NATIMUK POTABLE WATER SUPPLY: LATERAL THINKING AND OPERATOR INPUT EQUALS $4M SAVED

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ABSTRACT

The Wimmera Mallee Pipeline Project was required to deliver piped raw water to supply the township of Natimuk. GWMWater planned to build a treatment plant in 2012. Innovative thinking by the design team identified options to bring drinking quality water from Horsham, eliminating the need for a treatment plant and generating savings of nearly $4 M. As the design proceeded, further improvements meant that Natimuk could be supplied under gravity from Horsham's treatment plant. The final design proved to have significant benefits for Horsham as well.

1.0 INTRODUCTION TO THE WIMMERA MALLEE PIPELINE

From early in the 20th century, a network of open channels was constructed to deliver domestic and stock water supplies to farms and towns across most of the Wimmera and Mallee Districts.

The water is currently provided by an annual channel run through 18,000 km of open earthen channels to town storages and farm dams.

Water is primarily sourced from the headworks reservoirs located in the Grampians, with some water supplied from the Murray and Goulburn River systems. Over 85% of the water delivered into the open channel system never made it to its destination.

The existing channel system is highly inefficient. On average 120,000 ML is released from the head works and only 17,000 in used by customers. The remaining 103,000 ML is lost due to seepage and evaporation.

Security of supply is defined as the probability of supplying full entitlement i.e. without restrictions. The current channel supply system provides approximately 78% security of supply for stock and domestic customers and 88% for urban customers. The channel system will be replaced by a network of 9000 km of pipes, to be completed early next year. The new pipeline will provide 96% security.

The new pipeline system has a capacity to deliver some 32 GL of water to customers, providing for existing consumption and an allowance for growth. The environment will benefit from the return of 80 GL of savings.

1.1 Wimmera Mallee Pipeline Project Objectives for Natimuk

Natimuk is a town of 450 people about 25 km west of Horsham. Natimuk's water supply was delivered once or twice a year as a channel run into two earthen storages on the outskirts of town. It was then pumped, untreated, into the reticulation system.

The Wimmera Mallee Pipeline Project's (WMPP) objective for supplying Natimuk involved building a 1.5 ML covered storage tank next to the old, soon to be decommissioned, dams.

Since the tank could be kept full from the new pipeline, it is only 1% of the size of the dams.

2.0 GWMWATER PLANS FOR DRINKING WATER TO NATIMUK

Now, the pipeline water is much cleaner than the channel water, so GWMWater could economically treat it to drinking water standards. A water treatment plant was committed for construction in the Water Plan in 2012-13. This plant would be built at the site next to the new tank at an estimated cost of $1.5 M.

2.1 Better Ways

Figure 1 shows what is referred to as the Supply System 6 pipeline layout for supplying Natimuk from the rural system. Water is distributed from headworks in the Grampians at the south east corner of the System, heading north and north-west.

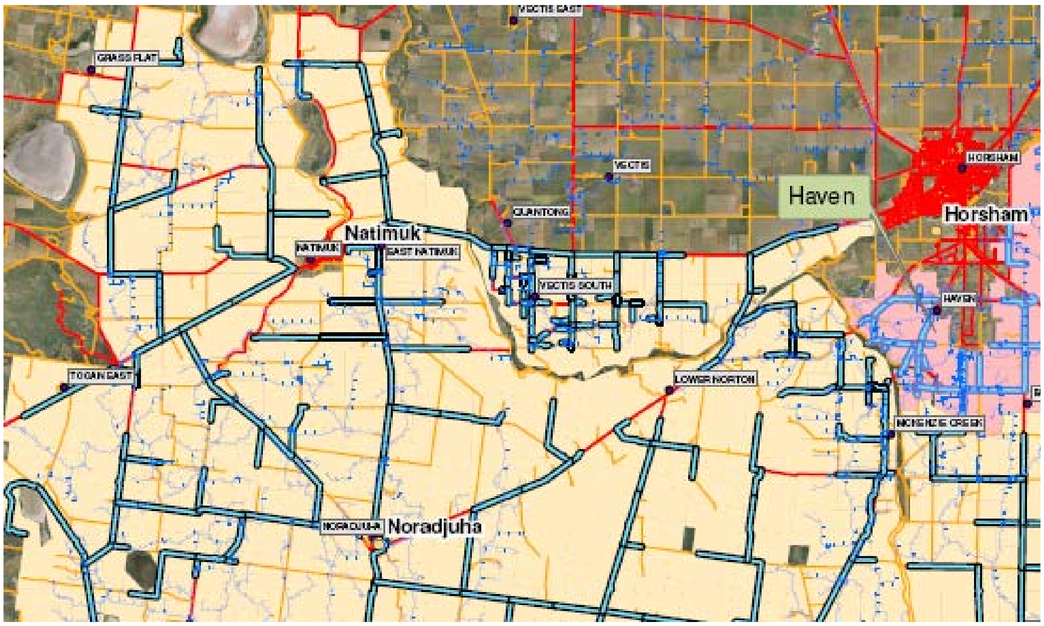


Figure 2: ***2007 Design for Supply to Natimuk from the South East***

Notice, in particular, the pipes delivering water to the Quantong area between the Wimmera Highway and the Wimmera River in the north. Notice that the design included pipeline along 80% of the highway between Natimuk and Horsham to supply Quantong. What if we completed the pipeline all that way? Could we supply Natimuk by connecting it into the Horsham System?

Computer modelling showed that Horsham's WTP had ample capacity. Two options were identified.

The first required that a new main be built from Horsham's primary supply point in the south east of the town to the western edge, skirting the built-up areas. The second required that the trunk main through Horsham into the western parts was increased in size and extended to cope with the extra demand. A pumping station would also be needed to get the water to Natimuk.

2.2 The Savings

The second option would work best (Figure 2). And it would save one and a half million dollars on the water treatment plant at Natimuk. Not only that, it proved to be cheaper for the Pipeline Project as well.

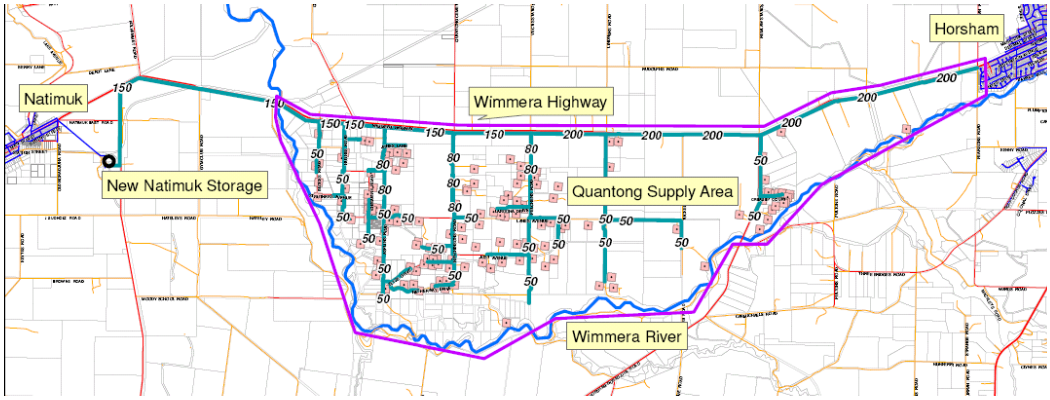


Figure 3: ***Supply to Natimuk and Quantong from Horsham***

The WMPP team found that, by removing the supply of Natimuk and Quantong from their rural network, the pipe sizes all the way back to the headworks could be reduced significantly and they wouldn't need as many pump stations. They found that, with the savings in the rural network, they could build the upgrades in Horsham and reduce the overall cost by more than $2 million.

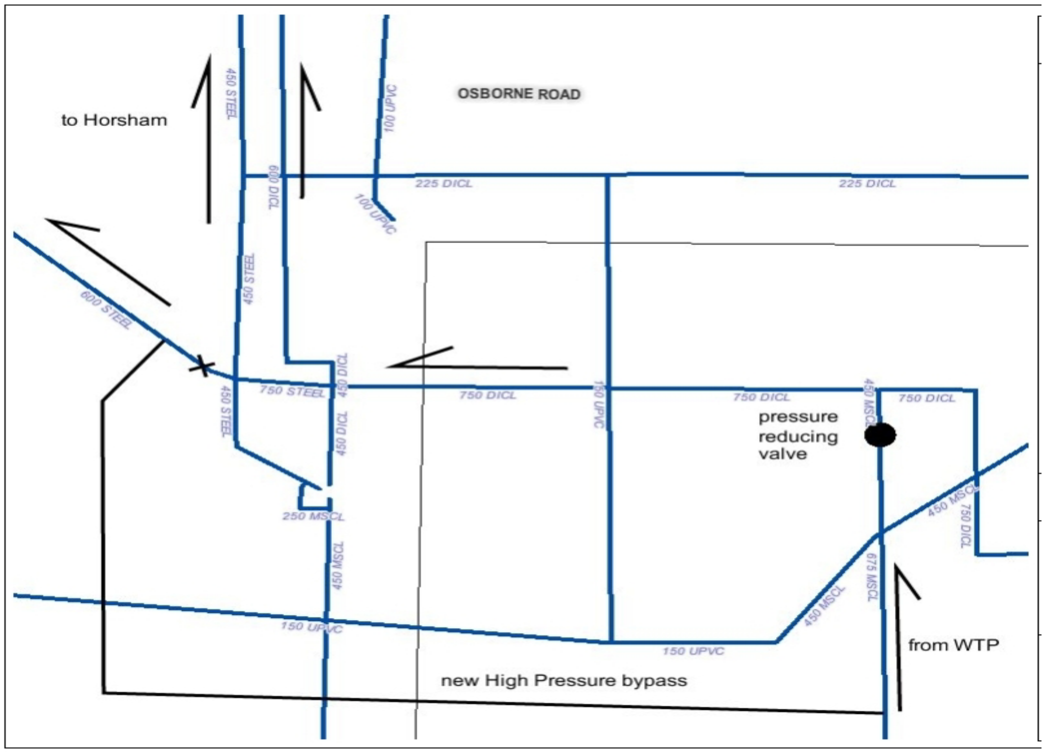
That's a total saving of nearly $4 million – from one little idea. This doesn't include the annual savings from not having to operate a treatment plant.

2.3 Now Let's Build It

We have a concept – to connect Natimuk's supply to a trunk main that runs through the south western part of town and to construct a pumping station on that main to deliver the water the 25 km to Natimuk (Figure 2). It's time to get down to the detail, time to call together an advisory team of engineers and operators to find out how the system really works.

2.4 Do We Really Need the Pump Station?

If we have a look at the Morson Hub, where Horsham's supply comes into town from the treatment plant in the Grampians (Figure 3), we find that the pressure head in the trunk main is some 60 m. This pressure is then reduced and water is delivered at 30 m to Horsham. What if we connected the trunk main to Natimuk to the high pressure side of Morson PRV? Could we deliver water without a pump station?



<u>Figure 4:</u> ***Morson Hub showing new HP Bypass***

Out came the modellers again who figured that it is possible; we could bypass the PRV at Morson through a new HP bypass. This generates massive savings in power costs and also greenhouse gas production. Now the Operations group are really starting to sit up and listen.

<u>Figure 5:</u> ***High Pressure Spine through Horsham***

3.0 HOW TO BUILD A HIGH PRESSURE SPINE THROUGH HORSHAM

What we are really proposing is to convert the large diameter main that runs through the south west part of Horsham to a high pressure spine, carrying up to 60 m head. The operators and engineers again got together to work out how this could be done without adversely effecting customers and without bursting some of the older reticulation. The design in Figure 4 is the result.

All connections into the reticulation had to be removed from the spine and three had to be reinstated through pressure reducing valves (PRVs). This had to be done making sure that circulation in the reticulation was maintained or improved and that customer supply pressures were maintained or improved. Our operators could highlight pre-existing problems and where services were marginal. Our designs could therefore actually enhance service delivery – a valuable secondary benefit of this project.

3.1 Secondary Benefits

Having a high pressure spine through Horsham opens up all sorts of possibilities:

- improved control of pressures and flows through town now and as Horsham grows
- all PRV stations along the high pressure spine have pressure and flow monitoring connected through SCADA to the Operational Management Centre, bringing the operation and modelling capabilities for Horsham's water supply into the 21st century.
- better chlorine distribution through the reticulation
- possible ability to remove the high level tower from the system
- ability to supply the Horsham South area without booster pumping which means decommissioning the pump station
- more scope and flexibility for future development using PRVs.

4.0 HOW COMMUNICATION BETWEEN OPERATIONS AND ENGINEERING LED TO BETTER OUTCOMES

The initial design included many PRV stations. The operators could demonstrate that the system could work with only four.

The operators' knowledge of how the system really works helped the design team formulate the optimum design.

Operators were involved in proving and confirming the connections to be removed.

Operators and engineers together designed dewatering and construction procedures to minimise interruptions to customers. In the end, most of the work has been completed without any interruption to supply.

The final Backflow Prevention Device (BPD) design turned out to be far simpler than the first design proposed by the engineering consultants (Figures 5, 6). The initial design was a large installation in a full enclosure, the final a small installation covered by a simple cage that could easily be removed by two operators, leaving the BPD clear of any obstruction for work.

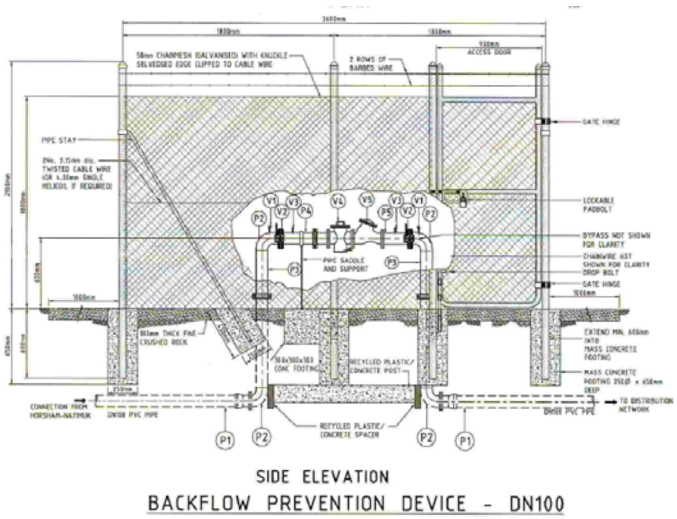


Figure 6: ***BPD with full enclosure***

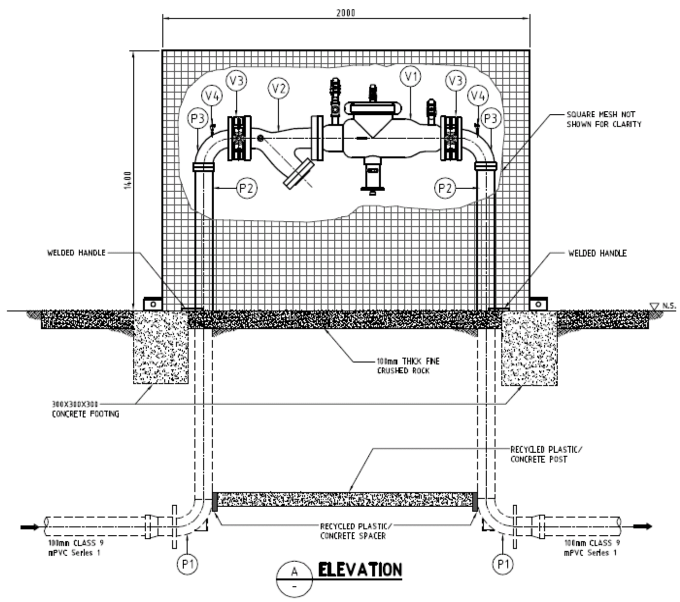


Figure 7: ***BPD with cage***

The construction works at Morson were quite complicated. The operators' knowledge of the system, compared to the plans, proved to be essential to maintaining water supply right through the construction period. A critical failure at Morson 18 months ago taught the operators some valuable lessons. This information meant these works could proceed without interruption to supply. The design team were able to proceed with confidence, knowing the operators were able to cover all contingencies.

5.0 CONCLUSION

If operators and engineers are involved together from the start and throughout the development of the project, the construction phase will go smoothly. In many cases the operators' reality checks on the design ideas saved much time and anguish for everyone including the contractors.