ABSTRACT

Greater Mexico City is home to more than 19 million people and accordingly water supply is an issue of significant importance. Many of its supply systems, although recently constructed (in relative terms), are underperforming and leaks are prevalent. This case study is focused on a project to review and improve a well collection system consisting of over 20 km in length with branch lines feeding a main pipeline with an ultimate size of 1200 mm in diameter. This system feeds a reservoir and subsequent distribution system. For many years, the system has been underperforming in terms of its intended function of supplying water to the reservoir, but also due to several main line and branch line breaks and leaks which have necessitated the complete shut down and pressurization of the lines. Given the intensity of population, traffic congestion and overall water shortage, such events and their effects can only be described as significant.

Despite the magnitude of the capital investment deployed to construct this system, it has suffered from a meaningful lack of ongoing investment in operations and maintenance and, as such, essentially all maintenance activity are reactionary in nature and generally treat the symptoms, rather than the cause, of any underlying problems. For instance, the original system was designed and installed with 36 surge relief valves and over 50 combination and air release valves which have been rarely (if ever) inspected or maintained. As a result, the system operation is limited and restricted, especially during times of draining, filling and restart. The operational difficulty has anecdotally been recorded as getting worse and therefore this system is a classic example of how poor maintenance and operation leads to a compounding problem.

This project included conducting condition assessments of the pipe, leak detection, transient pressure monitoring and modelling, as well as a review of the system components including air valves. This paper is specifically concerned with the improvements to air management and transient (or surge) control recommendations which have resulted in the immediate and significant improvement in system performance. The utility has noticed a dramatic reduction in the amount of breaks and leaks, in addition to reducing the “down time” associated with emptying and filling the main line to approximately half. The linkages to air management as a means for transient control and the impact on water loss are illustrated through the practical application of theory to a large, live, and important system.

This experience is an example of how a fiscally constrained utility is able to employ intelligent approaches to dealing with a complex system in order to identify and isolate the key problems leading to system inefficiency and ineffectiveness, in addition to the improvement of these conditions through minimal capital costs or increases to operation and maintenance costs. This was in large part accomplished through the development of a hydraulic transient model in conjunction with gathered field pressure and flow data – extremely important in the development of a useful model whose parameters are appropriately calibrated and subject to verification of results – in order to evaluate the system performance and risk. High risk and/or critical system points were pin-pointed from both the hydraulic operations and transient impacts perspectives, and the resulting set of recommendations focused on the replacement (and ongoing maintenance) of a modest number of key surge relief and air valves. As well, recommendations for the filling, draining and restart procedures were developed, including valve operations, timing and protocols. Furthermore, these recommendations were geared towards the reality of the utility in its local and fiscal context, as to limit investment into a few areas that would most significantly yield results while at the same time be simple to implement and maintain.

1 Contact Person. d.radulj@hydratek.com; 501-216 Chrislea Road, Woodbridge, Ontario L4L 8S5, Canada; +1 416 888 1024
2 Presenter.