

J Rayner and A Russell Information Request Response Rehabilitation Plan



ROCKHAMPTON REGIONAL COUNCIL

APPROVED PLANS

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

Development Permit No.: D/61-2021

Dated: 21 December 2021

STEER
ENVIRONMENTAL CONSULTING

J Rayner and A Russell C/- Dileigh Consulting Engineers –
Rehabilitation Plan - Information Request Response –
Development Application D/124-2016 for operational works
for stormwater, drainage works, earth works and access
works – situated at 17 Greenwood Close, Frenchville QLD
4701 – Described as lot 1 on SP245873, Parish of Archer.

Applicant Name: J Rayner and A Russell C/- Dileigh Consulting Engineers
DA #: D/124-2016
Project #: N/A
EA Application #: N/A
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Report Prepared by: STEER Environmental Consulting



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Project: Development Application D/124-2016 for operational works for stormwater, drainage works, earth works and access works – situated at 17 Greenwood Close, Frenchville QLD 4701 – Described as lot 1 on SP245873, Parish of Archer.

Client: J Rayner and A Russell C/- Dileigh Consulting Engineers.

Document Version	Date	Author	Checked	Approved
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Signed				

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Table of Contents

.....	1
Document Status.....	2
1 Abbreviations.....	4
2 Introduction	5
2.1 Background	5
2.2 Information Request.....	5
Item 5.0 of the IR states (extracted directly from original RRC IR):.....	5
3 SC6.9.6 – Rehabilitation Plans.....	5
4 Methodology.....	7
4.1 Site Location and Biodiversity Mapping.....	7
5 Environmental Values	8
6 Ecosystem Threats	9
7 Ecosystem Condition - Level of Impact.....	9
8 Rehabilitation Goals and Objectives	10
9 Rehabilitation Activities	11
10 Performance Criteria.....	12
11 Management Zones	13
12 Implementation Schedule.....	13
13 Monitoring and Reporting	13
13.1 Land Survey	13
13.2 Vegetation Survey	14
13.3 Reporting	14
13.4 Appendix A – Rehabilitation Success Criteria.....	15

1 Abbreviations

- DA - Development Application
- IR - Information Request
- RRC - Rockhampton Regional Council
- STEER EC - STEER Environmental Consulting

2 Introduction

2.1 Background

J Rayner and A Russell C/- Dileigh Consulting Engineers have submitted to Rockhampton Regional Council (RRC), Development Application (DA) D/124-2016 for operational works for stormwater, drainage works, earth works and access works – situated at 17 Greenwood Close, Frenchville QLD 4701 – Described as lot 1 on SP245873, Parish of Archer. J Rayner and A Russell have previously proceeded with initial development works on the land in question, in preparation for construction of a dwelling on the land.

RRC officers have undertaken a detailed assessment of the application, and on 22 August 2016 have provided J Rayner and A Russell with a written request for further information (IR).

This rehabilitation plan has been generated for the purpose of responding to and addressing the requirements for item 5.0 of the IR.

2.2 Information Request

Item 5.0 of the IR states (extracted directly from original RRC IR):

Council officers have undertaken a detailed assessment of the development application and require you to provide further information to address the following issues:

- 5.0 Unauthorised earthworks has occurred on the adjoining Rockhampton Regional Council land (lot 1 RP618495), an environmental protection area, to the north of the site. Provide a rehabilitation plan for this area with reference to Planning Scheme policy SC6.9.6 – Rehabilitation Plans.**

3 SC6.9.6 – Rehabilitation Plans

This rehabilitation plan has been developed in accordance with Rockhampton regional Council SC6.9.6 – Rehabilitation Plans.

SC6.9.6 – Rehabilitation Plans requires the following:

A rehabilitation plan must be prepared where rehabilitation of a site/s is undertaken. A rehabilitation plan must address the following:

1. Methodology — describe the process used to develop the plan. Include all field surveys, mapping data and literature used. Provide background information and describe the complexity of the project.
2. Environmental values — describe the key environmental values within and adjoining the rehabilitation area. Environmental values may include but not be limited to fauna or flora, vegetation communities, cultural heritage, geological, habitat, environmental corridors or biophysical values.
3. Ecosystem threats — describe the current and future threats to ecosystem and environmental values. Threats may include but not be limited to weed infestation, illegal access, erosion, grazing, inappropriate fire or hydrological regimes, inappropriate access, sedimentation or salinity.
4. Ecosystem condition — identify the condition of ecosystems within the rehabilitation area. The condition assessment will be used to determine management objectives and activities. The current condition should be accompanied by a series of photographs taken from established reference points.
5. Rehabilitation targets — determine appropriate and realistic rehabilitation targets based on assessment of ecosystem threats and condition.
6. Overall rehabilitation goals — provide an overarching statement of the desired outcome(s) for the rehabilitation plan.
7. Rehabilitation objectives — develop objectives to meet rehabilitation goals. The objectives will form the basis of the rehabilitation plan. Objectives can be used to set milestones and determine rehabilitation progression.
8. Rehabilitation activities — identify and describe all activities that are required to meet the objectives. It must be clear what activities will be undertaken during the project and how they will be implemented.
9. Performance criteria — performance criteria must be measurable, specific and relate directly to rehabilitation goals, objectives and activities. The performance criteria may include but not be limited to floristic and structural vegetation parameters, weed abundance, erosion, natural revegetation, recruitment, vegetation condition and fauna populations.
10. Management zones — for clarity it is important to identify management zones based on rehabilitation activities. Define which parts of the rehabilitation area will be retained, regenerated and revegetated. The management zones must be provided in a geographical information system spatial layer or a clearly annotated site map/aerial photograph.
11. Implementation schedule — determine an appropriate implementation schedule stating what activities will be undertaken during development and what activities need to be continued once transferred to Council. To improve the handover process to Council it is necessary to identify at what stage Council will need to continue with rehabilitation activities.
12. Monitoring and reporting — provide a monitoring and reporting schedule that will be implemented over the duration of the project. Work records of all activities including photos of the works must be submitted to Council quarterly for the duration of the project (includes the maintenance period).

4 Methodology

The methodology of the rehabilitation plan follows the steps identified below:

- Identification of rehabilitation site location and surrounding environment.
- Assessment of impact of unapproved earthworks.
- Identification of appropriate rehabilitation targets/goals/objectives to remedy impacts of unapproved earthworks.
- Development and implementation of rehabilitation activities. Surface treatment of rehabilitation area and replanting activities.
- Measurement and monitoring of performance criteria.
- Maintenance of rehabilitation area through to handover.
- Reporting of rehabilitation outcomes.

4.1 Site Location and Biodiversity Mapping

The location of the unauthorised earthworks is on the adjoining Rockhampton Regional Council land (Lot 1 RP618495) to Lot 1 SP245873 (owned by J Rayner and A Russell). The location of the unauthorised earthworks are represented in Figure 1.

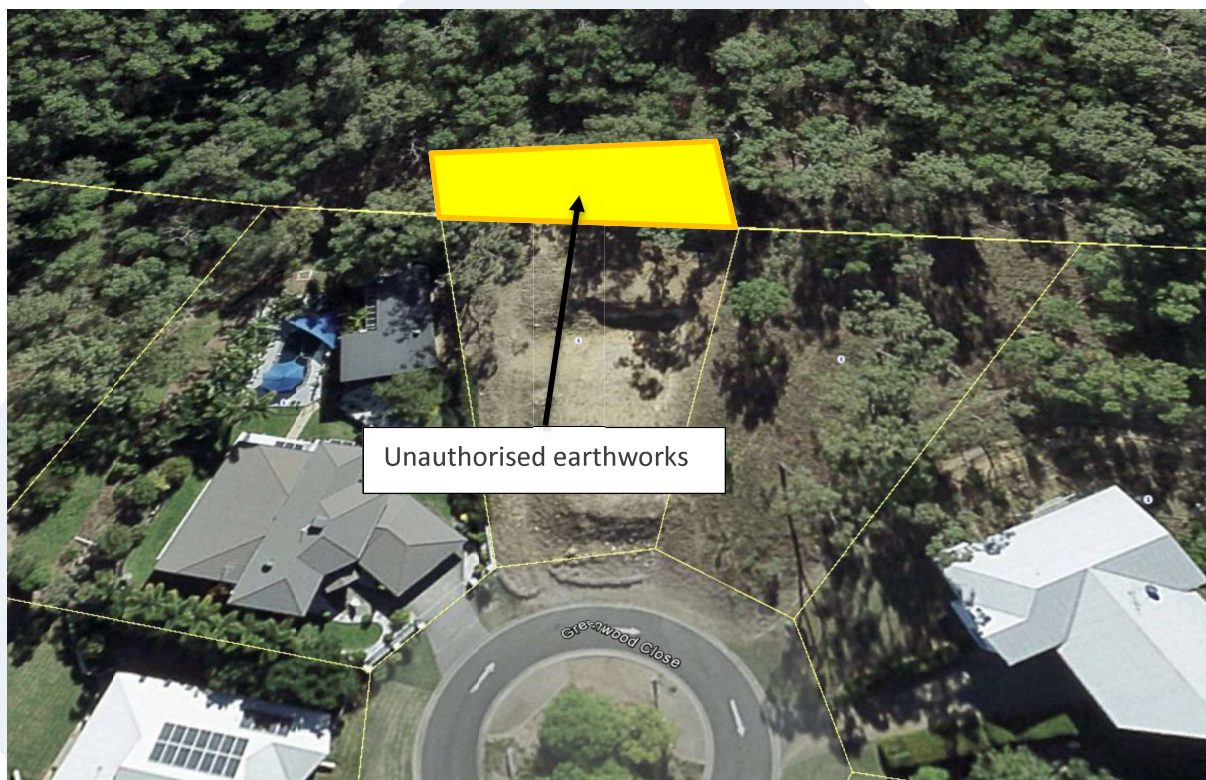


Figure 1. Location of unauthorised earthworks on Lot 1 RP618495, adjacent to Lot 1 SP245873.

RRC states that the site of the unauthorised earthworks has been mapped as having matters of high and general local environmental significance. Following investigation and assessment of the subject site, STEER Environmental Consulting (STEER EC) is in agreement that the site is covered by an area mapped as having matters of high and local environmental significance. The location of the site in relation to biodiversity areas overlay map OM-3A is shown in Figures 1 and 2.

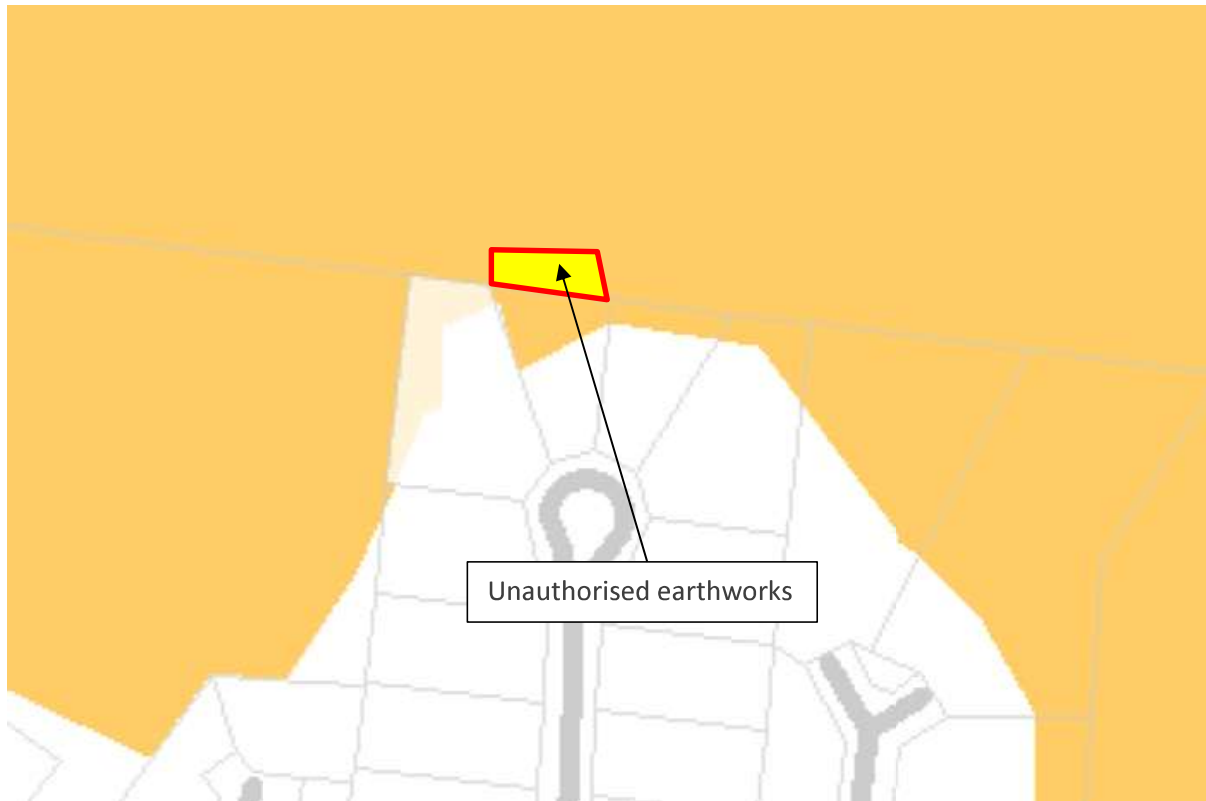


Figure 2. Location of unauthorised earthworks on Lot 1 RP618495, adjacent to Lot 1 SP245873. Large orange overlay indicates area mapped as having matters of state or local (high) environmental significance on biodiversity areas overlay map OM-3A.

5 Environmental Values

The key issue in this instance is presence of the area mapped as having matters of state or local (high) environmental significance. The rehabilitation area sits on the fringe of the area mapped as having matters of state or local (high) environmental significance, and as such serves an important role in providing a buffer between this area and other land uses. The key environmental values that are required to be protected are those values relating to:

- Existing remnant vegetation communities.
- Remnant ecosystems.
- Fauna and flora habitat.

The rehabilitation area should be managed to ensure these environmental values are protected and enhanced.

6 Ecosystem Threats

The primary current and future threats to the receiving environment adjacent to the rehabilitation area relate to:

- Degradation of ecosystem quality.
- Removal of naturally occurring native vegetation species.
- Invasion of non-native pest/weed species.

7 Ecosystem Condition - Level of Impact

The unauthorised earthworks have impacted upon an area of approximately 25m x 10m (250m²), and the unauthorised earthworks are basically an unauthorised open stormwater diversion drain that is approximately 20m long (see Figure 3). It appears that the intent of the open drain structure was to divert overland stormwater flowing from the gradient above Lot 1 SP245873, into a nearby stormwater gully. The open stormwater diversion drain is basically constructed as a simple “V” cut across the gradient of the existing slope, and it is approximately 1-2m wide. There is no evidence of the drain being stabilised in any manner.

In addition to the actual drain, there has been associated impact on either side of the drain, with disturbance occurring out to approximately 1m from the drain

Disturbance to vegetation is difficult to accurately assess, as the area is on the fringe of the area having matters of high and local environmental significance. Naturally occurring remnant native vegetation has generally been thinned in this area, and invasive pest species such as *Lantana camarus* are also in abundance. It is likely that both native and pest species have been disturbed by the unapproved earthworks.

An investigation and vegetation survey of the immediate area around the unapproved earthworks identified that the drain has been placed in such a manner that some native species such as *Macrozamia miquelii* (see Figure 3) have been left undamaged immediately adjacent to the unapproved earthworks. Although it appears that vegetation may have been protected on purpose during the construction of the unapproved earthworks, this cannot be verified.

The impacts upon the receiving environment that will need to be managed by rehabilitation are as follows:

- Construction of an unstabilised drain of approximately 20m length.
- Removal of at least one mature naturally occurring native tree (appears that a maximum of 2 trees may have been removed).
- Removal of approximately 1-2 *Macrozamia miquelii* shrubs.
- Likely removal of 2-3 *Acacia* species.



Figure 3. Unauthorised earthworks on Lot 1 RP4444. Open drain structure. Note Macrozamia miquelii left undamaged at left of drain, and Lantana camara at bottom right of image.

8 Rehabilitation Goals and Objectives

Following assessment of the surrounding receiving environment and the level of impact within the rehabilitation, the following rehabilitation goals have been identified.

The rehabilitation plan should achieve the following goals, so that the rehabilitated area will be:

- Safe to humans and wildlife
- Non-polluting
- Stable
- Able to sustain and support the existing ecosystems identified in the area mapped as having matters of state or local (high) environmental significance.

Objectives for the rehabilitation plan are detailed:

- Ensure the rehabilitation area achieves a safe, stable landform/grade.
- Manage and mitigate sediment discharge from the rehabilitation area through surface treatment, vegetation planting, sediment controls/barriers.

- Successfully introduce native vegetation into the rehabilitation area that will protect and preserve the adjoining ecosystem.

9 Rehabilitation Activities

Rehabilitation activities for the proposed rehabilitation area are detailed in Table 1.

Table 1. Rehabilitation activities.

Rehabilitation Activity	Detail
Stabilisation of unauthorised drain.	The unauthorised drain should be either stabilised through “rock armouring” or similar treatment, or removed. This process must be conducted to appropriate engineering standards and the satisfaction of RRC. Care should be taken during this process to not cause further damage to remaining vegetation.
Installation of sediment control measures.	Sediment management/mitigation structures such as rubble traps and geotextile sediment barriers should be installed to capture liberated sediment from the rehabilitation area.
Pest/weed removal	Prior to introduction of the new rehabilitation vegetation, pest/weed removal and/or treatment should be undertaken. This should primarily focus on removal of <i>Lantana camara</i> .
Planting of tubestock seedlings.	3 x <i>Eucalyptus crebra</i> and 3 x <i>Acacia</i> species (seeded from nearby naturally occurring <i>Acacia</i>) and 3 x <i>Macrozamia miquelii</i> (if reasonably available) should be replanted in the rehabilitation area in random placements, reasonably spaced from each other..
Application of mulch.	Clean, weed free mulch sourced from native vegetation should be applied around each of the replanted plants. Exposed areas of earth in the rehabilitation should be treated with mulch.
Spreading of fallen timber.	The rehabilitation area contains a small pile of dead timber that may be from the removal of vegetation from the area (see Figure 4). This timber should be carefully spread randomly across the rehabilitation area. Care needs to be taken not to damage newly introduced plants or existing remaining vegetation during this process.
Ongoing management	Irrigation and pest/weed management should be undertaken on an ongoing basis until rehabilitation success criteria have been met.
Handover of rehabilitation area	Handover of rehabilitation area to RRC after 12 months, or upon achievement of success criteria.



Figure 4. Fallen timber pile in/adjoining rehabilitation area.

10 Performance Criteria

As this rehabilitation project is relatively small, performance criteria can be quite strict. Whereas a large scale rehabilitation project may have targets of approximately 80% survival rate for plantings, in this type small-scale project much tighter expectations can required, such as 100% survival rate. With this in mind, the following performance criteria have been placed on this rehabilitation area:

- 100% survival rate of plantings after 12 months.
- No evidence of erosion or sediment discharge from the rehabilitation area after 12 months.
- No evidence of *Lantana camara* in the rehabilitation area after 12 months.

11 Management Zones

Due to the very small physical area of this rehabilitation plan, no management zones are proposed.

12 Implementation Schedule

It is envisaged that the rehabilitation plan will be implemented within two weeks of acceptance by RRC. If success criteria are met, the rehabilitation plan will have a life of 12 months, at which time the rehabilitation area will be handed over to RRC. It is expected that ongoing management of the area at this time will only involve monitoring for erosion following significant storm events.

13 Monitoring and Reporting

Monitoring rehabilitation success is an essential part of any rehabilitation program. Monitoring will consist of a Land Survey and Vegetation Survey to be conducted every 3 months. Each of these are discussed below.

13.1 Land Survey

Rehabilitation areas will be inspected for erosion rills, erosion gullies and topsoil depth to determine their erosion rating (see Table 2). Three inspection locations will be determined for the rehabilitation area.

Table 2. Erosion rating system.

Erosion Rating	Average Depth of Rills	Topsoil Depth	General Observations
0	< 10cm	> 90% of original depth	Generally little erosion. The majority of rills are only <10 cm depth.
1	< 20cm	>70% of original depth	Minimal instances of sheet-wash and gully erosion.
2	< 50cm	>50% of original depth	Minimal-moderate erosion occurring but limited to localised areas.
3	> 50cm	>40% of original depth	Moderate erosion occurring.
4	Any > 80cm depth	>30% of original depth	Heavy erosion occurring.

A general inspection of the rehabilitation area for rills, gullies and washouts will be undertaken in addition to inspection locations. This can be accomplished by a walkover of the site. Where a washout is encountered, an estimate will be made of its area. If multiple washouts are encountered, an estimate of the percentage of the rehabilitation area disturbed by washouts will then be made (i.e. 5%). Surface inspection following significant rain events will also be undertaken in order to identify erosion events and allow for remedial action to be taken.

13.2 Vegetation Survey

The rehabilitation area will be surveyed as follows:

- Trees/shrubs identified to a species level, approximated for height, measured for diameter and counted for species abundance.

This information will be required to assess the Completion Criteria (see Appendix A). Any signs of adverse health conditions will be noted. Fauna use of the rehabilitation areas will also be noted. All vegetation surveys will be completed in accordance with the Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland (or appropriate similar reference documents).

13.3 Reporting

Reporting of rehabilitation progress will be provided to RRC every 6 months during the life of the rehabilitation management plan. Therefore it is intended that reporting will consist of a 6-month report and then a final report at 12 months prior to handover to RRC.

13.4 Appendix A – Rehabilitation Success Criteria

Rehabilitation Goal	Mine Site Rehabilitation Objective	Rehabilitation Indicators	Rehabilitation Completion Criteria	Evidence of Compliance to be Supplied with Completion Criteria
Safe to humans and wildlife	Rehabilitation area floor remains safe for humans and animals now and in the future.	Erosion ratings are suitable for long term safety.	Erosion ratings (as adopted by the erosion rating system) are less than or equal to 2 (as defined in Table 2).	Evidenced in inspections of rehabilitation.
Non-Polluting	Erosion controlled to prevent sediment from entering waterways.	Erosion ratings represent sufficient soil stability to indicate a safe level of sediment loss.	Certification that erosion ratings represent sufficient soil stability to indicate a safe level of sediment loss.	Certification that erosion ratings represent sufficient soil stability to indicate a safe level of sediment loss.
Stable	Topsoil is stable and resistant to erosion.	Erosion rates.	Erosion rates measured or modelled using suitable modelling methods such as RUSLE and are no higher than 50% that of the surrounding environment.	Certification report comparing erosion losses (measured or modelled) from the rehabilitation site with surrounding environment.
		Erosion indicators such as rills, gullies and washouts are minimal.		
	Functional erosion structures.	Erosion structures are fit for purpose.	Inspection and certification of erosion and water control structures such as rubble traps, geofabric fencing.	Certification from a suitably qualified person showing structures are fit for purpose.
	Vegetation cover.	Vegetation cover, percentage and type.	100% survival rate for replanted vegetation.	On ground rehabilitation inspection, outlined in final rehabilitation report.

Sustain and support existing ecosystems.	Vegetation is suitable for the land use.	Physical parameters of the soil.	Erosion ratings (as adopted by the erosion rating system) are less than or equal to 2 (as defined in Table 2)	On ground rehabilitation inspection, outlined in final rehabilitation report.
		Vegetation diversity.	Weed prevalence and occurrence is no greater than pre-rehabilitation	On ground rehabilitation inspection, outlined in final rehabilitation report.
			An appropriate shrub density.	On ground rehabilitation inspection, outlined in final rehabilitation report.

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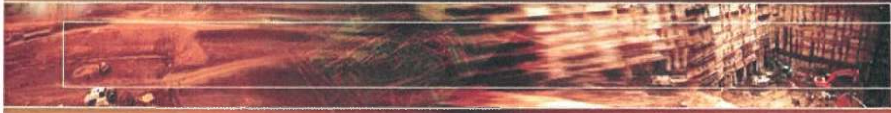
geotechnical • geo-environmental • groundwater



**GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENCE
17 GREENWOOD CLOSE, FRENCHVILLE**

Prepared for Angela Russell
Project No. R15-182A, 21 December 2015

practical engineering



*Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015*

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TABLE OF CONTENTS

SECTION 1 - INTRODUCTION		2
1.1	Project.....	2
1.2	Proposed Scope of Work.....	2
1.3	Commission	2
SECTION 2 - THE SITE		3
2.1	Site Description	3
2.2	Geology.....	5
SECTION 3 - FIELDWORK		6
3.1	Excavation and Sampling Methods.....	6
3.2	Test Pit Locations and Supervision.....	6
SECTION 4 - INVESTIGATION RESULTS		7
4.1	Reports	7
4.2	Subsurface Conditions	7
4.3	Groundwater	7
4.4	Laboratory Testing	7
	4.4.1 Particle Size Distribution	7
	4.4.2 Plasticity	7
	4.4.3 Rock Strength.....	8
SECTION 5 - GEOTECHNICAL DESIGN DISCUSSION		9
5.1	Ground Model	9
5.2	Existing Fill.....	9
5.3	Earthworks	10
	5.3.1 Excavatability.....	10
	5.3.1.1 Bulk and Confined Excavation.....	10
	5.3.2 Use of Cut for Fill.....	10
	5.3.3 Adjacent Services and Structures.....	10
	5.3.4 Compaction.....	11
	5.3.5 Traffickability.....	11
	5.3.6 Site Drainage	11
5.4	Reactive Soil Movements and Site Classification.....	11
5.5	Slope Stability Assessment	13
	5.5.1 Analysis Method.....	13
	5.5.2 Interpretation of Calculated Factor of Safety Values.....	14
	5.5.3 Analysis Results.....	14
	5.5.3.1 Existing Fill.....	14
	5.5.3.2 Remediated Fill	15
5.6	Batter Slopes.....	17
5.7	Retaining Wall Pressures	17
5.8	Foundations	18
5.9	On-Ground Slab and Pavement Properties.....	18
	5.9.1 Insitu Estimates of CBR	18
	5.9.2 Soaked Subgrade Properties	19

Important Information about your Geotechnical Engineering Report (2 pages)



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Proposed Residence
17 Greenwood Close Frenchville
Project No.: R15-182A
21 December 2015

TABLES:

Table 1: Summary of Reported Particle Size Distribution Test Results	7
Table 2: Summary of Reported Plasticity Test Results	8
Table 3: Summary of Reported Rock Strength Test Results	8
Table 4: Preliminary Maximum Unsurcharged Cut Batter Slopes for 'Dry' Slopes 3-4m High	17
Table 5: Retaining Wall Design Parameters	17
Table 6: Working Bearing Pressure for Strip/Pad Footings and 'Short' Bored Piles	18
Table 7: Subgrade Design Values	19

FIGURES:

Figure 1: 'Long term' soil strength parameters and stratigraphy	14
Figure 2: 'Long term' analysis for existing 'lower platform' fill profile	15
Figure 3: 'Long term' analysis for existing 'upper platform' fill profile	15
Figure 4: 'Long term' soil strength parameters and stratigraphy for 1V:2H controlled fill batter	16
Figure 5: 'Long term' analysis for existing 'lower platform' for 1V:2H controlled fill batter profile	16
Figure 6: 'Long term' analysis for existing 'upper platform' for 1V:2H controlled fill batter profile	16
Figure 7: Correlation of DCP Results and Insitu CBR	19

ATTACHMENTS:

Drawing No. 1	Locality Plan and Test Pit Locations
Appendix A	Test Pit Report Sheets with Explanatory Notes
Appendix B	Laboratory Test Report Sheets

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

SECTION 1 - INTRODUCTION

1.1 Project

It is understood that it is proposed to construct a double storey residential dwelling at 17 Greenwood Close, Frenchville. Existing earthworks had already been completed on the allotment comprising significant cut and fill to construct two reasonably level building platforms.

1.2 Proposed Scope of Work

For the scope of the proposed development and the anticipated ground conditions, it was proposed that geotechnical investigation comprise the excavation and sampling of four test pits as well as inspection and mapping of observable features at the site.

Using the results of the fieldwork and laboratory testing outcomes, it was proposed that a slope stability assessment report be produced to provide geotechnical information on each of the following topics:

- subsurface conditions;
- slope stability assessment;
- earthworks and site preparation;
- site classification to AS2870;
- retaining wall pressures;
- temporary and permanent batter slopes;
- effect of footings on slope stability; and
- anticipated construction aspects.

1.3 Commission

Based on the proposed development, the anticipated subsurface conditions and the proposed scope of investigation work, a fee to undertake the geotechnical investigation was presented in a proposal of 1 October 2015. Butler Partners (Regional) Pty Ltd (Butler Partners) was subsequently commissioned by Angela Russell to carry out the geotechnical investigation as proposed.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

SECTION 2 - THE SITE

2.1 Site Description

The site is described as Lot 1 on SP245873, and is located at the end of Greenwood Close, with an existing residential development on the adjoining lot to the west and vacant land to the east. An existing boulder retaining wall approximately 1.0m to 1.5m high was observed in the adjacent allotment along the western boundary. At the time of the investigation, the site had recently (understood to be within the last six to nine months) undergone significant earthworks including excavation and filling to create two reasonably level platforms in the area of proposed development. Subsurface conditions exposed in the approximately 3m to 4m high cut faces comprise extremely to distinctly weathered siltstone.

The joints observed in the exposed cut were relatively closely spaced (20mm to 300mm) and were rough and irregular. The dip angle in the distinctly weathered siltstone was estimated to be approximately 70° to 80° in a south to south west direction, across the rock face. The slope batters generally comprise sparse grass cover, with the building platforms mostly clear of vegetation. At the time of the fieldwork, there was some evidence of movement/creep observed through tension cracking near the crest of the uncontrolled fill at the front of the allotment.

Ground surface levels generally fall in a south-westerly direction with the former 'natural' slope (pre-earthworks) estimated to be in the order of 15 to 17 degrees with an overall difference in elevation across the site of approximately 15m. Four general views of the site at the time of investigation are given in Photographs 1 to 4.



Photograph 1: View from lower platform toward the rear of the allotment

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015



Photograph 2: View of cut face behind the upper platform



Photograph 3: View of the fill batter from Greenwood Close

*Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015*



Photograph 4: View along western boundary toward Greenwood Close

2.2 Geology

Reference to the Geological Survey of Queensland's 1:100 000 geological series Rockhampton sheet indicates that the site is mapped as the Lakes Creek Formation of the Berserker Group (comprising siltstone and lithic sandstone).

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

SECTION 3 - FIELDWORK

3.1 Excavation and Sampling Methods

Four test pits (Test Pits 1 to 4) were excavated and sampled to between 1.8m and 2.8m depth, with a track mounted Hitachi hydraulic excavator (20-tonne) equipped with a 450mm bucket. Strata identification was based on the inspection of cuttings recovered from the bucket, supplemented by the inspection of the test pit side walls and disturbed samples.

Dynamic cone penetrometer (DCP) tests were carried out adjacent to each test pit. DCP tests at Test Pits 1, 3 and 4 refused on rock 'floaters' in the fill profile. On completion of excavation all test pits were backfilled with spoil and surface compacted.

3.2 Test Pit Locations and Supervision

Test pit locations were set out by measurement from existing site features and their locations are indicated approximately on the attached Drawing No. 1. The ground surface level at each test pit location was determined by interpolation from ground surface contours provided on Finch Surveying Consultants' Drawing No. 5440DTM dated 11 August 2015.

An experienced geotechnical engineer set out the test locations, logged the stratigraphy encountered in the test pits, directed the insitu sampling and testing program and supervised the fieldwork.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

SECTION 4 - INVESTIGATION RESULTS

4.1 Reports

The subsurface conditions encountered in the test pits are given on Test Pit Report sheets included in Appendix A, using classification and descriptive terms defined in accompanying notes. Laboratory test report sheets are included in Appendix B.

4.2 Subsurface Conditions

For a description of the stratigraphy encountered in the test pits, the Test Pit Report sheets should be consulted. However, in broad summary, the subsurface conditions generally comprised sandy gravel fill varying in depths from 0.3m to 2.0m, underlain by 'natural' gravelly clay (in Test Pits 1 and 3), which in turn was underlain by low to high strength siltstone.

4.3 Groundwater

No free groundwater was encountered during test pit excavation, however it should be noted that groundwater levels can vary seasonally and with prevailing weather (and vegetation) conditions. If construction is to be undertaken at a significant time following this investigation and/or following significant 'wet' weather, it would be prudent to confirm groundwater levels prior to construction.

4.4 Laboratory Testing

Selected soil and rock samples recovered from the test pits were submitted to geotechnical testing laboratories for assessment of particle size distribution, plasticity and rock strength. The test results are summarised and discussed in the following sections.

4.4.1 Particle Size Distribution

Two selected samples of soil recovered from Test Pits 1 and 3 were tested for measurement of particle size distribution using wash sieve grading techniques and the reported results are summarised in Table 1.

Table 1: Summary of Reported Particle Size Distribution Test Results

Test Pit	Depth (m)	Sample Description	Sample Moisture Content (%)	Gravel Fraction ⁽¹⁾ (%)	Sand Fraction ⁽²⁾ (%)	Silt and Clay Fraction ⁽³⁾ (%)
1	0.5 – 0.8	Sandy Gravel (Fill)	7.9	72	18	10
3	1.5 – 1.7	Gravelly Clay	17.6	30	14	56

⁽¹⁾ Particle size <60mm, >2mm; ⁽²⁾ Particle size (approximately) <2mm, >0.075mm; ⁽³⁾ Particle size (approximately) <0.075mm

4.4.2 Plasticity

Two samples of soil were tested for measurement of plasticity using Atterberg limit and linear shrinkage test methods. The reported test results are summarised in Table 2, together with the soil classification and indicate that the samples tested were medium plasticity.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

Table 2: Summary of Reported Plasticity Test Results

Test Pit	Depth (m)	Sample Description	Sample Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Classification*
1	0.5 – 0.8	Sandy Gravel (Fill)	7.9	27	20	7	6.5	GC
3	1.5 – 1.7	Gravelly Clay	17.6	33	21	12	11.5	CI

* Australian Standard AS1726-1993, Geotechnical Site Investigation

4.4.3 Rock Strength

Selected rock samples, recovered from Test Pit 3, were tested for measurement of rock strength, using Point Load Test [$I_s(50)$] methods and the test results are tabulated below and are also given on the relevant Test Pit Report sheets.

Table 3: Summary of Reported Rock Strength Test Results

Test Pit	Depth (m)	Sample Description	Point Load Strength ($I_s(50)$)	Rock Strength Category*
3	2.13 – 2.5	DW Siltstone	0.30	Low
			0.49	Medium
			0.75	Medium
			0.34	Medium
			2.1	High
			2.7	High

* Australian Standard AS1726-1993, Geotechnical site investigations

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

SECTION 5 - GEOTECHNICAL DESIGN DISCUSSION

5.1 **Ground Model**

The results of the investigation indicate that the subsurface conditions at the test pit locations comprised sandy gravel fill overlying gravelly clay (Test Pits 1 and 3), which in turn was underlain by low to high siltstone.

In these ground conditions geotechnical design will need to consider (at least) the following:

- subsurface conditions;
- condition of the existing fill;
- rock excavatability;
- slope stability;
- temporary cut batter stability;
- classification of the site in accordance with AS2870;
- retaining wall pressures;
- suitable foundation types;
- appropriate founding depths and bearing pressures;
- variations in footing founding depths and founding conditions across the site; and
- possible construction difficulties.

Discussion of geotechnical design parameters, as well as design and construction recommendations and suggestions are detailed in the following sections.

5.2 **Existing Fill**

It is not known whether the existing fill material encountered in the test pits was 'controlled' on placement (i.e. it is not known whether the fill was placed and uniformly compacted to an appropriate engineering specification). Supporting documentation should be obtained and checked to confirm that the fill has been placed in a controlled manner to a specification that is appropriate for the proposed development. If documentation does not exist (or the specification used for filling is not appropriate for the proposed development) then it is suggested that the existing fill be assumed to be uncontrolled.

If the fill cannot be shown to be controlled, then consideration should be given to the potential for adverse variation to exist in both the composition and degree of compaction of the fill. The presence of voids within uncontrolled fill as well as potential soft/loose zones or inclusions of deleterious materials and 'oversize' may lead to potentially significant future total and differential settlements, occurring possibly over relatively short distances and to areas of slope instability.

To minimise the risk of potentially adverse settlement or instability within the fill occurring, it is recommended that all uncontrolled fill be removed and replaced/recompacted with controlled fill of low reactivity 'keyed in' to the weathered rock.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

5.3 Earthworks

5.3.1 Excavatability

5.3.1.1 Bulk and Confined Excavation

Based on the results of the fieldwork, excavation for building foundations would be expected to encounter some surface fill and soils, overlying weathered rock. The rock encountered in the test pits ranged from low to high strength, and it is considered possible that zones of 'stronger' and/or 'less jointed' rock may also exist within the proposed excavation depth.

Excavation of soil and extremely low to low strength rock should be readily achieved in bulk excavation using a large hydraulic excavator. Bulk excavation of medium to high strength rock will require relatively major use of 'rock breaker' equipment unless joint spacing is moderately close (less than 0.3m). In high strength (or stronger) rock (with relatively few discontinuities), rock breaker excavation methods only would be expected to be very slow and potentially severely damaging to equipment.

In confined (trench, footing, etc.) excavations in medium to high strength rock, heavy rock breaker equipment and slow excavation rates should be allowed for. Due to the inherent jointing and bedding planes contained in the rock, over break should be allowed for in pricing.

Consideration should be given in selecting suitable excavation methods/plant to the potential of encountering 'harder' rock below test pit location termination depths, and at 'shallower' depth intermediate to the test pit locations.

All confined excavations should be fully supported or battered/benched to a stable angle to ensure personnel safety.

5.3.2 Use of Cut for Fill

Organic soils, 'over-wet' soils, 'silts' and soils containing deleterious matter or oversize particles (>75mm size) should be excluded from use as structural fill.

The soils and low to medium strength rock should generally be suitable for re-use as 'controlled fill' provided that the excavated material is 'processed' so that it is well mixed and all 'oversize', organic/deleterious and any 'over wet' materials are excluded and expansive movement can be tolerated or designed for. All medium to high strength rock would be suitable for reuse as fill, but crushing and screening may be required to control particle size for 'hard' rock. The existing fill material encountered in the test pits appears suitable for reuse, but will require inspection and assessment for confirmation.

5.3.3 Adjacent Services and Structures

Care will be required to ensure that the effect of site earthworks does not impact adversely upon adjacent services and structures etc. (e.g. potential settlements induced by heavy rock breaking/blasting etc.). It is recommended that dilapidation surveys of adjacent structures and services etc. be undertaken prior to construction commencing on site where it is anticipated that rock breaking may be required.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

5.3.4 Compaction

All fill required to support settlement sensitive structures/features should be 'controlled', placed in layers not greater than 250mm (loose thickness) and be uniformly compacted to a minimum dry density ratio of 98% (Standard compaction).

Reactive clay material should be avoided for use as fill, if possible. However if/where any reactive material is to be used as fill, it should be placed and maintained at a moisture content of not drier than Standard optimum moisture content in order to reduce potential shrink-swell movements. It should be noted that over-compacting reactive clay fill (particularly at a moisture content below optimum) should be avoided as potentially significant expansion could occur on 'wetting up'. Due allowance must be made in design and detailing for reactive fill movements if reactive fill is used.

To assist with achievement of adequate control of fill placement, 'Level 1' geotechnical supervision and testing as set out in Section 8 of AS3798 – 2007 *Guidelines on earthworks for commercial and residential developments* is recommended.

5.3.5 Traffickability

Traffickability for plant will be adversely affected by wet weather and trafficking 'wet' subgrade during and following wet weather would be expected to potentially result in disturbance to the subgrade, with consequent loss of subgrade strength. Consideration should be given to the placement of a coarse granular working platform to those areas where traffickability is critical, particularly the existing driveway access. The required layer thickness will depend on the type of plant proposed to traffic the site, however, a layer thickness of not less than 150mm is anticipated for 'light' equipment.

5.3.6 Site Drainage

During construction, the site should be graded such that water is readily shed and does not collect and pond indiscriminately over the site, otherwise softening of the exposed subgrade will occur.

5.4 Reactive Soil Movements and Site Classification

As the site is underlain in part by fill, the site would be classified as 'Class P' (problem site) in accordance with Australian Standard AS2870 - 2011 *Residential slabs and footings*. However, if the fill is 'controlled' and has been placed to an appropriate engineering specification, AS2870 allows the site to be reclassified based on the assessment of reactive ground surface movement.

The magnitude of potential reactive soil movements has been estimated using the following equation (from Australian Standard AS2870 - 2011 *Residential slabs and footings*), and parameters for the site selected based on recommendations in AS2870, results of the laboratory testing and published information:

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

$$y_s = \frac{1}{100} \sum_{n=1}^N (\alpha I_{ss} \overline{\Delta u} \cdot h)_n$$

where y_s is the characteristic surface movement, in millimetres;
 α is the lateral restraint factor;
 I_{ss} is the shrink-swell index (taken as approximately 0.5% per pF to 1% per pF for the clayey gravel fill, based on the results of past experience and the laboratory test results);
 $\overline{\Delta u}$ is the soil suction change averaged over the thickness of the layer under consideration (estimated as 1.2pF at the ground surface in Rockhampton, reducing linearly to zero at the maximum depth of suction change);
 h is the thickness of layer under consideration, in millimetres; and
 N is the number of soil/fill layers within the depth of suction change (H_s – taken as 2.3m in Rockhampton).

Characteristic surface movements for the ground conditions encountered in the test pits (assuming all surface fill is less than five years old and topsoil is removed) have been calculated to be between 30mm and 35mm using the parameters and method discussed above, assuming normal seasonal moisture/suction variations (i.e. no influence from trees etc.). Based on the magnitude of the calculated characteristic surface movement, the site would be reclassified as 'Class M' (Moderately Reactive); if all uncontrolled fill is removed.

If 'reactive' fill is used to fill the site, then the calculated characteristic surface movement values given above may increase significantly. It should be carefully noted that the calculated surface movement values given above do not include any allowance for 'abnormal' influences such as vegetation effects or poor drainage. It is strongly recommended that the estimated characteristic surface movement values given above be recalculated once site earthworks are completed.

It is considered that the following issues must be carefully considered in design:

- Where controlled fill is placed over a natural soil subgrade, higher characteristic movements than those nominated above could potentially occur (as AS2870 indicates that the ratio of lateral restrained to unrestrained movement will increase), particularly if fill reactivity is significantly greater than that of the existing site soils. If filling of the site is proposed, a revised site classification should be considered taking into account the actual reactivity, compaction and depth of fill used.
- Vegetation has the potential to significantly increase soil suction change magnitude and depth ($\overline{\Delta u}$ and H_s respectively in the equation above), which leads to a significant increase in potential reactive soil movements adjacent to existing (or proposed) tree locations. If trees are to be planted 'close' to the building in the future (or are to remain close to the building sites), consideration should be given to constructing root barriers around the trees, and footing design must allow for potentially (significantly) higher reactive soil movements than are nominated above. In addition, if trees and large shrubs are removed less than approximately one year (or longer in drought) from the time of building construction, then significantly greater characteristic surface movements than are nominated above could be expected.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

- Abnormal subgrade moisture variations could potentially result in adverse, non-uniform reactive movements that are significantly greater than those nominated above for 'normal' seasonal moisture changes. The risk of 'abnormal' movement occurring could be reduced by ensuring over-watering of gardens, ponding water, broken/leaking pipes, planting trees/shrubs 'close' to buildings, etc. do not occur.

Good 'engineering practices' should be adopted in project design and detailing if control of reactive ground movement is desired. In particular, the following are recommended:

- trees/shrubs should not be planted or be allowed to remain closer than their mature height to movement sensitive features (unless significantly greater reactive movements than those estimated above are designed for);
- subgrade moisture should not be allowed to change during or following construction;
- site grades should be designed to readily shed water and prevent ponding around footings and other movement sensitive areas; and
- services should be designed to be flexible, to prevent any leakage and to rapidly remove any leakage should it occur.

5.5 Slope Stability Assessment

There was no current observable evidence of instability in the cut areas and natural profile. It is considered that the existing fill may have been placed on sloping ground and not 'keyed in', which has led to tension cracking observed near the crest of the fill embankment. Without remediation it is anticipated that the fill embankment will continue to creep and potentially undergo failure during major rain events. As a result, it is recommended to either remove the existing fill and replace with suitable material as described in Section 5.3, or design and construct an engineered retaining wall system to retain the existing fill material and prevent further movement. In both cases, all aspects of building design and construction must be taken into consideration to ensure the stability of the site does not become compromised, particularly during wet weather events.

It should also be noted that all design and construction works must take into account the potential effects to neighbouring properties. An existing boulder retaining wall approximately 1.0m to 1.5m high was observed in the neighbouring property along the western boundary.

For a properly designed and constructed development at the site founded in the underlying weathered rock, the risk of instability occurring and affecting the development is considered to be '**moderate**' using the system described in the guidelines produced by the Australian Geomechanics Society. A slope stability analysis has been carried out to assess 'long term' stability of the fill embankment that currently exists at the site.

5.5.1 Analysis Method

Slope stability analysis has been undertaken using the commercially available geotechnical analysis software Slope/W, which uses limit equilibrium methods to assess the Factor of Safety (FOS) against slope instability. The analysis carried out has adopted the following:

- Slope geometry based on information determined from Finch Surveying Consultants Drawing No. 5440DTM.
- Subsurface profiles based on the results of the investigation.
- Mohr-Coulomb strength model for soils.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

- 'Long term' analyses carried out using effective stress soil strength parameters.

5.5.2 Interpretation of Calculated Factor of Safety Values

In the 'long term' it is typical to adopt a minimum calculated FOS in the range of 1.4 to 1.5, depending on the level of uncertainty in input parameters. Where detailed investigation has been carried out and applied loads are well defined, a FOS at the low end of the range could be considered, however, as the degree of uncertainty in parameters, geometry, applied loads, groundwater conditions and variability increases the acceptable FOS limit from slope stability analysis should increase.

5.5.3 Analysis Results

5.5.3.1 Existing Fill

For the analysis an automated search of potential circular failure surfaces was carried out to assess the failure surface with the lowest calculated FOS. The soil strength parameters and stratigraphy is presented in Figure 1, with results of the analysis is presented in Figure 2 and Figure 3 showing the failure surface with the lowest calculated FOS.

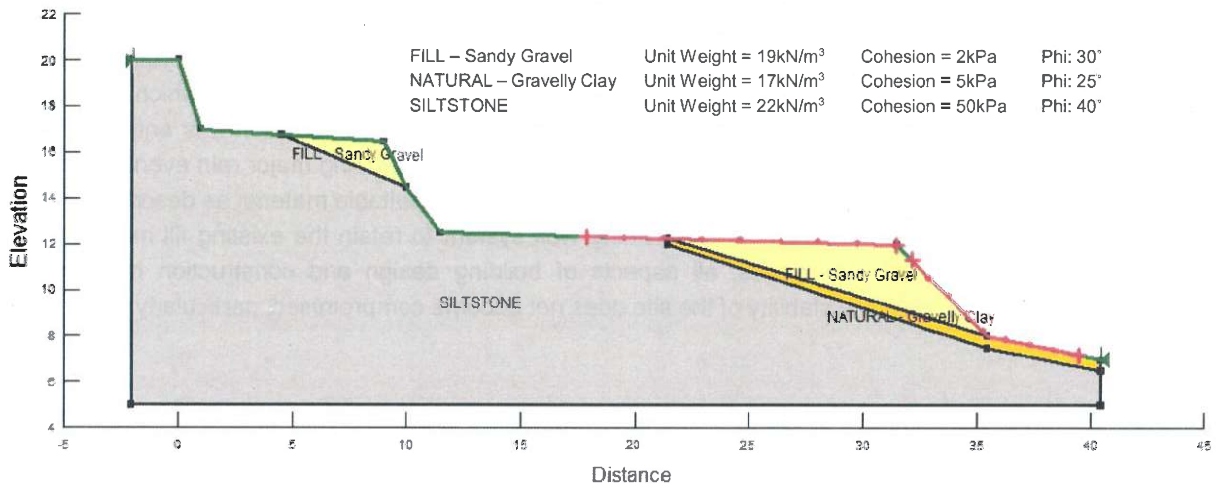


Figure 1: 'Long term' soil strength parameters and stratigraphy

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

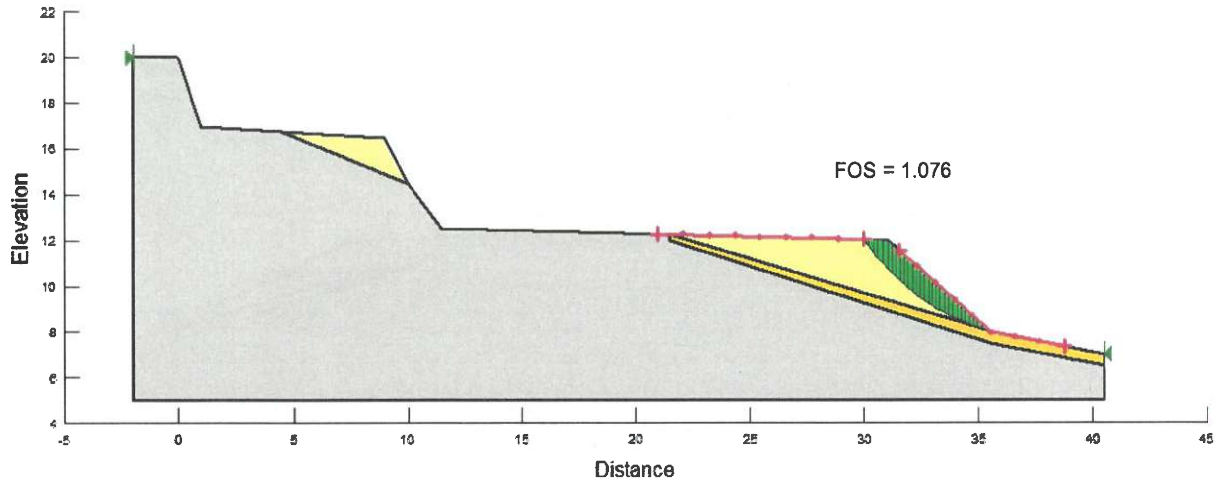


Figure 2: 'Long term' analysis for existing 'lower platform' fill profile

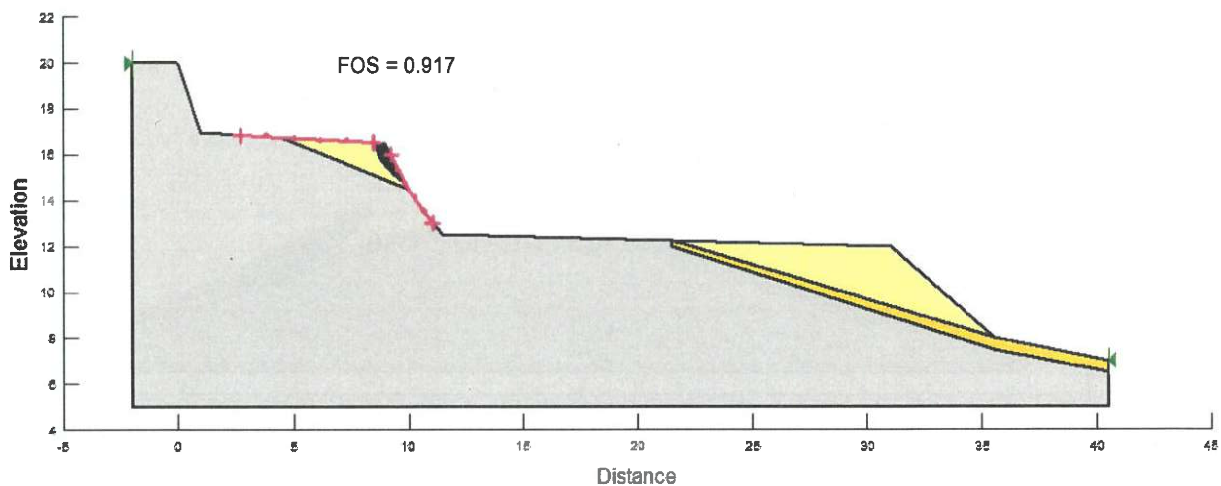


Figure 3: 'Long term' analysis for existing 'upper platform' fill profile

The results of the analysis discussed above indicate that, in its current state, the long term stability of the fill embankment is not acceptable and must either be removed and replaced as described in Section 5.3 or design and construct and engineered retaining wall to mitigate any further movement in the fill material.

5.5.3.2 Remediated Fill

An analysis was also performed to model the stability of the fill material if it was to be remediated and placed in a controlled manner under 'Level 1' supervision, as described in Section 5.3, and in accordance with the recommended maximum permanent slope recommendations in Table 4. The soil strength parameters and stratigraphy is presented in Figure 4, with results of the analysis is presented in Figure 5 and Figure 6 showing the failure surface with the lowest calculated FOS.

Proposed Residence
 17 Greenwood Close, Frenchville
 Project No.: R15-182A
 21 December 2015

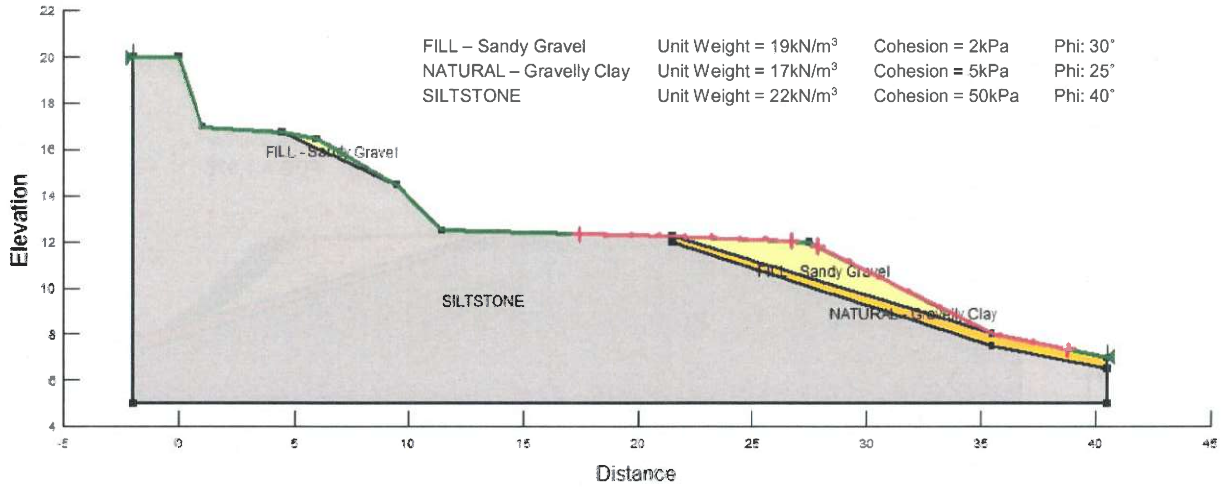


Figure 4: 'Long term' soil strength parameters and stratigraphy for 1V:2H controlled fill batter

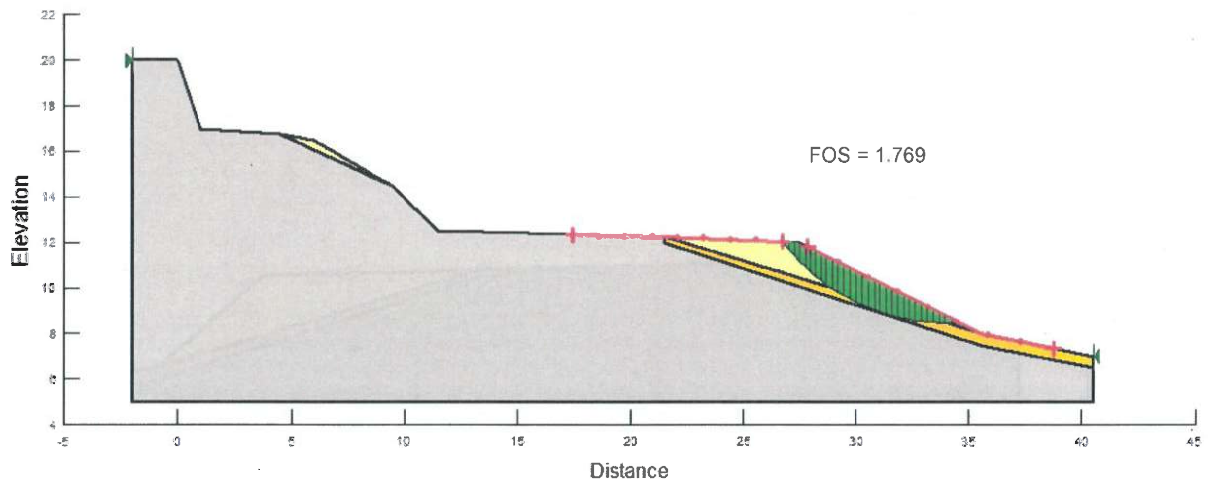


Figure 5: 'Long term' analysis for existing 'lower platform' for 1V:2H controlled fill batter profile

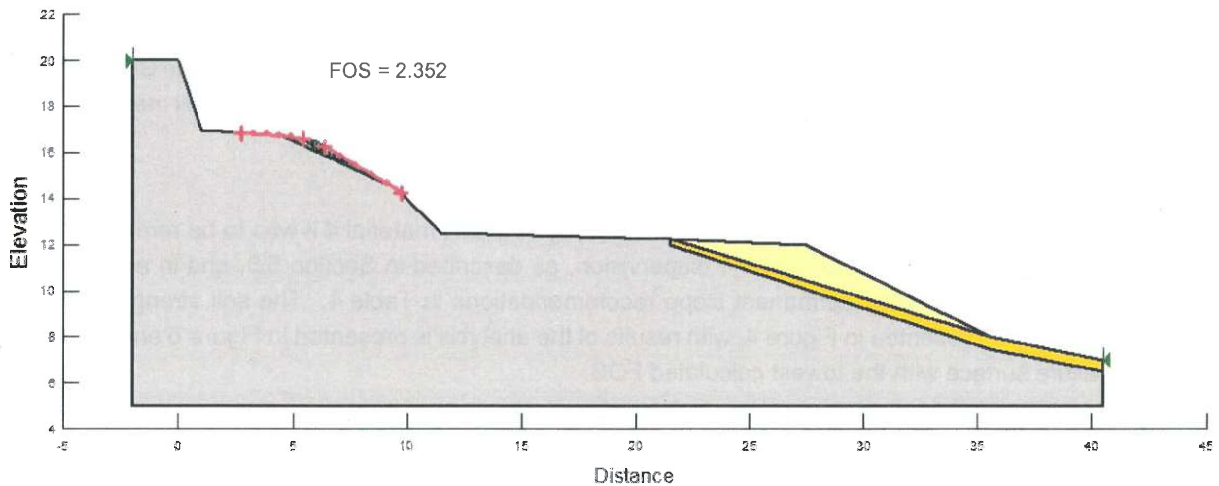


Figure 6: 'Long term' analysis for existing 'upper platform' for 1V:2H controlled fill batter profile

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

A long term FOS of 1.769 in the fill below the building would generally be expected to be acceptable.

5.6 Batter Slopes

If movement sensitive features/sections, etc. are not located 'close' to excavations, and geometry permits, battered slopes may be adopted. Provided slopes are protected from groundwater or surface water effects, the preliminary maximum cut slope angles given in the Table 4 may be used with a relatively low risk of instability for unsurcharged batters up to approximately 3m to 4m in height. Where batters exceed 4m in height mid-slope benches (not less than 3m wide) may be required and will require detailed stability assessment on a location by location basis. Detailed stability analysis prior to bulk earthworks design finalisation will be required to confirm stable batter slopes and detailed inspection by an experienced geotechnical engineer will be required at the time of construction to confirm the stability of batter faces and the need for any supplementary mechanical support.

Table 4: Preliminary Maximum Unsurcharged Cut Batter Slopes for 'Dry' Slopes 3-4m High

Material	Strength	Maximum Temporary Slope	Maximum Permanent Slope
Fill (Controlled – refer Section 5.3.4) ⁽¹⁾	-	1V:1H	1V:2H
Siltstone	low	1V:1H ⁽²⁾	1V:1.5H ⁽²⁾
	medium	1V:0.75H ⁽²⁾	1V:1H ⁽²⁾
	high	1V:0.5H ⁽²⁾	1V:1H ⁽²⁾

⁽¹⁾ Overfilled and cut back to design profile; ⁽²⁾ Subject to jointing

If insufficient space exists for the construction of cut batters at the maximum slopes given above, mechanical excavation support will be required in order to prevent excavation instability. At the batter angles nominated above there may be some localised slumping of batter slopes and it will be necessary to ensure that the faces are protected from any surface water or groundwater seepage effects.

5.7 Retaining Wall Pressures

Permanent retaining wall pressures can be obtained for drained, unsurcharged conditions, with horizontal and sloping backfill, using a triangular pressure distribution in conjunction with the parameters given in Table 5.

Table 5: Retaining Wall Design Parameters

Material	Strength	Total weight (t/m ³)	Horizontal Backfill		Sloping Backfill (1V:5H)	
			Lateral earth pressure coefficient			
			'Active' - k _a	'At Rest' - k _o	'Active' - k _a	'At Rest' - k _o
Sandy Gravel (Fill)	-	1.9	0.4	0.55	0.45	0.6
Siltstone	low	2.3	0.35	0.5	0.4	0.55
	medium		0.3	0.4	0.35	0.45
	high		0.2	0.3	0.25	0.35

Due allowance must also be included in the calculation of wall pressure for groundwater pressure, back-fill compaction, surcharge effects from adjacent structures and/or construction loading and the effects of sloping retained materials, reactive soil/fill pressures etc.

If a drainage system is installed behind retaining walls, it would still be prudent to allow for elevated water pressures as elevated groundwater levels may occur during or following prolonged 'wet' weather, or from blocked drainage etc. Drain design should incorporate free draining backfill and slotted pipe discharging into a sealed disposal system.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

5.8 Foundations

Design of pad/strip footings or 'short' bored piles could be based on the maximum working bearing pressures nominated in Table 6.

Table 6: Working Bearing Pressure for Strip/Pad Footings and 'Short' Bored Piles

Material	Strength	Allowable Working Pressure (kPa)*
Controlled Fill - Level 1 (placed and compacted to Section 5.3.4)	-	100
Siltstone	extremely low	350
	very low	700
	low	1000
	medium	2500

* Not underlain by any 'softer' material

It is recommended that the above strengths be confirmed by an experienced geotechnical engineer prior to the casting of foundation elements. It should be carefully noted that the potential presence of 'strength inversions' in the rock will require careful consideration in foundation design and the selection of maximum bearing pressures/founding depths.

It is considered that local variations in rock strength could be expected to occur over the site and it is suggested that a 'flexible' approach be adopted to the foundation design, construction methodology and costing, so that footing sizes/founding depths can be readily adjusted as required during construction, without cost/time penalties being incurred. Use of mass concrete may be required to transfer foundation stresses to suitable founding strata.

It is recommended that in order to minimise potential differential footing performance that all footings be extended to found in similar stratigraphy (i.e footings for a particular structure should not found partly in fill and partly in weathered rock).

5.9 On-Ground Slab and Pavement Properties

5.9.1 Insitu Estimates of CBR

The correlation between DCP results and insitu CBR given by AUSTRROADS¹, is reproduced in Figure 7 and can be used to estimate the CBR of proposed subgrade materials. Caution should be exercised with the interpretation of the DCP values as they are only relevant for the moisture conditions existing at the time of testing and 'false' interpreted CBR values can result from the presence of gravels etc. contained with otherwise 'clayey' soils.

¹ AUSTRROADS' Publication No. AP-17/92 (1992) Pavement Design: A Guide to the Structural Design of Road Pavements – Figure 5.2.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

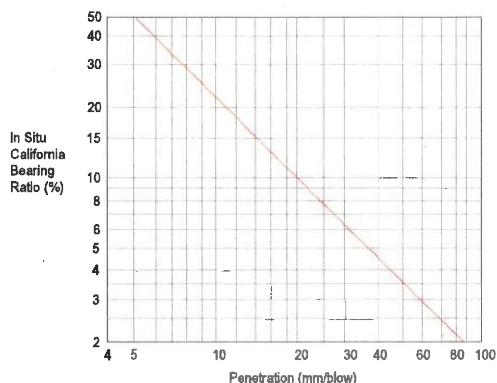


Figure 7: Correlation of DCP Results and Insitu CBR

5.9.2 Soaked Subgrade Properties

The design of on-ground slabs and pavements, cast over natural soil or controlled fill subgrade could be based on the 'soaked' parameters presented in Table 7, which are based on past experience and on the assumption that the subgrade is prepared in accordance with Section 5.3.

The subgrade design values will be significantly influenced by the properties of any compacted fill used.

Table 7: Subgrade Design Values

Subgrade Type	CBR (%)	Modulus of Subgrade Reaction* (kPa/mm)
Controlled Fill - Level 1 (placed and compacted to Section 5.3.4) Sandy Gravel	10 – 20	55 – 70
Gravelly Clay	3 – 5	20 – 30

* For transient loading only – sustained loads may cause consolidation settlement and appropriate design values must be determined by analysis

If reactive ground movement can occur, it is suggested that on-ground slabs be fully dowelled (and joints between slabs sealed to control differential movements and minimise under-slab moisture changes) and should be detailed to enable movement, independent of foundations, fixtures, etc.

BUTLER PARTNERS (REGIONAL) PTY LTD

NICK BLOXSOM
Geotechnical Engineer

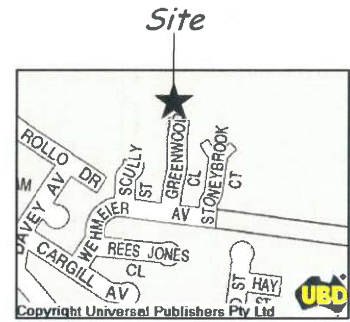
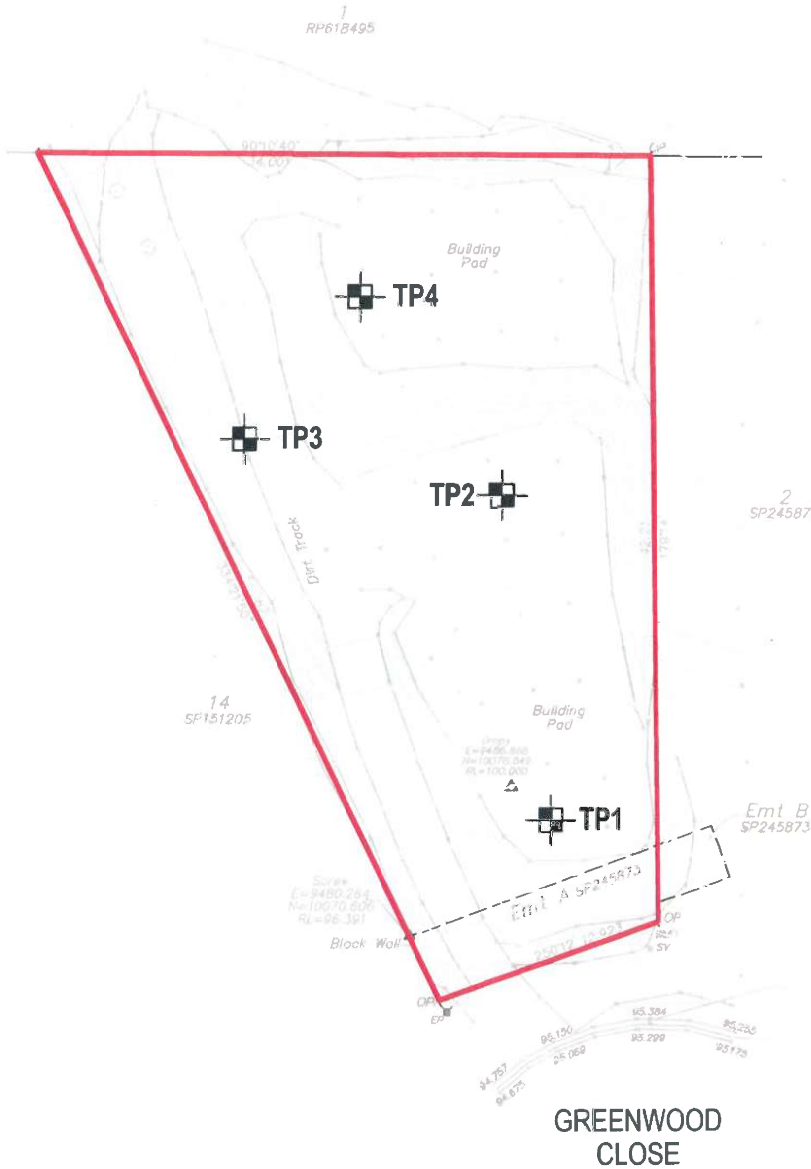
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Principal

Reviewed by
MIKE NEIGHBOUR
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UBD Reference: Rockhampton Map 4 Grid H16 (ARC&T,v4.0) not to scale

PROPOSED RESIDENCE

17 GREENWOOD CLOSE, FRENCHVILLE

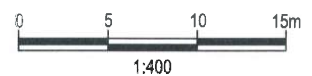
LOCALITY PLAN AND TEST PIT LOCATIONS

CLIENT:
Angela Russell

LEGEND

- 1 Test Pit
- Site Boundary

SCALE AT A4:



DATE: DECEMBER 2015

DRAWN: FD

APPROVED:

PROJECT No: R15-182A

DRAWING No: 1 REV: A

*Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015*

APPENDIX A

TEST PIT REPORT SHEETS WITH EXPLANATORY NOTES

TEST PIT REPORT

Client: Angela Russell

Project: Proposed Residence

Location: 17 Greenwood Close, Frenchville

Project No: R15-182A

TEST PIT 3

Page No: 1 of 1

Date: 23 November 2015

Ground Surface Level: RL100.8m*

Depth (m)	Description	RL (m)	Lithology	Sample Type	Depth (m)	Test Results
0	FILL - sandy gravel, brown, medium to coarse gravel with clay and cobbles	100.8				
1		100.0				
1.5	GRAVELLY CLAY (C1) - yellow-brown, fine to medium gravel				D	
1.7	SILTSTONE (DW) - low to medium strength, pale brown mottled grey	99.0				
2	- some high strength bands					
2.3				D		
2.5						
2.8	End of Test Pit at 2.8 m (Bucket Refusal)	98.0				
3						
4		97.0				
5		96.0				

D Disturbed Sample

E Environmental Sample

pp Pocket Penetrometer Test (kPa)

B Bulk Sample

U Undisturbed Tube (50mm diameter)

Is(50) Point Load Test Result (MPa)

V Vane Shear Strength (Uncorrected)kPa

Rig: 20T Hitachi Excavator

Bucket Size: 450mm

Groundwater: No free groundwater encountered during test pitting

Remarks: * Ground surface levels interpolated from Finch Surveying Consultants Drawing No. 5440DTM, dated 11 August 2015



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DYNAMIC CONE PENETROMETER TEST REPORT SHEET

CLIENT:	Angela Russell			DATE:	3 December 2015		
PROJECT:	Proposed Residence			PROJECT NO:	R15-182A		
LOCATION:	17 Greenwood Close, Frenchville			REPORT NO:	R15-182A_DCP_R1512-59		
DEPTH (m)	PENETRATION RESISTANCE – BLOWS/100mm						
	TEST PIT NUMBER						
	1	2	3	4			
0.0 – 0.1	9	10	15	6			
0.1 – 0.2	7	22+	10	8			
0.2 – 0.3	9		9	22+			
0.3 – 0.4	22+		7				
0.4 – 0.5			22+				
0.5 – 0.6							
0.6 – 0.7							
0.7 – 0.8							
0.8 – 0.9							
0.9 – 1.0							
1.0 – 1.1							
1.1 – 1.2							
1.2 – 1.3							
1.3 – 1.4							
1.4 – 1.5							
1.5 – 1.6							
1.6 – 1.7							
1.7 – 1.8							
1.8 – 1.9							
1.9 – 2.0							
2.0 – 2.1							
2.1 – 2.2							
2.2 – 2.3							
2.3 – 2.4							
2.4 – 2.5							
2.5 – 2.6							
2.6 – 2.7							
2.7 – 2.8							
2.8 – 2.9							
2.9 – 3.0							

Test Method AS 1289.6.3.2

Authorised Signatory

Dwain Carolan

Date 3/12/15

Accreditation No. 19665

Accredited for compliance with ISO/IEC 17025

Notes on Description and Classification of Soil

The methods of description and classification of soils used in this report are generally based on Australian Standard AS1726-1993 *Geotechnical Site Investigations*.

Soil description is based on an assessment of disturbed samples, as recovered from bores and excavations, or from undisturbed materials as seen in excavations and exposures or in undisturbed samples. Descriptions given on report sheets are an interpretation of the conditions encountered at the time of investigation.

In the case of cone or piezocone penetrometer tests, actual soil samples are not recovered and soil description is inferred based on published correlations, past experience and comparison with bore and/or test pit data (if available).

Soil classification is based on the particle size distribution of the soil and the plasticity of the portion of the material finer than 0.425mm. The description of particle size distribution and plasticity is based on the results of visual field estimation, laboratory testing or both. When assessed in the field, the properties of the soil are estimated; precise description will always require laboratory testing to define soil properties.

Where soil can be clearly identified as FILL this will be noted as the main soil type followed by a description of the composition of the fill (e.g. FILL – yellow-brown, fine to coarse grained gravelly clay fill with concrete rubble). If the soil is assessed as possibly being fill this will be noted as an additional observation.

Soils are generally described using the following sequence of terms. In certain instances, not all of the terms will be included in the soil description.

MAIN SOIL TYPE (CLASSIFICATION GROUP SYMBOL)

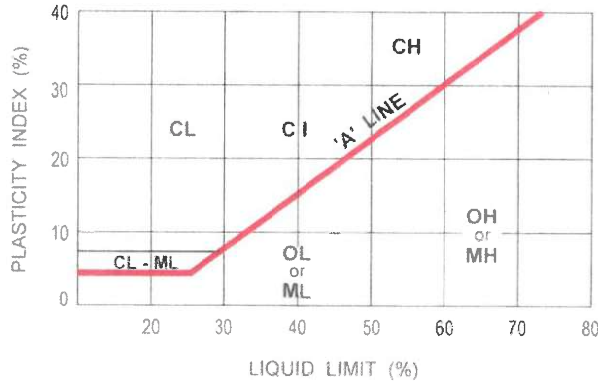
- strength/density, colour, structure/grain size, secondary and minor components, additional observations

Information on the definition of descriptive and classification terms follows.

SOIL TYPE and CLASSIFICATION GROUP SYMBOLS

	Major Divisions	Particle Size	Classification Group Symbol	Typical Names
COARSE GRAINED SOILS (more than half of material is larger than 0.075 mm)	BOULDERS	> 200mm		
	COBBLES	63 – 200mm		
	GRAVELS (more than half of coarse fraction is larger than 2.36mm)	Coarse: 20 – 63mm Medium: 6 – 20mm Fine: 2.36 – 6mm	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
			GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (more than half of coarse fraction is smaller than 2.36mm)	Coarse: 0.6 – 2.36mm Medium: 0.2 – 0.6mm Fine: 0.075 – 0.2mm	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
			SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (more than half of material is smaller than 0.075 mm)	SILTS & CLAYS (liquid limit <50%)	ML	Inorganic silts and very fine sands, silty/clayey fine sands or clayey silts with low plasticity.	
		CL and CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.	
		OL	Organic silts and organic silty clays of low plasticity.	
	SILTS & CLAYS (liquid limit >50%)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils.	
		CH	Inorganic clays of high plasticity.	
		OH	Organic clays of medium to high plasticity, organic silts.	
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.

PLASTICITY CHART FOR CLASSIFICATION OF FINE GRAINED SOILS



(Reference: Australian Standard AS1726-1993 *Geotechnical site investigations*)

DESCRIPTIVE TERMS FOR MATERIAL PROPORTIONS

Coarse Grained Soils		Fine Grained Soils	
% Fines	Modifier	% Coarse	Modifier
< 5	Omit, or use 'trace'	< 15	Omit, or use trace.
5 – 12	Describe as 'with clay/silt' as applicable.	15 – 30	Describe as 'with sand/gravel' as applicable.
> 12	Prefix soil as 'silty/clayey' as applicable	> 30	Prefix soil as 'sandy/gravelly' as applicable.

STRENGTH TERMS – COHESIVE SOILS

Strength Term	Undrained Shear Strength	Field Guide to Strength
Very soft	< 12kPa	Exudes between the fingers when squeezed in hand.
Soft	12 – 25kPa	Can be moulded by light finger pressure.
Firm	25 – 50kPa	Can be moulded by strong finger pressure.
Stiff	50 – 100kPa	Cannot be moulded by fingers, can be indented by thumb.
Very stiff	100 – 200kPa	Can be indented by thumb nail.
Hard	> 200kPa	Can be indented with difficulty by thumb nail.

DENSITY TERMS – NON COHESIVE SOILS

Density Term	Density Index	SPT "N"	CPT Cone Resistance
Very loose	< 15%	0 – 5	0 – 2MPa
Loose	15 – 35%	5 – 10	2 – 5MPa
Medium dense	35 – 65%	10 – 30	5 – 15MPa
Dense	65 – 85%	30 – 50	15 – 25MPa
Very dense	> 85%	> 50	> 25MPa

COLOUR

The colour of a soil will generally be described in a 'moist' condition using simple colour terms (eg. black, grey, red, brown etc.) modified as necessary by "pale", "dark", "light" or "mottled". Borderline colours will be described as a combination of colours (eg. grey-brown).

EXAMPLE

e.g. CLAYEY SAND (SC) – medium dense, grey-brown, fine to medium grained with silt.

Indicates a medium dense, grey-brown, fine to medium grained clayey sand with silt.

Notes on Description and Classification of Rock

The methods of description and classification of rock used in this report are generally based on Australian Standard AS1726-1993 *Geotechnical site investigations*.

Rock description is based on an assessment of disturbed samples, as recovered from bores and excavations, or from undisturbed materials as seen in excavations and exposures, or in core samples. Descriptions given on report sheets are an interpretation of the conditions encountered at the time of investigation.

Notes outlining the method and terminology adopted for the description of rock defects are given below, however, detailed information on defects can generally only be determined where rock core is taken, or excavations or exposures allow detailed observation and measurement.

Rocks are generally described using the following sequence of terms. In certain instances not all of the terms will be included in the rock description.

ROCK TYPE (WEATHERING SYMBOL), strength, colour, grain size, defect frequency

Information on the definition of descriptive and classification terms follows.

ROCK TYPE

In general, simple rock names are used rather than precise geological classifications.

ROCK MATERIALS WEATHERING CLASSIFICATION

Term	Weathering Symbol	Definition
Residual soil	RS	Soil developed from extremely weathered rock; the mass structure and substance fabrics are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded in water.
Distinctly weathered *	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by ironstaining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
- Highly weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance 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 fresh rock substance is no longer recognisable.
- Moderately weathered	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock may be no longer recognisable.
Slightly weathered	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition or staining.

* Subdivision of this weathering grade into highly and moderately may be used where applicable.

STRENGTH OF ROCK MATERIAL

Term	Symbol	Point Load Index I_p (50)	Field Guide To Strength
Extremely low	EL	<0.03MPa	Easily remoulded by hand to a material with soil properties.
Very low	VL	0.03 – 0.1MPa	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 30mm thick can be broken by finger pressure.
Low	L	0.1 – 0.3MPa	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	0.3 – 1.0MPa	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High	H	1.0 – 3.0MPa	A piece of core 150mm long by 50mm 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	3.0 – 10.0MPa	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely high	EH	>10MPa	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Notes:

1. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects.
2. The field guide visual assessment for rock strength may be used for preliminary assessment or when point load testing is not available.
3. Anisotropy of rock may affect the field assessment of strength.

COLOUR

The colour of a rock will generally be described in a 'moist' condition using simple colour terms (e.g. black, grey, red, brown, etc) modified as necessary by 'pale', 'dark', 'light' or 'mottled'. Borderline colours will be described as a combination of colours (e.g. grey-brown).

GRAIN SIZE

Descriptive Term	Particle Size Range
Coarse grained	0.6 – 2.0mm
Medium grained	0.2 – 0.6mm
Fine grained	0.06 – 0.2mm

DEFECT FREQUENCY

Where appropriate, a defect frequency may be recorded as part of the rock description and will be expressed as the number of natural (or interpreted natural) defects present in an equivalent one metre length of core; by use of the following defect frequency descriptive terms; or both. The descriptive terms refer to the spacing of all types of natural defects along which the rock is discontinuous and include, bedding plane partings, joints and other rock defects, but excludes known artificial fractures such as drilling breaks.

Defect Frequency	Description
Fragmented	Rock core is comprised primarily of fragments of length less than 20mm, and mostly of width less than the core diameter.
Highly Fractured	Core lengths are generally less than 20mm to 40mm with occasional fragments.
Fractured	Core lengths are mainly 30mm to 100mm with occasional shorter and longer sections.
Fractured to Slightly Fractured	Core lengths are mainly 100mm to 300mm with occasional shorter to longer sections.
Slightly Fractured	Core lengths are generally 300mm to 1,000mm with occasional longer sections and occasional sections of 100mm to 300mm.
Unbroken	The core does not contain any fractures.

EXAMPLE

e.g. SANDSTONE (XW) – low strength, pale brown, fine to coarse grained, slightly fractured.

ROCK DEFECT LOGGING

Defects are discontinuities in the rock mass and include joints, sheared zones, cleavages and bedding partings. The ability to observe and log defects will depend on the investigation methodology. Defects logged in core are described using the abbreviations noted in the following tables.

The *depth* noted in the description is measured in metres from the ground surface, the *defect angle* is measured in degrees from horizontal, and the *defect thickness* is measured normal to the plane of the defect and is in millimetres (unless otherwise noted).

Defects are generally described using the following sequence of terms:

Depth, Defect Type, Defect Angle (dip), Surface Roughness, Infill, Thickness

DEFECT TYPE

B	– Bedding
J	– Joint
S	– Shear Zone
C	– Crushed Zone

SURFACE ROUGHNESS

i	- rough or irregular, stepped
ii	- smooth, stepped
iii	- slickensided, stepped
iv	- rough or irregular, undulating
v	- smooth, undulating
vi	- slickensided, undulating
vii	- rough or irregular, planar
viii	- smooth planar
ix	- slickensided, planar

INFILL

Infill refers to secondary minerals or other materials formed on the surface of the defect and some common descriptions are given in the following table together with their abbreviations.

Ls	- limonite staining
Fe	- iron staining
Cl	- clay
Mn	- manganese staining
Qtz	- quartz
Ca	- calcite
Clean	- no visible infill

EXAMPLE

3.59m, J, 90, vii, Ls, 1mm

indicates a joint at 3.59m depth that is at 90° to horizontal (i.e. vertical), is rough or irregular and planar, limonite stained and 1mm thick.

Proposed Residence
17 Greenwood Close, Frenchville
Project No.: R15-182A
21 December 2015

APPENDIX B

LABORATORY TEST REPORT SHEETS



Rockhampton Laboratory
 3/197 Kent Street
 Rockhampton Queensland 4700
 Telephone : 61 (07) 4927 1400
 Accreditation No. 19665



Accredited for compliance with ISO/IEC 17025

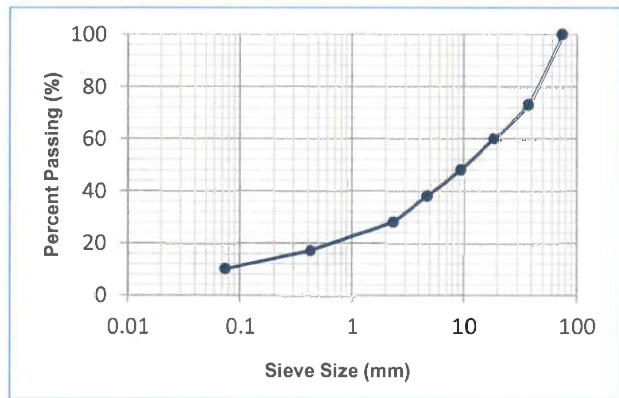
MATERIAL TEST REPORT

Client:	Angela Russell	Tested by:	DC	Date:	3/12/2015
Project:	Proposed Residence	Checked by:	DC	Date:	4/12/2015
Location:	17 Greenwood Close, Frenchville	Report No.:	R15-182A_MAT_R1511-582		
Project No:	R15-182A	THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL			

Sample No.:	R1511-582
Sampling Method:	AS1289.1.2.1 Cl.6.5.3
Date Sampled:	25/11/2015
Sampled by:	JB
Test Pit:	1
Depth (m):	0.5-0.8
Mositure Content (%):	7.9
Sample Description:	Sandy Gravel

Particle Size Distribution - AS1289.3.6.1, AS1289.2.1.1

AS SIEVE SIZE (mm)	PERCENT PASSING		
	MINIMUM LIMIT	RESULT	MAXIMUM LIMIT
75	-	100	-
37.5	-	73	-
19	-	60	-
9.5	-	48	-
4.75	-	38	-
2.36	-	28	-
0.425	-	17	-
0.075	-	10	-



Atterberg Limit - AS1289.2.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.3.1, AS1289.3.4.1

Sample Requirements	MINIMUM LIMIT	RESULT	MAXIMUM LIMIT
Liquid Limit (%)	-	27	-
Plastic Limit (%)	-	20	-
Plasticity Index (%)	-	7	-
Linear Shrinkage (%)	-	6.5	-
0.075mm / 0.425mm	-		-
Plasticity Index x 0.425mm rate	-		-
Linear Shrinkage x 0.425mm rate	-		-
Shrinkage defects	-	None	-

Comments:

Authorised Signatory

Dwain Carolan
Dwain Carolan

Date 7/12/15



Rockhampton Laboratory
 3/197 Kent Street
 Rockhampton Queensland 4700
 Telephone : 61 (07) 4927 1400
 Accreditation No. 19665



Accredited for compliance with ISO/IEC 17025

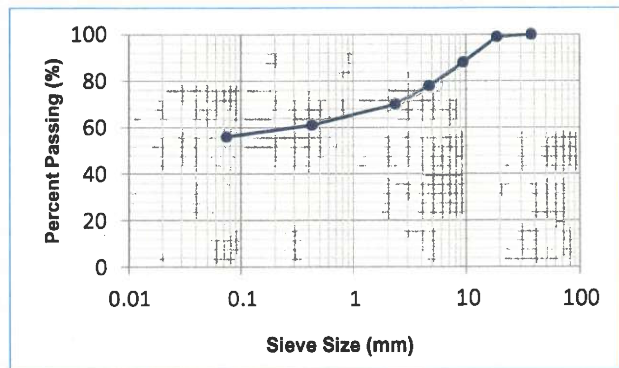
MATERIAL TEST REPORT

Client:	Angela Russell	Tested by:	DC	Date:	3/12/2015
Project:	Proposed Residence	Checked by:	DC	Date:	4/12/2015
Location:	17 Greenwood Close, Frenchville	Report No.:	R15-182A_MAT_R1511-583		
Project No:	R15-182A	THIS DOCUMENT SHALL NOT BE REPRODUCED EXCEPT IN FULL			

Sample No.:	R1511-583
Sampling Method:	AS1289.1.2.1 Cl.6.5.3
Date Sampled:	25/11/2015
Sampled by:	JB
Test Pit:	3
Depth (m):	1.5-1.7
Mositure Content (%):	17.6
Sample Description:	Gravelly Clay

Particle Size Distribution - AS1289.3.6.1, AS1289.2.1.1

AS SIEVE SIZE (mm)	PERCENT PASSING		
	MINIMUM LIMIT	RESULT	MAXIMUM LIMIT
37.5	-	100	-
19	-	99	-
9.5	-	88	-
4.75	-	78	-
2.36	-	70	-
0.425	-	61	-
0.075	-	56	-



Atterberg Limit - AS1289.2.1.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.3.1, AS1289.3.4.1

Sample Requirements	MINIMUM LIMIT	RESULT	MAXIMUM LIMIT
Liquid Limit (%)	-	33	-
Plastic Limit (%)	-	21	-
Plasticity Index (%)	-	12	-
Linear Shrinkage (%)	-	11.5	-
0.075mm / 0.425mm	-		-
Plasticity Index x 0.425mm rate	-		-
Linear Shrinkage x 0.425mm rate	-		-
Shrinkage defects	-	None	-

Comments:

Authorised Signatory

Dwain Carolan

Date 7/12/15

NOTES:

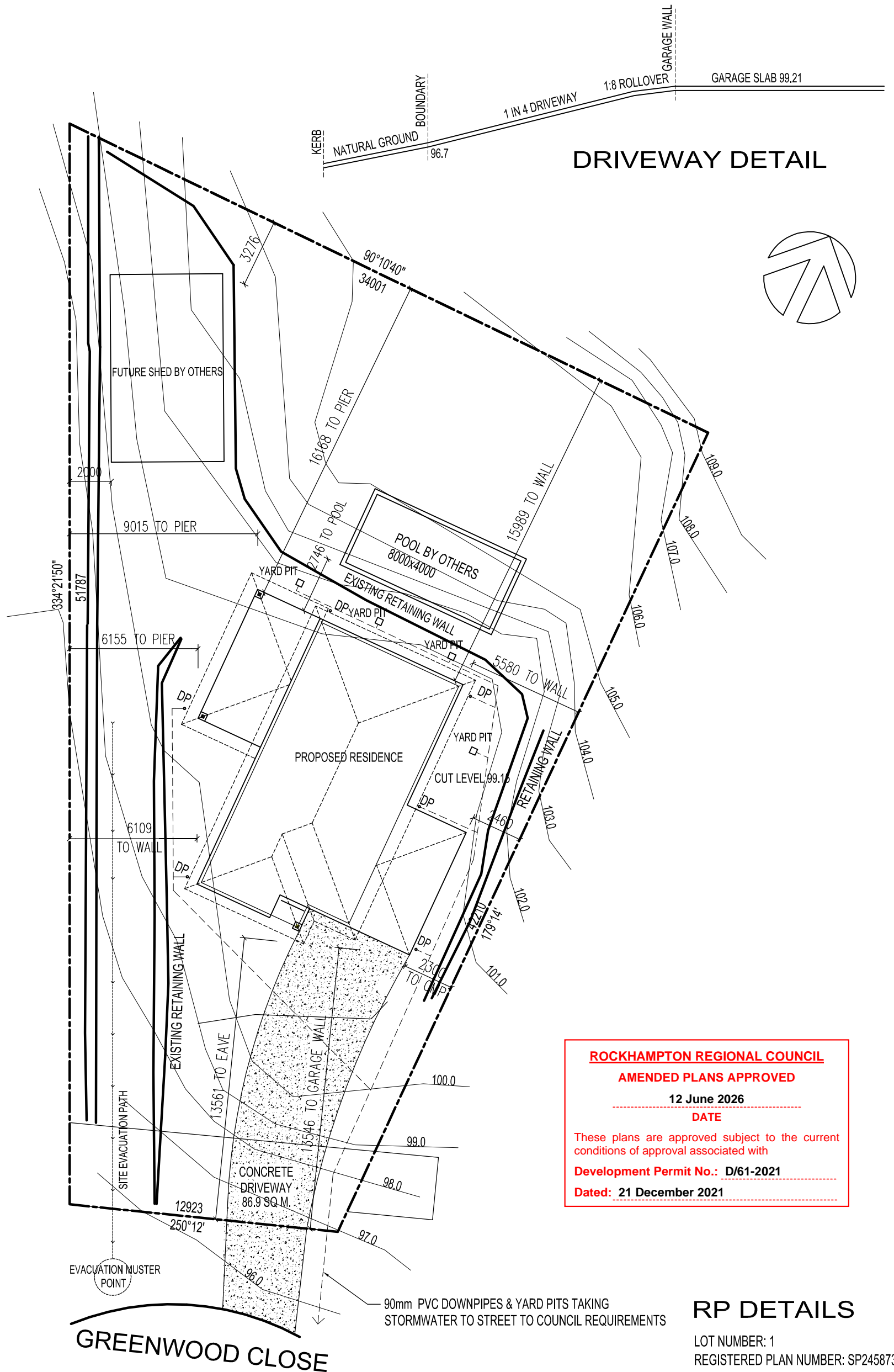
ALL CONSTRUCTION TO COMPLY WITH THE AUSTRALIAN BUILDING CODE REQUIREMENTS & RELEVANT AUSTRALIAN STANDARDS.

CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK.

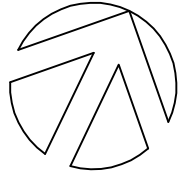
BUILDER MUST CHECK ALL BOUNDARY LINES & PEGS BEFORE COMMENCEMENT OF ANY BUILDING WORK.

SHOULD SITE CONDITIONS DIFFER FROM THOSE INDICATED SEEK INSTRUCTIONS FROM DESIGNER.

DIMENSIONS TAKE PRECEDENCE OVER SCALE. DO NOT SCALE OFF DRAWING.



DRIVEWAY DETAIL



ROCKHAMPTON REGIONAL COUNCIL
AMENDED PLANS APPROVED
 12 June 2026
 DATE
 These plans are approved subject to the current conditions of approval associated with
Development Permit No.: D/61-2021
 Dated: 21 December 2021

RP DETAILS

LOT NUMBER: 1
 REGISTERED PLAN NUMBER: SP245873
 PARISH : ARCHER
 COUNTY : LIVINGSTONE
 AREA: 1050 SQ.METRES
 SITE COVERAGE : 146.17 SQ M. (13.9%)

SITE PLAN

AMMENDMENT	DATE :	DETAILS :	CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK
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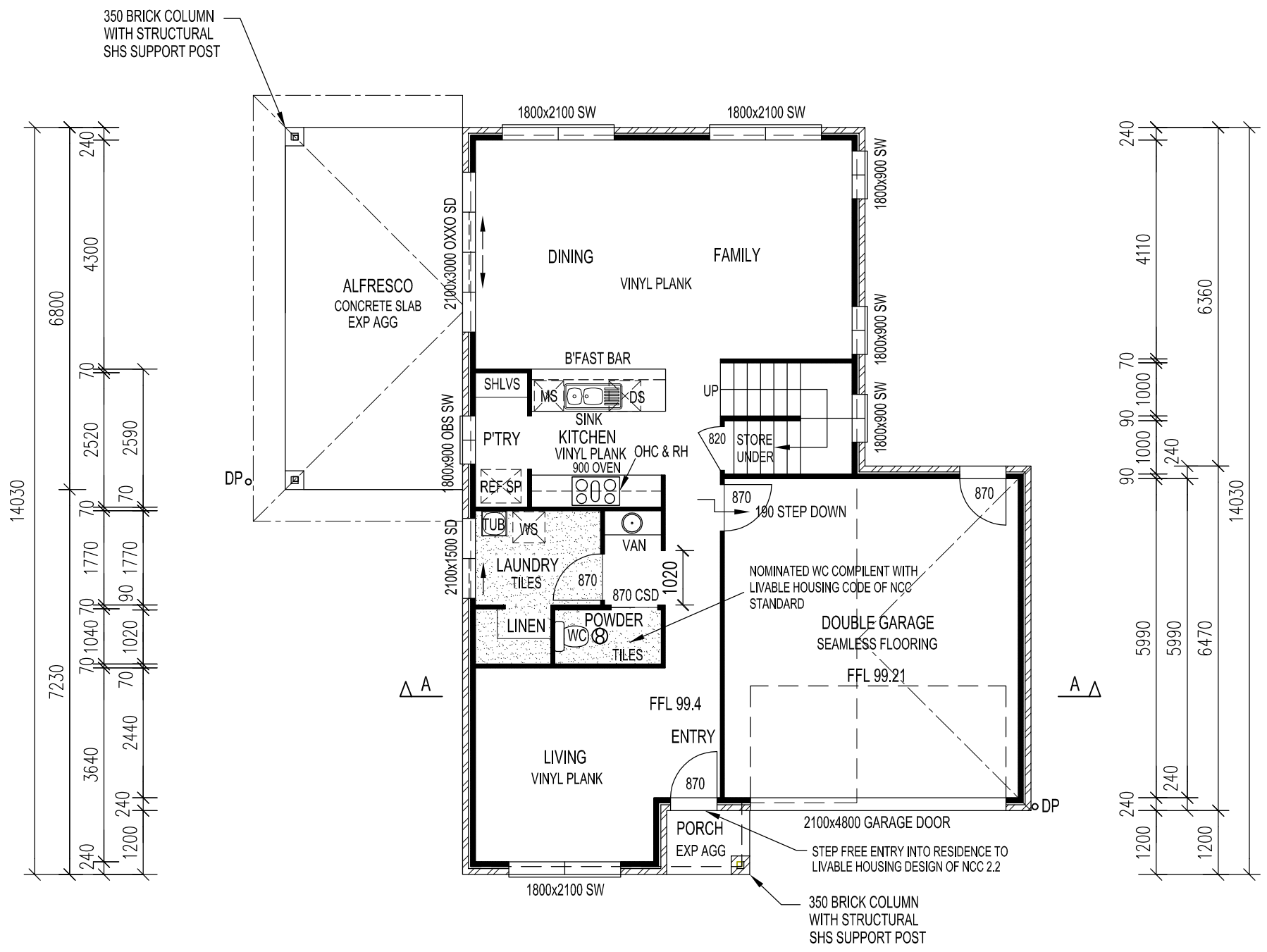
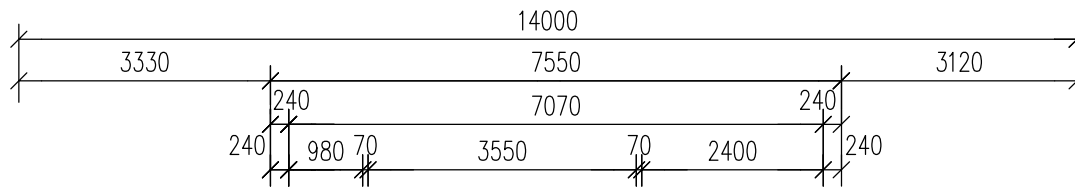
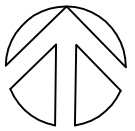


**PROPOSED NEW RESIDENCE AT LOT 1
 GREENWOOD CLOSE FRENCHVILLE**

DATE :	25.05.26
SCALE	1:200 (A3)
DRAWN :	PNC
DWG No.	25521
PAGE No.	1 of 15

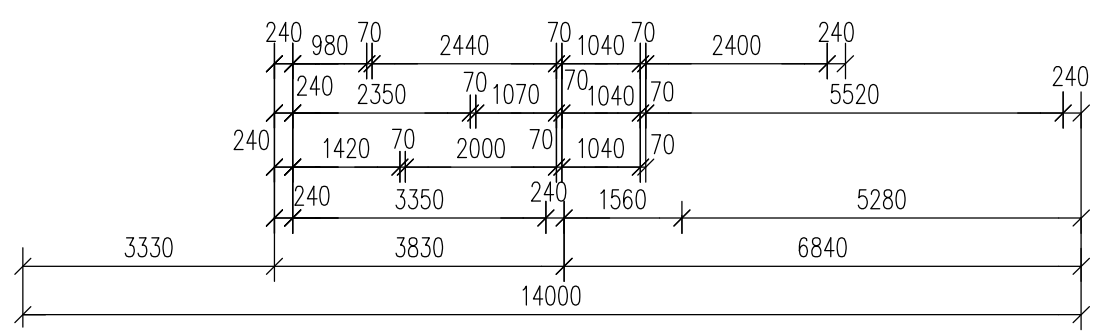


3/93 Bulcock St Caloundra 4551 Lic. No. 640598
 Ph/Fax : 07 54912393 Email : cdd79@bigpond.net.au



SCHEDULE OF AREAS

GROUND FLOOR
 LIVING INCL. GARAGE : 121.64 SQ M.
 PORCH : 1.87 SQ M.
 ALFRESCO : 22.65 SQ M.
 AREA OF UPPER FLOOR : 96.95 SQ M.
 TOTAL AREA : 243.11 SQ M.

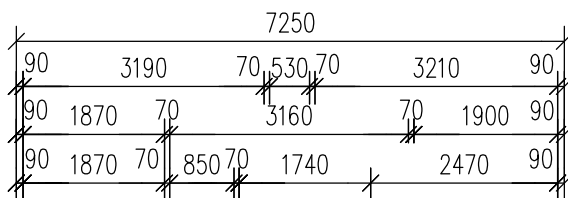


- DP 90mmØ PVC DOWNPIPES
- ⊗ MECHANICAL EXHAUST FAN TO NCC STANDARDS
- SA ⊗ SMOKE ALARM TO COMPLY WITH NCC STANDARDS AUSTRALIA

GROUND FLOOR PLAN

SEE ENGINEERS DRAWINGS FOR SOIL TEST, SLAB, FOOTING STRUCTURAL TIMBER/STEEL AND BRACING DETAILS.

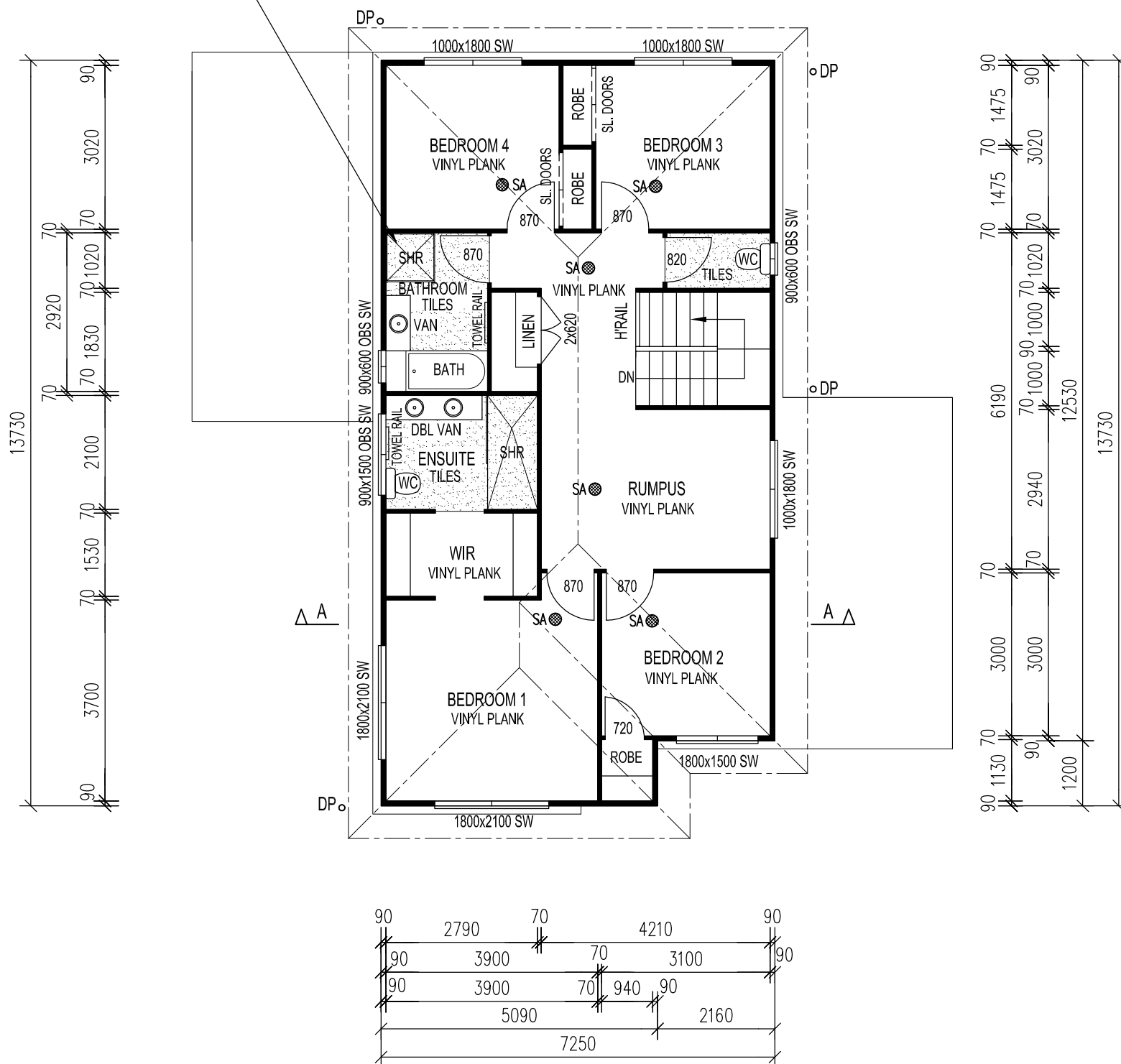
AMMENDMENT	DATE :	DETAILS :	CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK
	<p>PROPOSED NEW RESIDENCE AT LOT 1 GREENWOOD CLOSE FRENCHVILLE</p>		DATE : 08.04.26
			SCALE 1:100 (A3)
			DRAWN : PNC
			DWG No. 25521
			PAGE No. 2 of 15
			<p>3/93 Bulcock St Caloundra 4551 Lic. No. 640598 Ph/Fax : 07 54912393 Email : cdd79@bigpond.net.au</p>



ROCKHAMPTON REGIONAL COUNCIL
AMENDED PLANS APPROVED
12 June 2026
DATE

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Dated: 21 December 2021

HOBLESS AND STEP FREE SHOWER TO BATHROOM AND BLOCKING TO WALLS TO SUPPORT GRAB RAILS TO COMPLY WITH LIVABLE HOUSING CODE OF NCC STANDARD



AREA OF UPPER FLOOR : 96.95 SQ M.

UPPER FLOOR PLAN

- DP 90mmØ PVC DOWNPIPES
- SA ● SMOKE ALARM TO COMPLY WITH NCC STANDARDS AUSTRALIA

SEE ENGINEERS DRAWINGS FOR SOIL TEST, SLAB, FOOTING STRUCTURAL TIMBER/STEEL AND BRACING DETAILS.

AMMENDMENT	DATE :	DETAILS :	CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK
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PROPOSED NEW RESIDENCE AT LOT 1
 GREENWOOD CLOSE FRENCHVILLE

DATE :	08.04.26
SCALE	1:100 (A3)
DRAWN :	PNC
DWG No.	25521
PAGE No.	3 of 15



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 Ph/Fax : 07 54912393 Email : cdd79@bigpond.net.au

ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

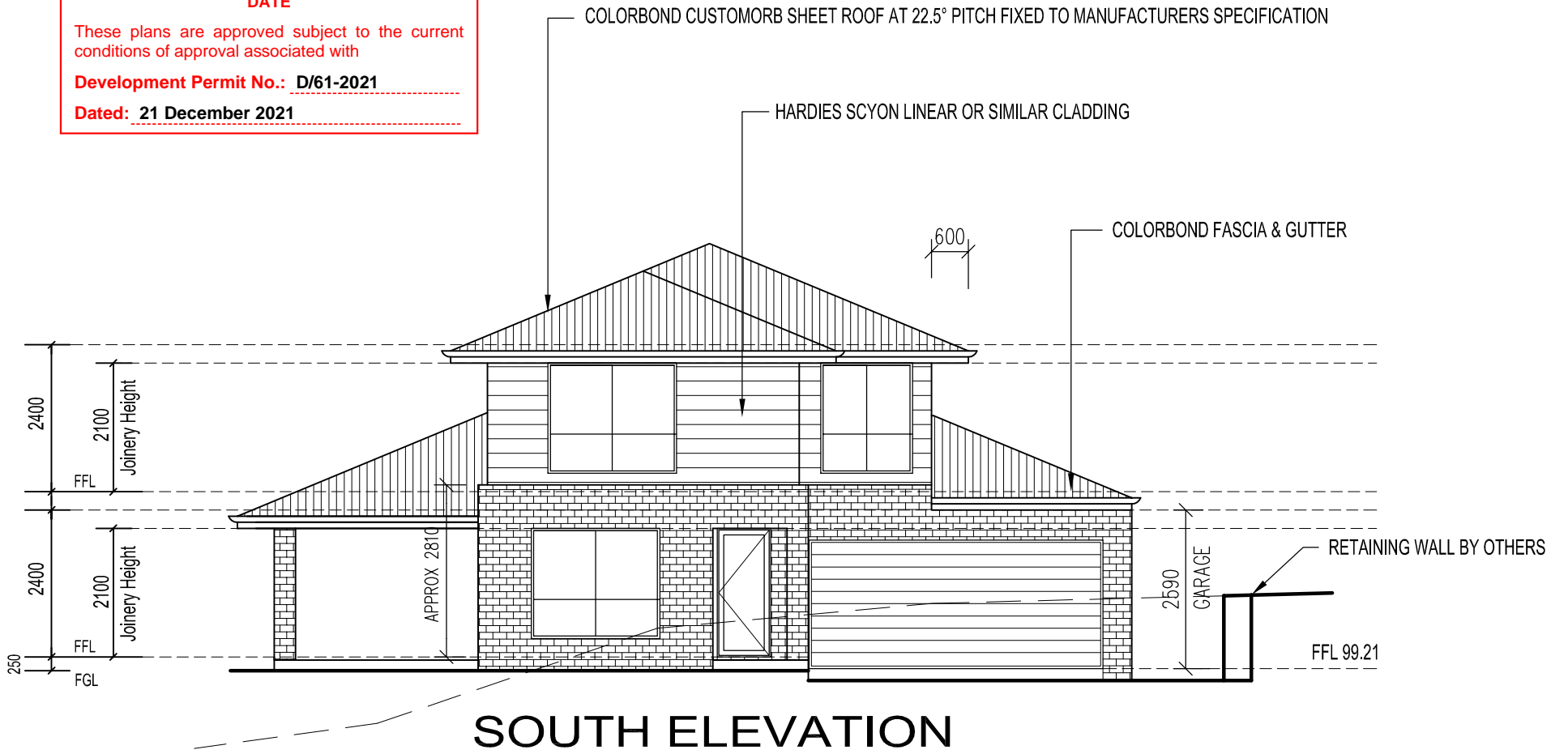
12 June 2026

DATE

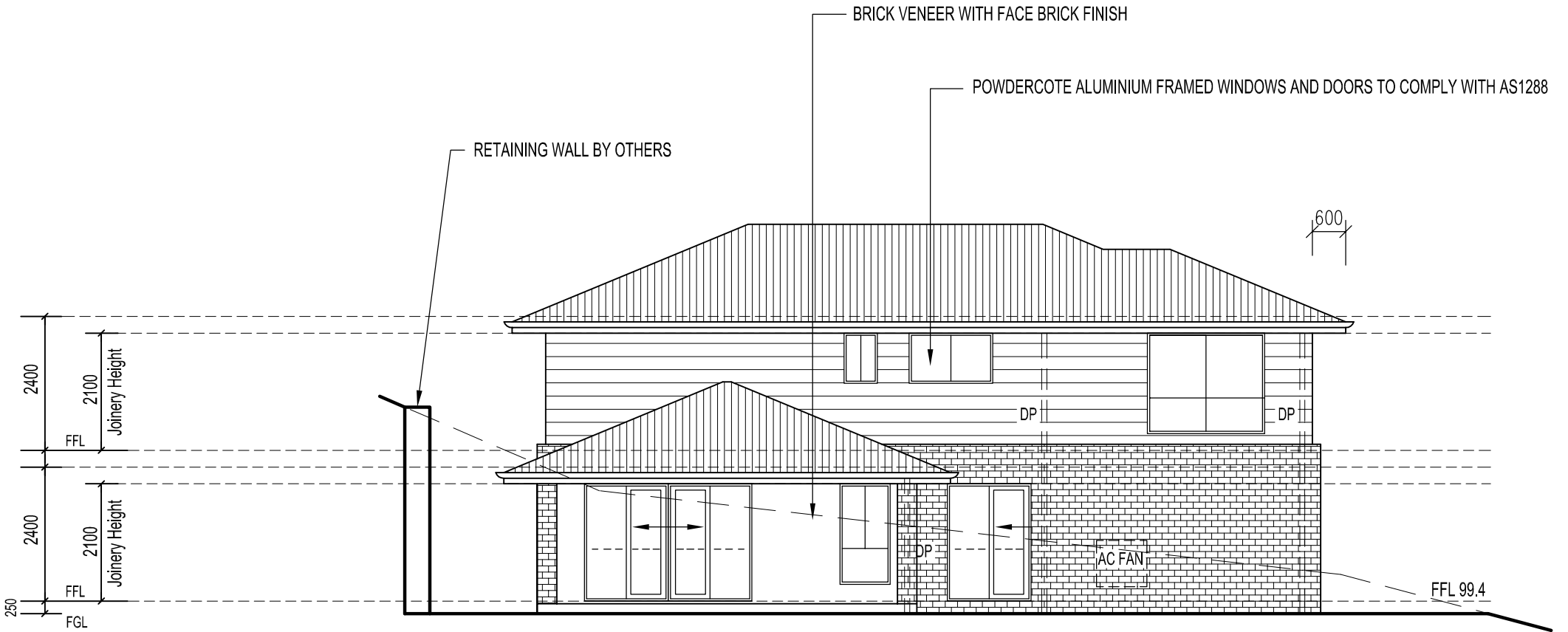
These plans are approved subject to the current conditions of approval associated with

Development Permit No.: D/61-2021

Dated: 21 December 2021



SOUTH ELEVATION



WEST ELEVATION

AMMENDMENT	DATE :	DETAILS :	CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK
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**PROPOSED NEW RESIDENCE AT LOT 1
GREENWOOD CLOSE FRENCHVILLE**

DATE :	08.04.26
SCALE	1:100 (A3)
DRAWN :	PNC
DWG No.	25521
PAGE No.	4 of 15



ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

12 June 2026

DATE

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Development Permit No.: D/61-2021

Dated: 21 December 2021

COLORBOND CUSTOMORB SHEET ROOF AT 22.5° PITCH FIXED TO MANUFACTURERS SPECIFICATION

HARDIES SCYON LINEAR OR SIMILAR CLADDING

COLORBOND FASCIA & GUTTER

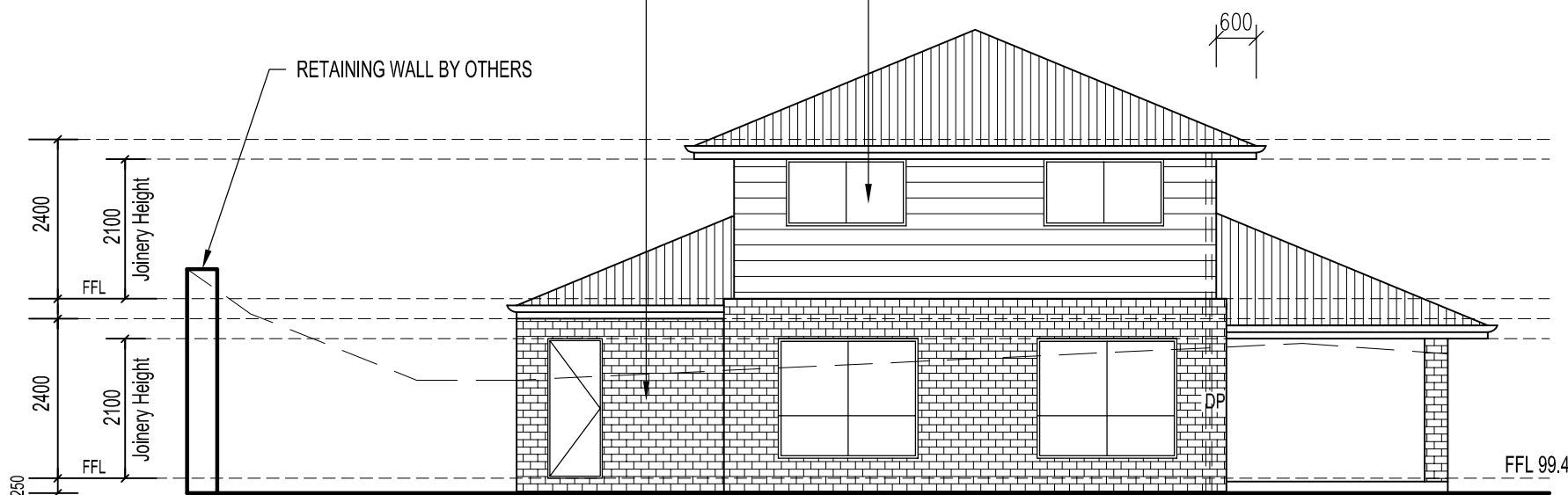


EAST ELEVATION

BRICK VENEER WITH FACE BRICK FINISH

POWDERCOTE ALUMINIUM FRAMED WINDOWS AND DOORS TO COMPLY WITH AS1288

RETAINING WALL BY OTHERS



NORTH ELEVATION

AMMENDMENT	DATE :	DETAILS :	CONTRACTOR TO CONFIRM ALL DIMENSIONS & LEVELS ON SITE PRIOR TO COMMENCEMENT OF ANY WORK
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**PROPOSED NEW RESIDENCE AT LOT 1
GREENWOOD CLOSE FRENCHVILLE**

DATE :	08.04.26
SCALE	1:100 (A3)
DRAWN :	PNC
DWG No.	25521
PAGE No.	5 of 15



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Ph/Fax : 07 54912393 Email : cdd79@bigpond.net.au

**CQ SOIL
TESTING**



ROCKHAMPTON REGIONAL COUNCIL

AMENDED PLANS APPROVED

12 June 2026

DATE

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

Development Permit No.: D/61-2021

Dated: 21 December 2021

Landslide Susceptibility Analysis

Site Address: Proposed Residence
Lot 1 (SP245873)
17 Greenwood Close, Frenchville

Prepared For: Hotondo Homes

Job Number: CQ30859

Issue Date: 22/04/2026



CQSOILTESTING.COM.AU



ABN 87 656 845 448
QBCC License 15 305 465
PO Box 9654
Park Avenue QLD 4701

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Client & Document Information

Client: Hotondo Homes
Project: Proposed Residence
Lot 1 (SP245873)
17 Greenwood Close, Frenchville
Investigation Type: Landslide Susceptibility Assessment
Job Number: CQ30859
Issue Date: 22/04/2026

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Document Control

Version	Date	Author	Design Drawings	Reviewer	Reviewer Initials
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Table of Contents

1.	Introduction	5
2.	Site Description	7
3.	Fieldwork.....	10
4.	Laboratory Testing	10
5.	Landslide Susceptibility Assessment.....	10
5.1	Landslide Hazard & Steep Land Overlap Mapping	10
5.2	Landslide Susceptibility Analysis	11
5.3	Landslide Risk Mitigation - Development Limitations & Considerations.....	12
6.	Comments	13
6.1	Site Classification	13
6.2	Site and Subgrade Preparation	13
6.3	Earthworks.....	14
6.4	Inferred Preliminary Retaining Wall Design Parameters.....	14
6.5	Footings	15
6.6	Drainage.....	17

Table of Figures

Figure 1: Preliminary Project Drawings (Source: Hotondo Homes, Drawing No. 25521, dated 26/02/2026)	5
Figure 2: Recent drone image of the site and surrounds (Source: CQ)	7
Figure 3: Image of site showing inferred recently placed sandstone blocks and fill in northwestern part	8
Figure 4: Hillside shading and ground surface contours (Source: QLD GeoResGlobe)	9
Figure 5: Council Landslide Hazard Overlay Map	11
Figure 6: Recommended influence zone	16

Table of Contents (Cont.)

Table of Tables

Table 1: Results of Landslide Susceptibility Analysis (Proposed Building Area)	12
Table 2: Global Stability Mohr-Coulomb Unfactored Material Parameters.....	15
Table 3: Ultimate Unfactored Bored Pile Design Parameters	16

Appendices

APPENDIX A – Borehole Logs	19
APPENDIX B – Site Photographs	24
APPENDIX C – Site Plan	28
APPENDIX D – Attachments	31

1. Introduction

This report outlines the results of the landslide susceptibility assessment and geotechnical investigation conducted by CQ Soil Testing (CQ) for a proposed residence at 17 Greenwood Close, Frenchville.

Preliminary drawings provided by Hotondo Homes indicate that the proposed residence will comprise a two-storey building (Figure 1). The preliminary drawings indicate that residence will be constructed on a levelled building pad with a retaining wall surrounding the east and north of the building. Earthworks to form the building pad along with construction of the retaining walls, had been carried out by Keppel Rock Walls prior to this assessment by CQ. The design and construction of the retaining walls was certified by Dileigh Consulting Engineers and CQ Building Certification as per the drawings and certification forms attached in Appendix D.

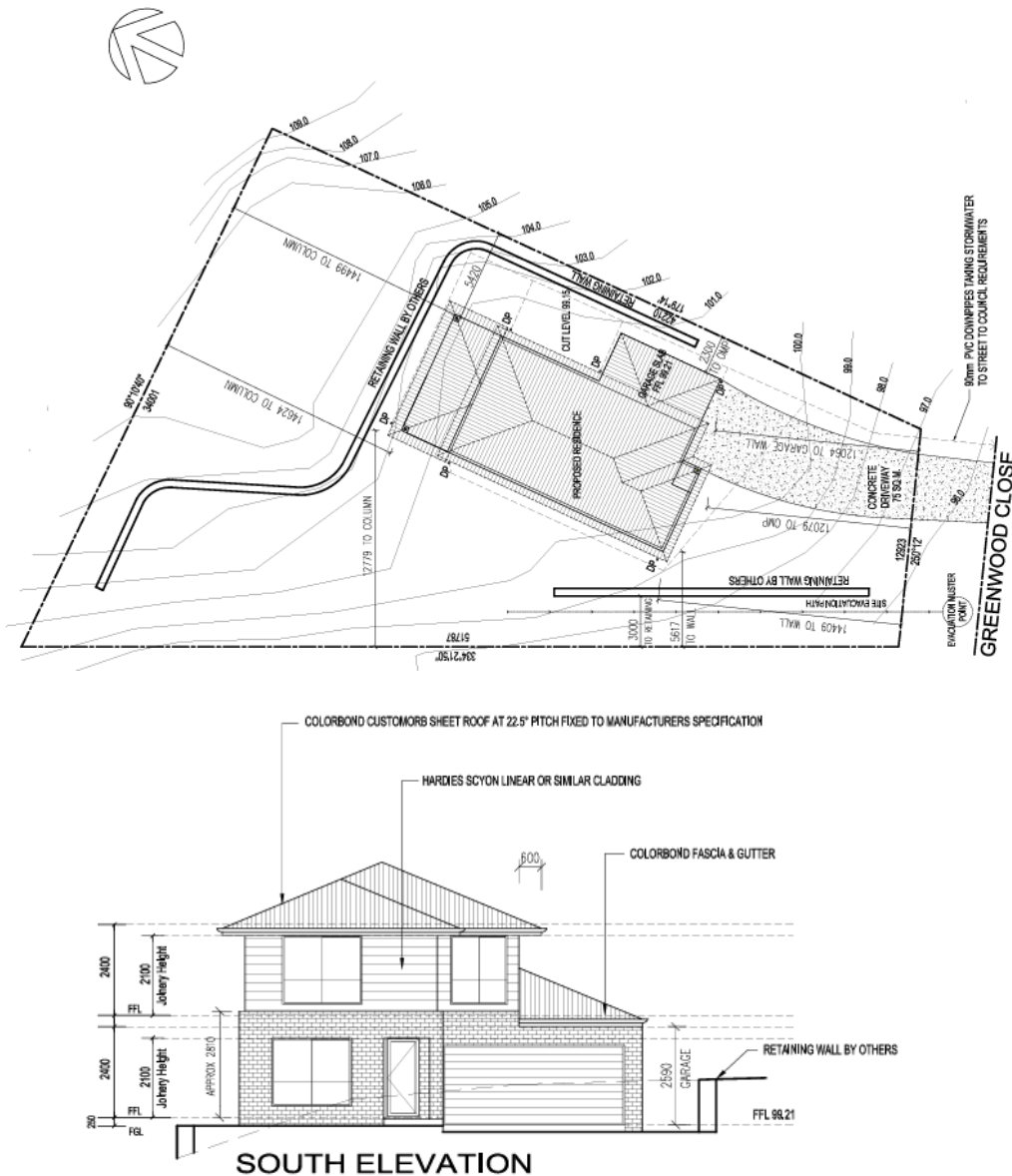


Figure 1: Preliminary Project Drawings (Source: Hotondo Homes, Drawing No. 25521, dated 26/02/2026)

Earthworks to form the building pad comprised cuts in the order of up to 3 m deep in the northern part, locally extending to 4 m where the retaining wall cornered the northeastern side of the platform adjacent to the eastern site boundary. A fill embankment up to about 2 m high had been constructed along the southwestern side of the pad. All embankments were supported by boulder walls having recently be designed, constructed and certified by others.

The provided documentation does not give specific structural details, such as the layout of footings and loading conditions for the proposed dwelling structure. However, for purposes of this report, it has been assumed that the loading conditions are 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.
- Footing recommendations, including allowable bearing pressure for high-level footings and ultimate base bearing and ultimate skin friction for the design of piles (as relevant).
- Drainage.

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

2. Site Description

The site is formally described as Lot 1 on SP245873 and covers an area of 1,050 m², with frontage to Greenwood Close on the southern boundary. A recent drone aerial image of the site and immediate surrounds is provided in Figure 2 below.



Figure 2: Recent drone image of the site and surrounds (Source: CQ)

The site was surrounded by existing residential dwellings to the south, east and west, with a national park comprising dense vegetation to the north.

New, recently constructed retaining walls support cut and fill earthworks for the building pad, with older boulder and sandstone retaining walls supporting previous earthworks along the western boundary, which drops down to the building pad on the neighbouring property. Although not shown on the provided retaining wall design drawings, one layer of sandstone blocks appear to have been added to the top of the sandstone block boundary retaining wall to support additional filling in the northwestern part.



Figure 3: Image of site showing inferred recently placed sandstone blocks and fill in northwestern part

Review of the attached contour plan, along with hillside shading data sourced from GeoResGlobe, indicates that the site is located on the southwest facing flanking slope of a hillslope that crests about 260 m to the northeast an RL of 205 m AHD. Locally, the site slopes downward from the northern extent which sits at an RL of 106 m AHD to the southwest at an RL of 97 m AHD. The calculated natural slope across the site, prior to earthworks, was estimated to range between about 12° to 20°.

Review of earlier aerial imagery indicates that several phases of earthworks have previously been carried out on the site, initially as part of what appears to have been subdivisional works with later phases to construct the western boundary wall as well as other phases of works to build a driveway to a more elevated cut and fill pad in the northeastern part. The upper 'scarp' type feature shown in Figure 4 below in the more elevated part of the site is inferred to be associated with earlier earthworks excavations as opposed to a landslide feature.

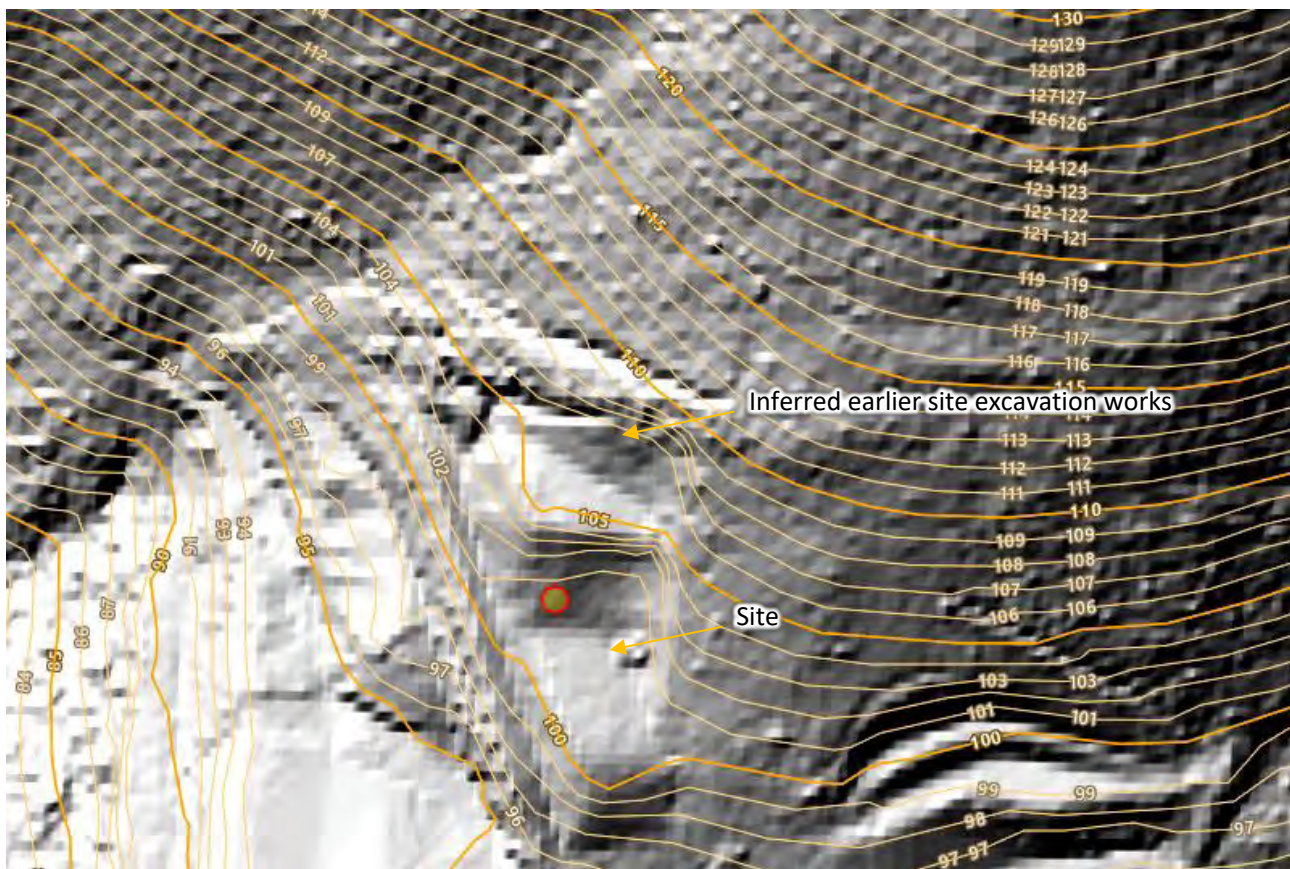


Figure 4: Hillside shading and ground surface contours (Source: QLD GeoResGlobe)

Natural surface drainage follows ground-surface gradients from the northeast corner of the site to the southwest. Surface water is expected to drain well from the site, considering the positive gradients; however, poorer drainage conditions could potentially develop on levelled areas.

During the CQ visit, the general topography of the building area and immediate surrounds were visually assessed for signs of previous landslide instability. Although the site has been subjected to recent earthworks, no indications of recent landslides or slips were observed across the proposed building area.

Review of regional surface geology presented on the Queensland Government website GeoResGlobe indicates that the site is underlain by Early Permian aged Lakes Creek Formation (PK1) comprising ‘siltstone and lithic sandstone’.

This report includes photographs of the site taken during the fieldwork, a sketch and GeoResGlobe mapping, as well as reports to improve understanding and appreciation of the site conditions and features.

3. Fieldwork

Fieldwork was undertaken on 24 March 2026 and included four boreholes (designated BH1 to BH4). The boreholes were drilled using a 4WD utility mounted auger drilling rig to refusal on rock at depths of between 1.1 m and 2 m below ground level (BGL), with borehole BH4 extended to target depth of 3 m BGL. The subsurface conditions were logged through tactile and visual assessment of returned spoil by an experienced geotechnician. Borehole logs and a test location plan are attached.

In summary, the subsurface conditions encountered were as follows:

- **Uncontrolled Fill:** Dense clayey sandy gravel was encountered in BH4 to a depth of 0.9 m BGL.
- **Natural Soils:** Very dense silty clayey gravel was encountered in BH1 to BH3 to depths of 0.5 m BGL. Very stiff silty clay with varying sand content of medium to high plasticity was encountered in BH4 to the termination depth of 3.0 m BGL.
- **Weathered Rock:** Extremely weathered (XW) rock encountered in BH1 to BH3 and upon which auger drilling refusal was encountered at depths of between 1.1 m to 2.0 m BGL.

Groundwater was not encountered during the borehole investigation with the soils logged as dry to moist. Groundwater is expected to rise significantly during the wet season and after heavy, prolonged rainfall.

It is important to note that the soil profile across the site may differ from what is indicated in the borehole logs. Therefore, if different conditions occur during construction, it is recommended to notify CQ Soil Testing.

4. Laboratory Testing

The laboratory testing undertaken on selected representative soil samples following AS1289- Methods of Testing for Engineering Purposes aims to determine the typical soil characteristics required for the engineering assessment. The results of the laboratory tests are attached to this report.

5. Landslide Susceptibility Assessment

5.1 Landslide Hazard & Steep Land Overlap Mapping

Rockhampton Regional Council has developed a Planning Scheme mapping tool to identify sites requiring a landslide hazard assessment before obtaining building approval. The Planning Scheme mapping identifies the site is mostly mapped as “steep land”, hence the need for a slope stability assessment under current regulatory guidelines (Figure 5).



Figure 5: Council Landslide Hazard Overlay Map

5.2 Landslide Susceptibility Analysis

The results of Landslide Susceptibility Analysis (refer to attached), including the relative susceptibility and correlated susceptibility rating are summarised in Table 1 below.

The following are assumed to achieve the reported Correlated Susceptibility Rating across the proposed building area:

- Natural site slope angles across the building area are between 15° and 30° degrees.
- The building is situated on a planar slope.
- Residual soils 1 m to 3 m deep.
- Cut earthworks estimated to be up to 4 m depth.
- Fill up to 1 m to 3 m high (across building area)
- Slope of cut less than 30 degrees (to the horizontal).
- Slope support has been assigned as rock wall.
- Located on a lower slope.
- No signs of instability.
- Site is fully sewerred.
- All stormwater will be piped into road drainage.

Table 1: Results of Landslide Susceptibility Analysis (Proposed Building Area)

Relative Susceptibility	Correlated Susceptibility Rating
0.9	Moderate

Based on the existing site conditions, the building area has a Moderate susceptibility rating. Recommendations and development limitations are provided in Section 5.3 and Section 6 to achieve a Low Risk of slope instability.

5.3 Landslide Risk Mitigation - Development Limitations & Considerations

Stability of the site and achievement of a **Low Risk** hinges on the stability of the existing retaining walls supporting the cut and fill embankments across the site. Provided the pre-existing and recently constructed retaining walls, which have been designed, constructed and certified by others remain ‘stable’ in the long term then there will be a Low Risk of slope instability for the proposed residence. This assessment did not include independent review and analysis of those retaining walls, rather it relies on the provided design and certification documentation for the retaining structures which was the responsibility of others. As per AS4678 design and certification of such walls should have included all forms of instability, including global stability.

It should be noted that no design and certification has been provided for the pre-existing retaining walls (i.e. along the western boundary). It is recommended that such information is sourced and confirmed prior to construction, to confirm they have been engineer designed and certified.

To achieve a **Low Risk** from slope instability for the proposed residence building works, the following recommendations must be implemented:

- The residence and all ancillary structures (e.g. retaining walls or pool etc.) must be supported on footings that penetrate through any fill and natural soil to socket at least 1 m into the underlying weathered rock.
- No additional cut and fill earthworks should be undertaken unless assessed and approved by a geotechnical RPEQ from CQ. Minimal earthworks, such as for levelling (<0.5 m depth/height) and excavations for underground services and footings would be considered acceptable.
- Surface and subsurface drainage improvements must be made to intercept and redirect water away from the development area and existing retaining walls to discharge into a formal drainage system.
- The attached geomechanics hillside practices should be adopted for the dwelling.
- A geotechnical RPEQ should inspect the site during construction to ensure the above mitigation measures are appropriately implemented and established.

6. Comments

The geotechnical comments in this report are based on factual information gathered during the fieldwork, industry practices, local experience, and published literature.

6.1 Site Classification

Based on the results of the investigation, the site would be strictly classified as Class P in accordance with AS2870 due to the presence of existing uncontrolled fill. As a result, the foundation system needs to be designed using appropriate engineering principles.

To indicate 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 3% 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 be up to 55 mm. Additional movement due to trees (yt) could be up to 25 mm.

The introduction of new fill will influence potential shrink-swell ground movements. The site must be reclassified if cut-and-fill earthworks are undertaken as part of this development. The fill settlement will be in addition to ground movements due to normal seasonal moisture variations. Typically, for well-compacted controlled fill placed within 2% of its OMC, the self-weight settlement is estimated to be approximately 1% (upper limit) to 0.5% (lower limit) of the fill height and generally occurs over an approximate 10-to-20-year period.

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](#)" and "[guide-preventing-structural-damages](#)" should be followed to ensure the site remains in optimal condition.

6.2 Site and Subgrade Preparation

Subgrade preparation should be undertaken on all site areas before construction of pavements, or ground slabs. Following the removal of vegetation and topsoil, large roots should be 'grubbed out'.

To achieve a uniformly well-compacted subgrade, the subgrade should be uniformly compacted to a depth of approximately 0.5 metres and achieve a minimum of 100% standard compaction or 75% dry density index. To prepare the subgrade, the upper 0.5 m depth may need to be scarified and moisture-conditioned (if required), and then recompacted.

Test rolling should be undertaken after subgrade preparation of the natural soils 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. There should be no noticeable movement during the test roll.

Proper drainage is recommended to prevent soil damage caused by swelling and softening. To achieve this, the subgrade should be carefully reshaped and graded to ensure it drains freely, allowing stormwater to flow away from the site and avoid ponding. The subgrade should also be appropriately sloped to prevent the formation of low spots, as these can act as drainage sinks and result in localised soil swelling and softening.

6.3 Earthworks

Earthworks must be carried out in accordance with AS3798-2007 *Guidelines on earthworks for commercial and residential developments*. Key recommendations regarding earthworks are provided below.

All vegetation, topsoil, existing uncontrolled fill and firm/loose (or weaker) materials must be removed, prior to construction. No additional filling must be undertaken as part of the works, unless assessed and approved by a geotechnical RPEQ from CQ.

All cut and fill earthworks must be supported by engineer designed and certified retaining structures, which must include an assessment of global slope instability.

Excavations in close proximity to existing structures and infrastructure, including on neighbouring properties, will need to be specifically designed to prevent undermining. If undermining is a potential issue the existing structures/infrastructure may need to be underpinned or excavations may require temporary structural shoring. The advice of a suitably qualified and experienced structural RPEQ must be sought regarding any potential undermining and design and construction of any underpins/temporary shoring (if required).

The above recommendations do not supersede any existing safety regulations or legislation applicable to excavations (e.g. limits on personnel entry into trenches).

The site should be graded to shed surface water runoff away from construction areas.

6.4 Inferred Preliminary Retaining Wall Design Parameters

Table 2 recommends retaining wall design parameters for the materials encountered during the investigation. These parameters are unfactored and drained (of pore pressures) and have been inferred based on available information.

AS 4678:2002 – Earth Retaining Structures recommends using long-term (drained) soil strength parameters for retaining wall design. These parameters should be considered when assessing long-term loading conditions, such as sustained lateral pressures acting on piles or embedded elements that form part of the retaining wall system. Long-term loads allow pore pressures within the soil to dissipate, and the soil behaviour is governed by its drained strength.

Table 2: Global Stability Mohr-Coulomb Unfactored Material Parameters

Material	Unsaturated Unit Weight (kN/m ³)	Saturated Unit Weight (kN/m ³)	Friction Angle (ϕ')	Cohesion (C')
Silty clayey gravel	18	19	32	0
Silty Sandy Clays	18	19	26	1
Weathered Rock	23	24	32	3

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

It is recommended that global stability analysis be undertaken on all retaining structures to ensure that suitable global stability FoS are reached and to confirm that an appropriate global stability factor of safety is achieved. For tiered retaining walls, the design should consider the entire system, rather than each wall in isolation, to ensure that the combined effects of height, ground slope, wall arrangement, and applied loads are appropriately accounted for. As a minimum it is expected that all retaining walls will need to be embedded into weathered rock, be it directed founded on or socketed into with shear piles, to address global stability. An RPEQ from CQ must review the retaining wall design details for the downslope landscaping area once detailed design is finalised.

It is recommended that passive pressures be ignored where disturbance may occur (ie. future trenching or earthworks processes).

Where retaining wall backfill may be exposed to overland flow, it should be capped with a low-permeability clay layer and/or an impermeable membrane (e.g. HDPE) to minimise stormwater ingress. Depending on the outcomes of a hydraulic assessment of the upslope catchment, surface diversion drains may also be required upslope of retaining walls. Subsurface drainage must be provided behind all retaining walls (e.g. a slotted pipe wrapped in a filter sock and embedded in free-draining gravel). The design must also consider site-specific groundwater conditions, with appropriate allowances made for hydrostatic pressure.

6.5 Footings

All footings for the proposed dwelling and related structures must extend through any fill and unsuitable natural soil to socket at least 1 m into the underlying very low strength (or stronger) weathered ‘bedrock’ (not ‘floaters’ in the soil profile). Based on the findings of the boreholes, it is anticipated that minimum footing depths in the order of 1 m to 4 m BGL (existing ground level) will be required.

On this basis, it is recommended that steel reinforced concrete shear piles or ‘bucket piers’ will be required to support the proposed structures. All piles should be engineered to resist design action effects, including bending moments and shear forces induced by lateral soil movements associated with sloping terrain.

High-level footings may be possible in areas of cut where very low strength (or stronger) weathered rock is exposed at the subgrade level, subject to an assessment by a geotechnical RPEQ. High-level footings founded at least 0.5 m into very low strength (or stronger) weathered rock may be designed using an allowable bearing pressure of 250 kPa. Elastic settlements would be expected to range up to about 0.5% of the footing width.

When footings are located near an underground service or other structural elements (such as other footings or retaining walls), they should be founded at least 0.3 metres below an imaginary line extending at a 45-degree angle from the base of the service or obstruction. Where footings are positioned near other structures, such as retaining walls or existing foundations, the potential influence on and from those structures should also be assessed. Figure 6 provides a visual reference.

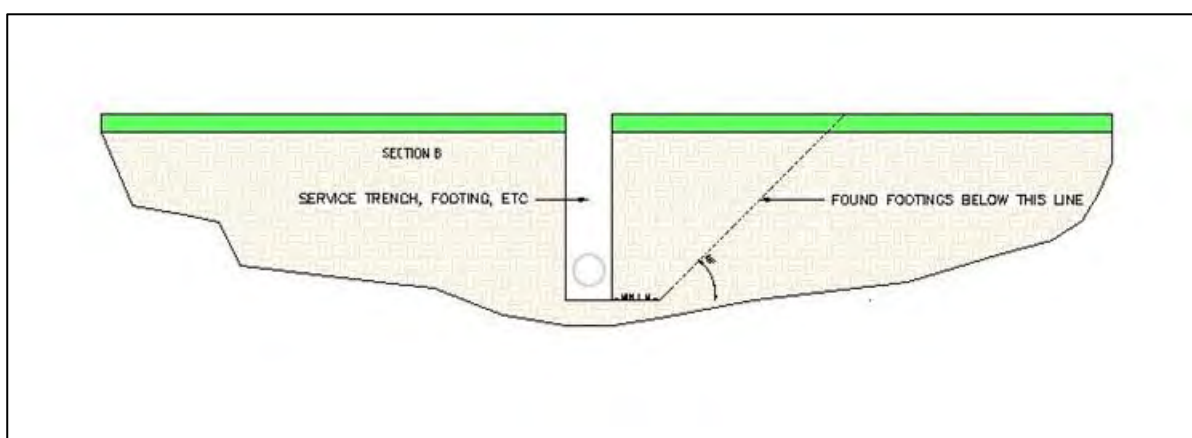


Figure 6: Recommended influence zone

The design of vertically loaded piers or ‘bucket piers’ founded at least two ‘pile’ diameters or 2x the pier width into the designated strata can adopt the ultimate values in Table 3. Screw piles are not recommended for this site.

The upper one metre of the pile skin friction in the clay soils should be ignored in the design, along with any sections of piers that require liners. For example, the piers should be designed assuming a 1-metre length of the pile is sticking out of the ground, cantilevering this metre. This precaution is necessary because a potential separation between the pile and the ground can occur due to soil shrinkage during drying.

Table 3: Ultimate Unfactored Bored Pile Design Parameters

Material	Skin Friction (kPa)	End Bearing (kPa)
Fill	Not recommended	Not recommended
Silty clayey gravel	25	Not recommended
Very stiff residual soil	20	Not recommended
Weathered rock	50	1800

To ensure the proper performance of piers, it is recommended that they be designed and certified by a qualified structural engineer and constructed in accordance with the minimum requirements specified in AS 2159—Piling Design and Installation. This standard outlines guidelines for the design and construction of piles, including the necessary reduction factors and design considerations.

Settlements of loaded piers like the one described above are not expected to exceed approximately 1% to 2% of the pier's diameter or width.

Most equipment, including excavators with auger attachments, should be able to excavate bored pile excavations in the fill, residual soils, and very low-strength weathered rock. However, when underlying low-strength or stronger weathered rock is encountered during bored pile excavations, larger machinery with specialised rock auger attachments will likely be needed to excavate rock formations, particularly below the borehole refusal depths. Pilot holes may be necessary to achieve the required pile depths and diameter. Due to the possibility of oversize materials, 'bucket' piers may be required to support the residence.

A suitably qualified geotechnical engineer should inspect and certify footings for bearing capacity during construction to ensure that they are correctly constructed and perform as expected over their design life.

6.6 Drainage

Permanent site drainage must be installed to ensure that surface water runoff is directed away from any structures, batters or retaining walls. Surface diversion swales and/or bunds must be constructed above the existing batters and retaining wall. Uncontrolled run off from surface water flows over the crests of the retaining walls will likely increase the risk of instability to unacceptable High or Very High levels. If the current, recently constructed finished surface levels do not promote drainage in a controlled fashion additional diversion drains and corrected pad grades will have to be implemented or established and maintained to address stability of the site and retaining walls.

Additional surface drainage should also be constructed around the dwelling to manage stormwater.

Specific drainage recommendations are as follows:

- Construct diversion drainage along the upslope sides of all retaining walls and the building area (e.g. concrete or rock lined drain or similar) to discharge any captured stormwater from the development area downslope of any structure or embankment.
- Perimeter, subsurface cut-off drains must be installed adjacent to new pavements and upslope from proposed building location, to intercept and divert potential subsurface seepage. All subsurface drains must daylight into a controlled drainage system.
- Where potentially exposed to overland flow, retaining wall backfill materials should be capped with a low permeability clay layer, and/or impermeable membrane (e.g. HDPE), in order to minimise the ingress of stormwater. Subject to hydraulic analysis of the up-slope catchment, it may also be necessary to install additional surface drainage swales above retaining walls. The lining selected for such drainage (e.g. turf rock, concrete, etc.) would depend on consideration by the designer of factors such as flow velocity and maintenance requirements.

- Grade the building platform(s) (minimum 1V:100H) to achieve positive drainage into edge drains and away from retaining wall crests.

Subsurface drainage must be installed behind any retaining walls (e.g. slotted 'aggi' pipe wrapped in filter 'sock' placed in gravel backfill). Depending on matters such as the extent of drainage installed and site-specific groundwater conditions, the designer must make an assessment of hydrostatic pressure to be accounted for in the design of the retaining structure.

All stormwater collected around the residence and other areas should be directed by pipes or lined channels (e.g. rock lined swales) to discharge into water tanks or the existing stormwater infrastructure along Greenwood Close. All overflow must be directed by pipes or lined channels onto a rock fill weir/dissipator or field inlet pit constructed at least 10 m downslope of all structures/retaining walls/batters and not directly above neighbouring structures/batters. If possible all stormwater should ultimately discharge into the existing roadside stormwater infrastructure. The stormwater system must be considered 'non-worsening' to the site and neighbouring allotments.

Subsurface disposal of stormwater must not be undertaken (including infiltration pits).

The surface and subsurface drainage system must be designed by a suitably qualified and experienced civil/hydraulic RPEQ.

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

Yours faithfully



David Pollock

Geotechnical Consultant – RPEQ (14121), NER, MIEAust



PATRICK MUNRO

Senior Soil Technician

APPENDIX A – Borehole Logs



CQ Soil Testing

32 Alexandra St, Park Avenue QLD 4701

Phone: 07 4936 1163

Geotechnical Log - Borehole

BH1

Latitude : -23.33957
 Longitude : 150.55039
 Total Depth : 1.3 m

Location : 17 Greenwood Cl, Frenchville QLD 4701, Australia
 Logged By : Zach Schonknecht
 Date : 24/03/2026

Job Number : CQ30859
 Client : Hotondo Homes
 Project : Slope Stability

Drilling Method	Water	DCP Blows	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Samples
Auger		9	0.5	Natural		GC	Natural Silty Clayey GRAVEL GM: fine to coarse sized, low plasticity clay, light brown, dry, very dense.	
		12						
		15						
		15	1.0	Natural		GM	Natural Clayey Silty GRAVEL GM: fine to coarse sized, low plasticity clay, with fine to coarse sand, light brown, dry, very dense.	
		15	1.2	Rock		XW	Rock EXTREMELY WEATHERED ROCK: light brown, dry.	
							BH1 Refusal at 1.3 m (Tungsten Carbide Drill Bit Refusal on Extremely Weathered Rock)	

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



CQ Soil Testing

32 Alexandra St, Park Avenue QLD 4701

Phone: 07 4936 1163

Geotechnical Log - Borehole

BH2

Latitude : -23.33951
 Longitude : 150.55033
 Total Depth : 2 m

Location : 17 Greenwood Cl, Frenchville QLD 4701, Australia
 Logged By : Zach Schonknecht
 Date : 24/03/2026

Job Number : CQ30859
 Client : Hotondo Homes
 Project : Slope Stability

Drilling Method	Water	DCP Blows	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Samples
Auger		15	0.5	Natural		GC	Natural Silty Clayey GRAVEL GM: fine to coarse sized, low plasticity clay, light brown, dry, very dense.	
		15	1.0	Natural		GM	Natural Clayey Silty GRAVEL GM: fine to coarse sized, low plasticity clay, with fine to coarse sand, light brown, dry, very dense.	
		14 15	1.9	Rock		XW	Rock EXTREMELY WEATHERED ROCK: light brown, dry.	
							BH2 Refusal at 2 m (Tungsten Carbide Drill Bit Refusal on Extremely Weathered Rock)	

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



CQ Soil Testing

32 Alexandra St, Park Avenue QLD 4701

Phone: 07 4936 1163

Geotechnical Log - Borehole

BH3

Latitude : -23.33954
 Longitude : 150.55037
 Total Depth : 1.1 m

Location : 17 Greenwood Cl, Frenchville QLD 4701, Australia
 Logged By : Zach Schonknecht
 Date : 24/03/2026

Job Number : CQ30859
 Client : Hotondo Homes
 Project : Slope Stability

Drilling Method	Water	DCP Blows	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Samples
Auger		9	0.1	Natural		GC	Natural Silty Clayey GRAVEL GM: fine to coarse sized, low plasticity clay, light brown, dry, very dense.	
		15	0.2	Natural		GC		
		12	0.3	Natural		GC		
		15	0.4	Natural		GM	Natural Clayey Silty GRAVEL GM: fine to coarse sized, low plasticity clay, with fine to coarse sand, light brown, dry, very dense.	
		15	0.5	Natural		GM		
		15	1.0	Rock		XW	Rock EXTREMELY WEATHERED ROCK: light brown, dry.	
			1.1				BH3 Refusal at 1.1 m (Tungsten Carbide Drill Bit Refusal on Extremely Weathered Rock)	

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

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



CQ Soil Testing

32 Alexandra St, Park Avenue QLD 4701

Phone: 07 4936 1163

Geotechnical Log - Borehole

BH4

Latitude : -23.33957
 Longitude : 150.55033
 Total Depth : 3 m

Location : 17 Greenwood Cl, Frenchville QLD 4701, Australia
 Logged By : Zach Schonknecht
 Date : 24/03/2026

Job Number : CQ30859
 Client : Hotondo Homes
 Project : Slope Stability

Drilling Method	Water	DCP Blows	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Samples
Auger			0.9	UNCONT ROLLED Fill		GC	Uncontrolled Fill Clayey Sandy GRAVEL GC: fine to coarse sized, fine to coarse grained sand, low plasticity clay, brown, dry to wet with depth, dense, floaters present.	
			1.0	Natural		CH	Natural Silty CLAY CH: high plasticity, trace fine to coarse grained sand, yellowish brown, moist, very stiff.	
			1.5	Natural		CI	Natural Silty Sandy CLAY medium plasticity, fine to coarse grained sand, trace fine to coarse sized gravel, yellowish brown, dry, very stiff.	
BH4 Terminated at 3 m								

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

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

APPENDIX B – Site Photographs



Site Photo



Site Photo



(07) 4936 1163



32 Alexandra Street, North
Rockhampton QLD 4701



info@cqsoiltesting.com.au

Photo description	Site photos		
Client	Hotondo Homes		
Location	17 Greenwood Cl, Frenchville QLD 47...		
Project name	Slope Stability		
Project No	CQ30859	Scale	Not to Scale
BH No	Photos	BH Depth	



Drone Photo



Drone Photo



(07) 4936 1163



32 Alexandra Street, North Rockhampton QLD 4701



info@cqsoiltesting.com.au

Photo description	Drone Photos		
Client	Hotondo Homes		
Location	17 Greenwood Cl, Frenchville QLD 47...		
Project name	Slope Stability		
Project No	CQ30859	Scale	Not to Scale
BH No	Photos	BH Depth	



Soil Profile



(07) 4936 1163



32 Alexandra Street, North Rockhampton QLD 4701

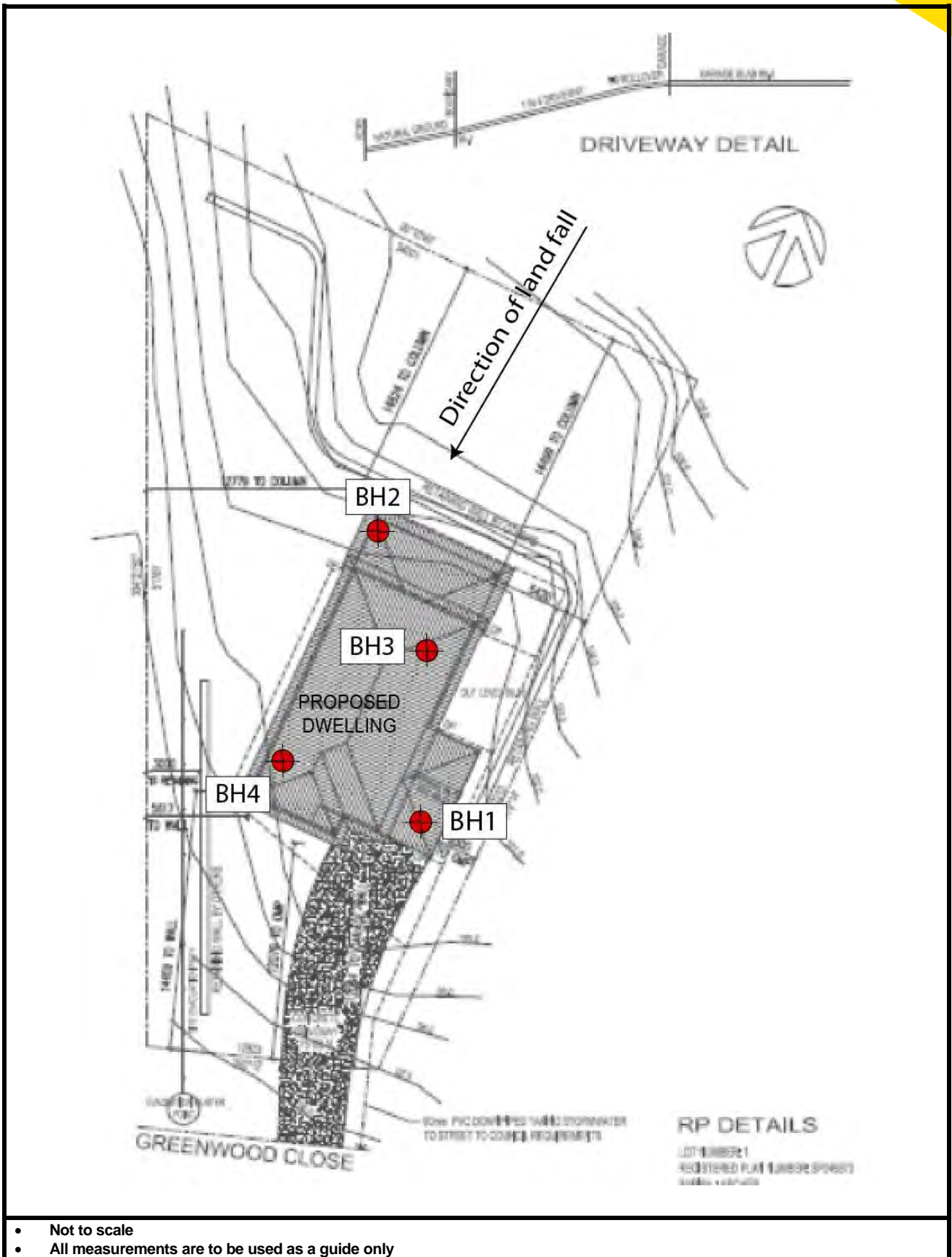


info@cqsoiltesting.com.au

Photo description	Soil Profile		
Client	Hotondo Homes		
Location	17 Greenwood Cl, Frenchville QLD 47...		
Project name	Slope Stability		
Project No	CQ30859	Scale	Not to Scale
BH No	Photos	BH Depth	

APPENDIX C – Site Plan

Site Plan



- Not to scale
- All measurements are to be used as a guide only



Date: 22/04/2026

Drafted By: Zach Schonknecht

Slope Stability Site Plan

Project ID:
CQ30859

Reviewed by:

17 Greenwood Ct, Frenchville QLD 4701,
Australia



APPENDIX D – Attachments

150°33'0"

1RP618495
Freehold

1LN2795
Reserve

1SP245873
Freehold

2SP245873
Freehold

14SP151205
Freehold

ASP245873
Easement

12SP151205
Freehold

15SP151205
Freehold


11SP151205
Freehold

150°33'0"


A product of
GeoResGlobe



Legend

 Cadastre (DCDB) parcel

Places: My Places(1)

 My Place 1



0 10 metres

Scale: 1:500

Printed at: A4

Print date: 15/4/2026

Projection: Web Mercator EPSG 102100 (3857)

For more information, visit
<https://georesglobe.information.qld.gov.au/help-info/Contact-us.html>



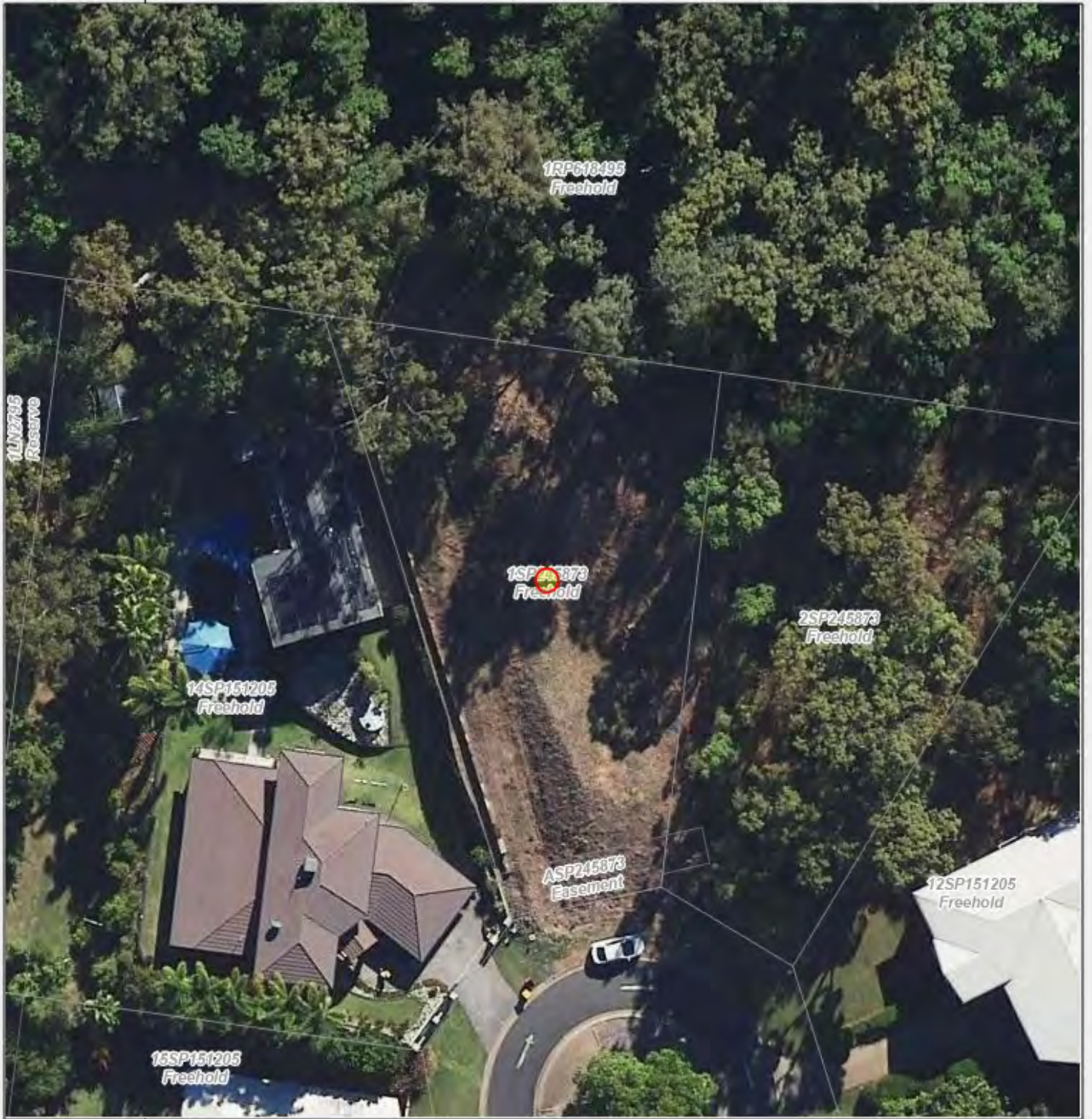
**Queensland
Government**

Department of Natural Resources and Mines,
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150°33'0"




150°33'0"

A product of
GeoResGlobe



Legend

-  Cadastre (DCDB) parcel
- Places: My Places(1)
-  My Place 1



0 10 metres



Scale: 1:500

Printed at: A4

Print date: 15/4/2026

Projection: Web Mercator EPSG 102100 (3857)

For more information, visit
<https://georesglobe.information.qld.gov.au/help-info/Contact-us.html>



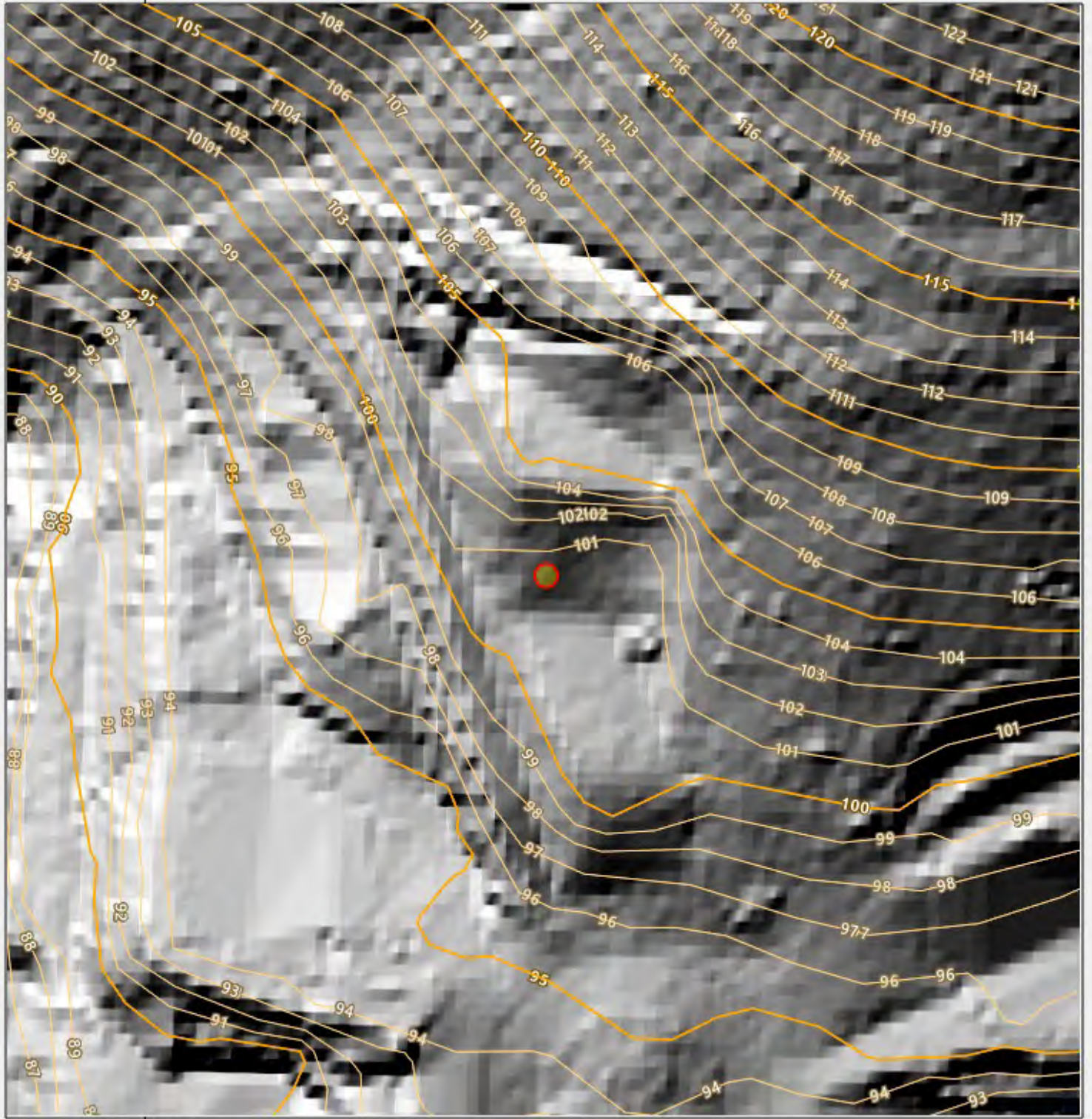
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150°33'0"



150°33'0"

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Legend located on next page



0 10 metres



Scale: 1:500

Printed at: A4

Print date: 15/4/2026

Projection: Web Mercator EPSG 102100 (3857)

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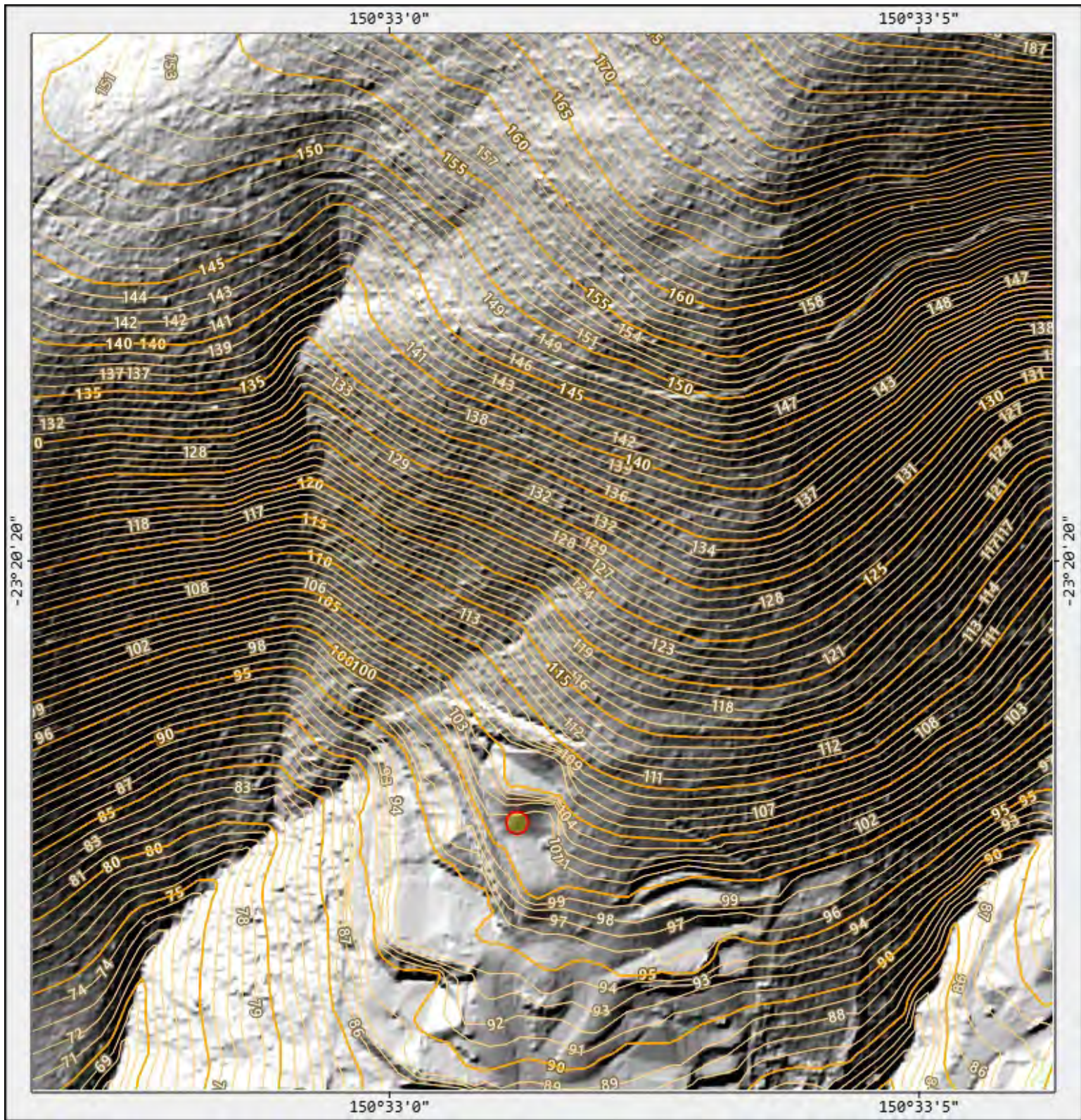


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0 25 metres

Scale: 1:1500

Printed at: A4

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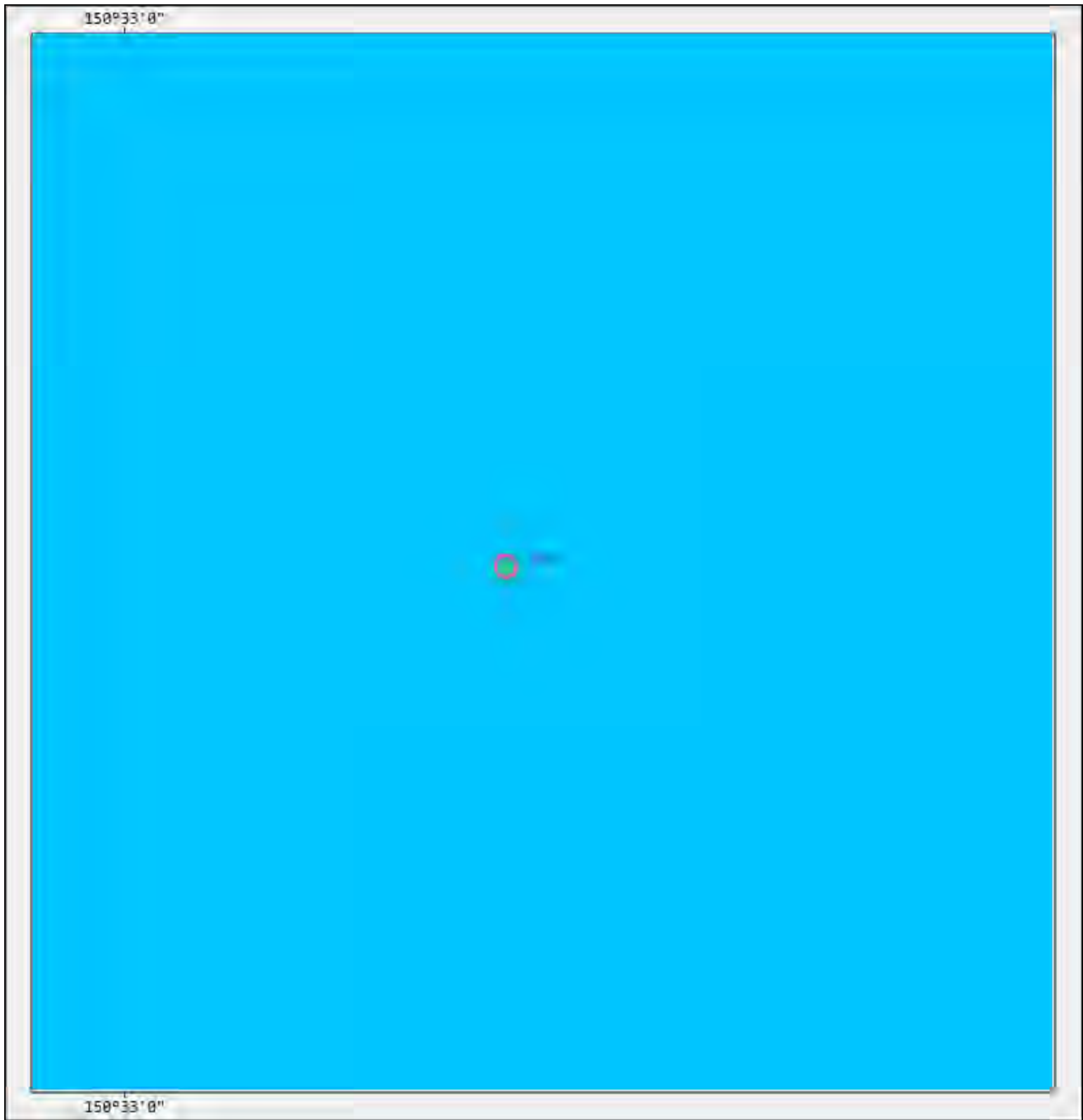


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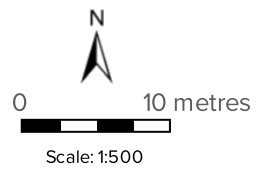
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Department of Natural Resources and Mines,
Manufacturing, and Regional and Rural Development

PDF report

Rock unit key (Surface):	11746
Rock unit name:	Lakes Creek Formation
Map symbol:	Pkl
Lithological summary:	Siltstone and lithic sandstone
Dominant rock:	ARENITE-MUDROCK
Rock type:	STRATIFIED UNIT (INCLUDING VOLCANIC AND METAMORPHIC)
Age:	EARLY PERMIAN
Legend:	Lakes Creek Formation (Pkl)
Legend sequence:	3290
Rock unit key (Solid):	11746
Layer:	Detailed surface geology

Created On: 15/04/2026, 9:24:06 am Created By: Guest

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**Queensland
Government**

PDF report

Lot:	1
Plan:	SP245873
Lot plan:	1SP245873
Area (sq m):	1050
Tenure:	Freehold
Segment parcel:	34891379
Parcel indicator:	
Local government:	Rockhampton Regional
Locality:	Frenchville
Accuracy:	B&D ENTRY CONTROLLED - 0.1M
Surveyed:	Y
Smart Map:	https://apps.information.qld.gov.au/data/v2/Cadastre/SmartMap?lot=1&plan=SP245873
st_area(shape):	9.28e-8
st_perimeter(shape):	0.0013114071
Layer:	Cadastre (DCDB) parcel

Created On: 15/04/2026, 9:21:47 am Created By: Guest

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8 APPENDICES

Appendix A - Landslide susceptibility analysis form

LANDSLIDE SUSCEPTIBILITY ANALYSIS

Analysis No. 1

Location: _____ Site No. _____

1 Natural Surface Slope			
Site		Level	Factor
	Less than 5 degrees	L	0.1
	Between 5 and 15 degrees	M	0.5
X	Between 15 and 30 degrees	M	0.8
	Between 30 and 45 degrees	H	1.2
	More than 45 degrees	M	0.8

2 Slope Shape			
Site		Level	Factor
	Crest or ridge	L	0.7
X	Planar / Convex	M	0.9
	Rough / Irregular	H	1.2
	Concave	H	1.5

3 Site Geology			
Site		Level	Factor
	Volcanic Extrusive rock	H	1.1
X	Sedimentary rock	M	1
	Low grade metamorphic rock	M	1
	High grade metamorphic rock	L	0.9
	Volcanic Intrusive rock	M	1

4 Soils			
Site		Level	Factor
	Rock at surface	VL	0.1
	Residual soil < 1m deep	L	0.5
X	Residual soil 1-3m deep	M	0.9
	Residual soil > 3m deep	H	1.5
	Colluvial soil < 1m deep	H	1.5
	Colluvial soil 1-3m deep	VH	2
	Colluvial soil > 3m deep	VH	4

5 Fill height			
Site		Level	Factor
	None	L	1
	Less than 1m	M	1.1
X	Between 1 and 3m	M	1.3
	Between 3 and 6m	H	1.7
	More than 6m	VH	2.5

6 Evidence of groundwater			
Site		Level	Factor
X	None apparent	L	0.7
	Minor moistness	M	0.9
	Generally wet	H	1.5
	Surface springs	VH	3

7 Cut height			
Site		Level	Factor
	None	L	1
	Less than 1m	M	1.1
	Between 1 and 3m	M	1.3
X	Between 3 and 6m	H	1.7
	More than 6m	VH	2.5

8 Slope of cut face			
Site		Level	Factor
X	Less than 30 degrees	L	0.5
	Between 30 and 45 degrees	M	1
	Between 45 and 60 degrees	H	1.5
	More than 60 degrees	VH	3

9 Material in cutting			
Site		Level	Factor
	High strength rock	L	0.5
	Medium strength rock	L	1
	Low strength rock	M	1.2
X	Very low strength rock and soil	H	1.5
	Soil	VH	2

10 Cut slope support			
Site		Level	Factor
	Concrete wall	L	0.5
	Crib wall	M	0.9
	Gabion wall	M	1
X	Rockwall	H	1.5
	Unsupported	H	2

11 Concentration of surface water			
Site		Level	Factor
	Ridge	L	0.7
	Crest	L	0.8
	Upper slope	M	0.9
	Mid slope	H	1.2
X	Lower slope	VH	1.5

12 Wastewater Disposal			
Site		Level	Factor
X	Fully sewerred	L	1
	Onsite disposal - Surface	L	1.2
	Onsite disposal - Soak/Trenches	M	1.5

13 Stormwater Disposal			
Site		Level	Factor
X	All stormwater piped into road drains	L	0.7
	Rain water tank with overflows	L	1
	Stormwater discharge on site	M	1.5

14 Evidence of instability			
Site		Level	Factor
X	No sign of instability	L	0.8
	Soil Creep	H	1.2
	Minor irregularity	VH	2
	Major irregularity	VH	5
	Active instability	VH	10

Summary

		Factor
1	Natural surface slope	0.8
2	Slope shape	0.9
3	Site geology	1
4	Soils	0.9
5	Fill height	1.3
6	Evidence of groundwater	0.7
7	Cut height	1.7
8	Slope of cut face	0.5
9	Material in cut	1.5
10	Cut slope support	1.5
11	Concentration of surface water	1.5
12	Wastewater disposal	1
13	Stormwater disposal	0.7
14	Evidence of instability	0.8
Relative Susceptibility (1x2x3x4x5x6x7x8x9x10x11x12x13x14)		0.947

0.9

Appendix B - Correlation between relative susceptibility and susceptibility rating

Relative Susceptibility	Susceptibility Rating
Less than 0.2	Very Low
0.2 - 0.6	Low
0.6 - 2.0	Moderate
2.0 - 6.0	High
Greater than 6.0	Very High

This form is made for the purpose of sections 98 and 99 of the *Building Act 1975*.

The building certifier for the work must give this signed form to the owner as the final inspection certificate for a single detached class 1a buildings and class 10 buildings or structures (excluding swimming pools and swimming pool fences) certifying the work is compliant with the building development approval.

Note: Form 17 – Final inspection certificate – swimming pool fences is the final inspection certificate for a regulated pool under the *Building Act 1975*.

Additional explanatory information is included in the Appendix at the end of this form.

1. Owner details

If the owner is a company, a contact person must be shown.

All correspondence will be mailed to this address.

Name (<i>in full</i>)	Dave Durrant		
Company name (<i>if applicable</i>)			
Contact person	Dave Durrant		
Business phone number		Mobile	0400 792 353
Email address	ddurant1975@gmail.com		
Postal address	4 Belfield Avenue		
		Suburb/locality	Frenchville
State	QLD	Postcode	4701

2. Property description

The description must identify all land the subject of the application.

The lot and plan details (e.g. SP/RP) are shown on title documents or a rates notice.

If the plan is not registered by title, provide previous lot and plan details.

Street address	17 Greenwood Close		
		Suburb/locality	Frenchville
State	QLD	Postcode	4701
Lot and plan details (<i>attach list if necessary</i>)			
1 SP345873			
Local government area the land is situated in			
Rockhampton Regional Council			

3. Building description

Building description

Retaining Walls

Class of building/structure

Class 10b

4. Details of the building development approval

Building development approval number

Building certifier reference number

20250741

5. Performance standards

If the building work uses a performance-based solution, list the performance requirements used.

Performance requirements

6. Certification

Pursuant to section 10 of the *Building Act 1975* for the performance of building certification functions.

I certify that on an inspection carried out in accordance with best industry practice, the building work for the above building or structure was inspected and complies with the building approval or certificates of inspection were accepted from competent persons at the following stages of the construction.

Inspection Type	Date of inspection	Date of certificate
Final	08 Apr 2026	08 Apr 2026


--	--	--

Dated this	Thursday 09	Day of	April	20	26
------------	-------------	--------	-------	----	----

7. Building certifier

Name (in full)	Luke Bray				
Company name (if applicable)	CQ Building Certification Rockhampton				
Contact person	Luke Bray				
Business phone number	(07) 4922 0600	Mobile			
Email address	admin@cqbc.com.au				
Postal address	7/46 Gladstone Road				
		Suburb/locality	Allenstown		
State	QLD	Postcode	4700		
Licence number	A1226600				

8. Signature of building certifier for the work

Signature		Date	09 Apr 2026		
-----------	---	------	-------------	--	--

LOCAL GOVERNMENT USE ONLY

Date received	Click or tap to enter a date.	Reference number/s			
---------------	-------------------------------	--------------------	--	--	--

Appendix – explanatory information

Who can complete and sign a Form 21? (section 99(2) of the *Building Act 1975*)

The relevant building certifier must complete and sign the Form 21 for the purpose of stating the work is certified compliant with the building development approval.

The building certifier is required to attach to this form, all relevant inspection documentation that has been relied on by the building certifier to certify the building work complies with the building development approval. Inspection documentation, for inspection of building work, means the following documents given for the building work:

- a compliance certificate
- a notice, given to the builder for the work by or for the building certifier about an inspection of the work
- a certificate about an inspection under this Act
- a final inspection certificate
- a certificate of occupancy
- a certificate relating to the inspection of the building work relied on by the relevant building certifier

Examples of the above documents are the **Form 16 – Inspection certificate**, **43 – Aspect certificate (QBCC licensee)** and **12 – Aspect inspection certificate (appointed competent person)**.

Visit the [Business Queensland website](#) for all approved and administrative building forms published by the department.

When is a Form 21 issued? (section 99 of the *Building Act 1975*)

If the building certifier is satisfied the final stage of building work complies with the building development approval and the inspection was carried out under industry best practice, that the work complies with the building development approval, they must within the required period give the Form 21 and the inspection documentation to the owner. The required period means the period that ends five business days after:

- accepting all the inspection documentation relied on by the building certifier, or
- all of the building work has been inspected.

Giving inspection documents to the relevant local government (section 149 of the *Building Act 1975*)

A private certifier must give the relevant local government copies of all inspection documentation within five business days after one of the following happens:

- the giving of the final inspection certificate for the building work or a certificate of occupancy for the relevant building
- the discontinuance of the engagement of the private certifier
- the lapsing of the building development approval; in these circumstances the certifier must also give the local government a copy of the relevant reminder notice issued under section 95 of the Building Act.

However, if the inspection documentation includes certificates relied on by the certifier, the five business days do not start until after the certifier has accepted all the certificates.

Note: under section 150 of the Building Act the building certifier must keep all inspection documentation for at least seven years.

Competent person (section 10 of the *Building Act 1975* and Part 6 of the BR 2021)

A building certifier must assess and decide to appoint an individual as a competent person before they can, as a competent person, give design-specification help. The building certifier is required to keep detailed records about what was considered when appointing a competent person.

A competent person cannot give inspection help to a building certifier until they have been appointed by the building certifier. For further information about assessment of someone as a competent person refer to the **Guideline for the assessment of competent persons**.

Under section 36 of the Building Regulation 2021 the building certifier must record the details of their decision making to appoint a competent person and keep this record for at least 7 years. A maximum 20 penalty units apply for each offence committed under this provision.

Inspection help (section 34 of the BR 2021)

A building certifier must be satisfied that an individual is competent to give the type of inspection help having regard to the individual's experience, qualifications and skills and if required by law to hold a licence or registration, that the individual is appropriately registered or licensed.

For further information about conducting inspections for class 2 to 9 buildings, refer to the **Guideline for inspection of class 2 to 9 buildings**.

For further information about conducting inspections for detached class 1a and 10 buildings or structures refer to the **Guideline for inspections of class 1 and 10 buildings and structures**.

PRIVACY NOTICE

The Department of Energy and Public Works is collecting personal information as required under the *Building Act 1975*. This information may be stored by the Department, and will be used for administration, compliance, statistical research and evaluation of building laws. Your personal information will be disclosed to other government agencies, local government authorities and third parties for purposes relating to administering and monitoring compliance with the *Building Act 1975*. Personal information will otherwise only be disclosed to third parties with your consent or unless authorised or required by law.

This form is the approved form that must be used in accordance with section 10 of the *Building Act 1975* and section 53 of the Building Regulation 2021. The relevant building certifier, another building certifier or an appointed competent person is stating a stage of work is compliant with the building development approval.

Explanatory information relevant to completion of this form is in the Appendix at the end of this form.

1. Stage of the building work

See section 44 of the BR 2021 for what constitutes a stage of assessable building work.

List stage/s of building work (indicate the stage)

Final

2. Property description

The description must identify all land the subject of the application.

The lot and plan details (e.g. SP/RP) are shown on title documents or a rates notice.

If the plan is not registered by title, provide previous lot and plan details.

Street address	17 Greenwood Close		
	Suburb/locality	Frenchville	
State	QLD	Postcode	4701

Lot and plan details (*attach list if necessary*)

1 SP345873

Local government area the land is situated in

Rockhampton Regional Council

3. Building/structure description

Building/structure description

Retaining Walls

Class of building/structure

Class 10b

4. Description of component/s certified

Clearly describe the extent of work covered by this certificate, e.g. all structural aspects of the steel roof beams.

Final

5. Basis of certification

Detail the basis for giving the certificate and the extent to which tests, specifications, rules, standards, codes of practice and other publications were relied upon by the inspecting person.

As visual inspection

6. Reference documentation

Clearly identify any relevant documentation, e.g. numbered structural engineering plans or aspect inspection certificates.

Building approval documentation

7. Building certifier reference number and building development approval number

Building certifier reference number	20250741	Building development approval number	
-------------------------------------	----------	--------------------------------------	--

8. Building certifier or appointed competent person

Under Part 6 of the Building Regulation a person must be assessed, by the relevant building certifier as competent to give inspection help for the stage work.

Name (<i>in full</i>)	Luke Bray		
Company name (<i>if applicable</i>)	CQ Building Certifications Rockhampton		
Contact person	Luke Bray		
Business phone number	(07) 4922 0600	Mobile	
Email address	admin@cqbc.com.au		
Postal address	7/46 Gladstone Road		
	Suburb/locality	Allenstown	
State	QLD	Postcode	4700
Licence class or registration type (<i>if applicable</i>)	A1226600		
Licence class or registration number (<i>if applicable</i>)	Level 2		

9. Signature of building certifier or appointed competent person

Signature		Inspection date	08 Apr. 2026
		Certificate date	08 Apr. 2026

LOCAL GOVERNMENT USE ONLY

Date received	Click or tap to enter a date.	Reference number/s	
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Appendix – explanatory information

IMPORTANT NOTE: a competent person who knowingly or reasonably suspects the information they are giving to the building certifier is false or misleading, including the information contained in this certificate (Form 16), commits an offence and is liable to a maximum penalty of 100 penalty units.

Who can complete this certificate? (sections 10 of the *Building Act 1975* (Building Act) and 53(2) of Building Regulation 2021 (BR 2021)).

This form must be completed and signed by a building certifier for the work or another building certifier or the appointed competent person (inspection) – **the inspecting person**.

When is a Form 16 needed?

This form is to be completed when an inspecting person inspects a stage of assessable building work, as stated in a notice for inspection and is satisfied that all relevant aspects of the stage of work have been completed and comply with the building development approval for the work.

The inspection time for a stage of work is to be agreed between the builder and building certifier and must be carried out by the inspecting person in accordance with best industry practice.

If satisfied the stage is compliant the inspecting person must give the builder for the stage of work the completed and signed Form 16. The regulation requires the inspecting person to provide the reasons why they are satisfied all aspects of the stage are completed and compliant, including any tests, specifications, rules, standards, codes of practice or other publications relied upon when making the assessment.

The inspecting person may rely on an aspect certificate from an appointed competent person (inspections), (Form 12 – Aspect inspection certificate) or a QBCC licensee (Form 43 – Aspect certificate (QBCC licensee)).

Restrictions for who can sign a Form 16 (section 46 of the BR 2021)

For a single detached class 1a building and class 10 building or structure only the building certifier for the assessable building work, or another building certifier, can sign the certificate of inspection (Form 16) for the following stages:

- after the excavation of foundation material and before the concrete for the footings, or slab, for the building or structure is poured (foundation/excavation stage)
- if the building or structure is to have footings – after the placement of formwork and reinforcement for the footings but before the concrete for the footings is poured (footings stage)
- if the building or structure is to have a slab – after the placement of formwork and reinforcement for the slab but before the concrete for the slab is poured (slab stage).
- the final stage of the work (for swimming pools, the final stage is at the completion of the pool and its fencing and, if no temporary fence for the pool was constructed, before the pool is filled with water to a depth of 300mm or more).

In addition to the stages above for a building development approval, if the structure is a swimming pool that includes a temporary fence, only the building certifier for the assessable building work, or another building certifier, can sign the certificate of inspection (Form 16) for the following stages:

- on the completion of the construction of the temporary fence and before the pool is filled with water to a depth of 300mm or more
- before an extension is given to extend the period within which the temporary fence must be constructed.

The relevant building certifier can use another building certifier to inspect the stages mentioned above, without assessing and appointing the person as a competent person.

While the building certifier can accept a competent person's aspect inspection certificate (Form 12) as part of their compliance assessment for the stage of work, it remains the building certifier's responsibility to complete and sign the Form 16 for the stages of work mentioned above.

Nothing prevents a competent person (inspection) who is not a building certifier from giving inspection help for an aspect of a stage mentioned above. However, for a single detached class 1a building or a class 10 building or structure, the building certifier must not accept an aspect inspection certificate for all aspects of the final stage.

Competent person (section 10 of the Building Act and Part 6 of the BR 2021)

A building certifier must assess and decide to appoint an individual as a competent person before they can, as a competent person, give inspection help. The building certifier is required to keep detailed records about what was considered when appointing a competent person.

A competent person cannot give inspection help to a building certifier until they have been appointed by the building certifier. For further information about assessment of someone as a competent person refer to the **Guideline for the assessment of competent persons**.

Inspection help (section 34 of the BR 2021)

A building certifier must be satisfied that an individual is competent to give the type of inspection help having regard to the individual's experience, qualifications and skills and if required by law to hold a licence or registration, that the individual is appropriately registered or licensed.

For further information about conducting inspections for class 2 to 9 buildings, refer to the **Guideline for inspection of class 2 to 9 buildings**.

For further information about conducting inspections for detached class 1a and 10 buildings or structures refer to the **Guideline for inspections of class 1 and 10 buildings and structures**.

Additional information

It is considered good practice for a building certifier or appointed competent person who is accepting and relying on this form and any attached certificates i.e. aspect certificates, to check the information or details contained in the form.

This form is also the inspection certificate to be used for temporary swimming pool fencing.

Aspect certificates– go to the Business Queensland website to access all building forms

Form 43 – Aspect certificate (QBCC licensee) – for aspect work for a single detached class 1a building and class 10 buildings and structures a building certifier or the appointed competent person can accept and rely on Form 43, the approved form from a QBCC licensee with the appropriate licence class that the work is compliant with the building development approval.

Form 12 – Aspect inspection certificate (appointed competent person) – for aspects of a stage or other aspect work for all classes of buildings and structures the building certifier may accept and rely on a Form 12 from an appointed competent person stating the aspect work is compliant with the building development approval.

Form 30 – QBCC licensee aspect certificate for Accepted development (self-assessable) – section 70 allows the QBCC licensee to give a Form 30 to the builder for the building work or the owner of the building, stating the subject aspect work complies with the relevant provisions, standards and codes.

PRIVACY NOTICE

The Department of Energy and Public Works is collecting personal information as required under the *Building Act 1975*. This information may be stored by the Department, and will be used for administration, compliance, statistical research and evaluation of building laws. Your personal information will be disclosed to other government agencies, local government authorities and third parties for purposes relating to administering and monitoring compliance with the *Building Act 1975*. Personal information will otherwise only be disclosed to third parties with your consent or unless authorised or required by law.

This form is the approved form that must be used in accordance with section 10 of the *Building Act 1975* and sections 73 and 77 of the *Building Regulation 2021* (Design-specification certificate) stating that an aspect of building work or specification will, if installed or carried out as stated in this form, comply with the building assessment provisions.

Additional explanatory information is included in the Appendix at the end of this form.

1. Property description

This section need only be completed if details of street address and property description are applicable.

E.g. in the case of (standard/generic) pool design/shell manufacture and/or patio and carport systems this section may not be applicable.

Where applicable, the description must identify all land the subject of the application.

The lot and plan details (e.g. SP/RP) are shown on title documents or a rates notice.

If the plan is not registered by title, provide previous lot and plan details.

Street address	Lot 1 Greenwood close		
	Suburb/locality	Frenchville	
State	QLD	Postcode	4701
Lot and plan details (<i>attach list if necessary</i>)			
Local government area the land is situated in			
Rockhampton Regional Council			

2. Description of aspect/s certified

Clearly describe the extent of work covered by this certificate, e.g. all structural aspects of the steel roof beams.

All structural aspects of proposed retaining wall.

3. Basis of certification

Detail the basis for giving the certificate and the extent to which tests, specifications, rules, standards, codes of practice and other publications were relied upon.

- Designed in accordance with
- Relevant Australian Standards & Codes including
 - AS/NZS 1170 Set: Structural Design Actions
 - AS3798: Guidelines on earthworks for commercial and residential developments
 - AS4678: Earth retaining structures
 - Generally accepted and sound engineering principles.
 - Block manufacturers recommendations
 - Geotechnical parameters as noted on the plans

4. Reference documentation

Clearly identify any relevant documentation, e.g. numbered structural engineering plans.

Dileigh Consulting Engineers Pty Ltd Drawing Set: D25.335 Struc_Greenwood CI RWall



Approved
Approval Number
20250741

Development Approval granted for the carrying out of "Building Work" in accordance with the Building Act 1975 & The National Construction Code

See Decision Notice for Approval Date and Conditions

5. Building certifier reference number and building development approval number

Building certifier reference number	Building development application number (if available)
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6. Appointed competent person details

Under Part 6 of the Building Regulation 2021 a person must be assessed as a competent for the type of work (design-specification) by the relevant building certifier.

Name (in full)	Glenn Brown		
Company name (if applicable)	Dileigh Consulting Engineers		
Contact person	Glenn Brown		
Business phone number	07 49 112 553	Mobile	
Email address	admin@dileigh.com.au		
Postal address	47 Normanby St		
	Suburb/locality	Yeppoon	
State	QLD	Postcode	4703
Licence class or registration type (if applicable)	Registered Professional Engineer of Queensland (RPEQ)		
Licence or registration number (if applicable)	7682		

7. Signature of appointed competent person

This certificate must be signed by the individual assessed and appointed by the building certifier as competent to give design-specification help.

Signature		Date	28/10/2025
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LOCAL GOVERNMENT USE ONLY

Date received	Click or tap to enter a date	Reference number/s
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Appendix – explanatory information

IMPORTANT NOTE: It is an offence for a competent person to give a building certifier a document, including this form, that the person knows or reasonably suspects, is false or misleading.

Who can complete this certificate? (section 10 of the *Building Act 1975* (Building Act) and 73 and 77 of the Building Regulation 2021 (BR 2021).

A building certifier can accept from a competent person (design-specification) a certificate stating that the competent person has assessed the building design or specification for the aspect of building work, and it will, if installed or carried out under the certificate, comply with the building assessment provisions, including any relevant standards and codes.

Schedule 10 of the BR 2021 defines *building design or specification* as any material, system, method of building or other thing related to the design of or specifications for building work.

When completing the certificate, a competent person is required under section 77 of the BR 2021 to include the basis for giving the certificate and state the extent to which the competent person has relied on tests, specifications, rules, standards, codes of practice or other publications.

What is the purpose of this form? (section 10 of the Building Act and sections 73 and 77 of the BR2 2021)

The information in this form informs the building certifier's decision making when they are assessing a building development application, issuing the building development approval for the building work the subject of the certificate (form) and when amending the building development approval due to the receipt of updated aspect information such as glazing or truss specifications or revised excavation drawings.

Can a manufacturer or supplier give this Form 15?

A building certifier can accept this form from a manufacturer or supplier who the certifier has decided is a competent person (design-specification).

A manufacturer or supplier of building materials can give this form if they have undertaken the design component for the product. For example a window manufacturer who designs, constructs and supplies the windows to industry could give this form.

Competent person (section 10 of the *Building Act 1975* and Part 6 of the BR 2021)

A building certifier must assess and decide to appoint an individual as a competent person before they can accept design-specification help.

When deciding whether a person can be a competent person, the building certifier must assess the person having regard to their experience, qualifications and skills and ensure the person holds a licence or registration if required.

The building certifier is required to keep detailed records about what was considered when appointing a competent person.

For further information about assessment of someone as a competent person refer to the **Guideline for the assessment of competent persons**.

What is required if a manufacturer or supplier did not do the design work for the product?

A manufacturer or supplier who is not part of the design process may give the construction contractor, builder, competent person or the building certifier evidence of suitability such as a product technical statement under Part A5 of the Building Code of Australia (BCA), for an aspect or material stating that it is compliant with the relevant reference documents in the BCA i.e. the applicable Australian Standard/s.

What if there is not enough space for all the supporting material/documents?

Items 2, 3 and 4 requires the competent person to clearly identify the extent of the assessment that was undertaken for aspect/s of work identified in this form.

For instance, there is provision for material such as specifications, standards, codes or other relevant publications to be referenced in the form. However, if the space in the form is not sufficient to accommodate all of this material, you can create and refer to additional material in an addendum or attachment to the form.

The form is the Microsoft Word version, that you can download and edited to include additional material in the relevant parts of the form. **Note:** that editing the form in the Microsoft Word version may cause the relevant boxes to expand and increase the length of the document. This is acceptable and does not change the approved form, provided the section text (description on the left-hand side of the page) is not altered.

Appointed competent person (design-specification) – (sections 34 and 36 of the BR 2021)

A building certifier must assess and decide to appoint an individual as a competent person to give design-specification help. The building certifier is required to keep detailed records about the assessment.

A building certifier must be satisfied that an individual is competent to give the design-specification help, and if required by law to hold a licence or registration, that the individual is qualified to do so.

An individual is appointed as competent to give design-specification help on or off site.

For further information about assessment of someone as a competent person refer to the **Guideline for the assessment of competent persons**.

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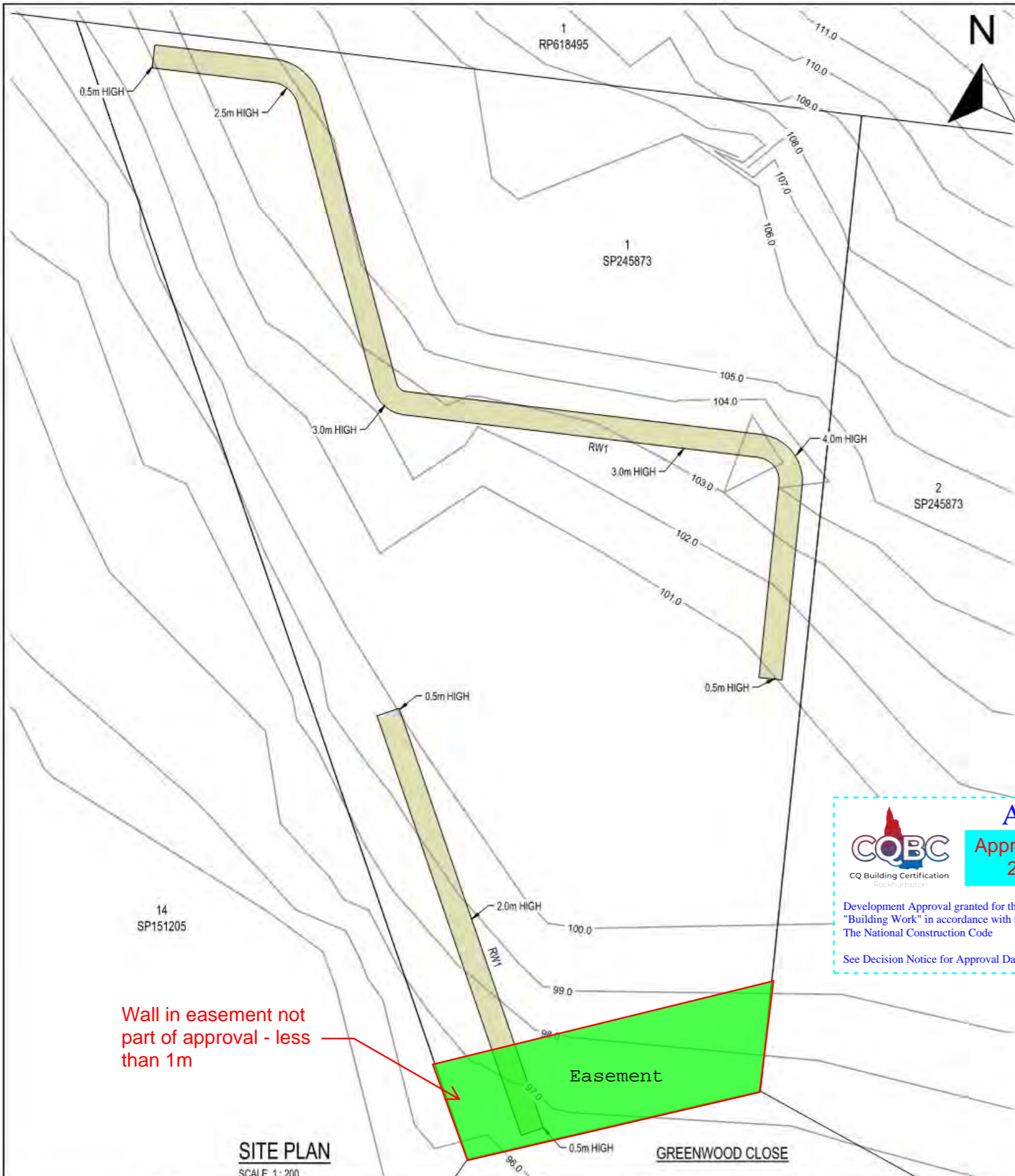


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Approval Number
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RETAINING WALL SCHEDULE

'H'	'X'	'D'	MIN. BEARING CAPACITY
1000	400	GRANULAR ONLY	100 kPa
2000	500	GRANULAR ONLY	150 kPa
3000	600	GRANULAR & CONC	150 kPa
4000	900	GRANULAR & CONC	200 kPa

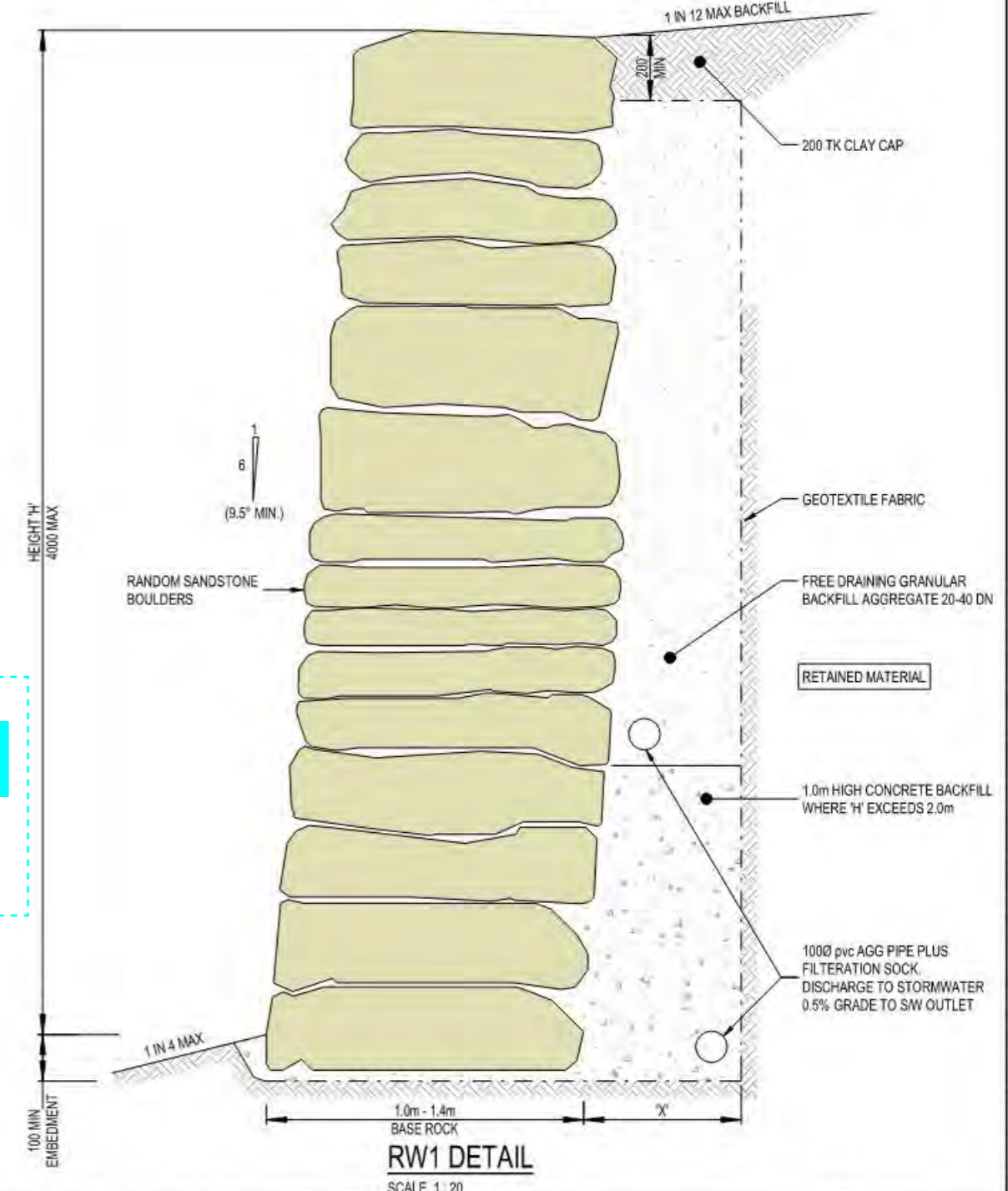
NOTE: WALL HEIGHT 'H' IN MAXIMUM DESIGN HEIGHT i.e. 1100 WALL TO BE BUILT TO 1500 DETAIL

NOTES:

- DRAINAGE**
- PROVIDE A DRAINAGE LAYER DIRECTLY BEHIND THE FACING UNITS CONSISTING OF 300mm MIN THICK LAYER OF 25-75mm CLEAN ROCK SCREENINGS WITH POSITIVE DRAINAGE PATH AT A SUITABLE OUTLET.
 - GEO-FABRIC SEPERATION TO BE PLACED BETWEEN IN-SITU AND DRAINAGE MATERIAL.

- DESIGN ASSUMPTIONS**
- DESIGN IS BASED ON RETAINING IN-SITU MATERIAL WITH A MINIMUM INTERNAL FRICTION ANGLE OF 28 DEGREES (SANDY CLAY). CONFIRM ONSITE.
 - RETAINING WALL DESIGNED AS CLASS B IN ACCORDANCE WITH AS4378.
 - FOOTING TO BE FOUNDED ON NATURAL MATERIAL WITH MINIMUM BEARING CAPACITY AS PER SCHEDULE.

- DESIGN PARAMETERS**
- MAXIMUM SURCHARGE LOADS APPLIED TO RETAINING WALL STRUCTURES:
CONSTRUCTION LIVE LOAD - 5.0 kPa
IN-SERVICE LIVE LOAD - 5.0 kPa
 - THE DESIGN ASSUMES NO WATER PRESSURE ACTING ON FACE.
 - THE DESIGN HAS NOT BEEN CONSIDERED FOR SEISMIC FORCES.



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20250741

CQBC
CQ Building Certification
Rockhampton

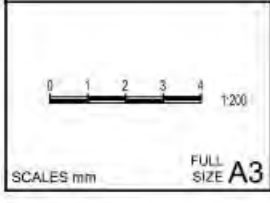
Development Approval granted for the carrying out of "Building Work" in accordance with the Building Act 1975 & The National Construction Code

See Decision Notice for Approval Date and Conditions

Wall in easement not part of approval - less than 1m

SITE PLAN
SCALE 1:200

RW1 DETAIL
SCALE 1:20



CONSTRUCTION ISSUE

REV	REVISION DESCRIPTION	DATE
A	FOR CONSTRUCTION	25/10/2025

DILEIGH
CIVIL / STRUCTURAL DESIGN & PROJECT MANAGEMENT

ACN 121 309 171
47 Normanby Street
Yeppoon, Queensland 4703

Phone: 07 49112553
Fax: 07 49363660
Email: admin@dileigh.com.au

Drawn	PS
Designed	RUE
Checked	GB
Approved	G BROWN
RPEQ 7882	Sign

KEPPEL ROCK WALLS
PROPOSED RETAINING WALLS
LOT 1 GREENWOOD CLOSE, FRENCHVILLE, QLD 4701
SITE LAYOUT AND RETAINING WALL DETAIL

Draw No	D25.335-S101
Revision	A

28/10/2025 10:56:32 AM C:\OneDrive - DILEIGH CONSULTING ENGINEERS PTY LTD\2025\2025-335-101-101 Greenwood Close Retaining Wall/2 Draw/Structural/D25.335-STRUC.A1.rvt

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>

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).

Black					
White					
Grey					
Brown					
Red					
Orange					
Yellow					
Green					
Blue					
< Darker			Paler >		

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)

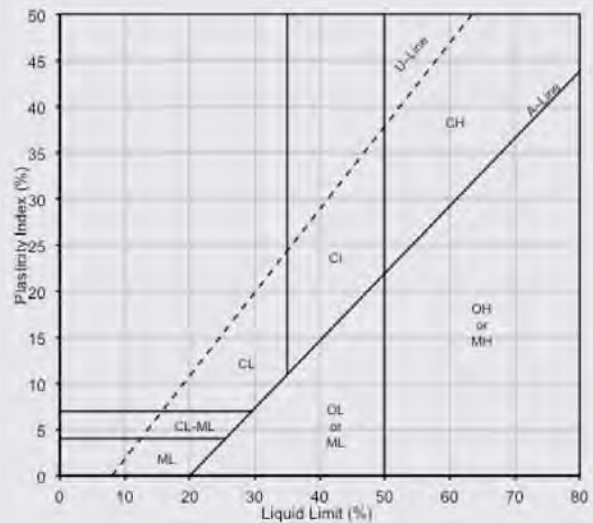
Descriptive Terms for Secondary and Minor Components

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
	$> 5, \leq 12$	with	$> 15, \leq 30$	with	$> 15, \leq 30$	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 difficulty. 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 is less than 63 mm is less than 0.075 mm	A particle size of 0.075 is about the smallest size distinguishable to the naked eye	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.075 mm				
				SILTS AND CLAYS Liquid Limit < 50%	DRY STRENGTH	DILATANCY	TOUGHNESS	GROUP SYMBOL
None to low	Slow to rapid				Low	ML	SILT	
Medium to high	≥ 12% clayey fines				Medium	CL, CI	CLAY	
SILTS AND CLAYS Liquid Limit > 50%	Low to medium			Slow	Low	OL	ORGANIC SILT	
	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	<p>COMMON: Conglomerate, Breccia, Sandstone, Mudstone, Siltstone, Claystone</p> <p>≥90% CARBONATE: Limestone, Dolomite, Calcirudite, Calcareneite, Calcisiltite, Calcilutite</p> <p>PYROCLASTIC: Agglomerate, Volcanic Breccia, Tuff</p>
Igneous	Formed from molten rock and have a crystalline texture. Typically massive and low porosity. Rock types are from coarse to fine grained.	<p>HIGH QUARTZ CONTENT: Granite, Microgranite, Rhyolite</p> <p>MODERATE QUARTZ CONTENT: Diorite, Microdiorite, Andesite</p> <p>LOW QUARTZ CONTENT: Gabbro, Dolerite, Basalt</p>
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	<p>FOLIATED: Gneiss, Schist, Phyllite, Slate</p> <p>NON-FOLIATED: Marble, Quartzite, Serpentinite, Hornfels</p>
Duricrust	Formed as part of a weathering profile and show evidence of being cemented in situ. Cementation is typically irregular and exhibits replacement textures.	<p>Ferricrete (Iron oxides and hydroxides)</p> <p>Silicrete (Silica)</p> <p>Calcrete (Calcium carbonate)</p> <p>Gypcrete (Gypsum)</p>

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 $I_{s(50)}$ the strength table implies a 20 times correlation between $I_{s(50)}$ 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)			
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 rocks 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











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

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



Rockhampton Building Approvals

Proudly Serving Queensland

2nd October 2025

ROCKHAMPTON REGIONAL COUNCIL
AMENDED PLANS APPROVED
12 June 2026
DATE

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

Development Permit No.: D/61-2021
Dated: 21 December 2021

Hotondo Homes Rockhampton
 97 Bolsover Street
 ROCKHAMPTON QLD 4700

Dear Sir/Madam,

BUSHFIRE ATTACK LEVEL ASSESSMENT – 17 Greenwood Close, Frenchville.

On the 2nd October 2025, a Bushfire Attack Level Assessment (BAL) was performed on the property of 17 Greenwood Close, Frenchville. The assessment was based on AS3959-2018 – Construction of Buildings in Bushfire prone areas.

The Assessment Table:

Step 1 Fire Danger Level	Queensland 40. Note: All Queensland is the same				
Step 2 Vegetation Classification as Table 2.3	Vegetation Group				
	Vegetation Type	Vegetation Score			
	Low Open Forrest	04 Group A			
Step 3 Distance from building to vegetation (m)	N – 25m E – 34m	S – 100+m W – 48m			
Step 4 Effective slope of land (look at the slope under)	N - 0° E - 3°	S - 20° W - 10°			
Step 5 Determination of BAL (using method 1) mark all results in here	FDI	Vegetation	Distance	Slope	BAL
	40	Group A 04	48m	10°	12.5

If you require any further information, please contact me on 07 4926 7000.

Yours faithfully,

Wayne Knobel – A1107962
 Rockhampton Building Approvals

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