BYPASSING A CRITICAL SEWER PUMP STATION FOR MAJOR UPGRADES: CHALLENGES AND LEARNINGS

Curtis Biggs, *Operations Maintenance Officer,* North East Water

ABSTRACT

North East Water provides sewer services to Wangaratta's approximately 30,000 residents. The Swan Street sewer pump station is the most critical in Wangaratta's sewer network, as it collects and transfers almost half the town's waste to the treatment plant. The station is over 70 years old and has been retrofitted in recent decades to manage the town's growth and changing sewer needs. These variations have created complexities in maintaining and operating the station.

In response to various faults and inefficiencies, the Swan Street pump station was scheduled for significant upgrades in 2022. The project required the replacement of two 85kW dry-mounted pumps, all internal pipework and the installation of a penstock isolation valve in the wet well. The works required the station to be taken offline for several days, presenting significant challenges. The pumps run at 85-90 litres per second, and the holding time of the station during peak flows is approximately one hour. The station has multiple inflow pipes ranging in diameter from 150 to 450mm, has no bypass system in place and has not previously been bypassed.

After initial site preparations, the well-known bypass company National Pump and Energy (NPE) were engaged to set up and manage an intricate bypass system. The system provided a power supply, pumps, hose and telemetry for 24hr monitoring and flow control. During the project, several challenges required onsite problem-solving or system adjustments. The smarts in the bypass system setup, combined with operator knowledge and contractor support, allowed the challenges to be overcome.

Significant efficiencies have been gained in pumping operations since the upgrade, and no blockages have occurred. Installation of the penstock valve has increased efficiency and safety when performing maintenance activities. The project provided important learnings that will be carried into future projects, and investigations into funding options to purchase a bypass system are underway.

1.0 INTRODUCTION

The Swan Street sewer pump station is the most critical in Wangaratta's sewer network, as it collects and transfers almost half the town's waste to the treatment plant. The station is over 70 years old and has been retrofitted in recent decades to manage the town's growth and changing sewer needs. These previous upgrades have seen the addition of a combined wet/dry well added outside the original building in the 1970s. The dry side of the well houses the pumps and pipework for the station, and space is limited. Adding to the complexity of the station are three entry points for inflows ranging in size from 225mm to 450mm in diameter. The station pumps around 2500Kl daily during normal flows, but that can double or triple during wet weather events. During these high flows, the holding time of the wet well storage is reduced to around 30 minutes. The station was identified as needing significant upgrades due to the difficulty in performing maintenance activities and to improve site safety and address the consistent pump blockages.

The Wangaratta Distribution team has managed a high level of calls over many years at the

Swan Street station due to pumps that were no longer fit for purpose, resulting in a large number of blockages and faults. Replacing these pumps also required the pipework in the dry well to be reconfigured, including upgrading the sluice and non-return valves. In addition to replacing the dry well pumps, several other required upgrades were identified. The Swan Street station is part of a routine wet well cleaning program that, under its previous configuration, required a confined space entry to manually install isolation bungs for flow control prior to cleaning. This isolation system carried risks to personnel and the station's operation, as was evident in a 2019 incident, where a bung was sucked into the pipework manifold and could not be retrieved. The bung isolated the pumps from the station, leading to a major incident where several vacuum trucks were required at multiple locations around the town's sewer reticulation to keep levels manageable until a diver could be mobilised to the site to retrieve the plug. As part of the upgrade, Penstock valves were installed in the wet well on the 450 and 300mm inflows to eliminate the need for CSE and prevent a similar incident. All works identified require the station to be offline or bypassed for several days. At the time, there was no bypass plan or system in place for Swan Street, and the station had not been taken offline since previous upgrades in the 1970s.

Figure 1: ***Aerial view of the Swan Street Sewer Pumps Station***

2.0 DISCUSSION

The initial planning for this project involved representatives from the Wangaratta Distribution, Maintenance and Electrical teams, along with a third-party contractor familiar with the site who would install the pumps and reconfigure the pipework. Initial meetings discussed the possible methodology, risk and logistics of the works for the upgrades. Given the nature of the work and the length of time the pump station would need to be offline, a bypass system was identified as the preferred option. National Pump and Energy were then approached, through the recommendation of our contractor, to investigate the bypass options.

In addition to the multiple points of inflow requiring isolation and adding to the job's complexity, there were limitations on the flow into the rising main. These limitations were caused by an aging pipeline that had previously experienced breakage due to water hammering when flows were higher than 90 litres per second. Planning for the project took several site visits over multiple

weeks to determine a timeline of works, including bypass setup and trial, installation of the penstock so the station could be isolated for the remaining work, which included all fabrication of pipework, and removal and installation of the Flygt 85kW pumps. A risk assessment had identified a number of areas requiring standby action, including standby vacuum trucks in the event of a bypass failure and all customers in the immediate residential area were notified of the planned works and possible disruptions.

2.1 Bypass system

The bypass system consisted of three primary electric pumps located in different parts of the reticulation system. A backup diesel pump was situated in the main inflow point on the 450mm main in case of failure of the electric pumps. The system used two 30kW Hydrostal submersible pumps in individual standard manholes on the 450mm gravity main. A Grindex Sandy 5.6kW submersible pump was placed in the internal well, which pumped around the station into the primary catchment side and discharged through the Hydrostal's. Fortunately, a 150mm bypass point was already installed into the 300mm discharge rising main that had previously been utilised for a high-level backup pump from previous years. The system included a full telemetry dashboard, which provided alarms and up-to-date monitoring of flows, pressures and levels. The bypass telemetry provided an almost exact replication of North East Water's telemetry system and provided a significant level of comfort with the capability and reliability of the system. Due to the complexity of the bypass system, NPE was engaged to man the bypass for the duration of the works.

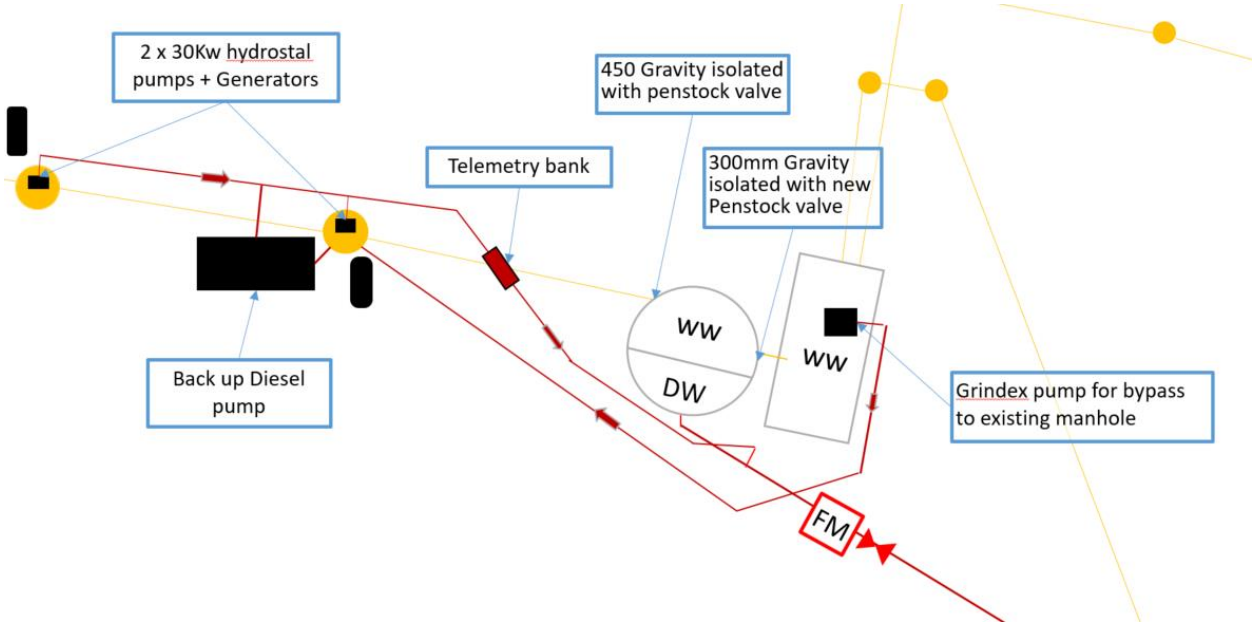

Figure 2: ***Overview of bypass setup***

2.2 Completion of works

After setting up and trialling the bypass system, the upgrade works began. The first day was allocated to the wet well isolation, cleaning and installation of the penstock valve, which allowed us to use positive isolation for the subsequent days. Four days were then allocated to the pump removal and reinstallation. The installation of the new pipework included a new 250mm knife valve directly onto the flange coming from the wet well, and then a custom 250mm Y piece was installed to the manifold. At the end of the Y manifold, two knife gate valves were installed so each pump could be independently isolated. This then flowed onto a custom-made suction bend knitted to the base of the pumps. The discharge side was renewed back to the rising main, including two further knife valves and new non-return valves. All spooling's were fabricated with green ends in the workshop and completed onsite after the final fitment of the pumps.

2.3 Challenges

Multiple challenges presented themselves during the project, some of which had been anticipated and some unexpected but manageable due to the risk mitigation methods employed. One challenge was an isolation valve on the rising main that had not been exercised in many years and, as a result, had seized. This valve needed to be closed for a period of the work and was luckily identified a week before work commenced. An attempt was made to exercise the valve by hand, but it could not be moved. The valve-actuating trailer was then used to exercise the valve, and whilst it did get it moving, the decision was made to cut a new valve in, allowing for greater control throughout the project.

Another challenge was that the old pumps were wired into a junction box in the dry well. The new pumps were supplied with enough cable to run back to the switchboard. It was difficult getting the cables through the old conduit, but this was resolved by installing a new 150mm conduit through the wall of the dry well and into the building where the switchboard is housed. These works will help with future telemetry or power needs within the dry well.

A significant and unexpected event occurred as work was nearing completion on the first day of the project. Workers were finishing up after a long day at around 7:30 pm when a contractor accidentally deflated an isolation bung that caused the wet well to fill with sewer. Similarly, a suction bend was removed from one of the pumps causing sewer to flow into the dry well. As these events occurred during peak flows of the evening, we were fortunate enough to have had sucker trucks on standby as part of our risk planning for the project. Both the trucks and the Wangaratta Distribution team were mobilised to the site within 25 minutes, and the sewer was pumped down to a level that allowed the bung to be reinstated. Following this, work continued to clean down all areas so that work could commence as scheduled the next day, and all operators were off-site by 1:30 am. The outcome could have been much worse if the risk assessment had not planned for such an event.

2.4 Learnings and future applications

Several key learnings from the project will improve our processes moving forward. Firstly, planning is critical. The issues encountered were managed within the project's timeframes due to good planning. Major service disruptions were avoided thanks to standby measures identified in the risk assessment and put in place for the duration of the works. Secondly, a good relationship with contractors is critical to allow for fluidity and flexibility when troubleshooting issues as they arise. Likewise, a good relationship with the team responsible for the site and clear and frequent communication are critical to delivering the project with the least disruption possible.

Finally, we have several other projects planned for this financial year that will require bypass systems of a similar nature. The learnings of this project will directly impact not only the planning and delivery of those projects but will also now offer a level of comfort with the bypass system and its capabilities in similar applications.

3.0 CONCLUSION

As stated, the Swan Street Sewer Pump station is a piece of critical infrastructure for North East Water's sewer system. The site has a history of being upgraded and retrofitted over the years to accommodate growth in the area. Several upgrades were identified as being required at the site. However, due to the site's configuration, the high volumes of waste it receives and the inability to take the station offline, the upgrades were complex to manage. Through rigorous risk assessment and project planning, the option to engage NPE to establish a bypass system, complete with telemetry, was taken up. Though several challenges presented themselves in the preparation and delivery of the project, these could be effectively controlled by the contingencies put in place through the risk assessment. The bypass system operated as planned, and with the telemetry giving us complete confidence in the capability and reliability of the system in real time, this method will be used in the future. North East Water has a number of upcoming projects where a complex bypass is required. These projects may have previously been put on hold due to the difficulty, but they will now progress with confidence. North East Water is also investigating options to invest in a bypass system to reduce the cost and reliance on contractors, particularly in emergency situation where bypass is required.

4.0 ACKNOWLEDGEMENTS

Reflecting on this project, there are a lot of people to acknowledge. Thank you to the Wangaratta Distribution team for being very easy to work with, also the North East Water industrial control

systems team who invested a lot of time into this project also. Thanks also goes to Active Mechanical Services for their expert advice and adaptability during this project. Thanks also to Operations Maintenance team for all their support during the project.