A GREEN WICKET AT THE 'G' – AN OVERVIEW OF THE MCG WATER RECYCLING FACILITY

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ABSTRACT

The ***Yarra Park MCG Water Recycling Facility*** is a Class A water treatment facility built on the doorstep of the iconic Melbourne Cricket Ground. A unique project that will secure the long-term water needs of the Yarra Park reserve and surrounds as well as provide a sustainable water solution to the Melbourne Cricket Ground. Commissioned in October 2012 and now providing recycled water for nearly 12 months this overview of the facility aims to provide a valuable insight into some operational conditions encountered at this innovative and unique facility.

1.0 INTRODUCTION

The decade-long Millennium drought felt Australia-wide had a huge effect on our cities and the people that live in them. In Melbourne, stage 4 water restrictions were imposed and harsh decisions regarding green assets were made. For caretakers of these facilities and the public that use them, this loss of amenity and usable passive and active recreation space was profoundly felt.

In 2008, the Department for Planning and Community Development along with ARUP developed an Integrated Water Management Plan for Melbourne's world famous sports precinct which includes the heritage-listed Melbourne Cricket Ground (MCG) and surrounding Yarra Park, Melbourne Park, and AAMI Park.

A key outcome of the Plan was the opportunity to develop a 600,000 Litres per day Water Recycling Plant in Yarra Park.

By 'mining' an existing sewer a potential alternative water source for irrigation, toilet flushing and wash down at the MCG could be realised. In late 2008, the Melbourne Cricket Club (MCC) took over management of Yarra Park from the City of Melbourne. The parkland was in a desperate state as water restrictions had forced the City to severely limit irrigation in order to continue watering of other public parklands.

As a part of this re-development the MCC has constructed and operates a Class A Water Recycling Facility (WRF) and associated infrastructure.

The primary purpose of this Water Recycling Facility is to provide Class A recycled water to irrigate the Yarra Park reserve, the Richmond football club " Punt Road Oval" and the associated MCG grounds during the summer 'irrigation' season. In tandem, the club was seeking to implement water conservation within the MCG with a view to removing the venue from Melbourne's top 100 water users list, therefore water is also used in a dedicated 3rd pipe system throughout the MCG complex for toilet flushing and stadium wash down.

In order to meet these water demand requirements the plant operates in two distinct operating modes; namely

- Summer 'Irrigation' Mode – producing 600kL net of Class A Water
- Winter ' Toilet Flushing' Mode – producing 200kL net of Class A Water

The WRF is located underground outside the the MCG in the Yarra Park reserve. The underground plant has a footprint of around 21 metres by 31 metres and is approximately 9 metres deep. The two surface structures have a footprint of 3 x 6.5 metres and 3.5 x 6.5 metres (see figure 1).

Figure 1: ***Above and below ground structures of the MCG WRF***

The plant extracts sewage from the City West Water (CWW) Wellington Pde South trunk main and is pumped via a dedicated rising main to the WRF. The source of the feed is predominantly domestic and commercial sewage from the homes offices and commercial properties in the inner East Melbourne precinct.

Figure 2: ***Catchment area for incoming sewage***

The plant process is made up of the following key elements:

- Wellington Pde sewage Pump station
- Inlet Works
- Membrane Bioreactor with submersible membranes
- Ultrafiltration modules
- Ultraviolet light disinfection
- Chlorination
- Chemical addition
- Odour Control
- Class A storage and distribution system

2.0 DISCUSSION

2.1 Regulatory Approvals

For Class A Water recycling schemes that have a high potential for direct human contact the scheme requires endorsement from the Department of Health and the EPA. The mechanism for these endorsements is through a Health and Environment Management Plan (HEMP) and a Recycled Water Quality Management Plan (RWQMP).

To ensure that Class A water quality is maintained and therefore safety for all end users and the public a number of critical control points have been identified and are used as part of the HACCP process and is integrated with the plants PLC/SCADA control system.

The process has identified 5 Critical Control Points (CCP) in the process:

- CCP 1 - Raw Water Inflow to the Plant
- CCP 2 - MBR Permeate / Ultrafiltration Feed Water
- CCP 3 - Ultrafiltration performance
- CCP 4 - Ultraviolet Light Disinfection
- CCP 5 - Chlorination

2.2 Solids Handling

The raw sewage to the plant passes through combined screen, grit removal and fats, oils and grease (FOG) skimmer unit before entering the bioreactor for biological treatment. Unlike traditional treatment plants where the screenings and grit are stored in bins and taken offsite, the Yarra Park facility returns the waste products back to sewer under a Trade Waste Agreement with CWW. The screens and grit are transferred to a Return Pump Station where 2 x KSB Amarex S submersible pumps recycle the rag and grit within the pump station before discharging back to the sewer.

2.3 SND – Simultaneous Nitrification / Denitrification and the Membrane Bioreactor

A biological treatment process was adopted for the removal of phosphorus and nitrogen in the waste water stream. This biological nutrient reduction is achieved by using a simultaneous nitrification / denitrification (SND) process and an internal recycle loop, nitrification occurs within the aerobic zone and denitrification occurs within the anoxic zone.

A submerged membrane bioreactor (MBR) system allows the solid liquid separation of the activated sludge treatment to occur within the biological tank. The MBR process is operated at a MLSS range of 8,000 to 12,000 mg/L. The membrane flux rate typically operates in the range of 10 – 20 L/m^2/hr.

This (MBR) design has significantly reduced the footprint of the overall plant reducing the costs for locating the plant in its unique underground location.

2.4 Class A Ultrafiltration and Disinfection Process

In order to achieve Class A water quality, a three-stage filtration and disinfection process is utilised comprising a Ultrafiltration membrane skid, Ultraviolet light disinfection and chlorination.

Ultrafiltration is achieved with a pre-validated Pentair X-flow XIGA membrane skid comprising 6 pressure vessels with 4 elements per vessel, The skid is capable of filtering 600kl/day. The two observed benefits of the XIGA membranes are high membrane area to volume ratio and superior backwash capabilities which have proved valuable in operating this plant.

Ultraviolet light (UV) disinfection utilises a pre validated UV reactor, validated in line with the USEPA LT2WTES Rules.

Figure 3: ***Ultrafiltration and UV disinfection units***

Chlorination takes place in the chlorine contact pipe (CCP). This pipe has a 7.8 kl volume and is 29 metres long with a diameter of 600 mm. This pipe design provides a baffle factor of 1, essentially providing for plug flow. This equates to a CT value 16 min.mg/L which exceeds the regulatory requirements.

2.5 Odour Control

Strict odour requirements in Yarra Park and surrounds have been set requiring the plant to treat odour to achieve less than one odour unit from the forced ventilation. The areas of concern requiring odour extraction in the plant include inlet works, return pump station, bioreactor and submersible membrane tanks. Odour concentrations from these units can exceed 250 odour units. The challenge of odour control both within the plant and in the surrounding parklands is met with a dedicated odour control unit (OCU). The OCU extracts the odour causing gases, forcing the foul air through a duel stage odour scrubber comprising of a Chemical scrubber tower and Activated carbon filter vessel. The system is designed to achieve 99.5 % efficiency that is monitored by in-line H_2S gas analysers at the inlet and outlet of the OCU.

Figure 4: ***Odour Control Unit (OCU) chemical scrubber tower, Carbon Filter vessel and surface ventilation stacks***

2.6 Class A Water Colour

During the Winter operating mode the Class A water is used as toilet flushing water and therefore particular attention is payed to achieving an aesthetic value of the recycled water in line with the Australian drinking water guidelines. Therefore water colour during this period is restricted to 15 Hazen Units (HU). Colour removal is instigated in the biological process with the reduction of COD and completed in the ultrafiltration (UF) process with the use of a coagulant to optimise colour removal efficiency across the membranes. Water colour can therefore be reduced from over 200 HU in some instances down to less than 15 HU.

2.7 Operating Modes – Summer vs Winter

The plant must be able to operate in the 2 distinct operating modes known as:

- Summer 'Irrigation' Mode – producing 600kL net of Class A Water; and
- Winter ' Toilet Flushing' Mode – producing 200kL net of Class A Water

The challenge of conditioning the plant to swing between these two operating modes is met by the introduction of a stored carbon source in the form of liquid sugar. The liquid sugar can be dosed at known concentrations into the influent system to be mixed with the RAS.

2.8 Operating Modes - Game Day Mode

At times the Melbourne Cricket Ground can be host to more than 90,000 fans in a time frame of less than 4 hours. The impact that this has on the quality of the incoming sewage is tremendous. Typical nitrogen and BOD levels can be impacted by more than 10 times. The plant is only capable of treating domestic sewage than has a base load and therefore the detrimental impact of receiving this quality sewage would be immense. Therefore, to maintain suitable operations the plant operates on a set "game day mode" where the plant stops taking influent during these high load events. A built in calendar system detects a game day and completes a shutdown sequence for up to 6 hours to allow the concentrated waste to pass before the plant restarts.

3.0 CONCLUSION

The Yarra Park MCG Water recycling Facility is the largest of its type in Victoria and provides a sustainable source of water for irrigation well into the future. The facility will essentially drought proof Yarra Park and reduce the Melbourne Cricket Grounds reliance on potable water by up to 50%.

Operationally the plant takes traditional, new and developing technology and locates it all in a small footprint underground facility that can be easily operated and maintained at a manageable cost.

The Yarra Park water recycling facility is a unique, high-profile 'proof-of-concept' example that will serve as a benchmark and focus of learning for the water industry, not just in Victoria but across Australia,

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