MANAGEMENT OF OPERATIONAL CONTROL

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ABSTRACT

The Victorian Government is implementing major water supply improvements to improve the security of supply for Melbourne and one project, the North South pipeline provides a supplementary supply of water from the northern Goulburn River Catchment to Melbourne Water's Sugarloaf Reservoir.

This paper discusses the combined industry approach in the preparation and management of a significant change from a predominantly unfiltered gravity supply to a filtered. A significant amount of work was required to ensure that assets, water quality and customers were not affected by this change and that a seamlessly transition was made.

Key aspects focussed on during the planning, preparation and operational phases for this changed transfer operation were:

- Understanding the operational and hydraulic changes to the MWC transfer system and its affect of our distribution facilities;
- Understanding the changed operational risks of changing to a pumped system;
- Understanding the potential for WQ impacts due to a change of source water; and
- Overall combined industry approach in the preparation and management of our distribution system and our customers.

KEY WORDS

Operational Change Control, Water Supply System, System Operation.

1.0 INTRODUCTION

To improve the security of supply to Melbourne the Victorian Government and Melbourne Water (MWC) are implementing major augmentations to supplement the current Upper Yarra and Thomson Catchment sources of supply. These projects are key initiatives from the Victorian Government White Paper Our Water Our Future (2004).

To utilise this additional water augmentation of the existing systems was required including:

- Upgrade of the Melbourne Water Winneke Water Treatment Plant;
- Construction of a new pumping station at Preston Reservoir; and
- Other minor changes to the transfer and distribution networks.

Treated water from Winneke Water Treatment Plant (WTP) is distributed to Melbourne via the 2100mm Winneke-Preston main. This water has been the predominant supply to the northern and western suburbs of Melbourne. The eastern and southern suburbs of Melbourne are supplied with water from the Silvan Reservoir which distributes water transferred from the Upper Yarra and Thomson Dams.

The major operational change as a result is to pump filtered Winneke water in a reverse direction through the 1700mm Silvan-Preston main to MWC's Olinda Reservoir. This pumping will normally occur during the winter periods. During the summer period pumping will cease due to higher demands in the north consuming all the water produced

at Winneke.
This major operational change including both the initial commissioning and on going pumping posed significant risks to Yarra Valley Water, including the distribution systems from asset failure due to water hammer and variation in water quality due to the changed supply source, changed flow rates in some mains and reversal of flows in others.

Due to the scale and nature of this major operational change and the fact that it had never been done before, YVW in conjunction with MWC prepared a joint strategy to manage the associated risks to the water supply infrastructure and water quality to ensure a smooth transition to the new operating regime.

2.0 DISCUSSION

2.1 System Operation

Traditional Operating Regime
Under a normal summer operating regime approximately 85% of YVW customers are supplied with unfiltered water from Silvan Reservoir and the remaining 15% are supplied from Cardinia and Sugarloaf Reservoirs. During the winter months supply from Sugarloaf Reservoir is increased as more water is available from the Maroondah Aqueduct and Yarra River. During winter approximately 70% of YVW customers are supplied with water from Silvan Reservoir and the remaining 30% from Cardinia Reservoir and Sugarloaf Reservoirs.

The summer and winter distribution of water from both Winneke WTP and Silvan Reservoir is normally achieved by gravity. There are a number of customers who regularly have a change in their source water depending on the operational regime at the time, impact from this change is minimal with no change in complaints and water quality compliance is unaffected.

New Operating Regime
Under the new "Winneke Maximisation" operating regime water will be supplied from Winneke WTP with the following changes:

- Greenvale Reservoir Zone & Hume Corridor supplied with filtered Winneke water via Plenty Pump Station which currently supplies Winneke water to Yan Yean and the Quarry Hills Zones; and
- The Preston Pump Station pumps filtered Winneke water in a reverse direction east along the Silvan Preston main to Olinda Reservoir at between 120 to 180ML/d. These areas are normally supplied from Silvan Reservoir via gravity supply.

As a result of this new operating regime 280,000 properties received filtered Winneke water for the first time increasing the number of YVW properties that receive filtered Winneke water from 260,000 to 540,000 or approximately 80% of the customer base.

2.2 Risk Assessment

In order to effectively eliminate, mitigate or control the risks an assessment was conducted to identify these risks and rank them. The following are some of the key risks identified:

- Water Quality:

- Change of source water from un-filtered to filtered;
- Change of flow direction creating discoloured water;
- Higher flow rates main stripping manganese slimes or bio films; and
- Increased water age / Low chlorine residuals causing taste & odour issues.

- Asset Failure, Hydraulic Capacity and Pressure:
  - Water hammer as the result of the failure of the pump station.
  - Pressure complaints in areas re-zoned; and
  - Network deficiency due to system re-configuration.

2.3 Water Quality

The two sources alternated seasonally are dissimilar in quality and treatment with Sugarloaf Reservoir being filtered and Silvan Reservoir being unfiltered.

Characteristics of the source waters

The main differences that customers may notice with filtered Winneke water are:

- The apparent colour is much lower when compared to Silvan water;
- The turbidity is much lower as it's filtered; and
- Winneke water has a higher salt content and TDS levels.

The change in source water was not expected to affect any domestic customers, however certain commercial and industrial customer groups were advised of these specific changes as it may impact on their onsite treatment processes or production processes. Table 1 lists the comparison of the parameters with the most significant variation.

The source change resulted in a limited number of enquiries relating to the clarity and colour of the water as it has a crystal clear blue tinge when put in a white bath or basin. There were some initial concerns from a few industrial customers with sophisticated onsite treatment process, these were resolved with either minor process adjustments or resulted in no issue.

Table 1: ***Comparison of water quality parameters of source water***

Parameter	Units	Silvan Reservoir	Winneke Reservoir
Colour	Pt/Co	9	2
Turbidity	NTU	0.6 - 2.0	0.2 - 0.9
Specific Conductance	uS/cm	55	124
Hardness	mg/L	12	25
Sodium	mg/L	4.4	11.5
TDS	mg/L	35	70

Reversal of flow direction and Stripping of manganese slimes

Reversal of flow direction in the Silvan-Preston main had the potential to strip bio films and suspend sediment that may have accumulated over time. This main had never flowed from west to east so there was a significant unknown risk associated with this. The internal walls of the main were inspected and analysed and the findings determined the risks to be minor.

The Winneke Preston main has a known history of manganese slime accumulation that can slough off at higher flows leading to customer complaints. Swabbing and high flow flushing have been undertaken by Melbourne Water in the past for manganese control and removal. Increased flows during Winneke maximisation has a low potential to strip

manganese deposits resulting in “black water” complaints.
This may occur if slimes are allowed to accumulate with out undertaking periodic high flow flushes for their removal. A series of high flows were managed in a controlled manner prior to the changed operating regime to ensure the main was in a suitable condition for the future “uncontrolled” higher flow events, and to develop a better understanding of the effects of increased flow on manganese / turbidity levels.

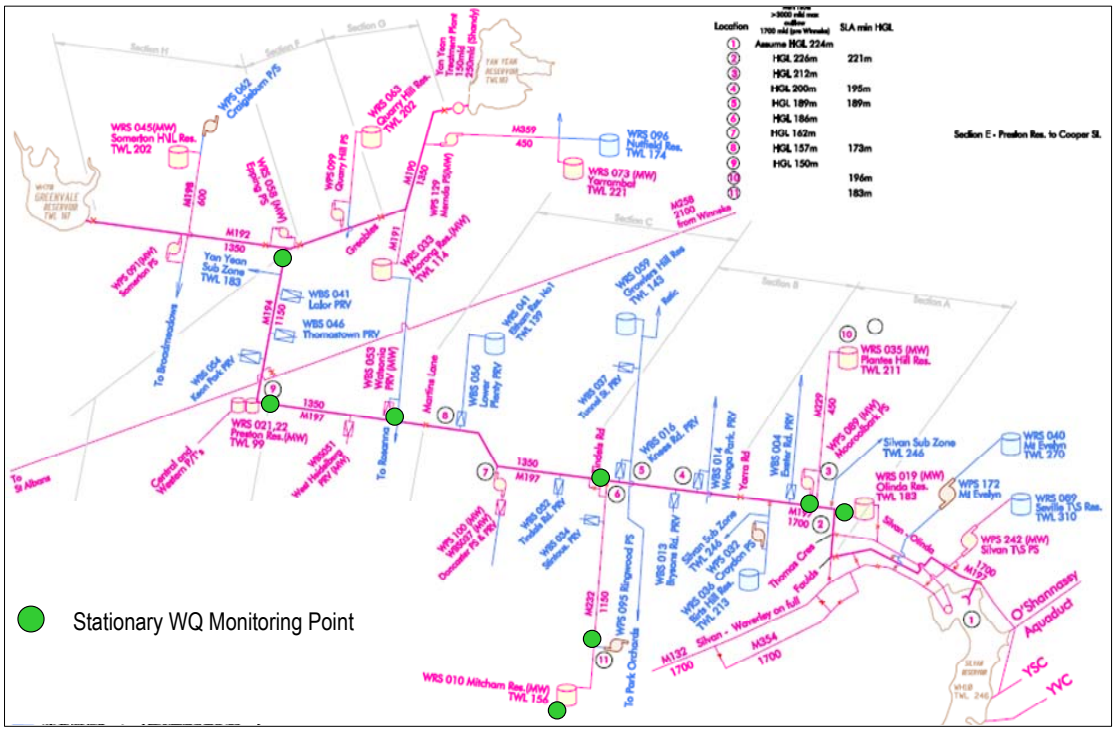

Figure 1: ***Water quality stationary monitoring points across the system***

Increased water age and low chlorine residuals
The change in flow rate and travel distance will also increase water age in some areas and have the potential to reduce chlorine residuals below historical levels. The major risk associated with this is that taste and odour can be generated from extended contact time with the coal tar enamel lining of the transfer pipes. We’ve experienced incidents of this in the Silvan – Preston and Harris Gully mains when the water has been at low flows and due to other operation activities and once this water gets into the distribution zones there is very little that can be done, in some instances it can be managed by spot dosing reservoirs.

Monitoring and management of WQ during change
Strategic locations in the system were identified for live monitoring of WQ during the change (see Figure 1) as a significant amount of water needed close monitoring to ensure poor quality water could be quickly identified and quantified to allow sufficient time to manage it so as not to affect customers. At these location samples were taken every 15 minutes and turbidity, colour, conductivity and chlorine and taste was recorded and reported.

2.4 Asset Failure Due To Water Hammer

Water hammer resulting from a power failure at the Preston Pump Station while pumps

are in operation is a key risk to YVW assets which was addressed on a zone by zone basis.
The MWC transfer system was designed with surge anticipation valves on the upstream side of the pumps and a pressure vessel on the downstream side of the pumps to mitigate the effects of any transient pressure waves.

System preparation and re-configuration
The simple approach to protecting assets was to contain all potential transient pressure waves within the transfer network which is predominantly bolted and welded steel or manage them through reservoirs to atmosphere when filling. Some minor capital works were undertaken to augment the system to ensure network redundancy via dual and alternate supplies. In many cases supplies were able to be simply isolated as they aren't required for non summer demands. In other cases some alteration to station PLC was undertaken. Some isolated areas had minor pressure reductions as a result of re-zoning, all customers affect by pressure reduction were notified in advance and has resulted in no complaints.

Site	Location	Operation	Operator	Date	Time
1.	Melrose Dve at Malvern Ave Mel ref: 16 A3	Ensure the 150mm (new) cross connection valve between the 225 and 150 mains is OPEN. Paint valve surrounds and lid white. **Detail A**	**CSO**		
2.	9 Coventry Street at the M350 Western Transfer Main Mel Ref: 16 A4	Measure and record pressure at front tap of No 9 Coventry Street and record. *Expected pressure ~ 80 m WG* Pressure = _____ m WG	**CSO**		

Figure 2: ***Extract from Operational Change Control Procedure***

All the system re-configuration works were performed in the weeks prior to the commissioning and initial operation of Preston Pump Station to ensure timely completion and confidence everything was operating as expected. This re-configuration was co-ordinated in close consultation with our operational counterparts at MWC under the control of our Operational Change Control Procedure (OCCP's), see Figure 2.

The use of OCCP's are essential in managing and controlling changes that have been made to ensure there is no impact to customer service levels and all risks and contingencies are considered and documented.

2.5 Commissioning Change Control

Due to the integrated nature of the transfer and distribution systems it was vitally important that the initial commissioning and operation of the Preston Pump Station was managed as one integrated change. At an early stage a joint industry working group was established to oversee and manage this change and as a part of this a joint change management structure was created to ensure all actions were coordinated and that all key information was available in order to make informed decisions on the right actions or contingencies (Figure 3). This was managed from a central control room with access to both MWC and YVW SCADA systems and live WQ field monitoring data. A key principle during the commissioning and initial operation was to completely isolate the

transfer system from the distribution system to ensure that any unknowns, faults or failures could be managed without impacting customers.
All actions were undertaken in line with the OCCP which allowed everything to be done slowly so as to be able to observe the "action – reaction" and make adjustments where necessary.

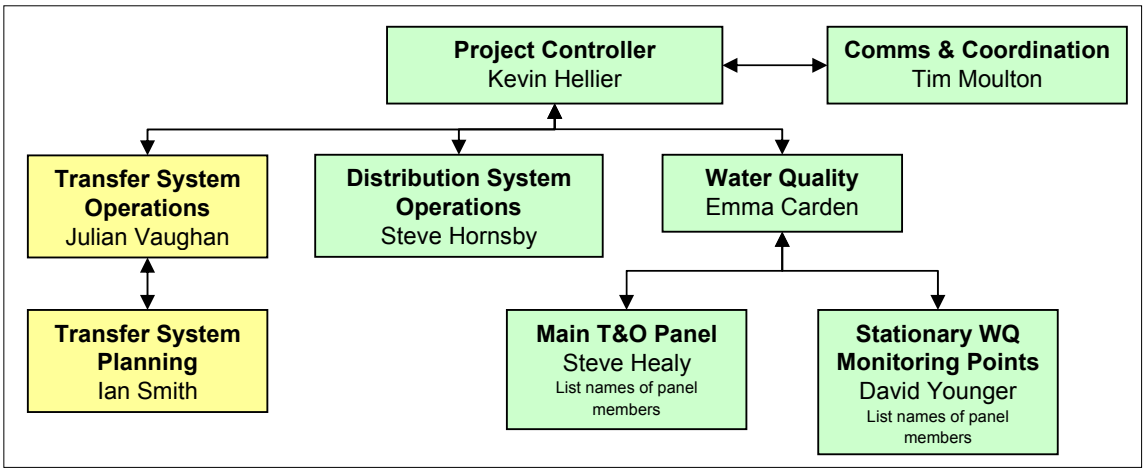

Figure 3: ***Commissioning change management structure***

3.0 CONCLUSIONS

This major system change was a resounding success from operational, asset protection, water quality and customer aspects. This is largely due to the following key aspects:

- Customer communication and engagement;
- System operational knowledge and strategic planning;
- Preparation and management; and
- Controlled and coordinated joint industry approach.

A collaborative, open and honest relationship between the water companies with a primary focus on working together ensured an effective and efficient outcome was achieved.

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