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'ON-SITE WASTEWATER MANAGEMENT REPORT'

For:

200 FOREST WAY, BELROSE NSW

CLIENT: Rob Macri

REFERENCE: REF-19-8741-A

DATE: 9 October 2019

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Document Management				
Version	Date	Author	Reviewed	Author
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INTRODUCTION

EnviroTech Pty. Ltd. has been engaged by the client to undertake an 'onsite wastewater management study' at the above mentioned site address. This report presents the results of that study.

Objective

The objective of the 'onsite wastewater management study' is to investigate the relevant site, soil, public health and economic factors that can impact on the selection, location and design of an on-site wastewater management system to determine:

- Whether or not the site is suitable for an on-site wastewater management system
- The best practical on-site wastewater management system for the specific site and proposed development.

This study has been prepared in accordance with:

- Australian Standard AS1547: 2012" On-site Domestic Wastewater Management"
- Dept. Local Government 1998, On-site Sewage Management for Single Households,
- Relevant Council Development Control Policies

Scope of Works

The scope of works undertaken for this site evaluation included:

- *Desktop Study:* An initial investigation to collate relevant information about the site and proposed development prior to the site inspection.
- *Site Assessment:* An on-site inspection by an engineer or scientist to record land surface, site features, identify potential site constraints and define the most appropriate land application area.
- *Soil Assessment*: A subsoil investigation by an engineer or scientist to record the soil profile and relevant soil properties within the land application area to determine potential soil limitations.
- *System Design:* An evaluation of the expected wastewater flowrate, site and soil limitations to select, size and position a waste treatment unit and land application system that will provide the best practical option.
- *Operation & Maintenance / Construction & Installation Guidelines*

DESKTOP INFORMATION

Address	200 Forest Way, Belrose
Council	Northern Beaches
Proposed Development	*Existing Nursey and proposed café*
Intended Water Supply Source	*Town Water*
Equivalent Population	*Existing Plant Nursery:* *100 customers (plus an additional 10 staff)* *Proposed café:* *50 customers (plus an additional 5 staff)*
Design Water Allowance	*Existing Plant Nursery:* • *25L/day** *Proposed café:* • *25L/day** **AS/NZS: 1547-2012, Table H4 Tearooms With restroom facilities used.*
Design Wastewater Flowrate	Existing plant nursery: • *2,750L/Day (Max flowrate)* *Proposed café* • *1375L/Day* *Total flowrate* • *4125L/Day*
Rainfall Station	066188- Belrose (Evelyn Place)
Evaporation Station	06662-SYDNEY (OBSERVATORY HILL)

SITE ASSESSMENT

This following relevant site features were recorded and given a rating in terms of their potential constraints to onsite wastewater management. The three ratings are minor limitation, moderate limitation or major limitation. Only those site features that are rated as being a major limitation to onsite wastewater management are further discussed in the 'Site Assessment Discussion'.

Landform Description

The landform is described by first dividing an area into landform elements of approximately 40-m diameter. A description of these elements is then provided. These landform elements define the boundaries of this site assessment.

Element	*Approx. Slope Tangent (%)*	*Slope Class*	*Morphological Type*	*Relative Inclination*		*Instability Risk*
1	2	Very Gently Inclined	Upper Slope	Waxing	Divergent	1

Vegetation

The vegetation is described by dividing the study area into vegetation elements. Each vegetation element has a unique set of properties.

Element	*Growth Form*	*Height Class*	*Cover Class*	*Structural Formation*
A	Grass	Low	Isolated Plants	Isolated Grasses

Element	*Exposure*	*Existing Erosion*		*Landform Element (s)*
		State	*Type*	
A	Excellent	Stabilised	-	1

Overland Flow

Run-on and run-off potential is largely determined by slope, surface cover and soil infiltration rate.

Landform element.	*Run-on*	*Run-off*	*Soil - Water Status*
1	Slow	Slow	Dry

Site & Soil Disturbance

The site assessor noted the following disturbance within the effluent application envelope:

None

Description: -

Rocky Outcrops

The site assessor noted the following rocky-outcrops within the effluent application envelope:

None

Description:

Setbacks

The following setbacks from the effluent application area have been proposed after considering Appendix R of AS1547:2012 'On-site Domestic Wastewater Management'. This Appendix provides a recent guide on how to determine setbacks distances based on site-specific constraints identified in this site assessment.

The constraint factors associated with each site feature (refer to Table R1) have been qualitatively assessed using Table R2 and a suitable setback then chosen from within the range stated in Table R1.

Site Feature	*Setback Range*	*Constraint Factors*	*Proposed Setback*
Buildings, Property Boundaries	3 – 6 m	LOW	>3 m(downslope) >6m (upslope)

Site Assessment Discussion

A range of site features that can commonly place limitations on on-site wastewater management have been assessed and classified. All features have been shown to place no major limitations to on-site wastewater management.

SOIL ASSESSMENT

The location of the borehole excavated during the site inspection is shown on the attached site plan. Physical and chemical soil properties were recorded on a soil profile log (see attached). On each property two boreholes are performed, the first analyses soil features listed below, and the second serves a confirmatory borehole. If soil properties found in the two boreholes on site differ, then both samples are taken for analysis.

The following properties were recorded for each soil horizon:

- Horizon depth and type
- Mottling
- Colour
- Structural stability
- Groundwater depth
- Bedrock depth
- Texture
- pH
- Phosphorus Sorption
- Electrical Conductivity
- Coarse Fragments

Erodability / Erosion Hazard

Soil erodability is the susceptibility of the topsoil to detachment and transport of soil particles. It is a characteristic of the soil surface and varies with time, soil / water status and land use. Soil erodability classification is stated as low, moderate or high.

Erosion hazard is the susceptibility of an area of land to the prevailing agents of erosion. It is a function of climate, soil erodability, vegetation cover and topography.

Refer to the soil classification (Pacific Environmental) report for more information about the boreholes and type of soil. See appendix H Section 2 DISPOSAL SITE.

Salinity & Drainage

Salinity is the concentration of water-soluble salts contained within a soil. Increases in soil salinity (i.e. salinisation) can occur as a result of irrigation water raising the level of an already saline groundwater. Management of potential salinisation problems involve ensuring that salts introduced to the soil surface are removed (by crop uptake or subsoil leaching) and by ensuring the irrigation area provides adequate subsoil drainage to prevent raising of saline groundwaters into root zones.

Drainage is a statement describing the site and soil drainage that is likely to occur most of the year. It is influenced by soil permeability, water source, landform description, evapotranspiration, slope gradient and slope length.

The drainage of this site should be adequate for the leaching of salts and ensure the groundwater level does not reach the root zone.

A major adverse effect of high soil salinity is the restrictive effects on plant growth. However, for this site the soil salinity levels (as indicated by the electrical conductivity values) are low enough that the adverse effects on plant growth will be minimal.

Soil Assessment Discussion

A range of soil properties that commonly place limitations on on-site wastewater management have been assessed and classified. In accordance with the Environmental and Health Protection Guidelines all soil properties have been shown to present no major limitations to on-site wastewater management.

ON-SITE WASTEWATER MANAGEMENT SYSTEM DESIGN

The design process adopted here involves an evaluation of the expected wastewater flow, site limitations and soil limitations, to select, size and position a waste treatment unit and land application system that will provide the best practical option.

Wastewater Treatment:

This report proposes that wastewater treatment using a NSW Health accredited (or equivalent) Aerated wastewater Treatment System.

Land Application System: Wisconsin Sand Mound

Reasons:

- Engineered land application method
- Allows even wastewater distribution over small areas
- Adequate space available with reduced buffer distances

Wisconsin Sand Mound Sizing Calculations

The steps in sizing the sand mound are as follows:

1) The distribution bed is sized according to the loading rate for sand-fill (50mm/day).
2) The minimum soil basal area requirement is determined using a DLR for the underlying soil,
3) The rest of the mound is designed around the distribution bed ensuring batters do not exceed a slope of 1V: 3H and the soil basal area is greater than or equal to that determined in Step 2.

Refer to layout & section plan included in Appendix B.

Effluent Application Area Sizing Per Sand Mound

SIZING INFORMATION		
Soil DLR (mm)	32 (Sand)	
Design Flowrate (L/day)	4125	
Sand Loading Rate (mm/day)	50	
Distribution Bed Area (m2)	82.5	
	Dimensions: Lg (m):	22.25
	Wg (m):	3.71
Approximate Mound Dimensions	Base Length – Lb (m):	30.11
	Basal Width – Wb (m):	11.75
	Basal Area (m2):	250.92
	Height (H) (m):	0.3
Basal Loading Rate (mm/day) (Effluent loading/actual basal area)	16.44	
Is Basal Loading Rate ≤ Soil DLR (If yes – mound is adequately sized)	Yes (16.44≤ 32)	

- The Sand Mound shall be constructed in accordance with AS1547: 2012.
- Refer to Appendix B for typical mound description and standard drawings.

The above table indicates the minimum dimensions for the Wisconsin Sand Mound for the existing plant nursery and proposed café. The existing Wisconsin Sand Mounds constructed for the site and designed by Pacific Environmental (See Appendix H Section 6 MOUND DIMENSIONS) are greater in size and will therefore be more than sufficient. Please Refer to Appendix A for the location of the existing Wisconsin Sand Mounds.

Site Modifications Recommended

Nil.

RECOMMENDATIONS

- Existing use of an Aerated Wastewater Treatment System (AWTS) with capacity to treat the design flowrate **(4125 L/ day)** to a secondary treatment standard with disinfection for the existing nursery and proposed café.

- Use of existing Wisconsin Sand Mounds each (in accordance with AS1547:2012) with dimensions of 30m (length) x 5.1m (width).

- Earth Bunds to be installed by on both sides of the mound, downslope and upslope, to prevent the overflow in case of system failure.

- It is recommended that consideration be given to water conservation where possible and the use of water saving devices (see Appendix G)

- The setbacks between the proposed land application area and site features should be adhered to.

- In order to establish the above irrigation, any trees or shrubs may need to be cropped or cleared. Clearing may be subject to a vegetation approval.

- Fit “full water-reduction facilities” to all water use outlets in the house:
    - Reduced flush 6/3 litre water closets,
    - Shower-flow restrictors,
    - Aerator faucets,
    - Front-load washing machines,

- Before installation, the client must consider:

    + Appendix B (Sand Mounds – Descriptions & Standard Drawings)
    + Appendix F (Operation & Maintenance Guidelines).

LIMITATIONS

Envirotech Pty Ltd has prepared this report for the exclusive use of our client, for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Envirotech, does so entirely at its own risk and without recourse to Envirotech for any loss or damage.

In preparing this report Envirotech has necessarily relied upon information provided by the client and/or their Agents. The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Under no circumstances can it be considered that these findings represent the actual state of the site at all points. Subsurface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after Envirotech's field testing has been completed.

Envirotech's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Envirotech in this report may be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

Should any site conditions be encountered during construction that vary significantly from those outlined and discussed in this report, Envirotech should be advised and a plan outlining the need for potential action developed accordingly.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. Envirotech cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Envirotech. This is because this report has been written as advice and opinion rather that instructions for construction.

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Wastewater
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Bushfire
Contamination
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Occupational Hygiene

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LEGEND:

- Site Boundary
- Other Fences
- Landform Element
- Watercourses, Dams
- Overland Flow Path
- Surface Spray Sprinkler
- Irrigation Pipework
- Soil Borehole
- Photo Location
- Building Area
- Land App. Area
- Paved Area

TITLE: AWTS + WISCONSIN SAND MOUNDS

SHEET SIZE: A4

SCALE: 1:800 @ A4

CLIENT: ROBERT

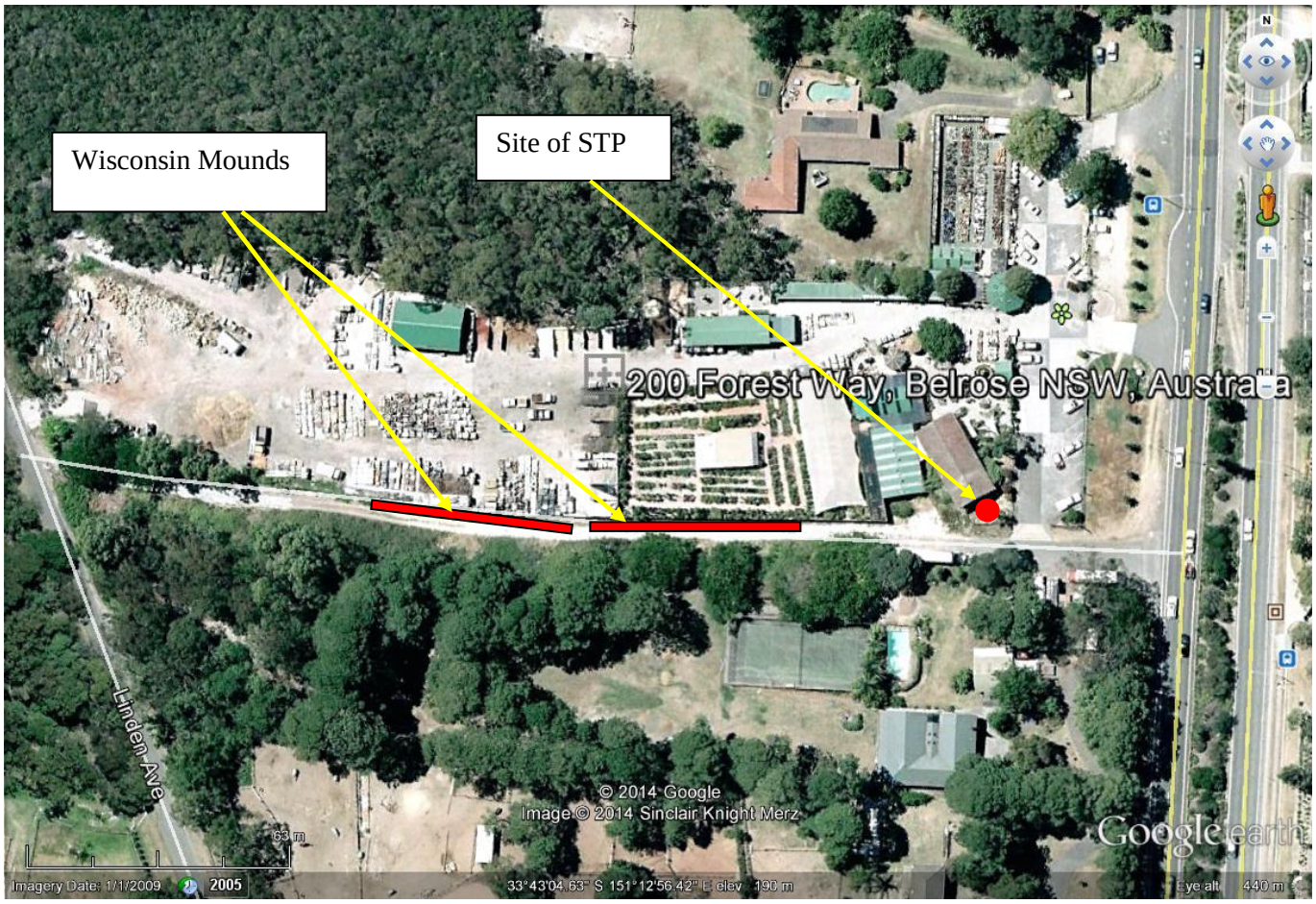
PROJECT: 200 FOREST ROAD,BELROSE (NORTHERN BEACHES LGA)

SHEET: 1/1

DATE: 21/10/2019

PROJECT REF / DRAWING NUMBER: DWG-19 8741-A

APPENDIX A – SITE PLAN



Appendix B: Raised Sand Mounds and "~~Eco-max~~" Systems - Descriptions & Standard Drawings

Sand Mound or "Wisconsin" Mound

A mound system for wastewater is a soil absorption system placed above natural ground surface. Mound systems are used to distribute effluent on sites where there is minimal soil before reaching groundwater, impermeable soils or bedrock.

A mound system includes a pretreatment chamber, usually a septic tank or AWTS, a pump chamber for dosing the wastewater; and a mounded drainfield containing a pressurised distribution system. A typical mound is shown on the following page.

Wastewater treatment occurs within the actual mound. Sand filtration reduces suspended solids and consequently Biological Oxygen Demand and through this process faecal coliform counts and viral pathogens are also reduced. Some further denitrification is likely to occur especially if the mounds are intermittently pressure dosed to allow wetting and drying phase. However, the sand mounds will not provide significant reductions in phosphorus concentration; this is provided by the subsoil underneath.

- **Good Construction Techniques:**

1) Preparation:

a) The site shall be cleared of shrubs and trees. Trees shall be cut at ground surface and the stumps removed and backfilled to natural surrounding soil conditions.

b) The mound perimeter and bed shall be marked out in proper orientation. Reference stakes set some distance from the mound perimeter are also required in case the corner markers are disturbed.

c) The area within the mound perimeter shall be ploughed. Use a twin or larger mouldboard, ploughing 18 – 20cm deep. Single ploughs should not be used, as the trace wheel runs in every furrow, compacting soil. A chisel plough may be sued in place of a mouldboard plough. Roughening the surface with backhoe teeth may be satisfactory. Roto-tilling is not recommended because of the damage it does to the soil structure.

d) Ploughing shall not be done when the soil is too wet. This leads to smearing and compacting of the soil. If a sample of the soil taken from the bottom of the plough furrow forms a wire when rolled between the palms, the soil is too wet. If it crumbles, ploughing may proceed.

2) *Delivery Pipe:*

a) Install the delivery pipe from the dosing chamber so it may drain after dosing. Backfill and compact the soil around the pipe.

3) *Sand-fill Media*

a) The sand-fill media may be medium sand, free of clay, limestone or organic material. It shall have a grain size of 0.3-mm to 1.0-mm with a uniformity coefficient of 4.

b) It shall be placed onto the ploughed area and moved into place either manually or by using a small truck-type tractor with a blade. It is essential to keep vehicles off the ploughed area and to have a minimum of 150mm of material beneath the tracks of the tractor to minimize compaction of the natural soil.

c) Build up until height reaches the elevation of the top of the distribution bed.

4) *Distribution Bed*

a) The distribution bed shall be formed in the top of the fill media. It shall have a level base and sides shaped to the specified slope. The base shall be at the design elevation. The tractor blade may be used to form the distribution bed, which is then usually leveled and sides shaped by hand.

b) It shall be carefully filled with graded river run aggregate (20 to 60 mm, non-crushed, rounded) and leveled at a minimum depth of 150mm. In working the aggregate, do not create ruts in the bottom of the distribution bed.

5) *Effluent Distribution Network*

a) The effluent distribution network shall be assembled and connected to the delivery pipes. Assemble the distribution network on the aggregate. The manifold should be placed so it will drain between doses, either out of the laterals or back into the pumping main. The laterals should be laid level. Polyethylene pipe complying with AS2439, AS 4129 or AS4130, or PVC Class 12 pipe complying with AS1477 are suitable materials.

6) *Pre-commissioning Tests*

A pre-commissioning test shall be carried out after all on-site components including the pump, have been installed but prior to covering the effluent distribution network in the distribution bed:

a) Fill pump to 'pump on' level with water;
b) Start pump;
c) Check effluent distribution pipework to ensure water flows uniformly from all perforations;
d) Record time taken to pump from 'pump on' to the 'pump off' level. This shall be approximately 3 minutes. Record the time in the on-system log.
e) Follow pump manufacturers recommendations for commissioning pump;
f) Check pumping main to ensure there are no leaks and that the air-release valve is functioning

7) *Finish of Distribution Bed*

To finish the distribution bed:

a) Additional aggregate shall be placed on the distribution bed to a total depth of 225mm;

b) A suitable backfill barrier shall be installed over the aggregate such as filter cloth;

c) A fine textured soil material such as silt loam shall be placed over the top of the distribution bed to a total depth of approximately 300mm with thickness reducing towards the sides.

d) A further 150mm (minimum) layer of good quality topsoil shall be placed over the entire mound surface.

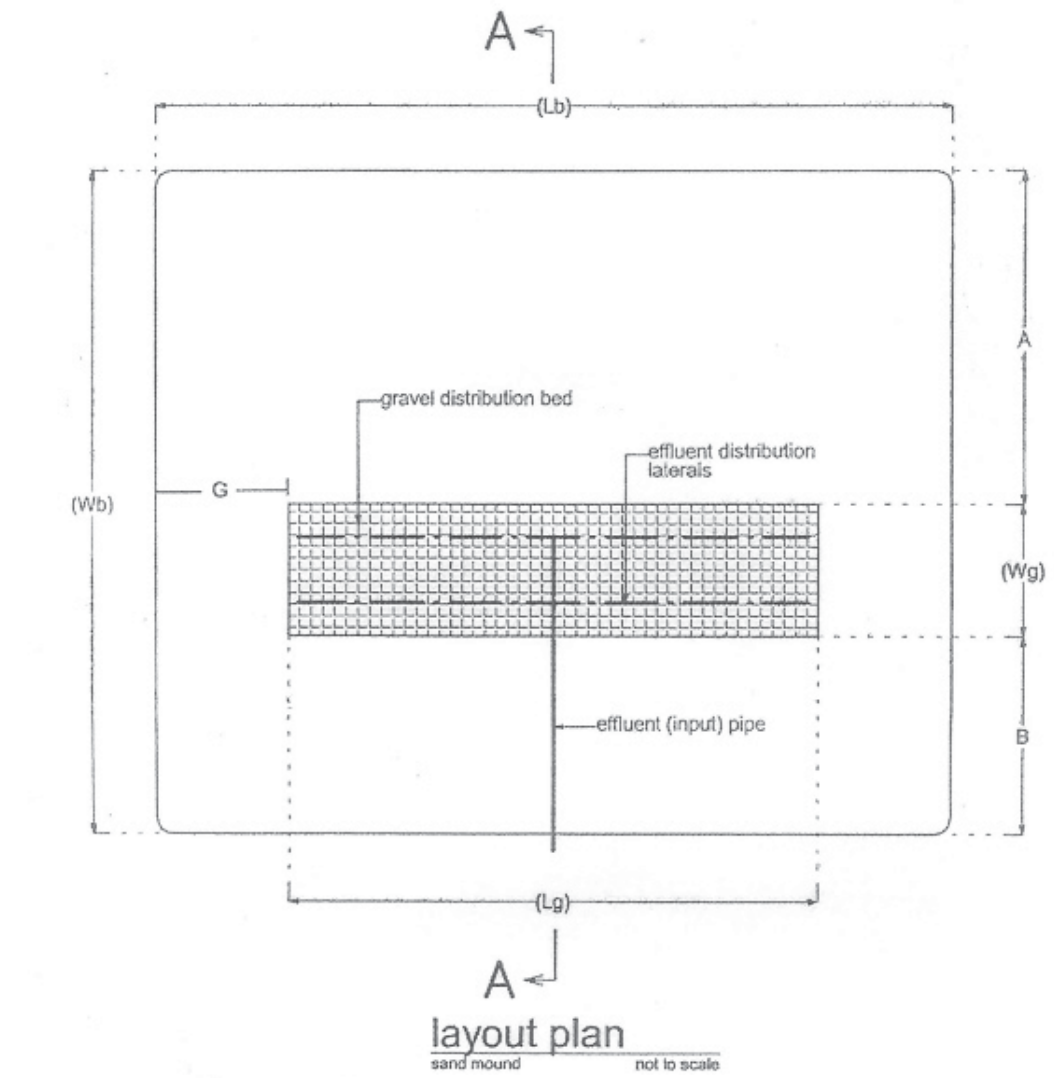
e) The mound surface shall be grassed using grasses adapted to the area. Shallow rooting ground cover can be planted around the base and up the side slopes.

Shrubs planted around the base of the mound should be tolerant of moisture as mound perimeter may become moist. Planting on top of the mound should be drought-tolerant as the upper portion of the mound can become dry.

Surface water shall be diverted around the perimeter and up-slope of the land-application area.

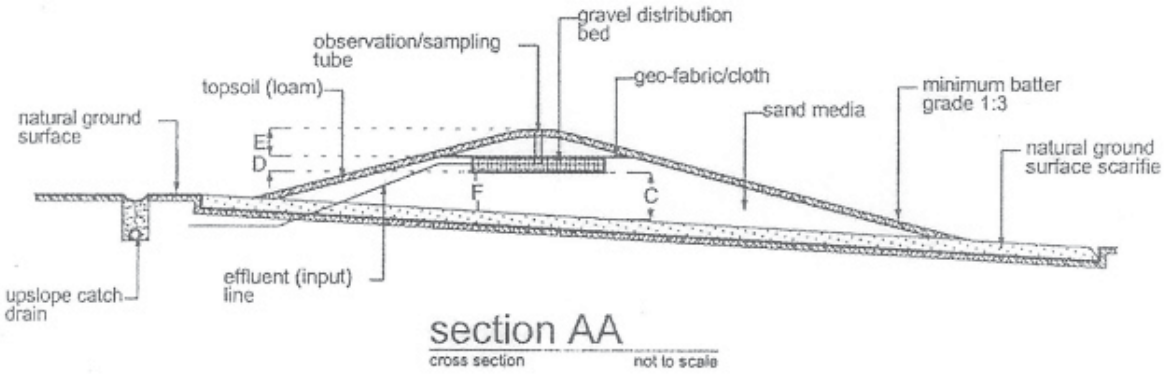
- **Operation & Maintenance Guidelines:**

Refer to Operation & Maintenance Guidelines for Land Application Systems



layout plan

sand mound not to scale



section AA

cross section not to scale

Note:

- Dimensions (Wg), (Wb), (Lb), (Lg), A and B to be determined based on site and soil conditions
- C = 600mm, D = 300mm and E = 300mm
- Where ground is level, Dimension A = Dimension B.

Wisconsin Sand Mound Calculations

Treatment Type	Secondary		
Is a Limiting Layer Present?	No		
Underlying Soil DLR	32	mm/day	(from Table N1 standard)
Design flowrate	4125	L / Day	
Ground slope (max 15%)	5.00%		(Maximum 15% Slope)
A (Aggregate Bed Width)	3.7081	m	(Limit between 1.2 - 2 m)
Ground slope	2.86241	degrees	
Mound Soil DLR (Sand)	50	mm/day	(from Table L1 standard)
Distribution bed area	82.5	m2	
Basal Area	250.917	m2	
Mound slope (always 1:3)	33.33%		
Mound slope	18.4349	degrees	
B = 6 to 8 times A	22.2486	m	
D =	0.6	m	
E = 0.6m on flat ground, > on sloping ground	0.7854	m	
F =	0.225	m	
G =	0.3	m	
H =	0.3	m	
I = determined by ground slope and 1 in 3 mound face slope	3.41845	m	
J = 2m minimum on sloping ground, or equals I on flat ground	4.62496	m	
K = determined by height of mound, and 1 in 3 mound face slope	3.93121	m	
Length (L = B + 2K)	30.111	m	
Width (W = I+A+J)	11.7515	m	
Basal loading rate =	16.4397	mm/day	

Table below for Copy-Paste to word

SIZING INFORMATION	
Soil DLR (mm)	32
Design Flowrate (L/day)	4125
Mound Soil DLR (Sand) (mm/day)	50
Distribution Bed Area (m^2)	82.5
Basal Area (m^2)	250.92
Ground Slope (%)	5.00%
Mound Slope (%)	33.33%
A (Aggregate Bed Width) (m)	3.71
B (Aggregate Bed Length) (m)	22.25
D (Upslope Height: Plowed layer to aggregate layer) (m)	0.60
E (Downslope Height: Plowed layer to aggregate layer) (m)	0.79
F (Aggregate Layer Height) (m)	0.23
G (Cap Layer Height) (m)	0.30
H (Top Soil Layer to Aggregate Layer) (m)	0.30
I (m)	3.42
J (m)	4.62
K (m)	3.93
L (Distribution Bed Length) (m)	30.11
Distribution Bed Width (A+J+I) (m)	11.75
Basal Loading Rate	16.44

Appendix D: WATER BALANCE / WET-WEATHER STORAGE REQUIREMENT-Nominated Area Method

Design Flow Rate	4125	L/day
Bed Area	55	m2
DLR	50	mm/day

Weather Station:

Precipitation: 066188- Belrose (Evelyn Place)

Evaporation: 06662-SYDNEY (OBSERVATORY HILL)

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Days in Month	(D)		days	31	28	31	30	31	30	31	31	30	31	30	31
Median Precipitation	(MP)		mm/month	84.7	121.5	102.5	88.5	66.8	119.8	64.4	44.6	55.5	50.6	83.9	85.4
Mean daily Evaporation	(E)		mm/day	4.6	3.9	3.1	2.6	1.9	1.2	1.5	1.9	2.5	3.3	4.3	4.4
Monthly Evaporation	(E)		mm/month	142.6	109.2	96.1	78	58.9	36	46.5	58.9	75	102.3	129	136.4
Crop Factor	(C)			0.7	0.7	0.7	0.6	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.7
Evapotranspiration	(ET)		mm/month	99.8	76.4	67.3	46.8	29.5	16.2	18.6	26.5	41.3	66.5	90.3	95.5
Infiltration Rate	(IR)		mm/month	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750
Application Rate	(AR)		mm/month	2325.00	2100.00	2325.00	2250.00	2325.00	2250.00	2325.00	2325.00	2250.00	2325.00	2250.00	2325.00
Monthly variation in effluent depth			mm	-154.04	-211.73	-136.42	-160.41	-135.68	-138.74	-132.72	-142.42	-170.01	-154.31	-177.24	-152.28
Effluent Depth in trench	Yr 1		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
	Yr 2		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
	Yr 3		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

Appendix F: Operation and Maintenance Guidelines

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.

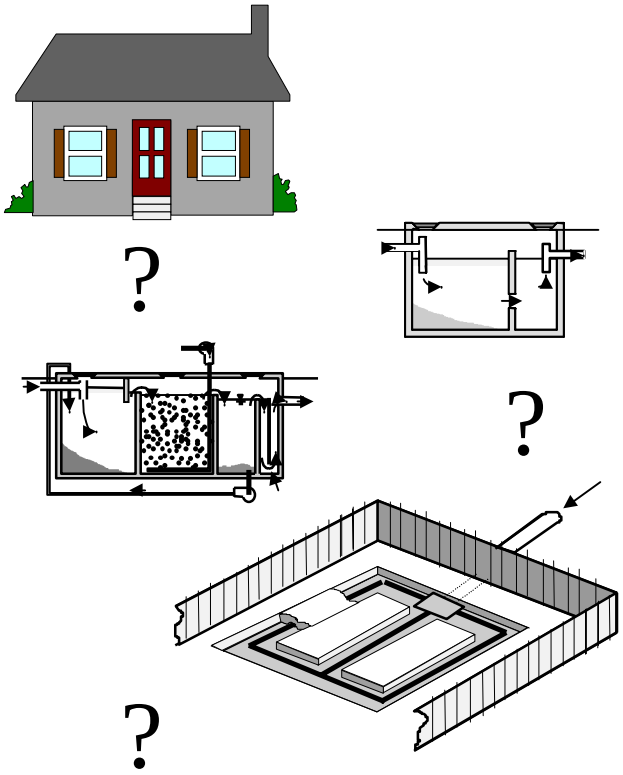
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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.

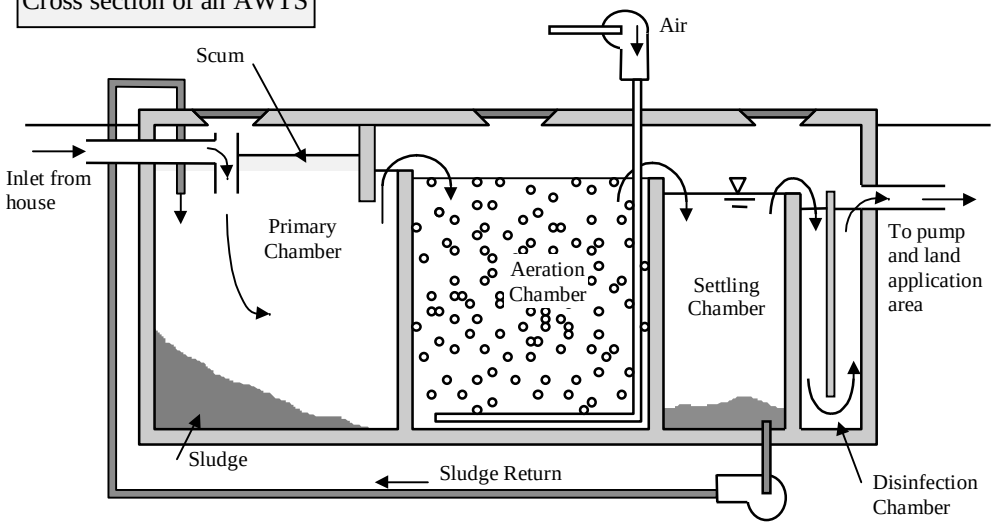
It consists of a series of treatment chambers combined with an irrigation system. An AWTS enables people living in unsewered areas to treat and utilise their wastewater.

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.

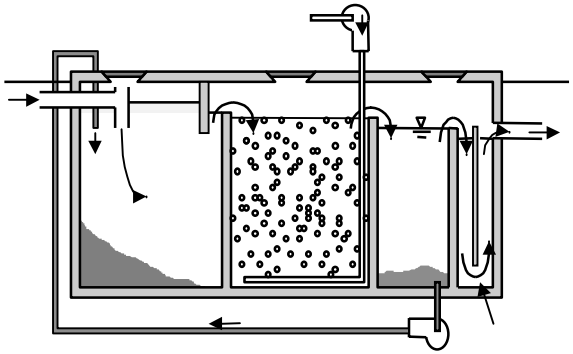
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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?

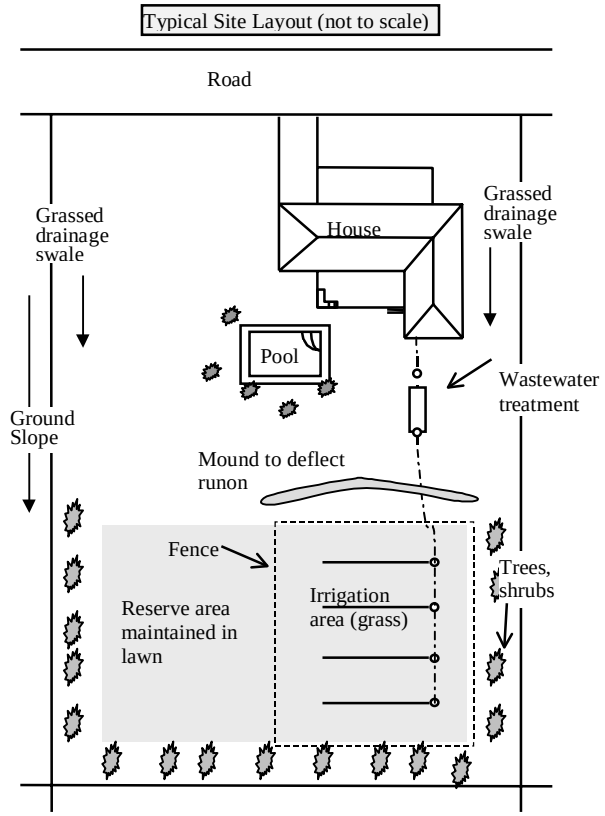
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

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:

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

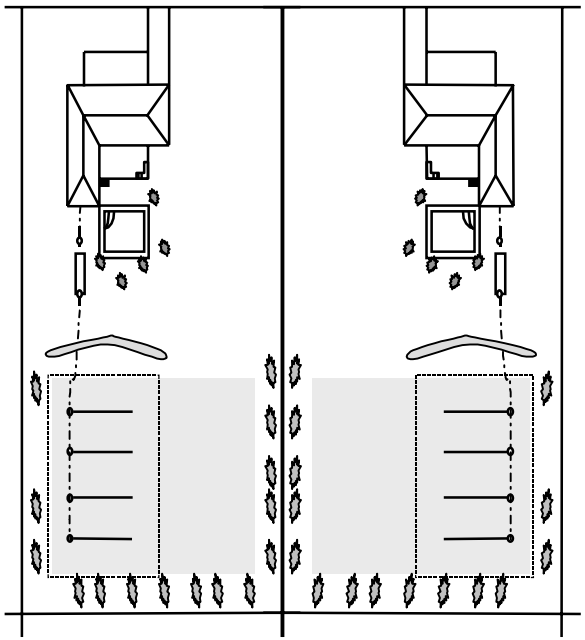
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

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



APPENDIX G: WATER CONSERVATION

Whilst this report is based on AA rated plumbing fixtures, AA rated plumbing would further conserve limited water supplies and enhance performance of the irrigation, soil and plant systems. Water saving devices will reduce the volume of water that needs to be applied to the site, and thus reduce the risk of any runoff.

Using the following water saving devices, the average household's water consumption can be reduced from 900 litres to 750 litres per day:

- Dual flush 6/3 litre pan and cistern (average household savings of 93 L/day) *
- AAA rated shower heads to limit flows to 7 L/minute *
- AAA rated dishwasher (not more than 18 litres for each wash cycle) **
- AAA rated washing machine (not more than 22 litres per dry kg of clothes) **

* Source: Independent Pricing and Regulation Tribunal of NS (1996), Water Demand Management: A Framework for Option Assessment

** Source: Sydney Water Demand Management Strategy, October 1995

Low phosphate, low sodium detergents are recommended to help improve the effluent quality. Low sodium detergents ensure that the soil structure, and hence its absorption capacity, is maintained as close as possible to a natural condition. Sodium in laundry powders is used as a filler. Therefore, in general, liquid detergents are preferred over powder. Low phosphorus detergents ensure that optimum plant growth is maintained and that excess phosphorus is not leached into the environment.

Bleaches, disinfectants and other cleaning compounds can harm wastewater treatment systems, such as septic tanks, because they kill bacteria that colonise the system and help treat wastewater. Use these products sparingly and always check that they are safe for septic systems. Avoid placing oil, paint, petrol, acids, degreasers, photography chemicals, cosmetics, lotions, pesticides and herbicides in the wastewater system. Even small amounts of these products can harm the performance of the onsite effluent management system.

SECTION 1.0 - INTRODUCTION

Four Season Nursery Belrose have engaged Pacific Environmental to undertake the process design of the treated effluent disposal field at the site at 200 Forest Way Belrose NSW. The sewage treatment plant that produces the treated effluent is proposed to be a secondary aerobic continuous plant with fixed film media and disinfection.

This design report is to detail the physical dimensions of a Wisconsin Mound type disposal field and to outline the design parameters used in the design.

The disposal field is to be located in an area of land along the southern boundary of the site and located on relatively low slope land. The application area is detailed at ***Appendix A- SITE PLAN***. An intrusive investigation of the soils in the application area has been undertaken by drilling four exploratory bores to 1.5 m to 3.2 m BGL, where sandstone was encountered. No groundwater was encountered during drilling exploratory bores. The site soils are uniformly 1.3 m sandy clays overlying non-dispersive clays, then sandstone.

The Wisconsin Mound area under consideration is West of the office/shop complex and STP location. The STP is located to allow access for maintenance. The effluent disposal mounds are located in an area where site equipment and storage areas cannot damage the mounds.

A hydraulic water balance calculation has been undertaken. This calculation demonstrates the capability of the proposed mound system to store and treat the produced effluent even under adverse wet weather conditions.

SECTION 2.0 DISPOSAL SITE

The disposal site will occupy a fenced area 5 m x 50 m. The soils are uniformly 1.3 m sandy clays overlying non-dispersive clays, then sandstone.

The site is flood free and above the 1:100 year flood level. The site investigations determined:

- The sub strata limits soil percolation with low permeability.

The design loading rate for the disposal field 15 mm/week, based upon percolation rates on site.

SECTION 3.0- EFFLUENT CHARACTERISTICS

The effluent characteristics produced by the proposed Extended Aeration Continuous (intermittent aeration) Activated Sludge Fixed Film Media secondary treated activated sludge system (STP) with and disinfection are:

- Average flow rate 2,955 L/day
- Maximum flow rate 3940 L/day
- BOD 10 mg/L
- Suspended Solids 15mg/L
- FColi 10 cfu

The Wisconsin Mound systems are normally designed for primary treated effluent and provide a treatment regime in their own right. Hence they are capable of accepting effluent of a quality far worse than that proposed. This factor of safety is introduced due to the proximity of the downstream storm water system (street drainage at 86 m west).

SECTION 4.0 –MOUND DESIGN PARAMETERS

The following design parameters have been used in the design of the Wisconsin Mounds for the site:

♦ Treated effluent maximum flow rate	3,900 L/day
♦ Treated effluent average flow rate summer	2,955 L/day
♦ Treated effluent flow rate winter and autumn	1,970 L/day
♦ Surrounding soil percolation rate	15mm/week
♦ Minimum depth of gravel bed at dispersion system in the mounds	200 mm
♦ Slope of mound walls (to AS/NZS 1547 2000)	1:3
♦ Rainfall data	Met Bureau
♦ Evaporation Data	Met Bureau
♦ Crop Factors	0.9 October to March 0.7 April to September
♦ Precipitation run-off for mounds at 1:3	70%
♦ Mound biological activity water consumption	26 L/m^3/day
♦ Mound pore space for storage	20%
♦ Applied effluent – calculated at mid depth of one operating mound	32.775 mm/day each
♦ Buffer zone to drainage channel	68 m
♦ Buffer zone to neighboring fence line	5.2 m
♦ Individual mound dimensions	30 m long, 0.8 m High, 5.1 m wide
♦ Storage required in one cell in June	9 mm< 12 mm available.

Each of the above parameters contains a factor of safety due to the proximity of the street drainage. The above assumes that the physical dimensions detailed at Section 4.0 are utilized. The application of the effluent is calculated at Mound mid depth and not at the base; however loss of effluent from the mound in the months April to September is based upon the application of this excess at the mound base area. The months April to September represent the "customer low" period and hence the continued assumption of 2,955 L/day is an overestimation and hence a factor of safety.

The above situation will alleviate concerns re the application of a mound disposal system in relative close proximity to a street drainage system. The mounds are effectively designed not to release water to the underlying soils during mean rainfall periods.

The evapotranspiration capability of a mound is greater than that of a top soil mound, which Section 3.0 of AS 1547 – 1994 has predicted.

The reported trials with a constructed transpiration mound, utilizing sand based compounds, produced a 30% increase in evapotranspiration available, this is due to biological activity within the mounds.

SECTION 5.0 – WATER BALANCE

A water balance has been undertaken and is attached at ***Appendix B- WATER BALANCE***. This balance utilizes data supplied by the Bureau of Meteorology for Pennant Hills for mean rainfall and evaporation. NSW EPA recommend that mean data be utilized in calculating the size of disposal areas.

The water balance shows that no water will escape the mounds to the underlying soils during a mean year. During June 9 mm depth of water will be stored in one mound interspace areas.

SECTION 6 – MOUND DIMENSIONS

The water balance calculations are based around mid depth dimensions of the mounds. The two (2) mounds utilized to achieve this water balance are each as follows:

♦ Mound side slope	1:3
♦ Mound finished level/height-	0.8
♦ Dispersion trench depth	0.233m
♦ Dispersion trench width	200mm
♦ Topsoil cover over dispersion trench	300mm
♦ Mound top soil cover above mound depth	150mm over whole mound
♦ Mound base ploughed below natural finished level	180-200mm
♦ Scrape natural surface and fill with mound sand depth	100mm
♦ Mound crest width	300mm
♦ Distance between mounds	2 m
♦ Width of mound base	5.1m
♦ Length of mounds each	30m
♦ Number of mounds	2 off
♦ Mound basal area for comparison purposes only	306 m^2
♦ Mound media	Medium sand with a topsoil content of a maximum of 15%. Maximum clay content 5% Iron oxide 55 to adsorb phosphorus
♦ Dispersion trench media	Coarse basalt aggregate

The distribution pipe work shall enter the mound dispersion channel at the centre of each mound. Each dispersion channel shall utilize Nitafim distribution drippers or similar, with drippers spaced at 600mm centers (minimum).