Site and Soil Assessment for On-Site Effluent Management System

Assessment Site: 361 Old Grattai Road, Erudgere NSW 2850

Client: Kate Hammill Stone, P.O. Box 8, Mudgee NSW 2850

(Our Reference: 36162-ER02_A)

LIST OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Disclaimer

This report has been prepared solely for Kate Hammill Stone in accordance with the scope provided by the client and for the purpose(s) as outlined throughout this report.

Barnson Pty Ltd accepts no liability or responsibility for or in respect of any use or reliance upon this report and its supporting material by anyone other than the client.

Project Name:	Lot 102 DP756897, 361 Old Grattai Road, Erudgere NSW 2850
Client:	Kate Hammill Stone
Project No.	36162
Report Reference	36162-ER02_A
Date:	27.08.2021
Revision:	Revision A

Prepared by:	Reviewed by:
	
Jeremy Wiatkowski Geotechnical Technician	Luke Morris B.E. MIEAust CPEng (NPER) Director

1.0 SYSTEM OVERVIEW

The following table provides a summary of the information for a sustainable onsite effluent management system proposed at Lot 102 DP756897, 361 Old Grattai Road, Erudgere NSW 2850. The following sections of this report provide site specific details justifying the section type.

Table 1: System Overview

Site Assessor	Jeremy Wiatkowski
Client	Kate Hammill Stone
Site Location	"Lot 102 DP756897", 361 Old Grattai Road, Erudgere NSW
No. of Bedrooms	2 Bedrooms – potential use by 4 people as advised by client
Water Source	Rainwater roof collection
Estimated Daily Flow (L/day)	Dry Composting Toilet – overflow estimated 2L/day Handwashing Basin + Shower + Bath + laundry – estimated 90L/person/day Total load for land application system – 90L/person/day + 2L For 3 persons = 3 x 90L/person/day + 2L = **270L/day**
Dry Compost Toilet	Dry compost toilet to be selected by client. System must be NSW Health Accredited. https://www.health.nsw.gov.au/environment/domesticwastewater/Pages/wcts.aspx
Tank Recommendation	No septic tank or treatment required if greywater is **not** stored for later use. Greywater must be treated if stored for later use.
Sub Soil Recommended Hydraulic Loading mm/day (DIR/DLR)	Evapotranspiration Absorption beds in category 6 soils have a design-loading rate of 5mm/day. (Refer to Table 7)
Recommended Effluent Application Type	Due to the category 6 soil (Medium to Heavy Clays) and shallow soil, it is recommended that an evapotranspiration absorption bed be utilised to disperse the onsite greywater and dry compost toilet overflow.
Effluent Design Criteria	***As per section 7.0 the minimum application area was determined by calculating the requirements of hydraulic loading. As shown absorption bed of 18.2m long x 3m wide is required to dispose of the proposed hydraulic load.***
Notes	• Dry Composting toilet to be installed by an accredited plumber. • The greywater from the residence and overflow effluent from the dry composting toilet to be dispersed by sub-soil land application of a type approved by the Local Council. • Systems to be installed strictly in accordance with the requirement of AS/NZS1547:2012.

2.0 INTRODUCTION

2.1 Overview

Barnson Pty Ltd on behalf of Kate Hammill Stone has prepared this report for submission to Mid-Western Regional Council. This report provides direction for sustainable on-site effluent management for a 2-bedroom cabin residence, on Lot 102 DP756897, at 361 Old Grattai Road, Erudgere NSW (refer **Figure 1).**

2.2 Key References

The following key references were utilised as part of this assessment:

- AS/NZS 1547:2012. *On-site Domestic Wastewater Management;*
- NSW Government 1998. *On site Sewerage Management for Single Households* (The Silver Book/OSMSH);
- NSW Government 2000. *The Easy Septic Tank Guide.* Developed by Social Change Media for the NSW Department of Local Government;
- NSW Health, 2001. 'Septic Tank and Collection Well Accreditation Guidelines";
- Mid-Western Regional Council Local Environment Plan, 2012;
- Mid-Western Local Environment Plan, 2011;
- Murphy B.W. & Lawrie J.W. 1998. Soil Landscapes of the Dubbo 1:250 000 Sheet Report, DLWC.
- Sydney Catchment Management Authority, 2019. *Designing and Installing On-Site Wastewater Systems;*

2.3 Disposal System

Figure 1 illustrates the site location. **Figure 2** illustrates the proposed buffer, setback areas and proposed application area.

The proposed effluent disposal system for this site is via a dry composting toilet into an absorption bed.

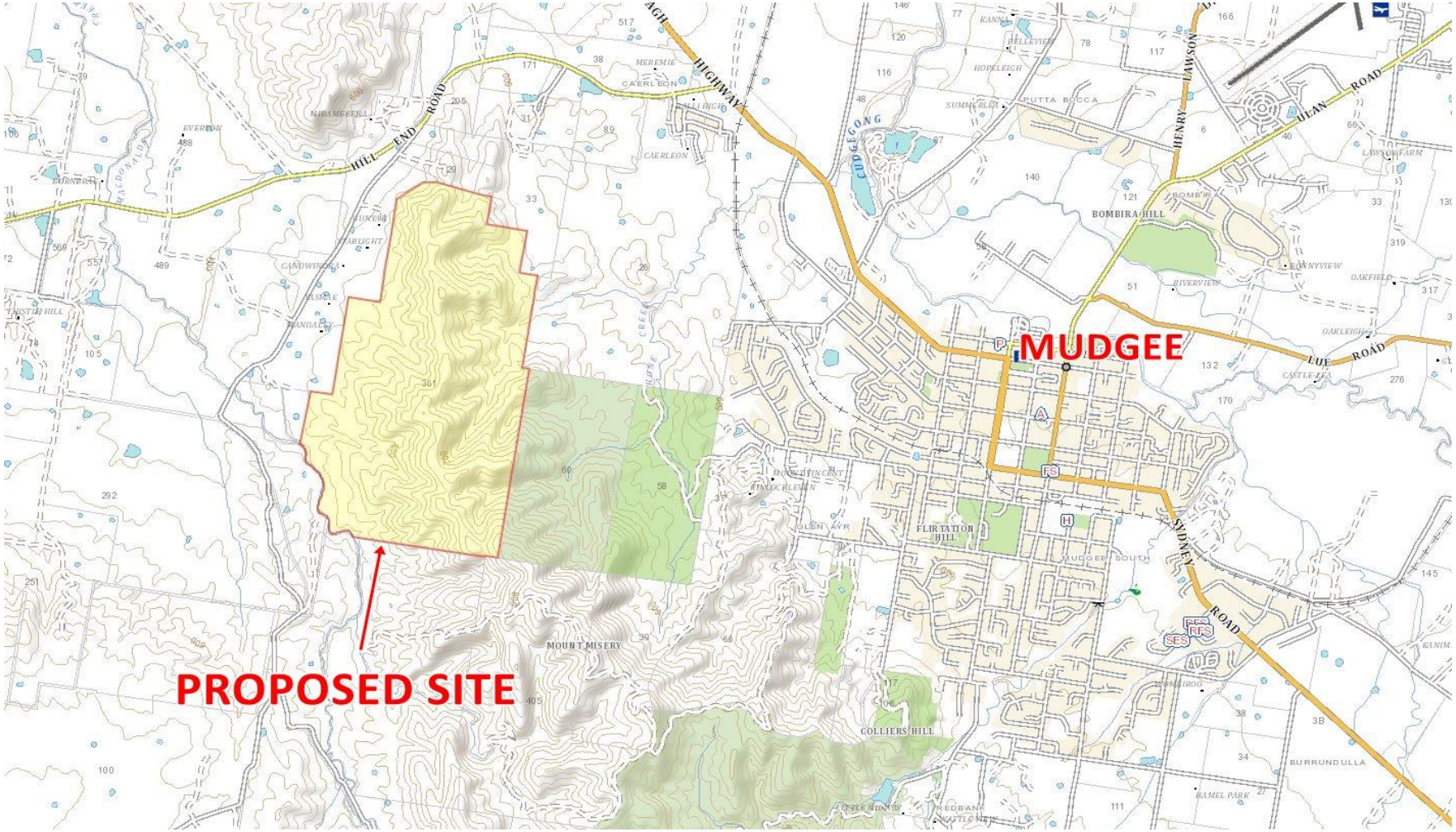

Figure 1 – Site Location Plan

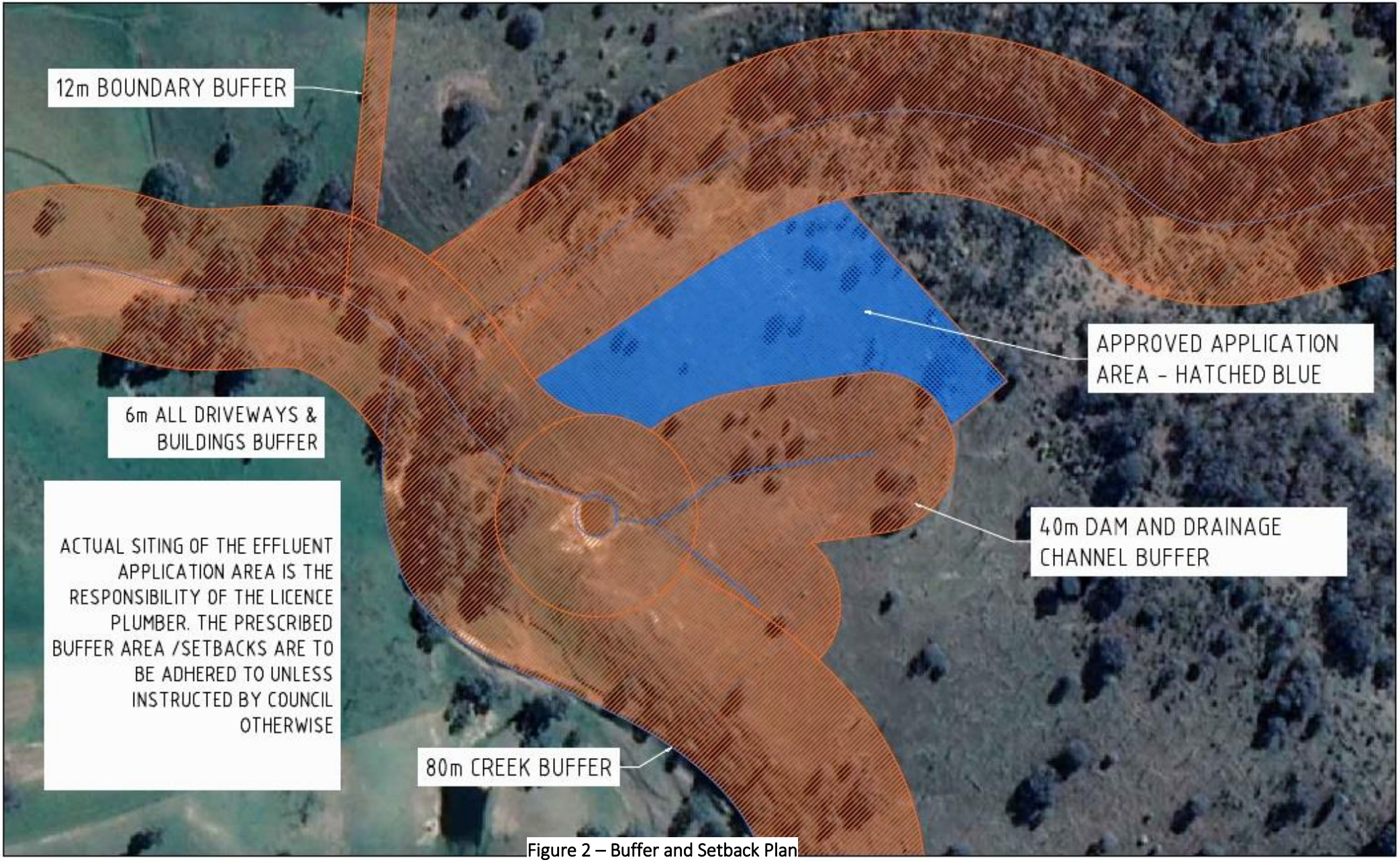

Figure 2 – Buffer and Setback Plan

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Client: KATE HAMMILL STONE
Project: EFFLUENT MANAGEMNT SYSTEM
Drawing Title: PROPOSED BUFFERS

Design JW
Drawn JW
Check LM
Original Sheet Size = A4
Certification
Drawing Number 36162-GD01
Revision A

3.0 SITE AND SOIL EVALUATION

3.1 Site Evaluators Details

The following table provides an overview of the evaluator's particulars.

Table 2: Details

Name / Role	Jeremy Wiatkowski
Role/ Qualifications	Geotechnical Technician
Company	Barnson Pty Ltd
Company Address	1/36 Darling Street Dubbo NSW 2830
Contact Details	1300 BARNSON
Date of Assessment	13/07/2021

3.2 Site Information

The following table provides an overview of the site information.

Table 3: Site Particulars

Address/Locality	361 Old Grattai Road, Erudgere NSW Lot 102 DP756897
Local Government Area	Mid-Western Regional Council
Owner	Kate Hammill Stone
Block Configuration	Approximately 409ha
Intended Water Supply	Rainwater roof collection supplied
Intended Power Supply	Supplied
Local Experience	Care needs to be taken to minimise runoff and erosion. Systems commonly malfunction due to lack of ongoing maintenance. The system is to be inspected and maintained regularly in accordance with manufacturer details, Council requirements, and prescriptions identified in this report.

3.3 Desktop Assessment

The following information was obtained via desktop review of the site.

Table 4: Desktop Assessment Details

Climate Overview[1]		Annual Average Rainfall for Mudgee is 659.1mm. Warm summers with large evaporative deficit, cool winters with small evaporative deficit. The mean summer monthly rainfall (January) is 64.6mm. The mean winter rainfall (July) is 43.4mm.
Soil Landscape Reference[2]	Area has been mapped within the "Avisford" Landscape Group. Non-calcic Brown Soils and Yellow Podzolic-Solodic Soils co-dominate the area.	
	Surface Conditions	Hardsetting
	Drainage	Moderate
	Available water holding capability	Moderate
	Water table depth	>70cm
	Depth to bedrock	>70cm
	Flood hazard	Nil
	Expected Nutrient deficiencies	Nitrogen, Phosphorus
	Soil Salinity	Low
	Erosion Hazard	Low
Underlying Geology[3]		*"Sandstone, shale, conglomerate.".*
Groundwater Review		No water bores were found within 500m of the proposed site, as illustrated in **Figure 3.** The area is mapped as being partially groundwater vulnerable as per the Mid-Western Regional Council LEP map GRV_006 **Figure 4.**

[1] Bureau of Meteorology online Climate Data website

[2] NSW Soil and Land Information System

[3] New South Wales 1:1000000

3.4 Groundwater Review

Although no groundwater information was available, no water bores were identified as occurring within the general area of the allotment. Information relating to historic groundwater report details on water bearing zones and standing water levels is provided in the table below.

Table 5: Groundwater Review

Groundwater Bore Reference	Total Depth (m)	Water Bearing Zones (m)	Standing Water Level (m)	Yield (L/s)	Salinity Yield
N/a	N/a	N/a	N/a	N/a	N/a

No groundwater was encountered during the site investigation. From this information, it can be determined that in this locality, subsequent contamination by secondary treated effluent is not a risk factor.

3.5 Surface Water Review

The site drains towards Macdonalds Creek located approximately 200m to the west of the proposed application area.

Figure 3 – Groundwater Bore Locations

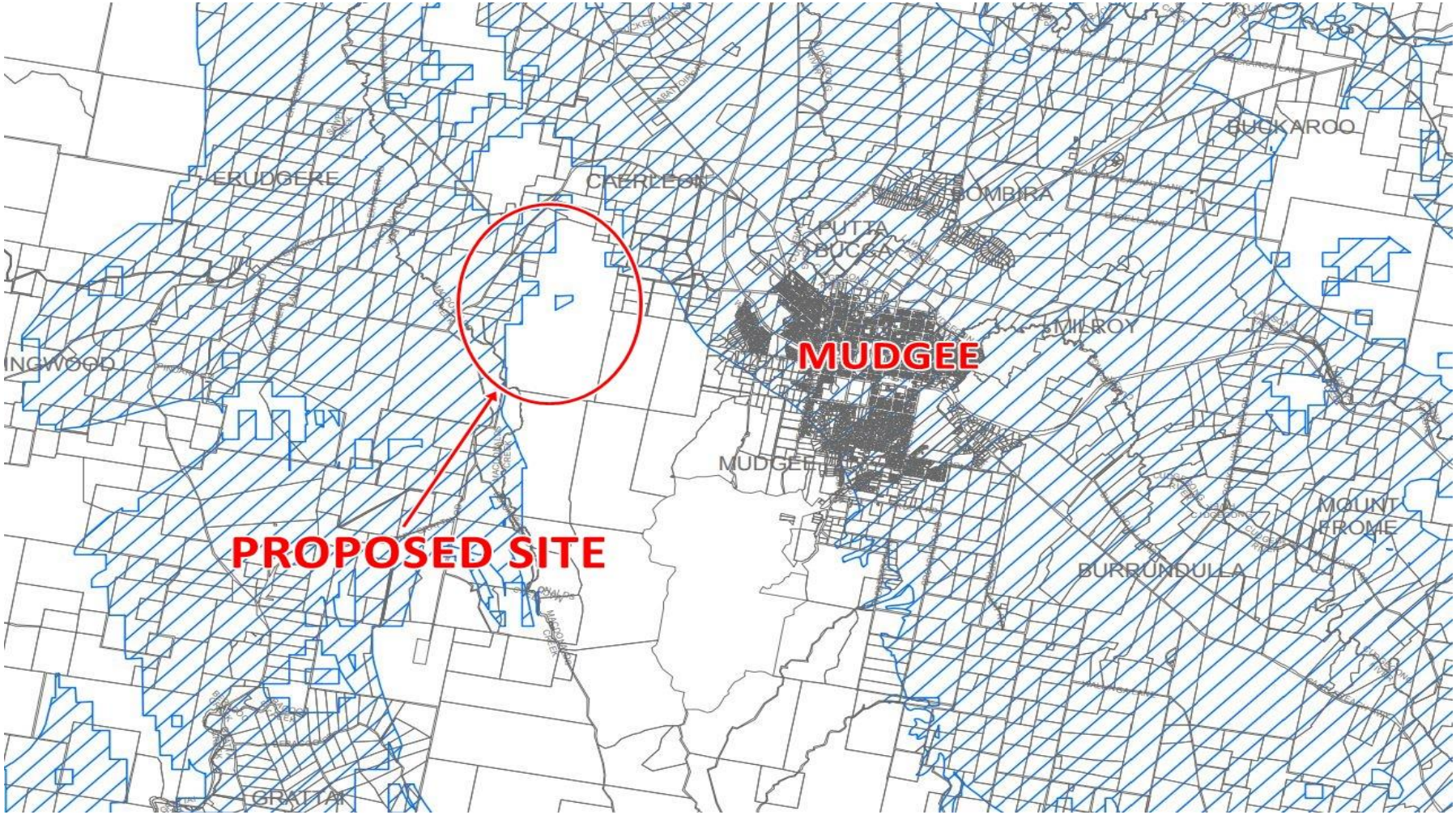

Figure 4 – Groundwater Vulnerability Map GRV_006

3.6 Field Assessment Information

A field inspection was conducted on 13/07/2021. The following table provides detail on the site assessment as well as the field and laboratory results.

Table 6: Site Assessment Details

Water Balance Attached		See ***Appendix A***
Exposure		Good exposure.
Slope		The site is sloping steeply to the west.
Elevation		Approximately 554m.
Run-On		None
Seepage		None
Erosion Potential		Low due to vegetation cover.
Site Drainage		The site drains towards Macdonalds Creek located approximately 200m to the west of the proposed application area.
Fill		None encountered
Surface rock/Outcrops		Encountered at 0.9m.
Is there sufficient land area for:	Application system, including buffers	Yes
	Reserve application system	Yes

3.7 Soil Assessment

A soil sample was taken and returned to Barnson Pty Ltd for analysis on 13/07/2021. The sample was collected to a depth of 800mm during the site investigation as per AS1289.1.2.1.6.5.3. Laboratory and results are provided at Appendix B. Field assessment parameters were also obtained. The following table provides detail on both field and laboratory assessment results.

Table 7: Soil Assessment Details

Depth to bedrock or hardpan via field assessment		>0.9m
Depth to high soil water table via field assessment		>0.9m
Soil Analysis	pH – subsoil $CaCl_2$ (lab), subsoil	4.6
	Emerson Test Result –subsoils (Lab)	6
	Liquid Limit, Plastic Limit, Plasticity Index, Linear Shrinkage. (%)	LL = 43 PL = 14 PI = 29 LS = 12 See Borelog in **Appendix B**
	Estimated Soil Category–topsoil, subsoil A, subsoil B,	6,6
	Structure massive, weak, high, moderate, strong (Field)	Strongly Structured
	Soil Profile description	See Borelog in Appendix B
	Sub soil Permeability (from table 5.2 of AS 1547:2012)	0.06-0.5(k_{sat}) (m/d) 2.5-20.8 (mm/hr) (Infiltration is Slow)
	Recommended Hydraulic Loading for disposal system (from Table 5.2 of AS 1547:2012)	5mm per day (For effluent disposal ETA beds)

4.0 SITE AND SOIL LIMITATION ASSESSMENT

The following two limitation tables are a standardised guide to the site and soil characteristics which may limit the suitability of the site for effluent disposal and which require attention through specific management practises. The tables have been reproduced from the NSW Government endorsed '*On-Site Sewerage Management for Single Households*' (1998), Tables 8 and 9. The highlighted categories represent site and soil conditions of the land covered in this report.

Table 8: Site Limitation Assessment

Site Feature	Relevant System	Minor Limitation	Moderate Limitation	Major Limitation	Restrictive Feature
Flood Potential	All land application systems	> 1 in 20 years		Frequent below 1 in 20 years	Transport in wastewater off site
	All treatment application systems	Components above 1 in 100 years		Components below 1 in 100 years	Transport in wastewater off site system failure
Exposure	All land application systems	High sun and wind exposure		Low sun and wind exposure	Poor evaporation transpiration
Slope %	Surface Irrigation	0-6	6-12	>12	Runoff, erosion potential
	Sub-surface irrigation	0-10	10-20	>20	Runoff, erosion potential
	Absorption	0-10	10-20	>20	Runoff, erosion potential
Landform	All systems	Hillcrests, convex side slopes and plains	Concave side slopes and foot slopes	Drainage plains and incised channels	Groundwater pollution hazard, resurfacing hazard
Run-on and upslope seepage	All land Application Areas	None-low	Moderate	High, diversion not practical	Transport of wastewater off site
Erosion potential	All land application systems	No sign of erosion potential		Indications of erosion e.g. rils, mass failure	Soil degradation and off-site impact
Site drainage	All land application systems	No visible signs of surface dampness		Visible signs of surface dampness, such as moisture-tolerant veg	Groundwater pollution hazard, resurfacing hazard
Fill	All systems	No fill	Fill present		Subsidence
Land area	All systems	Area available	Area not available		Health and pollution risk
Rock and rock outcrop	All land application systems	<10%	10-20%	>20%	Limits system performance
Geology	All land application systems	None		Major geological discontinuities, fractured or highly porous regolith	Groundwater pollution hazard

Table 9: Soil Limitation Assessment

Soil feature	Relevant system	Minor limitation	Moderate limitation	Major limitation	Restrictive feature
Depth to bedrock or hardpan (m)	Surface and sub-surface irrigation	> 1.0	0.5-1.0	< 0.5	Restricts plant growth
	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Depth to seasonal water table (m)	Surface and sub-surface irrigation	> 1.0	0.5-1.0	< 0.5	Groundwater pollution hazard
	Absorption	> 1.5	1.0-1.5	< 1.0	Groundwater pollution hazard
Permeability Category	Surface and sub-surface irrigation	2b, 3 and 4	2a, 5	1 and 6	Excessive runoff and waterlogging
	Absorption	3, 4		1, 2, 5, 6	Percolation
Coarse fragments %	All systems	0-20	20-45	>40	Restricts plant growth, affects trench installation
Bulk density (g/cc) SL L, CL C	All land application systems	 < 1.8 < 1.6 < 1.4	 > 1.8 > 1.6 >1.4		restricts plant growth, indicator of permeability
pH	All land application systems	> 6.0	4.5-6.0	-	Reduces plant growth
Electrical conductivity (dS/m)	All land application systems	<4	4-8	>8	Restricts plant growth
Sodicity (ESP)	Irrigation 0-40cm; absorption 0-1.2mtr	0-5	5-10	> 10	Potential for structural degradation
CEC mequiv/100g	Irrigation systems	> 15	5-15	< 5	Nutrient leaching
P sorption kg/ha	All land application systems	> 6000	2000-6000	< 2000	Capacity to immobilise P
Modified Emerson Aggregate Test – depressiveness	All land application systems	Classes 3-4	Class 2	class1	Potential for Structural degradation.

5.0 SYSTEM REQUIREMENTS

5.1 Mid-Western Regional Council Setback Requirements

The Mid-Western Regional Council 'On-Site Sewage Management Plan' (2008), provides recommended buffer distances. For this design, the following must be taken into consideration.

All Land Application Systems

- 80m to permanent surface waters (e.g. river, streams, lakes, etc.);
- 50m to domestic groundwater well on applicant's property and 200m to any groundwater well located on a neighbouring property;
- 40m to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc.)

Absorption Systems

- 12m if area up-grade and 6m if area down gradient of property boundary;
- 6m if area is up-gradient and 3m if area is down gradient of swimming pools, driveways and building.

Other site setback requirement as per AS/NZS 1547:2012 are provided in **Appendix C.**

Actual siting of the effluent application area is the responsibility of the licenced plumber. The prescribed buffer areas/setbacks are to be adhered to.

5.2 Design Allowances - AS/NZS1547:2012 Table H1

In accordance with AS/NZS1547:2012 Table H1, the recommended design flow allowance for greywater only use in Australia, with handbasin, shower, bath and laundry wastewater fixture is 90L/person/day. Given the proposed residence is 2 bedrooms in total, the number of persons is calculated at 3.

6.0 EFFLUENT MANAGEMENT

Barnson Pty Ltd has analysed the proposed on-site waste management system in accordance with the NSW Government endorsed *'Silver Book'* (1998) and the ANZ Standard 1547:2012 On-site Domestic Wastewater Management', with additional advice sought from the Sydney Catchment Management Authority '*Designing and installing On-site Wastewater Systems'* 2019 guideline. For this site, given the climate and soil constraints, absorption is considered the most appropriate effluent management device.

6.1 Hydraulic Loading Calculation

Given the proposed residence will be connected with wastewater fixtures (handbasin, shower, bath and laundry) and an overflow of estimated 2L/day from the dry composting toilet the daily flow (Q) for the system is calculated as 272L/per day.

The required bed area shall be determined from the following relationship:

$$Length\ of\ Absorption\ Bed\ = (Q)\ /\ (DLR\ x\ W)$$

Proposed Residence (Greywater Use)

Where Q = 272L, DLR =5mm/day (Table L1 AS 1577:2012 –Conservative Rate),

W (Width) = 3.0m

$$Length\ of\ Evaporation\ Bed = \left(\frac{272}{5\ x\ 3m}\right)$$
$$= 18.13m$$

Therefore, from the above calculation, 1 x Evaporation bed, 18.2m long, 3m wide will be required for the proposed 2-bedroom cabin (Greywater and dry compost overflow only).

6.2 Design Recommendations

Common failures of beds/trenches are often caused by poor installation practices. In addition to specifications outlined in AS/NZS 1547:2012, the following points should also be considered in the bed/trench design/construction which to meet the *minimum* dimensions of ***1 ETA bed, 18.2m long and 3m wide.***

- Beds/trenches are to be built along the contour to ensure even distribution and avoid any section being over loaded;
- Avoid cutting beds into weakened ground;
- Construction is to take place during fine weather. If it rains beds are to be completely covered to protect them from rain damage;
- Where the beds/trenches are dug by an excavator in clay soils, the bed walls are to be scarified to remove any smearing caused by the excavator bucket;
- All distribution pipes and arches should be laid in accordance with the manufactures instructions;
- If two beds or more are utilised, ensure effluent is distributed evenly via a splitter box or sequencing valve or other appropriate method;
- All distribution pipes and arches should be laid in accordance with the manufactures instructions;
- Consideration can be given to using a pressure dosed system, which would allow for a better, more even distribution of effluent along the trench, and prolong trench life;
- Inspection ports shall be provided for the beds/trenches system. The inspection port shall be installed so as to facilitate monitoring of the effluent level in each trench;
- Trenches/Beds may be gravity fed or pressure dosed using pumps or dosing siphons;
- Vegetation cover must be well maintained to ensure strong growth for maximum update of transpiration. The surrounding landscape and vegetation must also be maintained to minimise shading and maximise exposure.
- The beds/trenches should be in an enclosed area, with and no exposed to vehicle movement or stock that can cause compaction and premature trench failure;
- The beds/trenches are to be constructed along the contour via laser levelling to ensure the base is exactly level;
- It is recommended that a filter to be installed to prolong the life of the absorption bed and avoid blockage.
- A diversion berm/bank/drain should be built upslope of the trench. This will reduce run on. A design sketch is provided at Appendix D.

7.0 RECOMMENDATIONS & CONCLUSIONS

As per the '*On-Site Sewerage Management for Single Households'* (1998) publication, stakeholders should be aware that all on site systems and components have a finite life and at some point, will require replacement. Septic tanks and AWTS' generally require replacement every 25 years, whereas effluent disposal systems can have an expected life between 5-15 years. The owner is encouraged to obtain a copy of the NSW Government "The Easy Septic Guide" (2000) available from - https://www.olg.nsw.gov.au/wp-content/uploads/Easy-septic-guide.pdf

****As stated in AS1547-2012 section 5.5.3.4, a reserve application area of similar size to the current design should be considered as part of the risk management process to be available on a site for expansion or for resting of the land application system.*

The option provided in this report is a primary treatment septic fed into absorption beds. This is to be designed to accept the discharge from the wastewater treatment unit and it convey it securely and evenly to the land application area. The aim is to ensure uniform distribution of the effluent over the design area to help achieve effective aerobic/anaerobic decomposition within the soil. Typical design sketches for a bed/trench system as per AS 1547:2012 and *Design and Installation of On-Site Wastewater Treatment (*2012) are provided at ***Appendix D.***

Installation instructions shall be provided by the manufacturer or designer. Barnson will not be liable for the incorrect installation and/or construction of the system unless when inspected by Barnson the installation and construction of the system holds true to the design featured in this report. Installation should be in accordance with the prescriptions within AS 1547:2012.

Barnson has not verified the accuracy or completeness of this data, except otherwise stated in this report. The recommendations for the proposed system as suggested in this report are based on historical data obtained for the area. Barnson will not be liable in relation to incorrect recommendations should any information provided by the client be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

The accuracy of geotechnical engineering advice provided in this report may be limited by unobserved variations in ground conditions across the site in areas between and beyond test locations and by any restrictions in the sampling and testing which was able to be carried out, as well as by the amount of data that could be collected given the project and site constraints.

These factors may lead to the possibility that actual ground conditions and materials behaviour observed at the test locations may differ from those which may be encountered elsewhere on the site.

If the sub-surface conditions are found to differ from those described in this report, we should be informed immediately to evaluate whether recommendations should be reviewed and amended if necessary.

Please do not hesitate to contact the undersigned if you have enquires regarding this report.

Yours Faithfully

Jeremy Wiatkowski
Laboratory Technician

Reviewed By

Luke Morris
B.E. MIEAust CPEng (NPER)
Director

Appendix A – Water Balance Calculation

Barnson Job No	36162-ER01_A	
Location :	Erudgere	

Design Wastewater Flow	**Q**	**l/day**	272
Design Loading Rate	**R**	**mm/day**	5

Climate Zone	3 C	*As per Soil Landscapes of Dubbo 1:250 000* **Dropbox**

1	2	3	4	5	6	7	8	9	
Month	**Pan evap E (mm)**	**Evapo Transpiration Et (ET=0.75E)mm**	**Rainfall R (mm)**	**Retained Rainfall Rr (Rr=0.75R) mm**	**DLR per Month (mm)**	**Disposal Rate (3-5+6) mm**	**uent applied per mo (L)**	**Size of Area (8/7) m²**	**Days In Month**
Jan	229	171.75	94	70.5	155	256.25	8432	32.90536585	**31**
Feb	178	133.5	86	64.5	145	214	7888	36.85981308	**29**
Mar	155	116.25	76	57	155	214.25	8432	39.35589265	**31**
Apr	104	78	64	48	150	180	8160	45.33333333	**30**
May	51	38.25	70	52.5	155	140.75	8432	59.90763766	**31**
Jun	46	34.5	75	56.25	150	128.25	8160	63.62573099	**30**
Jul	41	30.75	60	45	155	140.75	8432	59.90763766	**31**
Aug	58	43.5	66	49.5	155	149	8432	56.59060403	**31**
Sep	89	66.75	60	45	150	171.75	8160	47.51091703	**30**
Oct	130	97.5	81	60.75	155	191.75	8432	43.97392438	**31**
Nov	165	123.75	78	58.5	150	215.25	8160	37.90940767	**30**
Dec	229	171.75	96	72	155	254.75	8432	33.09911678	**31**
							Mean area	46.4m²	

Month	First trial area	Application rate	Disposal rate	mm	Increase in Depth of Stored Effluent	th of Effluent for Mo	Increase in Depth of Effluent	Computed	Reset if Et<0	Equiv Storage
Dec	54.6m²	154.4322344	254.75	-100.3177656	-334.3925519	0	-334.3925519	-334.3925519	0	0
Jan		154.4322344	256.25	-101.8177656	-339.3925519	0	-339.3925519	-339.3925519	0	0
feb		144.4688645	214	-69.53113553	-231.7704518	0	-231.7704518	-231.7704518	0	0
Mar		154.4322344	214.25	-59.81776557	-199.3925519	0	-199.3925519	-199.3925519	0	0
Apr		149.4505495	180	-30.54945055	-101.8315018	0	-101.8315018	-101.8315018	0	0
May		154.4322344	140.75	13.68223443	45.60744811	0	45.60744811	45.60744811	45.60744811	2490.166667
Jun		149.4505495	128.25	21.20054945	70.66849817	45.60744811	116.2759463	116.2759463	116.2759463	6348.666667
Jul		154.4322344	140.75	13.68223443	45.60744811	116.2759463	161.8833944	161.8833944	161.8833944	8838.833333
Aug		154.4322344	149	5.432234432	18.10744811	161.8833944	179.9908425	179.9908425	179.9908425	9827.5
Sep		149.4505495	171.75	-22.29945055	-74.33150183	179.9908425	105.6593407	105.6593407	105.6593407	5769
Oct		154.4322344	191.75	-37.31776557	-124.3925519	105.6593407	-18.73321123	-18.73321123	0	0
Nov		149.4505495	215.25	-65.79945055	-219.3315018	0	-219.3315018	-219.3315018	0	0
Dec		154.4322344	254.75	-100.3177656	-334.3925519	0	-334.3925519	-334.3925519	0	0
Jan		154.4322344	256.25	-101.8177656	-339.3925519	0	-339.3925519	-339.3925519	0	0
Feb		144.4688645	214	-69.53113553	-231.7704518	0	-231.7704518	-231.7704518	0	0
Mar		154.4322344	214.25	-59.81776557	-199.3925519	0	-199.3925519	-199.3925519	0	0
Apr		149.4505495	180	-30.54945055	-101.8315018	0	-101.8315018	-101.8315018	0	0
May		154.4322344	140.75	13.68223443	45.60744811	0	45.60744811	45.60744811	45.60744811	2490.166667

Estimated area of effluent drainfield	54.6m²
Maximum depth of stored effluent (must not exceed 350mm)	179.99mm
Bed/Trench dimensions	3000mm
Length of bed/trench required	18.2m
<20m lengths of bed/trench	0.91

Trench Depth	450

Appendix B - Borehole Logs & Laboratory Testing Results

Barnson
1/36 Darling Street
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Telephone: 1300 227 676

BOREHOLE NUMBER 6

CLIENT Kate Hammill Stone **PROJECT NAME** Septic Design

PROJECT NUMBER 36162 **PROJECT LOCATION** 361 Old Grattai Road, Erudgeree NSW

DATE STARTED 13/7/21 **COMPLETED** 13/7/21 **R.L. SURFACE** **DATUM**

DRILLING CONTRACTOR Barnson **SLOPE** 90° **BEARING** ---

EQUIPMENT GT-10 Drill Rig **HOLE LOCATION** Borehole 6

HOLE SIZE 90mm **LOGGED BY** HC **CHECKED BY** NR

NOTES

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
Flight Auger & Tungsten Carbide (T.C) Bit		0			Sandy SILT: trace gravel: dark brown	0 4 8 12 16 20 24 2832	TOPSOIL
		0.2		CL	Silty CLAY: trace gravel: brown-orange: slightly moist: very stiff to hard: medium plasticity		RESIDUAL
	Disturbed Sample LS = 12.0% PI = 29%	0.5					
		1.0			Borehole 6 terminated at 0.9m		REFUSAL ON SEDIMENTARY ROCK
		1.5					

Material Test Report

Report Number:	**36162-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Amend Material Description*
Date Issued:	28/07/2021
Client:	Kate Hammill Stone
	P.O. Box 8, Mudgee NSW 2850
Contact:	Kate Hammill Stone
Project Number:	36162
Project Name:	Site Classification and Septic Design
Project Location:	361 Old Grattai Road, Erudgeree NSW
Work Request:	5087
Sample Number:	D21-5087G
Date Sampled:	13/07/2021
Dates Tested:	13/07/2021 - 22/07/2021
Sampling Method:	AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location:	**Borehole 6, Depth: 800mm**
Material:	Brown-Orange Silty CLAY Trace Gravel

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Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Nick Reardon
Laboratory Manager
NATA Accredited Laboratory Number: 9605

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	43		
Plastic Limit (%)	14		
Plasticity Index (%)	**29**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.0		
Cracking Crumbling Curling	Curling		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**	6	
Soil Description	Brown Orange Silty CLAY Trace Gravel		
Nature of Water	Distilled		
Temperature of Water (^{O}C)	14		

Appendix C - Site Setback Requirements

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2)

Site feature	**Setback distance range** (m) (See Note 1)	**Site constraint items of specific concern** (from Table R2) (see Note 1)
	Horizontal setback distance *(m)*	
Property boundary	1.5 – 50 (see Note 2)	A, D, J
Buildings/houses	2.0 – > 6 (see Note 3)	A, D, J
Surface water (see Note 4)	15 – 100	A, B, D, E, F, G, J
Bore, well (see Notes 5 and 6)	15 – 50	A, C, H, J
Recreational areas (Children's play areas, swimming pools and so on) (see Note 7)	3 – 15 (see Notes 8 and 9)	A, E, J
In-ground water tank	4 – 15 (see Note 10)	A, E, J
Retaining wall and Embankments, escarpments, cuttings (see Note 11)	3.0 m or 45° angle from toe of wall (whichever is greatest)	D, G, H
	Vertical setback distance *(m)*	
Groundwater (see Notes 5, 6, and 12)	0.6 – > 1.5	A, C, F, H, I, J
Hardpan or bedrock	0.5 – ≥ 1.5	A, C, J

NOTES:

1 The overall setback distance should be commensurate with the level of risk to public health and the environment. For example, the maximum setback distance should be adopted where site/system features are on the high end of the constraint scale. The setback distance should be based on an evaluation of the constraint items and corresponding sensitive features in Table R2 and how these interact to provide a pathway or barrier for wastewater movement.

2 Subject to local regulatory rules and design by a suitably qualified and experienced person, the separation of a drip line system from an upslope boundary, for slopes greater than 5%, may be reduced to 0.5 m.

TABLE R1
GUIDELINES FOR HORIZONTAL AND VERTICAL SETBACK DISTANCES
(to be used in conjunction with Table R2) (continued)

3	Setback distances of less than 3 m from houses are appropriate only where a drip irrigation land application system is being used with low design irrigation rates, where shallow subsurface systems are being used with equivalent low areal loading rates, where the risk of reducing the bearing capacity of the foundation or damaging the structure is low, or where an effective barrier (designed by a suitably qualified and experienced person) can be installed. This may require consent from the regulatory authority.
4	Setback distance from surface water is defined as the areal edge of the land application system to the edge of the water. Where land application areas are planned in a water supply catchment, advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist. Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
5	Highly permeable stony soils and gravel aquifers potentially allow microorganisms to be readily transported up to hundreds of metres down the gradient of an on-site system (see R3, Table 1 in Pang et al. 2005). Maximum setback distances are recommended where site constraints are identified at the high scale for items A, C, and H. For reading and guidance on setback distances in highly permeable soils and coarse-grained aquifers see R3. As microbial removal is not linear with distance, data extrapolation of experiments should not be relied upon unless the data has been verified in the field. Advice on adequate buffer distances should be sought from the relevant water authority and a hydrogeologist.
6	Setback distances from water supply bores should be reviewed on a case-by-case basis. Distances can depend on many factors including soil type, rainfall, depth and casing of bore, direction of groundwater flow, type of microorganisms, existing quality of receiving waters, and resource value of waters.
7	Where effluent is applied to the surface by covered drip or spray irrigation, the maximum value is recommended.
8	In the case of subsurface application of primary treated effluent by LPED irrigation, the upper value is recommended.
9	In the case of surface spray, the setback distances are based on a spray plume with a diameter not exceeding 2 m or a plume height not exceeding 0.5 m above finished surface level. The potential for aerosols being carried by the wind also needs to be taken into account.
10	It is recommended that land application of primary treated effluent be down gradient of in-ground water tanks.
11	When determining minimum distances from retaining walls, embankments, or cut slopes, the type of land application system, soil types, and soil layering should also be taken into account to avoid wastewater collecting in the subsoil drains or seepage through cuts and embankments. Where these situations occur setback clearances may need to be increased. In areas where slope stability is of concern, advice from a suitably qualified and experienced person may be required.
12	Groundwater setback distance (depth) assumes unsaturated flow and is defined as the vertical distance from the base of the land application systems to the highest seasonal water table level. To minimise potential for adverse impacts on groundwater quality, minimum setback distances should ensure unsaturated, aerobic conditions in the soil. These minimum depths will vary depending on the scale of site constraints identified in Table R2. Where groundwater setback is insufficient, the ground level can be raised by importing suitable topsoil and improving effluent treatment. The regulatory authority should make the final decision in this instance. (See also the guidance on soil depth and groundwater clearance in Tables K1 and K2.)

TABLE R2

SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES

(used as a guide in determining appropriate setback distances from ranges given in Table R1)

Item	Site/system feature	**Constraint scale** (see Note 1) **LOWER** ⟷ **HIGHER** **Examples of constraint factors** (see Note 2)		Sensitive features
A	Microbial quality of effluent (see Note 3)	Effluent quality consistently producing ≤ 10 cfu/100 mL *E. coli* (secondary treated effluent with disinfection)	Effluent quality consistently producing ≥ 10^6 cfu/100 mL *E. coli* (for example, primary treated effluent)	Groundwater and surface pollution hazard, public health hazard
B	Surface water (see Note 4)	Category 1 to 3 soils (see Note 5) no surface water down gradient within > 100 m, low rainfall area	Category 4 to 6 soils, permanent surface water <50 m down gradient, high rainfall area, high resource/environmental value (see Note 6)	Surface water pollution hazard for low permeable soils, low lying or poorly draining areas
C	Groundwater	Category 5 and 6 soils, low resource/environmental value	Category 1 and 2 soils, gravel aquifers, high resource/environmental value	Groundwater pollution hazard
D	Slope	0 – 6% (surface effluent application) 0 – 10% (subsurface effluent application)	> 10% (surface effluent application), > 30% subsurface effluent application	Off-site export of effluent, erosion
E	Position of land application area in landscape (see Note 6).	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Surface water pollution hazard, off-site export of effluent
F	Drainage	Category 1 and 2 soils, gently sloping area	Category 6 soils, sites with visible seepage, moisture tolerant vegetation, low lying area	Groundwater pollution hazard
G	Flood potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Off-site export of effluent, system failure, mechanical faults
H	Geology and soils	Category 3 and 4 soils, low porous regolith, deep, uniform soils	Category 1 and 6 soils, fractured rock, gravel aquifers, highly porous regolith	Groundwater pollution hazard for porous regolith and permeable soils
I	Landform	Hill crests, convex side slopes, and plains	Drainage plains and incise channels	Groundwater pollution hazard, resurfacing hazard
J	Application method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Off-site export of effluent, surface water pollution

NOTES:

1 Scale shows the level of constraint to siting an on-site system due to the constraints identified by SSE evaluator or regulatory authority. See Figures R1 and R2 for examples of on-site system design boundaries and possible site constraints.

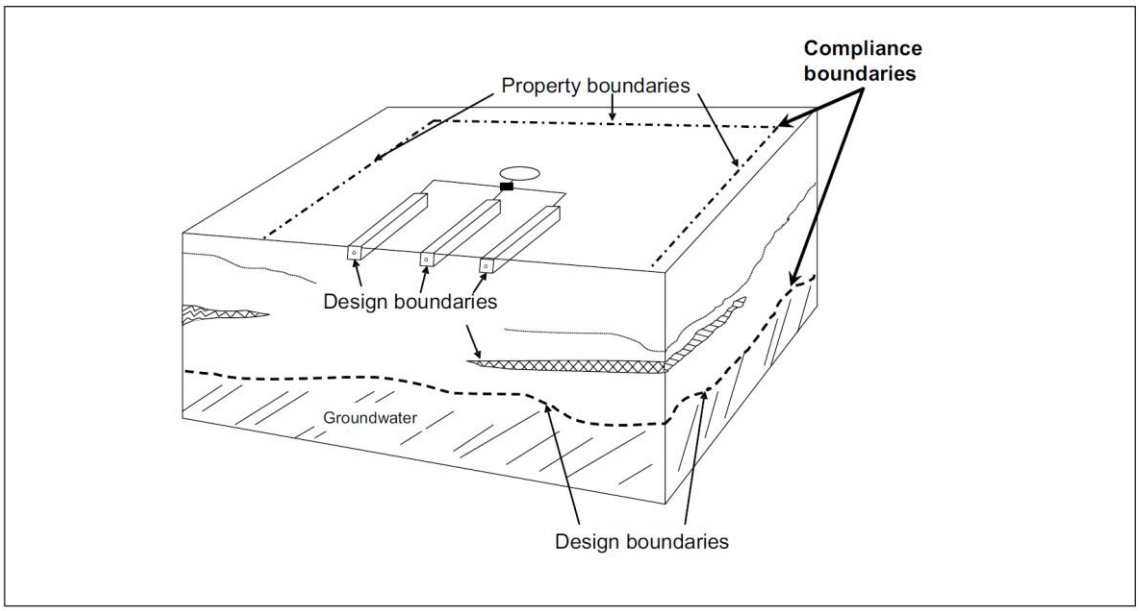
2 Examples of typical siting constraint factors that may be identified either by SSE evaluator or regulatory authority. Site constraints are not limited to this table. Other site constraints may be identified and taken into consideration when determining setback distances.

TABLE R2

SITE CONSTRAINT SCALE FOR DEVELOPMENT OF SETBACK DISTANCES

(used as a guide in determining appropriate setback distances from ranges given in Table R1) (continued)

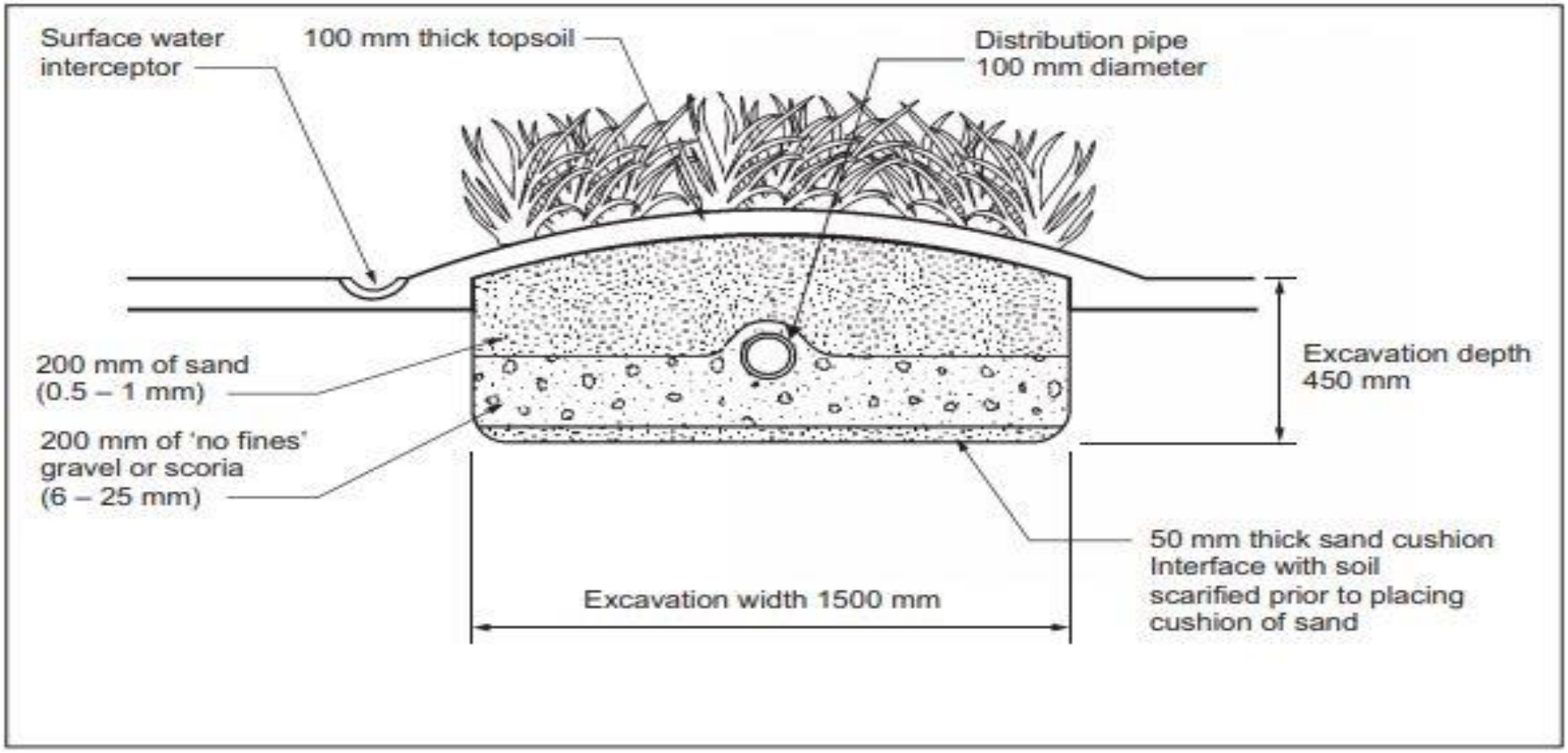
3	The level of microbial removal for any on-site treatment system needs to be determined and it should be assumed that unless disinfection is reliably used then the microbial concentrations will be similar to primary treatment. Low risk microbial quality value is based on the values given in ARC (2004), ANZECC and ARMCANZ (2000), and EPA Victoria *(Guidelines for environmental management: Use of reclaimed water* 2003).
4	Surface water, in this case, refers to any fresh water or geothermal water in a river, lake, stream, or wetland that may be permanently or intermittently flowing. Surface water also includes water in the coastal marine area and water in man-made drains, channels, and dams unless these are to specifically divert surface water away from the land application area. Surface water excludes any water in a pipe or tank.
5	The soil categories 1 to 6 are described in Table 5.1. Surface water or groundwater that has high resource value may include potable (human or animal) water supplies, bores, wells, and water used for recreational purposes. Surface water or groundwater of high environmental value include undisturbed or slightly disturbed aquatic ecosystems as described in ANZECC and ARMCANZ (2000).
6	The regulatory authority may reduce or increase setback distances at their discretion based on the distances of the land application up or downgradient of sensitive receptors.



(Adapted from USEPA 2002)

FIGURE R1 EXAMPLE OF DESIGN AND COMPLIANCE BOUNDARIES FOR APPLICATION OF SETBACK DISTANCES FOR A SOIL ABSORPTION SYSTEM

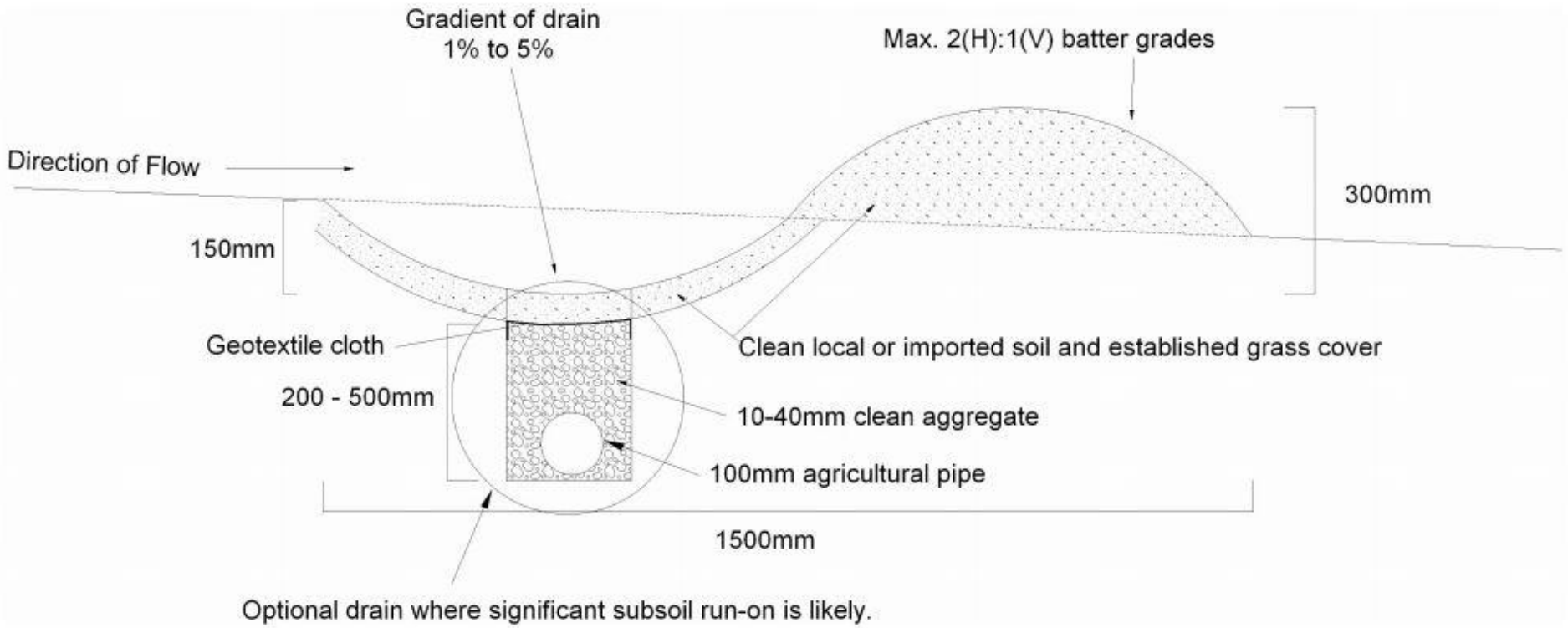
Appendix D – Evaporation Absorption Bed Concept Plans



NOTE: An LPED line can be used to dose load the ETA/ETS bed.

FIGURE L6 ETA/ETS BED DETAILS

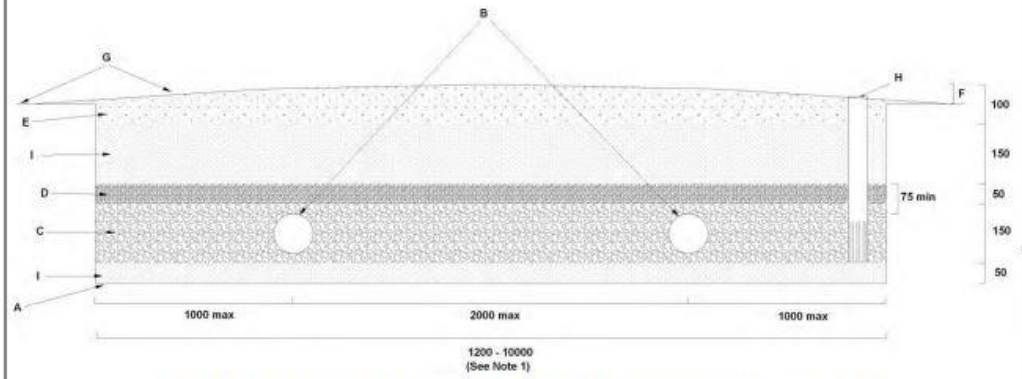
Cross Section: Upslope Diversion Drain



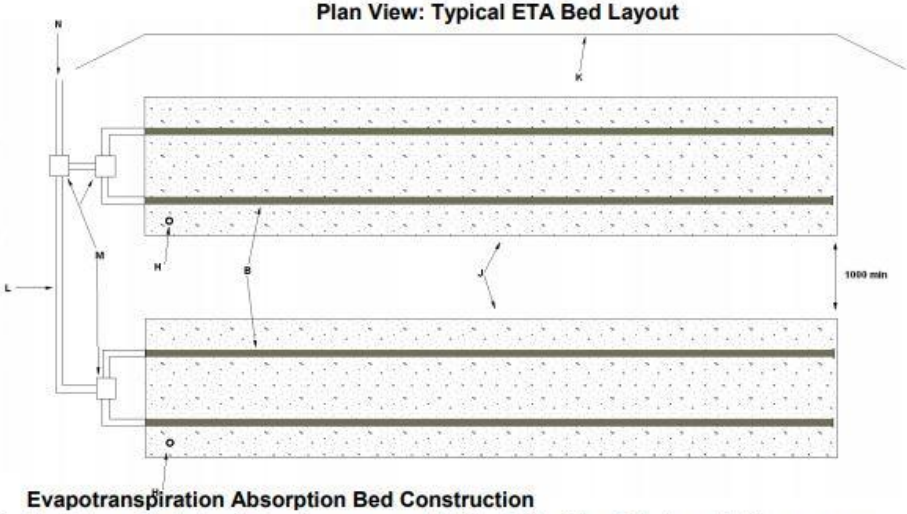
Standard Drawing 11A – Upslope Diversion Drain

(not to scale)

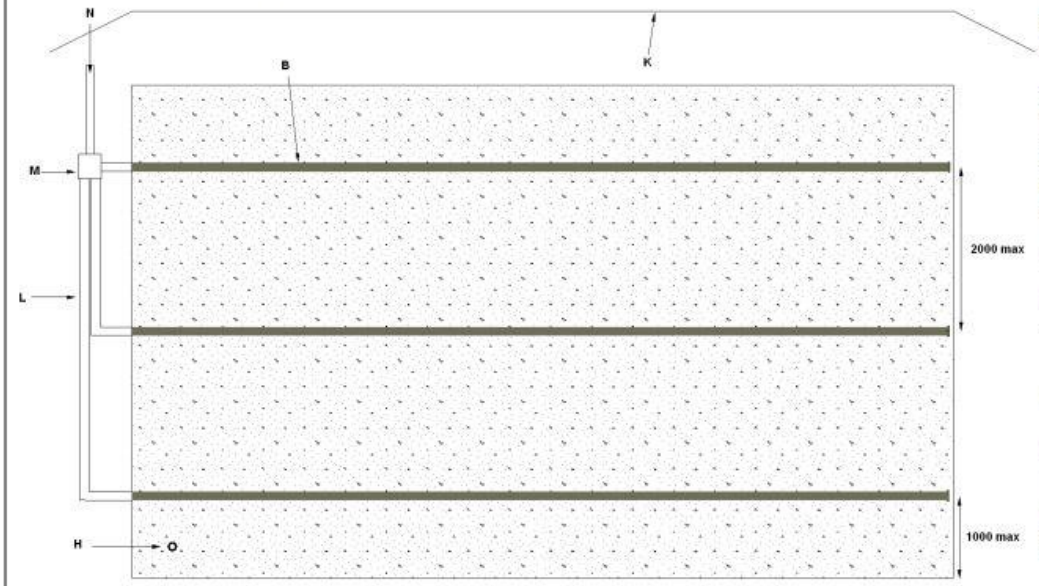
Cross Section: Evapotranspiration Absorption (ETA) Bed



Plan View: Typical ETA Bed Layout



Plan View: Typical Large ETA Bed Layout (applicable only if pressure-dosed and a flat site <5% slope)



Evapotranspiration Absorption Bed Construction

A The base of the bed must be level to ensure even distribution of effluent. It must also be scarified to overcome any smearing during excavation. Base levels should be checked with a dumpy / laser level.

B 100mm slotted PVC pipe.

C 20-40mm distribution aggregate.

D 5-10mm aggregate.

E Clean local or imported topsoil (sandy loam to loam).

F Allowance for settling after backfilling.

G Grass must be established across the construction area as soon as possible. Trench / bed surface should be level or slightly mounded.

H Inspection port on downhill side of the bed. Made from 50mm PVC pipe with perforations in the aggregate level of the bed.

I Fine sand (0.1mm).

J Bed dimensions are an example only. The basal area of the land application area must be determined according to the procedures set out in AS/NZS 1547:2012 and this Manual. The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The system may comprise a single trench / bed or multiple smaller trenches / beds. It is essential that effluent is distributed evenly to all units on a daily basis.

K Upslope stormwater diversion drain (see Standard Drawing No.11A for design detail). Subsoil drainage may be necessary on particular sites.

L 100 mm PVC gravity dosing pipe.

M Gravity splitter box to distribute effluent evenly between two to four separate trenches / beds. Should also be used to evenly dose multiple pipework within a single trench / bed.

N Gravity, siphon or pump fed effluent from treatment system.

Note

1 More than two distribution pipes will be required in beds wider than 4,000mm. Care should be taken with beds wider than 4,000mm to ensure a level base.

2 WaterNSW notes that drilling holes within PVC pipe makes them non-compliant with the AS/NZS 3500, as it impacts the structural integrity of the pipe.

Standard Drawing 11B – Evapotranspiration Absorption Bed

(not to scale)

LIST OF PLATES

Plate 1 – Overview of proposed site