PICKING UP THE PIECES – LESSONS FROM TAKING OVER A TRADE WASTE TREATMENT PLANT

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ABSTRACT

North East Water (NEW) took over control of the Wangaratta Trade Waste Treatment Plant (TWTP) during May 2015. The TWTP services two textile customers only. Textile waste is very different to sewerage, as it largely consists of poorly biodegradable 'chemical' waste, which has elevated concentrations of colour, metals, nutrients and salts. The treatment processes consist of a number of biological and chemical treatment processes and discharges to a local creek under EPA licence. When NEW took over the operation of the plant, it became quite apparent that a number of challenges and knowledge gaps were present, namely meeting licence requirements, limited process control and automation, accumulated sludge as well as broader reputational and ecological considerations. A game plan followed by significant changes needed to occur.

This paper presents the progression over the past 12 month period to overcome the challenges of taking over an unfamiliar and complex treatment facility.

1.0 INTRODUCTION

The Wangaratta Trade Waste Treatment Plant (TWTP) is located approximately 4 km south of the Wangaratta Central Business Area in North East Victoria. The plant is an activated sludge facility providing biological and chemical processes to treat industrial textiles waste.

The TWTP is a dedicated trade waste treatment facility and only services two textile customers. Textile waste received at the facility is very different to domestic sewerage and industrial waste sourced from food manufacturing, as it largely consists of poorly biodegradable 'chemical' waste, which has elevated concentrations of colour, metals, nutrients and salts. The treatment processes on site consist of a 42 ML mechanically aerated biological Equalisation Basin, an out of service 3.2 ML Oxidation Ditch, chemical dosing, clarification and discharges to an ephemeral creek under EPA license. Waste sludge from the process is transferred to the Sludge Holding Lagoon. Geobags are then used for dewatering and the sludge is stored in windrows in a Biosolids (Biomass) Storage Area. The key components of the TWTP layout and process are displayed in Figure 1

The composition of the influent received at the TWTP consists of waste materials and solutions from textile processes such as dying materials (typically imported) and applying coatings to materials such as fire retardants. Approximately 600 kl of waste water is sent to the TWTP per day, over 5 working days. Upstream processing can be variable, which leads to a highly inconsistent influent. There are also often periods where no inputs are received from industry this including weekends and extended shut down periods, such as a 3 weeks closure over the Christmas/New Year period. This variation in influent present additional challenges and the TWTP needs to be robust in order to ensure sustainable and compliant treatment. Many of the components within the influent are complex and bound with slow rates for biodegradability. An overview of the main components in the trade waste influent of concern and present challenges to the treatment process are outlined in Table 1.

Figure 1: ***Layout of the TWTP site***

Table 1: ***Components of the TWTP influent which present treatment challenges***

Waste Component	Source	Treatment Challenges and Ecological Consequences
Colour	Dying Materials	- Slowly biodegradable, can be evident in final treated effluent; - Aesthetic issue due to visibility.
Metals – Antimony	Imported Fabrics (washed)	- Minimal removal; - Can bio-accumulate in sediments.
Nutrients – locked Nitrogen & Phosphorous	Proban (Fire retardant)	- Minimal removal – Nitrogen limited in winter months and 90% of Phosphorous unable to be removed; - Nutrients are sources of pollution, in particular can cause algal blooms.
Salt	Dying and Washing with Caustic Soda.	- Not removed via current treatment; - Salt in the environment is an issue, causing contamination to both water and land (irrigation).

In May 2015, North East Water (NEW) resumed operational control of the TWTP with limited experience at the site and the knowledge that meeting licence compliance at the site would present a number of challenges. Upon resumption of operation control NEW was able to retain the single TWTP operator who had almost 20 years' experience in the operation of the site.

2.0 DISCUSSION

The TWTP has been in operation as a waste treatment plant since its construction in 1974. In 1986 the plant underwent a major upgrade with the addition of the Equalisation Basin and Final Lagoon. Between August 1995 and May 2015 the TWTP was operated under a third party contract agreement, where NEW owned the site and the third party held the EPA licence.

During the first 12 month of resumed operations at the TWTP, it was necessary to ensure the approach to operating the plant was primarily focused on learning and development. This included focusing on the development of operator skills, understanding the treatment processes, implementing additional monitoring and ensuring sensible process improvements were a priority. Additionally, NEW worked in consultation with the EPA and industry to better understand the composition of the influent received at the plant. NEW also recognised that plans were required for sludge management (both wet and dry) and for the longer term strategic approach to the operation of the site.

2.1 Meeting EPA Licence Compliance

The TWTP site is licence to discharge treated effluent into a local ephemeral creek in accordance with its EPA Licence. A number of licence parameters, in particular nutrients (Nitrogen and Phosphorous) and salt concentrations are difficult to meet on a consistent basis. Prior to NEW resuming control, the TWTP had had issues in meeting the discharge limits for Ammonia. This appeared to correlate with cooler temperatures, however it was evident that there was limited control in operating the process as an activated sludge plant. In particular the significant competition with inactive sludge within the Equalisation Basin reactor contributed to the challenges of removing Ammonia. Total Nitrogen compliance was also an issue, as often once nitrification was achieved (Ammonia converted to Nitrate), a lack of denitrification was also observed.

Over the past 12 months, significant research was carried out on the biological process occurring within the Equalisation Basin. This including increased monitoring of the Oxidation Reduction Potential (ORP) and Dissolved Oxygen (DO) levels. Closer monitoring of these parameters allowed a better understanding of what was occurring in the Equalisation Basin and has driven process improvement. Increased monitoring of the influent and the Equalisation Basin is also occurring to better understand the treatability of the incoming waste water.

Phosphorous license limits are also extremely difficult to meet. Whilst on paper the limits appear achievable, only 10% of the Total Phosphorous is available for chemical treatment. An initial review of chemical dosing practices resulted in an optimised dose rate which used less chemical and was able to achieve the maximum Phosphorous removal. Increased understanding of the complexity of the bound Phosphorous, with treatment options are a priority for the future, along with a full review of chemical dosing.

Additionally, a bypass was established which allowed out of specification treated effluent from the TWTP to be directed to the sewer and ultimately treated at the municipal Waste Water Treatment Plant (WWTP), which is also operated by NEW. This is not a desired activity, primarily due to the additional salt loading at the WWTP and affecting the subsequent irrigation of treated wastewater. It is useful to have this contingency in place to avoid licence non-compliance, a possible ecological incident or impacting on industry.

2.2 Operability, Process Control and Automation

A key priority for NEW at the point of operational handover was to ensure that staff training was carried out. NEW was in the fortunate position of retaining the highly experienced operator at the site. This enables the ongoing operation of the site and the implementation of a thorough training program for the local Treatment Team. Initially a NEW operator was paired with the experienced operator to ensure familiarity with the plant, basic operation and troubleshooting. This was then rotated through the local Treatment Team to ensure multiple operators were trained, which was achieved during the first 12 months. Not surprisingly, some of the NEW operators showed a high level of interest and enthusiasm in the TWTP which allowed the experience operator to integrate into the Treatment Team. Additionally, the experienced operator was able to work at other NEW Treatment sites and has been developing new skills in both water treatment and domestic waste water treatment.

Over the past decade NEW has made significant progress with the automation of its WWTP. It was therefore immediately apparent to the NEW operators that the TWTP lacked automation. Most key operational process at the TWTP required manual intervention. A plan of priorities was developed and over the past 12 months a number of automation and control improvements were installed. One major automation project undertaken was the optimisation of the aeration processes within the Equalisation Basin. The initial aeration set up was a heavily manual process, which involved manually switching on and off the aeration system multiple times per day. The operator's onsite undertook a significant amount of work to review and optimise the aeration process. Following the analysis of this data and with the installation of timers, this process was automated and programmed to provide optimal aeration for biological treatment.

A new PLC was installed at the site, which has enabled some relatively simple automation activities to occur. Onsite alarming has been established which has been an important improvement especially in regards to Critical Control Points (CCPs) for key parameters (e.g. clarified NTU) while discharging to creek. This has reduced the risk of a noncompliant discharge. The onsite SCADA system has been improved and remote access to the plant is now available.

2.3 Sludge Management

One ongoing issue for the site is the management of in-situ wet sludge within the process and the onsite stockpile of Biosolids (Biomass) which have been removed from the process. The onsite stockpile has been accumulating for many years and has now reached a point where it is inhibiting the removal of wet sludge from the process which is impacting treatment. The Equalisation Basin, Oxidation Ditch and Sludge Holding Lagoon all hold significant quantities of wet sludge. NEW is in the process of developing a plan to engage a contractor to de-sludge the facility over the next 12-18 months.

The site has a large stockpile of dried Biomass as seen in Figure 2. NEW windrowed the stockpile and undertook an extensive survey of the sludge to understand the levels of contaminants and enable classification of the waste. As a result of the monitoring program the majority of the waste could be classified as an Industrial Waste however elevated levels of contaminants were identified in some 'pockets' of the stockpiles.

Figure 2: ***Windrows of Biosolids Stockpiled at the TWTP***

There have been ongoing trials and investigations into possible beneficial uses for the Biomass to prevent sending the stockpile to landfill as a significant cost. Trials have included the possible use of the material in daily cover of landfill. NEW and the EPA are involved in ongoing discussions to determine an appropriate sustainable use of this product.

2.4 Ecological Impact Considerations

Discharging treated effluent into an ephemeral creek presents a number of immediate concerns which need to be further understood. In recent years, fish kills have been observed in the local creek system, however it was inconclusive that the discharge from the TWTP contributed. Regardless of the cause, a connection between the discharge from the site and any fish deaths could lead to reputational issues. NEW has had an approach to undertake an Ecological Risk Assessment (ERA) for all discharges from WWTP to determine whether the discharge is impacting the beneficial uses within the receiving waterway. Of particular concern to NEW is discharging to the creek during summer when natural flows cease and the discharge can make up to 100% of the creek flow (see Figure 3). The local creek is ephemeral and is often dry for up to six months of the year between Spring and Autumn. The findings of the ERA will be used to assist NEW in determining the most appropriate future options for the site to ensure ongoing sustainability of the site and to minimise any environmental impacts.

Figure 3: ***TWTP Discharge point into the local creek during summer***

The ERA process at the TWTP commenced in December 2015, with the collection of additional creek and effluent monitoring data. This was followed by an initial problem formulation session held with various stakeholders to identify stressors in the discharge and beneficial uses in the receiving environment. The outcomes of this session where used to develop the risk assessment, which using a range of data and other information to determine the level of risk for each stressor.

Due to the complex nature of the discharge there is some uncertainty around the level of risk for some stressors due to limited knowledge and information. External expertise is currently being sourced to better understand the nature of the TWTP discharge and the impacts it may have on beneficial uses, particularly in relation to bound nutrients and heavy metals.

3.0 CONCLUSION

The first year of operation has seen significant development in the understanding of such a complex waste stream and treatment process. While there are still a number of challenges that need to be addressed it appears that the process and skills within NEW are capable of overcoming these. NEW also envisage a number of opportunities for the site, due to its location and treatment capability, which will be explored in the future. Work will be ongoing over the next 12 - 18 months as all studies are finalised and future improvements and strategies are investigated. The outcomes of these ongoing studies will provide key information for the future licencing and compliance of the TWTP, as well as being used to guide future treatment process and operations.

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