UNLOCKING VALUE THROUGH A PLANNING-LED ALLIANCE — THE ALFRED STREET TO LOGANHOLME WWTP RISING MAIN

Paper Presented by:

Anthony Domanti

Author:

Anthony Domanti, *Senior Water Engineer*,

Parsons Brinckerhoff, Qld

7th Annual WIOA NSW Water Industry Operations Conference and Exhibition
Exhibition Park in Canberra (EPIC),
9 to 11 April, 2013

UNLOCKING VALUE THROUGH A PLANNING-LED ALLIANCE THE ALFRED STREET TO LOGANHOLME WWTP RISING MAIN

Anthony Domanti, *Senior Water Engineer,* Parsons Brinckerhoff, Qld

ABSTRACT

The wastewater conveyance system from Alfred Street pump station (Slacks Creek) to the Loganholme Wastewater Treatment Plant (WWTP) is a critical component of the Logan North wastewater network. Previous planning had identified a $132 M engineering solution to upgrade the network, which was operating at capacity.

Logan Water Alliance, a public and private sector enterprise involving Logan City Council, Tenix, Parsons Brinckerhoff and Cardno, took a fresh look at the upgrade solution by reassessing wastewater collection for the whole Logan North catchment, rather than focusing on the insufficient capacity at the Loganholme WWTP lift station. The Alliance developed a solution consisting of a 6.4 km DN1200 MSCL/PE rising main that will remove network capacity constraints and overcome operational risks associated with a lack of system redundancy and wet-weather overflows.

The project's numerous benefits include:

- maximising the use of existing infrastructure, particularly at the Alfred Street pump station
- avoiding construction of new pump stations
- using approximately 1.2 km of OD1200 horizontal directional drill to minimise community and environmental disturbance in sensitive areas
- configuring pump stations to achieve maximum operational flexibility
- reducing maintenance requirements and improving system longevity.

With a capital cost of $49 M, the project is scheduled for completion by mid-2014.

1.0 INTRODUCTION

Logan City Council's Logan Water Alliance (LWA) is one of the largest water infrastructure delivery programs of its type in Australia. The Alliance is a public and private sector enterprise involving Logan City Council, and engineering services providers Tenix, Parsons Brinckerhoff and Cardno. The team, consisting of 85 water professionals, was established in August 2009 to meet the demand for water services in the Logan City, one of south-east Queensland's fastest growing areas (see Figure 1). The Alliance will deliver new and improved water, wastewater and recycled-water infrastructure throughout Logan until at least mid-2014.

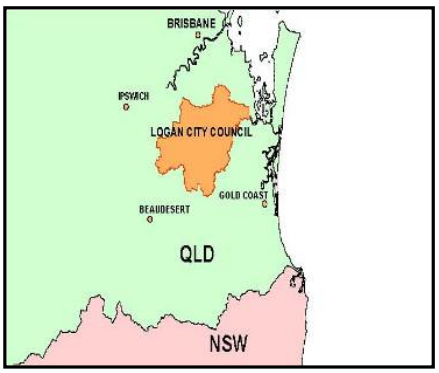


Figure 1: ***Locality map***

The Alliance is known within the water industry for its high-performing team and commitment to delivering *'the right projects for the right costs in the right timeframes'*. This attribute was recognised when the Alliance was awarded the Australian Water Association Queensland Branch's Project Innovation Award in July 2011.

Unlike many alliances, LWA's scope includes planning (master, catchment and detailed), as well as capital works delivery. This unique 'planning led' approach allows planning decisions to directly influence the scope and delivery of the Alliance's annual capital works program, and to 'unlock value' during the early stage of its projects, when the potential for value creation is at its greatest. This is the time when the cost of making changes to project parameters, such as location, scope and timeframe, is relatively small, while the ability to innovate and consider alternative approaches to infrastructure challenges is at its greatest, as illustrated in Figure 2.

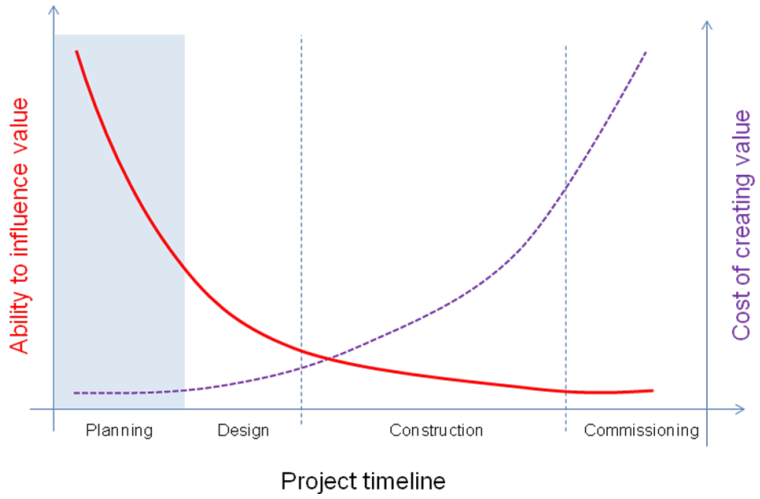


Figure 2: ***Value creation diagram***

This paper focuses on LWA's most notable value-for-money initiative to date - the Alfred Street Pump Station to Loganholme Wastewater Treatment Plant (WWTP) Rising Main project - which clearly demonstrates how value can be created during a project's planning phase.

2.0 DISCUSSION

For this project, the Alliance faced the challenge of upgrading the wastewater conveyance system in the Loganholme catchment; the system services a population of around 200,000 people. One constraint of the project was that, although the conveyance system needed to terminate at the existing Loganholme WWTP, the inlet works at the WWTP were unable to meet even the current demand. Before the Alliance was formed, Logan City Council had identified a $132 M solution for upgrading the conveyance system and the Loganholme WWTP inlet works. This solution included duplicating the existing conveyance system and involved:

- 4 km of deep wastewater gravity mains (tunnelling up to 19 m deep) in a highly developed catchment
- construction of a 30 m lift station at the Loganholme WWTP
- significant local community disruption (including traffic impacts, construction impacts, business impacts)
- high energy requirements associated with double lifts of wastewater flows.

2.1 Planning review

The Alliance's Planning and Project Development (P&PD) team reviewed the challenge, reassessing wastewater collection for the whole of the northern Logan catchment rather than focusing on the insufficient capacity at the Loganholme WWTP lift station. The Alliance developed a new approach to provide adequate long-term capacity between the Alfred Street pump station in Slacks Creek and the Loganholme WWTP. The team also reassessed inputs, such as the area's population trends, to identify several conveyance options. These options were assessed using a multicriteria analysis, which included assessments of whole-of-life costs and non-cost factors such as environmental, social and technical impacts. Figure 3 illustrates the planning assessment process adopted by LWA.

Figure 3: *LWA planning assessment process*

The team identified an alternative solution that appeared to offer significant savings in net present cost and annual operating costs. This option, along with eight others including 'non-infrastructure' and 'do nothing' options, were then rigorously tested using an optioneering process and value management workshops attended by LWA and Logan City Council stakeholders. The Alliance's recommended detailed planning solution consisted of a 7 km DN1350 shallow rising main, predominately through floodplain and open-space areas. This option would cost $64 m. Figure 4 compares the Alliance's recommended solution with the pre-Alliance solution.

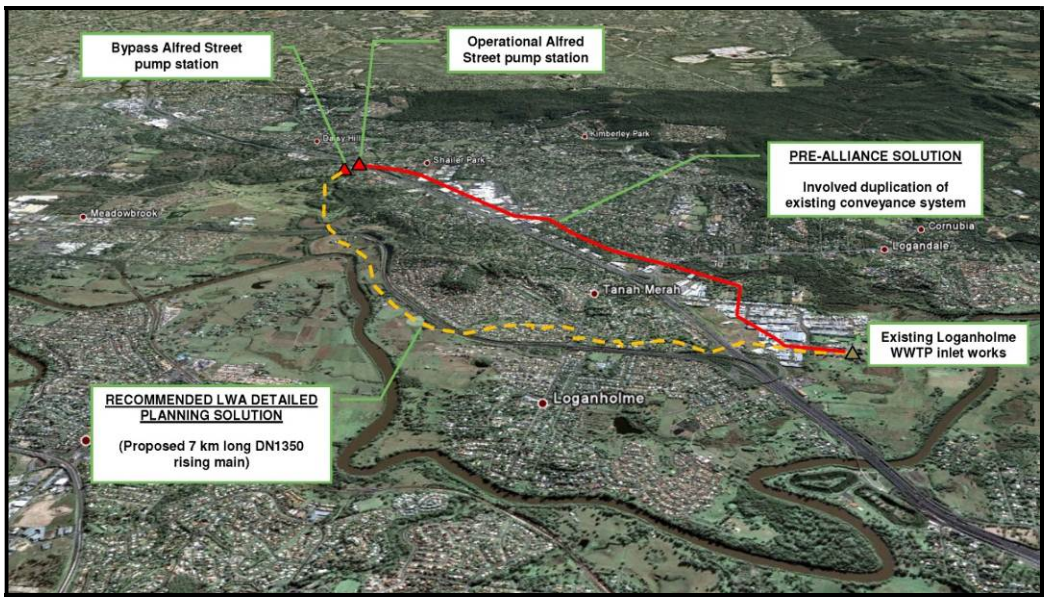


Figure 4: *Comparison of recommended solution (dashed line) with the pre-Alliance solution (solid line)*

2.2 Design phase

During the detailed design phase of the project, the Alliance refined the recommended planning solution represented in Figure 4. The process used to finalise the recommended solution included holding design, opportunity and risk (DOAR) workshops at the 30% and 85% design intervals. The Alliance used DOAR workshops to systematically review all aspects of the design and capture contributions from a wide variety of stakeholders, including designers, constructors and operators, as well as community, environmental and safety specialists. Safety in design, an essential consideration during the life of a project, was also assessed at the DOAR workshops. The following central issues were addressed in the detailed-design phase:

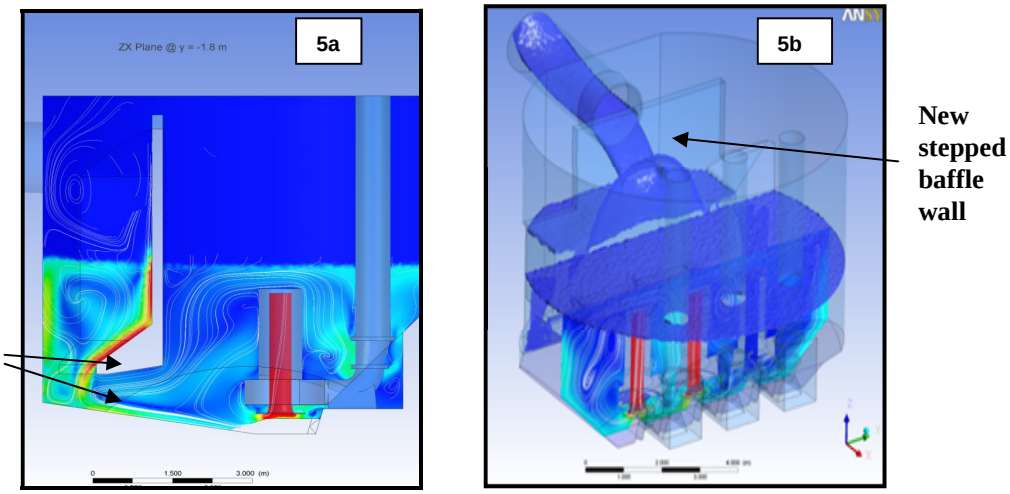
- maximising the use of existing infrastructure
- reducing maintenance requirements and improving system longevity
- minimising community and environmental disturbance.

Maximising the use of existing infrastructure

The Alfred Street pump station is the primary collection system that services the Loganholme wastewater catchment. There are two separate pump stations on the site: the original 'operational' pump station and the newer wet-weather 'bypass' pump station. From the planning phase it was recommended that the bypass pump station be converted to the duty pump station. The bypass pump station is a three-pump submersible type station with an 8.5 m dia. and an 18 m deep wet well, originally designed to deliver 1,300 L/s. The Alliance redesigned the bypass pump station using Computational fluid dynamics (CFD) modelling to reliably achieve the necessary 2,000 L/s, eliminate some existing problems associated with the pump suction conditions and, ultimately, ensure that a new pump station would not need to be constructed.

CFD modelling of the existing wet-well geometry, undertaken by Parsons Brinckerhoff (2011), revealed high swirl angles at the pump inlets for the scenarios with low water levels. Submerged vortices were also detected originating from the side benching. To overcome these hydraulic issues, modifications to the benching and baffle wall were needed. Figures 5a and 5b illustrate the final proposed bypass pump station wet well geometry comprising:

- replacing the existing baffle wall and droppers with a new stepped baffle wall
- modifying side benching
- providing a new flow splitter below the existing pumps.



Figures 5a & 5b: ***CFD modelling used in the design of the bypass pump station***

Reducing maintenance requirements and improving system longevity

Installing gas-release valves at rising-main high points is common in the water industry; however, if these valves are incorrectly designed, they can lead to community complaints about odour and noise, and require regular maintenance and expenditure. The design approach for managing gas was based on limiting the amount of air being drawn into the rising main (and dissolved gas coming out of solution) under negative transient or static pressures. Large volumes of air drawn into the line become malodourous and are then expelled on pump start, resulting in odour complaints. This was addressed primarily by ensuring the pipeline stayed full during its operation and through minimising the potential for dissolved gas coming out of solution due to a change in pressure.

The problems were overcome by using 'one-way out' and 'low-pressure sealing' gas release valves. In addition, the rising main's vertical profile was designed to ensure that, under static conditions, a minimum of 2–3 m head remained in the rising main. This was to ensure that the gas valves sealed (didn't leak sewage) and to reduce the amount of dissolved gas coming out of solution. As added protection for the rising main and to improve system longevity, calcium aluminate cement (CAC) mortar lining was provided at all high points.

Minimising community and environmental disturbance

Another important example of 'unlocking value' involved the use of trenchless technology, such as horizontal directional drilling (HDD), to minimise community and environmental disturbance.

The Alliance identified an opportunity to use HDD for a section of the proposed rising main that traversed an operational golf course, thus minimising construction impacts and reducing project costs. The preferred solution involves executing a single horizontal directional drill, approximately 1,209 m in length, to install the OD1200 PE100 PN16 high-density polyethylene (HDPE) rising main. When completed, this HDD will be the longest of this pipe diameter undertaken in Australia.

To assess the feasibility of the proposed HDD works and understand associated risks, the Alliance undertook detailed engineering investigations to determine ground conditions in the area. This involved a combination of geotechnical ground investigations, seismic survey, and a pilot bore along 350 m of the HDD section of the alignment. The proposed vertical alignment associated with the HDD pipeline will have a maximum depth of 12 m, and will pass under Slacks Creek four times.

Before committing to undertake the HDD, the Alliance worked closely with the proposed HDD contractor, independent specialist pipeline designers and tunnelling experts from Parsons Brinckerhoff.

The HDD works are scheduled to commence in April/May 2013, and will take approximately 26 weeks to complete.

2.3 Final design

The final design solution includes a 6.4 km x DN1200 MSCL/PE rising main that will remove network capacity constraints and remove operational risks associated with a lack of system redundancy.

The project's revised final capital cost was $49M, which is approximately $83M less than the pre-Alliance solution (see Figure 6).

Figure 6: ***Progressive value creation through a planning-led approach***

Figure 7 shows the final rising main alignment and the different construction methodologies to be implemented.

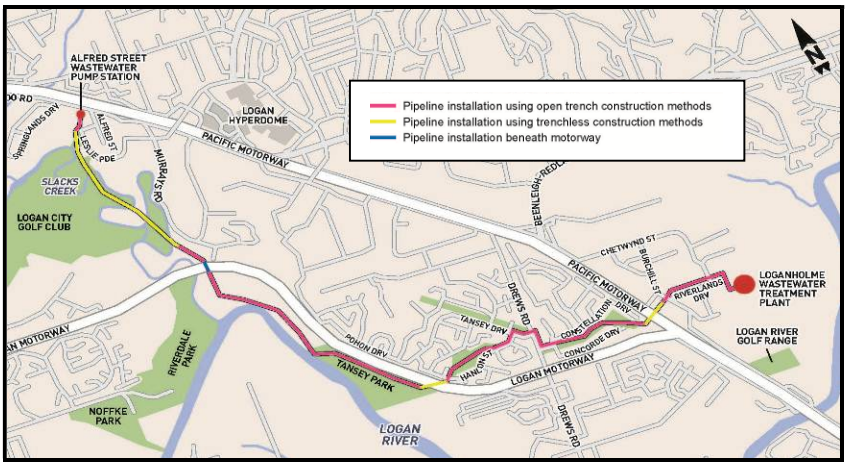


Figure 7: ***Alfred Street to Loganholme WWTP rising main: final configuration***

3.0 CONCLUSION

The greatest opportunity to unlock value on water and wastewater infrastructure projects is at the early stages of the project life cycle. Logan Water Alliance's planning-led approach has proven to be a successful mechanism for progressively unlocking value and delivering more effective and efficient water and wastewater systems by:

- challenging assumptions during project development to significantly reduce capital and whole-of-life costs
- significantly reducing operational, environmental and stakeholder impacts by multidisciplinary input in the early planning phase
- using DOAR workshops and robust engineering processes to understand and resolve key stakeholder issues.

4.0 ACKNOWLEDGEMENTS

The author wishes to thank Logan Water Alliance for its input and the opportunity to present this paper.

5.0 REFERENCES

Parsons Brinckerhoff. *CFD modelling of Alfred Street pumping station* (2011)