

# Mixer Installation at Ballarat South Wastewater Treatment Plant

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## ABSTRACT

Two years ago, Central Highlands Water (CHW) purchased 5 x new adaptive mixers from Xylem to replace existing single speed mixers as a way of improving performance and reducing energy costs at the Ballarat South Wastewater Treatment Plant (WWTP). After a significant investment of time and research into the best way to install the mixers, it became apparent that we would be unable to use the existing mixer guide rails for installation, highlighting a serious complication in the installation process that needed to be rethought. Once it was determined the existing stands were unsuitable, CHW were advised by Xylem that the mixers would need to be placed on tripod stands and bolted to the floor of the tank for secure installation. The new mixers were to be placed in the anoxic tanks and the bio reactor zone. To take these tanks off line would have effectively cut our treatment plant capacity in half, which was not viable. Despite these setbacks, an alternative option was suggested where an experienced dive team would conduct the installation without taking the plant offline.

## 1.0 INTRODUCTION

### 1.1 Background

The Ballarat South WWTP was first established in 1925. Since then, the plant has undergone numerous upgrades in order to keep up to date with advances in treatment technology as well to accommodate significant growth in the Ballarat population.

The most significant upgrade occurred in 1998. This upgrade focused on becoming a Biological Nutrient Removal (BNR) focused treatment plant with the aim of reducing phosphorus, ammonia and nitrate before the receiving water of the inland Yarrowee river.

As part of the 1998 upgrade the WWTP was fitted with Landia fixed-speed mixers. After approximately 5 years, these mixers were no longer viable due to excessive breakdowns and were subsequently changed to Flygt mixers whilst still maintaining a 5.5kw fixed-speed motor rating.

### **Photograph 1: Location of mixers at Ballarat South WWTP**



In 2020, 5 x new adaptive mixers were purchased to replace the existing mixers as part of an aging asset replacement program. The focus of this replacement program was on increasing performance and reducing CHW's carbon footprint. The new adaptive mixers have an inbuilt variable speed drive (VSD) which allows them to be tuned based on requirement and enables a more efficient way of mixing and thus saving energy whilst not compromising on performance.

## **2.0 DISCUSSION**

### **2.1 Delays and Opportunities**

Due to a variety of circumstances beyond our control (i.e., Covid-19), a plan was established in late 2021 around how to install the new mixers.

A number of actions were devised by the WWTP team in consultation with the CHW mechanical and electrical team in order to ascertain whether existing infrastructure was suitable for mounting the new mixers. In particular, questions were raised regarding whether the use of existing guiderails and existing cable runs could be repurposed, thus reducing costs. Despite our good intentions to repurpose existing guiderails and cables, investigations into doing this proved to be unfeasible. Essentially, we would need to run all new electrical cabling as well as install new mounting brackets/guiderails for the mixers.

Discussions with Xylem gave us two options for mounting the new mixers. These were:

1. A tripod type bracket anchored to the floor of the tank.
2. Guiderail mounted to a concrete block for anchoring.

Option 2, was quickly dismissed due to issues with the locations of mixers and the inability to stabilise the block of concrete in the middle of the tanks (see, Photograph 1 for locations of mixers). The only option was to order tripods as our means of installing the mixers.

### **2.2 The Fun Part!**

A key consideration for the installation of the new mixers was whether we would have to take the tank offline for installation. This was the most important aspect of planning the installation as removing half of the treatment plant from operation would cause significant upset to our processes, and ultimately was not an option.

Initial estimates indicated that the draining of the tanks to enable an install would take approximately 2 weeks. Adding in time for the installation and subsequent refilling of the tanks would take an additional 2 weeks on top of that, totalling 4 weeks of lost operation and risk to water quality.

Further complications were the need to remove the existing guiderails before any installation of the tripods could occur. Given the location of the mixers, the anticipated 4 weeks of lost operation would compromise our A Recycle process as well as lost capacity to our secondary clarifiers. Combined with a period of high rainfall and inflows the plant had been receiving, finding an opportunity to do the install was proving challenging.

After many discussions held internally within the operations team and the mechanical contractor, it was decided to explore the option of consulting with an experienced dive team to assist with the install of the mixers.

### **2.3 Resourcing**

The resourcing required to undertake the install consisted of a heavily coordinated approach to ensure the required skills and expertise were available, informed of the complexities, and that all appropriate pre-work was undertaken beforehand.

The contractors required to support this installation consisted of electricians, mechanical fitters, WWTP operators, the dive team, and mechanical and electrical (M&E) supervision from CHW specialists.

Overall, the resources required to undertake the install included:

- Dive team (consisting of 3x divers and 1x dive supervisor)
- Mechanical team for assembly and to assist the dive team (x 4)
- Electrical contractor (2 x electricians)
- WWTP staff (1-3 operators) included 1x M&E supervisor.
- Crane operator (1 x driver & 1 x dogman)

**Photograph 2: Diver (left), and CHW M&E Supervisor with new mixer (right)**



All up 4 teams were set up to carry out the project.

The amount of resources required to successfully complete this project was dependent upon good communication and clear understanding of roles. The use of divers, and the conditions in which they were working to install the new mixers, highlighted significant safety considerations that CHW was unfamiliar with. Great care was taken to ensure the dive team and install team were confident in all isolations and how flow was going to be controlled through the active parts of the plant.

## **2.4 Installation Week**

Initial estimates for the install of the new mixers was anticipated to take approximately 3-5 days. In order to cater for any unexpected challenges that may have arisen, CHW booked out all resources for a 5-day period. On the morning of the first day of installation, the dive team 'lost confidence' in the original decision to use Loxins mechanical fixings and suggested that we change to chem-set masonry anchors. This changed everything!

The original plan was to install 1x mixer per day over 5 days. The change to chem-set anchors meant that we needed to allow time for the anchors to cure properly before the mixer could be installed on the tripod. The suggested time for curing of the chem-set was a couple of hours, thus also requiring a re-visit to each tripod to tighten the anchors.

**Photograph 3: Mixer 1 installation**



From this change, the installation went as follow:

*Day 1: Monday* – set up of crane, diver setup and install tripod 1 and removal of old guiderail.

*Day 2: Tuesday* – 12-hour day ‘*longest day of install*’ to see completion of tripod 1. Tightening of 1 tripod. Install of tripod 2 and removal of old mixer guiderail. Install of tripod 3 and removal of old guiderail.

*Day 3: Wednesday* - re-setup position of crane. Remove old guide rail for mixer 4. Re-tighten tripod 3. Work day halted earlier due to heavy rainfall.

*Day 4: Thursday* - Install mixer tripod for 4 and 5.

*Day 5: Friday* - Re-tighten fixings for tripods 4 and 5. All mixers operational and working by lunchtime.

**Photograph 4: New mixer being lowered into tank with guiderail**



The longest time the WWTP had no mixing in any of the affected tanks was 48 hours. This was found to have no long-term impact on process. The most significant impact the plant had due to the install was when we were installing mixers 3, 4 and 5 as those mixers required shutting down our A-recycle and sending all flow from the aeration lanes to only 2 secondary clarifiers whilst the divers were in the tank.

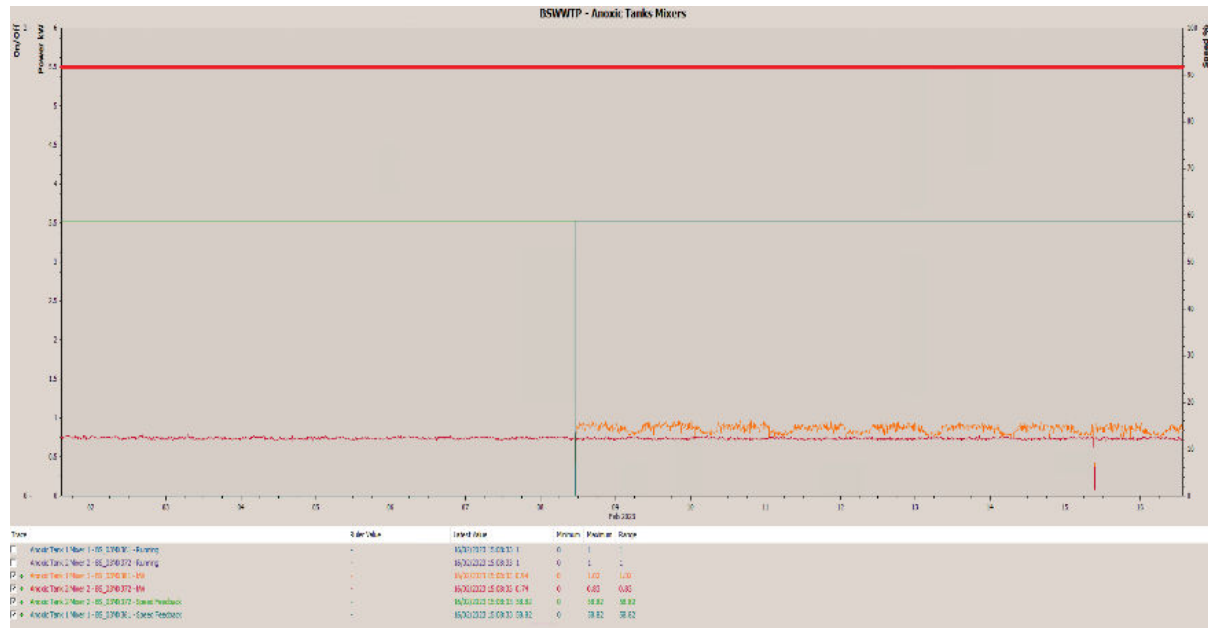
Despite some of the challenges with the install, the timeframe to undertake the installation did not cause any significant delay or stress on the crews involved nor the treatment process and day-to-day running of the WWTP.

### 3.0 CONCLUSION

There have been numerous positive outcomes from the installation of the 5x new mixers at Ballarat South WWTP.

One of the most significant improvements can be measured in the reduction of energy usage as per the graph below. Currently the new mixers are operating at 0.47 kw compared to 5.5kw which is a significant power savings for the site.

#### Trend 1. Power usage mixer comparison in kWh



Another important positive that has come out of this installation is the collaboration and cross-functional team work that was required to undertake this immense project. This project has been a great exercise in teamwork between CHW employees and contractors whilst still maintaining business priorities, safety, and a high level of service.

### 4.0 ACKNOWLEDGEMENTS

This installation wouldn't have been possible without the expertise and commitment to excellence from the following companies and their employees. Active Mechanical services, Ballarat Mobile Cranes, Service Stream, East West Dive Salvage, and Central Highlands Water staff, in particular the M&E team, and the Ballarat South WWTP team.

