

**PP201/2012-3**

**15 Karingal Drive WYE RIVER**

**Lot: 101 LP: 50268 V/F: 8889/970**

**Construction of a Single Dwelling & Removal  
of Two (2) Trees**

**B Pursehouse**

**Officer - Bernadette McGovan**

# **EXHIBITION FILE**

*This document is made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any Copyright.*

Submissions to this planning application will be accepted until a decision is made on the application.

If you would like to make a submission relating to a planning permit application, you must do so in writing to the Planning Department

# Application to AMEND a Planning Permit

If you need help to complete this form, read MORE INFORMATION at the end of this form.

**⚠** Any material submitted with this application, including plans and personal information, will be made available for public viewing, including electronically, and copies may be made for interested parties for the purpose of enabling consideration and review as part of a planning process under the *Planning and Environment Act 1987*. If you have any questions, please contact Council's planning department.

**⚠** This form cannot be used to:

- amend a permit or part of a permit if the Victorian Civil and Administrative Tribunal (VCAT) has directed under section 85 of the Act that the responsible authority must not amend that permit or that part of the permit (as the case requires); or
- amend a permit issued by the Minister under Division 6 of Part 4 of the Act (these applications must be made to the Minister under section 971 of the Act).

**⚠** Questions marked with an asterisk (\*) must be completed.

**ℹ** Click for further information.

Clear Form

## The Land **ℹ**

Address of the land. Complete the Street Address and one of the Formal Land Descriptions.

### Street Address \*

Unit No.:	St. No.: 15	St. Name: Karingal drive
Suburb/Locality: Wye River		Postcode: 3234

### Formal Land Description \*

Complete either A or B.

**⚠** This information can be found on the certificate of title.

If this application relates to more than one address, attach a separate sheet setting out any additional property details.

A Lot No.: 101  Lodged Plan  Title Plan  Plan of Subdivision No.: 50268

OR

B Crown Allotment No.: Section No.:

Parish/Township Name:

## Planning Permit Details **ℹ**

What permit is being amended?\*

Planning Permit No.: PP201/2012-2

## The Amended Proposal **ℹ**

**⚠** You must give full details of the amendment being applied for. Insufficient or unclear information will delay your application.

What is the amendment being applied for?\*

- Indicate the type of changes proposed to the permit.
- List details of the proposed changes.

If the space provided is insufficient, attach a separate sheet.

This application seeks to amend:

- What the permit allows  Plans endorsed under the permit
- Current conditions of the permit  Other documents endorsed under the permit

Details:

I would like to amend the permit to allow a second story, the area has been reduced in size to comply with height restrictions, I have attached drawings, RSS, Copy of Plan and a new LCA to accommodate this and a addendum to the LSR assessment.

Please call me for an immediate payment of application fee and any further queries, thank you.

**⚠** Provide plans clearly identifying all proposed changes to the endorsed plans, together with: any information required by the planning scheme, requested by Council or outlined in a Council checklist; and if required, include a description of the likely effect of the proposal.



## Development Cost i

### Estimate cost of development\*

If the permit allows *development*, estimate the cost difference between the development allowed by the permit and the development to be allowed by the amended permit.

Cost of proposed amended development:

\$390000.00

Cost of the permitted development:

\$300000.00

Cost difference (+ or -):

\$90000.00

Insert 'NA' if no development is proposed by the permit.

 You may be required to verify this estimate.

## Existing Conditions i

### Describe how the land is used and developed now \*

For example, vacant, three dwellings, medical centre with two practitioners, licensed restaurant with 80 seats, grazing.

Have the conditions of the land changed since the time of the original permit application?  Yes  No

If yes, please provide details of the existing conditions.

yes, structural concrete (underground contiguous pile walls/bored piers for house) works are now complete and septic is installed

Provide a plan of the existing conditions if the conditions have changed since the time of the original permit application. Photos are also helpful.

## Title Information i

### Encumbrances on title \*

Does the proposal breach, in any way, an encumbrance on title such as a restrictive covenant, section 173 agreement or other obligation such as an easement or building envelope?

- Yes (If 'yes' contact council for advice on how to proceed before continuing with this application.)
- No
- Not applicable (no such encumbrance applies).

Provide a full, current copy of the title for each individual parcel of land forming the subject site. The title includes: the covering 'register search statement', the title diagram and the associated title documents, known as 'instruments', for example, restrictive covenants.



## Applicant and Owner Details i

Provide details of the applicant and the owner of the land.

### Applicant \*

The person who wants the permit.

Name:		
Title: Mr	First Name: Ben	Surname: Pursehouse
Organisation (if applicable):		
Postal Address:	If it is a P.O. Box, enter the details here:	
Unit No.:	St. No.: 15	St. Name: Railway Place West
Suburb/Locality: Preston	State: Vic	Postcode: 3072

Please provide at least one contact phone number \*

<b>Contact information for applicant OR contact person below</b>	
Business phone:	Email: ben@uniquetileandstone.com.au
Mobile phone: 0422451616	Fax:

Where the preferred contact person for the application is different from the applicant, provide the details of that person.

<b>Contact person's details*</b>		Same as applicant <input type="checkbox"/>
Name:		
Title:	First Name:	Surname:
Organisation (if applicable):		
Postal Address:	If it is a P.O. Box, enter the details here:	
Unit No.:	St. No.:	St. Name:
Suburb/Locality:	State:	Postcode:

### Owner \*


The person or organisation who owns the land

Where the owner is different from the applicant, provide the details of that person or organisation.


<b>Owner's details*</b>		Same as applicant <input type="checkbox"/>
Name:		
Title:	First Name:	Surname:
Organisation (if applicable):		
Postal Address:	If it is a P.O. Box, enter the details here:	
Unit No.:	St. No.:	St. Name:
Suburb/Locality:	State:	Postcode:
Owner's Signature (Optional):	Date: day / month / year	

## Declaration i

This form must be signed by the applicant\*

 Remember it is against the law to provide false or misleading information, which could result in a heavy fine and cancellation of the permit.

I declare that I am the applicant; that all the information in this application is true and correct; that all changes to the permit and plan have been listed as part of the amended proposal and that the owner (if not myself) has been notified of the permit application.

Signature: 	Date: 14 / 02 / 2019 day / month / year
---	--

## Need help with the Application? i

If you need help to complete this form, read More Information at the end of this form or contact Council's planning department. General information about the planning process is available at [planning.vic.gov.au](http://planning.vic.gov.au)

Contact Council's planning department to discuss the specific requirements for this application and obtain a checklist. Insufficient or unclear information may delay your application.

Has there been a pre-application meeting with a council planning officer?

<input type="radio"/> No	<input type="radio"/> Yes	If 'Yes', with whom?:
		Date: day / month / year



# Imaged Document Cover Sheet

THIS COPIED DOCUMENT IS MADE AVAILABLE FOR THE SOLE PURPOSE OF ENLIGHTENING ITS CONSIDERATION AND REVIEW AS PART OF A PLANNING PROCESS UNDER THE PLANNING AND ENVIRONMENT ACT 1987. THE DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.

The document following this cover sheet is an imaged document supplied by **LANDATA®**, Land Use Victoria.

Document Type	<b>Plan</b>
Document Identification	<b>TP452300C</b>
Number of Pages (excluding this cover sheet)	<b>2</b>
Document Assembled	<b>14/02/2019 15:00</b>

**Copyright and disclaimer notice:**

© State of Victoria. This publication is copyright. No part may be reproduced by any process except in accordance with the provisions of the Copyright Act and for the purposes of Section 32 of the Sale of Land Act 1962 or pursuant to a written agreement. The information is only valid at the time and in the form obtained from the LANDATA® System. The State of Victoria accepts no responsibility for any subsequent release, publication or reproduction of the information.

The document is invalid if this cover sheet is removed or altered.

THIS COPIED DOCUMENT IS MADE AVAILABLE FOR THE SOLE PURPOSE OF ENABLING CONSIDERATION AND REVIEW AS PART OF A PLANNING PROCESS UNDER THE PLANNING AND ENVIRONMENT ACT 1987. THE DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.

TP 452300C

TITLE PLAN	EDITION 1
<p><b>Location of Land</b></p> <p>Parish: KAANGLANG</p> <p>Township:</p> <p>Section:</p> <p>Crown Allotment:</p> <p>Crown Portion:</p> <p>Last Plan Reference: LP 50268</p> <p>Derived From: VOL 8889 FOL 970</p> <p>Depth Limitation: 50 FEET</p>	<p><b>Notations</b></p> <p>ANY REFERENCE TO MAP IN THE TEXT MEANS THE DIAGRAM SHOWN ON THIS TITLE PLAN</p>

**Description of Land / Easement Information**

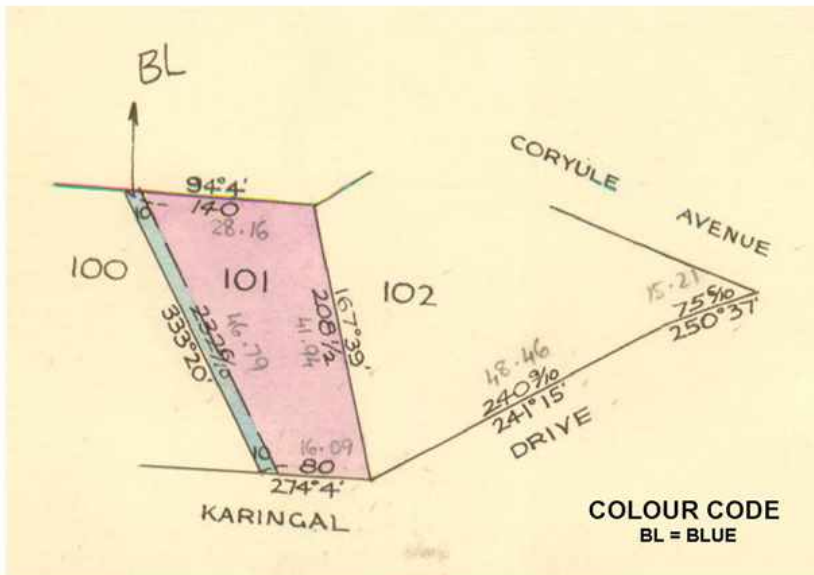
A-1 = RIGHT OF CARRIAGEWAY EASEMENT APPURTENANT TO THE WITHIN LAND CREATED BY INSTRUMENT R221493N

**ENCUMBRANCES REFERRED TO**  
 As to the land coloured blue -  
THE EASEMENTS (if any) existing over the same by virtue of - --  
 Section 98 of the Transfer of -  
 Land Act -

THIS PLAN HAS BEEN PREPARED FOR THE LAND REGISTRY, LAND VICTORIA, FOR TITLE DIAGRAM PURPOSES AS PART OF THE LAND TITLES AUTOMATION PROJECT

COMPILED: 08/07/2002  
 VERIFIED: DA

SEE SHEET 2 FOR FURTHER EASEMENT DETAILS

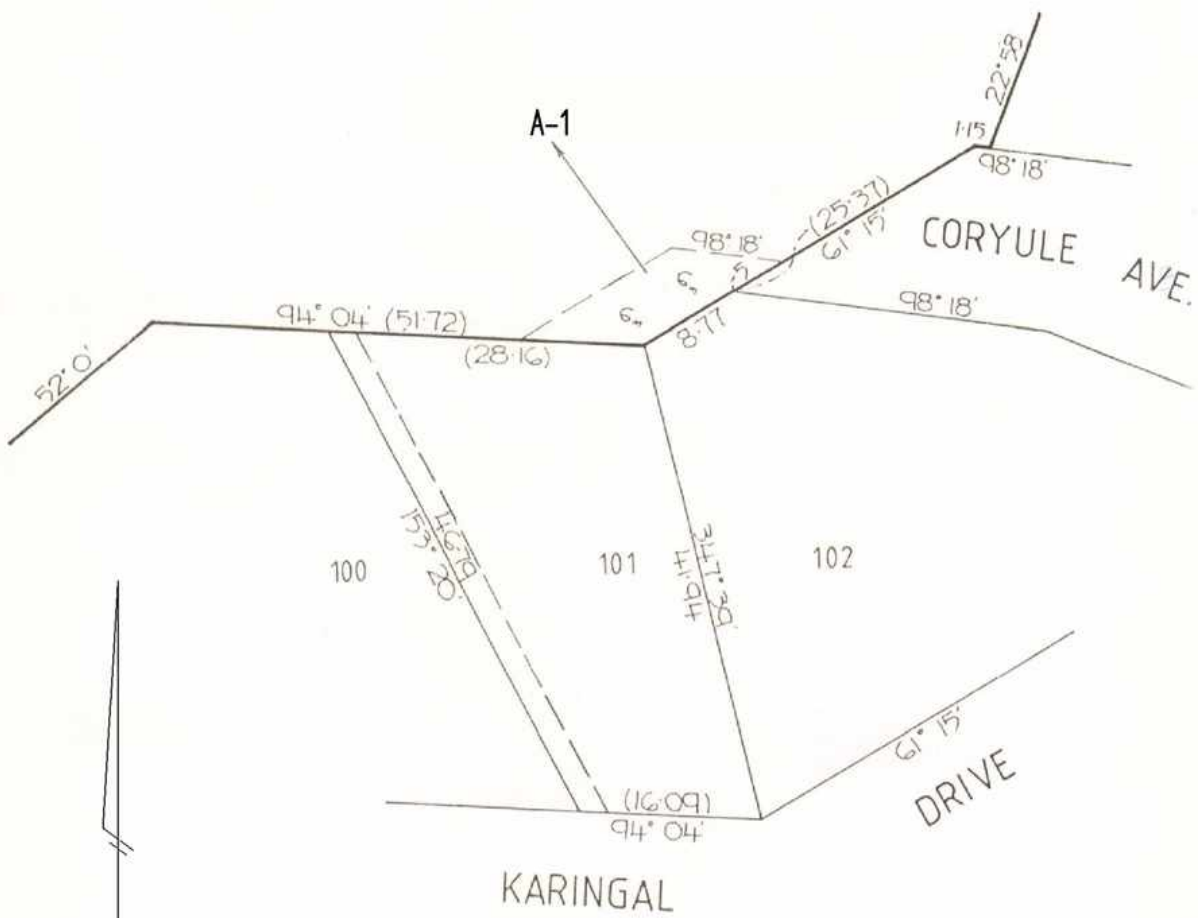




THIS COPIED DOCUMENT IS MADE AVAILABLE FOR THE SOLE PURPOSE OF PROVIDING CONSIDERATION AND REVIEW AS PART OF A PLANNING PROCESS UNDER THE PLANNING AND ENVIRONMENT ACT 1987. THE DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.

TITLE PLAN

TP 452300C



LENGTHS ARE IN METRES

Metres = 0.3048 x Feet  
Metres = 0.201168 x Links

Sheet 2 of 2 sheets

# LAND CAPABILITY ASSESSMENT REPORT

## FOR

### 15 KARINGAL DRIVE, WYE RIVER

Prepared for:	Ben Pursehouse
Prepared by:	Nerida L Harrison Graduate Engineering Geologist <i>BSc (Geology)</i>
Approved by:	David J Horwood Senior Engineering Geologist <i>BAppSc (Geology); MAusIMM CP(Geo); MAIG</i>
Reference No.	18L333LCA
Date:	14 February 2019
Revised:	



## Contents

1. INTRODUCTION .....	2
1.1. REPORT SUMMARY .....	2
1.2. SITE OVERVIEW .....	3
2. DESCRIPTION OF THE DEVELOPMENT .....	5
3. SITE AND SOIL ASSESSMENT .....	6
3.1. SITE KEY FEATURES .....	6
3.2. SITE ASSESSMENT RESULTS .....	8
3.3. SOIL KEY FEATURES .....	9
3.4. SOIL ASSESSMENT RESULTS .....	13
3.5. OVERALL LAND CAPABILITY RATING .....	13
4. WASTEWATER MANAGEMENT SYSTEM .....	14
4.1. EFFLUENT DISPOSAL SYSTEM .....	14
4.2. DESCRIPTION OF THE IRRIGATION SYSTEM .....	14
4.3. SIZING THE IRRIGATION SYSTEM .....	15
4.3.1 Water Balance .....	15
4.3.2 Nutrient Balance .....	16
4.3.3 Minimum Disposal Field and Land Application Area .....	17
4.4. SITING AND CONFIGURATION OF THE IRRIGATION SYSTEM .....	17
4.5. BUFFER DISTANCES .....	18
4.6. INSTALLATION OF THE IRRIGATION SYSTEM .....	18
4.7. TREATMENT SYSTEM .....	19
5. MONITORING, OPERATION AND MAINTENANCE .....	20
6. CONCLUSIONS .....	21
7. REFERENCES .....	22

## List of Tables

Table 1: Risk Assessment of Site Characteristics .....	6
Table 2: Risk Assessment of Soil Characteristics .....	10

## List of Appendices

Appendix I: Aerial Photo .....	23
Appendix II: Site Plan .....	24
Appendix III: Test Site and LAA Location Plan .....	25
Appendix IV: Borehole Descriptions .....	26
Appendix V: Ksat, Water and Nutrient Balance Computation .....	29
Appendix VI: Gypsum Requirement .....	33
Appendix VII: Runoff Coefficient Computation .....	35
Appendix VIII: Groundwater Movement Computations .....	36

---

## 1. INTRODUCTION

AGR Geosciences Pty Ltd (AGR) was engaged by Ben Pursehouse (the Client) to undertake a Land Capability Assessment (LCA) for the 892m<sup>2</sup> site at No. 15 Karingal Drive, Wye River. Due to the high landslide risk in the Wye River area, AGR were engaged to provide specific advice regarding on-site wastewater management to conform to appropriate landslide risk management.

This report is a risk assessment for on-site waste water management undertaken in accordance with EPA Vic Publication 891.4 *Code of Practice Onsite Waste Water Management* (2016) and AS/NZ 1547:2012 *On-site Domestic Wastewater management* (2012).

The field investigation and report which accompany this review have been undertaken and prepared by suitably experienced staff. AGR has appropriate professional indemnity insurance for work of this type.

### 1.1. REPORT SUMMARY

This report will accompany an Application to Install a Septic Tank submitted to the Colac-Otway Shire Council for an onsite wastewater management system for a private residence. This document provides information about the site and soil conditions. It also provides a detailed LCA for the 892m<sup>2</sup> lot, and includes a conceptual design for a suitable onsite wastewater management system, including recommendations for monitoring and management requirements.

A number of options have been considered for both the treatment system and land application area (LAA). However, our recommendation is that wastewater should be treated to a secondary standard by a suitable EPA-approved treatment system and in our opinion the effluent is best applied to the land via pressure compensated sub surface drip irrigation with terracing where required.

Secondary level treatment options may include an AWTS, single-pass sand filter, membrane bioreactor, with disinfection or any other suitable EPA approved alternative.

## 1.2. SITE OVERVIEW

<b>Allotment</b>	<p>Previously undeveloped and currently vacant lot within the fire affected zone. Planned development consists of an elevated, double storey, 3 bedroom, clad framed residential dwelling with front porch, side ramp and rear decking.</p> <p>Existing driveway providing access from Coryule Avenue</p>
<b>Ground cover</b>	<p>Previous fire has removed a great deal of understory and ground cover vegetation exposing bare soils.</p>
<b>Trees</b>	<p>Numerous medium to large Eucalyptus trees remain across the site especially over the upper plateau.</p>
<b>Topography</b>	<p>Crest of a subdued plateau located on the toe of a local spur between two more prominent southerly trending spurs belonging to a south-east trending ridge line. The site is sub horizontal on the crest of the hill and has 10m local relief on the southern flank.</p> <p>The site is directly downslope of a significant drainage line which off sets to the west around the hill. The drainage line is narrow with steep gully flanks.</p> <p>The plateaued hill upon which the subject site is located has most likely been partly formed by a debris flow deposit originating from upslope to the north and flowing down a wide drainage line or gully. The debris accumulation has offset the main drainage line which is now rejuvenating and incising the western side of the deposit.</p>
<b>Surface drainage</b>	<p>Generally fair conditions over the majority of the site, however the potential for poor drainage conditions exist at the base of the driveway and across the north-east corner of the property (plateau area). Minor hummocky ground with rolling mounds and depressions along the western boundary and southern half of the property.</p> <p>Run on expected from north-east adjacent property and Coryule Avenue. Potential to impact driveway and parking area.</p> <p>No direct evidence of sub-surface seepage although this may be expected during wet periods. Likely for seepage to discharge from Karingal drive cutting and from cutting along eastern border.</p> <p>Soil conditions dry to slightly moist near the building envelope. Conditions on the steeper slopes to the south-west were also dry at the time of the investigation.</p>
<b>Ground condition</b>	<p>Dry, patchy ground cover and exposed soils indicate dry surface soil conditions at the time of investigation.</p>



<b>Adjacent properties</b>	<p>The adjacent lot to the east is currently developed with an existing residential dwelling. The adjacent lot to the west was previously developed but is currently vacant following the destruction of the dwelling by past fire events.</p> <p>The western allotment is also relatively clear of vegetation and consists of numerous exposed high angle cuttings and battered terraces. Several recent slumps are evident in the face of the deep cutting immediately below the property boundary with the subject site.</p> <p>A well-defined drainage gully migrates around the western side of the subject site. The gully is young and narrow and in a state of incision. It is mostly likely a remnant feature of a broader, older gully within which colluvial debris has been deposited, off-setting the local drainage regime. The gully continues up slope and due north of the subject site.</p>
<b>Aspect</b>	Located on the north side of Karingal Drive. The allotment has a south to south-westerly aspect and slope orientation.
<b>Exposure to sun and wind</b>	Large gum trees provide dappled shade and moderate wind protection across the site.
<b>Slope / form / gradient</b>	<p>Natural slope angles on site range from 1° to 6° across the plateaux and 9° to 28° over the toe of the spur at the Karingal Drive end. Overall ground slope is approximately 30° below the plateaux.</p> <p>Slope angles on vacant slopes to the north-east range between 14° and 20° while natural slopes to the west of the gully average 34° to the south-east.</p> <p>The north-east corner of the property is virtually flat and part of a broader concave slope formation. The south-western half of the property is convex with steep slopes.</p> <p>Slope angles shallow towards the south-western corner inferring concave slope shapes near the toe of the slope above Karingal Drive.</p> <p>Other major breaks in slope relate to site cuts and excavations on adjacent properties.</p>
<b>Other features</b>	

---

## 2. DESCRIPTION OF THE DEVELOPMENT

<b>Site Address:</b>	15 Karingal Drive, Wye River, Victoria.
<b>Owner/Developer:</b>	<b>Mr Ben Pursehouse</b>
<b>Postal Address:</b>	
<b>Contact:</b>	Ben Pursehouse, 0422 451 616
<b>Council Area:</b>	Colac-Otway Shire Council.
<b>Zoning:</b>	Township Zone (TZ)
<b>Overlays:</b>	Bushfire Management Overlay (BMO) Design and Development Overlay (DDO) Erosion Management Overlay (EMO) Neighbourhood Character Overlay (NCO) Significant Landscape Overlay (SLO)
<b>Allotment Size:</b>	892 m <sup>2</sup> .
<b>Domestic Water Supply:</b>	Tank water only.
<b>Availability of Sewer:</b>	The area is unsewered and highly unlikely to be sewered within the next 10-20 years, due to low development density in the area and the considerable distance from existing wastewater services.
<b>Development:</b>	3 bedroom, two storey new development. Previously undeveloped and currently vacant lot within the fire affected zone.
<b>Anticipated Wastewater Load:</b>	A 3 bedroom residence with full water-reduction fixtures @ 4 people per maximum occupancy will have a wastewater generation of 150L/person/day (full water saving fixtures) for a total design load = <b>600L/day</b> (Table 4 EPA Code of Practice).

### 3. SITE AND SOIL ASSESSMENT

David Horwood and Nerida Harrison undertook a site investigation on the 15 January 2019.

#### 3.1. SITE KEY FEATURES

Table 1 summarises the key features of the site in relation to effluent management proposed for the site.

NOTE:

- The site is not within a special water supply catchment area.
- The site experiences high stormwater run-on.
- There is no evidence of a shallow water table.
- The risk of effluent transport offsite is moderate.

An aerial photograph is appended to provide recent and current site context (Appendix I).

A site plan describing the location of the proposed building envelope and other development works, wastewater management system components and physical site features is appended (Appendix II).

**Table 1 - Risk Assessment of Site Characteristics**

Feature	Description	Level of Constraint	Mitigation Measures
<b>Buffer Distances</b>	Relevant buffer distances in Table 5 of the Code (2016) are not achievable for nominated effluent fields.	Moderate	Maximise the setback distance between effluent field and cutting. Reduce application rate to minimise through flow. Insert sub surface cut off drain at the base of the southern property boundary to divert any water away from the cutting
<b>Climate</b>	70 <sup>th</sup> percentile average annual rainfall 981mm (SILO data), max. average 128 mm in August, min. average 44 mm in January. Average annual pan evaporation is 897mm.	Major	Use water balance to size effluent fields. Utilize sub surface drip irrigation.
<b>Drainage</b>	No signs of water loving plants or pooling water at time of investigation, reasonably well drained.	Moderate	Upgrade on site drainage. Install berms to divert water from adjacent properties in order to minimise surface water run on.
<b>Erosion &amp; Landslip</b>	Little evidence of erosion issues on site. Erosion risk in minor High landslip risk on western side due to cutting on adjacent property but engineering works have been implemented to minimise risk	Moderate	Reduce water loading as much as possible by utilising mandatory 3 star rated or better water efficient fixtures. Revegetate slopes and embankments.  Disperse effluent as widely as possible. Maximise the distance between the effluent field and the western property boundary.



Feature	Description	Level of Constraint	Mitigation Measures
<b>Exposure &amp; Aspect</b>	South westerly aspect, moderate wind exposure, dappled shade.	Moderate	Treat effluent to a minimum secondary treatment standard.  Apply appropriate crop factors to water balance allowing for shady conditions.
<b>Flooding</b>	The proposed effluent management area is located above the 1:100 year flood level (source WSC).	Nil	NN
<b>Groundwater</b>	Groundwater table deeper than 1.5m. No known groundwater bores within 50m site.	Minor	Use shallow, subsurface drip irrigation. Use raised terraces, if required.
<b>Imported Fill</b>	No fill was encountered onsite	Minor	NN
<b>Land Available for LAA</b>	Considering all the constraints and buffers, the site is deemed slightly constrained for disposal of "all waste" waste water on site. The preferred effluent management area is split into two areas, one north and one south of the proposed dwelling.	Moderate	Use water balance and nitrogen balance. Configure disposal field to comply with building and site boundary setbacks and buffer zones, where possible. Increase level of treatment.
<b>Landform</b>	Small spur formed by a relic debris deposit on the flanks of a natural wide gully. Localised steep slopes and plateaus with an overall relief of 11m across the site.	Moderate	Use water balance. Minimise run on to LAA with use of catch drains. Increase effluent area where possible to reduce application rate. Install terracing on the slopes of the lower effluent disposal field.
<b>Rock Outcrops</b>	No outcrops visible away from cuttings	Minor	Use sub-surface irrigation.
<b>Run-on &amp; Runoff</b>	High storm water run-on and moderate run-off hazard. Surface water catchment located above site.	Moderate	Determine appropriate run off coefficient for use in water balance. Increase catchment size.  Recommend diversion berm or surface drain to be installed at the north eastern property boundary to intercept surface run on.
<b>Slope</b>	The larger proposed effluent management area to the north is positioned on a relatively flat area, while the smaller southern disposal field is steeply sloping generally to the south-west. Slopes are typically convex or divergent.	Moderate	Install terracing to the steeply sloped lower effluent field in order to reduce slope angles
<b>Surface Waters</b>	There are no waterways on or near site.	Nil	NN

Feature	Description	Level of Constraint	Mitigation Measures
<b>Vegetation</b>	Large gum trees on site but little undercover	Moderate	Site will need to be regenerated after installation, recommend dense, high transpiration ground cover, low shrubs, native grasses and/or lawn for the effluent area. Other areas on site also require revegetation with deep rooted native trees and shrubs.

NN: not needed

### **3.2. SITE ASSESSMENT RESULTS**

The site is highly constrained due constraining site features such as, available land, set back requirements, climate, slope, exposure and aspect, run-on, run-off, and landslip risk.

The risk of surface water run on may be addressed by installing a catch drain or alternative surface drainage to the north and north east of the proposed upper effluent field to intercept surface run on from the catchment area above Site. A subsurface drain should also be installed below the proposed lower effluent field to divert any runoff away from the cutting below the property on Karingal Drive.

Existing site cuttings along Karingal Drive and on the adjacent property to the west are located below the proposed lower effluent disposal area. The EPA Code of Practice (2016) requires a minimum 15m setback to any cuttings or escarpments located on site. Maintaining this setback distance would limit the area available for waste water disposal to the point where the minimum area required for zero wet weather storage and complete nutrient uptake would be unachievable.

In the EPA Code of Practice (document 891.4, 2016) Section 3.9 states that council may reduce a setback distance in a non-potable water supply catchment where it considers that the risk to public health and the environment is negligible. In order for waste water to be successfully managed on site as close to regulatory conditions as possible, the available space must be maximised. We can achieve a 5m setback from the road cutting and a minimum of 6m from the adjacent property cutting, coupled with reduced application rate of 3.2mm/day, which will result in reduced deep seepage and minimal through flow and therefore the risk to public health can be minimised.

Additionally, the soil in southern portion of the site is very sandy which will have a polishing effect on wastewater that permeates through the soil, much like being passed through a sand filter. Sand is a highly effective, naturally absorptive material that can treat effluent to a very high standard, as such sand filters are used to upgrade waste water treatment systems from primary treatment to secondary treatment. Therefore, further treatment of secondary treated wastewater through sandy soils will only continue to improve the quality of the wastewater.

Groundwater movement calculations (Appendix VIII) were undertaken to determine that wastewater in the lower disposal field would take 5 – 16 days to percolate through the soil profile before reaching a subsurface cut off drain installed to divert water away from the road cutting. Wastewater in the upper disposal field would take 11 to 48 days to pass from the disposal field to the cutting on the adjacent property. Seeing as the site is neither in a potable water catchment nor is it environmentally sensitive, we suggest that minimum set back conditions can be reduced to enable maximum available space for effluent disposal.

Vegetation coverage within the proposed effluent field is sparse but established. It is recommended that the entire site requires re-vegetation with high transpiration trees, shrubs and grasses, especially over the proposed disposal area, upon completion of the installation works.

The steep slopes of the proposed lower effluent field pose a very high constraint on the methods of effluent disposal available for use on this site for reasons such as construction difficulty, risk of effluent run off and uniform waste water dispersal. Methods of disposal which require soil absorption such as trenches and modified ETA beds/trenches are not suitable for steep slopes. They require near flat ground surfaces for satisfactory construction. Absorption trenches are also inappropriate for high landslide risk areas where it is critical to avoid high volumes of water from accumulating in a concentrated way within the soil profile. Drip irrigation, surface or subsurface is generally the most appropriate way to disperse waste water in high landslide risk areas because it utilises evapotranspiration as well as absorption over a wide surface area within the near surface soil profile. The slopes on some parts of this site are too steep however for surface irrigation which poses a significant risk of effluent run off well beyond the minimum irrigation area and the site boundaries. Sub surface drip irrigation is therefore the best solution for waste water disposal but in order to accommodate the steep slopes, with terracing installed in the lower disposal field to reduce slope angles and flow through rates.

After consideration of all constraints, we consider the overall land capability of the site to sustainably manage all effluent onsite is satisfactory providing recommended mitigation measures discussed above and in Table 1 are implemented.

### **3.3. SOIL KEY FEATURES**

Soils on site have been assessed for their suitability for onsite wastewater management by a combination of soil survey and desktop review of published soil survey information.

A soil survey was carried out at the site to determine suitability for application of treated effluent. Soil investigations were conducted at two (2) locations in the vicinity of the proposed effluent field as shown in the Test Site and LAA Location Plan (Appendix III).

The bore holes were established to a minimum depth of 1.5m or to effective refusal using manual hand augers. Another four (4) boreholes were established to a minimum depth of 150mm into the limiting layer for permeameter installation. This was sufficient to adequately characterise the soils as only minor variation would be expected throughout the area of interest. Permeameters were inserted to a minimum depth of 150mm or 150mm into the limiting layer, and constant head draw down was monitored over a period of at least 60 minutes in order to calculate saturated hydraulic conductivity for the limiting soil layer.

Samples of all discrete soil layers for each soil type were collected for subsequent laboratory analysis of pH, Electrical Conductivity, Sodicity, Cation Exchange Capacity, Sodium Absorption Ratio and Emerson Aggregate Classification.

Two soil profiles were encountered during this investigation. Full profile descriptions are provided in the Borelogs (Appendix IV). Soil descriptions may be summarised as follow:

#### **Profile 1 (proposed upper disposal area; Boreholes 1 and 2)**

- A residual topsoil (A horizon) layer of massive, dark grey, dry sandy SILT with clay (Category 4 CLAY LOAM) containing <20% coarse fragments; overlying
- A residual subsoil (B-horizon) layer of weakly structured light grey, slightly moist silty CLAY with sand (Category 5 – LIGHT CLAY) with 5% orange mottling

#### **Profile 2 (lower slopes above Karingal Drive; geotechnical log of road cutting)**

- A transported colluvium ranging from dark orange/grey/brown clayey and sandy SILT (Category 4 CLAY LOAM) to dark yellow brown silty SAND with abundant coarse fragments.



Table 2 below provides an assessment of the physical and chemical characteristics of each soil type.

**Table 2 - Risk Assessment of Soil Characteristics**

Feature	Assessment	Level of Constraint	Mitigation Measures
<b>Cation Exchange Capacity (CEC)</b>	Topsoil: <b>10.7 MEQ%</b> Soil structural stability is considered unsatisfactory.	Major	Recommend adding organic matter (compost/humus) to soil profile to increase CEC and nutrient availability and ameliorate soil structure.  Typically >15 MEQ% is recommended for land application areas.
	Subsoil: <b>16.3 MEQ%</b> Soil structural stability is considered unsatisfactory.	Minor	NN  Typically >15 MEQ% is recommended for land application areas.
<b>Electrical Conductivity</b>	Topsoil: <b>0.029 ds/m</b> Soil conditions do not appear to be restricting plant growth.	Minor	NN
	Subsoil: <b>0.034ds/m</b> Soil conditions do not appear to be restricting plant growth.	Minor	NN
<b>Emerson Aggregate Class</b>	Topsoil: <b>Class 2, slaking and some dispersion</b>	Major	Soil amelioration required. Application of gypsum to improve soil structure and dispersity.
	Subsoil: <b>Class 1-2, slaking and some dispersion</b>	Major	Soil amelioration required. Application of gypsum to improve soil structure and dispersity.
<b>pH</b>	Topsoil: <b>5.7</b>	Minor	Optimum range for most plants.
	Subsoil: <b>5.0</b>	Minor	Suitable range for many acid-loving plants.
<b>Rock Fragments</b>	Topsoil: >20% coarse fragments in the A Horizon.	Major	Use raised terraced beds on the lower effluent field with imported topsoil.
	Subsoil: 0-10% coarse fragments in the A Horizon.	Minor	NN

Feature	Assessment	Level of Constraint	Mitigation Measures
<b>Sodicity (ESP)</b>	Topsoil: <b>3.2% Non Sodic.</b>	Minor	NN
	Subsoil: <b>4.8% Non Sodic.</b>	Minor	NN
<b>Sodium Absorption Ratio (SAR)</b>	Topsoil: <b>0.11</b>	Minor	Recommend use of low sodium domestic products to reduce the SAR ratio.
	Subsoil: <b>0.20</b>	Minor	Recommend use of low sodium domestic products to reduce the SAR ratio.
<b>Soil Depth to rock or other impermeable layer</b>	<p>Overall soil profile depth is &gt;1000mm below surface. 700mm topsoil layer over less permeable clay layer.</p> <p>Greater than 3000mm of sandy colluvium over bedrock on southern slopes.</p>	Moderate	<p>Suitable for subsurface irrigation.</p> <p>Suitable depth of topsoil to use A Horizon limiting layer.</p>
<b>Soil Permeability &amp; Design Loading/ Irrigation Rates</b>	<p>Topsoil: Sandy SILT (Category 4);</p> <p><b>Indicative</b> Ksat permeability is <b>0.06 -0.12m/day.</b></p> <p>3.5mm/day Design Irrigation Rate (DIR) for subsurface irrigation (EPA, 2016). This is 0.5% of lowest indicative Ksat for soil.</p> <p>Recommended application rate is &lt;10% of measured Ksat (TVA, 2004)</p>	Minor	<p>Use measured Ksat for limiting layer as seepage rate in water balance.</p> <p>Use up to 10% of Ksat value as comparison to maximum application rate.</p>
<b>Soil Permeability &amp; Design Loading/ Irrigation Rates</b>	<p>Topsoil: Sandy SILT (Category 4);</p> <p><b>Measured</b> Ksat permeability is <b>0.17m/d;</b></p> <p>3.5 mm/day Design Irrigation Rate (DIR) for subsurface irrigation (EPA, 2016). This is 2% of measured Ksat for the soil.</p> <p>Recommended application rate is &lt;10% of measured Ksat (TVA, 2004)</p>	Minor	<p>Use up to 10% of Ksat value as deep seepage rate in water balance.</p> <p>Maximum application rate to approximate 3.5mm/day relative to soil category where measured Ksat is reflective of inferred Ksat in Table 9 EPA (2016)</p>

Feature	Assessment	Level of Constraint	Mitigation Measures
<b>Soil Texture &amp; Structure</b>	Topsoil: <b>Sandy SILT (Category 4, Clay Loam)</b> EPA (2016) and AS/NZS 1547:2012. Topsoil is inferred to have a weak structure.	Moderate	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
	Subsoil: <b>Silty CLAY (Category 5, Light Clay )</b> EPA (2016) and AS/NZS 1547:2012.	Minor	Use up to 10% of Ksat value as deep seepage rate in water balance. Use measured Ksat to determine maximum application rate.
<b>Gleying</b>	Subsoil: No evidence of gleying witnessed in soil samples	Minor	Install drainage measures to limit surface run on and subsurface through flow to the irrigation area.
<b>Mottling</b>	Topsoil: 5% orange mottling evident in soil samples	Moderate	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
	Subsoil: 5% orange mottling evident in soil samples	Moderate	Soil amelioration recommended. Increasing organic content and apply gypsum to improve soil structure.
<b>Water table Depth</b>	>2m	Minor	Dispose of effluent via sub surface drip irrigation.

NN: not needed



### 3.4. SOIL ASSESSMENT RESULTS

For the soils in the proposed land application area (clay loam), several features present a moderate or major constraint. Primary constraints relate to soil structure, soil drainage, CEC, Emmerson Aggregate Class, rock fragments.

Soil chemistry elements such as CEC are a moderate constraint on this site. The cation exchange capacity is also a measure of plant nutrient availability. CEC may be below acceptable levels due to the loss of overlying soil horizons and organic matter during past fires. Adding organic compost and humus to the soil profile can help improve nutrient availability.

Soil characteristics relating to poor soil structure, soil drainage and dispersity can be mitigated or improved with the addition of gypsum. Gypsum adds bi-charged calcium ions to the soil which acts as a flocculating agent helping soil particles to clump together and aggregate, displacing singularly charged sodium ions which influence soil dispersity and potential soil erosion.

Based on the cation exchange capacity (CEC) and soil sodicity (ESP), a gypsum requirement of **0.0t/ha** has been calculated in order to ameliorate the soil profile to a desired level of 6% ESP to 600mm below surface, however, we recommend the application of 1kg of ground gypsum per Sqm be applied to the site in order to ameliorate other soil constraints such as the Emmerson Aggregate Class. The application of gypsum requires removal to the A Horizon and where practical to do so, deep ripping to a minimum depth of 600mm. As this is not always practical in areas of steep terrain with limited access and where deep soil disturbance can create slope instability problems, we recommend the application dry ground gypsum without ripping. Gypsum should be applied to the base of the irrigation channels prior to line installation and lightly watered in to dissolve the gypsum and encourage infiltration into the soil profile.

Long term soil amelioration may take several years and as such we recommend the application of liquid gypsum as an ongoing maintenance process. Liquid gypsum can be added to the pump well of the irrigation system and mixed with treated waste water ready for direct application to the subsurface soil profile. We propose that the application of **2L** of concentrated liquid gypsum added to the pump well of the irrigation system on a **biannually** basis should provide adequate ongoing sodic soil amelioration. Gypsum requirement computations are provided in Appendix VI.

The overall capability of the soil to sustainably manage effluent onsite is considered satisfactory providing recommended mitigation measures discussed above and in Table 2 are implemented.

### 3.5. OVERALL LAND CAPABILITY RATING

Based on the results of the site and soil assessment tabled above, the overall land capability of the proposed effluent management area is **highly constrained**. Subject to implementation of the mitigation measures recommended in Tables 1 and 2, it is possible to dispose treated wastewater on site.

It is therefore our recommendation that considering the site's physiographic constraints and soil characteristics, 'All Waste' effluent should be secondary treated and disposed on-site via pressure compensating sub-surface drip irrigation.

## 4. WASTEWATER MANAGEMENT SYSTEM

The following sections provide an overview of a suitable on-site wastewater management system, with sizing and design considerations and justification for its selection. Detailed design for the system should be undertaken at the time of the building application and submitted to Council.

### 4.1. EFFLUENT DISPOSAL SYSTEM

A range of possible land application systems have been considered for part on-site disposal, such as absorption trenches, evapotranspiration/absorption (ETA) beds, wick trench and bed systems, subsurface irrigation and mounds.

The preferred system is **pressure compensated sub surface drip irrigation**. Subsurface irrigation will provide even and widespread dispersal of the treated effluent within the root-zone of plants, does not require a reserve area and can be installed on slopes up to 30% (17°) before requiring terracing or a specialised irrigation design. This system will provide beneficial reuse of effluent, which is desirable given that the site is not serviced by town water. It will also ensure that the risk of effluent being transported off-site will be negligible and is the most accepted method of onsite waste disposal for minimising the risk of slope instability.

### 4.2. DESCRIPTION OF THE IRRIGATION SYSTEM

A detailed irrigation system design is beyond the scope of this report, however a general description of subsurface irrigation is provided here for the information of the client and Council.

Subsurface irrigation comprises a network of drip-irrigation lines that is specially designed for use with wastewater. The pipe contains pressure compensating emitters (drippers) that employ a biocide to prevent build-up of slimes and inhibit root penetration.

The lateral pipes are usually 1-1.5m apart for a CLAY LOAM, installed parallel along the contour. Installation depth is a minimum of 100mm into at least 150mm of good quality topsoil in accordance with AS/NZS 1547:2012. It is critical that the irrigation pump be sized properly to ensure adequate pressure and delivery rate to the irrigation network.

A filter is installed in the main line to remove fine particulates that could block the emitters. This must be cleaned regularly (typically monthly) following manufacturer's instructions. Vacuum breakers should be installed at the high point/s in the system to prevent air and soil being sucked back into the drippers when the pump shuts off. Flushing valves are an important component and allow periodic flushing of the lines, which should be done at six monthly intervals. Flush water should be returned to the treatment system via a return line.

All trenching used to install the pipes must be backfilled properly to prevent preferential subsurface flows along trench lines. Irrigation areas must not be subject to high foot traffic movement, and vehicles and livestock must not have access to the area otherwise compaction around emitters can lead to premature system failure.

### 4.3. SIZING THE IRRIGATION SYSTEM

To determine the necessary size of the irrigation area water balance modelling has been considered based on the water balance method outlined in AS1547:2012 and Victorian Land Capability Assessment Framework (2014). Final sizing of the irrigation system has been undertaken adopting a justifiable deep seepage rate based on the measured saturated hydraulic conductivity (Ksat) and comparing the minimum area for zero storage with the maximum allowable application rate or DIR from Table 9 of the EPA (2016). The Tennessee Valley Authority (2004) in their peer reviewed guidelines for drip irrigation recommends that the seepage or percolation rate used in water balance modelling may be 10-14% of measured Ksat and that the final application rate (DIR) should be less than 10% of measured Ksat.

The water balance presenting in this assessment adopts a trial land application area methodology to find the most suitably sized effluent field according to the justifiable deep seepage rate and the maximum allowable application rate.

The retained rainfall factor used in the water balance has been derived using a formula to calculate a weighted run off coefficient based on published run off coefficients for different land uses and surfaces and total catchment size. Professional judgement has been used where selected coefficients vary from published coefficients in the calculations and justification for the variation is provided with the computations attached to this report.

Crop factors used in the water balance may vary depending on the type of vegetation or degree of shading expected in the proposed effluent disposal area. Crop Nitrogen uptake rates used in the mass balance calculation may also vary and are selected with reference to either the type of vegetation growing on the subject area, or a particular vegetation type proposed for use in the effluent area. Published crop Nitrogen uptake rates are sourced from EPA Publication 168 (1991).

#### 4.3.1 Water Balance

The water balance can be expressed by the following equation:

$$\text{Precipitation} + \text{Effluent Applied} = \text{Evapotranspiration} + \text{Percolation}$$

Data used in the water balance includes:

- Mean monthly rainfall and mean monthly pan evaporation;
- Design daily flow rate for a 3 bedroom dwelling – 600L/day (from Table 4 of the Code and Table H2 of the Standard);
- Deep seepage Rate – 5.7mm/day<sup>1</sup>; (based on measured Ksat of 0.17m/day)
- Crop factor – 0.4; and
- Retained rainfall – 75% (flat to steeply sloping, sandy soil site with 12% impervious coverage over a local catchment of 1400m<sup>2</sup>. Local catchment includes properties above the subject site up to the north and north-east).

The results of the water balance are compared against the basic irrigation formula  $A = Q/DIR$  to ensure the final application rate for the disposal field (DIR) approximates that for the appropriate soil category in the EPA Code of Practice (2016) and AS1547:2012.

<sup>1</sup> This rate is significantly less than the recommended permeability rate of 10-14% of measured Ksat (TVA, 2004) and has been selected considering recommended rate reductions for sloping sites in accordance with AS1547:2012.

The water balance method is used to calculate the minimum area required to balance all inputs and outputs to the water balance. As a result of these calculations at least **189m<sup>2</sup>** is required for on-site wastewater disposal based on hydraulic loading not taking into account the minimum required buffers and offsets.

This yields an application rate of **3.2mm/day** which is less than the maximum 3.5mm/day from the EPA Code of Practice (2016) for application to a weakly structured clay loam and only 2% of measured Ksat<sup>2</sup>. The application rate is consistent with that for Category 4 soils with indicative permeability's similar to measured Ksat.

A full water balance is provided as Appendix V.

### 4.3.2 Nutrient Balance

A nutrient balance is considered to check that the Land Application Area is of sufficient size to ensure nutrients are assimilated by the soils and vegetation. It is acknowledged that a proportion of nitrogen will be retained in the soil through processes such as mineralisation and volatilisation. Typically, only sensitive sites with limiting site or soil constraints require nutrient considerations.

NOTE: Soil has a high PRI (phosphorus retention index) in clayey soils. Phosphorus is readily removed under these circumstances from wastewater fixation in clayey soil by the action of adsorption. Phosphate in dispersed effluent is lost within a few centimetres of the soil.

This leaves nitrogen (N) as the limiting factor in this proposed development.

The nutrient balance can be expressed by the following Mass Balance equation:

$$\text{Land Application Area (m}^2\text{)} = (\text{C} \times \text{Q}) / \text{L}_x$$

Data used in the nutrient balance includes:

- C = Concentration of nutrient - 25mg/L (from EPA Publication 464.2);
- Q = Design daily flow rate - 600L (from Table 4 of the Code and Table H2 of the Standard);
- L<sub>x</sub> = Critical loading rate of nutrients - 60.27 mg/m<sup>2</sup>/day (from EPA Publication 464.2).
- Nutrient loss to soil processes - 20% (Geary & Gardner 1996)
- Crop N uptake rate - 220 kg/ha/yr

As a result of the Mass Balance calculations, the minimum **Land Application Area** required for complete nutrient (nitrogen) uptake is **199m<sup>2</sup>** for on-site disposal.

A Full nutrient balance is provided in Appendix V.

---

<sup>2</sup> The recommended application rate is <10% of measured Ksat (TVA, 2004).



### 4.3.3 Minimum Disposal Field and Land Application Area

The nutrient loading is the most limiting factor here and as such nutrient loading and the mass balance would normally be used to nominate the minimum area required to balance both nutrient and hydraulic loading including all inputs and outputs.

Although water balance indicates that approximately 189m<sup>2</sup> is required as the minimum effluent disposal area required to achieve zero storage and complete nutrient uptake, this does not make any allowance for the hydraulic gradient of the site. As a result, some effluent would need to be applied to the land via raised terraces (over the lower effluent area) so as to provide near horizontal application areas.

The maximum available useable land for effluent disposal is 17m<sup>2</sup> (taking into account a 15m buffer from any cuttings), which is impractical and a fraction of the minimum required area based on nutrient or hydraulic loading. Seeing as an appropriately sized effluent system will result in a buffer of 5m from the road cutting and a minimum of 6m from the adjacent property cutting, in addition to the site being neither in a potable water catchment or environmentally sensitive area, we suggest that minimum set back conditions of 15m from a cutting can be reduced to enable maximum available space for effluent disposal.

Dispersing waste water over **189m<sup>2</sup>** will reduce the maximum application rate from 3.5mm/day to 3.2mm/day but is not enough to account for the nitrogen export, however with the required buffers implemented around the perimeters an additional 10m<sup>2</sup> can be allocated for nitrogen export buffer within the property boundaries.

## 4.4. SITING AND CONFIGURATION OF THE IRRIGATION SYSTEM

The preferred area for siting the irrigation field is divided into 2 sections, a larger field north of the proposed dwelling, and a smaller field immediately south of the proposed dwelling. The Test Site and LAA Location Plan display's the envelope of land that is suitable for effluent management, (Appendix III).

Final placement and configuration of the irrigation system will be determined by the client and/or system installer, provided it complies with the mandatory setback and buffers. The minimum area required according to the water balance is shown to scale (Appendix III). The recommended location for the effluent disposal shown in Appendix III has been selected on the basis that the available area with the greatest lateral width will encourage lateral hydraulic flow and minimise surface run off.

It is important that appropriate buffer distances to neighbouring properties, buildings and the drainage easement be maintained. It is also important to note that buffers are measured as the overland flow path for run-off water from the effluent irrigation area.

The Test Site and LAA Location Plan indicate site contours and flow path directions on the property (Appendix III).

It is highly recommended that the owner consult an irrigation expert familiar with effluent irrigation equipment and steeply sloping sites to design the system, and an appropriately registered plumbing/drainage practitioner to install the system. The irrigation plan must ensure even application of effluent throughout the entire irrigation area and that final configuration ensures an application rate or dosage to the irrigation field no greater the rates described in Section 4.3.3.

#### **4.5. BUFFER DISTANCES**

Setback buffer distances from effluent land application areas and treatment systems are required to help prevent human contact, maintain public amenity and protect sensitive environments. The relevant buffer distances for this site, taken from Table 5 of the Code (2016) are:

- 20 metres upslope from potable or non-potable groundwater bores;
- 100 metres upslope from watercourses in a potable water supply catchment.
- 30 metres upslope from surface waters and waterways (non-potable)
- 3 metres if area upslope and 1.5 metres if area downslope of property boundaries, swimming pools and buildings.
- For advanced secondary treatment: 1 metre if application area upslope and 0.5 metres if area downslope of property boundaries.
- 15 metres upslope from escarpments or cuttings.

Not all required buffer distances are achievable on this site, however as discussed in section 3.2 we recommend that the minimum set back distances to cuttings down slope of the effluent field should be reduced in this circumstance due to the minimal public and environmental risk posed by the treatment and disposal systems proposed (secondary treatment via pressure compensating sub surface irrigation).

The appended site plan shows the location of the proposed wastewater management system components, recommended setback distances and other relevant features such as the recommended location of cut off drains (Appendix III).

#### **4.6. INSTALLATION OF THE IRRIGATION SYSTEM**

Installation of the irrigation system must be carried out by a suitably qualified, licensed plumber or drainer experienced with effluent irrigation systems.

To ensure even distribution of effluent, it is essential that the pump capacity is adequate for the size and configuration of the irrigation system, taking into account head and friction losses due to changes in elevation, pipes, valves, fittings etc. To achieve even coverage, irrigation areas should be dosed alternately using an automatic indexing or sequencing valve and line spacing's should be progressively increased down slope.

The irrigation area and surrounding areas must be vegetated or revegetated immediately following installation of the system, preferably with turf or dense ground covering shrubs and grasses with high transpiration rates. The area should be fenced or otherwise isolated (such as by landscaping), to prevent vehicle and stock access; and signs should be erected to inform householders and visitors of the extent of the effluent irrigation area and to limit their access and impact on the area.

Stormwater run-on is expected to pose a moderate amount of concern for the proposed disposal areas. Upslope diversion berms and surface drainage should be constructed during installation of the disposal system and connected to the site drainage system and diverted to the legal point of discharge. Stormwater from roofs and other impervious surfaces must not be disposed of into the wastewater treatment system or onto the effluent management system.

Due to the sloping nature of the terrain on site the irrigation system should be designed by an irrigation specialist experienced with steeply sloping terrain to ensure an even distribution of effluent over the irrigation field.

#### **4.7. TREATMENT SYSTEM**

The minimum secondary effluent quality required is:

- BOD < 20 mg/L
- TSS < 30 mg/L
- E.Coli < 10 cfu/100mg

Refer to the EPA website for the list of approved options that are available<sup>3</sup>. Many of the secondary or advanced secondary treatment system options are capable of achieving the desired level of performance. The property owner has the responsibility for the final selection of the secondary treatment system and will include the details of it in the Septic Tank Permit to Install application form for Council approval.

As a guide, the two types of treatment methods which are able to produce high quality waste water are Membrane Bioreactor or MBR systems and Trickling Filters. MBR's combine treatment technologies such as aerated water treatment systems (AWTS) and membrane filtration. They typically use a pre-treatment settling tank, followed by aerobic bioreactor (AWTS) and finally a filter membrane followed by disinfection with UV for higher quality waste water. Trickle Filters such as generic sand filters use aerobic biological processes and mechanical filtration to treat effluent. They incorporate a settling or septic tank (which may be generic or alternative such as a worm farm) for primary treatment after which effluent is applied to the filter and then may be disinfected with either by chlorine or UV. Other methods of secondary treatment system such as Aerated Wastewater Treatment System's (AWTS) are also acceptable utilising disinfection to achieve advanced secondary standard.

If the proposed dwelling is to be used intermittently for short stay and holiday rental, consideration should be given to passive systems which are less reliant on power and regular maintenance. In this situation we recommend the application of Trickle Filters with disinfection so long as the system can achieve 20/30/10 standard effluent for greywater recycling.

Further consideration should be given to selecting a system that includes a suitably sized storage or balancing tank to moderate flow into the wastewater treatment system or a system that integrally uses multiple chambers where intermittent or periodic surge flows are expected. Where an AWTS is to be considered in this situation, selection of a system which includes recirculation or some other technology to accommodate intermittent flow is recommended.

Alternative methods of waste management to provide a reduction in daily flow rates may include the use of dry composting or incinerating toilets. Dry composting or incinerating toilets would effectively remove a portion of the daily water loading for the fixture from the water balance, thus reducing the required effluent disposal footprint. Recycling of advanced secondary treated greywater in house to toilets will also provide a similar outcome.

---

<sup>3</sup> <http://www.epa.vic.gov.au/en/your-environment/water/onsite-wastewater>

---

## 5. MONITORING, OPERATION AND MAINTENANCE

Maintenance is to be carried out in accordance with the EPA Certificate of Approval of the selected secondary treatment system and Council's permit conditions. The treatment system will only function adequately if appropriately and regularly maintained. We highly recommend the client enters into an ongoing service agreement with a service contractor approved by the treatment system manufacture.

To ensure the **treatment** system functions adequately, residents must:

- Have a suitably qualified maintenance contractor service the secondary or advanced secondary treatment system at the frequency required by Council under the permit to use;
- Use household cleaning products that are suitable for septic tanks;
- Keep as much fat and oil out of the system as possible; and
- Conserve water (3 star or better rating fixtures and appliances are recommended).

To ensure the **land application** system functions adequately, residents must:

- Regularly harvest (mow) vegetation within the LAA and remove this to maximise uptake of water and nutrients;
- Monitor and maintain the subsurface irrigation system following the manufacturer's recommendations, including flushing the irrigation lines;
- Regularly clean in-line filters;
- Not erect any structures and paths over the LAA;
- Avoid vehicle and livestock access to the LAA, to prevent compaction and damage;
- Ensure that the LAA is kept level by filling any depressions with good quality topsoil (not clay);
- Apply dry ground gypsum into irrigation channels during installation of the effluent system;
- Add 2L of concentrated liquid gypsum to the site via the irrigation system pump well upon commissioning of the irrigation system and thereafter at least biannually. The regular addition of liquid gypsum will provide an ongoing soil remediation measure designed to improve soil structure and permeability, and mitigate dispersion and erosion properties from developing;



## 6. CONCLUSIONS

As a result of our investigations we conclude that sustainable onsite wastewater management is feasible for the 3 bedroom development at 15 Karingal Drive, Wye River with the implementation of appropriate mitigation measures as outlined.

Specifically, we recommend the following:

- Secondary treatment of 'All Waste' by an EPA-accredited treatment system to a 20/30/10 standard.
- Application of treated effluent to a **189m<sup>2</sup>** (minimum) area via pressure compensating subsurface drip irrigation with terracing where required;
- Specialist design of the irrigation system by an irrigation expert experienced with steeply sloping terrain based on the maximum available space for effluent disposal as depicted in Appendix III;
- Separation of the effluent disposal area in the two zones located near the northern and southern property boundaries.
- **Direct** application of dripper lines installed along the natural contour over a minimum area of **121m<sup>2</sup>** in the northern or upper effluent disposal areas indicated in Appendix III applied at a maximum rate of **3.2mm/day (600L/day)**.
- **Terraced** irrigation of **68m<sup>2</sup>** over the southern slopes below the proposed dwelling as indicated in Appendix III at an applied rate of **3.2mm/day (600L/day)**.
- Detailed documentation of the as built irrigation design, including the filter, manifold, irrigation line location and diameter, number and length of dripper lines, number and location of vacuum breaker(s), sequencing valve(s), location of flush valve(s) and the location of the return line returning flush water back to the treatment system.
- Installation of 3 star or better water saving fixtures and appliances in the residence to conserve water and reduce the effluent load;
- Use of low phosphorus and low sodium (liquid) detergents to improve effluent quality and maintain soil properties for growing plants; and
- Operation and management of the treatment and disposal system in accordance with manufacturer's recommendations, the EPA Certificate of Approval, the EPA Code of Practice (2016) and the recommendations made in this report.



**DAVID J HORWOOD**

*BAppSc (Geology); AusIMM CP (Geo)*  
C.E.T. ACCREDITED

---

## 7. REFERENCES

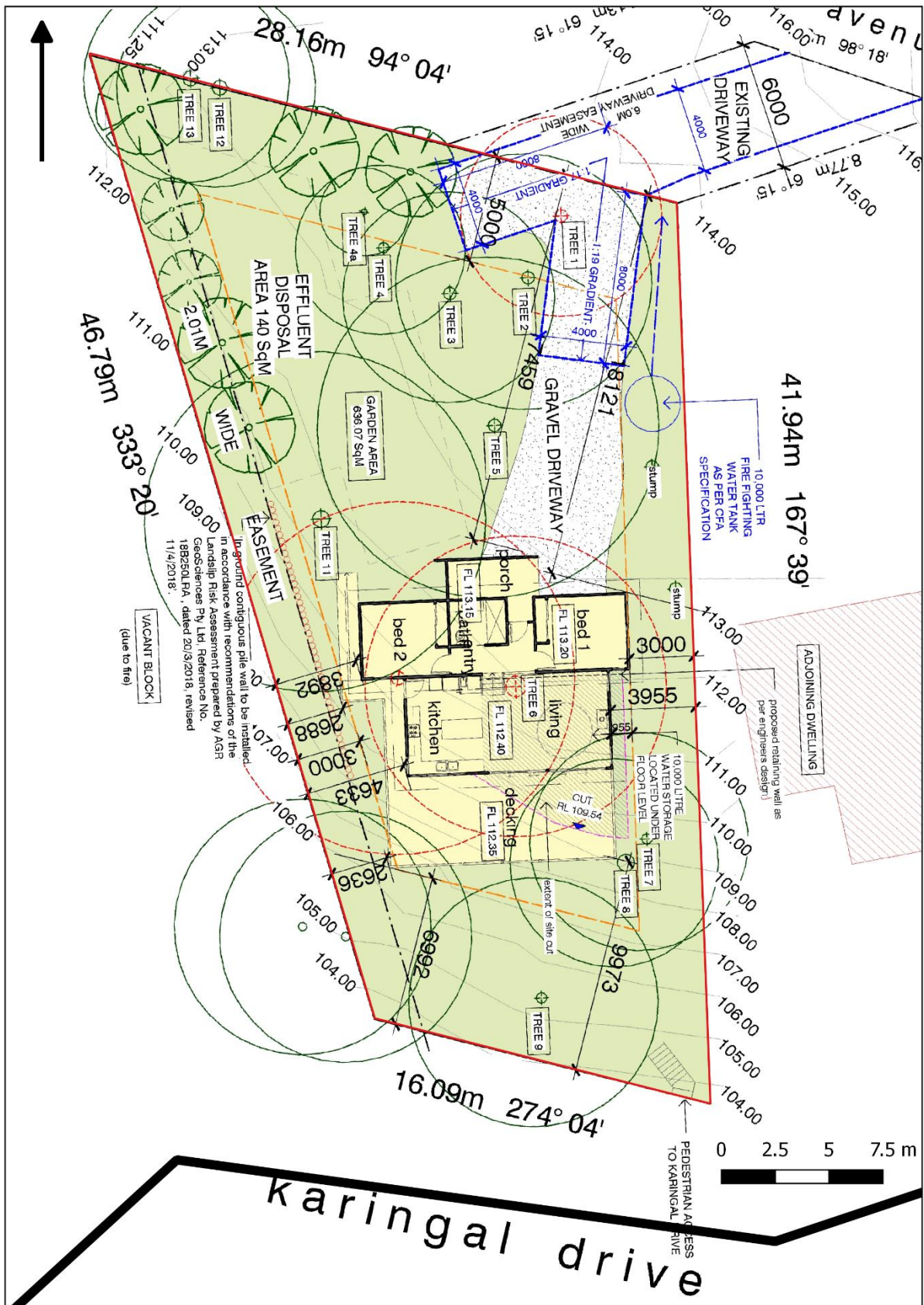
- Davis, J.G., Waskom, R.M. and Bauder, T.A. (2012) *Managing Sodic Soils*. Fact Sheet No. 0.504, Crop Series, Soil. Colorado State University.
- Environment Protection Authority (2003). *Guidelines for Environmental Management: Use of Reclaimed Water* Publication 464.2.
- Environment Protection Authority (1991). *Guidelines for Wastewater Irrigation* Publication 168.
- Environment Protection Authority (2016). Publication 891.4 *Code of Practice for Onsite Wastewater Management*.
- Geary, P. and Gardner, E. (1996). On-site Disposal of Effluent. In Proceedings from the one day conference *Innovative Approaches to the Management of Waste and Water*, Lismore 1996.
- Isbell, R.F. (1996). *The Australian Soil Classification*. CSIRO Publishing, Melbourne.
- McDonald, R.C., Isbell, R.F., Spreight, J.G., Walker, J. and Hopkins, M.S. (1990) *Australian Land Survey: Field Handbook*. Second Edition. Inkata Press, Melbourne.
- Municipal Association of Victoria, Department of Environment and Sustainability and EPA Victoria (2016) *Victorian Land Capability Assessment Framework*.
- Standards Australia / Standards New Zealand (2012). AS/NZS 1547:2012 *On-site domestic-wastewater management*.
- TVA (2004). *Wastewater Subsurface Drip Distribution: Peer Reviewed Guidelines for Design, Operation and Maintenance*. Tennessee Valley Authority, Tennessee.
- USEPA (2002). *Onsite Wastewater Treatment Systems Manual*. United States Environmental Protection Agency.

## Appendix I: Aerial Photo





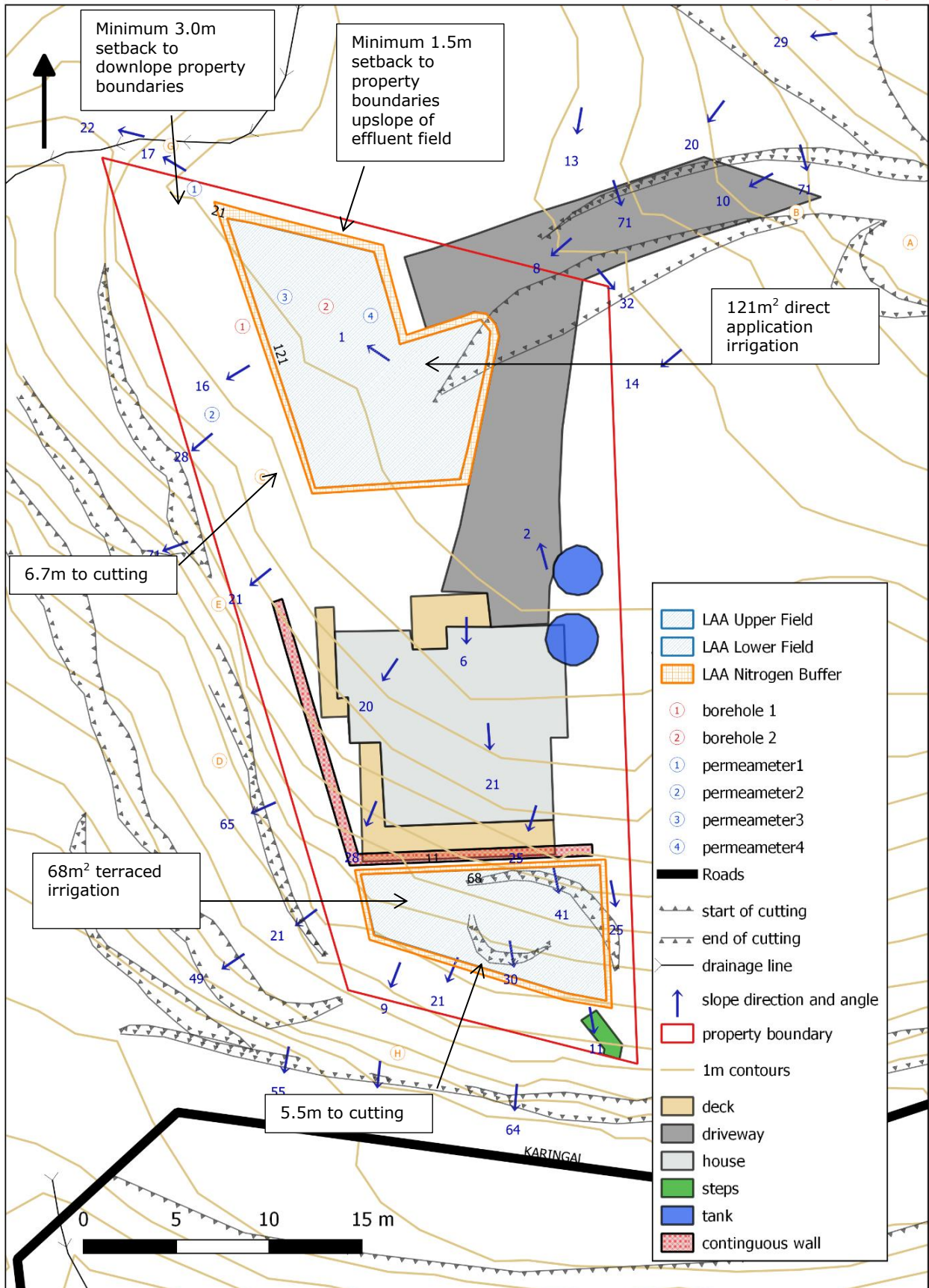
## Appendix II: Site Plan



A



## Appendix III: Test Site and LAA Location Plan



## Appendix IV: Borehole Descriptions

<b>AGR GeoSciences</b>														
Client:		Ben Pursehouse				Bore Hole				No. 1				
Project Address:		15 Karingal Drive Wye River				Field work Completed By:				David Horwood				
Reference No:		18L333LCA				Field Work Date:				15.1.2018				
Depth	Excavation Method	Graphic Log	Horizon	Material Description		Texture	Structure	Shade	Colour	Mottles	Moisture	Coarse Fragments	Boundary Type	Sample
100	Continuous Flight Auger			Sandy Silt		SCL	Mas				D	>20%		1
200				With Clay										
300				Category 4 Clay loams										
400														
500														
600														
700														
800			B2	Silty Clay		LC	Wk	Lt	Gy	Or <5%	SM	nil		2
900			Trace Sand											
1000			Category 5 Light clays											
1100														
1200				Siltstone					Dk	Gy				
1400				Highly Weathered										
1500														
1600														
1700														
1800														
1900														
2000														
2100				EOH										
2200														
2300														
2400														
2500														
<b>Comment:</b>														
<b>Texture:</b>														
S	Sand	ZL	Silty Loam		SIC	Silty Clay		D	Dry		Gr	(Single) Grained		
LS	Loamy Sand	SCL	Sandy Clay Loam		LC	Light Clay		SM	Slightly Moist		Mas	Massive		
CS	Clayey Sand	CL	Clay Loam		LMC	light Med Clay		M	Moist		Wk	Weakly Structure		
SL	Sandy Loam	ZCL	Silty Clay Loam		MC	Medium Clay		VM	Very Moist		Md	Mod Structured		
FSL	Fine Sandy Loan	FSCL	Fine Sandy Clay Loam		HC	Heavy Clay		W	Wet		St	Strongly Structure		
L	Loam	SC	Sandy Clay											
<b>Colour:</b> Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green														
Groundwater ▼		<b>Boundary Type:</b>			Sharp <5mm			Abrut 5-20mm			Clear 20-50mm			
Sample: 1					Gradual 50-100mm			Diffues >100mm						

### AGR GeoSciences

Client: Ben Pursehouse Bore Hole No. 2  
 Project Address: 15 Karingal Drive Wye River Field work Completed By: David Horwood  
 Reference No: 18L333LCA Field Work Date: 15.1.2018

Depth	Excavation Method	Graphic Log	Horizon	Material Description	Texture	Structure	Shade	Colour	Mottles	Moisture	Coarse Fragments	Boundary type	Sample			
100	Hand Auger			Clayey Silt	CL	Wk	Dk	Gy		D	<10%					
200				Category 4 Clay loams												
300																
400																
500																
600																
700																
800						B2	Silty Clay	LC	Wk	Lt	Gy	Or <5%	SM	nil		
900							Trace Sand									
1000							Category 5 Light clays									
1100																
1200																
1300							Refusal Bedrock			Dk	Gy					
1400							Siltstone									
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																
2400																
2500																

**Comment:**


Texture:				Moisture:			Structure:		
S	Sand	ZL	Silty Loam	SiC	Silty Clay	D	Dry	Gr	(Single) Grained
LS	Loamy Sand	SCL	Sandy Clay Loam	LC	Light Clay	SM	Slightly Moist	Mas	Massive
CS	Clayey Sand	CL	Clay Loam	LMC	light Med Clay	M	Moist	Wk	Weakly Structured
SL	Sandy Loam	ZCL	Silty Clay Loam	MC	Medium Clay	VM	Very Moist	Md	Mod Structured
FSL	Fine Sandy Loam	FSCL	Fine Sandy Clay Loam	HC	Heavy Clay	W	Wet	St	Strongly Structured
L	Loam	SC	Sandy Clay						

**Colour:** Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green


Groundwater <input type="checkbox"/>	<b>Boundary Type:</b> Sharp <5mm	Abrut 5-20mm	Clear 20-50mm
Sample: 1	Gradual 50-100mm	Diffues >100mm	

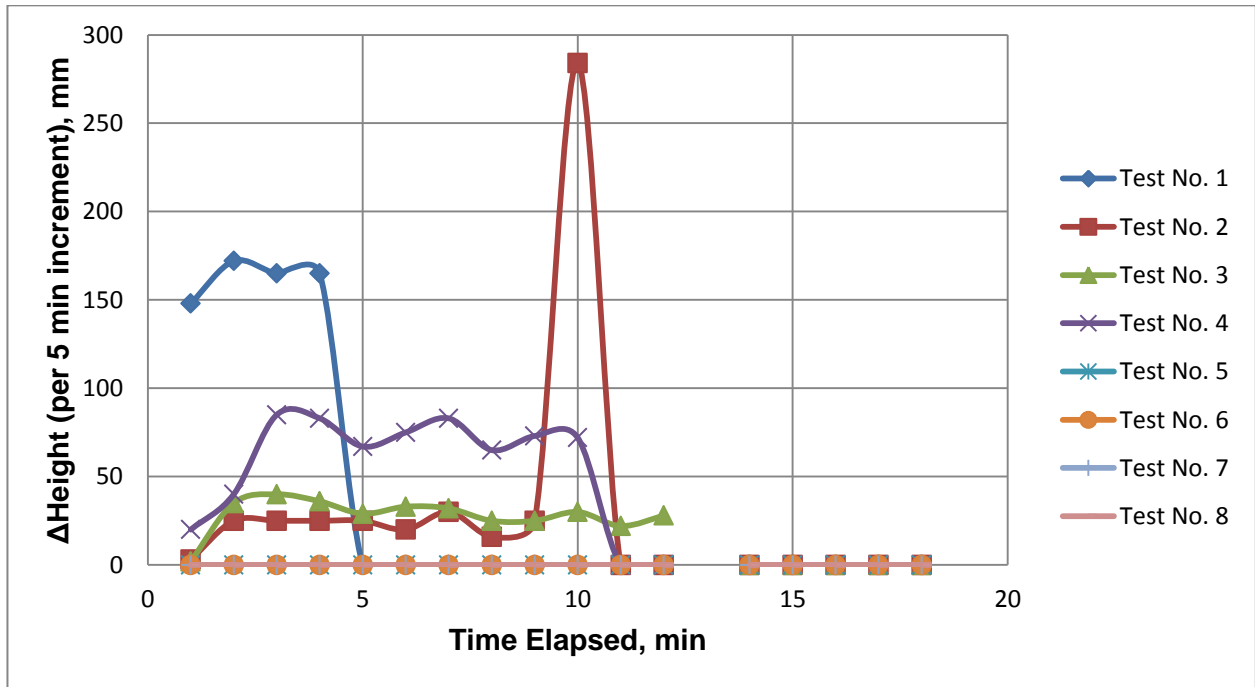
Client: Ben Pursehouse		Test Site: No. 2		1987. THIS DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.		Drilling Method: Cutting							
Project Address: 15 Karingal Drive Wye River		Field Work Completed By: DH		From 0		To 2500							
Reference No: 18B250LRA		Field Work Date: 5/03/2018											
Depth mm	Graphic Log	Group Symbol	Material Description	Shade	Colour	Mottle	Moisture	Consistency/Density	Field Test				
100			clayey SILT	very low plasticity	Dk	Gy / Br		D F					
200													
300													
400			sandy SILT	with clay	Dk	Or / Br		D F					
500													
600													
700			silty SAND	with clay	Dk	Yl / Br		D MD					
800													
900													
1000													
1100					with HW Sandstone Rock Fragments	very well graded							
1200					gravel to cobble sized	cobble to boulder sized							
1300						angular to sub round							
1400													
1500													
1600													
1700													
1800													
1900													
2000													
2100													
2200													
2300													
2400													
2500													
2600			EOH										
2700													
2800													
2900													
3000													
3100													
3200													
3300													
3400													
3500													
<b>Comment:</b> Sandstone boulders supported in matrix of clayey sand													
<b>Graphic Log</b>													
	Granular A Horizon		Cohesive A Horizon		Cohesive B Horizon		Granular B Horizon		EW Rock/C Horizon		Rock		Fill
<b>Field Test and Sampling</b>				<b>Moisture:</b>		<b>Relative Density:</b>		<b>Consistency:</b>					
SPT Standard Penetration Test (Relative density N - blows/300mm)				D Dry		VL		VS Very Soft					
PP Pocket Penetrometer (Force kgf/cm <sup>2</sup> - Unconfined Compressive Strength q <sub>u</sub> )				SM Slightly Moist		L		S Soft					
VS Vane Shear (Undrained cohesive (shear) strength Cu/Su kPa)				M Moist		MD		F Firm					
DCP Dynamic Cone Penetrometer (Penetration resistance N <sub>p</sub> - blows/100mm)				VM Very Moist		D		St Stiff					
Disturbed Sample D Undisturbed Sample U				W Wet		VD		VSt Very Stiff					
<b>Compaction:</b> PC Poorly Compacted MC Moderately Compacted WC Well Compacted VC Variably Compacted						Groundwater		H Hard					
<b>Colour:</b> Dk Dark Lt Light Bk Black Br Brown Gy Grey Or Orange Yl Yellow Re Red Bl Blue Gn Green Pk Pink Wh White													

## Appendix V: Ksat, Water and Nutrient Balance Computation

<b>Project:</b> 15 Karingal Drive Wye River	<b>Job No.:</b> 18L333LCA <b>Comp:</b> 29/01/2019 <b>Date:</b> 15/01/2019	 <b>AGR</b> ASSESSING GEOLOGICAL RISK						
<b>Client:</b> Ben Pursehouse	<b>Attendee:</b> NH							
<b>Subject:</b> Soil Permeability Calculations	<b>Review:</b> 0							
<b>SOIL PERMEABILITY CALCULATIONS</b>								
Refer Site Investigation Plan for locations of test sites								
Refer Borehole Profiles for soil types and depths encountered								
<b>Test Number:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
<b>Time Step (min):</b>	5	5	5	5				
<b>Hole Depth(mm):</b>	300	300	300	300				
<b>Hole Dia. (mm)</b>	75	75	90	90	75	75	75	75
<b>Tube Inside Dia. (mm):</b>	40	40	40	40	40/50	40/50	40/50	40/50
<b>Lim. Layer Depth(mm):</b>	50	50	50	50				
<b>Lim. Layer Material:</b>	SCL	SCL	SCL	SCL				
<b>Tube Insert. Depth:</b>	150	150	150	150				
<b>Tube Number:</b>								
<b>Test Liquid:</b>	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water	Tap Water
<b>Soil Moisture:</b>	D	D	D	D				
<b>Time</b>								
<b>Time</b>	0	150	257	143	125			
<b>Reading:</b>	5	298	260	145	145			
<b>Drop:</b>		148	3	2	20			
<b>Reading:</b>	10	470	285	180	185			
<b>Drop:</b>		172	25	35	40			
<b>Reading:</b>	15	635	310	220	270			
<b>Drop:</b>		165	25	40	85			
<b>Reading:</b>	20	800	335	256	353			
<b>Drop:</b>		165	25	36	83			
<b>Reading:</b>	25		360	285	420			
<b>Drop:</b>			25	29	67			
<b>Reading:</b>	30		380	318	495			
<b>Drop:</b>			20	33	75			
<b>Reading:</b>	35		410	350	578			
<b>Drop:</b>			30	32	83			
<b>Reading:</b>	40		426	375	643			
<b>Drop:</b>			16	25	65			
<b>Reading:</b>	45		451	400	716			
<b>Drop:</b>			25	25	73			
<b>Reading:</b>	50		735	430	788			
<b>Drop:</b>			284	30	72			
<b>Reading:</b>	55			452				
<b>Drop:</b>				22				
<b>Reading:</b>	60			480				
<b>Drop:</b>				28				
<b>Reading:</b>	65							
<b>Drop:</b>								
<b>Reading:</b>	70							
<b>Drop:</b>								
<b>Reading:</b>	75							
<b>Drop:</b>								
<b>Reading:</b>	80							
<b>Drop:</b>								
<b>Reading:</b>	85							
<b>Drop:</b>								
<b>Reading:</b>	90							
<b>Drop:</b>								



<b>Project:</b>	15 Karingal Drive Wye River	<b>Job No.:</b>	18L333LCA	 <b>AGR</b> ASSESSING GEOLOGICAL RISK
<b>Client:</b>	Ben Pursehouse	<b>Comp:</b>	29/01/2019	
<b>Subject:</b>	Soil Permeability Calculations	<b>Date:</b>	15/01/2019	
		<b>Attendee:</b>	NH	
		<b>Review:</b>	0	



	1	2	3	4	5	6	7	8
Starts uniform drop		10	25	25				
Stops uniform drop		45	60	50				
Time elapsed(min)		35	35	25				
Total Drop (cm)		16.6	19.5	36.8				
z		2.0	1.7	1.7				
Flow, Q (cm <sup>3</sup> /min)		6.0	7.0	18.5				
K <sub>sat</sub> (cm/min)		0.0077	0.0078	0.0207				
K <sub>sat</sub> (m/day)		0.110	0.113	0.297				
					<b>Average K<sub>sat</sub> (m/day)</b>			<b>0.1734</b>



<b>Project:</b> 15 Karingal Drive Wye River  <b>Client:</b> Ben Pursehouse <b>Subject:</b> Land Application Area Sizing Using Water Balance - Standard Irrigation	<b>Job No.:</b> 18L333LCA <b>Comp:</b> 29/01/2019 <b>Date:</b> 15/01/2019 <b>Attendee:</b> NH <b>Review:</b> 0	 ASSESSING GEOLOGICAL RISK														
<b>INPUT DATA</b>																
Design Wastewater Flow	Q	600	L/day													
Design Seepage Rate	DSR	5.7	mm/day													
Trial Land Application Area	LAA	189	m <sup>2</sup>													
Crop Factor	C	Shade	unitless													
Rainfall Runoff Factor	RF	0.75	unitless													
Effective Void Ratio	N	0.3	unitless													
Minimum Freeboard Topsoil Layer	F	100	mm													
Mean Monthly Pan Evaporation Data	Wye/Kennett River 70th percentile SILO															
Mean Monthly Rainfall Data	Wye/Kennett River 70th percentile SILO															
<b>Parameter</b>	<b>Symbol</b>	<b>Formula</b>	<b>Units</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>	<b>Total</b>
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation	E		mm/month	129	106	90	58	39	28	32	44	61	87	102	121	897.0
Rainfall	R		mm/month	43	45	57	71	99	105	112	128	108	94	65	54	981.0
Crop Factor	C		unitless	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
<b>OUTPUTS</b>																
Evapotranspiration	ET	E x C	mm/month	51.6	42.4	36.0	23.2	15.6	11.2	12.8	17.6	24.4	34.8	40.8	48.4	359
Seepage	S	DSR x D	mm/month	176.7	159.6	176.7	171.0	176.7	171.0	176.7	176.7	171.0	176.7	171.0	176.7	2080.5
<b>Total Outputs</b>		<b>ET+S</b>	<b>mm/month</b>	<b>228.3</b>	<b>202.0</b>	<b>212.7</b>	<b>194.2</b>	<b>192.3</b>	<b>182.2</b>	<b>189.5</b>	<b>194.3</b>	<b>195.4</b>	<b>211.5</b>	<b>211.8</b>	<b>225.1</b>	<b>2439.3</b>
<b>INPUTS</b>																
Retained Rainfall	RR	R x RF	mm/month	32.2	33.7	42.7	53.2	74.2	78.6	83.9	95.9	80.9	70.4	48.7	40.4	734.8
Applied Effluent	W	QxD	L/month	18600	18600	18600	18000	18600	18000	18600	18600	18000	18600	18000	18600	219000
<b>Total Inputs</b>		<b>RR+W</b>	<b>mm/month</b>	<b>50.8</b>	<b>50.5</b>	<b>61.3</b>	<b>71.2</b>	<b>92.8</b>	<b>96.6</b>	<b>102.5</b>	<b>114.5</b>	<b>98.9</b>	<b>89.0</b>	<b>66.7</b>	<b>59.0</b>	<b>953.8</b>
<b>DISPOSAL RATE</b>																
Disposal Rate	DR	(ET+S)-RR	mm/month	196.1	168.3	170.0	141.0	118.1	103.6	105.6	98.4	114.5	141.1	163.1	184.7	
<b>LAND AREA REQUIRED FOR ZERO STORAGE</b>				m <sup>2</sup>	95	100	109	128	157	174	176	189	157	132	110	101
<b>MINIMUM AREA REQUIRED FOR ZERO STORAGE:</b>				189	m <sup>2</sup>											
<b>ADOPTED LAND APPLICATION AREA:</b>				189	m <sup>2</sup>											
<b>DESIGN APPLICATION RATE:</b>				3.2	mm/day											
<b>STORAGE CALCULATION</b>																
Application Rate	AR	Q/LAA	mm/month	98.4	88.9	98.4	95.2	98.4	95.2	98.4	98.4	95.2	98.4	95.2	98.4	
Storage For The Month	ST	AR-DR	mm/month	-97.7	-79.4	-71.6	-45.8	-19.7	-8.3	-7.2	0.0	-19.3	-42.7	-67.9	-86.2	
Increase In Depth Of Stored Effluent	ΔH	ST/N	mm/month	-325.6	-264.7	-238.6	-152.6	-65.8	-27.7	-24.0	-0.1	-64.2	-142.3	-226.3	-287.5	
Storage Remaining From Previous Month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Storage At End Of Month	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cumulative Storage From Previous Year	CS		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage Depth for Nominated Area	MS		mm	0												
<b>DESIGN DIMENSIONS SUMMARY</b>																
Land Application Area	LAA	189	m <sup>2</sup>													
Maximum Storage Height	MS	0	mm													
Minimum Freeboard Topsoil Layer	F	100	mm													
Min Depth Of Land Application System	Z		mm													



# Nitrogen Balance

**Site Address:** 15 Karingal Drive Wye River

**SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE** 199 m<sup>2</sup>

## INPUT DATA<sup>1</sup>

Wastewater Loading				Nutrient Crop Uptake				
Hydraulic Load	600	L/day	Crop N Uptake	220	kg/ha/yr	which equals	60.27	mg/m <sup>2</sup> /day
Effluent N Concentration	25	mg/L						
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal						
Total N Loss to Soil	3000	mg/day						
Remaining N Load after soil loss	12000	mg/day						

## NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer		Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)			
Nitrogen	199 m <sup>2</sup>	Nominated LAA Size	189	m <sup>2</sup>	
		Predicted N Export from LAA	0.222	kg/year	
		Minimum Buffer Required for excess nutrient	10.09091	m <sup>2</sup>	

## CELLS

- XX Please enter data in blue cells
- XX Red cells are automatically populated by the spreadsheet
- XX Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS


## NOTES

<sup>1</sup> Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used.

Otherwise data should be obtained from a reliable source such as:

- EPA Guidelines for Effluent Irrigation
- Appropriate Peer Reviewed Papers
- Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households
- USEPA Onsite Systems Manual

## Appendix VI: Gypsum Requirement

<b>Project:</b> 15 Karingal Drive Wye River		<b>Job No.:</b> 18L333LCA <b>Comp:</b> 29/01/2019 <b>Date:</b> 15/01/2019		 <b>AGR</b> ASSESSING GEOLOGICAL RISK
<b>Client:</b> Ben Pursehouse <b>Subject:</b> Gypsum Requirement		<b>Attendee:</b> NH <b>Review:</b> 0		
Calculation $CEC \times 1.6 \times (ESP - ESP_D)$			<b>Sample 1</b>	
	<b>meq/100g</b>	<b>%</b>		
Exchangeable Calcium	7.2	66.7	Sample Depth (mm)	200
Exchangeable Magnesium	2.7	25.0	Depth of soil (mm)	700
Exchangeable Potassium	0.6	5.6	Gypsum factor (tons) <sup>1</sup>	1.6
Exchangeable Sodium	0.3	2.8	t/ha to kg/m <sup>2</sup> conversion	0.1
Exchangeable Hydrogen		0.0		
Cation Exchange Capacity (CEC)			MEQ%	10.7
Exchangable Sodium Percentage (ESP)			%	3.2
Desirable Exchangable Sodium Percentage (ESP <sub>D</sub> )			%	6.0
Calcium Replacement (ESP - ESP <sub>D</sub> )			%	0.0
Gypsum Requirement    t/ha <span style="background-color: yellow; padding: 2px;">0.00</span>				
	kg/m <sup>2</sup>	<span style="background-color: yellow; padding: 2px;">0.00</span>		
<sup>1</sup> US Department of Agriculture (1954) Agrigulture Handbook No. 60; Davis <i>et al</i> (2012)				

**Project:** 15 Karingal Drive  
Wye River  
**Client:** Ben Pursehouse  
**Subject:** Gypsum Requirement

**Job No.:** 18L333LCA  
**Comp:** 29/01/2019  
**Date:** 15/01/2019  
**Attendee:** NH  
**Review:** 0



Calculation CEC x 1.6 x (ESP - ESP<sub>D</sub>)

Sample 2


	meq/100g	%		
Exchangeable Calcium	6.8	41.5	Sample Depth (mm)	800
Exchangeable Magnesium	8	48.8	Depth of soil (mm)	100
Exchangeable Potassium	0.8	4.9	Gypsum factor (tons) <sup>1</sup>	1.6
Exchangeable Sodium	0.8	4.9	t/ha to kg/m <sup>2</sup> conversion	0.1
Exchangeable Hydrogen		0.0		
Cation Exchange Capacity (CEC)			MEQ%	16.3
Exchangable Sodium Percentage (ESP)			%	4.8
Desirable Exchangable Sodium Percentage (ESP <sub>D</sub> )			%	6.0
Calcium Replacement (ESP - ESP <sub>D</sub> )			%	0.0

Gypsum Requirement	t/ha	0.00
	kg/m <sup>2</sup>	0.00

<sup>1</sup>US Department of Agriculture (1954) Agriculture Handbook No. 60; Davis *et al* (2012)


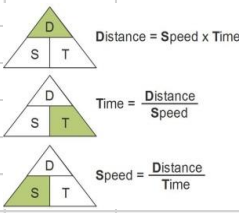


## Appendix VII: Runoff Coefficient Computation

<b>Project:</b>	15 Karingal Drive Wye River	<b>Job No.:</b>	18L333LCA	 <b>AGR</b> ASSESSING GEOLOGICAL RISK
<b>Client:</b>	Ben Pursehouse	<b>Comp:</b>	29/01/2019	
<b>Subject:</b>	Run off Coefficient	<b>Date:</b>	15/01/2019	
		<b>Attendee:</b>	NH	
		<b>Review:</b>	0	
<b>Proportional Land Use Zones areas of Total Catchment Area</b>				
Total area	<input type="text" value=""/> km <sup>2</sup>	<input type="text" value="1400"/>	m <sup>2</sup>	
<b>Land Use</b>	<b>Prop. Of Land <math>A_i</math></b>	<b><math>C_i</math></b>		
House, Roof	0.12	0.95		
Driveway, road	0.12	0.3		
Very Steep, sandy soil	0.25	0.2		
Flat sandy soil	0.51	0.1		
	0	0		
	0	0		
	$A_{total}$	1.0		
<b>Runoff coefficient for total area (Weighted C)</b>	<b>0.251</b>	Weighted C = $\sum C_i A_i / A_{total}$		

**NOTE:** Runoff Factor used in LCA water balance calculations is the inverse of the Runoff Coefficient. Ie the proportion of water retained or that infiltrates the soil as apposed to water runs off. If C = 0.3 then RF = 0.7

## Appendix VIII: Groundwater Movement Computation

<b>Project:</b> 15 Karingal Drive Wye River	<b>Job No.:</b> 18L333LCA <b>Comp:</b> 12/02/2019 <b>Date:</b> 12/02/2019	 <b>AGR</b> ASSESSING GEOLOGICAL RISK																																																		
<b>Client:</b> Ben Pursehouse	<b>Attendee:</b> NH																																																			
<b>Subject:</b> Land Capability Assessment	<b>Review:</b>																																																			
<p>Darcy's Law (flow): <math>Q = KiA</math>    where: K = Hydraulic Conductivity  <math>i =</math> Hydraulic Gradient          Groundwater Velocity: <math>V = Ki/n</math>    A = Cross sectional area  <math>n =</math> porosity          Hydraulic Gradient: <math>i = dh/dl</math>    dh = head loss over a distance or the rise from disposal field bounds to element at risk  <math>dl =</math> the distance/length of the head loss or the run from disposal field bounds to element at</p>																																																				
Application rate	3.2	mm/day																																																		
Width of field	7.3	m																																																		
Element at risk	Cutting																																																			
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;"><b>Lower Bounds</b></td> <td style="width: 50%; text-align: center;"><b>Upper Bounds</b></td> </tr> <tr> <td>K</td> <td style="text-align: center;">0.3</td> <td>m/day</td> </tr> <tr> <td>A</td> <td style="text-align: center;">0.02336</td> <td>m<sup>2</sup></td> </tr> <tr> <td>n</td> <td style="text-align: center;">25</td> <td>%</td> </tr> <tr> <td>dh</td> <td style="text-align: center;">1.5</td> <td>m</td> </tr> <tr> <td>dl</td> <td style="text-align: center;">3</td> <td>m</td> </tr> <tr> <td>i</td> <td style="text-align: center;">0.500</td> <td>m</td> </tr> <tr> <td>Q</td> <td style="text-align: center;">0.0035</td> <td>m<sup>2</sup>/day</td> </tr> <tr> <td>V</td> <td style="text-align: center;">0.600</td> <td>m/day</td> </tr> <tr> <td>K</td> <td style="text-align: center;">0.3</td> <td>m/day</td> </tr> <tr> <td>A</td> <td style="text-align: center;">0.02336</td> <td>m<sup>2</sup></td> </tr> <tr> <td>n</td> <td style="text-align: center;">25</td> <td>%</td> </tr> <tr> <td>dh</td> <td style="text-align: center;">5.5</td> <td>m</td> </tr> <tr> <td>dl</td> <td style="text-align: center;">10.3</td> <td>m</td> </tr> <tr> <td>i</td> <td style="text-align: center;">0.534</td> <td>m</td> </tr> <tr> <td>Q</td> <td style="text-align: center;">0.0037</td> <td>m<sup>2</sup>/day</td> </tr> <tr> <td>V</td> <td style="text-align: center;">0.641</td> <td>m/day</td> </tr> </table>			<b>Lower Bounds</b>	<b>Upper Bounds</b>	K	0.3	m/day	A	0.02336	m <sup>2</sup>	n	25	%	dh	1.5	m	dl	3	m	i	0.500	m	Q	0.0035	m <sup>2</sup> /day	V	0.600	m/day	K	0.3	m/day	A	0.02336	m <sup>2</sup>	n	25	%	dh	5.5	m	dl	10.3	m	i	0.534	m	Q	0.0037	m <sup>2</sup> /day	V	0.641	m/day
<b>Lower Bounds</b>	<b>Upper Bounds</b>																																																			
K	0.3	m/day																																																		
A	0.02336	m <sup>2</sup>																																																		
n	25	%																																																		
dh	1.5	m																																																		
dl	3	m																																																		
i	0.500	m																																																		
Q	0.0035	m <sup>2</sup> /day																																																		
V	0.600	m/day																																																		
K	0.3	m/day																																																		
A	0.02336	m <sup>2</sup>																																																		
n	25	%																																																		
dh	5.5	m																																																		
dl	10.3	m																																																		
i	0.534	m																																																		
Q	0.0037	m <sup>2</sup> /day																																																		
V	0.641	m/day																																																		
																																																				
Time (t) taken for waste water to reach element at risk from <b>Lower</b> boundary of	5.0	days																																																		
Time (t) taken for waste water to reach element at risk from <b>Upper</b> boundary of	16.1	days																																																		



<b>Project:</b> 15 Karingal Drive Wye River	<b>Job No.:</b> 18L333LCA
	<b>Comp:</b> 12/02/2019
	<b>Date:</b> 12/02/2019
<b>Client:</b> Ben Pursehouse	<b>Attendee:</b> NH
<b>Subject:</b> Land Capability Assessment	<b>Review:</b>

Darcy's Law (flow): $Q = KiA$	where: K = Hydraulic Conductivity
	i = Hydraulic Gradient
Groundwater Velocity: $V = Ki/n$	A = Cross sectional area
	n = porosity
Hydraulic Gradient: $i = dh/dl$	dh = head loss over a distance or the rise from disposal field bounds to element at risk
	dl = the distance/length of the head loss or the run from disposal field bounds to element at

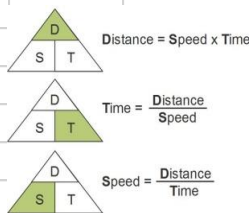
Application rate	3.2	mm/day
Width of field	9.5	m
Element at risk	Cutting	

**Lower Bounds**

K	0.3	m/day
A	0.0304	m <sup>2</sup>
n	25	%
dh	4	m
dl	7.4	m
i	0.541	m
Q	0.0049	m <sup>2</sup> /day
V	0.649	m/day

**Upper Bounds**

K	0.3	m/day
A	0.0304	m <sup>2</sup>
n	25	%
dh	5	m
dl	17	m
i	0.294	m
Q	0.0027	m <sup>2</sup> /day
V	0.353	m/day



Time (t) taken for waste water to reach element at risk from **Lower** boundary of **11.4** days

Time (t) taken for waste water to reach element at risk from **Upper** boundary of **48.2** days

14/2/2019

Ben Pursehouse  
15 Karingal Drive  
Wye River Vic

Dear Ben,

**RE: Landslip Risk Assessment for 15 Karingal Drive Wye River, Victoria**

AGR Geosciences Pty Ltd (AGR) conducted a Landslip Risk Assessment for a proposed development at the above mentioned address (Doc. 18B250LRA, 20/3/2018, revised 11/4/2018).

Following completion of the assessment and the subsequent planning approval we now understand that the development proposal has been redesigned and an application is to be made to the Colac Otway Shire to have the changes approved under Secondary Consent.

AGR has now completed a full review of the original assessment with reference to the new design proposal prepared by Impact Design Consultants (TP01-TP04 Rev. G dated 25/1/2019).

The identified hazards and proposed mitigation measures reported in the original Landslip Risk Assessment are still relevant and appropriate to the revised dwelling design. The new design does not add any additional slope stability hazards not already dealt with in the recommendations for hazard mitigation.

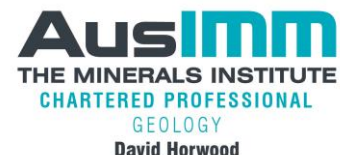
I can confirm that the new design does not alter the findings or conclusions the above mentioned revised assessment and that alteration of the original report is not warranted.

I trust this information is satisfactory to your requirements.

Yours Sincerely,




**DAVID J HORWOOD**  
*BAppSc (Geology); MAusIMM CP (Geo); MAIG*  
**SENIOR ENGINEERING GEOLOGIST**



**AusIMM**  
THE MINERALS INSTITUTE  
CHARTERED PROFESSIONAL  
GEOLOGY  
David Horwood

<b>FORM</b>	<b>A</b>	<b>Geotechnical Declaration and Verification Development Application</b>	
Office Use Only		Regulator: COLAC-OTWAY SHIRE	
<p><b>To be submitted with a development application. If this form is not submitted with the geotechnical report the report will be refused.</b> This form is essential to verify that the geotechnical report has been prepared in accordance with Schedule 1 to the Erosion Management Overlay and that the author of the geotechnical report is a geotechnical engineer or engineering geologist as defined by Schedule 1 to the Erosion Management Overlay. Alternatively, where a geotechnical report has been prepared for subdivision or is greater than two years old or by a professional person not recognized by Schedule 1 to the Erosion Management Overlay, then this form may be used as technical verification of the geotechnical report if signed by a geotechnical engineer or engineering geologist as defined by Schedule 1 to the Erosion Management Overlay.</p>			
<b>Section 1</b>		<b>Related Application</b>	
Reference			
DA Site Address		15 Karingal Drive WYE RIVER VIC	
DA Applicant		Ben Pursehouse	
<b>Section 2</b>		<b>Geotechnical Report</b>	
Details		Title: Landslip Risk Assessment for 15 Karingal Drive WYE RIVER	
		Author's Company/Organization Name: AGR Geosciences Pty Ltd	Report Reference No: 18B250LRA
		Author: David J Horwood	Dated: 11 / 4 / 2018
<b>Section 3</b>		<b>Checklist</b>	
Geotechnical Requirements (Tick as appropriate, either Yes or No)		<b>The following checklist covers the minimum requirements to be addressed in a geotechnical report. This checklist is to accompany the report. Each item is to be cross-referenced to the section or page of the geotechnical report which addresses that item.</b>	
Yes      No <input checked="" type="checkbox"/> <input type="checkbox"/>		A review of readily available history of slope instability in the site or related land as per <i>section 4.1; 4.1.2; 4.1.3</i>	
<input checked="" type="checkbox"/> <input type="checkbox"/>		An assessment of the risk posed by all reasonably identifiable geotechnical hazards as per <i>Sections 4.4, 5.0, 6.0, 7.0</i>	
<input checked="" type="checkbox"/> <input type="checkbox"/>		Plans and sections of the site and related land as per <i>Figures 1-9, Section 4.0</i>	
<input checked="" type="checkbox"/> <input type="checkbox"/>		Presentation of a geological model as per <i>Figures 1-9 Section 4.1.1; Section 4.2 &amp; Section 4.3</i>	
<input checked="" type="checkbox"/> <input type="checkbox"/>		Photographs and/or drawings of the site as per <i>Appendices ii-iii</i>	
<input checked="" type="checkbox"/> <input type="checkbox"/>		A conclusion as to whether the site is suitable for the development proposed to be carried out either conditionally or unconditionally as per <i>Section 8.0</i>	
<input type="checkbox"/> <input type="checkbox"/>		If any items above are ticked No, an explanation is to be included in the report to justify why. <Add reference>	
Yes      No <input checked="" type="checkbox"/> <input type="checkbox"/>		Subject to recommendations and conditions relevant to:	
<input checked="" type="checkbox"/> <input type="checkbox"/>		selection and construction of footing systems,	
<input checked="" type="checkbox"/> <input type="checkbox"/>		earthworks,	
<input checked="" type="checkbox"/> <input type="checkbox"/>		surface and sub-surface drainage,	
<input checked="" type="checkbox"/> <input type="checkbox"/>		recommendations for the selection of structural systems consistent with the geotechnical assessment of the risk,	
<input checked="" type="checkbox"/> <input type="checkbox"/>		any conditions that may be required for the ongoing mitigation and maintenance of the site and the proposal, from a geotechnical viewpoint,	
<input checked="" type="checkbox"/> <input type="checkbox"/>		highlighting and detailing the inspection regime to provide the Colac-Otway Shire and builder with adequate notification for all necessary inspections.	
<input checked="" type="checkbox"/> <input type="checkbox"/>		State Design life adopted: 50 Years	



<b>FORM</b>	<b>A</b>	<b>Geotechnical Declaration and Verification Development Application</b>				
<b>Section 4</b>		<b>List of Drawings referenced in Geotechnical Report</b>				
Design Documents		Description	Plan or Document No.	Revision or Version No.	Date	Author
		Site analysis	TP01	G	25/1/2019	Impact Design Consultants
		Design response – ground floor	TP02	G	25/1/2019	Impact Design Consultants
		Design response – first floor	TP03	G	25/1/2019	Impact Design Consultants
		Elevations	TP04	G	25/1/2019	Impact Design Consultants
<b>Section 5</b>		<b>Declaration</b>				
Declaration (Tick all that apply) Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>  <input checked="" type="checkbox"/> N/A <input type="checkbox"/>  <input checked="" type="checkbox"/> N/A <input type="checkbox"/>  <input checked="" type="checkbox"/> No <input type="checkbox"/>  <input type="checkbox"/> N/A <input checked="" type="checkbox"/>  <input checked="" type="checkbox"/> No <input type="checkbox"/>		<p>I am a geotechnical engineer or engineering geologist as defined by the Schedule 1 to the Erosion Management Overlay and on behalf of the company below, I:</p> <p>am aware that the geotechnical report I have either prepared or am technically verifying (referenced above) is to be submitted in a support of a development application for the proposed development site (referenced above) and its findings will be relied upon by Colac-Otway Shire in determining the development application.</p> <p>prepared the geotechnical report referenced above in accordance with the AGS (2007c) as amended and Schedule 1 to the Erosion Management Overlay.</p> <p>am willing to technically verify that the Geotechnical Report referenced above has been prepared in accordance with the AGS (2007c) as amended and Schedule 1 to the Erosion Management Overlay.</p> <p>am willing to technically verify that the landslip risk assessment prepared for the development application for the site confirms the land will achieve the level of &lt;tolerable risk&gt; of slope instability as a result of the considerations described in Section 2.0 of Schedule 1 to the Erosion Management Overlay taking into account the total development and site disturbances proposed.</p> <p>am willing to technically verify that the landslip risk assessment prepared for the site and related land being greater than two years old confirms the land will achieve the level of &lt;tolerable risk&gt; of slope instability as a result of the considerations described Section 2.0 of Schedule 1 to the Erosion Management Overlay taking into account the total development and site disturbances proposed.</p> <p>have professional indemnity insurance in accordance with and Schedule 1 to the Erosion Management Overlay of not less than \$1.0 million, being in force for the year in which the report is dated, with retroactive cover under this insurance policy extending back to the engineer's first submission to Colac-Otway Shire.</p>				
<b>Section 6</b>		<b>Geotechnical Engineer or Engineering Geologist Details</b>				
Company/ Organization Name		AGR Geosciences Pty Ltd				
Name (Company Representative)		Surname: Horwood		Mr /Mrs /Other: Mr		
		Given Names: David John				
		Chartered Professional Status: CP (Geo)		Registration No: 321719		
Signature				Dated: 14 / 2 / 2019		

**REGISTER SEARCH STATEMENT (Title Search) Transfer of Land Act 1958** Page 1 of 1

VOLUME 08889 FOLIO 970

Security no : 124076147159B  
Produced 14/02/2019 02:55 PM

**LAND DESCRIPTION**

Lot 101 on Plan of Subdivision 050268.  
PARENT TITLE Volume 08753 Folio 197  
Created by instrument E085897 30/06/1971

**REGISTERED PROPRIETOR**

Estate Fee Simple  
Sole Proprietor  
BEN PURSEHOUSE of 15 RAILWAY PLACE WEST PRESTON VIC 3072  
AQ607065C 05/01/2018

**ENCUMBRANCES, CAVEATS AND NOTICES**

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan or imaged folio set out under DIAGRAM LOCATION below.

**DIAGRAM LOCATION**

SEE TP452300C FOR FURTHER DETAILS AND BOUNDARIES

**ACTIVITY IN THE LAST 125 DAYS**

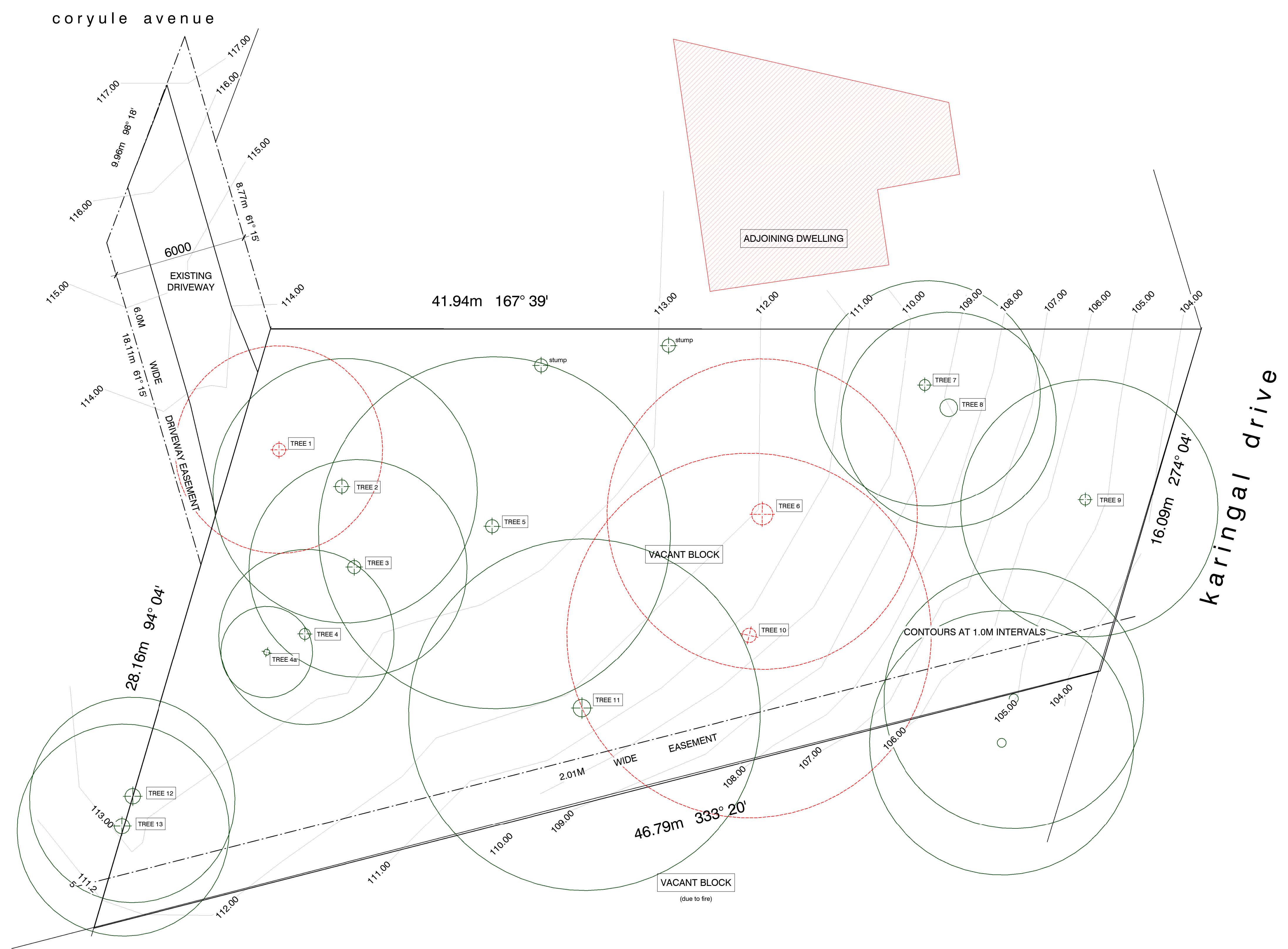
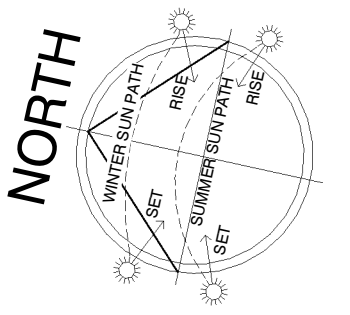
NIL

-----END OF REGISTER SEARCH STATEMENT-----

Additional information: (not part of the Register Search Statement)

Street Address: 15 KARINGAL DRIVE WYE RIVER VIC 3234

DOCUMENT END



**existing landscape legend:**

- existing tree
- 2 No. existing trees to be removed

**NOT FOR CONSTRUCTION PURPOSES**

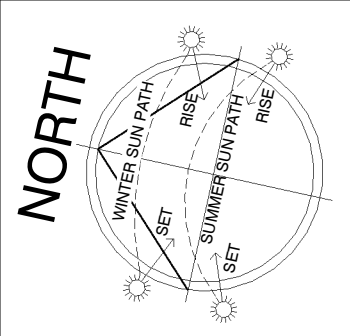


**proposed dwelling**  
 15 Karingal Drive, Wye River  
 town planning  
**B. Pursehouse**

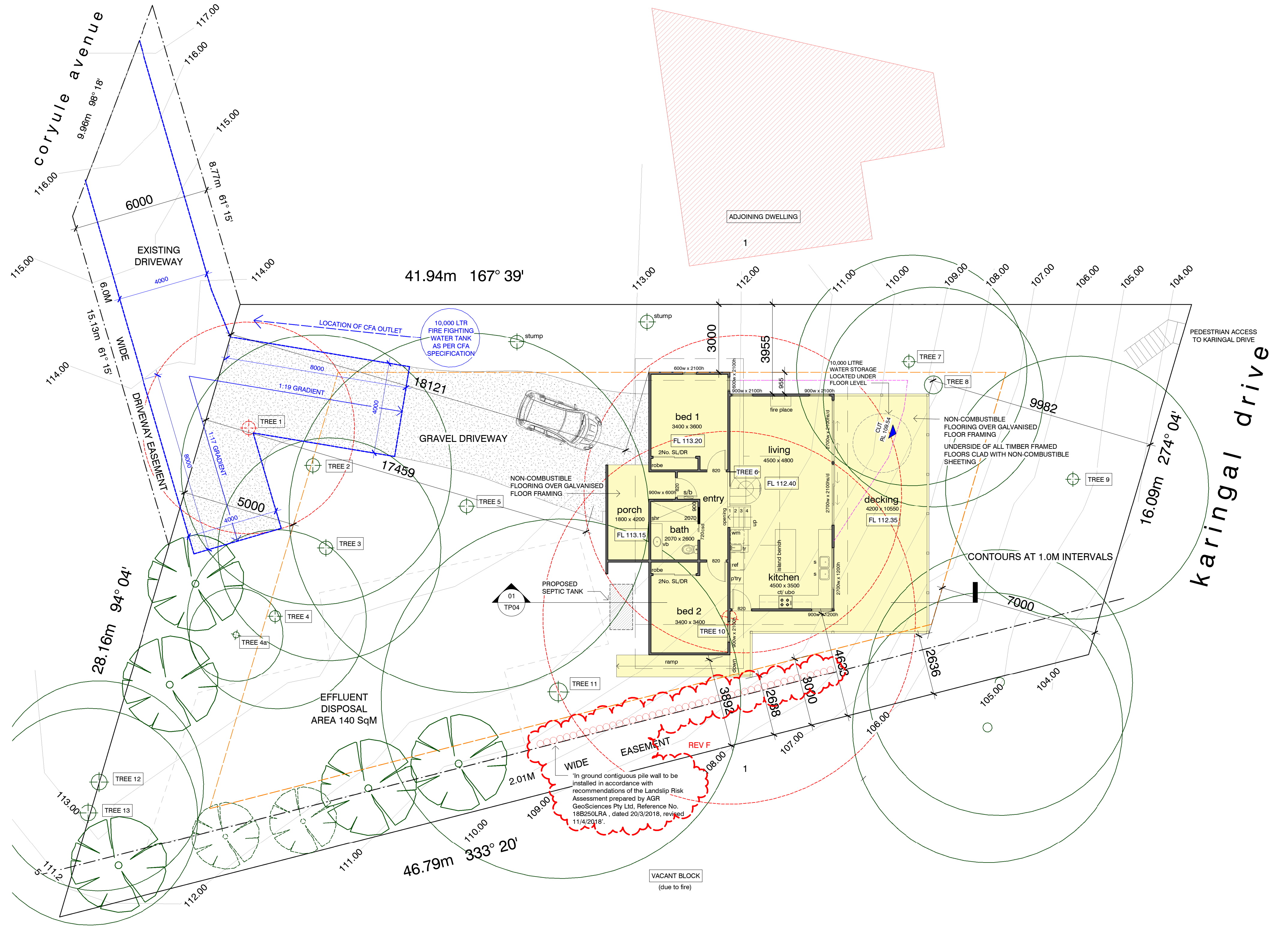
Rev G: Add First Floor 25.01.19  
 Rev F: TP F1 07.05.18 Council Change  
 Rev E: TP F1 04.05.18 Council Change  
 Rev D: TP F1 02.05.18 Council Change  
 revision C: TP F1 17.04.18 Bath Layout Change  
 revision/Rev B: TP F1 21.03.18

scale: 1:100 date: 14/12/2017  
 drawn by: dp job no.: 17-0001





THIS COPIED DOCUMENT IS MADE AVAILABLE FOR THE SOLE PURPOSE OF ENABLING ITS CONSIDERATION AND REVIEW AS PART OF A PLANNING AND ENVIRONMENT ACT 1987. THE DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.



- Legend:**
- proposed extension
  - gravel area
  - private open space
  - rubbish bins
  - clothes line
  - minimum setback requirements as per NEIGHBOURHOOD CHARACTER STUDY - SCHEDULE 1
  - extent of cut
  - CFA turning circle template

- proposed landscape legend:**
- Eucalyptus Bicstata (Victorian Blue Gum)
  - Acacia Melanoxylon (Blackwood)
  - Existing Tree
  - 3 No. existing trees to be removed

**development summary:**

site area:	890.00SqM
building area:	152.77SqM
site coverage:	17.17%
hard surface area:	85SqM
non-permeable surface area:	17.17%
permeability:	82.83%

**building areas:**

proposed porch:	10.01 SqM
proposed ground floor:	87.05 SqM
proposed first floor:	37.14 SqM
proposed decking:	55.71 SqM
<b>total</b>	<b>189.91 SqM</b>

**earthworks:**

porch floor level:	r.l. 113.15
ground floor level:	r.l. 113.20
lower floor level:	r.l. 112.80
decking level:	r.l. 112.75
CUT to finished surface level below:	r.l. 109.54

**proposed dwelling**  
15 Karungal Drive, Wye River  
town planning  
B. Pursehouse

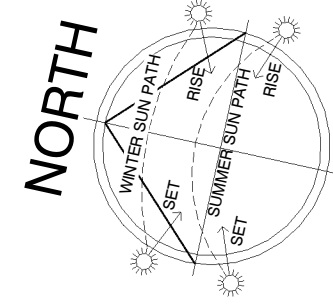
Rev G: Add First Floor 25.01.19  
Rev F: TP F1 07.05.18 Council Change  
Rev E: TP F1 04.05.18 Council Change  
Rev D: TP F1 02.05.18 Council Change  
Rev C: TP F1 17.04.18 Bath Layout Change  
revision: Rev B: TP F1 21.03.18

**NOT FOR CONSTRUCTION PURPOSES**

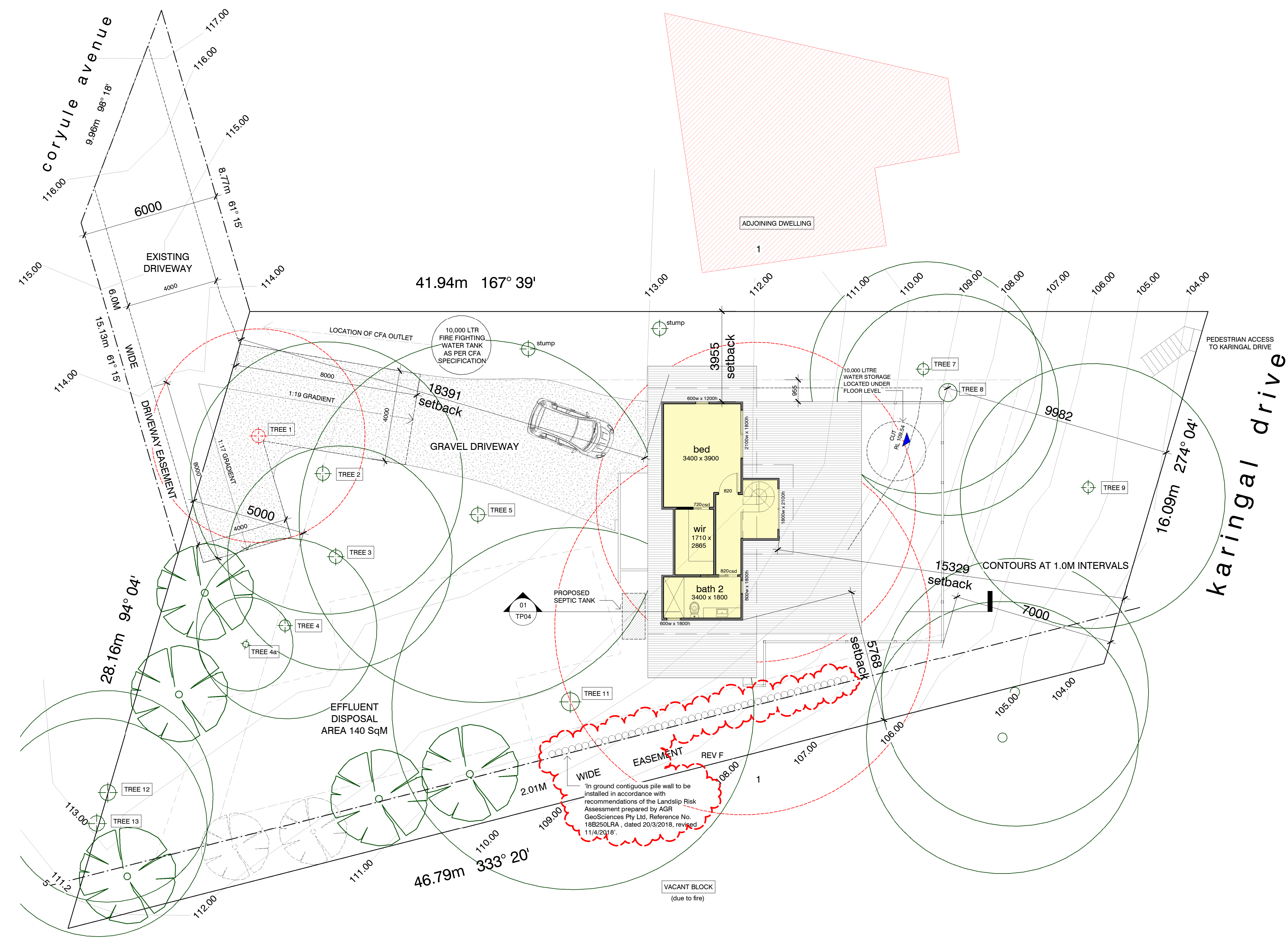


scale: 1:100 date: 14/10/2017  
drawn by: dp job no.: 17-0901  
revision: Rev B: TP F1 21.03.18





THIS COPIED DOCUMENT IS MADE AVAILABLE FOR THE SOLE PURPOSE OF ENABLING ITS CONSIDERATION AND REVIEW AS PART OF A PLANNING PROCESS UNDER THE PLANNING AND ENVIRONMENT ACT 1987. THE DOCUMENT MUST NOT BE USED FOR ANY PURPOSE WHICH MAY BREACH COPYRIGHT.



site plan - first floor

legend:

- proposed extension
- gravel area
- private open space
- b rubbish bins
- clothes line
- minimum setback requirements as per NEIGHBOURHOOD CHARACTER STUDY - SCHEDULE 1
- extent of cut
- CFA turning circle template

proposed landscape legend:

- Eucalyptus Bicstata (Victorian Blue Gum)
- Acacia Melanoxylon (Blackwood)
- Existing Tree
- 3 No. existing trees to be removed

development summary:

site area:	890.00SqM
building area:	152.77SqM
site coverage:	17.17%
hard surface area:	0SqM
non-permeable surface area:	17.17%
permeability:	82.83%

building areas:

proposed porch:	10.01 SqM
proposed ground floor:	87.05 SqM
proposed first floor:	37.14 SqM
proposed decking:	55.71 SqM
<b>total:</b>	<b>189.91 SqM</b>

earthworks:

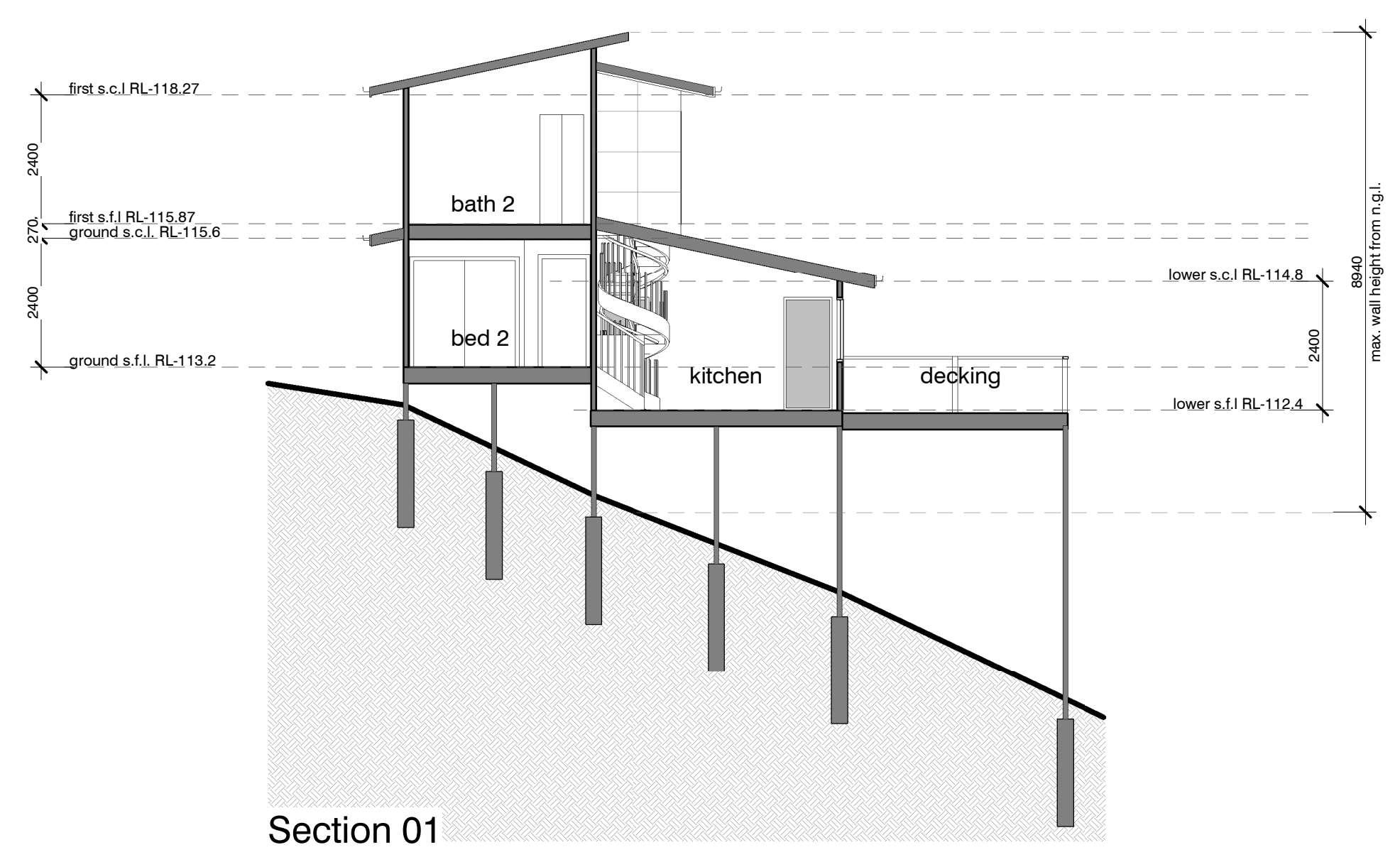
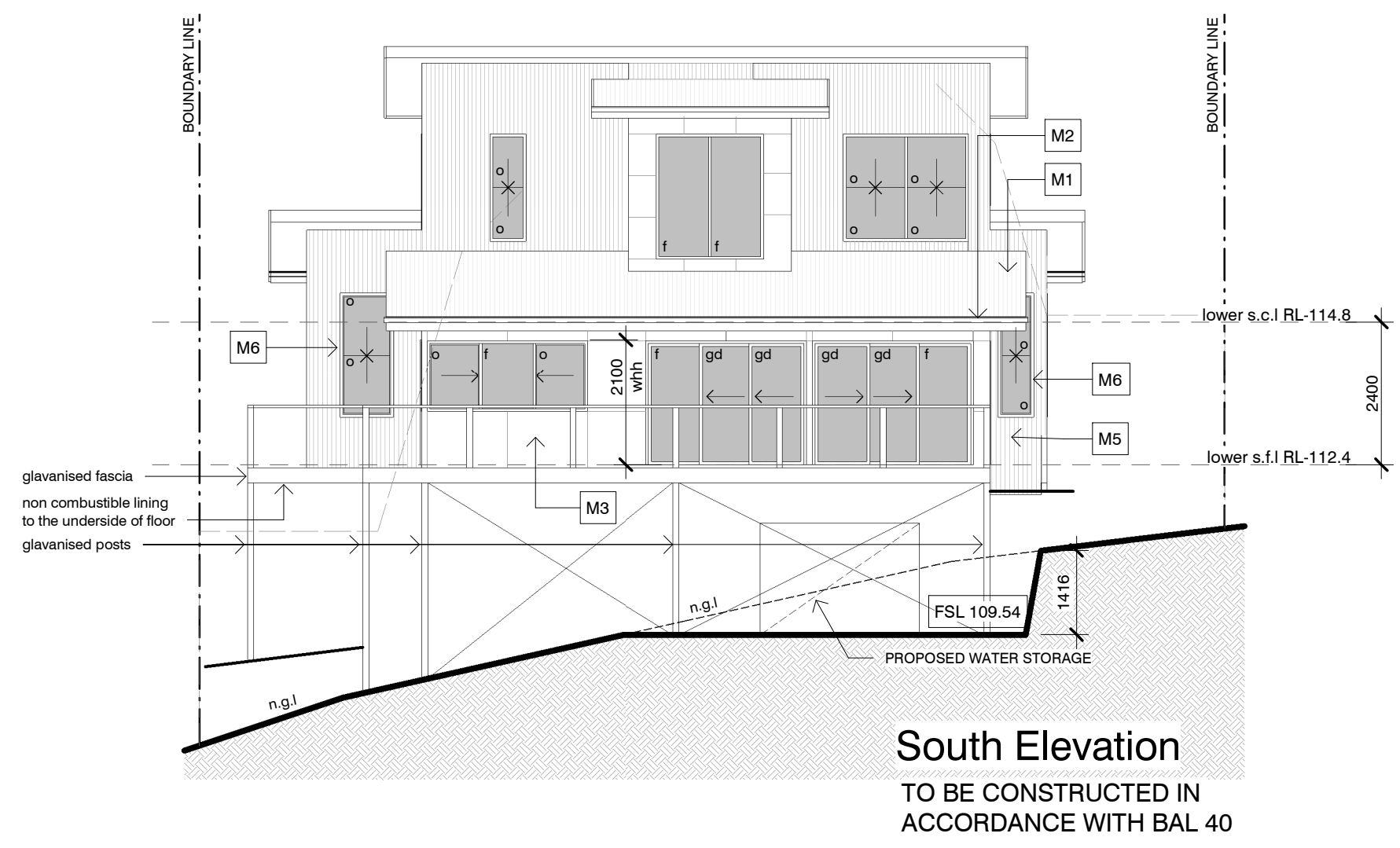
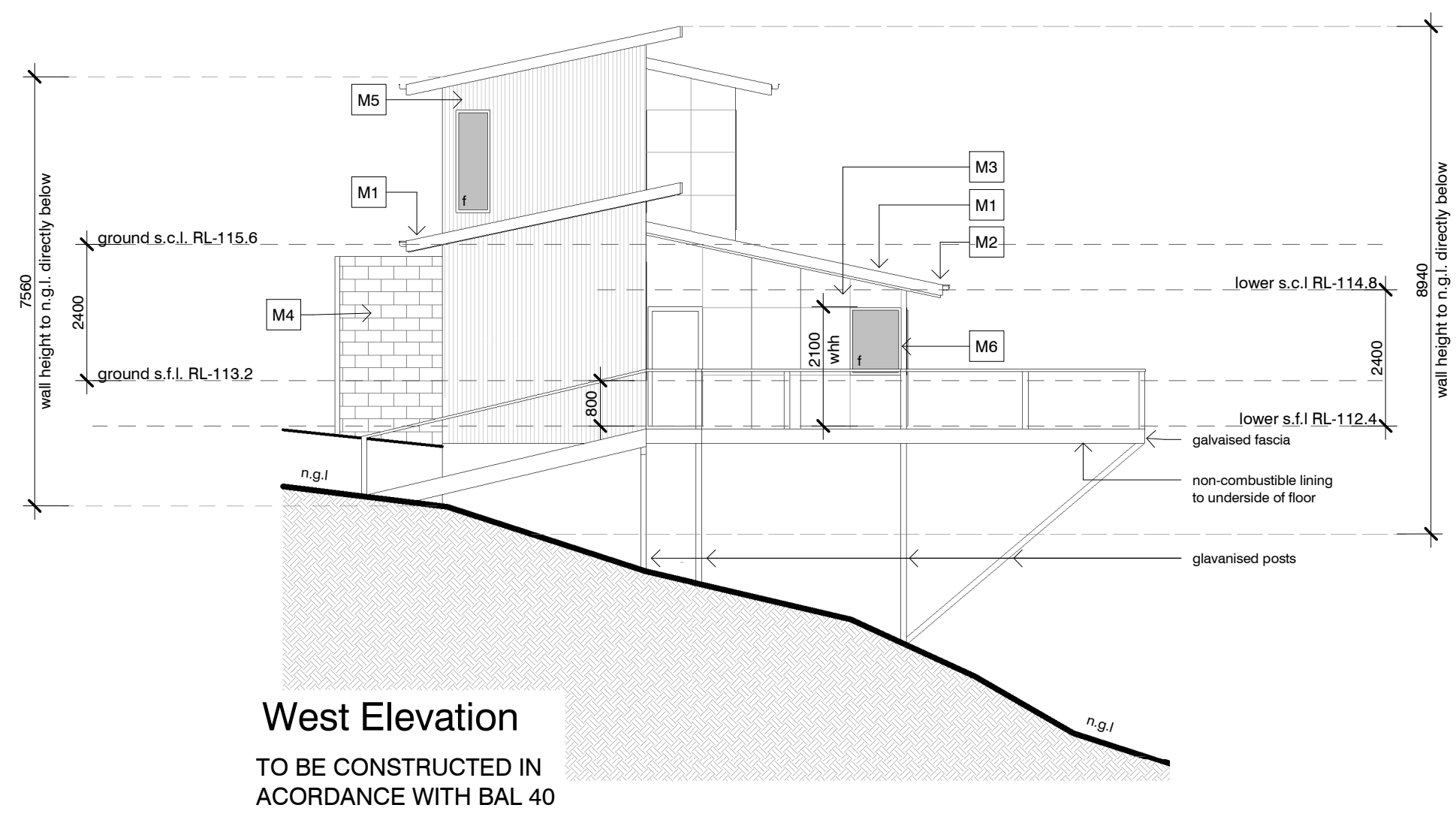
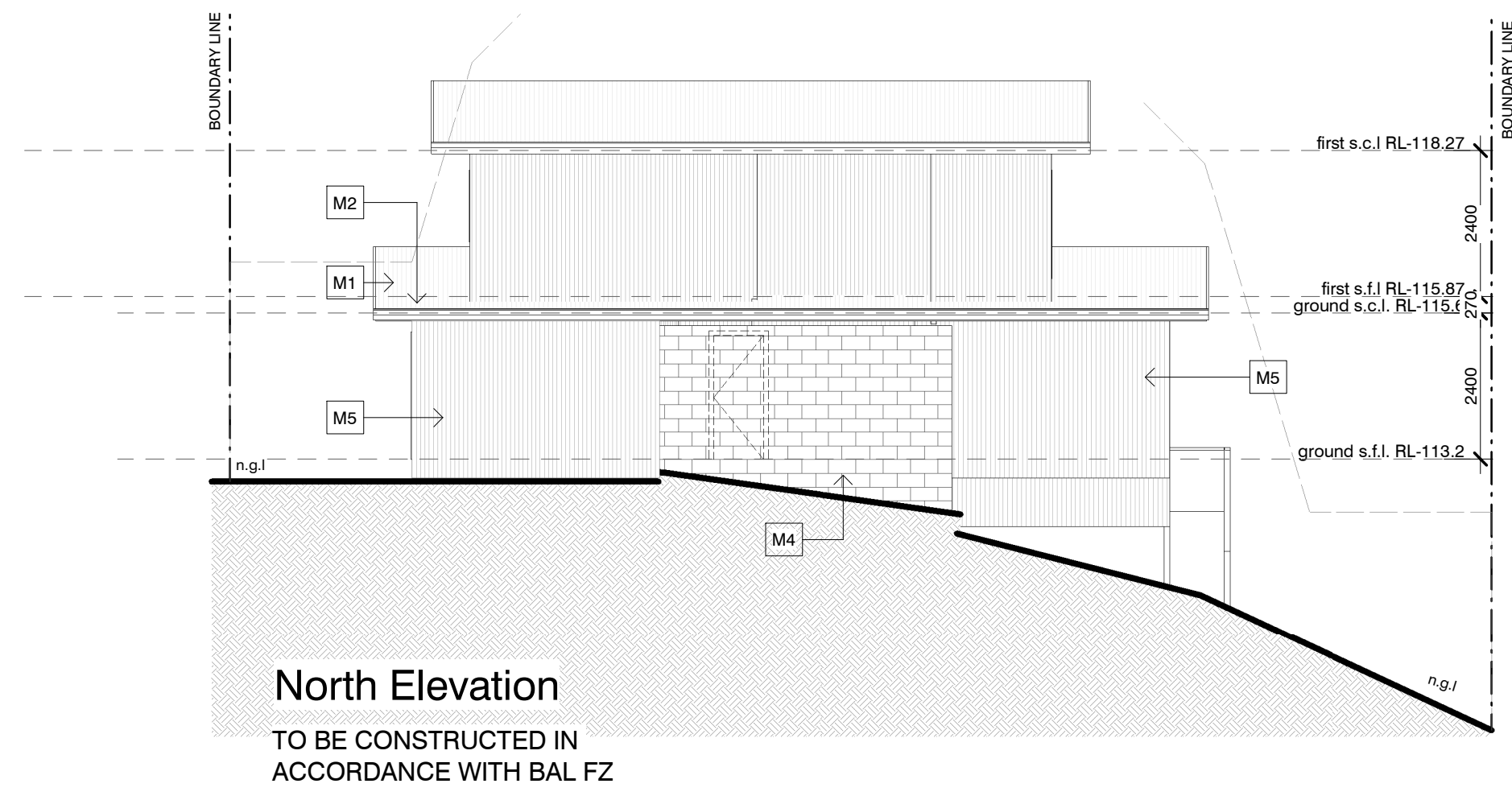
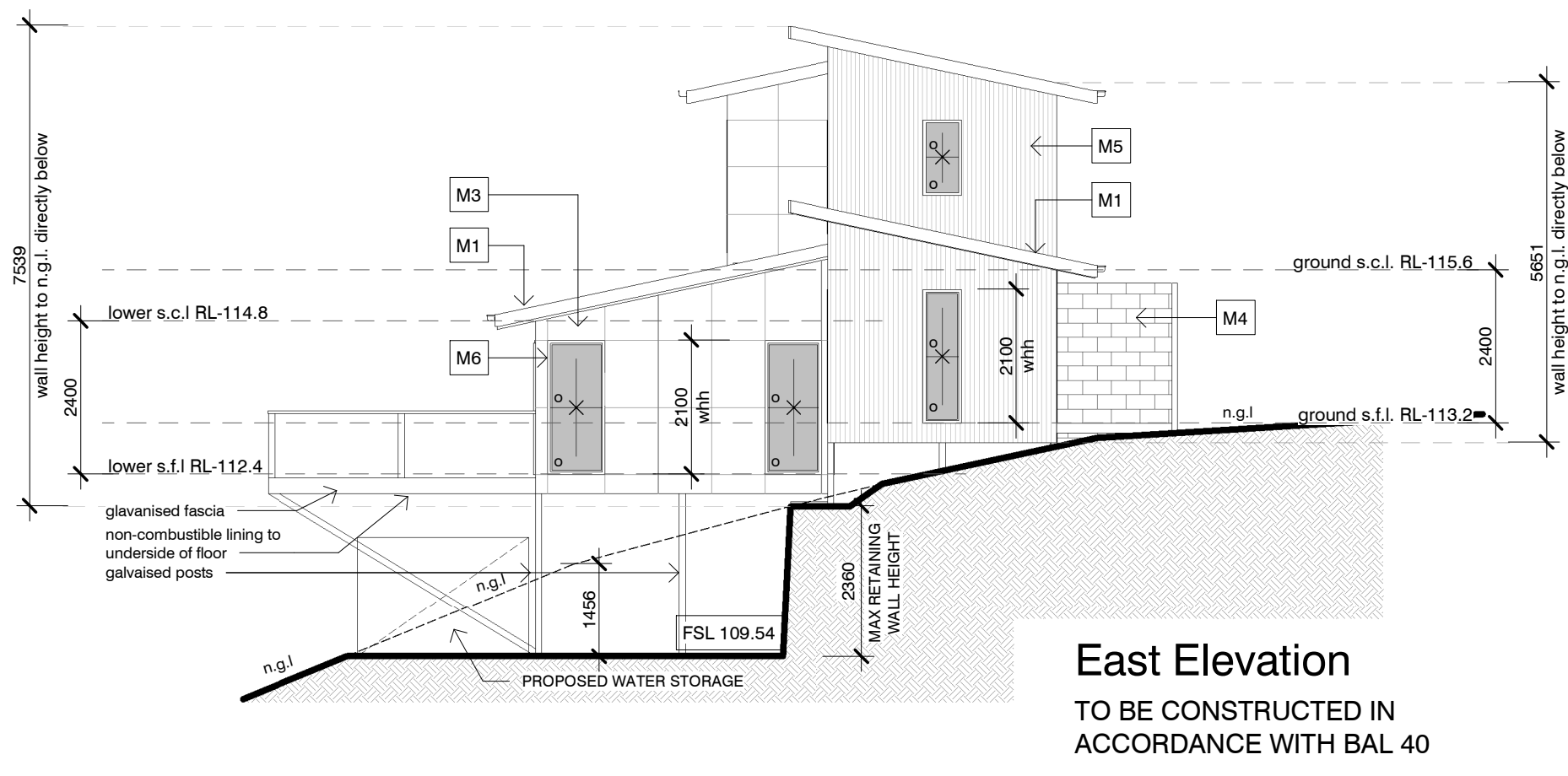
porch floor level:	r.l. 113.15
ground floor level:	r.l. 113.20
lower floor level:	r.l. 112.80
decking level:	r.l. 112.75
CUT to finished surface level below:	r.l. 109.54

proposed dwelling  
15 Karingal Drive, Wye River  
town planning  
B. Pursehouse

**NOT FOR CONSTRUCTION PURPOSES**







- legend:**
- sfl - structural floor level
  - scl - structural ceiling level
  - fl - finished floor level
  - cl - finished ceiling level
  - ngl - natural ground level
  - f - fixed window
  - o - operable window
  - ob - obscured window
  - ag - ag drain to base of site cut
  - gd - glass door
  - sc - solid core door
  - whh - window head height
  - RO - restricted openings: 125mm opening (where below 1.7m above f.f.) all windows to comply with AS 3959
- materials schedule:**
- M1 proposed zincalume roof @ 12° pitch over sarking and insulation blanket
  - M2 proposed zincalume guttering & fascia
  - M3 proposed FC sheet - dark grey
  - M4 proposed stone/ tile - grey beige
  - M5 proposed colorbond cladding - light brown/ beige
  - M6 proposed aluminium windows

**NOT FOR CONSTRUCTION PURPOSES**

**idc**  
IMPACT DESIGN CONSULTANTS

proposed dwelling  
15 Karingal Drive, Wye River  
town planning  
B. Pursehouse

Rev G: Add First Floor 25.01.19  
Rev F: TP F1 07.05.18 Council Change  
Rev E: TP F1 04.05.18 Council Change  
Rev D: TP F1 02.05.18 Council Change  
revision: Rev C: TP F1 17.04.18 Bath Layout Change  
revision: Rev B: TP F1 21.03.18

scale: 1:100  
date: 14/10/2017  
drawn by: dp  
job no.: 17-0001  
revision: Rev B: TP F1 21.03.18

© COPYRIGHT 2017 idc