	meq/100g		<0.2	----	----	----	----
ø Exchangeable Potassium	----	0.2	meq/100g		<0.2	----	----	----	----
ø Exchangeable Sodium	----	0.2	meq/100g		<0.2	----	----	----	----
ø Cation Exchange Capacity	----	0.2	meq/100g		<0.2	----	----	----	----
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	0.2	0.5	<0.1	0.1
Exchangeable Magnesium	----	0.1	meq/100g		----	0.1	0.2	7.7	7.2
Exchangeable Potassium	----	0.1	meq/100g		----	<0.1	<0.1	0.1	0.1
Exchangeable Sodium	----	0.1	meq/100g		----	<0.1	<0.1	3.6	2.7
Cation Exchange Capacity	----	0.1	meq/100g		----	0.4	----	----	----
Exchangeable Sodium Percent	----	0.1	%		----	9.3	3.7	31.4	26.6
^ Effective Cation Exchange Capacity	----	0.1	meq/100g		----	----	0.8	14.4	12.9
Calcium/Magnesium Ratio	----	0.1	-		----	2.0	2.5	<0.1	<0.1
Magnesium/Potassium Ratio	----	0.1	-		----	----	----	63.1	59.0

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	S22531F QT9, Depth: 0.9-1.2M	----	----	----	----
				Sampling date / time	05-Jun-2026 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2620567-006	--------	--------	--------	--------
					Result	----	----	----	----
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**5.8**	----	----	----	----
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**2**	----	----	----	----
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		**Light Gray (10YR 7/2)**	----	----	----	----
Texture	----	-	-		**Loamy Sand**	----	----	----	----
Emerson Class Number	EC/TC	-	-		**3**	----	----	----	----
ED005: Exchange Acidity									
ø **Exchange Acidity**	----	0.1	meq/100g		**0.2**	----	----	----	----
ø **Exchangeable Aluminium**	----	0.1	meq/100g		<0.1	----	----	----	----
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		**0.7**	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		**9.5**	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		**0.1**	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		**4.4**	----	----	----	----
Exchangeable Sodium Percent	----	0.1	%		**30.2**	----	----	----	----
^ **Effective Cation Exchange Capacity**	----	0.1	meq/100g		**14.9**	----	----	----	----
Calcium/Magnesium Ratio	----	0.1	-		<0.1	----	----	----	----
Magnesium/Potassium Ratio	----	0.1	-		**68.0**	----	----	----	----

QUALITY CONTROL REPORT

Work Order	: **EB2620567**	Page	: 1 of 5
Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Contact	: Customer Services EB
Address	: 2/40 BOYLAND AVENUE BRISBANE 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3552-8685
Project	: 26-258E	Date Samples Received	: 08-Jun-2026
Order number	: A 1042	Date Analysis Commenced	: 11-Jun-2026
C-O-C number	: ----	Issue Date	: 15-Jun-2026
Sampler	: ql-tani		
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE		
Quote number	: EN/333		
No. of samples received	: 6		
No. of samples analysed	: 6		

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 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*
Beatriz Brand	Senior Chemist	Brisbane Inorganics, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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

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: 7472882)									
EB2620301-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.5	7.3	1.8	0% - 20%
EB2620576-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.4	5.5	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 7472883)									
EB2620301-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	89	103	14.6	0% - 20%
EB2620576-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	2	4	64.6	No Limit
ED005: Exchange Acidity (QC Lot: 7477446)									
EB2620567-003	S22531C QT4, Depth: 1.5-1.8M	ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
ED006: Exchangeable Cations on Alkaline Soils (QC Lot: 7477423)									
EB2620188-018	Anonymous	ED006: Exchangeable Calcium	----	0.2	meq/100g	3.1	3.0	4.1	0% - 50%
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	<0.2	0.0	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	0.0	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	0.7	0.7	0.0	No Limit
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	3.8	3.7	0.0	0% - 50%
ED007: Exchangeable Cations (QC Lot: 7477438)									
EB2620283-026	Anonymous	ED007: Exchangeable Calcium	----	0.1	meq/100g	3.2	3.2	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	7.3	7.4	0.0	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	2.1	2.1	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 7477445)									

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 (%)*
ED007: Exchangeable Cations (QC Lot: 7477445) - continued									
EB2620567-003	S22531C QT4, Depth: 1.5-1.8M	ED007: Exchangeable Calcium	----	0.1	meq/100g	0.5	0.5	0.0	No Limit
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit

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**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 7472882)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	99.9	98.0	102
EA010: Conductivity (1:5) (QCLot: 7472883)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	101	95.0	105
ED005: Exchange Acidity (QCLot: 7477446)								
ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 7477423)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	7.46 meq/100g	109	70.0	130
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	4.45 meq/100g	95.9	70.0	130
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	0.75 meq/100g	103	70.0	130
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	4.725 meq/100g	89.6	70.0	130
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	17.41 meq/100g	99.8	70.0	130
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 7481150)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	7.46 meq/100g	122	70.0	130
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	4.45 meq/100g	110	70.0	130
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	0.75 meq/100g	110	70.0	130
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	4.725 meq/100g	96.6	70.0	130
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	17.41 meq/100g	111	70.0	130
ED007: Exchangeable Cations (QCLot: 7477438)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.2	24.31 meq/100g	108	79.0	113
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.2	7.95 meq/100g	94.6	85.0	115
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.2	1.08 meq/100g	96.1	70.0	122
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.2	7.56 meq/100g	95.7	76.0	112
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.2	41.05 meq/100g	102	82.0	112
ED007: Exchangeable Cations (QCLot: 7477445)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	24.31 meq/100g	101	79.0	113
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	7.95 meq/100g	89.3	85.0	115
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1.08 meq/100g	91.6	70.0	122
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	7.56 meq/100g	97.7	76.0	112

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
ED007: Exchangeable Cations (QCLot: 7477445) - continued								
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	41.05 meq/100g	97.8	82.0	112

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.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2620567**	Page	: 1 of 5
Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Telephone	: +61-7-3552-8685
Project	: 26-258E	Date Samples Received	: 08-Jun-2026
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE	Issue Date	: 15-Jun-2026
Sampler	: ql-tani	No. of samples received	: 6
Order number	: A 1042	No. of samples analysed	: 6

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

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

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

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 / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Snap Lock Bag (EA002) S22531A - QT1, Depth: 0.3-0.5M, S22531B - QT2, Depth: 0.6-0.9M, S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**11-Jun-2026**	12-Jun-2026	✓	**11-Jun-2026**	11-Jun-2026	✓
EA010: Conductivity (1:5)							
Snap Lock Bag (EA010) S22531A - QT1, Depth: 0.3-0.5M, S22531B - QT2, Depth: 0.6-0.9M, S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**11-Jun-2026**	12-Jun-2026	✓	**11-Jun-2026**	09-Jul-2026	✓
EA058: Emerson Aggregate Test							
Snap Lock Bag (EA058) S22531A - QT1, Depth: 0.3-0.5M, S22531B - QT2, Depth: 0.6-0.9M, S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**----**	----	----	**11-Jun-2026**	02-Dec-2026	✓
ED005: Exchange Acidity							
Pulp Bag (ED005) S22531B - QT2, Depth: 0.6-0.9M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**12-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED005) S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED005) S22531A - QT1, Depth: 0.3-0.5M	**05-Jun-2026**	**15-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓
ED006: Exchangeable Cations on Alkaline Soils							
Pulp Bag (ED006) S22531A - QT1, Depth: 0.3-0.5M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**12-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED006) S22531B - QT2, Depth: 0.6-0.9M, S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**15-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED007: Exchangeable Cations							
Pulp Bag (ED007) S22531B - QT2, Depth: 0.6-0.9M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**12-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED007) S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED007) S22531A - QT1, Depth: 0.3-0.5M	**05-Jun-2026**	**15-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓
ED008: Exchangeable Cations							
Pulp Bag (ED008) S22531B - QT2, Depth: 0.6-0.9M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**12-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED008) S22531C - QT4, Depth: 1.5-1.8M, S22531D - QT6, Depth: 0.3-0.5M, S22531E - QT7, Depth: 0.2-0.5M, S22531F - QT9, Depth: 0.9-1.2M	**05-Jun-2026**	**12-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓
Pulp Bag (ED008) S22531A - QT1, Depth: 0.3-0.5M	**05-Jun-2026**	**15-Jun-2026**	03-Jul-2026	✓	**15-Jun-2026**	03-Jul-2026	✓

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)							
Electrical Conductivity (1:5)	EA010	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	7	**28.57**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	7	**28.57**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	7	**28.57**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	7	**28.57**	**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).
Emerson Aggregate Test	EA058	SOIL	In house: Referenced to AS1289.3.8.1. Testing is performed only on soils with suitable aggregates; sands and gravels are usually unsuitable for this test. The test classifies the behaviour of soil aggregates, when immersed, on their coherence in water.
Exchange Acidity by 1M Potassium Chloride	* ED005	SOIL	In house: referenced to Rayment and Lyons, method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations	ED007 CALC	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Lyons Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations with pre-treatment	ED008 CALC	SOIL	In house: Referenced to Rayment & Lyons Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method (Alkaline Soils)	* ED006PR	SOIL	In house: Referenced to Rayment and Lyons method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
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.

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2620567**

Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Contact	: Customer Services EB
Address	: 2/40 BOYLAND AVENUE BRISBANE 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: taninder@qualtestgeo.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3552-8685
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 26-258E	Page	: 1 of 2
Order number	: A 1042	Quote number	: EB2021QUATESQLD0001 (EN/333)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE		
Sampler	: ql-tani		

Dates

Date Samples Received	: 08-Jun-2026 08:10	Issue Date	: 09-Jun-2026
Client Requested Due Date	: 15-Jun-2026	Scheduled Reporting Date	: **15-Jun-2026**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 1.9°C, 2.8°C, 5.8°C. - Ice Bricks present
Receipt Detail	: MEDIUM HARD ESKY	No. of samples received / analysed	: 6 / 6

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised where CEC has been requested, ALS has logged the AG-1 EB suite in order to determine the appropriate CEC method.**
- **Samples requiring Cation Exchange Capacity analysis have been assigned pH and Electrical Conductivity analysis in order to determine the appropriate CEC method, as per Raymont and Lyons (2011).**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EB2620567-001	[05-Jun-2026]	S22531A - QT1, Depth: 0.3-0.5M
EB2620567-002	[05-Jun-2026]	S22531B - QT2, Depth: 0.6-0.9M
EB2620567-003	[05-Jun-2026]	S22531C - QT4, Depth: 1.5-1.8M
EB2620567-004	[05-Jun-2026]	S22531D - QT6, Depth: 0.3-0.5M
EB2620567-005	[05-Jun-2026]	S22531E - QT7, Depth: 0.2-0.5M
EB2620567-006	[05-Jun-2026]	S22531F - QT9, Depth: 0.9-1.2M

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - AG-1 Agricultural Soil Suite 1	SOIL - EA058 Emerson Aggregate Test
EB2620567-001	05-Jun-2026 00:00	S22531A QT1, Depth:...	✓	✓
EB2620567-002	05-Jun-2026 00:00	S22531B QT2, Depth:...	✓	✓
EB2620567-003	05-Jun-2026 00:00	S22531C QT4, Depth:...	✓	✓
EB2620567-004	05-Jun-2026 00:00	S22531D QT6, Depth:...	✓	✓
EB2620567-005	05-Jun-2026 00:00	S22531E QT7, Depth:...	✓	✓
EB2620567-006	05-Jun-2026 00:00	S22531F QT9, Depth:...	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

QUALTEST

- A4 - AU Tax Invoice (INV)	Email	qualtest@qualtestgeo.com

TANINDER

- *AU Certificate of Analysis - NATA (COA)	Email	taninder@qualtestgeo.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	taninder@qualtestgeo.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	taninder@qualtestgeo.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	taninder@qualtestgeo.com
- A4 - AU Tax Invoice (INV)	Email	taninder@qualtestgeo.com
- Chain of Custody (CoC) (COC)	Email	taninder@qualtestgeo.com
- EDI Format - ENMRG (ENMRG)	Email	taninder@qualtestgeo.com
- EDI Format - XTab (XTAB)	Email	taninder@qualtestgeo.com

CERTIFICATE OF ANALYSIS

Work Order	: **EB2620576**	Page	: 1 of 3
Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Contact	: Customer Services EB
Address	: 2/40 BOYLAND AVENUE BRISBANE 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3552-8685
Project	: 26-258E	Date Samples Received	: 08-Jun-2026 08:10
Order number	: A 1042	Date Analysis Commenced	: 09-Jun-2026
C-O-C number	: ----	Issue Date	: 15-Jun-2026 13:36
Sampler	: ql-tani		
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE		
Quote number	: EN/333		
No. of samples received	: 3		
No. of samples analysed	: 3		

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*
Beatriz Brand	Senior Chemist	Brisbane Soil Preparation, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Soil Preparation, Stafford, QLD
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

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	S22534A QT1, Depth: 0.3-0.5M	S22534B QT7, Depth: 1.5-1.8M	S22534C QT9, Depth: 1.8-2.1M	----	----
			Sampling date / time	05-Jun-2026 00:00	05-Jun-2026 00:00	05-Jun-2026 00:00	----	----
Compound	CAS Number	LOR	Unit	EB2620576-001	EB2620576-002	EB2620576-003	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.4**	**5.7**	**6.4**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2**	**219**	**4**	**----**	**----**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**6.7**	**12.3**	**4.7**	**----**	**----**
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	**500000**	**4570**	**250000**	**----**	**----**
EA167: Corrosion Classification (per AS2159-2009)								
ø Exposure Classification - Concrete Piles Soil Condition A	----	-	-	**Moderate**	**Mild**	**Mild**	**----**	**----**
ø Exposure Classification - Concrete Piles Soil Condition B	----	-	-	**Mild**	**Non-aggressive**	**Non-aggressive**	**----**	**----**
ø Exposure Classification - Steel Piles Soil Condition A	----	-	-	**Non-aggressive**	**Mild**	**Non-aggressive**	**----**	**----**
ø Exposure Classification - Steel Piles Soil Condition B	----	-	-	**Non-aggressive**	**Non-aggressive**	**Non-aggressive**	**----**	**----**
ED040S: Soluble Major Anions								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	**40**	<10	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	**250**	<10	**----**	**----**

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2620576**

Client	: **QUALTEST LABORATORY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TANINDER	Contact	: Customer Services EB
Address	: 2/40 BOYLAND AVENUE BRISBANE 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: taninder@qualtestgeo.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3552-8685
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 26-258E	Page	: 1 of 2
Order number	: A 1042	Quote number	: EB2021QUATESQLD0001 (EN/333)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: 673 SILVERWOOD DRIVE, FLAGSTONE		
Sampler	: ql-tani		

Dates

Date Samples Received	: 08-Jun-2026 08:10	Issue Date	: 09-Jun-2026
Client Requested Due Date	: 15-Jun-2026	Scheduled Reporting Date	: **15-Jun-2026**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 1.9°C, 2.8°C, 5.8°C. - Ice Bricks present
Receipt Detail	: MEDIUM HARD ESKY	No. of samples received / analysed	: 3 / 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised where 'Aggressivity' has been requested, ALS has assigned Corr. Schedule 2.If you wish to discuss this further, please contact Client Services at ALSEnviro.Brisbane@alsglobal.com**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

EB2620576-001	: [05-Jun-2026]	: S22534A - QT1, Depth: 0.3-0.5M
EB2620576-002	: [05-Jun-2026]	: S22534B - QT7, Depth: 1.5-1.8M
EB2620576-003	: [05-Jun-2026]	: S22534C - QT9, Depth: 1.8-2.1M

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - Corr. Schedule 2 Soil on Steel & Concrete Piles (AS2159-2009)	SOIL - EA055-103 Moisture Content
EB2620576-001	05-Jun-2026 00:00	S22534A QT1, Depth:...	✓	✓
EB2620576-002	05-Jun-2026 00:00	S22534B QT7, Depth:...	✓	✓
EB2620576-003	05-Jun-2026 00:00	S22534C QT9, Depth:...	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

QUALTEST

- A4 - AU Tax Invoice (INV)	Email	qualtest@qualtestgeo.com

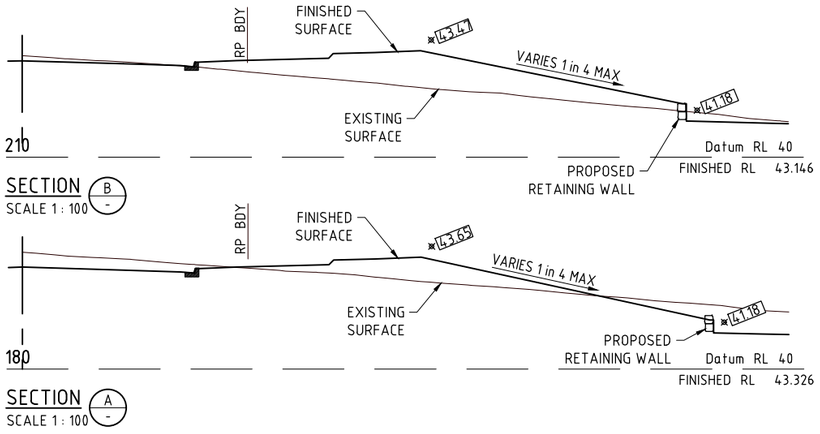
TANINDER

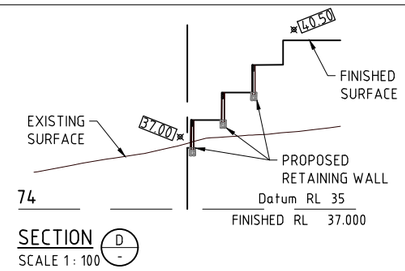
- *AU Certificate of Analysis - NATA (COA)	Email	taninder@qualtestgeo.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	taninder@qualtestgeo.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	taninder@qualtestgeo.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	taninder@qualtestgeo.com
- A4 - AU Tax Invoice (INV)	Email	taninder@qualtestgeo.com
- Chain of Custody (CoC) (COC)	Email	taninder@qualtestgeo.com
- EDI Format - ENMRG (ENMRG)	Email	taninder@qualtestgeo.com
- EDI Format - XTab (XTAB)	Email	taninder@qualtestgeo.com

APPENDIX C

Analysed Cross Sections

Qualtest Laboratory
Est. 1987

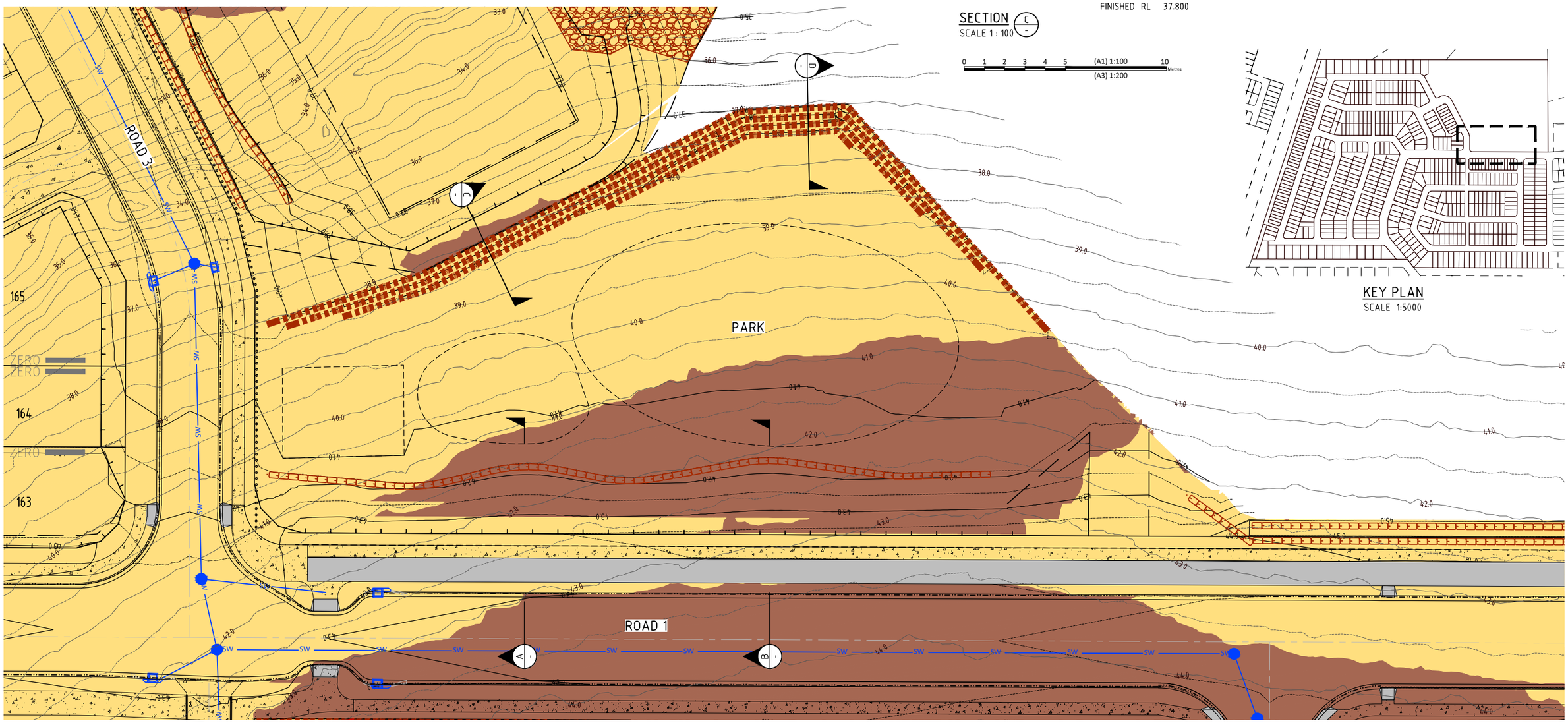




LEGEND:

- EXISTING CONTOURS — 32
- FINISHED CONTOURS — 32
- PRELIMINARY FILLING
- PRELIMINARY EXCAVATION
- PRELIMINARY RETAINING WALL
- PRELIMINARY BOUNDLER WALL

0 1 2 3 4 5 (A1) 1:100 10 Metres
(A3) 1:200



KEY PLAN
SCALE 1:5000

0 2.5 5 7.5 10 12.5 (A1) 1:250 25 Metres
(A3) 1:500

BRISBANE - SUNSHINE COAST - CENTRAL QLD
BRISBANE
JFP House - 76 Ernest Street,
South Brisbane Qld 4101
P 07 3012 0100 W www.jfp.com.au
JFP URBAN CONSULTANTS PTY. LTD. A.C.N. 050 414 045

PLANNERS
URBAN DESIGNERS
SURVEYORS
ENGINEERS
LANDSCAPE ARCHITECTS

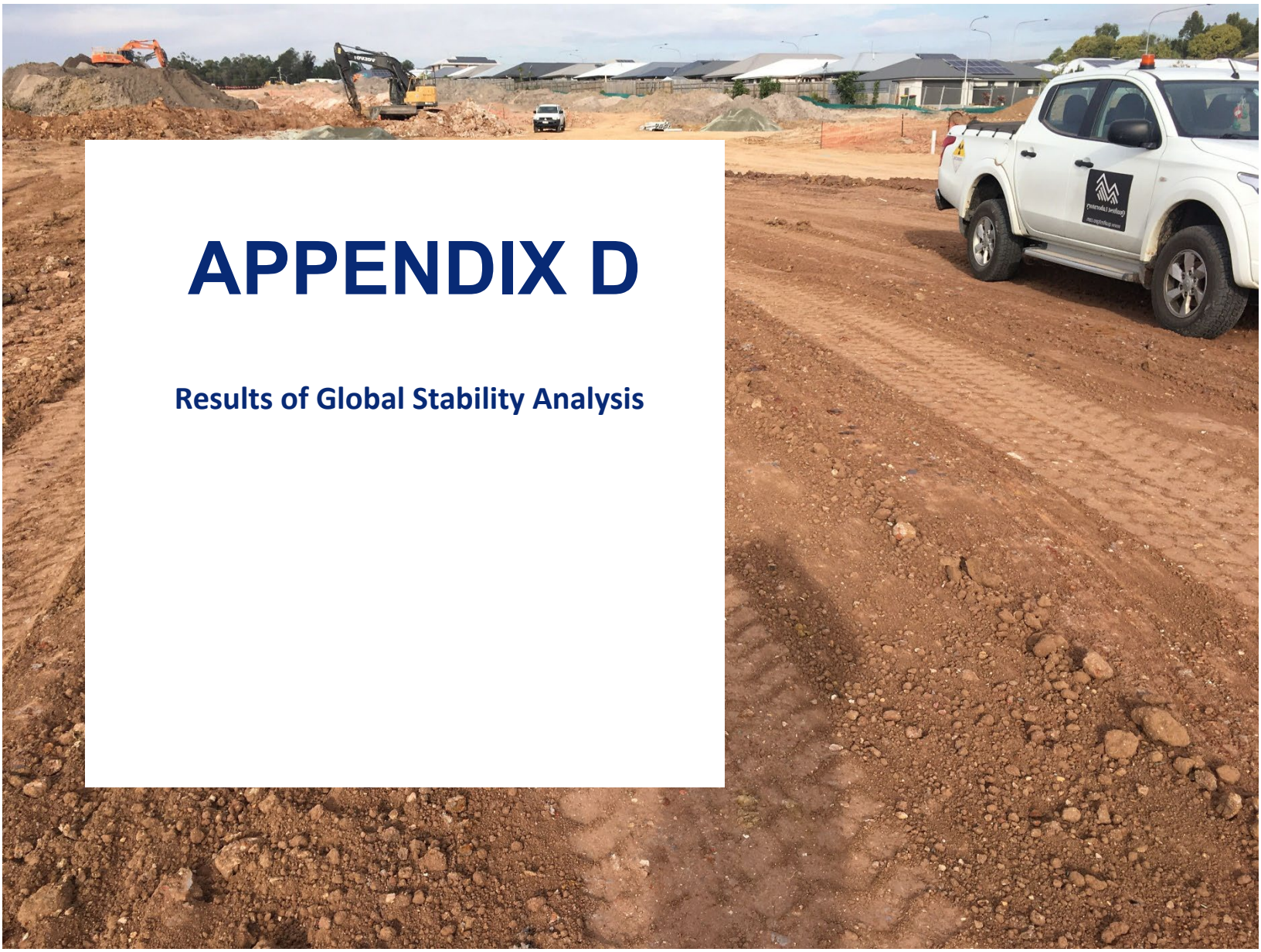
ENGINEERING CONCEPT - GEOTECH CROSS SECTION LOCATIONS

673 SILVERWOOD DRIVE, FLAGSTONE
THE TRUSTEE FOR CHANG FAMILY TRUST T/A ORIS ACCESSORIES PTY LTD

JOB NO:	PLAN:	ISSUE:
B4942EA1_DA1	SK01	A

SCALE: 1:250 @ A1
DATE: 16/06/2026
DRAFTED BY: LK
FILE NAME: B4942EA1_DA1 PARK SECTIONS.DWG

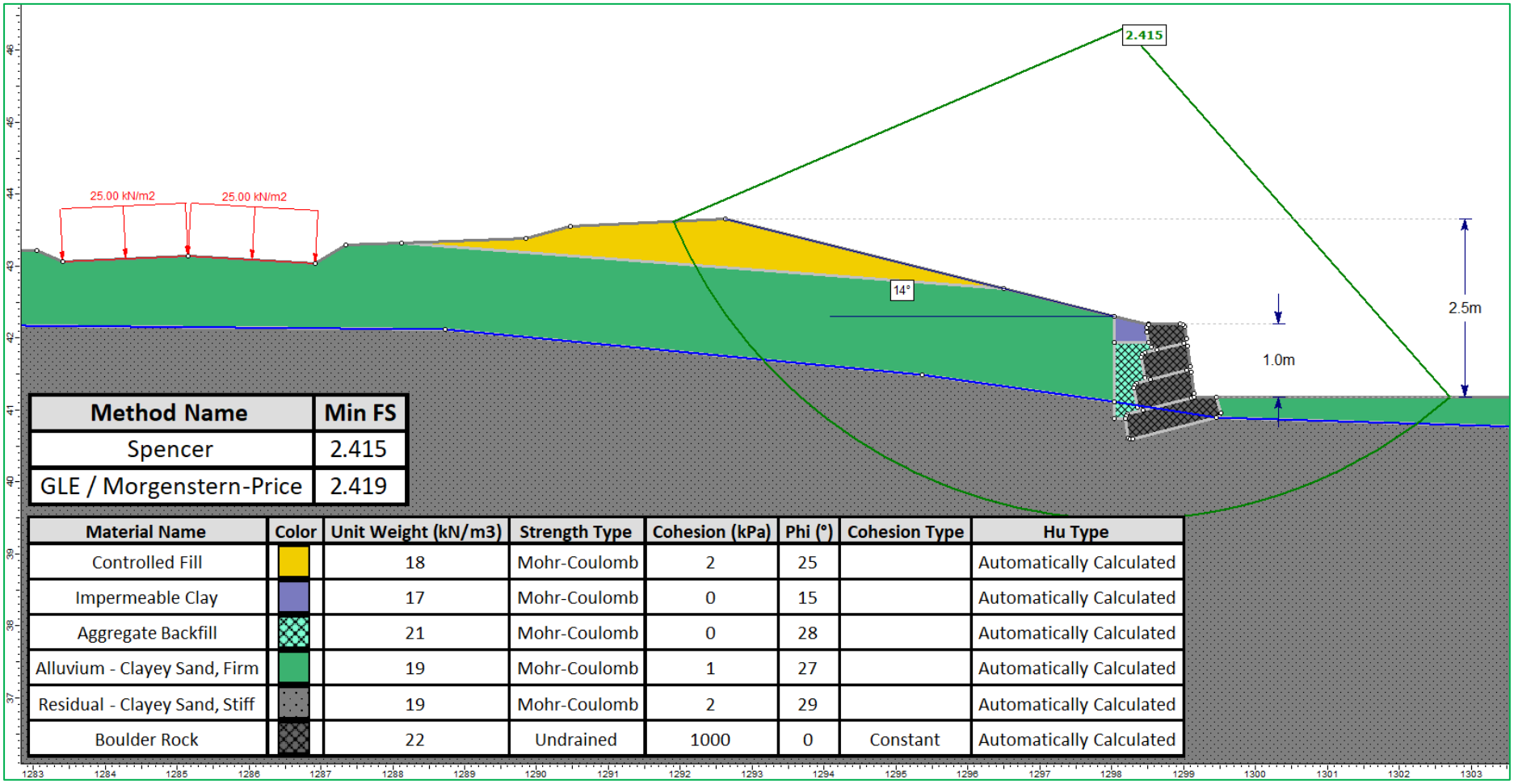
17/06/2026 N:\B4942\X\10\DA1\DES\GIS\WORKING DRAWINGS\SHEETHES\B4942EA1_DA1 PARK



APPENDIX D

Results of Global Stability Analysis

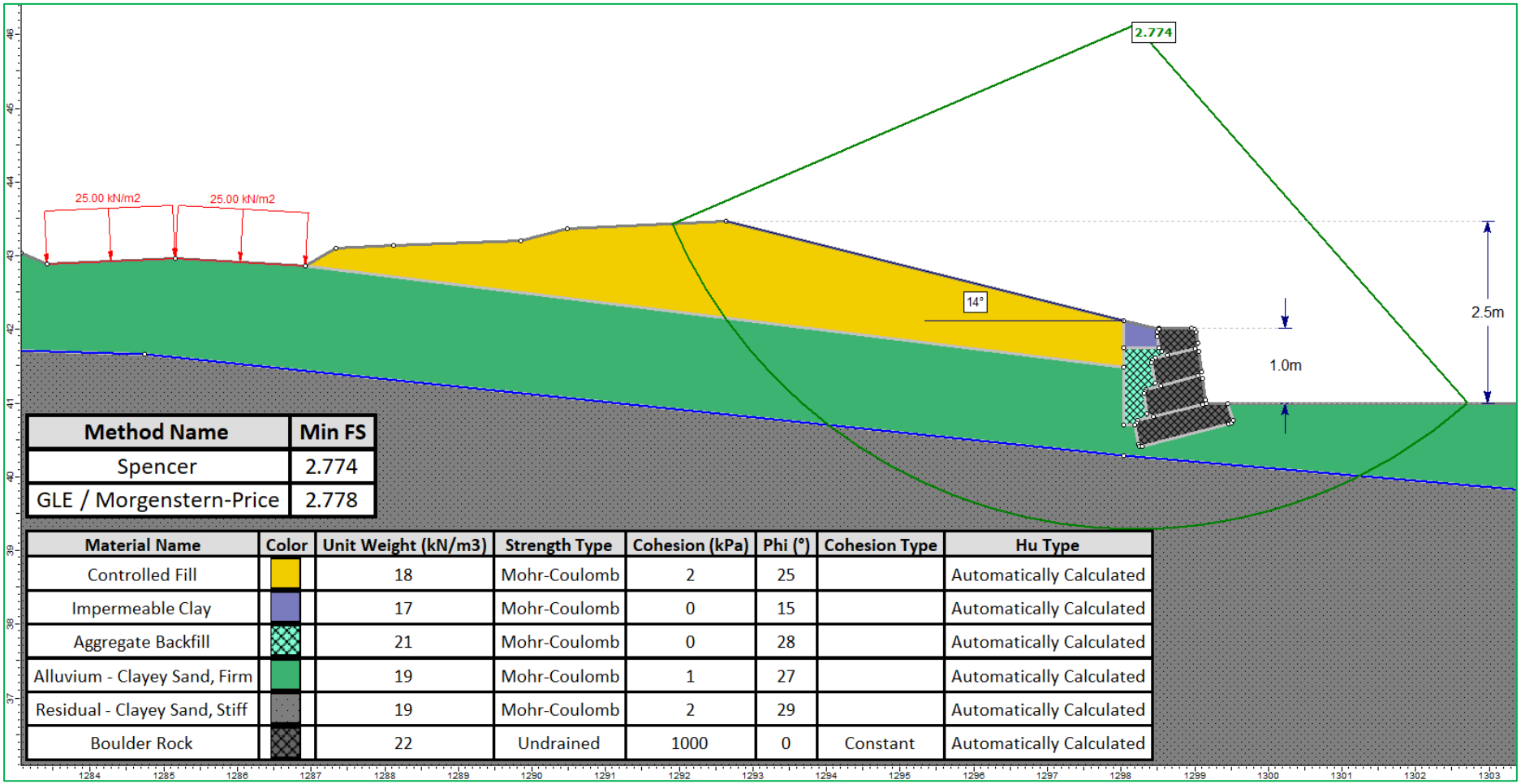
Qualtest Laboratory
Est. 1987



Method Name	Min FS
Spencer	2.415
GLE / Morgenstern-Price	2.419

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Hu Type
Controlled Fill		18	Mohr-Coulomb	2	25		Automatically Calculated
Impermeable Clay		17	Mohr-Coulomb	0	15		Automatically Calculated
Aggregate Backfill		21	Mohr-Coulomb	0	28		Automatically Calculated
Alluvium - Clayey Sand, Firm		19	Mohr-Coulomb	1	27		Automatically Calculated
Residual - Clayey Sand, Stiff		19	Mohr-Coulomb	2	29		Automatically Calculated
Boulder Rock		22	Undrained	1000	0	Constant	Automatically Calculated

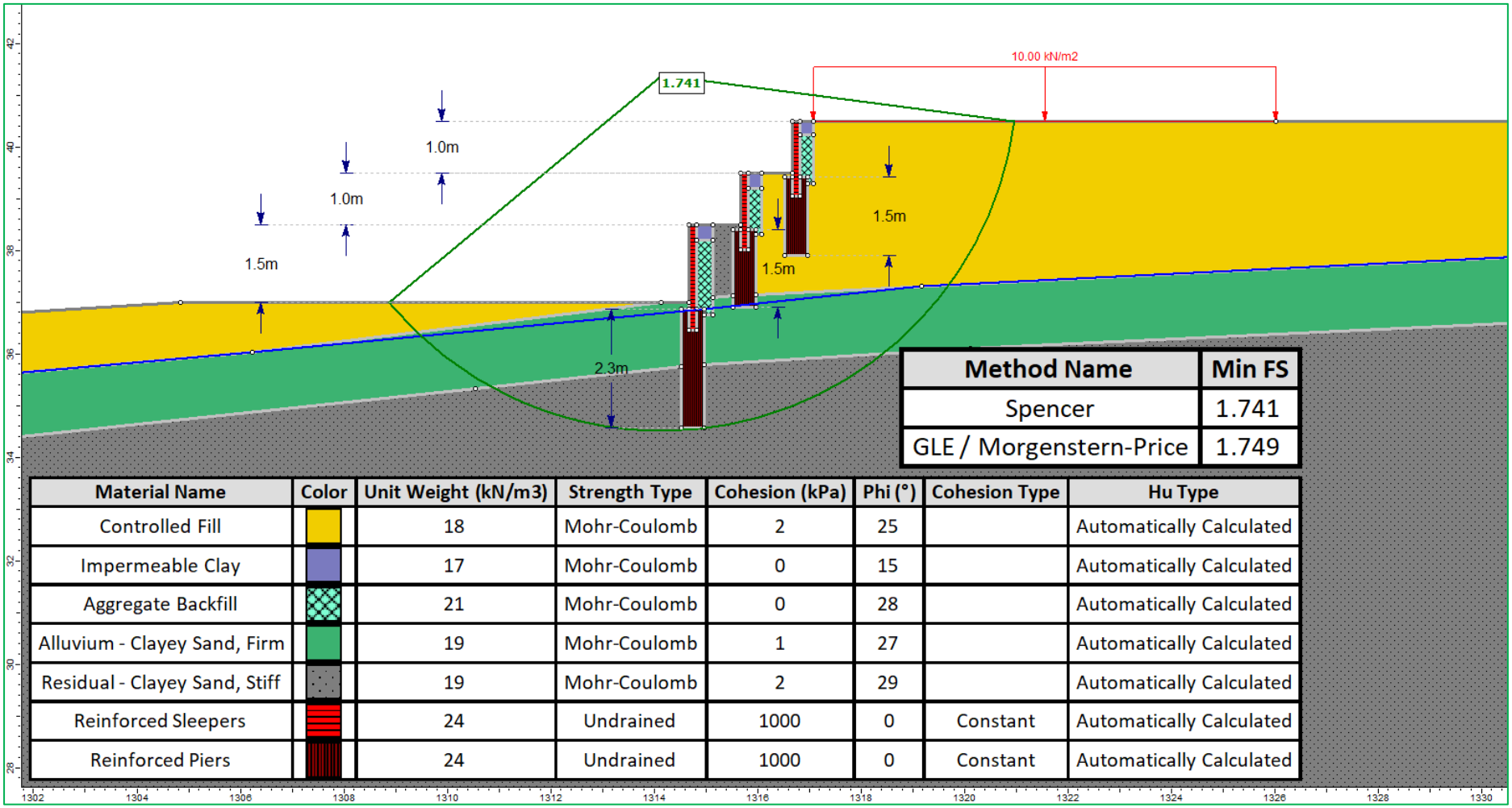
Appendix D1 – Design Case 1, Cross Section A, Road 1, Results of Global Stability Analysis



Method Name	Min FS
Spencer	2.774
GLE / Morgenstern-Price	2.778

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Hu Type
Controlled Fill		18	Mohr-Coulomb	2	25		Automatically Calculated
Impermeable Clay		17	Mohr-Coulomb	0	15		Automatically Calculated
Aggregate Backfill		21	Mohr-Coulomb	0	28		Automatically Calculated
Alluvium - Clayey Sand, Firm		19	Mohr-Coulomb	1	27		Automatically Calculated
Residual - Clayey Sand, Stiff		19	Mohr-Coulomb	2	29		Automatically Calculated
Boulder Rock		22	Undrained	1000	0	Constant	Automatically Calculated

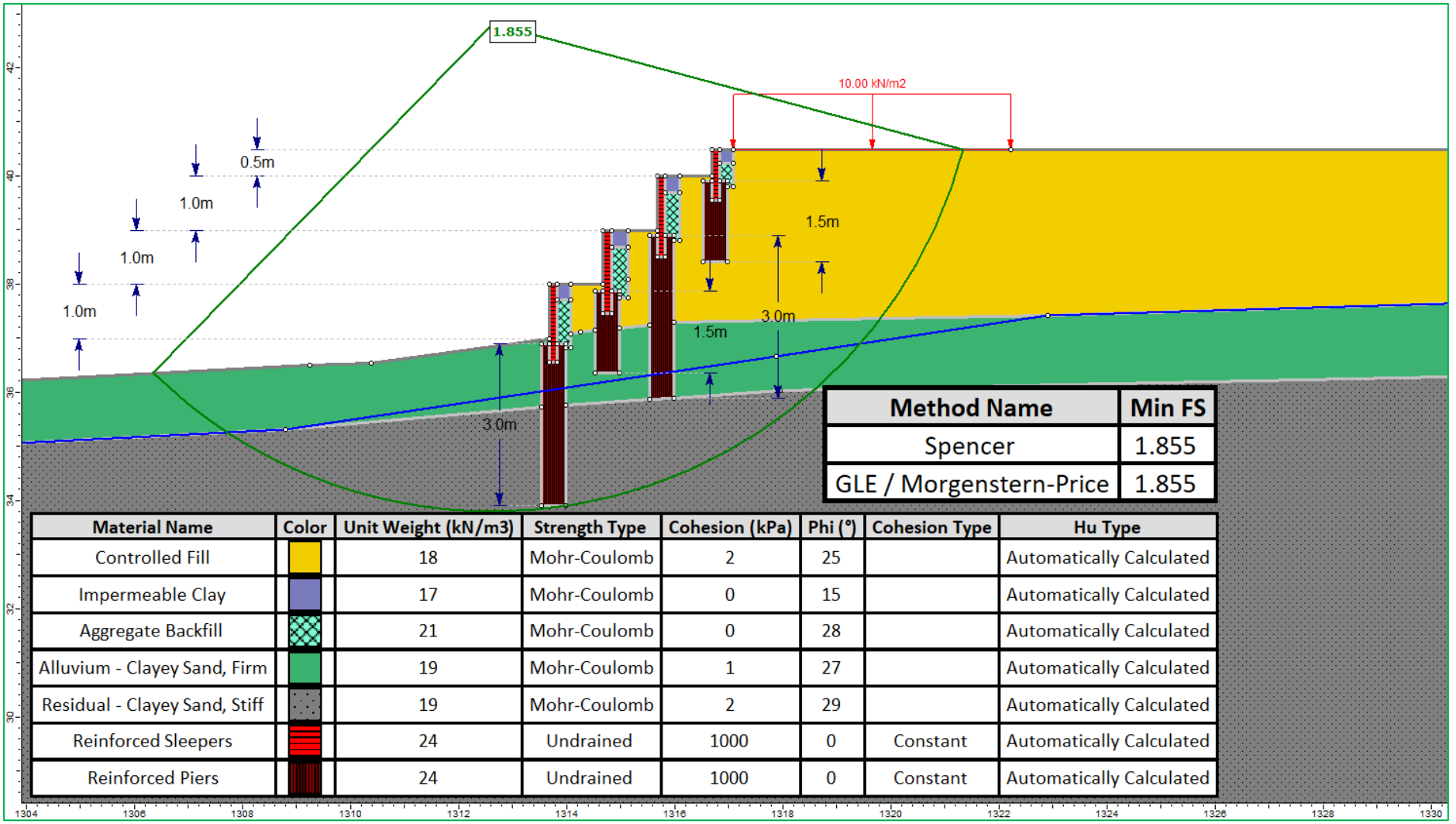
Appendix D2 – Design Case 2, Cross Section B, Road 1, Results of Global Stability Analysis



Method Name	Min FS
Spencer	1.741
GLE / Morgenstern-Price	1.749

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Hu Type
Controlled Fill		18	Mohr-Coulomb	2	25		Automatically Calculated
Impermeable Clay		17	Mohr-Coulomb	0	15		Automatically Calculated
Aggregate Backfill		21	Mohr-Coulomb	0	28		Automatically Calculated
Alluvium - Clayey Sand, Firm		19	Mohr-Coulomb	1	27		Automatically Calculated
Residual - Clayey Sand, Stiff		19	Mohr-Coulomb	2	29		Automatically Calculated
Reinforced Sleepers		24	Undrained	1000	0	Constant	Automatically Calculated
Reinforced Piers		24	Undrained	1000	0	Constant	Automatically Calculated

Appendix D3 – Design Case 3, Cross Section C, Park, Results of Global Stability Analysis



Appendix D4 – Design Case 4, Cross Section D, Park, Results of Global Stability Analysis