EPA VICTORIA

Victorian guideline for water recycling

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VICTORIA State Government

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EPA acknowledges Aboriginal people as the first peoples and Traditional custodians of the land and water on which we live, work and depend. We pay respect to Aboriginal Elders, past and present.

As Victoria's environmental regulator, we pay respect to how Country has been protected and cared for by Aboriginal people over many tens of thousands of years.

We acknowledge the unique spiritual and cultural significance of land, water and all that is in the environment to Traditional Owners, and recognise their continuing connection to, and aspirations for Country.

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This guideline was prepared in consideration of feedback from a wide range of government departments, industry and other relevant stakeholders. It incorporates lessons from the application of the current recycled water guidance and feedback from stakeholders involved in managing, supplying and using recycled water. The Department of Environment, Land, Water and Planning (DELWP) led the review of the guidelines as part of a working group of regulator and industry representatives from:

- DELWP
- EPA
- Department of Health (formerly DHHS)
- VicWater
- Yarra Valley Water.

Specialist consultants engaged by DELWP to assist with the review included Water Futures, Atura and Ecos Environmental Consulting.

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Acronyms and abbreviations

ACRONYM/ABBREVIATION	FULL TITLE
AQI	Air quality index
ABN	Australian business number
ABS	Australian Bureau of Statistics
ADI	Acceptable daily intake
ADWG	*Australian Drinking Water Guidelines*
AGWR	*Australian Guidelines for Water Recycling*
AICS	*Australian Inventory of Chemical Substances*
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZFA	Australian and New Zealand Food Authority
ANZG	*Australian and New Zealand Guidelines [for Fresh and Marine Water Quality. (2018)]*
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BGA	Blue-green algae
BOD	Biochemical oxygen demand
CAS	Chemical Abstracts Service
CCP	Critical control point
CEC	Cation exchange capacity
CF	Crop factor
CFU	Colony forming unit
CVO	Chief Veterinary Officer
DALY	Disability adjusted life years
DELWP	Department of Environment, Water, Land and Planning
DFSV	Dairy Food Safety Victoria
DHHS	Department of Health and Human Services
DH	Department of Health (see also DHHS)
DPI	Department of Primary Industry
EC	Electrical conductivity
ECP	Environmental control point
EIR	Irrigation efficiency factor
EMP	Environmental management plan
EPA	Environment Protection Authority
EPI	Estimation programs interface

ACRONYM/ABBREVIATION	FULL TITLE
ERF	Rainfall efficiency factor
ESC	Essential Service Commission
ESP	Exchangeable sodium percentage
GED	General environmental duty
GEM	Guideline for environmental management
GL	Guideline
GMP	Good manufacturing practices
GST	Goods and services tax
HACCP	Hazard analysis and critical control point
HBT	Health-based targets
HDPE	High density polyethylene
HEMP	Health and environment management plan
HH	Human health
HMP	Health management plan
HQ	Hazard quotient
IDEA	Intermittently decanted extended aeration
IR	Irrigation requirement
LCA	Land capability assessment
LF	Leaching fraction
LR	Leaching requirement
LRV	Log reduction values
MID	Minimum infective doses
MPN	Most probable number
NATA	National Association of Testing Authorities
NLDR	Nutrient load to demand ratio
NTU	Nephelometric turbidity units
PBT	Persistent bioaccumulative and toxic
PC	Protective concentrations
PE	Pan evaporation
PFU	Plaque forming unit
PIW	Prescribed industrial waste
QA	Quality assurance
QMRA	Quantitative microbial risk assessment

ACRONYM/ABBREVIATION	FULL TITLE
RF	Rainfall
RWQMP	Recycled water quality management plan
SAR	Sodium adsorption ratio
SEPP	State environment protection policy
SOP	Standard operating procedures
STP	Sewage treatment plant
TDS	Total dissolved solids
TOC	Table of contents
TPU	Treatment process units
UV	Ultraviolet
UVT	UV transmissivity
VBA	Victorian Building Authority
WHO	World Health Organization
WSAA	Water Services Association of Australia
WSUD	Water sensitive urban design
YVW	Yarra Valley Water

Glossary of terms

TERM	DESCRIPTION
Beneficial use	The use of the environment or any element or segment of the environment prescribed in Schedule 2 of SEPP (Waters) (Government of Victoria, 2018a) to be a beneficial use to be protected in accordance with SEPP (Waters).
Class of recycled water	Recycled water classes (A, B and C) that include health-related microbiological and process performance requirements but not environmental quality parameters such as salinity or nutrient limits.
Cross-connection	A physical connection between the recycled water and drinking water supply systems.
Drinking water	Water suitable for human consumption and other household uses as defined in the *Australian Drinking Water Guidelines*. Also known as potable water.
Dual pipe scheme	An urban water recycling scheme where recycled water is provided to householders for certain uses via a reticulation system that is separate from the drinking water supply. Sometimes referred to as a third pipe scheme.
E. coli	*Escherichia coli*. A bacterium found in the gut of warm-blooded animals used as an indicator of faecal contamination.
Hazard Analysis and Critical Control Point (HACCP)	An industry-recognised preventive risk management system that identifies, evaluates and controls hazards associated with the production of safe food or water.
Hazard	A biological, chemical, physical or radiological agent that has the potential to cause harm.
Hazardous event	An incident or situation that can lead to the presence of a hazard.
Health and Environmental Management Plan (HEMP) and Environment Improvement Plan (EIP)	A plan covering the use of recycled water that details the identification and management of health and environmental risks.
Industrial wastewater	Industrial wastewater produced from processes at industrial or commercial premises, including all waterborne waste from these facilities except sewage and prescribed industrial waste.
Log reduction value	Removal/inactivation for a target organism. The reduction in pathogen concentrations across a process or step measured in logs to the base 10 ($\log_{10}$). Calculated as $\log_{10}$ [feed water concentration] minus $\log_{10}$ [product water concentration].
Manager (scheme manager)	The body (or bodies) identified as being responsible for the management of recycled water and for engagement with recycled water users. The responsibilities are defined within the HEMP. This is the same as the supplier in most cases.
Pathogen	Organism capable of causing disease. In untreated wastewater, the key pathogen groups are bacteria, viruses, protozoa and helminths.
Preventive risk management	A philosophy that focuses on the systematic evaluation of processes to identify hazards, assess risks and implement preventive strategies to manage risks.
Proponent (scheme proponent)	The body (or bodies) facilitating the development of a recycled water scheme, but which may not have responsibility for managing the scheme once recycled water is supplied. This may be a developer for instance.

TERM	DESCRIPTION
Quantitative microbial risk assessment (QMRA)	A tool that uses quantitative data to mathematically assess the health risk from exposure to pathogens.
Recycled water	Water that has been derived from sewerage systems or industry processes and treated to a standard that is appropriate for its intended use. For the purpose of this guideline, the term does not include water derived from stormwater.
Recycled water system	The infrastructure that supplies and conveys recycled water from its source to its point of use and which may include a water recycling plant and other infrastructure.
Recycled Water Quality Management Plan (RWQMP)	A section of the HEMP that covers the production of class A recycled water at a treatment plant.
Risk	The likelihood of identified hazards causing harm in exposed populations (over a specified time frame) and the severity of consequences due to exposure to the hazard.
Risk assessment	The overall process of using available information to predict how often hazards or specified events may occur (likelihood) and the magnitude of their consequences.
Salinity	The content of salt in soil or water. Generally expressed in units of electrical conductivity (EC), although total dissolved solids (TDS) is also used to indicate salinity.
Scheme	A recycled water scheme can be discrete or can be interconnected and can consist of treatment plants, distribution systems, reticulation networks and users.
Sewage	Water that has been used by households, commercial premises or industry and discharged to the sewerage system for treatment at a sewage treatment plant (STP).
Sewage treatment plant	A treatment plant that treats sewage.
Sodicity	A chemical imbalance that occurs in soil when an excess of sodium (a monovalent ion) is present in the soil relative to divalent ions such as calcium and magnesium which results in clay particles being held together more loosely.
Supplier (of recycled water)	The body responsible for the supplying recycled water. This body may be responsible for producing a Recycled Water Quality Management Plan (RWQMP) if it is not produced by the scheme proponent or scheme manager. Often the scheme manager is the supplier. The supplier treats wastewater and provides recycled water for someone else to use (user) or use themselves. This is often a water corporation that might supply to a third party (market gardeners, residential premises) or using recycled water themselves. The supplier is the proponent when seeking approval.
User (of recycled water)	The body responsible for using recycled water. This body may be responsible for producing a user site management plan (SMP) if it is not produced by the proponent, manager or supplier. The user receives recycled water from the supplier and uses it. This may include residential premises, market gardeners and councils (parks and gardens).

TERM	DESCRIPTION
Water sensitive urban design (WSUD)	The integration of water cycle management into urban planning and design. Key principles are: • protect natural systems • integrate stormwater treatment into the landscape • protect water quality • reduce run-off and peak flows • add value while minimising development costs. For stormwater aspects of WSUD refer to www.wsud.melbournewater.com.au
Water recycling plant	A treatment plant that treats sewage from domestic and industrial sewer catchments and treats it for recycling; or treats industrial wastewater and treats it for recycling.

1. Introduction

1.1 About this guideline

The purpose of this publication is to provide clear guidance for the safe and sustainable use of recycled water in Victoria for suppliers, managers and users of treated wastewater. This guideline also outlines the Victorian regulatory process and requirements for water recycling for:

- wastewater suppliers and managers, such as water corporations
- producers of industrial wastewater
- those seeking to utilise recycled water as a resource.

This guideline promotes the use of the risk management framework used in the *Australian Guidelines for Water Recycling (AGWR)* within a Victorian context. Compliance with the guideline provides the basis for exemption of reuse schemes from EPA works approval and licensing requirements. It is intended to be interpreted and implemented with flexibility for specific circumstances.

This guideline replaces the following five publications from the Environment Protection Authority (EPA) and Department of Health and Human Services (DHHS):

- *Guidelines for Environmental Management: Use of Reclaimed Water* (publication 464) including Addendum to class A Information in 464.2.
- *Guidelines for Environmental Management: Dual Pipe Water Recycling Schemes – Health and Environmental Risk Management, including Addendum* (publication 1015)
- *Supply of Reclaimed Water for Drought Relief* (publication 887).
- *Industrial Water Reuse* (publication IWRG632)
- *DHHS Guide for the completion of a Recycled Water Quality Management Plan for class A water recycling schemes* (DHS 2008).

This guideline is intended to be used in conjunction with *Technical Information for the Victorian Guidelines for Water Recycling* (publication 1911).

1.2 Recycled water use in Victoria

The Victorian Government encourages safe and sustainable recycled water use for non-potable purposes.

Significant progress has been made over the last decade in recycled water use. As our cities and towns grow, so does the amount of wastewater we generate, providing more opportunities to use this valuable resource and diversify our water sources.

Recycled water can be substituted for water that is currently harvested from stressed and over-allocated watercourses, groundwater sources, or drinking water supplies. It can provide increased water security for many people in rural and urban areas. Recycled water use has the added benefit of protecting our waterways and bays from treated wastewater discharges. The safe and sustainable use of recycled water involves:

(a) taking sewage or industrial wastewater and treating it so it is fit for the intended use (fit-for-purpose)
(b) using the recycled water resource in a manner that provides economic and/or social benefit (direct or indirect), while still being protective of human health and the environment.

Advantages of recycled water use include:

- enhanced water security given the reliability of recycled water supply (quantity and quality) compared with the variability associated with traditional water sources
- capacity to supplement limited or costly traditional water sources
- reduced demand on Victoria's drinking water supplies
- potential treatment and disposal cost savings by turning a waste into a resource with economic or social benefits
- reducing diversion of water from watercourses and groundwater
- reduced discharges to surface waters
- enhanced liveability of our cities and towns, such as creating create cooler, greener places through passive irrigation
- improved public open spaces due to the watering of sporting grounds and other critical public assessments (especially during periods of water restrictions).

The concept of safe and sustainable water recycling is different from that of discharging of treated wastewater to land and waterways. The primary purpose of recycling is to use recycled water as a resource in a safe and sustainable manner. In irrigation recycling schemes this means applying water at a rate that does not exceed the plant's water or nutrient needs while maintaining soil conditions for optimum plant growth/yield.

It is important to apply Victoria's waste management hierarchy (Figure 1) when considering recycling water. Potential recycled water users should firstly explore opportunities to avoid and reduce their water and resource consumption by implementing water conservation and efficiency measures and cleaner production initiatives. Improved resource efficiency can reduce the volume of water needed, as well as increase the volumes and improve the quality of water available for recycling.

Source: *Statewide Waste and Resource Recovery Infrastructure Plan © Sustainability Victoria 2018*

Figure 1 Victoria's Waste Management Hierarchy

1.3 Guideline's objectives and scope

1.3.1 Objectives

This guideline aims to maximise sustainable and safe recycled water use in Victoria while minimising and managing associated risks. To qualify as 'sustainable and safe', use of recycled water must be protective of soil ecosystems, soil productivity, surface and groundwater resources, and human health.

To meet this objective, this guideline:

- sets a clear risk-based framework for wastewater suppliers so they can proactively manage human and environmental health risks associated with treating wastewater to ensure recycled water is fit for purpose
- establishes expectations for producers, suppliers, managers and users of recycled water
- recommends practicable environmental measures for treatment, quality, site selection, application, site management, monitoring and reporting to minimise any risk identified using the risk identification and management framework.

Compliance with this guideline provides the basis for exemption of reuse schemes from EPA works approval and licensing requirements (refer Section 1.3.3).

1.3.2 How the new guideline is different

This guideline has updated and replaced guidance on recycled water that was previously spread across five separate publications.

This new guideline streamlines and clarifies approval processes for producers, suppliers and users of recycled water, with the aim of facilitating an increased uptake of recycled water where risks to the environment and human health are acceptable. The five broad areas of change within this new guideline are to:

- provide for more efficient and proportional regulatory approval processes with clear accountabilities
- simplify the content of applications for wastewater recycling scheme approvals
- collate and clarify guidance on harm reduction (human health and the environment)
- simplify reporting and foster continuous improvement by establishing clear guidance on reporting and auditing requirements
- define EPA's role as having responsibility for the endorsement of RWQMP of class A recycled water schemes. This function was previously performed by DHHS.

1.3.3 Current regulatory state

Under the current legal framework, certain activities involving the management or discharge of waste (including wastewater) require a works approval and/or a licence from EPA. These are activities that can involve substantial risks of harm to human health or the environment and are set out in the Environment Protection (Scheduled Premises) Regulations 2017 (Scheduled Premises Regulations).

Applications for works approvals and licences are assessed by EPA to consider whether proposed activities to manage or discharge waste (including through the use of recycled water schemes) are acceptable, including whether they are in accordance with relevant policy and other requirements.

The Scheduled Premises Regulations also includes exemptions from works approval and/or licensing requirements in certain circumstances. Exemptions may be available for proposed activities involving the safe and sustainable use of recycled wastewater. These exemptions generally apply only where the proposed activity is assessed as meeting specifications acceptable to EPA.

This guideline is used by EPA to determine whether to grant works approvals, licences or exemptions under the current legal framework for activities that include recycled water schemes. It does so by setting out 'performance objectives' which recycled water schemes are required to meet in order to be acceptable to EPA.

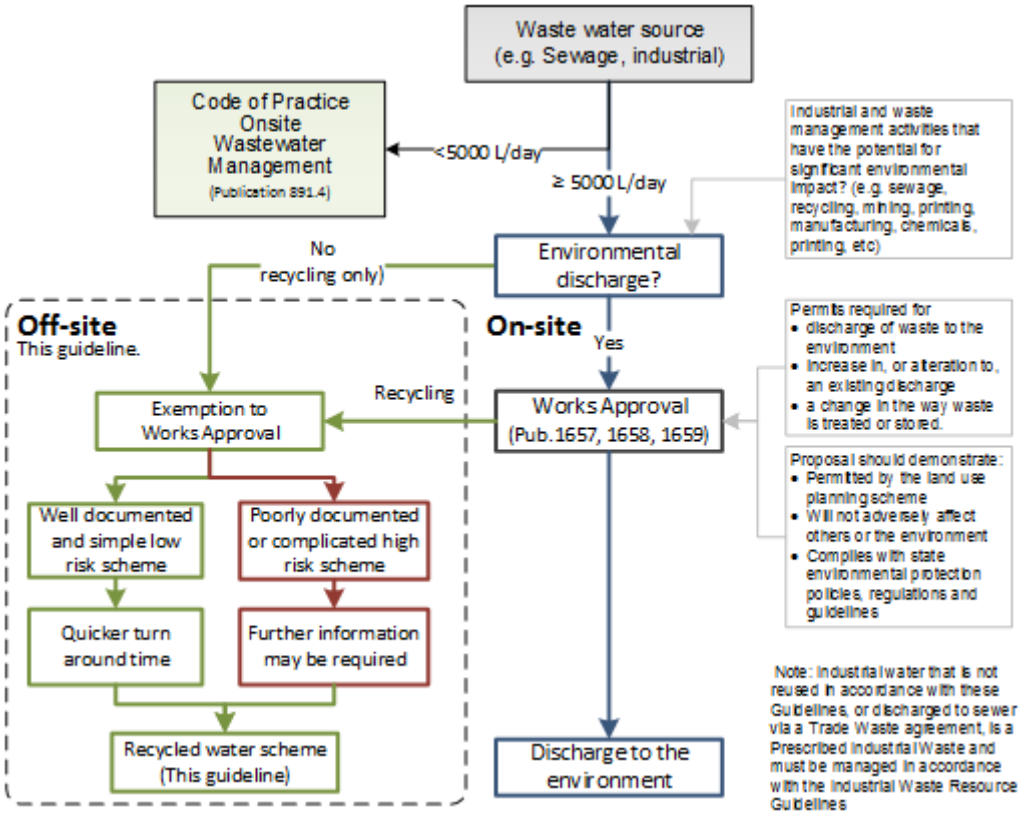

Figure 2 Overview of relationship between the works approval and exemption to the works approval for developing a recycled water scheme.

1.3.3.1 Non-potable recycled water schemes covered by this guideline

This guideline covers the management of health and environmental risks associated with non-potable recycled water schemes, and activities exceeding the threshold in the Environment Protection (Scheduled Premises) Regulations 2017 of 5,000 L/day design capacity or actual flow rate.

- Schemes which recycle water from sewerage systems. This includes municipal sewerage facilities treating mainly human sewage, as well as industrial and agricultural process water accepted via trade waste agreements and serving combined or individual commercial premises (for example, industrial wastewater from hotels, motels, schools and caravan parks).
- Industrial wastewater recycling schemes:
  - onsite sources of wastewater: schemes which recycled wastewater produced from processes at industrial or commercial premises, including all waterborne waste from these facilities (except sewage and prescribed industrial waste)
  - offsite sources of industrial wastewater treated onsite: premises on or from which industrial wastewater not generated at the premises, exceeding a design or actual flow rate of 5,000 L/day is released to the environment.
- Sewer mining schemes / third party access schemes, being systems and activities, which generally extract and recycle water from a wastewater sewerage network pipe.
- Recycled water schemes which blend other types of alternative water (for example channel water or stormwater).

In summary, all class A recycled water schemes producing more than 5,000 L/day, or class B or C recycled water schemes producing more than 1 ML/day, trigger the need for formal approval and will be assessed in accordance with this guideline. Note that works approvals are still required for the construction of wastewater treatment plants treating greater than 5,000 L/day

1.3.3.2 Recycled water schemes not covered by this guideline

This guideline is NOT intended to be used for:

- small onsite wastewater systems (treatment plants having a design or actual flow rate of less than 5,000 L/day). This includes domestic recycling from individual household systems (for example sullage, greywater or effluent from residential septic tanks). These systems should be managed using *Code of practice – onsite wastewater management* (publication 891)[1] (EPA Victoria, 2016), which provides standards and guidance to ensure the management of onsite wastewater (up to 5,000 L/day) protects public health and the environment, and uses our resources efficiently
- 'closed loop' water recycling schemes which do not discharge to the environment
- prescribed industrial waste - (Environment Protection (Industrial Waste Resource) Regulations 2009)
- schemes which only recycle stormwater (unless blended as described above).

1.3.4 Proposed regulatory state under the *Environment Protection Act 2017*

Changes to the current legal framework for environment protection are expected to come into effect from 1 July 2021. These changes will transform how pollution and waste is regulated in Victoria. The changes will be incorporated in the *Environment Protection Act 2017*. The intent of the changes is to help drive environmental improvements by ensuring everyone takes responsibility for the risk of harm to the environment from pollution and waste.

The cornerstone of these changes is the general environmental duty (GED). The GED requires that any person engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must be eliminated or (if it is not reasonably practicable to eliminate the risks) reduced so far as reasonably practicable.

Measures or controls to eliminate or reduce risks are reasonably practicable when they are proportionate to the risks from pollution or waste. Further, whether measures or controls are reasonably practicable takes into account what a person engaging in an activity knows, or ought reasonably to know, about the risks and any ways of eliminating or reducing them. This is called "state of knowledge".

State of knowledge can include:

- **Business and industry knowledge**: business documentation for safely performing activities, manuals and information from suppliers and contractors, safety data sheets and labelling, manufacturers' instructions for safe operating procedures, training provided in the use of equipment, contractual arrangements between parties participating in the activities. Standardised documents and manuals, guidance from industry associations and peak bodies distributed to members.
- **Regulatory and government agency knowledge**: EPA and other Victorian and national government authorities (including Sustainability Victoria, WorkSafe), guidance material, technical notes, compliance decisions and enforcement outcomes, advice (including advice given to your business specifically).
- **Independent organisations' knowledge**: reports from independent organisations such as Standards Australia, universities, and environmental engineers. The state of knowledge will develop over time as new technology, systems and processes develop or where there is an emerging risk.

This guidance will form part of the state of knowledge that helps industry and the community to minimise risks arising from waste (including wastewater intended for reuse or recycling) as far as reasonably practicable, and to fulfill their general environmental duties.

The *Environment Protection Act 2017* will also include a new system of permissions for activities that can involve substantial risks of harm to human health or the environment. These activities will be set out in Regulations to be made before the changes which are intended to come into effect on 1 July 2021. Under this system, persons responsible for recycled water schemes will require a permit to supply or use reclaimed wastewater that involves either:

- class A recycled water; or
- class B or class C recycled water, unless the scheme involves the discharge or deposit of less than 1 ML per day of reclaimed wastewater solely to land.

[1] https://www.epa.vic.gov.au/about-epa/publications/891-4

EPA will take these guidelines into account when assessing any application for a permit, including whether all reasonably practicable measures will be taken in order to comply with the general environmental duty in managing the water.

1.3.5 Transition from old to new guidance

This guideline and technical information document will come into effect immediately upon publication and must be used in assessing new schemes and amendments to existing schemes. Existing approved EIP/HEMPs will remain valid unless the proponent makes significant changes to the scheme and seeks reapproval, or until the EPA requires reapproval of the scheme under the new guidelines. Whether the changes are considered significant will be assessed on a case-by-case basis. Reuse applications, currently with EPA or submitted prior to the publication of new guidelines for assessment and approval, will be assessed under existing guidelines.

From time to time EPA develops environmental guidelines for specific recycling activities, for example the *Guidelines for wastewater irrigation* (publication 168) (EPA Victoria, 1991) as well as waste generating industries for example, *Environmental guidelines for the dairy processing industry* (publication 570) (EPA Victoria, 1997). Where available, the most recent version of these additional guidelines should be consulted. There are also a range of guidance and information documents available from relevant state departments that should be considered for specific uses and associated risks.

1.4 Treatment objectives

1.4.1 Treatment and classification overview

The required treatment level and associated water quality objectives vary depending upon the nature of a scheme's end uses. This guideline outlines the three classes of recycled water that represent the minimum standards of biological treatment and pathogen reduction for defined categories of use.

The required level of treatment increases with the potential for higher levels of exposure, reflecting the risks associated with particular uses. In addition to minimum levels of treatment, a specific recycled water use may also be subject to site management controls (see Section 6 of EPA Publication 1911 *Technical Information for the Victorian Guideline for Water Recycling*) to ensure protection of public health, agriculture and the environment.

The recycled water criteria outlined below in Section 1.4.2 apply at the end of the treatment process, meaning it applies to recycled water before it is supplied to the first user).

1.4.2 Classes of recycled water

The classification criteria for recycled water is provided in Table 1. Recycled water is classified into three classes (A−C) based on:

- generic categories of treatment processes known to produce specific levels of pathogen reduction
- physical-chemical water quality (for example, turbidity and BOD) and microbiological limits, which are designed to ensure optimal performance of the treatment processes (including disinfection where required) and provide a mechanism for monitoring process performance; and
- adoption of specific measures known to remove pathogens that may otherwise not be adequately controlled using standard treatment processes (such as, helminth removal, which requires lagoon storage or filtration prior to recycling).

Table 1 Classes of recycled water and corresponding standards for biological treatment and pathogen reduction.

Class	Water quality objectives - medians unless specified 1, 2	Treatment process	Range of uses– uses include all lower class uses
A	Microbiological objectives expressed as microbial log reduction target based on QMRA and based on Australian Guidelines for Water Recycling (Phase 1) and with attainment demonstrated in accordance with the Guidelines for validating treatment processes for pathogen reduction: Supporting class A recycled water schemes in Victoria (DH Victoria, 2013) • Turbidity < 2 NTU • < 10 / 5 mg/L BOD / SS • pH 6 – 9 [3]	The treatment processes should be designed to achieve the required Log Reduction Value (LRV) Table 2 shows LRV examples for dual pipe supply scheme	Acceptable uses of class A recycled water of the quality specified in Table 2 include: a. Uses included in a risk assessment (DHS, 2005). ▪ irrigation of public open spaces, such as parks and sports fields, where public access is unrestricted, and any irrigation method is used ▪ agricultural food production, i.e. foods consumed raw ▪ domestic garden watering, including vegetable gardens ▪ toilet flushing ▪ washing machine use. b. Uses not specifically included in the risk assessment, but likely to result in very low ingestion of recycled water: ▪ general outdoor uses such as car washing, dust suppression, construction and wash-down ▪ filling water features and ponds that are not used for swimming ▪ use in cooling towers. c. Firefighting and fire protection systems, including hydrants and sprinkler systems (as documented in the WSAA (2004) risk assessment). d. Other uses, considered on a case-by-case basis, where there is sufficient information provided to support their safety (contact EPA for advice regarding this). See also AGWR Phase 1 (NRMMC et al , 2006)
B	• < 100 *E. coli* org/100 mL • pH 6 – 9[3] • < 20 / 30 mg/L BOD / SS[5]	Secondary and pathogen (including helminth reduction for cattle grazing) reduction[4]	Agricultural: for example, dairy cattle grazing Industrial: for example, washdown water
C	• < 1,000 *E. coli* org/100 mL • pH 6 – 9[3] • < 20 / 30 mg/L BOD / SS[5]	Secondary and pathogen reduction[4] (including helminth reduction for cattle grazing use schemes)	Urban (non- potable) with controlled public access Agricultural: for example, human food crops cooked/processed, grazing/fodder for livestock Industrial: systems with no potential worker exposure

Notes:

1. Medians to be determined over a rolling 12- month period.
2. Refer also to *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911) and *Guidelines for wastewater irrigation,* (publication 168) (EPA Victoria, 1991) for additional guidance on water quality criteria and controls for salts, nutrients and toxicants.
3. pH range is 90th percentile. A higher upper pH limit for lagoon-based systems with algal growth may be appropriate, provided it will not be detrimental to receiving soils and disinfection efficacy is maintained.

4. Guidance on pathogen reduction measures and required pre-treatment levels for individual disinfection processes are described in *Disinfection of recycled water- Guidelines for environmental management* (publication 730) (EPA Victoria, 2002).
5. Helminth reduction requirements are up to 4 $\log_{10}$ and can include lagoon detention of primary treated effluent for ≥ 50 days or secondary treated effluent for ≥ 25 days, or some other equivalent Chief Veterinary Officer (CVO) and EPA approved process, such as media or membrane filtration. Alternatively, a risk-based assessment and derivation of the level of reduction required can be separately agreed with the CVO and EPA. Note that where the objective is to protect human health directly (for example no livestock involved in the transmission process) the treatment requirements for helminths can potentially be different to, and potentially less stringent than, where the recycled water will supply livestock. Therefore, risks associated with direct human exposures and the related health impacts on humans can be assessed separately from risks associated with exposures of livestock.

For class A recycled water schemes, pathogen log reduction values need to be defined and achieved for three pathogen groups: bacteria, viruses and protozoa. Treatment processes contributing to pathogen reduction must be specifically validated for their intended purpose. Default log reduction credits for class A recycled water attributed in the *Guidelines for validating treatment processes for pathogen reduction: Supporting class A recycled water schemes in Victoria* (DH Victoria, 2013) are acceptable. Pathogen reductions achieved by treatment and/or exposure control processes for other classes are acceptable. Suppliers have the option of tailoring the treatment requirements based on exposure levels. However, for class A schemes, the default relevant pathogen log reduction values (Table 2) represent the minimum pathogen reduction that must be continually achieved by the treatment processes when operating within critical limits. LRV values must also be consistent with the AGWR microbial water quality objectives in the current version of AGWR and any rolling review of that publication. Further details are given in Table 3.8 of the AGWR.

Note that for all schemes, suppliers should use the most resistant representative (or worst case) bacteria, virus or protozoan when validating treatment processes. This should be used at each treatment step for calculating log reductions, with the choice of representative pathogen varying with treatment process. However, suppliers have the option of using a more complex approach of assessing treatment processes based on the removals rate provided across the system for key pathogenic organisms. Full details of validation are given in *Guidelines for validating treatment processes for pathogen reduction: Supporting class A recycled water schemes in Victoria* (DH Victoria, 2013).

Table 2 Class A recycled water pathogen log reduction value objectives for dual pipe scheme

Group	Total pathogen log reduction value objective[1]
Bacteria	6-log reduction from raw sewage to recycled water
Viruses	7-log reduction[2] from raw sewage to recycled water
Protozoa	6-log reduction[3] from raw sewage to recycled water

Notes:

1. The log reduction value objectives in Table 2 reflect current version of the Australian Guidelines for Water Recycling with worst case exposure for dual pipe schemes. Fit-for-purpose LRVs should be developed for specific schemes.

2. Median removal, with a lower (critical) limit of 6-log reduction.

3. Median removal, with a lower (critical) limit of 5-log reduction.

For class A recycled water, Table 3 summarises uses considered acceptable from a human health perspective. Other issues and controls may be needed such as environmental and plumbing controls.

Table 3 Considerations for acceptable[1] uses of class A recycled water

Potential use	Environmental[2]	Plumbing/ communication[3]	Other
Residential			
Garden watering, including vegetables eaten raw	Risk assessment	Controls required	–
Car washing	Avoid run-off to stormwater system	Controls required	–
General outdoor use (for example, wash- down/construction)	Avoid run-off to stormwater system	Controls required	–
Ornamental ponds/water features	Management controls required	Controls required	Aesthetics
Toilet flushing	–	Controls required	Aesthetics
Washing machines[4]	–	Controls required	Public acceptance, aesthetics
Commercial/industrial/municipal			
Irrigation	Risk assessment	Controls required	–
Construction	Avoid run-off to stormwater system	Controls required	–
Wash-down	Avoid run-off to stormwater system	Controls required	–
Dust suppression	Avoid run-off to stormwater system	Controls required	–
Cooling towers	–	Controls required	*Legionella* control[5]
Toilet/urinal flushing	–	Controls required	Aesthetics
Hydrants (external & internal) and hose reels	–	Controls required	–

Notes

1. Uses are considered acceptable from a human health perspective.
2. Environmental considerations and controls are discussed in *Technical Information for the Victorian Guidelines for Water Recycling* (publication 1911).
3. Plumbing and communication controls are discussed in *Technical Information for the Victorian Guidelines for Water Recycling* (publication 1911.
4. Taps at the laundry trough should not be supplied with recycled water.
5. Under the *Public Health and Wellbeing Act 2009* a specific risk management plan is required to control the risk of Legionella from cooling tower systems. Contact DHHS for further information. https://www2.health.vic.gov.au/public-health/water/legionella-risk-management-guidelines.

Recycled water is not acceptable for the following uses:

- drinking
- cooking or other kitchen purposes
- bathing and showering
- filling domestic swimming pools and spas
- children's water toys.

These uses may result in the regular ingestion of recycled water volumes that are significantly greater than the quantities considered in the risk assessment. Management controls should therefore be in place to ensure recycled water is only used for its intended purposes.

1.4.3 Physical-chemical and pathogen limits

The water quality objectives given in Table 1 and Table 2 (BOD, SS, turbidity (as NTU), pH, and *E. coli* bacteria, and pathogen log reductions) are indicators of treatment process performance and pathogen reductions.

These criteria need to be achieved, and therefore regularly monitored to determine the class of recycled water. Further requirements for class A recycled water are discussed in *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911).

The treatment processes described in Table 1 and Table 2 are nominally effective in removing viruses and other microbial pathogens to safe levels, given the specified recycled water use. However, treatment plant operators should periodically undertake process verification ('due diligence' monitoring) to confirm that adequate removal of pathogenic microorganisms is occurring.

For class A recycled water supplied to residential households there is an aesthetic threshold of 1 mg/L total chlorine at the point of application. Sensitive crops may also be damaged at total chlorine levels above 1 mg/L and users should consider the sensitivity of crops in this regard

1.4.4 Livestock

Recycled water is considered acceptable for animals to drink. However, under the *Livestock Disease Control Act 1994*, pigs must not drink recycled water sourced from human waste.

1.4.4.1 Principles for using recycled water with livestock

The *Livestock Disease Control Act 1994* and its subordinate legislation outline requirements for livestock drinking and grazing land irrigated with recycled water sourced from municipal wastewater (this Act refers to this as 'sewage' or 'nightsoil'). These requirements are designed to protect:

- stock health (specifically cattle and pigs exposed to the water for drinking, or pasture/ fodder from irrigated land)
- humans (consuming meat and milk products).

A requirement for helminth control is a key component of the *Livestock Disease Control Act 1994*.This specifies that in order for recycled water to be suitable for use on cattle grazing land, and not be classified as sewage, treatment processes must be specifically designed and managed to reduce pathogens (particularly helminths) to acceptable levels. This is to prevent helminth infections in cattle ('beef measles' or *Cysticercus bovis*) caused by the helminth *Taenia saginata*, a human tapeworm in cattle which can impact meat quality.

Due to the potential transmission between humans, between pigs and between pigs and humans, and the significant biosecurity and human health implications, the use of recycled water is strictly prohibited for pigs in accordance with the *Livestock Disease Control Act 1994*.

For livestock production with recycled water, potential exposure routes and/or risks fall into the following categories:

- produce (food) safety (milk and meat)
- human health (via food)
- stock health
- environmental (exposure to other animals on and offsite).

The desired outcome is to ensure the producer and consumer of meat are not impacted by disease potentially derived from recycled water use.

1.4.4.2 Helminths

Pigs

The helminth of concern relating to pigs is *Taenia solium* because of the potential for catastrophic impact to humans (neurocysticercosis and other health impacts). For this reason, supplying pigs with recycled water sourced from wastewater that contains human faecal matter is prohibited. Transmission may also occur from piggery effluent to pigs if helminth reduction is not achieved.

Ascaris can also be transmitted from human sewage to pigs and from pig effluent to pigs.

Cattle

Incidents of beef measles in Australia do occur and have resulted in previous trade issues. These incidents usually relate to exposure of cattle to human faecal material, raw sewage or septic tank discharge, highlighting the importance of the wastewater treatment process.

1.4.4.3 Cyanobacteria and other harmful algae

Generally, cyanobacteria (commonly known as blue-green algae, BGA) in recycled water will not affect stock health, provided the appropriate withholding periods are implemented and stock are grazed on dry land. There is, however, a greater risk to stock health associated with drinking recycled water containing cyanobacteria or other harmful and nuisance algal blooms which may produce toxin. The schemes with open storage should consider algal toxin risk during algae dominated season and controls should be implemented to mitigate risks from algal toxins.

1.4.4.4 Recycled water containing animal effluent

Recycled water sources that include wastewater from abattoirs, rendering plants and knackeries

Water recycling schemes require individual endorsement from the CVO where they involve offsite use of abattoir, rendering plants and knackeries wastewater, or where these sources of wastewater are used for livestock production.

Other examples of stock pathogen sources entering the sewerage system are:

- stockyards (sale yards, hold yards prior to slaughter or export), intensive livestock farming facilities, animal processing plants
- washing facilities for livestock cartage vehicles.

Recycled water sourced from dairy processing water

Treatment of dairy processing waters should be undertaken in accordance with *Environmental Guidelines for the Dairy Processing Industry* (publication 570)[2] and any improvement based on industry best practice (for example *Management of dairy effluent 2008 DairyGains Victorian Guidelines*[3]). Some constraints may be imposed within the industry itself and therefore Dairy Food Safety Victoria (DFSV) should be consulted[4]. All other relevant measures specified in this guideline apply to this category of water recycled from dairy wastewater.

Acceptable livestock uses and appropriate management controls vary with the level of treatment and source of the recycled water.

If recycled water is used in accordance with these guidelines, it should be considered like any other fit-for-purpose water source used in a livestock operation. Therefore, no withholding periods are required for export of cattle to other farms, interstate or overseas. Audits associated with recycled water use should be able to check and verify if treatment and system management are sufficient to minimise this risk to acceptable levels as defined by the CVO or this guideline.

1.4.4.5 Chief Veterinary Officer (CVO) endorsement and notifications

The CVO is required to endorse recycled water schemes that will have:

1. Livestock grazing on pasture irrigated with recycled water where the wastewater treatment plant receive wastewater from abattoir, stockyard or intensive animal industry effluents generated offsite through trade waste agreement, making them a source of livestock pathogens.
2. Processes to remove helminths (if human faecal content is in the recycled water source) other than:
   a. 25-day hydraulic retention time in a lagoon system (equivalent to 4-log removal); or
   b. the specified sand filtration method (Note 1) or an equivalent microfiltration system that excludes particles greater than 20 microns in diameter.
3. Treatment processes that are not already approved by CVO but able to achieve a 4-LRV equivalent and/or lower LRV based on a treatment train specific risk assessment.

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[2] https://www.epa.vic.gov.au/about-epa/publications/570
[3] http://www.dairyingfortomorrow.com.au/wp-content/uploads/2008-DairyGains-Victorian-Effluent-Guidelines.pdf
[4] https://www.epa.vic.gov.au/business-and-industry/guidelines/water-guidance/dairy-farms-and-water
https://www.dairysafe.vic.gov.au/publications-media/regulations-and-resources/guidelines/418-farm-fsps-minimum-requirements-implementation-guide/file

The scheme manager must notify CVO if:

1. cattle are exposed to recycled water (sourced from municipal sewage) or pasture and fodder grown with it, which is not treated to appropriate levels (out of specifications)
2. pigs are exposed to recycled water (sourced from municipal sewage) or produce grown with it; or
3. cattle or pigs are allowed access to land historically irrigated with recycled water sourced from municipal sewage within two years of the last irrigation, if the water was not treated to appropriate levels.

   Note 1: Passed through a sand filter having a depth of sand not less than 600 mm – the sand of such filter having an effective size not greater than 0.5 mm and a uniformity coefficient not greater than 4.

1.4.4.6 Helminth removal for livestock

Recycled water sourced from wastewater containing human faeces

Acceptable helminth egg removal methods currently recognised by the CVO are:

1. achieving at least 25 days detention (which is equivalent to a $\log_{10}$ reduction value (LRV) of 4) in treatment lagoons (this may include either primary, secondary or maturation lagoons provided the helminth settling process is not disturbed by processes such as mixing, aeration or any other process), or a storage facility where all recycled water must be detained for at least 25 days from the time of the last discharge into the storage; or
2. an approved method of filtration, such as sand (or equivalent for example membrane) filtration.

Alternatives to the recognised methods for helminth egg removal above require specific approval from the CVO before the recycled water can be used in association with cattle grazing.

Recycled water from sources that do NOT contain human faeces.

If recycled water source does not contain human faeces:

- there are no restrictions on grazing of pigs or fodder uses
- the helminth removal requirements for recycled water sources from municipal wastewater (human sewerage or septic tanks containing human faeces) are not required
- all other relevant measures in this Guideline apply.

1.4.4.7 Land use restrictions

Pigs or cattle can access land that has been irrigated with recycled water that has not had adequate helminth removal (out of specification recycled water) if two years have passed since the last application of out of specification recycled water. If less than two years have passed, the CVO must be consulted prior to cattle or pig grazing.

1.4.4.8 Product supply and production restrictions

Recycled water sourced from municipal sewage (containing human faeces) must not be:

- exposed to directly to pigs; or
- used to grow produce that pigs may be exposed to (feed, fertiliser or bedding).

The recycled water supplier must ensure that recycled water or produce grown with it is not used in pig production.

The recycled water user must:

- confirm product end-use is not pigs, or ensure labelling is present on products irrigated with recycled water that declares pigs should not have access (feed, fertiliser and bedding) to the product
- ensure that fodder and crops irrigated with recycled water are ensiled or dried before packaging.

1.4.4.9 Site access restrictions

When class A recycled water is used, no specific public or stock access restrictions (other than pig prohibition) are recommended. Sensible stock restriction controls should be employed to protect soils from stock traffic and compaction when wet.

For lower quality recycled water (class B, C), restrictions on public/workers and stock access, and limits on irrigation times may be required. These limitations will depend on the stock exposure potential and the quality of recycled water used.

1.4.4.10 Stock pathogens

Untreated sewage potentially contains a range of pathogenic organisms that may pose a risk to livestock health. These risks are largely managed by following the recommended use of the various classes of recycled water. It is not recommended that recycled water lower than class B be used for livestock drinking water. The potential pathogens include viruses, bacteria, protozoa and helminths.

Stock grazed on pasture irrigated with water, or supplied with drinking water, from waterways downstream of a recycled water scheme may require individual identification, enhanced meat inspection and monitoring in accordance with the *Livestock Diseases Control Act 1994* and the *Meat Industry Act 1993* if the water has not been adequately treated for helminths.

1.4.4.11 Quality assurance programs for livestock

For food production, the use of industry accreditation programs (for example, Flockcare) and quality assurance (QA) systems under the Hazard Analysis and Critical Control Point (HACCP) framework to manage produce safety risks will be recognised as complementary to the risk management strategies in this guideline, lowering associated risks. Any additional management controls needed for food and produce safety associated with the use of recycled water must be addressed as part of these QA management systems.

Stock grazed on pasture irrigated with recycled water should be monitored in accordance with the *Livestock Diseases Control Act 1994* and monitoring should be described as part of the farm's food safety QA plan.

1.4.4.12 Out of specification recycled water discharges and livestock exposure

Treatment not achieving required helminth removal

If the treatment process does not achieve the required helminth removal, the recycled water should not be supplied to livestock production systems. If possible, the water should be treated further or supplied to lower risk uses. If this is not possible, the water authority should contact the CVO to discuss further options.

Discharge to aquatic environments

If water is discharged into the environment that has no or inadequate helminth treatment (including for operational reasons or equipment failures), the responsible party potentially exposes downstream users and those grazing riparian land to the risks posed by pathogens. The CVO must be informed in situations where this occurs, and the downstream livestock producers must also be informed, so that they can manage the risks to livestock.

Any party discharging wastewater has an important role in determining the types of downstream users that may be exposed and should proactively engage those producers ahead of incidents to assist them manage potential exposure. With enough notice, producers may be able to source alternative water sources.

Flood events may also cause pastures irrigated with recycled water to be flooded. In these cases, pigs or cattle can access land that has been flooded with water that has not had adequate helminth removal if two years have passed since the last application of out of specification recycled water. If less than two years have passed, the CVO must be consulted prior to cattle or pig grazing.

2. Recycled water management system

This guideline promotes the use of the *AGWR Framework for management of recycled water quality and use*. The AGWR Framework provides a structured risk-based approach to recycled water management and incorporates the concept of identifying and producing recycled water of a quality that is 'fit-for-purpose'. The framework comprises 12 elements organised within four areas (Figure 3)

The four areas are:

1. Commitment to responsible use and management of recycled water. This involves commitment to the development and application of preventive risk management to support the sustainable and safe use of recycled water.
2. System analysis and management. This involves understanding the entire recycled water system, the hazards and events that can compromise recycled water quality, and the preventive measures and operational controls necessary for risk minimisation and assuring safe and reliable supply and use of recycled water.
3. Supporting requirements. These requirements include basic elements of good practice such as employee training, community involvement, research and development, validation of process efficacy, and systems for documentation and reporting.
4. Review. This includes evaluation and audit processes to ensure that the management system is effective and provides the basis for review and continual improvement. Effective risk management systems are not static and must be capable of accommodating change, such as emerging issues, advances in technology and new institutional arrangements. Development should be an ongoing process whereby performance is continually evaluated and reviewed.

The AGWR framework has a Hazard Analysis and Critical Control Point (HACCP) component which is used to undertake this assessment.

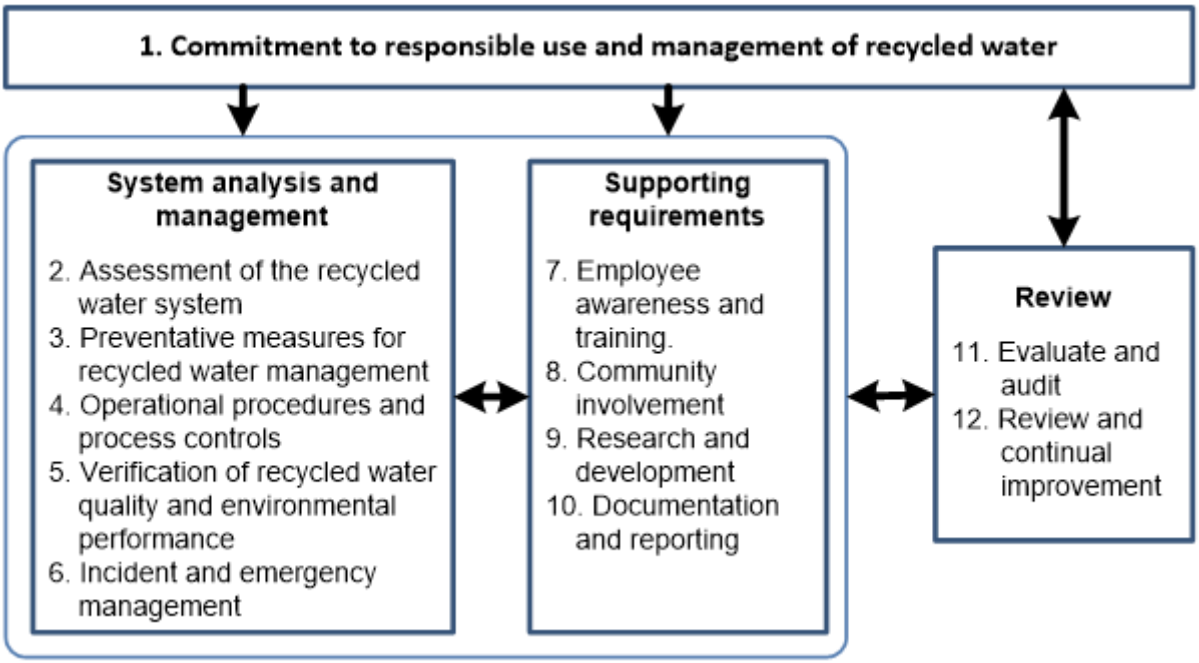

Figure 3 The 12 Elements within the four areas of the framework for management of recycled water quality and use (reproduced from the AGWR (NRMMC et al., 2006))

2.1 Commitment to responsible use and management of recycled water

2.1.1 Responsible use of recycled water

Organisational support and long-term commitment by an organisation's executives is the foundation for an effective system for managing recycled water. Executives should ensure that their actions and policies support effective management of recycled water quality. For example, appropriate staffing, training of employees, provision of adequate financial resources, active participation and reporting to the board or chief executive.

In some cases, this commitment may be reflected in documents such as deeds of agreements or contracts between parties. Organisations can help ensure this level of commitment by assigning responsibilities to relevant roles as key performance indicators, or similar, for appropriate staff.

Successful implementation requires:

- an awareness and understanding of the importance of recycled water quality management and how decisions affect the protection of public health
- the development of an organisational philosophy that fosters commitment to continual improvement and cultivates employee responsibility and motivation
- the ongoing and active involvement of executive to maintain and reinforce the importance of recycled water quality management to all employees as well as those outside the organisation (a communication strategy).

2.1.2 Recycled water policy

A recycled water policy is important in formalising the commitment to responsible, safe and sustainable recycled water use. The policy should provide a basis for developing more detailed guiding principles and implementation strategies. As such, it should be clear and succinct, and should address broad issues and requirements, such as:

- commitment to responsible recycled water use
- the application of a risk management approach
- recognition and compliance with relevant Regulations and other requirements
- communication and partnership arrangements with agencies with relevant expertise, and with users of recycled water
- communication and engagement with stakeholders like employees, contractors, and the public
- the intention to adopt best-practice management and a multiple-barrier approach
- continuous improvement in managing the treatment and use of recycled water
- the opinions and requirements of all partnership agencies, employees, recycled water users, other stakeholders and the wider community.

The policy needs to be highly visible, continually communicated, understood and implemented. All partners, contractors and partnership agencies should be made aware of the policy. An example of what such a policy might contain can be found in the AGWR.

2.1.3 Regulatory framework, notification and approvals

Regulatory and formal requirements for a recycled water scheme need to be identified, understood and documented. Recycled water suppliers and end-users should be familiar with the Acts, Regulations, policies, codes of practice, Australian Standards, guidelines, and other documents relevant to recycled water use and their obligations under these. Suppliers or scheme managers should demonstrate 'due diligence' and duty of care to human health and the environment. They should also ensure that legal risks are appropriately addressed. A summary of relevant legislation, policies and guidance documents is provided in Section 1.13 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911).

Regulatory agencies involved in scheme approval processes do not underwrite risks associated with recycled water schemes. If an approved recycled water scheme is not protective of public health or the environment, or is not considered safe to continue operation following a subsequent review or audit, it is the responsibility of the supplier or user to cease recycled water supply/use and improve preventive measures to ensure it is safe before continuing.

Recycled water use in compliance with this guideline forms a critical component of the exemption from the EPA works approval and licensing requirements. To demonstrate compliance with "Specifications acceptable to the Authority" a Health and Environment Management Plan (HEMP) must be prepared in accordance with these guidelines and approved by EPA. The HEMP provides the overall risk assessment and the related communication, management, auditing and reporting required for the recycled water scheme. The HEMP must be approved by EPA, with the appropriate endorsement from the CVO where relevant, prior to operation of the recycled water scheme. The HEMP must address the risks identified for the scheme and the preventive measures and

management plans required for the scheme. Non-compliance can potentially expose parties to legal action and create environmental and health risks. To assist in managing these risks, agreements should be developed between the supplier and recycled water users. The agreements should include, among other things, mechanisms to address a failure of a party to meet their responsibilities, such as the supplier restricting or ceasing supply. In the case of residential users, the agreements could be structured generically, such as with customer charters rather than individual contracts. HEMPs should detail these mechanisms and identify any specific responsibilities established in the agreements.

Formal agreements should be developed between suppliers and recycled water users and any scheme managers if these are separate entities to the suppliers. The detail in any agreement will vary according to the type of scheme implemented. Suggested issues that may be addressed in the recycled water use agreement include:

- defined roles and responsibilities to meet the objectives of this guideline
- responsibility for conveyance works such as pipes and channels
- ownership of the facilities
- cost of recycled water
- contract duration, including terms and conditions for termination
- recycled water characteristics (source, quality, quantity, pressure, flow variations)
- reliability of supply
- commissioning and commencement of the supply of recycled water scheme and its use
- intended uses and the purposes for which the supplied water is fit
- responsibility for operation, maintenance, monitoring and auditing processes
- liabilities (including risk allocation and insurance)
- food or stock feed safety controls associated with sale of produce or products generated with the use of recycled water
- authorisation for access for inspections
- record keeping
- reporting
- audit requirements
- cessation of supply
- dispute management
- responsibility for preparing and implementing the user site management plan
- other issues determined relevant by the parties involved.

Suppliers should develop a risk-based approach to determine management requirements for customers, which may be as follows:

- no additional agreement or site management plan (for example customer charter forms the agreement): Subject to ongoing inspections by supplier on low frequency basis.
- customer agreement and generic customer site management plan: customer subject to some ongoing inspections
- high risk customer with customer agreement and site-specific customer site management plan: Subject to more frequent ongoing inspections.

2.1.4 Approval and management

Recycled water schemes in Victoria require approval from EPA. All applications and enquires related to recycled water schemes within the scope of this guideline should be made through EPA.

There are four main stages of managing a water recycling scheme:

1. approval of development and construction
2. commencing operation
3. routine, ongoing operation
4. periodic review, maintenance and renewal.

EPA provides approval for recycled water schemes within the scope of this guideline. EPA approval is required for the first and second stages of the scheme to the point of the scheme being ready to operate. Other government agencies may be involved in the approval process either in an advisory and/or endorsement capacity, such as CVO. The scheme manager is responsible for the other stages including ongoing review.

Proponents of reuse schemes have the option of managing and reporting on an individual scheme basis, aggregation of similar schemes, or an organisation-wide basis. The decision of which approach is to be adopted will be at the discretion of EPA in discussion with proponents. Proponents with extensive experience in managing

recycled water schemes, with a good history of compliance and with risk-based management systems in place, are more likely to obtain approval for aggregate or organisation-wide management of recycled water schemes.

2.1.4.1 EPA approval and notification requirements

For the development of a recycled water scheme, EPA approval is required for:

- development and construction of recycled water scheme
- the Health and Environment Management Plan (HEMP)
- validation and commissioning of the treatment process
- final approval of recycled water scheme (exemption to a works approval and licence).

2.1.4.2 Ongoing EPA approval and notification requirements

For the ongoing operations, maintenance and renewal (re-approval) of the recycled scheme, there are several minor and major trigger events that require EPA notification and potential approval (Table 4). The frequency of notifications and approval requirements will depend on:

- the types of matters defined in the HEMP
- the type of modification to the system and how it impacts the risks assessed in the HEMP
- extent of operational non-compliance and frequency
- auditing non-compliance frequency/extent and triggers
- the discretion of EPA.

2.1.4.3 Specific approval requirements for industrial water reuse schemes

For industrial sources of wastewater, it is important to identify the proposed end use(s), volume(s), and the source water quality to understand if EPA approval or notification is required.

Written notification to EPA is required where industrial water is supplied from an EPA licensed premises, which has a licence and/or other conditions directly controlling the management of that industrial water source. Under these circumstances, an amendment to the licence or HEMP may be required to ensure that industrial water recycling is compliant with licence and HEMP requirements.

If the recycled water is used for an industrial process contained within an industrial site, the supplier and user (as agreed) will need to consider that it is fit for the intended purpose and manage:

- workplace risk via the WorkSafe Victoria framework
- business risk via existing business systems (for example, EMS)
- risk to consumers by ensuring product safety and quality (for example, via food safety, product specifications and fair-trading frameworks).

A HEMP will be required if the industrial wastewater is to be recycled for non-industrial uses offsite and the volume to be recycled is expected to be greater than 5,000 L/day. If the industrial water does not contain human faecal material and microbial risks are low, the HEMP will most likely be approved faster.

2.1.4.4 EPA approval processes

EPA approval is based upon the demonstration that the performance objectives identified within this guideline will be met. The measures that will be undertaken to meet the performance objectives of this guideline must be documented in a HEMP which is submitted to EPA for assessment against this guideline. EPA approval of the HEMP is the mechanism for obtaining an exemption from works approval and licensing (Figure 2). EPA may refer the HEMP to the CVO for aspects that relate to exposure of cattle to recycled water sourced from sewage, and wastewater sources with greater than 1 per cent livestock related waste (for example abattoir, rending plant, knackery, stock yard waste). Further discussion of the role of the CVO is provided in Section 2.1.7.4

The application process for developing a recycled water scheme requires sufficient information from the applicant so the EPA can determine if risks to human health and the environment will be adequately mitigated and the water is being recycled for an appropriate use (Figure 4).

EPA will approve or refuse to approve reuse scheme applications within reasonable time after it accepts the application as being complete and up to a standard suitable for assessment. This is based on the provision by the proponent of a well-documented, compliant application containing all relevant information in a well-structured and clearly assessable format. Assessment and approvals will take longer if relevant information is missing or if the information is poorly presented. EPA will not accept formal applications until the application document is complete.

Class A scheme RWQMP require in situ validation monitoring, full scale validation, critical limits verification or other RWQMP related commissioning activities. These are part of RWQMP commissioning and are part of conditions to approval of development and construction.

With certain schemes, or additional uses to schemes already approved and operating, the approval process may be quicker if well documented and the appropriate components in this guideline are addressed (Figure 4). Proponents can informally discuss their proposals with EPA and relevant government agencies prior to formal submission to help in forming complete applications.

This guideline informs the contents of an application to EPA and recommends how information should be presented. However, the guideline is not a statutory obligation. Therefore, proponents can present the information in another way if the relevant information is provided.

Where relevant, existing approvals, agreements, quality systems (such as ISO 9001, 22000, 55000, 14001 or HACCP), or works approvals can be used to assist and support approval of relevant parts of an application for an exemption to the works approval for developing a recycled water scheme. If an organisation has a recognised quality management system in place, this can potentially assist and be accepted and accommodated to the extent that it can address obligations set out in this guideline.

Table 4 Notifications, approval and audit requirements for development, operation and maintaining a recycled water scheme.

Components to consider for notification and approval from EPA and possible actions required	Notify EPA and seek approvals if required							Actions	
	Develop		Operate			Maintain		Operator	EPA
	Development	Commissioning validation	1st	2nd consecutive	3rd consecutive	Modification	Renewal	Cease supply	Infringement notice/fine
Scheme development and commissioning									
Development of recycled water (seeking exemption to works approval licence) and operational licence	A	A	--	--	--	--	--	--	--
HEMP*** – original submission; note that user approvals are separate and will not delay scheme approval	A	--	--	--	--	--	--		
HEMP – addition of treatment plant	N	--	--	--	--	--	--		
Modifications and improvements to the recycled water scheme									
Minor - small changes not impacting CCPs or ECPs in the HEMP (for example new user for approved uses, replacement treatment system with the same approved system, changes to CCP values/measures/actions to reflect operational requirements, new user (approved use for water quality), modifications to HEMP, RWQMP, addition of treatment process, addition/replacement of a CCP)	--	--	--	--	--	--	--	--	--
Major - changes that will impact CCPs or ECPs in the HEMP (for example change of treatment process or source water, new use not approved in HEMP, previously unapproved use, or volumetric high-risk user as determined by the supplier, removal of a treatment process, removal of a CCP, new user (previously unapproved use), fundamental change in source water; note that user approvals are separate and will not delay scheme approval)	--	--	N+A	N+A	N+A	N+A	--	Y*	--
Operational management of the recycled water scheme									

CCPs exceeded and water does not enter supply	--	--	--	--	--	--	--	Y**	--
CCPs exceeded and water does enter supply	--	--	N	N	N+A	--	--	Y**	--
Verification monitoring limit exceeded; (note in annual report)	--	--	--	--	--	--	--	Y**	--
Renewal of recycled water scheme (licence for exemption of works approval)									
If defined in HEMP at a set frequency	--	--	Y	Y	Y	--	Y	--	--
If defined in HEMP as based on continual compliance and this has been achieved.	--	--	N	N	Y	--	Y/N	--	--
Auditing requirements									
Frequency or risk-based audits as defined in the HEMP									
Compliant	--	--	--	--	M	--	--	N	N
Minor non-compliance	--	--	--	--	N	--	--	N	M
Major non-compliance	--	--	--	N	N+A	--	--	Y*	N >=2
Triggered Audits due to modification and operational risks									
Major modification (audit modification),	--	--	--	--	--	N+A	--	Y	--
User uses water for purpose not approved in HEMP but still fit for purpose	--	--	--	--	Y	--	--	--	--
User uses water for purpose not approved in HEMP and NOT fit for purpose (and potentially unsafe)	--	--	Y	Y	N+Y	--	--	M	M

Notes:

M = Maybe at the discretion of EPA, Y = yes, N = notify, A =approval required. -- = no, CCP = Critical Control Point, ECP = Environmental Control Point, HEMP = Health and Environment Management Plan.

*if not a CCP, cease supply of water if short-term exposure considered unsafe or until specification achieved.

**If CCP exceeded, then supply of recycled water must be ceased immediately, or other appropriate control measures implemented. The CVO must be notified if the CCP is related to Section 1.4.4.5.

*** class A schemes and class B and C schemes involving greater than 1 ML/d

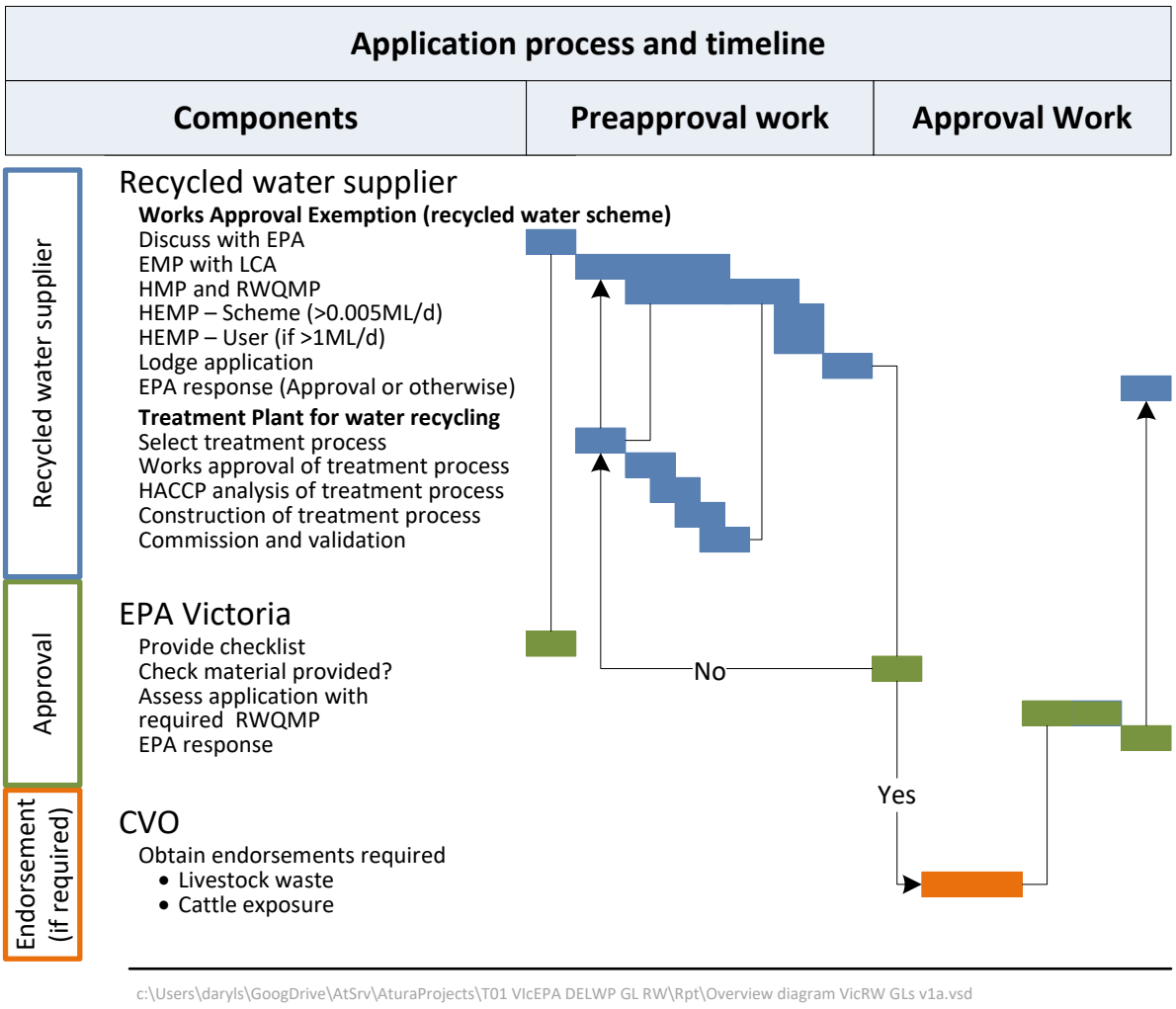

Figure 4 Indicative scheme development process; application, endorsement and approval

2.1.5 The Health and Environment Management Plan (HEMP)

2.1.5.1 Overview of the HEMP

A HEMP is essential for sustainable and safe water recycling. The HEMP is necessary for exemption from EPA works approval and licensing provisions and establishing the recycled water scheme. The primary objectives of a HEMP are to:

- ensure all aspects of the scheme which could pose a risk to human health and the environment have been identified and addressed through the application of a preventive risk management system
- demonstrate the performance objectives of this guideline can be complied with, by detailing the operational controls and preventive measures that will be implemented to manage risk (including routine operational monitoring)
- provide a framework to assess the scheme's ongoing sustainability (verification that it has worked by managing all associated risks).

The recycled water HEMP is required to:

1. initially establish and validate the scheme
2. in conjunction with the user site management plan (if applicable), guide operational and sustainability verification of the scheme.

Depending on the set-up of the recycled water scheme, different organisations/parties may be responsible for managing components of the HEMP. It is important that the roles and responsibilities of all stakeholders are clearly documented within the HEMP. This should include clear lines of accountability and reporting and actions to address any non-compliance with the HEMP and this guideline.

The HEMP must be authorised and signed by a person authorised as a representative of the proponent with documented responsibilities within the HEMP. Normally this would be a senior executive of the supplier/manager.

Where a supplier and/or manager does not have a valid HEMP or does not comply with the requirements specified in the HEMP, they could be subject to enforcement action pursuant to EPA's compliance and enforcement policy under the *Environment Protection Act 1970*. Enforcement action could include measures such as a remedial notice (which directs a supplier to undertake specified actions) and sanctions.

Components of the HEMP include:

- in relation to the human health aspects: Health Management Plan (HMP) and Recycled Water Quality Management Plan (RWQMP)
- in relation to the environmental and agricultural aspects: Environmental Management Plan (EMP) and Land Capability Assessment (LCA).

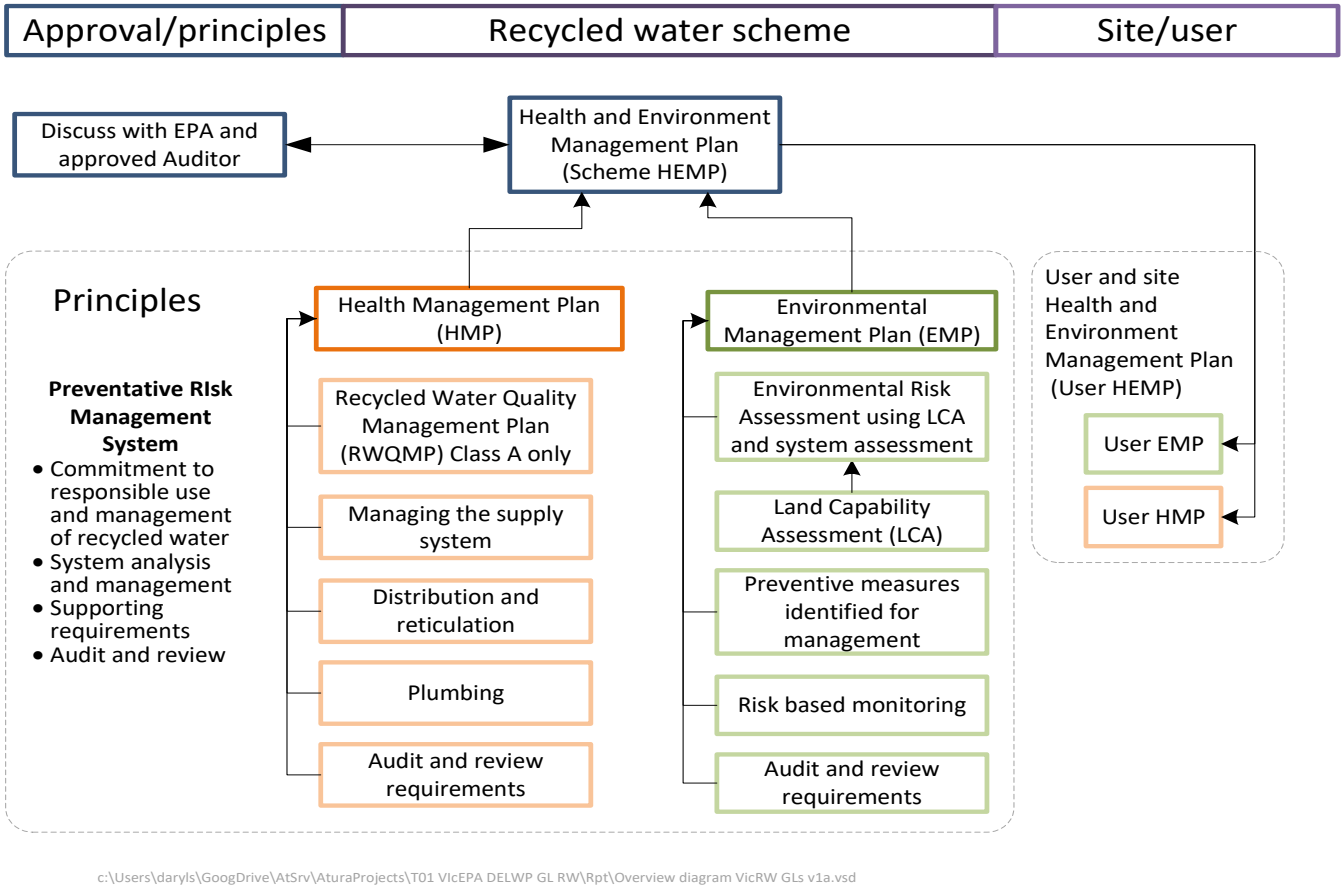

Figure 5 Health and Environmental Management Plan (HEMP) for the recycled water scheme establishment and ongoing management, and the relationship with recycled water user management plan

2.1.6 The recycled water quality management plan (RWQMP)

A RWQMP is required for class A or fit-for-purpose recycled water schemes (schemes supplying water for the range of acceptable high value uses listed for class A in Table 1 that have a high potential for direct human contact with recycled water.

The RWQMP needs to consider design, operation, maintenance and inspection of the treatment system and set out the source water, product water and distribution water monitoring program.

The RWQMP is a component of the HEMP for a class A scheme.

For suppliers operating more than one recycled water scheme (for example larger regional or metropolitan water corporations), the RWQMP may be incorporated into a broader enterprise-wide water safety management plan (see Figure 7 for an example). Similarly, one RWQMP may serve many HEMPs.

The focus of the RWQMP is on ensuring the treatment plant will produce water that meets the required microbial criteria for the selected reuse, and that the water quality is not compromised downstream of the treatment process. Therefore, the RWQMP should extend from the catchment of the system (including system inputs), through to the end of the treatment process. Where the supplier manages storage, the storage should also be included in the RWQMP.

The elements of the RWQMP are illustrated in Figure 6 and consist of:

- the treatment process's capability to meet the microbial criteria
- a monitoring and management program to achieve and maintain the criteria, developed within a risk management framework such as HACCP (Refer to Section 8 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911). This program should identify significant water quality risks, and management controls for these risks
- the prerequisite or supporting programs required for the treatment process and management program to be effective, such as standard operating procedures, equipment maintenance and calibration programs, and training requirements.

While the HACCP planning and prerequisite programs are essential for developing and implementing the RWQMP, it is not essential that they are included in the RWQMP and may be either linked documents or appendices to the RWQMP.

The RWQMP is underpinned by validation. Validation is discussed in more detail in *Technical Information for the Victorian Guideline for Water Recycling* (publication 191)1 and involves the collection and analysis of data relating to the recycled water system to demonstrate that (i) the treatment process is capable of achieving the required microbial criteria; and (ii) any management controls identified in the HACCP process, such as process monitoring, critical limits and corrective actions, will effectively prevent substandard water being delivered to the scheme.

For class A schemes, health risk management also applies to the distribution, reticulation and end-use aspects of the scheme; however, these areas do not need to be included in the RWQMP. They are discussed separately within the HEMP.

A guide designed to help recycled water scheme proponents develop a RWQMP for class A recycled water schemes is set out in *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911). The guide is designed as a RWQMP template for scheme proponents, managers, suppliers and their consultants. Highlighted boxes in each section of the guide should be completed taking into consideration the comments in each section of this guideline and the AGWR (NRMMC et al., 2006).

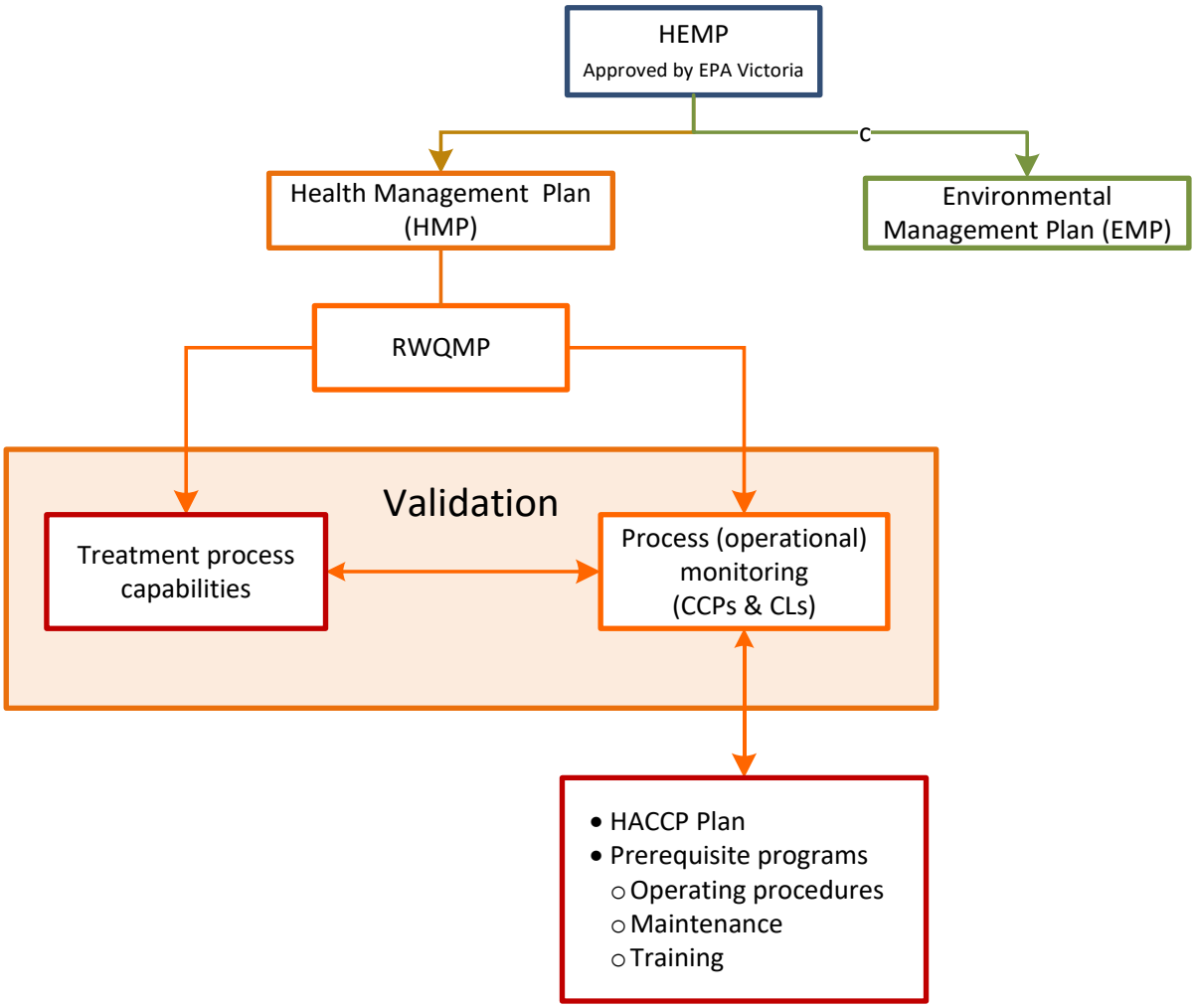

Figure 6 Elements of the recycled water quality management plan (RWQMP)

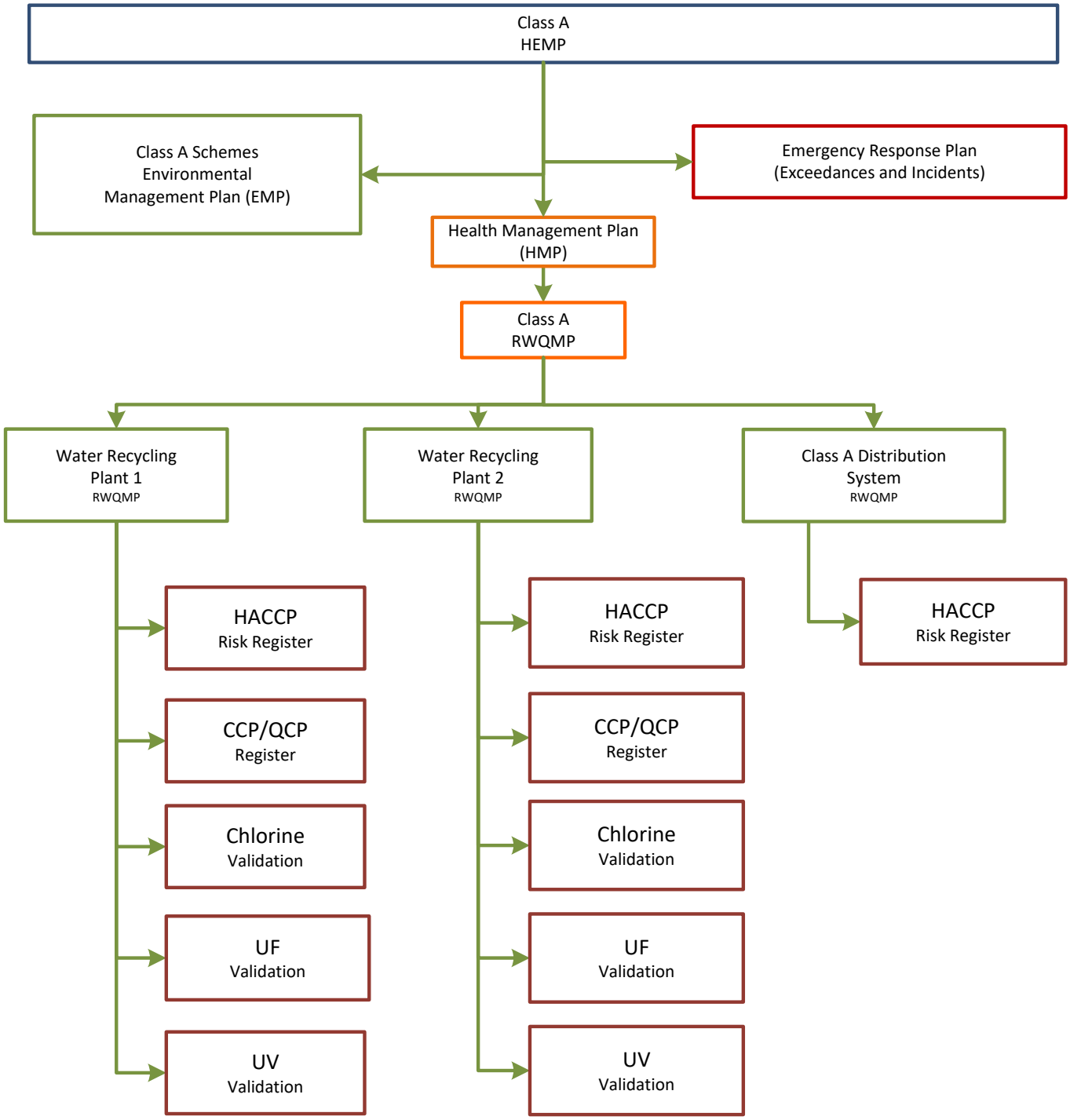

Figure 7 Example multi-scheme recycled water quality management plan (RWQMP)

2.1.7 Stakeholders and their roles and responsibilities

Assessment of the viability and risks associated with recycled water schemes should be undertaken by people with appropriate expertise in public and environmental health. This usually means involving agencies with responsibilities in these areas as well as consultants. Mechanisms to establish partnerships between all stakeholders and engage users should be developed to ensure effective communication between stakeholders so that all individual and organisations are committed, and remain committed, to responsible recycled water use.

2.1.7.1 Recycled water suppliers, scheme managers and users

2.1.7.1.1 Suppliers

Scheme proponents must develop a HEMP which is to be maintained by the supplier.

The recycled water supplier is normally the proponent for a recycled water scheme. The supplier of recycled water must comply with relevant aspects of the HEMP and RWQMP, including any subordinate obligations. Suppliers have a responsibility to keep a register of all schemes and users to which they supply recycled water. Each year, the supplier should provide EPA with summary details of the quantity and quality of recycled water supplied and any other information requested by EPA from time-to-time. There may be scenarios where there are multiple entities in the supply chain, each playing the role of supplier, for example bulk suppliers and retail suppliers.

Suppliers are responsible for communicating the appropriate use of recycled water and limitations with respect to residential users. In some cases, the number or nature of the users may justify the development of a site-specific management plan for the recycling activities (for example, body corporate management of a residential development, fire authority and the like). Users have responsibilities to maintain recycled water fixtures and fittings.

The supplier of recycled water is responsible for inspecting recycled water connections to ensure drinking water supply is protected and recycled water is not consumed.

The supplier has ultimate responsibility to ensure the recycled water scheme is managed in accordance with this guideline, including overseeing adherence to the user site management plan. This will require recycled water use as per the intended purpose, as defined in the HEMP. Suppliers need to verify through an audit process that users are following the user site management plan requirements.

Supply to certain premises with more susceptible users, such as schools, childcare centres, hospitals and aged care facilities, have by their nature a different subset of potentially more susceptible users of recycled water, and should be managed according to those different risks. This could include additional preventive measures, controls, surveillance, monitoring and auditing.

2.1.7.1.2 Scheme Managers

A scheme manager is a body identified in the HEMP as being responsible for managing recycled water reticulation and engaging with recycled water users. Scheme manager and supplier could be the same. The scheme manager is also responsible for ensuring that the scheme is managed in accordance with this guideline, including the development, endorsement, implementation and ongoing auditing and review of the HEMP (excluding the RWQMP, which is the responsibility of the supplier. This responsibility includes ensuring recycled water users are using the water appropriately and are informed of the risks associated with misuse or illegal connections. Mechanisms must be in place for the user to report on non-compliance in accordance with the HEMP.

Scheme managers have a responsibility to keep a register of all recycled water supplied to, and used within, the scheme. This register should include the location of the scheme, the quality and quantity of supply, and end uses of the recycled water. Each year, the scheme manager should provide EPA with summary details of the register. The scheme manager should ensure user site management plans are in place where required.

2.1.7.1.3 Users

The recycled water user needs to develop a user site management plan (see Section 9 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911)). The supplier needs to endorse the user site management plan but specific approval from EPA is not required for the user site management plan. Recycled water users are expected to follow the risk identification and management principles outlined in this guideline. Sometimes the same entity is both the recycled water provider and user, in which case the HEMP can incorporate the user site management plan within the same document. Users of recycled water are responsible for using recycled water in accordance with a user site management plan, in accordance with intended end uses and requirements of specific user contracts.

2.1.7.1.4 Agreements between parties

A suitable agreement needs to be formalised between all connected parties (sources of recycled water, treatment, distribution and user) if those parties are distinct.

2.1.7.2 EPA

EPA approves the development and ongoing management of a recycled water scheme by allowing an exemption from works approval and licensing requirements (Figure 2). EPA can review, revoke and modify approvals, as it sees fit.

EPA is responsible for developing environmental guidelines that encourage best practice and result in the development of safe and sustainable water recycling schemes that produce recycled water fit for its intended purpose.

It is the role of EPA to ensure that this guideline is effectively implemented. This is achieved, for example, by EPA undertaking audits of selected recycling schemes (on a random or priority site basis) to ensure compliance with this guideline. EPA may randomly audit recycled water schemes and users from time-to-time.

EPA is also responsible for reviewing the effectiveness of this guideline. Reviews will occur from time to time, reflecting up-to-date developments in the use and management of recycled water in Australia and overseas.

EPA may supplement this guideline with technical support documents where additional guidance on interpretation of requirements is needed. In addition, EPA has a role in emergency and incident management and response if environmental and public health is at risk.

EPA is responsible for ensuring class A recycled water quality criteria are protective of public health. Class A recycled water schemes generally have the potential for higher human (public and worker) exposure. Given the increased potential for direct human contact with recycled water in class A schemes, EPA is responsible for endorsing the RWQMP to verify that systems are in place to control the reliable production and use of class A water. Section 7 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911) provides a template for completion of the RWQMP and this guideline captures and replaces the previously published *Guide for the completion of a recycled water quality management plan for class A water recycling schemes*. EPA also has a role in emergency and incident management and response if public health is at risk due to contamination of the drinking water supplies or delivery of off-specification class A recycled water.

2.1.7.3 Department of Health

The Department of Health is involved in setting health standards at a national level and assessing new end uses for recycled water in conjunction with EPA.

If there is a possibility of a recycled water scheme to impact a drinking water scheme, for example through cross-connection, or food safety, then Department of Health has a role in emergency and incident management. If there is a known or suspected contamination to a public drinking water supply and individuals exposed may be at risk of illness, then legislative notification and reporting requirements of the *Safe Drinking Water Act 2003* can be triggered. Similarly, if an incident of recycled water has potential food safety implications and a recall is considered necessary (under the *Food Act 1984*), then the Department of Health must be notified.

2.1.7.4 Chief Veterinary Officer

The CVO endorses schemes that present a risk to stock health and/or human health via food consumption. In general, EPA involves CVO in the review of schemes that entail irrigation of fodder crops and stock drinking water. This covers both helminths and other relevant risks of concern where access to recycled water is directly provided to livestock via a supply contract, or fodder crops. There are specific legislative requirements under the *Livestock Disease Control Act 1994* as discussed in Section 2.1 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911). In relation to the approvals process, EPA determines if CVO involvement is required for approval of a new scheme, or modification of an operating scheme, and places each scheme into one of the following categories:

- CVO endorsement not required - EPA determines that the CVO endorsement is not required.
- Well detailed low risk approval - EPA refers the proposal to CVO noting that the proposal complies with all the default precautionary guidelines.
- Standard approval - EPA refers the proposal to CVO, noting that it is a non-standard input or process and that a risk-based approach has been used in deriving guidelines or alternate treatment processes.

For a new scheme application or change of treatment/use, submissions should address all relevant livestock health and related food safety issues that may need to be assessed due to livestock exposure to recycled water.

- The EPA's initial check of the application will confirm if the required information is provided, and if it can be forwarded to the CVO or sent back to the applicant for more information.
- Submissions from the EPA to the CVO should:
    - outline the treatment process and justify why/how the process meets the LRV equivalent (including but not limited to details regarding particulate size removal, protocols to ensure filters are operating at 100 per cent efficiency, protocols/procedures for when filters are not operating at optimum levels, testing protocols for influent and effluent)
    - describe the end users/downstream exposure and specify if any pig or cattle producers are nearby, as this will alter the risk profile of the application
    - outline how the microbial quality of the effluent (class A, B or C) will adhere to the specifications on acceptable agricultural uses of recycled water for livestock access as summarised in Section 1.4.4.

2.1.7.5 WorkSafe Victoria

WorkSafe Victoria, the workplace regulator, enforces the *Occupational Health and Safety Act 2004* and Occupational Health and Safety Regulations 2017. WorkSafe's jurisdiction on wastewater is broad and encompasses general duties on employers to provide, so far as is reasonably practicable, a working environment for their employees' workplace that is safe and without any risks to health. Employer duties to employees include the requirement to control the risk of exposure to employees of any hazardous contaminants in sewage, wastewater and recycled water.

2.1.7.6 Local government

Local councils have public health and environment protection responsibilities within their municipal area. Local government may be involved if sewage or industrial wastewater is not managed appropriately and creates a nuisance. Local governments should be consulted in relation to recycled water provision for public spaces, sports grounds and urban cooling uses.

2.1.7.7 Water corporations

Water corporations provide water and sewerage services and may have other roles such as waterway management and drainage or floodway management functions. Under the *Water Act 1989*, water corporations can make bylaws on trade waste, and under the *Water Industry Act 1994*, water corporations can make Regulations in relation to trade waste, such as the need to obtain trade waste agreements for industrial wastewater discharges.

2.1.7.8 Victorian Building Authority

The Victorian Building Authority (VBA) regulates building and plumbing practitioners to ensure the achievement of efficient and competitive building and plumbing industries in Victoria. The VBA administers the Plumbing Regulations 2018 that sit under the *Building Act 1993* and enforces standards and regulatory requirements for onsite regulated plumbing work. The VBA's services include, among other things:

- registering, licensing and disciplining plumbers
- providing technical advice and informed solutions to industry
- undertaking investigations and audits to enforce compliance with relevant legislation.

2.1.7.9 Community

The community consists of both users and general public who may be exposed to recycled water. Suppliers should establish pathways and procedures for continual open liaison with the community. Community awareness and involvement is discussed in Section 1.6 of *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911) and is critical to ensure management controls expected of users (such as using recycled water for intended purposes only and maintaining recycled water fixtures and fittings) are in place and being adhered to.

2.2 System analysis and management:

Technical Information for the Victorian Guideline for Water Recycling (publication 1911) provides detailed information to assist scheme managers and recycled water uses implement aspects of these guidelines:

- assessment of the recycled water system
- preventative measures for recycled water management
- verification of recycled water quality and environmental performance
- employee, operator, contractor and end user awareness and training
- validation, research and development
- community involvement and awareness.

2.3 Operational procedures and process control

This section covers the operational procedures and processes that formalise activities essential to ensure and verify that recycled water schemes consistently achieve acceptable health and environmental performance targets.

2.3.1 Operational procedures

2.3.1.1 Identify procedures for processes and activities

Even short periods of failure of source, treatment, distribution or exposure controls can lead to serious public health and environment risks. It is important to ensure all essential processes are continuously under appropriate control.

Process-control programs detail specific operational factors that ensure all processes and activities are carried out effectively and efficiently. Examples are given in the *AGWR* (NRMMC et al., 2006). As part of an overall process control program, detailed procedures are required for the operation of all processes and activities (both ongoing and periodic) from wastewater sources including trade waste customers, through to recycled water users.

The effective implementation of process-control programs relies on the skills and training of operational staff, which may include end users (for example ground staff at a facility irrigated with recycled water). Operators should be proficient, able to interpret the significance of changes in recycled water quality and treatment, and able to respond appropriately in accordance with established procedures.

Procedures are most effective when operational staff including end users are involved in their development, documentation and verification. Participation helps to ensure that all relevant activities are included, improves operator and end-user training and awareness, and fosters commitment to operational and process control.

2.3.1.2 Document procedures

Process control programs should be documented in hard copy operations manuals or online quality management systems. In the case of hard copies, these should be controlled copies readily accessible to all appropriate personnel. Documentation is covered in detail in Section 2.5.

2.3.2 Monitoring

Monitoring refers to a formal process of information collection and use of that information for a range of purposes. Monitoring can be used to:

- inform the risk assessment process
- validate the performance of recycled water systems to protect human health and the environment
- ensure preventive measures are working appropriately
- verify the performance of recycled water schemes against compliance criteria
- provide information needed for investigations, follow up and research and development.

Monitoring may also form part of the surveillance undertaken as a statutory requirement under licence or approval from EPA or other agencies or corporations. The principal types of monitoring are:

- baseline monitoring (‘Where are we now?’)
- validation monitoring (‘Will it work?’)
- operational monitoring (‘Is it working now?’)
- verification monitoring (‘Did it work?’).

The main functions of each of these types of monitoring are given in the *AGWR* (NRMMC et al., 2006).

2.3.3 Operational monitoring

2.3.3.1 Aim of operational monitoring

The general intent of operational monitoring is different from that of verification monitoring. Operational monitoring is used to confirm that preventive measures implemented to control hazards are functioning properly and effectively. Data from operational monitoring can be used as triggers for immediate short-term corrective actions to protect recycled water quality or to prevent increased risk to human or environmental health.

2.3.3.2 Develop monitoring protocols for operational performance

The goal of operational monitoring is to assess the performance of preventive measures through a planned sequence of observations and measurements. Key elements of operational monitoring include:

- developing operational monitoring plans from source to point of use and beyond, detailing strategies and procedures
- identifying parameters and criteria to be used to measure operational effectiveness and, where necessary, trigger corrective actions
- ongoing review and interpreting results to confirm operational performance.

2.3.3.3 Observation and measurement

Observational monitoring could include, for example:

- regular inspections of industrial waste facilities, sewer integrity and plant equipment
- monitoring of application methods, timing of irrigation, access controls and signage.

Because recycled water use is often subject to onsite controls and limitations on the range of permitted uses, operational monitoring needs to include observational monitoring or auditing to ensure that these controls and limitations are being maintained. Observational monitoring programs are often part of a customer site management plan with which the users of the recycled water must comply.

Measurement of operational parameters (for example turbidity and pH) is used to indicate whether processes are functioning effectively and is usually online or real-time to enable an automated control action to be initiated and prevent unsafe water being supplied to users.

2.3.3.4 Selection of operational parameters

Operational parameters should reflect the effectiveness of each process or activity and provide an immediate indication of performance. Typically, parameters should be readily measured and responded to appropriately. For example, where detention is used to remove pathogens, flow measurement can be used to determine that minimum requirements are being met. Similarly, where disinfection processes are used, online measurement of residuals can be used to determine if requirements are being met.

Indicators are often used as operational parameters in place of direct measurement of hazards. For example, turbidity and particle counting are used as an indicator of filtration plant performance.

Operational parameters should be monitored with sufficient frequency to reveal, in a timely fashion, any violation of operating targets or critical values. Online and continuous monitoring should be used wherever possible, particularly for treatment processes deemed to be CCPs.

2.3.3.5 Operational monitoring for health risks

Unacceptable risks from microbial infections can arise from even very brief, single exposures. Enough is known about most of the treatment processes and some of the usage control processes to ensure that operational monitoring can detect problems before excessive exposure has taken place. For example, this can mean online monitoring of processes such as filtration and disinfection. However, in lagoon systems, days to weeks may pass before water that has been tested will reach users, providing a window for less frequent monitoring and the use of microbial testing as part of operational monitoring. The *AGWR* (NRMMC et al., 2006) gives further examples of operational monitoring and supporting programs.

For class A water recycling schemes *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911) recommends that the CCP monitoring requirements, critical limits and alert limits be summarised in tabular form. The template provides a default layout for such an approach.

2.3.3.6 Operational monitoring for environmental risks

Operational monitoring for environmental risks is specific to the intended scheme and the end-use restriction barriers required. Examples of operational monitoring include application methods, the timing of irrigation, access controls and signage. Operational monitoring programs are often part of a customer site management plan that the recycled water users must comply with. Measurement of operational parameters is used to indicate if processes relating to preventive measures are functioning effectively.

2.3.3.7 Analyse results

Results must be reviewed frequently to confirm that records are complete and accurate, and to identify any deviations from critical limits or target criteria. Those responsible for interpreting and recording operational results should understand how the results should be assessed.

A system should be established for regular reporting of operational monitoring results to relevant staff, sections and organisations, using methods such as graphs or trend charts to facilitate interpretation.

2.3.4 Operational corrections and corrective responses

2.3.4.1 Establish and document procedures for corrective actions and responses

Procedures should be developed to re-establish process control immediately in situations where target criteria or critical limits are not met. The procedures should include instructions on required adjustments, process-control changes and additional monitoring. The *AGWR* (NRMMC et al., 2006) lists possible corrective actions. Responsibilities and authorities, including communication and notification requirements, should be clearly defined.

It is important to verify whether a corrective action has been effective, which usually requires additional monitoring. Other factors that should be considered are secondary impacts of the corrective action, and if adjustments or action may be needed further along in the supply system.

Where possible, the underlying cause of the problem should be determined, and measures implemented to prevent future occurrences. Analysis of the causes may help to identify possible solutions, such as modifying an operating procedure or improving training. Details of all incidents should be recorded and reported.

2.3.4.2 Establish procedures for corrective responses

Where the short-term evaluation of results indicates nonconformance, an investigation should be initiated. The performance of preventive measures and associated operational monitoring should be reviewed and, if necessary, corrective responses should be implemented as quickly as possible. Failure to take immediate or effective action may lead to situations requiring activation of incident and emergency response protocols. Corrective responses may also be required following reports from recycled water users.

Corrective actions should be developed in consultation with EPA and other stakeholders.

2.3.4.3 Establish rapid communication systems to deal with unexpected events

Because it is not always possible to anticipate every type of event, rapid communication systems should be established to deal with any unanticipated events. In some recycled water systems, responses must be prepared for times when normal corrective actions cannot re-establish operational performance sufficiently quickly to prevent recycled water of unacceptable quality from reaching users. In potential high-exposure schemes (for example growing of crops eaten raw), preventive measures and multiple barriers adopted to manage this risk should make this event very rare.

In the event of such failures occurring, they should be immediately reported to EPA (see Section 2.4). Corrective actions and responses should be documented, responsibilities and authorities should be clearly defined, and staff should be trained in appropriate procedures.

2.3.4.4 Cessation of supply

Schemes that require class A recycled water must have automatic shutdown mechanisms in place. This ensures that there is no supply at times of noncompliance with specific treatment and water quality criteria. The triggers for cessation of supply will depend on the treatment train used and will need to be specified in the approved HEMP.

As per Table 4, if a class A scheme CCP is exceeded and the water enters supply (that is, automatic shutoff mechanics fail) it must be reported to EPA immediately. Supply will only be resumed after EPA consultation. EPA needs to be notified immediately of confirmed microbial indicator detection (immediate resampling confirmed) in class A recycled water.

Table 5 lists the microbiological notification limit for all schemes other than class A. These limits apply at the end of the treatment process (that is, prior to discharge to storage facilities). If the notification limits are exceeded, immediate re-sampling should be undertaken. If they are exceeded on two consecutive occasions, supply should cease, an investigation undertaken, and corrective action taken. The user and the appropriate EPA Victoria regional office need to be notified immediately. Supply may resume when the problem has been rectified. The action/s taken to rectify the problem should be documented.

Table 5 Microbiological notification limits for recycled water classes other than class A

Class	Microbiological limits (*E. coli* per 100 mL)	Notification limits (*E. coli* per 100 mL)
B	< 100	Two consecutive samples ≥400 Rolling annual median ≥ 100
C	< 1,000	Two consecutive samples ≥4,000 Rolling annual median ≥ 1,000

2.3.5 Prerequisite programs

Certain operations and procedures performed regularly to ensure the recycled water scheme's compliance with health, environmental and regulatory criteria can be considered prerequisite programs. The prerequisite programs include hygienic working practices and design standards that are codified and recognised within the water industry as good practice. In this way, the prerequisite programs include elements of good practice that are analogous to the good manufacturing practice requirements of the food and pharmaceutical industries.

Some examples of prerequisite programs and associated standard operating procedures commonly used in Victoria are shown in Table 6.

Table 6 Examples of prerequisite programs that are commonly used in Victoria

Prerequisite program	Description of standard procedure/document
Design principles	• Water planning and design principles.
Trade waste agreement and sewage quality management system	• Audited agreements in place with trade waste customers to protect quality of recycled water. This also involves monitoring of sewage quality.
Emergency response plans	• Emergency response plan for recycled water quality.
Maintenance contractors' burst main, faulty meter and hydrant repair procedures	• Operating a valve (shutting down/recharging a main). • Water main repair procedure (other than mild steel mains). • Water main repair procedure (for mild steel mains). • Repair burst/leaking water mains. • Site establishment and reinstatement. • Integrated management plan (OH&S, environmental and emergency response). • Repair of a damaged / burst hydrant. • Repair a leaking hydrant / fire plug (ball and ring). • Repair / replace faulty water meters.
Connections and commissioning	• Commissioning new connections for recycled water customers. • Pre-commissioning cross connection checks of new recycled water zones. • Property connections process.
Temporary cross connections	• Potable – recycled water temporary cross connection procedure.
Recycled water mains renewal program	• Annual renewal program – planned recycled water main renewals for the current operating year. • Renewal enquiry. • Minimising unplanned interruptions. • Minimising customer interruptions. • Asset management database. • Asset management monthly reporting.

Prerequisite program	Description of standard procedure/document
New mains construction procedures	• Specification for recycled water. • Disinfecting new mains. • Design and construction of water mains. • Procedure for commissioning recycled water system.
Cross contamination and personal disease	• Public health safeguards. • Investigate waterborne illness report.
Complaints	• Managing customer complaints. • Management of temporary cross connections.
Cathodic protection of tanks and pipes	• Monitoring of impressed current cathodic protection systems.
Maintenance contract audit procedures	• Maintenance service agreement auditing strategy. • Contract compliance. • Contract surveillance. • Contract non-conformance. • Completion of audit / surveillance checklists. • Entering checklists and non-conformances into database.
Pest control	• Pest control contract around tanks and plants to prevent assets damage and contamination of recycled water.
Treatment chemical quality assurance	• Procedure to ensure that the correct treatment chemicals are used for dosing, backwashing and cleaning.
Calibration and maintenance of monitoring equipment	• Procedure to ensure that monitoring instruments give correct readings.
Agreements	• Recycled water agreement – standard.
	• Recycled water - class A end use protocol - irrigation of public open spaces.
	• Recycled water customer - customer site management plan information.
	• Dual pipe recycled water agreement.
Water quality monitoring	• Recycled water class A - microbial exceedance.
Field audits	• Procedure for recycled water field audit.
	• Procedure for recycled reservoir potable backup audit.
Water Sector, EPA, DHHS and DELWP partnership programs	• Emerging contaminants periodic review. • Periodic monitoring program for pathogens in sewage - large, regional and small-scale systems.

Establish a program for inspecting and maintaining equipment

Operators also need to understand the operation of monitoring equipment, so that causes of spurious results can be recognised and rectified. Regular inspection and maintenance of all equipment, from source to point of use, ensures continuing process capability. A calibration and maintenance program should be established and documented. The program should detail:

- operational procedures and records for maintaining equipment, including calibrating monitoring equipment
- schedules and timelines
- responsibilities
- resource requirements.

2.3.6 Materials and chemicals

2.3.6.1 Ensure only approved materials and chemicals are used

Materials and chemicals used in recycled water systems have the potential to adversely affect recycled water quality or the environment to which they are applied. Chemicals added to recycled water include:

- disinfectants
- oxidants
- coagulants
- flocculants
- antioxidants and chemicals for softening
- pH adjustment
- scale prevention.

Chemicals and products added to the soil environment include:

- inorganic and organic fertilisers
- manures
- gypsum
- lime
- other soil conditioners.

All chemicals should be evaluated for potential contamination, chemical and physical properties, maximum dosages, behaviour in water, migration and concentration build-up. In addition, the potential impact of such chemicals on materials used in treatment plants or on the environment should be considered. For example, ferric chloride, which is used as a coagulant, can severely corrode commonly used grades of stainless steel, and calcium nitrate amendments, used as a conditioner, can add excessive nitrate to the soil. Chemicals used in treatment processes must be securely stored as per *Liquid storage and handling guidelines (*publication 1698*)* to avoid spills or leakage.

2.3.6.2 Establish documented procedures for evaluating products, materials and chemicals

Chemical suppliers should be evaluated and selected on their ability to supply product in accordance with required specifications. Documented procedures for the control of chemicals, including purchasing, verification, delivery, handling, storage and maintenance should be established to assure their quality at the point of application. Responsibilities for testing and QA of chemicals (supplier, purchaser or both) should be clearly defined in purchase contracts.

Contaminants may be introduced when recycled water comes into contact with materials such as filter media, protective coatings, linings and liners, jointing and sealing products, pipes and fittings, valves, meters and other components. Products and materials used in recycled water infrastructure and plumbing systems should be authorised or approved to ensure compliance with:

- *Australian and New Zealand Standard AS/NZS 3500.1 (Plumbing and Drainage Requirements)* (Standards Australia)
- *AS/NZS 4020 (Testing of Products for Use in Contact with Drinking Water)* (Standards Australia)
- *WSAA National Codes for the urban water industry*.

2.4 Management of incidents and emergencies

2.4.1 Incidents and emergencies

A preventive risk management system should include the development of considered and controlled responses to incidents or emergencies that can compromise the safety of using recycled water. The objective is to ensure that incidents and emergencies are responded to efficiently and effectively.

Many incidents and emergency situations will be identified during the application of HACCP principles to the recycled water system (see *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911)) and appropriate corrective actions will be established during this process. However, it is essential that all realistic emergency scenarios are identified, and incident and emergency protocols planned and documented in the HEMP for the recycled water scheme.

For such incidents, there must be an adaptive capability to respond constructively and efficiently. Some of the potential hazards and events that can lead to emergency situations are listed in the *AGWR* (NRMMC et al., 2006).

It is acknowledged that some events cannot be anticipated or controlled or have such low probability of occurring that providing preventive measures would be too costly. For such incidents there must be an adaptive capability to respond constructively and efficiently.

2.4.2 Burst and leakage from storage and reticulation system

To mitigate the impact of bursts and leaks, the following measures are suggested:

- Stormwater treatment and conveyance system can accommodate additional nutrient loads from recycled water.
- Drainage from any irrigation system is minimised and recycled if possible.
- Provide an appropriate buffer between surface waters and large reticulation mains carrying recycled water with high nutrient loads (a suitable buffer distance depends on slopes of land; soil drainage characteristics; and vegetation).
- Appropriate construction standards are used to minimise the potential for leaks in the system and either preventive maintenance schedules or meters in the reticulation system are used to identify and manage leaks.
- Devise an early response plan to minor bursts and leaks.
- Devise an incident response plan to major bursts and leaks (the definition of 'major' to be established in the relevant HEMP).
- Flushing from recycled water mains does not cause direct discharge to nearby waterways (locate flushing points to ensure discharges are accommodated through stormwater treatment and conveyance systems, discharged to sewer or land, or transported off-site).
- Discharge of recycled water from disinfection or slug dosing procedures does not directly discharge to surface waters (for example, discharge to land or to sewer for treatment) or its discharge to waterways is minimised. Unplanned flushing events and emergency situations are not covered by this requirement. Protocols should be established consistent with incident response plans for major bursts.

2.4.3 Protocol development

Effective communication is vital in managing incidents and emergencies. Clearly defined protocols for both internal and external communications should be established with the involvement of relevant agencies including EPA. Examples of triggers for notifying EPA are given in Section 2.4.7 and these should be addressed in the incident notification protocol. The protocol should spell out roles and responsibilities of stakeholders and agencies in detail. A worked example of an incident notification report, based on a real incident, in this case for a cross-connection, is given in *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911). The example shows who was contacted and how the protocol was implemented in practice. An example of requirements relating to the control and notification of algae is provided in *Technical Information for the Victorian Guideline for Water Recycling* (publication 1911).

As part of developing the HEMP, the recycled water supplier should identify potential incidents and emergencies relating to the recycled water system and develop sound protocols, documenting response actions, roles and responsibilities, and communication strategies.

For all identified incidents and emergencies, clearly defined response protocols should be developed to ensure that public and environmental health risks are managed efficiently and effectively. These protocols should be developed in consultation with EPA and other relevant agencies and should be consistent with guidance in the *Emergency Management Manual Victoria* (Government of Victoria, 2018b). Key areas to be addressed in any incident or emergency response protocol include clearly specified:

- response actions, including increased monitoring
- responsibilities and authorities internal and external to the organisation
- predetermined agreements on lead agencies for decisions on potential health or environmental impacts
- plans for alternative water supplies
- communication protocols and strategies, including notification procedures (internal, regulatory body, media and public)
- mechanisms for increased health or environmental surveillance.

It is critical that employees are trained in emergency response to ensure that they can manage potential incidents and emergencies effectively. Therefore, the recycled water supplier and user, as applicable, should train employees and regularly review emergency protocols.

In addition to the above, effective communication is vital in managing incidents and emergencies, both for responding efficiently to the situation and maintaining consumer confidence in the recycled water system. Therefore, incident and emergency protocols should incorporate aspects relating to communication, including:

- the key people, agencies and other businesses that must be notified of the incident or emergency (these contact lists should be updated regularly (for example six-monthly) to ensure they are accurate)
- detailed notification forms including procedures for internal and external notification
- the responsibilities of the relevant organisations and authorities.

2.4.4 Public and media communications strategy

A public and media communication strategy could be developed for effectively delivering key messages regarding an incident or emergency. This would be developed before any emergency situation occurs, and should ensure that:

- an appropriately trained, authoritative contact is designated to handle all incident and emergency communications
- draft public and media notices are prepared in advance
- all employees are kept informed during any incident
- all consumers are notified of incidents that may have affected their supply or safety and are provided with information on the detail of the incident, when the incident has ended, the actions taken and the measures put in place to minimise future occurrences.

Post-incident surveys of the community are valuable to establish the perceptions of recycled water users relating to events and how they were managed.

2.4.5 Review and documentation

Emergency and incident response protocols should be regularly reviewed to ensure they are practicable and up to date, and to provide opportunities to improve their effectiveness before an emergency occurs.

Following any emergency or incident situation, an investigation should be undertaken, addressing questions such as the following:

- What was the cause of the problem?
- How was the problem first identified or recognised?
- What were the most critical actions required?
- What communication problems arose and how were they addressed?
- What were the immediate and longer-term consequences?
- How well did the protocol function?

Appropriate documentation and reporting of the incident or emergency should also be established within the HEMP. The organisation should learn as much as possible from the incident to improve preparedness and planning for future incidents. Review of the incident may indicate necessary amendments to existing protocols for the HEMP.

2.4.6 Incident and emergency management for industrial water

It is important to have appropriate processes and procedures in place to manage any incident or emergency should they occur (for example, wash bays for washing after a spill and reporting requirements for incidents and emergencies). While this guideline does not specify notification procedures, it is likely that in developing a suitable procedure, EPA or WorkSafe may need to be notified of certain incidents associated with some schemes. For example, EPA to be notified of any spills or discharges of industrial water to land, waterways or stormwater; WorkSafe to be notified of any significant injury or illness to a worker related to the recycling of industrial water.

The HEMP should include or refer to the relevant document(s) that describes the incident and emergency management procedures, including who is responsible for the associated tasks (for example, cleanup of spills, system checking or shut-down and incident reporting to necessary parties).

2.4.7 Notifications

In the event of an emergency incident the appropriate regional office of EPA must be notified along with any other relevant regulatory body and affected party as soon as practicable. Any accidental or unintended cross connections with the drinking water supply system must be immediately reported to DH as well in accordance with the *Safe Drinking Water Act 2003*. The timelines for reporting these incidents must be documented within the HEMP. The HEMP should identify the categories of response required based on the nature of the water recycling scheme. For example, the risk of discharge of class C recycled water in an area of high recreational use could be as high as

more complex schemes such as a class A scheme. Process failure associated with a higher risk reuse scheme requires a proportional response. Notification should be prompt and include details of corrective and future preventive action. The HEMP must document responsibilities and reporting arrangements, including timelines for reporting to EPA and other relevant regulatory bodies, for emergency situations. Inclusion of a notification reporting template within the HEMP will assist in compliance with reporting requirements.

2.5 Documentation and reporting

2.5.1 Documentation

Documentation is important to ensure that:

- the HEMP documents the measures in place to ensure a safe, sustainable and compliant recycled water scheme
- appropriate arrangements are in place for the submission of performance reports to agencies and the community
- appropriate arrangements are in place to report incidents of non-compliance to the relevant agencies and stakeholders.

The HEMP should document (or cross-reference the relevant document) each step of the risk management process to:

- demonstrate to stakeholders that the process has been conducted properly
- provide evidence of a systematic approach to risk identification and analysis
- provide a record of the risks
- provide an accountability mechanism and tool
- develop and protect the organisation's knowledge base
- satisfy regulatory requirements
- facilitate reviews and audits by providing written evidence of the system
- establish due diligence and credibility
- ensure scheme sustainability.

Documentation should include descriptions of:

- preventive measures and their purpose, target criteria and related critical limits
- critical control points, including specific operational procedures and criteria, monitoring and corrective actions
- standard operational procedures (SOPs) for relevant activities
- operational monitoring protocols, including parameters and criteria
- schedules and timelines
- corrective actions to be implemented when required
- data and records management requirements
- maintenance procedures
- responsibilities and authorities
- incident and emergency response plans
- internal and external communication and reporting requirements
- training programs
- procedures for evaluating results and reporting.

A document control system should be developed to ensure that only the most recent version of appropriately approved document is in use[5]

2.5.1.1 Monitoring records

Records of all monitoring results and analyses should be kept for at least ten years in order to analyse trends and demonstrate ongoing compliance with the objectives of this guideline. Records should include:

- monitoring data
- breaches of critical limits and corrective actions taken
- details of incidents and emergencies and corrective actions taken
- inspection and maintenance reports

[5] This could include availability of an online version of the most recent version of appropriately approved document

- annual reports, as discussed in this chapter
- assessment of community behaviours relating to recycled water use.

These records should be made available to EPA and users upon request.

2.5.1.2 Records-management system

Documentation should be visible and readily available to operators and end users, where required. Mechanisms should be established to ensure that operators and end users read, understand and adhere to the appropriate documents.

Operation of systems and processes generates large amounts of data that need to be recorded. Efficient record keeping can indicate and forewarn of potential problems and provide evidence that the system is operating effectively. Activities that generate records include:

- operational and recycled water quality monitoring
- soil, plant, groundwater and surface water monitoring at application and receiving environments
- corrective actions
- incident and emergency responses
- training
- research and development, validation and verification
- assessment of the water supply system (flow diagrams, potential hazards, and so on)
- community consultation
- performance evaluations, audits and reviews.

Documentation and records systems should be kept as simple and focused as possible. There should be sufficient detail to provide assurance of operational control, when coupled with a suitably qualified and competent operator or end user. Retention of corporate memory should also be considered in documentation of procedures.

Records of all activities should be easily accessible but should be stored in a way that protects them against damage, deterioration or loss. A system should be in place to ensure that operators and end users (where required) are properly trained to fill out records, and that records are regularly reviewed by the appropriate authority, signed and dated. Electronic or online documentation is preferable, as it provides faster and easier access, distribution and updating. However, such documentation should be backed up regularly. Records should be retained of items such as:

- management controls and monitoring
- reporting and auditing requirements
- monitoring results and analyses
- inspection and maintenance programs.

2.5.2 Reporting

The following information for all schemes should be made available to EPA upon request:

- an analysis of the monitoring data collected for managing environmental risks
- a summary of incidents and emergencies, including corrective actions
- a listing or register of supplied recycling schemes, including quality, quantity and type of use
- a summary of audit outcomes (if an audit has been undertaken during the annual reporting period)
- for class A schemes only:
    - an analysis of the monitoring data collected under the RWQMP
    - a summary of the review and improvement process outlined in Review and continuous improvement in Section 2.7 including a statement as to whether the HEMP has been complied with, a summary of priority areas for improvement and including actions to address any non-compliances with the HEMP.

Recycled water suppliers and users should notify one another of any non-compliance and the supplier should in turn notify EPA and include this information in the annual report.

As noted in Section 2.4.7, it is necessary to notify EPA of emergencies and incidents in a timely manner, as defined within the HEMP.

2.6 Evaluation and audit

Periodic auditing of the HEMP is important to ensure that suppliers and users meet their obligations under the *Environment Protection Act 1970* and this guideline. An audit program for schemes with more than 1 ML/d should comply with the principles in the *ISO 19011:2018 Guidelines for auditing management systems* (ISO, 2018). For

each scheme, the relevant supplier should develop and implement an auditing program that ensures that the HEMP has been implemented and that it is updated to address changes in risk. The audit should be part of how the supplier undertakes review and improvement activities to ensure the HEMP remains relevant.

2.6.1 Audit requirements for schemes other than class A schemes

The objectives of the audit program should be to determine:

- that the supplier and user/s are meeting their obligations under this guideline and any other relevant legislation, policies, standards and guidelines
- whether the HEMP is being implemented resulting in compliance with this guideline
- any inadequately managed risk exposures (environmental, human and stock health) and possible adverse publicity associated with the recycling scheme are identified.

The details of an audit program should be established by the supplier, in coordination with the auditor. The audit program should be based on the size, risk and complexity of the scheme and include audit frequency and the use of independent audit processes, described in the HEMP.

EPA may conduct selected audits of recycling schemes to ensure compliance with this guideline. EPA may choose to terminate approval of a recycled water scheme if non-compliances are reported until those non-compliances are addressed.

2.6.2 External audit requirements for class A schemes

It is a requirement for all class A schemes to engage a suitably qualified external auditor to undertake audit of the scheme and submit an audit report to EPA within the first 12 months of commissioning.

The details and the frequency of the ongoing external audit program should be described in the HEMP with consideration to the size, complexity, and risk of the scheme.

The frequency of external audits should be a minimum of once in every three years. More frequent audits may be required for poor performing and/or problematic sites in consultation with EPA.

External audits should ensure the performance of the system is achieving the intended outcomes in terms of water quality, and not causing illness, harm or impacts, including:

- that the provisions within the HEMP and RWQMP are implemented
- that any issues identified in system monitoring or system review (including internal audits; see Section 2.6.3) as potentially impacting on compliance with the guideline performance objectives are being appropriately addressed
- that any changes in the system management that could impact on compliance with the guideline performance objectives are identified and are being appropriately addressed
- that a preventive risk management system is in place and that it appropriately addresses risk identification, assessment and management
- that with respect to livestock use of recycled water the audit must assess the livestock risks identified in HEMP are being managed appropriately
- identify emerging issues identified within the scheme or changes to the way key controls or processes are operated that could impact on performance.

The HEMP should document a minimum audit scope, the process for conducting and determining key elements of the audits, the responsibilities for acting upon the audit's outcomes and the process for review and amendment of the audit process.

It may be appropriate to audit the RWQMP separately from the HEMP, particularly where different parties are responsible for their implementation. In these cases, the audit program should be specifically identified in each document.

EPA may carry out unannounced audits as part of their regulatory role and suppliers can similarly carry out audit unannounced on scheme users.

2.6.3 Internal audits

Internal audits should be conducted to identify issues and improvements outside the external audit schedule and following up the identified non-compliance and/or improvements during external audit thus avoiding a statutory non-compliance. Internal audits may be conducted by staff within the organisation or a third party, or through elements of other certification audits.

Internal audits will involve trained staff and should include review of the management system and associated operational procedures and monitoring programs. Audits should also cover the records generated to ensure that the system is being implemented correctly and is effective.

Where relevant, existing auditing processes, (such as internal audits, technical audits, gap audits, and ISO 9001, 22000, 55000, 14001 or HACCP management system audits), can be used to assist and support internal and external audits.

2.6.4 Document and communicate audit results

Audit results should be appropriately documented and communicated to management and personnel responsible. Results of audits should also be considered in the review by senior executives and included in annual reports. Works should be undertaken to manage, track and rectify report findings. If major issues arise in audits this should lead to immediate notification to EPA and consideration of cessation of supply of water.

2.6.5 Information on auditors

The auditor or support team should possess:

1. an understanding of water business operations, wastewater treatment systems, risk management systems (such as HACCP) and the processes involved in delivering safe recycled water to the consumer
2. demonstrated experience and expertise, to identify the risks to recycled water quality and associated controls.

EPA-appointed auditors are not required, though they can be used if appropriate. Information on the appointment process and a list of EPA-appointed auditors is available from the EPA website[6]. Refer to *Environmental auditor guidelines for conducting environmental audits* (publication 953). (EPA Victoria, 2007) for further details.

2.7 Review and continuous improvement

2.7.1 Review and improvement

The HEMP should be regularly reviewed at least annually and, where necessary, updated to ensure it remains relevant. The review should:

- assess overall performance against guidelines and regulatory requirements
- address emerging problems and trends identified through monitoring results, internal reviews, incidents and emergencies
- identify priorities for improving recycled water quality management, and research and development opportunities
- incorporate management responses to emerging issues that relate to recycled water quality and confirm whether the HEMP appropriately manages risks associated with these.

The HEMP is a ‘living’ document and will undergo continual review and improvement. EPA approval of the HEMP will be required where significant changes are made. Where relatively insignificant changes are made, an updated copy of the HEMP can be provided to the EPA upon request. If in doubt, advice should be sought from EPA.

For short-term schemes, the review and continual improvement component may not be applicable, however lessons learnt should be applied to improve any future schemes.

In particular, the HEMP monitoring systems, CCPs and ECPs should be assessed annually to consider risk-based improvements required to ensure an acceptable level of risk is maintained by the recycled water scheme.

[6] https://www.epa.vic.gov.au/for-business/find-a-topic/environmental-audit/environmental-auditors

2.7.2 Improvement

In order to ensure continuous improvement, the highest levels of the organisation(s) should review the effectiveness of the recycled water quality management system and evaluate the need for change, by:

- reviewing reports from audits, recycled water quality performance, environmental performance and previous management reviews
- considering concerns of users of recycled water, regulators and other stakeholders
- evaluating the suitability of the recycled water quality policy, objectives and preventive strategies in relation to changing internal and external conditions such as:
    - changes to legislation, expectations and requirements
    - changes in the activities of the organisation
    - advances in science and technology
    - outcomes of recycled water quality incidents and emergencies
    - reporting and communication.

The review by senior managers should be documented.

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