Northern Territory Government

DEPARTMENT OF
HEALTH AND FAMILIES

ENVIRONMENTAL HEALTH

GUIDELINES FOR MANAGEMENT OF RECYCLED WATER SYSTEMS

SEPTEMBER 2009

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1. Introduction

Recycled water is an integral part of ensuring a sustainable water supply in the Northern Territory. With the changes and improvements in technology, the effect of climate change on water resources, increasing population and the increasing price of water, future demand for recycled water is expected to increase. The private sector is expected to play a major role in meeting this demand

1.1 Purpose of these guidelines

There has been a recent move towards a nationally consistent approach to the management of the use of recycled water from sewage effluent, greywater and stormwater sources. The *Australian Guidelines for Water Recycling: Managing Health and Environmental Heath Risks (Phase 1) 2006* (NRMMC, EPHC and AHMC) adopts the principles of hazard analysis and risk assessment to manage the use of recycled water.

The Northern Territory Government supports a consistent approach to water recycling in Australia. These guidelines align the principles outlined in the national guideline to the approvals process for recycled water systems in the NT.

The purpose of these guidelines is to provide a framework to manage the public health and environmental risks associated with the use of recycled water. The guideline emphasises a risk management approach to recycled water systems to encourage water recycling that is safe, economically viable, environmentally sustainable and socially acceptable.

These guidelines do not prescribe the water quality standards or treatment for all possible uses of recycled water. Instead the guidelines provide a framework outlining the risk assessment process that should be applied to any recycled water system to ensure the system is managed safely.

These guidelines introduce new approval requirements. It provides practical advice, including some examples, for obtaining approval to install and operate a recycled water system within the Northern Territory legislative framework.

These guidelines will be regularly revised to reflect the operational experiences of managing, implementing and regulating recycled water systems.

1.2 Scope of these guidelines

These guidelines are intended to be used by anyone planning a large-scale recycled water system. This includes residential dual reticulation, multi-unit dwellings, urban irrigation and commercial & non-food crops. Furthermore, a proposal is considered to be large scale if it has a minimum capacity of 150 equivalent persons (EP) or 22 kL/day,

The Department of Health and Families also intend to use these guidelines for approving recycled water systems in accordance with Public Health legislation. The existing process for Site Specific Design Approval of an Alternative On-site Wastewater System still applies for proposals with a maximum capacity of 150 EP, however the principles of these guidelines will apply for those proposals, especially Part 7 - Monitoring requirements.

Notwithstanding, proposals with a daily flow less than 22 kL/day that present an increased public health and environmental risk will require a recycled water system application. This determination will be made by the Department of Health and Families (DHF) on a case-by-case basis.

These guidelines include recycled water taken from greywater and blackwater sources but not necessarily stormwater or industrial sources, though the process adopted in these guidelines may be useful for all recycled water systems.

These guidelines do not apply to single dwelling domestic wastewater recycling where the wastewater generated on the premises is used within the boundaries of the same property.

The approvals process for greywater and sewage systems is summarised in Table 1.

1.3 Structure of the guidelines

The approvals process for recycled water systems has been streamlined to provide regulatory simplicity and efficiency. There are two stages of the approvals process: approval to install and approval to operate.

The following sections of the guideline are structured to correspond to the steps that need to be taken to obtain approval to install, operate and to successfully manage a recycled water system.

STEP ONE: Preliminary assessment of recycled water system (section 3)

STEP TWO: Planning for recycled water use (section 4)

STEP THREE: Approval to install (section 5)

STEP FOUR: Risk assessment (section 6)

STEP FIVE: Monitoring (section 7)

STEP SIX: Management procedures (section 8)

STEP SEVEN: Awareness and training (section 9)

STEP EIGHT: Approval to operate (section 10)

STEP NINE: Operation and audit (section 11)

Section 2 provides a summary of the existing statutory framework for the use of recycled water including an outline of legislation, and the agencies that deal with water recycling in the Northern Territory. Summary information on the various guidelines that relate to the use of recycled water for specific situations is also provided.

Table 1 Approval Summary

	Department of Health and Families (DHF)	Department of Planning and Infrastructure – Building Advisory Services (BAS)	Other
Conventional[1] On-site Wastewater Systems	(a) Product Approval of an On-site Wastewater System required. (b) DHF is the repository for all self-certified documentation lodged by Licensed Plumbers for installations outside Building Control Areas. (c) DHF may choose to approve the installation of these systems for the scheduled fee.	BAS is the repository for *Plumbing Compliance Certification* documentation lodged by Building Practitioners for installations within Building Control Areas	None required
Alternative[2] On-site Wastewater Systems	Ditto dots points (a) & (b) plus DHF is the approval authority for the Site Specific Design of all Alternative On-site Wastewater Systems.		NRETAS licence may be required under the *Waste Management and Pollution Control Act 1998*
Recycled Water Systems	DHF is the approval authority of all recycled water systems	None	Connection to a Power and Water Corporation sewage system requires approval NRETAS licence may be required under the *Waste Management and Pollution Control Act 1998*

[1] Conventional On-site Wastewater System comprise septic tanks or greywater diverter devices with absorption trenches, absorption beds, mound systems or evapotranspiration areas.

[2] Alternative On-site Wastewater System comprise Aerated Wastewater Treatment Systems and Greywater Treatment Systems, generally up to a maximum of 150 EP.

2. Recycled water framework

The current legislation and guidelines relevant to the use of recycled water in the Northern Territory are listed below. The requirements for compliance will be dependent on the proposed end use of the recycled water produced by the system, the level of public access and environmental issues associated with the recycled water system.

It is the responsibility of the proponent to confirm compliance with all regulatory requirements.

2.1 Existing legislative requirements

Local Government Authorities

Local Government Authorities in the Northern Territory have no jurisdiction over recycled water systems.

Public Health Act

The Department of Health and Families (DHF) has responsibilities under the *Public Health Act* for monitoring and managing public health risks and improving public health through regulation, health promotion and other public health measures. DHF plays a key role in setting water quality compliance values for recycled water and must be informed of any incident that poses a risk to public health.

A recycled water system must obtain approval from the Department of Health and Families under Regulation 17 of the *Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations*.

Waste Management and Pollution Control Act 1998

The *Waste Management and Pollution Control Act* places a general environmental duty of care upon all persons to take all reasonable and practicable measures to prevent or minimise harm to the environment. For the purposes of that Act and this Guideline, the discharge of sewage and or effluent without a licence to discharge issued by the Department of Natural Resources, Environment and the Arts (NRETAS) granted under the *Waste Management and Pollution Control Act* is an offence. Recycled water must have no unsustainable impacts on land, groundwater and surface water.

Building Act 1993

Plumbing of recycled water systems located within Building Control Areas must comply with the requirements of the *Building Act*.

Work Health Act 1986

The *Work Health Act* provides the general requirements for health, safety and welfare, which must be met at all places of work in the Northern Territory.

The *Work Health Act* states that an employer shall, so far as is practicable:

- provide and maintain a working environment at a workplace that is safe and without risk to the health or safety of the workers working at the workplace, and
- ensure that the health and safety of any other person is not adversely affected as a result of the work in which the employer or any worker is engaged.

The employer obligations contained in the *Work Health Act* are the same for workplaces where recycled water is used as they are for any other workplace. A person in control of the workplace (the employer) has a duty to ensure that recycled water provided for use by employees at work is safe and without risks to health when properly used.

The employer of a workplace may meet this obligation by:

- conducting a risk assessment on the use of the recycled water
- identifying safe use procedures including storage and handling
- providing training on the safe use of recycled water
- providing personal protective equipment for the use of recycled water.

For example if a recycled water system involved supplying recycled water to a golf course for irrigation, the golf course as an employer would have an obligation to its employees to ensure the recycled water is used safely. This might include undertaking a risk assessment of the use of the recycled water and providing training and information on its safe use and handling to relevant employees.

Food Act 2004

Under section 16(2) of the *Food Act 2004* a person may not sell food that is "unsuitable". Under section 11(1) food is defined as unsuitable "if it contains a biological or chemical agent, or other matter or substance, that is foreign to the nature of the food". Although the *Food Act 2004* does not apply directly where recycled water is used to irrigate food crops, the *Food Act 2004* is applicable once these crops are harvested and the food is available for sale for human consumption.

However, under section 11(2) food may contain certain contaminants specified in the *Australia New Zealand Food Standards Code* if they are below the maximum residue limit (MRL) set for those contaminants in the Code. If a chemical is detected in food that is above the maximum residue limit for that chemical, or is detected at any limit for a chemical for which there is no limit, then the food would be considered unsuitable.

2.2 Other guidelines

The following selection of guidelines will assist with the preparation and information requirements for recycled water systems:

Australian Guidelines for Water Recycling: Managing Health and Environmental Health Risks (Phase 1) 2006

The *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) 2006* (hereafter referred to as the 'AGWR') has been produced by the Environment Protection and Heritage Council, Natural Resources Management Ministerial Council and the Australian Health Ministers Conference to provide guidance on best practices for water recycling.

The AGWR provide a risk assessment framework that is applicable to the recycling of water from stormwater, greywater and treated sewage sources. The AGWR are not mandatory but are designed to provide an authoritative reference that can be used to support beneficial and sustainable recycling. The AGWR are intended to be used by anyone involved in the supply, use and regulation of recycled water systems.

The AGWR can be downloaded from the Environment Protection and Heritage Council website: http://www.environment.gov.au/water/publications/quality/index.html

ANZECC Guidelines for Fresh and Marine Water Quality (2000)

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality do not apply directly to recycled water, however they provide an outline for setting water quality criteria. Specifically they provide guidance on designing and implementing water quality monitoring and assessment programs for irrigation that may be useful in the development of a recycled water system.

The ANZECC guidelines can be downloaded from the Department of the Environment and Water Resources (Australian Government) website:

http://www.environment.gov.au/water/publications/quality/index.html

2.3 Standards

Australian Standard AS/NZS 3500:2003, Plumbing and Drainage

The Australian Standard AS/NZS 3500:2003, Plumbing and Drainage (the Standard) specifies uniform requirements for the installation of water services and takes account of regulations stipulated by the authorities responsible for the administration of water supply legislation in each State and Territory of Australia. The requirements of the Standard apply to the cold water service from the point of connection to the water main up to the outlet points within the property. This Standard applies to new installations as well as alterations, additions and repairs to existing installations.

The standards are enforceable when called up by the Building Code of Australia.

Food Standards Code

Standard 3.2.2 – Food Premises and Equipment of the Food Standards Code requires food businesses to use potable water for all activities on the food premises. The Australain Drinking Water Guideline are referenced as a guide for what constitutes potable water.

However, food businesses in the Northern Territory are able to use recycled water providing they can either:

- recycle the water to potable quality; or
- demonstrate that the use of non-potable water will not adversely affect the safety of the food.

Food businesses wishing to use recycled water should contact the DHF Environmental Health Program. For further information, go to the FSANZ website.

2.4 Other requirements

Power and Water Corporation is the main provider of water and sewerage services in the Northern Territory, and therefore has conditions and approvals for connections and discharge to their systems. Proponents of recycled water systems must liaise with Power and Water Corporation regarding connections and discharges to their systems.

3. STEP ONE: Preliminary assessment of recycled water system

Preliminary identification of the potential hazards and hazardous events associated with the proposed recycled water system is necessary to inform the design phase of the recycled water system.

This chapter will assist the proponent of a recycled water system to:

- outline all individual source(s) of the recycled water
- identify the actual and potential hazards present in the source(s) of the recycled water
- outline the proposed end use(s) of the recycled water
- identify all the hazards associated with the end use(s) of the recycled water
- identify the intended and the potential receiving environment(s) and any potential human routes of exposure for the recycled water.

Parts 3 and 4 may form part of an iterative process and should be completed concurrently.

AGWR Section 2.2 provides further information about the 'Assessment of the recycled water scheme' including:

- Intended uses and sources of recycled water
- Recycled water system analysis
- Assessment of water quality data
- Hazard identification and risk assessment.

3.1 Source of recycled water

All potential sources of recycled water that will be used by the system need to be identified so that the type and amount of hazard can be assessed. Potential sources of recycled water include, but are not limited to:

- untreated sewage
- greywater
- industrial process water[3]
- stormwater[3].

Each individual source of recycled water will have different quality characteristics and different contaminants. Contaminants in recycled water are identified as a potential hazard to the environment and/or people that come into contact with the recycled water and may include:

- biological contaminants (e.g. pathogens)
- chemical contaminants (e.g. insecticides, cleaning products)
- physical contaminants (e.g. debris)
- radiological agents.

For each source of recycled water that the system proposes to use the potential and actual hazards should be identified and listed. Appendix 1 contains examples of some hazards that may be present in sources of recycled water.

[3] DHF approval is only required where the source of the recycled water includes greywater or sewage.

An estimate of the quantity of water available from the proposed sources to the recycled water system should be made. The quantity should be expressed as a total volumetric flow on a daily basis (i.e. kL/day) and as average and peak demand flow rates.

The estimate will need to take account of any residual flows that may need to remain in the source system. For example some residual flows will be required in the sewer, where a recycled water system involves sewer mining, to ensure the sewerage maintains adequate flows for flushing. An estimate of the necessary residual flows may be provided by contacting the relevant water utility in most instances.

The impact of rainfall events and drought will also need to be considered in determining the availability and reliability of wastewater from a source. This will assist in determining any storage requirements that may be necessary.

3.2 End use of recycled water

All intended end uses of the recycled water need to be identified to determine the required final water quality and any management actions needed to ensure the safe use of the recycled water. The requirements for water quality compliance will be dependent on the proposed end use for the recycled water produced by the system. Potential end uses of recycled water include, but are not limited to:

- pasture irrigation
- golf course irrigation
- dual reticulation
- lawn and garden irrigation
- cooling tower make-up water
- water features
- process water.

The risk assessment process adopted in these guidelines focuses on the end quality of recycled water produced. The recycled water produced by the system should achieve the compliance values for water quality consistent with the proposed end use regardless of the treatment process implemented.

For each proposed end use of recycled water the water quality criteria should be identified and listed.

An estimate of the quantity of water required for the proposed end uses should be made. The proponent of the system should be confident of the potential markets for the recycled water when estimating the quantity of recycled water to ensure that a reliable demand base is available. The quantity should be expressed as a total volumetric flow on a daily basis and as average and peak demand flow rates.

The estimate will need to account for the efficient and environmentally sustainable use of the water. The impact of rainfall events and drought will also need to be considered in determining the demand for recycled water.

3.3 Receiving environment and routes of exposure

Recycled water can be treated to a very high quality; however, if not correctly managed, exposure to recycled water has the potential to adversely impact on the health of people and the environment.

Environmental exposure to recycled water and the potential effects will generally be specific to the site. The potential environmental impacts from the recycled water system need to be identified and listed.

Humans may also be exposed to recycled water through:

- ingestion
- inhalation
- contact with skin.

The potential human health impacts from the recycled water system need to be identified and listed. The potential for inadvertent or unauthorised use of the recycled water will need to be considered, in this context.

The AGWR provides further information on the identification of both the environmental and human risks from the use of recycled water and includes some examples.

3.4 Irrigation of recycled water sourced from an approved DHF recycled water system

Third parties intending to irrigate recycled water from an existing approved DHF recycled water system (e.g. Alice Springs Reuse Scheme) still require a separate DHF approval.

The proponent will need to complete a recycled water irrigation application that includes a Risk Management Plan (RMP) based on elements of the DHF Guidelines for Management of Recycled Water Systems and Australian Guidelines for Water Recycling: Managing Health and Environmental Health Risks (Phase 1). The RMP should include the following:

- Commitment to responsible use and management of recycled water
- Assessment of the recycled water scheme
- Preventative measures for recycled water management
- Operational procedures and process control
- Management of incidents and emergencies

For more information refer to Environmental Health Fact Sheet No. 513 *Recycled Water Irrigation: Information Guide for Applicants* and *Application for irrigation of recycled water sourced from a DHF approved recycled water system.* Both documents are available at: www.nt.gov.au/envirohealth > wastewater management.

4. STEP TWO: Planning for recycled water use

Proper planning of a recycled water system is necessary to ensure an appropriate and safe quality of water as well as community acceptance of the proposed recycled water uses.

This chapter will assist the proponent of a recycled water system to:

- develop a sustainable recycled water policy for the proposed recycled water system
- identify all stakeholders of the proposed system including any community interests
- develop a communication strategy for engaging and consulting with all identified stakeholders
- assess the financial viability of the proposed system
- commence negotiation of the recycled water agreements, where they are required
- identify an appropriate site for the recycled water system.

Parts 3 and 4 may form part of an iterative process and should be completed concurrently.

AGWR Section 2.1 provides further information about the 'Commitment to responsible use and management of recycled water quality' including:

- Responsible use of recycled water
- Regulatory and formal requirements
- Partnerships and engagement of stakeholders (including the public)
- Recycled Water Policy.

4.1 Recycled water policy

The proponent of a recycled water system should develop a recycled water policy that shows commitment to the development and operation of a safe, economically viable, environmentally sustainable and socially acceptable recycled water system

The proponent should ensure that the recycled water policy:

- is appropriate to the purpose of the recycled water system
- includes a commitment to the responsible use of recycled water and the continuous application of a risk management approach to the system
- includes a commitment to comply with all regulatory requirements
- establishes the objectives of the recycled water system
- is communicated and understood by all identified stakeholders
- is regularly reviewed for ongoing suitability.

The AGWR provides further information on the development and implementation of a recycled water system policy including an example.

4.2 Communication planning

Early and inclusive consultation with the appropriate stakeholders of a recycled water system is a vital element in the success of the system. For some recycled water systems, public consultation will be a compulsory component of the environmental assessment under the *Northern Territory Planning Scheme.* However all recycled water systems should incorporate a communication planning process.

Essential features of a good communication plan include:

- identifying the aim of the communication plan. The aims will also be used to judge whether the communication has been successful
- timely communication. Good communication takes time. Ideally communication with stakeholders will commence when development of a recycling project is being considered and will continue throughout the life of the project
- two-way relationship. The communication should allow a two-way flow so that stakeholders' opinions are captured and opportunities to both listen and provide feedback are available.

AGWR Section 2.1 provides further information on the development and implementation of a recycled water system communication plan.

Community consultation

The recycled water system proponent should decide on the level of community engagement in the planning stages of the project.

As part of the process the proponent should identify the primary audience for community engagement to maximise the opportunity for participation and feedback on the system. The primary audience would normally consist of those community members who will have the greatest exposure to the system and/or be directly impacted by the system.

If there are other audience(s) within the community that will be targeted by the program they should also be identified and listed.

Once the proponent has identified the community engagement audience there are many possible techniques that can be applied.

Stakeholder engagement

In addition to the identified community that may be affected by, or have an interest in, the water recycling system, the proponent of the recycled water system will also need to communicate with other parties such as local and Northern Territory Government agencies.

The primary contact for recycled water systems will be the Department of Health and Families – Environmental Health Program. The proponent of the system should discuss the proposal/plans, including the statutory requirements, with DHF as early as possible in the project to ensure that all relevant issues are addressed during the planning stage and prior to the commencement of the design and operation phases.

Other state government agencies have mainly advisory (but sometimes regulatory) roles in recycled water systems. Appendix 2 contains contact details (correct at April 2009) for the NT government agencies that can provide advice on water recycling systems in the Northern Territory.

4.3 Financial planning

Financial assessment is used to determine the long term viability and sustainability of a recycled water system and is particularly important where the system plans to provide essential services to end users (such as toilet flushing).

Financial assessment considers whether the projected revenues will be sufficient to cover expenditures and whether the financial return is sufficient to make the project commercially viable. A price for recycled water that is to be supplied to a third party should reflect both the value of the resource and the capital and operating cost of the system.

A budget for the operation and maintenance of the recycled water system should be provided and maintained. The budget should show funding sources for the operation of the system. The budget shall be for the life of the system to offer some assurance around the long-term viability of the provision of recycled water services.

4.4 Site Selection

Selecting a suitable site is critical to the successful establishment of a recycled water system. The criteria for site selection will be dependant on the proposed end use of the recycled water but there are some criteria common to all recycled water treatment processes.

In selecting a suitable site for the construction of a recycled water system particular attention should be paid to:

land use conflicts. The surrounding uses of land should be consistent with the recycled water system. Where the system is located in close proximity to residential premises planning consideration needs to be given to minimising odour and noise nuisance, providing a buffer distance[4] and managing the visual amenity of the site.

proximity to the end use. A site that is located sufficiently close to the proposed end-use is preferred to minimise the environmental impacts from constructing pipelines and potentially pumping the recycled water as well as to improve the financial viability of the project.

proximity to sensitive environments. Some environments may be so sensitive as to preclude the operation of a recycled water system or the use of recycled water in the vicinity of the environment.

4.5 Recycled water agreement

With the users

With the exception of dual reticulation systems[5], whenever a recycled water producer supplies another person or organisation with recycled water, the two parties should negotiate an agreement. This is because the “user” of the water will not be bound by the conditions of the approvals for the recycled water system.

The agreement should specify the obligations and responsibilities with respect to the supply and use of the recycled water.

Preliminary discussions between the proposed user(s) and the proponent of the recycled water system should commence at the beginning of the project to provide some certainty around the demand for the recycled water.

With the suppliers

Where a recycled water system involves sourcing the water from a third party such as through sewer mining, a recycled water agreement will be required between the proponent of the recycled water system and the organisation that will supply the water for treatment.

Preliminary discussions between the proposed supplier(s) and the proponent of the recycled water system should commence at the beginning of the project to provide some certainty around the supply of water to the recycled water system.

[4] The NSW DEC guidelines: Use of Effluent by Irrigation provide some guidance on separation distances on buffer zones for the irrigation of recycled water.

[5] Dual reticulation systems should provide individual users and/or households with the “terms of use” for the recycled water product.

5. STEP THREE: Approval to install

A recycled water system must obtain approval to install from the Department of Health and Families under Regulation 26 of the *Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations*. In some situations proponents of a system may wish to install a pilot or trial sized treatment process – an approval to install will be necessary in order for the trial to occur.

This chapter will assist the proponent of a recycled water system to:

- identify and completed all the information requirements for the approval to install including the previously mentioned steps
- collate the information and prepare a submission to DHF for approval to install.

A proponent of a recycled water system may wish to apply for an approval to install and an approval to operate at the same time. To apply for an approval to operate the appropriate information must be available (as outlined in the following sections). The approval to operate will be made subject to appropriate validation (where validation has not previously occurred) and verification of the system and may contain additional conditions.

5.1 Prelodgement advice

DHF provides a prelodgement service that enables an applicant to discuss a proposal prior to lodging the approvals application. The idea of seeking prelodgement advice is to help identify issues relevant to the proposal or site location, and to identify any specific concerns related to the proposed system.

It should not be used to seek determination of the application (i.e. advise if the application will be approved/refused).

It is also possible (and strongly recommended) to discuss a proposal with any other agencies (e.g. Power and Water Corporation, NRETAS, DPI) during the conceptualisation phase of the project.

It is recommended that the proponent of a system contact the DHF, for further information about arranging a prelodgement meeting.

5.2 Supporting information and lodgment

To obtain DHF approval to install a recycled water system, the information outlined in the previous steps one (preliminary assessment) and two (planning for recycled water use) must be fully completed.

The form in Appendix 4, together with all other supporting information, must be lodged with DHF.

Any information provided to DHF as documentation supporting an application for approval to install, will be treated as commercial in confidence and not released without permission from the proponent of the system.

5.3 Approval process

Following is a summary of the approval to install process. The duration taken to decide an application will depend on the risk and complexity of the system as well as any additional information requested to decide the application.

Application lodged with DHF.

1. DHF gives acknowledgement notice.
2. DHF refers application to relevant state agencies.
3. DHF and advisory state departments review application.
4. Advisory state agencies give DHF an information request, if required.
5. DHF gives the information request to applicant, if required.
6. Applicant responds to the information request.
7. DHF advises state agencies of response.
8. State agencies offer advice on application response to DHF.
9. DHF determines the application.
10. DHF advises applicant and advisory state agencies of decision.

5.4 Approval conditions

Approval to install may include a number of conditions imposed by DHF, which need to be addressed in the final submission for approval to operate. The conditions will be based on the preliminary assessment of the system and its overall risk.

The approval to install will include a condition that any recycled water from the system will not be discharged to the environment or used until the system has been validated (where necessary) and verified. Until validation and verification of the system has occurred all recycled water must be disposed of to sewer (providing it is available) in accordance with a trade waste approval from the Power and Water Corporation.

The conditions will explicitly reference the source of the recycled water, the end uses and the final recycled water quality for each of the end uses.

6. STEP FOUR: Risk assessment process

A risk management framework is seen as the most effective way to ensure the appropriate quality of recycled water for the proposed end use (NRMCC, EPHC and AHMC 2006). A risk management approach involves identifying and managing risks in a proactive way, rather than simply reacting when problems arise.

A number of existing guidelines adopt a risk management framework for assessing water quality, including the *Australian Drinking Water Guidelines* (NHMRC & NRMMC 2004), the *World Health Organization (WHO) Guidelines for Drinking-Water Quality* (WHO 2004) and most recently the Australian Guidelines for Water Recycling (2006). All of these approaches incorporate Hazard Analysis and Critical Control Point (HACCP) principles and are consistent with other established systems such as ISO 9001 and Australian Standard AS/NZS 4360.

These guidelines follow a risk management approach and apply HACCP principles in order to provide measurable and ongoing assurance that performance requirements are met. The principles are also being applied to ensure that, as far as possible, any non-conformance with the system requirements is detected before supply, discharge or application of recycled water, to minimise the risk to public health and environment.

AGWR Section 2.3 provides further information about the 'Preventative measures for recycled water management' including:

- Preventative measures and multiple barriers
- Critical control points

AGWR Chapter 3 provides further information about 'Managing health risks in recycled water'

This Part will assist the proponent of a recycled water system to:

- assemble a project team with the appropriate knowledge and expertise for the recycled water system
- prepare a recycled water system flow diagram
- identify the context and outline the criteria for the risk assessment
- undertake a complete risk assessment of the system prior to any controls
- implement the appropriate preventive controls and undertake a residual risk assessment of the system
- reduce all risks from the recycled water system to an acceptable level
- design a recycled water system that incorporates the management actions identified in the risk assessment.

The Risk Assessment process detailed in AGWR Chapter 3 applies to all high risk proposals. This includes the calculation of DALYs, Hazard identification, Dose response, Exposure assessment, and Risk characterisation.

6.1 Hazard identification and risk assessment

a) Assemble a team with the appropriate expertise and knowledge on the recycled water system

The team will have the collective responsibility for identifying the hazards that can occur in the recycled water production and delivery process. The team members need to have the skills required to identify hazards and the barriers necessary for their control as well as have the authority to ensure that barrier management is developed and will be selected depending on the focus of the hazards being identified.

The team members should come from a range of backgrounds (health, engineering, environmental, planning, etc). In some instances this stage will necessitate the proponent of the recycled water system going to tender to identify the appropriate expertise for the design and implementation of the project – where the knowledge is not available "in house."

In situations where required skills are unavailable locally, the team leader should explore opportunities for external support including benchmarking or partnering arrangements with other organisations, agencies, national or international assistance programs and internet resources.

A list of team members, their positions, responsibilities and contact details, should be compiled for reference. This list should be updated on a regular basis so the details remain current. Once all details are inserted into the table, the table needs to be signed off as an accurate record of that information and the details changed as required. Failure to update the list, due to restructuring of organisations, change of jobs etc, could cause a significant risk in terms of communication.

b) Establish the risk context of the system and the criteria against which risk will be evaluated

Outline the context

Setting the scope and boundaries of the risk assessment involves defining the extent of the recycled water system, including specific inclusions and exclusions (AS/NZS 4360:1999). Defining the extent of the recycled water system will allow the identification and management of potential hazards with the system.

Defining a recycled water system involves subdividing the system into a set of steps in order to provide a logical framework that helps ensure significant risks are not overlooked. In general, the construction of a flow diagram is considered the tool of choice. The flow diagram also provides visualisation of possible routes of contamination, transfer pathways and barriers. In practice, most hazards may not pose a significant risk but they need at least to be considered in the first instance to prevent some being overlooked and to demonstrate due diligence.

The recycled water project team should construct a general flow diagram showing all the steps in the system from source to end use. As a minimum the process flow diagram should include:

- all steps of the process – both under the control of the proponent and outside the control of the proponent
- the source(s) of water
- the basic proposed treatment system
- any storages both prior to and following treatment
- the proposed distribution system
- the proposed end uses
- any residuals produced from the treatment process
- any unintended or unauthorised end uses
- any discharges or releases to the environment
- the receiving environment and/or routes of exposure
- any additional considerations needed to maintain the quality and/or safety of the recycled water.

This step is easier if the system is considered on a broad scale first and then the larger components are broken into their sub-components. It is also beneficial if each process step is numbered in a logical fashion as this will facilitate the hazard analysis step. The information should be displayed in a format that is most useful to the operator of the system.

It is most important to represent the flow diagram accurately. Confirmation of the flow diagrams is a necessary part of the whole risk assessment and management process to make sure that all parts of the proposed system are properly assessed. Confirmation of flow diagrams should therefore involve those people familiar with a system and/or field audits where possible. The flow chart should be signed off by the team leader for authenticity and status.

Set the criteria

Decisions concerning whether risk management is required may be based on operational, technical, financial, legal, social, environmental, humanitarian or other criteria. The criteria should reflect the context defined above. These often depend on the recycled water system's policies, goals and objectives and the interests of stakeholders.

Criteria may be affected by the perceptions of stakeholders and by legal or regulatory requirements. It is important that appropriate criteria be determined at the outset. Although the broad criteria for making decisions are initially developed as part of establishing the risk management context, they may be further developed and refined subsequently as particular risks are identified and risk analysis techniques are chosen. The risk criteria must correspond to the type of risks and the way in which risk levels are expressed.

The *Australian Standard AS/NZS 4360:1999 Risk Management* outlines three methods for ranking risks; qualitative, semi-quantitative and quantitative.

Semi-quantitative and quantitative risk assessments rely on numerical estimates of risk based on research and/or actual recorded events (e.g. the risk of illness caused by a specific pathogen following specific exposure). Quantitative assessments generally require numerical information on hazard identification, dose response, exposure assessment and risk assessment. Quantitative risk assessments are most commonly used to assess health risks. Quantitative risk assessment is preferred for systems that consider high-risk end uses; for example dual reticulation projects.

More information on quantitative risk assessment for recycled water systems is contained in AGWR Section 3.2.

Qualitative assessments use a combination of the likelihood of a risk event occurring and the impact if that event occurs to give an overall risk rating. The descriptions for each of the criteria should be determined at the beginning of the risk assessment process.

Simple risk assessment matrices are available and have been successfully applied to prioritising hazards in the water industry (e.g. Gray and Morain, 2000; Deere *et al*. 2001). These matrices typically apply technical information from guidelines, scientific literature and industry practice with well informed "expert" judgement supported by third party peer review or benchmarking. An important consideration is that the risk ranking is specific for each water supply system since each system is unique. Tables 2 to 4 outline an example of likelihood, impact and rating measures adapted from *AS/NZS 4360:1999 Risk Management*. Likelihood and impact measures should be developed for each of the criteria identified above. Qualitative assessments are most commonly used in the absence of adequate data to allow quantitative analysis for example environmental risk assessments.

For quantitative health risk analysis it is recommended that the tolerable level of risk be expressed in disability adjusted life years (DALYs). Regardless of the chosen method the tolerable level of risk should be identified. Refer to AGWR Section 3.1 for further information about DALYs. Risks above the tolerable level will require the application of control measures to reduce the risk to an acceptable level.

Table 2 Example definitions of consequence

Score	Descriptor	Example Definition	
		Human Health	Environment
5	Catastrophic	Severe illness or death affecting a large population	Severe, permanent environmental impact
4	Major	Severe illness or death affecting a small population	Severe, long-term environmental impact
3	Moderate	Short term, low level illness, affecting a large population	Localised, medium-term environmental impact
2	Minor	Short term, low level illness, affecting a small population	Localised, short-term environmental impact
1	Insignificant	No detectable human health illness	No detectable environmental impact

Table 3 Example definitions of likelihood

Score	Descriptor	Example Definition
E	Almost certain	Event is expected to occur often (several times per year)
D	Likely	Event will probably occur often (once every 1 to 3 years)
C	Possible	Event might occur (once every 3 to 10 years)
B	Unlikely	Event could occur (once every 20 years)
A	Rare	Event will occur only in rare circumstances (once every 100 years)

Table 4 Risk ratings

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Almost certain**	Low	Medium	High	Very High	Very High
	Likely	Low	Medium	High	Very High	Very High
	Possible	Low	Medium	Medium	High	Very High
	Unlikely	Low	Low	Low	High	High
	Rare	Low	Low	Low	Medium	High

c) Identify hazardous contaminants

In terms of the quality of the end product, a hazard is classed as a biological, chemical or physical agent with the potential to cause an adverse effect when present at a certain level. This information will mainly come from the previously completed assessment of the source(s) of the recycled water in step two. However, additional hazardous contaminants may be added during treatment (e.g. chemicals) or produced as a result of the treatment (e.g. screenings). Examples of biological and chemical hazards are presented in more comprehensive detail in Appendix 1.

Hazards may also exist which have the potential to affect the operating staff. In some cases, a control measure for a product hazard, such as chlorine used for disinfection, may cause an occupational health and safety issue if not stored, used and managed appropriately.

Although there is an emphasis in this section on assuring quality of product, the hazard elements are also important in assuring staff safety from an occupational health and safety perspective.

d) Identify and analyse the hazard events with existing controls in place

Once hazards are identified, it is important to consider the corresponding events that lead to their presence, that is, the scenarios by which hazards can enter, or arise in, the system. These scenarios might be termed “hazard events”, “hazard causes” or “hazardous events”.

Using the validated flow diagram and identification of the raw materials, each part of the process should be worked through and hazardous events identified which have the potential to impact on the final intended use of the product or operations. At each step of the process, the objective is to identify what could happen to lead to contamination of the recycled water by the identified hazards (product hazards or operating hazards).

In terms of product hazards, the team should also consider influencing factors such as:

- accidental or deliberate contamination
- pollution source control practices
- wastewater treatment processes including raw materials
- receiving and storage practices
- sanitation and hygiene
- equipment and infrastructure maintenance and protection practices
- design deficiencies (known and unknown)
- quality control reports, customer complaints, inspection reports (not hazards per se but can be indicative of where hazards may exist)
- intended consumer use
- unintended or unauthorised use.

Events can cause contamination directly and indirectly. For example, pathogens can enter recycled water supplies directly from faeces. However, the growth of toxic cyanobacteria (blue-green algae) that release toxins, are promoted by a combination of factors such as temperature, nutrients and sunlight. As such these factors should be considered contributory factors leading to the presence of a hazard.

These contributory factors may require managing as part of risk management plan. It may be that some parts of the process pose no or insignificant hazards however this information still needs to be documented to show that due diligence has been applied through the hazard identification process.

Once the hazard events have been identified, the next step is to translate each hazard event into a ‘risk score’, i.e. the probability of it occurring, with no controls in place, using the criteria developed above. This analysis should consider the range of potential consequences and how these could occur.

e) Evaluate the risks

This step allows each hazard event to be prioritised for action so that those that present an unacceptable risk can be identified, prioritised and managed to remove the hazard or to reduce the likelihood and/or consequence of the event occurring. The estimated levels of risk should be compared against the pre-established criteria and the balance between the potential benefits and adverse outcomes compared. This enables decisions to be made about the extent and nature of risk management required and about priorities.

The objective of this part of the exercise is to separate the "bad" hazardous events from the "not so bad", i.e. the ones that need to be focused on and/or need extra control measures.

6.2 Risk management and Critical Control Points

a) Treat the risks

Once hazardous events have been assessed and prioritised, the next step is to manage the risks. One way to manage risks is to implement barriers to contamination. Barriers can be defined as control points, i.e. points that control the risk by reducing or eliminating the transfer of pathogens or chemicals to end-users.

However, some of these control points can be elevated to a more significant level by being termed **Critical Control Points** (CCPs). In the standard "Codex HACCP", a CCP is defined as a point, step or procedure at which control is *essential* to prevent or eliminate a hazard or reduce it to an acceptable level. Other control measures may be just as important but are considered on a case-by-case basis.

Some systems may have numerous valuable control measures and control points, none of which are in themselves critical, leading to no CCPs. This situation arises because in multiple barrier systems, the final quality of the water results from the sequential action of those multiple barriers. Alternatively, several CCPs might exist in the same system to control the same hazard. CCPs generally have the following properties:

- Limits for operational acceptability can be defined for example numerical quality criteria can be defined
- These limits can be monitored, directly or indirectly through surrogate organisms
- A pre-determined corrective action (response) can be enacted when deviations are detected by monitoring
- The corrective action will protect water safety by bringing the control measure back into specification or by enhancing or implementing additional control measures
- The process of detection of the deviation and completion of the response can be completed in a timeframe adequate to maintain water safety.

Importantly, the CCPs are those steps that are essential for confidence in the safety of the recycled water product. This does not mean that if the step were omitted the recycled water would always be unsafe. It simply means that there would not be confidence that the recycled water would remain safe in the absence of the proper functioning of that CCP. Control points might simply be defined as points in the system.

The determination of what constitutes a CCP can be facilitated by the use of a decision tree. HACCP provides a logic decision tree however, for the purposes of this document the decision tree has been modified for ease of use (see Figure 1).

However, the method for choosing CCPs needs to be flexible and should be guided by the expertise of the team.

Because control and critical control points are identified as being essential for risk management, critical limits need to be set for each point, to show that the defined hazardous event is under control. Critical limits may consist of either measurable or observable factors and should preferably be on-line or rapid to ensure a prompt response to any exceedances.

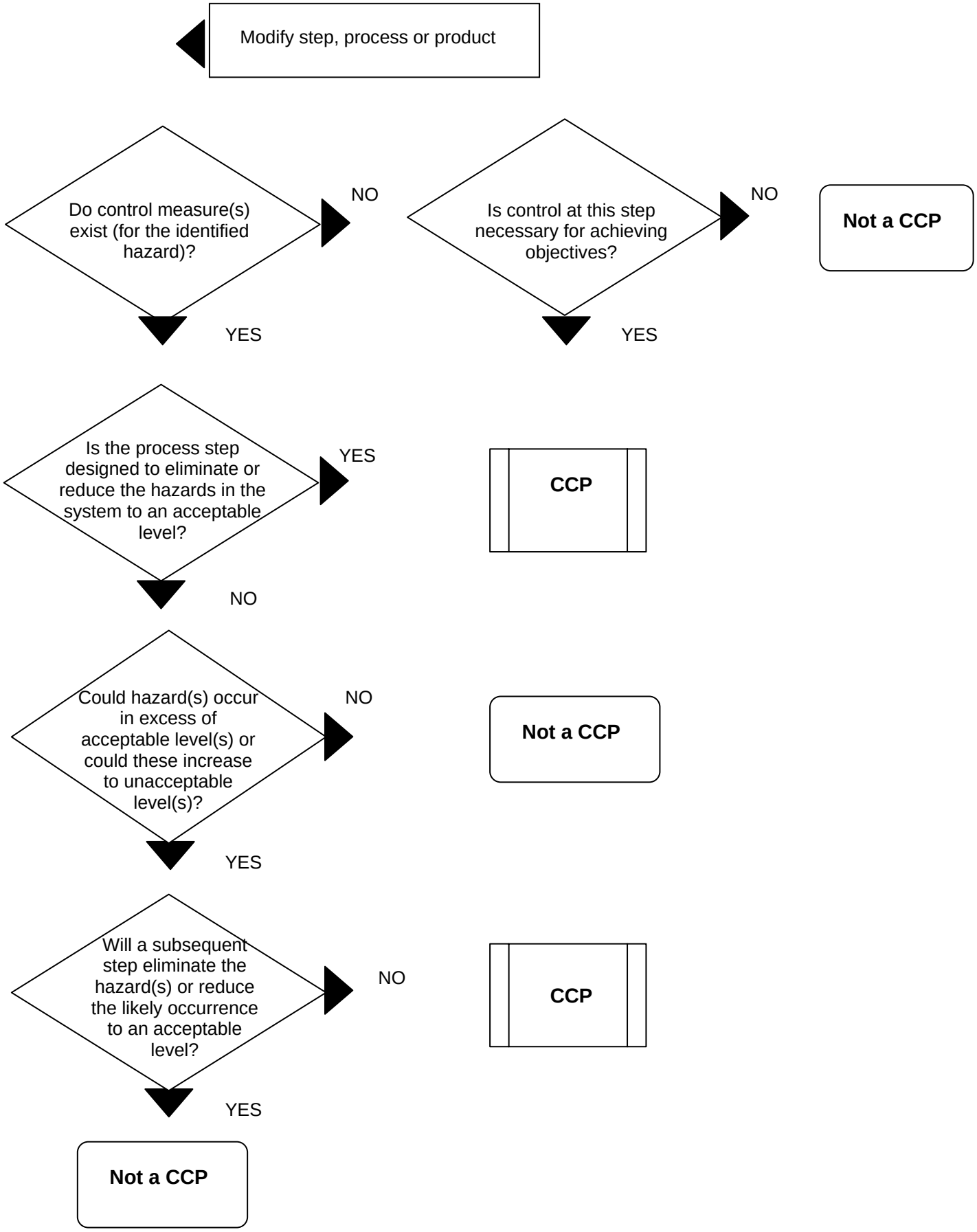
A critical limit separates acceptability from unacceptability. Typically, the operational limit is a target based on the need to detect any system deviations in advance of recycled water safety being threatened. Therefore, the operational limits are generally targets that are more stringent than the critical limits and may involve detecting trends towards critical limits.

Examples of criteria that are used as operational or critical limits include measurable variables, such as chlorine residuals, pH and turbidity, or observable factors, such as observing the integrity of vermin-proofing screens. Each CP and CCP has operational and critical limits that are specific for each hazard and event. The limits need to be directly or indirectly measurable. Current knowledge and expertise, including industry standards and technical data, as well as locally derived historical data, can be used as a guide when determining the limits. Target limits might be set for the system to run at optimal performance whilst action limits might be set when corrective actions are required to prevent or limit the impact of potential hazards on the safety and quality of the water.

Limits can be upper limits, lower limits, a range or an envelope of multiple measures. They are usually indicators that can be readily interpreted at the time of monitoring and where action can be taken in response to a deviation to prevent unsafe recycled water being supplied or a hazard getting into the final product or the environment. In most cases, routine monitoring of CPs/CCPs will be set based on simple surrogate observations or tests, such as turbidity or structural integrity, rather than complex microbial or chemical tests. The complex tests are generally applied as part of validation and verification activities (discussed below) rather than in monitoring operational limits.

Routine monitoring should be sensible and suitable for controlling the hazard within the set limit. It may not be appropriate for every CCP to have both an operational and a critical limit. Determine what is appropriate for the particular system. The team needs to make sure that the limit set will be at such a level to ensure that the final recycled water product is acceptable.

Figure 1 Modified HACCP decision tree



b) Monitor and review

It is necessary to monitor the effectiveness of all steps of the risk management process. This is important for continuous improvement and to demonstrate due diligence.

Monitoring is defined as the act of conducting a planned sequence of observations or measurements of control parameters of the CPs/CCPs to detect when they have failed or if they are about to fail, i.e. when they have reached their operational and/or critical limits as defined above. When considering monitoring requirements for each control barrier, it is important to set realistic goals. The frequency of a particular monitoring regime for instance, should be in line with the speed at which a barrier can fail.

Therefore, for a factor such as fence integrity, one might decide that fence checks at monthly intervals would be adequate whereas for monitoring of weather patterns, daily reports may be necessary.

Monitoring relies on establishing the "what", "how", "when" and "who" principles. For instance:

- What will be monitored?
- How will it be monitored?
- When will it be monitored?
- Who is responsible?

The proponent of a system may find in completing this step that what has been set as the critical limit may not actually be appropriate. The proponent may have to iterate between the steps above to achieve a sensible and suitable outcome.

The following table shows what could be monitored if bacterial contamination of source water is identified as a potential hazard and disinfection is identified as a CP/CCP.

	Frequent monitoring example: disinfection control
What?	Flow and turbidity will be monitored to provide for a minimum retention time of 15 minutes with a turbidity of < 5.0 NTU
How?	Measured via telemetry and on-line probes with alarms
When?	The telemetry is downloaded automatically and continuously monitored
Who?	Telemetry officer

If monitoring shows that an operational or critical limit has been exceeded, then the potential exists for the recycled water to be, or to become, unsafe. The objective is to monitor CPs to a statistically valid sampling plan and in a timely manner to prevent the supply of any potentially unsafe water. A permanent record of monitoring must be maintained.

Documentation is necessary to demonstrate that both the recycled water risk management plan is in place and that it is being adhered to. Further, recording monitoring activities and any noteworthy events that have occurred provides a valuable body of information for facilitating trend analysis.

Documentation is not only an essential part of following the plan but is also a powerful way of demonstrating that all due diligence and reasonable precautions have been taken by the recycled water proponent as the information is readily available for people to see.

To be duly diligent, the risk assessment needs to be reviewed at predetermined periods to incorporate new information as it becomes available and to make sure that the risk management is still capable of controlling the identified hazards.

7. STEP FIVE: Monitoring requirements

Monitoring of the recycled water system is important to:

- validate and verify that the system design and equipment is adequate and suitable for the necessary treatment
- confirm the ongoing operational performance of the treatment system to protect human health and the environment
- detect any potential or actual failures on the treatment system and implement the appropriate corrective actions.

This chapter will assist the proponent of a recycled water system to:

- prepare a monitoring plan to validate and verify the recycled water system
- prepare a monitoring plan for the ongoing operation of the system including operational target (set points) and critical limits, site and/or receiving environment and customer satisfaction monitoring.

The following information on the validation and verification processes is summarised in Table 5.

7.1 Validate processes

Recycled water systems require a high standard of operation, monitoring and control to maintain the water quality of the end product. To ensure that appropriate treatment systems are selected, a validation process will need to be developed and undertaken to determine whether the proposed treatment technologies/systems will perform effectively. Assumptions and manufacturer specifications for each piece of equipment and each barrier need to be validated for each system being studied to prove that it is effective in that system.

Validation plays a key role in determining log reduction values attributable to a particular treatment process and the related operational monitoring requirements such as critical limits and target criteria.

For some processes (e.g. chlorination) published data recognised by DHF can be used. Individual validation for other technologies (e.g. micro and ultra filtration, UV disinfection) will be required as these processes are known to produce variable results. Innovative processes will always require individual validation.

Validation techniques and protocols will depend on the technology used and should be discussed with DHF in the early planning stages. Validation by other jurisdictions will be favourably considered by DHF.

Validation of a treatment system shall include all components of the process, such as treatment technology, balancing tanks, storages, on-line monitoring and disinfection. Validation will also include a review of the process flow diagram used in the risk assessment against the actual system to ensure all potential hazardous events have been captured and CCPs identified.

More information on ‘Validation, research and development’ is contained in AGWR Section 2.9

Once the treatment system validation process has been approved by DHF (in particular the final quality criteria), with advice from NRETAS and DPI, the treatment system will be recognised as a validated treatment system for use in recycled water systems for that particular influent quality and end use. DHF will maintain a record of all validated systems.

The benefit of a treatment system acquiring validated status is that a validated system can be commissioned at any site, provided that the influent quality and proposed end uses are comparable. However, the system will still need to undergo the minimum system verification testing in-situ (see below).

Processes will be required to be re-validated where there are changes to the influent quality, system design and/or technology that may affect the performance of the process and in turn the final recycled water quality. Where additional end uses of the recycled water are proposed further validation of the system may be required based on a risk assessment process.

The validation process must meet the following requirements with regards to location, water quality compliance and discharges; with all procedures for sampling and testing documented in a monitoring plan.

Location

Validation can be undertaken in-situ at the installation site of the recycled water system under consideration. In many circumstances, the manufacturer[6] of a package treatment process may elect for the system to undergo validation testing in-situ for the first treatment system installed.

Alternatively, packaged systems or off-the-shelf technologies can be validated off-site, by the proponent of a recycled water system and/or the manufacturer of the system. This is on the proviso that the test treatment system is the same as the system proposed, and the influent treated by the validation process is of similar (or worse) quality than the proposed influent.

Water quality compliance

The treatment system must be validated to meet the water quality compliance values required for the proposed recycled water end use as guided by the risk assessment process and outlined by DHF in the conditions for the approval to install. The monitoring requirements (parameters, sample points, method and frequency) for validation will be based on the proposed end use and the influent strength and must be clearly outlined in the validation monitoring plan.

For guidance Table 5 outlines the minimum recommended monitoring requirements for the validation of systems that incorporate the treatment of blackwater.

Proponents (and manufacturers) are not restricted in the technology or treatment to be used to meet the water quality compliance values.

Recycled water system proponents (and/or manufacturers) may choose to validate the pathogen removal capability of their treatment components. The ability of a treatment component to remove pathogens is usually referred to as a log reduction. For example a one log reduction indicates that 90 per cent of the pathogens have been removed, a two log reduction indicates that 99 per cent of the pathogens have been removed and so on.

Recommended log reductions for recycled water uses are shown in Table 3.7 and for treatment processes in Table 3.8 of the AGWR. All high risk proposals must demonstrate log reductions in accordance with the AGWR tables.

Where low concentrations of pathogens are present in the influent it may be desirable to challenge test the recycled water treatment systems (or parts of) by spiking the influent with seeded organisms and monitoring the organisms in both the influent and treated water streams in order to demonstrate the log reduction. Challenge testing is useful to validate the log reduction of the system process or processes where the influent strength is highly variable or where the same technology is likely to be applied to different strength

[6] As opposed to the recycled water system proponent, where the “manufacturer” wishes to validate the system for the treatment of a variety of source waters and/or end uses.

influents. Understanding the log reduction capability of a system process or processes can also help to confirm the risk assessment.

In some instances, for example where the proposed end use of the recycled water represents a high risk or the recycled water system (treatment, distribution and/or use) is of a novel configuration, it will be mandatory to challenge test the recycled water treatment system (or parts of it) to demonstrate an adequate log reduction of pathogens. Such challenge testing will be at the direction of DHF.

Appropriately trained personnel should collect all water quality samples. A laboratory accredited for the specified tests by an independent body acceptable to DHF, such as the National Association of Testing Authorities (NATA) or equivalent shall carry out all analyses. Where challenge testing is undertaken, it shall be undertaken by a laboratory with the appropriate NATA accreditation.

Results consistent with the compliance values must be produced for a continuous minimum period of twelve (12) weeks for all recycled water systems regardless of the level of risk.

Where sample results are collected from an online sampler, a schedule of online calibrations shall be developed and records of the online calibrations shall be maintained.

Discharges

During the validation period, all recycled water shall be discharged to sewer, unless otherwise permitted by DHF. Such diversion must be in accordance with the local water authority's requirements, which may limit discharge rates and/or timing.

7.2 Verify recycled water quality

Implementation of a risk management plan in itself is not sufficient to show that the plan is being followed in practice. Verification needs to be carried out to make sure that a process or system is performing as planned. Verification of a recycled water system will involve making sure that the system in general is not having adverse impacts on the receiving environment. Verification could mean additional checks of operational practices as well as monitoring of receiving environments for particular nutrients or pathogens, etc.

Verification of the recycled water system will assess the overall performance of the treatment system, including the operational and critical control limits, and the ultimate quality of the recycled water. System-specific verification is essential as variability in water or waste stream composition for instance, may have a large impact on the efficacy of certain removal processes.

The operation of the entire recycled water system must be included in the verification.

The verification process must meet the following requirements for location water quality compliance, sample collection, discharges, cross-connection and reporting; with all procedures for sampling and testing documented in a monitoring plan.

More information on verification of recycled water systems is contained in AGWR Section 2.5 and AGWR Chapter 5.

Location

The verification samples must be taken in-situ at the site of the recycled water system.

Water quality compliance

Specification of the target operating range and critical limits for each variable of the treatment process (e.g. flow rate, pressure, chlorine residual, etc) that will produce recycled water of sufficient quality to meet the compliance values is required to be tested and confirmed during the verification period. The method, location and frequency for each of the proposed monitoring parameters must also be clearly specified in the operational monitoring plan.

For guidance Table 5 outlines the minimum recommended monitoring requirements for the verification of systems that incorporate the treatment of blackwater. The specific parameters to be monitored should relate to the water quality objectives for the system, and should be developed in consultation with DHF.

Appropriately trained personnel should collect all water quality samples. A laboratory accredited for the specified tests by an independent body acceptable to DHF, such as the National Association of Testing Authorities (NATA) or equivalent shall carry out all analyses. Where challenge testing is undertaken, it shall be undertaken by a laboratory with the appropriate NATA accreditation.

Triplicate sampling is recommended to improve the statistical analysis of the data.

Results consistent with the compliance values must be produced for a continuous, minimum period of four (4) weeks for all recycled water systems regardless of the level of risk. Where validation of the recycled water system has occurred in-situ, the verification period can be included in the final four (4) weeks of the validation period.

Where sample results are collected from an online sampler, a schedule of online calibrations shall be developed and records of the online calibrations shall be maintained.

Discharges

During the verification period, all recycled water shall be discharged to sewer (where available), unless otherwise permitted by DHF. Such diversion must be in accordance with the local water authority's requirements, which may limit discharge rates and/or timing.

Cross-connections

Where there is concurrent potable water supply to the recycled water system, there is a requirement to install testable double check backflow prevention devices on water and wastewater connections of the property with the recycled water system.

Recycled water shall not be provided for end use until an authorised Plumbing or Drainage Inspector, or if acceptable to the local water authority, a licensed plumber with accreditation in recycled water systems and backflow testing and maintenance, has verified there are no cross connections at that point in time.

7.3 Ongoing operational monitoring

Ongoing operational monitoring is required to ensure the recycled water quality is maintained and the health of users and the environment is protected.

The risk assessment and HACCP process will have identified appropriate critical limits for water quality parameters that shall form part of the ongoing monitoring plan. It is the responsibility of the proponent of the recycled water system to prepare an ongoing operational sampling regime that reflects the risk assessment and HACCP process. DHF will review the propose schedule and either approve, request additional information or recommend changes.

The operational monitoring must meet the following requirements for water quality compliance, application site and receiving environment monitoring, customer satisfaction, and cross connection; with all procedures for sampling and testing documented in a monitoring plan.

Water quality compliance

Specification of the target operating range and critical limits for each variable of the treatment process (e.g. flow rate, pressure, chlorine residual, etc) that will produce recycled water of sufficient quality to meet the compliance values is required to be monitored and confirmed during the ongoing operation. The method, location and frequency for each of the proposed monitoring parameters must also be clearly specified in the operational monitoring plan.

For guidance Table 6 outlines the minimum likely acceptable monitoring requirements for the verification of systems that incorporate the treatment of blackwater. Over time the sampling frequencies may be reduced based on a satisfactory historical record and subject to the approval of DHF.

Appropriately trained personnel must collect all water quality samples. A laboratory accredited for the specified tests by an independent body acceptable to DHF, such as the National Association of Testing Authorities (NATA) or equivalent shall carry out all analyses. Where challenge testing is undertaken it shall be undertaken by a laboratory with the appropriate NATA accreditation.

Triplicate sampling is recommended to improve the statistical analysis of the data.

Results consistent with the compliance values must be produced for all operational monitoring. Where guideline values are exceeded, sampling frequencies should be increased.

Where sample results are collected from an online sampler, a schedule of online calibrations shall be developed and records of the online calibrations shall be maintained.

Application site and receiving environment monitoring

Application site and receiving environment monitoring (parameters and frequency) will depend upon the final end use of the recycled water and/or the risk of the recycled water system discharging to the environment but is particularly relevant to recycled water systems involving irrigation.

Where systems present a high risk to the environment it will also be important to undertake baseline monitoring of the environment to establish the pre-existing conditions of the environment prior to the application and/or discharge of recycled water. Ongoing site and environmental monitoring could then be used to benchmark the effectiveness of controls in preventing environmental impacts.

Environmental aspects that may require monitoring include:

- soil health including chemistry and structure
- plant health including terrestrial and aquatic vegetation
- groundwater and surface water quality and quantity
- noise
- odour.

Site application and receiving environment monitoring need not be complex where the risks are not significant and may include simple site and visual inspections to assess any impacts.

Customer monitoring

Ongoing operational monitoring should also include a formal process for monitoring customer satisfaction with the recycled water system. A procedure should be established to record and respond to any actual or perceived complaint from customers or other stakeholders.

In the longer term customer and stakeholder monitoring can be used to generate trends and improve the preventive actions for the recycled water system.

Cross-connections

Where there is concurrent potable water supply to the recycled water system, it is recommended that 20 per cent of the properties connected to the system are audited every year to monitor the potential for cross connection of the potable water supply and the recycled water supply.

Figure 2 Flow chart validation and verification monitoring requirements

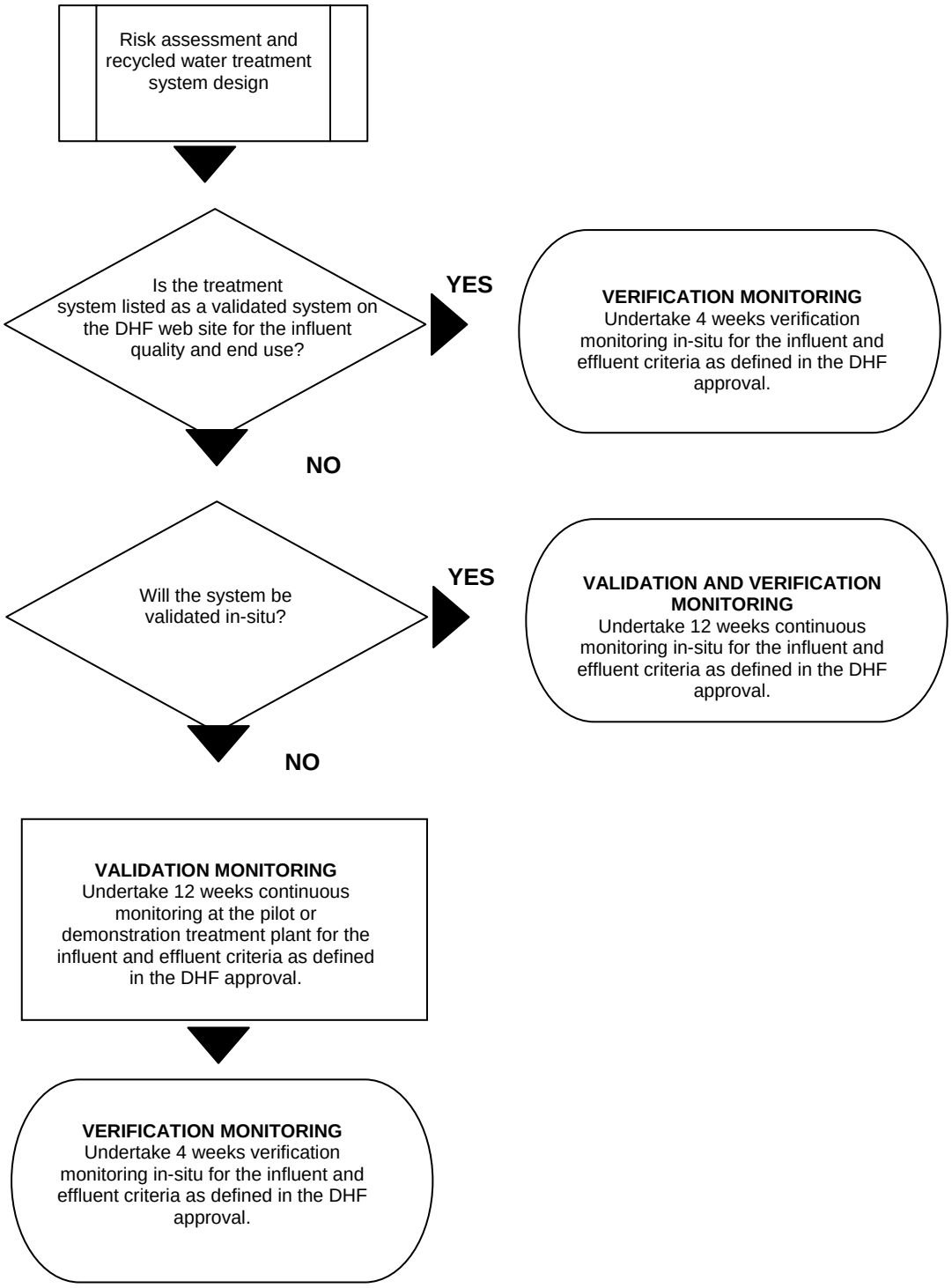


Table 5 Recommended validation and verification monitoring

Exposure Risk Level	Potential End Uses	Validation (and Verification) Monitoring			
		Parameter	Effluent Compliance Value	Influent Monitoring Frequency	Effluent Monitoring Frequency
HIGH	End uses with a high level of human contact, including: **-** Residential dual reticulation **-** Multi-unit dwellings, internal reuse and external irrigation* - Commercial food crops consumed raw or unprocessed (e.g. salad crops)[11] - Urban irrigation with unrestricted access and application*	*E.coli*[1]	< 1 cfu/100 mL	Weekly	2 times/week
		BOD	< 10 mg/L	Not required	2 times/week
		SS	< 10 mg/L	Not required	2 times/week
		pH	6.5 – 8.5	Continuous online (or weekly)	Continuous online
		Turbidity	< 2 NTU (95%ile)[9] < 5 NTU (maximum)	Continuous online (or weekly)	Continuous online
		Disinfection	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	NA	Continuous online
		Coliphages[1]	< 1 pfu/100 mL	Fortnightly	Weekly
		Clostridia[1]	< 1 cfu/100 mL	Fortnightly	Weekly
MEDIUM	End uses with a medium level human contact, including: - Urban irrigation with some restricted access and application** - Commercial food crops[11] - Fountains and water features	*E.coli*[1]	< 100 cfu/100 mL	Weekly	2 times/week
		BOD	< 20 mg/L	Not required	2 times/week
		SS	< 30 mg/L	Not required	2 times/week
		pH	6.5 – 8.5	Continuous online (or weekly)	Continuous online
		Turbidity	< 5 NTU (95%ile)[9]	Continuous online (or weekly)	Continuous online
		Disinfection	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	NA	Continuous online
LOW	End uses with a low level of human contact, including: **-** Urban irrigation with enhanced restricted access and application irrigation (e.g. sub-surface irrigation of playing fields)*** **-** Commercial food crops[11]	*E.coli*[1]	< 1000 cfu/100 mL	Weekly	2 times/week
		BOD	< 20 mg/L	Not required	2 times/week
		SS	< 30 mg/L	Not required	2 times/week
		pH	6.5 – 8.5	Continuous online (or weekly)	Continuous online
		Disinfection (if used)	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	NA	Continuous online
	Non-food crops (trees, turf, woodlots, flowers)	*E.coli*[1]	< 10000 cfu/100 mL	12 monthly	12 Monthly
		BOD	NA	Not required	Not required
		SS	NA	Not required	Not required
		pH	NA	Not required	Not required
		Disinfection (if used)	NA	Not required	Not required

Table 6 Recommended operational monitoring requirements

Exposure Risk Level	Potential End Uses	Ongoing Monitoring			
		Parameter	Compliance Value	Monitoring Frequency	Effluent Monitoring Frequency
HIGH	End uses with a high level of human contact, including: - Residential dual reticulation - Multi-unit dwellings, internal reuse and external irrigation* - Commercial food crops consumed raw or unprocessed (e.g. salad crops)[11] - Urban irrigation with unrestricted access and application*	*E.coli*[1]	< 1 cfu/100 mL	Weekly[a]	- Audit required once every 12 months. - Plumbing maintenance and alteration audits required once every five years, including backflow and cross-connection auditing. - Random audits may be carried out by DHF at any time.
		Turbidity	< 2 NTU (95%ile)[9] < 5 NTU (maximum)	Continuous online (or weekly)	
		pH	6.5 – 8.5	Continuous online (or weekly)	
		Disinfection	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	Continuous online (or weekly)	
		Ongoing monitoring of coliphages and Clostridia dependant on the outcomes of the validation monitoring. For residential dual reticulation systems where chlorine is not used as the primary disinfectant chlorination will be required to provide a measurable residual at the point of use. Chorine residuals will be sampled at the delivery point of the system to ensure a chlorine residual is maintained.			
MEDIUM	End uses with a medium level human contact, including: - Urban irrigation with some restricted access and application** - Commercial food crops[11] - Fountains and water features	*E.coli*[1]	< 100 cfu/100 mL	Monthly[a]	- Audit required once every three years. - Plumbing maintenance and alteration audits required once every five years, including backflow and cross-connection auditing. - Random audits may be carried out by DHF at any time.
		Turbidity	< 5 NTU (95%ile)[9]	Continuous online (or weekly)	
		pH	6.5 – 8.5	Continuous online (or weekly)	
		Disinfection	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	Continuous online (or weekly)	
LOW	End uses with a low level of human contact, including: - Urban irrigation with enhanced restricted access and application irrigation (e.g. sub-surface irrigation of playing fields)*** - Commercial food crops[11]	*E.coli*[1]	< 1000 cfu/100 mL	Monthly[a]	- Audit required once every three years. - Plumbing maintenance and alteration audits required once every five years, including backflow and cross-connection auditing. - Random audits may be carried out by DHF at any time.
		SS	< 30 mg/L	Monthly[a]	
		pH	6.5 – 8.5	Continuous online (or weekly)	
		Disinfection (if used)	Cl: 0.2-1.0 mg/L residual[8] UV: TBA Ozone: TBA	Continuous online (or weekly)	
	Non-food crops (trees, turf, woodlots, flowers)	*E.coli*[1]	< 10000 cfu/100 mL	12 monthly	

[a] review frequency after 6 months operation

Notes to Table 5 and Table 6

Refer to Table 3.8 of the *Australian Guidelines for Water Recycling: Managing Health and Environmental Health Risks (Phase 1) 2006* for detailed explanation of 'Potential End Uses'.

*Urban irrigation with the potential for full public contact, no control to restrict access or minimise spray drift

**Urban irrigation with restricted public access (see Glossary of Terms) during irrigation

***Urban irrigation with restricted public access (see Glossary of Terms) and a combination of:

- no access after irrigation (normally 1 to 4 hours or until irrigation area is dry)
- minimum buffer zones to the nearest point of public access
- spray drift controls, e.g. low throw sprinklers, vegetation screening OR
- sub-surface irrigation.

1. Water quality objectives represent rolling media of 5 consecutive samples for numbers of micro-organisms.
2. Residential systems with dual reticulation will require some validation (verification) monitoring that there is a chlorine residual present at the point of use.
3. Testing requirements assume blackwater as the source of influent.
4. Proponent may choose to challenge test to validate system against different strength influents.
5. DHF may direct proponent to challenge test where adequate log removal needs to be demonstrated, e.g. novel configuration or high-risk installations.
6. A minimum period of 12 weeks of continuous compliance with the discharge limits is required during the validation period.
7. Refer to the Tables 3.7 and 3.8 in the AGWR for log removal criteria. Monitoring described is indicative since monitoring programs will need to be customised to reflect the source(s) and end uses(s) of the recycled water.
8. Total chlorine residual after a minimum contact time of 30 minutes.
9. Limit met prior to disinfection.
10. All exceedances of any of the values should be investigated and managed as an incident.
11. Refer Environmental Health Fact Sheet No. 512 *Standards for Microbiological Quality of Recycled Water for Irrigating Food Crops*

8. STEP SIX: Management procedures

Effective management is the key to ensuring that the requisite level of environmental and public health protection for any given community is achieved and maintained for a recycled water system. Numerous technologies are currently available to meet a broad range of recycled water treatment needs. Without proper management, however, these treatment technologies will fail to perform as designed and efforts to protect public health and the environment will be compromised.

Whilst the management procedures will form the basis of the submission for an approval to operate, the primary objective of the procedures is to provide an informative document for the ongoing operation and maintenance of the recycled water system. For this reason the procedures will need to be regularly reviewed and audited to ensure the information remains relevant to the system.

The system owner shall be responsible for the continuous implementation of the management procedures for the life-cycle of the system as well as updating and revising them where and when appropriate. If a transfer of ownership occurs the previous owner must ensure that the new system owners have a complete understanding of their obligations and responsibilities, which shall be set out in the current management procedures provided by the proponent on handover.

This chapter will assist the proponent of a recycled water system to:

- develop and document procedures for the operation of the recycled water system
- develop and document protocols for incident and emergency response including communication systems to deal with unexpected events.

8.1 Operational procedures

Operational procedures should be developed for each step in the treatment system for the recycled water system to ensure its safe operation. Particular attention should be given to ensuring that the appropriate strategies for managing the significant risks, identified in the risk assessment, are included. The process flow diagram developed in section 6.1 will be a useful tool in identifying where an operational procedure will be required.

The complexity of operational procedures will depend on the size and components of the recycled water system and the risk associated with the operational step.

Table 8 outlines an example template for preparing operational procedures. Appendix 4 contains a worked example of an operational procedure.

Table 8 Example operational procedure template

Process Step	Information on the Specific Process Step
Objectives	The objective of the operational procedure, i.e. what the procedure is trying to achieve.
Management Strategies	Outlines the management strategies that will be implemented for managing the process step to maintain the integrity of the recycled water system and the final quality of the recycled water.
Action	Steps taken to implement the nominated strategy, including when and by whom necessary tasks must be performed, maintenance requirements, consultation and monitoring.
Performance Indicators	Identifies the monitoring parameters that will be used to assess the performance of the management strategy.
Corrective Action	Identifies the corrective action, which will be undertaken if the management strategy is not working or there is a non-conformance with the procedure or monitoring limits.
Reporting	Describes the reporting, review arrangement (including auditing) for each task in the plan. This would include how often, by whom and reporting to whom.

8.2 Incidents and emergency response

An incident or emergency is any event that causes or has the potential to cause harm to either the health of the public or the environmental. Considered and controlled responses to incidents and emergencies in the recycled water system context are important to protect the health of the public and the environment.

The procedures that will be followed in the event of an emergency should be documented in a similar manner to the operational procedures. As a minimum incident and emergency procedures would be expected to be developed for; unplanned disruptions to treatment processes and cross connection incidents involving potable drinking water systems.

The procedures need to include:

- the names of key emergency response personnel
- personnel responsibilities and contact details (including all-hours telephone numbers)
- contact details for emergency services (e.g. ambulance, fire brigade, spill clean-up services)
- the location of on-site information on hazardous materials, including MSDS (Material Safety Data Sheets) and spill containment material
- steps to follow to minimise damage and control the emergency
- instructions and contact details for notifying the appropriate emergency services, DHF (public health emergency), NRETAS (environment emergency), and end users or the community if necessary.

More information on ‘Management of incidents and emergencies’ is contained in AGWR Section 2.6.

The recycled water system should be designed such that bypassing of untreated or partially treated wastewater direct to the point of use is not permitted or possible. When recycled water may be temporarily unsuitable for use due to an incident or emergency, an alternative source and/or disposal option should be made available for essential services to protect human health and the environment.

All employees of a recycled water system should be trained in the incident and emergency response procedures. The procedures should also be regularly practiced and reviewed to ensure the response remains appropriate.

Following the occurrence of an incident or emergency the corresponding procedure should be reviewed and updated to reflect any lessons learnt.

9. STEP SEVEN: Awareness and Training

All employees and end users of a recycled water system need to be aware of specific safety and environmental aspects of the treatment and use of recycled water.

This chapter will assist the proponent of a recycled water system to:

- identify the immediate and ongoing training and awareness needs of the recycled water system employees and end users
- document the training qualifications of the recycled water system operator(s).

More information on 'Operator, contractor and end user awareness and training' is contained in AGWR Section 2.7.

9.1 Training and awareness needs

The training and awareness needs of individuals involved with a recycled water system should be appropriate to the degree of risk and responsibility associated with their actions. For example, operators must be highly skilled in the management and operation of recycled water supply because their actions greatly influence the quality of the final product. Similarly for end users of recycled water, the training should ensure compliance with end use controls so that they are aware of why certain requirements are necessary to protect human health and the environment.

Specific relevant areas of training for various users might include:

Operator

- personal hygiene
- occupational health and safety, environmental and operational procedures and regulatory requirements
- documenting, reporting and recording requirements
- sampling protocols and procedures
- interpretation and recording results
- monitoring, operation and reporting of treatment process
- equipment maintenance and operation
- managing and reporting incidents and non-conformance
- emergency response preparedness
- water microbiology and chemistry
- liaison with end users
- other areas identified in the risk assessment.

End users

- personal hygiene
- basic information on the recycled water system
- how the recycled water can be used, safety aspects, and water conservation
- how the recycled water should NOT be used
- storage of the recycled water
- other areas identified in the risk assessment.

Visitors to site

- site induction
- personal hygiene
- safety aspects to be aware of whilst attending site
- other areas identified in the risk assessment.

A training and education program might include a mixture of formal training courses, information sessions, induction programs, on-the-job mentoring, brochures and/or posters.

Where necessary training should be regularly repeated (e.g. annually) to ensure that skill levels are maintained and due diligence can be demonstrated.

9.2 Operator Qualifications

Given the responsibilities of the operator of a recycled water system, formal recognised qualifications in the treatment system are recommended, however an equivalent of the 'NSW TAFE Certificate II in Water Industry Operations' is not available in the Northern Territory. The Certificate II is designed to assist both new and established workers competently and safely operated a treatment plant.

The operator shall receive training by the treatment plant manufacturer specific to the treatment plant and system installed. This training shall include theory and practice of operations, the function of each component of the system, how to evaluate the operation of each unit and safe working practices. All training should be recorded including detail of the content, the date and who conducted the training.

The proponent of a recycled water system must document and submit to DHF the following details about the operator:

- Name, contact details and qualifications
- Current certified copy of the operator's qualifications (where applicable)
- Outline of any ongoing training required
- Copy of service contract
- Details of backup operators.

10. STEP EIGHT: Approval to operate

To obtain approval to operate, a recycled water system must be approved by the Department of Health and Families under Regulation 17 of the *Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations*

This chapter will assist the proponent of a recycled water system to:

- identify and complete all the information requirements for the approval to operate including the completed templates mentioned in previous sections
- collate the information and prepare a submission to DHF for approval to operate

A proponent of a recycled water system may wish to apply for an approval to install and an approval to operate at the same time. To apply for an approval to operate the appropriate information must be available (as outlined in the above sections). The approval to operate will be made subject to appropriate validation (where validation has not previously occurred) and verification of the system and may contain additional conditions.

10.1 Prelodgement advice

DHF provides a prelodgement service that enables an applicant to discuss a proposal with them prior to lodging the approvals application. The idea of seeking prelodgement advice is to help identify issues relevant to the proposal or site location, and to identify any specific concerns related to the proposed system.

It should not be used to seek determination of the application (i.e. advise if the application will be approved/refused).

It is also possible (and recommended) to discuss a proposal with any other agencies (e.g. NRETAS, DPI) during the conceptualisation phase of the project.

It is recommended that the proponent of a recycled water system contact DHF for further information about arranging a prelodgement meeting.

10.2 Supporting information and lodgment

To obtain a DHF approval to operate a recycled water system, the information and templates outlined in steps four (risk assessment) to seven (awareness and training) in the sections above should be fully completed. Together the information from all steps (one to nine) of the process will form the System Management Manual (SMM) for the recycled water system.

In addition to the System Management Manual, the proponent of the recycled water system should also provide DHF with the monitoring results from the validation and verification of the system.

The form in Appendix 4, together with the System Management Manual and the evaluation report, should be lodged with DHF Environmental Health Program.

Any information provided to DHF as documentation supporting an application for approval to operate will be treated as commercial in confidence and not released without permission from the proponent of the system.

10.3 Approval process

Plumbing and drainage of the systems shall be assessed in accordance with the requirements of the local water authority and/or the Department of Planning and Infrastructure (inside Building Control Areas). All plumbing work inspections must be carried out by an authorised Plumbing and Drainage Inspector, or, if acceptable to the local water authority and/or the Department of Planning and Infrastructure (inside Building Control Areas), a licensed plumber with knowledge in recycled water systems and backflow testing and maintenance.

Following is a summary of the approval to operate process. The duration taken to decide an application will depend on the risk and complexity of the system as well as any additional information requested to decide the application.

1. Application lodged with DHF
2. DHF gives acknowledgement notice
3. DHF refers application to relevant state agencies
4. Compliance audit of recycled water system against System Management Manual
5. Plumbing and drainage inspection
6. DHF and advisory state agencies review application
7. Advisory state agencies give DHF an information request, if required
8. DHF gives the information request to applicant, if required
9. Applicant responds to the information request
10. DHF advises state agencies of response
11. State agencies offer advice on application response to DHF
12. DHF determines the application
13. DHF advises applicant and advisory state agencies of decision

10.4 Approval conditions

An approval to operate a recycled water system may include a number of conditions imposed by DHF, which need to be addressed during the ongoing operation and maintenance of the system. The conditions will be based on the risk assessment and the information provided by the proponent of the system.

DHF may require, as a condition of the approval to operate, that the proponent of the recycled water system provides DHF with copies of the relevant laboratory analytical reports, from a laboratory accredited for the specific tests by an independent body acceptable to DHF, such as the National Association of Testing Authorities (NATA) for the validation and verification testing requirements.

The supply of recycled water for the proposed end uses is not appropriate until the system has been properly validated and verified and the results formally acknowledged by DHF. Some specific operational and audit requirements are outlined in the following section.

11. STEP NINE: Operational reporting and audit

Recycled water systems may be subject to periodic review by DHF to ensure that the system is complying with the conditions of approval and that the information in the System Management Manual remains up-to-date and accurate.

In addition to the review standard ongoing reporting requirements of the recycled water system may be included in the conditions for approval by DHF. Details of these reporting and audit requirements are outlined in the following sections.

More information on 'Documentation and Reporting' is contained in AGWR Section 2.10.

11.1 Record keeping

Following is a summary of the basic records that it is expected a recycled water system owner will need to keep:

Record	Description
Volume wastewater treated	Total wastewater (influent) treated by the recycled water system shall be recorded.
Volume treated recycled water	Total recycled water flows shall be recorded for all recycled water delivered to end users and all potable top ups into the system.
Analytical testing	Details of results of analytical testing must be maintained. Incidents of exceedance of critical limits must be recorded.
Online monitoring	Details of online monitoring must be maintained. Incidents of exceedance of critical limits must be recorded.
Discharge to sewer and residuals	Where applicable, the volumes and occurrence of discharges from the system such as overflows or waste streams shall be recorded as per any conditions set by DHF. Where residuals are managed by alternative processes reporting shall be as agreed with by DHF and the EPA.
Energy	Total energy consumption for the recycled water system shall be recorded.
Maintenance	Any maintenance on system components must be recorded and these records maintained. All on-site plumbing works are to be documented (including any works on the potable system).
Complaints	Any complaints relating to the recycled water system shall be recorded including the action taken and the outcome.
Incident reporting	In the event of incident or non-conformance an incident report must be prepared, including detailed information regarding the incident, any corrective actions, results of any monitoring, correspondence and any preventive actions. Where critical limits for water quality or system operation are exceeded, each event shall be logged as an incident and reported (see section 8.2).
Emergency reporting	Emergency events shall be recorded and reported (see section 8.2) as soon as practicable including the incident, date, time, immediate corrective actions, any monitoring and proposed further actions. An emergency incident report detailing the monitoring results and the preventive actions should also be added following a review of the incident.

11.2 Audit reporting

The recycled water system proponent shall engage an auditor to audit and prepare compliance reports on a regular basis; as set by the conditions of the approval to operate (between 6 months and 3 years).

The audits are to confirm that the recycled water system is operating within the System Management Manual and will ensure that:

- the ongoing operation and maintenance requirements are being undertaken
- the system is performing to produce recycled water that conforms to the appropriate water quality compliance values
- the operational procedures are up-to-date and reflect the actual operational activities
- the record and reporting requirements are being maintained.

More information on ‘Evaluation and Audit’ and ‘Review and continuous improvement’ is contained respectively in AGWR Sections 2.11. & 2.12.

All auditing is to be performed by an independent, accredited third party auditor. The auditor shall be responsible for conducting the audit and providing DHF with a compliance report.

An annual audit of at least 20 per cent of services, in a system that services properties with recycled water, shall be undertaken by the proponent. If the audit indicates any cross connections have occurred, the inspection system frequency and practices should be reviewed and appropriate measures taken.

In addition, an independent third party plumbing maintenance and alteration inspection of the recycled water system (including the recycled water pipe network) must be undertaken at least once every five years, with testable backflow prevention devices tested and certified every 12 months by a plumber accredited for testing backflow prevention devices.

The provision of these audit services shall be at the expense of the recycled water system proponent.

All data, whether required to be recorded under this guideline or recorded as part of the treatment plant operation and maintenance by any responsible person shall be made available to auditors in electronic or other suitable format as required by the auditor. The auditor report shall be provided to DHF on their request.

Glossary of Terms

95 percentile	Statistical ranking designation. The 95 percentile of a group of sample results is the number such that 95 percent of the results in the group are less than that number.
blackwater	Waste water from a toilet or bidet.
centralised system	Systems where water is supplied from a few large sources (rivers, reservoirs, groundwater, oceans, wastewater) and then delivered to customers via a network of pipes. Wastewater is then produced and collected from individual sources (dwellings, industrial sites, open land) and transported by another network of pipes to a treatment plant.
cfu	Cfu or colony-forming units are a measure of viable bacterial numbers. Unlike in direct microscopic where all cells are, dead and living, are counted, cfu measures viable cells. By convenience the results are given as coliform-forming units per 100 millilitres
challenge test	If microbial indicators are not present at high enough concentrations to reliably validate the log reduction of a process, seeded organisms are used to spike the influent to the recycled water process to demonstrate the required log removal capability. Challenge testing is useful when the indigenous microbial indicators are likely to be present at too low a concentration, and are too poorly understood, to provide a sound basis for validation.
clostridia	For the highest exposure applications, the final priority is to monitor spores of sulphite-reducing clostridia or spores of *Clostridium perfringens* as representative of faecally derived protozoan oocysts. Clostridia have a greater resistance to inactivation than bacterial and viral pathogens and should not be used as indicators for these organisms.
coliphage	Coliphages are considered to be representative of faecally derived viruses. There are many types of coliphages, and the choice of which to monitor depends on the situation. However, usually one or both of two groups, somatic coliphages and FRNA coliphages, are monitored. If only one of the two groups of coliphage is monitored, the somatic coliphage is generally more conservative than the FRNA coliphages.
Critical Control Point (CCP)	A point, step or procedure at which control can be applied and which is essential to prevent or eliminate a hazard or reduce it to an acceptable level.
critical limit	A prescribed tolerance that must be met to ensure that a critical control point effectively controls a potential health hazard; a criterion that separates acceptability from unacceptability.
customer	An individual or organisation that uses water or generates wastewater.
DHF	Department of Health and Families

dual reticulation	Two separate and distinct piping systems, one of which is used to transport potable water, and the other for recycled water for non-potable uses.
effluent	The out flow of water or wastewater from any water processing system or device.
equivalent persons (EP)	Number of persons generating wastewater flowing into any on-site wastewater system or recycled water system on a daily basis. 150 litres wastewater flow per day and 50 grams BOD^5 per day in raw wastewater is considered as one equivalent person per load or capacity.
Escherichia coli	*Escherichia coli* is the most common thermotolerant coliform present in faeces and is regarded as the most specific indicator of recent faecal contamination. *E. coli* monitoring should always be undertaken during validation. Tests for thermotolerant coliforms can be simpler but *E. coli* is a better indicator because some environmental coliforms are thermotolerant (*Klebsiella, Citrobacter and Enterobacter*). (ADWG)
greywater	Includes the household wastewater of baths, showers, basins, laundries and kitchens (Plumbing Code).
hazard	In the wastewater context, a biological, chemical or physical characteristic or condition of wastewater with the potential to cause harm (NRMMC, EPHC and AHMC 2006).
hazard analysis critical control point (HACCP) system	A systematic methodology to control safety hazards in a process by applying a two-part technique: first, identification of hazards, their severity and likelihood of occurrence; and second, identification of critical control points and their monitoring criteria to establish controls that will reduce, prevent, or eliminate the identified hazards (NRMMC, EPHC and AHMC 2006).
hazard control	The application or implementation of preventive measures that can be used to control identified hazards (NRMMC, EPHC and AHMC 2006).
hazard identification	The process of recognising that a hazard exists and defining its characteristics (NRMMC, EPHC and AHMC 2006).
hazardous event	An incident or situation that can lead to the presence of a hazard (what can happen and how) (NRMMC, EPHC and AHMC 2006).
industrial wastewater	Wastewater derived from industrial sources or processes.
integrated water cycle management	A management process by which all urban water and wastewater systems are considered within a catchment and policy framework so as to deliver sustainable environmental, economic and social outcomes.
kL (kilolitre)	One thousand litres (1000 L)
local water authority	The organisation, agency or company that has responsibility and authority for treating and/or supplying water and wastewater to a regional area.

median	The midpoint in a series of numbers: half the data values are above the median and half are below. For example, in the odd series 1, 4, 9, 12, and 33, 9 is the median. In the even series 1, 4, 10, 12, 33 and 88, 11 is the median (halfway between 9 and 12). Note, the median is not necessarily the same as the AVERAGE (or mean). For example, the median of 2, 6, 10, 22 and 40 is 10 but the average is 18.
monitoring	Systematically keeping track of something, including sampling or collecting information and documenting it.
multi-unit dwellings	Those not defined as a single dwelling but with occupancy of less than 2,500 persons. For example, high-rise apartment development, low-rise townhouse development, etc
non-potable water	Water suitable for purposes other than potable (drinking) water use.
operational monitoring	The planned measurements and observations used to assess whether performance criteria are being met.
owner	The individual or organisation that owns the recycled water system.
pfu	Refers to any entity which can give rise to a plaque. For example: if a phage stock solution has 1010 pfu/mL, it means that every mL of this stock has 1010 phage particles which can form plaques. This (pfu/mL) is the conventional way to refer to the concentration of a phage preparation.
potable (drinking) water	Water suitable for human consumption.
preventive measure	Any planned action, activity or process that is used to prevent hazards from occurring or reduce them to acceptable levels.
proponent	The individual or organisation that is proposing to carry out a recycled water system and will be responsible for the operation of the system.
recycled water	Water taken from sewage, greywater or stormwater systems and treated to a level suitable for its intended use. Recycled water can include reclaimed water.
recycled water scheme	Includes all components from the collection of the source(s) water to the final and use(s) and includes the recycled water system.
recycled water system	The total treatment process system that receives wastewater and produces a final treated effluent stream suitable for its intended end use.

restricted access	Restricted access during irrigation of an area. An acceptable method of restricting access is posting visible signs notifying that the area is irrigated with recycled water and that the public should avoid contact with sprays or pooling wastewater. Alternative approaches that achieve an equivalent or better level of restricted access may also be acceptable where agreed with DHF. Public access restrictions do not cover on-site workers. On-site worker access should be restricted as far as it does not impede their duties and to ensure compliance with relevant occupational health and safety requirements.
reticulation	A network of water pipes, which delivers water supply to customers.
risk	The likelihood of a hazard causing harm in exposed populations in a specified time frame, including the magnitude of that harm (NRMMC, EPHC and AHMC 2006)
risk assessment	A scientifically based process to assess the scale of a hazard if it occurs based on the following elements: (i) hazard identification, (ii) hazard characterisation, (iii) exposure assessment, and (iv) risk characterisation.
risk management	The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control options, including regulatory measures.
sewage	Waste water from greywater and blackwater sources (e.g. toilet, and bidet discharges)
sewerage	A system of sewers and pumping stations for the removal of waste, operated by local water authorities.
stakeholder	A person or group (e.g. an industry, a government jurisdiction, a community group, the public, etc.) that has an interest or concern in something.
surface water	All water naturally open to the atmosphere (e.g. rivers, streams, lakes and reservoirs).
seeded organism	Seeded organisms such as FRNA coliphages or Bacillus subtilis bacteria, may be used to spike recycled water influent to challenge test the system during validation to demonstrate the log removal potential.
system management manual (SMM)	The SMM is an overarching document that sets out the responsibilities and tasks required of the recycled water system.
urban irrigation	Provision of sufficient water for the growth of lawns, parks, golf courses, bowling greens and gardens by drip, furrow, flood, sprinkler or subsurface water application to soil.

validation	Validation testing assesses whether a system *will* meet the water quality compliance values. Validation testing takes a minimum of twelve (12) weeks. Treatment systems that have been validated can be commissioned at any site but must still undergo a minimum of four (4) weeks verification testing in-situ.
verification	Verification testing confirms that a system *is* meeting the water quality compliance values. Verification testing of water quality parameters must be undertaken in-situ for a minimum of four (4) weeks. Once a treatment system has undergone verification testing and met water quality compliance requirements, the recycled water system can be commissioned.
waste	Effluent, being any matter or thing, whether solid or liquid or a combination of solids and liquids, which is of a kind that may be removed from a human waste storage facility, sullage pit or grease trap, or from any holding tank or other container forming part of or used in connection with a human waste storage facility, sullage pit or grease trap
wastewater	Water that has been contaminated by some activity, includes greywater and sewage.

References

ANZECC and ARMCANZ 2000a. ***Australian and New Zealand Guidelines for Fresh and Marine Water Quality,*** National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand.

Codex Alimentarius Commission 1996. ***Hazard Analysis and Critical Control Point (HACCP) System,*** Report of the Twenty-Ninth Session of the Codex Committee on Food Hygiene 23- 28 June 1996; Alinorm 97/13A, Codex Alimentarius Commission, WHO and FAO of the United Nations.

Codex Alimentarius Commission 1997. ***Hazard Analysis and critical control point (HACCP) systems and guidelines for its application.*** Annex to CAC/RCP 1-1969 rev.3, Codex Alimentarius Commission, Geneva.

DEC (Department of Environment and Conservation NSW) 2003. ***Use of effluent by irrigation****. Government of New South Wales*, Sydney.

Deere, D.A., Stevens, M., Davison, A.D., Helm, G. and Dufor, A. 2001. Management Strategies. In Fewtrell, L. and Bartram, J. ***Water Quality: Guidelines, Standards and Health. Risk Assessment and Management for Water-related Infectious Disease.*** IWA Publishing, London, U.K.

DIPNR (Department of Infrastructure, Planning and Natural Resources) 2004. **Meeting the challenges – Securing Sydney's water future – The Metropolitan Water Plan**, NSW Department of Infrastructure, Planning and Natural Resources, October 2004, Sydney.

EPA (Environment Protection Authority) 1997. ***Environmental Guidelines: Use & Disposal of Biosolids Products.*** Government of New South Wales, Sydney.

Gray, R. and Morain, M. 2000. ***HACCP application to Brisbane Water. Water 27,*** January/February, 41-42.

IPART (Independent Pricing and Regulatory Tribunal) 2005. ***Report into the Review of the Water and Wastewater Industries 2005****.* Independent Pricing and Regulatory Tribunal of New South Wales, Sydney.

NHMRC, NRMMC (National Health and Medical Research Council and Natural Resource Management Ministerial Council) 2004. ***Australian Drinking Water Guidelines****. Australian Government*.

NRMMC, EPHC and AHMC (Environmental Protection and Heritage Council and Natural Resource Management Ministerial Council) 2006 ***Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)***. Australian Government.

NSW Health 2004. Interim Guidance for Greywater and Sewage Recycling in Multi-unit Dwellings and Commercial Premises. NSW Government.

WHO (World Health Organisation) 2004. ***Guidelines for Drinking-water Quality***, 3rd Edition, Volume 1. WHO, Geneva.

Appendix 1: Examples of potential recycled water hazards

The following table lists potential hazards that may be present in sources of recycled water or added during the treatment process. However the presence of one or more of these potential hazards does not necessarily mean the recycled water will pose a risk to public health or the environment. The recycled water treatment and usage controls will aim to reduce the risks from any hazards to an acceptable level.

Hazard	Description
Biological	
Algae	Comparatively simple chlorophyll-bearing plants, most of which are aquatic, and microscopic in size. Under suitable conditions, some types of algae may grow in untreated or partially-treated wastewaters, producing algal toxins such as microcyctins, nodularins, cylindrospermopsin and saxitoxins. Toxins have been implicated as having serious impacts on human and animal health by the consumption of contaminated water. Many of these toxins are hepatotoxic and some are neurotoxic.
Bacteria	Unicellular micro-organisms typically ranging in size from 0.2 to 5 microns that include many shapes including spheres, rods and spirals. Bacteria common to sewage include pathogens such as *Campylobacter, Salmonella* spp, *Clostridium* spp. and *Legionella* spp. There are typically a million bacterial cells in a millilitre of fresh water.
Helminth	A worm-like invertebrate of the order Helminths and a parasite to humans and other animals. Helminth parasites include tapeworms, roundworms and flukes. Helminth eggs may be > 0.1 millimetres and visible to the naked eye. Helminths tend to be less abundant and more easily removed from water.
Protozoa	A phylum of single celled animals ranging in size from around 1 to 300 nanometres, although some are up to 0.5 mm. Under certain adverse conditions, some protozoa produce a protective capsule called a cyst. A cyst permits the organism to survive when food, moisture, or oxygen is lacking, when temperatures are not suitable, or when toxic chemicals are present. A cyst also enables a parasitic species to survive outside its host in order to get a new host. Parasitic protozoa commonly present in sewage and of concern to human health include *Cryptosporidium* spp. and *Giardia* spp.
Viruses	Molecules of nucleic acid (RNA or DNA), ranging in size from 20 to 300 nanometres, that can enter cells and replicate in them. Some common viruses found in sewage include norovirus and enterovirus (hepatitis A). Viruses cannot reproduce in the natural environment.
Physical	
Biochemical oxygen demand	The decrease in oxygen content in a sample of water that is brought about by the bacterial breakdown of organic matter in the water.
Biosolids	Primarily an organic solid product produced by the sewage treatment process. Solids become biosolids (as opposed to wastewater solids) when they are further treated by a digestor or other treatment process.
pH	An expression of the intensity of the basic or acid condition of a liquid. Natural waters usually have a pH between 6.5 and 8.5.
Screenings	The solid waste collected in the inlet screens to a treatment process including solids disposed of to wastewater.
Suspended solids	Suspended solids measure the presence in the water of fine suspended matter such as clay, silt, colloidal particles, plankton and other microscopic organisms. High suspended solids can result in a water sample having a ‘muddy’ or ‘milky’ appearance.

Chemical	
Ammonia	Ammonia dissolves rapidly in water and is a food source for some microorganisms, and can support nuisance growths of bacteria and algae. It is used commercially in animal feeds and fertilisers, and in the manufacture of fibres, plastics and explosives. Ammonia products are widely used as cleaning agents and food additives. Ammonia can be an important indicator of pollution as it can be formed as an intermediate product in the breakdown of nitrogen-containing organic compounds, or of urea from human or animal excrement. Most uncontaminated source waters have ammonia concentrations below 0.2 mg/L. High concentrations (greater than 10 mg/L) have been reported where water is contaminated with animal waste.
Chloride	Chloride in recycled waters comes from a variety of salts (including detergents) and is present as an ion (Cl-). Chloride is essential for humans and animals. It contributes to the osmotic activity of body fluids. Healthy individuals can tolerate the intake of large quantities of chloride provided there is a corresponding intake of fresh water. However, it can be toxic to plants, especially if applied directly to foliage and aquatic biota.
Disinfection by-products	Disinfection by-products are formed from the reactions between disinfectants, particularly chlorine, and organic material. Most disinfectants used to render water safe from pathogenic microorganisms will produce by-products in the disinfection process. Chlorine is the most common disinfectant. It reacts with naturally occurring organic components or ammonia to produce a complex mixture of by-products such as dichloracetic acid, trichloracetic acid and THMs and chloramine by-products. However, some (such as formaldehyde) can be produced by other oxidising disinfectants such as ozone. Some more recent byproducts of concern include bromate and epoxides (from ozone treatment) and nitrosodimethylamine (NDMA).
Metals	Heavy metals may be present in raw wastewaters as a result of industrial discharges to sewers. Some heavy metals such as cadmium, chromium and mercury have been associated with human health concerns.
Pesticides	Pesticides may enter municipal wastewater systems by a variety of means including stormwater runoff, personal use and illegal disposal to sewage systems. There are a wide variety of pesticides that have varying levels of toxicity to humans. These include benzo(a)pyrene, 2, 4D, aldrin and dieldrin (total), chlordane, DDT (total isomers), heptachlor & epoxide and lindane. Pesticides have been designed and used to have detrimental effects on a wide range of biological species.
Pharmaceuticals	Pharmaceuticals (and their active metabolites) are excreted to sewage by people as well as direct disposal of unused drugs by households. Since pharmaceuticals are designed to instigate biological responses, their inherent biological activity and the diverse range of compounds identified in sewage (and the environment) have been cause for considerable concern during the last decade. Issues regarding potent endocrine disrupting compounds, aquatic toxicity and the spread of antibacterial resistance have significant ecological implications.
Total dissolved solids	Total dissolved solids (TDS) consist of inorganic salts and small amounts of organic matter that are dissolved in water. Clay particles, colloidal iron and manganese oxides, and silica may also contribute to total dissolved solids. Major salts in recycled water typically include sodium, magnesium, calcium, carbonate, bicarbonate, potassium, sulphate and chloride.
Total nitrogen	An important nutrient found in high concentrations in recycled waters, originating from human and domestic wastes. A useful plant nutrient that can also cause off-site problems of eutrophication in lakes, rivers and estuaries. It can also contaminate ground waters.
Total phosphorus	An important nutrient found in high concentrations in recycled waters, originating principally from detergents but also from other domestic wastes. A useful plant nutrient that can also cause off-site problems of eutrophication in water bodies.

Descriptions generally adapted from the Australian Guidelines for Water Recycling (2006) and the Australian Drinking Water Guidelines

Appendix 2: NT Government Agencies that can provide advice on water recycling

Department of Health and Families **Environmental Health Program**	2nd Floor, Casuarina Plaza 258 Trower Road Casuarina Ph. (08) 8922 7142 Fax. (08) 8922 7334 Email: envirohealth@nt.gov.au Website: http://www.nt.gov.au/health/envirohealth
Department of Planning and Infrastructure **Building Advisory Services**	Ground Floor, Cavenagh House 38 Cavenagh Street Darwin Ph. (08) 8999 8961 Fax. (08) 8999 8967 Email: bas.lpe@nt.gov.au Website: http://www.nt.gov.au/lands/building/index.shtml
Department of Natural Resources , Environment, The Arts and Sport	2nd Floor, Darwin Plaza 41 Smith Street Darwin Ph. (08) 8924 4139 Fax. (08) 8924 4053 Email: environment.nreta@nt.gov.au Website: http://www.nt.gov.au/nreta/environment/index.html
Power and Water Corporation	Ben Hammond Complex Illiffe Street Stuart Park Ph. (08) 8985 7130 Fax. (08) 8924 5166 Website: http://www.nt.gov.au/powerwater/

Appendix 3: Worked example of an operational procedure

Process Step	Screening and grit removal cleaning and maintenance
Objectives	• To maintain the screening and grit removal equipment in proper working order to ensure adequate treatment of the water and wastewater. • To remove solids and grit prior to the subsequent treatment system and reduce the amount of grit that is pumped through the process.
Management Strategies	The grit removal process step removes coarse solids and other large materials often found in raw wastewater. These materials are removed to enhance the operation and maintenance of subsequent treatment units. The recycled water preliminary treatment operations include coarse screening and grit removal. The coarse screening removes large objects such as rags, wood, plastics, and other large garbage items, which are then disposed of to a local landfill. This procedure will help to ensure that the screening and grit removal equipment is maintained appropriately to prolong the life of the equipment and to ensure optimum performance of processes. The procedure will also help to ensure that this facility is operated and maintained in the correct manner, which is critical for compliance with relevant approvals and regulations. Not following this procedure could allow untreated or partially treated to contaminate the land area and surface waters in and around the recycled water treatment plant.

Action	**Make and Model** **XYZ0123** **Responsibility** Plant Operator **Frequency** Twice a week **Equipment** Shovel, rake 1. Visually inspect the grit collector arms to make sure they are turning smoothly. Inspect the grit conveyor for operation and any obvious structural problems. Check for excessive heat or unusual noises. 2. If non-routine maintenance is identified, and the plant operator has not previously performed the work, the plant operator shall notify the system supervisor to determine if they or a contractor will perform the maintenance activity. 3. Using a shovel, clean the drop chute leading from the grit screw conveyor to the belt conveyor. 4. Using a rake level out pile of debris and garbage deposited in the grit box. 5. When the grit bin is full on one side then the conveyor belt should be turned off and by the switch located above the grit bin at the end of the conveyor. 6. The lid on the grit bin should be moved to cover the full side. 7. The grit bin should then be repositioned with a truck to the empty side. 8. The empty side of the grit bin should be positioned under the drop chute and lid should be covering the full side allowing debris to fill the empty side of the bin. 9. The conveyor belt switch should be turned back into auto. 10. Once one side of the bin has been filled the plant operator should arrange pick up of the screenings and grit by the licensed contractor for disposal off-site. 11. Plant operator to record activities in the daily log book.
Performance Indicators	Screening and grit removal equipment is operating correctly. No spillage or debris around equipment.
Corrective Action	If problems are found with the equipment that requires further inspection or repair the plant operator must notify the system supervisor as soon as possible. If a problem is found that requires immediate inspection of repairs then the emergency notification procedure should be consulted.
Reporting	All activities should be recorded in the daily log book.

Northern Territory Government

DEPARTMENT OF
HEALTH AND FAMILIES

APPLICATION FOR RECYCLED WATER SYSTEMS AND RECYCLED WATER SCHEMES FOR TOWNS, SUBDIVISIONS AND COMMUNITIES

This application applies to the following wastewater reuse systems or schemes with a daily flow exceeding 22 kL/day or a capacity of 150 EP. Notwithstanding, proposals with a daily flow less than 22 kL/day that present an increased public health and environmental risk will require a recycled water system application. This determination will be made by the Department of Health and Families (DHF) on a case-by-case basis.

1. TYPE OF RECYCLED WATER SYSTEM OR SCHEME

This application is for: *(Please tick appropriate boxes)*

- ❑ Collection of wastewater
- ❑ Treatment of wastewater
- ❑ Reclaimed water reuse
- ❑ Effluent disposal

For the following: *(Please specify name or area)*

- ❑ Town /township _____
- ❑ Small community _____
- ❑ Aboriginal community / homeland _____
- ❑ New development / subdivision _____
- ❑ Tourist development _____
- ❑ Domestic wastewater of industrial / commercial development _____

  _____
- ❑ Other _____

This system / scheme is:

- ❑ An extension to existing system / scheme _____
- ❑ Upgrading of existing system / scheme _____
- ❑ A new system / scheme _____

2. WASTEWATER TECHNOLOGY USED

From the list of technologies below, please indicate the components of the wastewater system / scheme:

a) Collection system:

- ❑ Sewage system (raw sewage collection, no septic tanks) with gravity sewers only
- ❑ Sewage system with pumped and gravity lines in the network
- ❑ Septic tank effluent drainage
- ❑ Other *(please specify)* _____

b) Treatment system:

- ❑ Primary treatment
- ❑ Activate sludge
- ❑ Extended aeration
- ❑ Intermittently aerated decanted system
- ❑ Attached media system such as trickling filter, rotating bio-reactor
- ❑ Other biological treatment
- ❑ Filtration system (sand, micro-filtration, etc)
- ❑ New technology *(please specify)* _____
- ❑ Nutrient removal
- ❑ Combination of any of the above *(please specify)* _____

b) Reclaimed water reuse:

- ❑ Municipal irrigation *(please specify)* _____
- ❑ Crop irrigation *(please specify)* _____
- ❑ Soil Aquifer Treatment
- ❑ Passive usage / ornamental
- ❑ Other non-potable use *(please specify)* _____

If reuse is by irrigation:
(Please tick the proposed irrigation option)

- ❑ Surface irrigation
  - ❑ Spray
  - ❑ Drip
  - ❑ Flood
  - ❑ Furrow
- ❑ Subsurface disposal / irrigation
  - ❑ Shallow subsurface irrigation
  - ❑ Absorption trench
  - ❑ Evapotranspiration bed

3. APPLICATION DETAILS

Name & description of system for approval:

_____

_____

_____

4. INSTALLATION ADDRESS / LOCATION

Street _____ Township, Community or Suburb _____

Street Number _____ Lot Number _____

5. APPLICANT DETAILS

Name _____

Address _____

_____

Phone _____ Fax _____

Email _____ Mobile _____

6. OWNER DETAILS (if different from the Applicant)

Name _____

Address _____

_____

Phone _____ Fax _____

Email _____ Mobile _____

7. OPERATOR DETAILS

Name _____

Address _____

_____

Phone _____ Fax _____

Email _____ Mobile _____

8. APPLICATION REQUIREMENTS

Please attach full details for the listed items

Approval to install

- ❑ Concept report explaining the application and its purpose, taking into account information required with this form.
- ❑ Sources of the recycled water.
- ❑ Quality of the source water including the potential hazards.
- ❑ Quantity of water available from each of the sources, expressed as a total daily volumetric flow rate and as average and peak demand flow rates.
- ❑ End uses of the recycled water.
- ❑ Quality of the recycled water appropriate for the end use and considering the potential hazards in the source water(s).
- ❑ Quantity of water required for the end uses, expressed as a total daily volumetric flow rate and as average and peak demand flow rates.
- ❑ Potential environmental impacts of the system.
- ❑ Potential public health impacts of the system including the routes of exposure.
- ❑ Recycled water policy for the system.

- ❑ Communication plan/strategy for the system.
- ❑ Contingency measures for malfunctions of the system and its components.
- ❑ Soil assessment for recycled water irrigation or disposal site and other site characteristics including proximity to housing, public areas, roads, watercourses and the marine environment and irrigation application methods and irrigation system technical design details.
- ❑ Plan (to scale) of the recycled water system indicating the:
  - ❑ site of the treatment process
  - ❑ surrounding land use(s) within 100 metres of the treatment system and, where relevant, any application areas
  - ❑ location of the end uses(s) including recycled water application areas where relevant
  - ❑ any sensitive receiving environments(s).

Proposal details

- ❑ Process flow diagram of the recycled water system (from source to end use) identifying the Critical Control Points in the process.
- ❑ Risk assessment summary showing the identification of hazards and the analysis of hazardous events.
- ❑ Risk management plan.
- ❑ Monitoring plan outlining validation, verification and operational monitoring (type, limit, frequency, location, responsibility).
- ❑ Operational and maintenance procedures.
- ❑ Training and awareness plan.
- ❑ Where relevant, provide evidence of a[7]:
  - ❑ recycled water agreement with end users outlining their obligations and responsibilities
  - ❑ recycled water agreement with the suppliers of recycled water
  - ❑ copies of relevant analytical reports from a laboratory accredited for the specific tests by an independent body acceptable to DHF, such as the National Association of Testing Authorities (NATA) or equivalent, for the validation and verification testing requirements8.

[7] It is recognised that the actual agreements may contain commercial in confidence information and as such a copy of the actual agreement is not required. However, where relevant, some evidence that an agreement should be provided.
[8] The results of the validation and verification monitoring may be required as a condition of the approval to operate. In such circumstances the information may be supplied after an approval to operate has been issued; however, recycled water should not be supplied for end uses until the results of the validation and verification sampling have been formally acknowledged by DHF.

9. SUBMITTING THE APPLICATION

Regions: Darwin, Katherine, East Arnhem

Director Environmental Health
Department of Health and Families
PO Box 40596
Casuarina NT 0811

2nd Floor, Casuarina Plaza
258 Trower Road, Casuarina

Regions: Alice Springs, Barkly

Manager Environmental Health Central Australia
Department of Health and Families
PO Box 721
Alice Springs NT 0871

Mwerre House
60 Hartley Street, Alice Springs

10. FURTHER INFORMATION

Contact the Environmental Health Program:
Phone: (08) 8922 7152
Fax: (08) 8922 7334
Email: envirohealth@nt.gov.au

11. STATEMENT BY APPLICANT

I understand that the Department of Health and Families (DHF) may require further details if necessary, and that failure to supply all the details referred to in this application form and any additional information requested by DHF concerning my application above may result in delays in processing the application.

Name _____

Company _____

Address _____

Signature _____ Date _____