Broadcrest Consulting Pty Ltd

212 The Driftway, Londonderry NSW

On-Site Wastewater Report

February 2021

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Wastewater | Stormwater | Flood | Environmental | Geotechnical | Acoustic | Structural

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Document controls

Approval and Authorisation

Title	212 The Driftway, Londonderry NSW On-Site Wastewater Report
Authored on behalf of Broadcrest Consulting Pty Ltd by:	Kyle Ryan Engineer | Civil and Environmental
Signed:	[redacted]
Dated:	15.02.2021

Document Status

Date	Internal Reference	Document Status	Prepared by	Reviewed by
10.02.2021	0882-WW-A-01	For Release	K. Ryan	K. Ferry
15.02.2021	0882-WW-A-02	For Release	K. Ferry	K. Ryan

Contents

1 INTRODUCTION

1.1 Foreword

An On-Site Wastewater Report is a technical document which specifies how the sewage produced on-site will be managed, treated, and then disposed. An On-Site Wastewater Report carefully considers the environment, health, cost, and long-term management options for the on-site management of sewage.

1.2 Background

Broadcrest Pty. Ltd. was engaged by Rose Refalo to produce an On-Site Wastewater Management Report at 212 The Driftway, Londonderry NSW (the site). The report will accompany plans to construct a new Granny flat. The existing residence will continue to use the existing Septic tank and absorption trench, it is proposed to continue using this system until deemed unsuitable. No further assessment has been undertaken of this system.

A site inspection was carried out on the 2nd of February 2021 which involved a visual assessment of the site and soil sampling. The assessment of the results, system design and recommendations are detailed in this report.

1.3 Objectives

The performance objectives of the On-Site Wastewater Assessment are to:

- Protect human health
- Protect ground and surface water
- Maintain and enhance the quality of the land and vegetation
- Maintain and enhance community amenity
- Ensure maximum re-use of resources
- Promote an ecologically sustainable development.

1.4 Scope of Works

The scope of works included the following:

- A site inspection
- Soil sampling and analysis
- Wastewater management assessment
- Drafting of the proposed system
- Reporting in accordance with the associated legislations and guidelines.

1.5 Compliance

This report has been produced in accordance with the following guiding documents:

- Penrith City Council 2014, *Penrith Development Control Plan*
- DLG 1998, *On-site Sewerage Management for Single Households*
- SCA 2012, *Designing and Installing On-Site Wastewater Systems*
- Australian Standard AS 1289.3.8.1:2006 *Methods for testing soils for engineering purposes*
- Australian Standard AS 1546.1-3:2008 *On-site domestic wastewater treatment units*
- Australian Standard AS 1547:2012 *On-site domestic wastewater management*

2 SITE INFORMATION

TITLE

Address / Locality	212 The Driftway, Londonderry NSW
Lot Area:	~2.7 ha
Council / LGA:	Penrith City Council
Intended Water Supply:	Town Water
Design Wastewater Loading: (litres / day)	Proposed Granny flat: 450L/day (2 bedroom – 3ep x 150L/ep/day)[1]

1. Sizing based upon *On-Site Sewerage Management and Greywater Reuse* (Penrith City Council 2014) with two persons for a master / guest bedroom and one person per additional bedroom, at 150L/Day per person for Town / Bore Water.

INSPECTION

Date	Evaluator(s)
02.02.2021	K. Ferry

3 SITE ASSESSMENT & INVESTIGATION

3.1 General

The site occupies approximately 2.7ha of land zoned RU4 (Primary Production Small Lots), within Penrith City Council LGA. At the time of inspection, the site consisted of one existing dwelling and a shed surrounded by flat grassland. The proposed development is a new Granny flat.

Figure 3.1: Landscape at the time of the site inspection

3.2 Assessment Methodology

The assessment methodology of this report follows that prescribed in DLG (1998), whereby the restriction imposed by a site/soil features are categorised by severity, and their impact forms the basis for subsequent system selection, design and recommendations (Table 3.1)

Table 3.1 – Site / soil limitation assigned per DLG (1998)

Limitation	Description
Minor	This feature has been assessed and deemed to pose no obstacle to OSSM, given the recommended system and measures are implemented.
Moderate	This feature requires consideration. It may typically be overcome by site modifications or by appropriate selection, design and sizing of treatment / application systems.
Major	This feature precludes the use of a given treatment, land application method, or Effluent Management Area (EMA). Particular Major Limitations may prevent OSSM entirely, require an off-site management approach, or re-evaluation of the development scope.

3.3 Site Assessment Summary

A summary of limitations pertinent to the suitability of the site for On-Site Sewerage Management (OSSM) is provided in Table 3.2 below.

Table 3.2 – Assessment summary of site features

Factor Assessed	Description	Limitation
Climate	Monthly evaporation exceeds rainfall for majority of year.	Minor
Temperature	Annual mean daytime maximum > 15°C.	Minor
Flood Potential	No flood study available for this site. Site is expected to be above 1:100 year flood level.	Minor
Exposure	Excellent wind and solar exposure.	Minor
Slope	<0-1%	Minor
Landform	Level	Minor
Run-on and Seepage	Low potential of stormwater run on interacting with the proposed EMA.	Minor
Site-drainage	No significant signs of ongoing surface moisture or ponding. During significant rainfall temporary ponding is expected due to level ground and clay subsoil.	Moderate
Erosion Potential	No erosion in proposed EMA identified.	Minor
Site and Soil Disturbances	Active site / soil disturbances expected around residence construction area.	Minor
Buffer Distances & Available land area	All prescribed buffer distances can be achieved.	Minor
Groundwater Bores	No groundwater bores have been identified within 250 m of the proposed EMA.	Minor
Rock Outcropping	No outcropping identified.	Minor
Geology / Regolith	No geological discontinuities, fractures or highly porous regolith identified.	Minor

3.4 Climate

Londonderry has a humid subtropical climate with hot summers and mild to cool winters. Median annual rainfall is 792.2mm and evaporation 1387mm. Average monthly evaporation is greater than median rainfall throughout the year (Appendix B) (*Minor Limitation)*.

Mean daytime maximum and minimum temperatures from 30.5°C to 3.5°C in January to July respectively. The mean annual daytime maximum of 24.3°C proves suitable for biological wastewater treatment systems (i.e. AWTS) (*Minor Limitation*).

3.5 Flood potential

A flood investigation has not been completed as part of this Assessment. No flood study available for this site. The proposed Effluent Management Areas are assumed to be free from frequent flooding (*Minor Limitation*).

3.6 Exposure

The proposed effluent management area has excellent solar and wind exposure (*Minor Limitation*).

Landform Feature	Aspect	Solar Exposure	Wind Exposure	Limitation
A	Level	Excellent	Excellent	Minor

3.7 Slope

Slope has the potential to become a restrictive landform feature for OSSM with increased slope increasing the risk of run-off and/or erosion. Slope within the proposed effluent management area was approximately 0-1% gradient (*Minor Limitation*).

Landform Feature	Approximate Slope Tangent (%)	Slope Classification	Limitation
A	0-1%	Level	Minor

Table 3.3. - Percentage Slope and Land Application Limitations

Slope Range [%]	Slope Classification	Limitation				
		Surface Irrigation (Spray & Drip)	Absorption Systems	Mounds	Conventional Trenches & LPEDs	Sub-surface Irrigation
0 – 1	**Level**	**Minor**	**Minor**	**Minor**	**Minor**	**Minor**
1 – 3	Very Gently Inclined	Minor	Minor	Minor	Minor	Minor
3 – 10	Gently Inclined	Minor	Minor	Minor	Minor	Minor
10 – 15	Moderately Inclined	Major	Major	Moderate	Moderate	Minor
15 – 20		Major	Major	Major	Moderate[2]	Minor
> 20	Steeply Inclined	Major	Major	Major	Moderate[3]	Moderate[1]

3.8 Landform

The landform describes the surface shape and topographic position at the proposed EMA. Typical landform descriptors per AS1547:2012 are detailed below.

Landform Feature	Slope Configuration	Limitation	
A	Level	Minor	

3.9 Surface Water and Seepage

Surface water and seepage flow is determined by the catchment preceding the EMA and the prevailing landform features. General assessment of the likely surface water interaction with the landform and EMA has been provided.

Landform Feature	Catchment		Surface Flow		Soil Moisture	Seepage Potential	Limitation
	Size	Surface Coverage	Run-on	Run-off			
A	Limited	Grass	Minor	Minor	Moist	Minor	Minor

3.10 Site drainage

No significant signs of ongoing surface moisture or ponding. During significant rainfall temporary ponding is expected due to the level ground and clay subsoil. *(Moderate Limitation). I*rrigation recommended to maximize evapotranspiration.

3.11 Erosion potential

Erosion and surface soil movement results from the interaction of the existing landform, surface flows and surface coverage. The following existing erosion conditions were identified and assessed in proposing additional hydraulic loading in the form of effluent. Soils are potentially erodible where surface cover is broken and as such, site and soil disturbances should be minimised (*Minor Limitation*).

Landform Feature	Surface Flow Type	Erosion Hazard		Limitation
		Surface Flow	Wind	
A	Unconcentrated	Low	Low	Minor

3.12 Site & Soil Disturbances

No site or soil Disturbances were identified on site; Active site and soil disturbance expected during construction no further ongoing significant site or soil disturbances are anticipated *(Minor Limitation).*

3.13 Domestic Bore

WaterNSW data indicated no groundwater bores located within 250m of the site *(Minor Limitation).*

3.14 Buffer Distances & Available Land Area

Minimum offset distances are designated by local approval authorities within their guiding documents to ensure the ongoing protection of community health, sensitive ecosystems, and the maintenance of community amenity. Where LGA guidance on a constraint is not available, appropriate offsets have been nominated in accordance with AS1547:2012 and Table 5 DLG (1998).

The site-specific constraints for the proposed EMA and land application method have been assessed as per Table 3.4.

Table 3.4 – Minimum buffer distances from sensitive site features

Site Feature	Minimum Setback		Proposed Setback	Limitation
	If EMA is upslope of feature	If EMA is downslope / level with feature		
Dwellings	15m		15m	Minor
Property Boundaries	6m	3m	>3m	Minor
Driveways	6m	3m	>3m	Minor
Paths & Walkways	3m		-	Minor
Pools	15m		-	Minor
Watercourses	100m		>100m	Minor
Domestic Bore / Well	250m from high water level		>250m	Minor
Dam / Drainage Depression	40m from high water level		>40m	Minor

3.15 Rock Outcropping

No rock outcrop or surface boulders were identified across much of the site (*Minor Limitation)*.

3.16 Geology / Regolith

No geological discontinuities, fractures, or highly porous regolith are expected within and surrounding the EMA (*Minor Limitation*).

4 SOIL ASSESSMENT

4.1 Soil Assessment Summary

Investigation of the site for suitability for OSSM was accompanied by soil assessment within the proposed EMA. The soil characteristics where assessed per AS 1547:2012, AS 1289.3.8.1:2006, and NSW DLWC (2001) methodologies. The summary of the soil investigation is presented in Table 4.1.

Table 4.1 – Assessment summary of site features

Factor Assessed	Description	Limitation
Depth to bedrock / hardpan	>1,200 mm	Minor
Depth to high watertable	NIL free water or waterlogging characteristics	Minor
Coarse Fragments	< 5% across all upper strata	Minor
pH	5.8-6.1	Moderate
Electrical Conductivity (ECe)	0.32-3.44 dS/m across all samples.	Minor
Sodicity (ESP)	N.A – Single lot	-
Cation exchange capacity (CEC)	N.A – Single lot	-
Phosphorous sorption	N.A – Single lot	-
Dispersiveness	N.A	Minor

4.2 Soil Landscape Map

The 1:100,000 Soil Landscape Mapping indicates the site occurs on the Berkshire Park Stagnant Alluvial Landscape. The soil landscape consists of dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system.

Soils consist of weakly pedal orange heavy clays and clayey sands, often mottled. Ironstone nodules common. Large (up to 20 cm) silcrete boulders occur in sand/clay matrix. Solods (Dy3.41), yellow podzolic soils (Dy4.11, Dy2.11, Dy2.21, Dy2.22), red podzolic soils (Dr4.11), chocolate soils (Dr4.11, Dr4.61), structured plastic clays (Uf6.11, Uf6.12), structured clays (Uf5.23, Gn4.11 and Gn3.11).

4.3 Depth to Bedrock / Hardpan

Soil depth was ascertained via two bore holes. ~1,200 mm depth reached without refusual (*Minor Limitation*).

4.4 Depth to High Watertable

No visible free water, soil saturation, grey mottling or similar was encountered within the sampling depth *(Minor Limitation).*

4.5 Soil Permeability Category

Soil permeability has been assigned per Table L1 of AS1547:2012.

Table 4.2 – Soil permeability and Design Loading Rate

Depth	Texture	Structure	Indicative Permeability	Design Irrigation Rate (DIR)
0 - 400 mm	Clay Loam	Weak	0.12 - 0.5 m / day	3.5 mm / day
400 - 1200 mm	Light Clay	Moderate	0.06 - 0.12m / day	3.0 mm / day

4.6 Soil Profiles

Table 4.3 – Bore Hole #1 and 2

Excavation #	1 & 2	Sample size:	50	[mm]	Date sampled:	02-02-2020
Inspection Method:	Thin Wall Tube Sample				Surface R.L:	-

Layer	Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Coarse Fragment	Structure	Modified Emerson
1	A1	400	S. Moist	Dark Brown	Clay Loam	<5%	Weak	3+
2	B1	1200	S. Moist	Brown	Medium Clay	<5%	Moderate	3+

Figure 4.1 Borehole 1 (top) and 2 (bottom)

4.7 Soil Chemistry

One sample from each horizon of Bore Hole #2 was tested for pH and EC by Broadcrest Consulting. The results were as follows:

Table 4.6: Soil Chemistry

Depth (mm)	Test	Result	Limitation	Recommendations
Bore Hole 2				
100	pH	6.13 (Slightly Acidic)	Moderate	Surface application of lime, or equivalent at 250 g/m^2
	ECe (dS/m)	0.32 (Non-Saline)	Minor	-
600	pH	5.83 (Mod Acidic)	Moderate	-
	ECe (dS/m)	3.44 (Non-Saline)	Minor	-

5 NOMINATED WASTEWATER MANAGEMENT

5.1 Proposed OSSM Summary

Site and soil constraints were evaluated in selection of appropriate treatment and effluent management method. For sizing, discrete water and nutrient balance calculations have been performed. A summary of the recommended OSSM system and application sizing is presented below:

Proposed treatment for each proposed lot

Treatment		Effluent Management
AWTS + disinfection or equivalent	→ (Pumped dosing)	Minimum **367m²** of sub-surface irrigation

5.2 Wastewater Treatment

It is proposed to treat all wastewater generated by the development to a secondary standard via a NSW Department of Health approved domestic aerated wastewater treatment systems (AWTS) or equivalent. The nominated unit must be capable of sustainably treating the calculated daily wastewater load.

Justification of the proposed treatment method is as follows:

- Accidental or deliberate discharges are less detrimental to the environment and have less potential to adversely impact on health
- Higher quality effluent produced
- High commercial availability
- Facilitates use of surface irrigation (maximising evapotranspiration)

Table 5.1 - Secondary Treatment Targets (per DLG 1998)

Biochemical Oxygen Demand (BOD^5)	Suspended Solids (TSS)	Total Nitrogen (TN)	Total Phosphorus (TP)	Faecal coliforms		Dissolved Oxygen (DO)
				Non-disinfected effluent	Disinfected effluent	
< 20 mg/L	< 30 mg/L	25 - 50 mg/L	10 - 15 mg/L	Up to 10^4 cfu/100 mL	< 30 cfu/100 mL	> 2 mg/L

A list of accredited AWTS systems and suppliers is available on the NSW Health website: *http://www.health.nsw.gov.au/environment/domesticwastewater/Pages/awts.aspx*

5.3 Effluent Management

Given the development proposed and site and soil conditions encountered, it is proposed to dispose of effluent from both the existing and proposed residences via **sub-surface spray irrigation**.

Water and nutrient balance modelling as described in the DLG guidelines has been undertaken to determine the necessary size for effluent management areas. The design irrigation rate (DIR) given in Section 4.5 has been adopted in the hydraulic balance and Appendix B provides the results. Appendix B also shows the results of the nutrient modelling. It uses site-specific soil data and assumes the nutrient concentrations in the treated effluent are 12 mg/L and 20 mg/L for phosphorous and nitrogen respectively.

Hydraulic and nutrient modelling for the site indicates that a **minimum dispersal area of 367m^2** is required, based on a 2-bedroom proposed Granny flat. The irrigation field should be positioned as identified in Appendix A. The existing dwelling will continue use of existing Septic tank + Absorption trenching application method.

Justification of the proposed treatment method is as follows:

- Irrigation maximises the disposal area and evapo-transpiration
- An irrigation area is available onsite meeting the minimum buffer distances
- Suitable soil type and depth has been obtained onsite to permit irrigation

5.4 Recommended Site Modifications

In order to address present site and soil constraints, the following modifications are recommended:

1. Correction of soil pH via amendment of Aglime to the current soil. Application of Aglime at a proportion of 250 g/m2 is recommended across the EMA.
2. Establishment of dense (>85% coverage) perennial groundcover over the EMA prior to commissioning of the application system.
3. The EMA is to be excluded from vehicular traffic via signage, bollards or similar.

6 ADDITIONAL INFORMATION

6.1 Pipework Detail

All associated plumbing / drainage work is to be in accordance with AS 3500.2:2015 *Sanitary Plumbing Drainage*. Positioning of the receiving treatment system is to ensure drainage from internal plumbing fixtures achieves the minimum grade and cover of the excerpts below.

Table 6.1 – Excerpts of AS3500.2:2015

Nominal Pipe Diameter (DN)	Minimum Grade	
(mm)	(%)	(Ratio)
65	2.50	1:40
80	1.65	1:60
100	1.65*****	1:60*****
125	1.25	1:80
150	1.00	1:100

*Drains from treatment plants may be 1.00% Min.

	Minimum depth of cover (mm)	
Location	Cast iron & Ductile iron	Other materials
Subject to vehicular loading	300	500
All other locations	NIL	300

6.2 Licensing

Operating a system of sewage management is a Prescribed Activity under the Local Government Act 1993 and clause 45 of the Local Government (Approvals) Regulation 1999. This means that an 'Approval to Operate' a system of sewage management must be obtained from Council.

6.3 Detailed Design

A detailed system design may still be requested at the 'Application to Install' stage. This design will include the size and location of all system components including tanks, distribution lines, valves, etc. These additional requirements will be furnished by the nominated treatment system suppliers / licensed installers. Additional information for the property owner is available in Appendix C.

7 CONCLUSION

- It is proposed to construct a secondary dwelling (granny flat) with a new wastewater system.
- The anticipated wastewater loading rates are calculated to be **450 L/day** based on a two-bedroom residence
- It is proposed to secondary treat all wastewater within a NSW Health approved Aerated Wastewater Treatment System (AWTS), with a rated flow capacity of at least 450L/day.
- Application of the secondary treated effluent is proposed for each proposed lot via **subsurface irrigation with an area of 367m^2**, as detailed in Appendix A.
- Surface application of Lime (250g/m^2) or equivalent is recommended to amend the moderately acidic soil layer.
- The effluent management areas are to be well maintained with regular mowing with clippings removed.

APPENDIX A: SITE PLAN

ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
B-01	15-02-21	KF	KF	LS	FOR RELEASE
A-01	08-02-21	KF	KF	LS	FOR RELEASE

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PROJECT	OSSM - PROPOSED GRANNY FLAT
PROJECT DESCRIPTION	AWTS + SUB SURFACE IRRIGATION
LOCATION	212 THE DRIFTWAY, LONDONDERRY
CLIENT	ROSE REFALO
LGA	PENRITH CITY COUNCIL
PROJECT NUMBER	0872
REVISION	01-B
DRAWING NUMBER	01
DATE	15-02-2021
SCALE	1:300
PAPER SIZE	A3
SHEET No.	1 OF 1

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APPENDIX B: CLIMATE DATA

B1. - Climate Statistics

Table B1.1. Weather Stations

Statistic	Station No.	Station Name	Distance from site [km]
Temperature	67105	RICHMOND RAAF	3.95
Precipitation	67021	RICHMOND - UWS HAWKESBURY	1.47
Evaporation	67021	RICHMOND - UWS HAWKESBURY	1.47

Figure B.1 - Monthly Cimate Statistics

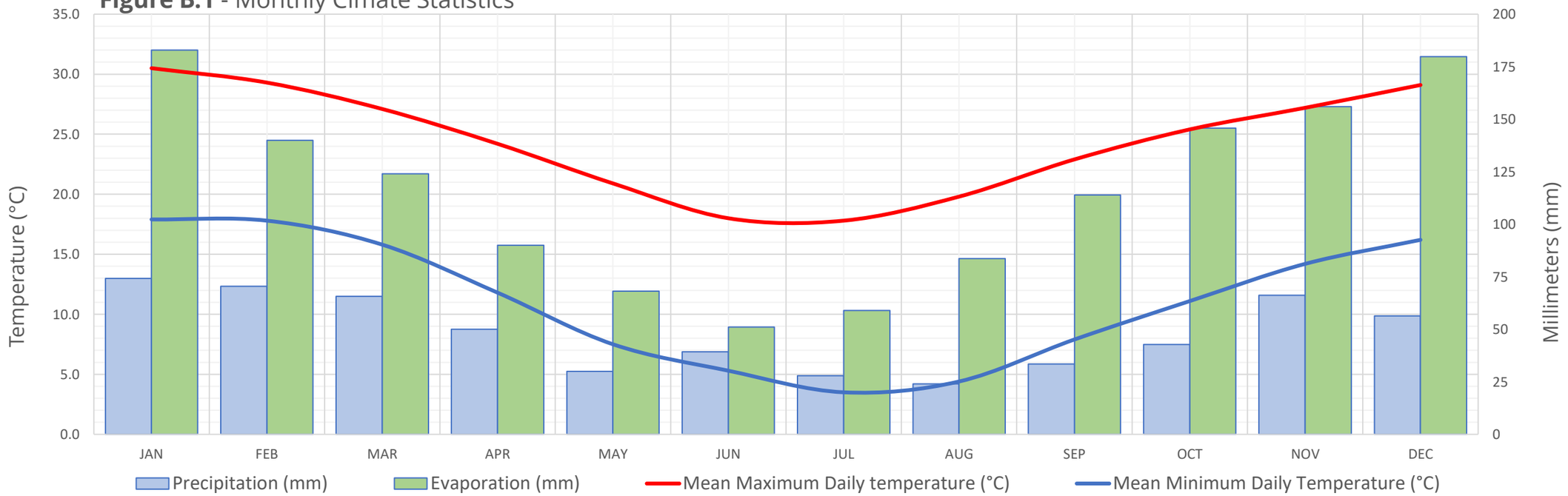


Table B1.2. Site Climate Statistics

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Max. Temperature	[T]	[°C]	**30.5**	29.3	27.1	24.2	20.9	18.0	17.8	19.8	22.9	25.4	27.2	29.1	24.3
Mean Min. Temperature	[T]	[°C]	17.9	17.8	15.8	11.8	7.5	5.3	**3.5**	4.4	7.9	11.1	14.2	16.2	11.1
Days	[D]		31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation[1]	[P]	[mm/month]	74.2	70.5	65.7	50	30	39.3	27.9	24	33.5	42.8	66.2	56.4	792.2
Evaporation	[E]	[mm/day]	5.9	5	4	3	2.2	1.7	1.9	2.7	3.8	4.7	5.2	5.8	3.8
		[mm/month]	182.9	140	124	90	68.2	51	58.9	83.7	114	145.7	156	179.8	1387
Natural Site Balance[2]	[P-E]	[mm/month]	-108.7	-69.5	-58.3	-40	-38.2	-11.7	-31	-59.7	-80.5	-102.9	-89.8	-123.4	

[1] Median historic precipitation. Note: total is not equivalent to annual median.

[2] Negative value indicates monthly mean evaporation > precipitation

B2. - Water Balance

Table B2.1. Site & Soil Parameters

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	450	L/day
Soil Texture		Light Clay	
Soil Structure		Moderate	
Indicative Permeability	K_{sat}	0.06 to 1.2	m/day
Design Irrigation Rate	DIR_{day}	3	mm/day

Table B2.2. Effluent water balance

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Days per Month	D	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Crop Factor	C		0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	0.7
Effluent Irrigation	(Q x D)	mm/month	13950	12600	13950	13500	13950	13500	13950	13950	13500	13950	13500	13950	164250
Evapotranspiration	(E xC)	mm/month	128.0	98.0	86.8	54.0	34.1	23.0	23.6	37.7	62.7	94.7	109.2	125.9	970.9
Design Irrigation Rate	DIR_{Month}	mm/month	93	84	93	90	93	90	93	93	90	93	90	93	1095
Minmum Area Required	$A_{wb.min}$	m^2	95	113	122	144	144	**183**	157	131	113	96	102	86	129

Table B2.3. Water Balance Minimum Area Requirement

	Symbols	Area m^2
Minimum Area Required to Satisfy Water Balance:	A_{wb}	**183**

B3. - Nutrient Balance & Minimum irrigation area

Table B3.1. Nitrogen Balance

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	450	L/day
Surface Vegetation		Lawn - unmanaged	
Effluent Total Nitrogen (TN) Concentration[1]	TN	20	mg/L
Critical TN Loading Rate[2]	$L_{n.sfc}$	33	$mg/m^2/day$
Minimum Application Area	$A_{n.sfc}$	**274**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

Table B3.2. Phosphorus Balance

Parameter	Symbols	Values	Units
Design Wastewater Flowrate	Q	450	L/day
Surface Vegetation		Lawn - unmanaged	
Effluent Total Phosphorus (TP) Concentration[1]	TP	12	mg/L
Phosphorus Generated 50_{YR}	P_{gen}	98.55	kg
Soil Phosphorus Sorption Capacity	P_{sorp}	6,250	kg/Ha
Phosphorus Absorped 50_{YR}	P_{absorb}	0.208	kg/m^2
Critical TP Loading Rate[2]	$L_{p.sfc}$	3	$mg/m^2/day$
Phosphorus Uptake 50YR	$P_{uptake.sfc}$	0.060	kg/m^2
Minimum Application Area	$A_{p.sfc}$	**367**	m^2

[1.] Nominal ATWS Nutrient Concerntrations (DLG 1998, AS1547.3:2012)

[2.] Appendix 6, 'On-site sewage management for single households' (DLG 1998, AS1547.3:2012)

B4. - Minimum Effluent Irrigation Areas

Table B4.1. Minimum Irrigation Area Requirement

Balance	Area Required (m^2)
Water	367
Nitrogen	274
Phosphorus	367
Minimum Irrigation Area	**367**

APPENDIX C: INFORMATION FOR THE PROPERTY OWNER

ON-SITE SEWAGE MANAGEMENT SYSTEMS

If you live in or rent a house that is not connected to the main sewer then chances are that your yard contains an on-site sewage management system. If this is the case then you have a special responsibility to ensure that it is working as well as it can.

The aim of this pamphlet is to introduce you to some of the most popular types of on-site sewage management systems and provide some general information to help you maintain your system effectively. You should find out what type of system you have and how it works.

More information can be obtained from the pamphlets:

Your Septic System
Your Aerated Wastewater Treatment System
Your Composting Toilet
Your Land Application Area

You can get a copy of these pamphlets from your local council or the address marked on the back of this pamphlet.

It is important to keep in mind that maintenance needs to be performed properly and regularly. Poorly maintained on-site sewage management systems can significantly affect you and your family's health as well as the local environment.

What is an on-site sewage management system?

A domestic on-site sewage management system is made up of various components which - if properly designed, installed and maintained - allow the treatment and utilisation of wastewater from a house, completely within the boundary of the property.

Wastewater may be blackwater (toilet waste), or greywater (water from showers, sinks, and washing machines), or a combination of both.

Partial on-site systems - eg. pump out and common effluent systems (CES) - also exist. These usually involve the preliminary on-site treatment of wastewater in a septic tank, followed by collection and transport of the treated wastewater to an off-site management facility. Pump out systems use road tankers to transport the effluent, and CES use a network of small diameter pipes.

How does an on-site sewage management system work?

For complete on-site systems there are two main processes:

1. treatment of wastewater to a certain standard
2. its application to a dedicated area of land.

The type of application permitted depends on the quality of treatment, although you should try to avoid contact with all treated and untreated wastewater, and thoroughly wash affected areas if contact does occur.

Treatment and application can be carried out using various methods:

Septic Tank
Septic tanks treat both greywater and blackwater, but they provide only limited treatment through the settling of solids and the flotation of fats and greases. Bacteria in the tank break down the solids over a period of time. Wastewater that has been treated in a septic tank can only be applied to land through a covered soil absorption system, as the effluent is still too contaminated for above ground or near surface irrigation.

AWTS
Aerated wastewater treatment systems (AWTS) treat all household wastewater and have several treatment compartments. The first is like a septic tank, but in the second compartment air is mixed with the wastewater to assist bacteria to break down solids. A third compartment allows settling of more solids and a final chlorination contact chamber allows disinfection. Some AWTS are constructed with all the compartments inside a single tank. The effluent produced may be surface or sub-surface irrigated in a dedicated area.

Composting Toilets
Composting toilets collect and treat toilet waste only. Water from the shower, sinks and the washing machine needs to be treated separately (for example in a septic tank or AWTS as above). The compost produced by a composting toilet has special requirements but is usually buried on-site.

These are just some of the treatment and application methods available, and there are many other types such as sand filter beds, wetlands, and amended earth mounds. Your local council or the NSW Department of Health have more information on these systems if you need it.

Regulations and recommendations

The NSW Department of Health determines the design and structural requirements for treatment systems for single households. Local councils are primarily responsible for approving the installation of smaller domestic septic tank systems, composting toilets and AWTSs in their area, and are also responsible for approving land application areas. The NSW Environment Protection Authority approves larger systems.

The design and installation of on-site sewage management systems, including plumbing and drainage, should only be carried out by suitably qualified or experienced people. Care is needed to ensure correct sizing of the treatment system and application area.

Heavy fines may be imposed under the Clean Waters Act if wastewater is not managed properly.

Keeping your on-site sewage management system operating well

What you put down your drains and toilets has a lot to do with how well your system performs. Maintenance of your sewage management system also needs to be done well and on-time. The following is a guide to the types of things you should and should not do with your system.

DO

- ✓ Learn how your sewage management system works and its operational and maintenance requirements.
- ✓ Learn the location and layout of your sewage management system.
- ✓ Have your AWTS (if installed) inspected and serviced four times per year by an approved contractor. Other systems should be inspected at least once every year. Assessment should be applicable to the system design.
- ✓ Keep a record of desludgings, inspections, and other maintenance.
- ✓ Have your septic tank or AWTS desludged every three years to prevent sludge build up, which may 'clog' the pipes.
- ✓ Conserve water. Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.
- ✓ Discuss with your local council the adequacy of your existing sewage management system if you are considering house extensions for increased occupancy.

DON'T

- ✗ Don't let children or pets play on land application areas.
- ✗ Don't water fruit and vegetables with effluent.
- ✗ Don't extract untreated groundwater for cooking and drinking.
- ✗ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your system via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't install or use a garbage grinder or spa bath if your system is not designed for it.

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

Your sewage management system is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

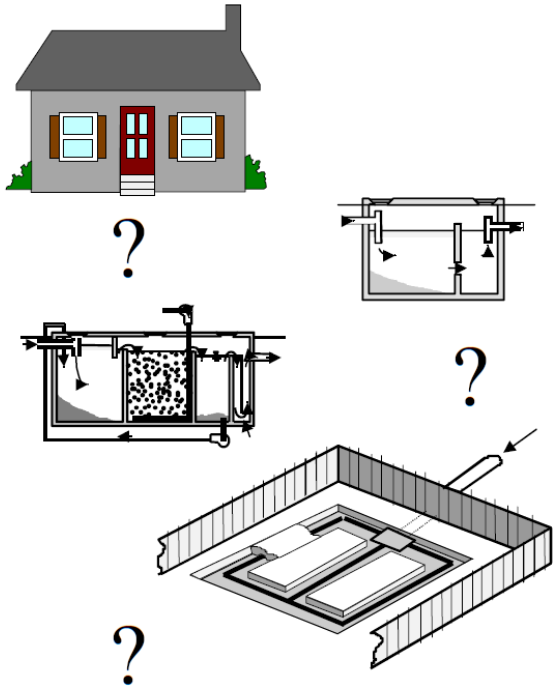
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained sewage management systems are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your management system you can do your part in helping to protect the environment and the health of you and your community.

For more information please contact:

Managing Wastewater In Your Backyard



Aerated Wastewater Treatment Systems (AWTS)

In unsewered areas, the proper treatment and utilisation of household wastewater on-site is critical in preserving the health of the public and the environment. AWTS have been developed as a way of achieving this.

What is an AWTS?

An AWTS is a purpose built system used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

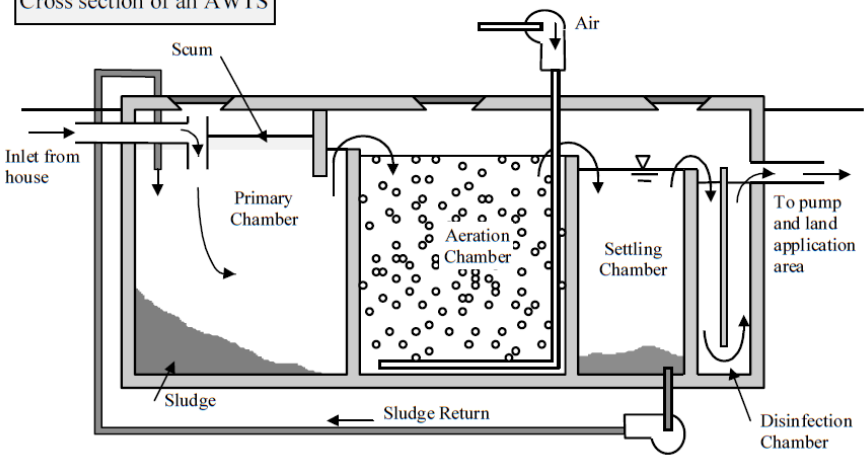
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

How does an AWTS work?

Wastewater from a household is treated in stages in several separate chambers. The first chamber is similar to a conventional septic tank. The wastewater enters the chamber where the solids settle to the bottom and are retained in the tank forming a sludge layer. Scum collects at the top, and the partially clarified wastewater flows into a second chamber. Here the wastewater is mixed with air to assist bacteria to further treat it. A third chamber allows additional clarification through the settling of solids, which are returned for further treatment to either the septic chamber (as shown) or to the aeration chamber. The clarified effluent is disinfected in another chamber (usually by chlorination) before irrigation can take place.

Bacteria in the first chamber break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the chamber and must be pumped out periodically.

Cross section of an AWTS



Regulations and recommendations

Local councils are primarily responsible for approving the smaller, domestic AWTSs in their area. The Environment Protection Authority (EPA) approves larger units, whilst the NSW Department of Health determines the design and structural requirements for all AWTSs.

At present AWTSs need to be serviced quarterly by an approved contractor at a cost to the owner. Local councils should also maintain a register of the servicing of each system within their area.

AWTSs should be fitted with an alarm having visual and audible components to indicate mechanical and electrical equipment malfunctions. The alarm should provide a signal adjacent to the alarm and at a relevant position inside the house. The alarm should incorporate a warning lamp which may only be reset by the service agent.

Maintaining your AWTS

The effectiveness of the system will, in part, depend on how it is used and maintained. The following is a guide on good maintenance procedures that you should follow:

DO

- ✓ Have your AWTS inspected and serviced four times per year by an approved contractor. Assessment should be applicable to the system design.
- ✓ Have your system service include assessment of sludge and scum levels in all tanks, and performance of irrigation areas.
- ✓ Have all your tanks desludged at least every three years.
- ✓ Have your disinfection chamber inspected and tested quarterly to ensure correct disinfectant levels.
- ✓ Have your grease trap (if installed) cleaned out at least every two months.
- ✓ Keep a record of pumping, inspections, and other maintenance.
- ✓ Learn the location and layout of your AWTS and land application area.
- ✓ Use biodegradable liquid detergents such as concentrates with low sodium and phosphorous levels.
- ✓ Conserve water.

DON'T

- ✗ Don't put bleaches, disinfectants, whiteners, nappy soakers and spot removers in large quantities into your AWTS via the sink, washing machine or toilet.
- ✗ Don't allow any foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.
- ✗ Don't use more than the recommended amounts of detergents.
- ✗ Don't put fats and oils down the drain and keep food waste out of your system.
- ✗ Don't switch off power to the AWTS, even if you are going on holidays

Reducing water usage

Reducing water usage will lessen the likelihood of problems such as overloading with your AWTS. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system entering a nearby river, creek or dam.

Conservative water use around the house will reduce the amount of wastewater which is produced and needs to be treated.

Your AWTS is also unable to cope with large volumes of water such as several showers or loads of washing over a short period of time. You should try to avoid these 'shock loads' by ensuring water use is spread more evenly throughout the day and week.

Warning signs

You can look out for a few warning signs that signal to you that there are troubles with your AWTS. Ensure that these problems are attended to immediately to protect your health and the environment.

Look out for the following warning signs:

- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land application area.
- Black coloured effluent in the aerated tank.
- Excess noise from the blower or pumping equipment
- Poor vegetation growth in irrigated area.

Odour problems from a vent on the AWTS can be a result of slow or inadequate breakdown of solids. Call a technician to service the system.

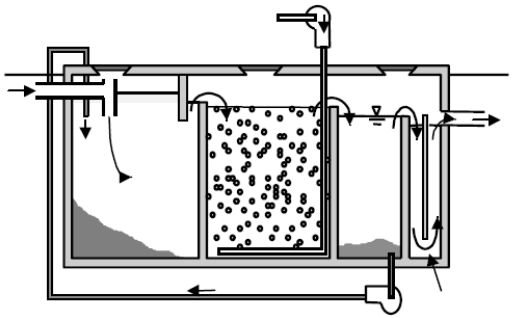
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained AWTSs are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your treatment system you can do your part in helping to protect the environment and the health of you and your family.

If you would like more information please contact:

Your Aerated Wastewater Treatment System



LAND APPLICATION AREAS

The reuse of domestic wastewater on-site can be an economical and environmentally sound use of resources.

What are land application areas?

These are areas that allow treated domestic wastewater to be managed entirely on-site.

The area must be able to utilise the wastewater and treat any organic matter and wastes it may contain. The wastewater is rich in nutrients, and can provide excellent nourishment for flower gardens, lawns, certain shrubs and trees. The vegetation should be suitably tolerant of high water and nutrient loads.

How does a land application area work?

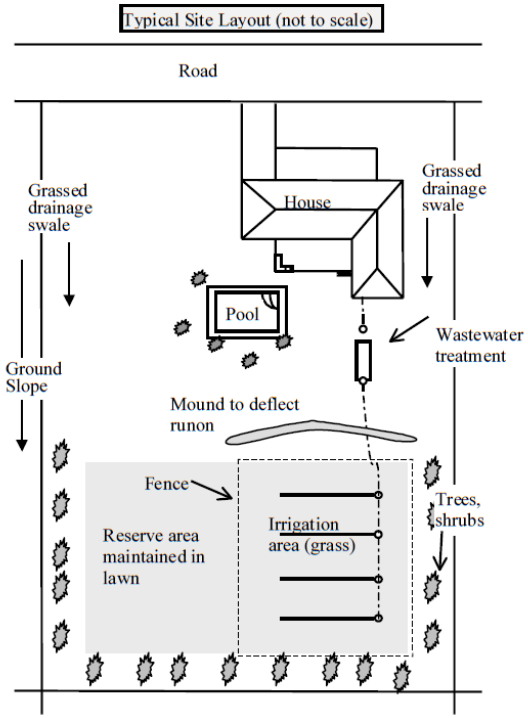
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

Soil absorption systems do not require highly treated effluent, and wastewater treated by a septic tank is reasonable as the solids content in the effluent has been reduced. Absorption systems release the effluent into the soil at a depth that cannot be reached by the roots of most small shrubs and grasses. They rely mainly on the processes of soil treatment and then transmission to the water table, with minimal evaporation and up-take by plants. **These systems are not recommended in sensitive areas as they may lead to contamination of surface water and groundwater.**

Irrigation systems may be classed as either subsurface or surface irrigation. If an irrigation system is to be used, wastewater needs to be pre-treated to at least the quality produced by an aerated wastewater treatment system (AWTS).

Subsurface irrigation requires highly treated effluent that is introduced into the soil close to the surface. The effluent is utilised mainly by plants and evaporation.

Surface irrigation requires highly treated effluent that has undergone aeration and disinfection treatments, so as to reduce the possibility of bacteria and virus contamination.



The effluent is then applied to the land area through a series of drip, trickle, or spray points which are designed to eliminate airborne drift and run-off into neighbouring properties.

There are some public health and environmental concerns about surface irrigation. There is the risk of contact with treated effluent and the potential for surface run-off. Given these problems, subsurface irrigation is arguably the safest, most efficient and effective method of effluent utilisation.

Regulations and recommendations

The design and installation of land application areas should only be carried out by suitably qualified or experienced people, and only after a site and soil evaluation is done by a soil scientist. Care should be taken to ensure correct buffer distances are left between the application area and bores, waterways, buildings, and neighbouring properties.

Heavy fines may be imposed under the Clean Waters Act if effluent is managed improperly.

At least two warning signs should be installed along the boundary of a land application area. The signs should comprise of 20mm high Series C lettering in black or white on a green background with the words:

RECLAIMED EFFLUENT
NOT FOR DRINKING
AVOID CONTACT

Depending on the requirements of your local council, wet weather storage and soil moisture sensors may need to be installed to ensure that effluent is only irrigated when the soil is not saturated.

Regular checks should be undertaken of any mechanical equipment to ensure that it is operating correctly. Local councils may require periodic analysis of soil or groundwater characteristics

Humans and animals should be excluded from land application areas during and immediately after the application of treated wastewater. The longer the period of exclusion from an area, the lower the risk to public health.

The householder is required to enter into a service contract with the installation company, its agent or the manufacturer of their sewage management system, this will ensure that the system operates efficiently.

Location of the application area

Treated wastewater has the potential to have negative impacts on public health and the environment. For this reason the application area must be located in accordance with the results of a site evaluation, and approved landscaping must be completed prior to occupation of the building. Sandy soil and clayey soils may present special problems.

The system must allow even distribution of treated wastewater over the land application area.

Maintaining your land application area

The effectiveness of the application area is governed by the activities of the owner.

DO

- ✓ Construct and maintain diversion drains around the top side of the application area to divert surface water.
- ✓ Ensure that your application area is kept level by filling any depressions with good quality top soil (not clay).
- ✓ Keep the grass regularly mowed and plant small trees around the perimeter to aid absorption and transpiration of the effluent.
- ✓ Ensure that any run off from the roof, driveway and other impermeable surfaces is directed away from the application area.
- ✓ Fence irrigation areas.
- ✓ Ensure appropriate warning signs are visible at all times in the vicinity of a spray irrigation area.
- ✓ Have your irrigation system checked by the service agent when they are carrying out service on the treatment system.

DON'T

- ✖ Don't erect any structures, construct paths, graze animals or drive over the land application area.
- ✖ Don't plant large trees that shade the land application area, as the area needs sunlight to aid in the evaporation and transpiration of the effluent.
- ✖ Don't plant trees or shrubs near or on house drains.
- ✖ Don't alter stormwater lines to discharge into or near the land application area.
- ✖ Don't flood the land application area through the use of hoses or sprinklers.
- ✖ Don't let children or pets play on land application areas.
- ✖ Don't water fruit and vegetables with the effluent.
- ✖ Don't extract untreated groundwater for potable use.

Warning signs

Regular visual checking of the system will ensure that problems are located and fixed early.

The visual signs of system failure include:

- surface ponding and run-off of treated wastewater
- soil quality deterioration
- poor vegetation growth
- unusual odours

Volume of water

Land application areas and systems for on-site application are designed and constructed in anticipation of the volume of waste to be discharged. Uncontrolled use of water may lead to poorly treated effluent being released from the system.

If the land application area is waterlogged and soggy the following are possible reasons:

- Overloading the treatment system with wastewater.
- The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- The application area has been poorly designed.
- Stormwater is running onto the area.

HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area