Clearwater

CASE STUDY

Queen Victoria Market – Rainwater Harvesting

City of Melbourne
Cnr Queen and Therry Street,Melbourne,Victoria

Overview

Queen Victoria Market (QVM) is one of Melbourne's major tourist attractions, selling fresh food, delicacies, clothing and gifts. A great 19th century architectural example, it is located above Melbourne's first cemetery. With daily food handling and sanitation activities, QVM is one of the top 200 water-using-businesses within metropolitan Melbourne.

The QVM rainwater harvesting project is an outcome of the City of Melbourne's total water management strategy **Total Watermark 2004** and its Water Sensitive Urban Design Guidelines. A site specific Sustainable Water Management Plan aims to reduce the use of potable water by 30%. As part of the strategy to reduce potable water consumption and limit stormwater runoff, a rainwater harvesting system was installed in 2008, which collects water for toilet flushing. The significance of this project is in the integration of social, economic and environmental benefits achieved through rainwater harvesting at a high profile, heritage listed site. This project is widely regarded as a Water Sensitive Urban Design demonstration site for markets at a state and national level.

Rainwater is collected as runoff from a section of the QVM shed roofs, making up approximately 1.1ha in size. The water is piped to a large underground storage tank (600kL), situated underneath one of the outdoor car parks. From there, it is pumped to the most heavily used toilet block within the market complex, to be used for toilet flushing. The water is stored in header tanks (2 x 2kL), which are situated above the toilet block and can be topped up with potable water. Header tanks were used to minimise power consumption by the pump. The toilets were converted to 6/3 flushes to further conserve water.

Organisations

City of Melbourne
- (Responsible Council)
- Queen Victoria Market (Site Owner and Maintenance)
- Victorian Government – Stormwater and Urban Water

Conservation Fund (Funding Partner)
Coomes Consulting (Design Consultants)
Allwaste Solutions (Construction Contractors)
Monash University (Water Quality Monitoring)

> *A WSUD demonstration site for rainwater harvesting at a beloved, high profile, heritage site*

Cost

Overall Project Cost: $802,000 (out of which Grant Funding: $250,000)
Design Cost: $140k
Construction Cost: $600k
Community Engagement: $28k
Stormwater Quality Monitoring: $34k

Timeframe

September 2006 – May 2007: Design
Dec 2007 – May 2008: Construction
Jan – Sept 2007: Stallholder engagement activities
May – Jun 2008: Water quality monitoring

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Objectives

- Reduce potable water use at the QVM by harvesting rainwater for toilet flushing: provide a system with 80% reliability for a daily demand estimated at 30kL/day on market days (corresponds to close to 3000 flushes/day)
- Ensure that only roofwater (and not stormwater) is captured to avoid the need for treatment
- Improve stallholders' water efficient practices
- Decrease runoff volumes from the site, thereby also reducing levels of pollutants entering the Yarra River and Port Phillip Bay
- Increase community awareness and education around sustainable water management

Comply with complex site challenges:

- **heritage-listed site:** lack of space and strict aesthetics guidelines
- **location above a cemetery:** precludes excavations (except in places where previous excavations have been undertaken)
- **near-daily market activities:** limited window of opportunity for construction work and daily refill of any excavations
- **topography:** the site falls to the North-East of the site, while the only space for an underground tank is in the South-Eastern corner

Ensure the use of rainwater does not increase public health risks

Outcomes

Reduction in potable water demand due to:

- reuse of rainwater for toilet flushing (supply of approx. 5 ML/yr)
- replacement of all toilets with low-use 3/6L flushes

Decreased stormwater discharge from site, which reduces:

- pressure on Elizabeth St main drain which has a history of flooding, and stormwater pollutant loads reaching downstream environments (Yarra River and Port Phillip Bay)

Community awareness and education fostered through:

- On-site educational signage (toilet building)
- Engagement with stallholders through regular bulletins and educational activities undertaken by the onsite Sustainability Officer
- Ad-hoc tours to showcase the sustainable initiatives of the QVM (e.g. as part of the Sustainable Living Festival)
- QVM's website: the sustainability page features a section on the benefits of the rainwater harvesting project, as well as resource kits for schools running self-guided tours of the market.

The QVM rainwater harvesting project is a demonstration site for other fully functional markets. It shows that reduction in potable water demand can be achieved on a site with limited space and complex heritage requirements.

Solar panels will partly power the pumps and therefore reduce greenhouse gas emissions. Results from the monitoring campaign showed that the water quality drawn from the header tank is of suitable quality for toilet flushing.

Real time monitoring allows tracking of tank levels, pump running hours, faults etc. Any faults within the system trigger an SMS to the QVM maintenance crew, which allows speedy intervention.

Queen Victoria Market from above (Image courtesy of Wikimedia Commons)

Lessons learnt

Close relationships and constant collaboration was needed to comply with Heritage Victoria's stringent requirements.

In any case, when working on a heritage-listed site, expect to have to come up with alternative (and often more costly) design solutions multiple times. For example, the design consultants first suggested to divert the existing downpipes into a collection pipe which would run just below the roofline along existing trusses, but Heritage Victoria refused any solution which would involve visible pipes. The design therefore had to make use of the existing underground collection pipes. This resulted in:

- A more time consuming and more expensive solution. It involved checking the underground system for cracks, thoroughly cleaning it out and finally building underground diversions.
- A reduction in the achievable yield for the project. Due to the topography of the site, the roof surface
- that could be included in the scheme had to be reduced. Indeed, the existing underground drains of the Northern roof sections connect to pits were situated too deep and therefore could not be conveyed to the only possible site for the storage tank. This prohibited the use of this portion of the roof catchment.

In cases where your project can't overcome all challenges, try to think of acceptable and innovative compromises. While the initial plan was to harvest water off the entire roof of the QVM, several challenges including heritage requirements and topographic elements, did not allow for this option. While a reduced catchment area meant a reduced supply and yield for the end-use, the simple solution was to reduce the demand for the site. By replacing all existing toilets (using a 11L cistern) with 3/6L flush toilets, the demand could be reduced from 30kL/day to about 20kL/day on market days.

After installing equipment, ensure you clean up the site and remove any temporary protection measures. The flow meter in the toilet blocks seemed to be faulty when the system was first put online. This was due to the fact that a plastic bag (used to protect the flow meter during installation) had been left in place, partly blocking the flow through the pipe and impeding flow measurements.

Excavations in historical areas (such as in city centres) will generally reveal more existing underground services than records show.

Underground storage tank under construction (Image courtesy of Spiire)

Educational signage outside the main toilet block (Image courtesy of Spiire)