ON-SITE SEWAGE MANAGEMENT IN RURAL NSW DO EPA GUIDELINES APPLY?

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Abstract

As part of its development of an On-Site Sewage Management Strategy, Dungog Shire commissioned a survey of 60 on-site sewage management units. Transpiration beds were the most common system (42% of total). These beds typically averaged 146 m^2. Boggy soils and green plumes were evident in 33% of systems. Inadequate bed size was compounded by shallow soils, septic tanks that needed desludging, and by stormwater run-on. Aerated wastewater treatment systems (AWTS) were most common in new rural residential subdivisions (23% of systems inspected). Only 1 of the 14 AWTS inspected had a green plume suggesting failure. Owners avoid surface ponding by moving the sprinklers around their gardens.

Stream water quality below villages suggested that on-site sewage has little impact on faecal coliform or nutrient concentrations in the shire's waterways. Faecal contamination in village gutters was however extremely high. This result suggests contamination from on-site sewage systems is more likely to be a public health rather than an environmental health issue.

Council has based its On-site Sewage Management Strategy on a combination of AS/NZS 1547:2000 and the 'Silver Book' (DLG, 1998). Council decided upon two Development Control Plans (DCP). The first DCP is for new systems within single established properties. It emphasises public health, and relies on soil type and hydraulic loading based approach to determining the size of the disposal area. The second DCP is designed for subdivisions. In addition to the soil and hydraulic loading approach, this DCP requires a minimum block size of 3 300 m^{2}if an AWTS is used and 1.5 ha if transpiration systems are utilised. Risk assessment is used to determine the frequency of inspections.

Key words

AWTS, faecal contamination, transpiration beds

1 Introduction

Dungog Shire is a local government area about 50 km north of Newcastle. The shire contains numerous villages that are not sewered but have reticulated water. Housing blocks in the villages are typically less than 1000 m^2. Frequently there is less than 100 m^2 available for sewage disposal. Often the residents have very limited financial resources, making significant improvements to their disposal system unlikely.

The Wallis Lake oyster contamination scare in 1997 has increased public awareness of the risks associated with inadequate management of sewage. Additionally the State Government has increasingly made regulation of on-site sewage systems the responsibility of Council. Dungog Shire Council arranged the preparation of a Management Strategy for On-site Sewage Systems.

This strategy required:

- An assessment of on-site management of sewage in the shire,
- An assessment of the current and potential impacts of on-site management of sewage on human and environmental health; and
- The development of a DCP to provide guidance for Council and residents in installing and managing on-site sewage processing systems.

This paper describes the strategy development and the resulting DCPs.

2 Survey of On-site Sewage Management

In October 2000, 60 on-site sewage systems were inspected. The condition of each system was determined with respect to type, size, number of people using it. Each system was assessed for its potential to impact on human and environmental health. The results are tabulated in Table 1.

Table 1. Types of treatment systems utilised in Dungog Shire (n=60) (All systems had primary treatment in septic tanks).

Type of system	Pumpout	Absorption trench	Transpiration	AWTS	End of pipe (i.e. straight from tank onto ground surface).	Ponds
Number inspected	3	8	25	14	9	1
Typical use	Schools, Gresford CED & Hotel	Largely single person dwellings	Largely installed when water supplied to villages	More common with families and newer homes & rural residential	Most common in rural properties, especially rented ones	Motel site
Number of sites where wastewater is surface ponding or running off the site						
Rural	0	0	1	0	6	0
Town	1	0	2	0	2	0
% Failure based on presence of runoff or pools	33%	Zero	12%	Zero	89%	Zero
Number of sites where green plumes only were evident	1	Zero	5	1	Zero	Zero
% failure (pools or plumes)	33%	Zero	33%	7%	89%	Zero

Table 1 shows transpiration beds are the most common form of wastewater disposal. Some 12% of these had free water on their surface, while 33% had either free water or green plumes extending from the disposal area. One of the 14 (i.e. 7% of total number of systems inspected) of the AWTS had a green plume extending from the disposal area, but there was no evidence of surface ponding.

Table 2 Site limitations based on risk factors identified in the survey (Risk criteria derived from Dept Local Gov, 1998 and AS/NZS 1547-2000).

Site feature	Type of system	Minor limitation	Moderate limitation	Major limitation	Remediation and site specific comments
Flood potential	All except pumpout	55 out of 60 sites	Public toilets near waterways. Some homes near streams	None	Keep 40 m from stream line if possible
Exposure	All except pumpout	Not an issues at most sites.		Could be an issue in highland valleys. But area is sparsely settled.	Develop disposal area in sunny locations.
Slope %	AWTS	<6%-19 sites	5 sites	>12% 1 site	Install diversion or terraces
	Subsurface	<10% 30 sites	2 sites		
Run-on [1]		49	7	1	
Erosion		56	6	0	Ensure thick vegetation
Poor drainage	Not an obvious problem in dry weather. Poor drainage related more to undersized transpiration beds.				
Fill	Not obvious. Some systems built on terraces to reduce runoff				
Buffer distances	A major problem in urban areas where side slope deposits contaminated runoff into neighbours. EPA suggests average perimeter buffer of 4.5m. This leaves a centre 5 to 10m strip of an urban backyard creating a 30 to 80 m^2disposal area.				
	>100 m from rivers, >40 m from dams	42	15	3	Maximise application area. Convert to AWTS when practical. Disinfection essential.
Land area available for wastewater disposal	All the transpiration areas in town blocks are too small				
Rocks & soil depth	Shallow soils most obvious around Clarencetown				

1. Run-on refers to external water entering the disposal site. Diversion banks are essential to prevent this.

Table 2 shows the frequency of different site limitations for on-site management of sewage in Dungog Shire. The most common problem was the size of the disposal area. Most blocks in the villages are below 1 000 m^2, with approximately 700 m^2 being common. Much of the typical block is covered with a dwelling, associated sheds, paths and gardens. Often there is only 100 to 200 m^2 available for effluent disposal. There is little opportunity for 'rest' areas and it is almost impossible to have any wet weather storage. Additionally the villages have commercial enterprises such as butcher shops, cafes, hotels and other holiday accommodation. These enterprises can generate highly variable sewage volumes. This variation can seriously interfere with efficient operation of on-site systems.

Although owners of AWTS appear to have reasonable understanding of system management , the small irrigation areas in villages and the consequent need to move sprinklers greatly increases the potential for contact with effluent and for runoff into neighbouring properties during wet weather. Adequate disinfection is considered critical.

None of the systems surveyed met the criteria set out in the current guidelines - 'Environmental and Health Protection Guidelines: On-site Sewage Management for Single Households' (DLG , 1998).

3 On-Site Sewage Management Impacts On-Stream Water Quality

Major streams in the Dungog Shire arise in forested mountains then proceed through dairying and beef grazing country. Villages occur in the mid-catchment area. Water quality data provided by Hunter Water Corporation (unpubl. data) showed faecal contamination is greatest in agricultural areas (Table 3). Sampling below villages showed minor increases in nitrogen and phosphorus concentrations. Chlorophyll *a* concentration did increase markedly in the lower catchment, however, this sampling site was a weir pool where quiescent water would be conducive to algal blooms.

Table 3. 50% Exceedance for Various Contaminants in the Upper, Middle and Lower portions of the Dungog Catchment[1])

Concentrations of various contaminants in the streets of unsewered villages are also shown.

Site	Faecal coliforms (cfu / 100 mL)	Nitrogen (mg/L)	Phosphorus (mg/L)	Chlorophyll a (ug/L)
Upper catchment (below grazing area)	220	0.50	0.045	0.35
Middle catchment (downstream of villages)	48	0.57	0.058	0.53
Lower catchment	14	0.60	0.058	6.14
Runoff in village gutters	11,673	2.08	0.38	Not recorded

[1] Percentile exceedance is the percentage of samplings that a particular concentration is exceeded. For example the faecal coliform population in the upper catchment contains 220 or less faecal coliforms per 100 ml in 50% of samples.

Sampling within unsewered villages showed runoff water was severely contaminated, especially with faecal coliforms. Some of this could have been from domestic animals, however, significant faecal contamination has been identified in other studies of surface water within unsewered villages, e.g. Jambaroo and Oakdale, (R Tuft, in Sydney Water, 1999).

These results suggest agricultural activities were more significant contributors to waterway contamination than villages. This result is consistent with the findings of the Healthy Rivers Commission Report for the Williams River (1998) which suggested on-site sewage systems contributed less than 7% of the total phosphorus load in the river. Faecal contamination of surface water within villages is, however, severe, creating a potential health hazard.

4 Council's management of on-site sewage systems

4.1 New subdivisions

Techniques derived from Jellife (1998) were used to determine the number of transpiration beds and AWTS that were 'sustainable' per ha. This approach considers the likely contaminant production from different on-site sewage management systems, the risk of failure of different systems, the 'acceptable' concentrations of contaminants in the receiving waters and the potential for contaminants from on-site systems to reach the waterways. The modelling indicated one transpiration bed per 1.5 to 2.5 ha was sustainable. It also showed one AWTS per 0.33 to 0.5 ha was 'sustainable'. These results suggest systems based on transpiration beds contribute 5 times the contamination load of AWTS. Our observations in the Dungog area, presented above, indicate transpiration beds and absorption trenches are more likely to fail than AWTS, and this results in runoff of highly contaminated effluent. The sustainable number of units per ha is used to set the minimum block size for subdivision in unsewered areas.

The size of the disposal area within the block is determined from a combination of the soil and hydraulic loading approach in AS/NZS 1547:2000 (Standards Australia and Standards New Zealand) and the site assessment protocols in DLG (1998) . Table 4 shows the guideline disposal area requirements as presented in the DCP. These disposal area requirements assume six people in the dwelling and moderate limitations due to soil type and landscape position. Applicants can seek variations if valid reasons are presented.

Table 4. Acceptable Disposal Area for Wastewater Disposal Systems.

Disposal System	Suitable soils	Unsuitable soils	Assumed conditions	Minimum size required
Absorption trench	Subsoils from sandy loams to light clay	Subsoils of gravel and sands and medium to heavy clays	4mm/day infiltration maximum of 6 people in the dwelling (180 L/person/day) Trench width is 0.6m, walls are 0.8m	=(180*6) (4*(0.6+0.8+0.8)) or 112m long.
Evapo-transpiration/ absorption/ seepage	Subsoils from loams to heavy clay	Gravels to light loams	5mm/day infiltration maximum of 6 people in the dwelling (180 L/person/day)	=(180*6) 4 or 270 m^2
Mound systems	Sandy loams to clays (Gypsum needed for structure)	Gravels, sands and loamy sands	6m wide mound. 4mm/day infiltration maximum of 6 people in the dwelling (180 L/person/day) application of a minimum of 1 kg of gypsum m^{-2} of the mound base during construction is essential.	=(180*6) (4*6) or 6m wide by 45m long.
Irrigation systems	Surface soils ranging from sands to heavy clay (provided structure in maintained)	Impermeable rocks shallow sites.	15mm/week maximum of 6 people in the dwelling (180 L/person/day, 6090L/week)	=180 * 6 * 7 15 =504 m^2. (A resting area of another 500 m sq is recommended)

4.2 On-site sewage management for existing buildings

The discussion above suggests the main threat of on-site sewage systems is likely to be to public health rather than to environmental health. Council therefore decided the focus for on-site sewage management in villages should be on:

1. ensuring either subsurface disposal of primary treated sewage with no return of contaminated wastewater to the surface;

or

2. adequate disinfection followed by well managed surface irrigation.(Irrigation systems must be subsurface unless the water is from an aerated wastewater treatment system with a certified, and operating disinfection system delivering water with contamination of less than 20 faecal coliforms/100 ml).

Approvals to Operate have been issued to all applicants. Council now is inspecting all systems within the Shire. AWTS will be included in the initial inspection, but subsequently, Council will largely rely on reports from service companies.

Owners of failing systems (e.g. systems with obvious surface ponding and runoff or death of plants in disposal area) will be required to undertake improvements to meet acceptable standards. Additionally all systems will be classified on the basis for risk of failure in the future. High risk systems will be inspected annually while lower risk systems will receive random, less frequent inspections, averaging twice per decade.

High risk criteria are:

1. Site assessment as per AS/NZS 1547-2000 and Environment & Health Protection Guidelines (DLG, 1998) shows at least one major limitation to use;
2. The site is less than 2000 m^2 and is adjacent to similarly sized blocks;
3. The current disposal area is inadequately sized as defined in Table 4; and
4. The site has capacity for more than 15 people.

Low risk criteria are:

1. Site assessment as per AS/NZS 1547:2000 and Environment & Health Protection Guidelines (DLG, 1998) shows minor to moderate limitation to use;
2. The site has an adequately installed and maintained AWTS. Or the site has a minimum transpiration or trench size as specified in Table 4;
3. The disposal area is well defined and kept separate by a minimum of 20 m from any site development;
4. A combination of site location, and appropriate drainage diversion prevents run-on to the disposal area;
5. The property is at least 4000 m^2if utilising an AWTS and 1.5 ha if based on a transpiration bed, with the dedicated disposal area at least 100 m from permanent surface water, 250 m from domestic groundwater wells and bores, and 40 m from other waters; and
6. The site has eight or fewer people utilising the system.

5 Conclusions

Dungog Shire Council has developed a series of DCPs and Management Strategies to meet its obligations to manage on-site sewage systems within its Local Government Area. The DCPs and Strategies are based on AS/NZS 1547:2000 and Environment & Health Protection Guidelines (DLG, 1998). However, effluent disposal areas on many existing allotments are too small, and some systems result in surface ponding and runoff. A combination of inspection, public education and pressure for improvements to failing systems is proposed.

6 References

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