

Appendix A

Summary of Relevant Previous Studies and Strategies

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Appendix A Summary of Relevant Previous Studies and Strategies

There has been a substantial body of work undertaken over the past few years in the general area of integrated water management and specifically, on the potential for the use of alternative water sources to supply demands for non-potable water. The main studies, projects and documents of relevance are discussed briefly below.

1.1 Vision and Strategy

Think water, act water [Australian Capital Territory Government, 2004] sets out a vision and objectives for integrated water management for Canberra. This strategy involves several components including demand management, non-potable substitution and augmentation of the water supply system.

The main objective of the strategy was to provide an adequate and secure water supply for the ACT. Accordingly, the ACT Government has set the following targets for the reduction of potable water use:

- A reduction in per capita consumption of mains water by 12 per cent by 2013 and 25 per cent reduction by 2023. These reductions will be achieved through:
 - water efficiency measures
 - sustainable water recycling
 - use of stormwater and rainwater
- An increase in the use of reclaimed water from 5 per cent to 20 per cent by 2013.

Think water, act water identified water efficiency measures for residential housing, and noted that initiatives are needed for commercial and industrial sectors, and from government buildings and public housing. The strategy also recognised that alternative water supplies such as rainwater, stormwater and wastewater may be required.

In determining the potential supply available, *Think water, act water* considers the enlargement of the Cotter Dam and the ACT's participation in the cap on water diversions from the Murray Darling Basin.

The strategy also outlines the ACT government's responsibility to:

- protect water quality,
- address environmental flow requirements,
- manage riparian zones and,
- use adaptive management in managing the ACT's water resources.

The impact of urbanisation on water resources is to be addressed through the implementation of water sensitive urban design, to be implemented by developers in greenfield developments, and to be retrofitted by the ACT Government where possible into developed areas.

Think water, act water acknowledges that to meet the objectives of the strategy, the community needs to be involved. Therefore, it proposes an information and awareness program, and the engagement of community groups.

Finally, the strategy is to undergo review every 5 years to ensure that it remains current, and the ACT Water Report is to report annually on the effectiveness of implementation. The strategy is currently under review. Responsibility to implement each of the recommendations of the strategy is attributed to relevant government departments.

1.2 Policies and Guidelines

A range of government policy and legislation is relevant to the use of alternative water supplies for non-potable uses:

ANZECC Guidelines

The *Australian and New Zealand guidelines for fresh and marine water quality* (ANZECC Guidelines) (ANZECC, 2000) provide a framework for managing water quality in rivers, lakes, estuaries and coastal waters. The core concept of the guidelines is to protect water quality to ensure that the “environmental values” of that water can be supported over the long term. Environmental values are the values or uses of a water body that are important to the community, such as aquatic ecosystems, aquatic foods, recreation, visual amenity, drinking water and agricultural uses of water. The guidelines set out a decision making framework to determine if the environmental values of a water body will be protected by the current quality or if action to improve water quality should be taken.

Australian Guidelines for Water Recycling (AGWR)

The *Australian Guidelines for Water Recycling* (AGWR) provides a nationally consistent framework for implementing and managing the sustainable use of alternative water sources, including sewage, grey water and stormwater.

Phase 1 of the AGWR, *Managing Health and Environmental Risks* (NRMMC-EPHC-AHMC 2006), was published in 2006 and provides nationally consistent approach for the management of recycled water.

The AGWR advocates a risk management based approach and is designed to be suitable on a wide range of scales, from small on-site schemes through to large utility run schemes. The risk management framework outlined in the AGWR is based on the *Australian Drinking Water Guidelines* (NHMRC -NRMMC 2004) and World Health Organisation’s *Guidelines for Drinking-water Quality* (WHO 2004). Whilst not mandatory, the AGWR was designed to be used by any government or private entity involved in the supply, use or regulation of recycled water.

The approach advocated in the AGWR utilises microbial risk assessment to calculate the risks to human health associated with a recycled water scheme. Performance targets for the treatment processes are determined in terms of log reduction for each pathogen group to achieve a residual risk that is considered tolerable. The tolerable risk level is defined as 10^{-6} disability adjusted life years (DALYs) per person per year. The required log reductions are calculated as a function of the concentration of the hazardous microorganisms in the source water, the exposure pathway and the exposure frequency.

In terms of environmental protection, the AGWR also advocates a risk assessment based approach focusing on the chemical hazards of recycled water use (the microbial risks are largely dealt with by the measures to protect human health).

The second module of Phase 2 of the AGWR, *Stormwater Harvesting and Reuse* (NRMMC-EPHC-NHMRC, 2008) extends the advice provided in Phase 1 to cover the harvesting and reuse of stormwater.

ACT Wastewater Reuse for Irrigation – Environmental Protection Policy 1999

The key document governing water recycling in the ACT is the *Wastewater Reuse for Irrigation - Environment Protection Policy* (EPP) (Environment ACT 1999). The aim of the EPP is to assist in the application of the Environment Protection Act 1997, and associated regulations, as they apply to recycled water, to ensure adequate protection of public health and the environment.

The EPP specifies final water quality required for different end uses to ensure the water is fit-for-purpose and suggests treatment processes that should achieve the required quality. Alternative treatment processes are acceptable as long as the proponent can demonstrate that the scheme meets the required water quality parameters. The EPP primarily relates to water recycling for irrigation; however it also provides final water quality requirements for residential garden watering and toilet flushing.

The EPP was developed with advice from the Health Protection Service, ACT Department of Health and Community Care, and it refers to the *Guidelines for Sewerage Systems – Use of Reclaimed Water* (ARMCANZ-ANZECC-NHMRC 2000). The EPP does not apply to stormwater recycling.

At the time of the AGWR release, the ACT Environment Protection Authority (EPA) reviewed the EPP against the AGWR and felt that the EPP was at least, if not more, stringent than the AGWR (NWC, 2006). The ACT EPA concluded that the EPP remained appropriate for the types of schemes in the ACT especially given that most schemes are small and require potable top up to meet demand. The ACT EPA indicated that if the EPP did not cover an important parameter associated with a future scheme, then it would refer to the AGWR in that case.

1.3 Broad scale plans and studies

Canberra Integrated Waterways Project [Maheepala et al., 2009]

A broad study of opportunities for non-potable reuse focussing on stormwater harvesting and ASR was undertaken and is documented in the *Canberra Integrated Waterways* Draft Report by CSIRO [Maheepala et al., 2009]. The purpose of the report was to identify stormwater harvesting opportunities with potential to provide 3 GL of fit for purpose water for non-potable uses and quantify the associated costs and benefits. Existing and potential ponds and demands were identified and catchment parameters, pond dimensions and reuse demand volumes were calculated. ASR and wastewater top-up were also considered. The documentation of these provides a valuable database of information. A large number of scenarios were considered and least cost options were identified. Costs were estimated based on cost curves and simplifying assumptions. Three master plans were developed, with Plans B and C superseding Plan A and using reliabilities of 95% and 85% respectively. The resulting plans have costs in the order of \$150 M - \$180 M with levelised costs ranging from \$2.94 to \$3.67 per kL including pond construction. More detailed triple bottom line assessment was also undertaken. The data and methods from this study will be used extensively within the present study with further refinements and updating where required.

Water Management Plan for ACT Sportsgrounds, Parsons Brinkerhoff, May 2009 [PB, 2009]

This report documents an investigation of the potential non-potable water sources that could be supplied to sportsgrounds in the ACT to assist in meeting the targets set out in *Think water, act water*. The objective of the investigation was to ensure that no sports ground would solely rely on potable water by 2013. The Report focussed primarily on stormwater harvesting options utilising the ACT's existing ponds and lakes, but also covered the use of recycled water, groundwater and managed aquifer recharge.

The discussion around recycled water component of the Report was based largely on the work undertaken in the Recycled Water Strategy for Canberra. The Report generally didn't propose stormwater harvesting schemes where recycled water supply was already available or planned. An exception to this was the supply of stormwater to Belconnen North, which was investigated but not included in the final recommendation.

The Report recommended the following schemes be implemented:

- The connection of NCWRS to LMWQCC as proposed in Recycled Water Strategy for Canberra
- Supply North and South Tuggeranong with stormwater from Lake Tuggeranong
- Establish a South Canberra Recycled Water Scheme with recycled water supply from Fyshwick Sewage Treatment Plant.

Risk assessment of potential human contact with irrigation water, GHD, 2010

A risk assessment was conducted by GHD and reviewed by AECOM. The assessment found that risks associated with existing lakes and ponds were high while those for irrigation with non-potable water were low to negligible after mitigation. It is considered that overall the assessment is realistic while some risks may be over or under stated. The review focussed on human health risks and it is considered that a more comprehensive assessment building on this work would be beneficial. This is included in Discussion Paper 1 in Volume 2 of this report.

1.4 Recycled wastewater

Canberra Sewerage Strategy 2010 – 2060 – Stage 1 Options Report, [ActewAGL, 2010a]

ACTEW has identified and evaluated a number of possible directions for providing sewerage services to Canberra for the next 50 years. Using a multi criteria assessment (MCA) framework, the report assessed a range of options identified under the following scenarios:

- Baseline (i.e. existing and what is planned for implementation)
- Enhanced technology
- Dispersed treatment
- Increased recycling - three options; 15%, 40% and 100% reuse
- Low energy

The baseline scenario for recycled water includes the existing system, with measures that ACTEW intend to implement over the next few years, including upgrades to FSTP, expansion of NCWRS and integration of NCWRS with the stormwater harvesting scheme recently constructed in Mitchell and decommissioning of the Southwell Park water mining plant. The baseline scenario would see recycled water use increase to 10% at an estimated capital of \$106 million (including upgrades to FSTP).

The report concluded that further expansion of the recycled water network beyond the baseline would provide significant community benefits and for that reason should be considered further to achieve an optimum degree of recycling, somewhere between 15% and 30%. Stage 2 of the strategy will compare and assess different levels of recycling within that band.

The report also recognises the need for the expansion of the recycled water network to integrate with ACT Government work on stormwater schemes.

Strategic Review of Sewerage Services – Effluent Reuse Options for Canberra [KBR, 2010]

This report expanded on previous work to develop a 50 year strategic plan for effluent reuse in Canberra. The report looked at a range of options for increasing recycled water use in stages, from existing levels up to a hypothetical scenario for 100% recycling by supplying recycled water to large scale agricultural areas in the ACT and NSW.

The study found that implementation of Stages 1, 2 and 3, which included connection of NCWRS to LMWQCC, utilising Lake Burley Griffin as a storage and expanding recycling to Central Canberra, would meet the 20% reuse target set out in *Think water, act water*.

The report also concluded that 100% reuse could be achieved with implementation of all available urban and agricultural uses, but that increasing reuse beyond 25% would have significant impacts on downstream irrigation users. The report found that implementation of stages beyond Stage 3 and the agricultural reuse options would have significant impact on environmental flows and downstream irrigators on the Murrumbidgee and would also attract significant infrastructure costs.

Future Water Planning - Recycled Water Strategy for Canberra [ACTEW, 2008]

In 2008 ACTEW developed a strategy to assist in achieving the target set out in *Think water, act water* (ACT Government, 2004) to recycle 20% of wastewater discharge by 2013 by identifying options for expanding existing recycling schemes in a staged approach.

The report recommended a number of short, medium and long-term options to increase recycled water use. Implementation of the recommended strategy would see the reuse target of 20% met in the long term if considered in conjunction with grey water recycling schemes. The key components of the strategy to included:

- A strategic shift from decentralised schemes (three schemes) to centralised recycling and supply of recycled water (two schemes)

- Connection of NCWRS to LMWQCC through Belconnen via O'Connor Reservoir
- Further investigation of option for storing treated effluent in Lake Burley Griffin
- Decommissioning the Southwell Park water mining plant
- Investigation into supplying recycled water to new residential developments.

Reclaimed Water Projects Sustainability Report [KBR, 2005]

This project investigated a range of options available for reusing water in the ACT by undertaking a sustainability assessment using multi criteria analysis to identify the most sustainable options. The objective of the report was to determine if the water policy target of 20% reuse is a reasonable target for an inland city that has major irrigation downstream, which is dependent on discharges from the LMWQCC.

The social and environmental issues and cost implications of meeting targets were investigated and the report concluded that options that met the target were generally not affordable within the timeframe. The report concluded that a reuse target of 10% within the 2013 timeframe was more achievable.

The highest ranked option was connection of LMWQCC to the NCWRS and to supply customers in North Canberra, South Canberra, Belconnen and the Woden Valley. This option resulted in reuse of 16.5% of all wastewater.

1.5 Stormwater reuse

The planning and design of several stormwater reuse schemes is in progress with many being undertaken as part of the Canberra Integrated Waterways (CIUW) project. There are 3 pilot projects in progress:

- Inner North (Flemington Road Ponds 1 and 2, Dickson and Lyneham ponds)
- Lake Tuggeranong
- North Weston Creek Pond

There are also a number of schemes that are planned or under development:

- Lake Ginninderra
- Coombs Pond
- Valley Ponds

Canberra Integrated Urban Waterways – Preliminary Sketch Plan Design Report – Part B, Stage 1, [GHD, 2010]

This report covers the design of schemes for Lake Tuggeranong, Tuggeranong Weir, Isabella Pond, Upper and Lower Stranger Ponds. Only stage 1 of the scheme is reported with an estimated capital cost of approximately \$10 M and levelised cost of \$3.82. The design of the pump station and pipe layout is documented in the report.

Designs for Lake Ginninderra and the northern ponds are covered in Part C which is still in preparation. For the purposes of this study, reference was made to a draft containing details of Stage 1 of the Lake Ginninderra scheme.

The design of the Inner North scheme, including diversion of flows from the Dickson and Lyneham wetlands and reticulation system is documented in a number of reports:

- Final Report for Design Acceptance: Canberra Integrated Urban Waterways: Dickson and Lyneham Ponds
- Flemington Road Pond Reticulation, Preliminary Sketch Plan Report, [Cardno Young, 2010]
- Final Sketch Plan, Canberra Urban Waterways: Flemington Road Ponds Reticulation, [URS, 2011]

The proposed Dickson and Lyneham wetlands [URS, 2010] are intended to provide stormwater quality treatment and achieve reductions in nutrient loads of 50-60%. The average extended detention depths of the systems are in the order of 1m and they are likely to operate primarily as open water ponds. They are expected to yield up to an average of 430 ML/year of stormwater for reuse.

In the preliminary sketch plans for the Flemington Ponds [Cardno Young, 2010], extensive modelling of catchment behaviour was undertaken to understand the low observed inflows. It was proposed to link the Dickson and Lyneham wetlands to Flemington Ponds to improve the potential yield as well as hydraulically link the two Flemington ponds (P1 and P2) and consider the implementation of an aquifer storage and recovery (ASR) scheme at the EPIC site.

A design for the irrigation reticulation system for Flemington Ponds [URS, 2011] recommended that a new pump station be constructed to replace the existing one to service the expanded set of users and also potentially service the proposed aquifer storage and recovery. The reticulation system was designed based on hydraulic modelling and costs were estimated at \$10M including a contingency of 40%. A number of the assumptions and approaches adopted differ from those used by GHD for the Part B and C studies.

These studies included evaluation of different servicing options including direct supply, balancing storages and variation of timing of supply. Generally it was found that an approach using balancing storages was preferable to direct supply as it reduced pipe sizes and improved cost effectiveness.

1.6 Integration of non-potable water supply schemes

While a number of studies of various opportunities are being undertaken, they all adopt a variety of different assumptions, different constraints and complexities are encountered and different approaches are used. While each study has merits in its own right, there is difficulty in comparing them to allow prioritisation of works to occur and to support a strategic approach to their implementation. A key focus of the Non-potable Water Master Plan study was to address this issue. It is noted that significant detailed design work has been undertaken in a number of cases. Where possible, this study has drawn on information from these, while necessarily simplifying to allow a broader overall master plan to be developed. It is noted that this study should not be seen as superseding the previous detailed work or prescriptively setting out alternatives but rather to evaluate the relative priorities of different schemes and evaluate the interactions between schemes and the effects these have on the preferred arrangement of individual schemes.