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The Application of a Third Pipe Recycled Water Scheme – Business Risk Considerations

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EXECUTIVE SUMMARY

VicUrban is developing a 645 ha site north of Melbourne at Epping North, involving approximately 8500 residential allotments. The development has been named Aurora, and Yarra Valley Water will be the water authority responsible for the water and waste water systems. The objective is to use this development to 'show case' new standards for environmentally, socially and economically sustainable development in Victoria. Water conservation will be a key feature, and it is proposed that this be achieved by using AAA rated household appliances (low water use), rainwater tanks, and recycling treated wastewater back via a third pipe for toilet flushing and garden use. The potential water demand reduction with such change is to reduce the water demand by up to 70%.
Adopting alternative water and sewerage servicing options will also bring new scientific and legal risks. The key is to ensure that the risks are suitably managed. The largest residual risks at Aurora included ensuring that design reclaimed water volumes were actually used, and improper use of reclaimed water and cross connections are avoided.

INTRODUCTION

VicUrban is undertaking an 8500 lot residential development north of Melbourne at Epping North. The development has been named Aurora. The objective of VicUrban is to use this to 'show case' new standards for environmentally, socially and economically sustainable development in Victoria. Water conservation will be a key feature, and it is proposed that this be achieved by using AAA rated household appliances (low water use), rainwater tanks, and recycling treated wastewater back via a third pipe for toilet flushing and garden use. It is projected that these methods will:

- reduce the demand for potable water to 30% of that normally required, and
- avoid the need to discharge sewage from the development, avoiding a long and costly outfall sewer from the estate.

The project will require a large number of changes relative to the traditional approach to servicing new subdivisions.

VicUrban proposes that the responsibility for water supply and wastewater disposal will lie with Yarra Valley Water Ltd, the water authority responsible for provision of these services in the region.

Yarra Valley Water strongly supports the initiative. However, because the development introduces a number of new concepts and operational requirements that are different from those involved in servicing a normal residential development, there is potential for a

significant business risk to the water authority. In order to ensure that the risks had been identified and would be acceptable, Yarra Valley Water undertook a business risk analysis to identify new risks beyond those associated with providing traditional services and how risks might be reduced to an acceptable level while still retaining most of the water savings.

OBJECTIVES AND GUIDING PRINCIPLES

The objective of the study was to undertake an independent review of the Aurora project to determine the business risk associated with the proposed services and, where the risks exceeded that for traditional services, recommend options to reduce the risk, together with reporting on the reduction in risk that can be achieved.

Yarra Valley Water's guiding principles with respect to the system were:

- YVW will assume ownership and management responsibility for the provision of all water, sewerage and recycled water services within the estate.
- Customer service standards for services provided using a non-traditional service option should not be materially inferior to the service standards provided using traditional approaches.
- Department of Human Services guidelines and standards will be achieved and Environment Protection Authority approval will be achieved prior to implementation of alternative service options that could impact health or the environment.
- Any potential risks associated with an alternative service option will have a management plan that will include monitoring and the capacity to revert to an option carrying the same risk as traditional services.
- Developer prices will be set to recover YVW's costs, established using an 'open book' cost model.

METHODOLOGY

The review was based on the *Framework for Management of Drinking Water Quality* being incorporated in the Australian Drinking Water Guidelines, and the risk management principles outlined in AS4360 (Risk Management). This involved:

- An in-house review of the proposed system against the management elements of the Framework to ensure that the elements of good management relevant to the water supply system are in place.
- A review of the proposed system against a checklist of possible causes of system failure and risks to identify possible failure modes and risks, and to consider what disadvantages, such as loss of water saving, and benefits would occur if measures were to be taken which would reduce the risk.
- A review of the legal aspects of the proposed scheme.

Risks that were determined to be high or extreme were further assessed to determine how the risk may be reduced.

THE PROPOSED AURORA SYSTEM

Flow schematics for the Aurora system and the house component are shown in Figures 1 and 2. Key features are:

- Conventional domestic gravity sewerage collection system.

- Conventional sewage treatment system with no tertiary treatment for nutrient removal, achieving a Class B effluent standard.
- Emergency and balancing storage, with treated wastewater lagoon storage sufficient to provide storage of effluent during winter when demand for reclaimed water is low
- Emergency discharge to creek
- Recycled water treatment plant treating to a Class A standard including chlorination
- Dedicated reclaimed water reticulation system (third pipe system).
- Use of reclaimed water for municipal and industrial uses (eg watering of playing fields and grassed areas), fire-fighting system (hydrants), external garden use by residents, and hard piped for toilet flushing.
- Rainwater collection and storage system. First flush bypass. Rainwater pumped to pressure solar hot water system (gas boost) operating at 65 ^{o}C to provide for disinfection. UV may be added to provide additional disinfection. Potable water will be piped directly into the inlet to the hot water system for make up as required. Cold potable water will be supplied at mains pressure and mixed with hot rainwater through tempering valve to reduce the hot water temperature to 45 – 55^{o}C.

There will be a Customer Contract between YVW and the customers. This will exclude certain uses (eg drinking).

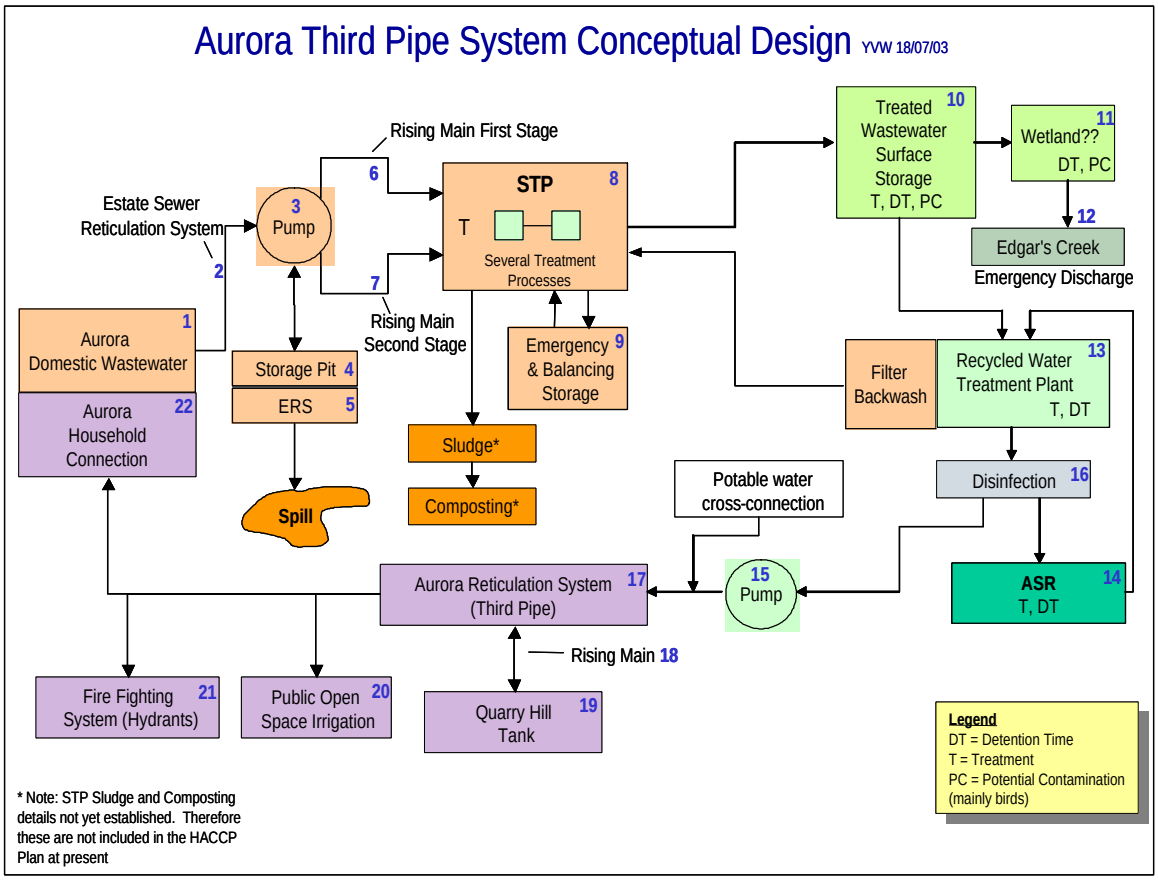

Figure 1 Conceptual Flow Diagram for the Aurora System

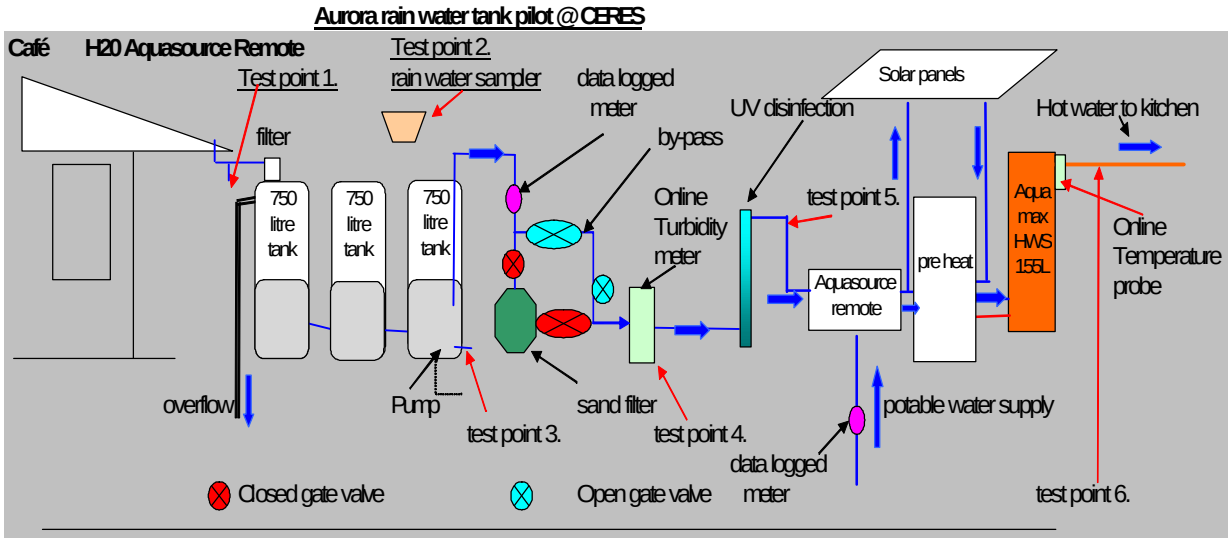

Figure 2 Conceptual Flow Diagram for the Aurora Individual House System

ISSUES IDENTIFIED FROM THE MANAGEMENT SYSTEMS REVIEW

In undertaking the review of management systems for the scheme, it was assumed that

- YVW will develop a HACCP plan for the new scheme as an extension to YVW's existing HACCP Plan.
- YVW will extend components of its existing management system as required for the new scheme, eg for emergency response, training, community consultation, audit, and management review and continuous improvement.

The management systems review indicated that:

- The EPA Guidelines for use of Reclaimed Water (EPA, 2002) provides guidance on the requirements for reclaimed water schemes. These provide an important set of requirements for the management system to comply with, including HACCP Plan Critical Control Limits. They do not extend to certain uses (eg recreational use of water including make up for swimming pools and playing under sprinklers, potable use, or watering of garden crops which are consumed wet). The ability to exclude these uses by resident' use needs careful consideration.
- If more sensitive uses of reclaimed water were to be proposed (such as recreational use), validation of critical limits for these uses would be an important requirement and could be difficult.
- Training of staff and contractors will be an important component of the management requirements. YVW has an existing program of training that will need to be extended.
- Important considerations relating to the Customer Charter include:
  - the extent of liaison with the community, prior to building the scheme, required to confirm their acceptance of the restrictions associated with the proposed scheme (such as restrictions on use of reclaimed water) and requirements regarding access prior to building the scheme;
  - the extent of liaison with customers, when the scheme is operating, required to ensure their customers' awareness of the requirements; and

– whether YVW has legal rights to access to customer's properties as required under the scheme, and the restrictions imposed on the usage of water supplied are reasonable and consistent with the requirements of the Trade Practices Act.

ISSUES IDENTIFIED FROM THE ASSESSMENT OF THE WATER SUPPLY SYSTEMS

Many aspects of the proposed scheme involved water and sewerage systems that were conventional in nature, and did not give rise to an unusual level of risk. These included, for example:

- Domestic wastewater collection, transfer and storage systems;
- Sewage treatment;
- Reticulation (including the third pipe system);
- Fire fighting supply;
- Rainwater systems.

However, some aspects of the proposed scheme did present a high level of risk. These are summarised in Table 1.

Table 1: Higher Risk aspects of the Water Supply Scheme

Aspect	Risk Minimisation Strategy
• Potable water supply system directly connected to the reclaimed water supply for make up	Design system so that direct connection is not required
• Acccidential cross connection between the reclaimed water system and the potable system	High level of scheme management
• Improper use of reclaimed water where the water is used for watering of public open space	Comply with guidelines
• Failure of treatment and disinfection systems	Design and operation of systems
• Use of reclaimed water from fire hydrants by water carters	Signage and community awareness program
• Improper use of reclaimed water by residents (eg swimming pools)	Awareness program
• Accidental cross connection within households	High level of scheme management
• Management of systems (cost)	Careful planning
• Insufficient treated effluent storage leading to requirement to dispose of effluent that does not comply with requirements	System design
• Developer – YVW agreement that gives rise to loss of income if scheme does not proceed	Planning
• Pricing structures	Careful planning and agreement with Government on pricing

• Design of scheme, particularly related to the overall water balance and provision for disposal of excess effluent (avoiding need for outfall sewer)	Planning
• Customer acceptance and customer use of water (and hence inability to achieve the assumed water balance)	Customer awareness program
• Service provision within customer properties	Planning
• Training of YVW staff, and plumbers and contractors	Training scheme

ISSUES IDENTIFIED FROM THE REVIEW OF LEGAL ASPECTS

The additional risks associated with the Aurora scheme have the potential to expose Yarra Valley Water to greater legal liability. For this reason, Yarra Valley Water commissioned a legal analysis to determine the potential sources of legal liability associated with the supply of reclaimed water for residential use, and how those legal risks could be reduced..

The legal analysis revealed that two of the most significant areas of exposure with respect to the supply of reclaimed water for residential use were associated with:

- reclaimed water not meeting the quality requirements for Class A water; and
- customers improperly using reclaimed water in their residential households.. Given the design of the Aurora scheme, the most likely "improper uses" that were identified were:
    - a person drinking reclaimed water from an external tap; or

a person drinking reclaimed water after a cross connection between the potable and non-potable water supply systems occurred.Whilst Yarra Valley Water is experienced in managing water "quality" risks, managing the risk of "improper use" by customers is somewhat more difficult, and required consideration of how the scheme could be designed and managed so as to minimise the risk of improper use.

Statutes

In Victoria, there are a number of Acts, Regulations and Guidelines that impose legal obligations on a water company that supplies reclaimed water. While this report specifically addresses Victorian requirements, similar legislation exists in other jurisdictions.

Relevant Victorian statutes include (among others):

- the *Environment Protection Act 1970* (Vic);
- the *Health Act 1958* (Vic);
- the *Trade Practices Act 1974* (Commonwealth); and
- the *Water Industry Act 1994* (Vic).

The Victorian *Environment Protection Act* imposes liability on persons who cause or permit pollution. If a water authority supplies reclaimed water without implementing appropriate management controls, there is a risk that the reclaimed water could cause pollution of surface or groundwater bodies. The Victorian Environment Protection Authority's *Guidelines on the Use of Reclaimed Water* set out a range of management controls designed to ensure that the supply and use of reclaimed water does not pose a risk to the environment or to human health. Compliance with the Guidelines is likely to reduce the risk that pollution will occur. If pollution does occur, compliance with the Guidelines may reduce the likelihood that the Environment Protection Authority will seek to prosecute for an offence under the *Environment Protection Act*, or may mitigate the penalty that may be imposed by a Court as a consequence of conviction for a pollution offence.

Compliance with the Guidelines may also be a condition of the environmental approvals issued by the Environment Protection Authority for the construction and operation of the sewage treatment plant or the reclaimed water treatment plant.

For these reasons, it is considered highly important that the management system for the Aurora scheme is developed in consultation with the Environment Protection Authority and the Department of Human Services, and is approved by these authorities as complying with the requirements of the Guidelines.

Other relevant Victorian statutes include the *Health Act* , which makes it an offence for a person to cause a nuisance by doing something that is dangerous to health, or noxious or injurious to personal comfort.

The *Trade Practices Act* imposes liability if goods and services are not fit for their intended purposes or are defective. It also imposes liability for =conduct that is misleading or deceptive.

With regard to offences under the *Environment Protection Act* and the *Health Act*, it is considered unlikely that a water company would incur liability if a person uses reclaimed water for an improper purpose, or if a cross connection occurs for which they were not responsible, provided the water company implements appropriate management controls to reduce the risk of improper use occurring.

With regard to the *Trade Practices Act*, the water company needs to ensure that it informs customers of the nature of the reclaimed water and what it can be used for. This is no different to the issues that water companies face in delivering potable water, or to those who deliver untreated water. It is the supply of defective goods, as defined in the *Trade Practices Act*, which introduces a new dimension probably not normally faced by a water company. A ‘defect’ may exist if the good is not what a person is generally entitled to expect. From that perspective, it is probably reasonable for a person to expect to be able to drink from an outside tap. To reduce this risk of liability, customers need to be made fully aware of the purposes for which reclaimed water may be used, including by implementing measures such as colour coding and labelling external reclaimed water taps and erecting warning signs in suburban streets.

The Victorian *Water Industry Act* gives water and sewerage licensees in the Melbourne metropolitan area powers to construct and operate its systems. There is uncertainty as to whether the statutory powers granted to Yarra Valley Water under the *Water Industry Act* and other governing instruments made under that Act extend to the supply of reclaimed water. If Yarra Valley Water cannot rely on its statutory powers to impose conditions about the use of reclaimed water and to monitor customer compliance with , it must rely on its limited powers as a company. As a company, Yarra Valley Water would be unable to

impose conditions on customers about the use of reclaimed water via the mechanism of the "implied customer contract". As such, it would need to enter into a separate agreement with each customer for the supply of reclaimed water. Clearly, this is a disincentive to the supply reclaimed water. It would be preferable if the current uncertainty surrounding the extent of Yarra Valley Water's statutory powers in relation to reclaimed water was resolved by legislative amendments to the *Water Industry Act* to make clear that the supply of reclaimed water falls within its statutory functions as a water and sewerage licensee .

Common law

In addition to potential liability for offences under legislation, a water company may also be exposed to liability under the common law of negligence or nuisance in relation to the supply of reclaimed water for residential use.

The most likely cause of action against a water company is in negligence. To successfully sue in negligence, a claimant essentially needs to establish that the water company breached its "duty of care" to the claimant, and the claimant has suffered an injury or loss as a result. A water company will breach its duty of care to a person if it should have reasonably foreseen that its conduct in supplying reclaimed water could cause harm to a person, and it failed to do what a reasonable person in the water company's position would do to avert that harm.

Recent decisions in the High Court indicate that it is necessary to undertake a risk analysis to determine if a duty of care has been breached. This requires the likelihood and consequence of a particular risk to be determined, together with an assessment of what could be reasonably taken to eliminate the risk in light of the cost inconvenience and difficulty of doing so.

Minimising the risk of Legal Liability

One obvious way to reduce the risk of legal liability is to ensure the system is designed to minimise the risk of improper use. The Guidelines provide excellent advice in this respect, and the risk of legal liability will be reduced by taking measures such as:

- Colour coding of pipes, meters and taps;
- Keyed locks;
- Potable taps outside;
- Different hose fittings;
- Running a community awareness program;
- Educating employees;
- Operating the reclaimed water supply system at a lower pressure; and
- Keeping abreast of scientific knowledge and acting on this knowledge.

DISCUSSION AND CONCLUSIONS

The key areas of residual risk identified in the risk assessment from a third pipe system, assuming that design issues were able to be satisfactorily resolved, were:

- Uncertainty in the extent to which residents will use potable water and not use reclaimed water. If residents use more potable water and less reclaimed water than assumed, this could lead to excess water which is not able to be disposed of in an

acceptable way. The residents' usage of reclaimed water instead of potable water will depend on a variety of factors, including whether usage is mandatory (eg use of reclaimed water for toilet flushing), the constraints and costs associated with the usage of reclaimed water and potable water, and the extent to which residents will accept those constraints and costs.

- Improper use of reclaimed water by residents. This can be minimised by colour coding, signage and keyed taps. The likelihood of improper use could be further reduced by imposing constraints on its use (eg only to subsurface garden use); however, this less usual and may reduce the usage of reclaimed water and may lead to an increased risk of not being able to dispose of excess reclaimed water.
- The potential for cross connection occurring between the reclaimed water system and the potable water system. Cross connection may occur within the reticulation system (less likely), or within residences (more likely). Experience elsewhere (eg Rouse Hill, The Netherlands and the USA has shown that ensuring the absence of cross connections is difficult to achieve, and may result in the requirement to treat to a higher level such that cross connection would not be expected to present a health risk.

It must also be acknowledged that a possible strategy to reduce these risks is to treat the reclaimed water to a higher standard, eg to a level at which accidental use of the water for potable or recreational purposes would not be expected to adversely affect the health of persons involved. This is an approach that has been adopted in The Netherlands. Resolution of the appropriate level of treatment requires a business decision considering benefit, risks, and risk management processes.

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