SECURING THE SHIRES WATER SUPPLY

Paper Presented by:

Barry Jones

Author:

Barry Jones, *Water Treatment Plant Operator*,

Eurobodalla Shire Council

5th Annual WIOA NSW Water Industry Engineers & Operators Conference
Exhileracing Events Centre, Newcastle
29 to 31 March, 2011

SECURING THE SHIRES WATER SUPPLY

Barry Jones, *Water Treatment Plant Operator,* Eurobodalla Shire Council

ABSTRACT

The Eurobodalla Shire Council commenced operation of its water supply system in 1936 supplying the village of Narooma from a weir located near Gulaga (Mt Dromedary) in Tilba. Since then the Shire has expanded to now supply to Narooma, Bodalla, Moruya, Broulee, Mogo, Batemans Bay and many of the surrounding small villages. The supply relies on the flows in the Tuross, Moruya and Buckenboura Rivers all running through unprotected catchments. Water is stored in Deep Creek Dam, which acts as the emergency supply for the Shire.

The need for filtration of the water supply system was identified in the *Integrated Water Cycle Management Strategy,* (2003) as a short term measure to increase security and quality of supply. In 2006 a quantitative risk assessment process was undertaken for the Shire's water supply, which established that "*there is a categorical and explicit need to introduce filtration, particularly for the Tuross supply, and probably for the Moruya system*", in order to achieve the objectives of meeting the framework of the new Australian Drinking Water Guidelines.

The result was the engagement of NSW Water Solutions to develop a design concept report. Project management was carried out by NSW Public Works South Coast Office and Water Infrastructure Group were awarded the contract in August 2009 for the development and construction contract with commissioning to be complete by February 2011. This paper will present an overview of the process from establishing the need for the new water treatment plant, the risk assessment involved in determining this, the options studies for selecting the most appropriate technology, the design development phase, which identified smart design allowing for reductions in energy requirements to the construction and commissioning of the water treatment with arguably the best view on the East Coast.

1.0 INTRODUCTION

In 1998 the shire of Eurobodalla suffered a drought; Eurobodalla Shire Council requested the Department of Land and Water Conservation (DLWC) in conjunction with council to conduct a review into Council's water supply and how best to develop it for the future.

A study was conducted to project the population growth. DLWC reported to Eurobodalla Shire Council (ESC) a complete review of water management should be conducted to cover all aspects of Council's operations, and best plan the strategy to move forward.

In December 2000 council accepted the Minister for Land and Water Conservation's offer for assistance to conduct the required Integrated Strategy Study.

The DLWC conducted the initial study of the existing Shire waterways and in 2001 contracted Department of Public Works and Services to address the issues identified and to provide a range of solutions to these problems.

Workshops were conducted involving councillors and senior staff to establish and pinpoint business objectives. Following this two rounds of community consultation were held, as well as individual meetings within government agencies to ensure all options proposed would meet government regulations. The findings were summarised and presented to Council in November 2002, which was then displayed for public comment. At the same

time detailed financial models were produced to determine the relative cost of each option.

Eurobodalla's Integrated Water Cycle Management Strategy was the first pilot project of its type to be produced and adopted by local government in NSW. The innovative report enables planning of water, sewerage and drainage services and long term cost saving to be provided for existing and future residents, businesses and visitors to the Shire over the next 30 years.

The Integrated Water Cycle Management Strategy returned seven separate options. These options detail a range of possible actions and infrastructure construction activities with associated costs identified in terms of Environmental, Social and Economic outcomes. One of the social outcomes was to construct the Shires first water filtration plant. This allows Moruya river pump station to supply water to deep creek dam at a higher turbidity.

2.0 DISCUSSION

2.1 Hazard Analysis and Critical Control Points (HACCP)

In November of 2005 a HACCP was conducted to assess and identify the water quality risks and recommend control measures for managing the risk.

This workshop held over 3 days involved representatives from Eurobodalla Shire Council, Dept Energy Utilities and Sustainability, Southern Area Health Service, NSW Health Water Unit, Southern Region CMA, Dept of Commerce, Hastings Water, ICAM at ANU and Water Futures.

Working to guidelines given in the briefing paper and consistent with the ADWG (2004) the group assessed 236 risks from catchment to ESC's water consumers. Each risk was brain stormed and scored according to its risk. The highest scoring risks were discussed in depth to consider the control measures. The aim of this was to reduce the risk to an acceptable level. Any uncertainties were deliberated on and investigative actions suggested hopefully reducing the uncertainties.

Some of the highest scoring risks related to Toxins, Turbidity, Colour, Pathogens and Nutrients. From the risk assessment 51 control measures were recommended along with 16 investigative actions. Both the controls and actions were split into 3 levels of priority, Short-term (0-2 years), Mid-term (2-5 years) and Long-term (>5 years).

In May 2006 Water Futures Pty Ltd delivered a report using the information gathered at the recommending the HACCP to: "as a first priority, we believe that filtration (and/or alternative disinfection) is immediately essential to control Cryptosporidium. In deciding between filtration and alternative disinfection, we believe the choice is clear. We recommend filtration since there is also a need to reduce turbidity below 1 NTU to support adequate disinfection. In addition, there was a high risk of post-bushfire runoff contamination, which is effectively mitigated by filtration."

As a second priority, in addition to introducing filtration, "*we recommend increasing the inherent reliability of the chlorination systems to control zoonotic bacterial pathogens. Ideally this would be a fully automated dosing system, such as an on line analyser controlled, residual-trim, flow-paced system interlocked to pump shut down immediately if residual drops below limits or dosing fails.*"

2.2 Studies for selecting the most appropriate technology

The Water Treatment Options Study released in 2007 was based on treating water from the main northern sources, Buckenboura River, Moruya/Deua River and the Deep Creek Dam.Other considerations covered in this study included:

Water quality range

- **Range 1:** treating 90th percentile from all sources and turbidity up to 25 NTU.
- **Range 2:** treating 90th percentile from all sources, turbidity up to 60 NTU and total algal cell counts from Deep Creek Dam of 67,000 cells/ml.
- **Range 3:** worse raw water that can be expected in the northern system, turbidity up to 110 NTU. A plant designed to handle the range of raw water based on past monitoring.
- Both locations, Deep Creek dam and Denhams Beach Reservoir option was cost estimated to show the capital, operation and maintenance and net present value (NPV) over 20 years.

Table 1: ***Eurobodalla Northern Water Treatment Plant Options***

	Range 1	Range 2	Range 3
Option A	Direct filtration + PAC + UV	DAF + Gravity filtration + PAC + UV	DAF + (Clarifier) + Gravity filtration + PAC + UV
Option B	Direct filtration + Ozone/BAC	DAF + Gravity filtration + Ozone/BAC	DAF + (Clarifier) + Gravity filtration + Ozone/BAC
Option C	Membrane filtration + PAC	DAF + Membrane filtration + PAC	DAF + (Clarifier) + Membrane filtration + PAC
Option D	Membrane filtration + Ozone/BAC	DAF + Membrane filtration + Ozone/BAC	DAF + (Clarifier) + Membrane filtration + Ozone/BAC

Table 2: ***Option Costs***

($,000,000)	Range 1				Range 2				Range 3			
Option	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Deep Creek Dam												
Capital Cost	17.0	24.2	23.0	28.4	19.2	26.3	25.0	30.4	21.8	28.9	27.6	33.0
O&M Cost	0.7	0.3	0.7	0.4	0.7	0.4	0.7	0.4	0.8	0.4	0.7	0.5
NPV @7% for 20 years	24.0	27.9	30.3	32.7	27.3	30.6	32.9	35.2	30.0	33.3	35.6	37.9
Denhams Beach Reservoir												
Capital Cost	15.0	22.2	21.0	26.5	17.2	24.3	23.0	28.4	19.8	26.9	25.6	31.0
O&M Cost	0.7	0.4	0.7	0.4	0.8	0.4	0.8	0.5	0.8	0.4	0.8	0.5
NPV @7% for 20 years	22.9	26.2	28.6	31.0	25.6	28.9	31.2	33.6	28.2	31.5	33.9	36.3

After all the processes were considered with site issues, water quality, water treatment objectives and processes, the following recommendations were to:

- With a lower capital cost, operational convenience, available space the site close to the Denhams Beach Reservoir is the recommended site for the construction of the WTP.
- On an economical basis, the recommended process is dissolved air flotation (DAFF) and gravity filtration with powdered activated carbon (PAC) and ultraviolet (UV) treatment.
- It is recommended that a WTP built to treat design raw water quality Range 2 would give the most appropriate level of flexibility to treat the Northern System raw water quality.

Based on the above evaluation, it is recommended that a WTP be built at the Denhams Beach Reservoir site as per Option 2A in Table 1 for an estimated cost of $17.2M.

- Funding was provided through the Australian Government's Water for the Future, Water Smart Australia Program administered by the Department of Sustainability, Environment, Water, Population and Communities
- Total funding of $15M was received to support the construction of: The Moruya to Deep Creek Dam Pipeline ($10M) and the Northern Water Treatment Plant ($5M)

2.3 Design Development

The plant design for 30ML/d was based on being able to cover the shires current peek day demands and the projected peak day demands the Northern system could expect to see.
A decision by council was made to build the plant in two stages. The initial stage would see a 20ML/d plant built and expanded to 30 ML/d in the future.

At the time tenders are to be called contractors will be asked to submit two prices for construction, one based on the 20 ML/d with any main pipe work and channels designed for an additional 20% hydraulic capacity at the 30ML/d flow rate and one based on 30ML/d.

The following treatment processes were recommended to supply water to meet or better the Australia Drinking Water Guidelines.

- Powdered activated carbon treatment for algal toxin removal;
- Lime/CO2 stabilisation to reduce the corrosive nature of the water;
- Coagulation to remove the insoluble matter and colour from the water;
- Combined dissolved air floatation and dual media filtration;
- UV disinfection for cryptosporidium and Guardia treatment;
- Chlorination to disinfect the water and to provide free chlorine residual in the reticulated water;
- Gravity thickening and drying beds for plant waste treatment; and
- Provision to incorporate the Ozone/Biological Activated Carbon treatment into the treatment process in the future.
- Provision to incorporate fluoridation into the treatment process in the future. After public consultation and a review by Eurobodalla Shire Council fluoride was included in the current design.

Raw water will be supplied to the plant via the existing pipeline from Deep Creek Dam pump station. The pumps will be upgraded to variable speed drives allowing flow through the plant to be controlled between 10 ML/d to 30 ML/d.

The design calls for all electrical equipment to be efficient to reduce carbon emissions. The whole plant is controlled by smart technology using a SCADA based system. Where possible plug and play type equipment was used to reduce the need for calling electricians and fitters to replace or repair faults. Wireless ruggedized lap tops are being provided to allow the operator to view and control the plant from any location. If for any reason the wireless network was to fail an internal Ethernet loop allows the operator to plug in to the system from any room.

2.3 Construction and Commissioning

Water Infrastructure Group (WIG) was awarded the contract in August 2009 with site construction starting in September 2009.

There have been a number of design changes to the original that improved efficiency of the plant.

- The overall level of the plant was raised to allow gravitational flows to Denhams Beach Reservoir reducing the need to pump.
- Location of the Clearwater Pump Station was changed to allow a more efficient flow to Denhams Beach Reservoir when stage 2 constructions of the BAC/Ozone is completed.
- The wastewater tank shape from round to square, location closer to the plant and jet mixers replacing mechanical type.
- The road works layout and orientation of the drying beds to allow better access.
- The shape of the Lime and PAC Dosing Tank to provide greater certainty of contact time.
- Lime and Carbon dosing facilities have been rearranged in Chemical building 1 to shorten dosing lines after the location of the inlet pipe work was relocated to the eastern side of the plant. The lime also had the chemical feeders relocated from under the silo and fed by a screw conveyer to reduce the overall height of the silo and have better access to the chemical feeders if they require manual loading.
- Carbon Dioxide cylinder orientation from a horizontal to a vertical vessel will reduce the footprint of the CO2 system.
- Main building layout changed to allow internal access to all rooms.
- Filter tapered inlet channel was changed to a pipe manifold with individual magflows and butterfly valves to ensure even flow across all filters.
- Orientation of the DAFF filters to incorporate the Clearwater Tank into the main building to reduce head losses through the plant.

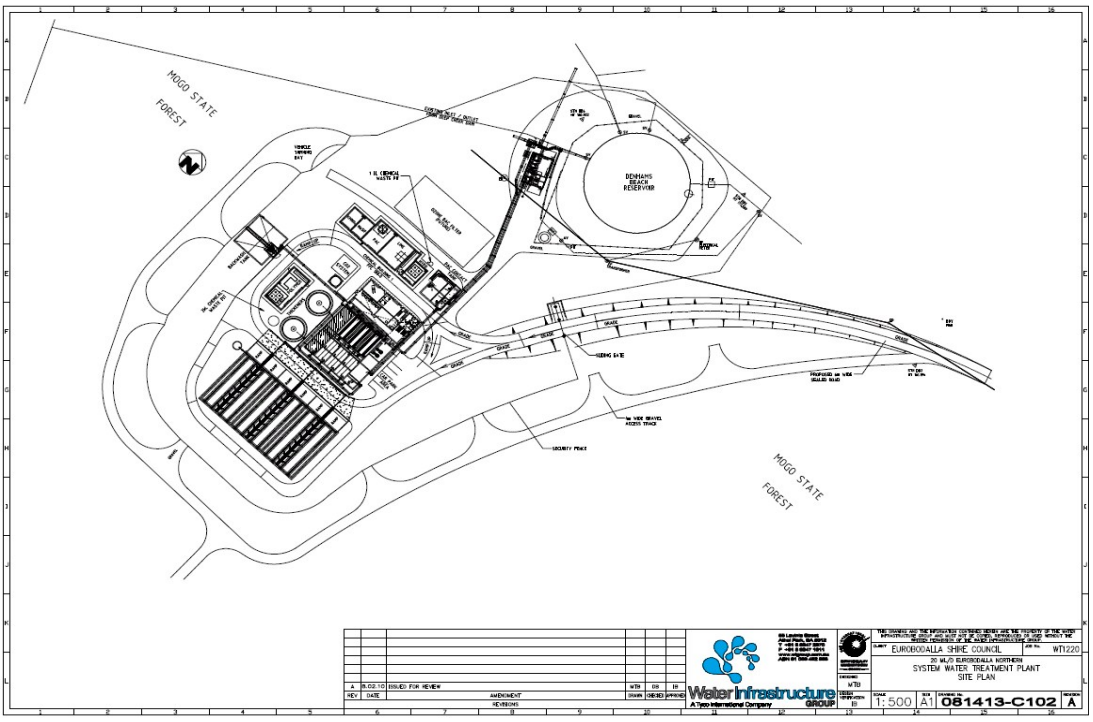

Figure 1: ***Site Layout***

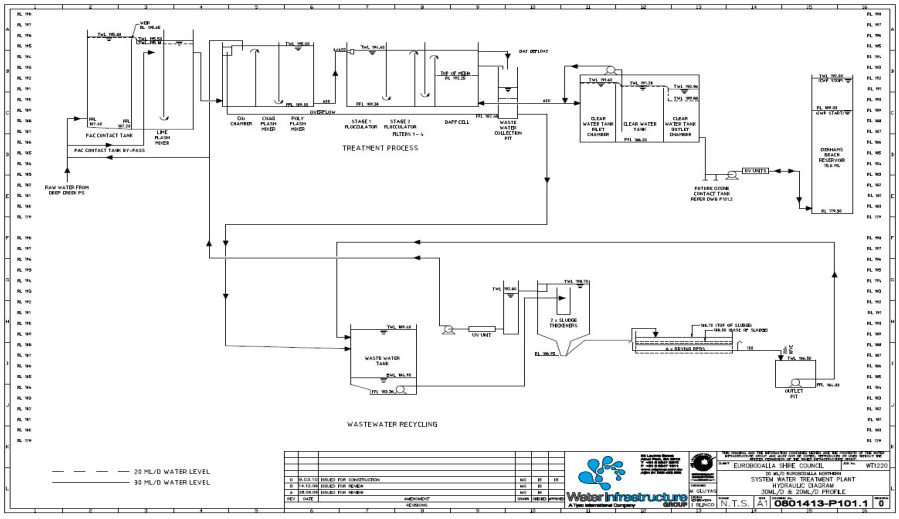

Figure 2: ***Hydraulic profile***

With minor construction and road works still being completed plant commissioning will commence on 21st of March 2011, 18 months after construction started. During this time there is to be a two week fault free running period which will then be followed by a six month operational period where Water Infrastructure Group will operate the plant in conjunction with council operators. After this time council will take full control. There will be two full time operators and one trainee based at the Northern WTP.

3.0 CONCLUSION

The new Northern Water Treatment Plant is scheduled to start production of clean drinking water in March 2011. Most of the plant is currently running and being tested as a closed loop to remove any operational issues before commissioning.

The new plant will supply quality drinking water to Eurobodalla Shire Council residents for years to come securing the water supply for the future and with the best view on the south coast.

4.0 REFERENCES

DPWS 2003
Eurobodalla Shire Integrated Water Cycle Management Strategy, NSW Department of Public Works and Services, 2003

ESC 2003
Report to works and facilities committee meeting, A.Mclean, Manager Storage & Distribution

Commerce 2006
Eurobodalla Water Supply Augmentation Scheme, Eurobodalla Water Supply Conceptual HACCP Plan Workshop Summary Paper, NSW Department of Commerce, 2006

Commerce 2007
Eurobodalla Shire Regional Supply Scheme, Water Treatment Options Study for Northern System Water Treatment Plant, NSW Department of Commerce, 2007

Commerce 2008
Eurobodalla Northern System Water Treatment Plant Concept Design Report, NSW Department of Commerce, NSW Water Solutions, 2008