PP156/2017-1

36 & 38 Riverside Drive WYE RIVER, 38 Riverside Drive WYE RIVER

Lot: 49 LP: 27735 V/F: 8704/706, Lot: 50 LP: 27735 V/F: 8704/705

Construction of a dwelling and associated works

M A BELLEMO

Officer - Bernadette McGovan

EXHIBITION FILE

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

Colac Otway

Office Use Only			Fee:	$
Application No.:			Receipt No.:	
Date Lodged:	/	/	Ward:	
Date Allocated:	/	/	Zone(s):	
Allocated to:			Overlay(s):	

Planning Enquiries
Phone: (03) 5232 9412
Web: www.colacotway.vic.gov.au

Application for **Planning Permit**

Use this form to make an application for a planning permit and to provide the information required by section 47 of the *Planning and Environment Act 1987* and regulations 15 and 38 of the Planning and Environment Regulations 2005.

Supplementary information requested in this form should be provided as an attachment to your application. ■ Please print clearly or complete the form electronically (refer to How to complete the Application for Planning Permit form).

Privacy notice

⚠ Information collected with this application will only be used to consider and determine the application. It will be made available for public inspection in accordance with section 51 of the *Planning and Environment Act 1987*.

Need help with the application?

If you need help to complete this form, read *How to complete the Application for Planning Permit form*. For more information about the planning process, refer to *Planning: a Short Guide*. These documents are available from your local council, the Planning Information Centre (Ph: 03 9637 8610, 8 Nicholson Street, Melbourne), or www.dse.vic.gov.au/planning.

Contact council to discuss the specific requirements for this application and obtain a planning permit checklist. Insufficient or unclear information may delay your application.

(1) Has there been a pre-application meeting with a council officer?

☑ Yes ☐ No

If yes, with whom?: Stewart Caldwell, Matthew White, Angus Go Date: 13/04/2017

The land

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

Street Address

Street No.: 36 and 38 Street Name: Riverside Drive

Suburb/Locality: Wye River Postcode: 3234

Formal Land Description

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

Lot No.: 49 and lot N°50 OR on Lodged Plan, Title Plan or Subdivision Plan No.: LP27735 plan of subdivision plan of Subdivision 027735

Crown Allotment No.: Section No.: Parish Name:

(3) Title information.

☑ ■ Attach a full, current copy of title information for each individual parcel of land, forming the subject site.

(4) Describe how the land is used and developed now.

eg. single dwelling, three dwellings, shop, factory, medical centre with two practitioners, licensed restaurant with 80 seats

Vacant. Previous single dwelling destroyed by bushfire.

(5) Plan of the land.

☑ ■ Attach a plan of the existing conditions. Photos are also helpful.

The proposal

⚠ You must give full details of your proposal and attach the information required to assess the application.

If you do not give enough detail or an adequate description of the proposal you will be asked for more information. This will delay your application.

(6) For what use, development or other matter do you require a permit?

Read *How to complete the Application for Planning Permit form* if you need help in describing your proposal.

New two-bedroom dwelling to replace previous dwelling destroyed by bushfire.

(7) Additional information about the proposal.

Contact council or refer to council planning permit checklists for more information about council's requirements.

■ Attach additional information providing details of the proposal, including:

- [x] Any information required by the planning scheme, requested by council or outlined in a council planning permit checklist.
- [x] Plans showing the layout and details of the proposal.
- [x] If required, a description of the likely effect of the proposal (eg. traffic, noise, environmental impacts).

(8) Encumbrances on title.

Encumbrances are identified on the certificate of title.

Is the land affected by an encumbrance such as a restrictive covenant, section 173 agreement or other obligation on title such as an easement or building envelope?

- [ ] No, go to 9.
- [x] Yes. ■ Attach a copy of the document (instrument) specifying the details of the encumbrance.

Does the proposal breach, in any way, the encumbrance on title?

- [x] No, go to 9.
- [ ] Yes, contact council for advice on how to proceed before continuing with this application.

⚠ Note

Council must not grant a permit that authorises anything that would result in a breach of a registered restrictive covenant (sections 61(4) and 62 of the *Planning and Environment Act 1987*).

Contact council and/or an appropriately qualified person for advice.

Costs of buildings and works/permit fee

Most applications require a fee to be paid. Where development is proposed, the value of the development affects the fee. Contact council to determine the appropriate fee.

(9) Estimated cost of development for which the permit is required.

Cost $ 700,000.00 ⚠ You may be required to verify this estimate.

Write 'NIL' if no development is proposed (eg. change of use, subdivision, removal of covenant, liquor licence)

(10) Do you require a receipt for the permit fee?

- [x] Yes
- [ ] No

Contact, applicant and owner details

(11) Provide details of the contact, applicant and owner of the land.

Contact

The person you want Council to communicate with about the application.

Name: Michael Bellemo

Organisation (if applicable): Bellemo & Cat

Postal address: 176 High Street

Northcote Postcode: 3070

Contact phone: 0394895812 ✔

Mobile phone: 0404053177 ✔

Email: bellemocat@bigpond.com ✔

Fax: ☐

Indicate preferred contact method

Applicant

The person or organisation who wants the permit.

✔ Same as contact. If not, complete details below.

Name:

Organisation (if applicable):

Postal address:

Postcode:

Owner

The person or organisation who owns the land.

☐ Same as contact ☐ Same as applicant

Where the owner is different from the applicant or contact, provide the name of the person or organisation who owns the land.

Name (if applicable): Damon Eisen

Organisation (if applicable): Alcyon Ceyx Pty Ltd

Postal address:

Postcode:

Checklist

(12) Have you?

✔ Filled in the form completely?

✔ Paid or included the application fee?

✔ Attached all necessary supporting information and documents?

✔ Completed the relevant council planning permit checklist?

✔ Signed the declaration on the next page?

Declaration

(13) This form must be signed. Complete one of A, B or C

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

A Owner/Applicant

I declare that I am the applicant and owner of the land and all the information in this application is true and correct.

Signature

Date: / /

B Owner

I declare that I am the owner of the land and I have seen this application.

Signature

Date: / /

Applicant

I declare that I am the applicant and all of the information in this application is true and correct.

Signature

Date: / /

C Applicant

I declare that I am the applicant and:

- I have notified the owner about this application;
- and all the information in this application is true and correct.

Signature

Date: 21 / 06 / 2017

Lodgement

Lodge the completed and signed form and all documents with:

Colac-Otway Shire
PO Box 283, COLAC VIC 3250
2-6 Rae Street, COLAC VIC 3250
Telephone: (03) 5232 9412
Fax: (03) 5232 1046
Email: inq@colacotway.vic.gov.au
TTY: (03) 5231 6787

For help or more information

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

VOLUME 08704 FOLIO 705 Security no : 124075740242D
Produced 16/01/2019 05:27 PM

LAND DESCRIPTION

Lot 50 on Plan of Subdivision 027735.
PARENT TITLE Volume 08461 Folio 958
Created by instrument C953758 05/12/1967

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
ALCYON CEYX PTY LTD of 25 CANNING STREET NORTH MELBOURNE VIC 3051
AJ449914V 25/01/2012

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 TP456231X 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: 38 RIVERSIDE DRIVE WYE RIVER VIC 3234

DOCUMENT END

Imaged Document Cover Sheet

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

Document Type	**Plan**
Document Identification	**TP456231X**
Number of Pages (excluding this cover sheet)	**2**
Document Assembled	**16/01/2019 18:48**

TITLE PLAN		EDITION 1	TP 456231X

Location of Land

Parish: KAANGLANG
Township:
Section:
Crown Allotment: 29D (PT)
Crown Portion:

Last Plan Reference: LP 27735
Derived From: VOL 8704 FOL 705
Depth Limitation: 50 FEET

Notations

ANY REFERENCE TO MAP IN THE TEXT MEANS THE DIAGRAM SHOWN ON THIS TITLE PLAN

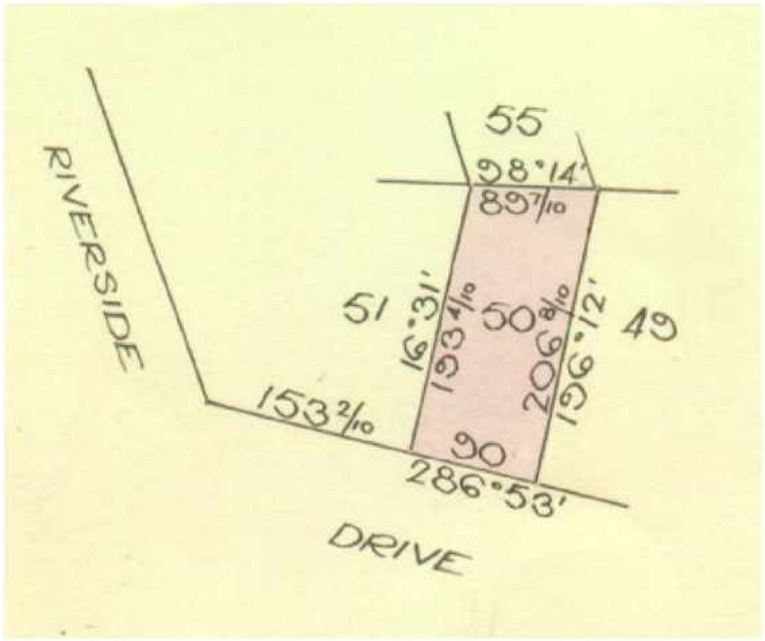
Description of Land / Easement Information

AN EASEMENT OF CARRIAGEWAY APPURTENANT TO THE WITHIN LAND CREATED BY INSTRUMENTS S393458E AND S393460B

E-1 = CARRIAGEWAY EASEMENT CREATED BY C/E S393463R

THIS PLAN HAS BEEN PREPARED FOR THE LAND REGISTRY, LAND VICTORIA, FOR TITLE DIAGRAM PURPOSES AS PART OF THE LAND TITLES AUTOMATION PROJECT
COMPILED: 08/08/2002
VERIFIED: DA

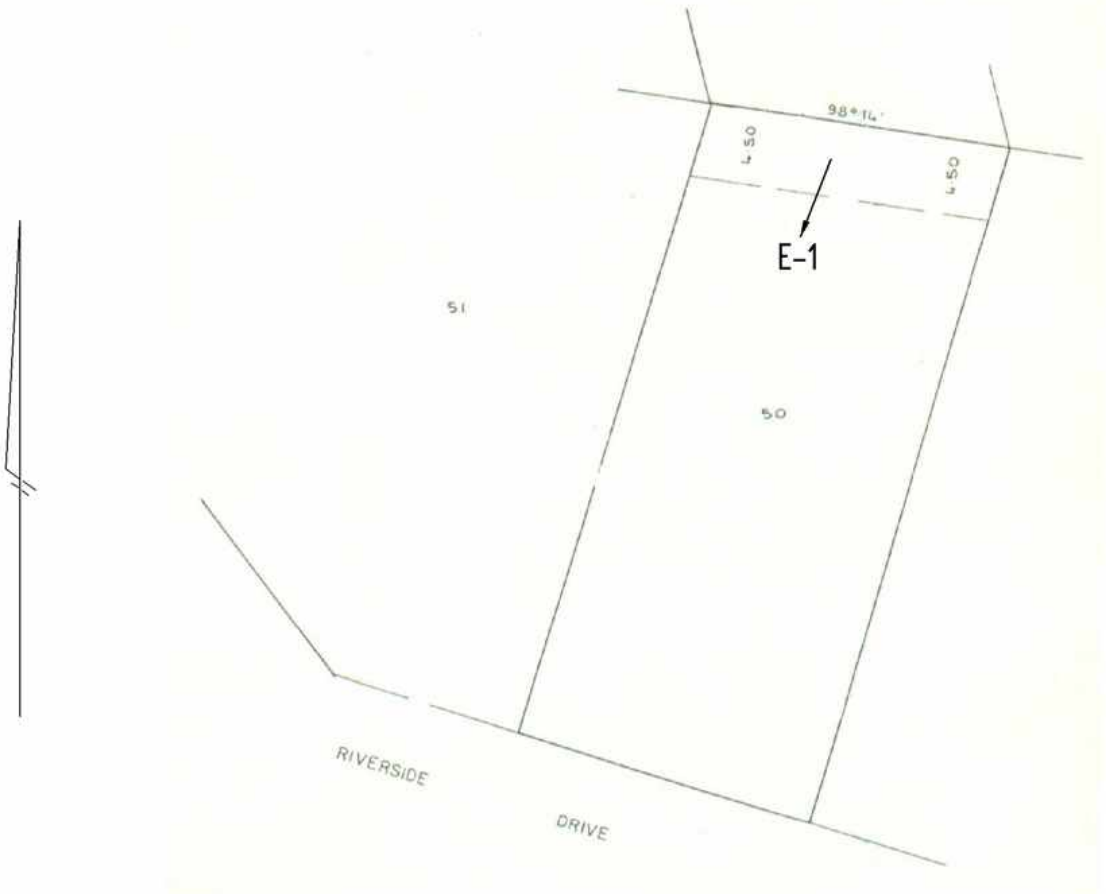
SEE SHEET 2 FOR FURTHER EASEMENT DETAILS



LENGTHS ARE IN LINKS	Metres = 0.3048 x Feet Metres = 0.201168 x Links		Sheet 1 of 2 sheets

TITLE PLAN

TP 456231X



LENGTHS ARE IN METRES	Metres = 0.3048 x Feet Metres = 0.201168 x Links		Sheet 2 of 2 sheets

36 RIVERSIDE DRIVE, WYE RIVER

DRAWING SCHEDULE

DRAWING #	DRAWING NAME	SCALE	REVISION	REV DATE
TP00	DRAWING SCHEDULE	-	-	-
TP01	EXISITNG SITE PLAN	1 : 200	-	-
TP02A	PROPOSED SITE PLAN (OPTION 1)	1 : 200	-	-
TP02B	PROPOSED SITE PLAN (OPTION 2)	1 : 200		
TP03	PROPOSED FLOOR PLAN	1 : 100	-	-
TP04	PROPOSED NORTH AND EAST ELEVATIONS	1 : 100	-	-
TP05	PROPOSED SOUTH AND WEST ELEVATIONS	1 : 100	-	-
TP06	PROPOSED SECTIONS A/A AND B/B	1 : 100	-	-

#	DATE	REVISION

GENERAL NOTES

Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36 RIVERSIDE DRIVE
WYE RIVER

DRAWING
DRAWING SCHEDULE

PROJECT #	DRAWN
SCALE -	DRAWING # A00
DATE DEC 2018	

CARRIAGEWAY EASEMENT

5.24

4.55

(18.04)
(278°14')

55

PEG

TOP OF BANK

(98°14')
(18.06 TO CLOSE)
(18.04 TITLE)

PEG

55

(98°14')
(18.06 TO CLOSE)
(18.04 TITLE)

PEG

50

4.5m WIDE CARRIAGEWAY EASEMENT

GRAVEL DRIVEWAY

EXISTING HOUSE

BALCONY

50

OUTLINE SHOWS LOCATION OF PREVIOUS HOUSE PRIOR TO FIRE

STL. POSTS

45

(16°31')
(38.91)

TOE OF BANK

LINE NL. IN DUMPY PEG

(16°12')
(41.62 TO CLOSE)
(41.60 TITLE)

TOP OF BANK

RET. WALL

45

UPDATED BAL SEPT 2016

LINE NL. IN DUMPY PEG

BAL-40
BAL-FZ

40

(41.34 TO CLOSE)
(44.32 TITLE)
(195°55')

No. 40
LOT 51
LP 27735

No. 38
LOT 50
LP 27735
724m²
(VACANT)

UPDATED BAL SEPT 2016

BAL-40
BAL-FZ

No. 36
LOT 49
LP 27735
774m²
(VACANT)

UPDATED BAL SEPT 2016

No. 34
LOT 48
LP 27735
(VACANT)

35

30

32.18

NOT MARKED

(18.11)
(286°53')

TOE OF

NOT MARKED

25.39

(18.11)
(286°53')

BANK

PEG

GRAVEL

ROAD

25

20

RIVERSIDE DRIVE

Exisitng Site Plan

scale 1 : 200

#	DATE	REVISION

GENERAL NOTES

LEGEND

Bellemo & Cat
176 High Street Northcote
ph 96700039 fx 96700097 mb 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
EXISTING SITE PLAN

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP01
DATE DEC 2018	

(278°14') 55 PEG (98°14') (18.06 TO CLOSE) (18.04 TITLE) TOP OF BANK PEG 55 PEG

4.55

4.5m WIDE CARRIAGEWAY EASEMENT

GRAVEL DRIVEWAY

FORMED CONCRETE RETAINING WALL

3920

ENGINEERED RETAINING WALL
GALVANISED STEEL UPRIGHTS WITH CONCRETE SLEEPERS

2610

DP UP DP BOX GUTTER

7160

FIRE FIGHTING WATER SUPPLY OUTLET connected to water tank with minimum 10000L reserved for firefighting. Pipework and fittings with a minimum of 65mm (excluding the CFA coupling) to achieve 20 lts/sec at the CFA pump

ROOF TERRACE PEBBLED SURFACE

FALL

COLORBOND ROOF COLOUR: TERRAIN

5400

EXISTING RETAINING WALL

EXISTING HOUSE

CARPARKING X 2 RL 51.00

4710

50

5925

CONCRETE RETAINING WALL

965

6005

10190

2830

BOX GUTTER

FALL

COLORBOND ROOF COLOUR: TERRAIN

MODWOOD DECK (WATER TANK AND STORAGE BELOW)

7860

45

BALCONY

(16°31') (38.91)

1500

4590 TOE OF BANK

16910

BANK

RET. WALL

TOP OF

45

UPDATED BAL SEPT 2016

TERRACED ETA BEDS (OPTION 1) (62m2)

CONCRETE RETAINING WALLS

BAL-40
BAL-FZ

40

No. 40
LOT 51
LP 27735

UPDATED BAL SEPT 2016

No. 38
LOT 50
LP 27735
724m²

BAL-40
BAL-FZ

(41°34') (44.32 TO CLOSE) (195°55') (41.34 TITLE)

No. 34
LOT 48
LP 27735
(VACANT)

35

No. 36
LOT 49
LP 27735
774m²

UPDATED BAL SEPT 2016

30

NOT MARKED

0

(18.11)
(286°53')

TOE

NOT MARKED

Engineer-designed geofabric installation as required at lower boundary

25.39

OF

GRAVEL

25

(18.11)
(286°53')

BANK

PEG

RIVERSIDE DRIVE

ROAD

20

SITE DEVELOPMENT SUMMARY

TOTAL SITE AREA = 1498m² (LOT 49 - 774m², LOT 50 - 724m²)

SITE COVERAGE HOUSE= 130m²	8.7%
OUTDOOR PERVIOUS AREA = 719 m²	98.7%
OUTDOOR NON PERVIOUS AREA = 20m²	1.3%
DECK/TERRACE = 88.2 m²	5.9 %

NOTE: SITE COVERAGE CALCULATIONS ARE BASED ON TOTAL SITE AREA OF LOTS 49 AND 50 COMBINED.

Proposed Site Plan

scale 1 : 200

WITH TERRACED (OPTION 1)

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SITE PLAN
OPTION 1

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP02A
DATE DEC 2018	

4.5m WIDE CARRIAGEWAY EASEMENT

EXISTING HOUSE

BALCONY

GRAVEL DRIVEWAY

FIRE FIGHTING WATER SUPPLY OUTLET connected to water tank with minimum 10000L reserved for firefighting. Pipework and fittings with a minimum of 65mm (excluding the CFA coupling) to achieve 20 lts/sec at the CFA pump

CARPARKING X 2
RL 51.00

CONCRETE RETAINING WALL

FORMED CONCRETE RETAINING WALL

ENGINEERED RETAINING WALL
GALVANISED STEEL UPRIGHTS WITH CONCRETE SLEEPERS

ROOF TERRACE
PEBBLED SURFACE

BOX GUTTER

FALL

COLORBOND ROOF COLOUR: TERRAIN

EXISTING RETAINING WALL

MODWOOD DECK (WATER TANK AND STORAGE BELOW)

CONCRETE RETAINING WALLS

TERRACED RHIZAPODS REED BEDS (OPTION 2) (4 x PODS + BALANCE TANK)

RET. WALL

UPDATED BAL SEPT 2016

BAL-40
BAL-FZ

No. 40
LOT 51
LP 27735

No. 38
LOT 50
LP 27735
724m²

No. 36
LOT 49
LP 27735
774m²

No. 34
LOT 48
LP 27735
(VACANT)

NOT MARKED

Engineer-designed geofabric installation as required at lower boundary

RIVERSIDE DRIVE

ROAD

GRAVEL

TOE

TOP

BANK

PEG

OF

(278°14')
(98°14')
(18.06 TO CLOSE)
(18.04 TITLE)
(16°31')
(38.91)
(18.11)
(286°53')
(195°55')
(44.32 TITLE)

SITE DEVELOPMENT SUMMARY

TOTAL SITE AREA = 1498m² (LOT 49 - 774m², LOT 50 - 724m²)

SITE COVERAGE HOUSE= 130m²	8.7%
OUTDOOR PERVIOUS AREA = 719 m²	98.7%
OUTDOOR NON PERVIOUS AREA = 20m²	1.3%
DECK/TERRACE = 88.2 m²	5.9 %

NOTE: SITE COVERAGE CALCULATIONS ARE BASED ON TOTAL SITE AREA OF LOTS 49 AND 50 COMBINED.

Proposed Site Plan

scale 1 : 200

WITH TERRACED (OPTION 2)

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

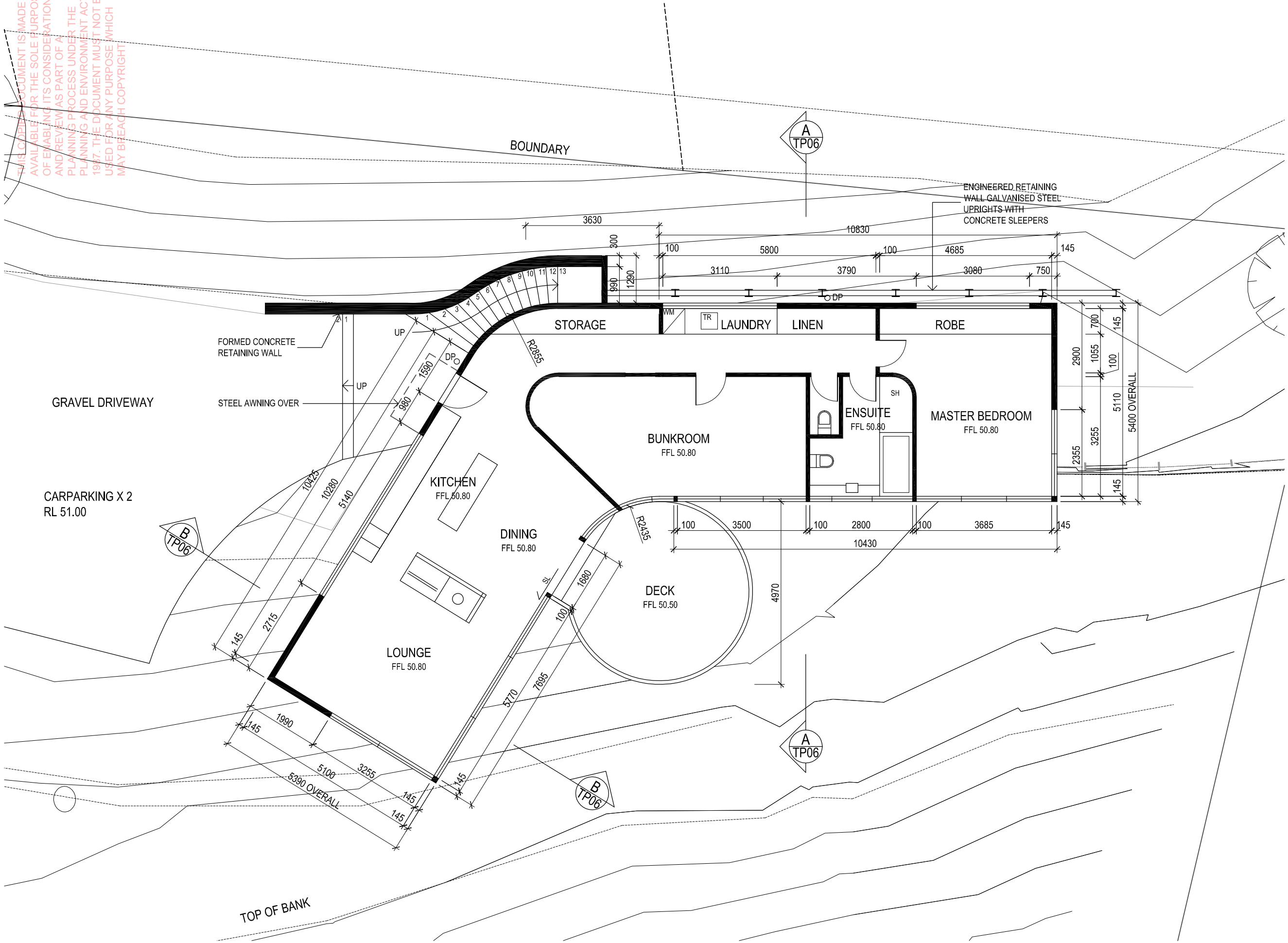
Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SITE PLAN
OPTION 2

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP02B
DATE DEC 2018	



Proposed Floor Plan

scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

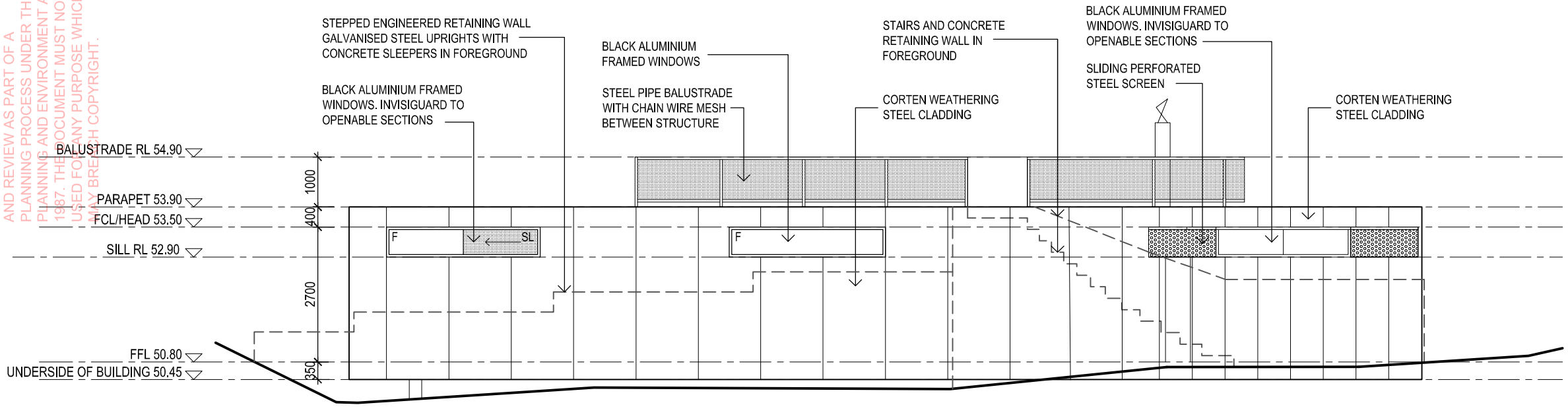
Bellemo & Cat
176 High Street Northcote
ph 96700039 fx 96700097 mb 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

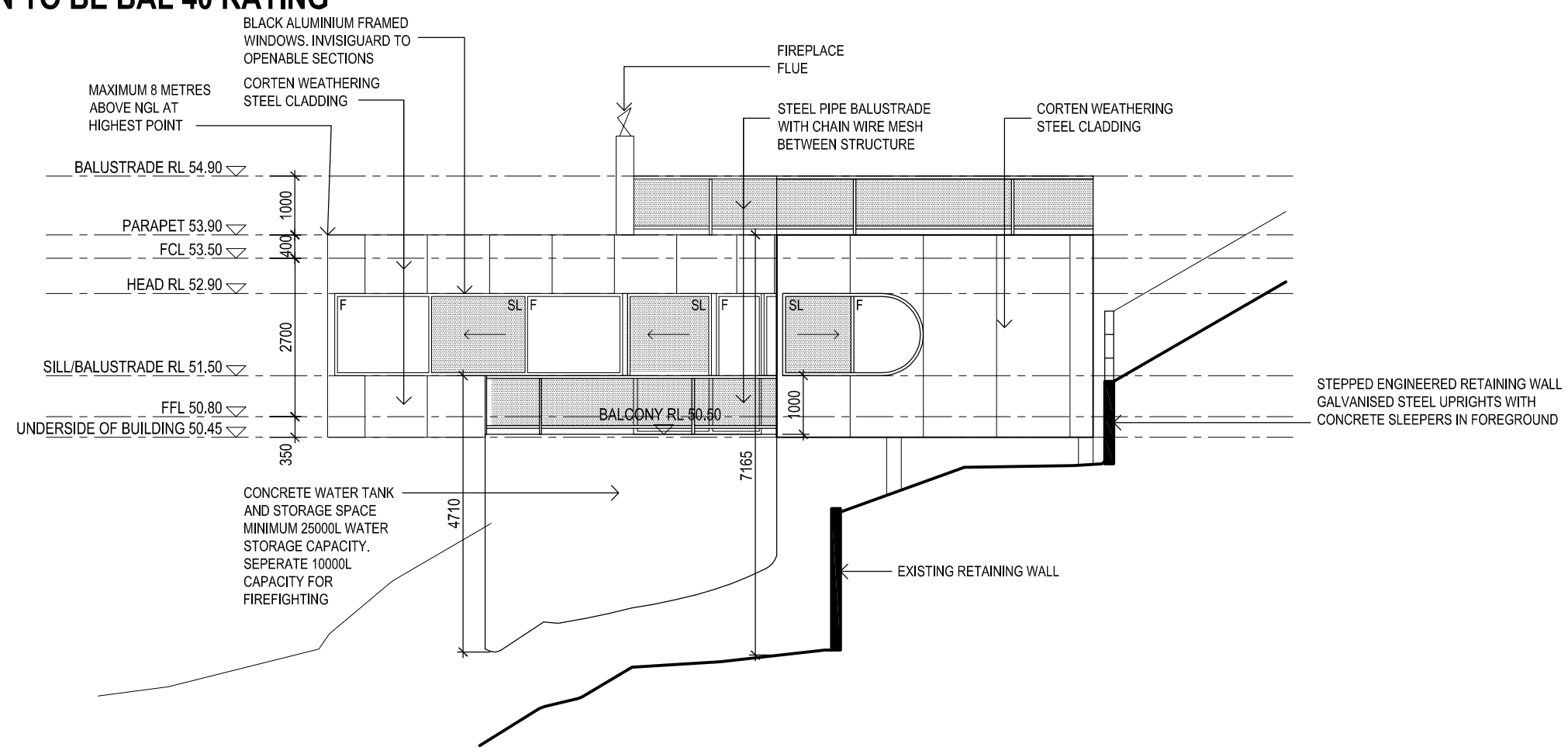
DRAWING
PROPOSED FLOOR PLAN
OPTION 1a

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP03
DATE DEC 2018	



NORTH ELEVATION
scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING



EAST ELEVATION
scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

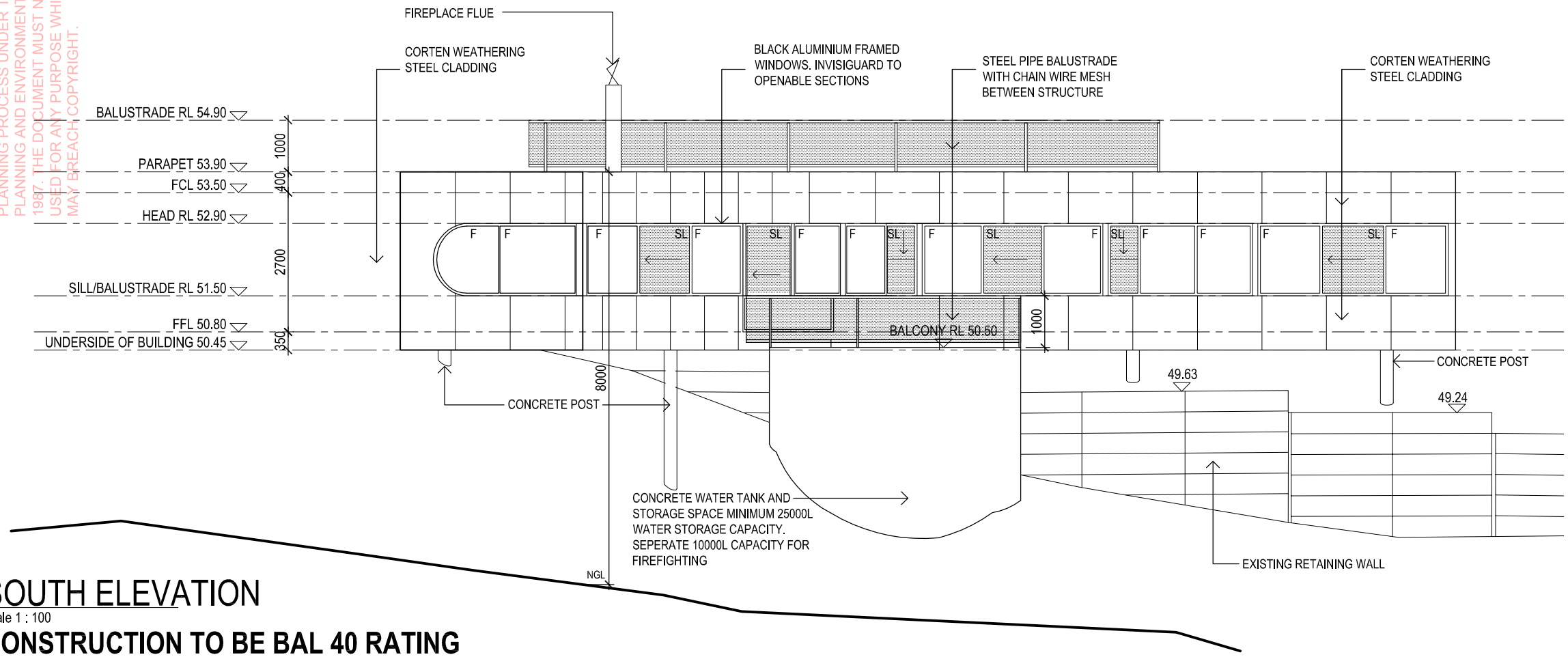
Bellemo & Cat
176 High Street Northcote
ph 96700039 fx 96700097 mb 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED ELEVATIONS
NORTH & EAST

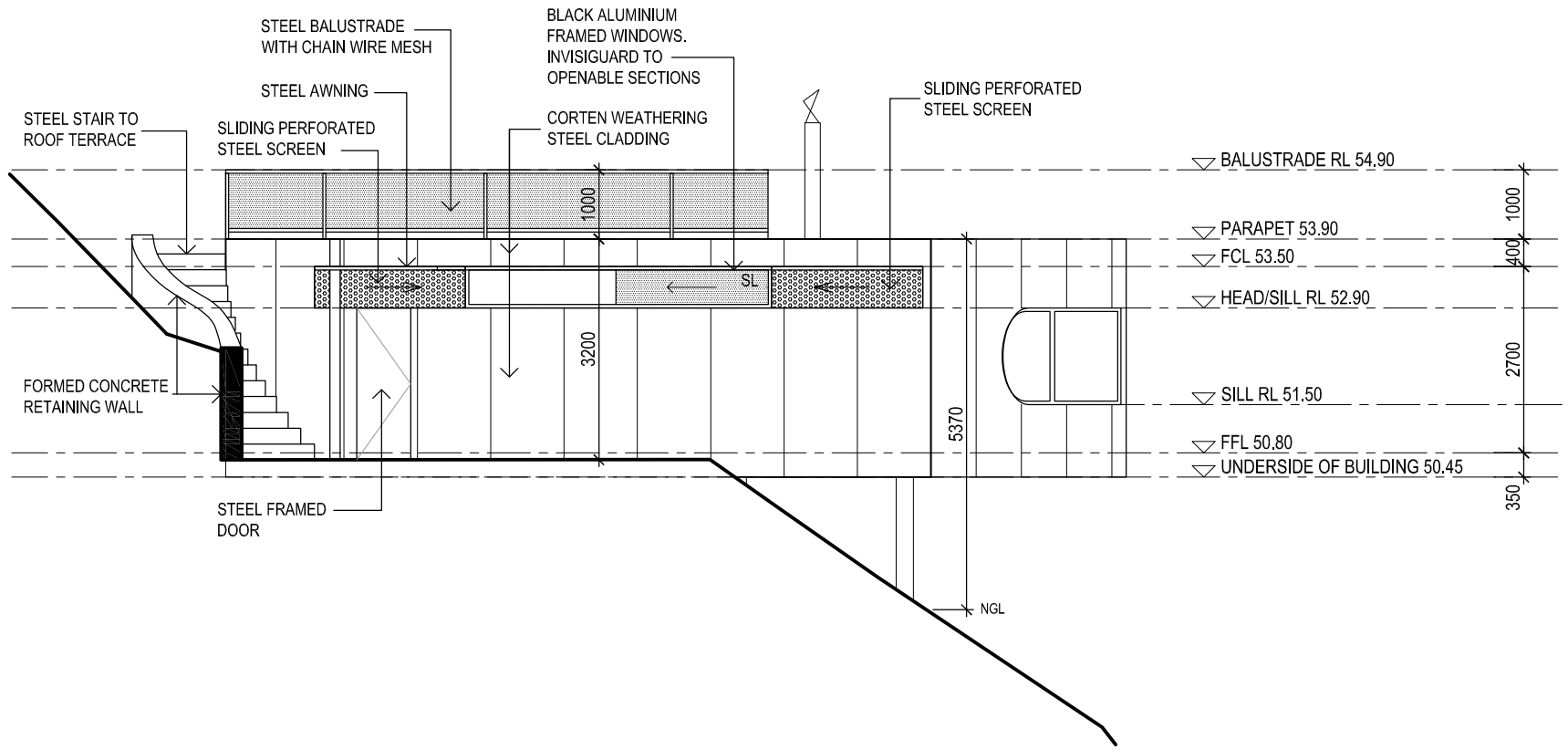
PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP04
DATE DEC 2018	



SOUTH ELEVATION

scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING



WEST ELEVATION

scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

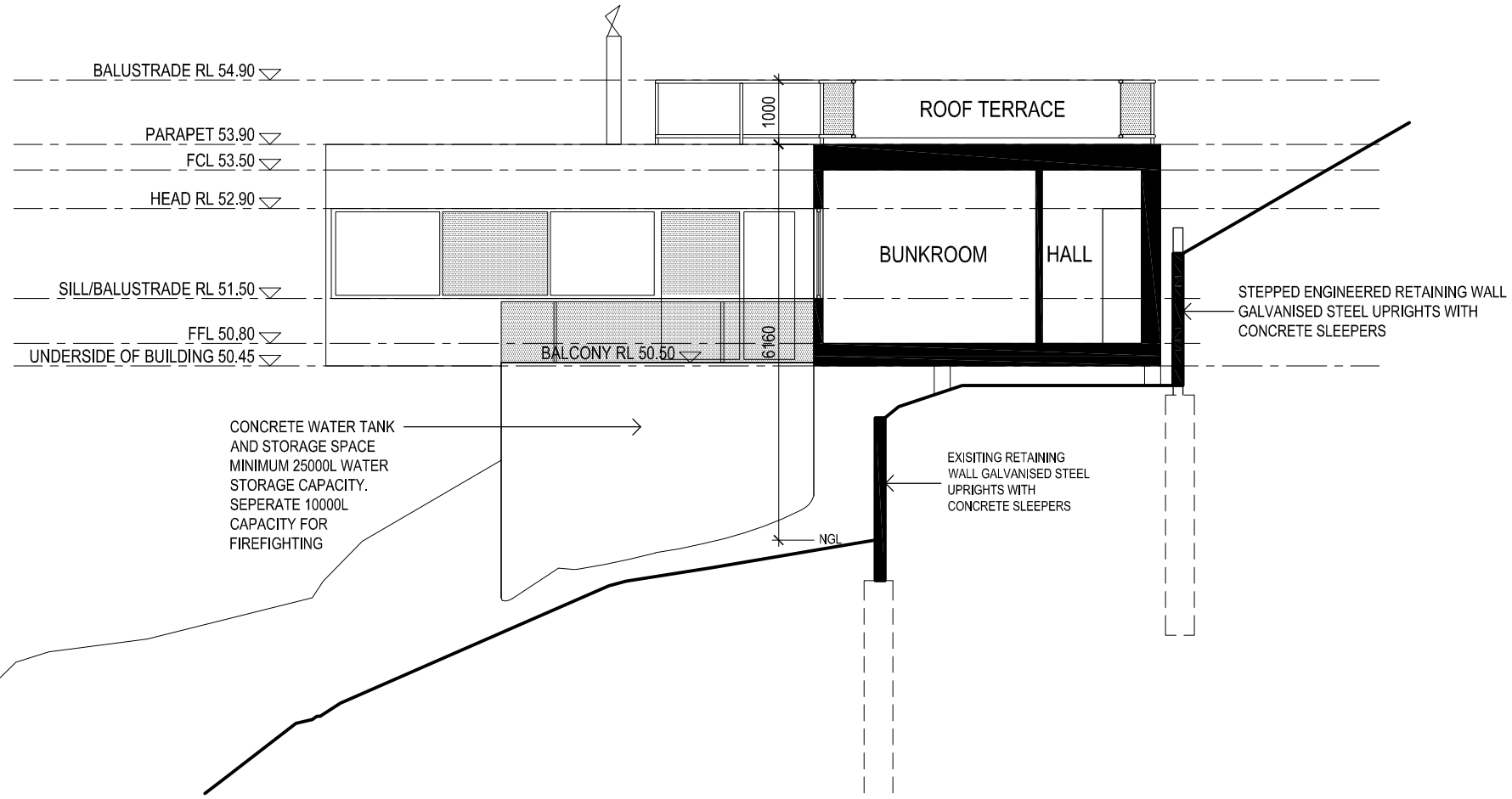
Bellemo & Cat
176 High Street Northcote
ph 96700039 fx 96700097 mb 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

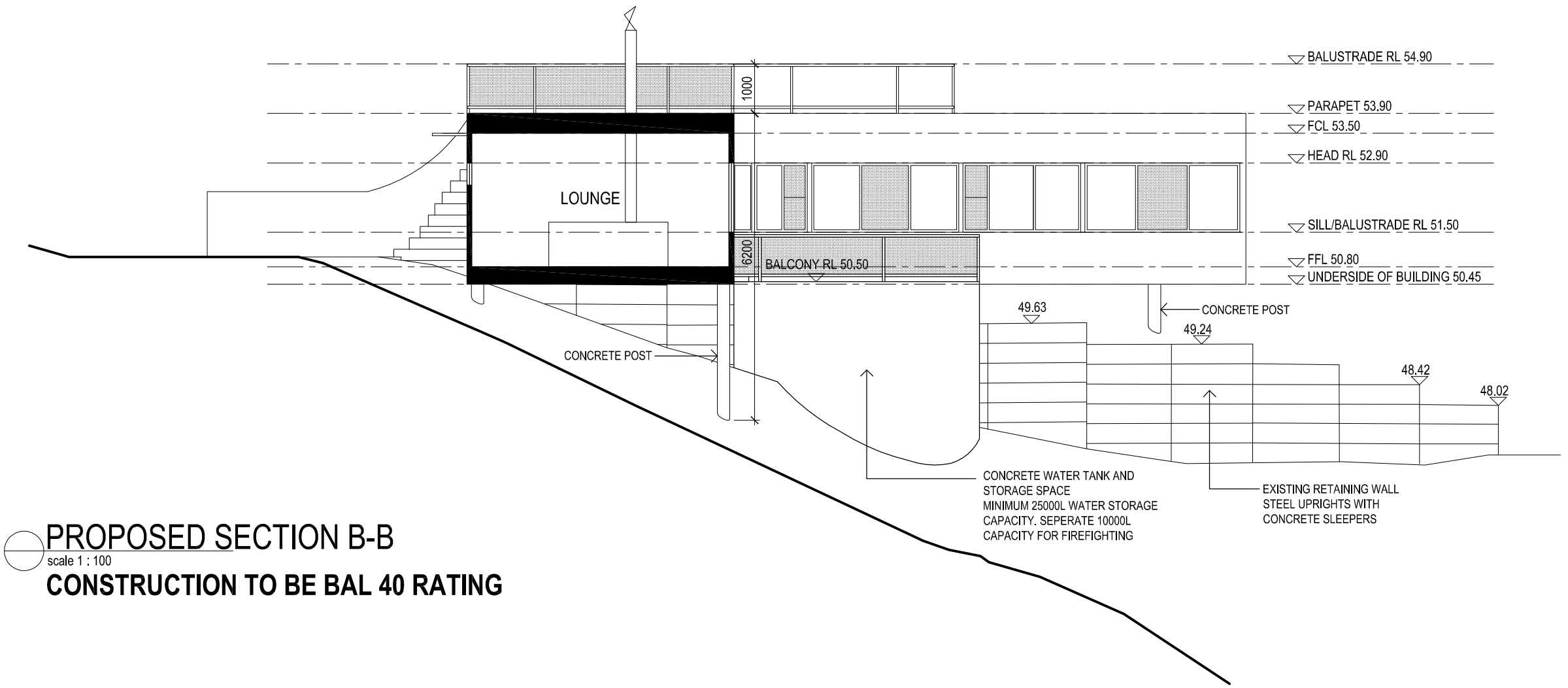
DRAWING
PROPOSED ELEVATIONS
SOUTH & WEST

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP05
DATE DEC 2018	



PROPOSED SECTION A-A
scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING



PROPOSED SECTION B-B
scale 1 : 100

CONSTRUCTION TO BE BAL 40 RATING

#	DATE	REVISION

GENERAL NOTES

LEGEND

Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SECTIONS

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP06
DATE DEC 2018	

Bellemo & Cat
176 High St Northcote 3070
p 03 94895812 **f**0394895735 **m** 0408 053177
ebellemocat@bigpond.com.au**w** www.bellemocat.com

19th December 2018

Bernadette McGovan,
Statutory Planner
Colac Otway Shire
PO Box 283,
Colac 3250

RE: REVISED PROPOSAL
APPLICATION NUMBER; PP156/2017
PROPERTY: 36 and 38 RIVERSIDE DRIVE, WYE RIVER VIC 3234

Dear Bernadette,

Please find attached the revised proposal for the above address.

The Proposal house has been redesigned and positioned so that previous risks identified have been reduced to "Tolerable".

In short this has been achieved by positioning the house over the 2 blocks (36 and 38) and thus further away from the east boundary of 36. In addition deep boring has taken place and the findings have been favourable with the presence of High strength rock beneath 7 metres. The extra land has also meant that the effluent field can be contained entirely on lot 38.

The revised proposal is a result of lengthy consultation with council, consultants and neighbours. It is understood that if supported a permit condition would require consolidation of the 2 blocks.

Enclosed are;

1 Amended Drawings TP00 thru to TP06

2 Revised LRA

3 Revised LCA

4 Revised Clause 54/NCO1including justification for rear boundary setback.

5 A statement on how the proposal responds to bushfire requirements.

Bellemo & Cat
176 High St Northcote 3070
p 03 94895812 **f**0394895735 **m** 0408 053177
ebellemocat@bigpond.com.au**w** www.bellemocat.com

If you have any questions or require any further information, please do not hesitate to contact me directly on 0408 053 177

Yours Sincerely,

Michael Bellemo
Bellemo & Cat Architects

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TOWN PLANNING APPLICATION REPORT

RE: REVISED PROPOSAL
APPLICATION NUMBER; PP156/2017
PROPERTY: 36 and 38 RIVERSIDE DRIVE, WYE RIVER VIC 3234

RESPONSE TO BUSHFIRE REQUIREMENTS

The subject property is in a BAL40 zone .
see TP02

Regarding Fire fighting access and safety:

- There is a trafficable gravel driveway from riverside drive to the proposed site and house, The car parking area has been designed so that vehicles can enter and exit in a forwards motion.
- Fire Fighting Water Supply Outlet connected to water tank with minimum 10000L reserved for firefighting. Pipework and fittings with a minimum of 65mm(excluding the CFA coupling)to achieve 20 lts/sec at the CFA pump

Regarding Fireproofing of proposed dwelling;

The exterior materials have been selected and will be detailed appropriately to comply with BAL 40 rating.

- The dwelling shall be clad in Cor-ten steel sheets, The underneath of the building shall also be clad in Cor ten steel sheets.
- The windows will be BAL 40 rated and Ember screens will be attached as per code to operable windows.
- Decking shall be Modwood ,an approved BAL40 material
- The roof will be trafficable in order to maintain gutters clear of leaf litter.
- Retaining walls proposed will be steel uprights and concrete sleepers.

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TOWN PLANNING APPLICATION REPORT

FOR: Building of a Single dwelling
ADDRESS: 36 and 38 Riverside Drive Wye River
DATE: 19 December 2018

This application is for the rebuilding of a single house on a lot that was destroyed in the bush fire inDecember 2015.
This proposal assumes the consolidation of the blocks at 36 and 38 Riverside Drive into one title so that the proposed dwelling sits well within the boundary of this newly consolidated title. Note the applicant owns both blocks.

ZONES AND OVERLAYS
32.05 TOWNSHIP ZONE
SCHEDULE TO CLAUSE 32.05 TOWNSHIP ZONE
42.03 SIGNIFICANT LANDSCAPE OVERLAY
43.02 DESIGN AND DEVELOMENT OVERALY
SCHEDULE TO THE DESIGN AND DEVELOPMENT OVERLAY
43.05 NEIGHBOURHOOD CHARACTER OVERLAY
44.06 BUSHFIRE MANAGEMENT OVERLAY

RESCODE ASSESSMENT

54.01 NEIGHBOURHOOD AND SITE DESCRIPTION

[See plans TP01 and TP02]

Neighbourhood

The neighbourhood has been significantly impacted by bushfire; previously the surrounding development was a mixture of single and double storey houses of lightweight construction.

Built form and scale

The houses were of varied scale with some smaller cottages mixed with larger holiday houses.

As the terrain is steep the built form is generally one of two types

- Single storey: The houses are on level ground at one point and suspended off the ground at the other end on tall posts with balconies high off the ground.
- Split level Double storey,the other response is to fill in the underneath of the house so that there is a two storey house at the downward slope and a one storey building at the higher end of the slope. so the mass is proportional to the slope of the terrain.

The houses are set into bush garden with a predominance of landscape over built form.

Character

The neighbourhood character of the Township of Wye River is of a relaxed coastal hamlet within the significant landscape of the Great Ocean Road region. The neighbourhood Character Overlay refers to the significance of the Landscape that ensures the dominance of vegetation over built form.

This section of Riverside Drive was seriously affected by the bushfires of December 2015 in which a lot of the vegetation and housing in the vicinity were burnt or subsequently removed. Therefore the current character is marred by fire but the previous character was of smaller houses nestled into tall bush on steeply sloping terrain.

Architectural style

The architectural style is contemporary with most houses built from light weight materials.

Roof styles

The roof styles are generally sloped or raked from one end to the other.

Fence style

There are no fences demarking property

54.01-2 Design response

This design responds to the conditions of the site and neighbourhood.

The sloped terrain and vegetation have determined the position and built form of this house.

In Accordance with Colac 54/NCO1 The proposed building is “nestled within the steep topography and the indigenous and native vegetation. The building sits below the tree canopy height, and there is sufficient space around it to accommodate substantial vegetation, as well as clearances required for wildfire management.”

54.02 NEIGHBOURHOOD CHARACTER

Response

The proposed design responds to the neighbourhood character of Wye River.
The house will be similar in form and massing to the predominate built form.
This is a house of modest size on one level and sits well below the canopy of the surrounding trees.
The Response of this proposal is to replace the house that was destroyed in fire with something of similar scale and type.
The built form is referential to the rather iconic building that was burnt in the fire, the gentle curved form allows for the building to settle into the site.
The orientation of the building allows north sun to penetrate the r living areas.
The style of the house is compact and contemporary with the color scheme designed to enable the house to recede into the surrounding landscape once revegetation has occurred.

54.03 SITE LAYOUT AND BUILDING MASSING

54.03-1 Street setback objective

Side setbacks
The siting of the proposed house is in keeping with the objective to allow space between buildings. The East side of the building is setback 5,925 mm from the side boundary and 10,190 mm from the west side.

Front setback
The house is sited within the guidelines for front setbacks.
It is sited to ensure minimum site cuts and excavation. This is consistent with the neighbourhood character.

54.03-2 Building height objective

Height of building
[See TP04& TP05 & TP06]
The height of the building respects the height of the neighbourhood. It is single storey.
The height of the building complies overall to the height restrictions.

54.03-3 Site coverage objective
The site coverage is within the guidelines

54.03-4 Permeability objectives
There is ample permeable surface area.
The rain water from the roof will be harvested.
Storm water will be dispersed widely below the house site to minimize ponding or pooling of water.

54.03-5 Energy efficiency protection objectives
The dwelling is designed so that solar access to north-facing windows is maximised.
The house is oriented with a broad side to the north and northeast to ensure good solar access for the living rooms..
There is no impact from this house on the solar access to surrounding properties.

54.03-6 Significant trees objectives

There are no significant trees left on the site as a result of the fires.

54.04 AMENITY IMPACTS

54.04-1 Side and rear setbacks objective
The side setback respects the preferred character to ensure space between dwellings is maintained.
The rear setback is closer than what is permissible so requires a Variation to the standard as the rear boundary setback varies between 4.115metres and 2.610metres (Ie averaging at 3.360metres);
the justification for this variation are;

1 Significant Landslip constraints.
2 Unusual access arrangements
3 There are no amenity impacts to neighbours.
4 There is ample distance from the nearest houses. The house directly to the rear (29 the Boulevard) at its closest pointis 16.5 metres away and the house to the north west(31 the Boulevard) is more than 18metres away.
5 The floor level of both 29 and 31 the Boulevard are way above the roof height of the proposed building.

54.04-2 Walls on boundaries objective
There are no walls on boundary.

54.04-3 Daylight to existing windows objective
This proposal has no impact on the daylight to existing windows as it is further than 3 meters from the windows of neighbouring houses.

54.04-4 North-facing windows objective
This development has no impact on the access to sunlight of neighbouring properties.

54.04-5 overshadowing open space objective
This development has no overshadowing of neighbouring properties

54.04-6 Overlooking objective
Due to the steep, open, unfenced nature of Wye River it is hard to determine what private open space is and therefore equally hard to determine if overlooking of it occurs. However this development has the same level of overlooking of neighbouring properties as the previous dwelling and is similar to the neighbouring properties and thus respects the neighbourhood character of this element.

54.05 ON-SITE AMENITY AND FACILITIES

54.05-1 Daylight to new windows objective
All windows in the proposed dwelling have access to open sky.

54.05-2 Private open space objective
There is ample private open space of the type that the open unfenced nature of Wye River enables.

54.05-3 Solar access to open space objective
There is good solar access to the open spaces.

54.06 DETAILED DESIGN

54.06-1 Design detail objective

Façade Articulation.

The façade has a surface of pre rusted cor-ten steel which is a rustic weathered material and will recede into the surrounding vegetation.
The roof deck balustrade will be a visually permeable steel mesh and galvanized steel handrail

Window and door proportions

The windows and doorway are placed for pragmatic reasons yet also provide a well balanced and considered articulation of the façade.

Verandah, eaves and parapets.

The Verandah balustrade will be steel mesh with the galvanized steel handrails.

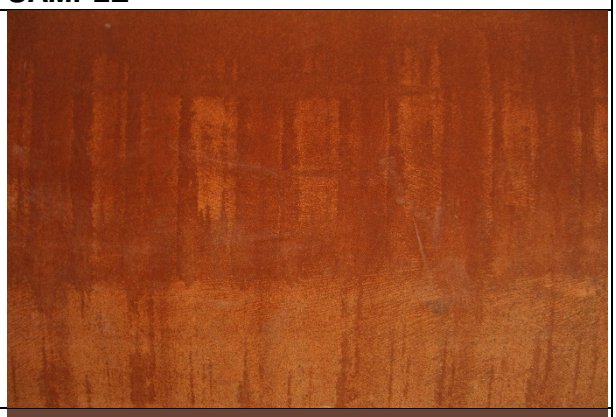
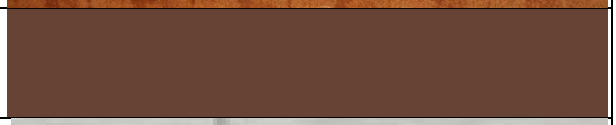
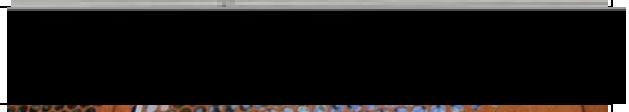
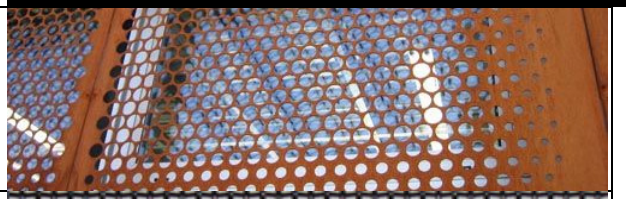
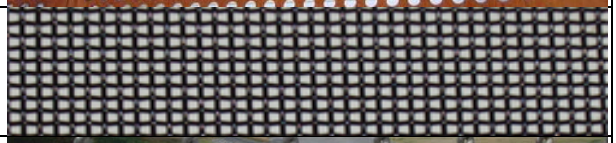
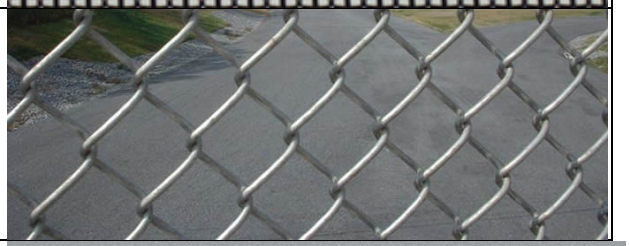
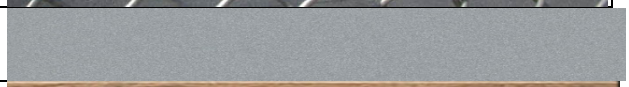
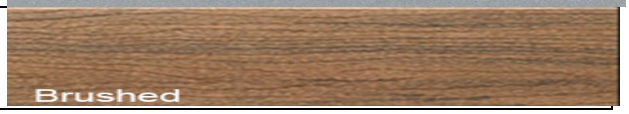
Roof form

The roof will be a flat with a trafficable section in the center to allow for the important task of maintaining and cleaning of leaf litter etc. to minimize fire risk.

54.06-2 Front fences objective

There is no front fence.

SCHEDULE OF MATERIALS

AREA	MATERIAL	COLOUR	SAMPLE
Wall	Cor-Ten Steel flat sheet	Rust	
Roof Cladding	Colorbond	Terrain	
Stair	Concrete	Grey concrete	
Window Frames	Steel	Black	
Window screen rear	Cor-ten steel perforated	Rust	
Window screens front	Invisi guard Bal40 screens	Black	
Balustrade material	Steel Diamond mesh		
Balustrade handrail	Galvanised steel	Grey	
Deck	Modwood timber	Black Bean brushed	

ST. QUENTIN
Surveyors • Town Planners • Engineers

Geotechnical Assessment of Landslide Risk

36-38 Riverside Drive, Wye River

December 2018

Prepared for:
Damon Eisen

Report Date:
15760G-LRA Rev1

ST. QUENTIN

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APPENDICES

EXECUTIVE SUMMARY

Our geotechnical landslide risk assessment has found there are possible landslide events, common to many sites in Separation Creek / Wye River, which may present risks to life and property.

Following our landslide risk assessment for the proposed development, we judged have the qualitative risk of property damage is "moderate to high" however subject to our recommendations and mitigation measures, we have judged the quantitative risk can be reduced to "tolerable" or less than 1×10^{-5} (landslide areas) subject to our recommendations and in accordance with guidelines published by the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled "Landslide Risk Management".

We have judged the critical (large) landslide event affecting this site is the western flank of the Riverside Drive Landslide. However, our analysis has demonstrated that whilst there are foreseeable risks associated with this feature, the distance to the inferred landslide edge is sufficient to reduce the risk below threshold for "tolerable", risk.

Significantly, our exploratory drilling program indicated relatively high and increasing rock strength (at about 7m) and slope stability analysis indicated a minimum factor of safety of 8.4 for large landslide events, which suggests a reduced risk of large landslide events affecting the proposed building envelope, subject to our recommendations.

The risk of landslide will increase where inappropriate excavation or constriction is conducted.

To reduce risk below tolerable levels, that is 1×10^{-5} (landslide areas) as defined by the AGS Guidelines, we recommend the following:

- **Footings must be extended into higher strength rock, at a minimum depth of about 8m.**
- **New excavations be kept to a minimum where possible and not exceed 1m in height. Proposed cuts or fills must be supported with engineer designed retaining structures and extended into higher strength rock.**
- **An appropriate founding depth for all footings should be verified by a qualified geotechnical engineer at time of construction.**
- **Construction of an appropriate engineer designed drainage system.**
- **A suitable effluent management system is required, preferred to be an enclosed 'reed bed' system, with no direct wastewater application to the site (using fully enclosed in pods). Refer 15760G-LCA**

The above requirements are essential in reducing & maintaining landslide risk below "tolerable" levels

1.0 INTRODUCTION

Landslides, erosion and other forms of earth / rock movements are common throughout the Otway Ranges and are a continual natural process of geomorphological shaping of the land.

Developments of sites in geologically active areas are potentially at risk of damage from natural soil or rock movements. Under certain conditions serious building damage, personal injury or even death may result from landslides.

Whilst the risks due to soil movement can usually be identified and steps often be taken to mitigate or reduce the risks to tolerable levels, it is not feasible to eliminate the risks of damage or personal injury entirely.

2.0 SCOPE OF REPORT

St. Quentin Consulting was commissioned by the client to provide a Landslide Risk Assessment on the property to meet the requirements of the Colac Otway Shire: Wye River-Separation Creek Resettlement Program) that was formed to assist rebuilding of bushfire affected areas impacted in December 2015.

The principles used in assessing the landslide risk follow the guidelines published in the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled “Landslide Risk Management”.

The purpose of the assessment is to identify possible landslide hazards on the subject site near the proposed development location and to provide guidance and options for possible risk mitigation.

This report follows an earlier investigation and report (ref: 14841G, August 2017) performed by this office for 36 Riverside Drive Wye River. The original proposal included re-construction of a new dwelling in a similar building envelope of a previous bushfire affected dwelling. Following council consultation during peer review process, we were unable to reach a consensus for the building reconstruction in this location. On this basis a new investigation was commissioned with a new building envelope that included consolidation of No. 36 & 38 Riverside Drive and re-siting the building position, further from the critical spatial zone of the Riverside Landslide Complex. This report includes the findings of the investigation in the new building position.

3.0 DEVELOPMENT DESCRIPTION

The proposed development is the construction of proposed residential development. Supplied plans indicate that the development will be positioned high on slope and about midway between the side boundaries of the site (No. 36 & 38). Plans and elevations prepared by the designer are considered to be an accurate representation of the proposed works (refer Appendix G for Geotechnical Declaration with drawing references and Appendix J for complete drawing set).

4.0 TESTING PROGRAM AND FINDINGS

4.1 Data gathering – desk top studies and previous investigations

There have been many of private and published landslide risk assessment reports conducted in the Otway Ranges (refer references). These reports suggest that landslide hazards are evident in particular areas and that inappropriate development can result in and may contribute to slope failure.

We acknowledge other investigation and reporting on or near the subject site. In preparation of our field investigation of the site, preliminary data was gathered from the following sources:

- Colac Otway Shire – landslide details and website information: inventory of known major landslides within the Shire developed by A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd.
- Corangamite Catchment Management Authority – ‘CCMA’ published landslide details, susceptibility mapping, field guide and information on its website.
- Department of Primary Industries – GeoVic website: details on geological features and mapping and the Victorian Resources Online website: information about soil properties.
- Aerial photos and maps published by Nearmap.com & Googlemaps.com.
- Previous investigations and reports by us and other consultants, published and unpublished.
- Department of Environment, Land, Water and Planning, Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions: Geotechnical Assessment, Coffey.
- Plans and elevations prepared by the client

- Golder Associates 2016 Victorian Bushfire Clean-Up, Wye River and Separation Creek Slope Stabilisation Works – 31 Riverside Drive, Wye River (1653161-071-TM-Rev0, 1653161-062-TM-Rev0)
- Historic Aerial Photographs.

The Department of Environment, Land, Water and Planning, Wye River and Separation Creek – published a geotechnical report by Coffey in April 2016. Coffey have provided a broad assessment of landslide risk. In context with this site, the Coffey report suggests a moderate risk to the property primarily based on unsupported slope (at the Riverside Drive boundary)

4.2 Field investigations

4.2.1 Site inspection and mapping

A thorough geomorphological appraisal of the site was conducted, identifying the main features of the site and the surrounding area to identify evidence of slope instability and past slope failures. Slope angles were measured with an inclinometer.

A plan showing the approximate borehole location and plan showing main geomorphic features is presented in Appendix A. A schematic cross section view of the site with a geological hazard model is presented in is presented in Appendix B.

4.2.2 Site description and geomorphology

The subject site is on the north side of Riverside Drive on a waxing divergent hillside sloping to the south. The overall natural slope of the land is relatively uniform and was measured to be approximately 30-37° (over the development area). The slope increases, to about 40° at the lower site slope. The upper road cutting features a slope of at least 55° and a total cut height of about 6m. The site features an unsupported site cut at the top of the site and a lower concrete sleeper retaining wall. Attached photos (in Appendix D) also show various views of the site including some of the above-mentioned features.

During our investigation, we encountered poorly drained regions on adjacent upslope sites and uncontrolled discharge of effluent from surface irrigation systems and stormwater that may impact this site.

4.2.3 Sub-surface conditions & test results

Four boreholes were performed using a specialist track-mounted drill rig (Comacchio GEO105), with boreholes performed to a maximum depth of 9m and shallower boreholes using a hand auger apparatus on steeper slopes, where there were access constraints. Our exploratory drilling program has revealed that the soil profile comprises soils overlying low strength rock and deeper 'higher' strength rock at about 7m or so. The composition of the soil layers in and near the proposed house area indicates the soil is "colluvium" derived, likely formed from large to very large slope movement. Exposed rock in adjacent road cutting was measured to ascertain dip and strike angles and measurements. The rock dip suggests a discontinuous bedding angle and direction to the naturally occurring slope indicating possible deep-seated slope movement. This has been interpreted as displaced and generally intact rock associated with the very large Illowra Landslide. An alternative interpretation in the colluvium soils are associated with the nearby large Riverside Drive Landslide, however we would consider that the distinct and different geomorphology (from adjacent the Riverside Drive Landslide) would not support this hypothesis. The bedding angle suggests increased risk of failure where site cut is proposed. Refer also to the following section for more details and description of previous nearby movements. A photograph showing exposed rock is shown in Appendix D. Disturbed soil samples were continuously collected logged and hand classified by an experienced and qualified geotechnical engineer. A description of the soil types observed in the boreholes is shown in Appendix C.

In-situ Standard Penetration Tests (SPT) were performed during our drilling program and suggested very high compressive strength below about 2m or so.

Soil/rock samples were forwarded to a NATA accredited laboratory for strength test (Triaxial compressive strength) shown in Appendix F. We have judged moisture from wash boring has influenced the results of the lower strength rock, however we have considered these are given and used to provide a more conservative outcome.

Slope stability analysis using input data derived from laboratory testing (Triaxial Tests) and modelled using Slope/W (by Geostudio) for large failures, which were judged to be the most critical in terms of the development siting. Slope/W analysis indicated a minimum factor of safety of 8.4.

4.2.5 Groundwater conditions

There is limited published bore data available on permanent / transient water table for this area of Wye River. No groundwater was encountered during our investigation above 3m or so and wash boring below 3m did not permit monitoring of groundwater. It is important to note that we encountered seepage / possible perched sub-surface conditions in two boreholes during a previous investigation at a lower site (on Riverside Drive) at about 1.5-3.0m, which suggests a perched water table often develops during seasonal wet periods or storm events.

Recent monitoring during intense rain events have recorded very high transient water subsurface flows, which has had a profound effect on the slope stability of some areas in Wye River. Without drainage management, these conditions can impact on stability of slopes and also eventually affect downstream waterway quality. Perched water table may prove problematic if construction is commenced after wet periods with potential collapse of deep excavations. For this reason, it is important upslope cut-off drains are provided to prevent/reduce transient water flows near the construction and effluent area. More details on drainage are provided in Section 8.2.

4.3 Previous landslide movements

There are several large notable landslide features in the Wye River locality, some affecting a large expanse of the Wye River township. Significant landslide features have been identified on Wye River Colac-Otway Shire Landslide Inventory Mapping (collated by A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd) and more recently by Trevor Smith (Coffey 2016), as part of the Wye River/Separation Creek resettlement program geotechnical assessment, authored of Coffey and commissioned by the DELWP.

A perspective view (nearmap) of very large failures is presented in Figure 1 and detailed landslide inventory from Department of Primary Industries and Coffey is presented in Figures 2 & 3 respectively. Interpretation of landslide features are included in Appendix E.

The following significant landslide features occur close to the subject site:

- **Potato Patch Landslide Feature:** A very large failure, known as the 'Potato Patch Slide' was identified by Miner et al. however does not impact the subject site.

- **Illowra Avenue Landslide Feature**: A very large area extends from the north of the site known as the 'Illowra Avenue Landslide'. It is inferred this feature encompasses about 40 hectares (Smith 2016). We have judged the geomorphology of this features and position of Riverside Drive suggests the site is part of the toe of the Illowra landslide complex. This is further supported by the inconsistent bedding angle noted throughout cuttings in this area.

  The age of the main Illowra landslide feature is classified as a 'fossil' landslide event (Smith 2016) presumably based on earlier mapping (Roberts 2006), inferred to be approximately 100,000 years old. However, it has been hypothesised this event could be more recent, due to the strong geomorphology (Miner 2016) which could potentially age the landslide as recent as around 1000 years old, which would be considered recent in geological terms. A detailed landslide inventory from Department of Primary Industries and Coffey is presented in Figures 2 & 3 respectively.

- **Riverside Drive Landslide Feature**: A large feature was noted by Miner et al. adjacent to Riverside Drive, known as the 'Riverside Landslide', this is characterised by a large scarp and flatter toe region at and below Riverside Drive where the remnant failure has come to rest. There are no records of the original landslide event, however the degree of weathering and obvious characteristics of the slides indicate it may be relatively recent, and potentially 50-200 years old. Exfoliation and localised failure have occurred further west of Riverside Drive (Roberts 2006) that have potentially impacted the south east of the subject site as recently as 1987. Smith (2016) characterises this as a "Distinct landslide that is active with small landslides occurring within the vicinity in 1987. Probably part of toe of Illowra Landslide."[2]

1. Golder Associates 2016 Victorian Bushfire Clean-Up, Wye River and Separation Creek Slope Stabilisation Works – 36 Riverside Drive, Wye River. Ref: 1653161-061-TM-Rev0
2. Department of Environment, Land, Water and Planning, Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions: Geotechnical Assessment, Coffey, 31 March 2016

Dahlhaus (2003), Roberts (2006-2004) and Miner (2007) have identified landslide features on or near Riverside Drive, refer Figure 2. Smith (2016) have also mapped and published landslide features in this area and interpreted these features, which are presented in Figure 3 and Figure 4. We note there is some variation of interpretation of the landslide features and boundaries, however significant landslides are mentioned by all consultants. Our own assessment and site inspection suggest the edge of the Riverside Drive landslide (inferred by Coffey) is closer the boundary of 36 Riverside Drive as inferred on the DELWP, Wye River and Separation Creek slope analysis as presented in Figure 5. We have judged this alignment is similar to the outer edge of the Dahlhaus 2003/ Miner 2007 interpretation. Further to this, we have judged that the outer boundary of possible regression could closely align to the boundary considered by Roberts (2006-2004). To this end we expect the several different scale landslide events could be possible, triggered with different likelihoods that are dependant under different environmental conditions.

Very small to small recent failures were noted by the author on and near the subject site which were photographed during our investigation and presented in Appendix D.

Evidence of rock falls on the site, predominately at the base of the steep cuts. Isolated rocks (with a longer travel distance) have also been noted and have been attributed to nearby construction (rather than naturally occurring). However, we suspect that similar falls could occur and potentially present a risk to life and property.

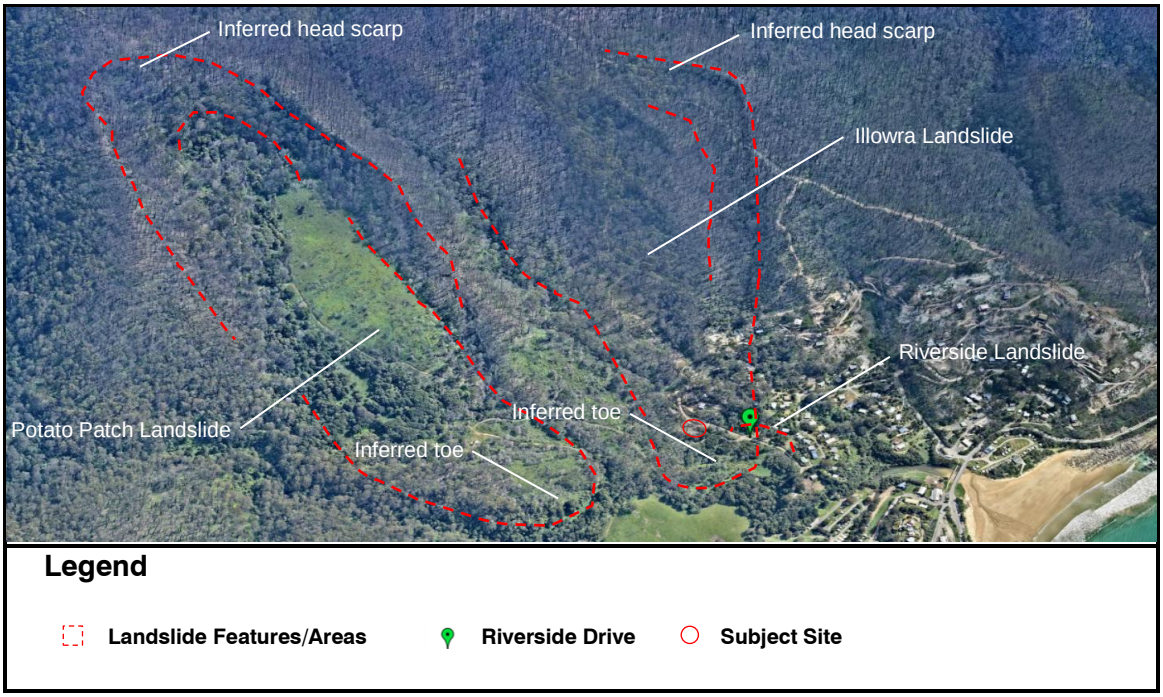

Figure 1: Aerial Map: nearmap multiview (note some image interpretation distortion evident)

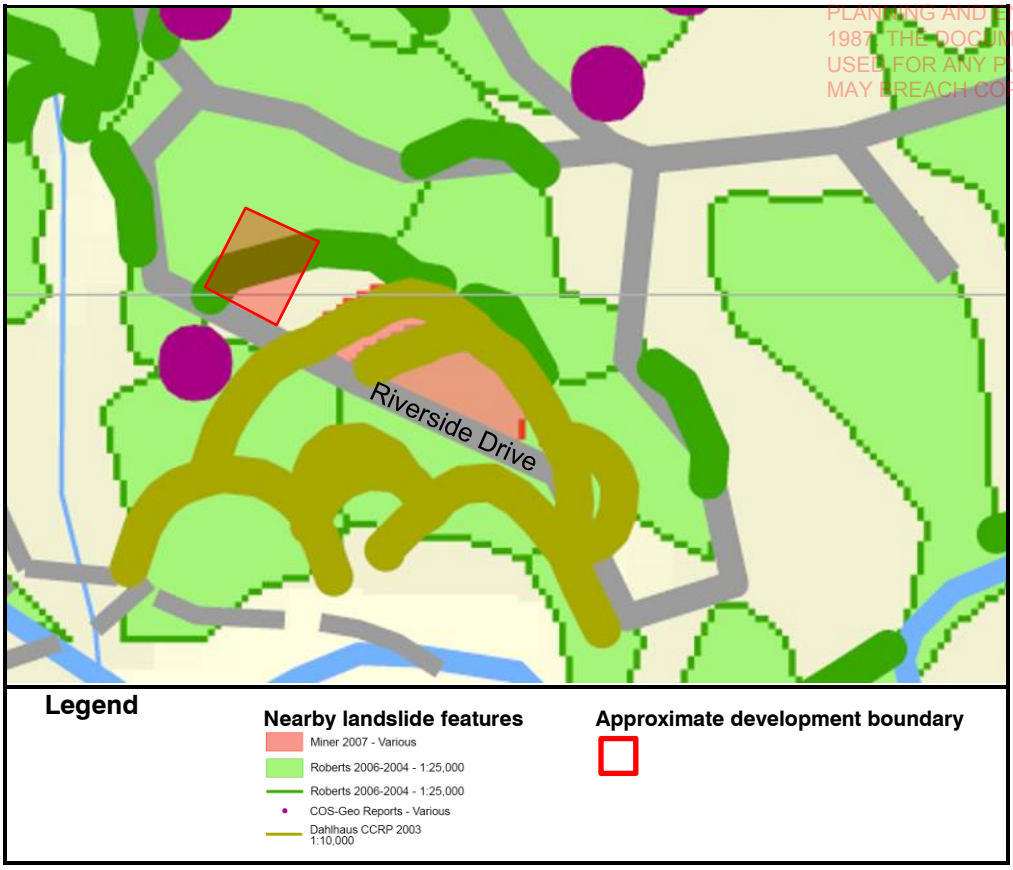

Figure 2: Department of Primary Industries Wye River Colac-Otway Shire Landslide Inventory (A.S. Miner Geotechnical and Dahlhaus Environmental Geology Pty Ltd)

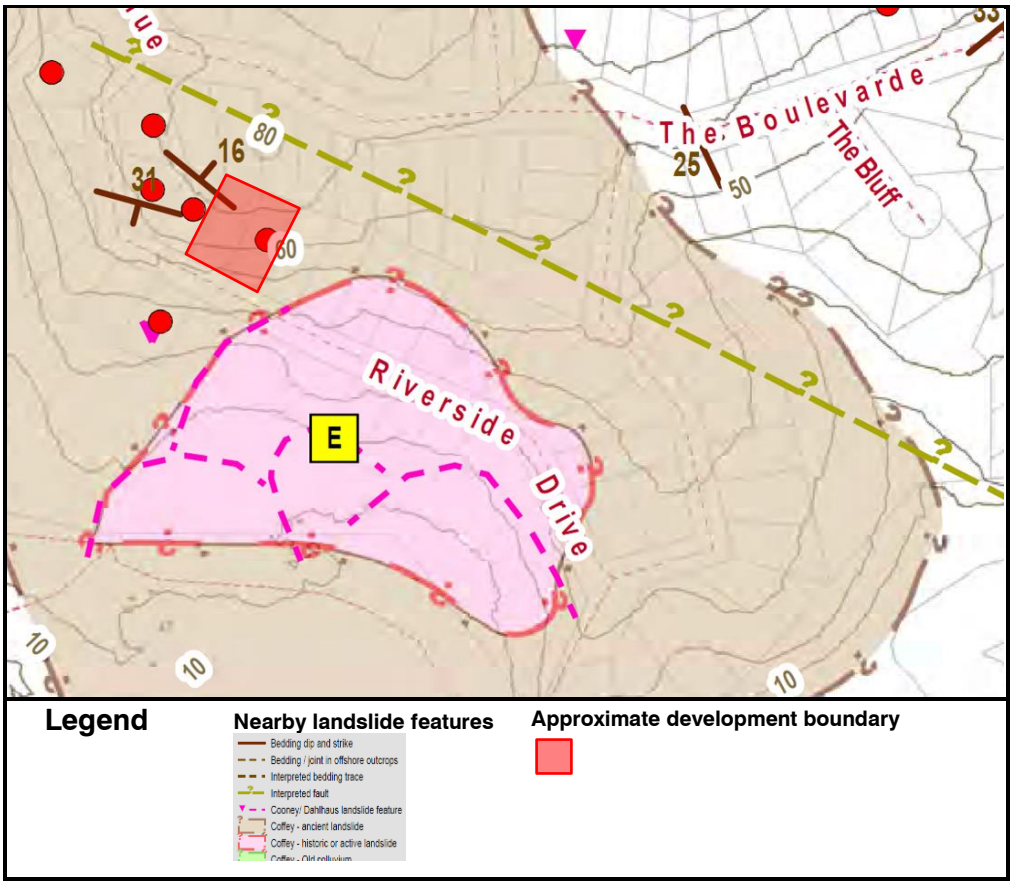

Figure 3: DELWP, Wye River and Separation Creek - Geotechnical Assessment, (Coffey 2016)

4.4 Historical aerial photographs

A historic search of aerial photographs was conducted to assist in interpreting previous landslide near the site. Three (3) aerial photographs from 1945, 1970 and 1986 were selected and reviewed to assess site feature and the land use activities onsite and in the surrounding area. Aerial photographs taken from Google maps and nearmap from 2008 and 2018 were also analysed and included. Copies of these aerial photographs are presented in Appendix E.

Key events relevant to the site are summarised in Table 1 below.

Table 1: Historical Aerial Photograph Summary

Year	Source	Information
1945	Aerial Photograph Landata	Poor quality image: black and white. Poor image stitching. Shows significant vegetation removal on and near site. Potato Patch Landslide Clearly visible and also features sparse vegetation. Surface scour, previous landslide and creep in a south-east direction. Drainage courses evident to the north of the site.
1970	Aerial Photograph Landata	Improved image quality: black and white. Apparently hummocky surface to the north and north west of the Wye River alignment indicate previous landslide movement, possibly more recent and potentially associated with the Riverside Drive Landslide. Creek alignment appears to be slightly different, however may be due to distortion of 1945 image.
1986	Aerial Photograph Landata	Improved image quality: colour. Formation of access track below Riverside Drive is prominent. Hummocky surface (small failures) were noted at base (south) and below the Riverside Drive alignment (north-east) of Riverside Drive landslide. No apparent change in the north-west flank of the Riverside Landslide.
2008	Aerial Photograph Landata	Good image quality: colour. Heavy vegetation, difficult to identify landslide features. No apparent change in the north west flank of the Riverside Landslide.
2018	Aerial Photograph Landata	Good image quality: colour. Heavy vegetation, difficult to identify landslide features. No apparent change in the north west flank of the Riverside Landslide.

4.5 Recent fire activity and increase in landslide risk

Vegetation removal and increased rainfall is commonly attributed to reactivation of landslides in landslide prone areas/slopes. Tree roots provide a matrix of reinforcement as well as reducing the moisture content and increased suction, which reduces the incidence of landslides. When vegetation is removed and heavy rainfall occurs the pore pressure increases (concentrations of saturated soils). New subsurface moisture pathways also can develop and as a result of these issues the landslide and erosion potential can increase significantly.

The effect of vegetation loss/removal and ensuing high rainfall during 2016 has been dramatic, with a notable increase in slope failure / movement and erosion (tunnel / surface). These conditions have not been seen in Wye River for a generation, since residential development in the area circa 1940's. For this reason, it is imperative that appropriate design and construction is accomplished for all structures (residences, retaining walls & vehicle platforms), effluent disposal and drainage systems.

5.0 GEOTECHNICAL STATEMENT REQUIRED BY EMO SCHEDULE 1

In accordance with Colac Otway Shire Planning Scheme, Erosion Management Overlay (EMO) 44.01 we provide the following information.

5.1 Practitioner details

The author of this report is Cameron Farrar, a professional geotechnical engineer with a Bachelor of Engineering and is registered member of the Institute of Engineers and Australian Geomechanics Society. The author has more than 20 years of experience in geotechnical engineering and management of slope instability issues and landslip risk management.

5.2 Currency
This report is based on field measurements made less than 12 months ago.

5.3 Site description
Refer to section 4.2.2.

5.4 Site assessment plans
Appendix A & B show slope and contour details of the development site area.

5.5 Sub-surface conditions
Borelogs, presented in Appendix C and section 4.2.3 describe the site's subsurface features.

5.6 Natural slope failure
Past failures and were identified on and near the site. Refer to section 4.3.

5.7 Site investigations
A site investigation was conducted to examine and sample the soil profile in order to assess the geotechnical/geological model. Details of the soil conditions revealed are included in this report (Appendix C) and are described in item 4.2.3 above.

5.8 Sub-surface investigation
Geological soil and rock samples were recovered from four test locations for examination by a professional geotechnical engineer.

5.9 Landslide risk
Subject to our recommendations, the risks for slope instability hazards identified are of a tolerable risk level and will remain so over the design life of the proposed development (as presented in development plans).

5.10 Development suitability
The subject lot is suitable for the proposed development and the proposed development can meet the tolerable risk criteria, as defined in the EMO schedule.

5.11 Special conditions and inspections
In our opinion and subject to our recommendations for engineer designed retaining walls, no other special geotechnical conditions are required for approval of the development and a program of periodic inspections is not required.

6.0 RISK ESTIMATION FOR PROPOSED DEVELOPMENT SITE

We have judged there are six significant and conceivable landslide events that may affect the proposed development site and individuals on the site.

Explanation of likelihood of each possible event is described below, based on 'best estimates' using derived frequency in accordance with the AGS 2007 Guidelines Section 5.4.2 Estimation of Annual Probability (Frequency) ($P_{(H)}$) of Each Landslide.

We have determined annual probability of each event in context with our developed geotechnical model with consideration of the proximity to past failures (including landslide inventory), geomorphology, degree of weathering and borehole information performed on this and nearby sites.

We have conducted detailed analysis for possible large (and judged to be critical) landslides associate with the nearby Riverside Landslide feature. It is judged to be economically unfeasible to provide engineering solution for large scale landslides, and therefore we have provided a scalar approach, based on regression of the landslide feature in terms of mm/yr and potential impact on life and property.

Conceivable landslide events affected the existing dwelling are:

1. **Debris strike from rocks above.** Evidence of rock falls were noted on this site, particularly at the bottom of the steep site cuts. We understand that rocks with significant travel distance (more than 2m or so) are likely attributed to re-construction of residential properties on the upper side of Riverside Drive and similar (or greater) travel distances would generally not be common without human or mechanical intervention. Notwithstanding this, we have judged that similar small or large (cobbles to boulder size) rocks could conceivably dislodge from the upper embankment or from

similar construction works above the site and impact pedestrians / or the proposed residence on the development site.

We have judged that debris strike failures (Hazard 1A & 1B) are **'likely'** based on evidence of previous debris noted on this and adjacent properties. We have judged the impact from the hazard would be minor, due to the inferred short travel distance.

2. **Gradual, down-slope creep of the upper shallow soil layers.** This is a common form of "landslide" throughout the Otway region which involves slow speed creep of the soil layers down the slope. Signs creep incidence are usually noted well before any serious damage or personal injury results and therefore the consequence to life is 'barely credible'.

   Due to previous vegetation removal and the very steep slope we have judged creep (Hazard 2) is **'almost certain'** to occur on the subject site over the design life of the building.

   As previously suggested creep incidence is usually noted well before any serious property damage occurs and is generally insignificant.

3. **Very small-small rotational failure**
   We have observed a number of recent very small failures near the site (within the last 12 months), ranging between 2-200m^3 in steep and unretained road and steep batters on adjacent site. The frequency of these failures near the subject site would suggest that similar size failures are **'likely'** to develop (Hazard 3C) and possible on more stable and reduce slope areas (Hazard 3A, 3B). We have judged that the likelihood of a critical failures (Hazard 3C), above the site could conceivable be reduced to **'unlikely'** subject to mitigation, including appropriately designed and constructed engineer designed retaining walls.

4. **Medium size rotational or translational failures of the existing cut slopes on the site.**
   In adverse conditions medium size rotational or translational slope failures (200-2,000m^3) may occur on the hillside. The shallow slope angle at the rear of the site suggests that medium size failures are **'unlikely'** to develop (Hazard 4A, 4B) however could conceivably occur and present a major risk to the property**.**

5. **Large scale rotational or translational failures of the slope.**
   Large scale slope failures (2,000-20,000m^3) have occurred in the area in the past however are 'generally' rare. However, the most significant landslide pertaining to this site is the Riverside Drive landslide complex. It is considered that this landslide is part of the toe of the Illowra Landslide that has re-mobilised and is still active. It is these embedded active failures that are considered to have the greatest potential of re-mobilisation than the very large 'fossil' landslides.

   The existing soil profile (colluvium derived), proximity to the nearby Riverside landslide complex and the existing slope angle (up to 37°) suggests that large size failures could occur on this site. Dahlhaus states, "The steepness of the slope is a causal factor in landslides, since gravitational force acts on all slope materials. However, when these relationships were tested by GIS analysis, the correlation between landslide occurrence and slope angle could not be seen, even in the areas with most data"[3].

   We recognise the active nature of the Riverside Landslide which has included subsequent small landslides as recent as 1987. Inferred features by Miner et al. in Figure 2 and Coffey in Figure 3 show a representation of the main scarp. We also recognise the Riverside Drive Failure edge is inconstant based on the interpretation of features from individuals and limitations of technology to map these features. However, these interpretations provide context for reactivation or regression of failures that may affect the subject site. Whilst it is not possible to determine exactly where a potential failure may initiate, the alignment of the existing scarp can infer the potential position or alignment of potential failures as suggested in Figure 4.

3. Landslide & Erosion, Background information for the development of the Corangamite Soil Health Strategy, Dahlhaus 2003

We have judged there are several associated 'large' failures, with the scale largely dependent on differing environmental climatic conditions. In order to more accurately estimate the likelihood of reactivation and consequence of the hazard we have divided large landslide into sub-category based on annual movement that may occur, as presented in Figure 4, measured in mm/year:

- **Hazard 5A**~10mm movement:/year: It is inferred that movements in this order are subtle and at times indistinguishable however may present as creep, small tension cracks, bent trunks or soil fretting or small scarps. All of these features were observed on adjacent sites are therefore are judged to be **'almost certain'** ($1x10^{-1}$), based on strong evidence as indicated. We have judged that the rate of regression would result in about 0.5m of regression displacement over the lifetime of the property but would not impact the building envelope, however marginally encroach the site boundary of No. 36 Riverside Drive.

- **Hazard 5B**~100mm movement:/year. Movement of this order would potentially present as obvious landside events, similar to previous landslide movements in Riverside Drive. We have judged such movements could result present as 5m regression displacement over the lifetime of the property. Due to the recent history of similar size failures, in the 1980's, we have judged movements 100mm/yr are judged to be **'likely'** ($1x10^{-2}$). Movements of this magnitude could potentially impact a large percentage of No. 36-38 Riverside Drive only however we have judged would not impact the building envelope due to the spatial proximity to the inferred landslide edge.

- **Hazard 5C**≥1000mm movement:/year: This would present as obvious large scarps and major movement that would impact the large area and include several properties and infrastructure near Riverside Drive.

  There is no evidence of recent landslide events of this magnitude in the vicinity of the subject site (since development of Wye River), however the distinct geomorphology of large to very large landslide events noted in Lidar images suggest failures of this magnitude have occurred within the current geology period but during very different climatic conditions (inferred to be very wet during early or pre-Holocene period). Furthermore, the impact would need to extend approximately 30m from the current inferred scarp to impact the dwelling. It would also require displacement of large intact rock, which has not shown significant evidence of movement since development in the region. The apparent increase in rock strength, noted to at least 9m and relatively high in-situ rock strength would reduce risk of large landslide events (in the order of ≥1000mm movement:/year).

  Furthermore, based on the evidence of previous failure that has occurred in the Riverside Drive failure, we'd expect failure as suggested to be 'regressive' by nature, rather than a large failure to occur en masse. Based on this hypothesis and evidence of minimal regression at the north-west flank of the Riverside Drive Landslide we have judged Hazard 5C to be **'rare'** ($1x10^{-5}$) for the lifetime of the dwelling.

  Influence of earthquake events is considered to be low with most registered earthquakes occurring offshore (south of Cape Otway) and low intensity since the 1950's with none registered closer than 20km (Geoscience Australia, 2017).

- **Hazard 5D**: This would present as obvious large translational failure with a failure plain through the Riverside Drive cutting (below). This would similarly impact the large area and include several properties and infrastructure near Riverside Drive and is similarly judged to be **'rare'**.

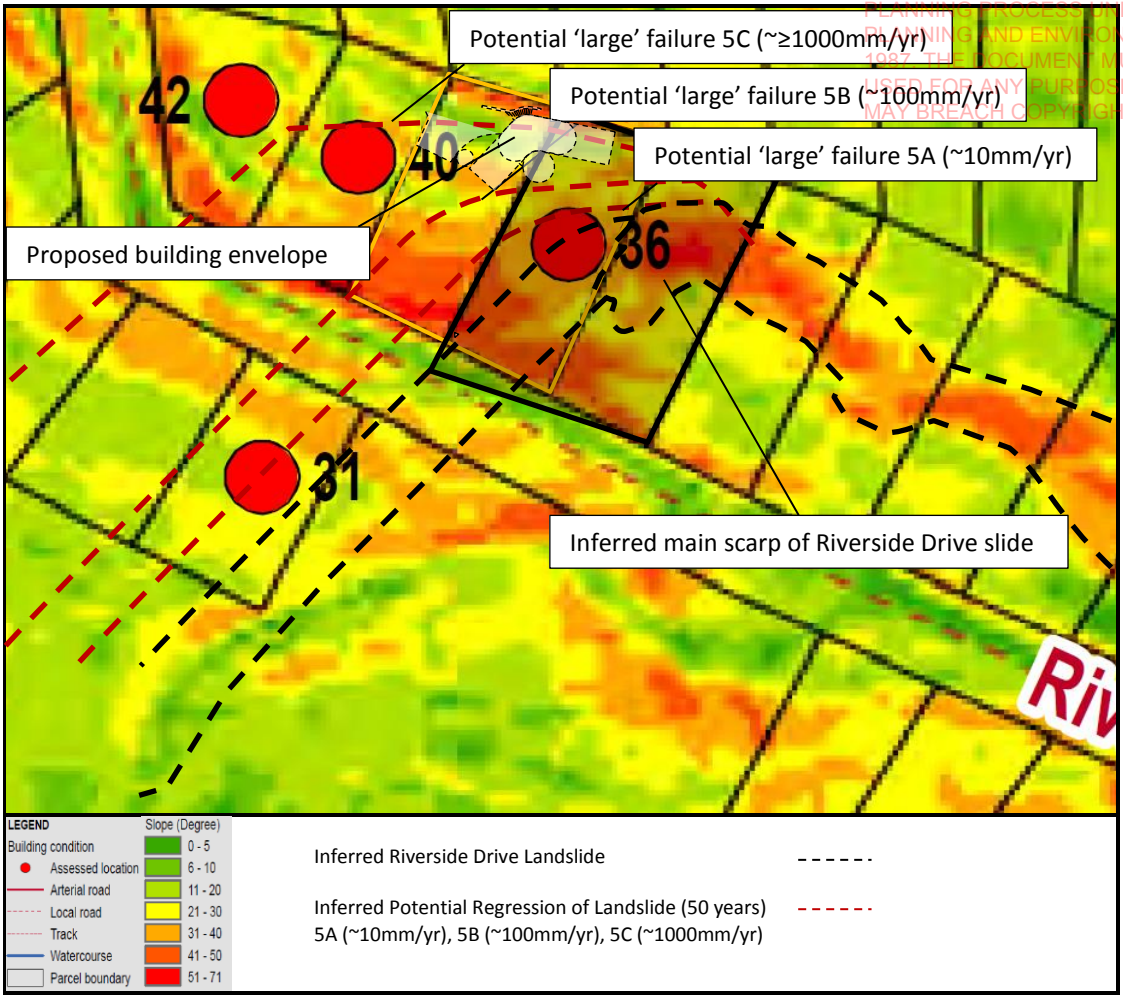

Figure 5: DELWP, Wye River and Separation Creek – Slope Analysis, Coffey 2016

6. Very large scale translational failures of the slope.

It is understood that very large failures similarly occur along weaknesses in the underlying rock layers or poorly drained regions and can potentially be triggered predominately by exceptional rainfall periods. Very large (>20,000m^3) and deeply seated' slope failures have occurred in the area, most notably the "Potato Patch Slide" and "Illowra Slide".

It has been hypothesised by Golder Associates[4] that deep rock noted below this site (No. 36-38 Riverside Drive) could potentially be deep colluvium that potentially represents a displaced failure 'block' associated with the Illowra Slide. Further to this, inspection of the exposed batter face by the author along Riverside Drive revealed discontinuity in the rock bedding plain and generally low strength rock in the vicinity of the site. It is possible that failure/remobilisation along deeper rock, (6m+ deep) is conceivable (Hazard 6), however based on our experience with both sites, we expect the higher rock strength, noted on 36-38 Riverside Drive would reduce risk of such events.,

As previously suggested, there is difference of opinion over the age of existing very large failures however for the purposes of our analysis, we have judged that such events to be **'rare'** or ($1x10^{-5}$) due to the supporting rock profile of the displaced block (being at the inferred toe of the Illowra landslide) that would greater reduce the likelihood of such scale failures to reoccur.

4. Golder Associates 2016 Victorian Bushfire Clean-Up, Wye River and Separation Creek Slope Stabilisation Works – 36 Riverside Drive, Wye River. Ref: 1653161-062-TM-Rev0

6.1 Estimation of qualitative risk of damage to property

Based on our measurements and observations and using the procedure and terminology from the AGS Guidelines (2007), we have assessed the "level of risk to property" for the proposed development site as "moderate to high". For each of the events described, the risk to property can be summarised below in Table 2.

Table 2.

Failure Mode (Element at Risk)		Likelihood of event occurring	Risk to Property	Consequence of event occurring
1A. Rock falls, debris strike above the building envelope (front of residence)		Likely	Minor	Moderate
1B. Rock falls, debris strike below the building envelope (vehicles on Riverside Drive)		Likely	Minor	Moderate
2. Slow speed soil creep (residence)		Almost Certain	Insignificant	Low-Moderate
3A. Small translational failure above Riverside Dr below the building envelope (vehicles)		Possible	Insignificant	Low
3B. Small rotational failure below building envelope (residence)		Possible	Minor	Moderate
3C. Small rotational failure of unsupported batter above the building envelope (residence)	existing conditions	Likely	Medium	High
3C.' Small rotational failure of unsupported batter above the building envelope (residence) with engineer retaining wall	improved conditions	Unlikely	Medium	Low
4A. Medium rotational failure above Riverside Dr, below the building envelope (vehicles)		Unlikely	Major	Moderate
4B. Medium rotational failure below the building envelope (residence)		Unlikely	Major	Moderate
5A. Large rotational failure with regression of the Riverside Drive landslide (10mm/yr) (residence)		Almost Certain	Insignificant	Low
5B. Large rotational failure associated with the Riverside Drive landslide (100mm/yr) (residence)		Likely	Minor	Moderate
5C. Large rotational failure associated with the Riverside Drive landslide (>1000mm/yr) (residence)		Rare	Major-Catastrophic	Moderate
5D. Large translational failure associated with the Riverside Drive landslide (residence)		Rare	Major-Catastrophic	Moderate
6. Very large remobilisation of colluvium, remobilisation of larger Illowra landslide complex (residence)		Rare	Catastrophic	Moderate

6.2 Estimation of quantitative risk of loss of life

AGS guidelines recommend that the "risk of loss of life" is calculated quantitatively to ensure that the value obtained does not exceed the value of "tolerable risk". Tolerable risk is defined as "the risk that society can live with" and has been denoted a value of 10^{-4} per annum (or a chance of 1 in 10,000) for an existing natural slope or 10^{-5} per annum (or a chance of 1 in 100,000) for an existing landslide area.

The qualitative risk of loss of life is calculated using the following formula:

$$R = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)}$$

Where R is the risk (the annual probability of loss of life)
$P_{(H)}$ is the annual probability of the hazardous event (the landslide)
$P_{(S:H)}$ is the probability of spatial impact by the hazard, given the event
$P_{(T:S)}$ is the temporal probability, given the spatial impact
$V_{(D:T)}$ is the vulnerability of the individual

For each of the conceivable events that may occur on this site as described above, the risk to life is calculated using the above-mentioned formula and summarised below in Table 3.

Table 3.

Failure Mode / Possible event		$P_{(H)}$	$P_{(S:H)}$	$P_{(T:S)}$	$V_{(D:T)}$	R
1A. Rock falls, debris strike above the building envelope (pedestrian at front of building)		10^{-2}	0.05	1.7×10^{-2}	1.0	8.5×10^{-6}
1B. Rock falls, debris strike below the building envelope (pedestrian on Riverside Drive)		10^{-2}	0.05	1.7×10^{-2}	1.0	8.5×10^{-6}
2. Slow speed soil creep (individuals in residence)		10^{-1}	0.5	1.7×10^{-1}	0	0
3A. Small rotational failure above Riverside Dr, below the building envelope (individuals in vehicles)		10^{-3}	0.5	8.5×10^{-2}	0.05	2.1×10^{-6}
3B. Small rotational failure below building envelope (individuals in residence)		10^{-3}	0.5	8.5×10^{-2}	0.05	2.1×10^{-6}
3C. Small rotational failure of unsupported batter above the building envelope (pedestrian at front of building)	existing conditions	10^{-2}	0.5	1.7×10^{-2}	1.0	**8.5×10^{-5}**
3C.' Small rotational failure of unsupported batter above the building envelope (residence) with engineer retaining wall (pedestrian at front of building)	improved conditions	10^{-4}	0.5	1.7×10^{-2}	1.0	8.5×10^{-7}
4A. Medium rotational failure above Riverside Dr, below the building envelope (pedestrians or individuals in vehicles)		10^{-4}	0.5	1.7×10^{-2}	1.0	8.5×10^{-7}
4B. Medium rotational failure below the building envelope (individuals in residence)		10^{-4}	0.5	1.7×10^{-2}	1.0	8.5×10^{-7}
5A. Large rotational failure below building envelope associated with regression of the Riverside Drive landslide (individuals in residence)		10^{-1}	0.01	8.5×10^{-2}	0.05	4.2×10^{-6}
5B. Large rotational failure associated with the Riverside Drive landslide (individuals in residence)		10^{-2}	0.1	8.5×10^{-2}	0.05	4.2×10^{-6}
5C. Large rotational failure associated with the Riverside Drive landslide (individuals in residence)		10^{-5}	1	1.7×10^{-1}	1.0	1.7×10^{-6}
5D. Large translational failure (individuals in residence)		10^{-5}	1	1.7×10^{-1}	1.0	1.7×10^{-6}
6. Very large remobilisation of colluvium, remobilisation of larger Illowra landslide complex (individuals in residence)		10^{-5}	1	1.7×10^{-1}	1.0	1.7×10^{-6}

***Improved conditions details, refer to specific requirements in section 7.0**

6.3 Explanation of qualitative risk to life calculations

The values presented in the above table are multiplied to achieve the estimated risk to life shown "R" in the table. Note that these calculations refer to an individual inside the building; the risks to a person outside have not been considered.

$P_{(H)}$ and $P_{(S:H)}$ are derived from direct reading or estimation from Appendix C of the AGS 2007 Guidelines, a copy of this attached in Appendix I.

$P_{(T:S)}$ is calculated as follows:

annual occupancy of the residence: 10/12 months
daily occupancy of the residence: 20/24 hours
part of the residence affected by the event: 1 (or 0.5 for half the house)
location of individual in the part of the residence: ¼

Where the whole building is affected by the event, the calculation for $P_{(T:S)}$ is:

$P_{(T:S)} = 10/12 \times 20/24 \times 1 \times 1/4 = 0.17$ or 1.7×10^{-1}

Where half of the building is affected by the event, the calculation for $P_{(T:S)}$ is:

$P_{(T:S)} = 10/12 \times 20/24 \times 1/2 \times 1/4 = 0.085$ or 8.5×10^{-2}

Where pedestrian is affected by the event, the calculation for $P_{(T:S)}$ is:

$P_{(T:S)} = 10/12 \times 1/24 \times 1 \times 1/2 = 1.7 \times 10^{-2}$

Where vehicle is affected by the event, the calculation for $P_{(T:S)}$ is:

$P_{(T:S)} = 10/12 \times 1/24 \times 1/2 \times 1 = 1.7 \times 10^{-2}$

$V_{(D:T)}$ (the vulnerability of the individual) is derived from data collected from studies of landslide events in Hong Kong, for a person in a building. The relevant part of the study is reproduced below in Table 4:

Table 4.

Case	Range in Data	Recommended Value	Comments
If building collapses	0.9 - 1.0	1.0	Death is almost certain
If building is filled with debris and person buried	0.8 – 1.0	1.0	Death is highly likely
If debris strikes building only	0 – 0.1	0.05 (5×10^{-2})	Very high chance of survival

- A value of 0 has been adopted for soil creep events.
- A value of 0.05 has been adopted for the small-scale failure events.
- A value of 1.0 has been adopted for medium-scale failure and small-scale failure events affecting pedestrians.
- A value of 1.0 has generally been adopted for the large-scale event (possible total collapse / destruction of the building) but has been reduced to 0.05 (for failure mode 5A & mode 5B) due to the inferred distance from the proposed hazard.

7.0 SUMMARY OF RISKS AND CONCLUSION

Our assessment has identified possible risks of loss of life and damage to property on the site, due to conceivable landslide events. We have judged the qualitative risk of property damage is "moderate to high" in accordance with guidelines published by the Australian Geomechanics Society (AGS) journal Volume 42 No 1 of March 2007, entitled "Landslide Risk Management", subject to the following requirements.

Our exploratory drilling program suggested increasing rock strength, and relatively high strength at about 7m. Slope stability analysis, using conservative figures indicated a minimum factor of safety of 8.4 for large landslide events (judged to be the most critical in terms of the property risk). This figure was considered high, particularly due to the landslide activity noted near the site and therefore our risk analysis was principally based on the proximity to the Riverside Landslide complex and potential regression that may impact the site. This analysis has demonstrated that whilst there are foreseeable risks, the distance to the inferred landslide edge is sufficient to reduce below threshold for 'tolerable' risk.

Subject to our recommendations and mitigation measures, including appropriately constructed footings, retaining structures and effluent systems, the risk to life can be potentially reduced below the recommended "tolerable risk" limit defined as 1 x 10^{-5} (landslide areas) by the AGS Guidelines.

In summary, to reduce risk to a tolerable level, that is (1 x 10^{-5} (landslide areas) defined by the AGS Guidelines) we recommend the following:

- **Footings must be extended into higher strength rock at a minimum depth of about 8m and potentially deeper below the existing surface level. Appropriate founding depth should be verified by a qualified geotechnical engineer at time of construction.**

- **New excavations be kept to a minimum where possible and not exceed 1m in height. Proposed cuts or fills must be supported with engineer designed retaining structures and extended into higher strength rock.**

- **Construction of an appropriate engineer designed drainage system.**

- **An appropriate effluent management system, preferred to be an enclosed 'reed bed' system, with no direct wastewater application to the site (fully enclosed in pods). Refer 15760G-LCA**

The above requirements are essential in reducing landslide risk below 'tolerable' levels.

The critical (large) landslide events affecting this site are associated with the western flank of the Riverside Drive Landslide. However, we have judged the spatial impact associated with the risk is significantly reduced due to the distance to the boundary of the inferred landslide edge.

It is important to re-iterate we have judged that the landslide risk has increased as a result of vegetation loss through direct bushfire impact, subsequent vegetation removal, very high rainfall and importantly the poor drainage conditions encountered on this site. For this reason, it is essential that appropriate design and construction is completed on this site.

We understand that hydro seeding has been conducted within the bushfire affected regions and have observed areas of soil nailing and retaining wall construction within the township. We also understand that a reticulated stormwater system is proposed for the township which is likely to reduce uncontrolled runoff across the area. However, it is extremely important that land owners also take direct action to reduce landslide risk on their individual sites. Particular focus must be placed on drainage, which will require specific engineering design to ensure stormwater and wastewater is managed and directed well away from the building envelope. We also recommend a comprehensive site re-vegetation program be conducted by the owner as soon as possible. New vegetation will provide improved soil reinforcement, replacing important plant/tree root systems that have been lost during the recent bushfires and subsequent tree removal.

Appropriate construction of buildings/retaining structures, re-vegetation and drainage management are key factors in reducing landslide risk. The importance of these issues cannot be understated given recent events in the area.

8.0 RECOMMENDATIONS and RISK MANAGEMENT PLAN

It is not feasible to remove all of the risks of building on the site but the risks can be reduced by appropriate engineering design, good hillside construction practices and by regular and frequent site maintenance.

Additional advice on risk reduction is included in "General Recommendations" Section of our report and in the attached Appendices and Report Addendum. We recommend particular attention be paid to the attached AGS "Geoguides" that are presented in Appendix H.

8.1 Site recommendations

The construction of an appropriately designed development may be possible, subject to our recommendations. The proposed development is considered appropriate for the site, provided drainage is improved and excavations are supported by and stabilised in accordance with AGS guidelines, see Appendix H Geoguide LR4.

Note that an increase in landslide risk can be expected if an inappropriate development is undertaken or if site maintenance is neglected. Maintaining the site drainage and monitoring the site and buildings

for any evidence of soil or slope movement are very important aspects of the ongoing site maintenance requirements.

8.2 Drainage management

We recommend a qualified engineer be engaged to design stormwater detention system for this site. The engineer should be mindful not to design deep trenches or pipes near the clay rock interface that can potentially increase land risk potential due to subsurface waters. Careful attention to drainage is essential to reduce the landslide risk and surface water must therefore be prevented from ponding anywhere on or near the site.

Care must also be taken to ensure that all levelled areas (vehicle parking bays, recreation areas etc.) have a slight fall (≥2°) to prevent surface water from ponding or seeping into the ground and diverted away from the buildings.

Past research has identified rainfall and/or poor site drainage as a common trigger of landslide events (et al. Wood 1982, Cooney 1980). This is of particular importance given the recent bushfire activity and subsequent extremely wet season we have recently experienced. Whilst rainfall intensity cannot be controlled, careful site drainage management and design can reduce saturation of the soil layers associated with soil movement.

8.3 Household effluent disposal

Household effluent must be widely dispersed by an enclosed reed bed system or alternatively terraced evapotranspiration beds , positioned laterally and supported with engineer designed retaining walls. Refer to separate land capability assessment report (ref: **15760G-LCA**).

8.4 Site vegetation

Suitable vegetation significantly improves the stability of a site by reducing the soil moisture content, minimising soil erosion and binding the soil structure together. Large trees should be retained wherever possible. Where large tree removal is necessary to accommodate the proposed building, they should be cut off at ground level with the root structures left intact.

As suggested, we also recommend that a re-vegetation program be instigated for the site, particularly due to removed trees that were affected by recent bushfire activity. Revegetation of the site will reduce the risk of slope failures. Suitable vegetation (trees and shrubs) should be established an appropriate distance from the building with regard to fire risk to assist the overall slope stability.

8.5 Site excavations and fill batters

All site excavations and unsupported filled zones deeper than 1.0m must be retained by engineer-designed retaining walls, founded into naturally occurring rock with appropriate drainage features or be constructed with a flat batter angle ~ 30°.

When cut vertically, exposed faces will require protection via engineer designed retaining systems. Alternatively, soil nails / shotcrete may be considered.

The following soil parameters presented in Table 5 may be assumed in the design process.

Table 5.

Soil parameter	Approx. value for colluvium (clay)*	Approx. value for low strength rock#	Approx. value for high strength rock#
Wet density (γ)	1.90 t/m^3	2.10 t/m^3	2.40 t/m^3
Undrained cohesion (cu)	70kPa	73.5kPa	81.2kPa
Drained cohesion (c')	5kPa	3kPa	20kPa
Angle of internal friction (ϕ')	9°	9°	20°

Note 1: * estimated and derived from conservative yet 'typical' values from our previous experience and published information by others.
Note 2: # from laboratory triaxial tests, refer Appendix F

We highly recommend a suitably qualified geotechnical engineer verify the subsurface profile, during construction sequence.

We cannot over emphasise the need for extreme caution when conducting deep excavations or construction near unsupported fill batters in these soils due to the landslide risk and sensitivity of the area.

The construction of appropriately designed walls or battered slopes will reduce the risk of soil movement and the collapse of any proposed site excavations. Cut areas must have a slight fall (≥2°) away from cut interface to prevent surface water from ponding or seeping into the near the base of any site cut.

8.6 Site classification

Australian Standard AS2870-2011 provides the following system of site classification for residential footing designs:

Site Classification	Foundation Type
A	Most sand and rock sites with negligible ground movement from moisture change
S	Slightly reactive clay sites subject to slight ground movement from moisture change
M	Moderately reactive clay sites subject to moderate ground movement from moisture change
H1/H2	Highly reactive
E	Extremely reactive
P	Sites with environmental factors that may affect the performance of the building including trees, deep fill, recently removed building, abnormal moisture conditions, soft soils, landslide risk or erosion.

NOTE 1: AS2870-2011 recommends a site inspection during excavation to confirm the soil profile.
NOTE 2: The above classification is made assuming that the site will not change significantly before construction of the proposed building. Site cuts greater than 500mm or the placement of addition uncontrolled fill is considered a significant change and the site may need to be re-classified.

We have classified the soil profile as “P” in accordance with Section 2 of AS2870-2011 (Australian Standard on Residential Slabs and Footings), due to the landslide risk (clause 2.1.3 (d)).

We recommend that an experienced engineer be commissioned to design footings, drainage systems and any retaining structures for the proposed residence.

8.7 Pad footings

Our testing indicates that “‘weathered rock” starts about 1.0m below surface however due to the variable rock strength and landslide risk, we recommend footings extent into higher strength rock, at a depth of about 8m below the existing surface level. An allowable bearing capacity of at least 1000kPa (1MPa) may be assumed for higher strength rock at about 8m below the existing surface level.

The above quoted depth to high strength rock is estimated from limited data and the depth to rock quality can vary significantly over short distances and on this basis, we recommended an inspection by a suitability qualified geotechnical engineer at time of excavation to verify founding depth.

We cannot understate the importance of verifying the founding depth, given the variable nature of rock encountered. We expect the landslide risk will increase potentially to unacceptable levels, without these measures.

We recommend engineer-designed footings designed according to the principles of AS 2870-2011 Section 4 and constructed in accordance with Sections 5 & 6, capability of resisting mass soil movements.

Having all footings appropriately designed and founded will reduce the risk of damage due to soil movement or slope failures.

8.8 General recommendations

The satisfactory performance of buildings on this site depends on good engineering and building practice. This includes:

a) Design of an appropriate development for the site;

b) Use of flexible construction materials whenever possible which are “movement tolerant” (e.g. clad frame is preferable to brick and articulated brick or stone walls are preferable to non-articulated);

c) Minimisation of site excavations wherever possible and the provision of adequate retaining structures and drainage for cut faces (or batter at an appropriate angle);

d) A re-vegetation program including planting suitable trees and shrubs (preferably indigenous) at an appropriate distance from the buildings to help support the soil and minimise erosion;

e) Appropriate site drainage to ensure surface water, excess roof water and household effluent does not pond or seep into the ground near building envelope;

f) Diversion on uncontained water around the building envelope area and be widely dispersed laterally well below the house site;

g) regular maintenance by the owner, including clearing of surface drains, sub-surface drains, repair of leaking plumbing, monitoring the site and buildings for any evidence of soil or slope movement and seeking immediate advice should any building distress become apparent.

Refer also to the attached Appendices for more general advice.

ST QUENTIN CONSULTING

Cameron Farrar
Geotechnical Engineer, MIE Aust (Reg No 4367740)

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Appendix A

Geomorphological site plans

ST. QUENTIN
Surveyors •Town Planners •Engineers
51 LITTLE FYANS STREET,
P.O. BOX 919, GEELONG 3220
TELEPHONE (03) 5201 1811 FAX (03) 5229 2909

Area geomorphological plan:
31-33 Riverside Drive Wye River

Aerial photography nearmap.com (Nov 2016)

Legend:

	Test site
	Study area
	Break in slope convex
	Break in slope concave
	Retaining wall

	Landslide feature
	Ridgeline
	Slope
	Inferred colluvium
	Water course

Project Ref:15760G

N
mga zone 55

ST. QUENTIN
Surveyors •Town Planners •Engineers
51 LITTLE FYANS STREET,
P.O. BOX 919, GEELONG 3220
TELEPHONE (03) 5201 1811 FAX (03) 5229 2909

Detailed site geomorphological plan:

36-38 Riverside Drive, Wye River

Aerial photography nearmap.com (Nov 2018)

Legend:

Test site	Landslide feature
Study area	Ridgeline
Break in slope convex	Slope
Break in slope concave	Inferred colluvium
Retaining wall	Land Application Area (ETA beds)

Project Ref:15760G

N

mga zone 55

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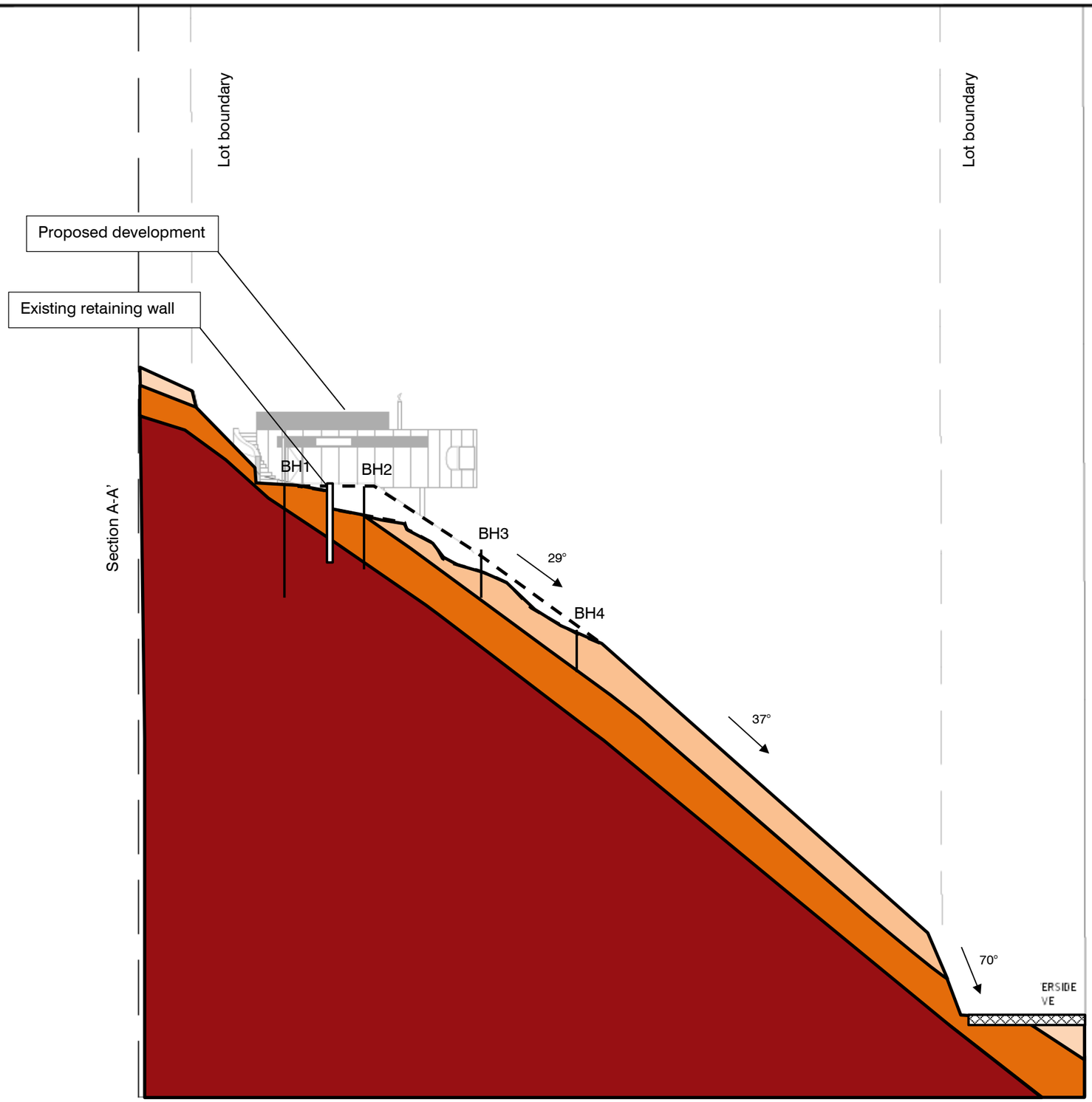
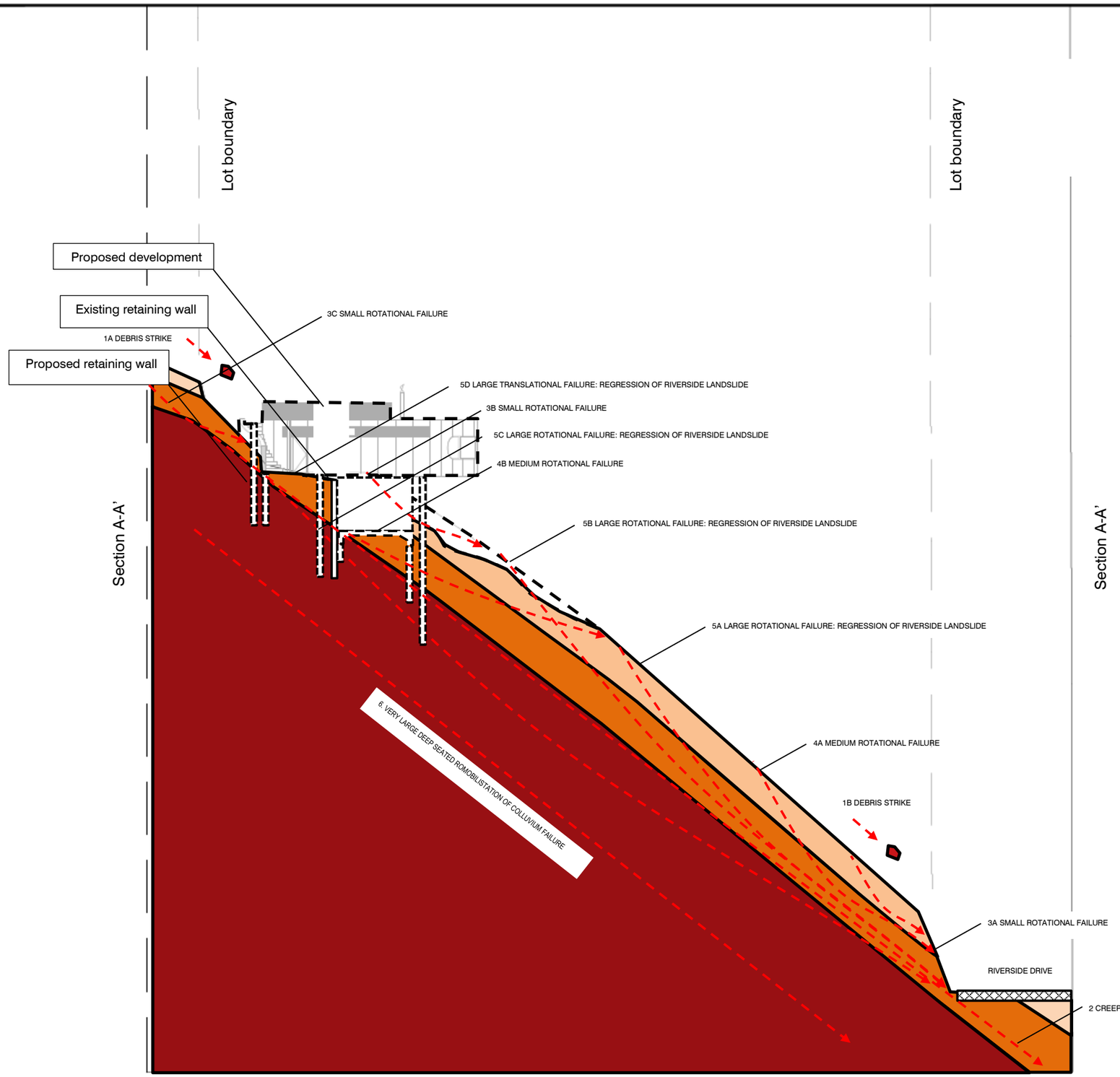
Appendix B

Geological model, hazard modes

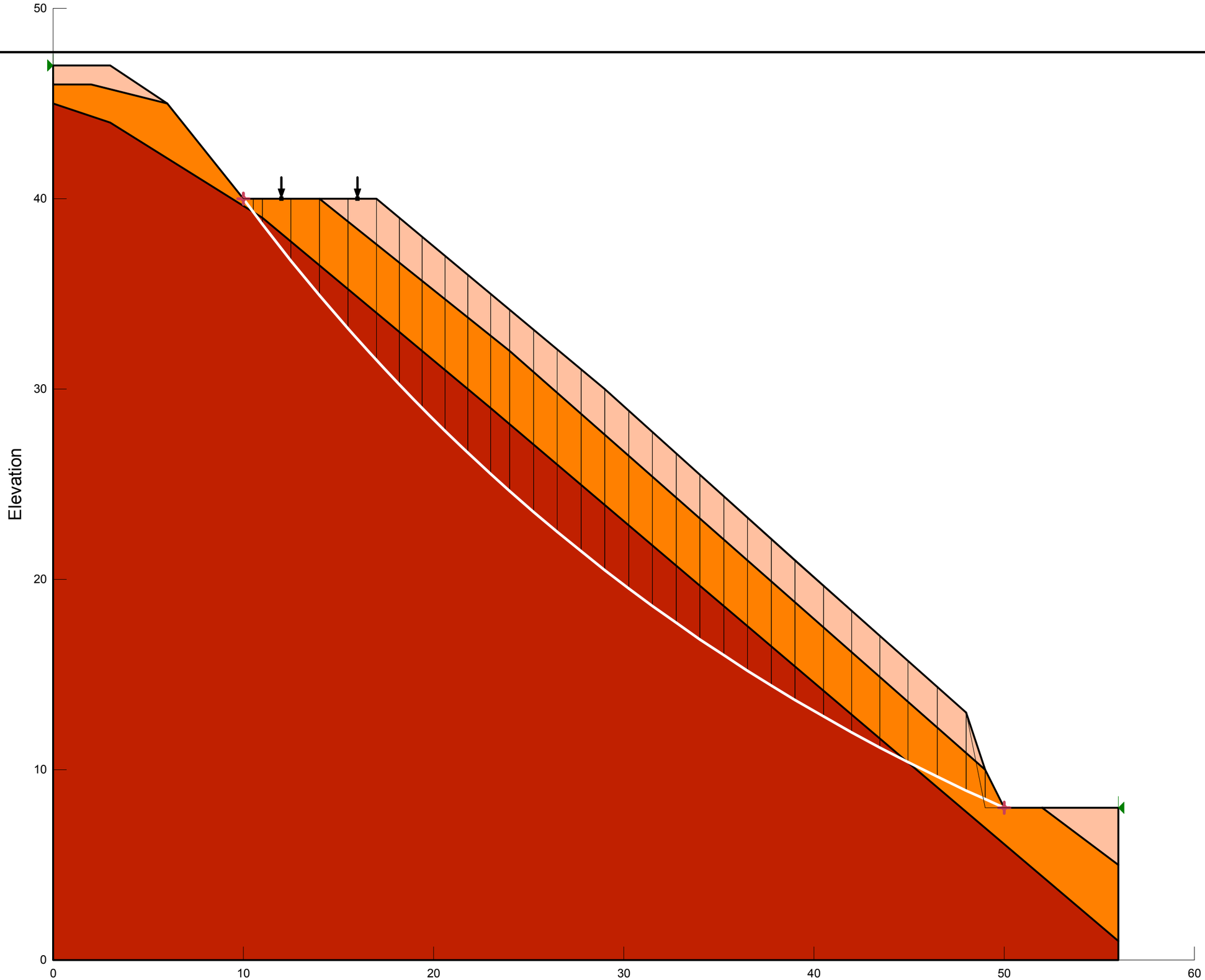
& Slope Stability Analysis (Slope/W)



PROJECT NO: 15760G DATE: 14.12.18	36 & 38 RIVERSIDE DRIVE WYE RIVER	ST. QUENTIN Surveyors - Town Planners - Engineers 51 LITTLE RYANS STREET, P.O. BOX 919, GEELONG 3220 TELEPHONE (03) 5201 1811 FAX (03) 5229 2909	COLLUVIUM FILL	LOW STRENGTH ROCK HIGHER STRENGTH ROCK	0 1 2 3 4 5m
DRAWN BY: A.V APPROVED BY: C.F	GEOTECHNICAL MODEL SECTION A-A'				



Project No.14807-E	36 & 38 RIVERSIDE DRIVE WYE RIVER	ST. QUENTIN Surveyors, Town Planners, Engineers 51 LITTLE FYANS STREET, P.O. BOX 918, GEELONG 3220 TELEPHONE (03) 5201 1811 FAX (03) 5229 2909	COLLUVIUM, FILL, LOW STRENGTH ROCK, HIGHER STRENGTH ROCK
DRAWN BY: A.V APPROVED BY: C.F	GEOTECHNICAL MODEL & HAZARD MDES		



Slope Stability	
36-38 Riverside Drive Wye River SlopeW Dec18 safe.gsz	
17/12/2018	1:200

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Appendix C

Borelogs

BOREHOLE LOG

Test Methods:
AS1289.1.2.1 VicRoads TB40
AS1289.6.3.2 AustStab Nat07
AS1726 AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive, Wye River , Victoria

Project No.: 15760G
Borehole No: BH 1
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description (Type, Plasticity, Colour, Particle characteristics)	Degree of Weathering (XW HW MW SW FS)	Soil Profile Photograph	Rock Strength (L M H EH)	Sample / Test	Test Results	Geology and additional observations
0.8		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'		Power Auger		SPT	N: 27	
1.5	1.50							
		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
2.3	2.50					SPT	N: 28	
3.0		Highly weathered rock (HW) Low to moderate strength rock, sandstone, yellow/orange		Wash Bore				
3.8						SPT	N: 22+ /150mm hammer bouncing	
4.5								
5.3						SPT	N: 22+ /150mm hammer bouncing	
6	6.00							
		Moderately weathered rock (MW) Moderate strength rock, sandstone, yellow						
6.8	7.00							
		Slighly weathered rock (MW) Higher strength rock, sandstone, yellow		Wash Bore		SPT	N: 20+ /40mm hammer bouncing	
7.5				Discontinuity @ 7.4m (0°)				
				Discontinuity @ 7.8 (60°)				
8.3				Discontinuity @ 8.0m (60°)				
				Discontinuity @ 8.5m (60°)				
9	9.00			Discontinuity @ 8.8m (60°)				
		Borehole 1 terminated at 9m						

Method:
- ☐ Hand Auger
- ☑ Auger Drilling
- ☐ Roller/Tricone
- ☑ Washbore
- ☐ Non Destructive Digging

Degree of Weathering
- XW Extremely Weathered Rock
- HW Highly Weathered Rock
- MW Moderaltely Weathered Rock
- SW Slightly Weathered Rock
- FR Fresh Rock

Rock Strength
- L Low
- M Medium
- H High
- EH Extremely High

Samples & Field Tests
- U50 Undisturbed Sample 50mm
- U63 Undisturbed Sample 63mm
- DS Disturbed Sample
- BS Bulk Disturbed Sample
- ES Environmental Sample
- PP Pocket Penetrometer (kPa)
- N Standard Penetration Test
- V Pilcon Shear Vane (kPa)
- DCP Dinamic Cone Penetrometer Test

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive,
Wye River , Victoria

Project No.: 15760G
Borehole No: BH 2
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description (Type, Plasticity, Colour, Particle characteristics)	Degree of Weathering (XW HW MW SW FS)	Soil Profile Photograph	Rock Strength (L M H EH)	Sample / Test	Test Results	Geology and additional observations
0.8		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'		Power Auger		SPT	N: 8	
1.5	1.50							
		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow				SPT	N: 18+ /50mm	
2.3	2.10						hammer bouncing	
	2.50	Highly weathered rock (HW) Low strength rock, sandstone, yellow/orange						
		Borehole 2 terminated at 2.5m						
3.0								
3.8								
4.5								
5.3								
6								
6.8								
7.5								
8.3								
9								

Method:
- ☐ Hand Auger
- ☑ Auger Drilling
- ☐ Roller/Tricone
- ☐ Washbore
- ☐ Non Destructive Digging

Degree of Weathering
- XW Extremely Weathered Rock
- HW Highly Weathered Rock
- MW Moderaltely Weathered Rock
- SW Slightly Weathered Rock
- FR Fresh Rock

Rock Strength
- L Low
- M Medium
- H High
- EH Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive, Wye River , Victoria

Project No.: 15760G
Borehole No: BH 3
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Degree of Weathering XW HW MW SW FS	Soil Profile Photograph	Rock Strength L M H EH	Sample / Test	Test Results	Geology and additional observations
0.2		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'						
0.5								
0.7								
0.9								
1.2								
1.4								
1.50								
1.6		COLLUVIUM (SAND/CLAY), stiff, medium plasticity, yellow, moist						
1.70								
1.8		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
2.1								
2.3								
2.5								
2.8								
2.80		Borehole 3 refused at 2.8m						

Method:
- [x] Hand Auger
- [ ] Auger Drilling
- [ ] Roller/Tricone
- [ ] Washbore
- [ ] Non Destructive Digging

Degree of Weathering

XW	Extremely Weathered Rock
HW	Highly Weathered Rock
MW	Moderaltely Weathered Rock
SW	Slightly Weathered Rock
FR	Fresh Rock

Rock Strength

L	Low
M	Medium
H	High
EH	Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive,
Wye River , Victoria

Project No.: 15760G
Borehole No: BH 4
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Degree of Weathering XW HW MW SW FS	Soil Profile Photograph	Rock Strength L M H EH	Sample / Test	Test Results	Geology and additional observations
0.2		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'						
0.5								
0.7								
0.80		Silty SAND (SMI), dense, fine to medium grained, yelloe						
0.9								
1.00		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
1.2								
1.4								
1.40		Borehole 4 refused at 1.4m						
1.6								
1.8								
2.1								
2.3								
2.5								
2.8								

Method:
- [x] Hand Auger
- [ ] Auger Drilling
- [ ] Roller/Tricone
- [ ] Washbore
- [ ] Non Destructive Digging

Degree of Weathering

XW	Extremely Weathered Rock
HW	Highly Weathered Rock
MW	Moderaltely Weathered Rock
SW	Slightly Weathered Rock
FR	Fresh Rock

Rock Strength

L	Low
M	Medium
H	High
EH	Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

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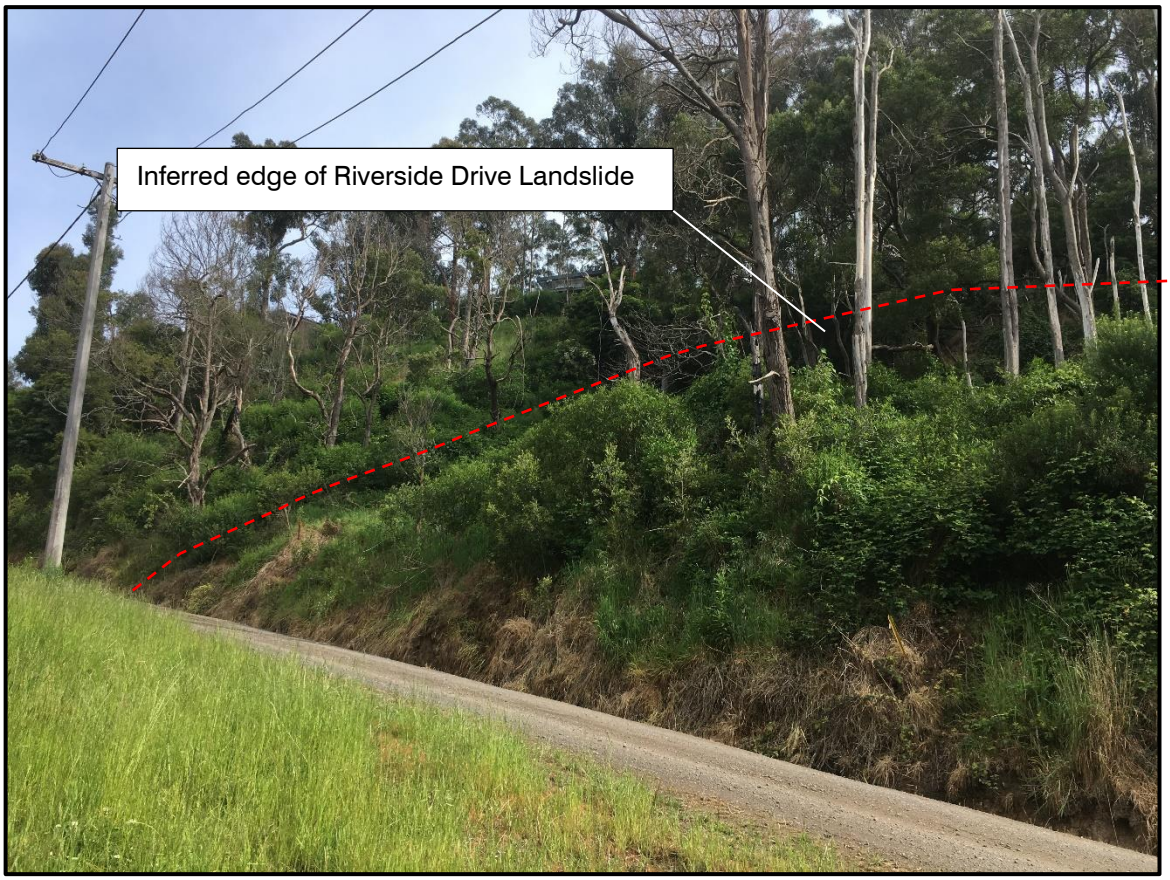
Appendix D

Site photographs

Drilling Program, November 2018

Drilling Program, November 2018 (detail)

Rock core sample, approximately 7.0-7.4m



North east view: existing site, note overturning retaining structure

North east view: existing site and proposed building envelope

South west view: existing site, downslope view

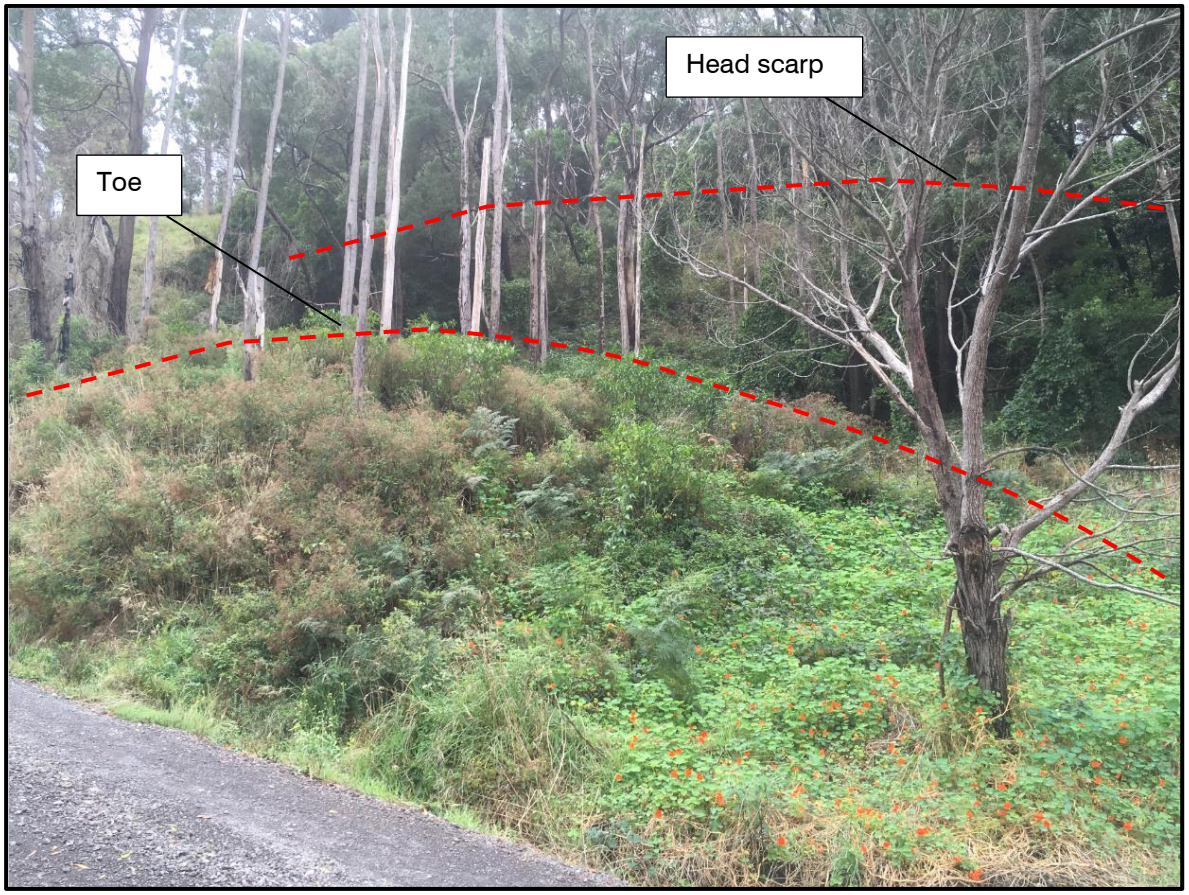
West view: existing site, mid-slope

North view: existing site, mid-slope

South west view-Riverside Drive-suspected toe of Illowra Slide

Riverside Drive-recent remedial works including geo-mesh and rock bolting

South east view: adjacent site, downslope view. Note large previous landslide scarp



North west view from Riverside Drive: adjacent site, large previous landslide scarp and toe (note toe extends south past Riverside Drive

Existing site surface. Colluvium with embedded cobble/rock, indicating previous landslide movement

Existing site slope. East view

Existing site. Fill/recent spoil placement., note scarp outline, indicating soil movement / possible slope instability

Fill/recent spoil placement, detail of scarp outline

Adjacent site (north). Note existing drain and poorly graded drainage

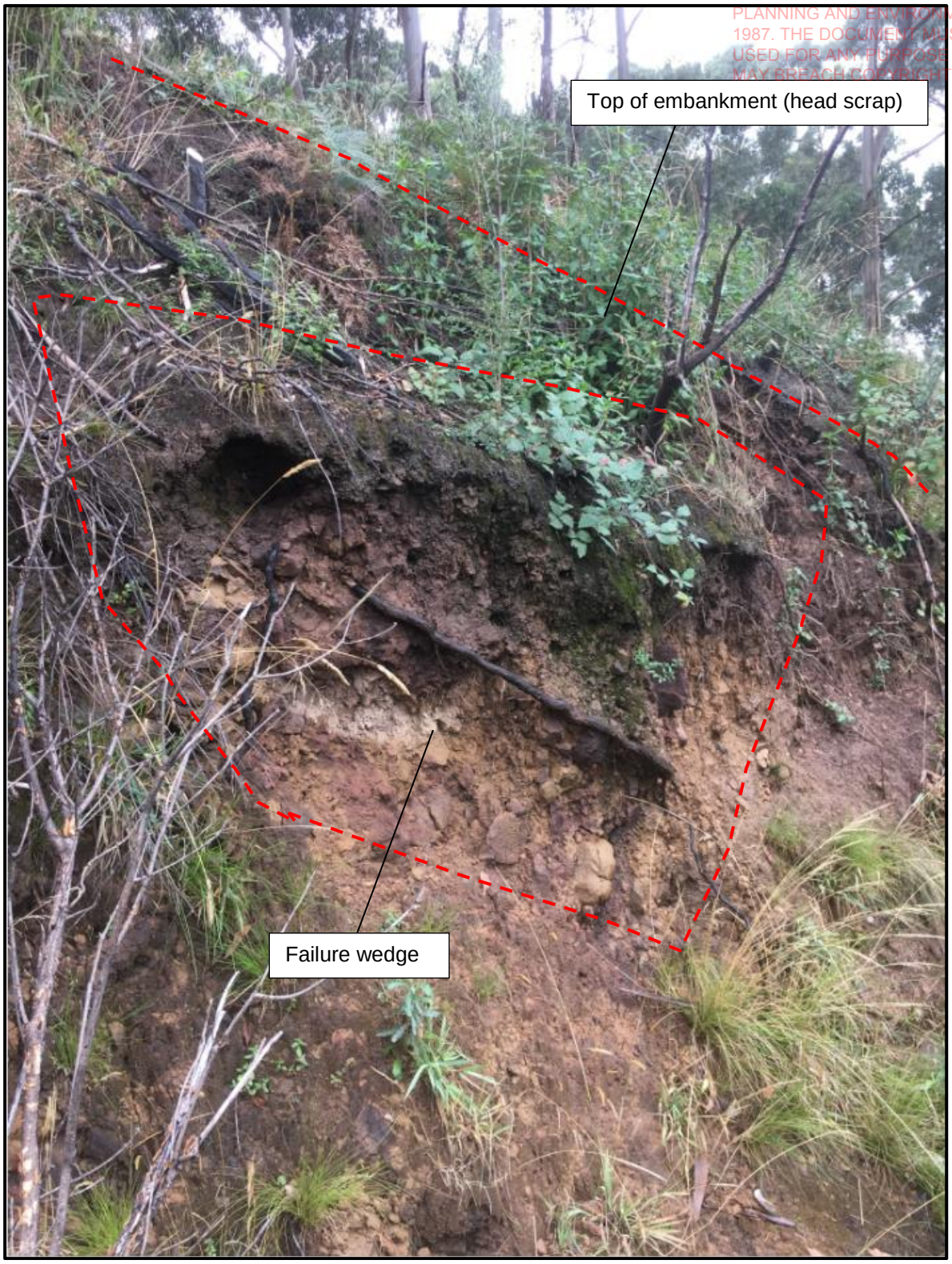
Adjacent site (north). Existing effluent disposal system

Adjacent site (north). Existing effluent disposal system, irrigation discharge hose (onto downslope site)

Adjacent site (north). View to the south, toward the subject site at 36 Riverside Drive, Wye River

Existing site cut, top of site, note recent failure at top of embankment

Existing site cut, low strength rock and evidence of colluvium



Existing site cut (wide view) top of site, note small failure wedge at top of embankment

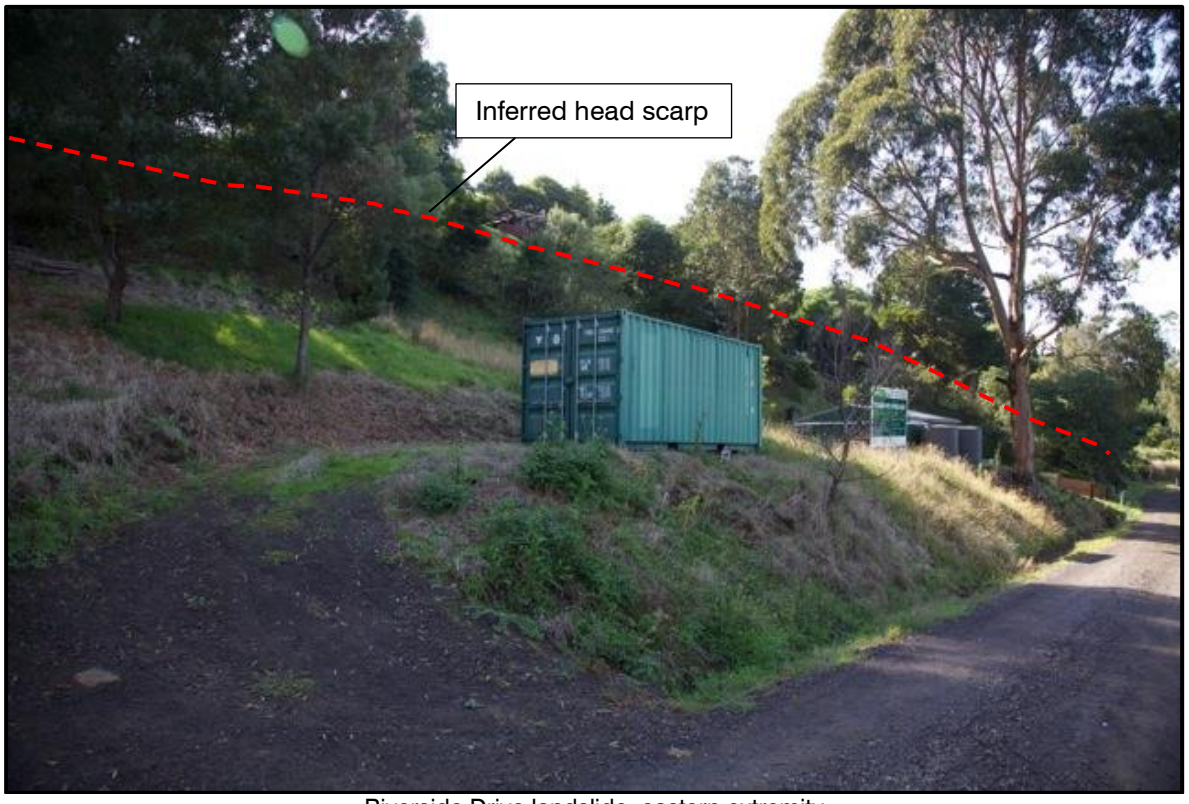
Existing site cut, bottom of site along Riverside Drive, note failure wedge-photo 1

Existing site cut along Riverside Drive, note failure wedge and uneven tree alignment indicating previous slope movement-photo 2

Adjacent site No. 42 Riverside Drive-low strength rock (possible colluvium in cutting)

Riverside Drive cutting, displaced boulder size rocks at base of road cutting

Riverside Drive Slide, western extremity



Riverside Drive landslide, eastern extremity

Riverside Drive road cutting, distressed face, imminent small failure

Riverside Drive road cutting, distressed face, imminent small failure-detail

Riverside Drive, bedding angle into slope, indicating possible deep-seated movement

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Appendix E

Aerial photographs

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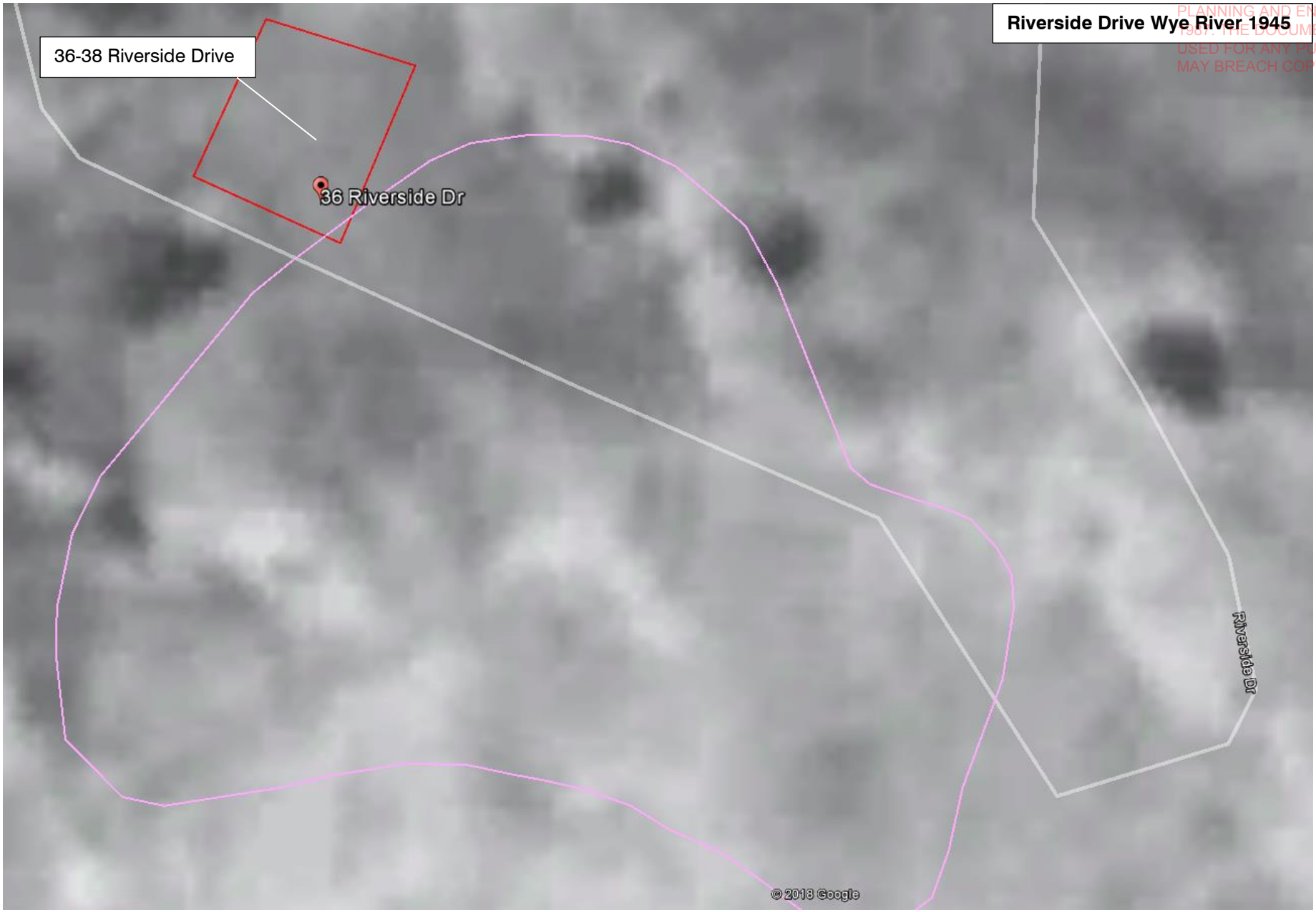

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Appendix F

Laboratory Results

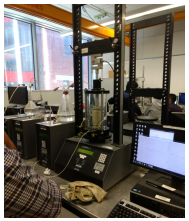
Triaxial Compression Test Report

Swinburne University
John Street Hawthorn
Victoria 3122
PH 03 9214 5408

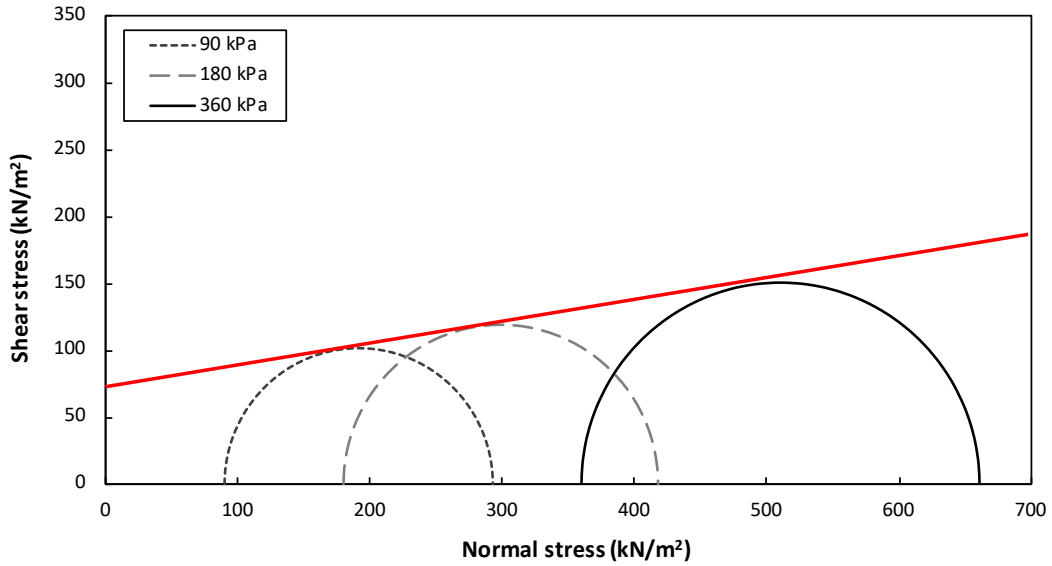
Client:	ST. QUENTIN
Project:	Triaxail Compression Test
Location:	AMDC 201
Sample ID:	Core
Type of Specimen	Undisturbed
Date Tested:	4/12/18

Test Photos:





Test	**1**	**2**	**3**
Sample Weight (g)	506.1	491.6	483.5
Initial Water Content (%)	17.50	19.11	18.80
Initial Dry Density (Mg/m3)	2.19	2.10	2.13
Normal stress (kPa)	90	180	360
Peak Shear Strength (kPa)	203	238	301
Cohesion (kPa)	**73.5**		
Friction Angle (degree)	**8.8**		



Comments: Silty clay sample with some rock aggregates

Tested By: Farshid Maghool
Javad Yaghoubi

Approved By: Farshid Maghool
Labortory Manager
Date:
6/12/18

Triaxial Compression Test Report

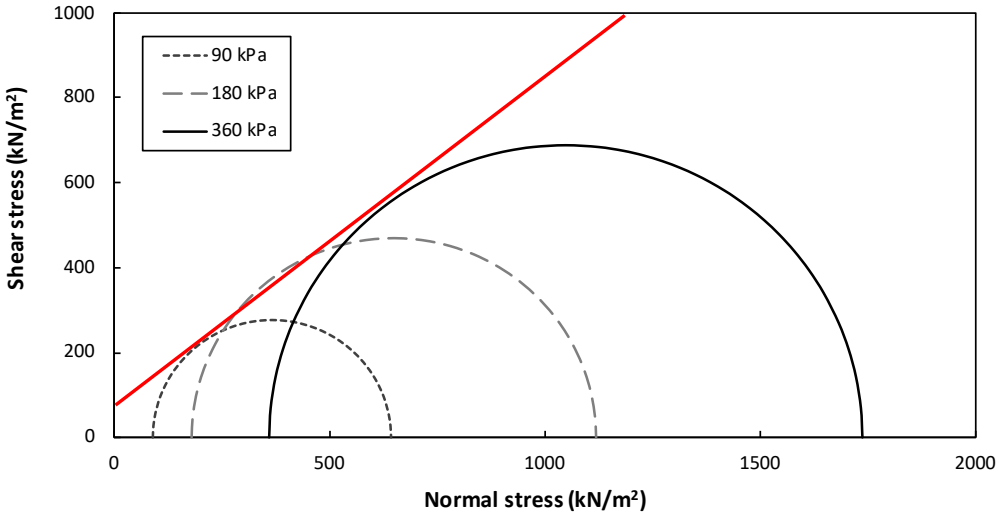
Swinburne University
John Street Hawthorn
Victoria 3122
PH 03 9214 5408

Client:	ST. QUENTIN
Project:	Triaxail Compression Test
Location:	AMDC 201
Sample ID:	Core
Type of Specimen	Undisturbed
Date Tested:	4/12/18

Test Photos:

Test	**1 Sample (3 Confining Stages)**
Sample Weight (g)	475.2
Initial Water Content (%)	8.95
Initial Dry Density (Mg/m3)	2.22

Normal stress (kPa)	90	180	360
Peak Shear Strength (kPa)	553	939	1377
Cohesion (kPa)	**81.2**		
Friction Angle (degree)	**36.9**		



Comments: Rock sample

Tested By: Farshid Maghool
Javad Yaghoubi

Approved By: Farshid Maghool
Labortory Manager
Date:
6/12/18

Appendix G

Geotechnical Declaration: Form A

FORM	A	**Geotechnical Declaration and Verification Development Application**
Office Use Only		

To be submitted with planning application. It must accompany the Geotechnical Assessment and/or Landslip Risk Assessment. This form is essential to verify that the Geotechnical Assessment and/or Landslip Risk Assessment has been prepared in accordance with Cl 44.01 of the Colac Otway Planning Scheme and that the author of the Assessment/s is a geotechnical engineer or engineering geologist as defined by this clause.

Section 1	**Related Application**	
Planning Application Number (if known)		
DA Site Address	**36-38 Riverside Drive, Wye River**	
DA Applicant	**Damon Eisen**	

Section 2	**Geotechnical Assessment and /or Landslip Risk Assessment**	
Details	Title: **Geotechnical Assessment of Landslide Risk at 36-38 Riverside Drive, Wye River**	
	Author's Company/Organisation Name: **St Quentin Consulting**	Report Reference No: **15760G -LRA**
	Author: **Cameron Farrar**	Dated: **February 2018**

Section 3 Checklist

Geotechnical Requirements (Tick as appropriate)

Assessment and/or Landslip Risk Assessment. The report must also cover any additional matters required by Clause 44.01. This checklist must accompany each report. Each item is to be cross-referenced to the section or page of the Geotechnical Assessment and/or Landslip Risk Assessment which addresses that item.

Yes	No	
✓		A review of readily available history of slope instability in the site or related land as per: **Section 4.1 and 4.3**
✓		An assessment of the risk posed by all reasonably identifiable geotechnical hazards as per: **Section 6**
✓		Plans and sections of the site and related land as per: **Section 4.2.2** and **Appendix A & B**
✓		Presentation of a geological model as per: **Section 4.2.3** and **Appendix A & B**
✓		Photographs and/or drawings of the site as per: **Appendix A, B & D**
✓		A conclusion as to whether the site is suitable for the development proposed to be carried out as per: **Section 7**
		If any items above are ticked No, an explanation is to be included in the report to justify why.

Yes	No	**Subject to recommendations and conditions relevant to:**
✓		Selection and construction of footing systems
✓		Earthworks
✓		Surface and sub surface drainage
✓		Recommendations for the selection of structural systems consistent with the geotechnical assessment of the risk
✓		Any conditions that may be required for the ongoing mitigation and maintenance of the site
	✓	Highlighting and detailing the inspection regime to provide adequate notification for all necessary inspections
✓		State Design life adopted: 50 years

NOTE: THIS FORM IS ADAPTED FROM: PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007
Australian Geomechanics Vol 42 No 1 March 2007

FORM	A	**Geotechnical Declaration and Verification Development Application**

Section 4 List of pertinent drawings and documents referenced in Geotechnical Report

Document	Description	Reference	Date
Schedule	Drawing Schedule	TP00	Dec 2018
Existing Site plan	Existing Site Plan	TP01	Dec 2018
Proposed Site plan 1	Proposed Site Plan (option 1)	TP02A	Dec 2018
Proposed Site plan 2	Proposed Site Plan (option 2)	TP02B	Dec 2018
Floor Plan	Proposed Floor Plan	TP03	Dec 2018
Elevations 1	Proposed North and East Elevations	TP04	Dec 2018
Elevations 2	Proposed South and West Elevations	TP05	Dec 2018
Sections	Proposed Sections A/A and B/B	TP06	Dec 2018

Section 5 Declaration

Declaration (Tick all that apply)				**I am a geotechnical practitioner as defined by the Schedule 1 to the Erosion Management Overlay and on behalf of the company below:**
Yes	✓	**No**		I am a geotechnical engineer or engineering geologist as defined by the Colac Otway Planning Scheme and on behalf of the company below
Yes	✓	**N/A**		I am aware that the Geotechnical Assessment and/or Landslip Risk Assessment I have either prepared or am technically verifying (referenced above) is to be submitted in support of a planning application for the proposed development site (referenced above) and its findings will be relied upon by the Colac Otway Shire Council in determining the planning application
Yes	✓	**N/A**		I prepared the Geotechnical Assessment and/or Landslip Risk Assessment referenced above in accordance with the Colac Otway Planning Scheme and the AGS Guidelines 2007as defined in the planning scheme.
Yes	✓	**No**		I technically verify that the Geotechnical Assessment and/or Landslip Risk Assessment referenced above has been prepared in accordance with the Colac Otway Planning Scheme and the AGS Guidelines 2007 as appropriate.
Yes		**No**	✓	I technically verify that the Geotechnical Assessment prepared for the planning application for the site confirms the land can meet the acceptable risk criteria specified in the schedule to Clause 44.01 of the Colac Otway Planning Scheme taking into account the total development and site disturbance proposed.
Yes	✓	**No**		I technically verify that the Landslip Risk Assessment prepared for the planning application for the site confirms the land can meet the tolerable risk criteria specified in the schedule to Clause 44.01 of the Colac Otway Planning Scheme taking into account the total development and site disturbance proposed.

Section 6 Geotechnical Engineer or Engineering Geologist Details

Company/ Organisation Name	**St Quentin Consulting**	
Name (Company Representative)	Surname: **Farrar**	Mr /Mrs /Other: **Mr**
	Given Names: **Cameron**	
	Chartered Professional Status: **Member Institute of Engineers**	Registration No: **4367740**
Signature		Dated: **18/12/2018**

Reference: AGS Guidelines 2007c "Practice Note Guidelines for Landslide Risk Management", Australian Geomechanics Society, Australian Geomechanics. V42. N1 March 2007.

Appendix H

AGS "Geogrids"

AUSTRALIAN GEOGUIDE LR4 (LANDSLIDES IN ROCK)

ROCK SLOPE HAZARD REDUCTION MEASURES

Removal of loose blocks - may be effective but, depending on rock type, ongoing erosion can result in more blocks becoming unstable within a matter of years. Routine inspection, every 5 or so years, may be required to detect this.

Rock bolts and rock anchors (Figure 5) - can be installed in the ground to improve its strength and prevent individual blocks from falling. Rock bolts are usually tightened using a torque wrench, whilst rock anchors carry higher loads and require jacking. Both can be designed to be "permanent" using stainless steel, or sheathing, to inhibit corrosion, but the cost can be up to 10 times that of the "temporary" alternative. You should inspect rock bolts and rock anchors for signs of water seepage, rusting and deterioration around the heads at least once every 5 years. If you notice any of these warning signs, have them checked by a geotechnical practitioner. It is recommended that you keep copies of design drawings and maintenance records (GeoGuide LR11) for the anchors on your site and pass them on to the new owner should you sell.

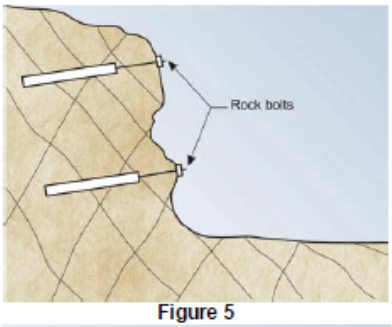


Figure 5

Rock fall netting, catch fences and catch pits (Figure 6) - are designed to catch or control falling rocks and prevent them from damaging nearby property. You should inspect them at least once every 5 years, and after major falls, and arrange for fallen and trapped rocks to be removed if they appear to be filling up. Check for signs of corrosion and replace steel elements and fixings before they lose significant strength.

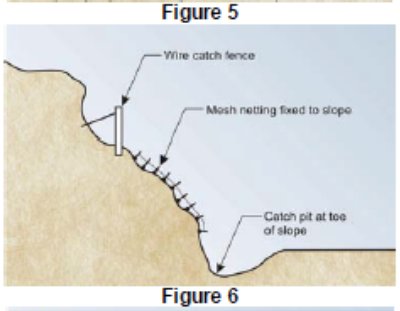


Figure 6

Cut-off drains (Figure 7) - can be used to intercept surface water run-off and reduce flows down the cliff face. Suitable drains are often excavated into the rock, or constructed from mounds of concrete, or stabilised soil, depending on conditions. Drains must be laid to a fall of at least 1% so they drain adequately. Frequent inspection is needed to ensure they are not blocked and continue to function as intended.

Clear trees and large bushes (Figure 7) - from slopes since roots can prize boulders from the face increasing the landslide hazard.

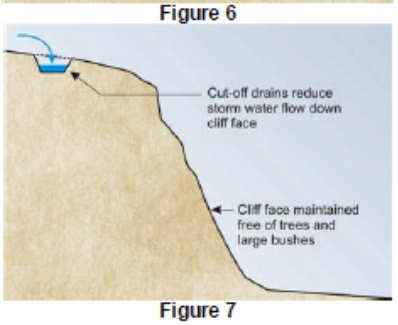


Figure 7

Natural cliffs and bluffs - often present the greatest hazard and yet are easily overlooked, because they have "been there forever". They can exist above a building, road, or beach, presenting the risk of a rock falling onto whatever is below. They also sometimes support buildings with a fine view to the horizon. Cliffs should be observed frequently to ensure that they are not deteriorating. You may find it convenient to use binoculars to look for signs of exposed "fresh" rock on the face, where a recent fall has occurred, or to go to the foot of the cliff from time to time to see if debris is collecting. A thorough inspection of a cliff face is often a major task requiring the use of rope access methods and should only be undertaken by an appropriately qualified professional. If tension cracks are observed in the ground at the top of a cliff take immediate action, since they could indicate imminent failure. **If you have any concerns at all about the possibility of a rock fall seek advice from a geotechnical practitioner.**

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

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

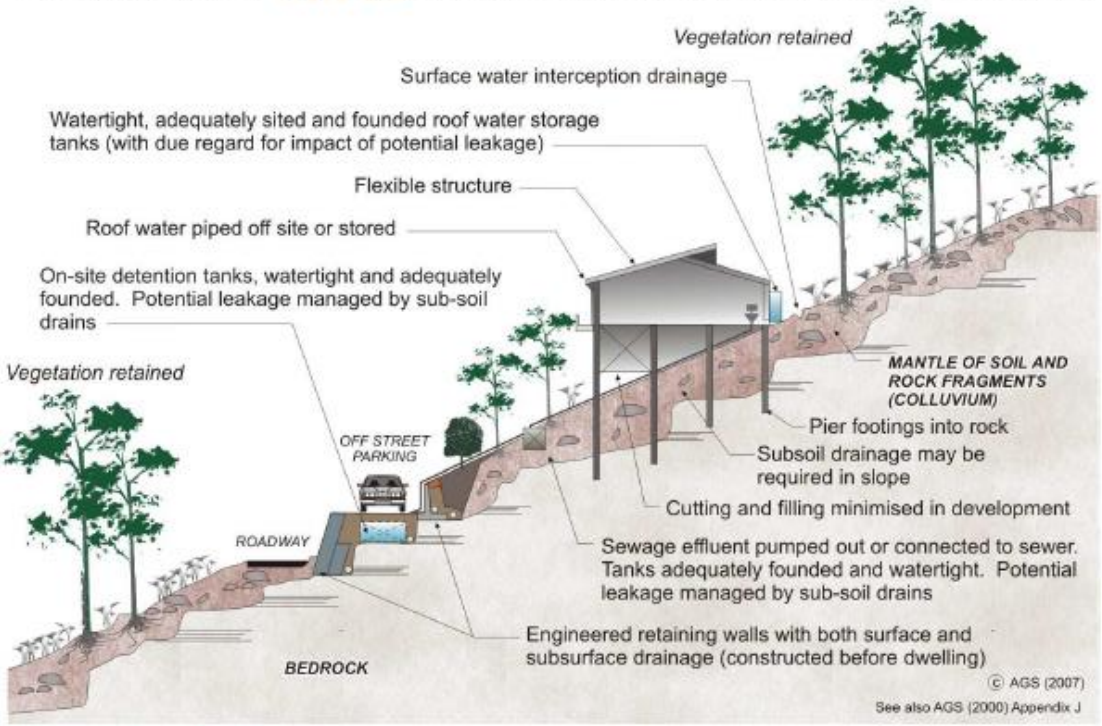
The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to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

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

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

EXAMPLES OF GOOD HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES GOOD?

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

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

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

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

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

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

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

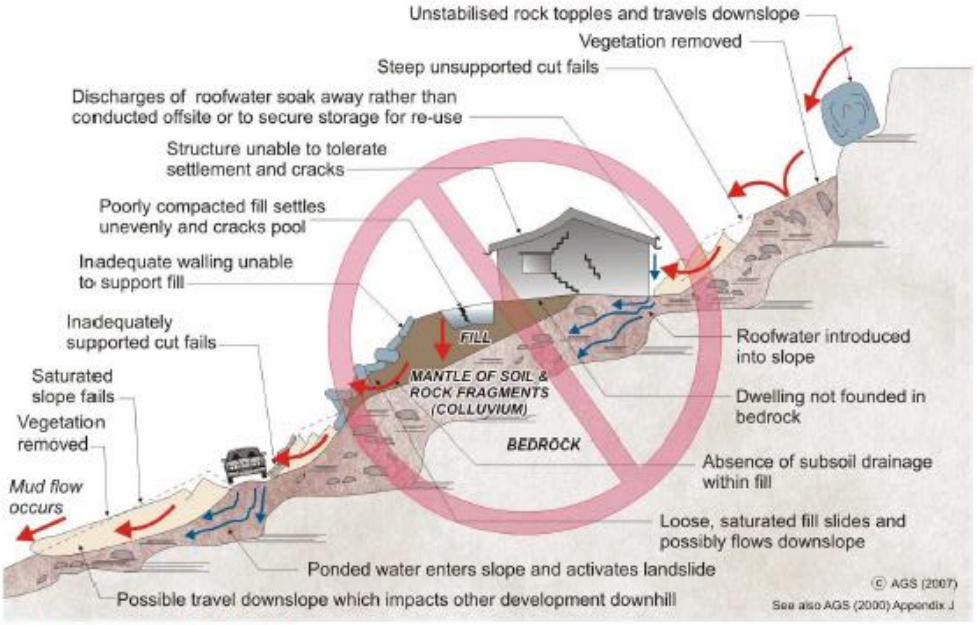
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing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

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

ADOPT GOOD PRACTICE ON HILLSIDE SITES

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

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

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

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

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

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

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

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

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

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

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

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

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	

ST. QUENTIN

Appendix I

AGS Terminology in assessing risk

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or L (5)
B - LIKELY	10^{-2}	VH	VH	H	M	L
C - POSSIBLE	10^{-3}	VH	H	M	M	VL
D - UNLIKELY	10^{-4}	H	M	L	L	VL
E - RARE	10^{-5}	M	L	L	VL	VL
F - BARELY CREDIBLE	10^{-6}	L	VL	VL	VL	VL

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

ST. QUENTIN

Appendix J

Architectural Drawings

36 RIVERSIDE DRIVE, WYE RIVER

DRAWING SCHEDULE

DRAWING #	DRAWING NAME	SCALE	REVISION	REV DATE
TP00	DRAWING SCHEDULE	-	-	-
TP01	EXISITNG SITE PLAN	1 : 200	-	-
TP02A	PROPOSED SITE PLAN (OPTION 1)	1 : 200	-	-
TP02B	PROPOSED SITE PLAN (OPTION 2)	1 : 200		
TP03	PROPOSED FLOOR PLAN	1 : 100	-	-
TP04	PROPOSED NORTH AND EAST ELEVATIONS	1 : 100	-	-
TP05	PROPOSED SOUTH AND WEST ELEVATIONS	1 : 100	-	-
TP06	PROPOSED SECTIONS A/A AND B/B	1 : 100	-	-

#	DATE	REVISION

GENERAL NOTES

Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36 RIVERSIDE DRIVE
WYE RIVER

DRAWING
DRAWING SCHEDULE

PROJECT #	DRAWN
SCALE -	DRAWING # A00
DATE DEC 2018	

#	DATE	REVISION

GENERAL NOTES

LEGEND

5.24

4.55

CARRIAGEWAY EASEMENT

(18.04)
(278°14')

55

PEG

(98°14')
(18.06 TO CLOSE)
(18.04 TITLE)

TOP OF BANK

PEG

55

(98°14')
(18.06 TO CLOSE)
(18.04 TITLE)

PEG

50

4.5m WIDE CARRIAGEWAY EASEMENT

GRAVEL DRIVEWAY

EXISTING HOUSE

BALCONY

OUTLINE SHOWS LOCATION OF PREVIOUS HOUSE PRIOR TO FIRE

STL. POSTS

50

45

LINE NL. IN DUMPY PEG

(16°31')
(38.91)

TOE OF BANK

TOP OF BANK

(16°12')
(41.62 TO CLOSE)
(41.60 TITLE)

RET. WALL

45

LINE NL. IN DUMPY PEG

No. 40
LOT 51
LP 27735

40

No. 38
LOT 50
LP 27735
724m²
(VACANT)

UPDATED BAL SEPT 2016

BAL-40
BAL-FZ

40

(41.34 TO CLOSE)
(44.32 TITLE)
(195°55')

35

No. 36
LOT 49
LP 27735
774m²
(VACANT)

UPDATED BAL SEPT 2016

No. 34
LOT 48
LP 27735
(VACANT)

32.18

NOT MARKED

30

30

30

(18.11)
(286°53')

TOE

NOT MARKED

25.39

OF

(18.11)
(286°53')

BANK

PEG

25

GRAVEL

ROAD

20

RIVERSIDE DRIVE

Exisitng Site Plan

scale 1 : 200

Bellemo & Cat
176 High Street Northcote
ph 96700039 **fx** 96700097 **mb** 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
EXISTING SITE PLAN

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP01
DATE DEC 2018	

#	DATE	REVISION

GENERAL NOTES

LEGEND

EXISTING HOUSE

BALCONY

4.5m WIDE CARRIAGEWAY EASEMENT

GRAVEL DRIVEWAY

FIRE FIGHTING WATER SUPPLY OUTLET connected to water tank with minimum 10000L reserved for firefighting. Pipework and fittings with a minimum of 65mm (excluding the CFA coupling) to achieve 20 lts/sec at the CFA pump

CARPARKING X 2
RL 51.00

CONCRETE RETAINING WALL

FORMED CONCRETE RETAINING WALL

ENGINEERED RETAINING WALL
GALVANISED STEEL UPRIGHTS WITH CONCRETE SLEEPERS

ROOF TERRACE
PEBBLED SURFACE

BOX GUTTER

FALL

COLORBOND ROOF COLOUR: TERRAIN

MODWOOD DECK (WATER TANK AND STORAGE BELOW)

EXISTING RETAINING WALL

TERRACED ETA BEDS (OPTION 1) (62m2)

CONCRETE RETAINING WALLS

RET. WALL

UPDATED BAL SEPT 2016

BAL-40
BAL-FZ

NOT MARKED

Engineer-designed geofabric installation as required at lower boundary

No. 40
LOT 51
LP 27735

No. 38
LOT 50
LP 27735
724m²

No. 36
LOT 49
LP 27735
774m²

No. 34
LOT 48
LP 27735
(VACANT)

RIVERSIDE DRIVE

SITE DEVELOPMENT SUMMARY

TOTAL SITE AREA = 1498m² (LOT 49 - 774m², LOT 50 - 724m²)

SITE COVERAGE HOUSE= 130m²	8.7%
OUTDOOR PERVIOUS AREA = 719 m²	98.7%
OUTDOOR NON PERVIOUS AREA = 20m²	1.3%
DECK/TERRACE = 88.2 m²	5.9 %

NOTE: SITE COVERAGE CALCULATIONS ARE BASED ON TOTAL SITE AREA OF LOTS 49 AND 50 COMBINED.

Proposed Site Plan

scale 1 : 200

WITH TERRACED (OPTION 1)

Bellemo & Cat
176 High Street Northcote
ph 96700039 fx 96700097 mb 0408 053177
e bellemocat@bigpond.com

NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SITE PLAN

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP02A
DATE DEC 2018	

#	DATE	REVISION

GENERAL NOTES

LEGEND

4.5m WIDE CARRIAGEWAY EASEMENT

EXISTING HOUSE

BALCONY

GRAVEL DRIVEWAY

FIRE FIGHTING WATER SUPPLY OUTLET connected to water tank with minimum 10000L reserved for firefighting. Pipework and fittings with a minimum of 65mm (excluding the CFA coupling) to achieve 20 lts/sec at the CFA pump

CARPARKING X 2
RL 51.00

CONCRETE RETAINING WALL

FORMED CONCRETE RETAINING WALL

ENGINEERED RETAINING WALL
GALVANISED STEEL UPRIGHTS WITH CONCRETE SLEEPERS

ROOF TERRACE
PEBBLED SURFACE

BOX GUTTER

FALL

COLORBOND ROOF COLOUR: TERRAIN

MODWOOD DECK (WATER TANK AND STORAGE BELOW)

EXISTING RETAINING WALL

CONCRETE RETAINING WALLS

TERRACED RHIZAPODS REED BEDS (OPTION 2) (4 x PODS + BALANCE TANK)

UPDATED BAL SEPT 2016

BAL-40
BAL-FZ

No. 40
LOT 51
LP 27735

No. 38
LOT 50
LP 27735
724m²

No. 36
LOT 49
LP 27735
774m²

No. 34
LOT 48
LP 27735
(VACANT)

NOT MARKED

Engineer-designed geofabric installation as required at lower boundary

GRAVEL

ROAD

RET. WALL

RIVERSIDE DRIVE

SITE DEVELOPMENT SUMMARY

TOTAL SITE AREA = 1498m² (LOT 49 - 774m², LOT 50 - 724m²)

SITE COVERAGE HOUSE= 130m²	8.7%
OUTDOOR PERVIOUS AREA = 719 m²	98.7%
OUTDOOR NON PERVIOUS AREA = 20m²	1.3%
DECK/TERRACE = 88.2 m²	5.9 %

NOTE: SITE COVERAGE CALCULATIONS ARE BASED ON TOTAL SITE AREA OF LOTS 49 AND 50 COMBINED.

Proposed Site Plan

scale 1 : 200

WITH TERRACED (OPTION 2)

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NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SITE PLAN

PROJECT #	DRAWN
SCALE 1:200@A3	DRAWING # TP02B
DATE DEC 2018	

#	DATE	REVISION

GENERAL NOTES

LEGEND

BOUNDARY

A TP06

B TP06

ENGINEERED RETAINING WALL GALVANISED STEEL UPRIGHTS WITH CONCRETE SLEEPERS

FORMED CONCRETE RETAINING WALL

STEEL AWNING OVER

GRAVEL DRIVEWAY

CARPARKING X 2
RL 51.00

STORAGE

LAUNDRY

LINEN

ROBE

BUNKROOM
FFL 50.80

ENSUITE
FFL 50.80

MASTER BEDROOM
FFL 50.80

KITCHEN
FFL 50.80

DINING
FFL 50.80

LOUNGE
FFL 50.80

DECK
FFL 50.50

TOP OF BANK

UP

DP

TR

WM

SH

SL

R2855

R2435

3630

10830

300

990

1290

100

5800

3110

3790

4685

3080

145

750

700

1055

2900

5110

5400 OVERALL

3255

2355

1590

980

10425

10280

5140

2715

1990

5100

5390 OVERALL

1680

5770

7695

4970

3500

2800

3685

10430

Proposed Floor Plan

scale 1 : 100

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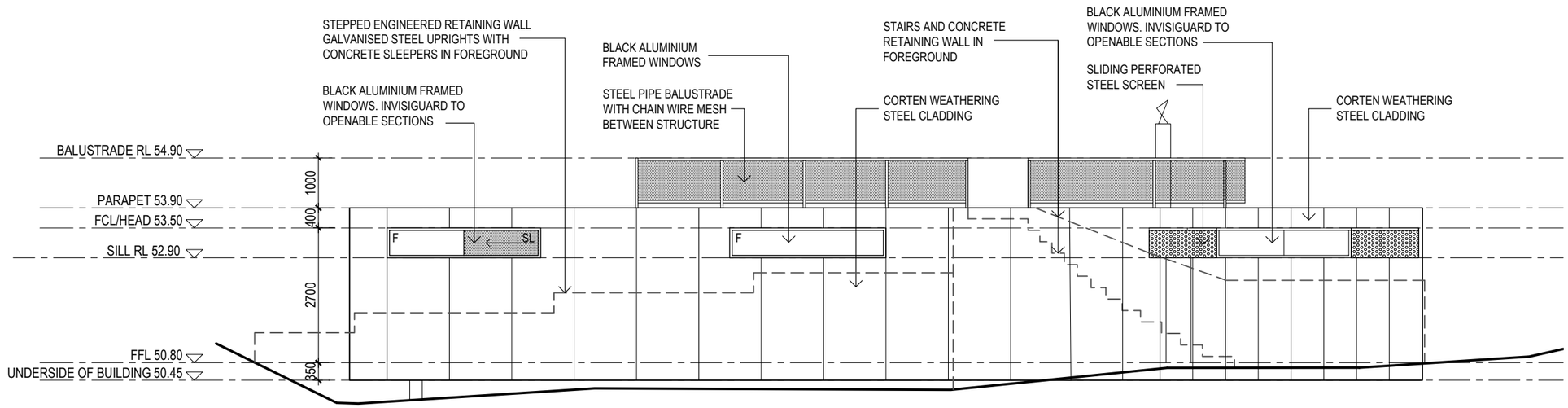
NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

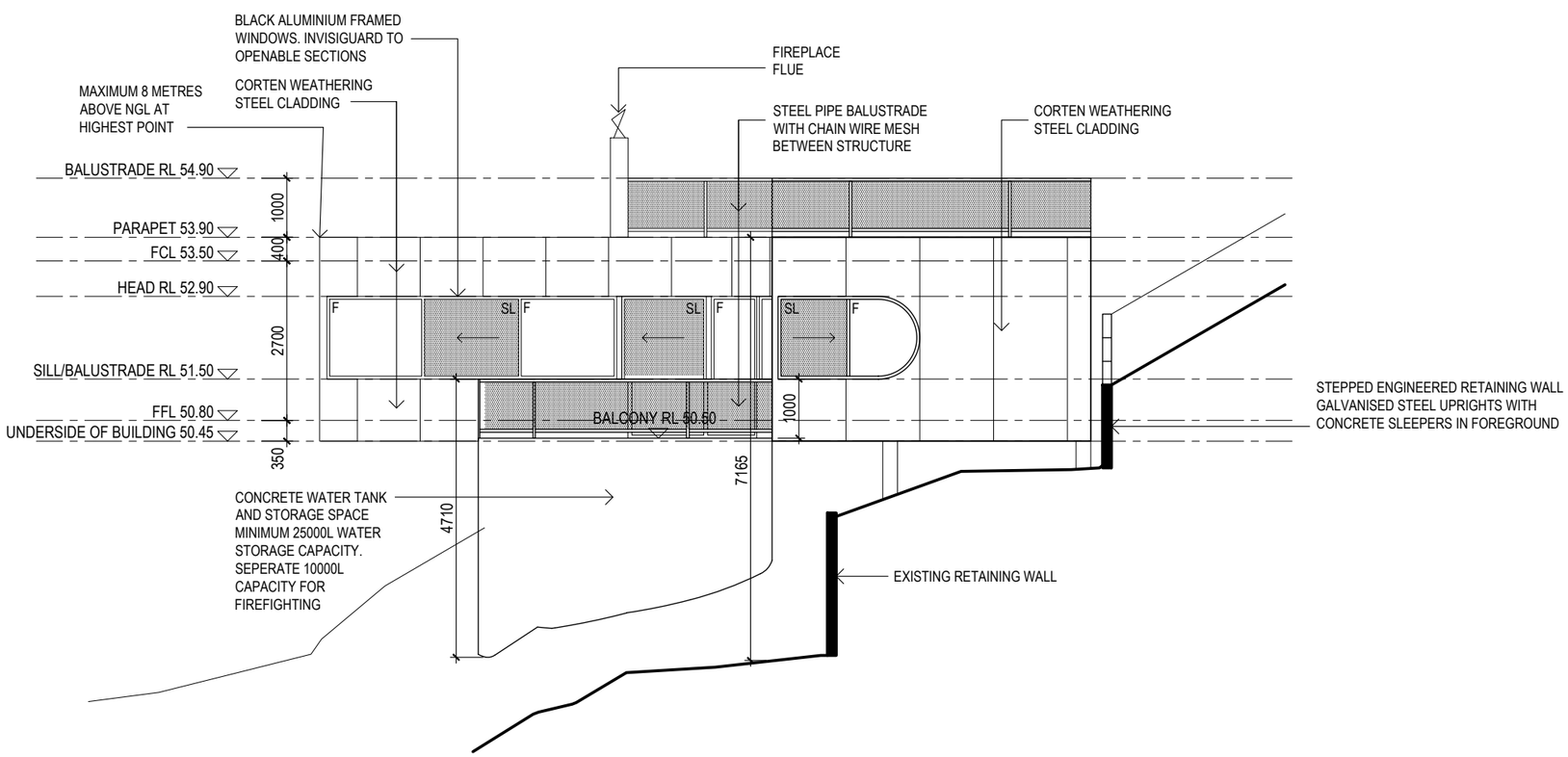
DRAWING
PROPOSED FLOOR PLAN
OPTION 1a

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP03
DATE DEC 2018	



NORTH ELEVATION

scale 1 : 100



EAST ELEVATION

scale 1 : 100

#	DATE	REVISION

GENERAL NOTES

LEGEND

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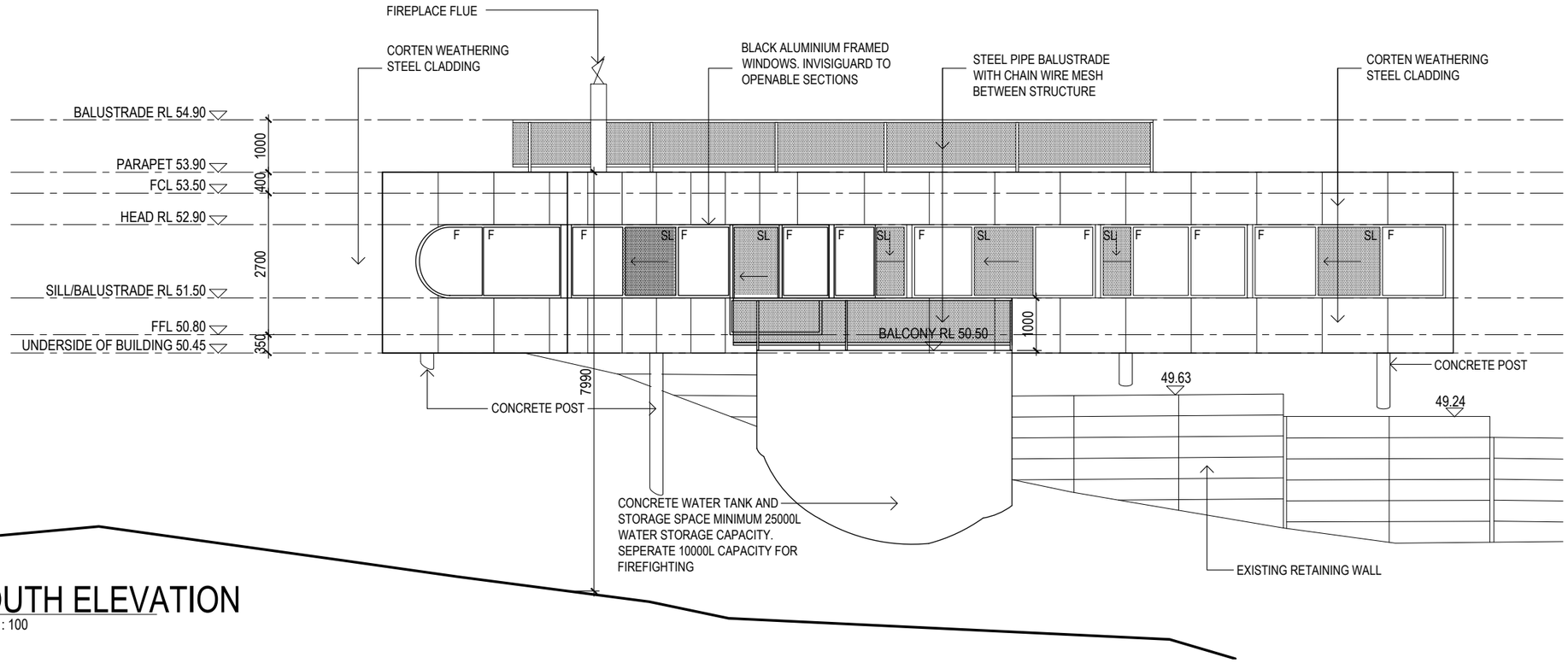
NORTH

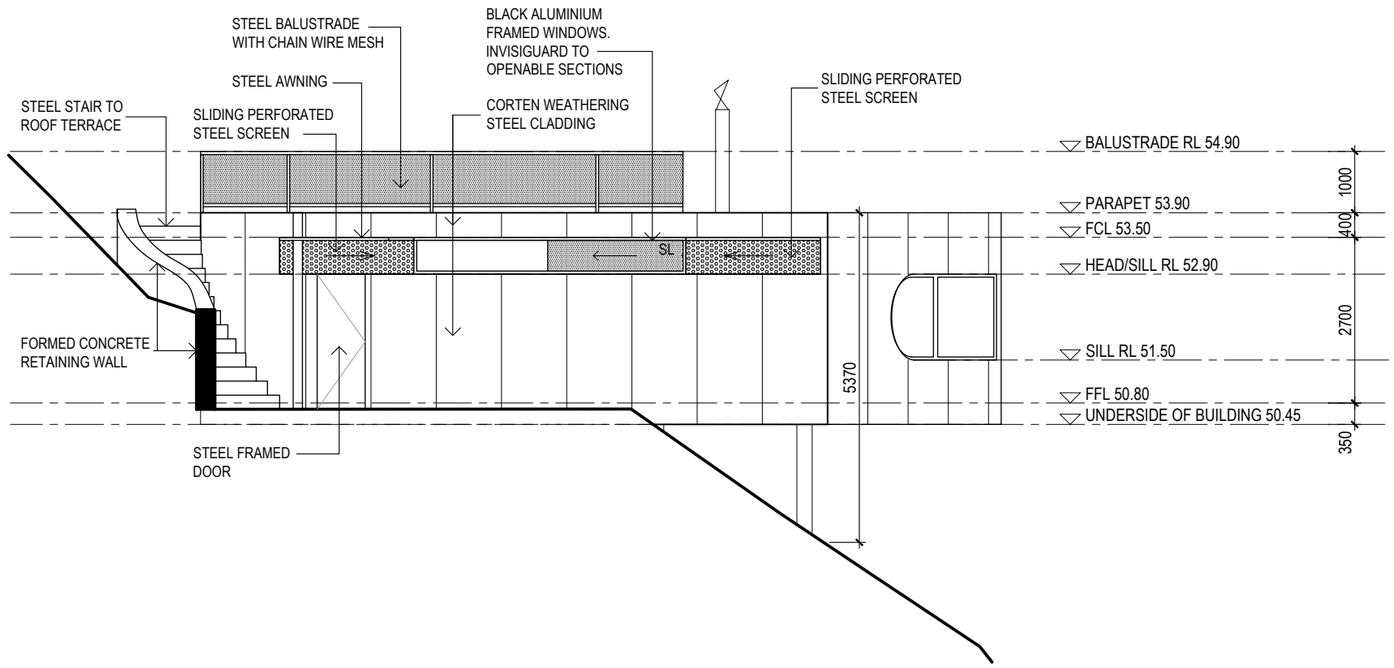
PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED ELEVATIONS
NORTH & EAST

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP04
DATE DEC 2018	



SOUTH ELEVATION
scale 1 : 100



WEST ELEVATION
scale 1 : 100

#	DATE	REVISION

GENERAL NOTES

LEGEND

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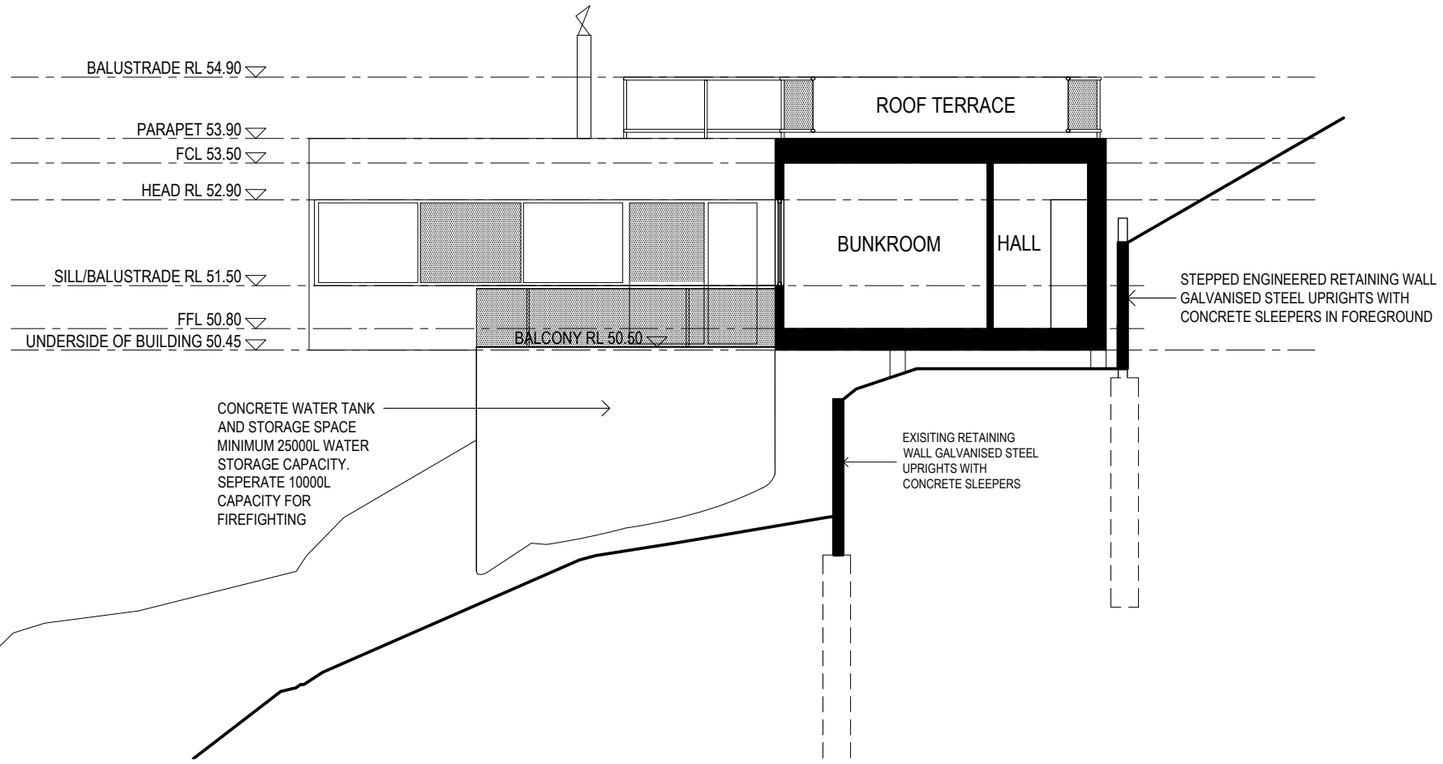
NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED ELEVATIONS
SOUTH & WEST

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP05
DATE DEC 2018	



PROPOSED SECTION A-A
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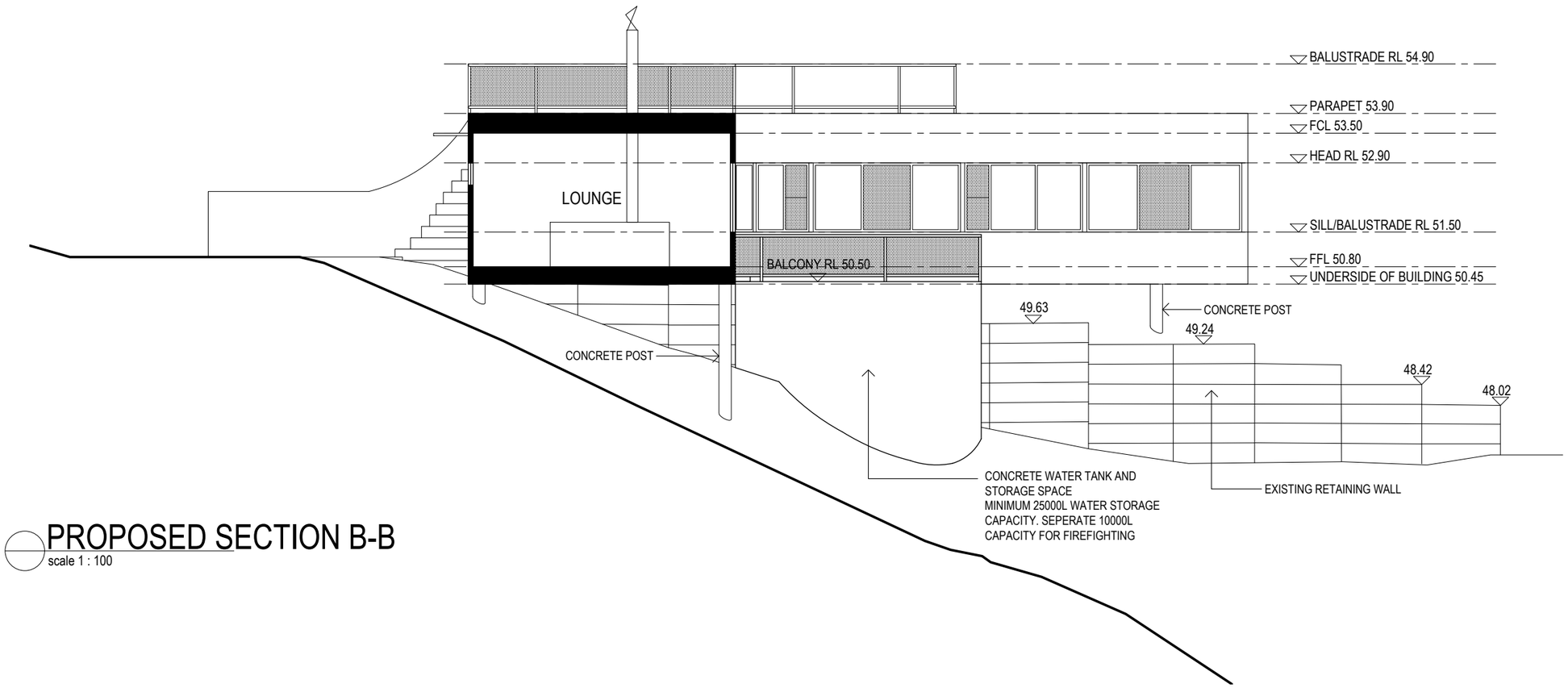

PROPOSED SECTION B-B
scale 1 : 100

#	DATE	REVISION

GENERAL NOTES

LEGEND

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NORTH

PROJECT
36-38 RIVERSIDE DRIVE
WYE RIVER

DRAWING
PROPOSED SECTIONS

PROJECT #	DRAWN
SCALE 1:100@A3	DRAWING # TP06
DATE DEC 2018	

GEOTECHNICAL INVESTIGATION ADDENDUM

TESTING PROGRAMME & REPORT

1. Report has been prepared by qualified persons and based on current available standards.
2. Recommendations are based on the assumption that limited test positions are representative of the sub-surface profile.
3. Whilst care has been taken to accurately report on the sub-surface conditions across the site it is not possible to anticipate unexpected sub-surface variations given the limited testing performed.
4. Changes in legislative policy may require report update or additional testing.

The purpose of this report is to conduct a limited and preliminary geotechnical investigation. Where any variation or anomalies are encountered, we recommend additional investigation and reporting by us to resolve any potential issues.

GENERAL COMMENTS

St Quentin Consulting does not accept responsibility for our report where it has been altered or not reproduced in full, including addendum.

Dimensions, slope, test locations are approximate only and must not be used for calculation of positioning.

Recommendations are based on information regarding the site and development type provided by the client or agent. If information supplied is not accurate or if significant changes are required, our report may be inappropriate. We cannot accept responsibility for significant changes and anticipate additional fees should further tests or report update be required.

Offset distance to any subsurface excavations must not exceed the minimum angle of repose for the in-situ naturally occurring soil. We estimate the maximum angle of repose for sand is 30 and 45 for clay soils. We do not recommend steeper angles unless competent rock is encountered.

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LAND CAPABILITY ASSESSMENT FOR PROPOSED DEVELOPMENT

36 & 38 Riverside Drive, Wye River

December 2018

Prepared for:
Damon Eisen

Report No:
15760G-LCA-Rev2

CONTENTS

SECTION **PAGE**

1.0 EXECUTIVE SUMMARY

Our Land Capability Assessment has found that the proposed construction site is acceptable for effluent disposal. Our assessment has identified some 'major' constraints that will need to be considered to enable safe and sustainable effluent disposal on site. These constraints do not prevent the satisfactory completion of the proposed development but will require careful planning and specific design.

Critical site constraints are listed as follows:

- Landslide risk (Major)
- Available land application area (Major)
- High rainfall (Major)
- Allotment slope (Major)

On the basis of the above constraints we have determined this site has a sensitivity rating of 'High' in accordance with the Colac Otway Shire Council Domestic Wastewater Management Plan.

Subject to constraints and our recommendations the dispersal of wastewater on the development poses a low and manageable environmental risk.

We recommend that the proposed household wastewater receive secondary treatment and that the treated effluent be dispersed using terraced ETA beds or alternatively into an enclosed reed bed, such as Rhizopod by Arris Pty Ltd which is a fully enclosed recirculating hydroponic pod system with no land application.

Due to the limited area available for effluent disposal we recommend a setback reduction of 1.5m, subject to council approval and 20/30/10 treatment. A minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by ETA beds or using the Arris 'Rhizopod' closed pod system. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by either ETA beds using the Arris 'Rhizopod' closed pod system will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

We recommend a minimum ETA bed area of 64 m^2 be adopted for the proposed development.

The treated effluent field must be positioned in accordance with offset and siting requirements as outlined in section 7.5 of our report 'Effluent disposal area siting'.

Due to the limited area available for effluent disposal we recommend a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by ETA beds or using the Arris 'Rhizopod' closed pod system. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by either ETA beds using the Arris 'Rhizopod' closed pod system will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

Guidance is given concerning the design and layout of a suitable system.

Final approval is subject to any specific policy requirements or other limiting environmental constraints not previously brought to our attention.

2.0 INTRODUCTION

St Quentin Consulting was commissioned by the client Damon Eisen to provide a Land Capability Assessment (LCA) report for the site.

The aims of the assessment were:

1. To assess various features of the site in their present condition in accordance with published standards and guidelines, principally various Septic Tanks Codes published by EPA Victoria and others.
2. Recommend an appropriate and environmentally sustainable treatment and disposal method for domestic wastewater.

3.0 PRACTITIONER

The author of this report is Cameron Farrar who is a professional geotechnical engineer with a Bachelor of Engineering degree and registered member of Engineers Australia. The author has more than 20 years of experience in the land capability assessment for effluent disposal.

4.0 PROPOSED DEVELOPMENT

This report provides recommendations for a two bedroom residence. We expect that local council may require a “study” or other habitable room to be counted as a bedroom. If the building type is changed significantly this report may be inappropriate. Planning report has revealed the site features a number of sensitive overlays and is included in Appendix I.

5.0 SITE FEATURES

The subject site is on the north side of the street. The site slopes toward the south with a slope angle of approximately 60% (30°). The site aspect is fair with respect to exposure to sunshine and wind. Surface drainage is considered to be good. The natural soil types comprise sandy loam and weathered rock prominently developed from Cretaceous age sediments (Otway Group). Existing vegetation consists mainly of grasses in the proposed effluent disposal with several native trees scattered across the site. A satellite view of the site is presented in Figure 1.

Figure 1: Aerial photograph of the site and surrounding area, nearmap.com (November 2018).

6.0 TESTING PROGRAM AND RESULTS

6.1 Soil profile and geomorphology

Four (4) test sites were assessed to investigate predominate soil types across the site. The visual and tactile estimation as outlined in the site and soil evaluation procedure AS1547:2012 was used to identify the relevant soil characteristics. Disturbed soil samples were sampled over the full depth of the soil profile and examined and classified. The soil profiles encountered were compared to soil descriptions in published reports, maps and charts from Department of Primary Industries (DPI) and other sources.

An experienced and qualified geotechnical engineer conducted a thorough geomorphological survey and visual appraisal of the site features the surrounding area to identify any important land features. Slope angles were measured with an inclinometer.

The resulting soil and land description is as follows:

Landform:	Hills
Geology:	Residual clay derived from Cretaceous age sediments
Aust. Soil Classification:	Brown dermosol

Our boreholes suggested evidence of minor fill or suspected landslide debris. Our testing suggested soil characteristics consistent with sandy loam.

Geology mapping with contours is presented in Figure 2. A description of the soils typically encountered during our drilling and sampling is presented on the attached sheet in Appendix B.

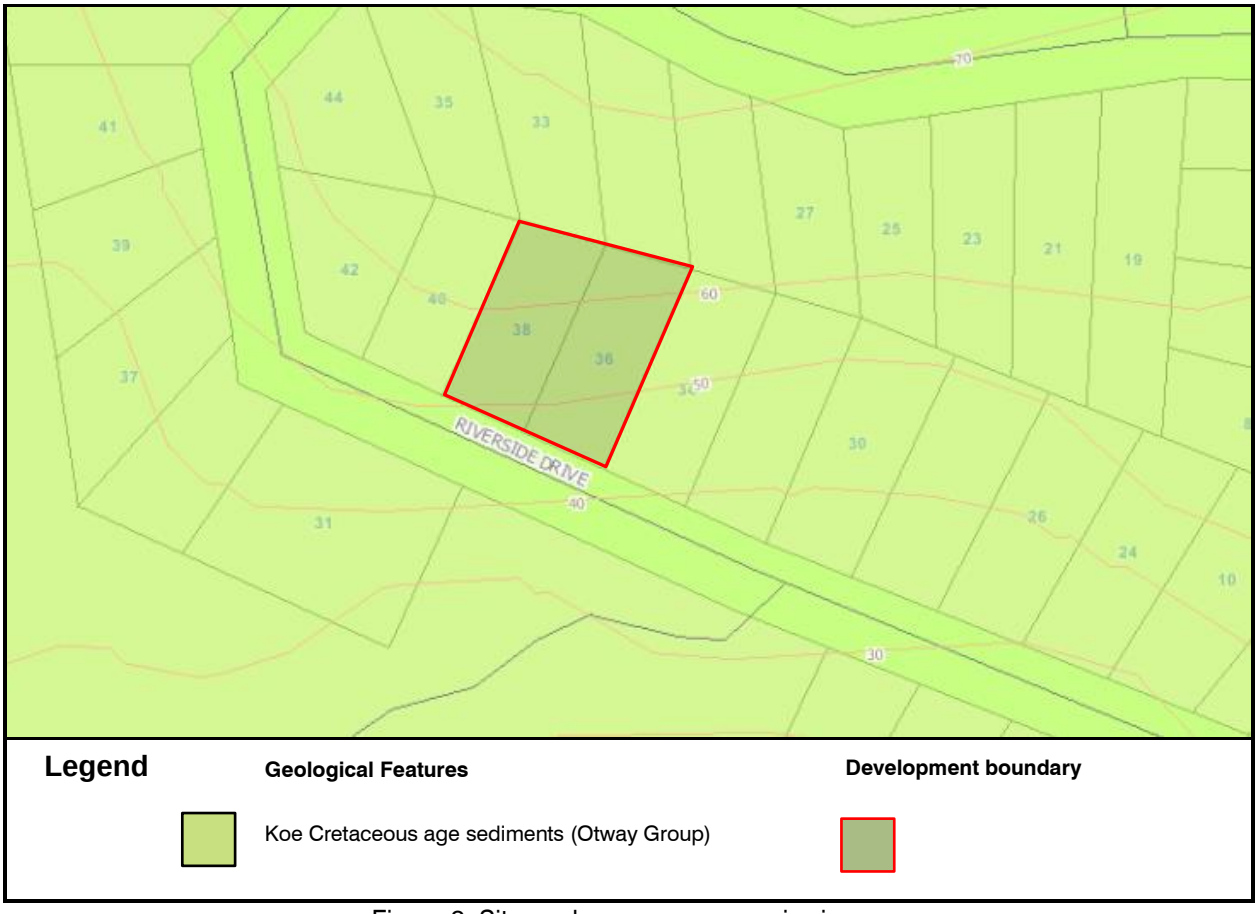


Figure 2: Site geology, source: geovic.vic.gov.au

6.2 Water table

There is limited published bore data available on permanent / transient water table for this area of Wye River. No permanent or perched water table was encountered during testing however a transient perched water table may develop in very wet conditions above the clay layer. For this reason, it is important upslope and downslope cut-off drains are provided to prevent/reduce transient water flows near the effluent area.

6.3 Land assessment and constraints

Various features of the site were assessed in accordance with the guidelines of the EPA Publications and reported in accordance with constraint levels outlined in VLCA-2nd Ed. Field measurements and observations were made and where necessary, samples were returned to our laboratory for further analysis. The results are shown in Table 1.

Table 1: Land assessment

Land feature	Result	Level of Constraint	Mitigation
Buffer Distances	Buffer distances achievable. Refer to section 7.5 for relevant offset requirements	Minor	Not Required
Climate	Rainfall Kennett River ~ 897 mm/yr, Evaporation* Kennett River ~ 897 mm/yr	Major	Rainfall exceeds evaporation in the wettest months. Adopt ETA beds and cut-off drains
Drainage	Proposed effluent area well drained	Nil	Not Required
Erosion or Landslide Risk	Landslide risk evident on this and adjacent sites	Minor	Not Required
Exposure & Aspect	Good exposure to wind and sun: surrounding area consisting of open grassland and isolated trees	Major	Position disposal field in well drained position exposed position to maximise evaporation
Flooding	Flooding not evident (>1:100 year flood level)	Nil	Not Required
Groundwater	Groundwater not evident above 1.5m	Nil	Not Required
Imported Fill	No fill present on site	Nil	Not Required
Site Drainage	The site receives negligible runoff and provides significant run-on. Moderate to high rainfall.	Moderate	Position disposal field in well drained position to prevent water logging. Adopt cut off drains
Slope	~60%	Major	Construct a terraced retaining structure for effluent disposal
Landform	A single landform exists on this site. No significant features were noted on or near the site	Nil	Not Required
Vegetation	Good grass cover. Dense trees occupy the site	Nil	Not Required
Surface Waters	No significant surface water or easement noted nearby	Minor	Adopt secondary treatment - 20/30/10 std.
Rock Outcrops	Not present	Nil	Not Required
Lot size	Considering the site constraints and proposed development size the allotment has sufficient area for effluent disposal	Major	Adopt tiered disposal area

* Closest / longest evaporation recording station record in the area

Based on the land assessment criteria, we have judged the land capability of the site is acceptable, provided constraints are addressed with corresponding and appropriate mitigation measures.

6.4 Soil assessment and constraints

An appraisal of the soil was conducted by visual and tactile estimation in accordance with the site and soil evaluation procedure as outlined in AS1547:2012 and reported in accordance with constraint levels outlined in VLCA-2nd Ed.

Based on our analysis we have determined the limiting geological stratum as poorly structured 'extremely weathered rock', however we have calculated the drip irrigation rate based on the overlying or imported 'sandy loam' which we expect will be utilised in a terraced/tiered arrangement. As outlined in AS/NZS1547:2012 we have adopted an indicative permeability (K_{sat}) of 1.5-3.0 m/day and a design loading rate of 8 mm/day.

Testing including pH, Emerson Class No. and salinity were also conducted and results are presented in Table 2.

Table 2: Soil assessment

Land feature	Result	Level of Constraint	Mitigation
Soil Depth	1.5 m*	Major	Adopt ETA beds
Permeability	Limiting layer: sandy loam ~ 1.5-3.0 m/d Subsoil: extremely weathered rock ~ 0.12-0.5 m/d	Major	Adopt a low DLR. Adopt ETA beds
Soil Structure	Topsoil: moderately structured sandy loam (soil category 2, AS 1547:2012) Subsoil: poorly structured extremely weathered rock (soil category 5, AS 1547:2012)	Moderate	Adopt ETA beds
Soil Plasticity	Nil	Moderate	Not Required
Emerson	Topsoil: sandy loam (Silty Sand): Class 2, some dispersion Subsoil: extremely weathered rock (XW Sandstone): Class 3, no dispersion	Moderate	Not Required
pH	6.0 (neutral)	Minor	Not Required

*Extremely weathered sandstone evident at about 1.5 m.

Based on the above soil assessment criteria, we have judged the soil capability of the site is acceptable subject to relevant outlined mitigation procedures.

6.5 Sensitivity Rating

Further to our land and soil assessment we have completed a sensitivity rating included a Sensitivity Proforma Checklist in accordance with Colac Otway Shire Domestic Wastewater Plan shown in Table 3. Based on the information gathered and our knowledge of the area we have assessed the site sensitivity rating as 'High'.

Table 3: Sensitivity Proforma Checklist

Land feature	Site specific input
PFI Identification Number	41111772 & 41111766
Property/Parcel Address	36 & 38 Riverside Drive, Wye River
Locality	Kennett River (climate data), Wye River township
Zoning	Township
Area (m^2)	1500 m^2
Soil Texture	sandy loam overlying extremely weathered rock
Soil Depth (m)	1.5 m
Soil Structure	moderately structured
Soil Limitations	Low permeability rate
Permeability (Ksat) (m/day)	0.12-0.5 m/d
Slope (%)	~60%
Presence of Surface Waters	Not present
Useable Lot Area (m^2)	~150 m^2

A corresponding checklist has been completed and is attached in Appendix J.

6.6 Wastewater volume

According to the EPA Code of Practice Onsite Wastewater Management 891.4 July 2016 and Australian Standard AS/NZS1547:2012 On-site Domestic Wastewater Management the following daily wastewater flows can be adopted:

Unlimited water supply (where a reticulated water supply is proposed)
Daily flow = (No of bedrooms + 1) x 150 litres per day

Limited water supply (where water is sourced only from rain water collection from roofs)
Daily flow = (No of bedrooms + 1) x 120 litres per day

Given the location of the site, it is unlikely this site will be supplied with reticulated water supply for the foreseeable future. However, to allow for potential increased seasonal loading we have adopted unlimited water supply to provide a more conservative outcome.

We understand the proposed dwelling includes 2 bedrooms and on this basis, we recommend the estimated wastewater volume produced to be **450 L/day.**

7.0 CONCLUSIONS AND RECOMMENDATIONS

Our Land Capability Assessment has found the proposed site is acceptable for effluent disposal. Our assessment however has concluded the site sensitivity is 'High' and we have identified some constraints which will need to be considered to enable safe and sustainable effluent disposal on site. Our assessment has found the site is constrained due to limiting factors including soil permeability, allotment size, allotment slope and high rainfall. These constraints however can be mitigated by careful planning and design.

Subject to constraints and our recommendations the dispersal of wastewater on the development poses a low and manageable environmental risk.

Due to the site slope and limited available area we recommend the effluent disposal field be sited in a terraced disposal field. We recommend sleeper retaining wall construction with individual wall height of about 1.0m.

Upslope and downslope cut-off drains must be provided to prevent/reduce transient water flows near the effluent area or building envelope. The surface runoff should be directed away from the effluent area and ultimately connected to the legal point of discharge.

We recommend that the proposed household wastewater receive secondary treatment and that the treated effluent be dispersed by using ETA beds or alternatively into an enclosed reedbed system, such as the Rhizopod design (by Arris Pty Ltd) or similar EPA approved system which incorporates an enclosed recirculating hydroponic pod system. Representation plans showing both land application options are presented in Appendix A.

Colac Otway Council require Secondary treatment to a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by either ETA beds or using the Arris 'Rhizopod' closed pod system beds will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

Without continual treatment via UV or chlorination dosing the system will not output at a minimum 20/30/10 standard. It is therefore important that regular maintenance is performed by a qualified professional so that this higher level of treatment is sustained for the life of the system.

The disposal field should preferably be located down slope from septic tank to enable effluent to discharge by gravity flow.

7.1 Treatment system

20/30/10 standard treatment can be achieved using both a septic tank (anaerobic treatment) and a pressure dosed sand filter (aerobic treatment) or by using a powered aerated water treatment system (AWTS) combined with additional treatment (using UV, ozone or chlorination).

All AWTS require a current EPA certificate of approval for operation. Regular maintenance of AWTS is essential to ensure correct performance and it is usually a requirement of the approval certificate that a service contract be maintained for the unit. Various AWTS are available on the market and these are generally the preferred method of treatment, note however that an AWTS may not be suitable where irregular or intermittent flows are likely such as from a holiday house.

If a septic tank is preferred, for a wastewater volume of 450 L/day we recommend a minimum sand filter size of 9 m^2 with filter media characteristics in accordance with the table shown below, in accordance with EPA standards (CA 1.3/03).

Table 4: Filter media characteristics

Dosage rate	Clay & Fine Silt Content	Effective Size*	Uniformity Coefficient**
≤50 L/m²/day	<5%	0.25 to 0.6 mm	<4

* Effective size: maximum particle size of smallest 10% by mass of the sand
** Uniformity coefficient: the ratio of the maximum particle size of the smallest 60% by mass of sand to the maximum particle size of the smallest 10% by mass of the sand

7.2 ETA Beds Land application area

7.2.1 Disposal area and length based on material type

Based on the material type and through interpretation of Table 5.1 & 5.2 in AS/NZS1547:2012 for "extremely weathered rock" the minimum disposal area and ETA bed length required to successfully disperse treated household wastewater based on the material type on the site is **56 m²** and **28 m** respectively (assuming a bed width of 2 m).

Note: the minimum disposal area will need to be further modified dependant on water balance calculations shown in section 7.2.2.

7.2.2 Disposal area and length based on water balance model

Based on the water balance model (refer Appendix D) the minimum area and length required to successfully disperse treated household wastewater on the site is **64 m²** and **32 m** respectively (assuming a bed width of 2 m).

The water balance model was calculated using the following input data:

- Design wastewater flow: 2 bedroom residence – 450 L/day from AS1547:2012
- Precipitation – Kennett River ~ 897 mm/yr
- Evaporation – Kennett River ~ 897 mm/yr
- Crop factor – seasonally variable from 0.6 to 0.8
- Coefficient of runoff – 0.75

7.2.3 Minimum design effluent area for combined blackwater/greywater treatment

Based on our tests and calculations and using design loading rates from AS/NZS1547:2012 we have determined that the following minimum ETA bed area and length required to successfully disperse treated household wastewater for the proposed residence. ETA bed sizing calculations are shown in Appendix D.

Table 5: Required area and length for 'ETA Bed System'

Effluent Volume Produced	Minimum Effluent Disposal Area#	ETA Bed Width*	ETA Bed Length+
450 L/day	64 m²	2 m	32 m

Not including the spacing between the ETA Bed units
Recommended minimum spacing between trench/bed units: 1.5m
* Bed width range between 1m and 4m, designer may choose a different width
+ Maximum length of 20m recommended (i.e. use 4 trenches of 8m each)

7.3 Reed bed (Rhizopod system)

The Rhizopod system by Arris Pty Ltd is a closed loop reed bed system that provides evapotranspiration within fully contained within pods with no land application. Reed bed technology has been available for some time however is not commonly used in the state of Victoria. The Rhizopod system is relatively new and we understand that six systems have been installed to date. The Rhizopod has EPA 'septic tank' approval (Certificate of conformance no. 336), importantly however the Rhizopod system is classified as a pump out system, which will require approximately 3-4 pump outs per year.

We are not able to provide a detailed design and layout of the treatment system due to the proprietary nature of the system. We recommend contacting the manufacturer Arris Pty Ltd for specific design details. We have had preliminary discussions with Arris regarding design, who have suggested 3-4 pods (max) would be appropriate for a 2-bedroom dwelling however we reiterate that specific design is required by Arris. A brochure of the Arris system with contact details is presented in Appendix G.

7.4 Effluent system design

It is beyond the scope of this report to provide a detailed design and layout of the treatment and disposal system. We have provided an indicative suggestion of the effluent disposal area shape used for illustrative purposes in Appendix A.

We recommend that an experienced contractor or consultant be engaged to design and install the system. The system manufacturer may be able to provide this service. A typical ETA bed system layout and cross section are shown on Appendix E & F (by way of example only).

Due to the limited available area and site slope in the area we recommend a terraced/tiered system may be constructed on the site. The fill tiered construction should feature a height less than 1.0m above the existing surface level and a spacing of about 2.0m. This will allow sufficient rows of ETA beds in each terrace. Onsite material loam (topsoil) won from site excavation may be used in as backfill material in the retained disposal platforms or terraces. We expect the disposal field media to have good long-term characteristics for effluent disposal similar to that of in-situ naturally occurring loam assuming disposal area is supplying treated effluent to at least '20/30/10 standard'.

Stormwater and roof runoff water must be diverted around the disposal field to an appropriate point of discharge for stormwater. Cut-off drains should be installed at the top and bottom of the irrigation field to reduce surface runoff. Drains should include lined agriculture drains and backfilled with free draining coarse aggregate.

7.5 Effluent disposal area siting

The effluent irrigation area must be located as follows:

1. In an area not subject to vehicular traffic.
2. No closer than 3.0m from a gas or water pipe (primary treatment).
3. No closer than 3.0m on the low side or 6.0m on the high side of a property boundary or building (primary treatment).
4. No closer than 1.5m from a gas or water pipe (secondary treatment).
5. No closer than 1.5m on the low side or 3.0m on the high side of a property boundary or building (secondary treatment).
6. No closer than 3.0m from a swimming pool or stormwater drain.
7. No closer than 7.5m from an underground tank, cutting or escarpment.
8. No closer than 10m from a non-potable groundwater bore.
9. No closer than 30m from a dam, stream or channel (non-potable).
10. No closer than 100m from a stream or river in a potable water supply catchment.

The disposal area must be permanently dedicated and marked with at least two clear warning signs.

Our analysis has shown there is sufficient available land for an effluent disposal area of 64 m^2, as shown in Appendix A.

7.6 Reserve field

The EPA Septic Tanks Code of Practice requires that provision for a "reserve" effluent disposal field in the event that the primary disposal field fails, proves to be inadequate or needs to be rested. The reserve field must be not less than the size of the primary field and must be located on the site in compliance with all the minimum setback distances etc. as described above.

Note that a reserve field is not required for wastewater that has been treated to 20/30/10 standard, as is proposed for this site.

7.7 Vegetation cover

Efficient effluent disposal assumes good vegetative cover. Therefore, it is recommended to establish and maintain grasses or suitable shrubs. Such vegetation can significantly assist the overall disposal process by transpiration from leaves and by maintaining soil permeability through fine root channels. Refer to the attached “Land Capability Assessment Addendum” for additional information and indicative list of suitable plant species.

Large trees should be retained wherever possible. Where large tree removal is necessary, they should be cut off at ground level with the root structures left intact.

7.8 Drainage management

Careful attention to drainage is essential to reduce risk of system failure. Surface water must therefore be prevented from ponding anywhere on or near the site.

We recommend installation of upslope cut-off drains above and below the effluent disposal area with run-off directed to the legal point of discharge.

The drains must be positioned and constructed with sufficient fall to discharge completely to prevent water from accumulating in the soil anywhere near the buildings. Any blockages must be cleared and repaired promptly.

Care must also be taken to ensure that all levelled areas (vehicle parking bays, recreation areas etc.) have a slight fall (≥2°) to prevent surface water from ponding or seeping into the ground and diverted away from the buildings.

7.9 Management, monitoring, care and operation

Colac Otway Council require secondary treatment to a minimum '20/30/10 standard' (i.e. 20 mg/l Biochemical Oxygen Demand, 30 mg/l Suspended Solids and E.coli <10 cfu /100mL) effluent is produced prior to dispersal on the land by ETA beds. Treatment of household wastewater to 20/30/10 standard with treated wastewater dispersion by ETA beds will maximise the potential for evapo-transpiration and minimise the risk of contamination of adjoining sites.

A septic system requires regular servicing and maintenance by an approved contractor to meet the conditions on the council approval certificate and the requirements of the manufacturer to ensure that the minimum ‘20/30/10 standard’ of effluent is consistently achieved.

E.coli <10 cfu /100mL can be achieved via chlorine, UV and Ozone however from experience dosing using chlorine may provide the simplest solution for the site conditions. An appropriate dose for secondary treatment is generally 15-45mg/L however recommend specialist advice from supplier of the domestic wastewater treatment supplier. Further specific requirements with regard to disinfection is discussed in AS1547:2102 Appendix P.

A healthy system should include a biological scum on the surface and be relatively free from strong odours. We recommend the effluent disposal system be checked by a suitably qualified plumber / drainer every 12 months. The tank level and quality should also be assessed. If necessary, the tank should be ‘desludged’ i.e. pumped out and any faulty mechanics repaired. Desludging is required concurrently at 3 to 5 year intervals. Similarly, when constructed, sand filter media should be checked concurrently every 3 to 5 years and media replaced where required. Drainage lines should be checked for blockages or fixture failures. Grease trap should be checked for blockages and pumped every 6-12 months.

The following guidelines regarding the care and operation of septic tanks as recommend in the EPA Septic Tanks Code of Practice:

- Restrict the use of germicides (strong detergents, disinfectants, nappy sanitisers, bleaches etc.),
- Use cleaning products, detergents etc. sparingly and check their suitability for septic tank systems,
- Use detergents with low levels of salt, phosphorus and chlorine. Detergents with low phosphorus and sodium are best suited for septic tanks and the environment. For more information regarding detergents we highly recommend visiting Lanfax Laboratories at lanfaxlabs.com.au under “Laundry Products Research” and click the downloadable “laundry brochure”.
- Do not flush sanitary napkins, disposable nappies or similar products into the system,
- Minimise the amounts of oil and fat washed into the system,
- Use a sink strainer to restrict food scrapes entering system,
- Do not use garbage disposal units,
- Do not modify the system without council approval,
- Conserve water.

Prepared by:

St Quentin Consulting Pty Ltd

C Farrar
Geotechnical Engineer B.Eng. MIE Aust (Reg. No. 4367740)

References

Australian Standard AS/NZS1547:2012 On-site Domestic Wastewater Management, Standards Australia, 2012

Australian Standard AS1726-2017 Geotechnical site investigations, Standards Australia, 2017

Australian Soil Resource Information System (ASRIS). Accessed December 2018 https://www.asris.csiro.au

EPA Publication 891.4 Code of Practice - Onsite Wastewater Management, July 2016

EPA Publication 746.1 Land Capability Assessment for Onsite Domestic Wastewater Management, March 2003

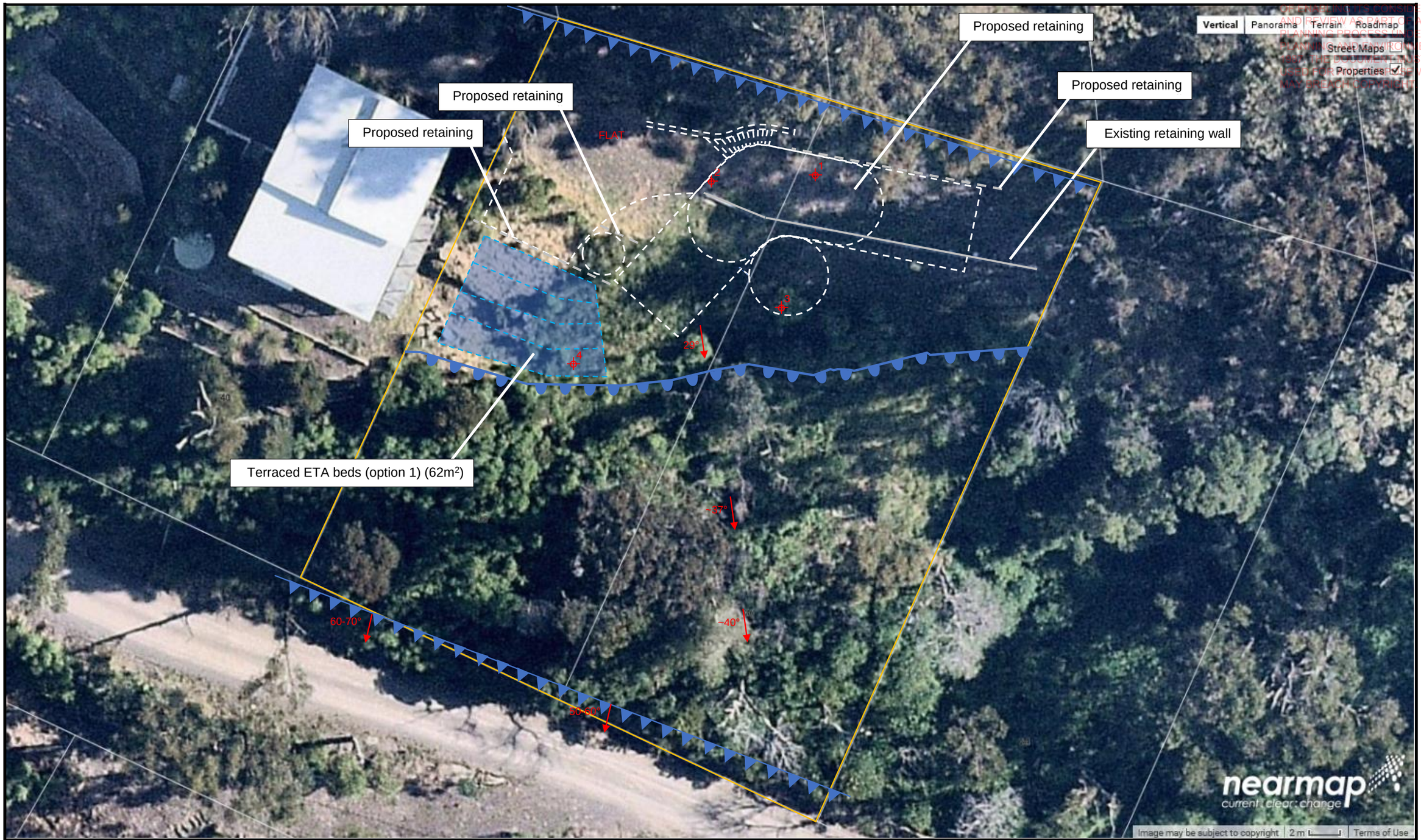
GeoVic 3 Energy and Earth Resources, State Government of Victoria. Accessed December 2018 http://www.energyandresources.vic.gov.au/earth-resources/maps-reports-and-data/geovic

Nearmap, nearmap.com. Accessed December 2018 https://au.nearmap.com/

Victorian Land Capability Assessment Framework, VLCA-2nd Ed, January 2014

Appendix A

Site Plan with land application options (1 & 2)



ST. QUENTIN
Surveyors •Town Planners •Engineers
51 LITTLE FYANS STREET,
P.O. BOX 919, GEELONG 3220
TELEPHONE (03) 5201 1811 FAX (03) 5229 2909

Site geomorphological plan with effluent disposal (option 1, ETA beds):

36-38 Riverside Drive, Wye River

Aerial photography nearmap.com (Nov 2018)

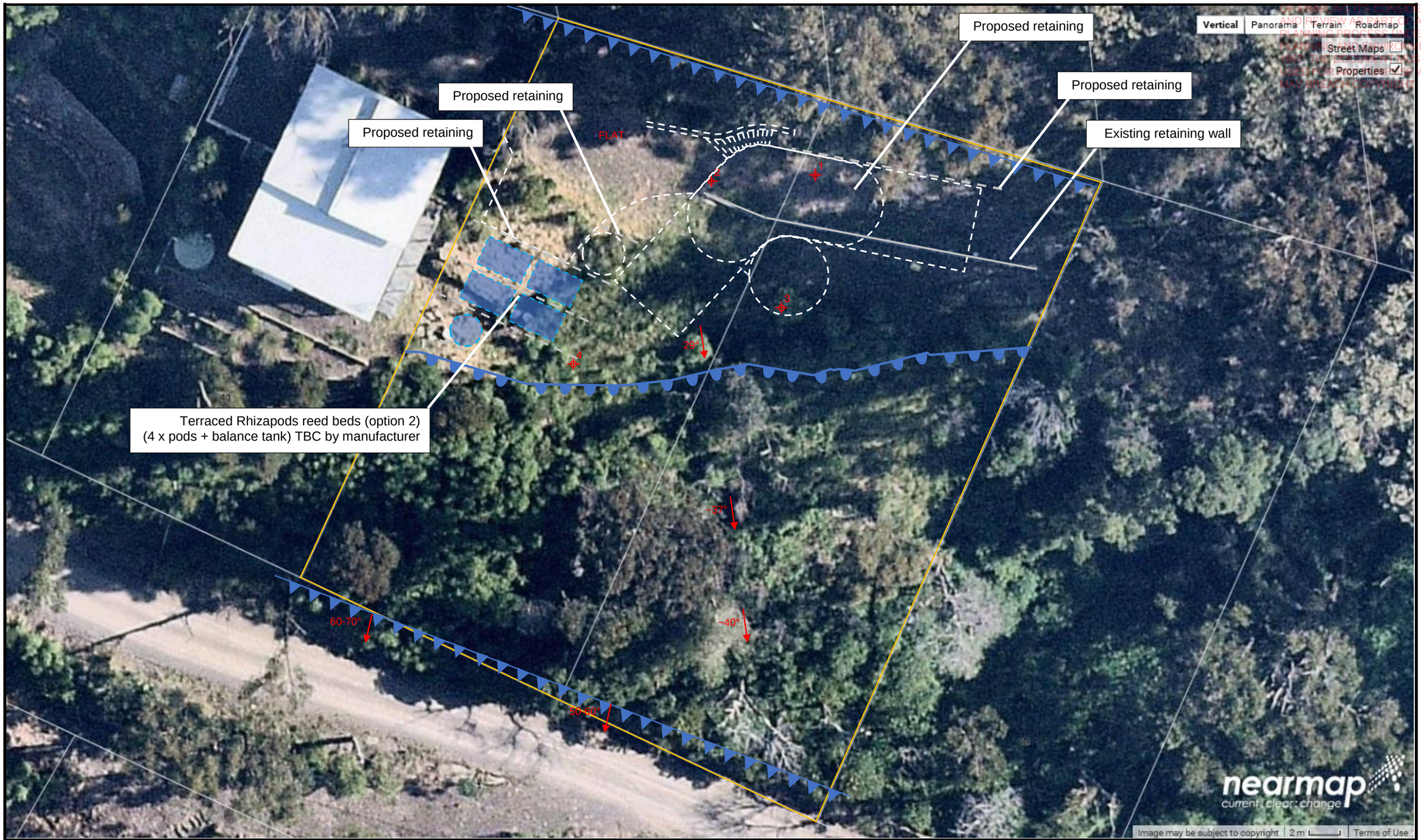
Legend:

Test site	Landslide feature
Study area	Ridgeline
Break in slope convex	Slope
Break in slope concave	Inferred colluvium
Retaining wall	Land Application Area (ETA beds)

Project Ref:15760G

N

mga zone 55



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Site geomorphological plan with effluent disposal (option 2, Reed beds):

36-38 Riverside Drive, Wye River

Aerial photography nearmap.com (Nov 2018)

Legend:

Test site	Landslide feature
Study area	Ridgeline
Break in slope convex	Slope
Break in slope concave	Inferred colluvium
Retaining wall	Land Application Area (Reed beds)

Project Ref: 15760G

N

mga zone 55

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Appendix B

Borehole Logs

BOREHOLE LOG

Test Methods:
AS1289.1.2.1 VicRoads TB40
AS1289.6.3.2 AustStab Nat07
AS1726 AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive, Wye River , Victoria

Project No.: 15760G
Borehole No: BH 1
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description (Type, Plasticity, Colour, Particle characteristics)	Degree of Weathering (XW HW MW SW FS)	Soil Profile Photograph	Rock Strength (L M H EH)	Sample / Test	Test Results	Geology and additional observations
0.8		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'		Power Auger		SPT	N: 27	
1.5	1.50							
		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
2.3	2.50					SPT	N: 28	
3.0		Highly weathered rock (HW) Low to moderate strength rock, sandstone, yellow/orange		Wash Bore				
3.8						SPT	N: 22+ /150mm hammer bouncing	
4.5								
5.3						SPT	N: 22+ /150mm hammer bouncing	
6	6.00							
		Moderately weathered rock (MW) Moderate strength rock, sandstone, yellow						
6.8	7.00							
		Slighly weathered rock (MW) Higher strength rock, sandstone, yellow		Wash Bore		SPT	N: 20+ /40mm hammer bouncing	
7.5				Discontinuity @ 7.4m (0°)				
				Discontinuity @ 7.8 (60°)				
8.3				Discontinuity @ 8.0m (60°)				
				Discontinuity @ 8.5m (60°)				
9	9.00			Discontinuity @ 8.8m (60°)				
		Borehole 1 terminated at 9m						

Method:
- ☐ Hand Auger
- ☑ Auger Drilling
- ☐ Roller/Tricone
- ☑ Washbore
- ☐ Non Destructive Digging

Degree of Weathering
- XW Extremely Weathered Rock
- HW Highly Weathered Rock
- MW Moderaltely Weathered Rock
- SW Slightly Weathered Rock
- FR Fresh Rock

Rock Strength
- L Low
- M Medium
- H High
- EH Extremely High

Samples & Field Tests
- U50 Undisturbed Sample 50mm
- U63 Undisturbed Sample 63mm
- DS Disturbed Sample
- BS Bulk Disturbed Sample
- ES Environmental Sample
- PP Pocket Penetrometer (kPa)
- N Standard Penetration Test
- V Pilcon Shear Vane (kPa)
- DCP Dinamic Cone Penetrometer Test

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive,
Wye River , Victoria

Project No.: 15760G
Borehole No: BH 2
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description (Type, Plasticity, Colour, Particle characteristics)	Degree of Weathering (XW HW MW SW FS)	Soil Profile Photograph	Rock Strength (L M H EH)	Sample / Test	Test Results	Geology and additional observations
0.8		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'		Power Auger		SPT	N: 8	
1.5	1.50							
		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow				SPT	N: 18+ /50mm	
2.3	2.10						hammer bouncing	
	2.50	Highly weathered rock (HW) Low strength rock, sandstone, yellow/orange						
		Borehole 2 terminated at 2.5m						
3.0								
3.8								
4.5								
5.3								
6								
6.8								
7.5								
8.3								
9								

Method:
- ☐ Hand Auger
- ☑ Auger Drilling
- ☐ Roller/Tricone
- ☐ Washbore
- ☐ Non Destructive Digging

Degree of Weathering
- XW Extremely Weathered Rock
- HW Highly Weathered Rock
- MW Moderaltely Weathered Rock
- SW Slightly Weathered Rock
- FR Fresh Rock

Rock Strength
- L Low
- M Medium
- H High
- EH Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive, Wye River , Victoria

Project No.: 15760G
Borehole No: BH 3
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Degree of Weathering XW HW MW SW FS	Soil Profile Photograph	Rock Strength L M H EH	Sample / Test	Test Results	Geology and additional observations
0.2		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'						
0.5								
0.7								
0.9								
1.2								
1.4								
1.50								
1.6		COLLUVIUM (SAND/CLAY), stiff, medium plasticity, yellow, moist						
1.70								
1.8		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
2.1								
2.3								
2.5								
2.8								
2.80		Borehole 3 refused at 2.8m						

Method:
- [x] Hand Auger
- [ ] Auger Drilling
- [ ] Roller/Tricone
- [ ] Washbore
- [ ] Non Destructive Digging

Degree of Weathering

XW	Extremely Weathered Rock
HW	Highly Weathered Rock
MW	Moderaltely Weathered Rock
SW	Slightly Weathered Rock
FR	Fresh Rock

Rock Strength

L	Low
M	Medium
H	High
EH	Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

BOREHOLE LOG

Test Methods:

AS1289.1.2.1	VicRoads TB40
AS1289.6.3.2	AustStab Nat07
AS1726	AS1547

ST. QUENTIN
Surveyors • Town Planners • Engineers

Client: Damon Eisen
Location: 36-38 Riverside Drive,
Wye River , Victoria

Project No.: 15760G
Borehole No: BH 4
Date: 27/11/2018

Sheet: 1 of 1
Logged by: C.F.
Checked by: O.R

Depth (metres)	Graphic Log	Material Description Type, Plasticity, Colour, Particle characteristics	Degree of Weathering XW HW MW SW FS	Soil Profile Photograph	Rock Strength L M H EH	Sample / Test	Test Results	Geology and additional observations
0.2		COLLUVIUM (SILTY SAND/ROCK): Fine to medium grained, brown, dry. Loam 'AS1547'						
0.5								
0.7								
0.80		Silty SAND (SMI), dense, fine to medium grained, yelloe						
0.9								
1.00		Exteremely weathered rock (XW) Very low strength rock, sandstone/mudstone, yellow						
1.2								
1.4								
1.40		Borehole 4 refused at 1.4m						
1.6								
1.8								
2.1								
2.3								
2.5								
2.8								

Method:
- [x] Hand Auger
- [ ] Auger Drilling
- [ ] Roller/Tricone
- [ ] Washbore
- [ ] Non Destructive Digging

Degree of Weathering

XW	Extremely Weathered Rock
HW	Highly Weathered Rock
MW	Moderaltely Weathered Rock
SW	Slightly Weathered Rock
FR	Fresh Rock

Rock Strength

L	Low
M	Medium
H	High
EH	Extremely High

Samples & Field Tests

U50	Undisturbed Sample 50mm	PP	Pocket Penetrometer (kPa)
U63	Undisturbed Sample 63mm	N	Standard Penetration Test
DS	Disturbed Sample	V	Pilcon Shear Vane (kPa)
BS	Bulk Disturbed Sample	DCP	Dinamic Cone Penetrometer Test
ES	Environmental Sample		

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Appendix C

Site Photographs

North east view: existing site, note overturning retaining structure

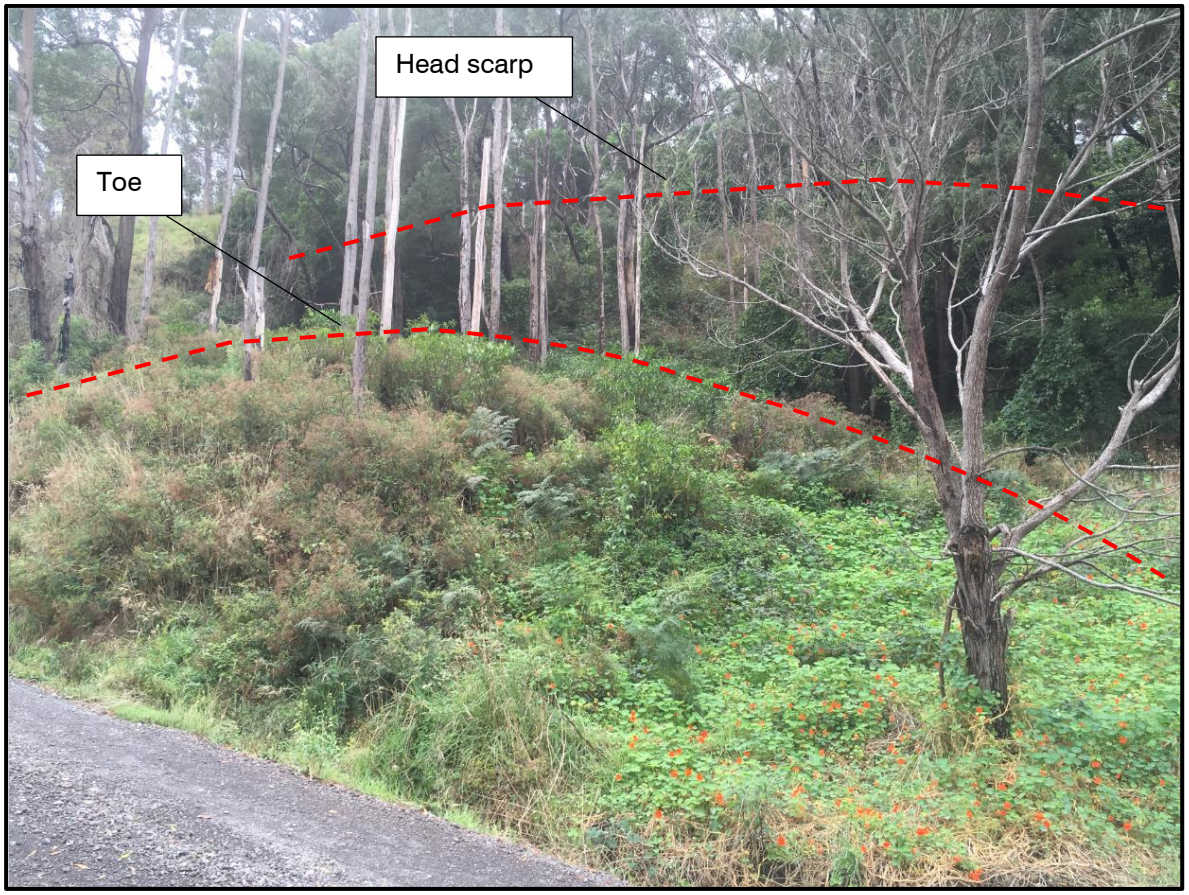
North east view: existing site and proposed building envelope

South west view: existing site, downslope view

West view: existing site, mid-slope

North view: existing site, mid-slope

South east view: adjacent site, downslope view. Note large previous landslide scarp



North west view from Riverside Drive: adjacent site, large previous landslide scarp and toe (note toe extends south past Riverside Drive

Existing site. Colluvium with embedded cobble/rock, indicating previous landslide movement

Existing site. Fill/recent spoil placement., note outline of scarp, indicating movement

Adjacent site (north). Note existing drain and poorly graded drainage

Adjacent site (north). Existing effluent disposal system

Adjacent site (north). Existing effluent disposal system, irrigation discharge hose (onto downslope site)

Adjacent site (north). View to the south, toward the subject site at 36 Riverside Drive, Wye River

Existing site cut, top of site, note recent failure at top of embankment

Existing site cut (wide view) top of site, note small failure wedge at top of embankment

Existing site cut, bottom of site along Riverside Drive

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Appendix D

ETA Bed Sizing

VICTORIAN LAND CAPABILITY ASSESSMENT FRAMEWORK

WATER BALANCE MODEL - ETA SYSTEMS / TRENCHES / BEDS

ST. QUENTIN
Surveyors ·Town Planners ·Engineers

Client: Damon Eisen
Assessor: Cameron Farrar
Location: 36 & 38 Riverside Drive, Wye River, Victoria
Project No.: 15760G-LCA
Date: 27/11/2018

DISPOSAL AREA SIZING USING NOMINATED AREA WATER BALANCE

INPUT DATA

Number of Bedrooms:	2	Actual number of bedrooms of proposed building
Water Supply:	150	Limited (water sourced only from rain water collection) or unlimited (reticulated water supply proposed)
Design Wastewater Flow (Q):	450 L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (July 2016)
Design Loading Rate (DLR):	8.0 mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (July 2016)
Minimum Disposal Area:	56 m²	Based on material type and through interpretation of Table 5.1 & 5.2 of AS/NZS 1547:2012
ETA Bed Width	2.0 m	As selected by designer
ETA Bed Length	28.1 m	
Crop Factor (C):	0.6-0.8	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type (suitable for pasture grass)
Rainfall Runoff Factor (RF):	0.75	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Rainfall Data:	Kennett River (70th Percen.)	BoM Station and number or 70th Percentile from Council Specific Data
Pan Evaporation Data:	Kennett River (70th Percen.)	BoM Station and number
Design storage depth:	300 mm	Maximum storage depth of 550mm

Parameter	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month (D):		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (R):		mm/month	43.0	45.0	57.0	71.0	85.0	91.0	98.0	110.0	93.0	84.0	65.0	54.0	896
Evaporation (E):		mm/month	129.0	106.0	90.0	58.0	39.0	28.0	32.0	44.0	61.0	87.0	102.0	121.0	897
Crop Factor (C):		unitless	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.8	
OUTPUTS															
Evapotranspiration (ET):	E x C	mm/month	103.2	84.8	63.0	40.6	23.4	16.8	19.2	26.4	42.7	69.6	81.6	96.8	668.1
Percolation (B):	DLR x D	mm/month	248	224	248	240	248	240	248	248	240	248	240	248	2920
Outputs:	ET + B	mm/month	351.2	308.8	311.0	280.6	271.4	256.8	267.2	274.4	282.7	317.6	321.6	344.8	3588.1
INPUTS															
Retained Rainfall (RR):	R x RF	mm/month	32	34	43	53	64	68	74	83	70	63	49	41	672
Applied Effluent (W):	(Q x D) / L	mm/month	219.7	198.5	219.7	212.6	219.7	212.6	219.7	219.7	212.6	219.7	212.6	219.7	2587.0
Inputs:	RR+W	mm/month	252.0	232.2	262.5	265.9	283.5	280.9	293.2	302.2	282.4	282.7	261.4	260.2	3259.0
STORAGE CALCULATION															
Storage remaining from previous month		mm/month	0	0	0	0	0	40	121	207	300	299	183	0	
Storage for the month (S):	(RR+W) - (ET+B)	mm/month	-99.2	-76.6	-48.5	-14.7	12.1	24.1	26.0	27.8	-0.3	-34.9	-60.2	-84.6	
Increase in depth of stored effluent		mm/month	-330.8	-255.3	-161.8	-49.1	40.2	80.3	86.7	92.7	-1.1	-116.3	-200.7	-281.9	
Cumulative Storage (M):		mm/month	0.0	0.0	0.0	0.0	40.2	120.5	207.3	300.0	298.9	182.7	0.0	0.0	
Max. Storage for Nominated Area (N):		mm	300												
Max. Volume for Nominated Area (V):	N x L	L	19047												
LAND AREA REQUIRED FOR ZERO STORAGE		m^2	43.74	45.81	52.00	59.38	67.18	71.60	72.02	72.69	63.40	54.79	49.48	45.84	

Minimum ETA bed area for zero storage: 73 m²

Area for design storage (L): 63.5 m²

Nominated ETA bed length: 32 m

VICTORIAN LAND CAPABILITY ASSESSMENT FRAMEWORK

TRENCH AND BED SIZING

ST. QUENTIN
Surveyors · Town Planners · Engineers

Client: Damon Eisen
Assessor: Cameron Farrar
Location: 36 & 38 Riverside Drive, Wye River, Victoria
Project No.: 15760G-LCA
Date: 27/11/2018

FORMULA FOR TRENCH AND BED SIZING			
L = Q/DLR x W			From AS/NZS 1547:2012
Where:	Units		
L = Trench or bed length	m		Total trench or bed length required
Q = Design Wastewater Flow	L/day		Based on maximum potential occupancy
DLR = Design Loading Rate	mm/day		Based on soil texture class/permeability
W = Trench or bed width	m		As selected by designer/installer

INPUT DATA				
Design Wastewater Flow	Q	450	L/day	Based on maximum potential occupancy
Design Loading Rate	DLR	300.0	mm/day	Based on soil texture class/permeability
Trench basal area required	B	1.5	m^2	
Selected trench or bed width	W	2.0	m	As selected by designer/installer

OUTPUT			
Required trench or bed length	L	**0.8**	m

CELLS

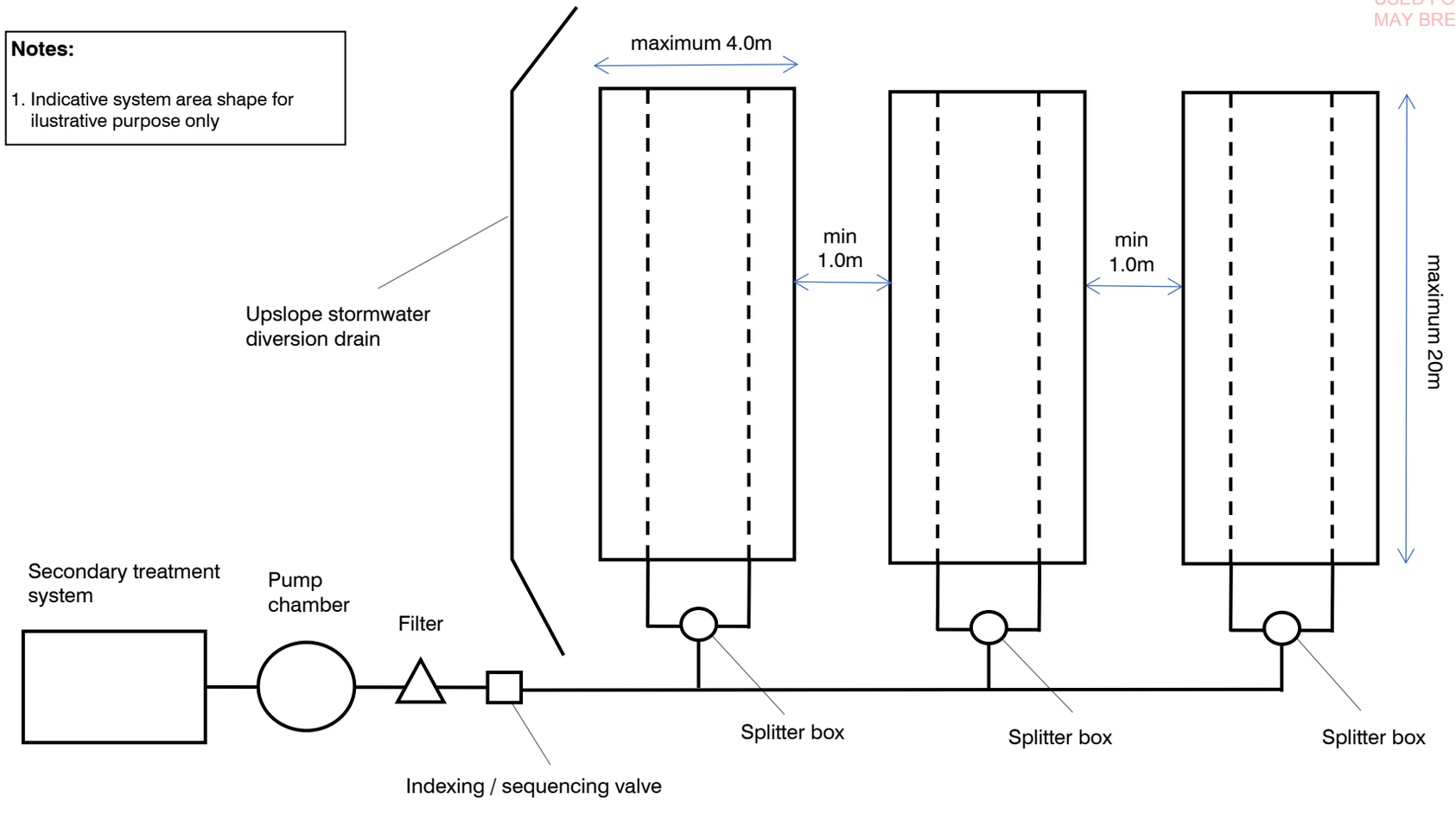
	Please enter data in blue cells
XX	Red cells are automatically populated by the spreadsheet
XX	Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS

Appendix E

Typical ETA Beds System Layout

Notes:

1. Indicative system area shape for ilustrative purpose only



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Surveyors ·Town Planners ·Engineers
51 LITTLE FYANS STREET,
P.O. BOX 919, GEELONG 3220
TELEPHONE (03) 5201 1811 FAX (03) 5229 2909

Typical ETA Bed Layout

Location: 36-38 Riverside Drive
Wye River, Victoria
Project No: 15760G-LCA
Scale: NOT TO SCALE

Drawn by: C.F.
Date: 27/11/2018
Approved by: C.F.
Date: 27/11/2018

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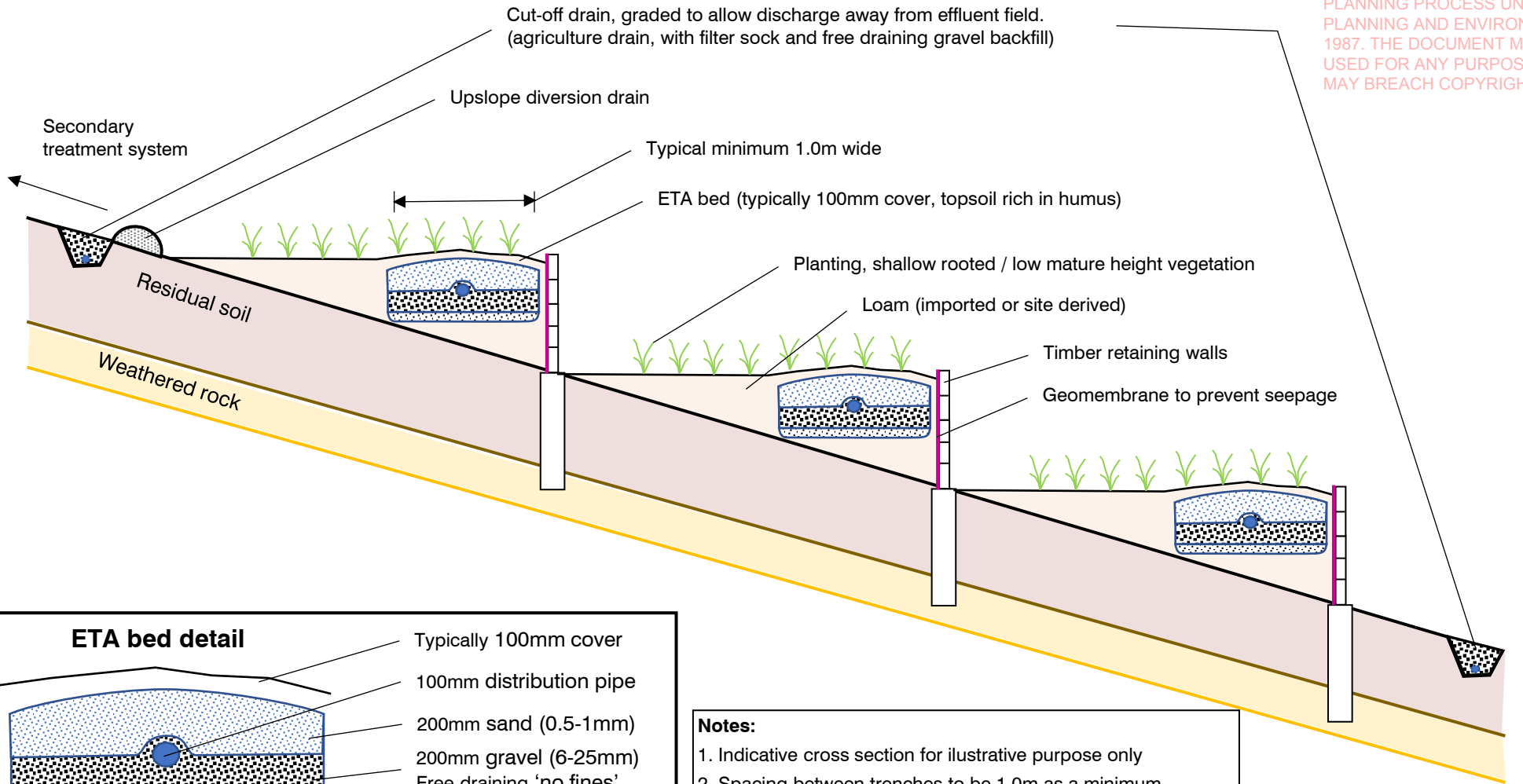
Appendix F

Typical ETA Beds Cross Section



ETA bed detail

Notes:

1. Indicative cross section for ilustrative purpose only
2. Spacing between trenches to be 1.0m as a minimum
3. Install cutoff drains to direct stormwater away from system

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Typical Terraced ETA Bed Cross Section

Location: 36-38 Riverside Drive
Wye River, Victoria
Project No: 15760G-LCA
Scale: NOT TO SCALE

Drawn by: C.F.
Date: 27/11/2018
Approved by: C.F.
Date: 27/11/2018

Appendix G

Arris Pty Ltd Rhizopod Brochure

Residential Water Solutions

Products for Rhizopod Water Systems

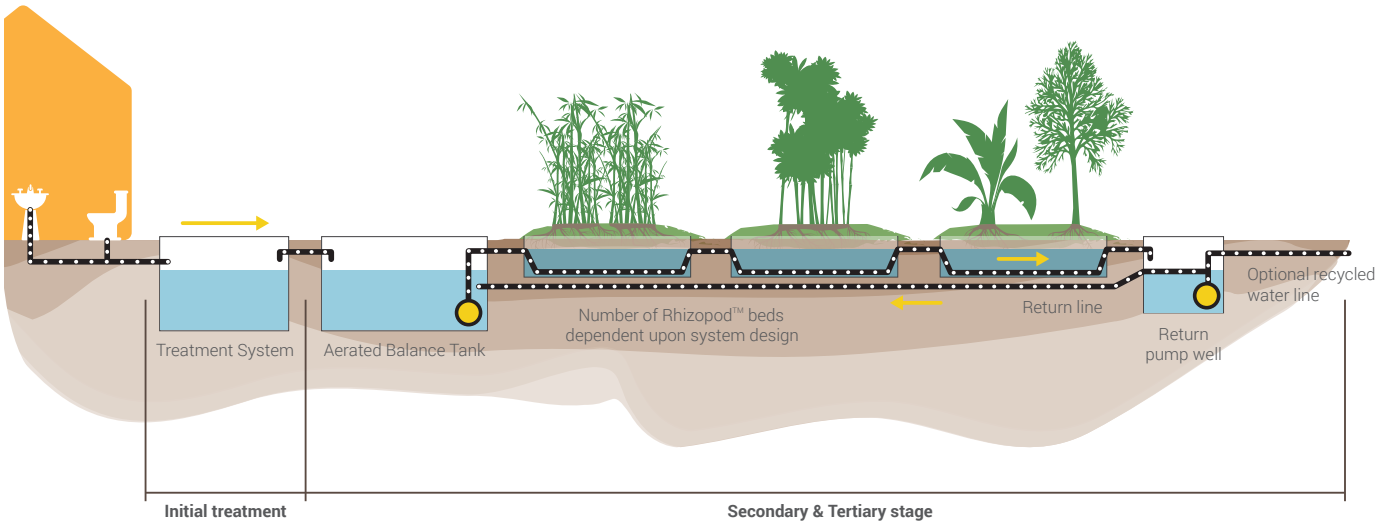
Wastewater Systems Pty Ltd

arris water treatment & technology

BACKGROUND

The Rhizopod system is an on-site wastewater treatment technology that takes advantage of evapotranspiration – the loss of water from the soil by evaporation and by transpiration from plants. This product is a unique completely contained recirculating hydroponic pod arrangement which uses plants to beneficially use and disperse the wastewater from your site.

The Rhizopod technology is a 'no release' system with nil discharge to the local environment



Rhizopods are being used for single domestic sites through to decentralised systems for small communities of 1600EP

It is independent of the local soil type, has a very small footprint, and allows for reduced setback distances.

Wastewater is treated to via either a package plant (AWTS) or a septic tank, and is then distributed to the self-contained pod. Effluent overflow drains to a balance tank for recirculation through the system.

The Rhizopod technology has been specifically designed for 'difficult' sites. If your block has heavy clay soils, high water-tables, nearby bores or waterways, or it's just too small to fit both the house you want to build and the on-site wastewater technology; then the Rhizopod system is the solution you need.

FIGURE 1 HOW THE RHIZOPOD WORKS ABOVE AND BELOW GROUND

Wastewater Systems Pty Ltd

arris water treatment & technology

For close to 20 years the Rhizopod system has been successfully installed in Australia to solve these types of problems. It can be used in new developments or retro-fitted onto existing houses. From single dwellings, to caravan parks, to housing estates, the Rhizopod system has been used to provide wastewater solutions on previously undevelopable land.

WHY RHIZOPOD?

The Rhizopod system can be retrofitted to existing holding tank installations to provide advanced treatment and reduce the cost of offsite disposal. Where existing holding tank installations are located in environmentally sensitive areas (eg fishing shack developments), and are failing or poorly managed, Rhizopod retrofits can improve community health, environmental outcomes, and provide other social benefits. The Rhizopod system can be used in situations where normal set back cannot be achieved, or the block is simply too small to allow traditional land application methods.

One of the advantages of this system is that there are a number of configurations and layouts that allows for installations for variable site conditions:

- Limited space;
- Unsuitable soils;
- Set back requirement issues;
- Elevations; and
- Retro-fits onto sites where previous on-site systems have failed

The advantage of this system is that there are a number of configurations and layouts that allow for installations under variable site conditions

For further information or to discuss installation of a Rhizopod™ System, contact your local service provider:

Wastewater Systems Pty Ltd

155 Inglis Street
Ballan, Victoria 3342
Ph: 1800 020 093
Fax: 03 53 68 15 10
glenvale@netconnect.com.au
www.wastewateraus.com.au

Arris Water Treatment & Technology

water@arris.com.au
www.arris.com.au

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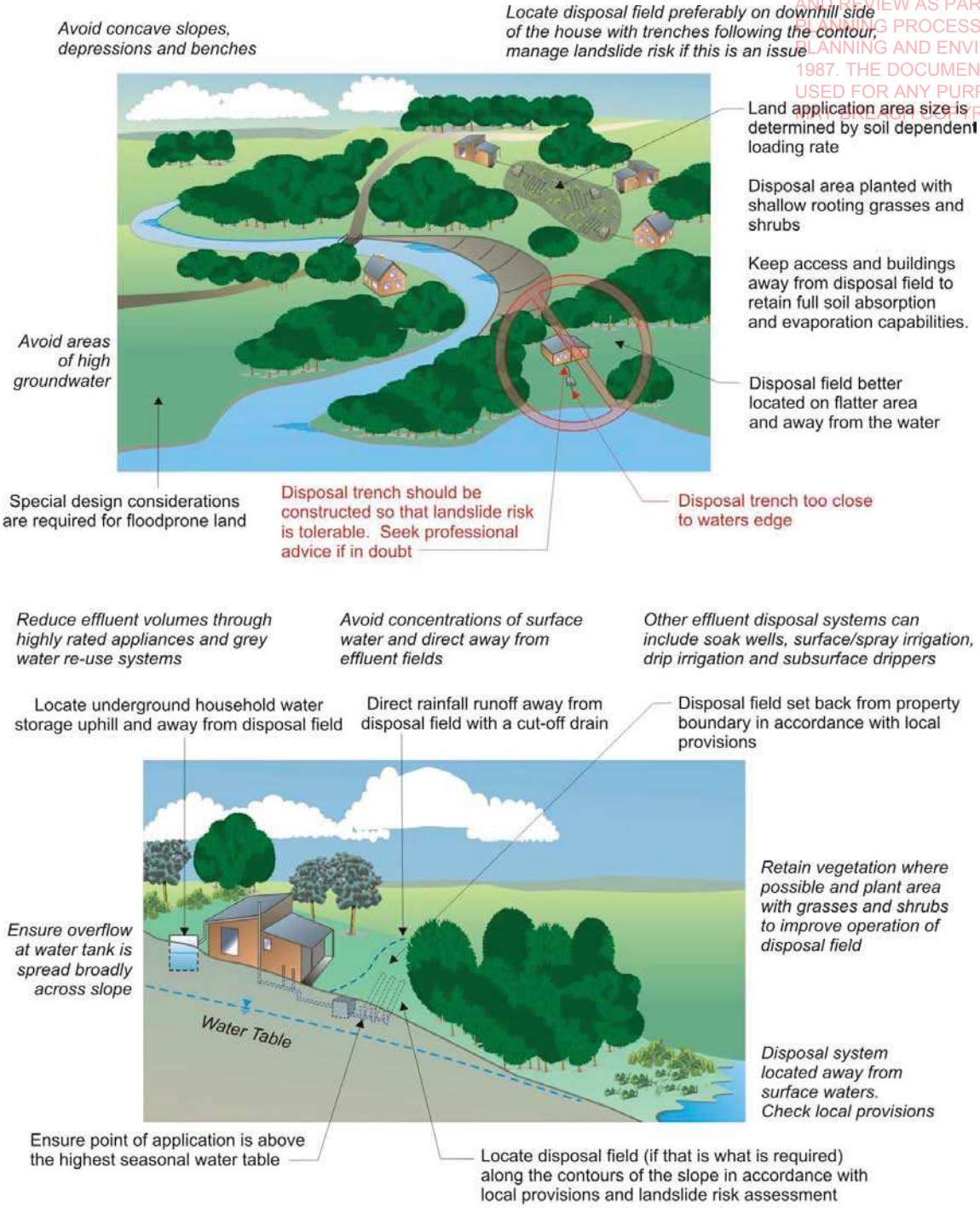
Appendix H

Australian Geoguides LR9 (Effluent Disposal)

AUSTRALIAN GEOGUIDE LR9 (EFFLUENT DISPOSAL)



Note: Adapted from EPA Vic. Publication 451 (March 1996) "Code of Practice - Septic Tanks", which was sourced from Vic. Department of Planning and Loddon-Campaspe Regional Planning Authority.

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

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

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

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Appendix I

Planning Report

PLANNING PROPERTY REPORT

From www.planning.vic.gov.au on 27 November 2018 05:02 PM

PROPERTY DETAILS

Address:	**36 RIVERSIDE DRIVE WYE RIVER 3234**
Lot and Plan Number:	**Lot 49 LP27735**
Standard Parcel Identifier (SPI):	**49\LP27735**
Local Government Area (Council):	**COLAC OTWAY** www.colacotway.vic.gov.au
Council Property Number:	**20185**
Planning Scheme:	**Colac Otway** planning-schemes.delwp.vic.gov.au/schemes/colacotway
Directory Reference:	**VicRoads 519 R6**

UTILITIES

Rural Water Corporation:	**Southern Rural Water**
Urban Water Corporation:	**Barwon Water**
Melbourne Water:	**outside drainage boundary**
Power Distributor:	**POWERCOR**

STATE ELECTORATES

Legislative Council:	**WESTERN VICTORIA**
Legislative Assembly:	**POLWARTH**

Planning Zones

TOWNSHIP ZONE (TZ)

SCHEDULE TO THE TOWNSHIP ZONE (TZ)

RCZ - Rural Conservation **TZ - Township**

Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

PLANNING PROPERTY REPORT

Planning Overlays

BUSHFIRE MANAGEMENT OVERLAY (BMO)

BMO - Bushfire Management

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

DESIGN AND DEVELOPMENT OVERLAY (DDO)

DESIGN AND DEVELOPMENT OVERLAY - SCHEDULE 4 (DDO4)

DDO - Design and Development

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Planning Overlays

EROSION MANAGEMENT OVERLAY (EMO)

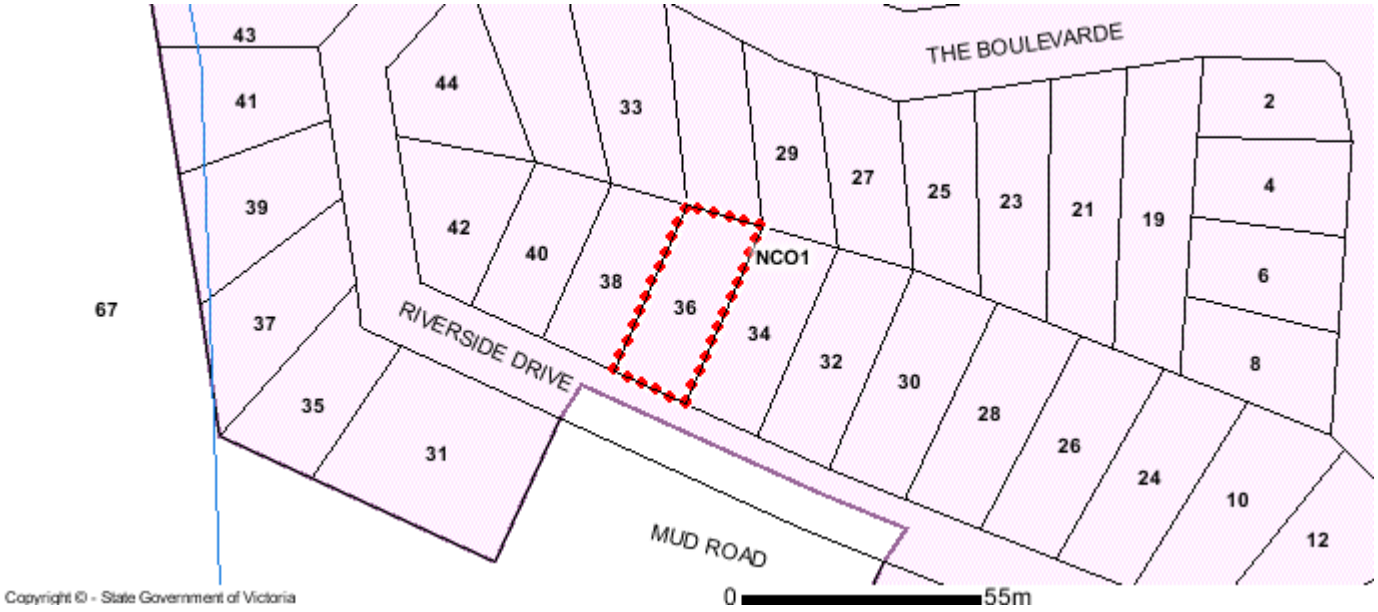
EROSION MANAGEMENT OVERLAY - SCHEDULE 1 (EMO1)

EMO - Erosion Management

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

NEIGHBOURHOOD CHARACTER OVERLAY (NCO)

NEIGHBOURHOOD CHARACTER OVERLAY - SCHEDULE 1 (NCO1)



NCO - Neighbourhood Character

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PLANNING PROPERTY REPORT

Planning Overlays

SIGNIFICANT LANDSCAPE OVERLAY (SLO)

SIGNIFICANT LANDSCAPE OVERLAY - SCHEDULE 2 (SLO2)

SLO - Significant Landscape

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend.

PLANNING PROPERTY REPORT

Areas of Aboriginal Cultural Heritage Sensitivity

All or part of this property is an 'area of cultural heritage sensitivity'.

'Areas of cultural heritage sensitivity' are defined under the Aboriginal Heritage Regulations 2018, and include registered Aboriginal cultural heritage places and land form types that are generally regarded as more likely to contain Aboriginal cultural heritage.

Under the Aboriginal Heritage Regulations 2018, 'areas of cultural heritage sensitivity' are one part of a two part trigger which require a 'cultural heritage management plan' be prepared where a listed 'high impact activity' is proposed.

If a significant land use change is proposed (for example, a subdivision into 3 or more lots), a cultural heritage management plan may be triggered. One or two dwellings, works ancillary to a dwelling, services to a dwelling, alteration of buildings and minor works are examples of works exempt from this requirement.

Under the Aboriginal Heritage Act 2006, where a cultural heritage management plan is required, planning permits, licences and work authorities cannot be issued unless the cultural heritage management plan has been approved for the activity.

For further information about whether a Cultural Heritage Management Plan is required go to http://www.aav.nrms.net.au/aavQuestion1.aspx

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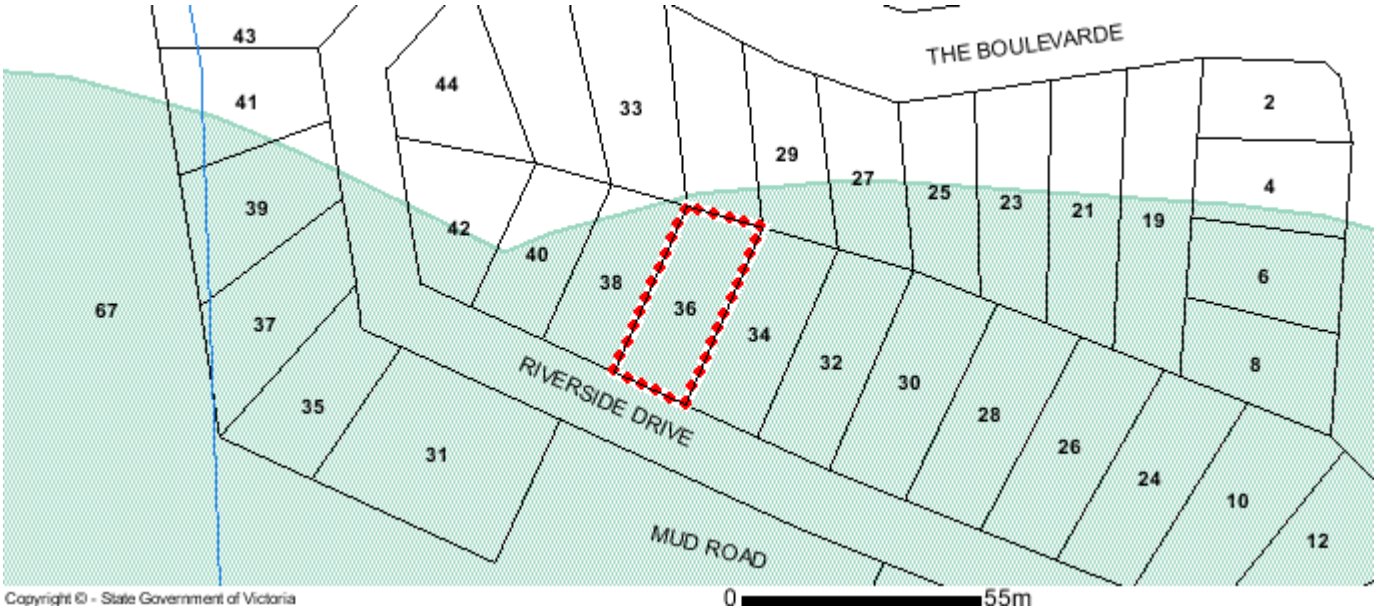

Aboriginal Heritage

PLANNING PROPERTY REPORT

Further Planning Information

Planning scheme data last updated on 20 November 2018.

A **planning scheme** sets out policies and requirements for the use, development and protection of land. This report provides information about the zone and overlay provisions that apply to the selected land. Information about the State and local policy, particular, general and operational provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the local council or by visiting https://www.planning.vic.gov.au

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the *Planning and Environment Act 1987*. It does not include information about exhibited planning scheme amendments, or zonings that may abut the land. To obtain a Planning Certificate go to Titles and Property Certificates at Landata - https://www.landata.vic.gov.au

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PLANNING PROPERTY REPORT

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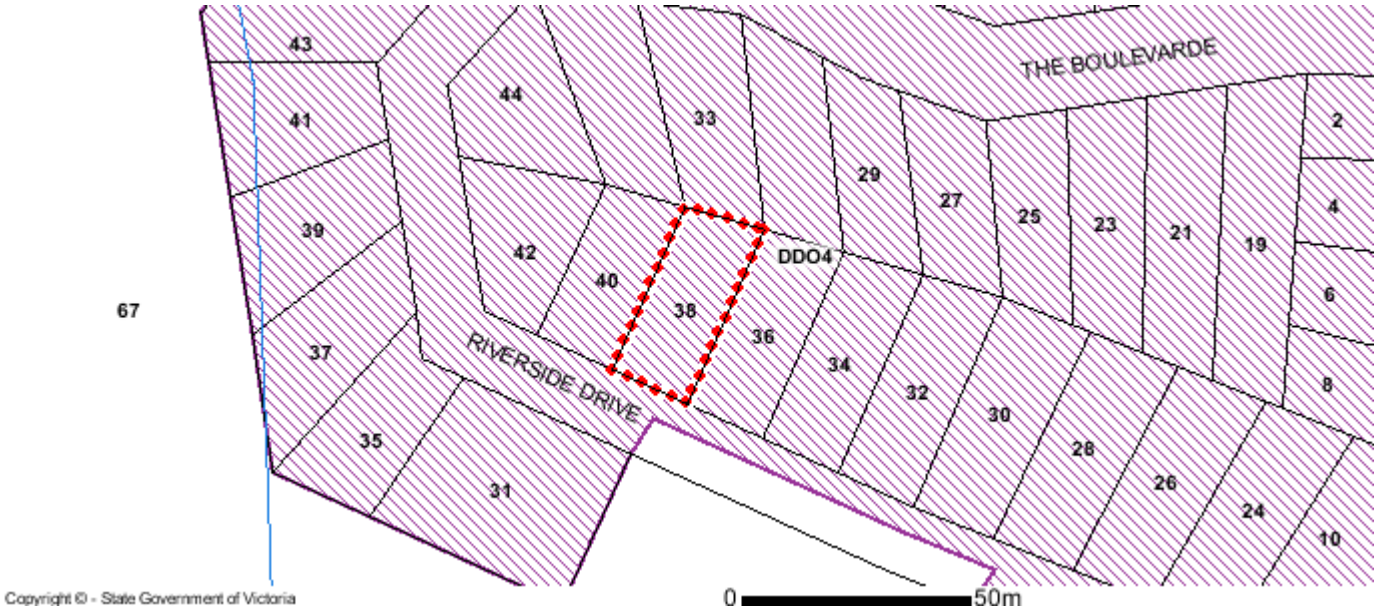

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PLANNING PROPERTY REPORT

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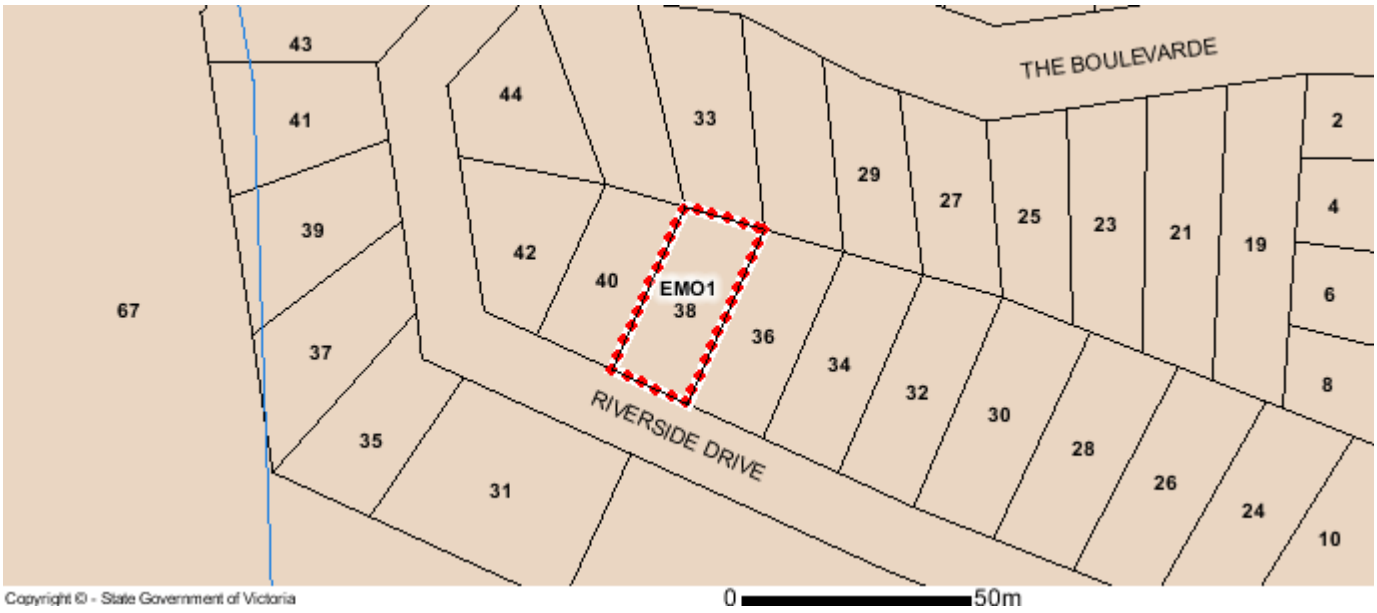

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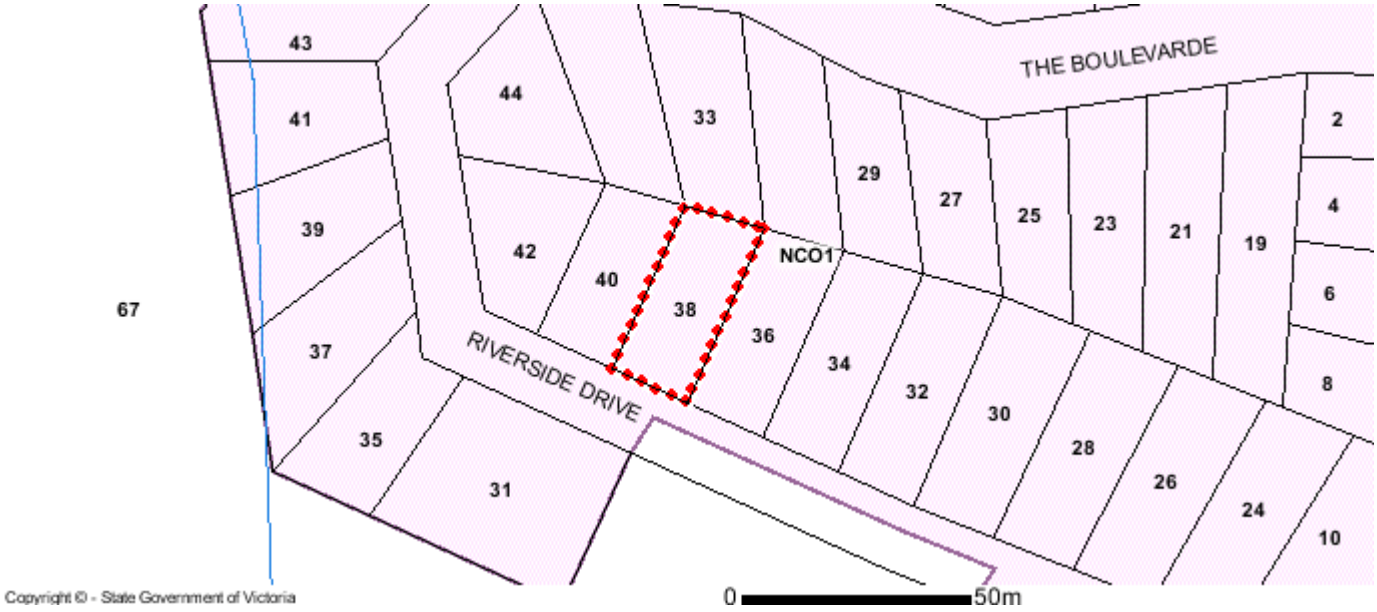

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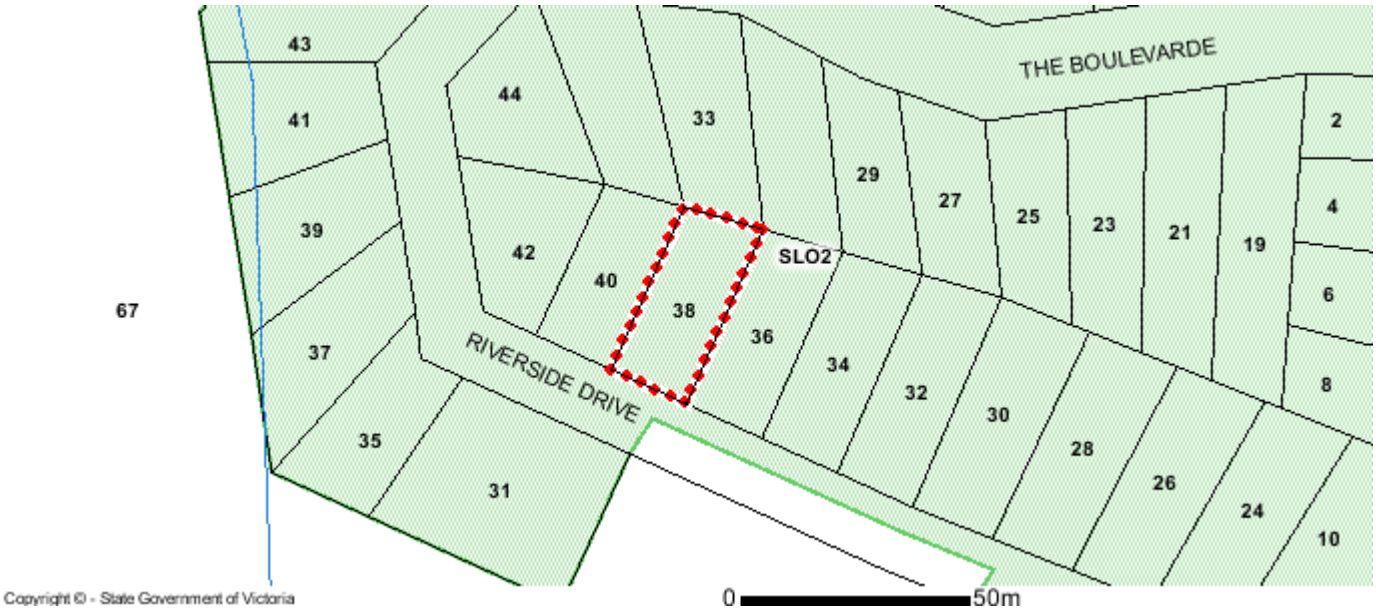

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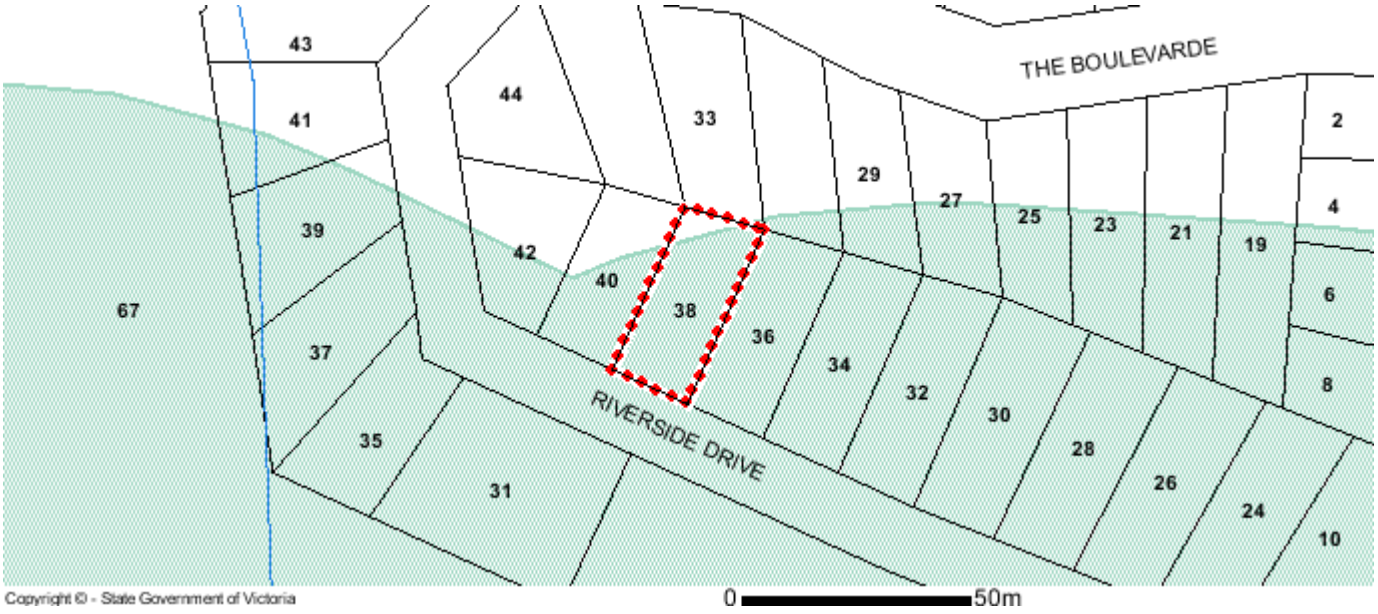

Aboriginal Heritage

PLANNING PROPERTY REPORT

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For other information about planning in Victoria visit https://www.planning.vic.gov.au

PLANNING PROPERTY REPORT

Designated Bushfire Prone Area

This property is in a designated bushfire prone area.
Special bushfire construction requirements apply. Planning provisions may apply.

Designated Bushfire Prone Area

Designated bushfire prone areas as determined by the Minister for Planning are in effect from 8 September 2011 and amended from time to time.

The Building Regulations 2018 through application of the Building Code of Australia, apply bushfire protection standards for building works in designated bushfire prone areas.

Designated bushfire prone areas maps can be viewed on VicPlan at http://mapshare.maps.vic.gov.au/vicplan or at the relevant local council.

Note: prior to 8 September 2011, the whole of Victoria was designated as bushfire prone area for the purposes of the building control system.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website www.vba.vic.gov.au

Copies of the Building Act and Building Regulations are available from www.legislation.vic.gov.au

For Planning Scheme Provisions in bushfire areas visit https://www.planning.vic.gov.au

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Appendix J

Land Capability Assessment Detailed Information Checklist

Minimum Requirements for a Detailed LCA Assessment and Report (High Risk)

Report Element	Detailed Requirements	Completed
1. Introduction and Background	Report summary/ executive summary.	☑
	Confirmation of Sensitivity Rating.	☑
	Confirmation of any relevant sensitivity overlays (e.g. landslip) as per communications with Council.	☑
	Confirmation that property/parcel(s) meets minimum lot size criteria for COS Planning Scheme Zone.	☑
	Current land use and development overview (including occupancy); single property/parcel, increase in building entitlements (subdivision) or non-domestic development.	☑
	Name, contact details and qualifications (insurances) of LCA assessor (author).	☑
	Site location (including address and property/parcel details) and owner.	☑
	Property/parcel area.	☑
	Proposed/existing water supply.	☑
	Availability of sewer.	☑
	Locality map showing the site in relation to surrounding region.	☑
	Site survey plan (2m contours) will need to be conducted by a qualified surveyor.	☑
2. Site Inspection and Field Investigations	Gather information on relevant Council, Water Corporation, Catchment Management Authority and State Government requirements, including restrictions and caveats on title, and planning/building/bushfire/flood controls, e.g. zones and overlays. Note Environmental Significant Overlays, potable water supply and DWSCs. Impose this information on a base map (or site plan) which shows their location with respect to title boundaries.	☑
	Broad overview of locality and landscape characteristics that may pose a constraint to the sustainable application of wastewater on the Site and adjacent land, e.g. climatic information, groundwater and bore water information. (Refer to stage 3 pp.34 EPA Code of Practice (2013)).	☑
	Details of date, time and methodology of site inspection and field investigations.	☑
	Site assessment that considers all of the parameters as per Table 1 of the Victorian LCA Framework (2014). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints.	☑
	Minimum of two soil test pits or auger holes within the identified available effluent management area with additional test pits required for more than one soil type (multiple soil landscapes or facets) as per the current EPA Code of Practice.	☑
	Soil assessment that considers all of the parameters in Table 2 of the Victorian LCA Framework (2014): • colour and mottling; • electrical conductivity; • Emerson Aggregate Class; • permeability and design loading rate (using soil texture); • pH; • rock fragments; • soil depth; • soil texture (field textural analysis); • watertable (depth to); • cation exchange capacity (CEC);	☑

Report Element	Detailed Requirements	Completed
	• sodicity (Exchangeable Sodium Percentage ESP); and • Sodium Absorption Ratio (SAR). Detailed explanation of the level of constraint with regards to DWM and recommended mitigation measures to overcome these constraints. Soil permeability testing conducted in situ for the soil within the available effluent management area as per constant head well permeameter method (AS/NZS 1547:2012) can be undertaken if desired, otherwise soil texture classification and application of effluent using the loading rates within the AS/NZS 1547:2012 is satisfactory.	
	Detailed review of available published soils information for the site. Soil landscapes and different soil facets should be mapped on the Site Plan.	☑
3. Available Area and Setback Distances	Calculation of available effluent management area and location on Site Plan.	☑
	Discussion regarding the achievability of the applicable setback distances (Table 5 of the EPA Code of Practice (2013)). Justification required.	☑
4. LCA Confirmation	Confirm the results from Stages 1-3 of the LCA checklist with Council to assess the final Sensitivity Rating for the site to confirm LCA requirements for system selection and design. Provide a Site Plan showing the available effluent management area(s) and completed Sensitivity Pro-forma Checklist.	☑
5. Cumulative Impacts	Using the desktop and site assessment information for the site, comment on any possible cumulative detrimental impacts that the development may have on beneficial uses of the surrounding land, surface water and groundwater.	☑
6. System Selection and Design	Design maximum wastewater load (generation rates) and organic load for the proposed development.	☑
	Description of existing system (if applicable).	☑
	Target effluent treatment quality.	☑
	Assess the capacity of the land to assimilate the treated wastewater based on the data collected and the total dissolved salts (TDS) in the potable water supply (see Section 2.3.4 and Appendix G of EPA Code of Practice (2013)) for both levels of effluent quality, primary and secondary.	☑
	Description and location of applicable DWM treatment system options (refer to the EPA website for list of currently approved systems).	☑
	List of effluent land application options and detailed description of preferred option and location.	☑
	Monthly water balance sizing the preferred effluent land application area. 70th percentile climate data must be used for your location within the relevant Climate Zone, as detailed in Section 6.2.2 of Technical Document. A copy of the 70th percentile climate data is attached in Appendix C of the Technical Document. All inputs, results and justification to be shown in the report.	☑
7. Mitigation Measures	Detailed discussion of mitigation measures to overcome any site or soil constraints posed to the sustainable treatment and application of wastewater on-site. This may include the following: • Storm water management • Soil amelioration; and • Vegetation establishment and management.	☑
8. Site	Description of ways to improve wastewater and DWM system performance for residents' reference.	☑

Report Element	Detailed Requirements	Completed
Management Plan	Operation and Management Plan.	☑
9. Conclusion	Conclusion summarising all the important design, sizing and mitigation requirements to ensure sustainable on-site DWM.	☑
10. Site Plan Requirements	Site address, including property/parcel number and street number.	☑
	All title boundaries.	☑
	All relevant zones and overlays and/or restrictions (e.g. Council zoning and overlays, including Environmental Significant Overlays and DWSCs).	☑
	Type of catchment (i.e. potable or other special water supply catchment).	☑
	North arrow.	☑
	Location of groundwater bores.	☑
	Contour lines (at maximum of 2m intervals), direction of slope and grade.	☑
	Location of soil test pits or auger holes.	☑
	Location of any significant site features e.g. rock outcrops or waterlogged regions.	☑
	Location of intermittent and permanent surface waterways (dams, creeks, reservoirs and springs).	☑
	Location of 1% and 5% Annual Exceedance Probability flood level contours lines (if applicable).	☑
	Location, depth and specified use of groundwater bores on the site and adjacent properties from the register of the relevant Rural Water Corporation. Depth to groundwater table in winter (if less than 2.1m deep).	☑
	Vegetation cover (can use aerial image as base map).	☑
	Relevant setback distances as per Table 5 EPA Code of Practice (2013).	☑
	Location of existing and proposed buildings, sheds, driveways, paths and any other improvements.	☑
	Available effluent management area(s).	☑
	Location of proposed land application area (sized to scale).	☑
	Location of proposed stormwater cut-off drains adjacent to the land application area.	☑
	Location of proposed DWM system (nominal).	☑
	Location of reserve land application area (sized to scale).	☑
11. Appendices	Copy of the monthly water balance calculations.	☑
	Figures.	☑
	Site Plan.	☑
	Soil bore logs for all test pits or auger holes.	☑
	Certificate of Title (s) for property/parcel (plan).	☑
	Proposed building plans.	☑
	Planning Permit application (where applicable).	☑
	Septic Tank Permit application.	☑

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P: (03) 5201 1811 F: (03) 5229 2909 E: admin@stqc.com.au
www.stqc.com.au ACN: 120 048 857 ABN: 45 120 048 857

LAND CAPABILITY ASSESSMENT ADDENDUM

TESTING PROGRAMME & REPORT

1. Report has been prepared by qualified persons and based on current available standards.
2. Recommendations are based on the assumption that limited test positions are representative of the sub-surface profile.
3. Whilst care has been taken to accurately report on the sub-surface conditions across the site it is not possible to anticipate unexpected sub-surface variations given the limited testing performed.
4. Changes in legislative policy may require report update or additional testing.

The purpose of this report is to determine the capability of the site to contain effluent with regard to the soil and land constraints. It is beyond the scope of this report to provide specific effluent system design. Where any variation or anomalies are encountered, we recommend additional investigation and reporting by us to resolve any potential issues.

EFFLUENT DISPOSAL CARE & MAINTENANCE

We recommend the following to assist in long term system serviceability and safe on site disposal:

1. Restrict germicides such as strong detergents, disinfectants, toilet clears with high acid content, nappy sanitisers, bleaches etc. that are likely to kill bacteria and affect the operation of the septic system.
2. Only use detergents with low alkaline salts and chlorine.
3. Sanitary napkins or disposable nappies must not be flushed into the system.
4. Limit the amount of fat and oils into the system.
5. Use sink strainer to limit the food that enters the system.
6. Do not use garbage disposal units.
7. Where odours occur, we recommend flushing approximately one cup of lime each day.
8. To reduce odours, we recommend filling the tank with water after installation or after desludging.
9. Grease trap should be checked for blockages and pumped every 6-12 months.
10. Inspect the system once a year by a qualified plumber or drainer.
11. Tank should be pumped concurrently every three years.

VEGETATION FOR TRANSPIRATION

Good vegetative cover is important to achieve effective transpiration of effluent disposal. It is therefore recommended to establish and maintain good grass cover over distribution areas and suitable shrubs or trees between distribution lines. Where trees are planted near drainage line, difficulties with root invasion can be anticipated. We do not recommend planting crops in disposal area.

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The following list includes some suitable water tolerant plants:

Botanical Names	**Common Names**
Phragmites australis	
Canna x generakis	Canna Lily, Calla Lily, Ginger Lily
Acacia Howittii	Sticky Wattle
Callistemon citrinus	Crimson Bottlebrush
Callistemon macropunctatus	Scarlet Bottlebrush
Leptospermun lanigerum	Wooley Tea-Tree
Melaleuca decussate	Cross Honey Myrtle
Melaleuca ericifolia	Swamp Paperbark
Melaleuca halmaturorum	Salt paperbark
Tamarix juniperina	Flowering Tamarisk
Eleocharis acuta	Cannas
	Common Spike-Rush
	Buffalo / kikuyu
	Geranium
	Hydrangeas
	Tall wheat grass
	Strawberry Clover, White Clover
	Perennial Rye
	Bougainvilliea

GENERAL COMMENTS

St Quentin Consulting does not accept responsibility for our report where it has been altered or not reproduced in full, including addendum.

Dimensions, slope, test locations are approximate only and must not be used for calculation of positioning.

Recommendations are based on information regarding the site and development type provided by the client or agent. If information supplied is not accurate or if significant changes are required our report may be inappropriate. We cannot accept responsibility for significant changes and anticipate additional fees should further tests or report update be required.

Offset distance to septic tanks or any subsurface excavations must not exceed the minimum angle of repose for the in-situ naturally occurring soil. We estimate the maximum angle of repose for sand is 30 and 45 for clay soils. We do not recommend steeper angles unless competent rock is encountered.

ST. QUENTIN

Surveyors • Town Planners • Engineers

stqc.com.au

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

VOLUME 08704 FOLIO 706

Security no : 124066663218J
Produced 21/06/2017 12:16 pm

LAND DESCRIPTION

Lot 49 on Plan of Subdivision 027735.
PARENT TITLE Volume 08461 Folio 958
Created by instrument C953759 05/12/1967

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
ALCYON CEYX PTY LTD of 25 CANNING STREET NORTH MELBOURNE VIC 3051
AH982252J 31/05/2011

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 TP456230A 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: 36 RIVERSIDE DRIVE WYE RIVER VIC 3234

DOCUMENT END

Imaged Document Cover Sheet

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

Document Type	**plan**
Document Identification	**TP456230A**
Number of Pages (excluding this cover sheet)	**2**
Document Assembled	**21/06/2017 12:21**

TITLE PLAN		EDITION 1	TP 456230A

Location of Land

Parish: KAANGLANG
Township:
Section:
Crown Allotment: 29D (PT)
Crown Portion:

Last Plan Reference: LP 27735
Derived From: VOL 8704 FOL 706
Depth Limitation: 50 FEET

Notations

ANY REFERENCE TO MAP IN THE TEXT MEANS THE DIAGRAM SHOWN ON THIS TITLE PLAN

Description of Land / Easement Information

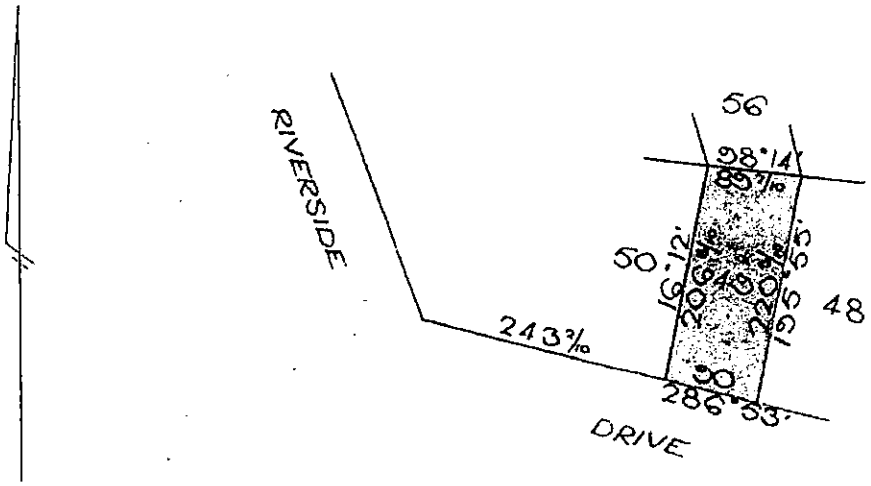
A-1 = RIGHT OF CARRIAGEWAY EASEMENT APPURTENANT TO THE WITHIN LAND CREATED BY INSTRUMENT S393463R

A-2 = RIGHT OF CARRIAGEWAY EASEMENT APPURTENANT TO THE WITHIN LAND CREATED BY INSTRUMENT S393456L

A-3 = RIGHT OF CARRIAGEWAY EASEMENT APPURTENANT TO THE WITHIN LAND CREATED BY INSTRUMENT S393457H

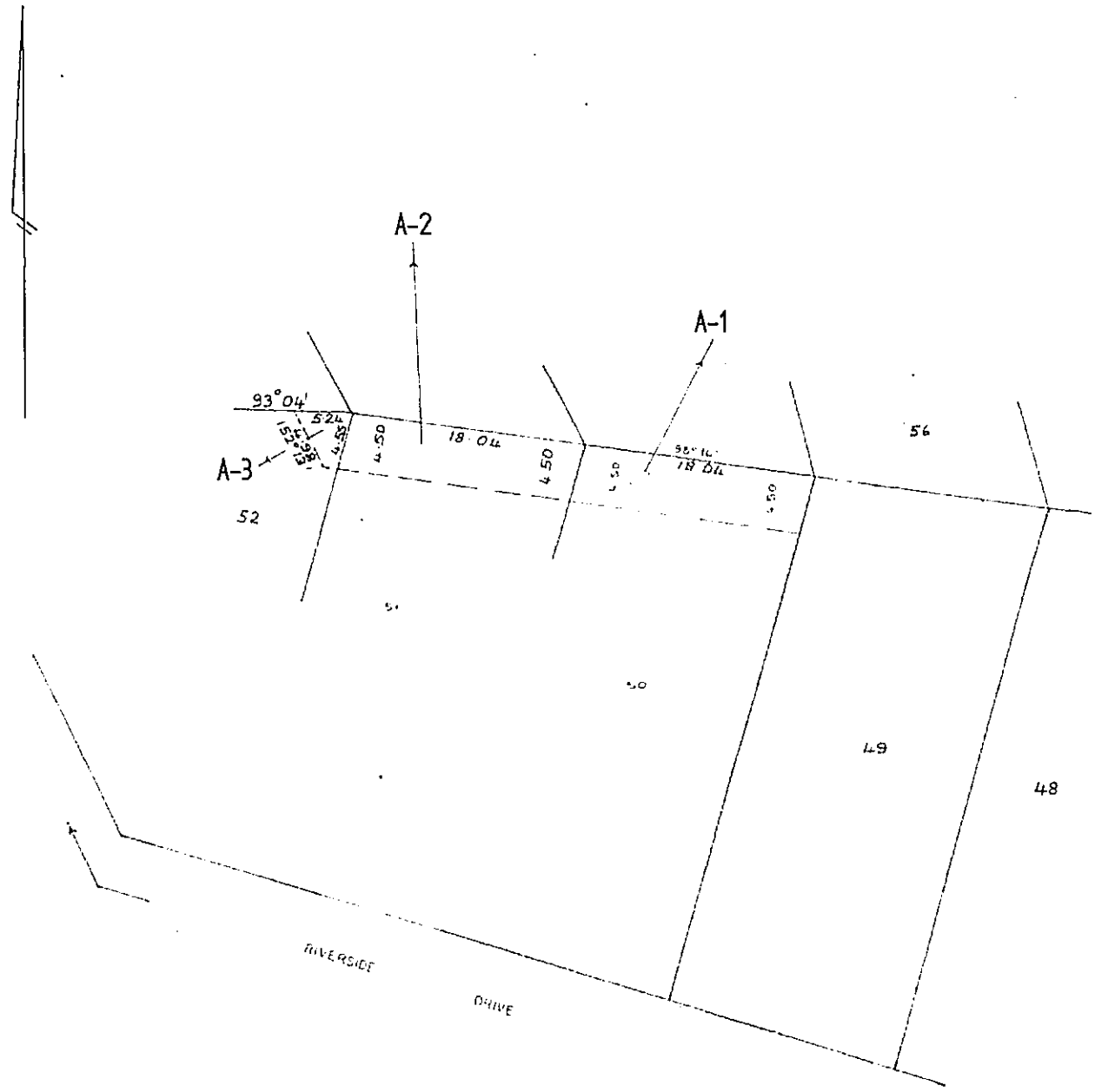
THIS PLAN HAS BEEN PREPARED FOR THE LAND REGISTRY, LAND VICTORIA, FOR TITLE DIAGRAM PURPOSES AS PART OF THE LAND TITLES AUTOMATION PROJECT
COMPILED: 08/08/2002
VERIFIED: DA

SEE SHEET 2 FOR FURTHER EASEMENT DETAILS



LENGTHS ARE IN LINKS	Metres = 0.3048 x Feet Metres = 0.201168 x Links		Sheet 1 of 2 sheets

TITLE PLAN		TP 456230A



LENGTHS ARE IN METRES	Metres = 0.3048 x Feet Metres = 0.201168 x Links		Sheet 2 of 2 sheets