Salisbury's Journey Towards Water Sustainability

The Salisbury program to recycle stormwater has evolved from being just an environmental solution, to a significant business opportunity.

As an important part of the City's biodiversity strategy, recreation and habitat reserves were developed during the 1980's, to complement the need for stormwater detention basins. The following decade water quality monitoring showed that the water flowing through the artificial wetlands was substantially improving. Heavy metals were dropping out, nutrient loads were being absorbed by the reed beds and the action of sunlight through the shallow water was killing some of the biotic contaminants.

From this research, Council came up with an innovative idea for storing water underground to irrigate Council reserves during the summer months. The first Aquifer Storage & Recovery (ASR) scheme was introduced, pumping water 200 metres into a lower aquifer and then drawing it from the same bore in the summer months.

Since then, the City of Salisbury has developed more than 50 wetlands covering over 6 square kilometers and has built 22 ASR bores, providing water to Council's reserves and school ovals. Importantly, this program has also served to substantially reduce the flow of polluted water into the marine environment of the Barker Inlet, a sensitive ecological area on Salisbury's doorstep. Council now captures more than a quarter of all stormwater flowing through the city and aims to increase this even further with numerous projects under construction and in the planning stage.

Major industries within the Council area are benefiting from this innovative solution as Council sells the water as a secondary water supply, through a dual-pipe reticulation system which also serves most residential subdivisions. Mawson Lakes' residents receive a secondary water supply through a cocktail of recycled stormwater and treated wastewater. As an alternative to direct supply through a dedicated pipe network, the City also trades between bores – both within and outside the city – in a process where credits gained from injecting into the aquifer in one location can be sold and used in another.

It is anticipated that this program within the City of Salisbury alone, will reduce the total metropolitan Adelaide demand on the River Murray by 25 per cent. Importantly, the program demonstrates the potential for Local Government to achieve environmental goals while marrying its economic development strategies and commercial objectives in a way that is finding new paths for public policy in this critical area of urban need.

A 'potted' history of the development of practical 'Water Sustainable Urban Design' thinking in Salisbury is provided below:

Background:

- Characteristics of the Salisbury landscape are typical of Adelaide:
    - Wide flat plain leading to a low range of hills around 8kms inland
    - Intersected by streams, generally dry in summer, that traditionally flowed into marshy coastal landscape
    - Very rich area, with aboriginals found in permanent occupation pre-European settlement

- Current suburban development of Salisbury, commencing in early 'sixties took place largely on the escarpment, where land is readily drained:
    - Stormwater left to pool on the flat plains
    - This pooled water formed the genesis of Salisbury wetlands

Early Wetlands – a conservation resource

- Initially Council Engineers sought to turn this pooled water into a recreation and conservation resource:
    - They had a strong conservation theme, and particularly sought to develop the wetlands as wildlife refuges, using native wetland grasses and vegetation
    - This was very successful, and the wetlands quickly established themselves as very important wildlife conservation areas, with a large number of birds, many rare, establishing roosting colonies in the area.

Role of Wetlands in Stormwater Detention

- Because much of Salisbury lay on a flat plain, wetlands became critical to further urban development of the City in the 'eighties:
    - Their capacity to retain stormwater at peak periods for subsequent release enabled the City to develop its area at a cost less than half traditional means of stormwater disposal
    - Wetlands were incorporated into every subdivision, in order to retain water as far as possible on site
    - And along new main roads

- And into major industrial sites
- This application was also favoured by many industries to enable potential industrial spills to be contained on site rather than suffer the penalties of potential escape into the public system

- By the early 'nineties, the City had over 30 major wetlands located on all stormwater systems:
  - Now over 50 wetlands of all sizes

Role of Wetlands in Water Cleansing

- Extensive monitoring of water quality in the wetlands was undertaken:
  - It was discovered that the quality of water leaving the wetland systems, after only a few days, was excellent
  - Reed beds facilitate bacterial action to remove nutrients
  - Slow moving water enables heavy metals, adsorbed to clay particles, to settle out
  - Action of sunlight in shallow wetlands assists in the breakdown of many biological contaminants
- In 1993 Council set their vision to eliminate flow of polluted stormwater into Barker Inlet:
  - Barker Inlet, with extensive mangroves, is the principal breeding ground for SA fisheries
  - Under considerable ecological threat from flow of stormwater and sewerage effluent

Aquifer Storage and Recovery (ASR)

- Around this time, the City was, for the first time, examining the potential reuse of the water from the wetlands – to irrigate City parks in the vicinity:
  - However, while the wetlands generated more than enough water, it all came in winter when it was not required on the parks
  - So we considered opportunities to store it over the year

- In conjunction with staff from Mines and Energy SA, council staff came up with the idea of storing in the aquifer

- In 1994, Council installed the first ASR bore adjacent the Paddocks wetlands off Maxwell Road, Salisbury South:

    - Pump water 200 metres underground into the natural sandy limestone aquifer in winter

    - Water meter to measure injection and extraction volumes

    - Instrumentation and laboratory analyses of samples provide a pollution 'trigger' to start and stop injection

    - Water extracted in summer through the same bore head

    - Now have ASR bores operating on all of our major wetlands throughout the City

Industrial applications

- City began supplying small quantities of water to industry on a cost charge:

    - Water popular with nurseries, as it contains less than 20% of the salt content of mains water

G.H. Michell & Parafield Airport Wetland

- In 1997 G.H.Michell, one of Australia's largest wool processing companies, whose plant in Salisbury South employed around 600 people, approached Council for assistance with water, wastewater and solid waste disposal issues:

    - Michell's used extraordinary quantities of mains water, and the growing price of mains water and effluent treatment costs was forcing them to look at relocation options

    - Council assisted Michell to devise programs to reduce their mains water usage by more than 1 million litres of water per day!!

    - Trials included using road tankers to deliver water from the Paddocks wetlands ASR bore to run one of the Michell production lines

    - A series of trial wetlands were built on the Michell site

- Proved that wetlands could satisfactorily cleanse rinse water from their plant for reuse
- This offered the opportunity to save the firm several millions a year.
- Proceeded to look for a site big enough, and found it on the nearby Parafield Airport
- Initially designed to collect stormwater and cleanse it in the traditional way
- However, also designed to take rinse water from Michells as a means to sustain the wetlands through the dry summer period
- Water stored in aquifer and sent back to Michells
- First SCADA (Systems Control and Data Aquisition) computer installed in City office to remotely monitor instrumentation and control pumping systems.
- Michell installed advanced effluent treatment plant capable of removing up to 70 tonnes per day of sludge from the effluent prior to discharge to sewer.
- Council and Michell again combined their resources to examine options to re-process the sludge by combining with chipped green waste from Councils Parks & Gardens to produce high grade compost. This is now an on-going part of the Michell operation and results in 70 tonnes of organic material no longer going to waste in landfill.

Edinburgh Parks

- The next extension of the concept was in the developing industrial area of Edinburgh Parks:
    - Located to the north of Salisbury, adjacent to the Edinburgh Air Base, Edinburgh Parks is a major land release of former Department of Defence owned land
    - An area of 700 Ha is being developed as an automotive supply park to GMHolden, for Defence research and electronics companies, and as a centre for freight logistics

- Salisbury council has created a large elongated wetland through the whole length of the site, and have installed purple “reWater” mains supplies to all sites

- This project is about to undergo further development to increase it’s harvest capacity

Mawson Lakes

- Possibly the most ambitious project to date, the whole of the new urban development of Mawson Lakes has been designed & constructed to be sustainable in terms of water use

- Mawson Lakes now houses a resident population of 10,000 people, a permanent workforce of 10,000 (principally in the adjacent Technology Park), and a campus of the University of South Australia, with around 5,000 students

- Every home and business in Mawson Lakes has a “purple reWater” pipe as well as a mains water pipe.

    - reWater is used to flush toilets and irrigate landscape areas

    - reWater is available from SA Water at a reduced price on mains water

    - The reWater supply is a ‘shandy’ of recycled stormwater and recycled wastewater

Key Non-Engineering Issues

Some of the real challenges of this programme relate, not to engineering, but to legal and institutional challenges:

- Water as a ‘business’ for the Council

    - Our primary focus is environmental, not financial

    - If it was financial, we would probably not have come this far

    - Current financial modelling indicates that it may become a very important revenue stream for Council

- Risk management issues for the City:
    - Liability for potential pollution of the aquifer
- Need for long term supply contracts with industry:
    - With limited term extraction licenses from the State
- Water pricing, based on uncertain long term costs and liabilities:
- Rights to water injected into the aquifer
    - Ownership of surface water
    - Protection of water stored in the aquifer from other potential users
- Relationship with SA Water:
    - MOU
- Environmental issues:
    - Long-term remediation of wetlands
    - Could easily become ‘pollution sinks’ if not managed properly
    - Protection of integrity of aquifers
- Planning challenges:
    - Catchment Water Plans
    - Development Plan
    - Industry requirements; subdivision requirements
    - Landscaping standards

Conclusions

- The fragile nature of the Australian environment exposes us to a critical lack of sustainability in current water use in our cities
- Salisbury wetland program commenced as a flood-protection and conservation program

- It now demonstrates that there is an alternative to the wasteful use of water in our cities

- It shows that our cities can become far more sustainable if we care enough

- It raises significant challenges for engineers and planners

- It raises significant challenges for Governments in coping with the legal and institutional issues that have arisen.

- All involved in urban Government have little choice but to address the issues of sustainability in Australian cities, not just in water but also in energy, and in biodiversity

- The Salisbury wetland program has been a developing and interesting experiment that can be easily replicated throughout the country

- It has already achieved one of its early goals:

  “There is a better way”