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Site and Soil Assessment for On-site Effluent Management System

Client: Desim Pty Ltd
Site Address: 65-67 Columbus Street
Ivanhoe, NSW 2878

29 November 2023

Our Reference : 41903-ER01_A

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DISCLAIMER

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

Installation must be by a licensed plumber and Barnson will not be liable for the incorrect installation and/or construction of the system. Installation and construction of the system must hold true to the design recommendations presented in this report. Installation should be in accordance with the prescriptions within AS 1547:2012.

Unless otherwise stated in this report, Barnson has not verified the accuracy or completeness of the data retrieved from online databases and guidance documents. The recommendations for the proposed system as presented 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 the 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.

Project:	Lot 6-7 DP17774, 65-67 Columbus Street, Ivanhoe NSW 2878	
Client:	Desim Pty Ltd	
Project Number:	41903	
Report Reference:	41903-ER01_A	
Date:	20/11/2023	
Prepared by:	Reviewed by:	
		
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1.0 SYSTEM OVERVIEW

The following table provides a summary of the information for a sustainable onsite effluent management system proposed at Lot 6-7 DP17774, 65-67 Columbus Street, Ivanhoe NSW 2878. The sections of this report that follow, provide site specific details justifying the recommendations.

Table 1 : System Overview

Site Assessor	Jeremy Wiatkowski
Client	Desim Pty Ltd
Site Location	“Lot 6-7 DP17774”, 65-67 Columbus Street, Ivanhoe NSW
No. of Bedrooms	Lot 6 – 2 x 2 Bedroom Dwellings – 4 bedrooms total Lot 7 – 2 x 2 Bedroom Dwellings – 4 bedrooms total
Water Source	Town water
Estimated Daily Flow per lot (L/day)	600L/Day based on 4 people at 150L/person/day per lot *One person per bedroom*
Tank Recommendation	1 x Aerated Wastewater Treatment System (AWTS) *One system per lot*
Tank Capacity	As per section 6.3 the minimum size tank required is >3500L
Sub Soil Assessment Class	Field assessment and subsequent laboratory tests have classed the subsoil as category 6, as shown in section 3.5.
Sub Soil Recommended Hydraulic Loading mm/day (DIR/DLR)	ETA/ETS Bed/trench systems in category 6 soils have a design-loading rate of 5mm/day as per AS1547:2012 Table 5.2 & L1. (Refer to Table 7)
Recommended Effluent Application Type	Due to the category 6 soil (Medium-Heavy Clays) it is recommended to dispose of AWTS secondary treated effluent onsite to an evapotranspiration (ETS) bed.
Effluent Design Criteria	As per section 7.0 the minimum application area was determined by calculating the requirements of hydraulic loading. As shown 2 evapotranspiration beds of 15m long x 4m wide is required to dispose of the proposed hydraulic load.
Additional Notes	During construction gypsum to be applied at 1 kg/m ² to the base of the excavated bed/trench to prevent the clay dispersing. The bed/trench shall be closed in, as soon as possible to protect the gypsum from raindrop impact.

2.0 INTRODUCTION

2.1 Overview

Barnson Pty Ltd on behalf of Desim Pty Ltd has prepared this report for submission to Central Darling Shire Council. This report provides direction for sustainable on-site effluent management for two 2 bedroom residences, proposed on each lot at Lot 6-7 DP17774, 65-67 Columbus Street, Ivanhoe 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’;
- Central Darling Local Environmental Plan 2012;
- Sydney Catchment Management Authority, 2019. *Designing and Installing On-Site Wastewater Systems*;

2.3 Onsite Effluent Management System

The onsite effluent management system proposed for each Lot consists of a AWTS with secondary treated effluent disposed into evapotranspiration beds. **Figure 1 & 2** illustrates the site location. **Figure 3** illustrates the proposed site layout supplied by the client. **Figure 4** illustrates the proposed buffer, setback areas and proposed application area.

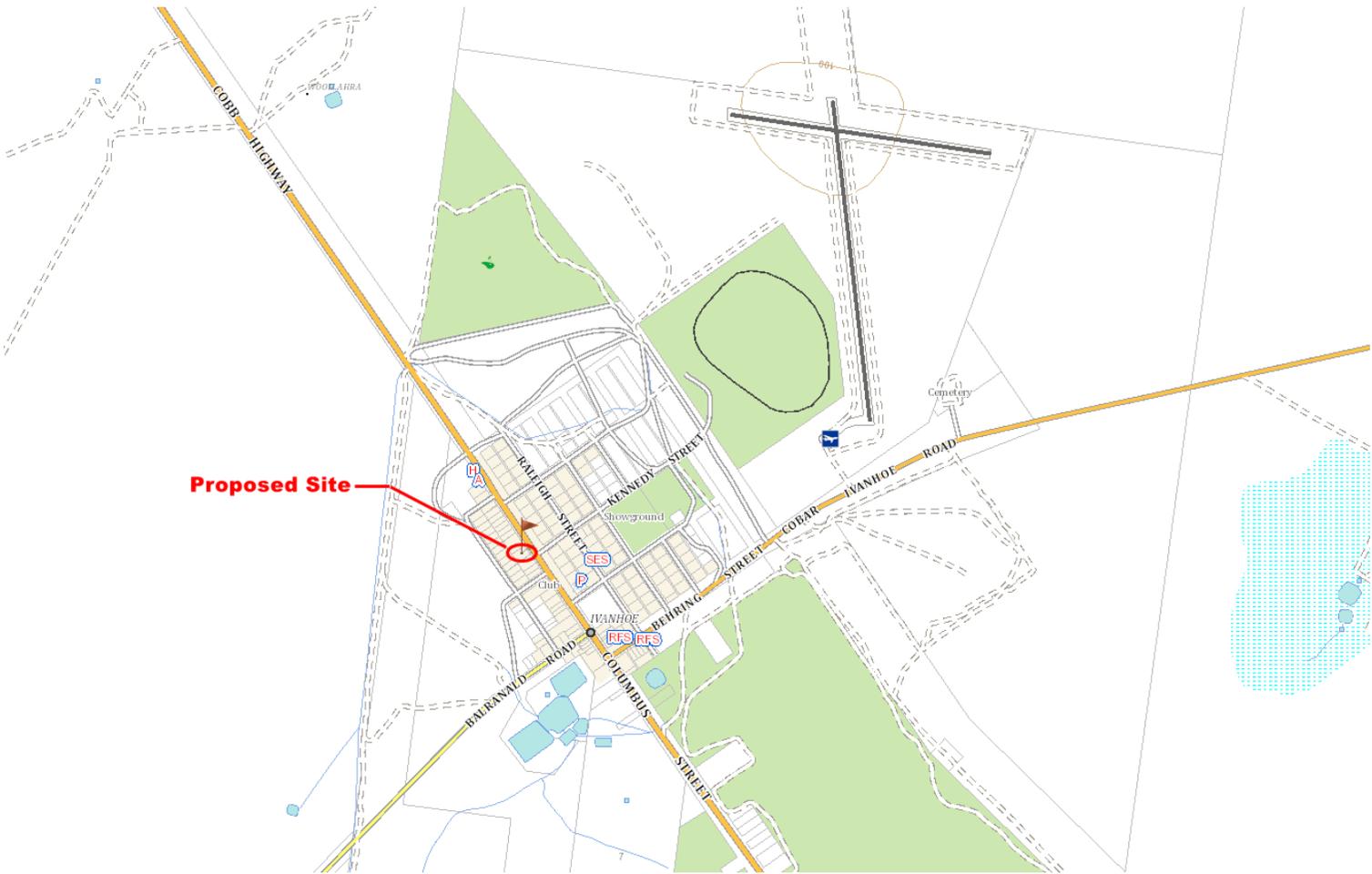


Figure 1 – Site Location Plan



Figure 2 – Buffer and Setback Plan

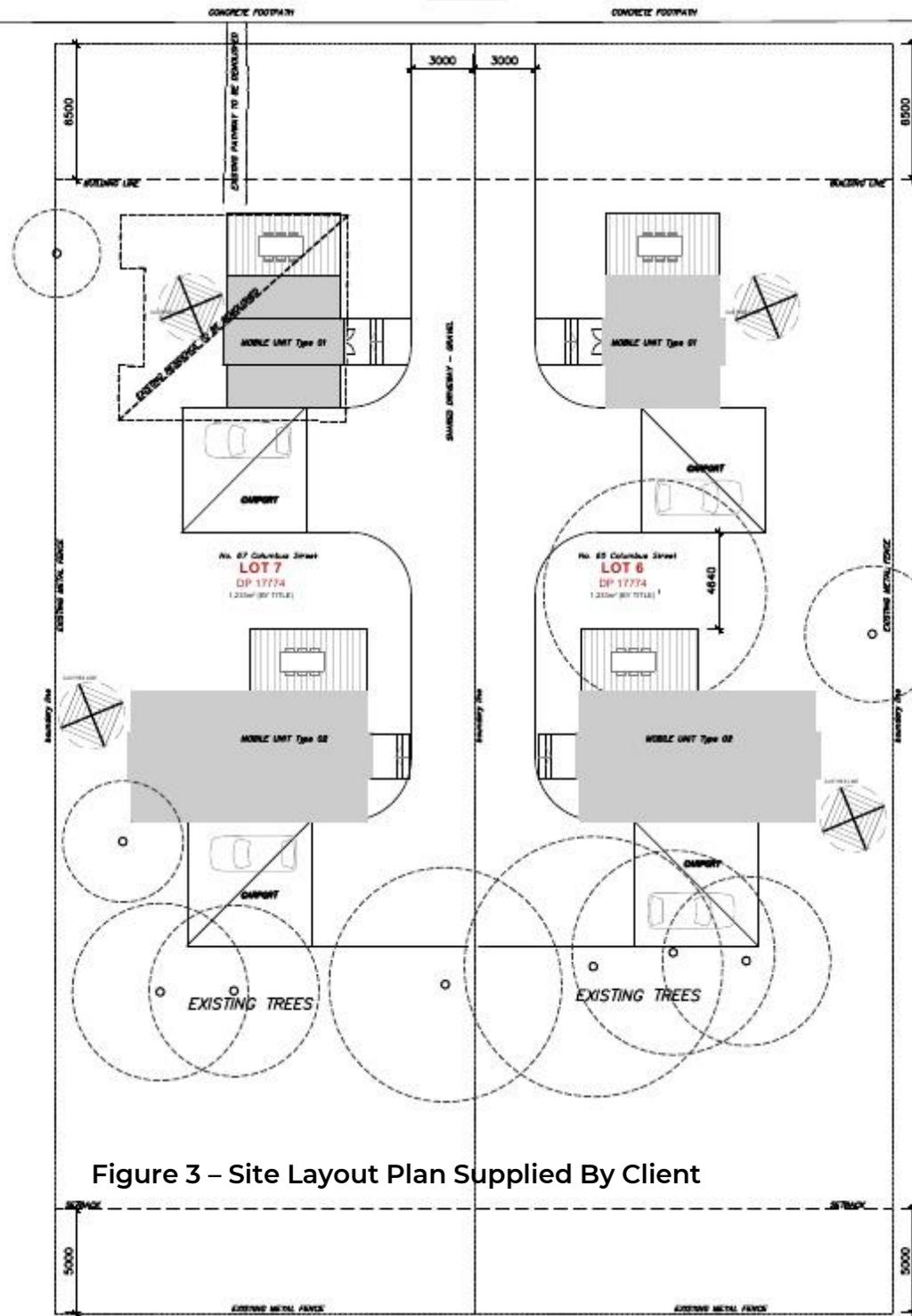
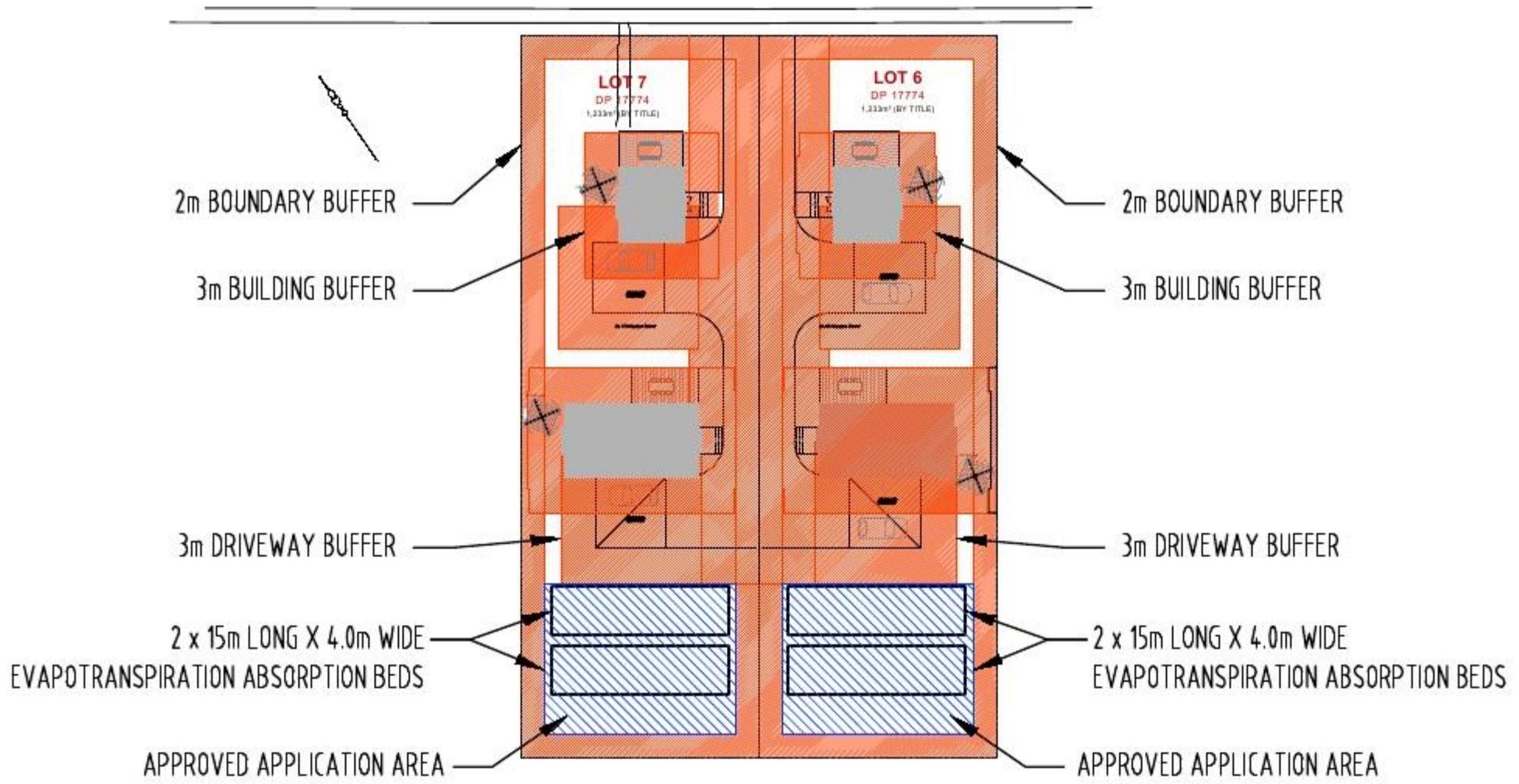


Figure 3 – Site Layout Plan Supplied By Client



THE PRESCRIBED BUFFER AREAS/SETBACKS ARE TO BE ADHERED TO UNLESS SPECIFIED BY COUNCIL OTHERWISE.

Figure 4 – Buffer and Setback Plan

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	5/10/2023

3.2 Site Information

The following table provides an overview of the site information.

Table 3: Site Particulars

Address/Locality	65-67 Columbus Street, Ivanhoe NSW Lot 6-7 DP17774
Local Government Area	Central Darling Shire Council
Block Configuration	Lot 6 – 1233m ² Lot 7 – 1233m ²
Intended Water Supply	Town water 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 Overview¹	Annual Average Rainfall for Ivanhoe is 307.2mm. Warm summers with large evaporative deficit, cool winters with small evaporative deficit. The mean summer monthly rainfall (January) is 29.9mm. The mean winter rainfall (July) is 23mm.
Underlying Geology²	<i>“Flat to gently undulating plains of red and brown clayey sand, loam and lateritic soils”.</i>
Groundwater Review	No water bores were found within 500m of the proposed site, as illustrated in Figure 5 . No flood planning or groundwater vulnerable maps were available of the proposed site.

¹ Bureau of Meteorology online Climate Data website

² Ivanhoe 1:250000

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

3.5 Surface Water Review

The proposed site is assumed to have poor drainage due to the minimal slope.



Figure 5 – Groundwater Bore Locations

3.6 Field Assessment Information

A field inspection was conducted on 5/10/2023. 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 <i>Appendix A</i>	
Exposure	Good exposure.	
Slope	The site is relatively flat	
Run-On	None	
Seepage	None	
Erosion Potential	Low due to vegetation cover.	
Site Drainage	The proposed site is assumed to have poor drainage due to the minimal slope	
Fill	None encountered	
Surface rock/Outcrops	None encountered	
Is there sufficient land area for:	Application system, including buffers	Yes
	Reserve application system	Yes

3.7 Soil Assessment

A soil sample was collected and returned to Barnson Pty Ltd for analysis on 5/10/2023. The sample was collected at a depth of 800mm during the site inspection as per AS1289.1.2.1.6.5.3. Laboratory report with 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		>1.5m
Depth to high soil water table via field assessment		>1.5m
Soil Analysis	pH – subsoil CaCl ₂ (lab), subsoil	8
	Emerson Test Result –subsoils (Lab)	6
	Liquid Limit, Plastic Limit, Plasticity Index, Linear Shrinkage. (%)	LL = 38 PL = 13 PI = 25 LS = 14.5 See Borelog in Appendix B
	Estimated Soil Category–topsoil, subsoil A	3,6
	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)	0.6-0.5(k _{sat}) (m/d) 2.5-20.8 (mm/hr) (Infiltration is Slow)
	Recommended Hydraulic Loading for disposal system (from Table 5.2 & L1 of AS 1547:2012)	5mm per day (For effluent disposal evapotranspiration 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. rills, 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 and 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		> 1.8	restricts plant growth, indicator of permeability
		< 1.6		> 1.6	
		< 1.4		>1.4	
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 – (dispersiveness)	All land application systems	Class 3, 4	Class 2	Class 1	Potential for Structural degradation.

5.0 SYSTEM REQUIREMENTS

5.1 Central Darling Shire Council Setback Requirements

Central Darling Council does not currently have an 'On-Site Sewage Management Plan', and therefore the distances provided in the 'On-Site Sewerage Management for Single Households' (1998) should be adhered to, unless otherwise directed by Council.

5.1.1. All Land Application Systems

- 100m to permanent surface waters (e.g. river, streams, lakes, etc.);
- 250m to any domestic groundwater well;
- 40m to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc.)

5.1.2. Absorption Systems

- 12m if area up-grade and 6m if area down gradient of property boundaries;
- 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 unless specified by council otherwise.

5.2 AS 1547:2012 Setbacks (Domestic Wastewater Management)

AS 1514:2012 identifies the following horizontal setbacks for domestic sites:

- Property Boundary –1.5-50m.
- Buildings/houses 2-6m
- Surface Waters – 15-100m
- Bores/Wells – 15-50m

5.3 Recommendations/Considerations – Buffer Distances

Given the identified site constraints, the proposed development and system requirements, the following point is noted:

Building & Driveway Setbacks– the proposed building and driveway setbacks for the application is 3.0m (onsite and neighbouring buildings).

Boundary Setbacks – the proposed boundary setbacks for the application is 2.0m.

Although the proposal does not adhere to the distances specified, it does conform to the site setbacks specified in Table R1 of AS 1547:2012. In accordance with AS 1547:2012, property boundary buffers as low as 1.5m is allowed based on treatment type, method of disposal, and the site and soil characteristics.

The factors considered in the standard (Table R2), for which property boundary buffers are applied as mitigative measure, include:

- the microbial quality of the effluent (A, Table R2),
- the slope of the site (D, Table R2), and
- the selected method of effluent application (J, Table R2).

With regard to the **microbial quality** of the effluent, the proposed AWTS will produce an effluent of very low microbial content, while the proposed absorption bed effluent disposal will ensure absorption and immobilisation of the treated effluent, eliminating the risk of exposure to the effluent.

The slope of the subject site is estimated at less than 1%. According to Table R2 of AS/NZS1547:2012, the lower value in the range of setbacks may be used for slopes up to 10%, provided that the method of effluent application is sub-surface.

The selected method of effluent application, absorption bed, will ensure absorption and immobilisation of the treated effluent preventing overland flow of effluent, off-site transfer and the risk of soil erosion.

Barnson is of the opinion that the recommended wastewater treatment system effectively addresses all the sensitive features relating to the property boundary setback distance allowing for relaxation of requirements to permit application of a shorter setback distances.

Central Darling Shire Council will have to consider the proposed buffer distances and provide approval for non-adherence to 'On-Site Sewerage Management for Single Households' (1998). See **Appendix C**

5.4 Design Allowances – AS/NZS1547:2012 Table H1

In accordance with AS/NZS1547:2012 Table H1, the recommended design flow allowance for use in Australia, using on site town water supply is 150L/person/day. Given the proposed residence is 4 bedrooms in total, the number of persons potentially occupying the residence assumed for the calculation of the design flow is 4 (1 person per bedroom).

6.0 SEPTIC TANK SELECTION AND CALCULATION

6.1 Silver Book/ NSW Health Guidelines

The '[On-Site Sewerage Management for Single Households' \(1998\)](#) guideline is based on the NSW Health guideline for septic tank capacity. Therefore, the calculation is the same.

Secondary effluent treatment will be provided by a NSW Health accredited septic tank. The [NSW Health 'Septic Tank and Collection Well Accreditation Guidelines' \(2016\)](#), set a sludge allowance of 1550L irrespective of the number of persons or which the septic tank is to be designed. It should be noted that in accordance with this guideline, a septic tank designed for a minimum of 5 persons needs to be de-sludge approximately every 4 years.

The general formula to calculate the minimum septic tank capacity in litres is:

$$S + (DF \times N) = C$$

$$\text{Sludge} + (\text{Daily Flow} \times \text{No. of Persons}) = \text{Capacity of the tank}$$

Residence - When DF = 150L/person/per day and N =4, therefore DF x N =**600L**

$$1550L + 600L = 2150L$$

Table 2 in the NSW Health Guidelines provides a minimum of 2300L tank capacity.

6.2 AS/NZS 1547:2012 Requirements

A more conservative approach is outlined in AS/NZS1547:2012, Appendix J. A more conservative figure of 200L per person for all waste tanks is provided, giving a daily flow volume of 800L for the residence. Therefore, a minimum capacity tank of **>3500L** is required for a residence with a design flow of up to 1000L. This conservative rate is to ensure that the unit has capacity to cope with peak discharge rates or for temporary or unusual overloads and includes no allowance for food waste disposal units. This tank design capacity also allows for the storage of sludge and scum at a rate of 80L/person/year. It should be noted that the higher cost of installing a larger septic tank may be offset by a reduced pump out frequency. Too frequent pump out removes microorganisms needed for degradation of wastewater solids. The longer pump out interval has beneficial implications for conservation of resources in that the volume of seepage requiring treatment and disposal can be reduced significantly.

6.3 System Recommendations

The following table provides details on the system selection.

Table 10: System Selection Details

Consideration of connection to centralised sewerage system	Distance to sewer	>1km
	Potential for future connection?	None planned
	Potential for reticulated water?	None planned
Expected Wastewater volume (litres/day)	Residence – 2 x 2-bedroom residence on each lot, potential maximum occupancy of 4 people per lot. Typical wastewater design flow is 150L/person per day in accordance with Table H3 of AS/NZS1547:2012 for households with full water reduction facilities, supplied by town water supply. Therefore, 4 people at 150L per person per day gives a total load of 600L/day	
Type of Treatment system best suited	<p>Aerated wastewater treatment systems (AWTS) with capacity of >3500L or more as per NSW Health accredited system –</p> <p>https://www.health.nsw.gov.au/environment/domesticwastewater/Pages/awts.aspx</p> <p>with secondary treated effluent to be distributed to an Evapotranspiration Absorption Bed</p>	

Water conservation measures should be adapted to the greatest extent possible in the proposed residence, particularly in relation to the high water use activities of showering, clothes washing and toilet flushing. AAA rated plumbing appliances and fittings should be used. Measures including use of front loading washing machines, low volume shower roses and dual flush toilets can reduce water usage by 30-40%. Detergents low in phosphorous and sodium should be used as much as possible. Following these measures will ensure the greatest lifespan for this effluent treatment and disposal system.

7.0 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.

7.1 Hydraulic Loading Calculation

Given the proposed residence will be connected by town water supply, the daily flow (Q) for the system is calculated as 600L/per day.

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

$$\text{Length of Absorption Bed} = (Q) / (DLR \times W)$$

Proposed Residence

Where Q = 600L, DLR = 5 mm/day (Table L1 AS 1547:2012 –Conservative Rate),

W (Width) = 4m

$$\begin{aligned} \text{Length of Bed} &= \left(\frac{600}{5 \times 4m} \right) \\ &= 30m \end{aligned}$$

Therefore, from the above calculation, 2 x 15m long, 4m wide evapotranspiration absorption beds per lot will be required for the proposed 2 x 2 bedroom residence per lot.

7.2 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 in the table below:

Building	Tank	Evapotranspiration Absorption Bed Size
Lot 6 2 x 2 Bedrooms	Aerated Wastewater Treatment System (AWTS)	2 x Evapotranspiration Absorption Beds x 15.0m Long x 4.0m Wide
Lot 7 2 x 2 Bedrooms	Aerated Wastewater Treatment System (AWTS)	2 x Evapotranspiration Absorption Beds x 15.0m Long x 4.0m 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;
- During construction gypsum to be applied at 1 kg/m² to the base of the trench or bed to prevent the clay dispersing. The trench shall be closed in, as soon as possible to protect the gypsum from raindrop impact.
- 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 to be pressure dosed using pumps or dosing siphons;
- The top of the absorption trench area should be turfed or grass planted to establish vegetation cover promptly after construction. This ensures the best uptake of effluent by evapotranspiration. Ensure that larger deep-rooting plants are not planted close to trenches to reduce the chance of root intrusion and clogging of the trenches
- 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;
- A diversion berm/bank/drain should be built upslope of the beds. This will reduce run on. A design sketch is provided at **Appendix D**.
- ETA beds are constructed with a domed upper surface to shed rainfall. The steeper the slope the more rainfall that will be shed.
- The bed must be located where it will be well exposed to ensure maximum evapotranspiration
- Vegetation cover must be well maintained to ensure strong growth for maximum uptake by transpiration. The surrounding landscape and vegetation must also be maintained to minimise shading and maximise exposure.
- Ensure that deep rooting trees or shrubs are not planted close to the beds to reduce the chance of roots intruding and clogging the beds.

8.0 RECOMMENDATIONS

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 secondary treatment septic fed into evapotranspiration 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* (2019) 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



Nardus Potgieter
MSc(Chem) BSc(Hons)(Env.Tech.)
Senior Environmental Scientist



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APPENDIX A

Water Balance

Barnson Job No	41903-ER01_A	
Location :	Ivanhoe	

Design Wastewater Flow	Q	l/day	600
Design Loading Rate	R	mm/day	5

Climate Zone	Hillston	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	luent applied per mo (L)	Size of Area (8/7) m ²	Days In Month
Jan	272.8	204.6	31.5	23.625	155	335.975	18600	55.361262	31
Feb	226.8	170.1	27.2	20.4	145	294.7	17400	59.04309467	29
Mar	186	139.5	33.4	25.05	155	269.45	18600	69.02950455	31
Apr	114	85.5	27.8	20.85	150	214.65	18000	83.85744235	30
May	68.2	51.15	32.1	24.075	155	182.075	18600	102.1557051	31
Jun	39	29.25	35.2	26.4	150	152.85	18000	117.7625123	30
Jul	46.5	34.875	30.5	22.875	155	167	18600	111.3772455	31
Aug	65.1	48.825	30.9	23.175	155	180.65	18600	102.9615278	31
Sep	108	81	28.9	21.675	150	209.325	18000	85.99068434	30
Oct	161.2	120.9	36.5	27.375	155	248.525	18600	74.84156523	31
Nov	210	157.5	30.3	22.725	150	284.775	18000	63.20779563	30
Dec	266.6	199.95	30.2	22.65	155	332.3	18600	55.97351791	31
								Mean area	81.8m ²

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	110m ²	169.0909091	332.3	-163.2090909	-544.030303	0	-544.030303	-544.030303	0	0
Jan		169.0909091	335.975	-166.8840909	-556.280303	0	-556.280303	-556.280303	0	0
Feb		158.1818182	294.7	-136.5181818	-455.0606061	0	-455.0606061	-455.0606061	0	0
Mar		169.0909091	269.45	-100.3590909	-334.530303	0	-334.530303	-334.530303	0	0
Apr		163.6363636	214.65	-51.01363636	-170.0454545	0	-170.0454545	-170.0454545	0	0
May		169.0909091	182.075	-12.98409091	-43.28030303	0	-43.28030303	-43.28030303	0	0
Jun		163.6363636	152.85	10.78636364	35.95454545	0	35.95454545	35.95454545	35.95454545	3955
Jul		169.0909091	167	2.090909091	6.96969697	35.95454545	42.92424242	42.92424242	42.92424242	4721.666667
Aug		169.0909091	180.65	-11.55909091	-38.53030303	42.92424242	4.393939394	4.393939394	4.393939394	483.3333333
Sep		163.6363636	209.325	-45.68863636	-152.2954545	4.393939394	-147.9015152	-147.9015152	0	0
Oct		169.0909091	248.525	-79.43409091	-264.780303	0	-264.780303	-264.780303	0	0
Nov		163.6363636	284.775	-121.1386364	-403.7954545	0	-403.7954545	-403.7954545	0	0
Dec		169.0909091	332.3	-163.2090909	-544.030303	0	-544.030303	-544.030303	0	0
Jan		169.0909091	335.975	-166.8840909	-556.280303	0	-556.280303	-556.280303	0	0
Feb		158.1818182	294.7	-136.5181818	-455.0606061	0	-455.0606061	-455.0606061	0	0
Mar		169.0909091	269.45	-100.3590909	-334.530303	0	-334.530303	-334.530303	0	0
Apr		163.6363636	214.65	-51.01363636	-170.0454545	0	-170.0454545	-170.0454545	0	0
May		169.0909091	182.075	-12.98409091	-43.28030303	0	-43.28030303	-43.28030303	0	0

Estimated area of effluent drainfield	110m ²
Maximum depth of stored effluent (must not exceed 350mm)	42.92mm
Bed/Trench dimensions	4000mm
Length of bed/trench required	27.5m
<20m lengths of bed/trench	1.375

Trench Depth	450
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APPENDIX B

Borehole Logs & Laboratory Results

CLIENT Desim Pty Ltd PROJECT NAME Site Classification

PROJECT NUMBER 41903 PROJECT LOCATION 65-67 Columbus Street, Ivanhoe NSW

DATE STARTED 5/10/23 COMPLETED 5/10/23 R.L. SURFACE _____ LONGITUDE ---

DRILLING CONTRACTOR Barnson SLOPE 90° LATITUDE ---

EQUIPMENT 1750 Drill Rig HOLE LOCATION Borehole 1

HOLE SIZE 90mm LOGGED BY NR CHECKED BY NR

NOTES _____

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
		0.0			Sandy SILT: red	0	TOPSOIL
		0.3		CL	Silty CLAY: red: slightly moist: very stiff to hard: medium plasticity	7	ALLUVIAL
	Disturbed Sample LS = 12.5%	0.5				8	
		1.0				9	
		1.1		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	10	ALLUVIAL
		1.5				13	
		2.0				19	
	Disturbed Sample LS = 14.0%	2.5				32	
		3.0					

BOREHOLE / TEST PIT WITH DCP 41903-G01A-G03A.GPJ GINT STD AUSTRALIA.GDT 26/10/23

Flight Auger & Tungsten Carbide (T.C) Bit

Borehole 1 terminated at 3m

CLIENT Desim Pty Ltd PROJECT NAME Site Classification

PROJECT NUMBER 41903 PROJECT LOCATION 65-67 Columbus Street, Ivanhoe NSW

DATE STARTED 5/10/23 COMPLETED 5/10/23 R.L. SURFACE _____ LONGITUDE ---

DRILLING CONTRACTOR Barnson SLOPE 90° LATITUDE ---

EQUIPMENT 1750 Drill Rig HOLE LOCATION Borehole 2

HOLE SIZE 90mm LOGGED BY NR CHECKED BY NR

NOTES

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
		0.0			Sandy SILT: red	0	TOPSOIL
		0.3		CL	Silty CLAY: red: slightly moist: very stiff to hard: medium plasticity	7	ALLUVIAL
		0.5		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	9	ALLUVIAL
		1.0		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	13	ALLUVIAL
		1.1		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	19	ALLUVIAL
		1.5		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	32	ALLUVIAL
		2.0		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity		ALLUVIAL
		2.5		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity		ALLUVIAL
		3.0		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity		ALLUVIAL

BOREHOLE / TEST PIT WITH DCP 41903-G01A-G03A.GPJ GINT STD AUSTRALIA.GDT 26/10/23

Flight Auger & Tungsten Carbide (T.C) Bit

Borehole 2 terminated at 3m

CLIENT Desim Pty Ltd PROJECT NAME Site Classification

PROJECT NUMBER 41903 PROJECT LOCATION 65-67 Columbus Street, Ivanhoe NSW

DATE STARTED 5/10/23 COMPLETED 5/10/23 R.L. SURFACE _____ LONGITUDE ---

DRILLING CONTRACTOR Barnson SLOPE 90° LATITUDE ---

EQUIPMENT 1750 Drill Rig HOLE LOCATION Borehole 3

HOLE SIZE 90mm LOGGED BY NR CHECKED BY NR

NOTES

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
		0.0			Sandy SILT: red	0	TOPSOIL
		0.3		CL	Silty CLAY: red: slightly moist: very stiff to hard: medium plasticity	7	ALLUVIAL
		0.5		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	9	ALLUVIAL
		1.1		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium to high plasticity	13	ALLUVIAL
		1.5				19	
		2.0				32	
		2.5					
		3.0					

BOREHOLE / TEST PIT WITH DCP 41903-G01A-G03A.GPJ GINT STD AUSTRALIA.GDT 26/10/23

Flight Auger & Tungsten Carbide (T.C) Bit

Borehole 3 terminated at 3m

CLIENT Desim Pty Ltd PROJECT NAME Septic Design

PROJECT NUMBER 41903 PROJECT LOCATION 65-67 Columbus Street, Ivanhoe NSW

DATE STARTED 5/10/23 COMPLETED 5/10/23 R.L. SURFACE _____ LONGITUDE ---

DRILLING CONTRACTOR Barnson SLOPE 90° LATITUDE ---

EQUIPMENT 1750 Drill Rig HOLE LOCATION Borehole 4

HOLE SIZE 90mm LOGGED BY NR 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: red	0	TOPSOIL
		0.2		CL	Sandy CLAY: red: slightly moist: very stiff to hard: medium to high plasticity	7	ALLUVIAL
	Disturbed Sample LS = 14.5% PI = 25%	0.9		CL	Silty Sandy CLAY: red-brown: slightly moist: hard: medium plasticity	32	ALLUVIAL

Borehole 1 terminated at 1.5m

BOREHOLE / TEST PIT WITH DCP 41903-G04A GPJ GINT STD AUSTRALIA GDT 26/10/23

Material Test Report

Report Number: 41903-1
Issue Number: 1
Date Issued: 26/10/2023
Client: Desim Pty Ltd
100 Harris Street, Pyrmont NSW 2009
Contact: Dejan Simovic
Project Number: 41903
Project Name: Site Classification & Septic Design
Project Location: 65-67 Columbus Street, Ivanhoe NSW
Work Request: 9031
Sample Number: D23-9031A
Date Sampled: 05/10/2023
Dates Tested: 05/10/2023 - 25/10/2023
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: Borehole 1, Depth: 800mm
Material: Red Silty CLAY

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Barnson Pty Ltd

Dubbo Laboratory

16 L Yarrandale Road Dubbo NSW 2830

Phone: 1300 BARNSON

Email: jeremy@barnson.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



A handwritten signature in blue ink, appearing to read 'J. Wiatkowski'.

Approved Signatory: Jeremy Wiatkowski

Geotechnical Technician

NATA Accredited Laboratory Number: 9605

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.5		
Cracking Crumbling Curling	Cracking & Crumbling		

Material Test Report

Report Number: 41903-1
Issue Number: 1
Date Issued: 26/10/2023
Client: Desim Pty Ltd
100 Harris Street, Pyrmont NSW 2009
Contact: Dejan Simovic
Project Number: 41903
Project Name: Site Classification & Septic Design
Project Location: 65-67 Columbus Street, Ivanhoe NSW
Work Request: 9031
Sample Number: D23-9031B
Date Sampled: 05/10/2023
Dates Tested: 05/10/2023 - 25/10/2023
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: Borehole 1, Depth: 2.0m
Material: Red-Brown Silty Sandy CLAY

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Barnson Pty Ltd

Dubbo Laboratory

16 L Yarrandale Road Dubbo NSW 2830

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Email: jeremy@barnson.com.au

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A handwritten signature in blue ink, appearing to read 'Jeremy Wiatkowski'.

Approved Signatory: Jeremy Wiatkowski

Geotechnical Technician

NATA Accredited Laboratory Number: 9605

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	14.0		
Cracking Crumbling Curling	Cracking & Curling		

Material Test Report

Report Number: 41903-1
Issue Number: 1
Date Issued: 26/10/2023
Client: Desim Pty Ltd
100 Harris Street, Pyrmont NSW 2009
Contact: Dejan Simovic
Project Number: 41903
Project Name: Site Classification & Septic Design
Project Location: 65-67 Columbus Street, Ivanhoe NSW
Work Request: 9031
Sample Number: D23-9031C
Date Sampled: 05/10/2023
Dates Tested: 05/10/2023 - 25/10/2023
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: Borehole 4, Depth: 800mm
Material: Red Sandy CLAY

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Accredited for compliance with ISO/IEC 17025 - Testing



A handwritten signature in blue ink, appearing to read 'J. Wiatkowski'.

Approved Signatory: Jeremy Wiatkowski

Geotechnical Technician

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 (%)	38		
Plastic Limit (%)	13		
Plasticity Index (%)	25		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	14.5		
Cracking Crumbling Curling	Cracking & Curling		
Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	6		
Soil Description	Red Sandy CLAY		
Nature of Water	Distilled		
Temperature of Water (°C)	22		

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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)
	<i>Horizontal setback distance (m)</i>	
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
	<i>Vertical setback distance (m)</i>	
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)

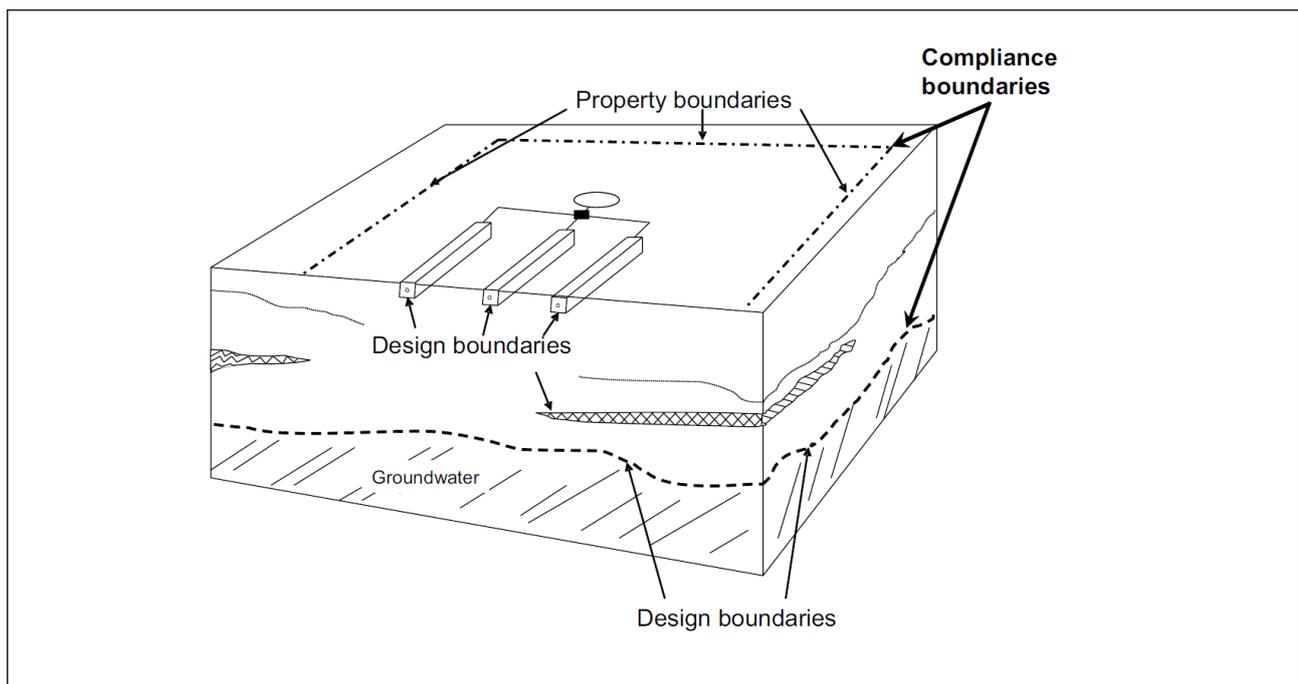
Item	Site/system feature	Constraint scale (see Note 1)		Sensitive features
		LOWER	HIGHER	
		←————→ Examples of constraint factors (see Note 2)		
A	Microbial quality of effluent (see Note 3)	Effluent quality consistently producing ≤ 10 cfu/100 mL <i>E. coli</i> (secondary treated effluent with disinfection)	Effluent quality consistently producing $\geq 10^6$ cfu/100 mL <i>E. coli</i> (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:

- 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.
- 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 (<i>Guidelines for environmental management: Use of reclaimed water</i> 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. |



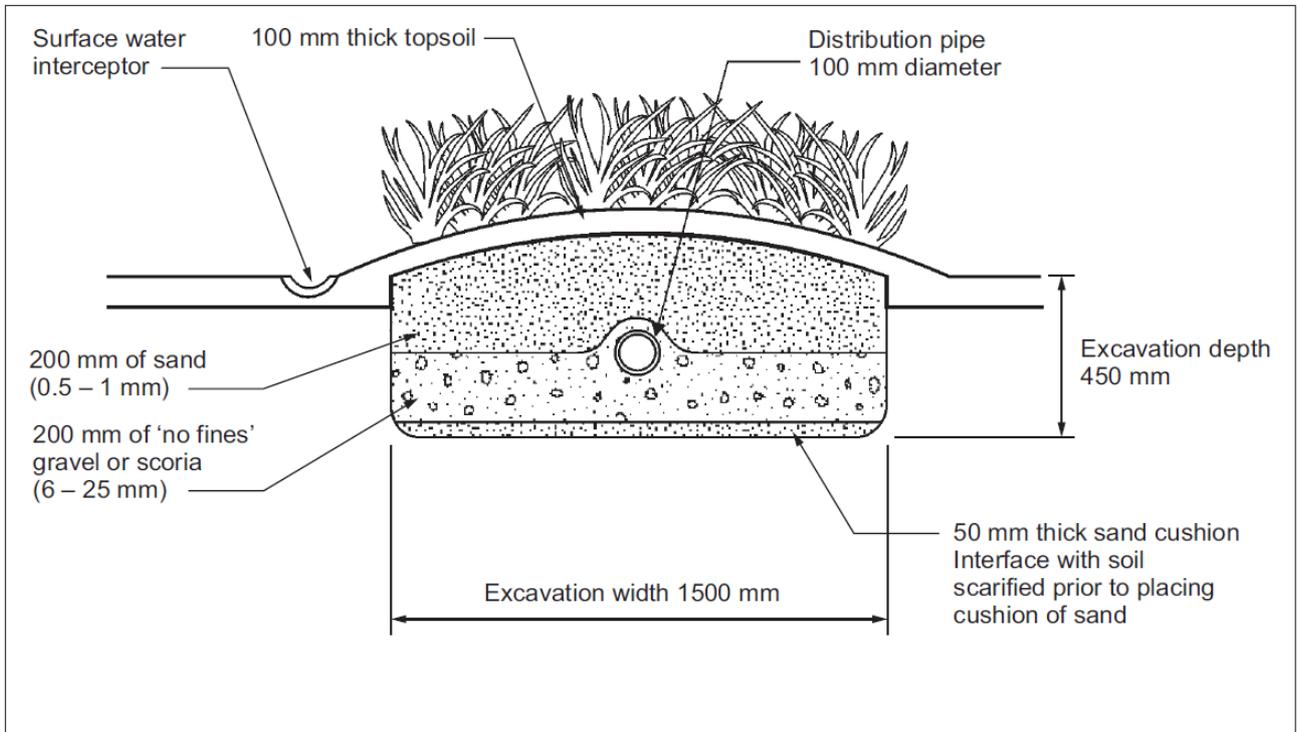
(Adapted from USEPA 2002)

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

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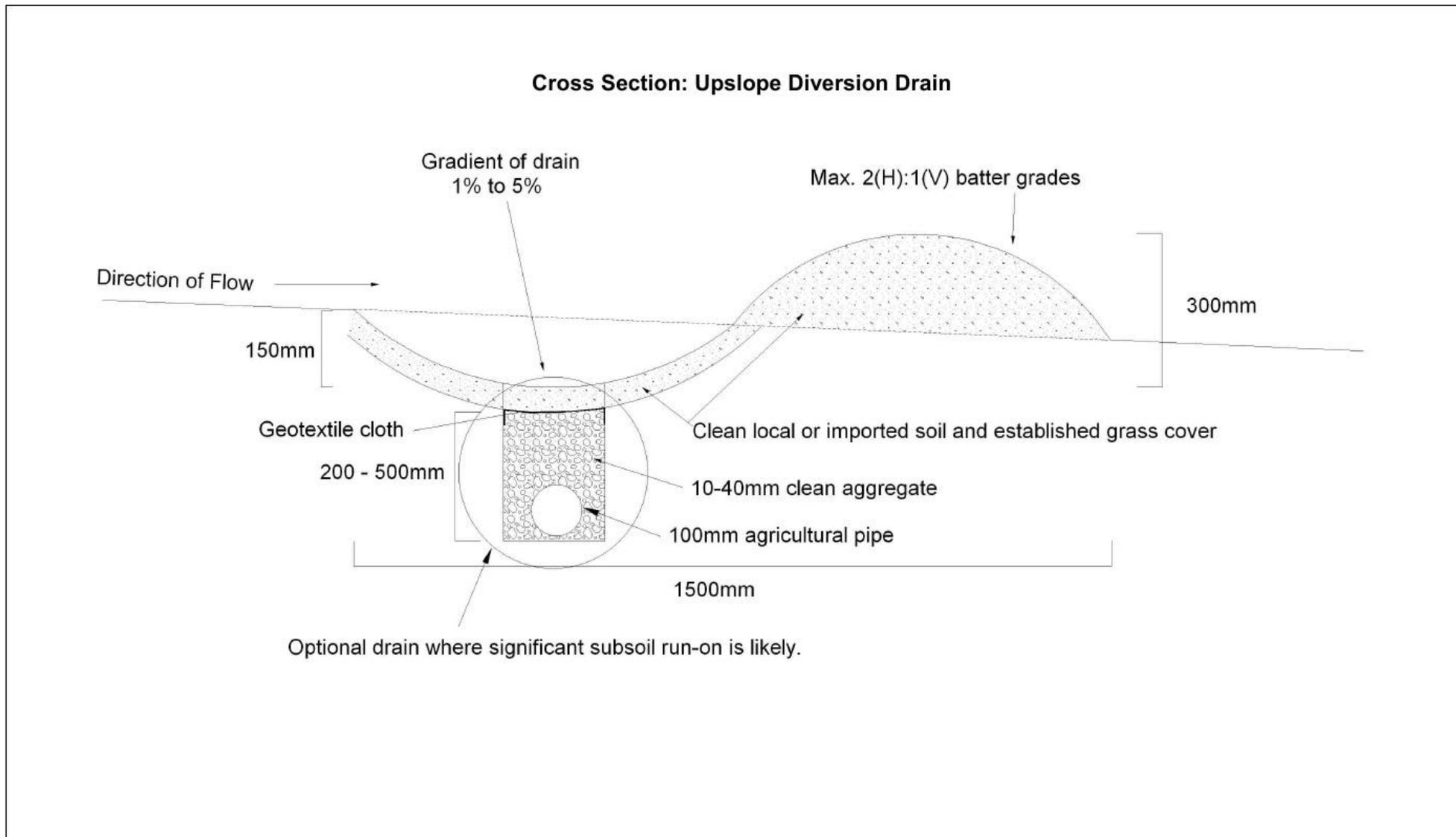
APPENDIX D

Evapotranspiration Bed Concept Plans

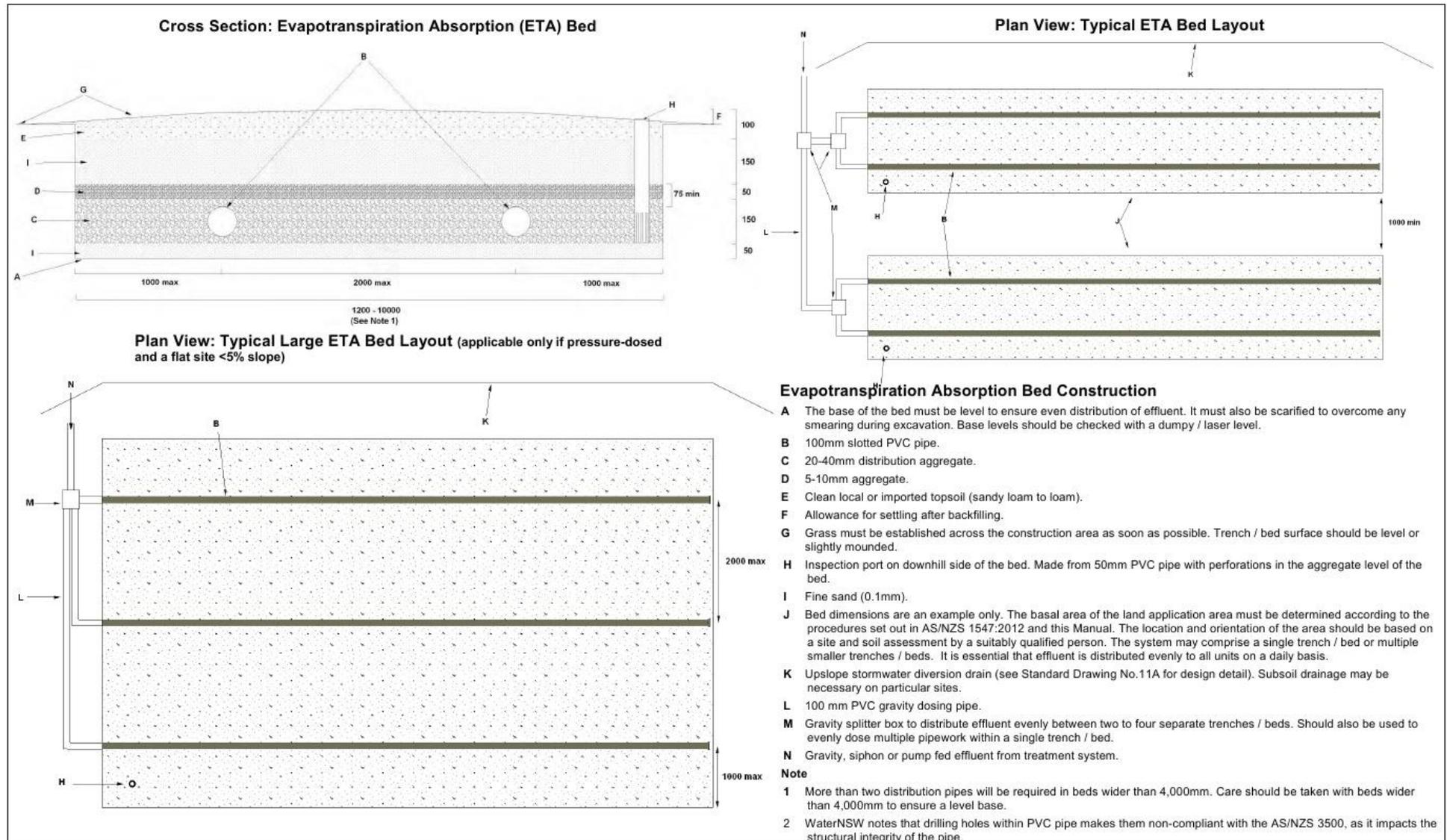


NOTE: An LPED line can be used to dose load the ETA/ETS bed.

FIGURE L6 ETA/ETS BED DETAILS



Standard Drawing 11A – Upslope Diversion Drain
(not to scale)



Standard Drawing 11B – Evapotranspiration Absorption Bed
(not to scale)

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APPENDIX E

List of Plates



Plate 1 – Overview of proposed site



Plate 2 – Overview of proposed site