NSW HEALTH

Greywater Reuse in Sewered Single Domestic Premises

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CONTENTS

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1 Introduction

Greywater is composed of variable quantities of components of wastewater which may come from the shower, bath tub, spa bath, hand basin, laundry tub, clothes washing machine, kitchen sink and dishwasher. Greywater therefore is those components of sewage which do not come from a toilet or urinal. Greywater contains impurities and micro-organisms derived from household and personal cleaning activities. Because of the high potential of greywater to contain pathogenic micro-organisms and other materials, it is considered by health authorities to be a potentially infectious and polluting liquid waste material which people normally want to eliminate from the inside of their homes. It is an accepted practice and community expectation in sewered areas that wastewater is drained to a sewer to promote sanitation and hygiene in the home.

Good quality drinking water in many areas of NSW is becoming a scarce commodity. Additional demands will be placed on limited water supplies as populations increase and there may be little scope to expand water supply catchments, particularly for large metropolitan areas. Domestic greywater from single sewered premises may also be considered to be a potential resource and may be reused on-site for ornamental garden and lawn watering, toilet flushing and laundry use depending on the type of greywater and its level of treatment. This reuse practice may reduce the demand on high quality water more suited for drinking and domestic purposes. However, because greywater contains pathogenic organisms and chemical pollutants it is essential that greywater reuse practices adequately protect public health, be consistent with the principles of ecological sustainable development and does not decrease the amenity of the local community.

Many communities and individuals already practice greywater reuse. Some people reuse greywater wisely but many reuse greywater poorly such as by bucketing bath water to the garden or diverting laundry washing machine water directly to a lawn where children and pets may be exposed to the greywater. Approaches are regularly made to NSW Health from householders who wish to install more sophisticated apparatus to facilitate greywater reuse and approaches have also been made by prospective manufacturers to market greywater diversion devices and greywater treatment systems. Reuse is often practiced without a clear understanding of the public and private health risks nor the environmental degradation that may be caused without properly designed land application systems for dispersal of greywater.

To reuse greywater sensibly it is necessary to install suitable equipment and land application systems. Therefore there will be a cost to homeowners to design, install and maintain reuse systems which protect public health and are ecologically sustainable. Such costs may be better directed, in the first instance, to items such as water conservation techniques and rain water harvesting for garden irrigation. As these items have less environmental and public health impacts than greywater reuse it is the first decision which should be considered both by individuals and the community.

For the purposes of this document there are two of types of greywater reuse practice.

- **Greywater diversion devices** which simply divert greywater (excluding kitchen wastewater) without storage or treatment.
- **Domestic greywater treatment systems** which collect, store and treat greywater (which may include kitchen wastewater) to a higher standard.

2 Scope

This document considers reuse of greywater in single domestic premises in sewered areas based primarily on public health considerations according to the characteristics of greywater. Environmental aspects are also considered. It does not specifically consider the design of land application systems which manage the application of greywater to land. Publications such as those listed in section 16 should be consulted for this purpose.

Conversely, in unsewered areas wastewater management from domestic premises must be considered in a holistic manner as there is no option to divert wastewater to the sewer if the land application system fails. Wastewater in unsewered areas therefore tends to be viewed from a different perspective rather

than as a resource which could be utilised. DLG 1998 should be consulted for greywater reuse in unsewered areas. Greywater reuse and management techniques presented in this document may still be relevant to unsewered areas.

In sewered areas, because wastewater is already discharged to a sewer, reuse is approached from a perspective of diverting greywater from an existing sewer to an often very limited land application system. The land area and the soil type may not be suitable for greywater reuse or only for very limited application.

3 Purpose

The purpose of this document is primarily to develop and articulate a public health viewpoint on domestic greywater reuse in NSW sewered areas. The target audience is principally those professionals involved in public health practice, policy development and administration in local government. It is they who will have the greatest input into the development and administration of sewage management strategies by their local authority and in the administration of the Local Government (Approvals) Regulation 1999; the legislation relevant to on-site wastewater management.
Householders who intend to recycle greywater may also find this document useful.

While there are other issues which could be considered, such as rainwater harvesting for garden irrigation and water conservation by using less drinking water, they are intentionally not covered. This document is not intended to be a manual, guideline or community education vehicle.

4 Definitions and Glossary

absorption - uptake of liquid into the soil

adsorption – increased concentration of molecules or ions on a surface, including exchangeable cations and anions on soil particles

blackwater - domestic wastewater (sewage) grossly contaminated with human excrement or discharges, or material grossly contaminated with human excrement or discharges, and includes wastewater arising from a toilet, urinal, bidet or bidette

BOD_5 (biochemical oxygen demand) – a measure of the dissolved oxygen required for the breakdown of organic material in the effluent; usually refers to a five day test which typically represents 70 – 80% of the total BOD in a sample; expressed in milligrams per litre (mg/L)

contamination - the presence of pathogenic micro-organisms

disinfection - a process which inactivates, kills or destroys pathogenic organisms but not their spores

domestic greywater treatment system (DGTS) - a system that collects, treats and disinfects greywater for re-use for toilet and urinal flushing, or for use in surface irrigation in dedicated non-trafficable areas or other land application systems

greywater (sullage) - domestic wastewater excluding toilet waste and may include wastewater arising from a hand basin, kitchen, bath, shower and laundry

greywater diversion device (GDD) - a device that diverts (or diverts and collects), and directs untreated greywater to a sub-surface irrigation area

immuno-compromised - the weakened status of the human immune system which makes a person more susceptible to infection

land application system – an ecologically sustainable method of applying treated or untreated wastewater to land which also does not cause an additional public health risk nor detracts from the local amenity of the area

Local Authority - also means the Local Government, the local council, or council

pathogenic - capable of causing disease in people

pollution – a substance when placed in the environment detracts or negatively alters the environment

sewage of a domestic nature– includes human faecal matter and urine and wastewater associated with ordinary kitchen, laundry and ablution activities of a household. It does not include the contents oif a pan, septic tank, cesspool or privy. Sewage is composed of all domestic wastewater (blackwater plus greywater)

spray irrigation - water in the form of low pressure droplets from a spray outlet applied to the soil

SS(suspended solids) – in wastewater analysis solids retained after filtration through a glass fibre filter paper followed by washing and drying at 105^{o}C, or by centrifuging followed by washing and removal of the supernatant liquid; expressed in milligrams per litre (mg/L)

sub-soil irrigation – this term is commonly used to denote utilisation of wastewater by trench method at a depth greater than 300mm below ground level

sub-surface irrigation – this term is commonly used to denote utilisation of wastewater by a method other than the use of trench, trickle or drip irrigation and which is commonly practiced at a depth between 100mm and 300mm below ground level

surface irrigation – water applied to the ground from above ground level

trickle or drip irrigation - water applied directly to a plant by spray, trickle or drip or to the soil below at least a 100mm layer of bark, wood chip or mulch

thermotolerant coliforms - (also known as faecal coliforms) aerobic and facultative anaerobic, gram-negative, non-spore forming, rod shaped bacteria, distinguished from non-faecal coliform organisms by incubation at 44.5^{o} C

treatment - a process which lessens the polluting or contaminating character of a wastewater

vectors - insects or animals, such as flies, mosquitoes or rodents, that are attracted to the putrescible organic material in wastewater and wastewater treatment systems, and that are capable of spreading disease

5 Greywater: Sources and Quantities

5.1 What is Wastewater?

Household wastewater (sewage) is also known as sewage and is divided into two distinct wastewater streams:

- blackwater is wastewater grossly contaminated by faeces or urine, i.e., the wastewater arising from a plumbing fixture designed to receive human excrement or discharges and includes a toilet, urinal, bidet and bidette; and
- greywater is wastewater which is not grossly contaminated by faeces or urine, i.e., the wastewater arising from a plumbing fixtures not designed to receive human excrement or discharges and includes bath, shower, hand basin, laundry and kitchen discharges.

5.2 What is Greywater?

Greywater is wastewater generated by the use of a:

- hand basin,
- shower,
- bath,
- spa bath,
- clothes washing machine,
- laundry tub,

- dishwasher and
- kitchen sink.

However, as explained below in 6.2, kitchen wastewater is generally unsuitable, without some form of treatment, for direct discharge to a land application systems. Other types of greywater may be suitable for direct application to a land application system.

5.3 How Much Greywater is Generated by Households?

The amount of wastewater generated by any household will vary greatly according to the dynamics of the household and is influenced by factors such as the number of occupants, the age distribution of the occupants, their lifestyle characteristics and water usage patterns. Some water usage surveys carried out in capital cities have identified an average wastewater flow of 586 litres per day per household. Other statistics for water usage types are contained in Table 1. Greywater represents about 68% of the total wastewater stream. When kitchen wastewater is also excluded the percentage of greywater becomes about 61%. It therefore appears that greywater represents a water resource provided that it can be managed in an environmentally responsible manner in accordance with ecologically sustainable development principles and that public health and the health of the household is protected.

Table 1: Approximate Percentage of Wastewater Generated in a Domestic Premises

Wastewater Type	Total Wastewater		Total Greywater	
	% Total	(L/day)	% Total	(L/day)
Toilet	32	186	---	---
Hand Basin	5	28	7	28
Bath / Shower	33	193	48	193
Kitchen	7	44	11	44
Laundry	23	135	34	135
Total	100	586	100	400

Because greywater generation varies so much it is important that each household determine how much greywater is generated before land application systems are designed and greywater diverted. There are sites on the internet which will help in this task, and references in section 16 which should be consulted.

6 Greywater Characteristics

The characteristics of greywater produced by any household will vary also according to the dynamics of the household and is again influenced by the factors of number of occupants, the age distribution of the occupants, their lifestyle characteristics and water usage patterns. Water is used as a medium to dilute and convey waste away from the occupants on the inside of the building and to flush the household plumbing fittings. Wastewater may have become contaminated in three ways due to the addition of waste material:

- the water is **contaminated by micro-organisms**, many of which may be pathogenic, i.e. cause disease;
- the water may be **polluted chemically** by dissolved salts such as sodium, nitrogen, phosphates and chloride or by organic chemicals such as oils, fats, milk, soap and detergents, which may provide food for micro-organism and plant growth; and
- the water may be **physically polluted** by particles of dirt, food, lint, sand, etc.

Once greywater has flowed beyond the building it may be considered as a resource capable of reuse.

6.1 How is Faecal Contamination Measured?

Thermotolerant coliforms are also known as faecal coliforms (expressed as colony forming units per 100 millilitres – cfu/100mL) and are a type of micro-organism which typically grow in the intestines of warm blooded animals (including humans) and are shed in their millions to billions per gram of faeces. When thermotolerant coliforms are detected in water, by a sample taken for laboratory analysis, it indicates recent faecal contamination from animals. In the case of greywater derived from a household wastewater system, the presence and elevated numbers of thermotolerant coliforms indicates the likely presence of human faeces and is therefore a gauge of the possible presence of pathogenic micro-organisms. An

absence of thermotolerant coliforms however, does not necessarily mean an absence of pathogenic micro-organisms as there may be pathogenic organisms present which are not associated with faecal material, eg food spoilage and food poisoning micro-organisms.

It is useful to bear in mind while reading the following sections that typical levels of thermotolerant coliforms found in raw sewage are in the order of 10^6 to 10^8 cfu/100mL and from 10^6 to 10^{10} cfu/100mL in septic tank effluent. (NOTE: 10^6 to 10^8 means 1,000,000 to 100,000,000 and 10^6 to 10^{10} means 1,000,000 to 10,000,000,000).

6.2 Kitchen Greywater

Kitchen wastewater is heavily **polluted physically** with food particles, oils, fats, and other highly pollutant waste and is often more pollutant than blackwater or raw sewage. It readily promotes and supports the growth of micro-organisms. Because of the solid food particles and because fats can solidify, kitchen wastewater may cause blockages in land application systems unless treated or removed from greywater.

Microbiologically, extremely high concentrations of thermotolerant coliforms ($2x10^9$ cfu/100mL) have been found in kitchen greywater but the more usual concentrations appear to be in the range of less than 10 to 10^6cfu/100mL. Such high levels are again indicative of raw sewage and on occasions kitchen greywater may be more contaminated with micro-organisms than raw sewage. The high thermotolerant coliform concentrations sometimes found in kitchen greywater is cause for concern and must be managed effectively to prevent disease transmission.

Kitchen greywater is **chemically polluted** as it also contains detergents and cleaning agents and where dishwashers are used the greywater is very alkaline from the detergent. Kitchen greywater may be harmful to soils by altering its characteristics in the longer term.

It is for these reasons of health and environmental risk that kitchen greywater is not to be reused nor diverted from the sewer. However, where kitchen greywater is to be reused it must only be used after treatment in a greywater treatment system.

6.3 Bathroom

The bathroom (hand basin, shower and bath) generates about 38% of the household wastewater flow (55% of greywater) and is considered to be the least contaminated type of greywater. **Microbiologically**, thermotolerant coliform concentrations have been assessed in shower and bath water to be in the range of 10^4 to 10^6 cfu/100mL. As people often urinate in showers and baths concern is often expressed about the increased health aspects of inappropriate disposal. While urine in a healthy person is sterile, some bladder infections may pass microorganisms in urine. However, the potential for these organisms to survive and cause infection is considered remote. The ammonia in urine is beneficial to plants but may harm the environment if not adequately dispersed. Wastewater from hand basins is more pollutant than bath or shower greywater. Soap is the most common **chemical contaminant** found in bathroom greywater and other common contaminants are from shampoo, hair dyes, toothpaste and cleaning chemicals. All of these contaminants are believed to adversely affect land applications systems and are difficult to remove from the wastewater. Biocidal soaps have little effect on reducing the bacterial load in greywater.

6.4 Laundry

Laundry wastewater represents about 23% of household wastewater (34% of greywater). Greywater from the laundry improves in quality from wash water to first rinse water to second rinse water. **Microbiologically**, thermotolerant coliform loads varied from 10^7 cfu/100mL when nappies were washed to 25 cfu/100mL for 2nd rinse water. Wash cycle water contains higher **chemical concentrations** from soap powders and soiled clothes (sodium, phosphate, boron, surfactants, ammonia, nitrogen) and is high in suspended solids, lint, turbidity and oxygen demand and if applied to land untreated can lead to environmental damage as well as posing a threat to public health.

1st rinse and 2nd rinse laundry greywater still contain a pollutant load and still pose a threat to public health, although greatly reduced. Also the laundry tub is sometimes used to irresponsibly and illegally dispose of harmful substances such as paints, solvents, pesticide and herbicide residues further

increasing the pollutant potential. Domestic pets which may often be washed in the laundry tub are a further source of contamination.

6.5 Swimming and Spa Pool Backwash Water

Swimming pool backwash water is highly concentrated in microorganisms, chemicals (such as body oils and cosmetics) and particulates such as powder residue, hair, lint and pool chemical residues. The amount of backwash water is difficult to estimate and is variable depending on the size of the pool, filter type and usage patterns. Mainly, because of the large surge volume, swimming pool backwash water is **not normally used in greywater recycling**.

6.6 Comparison to Raw Sewage and Blackwater

Raw sewage, blackwater and septic tank effluent are all forms of effluent which are directly and grossly contaminated with human excrement and therefore represent a public health threat. Sewage, blackwater and septic tank effluent are all managed by high level treatment before being released into the environment above ground level, and must be at least settled or filtered to remove solid particles before management by sub-soil land application in absorption trenches.

Raw sewage is usually directed, in metropolitan and urban areas, to a centralised sewage treatment plant for treatment and utilisation or disposal. Septic tank effluent is sewage which has been stored in a large vessel or tank and has turned septic, ie., all of the oxygen in solution has been consumed by the decaying process and the septic tank effluent becomes offensively smelly.

There are however, key differences between greywater and blackwater:

- greywater contains only about 1/10 of the nitrogen (nitrite and nitrate) as does blackwater;
- because blackwater (containing faecal material) is excluded from greywater there is a decreased load of faecal pathogenic organisms;
- the organic content of greywater decomposes more rapidly than blackwater and assimilation is assisted even further when greywater is reused by direct application in the root zone.

6.7 Effects of Storage

All forms of wastewater when stored will turn septic unless the wastewater is treated to a high standard. Similarly, when greywater is stored it will also turn septic giving rise to offensive odours and provide conditions for micro-organisms to multiply. Thermotolerant coliforms have been found to multiply by 10 to 100 times during the first 24 to 48 hours of storage before gradually declining. Significant levels of pathogens have been found in stored greywater after eight days. While it is unlikely for pathogens to grow in greywater the low infective dose (numbers of organisms need to cause disease) of some pathogenic micro-organisms are still of concern. Should the stored septic greywater be surface irrigated it will give rise to extremely offensive odours, provide conditions conducive to disease transmission and attract insect and rodent vectors. It is therefore concluded that greywater must not be stored, other than temporarily in a surge tank, unless adequately treated.

6.8 Treatment

Greywater diversion devices do not treat greywater. Depending on the greywater source, before greywater can be utilised directly into the soil it must, as a minimum, be coarse screened to remove materials that may clog pumps, block pipes or place too great a pollutant load in the soil for its treatment.

Various treatment processes may be used to treat greywater in greywater treatment systems depending on the method of greywater utilisation. Such processes include settling of solids, floatation of lighter materials, anaerobic digestion in a septic tank, aeration, clarification and finally disinfection. Treatment process only reduce the gross primary pollutant nature of wastewater. Secondary pollution may still occur because chemical components such as nitrates, phosphates, boron and sodium are not reduced.

6.9 Disinfection

Although disinfection is a treatment process it is often discussed separately. This is because disinfection is usually the last treatment process and is used to treat micro-organisms rather than pollutants. It depends on the prior treatment processes for its efficiency.

Disinfection is the process of inactivating pathogenic micro-organisms in wastewater. The disinfection process efficiency is measured by the analysis of thermotolerant coliforms, as an indicator of micro-organism contamination, and is discussed in section 6.1. Some pathogenic micro-organisms (eg *Cryptosporidium*) are resistant to disinfection and therefore caution still has to be exercised in managing greywater dispersal. Also, chlorine disinfection is variable in its effectiveness against different types of micro-organisms and this further reinforces the need to exercise caution when reusing greywater.

Some environmental conditions such as sunlight and drying also exhibit a disinfection effect. This effect however is minor and is negated by shade and irrigation at night.

Disinfection of wastewater will not be effective unless it is firstly treated to lower the biochemical oxygen demand and suspended solids to produce a clear effluent, low in organic matter. Disinfection must be performed where there is a likelihood that people and vectors may come into some contact with the treated greywater.

In the absence of disinfection the "barrier approach" is used to reduce risk where a barrier is placed between the effluent and people so as to prevent exposure. In this case the barrier is 100mm of soil. Untreated and undisinfected greywater must be reused by dispersal below ground level.

Manufactured domestic greywater treatment systems require accreditation by NSW Health. The document "Domestic Greywater Treatment Systems Accreditation Guideline" should be consulted for further details.

6.10 Greywater Reuse

Greywater contains solid particles which will cause land application system to block. Land application systems should have some type of on-line filter installed. Such filters will need frequent maintenance to ensure that greywater flow is not reduced significantly.

As greywater contains both microorganisms and nutrients for their growth, biofilms of microorganisms may develop on the inside of pipes and drippers used to distribute greywater. Biofilms may reduce the effectiveness of the distribution system and may even clog the distribution system when pieces of biofilm slough off.

Unless the correct dispersal piping system is chosen it is possible for plant roots to grow inside the pipes and cause blockages. Easily replaceable piping systems or those which inhibit microbial and plant root growth should be chosen.

As can be seen from the above discussion of greywater characteristics, greywater is both contaminated with micro-organisms and polluted with chemicals and particulates. Although generally not as contaminated as raw sewage greywater still presents a risk to public health. Disinfection is not efficient on untreated greywater so therefore the following greywater management dispersal practices must also be adopted.

Table 2: Suitable Greywater Reuse Application According to Treatment

Treatment	Greywater Reuse Application
Coarsely filtered untreated greywater (excluding kitchen greywater) – greywater diversion device	• sub-soil irrigation • sub-surface irrigation
Treated and disinfected greywater (to a standard of 20 mg/L BOD_5, 30 mg/L SS and 30 cfu thermotolerant coliforms / 100mL) – greywater treatment system	• sub-soil irrigation • sub-surface irrigation • surface irrigation
Treated and disinfected greywater (to a standard of 20 mg/L BOD_5, 30 mg/L SS and 10 cfu thermotolerant coliforms / 100mL) – greywater	• sub-soil irrigation • sub-surface irrigation • surface irrigation

treatment system	• toilet flushing • laundry use

7 Public Health Considerations

The health status of the household is usually reflected in the wastewater produced although a household enjoying good health will still excrete pathogenic micro-organisms which are part of the normal flora of the gut. Greywater is contaminated with human and animal excretions from bathing, food preparation and from clothes washing. All forms of greywater are capable of transmitting disease.

Disease transmission is principally through the faecal-oral route where the greywater may be directly ingested through contaminated hands, or indirectly ingested through contact with contaminated items such as grass, soil, toys, garden implements, and diversion or treatment devices while they are being serviced. Transmission may also occur through inhalation of irrigated spray, by penetration through broken skin, by insect vectors such as flies and cockroaches and vermin vectors such as rats and mice. Even household pets may transmit disease by tracking and carrying greywater into the home or when petted by children.

Ground water contamination and pollution may also lead to disease transmission. Contaminated drinking water aquifers may facilitate ingestion of pathogens when the water is used for drinking and other domestic purposes. Contaminated shallow spearpoint bores may be used for garden irrigation and cause disease episodes.

People vary in their susceptibility to disease. The young, elderly and immuno-compromised are more susceptible than the general population while some people may pass pathogenic micro-organisms without showing any symptoms of the disease.

As the number of persons in a community served by a centralised wastewater management facility increases so does the risk of transmission. This is because the diversity (number of the types) of pathogenic micro-organism load increases with the population. The same applies to a community increasingly served by on-site wastewater management systems such as greywater treatment devices. Such a risk to health should be recognised as a cumulative impact of installation or development. Therefore, to reduce the risk of transmission, all reused greywater must be totally contained within the boundaries of the premises.

Care must be taken to ensure that there is no cross connection between the greywater reuse system and the water supply so that drinking water is not inadvertently contaminated. This has the greatest chance of occurring when greywater is used for toilet flushing and a cross connection accidentally is made to the water supply. Greywater reuse plumbing if used for toilet flushing should be coloured purple and labelled “treated wastewater – not fit for human consumption.” A backflow prevention device should also be fitted to the water supply.

Where greywater reuse is practiced the sewer must still be available for reconnection or used as an overflow during wet weather or when excess greywater cannot be utilised. During wet weather untreated greywater may be brought to the surface as the water table rises and therefore provide a source of contamination.

Caution must be exercised with the reuse of greywater to ensure that the potential to transmit disease has been minimised. This is achieved by:

- minimising human contact with untreated greywater ie subsurface utilisation;
- placing barriers between the greywater and people (and their pets) to minimise exposure to greywater by containing greywater in vessels or tanks as it is utilised;
- disinfection to an even higher standard for utilisation in toilet and urinal flushing or laundry use;
- sign posting the land application system to advise that greywater is being reused and that contact must be avoided;
- using a dedicated land application system not used for recreation such as a childrens’ play area, BBQ area, etc;
- not storing greywater except for surge attenuation, unless treated and disinfected;
- preventing surface ponding or surface run-off of greywater and confining greywater within the disposal area;

- not irrigating greywater during periods of wet weather;
- distinguishing plumbing which contains recycled greywater and to prevent cross connection to the potable water supply;
- maintaining a connection to the sewer so as to enable isolation of the land application system;
- installing a backflow prevention device on the potable water supply when greywater is used for toilet flushing; and
- not irrigating raw or treated greywater on edible plants which are consumed raw.

Some harmful chemical and substances, such as lead from painting activities, may be brought home from work on working clothes. It is preferable that these items be washed at a commercial laundry and not at home. If washed at home precautions should be taken to ensure that other members of the household are not exposed and that residues are not discharged to a greywater reuse system.

It is well recognised that householders, unless dedicated to wastewater reuse practices, do not necessarily maintain their wastewater management systems unless there is a system of audit. **It is essential that councils institute an on-site wastewater management strategy which initially considers the impacts of greywater reuse in their areas before allowing greywater reuse and secondly, rigidly enforces an operating licence by a system of regular audit**. See section 15.

8 Environmental Considerations

One of the most important concepts is that of **"Ecologically Sustainable Development (ESD)."** There are many definitions of ESD and the following is used in DLG 1998. "ESD is development using, conserving, and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quantity of life, now and in the future can be increased." Four principles of ESD flow from this definition and are:

- the precautionary principle – if there are threats or serious irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- intergenerational equity – the present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing of environmental resources.

To achieve an ecologically sustainable approach these four principles need to be built into all decisions about on-site wastewater management.

To manage wastewater effectively it is essential that water conservation is practiced. Wastewater generation should be minimised for three important reasons:

- to conserve drinking water as a precious natural resource;
- to ensure that wastewater does not overload the installed greywater management system, which may then cause a public health risk, cause environmental damage or reduce neighbourhood amenity; and
- to minimise land requirements for a greywater reuse system.

Various water saving devices have been used to conserve water, including dual flush cisterns, water conserving shower heads, dishwashers and clothes washing machines. Some water using appliances, such as spa baths, are inconsistent with on-site greywater management because they simply consume and discharge too much water. Water may also be conserved using a range of practices such as shorter showers, turning the tap off when cleaning teeth, ensuring that taps do not continuously drip, and using dishwashers and clothes washers only when the load is full. Some local councils have developed successful water conservation programs by actively promoting these practices.

Water may also be conserved by capturing rainwater from the roof and storing in a tank reserved for garden irrigation where rainfall is adequate. This may be a cheaper option to greywater reuse and would also reduce storm water discharges to the environment.

DLG 1998 identifies how domestic wastewater may harm the environment and is summarised as follows:

- by overloading the land application system with nutrients;

- by exceeding the hydraulic loading the land application system with water causing run off of polluted water to stormwater drains, rivers, streams and other peoples property;
- by raising the water table which may affect foundations of houses and causes the soil to become permanently boggy;
- by causing the soil to become permanently saturated, prevent plants from growing and cause odours;
- by altering the soil salinity;
- by altering the soil permeability;
- by changing the soil pH;
- by altering the soil electrical conductivity;
- by altering the soil sodicity;
- by altering the soil cation exchange capacity;
- by altering the soil phosphorus sorption capacity;
- by altering the soil dispersiveness; and
- by degrading the soil with chemical impurities which affect the properties of the soil to assimilate nutrients or water.

Because greywater contains many impurities, including the nutrients of nitrogen and phosphorus, which may harm the environment and the soil in particular, great care must be exercised when designing land application areas to ensure that they are sustainable. There are some chemicals which are not capable of being treated or degraded in the soil . Therefore, the soil ecosystem must be capable of adsorbing, absorbing, assimilating or treating the chemical impurities and nutrients without medium term and long term degradation of the soil, or the environment. Domestic greywater treatment systems are designed primarily to treat organic matter and are not normally designed to remove many chemical salts, such as sodium, nitrates and phosphates, which may be found in greywater.

Greywater must therefore be contained within the confines of the premises on which it is generated and not be permitted to escape to harm the environment. Guidance may be obtained from DLG 1998 and Standards Australia 1994 on the design of land application systems.

The choice of cleaning products may influence the environmental impact of greywater. Only genuine biodegradable products and products with low phosphorus should be used. Common washing powders contain sodium salts as bulking agents which produces a saline greywater. Powdered products which use potassium salts or liquid concentrates produce better quality greywater. Some detergents and powder cleansers contain boron which not only can be toxic to plants in high concentrations but can also be toxic to animals.

9 Performance Objectives

Performance objectives have been developed to help make sure that on-site sewage management for single households is appropriate and will not affect public health or the environment. When considering the use of any on-site sewage management system, particular attention should be paid to the cumulative affects of multiple systems operating within a catchment and within the wider environment.

On-site wastewater management systems should meet the following environmental and health performance objectives over the short and long term:

- prevention of public health risk;
- protection of lands;
- protection of surface waters;
- protection of ground waters;
- conservation and reuse of resources; and
- protection of community amenity.

These performance objectives have been made more explicit in the “matters to be taken into consideration” (Clause 31(2) of the Local Government (Approvals) Regulation 1999), and “performance standards for operation of system of sewage management” (Clause 47(1)) **which must be taken into account by Local Authorities** when considering an application to install or operate an on-site wastewater management system. These performance standards are:

- the prevention of spread of disease by micro-organisms;

- the prevention of spread of foul odours;
- the prevention of contamination of water;
- the prevention of degradation of soil and vegetation;
- the discouragement of insects and vermin;
- ensuring that persons do not come into contact with untreated sewage or effluent (whether treated or not) in their ordinary activities on the premises concerned;
- the minimisation of any adverse impacts on the amenity of the premises and surrounding lands; and
- if appropriate, provision for the reuse of resources (including nutrients, organic matter and water).

10 Wastewater Reuse Standards

Other Guidelines have been developed for wastewater reuse which allow restricted wastewater reuse from centralised sewage treatment plants only after extensive treatment and disinfection through a controlled reticulated supply separate to the drinking water supply. These standards are not appropriate nor applicable to reuse within single domestic premises as they were developed for different reuse and epidemiological circumstances.

11 Domestic Greywater Reuse Options

There are two main options for greywater reuse Greywater Diversion Devices and Domestic Greywater Treatment Systems

11.1 Greywater Diversion Devices (GDD)

There are two main types of diversion devices:

11.1.1 Gravity Diversion Devices

A gravity diversion device incorporates a hand activated valve, switch or tap which is fitted to the outlet of the waste pipe of the plumbing fixture such as a laundry tub. The plumbing diversion device can be switched by the householder to divert greywater from the laundry tub by gravity directly to the diversion line and the dedicated land application system instead of the sewer. Greywater must not be stored. Gravity diversion devices must not be installed below the “S” bend on any plumbing fitting as this would allow sewer gasses to enter the home with potentially fatal consequences.

11.1.2 Pump Diversion Devices

A pump diversion device incorporates a surge tank to cope with sudden influxes of greywater for distribution by a pump to a sub-surface land application system. The surge tank must not operate as a storage tank. Kitchen greywater is not really suitable for collection in a pump diversion device because it will clog the device with fats, oils and food particles. Residues in the device cause foul odours and provide attraction for vermin. Where it is intended to utilise kitchen greywater it should be treated in a domestic greywater treatment system or passed through a grease arrestor. The greywater should be screened as it enters a surge tank for distribution by a pump to the sub-surface land application system. (Refer to Jeppesen and Soley 1994, Figure 6.2 and 6.3 on pages 56 and 57 for diagrams). The coarse screens must be cleaned regularly and the surge tank flushed periodically.

Surge tanks must have the following features:
- the surge tank must be vented;
- the overflow line must be connected to the sewer via a water seal tundish;
- the scour line must be connected to the sewer;
- all access openings to the tank must be sealed and vermin proof;
- a hopper floor must be provided and sloped to the scour line;
- the surge tank design should be based on household fixture ratings of AS3500 Section 6.1 where Note 1 under Table 6.1 specifies the maximum discharge from any fixture to be 500L.

A greywater diversion device must be designed and installed according to the following criteria:
- each installation must be for a single domestic dwelling only;
- only direct re-use of greywater should be permitted;
- minimum maintenance requirements must be specified;

- it must meet relevant health and plumbing requirements;
- only sub-surface irrigation should be permitted; and
- overflow connection to the sewer must be maintained.

11.2 Domestic Greywater Treatment Systems (DGTS)

A DGTS collects, stores, treats and may disinfect all or any of the sources of greywater to the standards specified in the NSW Health Accreditation Guideline for DGTS. Where the treated greywater is not disinfected it may only be utilised in a properly designed subsurface irrigation land application system. Where the treated and disinfected greywater meets a 30 cfu thermotolerant coliform / 100mL disinfection criteria it may be utilised by surface irrigation in a properly designed land application area. Where the treated and disinfected greywater meets a 10 cfu thermotolerant coliform / 100mL disinfection criteria it may also be used for toilet and urinal flushing and laundry use.
A DGTS requires a certificate of accreditation from NSW Health in accordance with the DGTS Accreditation Guideline which should be consulted separately. Alternatively, an accredited aerated wastewater treatment system (AWTS) may be installed for greywater treatment and utilisation by land application only.

12 Assessment and Design of Land Application Systems

It is essential that land application systems for greywater reuse be designed properly. To do this a wastewater audit may need to be done to determine wastewater usage. Alternatively, as a guide, weekly water meter readings should be taken which exclude water usage for non-domestic use. The percentage of wastewater in Table 1 on page 4 may then be used to estimate greywater generation for the household.

The site then needs to be evaluated for the land application system requirements. Sections 4.3.2, 4.3.3 and 4.3.4 and Appendices 2 and 6 in DLG 1998 may assist in this process. It may also be appropriate to engage a geotechnical engineer or soil scientist to prepare the site assessment and application to the Local Authority to operate the greywater reuse system.

13 Education

While regulation, auditing and enforcement are paramount in obtaining compliance with the performance objectives, education is also important to ensure that stakeholders understand the significance of the hazards associated with greywater reuse. An important part of greywater management is to ensure that all stakeholders are aware of their responsibilities and to have access to enough appropriate information and other resources. The level of knowledge required depends on the roles and responsibilities of the stakeholders.

All stakeholders, including system manufacturers, regulators, householders, and service providers should develop appropriate education and training programs to encourage best management practices for greywater reuse.

Householders who wish to reuse greywater need to understand and be dedicated to the principles of wastewater reuse because it is not just simply a matter of install and forget. DGTS, GDD and their attendant land application systems are complex and require constant monitoring and maintenance.

Obtaining a copy and becoming familiar with the references at the end of this document would be most appropriate for Local Authorities in developing their wastewater management strategies. It is recommended that pages 46 to 48 of DLG 1998 be consulted by Local Authority personnel. There is also information on the internet for householders to browse, or to form the basis of community education material.

14 Legislation

For a full explanation of the relevant legislation see Appendix A.

14.1 Carrying out Sewerage Work
Section 68 – Approvals Table Part B4 Local Government Act 1993

Under the provisions of Section 68, Part B4 of the Table prior local authority approval is required to "carry out sewerage work." Such sewerage work need to be performed by a person licensed by the Department of Fair Trading using approved materials.

NOTE: Section 68 – Approvals Table Part B 4 of the Act **does not apply** within areas where the reticulated sewer system is controlled by the Sydney Water Corporation of Hunter Water Corporation or on land to which the Water Supply Authorities Act 1897 applies. Under these circumstances the requirements of the water supply authority should be determined.

14.2 Installation Approval
(Section 68 – Approvals Table Part C5 Local Government Act 1993; and Local Government (Approvals) Regulation 1999)

As a DGTS is defined as a waste treatment device and the owner of the premises must obtain an approval to install construct or alter a waste treatment device under **Section 68 – Approvals Table Part C5 of the Act and the Local Government (Approvals) Regulation** prior to installation of both the DGTS and the land application system from the Local Authority. (It is recommended that this be done together with the approval if required at 14.1).

A GDD and its land application system does not require installation approval from the Local Authority.

14.3 Accreditation of Sewage Management Facilities by NSW Health
(Clause 43 Local Government (Approvals) Regulation 1999)

A Local Authority must not approve of the installation of a manufactured DGTS unless the DGTS has been accredited by NSW Health. However, a one off single design DGTS for one specific premises, or a test installation of a DGTS does not require NSW Health accreditation and Council may approve of its installation without accreditation. Any land application system does not require accreditation by NSW Health.

Neither a GDD nor its land application system requires accreditation by NSW Health.

14.4 Approval to Operate a System of Sewage Management
(Section 68 – Approvals Table Part F10 Local Government Act 1993; and Clause 45 Local Government (Approvals) Regulation 1999)

All DGTS, GDD and their land application systems require an approval to operate from the Local Authority. It is strongly suggested that the approval to operate is obtained from the local authority prior to the installation of the land application system.

14.5 Authorisation of Plumbing Materials
(Clause 13, and Schedule 2, Local Government (Approvals) Regulation, 1999.

The materials used to divert household wastewater (ie a GDD) must be authorised under the Manual of Authorisation Procedures for Plumbing and Drainage Products (SAA MP 52) of Standards Australia or by the Department of Land and Water Conservation. If any inconsistency arises, the authorisation of the Director-General of the Department of Land and Water Conservation prevails.

Table 3: Legislative Summary

Legislative Process	Relevant Authority	Greywater Diversion Device	Greywater Treatment System	Land Application System
Carry Out Sewerage Works Approval *	Local Gov't	✓	✓	✖
Installation Approval	Local Gov't	✖	✓	✖
Accreditation	NSW Health	✖	✓	✖
Operation Approval	Local Gov't	✓	✓	✓
Materials Authorisation*	DLWC	✓	✖	✖

(*) not applicable within the Sydney Water Corporation, Hunter Water Corporation areas or on land to which the Water Supply Authorities Act 1897 applies .

15 Roles of Agencies

15.1 All Local Authorities

Where a Local Authority contemplates allowing greywater re-use in its area then a Sewage Management Strategy should be prepared or altered to reflect appropriate management strategies. Section 2 (p31-34) and Appendix 1 (p137) of "On-site Sewage management for Single Households" (DLG 1998 and Jeppesen 1996) should be consulted for this purpose. The Sewage Management Strategy should be linked to the Council Management or Operational Plan. Issues that need to be fully considered include:

- the availability of the infrastructure needed to remove bisolid by-products from greywater diversion systems and treatment systems;
- the requirements for qualified and experienced DGTS maintenance personnel;
- all factors relevant in implementing the approval requirements of Section 68 of the Act; and
- the ability to administer and auditing system of reuse practice in administering operating approvals.

It is the Local Authority's primary function to discharge its obligations under Section 68, Local Government Act 1993 which are to:

- administer applications for approval to install DGTS (Section 68 – Approvals Table Part C5 Local Government Act 1993; and Local Government (Approvals) Regulation 1999);
- administer applications for approval to operate a GDD and DGTS (Section 68 – Approvals Table Part F10 Local Government Act 1993; Clause 45 Local Government (Approvals) Regulation 1999);
- ensure that the terms of any approval are complied with;
- ensure that all premises which divert or treat greywater do so within the scope of the legislation.

Council must also consider the means by which public health standards will be maintained in areas where greywater is to be used. Councils are able to enforce appropriate public health standards under the Orders provisions of Section 124 of the Act by:

- Order No.21: to ensure that premises are kept in a safe or healthy condition;
- Order No.22: to process or dispose of waste in a specified manner;
- Order No.24: to require that premises are connected to a sewer of the council.

To assist local authorities Appendix B contains a list of matters which, as a minimum, should be considered when assessing an application to install a DGTS or when considering an operating approval for a GDD or DGTS.

15.2 Local Authorities Outside the Sydney and Hunter Water Corporation Areas and outside land to which the Water Supply Authorities Act 1897 applies

Plumbing and drainage work outside the Sydney and Hunter Water Corporation Area and outside land to which the Water Supply Authorities Act 1897 applies is controlled by the local authority under the Local Government Act and Regulatons. Greywater service shall be considered as a sewage service in the context of the Local Government Act, 1993. **Section 68 of the Local Government Act 1993 and the Local Government (Approvals) Regulation 1999** are particularly relevant to the issue of greywater reuse.

15.3 NSW Department of Health

NSW Health is responsible for administering the requirements of Clause 43 of the Local Government (Approvals) Regulation in accrediting DGTS and disseminating accreditation notifications to Public Health Units, Local Authorities and the Department of Local Government.

NSW Health also convenes the Wastewater Management Advisory Committee to provide advice on domestic wastewater management. The membership of the WMAC includes the Department of Local Government, Environment Protection Authority, Department of Land and Water Conservation, Department of Urban Affairs and Planning and the Australian Institute of Environmental Health.

15.4 Department of Land and Water Conservation

The Department of Land and Water Conservation may authorise materials used to divert household wastewater (ie a GDD).

16 References

Department of Health Western Australia, 1996, Draft Guidelines for Domestic Greywater Recycling, Perth, Western Australia.

Department of Local Government (DLG), February 1998, Environment and Health protection Guidelines: On-site Sewage Management for Single Households,. (Also available on the Department of Local Government Web site at http://www.dlg.nsw.gov.au)

Department of Primary Industry Queensland, 1996, "Policy Options Paper, the Use of Greywater," Brisbane, Queensland.

Devine B, et al, 1998, "Greywater Recycling in Western Australia" in Water Journal of the Australian Water and Wastewater Association, March/April, 1998, Vol 25, No 2, Artarmon, NSW.

Hypes W D, et al, undated, "The Chemical/Physical and Microbiological Characteristics of Typical Bath and Laundry Water," Langley Research Centre, USA.

Jeppesen B, 1994, "Domestic Greywater Re-use, Australias Challenge for the Future" in Localised Treatment and Recycling of Domestic Wastewater Workshop Papers, Murdoch University, Perth, WA, Australia

Jeppesen B, March 1996, Model Guidelines for Domestic Greywater Reuse in Australia, Urban Water Research Association of Australia. (Available from AWWA bookshop)

Jeppesen B, and Solley D, March 1994, Domestic Greywater Reuse: Overseas Practice and its Applicability to Australia, Urban Water Research Association of Australia. (Available from AWWA bookshop)

Local Government Act, 1993.

Local Government (Approvals) Regulation, 1999.

Local Government (Orders) Regulation, 1999.

Local Government (Water Services) Regulation, 1999.

Rose J B, et al, 1991, "Microbial Quality and Persistence of Enteric Pathogens in Graywater from Various Household Sources," in Water Res Vol 25, No 1, pp 37-42, 1991.

Standards Australia, 1994, Australian Standard AS 1547 – 1994; Disposal of Sullage and Septic Tank Effluent from Domestic Premises, (Under review)

Appendix A

Detailed Legislative Explanation

A1 Approval to Carry Out Sewerage Works; Section 68 – Approvals Table Part B4 Local Government Act 1993; and Local Government (Approvals) Regulation 1999

Under the provisions of Part B4 of the Approvals Table of Section 68 of the Local Government Act 1993 the prior approval of the local Council is required to carry out sewerage work in areas outside the administration of the Sydney and Hunter Water Corporation and land to which the Water Supply Authorities Act 1897. A greywater service shall be considered as a sewage service in the context of the Local Government Act, 1993.

Where approval is required under Section 68 then Clause 13, Local Government (Approvals) Regulation 1999, requires that any sewerage work must comply with Schedule 2 and any other standards set out in the regulation. Schedule 2 specifies the standards for sewerage work and in particular Item 1 requires that sewerage work must comply with the Plumbing and Drainage Code of Practice except where otherwise provided. Further Item 7 specifies that materials used in sewerage work must be of a kind authorised by the Department of Land and Water Conservation or under the Manual of Authorization Procedures. If an inconsistency arises, the authorisation of the Director-General of the Department of Land and Water Conservation prevails.

Clause 15(2) specifies that when carrying out sewerage work council must have regard to the considerations of:

- the protection and promotion of public health;
- the protection of the environment;
- the safety of its employees;
- the safeguarding of its assets; and
- any other matter that it considers to be relevant in the circumstances.

Clause 20 requires that sewerage work be carried out by a person who is the holder of a permit issued in accordance with the NSW Code of Practice Plumbing and Drainage.

A2 Installation Approval (Section 68 – Approvals Table Part C5 Local Government Act 1993; and Local Government (Approvals) Regulation 1999)

Clause 25 of the Local Government (Approvals) Regulation 1999, defines **sewage management facility** to mean:

> *(a) a **human waste storage facility**, or*
> *(b) a **waste treatment device** intended to process sewage, and includes a drain connected to such facility or device".*

A DGTS is clearly a waste treatment device. However a GDD is not a human waste storage facility nor a waste treatment device.

Under section 68 of the Local Government Act 1993 prior council approval is required to:

> *"install, construct or alter a **waste treatment device** or a **human waste storage facility** or a drain connected to any such device or facility only with the prior approval of the council.*

Therefore the owner of a premises must obtain prior installation approval for a DGTS but not for a GDD from the Local Authority.

It is vital that Local Authorities in sewered areas become familiar with the provisions of the Regulation in relation to on-site wastewater management.

In approving the installation of a DGTS, Local Authorities must be aware of clause 28 of the Regulation which specifies the matters which must accompany applications for approval to install or construct sewage management facilities. Councils must also be aware of the requirements of clause 31, and in particular Clause 31(2) of the Regulation which specifies the matters to be taken into consideration in

determining applications for approval to install, construct or alter sewage management facilities. Clause 31 therefore, outlines the key performance standards for on site wastewater management.

Local Authorities should also consider any relevant Australian and New Zealand Standards, site assessments, its own Sewage Management Strategy and recommendations and guidelines from the Department of Local Government in assessing applications to install DGTS.

A3 Accreditation by NSW Health

Clause 43 (1) of the Local Government (Approvals) Regulation clarifies the role of NSW Health with respect to Local Authority's approval of the installation of a sewage management facility:

> *The **council must not approve** the installation or construction of a sewage management facility to which this Division applies unless the council is satisfied that the facility is to be installed or constructed to a design or plan that is the **subject of a certificate of accreditation from the Director-General of the Department of Health**, being a certificate that is in force.*

A certification of accreditation issued by the Director-General is to facilitate an approval to install, construct or alter a waste treatment device issued by the Local Authority under the provisions of Section 68, Local Government Act 1993. A certificate of accreditation issued by the Director-General is issued to a specific DGTS produced by a specific manufacturer. NSW Health accreditation addresses sewage management facilities for single domestic premises only. The NSW Health document "Domestic Greywater Treatment Systems Accreditation Guidelines" should be consulted by manufacturers to determine the requirements for DGTS accreditation.

Under clause 43(2) NSW Health accreditation of DGTS is not required for installation of a DGTS for test purposes, or where specifically designed by the owner/occupier/consultant for that particular premises and when a standard design is not used. Installation approval by the Local Authority is however, still required.

Clause 42 of the Regulation specifies those types of sewage management facilities which are to be accredited by NSW Health. In relation to greywater treatment and reuse clause 42 states:

> *"(1)This Division applies to such models of the following sewage management facilities as are generally available for purchase by retail:*
> *(f) septic tanks,*
> *(k) waste treatment devices that use aeration to produce treated bio-solids and effluent from sewage."*

Therefore a DGTS is subject to NSW Health accreditation where the system uses a septic tank or aeration to produce treated bio-solids and effluent from greywater.

It should be noted that accreditation by the Department of Health is required for the sewage management facility only and does not include the drains connected to the sewage management facility. Also note that a GDD is not a sewage management facility and does not require accreditation.

NSW Health certification of accreditation does not include the plumbing to or from the DGTS; the land application system nor the final disposal method. These are matters for the Local Authority to consider when granting installation approval.

In summary accreditation applies to a DGTS where it contains a septic tank and/or aerobic treatment process. Accreditation does not apply to:

- a GDD;
- a GTS installed for testing;
- a GTS designed for one individual premises (ie a non-commercial system);
- the pipes leading to or from the GTS;
- the land application system.

A4 Approval to Operate a System of Sewage Management; Section 68 – Approvals Table Part F10 Local Government Act 1993; and Clause 45 Local Government (Approvals) Regulation 1999

Clause 45 of the Regulation specifies that the operation of a system of sewage management (which includes both DGTS and GDD) is a prescribed activity under Section 68 of the Act and therefore requires a separate approval from the Local Authority subject to appropriate conditions. Again Local Authorities are required to consider the performance standards set out in clause 47 of the Local Government (Approvals) Regulation in determining an approval to operate a DGTS or GDD.

Clause 48 specifies mandatory conditions of approval to operate a system of sewage management.

A5 Authorisation of Plumbing Materials

Under Item 7, Schedule 2 and Clause 13 of the Local Government (Approvals) Regulation 1999, the materials used to divert household wastewater (ie a GDD) must be authorised under the Manual of Authorization Procedures for Plumbing and Drainage Products (SAA MP 52) of Standards Australia or by the Department of Land and Water Conservation. If an inconsistency arises, the authorisation of the Director-General of the Department of Land and Water Conservation prevails.

Table 3: Legislative Summary

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Accreditation	NSW Health	✖	✓	✖
Operation Approval	Local Gov't	✓	✓	✓
Materials Authorisation*	DLWC	✓	✖	✖

(*) not applicable within the Sydney Water Corporation of Hunter Water Corporation areas and land to which the Water Supply Authorities Act 1897 applies.

Appendix B

Matters to be Considered in Determining Applications for Installation and Operation of GTS and Operation of GDD

The Local Government (Approvals) Regulation 1999 specifies environment and health matters which must be taken into consideration prior to granting approval to install and operate a DGTS or to operate a GDD. These mandatory requirements which council must consider are specified in Clause 31 for installations and clause 47(1) for operation and are:

(a) preventing the spread of disease by micro-organisms,
(b) the prevention of spread of foul odours,
(c) preventing contamination of water,
(d) preventing degradation of soil and vegetation,
(e) the discouragement of insects and vermin,
(f) ensuring that persons do not come into contact with untreated sewage or effluent (whether treated or not) in their ordinary activities on the premises concerned,
(g) the re-use of resources (including nutrients, organic matter and water),
(h) the minimisation of adverse impacts on the amenity of the land on which it is installed or constructed and other land in the vicinity of that land.

Council must also include those mandatory conditions in relation to the operation of a sewage management facility specified in Clause 48.

NSW Health recommends that the Local Authority should also consider the following in conjunction with the above requirements:

- that final inspection of the DGTS by the Local Authority and written consent prior to commission the DGTS is a statutory requirement;
- the installation must be carried out by licensed plumber/drainer;
- the design and components of the DGTS must comply with the Greywater Design Criteria of the DGTS Accreditation Guideline;
- the operation and maintenance of the GTS should be the owners responsibility;
- the Local Authority's wastewater management strategy should be in place before any approvals are given;
- the owner of the premises must also obtain an approval to operate a system of sewage management as a prescribed activity under the Act (see Clause 45 of the Approvals Regulation and Section 68 of the Act);
- minimum maintenance requirements specified by the manufacturer should be adhered to;
- the treatment system should meet relevant health and plumbing requirements;
- there should be no connections to, or augmentation from the mains water supply; and
- treated and disinfected greywater may be utilised by (see section 6.9):
  - sub-surface irrigation;
  - surface irrigation in dedicated non-trafficable areas;
  - toilet and urinal flushing when treated to the higher level;
- the land application system must be appropriately sign posted that greywater is being reused and that contact must be avoided;
- the dedicated land application must not used for active recreation such as a childrens' play area, BBQ area, etc.
- contamination of the ground water must be prevented;
- surface ponding or surface run-off of greywater must not occur and greywater must be contained within the confines of the disposal area;
- greywater should not be used for irrigation during periods of wet weather;
- there should be an ability to distinguish plumbing which contains recycled greywater and to prevent cross connection to the water supply;
- a backflow prevention device must be installed to protect the potable water supply;
- a connection to the sewer must be maintained so as to enable isolation of the land application system; and
- greywater must not be used for irrigation of edible plants which are consumed raw.