ENTER THE MATRIX - USING VIRTUAL REALITY AND 360 DEGREE VIDEO TO IMPROVE STAKEHOLDER ENGAGEMENT

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KEYWORDS

Virtual reality, 360-degree video, stakeholder engagement, pump station renewals

EXECUTIVE SUMMARY

In 2020, Logan Water and its partners WSP and Downer Utilities have undertaken the detailed design of renewal works associated with the Loganholme Wastewater Treatment Plant Lift Station. The Lift Station is comprised of a 20m deep dry/wet-well arrangement, and over time has experienced numerous modifications. These works however have made the station heavily congested, making it difficult to operate and access in a safe manner. Logan Water employed innovative technologies to obtain critical feedback during the design process, including virtual reality and 360-degree videos, allowing for greater stakeholder engagement and efficiency in the design process.

INTRODUCTION

The Logan Water Partnership (Logan Water) is a public and private sector enterprise involving Logan City Council and engineering services providers Downer, WSP and Cardno. Under the partnership, Logan Water delivers new and improved water and wastewater infrastructure throughout Logan City; one of south-east Queensland's fastest growing areas. In 2020, Logan Water set out to improve the reliability and operability of one of the city's critical wastewater lift stations, located at the Loganholme Wastewater Treatment Facility in Loganholme. Logan Water assessed the condition of the lift station and identified that replacement of the pumps and reconfiguration of pipework was necessary. The detailed design process for this complex asset renewal project would require extensive input from a number of key stakeholders.

YEAR CASE STUDY WAS IMPLEMENTED

2020

CASE STUDY DETAIL

The specific issue/challenge

The Loganholme Wastewater Treatment Plant (WWTP) lift station was constructed in 1983 and comprises a 20m deep dry/wet well arrangement (Refer to Figures 1a to 1c). The lift station was originally equipped with three dry-mounted pumps with a capacity of 1,000 L/s. Over the last 40 years, the station has been retrofitted on several occasions and now consists of four dry-mounted submersible pumps with a design pumping capacity of approx. 3,500 L/s. As demonstrated in Figure 1b, the dry well footprint of the lift station is quite small (6.7m long x 10m wide) and is heavily congested with equipment such as knife gate valves, making it difficult to operate and undertake maintenance in a safe manner. The lift station also suffered reliability issues during recent weather events. Hydraulic assessment indicated that the lift station's pumps required replacement, and also recommended to reconfigure the historical pipework in the dry well to improve reliability and operator safety. This required Logan Water to commence developing a concept pipework arrangement which involved obtaining critical input from multiple stakeholders, including operational staff.

Very few personnel have entered the lift station's dry and wet wells as access is limited to confined-space-entry qualified staff and requires costly safety precautions to be in place. Historically, this has made it incredibly difficult to allow key stakeholders to comprehensively understand the station's physical condition and its associated operational issues.

The restricted access issues have also resulted in limited information on the condition of the wet well, particularly its original concrete plastic lining being available. Laser surveying and the use of drones were not able to be undertaken cost effectively as the station could not be taken offline and the concrete slab within the wet well further limits access (refer Figure 1c).

Approach

Logan Water utilised innovative technologies including virtual reality and 360-degree videos to obtain critical feedback from key stakeholders during the detailed design process. A concept design of the improved pipework layout for the lift station was drafted in SolidWorks (3D mechanical design program) and regularly distributed to stakeholders for review using Navisworks (a 3D model review software). The 3D design model was then converted to a Virtual Reality (VR) application and presented at a Project Opportunity and Risk (POAR) workshop. The POAR workshop was undertaken to systematically review all aspects of the concept design and allow feedback and contributions from a wide variety of stakeholders including designers, constructors and operators, as well as community, environmental and safety specialists. Key stakeholders who had never entered the lift station previously were able to utilise the VR technology to contribute feedback on the concept design. Figures 2a and 2b illustrate the VR technology being used to assess the concept design. The cost of the VR session was approximately $8,000.

In addition to utilising interactive VR technology, 360-degree video footage was taken of the existing lift station to obtain a better understanding of asset condition and configuration. This was achieved by using a proprietary Go-Pro 360 Camera which was custom fitted with two spotlights (Refer Figure 3) and lowered via a rope (Refer Figure 4). The 360-degree video footage predominantly focused on the wet well where the only information previously available were old design drawings that were assumed to be as-constructed. The footage provided valuable condition assessment information and assistance to designers and construction personnel during the design phase of this project (refer to Figures 5a, b and c). The use of these innovative technologies also provided significant safety benefits as it eliminated the need for confined space entry.

Project outcomes

The use of VR and 360-degree video technology created a far more engaging and energising experience for key stakeholders in comparison to the use of conventional 2D hard-copy drawings and associated drawing review sessions. Operational staff were able to provide critical feedback, which was used to refine the design and ensure that enough access was provided to conduct service and maintenance activities effectively.

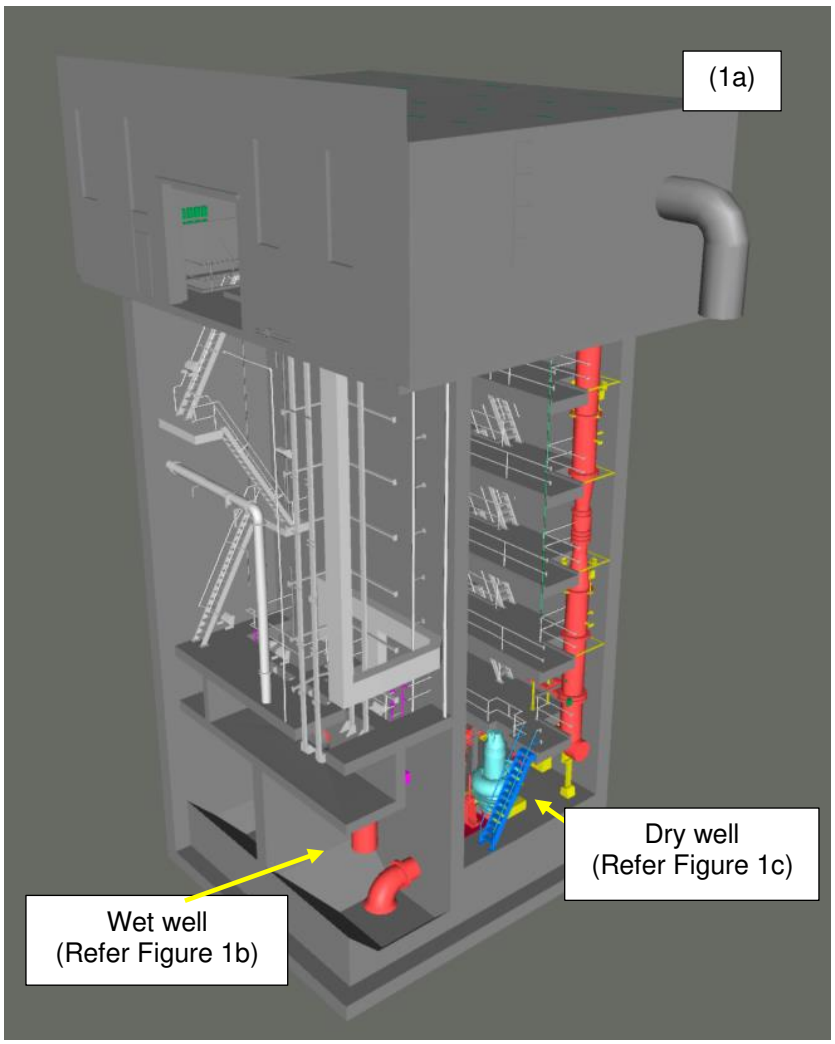
In addition, the utilisation of 360-degree video technology resulted in the following key project outcomes:

- It was identified that the wet well's existing plastic lined coating was in a relatively good condition and did not require replacement.
- It was found that the incoming gravity sewer was positioned close to one side of the concrete inlet channel (Refer Figure 5b) and this information was important as it assisted in the design associated with the new penstock mounting arrangement.
- Confined space entry into the wet well and dry well was avoided.
- Asset management stakeholders were provided with sound information to make decisions which directly impacted the renewal scope for the project.
- The approach promoted competitive pricing as the video footage was supplied to tenderers to improve their understanding of the asset's existing condition.
- The Navisworks 3D model of the final lift station renewal design (shown in Figures 6a to 6c) was fully endorsed by project stakeholders and construction is scheduled for March 2021.

Lessons learned

There are many lessons to be learned from the detailed design of this complex renewal project, including:

1. Providing a VR experience is a superior way of engaging stakeholders and obtaining feedback, over conventional 2D design review meetings.
2. The cost of VR technology is relatively low in comparison to the value added in understanding complex brownfield sites.
3. The 360-degree video footage obtainable from a proprietary Go-Pro camera allows key stakeholders input into condition assessments in a safe and controlled way, without the need for confined space entry.



Figures 1a to 1c: The Loganholme lift station is comprised of a 20m deep dry/wet-well arrangement with a pumping capacity of in excess of 3,500L/s

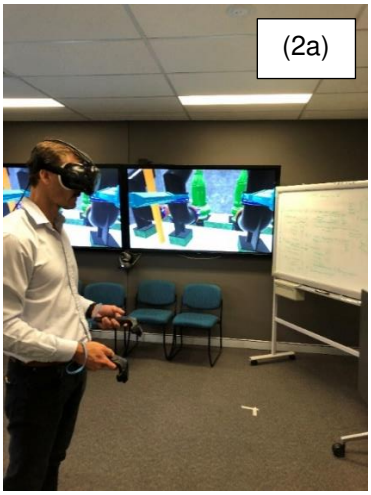
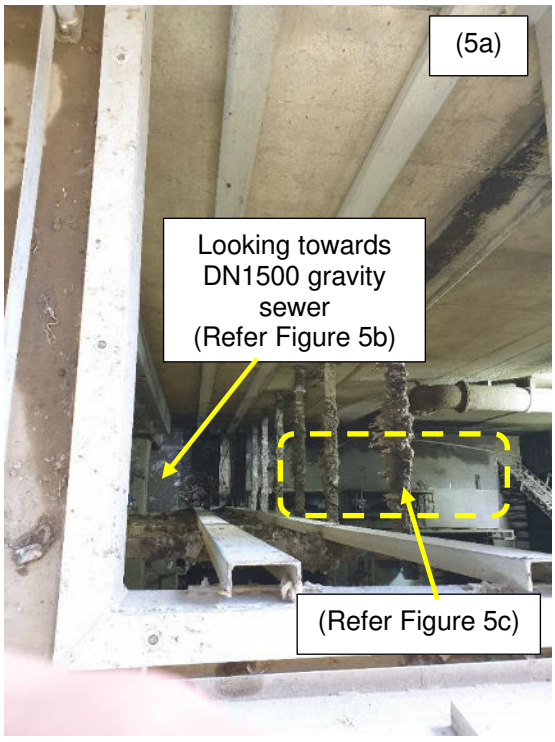


Figure 2a: Management staff who did not hold confined space tickets to enter the lift station were able to provide critical feedback on concept design through VR technology

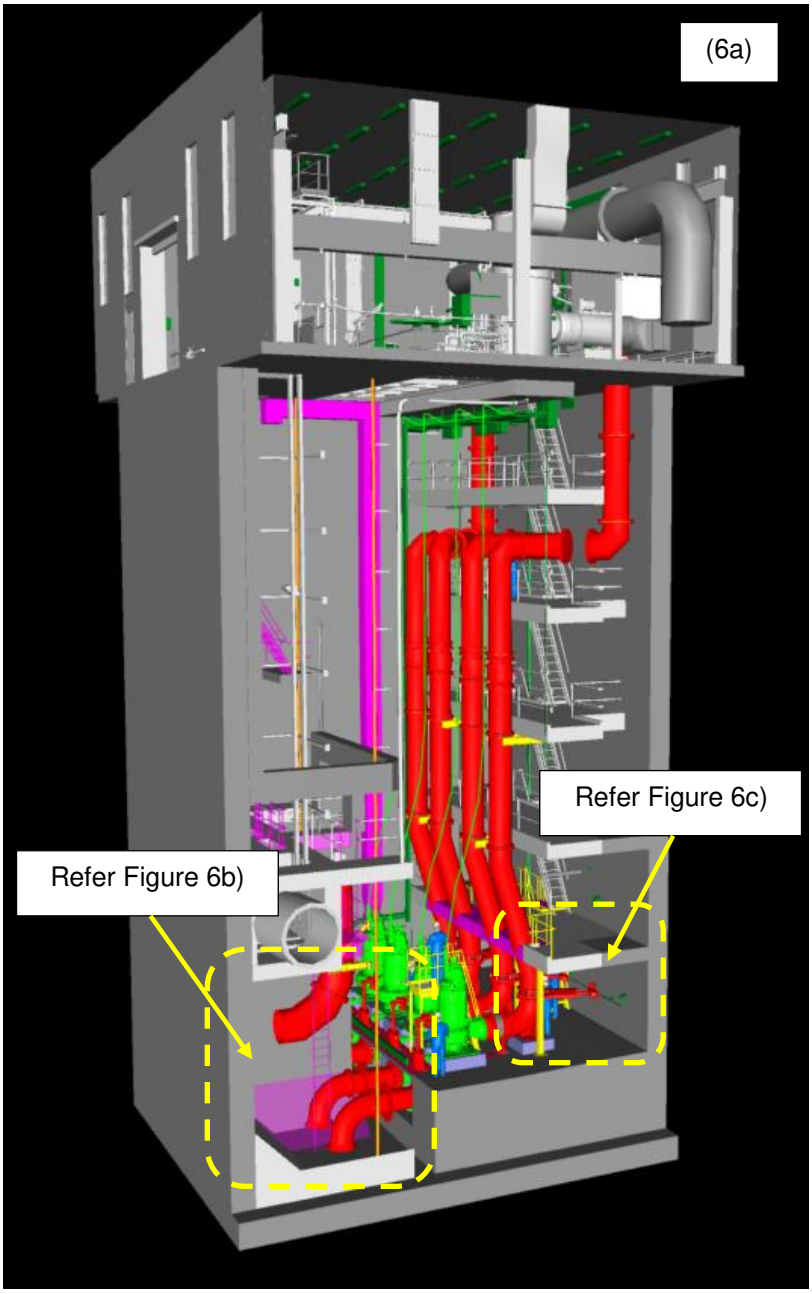
Figure 2b: Operational staff were able to provide input into the design to ensure operability issues were addressed

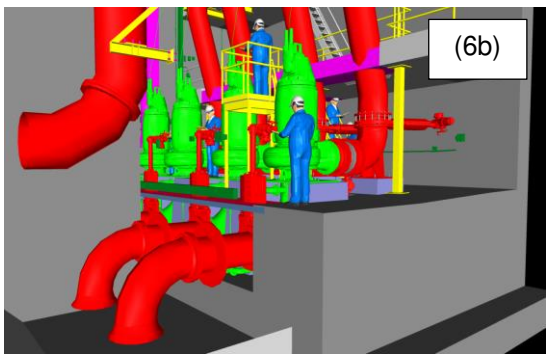
Figure 3: A Go-Pro 360 camera was used to inspect the lift station's wet well where conventional access is extremely difficult

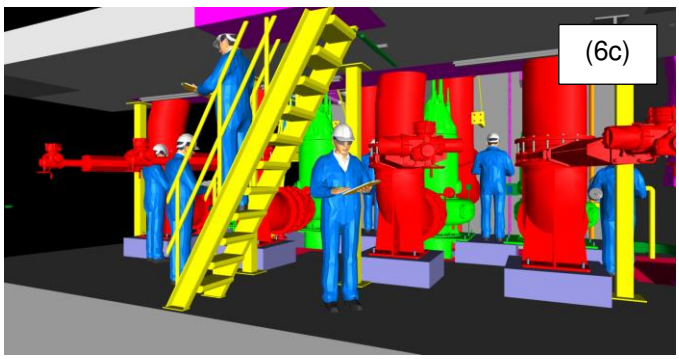
Figure 4: Example of the Go-Pro 360 camera being lowered into a confined space



Figures 5a to 5c: The Go-Pro camera was lowered from the main surface landing into the wet well via the bar-screen opening (5a). The camera was able to provide incredible 360-degree footage of the DN1500 gravity sewer (5b) and the wet well intermediate landing (5c).







Figures 6a to 6c: Navisworks 3D model views of the final Loganholme lift station renewal design