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ONSITE WASTEWATER FEASIBILITY STUDY

Prepared for:

Greg Morrison
Advanced Wastewater Management Services

Envirocycle®
A product of AWTS Maintenance Services Pty. Ltd.

Proposed Temple,
cnr of Nelson and McHale Roads, NELSON

Job Reference: 200965
Date: revised 25/02/2008

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List of amendments

Date	Amendments/revisions
25/02/2008	(1) Revision of report to include occupancy/usage rates outlined in the Statement of Environmental Effects (SEE); (2) Revision of wastewater flow-rates based on estimates outlined in the Baulkham Hill's Shire Council Development Control Plan (DCP) for onsite wastewater management; (3) Inclusion of a 100% reserve area (based on hydraulic loadings) on site plan; (4) Removal of typographical error in footnote on page 10; and (5) Various changes in response to issues raised in correspondence from Council dated the 3rd of January 2008 and the 1st of February 2008.

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ONSITE WASTEWATER FEASIBILITY STUDY

Our Ref.: 200965 Date: revised 25/02/2008

1. SITE LOCATION DETAILS

1.1. Client

Envirocycle®

1.2. Property Address

Corner of Nelson and McHale Roads, NELSON

1.3. Local Government Area

Baulkham Hills

2. PROPOSED DEVELOPMENTS

2.1. The following developments are proposed by the client for the above property

This property is currently undeveloped. It is proposed that a temple and an associated car parking area are to be constructed on this property.

All wastewater flows (black and greywater) from the proposed temple is proposed to be treated onsite with an Envirocycle Aerated Wastewater Treatment System (AWTS). All effluent (treated wastewater) is proposed to be disposed of onsite via sub-surface effluent irrigation.

3. REPORT OBJECTIVE

The objective of this report was to:

1) Assess the capacity of this site to deal with onsite effluent disposal; and
2) Define the minimum onsite effluent disposal area requirements based on the above proposed developments.

This report has been prepared for submission to Baulkham Hills Council with reference (where appropriate) to the Environment & Health Protection Guidelines[1]; the AS/NZS Standard 1547:2000[2]; and the DWE (2007) Interim Guidelines for Management of Private Recycled Water Schemes[3].

[1] Department of Local Government et al (1998) *Environment & Health Protection Guidelines. On-site Sewage Management for Single Households.*

[2] Standards Australia/Standards NZ (2000) *AS/NZS 1547:2000 Australian/New Zealand Standard – On-Site domestic wastewater management.* Standards Australia/Standards NZ.

[3] Department of Water and Energy (2007). *Interim NSW Guidelines for the Management of Private Recycled Water Schemes.*

4. SITE LOCATION

The site is located on the southeastern side of the intersection of Nelson and McHale Roads, Nelson (Figure 1).

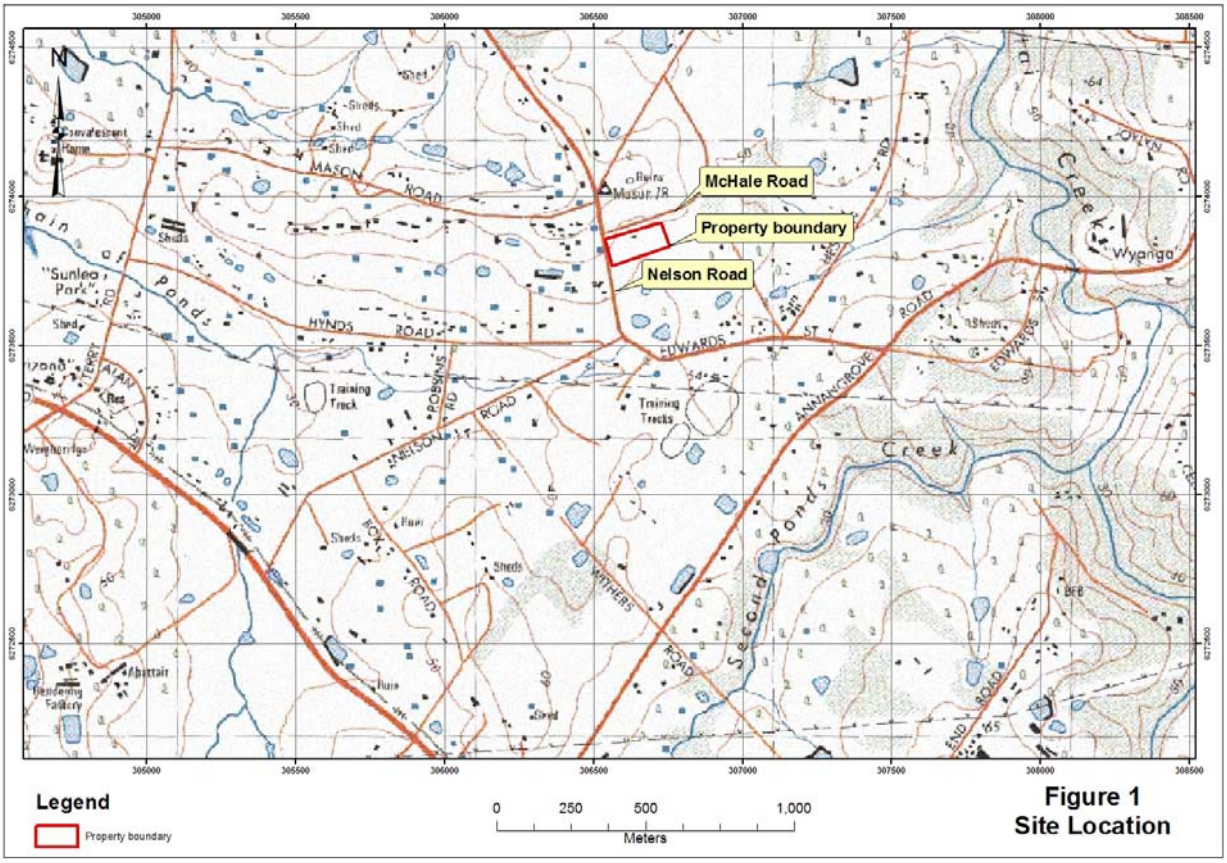


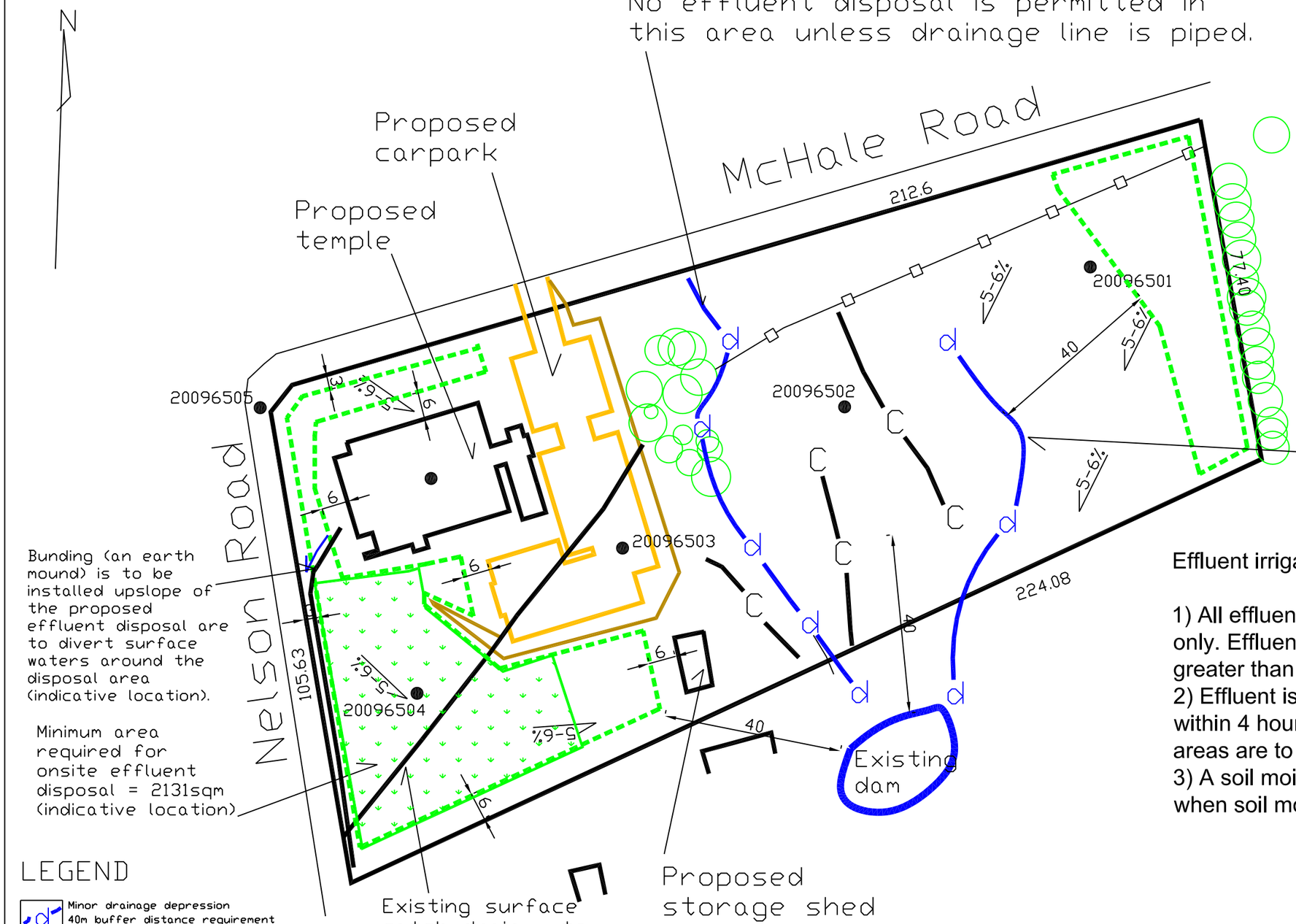
Figure 1. Site Location (Source: 1:25,000 Riverstone topographic map sheet)

5. SITE ASSESSMENT

5.1. Geology

Based on the 1:100,000 Sydney geological map series (Herbert, 1980), this property is underlain by Bringelly Shale, Minchinbury Sandstone and Ashfield Shale. The southern third of the site is underlain by Ashfield Shale, the central third of the site is underlain by Minchinbury Sandstone and the northern third of the site is underlain by Bringelly Shale.

Figure 2
Site constraints and available sub-surface effluent irrigation areas.



Effluent irrigation area access controls:

1) All effluent irrigation is to be via sub-surface methods only. Effluent irrigation pipes are to be installed a depth greater than 0.1m but less than 0.3m;
2) Effluent is not to be irrigated during operational hours or within 4 hours (nominal interval) before effluent irrigation areas are to be accessed for any purpose; and
3) A soil moisture sensor is to be installed to inhibit irrigation when soil moisture levels reach 95% saturation.

LEGEND

- Minor drainage depression 40m buffer distance requirement
- Catchment boundary
- 6 Buffer distance requirement (m)
- Total Available Sub-Surface Effluent Irrigation Area
- Minimum area required for onsite effluent disposal = 2131sqm (indicative location)
- Property boundary
- 3-5% Slope
- Soil Investigation Location

Notes:

1) The position of all features illustrated on this plan is approximate
2) Survey data was supplied by client;
3) Slope was estimated with a clinometer and is approximate only;
4) Refer to Attachment 8 for buffer distance requirements; and
5) Refer to Attachment 3 for site-specific management requirements.

0 25m 50m

Scale	PROPOSED MULT-USE HALL			Figure 2	
Designed by: JC	Checked by: JC	Date Drawn: 17/12/2007	Job No: 200965	Filename: 200965F2	Lot No:

Consultants: HARVEST SCIENTIFIC SERVICES

Project: Corner of Nelson and McHale Roads, NELSON

Client: Envirocycle

Council: BAULKHAM HILLS

5.2. Soil Landscape Group

Based on the Penrith 1:100,000 Soil Landscapes Map, soils on this site belong to the Blacktown Soil Landscape Group (Bannerman and Hazelton, 1990). This is a residual Soil Landscape Group which consists of gently undulating rises on Wianamatta Group Shales. Local relief is up to 30m and slopes are usually less than 5 percent.

The soils of this landscape group are generally shallow to moderately deep (<100cm) hardsetting mottled texture contrast soils on crests grading to yellow podzolic soils on lower slopes and drainage lines (Bannerman and Hazelton, 1990)..

The main limitations of this Soil Landscape Group are moderately reactive highly plastic subsoils, low soil fertility and poor soil drainage (Bannerman and Hazelton, 1990).

5.3. Soil Investigation

The soil on this site was investigated at five soil investigation locations (Figure 2). Soil properties were assessed based on the modified procedure outlined in Section 4.1C3.1.2 of the AS/NZ 1547:2000[1], which relies on the 1:100,000 Soil Landscape Map as identified above (see Section 5.2 of this report).

Soil depth was greatest at the top of the hill in the south-eastern portion of this site, and soils in this area were classified using the Australian Soil Classification (Isbell, 1996) as a Yellow Dermosols (based on soil profile 20094001). Soil depth decreased toward the northern portion of the investigation area (toward Stevens Road) and soil profiles (20094002, 20094003 and 20094004) were classified as Yellow Kandosols.

The general topsoil and subsoil profile characteristics are summarised in Section 5.3.1.

5.3.1. Soil Profile 200965-01 Red Kurosol (ASC)

Topsoil	**A Horizon (0 - 30cm):** A brown clay loam with excellent structure and a field pH of 6.5.
Subsoil	**B Horizon (30-80cm):** A red medium clay with an excellent structure and a field pH of 4.5. This horizon graded to weathered sandstone at a depth at a depth of approximately 0.8m.

Refer to Attachment 1 for Soil Profile Log and Figure 2 for soil investigation location.

Refer to Attachment 1 for Soil Profile Log and Figure 2 for soil investigation location.

[1] Standards Australia/Standards NZ (2000) *AS/NZS 1547:2000 Australian/New Zealand Standard – On-Site domestic wastewater management.* Standards Australia/Standards NZ

5.3.2. Topsoil Chemical Analysis

Laboratory analysis results (Attachment 2) from topsoil collected at location 20096501 were analysed in a NATA accredited laboratory. Laboratory analysis results are summarised below:

Phosphate Retention Index (g/kg)	2.2232
pH (water)	5.7
EC (1:5 – dS/m)	0.08
Exchangeable Sodium Percentage (%)	12.1
Cation Exchange Capacity	9.4

For the purpose of onsite effluent irrigation, this soil shows a medium acidity and very low salt content. The soil chemistry is unbalanced and can be improved by the application of lime and gypsum at a rate of 51g/m^2 and 300 g/m^2 respectively. These ameliorants are to be applied to the surface 150mm of topsoil and incorporated well.

5.3.3. Subsoil Chemical Analysis

Laboratory analysis results (Attachment 2) from subsoil collected at location 20096501 were analysed in a NATA accredited laboratory. Laboratory analysis results are summarised below:

Phosphate Retention Index (g/kg)	1.5795
pH (water)	4.9
EC (1:5 – dS/m)	0.42
Exchangeable Sodium Percentage (%)	37.7
Cation Exchange Capacity	15.9

For the purpose of onsite effluent irrigation, this soil shows a medium acidity and moderate content. Subsoils are sodic and exposure of subsoils should be avoided.

5.3.4. Soil Permeability Categories

Soil permeability categories for topsoil and subsoil samples were determined by field assessment of texture and structure and comparison with Table 4.1.1 of the AS1547:2000 standard[1]. Field texture was determined using the hand bolus method (Charman and Murphy, 1991).

Topsoil – A1 Horizons

Field Texture/s	Clay Loam
Structure	Excellent
Soil Permeability Category	4A

Subsoil – B Horizon

Field Textures	Medium Clay
Structure	Excellent
Soil Permeability Category	6A

A soil permeability category of 6A is the most limiting and was thus used in water balance calculations (Attachment 7). Based on accepted industry practise, a permeability of 15mm/week (reference to Table 4.2A4 of the AS1547:2000 standard[1]) was used for water balance calculations.

[1] Standards Australia/Standards NZ (2000) *AS/NZS 1547:2000 Australian/New Zealand Standard – On-Site domestic wastewater management.* Standards Australia/Standards NZ.

5.4. Climate

Average climate data was downloaded from the Bureau of Meteorology (BOM, 2004) webpage (www.bom.gov.au) for the nearest BOM weather station that contained both rainfall and evaporation data and was used for water balance calculations (Attachment 7). The following is a summary of the annual 50th percentile rainfall and average annual evaporation for this station.

Annual rainfall (50th percentile) in mm	836 Richmond (RAAF) (Bureau of meteorology weather station #67033)
Annual evaporation (average) in mm	1570 Richmond (RAAF) (Bureau of meteorology weather station #67033)

5.5. Land Slope[1] (within available effluent disposal areas)

~6 - 7%

5.6. Vegetation

The major part of this property is cleared and well grassed. A small group of trees is located in the central portion of the property.

5.7. Buildings

It is proposed that a temple and an associated car park be constructed on this property (Figure 2).

5.8. Other features

This property contains two minor drainage depressions. A dam is located to the east of the property (Figure 2). An existing 'cut off' drain extends from the southern corner of the property to the group of trees which is located in the central portion of the property (Figure 2).

[1] Slope was estimated by clinometer only and is approximate.

5.9. Site and Soil Assessment

The site and soil properties of the proposed effluent disposal areas (defined on Figure 2) were assessed based on the assessment rating criteria outlined in Tables 4 and 6 of the NSW Environment and Health protection guidelines[1]. Soil properties not measured in this assessment were evaluated based on knowledge of the likely soil properties of the Blacktown Landscape Group. A copy of the site and soil assessment rating is presented in Attachment 3 of this report.

5.10. Summary of site investigation

Based on the findings of this investigation, it was found that this site contains soils suitable for onsite effluent disposal. For site-specific management and soil amelioration requirements refer to Attachment 3.

[1] Department of Local Government et al (1998) *Environment & Health Protection Guidelines. On-site Sewage Management for Single Households.*

6. PROPOSED ON-SITE EFFLUENT TREATMENT AND DISPOSAL SYSTEM

The proposed on-site wastewater treatment and effluent disposal system for this property are outlined in following sections of this report.

6.1. Type of effluent treatment unit proposed

All wastewater from the proposed temple is proposed to be treated onsite via an Envirocycle Model 50NR Aerated Wastewater Treatment System (AWTS). The AWTS must have the capacity to treat the average and peak flow-rates outlined in Section 6.2 of this report.

The AWTS to be installed must be validated and verified is accordance with the requirements outlined in most recent version of the Department of Water and Energy (2007) 'Interim NSW Guidelines for the Management of Private Recycled Water Schemes'.

The required effluent quality is outlined in Attachment 4.

6.2. Estimation of wastewater flow rates

6.2.1. Estimated occupancy rates

Based on advice from the client the temple is proposed to be utilised based on the schedule outlined in Table 1.

Table 1. Summary of proposed occupancy rates[1]

Day	**Timeframe**	**Maximum number of people**
Monday to Friday	6am to 10am	30
	4pm to 10pm	40
Weekends	6am to 11pm	50
	11am to 4pm	150
	4pm to 10pm	200

[1] Based on statement of Environmental Effects supplied to Harvest Scientific Services on the 30th of January, 2008.

6.2.2. Peak flows

The average daily peak flow rate was estimated based upon the 24 hour period when the facility contains a maximum occupancy (i.e. either Saturday or Sunday) and the estimated peak flow-rate is outlined in Table 2.

A flow rate of 25L per seat was utilised for flow-rate calculations. This value of was based on Appendix 2 of Baulkham Hills Shire Council Development Control Plan No. 2.

Table 2. Estimated daily (24 hour) peak flow-rate (L/day)

Day	**Flow calculations (L/day)**	**Estimated flow (L/day)**
Weekend	400 persons x 25 L/person x 1 day	10,000
TOTAL[1]	**All sources with 20% safety factor.**	**12,000**

6.2.3. Average flows

The average daily flow rate was estimated to be 4,107 L/day. This value is based on the average weekly wastewater flow-rate (Table 3) divided by 7. The average daily flow-rate was utilised for design sizing purposes for effluent irrigation area sizing purposes.

A flow rate of 25L per seat was utilised for flow-rate calculations. This value of was based on Appendix 2 of Baulkham Hills Shire Council Development Control Plan No. 2.

Table 3. Estimated average weekly total wastewater flow

Day	**Flow calculations (L)**	**Estimated flow (L/week)**
Monday to Friday	70 persons x 25 L/person x 5 days	8750
Weekend	400 persons x 25 L/person x 2 days	20,000
Total	**All sources**	**28,750**

6.3. Type of effluent disposal system proposed

Sub-surface effluent irrigation only.

Refer to Attachment 5 for general specifications.

[1] Includes an increase of 20% as an estimate of peak flows.

6.4. Effluent irrigation access controls

Access to effluent irrigation area is to be controlled by the following measures:

- All effluent irrigation is to be via sub-surface methods only. Effluent irrigation pipes are to be installed a depth greater than 0.1m but less than 0.3m; and
- Effluent is not to be irrigated during hours of operation or within 4 hour (nominal interval) before effluent irrigation areas are to be accessed for any purpose.

6.5. Soil moisture sensor

A soil moisture sensor should be installed within the effluent irrigation area and set to prohibit irrigation when soil moisture levels reach 95% saturation.

6.6. Wet weather storage tank

A wet weather storage tank is to be installed onsite. The minimum tank storage volume is to be 41,000 litres. This value is equivalent to 10 days of storage at average effluent generation rates. A camlock fitting to be fitted to enable the wet-weather storage tank to double as a pump-out tank, if required.

6.7. Minimum area required for onsite effluent irrigation

Nutrient loading (Attachment 6) and water balance (Attachment 7) calculations based on the Environment & Health Protection Guidelines of 1998 were used to estimate the minimum effluent irrigation area requirements. The design sizing calculations for the proposed temple are presented below:

Nitrogen	1,797
Phosphorous[1]	771
Water Balance[2]	1,776

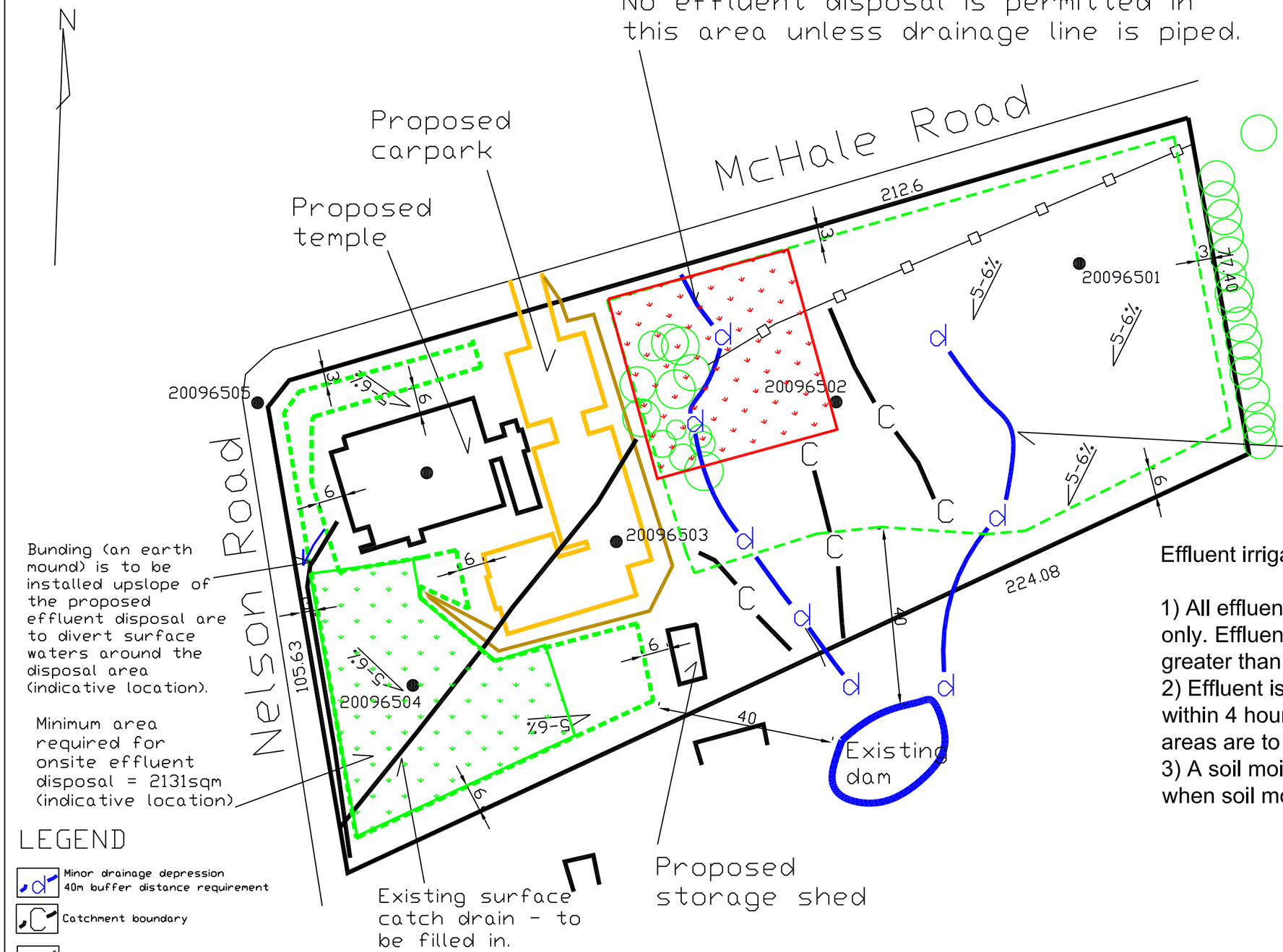
See Attachments 6 & 7 for indication calculation details.

The minimum required effluent disposal area is the greater value determined by the above methods. Based on this method, the minimum required effluent disposal area is **1,776 m^2**. Areas available for onsite effluent disposal are delineated on Figure 2.

[1] The proportion of phosphorous sorption capacity used was 1/3 – as recommended in Appendix 6 of the Environment & Health Protection Guidelines 1998; and

[2] The design percolation rate/design irrigation rate [DIR] used in the Water Balance calculation is based on subsoil textural characteristics with reference to Table 4.2A4 of AS/NZS1547:2000

Figure 3
Available reserve areas



LEGEND

- Minor drainage depression 40m buffer distance requirement
- Catchment boundary
- Buffer distance requirement (m)
- Minimum area required for onsite effluent disposal = 2131sqm (indicative location)
- Total available researve area
- Minimum area required reserve area = 1776sqm (indicative location)
- Property boundary
- Slope
- Soil Investigation Location

Notes:

1) The position of all features illustrated on this plan is approximate

2) Survey data was supplied by client;

3) Slope was estimated with a clinometer and is approximate only;

4) Refer to Attachment 8 for buffer distance requirements; and

5) Refer to Attachment 3 for site-specific management requirements.

Effluent irrigation area access controls:

1) All effluent irrigation is to be via sub-surface methods only. Effluent irrigation pipes are to be installed a depth greater than 0.1m but less than 0.3m;
2) Effluent is not to be irrigated during operational hours or within 4 hours (nominal interval) before effluent irrigation areas are to be accessed for any purpose; and
3) A soil moisture sensor is to be installed to inhibit irrigation when soil moisture levels reach 95% saturation.

0 25m 50m

Scale					
1:1000	PROPOSED MULT-USE HALL			Figure 3	
Designed by	Checked by	Date Drawn	Job No	Filename	Lot No
JC	JC	17/12/2007	200965	200965F3	
Consultants		Project			
HARVEST SCIENTIFIC SERVICES		Corner of Nelson and McHale Roads, NELSON			
		Client		Council	
		Envirocycle		BAULKHAM HILLS	

6.8. Location of effluent disposal areas

The location of the required effluent disposal area is to be selected by the client from the available effluent disposal areas outlined on Figure 2. Indicative effluent disposal area locations for are outlined on Figure 2.

Furthermore, all effluent disposal areas must comply with the buffer requirements outlined in Attachment 8 of this report. Refer to Attachment 9 for further details on the management of effluent disposal areas.

6.9. Reserve area

As per Baulkham Hill's Shire Councils Development Control Plan No. 2 (dated January 2004), a reserve area equivalent to 100% of the minimum area required based on Hydraulic loadings should be set aside and protected from further development. Therefore, a minimum of 1776 m^2 should be set aside as a reserve area.

The areas suitable for a reserve area are depicted on Figure 3. These areas include the main intermittent drainage line which bisects this site and the minor depression in the eastern portion of the site. These areas have been included because the drainage line may be easily piped and made suitable for irrigation and the minor drainage depression in the eastern portion of this site may be easily filled and made suitable for effluent irrigation.

7. CURRENCY OF REPORT AND REVIEW

Due to changes in regulatory and Council requirements this report should be reviewed every three months (nominal interval).

8. MONITORING

8.1. AWTS Effluent Quality

Effluent quality monitoring requirements for the proposed AWTS is to be determined by Baulkham Hill's Shire Council through consultation the Department of Water and Energy (DWE).

Effluent quality is to be monitored in accordance with the requirements outlined by the conditions of consent issued by Baulkham Hill's Shire Council.

8.2. Soil health

Monitoring of soil health is to be performed on an annual basis for three years and monitoring frequency it to be reviewed thereafter. Soil is to be monitored for at least the following properties:

- EC (1:5);
- pH;
- Exchangeable sodium percentage (ESP);
- Total nitrogen; and
- Total phosphorus.

8.3. Visual monitoring of effluent disposal areas

The functionality of effluent disposal areas should be reviewed by the Environmental Management Representative (EMR) within 1 week after commissioning and at least every three months thereafter. Visual signs of effluent disposal failure include the following:

- Surface ponding and run-off of treated wastewater
- Soil quality deterioration
- Poor vegetation growth
- Unusual odours

Refer to Attachment 9 for further details regarding the indicators effluent disposal area failure.

8.4. Effluent volume

An effluent volume flow meter should be installed to monitor effluent volumes being irrigated onsite. Effluent volumes irrigated should be reviewed on an annual basis with consideration for the long term sustainability of effluent irrigation on this site.

9. WARNING SIGNS

At least 2 warning signs should be installed along the boundary of the 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’

10. ENVIRONMENTAL MANAMAGENT PLAN

An Environmental Management Plan (EMP) for this site should be prepared in accordance with the DWE (2007) guidelines. The ongoing management of wastewater re-use on this site should be managed based on the environmental controls and protocols outlined in the approved EMP.

11. LIMITATIONS TO THIS REPORT

This report has been prepared subject to a number of limitations. These include:

- The application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document. In particular, the occurrence of earthquakes of any magnitude, extreme rainfall events or the effects of climate change have not been considered but should they occur, may have a significant impact on the site. The client agrees that such events are possible but nevertheless accepts the risk that they pose;
- The findings contained in this report are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site/sites at all points; and
- In preparing this report, Harvest Scientific Services has relied upon certain verbal information and documentation provided by the client and/or third parties. Harvest Scientific Services did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this report are based in whole or in part on such information, they are contingent on its validity. Harvest Scientific Services assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to Harvest Scientific Services.

12. CONCLUSION

Based on the findings of this report, it is concluded that this site has the capacity to deal with on-site effluent disposal. The minimum area required for subsurface effluent irrigation is 1,776sqm for the estimated wastewater load from the proposed temple. Furthermore, as a safeguard measure it is recommended that 20% of the nominated reserve area be irrigated as part of the primary irrigation area. Therefore, the total area required to be developed for effluent irrigation is **2131sqm.**

For general management requirements for effluent disposal refer to Attachment 9, for buffer distance requirements refer to Attachment 8 and for site-specific management and soil amelioration requirements refer to Attachment 3.

Prepared by:

Jim Cupitt BScAgr (Soil Science)
Senior Environmental Scientist

13. REFERENCES

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Disclaimer

This report was prepared in accordance with the scope of services set out in the contract between Harvest Scientific Services and the client, or where no contract has been finalised, the proposal agreed to by the client. To the best of our knowledge the report presented herein accurately reflects the clients intentions when it was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document.

The findings contained in this report are the result of discrete/specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site/sites at all points.

In preparing this report, Harvest Scientific Services has relied upon certain verbal information and documentation provided by the client and/or third parties. Harvest Scientific Services did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this report are based in whole or in part on such information, they are contingent on its validity. Harvest Scientific Services assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to Harvest Scientific Services.

ATTACHMENT 1

Soil Profile Log: 20096501													
Project	ONSITE WASTEWATER FEASIBILITY STUDY					**Method of Investigation**			Trench + Auger			
Job Number	200965					**Aspect**			~110°			
Location	Cnr of Nelson Road and McHale Road, NELSON					**Slope**			~5-6%			
Land Use	Proposed temple					**Topography**			Side slope			
Geology	Bringelly Shale					**Soil Landscape Unit**			Blacktown			
ASC Classification	Red Kurosol					**External Drainage**			Moderate			
Depth (cm)	**Graph**	**Horizon (cm)**	**Boundary**	**Munsell Colour**	**Colour Class**	**Texture**	**Coarse Fraction**	**Structure**	**Fabric**	**Peroxide test**	**pH**	**Drainage**	**Comments**
0-10		**A1 Horizon** (0-30cm)			Brown	Clay loam	-	Excellent	Rough		6.5	Excellent	Natural Layer
10-20													
20-30			clear										
30-40		**B2 Horizon** (30-80cm)	clear		Red	Medium Clay	-2-5% Shale fragments (2-5mm diam)	Excellent	Rough		4.5	Poor	
40-50													
50-60													
60-70													
70-80													
80-90		**B/C**											
90-100													
100-110	Hole Terminated in B/C horizon @ 0.8m in a red medium clay horizon												
110-120													
120-130													
130-140													
140-150													
150-160													
160-170													

ASC: Australian Soil Classification
N/A Not assessed

Notes:
1) Natural Layer

Author	JC
Date Logged	07/11/2007

Soil Profile Log: 20096502

Project	ONSITE WASTEWATER FEASIBILITY STUDY	**Method of Investigation**	Trench + Auger
Job Number	200965	**Aspect**	~110°
Location	Cnr of Nelson Road and McHale Road, NELSON	**Slope**	~5-6%
Land Use	Proposed temple	**Topography**	Side slope
Geology	Bringelly Shale	**Soil Landscape Unit**	Blacktown
ASC Classification	Red Kurosol	**External Drainage**	Moderate

Depth (cm)	Graph	Horizon (cm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	Peroxide test	pH	Drainage	Comments
0-10		**A1 Horizon** (0-40cm)			Brown	Clay loam	-	Excellent	Rough		6.5	Excellent	Natural Layer
10-20													
20-30			clear										
30-40		**B2 Horizon** (40-80cm)	clear		Red	Medium Clay	-2-5% Shale fragments (2-5mm diam)	Excellent	Rough		4.5	Poor	
40-50													
50-60													
60-70													
70-80													
80-90		**B/C**											
90-100													
100-110	Hole Terminated in B/C horizon @ 0.8m in a red medium clay horizon												
110-120													
120-130													
130-140													
140-150													
150-160													
160-170													

ASC: Australian Soil Classification
N/A Not assessed

Notes:
1) Natural Layer

Author	JC
Date Logged	07/11/2007

Soil Profile Log: 20096503

Project	ONSITE WASTEWATER FEASIBILITY STUDY	**Method of Investigation**	Trench + Auger
Job Number	200965	**Aspect**	~110°
Location	Cnr of Nelson Road and McHale Road, NELSON	**Slope**	~5-6%
Land Use	Proposed temple	**Topography**	Side slope
Geology	Bringelly Shale	**Soil Landscape Unit**	Blacktown
ASC Classification	Red Kurosol	**External Drainage**	Moderate

Depth (cm)	Graph	Horizon (cm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	Peroxide test	pH	Drainage	Comments
0-10		**A1 Horizon** (0-30cm)			Brown	Clay loam	-	Excellent	Rough		6.5	Excellent	Natural Layer
10-20													
20-30			clear										
30-40		**B2 Horizon** (30-80cm)	clear		Red	Medium Clay	-2-5% Shale fragments (2-5mm diam)	Excellent	Rough		4.5	Poor	
40-50													
50-60													
60-70													
70-80													
80-90		**B/C**											
90-100													
100-110	Hole Terminated in B/C horizon @ 0.8m in a red medium clay horizon												
110-120													
120-130													
130-140													
140-150													
150-160													
160-170													

ASC: Australian Soil Classification
N/A Not assessed
Notes:
1) Natural Layer

Author	JC
Date Logged	07/11/2007

Soil Profile Log: 20096504

Project	ONSITE WASTEWATER FEASIBILITY STUDY	**Method of Investigation**	Trench + Auger
Job Number	200965	**Aspect**	~110°
Location	Cnr of Nelson Road and McHale Road, NELSON	**Slope**	~5-6%
Land Use	Proposed temple	**Topography**	Side slope
Geology	Bringelly Shale	**Soil Landscape Unit**	Blacktown
ASC Classification	Red Kurosol	**External Drainage**	Moderate

Depth (cm)	Graph	Horizon (cm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	Peroxide test	pH	Drainage	Comments
0-10		**A1 Horizon** (0-30cm)			Brown	Clay loam	-	Excellent	Rough		6.5	Excellent	Natural Layer
10-20													
20-30			clear										
30-40		**B2 Horizon** (30-80cm)	clear		Red	Medium Clay	-2-5% Shale fragments (2-5mm diam)	Excellent	Rough		4.5	Poor	
40-50													
50-60													
60-70													
70-80													
80-90		**B/C**											
90-100													
100-110	Hole Terminated in B/C horizon @ 0.8m in a red medium clay horizon												
110-120													
120-130													
130-140													
140-150													
150-160													
160-170													

ASC: Australian Soil Classification
N/A Not assessed

Notes:
1) Natural Layer

Author	JC
Date Logged	07/11/2007

Soil Profile Log: 20096505

Project	ONSITE WASTEWATER FEASIBILITY STUDY	**Method of Investigation**	Existing road cutting
Job Number	200965	**Aspect**	~110°
Location	Cnr of Nelson Road and McHale Road, NELSON	**Slope**	~5-6%
Land Use	Proposed temple	**Topography**	Catchment boundary
Geology	Bringelly Shale	**Soil Landscape Unit**	Blacktown
ASC Classification	Red Kurosol	**External Drainage**	Moderate

Depth (cm)	Graph	Horizon (cm)	Boundary	Munsell Colour	Colour Class	Texture	Coarse Fraction	Structure	Fabric	Peroxide test	pH	Drainage	Comments
0-10 10-20 20-30		**A1 Horizon** (0-30cm)	clear		Brown	Clay loam	-	Excellent	Rough		6.5	Excellent	Natural Layer
30-40 40-50 50-60 60-70 70-80		**B2 Horizon** (30-80cm)	clear		Red	Medium Clay	-2-5% Shale fragments (2-5mm diam)	Excellent	Rough		4.5	Poor	
80-90 90-100 100-110 110-120 120-130 130-140 140-150 150-160 160-170		**B/C**	Hole Terminated in B/C horizon @ 0.8m in a red medium clay horizon										

ASC: Australian Soil Classification
N/A Not assessed

Notes:
1) Natural Layer

Author	JC
Date Logged	07/11/2007

ATTACHMENT 2

Laboratory analysis results

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

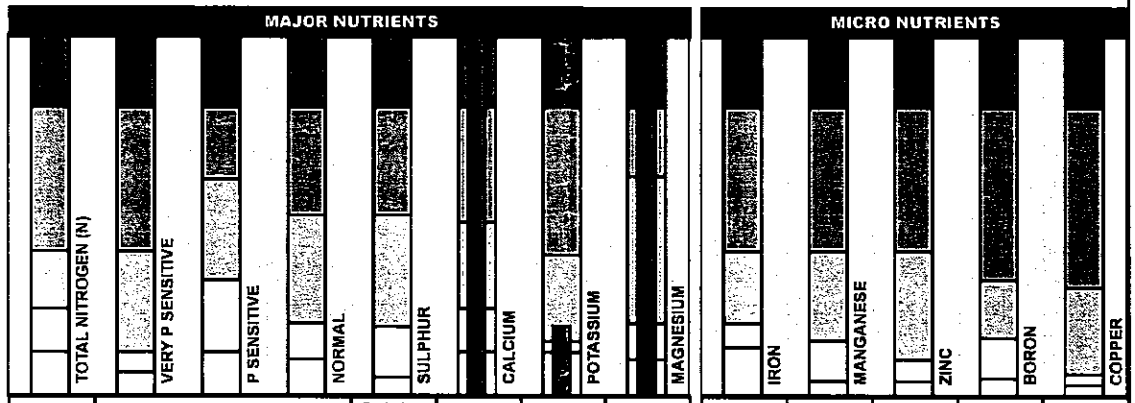
Batch N°: 4949
Sample No: 1

Report Status: ○ Preliminary ◉ Final

Quality System
AS/NZS ISO 9001: 2000 QEC 21650
Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	ND	ND	ND	7635	192	484	ND	ND	ND	ND	ND
kg/ha*	ND	ND	ND	14888	374	944	ND	ND	ND	ND	ND

Ammonium - N (NH_4): **ND mg/kg**

Nitrate - N (NO_3): **mg/kg**

Total Available Nitrogen: **mg/kg**

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Slight alkalinity	Very high	Not sodic - normal	High - calcic	High - calcic

RECOMMENDATION

Phosphate Retention Index: 31.5 % Medium
1579.5 mgP/kg 3080 kg/ha to 150mm

For the purpose of onsite effluent disposal report, this soil shows slight alkalinity and very high salt content. The soils ability to absorb phosphorus is medium, and at 150mm the soil can absorb a reasonable amount, increasing the longevity of the effluent disposal system.

If any further assistance is required please contact me at the office on 9980 6554.

Consultant:
Ryan Jacka

Authorised Signatory:
Simon Leake

Report Date: 26 Nov 2007

Signature - required for Final Reports

Record ID: 1

Date: 26/11/2007 **Sample Name:** 200907-01 (100-200mm) **Sample No.:** 1 **Batch No.:** 4949

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 4949
Sample No: 3

Report Status: ○ Preliminary ◉ Final

Quality System — Quality Endorsed Company
AS/NZS ISO 9001: 2000 QEC 21650

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CLIENT DETAILS:
Harvest Scientific Services

PO Box 427
NARELLAN NSW 2567

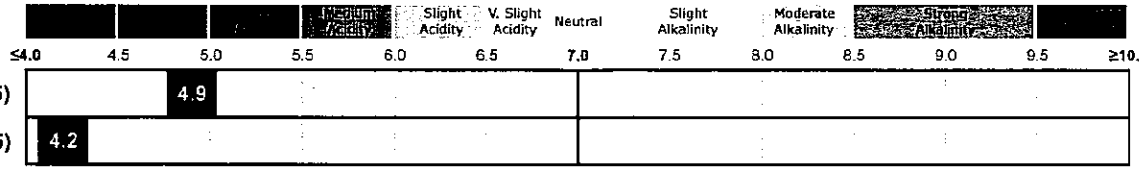
Attn: Jim Cupitt

PROJECT DETAILS:
Project Name:
Effluent Disposal
Location:
SESL Quote N°:
Client Job N°: 200964
Client Order N°:
Date Received: 16/11/2007

SAMPLE DETAILS:
Sample Name:
200965-01 (600-800mm)
Sample N°: 3
Sample Description:
Soil,
Test Type: pH(CaCl2), ECEC, PRI

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



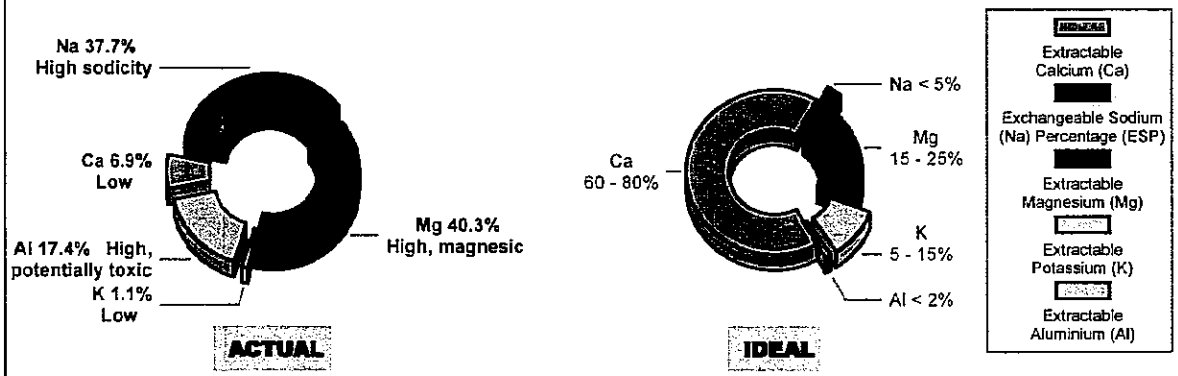
ELECTRICAL CONDUCTIVITY (dS/m)
(cmol⁺/kg or meq/100g)

SOLUBLE CATIONS (meq%)
Na K Ca Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

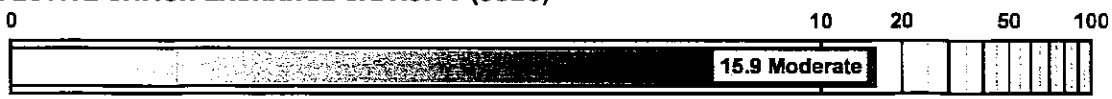
BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

Exhangeable Sodium Percentage (ESP)	37.7% - High sodicity				
Ca:Mg	0.2 Low - magnesic	K:Mg	00 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)



CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
3270 kg/ha (ie. 327 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 2.2 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
11620 kg/ha (ie. 1162 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 7.7 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 26/11/2007 Sample Name: 200965-01 (600-800mm) Sample No.: 3 Batch No.: 4949

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

Batch N°: 4949
Sample No: 2

Report Status: ○ Preliminary ◉ Final

Quality System
AS/NZS ISO 9001: 2000 QEC 21650
Quality Endorsed Company

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CLIENT DETAILS:
Harvest Scientific Services

PO Box 427
NARELLAN NSW 2567

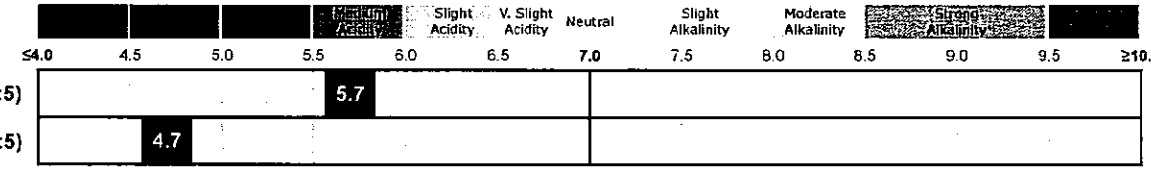
Attn: Jim Cupitt

PROJECT DETAILS:
Project Name:
Effluent Disposal
Location:
SESL Quote N°:
Client Job N°: 200964
Client Order N°:
Date Received: 16/11/2007

SAMPLE DETAILS:
Sample Name:
200965-01 (0-300mm)
Sample N°: 2
Sample Description:
Soil,
Test Type: pH(caCl2), ECEC, PRI

pH and ELECTRICAL CONDUCTIVITY

pH ANALYSIS



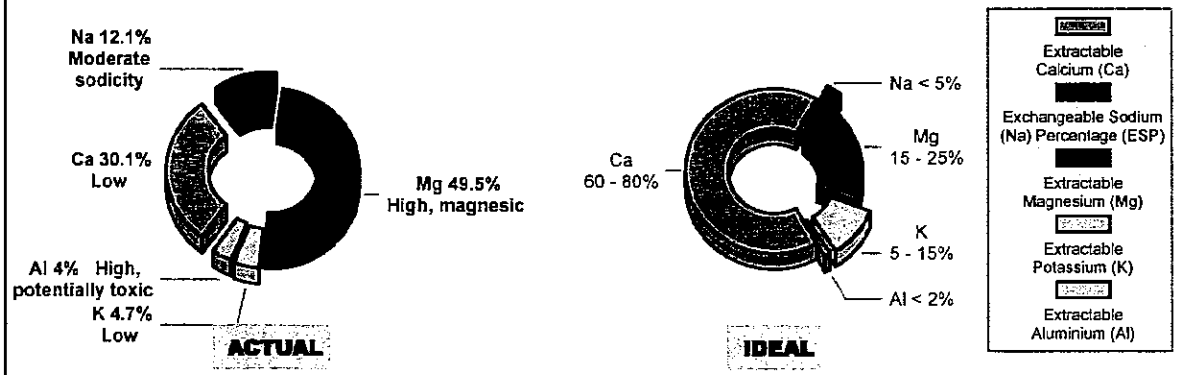
ELECTRICAL CONDUCTIVITY (dS/m)
(cmol⁺/kg or meq/100g)

SOLUBLE CATIONS (meq%)
Na K Ca Mg

CHLORIDE (mg/kg)
Not determined

CATION BALANCE

BASE SATURATION PERCENTAGE (BSP)



CATION RATIOS

Exhangeable Sodium Percentage (ESP)	12.1% - Moderate sodicity				
Ca:Mg	0.6 Low - magnesic	K:Mg	0.1 Low	Sodium Absorption Ratio	ND

EFFECTIVE CATION EXCHANGE CAPACITY (eCEC)

CALCULATED LIME REQUIREMENT (CLR)*

Surface application rate:
510 kg/ha (ie. 51 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 0.3 kg/m^3

CLR = Lime application required to reduce available Aluminium to 0. pH preference and cation ratios must also be considered when determining liming rate and product.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

CALCULATED GYPSUM REQUIREMENT (CGR)*

Surface application rate:
5560 kg/ha (ie. 556 g/m^2), based on treating a 150mm soil depth.

Volume application rate: 3.7 kg/m^3

CGR = Gypsum application required to achieve 70% exchangeable Calcium. The CGR is corrected for any Lime addition specified in CLR.

SEE PAGE 2 FOR FINAL RECOMMENDATIONS

* Calculation for kg/ha and g/m^2 is based on a Bulk Density of 1.3 and a soil depth of 150mm.

Date: 26/11/2007 Sample Name: 200965-01 (0-300mm) Sample No.: 2 Batch No.: 4949

Sydney Environmental & Soil Laboratory

Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Soil Chemistry Profile

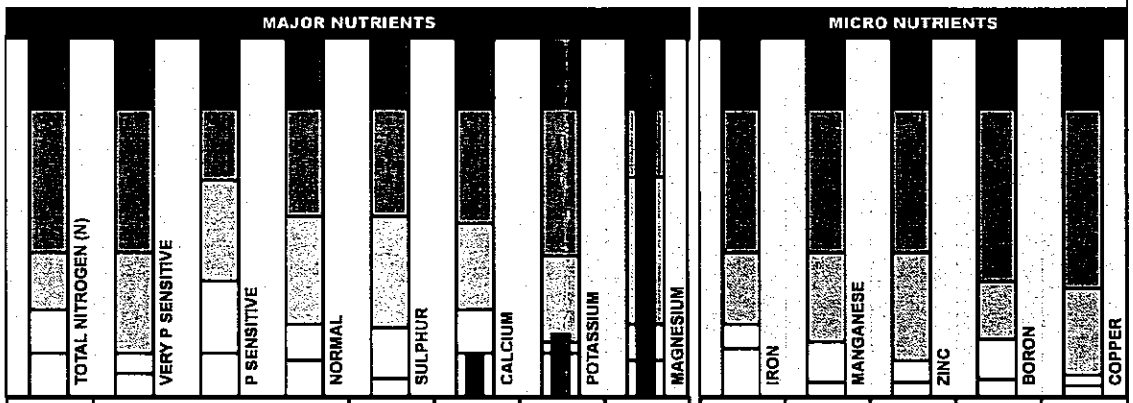
Batch N°: 4949
Sample No: 2

Report Status: ○ Preliminary ◉ Final

AS/NZS ISO 9001: 2000 QEC 21650 Quality Endorsed Company

Sydney Environmental and Soil Laboratory Pty Limited ABN 70 106 810 708 PO Box 357, Pennant Hills NSW 1715 Australia T: 02 9980 6554 F: 02 9484 2427 E: info@sesl.com.au W: www.sesl.com.au

PLANT AVAILABLE NUTRIENT PROFILE



	NH_4+NO_3	Phosphorus as PO_4	Sulphur as SO_4	Ca	K	Mg	Fe	Mn	Zn	B	Cu
mg/kg	ND	ND	ND	567	172	565	ND	ND	ND	ND	ND
kg/ha*	ND	ND	ND	1106	335	1102	ND	ND	ND	ND	ND

Ammonium - N (NH_4): **ND mg/kg**

Nitrate - N (NO_3): **mg/kg**

Total Available Nitrogen: **mg/kg**

Category	Description	Probability of response to a nutrient addition
Excessive	Potential phytotoxic response. No nutrient addition required. Drawdown is recommended.	<2
High	Nutrient level is more than adequate and luxury consumption may be occurring.	5-30
Sufficient	The most desirable category. Nutrient additions are appropriate for most plants.	30-60
Low	Potential "hidden hunger", or subclinical deficiency.	60-90
Deficient	Growth is likely to be severely depressed and deficiency symptoms present.	>90

* Calculation for kg/ha is based on a Bulk Density of 1.3 and a soil depth of 150mm.

ND denotes Not Determined.

Method References:
pH, EC, Sol Cat, NO3, Al, Cl; Bradley et al (1983)
Exch Cat, ECEC; Method 15A1 Rayment and Higginson (1992)
PO4; Method 9E1 Rayment and Higginson (1992)
NH4, SO4, Fe, Cu, Mg, Zn; Method 83-1 to 83-5 Black (1983)

SUMMARY OF SOIL CHEMISTRY

pH	EC	Sodicity (ESP)	Ca:Mg	Ca % of eCEC
Medium acidity	Very low	Moderate sodicity	Low - magnesic	Low

RECOMMENDATION

Phosphate Retention Index: 44.60 % Medium
2232.0 mgP/kg 4352.4 kg/ha to 150mm

For the purpose of onsite effluent disposal report, this soil shows medium acidity and very low salt content. The soils ability to absorb phosphorus is medium, and at 150mm the soil can absorb a reasonable amount, increasing the longevity of the effluent disposal system.

The soil chemistry is unbalanced, with low calcium and high potential aluminium toxicity. This can be improved with the above additions of lime and gypsum.

If any further assistance is required please contact me at the office on 9980 6554.

Consultant: Ryan Jacka

Authorised Signatory: Simon Leake

Report Date: 26 Nov 2007

Signature - required for Final Reports

Record ID: 1

Date: 26/11/2007 Sample Name: 200965-01 (0-300mm) Sample No.: 2 Batch No.: 4949

ATTACHMENT 3

PROPOSED EFFLUENT DIPOSAL AREA (FIGURE 2) - SITE AND SOIL ASSESSMENT RATING AND SITE-SPECIFIC RECOMENDATIONS

In order to establish the requirements necessary to dispose of effluent on-site, physical and chemical properties of the soil, together with other on-site constraints were compared to a recognised standard, the Site and Soil assessment rating (Table 1) from the Environment and Health Protection Guidelines (1).
Those criteria highlighted by shading indicate in broad terms the existing conditions relevant to this site.

Table 1A: Site Assessment Rating for On-site Systems

Site Feature	Relevant System	Minor Limitation	Moderate Limitation	Major Limitation
Flood Potential	All land application systems	Rare. Above 20 year ARI	Occasional	Frequent. Below 20 year ARI
	All treatment systems	Vents, openings, and electrical components above 1 in 100yr flood contour		Vents, openings, and electrical components below 1 in 100yr flood contour
Exposure		High sun and wind exposure		Low sun and wind exposure
Slope (%)	Surface irrigation Sub-surface Absorption system	0 – 6 0-10 0-10	6-12 10-20 10-20	>12 >20 >20
Landform	All systems	Hill crests, convex side slopes and plains	Concave side slopes and footslopes	Drainage paths and incised channels
Run-on and upslope seepage	All land application systems	None- low	Moderate (to be restricted by soil and water management devices	High. Diversion not practical
Erosion Potential	All land application systems	No signs	Some signs of erosion	Signs of erosion, eg. rills, mass movement and slope failure present
Site Drainage	All land application systems	No visible signs of surface dampness	Some indicators of poor drainage are present	Visible signs of surface dampness, such as moisture tolerant vegetation (sedges and ferns), and seepages, soaks and springs
Fill	All systems	No visible signs at the surface of fill material	Fill visibly present	
Buffer distance	*All systems* Surface irrigation Subsurface dripline irrigation	*Horizontal distance of 250m to domestic groundwater well.* *100 metres from permanent surface waters (river, streams, lakes etc), 40 metres from farm dams, intermittent waterways and drainage channels.* - 6 metres if up-gradient and 3 metres if down-gradient of driveways, property boundaries, and buildings. 15m from the dwelling. 3 metres to paths & walkways. 6 metres to swimming pools. - 6 metres if up-gradient and 3 metres if down-gradient of swimming pools, property boundaries, driveways and buildings.		Buffer distances not available
Land Area	All systems	Sufficient & appropriate land available.		Sufficient & appropriate land not available
Rocks and rock outcrops (% of land surface containing rocks >200mm diameter)	All land application systems	< 10%	10 - 20%	> 20%
Geology / Regolith		No major discontinuity nor fractured subsoil present.		Major discontinuity & fractured subsoil present.

(1) Department of Local Government et al (1998) *Environment & Health Protection Guidelines - On-site Sewage Management for Single Households.*

Table 1B: Soil Assessment Rating for On-site Systems (1)

Soil Feature	Relevant System	Minor Limitation	Moderate Limitation	Major Limitation	Restrictive Feature
Depth to bedrock/shale or hardpan (m)*	Surface Irrigation Sub-surface Irrigation	> 1.0	0.5 - 1.0	< 0.5	Restricts plant growth (trees), excessive runoff, waterlogging
	Absorption	> 1.5	1.0 – 1.5	<1.0	Groundwater pollution hazard. Resurfacing hazard
Depth to high episodic/seasonal watertable (m)**	Surface Irrigation Sub-surface Irrigation	> 1.0	0.5 - 1.0	< 0.5	Groundwater pollution hazard. Resurfacing hazard
	Absorption	>1.5	1.0 - 1.5	<1.0	Potential for groundwater pollution
Soil permeability Category	Surface Irrigation Sub-surface Irrigation	2b, 3 & 4	2a, 5	1 & 6	Excessive runoff, water-logging, percolation
Coarse Fragments	All land Applications	0 - 20%	20 - 40%	> 40%	May restrict plant growth, affect trench installation
Bulk density*	All land Applications	Not limiting		Limiting	Restricts plant growth, indicator of permeability
pH ($CaCl_2$)***	All land Applications	> 6.0	4.5 - 6.0	<4.5	Reduces optimum plant growth
Electrical Conductivity (dS/m) ****	All land Applications	< 4	4 – 8	> 8	Excessive salt may restrict plant growth
Sodicity (Exchangeable Sodium Percentage ESP)*	Surface & Subsurface Irrigation (0-40cm) Absorption system (0-1.2m)	0-5	5-10	>10	Potential for structural degradation
Cation Exchange Capacity (CEC) (cmol/kg)*	Surface Irrigation Sub-surface Irrigation	> 15	5 – 15	< 5	Unable to hold plant nutrients
Phosphorous Sorption (kg/ha) for 0 – 100cm*	All land Applications	>6000	2000 - 6000	<2000	Unable to immobilise any excess P
Modified Emerson Aggregate Test** (dispersiveness)	All land Applications	Class 1, 5, 8	Class 2	Class 3, 4	Potential for structural degradation

* Estimate only

** Not assessed.

***Based on Field pH

****Potential salinity levels were estimated based on the presence or absence of visual indicators of salinity.

(1) Department of Local Government et al (1998) *Environment & Health Protection Guidelines - On-site Sewage Management for Single Households.*

SITE-SPECIFIC MANAGEMENT REQUIREMENTS

Based on the above assessment, onsite limitations to effluent disposal should be ameliorated by the following site-specific management strategies:

- **SLOPE** – Slope within effluent disposal areas must not exceed the following thresholds:
    - Surface Effluent Irrigation = 10%
    - Subsurface Effluent Irrigation = 15%

  Should slope within the proposed effluent disposal area exceed the above limits that it will be necessary to undertake benching (cut and fill) to achieve the above limits, or less.
- **SOIL STRUCTURAL STABILITY AND DISPERSIVENESS.** The application of effluent with high levels of sodium may reduce the structural stability of soil in the disposal area. Thus it is recommended that washing products with low sodium levels be used by the property occupier. Further, to ameliorate potential dispersion the AS/NZ 1547:2000 recommends that application of gypsum to disposal areas. An initial application of gypsum at a rate of 300g/sqm should be applied and incorporated into the topsoil horizon prior to commissioning. In addition, for subsurface effluent irrigation it is recommended that additional gypsum be applied at a nominal rate of 100-200 g/sqm into excavated trenches prior to back filling;
- **PH.** Onsite soils are moderately acidic. To ameliorate this limitation agricultural lime should be applied to topsoil horizon at a rate of 50g per m^2 and incorporated into the topsoil (surface 150mm) horizon prior to commissioning of effluent disposal areas;
- **RAINFALL SURFACE FLOW CONTROL –** Cut-off drains or bunding (earth mound or raised garden bed) should be installed upslope of the proposed effluent disposal area and designed to divert surface water around the effluent disposal area. Cut-off drains are not required where there is no potential for inundation by surface waters, such as on catchment boundaries or with raised garden beds;
- **NUTRIENT MANAGEMENT –** Effluent disposal areas should contain a well maintained lawn that is regularly mown with the grass clipping removed. Removal of grass clippings reduces nutrient accumulations within effluent disposal areas; and
- **AWTS MANAGEMENT:** Refer to AWTS system manufacturer for AWTS management requirements.

ATTACHMENT 4

- Aerated Wastewater Treatment System (AWTS) Suggested Effluent Quality Specifications

The onsite sewage management system to be installed must comply with the performance criteria referred to in Clauses 44 and 45 of the Local Government (General) Regulation 2005.

The required effluent quality, validation and monitoring requirements are to be determined by the consent authority (i.e. Council) and are to be issued as part of the 'Licence to Operate an Onsite Sewerage Management System'.

Suggested effluent quality[1] for the proposed exposure risk (i.e. medium) as outlined by DWE (2007) is presented in Table 1.

Table 1. Summary of recommended effluent quality for a medium exposure risk category (DWE, 2007).

Quality Parameter	**Compliance value**
Thermotolerant Coliforms (T. coli)	< 10 cfu per litre
Biological Oxygen Demand (BOD_5)	< 20 milligrams per litre
Suspended Solids	< 30 milligrams per litre
pH	6.5 – 8.5
Turbidity	< 5 NTU (95%ile)

Furthermore, the AWTS to be installed must demonstrate test average total nitrogen and phosphorus values equal to or less than those values outlined in Table 2:

Table 2. Summary of recommended effluent total phosphorus and total nitrogen levels in treated wastewater (i.e. effluent) prior to irrigation. These nitrogen and phosphorus values were used for design sizing purposes i.e. nutrient loading calculations:

Effluent Quality Parameter	**Concentration**	**Failure Indicator**
Total N (Nitrogen)	<10.94 mg/L	>10.94
Total P (Phosphorous)	<12 mg/L	>12.0

Notes:

1) Total N = TKN (Total Kjeldahl Nitrogen) + TON (Total Oxidised Nitrogen).
2) Total N and Total P represent mean concentration values
3) Total N values are based on advice from Envirocycle. Should the mean N concentration exceed the failure indicator, the irrigation sizing should be adjusted accordingly.
4) Total P mean concentration values were estimated from Table 14 in the Environment & Health Protection Guidelines[1]. Should the mean P concentration exceed the failure indicator, the irrigation sizing should be adjusted accordingly.

Furthermore, the AWTS must have a capacity to treat as a minimum the Estimated Daily Wastewater flow as indicated in the main body of this report and have capacity deal with peak loads.

[1] Based on Tables 7.1 (page 39) of the DWE (2007) guideline.

ATTACHMENT 5

- Shallow sub-surface drip irrigation – System requirements

The required irrigation system which will receive treated effluent from the AWTS will consist of a shallow, pressurized, subsurface irrigation system. Pipes are to be buried at an approximate depth of 100mm.

This system must comply with the requirements outlined in Appendix 4.5C of the AS/NZ 1547:2000[1] Standard and be installed in accordance with current best practice (i.e. the AS 3500 Plumbers Code of Practice).

The use of standard garden fittings on irrigation equipment is not permitted. Fittings and pipework to be used for effluent irrigation should conform to AS2698 (Plastic Pipes & Fittings for Irrigation and Rural Applications).

[1] Standards Australia/Standards NZ (2000) *AS/NZS 1547:2000 Australian/New Zealand Standard – On-Site domestic wastewater management.* Standards Australia/Standards NZ

ATTACHMENT 6

Determination of minimum effluent irrigation area required based on nutrient loadings
Location : Nelson Road, Nelson
Wastewater Sources: Proposed temple
revised 25/02/2008

Nitrogen loadings

*Parameters

Q (wastewater flow rate L/day)	=	4107
Lx (critical loading rate mg/m^2/d)	=	25
C (conc. Of N in treated wastewater mg/L)	=	10.94

EIA required based on nitrogen loadings is **1797** square metres.

Phosphorous loadings

*Parameters

Phosphate Retention Index (PRI) (g P/kg)	=	2.2232
Critical loading rate of phosphate (mg/m^2/day)	=	3
Conc. of phosphate in treated wastewater (mg/L)	=	12
Wastewater flow rate L/day	=	4107

Results

Phosphorous sorption capacity=	33348	kg/ha
Phosphate adsorbed	1.1114888	kg/m^2
Phosphate uptake	0.055	kg/m^2
Phosphate generated	899.433	kg

EIA required based on phosphorous loadings is **771** square metres.

* Calculations based on formula detailed in the Environment and Health Protection Guidelines 1998.

ATTACHMENT 7

WATER BALANCE

IRRIGATION AREA DETERMINATION BASED ON THE NOMINATED AREA METHOD

(formula derived from the Environment & Health Protection Guidelines 1998)

Location : BAULKHAM HILLS COUNCIL AREA - NELSON

Rainfall Station Richmond (RAAF) 50th percentile (Bureau of meteorology weather station #67033)

Evaporation Station Richmond (RAAF) Mean (Bureau of meteorology weather station #67033)

Design Wastewater Flow	Q	l/day	4107
Design percolation*	R	mm/wk	15
Land Area	L	m^2	**1776**

*Based on a soil permeability category of 6A

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Days in Month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation	P	-	mm/month	75.6	78.4	74.8	45.3	29.4	32.7	24.4	21.2	30.5	53	61.8	56.2	583.3
Evaporation	E	-	mm/month	195.3	151.2	136.4	99	65.1	54	62	96.1	129	167.4	177	217	1549.5
Crop Factor	C	-		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	
Inputs																
Precipitation	P	-	mm/month	75.6	78.4	74.8	45.3	29.4	32.7	24.4	21.2	30.5	53	61.8	56.2	583.3
Effluent Irrigation	W	(Q x D)/L	mm/month	71.7	64.8	71.7	69.4	71.7	69.4	71.7	71.7	69.4	71.7	69.4	71.7	844.2
Inputs	I	P + W	mm/month	147.3	143.2	146.5	114.7	101.1	102.1	96.1	92.9	99.9	124.7	131.2	127.9	1427.5
Outputs																
Evapotranspiration	ET	E x C	mm/month	136.7	105.8	95.5	69.3	45.6	37.8	43.4	67.3	90.3	117.2	123.9	151.9	1084.7
Percolation	B	R/7 x D	mm/month	66.4	60.0	66.4	64.3	66.4	64.3	66.4	66.4	64.3	66.4	64.3	66.4	782.1
Outputs	O	ET + B	mm/month	203.1	165.8	161.9	133.6	112.0	102.1	109.8	133.7	154.6	183.6	188.2	218.3	1866.8
Storage	S	I - O	mm/month	-55.8	-22.7	-15.4	-18.9	-10.9	0.0	-13.7	-40.8	-54.7	-58.9	-57.0	-90.4	-
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Cum Storage	M	-	mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-

STORAGE	V	M(max)		0.0

ATTACHMENT 8

- Effluent Disposal Area Buffer Distance Requirements

Positioning of the effluent disposal areas must comply with the following buffer distance requirements:

System	Buffer Distance
All land application systems[1]	- 100 metres to permanent surface waters (e.g. river, streams, lakes etc) - 250 metres to domestic groundwater well - 40 metres to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation[1]	- 6 metres if area up-gradient and 3 metres if area down-gradient of driveways and property boundaries - 15 metres to dwellings - 3 metres to paths and walkways - 6 metres to swimming pools - 1m vertical height to a permanent or temporary water-table.
Surface drip and trickle irrigation[1]	- 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, property boundaries, driveways and buildings. - 1m vertical height to a permanent or temporary water-table.
Subsurface irrigation[1]	- 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, property boundaries, driveways and buildings. - 1m vertical height to a permanent or temporary water-table.
Absorption Systems[1] (primary treated effluent)	- 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, driveways and buildings. - 12 metres if area up-gradient and 6 metres if area down-gradient of property boundaries. - 1m to an effluent disposal area - 1m between absorption beds
Absorption Systems (secondary treated effluent, stormwater, and poolwater[2])	- 6 metres if area up-gradient and 3 metres if area down-gradient of swimming pools, driveways, buildings and property boundaries. - 1m to an effluent disposal area. - 1m between absorption beds

- Refer to Attachment 3 for site-specific management requirements; and
- Avoid compaction of the disposal area during construction of improvements.

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[1] Department of Local Government et al (1998) *Environment & Health Protection Guidelines. On-site Sewage Management for Single Household*

[2] Based on accepted industry practise.

ATTACHMENT 9

Public Information Brochures from the Environmental and Health Protection Guidelines[1]

[1] Department of Local Government et al (1998) *Environment & Health Protection Guidelines. On-site Sewage Management for Single Households.*

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.

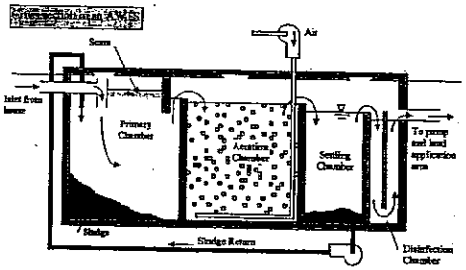
What is an AWTS?

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.

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.

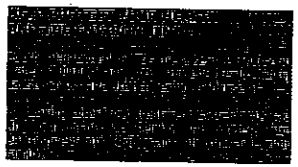
Warning signs

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:

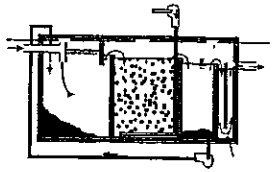
- Water that drains too slowly.
- Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- Sewage smells, this indicates a serious problem.
- Water backing up into your sink which may indicate that your system is already failing.
- Wastewater pooling over the land 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.



If you would like more information please contact:

Your Aerated Wastewater Treatment System



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.

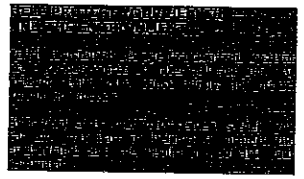
DON'T

- ✗ 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

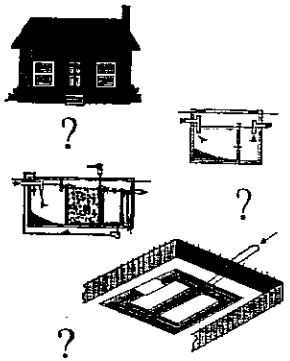
Reducing water usage will lessen the likelihood of problems such as overloading with your septic system. Overloading may result in wastewater backing up into your house, contamination of your yard with improperly treated effluent, and effluent from your system contaminating groundwater or a nearby waterway.

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.



For more information please contact:

Managing Wastewater In Your Backyard



DON'T

- ✱ Don't put large quantities of bleaches, disinfectants, whiteners, nappy soakers and spot removers into your septic tank 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 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 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 septic 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.

Warning signs

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

Look out for the following warning signs:

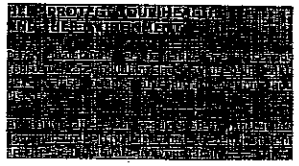
- ⚠ Water that drains too slowly.
- ⚠ Drain pipes that gurgle or make noises when air bubbles are forced back through the system.
- ⚠ Sewage smells, this indicates a serious problem.
- ⚠ Water backing up into your sink which may indicate that your septic system is already failing.
- ⚠ Wastewater surfacing over the land application area.

Trouble shooting guide

If there are odours check the following areas:

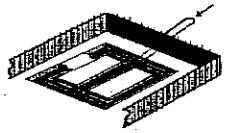
- ∧ Greasetrap (if installed), is it full or blocked?
- ∧ Absorption field, is it wet or soggy?
- ∧ Has there been recent heavy rain?

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



If you would like more information please contact:

Your Septic System



SEPTIC SYSTEMS

In unsewered areas, the proper treatment and reuse of household wastewater on-site is critical in ensuring minimal impact to public health and the environment. Septic systems have been developed as a way of achieving this.

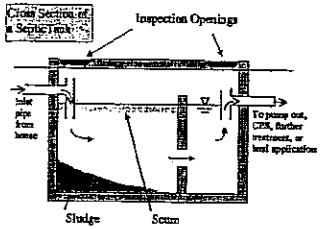
What is a septic system?

A septic system consists of a septic tank combined with a soil absorption system and/or transpiration beds or pump out connections. The system enables people living in unsewered areas to treat and disperse their sewage.

A septic tank is a structurally sound watertight tank used for the treatment of sewage and liquid wastes from a single household or multiple dwellings.

How does a septic system work?

All the wastewater from a household enters the tank. Most of the solids settle to the bottom and are retained in the tank forming a sludge layer, whilst fats and greases collect at the top in a scum layer.

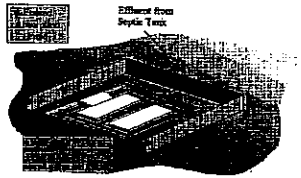


Bacteria in the septic tank break down the solid matter in the sludge and scum layers. Material that cannot be fully broken down gradually builds up in the tank and must be pumped out periodically.

There are three ways to handle septic tank effluent:

On-site application. The effluent flows from the septic tank to transpiration and/or absorption trenches. Here the effluent is mainly absorbed into the soil and partly evaporated by the sun and used by vegetation.

Such application systems have the potential to contaminate groundwater and are not recommended in sensitive locations or in higher density developments. Further treatment followed by subsurface irrigation should be considered.



Pump out. The effluent flows from the septic tank into a collection well or holding tank. At regular periods, a tanker pumps out the holding tank and transports the effluent to an off-site management facility.

Common effluent system (CES). The treated wastewater is transported to an off-site management facility through a network of small diameter pipes.

Regulations and recommendations

An on-site septic system requires approval from the local council before it is put in place. The regulations that apply to single household systems differ from those for multiple dwellings. The Environment Protection Authority (EPA) is responsible for approving septic tanks used to treat wastes generated by multiple dwellings like caravan parks and commercial and industrial premises. The NSW Department of Health determines the design and structural requirements for septic tanks and collection wells.

Local councils have the authority to approve systems certified by the NSW Department of Health for individual properties and ensure the systems do not have adverse impacts on health and the environment. Local councils are responsible for ensuring that the approved system is installed according to specifications and any special conditions, and is maintained and serviced correctly. You should consult your local council on the regulations that apply to you.

Care of the septic tank is only a part of the maintenance of your septic system. Management of the treated wastewater from your septic system is your responsibility and is discussed in the pamphlet "Your Land Application Area". Heavy fines may be imposed if the effluent is managed improperly.

Maintaining your septic system

The effectiveness of the system will, in part, depend on how it is operated and maintained. The following is a guide on how to achieve the most from your system.

DO

- ✓ Have your septic tank desludged every three years to prevent sludge build up, which may 'clog' the pipes and absorption trenches.
- ✓ Have your septic tank serviced annually by contractors to check scum and sludge levels, and the presence of blockages in the outlet and inlet pipes.
- ✓ 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 septic system and land application area.
- ✓ Check household products for suitability for use with a septic tank.
- ✓ Use biodegradable liquid detergents, such as concentrates with low phosphorous.
- ✓ Ensure your tank is mosquito-proofed.
- ✓ Conserve water.

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?

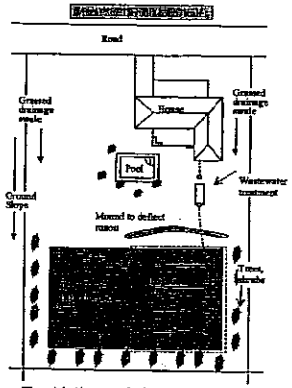
Treated wastewater applied to a land application area may be utilised or simply disposed, depending on the type of application system that is used. The application of the wastewater can be through a soil absorption system (based on disposal) or through an irrigation system (based on utilisation).

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:

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:

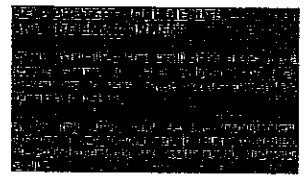
- ⚠ surface ponding and run-off of treated wastewater
- ⚠ soil quality deterioration
- ⚠ poor vegetation growth
- ⚠ unusual odours

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.



For more information please contact:

Your Land Application Area