Broadcrest Consulting Pty Ltd

259 West Wilchard Road, Castlereagh

On-Site Wastewater Report

November 2019

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

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Document controls

Approval and Authorisation

Title	259 West Wilchard Road, Castlereagh On-Site Wastewater Report
Authored on behalf of Broadcrest Consulting Pty Ltd by:	Cheyne Hudson, Senior Environmental Scientist
Signed:	
Dated:	18.11.2019

Document Status

Date	Internal Reference	Document Status	Prepared by	Reviewed by
21.10.2019	0410-WW-01-A	Draft for review	C. Hudson	K. Ferry
18.11.2019	0410-WW-01-A	For Submission	C. Hudson	K. Ferry

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 Ms. Kelly Smith to produce an On-Site Wastewater Management Report at 259 West Wilchard Road, Castlereagh (the site). The report will accompany plans for a proposed new eight (8) bedroom residential development.

A site inspection was carried out on 17 October 2019 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, *On-Site Sewage Management and Greywater Reuse*
- 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	259 West Wilchard Road, Castlereagh
Lot Area:	5.79 Ha
Council / LGA:	Penrith City Council
Intended Water Supply:	Town
Design Wastewater Loading: (litres / day)	1,350 L/day (8-bedrooms total on town water = 9 persons x 150L)

INSPECTION

Date	Evaluator(s)
17.10.2019	L. Starkey

3 SITE ASSESSMENT & INVESTIGATION

3.1 General

It is proposed to construct a new residence, detached rural shed and associated driveways at 259 West Wilchard Road, Castlereagh (Lot 1 of DP 1181666) (Figure 1). Both the residence and shed will be located in the north-eastern corner of the site on lands naturally and artificially elevated from the surrounding flood plain. At the time of inspection, the site was unoccupied. The site was well vegetated with grass and scattered stands of native trees (Figures 1 and 2).

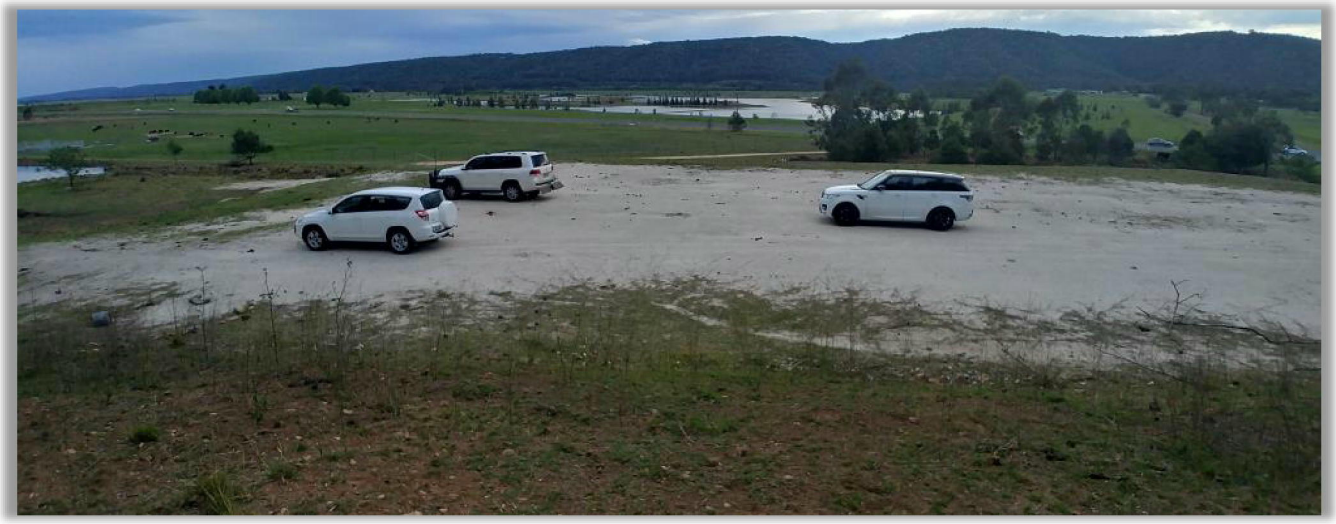

Figure 1: Photograph looking west over existing elevated platform and floodplain

Figure 2: Photograph looking north over vegetated land towards West Wilchard Road

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	EMA is positioned on elevated lands to avoid flood prone lands	Moderate
Exposure	Good sun and wind exposure	Minor
Slope	Approximately 10 - 15%	Moderate
Landform	Linear planar slope	Minor
Run-on and Seepage	Minimal interaction of stormwater and proposed EMA	Minor
Site-drainage	There are no signs of surface moisture or ponding	Minor
Erosion Potential	Low erosion potential	Minor
Site and Soil Disturbances	None evident or proposed within the proposed EMA	Minor
Buffer Distances & Available land area	All prescribed buffer distances can be achieved	Minor
Groundwater Bores	No bores have been identified within 250 m of the proposed EMA	Minor
Rock Outcropping	No rock outcropping identified	Minor
Geology / Regolith	NIL geological discontinuities, fractures or highly porous regolith	Minor

3.4 Climate

Castlereagh has a temperate climate, with mild to warm wet summers, and cool drier winters. Median annual rainfall is 704 mm and evaporation 1,382 mm. Average monthly evaporation is greater than median rainfall for all of the year (Appendix B) (*Minor Limitation)*.

Average daytime maximum temperatures range from 31°C to 5.3°C in January to July respectively. The mean annual daytime maximum of 24.7°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. However, the proposed effluent management area will be located in the north-eastern corner of the site on lands naturally and artificially elevated from the surrounding flood plain (*Minor – Moderate Limitation*).

3.6 Exposure

The proposed effluent management area is well exposed to wind and sun (minor *Limitation*).

Landform Feature	Aspect	Solar Exposure	Wind Exposure	Limitation
A	West	Good	Good	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 10 -15% gradient (*Moderate Limitation*).

Landform Feature	Approximate Slope Tangent (%)	Slope Classification
A	15	Moderately inclined

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		Major	Major	Major	Moderate[3]	Moderate[1]

3.8 Landform

The landform describes the surface shape and topographic position at and ~40m surrounding the proposed EMA. Typical landform descriptors per AS1547:2012 are detailed below.

Landform Feature	Morphological Type	Slope Configuration	Limitation
A	Upper- slope	Linear	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.

Given the linear planar upper-slope and minimal catchment preceding the landform, there is minimal risk of stormwater running onto the proposed EMA (*Minor Limitation).*

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

3.10 Site drainage

The proposed effluent management area appeared to be free draining with no signs of soil saturation, surface ponding, or noted presence of macrophytes (i.e. sedges, ferns, juncus) *(Minor Limitation).*

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.

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, such as cut and fill are required within the proposed effluent management area (*Minor Limitation).*

3.13 Domestic Bore

No groundwater bores have been identified within 250 m 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). In this instance, a potentially suitable effluent management area meeting all required buffer distances has been identified (Appendix A) *(Minor Limitation).*

The site-specific constraints for the proposed EMA and land application method are shown in 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	>3	Minor
Driveways	6m	3m	>3	Minor
Paths & Walkways	3m		>3m	Minor
Pools	6m		>6m	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
Natural Bushland	20m		>20m	Minor

3.15 Rock Outcropping

Steep rugged terrain and rock outcropping was identified on the site but avoided for effluent management purposes (*Minor Limitation)*.

3.16 Geology / Regolith

Site inspection and landscape mapping did not identify any geological discontinuities, fractures, or highly porous regolith which may introduce 'short-circuit' pathways of wastewater into the water table (*Minor Limitation*).

4 SOIL ASSESSMENT

4.1 Soil Assessment Summary

Investigation of the site for suitability for OSSM was accompanied by multiple Direct Push tube samples 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	>1,300 mm	Minor
Depth to high watertable	NIL free water or waterlogging characteristics	Minor
Coarse Fragments	< 5%	Minor
pH	Around 6.0 across all samples.	Moderate
Electrical Conductivity (EC)	< 4 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	Class 1	Minor

4.2 Soil Landscape Map

1:100,000 Soil Landscape Mapping indicates the proposed home and effluent management area occur on Berkshire Park Soil Landscape. Site inspection by Logan Starkey from Broadcrest confirms the mapping as accurate. The Berkshire Park Soil Landscape consists of dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system.

Soils typically consist of dark brown sandy-loams grading into brown sandy-clay-loam over brown sandy-clay with up to 20% ironstone nodules to approximately 1,000 mm depth.

4.3 Depth to Bedrock / Hardpan

Three (3) boreholes were sampled on site via a direct push tube sampler. Soil depth exceeded 1,300 mm (*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 Loading Rate (DLR)
0 – 400 mm	Silty-Loam	Moderate	1.5 - 3.0 m / day	50 mm / day
400 – 1,200 mm	Silty-Clay-Loam	Moderate	0.5 - 1.5 m / day	30 mm / day
>1,200 mm	Silty-Light-Clay	Strong	0.12 – 0.5 m / day	12 mm / day

4.6 Soil Profiles

Table 4.3 – BH #1 and BH #2

Excavation #	BH-01	Sample size:	Ø 50	[mm]	Date sampled:	17.10.2019
Inspection Method:	Direct push tube				Surface R.L:	-

Layer	Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Coarse Fragment	Structure	Modified Emerson
1	A1	400	Dry	Dark brown	Silty Loam	<5%	Moderate	No change
2	B1	1200	Dry	Reddish brown	Silty-Clay-Loam	<5%	Moderate	No change
3	B2	1200+	Dry	Yellowish brown	Silty-Light-Clay	<5%	Strong	No change

Figure 4.1 – BH #1 soil profile

Table 4.4 – BH #3

Excavation #	BH-03	Sample size:	Ø 50	[mm]	Date sampled:	17.10.2019
Inspection Method:	Direct push tube				Surface R.L:	-

Layer	Horizon	Lower Depth [mm]	Moisture	Colour	Field Texture	Coarse Fragment	Structure	Modified Emerson
1	A1	450	Dry	Dark brown	Silty Loam	<5%	Moderate	No change
2	B1	1000	Dry	Reddish brown	Silty-Clay-Loam	<5%	Moderate	No change
3	B2	1000+	Dry	Yellowish brown	Silty-Light-Clay	<5%	Strong	No change

Figure 4.2 – BH #2 soil profile

4.7 Soil Chemistry

One sample from each horizon of the test pits within the proposed EMA were tested for pH and EC by Broadcrest Consulting. The results were as follows:

Table 4.5: Soil Chemistry

Depth (mm)	Test	Result	Limitation	Recommendations
BH1 #1				
100	pH	6.4 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	80 (Non-Saline)	Minor	-
800	pH	6.3 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	94 (Non-Saline)	Minor	-
BH #2				
100	pH	6.5 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	102 (Non-Saline)	Minor	-
800	pH	6.2 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	100 (Non-Saline)	Minor	-
BH #3				
100	pH	6.5 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	105 (Non-Saline)	Minor	-
800	pH	6.2 (Mod Acidic)	Moderate	Application of lime at 250 g/m^2
	EC (µS/cm)	100 (Non-Saline)	Minor	-

5 NOMINATED WASTEWATER MANAGEMENT

5.1 Proposed OSSM Summary

Site and soil constraints where evaluated in selection of appropriate treatment and effluent management method. Summary of the recommended OSSM system and application sizing is presented below.

Treatment		Effluent Management
AWTS + disinfection or equivalent	(Pumped dosing) →	3x 15m long pressure dosed trenches

5.2 Wastewater Treatment

It is proposed to treat all wastewater generated by the development to a secondary standard within a new NSW Department of Health approved domestic aerated wastewater treatment system (AWTS) or equivalent treatment unit. A list of suitable suppliers is available on their website at *https://www.health.nsw.gov.au/environment/domesticwastewater/Pages/awts.aspx*

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
- Enables use of irrigation which maximises evapo-transpiration.

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

5.3 Effluent Management

Given the development and site and soil conditions encountered, it is proposed to dispose of effluent from the treatment system via pressure dosed absorption trenches as detailed in Table 5.2 below. Sizing of the application method was undertaken as follows:

A = Q / DLR

A = 1,350 / 30 = 45 m^2

In this instance, this could be provided by **three (3) trenches** of approximate dimensions **15 m (L) x 1.0 m (W) x 0.6 m (D).** The trenches must be:

- Positioned in the approximate location shown in Appendix A
- Constructed along the contour and laser levelled
- Pressure dosed from the aerated wastewater treatment system
- Evenly dosed to ensure even distribution across the trenches
- Stabilised with low growing vegetation prior to commissioning

Table 5.2 – Proposed Onsite Treatment

Effluent Management Method	Distribution Method	Nominal Width[2] [W] [m]	Design Daily Inflow [Q] [L/day]	Design Loading Rate[1] [DLR] [mm/day]	Required Absorption Area [SA = Q/DLR] [m^2]	Total Required Length [L_T = SA/W] [m]
Pressure-dosed absorption trench	splitter box or sequencing valve	1	1350	30	45	45

[1] Most restrictive soil horizon, see Table 4.5.1

Justification of the proposed effluent management method is as follows:

- Subsoil disposal prevents interaction with effluent, less likely to adversely impact on health or sensitive environmental constraints
- Trench system has inherent wet weather storage in its design
- Application method suitable for slope constraint (*Moderate Limitation*).
- Slope and soil condition favourable for management method
- System footprint can fit within the narrow band of suitable application area

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, anchoring method, 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

- The development is understood to be a new residence with eight (8) potential bedrooms
- The anticipated wastewater loading is calculated to be 1,350 L/day (eight-bedroom home on town water)
- It is proposed to treat all wastewater to a secondary standard within a new aerated wastewater treatment system. The system must be rated for the daily flow rate at minimum.
- Application of the secondary treated effluent is proposed via three (3) trenches of approximate dimensions 15 m (L) x 1.0 m (W) x 0.6 m (D) as detailed in Appendix A.
- Signage indicating effluent reuse is to be posted around the EMA.

APPENDIX A: SITE PLAN

ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
A-01	18.10.2019	CH	KF	CH	FOR RELEASE

BROADCREST
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PROJECT	OSSM - PROPOSED RESIDENCE
PROJECT DESCRIPTION	AWTS + PRESSURE DOSED ABSORPTION TRENCHES
LOCATION	4 HUDSON ROAD, KEMPSY NSW
CLIENT	KELLY SMITH
LGA	PENRITH CITY COUNCIL
PROJECT NUMBER	0410
REVISION	01-A
DRAWING NUMBER	01
DATE	18.01.2019
SCALE	1:500
PAPER SIZE	A3
SHEET No.	1 OF 1

APPENDIX B: CLIMATE DATA

B1. - Climate Statistics

Table B1.1. Weather Stations

	Station No.	Station Name	Distance from site [km]
Temperature	67113	PENRITH LAKES AWS	3.20
Precipitation	67002	CASTLEREAGH (CASTLEREAGH ROAD)	1.69
Evaporation	1012	MITCHELL PLATEAU	

Figure B.1 - Monthly Cimate Statistics

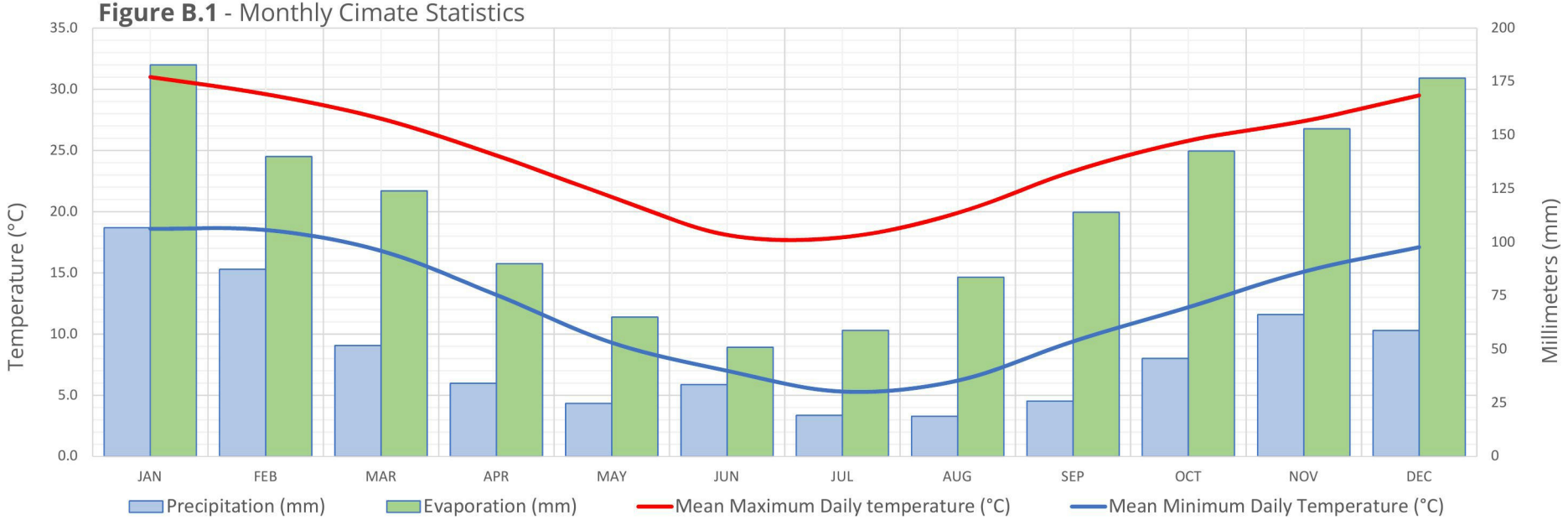


Table B1.2. Site Climate Statistics

Site Factors	Symbol	Units	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Mean Max. Temperature	[T]	[°C]	31.0	29.6	27.6	24.6	21.2	18.1	17.9	19.9	23.3	25.8	27.4	29.5	24.7
Mean Min. Temperature	[T]	[°C]	18.6	18.5	16.8	13.2	9.3	7.0	5.3	6.2	9.4	12.2	15.1	17.1	12.4
Days	[D]		31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation[1]	[P]	[mm/month]	106.8	87.4	51.8	34.2	24.8	33.6	19.2	18.8	25.9	45.8	66.3	58.8	704.6
Evaporation	[E]	[mm/day]	5.9	5.0	4.0	3.0	2.1	1.7	1.9	2.7	3.8	4.6	5.1	5.7	3.8
		[mm/month]	182.9	140	124	90	65.1	51	58.9	83.7	114	142.6	153	176.7	1382
Natural Site Balance[2]	[P-E]	[mm/month]	-76.1	-52.6	-72.2	-55.8	-40.3	-17.4	-39.7	-64.9	-88.1	-96.8	-86.7	-117.9	

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

[2] Negative value indicates monthly mean evaporation > precipitation

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.

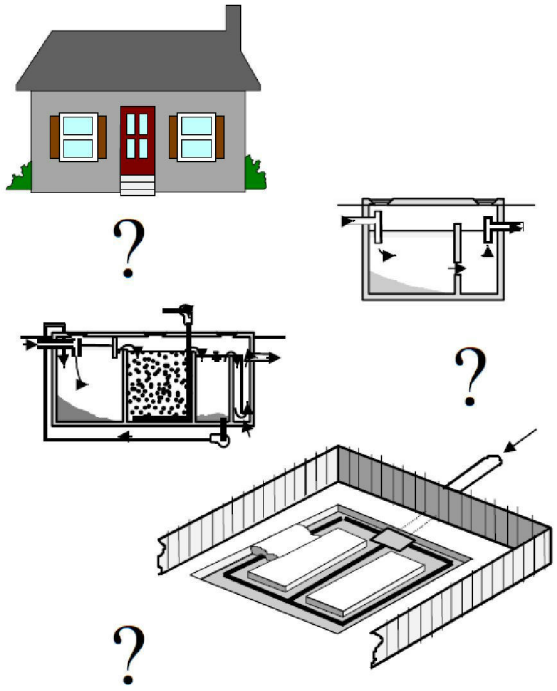
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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.

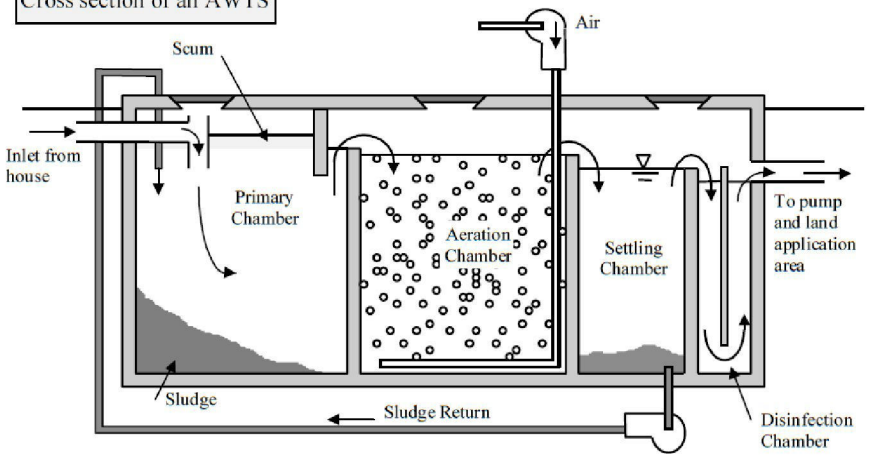
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

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.

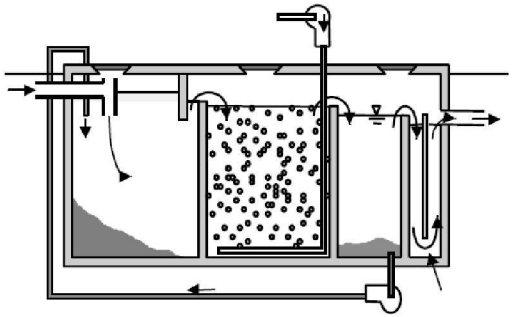
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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?

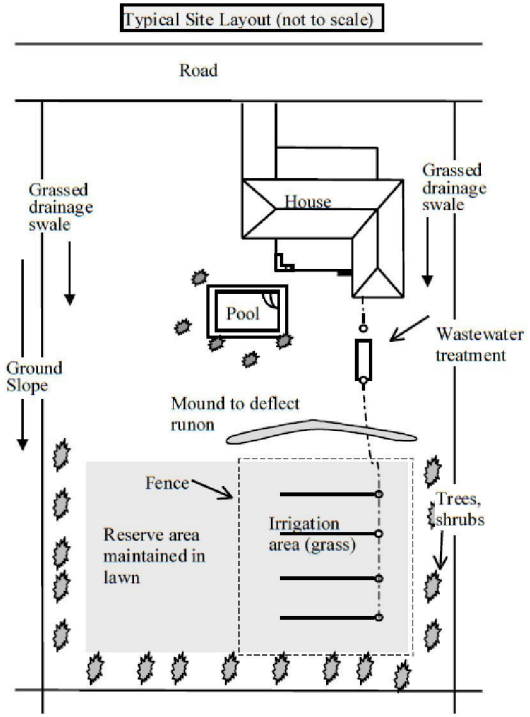
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

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