MARYBOROUGH WTP FILTER UPGRADE

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ABSTRACT

The content of this Platform Paper will cover the Filter Upgrade Program that was undertaken by Water Treatment Operators at Central Highlands Water for the Maryborough Water Treatment Plant. The Paper will also discuss in summary a program that is being undertaken to automate chemical dosing, increase of Raw, Filtered Water analytical surveillance and new main Switchboard/PLC construction.

The Paper will cover issues such as a source water change from Surface Water to Ground Water due to the current drought conditions and Manganese issues associated with filter media that has been in service since commissioning of the WTP.

The paper will talk to the initial investigation into the Filter upgrade program along with the steps that were taken to complete the program such as removal of existing filter media and nozzles, inspection of the Plenum, installation of the new nozzles and filter media. It will also include commentary that discusses the filter performance, pre and post the upgrade program being undertaken. This commentary will outline to the audience what NTU improvements can be made following a filter upgrade program.

The Paper will illustrate to the audience how the Water Treatment Plant Operators Project Managed the program and that it was completed on budget.

This Paper is further evidence of Water Treatment Plant improvements that can be made by utilising skills of operational staff to manage the project from inception to completion.

KEY WORDS

Media, Nozzles, Plenum, Turbidity, Manganese, Green sand, Laterals & Air scour.

1.0 INTRODUCTION

Maryborough is a medium sized Regional Town, 70 km north of Ballarat. Maryborough and the surrounding District that is serviced by Central Highlands Water has a population of approximately 12,000 residents. The Maryborough and surrounding District have been serviced since 1982 by a conventional clarification/filtration treatment plant consisting of 4 x Clarifiers followed by 4 x Sand Filters with a design throughput of 15 ML/d the traditional source of supply for this plant has been surface water from Evansford, Talbot and Tullaroop Reservoirs.

Due to the current drought, surface water availability is scarce and groundwater is the only feasible resource available. Central Highlands Water constructed a Bore site on the Moorlort Plains after receiving a Licence to extract from Goulburn-Murray Water.

Due to water restrictions, the demand on water at Maryborough had reduced to approximately 3ML/d and the WTP that was designed to have an output of 15 ML/d was being operated well under the design load.

To achieve this low flow, one of the four filters was taken offline.

After being offline for six months this filter was returned to service and the plant experienced a coloured water event. This was due to the filter media being anaerobic and the particulate manganese on the media (Green sand) became soluble and after oxidation via chloramination returning to being particulate.

Figure 1: ***Maryborough WTP Filter***

2.0 DISCUSSION

2.1 Filter refurbishment

Central Highlands Water contracted Peter Mosse to attend site and conduct a filter assessment. The CHW plant operators were also involved to assist Peter and gain a better understanding of filter operation. During the assessment a number of issues were highlighted which included finding mud balls, dead air scour pockets and manganese coated sand (green sand).

City Water Technology in consultation with Peter Mosse and Harold Archer of Water Treatment Australia were contracted to develop a filter assessment report that contained a scope of works that were required to be undertaken to complete a filter refurbishment program.

2.2 Refurbishment program

After reviewing the report a refurbishment program was developed by CHW operational staff to undertake the project and funding was applied for through Central Highlands Water's Capital Expenditure Working Group. Funding was approved and the program was implemented.

The program allowed for one filter to be taken offline and refurbished, with the filter that experienced the manganese issue the first one to be upgraded.

The existing sand was removed utilising an eductor truck and stored onsite. Old nozzles were removed and a Plenum floor inspection plate was installed by cutting out a section of concrete floor and installing a stainless steel inspection plate, as this had not formed part of the initial plant design. The purpose of this was so that CHW Operators could inspect the plenum floor for any media that had washed in over the years and to conduct a lateral pipe condition assessment.

Several items of interest were found once the filter sand had been removed. It was found that over time many nozzles had become blocked and had an amount of filter sand deposited under the cap.

Inspection of the laterals also revealed a small amount of filter sand had made its way into the laterals and into the plenum floor itself.

Cleaning of the laterals needed to be done and this was accomplished by flushing the debris through the Laterals into the Plenum. Once this was completed an eductor was utilised to remove this debris from within the Plenum.

Figure 2: ***Nozzle slot blockage***

Figure 3: ***Deposits under nozzle cap***

Once the Laterals and the plenum were cleaned, new nozzles were fitted (1260 in total) with correct bolt tensions and even level distribution. A tolerance of + or – 2 mm was a key requirement to help ensure good air scour pattern is achieved. This proved to be a difficult task at times as the concrete floor had some minor signs of deterioration due to 28 years of filter operation. Several bushes where the nozzles were located stripped requiring the insertion of Helicoils to achieve correct tension.

Figure 4: ***Nozzle installation***

After the installation of the nozzles and inspection cover, the filter was filled with water to approximately 200 mm. An air scour was then initiated and an unusual pattern was

noticed in the form of a dead spot that moved back and forth across the filter.
Several investigations were carried out on this issue including the measurement of the air water interface in the laterals and increasing the air scour rate.

It was decided after these tests that an increase in air scour rate was required and modifications to the existing blowers were made to increase air scour rate from 27 m/h to 36 m/h. As there was some spare capacity designed into the blower system we were able to modify the output by changing the drive pulley on the blower thus increasing the capacity.

2.3 Filter media installation

The new filter media that was installed included:

- 150 mm of Garnett (2.4 to 4.8mm)
- 150mm of Coarse sand (1.5 to 3.0mm)
- 750mm of fine sand (0.7 to 0.75mm)

A procedure was developed by Peter Mosse for the relaying of the media to allow for even distribution of the media when being installed, so that the media was ready for service. This procedure included air scouring the media several times and removing the fines that were produced and sat on top of the media. This was achieved by operators entering the Filter after completing a JSEA and scraping off the fines with a shovel.

The filter was then given a sodium hypochlorite soak as a measure to biologically clean the filter. This was achieved by adding sodium hypochlorite to achieve a free residual of 1 mg/l overnight. This was followed by another program of backwashing and fines removal.

The filter was then brought online at a low rate and the ripening period was monitored to ensure appropriate NTU levels were achieved. Once the operators were satisfied with the filters performance, they returned it to full service and started the refurbishment program on the next filter.

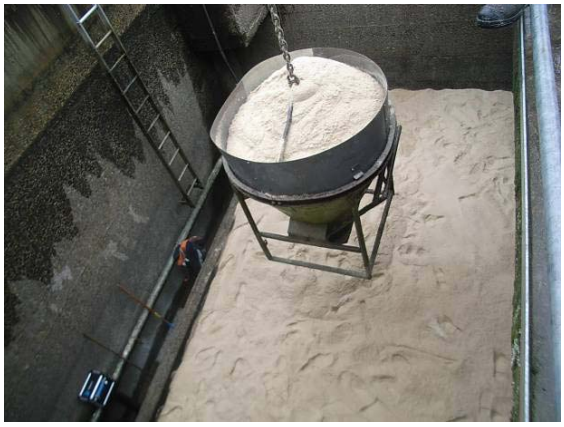
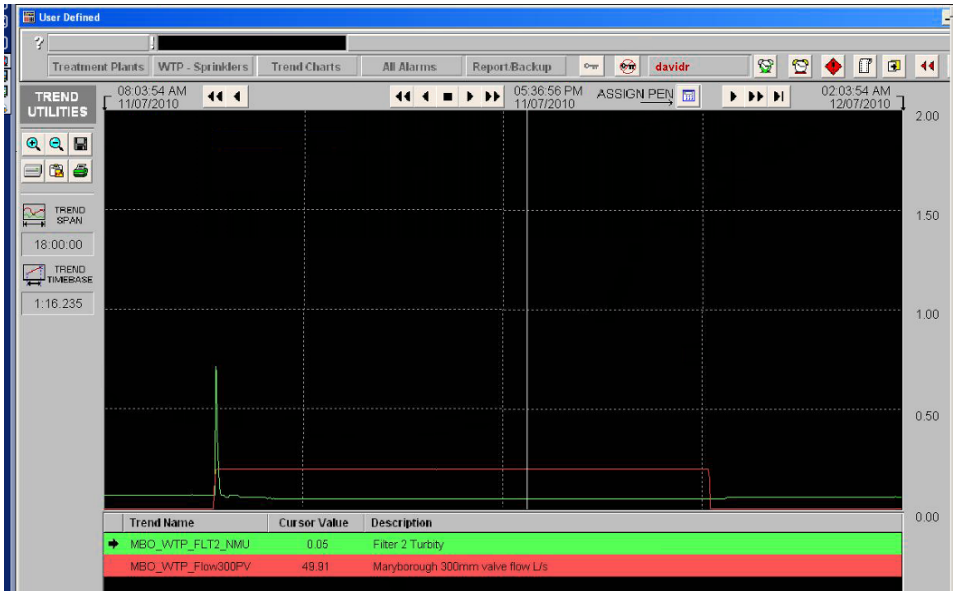


Figure 5: ***Installing media sand***

2.4 NTU improvement

The performance of the filter was analysed by operators studying the online trends for NTU along with ripening performance after backwash.

Turbidity (NTU) has shown to improve from pre refurbishment program data of 0.2 NTU to post program data of 0.06NTU and the ripening period time has reduced, allowing for better water quality to be supplied to the customer. This has also allowed for a greater level of confidence within the business that an appropriate barrier between Protozoa and the customer is being achieved.



2.5 Groundwater/Filter performance

As the plant was designed to treat surface water from Evansford, Talbot and Tullaroop Reservoir's some difficulties were encountered when the groundwater was introduced as a raw water source.

Poor floc formation is achieved after adding Aluminium Sulphate which produces poor settling characteristics. A carry over of this poor settling floc occurs and leads to an increased load on the filters. It could be said that they now operate in a direct filtration mode. These newly refurbished filters are performing extremely well under these

conditions and continue to produce water quality of <0.07 NTU.
The addition of Potassium Permanganate to remove Manganese and Iron is considered to indirectly aid floc formation and assist the filters in their performance. This was noticed on a few occasions when problems occurred with the potassium permanganate dosing system.

2.6 WTP Upgrade

Currently the filter backwash program is manually operated and requires the WTP Operator's to be onsite to conduct the backwash process. A WTP upgrade program is currently being undertaken and automated backwashing forms part of the scope of works. Once this has been completed the filters at the Maryborough WTP will backwash on time, with headloss followed by Turbidity (NTU) as the secondary trigger points. This upgrade will further enable the newly refurbished filters to perform as designed and to ensure that they act as an important barrier to provide safe drinking water to the customer.

The plant upgrade also incorporates other projects. These include new switchboards (Main and ancillary), new PLC, new raw water analysers to allow operators to better understand groundwater and surface water characteristics (pH, NTU and EC).

3.0 CONCLUSIONS

The filter refurbishment program conducted at the Maryborough WTP is evidence that water quality can be improved greatly by undertaking a maintenance program on your filters.

Filters that in essence looked from the surface to be performing adequately can have underlying issues such as mud balls, dead air sour pockets, structural damage etc and a well planned filter assessment program including operator involvement can achieve excellent water quality improvements.

Conducting a filter refurbishment program during periods of drought and lower than normal water production requirements is advantageous, as the operator is able to take a filter offline and not have to worry about loss of water production. Drought can be a good thing!!

It is possible to enter a filter safely and conduct an inspection. A well thought through method accompanied by an appropriate JSEA can allow access to maintain such a vital piece of plant that provides a safety barrier between protozoan and the customer.

Finally the filter refurbishment program is also further evidence that if given the opportunity, Operator's can excel in managing such a project and the learning that is achieved form this will enhance the operators knowledge of filter operation, maintenance and performance analysis.

4.0 ACKNOWLEDGEMENTS

The filter refurbishment program was a success due to the invaluable input and support from the following people:
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- Peter Mosse (Hydrological) and Bruce Murray (City Water Technology)
- Harold and Gordon Archer (Water Treatment Australia).