THE HAWKESBURY WATER REUSE SCHEME

C A Booth, R Attwater, C Derry, B Simmons

Abstract
Reuse of treated effluent and harvesting of stormwater are gaining broader recognition as means of conserving a valuable resource, while reducing impacts from pollutants and nutrient loads on our river systems. The Hawkesbury Water Reuse Scheme seeks to showcase an integrated approach to effluent and stormwater reuse and constructed wetland technologies, and provide a focus for community awareness of the potential benefits of water reuse.

Introduction
The Hawkesbury Water Reuse Scheme (HWRS) is centred within the Hawkesbury Campus of the University of Western Sydney (UWS) in Richmond NSW, approximately 80 km northwest of Sydney. The campus has a history of agricultural and horticultural studies, and is developing a long-term focus on issues of sustainability, particularly as they relate to urban and rural landscapes. The Hawkesbury Water Reuse Scheme has been built upon partnerships between the University and Sydney Water Corporation (SWC), Richmond TAFE, Hawkesbury City Council, and Clean Up Australia. Through these partnerships, and with its focus on issues of sustainability, the Scheme is an important element of the developing UWS Water Research Program.

Experiences derived from the management, research, and outreach activities associated with the Scheme will be relevant to water reuse initiatives developing around the urban-rural peripheries of coastal cities and inland regional townships (Simmons et al. 2000). The Scheme provides an opportunity for the partners to pursue the social and environmental benefits of water reuse, including:
• Nutrient recycling, harvesting and beneficial use for agricultural production;
• Minimising the impacts of effluent discharges into the Hawkesbury-Nepean River System;
• Influencing reductions in Sydney’s potable water demand;
• Promoting practical, acceptable and safe management strategies and practices.

UWS outreach programs associated with the Scheme seek to promote awareness, education and changes in behaviour towards greater community acceptance of water reuse. In doing so, challenges in monitoring behavioural changes will be researched and an integrated total water cycle management advocated and advanced.

An Environmental Management Plan (EMP) has been prepared for the HWRS as the technical reference for the Agreement between UWS and SWC concerning the supply and use of treated effluent from the Richmond Sewage Treatment Plant (STP). In its preparation, consideration has also been given to the possibility for the EMP to be upgraded to an Environmental Management System (EMS). The structure of the EMP builds on the AS/NZS ISO 14000 series guidelines on principles, systems and supporting techniques (Standards Australia 1996).

A general description of the Hawkesbury Water Reuse Scheme

Wet weather flows from the Richmond STP, and urban and rural stormwater from Richmond township flow through the HWRS area, into Rickabys Creek and then enter the Hawkesbury River, just upstream of Windsor. An important element within the HWRS is the Richmond Water Reuse Project, a Clean Up Australia “Fix Up” project. Through a UWS partnership with Clean Up Australia and the UWSH Foundation, treated effluent and stormwater harvesting infrastructure has been built incorporating separate wetland systems for treated effluent and stormwater polishing. An aerial photo of the location is shown in Figure 1, and a general schematic in Figure 2.

Effluent treatment and use

The Richmond STP currently uses trickling filter technology to achieve secondary level treatment of the effluent, followed by disinfection. An upgrade of the Richmond STP to an IDAL (intermittent decanted aerobic lagoon) plant which supports biological nitrogen removal is planned for completion in late 2004. The Richmond STP currently has a capacity of 14,000 EP (equivalent persons) and an average daily flow of 2.5ML, or average annual production of 927ML (Hird 1998). It is feasible that in approximately 5 years, effluent from North Richmond may be piped to the Richmond STP, increasing average daily flows to 4 ML/day.

Treated effluent from Richmond STP is collected in a Receiving Pond, and then pumped up into the first University storage, the Effluent Turkey Nest Dam (capacity 93 ML). Prior to the
construction of the in-line Stormwater Detention Basin (capacity 60ML), wet weather discharges from the STP overflowed from the Receiving Pond down the stormwater channel to Rickabys Creek.

Treated effluent is piped from the Turkey Nest to the Horticulture Dam (capacity 84 ML), Hillside Dam (capacity 76 ML) and directly to the cropping area north of Blacktown Rd. Between the Turkey Nest and the Horticulture Dam, supply lines link the Deer Farm and Grazing Unit to the Scheme. Supply lines from the Horticulture Dam include one line to the playing fields, and a pressurized line to the Horse Unit and the Horticulture areas. Storages for the Horticultural areas include the Horticulture Tank (capacity 0.1 ML) and the Yarramundi Dam (capacity 6.5 ML). This system of infrastructure supplies a number of water users, including the irrigation of:

- Pasture for the UWS Dairy, Horse Unit, and Grazing Unit;
- A range of horticultural crops and orchards; and
- University playing fields.

The EMP recognises a principal challenge of water reuse schemes, which is optimising storage management, and endeavours to strategically address this key issue. Targets have been identified on the basis of modelling available storages and minimising risk of dry weather discharges of treated effluent to Rickabys Creek (James 2000). As stormwater supplies come on-line to supplement current treated effluent supplies in Hillside Dam and Horticulture Dam, and additional storages are incorporated in the Scheme, these targets will be reconsidered. However, they do provide relevant management targets given the storage limitation for treated effluent and the need to have substantive storage capacity prior to the winter period of low irrigation demand.

Following the development of the EMP, an initial risk assessment was undertaken. The assessment identified the preliminarily risk management needs of the broad range of staff, contractors, students and general public who utilise the campus facilities. Further strategies for risk communication and management will be developed (Derry, Booth and Attwater 2003). Complementary research regarding effluent treatment and use includes questions of soil sustainability and monitoring (Aiken 2003), groundwater impacts, and the establishment of constructed wetlands.

**Effluent Wetlands**

An innovative, low cost system of Effluent Wetlands has been designed, based on concepts collaboratively developed with the UWS School of Engineering and Industrial Design and Australian Wetlands Pty Ltd. These wetlands, built as part of the Richmond Water Reuse Project, are capable of capturing and storing wet weather flows from the STP for periods of up to 5 days. A maximum of 24 ML of STP wet weather flows will be stored in these wetlands. These flows will be stored for periods of at least 10 days and then progressively pumped back to the Effluent Turkey Nest Dam. Opportunities to link these captured wet-weather flows back to the IDAL plant for further treatment if required are under consideration by UWS and SWC.

Operational protocols for the management of treated effluent within the wetlands will be developed within the EMP. These protocols will assist in minimising the need to discharge disinfect and treated effluent to Rickabys Creek and will optimise the integrated water harvesting and storage capabilities of the overall Scheme.

**Stormwater treatment and use**

The HWRS uses a total water cycle management approach to integrate the above use of treated effluent with treated stormwater. As outlined previously, the Richmond Water Reuse Project has provided key infrastructure for stormwater harvesting, polishing and reuse. A 60ML Stormwater Detention Basin has been constructed at the junction of the two main stormwater channels draining the upper catchment of Rickabys Creek. A 90ML Stormwater Turkey Nest Dam has also been constructed to store treated stormwater. On completion of the project, captured stormwater will pass through a series of constructed wetlands and be stored in a 25ML Holding Pond for either pumping for storage in the Stormwater Turkey Nest Dam or for release to Rickabys Creek as environmental flows of improved water quality. Current stormwater modelling by Stewart (2003) will support the integrated and equitable allocation of this valuable resource for both water users and environmental flows.

As part of the Richmond Water Reuse Project, considerable additional infrastructure in the form of pipes and
pumps have been provided as in-kind contributions by a range of industry and business partners. This additional infrastructure has been installed to link the capture, treatment and storage elements with the Hillside Dam and upgraded infrastructure at Richmond TAFE. A proposal within the EMP strongly recommends linkage of the treated stormwater supply with Horticulture Dam. This would enable maximum flexibility of use of the two recycled water supplies.

**Stormwater Wetlands**

Similar to the Effluent Wetlands, collaborative concept development resulted in a series of Stormwater Wetlands being designed to polish harvested stormwater. The four one-hectare wetlands will deliver water to the 25 ML Holding Pond mentioned above. Detention times will be sufficient to produce a quality of stormwater suitable for uses including the provision of supplies to Richmond TAFE and as a back-up supply for the treated effluent, particularly in summer periods of high irrigation demand and during drought.

The wetland design allows a multitude of wetland filling and holding (treatment) scenarios which are important for research and demonstration purposes. A developing research program, in partnership with Australian Wetlands Pty Ltd, will investigate the role of ‘self-design’ in the establishment of ecosystem function of stormwater treatment wetlands. The protocols for capturing and treating stormwater will be identified in the EMP for the Scheme. Also, the environmental flows will be released from the Settling Pond in accordance with protocols to be developed with the NSW Department of Infrastructure, Planning and Natural Resources and operationally enabled though their inclusion within the UWS Environmental Management Plan.

**The role of the Hawkesbury Water Reuse Scheme in water research for Western Sydney**

The HWRS described above is an important element within an integrated suite of applied research and demonstration facilities being developed by the UWS. Complementary initiatives are also being pursued and include an On-site/Decentralised Wastewater Research and Training Centre. These, and other initiatives, form part of the UWS “Water Futures Research Initiative” which is a ‘whole-of-university’ transdisciplinary research program (Davey 2002). This initiative seeks to utilise and build upon the broad environmental, social and economic research base of UWS to help address key water management issues of significance to Sydney and its water supply catchments. The “Water Futures Research Initiative” recognises the unprecedented challenges faced in managing the urban water cycle on a more sustainable basis.

**The Authors**

All are members of the University of Western Sydney, Hawkesbury Campus. Adjoint Associate Professor Sandy Booth is the leader of the Integrated Catchment and Environmental Management (ICEM) Research Group, with over 25 years of experience in natural resource management issues in Australia and the Asia Pacific Region. Email: s.booth@uws.edu.au. Dr Roger Attwater has also worked on a range of catchment management issues and projects in NSW, WA, ACT, Thailand and now in China. Email: r.attwater@uws.edu.au. Chris Derry is an epidemiologist/risk analyst who has worked on a number of water consultancies locally and internationally. Email: c.derry@uws.edu.au. Bruce Simmons is Senior Lecturer, Environmental Management, currently supervising four research programs in stormwater and wastewater harvesting and re-use. Email: b.simmons@uws.edu.au.

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