



## Soil Investigation Report

Prepared For  
NCL Group Pty Ltd  
PO Box 314 CHEVRON ISLAND 4217

SITE ADDRESS - Lot 216 No.5 STONEY CREEK DRIVE FARLEY 2320

Local Authority - MAITLAND CITY COUNCIL

Date : 12th August 2024  
YOUR REF: 23024/2060  
OUR PROJECT JOB NUMBER: 246671

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## Section 1 - Commission

### **1.01 - Commission**

STA Consulting Engineers have been commissioned by NCL Group Pty Ltd to undertake a soil test and site investigation in order to determine a site classification in accordance with AS 2870 Residential Slabs and Footings. Unless otherwise stated, the scope of this commission is limited to obtaining sufficient information to enable a site classification to be made, collect information on the natural soil profiles observed, determine the bearing strength of the soils, identify the presence and depth of fill material, determine the soils reactivity and calculate the effects of trees where require

This commission does not extend to the testing of stockpiled materials stored on site, fill certification, or the testing of sub grade materials for pavement design. Whilst some comment may be made regarding foundations, the final design criteria is to be specified by the designing engineer.

### **1.02 - Site Classification Criteria**

This soil test has been prepared by reference to:

#### **Site Classification Criteria :**

AS 1289	Methods of testing soils for engineering purposes
AS 1726	Site Investigation Code
AS 2870	Classification of site in accordance with "Residential Slab & Footings"
AS 3798	Guidelines on earthworks for commercial and residential development

## **Section 2 - Findings**

### **2.01 Site Description**

At the time of the investigation the block was vacant. The vegetation consisted of grass, the tested area had a moderate slope and the drainage was poor.

### **2.02 Fieldwork & Laboratory Testing**

Two bore holes were undertaken across the site using a power auger drill rig mounted at the rear of a four wheel drive ute to a maximum depth of 1300mm. Dynamic Cone Penetrometer (D.C.P) tests and Pocket Penetrometer (P.P) tests were also undertaken at the time of the site investigation.

The bore holes were drilled using solid flight augers fitted with a steel V shaped bit or tungsten carbide bit

An authorised representative from STA Consulting Engineers set out the bore holes locations from existing site features, directed sampling and logged bore hole profiles. Engineering logs of the bore holes are presented in Section 3 , together with Explanation Sheets defining the terms and symbols used in the preparation of the logs.

Representative samples of residual soil was collected for the purpose of Laboratory testing. These tests include the following :-

- Moisture Contents
- Liquid Limit (LL)
- Linear Shrinkage (LS)
- Shrink /Swell (Iss)

Results of the Laboratory tests are indicated under Section 3.0 Soil Profile and Laboratory Results.

### **2.03 Subsurface Conditions**

The ground conditions encountered were generally a silty sand and sandy clay fill mix over natural weathered rock.

*Note : There is a danger that by simplifying the geological conditions as described above, small-scale variations that may have significant engineering implications can be overlooked. Where specific information is required, the reader should in all instances refer to the bore hole logs in Section 3 of this report.*

### **2.04 Groundwater**

Groundwater was not identified at the time of the subsurface investigation. It must be noted that ground moisture and ground water depths are typically influenced by climatic conditions and the permeability of the soils observed and may vary with season change or tidal influences.

## Section 2 - Findings

### **2.05 Site Classification**

After assessing the laboratory test results, on site conditions and surrounding conditions in accordance with AS 2870. This site has been classified: **Class M**

Please Note: Approximately 900 mm to 1100 mm of fill was encountered across the site. STA Consulting Engineers has been presented with documentation to show that it was compacted and certified in accordance with AS 3798 (Level One Supervision), by Douglas Partners Pty Ltd report number R.001.Rev0.

### **2.06 Comments (Detailed Plans Not Supplied)**

For a residential dwelling as defined under AS 2870 we are of the considered opinion that footings designed to suit a {Class " M "} classification, using engineering principles would be suitable on this site.

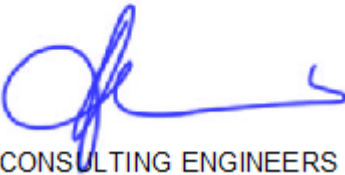
The proposed edge beam and slab for the residential dwelling on this site should be founded into the existing certified fill . This can be achieved by the use of bulk or drilled piers.

Complete field and laboratory test results are presented in Section 3 of this report. Please note that the test hole locations, and slope are estimations only and should not be taken as being absolute.

To ensure correct footing and or slab construction it is essential that a copy of this report and any relevant addendums (where applicable) are supplied to the concretor in full prior to their preparation. It is also advisable that such documentation is available on site for reference by the concretors and nominated inspectors.

We would like to thank you for giving us the opportunity to provide this service to you and should you wish to contact us again please do so.

Yours faithfully,



STA CONSULTING ENGINEERS

Bore Log Sheet

Bore Hole # 1										Bore Hole # 2									
Project Job No. ES246671-B Client: NCL Group Pty Ltd					Drill Method: Power Auger					Drill Method: Power Auger									
Depth (m)	Sample Location	Groundwater	Graphic Log	Extent of Fill	Symbols	SOIL DESCRIPTION	PP Value	D.C.P blows/ 100 mm	N <sup>o</sup> q (kPa )	Depth (m)	Sample Location	Groundwater	Graphic Log	Extent of Fill	Symbols	SOIL DESCRIPTION	PP Value	D.C.P blows/ 100 mm	N <sup>o</sup> q (kPa)
0						FILL - SILTY SAND (Black) Moist & Dense <i>Base of Founding Level</i>		6		0						FILL - SILTY SAND (Black) Moist & Dense <i>Base of Founding Level</i>			
						FILL - SANDY CLAY (Brown) Moist & Firm	300	3								FILL - SANDY CLAY (Brown) Moist & Firm			
0.5								7		0.5									
						(Pale Brown) Moist & Firm		12								Moist & Firm			
1.0						SANDSTONE (Grey / Pale Brown) Dry & Moderately Strong U.T.P.	350			1.0						SANDSTONE (Grey / Pale Brown) U.T.P. Dry & Moderately Strong			
1.5										1.5									
2.0										2.0									
2.5										2.5									
3.0										3.0									
3.5										3.5									
4.0										4.0									
4.5										4.5									
5.0										5.0									
Bore Hole Refusal - 1.3 m										Bore Hole Refusal - 1.0 m									

 This line represents the anticipated base level of the recommended founding material nominated on page 1 of this report. This level is to be used as a gauge only.

**Terms :-**  
D.C.P.-: Dynamic Cone Penetrometer  
N'q:- Allowable Bearing Capacity (kPa)  
PP:- Pocket Penetrometer Strength (kPa)  
U.T.P:- Unable to Penetrate  
→ Slope Direction

**Note :** kPa value is allowable bearing pressure caculated in accordance with paper 'Determination of allowable bearing pressure under small structures' by M.J Stockwell (June 1977)



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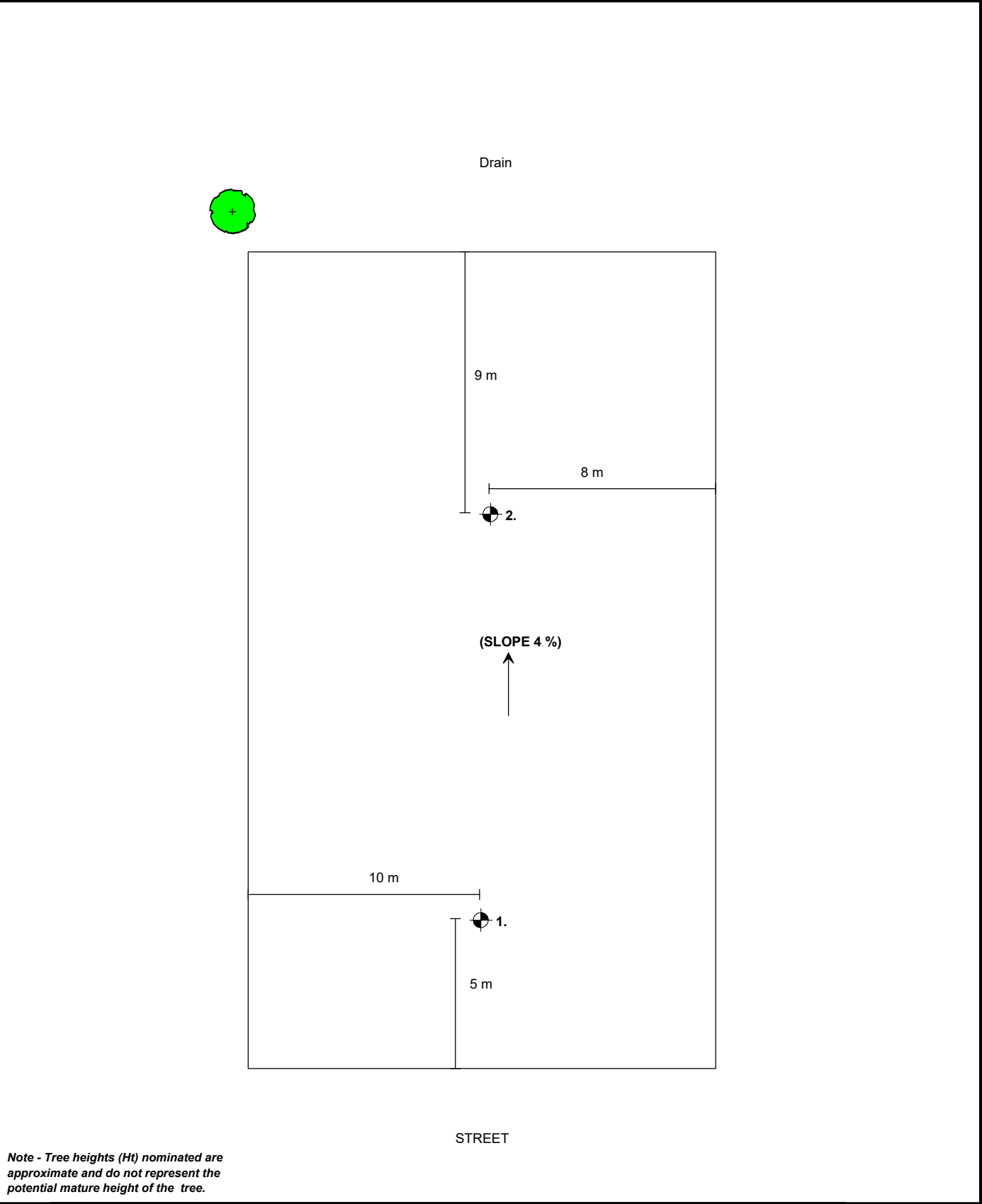
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**Client**  
NCL Group Pty Ltd  
PO Box 314 CHEVRON ISLAND 4217

**Site Address**  
Lot 216 No.5 STONEY CREEK DRIVE FARLEY 2320  
STASOD.2014-14-05

Section 3 - Bore Logs & Site Identification

Site Sketch ( Not to Scale )  
(All Dimensions Shown are Approximate Only)



Site Identification



Laboratory Test Results

Sample Location:-	B.H. # 1
Depth of Sample:-	1000 mm
Liquid Limit:-	42 %
Linear Shrinkage:-	12.5 %
Iss:-	2.5 %

Calculated Y's Value -	22 mm	Y's - characteristic surface movement determined on soil properties only, does NOT include the effects of trees (refer Design Y's Range)
Calculated Y't Value -	0 mm	Y't - the calculated potential surface movement due to the tree induced suction change in addition to the normal design suction change.
Est. Differential Settlement - of Level 1 Controlled Fill	6 mm	The estimated differential settlement is the value by which Level 1 controlled fill may further displace and is generally proportionate to the variation in fill heights.
Age of Level 1 - Controlled Fill	< 1 year	Note: The estimated differential settlement values may be re-assessed if predicted settlement figures are provided to STA Consulting Engineers from the company that undertook the fill certification.

Design Y's Range

Y's + Yt :-	25 to 35 mm
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Classification by characteristic surface movement as per AS2870-2011

SITE CLASSIFICATION SYMBOLS	DESIGN Y'S RANGE	GENERALISED DESCRIPTION (Guide Only)
'A'	$0 < Y_s$	Most sand and rock sites with little or no ground movement from moisture changes.
'S'	$0 < Y_s \leq 20$	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
'M'	$20 < Y_s \leq 40$	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
'H1'	$40 < Y_s \leq 60$	Highly reactive clay sites, which may experience high ground movement from moisture changes
'H2'	$60 < Y_s \leq 75$	Highly reactive clay sites, which may experience very high ground movement from moisture changes
'E'	$Y_s > 75$	Extremely reactive clay sites, which may experience extreme ground movement from moisture changes
'P'	N/A	Problem sites which generally have soils associated with uncontrolled fill, abnormal moisture conditions (trees), soft or collapsing soils, landslip etc..
'- D'	N/A	For classes M, H1, H2 and E this further classification may be required, based on the depth of expected moisture change. Applied to sites with deep-seated moisture changes characteristic of dry climates and corresponding to a design depth of suction change (Hs), equal to or greater than 3 metres.

Test Methods: AS1289 3.1.2 (liquid limit), 3.4.1(linear shrinkage), 7.1.1(shrink-swell)

Client

NCL Group Pty Ltd  
PO Box 314 CHEVRON ISLAND 4217

Site Address

Lot 216 No.5 STONEY CREEK DRIVE FARLEY  
2320



KCE Pty Ltd  
PO Box 574  
East Maitland, NSW 2323  
Attention: James Towns / Michael Budzon  
Email: james@kce.com.au

12 February 2024  
R.001.Rev0  
JAW:plh

## Report on Level 1 Testing and Inspections of Filling Proposed Tomhil Residential Subdivision – Stage 2 Owlpen Lane, Farley NSW

### 1. Introduction

This report presents the results of geotechnical inspections and testing associated with fill operations at the above site. The work was undertaken at the request of KCE Pty Ltd, the principal earthmoving contractor for the project.

The scope of testing and inspections provided by Douglas Partners Pty Ltd (Douglas) comprised surface stripping inspections and observation of fill operations, together with compaction and density testing within Stage 2 the Tomhil residential subdivision, located on the eastern side of Owlpen Lane, approximately 500 m south of Wollombi Road. The work was undertaken with reference to the earthworks Standard "Guidelines on Earthworks for Commercial and Residential Developments" (AS 3798, 2007).

A previous geotechnical investigation at the site has been undertaken by others (DRB, 2021). The client provided a copy of the previous report to Douglas for reference.

While Stage 2 included construction of a detention basin, the basin was constructed entirely in cut, and as such is not included in this report.

### 2. Specifications

The previous geotechnical report for the site (DRB, 2021) was limited to advice regarding the proposed pavements and provided recommendations for compaction of fill to be placed in road embankments. The report did not contain recommendations for compaction of fill in lot areas.

Based on Douglas' previous advice for the compaction of lot fill on similar projects in the local area, the following specifications were adopted for lot fill:

- A maximum loose layer thickness of 300 mm;



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#### Client

NCL Group Pty Ltd  
PO Box 314 CHEVRON ISLAND 4217

#### Site Address

Lot 216 No.5 STONEY CREEK DRIVE FARLEY 2320



Wind Loading Assessment as per AS4055:2021

Wind Loading Assessment Limitations

The following wind rating is applicable for dwellings which comply with AS4055 Section 1.2. If the proposed dwelling does not comply with these limitations the wind rating will need to be reassessed as per AS1170.2:2021.

Wind Rating	N2	
Terrain Category	TC2	
Topographic Class	T0	
Shielding Class	NS	Park / open space considered adjacent site

Limitations as per Section 1.2 AS4055:2021 - Wind Loads for Housing

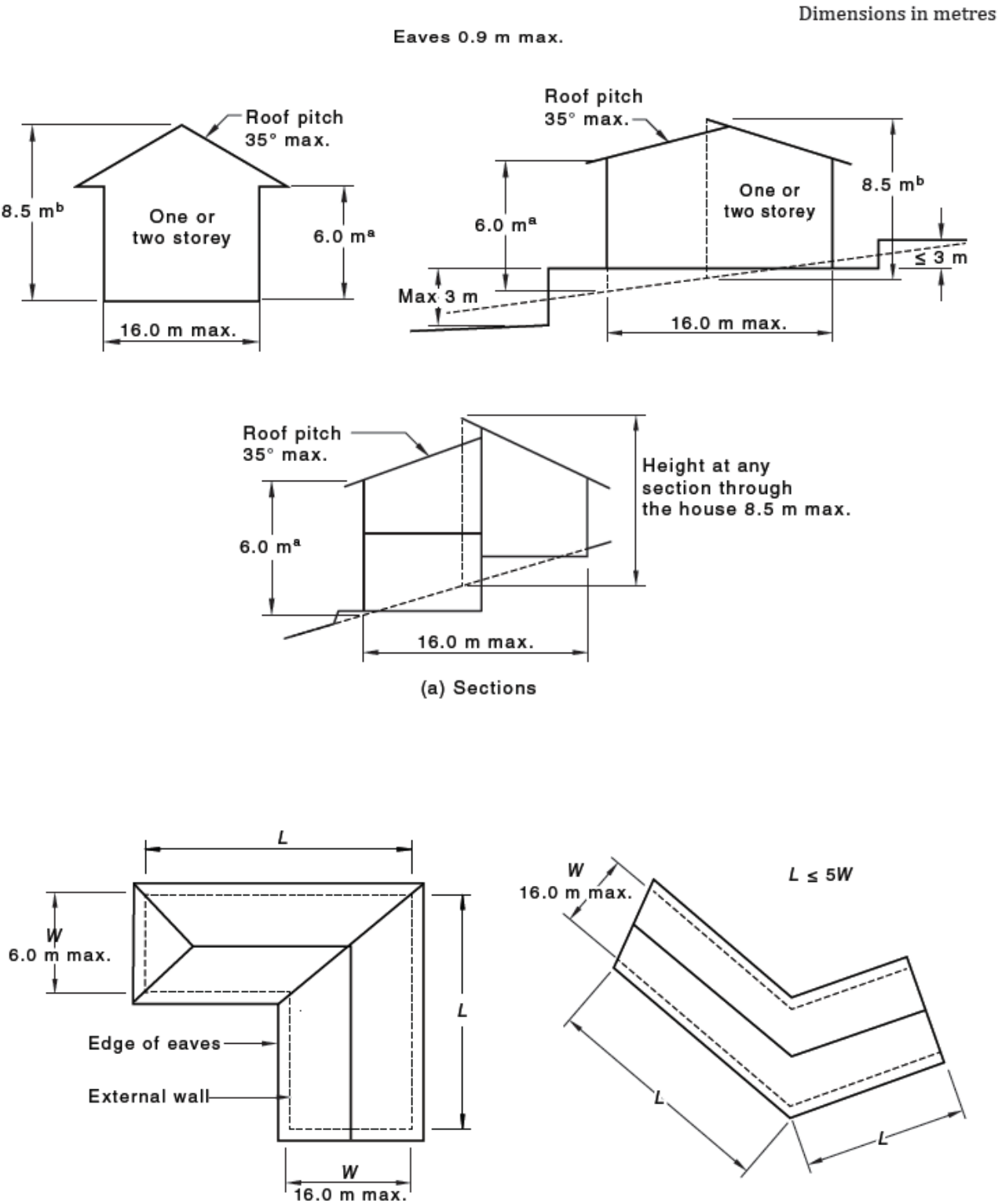
For the purpose of this document the following conditions (geometric limits) shall apply (See Figure 1.2):

- (a) The distance from averaged ground level to the underside of eaves shall not exceed 6.0m.
- (b) The distance from averaged ground level to the highest point of the roof, not including chimneys, shall not exceed 8.5m
- (c) The width (*W*) including roofed verandahs, excluding eaves up to a maximum of 0.9m, shall not exceed 16.0m. The length (*L*) shall not exceed five times the width.
- (d) The roof pitch shall not exceed 35°.

NOTE

Where wind loads on houses are determined using AS4055:2021, design parameters shall be derived from AS4055:2021 only. Where wind loads on buildings are determined using AS/NZS 1170.2:2021, design parameters in that Standard only shall be used.

Figure 1.2 AS4055:2021



**Terrain Categories / Aerial Photos**



**Shielding Class**



**Topographic Class**

(Indicative only based on checkwind program assessment)



## Section 4 - Glossary of Terms

The following are definitions of words used in this report and attached documents.

**Allowable Bearing Capacity** - Maximum bearing pressure that can be sustained by the foundation from the proposed footing system under service loads which should avoid failure or excessive settlement.

**Silt** - Fine grained soil that is non-cohesive and non-plastic when wet, can include some sand and clay.

**Sand** - Granular soil that may contain a small proportion of fines including silt or clay. The amount of fines may be assessed as small by visual inspection or if the amount passing a 425 um sieve is 15% or less. Material with a higher proportion of fines shall be treated as silt or clay.

**Clay** - Fine grained soil with plastic properties when wet. Includes sandy or silty clays.

**Rock** - Strong material including shaley material and strongly cemented sand or gravel that does not soften in water. Material that cannot readily be excavated by a back hoe may be taken to be rock.

**Foundation** - Ground which supports the building.

**Footing System** - General term used to refer to slabs, footings, piers and pile systems used to transfer load from the structure to the foundations.

**Liquid Limit [wl]** - Moisture content at which the soil passes from plastic to the liquid state as determined by the liquid limit test.

**Linear Shrinkage [LS]** - Decrease in length expressed as a percentage of the original length when a sample of soil is oven dried from a moisture content of about the liquid limit as determined by the linear shrinkage test.

**Plastic Limit [wp]** - Moisture content at which the soil becomes too dry to be in a plastic condition as determined by the plastic limit test.

**Plasticity Index [Ip]** - Numerical difference between the liquid limit and the plastic limit of a soil.

**Services** - Means all under ground services to the site including but not limited to power, telephone, sewerage, water & storm water.

**Site** - Block upon which the testing was carried out.

**Surface Movement (Ys)** - Design movement at the surface of a reactive site caused by moisture changes.

**Surface Movement Trees (Yt)** - Potential surface movement due to the tree-induced suction change in addition to the normal design suction change.

**Standard Residential Allotment** - Means that if the lot/allotment is larger than 650 metres square then the client needs to identify where the proposed dwelling structure is to be erected.

**Pocket Penetrometer (P.P)** - Instrument used to evaluate consistency and approximate unconfined compressive strength of saturated cohesive soils.

**Dynamic Cone Penetrometer (D.C.P)** - Field equipment used to determine underlying soil strength by measuring the penetration of the device into the soil after each hammer blow.

## Section 5 - Appendix

### 5.01 Soil test / Report Parameters

It is the clients responsibility to ensure that accurate details have been conveyed to STA Consulting Engineers prior to production of this report. STA Consulting Engineers is also not responsible for bracing and/or tie down requirements.

### 5.02 Site Class and Potential Surface Movement

Methods adopted are in accordance with guidelines specified in AS 2870 , appendix D. Potential surface movement and the resultant site classification are therefore in consideration of the local depth of the zone of consideration of significant soil moisture variations and the entire ground profile. This includes the influence of reactive clay based soils and/or the presence of fill, as well as the effect of stable materials such as dense sands or shallow rock. Site classification is divided into various classes, dependent on the Design Yst (potential movement). Class are;

Site Classification Symbols	Description
.....*A.....	Most shallow rock sites and some sand sites with little potential for movement through moisture change.
.....*S.....	Slightly reactive sites, have only slight potential for ground movement through moisture change.
.....M.....	Moderately reactive sites, can under go moderate ground movement through moisture change, May be considered as your average site.
.....H1.....	Highly reactive sites, can experience a high level of ground movement. Additional costs are generally incurred in building on such sites.
.....H2.....	Highly reactive sites, can experience a very high level of ground movement. Additional costs are generally incurred in building on such sites.
.....E.....	Extremely reactive sites can experience extremely high amounts of ground movement. Special considerations should be taken into account when building on these sites
.....P.....	Problem sites which generally have soils associated with uncontrolled fill, abnormal moisture conditions, mine subsidence, landslip and/or soft, collapsing or disturbed soils.
.....D.....	For classes M, H1, H2 & E this further classification may be required, based on the depth of expected moisture change. Applied to sites with deep-seated moisture changes characteristic of dry climates and corresponding to a design depth of suction change (Hs), equal or greater than 3 metres.

***\* Additional costs can be incurred on sites due to possible difficulties in excavations/earthworks.***

## Section 5 - Appendix

### 5.03 Field and Laboratory Procedures

Site testing is conducted in strict accordance with AS 1726, Geotechnical site investigations. Insitu scala-cone penetrometer, pocket penetrometer and shear vane testing are converted to allowable bearing pressures. Refer respectively to Determination of Allowable Bearing Pressures Under Small Structures (1977) by MJ Stockwell and Skempton's Theorem (1954). Clay based soils are sampled and tested for their plasticity parameters, in accordance with AS 1289 3.1.2, 3.4.1 and 6.3.2. STA Consulting Engineers is also NATA (National Association Testing Authorities) accredited for appropriate test procedures.

### 5.04 Site Maintenance

The performance of the footings and/or slab is largely dependent upon a responsible approach by the builder and the owner/occupant towards vegetation and site drainage. STA Consulting Engineers has classified the site allowing for the trees and vegetation present at the time of testing, however if any additional trees or vegetation are to be planted it is recommended that the following guidelines are adhered to.

It is not recommended to have trees within a distance from the structure equivalent to;

- 75 % of the mature tree height, for Class M
- 100 % of the mature tree height, for Class H1
- 125 % of the mature tree height, for Class H2
- 150 % of the mature tree height, for Class E

\* Note: Where offsets cannot be obtained as indicated above, root/moisture barriers must be adopted. Alternatively the designing engineer must be notified of such a scenario prior to the completion of the foundation recommendations.

<b>Additional Critical Issues are;</b>
<ul style="list-style-type: none"><li>• Water must not be permitted to pond in or around footings.</li><li>• Garden Beds adjacent to the structure should be avoided.</li><li>• The development of gardens should not interfere with effective site drainage.</li><li>• Moderated watering of the garden is preferred to indiscriminate neglect and/or irregular saturation.</li><li>• Plumbing leaks and in particular damaged storm water pipes should be repaired promptly.</li><li>• Grated drain inlets are to be positioned under exterior taps which are located adjacent to the structure.</li></ul>



### 5.05 Sub Surface Mining / Slope Stability

This report does not cover slope stability. If this is required an independent assessment and investigation should be carried out by a qualified Geotechnical Engineer specialising in this area.

Unless STA Consulting Engineers has been instructed to the contrary, findings and recommendations contained in this report are not relevant should existing or proposed mining projects and/or slope instability adversely influence the ground conditions.

## Section 5 - Appendix

### **5.06 Site Drainage**

Site preparation must include provision for a ground fall of no less than 1 in 20 away from the structure for a distance of at least 1 metre and where possible, a spoon drain at the base of cut banks directing surface drainage around and away from the footings.

### **5.07 Fill Material and Compaction**

For totally filling the pad to level, CBR 15 or decomposed rock is recommended. Fill placed behind a brick cavity is to be of a granular base consisting of either sand, CBR 15, decomposed rock or crusher-dust. Highly reactive clay-based soil is not recommended for use as fill. Fill is to be placed in 150 mm deep layers, moistened and compacted to achieve the equivalent of 95% standard compaction. Compaction testing is to be in accordance with AS 1289, section 5.2.1. A vibrating sheeps-foot roller is recommended for compaction of the totally-filled pad. A vibrating-plate or wacker-packer is recommended for compaction of fill restrained by a brick-cavity. ***Note; Fill is not to be compacted within 500 mm of the brick cavity base (retaining wall)***

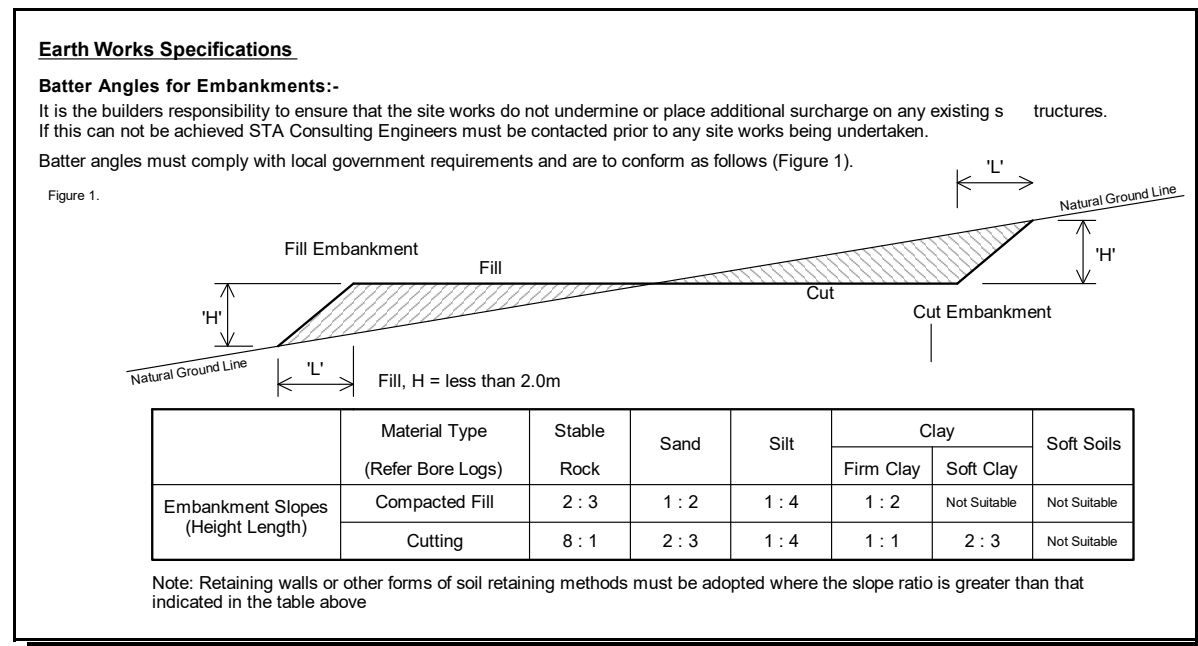
### **5.08 Existing / Proposed Services**

Existing or proposed services may have an impact on the design recommendations supplied by the designing engineer. Therefore it is strongly recommended that you contact the local authority and confirm the positioning of any underground services that may be on site prior to any proposed excavations.

## Section 5 - Appendix

### 5.09 Batter Angles for Embankments

Recommendations for unsupported cut/ fill batters are presented in the following table:



**TABLE 3: CUT/FILL BATTER RECOMMENDATIONS**

Recommendations in table 3 assume that:

- Excavations in soil are above the groundwater table;
- The ground surface at the crest of the excavation is horizontal;
- There is no surcharge at the crest of the excavation for a distance equal to the depth of the excavation;
- All cuts are protected from erosion.

Batters should be reassessed if any of the above criteria are not met.

## Section 6 - Disclaimer

Where any footing excavations may indicate significant variations to the ground conditions specified in this report then STA Consulting Engineers must be informed immediately before further work proceeds on site.

The site classification is based upon the condition of the site at the time of the investigation and does not take into account any proposed earthworks or proposed site preparation details unless indicated. If any extensive cutting, cut/filling or total filling is proposed, a re assessment of the site classification will be required.

The Yt range is based on the mature height of the trees and vegetation present at the time of testing. If any additional trees or vegetation are to be placed STA Consulting Engineers should be contacted to re-evaluate the site classification and design recommendations (*if applicable*).

Where this report is used by a designing engineer then an original of the complete report must be provided to that engineer.

The information contained within this report is only applicable to the site address supplied by our client. Also, if the site is not a standard residential allotment, information contained in this report is only relevant to those areas investigated.

The bore hole locations, slope directions and offsets are estimations only and should not be taken as being accurate or relied on for set out.

It is the clients sole responsibility to determine:

- the set out of any proposed structure on the site;
- the location of any services.

This report does not cover termite prevention, investigation or treatment. Any queries concerning these matters should be referred to appropriately qualified person.

It is the clients obligation to advise STA Consulting Engineers in writing of any known or suspected peculiarities or irregularities concerning the site.

Where STA Consulting Engineers relies upon information and documentation provided by the client the responsibility for the accuracy of any such information or documentation so provided is the clients sole responsibility.

Where the site is situated in a new development, it is the responsibility of the client to provide certifications of fill compaction to STA Consulting Engineers at the time of our engagement to prepare this report. Where the relevant certifications of fill compaction are not provided by the client to STA Consulting Engineers then the classification of this site may change which may increase the overall costs of construction of the proposed structure on the site. Where the certifications of fill compaction are provided after the completion of this report, then the client will be liable for an additional fee for the work necessary to revise the report in view of that additional documentation.

In the instances where by significant levels of filling are observed, there will always remain the possibility of tilt within a rafted foundation as a result of differential settlement in the fill. Australian Standard (AS2870-2011) does not cater for tilting of the slab as a result of differential settlement within certified filling nor does the Australian Standard address the possible occurrence when shallow foundations are adopted.

This report should only be relied upon by the client where the report is provided in an original format and not as a copy.

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