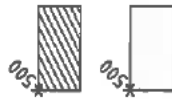


**WARNING**

THIS PLAN ONLY INDICATES AREAS OF FILL OF WHICH THE DEVELOPER AND THEIR AGENTS ARE AWARE. IT HAS NOT BEEN CHECKED BY THE TERRITORY, AND THE TERRITORY DOES NOT GUARANTEE ITS ACCURACY. IN NO WAY SHOULD THIS PLAN BE READ AS A CONCLUSIVE STATEMENT OF THE FULL EXTENT OF THE FILL THAT MAY BE FOUND ON THE WHOLE LAND DEPICTED. LESSEES AND PURCHASERS SHOULD MAKE THEIR OWN INQUIRIES IN REGARD TO THE EXACT DRAINAGE, GEOTECHNICAL AND FILL CONDITIONS AFFECTING THEIR BLOCKS.



AREA OF KNOWN CUT  
(DEPTH IN MILLIMETRES)

AREA OF KNOWN FILL  
(DEPTH IN MILLIMETRES)

STAGE BOUNDARY

DESIGN GRADING CONTOURS  
(10m INTERVALS)



POND 4

DATE	DESCRIPTION



THROSBY ESTATE  
STAGE 3





COMBINED BY  
 tait | waddington  
AN ACTING PARTNERSHIP OF TAIT WADDINGTON

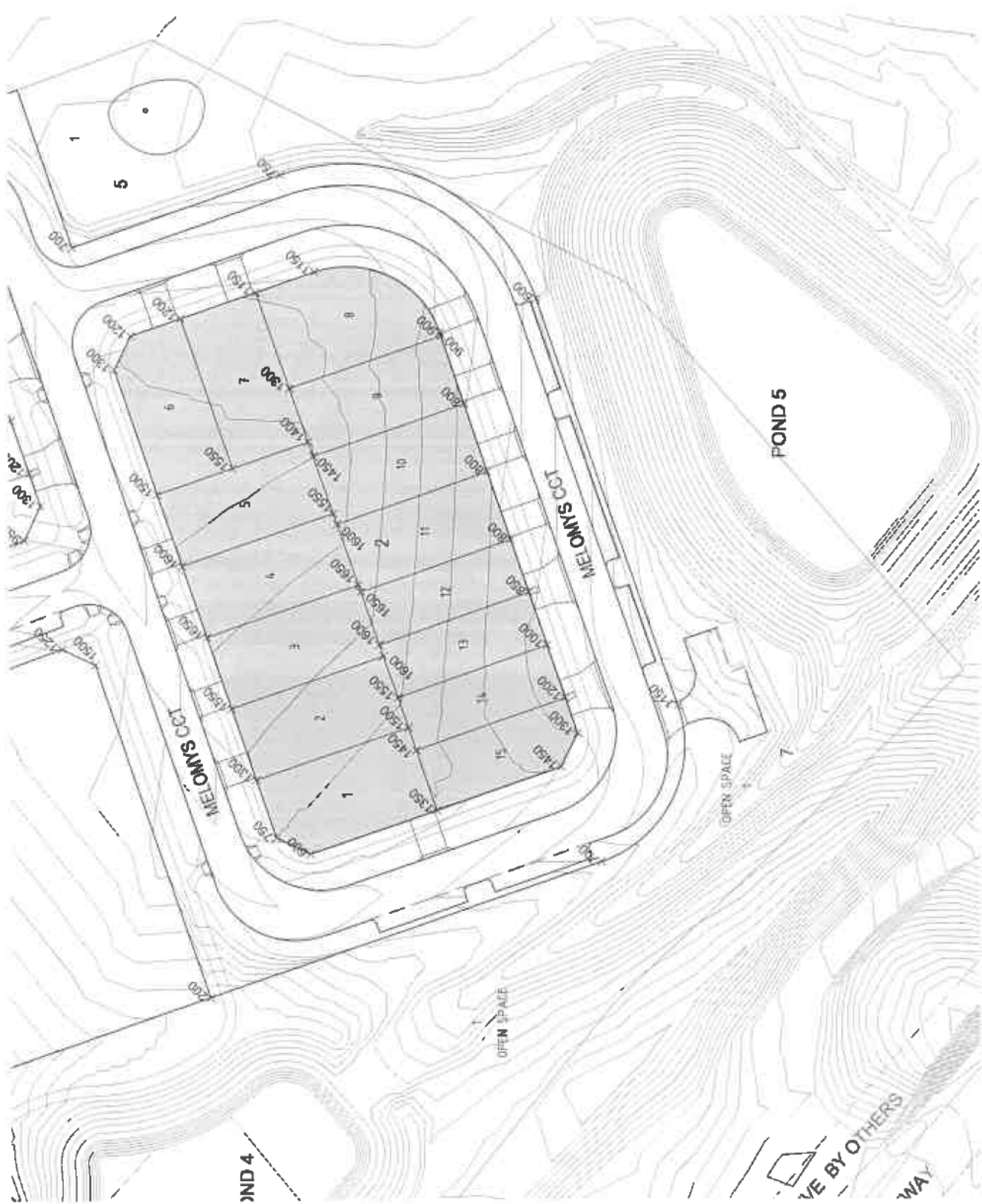






OWNER TITLE  
 FILL ON BLOCKS  
 SHEET 39  
 DRAWING NUMBER  
 C13178.3-F0359  
 NUMBER  
 A

**WARNING**

THIS PLAN ONLY INDICATES AREAS OF FILL OF WHICH THE DEVELOPER AND THEIR AGENTS ARE AWARE. IT HAS NOT BEEN CHECKED BY THE TERRITORY, AND THE TERRITORY DOES NOT GUARANTEE ITS ACCURACY. IN NO WAY SHOULD THIS PLAN BE READ AS A CONCLUSIVE STATEMENT OF THE FULL EXTENT OF THE FILL THAT MAY BE FOUND ON THE WHOLE LAND DEPICTED. LESSEES AND PURCHASERS SHOULD MAKE THEIR OWN INQUIRIES IN REGARD TO THE EXACT DRAINAGE, GEOTECHNICAL AND FILL CONDITIONS AFFECTING THEIR BLOCKS.

-  \*500  
AREA OF KNOWN CUT  
(DEPTH IN MILLIMETRES)
-  \*500  
AREA OF KNOWN FILL  
(DEPTH IN MILLIMETRES)
-  STAGE BOUNDARY
-  DESIGN GRADING CONTOURS  
(1.0m INTERVALS)



  1:1000		<b>THROSBY ESTATE</b> STAGE 3	CONSULTANTS <b>tait   waddington</b> <small>ARCHITECTS, PLANNERS &amp; ENVIRONMENTALISTS</small>		DRAWING TITLE <b>FILL ON BLOCKS</b>
					SHEET 40
DRAWING NUMBER <b>C1317B.3-F0840</b>				REVISION <b>A</b>	

**ANNEXURE B - SPECIMEN CROWN LEASE**

SPECIMEN ONLY

This is a market value lease - s238(2) (a) (ii) Planning and Development Act 2007



Volume Folio

CONDITIONS APPLICABLE

MOP (No.) Annexure

LEASE No

AUSTRALIAN CAPITAL TERRITORY CROWN LEASE

PLANNING AND DEVELOPMENT ACT 2007

AUSTRALIAN CAPITAL TERRITORY (PLANNING & LAND MANAGEMENT) ACT 1988 (CTR) ss. 28,30 & 31

THE PLANNING AND LAND AUTHORITY ON BEHALF OF THE COMMONWEALTH OF AUSTRALIA IN EXERCISING ITS FUNCTIONS GRANTS TO THE LESSEE THE LAND FOR THE TERM AND SUBJECT TO THE PROVISIONS SET OUT BELOW.

THE MEMORANDUM OF PROVISIONS (MOP) No. REGISTERED IN THE REGISTRAR-GENERAL'S OFFICE AND/OR ANY PROVISIONS SET OUT IN ANY ANNEXURE ARE PART OF THIS LEASE.

THIS DOCUMENT SHOULD BE PRESENTED TO THE ACT REVENUE OFFICE FOR NOTATION PRIOR TO LODGEMENT AT THE REGISTRAR-GENERAL'S OFFICE

1. LAND

Table with 5 columns: DISTRICT/DIVISION, SECTION, BLOCK, DEPOSITED PLAN, APPROXIMATE AREA square metres

2. LESSEE'S NAME AND ADDRESS

Empty box for Lessee's Name and Address

3. FORM OF TENANCY

Empty box for Form of Tenancy

4. TERM

GRANT DATE: TERM IN YEARS: 99 FROM THE COMMENCEMENT DATE
COMMENCEMENT DATE: EXPIRY DATE:

5. PURPOSE

SINGLE DWELLING HOUSING.

6. RESERVATIONS AND STATUTORY RESTRICTIONS

The statutory restriction(s) is/are: Section 298 of the Planning and Development Act 2007.

7. VARIATIONS TO MEMORANDUM OF PROVISIONS

Not Applicable

**8. EXECUTION**

<b>SIGNED BY</b>	
<b>SIGNATURE OF LESSEE</b>	<b>SIGNATURE OF WITNESS</b>
	<b>NAME OF WITNESS (BLOCK LETTERS)</b>

<b>SIGNED BY A DELEGATE AUTHORISED TO EXECUTE THIS LEASE ON BEHALF OF THE COMMONWEALTH:</b>	
<b>SIGNATURE</b>	<b>SIGNATURE OF WITNESS</b>
<b>NAME OF SIGNATORY (BLOCK LETTERS)</b>	

**OFFICE USE ONLY**

<b>EXAMINED</b>		<b>DATE:</b>	
<b>VOLUME: FOLIO</b>			
<b>REGISTERED:</b>			



**ACT**  
Government

Justice and Community Safety

LAND TITLES  
OFFICE OF REGULATORY SERVICES  
ACT Justice and Community Safety Directorate

**ANNEXURE**

Land Titles Act 1925

**SPECIMEN ONLY**

Form 029 - ANN

**TITLE AND LAND DETAILS**

Volume & Folio	District/Division	Section	Block	Unit

**ANNEXURE TO (insert dealing type)**

**TOTAL NUMBER OF PAGES IN ANNEXURE**

Crown Lease

2

1. The Authority, on behalf of the Commonwealth, grants over that part of the land ("Land") identified as a services easement on the Deposited Plan an easement ("Easement") in favour of the relevant provider (referred to as the "service provider");
2. The service provider may:
  - (1) provide, maintain and replace services supplied by that service provider through the Land within the site of the Easement; and
  - (2) do anything reasonably necessary for that purpose, including without limitation:
    - (a) entering or passing through the Land;
    - (b) taking anything on to the Land; and
    - (c) carrying out work, including without limitation, constructing, placing, repairing or maintaining pipes, poles, wires, cables, conduits, structures and equipment.
3. In exercising the powers in paragraph 2, the service provider must take all reasonable steps to:
  - (1) ensure that the work carried out on the Land causes as little disruption, inconvenience and damage as is practicable; and
  - (2) ensure that the Land is restored as soon as practicable to a condition that is similar to its condition before the work was carried out.
4. Paragraph 3(2), does not require the service provider to restore:
  - (1) the Land to a condition that would result in:
    - (a) an interference with:
      - (i) any service on or through the Land; or
      - (ii) access to any service on or through the Land; or
    - (b) a contravention of a law of the Territory; or

**SPECIMEN ONLY**

(2) any building or structure placed or constructed on any part of the Land comprising the Easement.

5. The Lessee must not place or construct, nor permit to be placed or constructed, a building or structure or any part of a building or structure on any part of the Land comprising the Easement UNLESS written advice from the service provider is obtained;
6. For the purposes of the Easement, "services", includes, without limitation, the supply of water, gas, electricity and discharge or drainage of water, stormwater and sewage.
7. Nothing in this clause diminishes or affects any rights or powers of a service provider conferred under any statute, regulation or law.

**SPECIMEN ONLY**

**AUSTRALIAN CAPITAL TERRITORY  
LAND TITLES ACT 1925  
Section 103A**

**Memorandum Of Provisions**

Memorandum of Provisions No.2,000,050

**1. INTERPRETATION**

IN THIS LEASE, unless the contrary intention appears, the following terms mean:

- 1.1 'Act' - the Planning and Development Act 2007;
- 1.2 'Authority' – the Planning and Land Authority established by section 10 of the Planning and Development Act 2007;
- 1.3 'Building' - any building, structure or improvement on or under the Land;
- 1.4 'Class' - for a building or structure, means the class of building or structure under the building code as defined in the Building Act 2004;
- 1.5 'Commencement Date' - the Commencement Date specified in item 4;
- 1.6 'Commonwealth' – the Commonwealth of Australia;
- 1.7 'Dwelling' -
  - (a) means a Class 1 building, or a self-contained part of a Class 2 building, that:
    - (i) includes the following that are accessible from within the building, or the self-contained part of the building:
      - (1) not more than 2 kitchens;
      - (2) at least 1 bath or shower;
      - (3) at least 1 toilet pan; and
    - (ii) does not have access from another building that is either a Class 1 building or the self-contained part of a Class 2 building; and
  - (b) includes any ancillary parts of the building and any Class 10a buildings associated with the building;

- 1.8 'Land' - the Land specified in item 1;
- 1.9 'Lease' - the Crown lease incorporating these provisions;
- 1.10 'Lessee' includes:
- (a) where the Lessee is or includes a person, the executors, administrators and assigns of that person; and
  - (b) where the Lessee is or includes a corporation, the successors and assigns of that corporation;
- 1.11 'Multi-unit housing' means the use of land for more than one dwelling and includes but is not limited to dual occupancy housing;
- 1.12 'Premises' - the Land and any Building at any time on the Land;
- 1.13 'Purpose' - the Purpose specified in item 5;
- 1.14 'Single dwelling housing' means the use of land for residential purposes for a single dwelling only;
- 1.15 'Territory':
- (a) when used in a geographical sense, the Australian Capital Territory; and
  - (b) when used in any other sense the body politic established by section 7 of the Australian Capital Territory (Self-Government) Act 1988 (C'th);
- 1.16 Where the Lessee comprises two or more persons or corporations, an agreement by the Lessee binds them jointly and individually;
- 1.17 The singular includes the plural and vice versa;
- 1.18 A reference to one gender includes the other genders;
- 1.19 A reference in this lease to any statute or statutory provision shall include a reference to any statute or statutory provision that amends, extends, consolidates or replaces the statute or statutory provision and to any other regulation, instrument or other subordinate legislation made under the statute;
- 1.20 A reference to an item is a reference to the corresponding item in the Lease.

## **2. LESSEE'S OBLIGATIONS**

The Lessee must:

### **RENT**

- 2.1 pay to the Authority the rent of 5 cents per annum if and when demanded;

## **BUILDING SUBJECT TO APPROVAL**

- 2.2 not, without the prior written approval of the Authority, except where exempt by law, construct any Building, or make any structural alterations in or to any Building;

## **COMPLETE CONSTRUCTION**

- 2.3 within twenty-four (24) months from the Commencement Date or within such further time as may be approved in writing by the Authority, complete construction of an approved development on the Land as approved by the Authority at a cost of not less than one hundred and eighty thousand dollars (\$180,000) per Dwelling;

## **UNDERGROUND FACILITIES**

- 2.4 ensure that facilities for electrical and telephone cables are installed underground to a standard acceptable to the Authority;

## **PURPOSE**

- 2.5 use the Land for the Purpose;

## **PRESERVATION OF TREES**

- 2.6 during the period allowed for construction, not damage or remove trees identified in a development approval for retention or to which the Tree Protection Act 2005 applies, without the prior written approval of the Territory;

## **REPAIR AND MAINTAIN**

- 2.7 repair and maintain the Premises to the satisfaction of the Authority;

## **RIGHT OF INSPECTION**

- 2.8 subject to the Act, permit anyone authorised by the Authority to enter and inspect the Premises at all reasonable times and in any reasonable manner;

## **RATES AND CHARGES**

- 2.9 pay all rates, taxes, charges and other statutory outgoings, which become payable on or in respect of the Land, as they fall due;

## **CLEAN AND TIDY**

- 2.10 at all times, keep the Premises clean, tidy and free from rubbish and other unsightly or offensive matter PROVIDED ALWAYS THAT should the Lessee fail to do so the Authority may, at the cost of the Lessee, cause any matter or thing to be removed from the Premises and restore the Premises to a clean and tidy condition.

### **3. MUTUAL OBLIGATIONS**

The parties agree that:

#### **OWNERSHIP OF MINERALS AND WATER**

- 3.1 all minerals on or in the Land and the right to the use, flow and control of ground water under the surface of the Land are reserved to the Territory;

#### **FAILURE TO REPAIR AND MAINTAIN**

- 3.2 if the Lessee fails to repair and maintain the Premises in accordance with subclause 2.7, the Authority may, by written notice to the Lessee, require the Lessee to carry out the repairs and maintenance within a specified period of not less than one month;

- 3.3 if the Authority believes that any Building is beyond repair, the Authority may, by written notice to the Lessee, require the Lessee to:

- (a) remove the Building; and
- (b) construct a new Building to a standard acceptable to the Authority according to approved plans;

within a specified period of not less than one month;

- 3.4 if the Lessee fails to comply with a notice given under subclause 3.2 or 3.3, the Authority may enter the Premises, with anyone else and with any necessary equipment, and carry out the work which the Lessee should have carried out. The Lessee must pay to the Authority, on demand, the costs and expenses of that work;

#### **TERMINATION**

- 3.5 if:
- (a) the Lessee at any time does not use the Land for a period of one year for the Purpose; or
  - (b) the Lessee fails to do any of the things which the Lessee has agreed to do in this Lease and that failure continues for three months (or such longer period as may be specified by the Authority) after the date of service on the Lessee of a written notice from the Authority specifying the nature of the failure;

THEN the Authority on behalf of the Commonwealth may terminate the Lease by giving a written notice of termination to the Lessee. That termination will not adversely affect any other right or remedy which the Authority or the Commonwealth may have against the Lessee for the Lessee's failure;

- 3.6 the power of the Authority on behalf of the Commonwealth to terminate the Lease under subclause 3.5 shall not be affected by:
- (a) the acceptance of rent or other money by the Authority during or after the notice has been given; or
  - (b) any delay in exercising any right, power or remedy under the Lease;

#### FURTHER LEASE

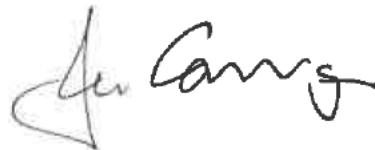
- 3.7 the Lessee will be entitled to a further Lease of the Land on such terms as the Act provides;

#### NOTICES

- 3.8 any written communication to the Lessee is given if signed on behalf of the Authority and delivered to or sent in a prepaid letter addressed to the Lessee at the Land or at the last-known address of the Lessee or affixed in a conspicuous position on the Premises;

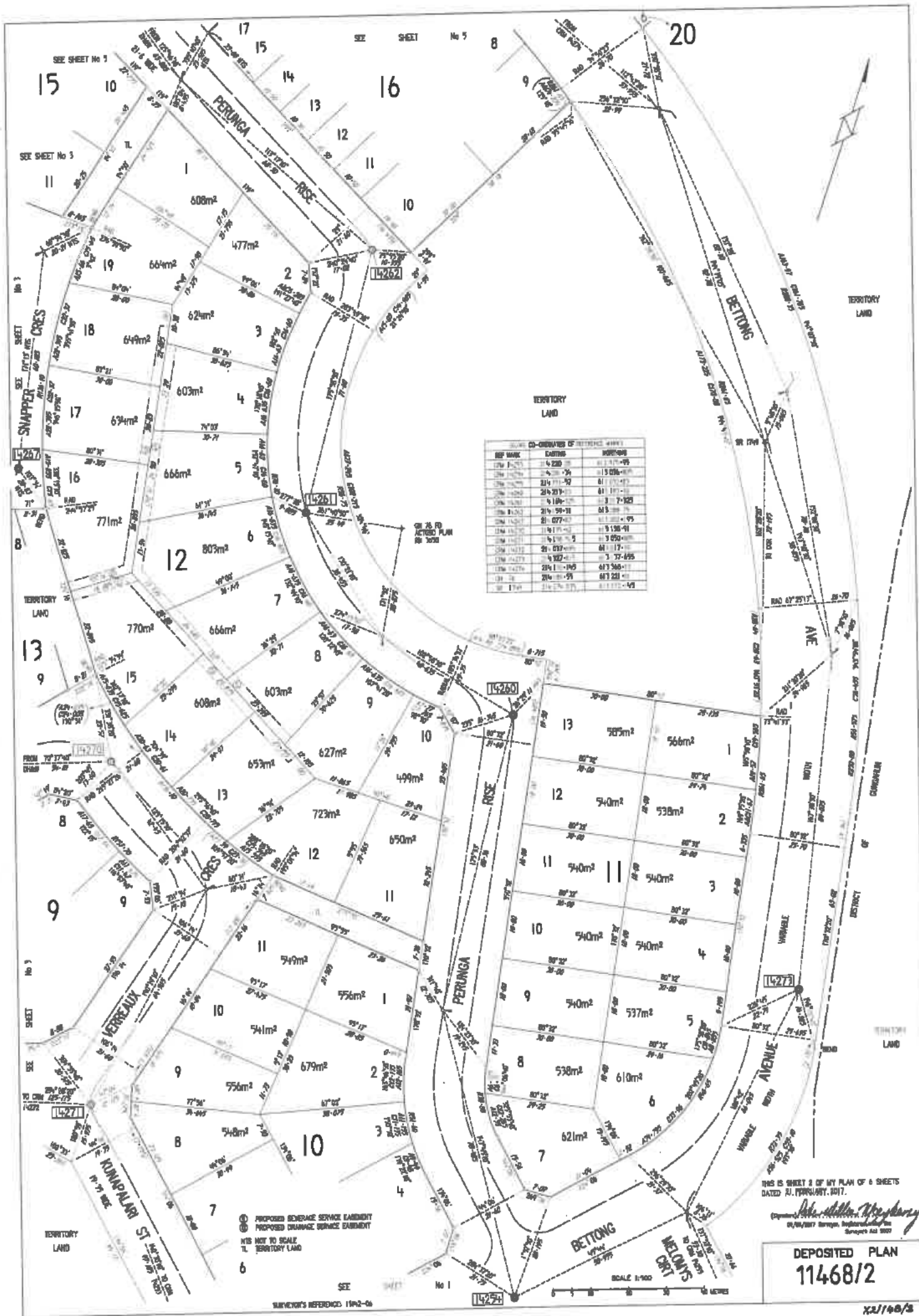
#### EXERCISE OF POWERS

- 3.9 Any and every right, power or remedy conferred on the Commonwealth or Territory in this Lease, by law or implied by law may be exercised on behalf of the Commonwealth or the Territory or as the case may be by:
- (a) the Authority;
  - (b) an authority or person for the time being authorised by the Authority or by law to exercise those powers or functions of the Commonwealth or Territory; or
  - (c) an authority or person to whom the Authority has delegated all its powers or functions under the Planning and Development Act 2007.



.....  
Signed by **JIM CORRIGAN** )  
a delegate authorised to execute this )  
Memorandum of Provisions on behalf )  
of the Commonwealth )

**ANNEXURE C - DEPOSITED PLAN**



SEE SHEET No 5 8

20

SEE SHEET No 1

SEE SHEET No 3

SEE SHEET No 1

SEE SHEET No 1

SEE SHEET No 1

SEE SHEET No 1

SEE SHEET No 1

SEE SHEET No 1

SEE SHEET No 1

COORDINATES OF REFERENCE MARKS

REF. MARK	EASTING	NORTHING
14251	4 220	15 000
14252	4 220	15 000
14253	4 220	15 000
14254	4 220	15 000
14255	4 220	15 000
14256	4 220	15 000
14257	4 220	15 000
14258	4 220	15 000
14259	4 220	15 000
14260	4 220	15 000
14261	4 220	15 000
14262	4 220	15 000
14263	4 220	15 000
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14271	4 220	15 000
14272	4 220	15 000
14273	4 220	15 000
14274	4 220	15 000
14275	4 220	15 000
14276	4 220	15 000
14277	4 220	15 000
14278	4 220	15 000
14279	4 220	15 000
14280	4 220	15 000

PROPOSED SEWERAGE SERVICE EMBANKMENT  
 PROPOSED DRAINAGE SERVICE EMBANKMENT  
 THIS IS NOT TO SCALE  
 TERRITORY LAND

THIS IS SHEET 2 OF MY PLAN OF 6 SHEETS  
 DATED 21 FEBRUARY 2017.  
*John Allan McPherson*  
 01/04/2017 Survey, Instrumentation  
 Singapore Act 50/2017

DEPOSITED PLAN  
 11468/2

SEE SHEET No 1

SCALE 1:100

XZ/100/3



**ANNEXURE D - SITE CLASSIFICATION CERTIFICATE**

# About this Inspection Report

Douglas Partners



## Introduction

These notes are provided to amplify DP's inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

## Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

## Copyright and Limits of Use

This inspection report is the property of DP and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Conditions of Engagement for the commission.

DP does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

## Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to DP);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while DP was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and

- DP's experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

Every care is taken with the inspection report as it relates to interpretation of subsurface conditions and any recommendations or suggestions for construction or design. However, DP cannot anticipate or assume responsibility for:

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

Should these issues occur, then additional advice should be sought from DP and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

# Foundation Maintenance and Footing Performance: A Homeowner's Guide



CSIRO

BTF 19  
replaces  
Information  
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

## Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

## Causes of Movement

### Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

### Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

### Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

### Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

### Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

## GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landfills; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

### Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

### Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

### Effects of Uneven Soil Movement on Structures

#### Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpend).)

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

#### Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

#### Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

#### Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical - i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

#### Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

**Effects on framed structures**

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

**Effects on brick veneer structures**

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

**Water Service and Drainage**

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.

Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.

- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

**Seriousness of Cracking**

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

**Prevention/Cure**

**Plumbing**

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

**Ground drainage**

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish water table height and subsoil water flows. This subject is referred to in BTP 19 and may properly be regarded as an area for an expert consultant.

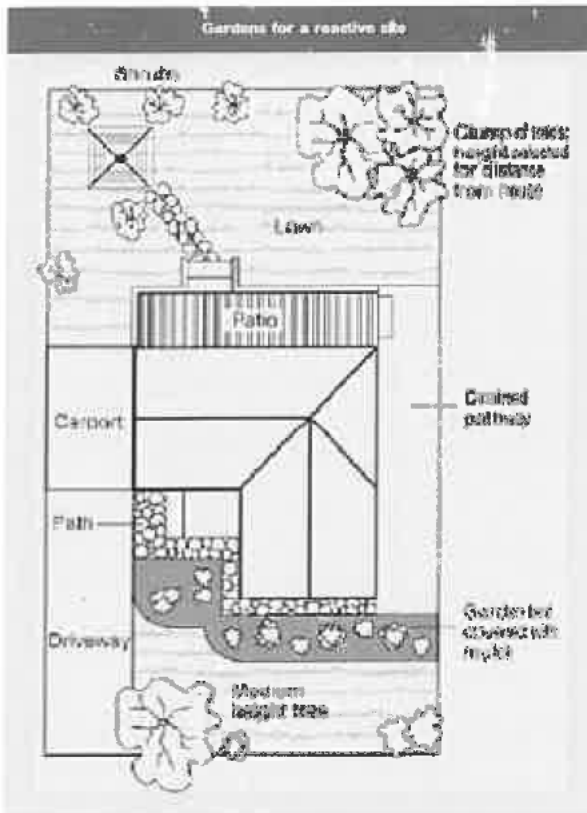
**Protection of the building perimeter**

It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

**CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS**

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5-15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15-25 mm but also depend on number of cracks	4



- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content creates an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

#### The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

#### Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

#### Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

#### Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

#### Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTf was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnostics.

should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:80. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTf 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

#### Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

**Warning:** Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 2                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 39:** Located on the boundary of Blocks 2 & 3 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, dense, dry to moist, silty sand (cemented) to 0.3 m then stiff to very stiff, dry to moist sandy silty clay to 0.8 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**Test Pit 40:** Located on the boundary of Blocks 1 & 19 Section 12. Dry to moist topsoil filling with rootlets to 0.05 m depth overlying medium to high strength, moderately weathered dacite to the refusal depth of 0.1 m.

**SITE CLASSIFICATION:** Class S (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes 'About this Inspection Report'.

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



**Douglas Partners**  
Geotechnics | Environment | Groundwater

# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 3                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 38:** Located on the boundary of Blocks 3 & 4 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then very stiff to hard, dry to moist sandy silty clay to 0.4 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**Test Pit 39:** Located on the boundary of Blocks 2 & 3 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, dense, dry to moist, silty sand (cemented) to 0.3 m then stiff to very stiff, dry to moist sandy silty clay to 0.8 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**SITE CLASSIFICATION:** Class S (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



**Douglas Partners**  
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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 4                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 38:** Located on the boundary of Blocks 3 & 4 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then very stiff to hard, dry to moist sandy silty clay to 0.4 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**Test Pit 39:** Located on the boundary of Blocks 2 & 3 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, dense, dry to moist, silty sand (cemented) to 0.3 m then stiff to very stiff, dry to moist sandy silty clay to 0.8 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**SITE CLASSIFICATION:** Class S (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 5                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Callbre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 37:** Located on the boundary of Blocks 5 & 6 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then well compacted, dry to moist silty clayey gravel filling (regrade) to 0.3 m, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.7 m.

**Test Pit 38:** Located on the boundary of Blocks 3 & 4 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then very stiff to hard, dry to moist sandy silty clay to 0.4 m depth, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.6 m.

**SITE CLASSIFICATION:** Class S (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoil / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 6                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 36:** Located on the boundary of Blocks 7 & 8 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, overlying medium strength, highly weathered dacite to the slow progress depth of 0.4 m.

**Test Pit 37:** Located on the boundary of Blocks 5 & 6 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then well compacted, dry to moist silty clayey gravel filling (regrade) to 0.3 m, overlying medium to high strength, highly weathered dacite to the refusal depth of 0.7 m.

**SITE CLASSIFICATION:** Class B (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes 'About this Inspection Report'.

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.

*Archie Hogg*



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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 7                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Callbre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 36:** Located on the boundary of Blocks 7 & 8 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, overlying medium strength, highly weathered dacite to the slow progress depth of 0.4 m.

**Test Pit 43:** Located on the boundary of Blocks 14 & 15 Section 12. Dry to moist topsoil filling with rootlets to 0.15 m depth overlying high strength, slightly weathered dacite to the refusal depth of 0.4 m.

**SITE CLASSIFICATION:** Class S (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes 'About this Inspection Report'.

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



**Douglas Partners**  
Geotechnics | Environment | Groundwater

# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 8                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 36:** Located on the boundary of Blocks 7 & 8 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, overlying medium strength, highly weathered dacite to the slow progress depth of 0.4 m.

**Test Pit 43:** Located on the boundary of Blocks 14 & 15 Section 12. Dry to moist topsoil filling with rootlets to 0.15 m depth overlying high strength, slightly weathered dacite to the refusal depth of 0.4 m.

**SITE CLASSIFICATION:** Class 8 (slightly reactive) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

**REFERENCES:** 1. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



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# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 9                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 35:** Located on the boundary of Blocks 9 & 10 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, well compacted, dry to moist silty gravelly clay with some sand filling to 0.5 m depth, dense, dry to moist silty gravelly sand to 1.0 m depth, then stiff to very stiff, moist to dry sandy silty clay to 1.2 m depth, overlying medium to high strength, moderately weathered dacite to the refusal depth of 1.3 m.

**Test Pit 36:** Located on the boundary of Blocks 7 & 8 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, overlying medium strength, highly weathered dacite to the slow progress depth of 0.4 m.

### BULK EARTHWORKS:

Filling within the block placed under Level 1 control as defined in AS 3798 – 2007 (Ref 1).

**SITE CLASSIFICATION:** Class S\* (slightly reactive/filled) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 2). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 2) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

- REFERENCES:**
1. AS 3798-2007 'Guidelines on Earthworks for Commercial and Residential Developments', Standards Association of Australia.
  2. AS 2870-2011 'Residential Slabs and Footings,' Standards Association of Australia.



**Douglas Partners**  
Geotechnics | Environment | Groundwater

# SITE CLASSIFICATION REPORT SUMMARY

**BLOCK:** 10                      **SECTION:** 12                      **SUBURB:** Throsby  
**JOB No:** 77374.09                      **DATE:** January 2017  
**CLIENT:** Calibre Consulting (ACT) Pty Ltd

## CLASSIFICATION PROCEDURES:

### EXISTING SUBSURFACE CONDITIONS:

**Test Pit 34:** Located on the boundary of Blocks 11 & 12 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, then well compacted, moist to dry silty clayey gravel with cobble filling (regrade) to 0.5 m depth, overlying medium to high strength, moderately weathered dacite to the refusal depth of 0.8 m.

**Test Pit 35:** Located on the boundary of Blocks 9 & 10 Section 12. Dry to moist topsoil filling with rootlets to 0.1 m depth, well compacted, dry to moist silty gravelly clay with some sand filling to 0.5 m depth, dense, dry to moist silty gravelly sand to 1.0 m depth, then stiff to very stiff, moist to dry sandy silty clay to 1.2 m depth, overlying medium to high strength, moderately weathered dacite to the refusal depth of 1.3 m.

### BULK EARTHWORKS:

Filling within the block placed under Level 1 control as defined in AS 3798 – 2007 (Ref 1).

**SITE CLASSIFICATION:** Class S\* (slightly reactive/filled) based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 2). If the building pad is founded entirely on weathered rock, a Class A classification may be appropriate. Therefore the classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

**FOOTING SYSTEMS:** Reference must be made to AS2870-2011 (Ref 2) which indicates footing systems that are appropriate for each site classification. All footings must be founded within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any on-site or off-site constraints.

**MAINTENANCE GUIDELINES:** CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

### COMMENTS/ LIMITATIONS:

The successful purchaser must make their own interpretations, deductions and conclusions from the information made available and will need to accept full responsibility for such interpretations, deductions and conclusions.

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to the construction should include removal of all vegetation, topsoil and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Hard rock excavation must be anticipated.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

- REFERENCES:**
1. AS 3798-2007 'Guidelines on Earthworks for Commercial and Residential Developments', Standards Association of Australia.
  2. AS 2870-2011 'Residential Slabs and Footings', Standards Association of Australia.

