

GP Friel Ltd. Victoria St & Waterloo Quay Wastewater Renewal CCNZ Award Entry

March 2019





25 March 2019

Our ref: Your ref: GPF

Victoria Street and Waterloo Quay Sewer Renewwal

GHD, on behalf of Wellington Water, administered the Contract and carried out construction monitoring for the Victoria Street and Waterloo Quay sewer renewal project constructed by G. P. Friel Ltd (GPFL).

Several challenges were encountered on these sites. GHD and GPFL worked through these challenges collaboratively, with GPFL always offering up practical solutions for the project team to work through. The key challenges faced and worked through by the project team were traffic management, service clashes, design changes, working with Kiwi Rail and dewatering.

Successful dewatering was key to the delivery of the Victoria St Sewer renewal project. Dewatering presented significant risks, including environmental risk, structural risks to surrounding buildings and project delivery risks. These risks were well managed by GPFL. They developed a dewatering plan which was executed successfully and were able to and willing to adapt their methodology on site as needed.

Working in the CBD and on a main commuter route had its challenges. GPFL proposed an effective traffic management plan that was well implemented, carefully monitored and adapted by GPFL to suit the specific day-to-day site conditions. The well planned and executed traffic management resulted in a site that was safe for the site team, pedestrians and road users, while also minimising delays and frustration to road users.

The success of these projects was a result of the collaborative working environment created and encouraged by GPF, GHD, and the customer. All partied worked together to deliver a common outcome and effectively manage the project risks.

Sincerely GHD

Summer Faulkner Project Manager +64 4 4747325

Table of Contents

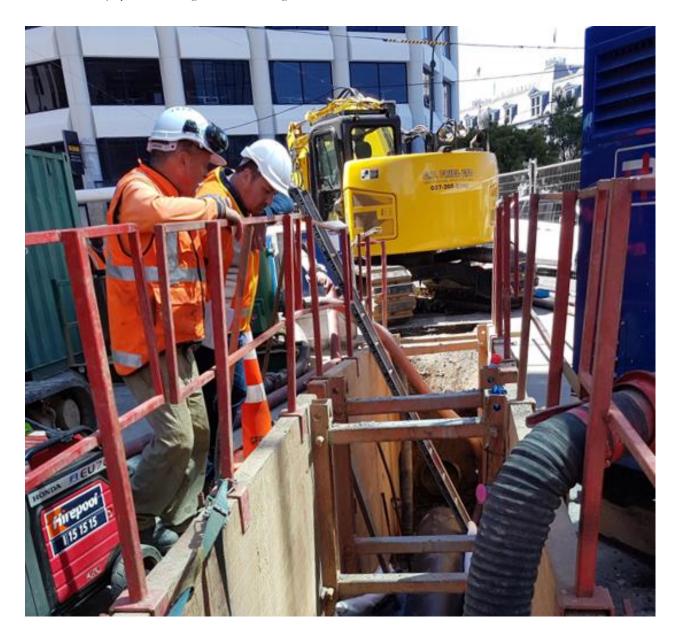
I.	Overview
II.	Victoria St - Construction
	Significant Design Change
	Traffic Management and working with the RCA
	Dewatering and the dewatering consent
III.	Waterloo Quay - Construction
	Significant Design and Consenting issues
	Unforeseen Underground Obstructions
	Traffic Management and working with the RCA
IV.	Health & Safety
V.	Planning & Execution14
	Programme
	Budget
VI.	Customer Satisfaction16
VII.	Why this is a Winning Project16

Overview

REFERENCE	D1270
PROJECT NAME	Victoris St & Waterloo Quay Wastewater Renewals
CUSTOMER	Wellington Water Ltd.
VALUE	\$1.1M
PROGRAMME	August 2017 – August 2018

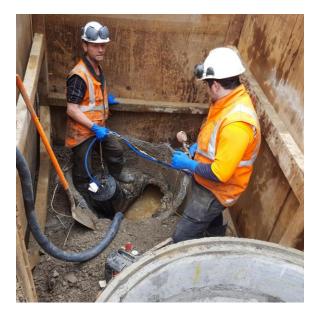
GPFL completed wastewater renewals in Victoria St and Waterloo Quay between August 2017 and August 2018 on behalf of Wellington Water. They were valued at just over \$1M. The work was deferred from a larger contract called Southern Sewers that also included renewals in Bruce Ave., Comorandel St, Camperdown Rd and Northland Rd.

The project was designed by Aecom and they were involved at the start of the project as Engineers Representative. Following the formation of the Wellington Water Consultancy Panel that role was handed over to GHD. Aecom, GHD & GPFL worked well together and the transition was completed seamlessly and without detriment to the project.



Victoria St - Construction

The Victoria St Wastewater renewal was intended to address seawater infiltration into the pipeline between Hunter St and Willeston St where it was having a significant impact on the nearby pump station and the whole of the downstream network. The existing asset had been constructed in the 1980s but the quality of the product was not of the required standard. The proposed solution was an online renewal with a 500OD PE100 pipe constructed between 2m and 3m deep on the centreline of the carriageway.

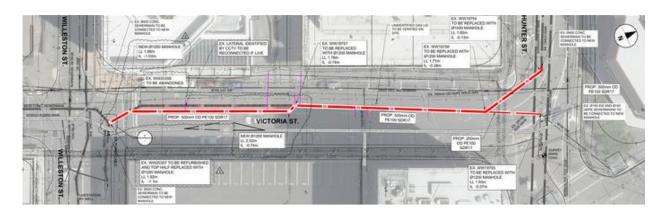


Ray Dunn & Eddie Dunn of GPFL

Victoria St Wastewater Renewal		
Customer	Wellington Water	
Engineer	Aecom/GHD	
Value	\$450k	
Scope	Installation of 119m of 500OD PE100 SDR17 wastewater main by open trenching	
Resources	 14T Sumitomo Excavator 5.5T Yanmar Excavator Various Trucks 2.5m Trench Shields Hydraulic Aluminium Trench Struts 2 x 4" Pumps 6" Pump 2" Pump Grundocrack pipe bursting tool 	

There were three key risks on the project that were effectively managed to make this project a success:

- Significant Design Change & Unexpected Operational Issues
- Traffic Management and working with the RCA
- Dewatering and the dewatering consent



Construction drawing showing the layout of the project

Significant Design Change & Unexpected Operational Issues

At the first site inspection post award GPFL noted that the existing main was full. We assumed that this was a blockage and communicated with WWL Operations. In reality the infiltration was so bad that pump station 7 was not coping with the flow so the pipe was acting as storage during high tide.

As this was a storage main it was not suitable for online renewal.

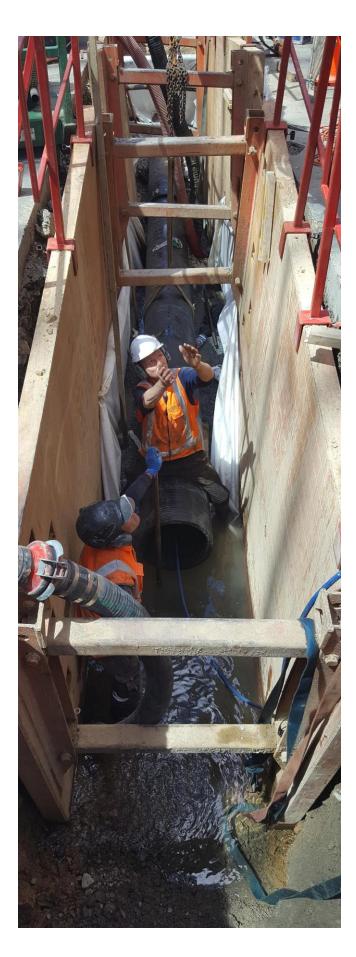
We proposed an offline renewal for the first half of the alignment and identified an available corridor in the carriageway. Although the new alignment introduced risks associated with traffic management and excavating adjacent to an existing trench; it also minimised risks associated with overpumping the live sewer. We worked closely with Aecom and ran construction in parallel with redesign in order to minimise the impact on the budget and programme.

The second part of the alignment was upstream of the storage level in the pipe so for this section of construction the line could be over pumped to the pumpstation.

In addition to the design change described above the team on site had to quickly change their plans when an unrelated issue with the existing rising main in another part of the street caused it to burst. This meant that we could no longer overpump the existing sewer and the job came to a stop. We remobilised the crew and worked with WWL to repair the damage so that the project could continue.

Successfully overcoming these issues was possible because the project team collaborated.

Contractor, Consultant and Customer working together to deliver a common outcome was at the heart of the success of this Victoria St Wastewater Renewal.



Traffic Management and working with the RCA

Working in the CBD can be a difficult proposition when it comes to managing traffic and pedestrians while trying to deliver a construction project. Victoria St is a busy commuter route through the city and is heavily trafficked by vehicles at peak times. It also has business frontages and some of the highest pedestrian volumes in the CBD.

Well planned and executed traffic management can create an environment that makes a project safe and productive. Fresh from success on the Terrace and armed with a new and improved in-house traffic management capability we were confident that they could deliver a traffic management solution that would keep our crews and passers-by safe, satisfy the RCA, and facilitate the work

By approaching the RCA with plenty of lead in time we were able to negotiate a permanent lane closure on Victoria St. The RCA's default position in this area of the city would have been a 9am to 4pm set up but the permanent lane closure increased productivity and also delivered a safer solution:

- No requirement for road plates or other temporary surfaces
- A consistent layout for drivers and pedestrians encountering the site on a daily basis
- Reduced interface between traffic management personnel and live traffic

These benefits would be enough to secure a lane closure but there is a production advantage that can be used to offset disruption and sell the solution. Better production = a shorter overall programme.

This project represents another example of WCC RCA being 'on board' with contractors and asset owners to help us tailor traffic management solutions that are the right fit for the city and not just strictly applying rules.



Well planned and executed traffic management can create an environment that makes a project safe and productive.



Dewatering and the dewatering consent

The new main was constructed with its outfall at 3m deep and the head at 2m deep. The water table was encountered at between 1m below ground level at high tide and 2m below ground level at low tide. The reclaimed ground was poorly compacted and with little or no fine content. The water travelled through it freely flowing into the excavation. Existing abandoned services that we encountered acted like subsoil drains collecting water and discharging it into the trench. It was very wet!

Dewatering was a significant element of the construction work and a dewatering consent was secured post award by Aecom. The consent conditions required settlement monitoring of the adjacent structures and monitoring of the water extraction rates and quantities. The settlement monitoring was managed by Aecom and did not show any significant movement of the adjacent structures. The flow rates and quantities were measured on site by using a water meter built into the delivery line of the dewatering system.

We used one 6" and one 4" pump to carry out the majority of the dewatering. A 2" pump provided assistance locally and during welding operations. The two large dewatering pumps were connected by a manifold to a single delivery line that included the water meter. A second 4" pump was also on site to overpump the existing sewer. The site had plenty of pumps.

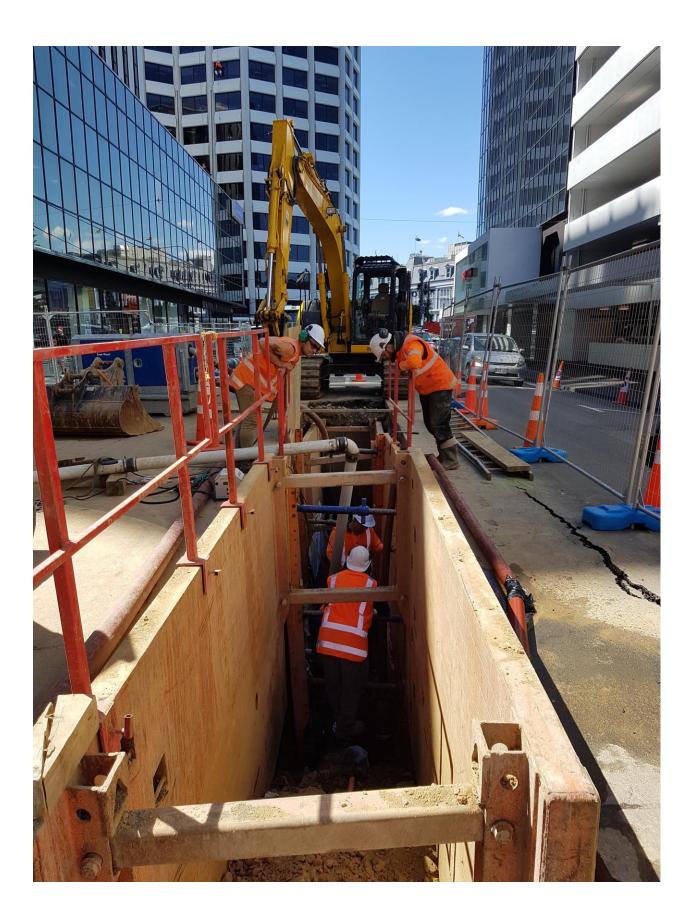
Pumping was partly from the trench and partly from a deep well installed at the outfall end of the project. The deep well was installed by vertically ramming a steel casing using a grundocrack tool suspended from our 5.5T excavator. The grundocrack tool is normally used for horizontal pipe bursting so this is an innovative application of the tool that we have never tried before. It was completed successfully and added value to the project by giving an extra avenue to dewater the trenches. The dewatering system worked for approximately 352 hours over a three month period. 15,410,000 litres of water was extracted. On the biggest shift 1,010,000 litres of water was extracted. The average flow rate was 12.16ltr/sec and the on the biggest day it was 28.06ltr/sec.

Aecom/GHD worked closely with GWRC to keep them informed throughout the project. GWRC added additional controls in terms of contamination testing but as these did not show any adverse issues; the project continued to dewater.

Effective dewatering was key to the successful delivery of the Victoria St Sewer renewal project. Dewatering presented a significant risk not only to the environment but also to project delivery. Failure to control the water would have resulted in serious productivity issues, lost welds or other quality defects. The project had a dewatering plan, and the consultants supported the site team to execute that plan successfully.



Installation of a deep well using a pneumatic pipe bursting tool – Willeston St/Victoria St Intersection



Waterloo Quay -Construction



The Waterloo Quay Wastewater renewal was intended to address a poor condition asset that was at the end of it's design life. As part of the work the main was upsized to cope with high flows from the upstream catchment. The proposed solution was to upsize the existing sewer from a 150mm diameter earthenware main to a 250mm OD PE100 main by pipe bursting. The existing main was approximately 2.5m deep in the carriageway of Waterloo Quay with a section under the rail crossing into Centerport.

The project had a number of design and consent issues that we had to react to on site, it was hampered in the early stages by onerous traffic management constraints and it suffered from a series of unforeseen underground obstructions. These issues compromised our plan and caused us to have to change the way we delivered the project.

- Significant Design and Consenting issues
- Unforeseen Ground Conditions
- Traffic Management and working with the RCA

Waterloo Quay Wastewater Renewal		
Customer	Wellington Water	
Engineer	Aecom/GHD	
Value	\$650k	
Scope	Installation of 260m of 250OD PE100 SDR17 wastewater main by pipe bursting	
Resources	 5.5T Yanmar Excavator Hino 700 Truck Hino 500 Truck 2.5m Trench Shields Hydraulic Aluminium Trench Struts Grundocrack Pipe Bursting Tool 250 CFM Compressor 	

Significant Design and Consenting issues

The design had identified a manhole as being in the footpath that actually turned out to be in the carriageway. The manhole in the footpath was key to our methodology. We had intended to use it as the location for our main launch pits to complete the work. During construction we had to excavate additional holes in the carriageway in a difficult TM location. This added to the complexity of the TM issues described below. At design stage the consultant had failed to secure a deed of grant to cross the rail corridor. While this process took place we re-phased the work to put that section at the end of the programme and maximise the available time available to work through the Kiwirail process. This was successful and ensured that the deed of grant did not delay the work.

By collaborating with Engineer we were able to minimise the impact of design and consenting issues on the outcome of the project. But these issues highlight the importance of investing at the early part of a project to deliver budget certainty when in construction.



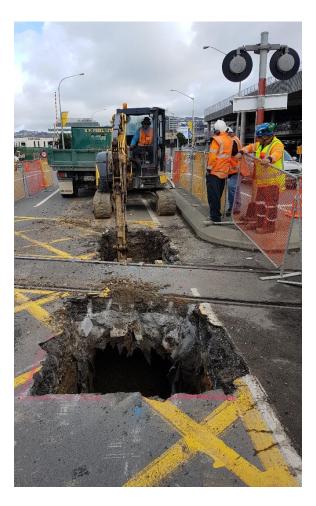
Construction drawing showing the layout of the project

Unforeseen Underground Obstructions

During the work we encountered a significant unforeseen underground obstruction that resulted in the pipe bursting tool becoming stuck in the ground. We were faced with a compromised sewer and an immobile pipebursting tool stuck in the ground under Waterloo Quay. We had to react quickly to recover the tool, break out the obstruction and complete the pipe burst. All of this added to the complexity of the TM issues described below.

After encountering the first obstruction we reviewed the CCTV footage for the relevant location and could identify the repair from the inside of the pipe by looking at the colouring of the existing pipe. We reviewed the remaining CCTV footage and identified three other potential repairs that would be constructed in the same way. One of those repairs was under the rail corridor. We confirmed that the repairs were also surrounded in reinforced concrete by trial holing. If we had not taken this step we could have ended up with a compromised sewer and immobile pipe bursting tool under the rail corridor in Waterloo Quay. Out of the box thinking saved the project significant time, money and potential media attention.

We put together and delivered a new plan to break out the concrete repairs. We approached Kiwirail and Centerport and lead a negotiation to access to an existing blockage of the line that was not too far removed from our programme. We worked 24/7 to take advantage of the rail closure and replaced the repaired section of pipe with a sacrificial length of earthenware main that we would later burst as planned. During the block of line we shared our TM with the Kiwirail/Centerport teams resulting in a direct cost saving for them. By taking a whole of city approach we were able to solve our problems and enhance the ability of other contractors and customers to achieve their own goals.





Work taking place under the rail crossing into Centerport

Traffic Management and working with the RCA

All the issues described above were exacerbated by and themselves contributed to a very complex TM environment. At the outset of the project we knew that the traffic management presented a high risk and would be critical to delivery of a successful project. Waterloo Quay is a high flow, high speed road that acts as the main corridor for traffic entering and exiting Wellington's CBD. We had just successfully completed CBD renewals on the Terrace and Victoria St. We applied the same approach here engaging with the RCA early in the process and discussing ways that we could deliver the work while understanding their goals around disruption.

At the start of the process we were talking about leaving a permanent central median closure so that we could leave protected excavations in the carriageway and minimise the time associated with demobilisation and remobilisation. The southbound lanes would be shifted to the edge of the carriageway with two lanes maintained during peak flows and work restricted to off peak hours. Towards the end of the process there was a change of personnel at the RCA that resulted in the plan being hijacked and a straight 9am to 4pm constraint being applied. Site level discussions between the RCA and our traffic management team became unproductive and there was a risk that our relationship with the RCA might breakdown.

We quickly found during delivery that it was not possible to complete a pipe bursting operation at 2.5m deep under that constraint. It became even more difficult due to the design changes and unforeseen obstructions described above. GPFL chose to suspend the work and reengage the RCA at a higher level.

We worked through their constraints and together we planned and delivered a better TM solution than we proposed at the outset. We identified that the morning peak would be the only affected flow and would need two lanes to manage disruption. For the remainder of the day we reduced the flow to a single lane and maximised our working space. To secure this concession GPFL committed to working two shifts per day to maximise our use of the available working time and minimise the overall project duration. We attended the TM full time in order to work with the RCA on unforeseen issues that might arise during the morning peak.

The result was that the work was delivered in a safe and high production environment with working space and working time maximised. Traffic disruption was effectively managed by maintaining traffic flow at the morning peak. Wellington Water and GHD were trialling a traffic disruption application called mooven at the time. After the event we were able to provide the RCA with measurable data that showed that disruption was managed to an acceptable level.

The Waterloo Quay renewal presented a significant traffic management risk at the start. During the work there was a period where it could have had a negative impact on our relationship with the RCA. Once we identified that; we were able to manage the situation and turn it into a success story.





Health & Safety

As described in the sections above this project had some significant health and safety challenges that had to be overcome to deliver the project. Deep excavations with high groundwater table and complex traffic management in heavy flow and high speed environments were two of the biggest risks. But, as described above, these were well managed and did not result in any significant incidents.

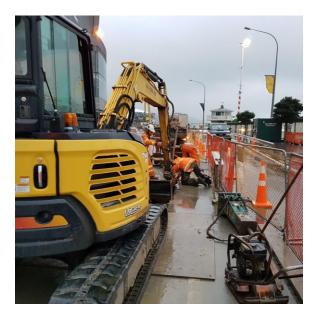
Across the two renewals we had 62 health and safety observations reported through our internal system. This is great – we want more of these on our projects so that we can identify trends and proactively manage risks.

Of the health and safety observations there were no incidents or injuries. Again this is great as it shows that our risk management processes on site and at a project level worked well to protect our people and any other stakeholders who could be affected by our activities.

During the process we did identify a trend around work at height risks. A number of our personnel identified that the currently available edge protection options did not suit the work taking place when pipe bursting at Waterloo Quay. Due to shoring arrangements and traffic management constraints there was very little space to erect fencing and no way to fix the fencing to shields. Work at height and specifically the risk of falling into open excavations has the potential to cause serious harm and so we decided to put in place some additional controls to control the risk. The site team put their heads together and came up with a smart way of supporting a stable barrier right on the top edge of the trench. This system maximises the available construction space while making sure our people are protected. We have successfully used this system on a number of our subsequent projects – it is now part of our normal "toolkit" for dealing with work at height risks.











Planning & Execution

Programme

The project was deferred from a previous year due to budgetary constraints and the scope changed significantly throughout construction. GPFL worked closely with WWL and GHD to deliver the work to a timescale that suited all parties.

On Victoria St a programme constraint was imposed on the project by the RCA associated with a traffic management brownout in the CBD over the month of December. This was successfully met by the project and meant that there was a break in construction before we were given access to Waterloo Quay.

Having dealt with a break in construction we were then challenged to complete the work by the end of the local government financial year. The original scope was completed within that period with additional instructed reinstatement following in July and August.

Budget

There was significant design change and additions to the scope of this project. Managing that change was a big part of the project and required WWL, GHD and GPFL to work together to identify and evaluate variations fairly. We used a cloud based project management platform called Procore to raise RFIs and early warnings that kept all parties informed and enabled us to manage the change to minimise the associated cost impact.

Despite the level of change on these two renewals the project was delivered within the original budget for the wider Southern Sewer scheme. Variations were submitted in a timely manner and with sufficient supporting information so that they were easily approved. The Customer and Engineer were satisfied that the final value of the project fairly represented the work required to complete it.

Customer Satisfaction

Our track record for successfully delivering complex underground infrastructure in challenging CBD environments clearly demonstrates that our team leads the industry in this field. We collaborate with our Customer and the Engineer to produce value for money solutions that deliver the best outcome for the City.

The letter, at the start of this submission, from Summer Faulkner (GHD) – Project Manager clearly describes that our customer was satisfied with the collaborative approach that we took to problem solving, identifying risk and successfully implementing solutions.



"The success of these projects was a result of the collaborative working environment created and encouraged by GPFL, GHD, and the customer. All parties worked together to deliver a common outcome and effectively manage the project risks."

Summer Faulkner, GHD Project Manager

Why this is a Winning Project

We successfully completed these complex renewals including deep trenching, large scale dewatering and pipe bursting in a CBD environment where traffic flows were heavy and traffic was travelling at speed.

We effectively managed significant design change, consenting issues and unforeseen ground conditions by collaborating with the Customer and Engineer. We applied a "Best for City" approach and were able to deliver a value for money outcome.

We engaged with the RCA to plan and implement Traffic Management solutions that balanced, health and safety risks, disruption to the travelling public and production on site. We were able to react when our plans were not working to improve the situation and deliver the work.

We put Health & Safety first by encouraging reporting, identifying trends and taking action to address those trends. Edge protection critical in protecting our people for work at height risks but it can often be challenging to implement in due to other constraints such as Traffic Management, Excavations & Plant & Vehicle Movements. The system that we developed on Waterloo Quay will benefit all of our future projects by giving us another tool that we can apply.

The product is excellent. We have delivered renewed wastewater assets that will last over 100 years. The Victoria St renewal has addressed infiltration issues and reduced the whole life cost of the pump station network. The Waterloo Quay renewal has increased the capacity of the network future proofing it against development in the area.



The team connect to the outfall in Victoria St

The Work We Do

Victoria St & Waterloo Quay Sewer Renewals

