Attachment to item number 5.1 -

Certificate of Title

Natural values survey

Attachment to item number 5.2 -

Bushfire hazard report prepared by Rogerson & Birch Surveyors and dated 28 April 2025

Geotechnical site investigation for foundations and wastewater prepared by Enviro Tech Consultants dated 27 May 2025 and 6 August 2025

Sorell Council

Development Application: 7.2025.10.1 - Subdivision Application 5 Cherry Court, Forcett - P1.pdf
Plans Reference:P1
Date Received:26/06/2025

BUSHFIRE ASSESSMENT REPORT

Proposed Subdivision (2 lots)

Address: 5 Cherry Court, Forcett TAS 7173

Title Reference: C.T.140818/13

Prepared by James Rogerson, Bushfire Hazard Practitioner
(BFP-161)
VERSION – 1.0
Date: 28/04/2025

Contents

Disclaimer: The information contained within this report is based on the instructions of AS 3959-2018 the standard states that *"Although this Standard is designed to improve the performance of building when subjected to bushfire attach in a designated bushfire-prone area there can be no guarantee that a building will survive a bushfire event of every occasion. This is substantially due to the degree of vegetation management, the unpredictable nature and behaviour of fire and extreme weather conditions." (Standards Australia Limited, 2011)*

INTRODUCTION

1.1 Background

This Bushfire Assessment Report and associated Bushfire Hazard Management Plan (BHMP) has been prepared by James Rogerson of *JR Bushfire Assessments* (for Rogerson & Birch Surveyors) on behalf of the proponent to form part of supporting documentation for a proposed subdivision of 2 lots at 5 Cherry Court, Forectt. Under the Tasmanian Planning Scheme – Sorell (TPS) and C13.0 Bushfire-Prone Areas Code it is a requirement that a subdivision application within a bushfire-prone area must accomplish a minimum Bushfire Attack Level (BAL) rating of BAL-19 for all future dwellings on newly formed allotments. This report also includes an associated BHMP which is also a requirement under C13.0.

The proposed development is within a Bushfire-Prone Area overlay and there is bushfire-prone vegetation within 100m from the site. Therefore, this site is within a bushfire-prone area.

1.2 Scope

This Bushfire Report offers an investigation and assessment of the bushfire risk to establish the level of bushfire threat and vulnerability on the land for the purpose of subdivision. This report includes the following:

- A description of the land and adjacent land, and description of the use or development that may be at threat by a bushfire on the subject site;
- Calculates the level of a bushfire threat and offers opinions for bushfire mitigation measures that are consistent with AS3959:2018 and C13.0.
- Subdivision Proposal Plan (Appendix B)
- Bushfire Hazard Management Plan (Appendix C)
- Planning Certificate (Appendix D)

1.3 Scope of BFP Accreditation

I, James Rogerson am an accredited Bushfire Practitioner (BFP-161) to assess bushfire hazards and endorse BHMP's under the the *Chief Officers Scheme for the Accreditation of Bushfire Hazard Practitioners.* I have successfully completed the *Planning for Bushfire Prone Areas Short Course* at University of Technology Sydney.

1.4 Limitations

The site assessment has been conducted and report written on the understanding that:

- The report only deals with the potential bushfire risk, all other statutory assessments are outside the scope of this report;
- The report only classifies the size, volume and status of the vegetation at the time the site assessment was conducted.
- Impacts on future development and vegetation growth have not been considered in this report. No action or reliance is to be placed on this report, other than which it was commissioned.

1.5 Proposal

The proposal is for subdivision of C.T.140818/13 into two resultant titles. See proposal plan (Appendix B).

2 PRE-FIELD ASSESSMENT

2.1 Site Details

Table 1

Owner Name(s)	Phillip J. & Jane A. Sargent
Location	5 Cherry Court, Forcett Sorell TAS 7173
Title Reference	C.T.140818/13
Property ID	2281192
Municipality	Sorell
Zoning	Rural Living Zone A
Planning Overlays	13 – Bushfire-prone Areas Code, 16 – Safeguarding of Airports Code & 15 – Landslip Hazard Code
Water Supply for Firefighting	The property is not serviced by reticulated water.
Public Access	Access to the development is off Cherry Court.
Fire History	No recorded fires on the *LIST*
Existing Development	Existing Class 1a dwelling, a Class 10a shed & gravel driveway.

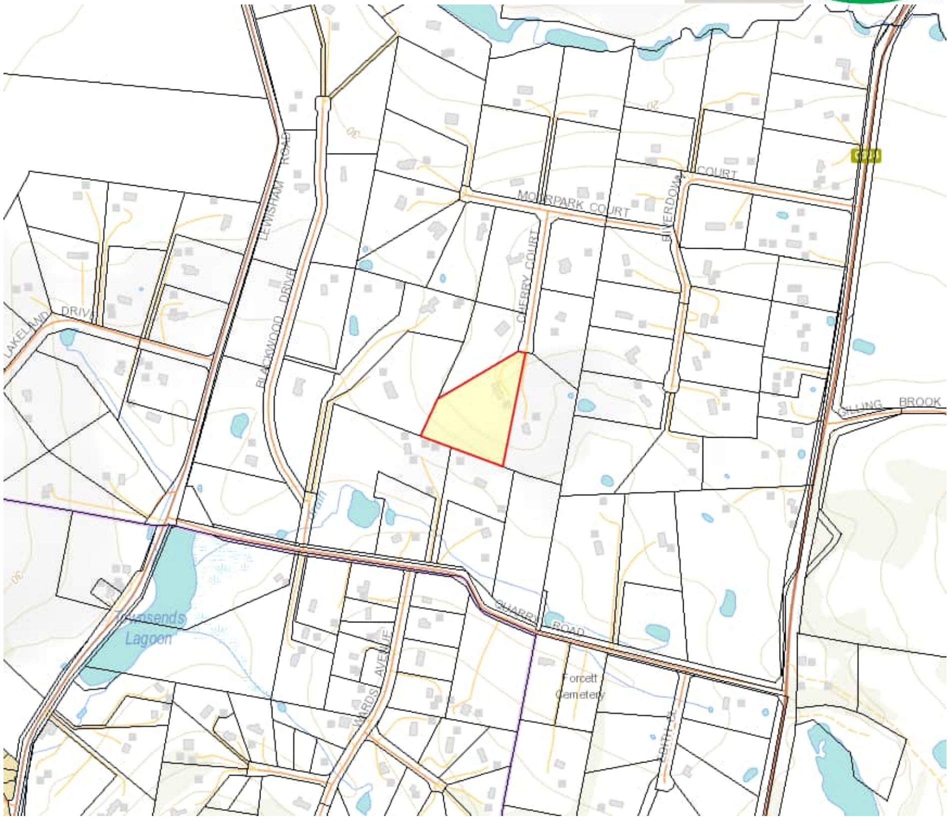

Figure 1 - Location of subject site. Source: The LIST, © State of Tasmania

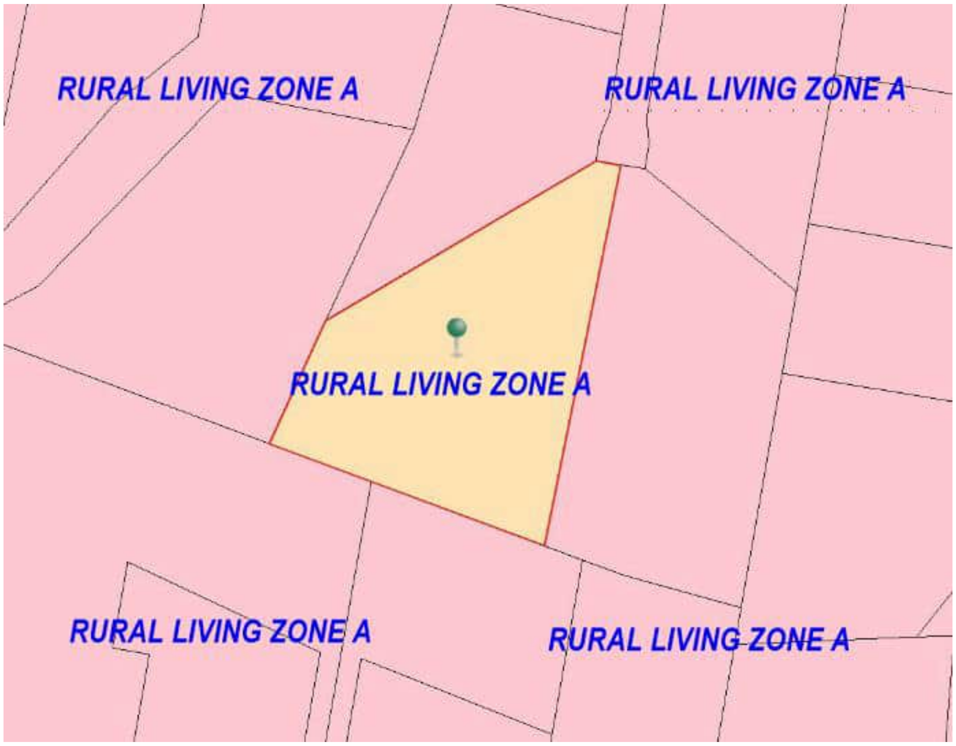

Figure 2 - Planning Scheme Zoning of site and surrounding properties. Source: The LIST, © State of Tasmania

2.2 TASVEG Live

There is 1 classified vegetation community on the subject site, and 1 additional community on the surrounding land and parcels. Figure 3 below shows the classified vegetation from TASVEG Live (Source: The LIST).

Please note that TASVEG Live classification does not necessarily reflect ground conditions.

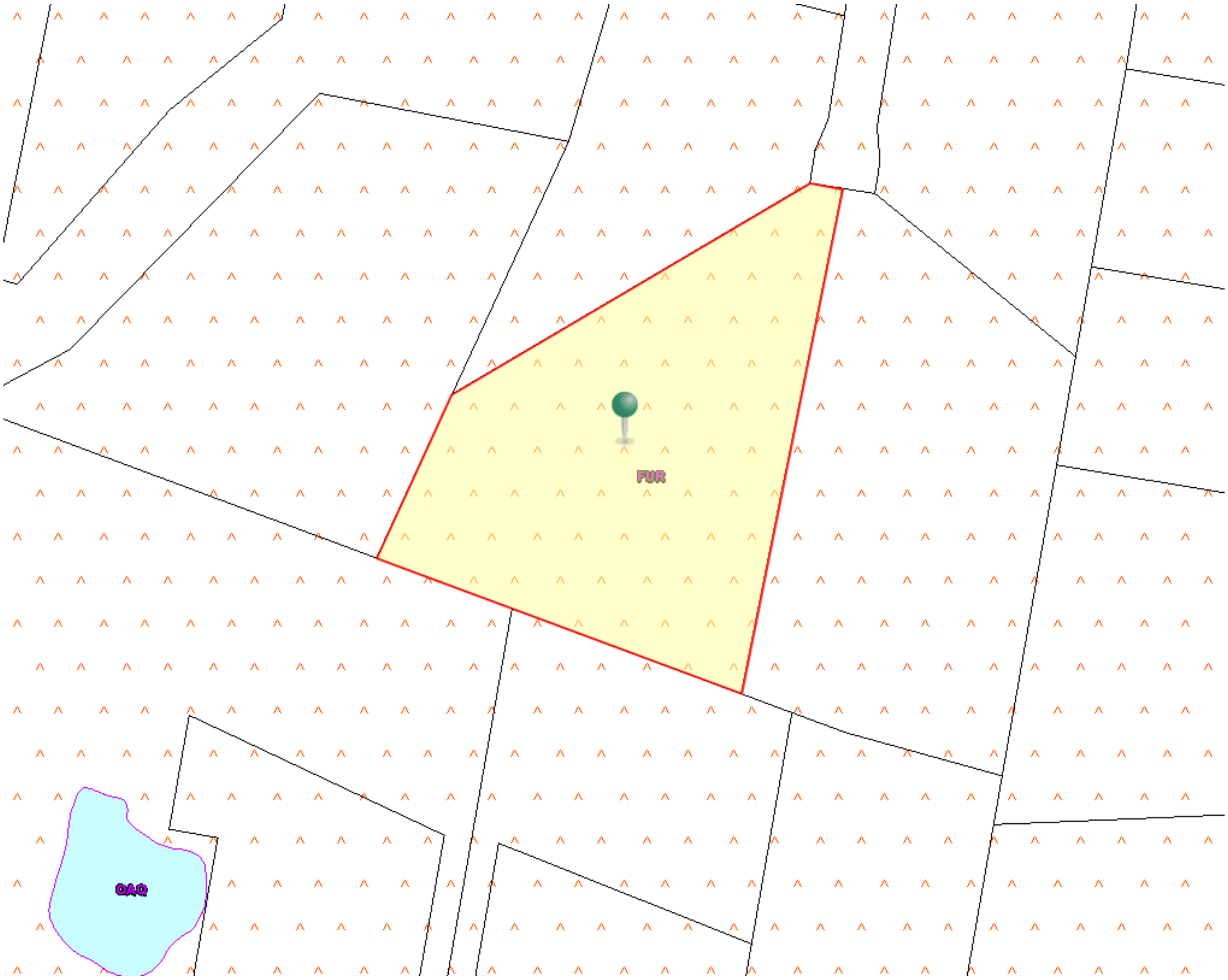

Figure 3 - TASVEG4.0 communities on subject site and surrounding land. FUR – Urban areas & OAQ – Water, sea

3 SITE ASSESSMENT

The site assessment was conducted by James Rogerson (BFP-161) on the 25th of April 2025.

3.1 Bushfire Hazard Assessment

C13.0 Bushfire Prone Areas Code defines Bushfire-prone areas as follows;

> *a) Land that is within the boundary of a bushfire-prone area shown on an overlay on a planning scheme map; or*
>
> *b) Where there is no overlay on a planning scheme map, or where the land is outside the boundary of a bushfire-prone area shown on such map, land that is within 100m of an area of bushfire –prone vegetation equal or greater than 1ha.*

The subject site is within a bushfire-prone areas overlay for the TPS, and the subject site is within 100m of an area of bushfire-prone vegetation equal or greater than 1ha. Therefore, this proposed subdivision is within a bushfire-prone area as per the TPS.

For the purposes of the BAL Assessment, vegetation within 100m of the proposed subdivision site was assessed and classified in accordance with AS3959:2018 Simplified Procedure (Method 1) (relevant fire danger index: 50-which applies across Tasmania).

BUSHFIRE THREAT DIRECTION

The Bushfire threat to this development is from the **GRASSLAND FUEL** within and surrounding the property.

Prevailing Winds: The prevailing winds for this site are primarily westerly, north westerly.

3.2 Vegetation and Effective Slope

Vegetation and relevant effective slopes within 100m of the proposed subdivision have been inspected and classified in accordance with AS 3959:2018. Effective Slope refers to the slope of the land underneath the classified bushfire-prone vegetation relative to the building site and not the slope between the vegetation and the building site. The effective slope affects a fires rate of spread and flame length and is an acute aspect of bushfire behaviour.

WITHIN THE PROPERTIES (BDY) & PROPERTIES DESCRIPTION

The property is a medium sized, developed, Rural Living Zone A zoned property, located in the southwestern part of Forcett, just north of Lewisham. The Property is located at the cul-de-sac at the termination of Cherry Court. The property is north of Quarry Road, west of Old Forcett Road and east of Lewisham Road. The property is orientated north/south and shaped oddly. The property is surrounded by medium-sized developed parcels all zoned Rual Living Zone A. The terrain within the property varies, and gains steepness the further south the property is. The property hosts an existing Class 1a dwelling, in addition to a Class 10a shed, landscaped areas, cultivated gardens, and a gravel driveway. (See Figure 4 for slopes).

The land directly surrounding the dwelling and shed is used as private open space (POS) and is therefore classed as MANAGED LAND or LOW THREAT VEGETATION per Clause 2.2.3.2 (e)(f) of AS3959:2018. To the rear of the dwelling is grassed, however the grass between the dwelling and a paddock fence is mowed regularly and is justified by viewing aerial images dating back 5 years, thus, this area of grass can be classed as LOW THREAT VEGETATION per Clause 2.2.3.2 (f) of AS3959:2018. The remainder of the property is covered with grass, appearing in an unmanaged condition due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of AS3959:2018.

NORTHEAST OF THE PROPERTIES BDY

To the northeast of the property (upslope, across slope & downslope >0°-5°) is 4 Cherry Court. This property is a medium-sized, developed, Rural Living Zone A block. The property hosts an existing Class 1a dwelling, in addition to various Class 10a sheds, landscaped areas, cultivated gardens, and a gravel driveway. The land directly surrounding the dwelling and sheds is used as private open space (POS) and is therefore classed as MANAGED LAND or LOW THREAT VEGETATION per Clause 2.2.3.2 (e)(f) of AS3959:2018. The remainder of the property is covered with grass, appearing in an unmanaged condition due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of AS3959:2018.

EAST, SOUTHEAST OF THE PROPERTIES BDY

To the east, southeast of the property (downslope >0°-5° & across slope) is 8 Cherry Court and C.T.48364/1. These properties are Medium-sized, developed and vacant Rural Living Zone A zoned lots. 8 Cherry Court hosts an existing Class 1a dwelling, in addition to various Class 10a sheds, landscaped areas, cultivated gardens, and a bitumen driveway. The land directly surrounding the dwelling and sheds is used as private open space (POS) and is therefore classed as MANAGED LAND or LOW THREAT VEGETATION per Clause 2.2.3.2 (e)(f) of AS3959:2018. The remainder of the property is covered with grass, appearing in an unmanaged condition due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of AS3959:2018.

C.T.48364/1 is a vacant lot covered with pasture grass that is appearing unmanaged, due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of AS3959:2018. Noting this property is on Quarry Road and does not have a numbered street address.

SOUTH, SOUTHWEST OF THE PROPERTIES BDY

To the south, southwest of the property (downslope >0°-5°) is 39-45 Quarry Road (4 properties). These properties are medium-sized, developed, Rural Living Zona A zoned properties, which consist of existing Class 1a dwellings, in addition to various Class 10a sheds, buildings, landscaped areas, cultivated gardens, various gravel driveways. Land directly surrounding the dwellings and sheds is used as POS and is therefore classed as MANAGED LAND or LOW THREAT VEGETATION per Clause 2.2.3.2 (f) of AS3959:2018. The remainder of these properties is covered with grass, appearing in an unmanaged condition due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of

WEST, NORTHWEST OF THE PROPERTIES BDY

To the west, northwest of the properties (across slope & downslope >0°-5°) are 3 Cherry Court and 1-3 Blackwood Drive (2 properties). These properties are medium-sized Rural Living Zone A property, which consists of existing Class 1a dwellings, in addition to various Class 10a sheds, buildings, landscaped areas, cultivated gardens, and various gravel driveways. Land directly surrounding the dwelling and sheds is used as POS and is therefore classed as MANAGED LAND or LOW THREAT VEGETATION per Clause 2.2.3.2 (f) of AS3959:2018. The remainder of these properties is covered with grass, appearing in an unmanaged condition due to minimal land use and is therefore classed as GROUP G GRASSLAND per Table 2.3 of

Figure 4 below shows the relationship between the subject site and the surrounding vegetation.

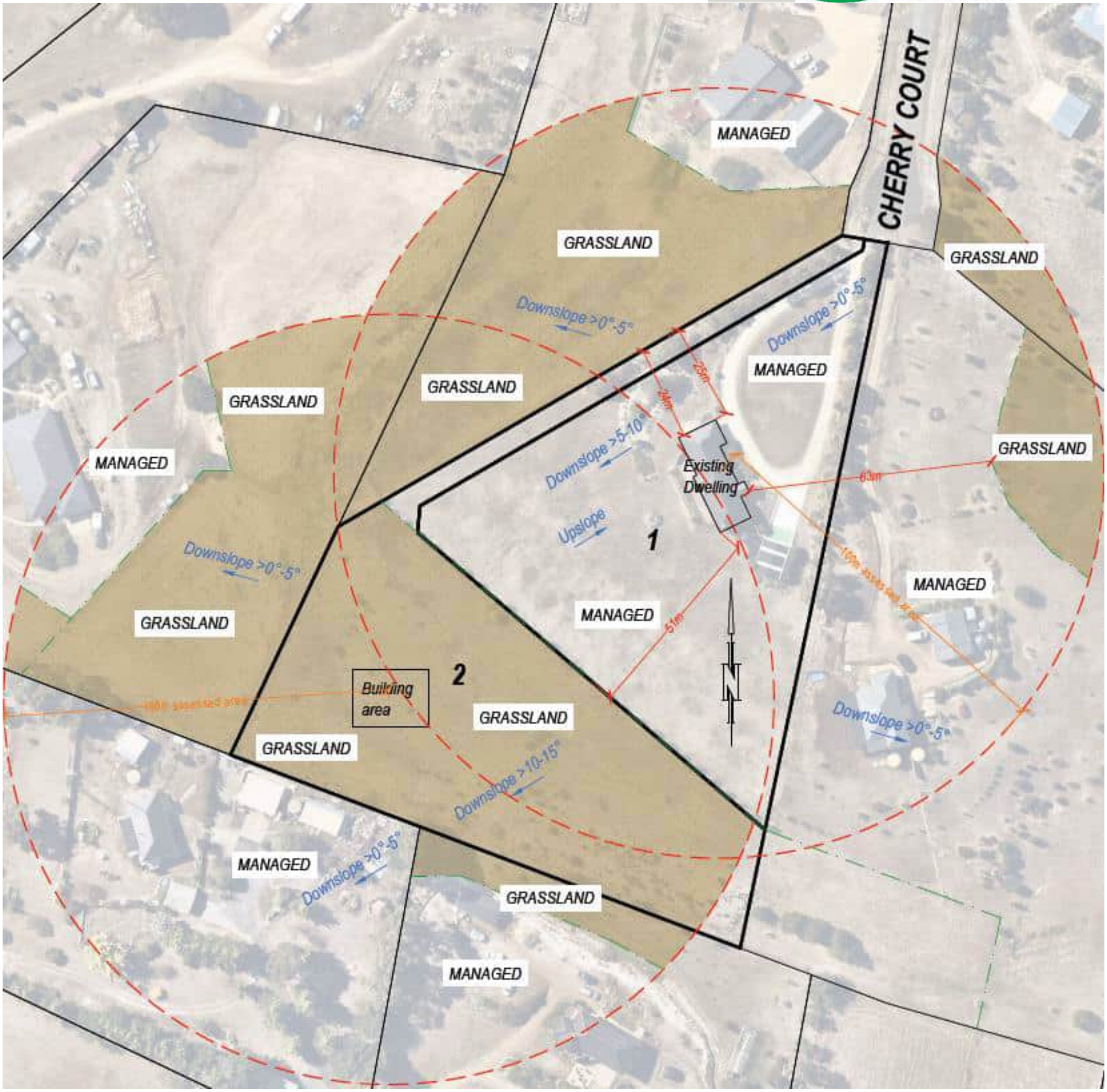

Figure 4 classified vegetation (within 100m of site) and existing separation from bushfire-prone vegetation (not to scale)

3.3 Bushfire Attack Level (BAL)

Table 2 - BAL rating for each lot and required separation distances

LOT 1 – EX. DWELLING (Existing Separation)				
DIRECTION OF SLOPE	**NE**	**SE**	**SW**	**NW**
Vegetation Classification	MANAGED GRASSLAND	MANAGED	MANAGED GRASSLAND	MANAGED GRASSLAND
Existing Horizontal distance to classified vegetation	63m-100m (G)	N/A	51m-100m (G)	24m-100m (G)
Effective Slope under vegetation	Downslope >0°5°	Downslope >0°-5°	Downslope >5°-10° Downslope >10°-15°	Downslope >0°-5°
Exemption	>50m to (G)		>50m to (G)	
Current BAL value for each side of the site	BAL-LOW	BAL-LOW	BAL-LOW	BAL-12.5
Separation distances to achieve BAL-19	N/A	N/A	N/A	11m
Separation distances to achieve BAL-12.5	N/A	N/A	N/A	16m
Current BAL rating	**BAL-12.5**			

LOT 2 – BUILDING AREA (Building Area Separation)				
DIRECTION OF SLOPE	**N**	**E**	**S**	**W**
Vegetation Classification	GRASSLAND MANAGED (partly)	GRASSLAND MANAGED	GRASSLAND	GRASSLAND MANAGED
Existing Horizontal distance to classified vegetation	0m-100m (G)	0m-46m (G)	0m-23m (G)	0m-68m (G)
Effective Slope under vegetation	Upslope	Across slope Upslope	Downslope >10°-15°	Downslope >0°-5°
Exemption				
Current BAL value for each side of the site	BAL-FZ	BAL-FZ	BAL-FZ	BAL-FZ
Separation distances to achieve BAL-19	10m	10m	15m	11m
Separation distances to achieve BAL-12.5	14m	14m	22m	16m
Current BAL rating	**BAL-FZ**			

3.4 Definition of BAL-LOW

Bushfire Attack Level shall be classified BAL-LOW per Section 2.2.3.2 of AS3959:2018 where the vegetation is one or a combination of any of the following Exemptions:

a) Vegetation of any type that is more than 100m from the site.
b) Single areas of vegetation less than 1 hectare in area and not within 100m of other areas of vegetation being classified.
c) Multiple areas of vegetation less than 0.25 ha in area and not within 20m of the site, or each other.
d) Strips of vegetation less than 20m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified.
e) Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.
f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.

NOTE: Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100mm).

The BAL level will also be classified as BAL-LOW if Grassland fuel is >50m from the site for any effective slope per Table 2.6 of AS3959:2018.

Where there were multiple fuel classifications and effective slopes, the predominant fuel and slope have been used in the BAL table above.

BAL ratings are as stated below:

BAL LOW	BAL 12.5	BAL 19	BAL 29	BAL 40	BAL FZ
There is insufficient risk to warrant any specific construction requirements, but there is still some risk	Ember attack and radiant heat below 12.5 kW/m²	Increasing ember attack and windborne debris, radiant heat between 12.5 kW/m² and 19 kW/m2	Increasing ember attack and windborne debris, radiant heat between 19kW/m² and 29 kW/m2	Increasing ember attack and windborne debris, radiant heat between 29 kW/m² and 40 kW/m². Exposure to flames from fire front likely	Direct Exposure to flames, radiant heat and embers from the fire front

4 BUSHFIRE PROTECTION MEASURES

4.1 Hazard Management Areas (HMA)

Hazard Management Area as described in the Code "*maintained in a minimal fuel condition and in which there are no other hazards present which will significantly contribute to the spread of a bushfire*". Also as described from Note 1 of AS3959:2018 Clause 2.2.3.2 "*Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm)*".

Compliance to C13.6.1

The building areas within both lots require a Hazard Management Area (HMA) to be established and maintained between the bushfire vegetation and the area at a distance equal to, or greater than specified for the Bushfire Attack Level in Table 2.6 of AS3959:2018.

The existing dwelling in Lot 1 and the building area for Lot 2 are to be maintained as an HMA. The HMA for Lot 1 is to be implemented prior to sealing of titles and prior to occupancy of a future habitable dwelling for lot 2.

Requisite fuel management is required for Lot 2.

Due to existing developed land, some BAL-19 and BAL-12.5 setbacks are already achieved for Lot 1.

Minimum separation distances for each lot are stated below.

LOT 1 – BAL-19 BUILDING AREA; Existing Dwelling (Required Separation)				
Aspect	**NE**	**SE**	**SW**	**NW**
BAL-19	11m (achieved)	11m (achieved)	15m (achieved)	11m (achieved)

LOT 2 – BAL-19 BUILDING AREA; Building Area (Required Separation)				
Aspect	**N**	**E**	**S**	**W**
BAL-19	10m	10m	15m	11m

The Tasmanian Fire Service provides the following advice regarding the implementation and maintenance of Hazard management areas:

- Removing of fallen limbs, sticks, leaf and bark litter
- Maintaining grass at less than a 100mm height
- Removing pine bark and other flammable mulch (especially from against buildings)
- Thinning out understory vegetation to provide horizontal separation between fuels
- Pruning low-hanging tree branches (<2m from the ground) to provide vertical separation between fuel layers
- Pruning larger trees to maintain horizontal separation between canopies
- Minimize the storage of flammable materials such as firewood
- Maintaining vegetation clearance around vehicular access and water supply points
- Use of low-flammability species for landscaping purposes where appropriate
- Clearing out any accumulated leaf and other debris from roof gutters.

Additional site-specific fuel reduction or management may be required. An effective hazard management area does not require removal of all vegetation. Rather, vegetation must be designed and maintained in a way that limits opportunity for vertical and horizontal fire spread in the vicinity of the building being protected. Retaining some established trees can even be beneficial in terms of protecting the building from wind and ember attack

4.2 Public and Fire Fighting Access

Public Access

The proposed development fronts Cherry Court. Cherry Court is bitumen sealed and is maintained by Sorell Council. Cherry Road has a nominal carriageway width of 6m.

No upgrades are required to the public road and the public road comply with public access road requirements.

Property Access

Current Conditions:

Lot 1

Currently, Lot 2 is accessed via an existing gravel driveway, which runs perpendicularly off Cherry Court, then flows south before looping back around to Cherry Court to form a closed loop. A Parking/turning area of concrete exists perpendicular off the access adjacent to the shed (which is sufficient area for a turning head).

The existing nominal carriage width of the access to Lot 1 is 4m for an approximate total carriageway length of 150m (for the entire loop).

Lot 2

There is currently no access to Lot 2.

Figure 5 – Existing access loop for Lot 1

Figure 5.1 – Existing parking/turning area for Lot 1

Compliance to C13.6.2

Lot 1

Access to the existing dwelling within Lot 1 is >30m but <200m and access is required for a fire appliance. However, the access is already nominally 4m wide and has a sufficient turning head accessible off the access and therefore the access will comply with Acceptable Solution A1 and Table 13.2 (B) of C13.6.2 demonstrated below in Table 3.

Lot 2

Access to the building area within Lot 2 will be >30m, but <200m and access is required for a fire appliance. Therefore, the access must comply with Acceptable Solution A1 and Table 13.2 (B) of C13.6.2 demonstrated below in Table 3.

Table 3 - Requirements for access length greater than 30m and less than 200m per Table C13.2 (B)

Access Standards: (access length >30m, <200m)

a) All-weather construction;
b) Load capacity of at least 20 t, including bridges and culverts;
c) Minimum carriageway width of 4m;
d) Minimum vertical clearance of 4m;
e) Minimum horizontal clearance of 0.5m from the edge of the carriageway;
f) Cross falls less than 3 degrees (1:20 or 5%)
g) Dips less than 7 degrees (1:8 or 12.5%);
h) Curves with a minimum inner radius of 10m;
i) Maximum gradient of 15 degrees (1:3.5 or 28%) for sealed roads, and 10 degrees (1:5.5 or 18%) for unsealed road; and
j) Terminate with a turning area for fire appliances provided by one of the following
    i. A turning circle with a minimum outer radius of 10m; or
    ii. A property access encircling the building; or
    iii. A hammerhead 'T' or 'y' turning head 4m wide and 8m long.

4.3 Water Supply for Fire Fighting

Current Conditions:

Site assessment confirmed the property is not serviced by reticulated water. Therefore, static water supply tanks are required for this development as per below.

Compliance to C13.6.3

Both lots

Both lots **must** be provided with a firefighting water supply that meets the requirements for Acceptable Solution A2 of section C13.6.3 and Table C13.5.

Firefighting water supply requirements for lot 1 must be adhered to prior to sealing of titles and prior to occupancy of a future habitable dwelling for Lot 2.

Static water supply requirements are outlined in Table 4 below which is per C13.6.3 and Table C13.5.

Table 4 – Requirements for Static Water Supply per C13.6.3 and Table C13.5

A. Distance between building area to be protected and water supply
  - a) the building area to be protected must be located within 90m of the fire fighting water point of a static water supply; and
  - b) the distance must be measured as a hose lay, between the fire fighting water point and the furthest part of the building area

B. Static Water supplies
  - a) may have a remotely located offtake connected to the static water supply;
  - b) may be a supply for combined use (fire fighting and other uses) but the specified minimum quantity of fire fighting water must be available at all times;
  - c) must be a minimum of 10,000L per building area to be protected. This volume of water must not be used for any other purpose including fire fighting sprinkler or spray systems;
  - d) must be metal, concrete or lagged by non-combustible materials if above ground; and
  - e) if a tank can be located so it is shielded in all directions in compliance with section 3.5 of Australian Standard AS 3959-2009 Construction of buildings in bushfire-prone areas, the tank may be constructed of any material provided that the lowest 400mm of the tank exterior is protected by:
    - (i) metal;
    - (ii) non-combustible material; or
    - (iii) fibre-cement a minimum of 6mm thickness.

C. Fittings, pipework and accessories (including stands and tank supports)

Fittings and pipework associated with a fire fighting water point for a static water supply must:

- (a) have a minimum nominal internal diameter of 50mm;
- (b) be fitted with a valve with a minimum nominal internal diameter of 50mm;
- (c) be metal or lagged by non-combustible materials if above ground;
- (d) if buried, have a minimum depth of 300mm [S1];
- (e) provide a DIN or NEN standard forged Storz 65mm coupling fitted with a suction washer for connection to fire fighting equipment;
- (f) ensure the coupling is accessible and available for connection at all times;
- (g) ensure the coupling is fitted with a blank cap and securing chain (minimum 220mm length);
- (h) ensure underground tanks have either an opening at the top of not less than 250mm diameter or a coupling compliant with this Table; and
- (i) if a remote offtake is installed, ensure the offtake is in a position that is:
  - (i) visible;
  - (ii) accessible to allow connection by fire fighting equipment;
  - (iii) at a working height of 450 – 600mm above ground level; and
  - (iv) protected from possible damage, including damage by vehicles.

D. Signage for static water connections

The fire fighting water point for a static water supply must be identified by a sign permanently fixed to the exterior of the assembly in a visible location. The sign must:
  - a) comply with water tank signage requirements within Australian Standard AS 2304-2011 Water storage tanks for fire protection systems; or

b) comply with the Tasmania Fire Service Water Supply Guideline published by the Tasmania Fire Service.

E. Hardstand

A hardstand area for fire appliances must be:

a) no more than 3m from the fire fighting water point, measured as a hose lay (including the minimum water level in dams, swimming pools and the like);
b) no closer than 6m from the building area to be protected;
c) a minimum width of 3m constructed to the same standard as the carriageway; and
d) connected to the property access by a carriageway equivalent to the standard of the property access.

4.4 Construction Standards

Future (or existing) habitable dwellings within the specified building areas on each lot must be designed and constructed to the minimum BAL ratings specified in the BHMP (Appendix C) and to BAL construction standards in accordance with AS3959:2018 or subsequent edition as applicable at the time of building approval.

The BAL-19 and BAL-12.5 building setback lines on the BHMP define the minimum setbacks for habitable buildings.

Future Class 10a buildings within 6m of a Class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.

5 STATUTORY COMPLIANCE

The applicable bushfire requirements are specified in State Planning Provisions C13.0 – Bushfire-Prone Areas Code.

Clause	Compliance
C13.4 Use or development exempt from this code	N/A
C13.5 Use Standards	
C13.5.1 Vulnerable Uses	N/A
C13.5.2 Hazardous Uses	N/A
C13.6 Development Standards for Subdivision	
C13.6.1 Provision of Hazard Management Areas.	To comply with the Acceptable Solution A1, the proposed plan of subdivision must; • Show building areas for each lot; and • Show hazard management areas between these building areas and that of the bushfire vegetation with the separation distances required for BAL 19 in Table 2.6 of *Australian Standard AS 3959:2018 Construction of buildings in bushfire-prone areas.* The BHMP demonstrates that lot 1 can accommodate a BAL rating of BAL-12.5 and BAL-19 for Lot 2 with on-site vegetation managing and clearing for Lot 2. The HMA for Lot 1 is to be implemented prior to sealing of titles and prior to occupancy of a future habitable dwelling for Lot 2. Subject to the compliance with the BHMP the proposal will satisfy the Acceptable Solution C13.6.1(A1)
C13.6.2 Public and firefighting access; A1	The BHMP (through reference to section 4 of this report) specifies requirements for private accesses are consistent with Table C13.2. Lot 1's existing access is compliant with Table C13.2 (B). Lot 2 must comply with Table C13.2 (B). The access for Lot 2 must be constructed prior to occupancy of a future habitable dwelling. Subject to the compliance with the BHMP the proposal satisfies the Acceptable Solution C13.6.2(A1).
C13.6.3 A2 Provision of water supply for firefighting purposes.	Static water supply is required for both lots per C13.6.3 A2. Firefighting water supply requirements for Lot 1 must be installed prior to sealing of titles and prior to occupancy of a future habitable dwelling for Lot 2. Subject to the compliance with the BHMP the proposal satisfies the Acceptable Solution C13.6.3

6 CONCLUSION & RECOMMENDATIONS

The proposed subdivision is endorsed that each lot can meet the requirements of Tasmanian Planning Scheme – Sorell and C13.0 Bushfire-prone Areas Code for a maximum BAL rating of BAL-12.5 for Lot 1 and BAL-19 for Lot 2. Providing compliance with measures outlined in the BHMP (Appendix C) and sections 4 & 5 of this report.

Recommendations:

- The HMA's within the subdivision be applied in accordance with section 4.1 of this report and the BHMP (Appendix C).
- Bushfire protection measures for all lots outlined in Sections 4.1, 4.2 and 4.3 to be implemented prior to sealing of titles for Lot 1 and prior to occupancy of a future habitable dwelling Lot 2.
- Sorell Council condition the planning approval on the compliance with the BHMP (as per Appendix C).

7 REFERENCES

Department of Primary Industries and Water, The LIST, viewed April/May 2025, www.thelist.tas.gov.au

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Building Act 2016. The State of Tasmania Department of Premier and Cabinet. https://www.legislation.tas.gov.au/view/html/inforce/current/act-2016-025

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8 APPENDIX A – SITE PHOTOS

Figure 6 – Grassland fuel in Lot 2, managed land in the backround, view facing SW

Figure 7 – Grassland fuel within Lot 2, view facing E, SE

Figure 8 – Grassland fuel to the west of the property, view facing W, NW

Figure 9 – Grassland fuel east of the property, view facing E

Figure 10 – Existing managed land and dwelling in Lot 1, view facing S

Figure 11 – Existing dwelling and managed land to the east of the property, view facing E, NE

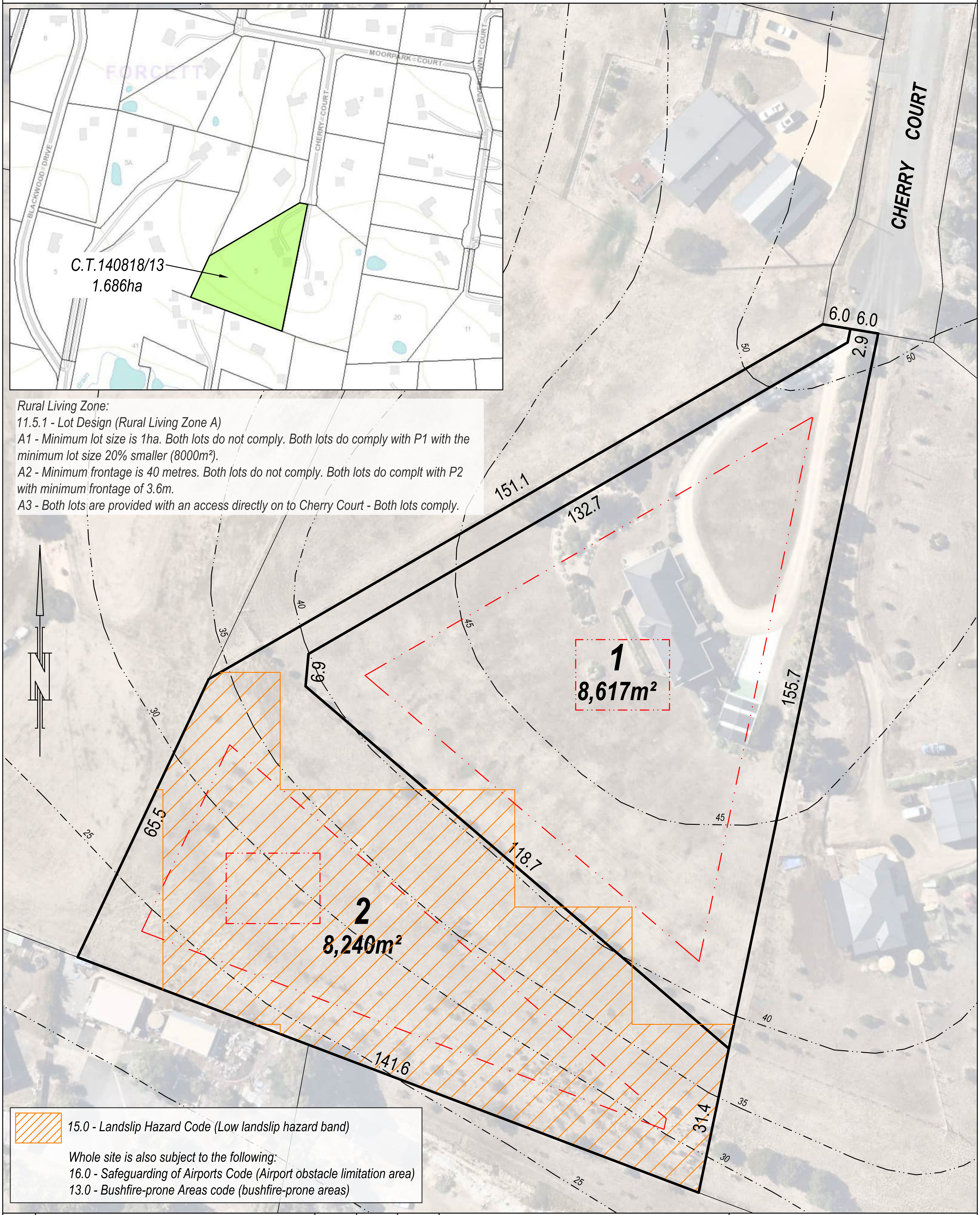
9 APPENDIX B – SUBDIVISION PROPOSAL PLAN

ROGERSON & BIRCH SURVEYORS
UNIT 1, 2 KENNEDY DRIVE
CAMBRIDGE 7170
PHONE: (03)6248 5898
EMAIL: admin@rbsurveyors.com
WEB: www.rbsurveyors.com

This plan has been prepared only for the purpose of obtaining preliminary subdivsional approval from the local authority and is subject to that approval.

All measurements and areas are subject to the final survey.

Base image by NEARMAP (https://www.nearmap.com/au), © Nearmap 2024
Base data from the LIST (www.thelist.tas.gov.au), © State of Tasmania



Rural Living Zone:
11.5.1 - Lot Design (Rural Living Zone A)
A1 - Minimum lot size is 1ha. Both lots do not comply. Both lots do comply with P1 with the minimum lot size 20% smaller (8000m²).
A2 - Minimum frontage is 40 metres. Both lots do not comply. Both lots do complt with P2 with minimum frontage of 3.6m.
A3 - Both lots are provided with an access directly on to Cherry Court - Both lots comply.

▨ *15.0 - Landslip Hazard Code (Low landslip hazard band)*

Whole site is also subject to the following:
16.0 - Safeguarding of Airports Code (Airport obstacle limitation area)
13.0 - Bushfire-prone Areas code (bushfire-prone areas)

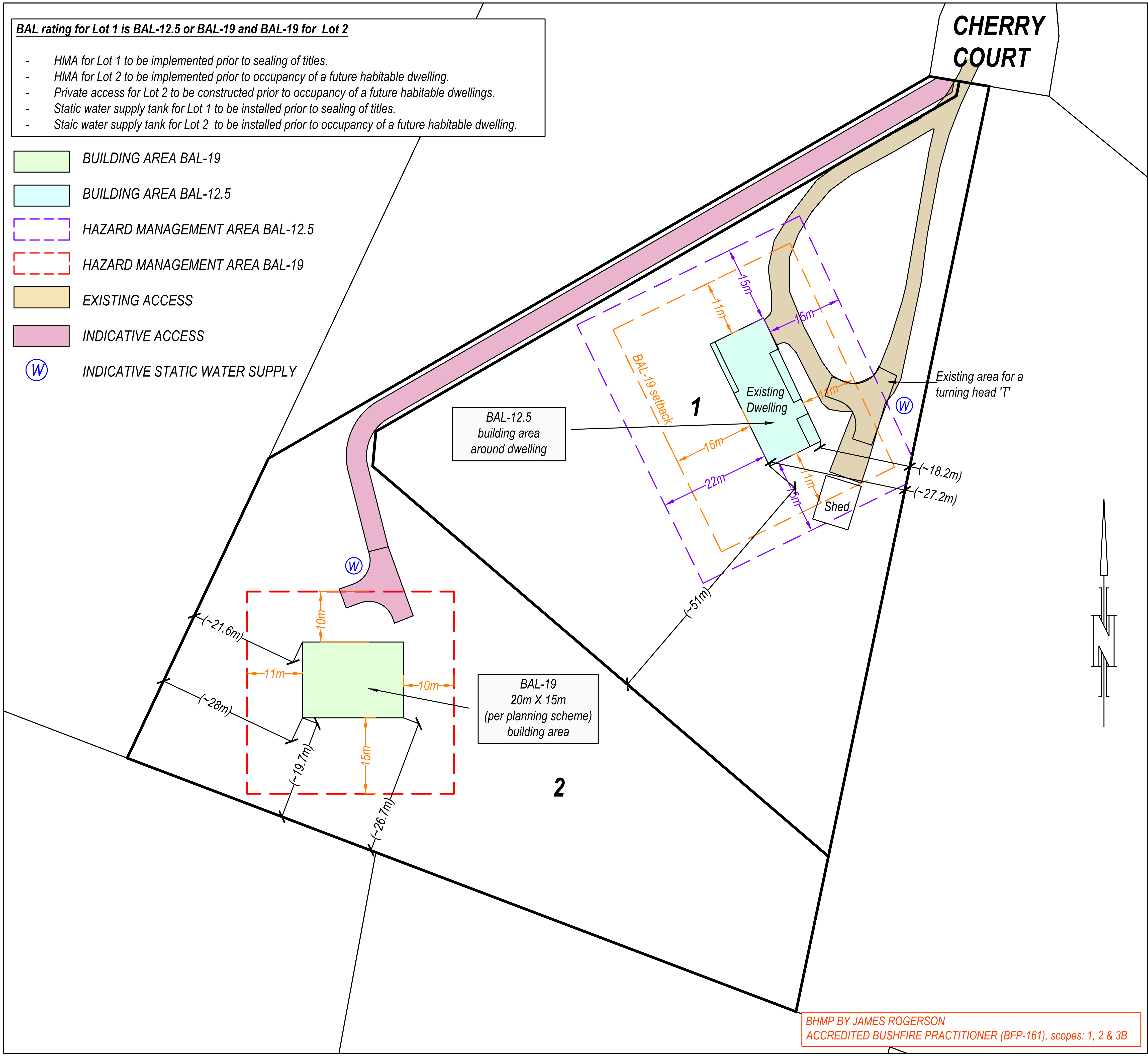
REV	AMENDMENTS	DRAWN	DATE	APPR.
E				
D				
C				
B				
A				

OWNER: P.J & J.A SARGENT
TITLE REFERENCE: C.T.140818/13
LOCATION: No.5 CHERRY COURT
FORCETT

Proposed Subdivision

Date: 3-3-2025	**Reference:** SARGP01 15979-00
Scale: 1:750 (A3)	**Municipality:** SORELL

10 APPENDIX C – BUSHFIRE HAZARD MANAGEMENT PLAN



BAL rating for Lot 1 is BAL-12.5 or BAL-19 and BAL-19 for Lot 2

- *HMA for Lot 1 to be implemented prior to sealing of titles.*
- *HMA for Lot 2 to be implemented prior to occupancy of a future habitable dwelling.*
- *Private access for Lot 2 to be constructed prior to occupancy of a future habitable dwellings.*
- *Static water supply tank for Lot 1 to be installed prior to sealing of titles.*
- *Staic water supply tank for Lot 2 to be installed prior to occupancy of a future habitable dwelling.*

🟩	*BUILDING AREA BAL-19*
🟦	*BUILDING AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-19*
🟨	*EXISTING ACCESS*
🟪	*INDICATIVE ACCESS*
Ⓦ	*INDICATIVE STATIC WATER SUPPLY*

BHMP BY JAMES ROGERSON
ACCREDITED BUSHFIRE PRACTITIONER (BFP-161), scopes: 1, 2 & 3B

ROGERSON & BIRCH SURVEYORS
UNIT 1, 2 KENNEDY DRIVE
CAMBRIDGE 7170
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BUSHFIRE HAZARD MANAGEMENT PLAN

LOCATION:	5 Cherry Court, Forcett TAS 7173
TITLE REFERENCE:	C.T.140818/13
PROPERTY ID:	2281192
MUNICIPALITY:	Sorell
DATE:	2nd of May 2025 (v1.0)
SCALE: 1:750 @ A3	REFERENCE: SARGP01

REQUIREMENTS

1. HAZARD MANAGEMENT AREAS (HMA)
   - 1.1. HMA to be established to distances indicated on this plan and as set out in Section 4.1 of the Bushfire Hazard Report.
   - 1.2. Vegetation in the HMA needs to be strategically modified and then maintained in a low fuel state to protect future dwellings from direct flame contact and intense radiant heat. An annual inspection and maintenance of the HMA should be conducted prior to the bushfire season. All grasses or pastures must be kept short (<100 mm) within the HMA. Fine fuel loads at ground level such as leaves, litter and wood piles must be minimal to reduce the quantity of wind borne sparks and embers reaching buildings; and to halt or check direct flame attack.
   - 1.3. Some trees can be retained provided there is horizontal separation between the canopies; and low branches are removed to create vertical separation between the ground and the canopy. Small clumps of established trees and/or shrubs may act to trap embers and reduce wind speeds.
   - 1.4. No trees to overhang houses to prevent branches or leaves from falling on the building.
   - 1.5. Non-combustible elements including driveways, paths and short cropped lawns are recommended within the HMA.
   - 1.6. Fine fuels (leaves bark, twigs) should be removed from the ground periodically (pre-fire season) and all grasses or pastures must be kept short (<100 mm).
2. CONSTRUCTION STANDARDS
   - 2.1. Future dwellings within the specified building areas to be designed and constructed to BAL ratings shown on this plan in accordance with AS3959:2018 at the time of building approval
   - 2.2. Future outbuildings within 6m of a class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.
3. PUBLIC AND FIRE-FIGHTING ACCESS REQUIREMENTS
   - 3.1. Access to all lots must comply with the design and construction requirements specified in Section 4.2 of the Bush Fire Report.
4. STATIC FIRE-FIGHTING WATER SUPPLY
   - 4.1 New habitable dwellings and existing dwellings must be supplied with a static water supply that is;
     - Dedicated solely for fire fighting purposes;
     - Minimum capacity of 10,000L;
     - is accessible by fire fighting vehicles and within 3.0m of a hardstand area; and
     - Consistent with the specifications outlined in section 4.3 of the Bushfire Report.

This plan is to be read in conjunction with the preceding *Bushfire Assessment Report "Proposed Subdivision (2 lots) 5 Cherry Court, Forcett" dated 28/04/2025.*

J.R. BUSHFIRE ASSESSMENTS
JAMES ROGERSON
BFP-161
PHONE: 0488 372 283
EMAIL:
jr.bushfireassessments@gmail.com

11 APPENDIX D – PLANNING CERTIFICATE

BUSHFIRE-PRONE AREAS CODE

CERTIFICATE[1] UNDER S51(2)(d) *LAND USE PLANNING AND APPROVALS ACT 1993*

1. Land to which certificate applies

The subject site includes property that is proposed for use and development and includes all properties upon which works are proposed for bushfire protection purposes.

Street address: **5 Cherry Court, Forcett TAS 7173**

Certificate of Title / PID: **C.T.140818/13 / 2281192**

2. Proposed Use or Development

Description of proposed Use and Development: **Subdivision (2 lots) of C.T.140818/13**

Applicable Planning Scheme: **Tasmanian Planning Scheme - Sorell**

3. Documents relied upon

This certificate relates to the following documents:

Title	**Author**	**Date**	**Version**
SUBDIVISION PROPOSAL PLAN	ROGERSON & BIRCH SURVEYORS	03/03/2025	00
BUSHFIRE ASSESSMENT REPORT – 5 CHERRY COURT, FORCETT	JAMES ROGERSON – JR BUSHFIRE ASSESSMENTS	28/04/2025	1.0
BUSHFIRE HAZARD MANGAEMENT PLAN– 5 CHERRY COURT, FORCETT	JAMES ROGERSON – JR BUSHFIRE ASSESSMENTS	02/05/2025	1.0

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[1] This document is the approved form of certification for this purpose and must not be altered from its original form.

4. Nature of Certificate

The following requirements are applicable to the proposed use and development:

☐	**E1.4 / C13.4 – Use or development exempt from this Code**	
	Compliance test	**Compliance Requirement**
☐	E1.4(a) / C13.4.1(a)	

☐	**E1.5.1 / C13.5.1 – Vulnerable Uses**	
	Acceptable Solution	**Compliance Requirement**
☐	E1.5.1 P1 / C13.5.1 P1	***Planning authority discretion required. A proposal cannot be certified as compliant with P1.***
☐	E1.5.1 A2 / C13.5.1 A2	
☐	E1.5.1 A3 / C13.5.1 A2	

☐	**E1.5.2 / C13.5.2 – Hazardous Uses**	
	Acceptable Solution	**Compliance Requirement**
☐	E1.5.2 P1 / C13.5.2 P1	***Planning authority discretion required. A proposal cannot be certified as compliant with P1.***
☐	E1.5.2 A2 / C13.5.2 A2	
☐	E1.5.2 A3 / C13.5.2 A3	

☐	**E1.6.1 / C13.6.1 Subdivision: Provision of hazard management areas**	
	Acceptable Solution	**Compliance Requirement**
☐	E1.6.1 P1 / C13.6.1 P1	***Planning authority discretion required. A proposal cannot be certified as compliant with P1.***
☐	E1.6.1 A1 (a) / C13.6.1 A1(a)	
☒	E1.6.1 A1 (b) / C13.6.1 A1(b)	Provides BAL-19 for all lots (including any lot designated as ‘balance’)
☐	E1.6.1 A1(c) / C13.6.1 A1(c)	

☐	**E1.6.2 / C13.6.2 Subdivision: Public and fire fighting access**	
	Acceptable Solution	**Compliance Requirement**
☐	E1.6.2 P1 / C13.6.2 P1	
☐	E1.6.2 A1 (a) / C13.6.2 A1 (a)	
☒	E1.6.2 A1 (b) / C13.6.2 A1 (b)	Access complies with relevant Tables

☐	**E1.6.3 / C13.1.6.3 Subdivision: Provision of water supply for fire fighting purposes**	
	Acceptable Solution	**Compliance Requirement**
☐	E1.6.3 A1 (a) / C13.6.3 A1 (a)	
☐	E1.6.3 A1 (b) / C13.6.3 A1 (b)	
☐	E1.6.3 A1 (c) / C13.6.3 A1 (c)	
☐	E1.6.3 A2 (a) / C13.6.3 A2 (a)	
☒	E1.6.3 A2 (b) / C13.6.3 A2 (b)	Static water complies with the relevant Table.
☐	E1.6.3 A2 (c) / C13.6.3 A2 (c)	

5. Bushfire Hazard Practitioner

Name: JAMES ROGERSON

Phone No: 0488 37 2283

Postal Address: UNIT 1-2 KENNEDY DRIVE,
CAMBRIDGE PARK

Email Address: JR.BUSHFIREASSESSMENTS@GMAIL.COM

Accreditation No: BFP – 161

Scope: 1, 2, 3B

6. Certification

I certify that in accordance with the authority given under Part 4A of the *Fire Service Act 1979* that the proposed use and development:

☐ Is exempt from the requirement Bushfire-Prone Areas Code because, having regard to the objective of all applicable standards in the Code, there is considered to be an insufficient increase in risk to the use or development from bushfire to warrant any specific bushfire protection measures, or

☒ The Bushfire Hazard Management Plan/s identified in Section 3 of this certificate is/are in accordance with the Chief Officer's requirements and compliant with the relevant **Acceptable Solutions** identified in Section 4 of this Certificate for lot 3.

Signed: *certifier* Rogerson

Name: JAMES ROGERSON

Date: 2/5/2025

Certificate Number: 161

(for Practitioner Use only)

GEOTECHNICAL SITE INVESTIGATION

5 CHERRY COURT - FORCETT

PROPOSED SUBDIVISION

Client: Phillip J. & Jane A. Sargent

Certificate of Title: 140818/13

Investigation Date: 27/05/2025

Sorell Council

Development Application: 7.2025.10.1 - Subdivision Application 5 Cherry Court, Forcett - P1.pdf
Plans Reference:P1
Date Received:26/06/2025

Refer to this Report As

Enviro-Tech Consultants Pty. Ltd. 2025. Geotechnical Site Investigation Report for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 27/05/2025.

Report Distribution

This report has been prepared by Enviro-Tech Consultants Pty. Ltd. (Envirotech) for the use by parties involved in the proposed development of the property named above.

Permission is hereby given by Envirotech and the client, for this report to be copied and distributed to interested parties, but only if it is reproduced in colour, and only distributed in full. No responsibility is otherwise taken for the contents.

Limitations of this report

In some cases, variations in actual Site conditions may exist between subsurface investigation boreholes. This report only applies to the tested parts of the Site at the Site of testing, and if not specifically stated otherwise, results should not be interpreted beyond the tested areas.

The Site investigation is based on the observed and tested soil conditions relevant to the inspection date and provided design plans (building footprints presented in Attachment A). Any site works which has been conducted which is not in line with the Site plans will not be assessed. Subsurface conditions may change laterally and vertically between test Sites, so discrepancies may occur between what is described in the reports and what is exposed by subsequent excavations. No responsibility is therefore accepted for any difference in what is reported, and actual Site and soil conditions for parts of the investigation Site which were not assessed at the time of inspection.

This report has been prepared based on provided plans detailed herein. Should there be any significant changes to these plans, then this report should not be used without further consultation which may include drilling new investigation holes to cover the revised building footprint. This report should not be applied to any project other than indicated herein.

No responsibility is accepted for subsequent works carried out which deviate from the Site plans provided or activities onsite or through climate variability including but not limited to placement of fill, uncontrolled earthworks, altered drainage conditions or changes in groundwater levels.

At the time of construction, if conditions exist which differ from those described in this report, it is recommended that the base of all footing excavations be inspected to ensure that the founding medium meets that requirement referenced herein or stipulated by an engineer before any footings are poured.

Investigation Summary

Site Classification

In accordance with AS2870 – 2011 and after thorough consideration of the known details pertaining to the proposed subdivision and associated works (hereafter referred to as the Site), the geology, soil conditions, soil properties, and drainage characteristics of the Site have been classified as follows:

CLASS P based on the following problematic ground conditions identified at the site:

- Class 1 dispersive soils are present at the Site with CLASS P foundation conditions requiring specialised management measures to mitigate erosion hazards
- Highly variable depth to bedrock and highly variable soil reactivity with possible historic sandstone terrain clay infill features including deep clay filled fractures and possible buried cliff forms.

Notwithstanding the problematic soil conditions observed at the Site, the soil in lot 2 is classified as Class H1, and may be increased to H2 if filling works is proposed within building areas.

Future Building Pad Considerations

Concentrated loads including but not limited to slab edge or internal beam or strip footings shall be supported directly on piers or pads with the following to be expected at the building pad finished ground level:

- Extremely weathered sandstone bedrock with an allowable bearing capacity of 400 kPa
- Deep clay zones/pockets with footings to be deepened to 2.1m.

Site Investigation

The Site investigation is summarised in Table 1.

Table 1 Summary of Site Investigation

Client	**Phillip J. & Jane A. Sargent**
Project Address	5 Cherry Court - Forcett
Council	Sorell
Planning Scheme	Tasmanian Planning Scheme
Inundation, Erosion or Landslip Overlays	Sorell local provisions schedule - SOR-S1.7.1 – dispersive soils. Low landslip hazard band
Proposed	Subdivision
Investigation	Fieldwork was carried out by an Engineering Geologist on the 27/5/2025
Site Topography	The building site has a strong slope of approximately 27% (15°) to the southwest
Site Drainage	The site receives overland flow runoff directly from the northeast.
Soil Profiling	Two investigation holes were direct push sampled from surface level around the proposed subdivision (Appendix A):
Investigation Depths	The target excavation depth was estimated at 2.3 m. Borehole BH01 was direct push sampled to 2.3 m and borehole BH02 was direct push sampled to 0.8 m (ending in SANDSTONE). Borehole logs and photos are presented in Appendix B & C.
Soil moisture and groundwater	Recovered soil at the site was moist at the time of the investigation. Groundwater was not encountered.
Geology	According to 1:250,000 Mineral Resources Tasmania geological mapping (accessed through The LIST), the geology comprises of: Permian - Triassic Dominantly quartz sandstone.

Planning and Building Regulations (TPS)

Landslip Overlay Overview

The proposed building and works fall within the LIST Landslip Hazard Overlay (low hazard band) as presented in Appendix 1. Landslide hazard reporting requirements are presented in Table 2.

Table 2 Landslip Hazard Reporting Requirements Framework

Council	Sorell
Planning Scheme	Tasmanian Planning Scheme
Planning Scheme Code	C15.0 Landslip Hazard Code
Landslip Hazard Band	Low
Landslip Planning Map Component	Remaining areas slopes 11-20 degrees
Proposed Development Is Exempt From Planning	Yes
Significant Works	Yes
Critical Use, Vulnerable Use or Hazardous Use	No
Subdivision that creates a new road or extends an existing road in a medium landslip overlay	No
Development Code to Be Addressed	C15.7.1 Subdivision within a landslip hazard area
Additional Information Required for Footing System	NO
Planning Report Requirements	NA
Modelling Timeframe	Building design life
Directors Determination Reporting Requirements	If the AS 2870 classification report does not include sufficient information for the design of a footing system or significant work, the Site classifier may recommend further geotechnical site investigation reporting
Certificate of Likely Compliance	Certificate by qualified person (Engineer-Civil, Engineering Geologist or Geotechnical Engineer) a) take into account the AS 2870 site classification, any further geotechnical site investigation and any relevant landslip management plan; and b) be satisfied that the proposed work, including significant work and the installations for the management and disposal of stormwater, sewage, water storage overflow or other wastewater, will not cause or contribute to landslip movement on the site or adjacent land. c) be satisfied that the proposed work can achieve and maintain a tolerable risk for the intended life of the building.
Site Classification Requirements	Class P unless otherwise determined in a Site Classification report
Reporting Guideline Requirement	NA

Site Overview

Topography and Site Layout

The Site slopes from north to south, with the building envelope positioned on a steeper section of the slope where contour spacing indicates a gradient of approximately 10 degrees. The Low Landslip Hazard Overlay under the Tasmanian Planning Scheme applies only to a small portion of the Site, specifically a 10 m × 10 m area at the driveway terminus and the entire building envelope. The access driveway itself extends approximately 100–200 m across gently sloping terrain outside the hazard overlay. No significant breaks in slope or signs of instability were observed.

Surface Conditions

Extremely weathered sandstone is exposed near the terminus of the proposed driveway, where surface soil cover is minimal. Across the broader Site, no evidence of instability—such as tension cracking, ground slumping, surface erosion, or water ingress—was observed during inspection. Ground cover comprises predominantly pasture grasses with scattered small trees. The surface is generally stable, with no visible signs of recent or active ground movement.

Photographic Evidence

Photographs taken during the field investigation (refer to appended figures) confirm the presence of exposed sandstone in the driveway terminus area and show typical site slopes within the building envelope. No features suggestive of landslip activity—such as scarps, bulges, or erosional rilling—were observed. Portions of the Site appear to have been lightly benched or cleared to facilitate access and construction planning.

Subsurface Conditions

The geology of the site has been documented and described according to Australian Standard AS1726 for Geotechnical Site Investigations, which includes the Unified Soil Classification System (USCS). Soil layers, and where applicable, bedrock layers, are summarized in Table 2.

Two boreholes (BH01 and BH02) were drilled within the proposed building envelope to evaluate the underlying ground conditions in support of the slope stability and landslide risk assessment.

- **BH02**, located at the northwestern extent of the building area near the terminus of the access handle, encountered a **shallow soil profile** comprising topsoil and silty clay overlying **extremely weathered sandstone** at a depth of **0.7–0.8 m**. The presence of shallow bedrock in this area is consistent with surface exposures of sandstone observed nearby.
- **BH01**, positioned approximately **17 m to the southeast of BH02**, and slightly **upslope**, encountered a **significantly deeper soil profile** extending to **2.3 m** with no refusal or bedrock encountered. The profile consists of alternating layers of **silty clay, silty sand, sandy clay**, and **clayey sandy silt**, indicating a zone of deeper residual or colluvial soil accumulation in this part of the Site.

Soils across the building envelope are of **medium to high plasticity**, with localised variability in grain size and consistency. Both boreholes remained dry, with **no groundwater seepage** observed during drilling. The contrast in soil thickness across short distances highlights the need for differential footing considerations; however, no materials or conditions indicative of slope instability were encountered. The subsurface profile is consistent with **low landslide risk**, assuming standard site drainage and foundation design measures are implemented.

Table 3 Soil Summary Table

#	Layer	Details	USCS	BH01	BH02
1	SILT	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots; angular gravel, S-F	ML	0-0.3 DS@0.2	0-0.2
2	Silty CLAY	Silty CLAY with sand, very dusky red, medium plasticity, fine to medium grained sand, S-H	CI		0.2-0.5 DS@0.3
3	CLAY	CLAY trace sand, black, high plasticity, fine to medium grained sand, VSt	CH	0.3-0.6 DS@0.4	
4	Silty SAND	Silty SAND with clay, dark brown, well sorted, medium grained sand, VL-VD	SM		0.5-0.7 DS@0.6
5	Silty CLAY	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand, VSt	CI	0.6-0.8 DS@0.7	
6	Silty Sandy CLAY	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand, H	CI	0.8-1.3 DS@1.1	
7	Silty SAND	Silty SAND, black, well sorted, coarse grained sand, D	SC	1.3-2 DS@1.7	
8	Clayey Sandy SILT	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand, H	ML	2-2.3 DS@2.0	
9	SANDSTONE	Extremely Weathered SANDSTONE Bedrock			0.7-0.8 REF

Consistency[1]	**VS** Very soft; **S** Soft; **F** Firm; **St** Stiff; **Vst** Very Stiff; **H** Hard. Consistency values are based on soil strengths AT THE TIME OF TESTING and is subject to variability based on field moisture condition
Density[2]	**VL** Very loose; **L** Loose; **MD** Medium dense; **D** Dense; **VD** Very Dense
Rock Strength	**EL** Extremely Low; **VL** Very Low; **L** Low; M Medium; **H** High; **VH** Very High; **EH** Extremely High
PL	Point load test (lump)
DS	Disturbed sample
PV	Pocket vane shear test
FV	Downhole field vane shear test
U50	Undisturbed 48mm diameter core sample collected for laboratory testing.
REF	Borehole refusal
INF	DCP has continued through this layer and the geology has been inferred.

---

[1] Soil consistencies are derived from a combination of field index, DCP and shear vane readings.

[2] Soil density descriptions presented in engineering logs are derived from the DCP testing.

Landslide Risk Assessment

Scenario 1 – Shallow Translational Slide on Steeper Slope (Building Envelope)

Description:
A small translational slide (<1 m depth) occurs within the steeper portion of the slope, affecting the proposed building envelope. The slide originates within the colluvial soils overlying the deeper section of the site (e.g., near BH01), triggered by prolonged rainfall or poor surface drainage.

Scenario 2 – Shallow Slip Adjacent to Driveway Terminus (Exposed Sandstone Zone)

Description:
A shallow surface failure (<0.5 m depth) develops near the sandstone outcrop at the driveway terminus due to surface erosion or poor control of runoff. The slip impacts vehicle access but does not endanger occupants.

Scenario 3 – Deep Seated Landslide Involving Entire Slope Profile

Description:
A deep-seated failure (>2 m depth) involving both colluvial and residual soils across the mid- to lower-slope area of the building envelope. This would be associated with extreme, prolonged rainfall and potentially occur in highly exceptional conditions.

Scenario	Likelihood	Consequence (Life)	Consequence (Property)	Risk to Life	Risk to Property
1 – Shallow translational slide within the building envelope Triggered by prolonged rainfall or poor drainage on the mid-slope colluvial soils.	Rare	Occupants may be present; minor structural impacts	Medium (Localised damage; repairable footing or slab movement)	Acceptable	Low
2 – Shallow slip near driveway terminus in exposed sandstone zone. Caused by uncontrolled runoff or surface erosion.	Unlikely	No direct risk to occupants	Minor (superficial damage to driveway or verge)	Acceptable	Low
3 – Deep-seated failure involving entire slope profile Exceptional event (e.g. long-duration rainfall) causing failure through colluvial and residual soils.	Rare	Potential structural collapse if occupied	Major (Total building loss possible)	Acceptable	Low

These risk levels are consistent with an **Acceptable Risk** outcome under AGS 2007 for residential-type land use, especially where mitigation measures (e.g. surface drainage control and appropriate foundation design) are adopted.

Performance Criteria C15.6.1 – Assessment of Landslip Risk

P1. Each lot, or a lot proposed in a plan of subdivision, within a landslip hazard area must not create an opportunity for use or development that cannot achieve a tolerable risk from landslip, having regard to:

(a) Any increase in risk from a landslip for adjacent land

Minor cuts for the proposed turning circle will occur in areas where shallow soil overlies competent sandstone. The presence of shallow bedrock ensures these works will remain stable and not affect overall slope integrity. There will be no increase in landslip risk to adjacent land because of the proposed excavation. Management is recommended for soil dispersion.

(b) The level of risk to use or development arising from an increased reliance on public infrastructure
There is no increased reliance on public infrastructure as a result of the development. The Site is serviced via a private driveway with all civil works and drainage systems to be managed within the title boundaries. No public road embankments, retaining structures, or essential infrastructure are affected by the landslip overlay or proposed development.

(c) The need to minimise future remediation works

The proposed lot layout and building location have been informed by geotechnical investigation and are sited on terrain where slope stability is not compromised. With appropriate site drainage and footing design, the risk of instability is low and future remediation works are unlikely to be required. The use of existing topography and shallow bedrock in parts of the Site contributes to long-term slope stability.

(d) Any loss or substantial compromise, by a landslip, of access to the lot on or off site

The access road is located mostly outside the landslip hazard overlay, with only a small section (approx. 10 m × 10 m) at the driveway terminus intersecting the Low Hazard band. This portion sits on shallow, exposed sandstone with no signs of instability. The risk of access compromise due to landslip is therefore negligible, and access to the dwelling site is considered robust.

(e) The need to locate building areas outside the landslip hazard area

The proposed building envelope lies within the Low Landslip Hazard Overlay, however it has been assessed as geotechnically suitable for residential development. The risk is considered acceptable under the AGS 2007 Guidelines, and no additional protection measures beyond standard design responses are required.

(f) Any advice from a State authority, regulated entity or a council

This assessment has been prepared in accordance with the requirements of the Tasmanian Planning Scheme and relevant hazard mapping. The report is available for council review and can be used to support a planning determination. No additional advice has been received from other authorities to date.

(g) The advice contained in a landslip hazard report

This geotechnical report forms the basis of the landslip hazard assessment. It confirms that the level of risk to life and property is within acceptable tolerances, and that standard drainage and foundation design measures are sufficient to ensure slope stability.

Sorell local provisions schedule - SOR-S1.7.1 Development on dispersive soils

Objective

That buildings and works with the potential to disturb dispersive soil are appropriately located or managed:

(a) to minimise the potential to cause erosion; and

(b) to reduce risk to property and the environment to an acceptable level.

Acceptable Solutions

Given the proposed development involves disturbance of soils and is not for a habitable building or an extension less than 100 m^2, the building and works do not meet LPS acceptable solutions, and performance solution SOR-S1.7 is to be addressed.

Performance Criteria

Building and works must be designed, sited and constructed to minimise the risks associated with dispersive soil to property and the environment, having regard to:

Performance Criteria	Consideration
(a) the dispersive potential of soils in the vicinity of proposed buildings, driveways, services and the development area generally;	The soils across the development area, including near proposed buildings, driveways, and services, are predominantly severely dispersive, posing a high erosion risk if exposed or subjected to concentrated surface water.
(b) the potential of the development to affect or be affected by erosion, including gully and tunnel erosion;	The development also presents erosion risk in areas where cuts are proposed, as overland flow may traverse these surfaces and interact directly with exposed, severely dispersive soils, increasing the potential for tunnel and gully erosion without appropriate control measures.
(c) the dispersive potential of soils in the vicinity of water drainage lines, infiltration areas and trenches, water storages, ponds, dams and disposal areas;	The dispersive potential of soils is high in areas where water drainage lines are proposed—particularly along the driveway—necessitating careful stormwater management to avoid erosion and tunnel initiation. Infiltration of stormwater should be minimised, especially within dispersive soils, and the use of trenches for stormwater disposal is not recommended. While no water storages, ponds, or dams are proposed, design of disposal areas must ensure runoff is discharged in a controlled, non-erosive manner to prevent interaction with exposed dispersive subsoils. Wastewater absorption trenches are of less concern.
(d) the level of risk and potential consequences for property and the environment from potential erosion, including gully and tunnel erosion;	The risk of gully and tunnel erosion is moderate to high in areas where dispersive subsoils may be exposed, particularly near cuts and concentrated surface flows. This poses potential consequences for property and the environment, including infrastructure damage and sedimentation, if not properly managed.
(e) management measures that would reduce risk to an acceptable level; and	This report outlines a range of management measures to reduce erosion risk to an acceptable level, including site-specific recommendations detailed in the main text and general best-practice controls presented in Appendix G.
(f) the advice contained in a dispersive soil management plan.	This report includes Dispersive Soil Management which provides guidance on erosion control, surface water management, and treatment of dispersive soils to ensure risks are appropriately mitigated.

Recommendations

General

For Class P Sites, the designer should be a qualified engineer experienced in the design of footing systems for buildings.

Dispersive soils

Findings

Select soil samples from boreholes BH01 and BH02 were assessed for sodicity using the Emerson Class Number method in accordance with AS1289.3.8.1 (Appendix E). The results indicate that most soils tested are classified as Emerson Class 1, which are considered severely dispersive and present a high risk of erosion if left unprotected or exposed to uncontrolled surface water.

Specifically, five of the eight tested layers were assigned Class 1, with dispersive characteristics identified in both clay-rich and sandy soil horizons. These dispersive soils occur within the upper 1.7 m of the profile and coincide with the building envelope area. Only two samples (0.2 m and 2.0 m depths) returned Class 2 results, indicating low to moderate dispersion potential.

Hazard Analysis

Soil at the Site is highly susceptible to tunnel erosion, and particularly in areas where the soil is deeper—particularly around BH01. Risks will be apparent if the dispersive subsoils are exposed or subjected to uncontrolled surface water flow.

The risk of soil dispersion and tunnel erosion is greatest where stormwater may accumulate or become concentrated over exposed Class 1 dispersive soils. Of particular concern is the section where the driveway turns south toward the building envelope, as this location coincides with a natural overland flow path, increased slope gradient and there the driveway cut is proposed. Without appropriate mitigation, there is potential for channelised flow to initiate gully or tunnel erosion into both natural and filled soils.

The main length of the driveway, which traverses gently sloping terrain with broader flow paths, presents a lower hazard, assuming that surface water is dispersed evenly and not allowed to concentrate. However, poor drainage design or compacted verge conditions could still lead to localised erosion.

To reduce the potential for slope degradation and soil loss, stormwater must be effectively intercepted, diverted, and managed across the development.

Site specific recommendations

Soil cut batters

The key management measures for dispersive soils in cut embankments, as outlined in Appendix G, must be followed carefully to minimise erosion risk and maintain slope stability. Particular attention should be given to the section detailing the use of sand barriers within the embankment profile, which are essential for intercepting subsurface flow and reducing the potential for tunnel erosion through dispersive materials.

Dispersive soils in cut embankments are highly susceptible to tunnel erosion. To improve the stability of dispersive soils, it is recommended that all Emerson Class 1 which are exposed in cuts be treated with gypsum at an application rate of 1 kg/m². This amendment will assist in displacing sodium ions from clay particles, thereby improving soil structure, increasing shear strength, and enhancing the soil's resistance to both tunnel and surface erosion. This treatment is critical to ensuring the long-term performance of erosion control measures on-site.

The gypsum must be applied for chemical stabilisation immediately following cuttings. A very light sprinkle of water will be required on the class 1 dispersive soil to activate the chemical amelioration process and promote slight infiltration WITHOUT causing runoff. Following activation of the gypsum, sand barriers should be placed over the cut face —comprising a 200 mm sand layer and non-dispersive topsoil cover— to interrupt subsurface flow and protect exposed faces. All erosion control measures must be implemented immediately following excavation to prevent tunnel erosion initiation.

In this case, driveway cut angles may be safely maximised due to the presence of shallow sandstone bedrock, which provides a stable founding surface. This allows for the formation of a shallow batter over the exposed soil face, enabling the effective application of sand or stabilised sand layers. The shallow gradient will help prevent erosion of these treatments by overland flow and support long-term batter stability.

Earth Retaining Walls as an Alternative to Soil cut batters

Earth retaining walls provide an effective alternative to soil cut batters, particularly in areas where shallow soils overlie bedrock. This approach is especially suitable at the top of the driveway cut batters, where exposed bedrock offers a stable foundation for wall construction. In addition to improving slope stability, retaining walls act as a physical barrier against tunnel erosion, reducing the risk of subsurface flow paths developing in dispersive soils.

Use of Class 1 Soils for Filling

It is recommended that dispersive soil not be used as fill beneath the building envelope, due to its high erosion potential and poor structural performance. The use of dispersive fill should be avoided unless it is:

- Chemically treated with gypsum at the specified application rates or
- Capped with an impervious surface (paving, liner red gravel etc) with measure put in place to prevent waver from moving beneath the capping

Roofed and Paved Area Stormwater Management

All captured water on-site, including roof runoff, must be managed to remain at the surface and be evenly dispersed downslope across the Site. Roof runoff must be directed to detention tanks, with overflow discharged via surface irrigation—not into soakage pits. Due to the absence of non-dispersive topsoil, imported loam is required in irrigation areas. Irrigation must either:

- Be delivered just below the surface, draining directly into the imported loam without contact with dispersive soils; or
- Be applied via above-ground sprinklers onto imported loam to prevent erosion and maintain surface stability.

Runoff from pavements and other impervious surfaces must either be captured and redirected into detention tanks for controlled redistribution.

For driveways, runoff should be directed via cross-slope or in-slope alignment into lined side drains or swales. These must convey collected water to designated redistribution areas —such as detention tanks with surface irrigation or into distribution swales. Overflow must be dispersed across imported loam soils which is not located upgradient or downgradient of existing structures and ensuring water is not concentrated near foundations or fill. If distribution swales are used, they must be lined, constructed with low gradients, and designed to promote sheet flow rather than concentrated runoff. Distribution swale overflow must discharge onto non-dispersive imported loam soils.

Service Trenches

An effective measure to prevent stormwater ingress into backfilled service trenches is to ensure the trench surface is well sealed with non-dispersive soils or stable topsoil. As an additional site-specific recommendation, service trenches should be backfilled with compacted sand, which will help prevent water channelisation and reduce the risk of tunnel erosion along trench alignments.

For further guidance, general recommendations are presented in Appendix G.

Plumbing

Refer to hydraulic design drawings for detailed plumbing advice and requirements.

Refer to Table 4 to assess soil movement (Ys) around pipework for different depth ranges. The Site is assigned a Class P management measure for plumbing given the severely dispersive soils observed at the Site (see service trench management above).

*Table 4 Millimetres soil movement (Ys) for determining plumbing requirements for various soil depths **

Building	Profiles	P*	E Ys >75	H2 Ys 60-75	H1 Ys 40-60	M Ys 20-40	S Ys 0-20	A Ys 0
Dwelling	BH01 BH02	YES			0-0.4	0.4-1.1	1.1-3	>3

* Depths in this table are based on surfaces at the time of testing and do not allow for the influence of any additional fill added to the soil profile unless the Iss calculation depth has been modified based on the proposed cut and fill (see 'Footing Minimum Target Depths'). Where additional fill is proposed (and not indicated in the attached plans) Enviro-Tech are to be advised of final FFL's so the Site classification can be recalculated according to the specific fill reactivity and thickness used in the design.

Class M

When pipework service trench basses fall within Class M depth range as shown in Table 4, and all plumbing recommendations herein have been implemented, all stormwater and sanitary plumbing drains should have fittings set at their midposition during installation to allow 0.5ys movement in any direction. Pipe wrappings can be used at critical points.

AS3500.2:2021 Appendix G of AS3500.2:2021 should be referred for general advice.

Wastewater and Stormwater Management

If swale drains or absorption trenches are proposed for tank overflow or roof catchment management, the stormwater is not to be diverted within 45° downgradient of any building structure unless verified in a plan provided to Envirotech for approval. The proposed wastewater absorption area is suitably located.

Site Drainage

Where possible, all levelled cut surfaces into severely dispersive soils should be sealed with a hard surface treatment such as pavement, a liner, or a combination of gypsum treatment followed by topsoiling to prevent tunnel erosion. Water pooling should be avoided, as prolonged saturation can initiate piping in dispersive materials. Site drainage should be designed with gentle gradients to ensure that surface water is directed away from vulnerable areas, reducing the risk of subsurface erosion and soil instability.

Surface drainage shall be considered in the design of the footing system, and necessary modifications shall be included in the design documentation. The surface drainage of the site shall be controlled from the beginning of the preparation and construction of the site. The drainage system shall be completed after the completion of the building construction.

Ideally, the areas around the footprint of the building should be graded or drained so that the water cannot pond against or near the building. As soon as footing construction has been completed, the ground immediately adjacent to the building should be graded to a uniform fall of 50mm minimum away from the building over the first metre. The final provision of paving to the edge of the building can greatly limit soil moisture variations due to seasonal wetting and drying.

Wastewater

Where possible, wastewater trenches should be designed to minimise cut and fill, with a preference for elongated layouts rather than condensed configurations. An elongated trench alignment not only reduces excavation volume but also improves the dispersion of wastewater across a broader area. Prior to backfilling, gypsum should be applied to the exposed natural soils within the trench footprint to reduce dispersive behaviour. With these management measures in place, the overall risk associated with wastewater trenches is considered low to moderate.

Temporary Site Drainage

It is recommended that drainage protection works (cut off drains/mounds) are put in place above (upgradient of) the work area to prevent water and sediment from accumulating in and around footings and reduce the risk of erosion and instability around any proposed earth retaining structures.

Permanent Cut Batters – Soil and Rock

To ensure that cuts remain serviceable, it is recommended that unretained cuts in soil do not exceed 1V: 3H and unsupported baters in bedrock do not exceed 2V: 1H. Before cuts are approached by workers, cuts must be appropriately scaled to remove any loose soil and rock. The bedrock should not be increased beyond 2.0 m height relative to depth below natural level, without inspection by a suitably qualified person to ensure that these cuts are safe to work under.

Filling Works

The use of dispersive soil as fill presents a high risk of tunnel erosion, especially where exposed to surface or groundwater. To manage this risk, dispersive soils should either be removed, chemically treated with gypsum or lime, or protected from water ingress through drainage or surface sealing. Chemical treatment must be applied at the correct rate based on lift thickness, with 300 mm lifts receiving full application and 150 mm lifts requiring half the rate. Compaction should be carried out at or near optimum moisture content, especially around structural elements.

The bedrock surface across the Site offers a favourable condition for keeping surface water movement above ground, reducing the risk of infiltration into dispersive layers. All roads and cut excavations into sandstone should incorporate spoon drains, ideally constructed from concrete or other impermeable materials, to collect and divert runoff away from the toe of the cut. Paving should be installed at the interface between the spoon drain and exposed soil to ensure stormwater remains above dispersive zones. On down-gradient margins, water may be allowed to re-enter the land surface, provided the paved margins are treated with gypsum or otherwise stabilised to prevent tunnel and surface erosion.

Long-term erosion management

The following measures are generally recommended for maintaining long-term erosion stability of soil slopes:

- Slopes exceeding 1V: 4H and up to 1V: 3H will need to be effectively stabilised with mulch/topsoil mixes, drill/broadcast seeding, hydroseeding or soil binders.
- Slopes up to 1V:2Hcan be stabilised with straw mulching.
- Slopes exceeding 1V: 2H and up to 1V:1.5H may be effectively stabilised with hydromulching
- Slopes exceeding 1V:1.5H but no greater than 1V: 1H will generally require measures such as erosion control blankets.

Kris Taylor, BSc (hons)

Environmental & Engineering Geologist

Notes About Your Assessment

The Site classification provided and footing recommendations including foundation depths are assessed based on the subsurface profile conditions present at the time of fieldwork and may vary according to any subsequent *Site works* carried out. *Site works* may include changes to the existing soil profile by cutting more than 0.5 m and filling more than 0.4 to 0.8 m depending on the type of material and the design of the footing. All footings must be founded through fill *other than* sand not exceeding 0.4 m depth or sand not exceeding 0.8 m depth, or otherwise a Class P applies (AS2870 Clauses 2.5.2 and 2.5.3).

For reference, borehole investigation depths relative to natural soil surface levels are stated in borehole logs where applicable.

In some cases, variations in actual Site conditions may exist between subsurface investigation boreholes. At the time of construction, if conditions exist which differ from those described in this report, it is recommended that the base of all footing excavations be inspected to ensure that the founding medium meets the requirement referenced herein or stipulated by an engineer before any footings are poured.

The site classification assumes that the performance requirements as set out in Appendix B of AS 2870 are acceptable and that site foundation maintenance is carried out to avoid extreme wetting and drying.

It is the responsibility of the homeowner to ensure that the soil conditions are maintained and that abnormal moisture conditions do not develop around the building. The following are examples of poor practises that can result in abnormal soil conditions:

- The effect of trees being too close to a footing.
- Excessive or irregular watering of gardens adjacent to the building.
- Failure to maintain Site drainage.
- Failure to repair plumbing leaks.
- Loss of vegetation near the building.

The pages that make up the last six pages of this report are an integral part of this report. The notes contain advice and recommendations for all stakeholders in this project (i.e. the structural engineer, builder, owner, and future owners) and should be read and followed by all concerned.

References

AS 1289.6.3.2-2003 Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9 kg dynamic cone penetrometer test, Standards Australia, Sydney, Retrieved from SAI Global

AS 1289.7.1.1-2003 Methods of testing soils for engineering purposes Method 7.1.1: Soil reactivity tests—Determination of the shrinkage index of a soil—Shrink-swell index, Standards Australia, Sydney, Retrieved from SAI Global

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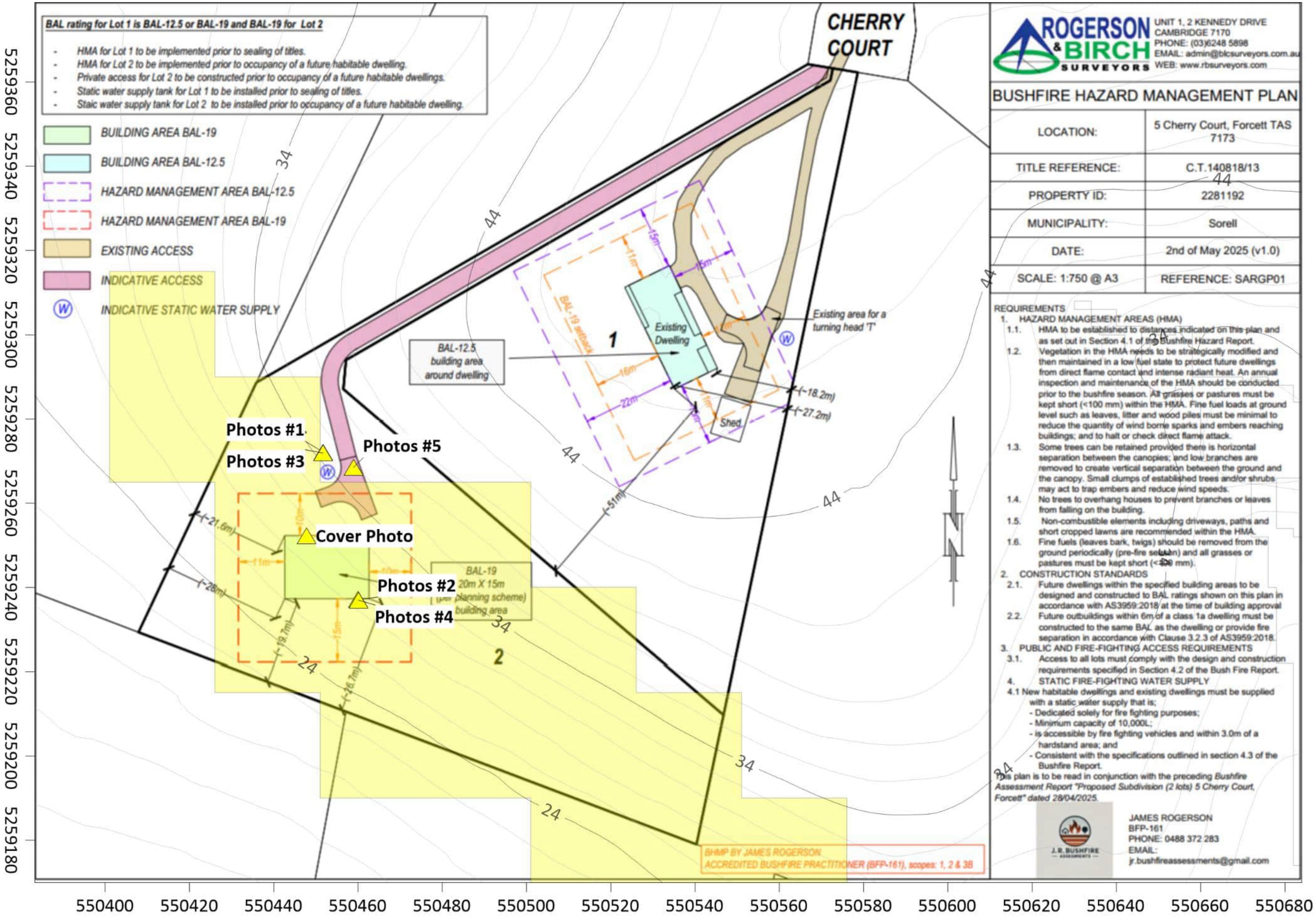
AS4055 (2021). Australian Standard. Prepared by Committee BD-099, Wind Loads for Housing. Approved on behalf of the Council of Standards Australia on 1st June 2021 and published on 25th June 2021.

DPIPWE 2009. Dispersive Soils and their Management. Technical Reference Manual. Sustainable Land Use Department of Primary Industries Water and Environment.

Webster, S.L., Brown, R.W. and Porter, J.R. (1994) Force Projection Site Evaluation Using the Electric Cone Penetrometer (ECP) and the Dynamic Cone Penetrometer (DCP). Technical Report No. GL-94-17, Air Force Civil Engineering Support Agency, US Air Force, Tyndall Air Force Base, FL.

Appendix A Mapping



BAL rating for Lot 1 is BAL-12.5 or BAL-19 and BAL-19 for Lot 2

- *HMA for Lot 1 to be implemented prior to sealing of titles.*
- *HMA for Lot 2 to be implemented prior to occupancy of a future habitable dwelling.*
- *Private access for Lot 2 to be constructed prior to occupancy of a future habitable dwellings.*
- *Static water supply tank for Lot 1 to be installed prior to sealing of titles.*
- *Staic water supply tank for Lot 2 to be installed prior to occupancy of a future habitable dwelling.*

🟩	*BUILDING AREA BAL-19*
🟦	*BUILDING AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-19*
🟫	*EXISTING ACCESS*
🟪	*INDICATIVE ACCESS*
Ⓦ	*INDICATIVE STATIC WATER SUPPLY*

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WEB: www.rbsurveyors.com

BUSHFIRE HAZARD MANAGEMENT PLAN

LOCATION:	5 Cherry Court, Forcett TAS 7173
TITLE REFERENCE:	C.T.140818/13
PROPERTY ID:	2281192
MUNICIPALITY:	Sorell
DATE:	2nd of May 2025 (v1.0)
SCALE: 1:750 @ A3	REFERENCE: SARGP01

REQUIREMENTS

1. HAZARD MANAGEMENT AREAS (HMA)
   - 1.1. HMA to be established to distances indicated on this plan and as set out in Section 4.1 of the Bushfire Hazard Report.
   - 1.2. Vegetation in the HMA needs to be strategically modified and then maintained in a low fuel state to protect future dwellings from direct flame contact and intense radiant heat. An annual inspection and maintenance of the HMA should be conducted prior to the bushfire season. All grasses or pastures must be kept short (<100 mm) within the HMA. Fine fuel loads at ground level such as leaves, litter and wood piles must be minimal to reduce the quantity of wind borne sparks and embers reaching buildings; and to halt or check direct flame attack.
   - 1.3. Some trees can be retained provided there is horizontal separation between the canopies; and low branches are removed to create vertical separation between the ground and the canopy. Small clumps of established trees and/or shrubs may act to trap embers and reduce wind speeds.
   - 1.4. No trees to overhang houses to prevent branches or leaves from falling on the building.
   - 1.5. Non-combustible elements including driveways, paths and short cropped lawns are recommended within the HMA.
   - 1.6. Fine fuels (leaves bark, twigs) should be removed from the ground periodically (pre-fire season) and all grasses or pastures must be kept short (<100 mm).
2. CONSTRUCTION STANDARDS
   - 2.1. Future dwellings within the specified building areas to be designed and constructed to BAL ratings shown on this plan in accordance with AS3959:2018 at the time of building approval
   - 2.2. Future outbuildings within 6m of a class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.
3. PUBLIC AND FIRE-FIGHTING ACCESS REQUIREMENTS
   - 3.1. Access to all lots must comply with the design and construction requirements specified in Section 4.2 of the Bush Fire Report.
4. STATIC FIRE-FIGHTING WATER SUPPLY
   - 4.1 New habitable dwellings and existing dwellings must be supplied with a static water supply that is;
     - Dedicated solely for fire fighting purposes;
     - Minimum capacity of 10,000L;
     - is accessible by fire fighting vehicles and within 3.0m of a hardstand area; and
     - Consistent with the specifications outlined in section 4.3 of the Bushfire Report.

This plan is to be read in conjunction with the preceding *Bushfire Assessment Report "Proposed Subdivision (2 lots) 5 Cherry Court, Forcett" dated 28/04/2025.*

J.R. BUSHFIRE ASSESSMENTS

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BFP-161
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BHMP BY JAMES ROGERSON
ACCREDITED BUSHFIRE PRACTITIONER (BFP-161), scopes: 1, 2 & 3B

Figure 1 Planning Scheme Landslip Hazard Overlay Mapping, Proposed Building and Works & Photo Locations

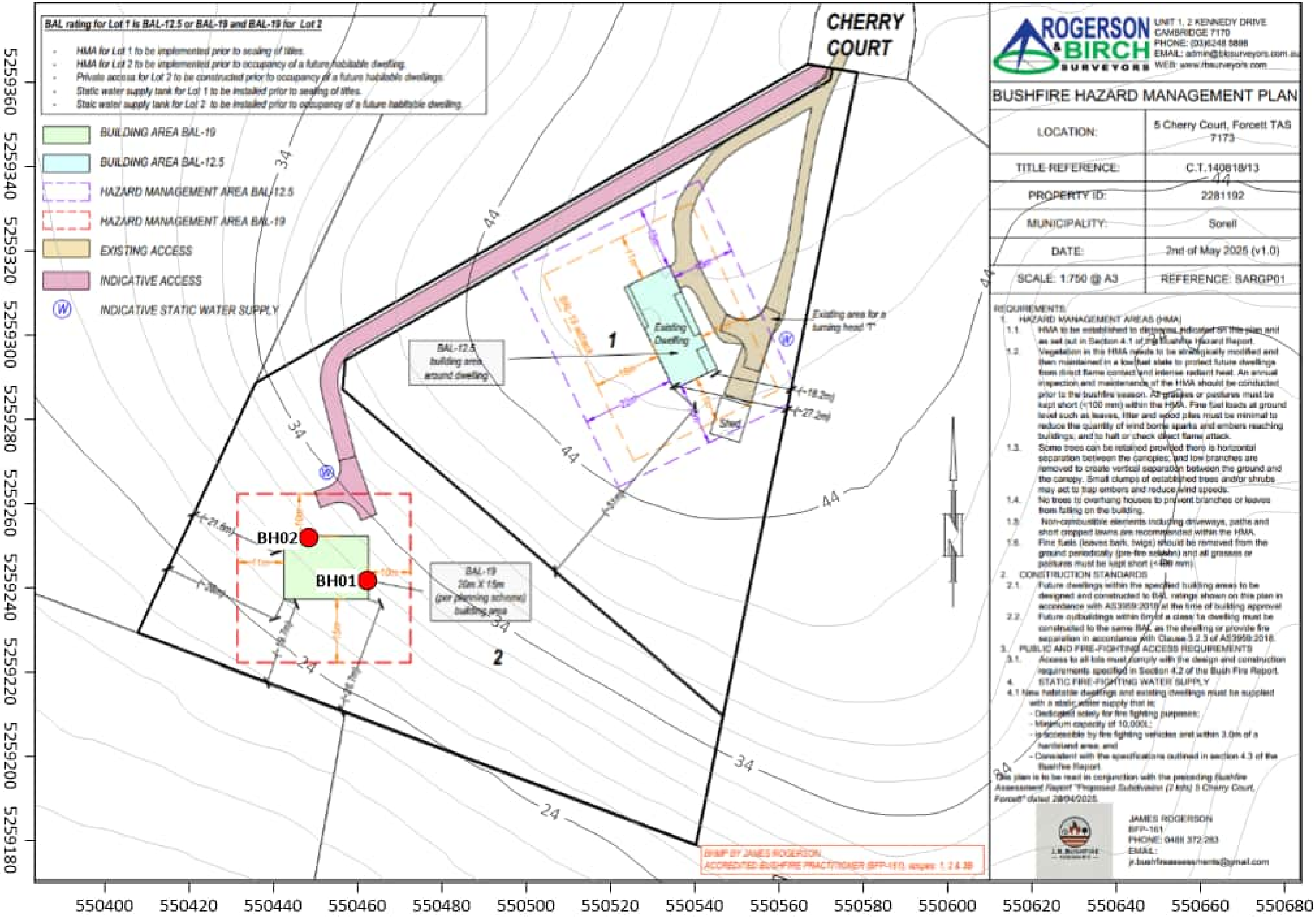

Figure 2 Site Borehole Locations

Appendix B Site photos

Photo #1

Photo #2

Photo #3

Photo #4

Photo #5

Appendix C Borehole Logs

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Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation
STRUCTURE: Subdivision
EASTING: 550462
NORTHING: 5259242
ACCURACY
HORIZ: 1m **VERT:** ~0.1m

Borehole : BH01
DATE TESTED: 27/05/2025
LOGGED BY: M. Scalisi
ELEVATION: 29.9

LOCATION: 5 Cherry Court - Forcett
CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: AMS Powerprobe 9120 RAP
ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS50 MPa) NSPT	NDCP/100mm
0.0	ML	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	soft to firm	1	29.8 29.6	Moist	11		DS					1.0 1.9 1.9
0.5	CH	CLAY trace sand, black, high plasticity, fine to medium grained sand	very stiff	3	29.4		27		DS					6.0 9.0 6.0
	CI	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand		5	29.2		34		DS					6.0 7.0
1.0	CI	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand	hard	6	29.0 28.8 28.6		32		DS					13.0 16.0 13.0 11.0 13.0
1.5	SC	Silty SAND, black, well sorted, coarse grained sand	dense	7	28.4 28.2 28.0		32		DS					14.0 14.0
2.0	ML	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand	hard	8	27.8 27.6		28		DS					
		Borehole Ended At Target Depth End of borehole at 2.3m depth.												

GROUNDWATER: Not Encountered

PAGE 1 of 1

TESTING: Penetrometer: AS 1289.6.3.2

DCP Blows per 100mm. For penetrometer blows per 100mm <1, distance travelled per blow is measured and converted back to blows per 100mm

DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV(Ømm): downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

enviro·tech
CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation
STRUCTURE: Subdivision
EASTING: 550448
NORTHING: 5259252
ACCURACY
HORIZ: 1m **VERT:** ~0.1m

Borehole : BH02
DATE TESTED: 27/05/2025
LOGGED BY: M. Scalisi
ELEVATION: 29.2

LOCATION: 5 Cherry Court - Forcett
CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: AMS Powerprobe 9120 RAP
ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS50 MPa) NSPT 0 10 20 30 40	NDCP/100mm 0 5 10 15 20
0.0	ML	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	soft to firm	1	29.2 29.0									
	CI	Silty CLAY with sand, very dusky red, medium plasticity, fine to medium grained sand	soft to hard	2	28.8	Moist	27		DS					
0.5	SM	Silty SAND with clay, dark brown, well sorted, medium grained sand	very loose to very dense	4	28.6		23		DS					
		Extremely Weathered SANDSTONE Bedrock pale yellow		9	28.4									

Refusal in Extremely Weathered SANDSTONE Bedrock

End of borehole at 0.8m depth.

GROUNDWATER: Not Encountered

PAGE 1 of 1

TESTING:

DS: disturbed sample; PV: pocket vane; PP: pocket penetrometer; FV: downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

Appendix D Core Photographs

BH01

BH02

*** 1 metre core tray length**

Appendix E Geotechnical Testing

Dynamic Cone Penetrometer (DCP)

Dynamic cone penetrometer (DCP) testing was conducted according to AS 1289.6.3.2 with the results presented in Appendix C.

Soil Dispersion (Emerson aggregate test)

Select soil samples were tested for sodicity using the Emerson Class number method according to AS1289.3.8.1. The results presented in Table 5 demonstrate that:

- The majority of the soil layers mapped at the Site comprise Emerson Class 1 category soils which are considered severely dispersive

Table 5 Summary of the Emerson class results.

Layer	Soil	Depth	Sample ID	Emersion Class	Date Tested	Water	pH
1	SILT	0.2	BH01 0.2	Class 2	30/05/2025	DI 16°C	6.07
2	Silty CLAY	0.3	BH02 0.3	Class 1	30/05/2025	DI 16°C	6.44
3	CLAY	0.4	BH01 0.4	Class 1	30/05/2025	DI 16°C	5.93
4	Silty SAND	0.6	BH02 0.6	Class 1	30/05/2025	DI 16°C	6.52
5	Silty CLAY	0.7	BH01 0.7	Class 1	30/05/2025	DI 16°C	6.91
6	Silty Sandy CLAY	1.1	BH01 1.1	Class 1	30/05/2025	DI 16°C	7.25
7	Silty SAND	1.7	BH01 1.7	Class 1	30/05/2025	DI 16°C	7.06
8	Clayey Sandy SILT	2	BH01 2.0	Class 2	30/05/2025	DI 16°C	6.92

Appendix F Geotechnical Interpretation

Footing Minimum Target Depths

Footing design for the proposed structures are to consider the depths of limiting layers at the base of potentially problematic soils. Where practical/allowable, thickened beams may be deepened through problematic soil layers according to engineering specifications (Table 6). Table 7 should be referred to where only 50kPa allowable bearing capacity is required.

Table 6 also presents a summary of the estimated soil depths and associated layers where less than 5mm of vertical soil movement can expected due to soil moisture fluctuations from normal seasonal wetting and drying cycles. Where 5mm tolerances are required, concentrated loads including but not limited to slab edge or internal beam or strip footings shall be supported directly on piers in accordance with minimum target layer depths presented in Table 6, with considerations given to required bearing capacities in accordance with Table 7.

Table 6 Soil characteristic surface movements and recommended footing minimum target depths

Footing design parameters	**BH01**	**BH02**
Ys Calculation Depth	0m^	0m^
Surface movement Ys (mm)	45	10
Soil reactivity class	H1	S
Base of problem soil layer (m)*	0.2	-
Layer at base of problem soil*	1	-
Pier/Footing minimum target depth (m)#	>2.1^	>0.8^
Pier/footing minimum target layer#	8	9
Allowable bearing capacity at target depth (kPa)	400	400

- No problem layers encountered

^ Calculations relative to surface of borehole at the time of investigation

* Base of problematic soil layer depth below top of borehole surface at the time of testing to achieve 100 kPa allowable bearing capacity or greater.

Target soil layer depth where Ys values from normal wetting and drying cycles are estimated at less than 5mm vertical movement. >minimum bored pier depths (see bearing capacity table for bored pier design depths).

Soil and Rock Allowable Bearing Capacity

Soil allowable bearing capacity was calculated from correlations with DCP blow counts. Where high clay and silt content is observed in the soil, soil allowable bearing capacity is determined from undrained shear strengths using field vane correlated DCP values. Interpretive bearing capacity presented in Table 7.

Table 7 Soil allowable bearing capacities and problematic ground conditions.

Depth below investigation surface (m)	**Allowable Bearing Capacity (kPa)**	
	BH01	**BH02**
0	70~	
0.1	80~	
0.2	**150***	
0.3	**250**	
0.4	**290**	
0.5	**290**	
0.6	**250**	
0.7	**>400**	**SANDSTONE**
0.8	**>400**	
0.9	**>400**	
1	**>400**	
1.1	**>400**	
1.2	**>400**	

Correlations drawn from DCP and vane shear testing.

~ Problematic soil layer attributed to loose, soft, or low allowable bearing capacity soil (<100 kPa)

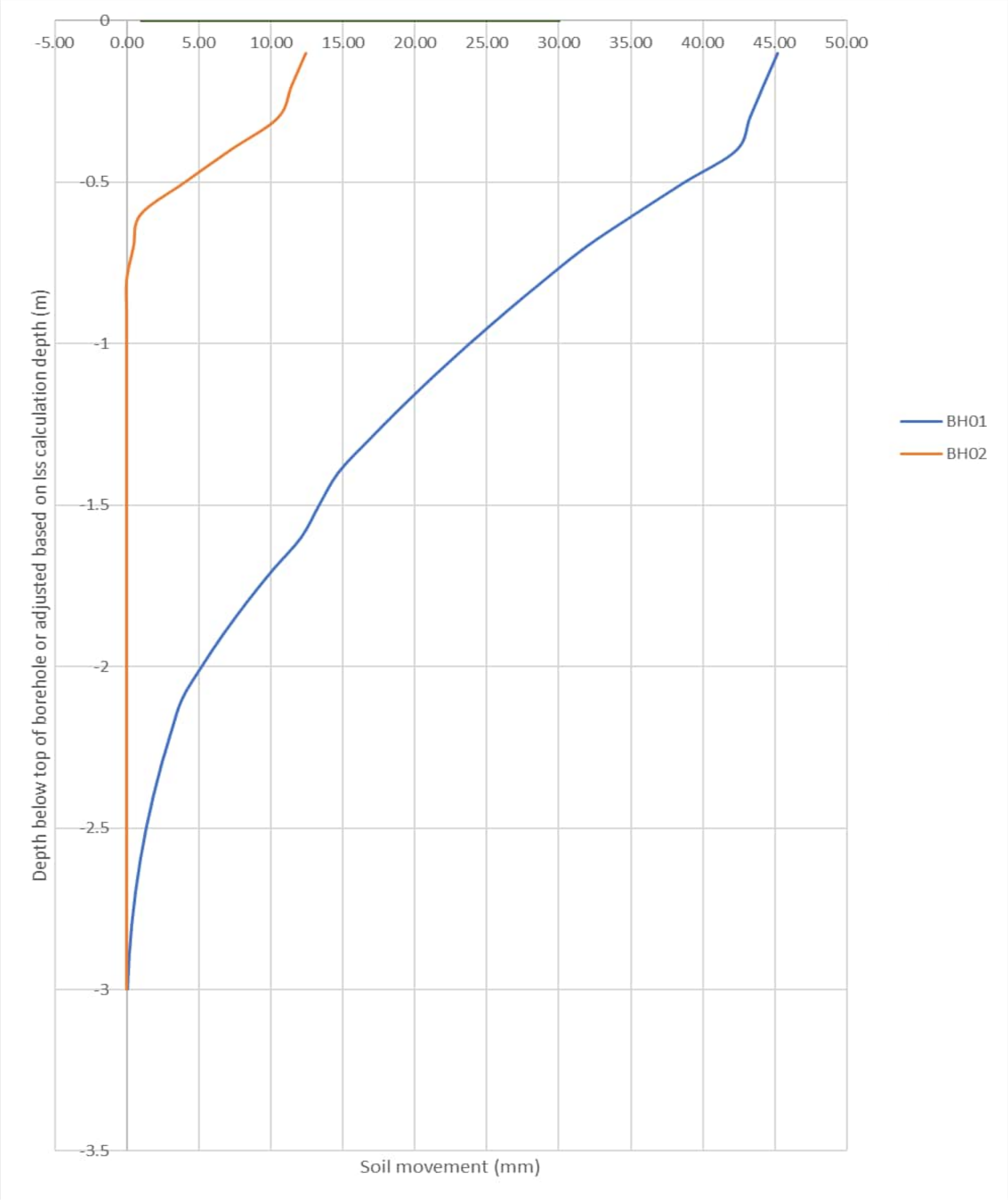
*Soil layer expected at the base of problematic soil layers at test location (or at surface where problematic soils not encountered) to achieve 100 kPa allowable bearing capacity or greater.

Characteristic Surface Movement (Ys)

The characteristic surface movement (soil reactivity) is calculated according to AS 2870 Section 2.3. The calculations are based on Iss % testing results where applicable and are based on complete soil profiles for boreholes drilled within the building Site. In the case of where cut and fill are proposed and building finished floor levels (FFL) are made available, the Iss value is recalculated based on the FFL and estimated cut and fill as per Table 6.

According to AS 2870 Section 2.3, calculations consider the depth of groundwater and bedrock. Soil characteristic surface movements from normal wetting and drying cycles are presented in Figure 3.

Figure 3 Calculated Characteristic Soil Movement Based on Soil Testing



Appendix G General Advice - Dispersive Soil Management

The Site may be susceptible to tunnel erosion if subsurface drainage is not adequately managed. Tunnel erosion typically initiates in excavated cuts; however, it can also develop where dispersive soils are exposed through excavation, leading to the release of pore water and concentrated groundwater discharge. Additional contributing factors may include broken pipes, ineffective stormwater infrastructure, or unmanaged surface flows. If left unaddressed, these conditions can result in progressive subsoil loss, potentially undermining footings or causing settlement-related damage to the structure.

Tunnel erosion typically progresses upslope, initiated by the dissolution and removal of highly dispersive Class 1 and Class 2 soil layers. As tunnels enlarge, they can undermine surrounding soils that may not be dispersive but are still susceptible to collapse due to loss of subsoil support. If unmanaged, tunnel erosion can extend beyond property boundaries, posing a risk to nearby infrastructure including buildings, roads, and underground services. For further background on the management of Emerson Class 1 soils, refer to the Department of Primary Industries, Parks, Water and Environment (DPIPWE, 2009) guidance document.

Dispersive soils should be managed through a combination of drainage control and ground treatment measures. These may include overland flow management, controlled cut and fill practices, and, in more severe cases, the installation of sand barriers to interrupt subsurface flow paths. Where dispersive soils are exposed—particularly on batters or in excavation faces—chemical treatment using gypsum or lime may be employed to improve soil cohesion and reduce erosion potential. Application rates should be guided by Emerson Class test results, as outlined in Table 8.

Gypsum and hydrated lime are proven effective in mitigating erosion in dispersive soils by displacing sodium ions on clay particles and replacing them with calcium. This cation exchange improves soil structure, increases shear strength, and enhances resistance to tunnel and surface erosion. The effectiveness of treatment is influenced by the soil's properties; higher application rates of gypsum are typically required for soils with greater cation exchange capacity, elevated pH, and lower Emerson Class numbers. Application guidelines should be based on laboratory test results, including Emerson Class assessment, to ensure appropriate treatment dosages.

Table 8 Prescribed gypsum and hydrated lime application rates – see Emerson soil testing results

Dispersive soil Emerson class	Gypsum/Hydrated Lime Application Rate pH < 7.5	Gypsum Application Rate pH > 7.5
Class 3	0 to 0.3 kg/m2	0.2 – 0.5 kg/m2
Class 2	0.5 kg/m2	1.0 kg/m2
Class 1	1.0 kg/m2	1.5 kg/m2

Where practicable, vehicle driveways and parking areas should be located on level or gently sloping terrain to minimise the need for deep excavation and reduce disturbance to dispersive soils identified on Site.

General Recommendations

To minimise disturbance and erosion in areas where Class 1 dispersive soils have been identified, the following measures are recommended:

- **Drainage Control:** Construct soil cut-off mounds or shallow interceptor trenches in non-dispersive soils, no deeper than 0.2 m above the interface with Class 1 dispersive soils. These should be positioned upslope of any proposed cuts to divert surface water before it reaches vulnerable areas.
- **Chemical Treatment:** Apply gypsum or hydrated lime to exposed dispersive soils where surface water movement is expected—particularly on freshly cut embankments, filled areas, service trenches, and zones where topsoil has been removed.
- **Surface Protection:** Cover all severely dispersive soils with either impermeable surfacing (e.g. paving) or a layer of non-dispersive topsoil to reduce erosion and limit moisture ingress.
- **Batter Stabilisation:** Place non-dispersive topsoil over freshly cut batters to protect against surface erosion and reduce the likelihood of tunnel initiation.
- **Remediation of Existing Tunnels:** Where tunnel erosion has already occurred, additional stabilisation of natural or constructed drainage gullies may be required. This may include the use of sand barriers and, in more severe cases, geotextile-wrapped drainage rock structures. When correctly designed, such barriers can intercept subsurface flow, promote controlled surface discharge, and direct water away from at-risk areas.

Key Management Measures for Dispersive Soils in Cut Embankments:

Surface water drainage can erode dispersive soils in embankment cuts. Groundwater discharge may worsen tunnel erosion by accelerating the development of secondary porosity—where subsurface flow progressively enlarges voids within the soil mass, leading to tunnel formation and internal instability. Management considerations:

- **Topsoil Removal Risks:** Earthworks commonly begin with the removal of non-dispersive topsoil, which often acts as a natural protective layer. Once removed, the underlying dispersive soils become highly vulnerable to erosion.
- **Barrier Construction in Cut Slopes:** Where excavation is necessary, erosion can be mitigated through immediate installation of physical barriers:
    - Place a sand layer (sand barrier) over exposed dispersive soil within the cut to interrupt flow paths.
    - Construct an earth retaining wall in front of the cut to contain soil and stabilise the slope face.
- **Timely Implementation:** All erosion control measures must be implemented immediately following excavation to prevent the initiation of tunnel erosion.
- **Use of Retaining Structures:** Low-height retaining walls (e.g., timber sleeper walls) constructed at the base of cut faces can assist in retaining eroding soils and maintaining the effectiveness of sand barriers.

Sand Barriers

To manage dispersive soils exposed in cut slopes, the following layered treatment is recommended:

- **Chemical Stabilisation:** Apply gypsum or hydrated lime at application rates specified in Table 8, based on Emerson Class testing.
- **Sand Layer:** Install a minimum 100 mm thick layer of clean, free-draining sand to act as a barrier and interrupt preferential flow paths.
- **Topsoil Cover:** Place a layer of non-dispersive, free-draining topsoil (such as loam) over the sand barrier to retain the sand in place and facilitate effective revegetation or application of surface treatments.
- **Erosion Control:** Implement surface erosion protection measures as outlined in the Erosion Control section to prevent wash-off and maintain system effectiveness.

Retaining Walls

The following measures are recommended when constructing retaining walls in areas with dispersive soils:

- Retaining walls should be founded on bedrock or non-dispersive soils to reduce the risk of tunnel erosion and structural instability.

- Where walls are constructed in Class 1 dispersive soils, freshly cut surfaces may be treated with gypsum or hydrated lime at application rates specified in Table 8 to reduce erosion potential.

Drainage

Effective drainage is critical in dispersive soil environments to prevent erosion, tunnel formation, and structural damage. The following measures are recommended:

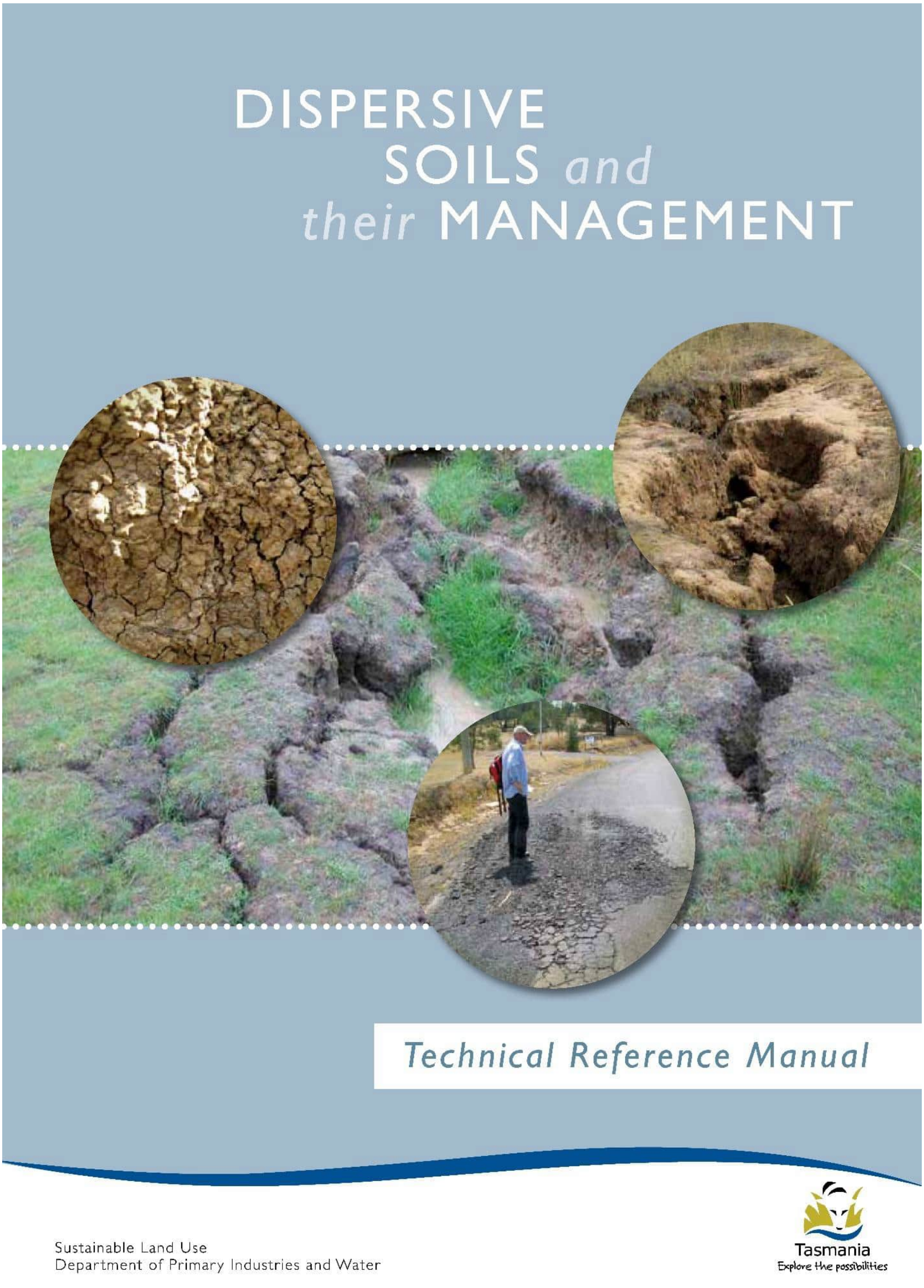
- Divert surface water away from cut and fill slopes to reduce infiltration into dispersive soils.
- A sealed toe drain is essential to prevent water from soaking into freshly cut dispersive soils and migrating through dispersive fill layers beneath paved surfaces.
- For optimal surface drainage over Class 1 soils, install concrete spoon drains in preference to earthen swales to minimise erosion risk.
- Where earthen swale drains are used, stabilise Class 1 soils with gypsum or hydrated lime at a rate adjusted to soil pH. A liner (e.g. 20 mm bentonite layer) beneath topsoil and turf may be used to limit vertical water infiltration.
- Subsurface drains installed in Class 1 soils should be backfilled with a sand mix containing 2% gypsum or hydrated lime to inhibit dispersion and maintain flow pathways.
- Non-perforated drainage pipes should be used to divert water away from identified groundwater discharge points, limiting further erosion.

Filling

The use of dispersive soils as fill presents a significant risk for tunnel erosion, especially where water movement is poorly controlled. The following measures are recommended to reduce risk and ensure long-term stability:

- Dispersive soil used as fill is highly susceptible to tunnel erosion, particularly when exposed to concentrated surface or groundwater flow.
- Groundwater can migrate along the base of and within fill layers, initiating erosion of dispersive materials and undermining overlying structures.
- All proposed filling, especially within or near building footprints, should be carefully managed. This may involve either:
  - Removal of Class 1 dispersive soil from beneath the structure, or
  - Chemical treatment of dispersive fill using gypsum or hydrated lime, applied to the surface of each compacted lift.
  - Preventing water from intercepting dispersive soil by liming the fill or with careful drainage management
- When chemically treating fill:
  - Use 300 mm thick lifts with full application rates as specified in Table 8.
  - For 150 mm thick lifts, halve the application rate accordingly.
- Ensure compaction is achieved close to optimum moisture content, particularly in areas adjacent to footings and structures.
- Paved surfaces over filled areas significantly reduce the risk of tunnel erosion, if cut-off drains are installed to prevent water ingress at the fill base.
- Where feasible, spoon drains and pavement edges at the toe of cut batters should be founded on non-dispersive soil or bedrock to intercept all surface water and eliminate seepage pathways.
- If topsoil is removed prior to filling, and it is classified as slightly dispersive (Class 3) or non-dispersive (Class 4 or higher), it may be replaced with a liner or imported non-dispersive material to protect the dispersive fill beneath.

DPIPWE 2009 Dispersive Soils and their Management. Technical Reference Manual. Sustainable Land Use Department of Primary Industries Water and Environment.



DISPERSIVE SOILS *and* *their* MANAGEMENT

Technical Reference Manual

Sustainable Land Use
Department of Primary Industries and Water

Tasmania
Explore the possibilities

4.1 MANAGEMENT OPTIONS FOR TUNNEL EROSION

Past efforts to repair tunnel erosion in agricultural landscapes have relied on mechanical destruction of the tunnel system by deep ripping, contour furrowing, and contour ripping. Unfortunately many of these techniques either failed or resulted in tunnel re-emergence in an adjacent areas (Floyd 1974, Boucher 1995). The use of these 'agricultural' techniques is inappropriate in peri-urban areas where tunnel repair requires a low incidence of re-failure due to the potential for damage to infrastructure. Experience with the construction of earth dams using dispersive clays, demonstrates that repair and prevention of tunnel erosion in urban and peri-urban environments is best achieved using a combination of,

» Identification and avoidance of dispersive soils.

» Precise re-compaction.

» Chemical amelioration.

» Sand blocks and barriers.

» Topsoil, burial and revegetation.

4.2 IDENTIFICATION AND AVOIDANCE OF DISPERSIVE SOILS

The risk of tunnel erosion resulting from construction activities on dispersive soils can often be reduced or eliminated by identifying and avoiding areas containing dispersive soils. The presence and severity of dispersive soils can vary enormously over short distances (Figure 13). In many instances, large scale (ie 10 x 10 or 20 x 20 meter grid) soil survey and screening of soils for dispersion, (using the Emerson crumb test - section 3, Appendix I) can be used to site dwellings and infrastructure away from dispersive soils. Advice should be sought from a suitably qualified and experienced engineer or soil professional.

Figure 13. The severity (or sodium content) and depth of dispersive subsoils can vary considerably over short distances. (a). At this site highly dispersive subsoils exist meters away from (b) non-dispersive soils.

4.3 COMPACTION

Ritchie (1965) demonstrated that the degree of compaction within the dam wall was the single most important factor in reducing dam failure from piping (tunnel erosion). A high degree of compaction reduces soil permeability, restricting the movement of water and dispersed clay through the soil matrix, which decreases the severity of dispersion and restricts tunnel development (Vacher *et al.* 2004). However, dispersive soils can be difficult to compact as they lose strength rapidly at or above optimum moisture content, and thus may require greater compactive force than other soils (McDonald *et al.* 1981). Bell & Bryun (1997) and Bell and Maud (1994) suggest that dispersive clays must be compacted at a moisture content 1.5 -2% above the optimum moisture content in order to achieve suficent density to prevent piping (Elges 1985).

Construction of structures such as earth dams and footings for buildings with dispersive soils require geotechnical assessment and advice from a qualified and experienced engineer, in order to determine compaction measures such as the optimal moisture content, number of passes, and maximum thickness of compacted layers.

Normal earth moving machinery including bull-dozers, excavators and graders do not provide sufficient compactive force to reduce void spaces or achieve adequate compaction in dispersive soils. A sheepsfoot roller of appropriate weight is usually required to compact dispersive soils. By comparison a D6 dozer applies only 0.6 kg/cm^2 pressure compared to 9.3 kg/cm^2 for a sheepsfoot roller (Sorensen 1995).

4.4 CHEMICAL AMELIORATION

Initiation of tunnel erosion is predominantly a chemical process, so it makes sense to use chemical amelioration strategies when attempting to prevent or repair tunnel erosion in dispersive soils. Despite the widespread use of gypsum and lime to treat sodic soils in agriculture, the use of gypsum and lime to treat tunnel affected areas has been relatively rare (Boucher 1990).

Hydrated lime (calcium hydroxide) has been widely used to prevent piping in earth dams. Rates of application have varied depending on soils and degree of compaction used in construction. Laboratory testing usually indicates that only around 0.5 – 1.0% hydrated lime is required to prevent dispersion, however difficulties with application and mixing necessitate higher rates of application (Moore *et al.* 1985). Moore *et al.* (1985) cite examples of the use of hydrated lime to control piping in earth dams at rates between 0.35% (N.S.W. Australia) and 4% (New Mexico). Elgers (1985), and McElroy (1987) recommend no less than 2% hydrated lime (by weight of the total soil material) to prevent dispersion within dam embankments, while Bell and Maud (1994) suggest that 3% - 4% by mass of hydrated lime should be added to a depth of 0.3m on the upper face of embankments. In alkaline (pH >7.0) soils (most sodic subsoils in Tasmania are neutral or alkaline) the effectiveness of hydrated lime is reduced by the formation of insoluble calcium carbonate (Moore *et al.* 1985), such that gypsum is preferred to hydrated lime. It is important to note that agricultural lime (calcium carbonate) is not a suitable substitute for hydrated lime due to its low solubility (McElroy 1987). Also note that excessive applications of lime may raise soil pH above levels required to sustain vigorous plant growth.

Gypsum (calcium sulphate) is more effective than lime for the treatment of dispersive soils as it increases the electrolyte concentration in the soil solution as well as displacing sodium with calcium within the clay structure (Raine and Loch 2003). Gypsum is less commonly used than hydrated lime in dam construction and other works due to its lower solubility, and higher cost. Elges (1985) recommends that in construction, a minimum of 2% by mass of gypsum be used. Bell and Maud (1994) present a means of calculating the amount of gypsum required to displace excess sodium and bring ESP values within desired limits (normally < 5). Be aware that application of excessive amounts of gypsum may cause soil salinity to temporarily rise beyond the desired level for plant growth.

NOTE:

- Use of gypsum in Tasmania is covered under the Fertiliser Act 1993, which has established the allowable limit for cadmium and lead at 10 mg/kg and 5 mg/kg for mercury.
- Gypsum is usually imported into Tasmania from Victoria or South Australia, which have different standards for allowable heavy metal content.
- Purchasers of gypsum should check with suppliers to ensure that gypsum imported into Tasmania is compliant with current regulations.

Alum (aluminium sulphate) has been effectively used to prevent dam failure and protect embankments from erosion. Application rates are not well established. Limited data suggests mixtures of 0.6 – 1.0% (25% solution of aluminium sulphate) (Bell and Bruyn 1997, McElroy 1987) to 1.5% (Ouhadi, and Goodarzi 2006) of the total dry weight of soil may be appropriate. Alum is however highly acidic (pH 4-5), and thus alum treated soils will need to be capped with topsoil in order to establish vegetation (Ryker 1987). Soil testing is required to establish appropriate application rates for Tasmanian soils.

Long chain polyacrylamides have been shown to increase aggregate stability, reduce dispersion and maintain infiltration rates in dispersive soils (Levy *et al.* 1992, Raine and Loch 2003). However the effect is highly variable between various polyacrylamide products and the chemical and physical properties of the soil. The benefit of polyacrylamides is generally short due to their rapid degradation (Raine and Loch 2003). Further advice and laboratory testing should be conducted before using polyacrylamides to protect earth dams from piping failure.

Note that appropriate application rates for gypsum, hydrated lime, alum and polyacrylamides have not been established for dispersive soils in Tasmania. Extensive laboratory assessment of materials used for the construction of dams or embankments is required before locally relevant 'rules of thumb' can be established for the use of these products.

4.5 SAND BLOCKS AND SAND BARRIERS

Sand filters were first developed to prevent piping in earth dams. Sand filters prevent dam failure by trapping entrained sand and silt, blocking the exit of the tunnel and preventing further tunnel development (Sherard *et al.* 1977). Following the work of Sherard *et al.* (1977), Richley (1992 and 2000) developed the use of sand blocks to prevent tunnel erosion during installation of an optical fibre cable in highly dispersive soils near Campania, Tasmania. The sand blocks work slightly differently to the sand filters in that they allow the free water to rise to the surface through the sand. The use of sand blocks has recently been modified by Hardie *et al.*, (2007) to prevent re-initiation of tunnel erosion along an optical fibre cable near Dunalley. Modifications to the original technique developed by Richley (1992 and 2000) include (Figure 14 &15);

- Upslope curved extremities to prevent the structure from being by-passed.
- Geotextile on the downslope wall to prevent collapse or removal of sand following settlement or erosion.
- Application of gypsum (around 5% by weight) to ensure infiltrating water contains sufficiently electrolyte to prevent further dispersion.
- Earth mound upslope of the structure to prevent run-on entering the sand blocks.

Figure 15. (a) Installation of sandblock perpendicular to a service trench. Note securing of geotextile to the optical fibre cable to prevent water flowing past the sand block. (b) Sandblock before final topsoiling.

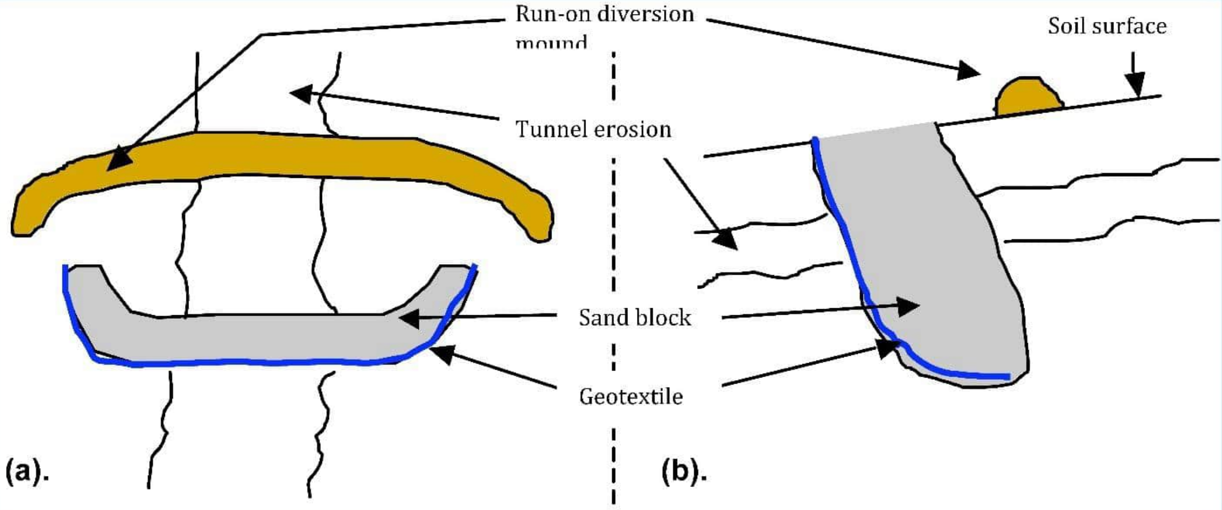


Figure 14. Modified sand block design. (a) plan view, (b) cross section view. The depth of the sand block is determined by the depth of dispersive soils or tunnel erosion. The span length of the structure is determined by the width of the tunnelling.

4.6 USE OF TOPSOIL / BURIAL AND REVEGETATION

Topsoil or burial of exposed dispersive soils reduces the likelihood of subsoil dispersion and initiation of tunnel erosion by;

- Providing a source of salt to increase the electrolyte content of infiltration water.
- Preventing desiccation and subsoil cracking.
- Promoting even infiltration.
- Providing a protective cover from raindrop impact.
- Providing a suitable medium for revegetation.

Topsoil minimises the interaction between water and dispersive clays by providing both a physical and chemical barrier. Topsoil also reduces soil desiccation and development of surface cracks (Sorensen 1995). It is suggested that exposed dispersive subsoils be covered with at least 150mm of non dispersive topsoil and sown with an appropriate mix of grass species. In some cases it will be necessary to protect the topsoil from erosion with 'jute' cloth or similar product.

The suitability of planting trees in tunnel affected areas is influenced by the amount of annual rainfall and frequency of soil cracking resulting from desiccation. Boucher (1995) recommends the preferred option for revegetation of reclaimed tunnel erosion is a widely spaced tree cover in association with a combination of perennial and annual pastures, rather than a dense stand of trees or pasture alone. Experience in Tasmania suggests that in low rainfall areas, or areas in which existing trees or shrubs cause soil drying and cracking, the preferred option for revegetating tunnel affected land is a dense healthy pasture. In high rainfall areas, dense plantings of trees have been successfully used to repair or stabilise tunnel erosion for example Colclough (1973) successfully used Pinus radiata to stabilise tunnel-gully affected land in a moderate rainfall area near Tea Tree, Tasmania.

5.0 ACTIVITIES THAT INCREASE THE RISK OF EROSION ON DISPERSIVE SOILS

ACTIVITIES THAT INCREASE RISK OF INITIATING TUNNEL EROSION, INCLUDE;

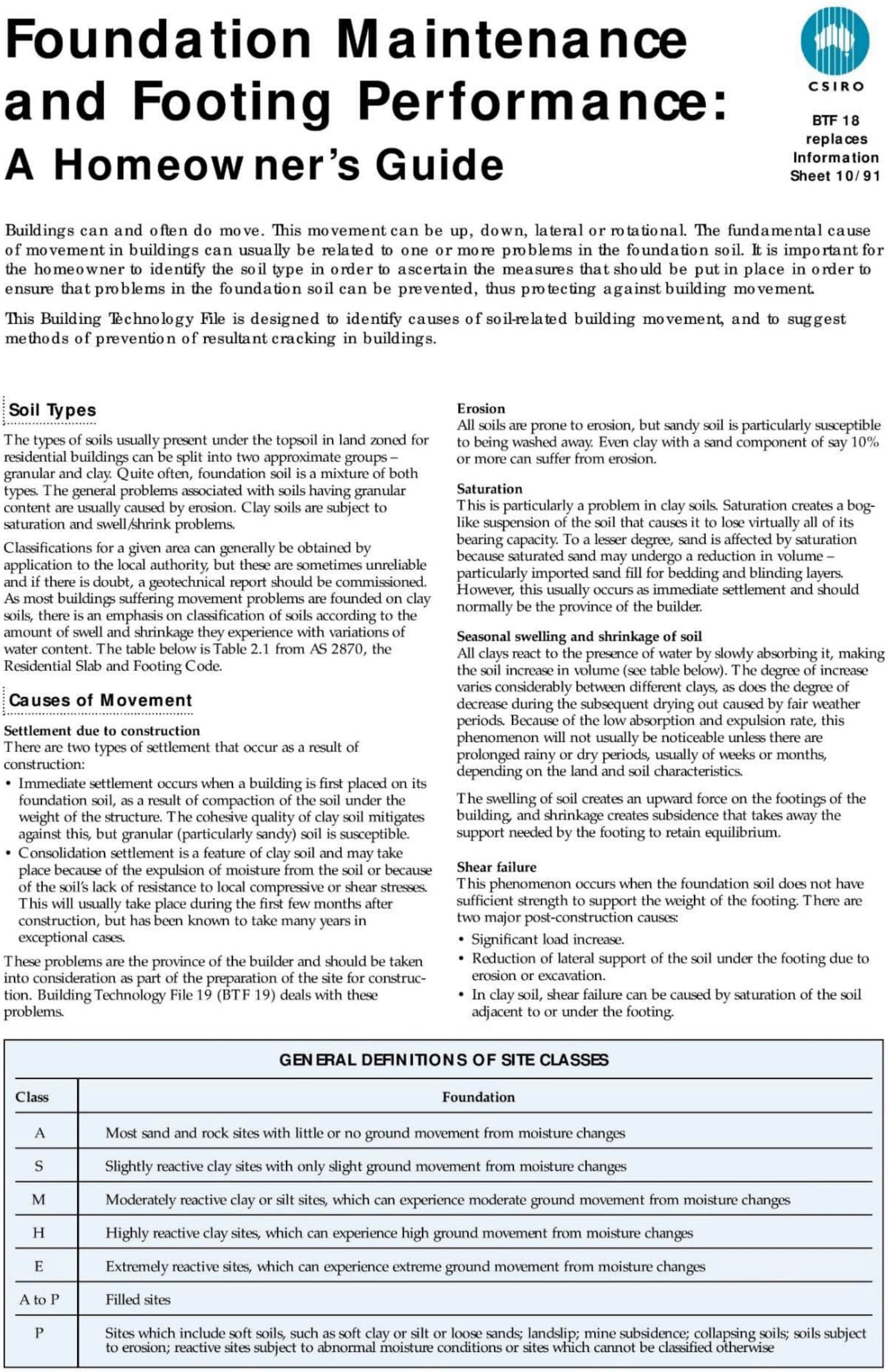
- Removal of topsoil.
- Soil excavation or expose of subsoils to rainfall.
- Supply of services via trenches.
- Construction of roads and culverts in dispersive subsoils.
- Installation of sewage and grey water disposal systems in dispersive subsoils.
- Dam construction from dispersive soils.

OPTIONS FOR REDUCING THE RISK OF TUNNEL EROSION DURING CONSTRUCTION AND DEVELOPMENT WORKS ON DISPERSIVE SOILS INCLUDE,

- Where possible do not remove or disturb topsoil or vegetation.
- Ensure that dispersive subsoils are covered with an adequate layer of topsoil.
- Avoid construction techniques that result in exposure of dispersive subsoils.
- Use alternatives to 'cut and fill' construction such as pier and post foundations.
- Where possible avoid the use of trenches for the supply of services ie water & power.
- If trenches must be used, ensure that repacked spoil is properly compacted, treated with gypsum and topsoiled.
- Consider alternative trenching techniques that do not expose dispersive subsoils.
- Ensure runoff from hard areas is not discharged into areas with dispersive soils.
- If necessary create safe areas for discharge of runoff.
- If possible do not excavate culverts and drains in dispersive soils.
- Consider carting non-sodic soil to create appropriate road surfaces and drains without the need for excavation.
- Ensure that culverts and drains excavated into dispersive subsoils are capped with non-dispersive clays mixed with gypsum, topsoiled and vegetated.
- Avoid use of septic trench waste disposal systems; consult your local council about the use of alternative above ground treatment systems.
- Where possible do not construct dams with dispersive soils, or in areas containing dispersive soils.
- If dams are to be constructed from dispersive clays, ensure you consult an experienced, qualified civil engineer to conduct soil tests before commencing construction.
- Construction of dams from dispersive soils is usually possible, using one or a combination of: precise compaction, chemical amelioration, capping with non-dispersive clays, sand filters and adequate topsoiling.

With all forms of construction on dispersive soils, ensure you obtain advice and support from a suitably experienced and qualified engineer or soil professional before commencing work.

Appendix H Foundation Maintenance & Footing Performance (CSIRO)



Foundation Maintenance and Footing Performance:

A Homeowner's Guide

CSIRO

BTF 18
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; landslip; 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 perpends).

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.

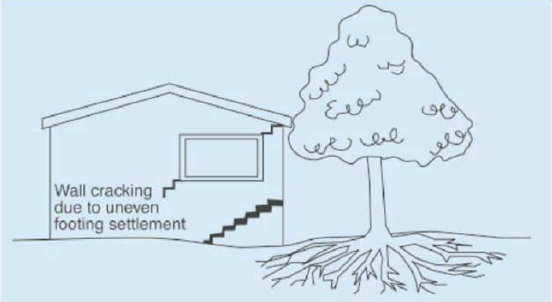
Seasonal swelling/shrinkage in clay

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.

Trees can cause shrinkage and damage



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 watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

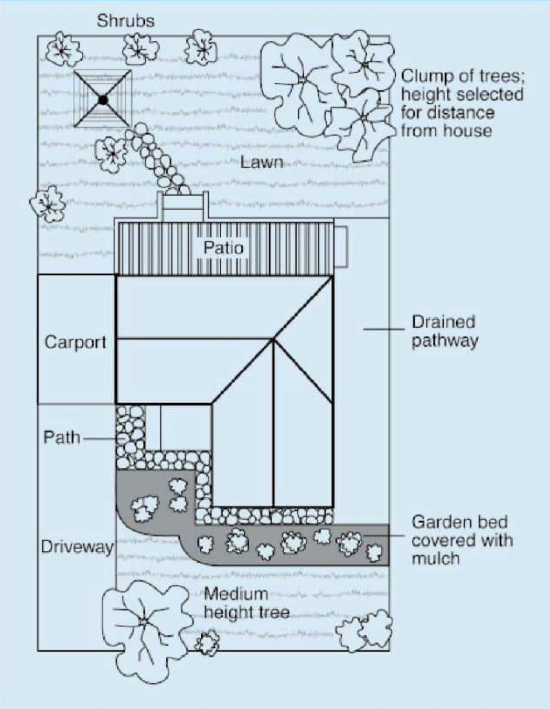
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. 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:

- 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 create 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 Diagnosis.

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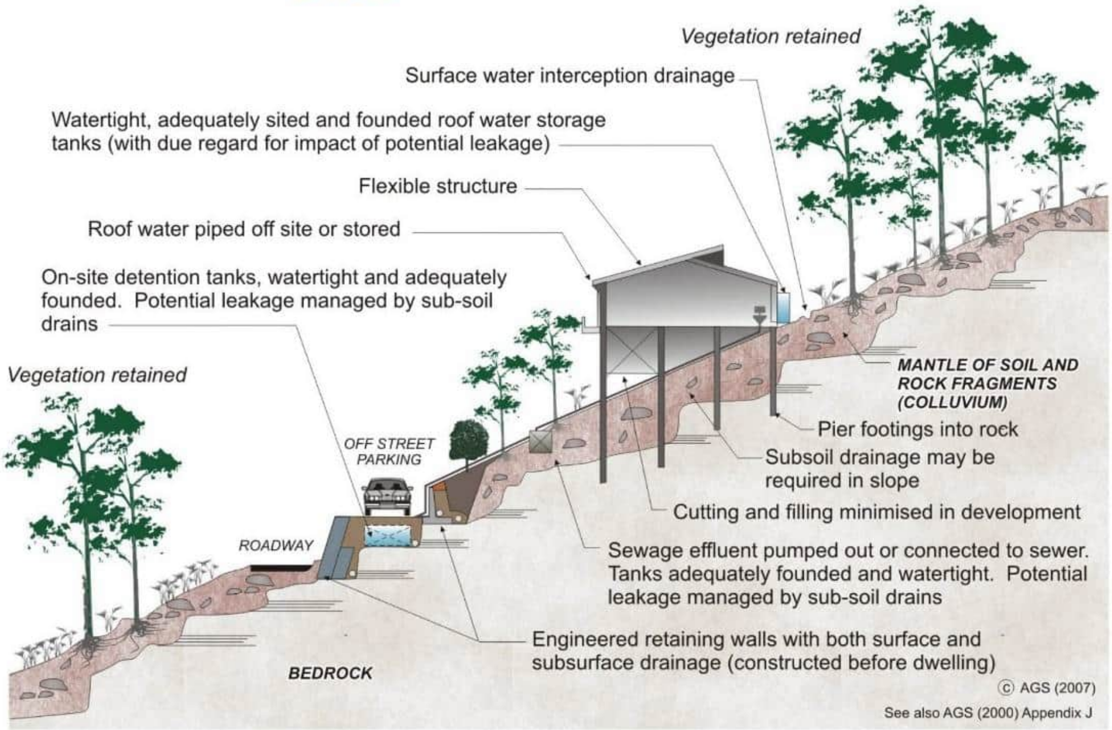
Appendix I Examples of Good Hillside Construction (AGS LRM LR8)

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.



EXAMPLES OF **GOOD** HILLSIDE CONSTRUCTION PRACTICE

© AGS (2007)
See also AGS (2000) Appendix J

WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

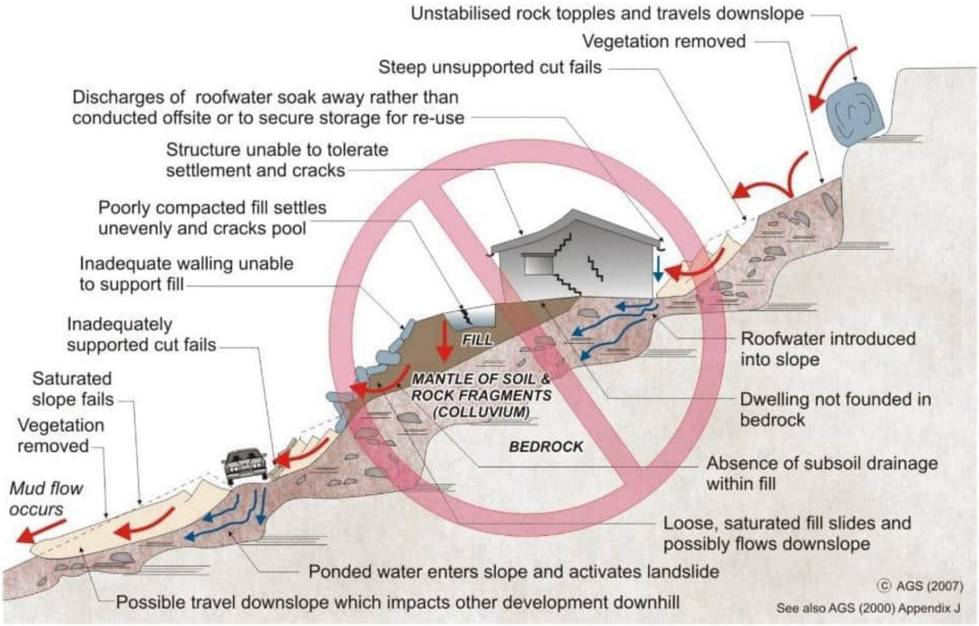
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



© AGS (2007)

See also AGS (2000) Appendix J

WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

Form **55**

To: Phillip J. & Jane A. Sargent — *Owner /Agent*

5 Cherry Court — *Address*

Forcett Sorell TAS 7173 — *Suburb/postcode*

Qualified person details:

Qualified person: Kris Taylor

Address: 445 Macquarie Street
Hobart 7004

Phone No: 0476 595 889

Fax No:

Licence No: NA

Email address: office@envirotechtas.com.au

Qualifications and Insurance details: Bachelor of Science with Honours in Geology. Loyd's Underwriting $2,000,000.
Soil and rock mechanics.
Soil and rock testing.

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Geo-technical Reports

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work: Landslip Hazard Report

Address: 5 Cherry Court
Forcett 7173

Lot No: 13

Certificate of title No: 140818/13

The assessable item related to this certificate: Landslip Hazard Report prepared by a geotechnical practitioner with experience and competence in the preparation of landslip hazard reports

(description of the assessable item being certified)
Assessable item includes –

- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Geotechnical

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable items, at any stage, as part of – *(tick one)*

● building work, plumbing work or plumbing installation or demolition work

OR

○ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents: Enviro-Tech Consultants Pty. Ltd. 2025. Landslip Hazard Assessment Report for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 27/05/2025.

Relevant calculations:

References:
Directors Determination - Landslip Hazard Areas Areas
Extract from Australian Geomechanics Journal and News of the Australian Geomechanics Society Volume 42 No 1 March 2007. Landslide Risk Management
Building on Tasmanian Landscapes: Guidance for Geotechnical
Reporting in Tasmania (Mineral Resources Tasmania, 2018)

Substance of Certificate: (what it is that is being certified)

Scope and/or Limitations

Tasmanian Planning Scheme – State Planning Provisions: To ensure that a tolerable risk can be achieved and maintained for the type, scale and intensity and intended life of use or development on land within a landslip hazard area.

Directors determinatiopn: lowest level of likely risk from landslip to secure the benefits of a use or development in a landslip hazard area, and which can be managed through routine regulatory measures or by specific hazard management measures for the intended life of each use or development.

I certify the matters described in this certificate.

Qualified person:

Signed:

Certificate No:

Date: 27/05/2025

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

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To: Phillip J. & Jane A. Sargent — *Owner /Agent*
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Licence No: NA

Email address: office@envirotechtas.com.au

Qualifications and Insurance details: Bachelor of Science with Honours in Geology. Lloyd's Underwriters: soil and rock mechanics, soil and rock testing

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Geo-technical Reports

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work: Geotechnical Site Investigation

Address: 5 Cherry Court
Forcett 7173

Lot No: 13

Certificate of title No: 140818/13

The assessable item related to this certificate: Geotechnical Site Investigation written in accordance with AS1726 by a geotechncial practitioner with appropriate experience, training and qualifications.*

(description of the assessable item being certified)
Assessable item includes –
- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Geotechnical including landslide risk assessment in accordance with "Practice Note Guidelines for Landslide Risk Management 2007" published by the Australian Geomechanics Society.*

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable items, at any stage, as part of – *(tick one)*

● building work, plumbing work or plumbing installation or demolition work

OR

○ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents: Enviro-Tech Consultants Pty. Ltd. 2025. Geotechnical Site Investigation for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 27/05/2025.

Relevant calculations:

References: - AS1726-2017 Geotechnical Site Investigations

Substance of Certificate: *(what it is that is being certified)*

- An assessment of:
- Foundations for proposed building structures.*

Scope and/or Limitations

The Geotechnical Site Investigation applies to the Site and Project Area as inspected and does not account for future alteration to foundation conditions as a result of earth works, drainage condition changes or variations in site maintenance which are not included within the provided plans.

***This report contains soil classification information prepared in accordance with AS2870 as well as AS2870 extracts which may be used as general guidance for plumbing design. The hydraulic designer is to use their own judgment in the application of this information and this report must be read in in conjunction with hydraulic plans for the proposed development.**

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:			27/05/2025

MC Planners Ref: 25051

3 September 2025

General Manager
Sorell Council
Via email – sorell.council@sorell.tas.gov.au

Attention: Shane Wells

Dear Shane

FURTHER INFORMATION REQUEST - 7.2025.10.1 - 5 CHERRY COURT, FORCETT

Thank you for your Request for Further Information under Section 54 of the *Land Use Planning and Approvals Act 1993* (LUPAA) dated 18 July 2025.

In supporting this response, the following reports and documents are included:

- Attachment 1 – Final Geotechnical Site Investigation – including Form 55 Certificates for Landslip Hazard, Geotechnical Site Investigation and Wastewater Management
- Attachment 2 - On-Site Wastewater Report

1. Environmental Health

> 1. Demonstrate Compliance with Clause 11.5.3 P2 of the Tasmanian Planning Scheme – Sorell 2022 by providing a:
>
>   a) Site & Soil Evaluation Report for lot 2 in accordance with AS/NZS 1547-2012 detailing the site and soil conditions and the suitability for onsite wastewater disposal. The Report should be prepared by a suitably qualified person such as an Engineer, Geologist, Environmental Health Officer or a Soil Scientist. (please note the Geotechnical Site Investigation prepared by Envirotech could be updated to include this information); and
>   b) plan to indicate the location of a suitable future wastewater land application area.

Response: Please see Attachment 1 and Attachment 2, which provide an updated Geotechnical Site Investigation, Form 55 Certificates and an On-Site Wastewater Report detailing the suitability of the site for onsite wastewater disposal. Attachment 2 includes a plan showing the location of a future wastewater land application area.

We trust this meets the requirements of the request. If Council requires any further information or clarification with respect to this application, please contact us on planning@mcplanners.com.au or mobile 0422505146.

Yours faithfully

MC PLANNERS

Angela Dionysopoulos

PLANNER

ATTACHMENT 1

Finalised Geotechnical Site Investigation

Form 55 Certificates – Landslip Hazard, Geotechnical Site Investigation and Wastewater Management

ATTACHMENT 2

On-Site Wastewater Report

ON-SITE WASTEWATER REPORT

Phillip & Jane Sargent

5 Cherry Court – Forcett

Fysh Design Reference: ***CKD-HYD-315***

Date:28/08/2025

For Development Approval / Planning

Preliminary – Not for issue

TABLE OF CONTENTS

1. INTRODUCTION AND SCOPE OF ENGAGEMENT

Fysh Design have been engaged to provide concept site servicing design for on-site wastewater system for the proposed subdivision lot of 5 Cherry Court, Forcett

It is proposed the new lot will require its own onsite wastewater system due to no TasWater servicing in the area

The following report outlines the methodology and assumptions used for the proposed **concept** of the wastewater system

Please note: This report only outlines very conceptual and the possibility that a suitable wastewater system will fit on the site. This is not assessment for detailed design or construction purposes and only to be viewed for subdivision assessment purposes.

It will be the responsibility of the future lot owner to seek their own soil testing and wastewater design solution with their designed dwelling and layout of the site.

2. WASTEWATER DESIGN

Site Conditions

Client: Phillip & Jane Sargent

Address: 5 Cherry Court, Forcett

Site Area – Approx 1ha (Lot 2)

Building Type – Residential

Drainage lines & Water Courses – Free drainage with overland flow run off directly from the northeast

Vegetation – Mixed native grass species, gum trees

Rainfall in the previous 7 days – 51.1mm

Average slope approx. Gentle slope of 15% (8 degrees) to the Southwest within the proposed land application area

Domestic water supply – Rainwater Tank Supply

Background Information

Mapped Geology – Mineral Resources Tasmania 1:250,000

Rock Type – Sandstone

Soil Depth – 2.3m to clayey sandy silt refusal

Landslide Zoning – Low Landslip Hazard Zone

Local Rainfall Data – Annual rainfall approx. 495mm (Hobart Airport Point Station)

Local Services – Onsite wastewater disposal, Rainwater tank water supply

A site and soil report were conducted by Enviro-Tech Soil Consultants on the 27th of May 2025 (see attached with compiled documents) Figure 1 below displays the soil profile and properties analysed by Enviro-Tech Soil Consultants.

Test auger holes were completed within the new lot to identify the profile and variation in soil materials on site. Each test hole shown was specifically targeted for the assumed area the wastewater land application would be located and classified in accordance with AS1547.2012 (refer to figure 04)

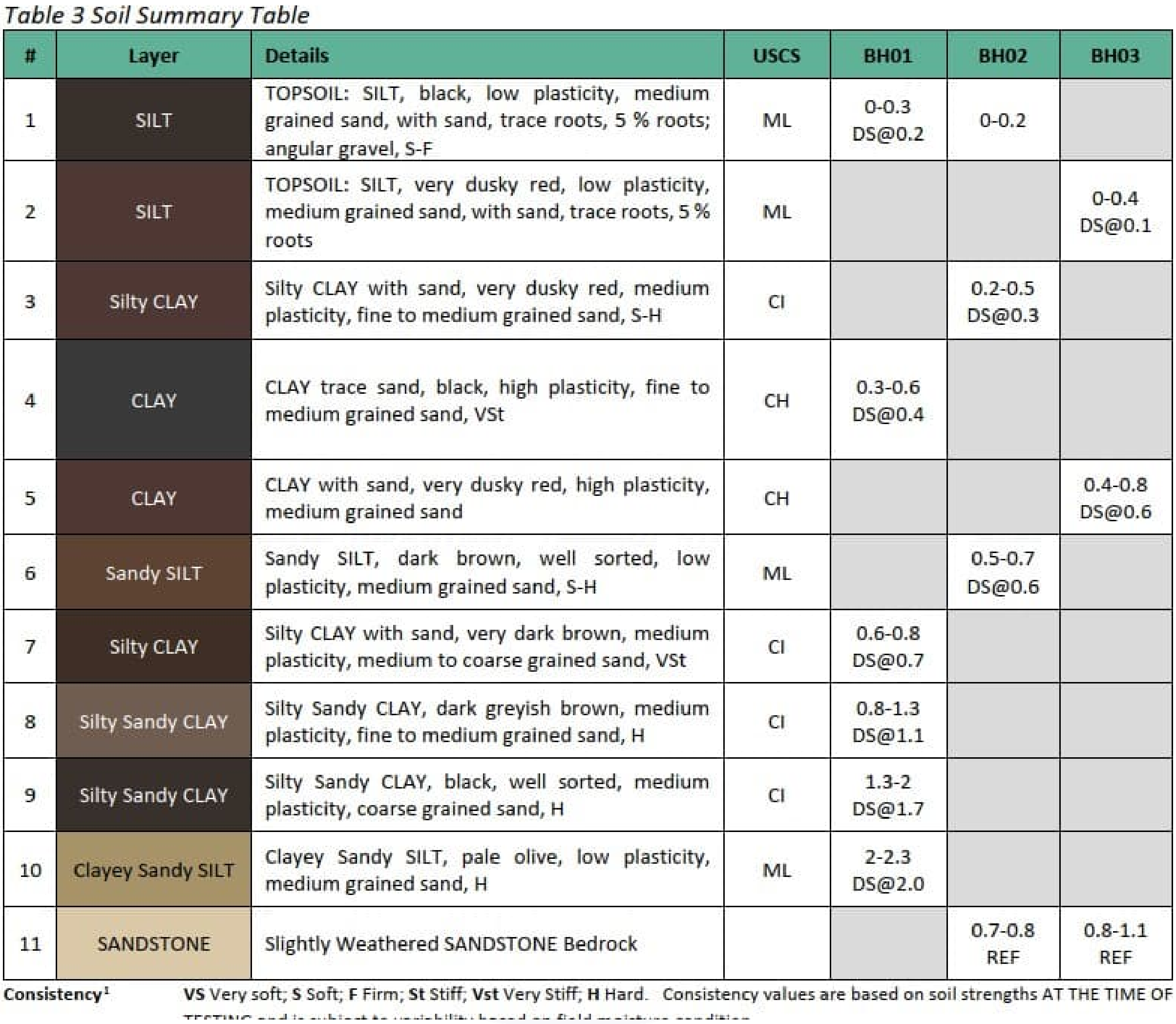
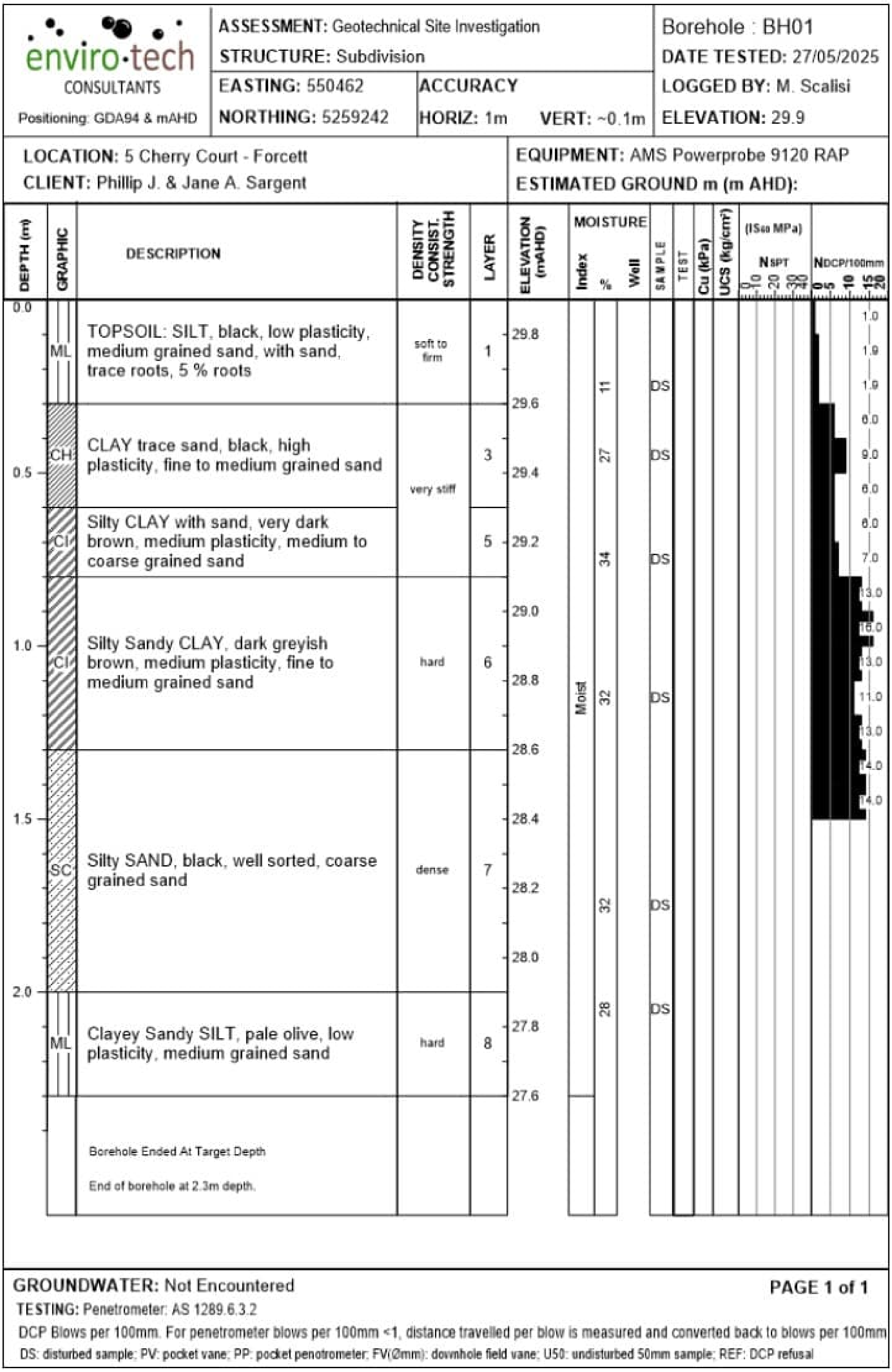


Table 3 Soil Summary Table

#	Layer	Details	USCS	BH01	BH02	BH03
1	SILT	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots; angular gravel, S-F	ML	0-0.3 DS@0.2	0-0.2	
2	SILT	TOPSOIL: SILT, very dusky red, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	ML			0-0.4 DS@0.1
3	Silty CLAY	Silty CLAY with sand, very dusky red, medium plasticity, fine to medium grained sand, S-H	CI		0.2-0.5 DS@0.3	
4	CLAY	CLAY trace sand, black, high plasticity, fine to medium grained sand, VSt	CH	0.3-0.6 DS@0.4		
5	CLAY	CLAY with sand, very dusky red, high plasticity, medium grained sand	CH			0.4-0.8 DS@0.6
6	Sandy SILT	Sandy SILT, dark brown, well sorted, low plasticity, medium grained sand, S-H	ML		0.5-0.7 DS@0.6	
7	Silty CLAY	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand, VSt	CI	0.6-0.8 DS@0.7		
8	Silty Sandy CLAY	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand, H	CI	0.8-1.3 DS@1.1		
9	Silty Sandy CLAY	Silty Sandy CLAY, black, well sorted, medium plasticity, coarse grained sand, H	CI	1.3-2 DS@1.7		
10	Clayey Sandy SILT	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand, H	ML	2-2.3 DS@2.0		
11	SANDSTONE	Slightly Weathered SANDSTONE Bedrock			0.7-0.8 REF	0.8-1.1 REF

Consistency[1] **VS** Very soft; **S** Soft; **F** Firm; **St** Stiff; **Vst** Very Stiff; **H** Hard. Consistency values are based on soil strengths AT THE TIME OF TESTING and is subject to variability based on field moisture condition

Figure 1, Site Overall Soil Profiles



enviro·tech CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation

STRUCTURE: Subdivision

EASTING: 550462

NORTHING: 5259242

ACCURACY

HORIZ: 1m **VERT:** ~0.1m

Borehole : BH01

DATE TESTED: 27/05/2025

LOGGED BY: M. Scalisi

ELEVATION: 29.9

LOCATION: 5 Cherry Court - Forcett

CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: AMS Powerprobe 9120 RAP

ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS₅₀ MPa) NSPT	NDCP/100mm
0.0	ML	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	soft to firm	1	29.8		11		DS					
	CH	CLAY trace sand, black, high plasticity, fine to medium grained sand	very stiff	3	29.6 29.4		27		DS					
0.5	CI	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand		5	29.2		34		DS					
1.0	CI	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand	hard	6	29.0 28.8	Moist	32		DS					
1.5	SC	Silty SAND, black, well sorted, coarse grained sand	dense	7	28.6 28.4 28.2 28.0		32		DS					
2.0	ML	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand	hard	8	27.8 27.6		28		DS					
		Borehole Ended At Target Depth End of borehole at 2.3m depth.												

GROUNDWATER: Not Encountered

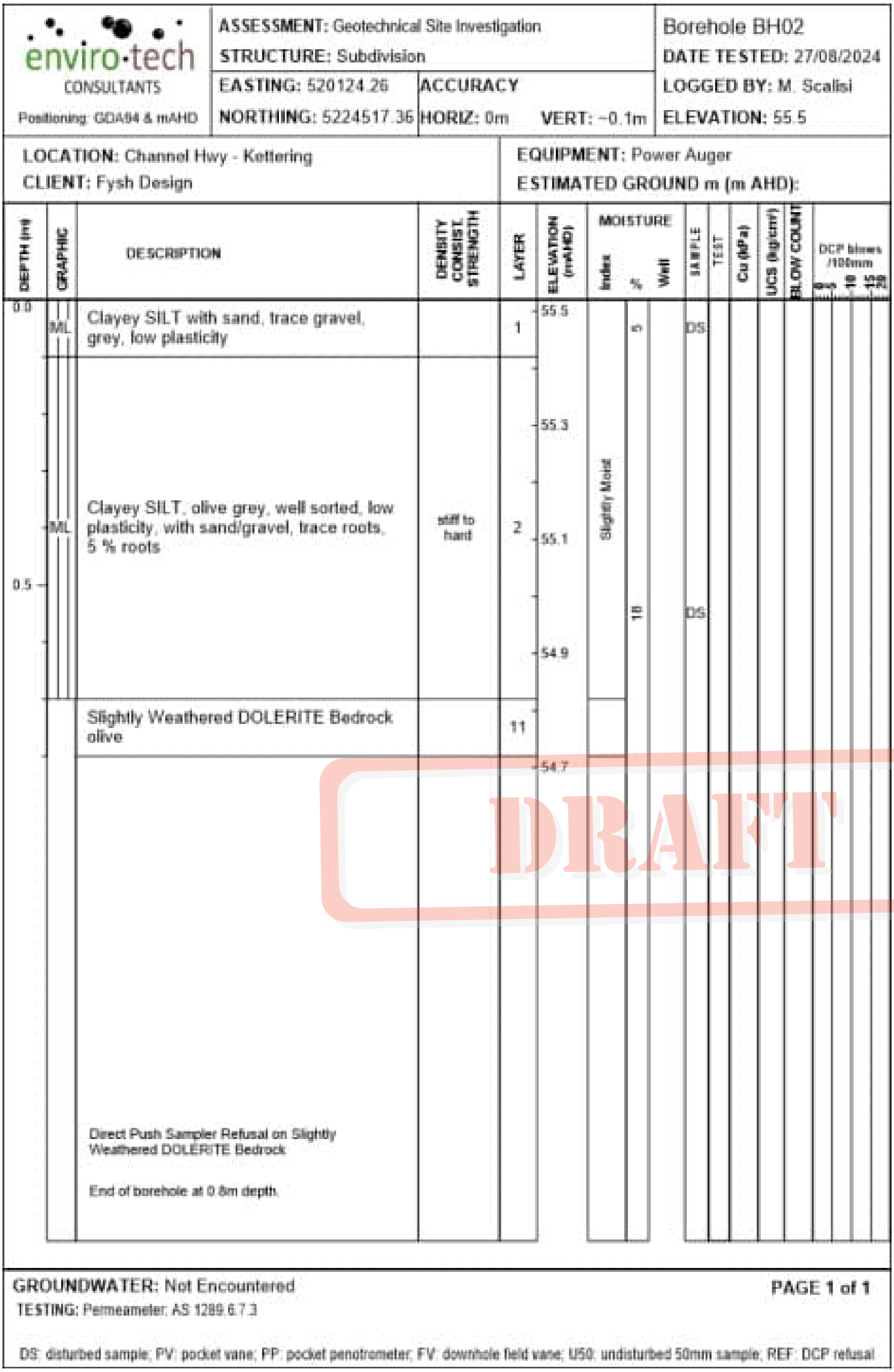
PAGE 1 of 1

TESTING: Penetrometer: AS 1289.6.3.2

DCP Blows per 100mm. For penetrometer blows per 100mm <1, distance travelled per blow is measured and converted back to blows per 100mm

DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV(Ømm): downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

Figure 2, Bore Hole 01 Soil Profile data



enviro·tech CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation

STRUCTURE: Subdivision

EASTING: 520124.26

NORTHING: 5224517.36

ACCURACY

HORIZ: 0m **VERT:** −0.1m

Borehole BH02

DATE TESTED: 27/08/2024

LOGGED BY: M. Scalisi

ELEVATION: 55.5

LOCATION: Channel Hwy - Kettering

CLIENT: Fysh Design

EQUIPMENT: Power Auger

ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	BLOW COUNT	DCP blows /100mm
0.0	ML	Clayey SILT with sand, trace gravel, grey, low plasticity		1	55.5		5		DS					
	ML	Clayey SILT, olive grey, well sorted, low plasticity, with sand/gravel, trace roots, 5 % roots	stiff to hard	2	55.3 55.1	Slightly Moist								
0.5					54.9		18		DS					
		Slightly Weathered DOLERITE Bedrock olive		11	54.7									

Direct Push Sampler Refusal on Slightly Weathered DOLERITE Bedrock

End of borehole at 0.8m depth.

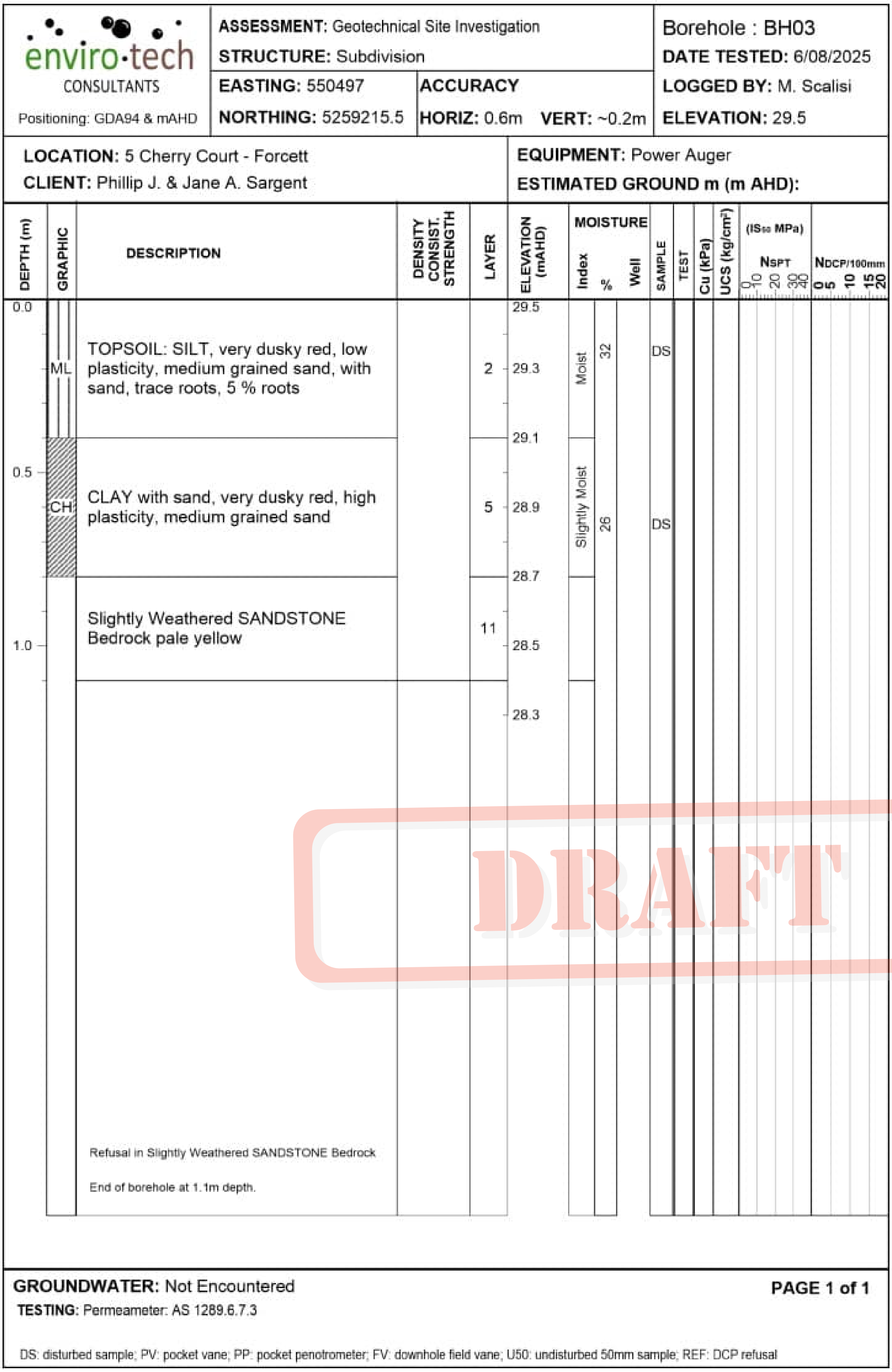
GROUNDWATER: Not Encountered

TESTING: Permeameter: AS 1289.6.7.3

PAGE 1 of 1

DS: disturbed sample; PV: pocket vane; PP: pocket penetrometer; FV: downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

Figure 3, Bore Hole 02 Soil Profile data



enviro·tech CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation
STRUCTURE: Subdivision
EASTING: 550497
NORTHING: 5259215.5
ACCURACY
HORIZ: 0.6m **VERT:** ~0.2m

Borehole : BH03
DATE TESTED: 6/08/2025
LOGGED BY: M. Scalisi
ELEVATION: 29.5

LOCATION: 5 Cherry Court - Forcett
CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: Power Auger
ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS_{50} MPa) N_{SPT} 0 10 20 30 40	$N_{DCP/100mm}$ 0 5 10 15 20
0.0	ML	TOPSOIL: SILT, very dusky red, low plasticity, medium grained sand, with sand, trace roots, 5 % roots		2	29.5 29.3	Moist	32		DS					
0.5	CH	CLAY with sand, very dusky red, high plasticity, medium grained sand		5	29.1 28.9	Slightly Moist	26		DS					
1.0		Slightly Weathered SANDSTONE Bedrock pale yellow		11	28.7 28.5									
		Refusal in Slightly Weathered SANDSTONE Bedrock End of borehole at 1.1m depth.			28.3									

GROUNDWATER: Not Encountered

PAGE 1 of 1

TESTING: Permeameter: AS 1289.6.7.3

DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV: downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

Figure 4, Bore Hole 03 Soil Profile data

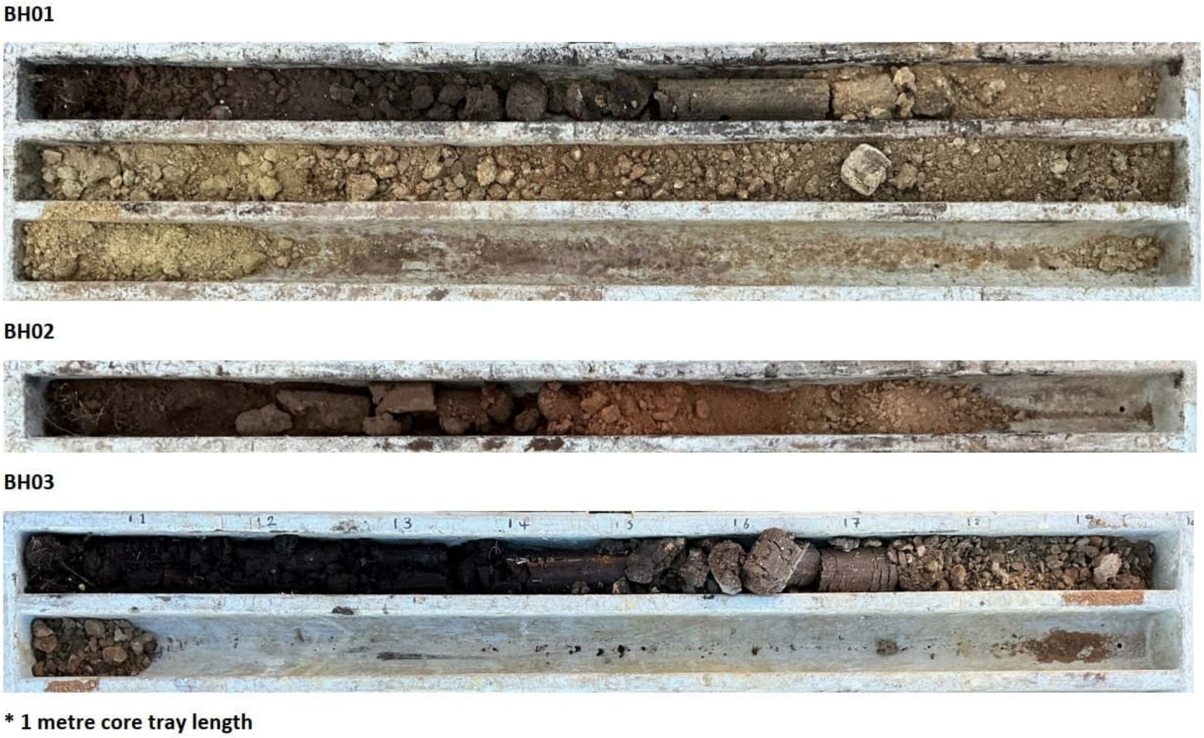
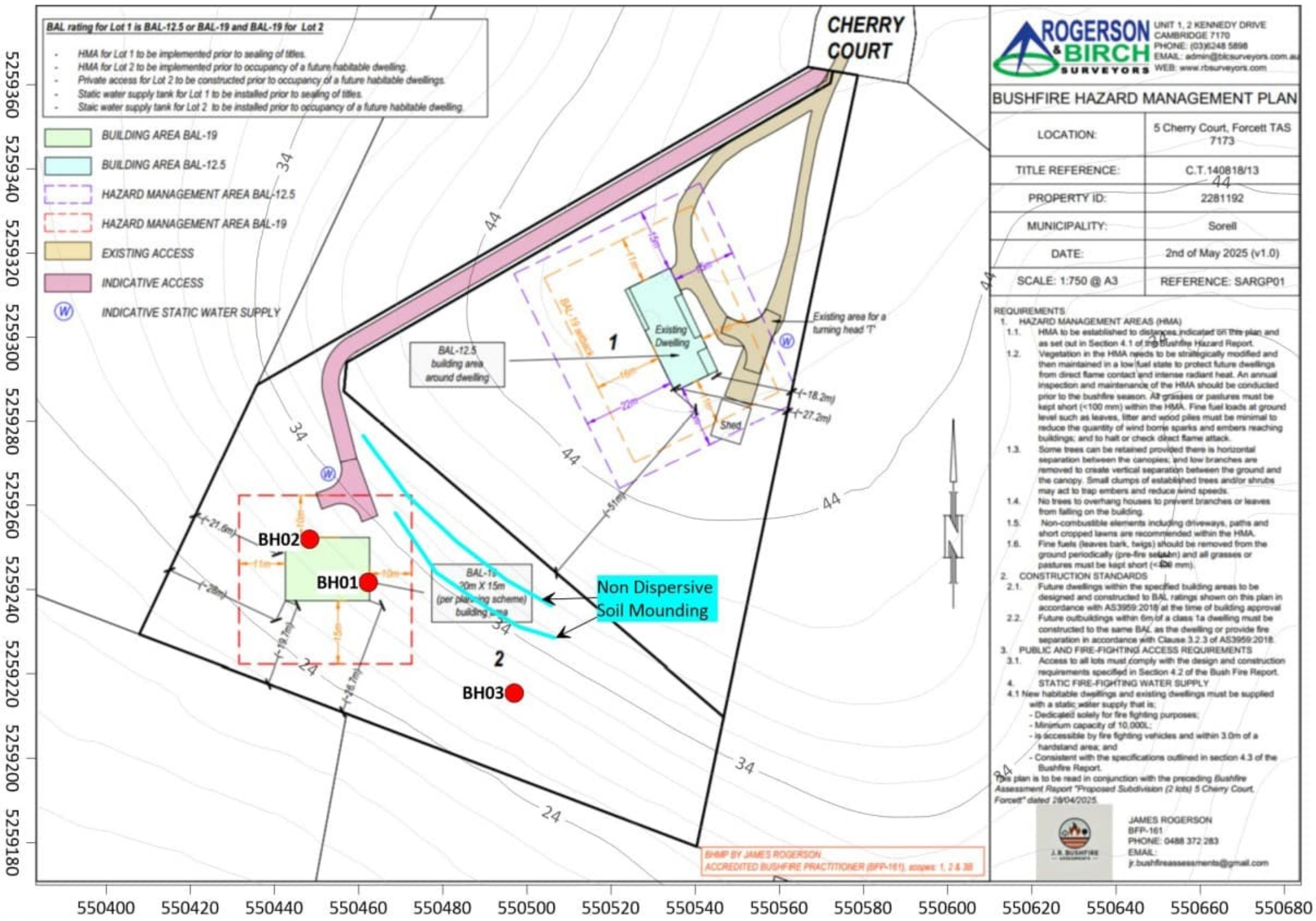


Figure 5 – Bore Hole Soil Samples



BAL rating for Lot 1 is BAL-12.5 or BAL-19 and BAL-19 for Lot 2

- HMA for Lot 1 to be implemented prior to sealing of titles.
- HMA for Lot 2 to be implemented prior to occupancy of a future habitable dwelling.
- Private access for Lot 2 to be constructed prior to occupancy of a future habitable dwellings.
- Static water supply tank for Lot 1 to be installed prior to sealing of titles.
- Staic water supply tank for Lot 2 to be installed prior to occupancy of a future habitable dwelling.

REQUIREMENTS

1. HAZARD MANAGEMENT AREAS (HMA)
   - 1.1. HMA to be established to distances indicated on this plan and as set out in Section 4.1 of the Bushfire Hazard Report.
   - 1.2. Vegetation in the HMA needs to be strategically modified and then maintained in a low fuel state to protect future dwellings from direct flame contact and intense radiant heat. An annual inspection and maintenance of the HMA should be conducted prior to the bushfire season. All grasses or pastures must be kept short (<100 mm) within the HMA. Fine fuel loads at ground level such as leaves, litter and wood piles must be minimal to reduce the quantity of wind borne sparks and embers reaching buildings; and to halt or check direct flame attack.
   - 1.3. Some trees can be retained provided there is horizontal separation between the canopies; and low branches are removed to create vertical separation between the ground and the canopy. Small clumps of established trees and/or shrubs may act to trap embers and reduce wind speeds.
   - 1.4. No trees to overhang houses to prevent branches or leaves from falling on the building.
   - 1.5. Non-combustible elements including driveways, paths and short cropped lawns are recommended within the HMA.
   - 1.6. Fine fuels (leaves bark, twigs) should be removed from the ground periodically (pre-fire season) and all grasses or pastures must be kept short (<100 mm).
2. CONSTRUCTION STANDARDS
   - 2.1. Future dwellings within the specified building areas to be designed and constructed to BAL ratings shown on this plan in accordance with AS3959:2018 at the time of building approval
   - 2.2. Future outbuildings within 6m of a class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.
3. PUBLIC AND FIRE-FIGHTING ACCESS REQUIREMENTS
   - 3.1. Access to all lots must comply with the design and construction requirements specified in Section 4.2 of the Bush Fire Report.
4. STATIC FIRE-FIGHTING WATER SUPPLY
   - 4.1 New habitable dwellings and existing dwellings must be supplied with a static water supply that is;
     - Dedicated solely for fire fighting purposes;
     - Minimum capacity of 10,000L;
     - is accessible by fire fighting vehicles and within 3.0m of a hardstand area; and
     - Consistent with the specifications outlined in section 4.3 of the Bushfire Report.

This plan is to be read in conjunction with the preceding *Bushfire Assessment Report "Proposed Subdivision (2 lots) 5 Cherry Court, Forcett" dated 28/04/2025.*

JAMES ROGERSON
BFP-161
PHONE: 0488 372 283
EMAIL:
jr.bushfireassessments@gmail.com

Figure 2 Site Borehole Locations

Figure 6 – Bore Hole Locations

Wastewater Loading Certificate for system design (As per Clause 7.4.2(d) of AS1547/2012) Off assumed loading new dwelling for new proposed lot

System Capacity – 6 people @ 120 L/Person/Day (rainwater tank supply)

Summary of Design Criteria – DIR (Drip Irrigation Rate) 5.0/m2/day

Q = Design Flow = 720L/Day

Q/ (DIRxLine separation) (1m)

720 / (5.0x1.0) = 150sqm (Minimum)

This calculation is based on the top 250mm layer of soil tested is imported loam or topsoil with below natural layer sandy loams **(Category 2)**

Water Supply – Rainwater Tank supply

Reserve area use - (unused paddock area) (not required)

Consequences of changes in loading capacity –1500L AWTS system and sub surface irrigation area to have some redundancy for unforeseen loads for short periods of time, permanent changes or increases of loads should be consulted with Fysh Design for advice.

Consequences of overloading the system – 1500L AWTS system and sub surface irrigation area to have some redundancy for unforeseen loads for short periods of time, permanent changes or increases of loads should be consulted with Fysh Design for advice.

Consequences of underloading the system – No odour should occur due to sub surface irrigation being secondary treatment

Consequences poor maintenance or attention – Refer to maintenance section of report.

Other Design considerations

- Use water saving fixtures.
- Remove excess fats and grease from kitchen dishes.
- Ensure no solids are put into the system.
- Food disposal system not to be used.
- Do not dispose of sanitary nappies or napkins to the system.
- Use biodegradable detergents.
- Do not dispose of powerful chemicals, bleaches, or whiteners etc down drain system.
- Spread load of washing machine and dishwasher routines throughout the day

Wastewater Classification and Recommendations

According to AS1547.2012 for on-site wastewater management the natural site soil in the property is classified as **Sandy Loams (Category 2).**

Table J1 of AS1547.2012 indicates based on a conservative population of up to 6 people within the station loading has been adopted. A 1500L capacity Advanced Secondary Aerated Wastewater system (min loading capacity of 1,500L per day) will be required with a max output of 720L / Per day. Sizing is based on design flows based on Table J1 of AS1547.2012 of a conservative 120L (rainwater tank supply) per person per day conservative to allow a minimum of 720L of settling flow and 780L overflow storage capacity

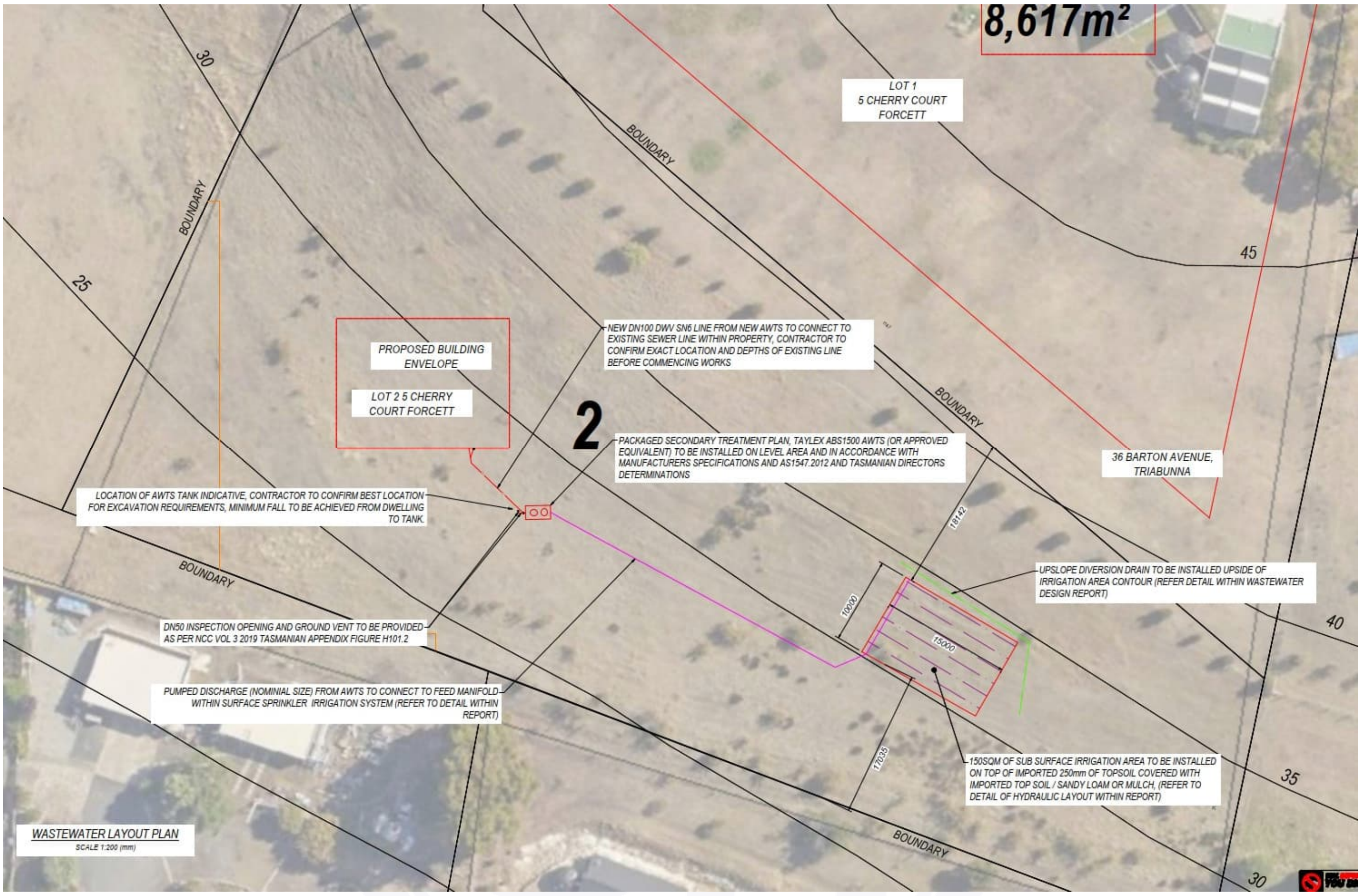
It is proposed all outflow from the dwelling is connected to a 1500L capacity AWTS then outflows via pumped discharged to an adequately sized sub surface irrigation area (150sqm) utilising buried slow drip lines via flow and return manifold system laid carefully within the existing eastern paddock grass area

An upslope cut off drain table drain is recommended for the sub surface irrigation area for peak rainfall events, to prevent water egress into the irrigation area (as per detail)

Please see design / construction details at the end of the report for further details on Irrigation area

I recommend during construction, any major variations in the soil or wastewater loadings that I be notified as shown in this report.

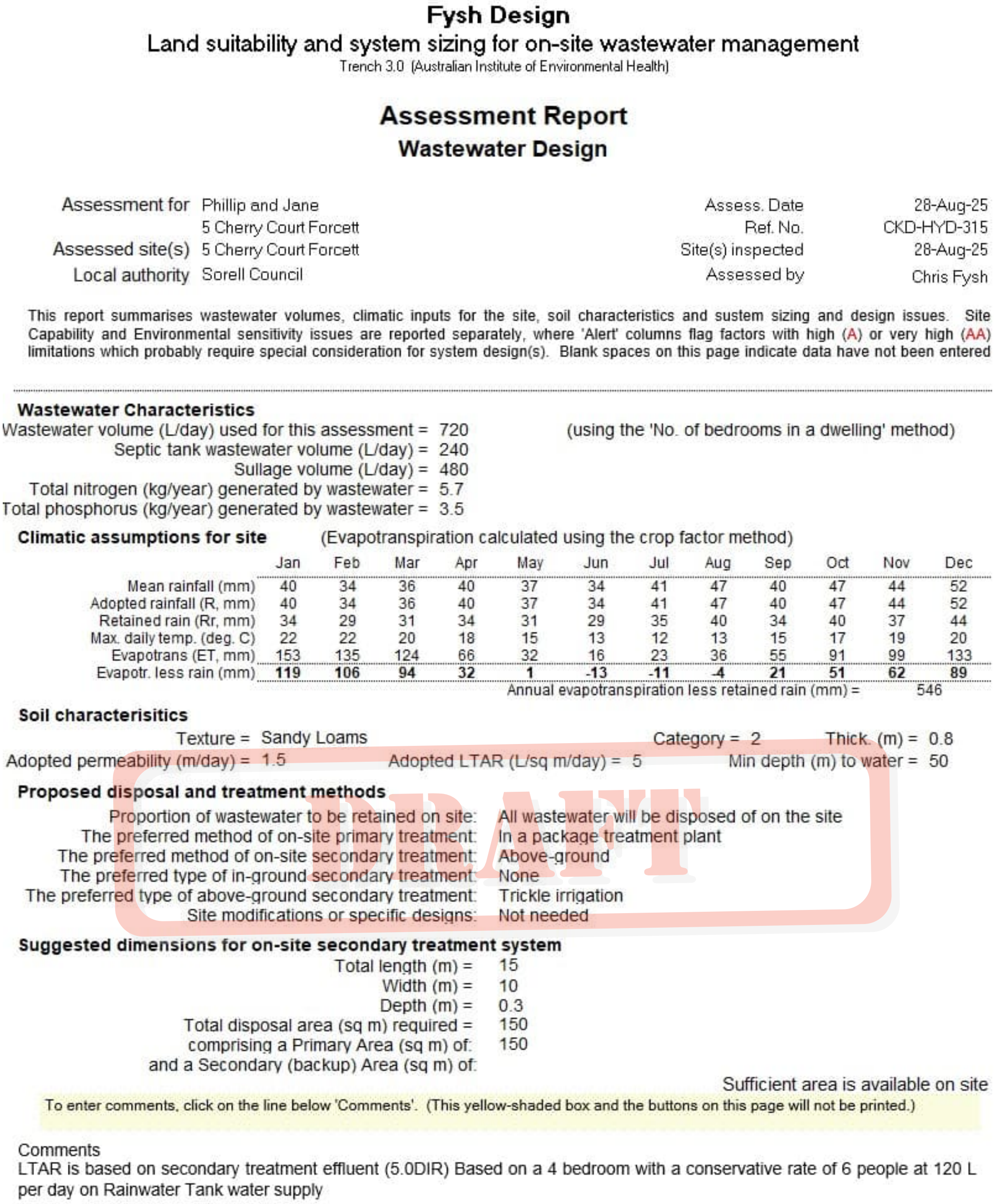
Wastewater Site Layout



PROPOSED OVERALL WASTEWATER SITE LAYOUT

SITE PHOTO OF PROPOSED IRRIGATION AREA

3. TRENCH 3 REPORTING



Fysh Design

Land suitability and system sizing for on-site wastewater management

Trench 3.0 (Australian Institute of Environmental Health)

Assessment Report

Wastewater Design

Assessment for	Phillip and Jane 5 Cherry Court Forcett	Assess. Date Ref. No.	28-Aug-25 CKD-HYD-315
Assessed site(s)	5 Cherry Court Forcett	Site(s) inspected	28-Aug-25
Local authority	Sorell Council	Assessed by	Chris Fysh

This report summarises wastewater volumes, climatic inputs for the site, soil characteristics and sustem sizing and design issues. Site Capability and Environmental sensitivity issues are reported separately, where 'Alert' columns flag factors with high (A) or very high (AA) limitations which probably require special consideration for system design(s). Blank spaces on this page indicate data have not been entered

Wastewater Characteristics

Wastewater volume (L/day) used for this assessment = 720 (using the 'No. of bedrooms in a dwelling' method)

Septic tank wastewater volume (L/day) = 240

Sullage volume (L/day) = 480

Total nitrogen (kg/year) generated by wastewater = 5.7

Total phosphorus (kg/year) generated by wastewater = 3.5

Climatic assumptions for site (Evapotranspiration calculated using the crop factor method)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean rainfall (mm)	40	34	36	40	37	34	41	47	40	47	44	52
Adopted rainfall (R, mm)	40	34	36	40	37	34	41	47	40	47	44	52
Retained rain (Rr, mm)	34	29	31	34	31	29	35	40	34	40	37	44
Max. daily temp. (deg. C)	22	22	20	18	15	13	12	13	15	17	19	20
Evapotrans (ET, mm)	153	135	124	66	32	16	23	36	55	91	99	133
Evapotr. less rain (mm)	**119**	**106**	**94**	**32**	**1**	**-13**	**-11**	**-4**	**21**	**51**	**62**	**89**

Annual evapotranspiration less retained rain (mm) = 546

Soil characterisitics

Texture = Sandy Loams

Category = 2

Thick. (m) = 0.8

Adopted permeability (m/day) = 1.5

Adopted LTAR (L/sq m/day) = 5

Min depth (m) to water = 50

Proposed disposal and treatment methods

Proportion of wastewater to be retained on site:	All wastewater will be disposed of on the site
The preferred method of on-site primary treatment:	In a package treatment plant
The preferred method of on-site secondary treatment:	Above-ground
The preferred type of in-ground secondary treatment:	None
The preferred type of above-ground secondary treatment:	Trickle irrigation
Site modifications or specific designs:	Not needed

Suggested dimensions for on-site secondary treatment system

Total length (m) = 15

Width (m) = 10

Depth (m) = 0.3

Total disposal area (sq m) required = 150

comprising a Primary Area (sq m) of: 150

and a Secondary (backup) Area (sq m) of:

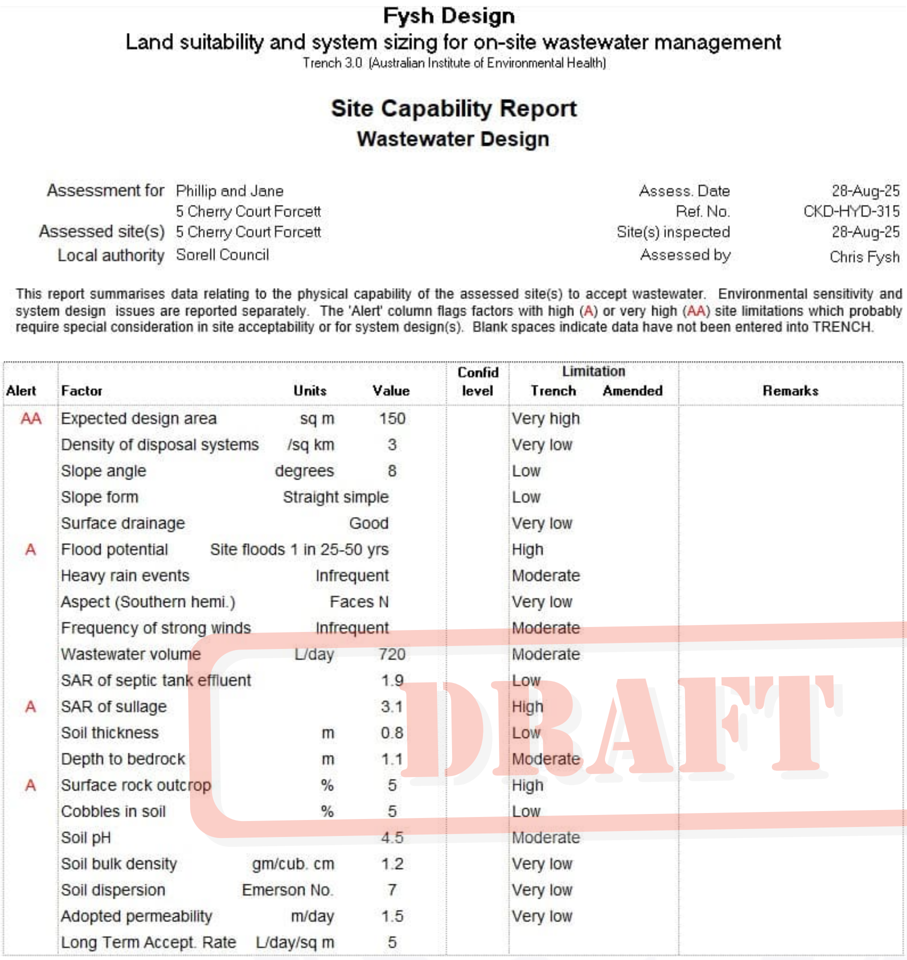
Sufficient area is available on site

To enter comments, click on the line below 'Comments'. (This yellow-shaded box and the buttons on this page will not be printed.)

Comments

LTAR is based on secondary treatment effluent (5.0DIR) Based on a 4 bedroom with a conservative rate of 6 people at 120 L per day on Rainwater Tank water supply

Figure 6: WASTEWATER ASSESSMENT REPORT



Fysh Design

Land suitability and system sizing for on-site wastewater management

Trench 3.0 (Australian Institute of Environmental Health)

Site Capability Report

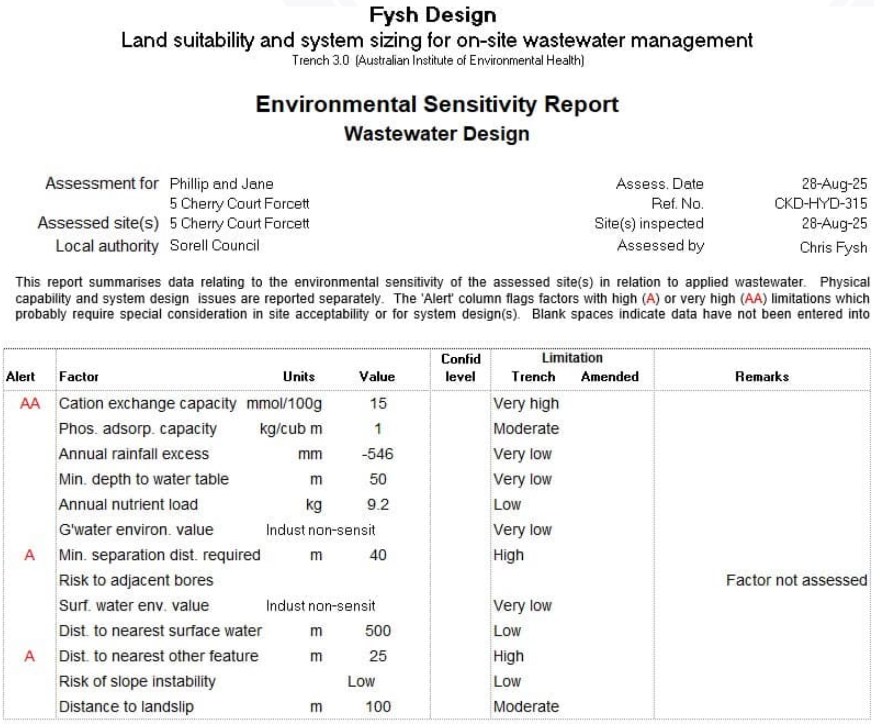
Wastewater Design

Assessment for	Phillip and Jane 5 Cherry Court Forcett	Assess. Date	28-Aug-25
		Ref. No.	CKD-HYD-315
Assessed site(s)	5 Cherry Court Forcett	Site(s) inspected	28-Aug-25
Local authority	Sorell Council	Assessed by	Chris Fysh

This report summarises data relating to the physical capability of the assessed site(s) to accept wastewater. Environmental sensitivity and system design issues are reported separately. The 'Alert' column flags factors with high (A) or very high (AA) site limitations which probably require special consideration in site acceptability or for system design(s). Blank spaces indicate data have not been entered into TRENCH.

Alert	Factor	Units	Value	Confid level	Limitation Trench	Limitation Amended	Remarks
AA	Expected design area	sq m	150		Very high		
	Density of disposal systems	/sq km	3		Very low		
	Slope angle	degrees	8		Low		
	Slope form		Straight simple		Low		
	Surface drainage		Good		Very low		
A	Flood potential		Site floods 1 in 25-50 yrs		High		
	Heavy rain events		Infrequent		Moderate		
	Aspect (Southern hemi.)		Faces N		Very low		
	Frequency of strong winds		Infrequent		Moderate		
	Wastewater volume	L/day	720		Moderate		
	SAR of septic tank effluent		1.9		Low		
A	SAR of sullage		3.1		High		
	Soil thickness	m	0.8		Low		
	Depth to bedrock	m	1.1		Moderate		
A	Surface rock outcrop	%	5		High		
	Cobbles in soil	%	5		Low		
	Soil pH		4.5		Moderate		
	Soil bulk density	gm/cub. cm	1.2		Very low		
	Soil dispersion	Emerson No.	7		Very low		
	Adopted permeability	m/day	1.5		Very low		
	Long Term Accept. Rate	L/day/sq m	5				

Figure 7: SITE CAPABILITY REPORT



Fysh Design

Land suitability and system sizing for on-site wastewater management

Trench 3.0 (Australian Institute of Environmental Health)

Environmental Sensitivity Report

Wastewater Design

Assessment for	Phillip and Jane 5 Cherry Court Forcett	Assess. Date	28-Aug-25
		Ref. No.	CKD-HYD-315
Assessed site(s)	5 Cherry Court Forcett	Site(s) inspected	28-Aug-25
Local authority	Sorell Council	Assessed by	Chris Fysh

This report summarises data relating to the environmental sensitivity of the assessed site(s) in relation to applied wastewater. Physical capability and system design issues are reported separately. The 'Alert' column flags factors with high (A) or very high (AA) limitations which probably require special consideration in site acceptability or for system design(s). Blank spaces indicate data have not been entered into

Alert	Factor	Units	Value	Confid level	Limitation Trench	Limitation Amended	Remarks
AA	Cation exchange capacity	mmol/100g	15		Very high		
	Phos. adsorp. capacity	kg/cub m	1		Moderate		
	Annual rainfall excess	mm	-546		Very low		
	Min. depth to water table	m	50		Very low		
	Annual nutrient load	kg	9.2		Low		
	G'water environ. value		Indust non-sensit		Very low		
A	Min. separation dist. required	m	40		High		
	Risk to adjacent bores						Factor not assessed
	Surf. water env. value		Indust non-sensit		Very low		
	Dist. to nearest surface water	m	500		Low		
A	Dist. to nearest other feature	m	25		High		
	Risk of slope instability		Low		Low		
	Distance to landslip	m	100		Moderate		

Figure 8: ENVIROMENTAL SENSITIVITY REPORT

4. IRRIGATION DETAIL

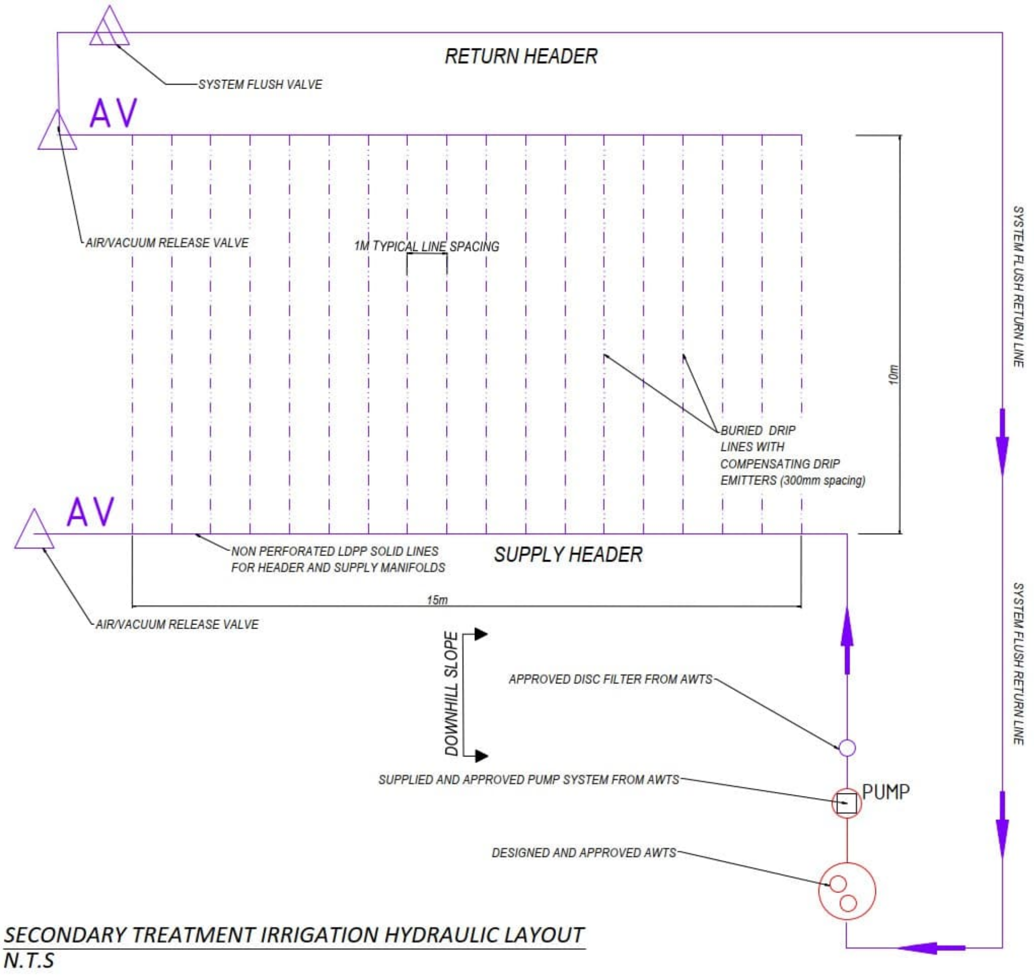


Figure 13: IRRIGATION LAYOUT

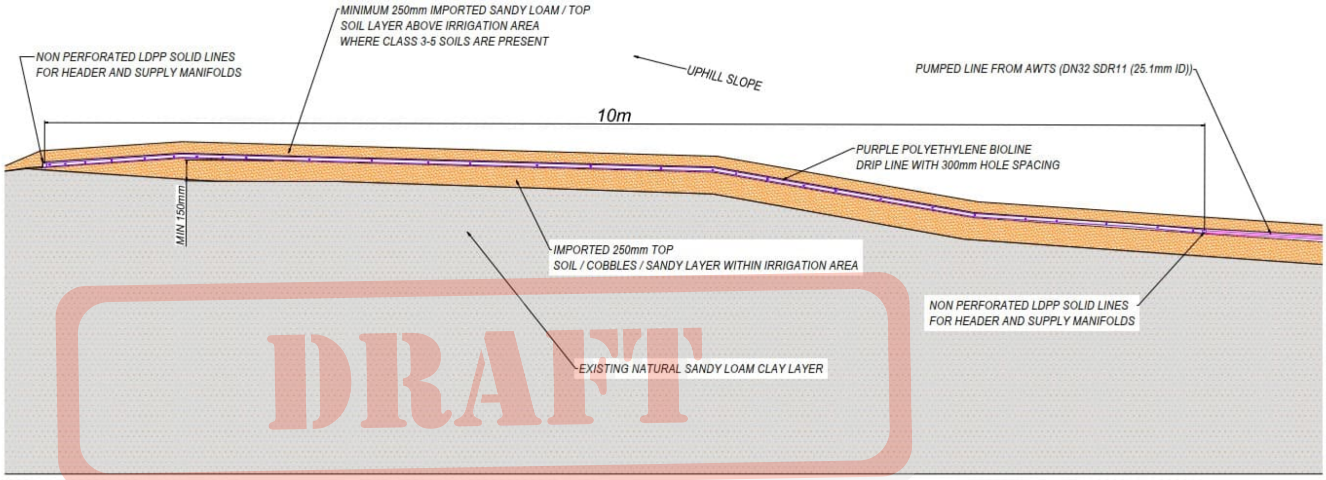


Figure 14: IRRIGATION CROSS SECTION

- Treatment dimensions of subsurface irrigation area to be minimum 150 sqm (15m x 10m), to be installed parallel on contour, levelled out with max 10% slope where possible.
- Base of irrigation to be excavated level imported sandy loam soil to be spread evenly across the irrigation area, compaction to be strictly avoided
- All works onsite to comply with AS1547.2012, AS3500.2, NCC2022 and all council regulations.

Tasmanian directors' determination guideline requirements for on-site wastewater management – building extensions, alterations, or outbuildings.

- A2 acceptable solution has been satisfied due to no existing wastewater system present due to being a new lot

Tasmanian directors' determination guideline requirements for Wastewater (standards for wastewater land application areas)

- A1 acceptable solution has been satisfied by irrigation area being a minimum of **100m** from an upslope proposed building,
- A2 acceptable solution has been satisfied with 500m distance to a downslope waterway
- A3 acceptable solution has been satisfied with 10m distance to a downslope boundary as per A3 (b) (iii) 1.5m plus 1m for every degree of gradient (8 degrees within the land application area)
  = 1.5+8 x 1m = 9.5m **17m achieved**
- A4 acceptable solution has been as no water bore detected on site. (Ref Envirotech Report)
- A5 acceptable solution has been satisfied as site is free draining and no ponding groundwater on site due to using sub surface irrigation and secondary treatment
- A6 acceptable solution has been satisfied as vertical separation between limiting layer of 0.5m (secondary treatment) due to using above ground / sub surface irrigation.

5. INSTALLATION AND COMMISIONING

3.1 The installation and operation of the system must comply with the conditions of accreditation and the manufacturer's instructions.

3.2 All plumbing work carried out in connection with the system installation must satisfy the requirements of the Building Act 2016, Building regulations 2016, The National Construction Code, Plumbing Permit (issued by the Permit Authority through the Council) and be carried out by a licensed plumber with appropriate training and competencies in onsite wastewater management systems.

3.3 All electrical work must be carried out by a licensed electrician and in accordance with relevant provisions of AS/NZS 3000.

3.4 The system requires a 240V AC power supply. A weather-proof isolating switch must be provided at the power outlet. The power supply must have its own clearly marked designated circuit breaker in the electricity supply fuse box.

3.5 Each system installation must be inspected and checked by the designer or the designer's agent. The designer on completion is to certify that the system has been constructed, installed, and commissioned in accordance with its design, the conditions of accreditation and any additional requirements set out in the permit. Note: Where the designer is not available to supervise the installation the designer should obtain signed certification from the installing plumber stating that the installation has been constructed/installed and commissioned in accordance with its design, the conditions of accreditation and any additional requirements of the council and/or permit authority 3.6 A report is to be prepared by the installing plumber detailing the inspection of the installation and the results of the commissioning tests and be accompanied by a certificate certifying that the system is operating and performing adequately (see 2.15).

3.7 Copies of the following reports/certificates must be submitted to the council and the owner as soon as practicable after the commissioning of the system and after each scheduled or unscheduled service or inspection for the period specified in the permit: (a) The initial plant installation and commissioning report (b) All required laboratory analytical test reports, and (c) All inspection and maintenance reports.

3.8 Copies of any report or certificate required by the conditions of accreditation must be made available to the Director on request.

3.9 The designer is to provide a written statement or document warning the user of which items and products that must not be placed in the system.

3.10 To verify that the plant is commissioned, sampling must be carried out at the first scheduled maintenance service, by the either the maintenance contractor or the installation contractor, for BOD5, TSS and Free Residual Chlorine. The samples are to be tested and reported on by a NATA certified laboratory. The test results are to be provided to the council and the owner.

6. MAINTENANCE AND MONITORING

- 4.1 Each installation must be serviced and monitored at not less than 3 monthly intervals in accordance with the conditions of accreditation, the conditions of permit / maintenance specified in a Schedule of Maintenance and manufacturer's requirements.
- Notes:
- (1) Only a licensed plumber and or his or her qualified technician can carry out the maintenance and required monitoring of the system other than electrical work unless licensed to do so.
- (2) The licensed plumber and his or her technician may need to complete training by the supplier before carrying out any maintenance on the system. The licensed plumber and their technician must comply with the applicable Directors Determination with regard to the training, reporting requirements and qualifications required to carry out servicing on the STS.
- (3) The maintenance and monitoring intervals may be combined provided the monitoring frequency remains at 3-month intervals.
- 4.2 The owner of the system must enter into and maintain a maintenance contract with a suitable licenced plumbing contractor.
- 4.3 The owner must notify the council that a maintenance contract is in place for the maintenance of the STS.
- 4.4 The system must be operated and maintained to ensure it performs continuously and without any intervention between inspections carried out by the plumber.
- 4.5 A service report is to be prepared by the plumber who carried out the work detailing the inspection of the installation and the results of all servicing tests and conditions at the completion of all scheduled or unscheduled services or inspections.
- 4.6 The service report is to be accompanied by a signed document certifying that the system is operating and performing adequately.
- 4.7 A copy of the service report and certifying document is to be provided to the occupant and council. Each service report is to contain a statement reminding the user about items and products that must not be placed in the system.
- 4.8 Each service must include monitoring the operation of the system and associated land application system.
- 4.9 Maintenance must be carried out on all mechanical, electrical and functioning components of the system including the associated land application system as appropriate.
- 4.10 The monitoring, servicing and reporting of the installation must include but not be restricted to the following matters, as appropriate:
- 4.10.1 Reporting on weather conditions, ambient temperature, effluent temperature
- 4.10.2 Odour
- 4.10.3 Check and test pump
- 4.10.4 Check and test air blower, fan or air venturi and clean/replace air filters
- 4.10.5 Check and test alarm system
- 4.10.6 Check slime growth on membranes and report the on condition of membranes
- 4.10.7 Check and report operation of sludge return, sludge level and de-sludging
- 4.10.8 Check and record water meter reading (if fitted)
- 4.10.9 Check and record operation of irrigation area, irrigation fittings Department of Justice – Certificate of Accreditation Doc/20/66067 Date of Issue: 14/08/20 Director of Building Control Page 13 of 20 Delegate of Minister for Building and Construction

4.10.10 Check and clean/replace irrigation filters.

4.10.11 Check and report on water quality (testing for pH, Turbidity, EC and dissolved oxygen)
4.10.12 Check, and replenish chlorine disinfection system.

4.10.13 Cleaning of the following items at above the waterline – I. clarifier II. pipework III. valves IV. walls of chambers.

7. CONCLUSION

This report has demonstrated that the proposed subdivision development at 5 Cherry Court Forcett complies with the onsite wastewater quality conditions of Sorell Council plumbing and environmental requirements.

Please contact cfysh@fyshdesign.com.au if you require any additional information.

Yours sincerely

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FYSH DESIGN
CIVIL HYDRAULIC

Sorell Council

Development Application: 7.2025.10.1 - Response to Request For Information - 5 Cherry Court, Forcett - P2.pdf
Plans Reference: P2
Date Received: 03/09/2025

GEOTECHNICAL SITE INVESTIGATION FOR FOUNDATIONS AND WASTEWATER

5 CHERRY COURT - FORCETT

PROPOSED SUBDIVISION

Client: Phillip J. & Jane A. Sargent

Certificate of Title: 140818/13

Investigation Date: 27/05/2025 & 06/08/2025

Refer to this Report As

Enviro-Tech Consultants Pty. Ltd. 2025. Geotechnical Site Investigation for Foundations and Wastewater Report for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 06/08/2025.

Report Distribution

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Limitations of this report

In some cases, variations in actual Site conditions may exist between subsurface investigation boreholes. This report only applies to the tested parts of the Site at the Site of testing, and if not specifically stated otherwise, results should not be interpreted beyond the tested areas.

The Site investigation is based on the observed and tested soil conditions relevant to the inspection date and provided design plans (building footprints presented in Attachment A). Any site works which has been conducted which is not in line with the Site plans will not be assessed. Subsurface conditions may change laterally and vertically between test Sites, so discrepancies may occur between what is described in the reports and what is exposed by subsequent excavations. No responsibility is therefore accepted for any difference in what is reported, and actual Site and soil conditions for parts of the investigation Site which were not assessed at the time of inspection.

This report has been prepared based on provided plans detailed herein. Should there be any significant changes to these plans, then this report should not be used without further consultation which may include drilling new investigation holes to cover the revised building footprint. This report should not be applied to any project other than indicated herein.

No responsibility is accepted for subsequent works carried out which deviate from the Site plans provided or activities onsite or through climate variability including but not limited to placement of fill, uncontrolled earthworks, altered drainage conditions or changes in groundwater levels.

At the time of construction, if conditions exist which differ from those described in this report, it is recommended that the base of all footing excavations be inspected to ensure that the founding medium meets that requirement referenced herein or stipulated by an engineer before any footings are poured.

Investigation Summary

Site Classification

In accordance with AS2870 – 2011 and after thorough consideration of the known details pertaining to the proposed subdivision and associated works (hereafter referred to as the Site), the geology, soil conditions, soil properties, and drainage characteristics of the Site have been classified as follows:

CLASS P based on the following problematic ground conditions identified at the site:

- Class 1 dispersive soils are present at the Site with CLASS P foundation conditions requiring specialised management measures to mitigate erosion hazards
- Highly variable depth to bedrock and highly variable soil reactivity with possible historic sandstone terrain clay infill features including deep clay filled fractures and possible buried cliff forms.

Notwithstanding the problematic soil conditions observed at the Site, the soil in lot 2 is classified as Class H1, and may be increased to H2 if filling works is proposed within building areas.

Future Building Pad Considerations

Concentrated loads including but not limited to slab edge or internal beam or strip footings shall be supported directly on piers or pads with the following to be expected at the building pad finished ground level:

- Extremely weathered sandstone bedrock with an allowable bearing capacity of 400 kPa
- Deep clay zones/pockets with footings to be deepened to 2.1m.

Site Investigation

The Site investigation is summarised in Table 1.

Table 1 Summary of Site Investigation

Client	**Phillip J. & Jane A. Sargent**
Project Address	5 Cherry Court - Forcett
Council	Sorell
Planning Scheme	Tasmanian Planning Scheme
Inundation, Erosion or Landslip Overlays	Sorell local provisions schedule - SOR-S1.7.1 – dispersive soils. Low landslip hazard band
Proposed	Subdivision
Investigation	Fieldwork was carried out by an Engineering Geologist on the 27/5/2025 & 06/08/2025
Site Topography	The building site has a strong slope of approximately 27% (15°) to the southwest
Site Drainage	The site receives overland flow runoff directly from the northeast.
Soil Profiling	Three investigation holes were direct push sampled from surface level around the proposed subdivision (Appendix A):
Investigation Depths	The target excavation depth was estimated at 2.3 m. Borehole BH01 was direct push sampled to 2.3 m, borehole BH02 was direct push sampled to 0.8 m, and borehole BH03 was direct push sampled to 1.1 m. Borehole logs and photos are presented in Appendix B & C.
Soil moisture and groundwater	Recovered soil at the site was moist at the time of the investigation. Groundwater was not encountered.
Geology	According to 1:250,000 Mineral Resources Tasmania geological mapping (accessed through The LIST), the geology comprises of: Permian - Triassic Dominantly quartz sandstone.

Planning and Building Regulations (TPS)

Landslip Overlay Overview

The proposed building and works fall within the LIST Landslip Hazard Overlay (low hazard band) as presented in Appendix 1. Landslide hazard reporting requirements are presented in Table 2.

Table 2 Landslip Hazard Reporting Requirements Framework

Council	Sorell
Planning Scheme	Tasmanian Planning Scheme
Planning Scheme Code	C15.0 Landslip Hazard Code
Landslip Hazard Band	Low
Landslip Planning Map Component	Remaining areas slopes 11-20 degrees
Proposed Development Is Exempt From Planning	Yes
Significant Works	Yes
Critical Use, Vulnerable Use or Hazardous Use	No
Subdivision that creates a new road or extends an existing road in a medium landslip overlay	No
Development Code to Be Addressed	C15.7.1 Subdivision within a landslip hazard area
Additional Information Required for Footing System	NO
Planning Report Requirements	NA
Modelling Timeframe	Building design life
Directors Determination Reporting Requirements	If the AS 2870 classification report does not include sufficient information for the design of a footing system or significant work, the Site classifier may recommend further geotechnical site investigation reporting
Certificate of Likely Compliance	Certificate by qualified person (Engineer-Civil, Engineering Geologist or Geotechnical Engineer) a) take into account the AS 2870 site classification, any further geotechnical site investigation and any relevant landslip management plan; and b) be satisfied that the proposed work, including significant work and the installations for the management and disposal of stormwater, sewage, water storage overflow or other wastewater, will not cause or contribute to landslip movement on the site or adjacent land. c) be satisfied that the proposed work can achieve and maintain a tolerable risk for the intended life of the building.
Site Classification Requirements	Class P unless otherwise determined in a Site Classification report
Reporting Guideline Requirement	NA

Site Overview

Topography and Site Layout

The Site slopes from north to south, with the building envelope positioned on a steeper section of the slope where contour spacing indicates a gradient of approximately 10 degrees. The Low Landslip Hazard Overlay under the Tasmanian Planning Scheme applies only to a small portion of the Site, specifically a 10 m × 10 m area at the driveway terminus and the entire building envelope. The access driveway itself extends approximately 100–200 m across gently sloping terrain outside the hazard overlay. No significant breaks in slope or signs of instability were observed.

Surface Conditions

Extremely weathered sandstone is exposed near the terminus of the proposed driveway, where surface soil cover is minimal. Across the broader Site, no evidence of instability—such as tension cracking, ground slumping, surface erosion, or water ingress—was observed during inspection. Ground cover comprises predominantly pasture grasses with scattered small trees. The surface is generally stable, with no visible signs of recent or active ground movement.

Photographic Evidence

Photographs taken during the field investigation (refer to appended figures) confirm the presence of exposed sandstone in the driveway terminus area and show typical site slopes within the building envelope. No features suggestive of landslip activity—such as scarps, bulges, or erosional rilling—were observed. Portions of the Site appear to have been lightly benched or cleared to facilitate access and construction planning.

Subsurface Conditions

The geology of the site has been documented and described according to Australian Standard AS1726 for Geotechnical Site Investigations, which includes the Unified Soil Classification System (USCS). Soil layers, and where applicable, bedrock layers, are summarized in Table 2.

Two boreholes (BH01 and BH02) were drilled within the proposed building envelope to evaluate the underlying ground conditions in support of the slope stability and landslide risk assessment.

- **BH02**, located at the northwestern extent of the building area near the terminus of the access handle, encountered a **shallow soil profile** comprising topsoil and silty clay overlying **extremely weathered sandstone** at a depth of **0.7–0.8 m**. The presence of shallow bedrock in this area is consistent with surface exposures of sandstone observed nearby.
- **BH01**, positioned approximately **17 m to the southeast of BH02**, and slightly **upslope**, encountered a **significantly deeper soil profile** extending to **2.3 m** with no refusal or bedrock encountered. The profile consists of alternating layers of **silty clay, silty sand, sandy clay**, and **clayey sandy silt**, indicating a zone of deeper residual or colluvial soil accumulation in this part of the Site.

Soils across the building envelope are of **medium to high plasticity**, with localised variability in grain size and consistency. Both boreholes remained dry, with **no groundwater seepage** observed during drilling. The contrast in soil thickness across short distances highlights the need for differential footing considerations; however, no materials or conditions indicative of slope instability were encountered. The subsurface profile is consistent with **low landslide risk**, assuming standard site drainage and foundation design measures are implemented.

Table 3 Soil Summary Table

#	Layer	Details	USCS	BH01	BH02	BH03
1	SILT	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots; angular gravel, S-F	ML	0-0.3 DS@0.2	0-0.2	
2	SILT	TOPSOIL: SILT, very dusky red, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	ML			0-0.4 DS@0.1
3	Silty CLAY	Silty CLAY with sand, very dusky red, medium plasticity, fine to medium grained sand, S-H	CI		0.2-0.5 DS@0.3	
4	CLAY	CLAY trace sand, black, high plasticity, fine to medium grained sand, VSt	CH	0.3-0.6 DS@0.4		
5	CLAY	CLAY with sand, very dusky red, high plasticity, medium grained sand	CH			0.4-0.8 DS@0.6
6	Sandy SILT	Sandy SILT, dark brown, well sorted, low plasticity, medium grained sand, S-H	ML		0.5-0.7 DS@0.6	
7	Silty CLAY	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand, VSt	CI	0.6-0.8 DS@0.7		
8	Silty Sandy CLAY	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand, H	CI	0.8-1.3 DS@1.1		
9	Silty Sandy CLAY	Silty Sandy CLAY, black, well sorted, medium plasticity, coarse grained sand, H	CI	1.3-2 DS@1.7		
10	Clayey Sandy SILT	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand, H	ML	2-2.3 DS@2.0		
11	SANDSTONE	Slightly Weathered SANDSTONE Bedrock			0.7-0.8 REF	0.8-1.1 REF

Consistency[1]	**VS** Very soft; **S** Soft; **F** Firm; **St** Stiff; **Vst** Very Stiff; **H** Hard. Consistency values are based on soil strengths AT THE TIME OF TESTING and is subject to variability based on field moisture condition
Density[2]	**VL** Very loose; **L** Loose; **MD** Medium dense; **D** Dense; **VD** Very Dense
Rock Strength	**EL** Extremely Low; **VL** Very Low; **L** Low; M Medium; **H** High; **VH** Very High; **EH** Extremely High
PL	Point load test (lump)
DS	Disturbed sample
PV	Pocket vane shear test
FV	Downhole field vane shear test
U50	Undisturbed 48mm diameter core sample collected for laboratory testing.
REF	Borehole refusal
INF	DCP has continued through this layer and the geology has been inferred.

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[1] Soil consistencies are derived from a combination of field index, DCP and shear vane readings.
[2] Soil density descriptions presented in engineering logs are derived from the DCP testing.

Landslide Risk Assessment

Scenario 1 – Shallow Translational Slide on Steeper Slope (Building Envelope)

Description:
A small translational slide (<1 m depth) occurs within the steeper portion of the slope, affecting the proposed building envelope. The slide originates within the colluvial soils overlying the deeper section of the site (e.g., near BH01), triggered by prolonged rainfall or poor surface drainage.

Scenario 2 – Shallow Slip Adjacent to Driveway Terminus (Exposed Sandstone Zone)

Description:
A shallow surface failure (<0.5 m depth) develops near the sandstone outcrop at the driveway terminus due to surface erosion or poor control of runoff. The slip impacts vehicle access but does not endanger occupants.

Scenario 3 – Deep Seated Landslide Involving Entire Slope Profile

Description:
A deep-seated failure (>2 m depth) involving both colluvial and residual soils across the mid- to lower-slope area of the building envelope. This would be associated with extreme, prolonged rainfall and potentially occur in highly exceptional conditions.

Scenario	Likelihood	Consequence (Life)	Consequence (Property)	Risk to Life	Risk to Property
1 – Shallow translational slide within the building envelope Triggered by prolonged rainfall or poor drainage on the mid-slope colluvial soils.	Rare	Occupants may be present; minor structural impacts	Medium (Localised damage; repairable footing or slab movement)	Acceptable	Low
2 – Shallow slip near driveway terminus in exposed sandstone zone. Caused by uncontrolled runoff or surface erosion.	Unlikely	No direct risk to occupants	Minor (superficial damage to driveway or verge)	Acceptable	Low
3 – Deep-seated failure involving entire slope profile Exceptional event (e.g. long-duration rainfall) causing failure through colluvial and residual soils.	Rare	Potential structural collapse if occupied	Major (Total building loss possible)	Acceptable	Low

These risk levels are consistent with an **Acceptable Risk** outcome under AGS 2007 for residential-type land use, especially where mitigation measures (e.g. surface drainage control and appropriate foundation design) are adopted.

Performance Criteria C15.6.1 – Assessment of Landslip Risk

P1. Each lot, or a lot proposed in a plan of subdivision, within a landslip hazard area must not create an opportunity for use or development that cannot achieve a tolerable risk from landslip, having regard to:

(a) Any increase in risk from a landslip for adjacent land

Minor cuts for the proposed turning circle will occur in areas where shallow soil overlies competent sandstone. The presence of shallow bedrock ensures these works will remain stable and not affect overall slope integrity. There will be no increase in landslip risk to adjacent land because of the proposed excavation. Management is recommended for soil dispersion.

(b) The level of risk to use or development arising from an increased reliance on public infrastructure
There is no increased reliance on public infrastructure as a result of the development. The Site is serviced via a private driveway with all civil works and drainage systems to be managed within the title boundaries. No public road embankments, retaining structures, or essential infrastructure are affected by the landslip overlay or proposed development.

(c) The need to minimise future remediation works

The proposed lot layout and building location have been informed by geotechnical investigation and are sited on terrain where slope stability is not compromised. With appropriate site drainage and footing design, the risk of instability is low and future remediation works are unlikely to be required. The use of existing topography and shallow bedrock in parts of the Site contributes to long-term slope stability.

(d) Any loss or substantial compromise, by a landslip, of access to the lot on or off site

The access road is located mostly outside the landslip hazard overlay, with only a small section (approx. 10 m × 10 m) at the driveway terminus intersecting the Low Hazard band. This portion sits on shallow, exposed sandstone with no signs of instability. The risk of access compromise due to landslip is therefore negligible, and access to the dwelling site is considered robust.

(e) The need to locate building areas outside the landslip hazard area

The proposed building envelope lies within the Low Landslip Hazard Overlay, however it has been assessed as geotechnically suitable for residential development. The risk is considered acceptable under the AGS 2007 Guidelines, and no additional protection measures beyond standard design responses are required.

(f) Any advice from a State authority, regulated entity or a council

This assessment has been prepared in accordance with the requirements of the Tasmanian Planning Scheme and relevant hazard mapping. The report is available for council review and can be used to support a planning determination. No additional advice has been received from other authorities to date.

(g) The advice contained in a landslip hazard report

This geotechnical report forms the basis of the landslip hazard assessment. It confirms that the level of risk to life and property is within acceptable tolerances, and that standard drainage and foundation design measures are sufficient to ensure slope stability.

Sorell local provisions schedule - SOR-S1.7.1 Development on dispersive soils

Objective

That buildings and works with the potential to disturb dispersive soil are appropriately located or managed:

(a) to minimise the potential to cause erosion; and

(b) to reduce risk to property and the environment to an acceptable level.

Acceptable Solutions

Given the proposed development involves disturbance of soils and is not for a habitable building or an extension less than 100 m^2, the building and works do not meet LPS acceptable solutions, and performance solution SOR-S1.7 is to be addressed.

Performance Criteria

Building and works must be designed, sited and constructed to minimise the risks associated with dispersive soil to property and the environment, having regard to:

Performance Criteria	Consideration
(a) the dispersive potential of soils in the vicinity of proposed buildings, driveways, services and the development area generally;	The soils across the development area, including near proposed buildings, driveways, and services, are predominantly severely dispersive, posing a high erosion risk if exposed or subjected to concentrated surface water.
(b) the potential of the development to affect or be affected by erosion, including gully and tunnel erosion;	The development also presents erosion risk in areas where cuts are proposed, as overland flow may traverse these surfaces and interact directly with exposed, severely dispersive soils, increasing the potential for tunnel and gully erosion without appropriate control measures.
(c) the dispersive potential of soils in the vicinity of water drainage lines, infiltration areas and trenches, water storages, ponds, dams and disposal areas;	The dispersive potential of soils is high in areas where water drainage lines are proposed—particularly along the driveway—necessitating careful stormwater management to avoid erosion and tunnel initiation. Infiltration of stormwater should be minimised, especially within dispersive soils, and the use of trenches for stormwater disposal is not recommended. While no water storages, ponds, or dams are proposed, design of disposal areas must ensure runoff is discharged in a controlled, non-erosive manner to prevent interaction with exposed dispersive subsoils. Wastewater absorption trenches are of less concern.
(d) the level of risk and potential consequences for property and the environment from potential erosion, including gully and tunnel erosion;	The risk of gully and tunnel erosion is moderate to high in areas where dispersive subsoils may be exposed, particularly near cuts and concentrated surface flows. This poses potential consequences for property and the environment, including infrastructure damage and sedimentation, if not properly managed.
(e) management measures that would reduce risk to an acceptable level; and	This report outlines a range of management measures to reduce erosion risk to an acceptable level, including site-specific recommendations detailed in the main text and general best-practice controls presented in Appendix G.
(f) the advice contained in a dispersive soil management plan.	This report includes Dispersive Soil Management which provides guidance on erosion control, surface water management, and treatment of dispersive soils to ensure risks are appropriately mitigated.

Recommendations

General

For Class P Sites, the designer should be a qualified engineer experienced in the design of footing systems for buildings.

Dispersive soils

Findings

Select soil samples from boreholes BH01 and BH02 were assessed for sodicity using the Emerson Class Number method in accordance with AS1289.3.8.1 (Appendix E). The results indicate that most soils tested are classified as Emerson Class 1, which are considered severely dispersive and present a high risk of erosion if left unprotected or exposed to uncontrolled surface water.

Specifically, five of the eight tested layers were assigned Class 1, with dispersive characteristics identified in both clay-rich and sandy soil horizons. These dispersive soils occur within the upper 1.7 m of the profile and coincide with the building envelope area. Only two samples (0.2 m and 2.0 m depths) returned Class 2 results, indicating low to moderate dispersion potential.

Hazard Analysis

Soil at the Site is highly susceptible to tunnel erosion, and particularly in areas where the soil is deeper—particularly around BH01. Risks will be apparent if the dispersive subsoils are exposed or subjected to uncontrolled surface water flow.

The risk of soil dispersion and tunnel erosion is greatest where stormwater may accumulate or become concentrated over exposed Class 1 dispersive soils. Of particular concern is the section where the driveway turns south toward the building envelope, as this location coincides with a natural overland flow path, increased slope gradient and there the driveway cut is proposed. Without appropriate mitigation, there is potential for channelised flow to initiate gully or tunnel erosion into both natural and filled soils.

The main length of the driveway, which traverses gently sloping terrain with broader flow paths, presents a lower hazard, assuming that surface water is dispersed evenly and not allowed to concentrate. However, poor drainage design or compacted verge conditions could still lead to localised erosion.

To reduce the potential for slope degradation and soil loss, stormwater must be effectively intercepted, diverted, and managed across the development.

Site specific recommendations

Soil cut batters

The key management measures for dispersive soils in cut embankments, as outlined in Appendix G, must be followed carefully to minimise erosion risk and maintain slope stability. Particular attention should be given to the section detailing the use of sand barriers within the embankment profile, which are essential for intercepting subsurface flow and reducing the potential for tunnel erosion through dispersive materials.

Dispersive soils in cut embankments are highly susceptible to tunnel erosion. To improve the stability of dispersive soils, it is recommended that all Emerson Class 1 which are exposed in cuts be treated with gypsum at an application rate of 1 kg/m^2. This amendment will assist in displacing sodium ions from clay particles, thereby improving soil structure, increasing shear strength, and enhancing the soil's resistance to both tunnel and surface erosion. This treatment is critical to ensuring the long-term performance of erosion control measures on-site.

The gypsum must be applied for chemical stabilisation immediately following cuttings. A very light sprinkle of water will be required on the class 1 dispersive soil to activate the chemical amelioration process and promote slight infiltration WITHOUT causing runoff. Following activation of the gypsum, sand barriers should be placed over the cut face —comprising a 200 mm sand layer and non-dispersive topsoil cover— to interrupt subsurface flow and protect exposed faces. All erosion control measures must be implemented immediately following excavation to prevent tunnel erosion initiation.

In this case, driveway cut angles may be safely maximised due to the presence of shallow sandstone bedrock, which provides a stable founding surface. This allows for the formation of a shallow batter over the exposed soil face, enabling the effective application of sand or stabilised sand layers. The shallow gradient will help prevent erosion of these treatments by overland flow and support long-term batter stability.

Earth Retaining Walls as an Alternative to Soil cut batters

Earth retaining walls provide an effective alternative to soil cut batters, particularly in areas where shallow soils overlie bedrock. This approach is especially suitable at the top of the driveway cut batters, where exposed bedrock offers a stable foundation for wall construction. In addition to improving slope stability, retaining walls act as a physical barrier against tunnel erosion, reducing the risk of subsurface flow paths developing in dispersive soils.

Use of Class 1 Soils for Filling

It is recommended that dispersive soil not be used as fill beneath the building envelope, due to its high erosion potential and poor structural performance. The use of dispersive fill should be avoided unless it is:

- Chemically treated with gypsum at the specified application rates or
- Capped with an impervious surface (paving, liner red gravel etc) with measure put in place to prevent waver from moving beneath the capping

Roofed and Paved Area Stormwater Management

All captured water on-site, including roof runoff, must be managed to remain at the surface and be evenly dispersed downslope across the Site. Roof runoff must be directed to detention tanks, with overflow discharged via surface irrigation—not into soakage pits. Due to the absence of non-dispersive topsoil, imported loam is required in irrigation areas. Irrigation must either:

- Be delivered just below the surface, draining directly into the imported loam without contact with dispersive soils; or
- Be applied via above-ground sprinklers onto imported loam to prevent erosion and maintain surface stability.

Runoff from pavements and other impervious surfaces must either be captured and redirected into detention tanks for controlled redistribution.

For driveways, runoff should be directed via cross-slope or in-slope alignment into lined side drains or swales. These must convey collected water to designated redistribution areas —such as detention tanks with surface irrigation or into distribution swales. Overflow must be dispersed across imported loam soils which is not located upgradient or downgradient of existing structures and ensuring water is not concentrated near foundations or fill. If distribution swales are used, they must be lined, constructed with low gradients, and designed to promote sheet flow rather than concentrated runoff. Distribution swale overflow must discharge onto non-dispersive imported loam soils.

Service Trenches

An effective measure to prevent stormwater ingress into backfilled service trenches is to ensure the trench surface is well sealed with non-dispersive soils or stable topsoil. As an additional site-specific recommendation, service trenches should be backfilled with compacted sand, which will help prevent water channelisation and reduce the risk of tunnel erosion along trench alignments.

For further guidance, general recommendations are presented in Appendix G.

Plumbing

Refer to hydraulic design drawings for detailed plumbing advice and requirements.

Refer to Table 4 to assess soil movement (Ys) around pipework for different depth ranges. The Site is assigned a Class P management measure for plumbing given the severely dispersive soils observed at the Site (see service trench management above).

*Table 4 Millimetres soil movement (Ys) for determining plumbing requirements for various soil depths **

Building	**Profiles**	**P***	**E Ys >75**	**H2 Ys 60-75**	**H1 Ys 40-60**	**M Ys 20-40**	**S Ys 0-20**	**A Ys 0**
Dwelling	BH01 BH02	YES			0-0.4	0.4-1.1	1.1-3	>3

* Depths in this table are based on surfaces at the time of testing and do not allow for the influence of any additional fill added to the soil profile unless the Iss calculation depth has been modified based on the proposed cut and fill (see ‘Footing Minimum Target Depths’). Where additional fill is proposed (and not indicated in the attached plans) Enviro-Tech are to be advised of final FFL’s so the Site classification can be recalculated according to the specific fill reactivity and thickness used in the design.

Class M

When pipework service trench basses fall within Class M depth range as shown in Table 4, and all plumbing recommendations herein have been implemented, all stormwater and sanitary plumbing drains should have fittings set at their midposition during installation to allow 0.5ys movement in any direction. Pipe wrappings can be used at critical points.

AS3500.2:2021 Appendix G of AS3500.2:2021 should be referred for general advice.

Wastewater and Stormwater Management

Due to the severely dispersive soil present at the Site and risk of tunnel erosion, if swale drains or absorption trenches are proposed for tank overflow or roof catchment management, the stormwater and wastewater is not to be diverted within 45° downgradient of any building structure unless verified in a plan provided to Envirotech for approval.

Wastewater Management

Although the proposed wastewater absorption area is suitably located away from the designated building envelope, measures need to be put in place to prevent tunnel development both upgradient of and downgradient of the adsorption areas.

Soil permeability is unusually high at the tested location, most likely attributed to the presence of tunnels or secondary porosity development from subsoil erosion. A wastewater system will work within the tested area given there is a high proportion of sand to clay, however it is recommended that the sandy clay loam Layer 9 is stabilised with gypsum where this layer is exposed within trenches. The gypsum is to be applied at a rate of 1.0kg/m2. The soil is generally considered Category 1, although concentrated flow is likely to increase the chances of tunnel development.

Wastewater trenches are to be designed to minimise cut and fill, with a preference for elongated layouts rather than condensed configurations. An elongated trench alignment not only reduces excavation volume but also improves the dispersion of wastewater across a broader area. With these management measures in place, the overall risk associated with wastewater trenches is considered low to moderate.

Site Drainage

Where possible, all levelled cut surfaces into severely dispersive soils should be sealed with a hard surface treatment such as pavement, a liner, or a combination of gypsum treatment followed by topsoiling to prevent tunnel erosion. Water pooling should be avoided, as prolonged saturation can initiate piping in dispersive materials. Site drainage should be designed with gentle gradients to ensure that surface water is directed away from vulnerable areas, reducing the risk of subsurface erosion and soil instability.

Surface drainage shall be considered in the design of the footing system, and necessary modifications shall be included in the design documentation. The surface drainage of the site shall be controlled from the beginning of the preparation and construction of the site. The drainage system shall be completed after the completion of the building construction.

Ideally, the areas around the footprint of the building should be graded or drained so that the water cannot pond against or near the building. As soon as footing construction has been completed, the ground immediately adjacent to the building should be graded to a uniform fall of 50mm minimum away from the building over the first metre. The final provision of paving to the edge of the building can greatly limit soil moisture variations due to seasonal wetting and drying.

Temporary Site Drainage

It is recommended that drainage protection works (cut off drains/mounds) are put in place above (upgradient of) the work area to prevent water and sediment from accumulating in and around footings and reduce the risk of erosion and instability around any proposed earth retaining structures.

Permanent Cut Batters – Soil and Rock

To ensure that cuts remain serviceable, it is recommended that unretained cuts in soil do not exceed 1V: 3H and unsupported baters in bedrock do not exceed 2V: 1H. Before cuts are approached by workers, cuts must be appropriately scaled to remove any loose soil and rock. The bedrock should not be increased beyond 2.0 m height relative to depth below natural level, without inspection by a suitably qualified person to ensure that these cuts are safe to work under.

Filling Works

The use of dispersive soil as fill presents a high risk of tunnel erosion, especially where exposed to surface or groundwater. To manage this risk, dispersive soils should either be removed, chemically treated with gypsum or lime, or protected from water ingress through drainage or surface sealing. Chemical treatment must be applied at the correct rate based on lift thickness, with 300 mm lifts receiving full application and 150 mm lifts requiring half the rate. Compaction should be carried out at or near optimum moisture content, especially around structural elements.

The bedrock surface across the Site offers a favourable condition for keeping surface water movement above ground, reducing the risk of infiltration into dispersive layers. All roads and cut excavations into sandstone should incorporate spoon drains, ideally constructed from concrete or other impermeable materials, to collect and divert runoff away from the toe of the cut. Paving should be installed at the interface between the spoon drain and exposed soil to ensure stormwater remains above dispersive zones. On down-gradient margins, water may be allowed to re-enter the land surface, provided the paved margins are treated with gypsum or otherwise stabilised to prevent tunnel and surface erosion.

Long-term erosion management

The following measures are generally recommended for maintaining long-term erosion stability of soil slopes:

- Slopes exceeding 1V: 4H and up to 1V: 3H will need to be effectively stabilised with mulch/topsoil mixes, drill/broadcast seeding, hydroseeding or soil binders.
- Slopes up to 1V:2Hcan be stabilised with straw mulching.
- Slopes exceeding 1V: 2H and up to 1V:1.5H may be effectively stabilised with hydromulching
- Slopes exceeding 1V:1.5H but no greater than 1V: 1H will generally require measures such as erosion control blankets.

K Taylor

Kris Taylor, BSc (hons)

Environmental & Engineering Geologist

Notes About Your Assessment

The Site classification provided and footing recommendations including foundation depths are assessed based on the subsurface profile conditions present at the time of fieldwork and may vary according to any subsequent *Site works* carried out. *Site works* may include changes to the existing soil profile by cutting more than 0.5 m and filling more than 0.4 to 0.8 m depending on the type of material and the design of the footing. All footings must be founded through fill *other than* sand not exceeding 0.4 m depth or sand not exceeding 0.8 m depth, or otherwise a Class P applies (AS2870 Clauses 2.5.2 and 2.5.3).

For reference, borehole investigation depths relative to natural soil surface levels are stated in borehole logs where applicable.

In some cases, variations in actual Site conditions may exist between subsurface investigation boreholes. At the time of construction, if conditions exist which differ from those described in this report, it is recommended that the base of all footing excavations be inspected to ensure that the founding medium meets the requirement referenced herein or stipulated by an engineer before any footings are poured.

The site classification assumes that the performance requirements as set out in Appendix B of AS 2870 are acceptable and that site foundation maintenance is carried out to avoid extreme wetting and drying.

It is the responsibility of the homeowner to ensure that the soil conditions are maintained and that abnormal moisture conditions do not develop around the building. The following are examples of poor practises that can result in abnormal soil conditions:

- The effect of trees being too close to a footing.
- Excessive or irregular watering of gardens adjacent to the building.
- Failure to maintain Site drainage.
- Failure to repair plumbing leaks.
- Loss of vegetation near the building.

The pages that make up the last six pages of this report are an integral part of this report. The notes contain advice and recommendations for all stakeholders in this project (i.e. the structural engineer, builder, owner, and future owners) and should be read and followed by all concerned.

References

AS 1289.6.3.2-2003 Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9 kg dynamic cone penetrometer test, Standards Australia, Sydney, Retrieved from SAI Global

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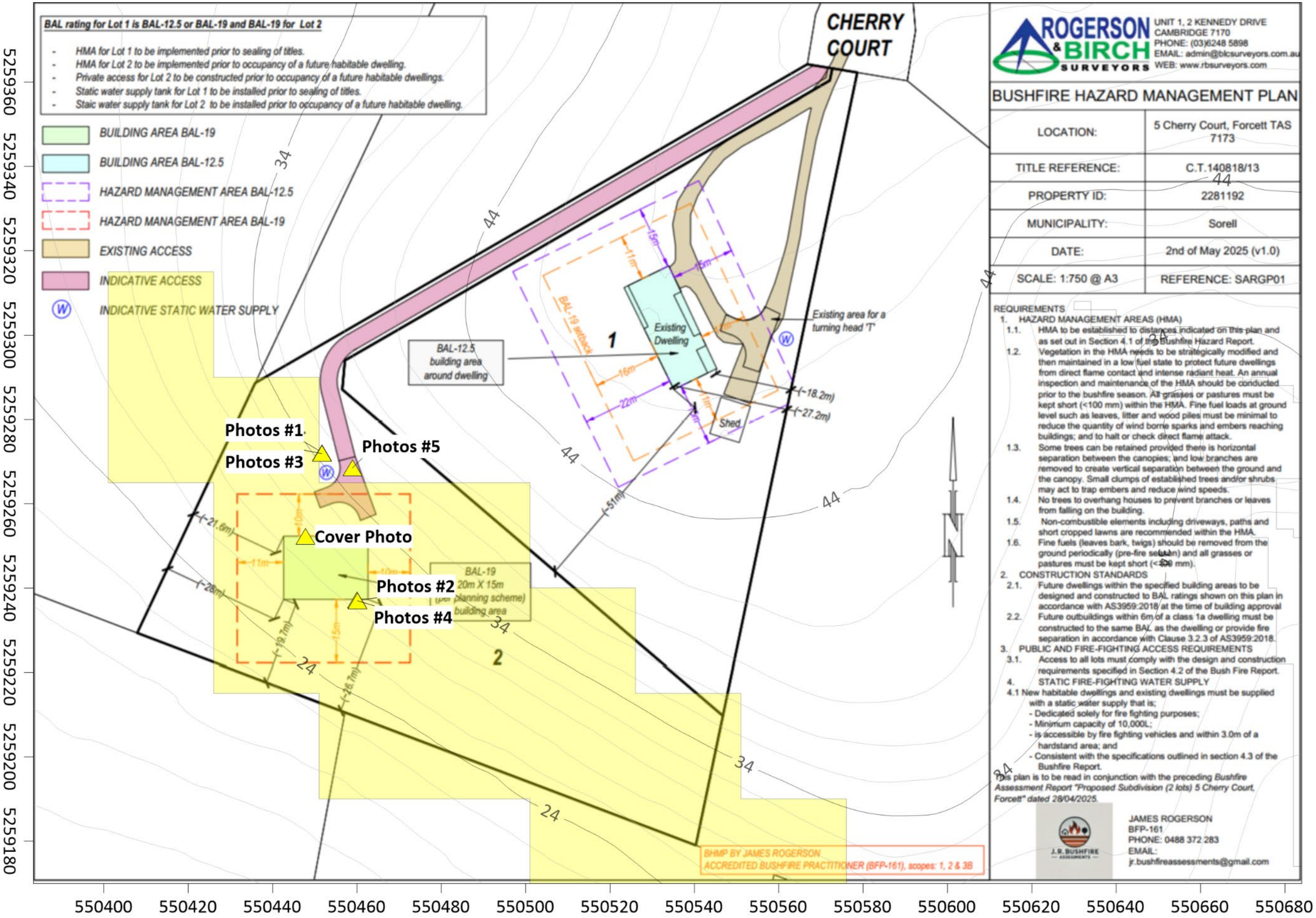
AS4055 (2021). Australian Standard. Prepared by Committee BD-099, Wind Loads for Housing. Approved on behalf of the Council of Standards Australia on 1st June 2021 and published on 25th June 2021.

DPIPWE 2009. Dispersive Soils and their Management. Technical Reference Manual. Sustainable Land Use Department of Primary Industries Water and Environment.

Webster, S.L., Brown, R.W. and Porter, J.R. (1994) Force Projection Site Evaluation Using the Electric Cone Penetrometer (ECP) and the Dynamic Cone Penetrometer (DCP). Technical Report No. GL-94-17, Air Force Civil Engineering Support Agency, US Air Force, Tyndall Air Force Base, FL.

Appendix A Mapping



BAL rating for Lot 1 is BAL-12.5 or BAL-19 and BAL-19 for Lot 2

- *HMA for Lot 1 to be implemented prior to sealing of titles.*
- *HMA for Lot 2 to be implemented prior to occupancy of a future habitable dwelling.*
- *Private access for Lot 2 to be constructed prior to occupancy of a future habitable dwellings.*
- *Static water supply tank for Lot 1 to be installed prior to sealing of titles.*
- *Staic water supply tank for Lot 2 to be installed prior to occupancy of a future habitable dwelling.*

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BUSHFIRE HAZARD MANAGEMENT PLAN

LOCATION:	5 Cherry Court, Forcett TAS 7173
TITLE REFERENCE:	C.T.140818/13
PROPERTY ID:	2281192
MUNICIPALITY:	Sorell
DATE:	2nd of May 2025 (v1.0)
SCALE: 1:750 @ A3	REFERENCE: SARGP01

REQUIREMENTS

1. HAZARD MANAGEMENT AREAS (HMA)
   - 1.1. HMA to be established to distances indicated on this plan and as set out in Section 4.1 of the Bushfire Hazard Report.
   - 1.2. Vegetation in the HMA needs to be strategically modified and then maintained in a low fuel state to protect future dwellings from direct flame contact and intense radiant heat. An annual inspection and maintenance of the HMA should be conducted prior to the bushfire season. All grasses or pastures must be kept short (<100 mm) within the HMA. Fine fuel loads at ground level such as leaves, litter and wood piles must be minimal to reduce the quantity of wind borne sparks and embers reaching buildings; and to halt or check direct flame attack.
   - 1.3. Some trees can be retained provided there is horizontal separation between the canopies; and low branches are removed to create vertical separation between the ground and the canopy. Small clumps of established trees and/or shrubs may act to trap embers and reduce wind speeds.
   - 1.4. No trees to overhang houses to prevent branches or leaves from falling on the building.
   - 1.5. Non-combustible elements including driveways, paths and short cropped lawns are recommended within the HMA.
   - 1.6. Fine fuels (leaves bark, twigs) should be removed from the ground periodically (pre-fire season) and all grasses or pastures must be kept short (<100 mm).
2. CONSTRUCTION STANDARDS
   - 2.1. Future dwellings within the specified building areas to be designed and constructed to BAL ratings shown on this plan in accordance with AS3959:2018 at the time of building approval
   - 2.2. Future outbuildings within 6m of a class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.
3. PUBLIC AND FIRE-FIGHTING ACCESS REQUIREMENTS
   - 3.1. Access to all lots must comply with the design and construction requirements specified in Section 4.2 of the Bush Fire Report.
4. STATIC FIRE-FIGHTING WATER SUPPLY
   - 4.1 New habitable dwellings and existing dwellings must be supplied with a static water supply that is;
     - Dedicated solely for fire fighting purposes;
     - Minimum capacity of 10,000L;
     - is accessible by fire fighting vehicles and within 3.0m of a hardstand area; and
     - Consistent with the specifications outlined in section 4.3 of the Bushfire Report.

This plan is to be read in conjunction with the preceding *Bushfire Assessment Report "Proposed Subdivision (2 lots) 5 Cherry Court, Forcett" dated 28/04/2025.*

JAMES ROGERSON
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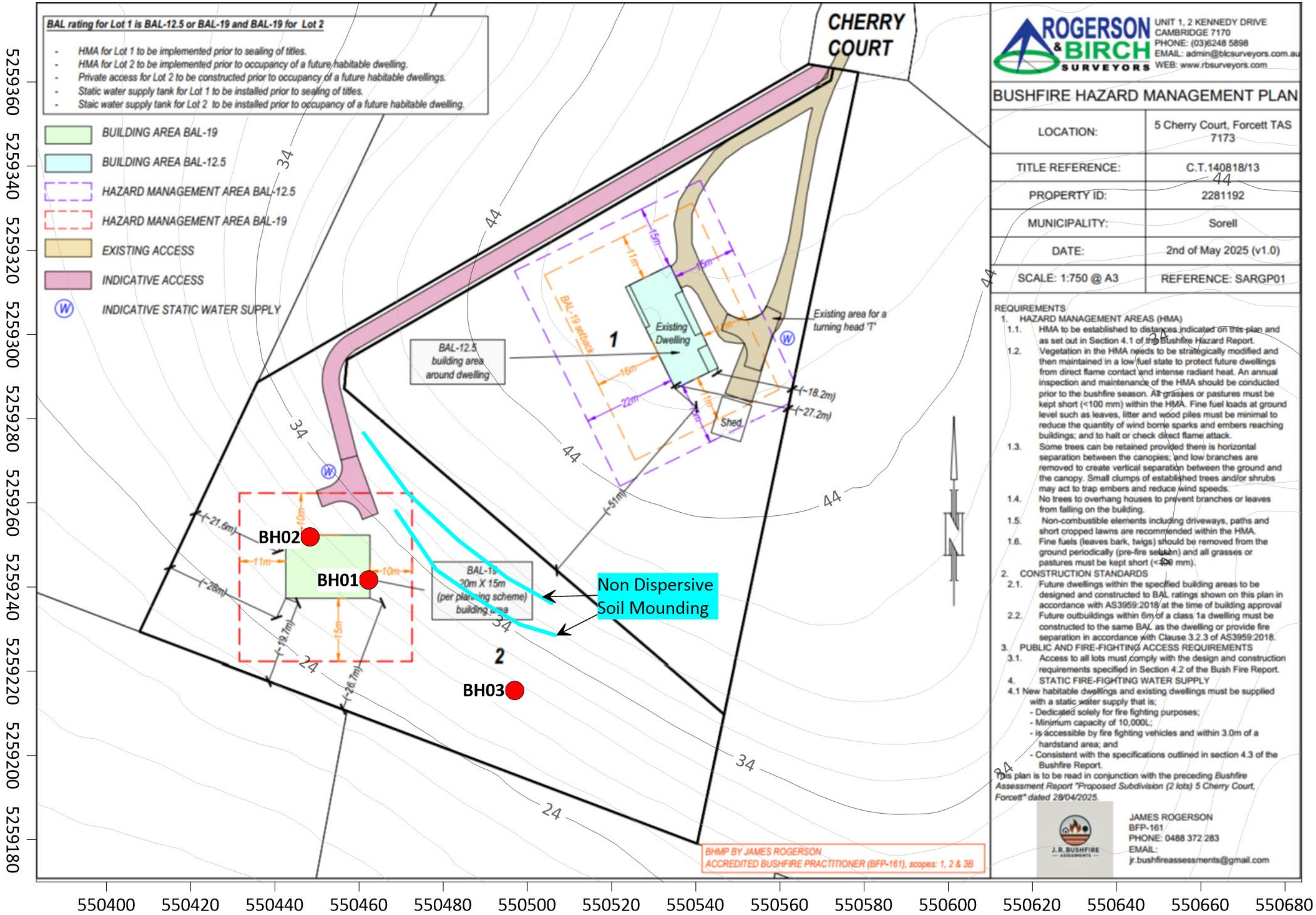
jr.bushfireassessments@gmail.com

Figure 1 Planning Scheme Landslip Hazard Overlay Mapping, Proposed Building and Works & Photo Locations



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🟩	*BUILDING AREA BAL-19*
🟦	*BUILDING AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-12.5*
▭	*HAZARD MANAGEMENT AREA BAL-19*
🟫	*EXISTING ACCESS*
🟪	*INDICATIVE ACCESS*
Ⓦ	*INDICATIVE STATIC WATER SUPPLY*

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   1.3. Some trees can be retained provided there is horizontal separation between the canopies; and low branches are removed to create vertical separation between the ground and the canopy. Small clumps of established trees and/or shrubs may act to trap embers and reduce wind speeds.
   1.4. No trees to overhang houses to prevent branches or leaves from falling on the building.
   1.5. Non-combustible elements including driveways, paths and short cropped lawns are recommended within the HMA.
   1.6. Fine fuels (leaves bark, twigs) should be removed from the ground periodically (pre-fire season) and all grasses or pastures must be kept short (<40 mm).
2. CONSTRUCTION STANDARDS
   2.1. Future dwellings within the specified building areas to be designed and constructed to BAL ratings shown on this plan in accordance with AS3959:2018 at the time of building approval
   2.2. Future outbuildings within 6m of a class 1a dwelling must be constructed to the same BAL as the dwelling or provide fire separation in accordance with Clause 3.2.3 of AS3959:2018.
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   - Minimum capacity of 10,000L;
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Figure 2 Site Borehole Locations

Appendix B Site photos

Photo #1

Photo #2

Photo #3

Photo #4

Photo #5

Appendix C Borehole Logs

enviro·tech CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation
STRUCTURE: Subdivision
EASTING: 550462
NORTHING: 5259242
ACCURACY
HORIZ: 1m **VERT:** ~0.1m

Borehole : BH01
DATE TESTED: 27/05/2025
LOGGED BY: M. Scalisi
ELEVATION: 29.9

LOCATION: 5 Cherry Court - Forcett
CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: AMS Powerprobe 9120 RAP
ESTIMATED GROUND m (m AHD):

DEPTH (m): 0.0, 0.5, 1.0, 1.5, 2.0

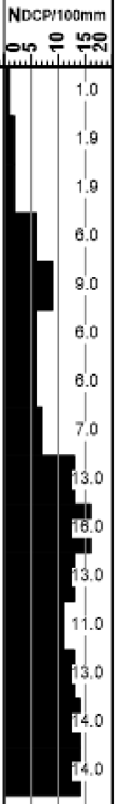
ELEVATION (mAHD): 29.8, 29.6, 29.4, 29.2, 29.0, 28.8, 28.6, 28.4, 28.2, 28.0, 27.8, 27.6

GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER
ML	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	soft to firm	1
CH	CLAY trace sand, black, high plasticity, fine to medium grained sand	very stiff	3
CI	Silty CLAY with sand, very dark brown, medium plasticity, medium to coarse grained sand		5
CI	Silty Sandy CLAY, dark greyish brown, medium plasticity, fine to medium grained sand	hard	6
SC	Silty SAND, black, well sorted, coarse grained sand	dense	7
ML	Clayey Sandy SILT, pale olive, low plasticity, medium grained sand	hard	8
	Borehole Ended At Target Depth End of borehole at 2.3m depth.		

MOISTURE Index	%	Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)
Moist	11		DS			
	27		DS			
	34		DS			
	32		DS			
	32		DS			
	28		DS			

(IS₅₀ MPa)

NSPT 0 10 20 30 40



GROUNDWATER: Not Encountered

PAGE 1 of 1

TESTING: Penetrometer: AS 1289.6.3.2

DCP Blows per 100mm. For penetrometer blows per 100mm <1, distance travelled per blow is measured and converted back to blows per 100mm

DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV(Ømm): downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

enviro·tech
CONSULTANTS
Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation
STRUCTURE: Subdivision
EASTING: 550448
NORTHING: 5259252
ACCURACY
HORIZ: 1m **VERT:** ~0.1m

Borehole : BH02
DATE TESTED: 27/05/2025
LOGGED BY: M. Scalisi
ELEVATION: 29.2

LOCATION: 5 Cherry Court - Forcett
CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: AMS Powerprobe 9120 RAP
ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	%	Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS50 MPa) NSPT 0 10 20 30 40	NDCP/100mm 0 5 10 15 20
0.0	ML	TOPSOIL: SILT, black, low plasticity, medium grained sand, with sand, trace roots, 5 % roots	soft to firm	1	29.2									
	CI	Silty CLAY with sand, very dusky red, medium plasticity, fine to medium grained sand	soft to hard	2	29.0 28.8	Moist	27		DS					
0.5	SM	Silty SAND with clay, dark brown, well sorted, medium grained sand	very loose to very dense	4	28.6		23		DS					
		Extremely Weathered SANDSTONE Bedrock pale yellow		9	28.4									

Refusal in Extremely Weathered SANDSTONE Bedrock
End of borehole at 0.8m depth.

GROUNDWATER: Not Encountered
TESTING:

PAGE 1 of 1

DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV: downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal enviro·tech CONSULTANTS

Positioning: GDA94 & mAHD

ASSESSMENT: Geotechnical Site Investigation

STRUCTURE: Subdivision

EASTING: 550497

NORTHING: 5259215.5

ACCURACY

HORIZ: 0.6m **VERT:** ~0.2m

Borehole : BH03

DATE TESTED: 6/08/2025

LOGGED BY: M. Scalisi

ELEVATION: 29.5

LOCATION: 5 Cherry Court - Forcett

CLIENT: Phillip J. & Jane A. Sargent

EQUIPMENT: Power Auger

ESTIMATED GROUND m (m AHD):

DEPTH (m)	GRAPHIC	DESCRIPTION	DENSITY CONSIST. STRENGTH	LAYER	ELEVATION (mAHD)	MOISTURE Index	MOISTURE %	MOISTURE Well	SAMPLE	TEST	Cu (kPa)	UCS (kg/cm²)	(IS50 MPa) NSPT 0 10 20 30 40	NDCP/100mm 0 5 10 15 20
0.0	ML	TOPSOIL: SILT, very dusky red, low plasticity, medium grained sand, with sand, trace roots, 5 % roots		2	29.5 29.3	Moist	32		DS					
0.5	CH	CLAY with sand, very dusky red, high plasticity, medium grained sand		5	29.1 28.9	Slightly Moist	26		DS					
1.0		Slightly Weathered SANDSTONE Bedrock pale yellow		11	28.7 28.5									
		Refusal in Slightly Weathered SANDSTONE Bedrock End of borehole at 1.1m depth.			28.3									

GROUNDWATER: Not Encountered

PAGE 1 of 1

TESTING: Permeameter: AS 1289.6.7.3

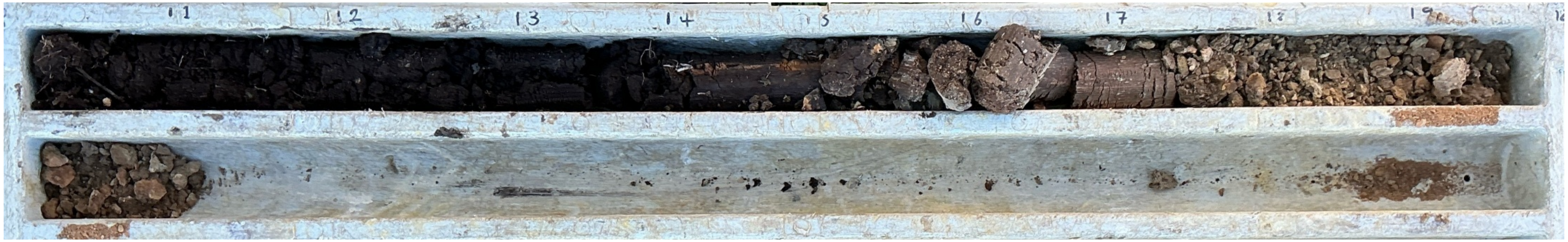
DS: disturbed sample; PV: pocket vane; PP: pocket penotrometer; FV: downhole field vane; U50: undisturbed 50mm sample; REF: DCP refusal

Appendix D Core Photographs

BH01

BH02

BH03



*** 1 metre core tray length**

Appendix E Geotechnical Testing

Dynamic Cone Penetrometer (DCP)

Dynamic cone penetrometer (DCP) testing was conducted according to AS 1289.6.3.2 with the results presented in Appendix C.

Soil Dispersion (Emerson aggregate test)

Select soil samples were tested for sodicity using the Emerson Class number method according to AS1289.3.8.1. The results presented in Table 5 demonstrate that:

- Most of the soil layers mapped at the Site comprise Emerson Class 1 category soils which are considered severely dispersive

Table 5 Summary of the Emerson class results.

Layer	Soil	Depth	Sample ID	Emersion Class	Date Tested	Water	pH
2	TOPSOIL: SILT	0.1	BH03 0.1	Class 2	8/08/2025	DI 14°C	6.6
1	TOPSOIL: SILT	0.2	BH01 0.2	Class 2	30/05/2025	DI 16°C	6.07
3	Silty CLAY with sand	0.3	BH02 0.3	Class 1	30/05/2025	DI 16°C	6.44
4	CLAY trace sand	0.4	BH01 0.4	Class 1	30/05/2025	DI 16°C	5.93
5	CLAY with sand	0.6	BH03 0.6	Class 1	8/08/2025	DI 14°C	7.4
6	Sandy SILT	0.6	BH02 0.6	Class 1	30/05/2025	DI 16°C	6.52
7	Silty CLAY with sand	0.7	BH01 0.7	Class 1	30/05/2025	DI 16°C	6.91
8	Silty Sandy CLAY	1.1	BH01 1.1	Class 1	30/05/2025	DI 16°C	7.25
9	Silty Sandy CLAY	1.7	BH01 1.7	Class 1	30/05/2025	DI 16°C	7.06
10	Clayey Sandy SILT	2	BH01 2.0	Class 2	30/05/2025	DI 16°C	6.92

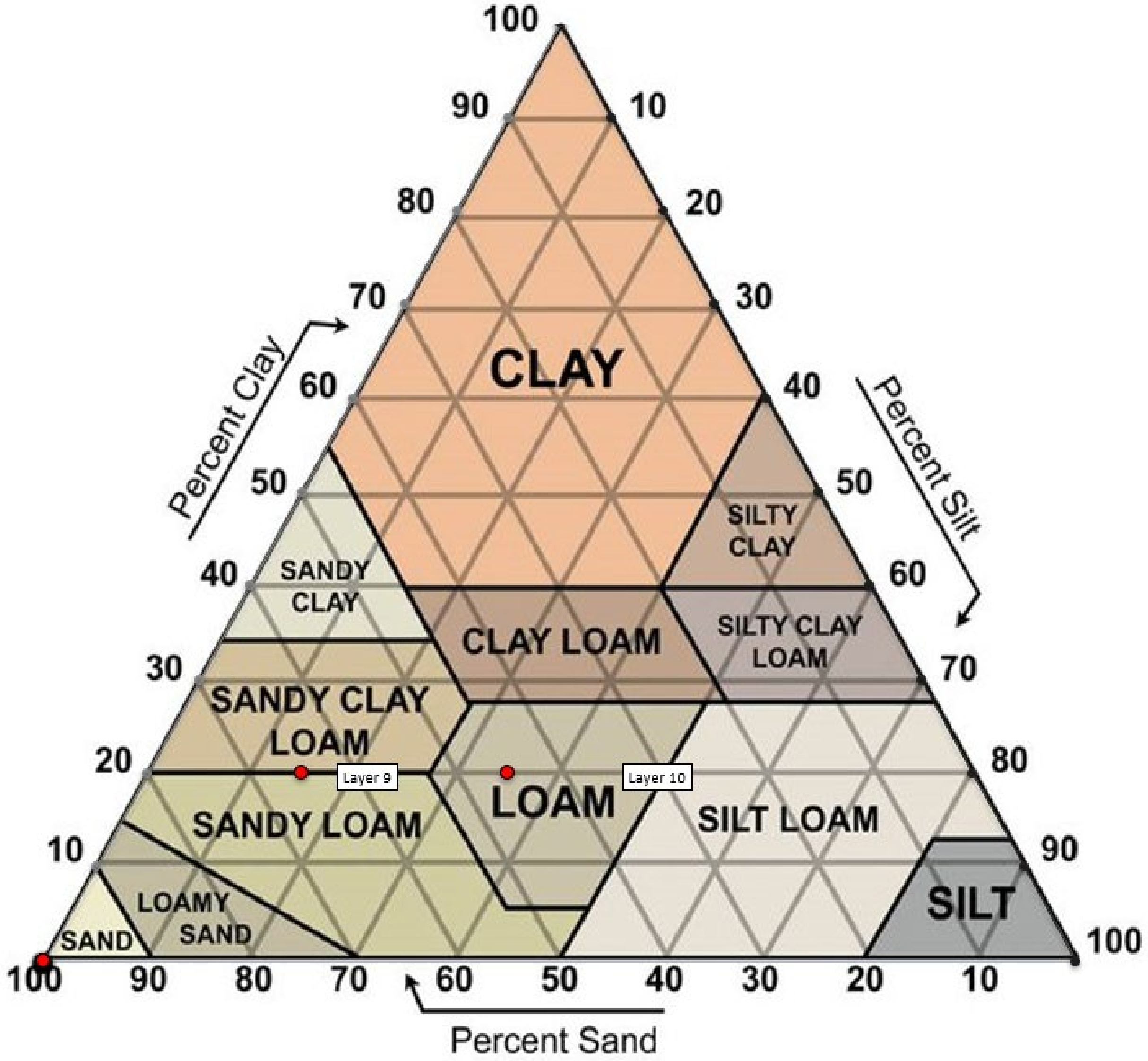
Permeameter Testing

Permeameter testing was carried out in borehole BH03. A soil auger was used to excavate the Soil to prepare for the test to ensure the soak well was effectively draining. Where applicable, the reported water table height has been used as the test depth. Results are presented Table 6.

The soil is interpreted as ranging from a loam to a borderline sandy clay loam to sandy loam.

Table 6 Permeameter testing results.

Borehole	Hole Depth (m)	Hole Diameter (mm)	Test Duration (min)	Flow Rate (cm3/min)	Ksat (m/day)	Ksat (mm/hr)
BH03	1	60	0.5	4935.0	3.3E+00	137.1


100
90
80
70
60
50
40
30
20
10
100
Percent Clay
10
20
30
40
50
60
70
80
90
100
Percent Silt
100
90
80
70
60
50
40
30
20
10
Percent Sand
CLAY
SILTY CLAY
SANDY CLAY
CLAY LOAM
SILTY CLAY LOAM
SANDY CLAY LOAM
Layer 9
Layer 10
LOAM
SANDY LOAM
SILT LOAM
LOAMY SAND
SAND
SILT

Appendix F Geotechnical Interpretation

Footing Minimum Target Depths

Footing design for the proposed structures are to consider the depths of limiting layers at the base of potentially problematic soils. Where practical/allowable, thickened beams may be deepened through problematic soil layers according to engineering specifications (Table 7). Table 8 should be referred to where only 50kPa allowable bearing capacity is required.

Table 7 also presents a summary of the estimated soil depths and associated layers where less than 5mm of vertical soil movement can expected due to soil moisture fluctuations from normal seasonal wetting and drying cycles. Where 5mm tolerances are required, concentrated loads including but not limited to slab edge or internal beam or strip footings shall be supported directly on piers in accordance with minimum target layer depths presented in Table 7, with considerations given to required bearing capacities in accordance with Table 8.

Table 7 Soil characteristic surface movements and recommended footing minimum target depths

Footing design parameters	**BH01**	**BH02**
Ys Calculation Depth	0m^	0m^
Surface movement Ys (mm)	45	10
Soil reactivity class	H1	S
Base of problem soil layer (m)*	0.2	-
Layer at base of problem soil*	1	-
Pier/Footing minimum target depth (m)#	>2.1^	>0.8^
Pier/footing minimum target layer#	8	9
Allowable bearing capacity at target depth (kPa)	400	400

- No problem layers encountered

^ Calculations relative to surface of borehole at the time of investigation

* Base of problematic soil layer depth below top of borehole surface at the time of testing to achieve 100 kPa allowable bearing capacity or greater.

Target soil layer depth where Ys values from normal wetting and drying cycles are estimated at less than 5mm vertical movement. >minimum bored pier depths (see bearing capacity table for bored pier design depths).

Soil and Rock Allowable Bearing Capacity

Soil allowable bearing capacity was calculated from correlations with DCP blow counts. Where high clay and silt content is observed in the soil, soil allowable bearing capacity is determined from undrained shear strengths using field vane correlated DCP values. Interpretive bearing capacity presented in Table 8.

Table 8 Soil allowable bearing capacities and problematic ground conditions.

Depth below investigation surface (m)	**Allowable Bearing Capacity (kPa)**		
	BH01	**BH02**	**BH03**
0	70~		
0.1	80~		
0.2	**150***		
0.3	**250**		
0.4	**290**		
0.5	**290**		
0.6	**250**		
0.7	**>400**	**SANDSTONE**	
0.8	**>400**		**SANDSTONE**
0.9	**>400**		**SANDSTONE**
1	**>400**		**SANDSTONE**
1.1	**>400**		
1.2	**>400**		

Correlations drawn from DCP and vane shear testing.

~ Problematic soil layer attributed to loose, soft, or low allowable bearing capacity soil (<100 kPa)

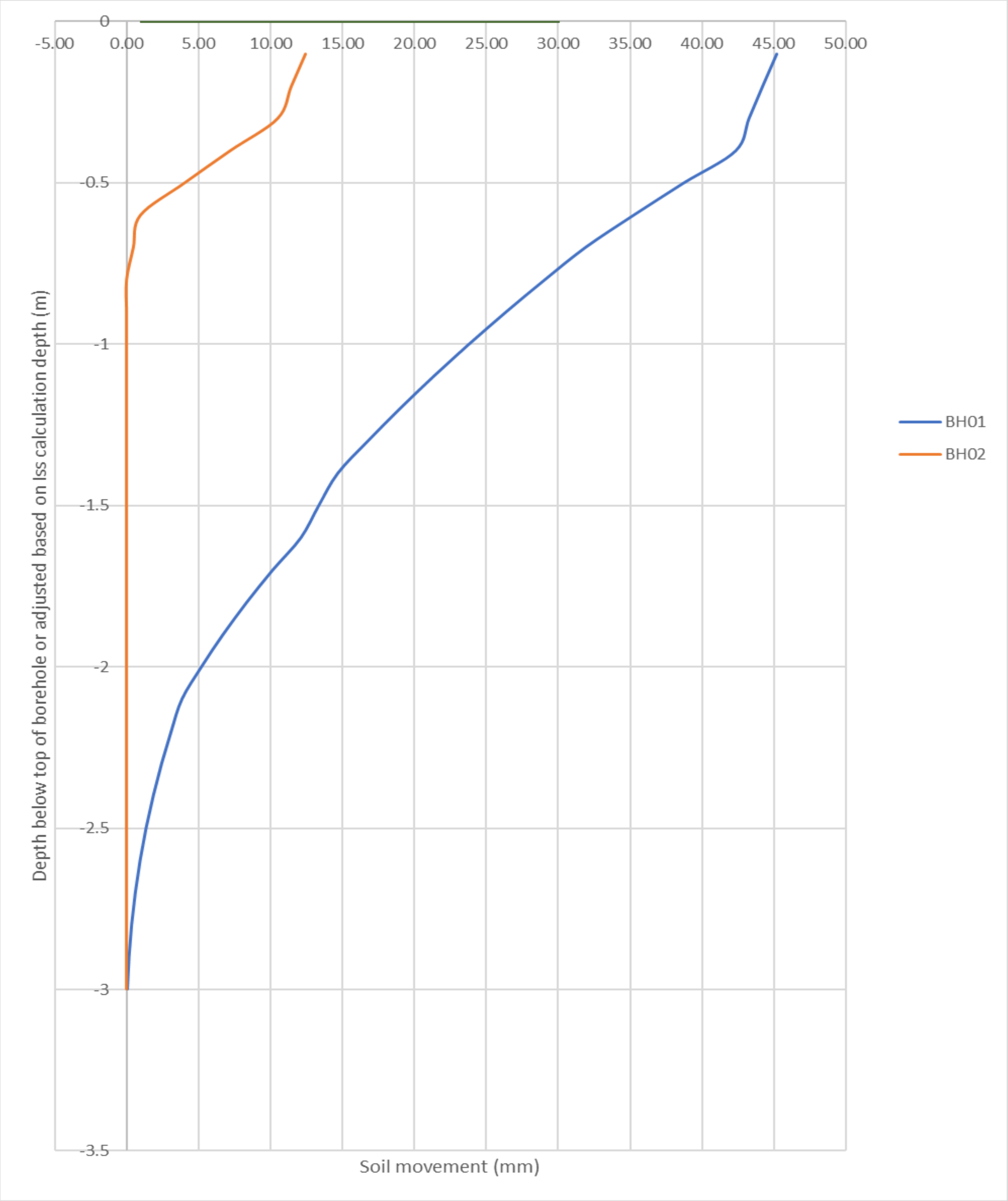
*Soil layer expected at the base of problematic soil layers at test location (or at surface where problematic soils not encountered) to achieve 100 kPa allowable bearing capacity or greater.

Characteristic Surface Movement (Ys)

The characteristic surface movement (soil reactivity) is calculated according to AS 2870 Section 2.3. The calculations are based on Iss % testing results where applicable and are based on complete soil profiles for boreholes drilled within the building Site. In the case of where cut and fill are proposed and building finished floor levels (FFL) are made available, the Iss value is recalculated based on the FFL and estimated cut and fill as per Table 7.

According to AS 2870 Section 2.3, calculations consider the depth of groundwater and bedrock. Soil characteristic surface movements from normal wetting and drying cycles are presented in Figure 3.

Figure 3 Calculated Characteristic Soil Movement Based on Soil Testing



Appendix G General Advice - Dispersive Soil Management

The Site may be susceptible to tunnel erosion if subsurface drainage is not adequately managed. Tunnel erosion typically initiates in excavated cuts; however, it can also develop where dispersive soils are exposed through excavation, leading to the release of pore water and concentrated groundwater discharge. Additional contributing factors may include broken pipes, ineffective stormwater infrastructure, or unmanaged surface flows. If left unaddressed, these conditions can result in progressive subsoil loss, potentially undermining footings or causing settlement-related damage to the structure.

Tunnel erosion typically progresses upslope, initiated by the dissolution and removal of highly dispersive Class 1 and Class 2 soil layers. As tunnels enlarge, they can undermine surrounding soils that may not be dispersive but are still susceptible to collapse due to loss of subsoil support. If unmanaged, tunnel erosion can extend beyond property boundaries, posing a risk to nearby infrastructure including buildings, roads, and underground services. For further background on the management of Emerson Class 1 soils, refer to the Department of Primary Industries, Parks, Water and Environment (DPIPWE, 2009) guidance document.

Dispersive soils should be managed through a combination of drainage control and ground treatment measures. These may include overland flow management, controlled cut and fill practices, and, in more severe cases, the installation of sand barriers to interrupt subsurface flow paths. Where dispersive soils are exposed—particularly on batters or in excavation faces—chemical treatment using gypsum or lime may be employed to improve soil cohesion and reduce erosion potential. Application rates should be guided by Emerson Class test results, as outlined in Table 9.

Gypsum and hydrated lime are proven effective in mitigating erosion in dispersive soils by displacing sodium ions on clay particles and replacing them with calcium. This cation exchange improves soil structure, increases shear strength, and enhances resistance to tunnel and surface erosion. The effectiveness of treatment is influenced by the soil's properties; higher application rates of gypsum are typically required for soils with greater cation exchange capacity, elevated pH, and lower Emerson Class numbers. Application guidelines should be based on laboratory test results, including Emerson Class assessment, to ensure appropriate treatment dosages.

Table 9 Prescribed gypsum and hydrated lime application rates – see Emerson soil testing results

Dispersive soil Emerson class	Gypsum/Hydrated Lime Application Rate pH < 7.5	Gypsum Application Rate pH > 7.5
Class 3	0 to 0.3 kg/m2	0.2 – 0.5 kg/m2
Class 2	0.5 kg/m2	1.0 kg/m2
Class 1	1.0 kg/m2	1.5 kg/m2

Where practicable, vehicle driveways and parking areas should be located on level or gently sloping terrain to minimise the need for deep excavation and reduce disturbance to dispersive soils identified on Site.

General Recommendations

To minimise disturbance and erosion in areas where Class 1 dispersive soils have been identified, the following measures are recommended:

- **Drainage Control:** Construct soil cut-off mounds or shallow interceptor trenches in non-dispersive soils, no deeper than 0.2 m above the interface with Class 1 dispersive soils. These should be positioned upslope of any proposed cuts to divert surface water before it reaches vulnerable areas.
- **Chemical Treatment:** Apply gypsum or hydrated lime to exposed dispersive soils where surface water movement is expected—particularly on freshly cut embankments, filled areas, service trenches, and zones where topsoil has been removed.
- **Surface Protection:** Cover all severely dispersive soils with either impermeable surfacing (e.g. paving) or a layer of non-dispersive topsoil to reduce erosion and limit moisture ingress.
- **Batter Stabilisation:** Place non-dispersive topsoil over freshly cut batters to protect against surface erosion and reduce the likelihood of tunnel initiation.
- **Remediation of Existing Tunnels:** Where tunnel erosion has already occurred, additional stabilisation of natural or constructed drainage gullies may be required. This may include the use of sand barriers and, in more severe cases, geotextile-wrapped drainage rock structures. When correctly designed, such barriers can intercept subsurface flow, promote controlled surface discharge, and direct water away from at-risk areas.

Key Management Measures for Dispersive Soils in Cut Embankments:

Surface water drainage can erode dispersive soils in embankment cuts. Groundwater discharge may worsen tunnel erosion by accelerating the development of secondary porosity—where subsurface flow progressively enlarges voids within the soil mass, leading to tunnel formation and internal instability. Management considerations:

- **Topsoil Removal Risks:** Earthworks commonly begin with the removal of non-dispersive topsoil, which often acts as a natural protective layer. Once removed, the underlying dispersive soils become highly vulnerable to erosion.
- **Barrier Construction in Cut Slopes:** Where excavation is necessary, erosion can be mitigated through immediate installation of physical barriers:
    - Place a sand layer (sand barrier) over exposed dispersive soil within the cut to interrupt flow paths.
    - Construct an earth retaining wall in front of the cut to contain soil and stabilise the slope face.
- **Timely Implementation:** All erosion control measures must be implemented immediately following excavation to prevent the initiation of tunnel erosion.
- **Use of Retaining Structures:** Low-height retaining walls (e.g., timber sleeper walls) constructed at the base of cut faces can assist in retaining eroding soils and maintaining the effectiveness of sand barriers.

Sand Barriers

To manage dispersive soils exposed in cut slopes, the following layered treatment is recommended:

- **Chemical Stabilisation:** Apply gypsum or hydrated lime at application rates specified in Table 9, based on Emerson Class testing.
- **Sand Layer:** Install a minimum 100 mm thick layer of clean, free-draining sand to act as a barrier and interrupt preferential flow paths.
- **Topsoil Cover:** Place a layer of non-dispersive, free-draining topsoil (such as loam) over the sand barrier to retain the sand in place and facilitate effective revegetation or application of surface treatments.
- **Erosion Control:** Implement surface erosion protection measures as outlined in the Erosion Control section to prevent wash-off and maintain system effectiveness.

Retaining Walls

The following measures are recommended when constructing retaining walls in areas with dispersive soils:

- Retaining walls should be founded on bedrock or non-dispersive soils to reduce the risk of tunnel erosion and structural instability.

- Where walls are constructed in Class 1 dispersive soils, freshly cut surfaces may be treated with gypsum or hydrated lime at application rates specified in Table 9 to reduce erosion potential.

Drainage

Effective drainage is critical in dispersive soil environments to prevent erosion, tunnel formation, and structural damage. The following measures are recommended:

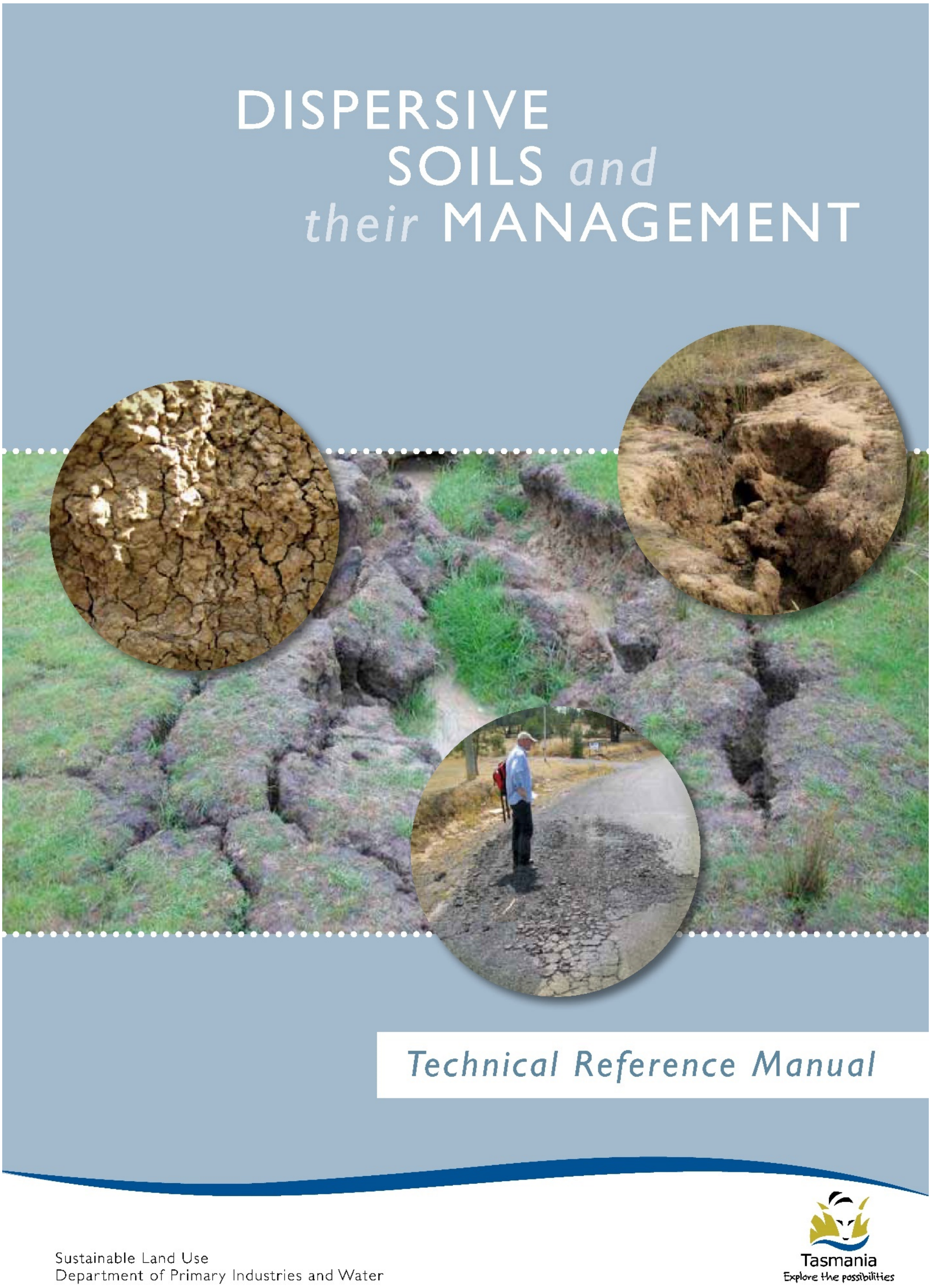
- Divert surface water away from cut and fill slopes to reduce infiltration into dispersive soils.
- A sealed toe drain is essential to prevent water from soaking into freshly cut dispersive soils and migrating through dispersive fill layers beneath paved surfaces.
- For optimal surface drainage over Class 1 soils, install concrete spoon drains in preference to earthen swales to minimise erosion risk.
- Where earthen swale drains are used, stabilise Class 1 soils with gypsum or hydrated lime at a rate adjusted to soil pH. A liner (e.g. 20 mm bentonite layer) beneath topsoil and turf may be used to limit vertical water infiltration.
- Subsurface drains installed in Class 1 soils should be backfilled with a sand mix containing 2% gypsum or hydrated lime to inhibit dispersion and maintain flow pathways.
- Non-perforated drainage pipes should be used to divert water away from identified groundwater discharge points, limiting further erosion.

Filling

The use of dispersive soils as fill presents a significant risk for tunnel erosion, especially where water movement is poorly controlled. The following measures are recommended to reduce risk and ensure long-term stability:

- Dispersive soil used as fill is highly susceptible to tunnel erosion, particularly when exposed to concentrated surface or groundwater flow.
- Groundwater can migrate along the base of and within fill layers, initiating erosion of dispersive materials and undermining overlying structures.
- All proposed filling, especially within or near building footprints, should be carefully managed. This may involve either:
    - Removal of Class 1 dispersive soil from beneath the structure, or
    - Chemical treatment of dispersive fill using gypsum or hydrated lime, applied to the surface of each compacted lift.
    - Preventing water from intercepting dispersive soil by liming the fill or with careful drainage management
- When chemically treating fill:
    - Use 300 mm thick lifts with full application rates as specified in Table 9.
    - For 150 mm thick lifts, halve the application rate accordingly.
- Ensure compaction is achieved close to optimum moisture content, particularly in areas adjacent to footings and structures.
- Paved surfaces over filled areas significantly reduce the risk of tunnel erosion, if cut-off drains are installed to prevent water ingress at the fill base.
- Where feasible, spoon drains and pavement edges at the toe of cut batters should be founded on non-dispersive soil or bedrock to intercept all surface water and eliminate seepage pathways.
- If topsoil is removed prior to filling, and it is classified as slightly dispersive (Class 3) or non-dispersive (Class 4 or higher), it may be replaced with a liner or imported non-dispersive material to protect the dispersive fill beneath.

DPIPWE 2009 Dispersive Soils and their Management. Technical Reference Manual. Sustainable Land Use Department of Primary Industries Water and Environment.



DISPERSIVE SOILS *and* *their* MANAGEMENT

Technical Reference Manual

Sustainable Land Use
Department of Primary Industries and Water

Tasmania
Explore the possibilities

4.1 MANAGEMENT OPTIONS FOR TUNNEL EROSION

Past efforts to repair tunnel erosion in agricultural landscapes have relied on mechanical destruction of the tunnel system by deep ripping, contour furrowing, and contour ripping. Unfortunately many of these techniques either failed or resulted in tunnel re-emergence in an adjacent areas (Floyd 1974, Boucher 1995). The use of these 'agricultural' techniques is inappropriate in peri-urban areas where tunnel repair requires a low incidence of re-failure due to the potential for damage to infrastructure. Experience with the construction of earth dams using dispersive clays, demonstrates that repair and prevention of tunnel erosion in urban and peri-urban environments is best achieved using a combination of,

- » Identification and avoidance of dispersive soils.
- » Precise re-compaction.
- » Chemical amelioration.
- » Sand blocks and barriers.
- » Topsoil, burial and revegetation.

4.2 IDENTIFICATION AND AVOIDANCE OF DISPERSIVE SOILS

The risk of tunnel erosion resulting from construction activities on dispersive soils can often be reduced or eliminated by identifying and avoiding areas containing dispersive soils. The presence and severity of dispersive soils can vary enormously over short distances (Figure 13). In many instances, large scale (ie 10 x 10 or 20 x 20 meter grid) soil survey and screening of soils for dispersion, (using the Emerson crumb test - section 3, Appendix I) can be used to site dwellings and infrastructure away from dispersive soils. Advice should be sought from a suitably qualified and experienced engineer or soil professional.

Figure 13. The severity (or sodium content) and depth of dispersive subsoils can vary considerably over short distances. (a). At this site highly dispersive subsoils exist meters away from (b) non-dispersive soils.

4.3 COMPACTION

Ritchie (1965) demonstrated that the degree of compaction within the dam wall was the single most important factor in reducing dam failure from piping (tunnel erosion). A high degree of compaction reduces soil permeability, restricting the movement of water and dispersed clay through the soil matrix, which decreases the severity of dispersion and restricts tunnel development (Vacher *et al.* 2004). However, dispersive soils can be difficult to compact as they lose strength rapidly at or above optimum moisture content, and thus may require greater compactive force than other soils (McDonald *et al.* 1981). Bell & Bryun (1997) and Bell and Maud (1994) suggest that dispersive clays must be compacted at a moisture content 1.5 -2% above the optimum moisture content in order to achieve suficent density to prevent piping (Elges 1985).

> Construction of structures such as earth dams and footings for buildings with dispersive soils require geotechnical assessment and advice from a qualified and experienced engineer, in order to determine compaction measures such as the optimal moisture content, number of passes, and maximum thickness of compacted layers.

Normal earth moving machinery including bull-dozers, excavators and graders do not provide sufficient compactive force to reduce void spaces or achieve adequate compaction in dispersive soils. A sheepsfoot roller of appropriate weight is usually required to compact dispersive soils. By comparison a D6 dozer applies only 0.6 kg/cm^2 pressure compared to 9.3 kg/cm^2 for a sheepsfoot roller (Sorensen 1995).

4.4 CHEMICAL AMELIORATION

Initiation of tunnel erosion is predominantly a chemical process, so it makes sense to use chemical amelioration strategies when attempting to prevent or repair tunnel erosion in dispersive soils. Despite the widespread use of gypsum and lime to treat sodic soils in agriculture, the use of gypsum and lime to treat tunnel affected areas has been relatively rare (Boucher 1990).

Hydrated lime (calcium hydroxide) has been widely used to prevent piping in earth dams. Rates of application have varied depending on soils and degree of compaction used in construction. Laboratory testing usually indicates that only around 0.5 – 1.0% hydrated lime is required to prevent dispersion, however difficulties with application and mixing necessitate higher rates of application (Moore *et al.* 1985). Moore *et al.* (1985) cite examples of the use of hydrated lime to control piping in earth dams at rates between 0.35% (N.S.W. Australia) and 4% (New Mexico). Elgers (1985)**,** and McElroy (1987) recommend no less than 2% hydrated lime (by weight of the total soil material) to prevent dispersion within dam embankments, while Bell and Maud (1994) suggest that 3% - 4% by mass of hydrated lime should be added to a depth of 0.3m on the upper face of embankments. In alkaline (pH >7.0) soils (most sodic subsoils in Tasmania are neutral or alkaline) the effectiveness of hydrated lime is reduced by the formation of insoluble calcium carbonate (Moore *et al.* 1985), such that gypsum is preferred to hydrated lime. It is important to note that agricultural lime (calcium carbonate) is not a suitable substitute for hydrated lime due to its low solubility (McElroy 1987). Also note that excessive applications of lime may raise soil pH above levels required to sustain vigorous plant growth.

Gypsum (calcium sulphate) is more effective than lime for the treatment of dispersive soils as it increases the electrolyte concentration in the soil solution as well as displacing sodium with calcium within the clay structure (Raine and Loch 2003). Gypsum is less commonly used than hydrated lime in dam construction and other works due to its lower solubility, and higher cost. Elges (1985) recommends that in construction, a minimum of 2% by mass of gypsum be used. Bell and Maud (1994) present a means of calculating the amount of gypsum required to displace excess sodium and bring ESP values within desired limits (normally < 5). Be aware that application of excessive amounts of gypsum may cause soil salinity to temporarily rise beyond the desired level for plant growth.

NOTE:

- Use of gypsum in Tasmania is covered under the Fertiliser Act 1993, which has established the allowable limit for cadmium and lead at 10 mg/kg and 5 mg/kg for mercury.
- Gypsum is usually imported into Tasmania from Victoria or South Australia, which have different standards for allowable heavy metal content.
- Purchasers of gypsum should check with suppliers to ensure that gypsum imported into Tasmania is compliant with current regulations.

Alum (aluminium sulphate) has been effectively used to prevent dam failure and protect embankments from erosion. Application rates are not well established. Limited data suggests mixtures of 0.6 – 1.0% (25% solution of aluminium sulphate) (Bell and Bruyn 1997, McElroy 1987) to 1.5% (Ouhadi, and Goodarzi 2006) of the total dry weight of soil may be appropriate. Alum is however highly acidic (pH 4-5), and thus alum treated soils will need to be capped with topsoil in order to establish vegetation (Ryker 1987). Soil testing is required to establish appropriate application rates for Tasmanian soils.

Long chain polyacrylamides have been shown to increase aggregate stability, reduce dispersion and maintain infiltration rates in dispersive soils (Levy *et al.* 1992, Raine and Loch 2003). However the effect is highly variable between various polyacrylamide products and the chemical and physical properties of the soil. The benefit of polyacrylamides is generally short due to their rapid degradation (Raine and Loch 2003). Further advice and laboratory testing should be conducted before using polyacrylamides to protect earth dams from piping failure.

Note that appropriate application rates for gypsum, hydrated lime, alum and polyacrylamides have not been established for dispersive soils in Tasmania. Extensive laboratory assessment of materials used for the construction of dams or embankments is required before locally relevant 'rules of thumb' can be established for the use of these products.

4.5 SAND BLOCKS AND SAND BARRIERS

Sand filters were first developed to prevent piping in earth dams. Sand filters prevent dam failure by trapping entrained sand and silt, blocking the exit of the tunnel and preventing further tunnel development (Sherard *et al.* 1977). Following the work of Sherard *et al.* (1977), Richley (1992 and 2000) developed the use of sand blocks to prevent tunnel erosion during installation of an optical fibre cable in highly dispersive soils near Campania, Tasmania. The sand blocks work slightly differently to the sand filters in that they allow the free water to rise to the surface through the sand. The use of sand blocks has recently been modified by Hardie *et al.*, (2007) to prevent re-initiation of tunnel erosion along an optical fibre cable near Dunalley. Modifications to the original technique developed by Richley (1992 and 2000) include (Figure 14 &15);

- » Upslope curved extremities to prevent the structure from being by-passed.
- » Geotextile on the downslope wall to prevent collapse or removal of sand following settlement or erosion.
- » Application of gypsum (around 5% by weight) to ensure infiltrating water contains sufficiently electrolyte to prevent further dispersion.
- » Earth mound upslope of the structure to prevent run-on entering the sand blocks.

Figure 15. (a) Installation of sandblock perpendicular to a service trench. Note securing of geotextile to the optical fibre cable to prevent water flowing past the sand block. (b) Sandblock before final topsoiling.

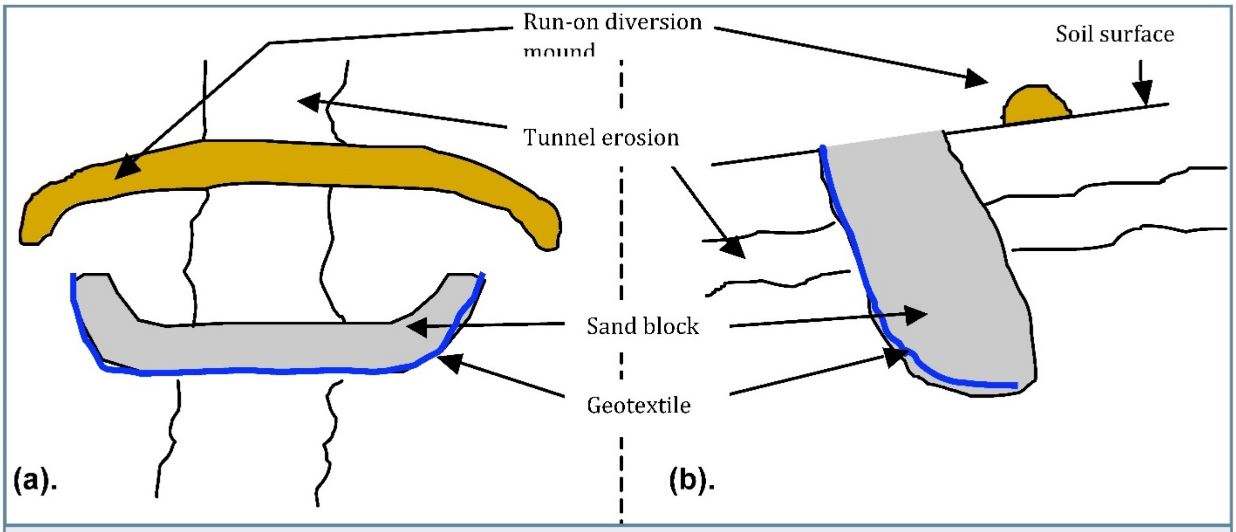


Figure 14. Modified sand block design. (a) plan view, (b) cross section view. The depth of the sand block is determined by the depth of dispersive soils or tunnel erosion. The span length of the structure is determined by the width of the tunnelling.

4.6 USE OF TOPSOIL / BURIAL AND REVEGETATION

Topsoil or burial of exposed dispersive soils reduces the likelihood of subsoil dispersion and initiation of tunnel erosion by;

- Providing a source of salt to increase the electrolyte content of infiltration water.
- Preventing desiccation and subsoil cracking.
- Promoting even infiltration.
- Providing a protective cover from raindrop impact.
- Providing a suitable medium for revegetation.

Topsoil minimises the interaction between water and dispersive clays by providing both a physical and chemical barrier. Topsoil also reduces soil desiccation and development of surface cracks (Sorensen 1995). It is suggested that exposed dispersive subsoils be covered with at least 150mm of non dispersive topsoil and sown with an appropriate mix of grass species. In some cases it will be necessary to protect the topsoil from erosion with 'jute' cloth or similar product.

The suitability of planting trees in tunnel affected areas is influenced by the amount of annual rainfall and frequency of soil cracking resulting from desiccation. Boucher (1995) recommends the preferred option for revegetation of reclaimed tunnel erosion is a widely spaced tree cover in association with a combination of perennial and annual pastures, rather than a dense stand of trees or pasture alone. Experience in Tasmania suggests that in low rainfall areas, or areas in which existing trees or shrubs cause soil drying and cracking, the preferred option for revegetating tunnel affected land is a dense healthy pasture. In high rainfall areas, dense plantings of trees have been successfully used to repair or stabilise tunnel erosion for example Colclough (1973) successfully used Pinus radiata to stabilise tunnel-gully affected land in a moderate rainfall area near Tea Tree, Tasmania.

5.0 ACTIVITIES THAT INCREASE THE RISK OF EROSION ON DISPERSIVE SOILS

ACTIVITIES THAT INCREASE RISK OF INITIATING TUNNEL EROSION, INCLUDE;

- Removal of topsoil.
- Soil excavation or expose of subsoils to rainfall.
- Supply of services via trenches.
- Construction of roads and culverts in dispersive subsoils.
- Installation of sewage and grey water disposal systems in dispersive subsoils.
- Dam construction from dispersive soils.

OPTIONS FOR REDUCING THE RISK OF TUNNEL EROSION DURING CONSTRUCTION AND DEVELOPMENT WORKS ON DISPERSIVE SOILS INCLUDE,

- Where possible do not remove or disturb topsoil or vegetation.
- Ensure that dispersive subsoils are covered with an adequate layer of topsoil.
- Avoid construction techniques that result in exposure of dispersive subsoils.
- Use alternatives to 'cut and fill' construction such as pier and post foundations.
- Where possible avoid the use of trenches for the supply of services ie water & power.
- If trenches must be used, ensure that repacked spoil is properly compacted, treated with gypsum and topsoiled.
- Consider alternative trenching techniques that do not expose dispersive subsoils.
- Ensure runoff from hard areas is not discharged into areas with dispersive soils.
- If necessary create safe areas for discharge of runoff.
- If possible do not excavate culverts and drains in dispersive soils.
- Consider carting non-sodic soil to create appropriate road surfaces and drains without the need for excavation.
- Ensure that culverts and drains excavated into dispersive subsoils are capped with non-dispersive clays mixed with gypsum, topsoiled and vegetated.
- Avoid use of septic trench waste disposal systems; consult your local council about the use of alternative above ground treatment systems.
- Where possible do not construct dams with dispersive soils, or in areas containing dispersive soils.
- If dams are to be constructed from dispersive clays, ensure you consult an experienced, qualified civil engineer to conduct soil tests before commencing construction.
- Construction of dams from dispersive soils is usually possible, using one or a combination of: precise compaction, chemical amelioration, capping with non-dispersive clays, sand filters and adequate topsoiling.

With all forms of construction on dispersive soils, ensure you obtain advice and support from a suitably experienced and qualified engineer or soil professional before commencing work.

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

CSIRO

BTF 18
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; landslip; 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 perpends).

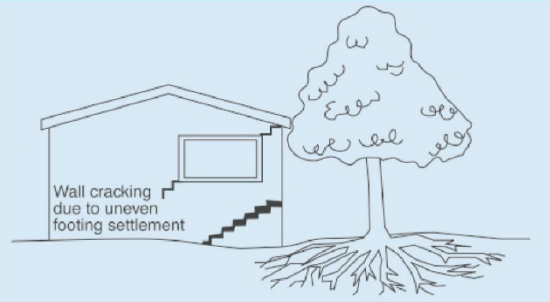
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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.

Trees can cause shrinkage and damage



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 watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

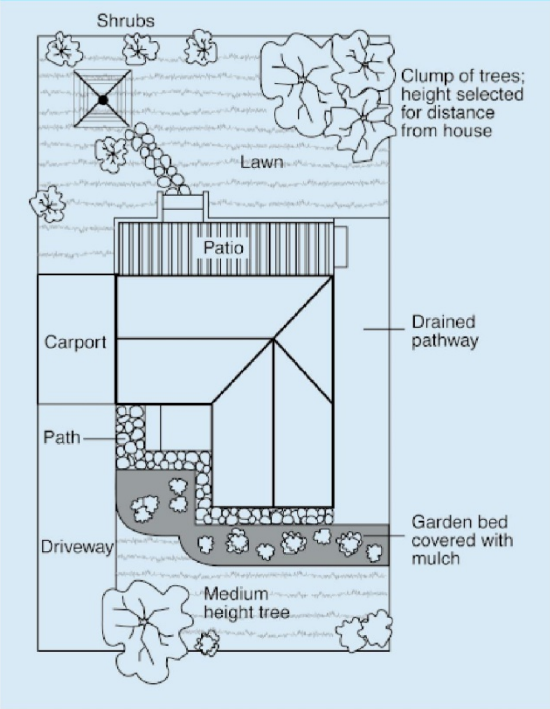
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. 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:

- 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 create 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 Diagnosis.

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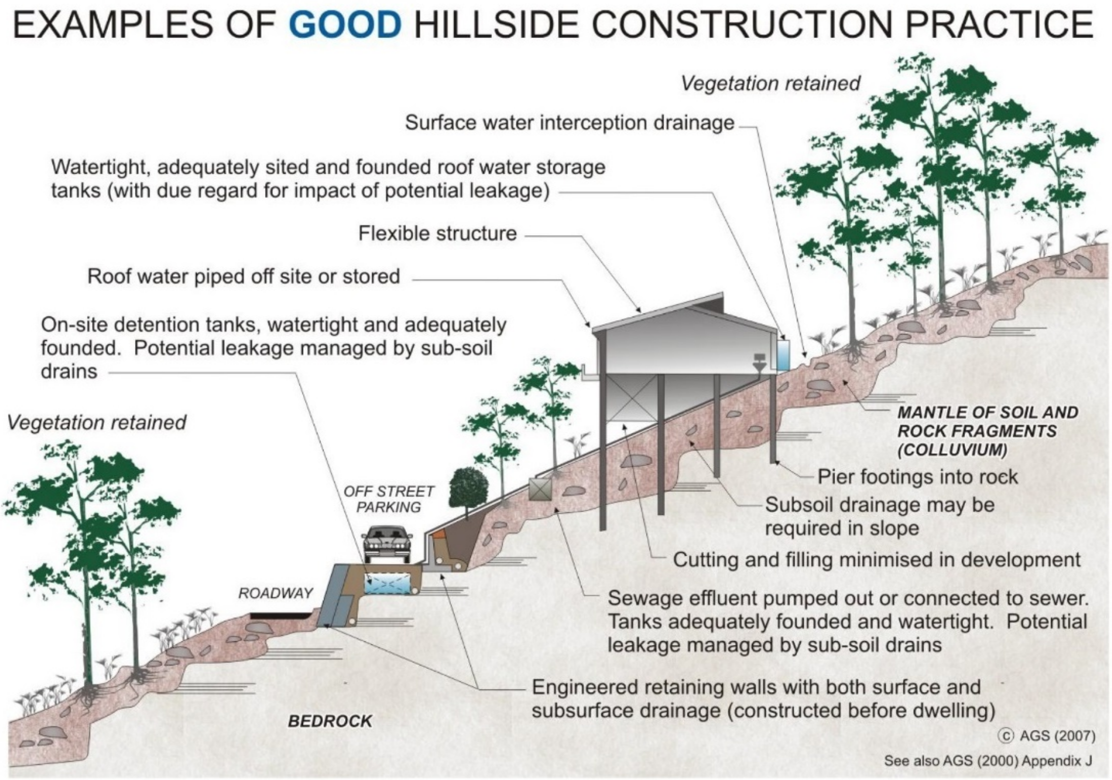
Appendix I Examples of Good Hillside Construction (AGS LRM LR8)

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.



ⓒ AGS (2007)

See also AGS (2000) Appendix J

WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

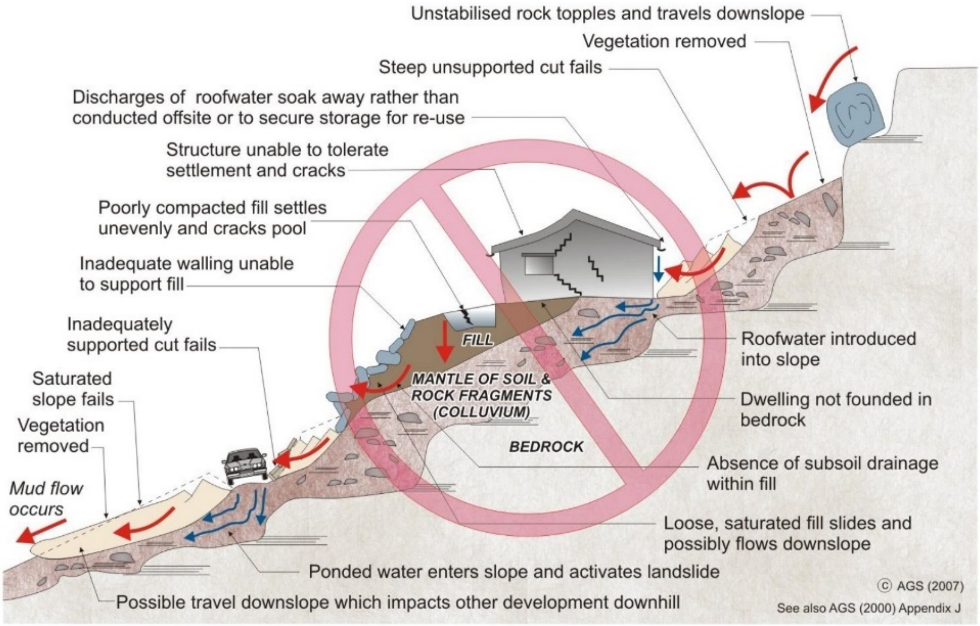
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

EXAMPLES OF POOR HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soak into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herring bone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal

GeoGuide LR10 - Coastal Landslides

- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

Form **55**

To: Phillip J. & Jane A. Sargent — *Owner /Agent*
5 Cherry Court — *Address*
Forcett Sorell TAS 7173 — *Suburb/postcode*

Qualified person details:

Qualified person: Kris Taylor
Address: 445 Macquarie Street
Hobart 7004
Phone No: 0476 595 889
Fax No:
Licence No: NA
Email address: office@envirotechtas.com.au

Qualifications and Insurance details: Bachelor of Science with Honours in Geology. Loyd's Underwriting $2,000,000. Soil and rock mechanics. Soil and rock testing.

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Geo-technical Reports

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work: Landslip Hazard Report

Address: 5 Cherry Court
Forcett 7173
Lot No: 13
Certificate of title No: 140818/13

The assessable item related to this certificate: Landslip Hazard Report prepared by a geotechnical practitioner with experience and competence in the preparation of landslip hazard reports

(description of the assessable item being certified)
Assessable item includes –

- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Geotechnical

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable items, at any stage, as part of – *(tick one)*

● building work, plumbing work or plumbing installation or demolition work

OR

○ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents: Enviro-Tech Consultants Pty. Ltd. 2025. Landslip Hazard Assessment Report for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 06/08/2025.

Relevant calculations:

References:
Directors Determination - Landslip Hazard Areas Areas
Extract from Australian Geomechanics Journal and News of the Australian Geomechanics Society Volume 42 No 1 March 2007. Landslide Risk Management
Building on Tasmanian Landscapes: Guidance for Geotechnical Reporting in Tasmania (Mineral Resources Tasmania, 2018)

Substance of Certificate: (what it is that is being certified)

Scope and/or Limitations

Tasmanian Planning Scheme – State Planning Provisions: To ensure that a tolerable risk can be achieved and maintained for the type, scale and intensity and intended life of use or development on land within a landslip hazard area.

Directors determinatiopn: lowest level of likely risk from landslip to secure the benefits of a use or development in a landslip hazard area, and which can be managed through routine regulatory measures or by specific hazard management measures for the intended life of each use or development.

I certify the matters described in this certificate.

Qualified person: *Signed:*

Certificate No:

Date: 06/08/2025

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Email address: office@envirotechtas.com.au

Qualifications and Insurance details: Bachelor of Science with Honours in Geology. Lloyd's Underwriters: soil and rock mechanics, soil and rock testing

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Geo-technical Reports

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work: Geotechnical Site Investigation

Address: 5 Cherry Court
Forcett 7173
Lot No: 13
Certificate of title No: 140818/13

The assessable item related to this certificate: Geotechnical Site Investigation written in accordance with AS1726 by a geotechncial practitioner with appropriate experience, training and qualifications.*

(description of the assessable item being certified)
Assessable item includes –
- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Geotechnical including landslide risk assessment in accordance with “Practice Note Guidelines for Landslide Risk Management 2007” published by the Australian Geomechanics Society.*

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable items, at any stage, as part of – *(tick one)*

● building work, plumbing work or plumbing installation or demolition work

OR

○ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents: Enviro-Tech Consultants Pty. Ltd. 2025. Geotechnical Site Investigation for Foundations and Wastewater for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 06/08/2025.

Relevant calculations:

References: - AS1726-2017 Geotechnical Site Investigations

Substance of Certificate: *(what it is that is being certified)*

- An assessment of:
- Foundations for proposed building structures.*

Scope and/or Limitations

The Geotechnical Site Investigation applies to the Site and Project Area as inspected and does not account for future alteration to foundation conditions as a result of earth works, drainage condition changes or variations in site maintenance which are not included within the provided plans.

***This report contains soil classification information prepared in accordance with AS2870 as well as AS2870 extracts which may be used as general guidance for plumbing design. The hydraulic designer is to use their own judgment in the application of this information and this report must be read in in conjunction with hydraulic plans for the proposed development.**

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:			6/08/2025

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Phone No: 0476 595 889

Fax No:

Licence No: NA

Email address: office@envirotechtas.com.au

Qualifications and Insurance details: Bachelor of Science with honours in geology, 25 years environmental geology experience, PI Insurance to $2,000,000 in environmental geology

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Site and soil evaluation and land application system design*

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work

Address: 5 Cherry Court
Forcett 7173

Lot No: 13

Certificate of title No: 140818/13

The assessable item related to this certificate: Site and soil evaluation for wastewater management

(description of the assessable item being certified)
Assessable item includes –
- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: On-site wastewater management

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable items, at any stage, as part of – *(tick one)*

● building work, plumbing work or plumbing installation or demolition work

OR

○ a building, temporary structure or plumbing installation

In issuing this certificate the following matters are relevant –

Documents:

Enviro-Tech Consultants Pty. Ltd. 2025. Geotechnical Site Investigation for Foundations and Wastewater for a Proposed Subdivision, 5 Cherry Court - Forcett. Unpublished report for Phillip J. & Jane A. Sargent by Enviro-Tech Consultants Pty. Ltd., 06/08/2025.

Site 'On-site wastewater design report' (CKEMP Design)

References:

Substance of Certificate: *(what it is that is being certified)*

- An assessment of Site and soil conditions for on-site wastewater management and design

Scope and/or Limitations

*Site and soil evaluation by Enviro-Tech Consultants Pty. Ltd.
Land application system design is assessed in a separate 'On-site wastewater report' by a licensed building service designer:
 - Chris Fysh Licensed Building Services Designer - Civil / Hydraulic (License No: 479819732)

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:			6/08/2025