ACT ENVIRONMENT AND HEALTH
WASTEWATER REUSE GUIDELINES

April 1997

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1. INTRODUCTION

1.1 Background

There is increasing recognition of the need to make more efficient use of available water supplies. While the discharge of suitably treated effluent to the river system is important for the maintenance of environmental flows from the ACT, the beneficial reuse of treated wastewater is encouraged to minimise demand on potable water supplies and off-stream diversions which may adversely affect aquatic ecosystems.

In the ACT, effluent reuse trials commenced in 1977 when chlorinated effluent from the Fyshwick Sewerage Treatment Plant was first used to irrigate a selection of RMC Duntroon playing fields. More recently, trials have commenced which aim to assess the potential for reusing treated domestic wastewater around the home for irrigation and for toilet flushing. The irrigation of Southwell Park using wastewater "mined" from a nearby trunk sewer and treated to meet high levels of public health and environmental standards, represents another recent wastewater re-use initiative.

These guidelines, which promote practices to minimise the risk to public health and the environment, have been developed in response to the initiatives outlined above and in anticipation of an increase in proposals to implement similar schemes.

1.2 Objectives of Guidelines

The objectives of these guidelines are to:

- promote the more effective and efficient use of available water resources through facilitating the beneficial use of wastewater; and
- in so doing ensure public health and environmental protection concerns are fully addressed.

1.3 Scope of Guidelines

The ACT wastewater guidelines:

- identify some possible uses for treated wastewater;
- provide treated wastewater quality guidelines for the protection of human health and the environment;
- recommend treatment levels, safeguards and controls;
- describe best environmental management practices for reuse systems;
- stipulate the need for sound monitoring programs; and

- outline the statutory approvals required to implement a wastewater reuse system.

These guidelines acknowledge that acceptable water quality requirements must be very carefully established. Too little emphasis on water quality requirements will lead to situations of unacceptable impact, while too stringent requirements will make treatment costs commercially non viable.

1.4 Wastewater Sources

Wastewater is defined as liquid wastes normally collected in a sewer system and processed in a treatment plant. Wastewater from residential areas comprises two components, blackwater which is toilet discharge and greywater which is shower washing machine and kitchen sink discharge.

For the purposes of these guidelines, wastewater sources are restricted to sewage from:

- sewer lines servicing individual blocks where treatment, disinfection and re-use occurs on site;
- trunk sewers where water can be extracted for treatment in a package treatment plant to meet significant local demand;
- final ponds in sewage treatment plants; and
- the treated effluent from sewage treatment plants which may otherwise be discharged to receiving waters.

Grey water such as that from laundry washing, bathing and showering is a particular class of wastewater and its reuse is gaining popularity. Currently best management practices aimed at minimising health and environmental risks associated with grey water reuse are being developed and will eventually be incorporated into these guidelines.

Wastewater does not include stormwater.

The suitability of industrial wastewaters for reuse and associated treatment requirements are industry specific. The limited industrial base of the ACT and the complexities of defining acceptable treatment requirements places the reuse of industrial wastewaters beyond the scope of these guidelines.

1.5 Wastewater Uses

While these guidelines focus on reuse for irrigation, effluent guidelines and recommended treatments are provided for some other uses in Table 1.

Table 1 Health Guidelines for Effluent Reuse[1]

Type of Reuse	Suggested Level of Treatment	Reclaimed Water Quality[2]	Monitoring[3]	Controls/Notes
Municipal irrigation, dust suppression, ornamental water bodies - uncontrolled public access	Secondary + Pathogen reduction by disinfection, ponding or filtration	Thermotolerant coliforms < 10 cfu/100ml - median value with four of five samples containing less than 40 cfu/100ml ≥1 mg/L Chlorine residue after 30 mins or equivalent level of pathogen reduction. [4] pH 6.5 - 8.0 (90% compliance)	Weekly Daily Weekly	Systems using detention only do not provide reduction of thermotolerant coliform counts to <10 per 100ml and are unsuitable as sole means of pathogen reduction for high contact uses. **Note: Thermotolerant coliforms value is to be reviewed for the** ARMCANZ, ANZECC, NH&MRC **Guidelines on which this Table is based in view of the fact that the standard for primary contact recreation is 150cfu/100ml**
Municipal irrigation, dust suppression - controlled public access Pasture and fodder Horticulture	Secondary + Pathogen reduction by disinfection or ponding Secondary Secondary	Thermotolerant coliforms < 1000 cfu/100ml - median value with four of five samples containing less than 4000 cfu/100ml	Monthly	 Grazing only where no ponding remains. Fodder crops to be dried or ensiled.
Pasture and fodder for dairy cattle	Secondary + Pathogen reduction by disinfection or detention in ponds or lagoons	Thermotolerant Coliforms < 200 cfu/100ml - median value with four of five samples containing less than 2000 cfu/100ml OR < 10 cfu/100ml - median value with four of five samples containing less than 100 cfu/100ml pH 6.5 - 8.0 (90% compliance)	Weekly Weekly	Withholding period 5 days No withholding period **Note: Thermotolerant coliforms value is to be reviewed for the** ARMCANZ, ANZECC, NH&MRC **Guidelines on which this Table is based c/-standard for primary contact recreation is 150cfu/100ml**
Residential: Garden watering Toilet flushing Car washing Path /wall washing	Secondary + Filtration + Pathogen reduction	Thermotolerant coliforms < 10 cfu/100ml - median value with four of five samples containing less than 40 cfu/100ml ≥1 mg/L Chlorine residue after 30 mins or equivalent level of pathogen reduction.[4] pH 6.5 - 8.0 (90% compliance)	Weekly Daily Weekly	Plumbing controls **Note: Thermotolerant coliforms value is to be reviewed for the** ARMCANZ, ANZECC, NH&MRC **Guidelines on which this Table is based in view of the fact that the standard for primary contact recreation is 150cfu/100ml.**

Table 1 Continued

Type of Reuse	Suggested Level of Treatment	Reclaimed Water Quality	Monitoring[3]	Controls/Notes
Silviculture, turf and non food crops	Secondary			Restricted public access. Withholding period 4 hours.
Food crops in direct contact with water eg sprays	Secondary + filtration + Pathogen reduction	Thermotolerant coliforms< 10 cfu/100ml - median value with four of five samples containing less than 40 cfu/100ml ≥1 mg/L Chlorine residue after 30 mins or equivalent level of pathogen reduction.[4] pH 6.5 - 8.0 (90% compliance)	Weekly Daily Weekly	
Food crops not in direct contact with water (eg flood or furrow) or which will be sold to consumers cooked or processed	Secondary + pathogen reduction	T Coliforms < 1000 cfu/100ml - median value with four of five samples containing less than 10000 cfu/100ml pH 6.5 - 8.0 (90% compliance)	Monthly Monthly	
Ornamental waterbodies - restricted access	Secondary	Thermotolerant coliforms < 10,000 cfu/100ml	Monthly	Surface films absent
Aquaculture Non-human food chain	Secondary Maturation ponds (5 days retention)	< 10,000 Thermotolerant coliforms/100ml TDS <1000mg/L	Weekly	
Aquaculture Human food chain	Secondary + Filtration Pathogen reduction	T Coliforms < 10 cfu/100ml - median value with four of five samples containing less than 40 cfu/100ml ≥1 mg/L Chlorine residue after 30 mins or equivalent level of pathogen reduction. [4] pH 6.5 - 8.0 (90% compliance)	Weekly Daily Weekly	Toxicants, dissolved oxygen and salinity controls may be required.

1 Source:-NWQMS*Guidelines for Sewerage Systems - Use of Reclaimed Water*, ARMCANZ, ANZECC, NH&MRC, 1996.

2 Thermotolerant coliforms are synonymous with Faecal coliforms.

3 These are the recommended maximum monitoring regimes only. The adoption of best management practices, demonstrated effluent quality and the risk to public health will be taken into account by the relevant authorities to determine the level of monitoring required.

4 Chlorine residual of ≥1 mg/L after 30 mins of chlorine contact ensures adequate disinfection. Where there is the potential to discharge to receiving waters effluent should be either dechlorinated or held until chlorine residual degrades to <0.5 mg/L.

Table 2 Environmental Guidelines for Effluent Reuse - Irrigation[1]

Parameter	Effluent Standard	Effluent Monitoring	Notes/Impact Monitoring
Nutrient levels	Nutrient loads should be balanced with plant requirements	Initial and periodic monitoring of effluent for P and N is required.	Nutrient balance calculations should be carried out pre-commissioning to determine the fate of nitrogen and phosphorus. (See Text) Elevated nutrients in groundwater may render the groundwater unsuitable for stock and domestic water supplies. Nitrate is a health risk to humans at 10mg/L and animals at 30mg/L. Groundwater should be monitored annually for nitrate to detect infiltration.
Total Dissolved Solids Electrical Conductivity	500 mg/L 800µs/cm	Initial and periodic monitoring for TDS or EC is required.	Without leaching and drainage, salts may be redistributed towards the soil surface by the upward movement of water associated with evaporation. Thus, periodic monitoring of top metre of soil for levels of soil salinity is required, particularly within the root zone areas. Groundwater should also be monitored periodically.
Sodium Adsorption Ratio	< 6	Initial and periodic monitoring SAR is required.	The structure of the clay in the soil can be damaged when the applied effluent contains more sodium than calcium or magnesium. Permeability and aeration problems can occur when irrigation water has an SAR above 6. A combination of high pH, high salinity with a SAR less than 6 can also cause soil damage. Monitoring of soil structure should be carried out annually to detect deterioration which may be caused by effluent irrigation.
Biochemical oxygen demand	Organic load should be at a rate of ≤40kg/ha/day	Initial and periodic monitoring of BOD is required.	High organic loading may lead to a reduction in the infiltration capacity of the soil. Monitoring of organic matter and soil structure should be carried out annually to detect deterioration which may be caused by effluent irrigation.
Acidity (pH units)	6.5-8.5	Initial and periodic monitoring of effluent pH is required.	Soil pH affects the availability of nutrients to plants. Groundwater should be monitored annually to detect changes in pH.
Chlorine residual	< 0.5mg/L where runoff is likely to enter receiving waters	Monitoring required only if there is a potential to discharge to receiving waters	Where runoff is likely to enter receiving waters, effluent should be either dechlorinated or held until the chlorine degrades from the recommended level for disinfection to <0.5mg/L.
Heavy metals/restricted substances	See Table 3	Monitoring required only if effluent is derived from industrial estates.	Monitoring of soils and groundwater required only if effluent is derived from potential sources of metals such as industrial estates.

1Source:The Utilisation of Treated Effluent by Irrigation , EPA NSW, 1995.

2. EFFLUENT QUALITY

2.1 Health requirements

Effluent Guidelines

Effluent guidelines for the protection of public health are outlined in Table 1 and include:

- thermotolerant coliform levels as an end point bacterial indicatorof faecal contamination;
- final disinfection chlorine residual and/or biocide contact time; and
- physical and chemical water quality that minimises conditions favourable to regrowth of pathogenic micro-organisms and nuisance slimes.

Levels of Treatment

Table 1 provides suggested levels of treatment which are a means of achieving acceptable endpoint microbiological and chemical safety guidelines. The guidelines recognise that technologies are evolving rapidly and that there is a need to encourage treatment innovation. Assurances of adequate treatment should be established by:

- demonstrated performance against microbiological criteria through monitoring as determined by the relevant authorities; or
- demonstrating that treatment processes are satisfactory to achieve the desired water quality outcomes (some initial and ongoing monitoring would still be required).

2.2 Environmental requirements

Effluent guidelines for environment protection are summarised in Table 2. The constituents of treated sewage effluent which may impact on the environment are discussed below.

Nutrients

The nutrients present in effluent which are most likely to be utilised by plants are nitrogen, phosphorus and potassium. Since full utilisation of nutrients is the goal of effluent irrigation schemes, the need to remove nutrients from effluent at the treatment stage is dependent on the potential to accumulate to unacceptable levels in soils, or impact significantly on receiving waters.

Nitrogen may be present at concentrations ranging between 10 to 50 mg/L in a variety of chemical forms: organic, ammonia, nitrate and nitrite. Any excess nitrogen in irrigation water may be carried through the soil to the water table. Elevated nitrogen levels may render groundwater unsuitable for stock and domestic water supplies. Nitrate is a health risk to humans at more than 10 mg/L and animals at more than 30 mg/L.
Phosphorus concentrations in treated sewage effluent are normally up to 10 mg/L. Application at this rate should be advantageous agronomically without

causing overloading problems. However, this should be evaluated on a case by case basis.

Potassium in sewage effluent is usually present at concentrations which are too low for optimum plant growth.

The rate of application of nutrients in irrigated effluent should be determined prior to irrigation. In conducting a mass balance for nutrients, the amount of the specific nutrient considered to be applied in the effluent per year should be compared with the amount taken up by biological or physical processes associated with the crop/soil system. Normal fertilising regimes would be reduced for irrigated playing fields or pasture to take advantage of the nutrient content of wastewater.

Salinity

The Total Dissolved Solids value of effluent is an important determinant of its suitability for land application. Municipal sewage effluents usually contain around 500 mg/L of TDS (or an electrical conductivity of approximately 800 μS/cm), and their application to land usually has limited impact on soil salinity levels if a moderate amount of leaching occurs.

With each effluent application, the salt concentration in the root zone progressively increases. Without the downward water flow associated with leaching and drainage, salts may be redistributed towards the soil surface by the upward movement of water in the soil associated with evaporation.

Thus, the effective operation of a viable, lasting effluent irrigation system requires periodic monitoring of the levels and distribution of soil salinity, particularly within the root zone areas.

Sodium Adsorption Ratio

Sodium is particularly important in irrigation because it can have adverse effects on soil structure and plant growth. The structure of the clay in the soil can be damaged when the applied effluent contains significantly more sodium than calcium or magnesium. The sodium adsorption ratio (SAR) as shown in the following equation defines the relationship of these three elements.

$$SAR = \sqrt{\frac{Na^{+}}{(Ca^{++}/2 + Mg^{++}/2)}}$$

Where Na = sodium concentration (meq/L) = (mg/L in effluent)/22.99

Mg = Magnesium concentration (meq/L) = (mg/L in effluent)/(24.32 × 0.5)

Ca = calcium concentration (meq/L) = (mg/L in effluent)/(40.08 × 0.5)

Permeability and aeration problems can occur when irrigation water has an SAR above 6. The SAR for typical municipal effluents seldom exceeds a value of 5 to 8. For the majority of *NSW* soils, effluent with a SAR value of less than 8.0 and an electrical conductivity value of less than 500μS/cm is likely to be safe. However, soil damage may occur at low SAR when combined with high pH and salinity. Monitoring of soil structure should be carried out periodically to detect deterioration which may be caused by effluent irrigation.

Biological Oxygen Demand

While organics in effluent when applied at an appropriate rate can revitalise soil fertility, continued overloading of organic matter may physically clog soil pores and favour anaerobic microbiological populations in the soil. Organic loading rates may influence liquid loading rates and the length of the resting period between applications required to permit re-aeration of the soil.

An organic loading rate of 40 kg/ha/day BOD is recommended as the maximum organic loading for most soils.

pH

Soil pH affects the availability of nutrients to plants. Effluent within the range of 6.5 to 8.5 is acceptable for irrigation.

Suspended Solids

The concentration of suspended solids should be such that it does not cause operational problems with irrigation schemes.

Metals

Although some metals are essential for plant growth, many are toxic at high concentrations. Metals are only of concern if effluent is derived from potential sources such as industrial estates. The following maximum concentrations of metals in irrigation waters have been developed.

TABLE 3: Maximum Concentration of Metals in Irrigation Waters[1]

Element	Tot Conc mg/L	Element	Tot Conc mg/L
Aluminium	5.00	Arsenic	0.10
Beryllium	0.10	Cadmium	0.01
Chromium	0.10	Cobalt	0.05
Copper	0.20	Iron	1.00
Lead	0.20	Lithium	2.50
Manganese	0.20	Mercury[2]	-
Molybdenum	0.01	Nickel	0.20
Selenium	0.02	Zinc	2.00

1 Source:- ANZECC (1992)
2 No guideline recommended at this time.

Topsoil concentrations of heavy metals and trace elements should be in accordance with the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites,* ANZECC & NHMRC, 1992.

Organic Compounds

Persistent and harmful pesticides such as organochlorine pesticides (OCs) and herbicides such as 2,4-D, 2,4,5-T and their derivatives are banned in the ACT and as such are not of concern. Pesticides and herbicides which are available in the ACT are unlikely to enter the sewer system and in any case would be bound to the sludge and organic matter. Organic compounds such as phenols and surfactants are usually present in sewage effluent at low concentrations.

Petroleum hydrocarbons, which are the most common hydrocarbon contaminants of wastewater in the ACT apart from oil and grease, are largely removed by wastewater treatment.

3. BEST MANAGEMENT PRACTICES

3.1 Health Related Safeguards and Controls

Plumbing

Where reclaimed water is piped to the site where it is to be used, there is a risk that the reclaimed water pipe could be mistaken for a potable water supply and cross connection could occur. To minimise the risk of cross connection and backflow the following measures are recommended:

- plans for the maintenance of complete pipeline system;
- appropriate pipeline identification;
- education of owner and operator(s); and
- surveillance of operation and inspection of modifications to the reclaimed water system.

If potable water is supplied into the reclaimed water system as make-up water, an approved air gap meeting the requirements of AS 3500 must be installed in the potable supply at the point where it enters the system.

To protect the potable supply from backflow in the event of a cross connection, the reclaimed water system should be operated at a lower pressure than the potable system where practicable. Pressure taps should also be provided to permit in situ testing for correct operation.

All pressure piping used for the reclaimed water system must be readily identifiable and distinguishable from potable water piping an the same site. Pipes and taps should be colour coded deep purple and/or marked with the words ***Reclaimed Water - NOT FOR DRINKING*** and connected to hoses by non standard fittings. They should also display the recommended International Public Information-Drinking Water Symbol with the Prohibition Overlay (ISO) Standard 7001 plus appendum.

For above ground installations, non potable water services should not be installed within 100 millimetres of parallel potable water supply. Below ground installations of non-potable water services should not be installed within 300 millimeters of any parallel water supply. Where reclaimed water is provided to residential areas as a piped non-potable supply, the minimum inspection frequency of the reclaimed water system should be:

- all new services at installation;
- all services on change of ownership; and
- all services following completion of property extensions or plumbing modifications.

Irrigation Systems

Although an effluent has a low count of thermotolerant coliforms and is disinfected, this does not necessarily imply the absence of bacterial, protozoan and viral pathogens. Systems are therefore recommended where practical which minimise human contact such as sub-surface irrigation, particularly where there is uncontrolled public access. However, the additional cost and the inflexibility of these systems needs to be considered.

Where above-ground irrigation is adopted, sprinklers which produce coarse droplets and not a fine mist should be used to minimise the risk of aerosol dispersion by wind drift.

For effluent which is not suitable for public access, spray irrigation systems should be surrounded by vegetative buffer zones and should not be sited in proximity to dwellings, public roads and parks. In general, a buffer zone of 50 metres for aerosols and 20 metres for low rise sprays should be provided around the perimeter of the site. Alternatively, irrigation could be carried out at night. Care should be taken to prevent surface flow or seepage into neighbouring properties.

Storage

Where reclaimed water may be unsuitable for use due to treatment failure or the normal reclaimed water application is not available, there is a need for the system operator to have available alternative storage and/or disposal options of adequate capacity. Care should be taken to prevent septicity taking place in the storage tanks or ponds. Disinfection may be required prior to use. Storage requirements are also discussed in Section 3.3.

3.2 Environment Protection Related Safeguards and Controls

Although treated effluent may meet the appropriate public health guidelines for application, there is a the potential for environmental harm to occur, particularly as a result of nutrients and salts finding their way into receiving waters and a build up of salts in the soil. Best management practices need to be adopted to reduce the likelihood of environmental harm. These practices will vary according to different circumstances.

The following factors need to be taken into account in determining the suitability of the site and the irrigation system:

- Proposed or existing land use;
- Site features including;
  - topography;
  - drainage characteristics including proximity to waterbodies;
  - depth to groundwater;
  - soil permeability;
  - vegetation;
  - public access and proximity to dwellings;
- Water balance for the site;
- Storage provisions for periods of wet weather when the soil is saturated;
- Nutrient balance assessment for the site (see section 2.2); and
- Appropriate design, installation and maintenance requirements for such systems.

Site Selection

Topography

Slopes up to 15 percent are acceptable for pasture irrigation, provided runoff and erosion are strictly controlled. Steep slopes can be used for plants such as trees and vines which are trickle irrigated. Retention banks may need to be built to prevent runoff from the site. Diversion drains upslope may be required to control stormwater onto the site.

Proximity to Waterbodies

The site should be least 500 metres from any surface water which is used as a domestic supply. The distance from natural watercourses will depend on the quality of the effluent, slope and permeability of the site.

Groundwater

Maintenance of a minimum depth of about three metres to groundwater is normally necessary to maintain aerobic conditions in the soil and prevent surface waterlogging.

Groundwater must be protected from contamination by irrigated effluent. Of particular concern is the potential contamination by nitrogen compounds, salts and toxic contaminants. The following points provide examples of appropriate groundwater protection approaches:

- Where they are agronomically viable, trickle systems provide more protection to groundwater than other irrigation systems because they involve the application of much lower volumes of effluent per unit area of land.
- Irrigation should normally be on a moisture deficit basis. A program to monitor soil water content combined with strategies to suspend irrigation when soil moisture content is high is desirable.
- The presence of one or more impervious geologic strata (eg a thick layer of compacted clay) above the groundwater aquifer may prevent deep percolation from reaching the aquifer.
- In the absence of protective geologic strata, reliance may be placed on an adequate depth to the normal groundwater table. On deep, moderately permeable soils, several metres may be required.

Baseline groundwater monitoring should be established to enable deterioration of groundwater quality to be detected.

Soil

Ideally soil should be medium grained, moderately permeable and well structured. Clay soils may be difficult to manage because of their low infiltration capacity and low hydraulic conductivity. These difficulties may be compounded by dissolved salts including sodium ions in the effluent. Sandy and gravely soils may also present some difficulties. Their infiltration capacity and permeability may be so high that effluent applied is not retained long enough for effective plant use and result in rapid movement to groundwater.

Soil depths in excess of 1.5 metres throughout the site are preferred to provide for the efficient utilisation of applied effluent. Lesser depths may be acceptable where shallow rooted pasture plants are cultivated.

Soil percolation rate needs to be taken into account when determining a suitable irrigation rate (see Table 4 below). Soil percolation should be determined in accordance with Australian Standard AS 1547-1994.

TABLE 4: Soil Percolation - Irrigation Rate

Soil Percolation Rate mm/hour	Corresponding Soil Permeability m/day	Irrigation rate L/m^2 day
<15	<0.06	Not Suitable
15	0.06	2.5
20	0.08	2.8
30	0.12	3.3
40	0.16	4.2
50	0.2	5.6
100	0.4	6.4
150	0.6	7.5
>500	>3.0	Not Suitable

Water Balance - Irrigation Area

The minimum area required is determined by calculating the area required for acceptable loading of each parameter (hydraulic, organic, nutrient or other parameters in Table 2) and selecting the largest of these areas.

The irrigation area based on the acceptable hydraulic loading should be calculated based on the average monthly rainfall and evapotranspiration rate and take into account soil percolation rate. The water balance in Table 5 is expressed as follows:

Maximum Effluent Rate (MER)= Evapotranspiration - Net Rainfall

TABLE 5: AVERAGE IRRIGATION REQUIREMENTS FOR THE ACT

MONTH	Aver mthly Rainfall (mm)	Aver mthly Evap (mm)	Crop Factor	Average Evapo-Trans (mm)	Average Irrig needs (mm)	Litres Per Ha (per mth)
January	63	252	0.95	239	176	1764000
February	55	200	0.9	180	125	1250000
March	54	170	0.85	145	91	905000
April	51	107	0.8	86	35	346000
May	49	68	0.7	48	0	0
June	38	46	0.55	25	0	0
July	42	52	0.55	29	0	0
August	46	80	0.65	52	6	60000
September	51	112	0.75	84	33	330000
October	66	158	0.85	134	68	683000
November	64	193	0.95	183	119	1193500
December	53	250	1	250	197	1970000

Nurient and organic loadings should be based on the irrigation demand (Table 5) and the concentrations of these parameters in the effluent as follows:

LOAD (Kg/day) = (Litres per Ha/mth*Concentration in Kgs)/ No of days in mth

Effluent should not be applied if soil moisture conditions are such that surface runoff or ponding is likely to occur. Irrigation of effluent should only be carried out under dry weather conditions.

Good irrigation practice requires well defined rest periods within the program to provide an opportunity for the applied water to be evapotranspired, and for soil micro-organisms to break down the organic matter contained in the effluent.

Runoff from the catchment above the irrigation area may need to be diverted to reduce discharge from the site, and the area to be irrigated should ideally be as level as possible.

Storage Requirements

Irrigation is not required at times when rainfall is sufficient to meet soil moisture deficit. Wet weather storage is required in effluent irrigation schemes because the amount of effluent produced by treatment plants cannot usually be varied in response to wet weather conditions. Storage is also usually required for effluent generated in the cooler months when low evapotranspiration rates restrict the full-scale application of effluent.

Monthly precipitation and evaporation data should be analysed to determine how often there may need to be a temporary reduction or cessation of effluent irrigation and the resultant storage requirements.

The site planned for storage lagoons should be carefully investigated and adequately designed to prevent seepage losses (eg lined with compacted clay, synthetic membranes) and maintain adequate freeboard.

It should be remembered that when effluent containing nutrients is stored for long periods there is a likelihood that algal blooms will develop. In such situations, all humans and animals should be excluded from contact with the water. Irrigation with the effluent should stop at once. The Health Protection Service should be notified for further advice.

Storage is not required where sewer mining is on a demand basis with the option of diverting the effluent to the sewer system during periods when irrigation is not required.

Storage may also not be required in circumstances where the quality of effluent is such that an authorisation may be obtained to discharge to receiving waters as required.

Irrigation Methods

All irrigation pipework and fittings in the system should comply with AS 1477 or AS 2698.2 - *Plastic pipes and fittings for irrigation and rural applications.* Irrigation systems to be permanently fixed with distribution pipelines buried at least 100mm. A typical sub-surface irrigation system is described in AS 1547-1994.

Environmental concerns can be minimised by ensuring schemes have inbuilt safety features such as cut off systems to prevent irrigation during storms and when there is no moisture deficit in the soil. Sub-surface systems in particular require a monitoring system to detect blockages.

Performance Monitoring

The appropriate monitoring regime will be determined by the relevant authorities and will depend on the reliability of the treatment process, the method of irrigation and the risk to public health and the environment.
Monitoring regimes in Table 1 which are consistent with the draft national guidelines are the maximum recommended where there may be a risk to public health. However, demonstration that treatment processes are satisfactory and that best management practices are maintained is an acceptable alternative to regular monitoring. Initial and periodic monitoring may be required to establish effluent quality and the reliability of the treatment process.

Table 2 provides guidance on monitoring which addresses environmental concerns specific to wastewater reuse. Initial and periodic monitoring of soil and groundwater is required to determine if there is any deterioration in quality as a result of wastewater reuse. The following practices should also be adopted:

- maintenance of records of monitoring data which should be made available for review by relevant authorities on request; and
- the utilisation of laboratories with demonstrated reliability and quality of analysis for analysis of samples to ensure the accuracy of monitoring data.

4. APPROVALS PROCESS

4.1 Planning

All proposals involving infrastructure will require formal construction approval through the Development Application (for non-residential area) or Building Application (residential area) process. Applications may also require formal assessment of potential environmental impacts under Part IV of the *Land (Planning and Environment) Act 1991.*

4.2 Environment Protection

A person installing or proposing to install a wastewater reuse scheme with a capacity in excess of three megalitres per year or in circumstances where the environment management authority is concerned that there is a risk of environmental harm, is required to hold one of the following:

- An environment agreement with the Authority; or
- A current environmental authorisation for the activity.

In developing the environment agreement the person must have regard to the following:

- These Wastewater Reuse Guidelines; and
- Environmental values as outlined in the Territory Plan where there is a potential for runoff to enter receiving waters.

In setting conditions for an environmental authorisation, the Authority will consider the same matters listed above.

4.3 Health

The applicant should apply in writing to the Health Protection Service, ACT Department of Health and Community Care for approval of any wastewater reuse system. The application should include information as described under section 4.4 of this guideline.

Prospective applicants are advised to discuss their proposal with the Health Protection Service on (06) 2051700 before submitting the application.

4.4. Information Required To Assess Effluent Irrigation Proposals

The following information should be provided in circumstances where an assessment of the environmental and health impacts of a wastewater irrigation system is required.

- A detailed description of the treatment process including a layout plan design capacity.
- Performance specification including the quantity, rate and quality of the effluent produced. Data will be required to substantiate expected quality from the treatment system. This may be obtained from an existing system or similar systems elsewhere in the case of a proposed new system.

- Information on effluent quality should be provided for the following parameters:
  - . Thermotolerant coliforms
  - . Total Phosphorus
  - . Total Nitrogen
  - . Sodium Absorption Ratio
  - . Acidity (pH)
  - . Total Dissolved Solids
  - . Turbidity
  - . Biological Oxygen Demand
- A preliminary description of the health and environmental impacts of the proposed system.
- Details of safeguards and controls that are required under this guideline.
- A description of the irrigation system.
- A description of the site to be irrigated including the following:
  - . proposed or existing land use;
  - . area;
  - . topography;
  - . drainage patterns including proximity to waterbodies;
  - . depth to groundwater;
  - . soil permeability; and
  - . public access.
- A water balance for the irrigation site including rainfall and evapotranspiration;
- A nutrient balance for the irrigation site.
- Storage provision for periods of wet weather when the soil is saturated.
- Details of performance monitoring regime.
- Any other information required to assess the proposal as necessary.

5. BACKGROUND DOCUMENTATION

Guidelines for Sewerage Systems - Use of Reclaimed Water, Agriculture and Resource Management Council of Australia and New Zealand - Australian and New Zealand Environment and Conservation Council - National Health and Medical Research Council, 1996.

Guidelines for the Utilisation of Treated Effluent by Irrigation, New South Wales Environment Protection Authority, *1995*.

New South Wales Guidelines for Urban and Residential Use of Reclaimed Water, NSW Recycled Water Coordination Committee, 1993.

Code of Practice for Domestic Wastewater, Victorian EPA, 1995

Australian Standard (AS 1547-1994), *Disposal systems for effluent from domestic premises.*

Effluent Irrigated Plantations: Design and Management, CSIRO, 1995.