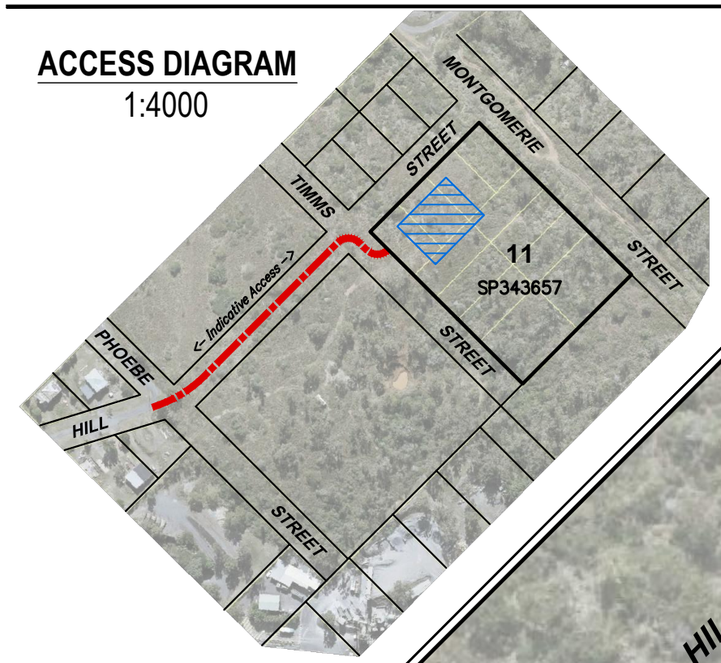
ACCESS DIAGRAM
1:4000



ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/180-2023

Dated: 4 July 2024

Denotes Proposed BLE
45m x 35m

IMPORTANT NOTE

This plan was prepared to accompany an application to Rockhampton Regional Council and should not be used for any other purpose.

The dimensions and areas shown hereon are subject to field survey and also to the requirements of council and any other authority which may have requirements under any relevant legislation.

In particular, no reliance should be placed on the information on this plan for any financial dealings involving the land.

This note is an integral part of this plan.

client

C. Brown & C. Stephens

project

18-24 Hill Street, Lakes Creek

plan of

Proposal Plan
(Proposed Building Location Envelope) with Ortho Underlay

rpd

Lot 1 on SP343657

lga

Rockhampton Regional Council

issue	date	details	authorised
A	6-12-2023	Initial issue	RJKF
-	-	-	-

created

capricornsurveygroupcq
SURVEYING & PLANNING SOLUTIONS
07 4927 5199 | reception@csgcq.com.au | 132 Victoria Parade, Rockhampton QLD 4700

scale **1:750 @ A3**

datum **-**

sheet no. **1 of 1**

cad file **9038-01-BLE-A**

plan no. **9038-01-BLE**

issue **A**

ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Permit No.: P/179-2024-PLUMB

Dated: 3 July 2024

CQ SOIL TESTING

Landslide Susceptibility Assessment And Geotechnical Comments

SITE ADDRESS:	Lot 1 on SP343657 Hill Street, Lakes Creek
Prepared for:	C Stephens
Job Number:	CQ24636
Issue Date:	16/02/2024

CQ SOIL TESTING technical excellence

ABN 87 656 845 448
QBCC License 15 305 465

PO Box 9654
Park Avenue QLD 4701

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info@cqsoiltesting.com.au

Client & Document Information

Client:	C Stephens
Project:	Lot 1 on SP343657 Hill Street, Lakes Creek
Investigation Type:	**Landslide Susceptibility Assessment and Geotechnical Comments**
Job Number:	CQ24636
Date of Issue:	16/02/2024

Contact Information

CQ SOIL TESTING ABN 87 656 845 448 PO Box 9654 PARK AVENUE QLD 4701	Telephone: (07) 4936 1163 Facsimile: (07) 4936 1162 Email: info@cqsoiltesting.com.au

Document Control

Version	Date	Author	Design Drawings	Reviewer	Reviewer Initials
A	16/02/2024	C Burke	C Tindoc	Scott Walton	SWW
		Ryan Kemp			

Table of Contents

INTRODUCTION

This report outlines the results of the landslide susceptibility assessment geotechnical investigation undertaken by CQ Soil Testing for the proposed new dwelling to be constructed at Hill Street, Lakes Creek.

It is understood that the project will involve the construction of a residential building located towards the western side of the site, along with the installation of a driveway on Hill Street. It is noted that the provided documentation does not provide specific details, such as proposed earthworks, the type of building and the loading conditions for the proposed building. However, for this report it has been assumed that bulk earthworks will be limited to 1 metre depth/height to level the building pad and driveway, and that the loading conditions will be consistent with those of a standard residential dwelling, with foundation pressures not exceeding 100 kPa.

This report outlines the results of the fieldwork, laboratory testing, analysis and interpretive reporting on the following items:

- Summary of subsurface conditions and adopted ground model.
- Foundation soil reactivity in accordance with AS2870 (Site Classification).
- Landslide Susceptibility Analysis.
- Earthworks and site preparation.
- Retaining wall design parameters.
- Allowable bearing pressures for high level footings.
- Ultimate base bearing and ultimate skin friction for the design of piles.

This report must be kept in entirety. This report relates exclusively to the proposed new dwelling at the address stated on page one of this report and has been prepared for the express purpose stated above. This document does not cover any other elements related to construction on the site.

SITE DESCRIPTION

The site is located at Lot 1 on SP343657, and is positioned on the southeastern side of Hill Street as shown on the attached cadastral mapping.

At the time of the investigation, the site was found to be vacant featuring vegetation that included a grass ground cover and scattered trees.

The contour and details survey plan (attached), along with the hillside shading data sourced from GeoResGlobe (attached), indicate that the site is located at the ridge of a small hill which slopes down towards the north, east and south with an average calculated maximum natural surface slope of approximately 20 degrees.

During the walkover, the site was visually inspected to assess the general topography for signs of previous landslide instability. No indications of previous landslides or slips were observed on this suggesting that there has been no recent soil creep or landslides in the upper soil mantle. No signs of instability were identified on the GeoResGlobe Hillside shading map.

Based on the review of regional surface geology presented on the Queensland Government website GeoResGlobe, the site is underlain by Early Permian aged Lakes Creek Formation (Pkl) comprising of '*Siltstone and lithic sandstone*'.

To improve the understanding and appreciation of the site conditions and features, this report is accompanied by photographs of the site taken during the fieldwork, site sketch and GeoResGlobe mapping and reports.

FIELDWORK

The fieldwork scope was undertaken on 29 January 2024 and included 5 boreholes (nominated Boreholes 1 to 5) at the approximate locations indicated on attached drawing. The boreholes were drilled using a 4WD utility-mounted rig equipped with 100mm diameter solid-flight augers. Borehole logs and test location plan are attached.

In summary, the subsurface conditions were as follows:

- **Building envelope (Boreholes 1 to 3):** A surficial topsoil layer typically up to 0.05 metres thick underlain by residual soils comprising medium dense to dense clayey gravel, very stiff silty sandy clay and very dense gravelly clayey sand.
- **Driveway (Boreholes 4 and 5):** Residual soils comprising a 0.2 metres thick surficial dense clayey sandy gravel underlain by residual soils comprising very stiff silty sandy clay, very dense gravelly clayey sand and weathered rock.

No groundwater was encountered during drilling of the boreholes. Groundwater levels can be affected by a variety of factors, including seasonal changes, precipitation, and local geology.

It is important to note that the soil profile across the site may potentially differ from what is indicated in the bore logs. Therefore, in the event of encountering different conditions during construction, it is imperative to notify CQ Soil Testing.

LABORATORY TEST RESULTS

The laboratory testing undertaken on selected representative soil samples in accordance with AS1289-Methods of Testing for Engineering Purposes is aimed at determining the typical soil behavior characteristics required for the engineering assessment. The results of the laboratory tests are attached to this report.

GEOTECHNICAL COMMENTS

The geotechnical comments presented in this report are derived from factual information obtained during the fieldwork, along with the application of best practices, local expertise, and relevant published literature.

SITE CLASSIFICATION

In strict accordance with AS2798, the site would be classified Class P due to the surrounding trees, and as a result the foundation system needs to be designed by following appropriate engineering principles.

To provide an indication of potential shrink swell ground movements due to normal seasonal moisture variations that could be experienced at this site, a shrink-swell index (Iss) value of 2.2% was inferred (based on the laboratory testing and previous experience in the area). Based on the inferred shrink-swell value and empirical methods described in Section 2.3 of AS2870, the calculated surface movement (ys) in response to normal seasonal soil suction could potentially be up to 45 mm consistent with a Class H1-D site classification.

Proper site maintenance is crucial for the long-term performance of any building's foundation system. As such, the guidelines outlined in the attached CSIRO publication "Foundation Maintenance and Footing Performance: A Homeowners Guide" should be followed to ensure the site remains in optimal condition.

LANDSLIDE RISK ASSESSMENT

Rockhampton Reginal Council have developed a Planning Scheme mapping tool, designed to identify if a site requires a landslide hazard assessment before obtaining building approval. The attached Planning Scheme mapping reveals that the site is mapped on the steep land planning scheme overlay. Consequently, this triggers the need for a landslide susceptibility assessment as per the regulatory requirements.

The results of the attached Landslide Susceptibility Analysis (refer attached), including the relative susceptibility and correlated susceptibility rating, are summarised in Table 1 below. The analysis has been undertaken for the existing site conditions and based on a natural maximum site slope of approximately 20 degrees. The following are assumed to achieve the reported Correlated Susceptibility Rating:

- Slope of cut faces less than 30 degrees.
- All cut slopes are retained using post and sleeper retaining walls designed with a minimum 1.5 global stability factor of safety.
- Onsite wastewater disposal using surface spray methods.
- Rainwater tank with overflows

***Table 1**: Results of AGS Qualitative Risk Assessment*

Relative Susceptibility	Correlated Susceptibility Rating
0.239	Low

Based on the relative susceptibility and correlated susceptibility rating, the site would be assessed as having a 'Low' landslide risk rating.

The attached geomechanics hillside practices should be adopted for the dwelling.

EARTHWORKS

Any new fill that will support structural loads should be placed and compacted under full time supervision and testing in accordance with AS3798–2007 Guidelines on Earthworks for Commercial and Residential Hardstands. These guidelines recommend:

- Remove grass and vegetation.
- Remove uncontrolled fill.
- Subgrade preparation.
- Test rolling after subgrade preparation using specific plant and load conditions such as a static 12 Tonne smooth steel wheeled roller, a pneumatic-tired plant that weighs at least 20 tonnes and has a ground pressure not less than 450 kPa per tyre, or a highway truck with a rear axle loaded to not less than 8 tonnes, with tyres inflated to 550 kPa.
- Soft areas identified will need to be removed and replaced with select material, subject to site-specific conditions.
- Structural fill should be placed in near horizontal layers, with a maximum loose thickness of 300mm (uncompacted) and then compacted to a minimum of 98% DDR for general fill and 100% DDR in the upper 0.5m beneath slabs and pavements. Moisture variation should not exceed ±2% of the OMC.
- Maximum particle size should be limited to two-thirds of the compacted layer thickness or 125 mm (whichever is greater).
- If the structural fill abuts slopes steeper than 8H:1V, it is recommended to cut benches into the slope equal to the height of the fill layer before filling.

RETAINING WALLS

Retaining wall design parameters for the materials encountered during the investigation are provided in Table 2: Retaining Wall Parameters. These parameters are unfactored and drained, and have been inferred based on the information available.

Table 2: Retaining Wall Parameters

Material	Unit Weight (kN/m^3)	Friction Angle (Ø)	Drained Cohesion (c')
Clayey sandy gravel (with in the upper 1 metre)	21	32	0
Silty sand clay	18	26	1
Clayey sandy gravel (Below 2 metres)	21	34	2
Gravelly clayey sand	21	33	1
Weathered rock	22	36	5

To ensure the safety and stability of retaining walls, it is essential that they are designed and certified by a qualified structural engineer and built in accordance with the minimum requirements outlined in AS4678 - Earth Retaining Structures.

Global stability assessment must be undertaken on all retaining structures to ensure that suitable global stability FoS are reached.

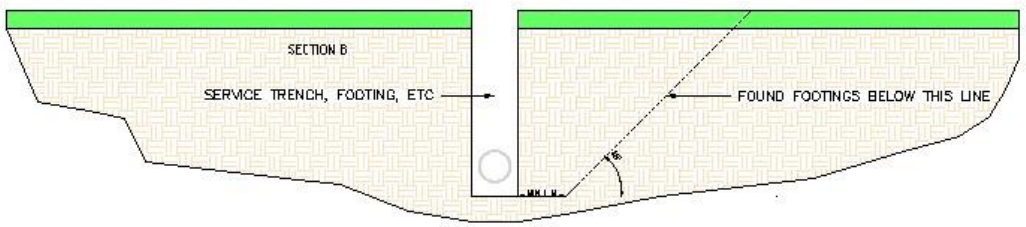
Passive pressures should be ignored in areas where disturbance may occur (ie. future trenching or earthworks processes).

FOUNDATIONS

High-level footings can be designed using an allowable bearing pressure of 100 kPa in the residual soils. Elastic settlements under such applied loading are predicted to be less than 0.5% of the footing width.

If footings are positioned near an underground service or other structure, it is recommended to extend the footing at least 0.3 m below an imaginary line projected at a 45-degree angle from the lowest point of the service/obstruction. Figure 1 provides a visual representation for reference.

Figure 1:



The design of vertically loaded bored piles that are founded at least two pile diameters into the designated strata can adopted the ultimate values in Table 3: Deep Level Footings – Ultimate Geotechnical Parameters.

The upper metre of the pile skin friction should be ignored in the design. For example, the pile should be designed assuming a 1 metre length of pile is sticking out of the ground, cantilevering this upper metre of pile. This precaution is necessary due to the potential separation between the pile and the ground due to soil shrinkage during drying.

Table 3: Deep Level Footings – Ultimate Geotechnical Parameters

Material	Fb (kPa)	Fs (kPa)
Clayey sandy gravel (with in the upper 1 metre)	Not recommended	Not recommended
Silty sand clay	450	20
Clayey sandy gravel (Below 2 metres)	650	10
Gravelly clayey sand	650	10
Weathered rock	1500	50

To ensure the proper performance of piles, it is crucial to have them designed and certified by a qualified structural engineer and constructed according to the minimum requirements specified in AS2159 - Piling Design and Installation.

Settlements of piles that are loaded in a manner like the one described above are not expected to exceed approximately 1% of the diameter of the pile.

Most equipment, including excavators with auger attachments, should be able to excavate bored pile excavations in the fill and residual. However, if underlying rock is encountered during bored pile excavations), larger machinery with specialised rock auger attachments may be needed to excavate rock formations.

If you should have any queries regarding this report, please do not hesitate to contact the undersigned at your convenience.

Yours faithfully

Ryan Kemp
Geotechnical Consultant – RPEQ, CPEng, NER, MEIAust

Scott Walton
Laboratory Manager

LABORATORY FINDINGS

A. Classification by characteristic surface movement as per AS2780-2011

Site Classification Symbols	Y's Range Value	Generalized Description (Guide Only)
'S'	0 – 20 mm	Slightly reactive clay sites which may experience only slight ground movement due to moisture changes
'M'	21 – 40 mm	Moderately reactive clay or silt sites which may experience moderate ground movement due to moisture changes
'H1'	41 – 60 mm	Highly reactive clay sites which may experience high ground movement due to moisture changes
'H2'	61 – 75 mm	Highly reactive clay sites which may experience very high ground movement due to moisture changes
'E'	>75 mm	Extremely reactive clay sites which may experience extreme ground movement due to moisture changes
'P'	N/A	Problem sites which generally have soils associated with uncontrolled fill, abnormal moisture conditions (trees), soft or collapsing soils, landslip etc...

B. Laboratory Test Results

Borehole Location	1	Borehole Location		Borehole Location	
Depth Range of Sample (m)	0.7-1.1	Depth Range of Sample (m)		Depth Range of Sample (m)	
Natural MC %	17	Natural MC %		Natural MC %	
% Passing 75 um Sieve	ND	% Passing 75 um Sieve		% Passing 75 um Sieve	
Liquid Limit %	ND	Liquid Limit %		Liquid Limit %	
Plastic Index %	ND	Plastic Index %		Plastic Index %	
Linear Shrinkage %	ND	Linear Shrinkage %		Linear Shrinkage %	
Shrink Swell Index	2.2	Shrink Swell Index		Shrink Swell Index	
Pocket Penetrometer kPa	ND	Pocket Penetrometer kPa		Pocket Penetrometer kPa	

C. Permeability Test Results AS1547-2000

Test Hole Number	Depth Of Test Hole	Range Tested	Permeability M/Day
NA	500 mm	250 – 500 mm	NA

APPENDIX A - SITE PHOTOGRAPHS

Image 1: Proposed Construction Site

Image 2: Proposed Construction Site

Image 3: Proposed Access Track

Image 4: Proposed Access Track

Image 4: Proposed Access Track

APPENDIX B - SITE PLAN

Contour plans and any associated drawings supplied by CQ Soil Testing are solely for the purpose of satisfying the QBCC's subsidence policy. Use or distribution of these drawings for any other purpose is not recommended and entirely at the users risk. CQ Soil Testing are not licensed surveyors and these drawings are not survey plans. Services shown are indicative only and are to be confirmed onsite prior to construction.

NOT FOR CONSTRUCTION

SERVICES LEGEND:

E	*Electricity Pit*	(T)	*Telecom Turret*	—T—	*U/G Telecom Line*
S	*Storm water pit*	T	*Telecom Pit*	—W—	*U/G Water Line*
H	*Fire Hydrant*	G	*Gully Pit*	—SW—	*U/G Stormwater Line*
K	*Kerb Adapter*	(S)	*Sewer Manhole*	—OHP—	*Overhead Power*
W	*Water Meter*	—S—	*Sewerage Line*	HC	*Sewer House Connection*
	Street Light	—E—	*U/G Power Line*		*Stormwater Gully Pit*

SITE LEGEND & NOTES:

10.000	*RL 10.000 is assumed as datum level (ie Not AHD)*
9.2	*Existing Contour*
9.820	*Denotes Surveyed RL*

Field Technician: J.S. *Date:* 30.01.2024

CQ SOIL TESTING
Servicing all of Central Queensland

QBCC - 15 305 465 ABN - 87 656 845 448

Phone: (07) 4936 1163
Email: info@cqsoiltesting.com.au
Website: www.cqsoiltesting.com.au

Project:
LOT 1 HILL STREET
LAKES CREEK, QLD

For:
C STEPHENS

Title: CONTOUR & SITE PLAN

Scale: 1:1000 (A3)	*Date:* FEB '24
Sheet: 2 of 2	*Drawn:* C.T.
Job No: CQ24636	*Rev:* A

Contour plans and any associated drawings supplied by CQ Soil Testing are solely for the purpose of satisfying the QBCC's subsidence policy. Use or distribution of these drawings for any other purpose is not recommended and entirely at the users risk. CQ Soil Testing are not licensed surveyors and these drawings are not survey plans. Services shown are indicative only and are to be confirmed onsite prior to construction.

NOT FOR CONSTRUCTION

SERVICES LEGEND:

E — Electricity Pit	T — Telecom Turret	—T—	U/G Telecom Line
S — Storm water pit	T — Telecom Pit	—W—	U/G Water Line
H — Fire Hydrant	G — Gully Pit	—SW—	U/G Stormwater Line
K — Kerb Adapter	S — Sewer Manhole	—OHP—	Overhead Power
W — Water Meter	—S— Sewerage Line	HC	Sewer House Connection
Street Light	—E— U/G Power Line		Stormwater Gully Pit

SITE LEGEND & NOTES:

10.000	RL 10.000 is assumed as datum level (ie Not AHD)
9.2	Existing Contour
9.820	Denotes Surveyed RL

Field Technician: J.S. Date: 30.01.2024

CQ SOIL TESTING
Servicing all of Central Queensland

QBCC - 15 305 465 ABN - 87 656 845 448

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Website: www.cqsoiltesting.com.au

Project:
LOT 1 HILL STREET
LAKES CREEK, QLD

For:
C STEPHENS

Title: CONTOUR & SITE PLAN	
Scale: 1:500 (A3)	Date: FEB '24
Sheet: 1 of 2	Drawn: C.T.
Job No: CQ24636	Rev: A

APPENDIX C - BOREHOLE LOGS

CQ SOIL TESTING

CLIENT: C Stephens
PROJECT: Geotechnical Investigation
ADDRESS: 18-24 Hill Street, Lakes Creek
DRILL RIG: Drillman GT10

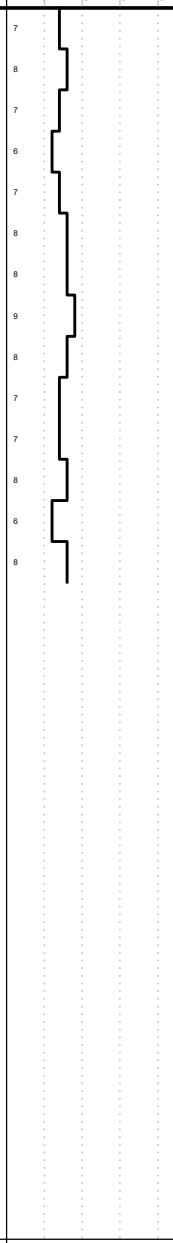
PROJECT #: CQ24636
LOGGED: RJ
EASTING:
NORTHING:

BORE HOLE 1

TEST DATE: 29/01/2024

RL (m)	Depth (m)	Graphic Log	Water	Material Description	Sampling & Testing: Type	Sampling & Testing: Results & Comments	DCP Results (blows per 100 mm)
			0.05	Topsoil			
				Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, brown, dry, dense.			
			0.6	Silty Sandy CLAY (CH): high plasticity, fine to coarse grained, brown, dry to moist, very stiff.			
	1						
			1.5	Silty Sandy Clay (CI): medium plasticity, fine to coarse grained, brown, dry, very stiff.			
	2						
			2.3	Gravelly Clayey SAND (SC): fine to coarse grained, low plasticity fines, yellowish brown, dry, very dense.			
	3						
			3.0	Bore Terminated at 3 m. Limit of Investigation.			

DCP Results (blows per 100 mm): 5 10 15 20



DRILLING METHOD: Solid Flight Auger

CASING:

GROUNDWATER: No groundwater seepage observed at time of drilling.

REMARKS: Bore Terminated.

LEGEND:

D - Disturbed Sample from Auger	**SPT** - Standard Penetration Test	- Groundwater Seepage Level
B - Bulk Sample from Auger	**Is_{50}** - Point Load Result (MPa)	- Standing Groundwater Level
C - Rock Core	**PP** - Pocket Penetrometer (kPa)	- Partial Groundwater Loss
U$_{40}$ - Undisturbed Sample (mm)		- Perched Groundwater Level

CQ SOIL TESTING

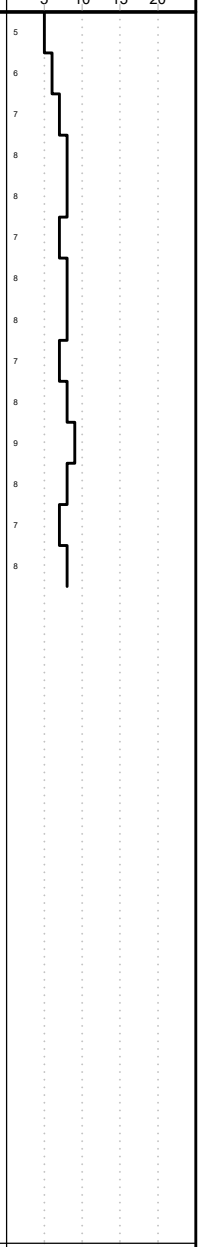
CLIENT: C Stephens
PROJECT: Geotechnical Investigation
ADDRESS: 18-24 Hill Street, Lakes Creek
DRILL RIG: Drillman GT10

PROJECT #: CQ24636
LOGGED: RJ
EASTING:
NORTHING:

BORE HOLE 2

TEST DATE: 29/01/2024

RL (m)	Depth (m)	Graphic Log	Water	Material Description	Sampling & Testing: Type	Sampling & Testing: Results & Comments	DCP Results (blows per 100 mm)
			0.05	Topsoil			
				Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, brown, dry, medium dense to dense.			
			0.4	Silty Sandy CLAY (CH): high plasticity, fine to coarse grained, brown, dry to moist, very stiff.			
	1		0.9	Silty Sandy Clay (CI): medium plasticity, fine to coarse grained, brown, dry, very stiff.			
	2		2.0	Gravelly Clayey SAND (SC): fine to coarse grained, low plasticity fines, yellowish brown, dry, very dense.			
	3		3.0	Bore Terminated at 3 m. Limit of Investigation.			



DRILLING METHOD: Solid Flight Auger

CASING:

GROUNDWATER: No groundwater seepage observed at time of drilling.

REMARKS: Bore Terminated.

LEGEND:

D - Disturbed Sample from Auger	**SPT - Standard Penetration Test**	**- Groundwater Seepage Level**
B - Bulk Sample from Auger	**Is_{50} - Point Load Result (MPa)**	**- Standing Groundwater Level**
C - Rock Core	**PP - Pocket Penetrometer (kPa)**	**- Partial Groundwater Loss**
U40 - Undisturbed Sample (mm)		**- Perched Groundwater Level**

CQ SOIL TESTING

CLIENT: C Stephens
PROJECT: Geotechnical Investigation
ADDRESS: 18-24 Hill Street, Lakes Creek
DRILL RIG: Drillman GT10

PROJECT #: CQ24636
LOGGED: RJ
EASTING:
NORTHING:

BORE HOLE 3

TEST DATE: 29/01/2024

RL (m)	Depth (m)	Graphic Log	Water	Material Description	Sampling & Testing: Type	Sampling & Testing: Results & Comments	DCP Results (blows per 100 mm)
			0.05	Topsoil			
				Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, brown, dry, dense.			
			0.5	Silty Sandy CLAY (CH): high plasticity, fine to coarse grained, brown, dry to moist, very stiff.			
	1						
			1.5	Silty Sandy Clay (CI): medium plasticity, fine to coarse grained, brown, dry, very stiff.			
	2						
			2.2	Bore Terminated at 2.2 m. Limit of Investigation.			
	3						

DCP Results (blows per 100 mm): 5 10 15 20

6 7 7 8 7 8 9 8 7 8 8 8 7

DRILLING METHOD: Solid Flight Auger

CASING:

GROUNDWATER: No groundwater seepage observed at time of drilling.

REMARKS: Bore Terminated.

LEGEND:

D - Disturbed Sample from Auger	**SPT - Standard Penetration Test**	**- Groundwater Seepage Level**
B - Bulk Sample from Auger	**Is_{50} - Point Load Result (MPa)**	**- Standing Groundwater Level**
C - Rock Core	**PP - Pocket Penetrometer (kPa)**	**- Partial Groundwater Loss**
U40 - Undisturbed Sample (mm)		**- Perched Groundwater Level**

CQ SOIL TESTING

CLIENT: C Stephens
PROJECT: Geotechnical Investigation
ADDRESS: 18-24 Hill Street, Lakes Creek
DRILL RIG: Drillman GT10

PROJECT #: CQ24636
LOGGED: JS
EASTING:
NORTHING:

BORE HOLE 4

TEST DATE: 29/01/2024

RL (m)	Depth (m)	Graphic Log	Water	Material Description	Sampling & Testing: Type	Sampling & Testing: Results & Comments	DCP Results (blows per 100 mm)
				Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, brown, dry, dense.			
			0.2	Silty Sandy CLAY (CH): high plasticity, fine to coarse grained, brown, dry to moist, very stiff.			
	1		1.2	Silty Sandy Clay (CI): medium plasticity, fine to coarse grained, brown, dry, very stiff.			
	2		2.0	Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, yellowish brown, dry, very dense.			
			2.3	Weathered Rock			
	3		2.4	Bore Terminated at 2.4 m. Limit of Investigation.			

DCP Results (blows per 100 mm): 5, 10, 15, 20

4, 6, 7, 8, 9, 9, 9, 10

DRILLING METHOD: Solid Flight Auger

CASING:

GROUNDWATER: No groundwater seepage observed at time of drilling.

REMARKS: Tungsten carbide bit refusal on weathered rock.

LEGEND:

D - Disturbed Sample from Auger	**SPT - Standard Penetration Test**	**- Groundwater Seepage Level**
B - Bulk Sample from Auger	**Is_{50} - Point Load Result (MPa)**	**- Standing Groundwater Level**
C - Rock Core	**PP - Pocket Penetrometer (kPa)**	**- Partial Groundwater Loss**
U - Undisturbed Sample (mm)		**- Perched Groundwater Level**

CQ SOIL TESTING

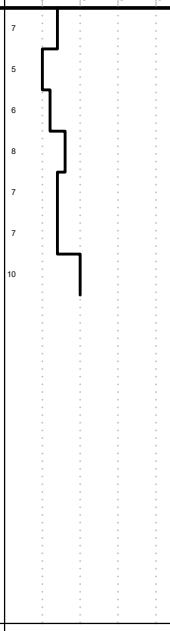
CLIENT: C Stephens
PROJECT: Geotechnical Investigation
ADDRESS: 18-24 Hill Street, Lakes Creek
DRILL RIG: Drillman GT10

PROJECT #: CQ24636
LOGGED: JS
EASTING:
NORTHING:

BORE HOLE 5

TEST DATE: 29/01/2024

RL (m)	Depth (m)	Graphic Log	Water	Material Description	Sampling & Testing: Type	Sampling & Testing: Results & Comments	DCP Results (blows per 100 mm)
				Clayey Sandy GRAVEL (GC): fine to coarse grained, low plasticity fines, brown, dry, dense.			
			0.2	Silty Sandy CLAY (CH): high plasticity, fine to coarse grained, brown, dry to moist, very stiff.			
	1		1.0	Silty Sandy Clay (CI): medium plasticity, fine to coarse grained, brown, dry, very stiff.			
			1.5	Bore Terminated at 1.5 m. Limit of Investigation.			
	2						
	3						



DRILLING METHOD: Solid Flight Auger

CASING:

GROUNDWATER: No groundwater seepage observed at time of drilling.

REMARKS: Tungsten carbide bit refusal on 'floater'.

LEGEND:

D - Disturbed Sample from Auger
B - Bulk Sample from Auger
C - Rock Core
U$_{xx}$ - Undisturbed Sample (mm)
SPT - Standard Penetration Test
Is$_{50}$ - Point Load Result (MPa)
PP - Pocket Penetrometer (kPa)
- Groundwater Seepage Level
- Standing Groundwater Level
- Partial Groundwater Loss
- Perched Groundwater Level

APPENDIX D - ATTACHMENTS

APPENDIX E - LIMITATIONS

1. Recommendations given in this report are based on the information supplied by the client regarding the proposed building construction in conjunction with the findings of the investigation. Any change in construction type, building location or omission in the client supplied information, may require additional testing and/or make the recommendations invalid.

2. The recommendations herein may identify a target soil stratum into which the footings should be founded. The target stratum has been located by the depth in mm of the target stratum's upper horizon boundary below the existing ground surface level at the time of the site investigation. Any cutting or filling works and any surface erosion or deposits subsequent to the site investigation, will alter the measured location of the stratum relative to the surface. Where required, the author should be notified in such cases to confirm the location of the target stratum.

3. The description of the soil given in Section 3.0 of this report is intended as a brief overview of the soil's primary constituents. For a detailed classification of the soil, the reader should refer to the Soil Profile Reports and/or Borehole Reports.

4. Every reasonable effort has been made to locate the test sites so that the borehole profiles are representative of the soil conditions within the area investigated. The client should be made aware, however, that exploration is limited by time available and economic restraints. In some cases, soil conditions can change dramatically over short distances, therefore, even careful exploration programs may not locate all the variations.

5. If soil conditions different from those shown in this report are encountered or are inferred from other sources, then the author must be notified immediately.

6. This report may not be reproduced except in full, and only then with the permission of the entity trading as CQ Soil Testing. The information and site sketch shall only be used and will only be applicable for the development shown on the client-supplied information provided for this site.

7. All information contained within this report is the intellectual property of the entity trading as CQ Soil Testing. All information contained within can only be used for the express purposes of the commissioned scope of works.

8. Any dimensions, contours, slope directions and magnitudes shown on the site sketch plan shall not be used for any building construction or costing calculations. The purpose of the plan is to show the approximate location of field tests only.

9. Any changes made to these recommendations by persons unauthorized by the author will legally be interpreted by that person assuming the responsibility for the long-term performance of the footing system.

10. The recommendations contained in this report have not taken into consideration the long-term effects of any previous, current, or potential subsurface work by mining companies or potential slope instability problems. At the time of writing this report neither our client (nor his agent) nor the local authority had made the author aware that these problems may be affecting this allotment. If a mining subsidence or slope stability assessment is required for this allotment, the recommendations of a suitably qualified geotechnical engineer should be sought.

11. Removal of trees from a site before an investigation can cause significant swelling of the soil over large areas. The removal of large trees from a construction site during development is rarely picked up during the investigation phase and is generally outside the scope of AS2870. Sites affected by large trees are often classified "P". If, during the footing excavation, it is noticed that there are soils with varying moisture contents or evidence of large trees having been removed CQ Soil Testing should be notified immediately.

12. The following documents are available from the CSIRO and QBCC and shall be read and adhered to in relation to this site:

- Builder's Guide to Preventing Damage to Dwellings- Part 1 Site Investigation and Preparation
  http://www.publish.csiro.au/nid/22/pid/3621.html
- Builder's Guide to Preventing Damage to Dwellings- Part 2 Sound Construction Methods
  http://www.publish.csiro.au/nid/22/pid/3661.html
- QBCC Subsidence Fact Sheet
  https://www.qbcc.qld.gov.au/sites/default/files/Homeowner%27s%20Guide%20to%20Subsidence.pdf

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Explanatory Notes of Abbreviations and Terms

Used on Borehole and Excavation Logs

General

Information obtained from site investigations is recorded on log sheets. The "Engineering Log – Borehole or Non Cored Borehole" presents data from drilling operations where a core barrel has not been used to recover material, and information is based on a combination of regular sampling and in-situ testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Engineering Log – Cored Borehole" presents data from drilling operations where a core barrel has been used to recover material – commonly rock. The "Engineering Log - Excavation" presents data obtained on the subsurface profile from observations of excavations, either natural or man-made. It may contain a scaled, graphical presentation of the typical excavation profile. Refusal of the excavation plant is noted should it occur.

As far as is practicable, the data contained on the log sheets is factual. Some interpretation is inevitable in the assessment of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classification is generally based on AS1726-2017.

Drilling Method

Code	Description
ADT	Auger drilling with TC-bit
ADV	Auger drilling V-bit
AS	Auger screwing
AT	Air track
CA	Casing advancer
CC	Concrete core
CTR	Cable tool rig
DB	Wash bore drag bit
HA	Hand auger
HAND	Hand methods
HF	Hollow flight auger
HMLC	Diamond core 62mm diameter
HQ	Wire line core barrel 64mm diameter
HQ3	Wire line core barrel 62mm diameter
NDD	Non destructive drilling
NMLC	Diamond core 52mm diameter
NQ	Wire line core barrel 47mm diameter
NQ3	Wire line core barrel 45mm diameter
PT	Continuous push tube
PQ	Wire line core barrel 85mm diameter
RAB	Rotary air blast
RC	Reverse circulation
RD	Rotary blade or drag bit
RR	Rock roller
RT	Rotary tricone bit
SD	Sonic drilling
TBX	Tube-X
VC	Vibro-core drilling
WB	Wash bore drilling

Drilling Penetration

Ease of penetration in non-core drilling

VE	Very easy
E	Easy
F	Firm
H	Hard
VH	Very hard

Support and Casing

Code	Description	Code	Description
C	Casing	Hw	114.3 mm
M	Mud	NW	88.9 mm
W	Water	PVC	150 mm

Core Run

Core lifts are identified by a line and depth with core loss per run as a percentage. Core loss is shown in the core run unless otherwise indicated.

Defect Spacing

The average distance between defects is measured parallel to the core axis in mm and may be expressed as a range or average.

Angle / Orientation

Angle from horizontal and orientation to magnetic north.

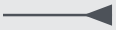
For inclined cored boreholes the Alpha and Beta angles are presented for orientated core. Alpha (α) is measured relative to the core axis, whilst Beta (β) is measured clockwise from the reference line looking down the core axis in the direction of drilling.

Excavation Method

N	Natural exposure
X	Existing excavation
BB	Tractor mounted backhoe bucket
EX	Hydraulic excavator
EH	Hydraulic excavator with hammer
B	Bulldozer blade
R	Ripper

Water / Drilling Fluid

The drilling fluid used is identified and loss of return to the surface is estimated as a percentage, generally of each core lift.

Symbol	Description
	Water inflow
	Water outflow
	Water level: during drilling or immediately after completion of drilling
	Groundwater level with date observed prior to introduction of fluids or after standpipe construction
Not observed	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole / test pit.
Not encountered	The borehole / test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole / test pit been left open for a longer period.

Colour

The colour of a soil or rock is described in a moist/wet condition using simple terms, such as black, white, grey, red, brown, orange, yellow green or blue. These are modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours are described as a combination of these colours (e.g. orange-brown). Where a soil or rock consists of a primary colour with a secondary mottling it is described as (primary colour) mottled (first colour) and (secondary colour).

Description of Soil

i. Soil name (BLOCK LETTERS)

ii. Plasticity or particle size of soil

iii. Colour

iv. Secondary soil components names & estimated proportions, including their plasticity / particle characteristics, colour

v. Minor soil components name, estimated proportions, including their plasticity / particle characteristics, colour

vi. Other minor soil components

vii. Moisture condition

viii. Consistency / density

ix. Structure of soil, geological origin

x. Additional observations

Particle Size

Term		Grain Size
Clay		< 2 µm
Silt		2 – 75 µm
Sand	Fine	0.075 – 0.21 mm
	Medium	0.21 – 0.6 mm
	Coarse	0.6 – 2.36 mm
Gravel	Fine	2.36 – 6.7 mm
	Medium	6.7 – 19 mm
	Coarse	19 – 63 mm
Cobbles		63 – 200 mm
Boulders		> 200 mm

Fine Grained and Coarse Grained Soils

Term	Description
Fine Grained Soil (cohesive)	More than 35% of the material less than 63 mm is smaller than 0.075 mm (silts and clays)
Coarse Grained Soil	More than 65% of the material less than 63 mm is larger than 0.075 mm (sands, gravels and cobbles)

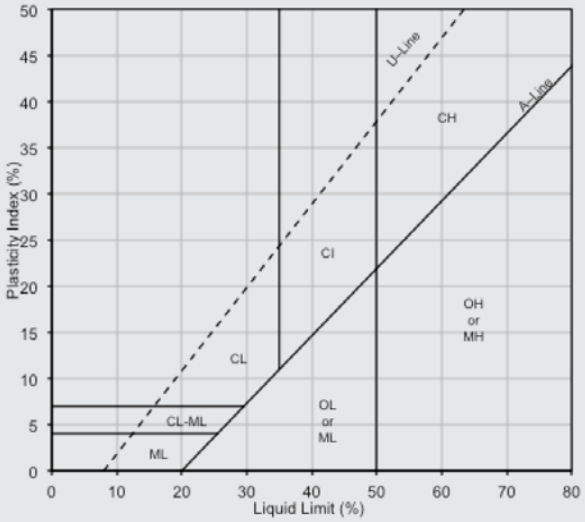
Descriptive Terms for Secondary and Minor Components

Designation of Components	In coarse grained soils				In fine grained soils	
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand / Gravel	Terminology
Minor	≤5	trace	≤15	trace	≤15	trace
	>5, ≤12	with	>15, ≤30	with	>15, ≤30	with
Secondary	>12	prefix	>30	prefix	>30	prefix

Plasticity – Fine Grained Soils

Liquid Limit (LL) %	Description
≤ 35	Low plasticity (L)
>35 to ≤ 50	Medium plasticity (I)
> 50	High plasticity (H)

Plasticity Chart– Fine Grained Soils



Consistency Terms – Fine Grained Soils

Term	Undrained shear strength (kPa)	Indicative SPT (N) Blow Count	Field Guide to Consistency
Very Soft (VS)	<12	0 – 2	Easily penetrated several centimetres by fist, exudes between fingers when squeezed in fist
Soft (S)	12 – 25	2 – 4	Easily penetrated several centimetres by thumb, easily moulded by light finger pressure
Firm (F)	25 – 50	4 – 8	Can be penetrated several centimetres by thumb with moderate effort, and moulded between the fingers by strong pressure
Stiff (St)	50 – 100	8 – 15	Readily indented by thumb but penetrated only with difficultly. Cannot be moulded by fingers
Very Stiff (VSt)	100 – 200	15 –30	Readily indented by thumb nail, still very tough
Hard (H)	>200	>30	Indented with difficulty by thumb nail, brittle
Friable (Fr)	-		Can be easily crumbled or broken into small pieces

Density Terms – Coarse Grained Soils

Term	Density Index (%)	SPT (N) Blow Count
Very Loose (VL)	< 15	0 – 4
Loose (L)	15 – 35	4 – 10
Medium Dense (MD)	35 – 65	10 – 30
Dense (D)	65 – 85	30 – 50
Very Dense (VD)	> 85	>50

Particle Characteristics – Coarse Grained Soils

Term	Description
Well Graded	Having good representation of all particle sizes
Poorly graded	With one or more intermediate size poorly represented
Gap graded	With one or more intermediate sizes absent
Uniform	Essentially of one size

Angularity – Coarse Grained Soils

	Rounded
	Sub-rounded
	Angular
	Sub-angular

Origin of Soil

Fill	Formed by humans
Aeolian	Formed by wind
Alluvial	Formed by streams and rivers
Colluvial	Formed on slopes (talus)
Estuarine	Formed in marine environments
Lacustrine	Formed in lakes
Residual	Formed by weathering insitu

Soil Moisture

	Term	Code	Description
Coarse Grained	Dry	D	Looks and feels dry and free running
	Moist	M	Soil feels cool, darkened in colour, soils tend to stick together, soil grains do not run freely through fingers and no visible free water
	Wet	W	Soil feels cool, darkened in colour, soils tend to stick together, free water on remoulding
Fine Grained	Moist, Less than Plastic Limit	W < PL	Hard and friable or powdery, moisture content well below Plastic Limit
	Moist, Near Plastic Limit	W ≈ PL	Soil feels cool, darkened in colour, can be moulded, near Plastic Limit
	Moist, Wet of Plastic Limit	W > PL	Soil feels cool, dark, usually weakened, free water, moisture content well above Plastic Limit
	Wet, Near Liquid Limit	W ≈ LL	Soil exudes easily
	Wet, Wet of Liquid Limit	W > LL	Soil behaves as a liquid

Boundary Classifications

Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.

Graphic Symbols

	Asphalt		MH
	CH		ML
	CI		OH
	CL		OL
	Concrete		PT
	Fill		SC
	GC		SM
	GM		SP
	GP		SW
	GW		

Soil Classification

Soils are described in general accordance with AS1726-2017 as shown below.

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)						GROUP SYMBOL	PRIMARY NAME
COARSE GRAINED SOILS More than 65% of the material is less than 63 mm and is larger than 0.075 mm	A particle size of 0.075 is about the smallest size distinguishable to the naked eye	GRAVELS More than half of coarse fraction is larger than 2.36 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GP	GRAVEL
			GRAVELS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		GM	SILTY GRAVEL
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SW	SAND
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SP	SAND
			SANDS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		SM	SILTY SAND
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		SC	CLAYEY SAND
FINE GRAINED SOILS More than 35% of the material less than 63 mm is less than 0.075 mm		IDENTIFICATION PROCEDURES ON FRACTIONS < 0.075 mm					
		SILTS AND CLAYS Liquid Limit < 50%	DRY STRENGTH	DILATANCY	TOUGHNESS	GROUP SYMBOL	PRIMARY NAME
			None to low	Slow to rapid	Low	ML	SILT
			Medium to high	≥ 12% clayey fines	Medium	CL, CI	CLAY
			Low to medium	Slow	Low	OL	ORGANIC SILT
		SILTS AND CLAYS Liquid Limit > 50%	Low to medium	None to slow	Low to medium	MH	SILT
			High to very high	None	High	CH	CLAY
			Medium to high	None to very slow	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS: readily identified by colour, odour, spongy feel and frequently fibrous texture						PT	PEAT

Description of Rock

i. Rock name (BLOCK LETTERS)

ii. Grain size and mineralogy

iii. Colour

iv. Fabric and texture

v. Features, inclusions, minor components, moisture content and durability

vi. Strength

vii. Weathering and/or alteration

viii. Rock mass properties – discontinuities and structure of rock

ix. Interpreted stratigraphic unit

x. Additional observations including geological structure

Simple rock names are used to provide a reasonable engineering description, rather than a precise geological classification. The rock name is chosen by considering the nature and shape of the grains or crystals, the texture and fabric of the rock material, the geological structure and setting, and information from the geological map of the area. Further guidance on the naming of rocks can be found in AS1726-2017, Tables 15, 16, 17 and 18. Typical rock types are described below, though subject to site specific variations.

Rock Type	Description	Example of Rock Name
Sedimentary	Formed by deposited beds of sediments, have grains that are cemented together and often rounded. Significant porosity	COMMON: Conglomerate, Breccia, Sandstone, Mudstone, Siltstone, Claystone ≥90% CARBONATE: Limestone, Dolomite, Calcirudite, Calcarenite, Calcisiltite, Calcilutite PYROCLASTIC: Agglomerate, Volcanic Breccia, Tuff
Igneous	Formed from molten rock and have a crystalline texture. Typically massive and low porosity. Rock types are from coarse to fine grained.	HIGH QUARTZ CONTENT: Granite, Microgranite, Rhyolite MODERATE QUARTZ CONTENT: Diorite, Microdiorite, Andesite LOW QUARTZ CONTENT: Gabbro, Dolerite, Basalt
Metamorphic	Formed when rocks are subject to heat and/or pressure and have typically have directional fabric. Typically have low porosity and crystalline structure. Rock types are from coarse to fine grained	FOLIATED: Gneiss, Schist, Phyllite, Slate NON-FOLIATED: Marble, Quartzite, Serpentinite, Hornfels
Duricrust	Formed as part of a weathering profile and show evidence of being cemented in situ. Cementation is typically irregular and exhibits replacement textures.	Ferricrete (Iron oxides and hydroxides) Silicrete (Silica) Calcrete (Calcium carbonate) Gypcrete (Gypsum)

Note: ( ) denotes dominant cementing mineralogy

Grain Size

Terms describing dominate grain size in sedimentary rocks.

Term	Grain size
Coarse	Mainly 0.6 mm to 2 mm
Medium	Mainly 0.2 mm to 0.6 mm
Fine	Mainly 0.06mm (just visible) to 0.2 mm

Terms describing dominate grain size in igneous and metamorphic rocks

Term	Grain size
Coarse	Mainly greater than 2 mm
Medium	0.06 mm to 2 mm
Fine	Mainly less than 0.06 mm (just visible) to 0.2mm

Texture and Fabric

Sedimentary rocks

Thickness	Bedding Term
< 6 mm	Thinly laminated
6 – 20 mm	Laminated
20 – 60 mm	Very thinly bedded
60 – 200 mm	Thinly bedded
0.2 – 0.6 m	Medium bedding
0.6 – 2 m	Thickly bedded
> 2 m	Very thickly bedded

Igneous rocks

Term	Definition
Amorphous	Indicates that the rock has no obvious crystalline structure
Crystalline	A regular molecular structure, showing crystal structure and symmetry.
Cryptocrystalline	The texture comprises crystals that are too small to recognise under an ordinary microscope. Indistinctly crystalline.
Porphyritic	Indicates the presence of phenocrysts (relatively large crystals in a fine grained ground mass) in igneous rocks.
Flow banded	Indicates visible flow lines in volcanic rocks and some intrusive rocks
Glassy	Entirely glass like. No crystalline units and without crystalline structure.
Vesicular	A texture of volcanic rocks that indicates the presence of vesicles (small gas bubbles). Where the vesicles are filled with a mineral substance they are termed Amygdales and the texture is Amygdaloidal.

Metamorphic

Term	Definition
Foliation	The parallel arrangement of minerals due to metamorphic process, which shall be defined by the terms in weak, moderate and strongly foliated.
Porphyroblastic	A texture indicating the presence of porphyroblasts (larger crystals formed by recrystallization during metamorphism, such as garnet or staurolite in a mica schist).
Cleavage	A type of foliation developed in fine grained metamorphic rocks such as slates.

Bedding and Fabric Development

Type	Definition
Massive	No obvious development of bedding – rock appears homogeneous
Poorly Developed	Bedding is barely obvious as faint mineralogical layering or grain size banding, but bedding planes are poorly defined.
Well Developed	Bedding is apparent in outcrops or drill core as distinct layers or lines marked by mineralogical or grain size layering.
Very Well Developed	Bedding is often marked by a distinct colour banding as well as by mineralogical or grain size layering.
Indistinct fabric	There is little effect on strength properties
Distinct Fabric	The rock may break more easily parallel to the fabric

Rock Strength

Term (Code)	UCS (MPa)	$Is_{(50)}$ (MPa)	Field Guide to Strength
Very Low (VL)	0.6 – 2	> 0.03 to ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low (L)	2 - 6	> 0.1 to ≤ 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blow of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm in diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium (M)	6 - 20	> 0.3 to ≤ 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm in diameter can be broken by hand with difficulty.
High (H)	20 - 60	> 1 to ≤ 3	A piece of core 150 mm long by 50 mm in diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High (VH)	60 -200	> 3 to ≤ 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High (EH)	>200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Rock strength is assessed by laboratory Uniaxial Compressive Strength (UCS) testing and/or Point Load Strength Index (PLT) testing to obtain the $Is_{(50)}$ the strength table implies a 20 times correlation between $Is_{(50)}$ and UCS used for classification. Note however, multiplier may range from 4 (e.g. some carbonated and low strength rocks) to 40 (e.g. some igneous rocks and/or some high strength rocks). A site specific correlation based on testing, previous investigation or literature may be used where available. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considered weaker due to the effect of rock defects.

Visual Log

A diagrammatic plot of defects showing type, spacing and orientation in relation to the core axis.

- Defects open in situ or clay sealed
- Defects closed in-situ
- Drill induced fractures or handling breaks
- Infilled seam

Rock Weathering and or Alteration Classification

Term (Code)		Definition	
Residual soil (RS)		Soil developed on extremely weathered rock. The rock mass structure and substance fabric are no longer evident but the soil has not been significantly transported.	
Extremely weathered (EW) Extremely altered (XA)		Rock is weathered to such an extent that it has 'soil' properties, i.e, it either disintegrates or can be remoulded in water, but the texture of original rock is still evident.	
Highly weathered (HW) Highly Altered (HA)	Distinctly weathered (DW)*	Whole rock material is discoloured usually by extent that iron staining or bleaching and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable	*Where is it not practical to distinguish between 'HW' and MW'. Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores
Moderately weathered (MW) Moderately Altered (MA)	Distinctly Altered (DA)	Whole rock material is discoloured usually by staining that original colour of the fresh rock is no longer recognisable	
Slightly weathered (SW) Slightly altered (SA)		Rock is slightly discoloured but shows little or no change of strength from fresh rock	
Fresh rock (F)		Rock shows no sign of decomposition or staining.	

Rock Core Recovery

TCR = Total Core Recovery (%)

$$\frac{\text{Length of Core Recovered}}{\text{Length of Core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$\frac{\text{Sum Length of Cylindrical Core Recovered}}{\text{Length of Core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$\frac{\text{Sum Length of Sound Core Pieces > 100mm in length}}{\text{Length of Core run}} \times 100$$

Types of Discontinuities

Term	Code	Description
Parting	Pt	A defect parallel or sub-parallel to a layered arrangement of mineral grains or micro-fractures, which has caused planar anisotropy in the rock substance.
Joint	Jt	A defect across which the rock substance has little tensile strength, but that is not related to textural or depositional features within the rock substance.
Sheared Zone	SZ	A zone with roughly parallel planar boundaries of rock substance consisting of closely spaced joints with smooth slickensided surfaces often curved. The joints divide the rock mass into unit blocks usually of lenticular or wedge shape.
Crushed Zone	CZ	A zone or seam with roughly parallel planar boundaries of rock substance composed of disoriented, usually angular, fragments of the host rock substance
Seam	Se	A zone or seam with roughly parallel boundaries, infilled by soil (IS) or decomposed rock (DS)
Fault	F	A fracture (defect) in rock along which there has been an observable amount of displacement.
Vein	Ve	A zone of minerals intruded into a joint or fissures.

Type of Structures

Term	Code	Description
Bedding	Bg	A layered arrangement of minerals parallel to the surface of deposition which has caused planar anisotropy in the rock substance.
Cleavage	C	An alignment of fine grained minerals caused by deformation.
Schistosity	SH	A layered arrangement of minerals to each other
Foliation	Fo	A planar alignment of minerals caused by deformation.
Void	Vo	A completely empty space
Dyke	DK	Sheet-like bodies of igneous rock that cut across sedimentary bedding or foliations in rocks. They may be single or multiple in nature
Sill	Sl	A sill is an intrusion of magma that spreads underground between the layers of another kind of rock
Contact	Cn	A contact between intrusive and stratigraphic units.
Boundary	Bd	A distinct boundary between two stratigraphic units

Note: Drill breaks (DB) and handling breaks (HB) are not included as natural discontinuity.

Discontinuity Spacing

Spacing (mm)	Description
>6000	Extremely Widely Spaced
2000 - 6000	Very Widely Spaced
600 - 2000	Widely Spaced
200 - 600	Medium Spaced
60 - 200	Closely Spaced
20 - 60	Very Closely Spaced
<20	Extremely Closely Spaced

Discontinuity Planarity

Code	Description
Cu	Curved – A defect with a gradual change in orientation
Ir	Irregular – A defect with many sharp changes in orientation
Pl	Planar – Defect forms a continuous plane without variation in orientation
St	Stepped – A defect with distinct sharp steps or step
Un	Undulose – A defect with undulations
Vu	Vuggy – An open void with crystallisation
Wv	Wavy – A wavy defect surface

Discontinuity Roughness

Abbreviation	Description
Ro	Rough – Many small surface irregularities generally related to the grain size of the parent rock
Sm	Smooth – Few or no surface irregularities related to the grain size of the parent rock
Po	Polished – Planes have a distinct sheen or a smoothness
Sl	Slickensided – Planes have a polished, grooved or striated surface consistent with differential movement of the parent rocs along the plane
VR	Very rough – many large surface irregularities, amplitude generally more than 1mm

Infill Material

Code	Name	Code	Name
Ca	Calcite	Gp	Gypsum
Ch	Chlorite	Mn	Manganese
Cl	Clay	MS	Secondary mineral
Co	Coal	Py	Pyrite
Fe	Limonite / Ironstone	Um	Unidentified mineral
Fe Cl	Iron oxide clay	Qz	Quartz
Fl	Feldspar	X	Carbonaceous

Discontinuity Observation

Term	Code	Description
Clean	CN	No visible coating or infill
Stain	SN	No visible coating or infill but surfaces are discoloured by mineral staining
Veneer <1 mm	VNR	A visible coating or soil or mineral substance but usually unable to be measured. If discontinuous over the plane, patchy veneer.
Coating >1 mm to <10 mm	CT	A visible coating or infilling of soil or mineral substance. Describe composition and thickness.
Filling (Filled) >10 mm	FLD	A visible filling of soil or mineral substance. Describe composition and thickness.

Samples and Field Tests

Code	Description
B	Bulk disturbed sample
BLK	Block sample
C	Core sample
DS	Small disturbed sample
ES	Soil sample for environmental testing
EW	Water sample for environmental testing
FP	Pressuremeter
G	Gas sample
H	Hydraulic fracturing
HP	Hand penetrometer test
I	Impression device
$Is_{(50)}$	Point Load Index
K	Permeability
LB	Large bulk disturbed sample
N	Standard penetration test result (N* denotes SPT sample recovery)
O	Core orientation
P	Piston sample
PID	Photoionisation detector reading in ppm
R	Hammer bouncing / refusal
SPT	Standard Penetration Test
U	Undisturbed push in sample
UCS	Uniaxial Compressive Strength
U50	Undisturbed tube sample (50 mm diameter)
U75	Undisturbed tube sample (75 mm diameter)
VS	Vane shear test
● (A)	Axial Test
○ (D)	Diametral Test
□	Irregular Lump test

Laboratory Tests

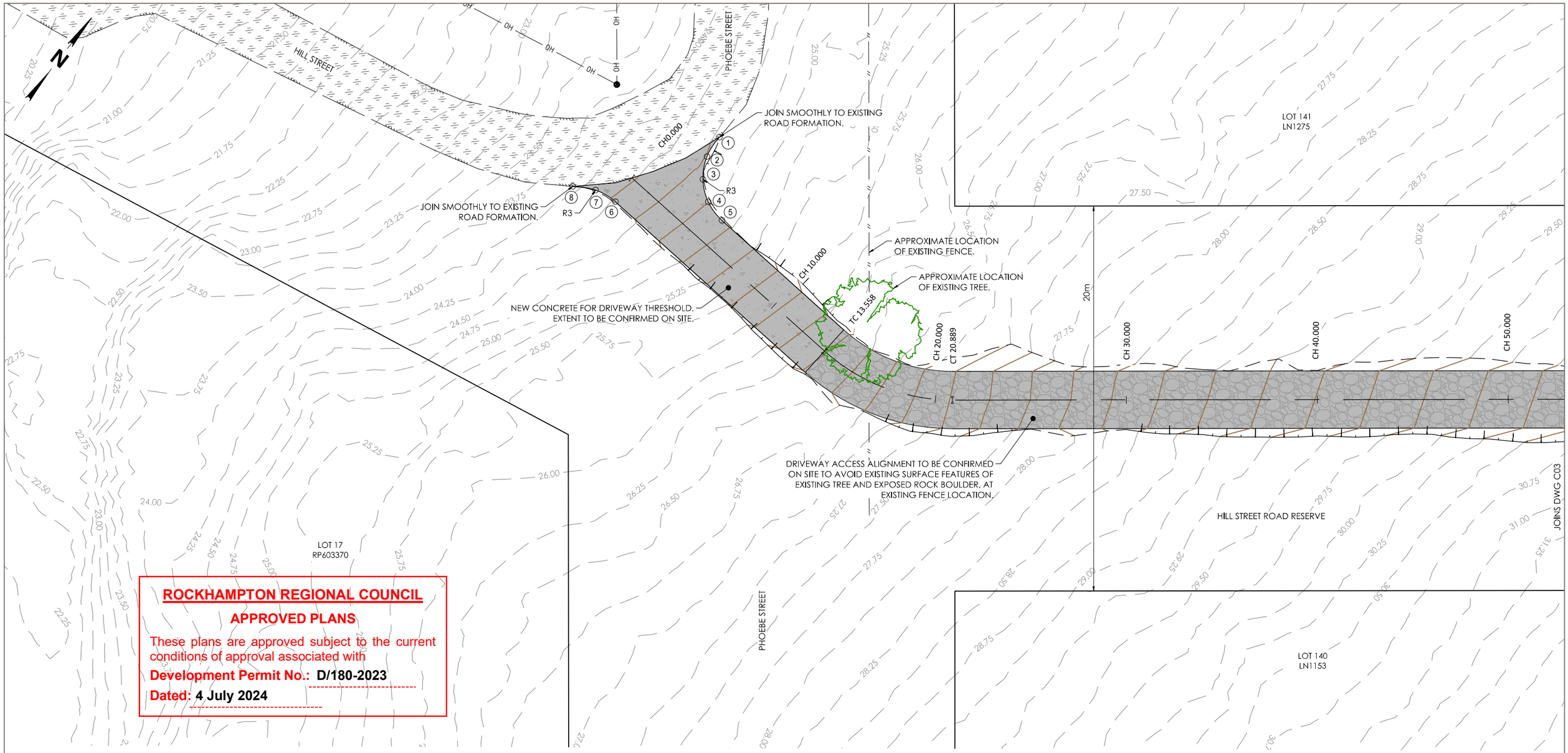
Code	Description
ACM	Asbestos Containing Material
CD	Consolidated Drained
CU	Consolidated Undrained
LL	Liquid Limit
LS	Linear Shrinkage
MC	Moisture Content
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
PBT	Plate Bearing Test
PI	Plasticity Index
PL	Plastic Limit
PSD	Particle Size Distribution
ρ_b	Bulk Density
ρ_p	Particle Density
ρ_d	Dry Density
UU	Undrained Unconsolidated

Backfill / Standpipe Detail

Symbol	Description	Symbol	Description
	Cement seal		Filter pack: sand filter
	Grout backfill		Filter pack: gravel filter
	Blank pipe		Bentonite seal
	Slotted pipe		Cutting – excavated material backfill
	Surface Completion: Monument Above Ground		Surface Completion: Gatic Ground Monument

Completion Details

Type	Description
Collapse	Exploratory hole collapsed before reaching planned depth
Equipment Failure	Boring or excavator equipment operational failure
Flooding	Flooding of excavation
Machine Limit	Limit of machine capability reached
Obstruction	Obstruction preventing further advancement
Possible services	Indication of possible services below
Services present	Services encountered during exploratory hole
Squeezing	Hole squeezing boring equipment
Target Depth	Depth reached as planned
Target Depth Instrumentation Installed	Depth reached as planned instrumentation installed
Target Depth Standpipe Installed	Depth reached as planned open standpipe constructed
Material Refusal	Material preventing further advancement



ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/180-2023

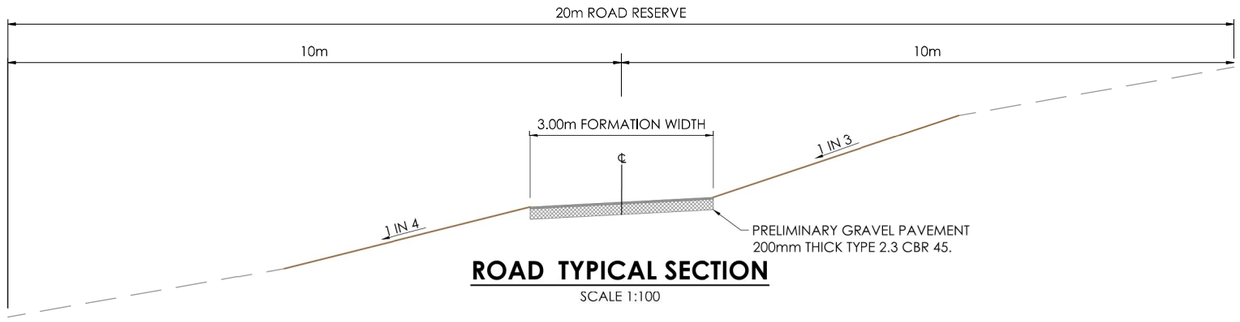
Dated: 4 July 2024

LEGEND

	EXISTING SEAL AREA
	PROPOSED CONCRETE AREA (REFER ARCHITECTS & STRUCTURAL ENGINEERING PLANS FOR FURTHER DETAILS)
	PROPOSED GRAVEL PAVEMENT AREA
	EXISTING LOT BOUNDARY
	EXISTING EDGE OF SEAL
	EXISTING FENCE
	PROPOSED TOE OF BATTER
	PROPOSED TOP OF BATTER
10.00	EXISTING CONTOUR
10.00	PROPOSED CONTOUR

CORNER WIDENING 1

POINT ID	EASTING	NORTHING	RL
1	251335.286	7411666.611	24.546
2	251335.400	7411665.407	24.511
3	251335.968	7411664.341	24.594
4	251336.910	7411663.585	24.746
5	251338.074	7411663.262	24.917
6	251333.080	7411660.594	24.296
7	251331.884	7411660.432	24.103
8	251330.823	7411659.846	23.958



ROAD TYPICAL SECTION

SCALE 1:100

Revision	Date	Revision Description	Drawn	Design	Checked
1	05/04/2024	FOR REVIEW / MCU INFORMATION REQUEST RESPONSE	CJ/ER	CJ	MD

MATTHEW DENNIS R.P.E.Q 24862

APPROVAL FOR ISSUE FOR AND ON BEHALF OF JANES AND STEWART STRUCTURES PTY LTD

0 1.0 4.0m 1:200

A3 SHEET - DO NOT SCALE

Client: **C. BROWN & C. STEPHENS**

Janes and Stewart Structures Pty Ltd
120 William Street | Po Box 1072
Rockhampton 4700
07 4922 1948
janes.and.stewart@jsstructures.com.au
ABN 30 620 233 025

JS2 Janes and Stewart Structural+Civil CONSULTANTS

Project: **18-24 HILL STREET ACCESS DRIVEWAY**

18-24 HILL STREET, LAKES CREEK

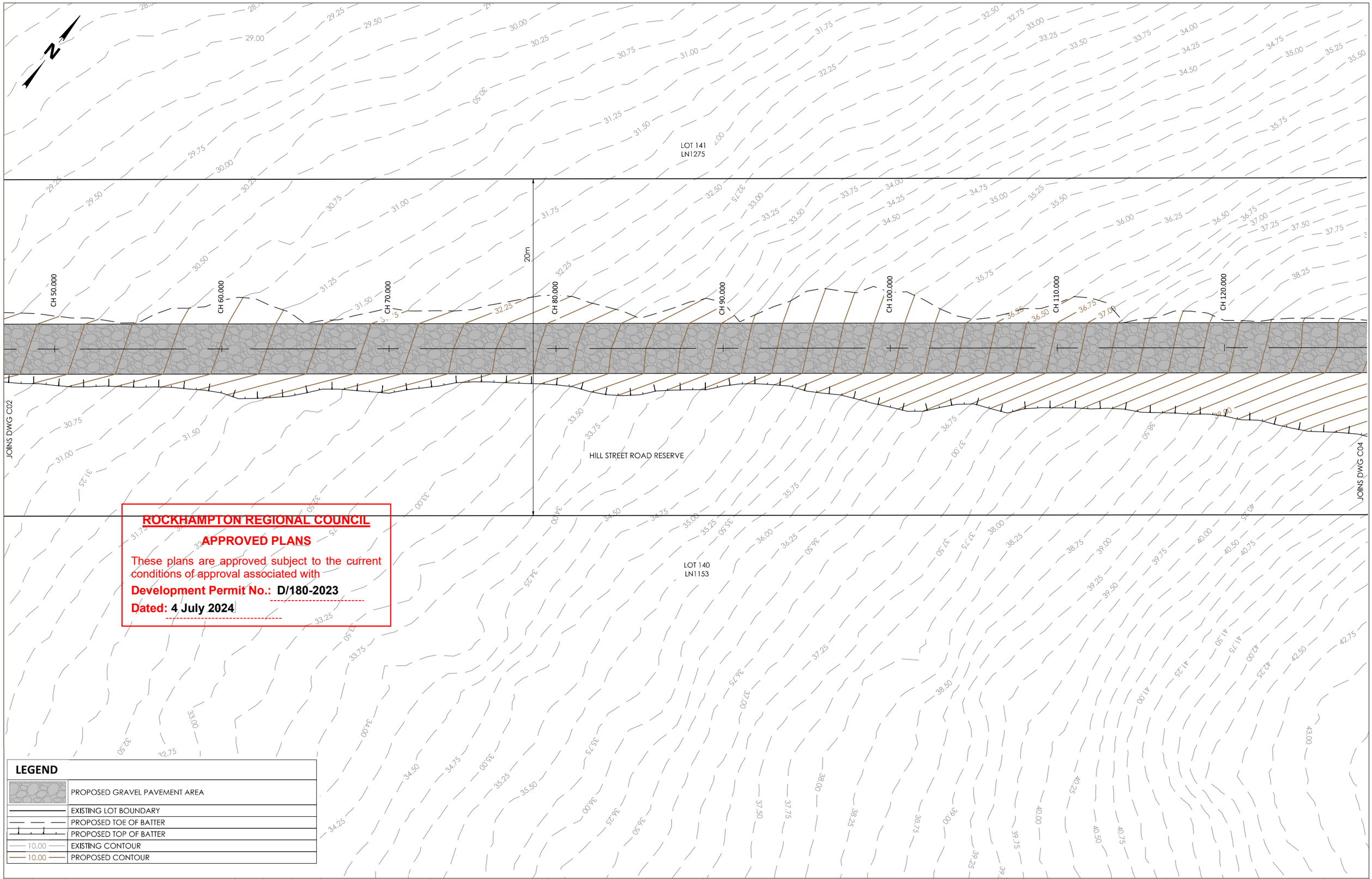
PRELIMINARY
NOT FOR CONSTRUCTION PURPOSES

Title: **DRIVEWAY PLAN 1 OF 3**

Project Number: 24015

Drawing: **C02**

Revision: 1



ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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Development Permit No.: D/180-2023

Dated: 4 July 2024

LEGEND	
	PROPOSED GRAVEL PAVEMENT AREA
	EXISTING LOT BOUNDARY
	PROPOSED TOE OF BATTER
	PROPOSED TOP OF BATTER
10.00	EXISTING CONTOUR
10.00	PROPOSED CONTOUR

Revision	Date	Revision Description	Drawn	Design	Checked
1	05/04/2024	FOR REVIEW / MCU INFORMATION REQUEST RESPONSE	CJ/ER	CJ	MD

MATTHEW DENNIS R.P.E.Q 24862

APPROVAL FOR ISSUE FOR AND ON BEHALF OF JANES AND STEWART STRUCTURES PTY LTD

0 1.0 4.0m 1:200

A3 SHEET - DO NOT SCALE

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07 4922 1948
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ABN 30 620 233 025

Janes and Stewart Structural+Civil CONSULTANTS

Project: **18-24 HILL STREET ACCESS DRIVEWAY**

18-24 HILL STREET, LAKES CREEK

PRELIMINARY
NOT FOR CONSTRUCTION PURPOSES

Title: **DRIVEWAY PLAN 2 OF 3**

Project Number: 24015

Drawing: **C03**

Revision: 1

LOT 141
LN1275

TIMMS STREET

20m

LOT 90
RP603370

HILL STREET

CH 130.000
CH 140.000
CH 150.000
CH 160.000
TC 160.111
CH 170.000
CT 173.199
TC 176.106
CH 180.000
CT 186.591
CH 190.000
CH190.686

PAVEMENT SURFACE TO BE EITHER GRAVEL OR SEALED IN THIS AREA. TO BE CONFIRMED ON SITE.

4.00

8.2m

HILL STREET ROAD RESERVE

JOINS DWG C03

LOT 140
LN1250

LOT 1
SP343657

ROCKHAMPTON REGIONAL COUNCIL

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LEGEND

	PROPOSED GRAVEL PAVEMENT AREA
	PROPOSED GRAVEL OR SEALED PAVEMENT. TO BE CONFIRMED ON SITE.
	EXISTING LOT BOUNDARY
	PROPOSED TOE OF BATTER
	PROPOSED TOP OF BATTER
10.00	EXISTING CONTOUR
10.00	PROPOSED CONTOUR

Revision	Date	Revision Description	Drawn	Design	Checked
1	05/04/2024	FOR REVIEW / MCU INFORMATION REQUEST RESPONSE	CJ/ER	CJ	MD

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Project: 18-24 HILL STREET ACCESS DRIVEWAY

18-24 HILL STREET, LAKES CREEK

PRELIMINARY
NOT FOR CONSTRUCTION PURPOSES

Project Number: 24015

Title: DRIVEWAY PLAN 3 OF 3

Drawing: C04

Revision: 1