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**Limited Scope Reconnaissance Land Capability Assessment and Onsite  
Wastewater System Concept Design for**

**Proposed 85-Lot Subdivision  
Friends, Hoopers, Williams &  
Willung Roads  
Rosedale**

**October 2021**

## Report Details

Table 1: Site, Client, Author and Report Details	
Address	Friends, Hoopers, Williams & Willung Roads Rosedale
Nature of Proposed Development	Proposed 85 Lot Subdivision
Client	Beveridge Williams
Author	Sven Nielsen MEngSc CPSS
Report Number	SR04345
Report Date	14/10/2021

Table 2: Copies Recipient	
1 PDF	Chris Curnow, Project Manager, Beveridge Williams
1 PDF	Strata Geoscience and Environmental Project File

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## Executive Summary

Beveridge Williams contracted Strata Geoscience and Environmental Pty Ltd to conduct a Reconnaissance Land Capability Assessment and Onsite Wastewater System Design at Friends, Hoopers, Williams & Willung Roads Rosedale.

The investigation consisted of desktop and field reconnaissance, preliminary risk analysis, modelling and reporting. It is noteworthy that's the proposed subdivision exists across multiple titles and at the time of this investigation access was only available to 23 Hoopers Road, 91 Friends Road and Lot 1 Willung Road (see site investigation results in Appendix. Further reconnaissance on the remaining land associated with the proposed development will be required once access is available and as a results the modelling and recommendations must be treated as preliminary to be ratified at a later date subject to further investigation.

Desktop and field investigation, combined with risk modelling found that the site has constraints associated with:

- Erosion
- Exposure
- Soil Texture
- Emmerson
- Soil Drainage
- Climate
- Vegetation Cover
- Groundwater Bores
- Fill



Given these findings, the following concept design recommendations are made:

- Treatment of all effluent generated onsite to a minimum of secondary levels
- Land application via subsurface irrigation scaled via water and nutrient balancing.
- Appropriate setbacks from all site boundaries, surface waters and bores.

Furthermore, all installed treatment plants should have a regular servicing contract in place between a qualified servicing agent and the property owner to further limit risk.

## 1. Introduction, Guidelines and Standards Referenced

Strata Geoscience and Environmental Pty Ltd was commissioned to perform a limited scope Land Capability Assessment for:

Table 3: Site and Client Details	
Client/Agent	Beveridge Williams
Site Address	Friends, Hoopers, Williams & Willung Roads Rosedale (see Site Plan)
Nature of Development	Proposed 85 Lot Subdivision

The investigation was conducted based upon specific development plans supplied by the client (Figure 2) and with reference to the following documents:

1. EPA Victoria (2016) Code of Practice for Onsite Wastewater Management
2. Australian Standard AS1547-2012 Onsite Wastewater Management

The investigation also follows the principles outlined in:

1. 2006 MAV & DSE Model LCA Report
2. EPA Publication 746.4 Guidelines for Land Capability Assessment
3. MAV DEPI & EPA 2014 Land Capability Assessment Framework
4. AS1726-1993 Geotechnical Site Investigations.

## 2. Description of the Development

Table 4: Site Description	
Site Address	Friends, Hoopers, Williams & Willung Roads Rosedale
Owner/Developer/Agent	Beveridge Williams
Address	As above
Council Area	Wellington
Zoning	RLZ/PUZ6/RDZ2
Min Proposed Allotment Size	7069 m <sup>2</sup> approx.
Domestic Water Supply	Reticulated
Anticipated Wastewater Load	Up to 1080 L/D (See Section 6)
Availability of Sewer	Unsewered and likely to be unsewered in mid term

### 3. Site Plans and Key Site Features

A range of soil and landscape features were assessed for their potential to impact upon land application area siting and level of wastewater treatment required over the site. Figures 1-2 give locality and proposed site plans respectively whilst Table 5 summarises key features as in relation to effluent management over the site.

**Figure 1 Locality Plan, Site Survey Plan (if available), Surface Water and  
Groundwater Bore Feature Plan**





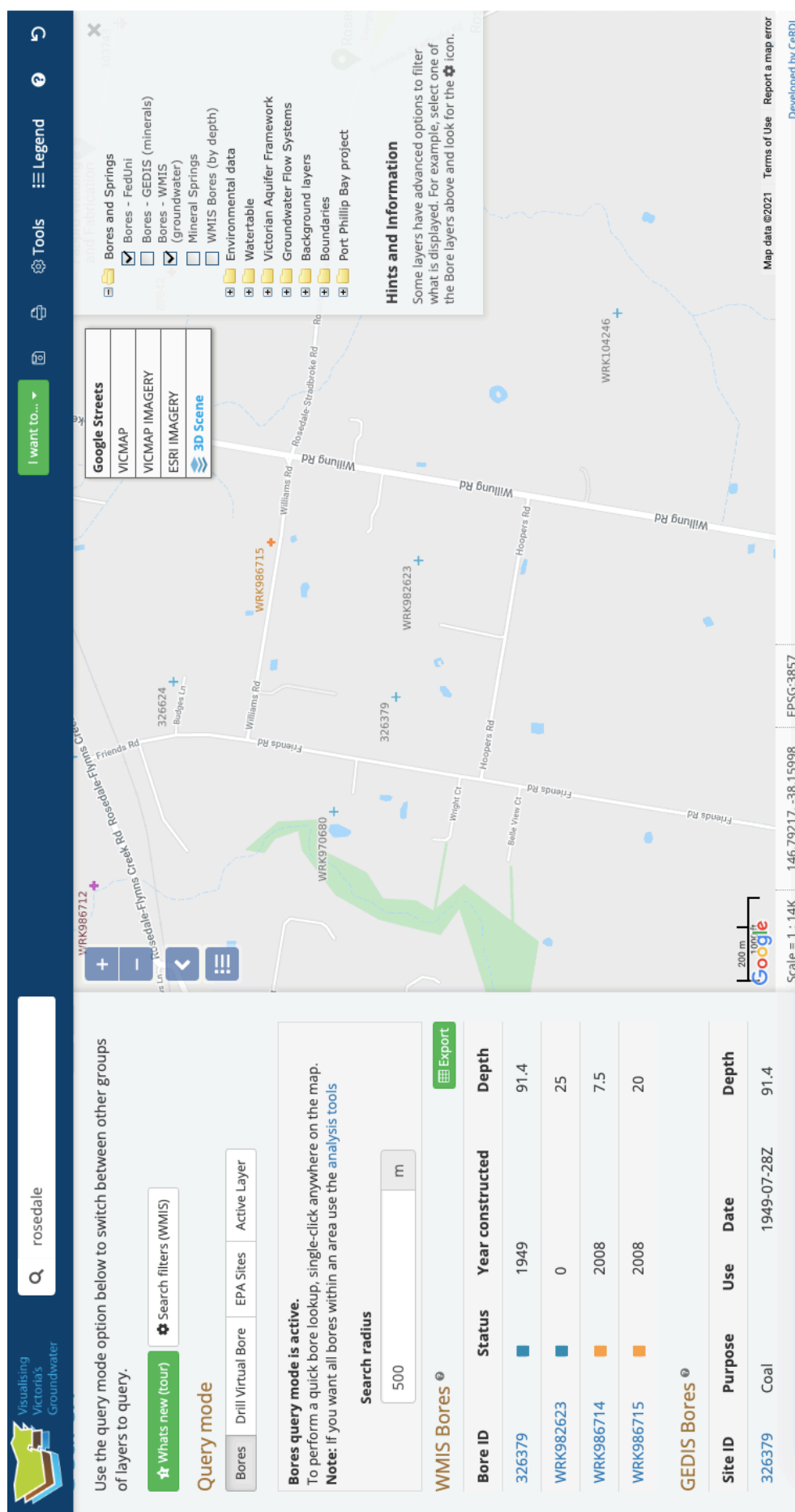
Reconnaissance LCA and Onsite System Concept Design for  
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### Figure 2 Proposed Subdivision Plan

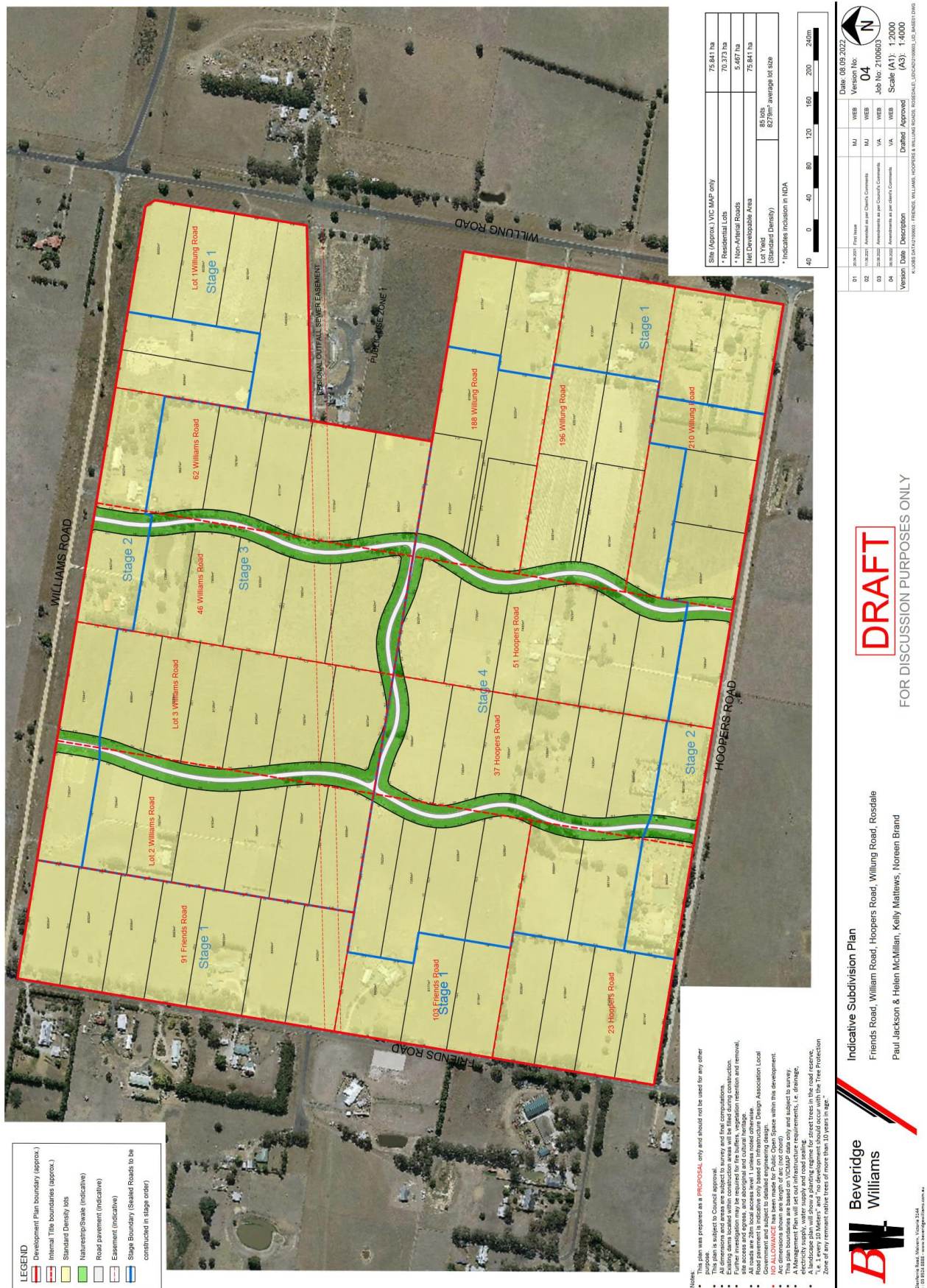




Table 5 Site Features	
Climate	The nearest weather station with <b>long term</b> data is the Traralgon EPA Station with a mean annual rainfall of 618.2 mm (BOM 2021). Climate Data from BOM presented in Appendix 2. The region has a near Mediterranean climate with maximum temperatures and minimum rainfall in the summer.
Exposure	The site is relatively shielded with exposure to winds which predominate from the NW/SW directions
Vegetation	Sparse with some mature trees
Landform	Undulating slopes
Slope, Slope Stability and Aspect	Minor slope, no identified stability issues, variable aspects
Fill	No fill evident in proposed land application areas
Rocks and Rock Outcrops	None observed.
Erosion Potential	No evidence of erosion, soils possibly subject to dispersion and surface rill or sheet erosion. Recommend irrigation systems into constructed ornamental garden beds.
Nearest Surface Water	Multiple dams onsite
Flood Potential	Unknown
Stormwater Run-on and Upslope Seepage	Stormwater to be directed away from proposed effluent envelopes. No seepage observed.
Groundwater	<p>Two registered bore on proposed development area and one immediately to the north over Williams Road. (See VVG Portal results) Risk to groundwater from subsurface irrigation into topsoils of secondary effluent considered low if recommended buffer distances maintained. Based on the Department of Natural Resources and Environment Groundwater Resources Victoria Map groundwater is likely to be &gt;10m below ground surface and have a salinity range of 501-1000 mg/L TDS.</p> <p>The following beneficial uses are indicated SEPP (Waters):</p> <ul style="list-style-type: none"> <li>• Maintenance of ecosystems</li> <li>• Stock watering</li> <li>• Industrial water use</li> <li>• Primary contact recreation</li> <li>• Buildings and structures</li> </ul>
Site Surface Drainage and Subsurface Drainage	The site receives minimal run on and does not show signs of springs or other areas of ephemeral subsurface water retention.
Recommended Buffer Distances	Given the significant land area, all buffer distances as stipulated in EPA (2016) are achievable. Please refer to Note 4 Table 5 of EPA 2016.
Available Land Application Area	There is surplus space to land application area requirements (including reserves).

## 4. Soil Assessment and Constraints

Soils have been assessed for their suitability for onsite wastewater management through both desktop review and intrusive field investigation.

### 4.1 Site Geology

Referring to Geoscience Australia 1:250000 geological mapping series, the site is underlain by Quaternary alluvial deposits.

### 4.2 Field Investigation

Field investigation consisted of drilling two soil bores using a 25mm soil probe to 1.5m or refusal with retrieval of undisturbed soil cores for logging, sampling and testing for pH, EC, CEC, Emmerson Class.

Bore logs and soil permeability data/soil test results (where relevant) are presented in Appendix 1.

With reference to the classification system of Isbell (2002) soils are classified as Brown **Dermosols** being structured clays soils. Soils will exhibit duplex profiles with lighter SILTY SAND (SM)/Clayey SAND (SC) grading to CLAYS (CL/CH) at variable depths from the existing ground surface. Subsoils clays will exhibit a moderate structure and will show the existence of vertical macropores throughout drier periods, significantly increasing their unsaturated hydraulic conductivities. Subsoils will show moderate to high cation exchange complex for the absorption of nutrients, may contain dispersive phases and a slightly acidic pH trend.

<b>Table 4 Typical Soil Characteristics</b>	
Soil Depth (m)	1.5m+
Depth to Water Table (m)	2.5m+
Coarse Fragments (%)	0-5%
Colloid Stability	Possibly dispersive soil phases present.
Soil Nutrient Attenuation	Good – clay phases will have high Cation Exchange Capacity.
Soil Permeability and Concept Design Loading Rates	DIR of 3mm/d appropriate DLR of 8-12 mm/d appropriate
Basement Permeability	Basement rock likely >5m – permeability therefore not relevant

	<b>Topsoils</b>	<b>Subsoils</b>
Description	Silty SAND (SM)/Clayey SAND(SC)	CLAY (CH)
Soil Category (AS1547-2011)	2	5
DIR (mm/d)/DLR (L/D)	4.5	3
pH	5.8	5.5
EC	0.9	4.1
EMMERSON	8	7

## 5. Land Capability Assessment Matrix

### 5.1 Assessment Matrix

Referring to MAV & DSE (2006), EPA Victoria Publication 746.1 Land Capability Assessment for Onsite Domestic Wastewater Management and MAV DEPI & EPA 2014 Land Capability Assessment Framework, a qualitative LCA assessment table has been produced for the site.

**Table 6: Risk Assessment of Site Characteristics (MAV, DEPI, EPA 2014)**

Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
<b>Aspect</b> (affects solar radiation received)	North / North-East / North-West	East / West / South-East / South-West	South	Minor
<b>Climate</b> (difference between annual rainfall and pan evaporation)	Excess of evaporation over rainfall in the wettest months	Rainfall approximates to evaporation	Excess of rainfall over evaporation in the wettest months	Moderate
<b>Erosion</b> <sup>1</sup> (or potential for erosion)	Nil or minor	Moderate	Severe	Moderate
<b>Exposure to sun and wind</b>	Full sun and/or high wind or minimal shading	Dappled light	Limited patches of light and little wind to heavily shaded all day	Minor
<b>Fill</b> <sup>2</sup> (imported)	No fill or minimal fill, or fill is good quality topsoil	Moderate coverage and fill is good quality	Extensive poor quality fill and variable quality fill	Moderate
<b>Flood frequency (ARI)</b> <sup>3</sup>	Less than 1 in 100 years	Between 100 and 20 years	More than 1 in 20 years	Minor
<b>Groundwater bores</b> <sup>4</sup>	No bores onsite or on neighbouring properties	Setback distance from bore complies with requirements in EPA Code of Practice 891.4 (as amended)	Setback distance from bore does not comply with requirements in EPA Code of Practice 891.4 (as amended)	Moderate

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Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
<b>Land area available for LAA</b>	Exceeds LAA and duplicate LAA and buffer distance requirements	Meets LAA and duplicate LAA and buffer distance requirements	Insufficient area for LAA	Minor
<b>Landslip (or landslip potential) <sup>5</sup></b>	Nil	Minor to moderate	High or Severe	Minor
<b>Rock outcrops (% of surface)</b>	<10%	10-20%	>20%	Minor
<b>Slope Form (affects water shedding ability)</b>	Convex or divergent side-slopes	Straight side-slopes	Concave or convergent side-slopes	Minor
<b>Slope gradient <sup>6</sup> (%)</b>				
(a) for absorption trenches and beds	<6%	6-15%	>15%	Minor
(b) for surface irrigation	<6%	6-10%	>10%	Minor
(c) for subsurface irrigation	<10%	10-30%	>30%	Minor
<b>Soil Drainage <sup>7</sup> (qualitative)</b>	No visible signs or likelihood of dampness, even in wet season	Some signs or likelihood of dampness	Wet soil, moisture-loving plants, standing water in pit; water ponding on surface, soil pit fills	Minor

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Characteristic	Level of Constraint					Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor		Moderate	Major		
Stormwater run-on	Low likelihood of stormwater run-on			High likelihood of inundation by stormwater run-on		Minor
Surface waters - setback distance (m) <sup>9</sup>	Setback distance complies with requirements in EPA Code of Practice 891.4 (as amended)			Setback distance does not comply with requirements in EPA Code of Practice 891.4 (as amended)		Minor – 30m setback for primary irrigation field
Vegetation coverage over the site	Plentiful vegetation with healthy growth and good potential for nutrient uptake		Limited variety of vegetation	Sparse vegetation or no vegetation		Moderate
Characteristic	Level of Constraint					Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor		Moderate	Major		
Soil Drainage <sup>8</sup> (Field Handbook definitions)	Rapidly drained. Water removed from soil rapidly in relation to supply, excess water flows downward rapidly. No horizon remains wet for more than a few hours after addition	Well drained. Water removed from the soil readily, excess flows downward. Some horizons may remain wet for several days after addition	Moderately well drained. Water removed somewhat slowly in relation to supply, some horizons may remain wet for a week or more after addition	Imperfectly drained. Water removed very slowly in relation to supply, seasonal ponding, all horizons wet for periods of several months, some mottling	Poorly/Very poorly drained. Water remains at or near the surface for most of the year, strong gleying. All horizons wet for several months	Major

Table 7: Risk Assessment of Soil Characteristics				
Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
<b>Electrical Conductivity (ECe) (dS/m) as a measure of soil salinity <sup>1</sup></b>	<0.8	0.8 – 2	>2	Minor
<b>Emerson Aggregate Class (consider in context of sodicity)</b>	4, 5, 6, 8	7	1, 2, 3	Moderate
<b>Gleying <sup>2</sup> (see Munsell Soil Colour Chart)</b>	Nil	Some evidence of greenish grey / black or bluish grey / black soil colours	Predominant greenish grey / black, bluish grey / black colours	Minor
<b>Mottling (see Munsell Soil Colour Chart)</b>	Very well to well-drained soils generally have uniform brownish or reddish colour	Moderately well to imperfectly drained soils have grey and/or yellow brown mottles and in the mottled areas occur higher in the profile the less well-drained the soil	Poorly drained soils have predominant grey colours with yellow brown or reddish brown mottles located along root channels, large pores and cracks	Minor
<b>pH <sup>3</sup> (favoured range for plants)</b>	5.5 - 8 is the optimum range for a wide range of plants; 4.5 - 5.5 suitable for many acid-loving plants		<4.5, >8	Minor



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Characteristic	Level of Constraint			Assessed Level of Constraint for Site and Mitigation if required
	Nil or Minor	Moderate	Major	
<b>Rock Fragments (size &amp; volume %)</b>	0 – 10%	10 – 20 %	>20%	Minor
<b>Sodicity <sup>4</sup> (ESP %)</b>	<6%	6 – 8%	>8%	Minor
<b>Soil Depth to Rock or other impermeable layer (m) <sup>5</sup></b>	>1.5 m	1.5 – 1 m	<1 m	Minor
<b>Soil Structure (pedality)</b>	Highly or Moderately structured	Weakly-structured	Structureless, Massive or hardpan	Minor
<b>Soil Texture, <sup>6</sup> Indicative Permeability</b>	Cat. 2b, 3a, 3b, 4a	Cat. 4A, 4c, 5a	Cat. 1, 2a, 5b, 5c, 6	Moderate
<b>Watertable Depth (m) below the base of the LAA</b>	>2 m	2 – 1.5 m	<1.5 m	Minor

**Legend:**

Nil or Minor: If all constraints are minor, conventional/standard designs are generally satisfactory.

Moderate: For each moderate constraint an appropriate design modification over and above that of a standard design, should be outlined.

Major: Any major constraint might prove an impediment to successful on-site wastewater management, or alternatively will require in-depth investigation and incorporation of sophisticated mitigation measures in the design to permit compliant onsite wastewater management.

## 5.2 LCA Conclusions

Qualitative LCA modelling has identified the following site constraints/risks:

- Erosion
- Exposure
- Soil Texture
- Emmerson
- Soil Drainage
- Climate
- Vegetation Cover
- Groundwater Bores
- Fill

## 5.3 Risk Mitigation and Design Implications

The identified constraints may be risk mitigated by:

- Treat to minimum secondary levels
- Install subsurface irrigation into constructed ornamental garden beds scaled to the water balance model
- Confirm minimum setback distances to all sensitive environmental receivers

Please refer to See Section 6 and Appendices for further specific system recommendations.

## 6. Proposed Onsite Wastewater System Design

### 6.1 General System Recommendations

Given the results of the LCA, the following recommendations are made for a suitable wastewater treatment system:

- Secondary treatment of effluent with subsurface disposal via water/nutrient balanced irrigation is a suitable method for onsite wastewater system disposal.

### 6.2 Onsite Wastewater Flow and Land Application Area Modelling

For modelling purposes, it is proposed that a **five bedroom** equivalent dwelling with standard water saving fixtures will be constructed with a loading rate of **180L/EP/day** and a total daily loading of **1080 L/day** being applicable.

Therefore, the calculated effluent flows and required disposal area for is as follows:

#### 6.2.1 Water Balance and Land Application Area Modelling

Please refer to Appendix 2 for the water balance modelling based upon VLCAF (2013). The nominated area method is used to calculate the area required to balance all inputs and outputs, without the need for wet weather storage. As a result of these calculations, at least **518 m<sup>2</sup>** of area is required to achieve zero wet weather storage.

#### 6.2.2 Nutrient Balance and Land Application Area Modelling

Please refer to Appendix 2 for the nutrient balance modelling (Nitrogen and Phosphorus) based upon VLCAF (2013). The methodology aims to ensure that the LAA is of sufficient size to ensure all nutrients from the applied effluent are assimilated by soils and vegetation. As a result of these calculations, at least **358 m<sup>2</sup>** of area is required to achieve sustainable assimilation of N and P over the nominated system design life.

**BASED UPON THE ABOVE MODELLING THE MINIMUM MODELLED LAA REQUIREMENT IS 518 m<sup>2</sup> FOR SECONDARY TREATED EFFLUENT BASED UPON THE WATER BALANCE MODEL.**

### 6.2.3 Alternative Land Application Area Modelling

Given that the water balance model produces the most conservative LAA, it has been used to calculate the subsurface irrigation area for a range of loadings based upon the “Number of bedrooms plus 1” model at 180L/person/day. Results are detailed in Table 8 below:

Table 8 LAA Requirement for Various Dwelling Sizes		
Number of Bedrooms	Theoretical Loading (L/day)	Required LAA (m <sup>2</sup> of Irrigation)
4	900	432
5	1080	518
6	1260	604
7	1440	691

## 6.3 System Concept Design

### 6.3.1 Treatment System

Given the above modelling the following treatment system would be appropriate:

- Minimum 4 star WELS rated dual flush toilets (3/4.5L) or approved dry composting toilets
- Min DN100 gravity fed sewer pipe
- Min 1500L/day (Treatment Capacity) Approved Packaged Treatment Plant capable of secondary treatment

### 6.3.2 Land Application Areas

The land application areas could consist of:

- Min 518m<sup>2</sup> of subsurface irrigation dosed into constructed ornamental gardens as detailed in Appendix 3.
- Irrigation should be zoned into maximum 200m<sup>2</sup> zones and dose loaded via a pressure dosed sequencing valve.

### 6.3.3 Provision of Adequate Setback Distances and Relevance of Reserve Provision

Given the minimum land application areas modelled above combined with the current development plan, setback distances complying with the minimum requirements of EPA Vic (2016) are achievable (see Figure 2 and Appendix 3).

It is noteworthy that Section 3.10.2 of EPA (2016) stipulates that a reserve area is not required for a surface or sub-surface pressure-compensating irrigation system where the size of the system has been calculated and designed using the latest version of the Model LCA Report and the recommended Design Irrigation Rates in Tables 3 and 9.

### 6.4 System Risk Management

Risk identification and reduction measures compliant with AS1547 – 2012 Clause A3.2 is presented below:

<b>Table 9 System Risk Management</b>		
<b>Risk</b>	<b>Factors that Increase Risk Likelihood</b>	<b>Design Risk Reduction Measures</b>
Hydraulic Overloading of System	<ul style="list-style-type: none"> <li>• Under scaled system</li> <li>• Prolonged overuse</li> <li>• Leaking taps</li> <li>• Shock Loading</li> <li>• Excessive solid disposal</li> </ul>	<ul style="list-style-type: none"> <li>• Scale to peak potential loading using water balance modelling</li> <li>• Use Conservative DLR/DIR</li> <li>• Use water conservation practices eg water reduction fixtures</li> <li>• Not rated for spa installation</li> </ul>
Biological Failure	<ul style="list-style-type: none"> <li>• Overuse of household chemicals</li> <li>• Shock loading</li> </ul>	<ul style="list-style-type: none"> <li>• Limit detergents and bleach use where practical</li> <li>• System not fit for spa or sinkerator installation</li> </ul>
Marginal Soil Conditions	<ul style="list-style-type: none"> <li>• Low soil hydraulic conductivity</li> <li>• Dispersive soils</li> <li>• Poor drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Use appropriate DLR/DIR after permeability testing</li> <li>• Treat with gypsum, manage sodium inputs</li> <li>• Dose effluent into constructed garden beds.</li> </ul>
Site Constraints	<ul style="list-style-type: none"> <li>• See section 5</li> </ul>	<ul style="list-style-type: none"> <li>• See recommendations Section 5</li> </ul>

Risk	Factors that Increase Risk Likelihood	Design Risk Reduction Measures
High Rainfall/Torrential Rainfall	<ul style="list-style-type: none"> <li>• Inappropriate LAA Scaling</li> <li>• Stormwater impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Use suitable hydraulic scaling following water balance model</li> <li>• Stormwater Diversion around LAA if required</li> </ul>
Clogged Filter	<ul style="list-style-type: none"> <li>• Overloading</li> <li>• Infrequent cleaning</li> </ul>	<ul style="list-style-type: none"> <li>• Clean monthly</li> <li>• Regular servicing inline with manufacturers recommendations</li> </ul>
Pipe Blockages	<ul style="list-style-type: none"> <li>• Overloading</li> <li>• Infrequent de-sludging</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce solids inflows</li> <li>• Service AWTs regularly</li> <li>• Check IO's/flush lines regularly</li> </ul>
Sludge transport to LAA	<ul style="list-style-type: none"> <li>• Infrequent de-sludging</li> <li>• Clogged outlet filter</li> <li>• High organic loading</li> </ul>	<ul style="list-style-type: none"> <li>• Regular servicing inline with manufacturers recommendations</li> <li>• Clean outlet filter/flush lines regularly</li> <li>• No sinkerator installation</li> </ul>
Broken pipes in LAA	<ul style="list-style-type: none"> <li>• Stock/vehicles</li> </ul>	<ul style="list-style-type: none"> <li>• Exclude stock/vehicles</li> </ul>

## 6.5 System Management and Maintenance

The proposed system is designed to allow for system automation and as such there are negligible management requirements from owners/site managers. A detailed operations manual and maintenance log should be provided to the owners/site managers upon installation of the system. This should remain onsite and will provide details on troubleshooting, emergency service technical support, service scheduling, flow rate and effluent quality monitoring.

Emergency contacts for on call service agents should be listed next to alarm modules and in operations manual to provide support in the event of technical difficulties/breakdown

#### 6.5.1 Servicing

The following servicing program is recommended:

- Servicing of AWTs and associated infrastructure (via a servicing contract) is proposed in line with minimum manufacturer's recommendations.
- Desludging of anaerobic/sedimentation chambers and septic tanks at a maximum frequency of three years.

#### 6.5.2 Monitoring

Annual effluent sampling and analysis at a NATA accredited laboratory is recommended over the first two years of operation. Sampling should be conducted by suitable qualified personnel and involve chain of custody documentation.

The following parameters should be included in any analysis

- BOD
- TSS
- Thermotolerant Coliforms
- Oil and Grease
- Total Nitrogen
- Ammonia
- Total Phosphorous
- pH



### 6.5.3 Effluent Quality Objectives

The proposed upgraded treatment system process will perform to a minimum secondary treatment standard as prescribed by EPA (2016). Namely:

- BOD <20mg/L
- TSS<30mg/L
- CFU<30cfu/100ml

If treatment quality objectives are not met then advice MUST be sort from the servicing agent, manufacturer and designer.

### 6.5.4 Contingency Planning

Specific contingencies for installed systems will be included in the operations manual and include:

Table 10 Contingency Planning	
Problem	Contingency
Overflow of effluent from treatment plant	<ul style="list-style-type: none"><li>• Call service agent immediately</li><li>• Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off)</li><li>• Minimise building use until problem fixed</li><li>• Attempt to contain pooling effluent (only if safe to do so)</li></ul>
Critical components of treatments Plants not working	<ul style="list-style-type: none"><li>• Structure duty standby of all critical components with auto changeover.</li></ul>
Treatment plant pump not working (Alarm ringing/flashing)	<ul style="list-style-type: none"><li>• Check power supply to pump</li><li>• Call service agent immediately</li><li>• Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off)</li><li>• Minimise building use until problem fixed</li></ul>

Structural failure of treatment plant tank	<ul style="list-style-type: none"> <li>• Call service agent immediately</li> <li>• Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off)</li> <li>• Minimize building use until problem fixed</li> </ul>
Effluent overflowing in land application area	<ul style="list-style-type: none"> <li>• Call service agent immediately</li> <li>• Reduce/cease effluent loading into system (ie ensure all taps, fixtures etc are off)</li> <li>• Minimise building use until problem fixed</li> <li>• If problem persists seek advice from designer</li> </ul>
Water run on to land application area	<ul style="list-style-type: none"> <li>• Ensure upslope diversion of any run on</li> <li>• Check existing diversion system and clear if required</li> </ul>
Land application area emitting odours	<ul style="list-style-type: none"> <li>• Call service agent immediately – check treatment quality of effluent at outlet to land application area</li> <li>• Check for physical damage to land application area</li> <li>• If problem persists seek advice from designer</li> </ul>
Excessive growth of vegetation in land application area	<ul style="list-style-type: none"> <li>• Check for physical damage to land application area.</li> <li>• Mow/slash/thin/prune/weed land application area at regular intervals.</li> <li>• Remove aggressive invasive weed species.</li> <li>• If problem persists seek advice form designer</li> </ul>

## 7. Conclusions and Further Recommendations

In conclusion, the following comments and recommendations are made:

- Given the identified site and soil limitations, secondary treatment with subsurface disposal into constructed ornamental gardens is recommended.
- The maximum wastewater flow rate modelling shows that the generated flows from the proposed development is likely to be no more than 1080 L/day.
- Modelled flows will likely require a land application area comprising:
  - Min 518 m<sup>2</sup> of subsurface irrigation based upon the water balance method.
- It is likely that peak flows associated with the modelled development should be within the buffering capacity of proposed system both in terms of the system sizing as well as for effluent acceptance into the disposal area.
- Given the lot sizes and current development plan adequate setback distances can be met.
- Any earthworks and drainage installation associated with lot development may alter conditions of the site and as a result the recommendations of this report MUST be reconfirmed after these works have occurred. Failure to ensure this will void report recommendations. Stormwater diversion or interceptor drain installation may be appropriate at this time.

- **If the prescriptions of this report are followed the likely human and environmental health risks associated with effluent disposal over the site is low.**



**S Nielsen MEngSc CPSS**  
*Environmental Engineering Scientist*  
*Strata Geoscience and Environmental Pty Ltd*  
E: [sven@strataconsulting.com.au](mailto:sven@strataconsulting.com.au)  
W: [www.strataconsulting.com.au](http://www.strataconsulting.com.au)



## 8. References

- AS1726-1993- Geotechnical Site Investigations
- AS 1547-2012 Onsite Wastewater Disposal
- Bureau of Meteorology Website- Monthly Climate Statistics
- EPA (2016) Vic Code of Practice for Onsite Wastewater Management
- MAV & DSE 2006 (as amended) Model LCA Report
- VLCAF (2016) Victorian Land Capability Assessment Framework – Calculation of Water and Nutrient Balances
- Isbell (2002) Australian Soil Classification (Revised Edn) CSIRO Publishing

## Appendix 1 Site Photos and Indicative Borelogs

**VicPlan** Environment, Land, Water and Planning  
State Government

**Home** **Map** **Tools**

**Navigation**  
Home Initial View Previous Extent Next Extent Zoom to XY Zones ON Overlays OFF

**Find Data**  
Identify

**Tasks**  
Google Street View Print Export Upload Data Share Time Slider Help Feedback

**Tool Labels**  
✓ X

**23 HOOPERS ROAD ROSEDALE 3847**

**Property Information**  
Property Information  
Property Details  
Address 23 HOOPERS ROAD ROSEDALE 3847  
LGA WELLINGTON  
Planning Scheme WELLINGTON  
Create Planning Property Report

**Planning Scheme Zones**  
RLZ RURAL LIVING ZONE  
RLZ1 RURAL LIVING ZONE - SCHEDULE 1

**Planning Scheme Overlays**  
DPO DEVELOPMENT PLAN OVERLAY  
DPO8 DEVELOPMENT PLAN OVERLAY - SCHEDULE 8

Welcome to ... Layers Property Info... Go

Scale 1: 10,000

Hybrid

VicPlan version 2.3.1



*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*









*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*



**BOREHOLE LOG INFORMATION**

PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 1  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPT H (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<u><b>FILL</b></u> Topsoil, sand, silt, clay, loose, moist						
<b>200</b>	<u><b>SILTY SAND (SM)</b></u> Pale brown, loose, moist						
<b>400</b>	Grading to <u><b>SILTY CLAY (CI)</b></u> Orange/brown, stiff, slightly moist, intermediate plasticity						
<b>600</b>					2.3		
<b>1200</b>					3.6		
		GNO					
<b>1500</b>	<u><b>END OF BOREHOLE</b></u>				6+		

ABBREVIATIONS PER APPENDIX

Appendix A

Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale



PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: Per Sketch

HOLE NO.: 2  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<u>FILL</u> Topsoil, sand, silt, clay, loose, moist						
200	<u>SILTY SAND (SM)</u> Pale brown, loose, moist						
400	Grading to <u>SILTY CLAY (CI)</u> Orange/brown, stiff, slightly moist, intermediate plasticity						
600					2.3		
1200					3.6		
1500	<u>END OF BOREHOLE</u>	GNO			6+		

ABBREVIATIONS PER APPENDIX

Appendix A

Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale

PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 3  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> <i>Topsoil, sand, silt, clay, loose, moist</i>						
200	<b><u>SILTY SAND (SM)</u></b> <i>Pale brown, loose, moist</i>						
400	Grading to <b><u>SILTY CLAY (CI)</u></b> <i>Orange/brown, stiff, slightly moist, intermediate plasticity</i>						
600					2.3		
1200					3.6		
1500	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

ABBREVIATIONS PER APPENDIX

Appendix A

[illegible]



*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*













Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale



**BOREHOLE LOG INFORMATION**

PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 1  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated						
200	<b><u>SILTY SAND (SM)</u></b> Pale brown/grey, very moist, loose						
400	Grading to <b><u>SILTY CLAY (CI)</u></b> Orange/brown, firm, slightly moist, intermediate plasticity						
600					2.2		
1200					4.1		
1500	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

ABBREVIATIONS PER APPENDIX

Appendix A

Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale



PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 2  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> <i>Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated</i>						
<b>200</b>	<b><u>SILTY SAND (SM)</u></b> <i>Pale brown/grey, very moist, loose</i>						
<b>400</b>	Grading to <b><u>SILTY CLAY (CI)</u></b> <i>Orange/brown, firm, slightly moist, intermediate plasticity</i>						
<b>600</b>					2.1		
<b>1200</b>					4.3		
<b>1500</b>	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

ABBREVIATIONS PER APPENDIX

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PROJECT NO.: 08534  
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HOLE LOCATION: *Per Sketch*

HOLE NO.: 3  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated						
200	<b><u>SILTY SAND (SM)</u></b> Pale brown/grey, very moist, loose						
400	Grading to <b><u>SILTY CLAY (CI)</u></b> Orange/brown, firm, slightly moist, intermediate plasticity						
600					2.2		
1200					4.4		
1500	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

Appendix A





*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*







Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale



**BOREHOLE INFORMATION**

PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 1  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated						
200	<b><u>SILTY SAND (SM)</u></b> Pale brown/grey, very moist, loose						
400	Grading to <b><u>SILTY CLAY (CI)</u></b> Orange/brown, firm, slightly moist, intermediate plasticity						
600					2.2		
1200					4.3		
1500	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

ABBREVIATIONS PER APPENDIX

Appendix A



Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale



PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: *Per Sketch*

HOLE NO.: 2  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b>FILL</b> Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated						
200	<b>SILTY SAND (SM)</b> Pale brown/grey, very moist, loose						
400	Grading to <b>SILTY CLAY (CI)</b> Orange/brown, firm, slightly moist, intermediate plasticity						
600					2.2		
1200					4.3		
1500	<b>END OF BOREHOLE</b>	GNO			6+		

ABBREVIATIONS PER APPENDIX

Appendix A

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Friends, Hoopers, Williams & Willung Roads Rosedale



PROJECT NO.: 08534  
DATE: 20/7/2021  
HOLE LOCATION: Per Sketch

HOLE NO.: 3  
METHOD: Mechanical Push Tube  
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm <sup>2</sup> )	EXISTING FOOTING (mm)	DEPTH (mm)
	<b><u>FILL</u></b> Topsoil, sand, silt, clay, soft, loose, very moist, becoming saturated						
200	<b><u>SILTY SAND (SM)</u></b> Pale brown/grey, very moist, loose						
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600					2.2		
1200					4.3		
1500	<b><u>END OF BOREHOLE</u></b>	GNO			6+		

Appendix A

ABBREVIATIONS PER APPENDIX

## Appendix 2 Climate Data, Water and Nutrient Balance Calculations (after VLCAF 2016)

Irrigation area sizing using Nominated Area Water Balance & Storage Calculations																
Site Address:																
Date:	####					Assessor:	Nielsen									
INPUT DATA																
Design Wastewater Flow	Q	1,080	L/day	Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013)												
Design Irrigation Rate	DIR	3.0	mm/day	Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013)												
Nominated Land Application Area	L	518	m <sup>2</sup>													
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type <sup>2</sup>												
Rainfall Runoff Factor	RF	1	unitless	Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff												
Mean Monthly Rainfall Data	Traralgon EPA			BoM Station and number												
Mean Monthly Pan Evaporation Data	East Sale Airport			BoM Station and number												
Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	365
Rainfall	R		mm/month	42	43.5	41.8	48.8	45.9	52.6	52.1	62.3	53.2	55.1	60.2	54.3	612.8
Evaporation	E		mm/month	201.5	162.4	136.4	84	52.7	42	46.5	68.2	93	124	153	196	1349.7
Crop Factor	C		unitless	0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.60	0.70	0.80	0.80	0.80	
OUTPUTS																
Evapotranspiration	ET	ExC	mm/month	161	130	95	59	32	25	28	41	65	99	122	149	1006.54
Percolation	B	DIRxD	mm/month	93.0	84	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0
Outputs		ET+B	mm/month	254.2	213.92	188.5	148.8	124.6	115.2	120.9	133.9	155.1	192.2	212.4	241.8	2101.5
INPUTS																
Retained Rainfall	RR	RxRF	mm/month	42	43.5	41.8	48.8	45.9	52.6	52.1	62.3	53.2	55.1	60.2	54.3	612.8
Applied Effluent	W	(QxD)/L	mm/month	64.6	58.4	64.6	62.5	64.6	62.5	64.6	64.6	62.5	64.6	62.5	64.6	761.0
Inputs		RR+W	mm/month	106.6	101.9	106.4	112.3	110.5	115.1	116.7	126.9	115.7	119.7	122.7	118.9	1373.8
STORAGE CALCULATION																
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	(RR+W)-(ET+B)	mm/month	-147.6	-112.0	-82.0	-36.5	-14.1	-0.1	-4.2	-7.0	-39.4	-72.5	-89.7	-122.9	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0.00												
	V	NxL	L	0												
LAND AREA REQUIRED FOR ZERO STORAGE																
			m <sup>2</sup>	158	177	228	327	425	518	487	467	318	244	213	179	
MINIMUM AREA REQUIRED FOR ZERO STORAGE:																
			m <sup>2</sup>	518.0												

Nutrient Balance												
Site Address:												
SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON MOST LIMITING NUTRIENT BALANCE										358	m <sup>2</sup>	
INPUT DATA <sup>1</sup>												
Wastewater Loading				Nutrient Crop Uptake								
Hydraulic Load		1080	L/day	Crop N Uptake	220	kg/ha/yr	which equals	60.27	mg/m <sup>2</sup> /day			
Effluent N Concentration		25	mg/L	Crop P Uptake	50	kg/ha/yr	which equals	13.70	mg/m <sup>2</sup> /day			
% N Lost to Soil Processes (Geary & Gardner 1996)		0.2	Decimal	Phosphorus Sorption								
Total N Loss to Soil		5400	mg/day	P-sorption result	240	mg/kg	which equals	3360	kg/ha			
Remaining N Load after soil loss		21600	mg/day	Soil Bulk Density	1400	kg/m <sup>3</sup>						
Effluent P Concentration		8	mg/L	Depth of Soil	1	m						
Design Life of System		25	yrs	% of Predicted P-sorp. <sup>2</sup>	0.5	Decimal						
NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES												
Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)									
Nitrogen	358	m <sup>2</sup>	Nominated LAA Size			561	m <sup>2</sup>					
Phosphorus	269	m <sup>2</sup>	Predicted N Export from LAA			-4.46	kg/year					
			Predicted P Export from LAA			-3.42	kg/year					
			Phosphorus Longevity for LAA			270	years					
			Minimum Buffer Required for excess nutrient			0	m <sup>2</sup>					
PHOSPHORUS BALANCE												
Using the nominated LAA Size												
Nominated LAA Size	561	m <sup>2</sup>										
Daily P Load	0.009	kg/day	→ Phosphorus generated over life of system			78.840	kg					
Daily P Uptake	0.008	kg/day	→ Phosphorus vegetative uptake for life of system			0.125	kg/m <sup>2</sup>					
Measured P-sorption capacity	0.336	kg/m <sup>2</sup>										
Assumed P-sorption capacity	0.168	kg/m <sup>2</sup>	→ Phosphorus adsorbed over 50 years			0.168	kg/m <sup>2</sup>					
Site P-sorption capacity	94.248	kg	→ Desired Annual P Application Rate			6.575	kg/year					
							which equals	0.018	kg/day			
P-load to be sorbed	0.349	kg/year										

## Relevant Climate Data

### Text search

Select your data type, your location, then select from the list of stations.  
If you prefer to see the station locations, use the map search instead.

[Help](#)

**1: Selected: Daily weather observations**

Data aboutWeather & climate

Type of data

ObservationsStatistics

☒ Daily ☐ Monthly ☐ Daily ☐ Monthly

Daily weather observations data for the last month. Links to data for the previous year. Data may be from a number of stations.

**2: Select a weather station in the area of interest**

OR - search by

Search by name

**Matching towns** (click one to select it)

Rosedale, NSW, 35.82°S, 150.22°E

Rosedale, QLD, 24.63°S, 151.91°E

Rosedale, SA, 34.56°S, 138.85°E

Rosedale, VIC, 38.15°S, 146.78°E

**Nearest Bureau stations** (click one to select it)

☒ Only show open stations (may no longer report all data types)


085280 Latrobe Valley VIC (27.3km away)

085072 Sale VIC (30.9km away)

085314 East Sale Airport VIC (31.8km away)

085151 Yarram VIC (45.9km away)

085283 Willow Grove VIC (49.8km away)


**More information:**  
[Geoscience Australia](#)   
(opens new window)

**More information:**  
[for the selected station](#)  
(opens new window)

**3: Get the data**

If you already know the station number you may enter it below instead of using the search above.

Station number (Opens in new window)

 [Save](#) | [Clear](#)

### Text search

Select your data type, your location, then select from the list of stations.  
If you prefer to see the station locations, use the map search instead.

[Help](#)

**1: Selected: Monthly rainfall**

Data aboutRainfall

Type of data

ObservationsStatistics

☐ Daily ☒ Monthly ☐ Daily ☐ Monthly

Monthly rainfall data and graphs for all available years.

**2: Select a weather station in the area of interest**

OR - search by

Search by name

**Matching towns** (click one to select it)

Rosedale, NSW, 35.82°S, 150.22°E

Rosedale, QLD, 24.63°S, 151.91°E

Rosedale, SA, 34.56°S, 138.85°E

Rosedale, VIC, 38.15°S, 146.78°E

**Nearest Bureau stations** (click one to select it)

☒ Only show open stations (may no longer report all data types)


085009 Traralgon EPA VIC (22.4km away)

085272 Thomson River @ Sale Wharf VIC (24.7km away)

085236 Callignee North VIC (26.4km away)

085297 Maffra VIC (26.6km away)

085034 Glenmaggie Weir VIC (26.8km away)


**More information:**  
[Geoscience Australia](#)   
(opens new window)

**More information:**  
[for the selected station](#)  
(opens new window)

**3: Get the data**

If you already know the station number you may enter it below instead of using the search above.

Station number (Opens in new window)

 [Save](#) | [Clear](#)

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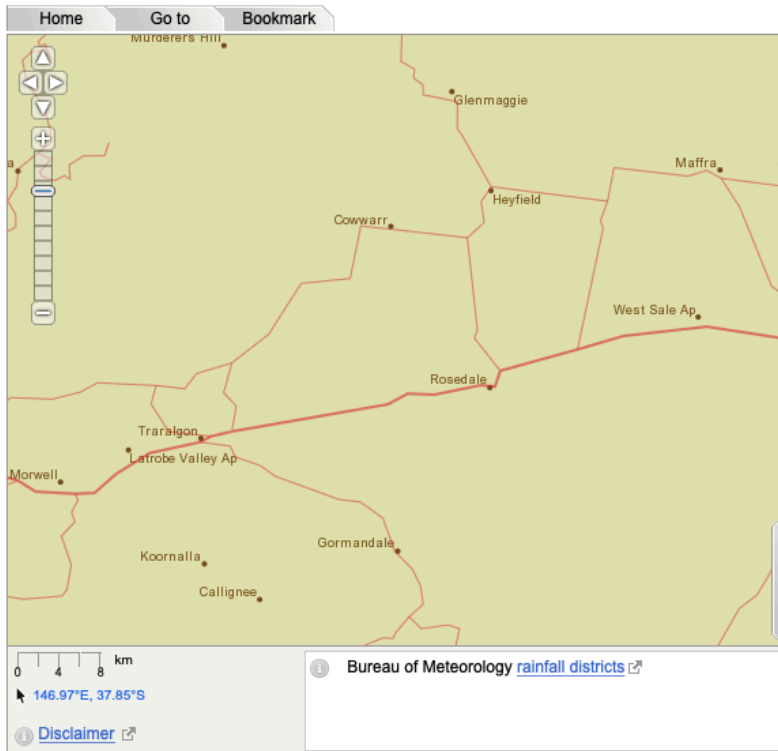
54

Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale

## Map search

Select your data type, then click green station dots for linked information.

Home Go to Bookmark [Print](#) [Help](#)



**Data** **Map layers**

Background: Basic

Land Sea

Features:

- ☒ Places
- ☒ Roads
- ☐ Rivers
- ☐ Lakes
- ☐ Catchments
- ☒ Rainfall districts

[Clear all](#)

[Map layers metadata](#)

**Overview**

**Bureau of Meteorology rainfall districts**

[Disclaimer](#)

# Reconnaissance LCA and Onsite System Concept Design for Friends, Hoopers, Williams & Willung Roads Rosedale

## Monthly Rainfall (millimetres)

### TRARALGON EPA

Station Number: 085009 · State: VIC · Opened: 1999 · Status: Open · Latitude: 38.20°S · Longitude: 146.53°E · Elevation: Unknown m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000												41.8	
2001		15.6	29.8	103.6	11.6	62.6	32.8	97.0	35.6	94.0	91.4	58.0	
2002	50.2	30.6	51.0	71.8	49.2	8.6	14.0	17.0	2.2	69.8	36.6	36.0	437.0
2003	22.8	12.4	46.2	44.8	21.8	58.8	78.0	61.8	76.4	92.0	40.0	47.0	602.0
2004	69.2	32.8	11.4	59.6	50.8	71.8	59.2	50.0	78.4	43.2	94.4	69.6	690.4
2005	44.0	88.6	18.6	18.0	11.4	20.6	66.0	73.4	71.4	56.6	48.0	46.6	563.2
2006	85.0	22.8	14.8	73.0	66.2	9.6	34.6	41.2	45.8	14.6	48.8	23.8	480.2
2007	46.4	69.8	66.2	44.4	33.2	84.6	88.6	45.6	66.6	41.0	75.6	79.8	741.8
2008	29.4	76.0	12.8	20.8	34.6	27.2	67.2	62.4	45.8	19.4	60.2	86.4	542.2
2009	4.6	11.4	27.0	53.2	23.2	35.8	51.8	78.4	60.6	68.0	56.6	50.6	521.2
2010	24.4	68.6	101.4	54.6	55.2	47.8	26.8	71.4	49.8	84.8	64.4	54.4	703.6
2011	34.8	105.4	78.2	82.8	47.0	35.2	71.2	51.0	68.8	49.4	107.4	48.8	780.0
2012	36.6	105.8	108.2	47.0	87.2	80.6	24.4	73.2	76.2	48.0	38.0	69.6	794.8
2013	2.8	22.8	16.4	10.2	35.2	133.4	37.6	79.6	57.6	91.2	51.0	38.0	575.8
2014	26.6	16.6	39.8	70.2	37.0	80.4	48.6	26.4	20.0	51.4	64.0	96.8	577.8
2015	48.2	56.0	30.0	43.4	60.2	36.4	52.8	86.8	22.8	18.8	56.6	23.6	535.6
2016	92.4	5.6	43.6	25.8	62.4	77.2	105.0	39.0	40.4	76.6	55.4	57.8	681.2
2017	18.8	31.0	30.4	40.4	41.6	19.6	47.4	72.0	88.2	48.0	18.6	126.2	582.2
2018	24.6	6.8	23.6	11.4		24.8	61.0	32.0	40.0	22.6	75.4	34.0	
2019	8.8	18.8	19.8	11.2	75.6	43.8	63.6	121.4	90.4	29.0	92.0	23.6	598.0
2020	95.4	105.0	29.0	116.8	68.8	35.2	32.2	69.4	26.6	83.8	29.0	28.8	720.0
2021	75.6	10.2	79.2	42.2	46.4	110.8	30.8	60.2					

Quality control: 12.3 Done & acceptable, 12.3 Not completed or unknown



*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*

Monthly Rainfall (millimetres)

TRARALGON EPA

Station Number: 085009 · State: VIC · Opened: 1999 · Status: Open · Latitude: 38.20°S · Longitude: 146.53°E · Elevation: Unknown m

Statistics for this station calculated over all years of data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
<b>Mean</b>	42.0	43.5	41.8	49.8	45.9	52.6	52.1	62.3	53.2	55.1	60.2	54.3	618.2
<b>Lowest</b>	2.8	5.6	11.4	10.2	11.4	8.6	14.0	17.0	2.2	14.6	18.6	23.6	437.0
<b>5th percentile</b>	4.5	6.8	12.8	11.2	11.6	9.6	24.4	26.4	19.1	18.6	28.5	23.6	473.7
<b>10th percentile</b>	8.4	10.2	14.8	11.4	20.8	19.6	26.8	32.0	22.5	19.3	35.8	23.8	508.9
<b>Median</b>	35.7	30.6	30.0	44.8	46.7	43.8	51.8	62.4	53.7	50.4	56.6	48.8	590.1
<b>90th percentile</b>	85.7	105.0	79.2	82.8	69.5	84.6	78.0	86.8	79.4	91.3	92.2	86.4	753.3
<b>95th percentile</b>	92.6	105.4	101.4	103.6	76.2	110.8	88.6	97.0	88.3	92.1	95.1	96.8	782.2
<b>Highest</b>	95.4	105.8	108.2	116.8	87.2	133.4	105.0	121.4	90.4	94.0	107.4	126.2	794.8

1) Calculation of statistics

Summary statistics, other than the Highest and Lowest values, are only calculated if there are at least 20 years of data available.

2) Gaps and missing data

Gaps may be caused by a damaged instrument, a temporary change to the site operation, or due to the absence or illness of an observer.

3) Further information

<http://www.bom.gov.au/climate/cdo/about/about-rain-data.shtml>.

*Reconnaissance LCA and Onsite System Concept Design for  
Friends, Hoopers, Williams & Willung Roads Rosedale*

**Mean total evaporation (mm)**

**Site details**

Site name: EAST SALE  
Latitude: 38.12 °S

Longitude: 147.13 °E

Site number: 085072  
Elevation: 4 m

Commenced: 1943  
Operational status: Still Open

**Yearly data**

**30 year statistics**

**Comparison site**

**First statistic**

**Second statistic**

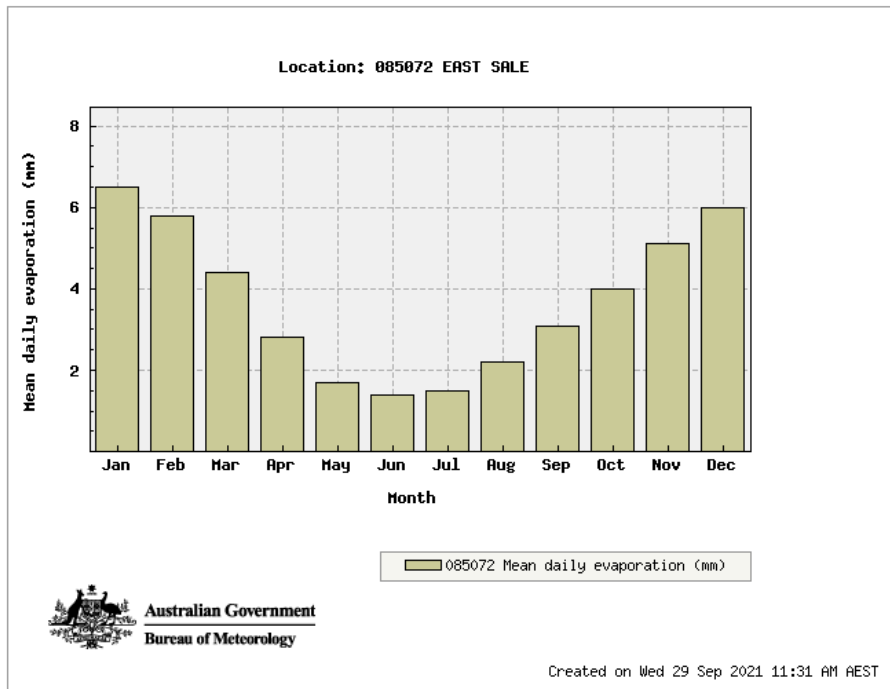
Note: Only one option can be redrawn at a time

Include data for the year:

2015



Redraw



**Statistics**

Mean daily evaporation (mm) for years 1971 to 2015

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
6.5	5.8	4.4	2.8	1.7	1.4	1.5	2.2	3.1	4.0	5.1	6.0	3.7	44

12.3 = Not quality controlled

### Appendix 3 Wastewater System Concept Design Proposed Irrigation Concept Design

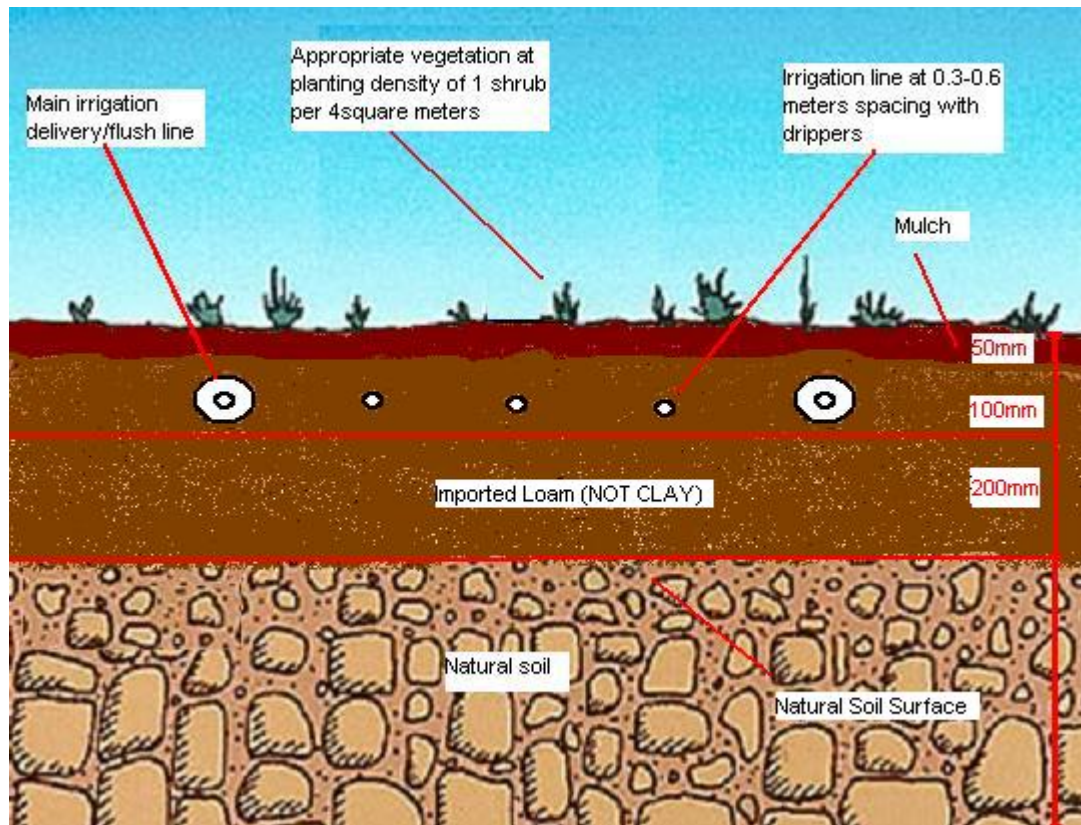


Figure 1 Irrigation cross section showing major delivery/flush lines and irrigation lines.

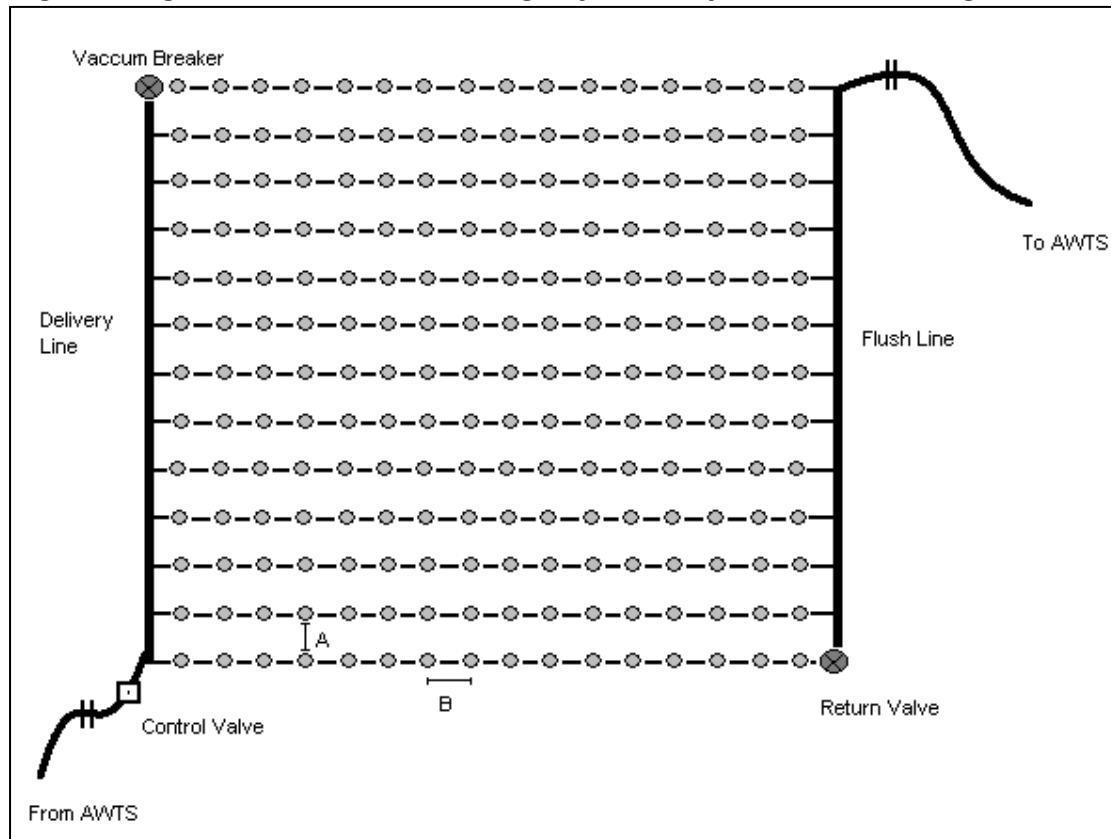


Figure 2 Irrigation Plan View

## **Site De-vegetation and Soil Renovation Processes**

1. Soils may be disturbed by site de-vegetation and removal of large trees. Soil may also be compacted by vehicular traffic or livestock. The following steps should be taken to renovate the soil profile before irrigation is installed:
  - a. Mechanically till, harrow or plough and level the residual soil surface. Ensure that all areas where vehicles or livestock have compacted the soil are deeply ripped or tilled to ensure adequate soil permeability. Ensure that the ground surface is levelled along natural slope contours and that all major rocks, gravels, road surfacing and large roots are removed.
  - b. Gypsum should be incorporated at the rate of 1kg/5m<sup>2</sup>
  - c. Imported topsoil (not clay) should be applied as shown in Fig 1 above. Do not compact this layer, and avoid travelling over with large machinery.
  - d. Irrigation should be laid as per the specifications below (point 2-18) and covered with further topsoil as per Fig 1 above.
  - e. Selected vegetation should be planted at a density of approx. 1 plant per 4m<sup>2</sup>.
  - f. Mulch should be placed over the site as shown in Figure 1 above.

## **Land Application Area Design and Construction Notes**

2. Delivery/flush line diameter = 25 -30 mm
3. Irrigation line diameter = 12-16mm
4. Irrigation line spacing (A) =300 mm for Sands, Sandy Loams and Loams to 600mm for Clay Loams, Light Clays and Heavy Clays (see the wastewater flow modelling section of this report for soil classification).
5. Dripper/Sprinkler spacing (B) as per manufacturers specifications.
6. A vacuum breaker should be installed at the highest point of the irrigation area (or in the case of multiple irrigation lots at each lot). This breaker should be protected and marked).
7. A flush line should be installed at the lowest point of the irrigation area incorporating a return valve for back flushing of the system back into the treatment chamber.
8. Irrigation areas greater than 400 m<sup>2</sup> should be split into 200 m<sup>2</sup> cells with effluent flows switched between irrigation lots with an automatic valve system.
9. All lateral lines MUST be installed parallel to the contours of the land. All minimum setbacks MUST be adhered to.
10. An inline filter must be inserted into the delivery line.
11. The first 100mm of the natural soil below the ground surface should be mechanically tilled to aid soil permeability.
12. Gypsum should be incorporated at the rate of 1kg/5m<sup>2</sup> into soils.
13. Imported topsoil (not clay) should be applied as shown above.
14. Selected vegetation should be planted at a density of approx. 1 plant per 4m<sup>2</sup>.
15. A minimum 50mm of heavy mulch should be imported to cover the ground surface.
16. Where practical a 50% reserve area should be identified on the site to allow movement or expansion of the irrigation area if required.
17. In areas of moderate to steep slopes (>10%) then upslope cut off drainage should be installed to minimise shallow ground water recharge of the irrigation area from upslope.
18. All livestock and Vehicles MUST be excluded from irrigation area.

## Appendix 4 Extract from EPAV 2016

### Code of practice – onsite wastewater management

Table 4: Minimum daily wastewater flow rates and organic loading rates <sup>1,10</sup>

Source	Design hydraulic flow rates for all water supplies <sup>2,4,5</sup> (L/person.day)	Organic material loading design rates (g BOD/person.day) <sup>7</sup>
Households with extra wastewater producing facilities <sup>6</sup>	220	60
Households with standard water fixtures	180	60
Households with full water-reduction fixtures <sup>3</sup>	150	60
Motels/hotels/guesthouse		
- per bar attendant	1000	120
- bar meals per diner	10	10
- per resident guest and staff with in-house laundry	150	80
- per resident guest and staff with out-sourced laundry	100	80
Restaurants (per potential diner) <sup>9</sup>		
- premises <50 seats	40	50
- premises >50 seats	30	40
- tearooms, cafés per seat	10	10
- conference facilities per seat	25	30
- function centre per seat	30	35
- take-away food shop per customer	10	40
Public areas (with toilet, but no showers and no café) <sup>8</sup>		
- public toilets	6	3
- theatres, art galleries, museum	3	2
- meeting halls with kitchenette	10	5
Premises with showers and toilets		
- golf clubs, gyms, pools etc. (per person)	50	10
Hospitals - per bed	350	150
Shops/shopping centres		
- per employee	15	10
- public access	5	3
School - child care	20	20
- per day pupil and staff	20	20
- resident staff and boarders	150	80
Factories, offices, day training centres, medical centres	20	15
Camping grounds		
- fully serviced	150	60
- recreation areas with showers and toilets	100	40

1. Based on EPA Code of Practice for Small Wastewater Treatment Plants, Publication 500 (1997).

2. When calculating the flow rate for an existing commercial premise, use this table or metered water usage data from the premise's actual or pro-rata indoor use.

3. WELS-rated water-reduction fixtures and fittings - minimum 4 Stars for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves and minimum 3 Stars for all appliances (e.g. water-conserving automatic clothes washing machines).

4. These flow rates take into consideration the likelihood of a reliable water supply being currently provided to a premises or in the future (e.g. from groundwater, surface water or reticulated water supply, or a tankered water supply).

5. Where Council is satisfied a household or premises is unlikely to be provided with a reliable water supply (e.g. a rural farming property where groundwater or surface water is unavailable or used only for stock) the design flow rates for Onsite Roof Water Tank Supply listed in the most current version of AS/NZS 1547 may be used.

6. Extra water producing fixtures include, but are not limited to, spa baths.

7. Based on Crites & Tchobanoglous (1998) and EPA Publication 500 (1997).

8. For premises such as public areas, factories or offices that have showers and toilets, use the flow rates for 'Premises with showers and toilets' in the calculations.

9. Number of seats multiplied by the number of seatings i.e., may include multiple seatings for breakfast, morning and afternoon teas, lunch and/or dinner.

10. The organic loading rate must be considered as well as the hydraulic flow rate when selecting the most suitable treatment system.

## Code of practice – onsite wastewater management

Table 5: Setback distances for primary and secondary treatment plants and effluent disposal/irrigation areas in sewered and unsewered areas (where applicable) <sup>1, 2, 6, 10,</sup>

Landscape feature or structure	Setback distances (m)		
	Primary sewage and greywater systems	Secondary sewage and greywater systems	Advanced secondary greywater systems <sup>3</sup>
<b>Building</b>			
Wastewater field up-slope of building <sup>7</sup>	6	3	3
Wastewater field down-slope of building	3	1.5	1.5
Wastewater up-slope of cutting/escarpment <sup>12</sup>	15	15	15
<b>Allotment boundary</b>			
Wastewater field up-slope of adjacent lot	6	3	1
Wastewater field down-slope of adjacent lot	3	1.5	0.5
<b>Services</b>			
Water supply pipe	3	1.5	1.5
Wastewater up-slope of potable supply channel	300	150	150
Wastewater field down-slope of potable supply channel	20	10	10
Gas supply pipe	3	1.5	1.5
In-ground water tank <sup>14</sup>	15	7.5	3
Stormwater drain	6	3	2
<b>Recreational areas</b>			
Children's grassed playground <sup>15</sup>	6	3 <sup>16</sup>	2 <sup>16</sup>
In-ground swimming pool	6	3 <sup>16</sup>	2 <sup>16</sup>
<b>Surface waters (up-slope of:)</b>			
Dam, lake or reservoir (potable water supply) <sup>8, 13</sup>	300	300 <sup>4</sup>	150
Waterways (potable water supply) <sup>9, 13</sup>	100	100 <sup>4, 5, 17</sup>	50
Waterways, wetlands (continuous or ephemeral, non-potable); estuaries, ocean beach at high-tide mark; dams, reservoirs or lakes (stock and domestic, non-potable) <sup>8, 9</sup>	60	30	30
<b>Groundwater bores</b>			
Category 1 and 2a soils	NA <sup>11</sup>	50 <sup>18</sup>	20
Category 2b to 6 soils	20	20	20
<b>Watertable</b>			
Vertical depth from base of trench to the highest seasonal water table <sup>18</sup>	1.5	1.5	1.5
Vertical depth from irrigation pipes to the highest seasonal water table <sup>18</sup>	NA	1.5	1.5

- Distances must be measured horizontally from the external wall of the treatment system and the boundary of the disposal/irrigation area, except for the 'Watertable' category which is measured vertically through the soil profile. For surface waters, the measuring point shall be from the 'bank-full level'.
- Primary water-based sewerage systems must only be installed in unsewered areas; secondary sewerage systems must only be installed and managed in sewered areas by Water Corporations; secondary greywater systems can be installed in sewered and unsewered areas (see [Section 3.12.3](#)).
- Advanced secondary greywater systems treating effluent to ≤10/10/10 standard.
- The setback distance in a Special Water Supply Catchment area may be reduced by up to a maximum of 50% conditional on the following requirements (otherwise the setback distances for primary treatment systems apply):
  - effluent is secondary treated to 20/30 standard as a minimum
  - a maintenance and service contract, with a service technician accredited by the manufacturer, is in place to ensure the system is regularly serviced in accordance with Council Septic Tank Permit conditions and
  - Council is satisfied the reduction in set-back distance is necessary to permit the appropriate development of the site and that risks to public health and the environment are minimised.



## Code of practice – onsite wastewater management

### Appendix A:

Table 9: Soil Categories and Recommended Maximum Design Loading/Irrigation Rates (DLR/DIR) for Land Application Systems <sup>1, 2, 5</sup>

Soil texture	Soil structure	Soil category	Indicative permeability (Ksat) (m/d)	Design Loading Rates and Design Irrigation Rates (DLR / DIR) (mm/day)					
				Absorption trenches/beds and Wick Trench & Bed Systems 6 for primary effluent (see Table L1 in AS/NZS 1547: 2012)	(ETA) Evapo-transpiration absorption beds and trenches (see Table L1 in AS/NZS 1547: 2012)	Secondary treated effluent applied to Wick Trench & Bed System <sup>a</sup>	Sub-surface and surface irrigation (see Table M1 in A3/NZS 1547: 2012)	LPED (see Table M1 in AS/NZS 1547: 2012)	Mounds (basal area) (see Table N1 in AS/NZS 1547: 2012)
Gravels and sands	Structureless (massive)	1	>3.0	NA <sup>1</sup>	NA <sup>2</sup>	25	5 <sup>a</sup> (see Note 2 in Table M1)	NA <sup>3</sup>	24
	Weakly structured	2a	>3.0						24
Sandy loams	Weakly structured	2b	1.4 - 3.0	15	15	30		4	24
	Massive								
Loams	High / moderate structured	3a	1.5 - 3.0	15	15	30	<sup>4</sup> (see Note 1 in Table M1)	3.5	24
	Weakly structured or massive	3b	0.5 - 1.5	10	10	30			16
Clay loams	High / moderate structured	4a	0.5 - 1.5	10	12	30	3.5 (see Note 1 in Table M1)	3	16
	Weakly structured	4b	0.12 - 0.5	6	8	20			8
	Massive	4c	0.06 - 0.12	4	5	10			5 (see Note to Table N1)
									8
Light clays	Strongly structured	5a	0.12 - 0.5	5	8	12	3 (see Note 1 in Table M1)	2.5 (see Note 4 in Table M1)	5
	Moderately structured	5b	0.06 - 0.12	(see Notes 2 and 3 in Table L1)	5 (see Notes 2, 3 & 5 in Table L1)	10			(see Note to Table N1)
Medium to heavy clays	Weakly structured or massive	5c	<0.06			8		NA	
	Strongly structured	6a	0.06 - 0.5						
	Moderately structured	6b	<0.06			5 (see Notes 2 and 3 in Table L1)	2 (see Note 2 in Table M1)		
	Weakly structured	6c	<0.06						

1. Adapted from Australian Standard AS/NZS 1547: 2012 – On-site domestic wastewater management.

2. The DLR and DIR are recommended maximum application rates for treated effluent. A water balance may indicate that a reduced application rate is required for a specific site.

3. The exception is where the soil does not have a high perched or high seasonal (winter) watertable (see AS/NZS 1547).

4. See Appendix E for design, installation and maintenance details.

5. Lower application rates may be required for reduced soil permeability in sodic and dispersive soils, soils with a perched or seasonally high watertable or soils with a limiting layer.

6. The application rate may be increased in sandy soils with a high watertable where an advanced secondary treatment system with disinfection replaces a primary treatment system on an existing lot that is too small to accommodate the maximum DIR for category 1 to 2b soils.

## Appendix 5 Professional Indemnity Insurance Certificate of Currency



**Contact** Laura Jones  
t 03 6270 0404  
e laura.e.jones@aon.com

Sven Nielsen  
17 Little Arthur Street  
NORTH HOBART TAS 7000

### Certificate of Currency

**Date of Issue** 10 May 2021

**In our capacity as Insurance Brokers to Sven Nielsen we hereby certify that the under mentioned insurance policy is current.**

<b>Policy Type</b>	Professional Indemnity
<b>Insured</b>	Strata Geoscience and Environmental Pty Ltd & Mr Sven Nielsen
<b>Insurer</b>	Tasman Underwriting Pty Ltd ABN: 76 006 090 464   Lloyds.Underwriters
<b>Policy Number</b>	TU/PI/20190269
<b>Period of Insurance</b>	26/05/2021 – 26/05/2022
<b>Interest Insured</b>	Legal Liability of Acts, Errors or Omissions committed by the Insured, in their Professional Capacity
<b>Limits of Liability</b>	\$2,000,000 any one claim and in the aggregate
<b>Jurisdictional Limit</b>	Australia and New Zealand Only

#### Further Information

Should you have any queries, please contact us. Our details are set out in the top right side of this document.  
This certificate is a summary of cover only. Please refer to the Policy Wording and Schedule for its full terms and conditions.

#### Important notes

- Aon does not guarantee that the insurance outlined in this Certificate will continue to remain in force for the period referred to as the Policy may be cancelled or altered by either party to the contract, at any time, in accordance with the terms of the Policy and the Insurance Contracts act 1984 (Cth).
- Aon accepts no responsibility or liability to advise any party who may be relying on this Certificate of such alteration to or cancellation of the Policy.
- This certificate does not:
  - represent an insurance contract or confer rights to the recipient; or
  - amend, extend or alter the Policy.

Office use only: AONMCAN2251 A316779/016

Aon Risk Services Australia Limited GPO Box 182, Hobart TAS 7001  
ABN 17 000 434 720 AFSL 241141



## Appendix 6 Terms and Conditions

### Scope of Work

These Terms and Conditions apply to any services provided to you ("the Client") by Strata Geoscience and Environmental Pty Ltd ("Strata"). By continuing to instruct Strata to act after receiving the Terms and Conditions or by using this report and its findings for design and/or permit application processes and not objecting to any of the Terms and Conditions the Client agrees to be bound by these Terms and Conditions, and any other terms and conditions supplied by Strata from time to time at Strata's sole and absolute discretion. The scope of the services provided to the Client by Strata is limited to the services and specified purpose agreed between Strata and the Client and set out in the correspondence to which this document is enclosed or annexed ("the Services"). Strata does not purport to advise beyond the Services.

### Third Parties

The Services are supplied to the Client for the sole benefit of the Client and must not be relied upon by any person or entity other than the Client. Strata is not responsible or liable to any third party. All parties other than the Client are advised to seek their own advice before proceeding with any course of action.

### Provision of Information

The Client is responsible for the provision of all legal, survey and other particulars concerning the site on which Strata is providing the Services, including particulars of existing structures and services and features for the site and for adjoining sites and structures. The Client is also responsible for the provision of specialised services not provided by Strata. If Strata obtains these particulars or specialised services on the instruction of the Client, Strata does so as agent of the Client and at the Client's expense. Strata is not obliged to confirm the accuracy and completeness of information supplied by the Client or any third party service provider. The Client is responsible for the accuracy and completeness of all particulars or services provided by the Client or obtained on the Client's behalf. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever suffered by the Client or any other person or entity resulting from the failure of the Client or third party to provide accurate and complete information. In the event additional information becomes available to the Client, the Client must inform Strata in writing of that information as soon as possible. Further advice will be provided at the Client's cost. Any report is prepared on the assumption that the instructions and information supplied to Strata has been provided in good faith and is all of the information relevant to the provision of the Services by Strata. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever if Strata has been supplied with insufficient, incorrect, incomplete, false or misleading information.

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While all reasonable care is taken reporting to the Client, Strata does not warrant that the information contained in any report is free from errors or omissions. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever resulting from errors in a report. Any report should be read in its entirety, inclusive of any summary and annexures.. Strata does not accept any responsibility where part of any report is relied upon without reference to the full report. Latter versions of any report invalidate any recommendations, assumptions, or designs contained in former reports. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever based upon the use of older versions of any report.

### Project Specific Criteria

Any report provided by Strata will be prepared on the basis of unique project development plans which apply only to the site that is being investigated. Reports provided by Strata do not apply to any project other than that originally specified by the Client to Strata. The Report must not be used or relied upon if any changes to the project are made. The Client should engage Strata to further advise on the effect of any change to the project. Further advice will be provided at the Client's cost. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever where any change to the project is made without obtaining a further written report from Strata. Changes to the project may include, but are not limited to, changes to the investigated site or neighbouring sites, for instance, variation of the location of proposed building envelopes/footprints, changes to building design which may impact upon sewage treatment plant system design, specification and performance.

### Interpretation

Strata is not responsible for the interpretation of site data or report findings by other parties, including parties involved in the design and construction process. The Client must seek advice from Strata about the interpretation of the site data or report.

### Design/Report Recommendations

Where sewage treatment plant and/or application system designs are provided by Strata, reasonable effort will be made to minimise environmental, public health and commercial risks associated with the disposal of effluent within site boundaries with respect to relevant Australian guidelines and industry best practise at the time of investigation. Strata is not liable, and accepts no responsibility, for any claim, demand, charge, loss, damage, injury or expense whatsoever resulting from:

- (i) changes to either the project or site conditions that affect the onsite wastewater land application system's ability to safely dispose of modelled wastewater flows; or
- (ii) changes to original use of site infrastructure or changes from original modelled loadings as a result of change of use or incorrect loading information supplied by the client; or
- (iii) seepage, pollution or contamination or the cost of removing, nullifying or clearing up seepage, polluting or contaminating substances; or
- (iv) poor system performance where septic tanks have not been de-sludged at maximum intervals of 3 years or sewage treatment plants have not been serviced in compliance with the manufacturers recommendations; or

## *Reconnaissance LCA and Onsite System Concept Design for Friends, Hoopers, Williams & Willung Roads Rosedale*

- (v) system /component failure of any recommended system/component; or
- (vi) poor contractor construction/installation practice; or
- (vii) Inferior product/component selection by installing contractor ; or
- (viii) any treatment plant , treatment plant component or land application area breakdown of any kind; or
- (ix) failure of the client to commission both interim and final inspections by the designer throughout the system construction; or
- (x) the selection of inappropriate plants for irrigation areas or any increased cost associated with upkeep of recommended plants or their replacement; or
- (xi) damage to any infrastructure by seepage/effluent including but not limited to foundations, walls, driveways and pavements; or
- (xii) land instability, soil erosion or dispersion caused by seepage/effluent or the installation of sewage plant infrastructure; or
- (xiii) Excavation difficulties given hard rock, watertables, collapsing soils or other difficult conditions; or
- (xiv) Dammmages to underground services via excavation or system installation; or
- (xv) design changes requested by the Permit Authority; or
- (xvi) time delays associated with any of the above, or to strata or any of its representatives being able to mobilise to site for any reason.

Furthermore Strata does not guarantee septic trench, bed or mound design life beyond 2 years from installation,. Strata does not warrant EPA sand filter designs.

Strata does not consider site contamination, unless the Client specifically instructs Strata to consider the site contamination in writing. If a request is made by the Client to consider site contamination, Strata will provide additional terms and conditions that will apply to the engagement.

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- (ii) the Client is entitled to a royalty free licence to use the same during the life of the works comprising the project.

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If any report is provided to the Client in an electronic copy except directly from Strata, the Client should verify the report contents with Strata to ensure they have not been altered in any way from the original provide by Strata.