

THE TRANSITION FROM TRICKLING FILTER TO SBR TREATMENT PLANTS



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ABSTRACT

The upgrades at Warracknabeal and St Arnaud Wastewater Treatment Plants (WWTP) has meant an improvement in the quality of re-use water and assisted the relevant plant operators to stay on top of any safety and operational issues. The fully automated systems ensure the operators know exactly when something goes wrong at the plants, meaning they can act quickly to fix any problems and keep the plants running smoothly. The operators say the plants virtually run themselves and just require daily checks and routine maintenance tasks. Extra training provided by GWMWater has been essential in learning how the plant operates and assisted the operators to better understand the electronics and safety.

The upgrade at Warracknabeal in November 2012 and St Arnaud in August 2013 introduced the first Linear Decanters of their type into Australia, which have now been adopted in other wastewater treatment plants across Australia. These Linear Decanters sit on a telescopic tube which moves up and down with the water level, drawing water from underneath the surface avoiding the rubbish that sits on top. The water then goes via a UV process on its way to the final destination, a re-use dam. In Warracknabeal the re-use water is used at the racecourse and golf club, whilst in St Arnaud it goes to Lord Nelson Park recreational facility, which includes both the lawn tennis club and golf course, with everyone enjoying the benefits of better quality water.

1.0 INTRODUCTION

The old Warracknabeal and St Arnaud WWTP utilised a Trickling Filter design. Warracknabeal was almost 70 years old, whilst St Arnaud was approximately 50 years old. Consequently they had reached the end of their intended design life. These facilities had deteriorated resulting in increased maintenance and operational resources to maintain their operation. Their deterioration led to inefficient operation and increased maintenance as well as environmental risks and lower quality re-use water.



Figure 1: *The original trickling filters at Warracknabeal WWTP*

Consultants, Australian Water Technologies (AWT) were engaged to investigate and review available technologies resulting in recommendations for both the Warracknabeal and St Arnaud WWTP upgrades. The study specified a ‘Sequencing Batch Reactor’ (SBR) as the type of plant that would meet stakeholder requirements at an effective cost, with the ability to modify the effluent quality in the future.

The design featured the installation of the first Linear Decaners in Australia.

Monitoring of the old plants was done eternally on a monthly basis with no internal testing being conducted. The new SBR plants are monitored by the operator daily for increased efficiency and building the knowledge of the plant performance.

2.0 DISCUSSION

During the early design phases both operators were invited to participate in several of the meetings. This gave us the opportunity to contribute on some design features and to be kept informed of what was happening. Seeing these new plants basically turn from paper to reality was an amazing process and was invaluable for both of us as operators, giving us the stepping stones in understanding how the plant operated and what maintenance was required.

During the construction phase we spent time on site with contractors seeing how the plant was constructed giving us an early understanding of how the various areas of the plant were connected, via underground piping and where they were located. If issues arose we then had a solid understanding of how the system operates. Onsite training was provided on free issue equipment from the suppliers as they were installed, such as inlet system, UV system and Decaners.



Figure 2: *The operators inspecting an Ultra Violet lamp*

The commissioning phase was by far the most important for us as operators as we had a short window in which to learn all of the technical and operation procedures, how to optimise the plant via SCADA and regular testing. Both of which we were not responsible for in the previous facilities.

We had both already completed the Basic Wastewater Treatment course held at the Water Industry Training Centre in Geelong. Both of us have since gone on to complete the Advanced Activated Sludge course.

Both of these courses were of great value, as it helped give us a better understanding of the process of the new Activated sludge plants.

2.1 Inlet System

Warracknabeal's influent is pumped via a rising main from the main pump station to the plants inlet works which collects wastewater from the entire town. St Arnaud's wastewater system is a gravity based system, so the only difference between the two WWTPs is the inlet system design to accommodate the different inflow types.

Previously the inlet screens were cleaned manually and the grit vortex chambers daily, with both the resultant screenings and grit disposed on site via burial. Now all inlet screenings and grit are binned via an automatic auger system and are disposed of at the relevant town council re-use facilities. This greatly reduced time and manual handling for both operators.



Figure 3: *The inlet screens at Warracknabeal (left) and St Arnaud (right)*

2.2 Treatment and Testing

St Arnaud and Warracknabeal's old WWTP were similar in design, both having Imhoff /Humus tanks and trickling filters to treat the water. Warracknabeal's plant effluent passed from a secondary clarifier straight into the wet weather storage.

St Arnaud's effluent would leave the plant and go into a lagoon system with an estimate of 60 days retention time before entering the final storage.

With the new SBR plants all the treatment is undertaken within one tank, greatly reducing the plant footprint and treatment time. Effluent is treated, decanted and put through an UV system before being sent to the final storage.

Previously there was no on site quality testing or monitoring.

Now each plant has registered sample points, with samples taken monthly and sent to Eco Science in Melbourne with results handed to the Water Regulations Division located in the Horsham Office.

Both WWTP's now have a fully equipped laboratory, resulting in approximately 40 tests conducted by the operators daily, weekly or monthly, depending on the type of tests required.

Samples are taken from the influent, two reactors, waste activated sludge (WAS) and the effluent, keeping an eye on pH, Alkalinity Suspended Solids (TSS), Chemical Oxygen Demand (COD), Ammonia, Total Nitrogen, Mixed Liquor, Sludge Age, Colour, and Nitrate. Samples are also collected for external testing.

2.3 Wasting

The two older plants had to be manually wasted each day. The volume was not measured and we were unsure of the quality of the sludge. This was another lengthy process, especially in winter months as the sludge would be very thick like a lumpy mortar mix.

The great thing about the new SBR plants is the automatic wasting system has a set volume of kL/d, which can be altered by the operator as required. The wasting occurs once every batch, 38 minutes into the cycle.

Each cycle happens approximately four times a day.



Figure 4: *The WAS pumps at Warracknabeal*

2.4 Decanting

As stated earlier the new plants were the first two in Australia to have Linear decanters installed. There are a lot of mechanisms for clear water draw-off in SBR treatment plants but the outstanding things about the Linear decanters are the low operating costs, high operational reliability and that they are basically maintenance-free.



Figure 5: *The linear decanter unit*

The decanters have a scum board holding back floating solid and draw water 200mm below the current tank water level so it only draws off clear water. This set up is a lot better than the humus tanks in our old plants, as most of the scum was washed over the edges and would make its way into the lagoons or final storages causing higher *E. coli* and TSS.

2.5 Ultra Violet Disinfection

Previously the only form of UV Disinfection was in St Arnaud and that was three lagoons with roughly 60 days retention time for the water to pass through the three lagoons before entering the final storage.

In Warracknabeal it would go directly from the plant effluent into the final storage.

Both new SBR plants are equipped with two UV Reactors each holding 10 lamps to treat the effluent before heading to the final storage. This allows us to stay easily within guidelines to meet Class C water Regulations, and is definitely more consistent, as the UV treatment can be monitored.

The old plants sometimes would have *E. coli* readings of 2000-4000, whereas now it is consistently below Class C Guidelines.



Figure 6: *UV disinfection unit*

3.0 CONCLUSION

Overall the two upgraded plants have been a huge success for GWMWater in both areas of water quality and OHS. They are a lot more pleasant to operate, but the major win for the operators is finally running a plant that they have control over at a technical level rather than by eye and smell, which was the case with the two older plants. To anybody looking at upgrading older plants or building new ones we strongly recommend the SBR with Linear decanters as an option, as they are a very pleasant plant to operate and maintain with excellent results.



Figure 7: *Aerial View of the new Warracknabeal WWTP*

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