

# CH<sub>2</sub> Setting a new world standard in green building design

## Design snap shot 09: Water Initiatives

### Summary

#### Introduction

This snap shot discusses the water initiatives developed for CH<sub>2</sub>. It outlines the reasons the water initiatives were developed, the costs and benefits and outcomes.

#### Drivers and objectives

Water is a major issue for the Greater Melbourne area, with shortages occurring over the last few years. The City of Melbourne's Total Watermark Strategy aims towards sustainable water management by 2020. This includes reduced water consumption, improved water quality, and improved use of wastewater and reclaimed water. The City of Melbourne is committed to reducing it and the community's potable water use by 40% per capita by 2020 and it was therefore important to incorporate water strategies and pioneer new technologies that reflected this commitment to integrated urban water management.

These objectives are also supported by State building regulations effective July 2005 requiring the installation of fittings and taps with a minimum of AAA level, and a water tank or solar hot water system. This is supported by the national Water Efficiency Labelling and Standards Scheme, which introduces mandatory labels on most appliances from 1 July 2006 and will provide guidelines on the purchase of water efficient appliances.

#### Costs and benefits

##### Costs

In general, apart from efficient fittings, the systems used by CH<sub>2</sub> are expensive when looked at using a basic economic payback, given the low cost of water in Australia. In the future, water prices may become much higher, but in the meantime the main justification is one of resource conservation, efficiency and looking to the future cost pressures which may eventuate. Water efficient fixtures and water efficient landscape design have a strong business case if integrated at the design phase.

##### Benefits

- Provision of 72% of water needs through recycled water
- Saving of 10,000 L a week of potable water
- Potential savings of services cost due to 60% load reduction
- Reduced waste water
- Development of technology and knowledge that can be used in other projects
- Meeting policy commitments and providing leadership through demonstration

##### Outcomes

The approach was to first reduce the consumption of water by using efficient fixtures, followed by initiatives to collect rainwater and then looking at water treatment.

CH<sub>2</sub> is anticipated to reduce consumption of water from the public water mains by more than half, compared to a standard equivalent building. This will be achieved as follows:

- Blackwater and greywater treatment on site via a Multi-Water Treatment Plant (providing 72 per cent of non-potable water).
- On site rainwater collection
- 25% of the building's potable water requirements is provided through rainwater and by reusing the water used to regularly test the building's fire sprinkler system (which by law must be sourced from the mains).
- Use of AAAA-rated water saving fittings.

## Lessons

Water use assumptions and projections for CH2 together with anticipated costs, benefits and savings indicate the need for integration of considerations of water conservation throughout design and operation. Currently there is no viable payback for installing water recycling technologies due to the relatively low cost of water in Australia. But a major driver of these technologies is from a future proofing stance, anticipating water becoming a valuable resource in the future, and the need for City of Melbourne to be a good corporate citizen, and leading the community on sustainable water management.

## More detail

Estimates of water demand for the CH2 building assume a total of 600 employees, the installation of water efficient fittings, and usage of 19 kL/day (5 ML/year). Water management measures implemented fall under the following categories:

- water efficiencies,
- water reuse (rainwater harvesting and sprinkle water),
- water recycling and
- other innovative water saving techniques (i.e. plant watering and tolerant types, shower towers, cooling towers).

The water initiatives discussed within include the efficient fittings used, on site water collection, and irrigation. These are discussed in terms of their role within the Potable and Non Potable Loop. The chilled ceiling panels and beams also use water, however this is described in a separate snap shot on each initiative as well as under the energy overview.

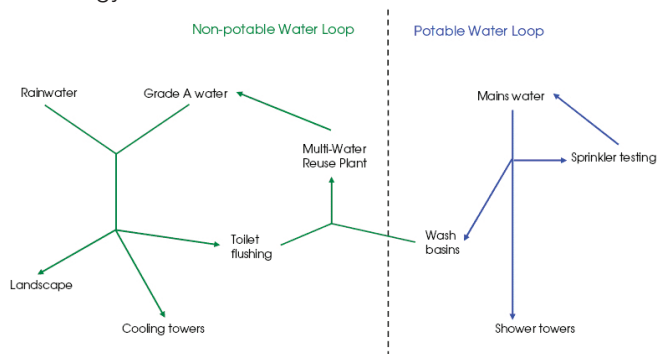
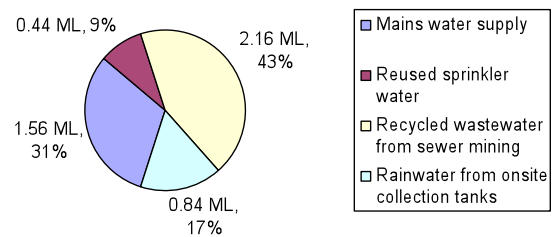


Figure 1. Water Cycle of CH2 (AEC)

The water system for CH2 is depicted in the above diagram developed by the ESD consultants, AEC. It describes the use of the non-potable water collected from the sewer and rainwater, the potable water from mains and the reuse of the sprinkler water. The specific contributions of each water source have been modelled as follows:

Sources for all Potable and Non Potable Uses of Water



## Efficiency

Installing efficient fixtures and fittings are invariably the most cost effective methods in order to save water. This can represent a saving of 30% compared to a typical commercial building's water use. CH2 is using the following AAAA rated fittings (using the Water Services Association labelling system):

- Showers – flow rate of 9L/min
- Taps – 2.5 L/min
- Toilets – 4/3L dual flush
- Urinals – automatic flushing using recycled water

Where water efficient systems were not yet available the specifications allowed for their later addition. For example, Provide concealed cisterns to all pans with the supply fed from the flushing system, the contractor to investigate the availability of 4 litre flushing cisterns when and if they become available. Excerpt from Hydraulic Specification

## Building management system and water meters

Linked to the building management system is a comprehensive system of water meters that will be installed on all major water uses in the building which include the cooling systems, hot water systems, irrigation and other services. These meters offer remote reading and real time monitoring benefits, with a greater ability to detect leaks and key water using area inefficiencies.

## Non-potable water loop

Much of the water which is used to flush sewage out of the toilet is wasted and unnecessary in the sewer system. The concept of sewer mining allows water to be taken out of the sewer, treated to 'class A' standard which includes dosing it with chlorine. This water can then be safely used for non-drinking purposes such as toilet flushing, garden watering, etc. The entire system will have the capacity to provide 100,000L per day, 45,000 of which will be used in CH2 and 55 000L for other Council purposes such as CH1, street cleaning and garden irrigation.

A city's sewer usually contains 95 per cent water, which is a burden on the system and a waste of water. The sewage, along with any generated on site, will be put through a Multi-Water Treatment Plant that will filter out the water and send the solids back to the sewer. The water recovered will supply all CH2's water cooling, plant watering and toilet flushing needs while reducing the burden on Melbourne's treatment plant. Chris Arms, CH Arms and Associates, Hydraulic engineer



Figure 2. Particle Removal Plant

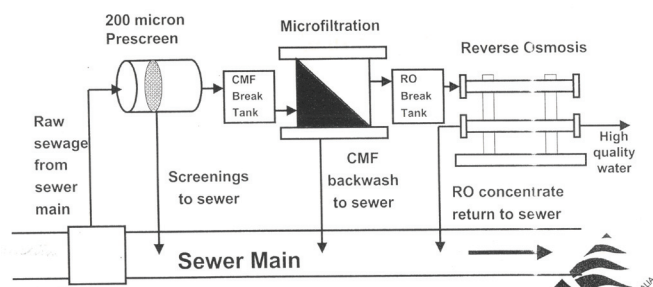


Figure 3. Explanation of process of water recycling

The system has been designed to be able to alter the amount extracted to meet the needs of the buildings, so for example over high leave periods like Christmas, the system can produce only 20,000 litres without any adverse effect.

The City of Melbourne explored the option of the water mining system being owned and maintained by the local water utility, City West Water, and then buying back the water from the utility. Although a viable option, it was the Council's decision to own the plant.

Drilling the mining pipe into an existing sewage manhole requires precision. A laser bore was used. Although the boring plant was relatively expensive, the precision was greater and the unit was lightweight, requiring less temporary works for the operation to occur. In addition, the unit came with its own extraction system to remove soil from the bore head. In terms of financial savings, considering the current water prices and savings on services cost, the payback period for the wastewater treatment system will be 15-20 years.

## Rainwater

A 20,000L rainwater tanks will store rainwater collected from the roof of the building. This rainwater will supplement and enrich the treated water from the mining plant. This water will be used for the irrigation of the plants.

## Irrigation

All the water to maintain the plants on the façade and the roof garden will be sourced from the water-mined system and enriched with oxygenated rainwater.

Some of the water recycled from the sewer mining plant will be used in the vertical gardens that will run the full height of the northern façade. The plants will be grown from special planter boxes built into the balconies on every storey. The role of these boxes is to grow three-to-four metre vines up the façade of the building via stainless steel mesh stretching from the ground to the roof. As one vine trails out, the vine on the next level takes over. The boxes are filled with Fytogen Flakes, a soil additive that looks like polystyrene flakes but acts like large water crystals, storing an enormous amount of water and air until the soil needs it.

Within each planter box is a sub-irrigation system that functions not unlike a toilet cistern. When the crystals dry out and the water is used up, a float triggers the device to re-fill with water, which is stored in the planter box until required. The combination of this device and the crystals provides the ideal wet-and-dry cycle required for the plants to thrive.



Figure 4. North Façade (DesignInc Melb)

In all projects there are moments of serendipity. While the design team were developing the planting on the northern façade, one of the concerns raised was the possibility that if the irrigation failed on a hot summer day, a façade of dead plants would not be a good look. Five years earlier, traders in Hardware Lane had proposed high level planter boxes. They had been sent away by Professor Rob Adams, Director Design and Urban Environment, with the request to develop a fool-proof watering system. Richard Rose, a trader in Hardware Lane, returned during the debate on CH2 to show off his new patent for a sub-irrigation system. This was improved in discussion with the landscape architect and developed into a planter which, when trialed, saved up to 20% of water when tested against standard irrigation systems.

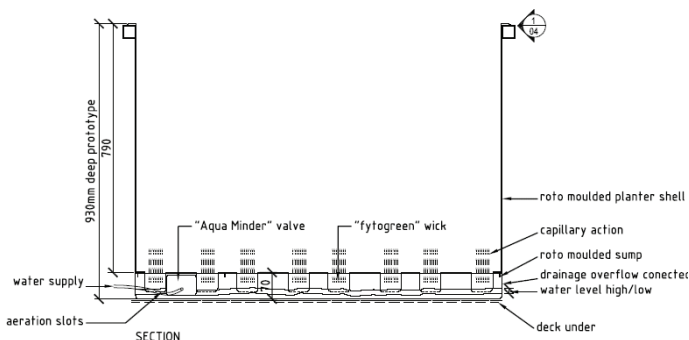


Figure 5. Planter box reticulation



Figure 6. Planter box

### Potable water loop

#### Sprinkler water collection

CH2 will be reusing water from the sprinkler system, particularly the testing of the pump (providing 25 per cent of potable water). An equivalent office building wastes 9,000L of drinking water a week to test the sprinkler systems. This water is used to test the pressure of the system and the pump and is run through the sprinkler pipes and out to sewer.

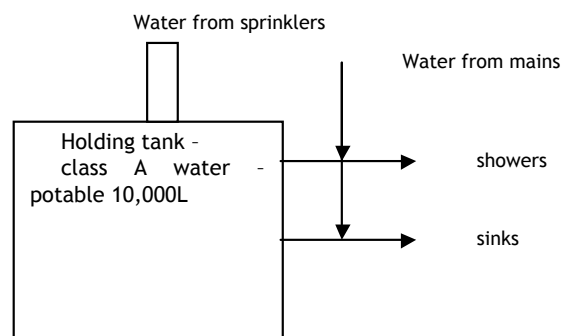


Figure 7. Explanation of water collection from sprinklers

CH2 will collect this water and use it as intended potable water by storing it in 20,000L tanks and drawing on it for water needed at sinks and showers.