

Land Capability Assessment

180 Star of the Glen Road, Bonnie Doon



Distribution

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Accreditation Land Capability Assessment for On-site Wastewater Management Certificate CET, 2015
 Experience 10 years' experience in geotechnical engineering and environmental assessments, with a focus on wastewater management across all states of Australia.

Edition	Description	Date
Rev0	Version 1	06/09/2022
Rev1	Version 2 – updated to include existing dwelling and GMW review	31/05/2023
Rev2	Version 3 – updated to include proposed office and GMW 2nd review	07/06/2023
Rev3	Updated wastewater load and recommendations	25/09/2024
Rev4	Minor update to site plan	01/10/2024

1. SUMMARY

The following summary table should be read in conjunction with the entire report.

<u>Designs wastewater load</u>	Proposed site use	3,600 L/day
<u>Soils characteristics</u>	<u>Horizon A</u>	<u>Horizon B</u>
Soil category	4a Clay Loam	4b Clay Loam
Indicative permeability	0.5-1.5 m/d	0.12-0.5 m/d
<u>Critical site features</u>	<ul style="list-style-type: none"> • With a potable water catchment area • Unnamed waterways and dams onsite • Steep sections of site • Potential high wastewater loading • Potential infrequent wastewater loading • Potential shallow rock at crest of hill. • Medium site risk rating. 	
<u>Minimum treatment requirements</u>	Secondary treated grey water or advanced secondary treated wastewater	
<u>Disposal system</u>	<u>Suitability</u>	<u>Area required</u>
Absorption trenches	Not suitable	N/A
Subsurface Irrigation	Suitable	1,560 m ²
ETA Beds	Suitable	410 m ²
Mound	Suitable	530 m ²
<u>Wastewater can be sustainably disposed to land</u>		Yes

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2. INTRODUCTION:

A.C. Geotechnical Pty Ltd (AC) have been engaged to undertake a Land Capability Assessment (LCA) for an approximately 17.57 ha site at 180 Star of the Glen Road, Bonnie Doon.

The objectives of the assessment was to determine the following:

- The capability of the site to sustainably manage wastewater within the allotment boundaries.
- A management program that should be put into place to minimise health and environmental impacts of on-site wastewater management, including the impact on surface water and groundwater, and

2.1 Proposed Development:

It is proposed to use the site short term accommodation with the proposed facilities:

- 3 x studio pods.
- 3 x two bedroom pods.
- Dwelling.
- Studio.

It is proposed to connect the existing three bedroom dwelling to the proposed septic system. No additions or alteration to the existing dwelling are proposed.

3. SITE DESCRIPTION:

3.1 Site Location:

The subject site is located on the east side of Star of the Glen Road, approximately 1.9 km north of the intersection with Glen Creek Road. The site is surrounded by similar size properties, the assumed land use of these properties is summarised in **Table 3.1**.

Table 3.1 -Surrounding land use

North	Native forest
South	Agriculture
East	Agriculture
West	Agriculture

3.2 Site Topography and Condition:

The site is roughly 'L' shaped with a ridge running in a north-south direction and a spur descending in an east-west direction at the north end of the site. Multiple gullies descend from the ridge on both the east and west side, none had flowing water at the time of this assessment (August). The gullies are marked as waterways on authority's maps. An unnamed creek is located at the west end of the site. A small dwelling and shed is located halfway up the spur, with a gravel access road connection to Star of the Glen Road. A farm dam is located downslope of the dwelling. Vegetation on the site comprises open pasture and scattered native trees. Site photographs are included in **Appendix B**.

3.3 Key Site Information:

Site Address	180 Star of the Glen Road, Bonnie Doon
Owner/Applicant	Abhi Garde
Local Council	Mansfield
Zoning	Farming Zone (FZ)
Total Land Area	Approximately 17.57 ha
Domestic Water Supply	Reticulated/Tank
Anticipated wastewater loads (Litres/day)	<u>EPA Code of practice - onsite wastewater management (2016)</u> <u>Glamping tent</u> 3 x studio pods (2 persons) = 300L/day = 900L/day 3 x two bedroom pods = 600L/day = 1,800L/day <u>Existing dwelling</u> Dwelling = 4x150 = 600L/day <u>Studio</u> Studio = 2x150 = 300L/day <u>Total Wastewater Loading</u> 3,600 L/day
Organic Material Loading Design Rates	<u>EPA Code of practice - onsite wastewater management (2016)</u> 60 g per person per day (19 x 60) = 1,140 g/day
Availability of sewer	Sewer is not likely to become available to this area in the near future
Groundwater Quality	Groundwater is classified as potable (500-1000 mg/L TDS) www.vvg.org.au
Water Table	Local registered bores in the area suggest the ground water is held approximately 10-50 m below the surface
Climate	Average annual rainfall 671 mm
Flood Potential	Outside a 1 in 100-year flood event
Water catchment area	Yes
Proximity to waterways	Unnamed water ways and dams
Vegetation	Pasture, scattered native trees
Exposure	Generally open
Slope	Gentle to steep
Landform	Hills
Erosion Potential	Moderate
Surface Drainage	Good
Rocks and Rock Outcrop	None
Mansfield Shire Sub Catchment Risk Rating	Low – Individual risk assessment undertaken (refer Section 3.5)

3.6 Mansfield Shire Domestic Wastewater Management Plan – Risk Rating:

Mansfield Shire Council requires a risk assessment to be undertaken using Edis Algorithm as per Mansfield Shire Council Land Capability Assessment Template. The Land Capability Assessment Matrix is included in **Section 5** with water balances is included in **Appendix D**.

Edis algorithm to determine site risk rating is outlined below with input data in **Table 3.6**.

$$(R_n) = ((R_{\text{Distance to reservoir/offtake point}} + R_{\text{Soil type rating}}) \times (R_{\text{Distance to river}} + R_{\text{Distance to stream}} + R_{\text{Distance to drain}} + R_{\text{Lot size}}) + (2 \times R_{\text{LCA}}) + (3 \times R_{\text{System fail rate}} \times R_{\text{Density}})) / 10$$

Table 3.6 -Risk assessment inputs.

LAND FEATURE	LAND CAPABILITY RISK RATING			RISK RATING
	LOW (Rating of 1)	MEDIUM (Rating of 2)	HIGH (Rating of 3)	
R res Distance to reservoir (km)	> 15 km	2 - 15 km	< 2 km	2
R soil Soil type rating (from Appendix C of the Edis Report)	1	2	3	1
R river Distance to River (m)	> 80 m	40 - 80 m	< 40 m	1
R stream Distance to Stream (m)	> 80 m	40 - 80 m	< 40 m	1
R drain Distance to Drain (m)	> 40 m	10 - 40 m	< 10 m	3
R lot Lot size (ha)	> 10 ha	2 - 10 ha	0.2 - 2 ha	1
R LCA LCA rating (from Table 5)	1 – 2	3	4 - 5	3
R fail System fail rate (%)	< 5 %	5 - 10 %	> 10%	2
R dens Density (dwellings/km2)	< 20	20 - 40	> 40	1

An individual side risk rating of 3.0 – Medium risk, has been allocated to this site.

4. SOIL ASSESSMENT AND CONSTRAINTS:

4.1 Soil Profile:

The soil profile encountered during the investigation consisted of near surface silt overlaying medium plasticity, orange/brown gravelly clay, refusal on inferred siltstone rock was encountered at a depth of 800 mm below the existing ground level.

The critical soil horizon are the medium plasticity gravelly clay and shallow siltstone rock.

No groundwater was encountered during this investigation.

No abnormal moisture conditions were identified through this assessment

Borelogs are included in **Appendix C**.

4.2 Site Exposure:

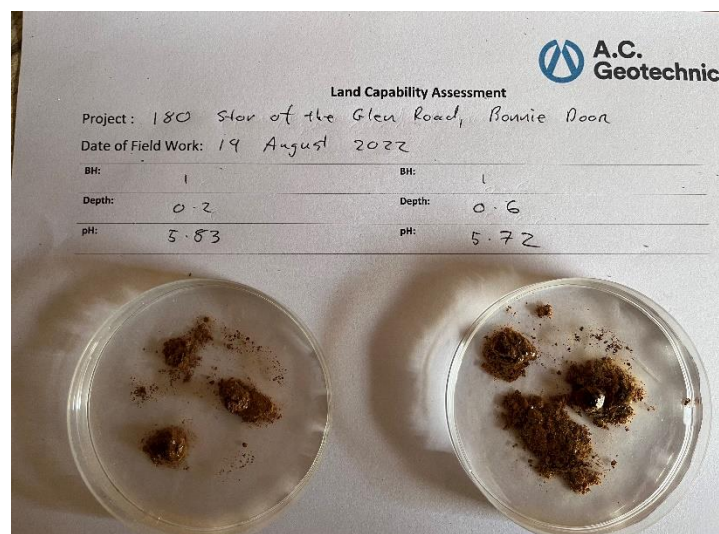
A general assessment of the site exposure is as follows:

The site is exposed to the prevailing winds. The proposed effluent disposal area is generally exposed to sun and wind all year round.

4.3 Soil Assessment:

Table 4.3 -Summary of soil assessment

BORE HOLE 1	SAMPLE DEPTH: 200mm		SAMPLE DEPTH: 600mm	
<u>SOIL ASSESSMENT</u> <u>(AS1547-2012)</u>	<u>SOIL HORIZON: A</u>		<u>SOIL HORIZON: B</u>	
Soil Colour	Orange/brown		Orange/brown	
Soil Texture	Clayey loam		Clayey loam	
Coarse Fragments (%)	,10%		,10%	
Soil Structure	Weak		Weak	
Soil Dispersion	Non-dispersive		Non-dispersive	
Soil Permeability	0.12-0.5mm/d		0.12-0.5mm/d	
Soil Category	4b		4b	
Design Irrigation Rate / Design Loading Rate	DIR	3.5 mm/d	DLR	6.0 mm/d
pH 1:5 Ratio Electronic Method	5.83		5.72	
Electrical Conductivity	0.071 dS/m		0.082 dS/m	
Salinity Hazard	Non-saline		Non-saline	



4.4 Field Assessed Permeability:

In situ permeability testing with a constant head permeameter was undertaken in multiple locations across the site, see site plan for locations in **Attachment A**, in accordance with AS 1547-2012 using the constant-head test method. The field assessed permeability was calculated using the Talsma-Hallam constantly maintained head of water equation identified in AS 1547-2012.

$$K_{sat} = \frac{4.4 Q [0.5 \sinh^{-1}(H/2r) - \sqrt{\{(r/H)^2 + 0.25\}} + r/H]}{2\pi H^2}$$

Where:

K_{sat} = saturated hydraulic conductivity of the soil in cm/min

4.4 = correction factor for a systematic under-estimate of soil permeability in the mathematical derivation of the equation

Q = rate of loss of water from the reservoir in cm³/min

H = depth of water in the test hole in cm

r = radius of the test hole in cm

Table 4.2 -Summary of insitu permeability

CONSTANT HEAD PERMEABILITY	
Rate of loss of water from reservoir (Q)	24.005 cm ³ /min
Indicative permeability (K_{sat})	0.015 m/day
Indicative permeability (K_{sat})	0.22 m/day

Note: The results in the table above are based on average readings taken from the test holes.

The corresponding K_{sat} value of 0.22 m/day in EPA Onsite Wastewater Management – Code of Practice Publication No. 891.4 July 2016 Appendix A Table 9 is category 4 (clay loam soil).

4.5 Critical site Features:

The critical site features are:

- With a potable water catchment area
- Unnamed waterways and dams onsite
- Steep sections of site
- Potential high wastewater loading
- Potential infrequent wastewater loading
- Potential shallow rock at crest of hill.
- Medium site risk rating.

5. LAND CAPABILITY ASSESSMENT MATRIX:

The table below is a Land Capability Assessment (LCA) following the EPA Publication 746.1. The LCA has been developed for the whole site however soils information relates to soils within the vicinity of the building envelop.

Table 5.1 -Land capability assessment matrix - Site

Land Features	Land Capability Class Rating					Site Rating	Comments	Mitigation
	Very Good (1)	Good (2)	Fair (3)	Poor (4)	Very Poor (5)			
General Characteristics								
Site drainage / runoff	No visible signs of dampness	Moist soil but no standing water		Visible signs of dampness i.e. water tolerant plants	Water ponding on surface	1	No abnormal moisture condition	N/A
Runoff	None	Low	Moderate	High	Very High	3	Steep site with multiple drainage gullies	Locate LAA on top of spur away from gullies
Flood / inundation potential (yearly return exceedance)	Never	< 1 in 100	>1 in 100 to < 1 in 20	> 1 in 20		1	No flood potential	N/A
Proximity to water courses	> 60 metres			< 60 metres		4	Unnamed waterways and dams onsite	N/A
Slope (%)	0 - 2	2 - 8	8 – 12	12 – 20	> 20	4	Steep sections of site	Locate LAA on top of spur, away from steep gullies

Landslip	No potential for failure		Low potential for failure	High potential for failure	Present or Past Failure	3	Low landslip potential	Locate LAA on top of spur, away from steep gullies
Groundwater table (m) seasonal watertable depth	>5.0	2.5 – 5.0	2.0 – 2.5	1.5 – 2.0	<1.5	1	Groundwater held between 10-50 m below the surface	N/A
Rock Outcrops (% of land surface containing rocks >200mm)	0%	<10%	10-20%	20-50%	>50%	1	None	N/A
Erosion Potential	No erosion potential	Minor	Moderate	High	Severe erosion potential	2	Minor due to steep slopes	Maintain current level of surface cover where practical
Exposure	High sun and wind exposure		Moderate	Low sun and wind exposure		1	High exposure to sun and wind	N/A
Landform	Hill crests, convex side slopes and plains		Concave side slopes and foot slopes		Floodplains and incised channels	1	Hill crest	N/A
Vegetation Type (land application area)	Turf or pasture				Dense Forest	1	Pasture and scattered trees	N/A
Fill	No Fill present		Fill Present			1	No fill encountered	N/A
Rainfall (mm/yr)²	<450	450 - 650	650 – 750	750 - 1000	>1000	3	Average annual rainfall of 660.9 mm	LAA size to be determined by water balance calculations
Pan evaporation (mm/yr)³	>1500	1250 - 1500	1000 – 1250	-	<1000	3	Annual evaporation of 1284.1 mm	LAA size to be determined by water balance calculations

Table 5.2 -Land capability assessment matrix - Soils

Soil Profile Characteristics								
Profile depth	>2.0m	1.5–2.0m	-	1.0–1.5m	<1.0m	4	Rock encountered at approximately 800 mm below surface	Shallow disposal method required
Shrinkage* (%)	Low <4%	Moderate 4-12%	High 12-20%	Very High >20%		2	Medium plasticity clays	N/A
Permeability* (m/d)	0.15–0.30	0.08–0.15 0.30-0.60	0.06-0.08 0.60-1.50	- 1.50-2.00	<0.06 >2.00	1	In-situ permeability of 0.22 m/d	LAA size to be determined by water balance calculations
Soil Permeability Category ¹	2 and 3	4		5	1 and 6	2	Clay loam	LAA size to be determined by water balance calculations
Coarse fragments* (%)	<10	10-20	20-40		>40	1	<10%	N/A
Emerson Test* (dispersion / slaking)	4,6,8	5	7	2,3	1	1	Non-dispersive	N/A
Electrical Conductivity (Ece) (dS/m)	<0.3	0.3-0.8	0.8-2.0	2.0-4.0	>4.0	1	Non-saline	N/A
pH	6-8		4.5-6		<4.5, >8	3	Slightly acidic	N/A

¹ Source: AS1547-2012

² Source BOM station – Eildon Fire Tower (088164)

³ Source BOM station – Eildon Fire Tower (088164)2019

* Relevant to soil layer(s) associated with wastewater application

6. MANAGEMENT PROGRAM:

The onsite wastewater system design and management program must suit the capability of the site and will consider the proposed development. The following sections discuss the inputs used to assess the suitability and requirements of EPA approved land based systems. Detailed design for the system is beyond the scope of this study.

6.1 Treatment System:

Based on site conditions, risk rating and high wastewater loading, advanced secondary treatment of effluent is considered necessary for sustainable management of wastewater.

An advanced secondary treatment system would likely involve an Aerated Wastewater Treatment System (AWTS) with disposal via a mound system. Alternatively, a sand filter could be used in place of the AWTS to reduce ongoing maintenance and power consumption.

If only greywater is to be produced, composting toilets are installed in place of plumbed toilets, an advanced treatment system is not required. All greywater would be required to be treated in a conventional primary septic tank with disposal via a mound system. The mound would provide secondary treatment of greywater.

6.1.1 Aerated Wastewater Treatment System (AWTS):

AWTS are pre-fabricated or pre-engineered treatment systems designed to treat small wastewater flows. They are tank-based systems that typically employ the following processes:

- Settling of solids and flotation of scum in an anaerobic primary chamber.
- Oxidation and consumption of organic matter through aerobic biological processes.
- Clarification – secondary settling of solids; and
- Disinfection prior to disposal.

Good maintenance of AWTS (e.g. removal of sludge) is essential to ensure a consistently high level of performance. By law, AWTS are required to be serviced quarterly by an approved maintenance contractor.

6.1.2 Sand Filters:

Sand filters provide advanced secondary treatment to water that has already undergone primary treatment in a septic tank or similar device. They contain approximately 600mm depth of filter media (usually medium to coarse sand, but other media can be incorporated) within a lined excavation containing an underdrain system. Selection of the filter media is critical, and a carefully designed distribution network is necessary. A dosing well and pump is normally used to allow periodic dosing. Depending on the desired level of treatment, sand filters can be single pass or may incorporate partial recirculation.

6.2 Treatment System Location:

Based on requirements of EPA 891.4, above-ground and in-ground treatment systems must comply with the same setback distances to building footings and boundary fences as land application systems.

6.2.1 Septic Tank Sizing:

A minimum septic tank/treatment plant capacity of 4000 L is required for this site, this would provide adequate storage during peak periods.

6.3 Land Application:

A range of possible land application systems have been considered, such as absorption trenches/beds, evapotranspiration/absorption (ETA) beds, mound systems and sub-surface irrigation. AS1547:2012 outlines factors affecting the construction and operation of common land application systems and a guide to selecting a system taking into consideration site features, subsurface soil conditions and identified constraints. The suitability of EPA approved land based systems are discussed in **Table 6.3.1**.

Table 6.3.1 Land Application System

Land Application	Description	Site Suitability
Absorption Trenches	Trenches are the most common type of land application system and are generally used on lots which are reasonably flat and where water soaks into the soil readily in all weather conditions. Commonly, distribution pipes, self-supporting arch trenching or box trenching are laid in trenches filled with aggregate/rock. Effluent then soaks into the surrounding soil.	Not considered suitable, due to large setback distances requires and shallow siltstone rock layer across the site.
ETA Beds	Beds are shallower forms of trenches. Because beds have smaller sidewall area compared with trenches, the absorption provided by sidewall loading is reduced. This is compensated for by reducing the design loading rate.	Suitable.
Mound System	A mound system permits the absorption area to be sited in a location where the natural water table or impermeable rock approaches the ground surface. The mound is filled with medium-grade sand to provide suitable filtering before intercepting the natural soils. A pump/siphon dosing system distributes effluent uniformly through a bed of aggregate placed at the top of the mound. The sand media in the mound system acts as a secondary treatment system, removing the need for a separate sand filter or AWTS, where on secondary treatment is required. Or provided an advanced secondary treatment system when used in conjunction with a sand filter of AWTS.	Suitable – preferred.
Sub-surface Irrigation	Subsurface drip irrigation requires secondary treated effluent dosing lines buried in the topsoil at shallow depth. Irrigation systems operate by both soil absorption and evapotranspiration from plants/trees	Limited Suitable with small wastewater load. Inadequate suitable space onsite with large wastewater loads.

6.3.1 Disposal systems:

Water balance modelling has been undertaken to calculate the minimum size of the LAA. The water balance takes into account the average rainfall, evaporation data, the daily effluent load, the design irrigation/loading rates for secondary treated effluent, the seasonal crop factor and the retained rainfall. The water balance model is designed so that the land application area is based upon a depth of saturated soil (i.e. water stored within indicative soil porosity) that meets the upper limits of acceptance for each land application method. The water balance must ensure that the soil can sustain growth during the summer months. The design system parameters used for the water balance calculations are summarised in **Table 6.3.2**.

Table 6.3.2 Design System Parameter

Treatment system	Application System	DIR / DLR	Runoff coefficient	Maximum storage depth
Primary treatment	Absorption trenches		<u>Not suitable</u>	
Secondary treatment	ETA Beds / wick trenches	10	25%	0 mm
	Mound System*	8	25%	0 mm
	Sub-surface irrigation	3.5	25%	0 mm

* Mound disposal system incorporates a secondary treatment sand media, removing the requirement for a separate secondary treatment system

6.4 Land Application Outputs:

Minimum Land Application Area (LAA) sizing for each application method was calculated using water balance calculations. LAA sizing calculations are included in **Appendix D**. The minimum required disposal area for each system is summarised in **Table 6.4**.

Table 6.4 Required Land Application Area (LAA)

Disposal system	Mixed use site
Wastewater output	3,600L / day
Subsurface irrigation	1560 m ²
ETA Beds / wick trenches	410 m ²
Mound	530 m ²

6.5 All wastewater:

If all wastewater is to be treated and disposed to site (toilets/showers/kitchen) an advanced secondary treatment system will be required. The preferred system for the treatment of all wastewater would be via an AWTs or sand filter with disposal via subsurface irrigation or ETA beds.

6.6 Composting toilets with greywater disposal:

If only greywater is collected (composting toilets are installed) a secondary treatment system for greywater would be required. This would involve treatment in a primary septic tank with secondary treatment and disposal via a mound.

6.7 Designated Area:

The Land Application Area (LAA) shall be located in a designated area to enhance evapotranspiration and shall:

- Not be used for purposes that compromise the effectiveness of the system or access for maintenance.
- Be used only for effluent application.
- Have boundaries clearly delineated by appropriate vegetation or other type of border.
- Have no run-off seepage or effluent beyond the designated area.

The site plan in **Appendix A** presents several potential areas suitable for LAA placement as well as setback areas from site features which must be maintained. Please note that the final LAA placement is the responsibility of the owner and should be included in a detailed design providing the minimum LAA and setback distances are maintained.

The required LAA will be smaller than that marked on the site plan. An appropriately sized LAA, as discussed in **Section 6.4**, must be located entirely within the area nominated on the site plan

Setback distances for advanced secondary treated wastewater and secondary treated greywater disposal are included in **Section 6.7.1**.

6.7.1 Setback Distances:

The minimum setback distances for advanced secondary treated wastewater and secondary treated greywater below should be used to assist in placement of wastewater envelopes for this site.

Table 6.4 Minimum Setback Distances

Landscape feature or structure	Setback distance (m) (Advanced secondary treated wastewater)	Setback distance (m) (Secondary treated greywater)
<u>Building</u>		
Wastewater field up-slope of building	3	3
Wastewater field down-slope of building	1.5	1.5
Wastewater field up-slope of cutting/escarpment	15	15
<u>Allotment boundary</u>		
Wastewater field up-slope of Allotment boundary	3	3
Wastewater field down-slope of Allotment boundary	1.5	1.5
<u>Services</u>		
Water supply pipe	1.5	1.5
Wastewater field up-slope of potable supply channel	150	150
Wastewater field down-slope of potable supply channel	10	10
Gas supply pipe	1.5	1.5
In-ground water tank	7.5	7.5
Stormwater drain	3	3
<u>Recreational areas</u>		
Children's grassed playground	3	3
In-ground swimming pool	3	3
<u>Surface water – up-slope of</u>		
Waterway, non-potable creeks, dams, channels	30	30
Waterway, potable creeks, dams, channels	50	50
<u>Groundwater bores</u>		
Category 2b to 6 soils	20	20

6.8 Monitoring, Operation and Maintenance:

The septic tank is de-sludged every 3 years; however, this frequency may vary depending on the following conditions.

- whether the tank is an adequate size for the daily wastewater flow
- the composition of the household and personal care products
- the amount of organic matter, fat, oil and grease washed down the sinks
- the use of harsh chemicals such as degreasers
- overuse of disinfectants and bleaches
- the use of antibiotics and other drugs, especially dialysis and chemotherapy drugs
- whether any plastic or other non-organic items are flushed into the tank.

After pump-out, tanks must not be washed out or disinfected. They should be refilled with water to reduce odours and ensure stability of plumbing fixtures. A small residue of sludge will always remain and will assist in the immediate re-establishment of bacterial action in the tank.

To ensure the treatment systems function adequately, residents must:

- Use soapy water (made from natural unscented soap), vinegar and water or bi-carbonate of soda and water to clean toilets and other water fixtures and fittings.
- Read labels to learn which bathroom and laundry products are suitable for septic tanks. Generally plain, noncoloured, unscented and unbleached products will contribute to a well-functioning septic tank.
- Use detergents with low levels of salts (e.g. liquid detergents), sodium absorption ratio, phosphorus and chlorine (see www.lanfaxlabs.com.au).
- Wipe oils and fats off plates and saucepans with a paper towel and dispose of in the kitchen compost bin.
- Use a sink strainer to restrict food scraps entering the septic system.
- Ensure no structures such as pavements, driveways, patios, sheds or playgrounds are constructed over the tank or absorption trench area.
- Ensure the absorption trench area is not disturbed by vehicles or machinery.
- Engage a service technician to check the sludge and scum levels, pumps and alarms annually.
- Keep a record of the location of the tank and the trenches and all maintenance reports (including the dates of tank pump-outs, tank inspections and access openings) and ensure the service technician sends a copy of the maintenance report to the local Council
- Have the tank desludged when the combined depth of the scum and sludge is equal to the depth of the middle-clarified layer.

Indications of failing septic tanks and soil absorption trenches

- Seepage along effluent absorption trench lines in the soil.
- Lush green growth down-slope of the soil absorption trench lines.
- Lush green growth down-slope of the septic tank.
- Inspection pits and/or the soil absorption trenches consistently exhibiting high water levels.
- Soil absorption trench lines become waterlogged after storms.
- General waterlogging around the land disposal area.
- Presence of dead and dying vegetation (often native vegetation) around and down-slope of the land disposal areas.
- A noxious odour near the tank and the land disposal area.
- Blocked water fixtures inside the house, with sewage overflowing from the relief point.
- High sludge levels within the primary tank (within about 150 mm of inlet pipe).
- Flow obstructed and not able to pass the baffle in the tank.
- The scum layer blocking the effluent outflow.

6.8.1 Storm Water Management:

All stormwater must be disposed of to the legal point of discharge.

Note: An agricultural drain (AG) must be installed on the high side of the wastewater envelop. The drain is to be installed a minimum of 100mm into the naturally occurring clay soils and allow sufficient fall to intercept and drain all overland and subsurface run-off to a legal point of discharge. If a legal point of discharge cannot be obtained, the drainage line may discharge directly to the surface soils, a minimum distance of 10 metres beyond the wastewater disposal area.

7. CONCLUSIONS:

From this investigation it is concluded that the use of an on-site wastewater treatment and disposal system is environmentally sustainable, although extremely limited, if the recommendations made in this report are followed.

8. REFERENCES:

- Environmental Protection Authority – Guidelines for Environmental Management Code of Practice – Onsite Wastewater Management, July 2016 ~ Publication 891.4
- Municipal Association Victoria (MAV) January 2014, Model Land Capability Assessment Framework
- Australian/New Zealand Standard AS/NZS 1547-2012 – On-site domestic wastewater management.
- A.C. Geotechnical Pty Ltd - Field and Laboratory data (where applicable) collected and recorded.
- Environmental Protection Authority - “Code of Practice - Septic Tanks”, March 1996” ~ Publication 451.
- Environmental Protection Authority, Information Bulletin- “Land Capability Assessment for onsite Domestic Wastewater Management”, March 2003 ~ Publication 746.1.
- Mansfield Shire Domestic Wastewater Management Plan Pilot Project - Part 2 Domestic Wastewater Management Plan - 19 August 2014.
- Mansfield Shire – Land Capability Assessment Template – High Risk Sites.





Notes

1. LAA must be setback a minimum of 3.0 m from all boundaries
2. LAA area must be setback a minimum of 1.5 m from the low side of the proposed dwelling.
3. LAA area must be setback a minimum of 30 m from the onsite dam and 50 m from waterways at base of gullies.
4. Minimum setback distances are outlined in **Section 6.7.1.**
5. The actual disposal area will likely be smaller than the nominated LAA.
6. The disposal system must be located entirely with the nominated LAA.
7. The nominated LAA is approximate and all required setback distances must be marked out onsite prior to installation.



Not to Scale
Investigation locations are approximate

Legend

-  Investigation Location
-  Suitable disposal area

Attachment A: Site Plan 22279

180 Star of the Glen Road
Bonnie Doon
Date of field work: 19 August 2022

Appendix B

Site Photographs



Appendix C

Borelog

Borehole Record BH01



**A.C.
Geotechnical.**

Page 1/1

Project Number	22279	Date	19/08/2022
Project Location	Land Capability Assessment 180 Star of the Glen Road, Bonnie Doon	Drilling Method Logged	HA AC
Depth (m)	Description		
0.00	SILT (ML); Dark brown, firm, moist.		
0.20	Gravelly, silty CLAY (CI): medium plasticity, orange/brown, stiff, moist, near plastic limit, minor sands.	Disturbed sample - 0.2 m	
		Disturbed sample - 0.6 m	
0.80	Borehole terminated - Refusal on siltstone rock		

Appendix D

Constant Head Calculations & Water Balance

INSITU CONSTANT HEAD PERMEABILITY



Project Address:	180 Star of the Glen Road	Project Number:	22279_Rev3
Location:	Bonnie Doon	Date:	25/09/2024
Client:	Abhi Garde		

INPUT DATA

Borehole		Reservoir	
Borehole diameter	100 cm	Diameter	97 mm
Borehole Depth	500 cm	Base area	295.4426 mm ²
Water level from surface	250 cm		
Depth of water in hole	250 cm		

FIELD DATA

	Test 1	Test 2	Test 3	Test 4	
Time intervals (min)	Water depth in reservoir				
Initial Depth	0	200	200	200	
5					
10					
15					
20	185	182	192	176	Average
Q (cm ² /min)	-273.284405	26.589834	11.817704	35.453112	-49.8559388
Ksat (cm/min)	-0.17564208	0.0170895	0.007595333	0.022786	-0.03204281
Ksat (m/d)	-2.52924596	0.246088797	0.109372798	0.328118395	-0.46141649

WATER BALANCE ETA BEDS



Project Address:	180 Star of the Glen Road	Project Number:	22279_Rev3											
Location:	Bonnie Doon	Date:	25/09/2024											
Client:	Abhi Garde													
INPUT DATA														
Daily flow allowance (per person)	0 L													
Daily wastewater volume	3600 L													
Effluent quality	Secondary													
Effective rainfall	0.75 %													
Soil texture	Clay loam													
Soil structure	Weak													
Soil category	0.12-0.5													
Indicative Permeability	0.12-0.5 Ksat													
ETA BEDS														
DLR	10 mm/d													
Porosity	40 %													
Maximum Storage Depth	0 mm													
Crop Factor - standard pasture	0.85	0.85	0.85	0.6	0.6	0.6	0.6	0.6	0.6	0.85	0.85	0.85		
crop factors -Lucene	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1		
Crop factor - Shade	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
Crop factor - woodlot	1	1	1	1	1	1	1	1	1	1	1	1		
Rainfall Data	Eildon Fire Tower (088164)													
Evaporation Data	Eildon Fire Tower (088164)													
Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (mm)		47.4	37.2	40.4	51.4	54.9	67.6	66.1	73.7	63.4	57.7	58.3	53	671.1
Evaporation (mm)		232	162.6	144.4	89.8	38.2	29.1	29	45	67	105.8	142.1	199.1	1284.1
Output														
Evapotranspiration (mm)		197.2	138.21	122.74	53.88	22.92	17.46	17.4	27	40.2	89.93	120.79	169.24	1017
Percolation (mm)		310	280	310	300	310	300	310	310	300	310	300	310	3650
Total Output (mm)		507.2	418.21	432.74	353.88	332.92	317.46	327.4	337	340.2	399.93	420.79	479.24	4667
Inputs														
Effective Rainfall (mm)		35.55	27.9	30.3	38.55	41.175	50.7	49.575	55.275	47.55	43.275	43.725	39.75	503.33
Application Rate (mm)		272.2	245.85	272.2	263.41	272.2	263.41	272.2	272.2	263.41	272.2	263.41	272.2	3204.9
Total Inputs (mm)		307.75	-418.2	302.5	301.96	313.37	314.11	321.77	327.47	310.96	315.47	307.14	311.95	3708.2
Storage Calculations														
Waste Loading (mm)		471.65	390.31	402.44	315.33	291.75	266.76	277.83	281.73	292.65	356.66	377.06	439.49	
Volume of Wastewater (mm)		111600	100800	111600	108000	111600	108000	111600	111600	108000	111600	108000	111600	1E+06
Cumulative Storage (mm)		0	0	0	0	0	0	0	0	0	0	0	0	
Area														410 m2
Width														3 m
Length														82 m

WATER BALANCE SUBSURFACE IRRIGATION



Project Address:	180 Star of the Glen Road	Project Number:	22279_Rev3											
Location:	Bonnie Doon	Date:	25/09/2024											
Client:	Abhi Garde													
INPUT DATA														
Daily flow allowance (per person)	0 L													
Daily wastewater volume	3600 L													
Effluent quality	Secondary													
Effective rainfall	0.75 %													
Soil texture	Clay loam													
Soil structure	moderate													
Soil category	4a													
Indicative Permeability	0.5-1.5 Ksat													
SUBSURFACE IRRIGATION														
DLR	3.5 mm/d													
Porosity	45 %													
Maximum Storage Depth	0 mm													
Crop Factor - standard pasture	0.85	0.85	0.85	0.6	0.6	0.6	0.6	0.6	0.6	0.85	0.85	0.85		
crop factors - Lucene	0.95	0.9	0.85	0.8	0.7	0.55	0.55	0.65	0.75	0.85	0.95	1		
Crop factor - Shade	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4		
Crop factor - woodlot	1	1	1	1	1	1	1	1	1	1	1	1		
Rainfall Data	Eildon Fire Tower (088164)													
Evaporation Data	Eildon Fire Tower (088164)													
Parameter	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month		31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall (mm)		47.4	37.2	40.4	51.4	54.9	67.6	66.1	73.7	63.4	57.7	58.3	53	671.1
Evaporation (mm)		232	162.6	144.4	89.8	38.2	29.1	29	45	67	105.8	142.1	199.1	1284.1
Output														
Evapotranspiration (mm)		197.2	138.21	122.74	53.88	22.92	17.46	17.4	27	40.2	89.93	120.79	169.24	1017
Percolation (mm)		108.5	98	108.5	105	108.5	105	108.5	108.5	105	108.5	105	108.5	1277.5
Total Output (mm)		305.7	236.21	231.24	158.88	131.42	122.46	125.9	135.5	145.2	198.43	225.79	277.74	2294.5
Inputs														
Effective Rainfall (mm)		35.55	27.9	30.3	38.55	41.175	50.7	49.575	55.275	47.55	43.275	43.725	39.75	503.33
Application Rate (mm)		71.538	64.615	71.538	69.231	71.538	69.231	71.538	71.538	69.231	71.538	69.231	71.538	842.31
Total Inputs (mm)		107.09	-236.2	101.84	107.78	112.71	119.93	121.11	126.81	116.78	114.81	112.96	111.29	1345.6
Storage Calculations														
Waste Loading (mm)		270.15	208.31	200.94	120.33	90.245	71.76	76.325	80.225	97.65	155.16	182.06	237.99	
Volume of Wastewater (mm)		111600	100800	111600	108000	111600	108000	111600	111600	108000	111600	108000	111600	1E+06
Cumulative Storage (mm)		0	0	0	0	0	0	0	0	0	0	0	0	
Land area required														1560 m2

NUTRIENT BALANCE



A.C. Geotechnical.

Project Address:	180 Star of the Glen Road	Project Number:	22279_Rev3
Location:	Bonnie Doon	Date:	25/09/2024
Client:	Abhi Garde		
Nitrogen Balance -Nitrogen			
Hydraulic Loading	3600	l/day	
Effluent N concentration	25	mg/l	
Daily N loading	90000	mg/day	
Annual N loading	32850000	mg/year	
Denitrification loss	20	%	
Denitrification loss	26280000	mg/year	
Total annual N loading	26.28	kg/year	
Plant uptake	220	kg/ha/year	
Minimum area for uptake	1195	m ²	

Appendix E

Property Reports

From www.planning.vic.gov.au at 19 August 2022 04:21 PM

PROPERTY DETAILS

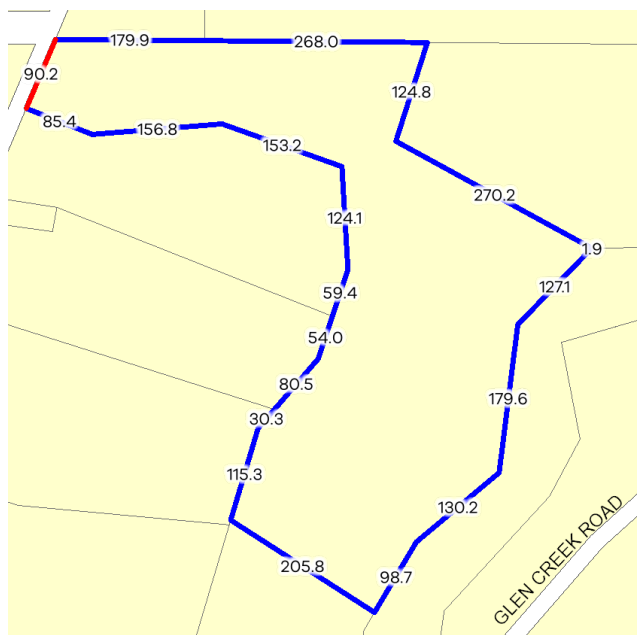
Lot and Plan Number: **Lot 8 PS316101**
 Address: **180 STAR OF THE GLEN ROAD BONNIE DOON 3720**
 Standard Parcel Identifier (SPI): **8\PS316101**
 Local Government Area (Council): **MANSFIELD** www.mansfield.vic.gov.au
 Council Property Number: **A7566**
 Directory Reference: **Vicroads 47 G9**

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

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

SITE DIMENSIONS

All dimensions and areas are approximate. They may not agree with those shown on a title or plan.



Area: 175656 sq. m (17.57 ha)

Perimeter: 2535 m

For this property:

— Site boundaries

— Road frontages

Dimensions for individual parcels require a separate search, but dimensions for individual units are generally not available.

Calculating the area from the dimensions shown may give a different value to the area shown above

For more accurate dimensions get copy of plan at [Title and Property Certificates](#)

UTILITIES

Rural Water Corporation: **Goulburn-Murray Water**
 Urban Water Corporation: **Goulburn Valley Water**
 Melbourne Water: **Outside drainage boundary**
 Power Distributor: **AUSNET**

STATE ELECTORATES

Legislative Council: **NORTHERN VICTORIA**
 Legislative Assembly: **EILDON**

PLANNING INFORMATION

Planning Zone [RURAL LIVING ZONE \(RLZ\)](#)
[RURAL LIVING ZONE - SCHEDULE 1 \(RLZ1\)](#)

Planning Overlay [BUSHFIRE MANAGEMENT OVERLAY \(BMO\)](#)
[ENVIRONMENTAL SIGNIFICANCE OVERLAY \(ESO\)](#)
[ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 1 \(ESO1\)](#)

Areas of Aboriginal Cultural Heritage Sensitivity:

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

Planning scheme data last updated on 17 August 2022.

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

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

For details of surrounding properties, use this service to get the Reports for properties of interest.

To view planning zones, overlay and heritage information in an interactive format visit <https://mapshare.vic.gov.au/vicplan>

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

Areas of Aboriginal Cultural Heritage Sensitivity

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

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

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

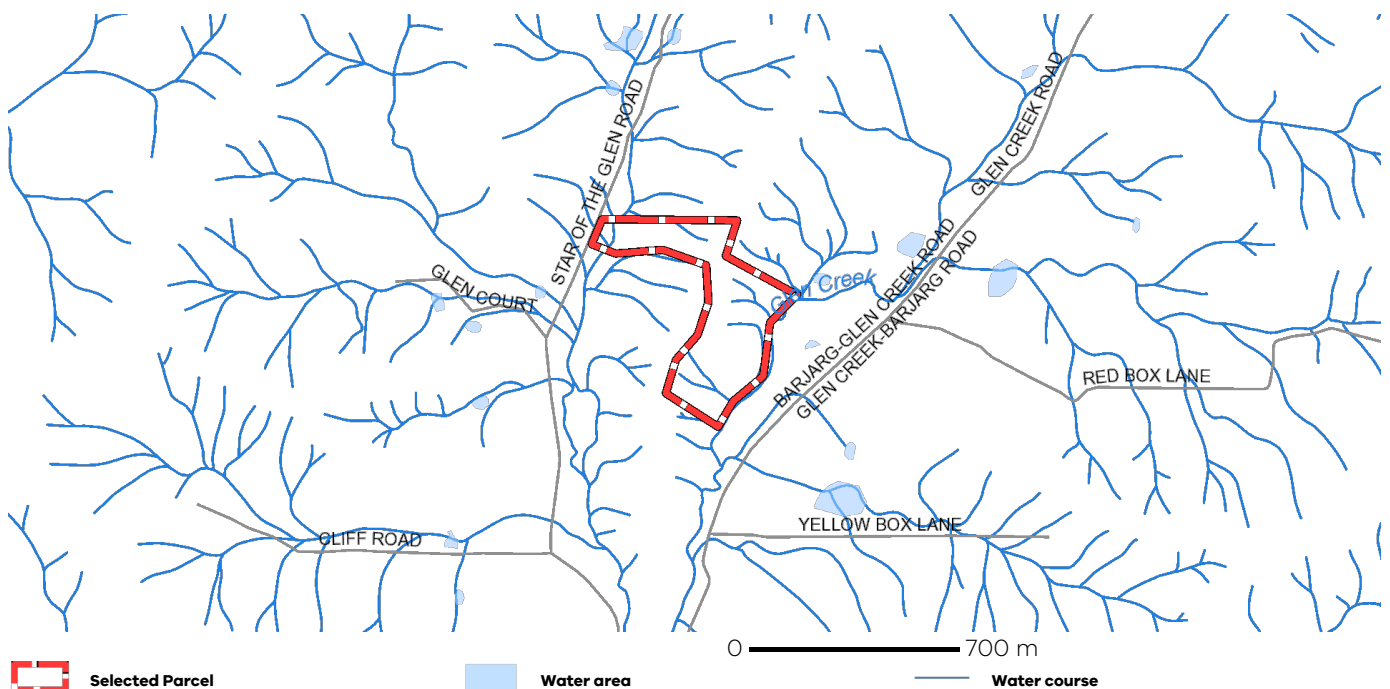
If a significant land use change is proposed (for example, a subdivision into 3 or more lots), a cultural heritage management plan may be triggered. One or two dwellings, works ancillary to a dwelling, services to a dwelling, alteration of buildings and minor works are examples of works exempt from this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

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

For further information about whether a Cultural Heritage Management Plan is required go to <http://www.aqv.nrms.net.au/aqvQuestion1.aspx>

More information, including links to both the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2018, can also be found here - <https://www.aboriginalvictoria.vic.gov.au/aboriginal-heritage-legislation>

Area Map



From www.planning.vic.gov.au at 19 August 2022 11:39 AM

PROPERTY DETAILS

Address: **180 STAR OF THE GLEN ROAD BONNIE DOON 3720**

Lot and Plan Number: **Lot 8 PS316101**

Standard Parcel Identifier (SPI): **8\PS316101**

Local Government Area (Council): **MANSFIELD**

Council Property Number: **A7566**

Planning Scheme: **Mansfield**

Directory Reference: **Vicroads 47 G9**

www.mansfield.vic.gov.au

[Planning Scheme - Mansfield](#)

UTILITIES

Rural Water Corporation: **Goulburn-Murray Water**

Urban Water Corporation: **Goulburn Valley Water**

Melbourne Water: **Outside drainage boundary**

Power Distributor: **AUSNET**

STATE ELECTORATES

Legislative Council: **NORTHERN VICTORIA**

Legislative Assembly: **EILDON**

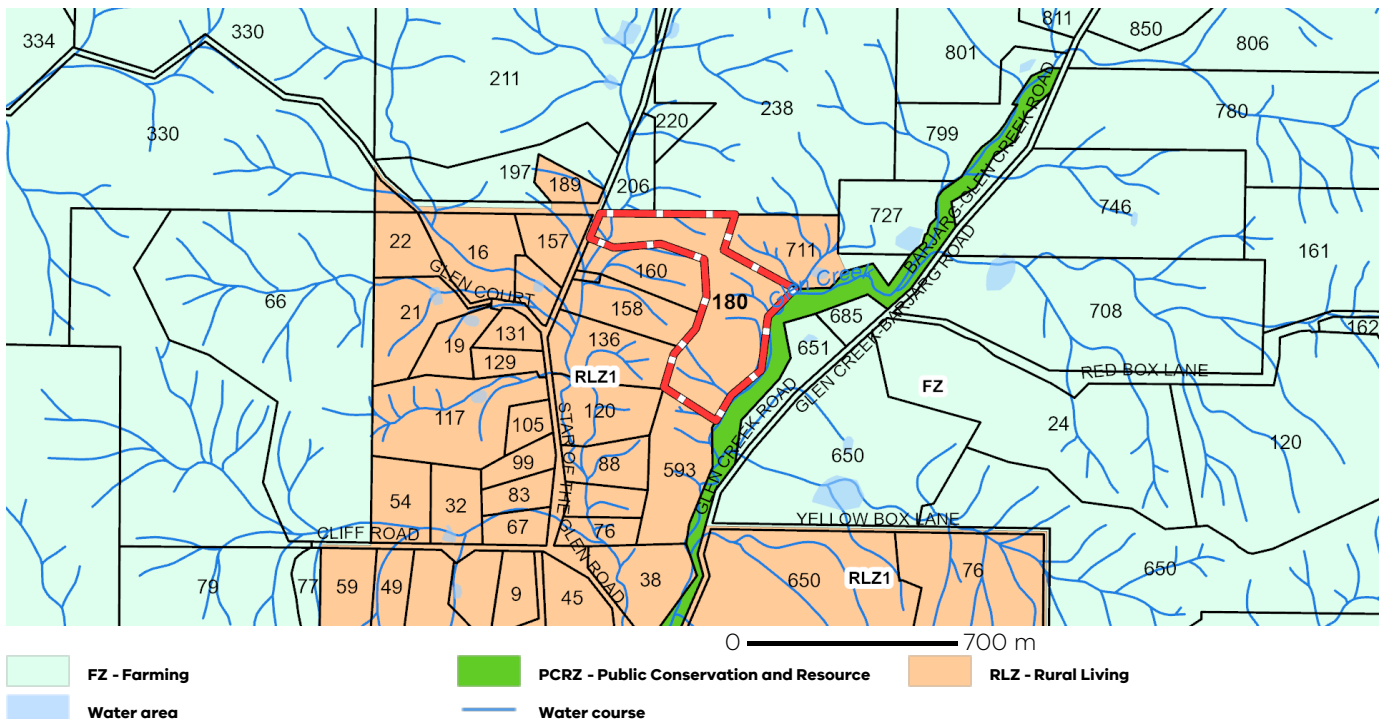
OTHER

Registered Aboriginal Party: **Taungurung Land and Waters
Council Aboriginal Corporation**

[View location in VicPlan](#)

Planning Zones

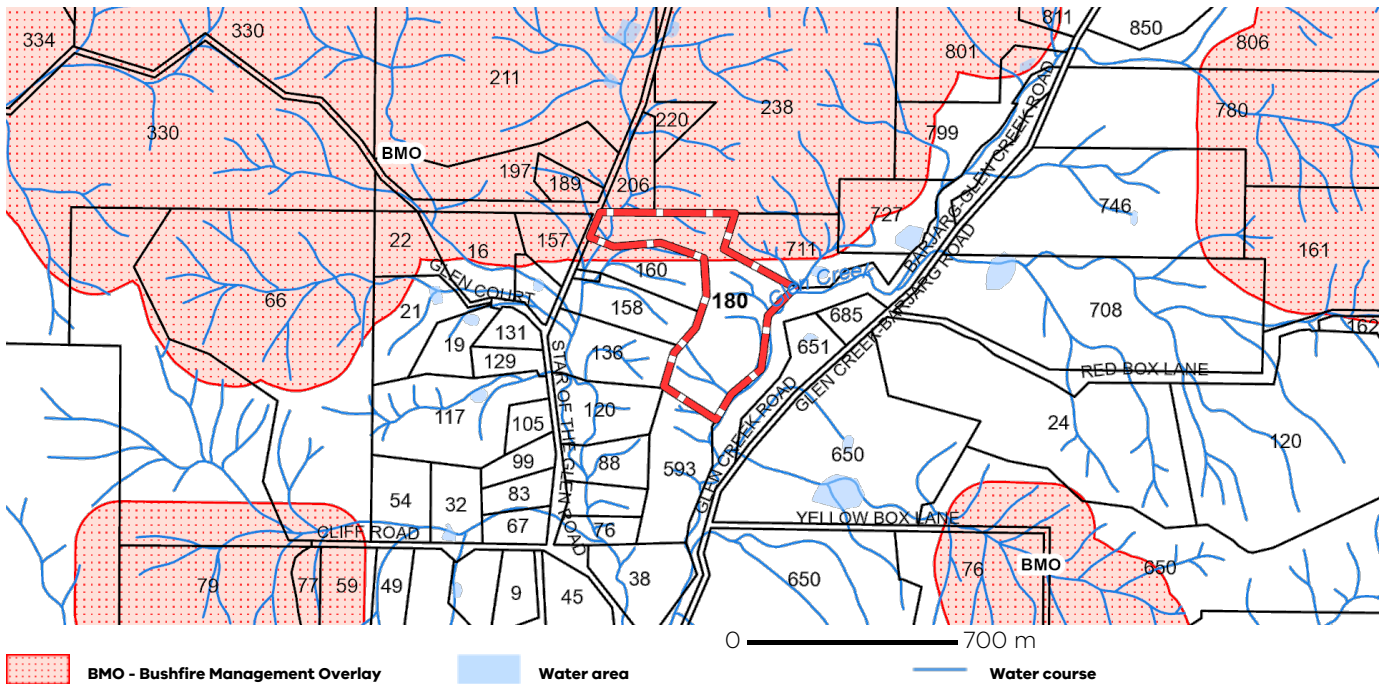
[RURAL LIVING ZONE \(RLZ\)](#)
[RURAL LIVING ZONE - SCHEDULE 1 \(RLZ1\)](#)



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

Planning Overlays

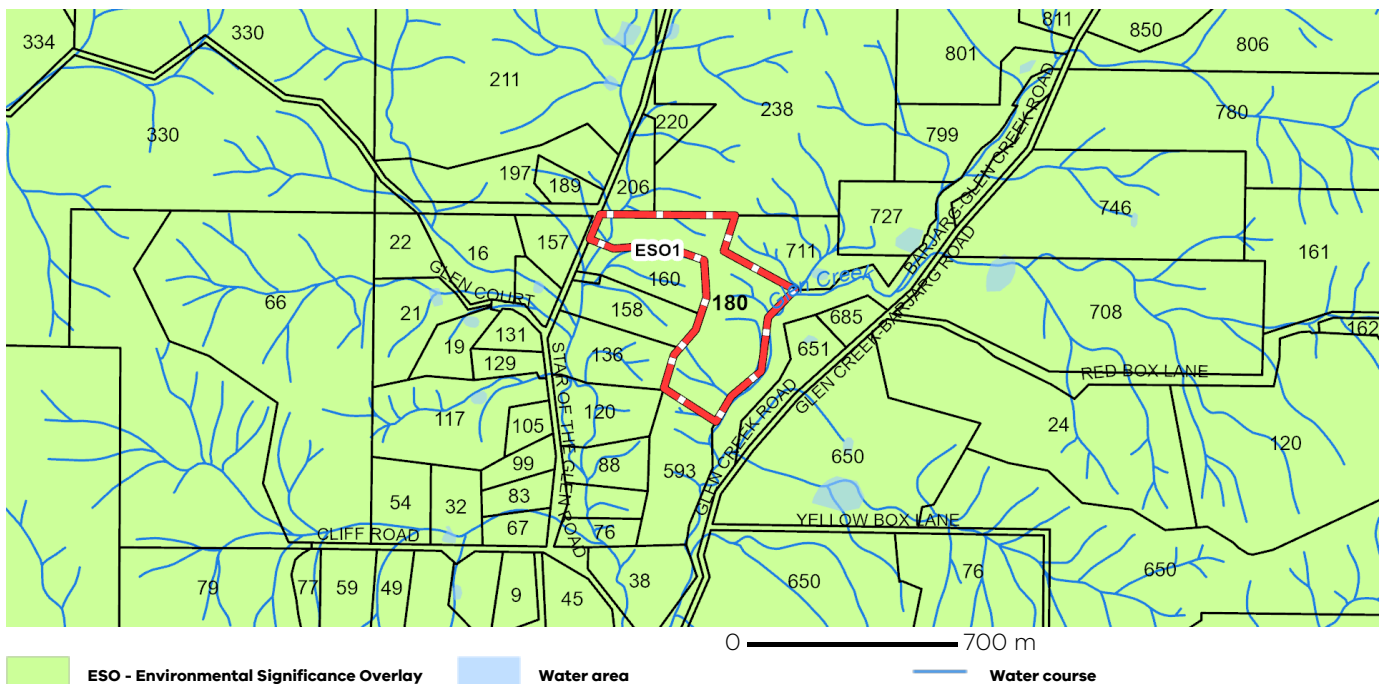
BUSHFIRE MANAGEMENT OVERLAY (BMO)



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

ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO)

ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 1 (ESO1)



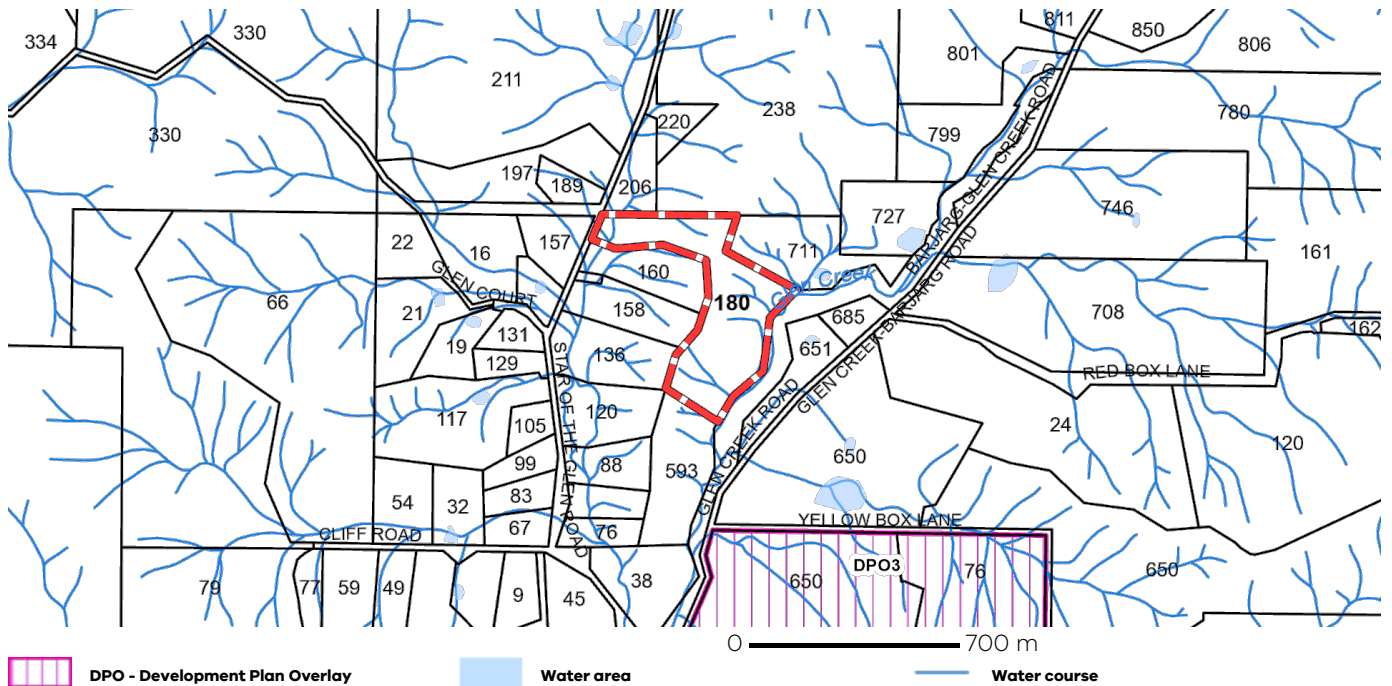
Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

Planning Overlays

OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

DEVELOPMENT PLAN OVERLAY (DPO)



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

Areas of Aboriginal Cultural Heritage Sensitivity

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

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

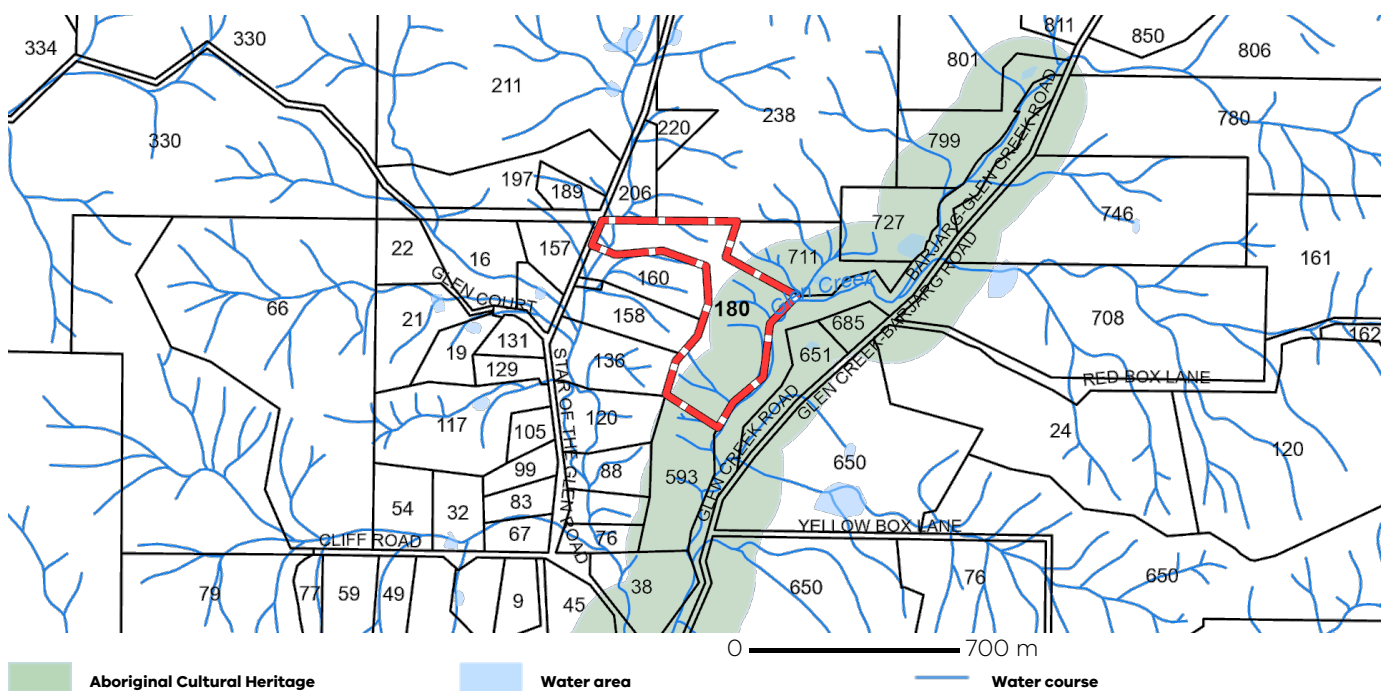
Under the Aboriginal Heritage Regulations 2018, 'areas of cultural heritage sensitivity' are one part of a two part trigger which require a 'cultural heritage management plan' be prepared where a listed 'high impact activity' is proposed.

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

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

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

More information, including links to both the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2018, can also be found here - <https://www.aboriginalvictoria.vic.gov.au/aboriginal-heritage-legislation>



Further Planning Information

Planning scheme data last updated on 17 August 2022.

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

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For details of surrounding properties, use this service to get the Reports for properties of interest.

To view planning zones, overlay and heritage information in an interactive format visit <https://mapshare.maps.vic.gov.au/vicplan>

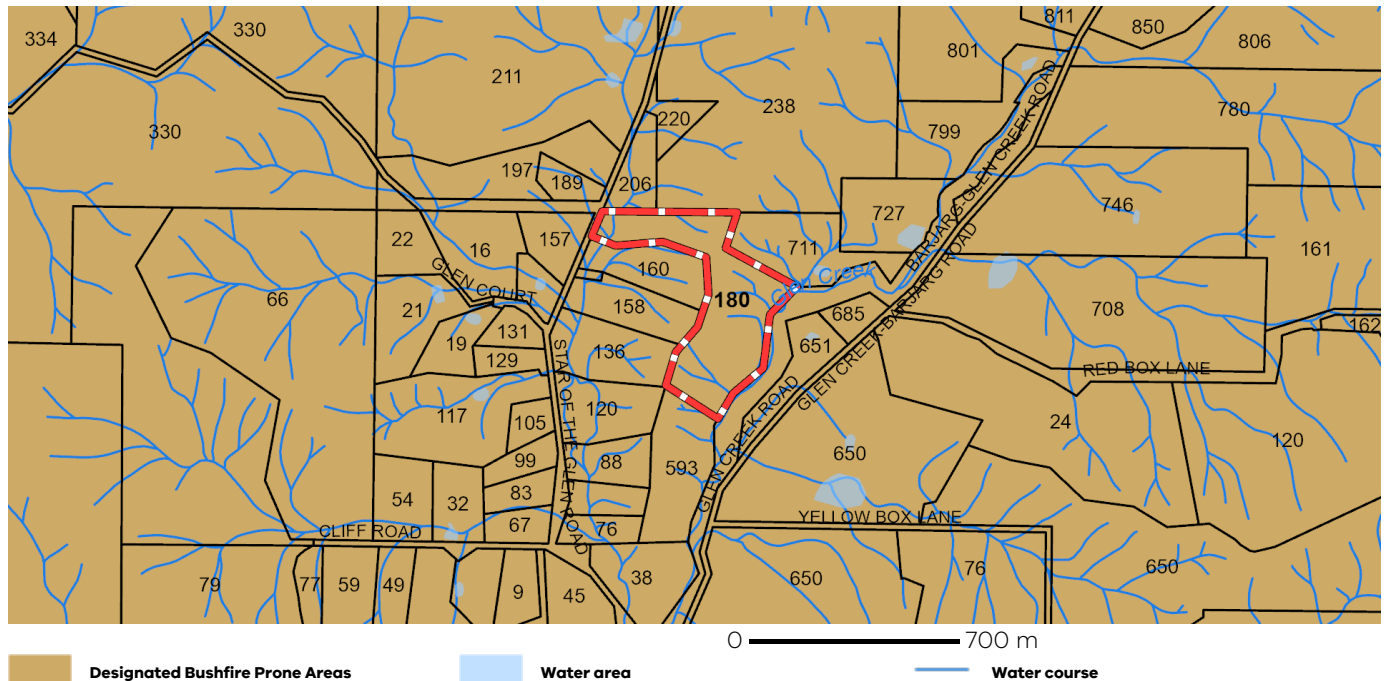
For other information about planning in Victoria visit <https://www.planning.vic.gov.au>

Designated Bushfire Prone Areas

This property is in a designated bushfire prone area. Special bushfire construction requirements apply to the part of the property mapped as a designated bushfire prone area (BPA). Planning provisions may apply.

Where part of the property is mapped as BPA, if no part of the building envelope or footprint falls within the BPA area, the BPA construction requirements do not apply.

Note: the relevant building surveyor determines the need for compliance with the bushfire construction requirements.



Designated BPA are determined by the Minister for Planning following a detailed review process. The Building Regulations 2018, through adoption of the Building Code of Australia, apply bushfire protection standards for building works in designated BPA.

Designated BPA maps can be viewed on VicPlan at <https://mapshare.vic.gov.au/vicplan/> or at the relevant local council.

Create a BPA definition plan in [VicPlan](#) to measure the BPA.

Information for lot owners building in the BPA is available at <https://www.planning.vic.gov.au>.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website <https://www.vba.vic.gov.au>. Copies of the Building Act and Building Regulations are available from <http://www.legislation.vic.gov.au>. For Planning Scheme Provisions in bushfire areas visit <https://www.planning.vic.gov.au>.

Native Vegetation

Native plants that are indigenous to the region and important for biodiversity might be present on this property. This could include trees, shrubs, herbs, grasses or aquatic plants. There are a range of regulations that may apply including need to obtain a planning permit under Clause 52.17 of the local planning scheme. For more information see [Native Vegetation \(Clause 52.17\)](#) with local variations in [Native Vegetation \(Clause 52.17\) Schedule](#)

To help identify native vegetation on this property and the application of Clause 52.17 please visit the Native Vegetation Information Management system <https://nvim.delwp.vic.gov.au/> and [Native vegetation \(environment.vic.gov.au\)](https://www.environment.vic.gov.au) or please contact your relevant council.

You can find out more about the natural values on your property through NatureKit [NatureKit \(environment.vic.gov.au\)](https://www.environment.vic.gov.au)

