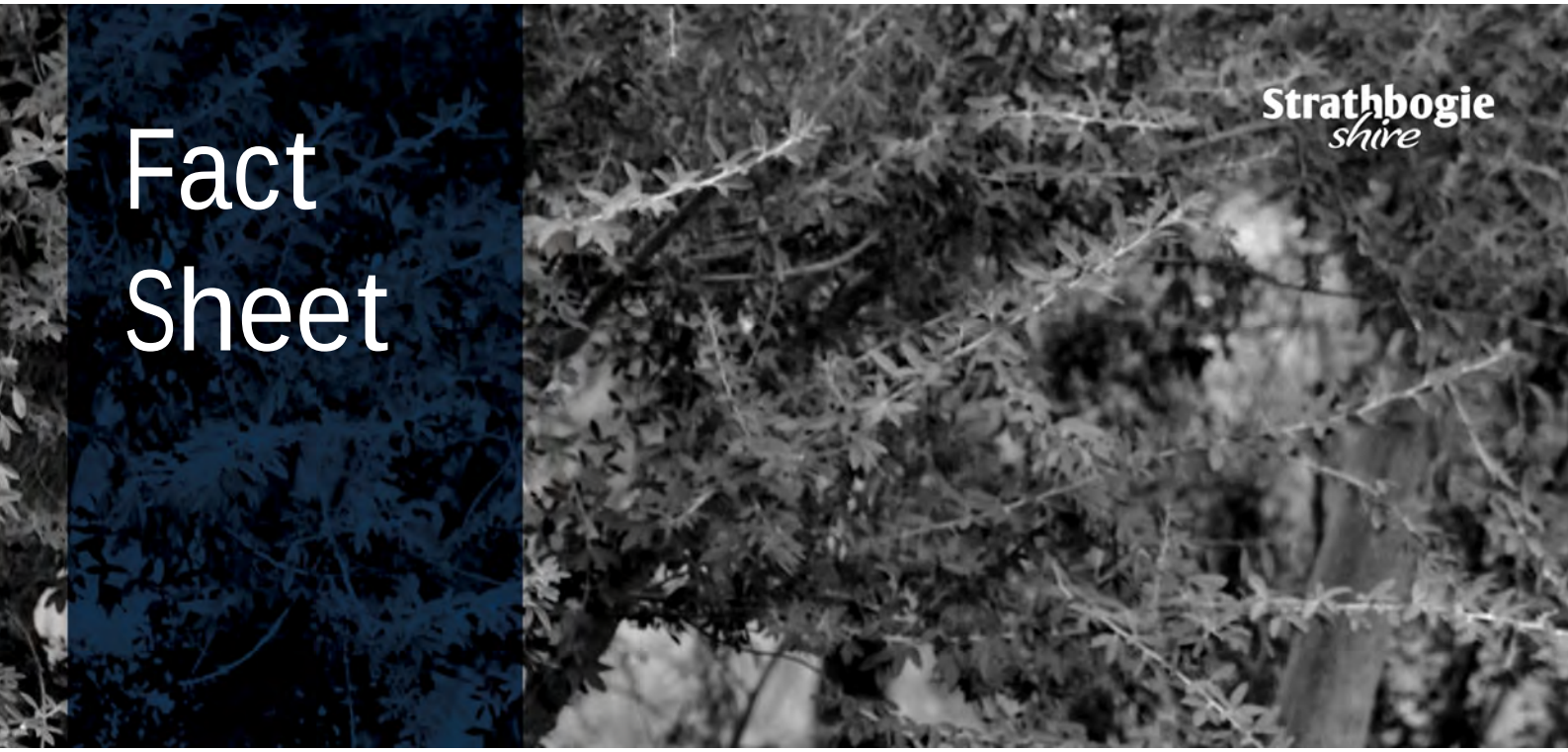


Lovers Hill Development Plan

Strathbogie Shire Council has received an application to approve a Development Plan and Plan of Subdivision that will allow for subdivision of land on Avenel-Longwood Rd, known as Lovers Hill.

A Development Plan generally in accordance with a Development Plan Overlay, is exempted from notice requirements and review rights at VCAT.

This means, at this time, we are informing and reminding you of what will be taking place over the next few years at this site.

The subdivision plan includes two stages of development. The first stage allowing for thirteen (13) lots and the second stage allowing for twenty-three (23) lots.

Why are we just hearing about this now?
This plan was approved almost 10 years ago when the land was rezoned from Farming Zone to Low Density Residential Zone. This was under planning scheme amendment C028 and happened in 2013.

At this time there the community was engaged through advertising, information on our website and letters to nearby properties.

We know there will be interest from our community. Because this plan was approved almost 10 years ago, and we wanted to take the opportunity to remind and inform our community what's happening.

What happens if I want to make a submission?
Approval of a Development Plan, in accordance with a Development Plan Overlay, is exempt from notice requirements and review rights at VCAT. This is for community information only to keep you aware of processes previously put in place.

The project moved through the advertising and submission period in 2013. At this time the submissions from the public went to an independent body called Planning Panels Victoria, which is common practice and a democratic process for resident concerns to be heard. After this, Council and the State Government were able to allow it to go ahead.

What is a Development Plan?
Development Plans guide the design and development of larger lots and have to be generally in accordance with a Development Plan Overlay that has been applied through a

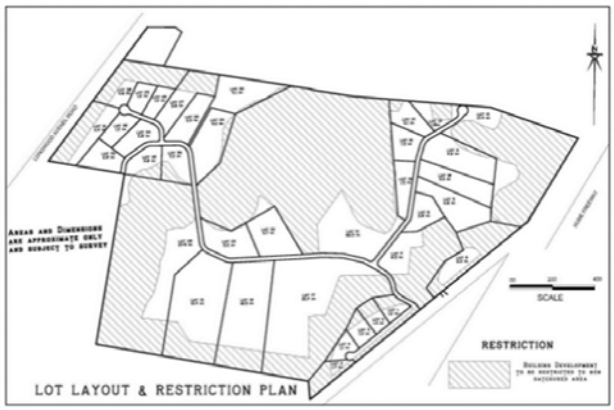
regulatory process that includes community consultation and is a result of a planning scheme amendment.

When will we see works on the site?
The Development Plan has been referred once consent is received from these referral authorities the Development Plan will be heard before Council. It is only after this works can start.

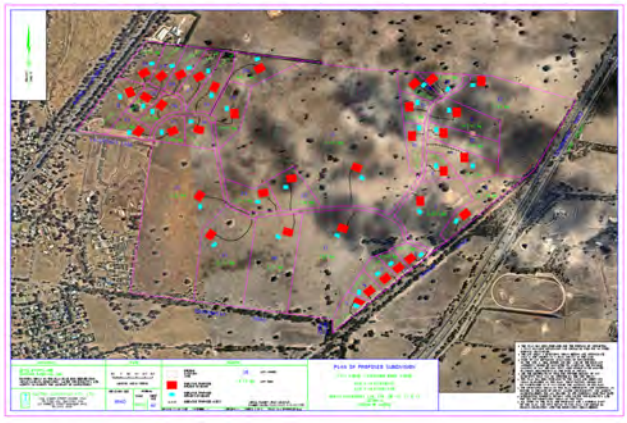
How can I find out more information?
You can find more information on our website at **www.strathbogie.vic.gov.au**, we'll update you through local newspapers, you can drop into our Customer Service Centre in Nagambie or Euroa or phone one of our Planning Team members for a chat on 1800 065 993.

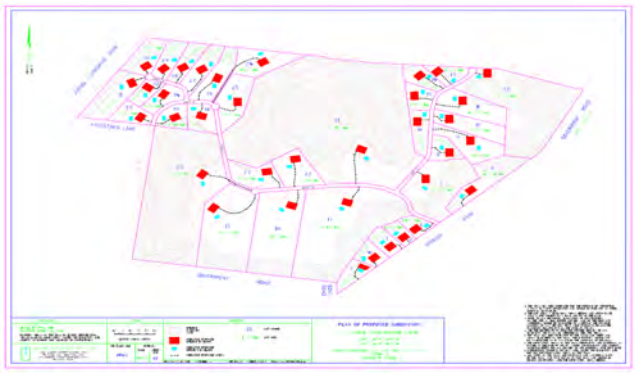
The map below shows the two stages of the plan of subdivision.

The map below shows the area of land on which the Development Plan applies.



The images below show the 36 blocks in the plan of subdivision.





February 2022
Doc ID#766729

PLANNING PERMIT APPLICATION

36 LOT RURAL LIVING SUBDIVISION

IN TWO STAGES

LOVERS HILL, AVENEL

2353 AVENEL-LONGWOOD ROAD, AVENEL 3664

Ellen Hogan & Associates P/L
Land Development Services
PO Box 658
Mansfield Vic 3724

@ 26 August 2021

1. PROPERTY LOCATION

Avenel is located on the western side of the Hume Highway in the Shire of Strathbogie. The township is approximately one hour and 20 minutes from the Melbourne CBD. The Strathbogie Shire, situated in the Hume Region, has enormous growth potential due to its location between two major highways, the Hume, and Goulburn Valley. The Hume Highway connects Melbourne and Sydney and the Goulburn Valley Highway to Shepparton and beyond.

The subject land is on the north east side of the Avenel Township bound to the east by Spencer Road and the Hume Freeway and to the west the Avenel-Longwood Road. The subject site is commonly known as “Lovers Hill”.

2. PROPERTY DESCRIPTION

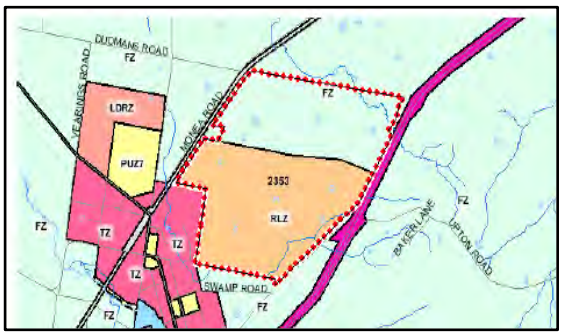
The property known as Lovers Hill, Avenel has been extensively used for sheep grazing and consists of 241 hectares in various titles. The site varies between flat to steep hill country and is covered in pasture grass that has been heavily grazed in the past by sheep. The site has scattered Eucalyptus trees (predominantly Red gums) throughout and areas where natural regeneration has occurred.

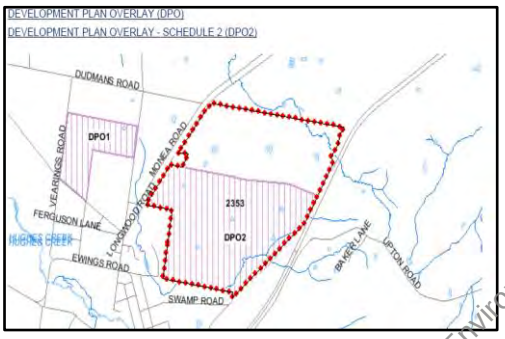
An ephemeral waterway or natural drainage line runs almost parallel with the eastern boundary.

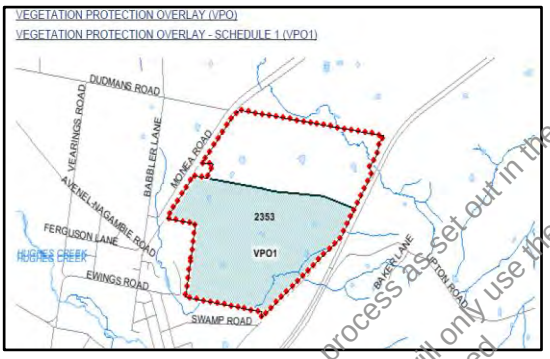
The land is zoned Rural Living with a Development Plan Overlay (Schedule 2), Vegetation Protection Overlay (Schedule 1)

Land abutting to the north and south is included in the Farm Zone with the Township located in the south west corner

Strathbogie Planning Scheme – zones and overlays



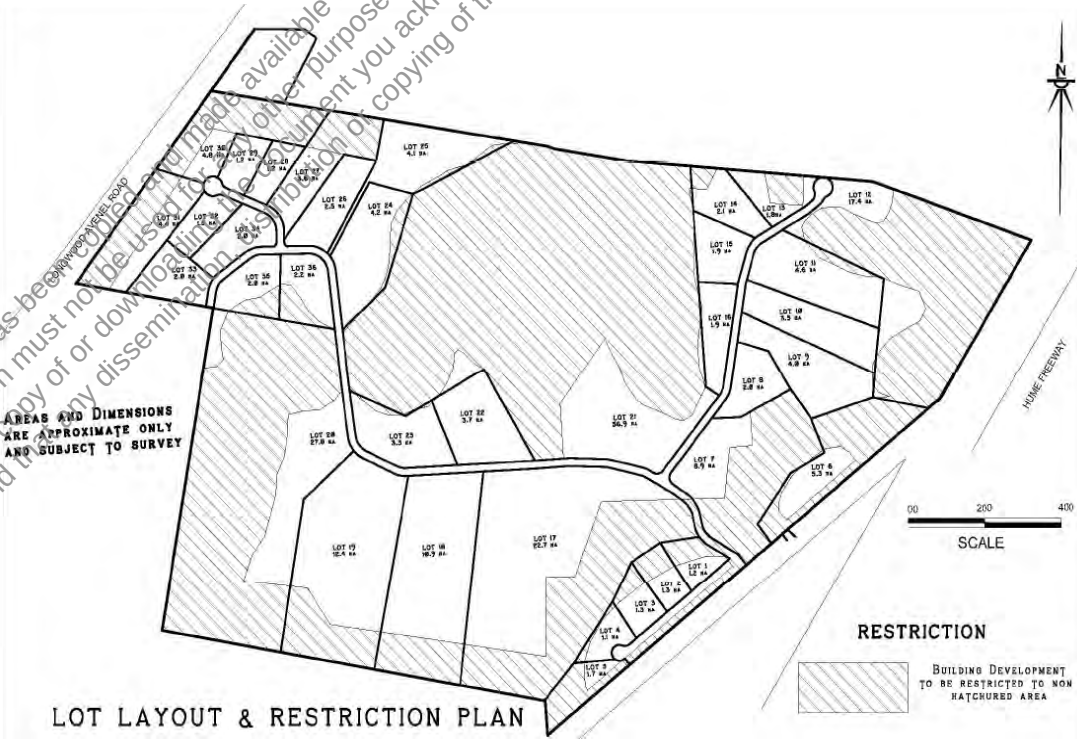




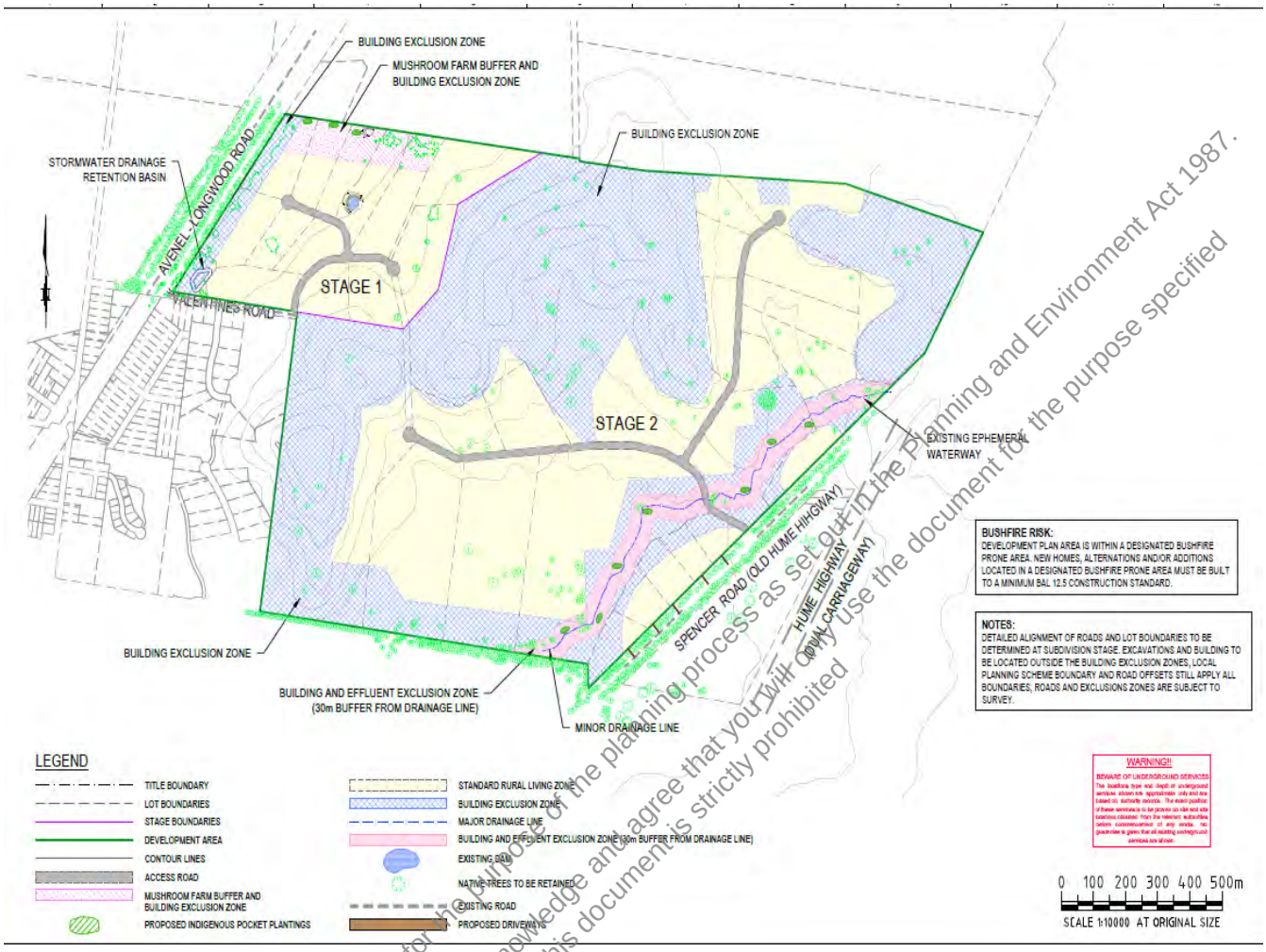
3. PLANNING CONTROLS AND CONSIDERATIONS

3.1 Development Plan 2 – Lovers Hill Avenue

The subdivision plan submitted for planning approval is generally in accordance with the Lot Layout and Restriction Plan included in Schedule 2 of the Development Plan Overlay in the Strathbogie Planning Scheme.



Subdivision layout plan lodged indicating Lot layout and restrictions



Supporting information required as part of Schedule 2 of the DPO are:

- Land Contours
- Slopes
- Irrigation pathways
- Existing trees on the land
- Existing buildings
- Surrounding roads
- Drainage lines and water courses
- Existing dams
- Surrounding land uses and nearby buildings
- Lot boundaries and lot areas
- 100metre buffer from boundary with Fresh Fields Mushrooms facility
- Building restriction zones
- Stages of development and road layout

The documents submitted have considered the points above and the subdivision has been designed based on the lot layout and restrictions plan in the DP Schedule 2 and the site constraints.

Documents submitted include:

- An extensive Land Capability Assessment, Paul Williams and Associates
- Traffic Impact Assessment Report, Stuart Redman, Traffic Works
- Vegetation Quality Assessment (Bill Richdale dated April – May 2019) in relation to existing vegetation and ground covers on the site.
- Vegetation Quality Assessment Spencer Road Reserve (Bill Richdale August 2020)

The subdivision plan submitted reflects the layout and restriction plan included in the DP Overlay – Schedule 2, other than a request for consideration for access to be directly off Spencer Road for five of the allotments in Stage 2 of the proposal.

Other than this request the subdivision plan is generally in accordance with the Lot Layout and Restriction Plan included in the schedule.

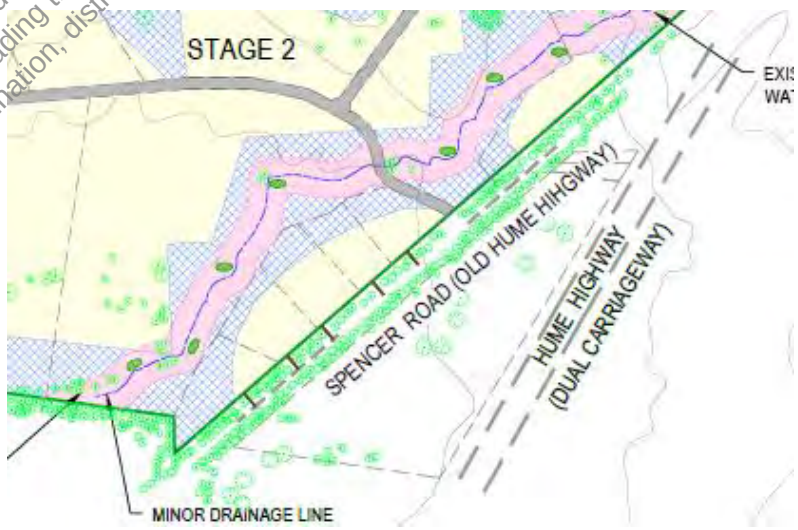
3.2 Access directly off Spencer Road

The lot layout and restriction plan discussed above indicates an internal access road that runs parallel to Spencer Road. The internal road ends with a court bowl and shows access to five allotments.

Our DP indicates access/egress directly from Spencer Road. Spencer Road extends half-way along the eastern boundary of the subject site before reaching a dead end.

Mr. Bill Richdale, Consulting Ecologist completed A Vegetation Quality Assessment for Spencer Road Reserve, Avenel dated August 2020. Not only did the assessment look at the existing vegetation on the site itself but he assessed the vegetation along Spencer Road reserve. Mr. Richdale looked at nine possible locations for crossovers along this reserve to cater for the five lots that abut. One accessway though can be accommodated from the internal access road that runs through the property.

Mr. Richdale's assessment of the road reserve found it to be a weedy and degraded remnant patch of EVC55-62 Plans Grassy Woodland. The degraded status of the patch is most likely a result of it being directly between two farming properties and alongside a rural road. He determined that *the 650-metre strip of degraded remnant Plains Grassy Woodland found within the study site on Spencer Road, Avenel, would not be impacted upon by the proposed construction of five, 4 metre wide by 26 metre long, gravel driveways. (Page 17)*



In comparison Mr. Richdale's assessment also looked at the proposed internal court bowl located on the boundary fence and as indicated in the DPO. His assessment concludes that there would be a strong possibility that the Tree Root Zone (TRZ) of the large canopy trees located along this fence-line could be compromised by more than 10 percent if a formal road were to be built in this area. These trees would then be deemed lost.

Mr. Richdale's assessment provides that gravel crossover driveways crossing the road reserve via Spencer Road into the residential lots, would not compromise the lateral roots and therefore the nearby canopy Eucalyptus trees would be preserved rather than lost.

This section of Spencer Road is in the 60kph zone of the Avenel township and finishes at the access point to Stage 2.

3.3 Boundaries and buffer zones

The plan shows the allotment boundaries and lot areas.

It also includes a 100metre buffer from the boundary to the Fresh Fields Mushrooms Facility located to the north of the property on the Longwood-Avenel Road.

The 100-metre buffer has been incorporated to reflect the Lot Layout and Restriction Plan included in Schedule 2 of the Development Plan Overlay.

3.4 Exclusion Zones

The DP also includes building exclusion zones. The exclusion zones take in a large portion of the steep hilled area in the middle of the site, along the ephemeral waterway and boundary setbacks.

These zones have been incorporated in the DP submitted and in accordance with Figure 1 in the Schedule to the DP Overlay

3.5 Land Capability Assessment

A Land Capability Assessment (LCA) has been completed by Paul Williams and Associates and is included in this application.

This LCA mapping is very extensive and includes slopes, irrigation pathways and contours.

The site is defined in the minor catchment 25, Wormangal Creek of the Strathbogie Shire's Domestic Wastewater Management Plan (DWMP) where the area has been assessed as having a medium risk to water quality. The site is not within a Declared Water Supply Catchment for potable water supplies.

The DWMP requires that all sites located in a medium risk minor catchment and outside of a Declared Water Supply Catchment must undertake a LCA prepared in accordance with the Environment Protection Authority's Septic Tank Code of Practice.

The site has a natural drainage line indicated on the DP. The LCA has included a 30-metre setback to this drainage line for effluent disposal purposes.

The report concludes that the development is suitable for sustainable on-site effluent disposal and supports the subdivision of the land into 36 lots ranging in size from 1.235 hectares to 28.58 hectares.

3.6 Traffic Impact Assessment

A traffic impact assessment report (TIAR) in support of the DP has been prepared and is submitted with this application. The report has been prepared by Traffic Works Pty. Ltd.

3.7 Environmental Management Plan

CLAUSE 42.02 VEGETATION PROTECTION OVERLAY - SCHEDULE 1

An overall Environmental Management Plan has been prepared for the site. This plan indicates new plantings along the Building Exclusion Zone with the Mushroom Farm in Stage 1**. No native vegetation will be removed**, including along the Avenel-Longwood Road in Stage 1. The new vegetation will affect only those allotments that have a boundary with the Mushroom Farm. The proposal will be to provide more vegetation along this boundary where needed.

Stage 2 of the development will see pockets of native vegetation established along the ephemeral waterway. Three large allotments to be created at subdivision stage will have this waterway within their boundaries. The new pockets of vegetation will focus on areas where erosion treatment is required, although erosion is minimal for most of the waterway's length. Existing small pockets of regrowth vegetation along the waterway will be retained and encouraged to establish.

There is no native vegetation to be removed under Stage 2.

Given no native vegetation is to be removed no offsets have been identified. This is also reflected in the report prepared by Mr. Bill Richdale, April – May 2019 and August 2020.

The Land Management Plan as part of this DP is an overarching Plan and more detail such as number of trees, species and specific locations for tree pockets will be required at subdivision stage. This will be done in two Stages. More specific information will be required for inclusion in the Section 173 Agreements developed for each stage of subdivision.

3.8 Reticulated Water Supplies

Each of the allotments will be provided with reticulated water supplies from Goulburn Valley Water. Firefighting requirements such as access and fire hydrants will be provided by the Country Fire Authority following formal referral of this subdivision application.

3.9 Bushfire Planning

CLAUSE 13.02-1S – Murrindindi Planning Scheme

This policy must be applied to all planning and decision making under the *Planning and Environment Act 1987* relating to land that is:

- Within a designated bushfire prone area

Objective

To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.

Use and development control in a Bushfire Prone Area

In a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:

- *Subdivisions of more than 10 lots.*

Details of the future subdivision stages of the land including road layout are attached.

This subdivision provides for two access points one from Avenel-Longwood Road and the other from Spencer Road. There will be an interlinking road between both stages that will enable access/egress through the site also. This will provide two points of access/egress and an alternative if one access is obstructed.

All roads will be constructed to meet the CFA's standards for fire fighting purposes.

As the site will be connected to reticulated water supplies, Fire hydrants and plugs can be installed in accordance with CFA requirements.

The land management plan recommends clumps of trees to be established along the ephemeral waterway on the eastern side of the land so that no continuous canopy of trees are located in this area.

3.10 Significant Infrastructure

There will be no significant infrastructure that will cause visual impact both within and outside the subdivision.

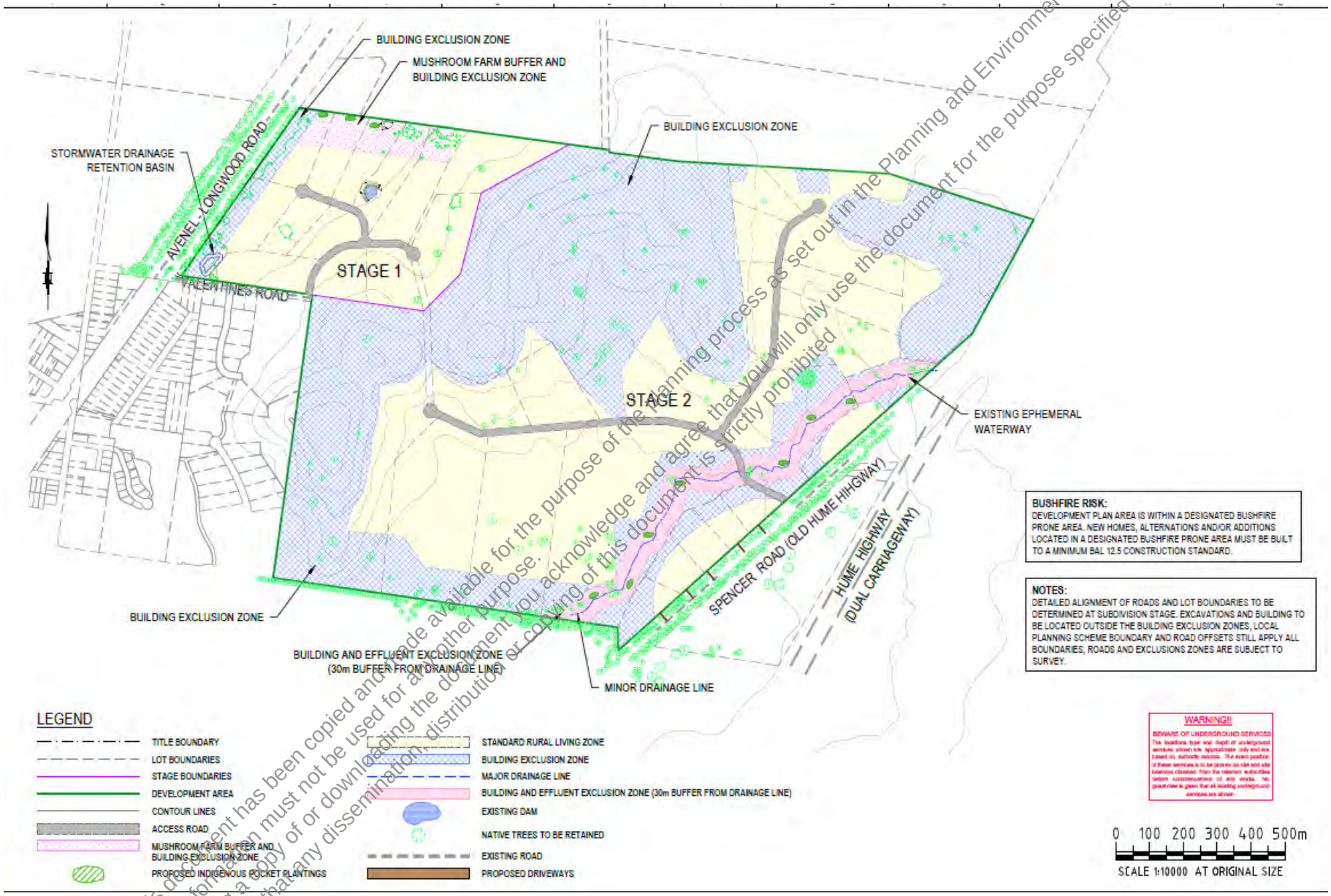
3.11 Staging

It is proposed to subdivide the land in two stages

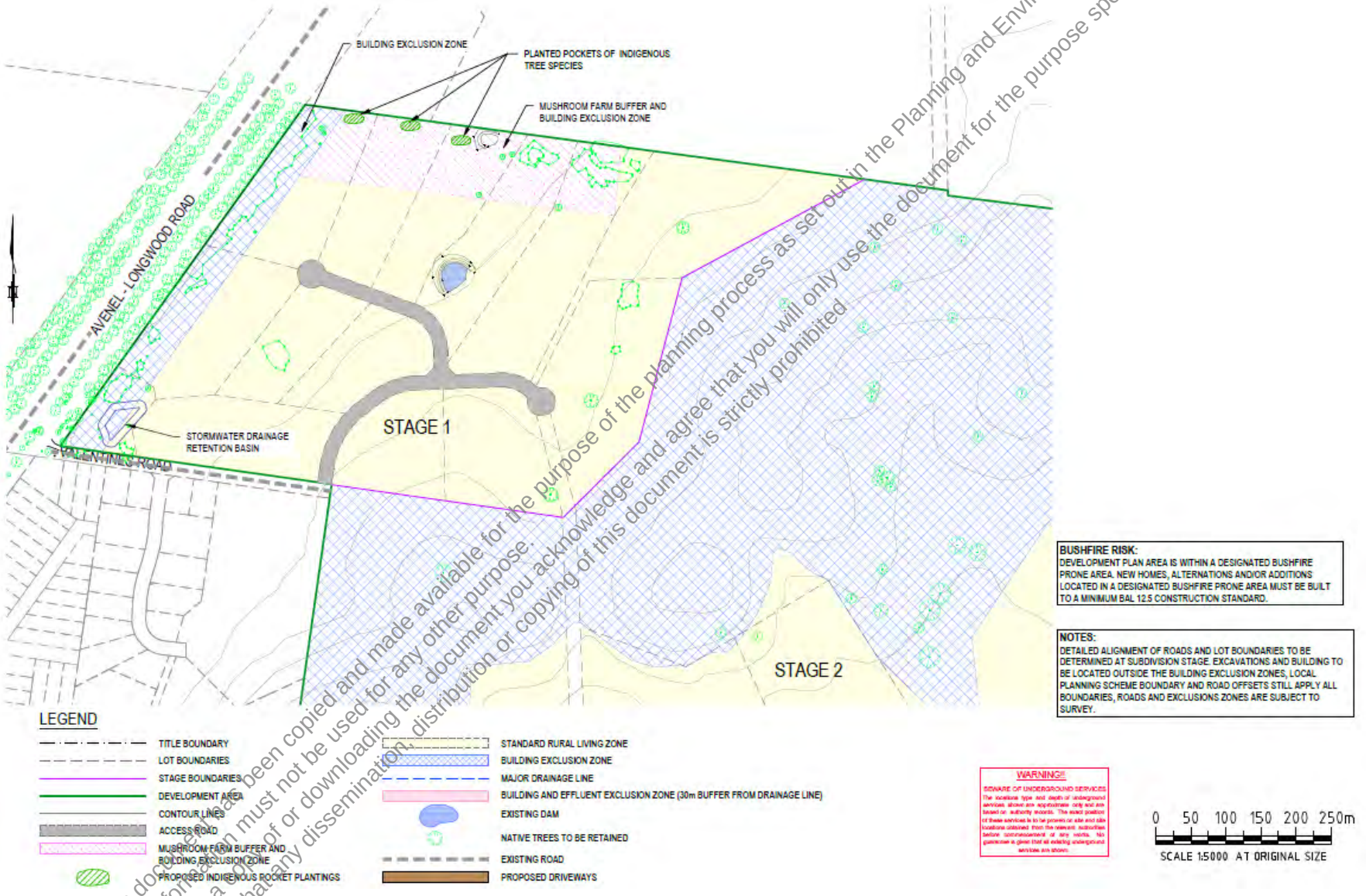
ATTACHMENTS:

- Title details
- Subdivision plan
- Traffic Impact Assessment Report
- Land Capability Assessment including supporting plans
- Environment Management Plan - Version 1
- Vegetation Quality Assessment for 2353 Avenel-Longwood Road, Avenel (Bill Richdale April – May 2019)
- Vegetation Quality Assessment for Spencer Road Reserve, Avenel (Bill Richdale August 2020.
- See staged plans below

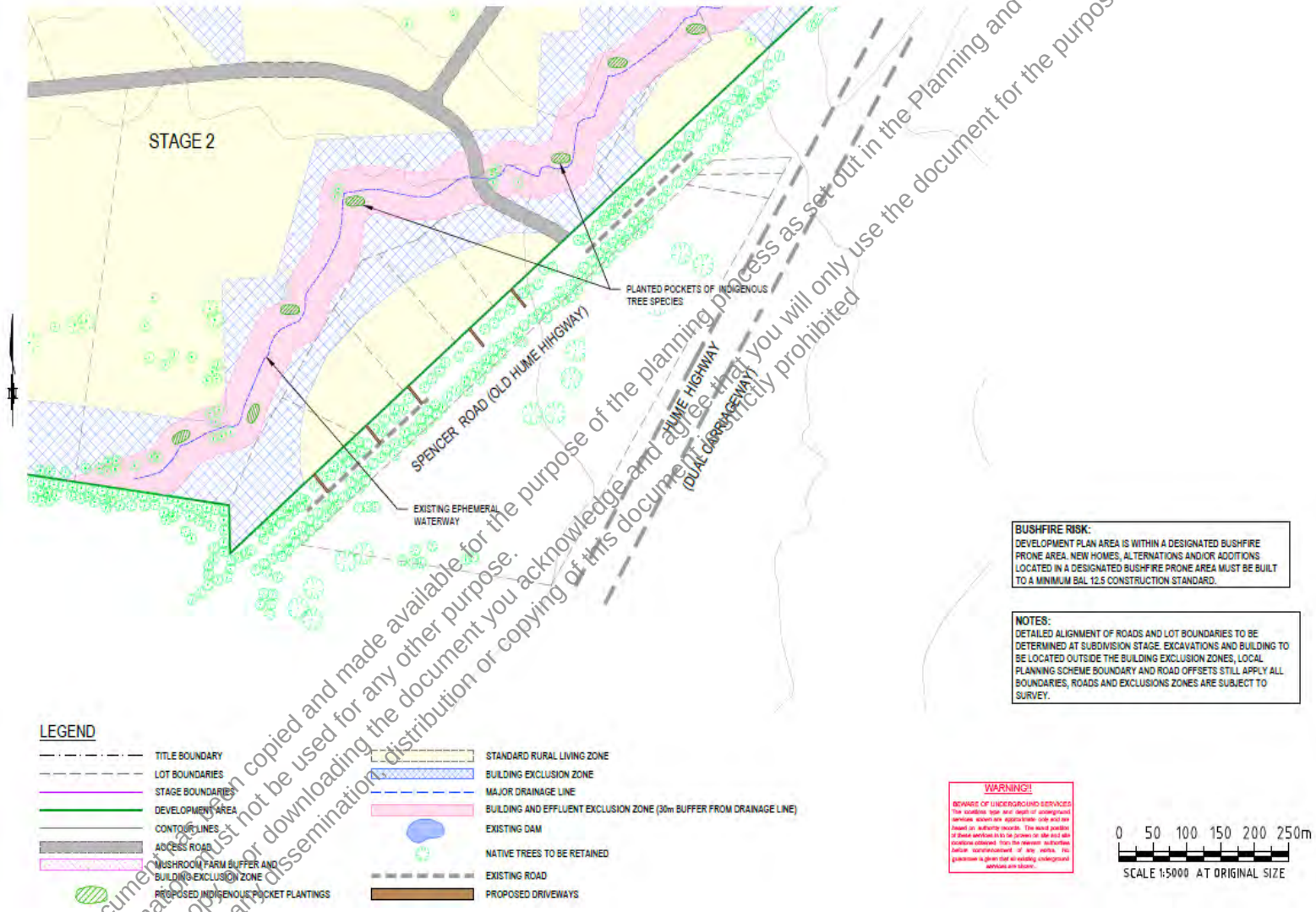
Subdivision layout plan in two stages

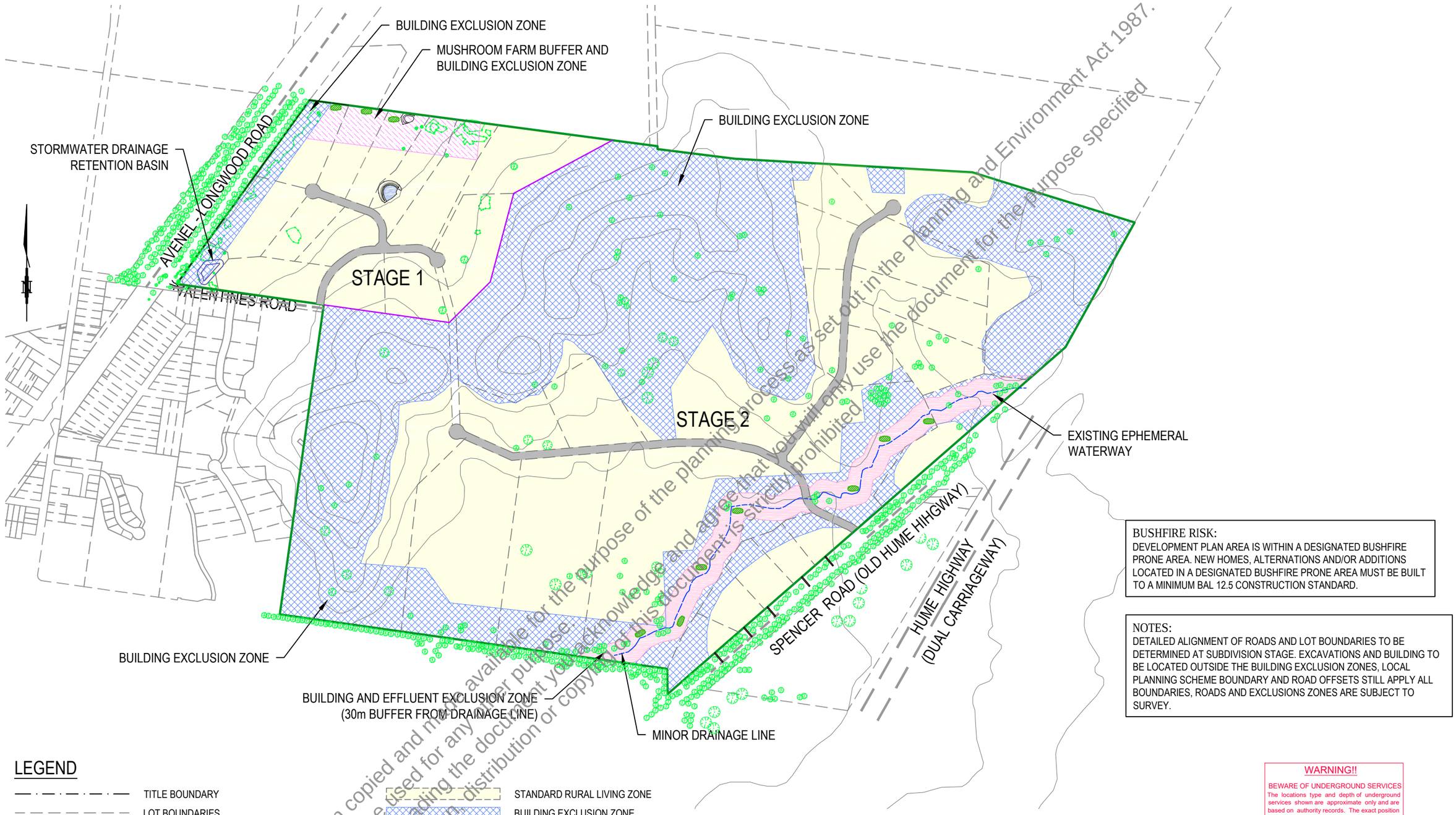


STAGE 1



STAGE 2 – ACCESS OFF SPENCER ROAD





BUSHFIRE RISK:
DEVELOPMENT PLAN AREA IS WITHIN A DESIGNATED BUSHFIRE PRONE AREA. NEW HOMES, ALTERNATIONS AND/OR ADDITIONS LOCATED IN A DESIGNATED BUSHFIRE PRONE AREA MUST BE BUILT TO A MINIMUM BAL 12.5 CONSTRUCTION STANDARD.

NOTES:
DETAILED ALIGNMENT OF ROADS AND LOT BOUNDARIES TO BE DETERMINED AT SUBDIVISION STAGE. EXCAVATIONS AND BUILDING TO BE LOCATED OUTSIDE THE BUILDING EXCLUSION ZONES, LOCAL PLANNING SCHEME BOUNDARY AND ROAD OFFSETS STILL APPLY ALL BOUNDARIES, ROADS AND EXCLUSIONS ZONES ARE SUBJECT TO SURVEY.

LEGEND

- TITLE BOUNDARY
- LOT BOUNDARIES
- STAGE BOUNDARIES
- DEVELOPMENT AREA
- CONTOUR LINES
- ACCESS ROAD
- MUSHROOM FARM BUFFER AND BUILDING EXCLUSION ZONE
- PROPOSED INDIGENOUS POCKET PLANTINGS
- STANDARD RURAL LIVING ZONE
- BUILDING EXCLUSION ZONE
- MAJOR DRAINAGE LINE
- BUILDING AND EFFLUENT EXCLUSION ZONE (30m BUFFER FROM DRAINAGE LINE)
- EXISTING DAM
- NATIVE TREES TO BE RETAINED
- EXISTING ROAD
- PROPOSED DRIVEWAYS

WARNING!!
BEWARE OF UNDERGROUND SERVICES
The locations type and depth of underground services shown are approximate only and are based on authority records. The exact position of these services is to be proven on site and site locations obtained from the relevant authorities before commencement of any works. No guarantee is given that all existing underground services are shown.

0 100 200 300 400 500m
SCALE 1:10000 AT ORIGINAL SIZE

REFERENCES

PLAN No.	TITLE

REVISIONS

No.	DATE	DESCRIPTION	APP'D
0	26/11/18	PRELIMINARY ISSUE	K.R.

BUNDALAGUAH ENGINEERING
A.C.N. 063 010 444
P.O.Box 388, ALEXANDRA 3714
Ph. 03-57723200
Fax 03-5723222
Email:kim@bundalaguah.com.au

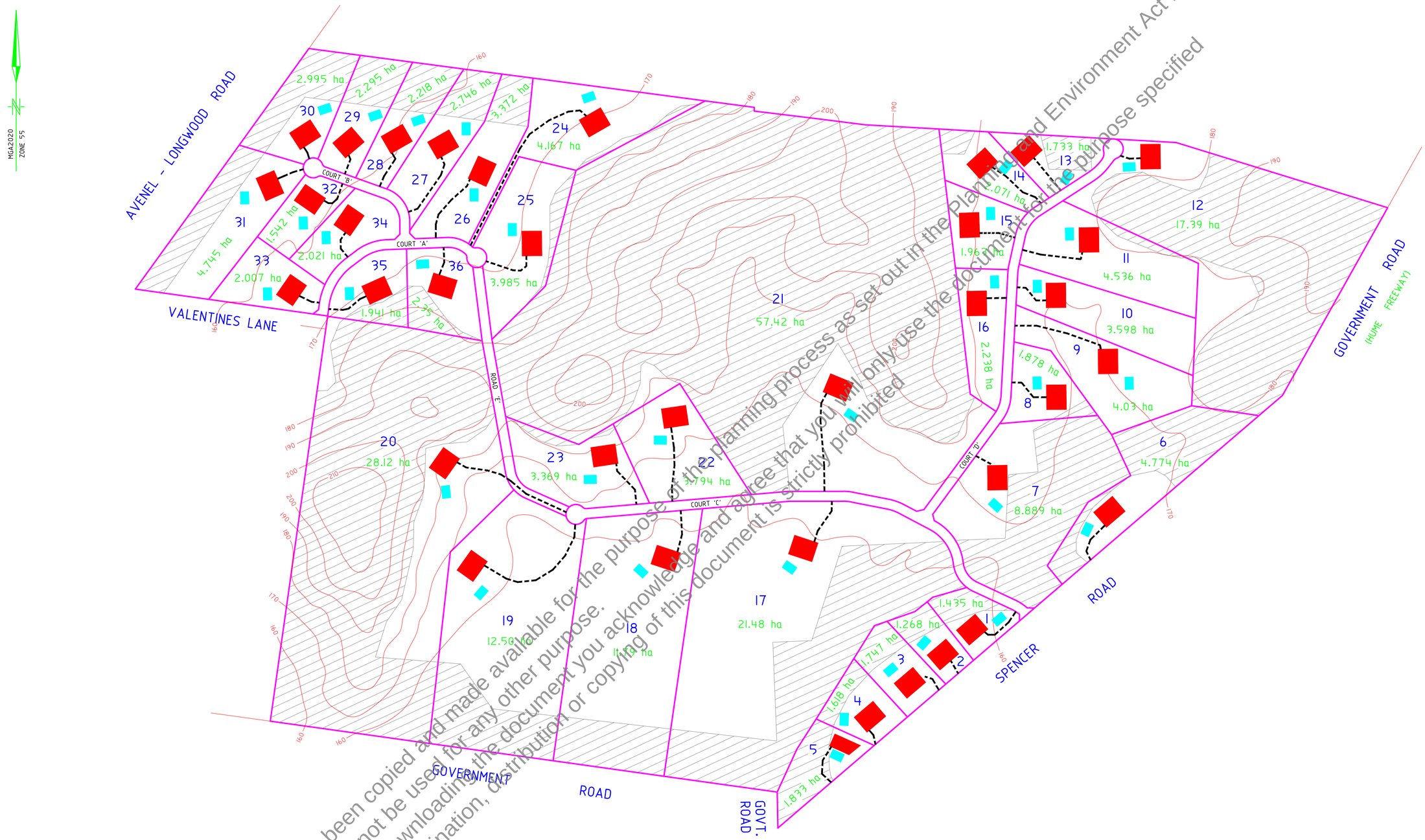
PLANNING PERMIT NO. -

DESIGNED: 26/11/18 K RHODES
DRAWN: 26/11/18 L BOŠNJAK
CHECKED: 26/11/18 K RHODES

STRATHBOGIE SHIRE COUNCIL
DRAWING No. A3-539-01
REV. 0

LOVERS HILL ESTATE
2353 AVENEL-LONGWOOD ROAD, AVENEL
DEVELOPMENT PLAN

A3-539-01REV0



NOTATIONS

LEVEL DATUM: AHD
CONTOUR INTERVAL: 10m

CONTOURS SHOWN ON THIS PLAN HAVE BEEN DERIVED FROM VICMAP/LANDATA INFORMATION. SALTER SURVEYING PTY. LTD. ACCEPTS NO LIABILITY FOR ACCURACY OR COMPLETENESS.

SALTER SURVEYING PTY. LTD.
52A. SYDNEY STREET KILMORE 3764
TEL.5782 1414 FAX.5782 2416
125 ROBERTS STREET ESSENDON 3040
TEL.9374 3008

SCALE

40 0 40 80 120 160

LENGTHS ARE IN METRES

SURVEYORS REF.	ORIGINAL SCALE	SHEET SIZE
11140	1:4000	A1

LEGEND

- BUILDING EXCLUSION ZONE
- INDICATIVE PROPOSED BUILDING ENVELOPE
- INDICATIVE PROPOSED EFFLUENT ENVELOPE
- INDICATIVE PROPOSED ACCESS
- 18 LOT NUMBER
- 11.79 ha LOT AREA

DRAWN: 25/11/21,GP	AMENDED: -	VERSION: 1	SHEET: 1 OF 1	PLAN No.: BUN11140PP.dwg

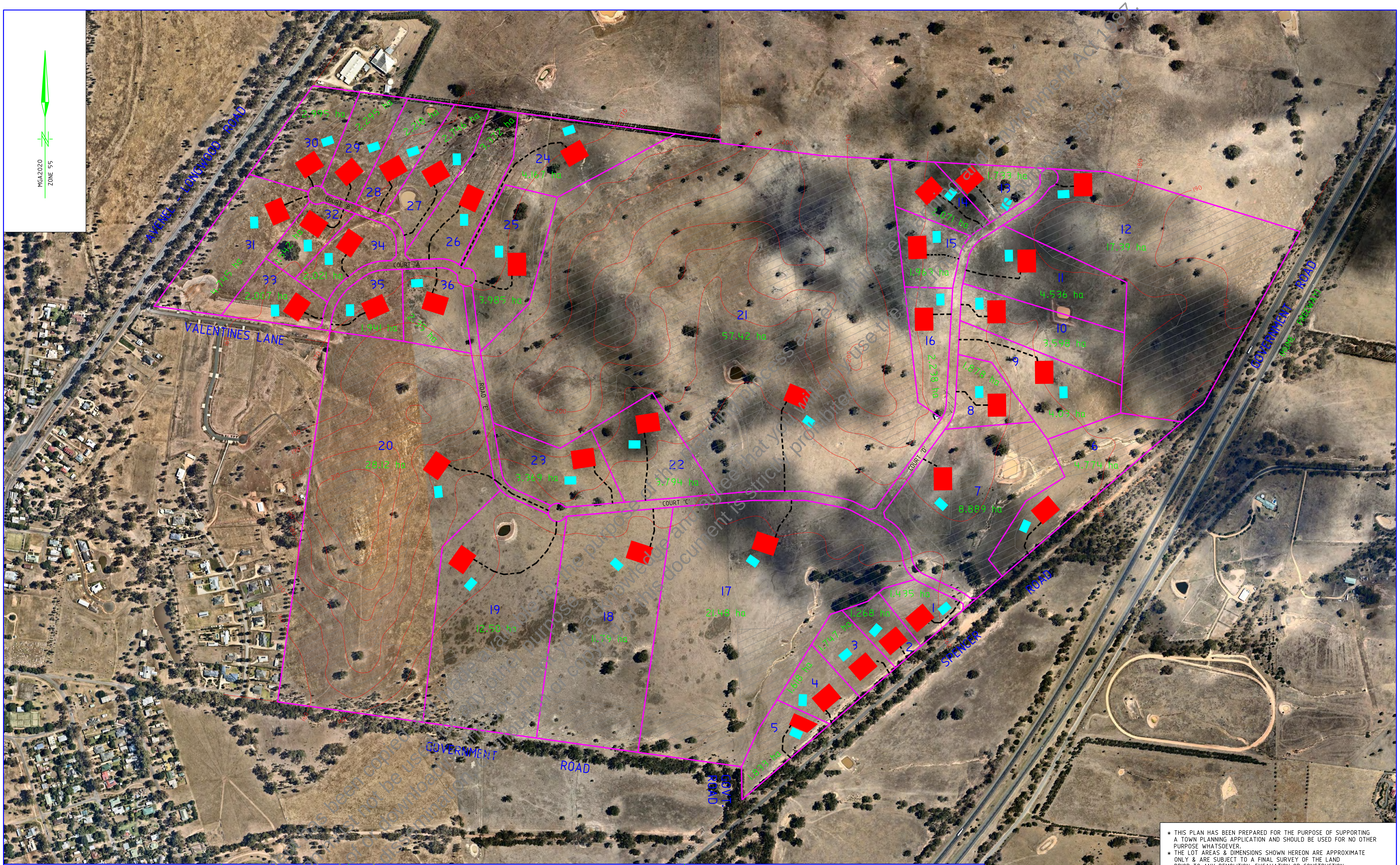
PLAN OF PROPOSED SUBDIVISION

2353 AVENEL - LONGWOOD ROAD, AVENEL

LOT 2 on PS513465T
LOT 2 on PS514503H

CROWN ALLOTMENTS 20A, 20B, 21B, 26, 27 & 28
SECTION G
PARISH OF AVENEL

* THIS PLAN HAS BEEN PREPARED FOR THE PURPOSE OF SUPPORTING A TOWN PLANNING APPLICATION AND SHOULD BE USED FOR NO OTHER PURPOSE WHATSOEVER.
* THE LOT AREAS & DIMENSIONS SHOWN HEREON ARE APPROXIMATE ONLY & ARE SUBJECT TO A FINAL SURVEY OF THE LAND
* PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, A "DIAL BEFORE YOU DIG" AND/OR THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ASCERTAIN THE POSSIBLE LOCATION OF ANY SERVICES THAT WERE UNABLE TO BE LOCATED BY DIRECT MEASUREMENT ON THE DATE OF SURVEY.
* SEE THE CERTIFICATE OF TITLE FOR FURTHER DETAILS OF ANY EASEMENTS THAT MAY BE AFFECTED BY THE SITE SHOWN.
* THIS PLAN HAS BEEN PREPARED TO THE SCALE AND SHEET SIZE SHOWN ELSEWHERE ON THIS PLAN. THESE FACTORS SHOULD NOT BE MANIPULATED AS IT MAY IMPAIR THE ACCURACY OF THE PLAN.
* THE INFORMATION SHOWN ON THIS PLAN REPRESENTS SITE CONDITIONS AS EXISTED ON THE DATE OF SURVEY. SALTER SURVEYING PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY CHANGES TO SITE CONDITIONS SINCE THAT DATE.
* INTELLECTUAL PROPERTY REMAINS WITH SALTER SURVEYING PTY. LTD. FOR ALL THE INFORMATION SHOWN ON THIS PLAN.
* ALL NOTES ON THIS PLAN ARE IMPORTANT AND A INTEGRAL PART OF THIS PLAN, AND MUST REMAIN ON THIS PLAN AND SHOULD BE READ IN CONJUNCTION WITH THE INFORMATION SHOWN HEREON.



NOTATIONS	SCALE
LEVEL DATUM: AHD CONTOUR INTERVAL: 10m CONTOURS SHOWN ON THIS PLAN HAVE BEEN DERIVED FROM VICMAP/LANDATA INFORMATION. SALTER SURVEYING PTY. LTD. ACCEPTS NO LIABILITY FOR ACCURACY OR COMPLETENESS.	40 0 40 80 120 160 LENGTHS ARE IN METRES

SALTER SURVEYING PTY. LTD.
52A. SYDNEY STREET KILMORE 3764
TEL.5782 1414 FAX.5782 2416
125 ROBERTS STREET ESSENDON 3040
TEL.9374 3008

SURVEYORS REF.	ORIGINAL SCALE	SHEET SIZE
11140	1:4000	A1

LEGEND

- BUILDING EXCLUSION ZONE
- INDICATIVE PROPOSED BUILDING ENVELOPE
- INDICATIVE PROPOSED EFFLUENT ENVELOPE
- INDICATIVE PROPOSED ACCESS
- 18 — LOT NUMBER
- 11.79 ha — LOT AREA

AERIAL IMAGERY FROM NEARMAP.
IMAGERY DATE: 30/12/2020 & 8/02/2010.

DRAWN: 25/11/21,GP	AMENDED: -	VERSION: 1	SHEET: 1 OF 1	PLAN No.: BUN11140PP.dwg

PLAN OF PROPOSED SUBDIVISION

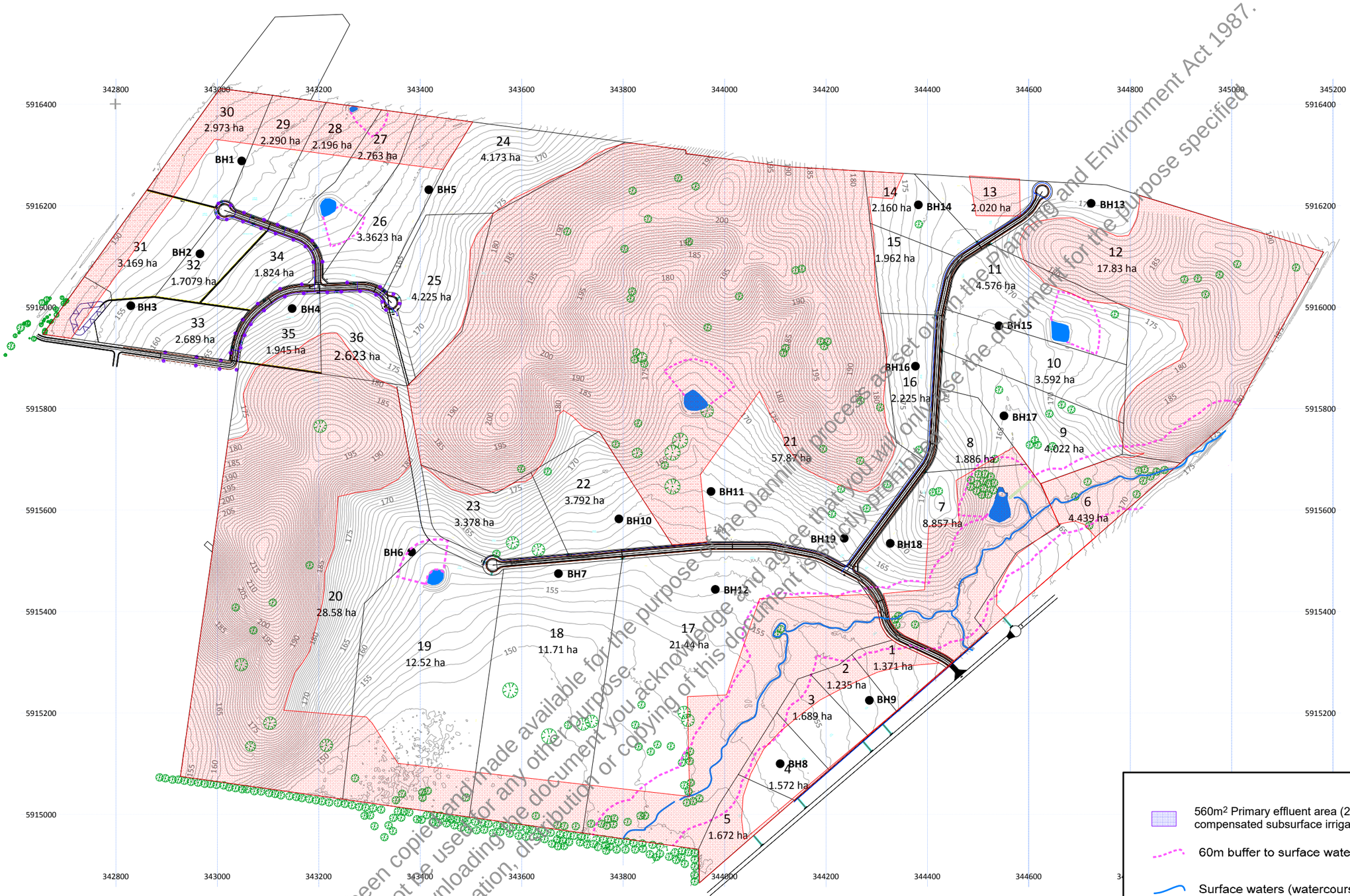
2353 AVENEL - LONGWOOD ROAD, AVENEL

LOT 2 on PS513465T
LOT 2 on PS514503H

CROWN ALLOTMENTS 20A, 20B, 21B, 26, 27 & 28
SECTION G
PARISH OF AVENEL

* THIS PLAN HAS BEEN PREPARED FOR THE PURPOSE OF SUPPORTING A TOWN PLANNING APPLICATION AND SHOULD BE USED FOR NO OTHER PURPOSE WHATSOEVER.
* THE LOT AREAS & DIMENSIONS SHOWN HEREON ARE APPROXIMATE ONLY & ARE SUBJECT TO A FINAL SURVEY OF THE LAND
* PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE, A "DIAL BEFORE YOU DIG" AND/OR THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ASCERTAIN THE POSSIBLE LOCATION OF ANY SERVICES THAT WERE UNABLE TO BE LOCATED BY DIRECT MEASUREMENT ON THE DATE OF SURVEY.
* SEE THE CERTIFICATE OF TITLE FOR FURTHER DETAILS OF ANY EASEMENTS THAT MAY BE AFFECTED BY THE SITE SHOWN.
* THIS PLAN HAS BEEN PREPARED TO THE SCALE AND SHEET SIZE SHOWN ELSEWHERE ON THIS PLAN. THESE FACTORS SHOULD NOT BE MANIPULATED AS IT MAY IMPAIR THE ACCURACY OF THE PLAN.
* THE INFORMATION SHOWN ON THIS PLAN REPRESENTS SITE CONDITIONS AS EXISTED ON THE DATE OF SURVEY. SALTER SURVEYING PTY. LTD. ACCEPTS NO RESPONSIBILITY FOR ANY CHANGES TO SITE CONDITIONS SINCE THAT DATE.
* INTELLECTUAL PROPERTY REMAINS WITH SALTER SURVEYING PTY. LTD. FOR ALL THE INFORMATION SHOWN ON THIS PLAN.
* ALL NOTES ON THIS PLAN ARE IMPORTANT AND A INTEGRAL PART OF THIS PLAN, AND MUST REMAIN ON THIS PLAN AND SHOULD BE READ IN CONJUNCTION WITH THE INFORMATION SHOWN HEREON.

Paul Williams & Associates Pty Ltd



0 100 200 300 400 500
SCALE OF METRES
(1:8,000 @ A3)

560m² Primary effluent area (20/30 standard, pressure compensated subsurface irrigation) (5-bedroom residence).

60m buffer to surface waters (water course and dam).

Surface waters (watercourse, dam).

Building exclusion zone.

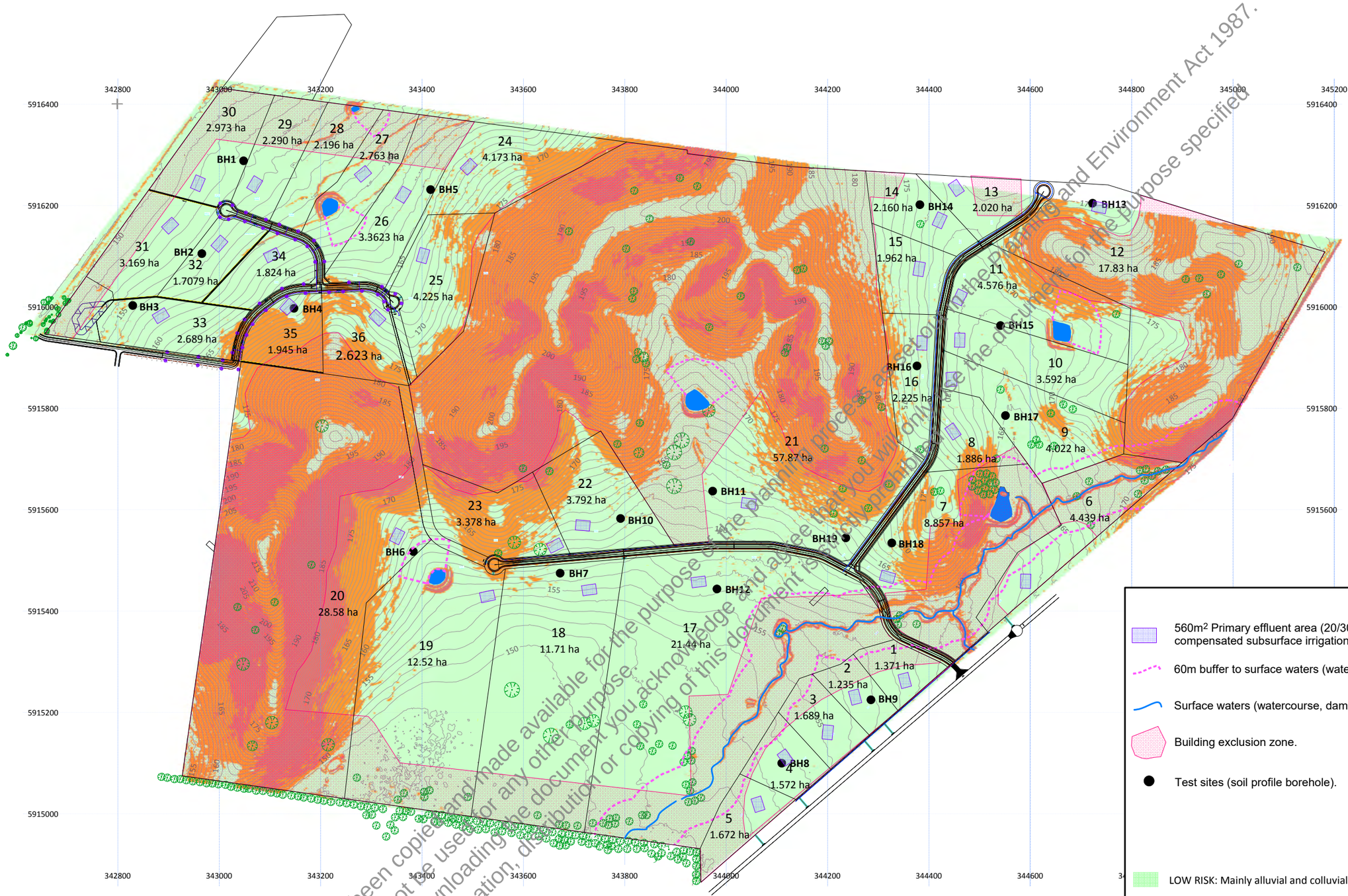
Test sites (soil profile borehole).

CONTOURS SHOWING BUILDING EXCLUSION ZONES

2353 AVENEL-LONGWOOD ROAD, AVENEL

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 3

Paul Williams & Associates Pty Ltd



560m² Primary effluent area (20/30 standard, pressure compensated subsurface irrigation) (5-bedroom residence).

60m buffer to surface waters (water course and dam).

Surface waters (watercourse, dam).

Building exclusion zone.

Test sites (soil profile borehole).

LOW RISK: Mainly alluvial and colluvial soils, ground slopes to 10%

MEDIUM RISK: Mainly colluvial & residual soils, ground slopes 10% to 20%

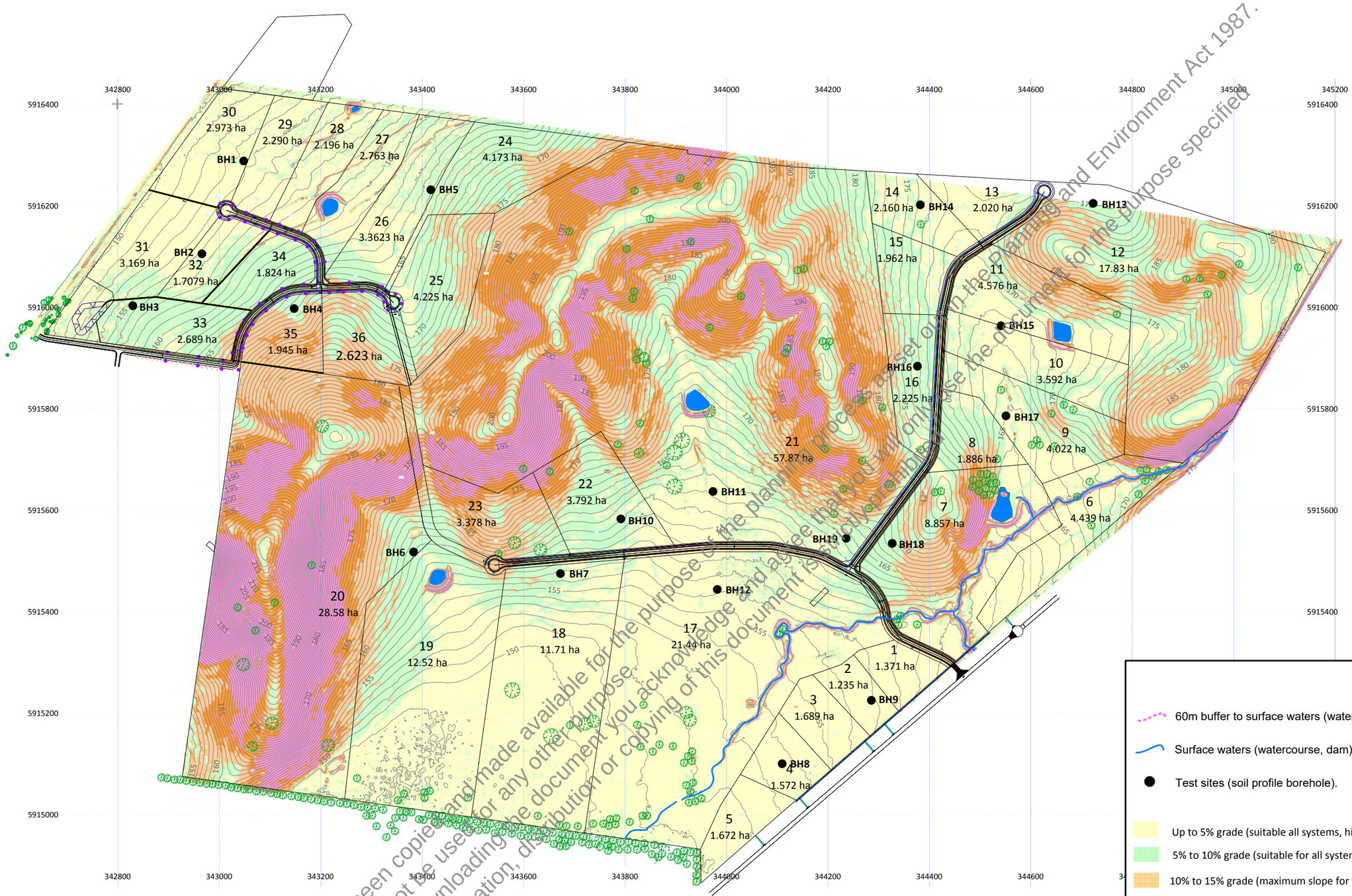
HIGH RISK: Mainly residual soils, ground slopes >20%

LAND-SOIL RISK FOR SUBSURFACE IRRIGATION SYSTEMS

2353 AVENEL-LONGWOOD ROAD, AVENEL

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 4

Paul Williams & Associates Pty Ltd



60m buffer to surface waters (water course and dam).

Surface waters (watercourse, dam).

Test sites (soil profile borehole).

Up to 5% grade (suitable all systems, high level of drainage detail required).

5% to 10% grade (suitable for all systems).

10% to 15% grade (maximum slope for trench systems - reduced DIR for irrigation).

15% to 20% grade (trenches not suitable - reduced DIR for irrigation).

20% + grade (high engineering input for irrigation design required).

0 100 200 300 400 500

SCALE OF METRES

(1:8,000 @ A3)

SLOPE CATEGORIES

2353 AVENEL-LONGWOOD ROAD, AVENEL

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 2

BARRY THOMPSON

LAND CAPABILITY ASSESSMENT
FOR
ON-SITE WASTEWATER MANAGEMENT
AT
2353 AVENEL-LONGWOOD ROAD, AVENEL

REPORT No. A190314 SEPTEMBER 2019

By

Paul Williams, B.App.Sc.
Paul Williams & Associates Pty Ltd
CONSULTANTS IN THE EARTH SCIENCES

IMPORTANT NOTE

The land capability assessment report consists of this cover sheet, two written sections, five drawings and four appendices.
The report elements are not to be read or interpreted in isolation.

TABLE OF CONTENTS

SECTION 2 RECOMMENDATIONS

ASSESSOR'S ACADEMIC & PROFESSIONAL QUALIFICATIONS

Paul Williams is the Director and principal earth scientist at Paul Williams & Associates Pty Ltd. He has a Bachelors Degree in Applied Science (Geology and Land Use) (awarded in 1978) and has since specialised in vadose zone hydrology, soil science, land-soil risk assessment and engineering geology.

He is a member of the Foundation and Footings Society (Vic) Inc. and is a Registered Building Practitioner (EC1486)

All fieldwork and analyses are undertaken by, or directly supervised by Paul Williams.

ASSESSOR'S PROFESSIONAL INDEMNITY INSURANCE

Policy Number:	RSM0000001
Period of Cover:	14/2/2019 – 14/2/2020
Geographical Coverage:	Worldwide (excluding U.S.A. & Canada)
Retro-active Date:	Unlimited
Limit of Indemnity:	$4,000,000
Underwriting Company:	Lloyds of London (About Underwriting)

EXECUTIVE SUMMARY

The proposed development at 2353 Avenel-Longwood Road, Avenel, is suitable for sustainable on-site effluent disposal.

It is proposed to subdivide an allotment of 169.1 hectares into 36 lots ranging in size from 1.235 hectares to 28.58 hectares, as shown in Drawings 2 through 4.

Each allotment is able to support a residence and associated onsite wastewater system.

The site is in the Farming zone and is not in Special Water Supply Catchment.

The site is not sewered. For design purposes, mains water (equivalent) is assumed.

Table One
Description of Development

Parameter	Site specific element
SPI Number	2\LP124174, 3\PS348068, 1\PS513465, 1\PS514503
Property Address	2353 Avenel-Longwood Road, Avenel
Owner	
Contact	
Locality	Avenel
Zoning and Overlays	Farming
Area	Ranging from 1.235 hectares to 28.58 hectares.
Usable Lot Area	At least double proposed land application areas.
Soil Texture	Category 4/6 (loam) over Category 6 (sodic/magnesic medium/heavy clay).
Soil Depth	1.3 to 2+m for LSU A and B.
Soil Structure	Weakly structured.
Soil Constraints	Low ksat, sodic/magnesic clays (Category 6 soils).
Permeability	0.04m/day after renovation.
Slope	LAA restricted to areas with slope less than 10%.
Distance to Surface Waters	60m (minimum) to watercourse and dams.
Water Supply	Mains equivalent (assumed for design purposes).
Wastewater Load	900 litres (5-bedroom dwellings).
Availability of Sewer	Not available

The assessment has been made in the context of prioritising public and environmental health with a design compromise between rational wastewater reuse and sustainable wastewater disposal.

Our field testing which included soil profile logging and sampling, laboratory testing, permeability testing and subsequent reporting including water and nutrient balance modelling and risk assessment has revealed that on-site effluent disposal is rational and sustainable.

Effluent shall be treated to at least the 20/30 standard and distributed by subsurface irrigation utilising the processes of evapotranspiration and deep seepage.

The irrigation area has been determined for the 9th decile wet year and satisfies the requirements of *SEPPs (Waters of Victoria)* in that the effluent irrigation system cannot have any detrimental impact on the beneficial use of surface waters or groundwater.

For the proposed development increases in effluent volume above 900 litres/day may be possible.

With regard to density of development and cumulative risk the assessment has considered risk associated with subsurface flows and surface flows.

In regard to subsurface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained the risk to surface and ground waters is negligible. Once the effluent is placed underground, the extraordinary long travel times via ground water to surface waters ensures adequate nutrient attenuation.

In regard to surface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained, the risk to surface and ground waters is no greater than for a sewered development.

The results of the land capability assessment and risk analysis indicate that primary effluent and trench systems are not appropriate for this site.

Where risk is defined as the product of consequences and frequency, risk can be reduced to negligible levels if effluent is treated to a secondary level and disposed via pressure compensated subsurface irrigation, as described in Section 2, below.

Residential use requires AWTS or sand filter with pressure compensated subsurface irrigation and load balancing facility/function.

Intermittent (e.g. holiday) use requires sand filter with pressure compensated subsurface irrigation and load balancing facility/function.

The LCA supports a conservative, scientifically based, well founded wastewater management system with inherent multiple barriers of safety.

Cumulative risk from the development is extremely low. The risk of serious or irreversible damage is extremely low.

All requirements of *SEPP (Waters of Victoria)* can be met.

Paul Williams & Associates Pty. Ltd.
ABN 80 006 412 862
CONSULTANTS IN THE EARTH SCIENCES

P. O. Box 277, Sunbury, Victoria, 3429
2 Argyle Place, Sunbury, Victoria, 3429
Telephone: 03 9744 6426

A190314 – SEPTEMBER 2019

BARRY THOMPSON

LAND CAPABILITY ASSESSMENT
FOR
ON-SITE WASTEWATER MANAGEMENT
AT
2353 AVENEL-LONGWOOD ROAD, AVENEL

SECTION 1. SITE INVESTIGATION

1.1 INTRODUCTION

On instruction from the land owner, an investigation was undertaken to assess land capability for on-site effluent disposal at 2353 Avenel-Longwood Road, Avenel.

It is proposed to subdivide an allotment of 169.1 hectares into 36 lots ranging in size from 1.235 hectares to 28.58 hectares, as shown in Drawings 1 through 3.

Each allotment is able to support a residence and associated onsite wastewater system.

The site is in the Farming zone and is not in Special Water Supply Catchment.

The site is not sewered. For design purposes, mains water (equivalent) is assumed.

The assessment has been made in the context of prioritising public and environmental health with a design compromise between rational wastewater reuse and sustainable wastewater disposal.

1.2 INVESTIGATION METHOD

The reconnaissance site investigation was carried out in accordance with *SEPPs (Waters of Victoria)* and related documents. This report is in accordance with or exceeds the requirements of *Strathbogie Shire Domestic Wastewater Management Plan, 2015,* Brayd Consulting and *Code of Practice - Onsite Wastewater Management, E.P.A.* Publication 891.4, July 2016. Guidance has been sought from *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments,* Dr Robert Edis, April 2014*. AS/NZS 1547:2012*, *Guidelines for Wastewater Irrigation*, E.P.A. Publication 168, April 1991, *Wastewater Subsurface Drip Distribution*, Tennessee Valley Authority, March, 2004, *AS 2223, AS 1726, AS 1289, AS 2870* and *Australian Laboratory Handbook of Soil and Water Chemical Methods*.

Our capability assessment involved the mapping of unique land-soil unit(s) which were defined in terms of significant attributes including; climate, slope, aspect, vegetation, soil profile characteristics (including colloid stability, soil reaction trend and electrical conductivity), depth to rock, proximity to surface waters and escarpments, transient soil moisture characteristics and hydraulic conductivity.

Exploratory boreholes were augered and existing exposures were viewed. The soil profile was logged and representative soil samples were taken for laboratory testing.

Water and nutrient balance analyses were based on the mean monthly rainfall data and 9th decile annual rainfall for Avenel and mean evaporation data for Goulburn Weir and were undertaken in accordance with *Guidelines for Wastewater Irrigation, E.P.A.* Publication 168, April 1991 (Part), *AS/NZS 1547:2012* and in-house methods.

Redistribution of monthly rainfall was adjusted in proportion to the deviation of means from the minimum mean (see Appendix C, part 2). The rainfall and evaporation data were obtained from the National Climate Centre, Bureau of Meteorology. The data was subsequently analysed and applied to our water and nutrient balance analyses.

The results of the investigation and *in situ* and laboratory testing are given in Section 1.3, below, and in Appendix A, to this report.

1.3 CAPABILITY ASSESSMENT

We have used the attributes determined by the investigation to define two (2) land-soil unit, as follows:-

1.3.1 Land-Soil Unit A. This land-soil unit consists of gently to steeply sloping terrain comprising colluvial fans and remnant slopes, as shown in Drawings 1 through 4 and Figures 1 and 2.

1.3.1.1 Climate. The general area receives a mean annual rainfall of 604mm, a 9th decile annual rainfall of 775mm and a mean annual evaporation of 1361mm. Mean evaporation matches or exceeds the adjusted 9th decile rainfall in October through April.

Rainfall and evaporation data are presented in Appendix B, to this report.

1.3.1.2 Slope and Aspect. The site occupies a series of gently sloping colluvial fans with grades ranging from less than 5% to around 15% and remnant slopes with grades ranging from 10% to steeper than 20%, as shown in Drawings 1 through 4.

All land application areas can be placed on land sloping at less than 10% grade.

The unit is exposed to the prevailing winds and is subject to full winter sunshine.

1.3.1.3 Vegetation and Land Use. The unit is vegetated with sparse to dense pasture grasses, weeds and occasional thistles and remnant *Eucalyptus spp* and regrowth, as shown in Figures 1 and 2.

1.3.1.4. Slope Stability. For the encountered subsurface conditions, slope degree and geometry and for the proposed range of hydraulic loadings, the stability of the ground slopes within the disposal areas are unlikely to be compromised.

1.3.1.5 Subsurface Profile. The unit is underlain by colluvial materials of Quaternary Age and residual materials formed on metasedimentary rocks of Ordovician Age.

The general subsurface profile consists of:-

- A topsoil (A_1-horizon) layer of grey-brown, moist, medium dense sandy silt, gravelly sand and silty sand with some clay of low plasticity (loam/sandy loam), with a soil reaction trend of 5.9 to 6.2 pH and electrical conductivity of 0.17 to 0.36 dS/m, to depths of 0.0 to 0.1m, overlying,

- A colluvial (A_2-horizon) layer of light grey-brown, grey-brown and brown, moist, medium dense clayey-sandy gravel and silty sandy gravel (sand/sandy loam), with a soil reaction trend of 6.0 to 7.1 pH and electrical conductivity of 0.17 to 0.45 dS/m, to depths of 0.3 to 0.5m, overlying,

- A residual soil (B-horizon) layer of orange-grey, poorly-structured, “gritty” silty clay and sandy clay of low plasticity (medium clay), with a soil reaction trend of 6.0 to 8.1, electrical conductivity of 0.20 to 1.82 dS/m and free swell of zero% to 65%, to depths of 1.1 to at least 2m, overlying,

- An extremely weathered (B_2-horizon) layer of orange-grey, red-grey, orange-brown, moist, poorly-structured “gritty” silty clay and sandy clay of low plasticity (medium/heavy clay), with a soil reaction trend of 6.0 to 8.1 pH, electrical conductivity of 0.20 to 1.82 and free swell of 30% to 65%, to depths of 1.6 to at least 2m, overlying,

- Highly and less weathered, highly fractured metasediments (siltstone, claystone and sandstone).

Borehole logs are presented in Appendix A2.

1.3.1.6 Soil Permeability. The *in-situ* permeability tests were attempted on 23rd May 2019.

The field testing was abandoned due to spontaneous dispersion of the soil clay fraction.

Where the soils are dispersive *insitu* permeability testing realises inaccurate, low or nil results.

The hydraulic conductivity can be estimated by using test waters containing calcium chloride and/or by laboratory assessment of colloid stability and determination of ameliorant quantities (e.g. gypsum/lime requirement) and swell potential.

A conservative estimate of permeability has been deduced as follows (see Code 3.6.1):-

Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined dispersion and swell potential shows the colluvial and residual clay soils (and clay fractions) to be dispersive. They are therefore by definition Category 6 soils with saturated hydraulic conductivity less than 0.06m/day.

Similar dispersive soils have responded positively (with sufficiently improved hydraulic capability) following applications of gypsum.

For the limiting poorly-structured clay and clayey soils and assuming renovation by gypsum application we have adopted an estimated and conservative design saturated hydraulic conductivity of 0.040m/day.

Peak deep seepage is conservatively estimated at 4mm/day (<10% k_{sat}). Average daily deep seepage is 1.7mm.

1.3.1.7 Basement Material Permeability. From the literature and from examination of exposures in the vicinity, the hydraulic conductivity of the basement material (fractured metasediments) could be in excess of 0.5m/day (adopt 1m/day for buffer design).

1.3.1.8 Colloid Stability. The results of the Emerson Crumb Tests, Dispersion Index tests and observations of any discolouration of water in the boreholes indicate that all encountered materials range from non-dispersive (minor topsoils) to dispersive (all clay materials).

Low colloid stability is demonstrated in the north-west corner of the site where extensive contour bunds have been constructed to control sheet erosion.

The Emerson Class was 5 to 2 and the Dispersion Index was zero to 15.

The electrical conductivity was determined for all horizons using a 1:5 soil/water extract and converted to EC (saturation extract).

The determined electrical conductivity (EC_{se}) ranged from 0.17 dS/m 1.82 dS/m.

Soil reaction trend ranged from 5.9 pH to 8.1 pH which is within a tolerable range.

Exchangeable Sodium was 9.3% to 17.8% (desirable range is <5%).

Exchangeable Magnesium was 32.8% to 64.6% (desirable range is 12% to 15%).

Exchangeable Calcium was 2.3% to 5.8% (desirable range is 65% to 70%).

The adjusted CEC was 7.53 to 14.57 (desirable range is 15+).

The Calcium/Magnesium ratio was 0.03 to 0.11 (desirable range is 2 to 4).

To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Sodium and Magnesium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil – see Section 2.2.8, below.

1.3.1.9 AS1547:2012 Soil Classification. In accordance with *AS/NZS1547:2012* the colluvial and residual materials can be classified as Category 6 soils (sodic and magnesic medium/heavy clays).

1.3.1.10 Surface Drainage. A prominent ridge line running from south-west to north-east traverses the site, as shown in Drawings 2 through 4. The surface slopes to the north-west and west, generally over the north-western portion of the site and to the east, south, south-west and south-east, generally over the eastern portion of the site. In the east, land application areas will drain to a tributary of Hughes Creek to the Goulburn River. In the north-west, land application areas will drain to Wormangal Creek to Pranjip creek and the Goulburn River.

All land application areas are located at least 60 metres from any surface waters.

1.3.1.11 Groundwater. No ground water was encountered in the boreholes.

Subsurface flow direction will generally reflect natural surface flow direction.

There are no groundwater bores within a significant distance of any proposed land application areas.

The Victorian groundwater data base and our bore logs indicate groundwater is deeper than 2 metres of the surface in the vicinity of the tributary to Hughes Creek (in the south-east) and the site's western periphery and between 5 metres and 50 metres elsewhere.

Regionally the groundwater is contained in the underlying metasediments. The yield is low and quality ranges from fair to moderate (500 to 3,500 mg/litre TDS) with beneficial use including most stock.

1.3.1.12 Nutrient Attenuation. Clay soils (as found on this site) can fix large amounts of phosphorous. Phosphate-rich effluent seeping through these soils will lose most of the phosphorous within a few metres.

The limiting nutrient for this site is nitrogen. No phosphorous balance is required.

Nitrogen, contained in organic compounds and ammonia, forms nitrate-N and small amounts of nitrite-N when processed in an aerated treatment plant. Several processes affect nitrogen levels within soil after irrigation. Alternate periods of wetting and drying with the presence of organic matter promote reduction to nitrogen gas (denitrification). Plant roots absorb nitrates at varying rates depending on the plant species (see Appendix B), however nitrate is highly mobile, readily leached, and can enter groundwater via deep seepage and surface waters via overland flow and near-surface lateral flow.

Based on the water and nutrient balance (see Appendix B), and assuming 30mg/litre N in the effluent (general case) and 20mg/litre P, a denitrification rate of 20%, with N uptake of 220 kg/ha/year for the an appropriate grass cover equivalent to a rye/clover mix) and sequential zoned dosing of the irrigation area, a conservative estimate can be made of the nitrogen content in the deep seepage and lateral flow.

For the general case and without considering further expected denitrification below the root zone and in the groundwater (reported to be in the vicinity of 80%), denitrification in the lateral flow (external to the irrigation areas but within the curtilage of each allotment) and plant uptake in the lateral flow, the irrigation area would need to be 360m^2 for 900 litres/day of effluent for complete attenuation.

The hydraulic component of the water and nutrient balance have shown that an irrigation area of 560m^2 (5-bedroom dwelling) would be required to limit surface rainwater flows to episodic rain events.

For the development and to satisfactorily attenuate nitrogen on-site and to accommodate the design hydraulic loading, the application rate should not exceed **1.7mm/day**.

1.3.2 Land-Soil Unit B. This land-soil unit consists of gently sloping terrain, as shown in Drawings 1 through 4 and Figure 3.

1.3.2.1 Climate. The general area receives a mean annual rainfall of 604mm, a 9th decile annual rainfall of 775mm and a mean annual evaporation of 1361mm. Mean evaporation matches or exceeds the adjusted 9th decile rainfall in October through April.

Rainfall and evaporation data are presented in Appendix B, to this report.

1.3.2.2 Slope and Aspect. The site is very gently to gently sloping with subdued areas in the south, as shown in Drawings 1 through 4. Slopes range from less than 1% grade to 5% grade.

All land application areas can be placed on land sloping between 1% grade and 5% grade.

The unit is exposed to the prevailing winds and is subject to full winter sunshine.

1.3.2.3 Vegetation and Land Use. The unit is vegetated with sparse to dense pasture grasses, weeds, *Juncus spp* and remnant *Eucalyptus spp*, as shown in Figure 3.

1.3.2.4. Slope Stability. For the encountered subsurface conditions, slope degree and geometry and for the proposed range of hydraulic loadings, the stability of the ground slopes within the disposal areas are unlikely to be compromised.

1.3.2.5 Subsurface Profile. The unit is underlain by alluvial materials of Quaternary Age.

The general subsurface profile consists of:-

- A topsoil (A-horizon) layer of grey-brown, moist, medium dense silty sand, silt and clayey silt (loam), with a soil reaction trend of 5.9 to 6.6 pH and electrical conductivity of 0.10 to 0.28 dS/m, to a depth of 0.1m, overlying,
- An alluvial (A_L-horizon) layer of light brown, moist medium dense silty sand (loam) with a soil reaction trend of 6.0 to 7.1 pH, electrical conductivity of 0.15 dS/m, to a depth of 0.6m, overlying.
- An alluvial (A_L-horizon) layer of interbedded light yellow-grey and yellow-grey, moist, medium dense (and indurated) sandy and clayey sand (sandy loam), and orange-grey, very stiff silty clay and sandy clay of low plasticity (medium/heavy clay), with a soil reaction trend of 6.0 to 7.1 pH, electrical conductivity of 0.14 to 0.37 dS/m and clay fraction free swell of zero% to 60%, to a depth of at least 2m.

1.3.2.6 Soil Permeability. The *in-situ* permeability tests were attempted on 23rd May 2019.

The field testing was abandoned due to spontaneous dispersion of the soil clay fraction.

Where the soils are dispersive *insitu* permeability testing realises inaccurate, low or nil results.

The hydraulic conductivity can be estimated by using test waters containing calcium chloride and/or by laboratory assessment of colloid stability and determination of ameliorant quantities (e.g. gypsum/lime requirement) and swell potential.

A conservative estimate of permeability has been deduced as follows (see Code 3.6.1):-

Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined dispersion and swell potential shows the colluvial and residual clay soils (and clay fractions) to be dispersive. They are therefore by definition Category 6 soils with saturated hydraulic conductivity less than 0.06m/day.

Similar dispersive soils have responded positively (with sufficiently improved hydraulic capability) following applications of gypsum.

For the limiting poorly-structured clay and clayey soils and assuming renovation by gypsum application we have adopted an estimated and conservative design saturated hydraulic conductivity of 0.040m/day.

Peak deep seepage is conservatively estimated at 4mm/day (<10% k_{sat}). Average daily deep seepage is 1.7mm.

From the literature and from examination of exposures in the vicinity, the hydraulic conductivity of the basement rocks would be in excess of 0.05m/day (adopt 1m/day for buffer design).

1.3.2.7 Basement Rock Permeability. From the literature and from examination of rock profiles and rock mass defect character in the vicinity, the hydraulic conductivity of the basement rocks would be in excess of 0.05m/day (adopt 1m/day for buffer design).

1.3.2.8 Colloid Stability. The results of the Emerson Crumb Tests, Dispersion Index tests and observations of any discolouration of water in the boreholes indicate that all encountered materials are non-dispersive and dispersive.

The Emerson Class was 5 to 2 and the Dispersion Index was zero to 13.

The electrical conductivity was determined for all horizons using a 1:5 soil/water extract and converted to EC (saturation extract).

The determined electrical conductivity (EC_{se}) ranged from 0.10 dS/m 0.37 dS/m.

Soil reaction trend ranged from 5.9 pH to 7.2 pH which is within a tolerable range.

Exchangeable Sodium was 17.8% (desirable range is <5%).

Exchangeable Magnesium was 58% (desirable range is 12% to 15%).

Exchangeable Calcium was 5.8% (desirable range is 65% to 70%).

The adjusted CEC was 11.25 (desirable range is 15+).

The Calcium/Magnesium ratio was 0.1 (desirable range is 2 to 4).

To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Sodium and Magnesium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil – see Section 2.2.8, below.

1.3.2.9 AS1547:2012 Soil Classification. In accordance with *AS/NZS1547:2012* the alluvial clay materials can be classified as Category 6 soils (medium/heavy clays).

1.3.2.10 Surface Drainage. The proposed effluent areas slope to the south-west and west, generally. The proposed effluent areas drain to surface waters located at least 60m distant.

Surface drainage will be via a tributary of Hughes Creek to the Goulburn River.

1.3.2.11 Groundwater. No ground water was encountered in the boreholes.

Subsurface flow direction will generally reflect natural surface flow direction (i.e. west and south-west directions).

There are no groundwater bores within a significant distance of the proposed land application areas.

The Victorian groundwater data base indicates groundwater is deeper than 2 metres of the surface.

Regionally the groundwater is contained in avulsion channels within the alluvial terrace complex. The yield is low and quality ranges from poor to moderate (500 to 3,500 mg/litre TDS) with beneficial use including most stock.

1.3.2.12 Nutrient Attenuation. Clayey soils (as found on this site) can fix large amounts of phosphorous. Phosphate-rich effluent seeping through these soils will lose most of the phosphorous within a few metres.

The limiting nutrient for this site is nitrogen. No phosphorous balance is required.

Nitrogen, contained in organic compounds and ammonia, forms nitrate-N and small amounts of nitrite-N when processed in an aerated treatment plant. Several processes affect nitrogen levels within soil after irrigation. Alternate periods of wetting and drying with the presence of organic matter promote reduction to nitrogen gas (denitrification). Plant roots absorb nitrates at varying rates depending on the plant species (see Appendix B), however nitrate is highly mobile, readily leached, and can enter groundwater via deep seepage and surface waters via overland flow and near-surface lateral flow.

Based on the water and nutrient balance (see Appendix B), and assuming 30mg/litre N in the effluent (general case) and 20mg/litre P, a denitrification rate of 20%, with N uptake of 220 kg/ha/year for the an appropriate grass cover equivalent to a rye/clover mix) and sequential zoned dosing of the irrigation area, a conservative estimate can be made of the nitrogen content in the deep seepage and lateral flow.

For the general case, and without considering further expected denitrification below the root zone and in the groundwater (reported to be in the vicinity of 80%), denitrification in the lateral flow (external to the irrigation areas but within the curtilage of the allotment) and plant uptake in the lateral flow, the irrigation area would need to be 360m^2 for 900 litres/day of effluent for complete attenuation.

The hydraulic component of the water and nutrient balance have shown that an irrigation area of 560m^2 (5-bedroom dwelling) would be required to limit surface rainwater flows to episodic rain events.

For the development and to satisfactorily attenuate nitrogen on-site and to accommodate the design hydraulic loading, the application rate should not exceed **1.7mm/day**.

1.4 RISK MANAGEMENT & MITIGATION

SEPP (Waters of Victoria) requires that the proposal be assessed on a risk-weighted basis and cumulative effects[a] be considered.

A multiple risk-reduction approach is used in assessing this development, with components listed below:

1.4.1 Water Usage. With respect to daily effluent production, the systems are overdesigned. Current best practice allows for a (continuous) daily effluent flows of 900 litres as per *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016.

The design flow is unlikely to be continuous and (at least) standard water reduction fixtures are a mandatory requirement under local building codes.

1.4.2 Secondary Treatment. Primary (septic) treatment and trench disposal methods are not appropriate for either land-soil unit. The prevailing soil conditions are characterised by high colloid instability which makes it extremely difficult to establish and control the required soil ameliorant application(s).

The LCA recommends AWTS and sand filters with pressure compensated subsurface irrigation. These systems generate a much higher quality of effluent than septic systems.

1.4.3 Large Block Size. Many under-performing effluent fields are placed on blocks where area is limited. Limited area can lead to inadequately sized or inappropriately placed effluent fields and a lack of options should the daily effluent volumes increase.

For the proposed minimum lot area (1.235 hectares), size is not a constraining factor.

[a] We would contend that there can be no significant cumulative effect if the provisions of *SEPP (Waters of Victoria)* are met (i.e. all wastes contained onsite).

1.4.4 Management Plan. Historically, inadequate maintenance has played a major part in the failure of onsite effluent disposal systems. There is a management plan within the LCA (see Appendix D). This plan gives guidance on the implementation of mandatory operation, maintenance and inspection procedures.

1.4.5 Sizing of Treatment Systems. No specific proprietary treatment plant is recommended, however treatment plants or sand filters must have current JAS/NZS accreditation, which match effluent volumes with plant capacity.

1.4.6 Load Balancing. Surge flows are possible due to parties, gatherings, etc. Under these conditions the systems may become overwhelmed for a period. This potential problem can be eliminated by installing a plant with a load balancing facility (or equivalent function) which enables short-term storage and sustainable flows to the distribution area over extended time. The load balancing facility also provides temporary storage should the plant fail or if there is a power outage.

1.4.7 Zoned Dosing. The LCA stipulates that the effluent area is (automatically) irrigated sequentially by zones or time to promote the creation of transient aerobic and anaerobic soil conditions.

The effluent field is sized conservatively for nitrogen attenuation, using pasture grass (rye/clover eq mix), which has a nitrogen uptake of 220 kg/ha/year. Zoned dosing will increase the efficiency of the field for removing nitrogen from the soil.

Undersized effluent fields are at risk of becoming anaerobic for long periods, with the risk of microbial build-up. This leads to secretion of microbial polysaccharides, which coat soil particles and restrict the ability of the soil to adsorb nutrients and attenuate pathogens. Polysaccharides can also coat the interior of pipes and block drainage holes if drainage is slow due to the field being overloaded with effluent. This can lead to effluent surcharge from the ends of the drainage pipes, forming preferential flow paths through overlying soil and draining overland to nearby surface waters.

The alternating aerobic and anaerobic conditions created by zoned dosing prevent the build-up of microbial polysaccharides, and ensures efficient renovation of effluent.

1.4.8 Pressure Compensated Subsurface Disposal. Conservatively sized irrigation areas with pressure compensated subsurface disposal and zoned dosing deliver effluent directly into the soil. Under saturated conditions, water flow is downwards in the direction of maximum hydraulic gradient. For a surface flow containing effluent to occur, the effluent would have to rise, *against gravity*, through at least 150mm of soil. Under unsaturated conditions, water flow is multi-directional due to capillary forces and matrix suction. The atmosphere provides a capillary break with capillary forces and matrix suction reducing to zero at the air/soil interface. Gravitational forces outweigh the capillary forces and matrix suction long before the surface is reached. Hence, any surface flow from the effluent area cannot contain any effluent, regardless of the intensity and duration of rain events. Surface flow can only consist of **rainfall** in excess of soil storage capacity and hydraulic conductivity.

Note: For a pressure compensated distribution network to function properly, lines must be placed parallel to contours and/or horizontal for even effluent distribution. This requirement, alone, requires a high level of quality assurance at the design and construction phases.

1.4.9 Oversized Effluent Areas. Design effluent areas are oversized and are based on conservative estimates of renovation and complete attenuation of nitrogen. The deep seepage rate is lower than the hydraulic conductivity of the limiting layer (<10%).

1.4.10 Reserve Areas. Although reserve areas are not required for subsurface irrigation (*Code of Practice*, 2016), they have been stipulated in the recommendations and constitute an additional barrier of safety. The reserve area is a spare effluent field, which is left undeveloped, but can be readily constructed and commissioned in the case of contingencies through the chain of ownership.

1.4.11 Buffer Distances. Buffer distances are set out in the *Code of Practice* to allow for attenuation of pathogens and nutrients, should an effluent surcharge occur, either overland or subsurface.

All land application areas are located at least 60m from surface waters.

The time taken for groundwater to reach the nearest potable surface waters can be estimated by using the Darcy equation (which states that velocity is the product of the hydraulic conductivity and the hydraulic gradient). From the literature, the regional gradient is about 0.002.

Flow times can be estimated for groundwater to flow the 60m (minimum) to the nearest surface waters at this site.

For a conservative basement hydraulic conductivity of 1m/day[b] (fractured metasediments) with a hydraulic gradient of 0.002, the time taken for groundwater to flow a distance of 60m is over 80 years.

For perched groundwater flows in the slopewash materials (hydraulic conductivity of 0.6m/day) and a hydraulic gradient equivalent to the steepest allowable slope (10%), the time taken for perched groundwater to flow a distance of 60m is about 2.5 years and assumes no evapotranspiration during this time.

For a surface effluent discharge on a 10% slope and for the prevailing soil hydraulic characteristics, the estimated maximum travel distance of effluent before reabsorption is about 1m[c].

1.4.12 System Failure. A properly designed and constructed onsite effluent system consisting of the treatment plant and the irrigation area can suffer degrees of failure. Failure can take the form of mechanical (plant), accidental (toilet blockages, damaged irrigation lines, high BOD influent), operational (power outage, overloading) and maintenance (failure to check filters, failure to participate in maintenance programme).

1.4.12.1 Mechanical Breakdown. Mechanical plant breakdown typically involves compressor and pump malfunction causing no aeration and high-water levels, respectively. Both of these situations are alarmed (both audible and visual). The proposed plants will benefit from a service contract providing 24-hour repair cycles. If the alarms were ignored (or malfunctioned) and the household continued to produce waste until the load balancing tank and plant capacities were exceeded (at least 3 days), a mixture of septic and raw effluent would back up to the interior of the units and/or surcharge through the plant hatches. It is difficult to imagine how this outcome could be allowed to manifest. In addition, a plant malfunction with the residents absent could not cause an effluent surcharge because no influent would be produced during this period.

1.4.12.2 Accidents. Toilet blockages and accidentally damaged irrigation lines could allow localised surface surcharge of treated effluent. This is why minimum buffers to surface waters have been maintained. High BOD influent (e.g. dairy or orange juice) can realise a lesser quality than 20/30 standard for some weeks. Provided the high BOD influent is not continuous, the soils will continue to satisfactorily renovate the effluent.

1.4.12.3 Operational Breakdown. Operational failures including power outages and transient hydraulic overloading are accommodated by the load balancing facility, as described in Section 1.4.6, above.

1.4.12.4 Maintenance Breakdown. Maintenance breakdowns such as failure to clean line filters can lead to expensive pump repairs and in extreme cases leakage (of 20/30 standard effluent) from the outlet pipe. This leakage would occur in proximity to the dwelling and would be noticed and acted on.

Refusal to participate in the management programme would be acted on by the responsible authority within one maintenance cycle.
AWTS and pumped systems have mechanical components which can malfunction and will age. The management plan including the maintenance and monitoring programmes are essential to ensure safe onsite effluent disposal.

A prepaid maintenance, monitoring and reporting programme involving a certified and insured entity (i.e. external audit) would ensure safe onsite effluent disposal and reduce the responsible authority's burden of responsibility.

1.4.13 Risk Summary. With regard to density of development and cumulative risk the assessment has considered risk associated with subsurface flows and surface flows.

In regard to subsurface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained (see items 1.4.1 through 1.4.12.4), the risk to surface and ground waters is negligible. Once

[b] This is a conservatively high figure to demonstrate maximum possible flow rates. A conservatively low figure was used for calculation of effluent application rates (see recommendations) to demonstrate irrigation sustainability.

[c] Source: *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments* (Dr Robert Edis April 2014).

the effluent is placed underground, the extraordinary long travel times via ground water to surface waters ensures adequate nutrient attenuation.

In regard to surface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained (see items 1.4.1 through 1.4.12.4), the risk to surface and ground waters is no greater than for a sewered development. Indeed, it could be considered that the risk is less than for a sewered development because there can be no mains failure (because there is no mains).

The LCA recommends a conservative, scientifically based, well founded wastewater management system with inherent multiple barriers of safety. Cumulative risk from the development is also extremely low. The risk of serious or irreversible damage is extremely low.

All requirements of *SEPP (Waters of Victoria)* have been met.

Figure 1: Land-soil unit A, (north-west corner of site), viewed from north to south, showing contour bunds.

Figure 2: Land-soil unit A (typical), showing slope up to 5% grade and 5% to 10% grade at right rear.

Figure 3: Land-soil unit B, Lots 1 through 6 (typical) viewed from south-west to north-east.

SECTION 2. RECOMMENDATIONS

2.1 APPLICATION

The following recommendations are based on the results of our assessment, and are made in accordance with *SEPPs (Waters of Victoria),* the *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, *AS 1726*, and *AS/NZS 1547:2012*.

They are based on the mean saturated hydraulic conductivity of the limiting clayey materials and are designed to demonstrate the viability of on-site effluent disposal for a residence and a daily effluent production of up to 900 litres and are considered to be conservative.

2.2 SUBSURFACE IRRIGATION

2.2.1 General. Based on the results of the water balance analysis and considering the prevailing surficial and subsurface conditions including soil profile thickness[d] and slope and on condition that adequate site drainage is provided (as described in Section 2.4, below), on-site irrigation systems are appropriate for effluent disposal for land-soil units A and B.

2.2.2 Effluent. Effluent will be generated from a residence and will include black and grey water (all wastes).

2.2.2.1 Effluent Quality. Effluent shall be treated by AWTS or sand filter to a standard that meets or exceeds the water quality requirements of the 20/30 standard for BOD/SS.

2.2.2.2 Effluent Quantity. The daily effluent volume of 900 litres has been calculated from *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, Table 4 and assumes mains water (equivalent) and WELS-rated water-reduction fixtures and fittings – minimum 4 Stars for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves and minimum 3 Stars for all appliances.

2.2.2.3 Load Balancing. Transient hydraulic loads in excess of the expected daily load may occur. In addition, and in the case of power outages and/or mechanical breakdown, the load balancing tank/function can act as a temporary storage.

We recommend that the effluent treatment system be fitted with a load balancing facility or equivalent function to allow transient high hydraulic loads to be retained and distributed to the irrigation area during periods of low load.

2.2.3 Application Rates and Irrigation Areas. An irrigation area and application rate has been determined from the results of the water and nutrient balance analyses and *AS/NZS 1547:2012, Appendix M*.

Note: The irrigation area is directly proportional to the design daily hydraulic loading. The irrigation area can be reduced for smaller design daily hydraulic loads.

2.2.3.1 Hydraulic Loading. To satisfy the requirement for no surface discharge in the 9th decile wet year and allowing for slope, effluent shall be applied at an application rate not exceeding 1.7mm/day.

2.2.3.2 Nutrient Loading. The requirements of *SEPPs (Waters of Victoria)* would be satisfied with effluent applied at an application rate not exceeding 2.5mm/day.

2.2.3.3 Design Loading. To satisfy the requirement for no surface discharge in the 9th decile wet year and on-site attenuation of nutrients, the effluent shall be applied at a rate not exceeding **1.7mm/day**.

2.2.4 General Requirements. For subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with *AS/NZS1547:2012* and a "system specific" JAS/ANZ accreditation, as appropriate.

[d] Minimum 1400mm required for evapotranspiration-absorption trenches.

The irrigation area is to be a dedicated area. To prevent stock and vehicular movements over the area, the effluent area shall be "fenced".

2.2.5 Subsurface Distribution System. A distribution network design similar to that shown in *AS/NZS1547:2012, Figure M1* is appropriate.

2.2.5.1 Ground Preparation and Excavations. Preparation of the ground is to include the redistribution of topsoil to form a free draining, smooth surface. Pipe excavations shall only be undertaken in drier periods when soil moisture contents are relatively low and when heavy rainfall and storms are not normally expected.

2.2.5.2 Pump System and Pipe works. Uniform delivery pressure of the effluent throughout the distribution system is essential. Percolation or drip rates shall not vary by more than 10% from the design rate over the whole of the system (i.e. pressure compensated).

The distribution pipes shall be placed coincident with slope contours. The dripper system is to provide an effective even distribution of effluent over the whole of the design area. Line spacing shall be no closer than 1000mm.

2.2.6 Sequential Zoned Irrigation. The efficiency of irrigation effluent disposal systems can be highly variable. We recommend that as part of the daily irrigation process, the effluent area be irrigated sequentially by zones or time to promote the creation of transient aerobic and anaerobic soil conditions.

The inspection regime described in Section 2.2.7, below, is to be strictly adhered to.

2.2.7 Inspections and Monitoring. We recommend that the mandatory testing and reporting as described in the *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, include an annual (post spring) report on the functioning and integrity of the distribution system and on the functioning and integrity of the cut-off drains and outfall areas.

It is expected that the frequency of inspections and monitoring will intensify as systems age.

2.2.8 Soil Renovation. To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Magnesium and Sodium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil.

Application rates are related to water (irrigation and mean rainfall) available to dissolve the gypsum. The water required to dissolve 1 kilogram of gypsum is about 400 litres.

In this instance, where irrigation water is expected to be continuous, available water is sourced from mean rainfall plus irrigation water.

2.2.8.1 Application of Gypsum Without Ripping. A suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 0.5kg/m^2. After smoothing of the surface (by redistribution of topsoil), the irrigation network can be constructed.

After two months gypsum is to be broadcast over the irrigation area at a rate of 0.5kg/m^2 (mean rainfall plus irrigation is at least 100mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 10 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.5kg/m^2.

Gypsum is to be fine ground "Grade 1" agricultural quality.

2.2.8.2 Application of Gypsum With Ripping. A suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 1kg/m^2 followed by ripping to a depth of at least 500mm. After smoothing of the surface (by redistribution of topsoil), the irrigation network can be constructed.

After two months gypsum is to be broadcast over the irrigation area at a rate of 0.5kg/m^2 (mean rainfall plus irrigation is at least 100mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 6 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.5kg/m^2.

Gypsum is to be fine ground "Grade 1" agricultural quality.

2.2.9 AWTS and Sand Filter. It is assumed that the design, construction, operation and maintenance of all treatment elements are carried out in accordance with *AS/NZS1547:2012* and a current JAS-ANZ accreditation.

The AWTS or sand filter are to be sized to successfully treat a daily hydraulic load of 900 litres and a nutrient load of 360 grams BOD.

The sand filter shall have a minimum plan area of 18m^2 with the sand media complying to the *Code* Appendix G. The sand media must have less than 5% fines, effective size (D10) between 0.25 and 0.60mm and uniformity coefficient (D60/D10) less than 4mm.

Note: The sand filter plan area can be proportioned to suit different design hydraulic loads. The plan area is determined by dividing the hydraulic load by 50.

2.3 RESERVE AREA

The expected design life of fifteen years may vary due to construction and maintenance vagaries and possible effluent volume increases through the chain of ownership.

There is sufficient available area on the allotment for extension/duplication of the effluent areas.

2.4 SITE DRAINAGE.

Our recommendations for on-site effluent disposal have allowed for incident rainfall only and are conditional on the installation of a shallow cut-off drain, which shall be placed upslope of the disposal area.

Care shall be taken to ensure that the intercepted and diverted surface waters are discharged well away and down slope of the disposal field.

Cut-off drain detail is shown in Drawing 5.

The owner shall also ensure that any upslope site works do not divert and/or concentrate surface water flows onto the disposal area.

2.5 BUFFER DISTANCES

The water balance analysis has shown that potential surface (rain water) flows from the effluent area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient have been used to evaluate (via Darcy's Law) the buffer distances with respect to subsurface flows.

Our analysis and evaluation have shown that the default setback distances given in *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, Table 5 and *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments,* Dr Robert Edis, April 2014 are conservative and can be applied without amendment.

For a building located downslope of an effluent field, your engineer shall evaluate the integrity of building foundations with respect to the assigned buffer distance.

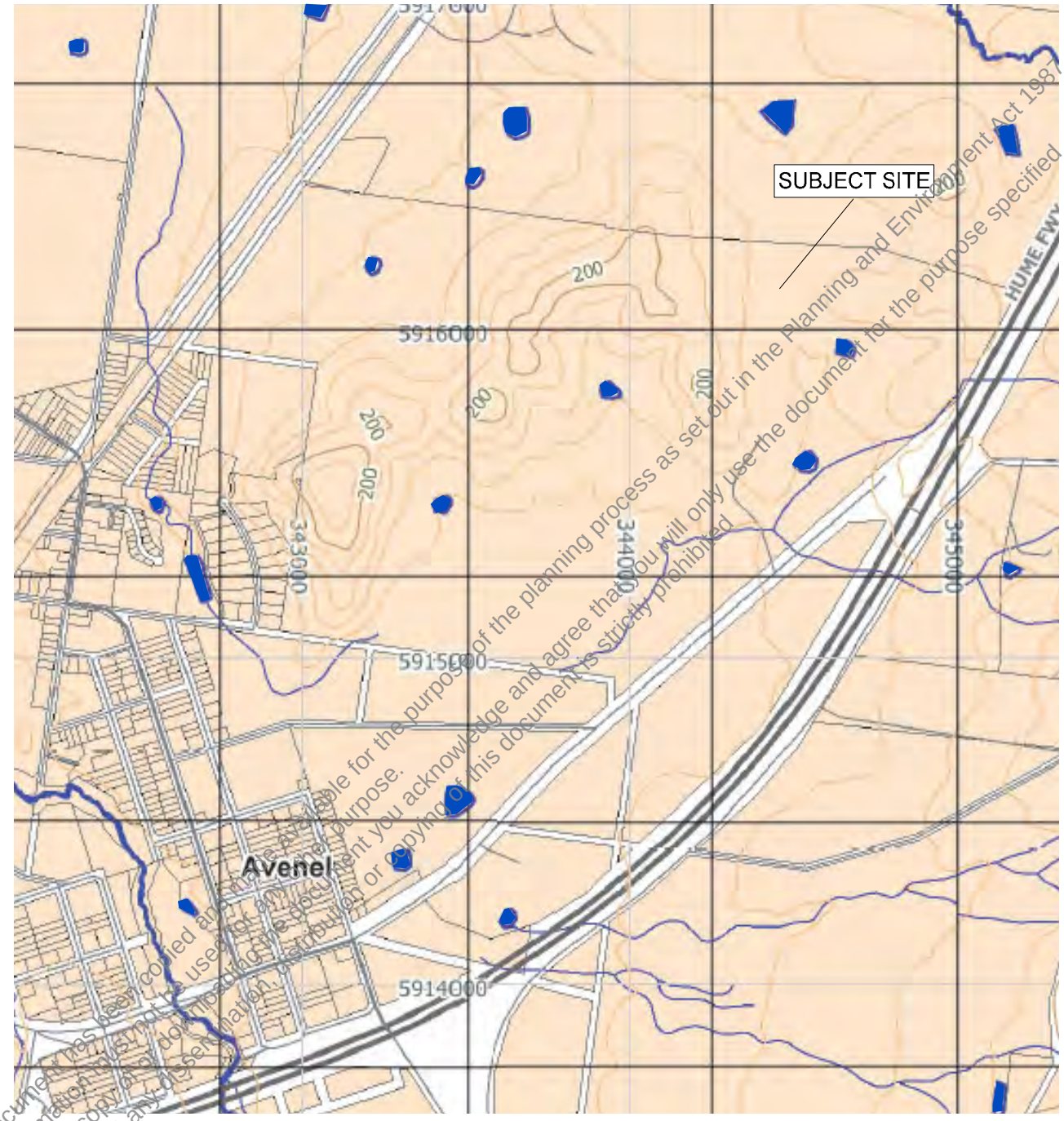
2.6 SUMMARY OF RECOMMENDATIONS

Our capability assessment has shown that at least one rational and sustainable on-site effluent disposal method (20/30 standard subsurface irrigation) is appropriate for the proposed development, subject to specific design criteria, described above, and in particular, the requirement for soil amelioration.

A management plan is presented in Appendix D, to this report.

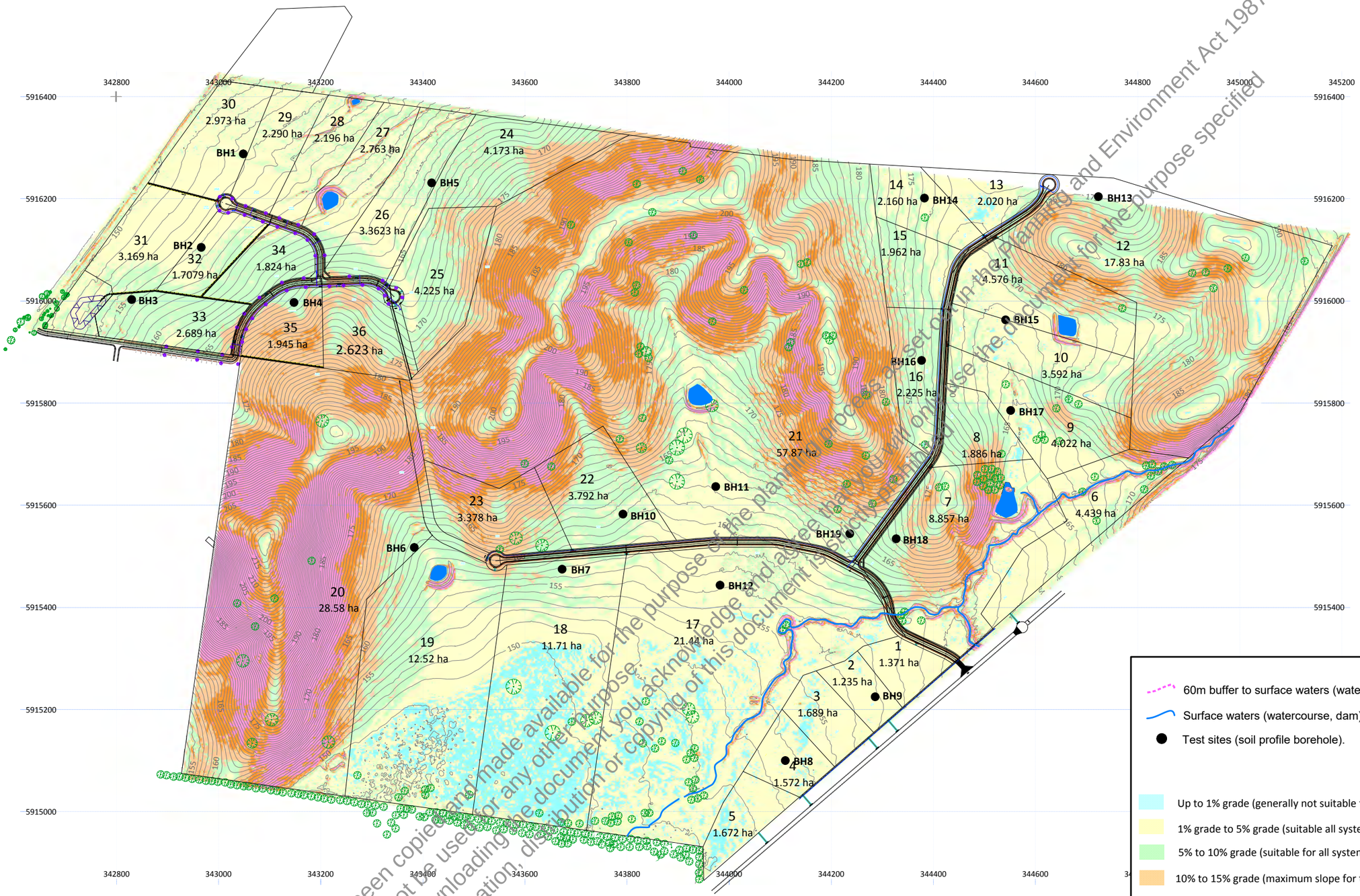
Paul R. WILLIAMS B.App.Sc.
PRINCIPAL HYDROGEOLOGIST
Building Practitioner No. EC-1486

Paul Williams & Associates Pty Ltd



LOCATION OF SUBJECT SITE		
2353 AVENEL-LONGWOOD ROAD, AVENEL		
BARRY THOMPSON		
Scale: 1:25,000	Drawn: P.R.W.	Report Number: A190314
Contour Interval: 10m	Date: September 2019	Drawing Number: 1

Paul Williams & Associates Pty Ltd



60m buffer to surface waters (water course and dam).

Surface waters (watercourse, dam).

Test sites (soil profile borehole).

Up to 1% grade (generally not suitable for any system, impracticable to drain).

1% grade to 5% grade (suitable all systems, high level of drainage detail required).

5% to 10% grade (suitable for all systems).

10% to 15% grade (maximum slope for trench systems - reduced DIR for irrigation).

15% to 20% grade (trenches not suitable - reduced DIR for irrigation).

20% + grade (high engineering input for irrigation design required).

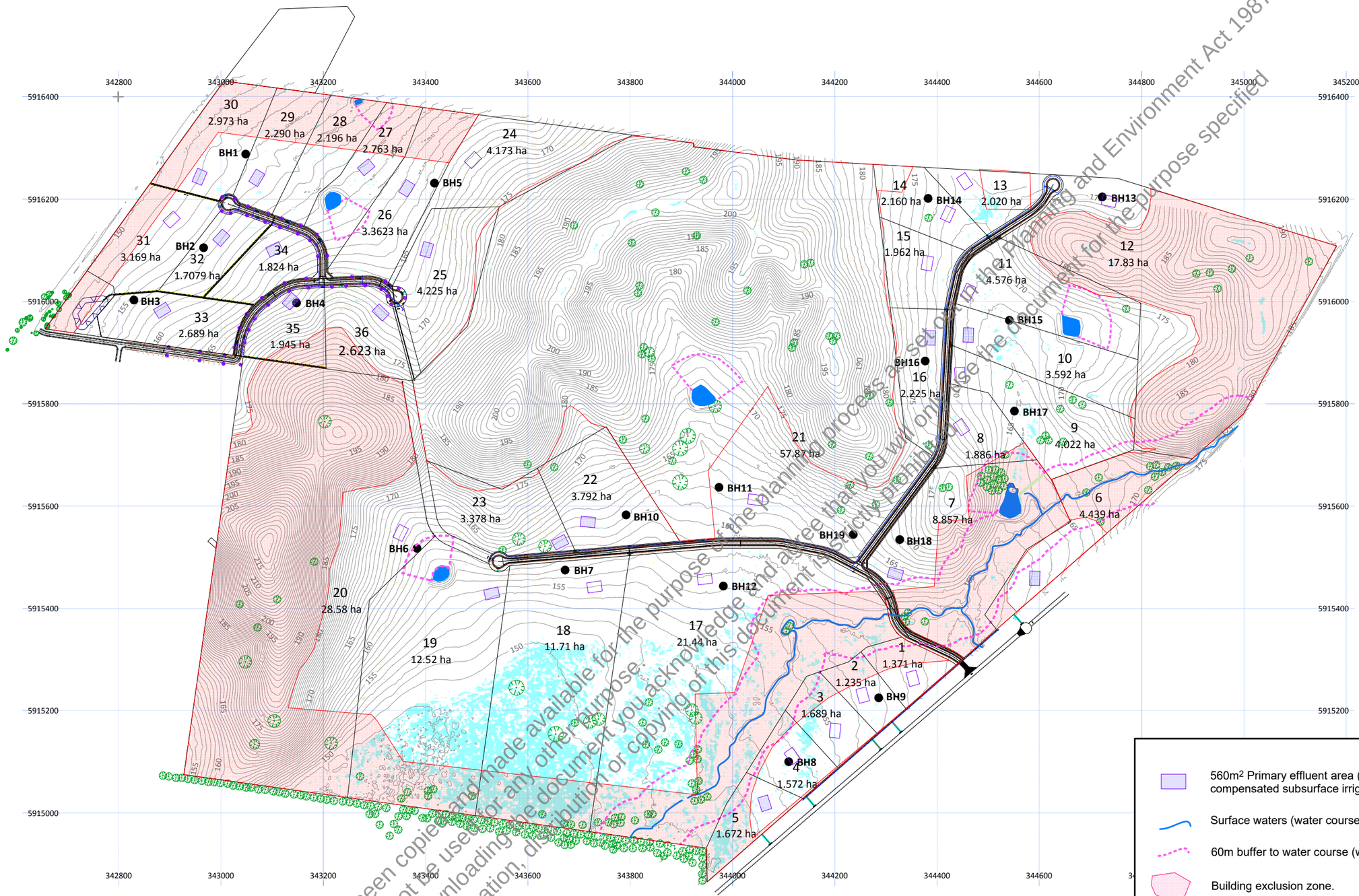
SLOPE CATEGORIES

2353 AVENEL-LONGWOOD ROAD, AVENEL

BARRY THOMPSON

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 2

Paul Williams & Associates Pty Ltd



560m² Primary effluent area (20/30 standard, pressure compensated subsurface irrigation) (5-bedroom residence).

Surface waters (water course, dam).

60m buffer to water course (watercourse, dam).

Building exclusion zone.

Effluent exclusion zone (all systems impracticable - poorly drained terrain).

Test sites (soil profile borehole).

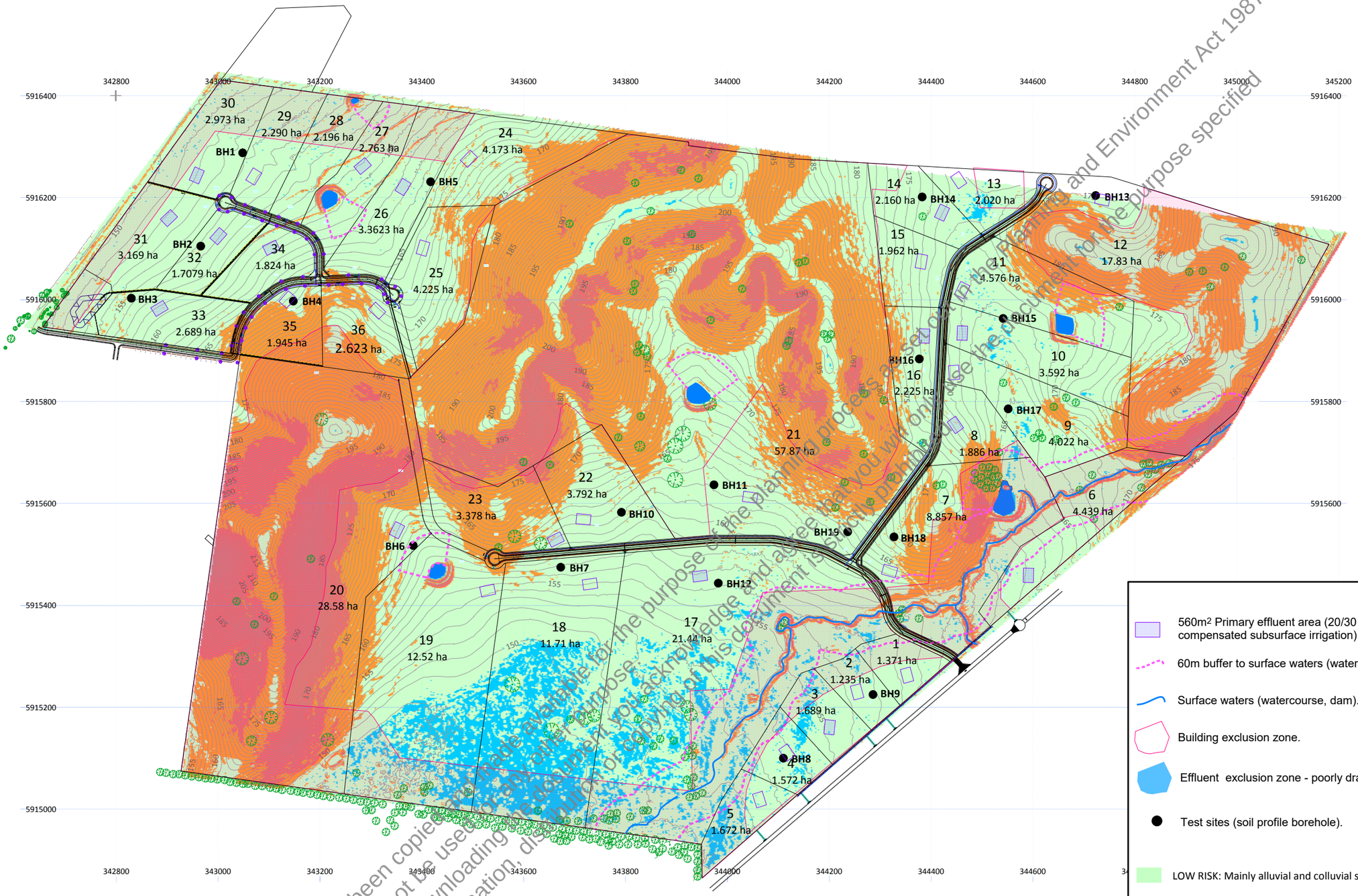
CONTOURS SHOWING BUILDING & EFFLUENT EXCLUSION ZONES

2353 AVENEL-LONGWOOD ROAD, AVENEL

BARRY THOMPSON

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 3

Paul Williams & Associates Pty Ltd



560m² Primary effluent area (20/30 standard, pressure compensated subsurface irrigation) (5-bedroom residence).

60m buffer to surface waters (water course and dam).

Surface waters (watercourse, dam).

Building exclusion zone.

Effluent exclusion zone - poorly drained terrain (slope less than 1%)

Test sites (soil profile borehole).

LOW RISK: Mainly alluvial and colluvial soils, ground slopes to 10%

MEDIUM RISK: Mainly colluvial & residual soils, ground slopes 10% to 20%

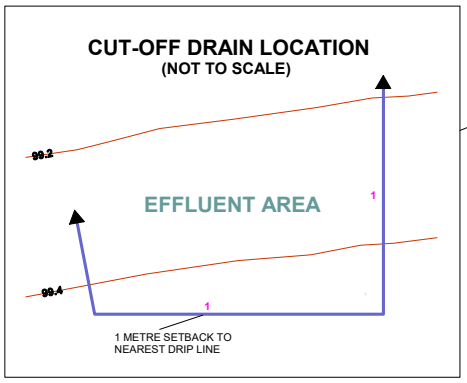
HIGH RISK: Mainly residual soils, ground slopes >20%

LAND-SOIL RISK FOR SUBSURFACE IRRIGATION SYSTEMS

2353 AVENEL-LONGWOOD ROAD, AVENEL

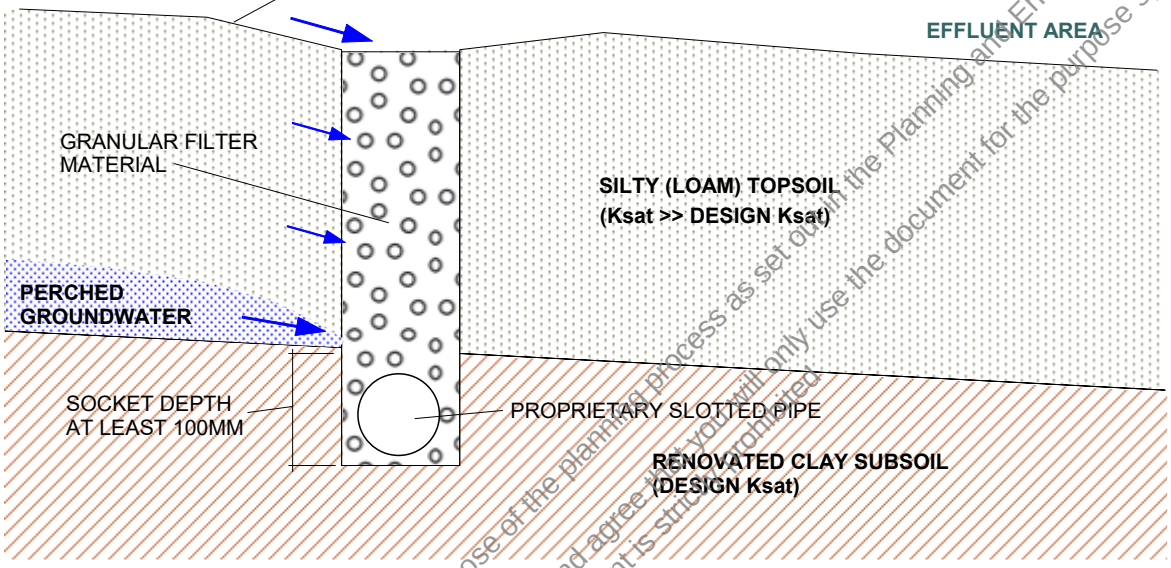
BARRY THOMPSON

Drawn: PRW	Project Number: A190314
Date: 11/09/2019	Drawing Number: 4



NOTE: CUT-OFF DRAIN LOCATION IS SCHEMATIC ONLY. FINAL LOCATION TO BE DETERMINED BY DESIGN ENGINEER AS PART OF SITE DRAINAGE DESIGN.

SURFACE REGRADED BY CUTTING TO FACILITATE COLLECTION OF SURFACE FLOWS - DEGREE OF CUT SLOPE LIMITED BY REQUIREMENTS FOR SAFE & EFFICIENT MOWING/MAINTENANCE



NOTES:
1. DRAIN TO BE DESIGNED, CONSTRUCTED & MAINTAINED TO ENSURE THAT NO SURFACE & PERCHED GROUNDWATER FLOWS ENTER THE IRRIGATION AREA.
2. DRAIN TO BE LOCATED ON ALL UPSLOPE SIDES OF IRRIGATION AREA (NO CLOSER THAN 1m FROM NEAREST SUBSURFACE DISTRIBUTION LINE).
3. DRAIN TO HAVE UNSPECIFIED FALL.
4. MINIMUM SOCKET DEPTH OF 100mm INTO CLAY SUBSOIL (WHERE ENCOUNTERED) OR AT LEAST 400mm DEEP.
5. DRAIN CROSS SECTIONAL AREA RELATED TO DESIGN FLOWS AS DETERMINED BY A SUITABLY QUALIFIED AND EXPERIENCED ENGINEER.
6. OFF-SITE DRAIN OUTFALL TO LEGAL POINT OF DISCHARGE SUBJECT TO LOCAL AUTHORITY REQUIREMENTS.
7. ON-SITE DRAIN OUTFALL TO INCLUDE APPROPRIATE ENERGY DISSIPATION TO AVOID EROSION.
8. ALL DRAINS AND OUTFALL AREAS SUBJECT TO POST-SPRING INSPECTION.

NOTE: DRAWING NOT TO BE USED FOR SET-OUT PURPOSES

CUT-OFF DRAIN DETAIL FOR 20/30 STANDARD EFFLUENT IRRIGATION FIELDS

DUPLEX/GRADATIONAL SOIL PROFILES

BARRY THOMPSON

Scale: 1:10 (Approximately)	Drawn: P.R.W.	Report Number: SPEC 014
Contour Interval: N/A	Date: September 2019	Drawing Number: 5

APPENDICES

APPENDIX A1
SOIL PERMEABILITY

Where the soils are dispersive *insitu* permeability testing realises inaccurate, low or nil results.

The hydraulic conductivity can be estimated by using test waters containing calcium chloride and/or by laboratory assessment of colloid stability and determination of ameliorant quantities (e.g. gypsum/lime requirement) and swell potential.

A conservative estimate of permeability has been deduced as follows (see Code 3.6.1):-

Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined dispersion and swell potential shows the alluvial, colluvial and residual clay soils (and clay fractions) to be dispersive. They are therefore by definition Category 6 soils with saturated hydraulic conductivity less than 0.06m/day.

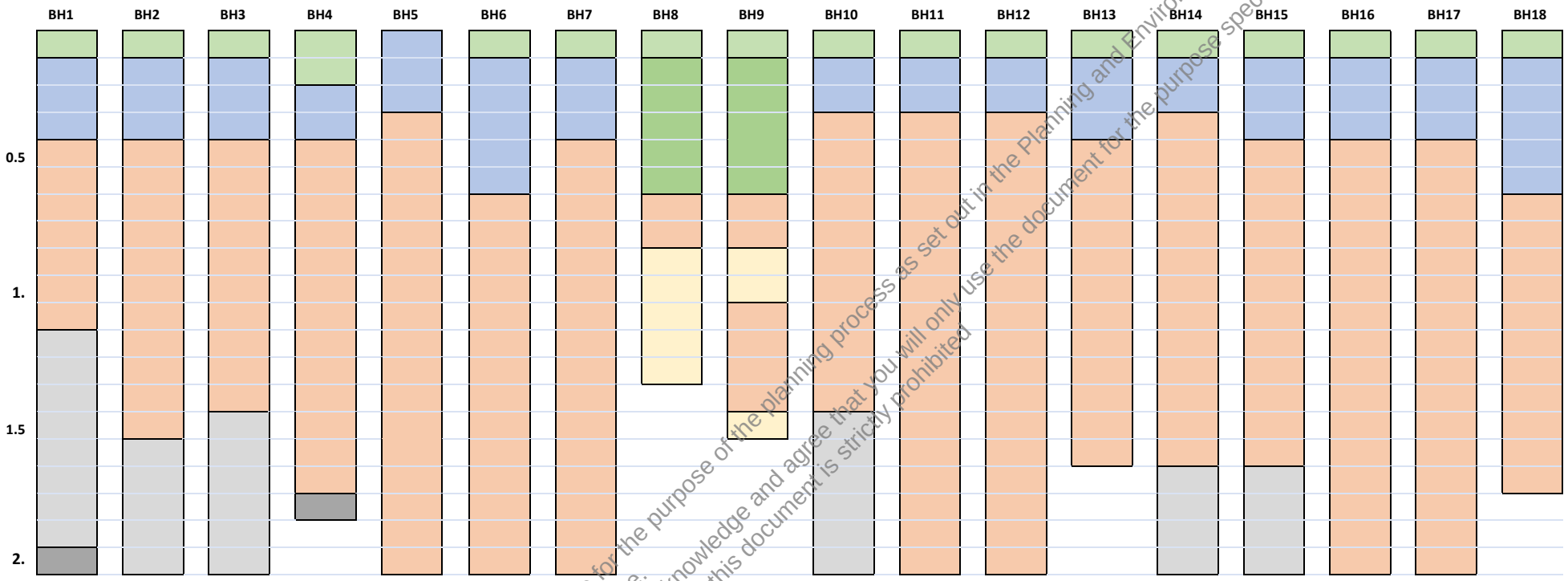
Similar dispersive soils have responded positively (with sufficiently improved hydraulic capability) following applications of gypsum.

For the limiting poorly-structured clay and clayey soils and assuming renovation by gypsum application we have adopted an estimated and conservative design saturated hydraulic conductivity of 0.040m/day.

Peak deep seepage is conservatively estimated at 4mm/day (<10% k_{sat}). Average daily deep seepage is 1.7mm.

From the literature and from examination of exposures in the vicinity, the hydraulic conductivity of the basement rocks would be in excess of 0.05m/day (adopt 1m/day for buffer design).

APPENDIX A2
LOGS OF BOREHOLES



Silty SAND/Sandy SILT/Gravelly SAND; grey-brown, sand fine to coarse, some clay of low plasticity, non-dispersive and (mainly) dispersive clay fraction (**loam/sandy loam**) **TOPSOIL**

Silty SAND; light brown, sand fine to medium **(loam) ALLUVIUM**

Clayey-sandy GRAVEL/Silty-sandy GRAVEL; light grey-brown, grey-brown, brown, sand fine to coarse, low plasticity clay, dispersive clay fraction (**sand/sandy loam**) **SLOPEWASH/COLLUVIUM**

Silty CLAY/CLAY; orange-grey, low plasticity, some fine sand, dispersive (**medium/heavy clay**) **RESIDUAL & ALLUVIUM**

Silty CLAY/CLAY; orange-grey, red-grey, orange-brown, low, some fine to coarse sand, dispersive (**medium clay**) **EXTREMELY WEATHERED SANDSTONE/SILTSTONE**

Silty CLAY; grey-brown, orange-brown, low plasticity, rock fragments to 60mm diameter, dispersive **(medium/heavy clay) EXTREMELY TO HIGHLY WEATHERED SANDSTONE/SILTSTONE**

Clayey SAND/SAND; light yellow-grey, yellow-grey, sand fine to coarse, low plasticity clay, indurated, dispersive clay fraction (**sand/loam**) **ALLUVIUM**

For locations of boreholes refer Drawing 2.

All boreholes terminated at required depth (2m) or refusal.

APPENDIX A3
SELECTED SOIL PROFILE PHOTOGRAPHS

BOREHOLE BH5 (Lot 26): Truncated clay profile from land-soil unit A.

BOREHOLE BH 11 (Lot 21): Typical colluvial/residual profile.

BOREHOLE BH 8 (Lot 4): Typical alluvial profile with alternating sand and clay with indurated zones. Hole terminated at refusal in indurated gravels.

APPENDIX A4
SUMMARY OF LABORATORY TEST RESULTS

RESIDUAL CLAY PROFILE

Property	LAND-SOIL UNIT A			
Depth (average)	0-10cm	10-40cm	40+cm	Desirable
Horizon	A	B_1	B_2	-
pH	5.9-6.2	6.0-7.1	6.0-8.1	-
EC (dS/m)	0.17-0.36	0.17-0.45	0.20-1.82	-
Exchangeable Sodium %	-	13.4-13.6	9.3-17.8	0.5%–5%
Exchangeable Magnesium %	-	61-64.6	32.8-58	12%-15%
Exchangeable Calcium %	-	2.3-2.6	3.5-5.8	65%-70%
CEC ($cmol^+/kg$)	-	10.74-14.57	7.53-11.25	15+
Calcium/Magnesium Ratio	-	0.03-0.04	0.1-0.11	2-4
Gypsum Req (t/ha)	-	18.69-27.13	5.33-20.07	-
Lime Req (t/ha)	-	0	0-1.56	-
Emerson	5-2	2	2	-
Dispersion Index	0-15	12-15	9-15	-
Free Swell (%)	-	0-40	30-65	-
Ksat (m/day)[1]	<0.6	<0.06	<0.06	-
Soil Permeability Category[1]	4	6	6	-
AS/NZS 1547 Classification	sandy loam	medium clay	medium clay	-

1. After renovation including gypsum application. Estimated by visual tactile methods, AS/NZS1547, AS1289 and database or by insitu measurement as shown.

ALLUVIAL CLAY PROFILE

Property	LAND-SOIL UNIT B			
Depth	0-10cm	10-40cm	40+cm	Desirable
Horizon	A	Al	Al	-
pH	5.9-7.2	6.0-6.9	6.5-7.1	-
EC (dS/m)	0.10-0.28	0.14-0.31	0.17-0.37	-
Exchangeable Sodium %	-	-	17.8	0.5%–5%
Exchangeable Magnesium %	-	-	58	12%-15%
Exchangeable Calcium %	-	-	5.8	65%-70%
CEC ($cmol^+/kg$)	-	-	11.25	15+
Calcium/Magnesium Ratio	-	-	0.1	2-4
Gypsum Req (t/ha)	-	-	20.07	-
Lime Req (t/ha)	-	-	0	-
Dolomite Req (t/ha)	-	-	0	-
Emerson	5-3	5-3	2	-
Dispersion Index	0-9	0-9	10-15	-
Free Swell (%)	0	0	20-60	-
Ksat (m/day)[1]	<0.6	<0.6	<0.06	-
Soil Permeability Category[1]	4	4	6	-
AS/NZS 1547 Classification	loam	loam	medium clay	-

1. After renovation including gypsum application. Estimated by visual tactile methods, AS/NZS1547, AS1289 and database or by insitu measurement as shown.

All test results in green highlight from SWEP Analytical Laboratories.
All test results in blue highlight from in-house laboratory.

APPENDIX B

Paul Williams & Associates Pty Ltd A190314

WATER/NITROGEN BALANCE (20/30 irrigation): With no wet month storage.

Rainfall Station: Avenel/ **Evaporation Station:** Goulburn Weir

Location: Avenel
Date: September, 2019
Client: Barry Thompson

ITEM		UNIT	#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Days in month:			D	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation (Mean)		mm	A	230	187	153	88	44	27	27	45	70	120	163	207	1361
Rainfall (9th Decile wet year adjusted)		mm	B1	44	35	45	48	77	89	94	88	82	72	56	45	775
Effective rainfall		mm	B2	40	32	41	43	69	80	85	79	74	65	50	41	698
Peak seepage Loss[1]		mm	B3	124	112	124	120	124	120	124	124	120	124	120	124	1460
Evapotranspiration(ΣA)		mm	C1	161	131	107	53	22	12	11	20	39	78	114	145	892
Waste Loading(C1+B3-B2)		mm	C2	245	211	191	130	77	52	50	65	85	137	184	228	1655
Net evaporation from lagoons (10(0.8A-B1xlagoon area(ha)))		L	NL	0	0	0	0	0	0	0	0	0	0	0	0	0
Volume of Wastewater		L	E	27900	25200	27900	27000	27900	27000	27900	27900	27000	27900	27000	27900	328500
Total Irrigation Water(E-NL)/G		mm	F	50	45	50	48	50	48	50	50	48	50	48	50	587
Irrigation Area(E/C2)annual.		m^2	G													560
Surcharge/Storage		mm	H	-195	-166	-141	-81	-27	-4	0	-15	-36	-87	-135	-179	0
Actual seepage loss		mm	J	-71	-54	-17	39	97	116	124	109	84	37	-15	-55	504
Direct Crop Coefficient:			I	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture:
Rainfall Retained:	90	%	K	1. Seepage loss (peak) equals deep seepage plus lateral flow: 4mm (<10% ksat after renovation)												
Lagoon Area:	0	ha	L	CROP FACTOR												
Wastewater(Irrigation):	900	L	M	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture:
Seepage Loss (Peak):	4	mm	N	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	Shade:
Irrig'n Area(No storage):	560	m^2	P2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	Fescue:
Application Rate:	1.6	mm	Q	1	1	1	1	1	1	1	1	1	1	1	1	Woodlot
Nitrogen in Effluent:	30	mg/L	R	NITROGEN UPTAKE:												
Denitrification Rate:	20	%	S													
Plant Uptake:	220	kg/ha/y	T													
Average daily seepage:	1.7	mm	U													
Annual N load:	7.88	kg/yr	V													
Area for N uptake:	358	m^2	W													
Application Rate:	2.5	mm	X													

Species:	Kg/ha.yr	pH	Species:	Kg/ha.yr	pH	Species:	Kg/ha.yr	pH
Ryegrass	200	5.6-8.5	Bent grass	170	5.6-6.9	Grapes	200	6.1-7.9
Eucalyptus	90	5.6-6.9	Couch grass	280	6.1-6.9	Lemons	90	6.1-6.9
Lucerne	220	6.1-7.9	Clover	180	6.1-6.9	C cunn'a	220	6.1-7.9
Tall fescue	150-320	6.1-6.9	Buffalo (soft)	280	6.1-6.9	P radiata	150	5.6-6.9
Rye/clover	220		Sorghum	90	5.6-6.9	Poplars	115	5.6-8.5

PART 2

RAINFALL DATA & 9TH DECILE REDISTRIBUTION

REDISTRIBUTION OF RAINFALL

Rainfall to be redistributed (9th decile) =	774.9	mm/yr
Minimum mean rainfall =	35.3	mm
9th decile (annual) - mean rainfall (annual) =	176.6	mm

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
	40	35	40	42	56	62	64	62	58	54	46	40	598.3
Deviation from minimum mean (mm)	4	0	5	7	21	27	29	26	23	18	10	5	175
Redistributed rainfall (mm) (1)	**44**	**35**	**45**	**48**	**77**	**89**	**94**	**88**	**82**	**72**	**56**	**45**	775

1. The distribution is adjusted in proportion to the deviation of means from the minimum mean.

Station: Avenel (Post Office) Number: 88002 Opened: 1900 Now: Open
Lat: 36.89° S Lon: 145.23° E Elevation: 152 m

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	39.6	35.3	40.3	41.8	55.8	61.9	64.4	61.6	58.3	53.7	45.5	40.1	603.6
Lowest	0.0	0.0	0.0	0.0	0.0	4.4	8.8	4.8	6.1	0.0	0.0	0.0	260.2
5th %ile	2.1	0.3	2.0	2.8	10.8	15.3	21.8	11.8	14.0	8.4	5.4	3.9	343.8
10th %ile	7.2	2.1	4.8	6.1	14.3	18.1	26.5	20.0	18.1	14.3	12.3	5.7	412.7
Median	31.2	22.9	31.9	34.0	50.5	57.5	60.8	59.2	48.4	45.9	39.5	30.0	596.2
90th %ile	88.2	82.2	90.5	91.1	104.2	105.9	105.4	109.4	111.9	109.7	90.1	81.7	774.9
95th %ile	104.0	105.3	111.4	106.1	124.2	114.1	122.6	119.4	141.5	116.5	105.7	96.9	842.0
Highest	157.2	226.0	198.4	183.2	167.6	169.0	134.3	156.5	168.6	160.2	139.5	251.3	1034.0

APPENDIX C1

LAND CAPABILITY ASSESSMENT TABLE
(Non-potable water supply catchments)
LAND-SOIL UNIT A-COLLUVIAL/RESIDUAL SOILS

LAND FEATURE	LAND CAPABILITY RISK RATING				AMELIORATIVE MEASURE & RISK REDUCTION
	LOW	MEDIUM	HIGH	LIMITING	
Available land for LAA	Exceeds LAA and duplicate LAA requirements	Meets LAA and duplicate LAA requirements	Meets LAA and partial duplicate LAA requirements	Insufficient LAA area	Non-limiting to limiting for trenches & beds: Full reserve area unavailable. Non-limiting for subsurface irrigation: Full reserve area available
Aspect	North, north-east and north-west	East, west, south-east, south-west	South	South, full shade	North-west, west, south-easterly and south-westerly aspects.
Exposure	Full sun and/or high wind or minimal shading	Dappled light (partial shade)	Limited light, little wind to heavily shaded all day	Perpetual shade	Full winter sunshine and full wind exposure.
Slope Form	Convex or divergent side slopes	Straight sided slopes	Concave or convergent side slopes	Locally depressed	Regrade finished LAA surface by smoothing and redistribution of topsoil.
Slope gradient:					
Trenches and beds	<5%	5% to 10%	10% to 15%	>15%	<10%: Non-limiting for trenches.
Subsurface irrigation	<10%	10% to 30%	30% to 40%	>40%	<10%: Non-limiting for irrigation.
Site drainage: runoff/run-on	LAA backs onto crest or ridge	Moderate likelihood	High likelihood	Cut-off drain not possible	Cut-off drain required upslope.
Landslip[5]	Potential	Potential	Potential	Existing	Unremarkable
Erosion potential	Low	Moderate	High	No practical amelioration	All runoff to be dispersed without concentrating flows. LAA stabilised with gypsum.
Flood/inundation	Never		<1%AEP	>5% AEP	Unremarkable
Distance to surface waters (m)	Buffer distance complies with Code requirements		Buffer distance does not comply with Code requirements	Reduced buffer distance not acceptable	LAA located at least 60m from watercourse and dams (see Drawings 1 through 4).
Distance to groundwater bores (m)	No bores on site or within a significant distance	Buffer distances comply with Code	Buffer distances do not comply with Code	No suitable treatment method	No bores within a significant distance.
Vegetation	Plentiful/healthy vegetation	Moderate vegetation	Sparse or no vegetation	Propagation not possible	All land application areas to be seeded (rye/clover mix) after regrading.
Depth to water table (potentiometric) (m)	>2	2 to 1.5	<1.5	Surface	Water table 2+ (ground steeper than 1% grade).
Depth to water table (seasonal perched) (m)	>1.5	<0.5	0.5 to 1.5	Surface	Perching probable. (Install cut-off drain and design LAA for limiting clay soils)
Rainfall[6] (9th decile) (mm)	<500	500-750	750-1000	>1000	Near-limiting for trench systems. Non-limiting for subsurface irrigation - Design by water balance.
Pan evaporation (mean) (mm)	1250 to 1500	1000 to 1250	750 to 1000	<750	Design by water balance.
SOIL PROFILE CHARACTERISTICS					
Structure	High or moderately structured	Weakly structured	Structureless, massive or hardpan		Improve and maintain structure by gypsum application.
Fill materials	Nil or mapped good quality topsoil	Mapped variable depth and quality materials	Variable quality and/or uncontrolled filling	Uncontrolled poor quality/unsuitable filling	No fill present.
Thickness: (m)					
Trenches and beds	>1.4	1.2 to 1.4	<1.4	<1.2	Non-limiting for trench systems.
Subsurface irrigation	1.5+	1.0 to 1.5	0.75 to 1.0	<0.75	Non-limiting for irrigation systems.
Permeability[7] (limiting horizon) (m/day)	0.15-0.3	0.03-0.15 0.3-0.6	0.01-0.03 0.6-3.0	>3.0 <0.03	After renovation; design by water balance
Permeability[8] (buffer evaluation) (m/day)	<0.3	0.3-3	3 to 5	>5.0	Evaluate flow times via Darcy's Law (assume 1m/day for metasediments)
Stoniness (%)	<10	10 to 20	>20		Unremarkable
Emerson number	4, 5, 6, 8	7	2, 3	1	Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Dispersion Index	0	1-8	8-16		Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Reaction trend (pH)	5.5-8	4.5-5.5	<4.5>8		Ideal range for grasses.
E.C. (dS/m)	<0.8	0.8-2	2-4	>4.0	Non-limiting for trench systems. Non-limiting for irrigation.
Exchangeable Na (%)	0.5-5	5-10	10-15	>15	9.3 to 17.8: Limiting for trenches, non-limiting for irrigation.
Exchangeable Mg (%)	12-17	17-25	25-40	40+	32.8 to 64.6: Limiting for trenches, non-limiting for irrigation.
Exchangeable Ca (%)	65-70	40-65	5-40	<5	2.3 to 5.8: Limiting for trenches, non-limiting for irrigation.
Adjusted CEC	15+	10-15	5-10	<5	7.53 to 14.57: Non-limiting for trenches.
Free swell (%)	<40	40-80	80-120	>120	Low-swelling clay fraction.

There are limiting and high-risk factors for primary effluent trench systems (rainfall and colloid stability).

There are no limiting factors for secondary effluent subsurface irrigation.

[5] Landslip assessment based on proposed hydraulic loading, slope, profile characteristics and past and present land use.
[6] 9th decile monthly rainfalls used in water balance analyses.
[7] Saturated hydraulic conductivity from *insitu* testing and data base.
[8] Saturated hydraulic conductivity estimated from AS/NZS1547:2012 and data base.

APPENDIX C

LAND CAPABILITY ASSESSMENT TABLE
(Non-potable water supply catchments)
LAND-SOIL UNIT B-ALLUVIAL SOILS

LAND FEATURE	LAND CAPABILITY RISK RATING				AMELIORATIVE MEASURE & RISK REDUCTION
	LOW	MEDIUM	HIGH	LIMITING	
Available land for LAA	Exceeds LAA and duplicate LAA requirements	Meets LAA and duplicate LAA requirements	Meets LAA and partial duplicate LAA requirements	Insufficient LAA area	Non-limiting for trenches & beds: Full reserve area available. Non-limiting for subsurface irrigation: Full reserve area available
Aspect	North, north-east and north-west	East, west, south-east, south-west	South	South, full shade	South and south-westerly aspects.
Exposure	Full sun and/or high wind or minimal shading	Dappled light (partial shade)	Limited light, little wind to heavily shaded all day	Perpetual shade	Full winter sunshine and full wind exposure.
Slope Form	Convex or divergent side slopes	Straight sided slopes	Concave or convergent side slopes	Locally depressed	Regrade finished LAA surface by smoothing and redistribution of topsoil.
Slope gradient:					
Trenches and beds	<5%	5% to 10%	10% to 15%	>15%	<1 to 5%: Non-limiting for trenches.
Subsurface irrigation	<10%	10% to 30%	30% to 40%	>40%	<1 to 5%: Non-limiting for irrigation.
Site drainage: runoff/run-on	LAA backs onto crest or ridge	Moderate likelihood	High likelihood	Cut-off drain not possible	Cut-off drain required upslope.
Landslip[9]	Potential	Potential	Potential	Existing	Unremarkable
Erosion potential	Low	Moderate	High	No practical amelioration	All runoff to be dispersed without concentrating flows. LAA stabilised with gypsum.
Flood/inundation	Never		<1%AEP	>5% AEP	Unremarkable
Distance to surface waters (m)	Buffer distance complies with Code requirements		Buffer distance does not comply with Code requirements	Reduced buffer distance not acceptable	LAA located at least 60m from watercourse (see Drawings 1 through 4).
Distance to groundwater bores (m)	No bores on site or within a significant distance	Buffer distances comply with Code	Buffer distances do not comply with Code	No suitable treatment method	No bores within a significant distance.
Vegetation	Plentiful/healthy vegetation	Moderate vegetation	Sparse or no vegetation	Propagation not possible	All land application areas to be seeded (rye/clover mix) after regrading.
Depth to water table (potentiometric) (m)	>2	2 to 1.5	<1.5	Surface	Water table 5+m.
Depth to water table (seasonal perched) (m)	>1.5	<0.5	0.5 to 1.5	Surface	Perching probable. (Install cut-off drain and design LAA for limiting clay soils)
Rainfall[10] (9th decile) (mm)	<500	500-750	750-1000	>1000	Near-limiting for trench systems. Non-limiting for subsurface irrigation - Design by water balance.
Pan evaporation (mean) (mm)	1250 to 1500	1000 to 1250	750 to 1000	<750	Design by water balance.
SOIL PROFILE CHARACTERISTICS					
Structure	High or moderately structured	Weakly structured	Structureless, massive or hardpan		Improve and maintain structure by gypsum application.
Fill materials	Nil or mapped good quality topsoil	Mapped variable depth and quality materials	Variable quality and/or uncontrolled filling	Uncontrolled poor quality/unsuitable filling	No fill present.
Thickness: (m)					
Trenches and beds	>1.4	1.4	<1.4	<1.2	Non-limiting for trench systems.
Subsurface irrigation	1.5+	1.0 to 1.5	0.75 to 1.0	<0.75	Non-limiting for irrigation systems.
Permeability[11] (limiting horizon) (m/day)	0.15-0.3	0.03-0.15 0.3-0.6	0.01-0.03 0.6-3.0	>3.0 <0.03	After renovation; design by water balance
Permeability[12] (buffer evaluation) (m/day)	<0.3	0.3-3	3 to 5	>5.0	Evaluate flow times via Darcy's Law (assume 1m/day for fractured metasediments)
Stoniness (%)	<10	10 to 20	>20		Unremarkable
Emerson number	4, 5, 6, 8	7	2, 3	1	Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Dispersion Index	0	1-8	8-15	>15	Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Reaction trend (pH)	5.5 to 8	4.5 to 5.5	<4.5>8		Ideal range for grasses.
E.C. (dS/m)	<0.8	0.8 to 2	2-4	>4.0	Non-limiting for trench systems. Non-limiting for irrigation.
Exchangeable Na (%)	0.5-5	5-10	10-15	>15	17.8: Limiting for trenches and non-limiting for irrigation.
Exchangeable Mg (%)	12-17	17-25	25-40	40+	58: Limiting for trenches, non-limiting for irrigation.
Exchangeable Ca (%)	65-70	40-65	5-20	<5	5.8: Non-limiting for trenches, non-limiting for irrigation.
Adjusted CEC	15+	10-15	5-10	<5	11.25: Non-limiting for trenches.
Free swell (%)	<40	40-80	80-120	>120	Low-swelling clay fraction.

There are limiting and high-risk factors for primary effluent trench systems (rainfall and colloid stability).

There are no limiting factors for secondary effluent subsurface irrigation.

[9] Landslip assessment based on proposed hydraulic loading, slope, profile characteristics and past and present land use.
[10] 9th decile monthly rainfalls used in water balance analyses.
[11] Saturated hydraulic conductivity from *insitu* testing and data base.
[12] Saturated hydraulic conductivity estimated from AS/NZS1547:2012 and data base.

APPENDIX D

MANAGEMENT PLAN

Paul Williams & Associates Pty. Ltd.
ABN 80 006 412 862
CONSULTANTS IN THE EARTH SCIENCES

P. O. Box 277, Sunbury, Victoria, 3429
2 Argyle Place, Sunbury, Victoria, 3429
Telephone: 03 9744 6426
Mobile: 0418 171 796
Email: paul@rockdr.com.au

A190314-SEPTEMBER 2019

MANAGEMENT PLAN
FOR
ON-SITE EFFLUENT DISPOSAL VIA SUBSURFACE IRRIGATION
AT

2353 AVENEL-LONGWOOD ROAD, AVENEL

1. INTRODUCTION

This document identifies the significant land-soil unit constraints (as identified in A190314) and their management and day-to-day operation and management of the on-site effluent system.

2. SIGNIFICANT LAND-SOIL UNIT CONSTRAINTS

2.1 Allotment Size. The day-to-day operation and management of on-site effluent systems, as described below, is not constrained by lot size or geometry.

Although all requirements of *SEPPs* have been met or exceeded through conservative design, prudence dictates that individual lot owners assiduously follow the management programme given in Section 4, below.

2.2 Nitrogen Attenuation. To reduce nitrates to insignificant levels, the effluent should not contain more than 30mg/litre total nitrogen.

Provided the irrigation areas are at least as large as those required to satisfy the nitrogen loading, as described in A190314 Sections 1.3.1.13, 1.3.2.13 and 2.2.3.2, and that the (specified) grass is cut and (periodically) harvested, nitrogen will be attenuated on-site.

2.3 Hydraulic Conductivity. The limiting soils of this site are dispersive, low-swelling clays with a low hydraulic conductivity. The hydraulic conductivity is significantly influenced by soil structure, soil colloid stability and swell characteristics. Breakdown or reduction of these soil parameters over time may manifest as reduced performance of the irrigation system. The monitoring and inspection regime detailed in Section 4.7.2, below, should be adhered to.

2.4 Site Drainage. Our recommendations for on-site effluent disposal have allowed for incident rainfall (not surface flow or lateral subsurface flow) and are conditional on the installation of a cut-off drain, which should be placed upslope of the disposal area. Care should be taken to ensure that the intercepted and diverted surface waters and any perched groundwater is discharged well away and down slope of the disposal field (see Drawing 5).

The owner should also ensure that any upslope works do not divert and/or concentrate surface water flows onto the disposal area.

2.5 Vegetation. The effluent disposal areas have been sized via water balance analyses utilising crop factors for pasture (rye/clover mix).

3. THE ONSITE EFFLUENT SYSTEM

The onsite effluent system consists of the influent (toilets, kitchens, bathroom, laundry), a load balancing tank/facility, the treatment plant/sand filter (a device to treat the effluent to at least the 20/30 standard), the irrigation area including effluent distribution system (delivery pipes and drippers), prescribed irrigation area vegetation, associated infrastructure (cut-off drains, outfall areas, fencing), a service and maintenance programme and on-going management.

4. MANAGEMENT

The owner is required to understand (and ensure that users understand) that sustainable operation of the onsite effluent system is not automatic. Sustainable operation requires on-going management, as outlined below.

4.1 Effluent. Effluent will be generated from a residence and will include black and grey water (all wastes).

4.1.2 Effluent Quality. Effluent should be treated to a standard that meets or exceeds the water quality requirements of the 20/30 standard.

4.1.3 Effluent Quantity. The daily effluent volume of 900 litres has been calculated from *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, Table 4 and assumes mains water supply (equivalent) and WELS-rated water-reduction fixtures and fittings – minimum 4 Stars for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves and minimum 3 Stars for all appliances.

4.2 Treatment Plant. For subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with *AS/NZS1547:2012* and a current JAS-ANZ accreditation.

4.3 Irrigation Area. The irrigation area has been determined from the results of the water and nutrient balance analyses and AS/NZS 1547:*2012*, *Appendix M*.

4.3.1 Effluent Area Requirement. For a daily effluent flow of 900 litres and to satisfy the requirement for no surface rainwater flow in the 9th decile wet year and on-site attenuation of nutrients, the effluent should be applied to an irrigation area of 560m^2.

Effluent distribution is as detailed in Section 4.3.2, below.

In case of an increase in effluent production through the chain of ownership, there is sufficient area available for duplicating the irrigation areas.

Any landscaping and/or planting proposals require endorsement from the Strathbogie Shire.

4.3.2 Distribution System. The distribution system must achieve controlled and uniform dosing over the irrigation area. A small volume of treated effluent should be dosed at predetermined time intervals throughout the day via a pressurised piping network that achieves uniform distribution over the entire irrigation area.

Uniform delivery pressure of the effluent throughout the distribution system is essential. Drip rates should not vary by more than 10% from the design rate over the whole of the system.

To minimise uneven post-dripper seepage, the distribution pipes must be placed parallel with slope contours.

Line spacing shall be not closer than 1000mm under any circumstances.

To facilitate the creation of transient aerobic and anaerobic soil conditions we recommend that as part of the daily irrigation process, the effluent area be irrigated sequentially by zones or time.

4.3.3 Soil Renovation. To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Magnesium and Sodium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil.

Application rates are related to water (irrigation and mean rainfall) available to dissolve the gypsum. The water required to dissolve 1 kilogram of gypsum is about 400 litres.

In this instance, where irrigation water is expected to be continuous, available water is sourced from mean rainfall plus irrigation water.

4.3.3.1 Application of Gypsum Without Ripping. A suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 0.5kg/m^2. After smoothing of the surface (by redistribution of topsoil), the irrigation network can be constructed.

After two months gypsum is to be broadcast over the irrigation area at a rate of 0.5kg/m^2 (mean rainfall plus irrigation is at least 100mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 10 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.5kg/m^2.

Gypsum is to be fine ground “Grade 1” agricultural quality.

4.3.3.2 Application of Gypsum With Ripping. A suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 1kg/m^2 followed by ripping to a depth of at least 500mm. After smoothing of the surface (by redistribution of topsoil), the irrigation network can be constructed.

After two months gypsum is to be broadcast over the irrigation area at a rate of 0.5kg/m^2 (mean rainfall plus irrigation is at least 100mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 6 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.5kg/m^2.

Gypsum is to be fine ground “Grade 1” agricultural quality.

4.3.4 Buffer Distances. The water balance analysis has shown that potential surface rainwater flows from the effluent area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient (equivalent to the ground slope and regional gradients) have been used to evaluate (via Darcy’s Law) the buffer distances with respect to subsurface flows.

Our analysis and evaluation have shown that the default setback distances given in *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, Table 5 are conservative and can be applied without amendment.

For a building located downslope of an effluent field, your engineer should evaluate the integrity of building foundations with respect to the assigned buffer distance.

Buffer distances are to be applied exclusive of the irrigation area.

4.3.5 Buffer Planting. All downslope (Title inclusive) buffers may be required to filter and renovate abnormal surface discharges. Hence, they are to be maintained with existing or equivalent groundcover vegetation.

4.3.6 Buffer Trafficking. On all allotments, buffer trafficking should be minimised to avoid damage to vegetation and/or rutting of the surface soils.

Traffic should be restricted to ‘turf’ wheeled mowing equipment and to maintenance, monitoring and inspections by pedestrians, where possible.

4.4 Vegetation. The system design for on-site disposal includes the planting and maintenance of suitable vegetation, as specified in A190314 and/or similar documents.

Specifically, this irrigation area has been sized (in part) utilising crop factors and annual nitrogen uptake for a rye/clover eq mix.

The grass needs to be harvested (mown and periodically removed from the irrigation area).

Where a variation to recommended grass species is proposed, it must be demonstrated that the nitrogen uptake and crop factors (as specified in A190314 Appendix B – water balance) are met or exceeded.

4.5 Verification. The Council is to be satisfied that the effluent system has been constructed as designed.

4.6 Associated Infrastructure. The following items are an integral part of the onsite effluent system.

4.6.1 Cut-off drains. Cut-off drains are designed to prevent surface and near-surface water flows from entering the effluent area. They should be constructed and placed around the effluent area, as detailed in Drawing 5.

4.6.2 Outfall areas. All pipe outfalls should be at grade and designed to eliminate scour and erosion.

A grassed outfall would normally be adequate. However, should monitoring and inspections reveal rill or scour formation, the outfall will need to be constructed so that energy is satisfactorily dissipated.

Should this situation occur, professional advice is to be sought.

4.6.3 Fencing. The disposal area is to be a dedicated area. Adequate fencing must be provided to prevent stock, excessive pedestrian and vehicular movements over the area.

4.7 Service and Maintenance Programme. The minimum requirements for servicing and maintenance are set out in the relevant JAS-ANZ accreditation and the manufacturer's recommendations.

4.7.1 Treatment Plant. Aerated treatment plants and sand filters should be serviced at least one time per year (or as recommended in the JAS-ANZ accreditation and the effluent should be sampled and analysed as required by the JAS-ANZ accreditation. The local authority is to ensure compliance.

The manufacturer's recommendations are to be followed. Generally, low phosphorous and low sodium (liquid) detergents should be used. Plastics and other non-degradable items should not be placed into the tanks. Paints, hydrocarbons, poisons etc should not be disposed of in sinks or toilets. Advice from a plumber should be obtained prior to using drain cleaners, chemicals and conditioners. It is important to ensure that grease does not accumulate in the tanks or pipes. Grease and similar products should be disposed of by methods other than via the on-site effluent system.

4.7.2 Monitoring and Inspections. We recommend that the mandatory testing and reporting as described in the *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, include an annual (post spring) and post periods of heavy and/or prolonged rainfall report on the functioning and integrity of the distribution system and on the functioning and integrity of the cut-off drains, outfall areas and soil media.

The effluent areas should be regularly inspected for excessively wet areas and vegetation integrity.

The inspection regime described in A190314, Section 2.2.7, should be strictly adhered to.

Paul R. WILLIAMS B.App.Sc.
PRINCIPAL HYDROGEOLOGIST
Registered Building Practitioner EC1486

Attachment

Native vegetation removal report

A report to support an application to remove, destroy or lop native vegetation in the **Intermediate** Assessment Pathway using the modelled condition score

This report provides information to support an application to remove native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation*. The report is not an assessment by DELWP or local council of the proposed native vegetation removal. Biodiversity information and offset requirements have been calculated using modelled condition scores contained in the *Native vegetation condition map*.

Date and time: **08 November 2021 13:00 PM**

Lat./Long.: -36.8971877605596,145.251869620935

Native vegetation report ID: 364-20211108-024

Address: Address unknown

Assessment pathway

The assessment pathway and reason for the assessment pathway

Assessment pathway	**Intermediate Assessment Pathway**
Extent of past plus proposed native vegetation removal	0.098 hectares
No. large trees	1 large tree(s)
Location category	Location 1 The native vegetation is not in an area mapped as an endangered Ecological Vegetation Class, sensitive wetland or coastal area. Removal of less than 0.5 hectares will not have a significant impact on any habitat for a rare or threatened species.

Offset requirement

The offset requirement that will apply if the native vegetation is approved to be removed

Offset type	General offset
Offset amount	0.089 general habitat units
Offset attributes	
Vicinity	Goulburn Broken Catchment Management Authority (CMA) or Strathbogie Shire Council
Minimum strategic biodiversity value score	0.608
Large trees	1 large tree(s)

Native vegetation removal report

Biodiversity information about the native vegetation

Description of any past native vegetation removal

Any native vegetation that was approved to be removed, or was removed without the required approvals, on the same property or on contiguous land in the same ownership, in the five year period before the application to remove native vegetation is lodged is detailed below.

Permit/PIN number	Extent of native vegetation (hectares)
None entered	0 hectares

Description of the native vegetation proposed to be removed

Extent of all mapped native vegetation	0.098 hectares
Condition score of all mapped native vegetation	0.685
Strategic biodiversity value score of all mapped native vegetation	0.760
Extent of patches native vegetation	0.010 hectares
1	0.010 hectares
Extent of scattered trees	0.088 hectares
No. large trees within patches	0 large tree(s)
No. large scattered trees	1 large tree(s)
No. small scattered trees	1 small tree(s)

Additional information about trees to be removed, shown in Figure 1

Tree ID	Tree circumference (cm)	Benchmark circumference (cm)	Scattered / Patch	Tree size
A	348	94	Scattered	Large
B	66	94	Scattered	Small

Other information

Applications to remove, destroy or lop native vegetation must include all the below information. If an appropriate response has not been provided the application is not complete.

Photographs of the native vegetation to be removed

Recent, dated photographs of the native vegetation to be removed must be provided with the application. All photographs must be clear, show whether the vegetation is a patch of native vegetation or scattered trees, and identify any large trees. If the area of native vegetation to be removed is large, provide photos that are indicative of the native vegetation.

Ensure photographs are attached to the application. If appropriate photographs have not been provided the application is not complete.

Topographical and land information

Description of the topographic and land information relating to the native vegetation to be removed, including any ridges, crests and hilltops, wetlands and waterways, slopes of more than 20 percent, drainage lines, low lying areas, saline discharge areas, and areas of existing erosion, as appropriate. This may be represented in a map or plan. **This is an application requirement and your application will be incomplete without it.**

The land is topographically flat. There are no topographical features

Avoid and minimise statement

This statement describes what has been done to avoid the removal of, and minimise impacts on the biodiversity and other values of native vegetation. **This is an application requirement and your application will be incomplete without it.**

Every effort has been made to place the proposed driveways in gaps within the tree canopy so as to avoid the loss of native trees.

Defendable space statement

Where the removal of native vegetation is to create defendable space, a written statement explaining why the removal of native vegetation is necessary. This statement must have regard to other available bushfire risk mitigation measures. This statement is not required if your application also includes an application under the Bushfire Management Overlay.

N/A

Offset statement

An offset statement that demonstrates that an offset is available and describes how the required offset will be secured. **This is an application requirement and your application will be incomplete without it.**

A third-party offset will be purchased.

Next steps

Applications to remove, destroy or lop native vegetation must address all the application requirements specified in *Guidelines for the removal, destruction or lopping of native vegetation.*If you wish to remove the mapped native vegetation you are required to apply for a permit from your local council. This *Native vegetation removal report*must be submitted with your application and meets most of the application requirements. The following needs to be added as applicable.

Property Vegetation Plan

Landowners can manage native vegetation on their property in the longer term by developing a Property Vegetation Plan (PVP) and entering in to an agreement with DELWP.

If an approved PVP applies to the land, ensure the PVP is attached to the application.

Applications under Clause 52.16

An application to remove, destroy or lop native vegetation is under Clause 52.16 if a Native Vegetation Precinct Plan (NVPP) applies to the land, and the proposed native vegetation removal is not in accordance with the relevant NVPP. If this is the case, a statement that explains how the proposal responds to the NVPP considerations must be provided.

If the application is under Clause 52.16, ensure a statement that explains how the proposal responds to the NVPP considerations is attached to the application.

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

For more information contact the DELWP Customer Service Centre 136 186

www.delwp.vic.gov.au

Figure 1 – Map of native vegetation to be removed, destroyed or lopped

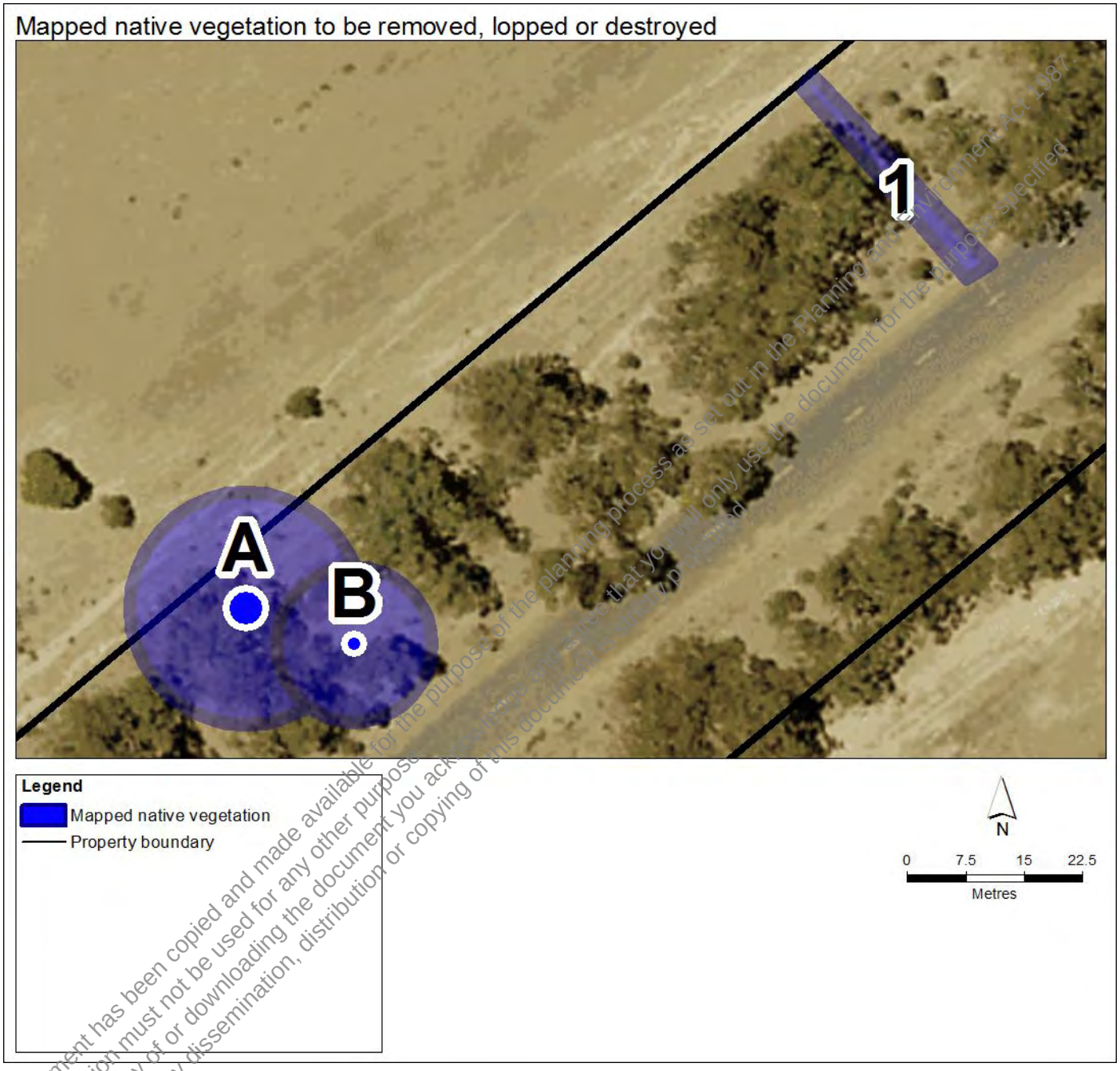


Figure 2 – Map of property in context

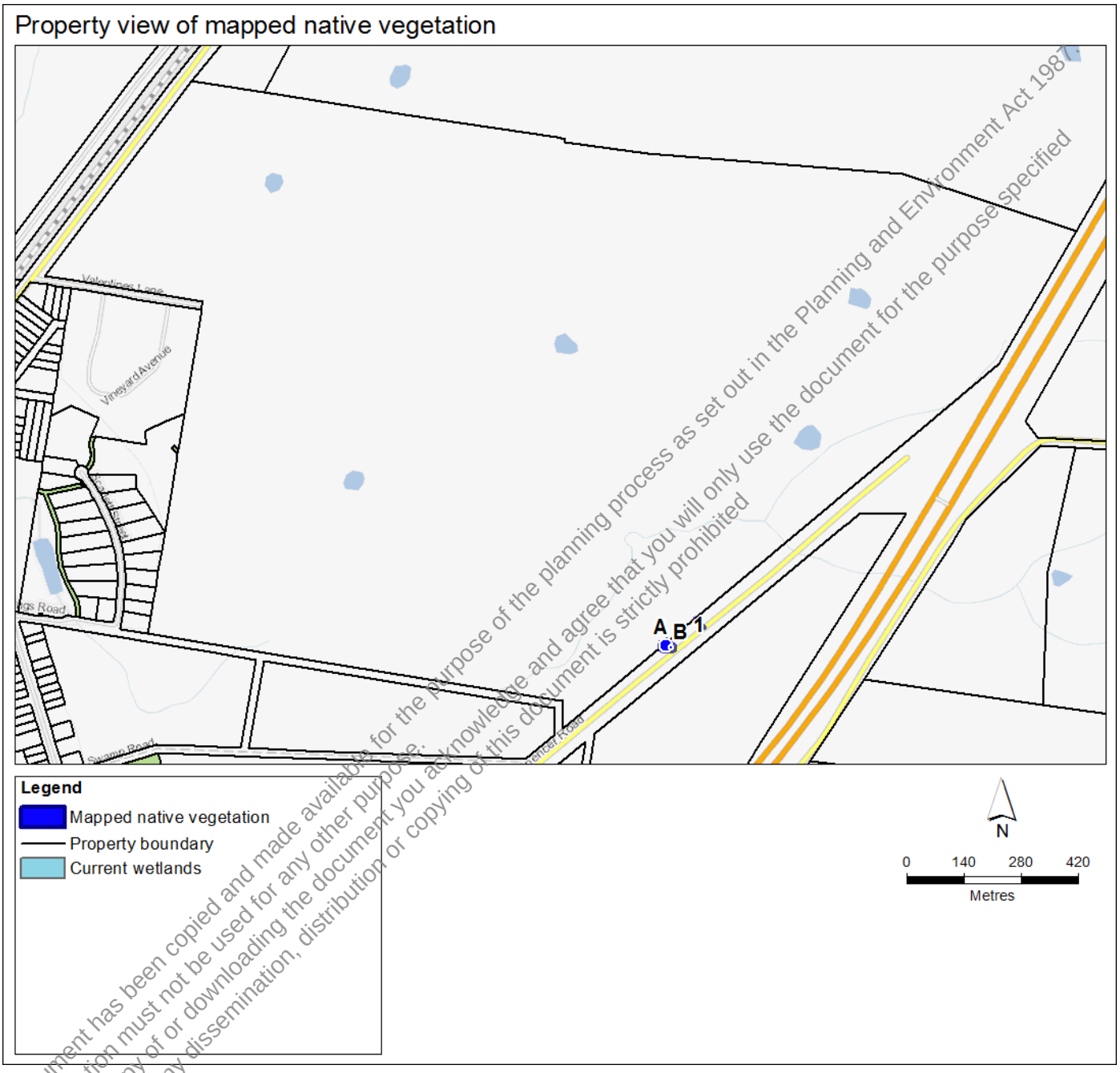
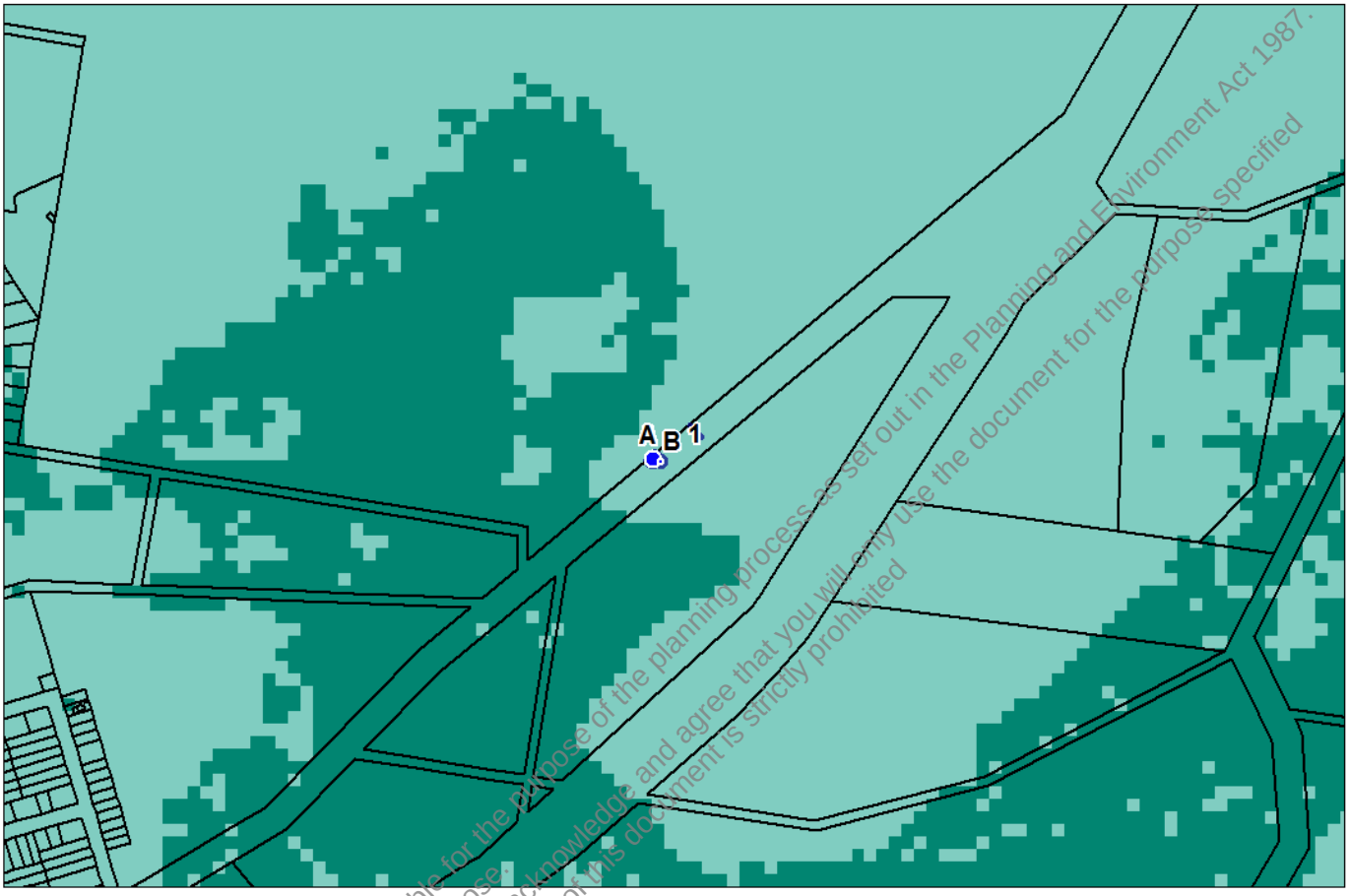


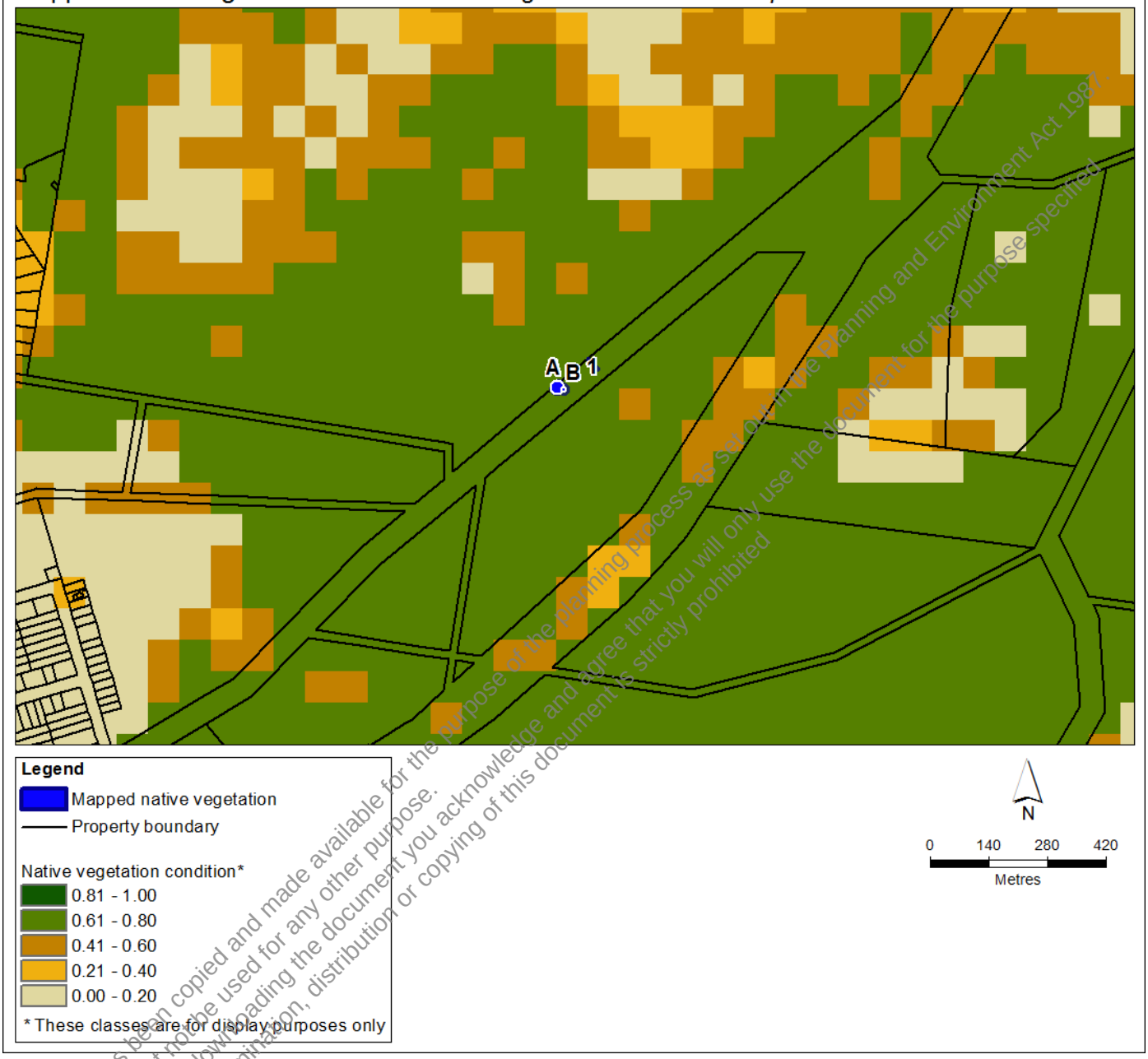
Figure 3 – Biodiversity information maps

Mapped native vegetation and the *Native vegetation location map*

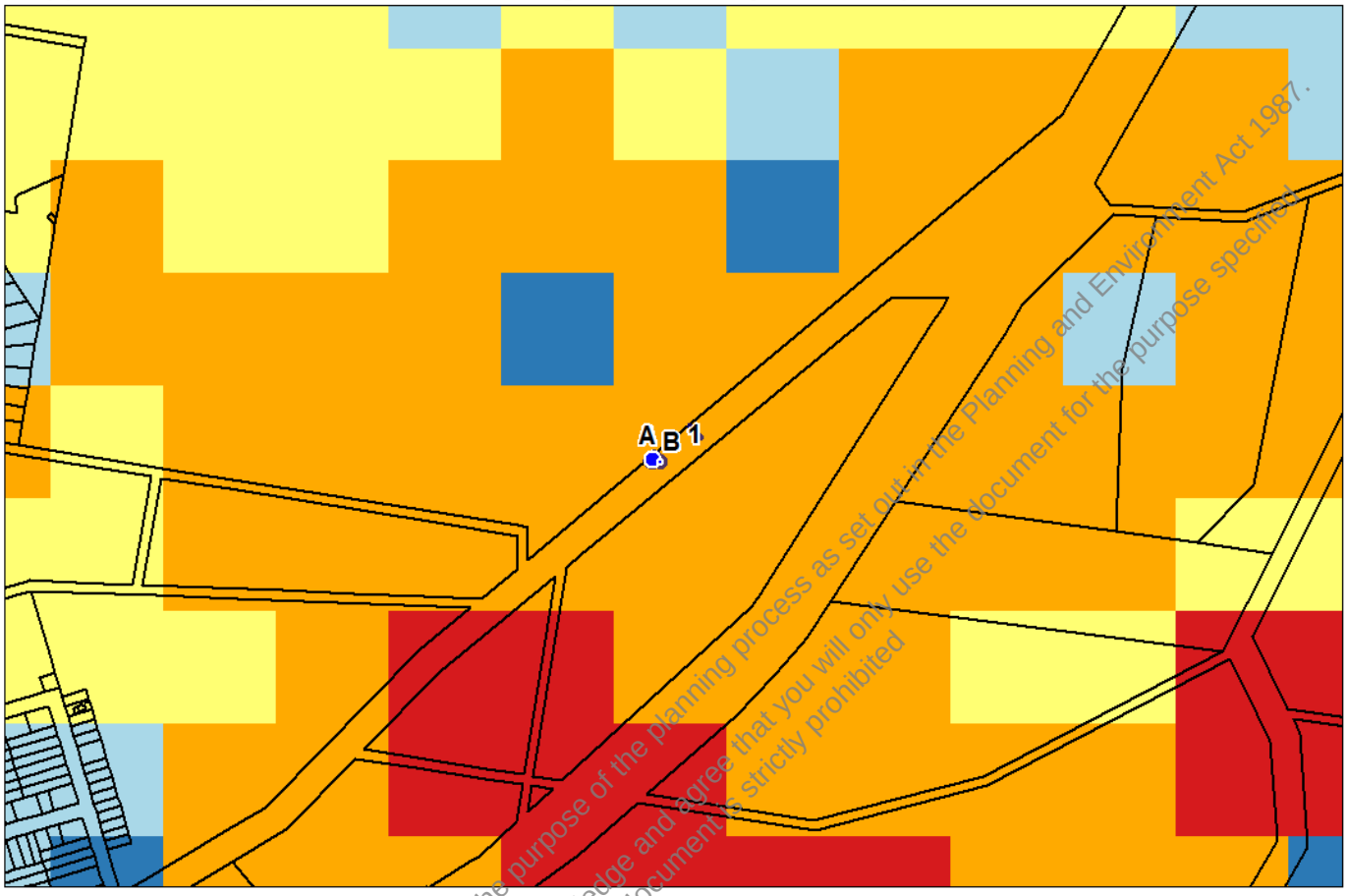


Native vegetation removal report

Mapped native vegetation and the *Native vegetation condition map*



Mapped native vegetation and the *Strategic biodiversity value map*



Appendix 1 - Details of offset requirements

Native vegetation to be removed

Extent of all mapped native vegetation (for calculating habitat hectares)	0.098	The area of land covered by a patch of native vegetation and/or a scattered tree, measured in hectares. Where the mapped native vegetation includes scattered trees, each tree is assigned a standard extent and converted to hectares. A small scattered tree is assigned a standard extent defined by a circle with a 10 metre radius and a large scattered tree a circle with a 15 metre radius. The extent of all mapped native vegetation is an input to calculating the habitat hectares.
Condition score*	0.685	The condition score of native vegetation is a site-based measure that describes how close native vegetation is to its mature natural state. The condition score is the weighted average condition score of the mapped native vegetation calculated using the *Native vegetation condition map.*
Habitat hectares	0.067	Habitat hectares is a site-based measure that combines extent and condition of native vegetation. It is calculated by multiplying the extent of native vegetation by the condition score: ***Habitat hectares = extent x condition score***
Strategic biodiversity value score	0.760	The strategic biodiversity value score represents the complementary contribution to Victoria's biodiversity of a location, relative to other locations across the state. This score is the weighted average strategic biodiversity value score of the mapped native vegetation calculated using the *Strategic biodiversity value map*.
General landscape factor	0.880	The general landscape factor is an adjusted strategic biodiversity value score. It has been adjusted to reduce the influence of landscape scale information on the general habitat score.
General habitat score	0.059	The general habitat score combines site-based and landscape scale information to obtain an overall measure of the biodiversity value of the native vegetation. The general habitat score is calculated as follows: ***General habitat score = habitat hectares x general landscape factor***

* **Offset requirements for partial removal:** If your proposal is to remove parts of the native vegetation in a patch (for example only understorey plants) the condition score must be adjusted. This will require manual editing of the condition score and an update to the calculations that the native vegetation removal tool has provided: habitat hectares, general habitat score and offset amount.

Offset requirements

Offset type	General offset	A general offset is required when the removal of native vegetation does not have a significant impact on any habitat for rare or threatened species. All proposals in the Basic and Intermediate assessment pathways will only require a general offset.
Offset multiplier	1.5	This multiplier is used to address the risk that the predicted outcomes for gain will not be achieved, and therefore will not adequately compensate the biodiversity loss from the removal of native vegetation.
Offset amount (general habitat units)	0.089	The general habitat units are the amount of offset that must be secured if the application is approved. This offset requirement will be a condition to any permit or approval for the removal of native vegetation. ***General habitat units required = general habitat score x 1.5***
Minimum strategic biodiversity value score	0.608	The offset site must have a strategic biodiversity value score of at least 80 per cent of the strategic biodiversity value score of the native vegetation to be removed. This is to ensure offsets are located in areas with a strategic biodiversity value that is comparable to the native vegetation to be removed.
Vicinity	Goulburn Broken CMA or Strathbogie Shire Council	The offset site must be located within the same Catchment Management Authority boundary or municipal district as the native vegetation to be removed.
Large trees	1 large tree (s)	The offset site must protect at least one large tree for every large tree removed. A large tree is a native canopy tree with a Diameter at Breast Height greater than or equal to the large tree benchmark for the local Ecological Vegetation Class. A large tree can be either a large scattered tree or a large patch tree.

Vegetation Quality Assessment for Spencer Road Reserve, Avenel, VIC 3664

November 2021: Amended Version

Bill (W.E.) Richdale: Consulting Ecologist BSc., Dip EnvSc., MAppSc. (Member of the Ecological Society of Australia) ABN: 88 825 148 662 Email: richdale@optusnet.com.au
Website:https://sites.google.com/site/ecologicalconsultant/

& Aisha Richdale BA., MIR

Summary

This report is an amendment to an earlier version *Vegetation Quality Assessment at Spencer Road Reserve Avenel 2020*. The original report assessed driveway locations across the Spencer Road reserve, to provide access for the proposed Lovers Hill residential development.

Spencer Road is an unclassified road, approximately 1.74 km, located in Avenel, Victoria. The VQA was conducted along 650 metre stretch (approximately 2 hectares) of Spencer Road reserve in July-August 2020. The purpose of the VQA was to assess the quality and extent of native habitat within the road reserve and to situate five (5) driveways across the reserve to provide access to the proposed Lovers Hill residential development.

This amendment regards the situating of five (5) proposed, gravel laid, driveways along Spencer Road. Each driveway is (approximately) 26 metres long and 4 metres wide and are located in a manner to mitigate the loss of native vegetation.

Summation of key findings:

- The road reserve was determined to be a highly disturbed and degraded remnant of EVC 55_62 Plains Grassy Woodland.
- The canopy layer, comprised almost exclusively of *Eucalyptus microcarpa*, remains intact, however, the ground layer has largely been invaded by exotic species.
- The proposed driveways should only result in the loss of approximately 0.098 hectares. This includes:
    - approximately 25 percent cover of indigenous perennial understorey species within driveway 4;
    - removal of a small *Eucalyptus microcarpa* tree (waypoint 52) within driveway 3;
    - removal of a branch from a large *Eucalyptus melliodora* tree (waypoint 56) that crosses into driveway 3.

Contents

Appendices

Attachments

Native Vegetation Removal Report

1 Introduction
Background

An amendment to an earlier Vegetation Quality Assessment (VQA for Spencers Road 2020) was requested to reflect changes to the development plans regarding the situating of five (5) driveways along Spencer Road Avenel, VIC 3664.

The VQA was undertaken in July-August 2020, within Spencer Road, road reserve (henceforth the study site) that lies adjacent to the proposed Lovers Hill residential development. This report provides the parameters of the five (5) proposed driveways and subsequent offset requirements.

The dimensions of the proposed driveway are approximately 4 metres wide by 26 metres long and are situated in areas that are not as densely covered in vegetation. Areas outside of the proposed driveways will not be touched, so as to mitigate the loss of native vegetation.

This report provides:

- Description of Spencers Road Reserve (study site)
- Ecological Vegetation Class(es)
- General Planning & Legislation
- Description and details (VQA) of the:
    - road reserve
    - proposed five (5) driveway locations
- Native Vegetation Removal and Offsets (third-party offset)

1.1 Site Description

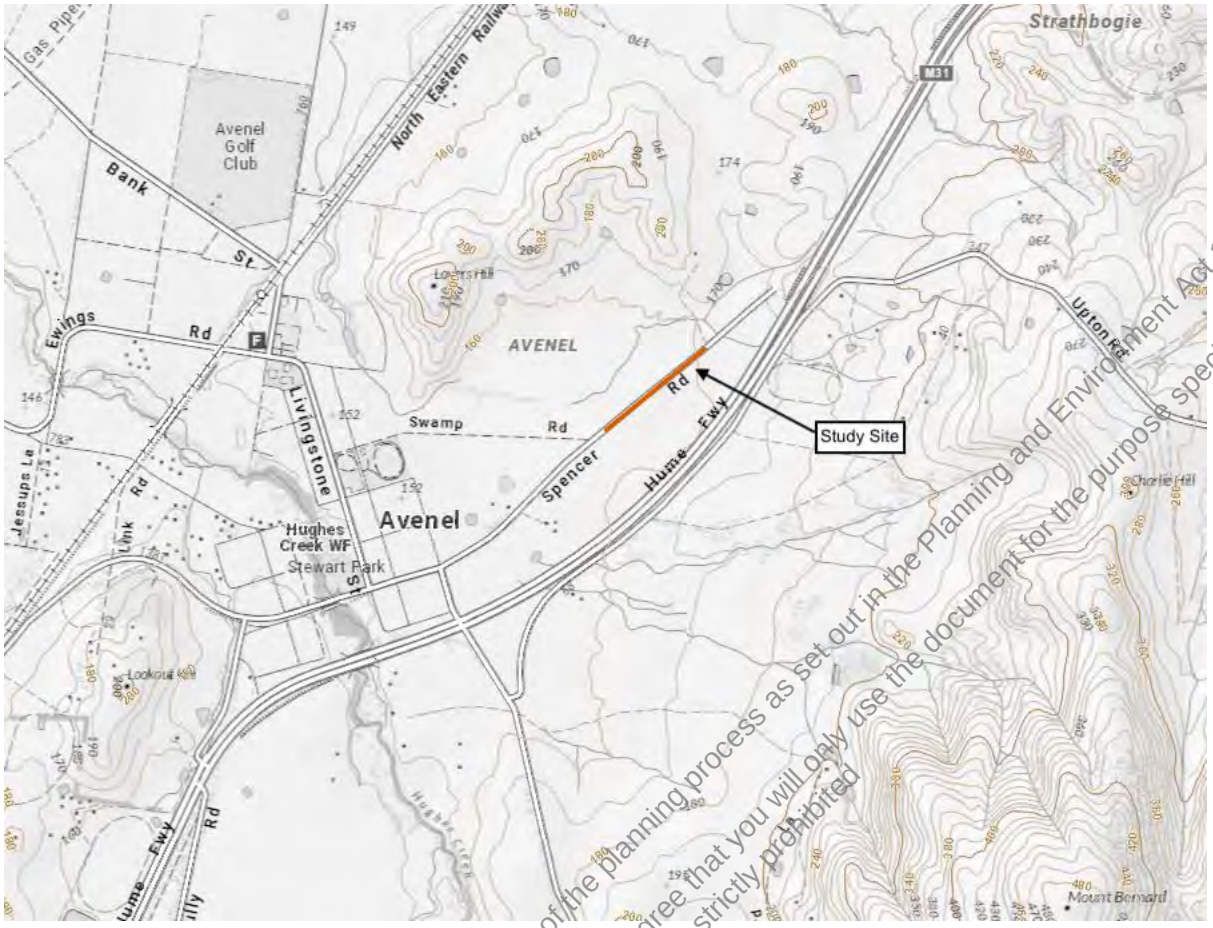
Photographs of study site are given in Appendix 4

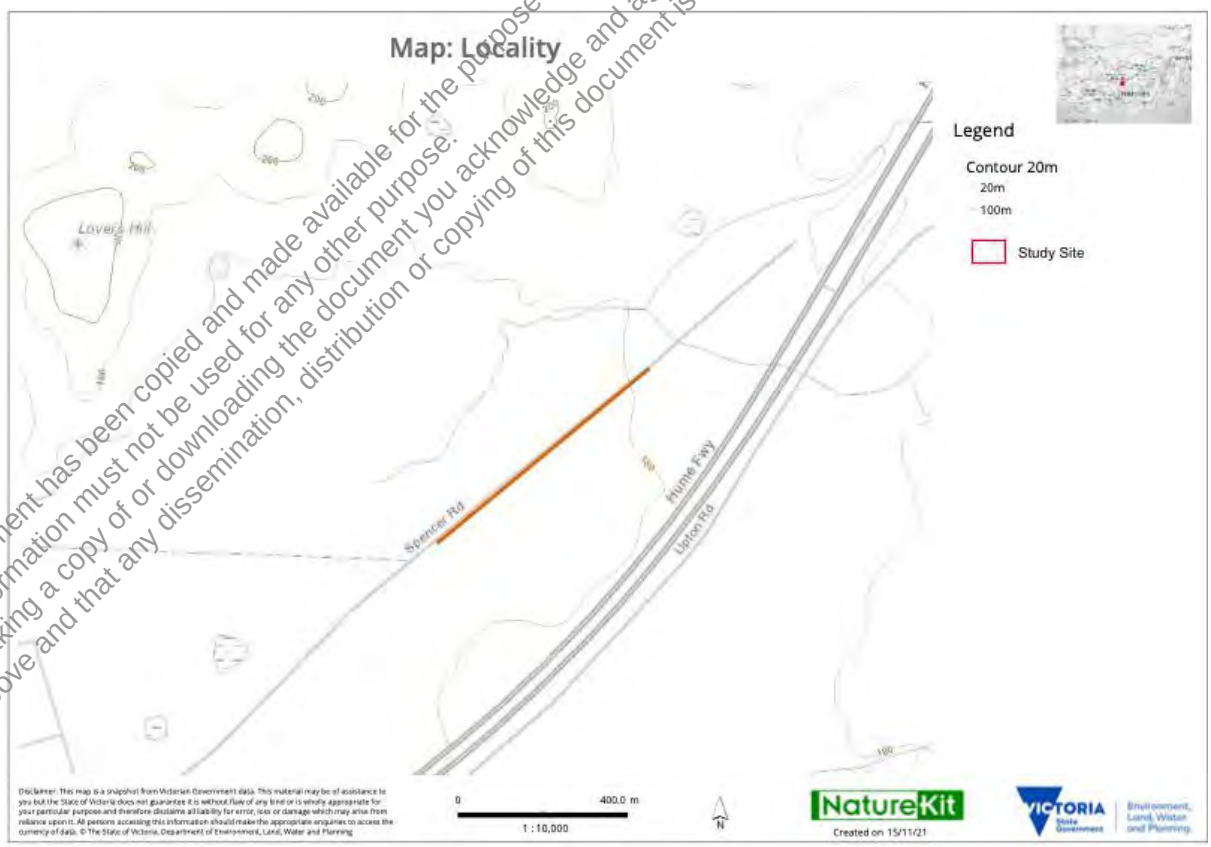
The study site is approximately 650 metres lengthways and 26 metres wide (from the Spencer Road to the Lover's Hill property boundary), or approximately 2 hectares.

Topographically, the study site relatively flat.

There is a small drainage line within the most southern end of the road reserve, making the area quite muddy and damp in comparison to the rest of the study site. In addition, mapping indicates that there is another intermittent drainage line north of the study site, that cuts through Spencer Road and into Lover's Hill (Mapshare 2021).

The study site is mostly comprised of *Eucaplyptus microcarpa*, with a few *Eucalyptus mellidora* and *Eucalyptus camalduensis* present. Overall, the study site is quite weedy, with *Eucalyptus* saplings and acacias found throughout. However, there appeared to be a noticeable shift between the southern and northern sections of the study site. The southern portion being considerably more weedy and wet, and the northern portion becoming drier with patches of bare earth and bryophytes. Additionally, there are scattered *Dianella revoluta,* and scattered native grasses in amongst the weeds, that appear to be more endemic towards the northern end of the reserve.





1.1.1 Bioregion and Ecological Vegetation Class (EVC)

Bioregions are generally defined as 'patterns of ecological characteristics in the landscape or seascape, providing a natural framework for recognising and responding to biodiversity values' (DSE 2011)

An *Ecological Vegetation Class* (EVC) are the standard unit for classifying vegetation types in Victoria, it is comprised of number of ecological characteristics, floristics and lifeforms. 'The combination of EVC and bioregion is used to determine the bioregional conservation status (BCS) of an EVC. This is a measure of the current extent and quality of each EVC, when compared to its original (pre-1750) extent and condition. On this basis a BioEVC will have BCS of endangered, vulnerable, depleted, least concern or rare' (DELWP).

Ecological Vegetation Classes

The southern section of the road reserve is listed as EVC 55_62 Plains Grassy Woodland within the Victorian Riverina bioregion; EVC 55_62 has bioregional conservation status of endangered.

The northern section is listed as EVC 247 Box Ironbark Forest/Grassy Woodland Complex, within the Central Victorian Uplands bioregion. EVC 247 is a complex comprised of Box Ironbark Forest (EVC 61; conservation status Vulnerable) and Grassy Woodland (EVC 175_61; conservation status endangered). The study site lacked the floristic composition and conditions of EVC 247 complex.

Eucalyptus microcarpa appears to be the dominant species within the study site, with a few *Eucalyptus mellidora* and *Eucalyptus camalduensis* being found. Thus, due to the dominating presence of *Eucalyptus microcarpa*, EVC 55_62 Riverina Plains Grassy Woodland was the EVC considered present at the study site.

1.2 General Planning & Legislation

This VQA adheres to the relevant local, state and federal planning regulations and legislation.

Local Government Area (council): Strathbogie Shire Council

Catchment Management Authority (CMA): Goulburn Broken Catchment Management Authority (GBCMA)

Lies within a designated bushfire prone area.

Zoning

Spencer Road Reserve is a government road within zoned Farming (FZ) and is adjacent to Rural Living Zone (RLZ).

Farming Zone (FZ): The purpose of FZ is to provide for farming and agriculture.

Rural Living Zone: RLZ caters for residential use in a rural setting.

Overlays

Spencers Road does not contain any overlays. However, it is directly adjacent to Lovers Hill which is subject to:

- Vegetation Protection Overlay (VPO)
- Schedule 1 to Clause 42.02 Vegetation Protection Overlay (VPO1)
- Development Plan Overlay
- Schedule 2 to Clause 43.04 Development Plan Overlay (DPO2): Development Plan 2 Lovers Hill Avenel

Planning Clause 52.17

Also applicable is *Planning Clause 52.17* which covers Native Vegetation – Victorian species, Under Clause 52.17 there is the need to:

1. Avoid the removal, destruction or lopping of native vegetation.

2. Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.

3. Provide an offset to compensate for the biodiversity impact if a permit is granted to remove, destroy or lop native vegetation

A number of exemptions exist under the clause. In some instances, native vegetation can removed, destroyed or lopped to *minimum extent necessary.*

Exemptions: Native trees (native vegetation) within one or two metres of an existing fence (with the extent of clearing depending on whether the land on the other side of the fence is cleared) can be removed without the requirement of a permit or an offset. If the vegetation is already cleared on one side of the fence then native vegetation within a metre of the fence can be cleared. If native vegetation exists on both sides of the fence, then native vegetation can be removed within two metres of a fenceline, without the need of a permit or an offset.

However, if a fence is planned to be erected, then native vegetation on either side of the fence has to be offset, because in the future native vegetation within one or two metres along the side of the fence can be removed without the requirement for a permit.

Planted native vegetation can also be removed without the requirement of a planning permit or an offset: "Native vegetation that is to be removed, destroyed or lopped that was either planted or grown as a result of direct seeding" (Planning Clause 52.17, DELWP 2017 b).

Re-growth native vegetation that is less than 10 years old growing on previously cleared land can be cleared without a permit (though there may be a consequential loss and the requirement of an offset) (Planning Clause 52.17).

Under Planning Clause 52.17 all native vegetation that is not indigenous to Victoria are considered environmental weeds. In addition, naturally occurring non-indigenous native vegetation are considered weeds (DSE 2004). For example, the native tree *Pittosporum undulatum*

(Sweet Pittosporum), indigenous to the forests of East Gippsland and perhaps West Gippsland (Flora Victoria), is a significant environmental weed outside of its natural range. Thus, non-indigenous native vegetation may be cleared without the need of a permit.

For further details refer to Planning Clause 52.17-17 table of exemptions.

Legislation Pertinent to the Study

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act) applies to sites where proposed developments or projects may have a significant impact on 'matters of national environmental significance' (MNES). There are currently seven MNES:

- World Heritage Properties
- National Heritage Place
- nationally listed threatened species and ecological communities

• listed migratory species

• Ramsar wetlands of international importance

• Commonwealth marine areas

• nuclear actions (including uranium mining).

Under the EPBC Act (1999), a proponent must refer proposed actions that may have a significant impact on matters on national environmental significance to the Australian Government Environment Minister (or delegate).

The Flora and Fauna Guarantee Act 1998

The Flora and Fauna Guarantee Act 1998 (FFG Act) was legislated to ensure the continued survival of all Victorian species of flora and fauna and all Victorian communities of plants and animals. The FFG Act provides a number of ways to assist in achieving its objectives, including:

• listing of threatened taxa, communities of flora or fauna and potentially threatening processes, and creation of Action Statements and Management Plans for all listed taxa communities of flora or fauna and processes

• declaration of a Critical Habitat if the habitat is critical for the survival of a species or a community of flora or fauna, if listed as Critical Habitat, the Minister for Environment may then make an Interim Conservation Order (ICO) to conserve the Critical Habitat (NB: no Critical Habitat has been declared in the State)

• protection of flora and fauna through listing offences such as penalties relating to not following an ICO and taking, trading in, keeping, moving or processing protected flora without a licence (NB: this does not apply to taking protected flora from private land (other than land which is part of the critical habitat for the flora) except for taking tree-ferns, grass, trees or sphagnum moss for the purpose of sale)

• the Department of Environment, Land, Water and Planning (DELWP) is the referral authority for matters under the FFG Act.

Planning and Environment Act 1987

The Act sets out procedures for preparing and amending the Victoria Planning Provisions and planning schemes. It is an enabling legislation and does not specifically define the scope of, or how planning should be done in detailed rules. The functions of the Act are to (planning.vic.gov.au):

- Set broad objectives for planning in Victoria.
- Set the main rules and principles for how the Victorian planning system works.
- Set up the key planning procedures and legal instruments in the Victorian planning system.

- Define the roles of responsibilities of the Minister, councils, government departments, the community and other stakeholders in the planning system.

Planning Clause 52.17 and other provisions fall under the Act.

Wildlife Protection Act 1975 & Associated Regulations

All native wildlife in Victoria is protected by the Wildlife Protection Act (1975) and subsequent regulations.

Under the Act a person must not hunt, take or destroy endangered, notable or protected wildlife; this includes all native vertebrate animals, all kinds of deer, non-indigenous quail, pheasants, and partridges, and all terrestrial invertebrate animals listed under the *Flora and Fauna Guarantee Act* (1988). The Wildlife Regulations 2013 provide further detail relating to the Act, including that a person not to damage, disturb or destroy any wildlife habitat (s42). Although, this does not apply if the person is authorised to do so under any other Act such as the *Planning and Environment Act* (1987).

The Wildlife Regulations 2013 provide further detail relating to the act, including that a person not to damage, disturb or destroy any wildlife habitat (s42). Although this does not apply if the person is authorised to do so under any other Act such as the *Planning and Environment Act* (1987).

Catchment and Land Protection Act 1994

Under the CaLP Act 1994, a landowner must:

Under s 20 of the CaLP Act, all landowners, including the Crown, public authorities and licensees of Crown lands, must, in relation to their land, take all reasonable steps to (Agriculture Victoria):

- avoid causing or contributing to land degradation which causes or may cause damage to land of another landowner;
- eradicate regionally prohibited weeds;
- prevent the growth and spread of regionally controlled weeds on their land;
- prevent the spread of, and as far as possible, eradicate established pest animals.

2 Methodology

The vegetation survey was carried out referring to the *Vegetation Quality Assessment Manual – guidelines for applying the habitat hectares scoring method* (Version 1.3 DSE, DELWP 2004). In addition, Kent and Coker (1995) was utilised. Kent and Coker (1995) provide the random walk methodology to survey the ground covering vegetation of the study site, whilst adhering to the Vegetation Quality Assessment Manual (DSE 2004 a) and other DELWP guidelines.

The vegetation within the study site was initially surveyed to determine what was exotic, what was naturally occurring (not planted) or planted native vegetation, and whether any EVCs were present or significant flora.

Any indigenous native vegetation present would be identified on-site and through the taking of samples, using relevant keys, texts and *Flora of Victoria*.

Photographs of the study site were taken.

By definition, only indigenous canopy trees can be considered either scattered or a patch of native vegetation. A patch of native vegetation occurs when three or more canopy trees outer driplines touches the dripline of at least one tree, thus, forming a continuous patch of native vegetation. Additionally, a patch of native vegetation can be defined as an area where at least 25 percent of total perennial plant understorey cover is native (DELWP 2017a).

The patches of native vegetation were marked out by walking around the edge of the extent of the understorey vegetation or around the edge of the canopy of trees (DELWP 2018). If present, patches of indigenous native vegetation were measured and marked out by GPS, whilst walking *around the outer* canopy drip-line of the trees or the edge of the area of understorey vegetation. Scattered or patches of indigenous understorey were identified and, if present, large old canopy trees were recorded.

Native trees that were planted are not considered in the assessment. As aforementioned, under Planning Clause 52.17 planted native vegetation may be removed without the need of a permit or offset (Planning Clause 52.17, DELWP 2017 b).

The diameter at breast height (trunk circumference) was measured for indigenous *Eucalyptus* canopy trees. The diameter at breast height (DBH) of a tree trunk is measured at 1.3 metres above ground level; the circumference at breast height (CBH) of a tree trunk is also measured at 1.3 metres above ground level.

Large scattered indigenous canopy trees (or the removal of a canopy tree from a patch of native vegetation) are assigned an area value of 0.0707 hectares and smaller indigenous canopy trees have an area value of 0.0314 hectares per tree (DELWP-ENSym NVR tool). The large tree (*Eucalyptus* spp.) benchmark is DBH 70 centimetres (cm) for EVC 55_62 (DSE 2004). The DBH benchmark for unidentified dead *Eucalyptus* trees (non-planted) which are approximately three metres tall, is 40 centimetres (or a CBH of 125.7 centimetres); (DELWP 2018).

A Native Vegetation Removal (NVR) report was generated using the Native Vegetation Information Management (NVIM) system tool (DELWP: https://nvim.delwp.vic.gov.au/).

The NVIM tool was used, as the total area of land occupied by the patch of native vegetation, in the proposed driveways, was less than 0.5 hectares (determined by GPS) in size. The NVIM tool generates the offset requirements for the removal of native vegetation that has an area of less than 0.5 hectares in a zone 1 or 2 location. If the study site lies within a zone 3 location, then a detailed VQA assessment would be mandatory, with the subsequent VQA results being sent to DELWP for the formulation of an NVR report.

The locations of native vegetation for Victoria are as follows (DELWP location categories – DELWP 2017 a):

Extent of native vegetation	Location category		
	Location 1	Location 2	Location 3
Less than 0.5 hectares and not including any large trees	Basic	Intermediate	Detailed
Less than 0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed
0.5 hectares or more	Detailed	Detailed	Detailed

Location 1 – includes all remaining locations in Victoria. These are low-risk areas of native vegetation loss having an impact upon the habitat for rare or threatened species (DELWP 2017 a).

Location 2 – includes locations that are mapped as endangered EVCs and or sensitive wetlands and coastal areas are not included in Location 3.

Location 3 native vegetation – includes locations where the removal of less than 0.5 hectares of native vegetation could have a significant impact on habitat for a rare or threatened species.

Significant Native Flora (ecological communities) and Fauna

Threatened flora and fauna species records were generated using the Victorian Biodiversity Atlas (VBA) database. VBA provides species list within a 5 km radius of the study site (from the approximate centre point). This list is cross-referenced with an EPBC Act Protected Matters Report (PMST) and *Fauna and Fauna Guarantee Act 1988 – Threatened List 2021 October*.

In addition, online sources such as Birdlife Australia, Museums Victoria, Flora of Victoria and SWIFFT are utilised.

The Protected Matters Search Tool (PMST) has also been consulted. PMST indicates whether any nationally listed communities or species occur within the area and general region.

2.1 Significant Fauna

A general fauna survey is conducted in conjunction with the vegetation quality assessment. The search effort is conducted for a minimum of 2 person-hours (or longer), during this time the study site is slowly traversed, logs, rocks or other debris are gently turned, any species directly sighted or heard are recorded. Trees bearing hollows and burrows are recorded, animal scats, burrows, nests and footprints are also noted.

Birds are identified on site with binoculars and listening for their species-specific vocalisations. Simpson and Day (1999) 'Field Guide to the Birds of Australia 6th edn' is referred to on-site to make identifications, in addition, a desktop search is conducted utilising sources such as Birdlife Australia to confirm identifications.

Records of endangered or threatened fauna species within a 5km radius of the site are given in Appendix 2..

2.2 Limitations

Limitations were GPS drift and the estimating (subjective) process of the VQA (Habitat Hectares) methodology (DSE / DELWP 2004).

The vegetation quality assessment was conducted in winter, which meant that spring to summer growth and flowering of species had not occurred. This means that understorey species that occur within the road reserve may have been missed as they were not yet visible or flowering. Furthermore, the absence of flowers made identification of some species difficult.

Tree Locations

127 64 127 Meters

GDA_1994_VICGRID94

Map Created on 18-Nov-2021

Legend

- Driveway Trees
- Dead Tree
- Large Trees: Scattered/outside driveway envelopes

VICTORIA State Government | Environment, Land, Water and Planning

3 Results & Discussion

No rare or threatened flora species were recorded within the study site.

Native species (flora) recorded during the survey are given in Appendix 1

A list of large scattered trees and their respective CBH and TPZs are given in Appendix 1.1.

Photographs are given in Appendix 4.

3.1 Road Reserve

21 native understorey species were recorded throughout the study site (road reserve) and three (3) Eucalyptus species were recorded: *Eucalyptus camaldulensis, Eucalyptus melliodora, Eucalyptus microcarpa*. *Eucalyptus microcarpa* was the dominant species throughout the study site.

There was recruitment of *Acacia* shrubs, mainly of the species *Acacia pycnantha,* and limited recruitment of *Eucalyptus* species, mainly *Eucalyptus microcarpa*.

The understorey vegetation, of the *Eucalyptus microcarpa* dominated remnant grassy woodland, was very weedy with scattered native understorey species. The southern section of the study site was found to be dominated by exotic grasses, whereas, the northerly end of the site had a greater presence of scattered native grasses, namely Wallaby Grass (genus *Rytidosperma)* and the lily *Dianella revoluta*. However, despite the greater presence of native graminoid species, the northern section was found to be quite weedy as well.

Additionally, at the southern end of the site there is an intermittent drainage line and the area appears to be damper which may account for the lush exotic grass and forb growth. This is in direct contrast with the northern end which was more open and drier. The invasion of weed species into the study site is due ecological edge effects, where the exotic associated agriculture grasses and forbs readily invade into the narrow strip of degraded remnant grassy woodland from the surrounding farmland (Lindenmayer and Fischer 2006).

The abiotic and biotic conditions of the remnant grassy woodland have been altered by the creation of a narrow strip of woodland sandwiched between agricultural pasture communities, which has led to the degraded nature of the road reserve and the strong presence of exotic understorey species (Lindenmayer and Fischer 2006).

The weeds, exotic grasses and forbs, in certain areas of the remnant woodland pose a high threat to the presence and survival of any native ground covering vegetation, or to the establishment of understorey shrubs and canopy trees. Where the exotic grass occurs, it is quite thick and overall does not provide openings for the establishment of native species. Where native grass species do occur, it is in the more cleared and open areas. Although, there were some *Einadia nutans* and *Dianella revoluta* plants in amongst the weeds.

There was a strong presence of bryophytes within the study site, especially towards the more northern end of the study site, where there are more bare patches of ground – Cryptogram soil crust.

Throughout the study site there were scattered *Acacia* trees and saplings, as well as scattered *Eucalyptus* saplings. Though *Acacia* saplings, especially those of *Acacia pycnantha,* were more prevalent. Most of the Eucalyptus saplings belong to the species *E.microcarpa.*

3.1.1 Road Reserve Results

A vegetation quality assessment (VQA) was conducted over the whole study site, as it was unified, though degraded, grassy woodland. However, only a very small section of the reserve should be lost due to the proposed five (5) driveways. In other words, the road reserve in its entirety will remain intact and thus the Native Vegetation Removal Report and subsequent offset pertains to the five (5) driveways.

Overall, there is significant cover of native species derived detritus across the study site, estimated at 20 percent coverage. The log coverage was also quite extensive with a total of 107.32 metres of logs over 1.69 hectares, with 32.79 metres of those logs being categorised as large logs. A large log has a benchmark circumference measurement of a minimum 110 centimetres, whilst smaller logs have a circumference of 31.42 centimetres up to 110 centimetres (EVC 55_62 benchmark Victorian Riverina bioregion).

The benchmark extent of logs is 100 metres per hectare or 169 metres per 1.69 hectares. Large logs are considered present if their extent is greater than, or equal to 25 percent of the EVC benchmark of log length, which is 42.25 metres upwards for 1.69 hectares. Therefore, large logs would be considered absent as only 32.79 metres of large logs were present in the 1.69 hectares site.

There were 32 large scattered (outside the driveway envelopes) canopy trees in total, which is equivalent to 19 to 20 large trees per hectare.

The benchmark number of large trees per hectare is 15 (EVC 55_62, Victorian Riverina bioregion benchmark). The canopy over of the woodland was about 20 percent with a canopy health of 45 percent. Benchmark canopy cover is 15 percent coverage.

The Vegetation Quality Assessment (VQA) results are as follows:

	Maximum Score Possible	Score for study site patch of native vegetation
Large Trees	10	9
Tree Canopy Cover	5	4
Lack of Weeds	15	0
Understorey	25	15
Recruitment	10	6
Organic Litter	5	4

Logs	5	3
EVC Standardiser	1x	1x
Standardised site Condition Score	75	41
Patch Size	10	4
Neighbourhood	10	3
Distance to Core Area	5	1
Final Habitat Score (out of a possible score of 100)	100	49
Final Score divided by a 100	1	0.49
Area of patch (hectares)		1.69

The weeds cover was considered to be high threat, as the dense coverage of weeds in places would out-compete native species, seedlings and graminoids. The score reflects the large number of old canopy trees, the extent of the tree canopy cover and the relatively good understorey coverage of native shrubs. However, the score could have been higher if there was a fuller range of understorey species and life forms, and if the competitive weed coverage was not so high or extensive.

3.2 Driveways

Five (5) driveway locations were situated within Spencer Road reserve.

Each driveway is approximately 4 metres wide and 26 metres long across Spencer Road reserve. The driveways are to constructed by layering gravel on top of the surface.

Each proposed driveway is situated within gaps or areas with sparser coverage of native vegetation, particularly canopy trees to mitigate the loss of native vegetation.

The construction of driveways may cut into the TRZ of the trees that are in close proximity, or adjacent to, the proposed driveways, as 90 percent of lateral tree root system lies between 30 to 41 centimetres below the surface and can spread up to 30.5 metres (Gardening Know How). However, if there is no cutting into the soil layer and gravel is laid on top of the surface, then the trees should be able to survive. Additionally, domestic vehicle traffic should not cause too much soil compaction and there will still be an extensive lateral tree root system outside of the driveway zone. Examples of gravel laid driveways are provided in Appendix 5.

The trees and native vegetation within or on the edge of the driveways were considered.

3.2.1 Results: five (5) driveways

There is estimated to be 25 percent cover of indigenous perennial understorey species within the location for driveway 4, which will have to be offset. Within driveway 3, there is also the loss of one small *Eucalyptus microcarpa* tree (waypoint 52 tree), and the lopping of a branch from a large *Eucalyptus melliodora* tree (waypoint 56). Both waypoint 52 and 56 tree require an offset (planning clause 52.17).

The locations and results of each driveway are as follows:

Driveway 1: Lat 36.898557 S/Lon:145.250003 E

Waypoint	Trees	CBH (m)	TPZ (m)	Notes
WP 39	*Eucalyptus microcarpa*	0.58	2.22	retained
WP 39	*Eucalyptus microcarpa*	1.92	7.33	retained
WP 40	*Eucalyptus microcarpa*	4.67	17.84*	retained: large

*Default Maximum TPZ 15 metres

The ground covering vegetation appears to consist of exotic grasses and forbs. There are some scattered *Acacia pycnantha* saplings, however, there is no understorey patch of native vegetation, as there is less than 25 percent cover of perennial native understorey plants.

Driveway 2: Lat 36.897956 S/Lon 145.250810 E

Waypoint	Trees	CBH (m)	TPZ (m)	Notes
WP 42	*Eucalyptus microcarpa*	2.40	9.12	retained: large
WP 43	*Eucalyptus microcarpa*	2.53	9.70	retained: large
WP 44	*Eucalyptus microcarpa*	3.02	11.53	retained: large
WP 45	*Eucalyptus microcarpa*	1.63	6.23	retained
WP 80	*Eucalyptus microcarpa* (?)	3.63	13.86	retained : large dead tree

The ground covering vegetation appears to consist of exotic grasses and forbs. There are scattered *Acacia pycnantha* saplings and a *Cassinia sifton* sapling, however, there is no understorey patch of native vegetation, as there is less than 25 percent cover of perennial native understorey plants.

Driveway 3: Lat 36.897451 S/Lon 145.251487 E

Waypoint	Trees	CBH (m)	TPZ (m)	Notes
WP 52	*Eucalyptus microcarpa*	0.66	2.52	removed: small. Within direct way of proposed driveway.
WP 53	*Eucalyptus microcarpa*	2.30	8.78	retained: large
WP 54	*Eucalyptus microcarpa*	2.53	9.70	retained: large
WP 55	*Eucalyptus microcarpa*	3.02	11.53	retained: large
WP 56	*Eucalyptus melliodora*	1.63	6.23	removed: large. A branch of this tree would have to be removed as it spreads across the

				proposed driveway. Thus, a permit would be required for the branch removal

The ground covering vegetation appears to consist of exotic grasses and forbs. There are scattered *Acacia pycnantha* saplings and one *Acacia genistifolia* shrub. There is no patch of native perennial understorey vegetation, as there is less than 25 percent cover of perennial native understorey plants.

Driveway 4: Lat 36.896989 S/Lon 145.252335 E

Waypoint	Tree	CBH (m)	TPZ (m)	Notes
WP 63	*Eucalyptus microcarpa*	2.20	8.40	retained: large
WP 64	*Eucalyptus camaldulensis*	1.72	6.57	retained
WP 65	*Eucalyptus microcarpa*	2.02	7.71	retained
WP 66	*Eucalyptus microcarpa*	1.63	6.25	retained
WP 68	*Eucalyptus microcarpa*	0.57	2.18	retained

The understorey cover consists of exotic grasses and forbs, as well as native grasses, shrubs and bryophytes. **The native perennial species are estimated to provide about 25 percent cover.**

Dianella revoluta var *revoluta*, *Rytidosperma* species and *Austrostipa* species provide 25 percent coverage. The estimated to be 25 percent cover of indigenous perennial understorey species within the location for driveway 4 will have to be offset

Acacia pycnantha species cover is 5 percent coverage, the saplings or small trees are scattered. *Pultenaea laxiflora* coverage consists of one small shrub. The detritus coverage, consisting of native derived organic material, is estimated to be 25 percent.

Driveway 5: Lat 36.896794 S/Lon 145.252737 E

Waypoint	Tree	CBH (m)	TPZ (m)	Notes
WP 75	*Eucalyptus microcarpa*	0.52	1.98	retained
WP 76	*Eucalyptus microcarpa*	4.40	16.80	retained: large
WP 77	*Eucalyptus microcarpa*	0.28	1.07	retained

There are some scattered native grasses (*Rytidosperma* species) as well as exotic grasses. However, the understorey plants, including an *Acacia implexa* tree would not provide 25 percent of perennial native plant cover. Perennial grass cover is estimated to be about 10 percent. Though, it is estimated that the bryophyte cover is around 25 percent within the bare ground areas, which in significant parts were covered in gravel.

There is a patch of *Dianella revoluta* on the edge of the driveway and there is an isolated *Dianella revoluta* tussock within the proposed driveway area.

3.2.2 Driveway Construction

The construction of driveways may cut into the TRZ of the trees that are in close proximity, or adjacent to, the proposed driveways, as 90 percent of lateral tree root system lies between 30 to 41 centimetres below the surface and can spread up to 30.5 metres (Gardening Know How). However, if there is cutting into the soil layer and gravel is laid on top of the surface, then the trees should be able to survive. Additionally, domestic vehicle traffic should not cause too much soil compaction and there will still be an extensive lateral tree root system outside of the driveway zone.

An example of *Eucalyptus* trees surviving alongside a gravel road is displayed in this image taken in a Parks Victoria nature reserve. And a second image shows a large old *Eucalyptus camaldulensis* tree beside a concrete roadway in a residential development located in the City of Darebin. Thus, the creation of driveways that do not cut deep into the soil surface should not affect the survival of the *Eucalyptus* trees in proximity to the edge of the driveways. Furthermore, their respective TRZ should not be compromised by 10 percent or more due to the construction method of the proposed driveways.

If an access road is built to the residential lots facing Spencer Road in accordance with the Council's Development Plan 2 Lovers Hill, Avenel, then there is a strong possibility that the TRZ of the canopy trees alongside the road reserve fence-line would be compromised by more than 10 percent; and therefore, the trees would be deemed lost (DSE 2011). Rather, the construction of *gravel driveways* across the road reserve into the residential lots, would not compromise the lateral roots and therefore the nearby canopy *Eucalpytus* trees would be preserved rather than lost.

3.3 Native Vegetation Removal Report (NVR)

NVR report is provided as an attachment.

Assessment pathway	Basic Assessment Pathway
Extent including past and proposed native vegetation removal.	0.098 ha
No. Large trees proposed to be removed	1 large tree (WP 56 branch removal)
Location category of proposed removal	Location 1** The native vegetation is not in an area mapped as an endangered Ecological Vegetation Class, sensitive wetland or coastal area. Removal of less than 0.5 hectares will not have a significant impact on any habitat for rare or threatened species.

**Note: This does not coincide with field observations, where the EVC is considered to be EVC 55_62 Plains Grassy Woodland which is an endangered EVC in a location two category (an endangered EVC).

3.3.1 Offset

The offset requirement that will apply if the native vegetation is approved to be removed:

Offset Type	General Offset
General offset amount	0.089 general habitats units
Vicinity	Goulburn Broken Catchment Management Authority (CMA) or Strathbogie Shire Council
Minimum strategic biodiversity value score	0.608
Large Tree	1 large tree(s)

3.3.2 Avoid and Minimise Statement

The placement driveways are in gaps where the loss of native vegetation, in particular native tree loss, will be minimised. Only one small *Eucalyptus microcarpa* tree and a branch of a large *Eucalyptus melliodora* tree in the proposed area of driveway number 3 will have to be removed. In addition to this, one small patches of native understorey vegetation effected in the construction of driveway 4 will be lost. However, the placement of driveways is done to avoid and minimise the loss of native canopy trees.

3.4 Weeds

No listed noxious weeds were observed at road reserve site (Agriculture Victoria 2017). Some weeds were difficult to identify due to a lack of flowering material. Ten (10) exotic species were recorded (though it is presumed that there are more) these species were the most prevalent/dominant throughout the site and formed thick patches within the ground layer.

Under the Catchment and Land Protection Act 1994 (CaLP Act) it is the *responsibility of the landowner* to control and eradicate regionally controlled weeds. The CaLP Act defines 4 categories of noxious weeds:

State Prohibited: weeds that do not occur in Victoria but pose a significant threat to the community and environs; or weeds that are present in Victoria yet pose a significant threat and are expected to be eradicated. The Victorian Government bears responsibility for their eradication, however under the CaLP Act section 70(1) it is expected that the landowner prevents their spread.

Regionally Prohibited: weeds that are not widely distributed in a region but are invasive and have the potential to spread. Landowners must take reasonable steps to control or eradicate regionally prohibited weeds.

Regionally Controlled: Invasive weeds that are usually widespread in a region. Landowners must control or eradicate regionally controlled weeds to prevent their spreading and growth.

Restricted Weeds: Weeds that pose a significant and unacceptable risk of spreading within that state and are a threat to other states and territories.

Exotic Species Recorded	
Scientific	**Common**
Arctotheca calendula	Capeweed
Briza minor	Quaking Grass
Cyperus eragrostis	Tall flatsedge
Ehrharta calycina	Perennial Veldt Grass
Ehrharta erecta	Panic veldtgrass
Ehrharta longifolia	Annual Veldt-grass
Hypochaeris glabra	Smooth Cat's ear
Hypochaeris radicata	Flatweed
Oxalis pes-caprae	African Wood Sorrel
Romulea rosea	Onion grass

3.5 Fauna

3.5.1 Fauna Observed

There was a noticeable lack of native bird species. This could be due to the presence of Noisy Miners (*Manorina melanocephala*) which are known to harass and drive out other native bird species.

Native species recorded were:

- Crimson Rosellas (*Platycercus elegans*)
- Eastern Rosellas (*Platycercus eximius*)
- Common Skinks (*Lampropholis guichenoti*)

3.5.2 Threatened & Endangered Fauna: 5km radius

No threatened or endangered species were observed during the survey.

Threatened native fauna includes species that are listed as critically endangered, endangered or vulnerable under the EPBC Act (1999); listed threatened under the FFG Act (1988); and listed as critically endangered, endangered, vulnerable or rare in Victoria's rare or threatened fauna advisory lists (DELWP/ DSE 2009, 2013).

Species list is given in Appendix 2.

3.6 Ecological Communities

No threatened or endangered species were recorded during the survey.

Listed Ecological Communities

The EPBC Act 1999 Protected Matters search tool highlights significant or threatened ecological communities (or matters of national environmental significance [MNES]) that *may* occur in the area. The presence of these communities within the study site is determined during the survey against descriptions and condition of the ecological communities.

PMST suggests that 5 ecological communities may exist within the study site these are:

Name	Status	Occurrence in study area	Comments
Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions	Endangered	Does not occur	Study site does not contain Buloke.
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered	Does not occur	Discussion below.
Natural Grasslands of the Murray Valley Plains	Critically Endangered	Does not occur	Treeless grassland. Study site does not meet the definition of the community.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plans	Critically Endangered	Does not occur	Study site does not contain riparian vegetation.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Does not occur	Study site does not support any White Box, Yellow Box or Blakely's Red Gum. Few examples of Yellow Box exist at the site. Study site does not meet the definition of the community.

Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

Despite the predominance of *Eucalyptus microcarpa* throughout the area, the study site fails to meet the condition threshold for the ecological community to be considered present. This failure to meet the threshold is due to the highly disturbed ground layer – the dominating presence of exotic species that has invaded the area – and lack of perennial native species across 2 hectares of the study site.

The condition threshold to be considered a remnant patch of Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia, requires the ground layer to be made up of approximately 50% perennial native species (SEWPAC 2012).

4 Conclusion

The study site was found to be a rather weedy and degraded remnant patch of EVC 55_62 Plains Grassy Woodland, which is typified by the predominance of Eucalyptus microcarpa. The degraded status of the patch is most likely a result of it being directly located between two farming properties and alongside a road that is occasionally frequented by locals.

Five (5) suitable areas were identified for the driveways, these areas were specifically located in gaps between the canopy trees as to ensure their survival. The construction of five, 4 metre wide by 26 metre long. gravel laid driveways would result in the loss of a small patch perennial understorey vegetation in driveway 4, and one (1) small *Eucalyptus microcarpa* (waypoint 52) and branch removal from a large *Eucalyptus melliodora* (waypoint 56) – both trees located within/next to driveway 3.

Overall, it was determined, that the 650-metre strip of degraded remnant Plains Grassy Woodland found within the study site on Spencer Road, Avenel, would not be impacted upon by the proposed construction of five (5), 4 metre wide by 26 metre long, gravel driveways.

4.1 References

Agriculture Victoria: http://agriculture.vic.gov.au/agriculture/pests-diseases-andweeds/protectingvictoria-from-pest-animals-and-weeds/legislation-policy-and-permits/noxiousweed-and-pestanimal-management-your-legal-roles-and-responsibilities

Agriculture Victoria 2017. Victorian Noxious Weeds List. 20th of July 2017.

Birds in Backyards: http://www.birdsinbackyards.net/

DELWP: Victorian Department of Environment, Land, Water and Planning

DELWP - ENSym NVR tool-spatial data standards: https://ensym.biodiversity.vic.gov.au/nvr_tool/

DELWP 2017. Guidelines for the Removal, destruction or lopping of native vegetation.

DELWP 2017b. Exemptions from requiring a planning permit to remove, destroy, or lop native vegetation. Guidance.

DELWP 2018. Assessors handbook. Applications to remove, destroy or lop native vegetation.

DELWP. Native Vegetation Information Management system (NVIM):

https://nvim.delwp.vic.gov.au/

DELWP. Nature Kit: https://www.environment.vic.gov.au/biodiversity/naturekit

DELWP. Victorian Biodiversity Atlas: https://www.environment.vic.gov.au/biodiversity/victorianbiodiversity-atlas

DSE: former Victorian Department of Sustainability and the Environment (now DELWP)

DSE (DELWP) 2004. EVC 55_62 Plains Grassy Woodland, Victorian Riverina bioregion, EVC/Bioregion Benchmark for Vegetation Quality Assessment.

DSE (DELWP) 2004. Vegetation Quality Assessment Manual – Guidelines for applying the habitat hectares scoring method. Version 1.3

DSE (DELWP) 2009. Advisory List of Threatened Invertebrate Fauna in Victoria – 2009

DSE 2011. Defining an acceptable distance for tree retention during construction works. Native Vegetation – Technical Information Sheet.

DSE (DELWP) 2013. Advisory List of Threatened Vertebrate Fauna in Victoria – 2013

DEPI: former Victorian Department of Environment and Primary Industries.

EPBC Act (1999): Commonwealth, The Environment Protection and Biodiversity Conservation Act 1999

EPBC Act (1999

FFG Act (1988): Victorian, The Flora and Fauna Guarantee Act 1988

Flora of Victoria: https://vicflora.rbg.vic.gov.au/

Gardening Know How: https://www.gardeningknowhow.com/

IUCN. https://www.iucn.org/content/habitat-loss-blamed-more-species-decline

Kent M. & Coker P. 1995. Vegetation Description and Analysis. A Practical Approach. John Wiley & Sons Ltd., Chichester, England.

Lindenmayer D.B. and Fischer J. 2006. Habitat Fragmentation and Landscape Change an Ecological and Conservation Synthesis. CSIRO Publishing, Collingwood 3066.

Lindenmayer D., Michael D., Crane M., Okada S., Florance D., Barton P., and Ikin K. 2016.

Wildlife Conservation in Farm Landscapes. CSIRO Publishing, Clayton South, 3169.

Planning Clause 52.17: http://planningschemes.dtpli.vic.gov.au/schemes/vpps/52_17.pdf

NSW Office of Environment & Heritage: https://www.environment.nsw.gov.au/

SEWAC: Department of Sustainability, Environment, Water, Population and Community now Department of Agriculture, Water and the Environment (DAWE)

SEWAC 2012, Grey Box (*Eucalyptus microcarpa)* Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia: A guide to the identification, assessment and management of a nationally threatened ecological community *Environment Protection and Biodiversity Conservation Act 1999*.

Simpson K. and Day N. 1999. Field Guide to the Birds of Australia. Penguin Group, Camberwell Victoria 3124.

SWIFFT (State Wide Integrated Flora and Fauna Teams): https://www.swifft.net.au/

White M., Cheal D., Carr G.W., Adair R., Blood K. and Meagher D. 2018. Advisory list of environmental weeds in Victoria. Arthur Rylah Institue for Environmental Research. Technical Report Series No.287.

Appendices

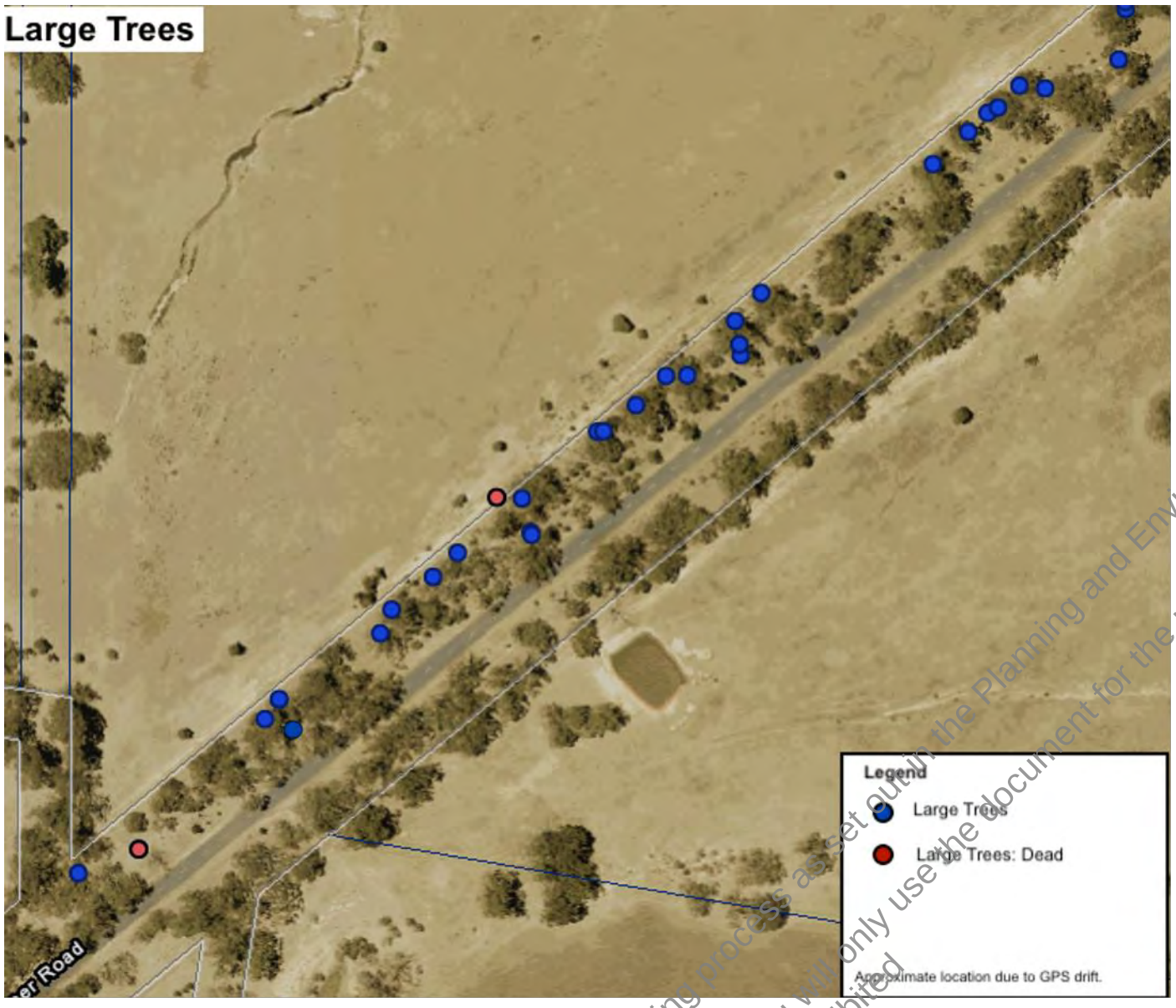
Appendix 1 Flora: recorded during survey

Native Species Recorded		
Scientific	**Common**	**Notes**
Acacia dealbata	Mimosa	Medium shrub
Acacia genistifolia	Spreading Wattle	Medium shrub
Acacia implexa	Lightwood	Medium shrub
Acacia mearnsii	Black Wattle	Medium shrub
Acacia paradoxa	Kangaroo Acacia	Small and medium shrub
Acacia pycnantha	Golden Wattle	Small to medium shrub
Amyema miquellii	Box mistletoe	Parasite
Anogramma leptophylla (?)	Jersey fern (?)	Ground fern
Austrostipa species	Spear grass species	Medium to small tufted graminoid
Carex appressa	Tall sedge	Medium to small tufted graminoid
Cassinia sifton	Sifton Bush	Small and medium shrub
Chloris truncata	Windwill-grass	Medium to small tufted graminoid
Crassula decumbens	Rufous Crassula	Small or prostrate herb
Dianella revoluta var *revoluta*	Spreading Flax-lily	Medium to small tufted graminoid
Einadia nutans subsp *nutans*	Nodding Saltbush	Prostrate shrub
Eucalyptus species sapling	Eucalyptus species	Small and medium shrub
Eucalyptus camaldulensis	River Red Gum	Canopy Tree
Eucalyptus melliodora	Yellow Box	Canopy Tree
Eucalyptus microcarpa	Grey Box	Canopy Tree
Juncus subsecundus	Finger Rush	Medium to small tufted graminoid
Lomandra filiformis	Wattle Mat Rush	Medium to small tufted graminoid
Pultenaea laxiflora	Loose-flower Bush-pea	Small shrub
Oxalis perennans	Yellow Wood-sorrel	Small or prostrate herb
Rytidosperma species	Wallaby grass species	Medium to small tufted graminoid

Appendix 1.1 Large Trees

***Large trees**: scattered/not within driveway envelopes*

Waypoints	Species	CBH(m)	TPZ(m)
WP 4	*Eucalyptus camaldulensis*	2.21	8.44
WP 5	*Eucalyptus microcarpa* (dead)	2.44	9.32
WP 6	*Eucalyptus microcarpa*	2.20	8.4
WP 7	*Eucalyptus microcarpa*	2.55	9.74
WP 8	*Eucalyptus microcarpa*	2.29	8.75
WP 9	*Eucalyptus microcarpa*	4.64	17.03
WP 10	*Eucalyptu microcarpa*	3.00	11.5
WP 11	*Eucalyptus microcarpa* (nearly dead)	2.52	9.62
WP 12	*Eucalyptus microcarpa*	3.68	14.05
WP 13	*Eucalyptus microcarpa*	2.50	9.54
WP 14	*Eucalyptus microcarpa*	2.40	9.2
WP 15	*Eucalyptus microcarpa*	2.50	9.54
WP 16	*Eucalyptus microcarpa*	3.02	11.53
WP 17	*Eucalyptus microcarpa*	2.60	9.93
WP 18	*Eucalyptus microcarpa*	2.96	11.30
WP 19	*Eucalyptus melliodora*	3.48	13.29
WP 20	*Eucalyptus microcarpa*	2.53	9.66
WP 21	*Eucalyptus microcarpa*	2.23	8.52
WP 22	*Eucalyptus camaldulensis*	2.48	9.47
WP 23	*Eucalyptus microcarpa*	3.04	11.61
WP 24	*Eucalyptus microcarpa*	3.00	11.5
WP 25	*Eucalyptus microcarpa*	4.44	16.96
WP 26	*Eucalyptus microcarpa*	4.10	15.66
WP 27	*Eucalyptus microcarpa*	2.26	8.63
WP 28	*Eucalyptus microcarpa*	4.42	16.88
WP 29	*Eucalyptus melliodora*	2.20	8.40
WP 30	*Eucalyptus microcarpa*	2.33	8.98
WP 31	*Eucalyptus microcarpa*	2.96	11.30
WP 32	*Eucalyptus microcarpa*	2.86	10.92
WP 33	*Eucalyptus microcarpa*	2.32	8.86
WP 34	*Eucalyptus microcarpa*	2.94	11.23
WP 35	*Eucalyptus melliodora*	3.37	12.87
WP 80	*Eucalyptus microcarpa* (?)	3.63	13.86



Appendix 2: Threatened and Endangered Fauna 5km Radius

Key:
No = Species habitat not present
Improbable = A small (low) chance that the species may occur
Likely = Species likely to occur/or site contains suitable habitat
Yes = Detected during survey

DSE/DELWP Listed
CR critically endangered
EN endangered
VU vulnerable
NT near threatened

FFG Act Listed
L listed as threatened

EPBC Act
cr critically endangered
en endangered
vu vulnerable
M migratory
m marine

VBA = Last Victoria Biodiversity Atlas Recording of Species

Scientific Name	Common Name	Conservation Status			Habitat	Likely occurrence	Comments
		DELWP	FFG	EPBC		VBA records	
Birds							
Chrysococcyx osculans	Black-eared Cuckoo	NT		m	The Black-eared Cuckoo is found in drier country where species such as mulga and mallee form open woodlands and shrublands. It is often found in vegetation along creek beds (Birds in Backyards).	No 1958	Study Site does not contain species habitat.
Circus assimilis	Spotted Harrier	NT				Improbable	

					Occurs in grassy open woodland including *Acacia* and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (NSW Office of Environment & Heritage).	1978	The study site and surrounding farmland may provide habitat for this species of raptor. Though species preferences native grasslands.
Climacteris picumnus victoriae	Brown Treecreeper (south eastern ssp.)	NT			Drier woodlands, forest clearings, edges; eucalypts along streams. Often on ground fallen timber (Simpson & Day 1999)	Likely 1981	There is the possibility that the remnant degraded grassy woodland may provide habitat to Brown Treecreeper.
Hirundapus caudacutus	White-throated Needletail	VU		vu/m/M	Aerial, mainly in E Aust, usually over coastal and mountain regions … N Asian migrant … Occurs in summer period (Simpson and Day 1999).	No 1975	Almost exclusively aerial. May be seen flying through area.
Lathamus discolor	Swift Parrot	CR	L	cr/m	Breeds in Tasmania, migrates during winter to mainland. Preferred wintering habitat: eucalyptus forests and woodlands consisting of flowering Grey Box, Red Ironbark, Mugga Ironbark, Yellow Gum and White Box. Feed in flocks, on nectar of lerp psyllid (FFG Action Statement no.169).	Improbable 1998	The Grey Box (*Eucalyptus microcarpa*) and Yellow Box (*Euclayptus melliodora*) trees of the road reserve or study site could provide feeding habitat. Though last sighting was some years ago.
Melanodryas cucullata cucullata	Hooded Robin	NT	L		Habitat comprises structurally diverse open woodlands containing Eucalyptus, Acacia or Callitris with an understorey of smaller trees, shrubs and grasses. They are not normally found in urban or densely forested areas. Hooded Robins are more positively associated with edge habitats, with deep and sheltered edges considered particularly important (SWIFFT).	Likely 1975	The small remnant degraded woodland of the study site may provide habitat for the Hooded Robin.
Oreoica gutturalis gutturalis	Crested Bellbird	NT	L		Dry inland and sub-inland woodland and scrub (Simpson & Day 1999).	Improbable 1958	The small remnant degraded woodland of the study site may provide habitat for the Crested Bellbird. Though last listing was some decade ago.

Pomatostomus temporalis temporalis	Grey-crowned Babbler	EN	L		Drier, more open forests, scrubby woodlands, trees, bordering roads along drainage lines, farmland with isolated trees (Simpson & Day 1999)	Likely 1978	The small remnant degraded woodland of the study site may provide habitat for the Grey-crowned Babbler. Though last listing was some decade ago.
Pyrrholaemus brunneus	Redthroat	EN	L		Mallee, mulga, saltbush, bluebush, lignum and spinifex country; coastal areas in western part of range (Simpson & Day 1999)	Improbable 1958	It is unlikely that the remnant degraded woodland of the study site provides habitat for Redthroat
Stagonopleura guttata	Diamond Firetail	NT	L		Mainly sedentary and often occurs in small flocks. In Victoria, they occur between 300-700mm rainfall in lowlands and foothills and mainly inhabit grassy woodlands or wooded farmlands containing River Red Gum Eucalyptus camaldulensis, Yellow Gum Eucalyptus leucoxylon, Murray Pine Callitris gracilis or Buloke Allocoasuarina luehmannii near permanent water but is less reliant on permanent water than the other two species in its genus (Immlemann 1982, Emison et al. 1987). (SWIFFT)	Improbable 1978	Mainly sedentary species. Remote possibility that the remnant degraded grassy woodland may provide habitat.
Reptiles							
Pogona barbata	Bearded Dragon	VU			Open sclerophyll woodlands or forests with places to perch such as logs and fallen branches (Museums Victoria).	Improbable 2015	Unlikely that the small strip of roadside degraded remnant grassy woodland would provide habitat for Bearded Dragon.

Appendix 3: Ecological Community Flowchart

Flowchart 1: Could a nationally threatened grassland or grassy woodland community be present?

Is the property within or near the area shown on the Grey Box Grassy Woodland distribution map on page 13?

NO → Outside known distribution for Grey Box (*E. microcarpa*) Grassy Woodlands and derived native grasslands of South Eastern Australia.
See national list for other threatened communities at: http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl

YES

Is at least 50% of the plant cover in the ground layer made up of perennial native species?
OR
Is at least 10% of plant cover in ground layer made up of perennial native grass species?

NO → Not a listed threatened ecological community as at June 2012.
See national list for communities that may have been listed since: http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl

YES

Is (or was previously) the most common tree species (or group of species) one of the following?

- grey box *Eucalyptus microcarpa* — YES → Grey Box (*E. microcarpa*) Grassy Woodlands or derived native grasslands of South Eastern Australia may be present. **Go to Flowchart 2.**
- white box *Eucalyptus albens*, yellow box *E. melliodora* Blakely's red gum *E. blakelyi* — YES → White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands or derived native grasslands may be present. **See information statement for that community**
- buloke *Allocasuarina luehmannii* slender cypress-pine *Callitris preissii* — YES → Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregion may be present. **See listing advice for that community**
- weeping myall *Acacia pendula* (NSW) — YES → Weeping Myall Woodlands may be present. **See policy statement for that community**
- peppermint box *Eucalyptus odorata* (SA only) — YES → Peppermint Box (*Eucalyptus odorata*) Grassy Woodland of South Australia may be present. **See policy statement for that community**
- coolibah *Eucalyptus coolabah* subsp. *coolabah* blackbox *Eucalyptus largiflorens* — YES → Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions may be present. **See listing advice for that community**
- Non-riverine/floodplain stands of river red gum, swamp gum, manna gum, yellow box (Victorian Volcanic Plains only) — YES → Grassy Eucalypt Woodlands of the Victorian Volcanic Plains. **See information statement for that community**

NO

Is the ecological community a type of natural temperate grassland?

- YES → A number of natural temperate grasslands are listed threatened ecological communities.
  See national list at: http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl
- NO → Not a listed threatened grassland or woodland ecological community as at June 2012
  See national list for communities that may have been listed since: http://www.environment.gov.au/cgi-bin/sprat/public/publiclookupcommunities.pl

Flowchart 2: Is the patch of potential Grey Box (*E. microcarpa*) Grassy Woodlands or derived native grasslands of sufficient quality for national listing?

Is (or was previously)[1] the most common tree species Grey Box (*Eucalyptus microcarpa*)?

NO[a] → Not the listed national ecological community

YES

Is the patch[2] at least 0.5 ha in size?

NO[b] → Not the listed national ecological community

YES

Do non-grass weeds[3] make up more than 30% of the plant cover[4] in the ground layer?

YES[c] → Not the listed national ecological community

NO

Do trees cover at least 10% of patch?

YES

Is the patch bigger than 2 ha?

YES

Are there at least 8 trees/ha:[5]
a) that contain hollows; or
b) have a diameter >60 cm at 1.3 m above ground level?

YES

Is at least 10% of the plant cover in the ground layer made up of perennial native grass species?

YES → The listed national ecological community is present

NO[d] → Not the listed national ecological community

NO

Are there at least 20 live trees/ha with a diameter >12 cm at 1.3 m above ground level?

YES

Is at least 50% of the plant cover in the ground layer made up of perennial native species?

YES → The listed national ecological community is present

NO[e] → Not the listed national ecological community

NO

Are there at least **8** perennial native species in the mid and ground layers?[6] (**6** in Flinders Lofty Block Bioregion, SA)

YES

Are there at least **12** perennial native species in the mid and ground layers?[6]

YES → The listed national ecological community is present

NO[d] → Not the listed national ecological community

NO

Is there evidence[1] that Grey Box trees were once common in the patch?

NO[a] → Not the listed national ecological community

YES

Are there at least **12** perennial native species in the mid and ground layers?[6]

YES → The listed national ecological community is present

1 Evidence that Grey Box was originally present might include stumps, historical records or presence in nearby vegetation.
2 When considering a patch it is important to note that a patch may extend beyond a property or development site boundary. For the purposes of determining whether or not a patch meets the minimum patch size of the condition thresholds for the ecological community, the entire patch should be considered, not just the area occurring on a property or development site.
3 A weed is defined here as a plant species that is not native to Australia and the species has established viable self-sustaining populations in a region.
4 Plant cover excludes mosses and lichens. Patches of bare ground or leaf litter are also not included.
5 Dead trees are included if present, up to 50% of the total tree count.
6 Relevant growth-forms to include are: grasses, other graminoids, forbs and shrubs less than 4 metres tall. Shrubs that are 4 metres or more in height and non-vascular plants (mosses and lichens) are not included.

Why does my patch not belong to the listed national ecological community? **a** Patch belongs to a different ecological community; **b** Patch is too small; **c** Degraded: patch is too weedy **d** Degraded: too few native species or insufficient native species cover in ground layer; **e** Degraded: too few trees AND insufficient native species cover in ground layer. Rehabilitation work may be able to restore degraded patches enough to qualify as the listed community.

Appendix 4 Photographs of Study Site (July-August 2020)

Capeweed (*Arctotheca calendula*) and exotic grasses

Eucalyptus microcarpa dominated degraded grassy woodland of the site

Exotic grasses

A patch of gravel and open ground.

Exotic grass areas within woodland

Scattered *Dianella revoluta*

Dianella revoluta amongst exotic grass

Exotic grasses. Large log (fallen tree)

Acacia saplings in photograph

Location of one of the 5 driveways.

Degraded Grassy Woodland of study site.

Appendix 5: Gravel Laid Driveways

Example of gravel laid driveway: native trees, including Eucalyptus trees, growing beside a gravel track in a Parks Victoria nature reserve.

A large old Eucalyptus camaldulensis tree growing beside a concrete roadway in a City of Darebin residential development.

"Lovers Hill Estate"
Avenel-Longwood Road, Avenel
Development Plan

Traffic Impact Assessment Report

Project No. 180459

FINAL Report – 30/04/2019

1st Floor 132 Upper Heidelberg Road Ivanhoe Vic 3079

PO Box 417 Ivanhoe Vic 3079 Ph: (03) 9490 5900 Fax: (03) 9490 5910
www.trafficworks.com.au

DOCUMENT CONTROL RECORD

Document prepared by:

Trafficworks Pty Ltd

ABN 59 125 488 977

1st Floor 132 Upper Heidelberg Rd Ivanhoe Vic 3079

PO Box 417 Ivanhoe Vic 3079

Ph (03) 9490 5900

Fax (03) 9490 5910

www.trafficworks.com.au

DISCLAIMER

Document Control				
Report Title		"Lovers Hill Estate" Avenel-Longwood Road, Avenel Development Plan - Traffic Impact Assessment Report		
Project Number		180459		
Client				
Client Contact		Ellen Hogan (of Ellen Hogan and Associates)		
Rev	Date Issued	Revision Details / Status	Prepared by	Authorised by
Draft	29/04/19			
FINAL	30/04/19			

EXECUTIVE SUMMARY

Trafficworks has been engaged by Ellen Hogan and Associates to undertake a traffic impact assessment for the proposed residential development at Lovers Hill Estate, Avenel-Longwood Road, Avenel (Land known as Crown Allotments 20A, 20B, 21B, 26, 27 and 28 of Sec. F in Avenel plus Lot 2 of PS513465).

The subject site is located to the northeast of Avenel and approximately 15km north east of the Seymour CBD. The 240-hectare subject site is bounded by Old Hume Highway to the east, Town Zone (TZ) to the west and Farming Zone (FZ) to the north and south.

A Traffic Impact Assessment (TIA) was carried out to:

- estimate the traffic generation and distribution of the proposed development
- determine the suitability of the proposed access location
- determine the likely traffic impacts of the existing road network
- identify any necessary mitigation works.

It has been identified that the proposed development:

- would not adversely affect traffic conditions on the adjacent road network
- would generally comply with the relevant traffic requirements set out in Austroads, the Council Planning Scheme and Infrastructure Design Manual.

A summary for the site and the proposed development is shown below.

Address	"Lovers Hill Estate" Avenel-Longwood Road, Avenel (Land known as Crown Allotments 20A, 20B, 21B, 26, 27 and 28 of Sec. F in Avenel plus Lot 2 of PS513465)
Zoning	Rural Living Zone (RLZ)
Proposed development	36 lot residential development (in two stages)
Road Network:	Avenel-Longwood Road (transitions from 60 km/h to 100 km/h heading in the north-eastbound direction, 270 m southwest of the subject site access) Old Hume Highway/Spencer Road (default rural speed limit of 100 km/h)
Recommendations	**Recommendation 1:** Ensure the proposed internal roads within the residential development are designed in line with the IDM design requirements. **Recommendation 2:** Introduce traffic calming devices to the proposed internal road from Access 2. **Recommendation 3:** That vegetation be trimmed/removed to the south west of the subject site Access 1 / Avenel-Longwood Road intersection to satisfy the SISD requirements. **Recommendation 4:** That Council/Regional Roads Victoria consider the extension of the existing 60 km/h zone on Avenel-Longwood Road to include the intersection with Access 1. **Recommendation 5:** That Council/Regional Roads Victoria consider a review of the existing default rural speed zone on the Old Hume Highway, specifically with consideration to the proposed residential development frontage and the intersection with Access 2.

	Recommendation 6: That all direct accesses from the subject site (Lots 1 to 7) to the Old Hume Highway be constructed generally in accordance with the Infrastructure Design Manual standard drawing SD255, Typical Swale Drain Vehicle Crossing (Rural Entrance).

Referenced Documents

References used in the preparation of this report include the following:

- *RTA Guide to Traffic Generating Developments, Version 2.2, October 2002 for traffic generation predictions and parking requirements*
- *Strathbogie Shire Council Planning Scheme*
- *Strathbogie Shire Council Road Register*
- *Infrastructure Design Manual Version 5.01 – January 2017*
- *Austroads Guide to Traffic Management Part 8: Local Area Traffic Management*
- *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*
- *Austroads Guide to Road Design Part 4: Intersections and Crossings*

TABLE OF CONTENTS

1 INTRODUCTION

Trafficworks has been engaged by Ellen Hogan and Associates to undertake a traffic impact assessment for the proposed residential development at Lovers Hill Estate, Avenel-Longwood Road, Avenel (Land known as Crown Allotments 20A, 20B, 21B, 26, 27 and 28 of Sec. F in Avenel plus Lot 2 of PS513465).

A traffic impact assessment was carried out to:

- estimate the traffic generation and distribution of the proposed development
- determine the suitability of the proposed access location
- determine the likely traffic impacts of the existing road network
- identify any necessary mitigation works.

2 EXISTING CONDITIONS

2.1 Subject Site

The subject site is located to the northeast of Avenel and approximately 15km north east of the Seymour CBD. The 240-hectare subject site is bounded by Old Hume Highway to the east, Town Zone (TZ) to the west and Farming Zone (FZ) to the north and south.

The site falls within a Rural Living Zone (RLZ) and forms part of the Strathbogie Shire Council (the Council) municipality. A Development Plan Overlay (DPO2) covers the subject site which requests consideration is given for a Traffic Impact Assessment Report (TIAR).

The location of the site and its surrounding environment is shown in Figure 1 and Figure 2.

Figure 1: Location Plan (Source: VicPlan website)

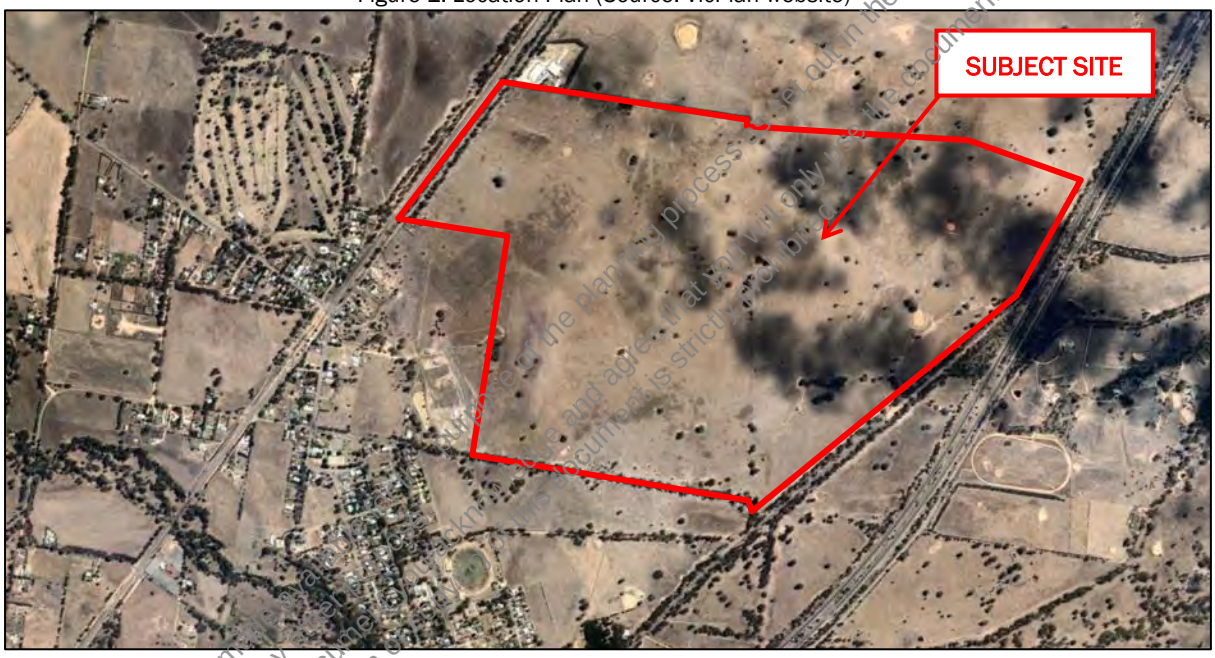
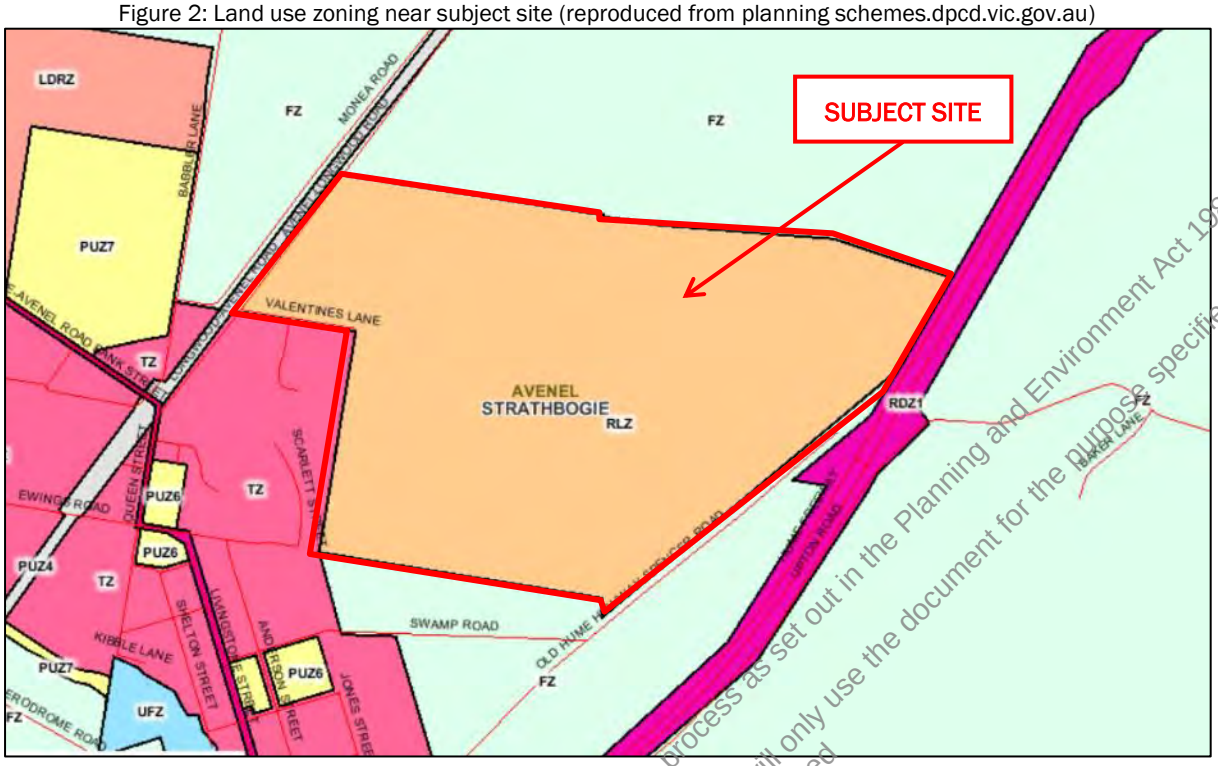


Figure 2: Land use zoning near subject site (reproduced from planning schemes.dpcd.vic.gov.au)



2.2 Road Network

The road network surrounding the subject site is explained in the subsequent sections.

2.2.1 Old Hume Highway (Spencer Road)

The section of the Old Hume Highway near the subject sit is known locally as Spencer Road. The road is classified as a local access road managed by Council, according to the *Council Road Register.* The section near the subject site is aligned generally in a northeast to southwest direction and provides connection to Avenel for a couple of residential properties and some farm land. The road was the former Hume Highway, but has been truncated by the construction of the Hume Freeway.

Near the subject site, the Old Hume Highway forms an undivided two-way road with a carriageway width of 7.4m sealed pavement with 0.5m unsealed shoulders. Due to the ambiguity around the speed zone for the Spencer Road section of the Old Hume Highway (i.e. no speed zone signs are present at the intersection with Jones Street) for the purposes of this report the default rural speed limit of 100 km/h has been assumed (Refer to Photos 1 and 2).

Photo 1: Looking southwest along the Old Hume Highway towards the end of the sealed section, just south of the subject site access (No. 2)

Photo 2: Looking northeast along the Old Hume Highway towards the 'end of the road' where the Hume Freeway truncates the road

2.2.2 Avenel-Longwood Road

Avenel-Longwood Road is classified as a link road managed by Council, according to the *Council Road Register.* It is aligned generally in a northeast to southwest direction and provides connection between Avenel and Longwood, approximately 20 km to the northeast.

The Avenel-Longwood Road is located within a Public Use Zone 4 – Transport (PUZ4), which also contains the Melbourne to Sydney Railway. The railway tracks are approximately 30 m away from the centre of the Avenel-Longwood Road (refer to Photo 3).

Near the subject site, Avenel-Longwood Road forms an undivided two-way road with a carriageway width of 6.5m sealed pavement with 1.5m unsealed shoulders.

Photo 3: Looking southwest along Avenel-Longwood Road with a train travelling north on the Melbourne to Sydney Railway (right of centre of the photo)

Approximately 370 m south west of the subject site access the speed zone signs transitions from the default rural speed limit of 100 km/h (past the subject site) to a 60 km/h speed zone for the Avenel township (refer to Photos 4 and 5).

Photo 4: Looking northeast along Avenel-Longwood Road, the subject site access (No. 1) can be seen on the right of the photo (where the vehicle is parked)

Photo 5: Looking southwest along Avenel-Longwood Road, the subject site access (No. 1) can be seen on the left of the photo (where the vehicle is parked)

2.3 Traffic Volumes

The existing traffic volumes were provided for Avenel-Longwood Road by Strathbogie Shire Council (100 m northeast of Bank Street, Avenel). The traffic survey occurred between Wednesday 2 August 2017 and Tuesday 22 August 2017. Based on the data collected during the survey period an estimate of the weekday AM and PM peak hour volumes was determined as follows:

- AM (8:00am to 9:00am) peak hour two-way traffic volume was 22 vehicles per hour (vph)
- PM (3:00pm to 4:00pm) peak hour two-way traffic volume was 26 vph

The daily two-way traffic volume was recorded as 258 vehicles per day (vpd).

Applying a conservative 1% annual growth factor to the collected data (for Avenel-Longwood Road) would indicate estimated AM and PM peak hour two-way traffic volumes at full development of the subject site (say 2024) of approximately:

- AM peak hour two-way traffic volume = 24 vph
- PM peak hour two-way traffic volume = 28 vph

The traffic volumes on the Old Hume Highway (Spencer Road) adjacent to the subject site are expected to be less than ten vehicles per day due to the road essentially being closed. For the purpose of this assessment it has been assumed that the traffic volume on this section of road is 1 vph.

2.4 Crash History

The *VicRoads Open Data* website details all casualty crashes along Arterial and local roads throughout Victoria. Scrutiny of these records indicates that no casualty crashes have occurred

near the subject site in the last five-year period. Therefore, it can be concluded that the roads near the subject site do not have a traffic safety problem that requires urgent remedial action.

Conclusion 1: The roads near the subject site do not have a traffic safety problem that requires urgent remedial action.

2.5 Pedestrians and Cyclists

No pedestrian and bicycle facilities are currently provided along either the Old Hume Highway or Avenel-Longwood Road.

2.6 Public Transport

There are no bus stops or local / regional bus services in the vicinity of the proposed development, however Avenel does have a railway station on the Melbourne to Sydney railway line.

3 PROPOSED DEVELOPMENT

3.1 Proposed Development Summary

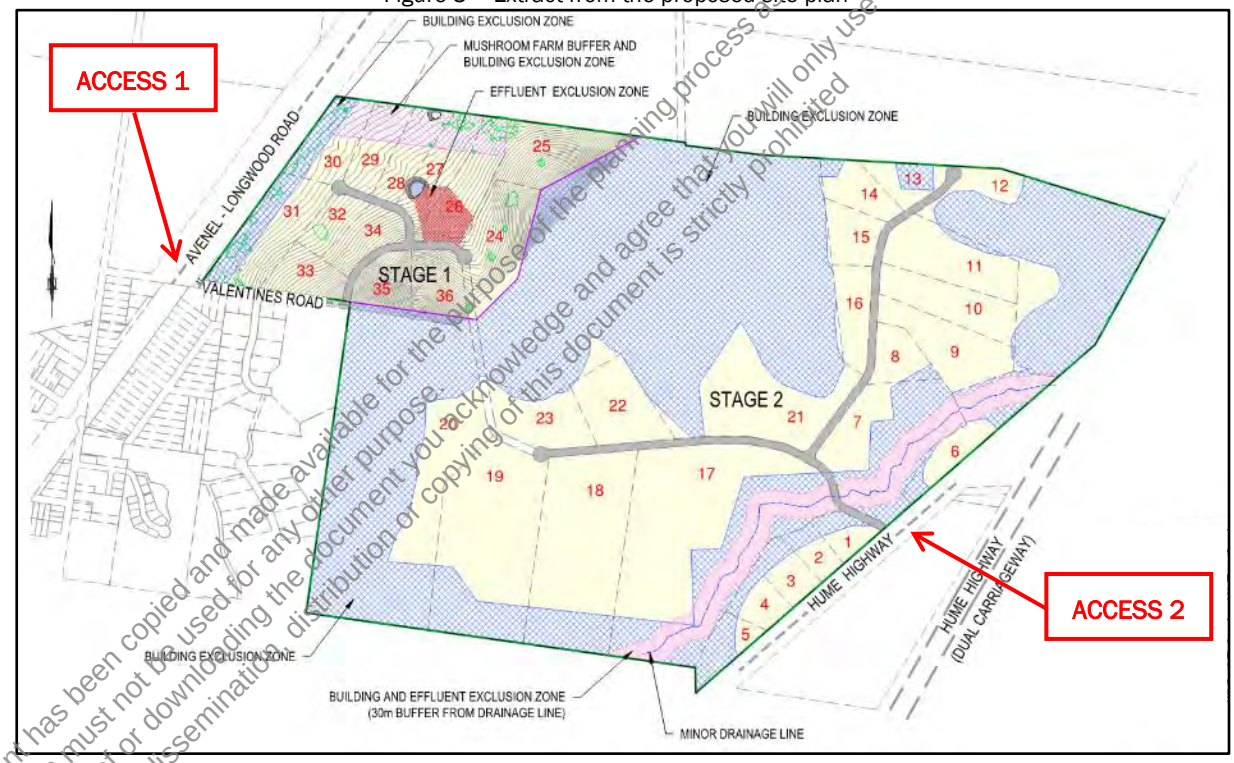
The proposed development consists of 36 conventional residential lots[1].

Vehicular access to the residential development is proposed to be provided as follows:

- Access 1[2] = Road access to the south of Lot 31, providing access to Lots 24 to 36 from Avenel-Longwood Road
- Access 2 = Road access between Lots 1 and 6, providing access to lots 7 to 23 from the Old Hume Highway
- Direct access to Lots 1 to 6 from the Old Hume Highway.

The proposed site plan is shown in Figure 3 and Attachment A.

Figure 3 – Extract from the proposed site plan



[1] Lot numbers as per the Lot Layout & Restriction Plan as shown in Figure 1 of DPO2

[2] The development connects to Avenel-Longwood Road via Valentines Road, an unmade 'paper' road (Access 1)

4 TRAFFIC GENERATION & DISTRIBUTION

4.1 Traffic Generation

The RTA *Guide to Traffic Generating Developments 2002* was used to estimate the traffic generation from the proposed developments within the subject site. The RTA Guide recommends a daily traffic generation rate of 9 vehicles per dwelling and a weekday peak hour rate of 0.85 vehicles per dwelling for conventional lots.

Based on these rates the proposed residential development is likely to generate a daily traffic volume of 324 vehicles per day (vpd) with a peak hour volume of 31 vehicles per hour (vph) at full development (i.e. Stages 1 and 2), refer to Table 1 below.

Table 1: Traffic generation to and from the proposed residential development

Land Use		Lots	RTA Guide Traffic Generation Rate		Traffic Generation	
			Hourly	Daily	Hourly	Daily
STAGE 1	Dwellings	13	0.85	9	11	117
STAGE 2	Dwellings	23	0.85	9	20	207
				TOTAL:	31	324

Conclusion 2: The proposed residential development is likely to generate a daily traffic volume of 324 vpd with a peak hour traffic volume of 31 vph.

4.2 Traffic Distribution

The peak hour traffic flow for the residential dwellings of the site is generally distributed as follows:

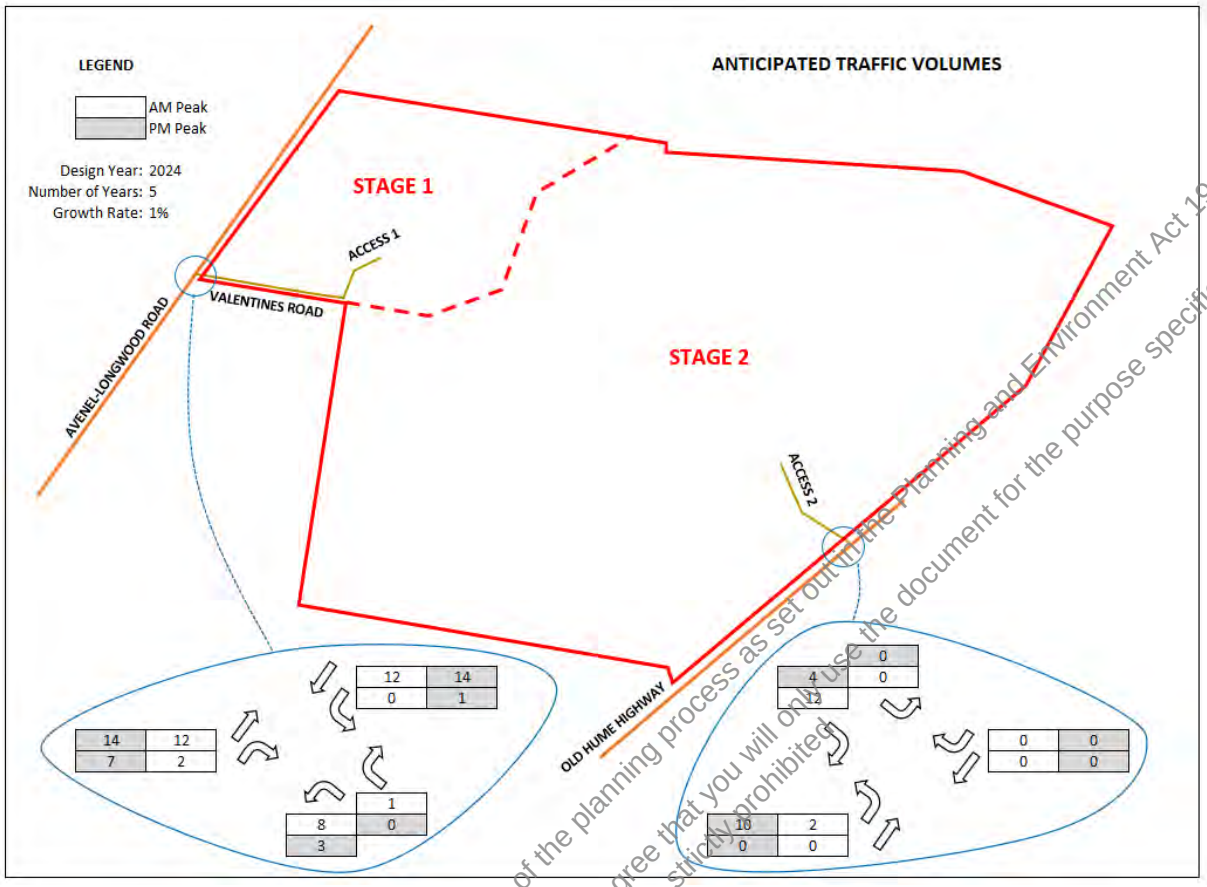
- AM peak 80% leaving 20% entering
- PM peak 30% leaving 70% entering

Traffic distribution (i.e. direction of approaches and departures) has been undertaken based on the percentage distribution of traffic under current conditions (on the adjacent road network).

4.3 Anticipated Traffic Volumes

Assuming the through traffic volumes on the Avenel-Longwood Road and Old Hume Highway will continue to grow at an annual compounded growth rate of 1%, the anticipated traffic volumes at the development access points are summarised in Figure 4.

Figure 4: Anticipated traffic volumes (2024)



Note: Traffic generation for Access 2 takes into consideration that Lots 1 to 6 have direct access to the Old Hume Highway

5 ASSESSMENT

5.1 Road Cross-Sections

The *Infrastructure Design Manual* (IDM) was originally prepared by the Cities of Greater Bendigo and Greater Shepparton, and the Shire of Campaspe. It provides a consistent set of requirements and standards for the design and development of infrastructure within rural towns in Victoria.

As per Table 6 of the IDM, Rural Living Access Road type streets should generally be designed with a road reserve of 20.0m and a carriageway width of 6.2m. The proposed internal roads within the development appear to be 20.0m wide which would satisfy the IDM design requirements.

Four court bowls are proposed to be provided at the ends of the proposed internal road. As per Section 12.4.2 of the IDM, rural living residential court bowls should be designed with a road reserve of 32.0m and a minimum seal width of 9.5m (to permit service and refuse vehicles to turn at the end of the court bowl without reversing or using driveways).

Recommendation 1: Ensure the proposed internal roads within the residential development are designed in line with the IDM design requirements.

5.2 Road Capacities

Section 12.4.2 of the IDM indicates that rural living access roads have the capacity to carry up to 1,000 vpd. The proposed access roads within the development provide access to 13 (Access 1) and 17[3] (Access 2) conventional residential lots resulting in a daily traffic generation of 117 vpd and 153 vpd respectively. This is well below the capacity of the internal road. Therefore, no further works need to be undertaken regarding the capacity of the roads.

5.3 Speed Zoning

It is expected that the proposed development will operate under the default urban 50 km/h speed limit. *Austroads Guide to Traffic Management Part 8: Local Area Traffic Management* (ARGD8) indicates that straight street section lengths (i.e. between slow or near-stop conditions) should be kept below 200 -250 m for target speeds of around 50 km/h.

The proposed internal road from Access 1 is designed generally in line with the AGRD8 requirements, however the proposed internal road from Access 2 has straight sections approximately 300 m to 500 m in length, which exceed the desirable lengths. Consideration should be given to introducing traffic calming devices (i.e. speed humps or horizontal deflections) to ensure self-enforceable speeds.

Conclusion 3: The proposed internal road from Access 2 has straights that exceed 250 m in length and will result in higher vehicular speeds.

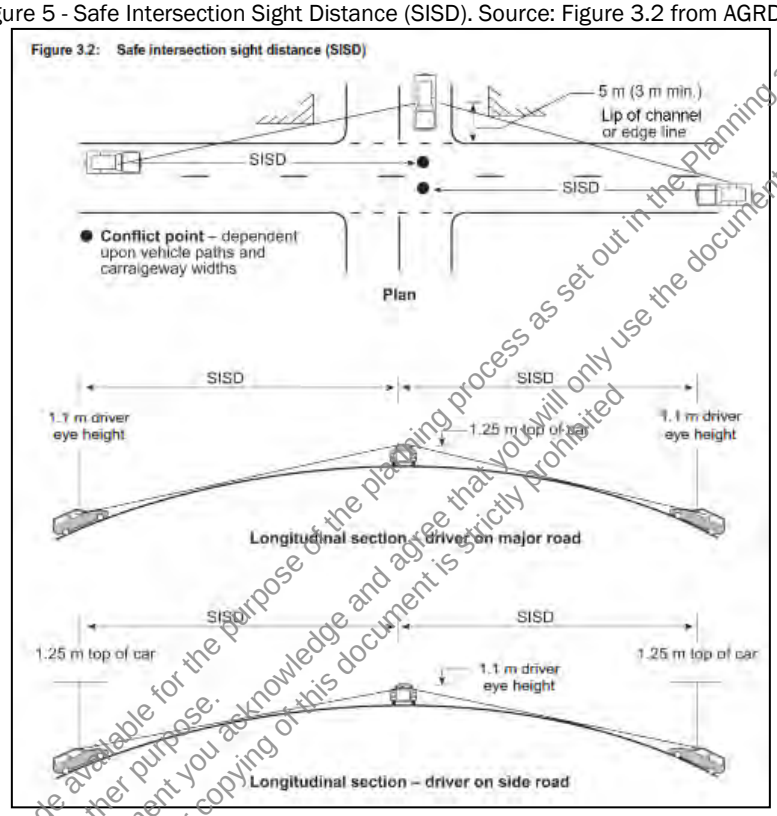
Recommendation 2: Introduce traffic calming devices to the proposed internal road from Access 2.

[3] traffic generation for Access 2 takes into consideration that Lots 1 to 6 have direct access to the Old Hume Highway

5.4 Sight Distance

The visibility criterion normally applied to intersections is Safe Intersection Sight Distance (SISD). The minimum SISD criteria along major roads are outlined in Table 3.3 of the *Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections* (AGRD4A). This document provides information in relation to the minimum distance which should be provided along major road to allow sufficient distance for a driver on a major road to observe a vehicle approaching from a minor road into collision situation (e.g. in the worst case, stalling across the traffic lanes) and to decelerate to a stop before reaching the collision point (refer Figure 5).

Figure 5 - Safe Intersection Sight Distance (SISD). Source: Figure 3.2 from AGRD4A

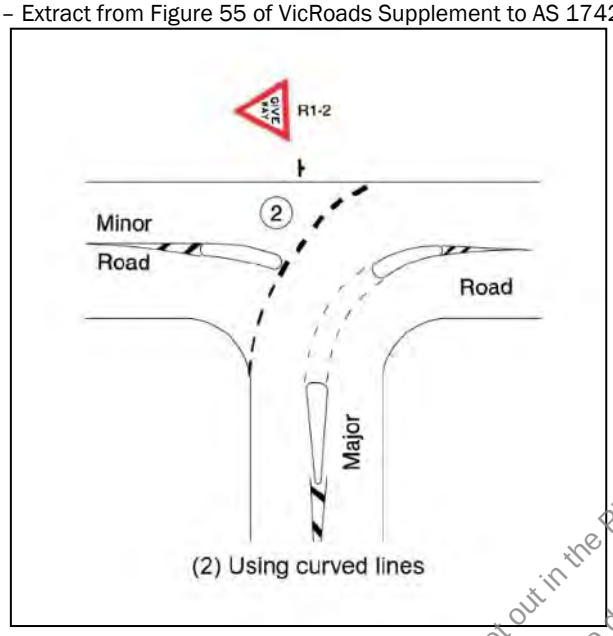


The minimum SISD criterion specified in Table 3.2 of the AGRD4A requires clear visibility for a desirable minimum distance of 285 m, relating to the general reaction time R_T of 2 seconds and a design speed of 110 km/h (design speed = posted speed + 10 km/h). This sight distance is applicable to the proposed access locations at the intersection with Avenel-Longwood Road (Access 1) and the Old Hume Highway (Access 2).

The longitudinal formation grade of the two roads along the subject site's road frontage requires no grade corrections to determine the minimum SISD need to be applied as specified in Table 3.4 of the Austroads Guide.

These visibility requirements, measured at 3.0 m (minimum) and 5.0m (desirable) from the edge of traffic lane, are satisfied at the subject site Access 2 / Old Hume Highway intersection. Furthermore, due to the road not continuing past the subject site, it is likely that the road would be realigned and the priority at the intersection altered so that development traffic has right of way (refer to Figure 6).

Figure 6 – Extract from Figure 55 of VicRoads Supplement to AS 1742.2:2009



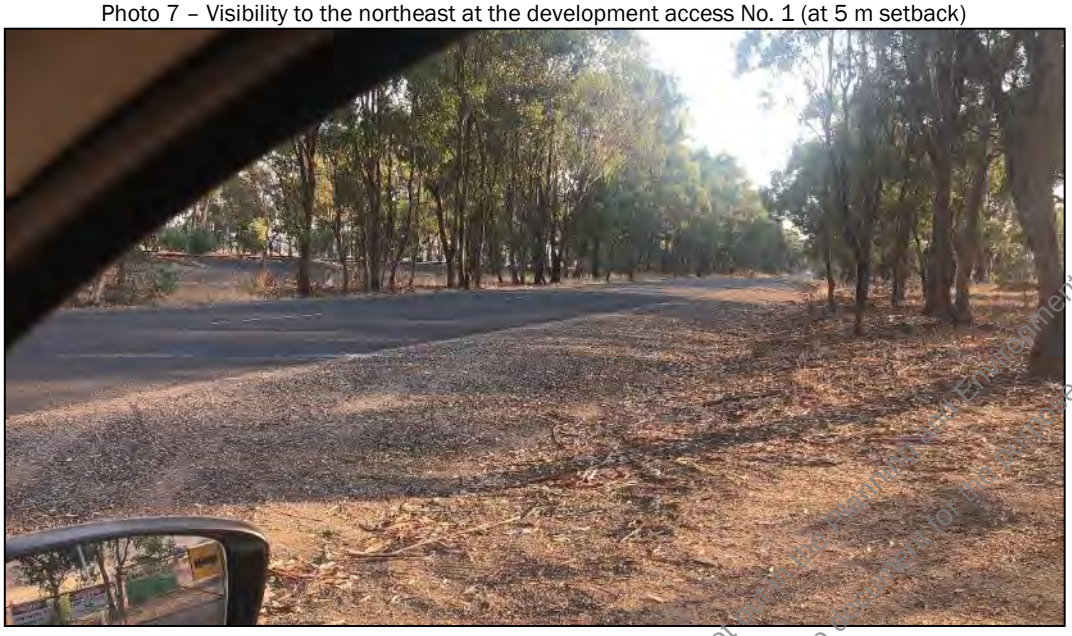
Conclusion 4: Sight distance requirements are satisfied at the subject site Access 2 / Old Hume Highway intersection.

Conclusion 5: The priority at the subject site Access 2 / Old Hume Highway intersection should be altered so that the development traffic has right of way.

The visibility requirements noted earlier in this section, measured at 3.0 m (minimum) and 5.0m (desirable) from the edge of traffic lane, are satisfied at the subject site Access 1 / Avenel-Longwood Road intersection to the right of the access (i.e. looking northeast, see Photos 6 and 7).

Photo 6 – Visibility to the northeast at the development access No. 1 (at 3 m setback)

Photo 7 – Visibility to the northeast at the development access No. 1 (at 5 m setback)



Conclusion 6: Sight distance requirements are satisfied at the subject site Access 1 / Avenel-Longwood Road intersection.

The visibility requirements, measured at 3.0 m (minimum) and 5.0m (desirable) from the edge of traffic lane, are **not** satisfied at the subject site Access 1 / Avenel-Longwood Road intersection to the left of the access (i.e. looking southwest, see Photos 8 and 9).

Photo 8 – Visibility to the southwest at the development access No. 1 (at 3 m setback), sight distance = 270 m

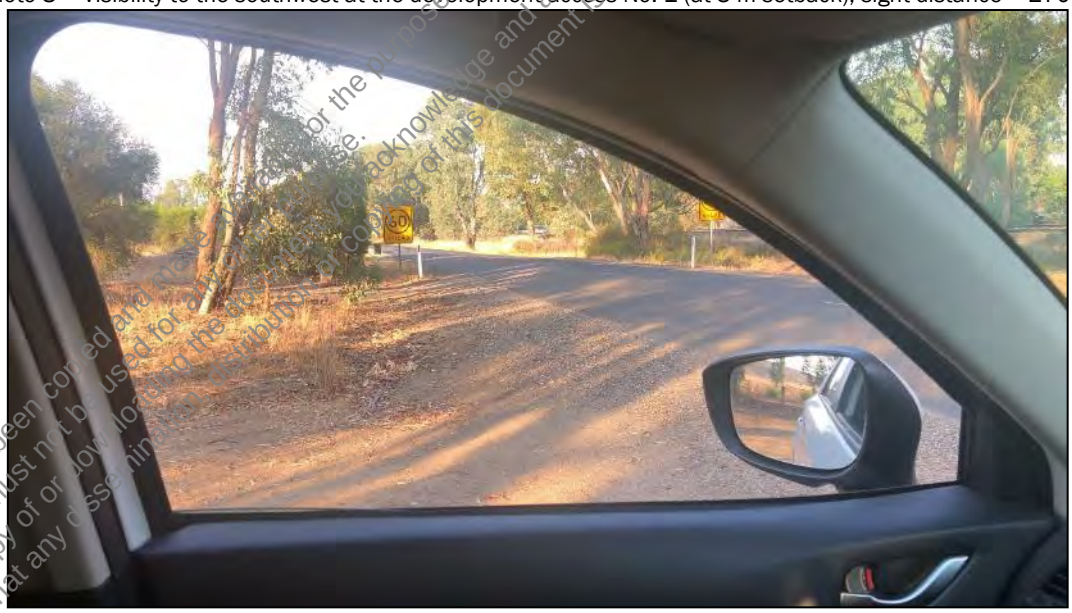


Photo 9 – Visibility to the southwest at the development access No. 1 (at 5 m setback), sight distance = 115 m

Conclusion 7: Sight distance requirements are not satisfied at the subject site Access 1 / Avenel-Longwood Road intersection, with 270 m (at 3 m offset to the left) and 115 m (at 5 m offset to the left).

Recommendation 3: That vegetation be trimmed/removed to the southwest of the subject site Access 1 / Avenel-Longwood Road intersection to satisfy the SISD requirements.

5.4.1 Accesses to Lots 1 to 6

Access driveways need to be located so that there is adequate entering sight distance to vehicles on the Old Hume Highway, as specified in Figure 3.2 of AS/NZS 2890.1. For a frontage road speed of 100 km/h, this equates to a minimum of 160 m at 2.5 m offset to the left from the edge of the frontage road.

As noted earlier, the visibility requirements, measured at 3.0 m (minimum) and 5.0m (desirable) from the edge of traffic lane, are satisfied at the subject site Access 2 / Old Hume Highway intersection. This also applies to the road frontage of the subject site to the north and south of Access 2, hence the visibility requirements for an access driveway (at 2.5 m offset to the left) would also be satisfied.

Conclusion 8: Sight distance requirements would be satisfied at the access driveways for Lots 1 to 6 that connect to the Old Hume Highway.

5.5 Turn Provisions

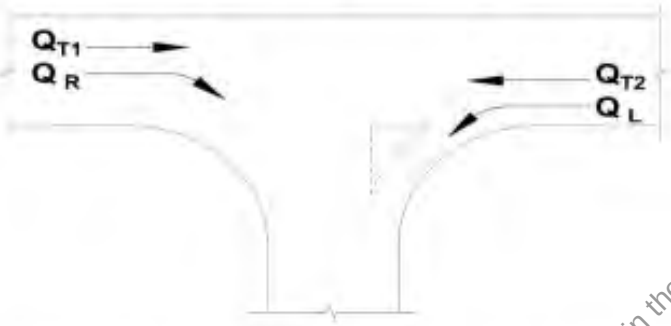
The traffic turning from major roads into minor roads should not delay through traffic. Turn treatments from major roads into minor roads at sign controlled intersections are generally provided for safe and efficient operation of the intersection.

The anticipated traffic volumes generated from the proposed development (outlined in Figure 4) were used to determine the turning warrants required at the subject site Access 1 / Avenel-Longwood Road intersection. The formulas shown in Figure A10 of the *Austroads Guide to Road*

Design Part 4: Intersections and Crossings (AGRD4), reproduced in Figure 7, were used to determine the major road volume **(Q_M)**. The results were then applied to Figure A11 of the AGRD4 (reproduced in Figures 8 & 9) to determine the turning warrants for the intersections.

Figure 7: Formulas used to determine the major road traffic (Source: Figure A10 of AGRD4)

Figure A 11: Calculation of the major road traffic volume parameter Q_M



Turn type	*Splitter island*	*Q_M (veh/h)*
Right	*No*	*= Q_{T1} + Q_{T2}+Q_L*
Right	*Yes*	*= Q_{T1} + Q_{T2}*
Left	*No/yes*	*= Q_{T2}*

5.5.1 Avenel-Longwood Road / Access 1 Intersection

The proposed intersection at Avenel-Longwood Road / Access 1 is proposed to be a sign controlled intersection. Turning warrants assessment undertaken at post development revealed that the intersection warrants for a basic right turn (BAR) treatment and a basic left turn (BAL) treatment at the intersection. Refer to Tables 2 – 3 and Figure 8 for the turning warrants assessment.

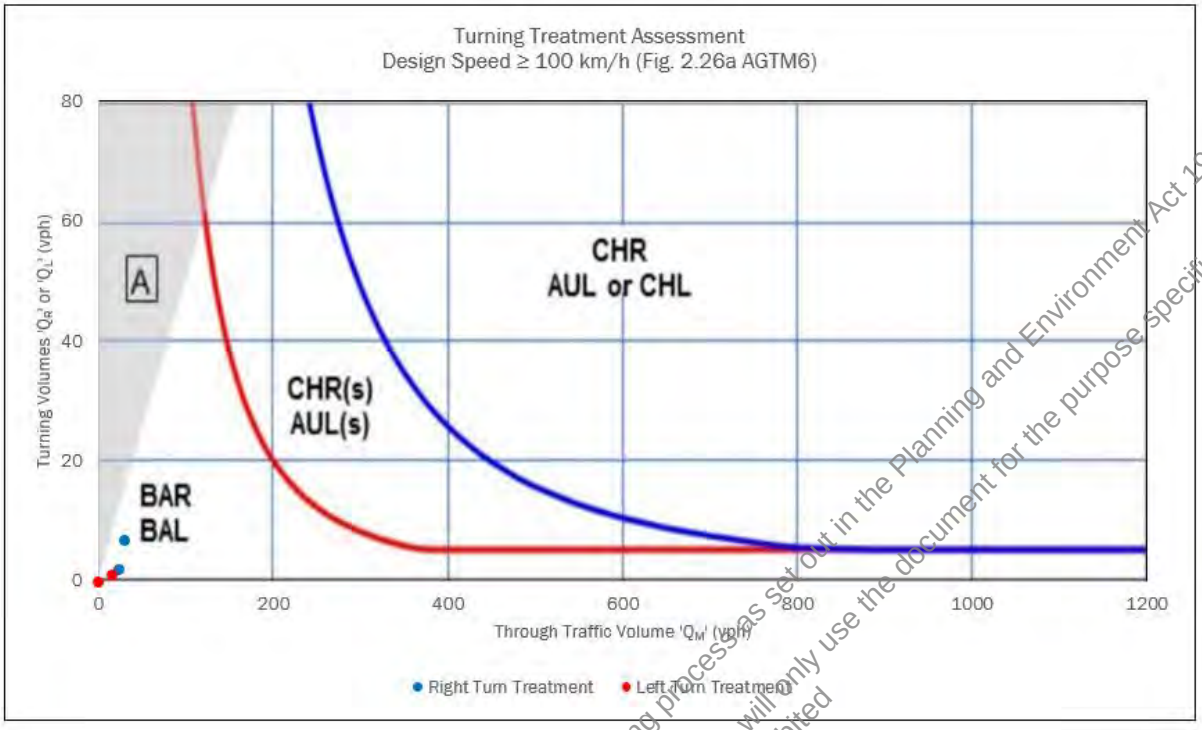
Table 2: Warrants for the left turn treatments at the Avenel-Longwood Road / Access 1 intersection

Road	Period	Q_{T2} vph	Q_L vph	Q_M vph	Warrants
Access 1	AM	12	0	0	N/A
	PM	14	1	14	BAL

Table 3: Warrants for the right turn treatments at the Avenel-Longwood Road / Access 1 intersection

Road	Period	Q_{T1} vph	Q_{T2} vph	Q_L vph	Q_R vph	Q_M vph	Warrants
Access 1	AM	12	12	0	2	24	BAR
	PM	14	14	1	7	29	BAR

Figure 8: Graph used to determine the warrants for the left turn and right turn treatments at the Avenel-Longwood Road / Access 1 intersection



As can be seen in Figure 8 above, the warrants for basic treatments (BAL and BAR) are triggered for both the left and right turn movements at the Avenel-Longwood Road / Access 1 intersection.

5.5.2 Old Hume Highway / Access 2 Intersection

The proposed intersection at Old Hume Highway / Access 2 is proposed to be a sign controlled intersection. Turning warrants assessment undertaken at post development revealed that the intersection warrants for a basic left turn (BAL) treatment at the intersection. However, due to the very low through traffic volumes, no right turn treatment is triggered. Refer to Tables 4 – 5 and Figure 9 for the turning warrants assessment.

Table 4: Warrants for the left turn treatments at the Old Hume Highway / Access 2 intersection

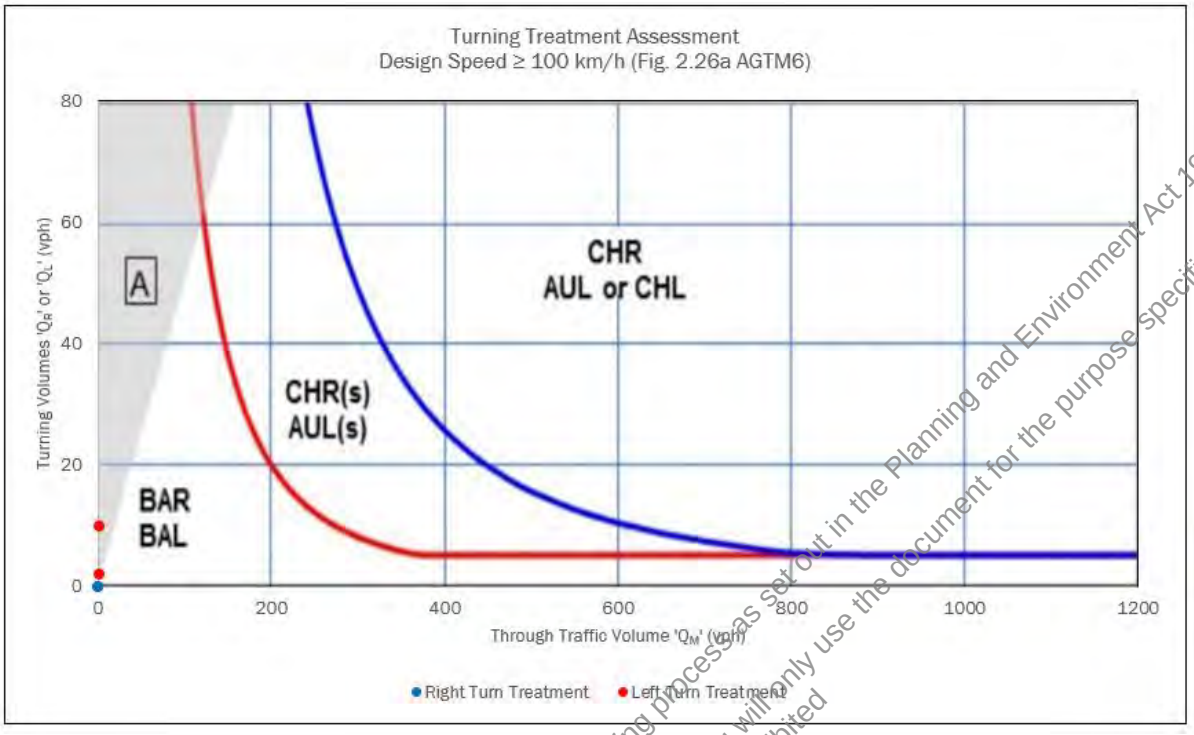
Road	Period	Q_{T2} vph	Q_L vph	Q_M vph	Warrants
Access 2	AM	1	2	1	BAL
	PM	1	10	1	BAL

Table 5: Warrants for the right turn treatments at the Old Hume Highway / Access 2 intersection

Road	Period	Q_{T1} vph	Q_{T2} vph	Q_L vph	Q_R vph	Q_M Vph	Warrants
Access 2	AM	1	1	2	0	0	N/A
	PM	1	1	10	0	0	N/A

Note: Traffic generation for Access 2 takes into consideration that Lots 1 to 6 have direct access to the Old Hume Highway

Figure 9: Graph used to determine the warrants for the left turn and right turn treatments at the Old Hume Highway / Access 2 intersection



As can be seen in Figure 9 above, the warrants for a basic left turn treatment (Type BAL) are triggered for the left turn movement only at the Old Hume Highway / Access 2 intersection.

As per Recommendation 3 of this report, the vegetation to the south west of Access 1 should be trimmed/removed to satisfy SISD requirements. In addition to these works, consideration should be given by Council/Regional Roads Victoria to extending the existing 60 km/h hour zone on Avenel Longwood Road to the north east of Access 1.

Conclusion 9: The existing 60 km/h zone on Avenel-Longwood Road should be extended approximately 500 m north east to include the intersection with Access 1.

Recommendation 4: That Council/Regional Roads Victoria consider the extension of the existing 60 km/h zone on Avenel-Longwood Road to include the intersection with Access 1.

Given the proposed residential frontage along the Old Hume Highway and the creation of Access 2 as part of this development, consideration should be given by Council/Regional Roads Victoria to reviewing the existing speed limit. As noted in Section 2.2.1 of this report, there is ambiguity surrounding the current speed zoning of this section of the Old Hume Highway (known as Spencer Street).

Conclusion 10: The existing speed zone on the Old Hume Highway should be reviewed given the ambiguity surrounding the current speed zoning of this section of the Old Hume Highway (known as Spencer Street).

Recommendation 5: That Council/Regional Roads Victoria review this section of the Old Hume Highway (known as Spencer Street), particularly the ambiguity surrounding the existing speed zone[4].

In the context of the very low traffic turn movements in the peak hours of (as show by the location of the movements in the bottom left corner of both Figures 8 and 9) Trafficworks considers the construction of a BAL and BAR treatment to be excessive.

This is further supported:

- for Access 1 when you consider the sight distance requirements for safe operation of the intersection is satisfied for the Avenel-Longwood Road when Recommendation 3 of this report is complied with.
- for Access 2 when you consider the sight distance requirements for safe operation of the intersection is satisfied for the Old Hume Highway.

Conclusion 11: Due to the low turn volumes, turn lane treatments are not considered to be required at the intersection of Access 1 with Avenel-Longwood Road.

Conclusion 12: Due to the low turn volumes, turn lane treatments are not considered to be required at the intersection of Access 2 with the Old Hume Highway.

5.5.3 Access Location & Operation

The proposed direct accesses from the subject site (Lots 1 to 7) to Old Hume Highway should be constructed generally in accordance with the Infrastructure Design Manual standard drawing SD255, Typical Swale Drain Vehicle Crossing Rural (Entrance) as shown in Attachment B.

Recommendation 6: That all direct accesses from the subject site (Lots 1 to 7) to the Old Hume Highway be constructed generally in accordance with the Infrastructure Design Manual standard drawing SD255, Typical Swale Drain Vehicle Crossing (Rural Entrance).

[4] assumed in this report to be the default rural speed limit of 100km/h

6 CONCLUSION

A traffic impact assessment was undertaken to determine the traffic impacts of the proposed residential development at Lovers Hill Estate, Avenel-Longwood Road, Avenel.

The subject site comprises land between the Old Hume Highway to the east, Town Zone (TZ) to the west and Farming Zone (FZ) to the north and south. The site is to be developed into a 36-lot residential development.

Vehicular access to the residential development is proposed to be provided by a combination of an internal access road and seven properties with direct access connecting to the Old Hume Highway. The proposed development also provides an internal access road connecting to Avenel-Longwood Road.

The key findings from the assessment are summarised below:

- the roads near the subject site do not have a traffic safety problem that requires urgent remedial action
- the proposed residential development is likely to generate a daily traffic volume of 324 vpd with a peak hour traffic volume of 31 vph
- the proposed internal road from Access 2 has straights that exceed the 250 m in length and will result in higher vehicular speeds
- the priority at the subject site Access 2 / Old Hume Highway intersection should be altered so that the development traffic has right of way
- sight distance requirements:
    - are satisfied at the subject site Access 1 / Avenel-Longwood Road intersection
    - are not satisfied at the subject site Access 1 / Avenel-Longwood Road intersection, with 270 m (at 3 m offset to the left) and 115 m (at 5 m offset to the left)
    - are satisfied at the subject site Access 2 / Old Hume Highway intersection
    - would be satisfied at the access driveways for Lots 1 to 6 that connect to the Old Hume Highway.
- the existing 60 km/h zone on Avenel-Longwood Road should be extended approximately 500 m north east to include the intersection with Access 1
- the existing speed zone on the Old Hume Highway should be reviewed given the residential development frontage and the intersection with Access 2 that will exist along the subject site frontage.
- due to the low turn volumes, turn lane treatments are not considered to be required at the intersection of:
    - Access 1 with Avenel-Longwood Road
    - Access 2 with the Old Hume Highway

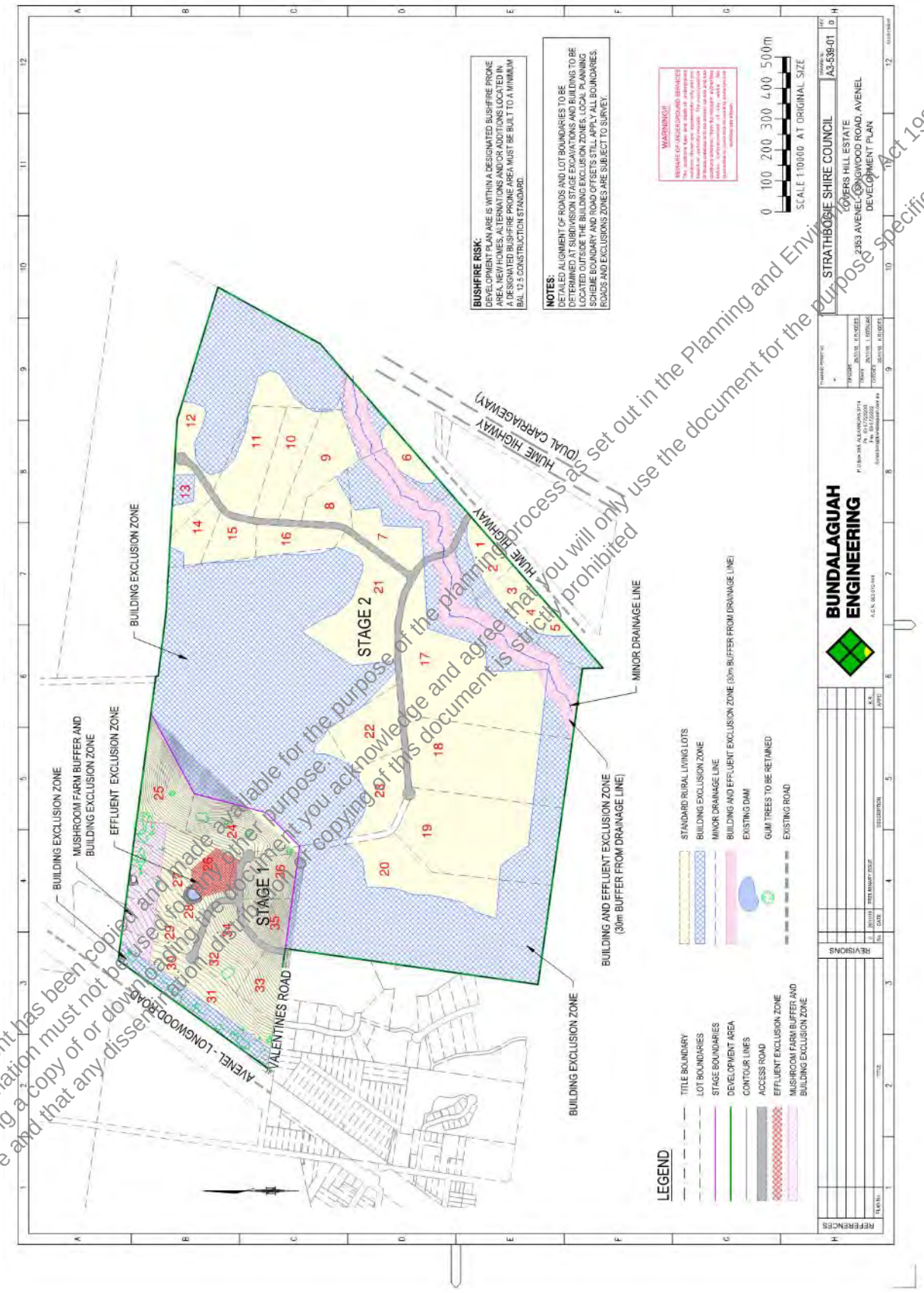
The key recommendations of the traffic impact assessment are summarised below:

- **Recommendation 1:** Ensure the proposed internal roads within the residential development are designed in line with the IDM design requirements.

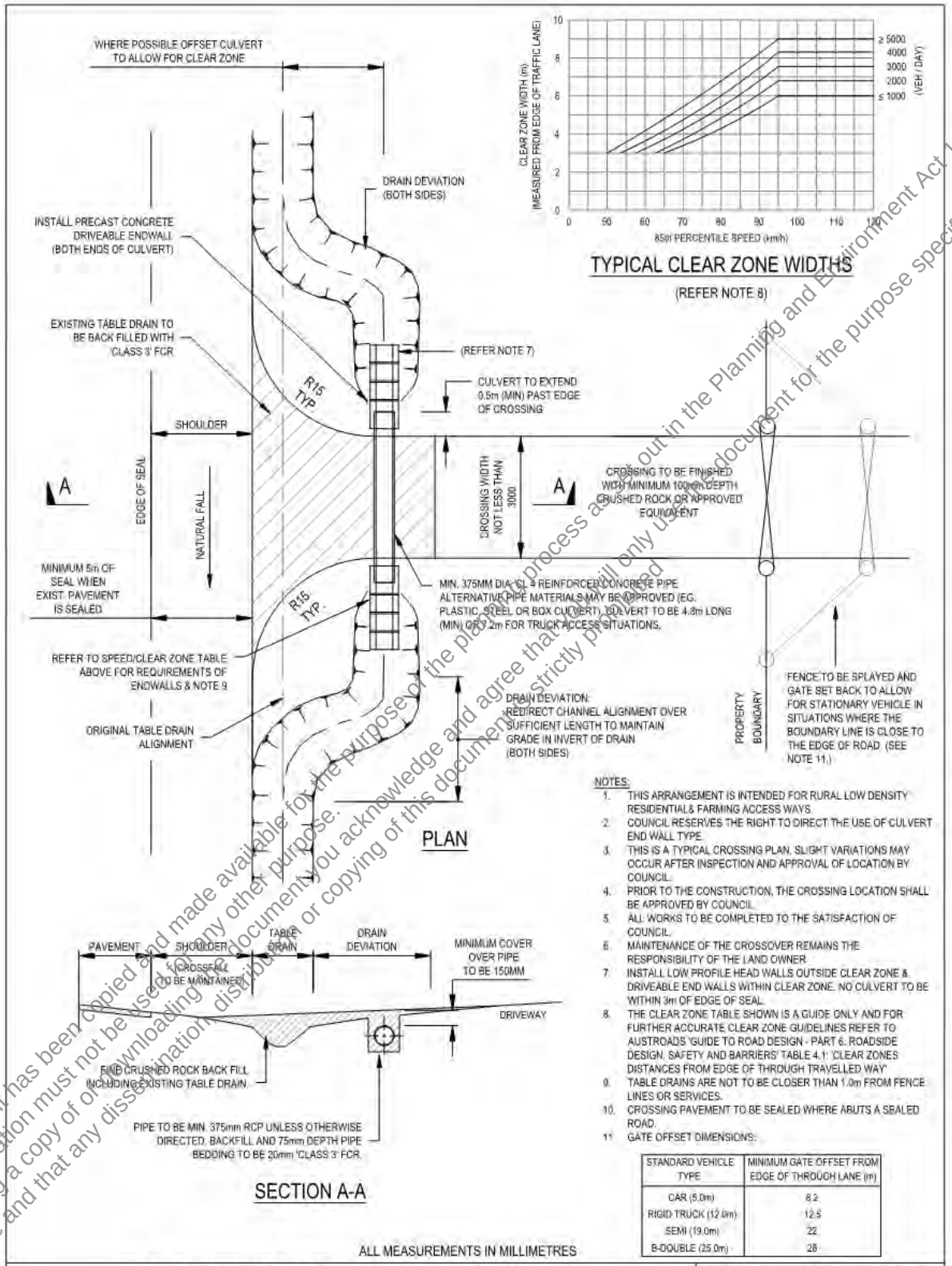
- **Recommendation 2:** Introduce traffic calming devices to the proposed internal road from Access 2.
- **Recommendation 3**: That vegetation be trimmed/removed to the south west of the subject site Access 1 / Avenel-Longwood Road intersection to satisfy the SISD requirements.
- **Recommendation 4:** That Regional Roads Victoria consider the extension of the existing 60 km/h zone on Avenel-Longwood Road to include the intersection with Access 1.
- **Recommendation 5:** That Council/Regional Roads Victoria review the existing default rural speed zone on the Old Hume Highway, specifically with consideration to the proposed residential development frontage and the intersection with Access 2.
- **Recommendation 6:** That all direct accesses from the subject site (Lots 1 to 7) to the Old Hume Highway be constructed generally in accordance with the Infrastructure Design Manual standard drawing SD255, Typical Swale Drain Vehicle Crossing (Rural Entrance).

Provided the recommendation is implemented, there are no traffic related reasons that would prevent this development from occurring.

ATTACHMENT A – PROPOSED SITE PLAN



ATTACHMENT B – STANDARD DRAWING



1st Floor 132 Upper Heidelberg Rd Ivanhoe Vic 3079
PO Box 417 Ivanhoe Vic 3079
ABN: 59 125 488 977
Ph: (03) 9490 5900 Fax: (03) 9490 5910
www.trafficworks.com.au

ENVIRONMENT MANAGEMENT PLAN

LOVERS HILL, AVENEL

2353 AVENEL-LONGWOOD ROAD, AVENEL 3664

Ellen Hogan & Associates P/L
Land Development Services
PO Box 658
Mansfield Vic 3724

Version 1

CONTENTS

1. Summary

All existing native vegetation is to be retained under this Environment Management Plan (EMP) As no native vegetation is to be removed there are no net gain targets to apply to the land due to the removal, lopping or fencing of the site.

New plantings and regeneration will be introduced along the northern boundary of the site with the Mushroom Farm and along the ephemeral water that runs parallel with Spencer Road on the eastern boundary.

In April – May 2019, Mr. Bill Richdale, Consulting Ecologist BSc., Dip EnvSc., MAppSc. (Member of the Ecological Society of Australia undertook a Vegetation Quality Assessment for 2353 Avenel-Longwood Road, Avenel. The purpose of this report was to undertake a vegetation and biodiversity assessment of the proposed development and to make recommendations on its management. His report whilst providing management options states the following in its conclusion (Page 13- 14)

> *Overall, due to the heavily degraded nature of the property, the proposed partial development will have a negligible impact on native vegetation and wildlife. The little native vegetation remaining on the property will be left largely undisturbed, however, some Juncus tussocks may be removed because of the rural living subdivision. As was discussed above, the overall condition of the property is heavily degraded through overgrazing, drought, and prior extensive clearing of native vegetation, thus, providing little suitable habitat for native wildlife. The proposed development seeks to protect the remaining trees on the property and the subsequent environment management proposal will only improve native wildlife habitat. In consideration of these factors, 2353 Avenel- Longwood Road is suitable for the proposed subdivision and will not impact upon the minimal native wildlife habitat that remains.*

Mr. Richdale's report discusses the opportunities for protecting existing and regenerated vegetation along the water to protect from stock and this is discussed in Stage 2 below.

All boundary fencing will be readjusted when surveyed to ensure they meet the requirements for the purposes of Clause 52.17 of the Strathbogie planning scheme. This will ensure no offsets are required due to setbacks from boundary fencing.

2. Property Location

The site is located on the east side of the Hume Highway on the north east side of the Avenel Township. Avenel Township is in the Shire of Strathbogie located between Seymour and Euroa. Avenel is one of our major towns in the Strathbogie Shire.

The Shire is situated in the Hume Region and its growth potential is high due to its location between two major highways, the Hume Freeway and the Goulburn Valley Highway.
The Hume Freeway connects Melbourne and Sydney and the Goulburn Valley Highway to Shepparton and beyond. Avenel is approximately one hour and 20 minutes from the Melbourne CBD.

The site is bound to the east by the Spencer Road and the Hume Freeway and to the west the Avenel-Longwood Road. The site is commonly known as “Lovers Hill”.

The Avenel area has high agricultural value for both broad acre grazing, cropping, intensive animal farming and horse industry.

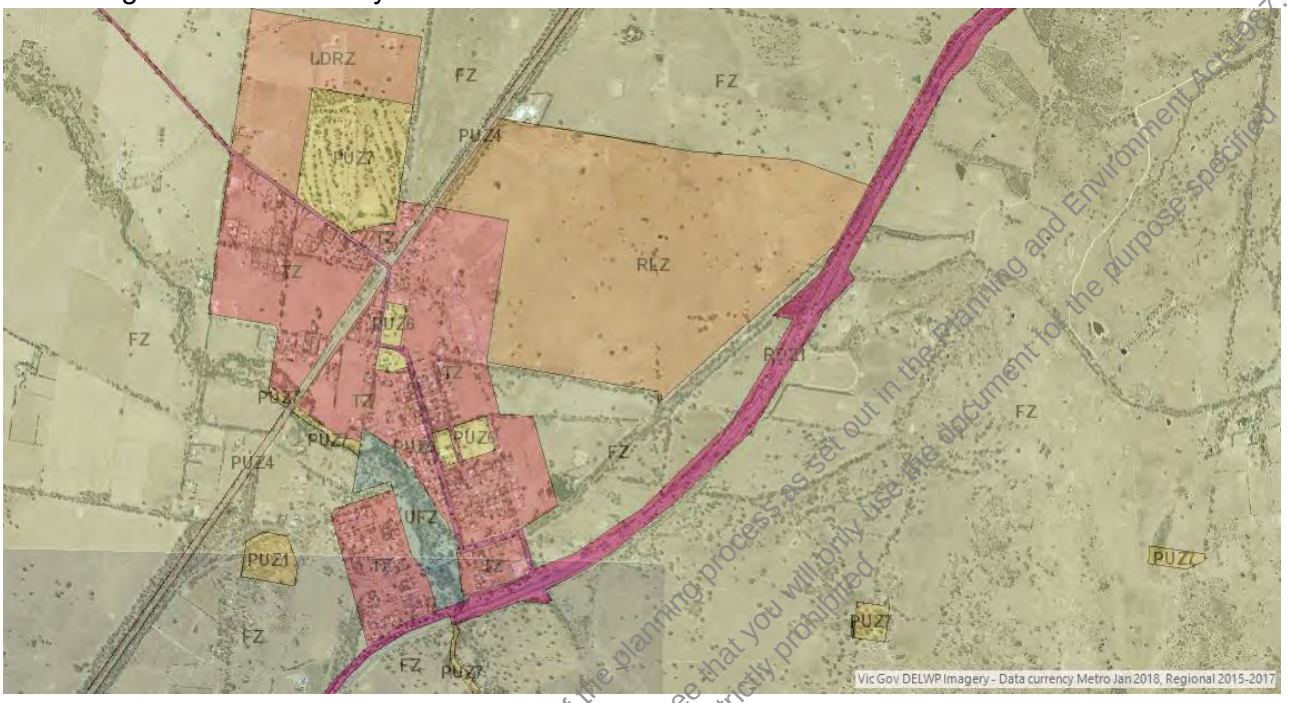


Diagram 1 – Aerial indicating location and zoning

3. Site description and topography

The property known as Lovers Hill has been used for many years for sheep grazing. The site contains various allotments that make up the total parcel of land to be developed.

The topography of the property is hill country with undulating areas on the west and eastern sides of the site. The steeper hill country dissecting the site makes for two distinct stages of development.

An ephemeral waterway and drainage lines running parallel with Spencer Road are located on its eastern boundary. There are scattered old paddock *Eucalyptus* trees throughout the property, along with patches of regenerated *Eucalyptus* trees along this waterway.

There is a strip of planted *Eucalyptus trees* along the southern fence-line within the property. A buffer of native vegetation is also located along the western boundary of the property and the Avenel – Longwood Road. Remnant vegetation is also established in part on the northern boundary with the Mushroom Farm

Relating to pasture areas, Mr. Richdale’s assessment of the site states (Page 7):

There are large areas of the property where the ground cover has been reduced to bare earth due to the extensive sheep grazing. Where there is ground covering grass and forbs, it is closely cropped, dead and difficult to identify. The grass and forbs present seem to be exotic pasture species.

Plan 2 below, prepared by Mr Paul Williams as part of his Land Capability Assessment for effluent disposal systems, indicates subdivision layout, contours, steeper slopes excluded from development, setbacks from waterways and drainage lines, and also boundary setbacks.

The plan highlights the topography of the site.

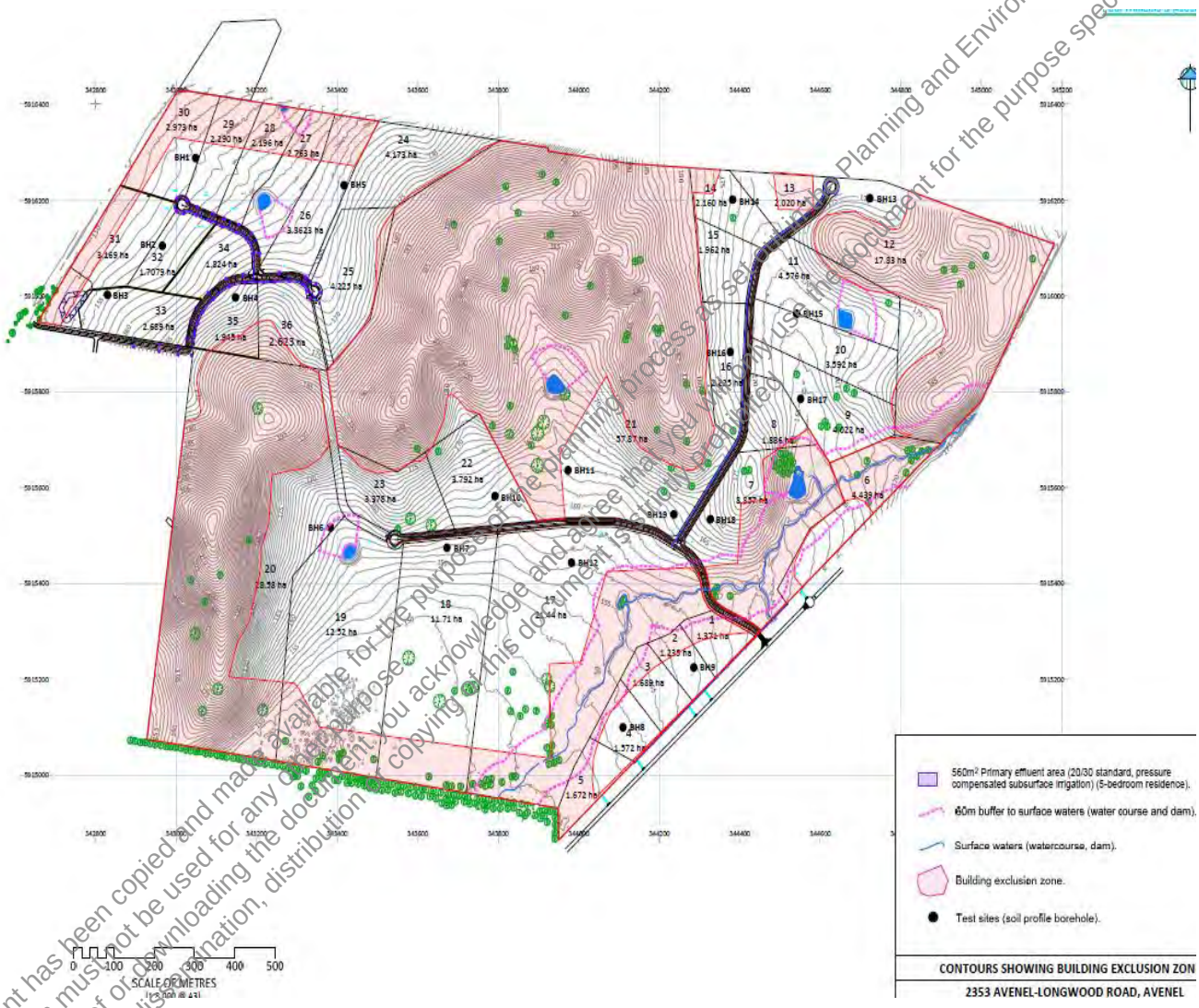


Diagram 2 – Map prepared by Paul Williams

4. Proposal

It is proposed to subdivide the property into thirty-six large rural living allotments. The site will be developed in two Stages. Each lot will be greater than 0.4 hectares in size with the largest allotment being 57.87 hectares. The larger allotments take in the majority of hill country. The remainder of the property will not be developed as indicated on diagram 3 above and in accordance with the Development Plan – Schedule 2 – Lovers Hill.

Stage one will be accessed via Valentines Road.

There is no native vegetation to be removed under this subdivision for either stages.

Access/egress to five allotments will be off Spencer Road and this access has been addressed in the Development Plan and through a separate report prepared by Bill Richdale dated August 2020.

5. Land Management Plan

5.1 Stage 1

Under stage one, extra pockets of trees will be planted within the buffer and building exclusion zone abutting the mushroom farm located on the northern boundary of the site as per the diagram below.

The building exclusion zones also takes in the western boundary along the Avenel-Longwood Road to protect existing native vegetation.

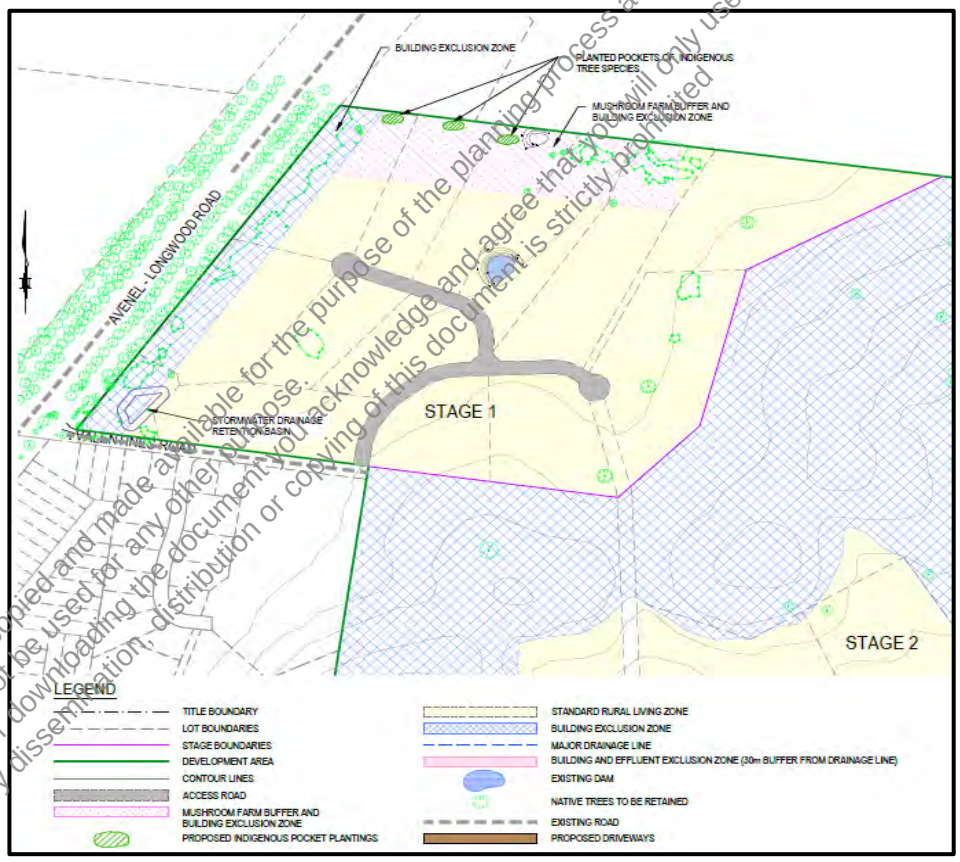


Diagram 3 – Stage 1 plantings

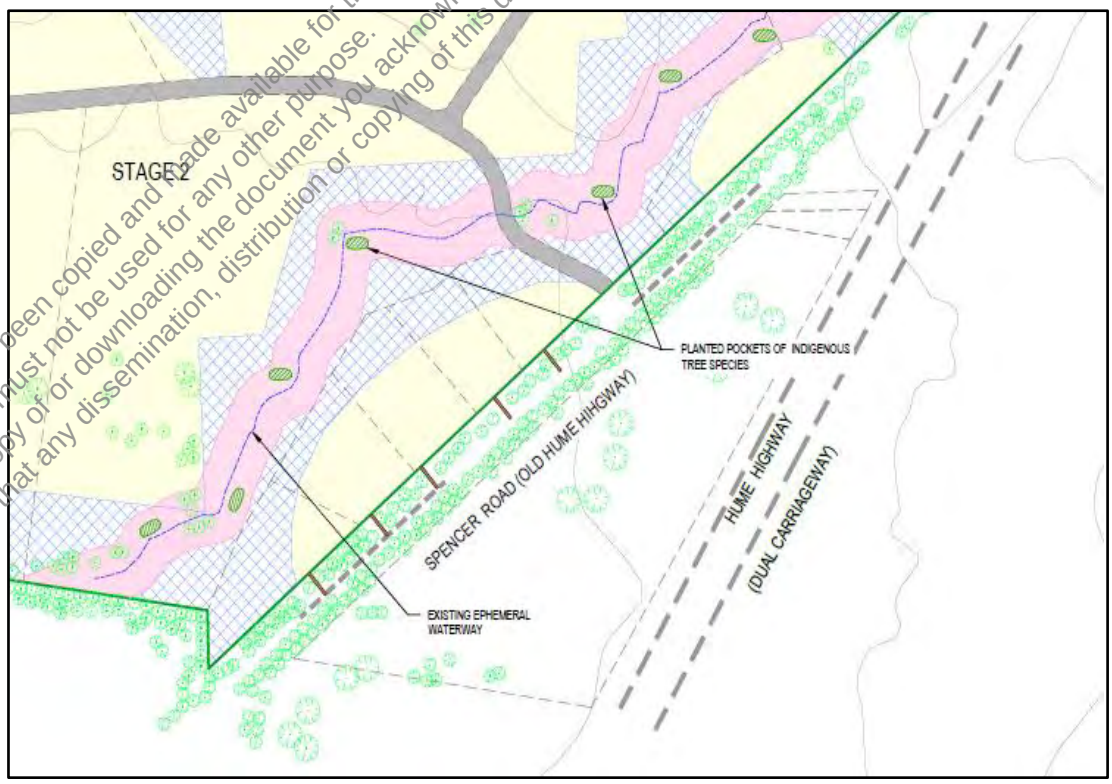
The stormwater drainage retention basin indicated on the plan above was required as part of a separate planning application for subdivision.

5.2 Stage 2

Stage 2 has an unnamed ephemeral waterway that runs parallel with Spencer Road. This waterway is to be included within three large allotments as indicated on the Development Plan.

Pockets of native vegetation will be planted along the waterway to improve soil stability and in areas where erosion has occurred during very heavy rainfall events.

Red gums will be the preferred trees planted along this waterway. Small pockets of trees as indicated in the picture on the right, are regenerating along the banks and these will be retained and encouraged to flourish. If stock were to be grazed on the property these pocket areas could be fenced to protect and enhance regeneration.



Pockets of trees will provide soil and erosion stability in areas where needed whilst not creating a thicket of trees along the entire length of the waterway where weeds and fire can easily spread. This approach will assist in managing weeds along the waterway itself.

The plantings along the waterway will require ongoing management by the developer initially and then landowners.

Where there is regeneration of Eucalyptus species occurring these should be fenced off from potential grazing. If the parent tree is nearby then the whole area should be excluded from grazing.

This should occur within the planned rural living lots and in the development exclusion zones. The scattered Eucalyptus trees should be excluded from grazing areas, that is fenced off, and if possible plantings of indigenous vegetation, including Eucalyptus seedlings, should occur around the tree — so that other patches of remnant woodland are created. The fencing of Eucalyptus trees and surrounds will allow the natural regeneration of Eucalyptus seedlings and hopefully other indigenous understorey vegetation, which otherwise may be trampled or grazed. In addition, the removal of nutrient load from sheep droppings and the compaction of soil around the lateral root zone of Eucalyptus trees can only assist in maintaining more healthy trees (Lindemayer et al 2016).

Areas of the property in the development exclusion zones should be re-vegetated with indigenous vegetation, in an effort to recreate woodland that can be used by native wildlife. Fallen branches, logs and rocks should be kept within all these fenced off areas.

The drainage lines or creaks riparian areas should be fenced and re-vegetated with deep rooted indigenous perennial grasses and forbs and planted with Eucalyptus trees (such as Eucalyptus camaldulensis), that will stabilise the banks and assist in preventing further erosion.

The larger the block of indigenous vegetation that can be created will provide greater habitat variety for native wildlife. Different animal species utilise different layers of woodland, that is why there needs to be structural diversity within the habitat zone.

Likewise, the dams could be partially fenced off from stock access and re-vegetated in appropriate indigenous vegetation. This would stop sediment flow into the dam, Improve water quality, whilst producing a wildlife asset, (Lindenmayer et al 2016). (Vegetation Quality Assessment for 2353 Avenel-Longwood Road, Avenel. April – May 2019, B. Richdale, Pages 13 – 14).

6. Ongoing Management

In Stage 1 the new trees to be planted will be within the building exclusion zone along the northern boundary. Significant trees to be retained can be advised to new landowners through a Section 173 Agreement.

In Stage 2 a Section 173 Agreement will be required for the three allotments to ensure the ongoing management and protection of existing, planted vegetation and regrowth areas along the waterway and the dam. This can be achieved through site specific EMP's for inclusion in Section 173 Agreements for each of the three allotments at subdivision stage.

The three landowners will be responsible for the ongoing management of new plantings following a specified timeframe negotiated between the Developer and the Strathbogie for the maintenance and care of these areas.

Large paddock trees to be protected

Sections of the waterway where grasses are acting as a filter for any sediment runoff

NORTH

AVENEL - LONGWOOD ROAD

BUFFER ZONE

STAGE 1

STORMWATER

STAGE 2

WATERWAY

WATERWAY

SPENCER ROAD

HUME HIGHWAY

LEGEND

NOTE: No native vegetation to be removed as part of the subdivision of both stages.

Ellen Hogan & Associates Pty. Land Development Services

TAYLOR CONSULTING ENGINEERS