Wastewater Treatment and Recycling in Urban Villages: Implementation and Policy Issues for Western Australia

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Abstract

With a drying climate and increasing urban populations many cities in Australia are facing drinking water shortages. In Perth, the capital of Western Australia (WA), summer water restrictions are common and in the face of declining rainfall the State Government is developing new water strategies.

One strategy involves a closer alignment and integration of land use planning with water management. This will require residential land developers to look at the total water cycle and how it fits into local and regional water plans. Another strategy, currently being trialled in WA and the focus of this research, involves the development of wastewater treatment and reuse systems for non-drinking water applications, such as irrigating public open space, in urban villages. By treating and reusing wastewater locally, developers can work with local and regional water planners to help reduce drinking water demand, whilst ensuring environmental flows are maintained.

In WA, two residential developments are installing decentralised wastewater, specifically greywater5, treatment and recycling systems; Bridgewater Lifestyle Village (BWLV) in Erskine and Timbers Edge Residential Resort (TimbersEdge) in Dawesville, refer figure 1. Both sites are located in high population growth corridors and environmentally sensitive areas that experience high water tables due to their proximity to the Peel Harvey Estuary. Both sites are currently under construction and represent two different greywater treatment systems and constitute the first trials of decentralised wastewater treatment and recycling within the Perth metropolitan area. BWLV is in the process of installing 380 greywater systems with a central overriding management system, with the treated greywater being used to irrigate the individual residences. Whereas TimbersEdge will have 260 homes connected to one central greywater treatment system, with the treated greywater then used to irrigate public open space within the development.

This paper will discuss: the complexities of getting the systems approved, including the legislative and regulatory constraints; the maintenance and monitoring schedules required to meet the environmental and public health issues; discuss the community involvement required to ensure that the systems are accepted and that the residents feel empowered and confident with the systems; and briefly discuss how these issues have led to the development of a new management tool, known as the DeWaTARS framework. The development of the DeWaTARS framework will enable the development and application process of future applications within the Perth metropolitan region.

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5 For the purpose of this paper, greywater is the term given to wastewater derived from the laundry and bathroom (not toilet or kitchen)
Introduction

Figure 1: Overview of the Greater Perth Metropolitan region, with Yanchep to the North and the City of Mandurah in the South. The Indian Ocean is to the West and the Darling Range is on the Eastern border. The map identifies the two case study sites in relation to the City of Perth and illustrates the study sites proximity to both the Peel Harvey Estuary and the Indian Ocean. Wetlands located within this region are generally shallow expressions of the underlying water table and are located on sandy soils.

The majority of Australians live in cities located along the coast. With rapidly increasing populations within these areas, there has been a trend towards high density, residential urban centres (Apostolidis, 2004; Apostolidis and Hutton, 2005). Perth, the capital city of Western Australia (WA) is a low-density automobile dependent urban sprawl, served by a centralised wastewater system and it is estimated that by 2051 the population will reach 3.2 million people (ABS, 2005).

In response, the Department of Planning and Urban Development has devised a strategy for Perth, known as “Network City”. The new strategy aims to transform Perth from a sprawling urban centre into an integrated transit-oriented series of urban villages connected by “activity corridors” that allow for the movement of people and freight (WAPC, 2005). This strategy offers Perth an opportunity to develop community scale decentralised wastewater treatment and recycling systems. Community scale systems offer new supply options previously unavailable in urban environments (Chanan and Woods, 2005). Currently, Perth’s wastewater is disposed of via centralised sewerage systems that discharge into ocean outfalls, sometimes described as “big pipes in, big pipes out” (Newman, 1993). With the expected increase in population, past projections have indicated that by 2007 new water sources will be required (Khan et al., 2004) and community scale treatment and recycling wastewater systems provide one option.

Following severe droughts in the 1980’s, Perth has experienced repeated episodes of below average rainfall frequency and intensity, which has seen drinking water resources accessed through catchment dams stretched (IOCL, 2002). For example, in 2001 there was an 18% decrease in rainfall going into water catchment dams, compared to the average rainfall figures for the previous 25 years; which included drought conditions in some years (Anon, 2004). Decreasing rainfall places pressure on groundwater extraction levels as water is drawn to replace the lower dam levels in the water catchment areas.

Perth is similar to other Australian cities where there is a cultural desire to have lush lawns and gardens that can equate to 50% of the total household water use (Mouritz and Hedgecock, 1992;
Loh and Coghlan, 2003; Anda and Ho, 2004; Radcliffe, 2004). Furthermore, as a community, Perth discharges more stormwater and treated sewage via ocean outfalls than is collected within the catchment area (Bjorland and McKay, 2001; Bixio et al., 2005; Cunliffe et al., 2005; Dillon and Ellis, 2004).

As in other developed countries the ability of the Australian water economy, to increase its volume of water supply has been hampered by economic and environmental factors, such as catchment volume variability and capped catchment and aquifer withdrawal levels. Despite this there has been no diminishing demand for water, rather, in most cases demand has been increasing. Water demand management is an ongoing challenge for cities. In WA many strategies have been implemented to encourage better water demand practices. These strategies vary from economic incentives, such as the waterwise rebate for water efficient appliances, public education programs on best practices for watering gardens and the implementation of summer water restrictions (GoWA, 2006 State Water Plan). Collectively, society can play a significant role in determining priorities and risk acceptability, therefore it is important to engage with community stakeholders by actively seeking their involvement in developing water options (Hartley, 2005; Hurlimann and McKay, 2005).

In Australia there is increasing interest in the local treatment and reuse of wastewater. The potential to reduce local demand by supplying non-potable water to residents at competitive prices is opening up new options to water management planners. The ability for these systems to operate independently from the traditional centralised system is providing avenues for urban fringe development, in areas that would otherwise be waiting upwards of ten years for central sewerage lines. Decentralised systems also allows for development in areas designated as high environmental impact zones/environmentally sensitive. For example development along the Peel Harvey Estuary system have strict environmental regulations to protect the receiving waters and associated RAMSAR wetlands, making traditional sewerage infrastructure difficult to install as the ability to bury the infrastructure deep underground is severely restricted. The shift away from centralised wastewater systems allows for solutions to treatment and recycling in diverse locations, that can be built to meet local needs, be cost effective and reduce the need to build bigger, more expensive treatment plants (Bischof et al., 1996).

A major concern of these emerging systems is the need for ongoing maintenance, operation and management. To ensure that best practices are achieved and the reduction of risks, the systems will need to have an integrated and well co-ordinated management system in place, as is current practice for the centralised wastewater system. One of the main reasons for the lack of uptake within the Perth metropolitan areas is the absence of clear legislative or regulatory frameworks.

In the urban areas of WA the uptake of reuse systems has been limited to large-scale or individual household scale projects. Large scale projects include the Kwinana wastewater recycling plant (KWRP) that provides treated wastewater for industry use (wastewater flows of >100kL/day). Individual household scale projects include aerated treatment units and septic tanks (wastewater flows of <1.8kL/day). However, on-site systems are not always feasible for urban developments that may be restricted by land size and the KWRP is currently only supplying recycled treated wastewater to local industry as the treatment plant is located within close proximity to the Kwinana Industrial area and there is no infrastructure in place to deliver the treated wastewater to residential developments. There are some 60 licensed wastewater-recycling projects in rural towns of WA where there is sufficient land available to implement wetland and lagoon technology. The economics of decentralised options in rural WA encourage these options, as outside of a couple of the large regional centres few centralised wastewater systems operate. In Perth there has been little incentive for developers to employ wastewater-recycling options within their developments and so there are no village scale decentralised wastewater treatment and recycling systems in operation.
As there are so few operational systems in WA there are few people qualified to install, operate and maintain the systems, with fewer maintenance services available (Dillon et al., 2004), therefore it is important for the successful implementation of these systems that a management framework is developed to help guide the application process and to ensure that the developers are fully aware of their obligations for maintenance, operation and monitoring. A review of the current management arrangements of other Australian and overseas examples has shown that the single home unit or large-scale municipal wastewater treatment plants are no longer the only two user categories capable of managing and operating a decentralised wastewater treatment system as outlined by WA Health Regulations. It is now possible to identify two new categories that can be considered viable user groups, these are:

- Small scale developments: 20 to 1,000 kL/day (10 – 500 households)
- Medium scale developments: 1,000 to 10,000 kL/day (500 – 5,000 households)

The use of flow capacity to describe each development has been chosen as the distinguishing factor between small and medium scale developments. This is in opposition of the Department of Planning and Infrastructure (DPI) use of acreage size as the distinguishing factor. Flow capacity was chosen as the distinguishing factor as urban villages tend to have high population densities on a smaller acreage, especially with the DPI requirement that all new developments dedicate 20% of the acreage to public open space. Another determining factor was that most regulated technological requirements are based on flow capacity i.e. the number of connections, rather than the size of the development.

With this in mind and the need to develop multiple water strategies, the WA State Government is investing in the research of practical case studies that assess the viability of decentralised wastewater schemes at the village scale. The first case study site of the research is Bridgewater Lifestyle Village (BWLV) located in Erskine, south of Perth, and encompasses 380 individual greywater systems centrally managed with primary treated greywater being used to irrigate the gardens of each home. The second site is Timbers Edge Residential Resort (TERV) located in Dawesville, also south of Perth, and encompasses 260 homes connected to one centrally managed greywater treatment system with the tertiary treated greywater being used to irrigate the estates public open space. Both of these sites are located in a high population growth corridor on the Peel Harvey estuary system, within close proximity to RAMSAR protected wetlands and experience high water table levels. In order to meet environmental and public health concerns, innovative solutions would be required with each site employing a wastewater treatment and recycling system that mimics natural processes.

The following sections will describe the specific case studies and the systems utilised; the difficulties in getting the systems operational such as the community objections and specifically the legislative constraints; the management requirements and outlines the DeWaTARS framework that is being developed to assist the implementation of decentralised systems.

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6 The Convention on Wetlands was formulated in 1971 and is an intergovernmental treaty that conserves wetlands of significant importance around the world. It is more commonly known as the RAMSAR convention, after the Iranian city in which the convention was signed. There are currently 153 member parties covering over 145.6 million hectares of wetlands.
Case Study Descriptions

Bridgewater Lifestyle Village

Photo 1: Bridgewater Lifestyle Village: The Peel Harvey Estuary is on the right and the Indian Ocean is on the left. Perth is to the North. This image illustrates the fragile location of the project site, to the right of the development a series of RAMSAR protected wetlands can be seen, and the importance of whole of water cycle management to ensure the safety of any potential receiving waters.

BWLV is located in the new locality of Erskine, Western Australia and is a development of National Lifestyle Villages Pty Ltd using the land-lease model under the Caravan Park Regulations Act. The total site area is approximately 20 Ha and is located directly on the Peel Harvey Estuary. The Estuary is under significant environmental pressure from many sources and it is important for the region to ensure that any residential development along the fringe is subjected to strict environmental controls.

Many of the wetlands located along the fringes of the Peel Harvey Estuary are designated RAMSAR wetlands and as such have strict regulations as to the land uses that surround them. Bridgewater Lifestyle Village abuts one of these designated wetlands, as seen in Photo 1, and as such the residences located near the eastern boundaries experience high water tables.

The development consists of 380 home sites with a central village clubhouse with recreation (swimming, gymnasium, lawn bowls, tennis) and social (cinema, BBQ area, video/book library) facilities. The residents, known as “lifestylers”, buy their home and lease the land for 60 years; this arrangement includes all services mentioned above as well the costs of operation and maintenance of the greywater system. The villagers are also encouraged to recycle their solid waste on site wherever possible. For example, kitchen waste is fed into the village worm farm and paper waste is being recycled into new paper. The lifestylers also enjoy the benefit of solar passive designed homes and roads, village orchard, village chickens and native species landscaping in home gardens and public open space.

The approved greywater system being used is known as the “Grey-flow” system and has been applied to every residence over the four stages of the development. In Stages 3 and 4, 88 houses, it has been necessary to include a nutrient reduction strategy for each system, as the Annual Average Maximum Groundwater Level is less than 500 mm in these areas. It was determined that a lined evapotranspiration trench (ETT) would be most effective with each ETT being 7m long and 450mm deep, with the width dependent on number of bedrooms per house. The ETTs are filled with aggregate and planted with local native sedges and water tolerant plants with luxury uptake capacity. Winter surplus diverts the treated effluent to the surrounding soil via a correctly sized leach drain. The ETTs are a landscape design feature in each yard in Stages 3 and 4. Each system automatically bypasses all greywater flow to the sewer in the event of pumping system failure or whilst maintenance is being conducted.
Timbers Edge Residential Village

Photo 2: TimbersEdge Residential Village: on the right is the Peel Harvey Estuary and the Indian Ocean is top of picture. Perth is to the North and Bridgewater Lifestyle Village is approximately to the left of the N symbol. This image illustrates that fragile location of the project site and the importance of whole of water cycle management to ensure the safety of any potential receiving waters.

The Timbers Edge Residential Village is a strata-titled land tenure system situated on approximately 18 Ha of land adjoining the environmentally challenged Peel Harvey Estuary. The village will have 260 homes within its boundary with a central community space that includes parks, swimming pool and other recreation facilities.

The 260 homes will be connected to one centrally managed subsurface flow or “Biofilter” greywater treatment system with the treated wastewater being used to irrigate the estates public open space. The greywater is collected from the shower, laundry and basins of each residence and is then pumped to a central greywater treatment and recycling system, with central management of the system. The Biofilter is a series of 5 lined constructed wetlands and will also include a specially designed final wetland for phosphorus removal. The latter is filled with various layers of nutrient absorbing substrates. The residents will manage the village through their own incorporated body with annual fees being raised to cover the costs. The financial and administrative responsibilities will be delegated to a strata management company and the management and operation of the system will be outsourced to a suitably licensed operator.

Discussion/Results

I. Difficulties in getting the systems operating

Due to the infancy of the wastewater recycling industry in WA there was an expectation a number of problems and issues would arise during the implementation phase. With this expectation, a brief search of the available literature was conducted in order to identify some of the problems encountered in other wastewater projects, both in Australia and overseas. A survey conducted on the Mawson Lakes wastewater project in Adelaide, Australia, highlighted the need for good community education and consultation showing that less than two thirds of the residents interviewed were aware of the proposed third pipe delivery of treated wastewater despite concerted efforts undertaken in the education of residents (Mitchell, 2004). In a further study, McKay and Hurlimann (2003) and Po et al (2003), concluded that people over 50 years of age have the most objections to wastewater recycling. This could pose a significant concern for these projects, as the majority of residents would fit into this age category. In addition, it also highlighted the need to employ an effective community education program, with further research being conducted into the success of various education methods.

By doing background research many of the common errors that arose could be mitigated against. Common issues such as the problem of untrained/unskilled installers working on projects has been mitigated by having the staff installing the systems instructed directly by the system designers; thus ensuring that there is no confusion, the correct materials are used and that there is a consistency of process used for installation.
Even still problems arise. A common issue is the lengthy approval process, although this was somewhat diminished by ensuring that all paperwork was completed in a timely matter. This issue could not be alleviated, as the legislative and regulatory frameworks for wastewater recycling are not clear (refer Legislation section for full details). The project delays highlighted this shortfall and provided valuable feedback that assisted the development of a workable framework for future projects.

The developments have also highlighted the need for developers to be organised and to be creative/adaptive to changes as they occur. The two separate case study sites highlight two very different approaches to project development. BWLV is one of a series of Villages under the National Lifestyle Villages Pty Ltd (NLV) portfolio using the land-lease model. This model is similar to a caravan park where the residents own their transportable homes and then lease the land from NLV. The weekly rental payments include the full use of the community facilities and as well as the monitoring, maintenance and operation costs, with the residents being responsible for replacing any parts on their greywater system. All the villages in the NLV portfolio, whilst having their own separate identity, have a similar feel about them, however this is the first attempt by NLV at recycling wastewater within their developments. The series of villages around the Perth area has led to a very well organised development team, which have all embraced the sustainability agenda and implement sustainable building, water and energy practices into each of the villages and with each new village undertaken the procedures become more streamlined.

The TimbersEdge development is a single one off development undertaken by Peel Waters Pty Ltd (Peel) using the strata-title model. The developers do have other village projects but they appear to be unconnected to each other, as each development has individual land lots that are owned entirely by the resident, leading to a more eclectic look to the homes. Each individual home pays an annual fee that is then used to pay for the communal facilities including the greywater treatment system. In this respect the developers of BWLV had a slight advantage as they had previously employed sustainable building and energy elements into their previous developments with wastewater recycling a logical next step that could be easily incorporated into the project timeline. Although the residents at TERV appeared to feel more empowered with the system as their elected members to the management body had a more hands on and direct contact with the system.

One issue that arose that was unforeseen at the beginning of the project was the importance of land sales staff education. Education of land sales staff team on the land area requirements for bio-mimicry systems, such as the evapotranspiration trenches utilised at BWLV, will ensure that residents build appropriately sized homes whilst leaving enough room to install the system. Education of staff will also ensure that the potential residents are aware from the outset that there will be wastewater recycling occurring within the development and that there are certain expectations and obligations on each resident, such as the use of correct washing powders and cleaning products.

1.1 Specific Legislative difficulties

Legislative and regulatory frameworks for wastewater management have significant impacts on the implementation of decentralised wastewater treatment and recycling systems. By creating a legislative framework that supports and encourages the implementation of decentralised systems, new water supply and treatment markets can be developed (Mattila, 2003), which can lead to the development and growth of a new sustainable water industry. In WA, the current framework has discouraged the deployment of decentralised wastewater systems within the Perth metropolitan region, resulting in few systems being implemented. Those systems that are in operation, or under construction, have experienced approval delays, confusing regulatory requirements and increased
set up costs. Although some projects have been able to negotiate lower headworks charges with Perth’s only water utility, the Water Corporation, a clearer more transparent Headworks Contributions Policy needs to be developed to act as incentives for developers. For example, in the Peel-Harvey region, on the southern rim of the greater Metropolitan Region of Perth, there are several wastewater-recycling projects seeking approval. Due to their proximity to the Peel-Harvey Estuary and nearby associated RAMSAR wetlands, there are concerns of possible environmental impacts on the receiving waters and the underlying aquifer. This perceived threat needs to be put into context considering the much larger problem of nutrient inputs from agriculture further upstream that has lead to the significant environmental impacts (including toxic events) in the estuary (Lavell et al., 2005). As a consequence, the environmental fragility of the area makes it not ideal for urban development. However, the awkward geography of the area and limited groundwater supplies lends itself to decentralised reuse schemes with reliable treatment methods as an economically viable option.

Research into the legislative constraints in WA highlights the WA Government Sewerage Policy 1994 and the WA Health Act 1911 (the Act) as two critical documents that complicate and/or restrict the adoption of decentralised systems (Strang, 2005). The Government Sewerage Policy (the Policy) states that:

I. All subdivision density development to be provided with reticulated sewerage, except where certain discretionary provisions may apply;
II. Unsewered subdivision or density development not to exceed R12.5* within the inner metropolitan area;
III. Subdivision or density development exceeding R5* in the outer metropolitan area to be subject to the provision of reticulated sewerage, except in certain circumstances set out in the policy, e.g. aged person’s accommodation.

(* R# are town planning terms and refers to the housing density per hectare. The higher the R number the more dense the development per hectare)

Therefore the Policy requires mandatory connection to the centralised sewerage system of all developments within the Perth Metropolitan region, where the majority of West Australians live, unless there are mitigating circumstances. Although mitigating circumstance provides scope for discretionary approval, the application process is complicated and requires creative solutions to many issues.

All urban developments can be provided reticulated sewerage for the collection of wastewater eventually and there is no conflict with either the Policy. The development of decentralised treatment plants with localised reuse of treated effluent, however, does come into conflict with the Policy, as the Policy is outdated and does not recognise that with the development of new technologies, the smaller land areas with higher residential density can support decentralised systems. Furthermore, the Economic Regulation Authority (ERA), which is the department that approves all new wastewater service licenses, and encourages new water service providers, bases their approval process on the Policy and it is for this reason, that the Water Corporation maintains its sole provider status for the Perth metropolitan area.

Within a legislative and regulatory context, the unchartered area of decentralised systems in urban areas of Perth has been shown to be a major deterrent for developers (Strang, 2005). Once a developer has decided to embark on this process and investigate the requirements for such a system, they encounter another stumbling block, that of the WA Health Act (the Act).

The Act provides regulatory guidelines on water quality measures, maintenance, operation and monitoring requirements. Complications occur when developers wish to install systems into
developments when either more than one connection to a system is desired, for example a caravan park with several cabins; or where several systems are maintained by one central management and operation system, for example a residential sub-division.

These systems are currently most constrained as they sit outside the current guidelines for approved wastewater system users, with the Act only identifying single households and large wastewater treatment plants (Strang, 2005) as suitable system users. With no regulatory guidelines to assist, developers have been tentative in implementing decentralised wastewater systems and as such only greywater recycling projects have been approved.

II. Maintenance and Monitoring to meet Environmental and Public Health requirements

Each development has been required to develop an Operating, Maintenance and Monitoring Manual that abides by each of the following documents:

I. Greywater Reuse System (Grey-Flow) - Conditions of Approval, App. No. GW0402 (Department of Health, 2005)
II. Nutrient and Irrigation Management Plan (NIMP) for BWLV NLV (2006).
III. Required contents of an OPERATION AND MAINTENANCE MANUAL for a recycled water scheme (DoH, 2004), Section 1
IV. Code of Practice for the Reuse of Greywater in Western Australia (DoH, 2005)

Each Manual is required to provide the following information:

I. Detailed description and diagram of the system components;
II. Designated roles and responsibilities outlined;
III. Operation and Maintenance outline for the system;
IV. Operation and Maintenance outline for the subsurface dripline irrigation;
V. Detailed site plans, including house plans and system location; and
VI. Occupational and Health Safety procedures.

Monitoring will be conducted on both systems with Lysimeters being used to determine the effect, if any, on the underlying groundwater system. It is expected that the monitoring will contribute to the knowledge of these systems and to help build confidence within regulators and legislators towards decentralised wastewater systems.

III. Community involvement

The two case study sites have different management approaches. BWLV has a more active role with the residents in the operation and management of the greywater system. Having the residents involvement with the system is essential at BWLV as there is an individual system for each residence, and with the treated greywater being used directly in the residence gardens it makes sense that there be a role for them. TimbersEdge has less resident responsibility with the system directly, as the treated greywater occurs away from their homes with the treated greywater being used to irrigate public open space.

However, both case study sites are aware of the importance of community education on the systems and have placed mechanisms within their system management structure to ensure optimum efficiency of the systems. BWLV has placed within their Operating, Maintenance and Monitoring Manual specific tasks that the residents are obliged to undertake. For Example, the householder should notify BWLV staff immediately in the event of any visible greywater ponding, strong
odours or structural damage to the Grey-Flow unit; avoid disposing of any chemicals or materials down household sinks that may affect the functioning of the Grey-Flow unit; the householder is to provide top-up mulch over the dripline to a minimum depth of 100mm at all times and should and problems arise contact the BWLV maintenance staff in order that the greywater can be diverted to sewer while the system is inspected.

At TimbersEdge the responsibility for carrying out the Operation and Maintenance requirements is borne solely by the Timbers Edge Corporate Body, with a fulltime caretaker being appointed to take care of the day-to-day servicing of grounds and infrastructure. The residents will be encouraged to observe the public open space and report any unusual occurrences, such as visible ponding of water.

The residents of both villages will be invited to participate in workshops that are designed to inform them on the systems, the safety implications and to educate them on best practice for disposing of chemicals so that the systems work within their optimal range. It has been noted that the residents of both villages are keen to be involved with the systems and continued research is underway the will help formulate best practice for community education programs for these type of projects.

IV. DeWaTARS

The assessment of the case studies has led to the development of a new management concept known as decentralised wastewater treatment and recycling systems or DeWaTARS. The concept focuses on six main criteria that need to be assessed when initiating a decentralised project:

I. The ability to develop and implement a risk assessment and management plan;
II. Public Liability insurance cover for residents and Workers Liability insurance for employees undertaking maintenance work on the system;
III. Management infrastructure needs to be in place to ensure that timely and efficient management of the system occurs;
IV. Ability to monitor the system;
V. Technical ability to maintain, operate and update the system;
VI. A cost recovery mechanism that is fair and equitable.

The key criteria have been identified to ensure that public and environmental health is maintained (Strang, 2005). The DeWaTARS concept focuses on closing the water cycle loop at a local scale with localised reuse of treated wastewater, initially for private and public open space irrigation, with scope for other reuse applications such as indoor toilet flushing, should the current legislation change. The concept also provides regulators and developers a tool for assessing application details that ensure: on-going maintenance and monitoring controls are in place; the integrity of the technology is sound; that there is a fair and equitable pricing system in place; and that a risk assessment and management plan is completed and implemented for both the construction and operating phases.

By using DeWaTARS regulatory authorities, involved in DeWaTARS implementation, can provide guidance to developers with simple parameters that: can apply to any treatment and recycling system that is independent from the centralised wastewater system; involves either multiple connections to the chosen technology or the central management of several on-site systems; ensures that the treated wastewater is used for local reuse whether that be for in-house, ex-house or for public open space irrigation; has centralised management by a wastewater service provider, who ensures operation, regular maintenance and monitoring; can include any technology that has been approved by relevant regulatory authorities.
This concept is still under development with the outcomes of the case studies ensuring that the concept is practical and easy to use. For example resident education programs are part of the concept, but how much can we expect developers to deliver; what are the best methods of delivering the necessary information; are different methods better for certain age groups. Although all of these questions may not be answered, considerable knowledge can be learnt, such as the level of communication and education of everyone involved affect the success of any decentralised wastewater projects, this includes the training of residents, maintenance staff, regulators and developers. The developers will assess the concept along with WA regulators and legislators to obtain their feedback and ensure that it is taken into consideration for the final model.

Conclusion

The development of decentralised wastewater treatment and recycling systems overseas and interstate has led to the WA State Government investing research into the feasibility of these systems in urban areas of the State Capital, Perth. The uptake of decentralised systems has been hampered in WA by unclear legislative and regulatory frameworks, where village scale treatment and recycling is not considered viable.

The two case study sites have shown that community involvement is important for the uptake of these systems by the residents living with them; that descriptive operating maintenance and monitoring manuals are essential to ensure that all public health and environmental concerns are being addressed; and that the new DeWaTARS management framework tool can provide guidance to developers utilising decentralised systems within their developments and assist them with the application process by ensuring that all relevant information required by the various legislative and regulatory bodies is collated.

Although the case study sites are still under development it is hoped that these developments will validate the assumption that decentralised wastewater recycling can be viable and sustainable options for securing WA water supplies.

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**Acknowledgements**

This research could not have been conducted without the WA Premiers Water Foundation, Murdoch University, National Lifestyle Villages Pty Ltd and Peel Waters Pty Ltd.