

31 October, 2018

Cameron Anderson Architects  
5 Lovejoy Street  
Mudgee  
NSW 2850

Attn: Cameron Anderson

**Geotechnical Investigation – Site Classification for 5 Yamble Close, Mudgee NSW 2850**

**Introduction**

Macquarie Geotechnical Pty Ltd has undertaken a geotechnical investigation at the above site. This work was done to classify the subject site in accordance with Australian Standard AS2870 2011 "Residential Slabs and Footings" and Australian Standard AS1726 2017 "Geotechnical Site Investigations".

The classification of a site involves a number of geotechnical factors such as depth of bedrock, the nature and extent of subsurface soils and any specific problems (slope stability, soft soils, filling, reactivity, etc).

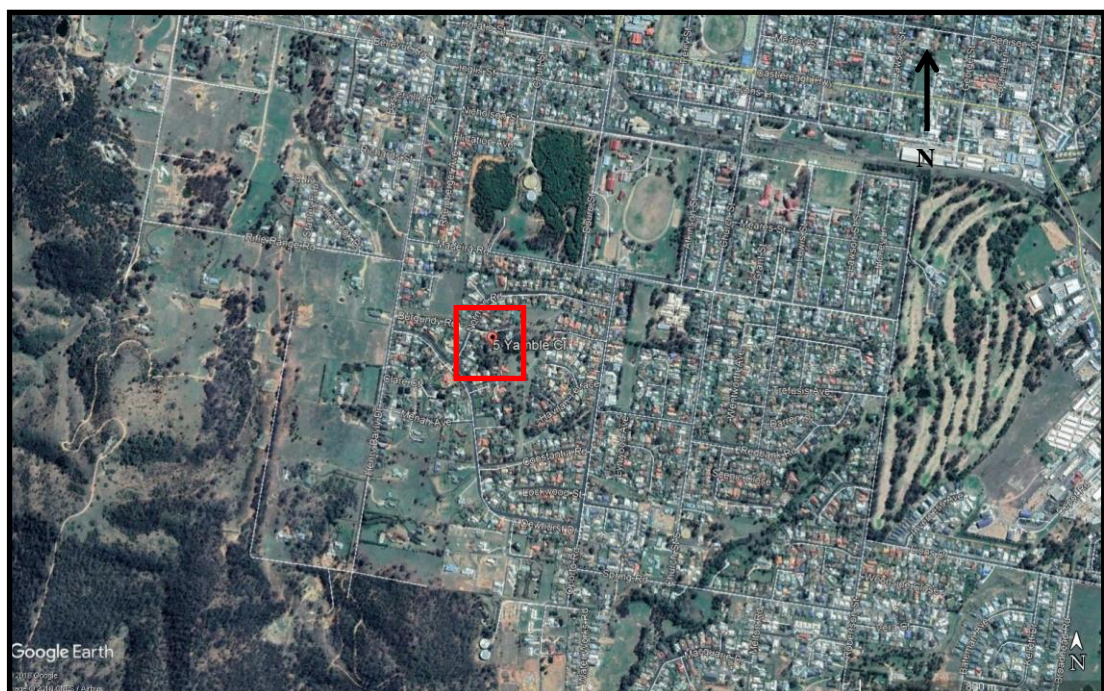
**Method**

One test borehole was drilled and logged on the 23<sup>rd</sup> October 2018 an Engineering Geologist from our Bathurst office. The borehole was drilled using a 4wd mounted Innovative Sampla 24LT.

In situ testing comprised of Dynamic Cone Penetration (DCP) testing in the borehole.

Samples were collected at 0.5m depth intervals and selected samples and two were tested for Linear shrinkage in accordance with AS1289 3.4.1.

**Location**



Site Location

**Figure 1: Site Location**



**Photograph 2: Site Location**

## Results

The subsurface conditions at the site are summarised in Table 1;

**Table 1: Sub-surface conditions**

Depth (m)	Material Description
0.00 – 0.30	TOPSOIL: Sandy GRAVEL trace clay: fine to coarse rounded to sub-rounded gravel, dark brown, fine to coarse sand, medium to high plasticity clay, medium dense to dense, dry (TOPSOIL).
0.30 – 1.00	Sandy GRAVEL with clay trace silt: fine to coarse rounded to sub-rounded gravel, dark brown, fine to coarse sand, medium to high plasticity clay, dense to very dense, dry. (RESIDUAL) (GP)
0.80 – 2.30	Silty SAND with gravel: fine to coarse, pale brown, very dense, dry (RESIDUAL) (SP-SM).

Notes: Groundwater was not encountered.

## Discussion & Recommendations

The classification of a site involves a number of geotechnical factors such as depth of bedrock, the nature and extent of subsurface soils and any specific problems (slope stability, soft soils, filling, reactivity, etc).

In accordance with AS2870 2011 the proposed development site will have an anticipated surface movement (Ys) of **25-30mm** and is classified as **“Class M”**.

An appropriate footing system should be designed in accordance with the above code to accommodate these anticipated movements. The possibility of additional movements, due to abnormal moisture variations, should be minimised by proper "site management" procedures as provided on the attached sheet.

It should be noted that this assessment is based on site conditions being represented by the natural soil profile. Any change in conditions noted during development, including cut or fill should be referred to Macquarie Geotechnical for appropriate inspection and assessment.

The recommended footing design parameters are presented in Table 2 below:

**Table 2: Summary of Geotechnical Design Parameters – Bearing Pressure**

Layer Depth Range (m)	Material Description (USCS)	Allowable End Bearing Pressure (kPa)
0.50 – 1.00	Sandy GRAVEL*	150
1.00 – 2.30	Silty SAND*	150

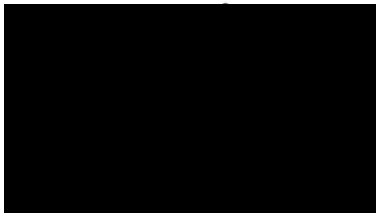
Note: \*Visual Description

### Conclusion

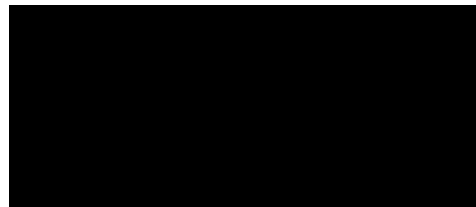
The findings of our report were based on our fieldwork, in-situ testing, laboratory testing, technical assessment and local knowledge for this site.

We trust the foregoing is sufficient for your present purposes, and if you have any questions please contact the undersigned.

Yours sincerely



**Craig Green**  
Project Engineering Geologist  
BSc (Geology) FGS



**John Boyle**  
Geotechnical Manager  
BSc (Hons) MEngSc (Geotechnical) Affil MIE Aust

Attached:                      Limitations of Geotechnical Site Investigation  
                                      Reactive Soils Notes  
References:                    Australian Standard 1726 – 2017 Geotechnical Site Investigations  
                                      Australian Standard 2870 – 2011 *Residential Slabs and Footings*

# LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

## Scope of Services

This report has been prepared for the Client in accordance with the Services Engagement Form (SEF), between the Client and Macquarie Geotechnical.

## Reliance on Data

Macquarie Geotechnical has relied upon data and other information provided by the Client and other individuals. Macquarie Geotechnical has not verified the accuracy or completeness of the data, except as otherwise stated in the report. Recommendations in the report are based on the data.

Macquarie Geotechnical will not be liable in relation to incorrect recommendations should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

## Geotechnical Investigation

Findings of Geotechnical Investigations are based extensively on judgment and experience. Geotechnical reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client and expressly for the Clients purposes.

This report is based on a subsurface investigation, which was designed for project-specific factors. Unless further geotechnical advice is obtained this report cannot be applied to an adjacent site nor can it be used when the nature of any proposed development is changed.

## Limitations of Site investigation

As a result of the limited number of sub-surface excavations or boreholes there is the possibility that variations may occur between test locations. The investigation undertaken is an estimate of the general profile of the subsurface conditions. The data derived from the investigation and laboratory testing are extrapolated across the site to form a geological model. This geological model infers the subsurface conditions and their likely behavior with regard to the proposed development.

The actual conditions at the site might differ from those inferred to exist.

No subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

## Time Dependence

This report is based on conditions, which existed at the time of subsurface exploration. Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report.

Macquarie Geotechnical should be kept appraised of any such events, and should be consulted for further geotechnical advice if any changes are noted.

## Avoid Misinterpretation

A geotechnical engineer or engineering geologist should be retained to work with other design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

No part of this report should be separated from the Final Report.

## **Sub-surface Logs**

Sub-surface logs are developed by geoscientific professionals based upon their interpretation of field logs and laboratory evaluation of field samples. These logs should not under any circumstances be redrawn for inclusion in any drawings.

## **Geotechnical Involvement During Construction**

During construction, excavation frequently exposes subsurface conditions. Geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed.

## **Report for Benefit of Client**

The report has been prepared for the benefit of the Client and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendations and should make their own enquiries and obtain independent advice in relation to such matters

Macquarie Geotechnical assumes no responsibility and will not be liable to any other person or organisations for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisations arising from matters dealt with or conclusions expressed in the report.

## **Other limitations**

Macquarie Geotechnical will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

## **Other Information**

For further information reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, 1987.

## DESIGN & MAINTENANCE PRECAUTIONS FOR REACTIVE SOILS

These precautions apply to residential masonry buildings founded on reactive clay soils. Such soils are prone to shrink/swell movements due to moisture variations caused by natural or artificial causes.

The owner should appreciate that on reactive clays it is virtually impossible to design an economic foundation system that will totally prevent movement. Some minor aesthetic cracking, while undesirable, is likely to occur in a significant proportion of houses. The basic design philosophy is to minimise any cracking and provide a serviceable structure. It is thus a compromise between economy and performance.

The following design precautions are recommended to minimise cracking from reactive soil movements:

- All surface water runoff must be directed away from the building by appropriate grading in order to prevent ponding near foundations. Site drainage should form part of the building contract. Leaking plumbing or blocked drains should be repaired promptly and site grading maintained to prevent ponding near foundations.
- Peripheral pathways, with impermeable underliner, should be provided around the building to improve site drainage and assist in the stabilisation of moisture conditions near foundations.
- All brickwork should be suitably articulated into discrete units to accommodate the expected movements. Brickwork over doors and windows should be avoided.
- Internal and external walls should be arranged along straight lines, where possible. All house drains and water pipes should be provided with sufficient flexibility to accommodate the expected differential movements (between foundation and uncovered outside area) at the level of the service.
- The extension of services through slabs should be avoided where possible in order to prevent hidden leaks under the slab area. Most plumbing fixtures can be arranged to exit through outside walls.
- Septic systems should be located so as not to influence the house or neighbouring foundations.
- Subgrades beneath elevated and well-ventilated floors should be covered with an impermeable liner (with protective soil blanket) to minimise excessive desiccation.

In addition, certain other site management precautions must be adhered to during the life of the structure. These precautions generally relate to the control of abnormal moisture variations due to the effects of drainage and vegetation. Recommendations on site management precautions are contained in the following section.

- Leaking plumbing or blocked drains should be repaired promptly and site grading maintained to prevent ponding near foundations. Garden watering, particularly by fixed systems, should be controlled to avoid over-watering. Proper garden maintenance should produce year round uniform moisture conditions.
- Trees and some shrubs can cause a substantial drying and shrinking of reactive clays, additional to that experienced in a drought or a long dry spell. This effect is most likely to result in damage when added to the drying effects from a drought or a long dry spell. Trees should be planted at a substantial distance from the house. The distance depends upon the species and soil conditions, but generally a distance equal to 75% of the mature height is a minimum.
- Problems during a drought can be minimised by extensive pruning (thus reducing water demand) and/or providing trees with adequate water. Frequent moderate watering during dry periods should minimise the risk of the tree extracting excessive moisture from beneath the foundation of the house. The owner should also immediately undertake this action if brickwork cracking due to tree drying is noticed. Most reactive clay failures can be minimised by controlling the combined drying effects of trees and drought.

Reference should be made to Appendix A of AS2870.2 "Residential Slabs. and Footings" and CSIRO 10-91 "A Guide to Home Owners on Foundation Maintenance and Footing Performance" for more detailed recommendations regarding Design and Site management precautions.