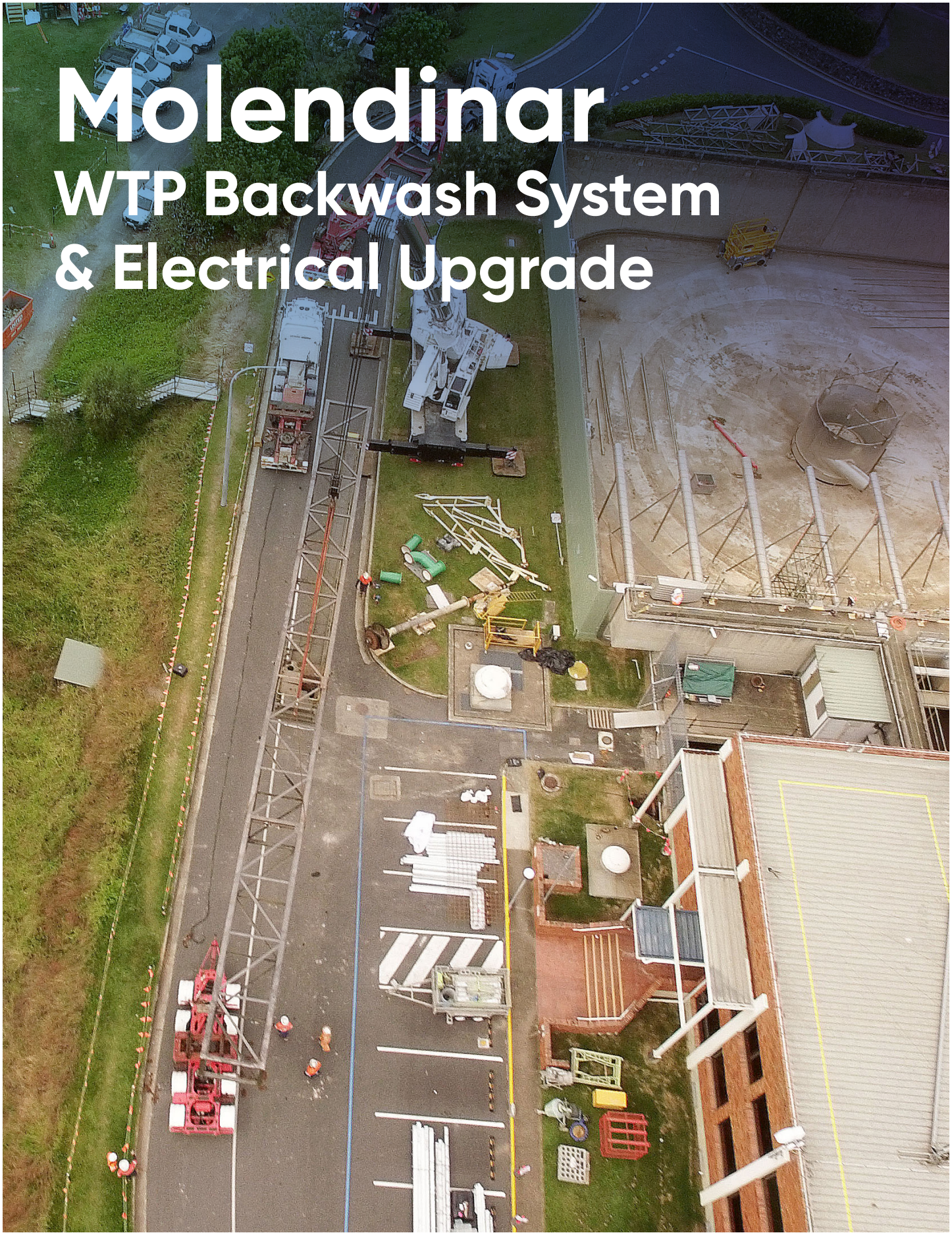
Molendinar

WTP Backwash System & Electrical Upgrade



Technical Overview

Pensar

The Project

The Molendinar Water Treatment Plant is the largest treatment plant on the Gold Coast, originally constructed in 1983. It supplies most of the region's drinking water, as far as Brisbane, in times of significant drought or high demand.

In an effort to ensure future capacity and reliability, Pensar was engaged for the upgrade of the backwash and electrical systems, and ultimately deliver the largest upgrade to this treatment plant since it was built. The scope for the deliverables included upgrading the existing backwash system - pump and blower replacement, pipework modifications, upgrade of the fire service water system and the upgrade of the existing electrical system which incorporated the switch room and switchboard upgrades.

Pensar's Director of Water, Patrick Newell, reflects on the Molendinar Water Treatment Plant, defining technical requirements and the technologies used.

"The Pensar Power Team installed new switchboards, motor control centres and cabling - basically a refurbishment of the entire system. Meanwhile, the Pensar Water Team played an integral part in delivering large-diameter pipe work, pumps and other process equipment associated with the project.

Getting the various divisions to develop a coherent design for our client was challenging but the outcome is what we've got today at Molendinar. With a project of this magnitude, there have been quite a few challenges that we've encountered, particularly the clarifier refurbishment which had a 34-metre long bridge structure that was to be removed in its entirety. The logistics around planning and executing this was intensive. Obviously, it came off without a hitch."

Queensland Minister for Energy and Water Supply, Mark Bailey, said the Gold Coast Desalination Plant will again supplement the coast's drinking water supply, this time due to works on the Molendinar WTP, which is the Gold Coast's largest treatment plant.

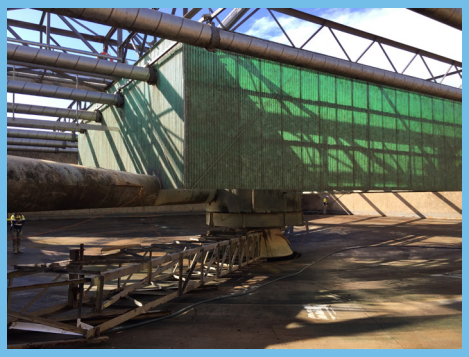
Minister Mark Bailey went on to say "This is about being smart, about how we use our water assets in the most cost effective and efficient way possible. The desalination plant is the best option available to ensure the ongoing supply of a safe and reliable water supply while we upgrade our Molendinar plant."

The project required the treatment plant to be taken offline for 10 weeks - which is a rarity in this industry. Pensar's team was able to draw on their experience and keep impact to a minimum."

"More than 20 suburbs will be supplied with desalinated drinking water for about a week including Gilston, Broadbeach, Nerang, Yatala, Coomera, Bundall and Mermaid Beach."

Installing DN750 Butterfly Valve

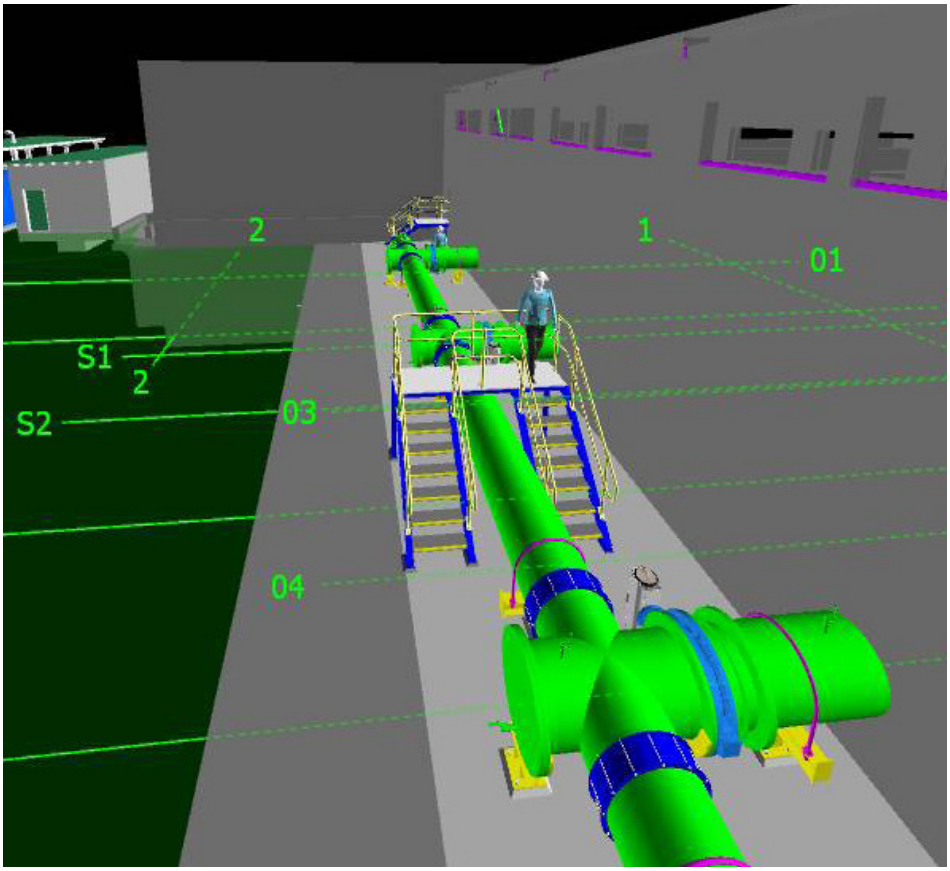
Refurbished Clarifier



Details of the Material Used

The Molendinar Water Treatment Plant's two clarifiers are standard units that contain two main mechanical components: a rake system used to remove the clarified sludge from the bottom of the clarifier, and a mixer and drive unit that assists in the flocculation system of the clarifier. The drive unit on the first clarifier was due for refurbishment and the rake was in poor condition and in need of replacement. As part of the clarifier's refurbishment at Molendinar, Pensar was tasked with refurbishing some components and replacing others.

The existing clarifier detention hood was formed by fibreglass sheeting. Upon inspection of the existing components within the clarifiers, it was found that certain parts such as the detention hood would need to be replaced with stainless steel components to ensure the treatment plant was compliant. It was through Pensar's design reviews that fibreglass components were found to be non-conforming with the 40/20 Australian Standards, which identifies materials such as fibreglass, as unsuitable to be in contact with drinking water. Pensar was able to remedy the original design flaw and substitute in the stainless-steel option at Seqwater's direction. Thus, abiding by 40/20 Australian Standards.



3D Model of the DN750 backwash header pipework

Technical Requirements

The project objective was to improve the backwash capacity of the plant. An initial concept design was completed which outlined how they anticipated the project would run and what was required. This identified the need to upgrade backwash pumps, air scour blowers and upgraded pipework, along with a sitewide electrical upgrade to bring the electrical systems of the site up to new standards. They identified that they had a very old generator that was underground in a downstairs area, which was not suitable as a back-up option for loss of power. They also needed to upgrade the high-voltage incoming system and put in place new transformers that would provide Seqwater with improved redundancies in terms of main power supply.

Pensar identified early in the project that this original concept design was not suitable to achieve expected plant performance outcomes, predominantly around the assumed temperatures of the water. This resulted in quite a bit of time to spent at the front end reviewing and getting Seqwater's buy-in on a reviewed design. This was extremely important because if Pensar used the original concept design, this may have resulted in a delivered system that could not meet the future needs of the region.

Upon identifying the inadequacies of the original design, Pensar overhauled and reassessed the design based on the much higher flows of the backwash. This changed the backwash flows from circa 900L/S to circa 1200L/S (litres per second), which meant that larger pumps and pipework were required to accommodate the increased flowrate.

At the site, there was an existing DN500 backwash header pipework system, the intent was to duplicate the existing system to have two DN500 backwash header pipework systems. Pensar's Water Team flagged to Seqwater, that there would be an extremely high velocity of flow going through the existing pipework. If left at the original size, Seqwater would go outside of all the standards for maximum velocity through pipelines, potentially stripping the concrete liner from the pipe due to high velocity of flow. An issue that arose was that no valve supplier could provide a valve that could meet the high velocity needs. Pensar's solution was to increase the backwash header pipework from a DN500 to a DN750, this required reworking the entire design. In the revised design, Pensar shifted the pipework outside the existing building and built an entire concrete structure with awning to house the larger pipework, as well as walkways to access the new valving and servicing hatches.

Managing the 10-week shutdown

Seqwater was aware from inception that the plant would be required to go offline for a period of time, they just didn't know for sure how long the plant would be idle and the impact this would have on operations. From a cost perspective, if Seqwater wasn't running the plant, they would have needed to bring-in additional suppliers, which would have carried considerable costs. Pensar spent a considerable amount of time staging and segregating the project into what could be done pre-shutdown to alleviate some of these costs. Through staging of works, Pensar managed to carry out a substantial amount of temporary works. This included demolishing the original HV station and building new HV transformers and temporarily connecting them into the existing main switchboard so that we could demolish the existing transformer onsite. This allowed us to build the new main switchroom on the old footprint of the transformers, meaning we were able to swing over critical items for the plant, so that even when the whole plant was shut down, we could run certain aspects of the plant off the new main switchboard.

Another additional scope item was replacing the existing chemical MCC board. Pensar conducted a number of building modifications to bring the room up to code in terms of air conditioning, fire suppression, alarming systems and ventilation. This was all done while the chemical system was still live and under operation. We limited the risk, by minimising items that weren't fully tested prior to the shutdown, because once they're removed there's no going back. Part of that was trying to have contingencies for additional work being weekend work and 24-hour shifts in the event that we identified issues, so the contingencies were around additional work crews and increasing the capacities of our crews to do more.

Commissioning refurbished water clarifier

New Eneraque generator

What's unique about this system

One of the interesting features of this system was the installation of a Remote ACB Switchboard. This technology de-rated the critical Arc Fault category rating of the Main switchboard to a low category. By having this board in place, it meant that in the event of a major fault, the Remote ACB Circuit Breakers would trip and protect the main switchboard and other MCC from being irreparably damaged also reducing the risk of Arc Flash to the operator. From an operator perspective, you operate these subsequent main switchboards and work on these boards with a much lower risk level. The category range for these boards carried the potential for High Arc Fault, therefore operators had to wear high-levels of protection and PPE to open and work on the boards. By installing the board at the front of the plant, it meant that all the downstream boards were at a lower category level and would therefore be safer for operators.

In addition to this system, Pensar supplied a brand new Eneraque generator that had the capability to run the entire plant. This system has an automated switch over to generator, and an automatic revert function. This was done as the area often experiences brown outs or total power failure. Seqwater was adamant that they needed a generator system with an automatic transfer, so that they could still operate the plant in the event of the loss of Mains supply. This was a complex integration and the Power Team spent a considerable amount of time training the operators who had not previously had a generator that could do any of these functions. The training and knowledge transfer on how to operate the generator was delivered by Pensar in a way that reflected various conditions. The Eneraque generator could be used in a planned shutdown with Energex, or a planned trial shutdown with operators. Additionally, the generator could operate in an unforeseen shutdown due to the loss of supply or maintenance from Energex. Pensar developed standard operating procedures for Seqwater, specifically for this system, so that any operator could come in and learn how to use the system and be supported by photos, diagrams and instructions for different operating methods.

Key Learnings

The transition of the project from the initial design to a redefined design was vastly different. The end result was a success, and the only way that this was achieved was through Seqwater's highly engaged design team and their dedicated interest in making sure the project was done correctly and achieved optimal results. Pensar was focussed on the end result, understanding the problem that Seqwater was trying to resolve and linking that to our design solution as opposed to simply considering the scope and making sure that we followed the initial design.

An additional factor that aided the project's delivery, was Pensar's use of 3D modelling technology for the various staging of works. These 3D models were particularly valuable to stakeholders who were not savvy in terms of project detail or didn't have the capacity to review the design in explicit detail beforehand. 3D modelling made it significantly easier for those involved in the project to see what the finished project would look like. Electrical specialists, hydraulic mechanical specialists and civil specialists could see a flow-through of the concept design applied to the various stages of works. This assisted operational and auxiliary divisions in understanding what Pensar was looking to achieve and reduced any confusion and ambiguity of scope.

Having a 3D model with all the data made it very easy to assess all the stages of works in the Molendinar Treatment Plant project. Normally we would cover these aspects in design review meetings and rely on 2D plans, which can be difficult to conceptualise for people that aren't technical specialists and can't comprehend the finer details. In this way the use of 3D modelling contributed significantly to planning and executing the various deliverables on the project, which in turn helped complete the project on time.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