ABSTRACT (100 WORDS)

This paper examines the following items in the context of the McLaren Vale wine region:

- Pressure on traditional sources of irrigation water have required users to explore alternatives;
- Sustainable water solutions for irrigation necessitate a cooperative approach among stakeholders; and
- The overall economics of a sustainable scheme must recognise value along the supply chain, such that source providers, infrastructure owners and end users each share in the net benefits of the scheme.

INTRODUCTION (MAX 8 PAGES)

The McLaren Vale wine region has been described as one of Australia's most consistent premium grape growing region with a Mediterranean climate and conducive soil types. The region's warm sunny days and cool nights are ideal for growing grapes, coupled with a low risk of rainfall or frost during the harvest period. There is a wide variety of soil types, a reflection of the varied terrain; red brown sandy loams, grey brown loamy sands with yellow clay sub-soils interspersed with lime, distinctly sandy soils and patches of red or black friable loams are all to be found.

McLaren Vale's sustainability credentials have been widely recognised because of its ongoing water efficiency practices and a growing organic wine and food culture. An emphasis on the environment and sustainability has led many growers to embrace innovative farming practices, including investment in reclaimed water for irrigation.

In McLaren Vale, there are three primary sources of water which are central to irrigated grape production. Groundwater aquifers and surface catchment dams that capture run-off have been the traditional sources, with augmentation from potable water providing a back-up supply source. For the past 15 years, treated wastewater has emerged as a source, which is distributed direct to growers in the region through a network of pipes and associated pumping stations. The desire among growers for a secure water supply, which underpinned economic growth in the region, was a key catalyst in the establishment of the Willunga Basin Water Company ("WBWC").

For the grape growers in the McLaren Vale region, the long term viability of the industry is dependent on having a secure and reliable water source. Historically water has been viewed as a right or entitlement, but more increasingly it is now seen as a key asset rather than just a natural resource.

Growers have come to recognise the value of water as a key input to the success of their business, and understand that the price of water should reflect the full cost to source and deliver it to them. In a 2013 report published by the Institution of Mechanical Engineers it was suggested that on average just over 100 litres of water is required to produce a single glass of wine.

The full cost encompasses the infrastructure and operating capability to deliver a product & service with value attributes the grower requires such as:

- an accessible connection
- water available when they need it
- a pressurised and on-demand system
- water of an appropriate quality

The ultimate aim of WBWC is to support the economic and environmentally sustainable production of premium grapes, which is recognised by the success of WBWC's grower customers. With over 40% of vineyards in the McLaren Vale region irrigated with recycled water supplied by WBWC, the benefits to the region are significant. In excess of $20 million of premium grapes are produced annually from customers utilising reclaimed water, which are crushed and turned into wine with a wholesale value of over $300 million.

The emergence of alternatives has empowered growers to make informed choices about the best value fit for purpose water that suits their needs and allow them to maximise their financial outcomes. WBWC owns and operates the reclaimed water distribution network, through which a significant percentage of irrigation used in the region now comes from a sustainable resource. The use of reclaimed water is very important to the sustainability of natural water resources as it takes significant pressure off the natural groundwater system. Water recycling has proven to be effective...
and successful in creating a new and reliable water supply, without compromising public health.

Treated wastewater is sourced from wastewater treatment plants operated by SA Water and the City of Onkaparinga with the major source being SA Water’s Christies Beach Wastewater Treatment Plant where over 24 ML/day of treated wastewater is made available for distribution to irrigators in the McLaren Vale wine growing region. Founded on a cooperative partnership with SA Water, the use of reclaimed water has a number of environmental and economic benefits including the reduction in nutrient discharges to Gulf St Vincent and the productive use of non-potable water for agricultural purposes.

Through a network of over 120kms of pipework and utilising 3 major pump stations, 4 booster pump stations and in excess of 1 GL of balancing storage, WBWC reliably delivers over 4 GL per annum to 180 customers in the McLaren vale region. By connecting to the network, growers are assured of a regular quality supply at pressure that protects them from groundwater scarcity and increasing salinity.

Customers who use the Willunga Basin Water scheme can irrigate by just turning on their tap – there is no need for storage, power or pumps on farms. The water is supplied at a pressure that suits most on-farm drip irrigation systems. There is no water ordering system – users simply access the water supply at a mutually agreed flow rate and each connection has a flow meter and water usage is logged continuously.

WBWC’s customers attest to the benefits that the system offers. By connecting to the network, growers are assured of a regular quality supply at pressure that protects them from groundwater scarcity and increasing salinity, a problem becoming more common amongst bore wells in the region.

The benefits of reclaimed water for irrigation were further recognised in 2007 with the commencement of a potable water replacement program that received $3.85M in Federal Government funding to provide financial assistance to customers using potable water to change supply source to reclaimed water. This project, funded under the Federal Government drought response strategy, resulted in the replacement of 682ML per annum of potable water off-setting in excess of 750ML of water extraction from the River Murray allowing for losses during potable water production.

The McLaren Flat and Blewitt Springs district (refer to Figure 1), within the borader McLaren Vale region, is not currently serviced by WBWC and relies on groundwater for irrigation. Growers in the district are reporting increasing groundwater salinity and reduced reliability of their bores during peak irrigation periods. The elevated salinity in the groundwater is transferred to the fruit resulting in reduced fruit quality. A reduced fruit quality can lead to reduced pricing for the grower or wineries seeking fruit from alternate regions to maintain their premium brand status.

This paper discusses strategies being investigated by WBWC to expand the supply of recycled wastewater into the McLaren Flat and Blewitt Springs region in the most efficient and cost effective manner.

**METHODOLOGY/ PROCESS**

The 2013/14 irrigation season presented a significant challenge for WBWC and their customers due to a 1 in 100 year heat event during the peak irrigation season. A total of 9 days were recorded above 40°C and average temperatures across the period were approximately 2°C above average which resulted in a significant demand on the WBWC network. While presenting an operational challenge during this period, this provided an opportunity to retrospectively review the operation of the system to ensure that any expansion of the system catered for these extreme events.

WBWC has data monitoring on their customer meters which, while not providing live data, does provide information to assess the behaviour of customers over an irrigation season. The behaviour of our customers was assessed over the 2013/14 irrigation season using the hourly average flow for the 3 months from December to February when the peak demands were experienced. This behaviour was then compared against the terms of the supply agreements which identified opportunities to improve the capacity of the existing infrastructure.

The supply agreements between WBWC and their customers include the following key conditions:

- Annual volume allocation,
- Maximum flowrate allocation, and
- Daily irrigation period (18hrs/day).

The annual volume allocation and flowrate allocation are linked based on the flowrate required to utilise the annual volume allocation over a theoretical 3 month irrigation period based on the allowable daily irrigation period. The design of the network and the available pumping capacity has been traditionally based on these contractual terms.

The review of the individual customer flowrate data highlighted a number of points that were in contrast to this theoretical position:
Approximately 50% of customers were regularly exceeding their maximum flowrate allocation, Customer irrigation is not regular and not all customers are irrigating at the same time, and Despite the number of customers exceeding their maximum flowrate the theoretical peak demand was not being met.

The information gained from this investigation suggested that using the theoretical contractual flowrates for determining the peak demands on the system introduces a level of conservatism that may lead to over-engineering of the supply infrastructure. In an industry that is competing on the international market and is being driven to reduce costs where possible, this may lead to non-competitive costs to the growers. This is particularly the case in the McLaren Flat and Blewitt Springs districts where the transition from bore water to reclaimed water would present a significant capital investment.

Figure 2 outlines the data obtained from the individual customer flowmeters and compares it to data obtained from the bulk flowmeters at the key pump stations. An assessment was also made of the potential reduction in peak flowrate if customers exceeding their flowrates were brought back in line with their contracted maximum flowrate. This showed that, at peak flows, there was a potential for a 10-15% reduction in the peak flowrate that could be achieved through managing customer behaviour.

To understand the basis for design of the system further, the 2013/14 irrigation season was used as the design basis for the system given, as a 1 in 100 year heat event, it was considered to be representative of an extreme irrigation season.

The 2013/14 irrigation season also presented a significant challenge in managing the long-term storage with the balancing storage capacity placed under considerable pressure. The available balancing storage for the season was within 4 weeks of being fully exhausted which was avoided due to a significant rain event (>50mm) which occurred in mid-February and reduced the demand on the WBWC network. Due to the pressure on the balancing storage, this season was also considered an appropriate season to assess the long term storage requirements of the network to enable future projection of balancing storage requirements to be estimated.

RESULTS/OUTCOMES

In order to capture the varying demand and storage requirements of the system, usage factors were determined for the network for a range of operating periods ranging from 1hr to 12 months. These usage factors were determined from the maximum usage that occurred during the 2013/14 irrigation season for each defined operating period, and normalising this to the theoretical flowrate required to deliver the total contracted volume allocation over the respective period.

For example, the maximum demand experienced for any 1hr operational period was 2.37ML/d. During the 2013/14 irrigation season the contracted volume allocation was 5870ML which equates to an average 1hr flowrate of 0.67ML/d over a 365 day period. This results is a calculated usage factor of 3.54 (= 2.37 / 0.67).

Table 1 summarises the usage factors that were determined for the various operating periods assessed. Based on these usage factors the peak flowrates (ML/d) can be calculated from any projected contracted volume allocation as follows:

Peak flowrate = Usage Factor x Contracted Volume Allocation / 365.

For example, for the same 1hr period as outlined above the peak flowrate for the period is calculated as:

Peak flowrate = 3.54 x 5870 / 365 = 56.9ML/d

This compares with the theoretical peak 1hr demand of 68ML/d based on the cumulative total of the maximum flowrates in the customer contracts to which the system has currently been designed. Using this method the available capacity in the system can be estimated as being 11.1ML/d or 16%. In relation to CAPEX, it is estimated that a pump station of approximately 11ML/d has a capital cost of $1-1.5M which is avoided under the newly calculated usage factors.

These usage factors also allows the balancing storage requirements to be determined for projected expansion scenarios. WBWC draw a consistent baseline flow from SA Water at the Christies Beach WWTP which provides an average daily flow of 22-24ML/d into the system. During any operational period, the balancing storage requirement can be calculated from the usage factor as follows:

Balancing storage requirement = (Peak Flowrate – CBWWTP Flowrate) x Operational Period.

For example during the 1hr period outlined above the balancing storage requirement is calculated as being:

Balancing storage requirement = (56.9 – 24) x (1/24) = 1.4ML.
The required storage volume for any expansion scenario is then determined by considering the highest of the balancing storage volumes calculated for all of the operational periods assessed. Table 1 shows the peak flowrate and balancing storage volumes calculated for the contracted volume during the 2013/14 irrigation season and with an additional 1,000ML of contracted demand. The table also shows the flowrates and volumes determined from the new usage factors as compared to usage factors based on previous assumptions.

The new usage factors predict a 10% or 168ML reduction in the predicted storage volumes required for this additional demand and suggest an additional 530ML would be required to service this additional demand. With the cost of above ground storages estimated at $10–15/kL this translates to a $1.7–2.5M reduction in anticipated CAPEX.

In conjunction with the estimated savings in pumping capacity, the new usage factor assumptions have translated to an estimated $2.7–4.0M in CAPEX savings for an additional 1,000ML in contracted demand.

In order to manage customer behaviour Willunga Basin Water Company provided all customers with details outlining compliance with their supply agreement, and in particular with their maximum flowrate allocation. Following this notification, a number of customers have modified their irrigation system and irrigation scheduling to ensure they are better able to meet their irrigation needs. While 2014/15 irrigation season has not seen the same heat events as 2013/14, the peak irrigation demands are approximately 9% lower then the 2013/14 season and only 25% of customers have been exceeding their maximum flowrate allocations. This increases the capacity available in the system and further creates efficiency in the expansion of supply to McLaren Flat and Blewitt Springs.

The steady growth in demand since the WBWC scheme commenced shows no sign of diminishing, recognising McLaren Vale’s status as a premium wine producing area. WBWC has commenced plans to expand its network in response to the demands of irrigators across the McLaren Vale region. Engineering investigations are complete and marketing and sales activities have begun, with McLaren Flat and Blewitt Springs confirmed as primary areas of focus over the next five years (see attached Figure 1).

Expansion of the network aims to maximise the recycling of a sustainable and reliable water source, provide greater financial and water supply security to irrigators, and further reduce the impact of discharge of wastewater to the environment. These elements support the McLaren Vale wine region’s important focus on sustainable vineyard practices.

CONCLUSION

By providing growers access to a secure supply of water, they are able to make investment decisions that take into account the cost of the water, without being constrained by scarcity. The use of reclaimed water also has significant environmental benefits including:

- a reduction in nutrient discharges to a sensitive marine environment
- reduced dependency on a stressed groundwater resource and
- replacement of potable water used for irrigation

The McLaren Flat and Blewitt Springs district, which is a sub-region of McLaren Vale, is facing an uncertain future with deteriorating groundwater quality threatening the long term viability of the district as a premium grape producing region. Willunga Basin Water Company has undertaken a detailed review of their network and, through optimisation and management of customer behaviour, identified $2.7–4.0M in CAPEX savings that can be realised to reduce the cost of expansion, and ultimately the cost to the customer.

Through customer management strategies Willunga Basin Water Company have also improved the overall efficiency of their system realising greater potential to service customers with existing infrastructure.

While these strategies ensure the most cost effective utilisation of existing infrastructure, Willunga Basin Water Company remain focussed on identifying storage opportunities to provide the balancing storage requirements in a cost effective manner.

With the McLaren Vale region’s economic and social sustainability revolving around the grape, wine and tourism industries, it is clear that WBWC plays a key role in the local area. Effluent reuse by irrigation has now become an accepted practice that will play a greater role in the security of McLaren Vale as a premium Australian wine producing region.
Figure 1: Willunga Basin Water Network including growth plans

**Key:**

- **Pipelines - constructed**
- **Pipelines - planning only**
- **Treatment Plant/Pump Station**
- **Water users**
Figure 2: Assessment of 2013/14 Irrigation from the Willunga Basin Water Company Network.

Table 1: Peak Flowrate and Balancing Storage Volumes for the Willunga Basin Water Network, as determined from old and new Usage Factors.

<table>
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<th>DEMAND PERIOD</th>
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MAX STORAGE REQUIREMENT (ML) | 991 | 952 | 1650 | 1482