
GUIDELINES FOR
ENVIRONMENTAL MANAGEMENT

DUAL PIPE WATER
RECYCLING SCHEMES –
HEALTH AND ENVIRONMENTAL
RISK MANAGEMENT

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DUAL PIPE WATER RECYCLING SCHEMES –
HEALTH AND ENVIRONMENTAL RISK MANAGEMENT

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FOREWORD

Improving the way we use our water resources is vitally important for ensuring a sustainable future for Victoria. Recycled water is recognised as a valuable source of water and, used appropriately, reduces the strain on our limited water resources.

These Guidelines for environmental management: Dual pipe water recycling schemes – health and environmental risk management (GEM: Dual pipe water recycling) provide a preventive risk management framework for managing health and environmental risks associated with dual pipe water recycling. Preventive risk management systems are being increasingly used by the water industry to assure water quality through focusing on the prevention of substandard water being delivered for use. These systems underpin the Australian Drinking Water Guidelines 2004 (National Health and Medical Research Council), the Victorian Safe Drinking Water Act 2003, and the redrafting of the national water recycling guidelines that is being led by the Natural Resource Management Ministerial Council and the Environment Protection and Heritage Council. These guidelines are at the forefront of current world thinking in applying these systems to recycled water production and use.

The release of these guidelines reflects increased interest in the use of dual pipe networks to provide recycled water for garden watering and toilet flushing. The Victorian Government's water strategy, *Securing Our Water Future Together*, requires EPA Victoria and the Department of Human Services (DHS) to build from the existing Guidelines for environmental management: use of reclaimed water (EPA, 2003) and establish a broad suite of guidance, including water quality standards and appropriate management controls, for alternative water supplies that include the use of recycled water in dual pipe networks. These guidelines focus on the management of health and environmental risks associated with dual pipe schemes where water is recycled from a sewage treatment plant. An important feature of these guidelines is its endorsement by the DHS.

These guidelines complement the GEM: Use of reclaimed water. Compliance with these guidelines is a requirement for all schemes regulated by EPA. They focus on key principles and performance objectives and outcomes through appropriate management practices, encouraging innovation. The guidelines provide the minimum regulatory requirements, with individual recycling schemes able to undertake increased risk management controls.

These guidelines have been overseen by a steering committee comprising representatives from EPA, the DHS, the Plumbing Industry Commission, the Victorian water industry (representatives from Melbourne Water, Barwon Water, City West Water, North East Water, South East Water, Western Water and Yarra Valley Water), the Australian Institute of Environmental Health, the Municipal Association of Victoria, the development industry (represented by the Urban Development Institute of Australia, the Association of Land Development Engineers and Coomes Consulting Group), and the Department of Sustainability and

Environment. This document provides integrated guidance from the key government agencies with responsibility for recycled water management.

The steering committee was supported by four technical working groups providing guidance on: managing health risk; managing environmental risk; plumbing and systems management; and community management controls and consultation.

The underlying philosophy of EPA's guidelines for environmental management (GEMs) is to provide a forward-looking approach rather than simply reflecting current trends. By focusing on those elements that represent best practice and providing a systematic approach to achieving these, the GEMs encourage suppliers and users of recycled water to strive for continuing improvement in environmental performance.



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These guidelines have been prepared with input from a wide range of departmental and industry stakeholders. The contributions of the organisations represented on the steering committee are acknowledged, including:

- Department of Human Services
- Plumbing Industry Commission
- Melbourne Water
- Barwon Water
- City West Water
- North East Water
- South East Water
- Western Water
- Yarra Valley Water
- Australian Institute of Environmental Health
- Municipal Association of Victoria
- the development industry (represented by the Urban Development Institute of Australia, the Association of Land Development Engineers and Coomes Consulting Group)
- Department of Sustainability and Environment

Central to the development of the guidelines was also the valuable contribution from members of the technical working groups, including:

Managing health risk:

- Amelia Savage, DHS (Chair)
- Dr Hamish Reid, EPA
- Dr Greg Ryan, South East Water
- Dr Rob Considine, Barwon Water
- Henry Mallia, Earth Tech Engineering P/L
- Dr Melita Stevens, Melbourne Water
- John Poon, Melbourne Water
- Bruce Boxer, Mitchell Shire Council

Managing environmental risk:

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- Peter Ralph, Yarra Valley Water
- John Park, Plumbing Industry Commission
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- Suzie Sarkis, EPA

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- Susanna Finger, EPA (Chair)
- Kerry Grenfell, Yarra Valley Water
- Bruce Mitchell, City of Whittlesea
- Ian Reimers, North East Water
- Chris Coulthurst, South East Water.

The technical background papers developed by each of the working groups are available from EPA (refer to Appendix E).

GLOSSARY OF TERMS AND ABBREVIATIONS

Term	Definition
Beneficial use	A use of the environment or any element or segment of the environment which (a) is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits or of the emission of noise or (b) is declared in State environment protection policy to be a beneficial use.
Class A recycled water	A health-based microbiological standard for recycled water quality that is defined in this guideline. Class A criteria do not include environmental quality parameters such as salinity or nutrient limits.
Cross-connection	A physical connection between the recycled water and drinking water supply systems.
DHS	Department of Human Services
Drinking water	Water intended primarily for human consumption. 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 that is used as an indicator of faecal contamination.
EC	Electrical conductivity. The capacity of the medium (water or soil) to conduct an electric current (measured in units of $\mu\text{S}/\text{cm}$ or dS/m).
EPA	Environment Protection Authority.
GEM	Guidelines for Environmental Management. Publications released by EPA to provide a best-practice framework for managing environmental obligations.
HACCP	Hazard Analysis and Critical Control Point. 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.
HEMP	Health and Environmental Management Plan. A plan covering the use of recycled water that details the management of health and environmental risks. The HEMP for a dual pipe scheme is equivalent terminology to the Environment Improvement Plan discussed in the GEM: Use of reclaimed water (EPA publication 464.2).
LCA	Land capability assessment.
Log reduction	Removal/inactivation efficiency for a target organism. Calculated as $\log_{10}(\text{feed water concentration}) - \log_{10}(\text{product water concentration})$.
Pathogen	Organism capable of causing disease. In untreated wastewater, the key pathogen groups are bacteria, viruses, protozoa and helminths.
PIC	Plumbing Industry Commission.
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.
QRMA	Quantitative microbial risk assessment – 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 and treated to a standard that is appropriate for its intended use.
Recycled water supplier	The body responsible for the Recycled Water Quality Management Plan, producing Class A recycled water for a dual pipe scheme.
Recycled water system	Everything from the collection or catchment of untreated water through to the end user or receiving environment of a dual pipe scheme.
Risk	The likelihood of identified hazards causing harm in exposed populations (over a specified time frame) and including the severity of consequences.
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.
RWQMP	Recycled Water Quality Management Plan. A section of the HEMP that covers the production of Class A recycled water at a treatment plant.
Salinity	The content of salt in soil or water. Generally expressed in EC, although Total Dissolved Solids (TDS) is also used to indicate salinity.

Scheme manager	The body identified as responsible for the management of recycled water reticulation within the dual pipe scheme and for engagement with residential users. The responsibilities are defined within the scheme HEMP.
Scheme proponent	An organisation or person that facilitates the development of a dual pipe scheme, but may not have responsibility for managing the scheme once recycled water is supplied. This may be a developer.
SEPP	State environment protection policy. SEPPs are adopted by Government, and gazetted pursuant to the Environment Protection Act 1970. The SEPPs describe environmental objectives for defined environmental segments (for example, water and land).
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, and if this occurs when there is a low ionic concentration in the soil water, dispersion of the clay particles occurs.
TDS	Total dissolved solids. A measure of water salinity, which has units of mg/L.
User	A person, community, group or organisation that uses recycled water.
WSUD	Water sensitive urban design. 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; and add value while minimising development costs. For stormwater aspects of WSUD refer to www.wsud.melbournewater.com.au .

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DUAL PIPE WATER RECYCLING

1. INTRODUCTION

Recycled water derived from treated sewage is widely recognised as a valuable and sustainable water resource.

Recycled water can be substituted for water that is currently harvested from stressed and over-allocated rivers, groundwater sources or drinking water supplies. It can provide increased water security for many users, both in rural and urban areas. The use of recycled water also reduces the impact of discharges from sewage treatment plants to surface waters.

The Guidelines for environmental management (GEM): Use of reclaimed water (EPA Publication 464.2, 2003) present a generic framework for managing water recycling schemes. Whilst these guidelines allow the supply of Class A recycled water for urban (non-drinking) use with uncontrolled access, they do not provide detailed guidance on managing the specific risks associated with dual pipe schemes for uses including garden watering and toilet flushing.

Dual pipe schemes require a higher level of risk management compared to traditional agricultural recycling schemes. This is primarily due to the reduced ability of the scheme manager to tightly control residential behaviour in using the recycled water.

Therefore these guidelines (GEM: Dual pipe water recycling) have been developed to provide a detailed framework for managing human health and environmental risks associated with the use of Class A recycled water in urban areas, and should be used as the primary reference document in the development of dual pipe schemes.

1.1 Objective

These guidelines aim to facilitate sustainable and safe recycled water use through dual pipe schemes. To qualify as 'sustainable and safe', recycled water use must be undertaken in a manner that is protective in both the short and long term of soil ecosystems, soil productivity, surface and groundwater resources, and human health. To meet these objectives, these guidelines have been developed using a preventive risk management approach.

These guidelines are targeted to recycled water suppliers, recycled water scheme managers, local councils and scheme proponents, and provide the basis for exemption of recycling schemes from EPA works approval and licensing requirements (refer to section 2.2).

1.2 Scope of guidelines

These guidelines focus on the management of health and environmental risks associated with dual pipe schemes where water is recycled from sewage treatment systems that have a design capacity or actual flow rate of greater than 5,000 litres per day (as defined in the Environment Protection (Scheduled Premises and Exemptions) Regulations 1996).

These guidelines are not intended for small on-site wastewater systems (that is, treatment plants having a design or flow rate of less than 5,000 litres per day).

Although the focus of these guidelines is on recycling from treated raw sewage, the principles could be applied to other water sources such as greywater (all non-toilet household wastewater) and stormwater.

1.3 Preventive risk management systems

Preventive risk management systems are being increasingly used by the water industry to assure water quality through focusing on the prevention of substandard water being delivered for use. These systems underpin the Australian Drinking Water Guidelines 2004 (NHMRC), the Victorian Safe Drinking Water Act 2003, and the redrafting of the national water recycling guidelines that is being led by the Natural Resource Management Ministerial Council and the Environment Protection and Heritage Council. The National Health and Medical Research Council and Australian Health Ministers Council are also involved in this review.

Consistent with the Australian Drinking Water Guidelines 2004, these guidelines promote the use of a framework that encompasses the following areas:

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, 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 technical working groups involved in producing these guidelines have assessed the generic risks associated with dual pipe schemes and documented the measures relevant to areas 2, 3 and 4 above, as far as possible. In most cases the Hazard Analysis and Critical Control Point (HACCP) framework has been used to undertake this assessment.

Some aspects of dual pipe schemes (including treatment processes and some receiving environment characteristics) will need to be assessed on a scheme-by-scheme basis to identify and manage risks, as there is no single set of management controls that are appropriate for all schemes.

1.4 Structure of guidelines

The framework for applying risk management to dual pipe schemes is organised into the following chapters:

Commitment to responsible use and management of recycled water

- Regulatory framework (Chapter 2)
- Roles and responsibilities (Chapter 3)

System analysis and management

- Recycled water system assessment (Chapter 4)
- Managing human health risks (Chapter 5)
- Managing the supply system (Chapter 6)
- Managing environmental risks (Chapter 7)
- Communicating management controls (Chapter 8)
- Incidents and emergencies (Chapter 9)

Supporting requirements

- Employee awareness and training (Chapter 10)
- Research and development (Chapter 11)
- Documentation and reporting (Chapter 12)

Review

- Auditing, review and improvement programs (Chapter 13)

2. REGULATORY FRAMEWORK

This chapter summarises the relevant legislation and statutory processes for obtaining the necessary approvals for a dual pipe scheme, including the development of a Health and Environment Management Plan (HEMP).

2.1 Legislation

The Acts, policies and regulations administered by EPA Victoria and other government agencies that are relevant to the use of recycled water in urban areas are listed in Appendix A.

Acts

Acts of particular significance to recycled water use in urban areas are:

- Environment Protection Act 1970
- Health Act 1958
- Building Act 1993.

Under the Environment Protection Act 1970 discharges to the environment must be managed so that they do not adversely affect the receiving environment (for example, land, surface water or groundwater). This Act includes works approval and licensing requirements administered by EPA Victoria, to ensure the appropriate control of such discharges.

The Health Act 1958 makes provision for the prevention and abatement of conditions and activities which are or may be offensive or dangerous to public health.

The regulatory requirements for on-site plumbing work in the State of Victoria are stated under Part 12A of the Building Act 1993. This Act establishes the Plumbing Industry Commission's function to

determine relevant plumbing regulations. The Plumbing Regulations 1998 set the requirements and competencies for licensing and registering industry operatives and specify the minimum technical standards for all on-site plumbing work.

Refer to Appendix A for other important legislation.

Regulations

The Environment Protection (Scheduled Premises and Exemptions) Regulations 1996 outline the premises and activities that are scheduled and subject to works approval and licensing provisions of the Environment Protection Act 1970.

The regulations also provide for exemptions from these works approval and licensing provisions for certain, otherwise scheduled, activities and premises (see section 2.2).

Policies

Government declares State environment protection policies (SEPPs) and waste management policies (WMPs) under the Environment Protection Act 1970. The SEPPs provide ambient environmental quality objectives and the attainment programs for achieving them. Compliance with the relevant policies must be attained for all activities that involve recycled water treatment and use.

The SEPPs of particular relevance to the use of recycled water include:

- SEPP (Waters of Victoria) 2003 (and its schedules)
- SEPP (Groundwaters of Victoria) 1997.

Other relevant state government policies include:

- SEPP (Management and Prevention of Contamination of Land) 2002.

Guidance documents

In addition to the aforementioned legislation, there is a variety of guidance material of which recycled water scheme proponents should be aware (such as the Guidelines for wastewater irrigation, (EPA Publication 168, 1991). Some of this documentation is referenced in the relevant sections of this guideline, with a summary list provided in Appendix A.

2.2 Exemption from works approval and licensing provisions

Although waste discharges to the environment are typically subject to works approvals and licensing by EPA, an exemption from these statutory processes is provided for:

‘an effluent reuse scheme or activity which meets discharge, deposit and operating specifications acceptable to the Authority’ – Environment Protection (Scheduled Premises and Exemptions) Regulations 1996.

The exemption acknowledges that, in contrast to a waste discharge, recycled water can be sustained as a resource. These guidelines define the acceptable discharge, deposit and operating specifications referred to in the Regulations above by providing ‘performance objectives’ for dual pipe schemes. Therefore, compliance with these guidelines forms a critical component of exemptions from EPA works approval and licensing requirements.

It should be noted that the exemption only extends to the use of recycled water in the scheme. Construction of a wastewater treatment plant may still be subject to works approval and licensing requirements.

In addition to providing performance objectives for dual pipe schemes, these guidelines include specific measures to meet the performance objectives.

However, it is important to note that these measures are flexible. A recycling scheme proponent may propose alternative measures to those suggested, provided they can demonstrate to the satisfaction of EPA that the performance objectives will be reliably achieved.

Where a proposed scheme does not provide measures that meet the performance objectives identified in these guidelines, works approval and licensing will apply.

2.3 The approval process

All Class A water recycling schemes in Victoria require approval from EPA and endorsement from DHS. This approval/endorsement is based upon the demonstration that the performance objectives identified within these guidelines will be met.

The measures that will be undertaken to meet the performance objectives of these guidelines must be documented in a HEMP that is submitted to EPA for assessment against these guidelines. Further detail on the components of a HEMP are provided in section 2.4.

EPA approval of the HEMP is the mechanism for obtaining an exemption of the dual pipe scheme from works approval and licensing. EPA will refer aspects of the HEMP that relate to public health to DHS for endorsement.

DHS’s review and endorsement is particularly focused on the Recycled Water Quality Management Plan (RWQMP) (a part of the HEMP that covers the production and delivery of Class A recycled water). However, other aspects of the HEMP relating to the protection of public health will also be considered.

This is discussed in more detail in Chapters 5, 6 and 8. An indicative schematic of the EPA and DHS approval/endorsement process for a Class A water recycling scheme is provided in Figure 2.1.

The supplier and manager of a dual pipe scheme that does not have a valid HEMP and the necessary approval from EPA (incorporating endorsement from DHS), or does not comply with the requirements specified in the HEMP, could be subject to enforcement action pursuant to the Environment Protection Act 1970.

Enforcement action could include such measures as the issuing of a Pollution Abatement Notice (which directs a scheme manager to undertake specified actions), prosecution or imposing fines via Penalty Infringement Notices.

All proposed schemes should be discussed at the planning stage with the relevant EPA regional office and DHS (see appendix B). These initial discussions are important for identifying potential issues that need to be resolved in the approvals process.

As noted earlier, treatment of wastewater is a scheduled activity pursuant to the Environment Protection (Scheduled Premises and Exemption) Regulation 1996 and may require a works approval from EPA. EPA regional offices should be contacted for further advice.

Both the works approval for a treatment plant and the HEMP are required to cover aspects of the treatment process. The information in Table 2.1 provides an indication of the content and scope of these two documents.

2.4 The Health and Environment Management Plan (HEMP)

The development of a HEMP is essential for sustainable recycling within a dual pipe scheme and necessary for exemption from EPA works approval and licensing provisions. The primary objectives of the HEMP are to:

- ensure that 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 that the performance objectives of these guidelines can be complied with, by detailing the operational controls and preventive measures that will be implemented to manage risk
- provide a framework to assess the ongoing sustainability of the scheme.

To meet these objectives, the HEMP must address the elements shown in Figure 2.2.

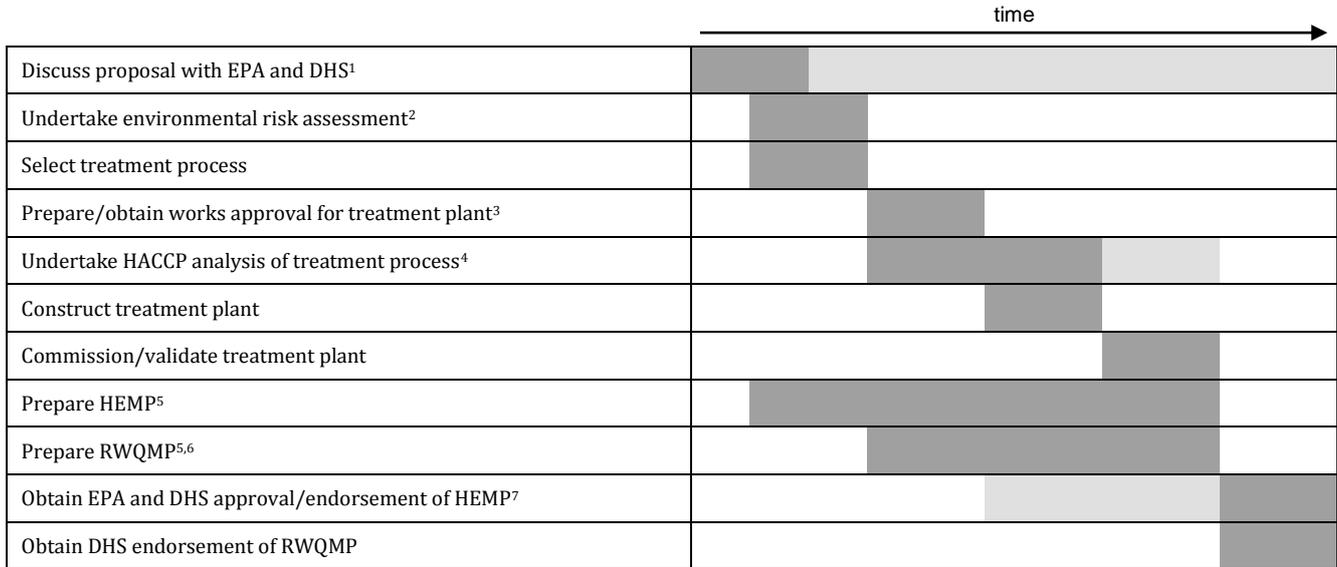
Depending on the set-up of the dual pipe scheme, different organisations/parties may be responsible for managing components of the HEMP. It is important that the roles and responsibilities are clearly documented within the HEMP, including clear lines of accountability and reporting and, specifically, actions to address any non-compliance with these guidelines.

The HEMP must be authorised and signed by a person authorised as a representative of the organisations with documented responsibilities within the HEMP. Normally this would be a senior executive of the relevant organisation(s).

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Further detail on the roles and responsibilities for a chapter. dual pipe scheme is provided in the following

Figure 2.1: Indicative EPA and DHS approval/endorsement process for urban dual pipe schemes



Notes to Figure 2.1:

1. Discussion with EPA and DHS is critical during the initial planning phase, but should also be ongoing (ongoing engagement is indicated by light grey shading).
2. The environmental risk assessment should include a land capability assessment (LCA) to assess the environmental sustainability of using recycled water. The environmental risk assessment forms a critical component in the selection of an appropriate treatment process (e.g., for the reduction of salinity), the design of the development (layout of reticulation system, stormwater management) and the informing of residents on the appropriate management of recycled water. Refer to Chapter 7 for details on managing environmental risks.
3. Refer to Table 2.1 for indicative content of works approval. The statutory time period for EPA to make a determination on whether to issue a works approval is four months from the acceptance of a complete works approval application.
4. Refer to Appendix C for details of HACCP process. Aspects of the HACCP plan may be amended during the commissioning and validation phase as more information on the practical operation of the treatment process is obtained.
5. Drafts of the HEMP and RWQMP can be reviewed/discussed with EPA and DHS, as required.
6. The RWQMP is the section of the HEMP that covers the operation, management and monitoring of the treatment plant, and is specifically endorsed by DHS.
7. Approval of the HEMP may be obtained prior to finalisation and DHS endorsement of the RWQMP. If this occurs, EPA approval will be conditional on the supplier obtaining DHS endorsement of the RWQMP, and the supply of water to the scheme will not be permitted until this endorsement has been obtained. There is no statutory time period for EPA/DHS approval/endorsement of the HEMP/RWQMP; however, early engagement – as indicated above – will ensure necessary time frames are established early on in the process.

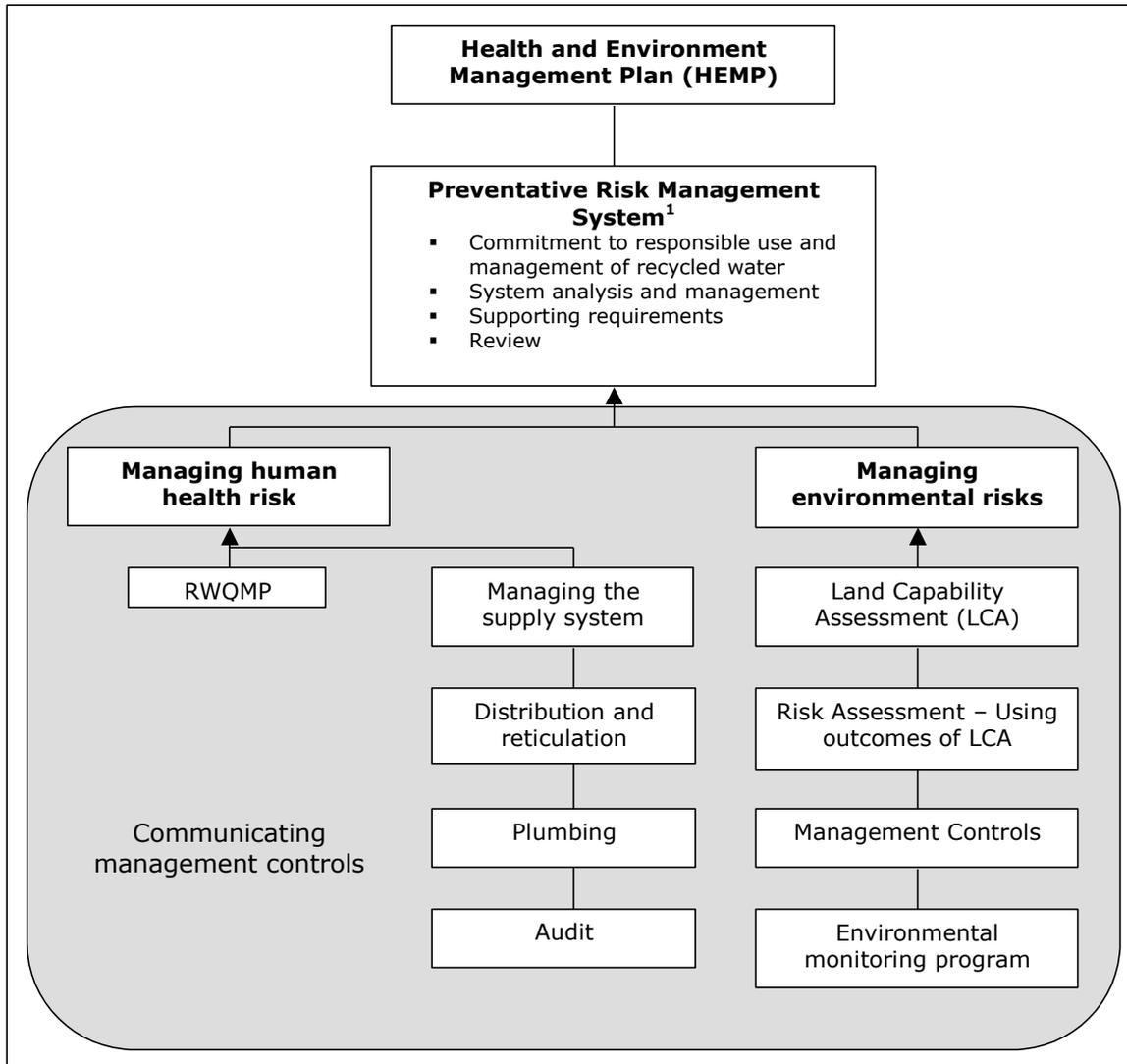
DUAL PIPE WATER RECYCLING

Table 2.1: Indicative content of works approval versus HEMP

Works approval	HEMP
<p>Location and site plans for the treatment plant.</p> <p>Design basis of the proposed treatment plant, indicating:</p> <ul style="list-style-type: none"> ▪ treatment process, including details of waste generation, minimisation, collection and storage ▪ evidence that target water quality objectives can be achieved by the proposed technology ▪ operational and maintenance procedures and plant failure contingency plans (can be covered in detail in HEMP). <p>Hazard and Operability (HAZOP) evaluation for the proposed treatment plant.</p> <p>Risk assessment of the impact of the treatment plant on the environment (includes storage lagoons and any environmental discharges outside the proposed recycling scheme).</p> <p>Compliance with relevant SEPP.</p> <p>Summary details of proposed recycling scheme.</p> <p>More information can be obtained from the EPA website.</p>	<p>Roles and responsibilities of individuals, groups and organisations within the scheme.</p> <p>Recycled water system description and hazard identification.</p> <p>Management controls for:</p> <ul style="list-style-type: none"> ▪ human health risks ▪ environmental risks ▪ plumbing and distribution system. <p>Community involvement and awareness (communication of management controls).</p> <p>Incident and emergency management.</p> <p>Employee awareness and training.</p> <p>Research and development, reporting, auditing and review.</p> <p>The information required in the HEMP is covered in the following chapters of these guidelines.</p>

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Figure 2.2: Components of a Health and Environment Management Plan



Note to figure 2.2:

1. The development of a HEMP should be underpinned by a preventive risk management system such as HACCP. The entire HACCP plan does not need to be included in the HEMP. However, it is critical that the operational controls and preventive measures identified in the HACCP process are fully documented in the HEMP. The HACCP plan may be required for approval and endorsement of the HEMP.

3. ROLES AND RESPONSIBILITIES

3.1 Suppliers, scheme managers and users

Suppliers

The supplier of recycled water must ensure that a RWQMP that has been endorsed by DHS is followed for the production of Class A recycled water.

The supplier must ensure that any dual pipe schemes using recycled water from its premises has an EPA-approved and DHS-endorsed HEMP or has an EPA works approval and licence for the recycling scheme.

Suppliers also have a responsibility to keep a register of all schemes 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 to scheme managers.

Scheme manager

The scheme manager is the body identified in the HEMP as being responsible for the management of recycled water reticulation within the dual pipe scheme and for engagement with residential users.

The scheme manager is also responsible for ensuring that the scheme is managed in accordance with these guidelines, 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 residential users of recycled water are using the water appropriately and are informed of the potential risks associated with misuse.

Scheme managers have a responsibility to keep a register for dual pipe schemes. This register should include the location of dual pipe schemes, the quality and quantity of supply, and end uses of the recycled water. It does not need to include the addresses of

individual residential properties. Each year, the scheme manager should provide EPA with summary details of the register (discussed further in Chapter 12).

Users

Users of recycled water are responsible for using recycled water in accordance with the HEMP. With respect to residential users, scheme managers are responsible for communicating the appropriate use of recycled water.

In some cases, the size or nature of the user may justify the development of a site-specific management plan for the recycling activities (e.g., body corporate management of a residential development, fire authority).

Community liaison

The community consists of both users of, and the general public who may be exposed to, recycled water in a dual pipe scheme.

Scheme managers should establish pathways and procedures for continual and open liaison with the community. Community awareness and involvement is discussed in Chapter 8 and is critical for ensuring that any management controls that are 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.

Legal risks

Recycled water suppliers and scheme managers should be familiar with the Acts, regulations, policies, codes of practice, Australian Standards, guidelines and other documents relevant to the use of recycled water (see Appendix A and the reference list at the end of these guidelines).

DUAL PIPE WATER RECYCLING

Suppliers and scheme managers should demonstrate 'due diligence' and ensure that the legal risks associated with dual pipe schemes are appropriately addressed.

Agreements

The use of recycled water in compliance with these guidelines and the HEMP forms a critical component of the exemption from the EPA works approval and licensing requirements. Therefore non-compliance can potentially expose parties to legal action and create environmental and health risks.

To assist in the management of these risks, agreements should be developed between the supplier, the scheme manager and the users of recycled water. The agreements should include, amongst other things, mechanisms to address a failure of a party to meet their responsibilities, such as the supplier or scheme manager 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.

The HEMP should detail these mechanisms and identify any specific responsibilities established in the agreements.

3.2 EPA Victoria

EPA is responsible for developing environmental guidelines that encourage best practice and result in the development of safe and sustainable water recycling schemes. It is the role of EPA to ensure that these guidelines are effectively implemented. This is

achieved, for example by undertaking audits of selected recycling schemes (on a random or priority site basis).

EPA is also responsible for reviewing the effectiveness of these guidelines. 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 will supplement these guidelines with technical support documents where additional guidance on interpretation of requirements is needed.

3.3 DHS

DHS is responsible for ensuring that Class A water quality criteria are protective of public health. Given the increased potential for the public to come into direct contact with recycled water in dual pipe schemes, DHS is also responsible for endorsing the HEMP and RWQMP for the scheme to verify that systems are in place to control the reliable production and use of Class A water.

3.4 Plumbing Industry Commission

The Plumbing Industry Commission (PIC) will assume an ongoing, active role in the enforcement of standards and regulatory requirements for all on-site regulated plumbing work. The PIC will monitor the industry performance and take corrective action if required. The measure of the industry performance will be validated through the inspection and monitoring powers of the Building Act 1993.

DUAL PIPE WATER RECYCLING

Roles and responsibilities summary

Performance objective

To ensure that suppliers, scheme managers and users of recycled water understand and meet their obligations as outlined in these guidelines.

Suggested measures to meet the performance objective

Supplier

- Develop an agreement covering the respective interests and obligations of suppliers and scheme managers.
- Identify and assess the risks posed by the production and supply of recycled water, including the development of an RWQMP.
- Ensure that any dual pipe scheme has a HEMP that has been approved by EPA and endorsed by DHS, or has works approval and licence. Maintain a register of recycled water scheme managers it supplies and submit this information annually to EPA.
- Maintain a register of recycled water users it supplies and submit this information annually to EPA.

Scheme manager

- Enter into a suitable agreement with the supplier and users.
- Identify and assess the risks posed by the use of recycled water.
- Ensure the recycling scheme has a HEMP that has been approved by EPA and endorsed by DHS, or has works approval and licence.
- Ensure that recycled water is used in accordance with the HEMP. Engage in community education to ensure residential users of recycled water are aware of the acceptable and appropriate uses of recycled water and any management controls they are expected to maintain.
- Maintain a register of recycled water users it supplies and submit a summary of this information annually to EPA.

Users

- Ensure recycled water is used in the manner directed by the scheme manager or detailed in a site-specific management plan.

4. RECYCLED WATER SYSTEM ASSESSMENT

The HEMP for a dual pipe scheme should include an assessment of the system to identify appropriate management controls for the risks associated with hazards and hazardous events. This assessment is best guided using a preventive risk management framework such as Hazard Analysis and Critical Control Point (HACCP). A discussion of the HACCP framework is provided in Appendix C.

This chapter provides the starting point for the analysis of the recycled water system and introduces some key aspects of HACCP: the hazard identification and risk assessment process.

4.1 System analysis

An essential prerequisite for hazard identification and risk assessment is to document a detailed description of the recycled water system. The recycled water system is defined as everything from the collection or catchment of untreated water through to the end-user or receiving environment.

This system analysis should include:

- the catchment for the sewage treatment plant, including an overview of the domestic and industrial or commercial trade waste inputs
- the sewage treatment plant, including the operation and design of the treatment process; the efficiency of the processes for removal of pathogens, nutrients and parameters such as organic contaminants (if applicable); monitoring equipment; process inputs such as coagulants; and processes for dealing with failure and emergencies

- the quality of the source water and the recycled water for physiochemical and microbial parameters
- storages, including the size, configuration and location of the storages; potential seasonal impacts on the storages; and intake or offtake locations
- the supply system (distribution, reticulation and plumbing) including the pipeline specifications; plumbing installation controls (pipe coding, installation audits); control valves; and maintenance regimes
- the end uses, including the intended uses for recycled water and demand profile; the lot sizes; expected irrigation methods; stormwater treatment processes; and soil, surface water and groundwater characteristics.

A process flow diagram should also be developed to schematically illustrate the system.

In situations where multiple organisations are involved in different parts of the system, administrative arrangements should be established to ensure an integrated overview of the system is established.

4.2 Hazard identification

The recycled water system analysis provides the basis for hazard identification, followed by risk assessment and control.

In this context:

- A hazard is a biological, chemical, physical or radiological agent that has the potential to cause harm. Examples of potential hazards are pathogens, salinity and chemical contaminants.

DUAL PIPE WATER RECYCLING

- A hazardous event is an incident or situation that can lead to the presence of a hazard (what can happen and how). Examples of hazardous events are spills to the sewer system, treatment plant failures or cross-connections between the recycled water and drinking water supplies.
- A risk is the likelihood of identified hazards causing harm in exposed populations in a specified time frame, including the severity of the consequences.

The distinction between hazard and risk is important to ensure that actions and resources are

directed based on the level of risk rather than just the existence of a hazard. To assess the level of risk, the framework provided by the Australian Drinking Water Guidelines (NHMRC 2004) or an alternative risk assessment framework can be used.

The risk assessments and suggested control measures for managing health, environmental and supply system risks are described generically in Chapters 5, 6, 7 and 8. However, it is important that individual system analysis is undertaken and all aspects described in Section 4.1 are consistently addressed within a risk management framework.

Recycled water system assessment summary

Performance objective

To assess the recycled water system, identifying potential sources of risk that will require control.

Suggested measures to meet the performance objective

- Develop a detailed description of the recycled water system, including inputs and water sources, treatment processes, the recycled water quality produced, storage, distribution and reticulation systems, and the intended uses of recycled water.
- Identify hazards and hazardous events at each point in the system.
- Undertake a risk assessment and identify control measures for significant risks.

5. MANAGING HUMAN HEALTH RISKS

This chapter identifies and assesses the potential health risks associated with recycled water and describes the health-based targets or water quality objectives for recycled water that is to be used in dual pipe schemes. It also describes the risk management controls, covering the treatment and storage of recycled water, that should be in place to ensure the targets are being met and the recycling scheme is safe for human health. Health risk management controls relating to the supply (distribution, reticulation and plumbing) system and end use of the recycled water are discussed separately in Chapters 6 and 8.

Where possible, specific health risk management controls are provided in this chapter. However, it should be noted that, in contrast to previous Victorian recycled water guidelines, prescriptive operational criteria for treatment plants are not included (for example, median and maximum values for recycled water turbidity). These prescriptive criteria are not included as it is not possible to set generic limits that are relevant to all water treatment processes. Instead, a framework is provided to guide the assessment of individual treatment plants and establish appropriate operating criteria that will indicate the production of safe recycled water on a scheme-by-scheme basis.

5.1 Hazard identification

The hazards to human health that are posed by recycled water are expected to be biological (pathogens) or chemical in nature.

Pathogens

Pathogenic microorganisms that are excreted by humans in domestic waste and enter the sewerage

system pose biological hazards. These pathogens fall into four major microbial groups:

- bacteria (such as *Salmonella*, *Campylobacter* and *Shigella*)
- viruses (such as rotavirus, hepatitis A virus and enterovirus)
- Protozoa (including *Cryptosporidium* and *Giardia*)
- helminths (such as the tapeworm *Taenia* and roundworm *Ascaris*).

Chemicals

Industrial and domestic chemicals that enter the sewerage system may pose chemical hazards. Chemicals of potential concern to human health include heavy metals and organic chemicals such as endocrine-disrupting chemicals (chemicals that mimic the effects of hormones such as oestrogen), pharmaceuticals, personal care products and plasticisers.

5.2 Risk assessment

Pathogens

The risks posed by pathogens via exposure through the anticipated uses of recycled water in dual pipe schemes have been analysed, and a Quantitative Microbial Risk Assessment (QMRA) was undertaken to determine the microbial criteria that will ensure adequate safety. These criteria are provided in Table 5.1.

Table 5.1: Microbial criteria for Class A recycled water in dual pipe schemes

Group	Criterion
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Bacteria ¹	< 10 E. coli/100 mL
Viruses ²	7-log reduction ³ from raw sewage to recycled water
Protozoa ²	6-log reduction ⁴ from raw sewage to recycled water

Notes to Table 5.1

1. Median – to be demonstrated during treatment plant validation.
2. As a default, the most resistant (or worst-case) virus or protozoan should be used at each treatment step for calculating log reductions. However, suppliers have the option of undertaking the more complex approach of assessing treatment processes based on the removals provided across the system for key pathogenic organisms (rotavirus, adenovirus, Hepatitis A virus, Cryptosporidium oocysts, Giardia cysts).
3. Median removal, with a lower (critical) limit of 6-log reduction.
4. Median, with a lower (critical) limit of 5-log reduction.

The microbial criteria are expressed as water quality targets for bacteria where target concentrations are measurable, and as treatment performance targets for viruses and protozoans where direct quantification of the target concentration is impractical due to limitations in analytical techniques. Details of the QMRA are contained in the document *Health Risk Management in Urban Recycling Schemes: Technical Background Paper*.

The microbial criteria apply at the end of the treatment process, that is, prior to recycled water entering the distribution system or being introduced to storages, unless it can be demonstrated that further pathogen removal will be reliably achieved and controlled downstream of the treatment process.

While helminths (parasitic worms) are also a pathogen of potential concern for recycled water systems, water quality objectives for these have not been derived. Helminth infections are not endemic in most parts of Australia, and it is considered that treatment processes providing a significant proportion of protozoan removal by sedimentation and/or filtration would effectively remove helminth eggs. However, treatment processes not incorporating these removal mechanisms should be specifically assessed for helminth removal.

Acceptable uses of Class A recycled water of the quality specified in Table 5.1 include:

- a. Uses included in the risk assessment:
 - irrigation of public open spaces, such as parks and sports fields, where public access is unrestricted and any irrigation method is used
 - 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 (a

risk assessment for firefighting is documented in the Water Services Association of Australia's Occasional Paper No. 11: Health Risk Assessment of Fire Fighting from Recycled Water Mains (2004)).

- d. Other uses, considered on a case-by-case basis, where there is sufficient information provided to support their safety (contact DHS for advice regarding this).

It should be noted that uses listed in this chapter are considered acceptable from a human health perspective. Other issues and controls may be relevant, such as environmental and plumbing controls. General uses and considerations are summarised in Table 5.2.

Class A recycled water of the quality specified in Table 5.1 is not considered 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 volumes of recycled water that are significantly greater than the quantities considered in the risk assessment. Management controls should therefore be in place to ensure that the recycled water is only used for its intended purposes. These controls are discussed in Chapters 6 and 8.

It is convenient to note at this point that recycled water is considered acceptable for pets to drink. However, it should also be noted that under the Livestock Disease Control Act 1994, pigs should not drink recycled water sourced from human waste. This restriction reflects a historical risk management decision that, regardless of water quality, pigs should not come into contact with recycled water.

Chemicals

The presence of chemicals in recycled water at levels that could potentially pose a health risk is not anticipated for most schemes, particularly those recycling water sourced from predominantly domestic sewage.

Chemicals entering the sewerage system are: managed through trade waste control; substantially diluted with other waste; and generally removed or degraded by treatment processes. Therefore the concentrations of chemicals of health concern are generally orders of magnitude below the levels either permitted in our drinking water supply or routinely consumed through dietary exposure. For this reason, specific water quality objectives for chemicals have not been established.

However, for schemes where trade waste inputs are a significant proportion of influent, site-specific assessment is needed.

DUAL PIPE WATER RECYCLING

Table 5.2: Considerations for acceptable¹ uses of Class A recycled water

Potential use	Environmental ²	Plumbing/ communication ³	Other
Residential			
Garden watering, including vegetables	Risk assessment	Controls required	–
Car washing	Avoid run-off to stormwater system	Controls required	–
General outdoor use (e.g., 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
Fire protection systems/hydrants	–	Controls required	–

Notes to Table 5.2

1. Uses are considered acceptable from a human health perspective.
2. Environmental considerations and controls are discussed in Chapter 7.
3. Plumbing and communication controls are discussed in Chapters 6 and 8.
4. Taps at the laundry trough should not be supplied with recycled water.
5. Under the Building Act 1993 a specific risk management plan is required to control the risk of Legionella from cooling tower systems. Contact DHS for further information.

DUAL PIPE WATER RECYCLING

5.3 Operational control and preventive measures

The quality of recycled water should be secured by the application of a Recycled Water Quality Management Plan (RWQMP).

The RWQMP is a component of the HEMP for the dual pipe scheme and requires specific endorsement from DHS. As discussed previously, one RWQMP may serve many HEMPs. These HEMPs do not need to reproduce the detail of the RWQMP, but may simply refer to it and ensure that any aspects of it that are critical to the safe operation of the scheme are identified.

Unless chemical hazards are expected to pose a potential health risk within a water recycling scheme (section 5.2), the focus of the RWQMP is on ensuring that the treatment plant will produce water that meets the required microbial criteria, 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 system assessment described in Chapter 4 can be used as a basis for establishing the RWQMP.

The elements of the RWQMP are illustrated in Figure 5.1 and consist of:

- the treatment process's capability to meet the microbial criteria
- a monitoring and management program for achieving and maintaining the microbial criteria, developed within a framework such as Hazard Analysis and Critical Control Point (HACCP), discussed in Appendix C. This

program should identify significant risks to the water quality 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.

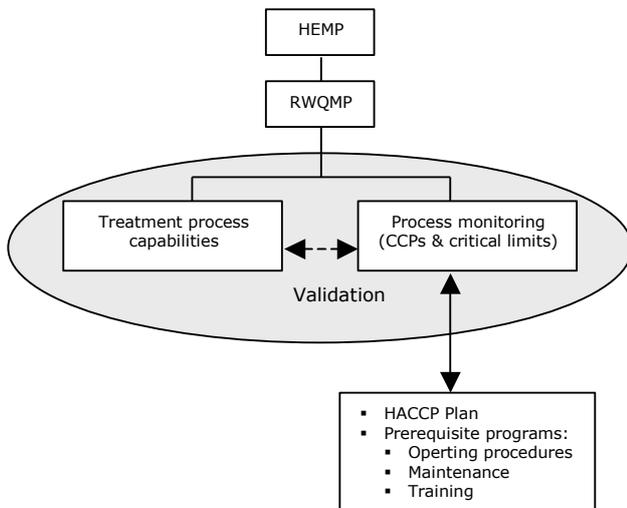
While the HACCP plan and prerequisite programs are essential for developing and implementing the RWQMP, it is not essential that they are included in the RWQMP, and may be either linked documents or appendices to the RWQMP. However, DHS may need to review the documents in order to endorse the RWQMP.

The RWQMP is underpinned by validation. Validation is discussed in more detail in Appendix C, and involves the collection and analysis of data relating to the recycled water system to demonstrate that a) the treatment process is capable of achieving the required microbial criteria and b) 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 dual pipe scheme.]

As discussed previously, health risk management also applies to the distribution, reticulation and end-use aspects of a dual pipe scheme; however, these areas need not be included in the RWQMP. They are discussed in Chapters 6 and 8 and should be covered separately within the HEMP.

Management controls for specific aspects of the recycled water system are discussed in the remainder of this section.

Figure 5.1: Elements of the RWQMP



System inputs

The scope to manage inputs to the sewerage system that are of potential health risk is limited, as the predominant sources of health risk are pathogens in human waste.

The regular input of chemicals can be managed; for example, through trade waste agreements. More information on the management of trade waste can be obtained from the EPA/VicWater publication *Best Practice Trade Waste Management by Water Businesses* (2004).

Treatment

The management controls for a specific treatment process should be identified using a framework such as HACCP (Appendix C). It is generally expected that these controls will rely on the operational monitoring of parameters that will provide a 'real-time' indication of the effectiveness of individual components within the treatment process.

Storage

Whilst the recycled water quality objectives must be met through treatment, the protection of water quality must extend throughout the system to the end user. Controls should be in place to manage any downstream risks to the water quality.

Generic health risks for recycled water storages have been assessed (refer to the document *Health Risk Management in Urban Recycling Schemes: Technical Background Paper*) and the management controls listed in Table 5.3 are recommended. It should be noted that this list is not exhaustive and additional risks or alternative management controls may be identified in the risk assessment for a specific system.

The management controls in Table 5.3 relate only to the protection of human health. Aesthetic water quality issues (such as odour due to stagnant water) may also arise in storages and may require management for community acceptance.

Drinking water back-up to the recycled water supply

Most dual pipe schemes will incorporate a drinking water connection to the recycled water system in order to ensure a secure supply of water at all times. Backflow can potentially place the drinking water supply at risk from contamination with recycled water.

It is recommended that this risk be managed through the inclusion of a registered air-gap or reduced pressure zone device (RPZD) (checked once per year and certified as per AS 2845) between the drinking water supply and recycled water system.

Any connections between the recycled water and drinking water supplies should be considered in both the HEMP for the recycled water supply and the risk management plan that is required for the drinking water supply under the Safe Drinking Water Act 2003.

End use

Management controls are required to ensure that recycled water is only used for the purposes listed in Table 5.2. Measures should be in place to minimise the consumption of significant volumes of recycled water (for example, via a cross-connection between the recycled and drinking water supplies) and water deliberately being used in a manner other than intended (for example, filling swimming pools).

Recommendations to manage these risks are provided in Chapters 6 and 8 respectively.

The following are not required to manage health risks associated with end use in dual pipe schemes:

- buffer distances for spray drift
- withholding periods for produce grown with recycled water
- vaccinations.

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Table 5.3: Suggested generic management controls to protect water quality in storages

Hazardous event	Control measure	Monitoring	Critical limit	Corrective action
Microbial contamination in covered storages.	Monitoring.	E. coli. Monthly in summer. Every two months in winter.	< 10 organisms/100 mL.	Disinfect or bypass storage, and undertake actions to address source of contamination.
Microbial contamination or increased microbial activity in uncovered storages.	Chlorination at storage outlet.	Total chlorine at storage outlet. At least monthly.	Ct ≥ 30 mg.L/min.	Increase chlorination.
	Monitoring.	E. coli. Weekly.	< 10 organisms/100 mL.	Increased chlorination or bypass storage, and undertake actions to address source of contamination.
		Turbidity. Weekly.	< 5 NTU.	Bypass storage or filter water and undertake actions to address source of elevated turbidity.
Blue-green algae growth in uncovered storages.	Monitoring.	Blue-green algae. Every two weeks in summer. Every two months in winter.	As per DSE alert levels ¹ .	Bypass storage and act to reduce algal numbers if possible.
Miscellaneous hazards.	Monitoring/maintenance.	Reservoir inspection. Weekly (uncovered). Monthly (covered).	-	As required to address any identified hazard to water quality.

Notes to Table 5.3:

1. Refer to Department of Sustainability and Environment Circular No. 287 Blue-green algae coordination arrangements for 2004/2005 and related matters, as updated.

DUAL PIPE WATER RECYCLING

Managing human health risks summary

Performance objective

To produce and deliver recycled water of a quality that is safe for use in urban dual pipe recycling schemes.

Suggested measures to meet the performance objective

- Utilise treatment technology that has been validated (detailed in Appendix C) as being capable of routinely achieving the target water quality objectives specified in Table 5.1.
- Develop a Recycled Water Quality Management Plan (RWQMP) within a preventive risk management framework such as HACCP. This should detail any risk assessments, and identify and validate control measures for the management of water quality.
- Implement measures to ensure recycled water is being used appropriately.

6. MANAGING THE SUPPLY SYSTEM

This chapter identifies the potential health risks associated with the construction, operation and maintenance of the dual pipe supply system and provides a framework for assessing and managing these risks. The supply system is defined as the distribution, reticulation and plumbing components of the dual pipe scheme.

This chapter is linked with Chapter 5 in addressing the potential health risks associated with dual pipe schemes. The risk of inadequately treated water entering the system from storages or the treatment plant, is specifically addressed in Chapter 5.

This chapter identifies the key potential hazards and recommended preventive measures for control within the distribution and reticulation system. In general, it is anticipated that the preventive measures identified in this chapter will be adequate for risk control in most schemes, but all scheme proponents should consider other potential risks and controls that may be applicable for a specific scheme.

This chapter also outlines the key operational hazards and recommended preventive measures for control within a residential property.

6.1 Distribution and reticulation

The key potential risks identified include:

- contamination of the drinking water supply system with recycled water due to cross-connections between the two supplies
- pathogen contamination from the use of sewer repair equipment during mains alteration and repair

- pathogen contamination from the environment during mains alteration and repair
- environmental impact due to burst mains and flushing events.

In order to control these risks the following preventive measures are recommended:

Design, construction and installation

- Design and construct the system in accordance with the Water Supply Code of Australia (WSA 03-2002, WSAA), including supplemental codes. It should be noted that this code recommends against permanent cross-connections between the recycled water and drinking water systems within the network downstream of storages.
- Protect any drinking water supply back-up to the recycled water system using an approved registered air-gap at the inlet to the recycled water storage (refer to section 5.3 and the Water Supply Code of Australia (WSA 03-2002, WSAA)) or through the installation of a reduced pressure zone device (RPZD) on the drinking water supply back-up to the recycled water supply (refer to AS/NZS 3500.1:2003). Note, where an RPZD is fitted, appropriate valving must be fitted to avoid excessive discharge of water to the environment should the pressure in the recycled water pipe exceed that in the drinking water supply.
- Develop a process to ensure that:
 1. the drinking water service pipe and drinking water meter into the property is only connected to the drinking water main in the street
 2. the recycled water service pipe and recycled water meter into the property is

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only connected to the recycled water main in the street.

Refer to Appendix D for a suggested process for inspections of recycled water and drinking water supply systems in developments. All service pipe and meter assemblies should be inspected. The recommendation to inspect all (100% of) service pipes and meter assemblies may be reviewed over time by EPA and DHS.

- Engage water main contractors with appropriate quality accreditation.
- Conduct regular auditing of contractors.
- Fire hydrants carrying recycled water should be clearly marked (for example, through labelling hydrants and fire plug covers with 'Recycled Water' and colouring hydrant covers or plug/valve surrounds purple), and be identified in accordance with the fire services' Guidelines for the Identification of Street Hydrants (1999).

System operation

- Implement standard operating procedures for managing and maintaining the recycled water system.
- Devise and implement an appropriate scheduled maintenance program.
- Ensure that sewer repair tools are not used to repair the recycled water main.
- Flush the recycled water system after recharge.
- Manage burst mains and flushing events in accordance with Chapter 7.

The maintenance of a chlorine residual for the control of microbial growth in the supply system is not considered essential for the protection of public

health. However, maintaining a total chlorine residual of between 0.5 and 1 mg/L within the system may assist in the control of aesthetic issues (for example, biofilm growth and sloughing).

6.2 Plumbing within the customer property

Please see Addendum issued February 2015 which updates Section 6.2 of this publication.

This section details installation requirements. The key potential risks identified include:

- pathogen, chemical or physical contamination via backflow
- pathogen, physical or chemical contamination from pipework failure below ground and backflow into the system
- pathogen, physical or chemical contamination of the drinking water with recycled water due to cross-connections.

In order to control these risks the following preventive measures are recommended.

- Undertake all plumbing works in accordance with AS/NZS 3500:2003 – National Plumbing and Drainage Code, which is consistent with the Plumbing Industry Commission (PIC) Recycled Water Plumbing Guide.
- Ensure a licensed plumber installs the recycled water system, including appropriate backflow prevention on the recycled water service. At the residential property level, dual check meters or dual check valves provide appropriate backflow prevention. Higher levels of protection should be considered at sites with increased levels of on-site hazards.
- Conduct auditing of meter and backflow prevention installations.

DUAL PIPE WATER RECYCLING

- Use approved materials with the appropriate watermarks and standard markings.
 - Separate above-ground recycled water and drinking water infrastructure by at least 100 mm.
 - Separate below-ground recycled water and drinking water infrastructure by at least 300 mm.
 - Use purple identification tape for all below-ground recycled water pipes.
 - Ensure that outdoor recycled water taps are coloured purple, have a removable handle and are located at least 300 mm from any drinking water tap.
 - Ensure recycled water taps are not interchangeable with drinking water taps. To prevent drinking water taps from being installed on a recycled water outlet, tap inlets should have different sized threads.
 - Locate prohibition signs on all recycled water tap outlets no further than 150 mm from the tap handle. These signs should read 'Do Not Drink' (refer to Figure 6.1).
- Use purple coloured recycled water meters.
 - Ensure the recycled water meter is not interchangeable with the drinking water meter. To prevent the incorrect installation and swapping of meters, recycled water meters should have different threads from drinking water meters.
 - All internal plumbing connections to the dual water supply system are to be inspected by the PIC to ensure compliance with the PIC Recycled Water Plumbing Guide 2005. The three inspection points are:
 1. connection from the recycled water meter to the house prior to backfilling
 2. rough-in stage within the house
 3. testing and commissioning (as per recycled water system commissioning process detailed in the PIC Recycled Water Plumbing Guide 2005).

The recommendation to inspect all (100% of) internal plumbing connections may be reviewed over time by EPA and DHS.

6.3 Ongoing system audit

As a minimum, the scheme manager should provide advice that will enable the customer to self-check that the drinking water outlets are connected to the drinking water supply. This advice should also be provided to new owners and occupants.

The scheme manager should also consider the development of an audit program to inspect a percentage of properties for incorrect connections.

Figure 6.1: Prohibition sign



DUAL PIPE WATER RECYCLING

Managing the supply system summary

Performance objective

To ensure that the construction, operation and maintenance of the dual pipe supply system protects human health and the environment.

Suggested measures to meet the performance objective

- Design and construct the recycled water distribution and reticulation system in accordance with the Water Supply Code of Australia (WSA 03-2002, WSA), including supplemental codes.
- Design and install fire hydrants carrying recycled water in accordance with the fire services' Guidelines for the Identification of Street Hydrants (1999).
- Undertake all plumbing works in accordance with AS/NZS 3500:2003 – National Plumbing and Drainage Code and the Plumbing Industry Commission (PIC) Recycled Water Plumbing Guidelines.
- Ensure that any drinking water supply back-up to the recycled water system is protected through an approved registered air-gap at the inlet to the recycled water storage or through the installation of a reduced pressure zone device on the drinking water supply back-up for the recycled water supply.
- Develop an inspection/audit process for the recycled and drinking water supply system.
- Provide appropriate training to contractors, operators and plumbing personnel.
- Develop an audit and education program for identification of household cross-connections, including a cross-connection self-test kit for residents.
- Implement appropriate standard operating procedures for managing and maintaining the recycled water system.
- Develop contingency plans for potential incidents and emergencies.
- Implement an inspection and audit program for the recycled water system.
- Ensure that environmentally acceptable provisions are made for the maintenance of the distribution and reticulation network (refer to Chapter 7).

7. MANAGING ENVIRONMENTAL RISKS

This chapter identifies the potential environmental risks associated with the use of recycled water in dual pipe schemes and provides a framework for assessing and managing these risks.

The controls to manage environmental risks typically need to be established on a site-by-site basis in order to avoid outcomes that may result in some schemes being unnecessarily costly and other schemes not providing adequate environmental protection.

This chapter focuses on the environmental risks associated with the acceptable uses of recycled water as specified in Table 5.2, but also identifies incidental exposures to the environment (such as bursts or leaks from the reticulation system and system flushing for maintenance) and inappropriate uses (such as garden over-watering, car washing on hard surfaces and hosing of hard surfaces). Significant emphasis is also placed on stormwater treatment and conveyance systems for the protection of waterways.

This chapter does not address:

- potential impacts on infrastructure, such as bio-clogging, corrosion of pipes and structural integrity impact due to saline and acidic soils
- management of storages and ornamental water features to prevent groundwater contamination, odour and algal blooms
- management of potential aesthetic impacts (such as recycled water colour and odour).

It should also be noted that consideration of the environmental risks associated with the use of recycled water for firefighting was examined. The

available literature suggests that, irrespective of the water source, firewater runoff will be acutely toxic to aquatic life due to the contaminants that are released during a fire. Therefore, it is not anticipated that additional environmental management controls would be required for the use of recycled water for firefighting. Details of the literature review are contained in the technical background paper Environmental risk management in dual pipe water recycling schemes (refer to Appendix E).

It is expected however that, for fire training purposes (i.e., planned activities), the necessary controls are similar to those for the management of recycled water mains flushing (see section 7.3). Such controls should be included in a site-specific management plan (refer to section 3.1).

7.1 Hazard identification

Raw sewage can contain a range of contaminants that may require management to achieve sustainable water recycling. These contaminants may be sourced from industrial/commercial (trade waste) and domestic inputs, and infiltration into the sewerage system. These guidelines primarily focus on the contaminants most commonly expected in recycled water and having wider environmental implications, namely nutrients and salts.

The presence of other key contaminant groups (such as metals, trace organics, pH) in recycled water at levels that could potentially pose an environmental risk is not anticipated for most dual pipe schemes. However, the risk assessment for a specific scheme should cover other key contaminant groups. The recycled water system assessment should include all aspects of the recycled water system from the collection or catchment of

untreated water (sewage), through to the receiving environment, as outlined in Chapter 4. Additional management controls (such as targeted treatment) may be required for schemes where industrial or trade waste inputs are significant.

Where chlorine is used as a disinfectant, consideration should be given to managing chlorine residuals so as not to affect plants during irrigation. A guidance level of >5 mg/L chlorine residual should stimulate a risk assessment of potential plant impacts. The aquatic toxicity of chlorine residuals should also be considered in assessing the management of bursts, flushing events and inappropriate uses.

A land capability assessment should be undertaken to help identify the specific environmental hazards of a scheme. Initially, this does not need to include a high level of detail, but should include the recycled water quality (including source inputs) and the background condition of the dual pipe catchment and surrounding environment, including the stormwater treatment and conveyance system. Additional information may be required for the key risk areas identified.

Nutrients

Elevated nutrient concentrations are considered to be key contributors to algal blooms and associated water quality problems. Considerable effort and resources have been invested in reducing nutrient loads from stormwater to enhance water quality of urban watercourses. Hence, it is important that dual pipe schemes are managed such that they do not compromise these efforts by increasing nutrient loads to waterways.

Of the range of nutrients expected in recycled water, phosphorus and nitrogen are environmentally the most significant.

Nutrients are beneficial for plant growth, but an excess build-up of some nutrients in soil and migration to surface water and groundwater can cause:

- toxicity to some plants (including phytotoxicity to native plants sensitive to high nutrient levels)
- loss of soil productivity
- toxicity to aquatic life
- nuisance growths of aquatic plants, algal blooms and associated water quality problems.

Salinity and sodicity

The presence of soluble salts within recycled water in some areas of Victoria can result in the following:

- Impact to plant growth or plant death. The problem is more severe in hot and dry climatic conditions.
- Toxicity due to specific ions (such as chloride, sodium and boron).
- Foliar damage from sodium and/or chloride ions.
- Impact to groundwater and surface water quality through salt migration.
- Impact on soil structure due to the application of excessive sodium in irrigation water. This can make the soil more dispersible and erodible, leading to the hydraulic conductivity of the soil being restricted. This may also lead to waterlogging or build-up of salinity.

Further complications of salinity problems can occur in geographic locations where the watertable is high (within two metres of the ground surface).

7.2 Risk assessment

The outcomes of the land capability assessment should be used as the basis for undertaking an environmental risk assessment, the objective of which is to:

- understand the condition and sensitivity of the environment (plants, soils, groundwater and surface water) and any other beneficial uses
- assess the capability of the catchment to sustainably utilise and manage recycled water of a given quality, given the predicted uses
- determine treatment requirements to produce an appropriate water quality
- define the environmental monitoring program and appropriate management controls for the scheme.

The assessment should consider the following policies and guidelines:

- State Environment Protection Policy (Waters of Victoria), which establishes catchment-specific water quality objectives for surface waters and an attainment program for driving improvements in water quality.
- State Environment Protection Policy (Groundwaters of Victoria), which defines segments of the groundwater environment and their associated beneficial uses, and establishes the levels of groundwater quality required to protect these beneficial uses.
- The National Water Quality Management Strategy – Australian and New Zealand

Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ 2000), which provides guidance on water quality for a range of uses including irrigation, aesthetics and protection of aquatic ecosystems.

- Guidelines for wastewater irrigation (EPA Victoria 1991, Publication 168), which provides technical information associated with the application of recycled water to land (including nutrients, salinity and sodicity).

Nutrients

The performance objective for nutrient management is to ensure that:

- the total applied nutrients (from recycled water and from any additional fertiliser application) are utilised for plant growth or remain stored within the soil for future uptake by plants
- the applied nutrients do not build up in the soil to a level where they cause an adverse impact on beneficial use of the environment (in surface waters, groundwater, soil).

Factors that should be considered in undertaking a risk assessment for nutrients are summarised in Figure 7.1.

Salinity and sodicity

Salinity and sodicity management aims to ensure that:

- salt or sodicity levels in the water or soil do not impact on plant health, surface waters, groundwater or surrounding land
- stored salt in the subsoil and groundwater is not mobilised by irrigation.

Figure 7.1 illustrates factors that should be considered in the risk assessment for salinity and sodicity, some of which are discussed in more detail below.

Additional leaching above that provided by rainfall is often recommended if there is a risk of salt build-up in the root zone. This is difficult to manage in a residential context and, if not managed appropriately, can lead to excessive salt and nitrate migrating to groundwater, export of salt and nitrate to surface waters, and groundwater table rise with subsequent waterlogging and salinisation.

Therefore, if the risk assessment identifies that significant additional leaching is required on residential properties to manage soil salinity, then consideration should be given to measures that reduce salt levels in the recycled water.

Incidental events

Environmental impacts as a result of these incidental events depend on the contaminant levels in recycled water. The greatest risk in terms of nutrients is considered to be the entry of high-nutrient recycled water into waters during dry periods when natural flows are low.

The risk assessment should consider the impact of incidental events on the environment. Events that should be considered include:

- bursts and leaks, likely to result in relatively large pollutant loads and more common during summer months
- flushing, a planned, usually infrequent event that is typically avoided during dry periods due to the limited availability of water.

Inappropriate uses

Inappropriate uses include those that generate runoff to stormwater. These can include washing down hard surfaces, washing cars on hard surfaces and over-watering gardens. The risks of such uses should be considered as part of the environmental risk assessment.

The greatest risk is considered to be the entry of high-nutrient recycled water into waterways during dry periods when natural flows are low.

7.3 Operational controls and preventive measures

Based on the outcomes of the environmental risk assessment, operational controls and preventive measures are required to ensure that the use of recycled water in dual pipe schemes is environmentally sustainable.

In addition to the management controls suggested below, a monitoring program should be established to monitor priority risk areas as defined by environmental risk assessment.

System inputs

Opportunities to manage the input of contaminants of concern (as defined by the risk assessment) into the sewerage system should be identified and implemented.

A program should also be developed to identify and evaluate the impacts of potential new inputs to the system or variations to an existing trade waste agreement.

Treatment management

An appropriate treatment process should be selected and managed to ensure that recycled water is of appropriate quality for protection of the environment.

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Storage and reticulation

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

- Ensure that the stormwater treatment and conveyance system can accommodate additional nutrient loads from recycled water.
- 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).
- Ensure 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).
- Manage flushing from recycled water mains such that there is no 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 educted and transported off-site).
- Manage the discharge of recycled water from disinfection or slug dosing procedures so that there is no direct discharge to surface waters (i.e., discharge to land or to sewer for treatment).

Unplanned flushing events and emergency situations are not covered by this requirement. Protocols should be established consistent with incident response plans for major bursts.

End-use management

Residential use

Recycled water can be used for a number of purposes including garden watering, car washing, and outdoor wash-down activities (excluding hard surfaces such as driveways) and construction, as outlined in Table 5.2.

The residential community should be appropriately informed to ensure that these activities do not adversely impact on the environment. Information on appropriate uses and the risks to the environment if recycled water is used inappropriately should be provided to residents.

Suggested key messages should include:

- optimise garden watering so that waterlogging and run-off do not occur
- limit watering to sensitive plants such as natives
- wash cars, boats and so forth on grassed areas to minimise run-off to the stormwater system
- avoid run-off of recycled water during construction and renovation activities.

Influencing customer behaviour through messages about conservation and demand management will play an important role in risk management. While residents should not be responsible for complex management regimes such as leaching, they should be expected to use recycled water appropriately. More information on communicating key messages is provided in Chapter 8.

Metering and appropriate pricing of recycled water are also important mechanisms to encourage the responsible use of recycled water, as they impose a user-pays system. Individual meters must be installed at each property to monitor recycled water use.

A single meter may be sufficient at multi-dwelling residential premises, such as apartment blocks, or where garden watering systems are managed by a single entity such as a body corporate.

Stormwater treatment and conveyance systems

Each development should be able to demonstrate that any additional nutrient loads as a result of the dual pipe scheme can be accommodated within the stormwater treatment and management system.

As with all residential developments, the stormwater system should be capable of reducing pollutant loads to levels that contribute to the achievement of identified water quality objectives for waterways. In order to assess this, existing tools such as the MUSIC model should be utilised.

Guidance on stormwater management systems can be found in Best Practice Environmental Management Guidelines Urban Stormwater (1999), Australian Runoff Quality (Engineers Australia 2004) and WSUD Engineering Procedures: Stormwater (Melbourne Water 2004).

Ornamental water features

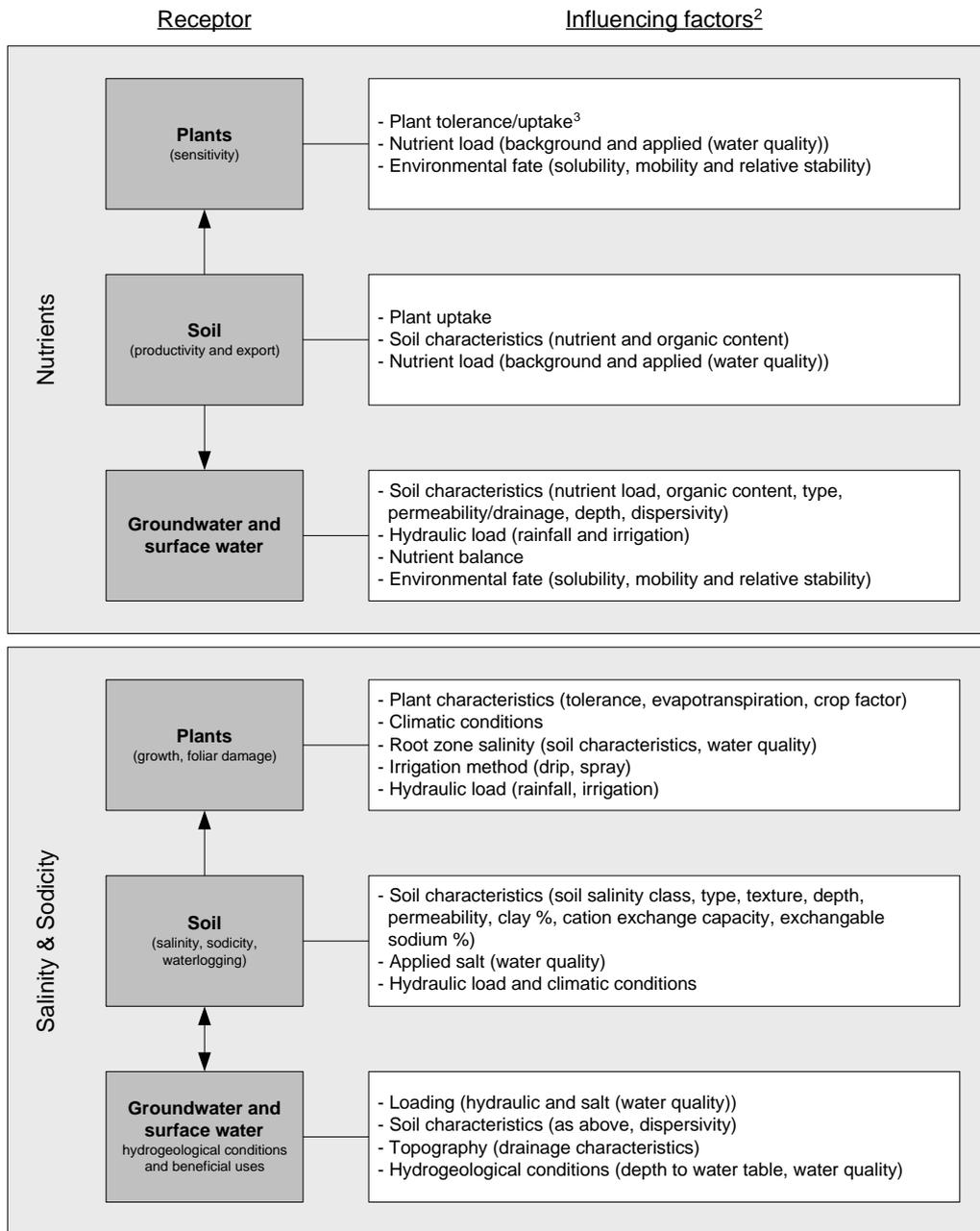
Whilst not specifically assessed in this chapter, the use of recycled water in ornamental water features should ensure that:

- features are not directly connected to waterways and/or groundwater (for example, ponds may require a liner)
- algal blooms, odour and other nuisances are controlled
- any nutrients and other contaminants (such as disinfection by-products, salt and heavy metals) are not toxic to aquatic life.

The management controls required should be determined on a scheme-by-scheme basis.

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Figure 7.1: Environmental Risk Assessment¹ considerations



Notes to Figure 7.1:

1. The process may be iterative in defining appropriate water quality objectives which are protective of environmental receptors. For example, water quality may affect influencing factors and vice versa.
2. In many cases environmental receptors are linked. For example, the accumulation of salt in soil affects the average root zone salinity and subsequently affects plant growth.
3. Information on plant uptake rates can be found NWQMS 2000 and Water Quality for Agriculture (FAO, Irrigation and Drainage Paper No. 29 Rev.1, 1985). Natives have a low uptake rate so residents should be told that they rarely need watering.

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Managing environmental risk summary

Performance objective

To ensure that the recycled water system, treatment process and the use of recycled water are managed in a manner that protects the environment.

Suggested measures to meet the performance objectives

- Undertake an environmental risk assessment, including a land capability assessment.
- Utilise treatment technologies that are capable of achieving water quality objectives as determined by the environmental risk assessment.
- Establish a strategy to reduce contaminant inputs into the sewerage system.
- Develop a program to monitor priority risk areas as defined by the environmental risk assessment. Establish triggers and corrective actions.
- Provide information to customers on the appropriate use and management of recycled water for environmental protection.
- Install meters at residential properties.
- Implement stormwater treatment and conveyance systems which are capable of accommodating additional pollutant loads from recycled water.
- Install, maintain and operate the distribution system to minimise losses to the environment.
- Prevent the direct discharge of recycled water to waterways during flushing or cleaning events.

8. COMMUNICATING MANAGEMENT CONTROLS

A communication and engagement strategy is a critical component of a dual pipe scheme and must be documented within the HEMP. Effective community communication and engagement tools are necessary to ensure recycled water is used responsibly for protection of human health and the environment.

This chapter is linked with chapters 5, 6 and 7 and identifies key components for effective engagement and communication of management controls.

8.1 Developing and implementing a communication strategy

The sustainability of a dual pipe scheme is reliant on the willingness and ability of the community to adopt the behaviours required to ensure protection of human health and the environment.

A communication strategy should be tailored to address the specific needs of the community and may encompass the following principles:

- focused information
- inclusiveness, accessibility and diversity
- flexibility
- commitment to ongoing consultation
- provision of information in an open and accountable way
- appropriate and considered timing
- responsiveness to and seeking of feedback
- evaluation and review.

The key components of the strategy are:

- determining roles and responsibilities

- defining the community
- determining community needs
- identifying key messages
- identifying communication tools
- implementation, maintenance, feedback, evaluation and review.

Determine roles and responsibilities

The roles and responsibilities of each organisation involved in the strategy should be clearly identified, including the scheme manager, scheme proponent, recycled water supplier and any other key stakeholders (such as local government).

Define the community

Segments of the community that should be considered include:

- the 'live-in' community:
 - residents, both current and future
 - businesses, organisations and groups that will be established within the development
- the 'regional' community:
 - individuals, groups and organisations with an interest in the development, but who will not necessarily live there (such as landlords, business owners, real estate agents, builders, plumbers, fire authorities, recreational facility users and visitors).

Information will need to be appropriately targeted to each segment of the community.

Determine needs of the community

Segments of the community may have specific communication needs, depending on their role within the community, demographic and language

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needs. The following may be considered in identifying the specific needs of the community.

- Demographic study.
- Community engagement, for example:
 - focus group meetings
 - one on one interviews.
- Potential new residents, landowners targeted for marketing and sales.
- Relevant public authorities and organisations that may have a stake in the scheme. For example, the local council, EPA, the waterway manager such as the catchment management authority, DSE, fire authorities and DHS.
- Local environment and ‘friends of’ groups, recreational clubs and other committees. Usually, the local council can provide a list of active groups in the region.
- Builders and developers.

Identify the key messages for the community

For the purpose of the HEMP, the key messages to be communicated are those regarding the management controls required in order for the scheme to be sustainable and safe.

Key messages should cover:

- acceptable/appropriate uses of recycled water (refer to Chapters 5, 6 and 7)
- inappropriate or potentially unsafe uses of recycled water (refer to Chapters 5, 6 and 7)
- the risks of inappropriate uses of recycled water

- the identification of the recycled water infrastructure versus the drinking water infrastructure (Chapter 6)
- the responsibilities of recycled water users – for example:
 - using recycled water appropriately and responsibly
 - advising visitors of appropriate uses of recycled water
 - undertaking cross-connection tests
 - maintaining recycled water infrastructure on own property (residents need to know what works a resident may undertake themselves, what work must be undertaken by a licensed plumber, and where appropriate plumbing supplies can be obtained)
- instructional information – for example:
 - step-by-step guides for cross-connection tests
 - conservation measures, responsible irrigation and fertiliser applications
- where to get further information and advice.

The strategy can also include the dissemination of other information regarding the scheme, such as:

- the source and quality of recycled water, how it is produced and how it is different from drinking water
- the expected look and smell of recycled water
- the security of supply

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- the recycled water billing system and whether or not water restrictions will apply to the recycled water supply
- when recycled water will be available (if residents occupy the development before the recycled water system is operational).

Identify communication tools

Expertise may be sought for the identification of communications that are most appropriate for the needs of the community. Tools may include:

- public information sessions
- community instructional workshops
- ‘frequently asked questions’
- home occupant kits, which may include:
 - fact sheets on recycled water quality and its appropriate use to ensure protection of human health and the environment
 - fact sheets on irrigation or garden watering with recycled water
 - instruction sheets on household plumbing and self cross-connection tests
 - list of roles and responsibilities
 - contacts list and notification instructions
- water bill inserts
- multilingual signs on all recycled water taps, using internationally recognisable symbols and tactile aids for the visually impaired
- signage and information boards in public areas
- open days
- media involvement
- school education programs

- feedback on the effectiveness of communication tools.

Tools should endeavour to include a clear pictorial representation of key instructions or messages that require communication.

Implement, maintain, obtain feedback, evaluate and review

The strategy is not static. There should be a continual process of communication and engagement to develop needs, key messages and tools, and to implement, evaluate and review the strategy. Continual reinforcement of key messages to target visitors, new residents (including tenants of rental properties) and the needs of the existing community will be required.

During the lifetime of the scheme the strategy should undergo regular evaluation, review and revision. This review should involve broad community engagement to assess knowledge retention and obtain feedback on the effectiveness of communication tools. Feedback may be gained through direct or indirect means and may include focus groups, interviews, surveys, observations and soil sampling. Feedback should be evaluated and used to revise the strategy, thus promoting a continual process of communication and engagement.

8.2 Terms and definitions

It is important that plain and consistent language is used in dual pipe schemes. The following terms and definitions are recommended for use in documentation that is to be distributed to the community, but are not intended to replace terms that are widely used and accepted within the water industry.

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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.

Drinking water: defined in the Australian Drinking Water Guidelines 2004 and suitable for human consumption. Also known as potable water.

Recycled water: water that has been derived from sewerage systems and treated to a standard that is appropriate for its intended use.

This term should replace the following terms currently used: reclaimed water; reused water; new water; treated effluent.

Sewage treatment plant: a treatment plant that treats sewage.

Recycled water treatment plant: a treatment plant that produces recycled water of a quality that is appropriate for its intended use.

Water treatment plant: a treatment plant that produces drinking water.

Recycled water system: the infrastructure that conveys recycled water from a recycled water treatment plant to the customer.

Communicating management controls summary

Performance objective

To develop an engagement and communication strategy that will ensure protection of human health and the environment by promoting the appropriate use of recycled water.

Suggested measures to meet the performance objective

- Identify who is responsible for the development, implementation, maintenance, feedback, evaluation and review of the communication and engagement strategy.
- Identify the segments of the community to whom the strategy will be targeted.
- Determine the communication needs of each segment of the community.
- Identify the key messages for communication to each segment of the community, covering the management controls required.
- Identify effective communication and engagement tools for delivering key messages.
- Implement, maintain, seek feedback, evaluate and review the communication and engagement strategy.
- Use consistent terminology that is easily understood by the layperson and/or target audience.

9. 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.

Many incidents and emergency situations will be identified during the application of HACCP principles to the recycled water system, 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 dual pipe scheme. Incidents identified in specific HACCP-based assessments could include:

- non-conformance with guideline values or water quality objectives
- incidents that increase the levels of potentially harmful contaminants or cause failure of treatment systems (such as spills, illegal discharges or incorrect dosing of chemicals)
- cyanobacterial (blue-green algae) blooms in storages
- other specific incidents or emergencies relevant to the dual pipe scheme.

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.

9.1 Protocol development

For all identified incidents and emergencies, 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 the relevant regulatory authorities and other key agencies, and should be consistent with existing government emergency response arrangement.

Key areas to be addressed in any incident or emergency response protocol include:

- response actions
- responsibilities of individuals or groups, both internal and external to the organisation
- plans for alternative water supplies
- 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.

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
- detailed notification forms including procedures for internal and external notification

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- the responsibilities of the relevant organisations and authorities.

A public and media communication strategy could also 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, the actions taken and the measures put in place to minimise future occurrences.

9.2 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 the effectiveness of them 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 and the HEMP.

Incidents and emergencies summary

Performance objective

To ensure that incidents and emergencies are responded to efficiently and effectively.

Suggested measures to meet the performance objective

- Identify potential incidents and emergencies relating to the recycled water system.
- Develop sound protocols, documenting response actions, roles and responsibilities, and communication strategies.
- Train employees and regularly review emergency protocols

10. EMPLOYEE AWARENESS AND TRAINING

For the successful operation of the dual pipe scheme, it is essential that employee training needs are identified and employees are adequately trained. Employees should have a sound knowledge base from which to make effective operational decisions. This requires training in the methods and skills required to perform their tasks efficiently and competently.

Depending on the role of the employee, training may need to cover:

- the principles of risk management
- knowledge and awareness of the HEMP, including roles, responsibilities and liabilities
- the recycled water system, including its operation and the control measures that are in place to ensure public and environmental health protection
- the organisation's protocols and policies for the system, such as system management and maintenance, sampling and analysis of water, consumer complaints, or incident and emergency plans
- statutory requirements relating to the recycled water system
- the roles and responsibilities of individuals and agencies that relate to the recycled water system, both internal and external to the organisation
- the documentation, reporting and auditing of the system.

Training can take place in a number of forms. It may include formal induction or training sessions (in-house or external), seminars, courses, manuals, newsletters, briefings and meetings, and should encourage employees to communicate and think critically about the operational aspects of their work.

Specific training needs should be identified, and it should be noted that the degree of training required by a particular employee, or group of employees, will depend on their role in the recycled water scheme. For some employees, their actions will have potential to impact on the health and environmental safety of the scheme. Treatment process operators in particular are critical in the production of safe water, and must have a sound understanding of the RWQMP. They should have detailed knowledge of the purpose of the critical control points in a treatment process and the significance if critical limits for these are not met.

Training programs should be adequately resourced, as sound training is fundamental to the operation of the recycled water system.

All training activities should be documented, and the records of employees who have participated in training maintained. Mechanisms for evaluating the effectiveness of training should also be established and documented.

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Employee awareness and training summary

Performance objective

To ensure that employees are adequately trained in the operational aspects of their work, and understand the potential impact of their actions on the safety of the recycled water scheme.

Suggested measures to meet the performance objectives

- Ensure that employees, including contractors, maintain appropriate experience and qualifications.
- Ensure that training needs are identified, and that adequate resources are available for training.
- Document training and maintain records of all employee training.

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11. RESEARCH AND DEVELOPMENT

Ongoing review and improvement is essential to ensure that the HEMP remains relevant and new information is used to revise and improve the HEMP.

Local research increases the understanding of specific characteristics of individual water supply systems. It may range from investigating mechanisms to optimise treatment plant performance to analysing variation in recycled water quality parameters and their relationship with soil changes in residential areas.

Research activities should be carried out under controlled conditions by qualified staff, and all protocols and results should be documented and recorded.

Participation in research and development activities through partnerships and industry-wide cooperation can be a cost-effective way to address broader issues associated with recycled water quality and treatment.

Applied research and development may be directed towards:

- increasing the understanding of potential hazards within the specific catchment – for example, through:
 - examining the chemical quality of sewage to identify potential sources of industrial discharges
 - assessing trade waste agreements to identify chemical contaminants that may be discharged into source waters
 - examining seasonal or outbreak impacts on the microbial quality of sewage and recycled water
 - monitoring source water to understand the temporal and spatial variability of water quality parameters
- investigating improvements, new processes, emerging water quality issues and new analytical methods
- validating the operational effectiveness of new products and processes
- improving assessments of potential impacts of recycled water on human health, soils and other receiving environments.

Research and development summary

Performance objective

To undertake research that allows for the continuous improvement of the recycled water scheme in terms of environment and health risk management.

Suggested measures to meet the performance objectives

- Participate in research and development initiatives.

12. DOCUMENTATION AND REPORTING

12.1 Documentation

The HEMP should also 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
- enable review and continuous improvement
- provide an accountability mechanism and tool
- ensure scheme sustainability.

In accordance with AS/NZS 4360:2004 Risk Management, documentation should include assumptions made, methods, data sources, analyses, results and reasons for decision.

Records of all monitoring results and analyses should be kept for at least 10 years in order to analyse trends and demonstrate ongoing compliance with the objectives of these guidelines.

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

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

12.2 Reporting

An annual report must be prepared and submitted to EPA and DHS that includes:

- A summary of the review and improvement process outlined in section 13.2, 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
- an analysis of the monitoring data collected for the management of environmental risks
- an analysis of the monitoring data collected under the RWQMP. EPA will defer this to DHS for review and comment
- 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.

The annual report must be signed by a person authorised as a representative of the organisations with documented responsibilities within the HEMP. Normally this would be a senior executive of the relevant organisation.

Notifications

In the event of an emergency incident, the supplier or scheme manager must notify the appropriate regional office of EPA and any other relevant regulatory body and affected parties as soon as

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practicable. The timelines for reporting these incidents must be documented within the HEMP.

The Environmental Health Unit of the DHS must be notified of the following:

- a system failure that may potentially impact on the end users of the recycled water
- an emergency or an incident that potentially places public health a risk

- any changes to the RWQMP or operation of the treatment process that may potentially impact on achieving the required microbial criteria.

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/DHS and other relevant regulatory bodies, for emergency situations.

Documentation and reporting summary

Performance objective

To ensure the HEMP documents the measures in place to ensure a safe, sustainable and compliant dual pipe scheme.

To ensure appropriate arrangements are in place for the submission of performance reports to agencies and the community.

To ensure appropriate arrangements are in place to report incidents of non-compliance to the relevant agencies and stakeholders.

Suggested measures to meet the performance objectives

- Document all aspects of the guideline in the HEMP, including the management controls, monitoring, reporting, and auditing requirements.
- Keep records of all monitoring results and analyses.
- Record and maintain details of all inspection and maintenance programs.
- Ensure the suppliers of recycled water notify the scheme manager and/or user of any non-compliance.
- Notify DHS and/or EPA of emergencies and incidents in a timely manner, as defined within the HEMP.
- Submit annual reports to EPA and DHS.

13. AUDITING, REVIEW AND IMPROVEMENT PROGRAMS

13.1 Auditing the dual pipe system

Periodic auditing of the HEMP (including the RWQMP) relating to a dual pipe scheme is essential for ensuring that suppliers, scheme managers and users meet their obligations under these guidelines.

It is a requirement for all dual pipe schemes to engage an auditor appointed pursuant to Part IXD of the Environment Protection Act 1970 to undertake a statutory audit of the scheme and submit an audit report pursuant to section 53V of the Environment Protection Act 1970 to EPA. EPA will provide a copy of the report to DHS for review and comment.

A statutory audit must be conducted within the first 12 months of commissioning of the dual pipe scheme. The frequency for ongoing audits should be determined in consultation with EPA and depend on the outcomes of the initial audit. It is anticipated, however that audits will occur at least every three years following the initial audit.

The audit should be developed in accordance with AS/NZS 19011:2003 Guidelines for Quality and/or Environmental Management Systems Auditing.

The scope of the audit should ensure:

- that the provisions within the HEMP are implemented
- that any issues identified in system monitoring or system review (see section 13.2) 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.

It should be noted that EPA/DHS approval/endorsement of the HEMP will include an initial review of the adequacy of the risk identification and management system. The significance of the audit process is that it will pick up emerging issues that have been identified within the scheme or changes to the way key controls or processes are operated that could impact on performance.

The scope of the audit, the process for conducting and determining key elements of the audits, the responsibilities for acting upon the outcomes of the audits and the process for review and amendment of the audit process should all be documented in the HEMP. 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.

Information on auditors

The auditor should possess, or have the ability to source from a support team, the following knowledge and skills:

1. an understanding of water business operations, wastewater treatment systems, risk management systems (i.e., HACCP) and the process involved in delivering safe recycled water to the consumer

2. demonstrated experience and expertise, to identify the risks to recycled water quality and the controls used to address the risks.

Information on the appointment process and a list of EPA-appointed auditors is available from the EPA website at www.epa.vic.gov.au/Industry. Refer to EPA Publication 953, Environmental auditor guidelines for conducting environmental audits, June 2004 (as amended) for further details.

13.2 Review and improvement

The HEMP should be regularly reviewed and, where necessary, updated to ensure it remains relevant.

The aim of the review is to:

- 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 potential risks associated with these.

Reviews should be conducted at least annually to assess monitoring results and review the HEMP. The HEMP is a 'living' document and will undergo continual review and improvement. The most up-to-date copy of the HEMP should be provided to EPA. EPA approval and DHS endorsement of changes to the HEMP will be required where significant changes are made – for example, a change to any critical controls point in the RWQMP.

Where relatively insignificant changes are made (such as an administrative change or a change in communication documentation), updates can be provided to EPA with the annual report. If in doubt, advice should be sought from EPA.

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Auditing, review and improvement programs summary

Performance objective

To develop and implement an auditing program that ensures the HEMP has been implemented and that it is updated to address changes in risk.

To undertake review and improvement activities to ensure the HEMP remains relevant.

Suggested measures to meet the performance objectives

- Audit dual pipe schemes to verify compliance with the HEMP.
- Review the HEMP and update in response to the review.
- Ensure audit programs comply with the principles of AS/NZS 19011:2003 Guidelines for quality and/or environmental management systems auditing.

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APPENDIX A – KEY ACTS AND REGULATIONS

Acts

Environment Protection Act 1970

Building Act 1993

Health Act 1958

Trade Practices Act 1974

Safe Drinking Water Act 2003

Food Act 1984

Livestock Disease Control Act 1994

Occupational Health and Safety Act 1985

Water Act 1989

Regulations

Environment Protection (Scheduled Premises And Exemptions) Regulations 1996, No. 66/1996

State environment protection policies

State Environment Protection Policy (Groundwaters Of Victoria) Publication S160

State Environment Protection Policy (Waters Of Victoria) Publication S13

State Environment Protection Policy (Prevention And Management Of Contaminated Land) 2002

Codes, standards and guidelines

EPA Victoria (2003) Publication 464.2: Guidelines for environmental management: Use of reclaimed water

EPA Victoria (1991) Publication 168: Guidelines for wastewater irrigation

EPA Victoria (2002) Publication 730: Guidelines for environmental management: Disinfection of treated wastewater

EPA Victoria (1999) Publication 441: A guide to the sampling and analysis of water, wastewaters, soils and wastes

EPA Victoria (2005) Publication 865.2: Environmental auditor guidelines for appointment and conduct

EPA Victoria (June 2004) Publication 953: Environmental auditor guidelines for conducting environmental audits

EPA Victoria (June 2004) Publication 952: Environmental auditor guidelines for the preparation of environmental audit reports on risk to the environment

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EPA Victoria (1993) Publication 384: Enforcement policy

Australian and New Zealand Environment Council and Agriculture and Resource Management Council of Australia and New Zealand (2000), National Water Quality Management Strategy – Australian New Zealand Guidelines for Fresh and Marine Water Quality

WSA 03–2002, Dual Water Supply Systems, First Edition, Version 1.1, A Supplement to the Water Supply Code of Australia, Water Services Association of Australia.

CFA (2004) Requirements For Water Supplies and Access For Subdivisions In Residential 1 and 2 and Township Zones

CFA, MFB and DSE Fire Services Guidelines - Identification of Street Hydrants For Firefighting Purposes

AS/NZS ISO 19011:2003 Guidelines for quality and/or environmental management systems auditing

AS/NZS 4360:2004 Risk Management

AS/NZS 3500:2003 National Plumbing And Drainage Code

AS 1345 Identification Of The Contents Of Piping, Conduits And Ducts

AS 1319 Safety Signs for the Occupational Environment

AS 2845.1 Water Supply – Backflow Prevention Devices

AS 2845.3 Water Supply – Backflow Prevention Devices – Field Testing And Maintenance

AS 2031 Sample Collection And Preservation Techniques

AS 2419-1 Fire Hydrant Installations

Plumbing Industry Commission & Water Authorities (2005) Recycled Water Plumbing Guide

NHRMC Australian Drinking Water Guidelines 2004

Department of Sustainability and Environment Circular No. 287 Blue-green algae coordination arrangements for 2004/2005 and related matters, as updated.

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APPENDIX B – KEY GOVERNMENT DEPARTMENTS AND AGENCIES

EPA Victoria head office

Herald and Weekly Times Tower,
40 City Road Southbank VIC 3006
Tel: (03) 9695 2700
<http://www.epa.vic.gov.au>

EPA Victoria metropolitan offices

South Metropolitan

35 Langhorne St Dandenong Victoria 3175
Tel: (03) 8710 5555

West Metropolitan

Refer head office details

Yarra Region

Refer head office details

EPA Victoria country offices

Gippsland Region

7 Church Street Traralgon VIC 3844
Tel: (03) 5176 1744

North East Region

24 Ely Street Wangaratta VIC 3677
Tel: (03) 5721 7277

North West Region

43 Williamson Street Bendigo VIC 3550
Tel: (03) 5442 4393

South West Region

Cnr Lt Malop and Fenwick St Geelong 3220
Tel: (03) 5226 4852

Department of Human Services

Environmental Health Unit
120 Spencer Street Melbourne VIC 3000
Tel: (03) 9637 4156

Plumbing Industry Commission

450 Burke Road Camberwell 3124
Tel: (03) 9889 2211

Department of Sustainability and Environment

240 Victoria Parade
East Melbourne 3002
Tel: 136 186

Municipal Association of Victoria

GPO Box 4326PP Melbourne 3001
Tel: (03) 9667 5555

Building Commission

PO Box 536E Melbourne 3001
Tel: (03) 9285 640

Water Services Association of Australia

Level 8 469 Latrobe St Melbourne 3000
Tel: (03) 9606 0678

Victorian Water Industry Association

Suite 1, Level 6, 2 Collins Street, Melbourne, Victoria
3000
Tel: (03) 9639 8868

APPENDIX C – HACCP FRAMEWORK

The production of safe and sustainable recycled water can be secured by the application of a water quality management system. This focuses on the prevention of substandard water being delivered for use, by ensuring that treatment steps, controls, monitoring and verification that are essential for achieving the required water quality objectives are in place.

This approach has been used by the food industry for many years through the application of the Hazard Analysis and Critical Control Point (HACCP) system. The water industry is increasingly adopting similar principles, as demonstrated in the Victorian Safe Drinking Water Act 2003, the Australian Drinking Water Guidelines (2004) and the WHO Guidelines for Drinking-Water Quality (2004).

This appendix describes the application of HACCP to analyse and control a wastewater treatment plant to ensure the removal of pathogens and achieve the required microbial criteria (Table 5.1). These principles can be equally applied to other aspects of the dual pipe scheme, including the supply system, end uses, and management of environmental risks.

HACCP comprises 12 steps – five preliminary steps and seven principles, as shown in Figure C.1. These are discussed in detail below.

Preliminary steps

i) Assemble team

The HACCP team should be multidisciplinary, encompassing a broad range of expertise and skill in all aspects of the recycled water system. Management within the organisation producing recycled water should also be represented to

ensure organisational support for the HACCP process.

ii) Describe product

The HACCP plan should specify that the product is Class A recycled water, including the specific microbial criteria and other any water quality objectives that are applicable.

iii) Identify intended use

The intended uses of Class A recycled water within the dual pipe scheme should be specifically described.

iv) Construct flow diagram

The recycled water system should be mapped, from the catchment of raw water to the delivery of water to the customer property. The flow diagram should include all transfer, treatment, input and monitoring steps, and is integral to a comprehensive system assessment (Chapter 4).

v) Confirm flow diagram

The flow diagram should be confirmed with any detailed design specifications or functional design reports that have been developed for the scheme. If the scheme is utilising any existing treatment processes or infrastructure, the flow diagram should be confirmed with an on-site inspection.

Principles

1) Identify hazards and assess risk

A significant hazard is one that must be prevented, eliminated or reduced to an acceptable level to produce safe recycled water. Hazards may be biological, chemical or physical. Generally the hazards of greatest concern for the recycled water plant are those that are biological (pathogens). However, it may also be appropriate to consider

chemical and physical hazards, such as those that may result in chemical contamination of the recycled water or physical damage to the recycled water plant.

The hazard analysis consists of three steps, which should be documented:

- Identify hazardous events at each step in the process that may impact on water quality. These, for example, are events that may result in ineffective pathogen removal or recontamination of treated water with pathogens.
- Determine the risk and significance of each hazardous event. This is the product of how frequently the hazardous event is expected to occur and what the consequences of that event occurring are. The framework provided in the Australian Drinking Water Guidelines (NHMRC 2004) or alternative risk assessment framework can be used for this assessment.

The HACCP team needs to identify at what point a hazardous event is considered to be significant. A rule of thumb for a risk assessment model that results in risk scores ranging from 1 to 25 (with 1 representing low risk and 25 representing extreme risk) is to consider that all events with a risk score of 5 or greater as significant.

- Identify control measures for each hazardous event. These include system input management, physical barriers (such as treatment steps), monitoring, standard operating procedures and personnel training. More than one control measure

may be required to control a particular hazard, and more than one hazard may be controlled by a particular control measure.

2) Determine critical control points (CCPs)

Hazardous events assessed as significant must be further assessed to identify whether they fall at a CCP. A CCP is essentially a step in the process that is critical for achieving or maintaining the required water quality. The decision tree in Figure C.2 can be used to determine if a hazardous event falls at a CCP.

CCPs must meet at least the following criteria:

- They must have control measures with operational parameters that can be measured and for which critical limits can be set to define the operational effectiveness of the activity (for example, chlorine residual for chlorination or integrity tests for membrane filtration processes).
- They must have control measures with operational parameters that can be monitored at a frequency that will reveal any failures in a timely manner.
- There must be corrective actions that can be implemented in response to deviation from critical limits.

Appropriate selection of CCPs is essential because the focus of operational control will be directed towards these processes and activities.

3) Establish critical limits

All CCPs must have critical limits for their operational parameters that are defined and validated. A critical limit distinguishes between

acceptable and unacceptable performance. When a critical limit is not met, corrective actions should be immediately instituted to resume control of the process.

For treatment processes, critical limits must indicate a decline in performance that equates to at least a 6-log removal of viruses and a 5-log removal of protozoan parasites. The derivation of these limits is discussed in the document *Health Risk Management in Urban Recycling Schemes: Technical Background Paper*.

For many processes operational parameters can be closely linked to performance and tightly controlled (for example, CTs for disinfection indicate the log removal of specific pathogens). However, for processes where operational parameters cannot be as definitively linked to performance (for example secondary treatment processes) a 5th percentile of performance, in terms of log removal, can be adopted. This value should be derived using a rigorous data set for pathogen removal and linked to a specific range of operating parameters. The upper and lower range of these operating parameters then form the critical limits for this step and upstream or downstream processes in the treatment train must be tightly managed to ensure that, at this 5th percentile of performance, the total train will still provide at least 6-log removal of viruses and 5-log removal of protozoans.

The information used to determine critical limits for monitoring of a particular CCP may include experimental studies, scientific literature and supplier specifications.

Critical limits must be validated to confirm they are accurate. Validation of critical limits forms part of

the verification of the water quality management system, and is discussed later in this appendix.

4) Determine monitoring requirements

Monitoring provides assurance that the treatment process is under control. All CCPs must have an associated monitoring activity to ensure that critical limits are met. A monitoring regime that identifies the location and frequency of monitoring, and a description of the method or procedure of monitoring must be established.

5) Establish corrective actions

Corrective actions are taken when a critical limit is not met. If a critical limit is indicative of the treatment process providing sufficient pathogen removal, then the corrective action for not meeting that limit might be to stop water delivery to end users or increase treatment downstream to adequately compensate for the loss in performance. The documentation of corrective actions must include what immediate action is required to resolve the problem, who is responsible for undertaking the corrective action, and who must be notified.

6) Establish verification procedures

Verification procedures are used to determine whether the control measures are effective and whether the water quality management plan is being implemented appropriately.

Verification includes:

- testing the monitoring and procedures identified in the HACCP plan during commissioning of the treatment process
- validation of critical limits (discussed later in this appendix)

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- equipment calibration
- cleaning and maintenance programs
- HACCP plan reviews and internal/external audits
- ongoing evaluation of monitoring data to assess the overall performance of the treatment process and HACCP plan.

7) Establish documentation and record keeping

Appropriate documentation provides the foundation for establishing and maintaining an effective HACCP plan. Documentation should include:

- information used to develop the HACCP plan
- CCPs, critical limits, monitoring and corrective actions
- standard operating procedures relied upon or specifically developed for the HACCP plan
- verification activities, including the validation of critical limits
- records generated as a result of monitoring
- reviews and modifications to the HACCP plan.

Validation

The validation of critical limits is essential for substantiating that the system can be controlled to meet the water quality objectives and the associated monitoring activities will be able to effectively indicate this. Validation must occur before supply of recycled water can commence.

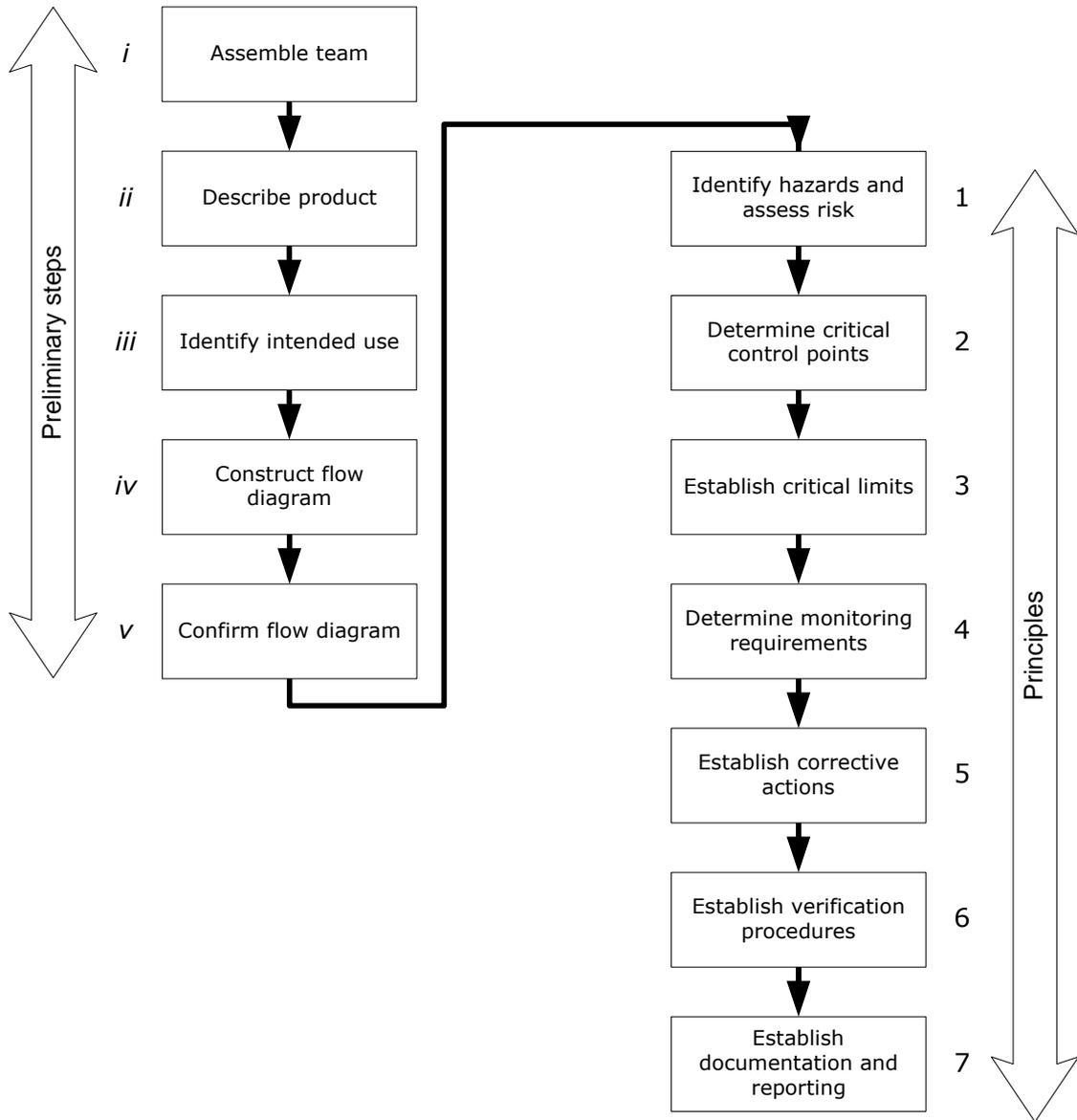
The first stage of validation is to consider data that already exist. This can include data from the scientific literature, existing guidance, historical

data (for example, from other schemes) and supplier knowledge.

The second stage of validation is to determine whether additional testing is required – for example, whether specific on-site studies are necessary – and to collect and analyse the appropriate data. As validation is not used for the day-to-day management of the system, parameters that may be inappropriate for operational monitoring can be used. These may include microorganisms or tracer studies.

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Figure C.1: The HACCP process

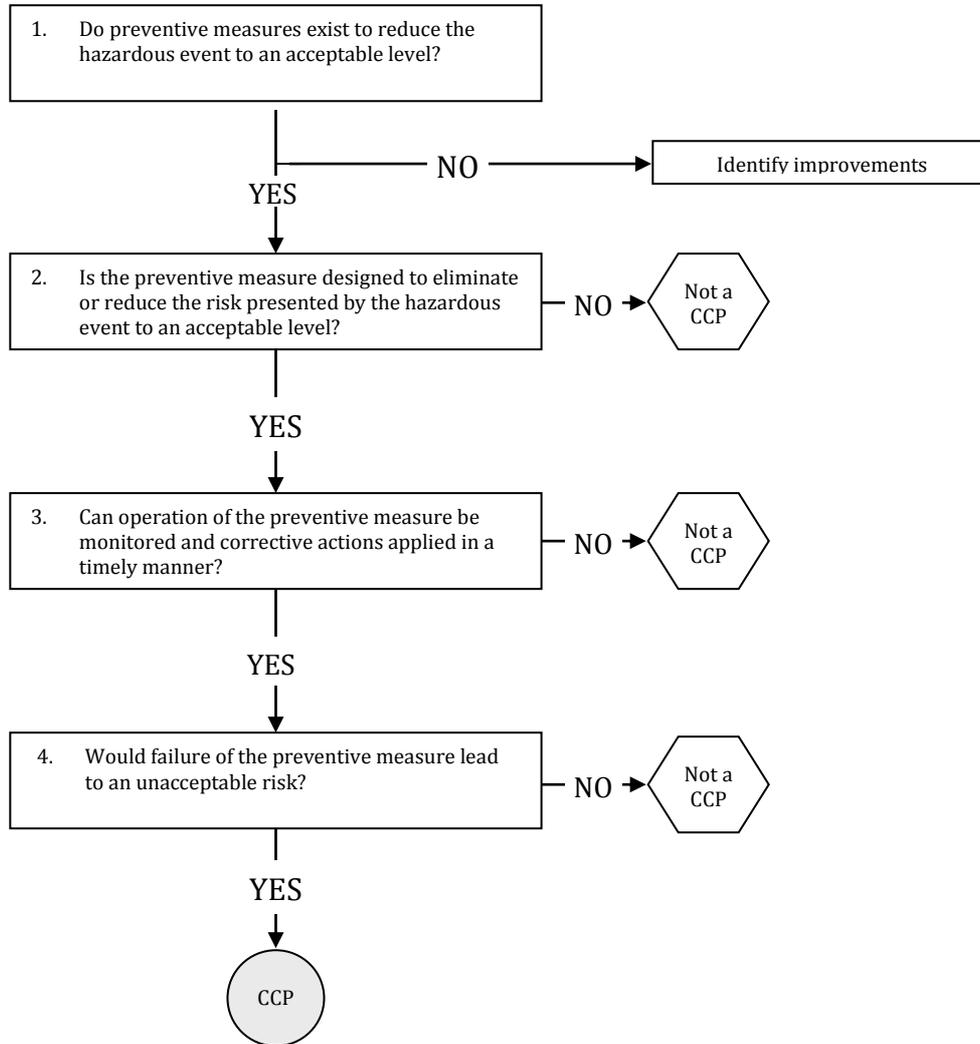


Adapted from Codex Alimentarius, WHO

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Figure C.2: Decision tree to identify CCPs

Consider the following for each hazardous event identified:



Adapted from the Australian Drinking Water Guidelines (NHMRC 2004)

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APPENDIX D – MANAGING THE SUPPLY SYSTEM

Table D.1: Suggested inspections for the recycled and drinking water supply systems

Inspection 1: System integrity inspection on street main to ball valve at end of service pipe – dry tapping	
1.	Turn off recycled water system and drain main empty.
2.	Charge drinking water system with water.
3.	Open successively all hydrants/fire plug and scours on drinking water system. Check that all outlets run with water.
4.	Open successively all hydrants/fire plug and scours on recycled water system. All outlets should run dry after a short time.
5.	Check that all hydrants/fire plug covers, hydrants/fire plugs/valve surrounds and marker posts/retro-reflective pavement markers are marked in accordance with WSAA standards.
6.	Open successively all service line ball valves on drinking water system. Check that all outlets run with water.
7.	Check that all service pipes and ball valve handles on drinking water system meet WSAA/water company standard and are not coloured purple.
8.	Open successively all service line ball valves on recycled water system. All outlets should run dry after a short time.
9.	Check that all service pipes and ball valve handles on recycled water system are coloured purple.
10.	Recharge recycled water system.
Inspection 2A: Meter assembly installation inspection – dry tapping	
1.	Check that drinking water meter has a dual non-return aspect or single non-return aspect with dual check valve, and is connected to the drinking water service pipe ball valve and is not coloured purple. Check that stop valve handle is not coloured purple.
2.	Check that purple recycled water meter has at least a single non-return aspect and is connected to purple ball valve with purple handle. Check that stop valve handle is coloured purple.

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Inspection 2B: Service pipe and meter assembly installation inspection – wet tapping

1. Check that tapping ferrule for drinking water is on blue drinking water main and handle is not coloured purple.
2. Check that drinking water service pipe is not coloured purple and is connected to drinking water tapping ferrule.
3. Check that drinking water meter has dual non-return aspect or single non-return aspect with dual check valve aspect and is connected to the drinking water service pipe ball valve and is not coloured purple.
4. Check that tapping ferrule for recycled water is on purple recycled water main and handle is coloured purple.
5. Check that purple recycled water service pipe is connected to recycled water tapping ferrule.
6. Check that purple recycled water meter is connected to purple service line and stop valve handle is coloured purple.
7. Turn on drinking water system ferrule.
8. Turn off recycled water system ferrule.
9. Open stop valve on drinking water system. Check that outlet runs with water.
10. Open stop valve on recycled water system. Check that outlet runs dry after a short time.
11. Turn off drinking water system ferrule.
12. Turn on recycled water system ferrule.
13. Open stop valve on drinking water system. Check that outlet runs dry after a short time.
14. Open stop valve on recycled water system. Check that outlet runs with water.
15. Turn on drinking water system ferrule.

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APPENDIX E – TECHNICAL BACKGROUND PAPERS

Technical background papers to these guidelines have been developed. These papers are designed to provide background information such as case studies and technical information that provides a basis for the approach adopted in these guidelines. The technical background papers are:

- Health Risk Management in Urban Recycling Schemes: Technical Background Paper
- Environmental Risk Management in Dual Pipe Water Recycling Schemes
- Plumbing and System Operation Report
- Community behaviour and engagement in dual pipe water recycling: A discussion paper of community perception and learning for future recycled water schemes.

Relevant references are provided within the technical background papers.

To obtain copies, or for information on these papers please contact:

Project Manager, Recycled Water
Water and Catchment Unit
EPA Victoria
GPO Box 4395QQ
Melbourne, Victoria 3001.

Additional guidance or technical addendums to this guideline will be available from the EPA Victoria website, www.epa.vic.gov.au.

EPA Victoria will be pleased to receive comments on these guidelines. Comments will, where appropriate, be incorporated in future editions. Comments on these guidelines should be sent to:

Project Manager, Recycled Water

Water and Catchment Unit

EPA Victoria

GPO Box 4395QQ

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