Department of Environment
and Resource Management

Toward a Water Sensitive Future

Toward Q
Tomorrow's Queensland

Queensland Government

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#29413

How to use this handbook

In a changing world, traditional, non-integrated approaches to water supply, wastewater disposal and waterway management may no longer satisfy the wide-ranging expectations of governments, industries and the general community. Major advances in aspects of urban water management have been made in the last decade, such as water sensitive urban design and integrated urban water management. Regulatory changes and industry-based technical information have steadily been introduced to facilitate these improved approaches. However, they still separate water supply and environmental water management to a degree. Therefore, scope remains to further integrate water management in the urban context. The term water sensitive is used to describe this holistic approach to urban water management.

The Queensland Department of Environment and Resource Management (DERM) has prepared this handbook to assist urban water managers to undertake more holistic planning. The handbook differs from DERM guidelines in that its primary purpose is not to facilitate compliance with specific legislation, but to assist with an improved overall approach to urban water challenges.

The handbook provides a stepped process for developing solutions which have multiple benefits and highlights the key ingredients for success at each step. These ingredients have been identified from real experiences of local governments and other water service providers in Queensland and interstate who have successfully implemented innovative solutions to urban water challenges. Case studies of various scales of urban water management, that is, regional, metropolitan, coastal and inland, demonstrate what can be achieved and how challenges have been overcome.

The handbook does not offer technical solutions to specific urban water issues, although sources of technical, legislative and planning information and tools are provided in the final chapter. The intent is to outline a general process which can assist urban water managers to show leadership in water cycle integration and water security for its many different users. Importantly, the handbook recognises that small achievements are just as valid as large, fully integrated projects, as long as opportunities for environmental, social and economic benefits are maximised during the planning and implementation process.

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What does water sensitive mean?

Water sensitive refers to managing all aspects of water in the urban context for towns, cities, catchments or regions, large or small. This approach considers the whole water cycle and aims for multiple benefits for all water users. The approach is based on the National Water Initiative (NWI) concept of water sensitive cities which combines integrated water cycle management and water sensitive urban design as described in the following excerpt.

> 'Water sensitive urban design and developments are not enough to create water sensitive cities unless they form part of a larger, coordinated approach to urban water management. The integrated management of all water sources, so that water is used optimally within a catchment resource, state and national policy context, is termed integrated urban water cycle management. This approach promotes coordinated planning, sustainable development and management of the water, land and related resources (including energy use) linked to urban areas and the application of water sensitive urban design principles.'[1]

What are the features of a water sensitive urban area?

Recent work has developed a water sensitive vision for urban centres. According to this vision, an urban area which has reached water sensitive status would demonstrate the three fundamental, integrated components of different supply sources, healthy ecosystems and informed community attitudes to water[2].

› Diverse sources of supply

A shift away from	To
The traditional reliance on rainfall and surface storages as the sole source of water supply.	A diverse portfolio of supply sources such as dams and reservoirs, groundwater, urban stormwater, rainwater tanks, recycled wastewater, greywater reuse and desalinated water. A mixture of centralised and decentralised systems.

The benefits

- Improves water security by reducing reliance on catchment rainfall as the sole source.
- A mix of centralised and decentralised systems builds greater resilience to short-term climate variability, long-term climate change and population growth.
- Reuse of previously wasted water can avoid the need for new, expensive water supply options.
- Greater energy efficiency leads to a reduced energy footprint and greenhouse emissions.
- The scale of infrastructure can be matched to the scale of need.
- Systems supply water to the quality needed for the use, e.g. no need to supply potable water for outdoor irrigation or toilet flushing if other sources are available.

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[1] www.nwc.gov.au

[2] Adapted from Wong, T & Brown, R, 2008, Transitioning to Water Sensitive Cities: Ensuring Resilience through a new Hydro-Social Contract. 11th International Conference on Urban Drainage, Edinburgh, Scotland.

› Healthy waterways and ecosystems

A shift away from

Seeing waterways as a drain, or a vehicle to dilute and transport waste.

To

Waterways and associated open spaces provide a range of ecological functions such as healthy aquatic ecosystems for flora and fauna, carbon sinks, natural cooling of the urban environment and food production capability.

Managing the whole catchment, and not just the waterway, recognising the role of natural green infrastructure that stores and uses water in productive ways.

The benefits

- Restoration of waterways and open spaces leads to improved ecosystem condition and liveability for the community.
- Multiple benefits through recreation and active lifestyles and improved aesthetics.
- Catchment and waterway activities can involve and bond community members with social benefits.

› Informed and supportive community

A shift away from

Seeing water as an abundant resource that is available on demand for minimal cost.

Seeing engineering solutions as the key to solving all water issues.

To

Increased capacity of urban water organisations to advance sustainable water management, supported by appropriate institutional arrangements and skilled personnel.

Widespread awareness of water scarcity so that supply/demand gaps in water resources are met by demand reduction as much as possible.

Community involvement in defining and solving urban water issues.

The benefits

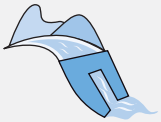
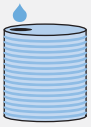
- Water consumption across entire communities can be significantly reduced via effective behavioural change programs.
- Community involvement improves the general understanding of the true value of water.
- Increased skills in the water industry grow from enhanced water literacy which leads to greater innovation in technical and social solutions to water issues.
- New local economies can develop around sustainable solutions to water issues.

There are many advantages to adopting a water sensitive approach. A courageous decision to do things differently can enable multiple benefits to be achieved and often leads to greater opportunities down the track. The following diagram suggests a few water sensitive opportunities in the urban context.

Urban centres in Australia are beginning to make substantial advances in one or more of these areas. Achievements to date are explored later in the handbook, but first, it is helpful to understand the urban water journey so far, where we currently are and what a water sensitive future might look like.

The urban water story

The method of managing water has evolved considerably since urbanisation began in Australia. The broad timeline below outlines the progression from the traditional approach of centralised water supply and wastewater infrastructure to the integrated water cycle management of today and the water sensitive vision for the future.

Phase (Approach)	Focus	Characteristics	Example activities
Past (Traditional)	**Water supply** 	• Driven by water supply access and security • Delivered by supply infrastructure • Centralisation of water supply, funded by taxes • Safe, cheap, limitless volume of water	• Construction of dams and pipelines
	Sewerage 	• Driven by public health protection • Delivered by sewerage schemes separate to water supply • Reticulated sewerage system discharging to waterways, funded by taxes/levies • On-site septic systems in areas where reticulation too costly	• Construction of reticulation systems to dispose of effluent
	Drainage 	• Driven by flood protection • Delivered by drainage channelisation to convey stormwater out of urban areas into receiving waterways • Waterways not a valued part of the urban landscape	• Waterways piped and located underground • Channelisation of river systems to allow more urban development in floodplain areas
Present (Transitional)	**Waterways** 	• Driven by social amenity and environmental protection • Delivered by management and/or regulation of point and diffuse sources pollution • Visual and recreational values of water integrated into planning • Active involvement of multiple stakeholders, e.g. community and environment groups	• Development of wetlands and bio-filtration systems to protect receiving waterways • Replacement of septic tanks with centralised sewerage systems
	Water cycle 	• Driven by limits to the ability of traditional water sources to supply growing populations and for waterways to handle pollution • Delivered by an integrated or total water cycle approach • Co-management of the water cycle among government, business and the community	• Integrated water cycle strategies which incorporate water conservation measures plus a range of supply sources (e.g. rainwater, stormwater, recycled effluent and seawater) that are fit-for-purpose (e.g. potable, irrigation or industry)
Future (Preferred)	**Water sensitive** 	• Driven by intergenerational equity and resilience to climate change • Delivered by adaptive, multi-functional infrastructure and urban design that reinforces water sensitive behaviours • Water professionals have the capacity for innovation and institutional arrangements are flexible to enable adaptive water management • An engaged community which supports sustainable lifestyles	• No urban centres have fully reached this stage yet, but waterway and water cycle achievements are all part of a water sensitive approach

[3] Adapted from Brown, R, Keath, N & Wong, T, 2008, Transitioning to Water Sensitive Cities: Historical, Current and Future Transition States. 11th International Conference on Urban Drainage, Edinburgh, Scotland.

Where are you and what does this mean?

- There is no set order for things to be done. A water sensitive approach can be taken no matter where you currently are.
- The scale of the urban water situation does not matter. Whether you are an inland rural council or coastal city, the same principles apply.
- Moving towards the water sensitive end can be achieved with small, incremental steps. You do not need to tackle every water issue at once to make a difference.

How to get started

› Different triggers

A decision to change the way urban water is currently managed is often linked to a trigger or catalyst, for example:

- water security or supply resilience—population and climate pressure on current supplies
- drought response—short-term water shortages
- regulatory changes—new requirements for environmental improvements, e.g. Total Water Cycle Management Plans, Healthy Water Management Plans, State Planning Policy (Healthy Waters) and tighter effluent discharge conditions
- monetary—emergence of new funding opportunities
- community pressure—groundswell from the public to change practices owing to concerns about waterway degradation, aesthetics or other drivers
- sustainability—commercial decisions to promote sustainability.

Each trigger will generate its own detailed set of issues to explore and address. However, no matter how large or small the water management challenge or opportunity may be, the process to develop a water sensitive solution will benefit from a sound, logical approach.

› The roadmap

The roadmap to develop a water sensitive solution involves five basic steps. These steps guide you through a logical process of understanding the issues, exploring the possibilities, choosing the path that best suits each situation, gaining approval or endorsement to proceed and implementing the project. At each step there are potentially many opportunities to embrace and challenges to overcome. Analysis of water sensitive projects undertaken in Queensland and elsewhere has revealed a number of ingredients for success and potential minefields to navigate. Key ingredients are provided at each step of the roadmap and links to case studies which illustrate what has been achieved by others.

The roadmap focuses on good process that is applicable to any situation and any scale of problem. It is not just about finding the best technical solutions.

Key ingredients	Step	Case studies
• Courage and leadership to tackle the issues—a champion for the cause • Early engagement with internal and external stakeholders and appropriate forums to scope the issues • The support of key decision-makers, particularly approval agencies • Catchment-wide approach to identifying underlying causes of issues/problems	**1** **Understand** Develop a holistic and shared understanding of the issues	**A project champion for demand management in the Central Highlands** • How the commitment of a project champion achieved a low-cost approach to reducing consumption **Stakeholder engagement shapes Pimpama–Coomera Waterfuture Master Plan** • Critical role of stakeholders in developing an integrated plan
• The right mix of people to contribute ideas and challenge traditional approaches • Relevant technical investigations—what has previously been done by others • Appreciation of the specific catchment context—avoid assumption that what has worked somewhere else will necessarily work here • Thorough investigation of opportunities to align with corporate strategies, other major plans or regulations and external/internal funding criteria • Potential problems identified and exploring options • Opportunities to co-design projects with partners from the outset	**2** **Explore** Look into what is possible at each stage of the water cycle, while considering the needs of all users	**Exploring urban water supply options for Kyogle** • A process that allowed multiple stakeholders to consider many options **Exploring industrial water supply options for Kwinana** • Various options for industrial recycled water industry were explored, but a specific trigger ultimately drove the solution
• Thorough evaluation of the strengths and weaknesses of each option in social, environmental and economic terms • Stakeholder involvement in the decision-making process to engender ownership of the preferred solution • Existing (or planned) regulatory frameworks, governance arrangements, funding sources, human resources and implementation tools are in place to enable the preferred solution to proceed • Engagement with approval agencies to identify potential critical issues • Endorsement of the preferred solution by the champion	**3** **Choose** Choose a water sensitive solution which solves the core problem and provides optimal additional benefits	**Community involvement in developing the Gowrie Creek Catchment Management Strategy** • A community-endorsed strategy with multiple benefits **Securing Dalby's water supply** • Challenges of partners, timing and external funding
• Continued engagement with key decision-makers and approval agencies • A compelling case for action that demonstrates – stakeholder support – fit-for-purpose technical solutions – regulatory compliance – realistic costs and multiple benefits – appropriate implementation tools and sufficient resources – operational and maintenance issues and costs fully addressed – council's role and the roles of others – achievable funding strategies and timeframes	**4** **Approve** Gain timely approval with stakeholder support	**Overcoming challenges in a new residential development in Brisbane** • Development approval challenges of being an eco-development pioneer **A compelling case for stormwater harvesting in Orange** • How regulatory hurdles were overcome to secure water supply
• Ongoing leadership by the project champion to maintain momentum • Ongoing involvement of stakeholders, including approval agencies, to resolve issues in an integrated way and maintain flexibility in project delivery • Project partners who share common goals and are committed to delivering within the timeframes required by funding bodies and approval agencies • A project team with the necessary skills and an operating environment that facilitates efficient delivery by the team • The most appropriate tools, for example education and behaviour change, active community involvement, regulation (e.g. planning schemes, policies), incentives (e.g. rebates, subsidies), pricing mechanisms (e.g. levies, rates, differential pricing) and engineering design guidelines (e.g. water sensitive urban design).	**5** **Deliver** Implement a water sensitive project that meets the agreed multiple objectives	**Innovative effluent reuse in Wide Bay** • Strong leadership has led to multiple and ongoing environmental, social and economic benefits **Introducing recycled water for industry in Toowoomba** • Project partners with shared goals achieve timely implementation **Implementing change through the planning scheme on the Gold Coast** • Implementing change through the planning scheme

The following chapters of this handbook provide further information on success stories and lessons learned for each step of the roadmap. Each chapter is colour coded to match the corresponding step of the roadmap. Detailed analysis of case studies provides a range of insights from real projects and shows the water sensitive gains that have been made. In each case study, achievements against the three water sensitive components are indicated by the relevant icon.

› Diverse sources of supply

› Healthy waterways and ecosystems

› Informed and supportive community

1. Understand the issues

› Why is this important?

A critical first step toward developing a water sensitive solution is to clearly and holistically understand the issues surrounding each urban water situation. A complete picture is needed so issues and causes of problems can be identified. It is important that stakeholders share this understanding and help decide the objectives for future action. For example, early involvement of key decision-makers within councils will greatly assist in getting internal support. Similarly, early engagement with the regulatory agencies involved in approving new approaches will make project implementation a smoother path later on.

Another key factor is to convince decision-makers and stakeholders a problem exists and the proponent genuinely seeks an innovative solution. This requires a project champion who is committed to seeing the process through to implementation and beyond. A champion can be an elected representative or senior official in the water utilities area. Although the champion is vital at all stages of a project, the key role at the start is to generate commitment and momentum in potential partners and stakeholders as well as lay down ground rules for an open and inclusive process.

› Key ingredients

	Important things to consider
› Courage and leadership to tackle the issues	Do we have a champion for the cause who has the leadership and influence to see this through?
› Early engagement with internal and external stakeholders and appropriate forums to scope the issues	Who are the right people to input their ideas? Who do we need to consult with to identify the range of stakeholders who should be involved? What forums should we plan in order to reach wide-ranging stakeholders from government, all water user sectors, business, community and environmental groups? If we decide to create an advisory group how can we best support the group so it functions effectively?
› The support of key decision-makers, particularly approval agencies	Have we identified and engaged with key decision-makers within our organisation? Which approval agencies will have a role in giving the green light for our ultimate decision? What is the best way to engage with approval agencies?
› Catchment-wide approach to identifying underlying causes of issues/problems	Have we considered our water supply issues within the context of the wider catchment? What are the interactions between various elements of the water cycle, e.g. urban and rural land uses, current and future surface and groundwater extraction rates, wastewater discharges, water quality, waterway and riparian health, stormwater and flooding, environmental flows and use of open space associated with waterways?

› Case study one: A project champion for demand management in the Central Highlands

Case study one showcases a demand management program in Central Queensland that succeeded because of the courage and leadership of a strong internal champion. It is an example of a low-cost approach to managing high water consumption in inland mining communities and focuses on the demand management side of water supply.

Highlights

- Leadership of a project champion changed Central Highland Regional Council's (council) approach to managing residential water usage
- Behavioural change can be a valuable, low-cost solution
- A compelling case for action was the key to project approval.

Drivers for change

Urban centres in the Central Highlands of Queensland are experiencing rapid population growth, driven largely by the mining sector. New residents tend to use large amounts of water, a behaviour attributed to high disposable incomes coupled with lack of awareness of local water supply issues. Innovative, low-cost options are required (in the post-amalgamation era of limited council funds) to address the problem.

What was achieved

Council faced the situation where water consumption in some locations exceeded the capacity of existing infrastructure to supply daily requirements. Council decided on a lower cost option which focused on reducing per capita demand via a behavioural change program.

A Drought Management Plan was prepared in 2008–9 which brought in permanent Level 0 restrictions related to garden watering.

In 2009, an education program commenced with water conservation messaging on local radio and in newspapers as well as water saving tips on the council website. Particular communities with high usage were named in the local newspaper to raise awareness of where the hotspots were. The importance of accurate consumption data was recognised during this process, and has resulted in 100 smart meters and relevant software being purchased in order to run a pilot program in a high-use locality. The aim of that approach was to gain a detailed understanding of usage patterns from the trial and use the data to inform further strategies such as targeted education of individual users. In the early stages of implementation, consumption in the identified communities showed positive signs of decreasing.

Challenges

The first time the water utilities manager recommended the behavioural change program to elected representatives, it was not thought to be appropriate for the area. Council's primary concern was permanent Level 0 restrictions previously introduced were already extreme as they represented challenges for the high per centage of shift workers and the elderly to utilise watering times and there might be resistance to council asking people to change their behaviours.

A report was prepared for council by the water utilities manager to clearly demonstrate unsustainable consumption figures. In the face of this evidence, council took the steps to introduce programs aimed at creating a sustainable pattern of water usage throughout the council's communities.

Achievements of the project champion

The water utilities manager instigated the behavioural change program to manage water demand and has pushed it through to approval and implementation stages with the encouragement and support of council. This case study demonstrates that the courage and commitment of one person within council can achieve incremental change in water management.

Further information

Central Highlands Regional Council ‹www.centralhighlands.qld.gov.au›.

› Case study two: Stakeholder engagement shapes Pimpama–Coomera Waterfuture Master Plan

Case study two is a large-scale integrated water cycle planning project in South East Queensland. The Pimpama–Coomera Waterfuture Master Plan has many water sensitive elements, but a particular highlight was the benefits derived from early and extensive stakeholder involvement.

Highlights

- An integrated urban water management strategy was developed for a rapidly-growing area of the Gold Coast City Council (council)
- An advisory committee played a central role in the decision-making process including multi-criteria assessment of options
- Investment in consultation led to widespread endorsement of the final plan.

Drivers for change

Predicted population growth in the Pimpama–Coomera area from 5000 to 150 000 over the next 50 years led council to recognise that a sustainable approach to securing long-term water supply was needed.

Severe drought and significant population growth was placing pressure on existing water supplies and highlighted the Gold Coast's vulnerability to climate change.

The success of the Gold Coast Waterfuture Strategy drove a master planning process for the Pimpama–Coomera area as the next step toward developing an integrated urban water community.

What was achieved

The Pimpama–Coomera Waterfuture Master Plan (the plan), prepared in 2004 by council, is an integrated urban water management strategy aimed at creating a more sustainable community in the rapidly growing Pimpama–Coomera area of the Gold Coast.

The plan integrates many elements of the urban water cycle, including reduced reliance on reticulated potable water via rainwater capture and recycling of wastewater, water conservation measures, pressure and leakage management, improved system monitoring.

Retention and natural treatment of stormwater via water sensitive urban design, improved landscape practices and associated energy savings are integrated in the plan.

The plan sets performance targets against which project outcomes can be measured and allows for continuous review as new technologies and other innovations emerge.

Discussions commenced in 2002 with stakeholders from council, other local governments and the state government on issues associated with sustainable water service provision. Later that year an advisory committee was established as the first stage of an extensive community consultation and engagement program. The advisory committee comprised representatives of resident associations, landholders, developers, environmental groups, industry associations, relevant state government departments and councillors. The advisory committee played a significant role in defining project objectives, developing an action plan, adopting a multi-criteria assessment methodology, evaluating options and recommending a preferred option following a thorough community consultation process.

Implementation of the plan focused on:

- revision of council policies and regulations, including the Planning Scheme, to extend the application of recycled water to other land uses, and provide for mandatory rainwater tanks and water sensitive urban design
- completion of relevant health impact assessments
- additional community engagement
- revision of relevant council business and operational systems
- revision of council's infrastructure charges
- preparation of a number of water infrastructure planning reports
- preparation of technical/feasibility reports including concept design of the Pimpama Wastewater Treatment Plant, the Recycled Water Treatment Plant, the Pimpama–Coombabah Recycled Water Transfer pipeline and the Aquifer Storage and Recovery system.

A new pricing regime was established for recycled water. Class A+ recycled water was priced at $1.34/kL for the 2009–10 financial year, which represents a saving of around 40 per cent on the current drinking water price.

Challenges

As one of the first master plans of this type, convincing elected officials to accept empowerment of the community in the planning process was a considerable challenge. This challenge was overcome by the strength and commitment of key champions for the project, especially their willingness to take risks and accept responsibility for new approaches.

Critical role of stakeholder involvement

Extensive consultation and stakeholder involvement was a key ingredient for successful development of the plan. Project participants reported that contact with stakeholders, including interaction with the advisory committee, was a vital component of a robust consultation approach and was considered a major factor in the project's success. A key factor of the consultation process was to ensure that technical information was communicated in a way that could be understood by all stakeholders (Davis & Farrelly, 2009).

The master planning process was successful in building capacity among council officers and industry participants.

Further information

Gold Coast City Council ‹www.goldcoast.qld.gov.au›.

Allconnex Water ‹www.allconnex.com.au›.

2. Explore the possibilities

› Why is this important?

Once the context of the challenge is better understood, the right environment needs to be created to allow the input of innovative ideas. Continued engagement with stakeholders is an essential part of this step, as is the gathering of technical and other information to inform the decision-making process.

This is the stage of the process where strategic thinking plays an important role because the array of possibilities identified will determine which detailed investigations are subsequently undertaken.

› Key ingredients

	Important things to consider
› The right mix of people to contribute ideas and challenge traditional approaches	Do we need to expand the range of stakeholders we have engaged with during the first stage of the process? Have we planned an appropriate mix of forums for people to put forward innovative ideas on water sensitive solutions?
› Appreciation of the specific catchment context; avoid assumption that what has worked somewhere else will necessarily work here	What has previously been done by others and is it transferable to our situation? What are the unique features of our situation that require detailed attention?
› Relevant technical investigations	What studies do we need to undertake to inform the decision-making process? Have we allowed enough time to undertake thorough technical investigations and thus avoid premature evaluation of options?
› Thorough investigation of opportunities to align with corporate strategies, other major plans and external/ internal funding criteria	In what ways do different options align with the priorities of others to improve the chances of funding support and approval to proceed?
› Potential problems identified and exploring options	While exploring each possibility, have we looked at how potential problems could be resolved?
› Opportunities to co-design projects with partners from the outset	So that we start looking for multiple benefits at the early stages of planning, have we looked for opportunities to co-design projects? Have potential project partners been identified and communication channels established between them?

› Case study three: Exploring urban water supply options for Kyogle

Case study three describes an integrated water cycle management strategy in the small New South Wales (NSW) town of Kyogle. Kyogle Council (council) demonstrated a sound approach to exploring their water supply and catchment issues and possible solutions within the context of aging infrastructure and limited funds.

Highlights

- A small rural town adopted an integrated approach to resolving urban water issues
- An initial concept study enabled thorough analysis of catchment and water supply issues
- A project reference group had significant input to the planning and decision-making process.

Drivers for change

Kyogle is a small rural shire in NSW near the Queensland border. Council supplies water, sewerage and stormwater services to about 3000 people and faced the following challenges:

- aging infrastructure
- increasing flooding issues
- limited budgets to spend on water management
- planned wastewater treatment infrastructure upgrade stalled because of conflicting regulations (pollution reduction licence requirements versus environmental flow regulations).

The NSW Office of Water saw the opportunity to support Kyogle, financially and technically, to pilot an Integrated Water Cycle Management (IWCM) strategy (the strategy).

What was achieved

Council, with support from the NSW Office of Water, completed the strategy in 2006 which provided a long-term overarching plan for the management of urban water services in Kyogle.

Key features of the strategy for Kyogle included:

- potable water supply—improved off-stream reservoir, new transfer line, refurbished water treatment plant and new service reservoir
- wastewater treatment facilities—upgrade to allow restricted reuse at the treatment works as well as wet weather inflow and infiltration reduction and rehabilitation program

- wastewater treatment upgrade—includes a hydroponic wetland able to receive and treat water from the treatment plant
- stormwater—flood mitigation, drainage improvements and additional stormwater quality improvement devices. Water sensitive urban design development controls on new development and local stormwater harvesting opportunities
- catchment management—consistent with activities of the Northern Rivers Catchment Management Authority including water sharing plan, improved on-site wastewater treatment systems and riparian rehabilitation

- source substitution—mandatory use of rainwater tanks in new developments, a retrofitting program with rainwater tank subsidies and promotion of greywater reuse

- conservation—through community education, leak detection and repair, high water users audits and tariffs, residential water saving devices and rebates and no new rural town water and wastewater connections.

The strategy followed the process outlined in the Integrated Water Cycle Management Guideline for NSW Local Water Utilities (October 2004). A concept study was undertaken in 2003 to gain an understanding of the water cycle issues facing the shire. Consultants were engaged in 2005 to undertake a strategy study on behalf of council. The consultants were part of a project delivery team which also comprised representatives from council, NSW Department of Energy, Utilities and Sustainability and NSW Department of Commerce.

A project reference group made up of community, council, state government and water utility representatives was established early and had input throughout the strategy's development.

A community consultation workshop was conducted by council in February 2006 to gauge public response to the preferred strategy.

The strategy was finalised in mid-2006. Implementation began immediately via augmentation of the sewage treatment plant and additional facilities. These have been mostly completed and are currently operational. Stormwater upgrades are in progress and land has been acquired for the new off-stream water reservoir. Initial design and pre-construction planning is in progress.

Funding for the strategy came from council budgets and state and federal grants. Additional levies for both water supply and stormwater and wastewater treatment have been applied to those residents who use these systems.

The sewerage augmentation and upgrade, including the joint detention basin, cost approximately $2.2 million.

Challenges

Inconsistent and conflicting state regulations, licensing and reporting is the biggest barrier to the success of sustainable water management for local government.

Extensive consideration of options

The strategy was developed on the sound understanding of issues and exploration of options. The initial concept study helped examine three broad categories of issues—catchment issues (e.g. land uses, riparian condition), water resource issues (e.g. water quality parameters for various uses) and urban issues (e.g. supply and treatment infrastructure, demand, stormwater management). The project reference group had significant involvement in exploring a series of sustainable water management options and approaches. The group was then involved in a triple bottom line (economic, environmental and social) assessment of the options. Where possible, solutions which met more than one element of the water management cycle were preferred. For example, the development of the new detention basin for the stormwater system also receives the water discharged from the sewage treatment plant once it has passed though the hydroponic wetland. The prominent role of the reference group resulted in full ownership and acceptance from the wider community and stakeholders on the preferred options.

Further information

Kyogle council ‹www.kyogle.nsw.gov.au›.

NSW Office of Water ‹www.water.nsw.gov.au›.

› Case study four: Exploring industrial water supply options for Kwinana

Case study four is an industrial water recycling project in the Western Australian area of Kwinana, south of Perth. The main message from this case study is that although many alternative water supply options were investigated for this heavy industrial area, an external trigger drove the final decision.

Highlights

- An industrial recycled water project was driven by the water quality and water security needs of large Kwinana industrial customers
- Various options were examined but a single customer trigger drove the ultimate solution.

Drivers for change

Perth has experienced a significant reduction in water security for all users since 1975 due to lower rainfall and runoff. Kwinana's existing groundwater supplies were fully allocated and new supplies were needed. Industry was concerned about the quality of alternative groundwater sources that were being investigated.

The company HIsmelt planned to establish a new pig iron plant at Kwinana. Recognising the water shortage issue, the Environmental Protection Agency required HIsmelt to use recycled water as a condition of environmental approval for the plant. Existing industries in the area were looking for an alternative to discharging wastewater into the sensitive marine environment of Cockburn Sound.

What was achieved

The Kwinana industrial area is home to a number of heavy industries that are substantial water users. Historically, industries in the area obtained water from groundwater sources. By the late 1990s groundwater supplies were fully allocated, which meant additional supplies were required to underpin industrial expansion.

In 1998 the Western Australian Water Corporation commenced a planning process and commissioned a consultancy to investigate demand for industrial water at varying levels of quality.

From there, a range of supply options were identified and working groups were established to analyse those options. Reclaiming wastewater emerged as the preferred option.

In 2001, record low inflows into Perth's dams focused public attention on water security and the use of potable water by industry. This served as a catalyst for action.

The environmental conditions placed upon the establishment of a new pig iron plant provided sufficient security of demand to enable investment in the Kwinana Water Reclamation Plant (the plant) to proceed. HIsmelt obtained a federal government grant to assist with the establishment of pipeline infrastructure. Design and construction took place between 2001 and 2004.

The plant has capacity to treat (via a microfiltration / reverse osmosis process) 24 ML/d of secondary treated wastewater from the Woodman Point Wastewater Treatment Plant (WWTP) and produce 17 ML/d of high quality industrial grade water (40–50 mg/L TDS) that is reticulated to Kwinana industrial customers through a dedicated scheme. Wastewater from industrial processes is also injected into the secondary treated wastewater pipeline (downstream of the plant inlet) for discharge in the ocean. The plant substitutes around 2 per cent of Perth's total annual potable water use.

There has been a 17 ML/d reduction in secondary treated wastewater flowing from the WWTP to the ocean. As part of the project, industry is also diverting their effluent discharge from Cockburn Sound to the better flushed marine environment of the Sepia Depression, 4 kilometres offshore in 20 metres deep ocean water.

Subsequent to the plant project, the Water Corporation developed the Water Forever strategy, which has a corporate target to recycle 30 per cent of Perth's wastewater by 2040. Indicatively, this includes 40 ML/d of recycled water from the WWTP.

The investment in the plant was $28 million (2004), plus the cost of the pipeline which was paid for by HIsmelt. The plant is owned and operated by the Water Corporation and its alliance partners. Its gross rate of return is around 3–4 per cent per annum.

The price of the plant recycled water was initially around 20 per cent higher than the price of potable water for industry. However, subsequent price determinations have seen the price of potable water rise to around 20 per cent higher than the plant recycled water in 2010–11, with a price path increasing this to around 50 per cent higher by 2012–13.

Challenges

It was difficult to secure industry agreement on the quality of water to come out of the plant. Ultimately, the water product had to meet the requirements of the most demanding customer. Strong industry demand for recycled water was essential for establishing a recycling project of this magnitude. The demand of existing industries would not have been sufficient for the plant to be built, i.e. HIsmelt's plant was critical to getting the project off the ground. Negotiating long-term commercial take-or-pay agreements with a range of customers was also challenging and this process delayed the plant's start-up date significantly.

Kwinana is a brownfield site. The amount of existing buried infrastructure made it difficult to construct the project which almost prevented the project from progressing.

Various options explored but solutions need to be fit-for-purpose

Relevant technical investigations were undertaken to identify the demand for recycled water and examine potential options. Kwinana is a heavy industry area, so this project may not have been possible if food processing industries had been present, requiring a higher quality of recycled water. This highlights that water supply solutions are always context-specific and their appropriateness for a given situation needs to be examined in detail. An existing industry representative body (Kwinana Industry Council) provided a forum for ongoing dialogue between government and industry, which smoothed the process to construct the plant.

Further information

Water Corporation ‹www.watercorporation.com.au›.

Kwinana Industry Council ‹www.kic.org.au›.

3. Choose the best option

› Why is this important?

More than one potential solution will usually emerge from the first two steps. A structured and transparent approach is then needed to choose the solution which best meets the needs of water users, integrates the water cycle as much as possible and has wide community support. A range of tools and methods are available to assist with developing evaluation criteria and assessing options (see implementation toolbox). However, a number of other key ingredients are needed to help choose a course of action which is achievable.

› Key ingredients

	Important things to consider
› Thorough evaluation of the strengths and weaknesses of each option in social, environmental and economic terms	Have we determined the most suitable evaluation criteria to use? Will we benefit from using a sustainability assessment tool, such as multi-criteria analysis, to evaluate options?
› Stakeholder involvement in the decision-making process to engender ownership of the preferred solution	What is the best way to involve stakeholders in the evaluation and decision-making process? Do we have measures in place to resolve differing opinions on the preferred option?
› Existing or planned regulatory frameworks, governance arrangements, funding sources, human resources and implementation tools are in place to enable the preferred solution to proceed	Have we considered whether the appropriate mechanisms are in place to make the preferred option possible? What other mechanisms need to be put in place to avoid potential hurdles?
› Engagement with approval agencies if applicable to identify potential critical issues	Have we continued our dialogue with approval agencies to make sure our preferred option can be implemented?
› Endorsement of the preferred solution by the champion	Is the champion fully on board with this option and will they drive it all the way?

› Case study five: Community involvement in developing the Gowrie Creek Catchment Management Strategy

Case study five is a catchment management strategy that was driven largely by the community. Their involvement in the decision-making process led to strong public support for the final strategy.

Highlights

- A community-endorsed strategy for waterway enhancement engendered long-term support and commitment to on-the-ground implementation
- A reference group had a strong role in prioritising creek rehabilitation works
- A partnership between Toowoomba City Council now part of Toowoomba Regional Council (council) and the community has enabled multiple benefits to be achieved.

Drivers for change

Channels and stormwater devices within Gowrie Creek and its main tributaries, West and East Creeks, have traditionally suffered from poor water quality, flash flooding and severe bank and bed erosion.

A collective decision was made by the council and members of the community to address these issues.

What was achieved

A Gowrie Creek Catchment Management Strategy (the strategy) was completed by council in 1998 which had a vision for transforming the catchment into a sustainable creek system that serves important ecological, recreational, drainage, cultural heritage and aesthetic functions.

Planning for the strategy started in 1996 with discussions between government and environment group personnel into issues affecting the waterways of Gowrie Creek catchment. A public meeting was subsequently held, from which a Gowrie Creek community reference group was formed. The group provided input into the future direction for creek rehabilitation and, with technical assistance from council officers, was central to the development and facilitation of the strategy.

Implementation of the strategy has achieved the following:

- improved flood immunity for the Toowoomba CBD from one in every two years to one in every 20 years. This is expected to increase to one in every 100 years with the final detention basin planned for 2012
- stormwater management in the form of gross pollutant traps and constructed wetland systems which include detention basins and ecological aspects to improve water quality, aesthetic value and environmental/habitat attributes
- tree planting to create a habitat corridor for birds and understorey planting along the creek corridor to enhance terrestrial and aquatic habitats

- enhanced awareness and appreciation of the creek via education of local residents on the interaction between stormwater quality and creek health
- increased aesthetic values which have led to reorienting homes towards waterways
- creation of important recreational linkages between urban creeks.

A special works agreement, under part 7 of the former *Water Resources Act 1989*, for all projects proposed in the strategy enabled them to be approved via a different process than if they were considered individually. This substantially reduced the amount of work required to achieve project approval and was one of the elements which enabled ongoing momentum and success.

Initial cost estimates (1998) were $36 million over 25 years. A levy was added to the rates for the acquisition of land along the creek corridor and funding for other infrastructure was received through rates and a state and federal flood mitigation program for flood and stormwater works.

Challenges

Council is unable to implement stormwater harvesting because the retention of stormwater from the system is not allowed under the statutory Water Resource (Condamine and Balonne) Plan 2004. This regulatory constraint has affected council's ability to maximise water sensitive benefits of the project.

Innovative ways and suitably skilled personnel are needed to manage and maintain wetlands and vegetated stormwater infrastructure.

Persistent drought and the lack of knowledge of suitable plants for local conditions, e.g. frost tolerant, affected the establishment of some of the vegetation in the wetlands and parks. Many principles for water sensitive urban design rely on viable waterway and riparian plants. This may create problems in areas which suffer from frost and unreliable rainfall.

Community-endorsed strategy engendered ownership

The development of the strategy was well supported and championed by Cr Dianne Thorley who subsequently became Mayor. As a result there were few barriers to achieving political and initial financial support. Development of the strategy involved extensive community input via a range of activities, including stakeholders and public meetings and a one-month public display period of options for creek rehabilitation.

Since endorsement of the strategy, more than 5000 people and groups have been involved in creek activities, including community-based water quality monitoring. A strong and clear strategic plan has helped to drive the process, keep staff and community focused and confident of the outcomes and help manage funds for a long-term outcome. It also shows commitment from council to the local community, for work that may not be able to be done until more funds are allocated.

Further information

Toowoomba Regional Council ‹www.toowoombarc.qld.gov.au›.

› Case study six: Securing Dalby's water supply

Case study six examines the challenges faced by the western Darling Downs town of Dalby in securing alternative water supplies.

This case study highlights the need to have the right mechanisms in place to enable preferred water supply projects to proceed.

Highlights

- Dalby's water supply has been enhanced by diversification in supply sources
- Strong commitment was needed by Dalby Shire Council, now part of Western Downs Regional Council (council) to overcome significant challenges
- The project highlights the need for partner agreements and funding sources to be in place to allow the preferred solution to proceed.

Drivers for change

Dalby is located on the Darling Downs approximately 210 km west of Brisbane. Previously Dalby drew its water from ten underground bores and surface storage on the Condamine River at Loudoun Weir (storage capacity 588 ML). Dalby was facing an uncertain future water supply due to increasing hot and dry weather, variable rain patterns, growing population from expansion of the coal seam gas (CSG) industry, and increased industrial demand, especially from the Dalby Bio-Refinery Limited (DBRL) Ethanol Plant.

What was achieved

Council has created a highly reliable base water supply for Dalby through a series of projects including:

- a demand management strategy comprising financial incentives to use water wisely, water restrictions which are well advertised and regulated through officer patrols, community education programs, rebates for water-efficient fixtures and appliances, Water Efficiency Management Plans for non-residential users and reduced council use of water in parks and gardens

- two groundwater desalination plants with the capacity to treat 2 ML/day of groundwater water each. This provides an additional 25 per cent of town water supply on an annual basis. The reverse osmosis produces water at a cost comparable to the treatment of river water but is much more reliable in dry times
- a water recycling scheme that includes a 1 ML/day recycled water treatment plant to supply Dalby Bio-Refinery Limited Ethanol plant and plans to ultimately recycle 100 per cent of the town's wastewater for industrial use and on major parks and sporting fields.

In 2002, initial technical and financial feasibility studies were undertaken to look at options for new potable and non-potable water supplies. After reviewing 15 options, desalination of sub-artesian waters plus a demand management program were considered the best approach. In 2003 a groundwater desalination plant was approved and constructed following internal costing and design studies. After commissioning of the plant in 2004, a scope was created in 2005 for the Dalby Water Supply Redevelopment program which involved construction of a desalination plant with the capacity to treat 4 ML/day of CSG water, a water recycling scheme and a demand management strategy.

State and federal funding was initially granted for the redevelopment of the Dalby Water Supply program on the proviso that a supply agreement for CSG water was reached with the provider, Arrow Energy. In 2006, when an agreement was signed with Arrow Energy, the cost estimate was $13 million. By mid-2007, planning and financial modelling revealed a higher cost estimate of $19 million for the 4 ML/d CSG desalination plant. In 2008, Arrow Energy was approached to cover the $6 million shortfall and agreed to further negotiations. However, in early 2009, when tenders were received, estimates for the desalination plant plus recycled water plant had risen to $28 million. A new supply agreement with Arrow Energy could not be finalised within timelines set by the federal Department of the Environment, Water, Heritage and the Arts, so the department withdrew funding support for the redevelopment project. At the same time, internal council recommendations were made to not proceed based on cost analysis in the tenders received and commercial issues.

In mid-2009, council held public information sessions on Dalby's current water supply situation and future water source options covering raw water sources and treatment options, the growth in users, major water consumers, future water sources under consideration and their new regional water restrictions policy.

Council awarded the tender for construction of the 1 ML/day recycled water treatment plant intended to supply the Dalby Bio-Refinery. A second tender was awarded to construct a 2 ML/day bore water desalination plant. As new state legislation now requires all CSG producers to desalinate CSG by-water, council entered negotiations with three CSG companies regarding the supply of treated CSG by-water to all principal towns within the Western Downs region.

Challenges

The urgency of securing additional water supplies meant that insufficient time was invested at the start to explore all the potential options and understand the pros and cons of each option.

A major challenge was the untried nature of CSG water as a source of supply. This affected many aspects of the planning process, particularly cost estimates and commercial arrangements with project partners. The long lead time in securing a supply agreement with Arrow Energy for CSG water jeopardised federal funding and ultimately led to termination of that aspect of the supply redevelopment project.

Complexities of partners, timing and funding

Consistent and committed champions within council were a critical aspect of the success of this project as well as the decision to commit a full-time council position to manage and drive the projects. Without that commitment, there may not have been a resolution to the water supply problem when the CSG option fell through.

Detailed studies are required to reveal true costs of each option prior to commencement. Severe water shortages led to premature decision making, a situation that was further exacerbated by new technologies in the CSG area which were not completely understood.

Further information

Western Downs Regional Council ‹www.wdrc.qld.gov.au›.

Department of the Environment, Water, Heritage and the Arts ‹www.environment.gov.au›.

4. Get the green light

› Why is this important?

If the previous steps have been followed, gaining approval should not be a major hurdle. This step summarises the main messages that need to be communicated to internal decision-makers or external approval agencies when the proposal is presented to them.

› Key ingredients

Important things to consider

› **Continued engagement with key decision-makers and approval agencies**

Am I confident that approval agencies and individual decision-makers are fully informed about the issues and, most importantly the benefits of the proposed project?

› **A compelling case for action that demonstrates**

- **stakeholder support**
- **fit-for-purpose technical solutions**
- **regulatory compliance**
- **realistic costs and multiple benefits**
- **appropriate implementation tools and sufficient resources**
- **operational and maintenance issues and costs fully addressed**
- **council's role and the roles of others**
- **achievable funding strategies and timeframes.**

Does our proposed solution adequately address all these elements?

› Case study seven: Overcoming challenges in a new residential development in Brisbane

Case study seven is a residential eco-development project which incorporated decentralised water and wastewater systems and energy efficiency measures. The project was the first of its type in Brisbane and there were considerable challenges in gaining Brisbane City Council (council) approval because of this. The case study highlights the commitment of project partners in seeing it through this difficult phase, and the important lessons learned from pioneering a new approach.

Highlights

- A combination of centralised and decentralised water supply and treatment systems created a sustainable residential development
- Being the first to try an innovative approach can be challenging but also rewarding
- Commitment of project partners made the development possible
- Long-term monitoring of water and energy use is important to understand the effectiveness of sustainable systems and the impact of human behaviour on resource use.

Drivers for change

The owner/developer of Silva Park Estate was dedicated to a sustainable approach to residential development. These aspirations were strongly supported by sustainability advocates within both private and government organisations who partnered to get the project off the ground. A number of site characteristics required an innovative approach to water supply and management, including steep slope of 20 per cent for three-quarters of the site, existing water supply and sewerage mains some distance away or at capacity, substantial pumping infrastructure to supply mains pressure water to the steep site and proximity to waterways—for example, Enoggera Creek—meant stormwater quality would need to meet council water quality objectives.

What was achieved

A 3.75 ha subdivision made up of 22 large (~1200 m^2) allotments was designed as a residential development with integrated water cycle systems, largely decentralised.

Developed through a partnership between a private developer, specialist consultants, BCC (Water Resources Branch) and state government agencies.

The project contained the following integrated water cycle elements:

- individual and communal rainwater tanks plumbed to homes, backed up by mains supply
- a reticulated water supply system that provided both mains back up and firefighting flows to government regulatory standards
- a diesel pump to supply firefighting flows from the large (2 x 75 kL) communal tanks
- low-energy greywater treatment systems and recycling for garden watering on a dedicated 200 m2 area for each home
- a reticulated sewerage system which drained into a pump well that was emptied into council sewers in off-peak times
- stormwater treatment and control systems to reduce stormwater run-off impacts on nearby Enoggera Creek.

The site was originally farm land and owned by the developer. Rather than subdivide the farm into large rural residential allotments, the developer chose to create higher density sustainable housing lots focusing on water and energy efficiencies. The sustainability aim of the project attracted support from development/consulting firms and the scientific research and development arm of the Department of Natural Resources and Water, now Department of Environment and Resource Management.

In 2001, consultants conducted preliminary site analysis and a master planning process.

Extensive consultation with the council planning department was undertaken to generate support for the project and endorsement as a demonstration project.

Market research was conducted to identify the demand for buying sustainable housing designs. Detailed planning then took place including:

- a detailed physical survey of the site, including mapping the opportunities and constraints of the natural features
- access and service arrangements
- an informal consultation process with residents in the greater area.

Technical scenarios were considered in consultation with council to inform the development application.

The development and operational works applications were lodged in 2002, but it took about three years before building approval was given.

Construction commenced in 2005 and was conducted with involvement from project designers, planners and a site manager to help ensure all the design elements were appropriately constructed.

Challenges

Being one of the first of its type, the lengthy development approval process was a major challenge. Some of the contributing factors to this delay were (Davis & Farrelly, 2009[4]):

- non-standard technologies
- lack of communication between the Water Resources and Planning branches of council and staff turnover in the Planning Branch
- concerns about community management schemes, road infrastructure and other planning aspects.

[4] Davis C. & Farrelly M. 2009. Demonstration projects—case studies from south east Queensland, Australia (Payne Road, Rocks Riverside Park, Coomera Waters), National Urban Water Governance Program, Monash University, Melbourne.

Project implementation also met with some challenges. House sales were initially slow due to economic downturn and prices being at the higher end of the market. Technical support from traditional service and maintenance sources has been unreliable because of the integrated nature of the systems, lack of technical capacity in the industry and financial issues associated with the developer.

Life cycle monitoring of the development revealed high energy costs associated with rainwater tank pumps and some sustainability problems with nutrients and salt loadings on the dedicated greywater irrigation areas.

Longer-term issues include lack of enforcement of community rules by the body corporate, as some residents took matters into their own hands and implemented solutions which contradicted the design objectives of the water cycle.

Gaining approval for innovative solutions can be challenging but worth it

The difficulties faced in implementing non-traditional water and sewerage services were overcome by the substantial commitment and involvement of government researchers and specialist consultants in sustainable design. Success of this demonstration project relied heavily on close engagement between research staff and both the residents and developer's staff. Those involved in the project highlighted the importance of engaging with major stakeholders early in the design and planning stages. Not only do key organisations need to be involved, but all relevant divisions of those organisations.

The use of an auto-start diesel pump to pressurise the reticulated water system, using water reserved in the communal tanks, was a significant leap forward. Without this innovation, the density of dwellings would not have been possible because fire flow regulations could not be met by domestic tanks alone.

Although there have been many challenges, monitoring results are showing up to 80 per cent self-sufficiency in household water supply even in extreme drought years. The decentralised systems, once fully operational throughout the subdivision, are expected to reduce demand on mains water supply by 190 kL/household/year and decrease sewage discharge volumes by 100 kL/household/year. This demonstrates that substantial potable water savings are achievable in domestic houses and that nutrient and organic loads to the sewage treatment plant can be significantly reduced.

Monitoring of water and energy use is very important to demonstrate the value of sustainable development. The commitment by researchers to carry out long-term monitoring has enabled refinement of some of the new technologies and helped to mitigate potential detractors of the project.

Sustainability as a selling point needs to be sensitive to the dynamic nature of the real estate market and it may be preferable to make it secondary to lifestyle and liveability.

Further information

Payne Road project ‹www.payneroad.com.au›.

Water quality research Australia ‹www.wqra.com.au›.

› Case study eight: A compelling case for stormwater harvesting in Orange

Case study eight showcases a stormwater harvesting project in the town of Orange, New South Wales, designed to augment existing surface water storage. Being the first major harvesting project of its type, Orange City Council (council) engaged early and proactively with external approval agencies to overcome potential regulatory hurdles.

Highlights

- Council developed the first large-scale stormwater harvesting project (direct to surface storage) in NSW
- Learning from the lessons of others and early and proactive engagement with regulatory agencies enabled timely approval
- Understanding the specific catchment context enabled a fit-for-purpose and community-supported solution to be developed.

Drivers for change

Orange was experiencing severe water shortages. Prolonged dry conditions and well below average run-off resulted in the city's water storages dropping to record lows. By late 2007 the storages were below 40 per cent and the outlook for rain was bleak. At their lowest levels in August 2008 the storages reached 26.7 per cent.

What was achieved

The Blackmans Swamp Creek stormwater harvesting project involved capturing a portion of the high flows in Blackman's Swamp Creek during storm events and transferring these into a holding dam for initial treatment then to the nearby Suma Park Dam to augment the city's bulk water supply.

The project required the development of a range of new infrastructure to support the scheme including gross pollutant traps, pumping stations, ponds, pipelines and monitoring equipment and a weir.

Access to existing high-quality water treatment infrastructure was critical to the success and relatively low cost of the project. The Department of Health felt confident in the effectiveness of treatment facilities.

This project is estimated to provide 800 ML of additional water into the Orange's raw water supply each year.

Council undertook extensive consultation with government and community stakeholders over the duration of the project. Consultation is ongoing during the operating phase. Education was also a critical component, particularly demonstrating to downstream water users that the existing catchment was already significantly altered from its natural state. Council has significant autonomy with respect to catchment management which enabled them to make the most of the necessary decisions.

The key benefit of the scheme is an effective contribution to long-term security of water supply.

It has also resulted in improved water quality downstream.

The total cost of the project was $5 million. A second stage is proposed as a future option but has not been investigated or costed in detail (OCC, 2008: 22–25[5]).

The project was funded on a 50:50 basis between council and the NSW Government and evolved from concept to operational reality within 18 months.

Challenges

The major technical challenge was meeting drinking water standards.

The scheme was a novel solution to water supply challenges. The existing regulatory framework was not set up for schemes of this nature, so close engagement with regulators from the start was essential. Council also had to develop operating rules to satisfy the concerns of regulators and the community, particularly downstream users.

Alterations to the design of the scheme had to be made to meet regulatory requirements.

Early and proactive engagement with regulatory agencies to gain approval

Council used the experiences of others, including Goulburn, to understand the regulatory hurdles faced by previous projects of a similar nature. Council engaged early and proactively with approval agencies and other stakeholders to garner support and resolve issues of concern. A detailed review of environmental factors was undertaken to demonstrate how potential risks would be managed. This was another key mechanism in gaining project approval.

A compelling case was prepared based on a sound planning process and included the following key elements.

- At the outset, the approach taken was not just to apply a short-term solution to get through the current emergency in the hope that it would rain again and the problem would go away. It was recognised that a much more strategic solution was necessary.
- It is important to identify and investigate all supply and demand side options.
- The project was part of a package of measures that comprised demand management and system operating solutions such as best practice pricing, water restrictions, education programs, water loss remediation strategies, working with high water users to reduce their water use and installing water efficient devices across the city.

[5] Orange City Council (2008) Review of Environmental Factors: Blackmans Swamp Creek Stormwater Harvesting.

- The solution was initially thought to be location specific because of
    - the close proximity of Blackman's Swamp Creek to Suma Park Dam
    - the availability of key existing infrastructure
    - the high level of treatment provided by council's main water filtration plant
    - the regularity of flows in Blackman's Swamp Creek which is a function of large impervious areas in the catchment.
- Investigation into a second scheme on the western side of the city has shown that the basic idea is highly transferable.
- Willingness to pursue an innovative approach.
- It is important to develop a technical solution and operating method that effectively addresses the key concerns.
- Previous experience and history are important considerations. Community concerns about a previous water reuse scheme involving a local gold mine were important influences on community perceptions.

Further information

Orange City Council ‹www.orange.nsw.gov.au›.

5. Deliver a water sensitive solution

› Why is this important?

Delivery of a project can experience many challenges. The role of the project champion continues to be critical to sustaining momentum and resolving problems as they arise. Ongoing involvement of stakeholders is also important to maintain community support, and in many cases, to help deliver behavioural change components of the project. A flexible approach to project delivery is also an important factor in maximising unforeseen benefits that may present themselves along the way. This flexibility also applies to the mix of tools and methods that are used so that optimal economic, social and environmental benefits can be derived.

› Key ingredients

	Important things to consider
› Ongoing leadership by the project champion to maintain momentum	Is our project champion still available for the project implementation period, given there will be many challenges to overcome?
› Ongoing involvement of stakeholders, including approval agencies, to resolve issues in an integrated way and maintain flexibility in project delivery	Have we continued to build our relationship with approval and regulatory bodies? How are we planning to keep stakeholders informed throughout the project? How will we provide opportunities for stakeholder input should there be decision points along the way?
› Project partners who share common goals and are committed to delivering within the timeframes required by funding bodies and approval agencies	Are we confident that our project partners share the same ultimate objectives? Have we made sure that project partners are co-designing from the outset? Are the appropriate agreements in place with partners to make sure the project can be delivered? Are all project partners able to deliver on their commitments with the timeframes required by funding bodies and/or approval agencies?
› A project team with the necessary skills, and an operating environment that facilitates efficient delivery by the team	Do we have all the necessary skills on board? Have we created a working environment which enables all project team members to operate collaboratively and efficiently?
› The most appropriate tools, for example: **• education and behavioural change** **• active community involvement** **• regulation (e.g. planning schemes, policies)** **• incentives (e.g. rebates, subsidies)** **• pricing mechanisms (e.g. levies, rates, differential pricing)** **• engineering design guidelines (e.g. water sensitive urban design).**	Have we optimised the mix of tools and processes to achieve our ultimate objectives? How can we maximise economic, social and environmental outcomes from the tools and methods we use?

› Case study nine: Innovative effluent reuse in Wide Bay

Case study nine exemplifies the many benefits to the environment and local economy that have been achieved via an innovative, water sensitive approach to wastewater reuse in the Fraser Coast region of Queensland.

Highlights

- An effluent reuse scheme aimed at irrigated agriculture has generated many ongoing economic, social and environmental benefits to the Fraser Coast region
- Courage and leadership to look beyond infrastructure upgrade options has led to multiple sustainable outcomes
- Strong engagement with Fraser Coast Regional Council (council) stakeholders promoted many positive messages to key decision-makers.

Drivers for change

Greater capacity in wastewater treatment was needed to service population growth in the Fraser Coast region. In order to protect marine ecosystems, the Environmental Protection Agency (now part of the Department of Environment and Resource Management) would not permit the discharge of additional treated sewage into local creeks that flow into Hervey Bay.

An expensive ocean outfall would have been the traditional solution, but the region's reliance on a healthy marine environment for tourism income deemed the outfall solution unacceptable to the community. An innovative approach was required to develop an alternative solution.

What was achieved

Wide Bay Water Corporation (the corporation) developed an effective effluent reuse scheme that now enables up to 100 per cent of the city's effluent to be reused for irrigation by sugarcane farms, turf farms, a corporation-owned native hardwood plantation, other rural industries and industrial estates for landscape watering.

The overall scheme comprises two irrigation schemes (Pulgul and Eli Creek) which are joined by a 12.5 km pipeline, plus a stormwater harvesting project which provides additional supply during peak demand periods.

Pulgul and Eli Creek wastewater treatment plants have been upgraded to increase their capacity and efficiency, and the pipeline which connects the two schemes enables transfer of water in response to peaks in demand.

The scheme has significantly reduced nutrient loads and organic matter entering marine waters. The 100 per cent effluent reuse figure exceeds the regulatory requirement to reuse 90 per cent.

By 2009, the corporation's hardwood plantation was growing 800 000 trees, well on the way to meeting the original target of one million by 2010. The plantation only utilises treated effluent when it is excess to requirements of sugarcane and other crops in the area. The hardwood plantation enables the corporation to trade carbon under an accredited government scheme.

Innovative incorporation of stormwater harvesting minimises odour and corrosion in the sewerage network, while preventing contaminants flowing into the bay through the stormwater system.

Sugarcane productivity has been significantly enhanced by the scheme, including a 45 per cent increase in tonnes of cane/ha, 62.5 per cent increase in tonnes of sugar/ha and 80 per cent increase in $/ha.

The corporation has an agreement with the Endeavour Foundation to mill timber from the plantation, thus creating employment opportunities for disadvantaged local people.

The corporation has actively engaged with the community to increase awareness of the benefits of the scheme. Activities include bus tours, school visits, videos sent to community groups, media advertising and brochures.

Engagement with industry included establishing a management board, support for irrigation trials and monitoring, shed meetings, training sessions and the involvement of BSES and the Department of Primary Industries (now part of the Department of Employment, Economic Development and Innovation).

State government agencies have used the scheme to demonstrate the operational and environmental monitoring protocols which other Queensland effluent reuse schemes should adopt.

In the late 1980s, investigations commenced into the feasibility of an effluent reuse scheme. An environmental assessment was undertaken for farming areas surrounding existing wastewater treatment plants at Eli Creek and Pulgul. A water and nutrient analysis was a critical part of the assessment to determine the amount of land and standard of water quality required for each crop.

The project started with a trial of the Pulgul Irrigation Scheme in 1990. A 485 ha farm was purchased to demonstrate what could be achieved by irrigating sugarcane, pasture, a eucalypt plantation and tea trees with effluent. The success of sugarcane production, in particular, was a turning point for community acceptance of recycled water as a valuable water source for agriculture.

As a result of the beneficial outcomes at Pulgul and interest generated amongst farmers, the corporation purchased an additional 320 ha and established a water board to develop and manage similar irrigation for the Eli Creek scheme.

A significant increase in productivity on Eli Creek farms led to the scheme's expansion in 2002. A pipeline was built between Eli Creek and Pulgul, so the integrated scheme could handle 8 ML of effluent a day.

Stormwater harvesting was subsequently added to the scheme for times when demand exceeds supply, particularly during peak cane growing periods from November to April.

A key success ingredient was strong engagement by the corporation with council to promote many positive messages to key decision-makers, for example:

- increasing regulator standards are a strong driver to do things differently
- objective comparison between the business case of reuse with the costly upgrade alternatives
- creating industry-based partnerships
- promoting the environmental benefits
- demonstrating the economic return to the community of reusing wastewater beneficially
- dynamic projects will help council water business to attract good staff
- helping council to understand changing expectations within the community.

The whole project cost, including capital cost of irrigation scheme, was $8 million minus subsidies of $6 million equalling a capital cost of $2 million.

The annual capital and loan payments were $140 000.

The annual operation and maintenance costs were $800 000 minus annual income of $100 000 equalling a total annualised cost of $840 000 which is $500 000 per year cheaper than the alternative (ocean outfall) wastewater treatment option.

Challenges

An initial expression of interest for buyers of effluent had little response. The corporation recognised they would need to be proactive in selling the benefits of effluent as a valuable resource to the agricultural community. A low-producing cane farm was purchased as a demonstration scheme and the resultant improvements in cane production proved the scheme's worth. Uptake of effluent for irrigation increased and the scheme continues to grow and diversify.

Leadership and courage

Strong leadership by the corporation and its board were critical to seeing the project through to fruition. This project demonstrates an innovative approach to solving a problem can have many benefits to the community and the environment.

Engagement with all stakeholders, especially key decision-makers within council, was a key ingredient to success.

The benefits have continued to grow from this courageous decision. Enhanced agricultural productivity has led to many economic and social benefits in the Fraser Coast region. Partnerships have emerged for the management of hardwood timber plantations that generate employment and growth in the local economy.

Further information

Wide Bay Water Corporation ‹www.widebaywater.qld.gov.au›.

› Case study ten: Introducing recycled water for industry in Toowoomba

Case study ten describes successful projects to deliver recycled water to a power station and coal mine from Toowoomba's main water reclamation facility. Shared goals of the project partners were a key factor in the accomplishment of these projects.

Highlights

- The Toowoomba Regional Council's (council) need to reuse effluent for beneficial purposes and industry's demand for a fit-for-purpose water supply was a successful partnership
- Shared goals with project partners led to timely delivery of the projects.

Drivers for change

Scarcity of water from traditional sources on the Darling Downs resulted in reduced security of supply for industrial water users. The Millmerran Power Station and New Acland Coal Mine required significant volumes of water to underpin their existing operations and future expansion plans.

What was achieved

Through negotiations with the council, these users accessed treated effluent to provide ongoing security of supply without impacting on potable water supplies.

New pipelines were built to convey water from the Water Reclamation Facility to the Millmerran Power Station (100 km) and New Acland Coal Mine (46 km).

Millmerran Power Station is supplied with class C recycled water and New Acland Coal Mine is supplied with class A + recycled water from a new advanced water treatment plant attached to the Wetalla Water Reclamation Facility.

The project has provided substantial benefits in terms of reducing the amount of groundwater that is being used in industrial operations.

It has also reduced the amount of treated effluent being discharged into Gowrie Creek and flowing into the Darling River. About 65 per cent is reclaimed for industrial use and 35 per cent of disinfected secondary (BNR) treated wastewater enters the downstream environment.

InterGen (operators of Millmerran Power Station) approached the council in 1999 regarding access to recycled water as an alternative to surface or groundwater supplies.

Council and InterGen agreed on a contract for council to supply 1000 ML/ year of class C effluent.

Supply came on line in 2001 following design and construction of a pipeline by Intergen from the Wetalla facility to the Millmerran Power Station.

New Hope Coal approached council in 2005 to obtain saline water from a proposed reverse osmosis recycling plant (for indirect potable reuse) for use in coal washing at New Acland Coal Mine.

When the reverse osmosis plant was cancelled because of community opposition, New Hope Coal negotiated with council for 3000 ML/ year of class A+ water to be supplied to the mine for use in coal washing and for all run-of-mine operations. It also negotiated an option for a further 2500 ML/ year to underpin its future expansion.

The Wetalla facility required development of an advanced water treatment plant (plant) to produce class A+ water. The plant was commissioned in late 2008 to supply 3000 ML/year to the New Acland Coal Mine.

New Hope Coal funded and built the 46 km pipeline from the Wetalla facility to the mine.

Both InterGen and New Hope Coal have entered into supply contracts with the council that allow them to access recycled water at commercial rates. The actual prices being charged for water are commercial-in-confidence.

The whole project cost is unknown due to the fact that pipeline infrastructure was paid for by the customers. Council financed the construction of the new plant, which is generating commercial rates of return for council.

Challenges

The project did not face any regulatory barriers. In fact, it assisted council to comply with its discharge licence obligations to explore options for beneficial reuse and to reduce the amount of effluent being discharged.

Some farmers downstream of the Wetalla facility were not happy about the reduced volume of effluent being discharged into Gowrie Creek. Irrigation licences issued by the state government covered the extraction of natural flows from Gowrie Creek and did not cover supplementary discharges from the Wetalla plant. While irrigators had opportunistically benefited from the use of the supplementary flows resulting from the treated water discharged from Wetalla, council and the state had consistently advised irrigators that council reserved the right to reduce or cease discharge to Gowrie Creek and to dispose of treated water for other beneficial reuses.

Successful implementation by project partners with shared goals

Council had the power to act to establish the scheme. Strong demand for recycled water was a critical element for timely implementation of this scheme. Shared goals of sustainable water management and willingness to enter into sound commercial arrangements facilitated a successful partnership between the provider and purchaser of recycled water.

Further information

Toowoomba Regional Council ‹www.toowoombarc.qld.gov.au›.

› Case study eleven: Implementing change through the planning scheme on the Gold Coast

Case study eleven describes the range of implementation programs and tools to deliver the Gold Coast Waterfuture Strategy (the strategy), and specifically highlights Gold Coast Water's (now Allconnex Water) efforts to implement city-wide change in water management via planning scheme amendments.

Highlights

- Many water sensitive solutions are being delivered through the implementation of the strategy
- Gold Coast is the leading local government in Queensland to attempt to integrate water cycle management via amendments to the planning scheme.

Drivers for change

One of the recommendations in the Gold Coast Waterfuture Strategy 2006–2056 was the planning scheme should be amended to recognise the availability of water as a natural resource constraint.

The Planning Scheme Review Program, which commenced in 2009, created an opportunity to incorporate integrated water cycle management for all new developments.

In 2010, a window of opportunity presented itself for Gold Coast Water to influence water outcomes in the planning scheme prior to its transition into the new, larger water distribution and retail entity, Allconnex Water.

What was achieved

The strategy was designed as a blueprint for managing the city's water supply in a sustainable way over a 50-year period. Developed via an extensive stakeholder involvement process during 2004–2005, the strategy commenced the implementation phase in 2006. Delivery of water sensitive solutions is occurring via a wide range of mechanisms and tools, including:

- education and behavioural change programs to encourage wise use of water across the community, e.g. community, home, school and business watersaver programs
- Home Watersaver Rebate Scheme (later adopted by the state government)

- stormwater quality improvement via guidelines for developers, installation of stormwater quality improvement devices (SQIDS) in locations across the city and drain markings to educate residents about preventing stormwater pollution
- water sensitive urban design promoted in new developments and a key component of the Pimpama–Coomera Waterfuture Master Plan area

- augmentation of existing surface water storage infrastructure
- a pressure and leakage management program
- recycled water used to irrigate public open space, golf courses and cane fields and to suppress dust on construction sites. Council's Recycled Water Tanker Program trains tanker operators in responsible handling of the product

- a project to implement a city-wide approach to integrated water cycle management via amending the planning scheme.

The planning scheme amendment project attempted to integrate the water outcomes outlined in the scheme. For example, water and wastewater management decisions come under infrastructure outcomes whereas water quality and catchment protection fall within natural resource outcomes. Gold Coast Water commissioned a consultancy to examine where the planning scheme could be influenced to facilitate integrated water cycle management. The outcomes of this study would inform the overall Planning Scheme Review Program being undertaken by the Planning Environment and Transport Directorate within council.

Challenges

There were challenges in Planning Environment and Transport's preparedness to go beyond state regulations for water management, for example—Queensland Development Codes. There were also challenges to drastically change the structure of the planning scheme for better assimilation of water supply elements and to incorporate other parts of the water cycle.

To meet high population growth in the region, the state government brought more land into the SEQ Regional Plan urban footprint and at the same time tightened the regulation of urban water management. Tighter regulation coupled with servicing of an expanding urban footprint means business-as-usual infrastructure solutions are no longer sustainable for the region.

The new institutional arrangements in SEQ separate the water supply business from councils into distribution and retail entities. This vertical separation of water businesses poses an increased challenge in collaborating with other councils and water businesses to implement consistent water cycle initiatives.

Planning scheme as an implementation tool

Courage and commitment by leaders in Gold Coast Water and more broadly in council has been instrumental in adopting innovative approaches to urban water management.

There remains a gap between the water scarcity policies and the principles of planning schemes and how these are delivered in outcomes.

Integration of the water cycle requires a strategic view that incorporates land use planning. This may be too big a challenge to overcome in the planning scheme.

Further information

Gold Coast City Council ‹www.goldcoast.qld.gov.au›.

Allconnex Water ‹www.allconnex.com.au›.

Implementation toolbox

A wide range of tools and methods can be used at each step of the roadmap and for different types of water sensitive projects. This chapter lists some of the common tools and methods and provides links to further information. A brief overview of existing state government requirements is also provided with an indication of the water sensitive outcomes they can help to facilitate.

› General process tools and methods

Step of the roadmap	Activity	Tools and methods to assist	Case studies where used
1	**Stakeholder engagement and forums to share information**	• Internal working groups comprising leaders of all council core business areas • Reference groups or advisory committees comprising representatives of councils, state government approval and referral agencies, urban water users (residential, commercial, industrial), environmental and other community groups, Indigenous community, economic development bodies and any other context-specific organisations • Focus groups which examine specific aspects of the water cycle • Specialised workshop methods for identifying issues, exploring possibilities, selecting preferred options • One-to-one discussions with key stakeholders • Community newsletters • Public meetings and displays at community events • Social surveys • Dedicated pages on websites which are kept up-to-date	All
2	**Technical investigations**	• Feasibility studies that examine technical, financial, environmental and social elements of potential solutions	Pimpama–Coomera, Kyogle, Kwinana, Dalby
	Alignment with other planning processes	• Corporate vision and corporate plans • Statutory and non-statutory regional plans • Regional water supply strategies • Water service provider plans (required under the *Water Supply (Safety and Reliability) Act 2008*) • Regional natural resource management plans	Central Highlands, Kyogle
	Funding sources (current 2010)	**Federal Government programs:** • National Water Security Plan for Cities and Towns • National Urban Water Desalination Plan • Stormwater Harvesting and Reuse Projects • Green Precincts Fund • ‹www.environment.gov.au›	Dalby, Orange, Wide Bay (note that previous programs funded these projects)

Step of the roadmap	Activity	Tools and methods to assist	Case studies where used
3	**Evaluation of options**	• Strengths, weaknesses, opportunities and threats (SWOT) analysis • Multi-criteria analysis (MCA) methods: [Note: There are many MCA methods available, and they are often customised for each project. The following sources are a useful starting point] – World Bank, Annex 4D.4 Multi-criteria Analysis, prepared by ERM ‹www.worldbank.org› – Matisse Papers on sustainability analysis (a subset of MCA) ‹www.matisse-project.net› – WSAA, 2008, "Sustainability Framework: Methodology for evaluating the overall sustainability of urban water systems", WSAA Occasional Paper No.17. Can be purchased from ‹www.wsaa.asn.au›. – UK Government, 2009, Multi-criteria Analysis: A Manual ‹www.communities.gov.uk› • Cost benefit analysis (CBA) methods: – Commonwealth Department of Finance, 2006, Introduction to Cost-Benefit Analysis and Alternative Evaluation Methodologies ‹www.finance.gov.au› – Commonwealth Department of Finance, 2006, Handbook of Cost Benefit Analysis ‹www.finance.gov.au›	Pimpama–Coomera, Kyogle, Kwinana
4	**Preparation of a compelling case**	Reports, strategies and plans which clearly demonstrate the need for action, for example: • data to support demand and supply scenarios, e.g. water balance models • fit-for-purpose technical solutions • equitable costing • achievable funding strategies and timeframes • operational and maintenance issues and costs fully addressed • economic, social and environmental costs and benefits	Central Highlands, Pimpama–Coomera, Orange
5	**Education and behavioural change**	• Community-based waterway enhancement projects (see also demand management projects, below)	Gowrie Creek, Central Highlands, Kyogle, Dalby, Gold Coast
	Regulation	• Water restrictions • Planning scheme amendments to better integrate elements of the water cycle	Central Highlands, Gold Coast
	Incentives	• Rebates, e.g. rainwater tanks and water/energy-efficient fittings and appliances • Subsidies, e.g. state and federal government funding programs (see funding above)	Dalby, Gold Coast, Kyogle, Kwinana
	Pricing	• Cost recovery by developers for water sensitive urban design and decentralised systems • Competitive pricing of recycled water compared with potable water supplies • Differential tariffs for high water users • Negotiated pricing with individual customers of non-traditional sources	Brisbane, Pimpama–Coomera, Kyogle, Kwinana, Toowoomba, Dalby

› Toolbox for specific projects

Project type	Tools and methods to assist
Demand management	• Lead by example, e.g. sustainable buildings, water conservation in public open space areas • Website information with water saving tips • Newspaper and radio advertising with consumption data trends, e.g. information about water use, dam levels • Information materials included with rates notices or other council mail-outs • Water restrictions (including long-term water conservation targets) • Water efficiency management plans for non-residential customers • Water Efficiency and Labelling Standards ‹www.waterrating.gov.au› • Water Efficiency Opportunities—best practice guidelines and case studies ‹www.environment.gov.au› • Waterwise resources ‹www.derm.qld.gov.au›
Total water cycle management	• Urban stormwater management ‹www.derm.qld.gov.au› • Managing waters' environmental values ‹www.derm.qld.gov.au› • Integrated Water Cycle Management Guideline for NSW Local Water Utilities, October 2004 ‹www.dwe.nsw.gov.au› • Demonstration Projects: Case studies from South East Queensland ‹www.urbanwatergovernance.com›
Water sensitive urban design	• Water by Design guidelines ‹waterbydesign.com.au› • ICON Water Sensitive Urban Developments ‹www.nwc.gov.au›
Recycled water projects	• Recycled water in Queensland ‹www.derm.qld.gov.au›
Decentralised systems	• Greywater Guidelines ‹www.dip.qld.gov.au› • Recycled water in Queensland ‹www.derm.qld.gov.au›

› Existing regulatory requirements

There are a number of regulatory requirements in place that impact upon urban water management. Many of these have a role in facilitating water sensitive outcomes such as improved water consumption behaviour, increased resilience in water supplies, sustainable building design and environmental water quality improvements. A list of current regulatory requirements is provided outlining how each contributes to water sensitive outcomes. The purpose of this list is to show how the state government's regulatory framework reflects the new approach to sustainable water management. It is also a useful prompt for how existing compliance efforts can be built upon to achieve further benefits.

Regulatory requirements – provision and legislation	Contribution to water sensitive outcomes
Water charging for residential rental properties – *Residential Tenancies and Rooming Accommodation Act 2008*	Having to pay for water used may result in a reduction in water consumption. As premises need to be water efficient before charging can occur, this should also reduce water consumption
Queensland Development Code MP4.1/2/3 – Sustainable Buildings	Improved water efficiency should reduce water consumption
Water use information to be sent to tenants of residential rental properties – *Water Supply (Safety and Reliability) Act 2008*	Improved information on water usage may reduce water consumption
Regionally consistent residential water billing – *Water Supply (Safety and Reliability) Act 2008*	Improved information on water usage may reduce water consumption
Outdoor water use conservation plan – *Water Supply (Safety and Reliability) Act 2008*	The introduction of these plans is to ensure water efficient practices are undertaken at all times to increase the sustainability of water supplies and reduce the risk of water shortages in the future
Strategic asset management plan – *Water Supply (Safety and Reliability) Act 2008*	Improved management of water assets
Customer service standards – *Water Supply (Safety and Reliability) Act 2008*	Improved management of water assets
Drought management plan – *Water Supply (Safety and Reliability) Act 2008*	Improved climate resilience of water assets
System leakage management plan – *Water Supply (Safety and Reliability) Act 2008*	Improved management of water assets
Drinking water quality management plan – *Water Supply (Safety and Reliability) Act 2008*	Ensures the safety and reliability of drinking water
Recycled water management plan – *Water Supply (Safety and Reliability) Act 2008*	Ensures the safety and reliability of recycled water
Water efficiency management plan provisions – *Water Supply (Safety and Reliability) Act 2008*	The primary aim of the water efficiency management plan provisions is to promote water savings by non-residential customers of water service providers
Various demand management programs in South East Queensland under Chapter 2a *Water Act 2000*	Improved water efficiency in SEQ
Sustainability Declaration – *Building Act 1975*	The sustainability declaration identifies the property's environmental and social sustainability features in the areas of energy, water, access and safety
Total Management Plan – Environmental Protection (Water) Policy 2009	Improved management of water assets
Total Water Cycle Management Plan – Environmental Protection (Water) Policy 2009	Improved environmental water quality
Environment Management Plan – Environmental Protection (Water) Policy 2009	Improved trade waste management
Chapter 10 of the Local Government Act	A local government water service provider instituting a two-part tariff and consumption-based charging is obliged to implement universal metering
***National Measurement Act*, NSC R49-1**	Covers the control and accuracy performance compliance of water meters while in service
Water Efficiency Labelling and Standards Act 2005	Promotes the adoption of efficient and effective water use and water saving technologies

A final case study

Brisbane, a WaterSmart City

The city of Brisbane aspires to be a water sensitive city, articulated through its WaterSmart City Strategy (the strategy). A snapshot of Brisbane's achievements to date and its aspirations for the future are presented to show how the elements of a water sensitive city can come together.

Highlights

Brisbane is experiencing high levels of population growth and has just come out of a severe drought. Brisbane City Council (council) has made a commitment to improve its water security and sustainability by adopting a whole-of-water cycle approach to water management. This integrates water supply, wastewater, stormwater and waterway management with land use and infrastructure planning.

In 2007, the Queensland State Government introduced changes to water supply and sewerage management services in South East Queensland. Despite new institutional arrangements, council remains committed to achieving 'Our Shared Vision: Living in Brisbane 2026' by establishing Brisbane as a WaterSmart City. This means:

- the water cycle will provide an enduring source of clean water for human and ecological needs
- community and waterway health will be safeguarded through fit-for-purpose water supplies and integrated catchment management
- the Brisbane River and Moreton Bay catchments will be managed to ensure water resources continue to contribute to Brisbane's prosperity even during periods of flood and drought.

Brisbane has made significant achievements under this overarching strategy.

Managing demand

Council, in partnership with the Queensland Water Commission, ran a very successful behavioural change program to reduce domestic consumption from pre-drought daily usage of 296 L/person/day to 140 L/person/day. The Target 140 program involved a combination of water restrictions and education. Programs such as the Business Water Efficiency Program also successfully reduced non-residential water demand.

Reducing system losses

More than 8 ML of water per day previously lost through leakage has been saved via the reduction of water pressure across the system and improved leakage detection.

Alternative water sources

Reduced reliance on potable water from surface storages has been achieved in a number of ways. More than half of all Brisbane's detached residential dwellings now have a rainwater tank purchased through council's Rainwater Tank Rebate Program. Wastewater recycling saves up to 20 ML of potable water each day and has the potential to allow long-term total production of 240 ML/day for SEQ as a whole. A number of stormwater harvesting projects are in place, including Mt Coot-tha Botanic Gardens. The Brisbane Aquifer Project sources groundwater under strict environmental conditions from aquifers across the city, contributing a total of 20 ML/day directly to the potable water supply network. Decentralised systems such as greywater recycling are promoted.

Flood management

The Be Floodwise program aims to reduce the risks of flooding for the community and includes a free online flood mapping tool (the Flood Flag map) to inform the population about flood risk at the local scale.

Water sensitive urban design

Water sensitive urban design infrastructure is being installed in many open space areas to improve urban stormwater flow and water quality. Water sensitive urban design has been strongly promoted through council's involvement with the Healthy Waterways Partnership which has developed a range of design guidelines and training programs for implementing best practice water sensitive urban design in buildings and public spaces.

Catchment management

A Local Waterway Health Assessment program monitors waterway health and is used to prioritise riparian and in-stream rehabilitation works. Council supports many volunteer-based catchment management groups, provides information on individual creek catchments via Know Your Creek handbooks and collaborates with residents to plant millions of trees under the Greening Brisbane Naturally program.

Council continues to build on these gains to further integrate the water cycle via its evolving WaterSmart City Strategy. Urban development in the future will be higher in density which means that the built form will need to be more integrated into the natural landscape, particularly around waterways and overland flow paths. Council is planning for this change as it aspires to become a truly water sensitive city.