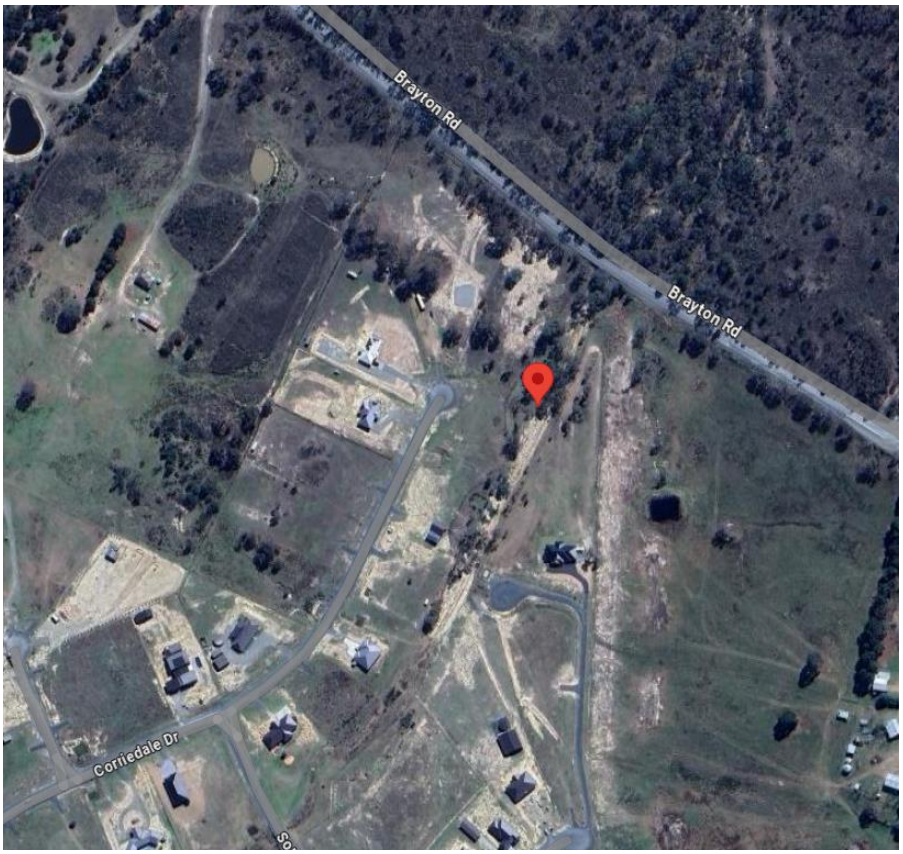
DEVELOPMENT APPLICATION



Document:	On-Site Wastewater Management Disposal Report
Project:	Nine Lot Subdivision
Location:	84 Corriedale Dr, Marulan (Lot 26 DP 1271846)
LGA:	Goulburn-Mulwaree Council
Prepared for:	Mr Oscar Merhebi
Revision:	A
Date:	21/05/2024
Project Reference:	21060-001

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Client	Mr Oscar Merhebi
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EXECUTIVE SUMMARY

Overview

This **Wastewater Management Report** has been prepared by **AKT Engineering & Consulting** on behalf of Mr Oscar Merhebi (the Applicant). It accompanies a Response to Submissions Report in support of Development Application (DA) for nine Lot subdivision to Goulburn-Mulwaree Council with regards to the land at No.84 Corriedale Drive, Marulan(the site).

The aim of the 'onsite wastewater management study' is to analyse the site, soil, public health, and economic aspects that influence the selection, location, and design of an on-site wastewater management system.

• Assessing the site's suitability for on-site wastewater management:

• Identify the most appropriate on-site wastewater management solution for the proposed development.

The assessment was prepared to assess compliance with related requirements described in:

- Australian Standard AS/NZS 3500 Plumbing and Drainage 2018
- Environment and Health Protection Guidelines (1998) On-site Sewage Management for Single Households (Department of Local Government)
- Sydney Catchment Authority Neutral or Beneficial Effect (NorBE) on Water Quality Assessment Guideline (2022)
- Water NSW (2019), Designing and Installing On-Site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice
- Goulburn Mulwaree Regional Council Development Control Plan (2009) Local Government Act 1993
- Australian Standard AS1547: 2012” On-site Domestic Wastewater Management”

This report is based on survey information available, architectural, and landscaping documentation for construction. The extent of the hydraulic model is restricted to the extent of survey.

On review of your project, and assessment of all the required elements, we do not foresee any costly items, or technical issues that would preclude this development from proceeding.

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1. INTRODUCTION

1.1. PURPOSE

The preparation of this wastewater management report is based on our understanding of the requirements and our understanding of the local conditions and constraints in attempting this type of development.

In undertaking the preparation of this water quality report, AKT hereby advised that it has no control over any approvals, additional 3rd party requirements, competitive development costs, nor does it have any control over any increase in statutory fees or future availability of external water quality capacity.

This wastewater management report & summary produced by AKT will therefore be provided on the basis of its best judgement as an experienced and qualified engineering consultant, familiar with the construction industry.

1.2. SITE LOCATION

The site is situated 26 km southeast of Goulburn, within the Goulburn Mulwaree Council Local Government Area (LGA) and is located within the boundaries of the Pejar Local Land Council (Pejar LALC; Aboriginal Land Council 2024). It has an area of approximately 2.22ha and contains an existing dwelling and container as well as areas of exotic grassland, regenerating grass and shrubland and areas of remnant trees. The property also contains a third order watercourse running parallel to its eastern border. The existing site will be subdivided into nine large lot residential(R5 Zoned) lots (**Figures 1 &2**).The lots range in size from approximately 2,000 to 5,561.067 m², providing ample space for residential development. The new lots Subdivision will be assessed from Corriedale Drive and Brayton Rd. Marulan .

Local Government	Goulburn _Mulwaree Council	
Water Supply	Town	
Daily wastewater	No, bedroom in the proposed. Dwelling (As per waters)	Assume 4 bedrooms **=1200 L/day**
Proposed wastewater treatment:	AWTS	
Proposed wastewater disposal:	Subsurface irrigation	

Table 1: Description of the development

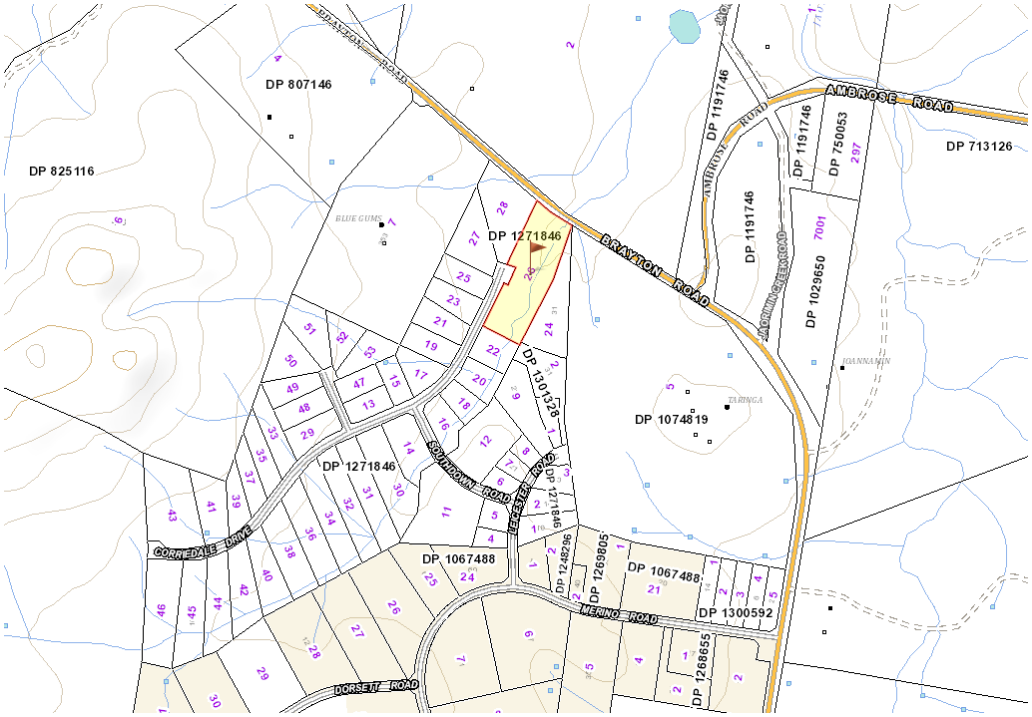


Figure 1: Image obtains from Spatial Map viewer.

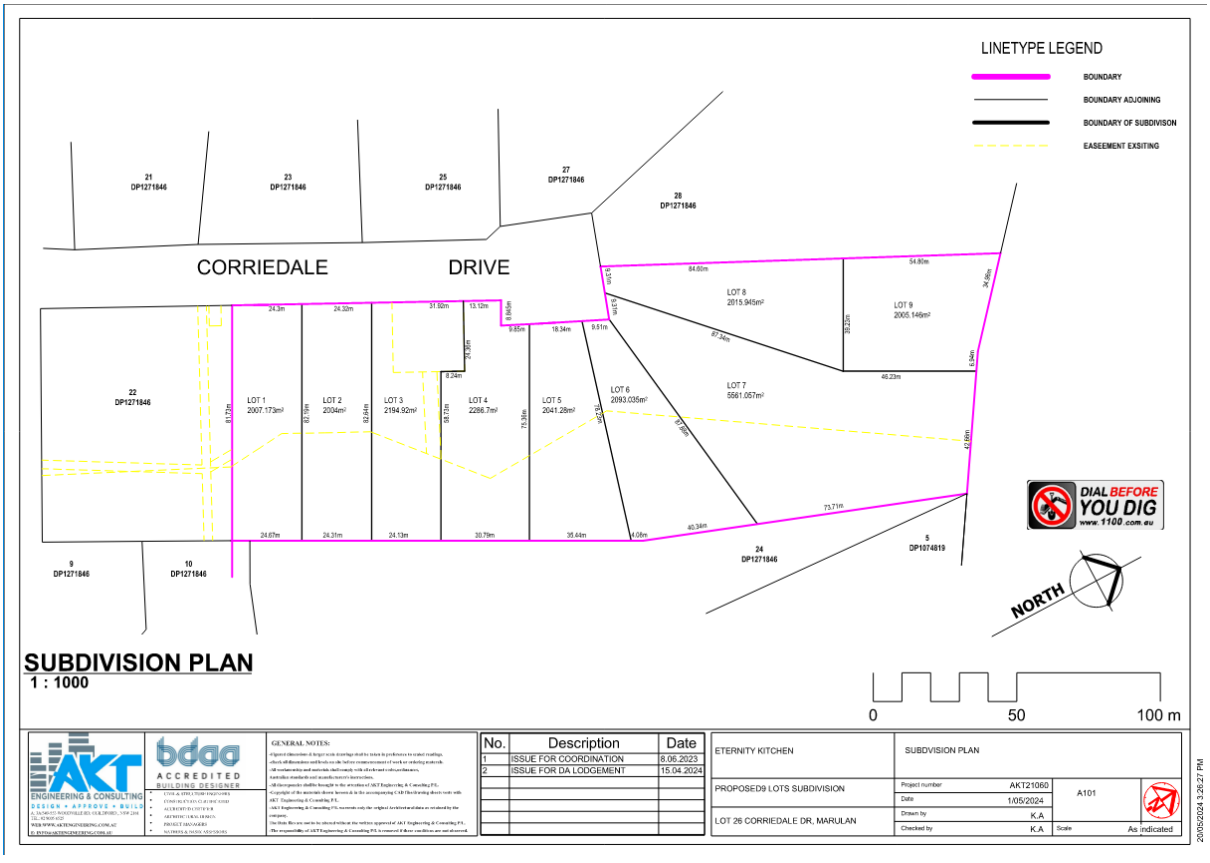


Figure 2: Proposed Subdivision Layout

1.3. SOIL CHARACTERISTICS

The development site is part of the Goulburn 1:250,000 Sheet map and report, and it is situated on the Bindook Road Soil Landscape, according to Hird C. (1991). Alluvial-colluvial material generated from parent rock was used to form the Bindook Road Soil Landscape in situ.

Additionally, it is connected to isolated instances of Goodmans Ford Soil Landscapes in the northern regions (Hird C., 1991). The majority of the site is situated in the type 2b soil horizon, which is made up of fine sandy loam topsoils layered above yellow clay loams.

It is anticipated that there would be moderate sheet erosion and moderate erodibility in the topsoil and subsurface layers. They should have moderate fertility and a pH of neutral soil. It should be noted that no site-specific soil profile studies have been done to verify.

AKT Engineering & Consulting conducted fieldwork on 8th May 2024. This design is based on the main investigation of the site's soils, topography, and hydrology seen on the day of inspection. This assessment was conducted in preparation for the installation of an Aerated Wastewater Treatment System (AWTS) for wastewater treatment and subsurface irrigation for wastewater disposal.

Characteristic	Level of Constraint			Assessed Level of Constraint for Site
	Nil or Low	Moderate	High	
General Characteristics				
Climate (difference between average annual rainfall and average pan evaporation, mm/year)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	
Exposure to sun and wind	Full sun and/or high wind or minimal shading and North / North-East / North-West aspect	Dappled light East / West / South-East / South-West aspect	Limited patches of light and little wind to heavily shaded all day and South aspect	
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake Turf or pasture	Limited variety of vegetation	Sparse vegetation or no vegetation, dense forest with little understorey	
Landslip (or landslip potential)	Nil	Low to moderate	High or Severe	
Slope Form (affects water shedding ability)	Hill crests, convex or divergent side-slopes and plains	Straight side-slopes and footslopes	Floodplains, concave or convergent side-slopes and incised channels	
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	
Slope gradient (%):				
(a) for absorption trenches and beds	<5%	5-15%	>15%	
(b) for surface/ subsurface irrigation	<10%	10-20%	>20%	
Erosion (or potential for erosion)	Nil or Low	Moderate	Severe	
Fill (imported)	No fill at present or fill is good quality topsoil or minimal fill required	Moderate coverage and good quality fill	Extensive poor-quality fill and variable quality fill	
Flood frequency (AEP)	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	
Privet bore used for household/drinking water purposes	No bores onsite or on neighbouring properties	>30m to the nearest privet bore	<30m to the nearest privet bore	

Proximity to water resources	>100m	<100m but reduced setback is supported (refer to Section 5.2.2 of the GSP)	<100m and reduced setback is not supported (refer to Section 5.2.2 of the GSP)	
Groundwater (wettest time of the year)	>2m	2.0 – 0.6m need for fill to achieve setbacks listed in Appendix 1	<0.6m fill is not practical to achieve setbacks listed in Appendix 1	
Land area available for LAA	Exceeds the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Meets the minimum required LAA size of AS1547 or Schedule 2 of the GSP	Insufficient area available for LAA as per AS1547 or Schedule 2 of the GSP	
Rock outcrops (% of surface)	<10%	10-20%	>20%	
Site Drainage (qualitative)	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness Moist soil but no standing water in soil pit.	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface	
Stormwater run-on/run-off	Low likelihood of stormwater run-on/run-off	Moderate likelihood of stormwater run-on/run-off, need for diversionary structures	High likelihood of inundation by stormwater run-on/run-off, diversion not practical	
Soil profile characteristics				
Soil permeability Category (AS1547)	2 and 3	4 and 5	1 and 6	
Profile depth	>2m	2.0-1.0	< 1.0m	
Hardpan or bedrock	>1.5m	1.5-0.6m Special design requirements and distribution techniques or soil modification will be necessary, depends on quality of treated wastewater and type of LAS	<0.6m	
Presence of mottling	None		Extensive	
Course fragments	< 10%	10-40%	>40%	
pH	6-8	4.5-6	<4.5, >8	
Electrical Conductivity (ECe)(dS/m)	<0.3	0.3-2	>2	
Sodicity ESP%	<3	6-8	>8	
Phosphorus adsorption (mg/kg)	>500	200-500	<200	

1.4. CLIMATE AND EROSION POTENTIAL

The nearest rainfall station to the location, according to the Australian Bureau of Meteorology, is Marulan (George St.), Rainfall Station 70063, which receives a mean annual rainfall of 716 mm. The entire year sees the same amount of rainfall, with a peak in February and a trough in September. In the summer and late spring, there is more evaporation. Marulan has an average annual moderate climate with high temperatures of 28.1°C and lowest temperatures of 12.9°C.

The projected R-Factor is 1,210, which is low, and the site is generally level, thus the probability of rill formation is minimal. The predicted soil erodibility (K-factor) is 0.05, which is high, indicating that the subsoils are potentially erodible. The Revised Universal Soil Loss Equation (RUSLE) predicts soil loss at this site to be 72 t/ha/yr1 (Soil Loss Class 1 - Table 4.2 in Landcom, 2004), indicating a modest erosion risk.

1.5. BIODIVERSITY.

Narla Environmental Pty Ltd (Narla) was engaged by Oscar Merhebi to prepare a Streamlined Biodiversity Development Assessment Report (SBDAR) to accompany a Development Application (DA) for the proposed subdivision at Lot 26 Corriedale Drive Marulan (Lot 26/-/DP1271846), hereafter referred to as the Subject Property .The proposed subdivision is subject to DA approval and has triggered a SBDAR as it will exceed the clearing threshold (0.25ha) for a property with a minimum lot size of less than 1ha. This SBDAR will assess the biodiversity impacts of the proposed subdivision in accordance with the requirements of the BC Act, Biodiversity Conservation Regulation 2017 and BAM (DPIE 2020a).

Narla have produced this report in order to assess any potential impacts associated with the DA and recommend appropriate measures to mitigate any potential ecological impacts in line with the requirements of the Consent Authority.

1.6. SUPPORTING DOCUMNTATION.

AKT Engineering and consulting has prepared concept Wastewater management plans for the development. These plans are detailed in drawings **AKT21060 _A102 (Appendix H).**

1.7. GOVERNING AUTHORITIES

The following Governing Authorities and Regulations shall have jurisdiction over the services:

Authority
Local Council – Goulburn-Mulwaree Council
Water NSW – Sydney Drinking Water Catchment.

2. TECHNICAL INFORMATION

2.1. WASTEWATER

The purpose of this document is to provide a summary of the Wastewater management report for the proposed nine lots Subdivision located at 84 Corriedale Dr,Marulan and to provide Goulburn-Mulwaree Council (GMC) with the background information to take into account during their assessment of the development application (DA).

The existing Sewer infrastructure within the vicinity of the subject site is complex.

The Site wastewater is to be managed in accordance with concept sewer management plans in **Appendix** (A).We have used a Drains model file to assess our development effects to existing drainage system,

Item	Design Criteria
Flooding	NSW Floodplain Development Manual Goulburn Mulwaree Council Development Control Plan 2009
Wastewater Drainage	• Australian Rainfall and Runoff (ARR) 2019 • Australian Standard AS/NZS 3500 Plumbing and Drainage 2018 • Goulburn Mulwaree Regional Council Development Control Plan (2009) Local Government Act 1993 • Environment and Health Protection Guidelines (1998) On-site Sewage Management for Single Households (Department of Local Government) • Sydney Catchment Authority Neutral or Beneficial Effect (NorBE) on Water Quality Assessment Guideline (2022) • Water NSW (2019), Designing and Installing On-Site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice • Australian Standard AS1547: 2012" On-site Domestic Wastewater Management"
On-Site Detention (OSD)	Australian Rainfall and Runoff (ARR) 2019 Goulburn Mulwaree Council Development Control Plan 2009 Goulburn Mulwaree Council - Standards for Engineering Works 2013 D5
Stormwater Quality	WaterNSW NorBE Water Quality Assessment Guideline 2022 Adoption Guidelines for Stormwater Biofiltration Systems Version 2 Goulburn Mulwaree Standards for Engineering Works 2013

Table 1: Wastewater Design Criteria

2.2. BACKGROUND

1. We reviewed the detailed survey, provided by Client. This survey described the subject site in detail but did not contain enough information on the existing pit and pipe network adjacent to the site.

2. A Drainage Asset search was made to Goulburn- Mulwaree Council of their asset information within the subject site and surrounds. This information was unavailable.

2.3. FLOODING

The Marulan Flood Study Commissioned by Goulburn Mulwaree Council, Conducted by GRC and currently on exhibition as a final Report (dated June 2023), provides critical data on flood risks, including the 1% Annual Exceedance Probability (AEP) flood extent. Here's an analysis of how this information impacts the proposed subdivision on Corriedale Dr and how to incorporate it into planning and development. The subject site is located adjacent to an existing intermittent watercourse that is a component of the catchment area of Jaorimin Creek.

The figure below shows that the site is practically affected by 1% AEP flood extents along the edge intermittent watercourse and affected by a minor overland floe path coming from the west.

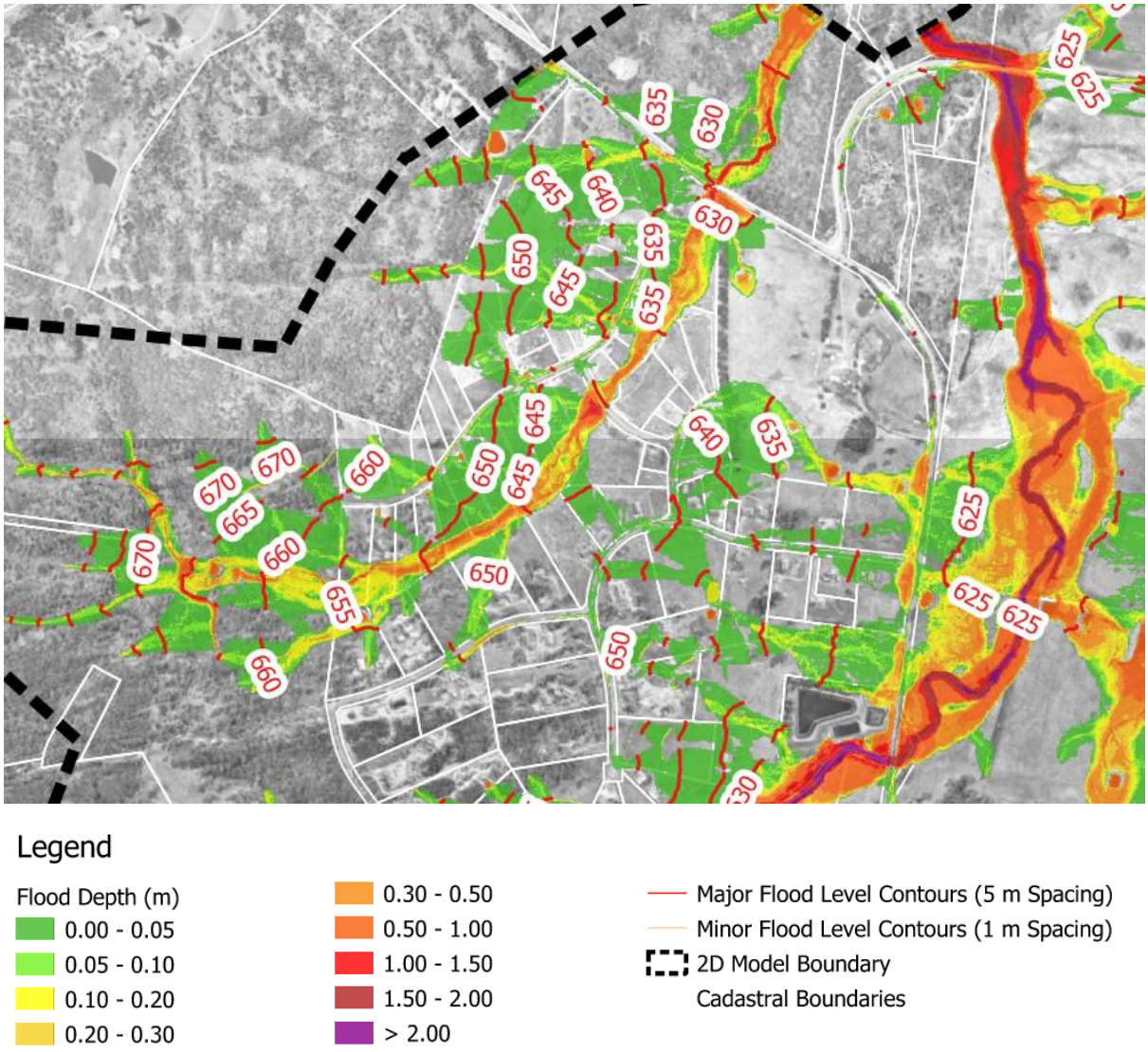


Figure 2- 1% AEP flood map expert, Marulan Flood Study (grc June 2023)

2.4. PROPOSED DEVELOPMENT

The proposed Aerated Wastewater Treatment System (AWTS) capable to treat a minimum of 1,200 L/day to secondary treat all wastewater generated by the proposed dwelling. Secondary-treated effluent will then be disposed of by subsurface irrigation.

Wastewater will be derived in toilets, basins, and the kitchen/outdoor BBQ area in the proposed development.

To secondary-treat all wastewater generated by the proposed home, it is proposed to install a NSW Health certified Aerated Wastewater Treatment System (AWTS) capable of processing a minimum of 1,200 L/day. Subsurface irrigation will be used to dispose of secondary-treated wastewater. A minimum Effluent Application Area (EAA) is required for hydraulic modelling for zero storage.

The best practical on-site wastewater management system for the specific site and proposed development, treated effluent has the potential to cause adverse harm to sensitive terrestrial biodiversity. Sun and wind exposure on the wastewater tank must be maximised to help with evaporation. Factors that affect this are local topography, vegetation, and the built environment. Improper location of a wastewater tank in the shade can reduce evaporation by up to 30 percent. A site investigation conducted found the proposed wastewater tank is well exposed to sun and wind.

2.5. ESTIMATION OF WASTEWATER LOAD

The potential wastewater load has been estimated using figures/recommendations.

provided in NSW Health Department, Well Accreditation Guideline, December 2021

Therefore, total estimated wastewater load from Stage 1 is:

Residents x Litre of wastewater	L/day
Residents (Family up to 5)	1200
Consumers (Weekdays)	1200
Consumers (Weekends)	1200

Table 2: Wastewater estimated load.

Design Wastewater Flowrate: 1200 Litres/ Day (weekdays)

Design Wastewater Flowrate: 1200 Litres/Day (weekdays)

The Flow Rate for the Proposed Dwelling as per the following on the Weekdays/Weekends:

1200/1000= 1.2 Litres/ Second

3. SOIL ASSESSMENT

The depth of the soil is a significant consideration when selecting an effluent disposal strategy. Soil depth is measured to a limiting layer, such as bedrock or a seasonally high water table (shown by grey mottling in the soils). In general, earth is an excellent substrate for treating wastewater. The wastewater is filtered as it flows through the soil, and pollutants (especially phosphorus) adsorb onto the soil particles. Furthermore, because viruses are frequently outside of their preferred environment, this gives them time to die. To give treatment in an irrigation region, at least 500 mm of soil is required, as per the site investigation the soil depth is greater than 900 which seen as a minor constraint,

Surface fill shall be stripped and removed, and care must be taken to ensure that no surface fill material is mixed with PASS material below. The sides of the wastewater tank also be stripped a further 200 mm laterally to ensure potential fill soils do not fall into the pit and cross contaminate, once fill material is removed, the surface shall be inspected by a qualified engineer of the receiving landfill facility, prior to excavation of PASS.

Soil that has dried out, undergone any oxidation of its sulfidic minerals, or which has a pH of less than pH 5.5, The pH of the water at the landfill into which the potential PASS is placed must not be less than pH 5.5 at any time. Installation of the proposed waste water collection and treatment systems: If waste water treatment on freshly excavated PASS cannot be performed immediately, plastic sheeting shall be placed over the stockpile to reduce oxidation, In order to facilitate mixing, the soils should be thinly spread <0.5 m, The proposed dwelling does not encounter any significant site limitations that would impede the implementation of an Aerated Wastewater Treatment System (AWTS) for wastewater treatment and subsurface irrigation for the disposal of treated wastewater.

The proposed location for subsurface irrigation complies with all additional setback distances and buffer zones mandated by Water NSW and Goulburn-Mulwaree Council. This consists of:

- 1500mm offset from building & boundaries.
- Permanent power supply, automated monitoring, alarm to be implemented.
- Located above the 1% AEP 1:100 flood contour.

Figure 3:on-site Soil assessment.

Figure 4: Looking East North Over proposed effluent management areas ,
Showing landform typical of the site

Figure 5: Looking North Over Proposed Effluent management areas.

Method:	crowbar/shovel
Depth to bedrock (m):	1000mm to restrictive layer; minor limitation
Depth to high soil water table:	No groundwater or subsoil mottling encountered at a depth of 1000mm; minor limitation
Slope (%):	<10% Slope, minor limitation
Coarse (%):	5-10% coarse rock fragments in subsoil, minor limitation
pH (soil/water):	pH 5.5-6; minor limitation
Electrical conductivity:	<4dSm, minor limitation
Salinity hazard:	No evidence of salinity observed in area of existing soil absorption bed or within immediate vicinity; minor limitation
Domestic groundwater use:	The Department of Primary Industries Office of Water search of groundwater bores found there are **no known groundwater bores** within 100m of the proposed effluent management area
Native vegetation and environmentally sensitive vegetation	No native vegetation is located within the proposed effluent management area.
Geological unit: *(From Geoscience*	Residual deposits – *A weakly-consolidated regolithic residuum such as soil or saprolite mostly developed in-situ as a result of*

Australia Portal)	*advanced weathering and/or pedogenesis.*		
Soil landscape: *(From eSPADE by NSW DPIE)*	Unmapped Soil Landscape –		
Australian Soil Classification *(From Geoscience Australia Portal)*	Soils belonging to the Kurosols order – *Duplex soil with an acidic subsoil of greater clay content than the topsoil. Moderate capacity to adsorb phosphate. The lower hydraulic conductivity of the subsoil can lead to interflow, however if the design of the absorption field is on the basis of subsoil hydraulic properties (as is normally the case), this is a moderate risk soil.*		
Surface rock:	Some rock fragments in proposed effluent management area		
Bulk density:	Poorly to Moderately-drained soil profile; minor limitation		
Soil profile, from two		Layer 1	DIR
similar soil profiles in EMA:	Texture Colour Depth Structure Coarse frag.	Sandy Loam Dark Brown 0-100mm Well structured 0-5%	NA
		Layer 2	DIR
	Texture Colour Depth Structure Coarse frag.	Sandy Loam Grey 200-300mm Massive 0-5%	NA
		Layer 3	DIR
	Texture Colour Depth Structure Coarse frag.	Sandy Clay Loam Grey 300-1000mm Moderately Structured 0-5%	3.5 mm/day

Table 3: Soil assessment Table.

Consideration must be given to the suitability of the existing vegetation, if present. Turf is the most prevalent and one of the most appropriate vegetation varieties for effluent management. Turf effectively covers expansive regions and facilitates nutrient absorption, specifically nitrogen, and evapotranspiration.

4. ON SITE WASTEWATER MANEGEMTN SYSTEM DESIGN

The design process involves evaluating wastewater flow, site and soil limits to select, size, and position the most practical waste treatment unit and land application system.

4.1. WASTEWATER TREATMENT

An Aerated Wastewater Treatment System is proposed to treat wastewater. The owner must supply the Council with the AWTS manufacturer's specs for the proposed treatment system. (For information on proposed AWTS, contact the manufacturer or the NSW Heath Register of Accredited Sewage Management Systems.

https://www.health.nsw.gov.au/environment/water/Pages/wastewater.aspx#sewage

To install/operate a sewage management system, the owner must apply under **Section 68** of the Local Government Act 1993. Council requires the owner to select an AWTS manufacturer and provide plans and specifications, including NSW Health Accreditation, tank dimensions and capacity, operation and maintenance details, and the Licensed Plumber's name, address, phone number, and license number.

The AWTS shall be installed and maintained in compliance with Section 5 of the Department of Local Government's 'On-site Sewage Management for Single Households' guidelines (1998) and AS/NZS 1547-2012 'On-site Domestic Wastewater Management' (Standards Australia, 2012). **Once approved by Goulburn-Mulwaree Council, the owner must engage into a servicing contract with an approved agent throughout the system's lifetime. Submit written service reports to Goulburn-Mulwaree Council after each quarterly service.**

This report proposes wastewater treatment using the septic tank and retro-fitting a new pressure dosed absorption bed as it is the most efficient solution for this site.

4.2. LOACTIONS OF AWTS:

It's important to avoid sites with active erosion when planning effluent management to prevent environmental damage and ensure the effectiveness of the management practices. the site investigation conducted by AKT Engineering & Consulting has determined that there are no signs of erosion in close proximity to the proposed EMA (Effluent Management Area), it's a positive finding, therefore, ensuring that the effluent management practices do not contribute to soil erosion or environmental degradation.

There are no major site constraints that would preclude the proposed dwelling from installing an Aerated Wastewater Treatment System (AWTS) for wastewater treatment and subsurface irrigation for processed wastewater disposal.

The AWTS must be positioned on a stable, level base and be downslope of the building so there is sufficient fall from drainage outlets in the dwelling. The location of AWTS must:

- Be at least 1.5m from any building.
- Have a power supply (and telephone line if telemetry or an automated monitoring/ alarm is fitted), will be required to deliver power to the treatment unit.
- Be located above the 1% AEP (1:100) flood contour.

- AWTS installation must comply with the manufacturer's recommendations, AS/NZS 3500.2:2018 Plumbing and Drainage Part 2 Sanitary Plumbing and Drainage' and Council requirements.

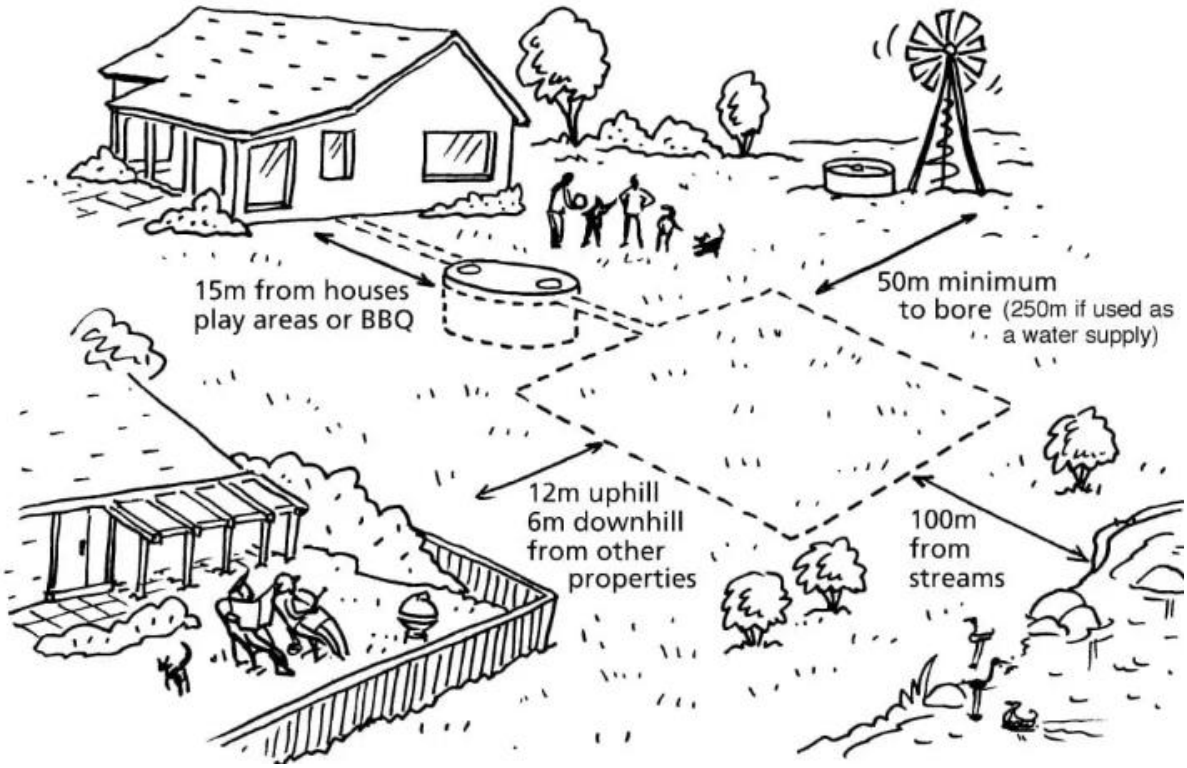


Figure 6:AWTS Setbacks

Water NSW recommends that EMAs are not located within 100 m from the high-water level in bores that are used for domestic potable water. A search of Water NSW's ground

water map did not identify any bores used for potable water within 100 m of the proposed EMA.

One of the most crucial aspects in selecting an EMA is its closeness to natural watercourses or dams. It will be necessary to keep buffers between the EMA and a watercourse or dam ranging from 40 to 100 metres, the existing site does not constraint any natural water course or water dam.

4.3. SEWER PIPES INSULATIONS.

The Sewer lines between plumbing amenities, AWTS, and irrigation areas must meet the requirements of 'AS/NZS 3500(Set):2018 Plumbing and Drainage Set', which specifies nominal pipe sizes and minimum grades. **Table 4** Contains these parameters.

Moreover ,If a sewer conveying untreated wastewater to a treatment system exceeds 60 meters, the minimum grade should be doubled and inspection ports fitted every 30 meters or at an angle or change in slope.

According to 'AS/NZS 3500.2:2018 Plumbing and Drainage Set', sewer pipes between plumbing amenities, AWTS, and irrigation areas must be buried at a depth that protects against mechanical damage or distortion.

Nominal pipe size (DN)	Minimum grade %	Minimum grade ratio
65	2.5	1:40
80	1.65	1:60
100	1.65*	1:60
125	1.25	1:80
150	1	1:100

* Except for drains from septic tanks, sewage treatment plants and unvented discharge pipes from tundishes, which may have a minimum grade of 1%,

Source: 'AS/NZS 3500.2:2018 Plumbing and drainage Part 2 Sanitary plumbing and drainage' Table 3.4.1. NB: pipe grades are expressed as a percentage of vertical to horizontal distances.

Table 4 Minimum Pipe Diameter and Grade.

Location	Ductile iron, Galvanised Steel	Plastics
	Minimum depth of cover (mm)	
1. Not subject to vehicular traffic (a) Without Pavement		
I. For single dwelling	100	100
II. For other than single dwelling	100	300
(b) With Pavement of brick or unreinforced concrete	100*	100*
2. subject to vehicular traffic (a) Other than roads	300	450
i. Without Pavement o	300	450
ii. With Pavement of-		
A. Reinforced Concrete for heavy Vehicular Loading or	Nil *	100*
B. Brick or unreinforced Concrete for Light Vehicular Loading	Nil *	75*
(b) Roads-		
(i) Sealed: or	600	600
(ii) Unsealed	600	750

3. Subject to construction equipment loading or in embankment conditions	600	750
4. Land Zone for agriculture Use	600	600
* Below The underside of the pavement Source: 'AS/NZS 3500 (Parts 0-4):2018 Plumbing and drainage Set'. Table 3.7.2 Minimum Cover for Buried Pipes'		

Table 5 Minimum Pipe Depth For trafficable areas.

4.4. SIZING THE IRRIGATION AREA:

The irrigation area required to control the wastewater load was determined using a monthly water and nutrient balance, as specified in DLG (1998). Soil texture classification for Design Irrigation Rate is based on ASNZ1547 (2012).

The **water balance** necessitates irrigation area as illustrated in **Table 6** based on the following variables:

- Big Hill (Glen Dusk) Rainfall Station.
- SCA Zone 3 monthly average evaporation; and
- Slope is <10% so no DIR reduction required.
- Application rate of 24.5mm/week or 2.8 mm/day for clay loam subsoil.

A=Q/DLR Where:
A = Area (m^2)
Q = Wastewater Flow =1200 L/day DLR = Design Loading Rate =2.8 mm/day

The **Nitrogen balance** necessitates irrigation area as illustrated in **Table 6** based on the following variables:

- AWTS will decrease Total Nitrogen to 27mg/L; and
- The vegetative rate in managed pastures is considered to be 240 kg/N/ha/year.

A = 3.65(C x Q) / Lx Where:
A = Area (m^2)
C = Concentration of Nutrient = 27 mg/L
Q = Wastewater Flow = 1200 L/day
Lx = Critical Loading Rate = 240 (Kg/ha/year)

The **phosphorus balance** necessitates irrigation area as illustrated in **Table 6** based on the following variables:

- AWTS will decrease Total Phosphorus to 12mg/L.
- P-sorption of 400mg/kg for clay loam subsoil
- Predicted sorption for a soil depth of 1 m. Crop uptake is assumed to be 30kg/ha/annum.
- 50-year design life of system.
- Bulk density of 1.5g/cm3

$$A=3.65(CxQ)/U_R+0.2d(1-n_p)G_sX_{sorp}$$

Where:

A = Area (m^2)
Wastewater Flow (Q) = 1200 L/day
Phosphorus Sorption (X_{sorp}) = 400 mg/kg
Design Soil Depth (d) = 1 m
Bulk Density = 1.5 g/cm^3
Soil Specific Gravity ($G_{s)}$ = 2.65 g/cm^3
P uptake (U_R) =30 kg/ha/year
Concentration of phosphorus = 12 mg/L

Wastewater Source	Design wastewater load (L/day)	Water balance Requires irrigation. area (m^2)	Nitrogen balance requires irrigation area (m^2)	Phosphorus balance requires irrigation area (m^2)	Required effluent disposal area –largest of the three methods (m^2)
Proposed New lots	1200	417	394	420	495

Table 6: Proposed irrigation areas

According to WaterNSW (2019), the irrigation area should be calculated using a hydraulic balance, with a dedicated nutrient uptake area downslope and/or around the irrigation field based on the difference in area between the nutrient load and hydraulic load areas. According to WaterNSW (2019), this strategy maintains vegetation on the appropriate area for hydraulic balance and reduces die-off during dry periods. This assessment needed a 430m^2 irrigation area, with an extra 65m^2 designated for downslope nutrient update.

The proposed location and setback distances for the land application area relevant to the site must be compliant with the Conditions of Consent, Goulburn-Mulwaree Council Development Control Plan, WaterNSW, and this report.

In simple terms, a water balance can be used to estimate irrigation area requirements based on climate and wastewater production. It is expressed as:

INPUTS	**=**	**OUTPUTS**
precipitation + applied wastewater	=	evapotranspiration + percolation + runoff

Wet weather storage can also be factored into the general equation as follows:

INPUT – OUTPUT = STORAGE REQUIREMENT

A water balance can be carried out using the attached Water Balance excel spreadsheet.

Table 7 describes the water balance parameters and how to apply them.

Table 7: Key Parameters of Water Balance Calculations

Parameter	Discussion
Precipitation	refers to deposits of water, either in liquid or solid form that reach the earth from the atmosphere; it can include rain, sleet, snow, hail, dew and frost. In the NSW climate, precipitation is in the form of rain and dew, and potentially frost in some desert areas.
Evapotranspiration	is the removal of water from soil by evaporation and by transpiration from plants. Monthly evapotranspiration is estimated to be a percentage of the monthly evaporation. This percentage is determined for a particular vegetation type by using a 'crop factor'. Crop factors vary, depending on the type of plant being grown, the local soil conditions, the time of the year, and exposure of the site. Due to generally high year-round daytime temperatures in the NSW, a crop factor of 0.8-1.0 would be appropriate for design purposes.
Percolation	is the movement of liquid downwards through the soil profile, beneath the root zone. A design percolation rate can be taken from AS/NZS1547:2012, depending on the soil type at the site.
Retained Rainfall	is the proportion of precipitation that is absorbed within the proposed land application area. This factor varies considerably with soil type; sandy soils will retain most or all water, while clay soils and thin soils will yield a high level of runoff. Slope also has an influence on runoff. The retained rainfall factor should be determined on a case by case basis from the results of the site and soil assessment. Australian Rainfall and Runoff (Pilgrim et al 1997 with current edition under review) provides useful information.

4.5. SUBSURFACE IRRIGATION DESIGN:

The subsurface irrigation plan presented on the Site Plan took into account the following WaterNSW (2019) design parameters.

- Construct an upslope diversion drain or berm to protect the effluent irrigation area from potential runoff and rainwater.
- The effluent irrigation area should be divided into two or more zones connected by a distribution or sequencing valve. Individual zones should not be larger than 400 square meters (usually 250 to 300 square meters). However, with a large enough pump, this irrigation area might be installed as a single zone.
- Pressure-compensating subsurface drip line (usually 16 millimetres) is utilized with emitters and laterals spaced roughly 600 millimetres apart (maximum 1,000 millimetres apart) and buried 100 to 150 millimetres deep.
- The system must be designed with adequate filtration. Before the sequencing valve, install a disc filter or a filter with a mesh size of 100-150 micron. A filter flush valve should be installed downstream from the field flush valve.
- The installer is expected to make changes to the alignment of drip lines and distribution lines.
- Install air release valves at high places in each region or field. For undulating terrain, extra valves may be required.

- The system must have the ability to flush out any suspended particles or organic growth that may build. To assist flushing back to the treatment system, a field flush valve must be put on the return line, as well as an in-field soakage pit or a small self-supporting arch absorption trench (maximum dimensions: 10m long, 0.6m wide, and 0.7m deep).

Please refer to the Further design requirements that are not visible on the Site Plan but are included in the Appendix and WaterNSW 2019.

5. CONCLUSIONS:

The proposed (AWTS) will ensure that the best management practice is applied to the development site in controlling and minimising the negative impacts of soil erosion .This assessment shows that on-site wastewater management can be implemented on the proposed 9-lots subdivision and suggests the following:

- Install an aerated wastewater treatment system to treat 1200L/day for proposed Lots1- 2 and Lots 4-9.
- Installed 417m^2 of subsurface irrigation for treated wastewater disposal, as outlined in the Appendix and illustrated on the Site Plan.
- Set aside an additional 51m^2 downslope for nutrient uptake.

6. INFORMATION SOURCES, ASSUMPTIONS, LIMITATIONS AND LIABILITY

6.1. PROJECT INFORMATION SOURCES

Document / programs
BOM (Bureau of Meteorology)
Australian Rainfall and Runoff (ARR) 2019
Australian Standard AS/NZS 3500 Plumbing and Drainage 2018
Goulburn Mulwaree Regional Council Development Control Plan (2009) Local Government Act 1993.
Environment and Health Protection Guidelines (1998) On-site Sewage Management for Single Households (Department of Local Government)
Sydney Catchment Authority Neutral or Beneficial Effect (NorBE) on Water Quality Assessment Guideline (2022)
Water NSW (2019), Designing and Installing On-Site Wastewater Systems. A Sydney Catchment Authority Current Recommended Practice
Australian Standard AS1547: 2012" On-site Domestic Wastewater Management.

Table 8 – Project information sources

6.2. ASSUMPTIONS AND LIMITATIONS

The information contained in this document is provided for the sole use of the recipient and no reliance should be placed on the information by any other person. In the event that the information is disclosed or furnished to any other person, AKT accepts no liability for any loss or damage incurred by that person whatsoever as a result of using the information.

This report is prepared in good faith and with due care for information purposes only and should not be relied upon as providing any warranty or guarantee as to the nature and condition of the building and/or its services or equipment. In particular, attention is drawn to the nature of the inspection and investigations undertaken and the limitations these impose in determining with accuracy the state of the building, its services or equipment.

Due to the limitations of our access to services in the preparation of this report, users of this report should not rely on any statements or representations contained within, but should undertake further and more detailed investigations to satisfy themselves as to the correctness of any statement or representation contained in this report.

6.3. LIABILITY

AKT shall not be held liable for any loss or damage resulting from any defect of the building or its services or equipment or for any non-compliance of the building or its services or equipment with any legislative or operational requirements, whether or not such defect or non-compliance is referred to or reported upon in this report, unless such defect or non-compliance should have been apparent to a competent Engineer undertaking inspection of the type undertaken for the purpose of preparation of this report.

7. REFERCENCES

Department of Local Government (1998) On-site Sewage Management for Single Households. NSW Government.

- *WaterNSW (2023a). Developments in the Sydney Drinking Water Catchment – Water Quality Information Requirements.*
- *WaterNSW (2023b). Using MUSIC in Sydney Drinking Water Catchment. A WaterNSW Current Recommended Practice*
- *Hird C., 1991, Soil Landscapes of the Goulburn 1:250,000 Sheet map and report, Soil Conservation Service of NSW, Sydney.*
- *Standards Australia (2012) Australian/New Zealand Standard 1547:2012 On-site domestic wastewater management. Standards Australia.*
- *NSW Health Septic Tank Accreditation Guidelines (2001).*
- *Goulburn Mulwaree Regional Council Development Control Plan (2009)*

8. GLOSSARY AND DEFINITIONS

Term/Abbreviation	Definition/Description
AS/NZS	Australian Standards/New Zealand Standards
DLR	Design Loading Rates
DIR	Design Irrigation Rate
DOH	Department of Health
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
Effluent	The liquid discharged from a wastewater treatment unit
Floodplain	The extend of flooding in an area in a one percent (1 in 100) Annual Exceedance Probability flood event for a particular waterway, which includes the floodway and flood fringe areas.
Groundwater	The area of an aquifer in which all pores and fractures are saturated with water. Also known as water in the phreatic zone.
GSP	Government Sewerage Policy 2019
L	Litre
Land Application Area (LAA)	The unencumbered plan area to which treated sewage from an on-site sewage system is distributed for further in-soil treatment and absorption or evaporation. This area is restricted to the distribution of treated sewage.
Land Application System (LAS)	The system used to apply effluent from a wastewater treatment unit into or onto the soil for further in-soil treatment and absorption or evaporation
LG	Local Government
m	Metre
On-site wastewater system	A wastewater treatment and disposal or reuse system that receives treats and applies wastewater to a land application area located within the boundaries of the freehold lot or survey strata within which wastewater was generated.
Primary treatment	The separation of suspended material from sewage in septic tanks, primary settling chambers, or other structures (including those which may be used to treat trade waste), before discharge to either a land application area or secondary treatment process. (For example, septic tanks with leach drains).
Priority areas	The Priority 1, 2, 3 and 3* areas assigned by the Department of Water and Environmental Regulation to guide land use and management decisions.
Public drinking water source area (PDWSA)	Underground water pollution control areas, catchment areas and water reserves that are constituted under the Metropolitan Water Supply, Sewerage, and Drainage Act 1909 or the Country Areas Water Supply Act 1947.
Reticulated sewerage	A network of sewers and associated wastewater treatment plant managed by a sewerage service provider.

Secondary treatment	Microbiological digestion and physical settling and filtering processes and decomposition of sewage constituents following primary treatment
Secondary treatment system	A sewage treatment system which produces treated sewage of secondary standard equal to or less than, i.e. 20 mg/L of Biochemical Oxygen Demand (BOD), 30 mg/L of Total suspended solids (TSS) and 10 cfu/100 mL of Escherichia (E) coli (for example, an aerobic treatment unit).
Sewage	Any kind of sewage, faecal matter or urine, and any waste composed wholly or in part of liquid
Sewerage service provider	A person or entity that provides a sewerage service in accordance with the Water Services Act 2012.
Site and soil evaluation	An assessment of all relevant constraints and the risks to public health and the environment of an on-site sewage system in accordance with AS/NZS 1547 On-site domestic wastewater management.
SPP 2.9	State Planning Policy 2.9 – Water Resources
Trade waste	Any wastewater, discharged from a business or industry, aside from that which comes from staff amenities or office facilities.
WAPC	The Western Australian Planning Commission
Wastewater	Is consistent to the definition of “sewage”, and does not include stormwater, surface water or ground water of a type that is ordinarily drained from land as part of the provision of a drainage service. This includes trade waste.
Water resources	Includes watercourses, waterways and their estuaries, inlets and floodplains, wetlands, groundwater, surface water, stormwater and drainage. A water resource includes all aspects of the water resource, including water, organisms and other components and ecosystems that contribute to the physical condition and ecological health of the water resource.
WWTP	Wastewater treatment plant

9. APPENDICIES

9.1. APPENDIX A: GENERAL RECOMENDEATIONS OF AWTS

The irrigation area needed to manage the flow regulated volume of 1200L/day was calculated using monthly water and nutrient balance, following the method described in DLG (1998). Soil texture classification for Design Irrigation Rate is from ASNZ1547(2012).

The irrigation area ought to be measured utilising a hydraulic balance, as per the guidelines provided by Water NSW (2019).

A designated nutrient assimilation area should be established downstream and/or surrounding the irrigation field, with its dimensions determined by the area difference between the nutrient load and hydraulic load areas. Water NSW (2019) asserts that this strategy will reduce the probability of vegetation mortality throughout the entire area during protracted dry periods and help maintain vegetation, at least on the area necessary to satisfy the hydraulic balance.

Additionally, a mapped drainage depression traverses the property. However, it was discovered during the site examination that this drainage depression does not exist at the location depicted on the map, but rather along the western boundary of the property. A 40m buffer is necessary to address this melancholy.

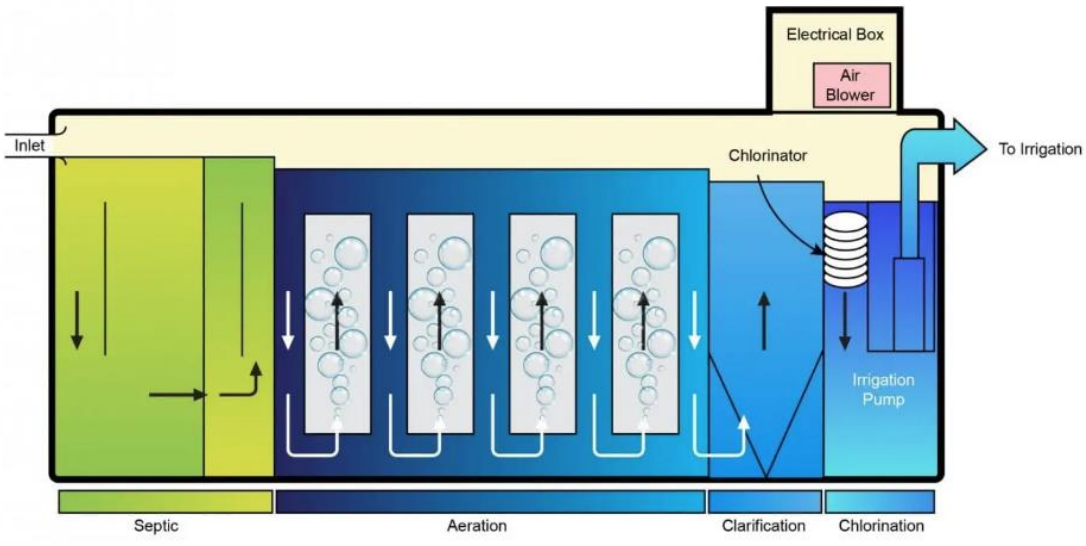


Figure 7: Shematic of AWTS

Buffer Distances

Buffer distances from land applications systems as specified by WaterNSW (2019) and NSW DLG (1998) are outlined in **Table 9**.

	Surface Irrigation	Subsurface Irrigation
Buildings and retaining walls	6 - 15 m	2 m downslope or flat, 6 m upslope
Premise's boundaries, paths, drives and walkways, recreation areas	15 m	3 m downslope or flat, 4 m upslope
In-ground potable water tanks, in-ground swimming pools	4 m not to be located upslope	4 m not to be located upslope
Permanent and intermittent watercourses	100 m from high water level	100 m from high water level
Bore or well used for domestic consumption	100 m from high water level	100 m from high water level
Dams, drainage depressions, roadside drainage and stormwater improvement devices	40 m from high water level	40 m from high water level

Table 9: Specified Buffer Distances.

Detergent Use:

Liquid detergents must be used in the household as powders contain elevated concentrations of salt which could alter the soil's chemistry and reduce its ability to percolate water. All cleaning products must be "Septic Friendly".

Water Saving Fixtures:

This design assumes at least four-star rated plumbing fixtures are used in any new home. If Basix requires more than four-star rated plumbing fixtures must be installed.

Signs:

A minimum of two Warning Signs must be installed along the edge of the EMA. The signs shall read “WARNING: RECLAIMED EFFLUENT/RECYCLED WATER, DO NOT DRINK, AVOID CONTACT” or similar. Lettering must be clearly visible from three meters away.

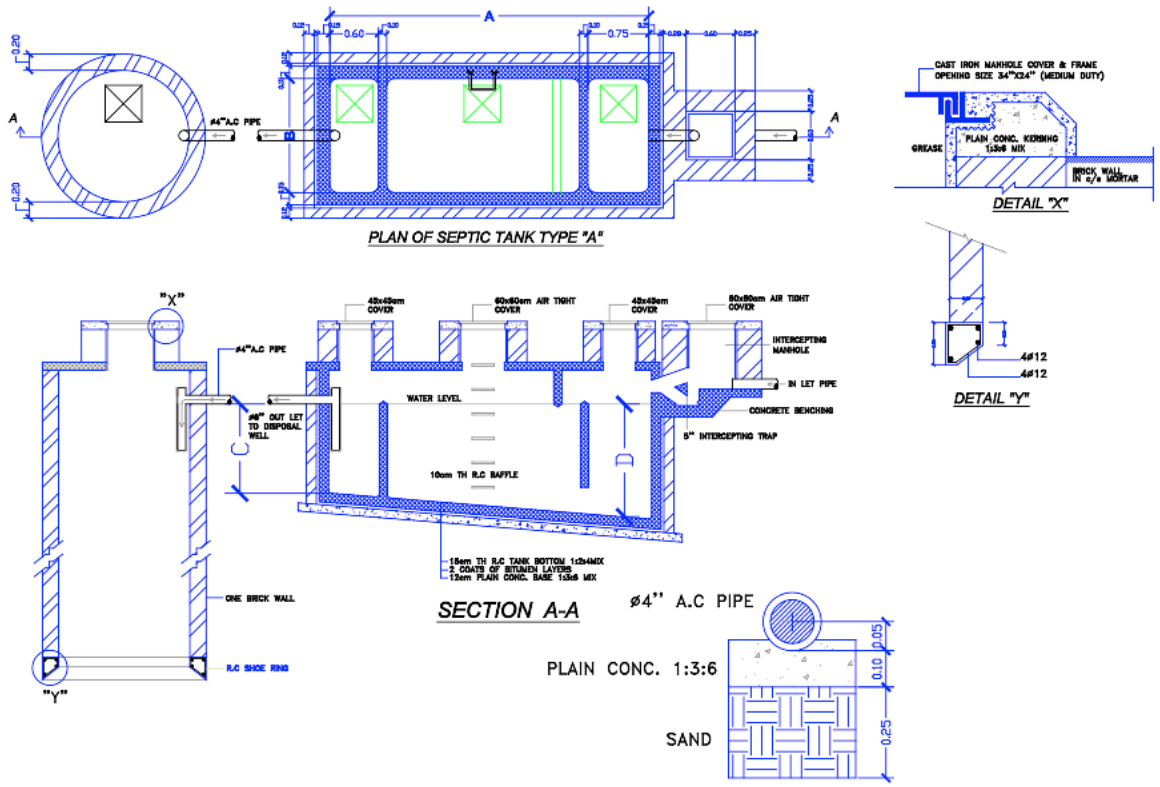


Figure 8: Septic tank details.

Upon careful consideration of the aforementioned factors, with specific emphasis on buffer distances, land that is amenable to on-site effluent management has been identified, Effluent should not be utilised beyond the designated areas, unless the supervising authority so chooses, It is the responsibility of the land owner to ensure no vehicles or footpaths are permitted to track over a constructed EMA.

We conclude the site is suited to dispose a treated effluent by subsurface irrigation. Specifically, our recommendations are:

- The treatment and application systems must be installed by a NSW Fair Trading-licensed contractor or contractors. This could be a licenced irrigation contractor, licenced pump installer, or both, with a minimum of three years of experience in effluent disposal.
- To install a NSW Health approved AWTS, capable of treating a minimum of 1,200 L/day all wastewater generated by the proposed dwelling.
- To install at least “three-star” plumbing fixtures, or better, in the proposed dwelling to reduce wastewater loads.
- To ensure that no other structures (existing or planned) are connected to the proposed AWTS unless the proper approval is granted by the Council.

- To maintain a good cover of vegetation (preferably fully managed lawn (clippings removed)) over the entire EMA.

- To protect the EMA from vehicle and stock access (fence off if necessary).

- To erect a minimum of two Warning Signs along the edge of the EMA.

- To preferentially select low phosphorus, liquid detergents.

- To install and manage the wastewater system according to the details of this report, its appendices and the manufacturer's recommendations.

- In the final phase of this procedure, a certificate of installation supplied by the installer must be submitted. This serves as an endorsement that the systems have been assembled in adherence to the System Design. The installation certificate must be duplicated and submitted to both the council and the system designer. Prior to the system receiving approval for use, a final inspection will be conducted by a council certifier.

9.2. APPENDIX B: HORIZONTAL AND VERTICAL SETBACK DISTANCES

Site Feature	Setback Distance, m
Horizontal setback distances	
Treatment tanks to buildings, property boundaries, driveways, paths and other tanks	1.2
Tranches, beds and soak wells to boundary, building, tanks and other land application systems	1.8
Tranches, beds and soak wells to trafficable areas	1.2
Any land application system to wells, stream, private bores or underground source of water intended for human consumption	30
Tranches, beds and soak wells to subsoil drainage or open drainage channel (as per **Section 5.2.2 of the GSP** a separation of 100m is required if there is discharge into a waterway or significant wetland without treatment of the discharge)	6.0
Spray Irrigation: • Boundaries, buildings, driveways etc • Sub-soil and open drain • Swimming pool • Treatment tanks	 1.8 6.0 3.0 1.2
Subsurface Dripper: • Boundaries, buildings, treatment tanks, driveways etc • Sub-soil and open drain • Swimming pool • Garden bore	 0.5 3.0 2.0 10.0
On-site wastewater system to water resources (for more details refer to **Section 5.2.2 of the GSP**)	100
On-site wastewater system must not be located within any area subject to inundation and/or flooding in a 10 per cent Annual Exceedance Probability (AEP) rainfall event	
Vertical setback distances	

Discharge point of the on-site wastewater system to the highest known groundwater level:
• PDWSA
• Sensitive water resource areas
• All other areas -
  ○ Sands
  ○ Gravels
  ○ Loams and heavy soils
	
	2.0
	1.5
	
	1.5
	1.0
	0.6

Hardpan or bedrock (depends on quality of treated wastewater and type of LAS)	0.6-1.5

9.3. APPENDIX C: INDICATIVE PHOSPHORUS SORPTION UPTAKE VALUES FOR EACH SOIL TYPE

Soil Category	Texture	Structure	Acceptable Psorp (mg/kg)
1	Gravels and sands[1]	Structureless	50
2a	Sandy loams	Weak	100
2b	Sandy loams	Massive	100
3a	Loams	High / moderate	200
3b	Loams	Weak / massive	200
4a	Clay loams	High / moderate	400
4b	Clay loams	Weak	400
4c	Clay loams	Massive	400
5a	Light clays	Strong	500
5b	Light clays	Moderate	500
5c	Light clays	Weak / massive	500
6a	Med-heavy clays	Strong	600
6b	Med-heavy clays	Moderate	600
6c	Med-heavy clays	Weak / massive	600

Source: WaterNSW (2019), Designing and Installing On-Site Wastewater Systems

Note 1: Some gravel and sands in Western Australia, for example Bassendean Sand prevalent on the Swan Coastal Plain, have zero or near zero capacity to adsorb phosphorus.

9.4. APPENDIX D: TYPE OF TREATEMENT AND LAND APPLIACTION SYSTEMS

Type of treatment and land application systems available*

Level of Treatment	Treatment System Examples	Land Application and Reuse System
Primary	• Septic tank • Greywater diversion device • Waterless composting toilet • Composting toilet	• Subsurface absorption system • Evapotranspiration beds • Amended soil and mounds • Burial (for composting toilets)
Secondary	• Aerated wastewater treatment system • Greywater treatment system	• Subsurface irrigation • Surface spray or drip irrigation • Other disposal systems appropriate for primary treated effluent as above
Advance secondary	• Membrane system • Greywater treatment with disinfection • Secondary treatment with additional disinfection (UV, chlorination etc.)	• Restricted non-potable reuse (e.g. toilet flushing, outdoor use) • Other disposal systems as above

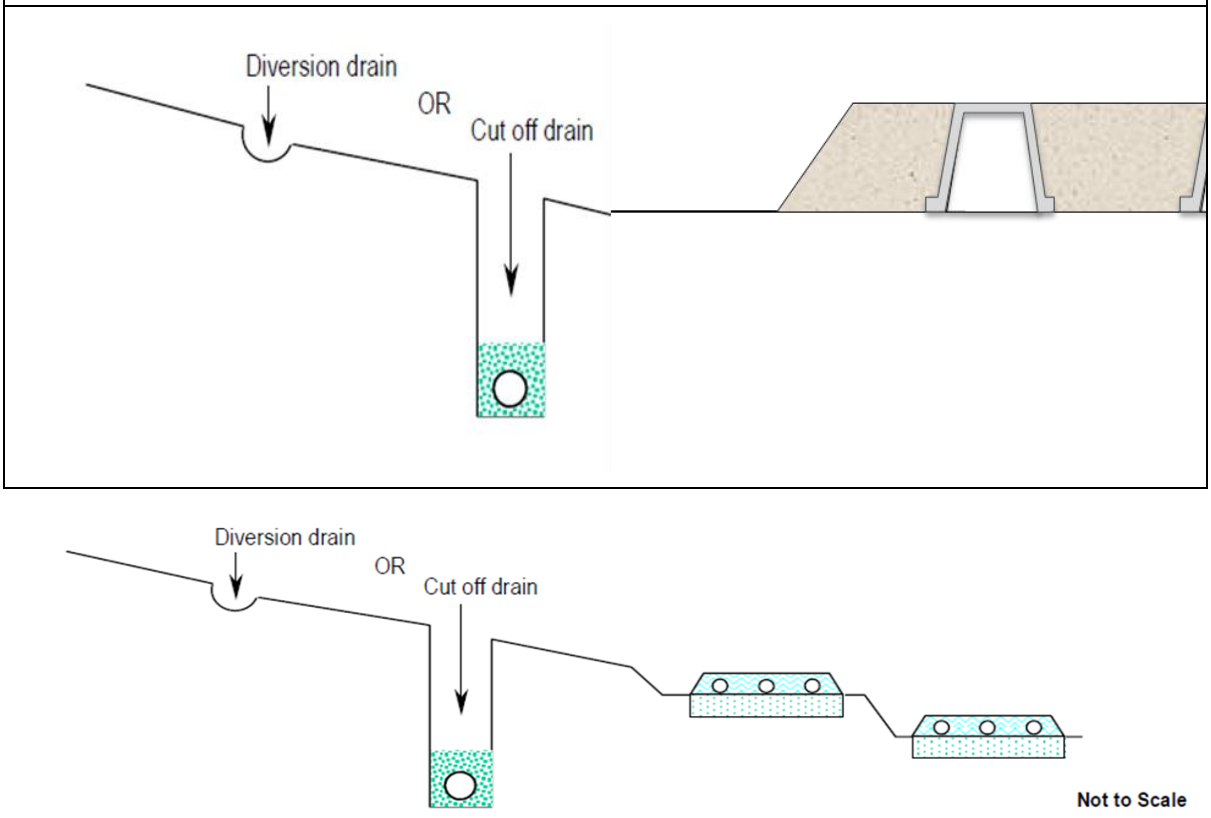
*check the list of approved wastewater systems on DOH website

Common land application systems (adapted from AS/NZS 1547:2012)

System	Considerations
Conventional Absorption Trench and Beds	• Only requires primary effluent treatment • Cheaper to install than other methods, and not influenced by climatic factors. • Requires deep soil, generally > 1.5 m, above limiting layers (e.g. bedrock or seasonal water tables) • Treatment by absorption trench may be impeded due to high % of coarse fragments • Soil supplementation may be an option to improve absorptive capacity • Sodic soils may lose permeability over life of system; larger trench lengths required • Ideal for sites with little to no constraints in terms of soil depth, rock content, waterlogging, inundation or shallow water tables.
Amended soil and Mounds	• Beneficial for shallow soils, high rock contents, or high water tables • Requires an above-ground mound for effluent absorption that contains imported sand/soil • Treatment will not be limited by soil absorption capacity, and less influenced by sodic soils as new soil can be imported. • Not influenced by climatic factors
Subsurface Irrigation	• Secondary treatment is required prior to irrigation • Suitable for areas of high exposure with high evaporation rates (limited during wet season) • Suitable for sites with shallow soils • Not suitable for areas that are seasonally inundated or waterlogged • Sodic soils may lose permeability over life of system; but sodicity generally lower in surface soils than subsoils • Can be hindered by high rock or gravel content

9.5. APPENDIX E: EXAMPLE OF MITIGATION MEAURES

Terracing, diversion drains and cut off drains



Recommended reductions in DIR according to slope (adopted from Table M2 AS/NZS 1547:2012)	
Slope	**Reduction in DIR**
Flat up to 10%	No reduction
10% to 20%	20%
10% to 30%	50%
>30%	Advice required from a suitably qualified and experienced person

9.6. APPENDIX F: WATER BALANCE

Site & Soil Evaluation
Irrigation area sizing

Please read the attached notes before using this spreadsheet

Irrigation area sizing using Nominated Area Water Balance for Zero Storage

Site Address:	84 Corriedale Drive,Marulan NSW 2579				
Date:	28	May	2,024	**Assessor:**	K A

INPUT DATA				
Design Wastewater Flow	Q	1,200	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)
Design Irrigation Rate	DIR	3.5	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)
Nominated Land Application Area	L	430	m^2	[1]
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2]
Rainfall Runoff Factor	RF	1.0	untiless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff
Mean Monthly Rainfall Data	big-hill-glen-dusk			BoM Station and number
Mean Monthly Pan Evaporation Data	SCA Zone 3			BoM Station and number

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	**365**
Rainfall	R		mm/month	58.2	49.7	55.2	26.6	35.2	39	38.2	46.5	45.6	47.2	64	49	**554.4**
Evaporation	E		mm/month	187	145	124	79	51	34	39	61	88	123	146	185	**1262**
Crop Factor	C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	150	116	87	55	31	20	23	37	62	98	117	148	**943.5**
Percolation	B	DIRxD	mm/month	108.5	98	108.5	105.0	108.5	105.0	108.5	108.5	105.0	108.5	105.0	108.5	**1277.5**
Outputs		ET+B	mm/month	258.1	214	195.3	160.3	139.1	125.4	131.9	145.1	166.6	206.9	221.8	256.5	**2221.0**
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	58.2	49.7	55.2	26.6	35.2	39	38.2	46.5	45.6	47.2	64	49	**554.4**
Applied Effluent	W	(QxD)/L	mm/month	86.5	78.1	86.5	83.7	86.5	83.7	86.5	86.5	83.7	86.5	83.7	86.5	**1018.6**
Inputs		RR+W	mm/month	144.7	127.8	141.7	110.3	121.7	122.7	124.7	133.0	129.3	133.7	147.7	135.5	**1573.0**
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-113.4	-86.2	-53.6	-50.0	-17.4	-2.7	-7.2	-12.1	-37.3	-73.2	-74.1	-121.0	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	186	205	266	269	358	417	397	377	298	233	228	179	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 417.0 m^2

9.7. APPENDIX G: NITROGEN AND PHOSPHORUS BALANCE

Land Capability Assessment Framework

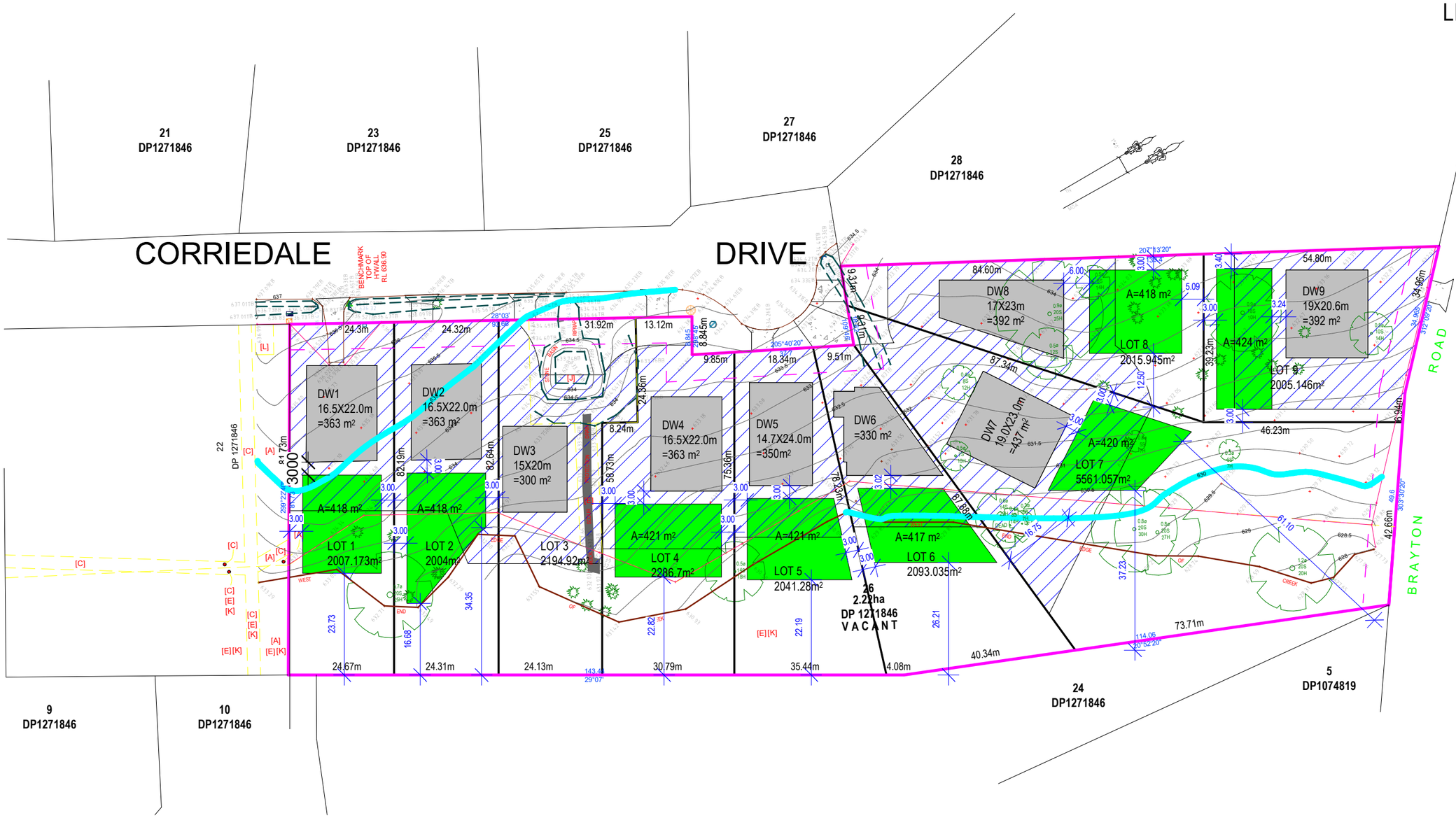
Please read the attached notes before using this spreadsheet

Nitrogen Balance

Site Address:	**84 Corriedale Drive,Marulan NSW 2579**									
SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE								**394**	m^2	
INPUT DATA[1]										
Wastewater Loading				**Nutrient Crop Uptake**						
Hydraulic Load	1200	L/day		Crop N Uptake	240	kg/ha/yr	which equals	65.75	$mg/m^2/day$	
Effluent N Concentration	27	mg/L								
% N Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal								
Total N Loss to Soil	6480	mg/day								
Remaining N Load after soil loss	25920	mg/day								
NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES										
Minimum Area required with zero buffer			**Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)**							
Nitrogen	394	m^2	Nominated LAA Size		430	m^2				
			Predicted N Export from LAA		-0.86	kg/year				
			Minimum Buffer Required for excess nutrient		0	m^2				

Phosphorus Balance		
Site address	**84 Corriedale Dr, Marulan**	
Daily Hydraulic Load	1200	L/day
TP effluent Conc	12	Mg/L
TP effluent Conc /Day	14400	Mg/day
	5256	g/year
P sorportion rate of Soil	400	mg/Kg
Bulk density of Soil	1.5	g/cm^3
	1500	kg/cm^3
land application area	420	m^2
Soil Depth	1m	m
Volume of Soil	336	m^3
Mass of Soil	504000	Kg
Total P sorption Capacity	201600	g
Vegetation	Grass	
P annual Uptake by Vegetation	30	Kg/ha/yr
	1260	g/yr
Net Annual P(in Soil)	3996	g/yr
Life Of System	50	Years

9.8. APPENDIX H: SITE PLAN



EFFLUENT DISPOSAL PLAN

1 : 1000

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bdaa ACCREDITED BUILDING DESIGNER
- CIVIL & STRUCTURE ENGINEERS
- CONSTRUCTION CERTIFICATED
- ACCREDITED CERTIFIER
- ARCHITECTURAL DESIGN
- PROJECT MANAGERS
- NATHERS & BASIX ASSESSORS

GENERAL NOTES:

-Figured dimensions & larger scale drawings shall be taken in preference to scaled readings.
-check all dimensions and levels on site before commencement of work or ordering materals.
-All workmenship and materials shall comply with all relevant codes,ordinances, Australian standards and manufacturers's instructions.
-All discrepancies shall be brought to the attention of AKT Engineering & Consulting P/L.

-AKT Engineering & Consulting P/L warrents only the original Architectural data as retained by the company.
The Data files are not to be altered without the written approval of AKT Engineering & Consulting P/L.
-The responsibility of AKT Engineering & Consulting P/L is removed if these conditions are not observed.

No.	Description	Date
1	ISSUE FOR COORDINATION	8.06.2023
2	ISSUE FOR DA LODGEMENT	15.04.2024

ETERNITY KITCHEN	EFFUENT DISPOSAL PLAN		
PROPOSED 9 LOTS SUBDIVISION	Project number	AKT21060	A102
	Date	1/05/2024	
LOT 26 CORRIEDALE DR, MARULAN	Drawn by	K.A	
	Checked by	K.A	Scale As indicated

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