No Power, No Problem

*Solving a unique Pressure Management Control Valve application for **City West Water***

Melbourne, the Capital City of Victoria, has a growing population of 4.9 million people and is Australia's second largest city. With a large urban footprint, the City is faced with the challenges of demand for infrastructure services whilst dealing with the depletion of the water supplies due to consistently high summer temperatures and drought conditions. These pressures have forced government to increase awareness of water usage and to construct Australia's largest desalination plant at a cost of 3.2 billion dollars.

Water is supplied to the Melbourne metropolitan area by three water companies, one of which is City West Water (CWW), who provides around 100 billion litres of water every year to over one million residents and 40,000 businesses, including Melbourne's Central Business District. Supplying so many with safe drinking water is a huge challenge and every year CWW is required to prepare a 'Drought Preparedness Plan' to manage any potential shortfalls in the water supply.

A big part of this plan is to proactively reduce leakage across the reticulation networks. CWW has established a suite of actions to achieve this, including active leak detection, mains renewals, rapid response to bursts and leaks, intelligent network technologies and pressure management.

There are several Pressure Reducing Valves (PRVs) installed across the CWW region which serve to reduce leakage and calm the network by stabilizing pressures.

One such valve installation is the Gourlay Road Pressure Managed Area (PMA). This is a district metered area serving 1,200 properties in the Caroline Springs area of Melbourne. This zone previously experienced very high pressures at times of low demand up to around 100m. CWW determined that more could be done to more effectively manage the pressures in this zone in order to reduce unnecessary stress on hot water services, taps and their network infrastructure.

The challenge was that the control valve had to provide data back to the company's SCADA system, and this would require power at the valve site. It was determined that running power to this installation was not economical and therefore required a more specialized control valve solution. This valve was requested to be self-powered, continually monitor PRV outlet pressure, flow and also provide PRV stem position feedback to provide trends of any potential unusual valve behavior.

CWW had previously worked with Challenger/Cla-Val on one of the previously successful pressure management projects and were satisfied with the product and services provided so when CWW designed the Gourlay Road PMA they approached Challenger/Cla-Val and asked for advice whether a self-powered PRV is achievable and can also provide supplementary power for the battery powered RTU logger. Challenger/Cla-Val provided an option of a PRV with a mini-hydro assembly which satisfied all the requirements.

The installed valve is a 150mm Pressure Reducing Valve complete with motorized reducing pilot, a valve position transmitter, a valve controller and an integral Hydro-Powered Turbine installed in the pilot system to power the valve. The turbine works by utilizing the available differential pressure across the valve to convert kinetic energy in the water into a charging electricity supply to a 12VDC 3.5Ahr rechargeable battery pack.

The motorized pilot on the valve allows the downstream pressure to be changed remotely using a 4-20mA signal from the SCADA system. This allows CWW to vary the pressure either on a set time schedule or whenever they deem it necessary. The pilot will always revert to operating as a mechanical pressure reducing pilot if ever there is a loss of power.

Valve position is provided by a stem position transmitter providing a 0-100% analogue feedback signal to the provided valve controller. The controller enables CWW to leave the valve in an automated state of control. Using the programmable controller to provide a flow vs pressure control curve, outlet pressures are modulated according to changes in flow. All site information is relayed to their onsite RTU all of which is powered by the Hydro Powered Turbine.

The controller was also programmed with a bespoke 'Alarm Condition' that in the event of an imminent power failure from the turbine, it will automatically drive the motorized pilot to its default high pressure setting before power is lost. Once power is restored, the controller automatically reverts to the Pressure versus Flow control curve.

For complete remote monitoring the controller retransmits; flow, outlet pressure, motorized pilot command signal, feedback and valve % position out to the RTU and can always be viewed live by CWW personnel. The controller also features a 'display time out' to conserve power when not in use.

The controller is extremely user friendly and was programmed to follow its own unique control curve. By monitoring incoming flow (x-axis) the outlet pressure is adjusted accordingly (y-axis).

As flow demands vary throughout the day the PRV now provides the correct pressure into the network; overcoming friction losses at peak demand and lowering pressures in times of low demand, in turn, minimizing background leakage and reducing stresses on the network pipe system.

The installation has now been operational for approximately 18 months.

The mini-hydro turbine assembled PRV provides a suitable solution for CWW to achieve the required outcome for this project. The flow modulation-controlled outlet pressure enabled further reduction in pressure at low flow conditions. The hydro-turbine enabled the RTU rechargeable battery with extended life and provides consistent communication to the SCADA monitoring. Sophie Wang, NRW Senior Engineer with CWW reports that the project was a success with estimates indicating that that there has been a 34% reduction in background leakage – a saving of $50,828 per year. A 43% reduction in bursts – another saving of $86,000 per year for every 100 incidents and importantly, less customer complaints. The product is certainly a preferred solution for similar future projects.