

CHANGING HORSES MIDSTREAM: THE DOLLARS AND SENSE OF THE WAIOHINE WTP UPGRADE

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ABSTRACT

In the 1990s South Wairarapa District Council installed one of the first membrane water treatment plants in New Zealand. By 2010, demonstrating compliance with the DWSNZ was difficult and the plant had some operational issues. After the assessment of a number of upgrade options, Council decided that rather than installing further equipment to make the existing plant comply with the standards it would take a different approach and develop a new groundwater source and treatment system that would have a lower DWSNZ log credit requirement. Three Ministry of Health (MoH) subsidy applications followed and three shallow bores were installed with an 880 metre pipeline to the existing plant. The second stage of the project involves extension of the existing treatment plant building and installation of UV disinfection and pH adjustment equipment. The good quality ground water allows treatment with UV disinfection alone, reducing operational costs and simplifying standards compliance. This project demonstrated how an in-depth understanding of the DWSNZ can identify the simplest and most cost effective path to compliance and the importance of the MoH subsidy programme in achieving that goal.

KEYWORDS

DWSNZ, standards, groundwater, WTP upgrade, bores UV disinfection

1 INTRODUCTION

A water supply has been provided at Featherston since the 1930s. In 1965 some of the existing supply was installed sourcing water from two local surface water sources; Taits Creek and Boar Bush. The water from these sources was chlorinated only and the quality was highly variable. In the early 2000's a pipeline was installed to connect the supply to the Waiohine Valley membrane filtration plant which supplied Greytown at that time. The Waiohine Valley plant was installed in 1999 and abstracts water from the Waiohine River before membrane treatment. The new pipeline allowed water from the membrane plant to be used at Featherston when the water quality in Taits Creek and Boar Bush was not suitable.

In 2005, a new shallow bore source was established for the Greytown supply and the Waiohine treatment plant became the primary supplier of water to the 2500 consumers in the Featherston township. The Taits Creek and Boar Bush intakes are still in place but they are now retained as emergency sources only. At this time the configuration of the system was as follows. Water from the Waiohine River flows through an irrigation water race and from the water race to a wet well. Two pumps provide water from the wet well to the raw water storage ponds, 350 metres north and through a vertical height of seven metres. Water from the two storage ponds is pumped through two banks of membranes, is chlorinated (gas) and stored in a 750m³ tank at the site. From storage, water flows 10 kilometres under gravity via a 300mm pipe to a 450m³ concrete reservoir at Boar Bush, part of the original supply. The water is re-chlorinated as it enters this tank and flows under gravity from this tank to the Featherston community.

By 2010 a number of problems had been identified with the membrane filtration plant including the amount of process water that was being used, fine clay particles in the source water, cyanobacterial growth in two raw water storage ponds, production of disinfection by-products and issues with maintaining *Drinking-water Standards for New Zealand 2005 (R2008)* (DWSNZ) validation. The plant was unable to process water when river water turbidity became elevated, and relied on using the limited raw water storage.

In 2011, South Wairarapa District Council received MoH subsidy funding to establish a new ground water source for the Waiohine treatment plant. Two bores were unproductive, but a third bore, nine metres deep and near to the plant was shown to provide a suitable quality though inadequate quantity of water.

In 2012 a further MoH subsidy application was made to establish further bores and to install UV disinfection as the main water treatment process.

2 WAIOHINE TREATMENT PLANT UPGRADE

2.1 DWSNZ COMPLIANCE

A key driver for the Waiohine plant upgrade has been demonstrating compliance with both the Health (Drinking Water) Amendment Act 2007, required from July 2014 and the DWSNZ. In 2010 the Waiohine River source had been assessed as needing 4-log protozoa treatment. Council had the option of either installing an additional treatment process or processes that would provide that level of protozoa treatment or finding a way to have the treatment level reduced. Limited testing of the bore that had been installed, indicated that turbidity was low (below 1NTU) and that a further two production bores would be sufficient to provide the quantity of water that was required. A decision was made to undertake *Cryptosporidium* testing (26 samples over 12 months) to establish a need for 3-log protozoa treatment only and to provide that level of treatment by installing UV disinfection. The need to progress the project meant that detailed design, tendering and physical works were to be completed before the need for 3-log protozoa treatment had been conclusively established.

2.1.1 UPGRADE

In early 2012, MoH subsidy funding was sought to:

- install two further shallow bores about 100 metres from the bore that had already been drilled,
- install electrical and telemetry equipment for all three bores,
- install 880 metres of DN250 PE pipeline to the existing treatment plant,
- install duty/standby UV reactors and instrumentation,
- extend the existing treatment plant building to accommodate the UV reactors,
- install 750m³ of additional treated water storage.

In 2012 a \$766,000 subsidy, 65% of the estimated total cost was sought. In August, Council was notified that \$617,500 of subsidy would be provided, the MoH declining to fund the additional storage. The following year an additional \$50,000 subsidy was provided to include pH adjustment equipment and detailed design.

Opus was contracted by Council to undertake the detailed design work in two parts, first for the pipeline to the treatment plant and second for the building extension, pH adjustment and UV reactors. The pipeline design was delayed by a number of factors, including the need to gather information about the quantity of water that was being produced by the plant, the demand from the community and the location of underground services.

The bores were located in the Waiohine River flood plain, within 200 metres of the main river channel. The risk of inundation of the bore electrical controls necessitated installing them on an elevated platform, above the 100 year flood level. The pipeline was designed to take water from the bores to the existing river pumps with a 'T' into the existing pipeline from the pump house to the plant. At the plant, water from the bores could be delivered either to the existing raw water ponds or to the proposed UV reactors.

A variation to the abstraction consent was sought and granted. The consent variation allows combined abstraction of up to 9000m³/day depending on river flows, from either the bores or the water race. The pipeline works were tendered and a local contractor completed the installation in February 2016. From this time water

has been supplied from the bores to the raw water ponds allowing further analysis to be undertaken on the source water, including *Cryptosporidium* testing.

Design for the building extension, pH adjustment equipment and UV reactors was completed in June, tenders let and a contractor appointed in July. The building extension is relatively simple addition to the existing structure. The pH adjustment is to be achieved by dosing soda ash, post UV. The duty/standby UV reactors were pre-purchased for installation by the contractor. This second stage of the project is set to be completed by the end of November 2016.

When completed, the plant will have the option of using water from either the bores or the water race. Water from either source can be pumped to either the raw water ponds or directly to the UV units. Water from the raw water ponds (ie from either source) can be treated by the membrane filtration plant and water from either source can be treated by UV alone. The design has included blank flanges so that if required it will be easy to configure the plant so that the membranes can precede the UV reactors if it is decided that pre-filtration is required. It is anticipated that the primary configuration of the plant will be to use water from the bores and supply it directly to the UV reactors. The supply will continue to be chlorinated and pH adjusted. Additionally the pipeline from the bores has been sized to facilitate the addition of two further bores if increased capacity is required. Though a pipeline from the Waiohine plant can provide water to the Greytown community, the plant will supply the Featherston community only. Greytown will continue to be supplied by the Greytown bore. Decisions on installing further bores to increase capacity and supply both communities from the Waiohine plant will be considered at a later date.

3 CONCLUSIONS

This upgrade project sought to find a least resistance path to legislative and DWSNZ compliance. Additionally, small Councils like South Wairarapa District Council have limited funding available for upgrading water supply infrastructure and identifying a cost achievable solution to compliance was essential. One option would have been to install further infrastructure around the existing membrane plant. For example a clarifier could have been installed upstream of the membranes and UV disinfection downstream. While solving some of the problems at the plant, this approach would not have entirely solved the problem of operational water loss and the question of cyanotoxins may have then required installation of some form of carbon filtration or dosing. It would also mean that the treatment target would remain at 4-log and compliance would need to be demonstrated by two processes, filtration and UV disinfection.

Ultimately Council decided to take a different tack, changing the water source type to provide better quality raw water, and then matching a disinfection only process to that raw water. This approach was dependent on reducing the protozoa log treatment level from 4-log to 3-log so that compliance could be demonstrated by UV disinfection alone. The benefits of this are that compliance is demonstrated by one process alone and the turbidity target for the treatment system is 1NTU. It will also considerably reduce the operational costs of the plant.

This project demonstrated how an in-depth understanding of the DWSNZ can identify the simplest and most cost effective path to compliance. It also showed the value in Council making a big but informed decision to change the approach it takes to abstracting and treating water at this supply, rather than being locked into an approach that has been determined by prior decisions.

In spite of the fact that the overall cost of the project at about \$1.4m is more than was originally anticipated, it also demonstrated the value of the MoH subsidy programme and how it allowed Council to make decisions that provide a long term solution to a difficult problem.

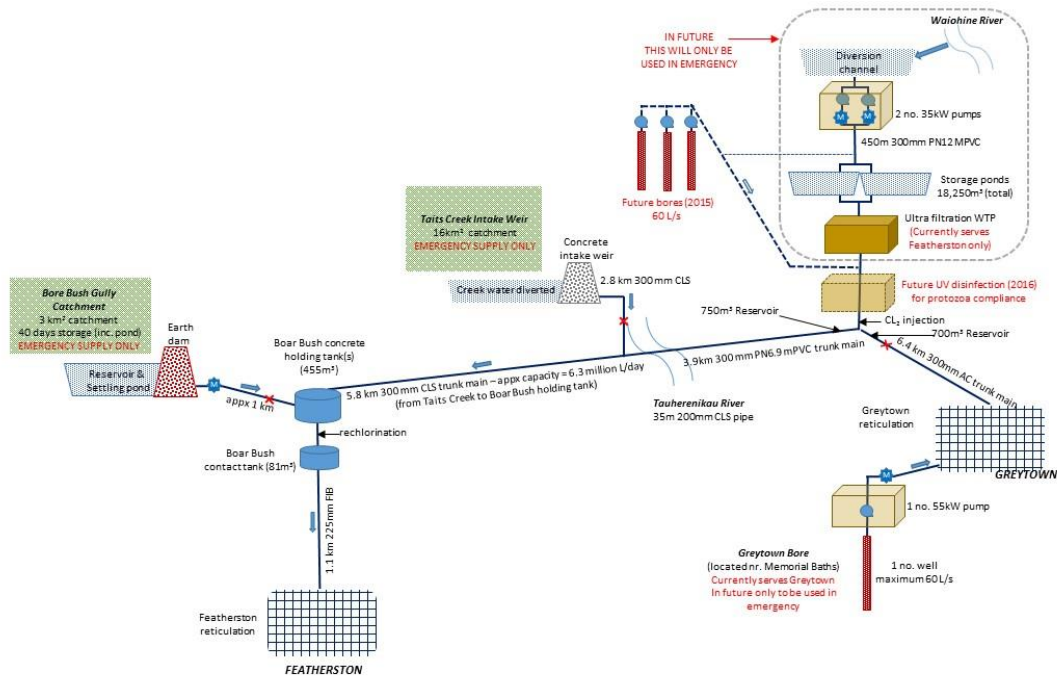


Figure 1: Schematic of the Featherston/Greytown water supply

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