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## **IMPLEMENTATION AND EXECUTION OF A WATER RECYCLING SCHEME AT KOORAGANG ISLAND**



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# IMPLEMENTATION AND EXECUTION OF A WATER RECYCLING SCHEME AT KOORAGANG ISLAND

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## ABSTRACT

Orica were the largest single consumer of drinking water in the lower Hunter, using over 4% per year of Hunter Water Corporation's (Hunter Water's) total water supply. Orica's plant, which opened in 1969, uses the water as part of their ammonium nitrate production process.

Hunter Water have constructed an Advanced Water Treatment Plant (AWTP) as part of an Alliance contract, to significantly reduce the drinkingwater supply demands of Orica. The Kooragang Industrial Water Scheme was created with the Mayfield West AWTP at the centre. To deliver the required quantity and quality of effluent to the scheme, the Shortland WWTW underwent several upgrades.

Hunter Water engaged Veolia as the treatment operations contractor delivering Operation and Maintenance services for water and waste water treatment infrastructure in the region. The commissioning of the Mayfield West AWTP took place at the same time. This meant a change in people, leadership and potential loss of knowledge about the treatment process.

Despite taking over the plant operation at a critical time, the new operator was able to smoothly manage this transition. They recognised the need for wastewater expertise as part of the Mayfield West AWTP operation team, provided support to the operators and leveraged of the existing operations such as Fairfield AWTP to provide support and technical expertise.

Four months after Hunter Water awarded the contract to Veolia, the Mayfield West AWTP is proving to be successful by consistently producing suitable water quality and smooth operations.

## 1.0 INTRODUCTION

The aboriginal meaning of Kooragang Island is 'A Place of Many Birds' and was formed from seven different islands which were used by families for farming. After the major floods in 1955, it was resumed by the State of Industrial Land and has housed the Newcastle coal terminals since 1984.

In 1969, Orica opened its facility to produce Ammonium Nitrate initially for agriculture. Twenty years later, they opened a second plant to exclusively supply ammonium nitrate for the mining industry. They employ 210 staff and 40 contractors from the local Hunter area and produce approximately 360,000 tonnes per annum of ammonium nitrate.

Given Orica's significant position on Kooragang Island and its significant water consumption of 2,300 ML per annum, Hunter Water recognised the need to decrease Orica's water footprint. Through this understanding, the decision was made to construct a Wastewater Recycling Plant at Mayfield West, which would service Kooragang Island through an 8km pipeline. The effluent was supplied by the neighbouring Shortland Waste Water Treatment Plant which is one of nineteen Wastewater Plants that the Hunter Water Corporation owns in the Hunter Valley, NSW. Figure 1 shows the close proximity of Shortland WWTP, Mayfield West AWTP and Kooragang Island.



**Figure 1:** *Location of Mayfield West AWTP, Shortland WWTW, Kooragang Island (highlighted in red) and Orica*

The commissioning of the Mayfield West AWTP was being finalised at the same time as the operations contract was awarded. This posed a significant challenge to Veolia the new operator. It was important the the correct operations team was selected with appropriate skills and experience.

## 2.0 DISCUSSION

### 2.1 Preparation in the Lead up to Commissioning of Mayfield West

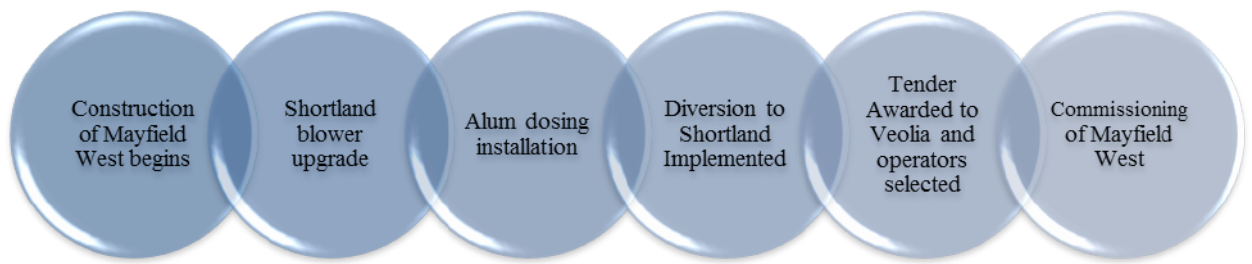
Shortland Waste Water Treatment Works (WWTW) is an activated sludge plant with chlorine disinfection which releases its effluent into the Hunter River. Figure 2 shows the treatment process steps at Shortland.



**Figure 2:** *Shortland WWTW Process Flow Schematic*

Construction commenced at Mayfield West AWTP under an Alliance contract with the existing water treatment team becoming involved and providing support. To provide suitable raw water for Mayfield West AWTP, Shortland WWTW required a number of upgrades including the addition of an Aluminium Sulphate dosing system, a blower upgrade and the diversion of influent from Newcastle 10 Pumping Station to provide more water to be able to achieve a minimum inflow of 12 ML per day. Waste tankers discharging into the inlet was also discontinued. The timeline for construction and upgrades is shown in Figure 3.

During the commissioning of Mayfield West, work on site began for the installation of a new dewatering facility at Shortland as part of the long term solution for managing the sludge blanket in the IDAL's and reducing the chance of fouling at Mayfield West.



**Figure 3:** *Timeline of Significant Events over 12 Months*

## 2.2 An Operator’s View Prior to Commissioning

From an operators point of view at Shortland WWTW, it was a time of a lack of clarity about the future given the commencement of the new Treatment Operation contract. The existing Shortland operators retired, taking with them decades of knowledge of the plant operation. None of the other operators had a chance to settle at Shortland for a lengthy period to be able to be equipped with an intimate knowledge of the plant. Thankfully, Hunter Water made the decision to retain one of the retiring plant operator for another month at Shortland WWTW to ensure continuity of services.

A similar situation occurred at Mayfield West AWTP as the Alliance had been conducting the commissioning, operation and troubleshooting of the Recycling Plant with the Water Treatment Team assisting to a degree.

The Shortland Wastewater team did not completely understand how their daily actions could influence the Mayfield West AWTP and product water. At the same time, the Water Operators did not fully understand what was taking place at the Wastewater Plant that was feeding the Recycling Plant.

## 2.3 Evolving and Supporting the Team Through Transition

Veolia won the treatment operation contract and this corresponded with the culmination of commissioning. Proactive decisions had to be made to give the Recycling Water Scheme the best possible start. Veolia had approximately six weeks from the finalisation of commissioning until they would be held completely accountable for the plant operations.

It was acknowledged that the experience of a water operator with the skills that come from strict water quality standards needed to be matched with a waste water operator from Shortland WWTW to ensure smooth operations at the new plant. The two operators needed to be able to establish a critical operational practice to what is virtually a new plant to the network. They also had to maintain the customer focus with each decision and implementation of routine maintenance and procedures.

The table hereafter shows the benefits provided by the Kooragang Industrial Water Scheme and the operational challenges that the new Treatment Operations provider had to face to deliver a reliable recycled water supply.

**Table 1:** *The Scheme’s objectives and challenges*

| <b>Situation before Mayfield West AWTP establishment</b>                                       | <b>Scheme's Objectives</b>                            | <b>Challenges at Mayfield West AWTP / Shortland WWTW to achieve targets</b>  |
|--|---|--|
| Orica consuming 4% per annum of potable water. Going from largest consumer to 19 <sup>th</sup> | Significantly replace potable water to recycled water | Forecasted consumption from Orica is obtained weekly. Diversion from local Wastewater network to Shortland WWTW is scheduled by the WWTW operators to obtain enough effluent to meet demand. Strong coordination between Orica, Mayfield West AWTP and Shortland WWTW required.                                |
| Orica's removal of minerals from potable water (using a demin plant)                           | Provide a permeate with a consistent quality          | Establish monitoring and control necessary to produce recycled water of an appropriate quality for the end users. Ensure appropriate response to CCPs.. High end monitoring and rigorous benchtesting to maintain integrity. Understand challenges at the WWTWs and how this can affect product water quality. |
| No Advanced Water Treatment Plant operated by Hunter Water                                     | Reliable operation of the plant                       | Good communication between Shortland WWTW and Mayfield West AWTP<br>Cultural change from water / wastewater treatment to advanced water treatment<br>Access to technical expertise & training<br>Establishment of daily rounds, benchtesting, stock orders, SOP development                                    |

## 2.4 My Contribution to the New Team

Given my experience as waste water operator at Shortland WWTW and my understanding of the importance to deliver a quality product to a customer, I was given ownership as one of two main operators of the Mayfield West AWTP. The other operator selected had an extensive knowledge of water treatment, especially from the Grahamstown catchment. This catchment is the largest supply to the area - so water testing, bench testing and analysers were more familiar to him than myself.

I brought to our team the operational knowledge of Shortland WWTW. I understood the process, the type of equipment installed at the plant, what the maintenance schedule involved, as well as the pressure the weather placed on the process. The Shortland WWTW SCADA was accessible from Mayfield West AWTP and it certainly made trouble shooting at Mayfield West AWTP easier. All of this combined with my daily morning check on the plant meant we could anticipate any fires starting and putting in measure to prevent them, rather than trying to put them out once they arise. To make the communication more robust, I developed a communication protocol between the Waste Water Plant and the Recycle Plant.

In collaboration with my co-workers, any procedural gaps were closed by developing routine task lists, water quality testing, analyser comparative bench tests. These documents were linked to the KIWS recycled water quality plan and the Safe Operating Procedures handed over by the Alliance commissioning team and Hunter Water. I considered while developing these tools what an on-call operator may find helpful, and ensured that they could be used by any operator unfamiliar with the site to be able to complete the duties of a Mayfield West Operator.

Following are examples of the systems established for the day to day operations of the

plant. This helps us every day to achieve an excellent product and a well operated Recycling Plant.

The figure displays three overlapping Veolia forms used for daily data collection and testing at a water recycling plant. The top form is a 'KIWS Daily Samples Sheet - TEST SHEET' with columns for dates from 3/02/2015 to 7/02/2015 and rows for various parameters like pH, Turbidity, Total Cl2, and Free Cl2. The middle form is another 'KIWS Daily Samples Sheet - TEST SHEET' with a task list (1-26) and columns for operator initials. The bottom form is a 'VEOLIA' form with sections for 'YESTERDAYS TOTAL FLOWS', 'MICROFILTRATION & REVERSE OSMOSIS', 'YESTERDAY RAINFALL', 'CHEMICAL USAGE', and 'TANK LEVELS %'.

**Figure 4:** Example of Daily Data, Daily/Weekly Tasks Sheet, and Routine Bench Testing

## 2.5 The Post Transition Phase

During the months that followed Veolia's new ownership of the Hunter Water Operations Contract, they excelled in using their vast array of global expertise within the Veolia network inviting visitors to the site for technical support and to share in the experience of Mayfield West.

They combined this and their rapport with their customers to co-ordinate many site tours

with Hunter Water Co-orporation, Government Officials, Orica, Community groups, Engineers Australia, and several local schools just to list a few.

I have been involved in leading those tours for Veolia and hopefully pass on my passion for the contribution to sustainability that Mayfield West makes. My most challenging tour group have been the school students because I put immense pressure on myself to try and captivate them and inspire them. In my tour package I created, I treat them as my most crucial audience as they will be making critical decisions around sustainability for our country's future.

Recently, operating Mayfield West has encouraged a move across into the Water Team within the contract. This has been an exciting evolution as an operator. To be operating across Waste Water, Water and Recycled Water can be viewed as a strategic movement within our group towards a united culture of Water & Wastewater Operators under the '1Veolia' umbrella.

### **3.0 CONCLUSION**

Operating an Advanced Water Treatment Plant extended the focus of the operational team beyond their plant and provided them with an understanding of the waste water treatment operation supplying raw water to the AWTP. The new operator provided their teams the ownership to setting up of systems at Mayfield West and gave them their trust and support for the benefits to the entire team and the customer.

The change in perception from an operators level become evident. The mindset transcended from a sole focus on the daily tasks to how the daily tasks influenced the whole scheme. Focus was put on a drive to do the best possible job at both Shortland WWTW and Mayfield West AWTP. Any troubleshooting is made in consideration of the other part of the scheme, to help support the greater network of water treatment and provide appropriate product water quality to the customer. It became evident follow up of the effectiveness of the tools I created was paramount.

Without doubt, I can conclude, with the exposure to this Advanced Water Treatment Scheme and the opportunity to support my team mates, I am more passionate about what I do than I ever have been before. I hope to undertake further study soon to become a more valuable asset to the team.

### **4.0 ACKNOWLEDGEMENTS**

Thank you to James Morrison, my Mayfield West colleague who has taught me so much about water and helped me appreciate what the Water Operators do. Marie Jourden, Deanne Pope, Brock McPhee and Dan Slocombe, without their decisiveness and experience I would never had had the opportunity to operate Mayfield West. Thank you to Marie for believing in me. Thank you Caitlin. Thank-you to Rob my partner for seeing me through my nervousness.

### **5.0 REFERENCES**

Operations – Orica Kooragang Island <http://www.orica.com>  
Islands of the Lower Hunter River NSW <http://www.geni.com>