RESTRUCTURING A RENEWALS PROGRAMME TO DELIVER LONG TERM VALUE

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ABSTRACT (500 WORDS MAXIMUM)

With an aging pool of assets and the increasing density of development, replacement of wastewater network infrastructure is becoming steadily more expensive and less practical. A well timed and managed renewals programme can provide great value for money to Utility Operators. This paper examines the traditional model of a wastewater networks renewals programme and suggests an alternative structure to provide long term value to Utility Operators, contractors and consultants.

The current renewals process relies heavily on scoping of works provided by Utility Operator's and their maintenance contractors. This then forms the basis for a request for design proposals and a tender for physical works under NZS 3910, or a design and construct tender under NZS 3916. The resulting works contract often fails to account for the specific capabilities and methodology of the contractor. Significant time can elapse between the initial investigation and the award of works and construction. As a result, the scope of the final solution can differ greatly from that first proposed. This has implications for consenting, costs and project timeframes.

Although the individual components of a wastewater renewals programme such as lining, trenched pipeline repairs and minor realignments are well understood, they often require the contractor to have access to an extremely broad pool of resources and capabilities. For example, many different lining technologies exist but not all will suit a particular section of pipeline. During the post tender period the contractor often has to mobilise significant resources in terms of project staff and equipment or hire multiple subcontractors to manage the works programme. This is often a significant cost component of the works. Organisational knowledge and resource is often lost at the completion of each tender cycle as incumbent contractors and consultants are replaced by a new team with the lowest conforming tender.

This paper will examine an alternative model that engages Utility Operators, contractors and consultants in a more collaborative process. It provides for accurate project scoping with early contractor and designer input into the process. A parallel consenting process reduces risk to programme. It seeks to provide more certainty around project cost, while not compromising on transparency and accountability for expenditure.

We will discuss a recent example of the implementation of the restructured delivery model in the upper north island of New Zealand, the lessons learned and project outcomes.

KEYWORDS

Renewals, lining, asset management, contract structure, programme delivery, design and construct, early contractor involvement

1 INTRODUCTION

New Zealand Utility Operators have an aging pool of assets with which to deliver service. A 2015 report prepared by the New Zealand Treasury identified asset age as a key challenge for New Zealand

Key challenges

We have a number of aging infrastructure networks that will need renewing. This is a simple consequence of when they were built; they are nearing the end of their life. For example, the schooling estate has an average age of 42 years and parts of our water network are now over 100 years old. Meeting the cost of infrastructure renewal and maintenance is even more challenging in areas with smaller rating and economic bases.

Figure 1: Extract from Treasuries 30 Year New Zealand Infrastructure Plan 2015

Network Operators of wastewater pipe networks face a mounting problem - how to deliver a cost efficient and proactive renewals programme that can deal with an increasing level of asset failure.

As detailed in Figure 2, in the five years between 1961 and 1965 almost a thousand kilometres of network wastewater pipes were laid in Auckland. In addition roughly the same length of wastewater transmission pipes where installed in the same period. Many of these assets are now reaching the end of their useful life and reactive maintenance costs are increasing. We have seen evidence of prolonged flushing and heavy cleaning programmes actually accelerating the failure of some assets. The age of the asset is sometimes secondary to the quality of materials - some more recently installed assets, such as pitch fibre sewers, have failed within 30 years of installation.

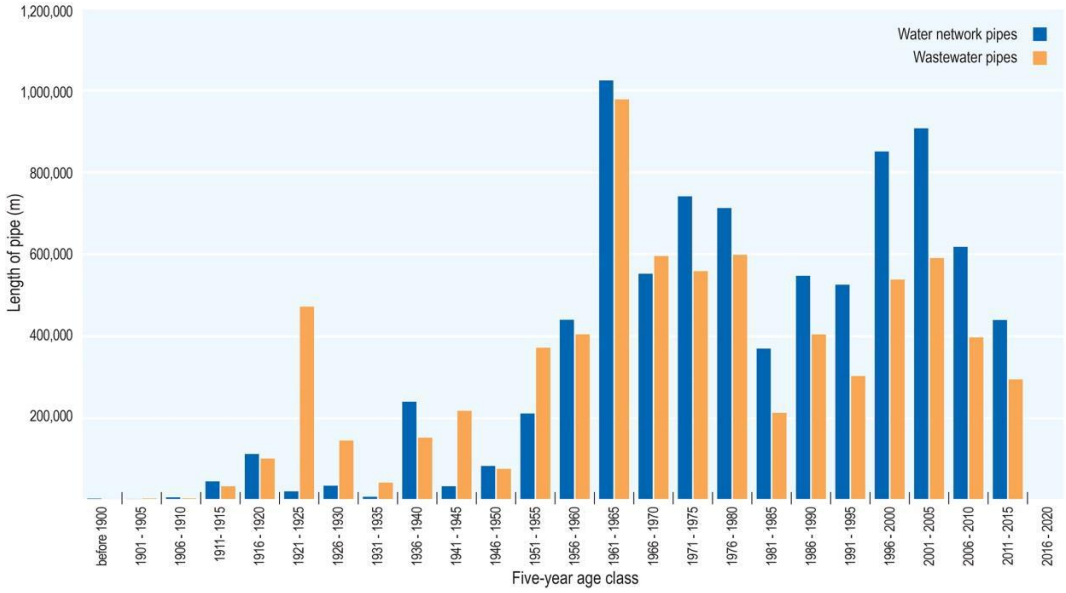


Figure 2: Extract from Asset Management Plan 2016 to 2036, Watercare Services Limited, 2016

This trend is not specific to Auckland, or New Zealand, and has been witnessed in developed countries all around the world. However it does present significant challenges to wastewater Utility Operators in New Zealand.

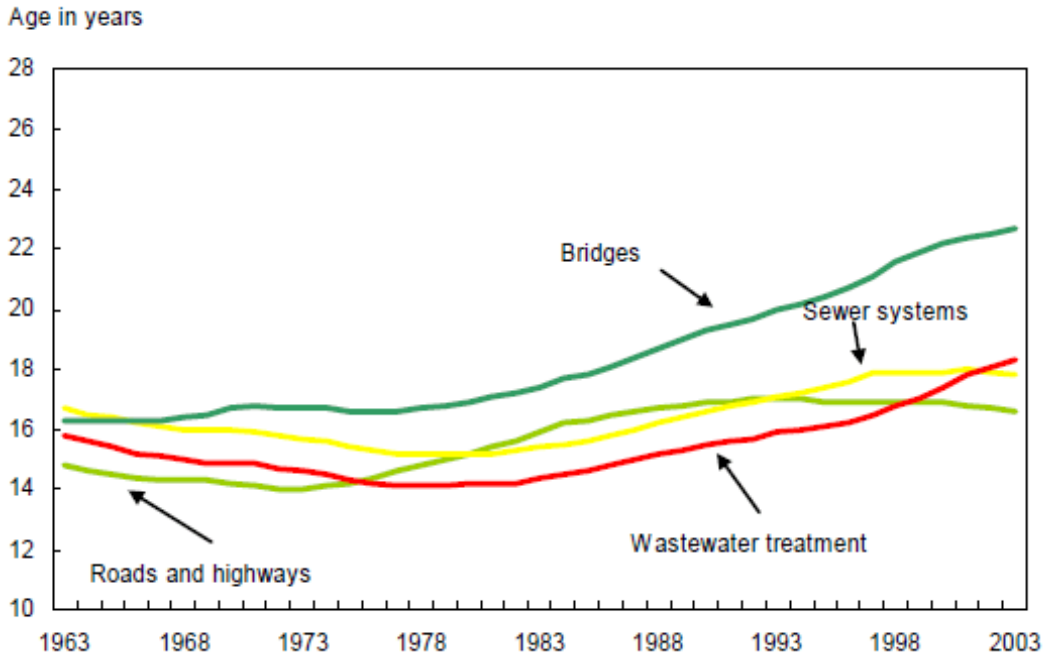


Figure 3: Statistics Canada 2006. The Age of Public Infrastructure in Canada

Without intervention, as assets age they become steadily more expensive and less practical to operate.

Utility Operators must decide when and where to intervene to provide their stakeholders with the best value for money. There are typically three levels of intervention to consider:

- Regular and scheduled maintenance
- Renewal/Rehabilitation
- Replacement

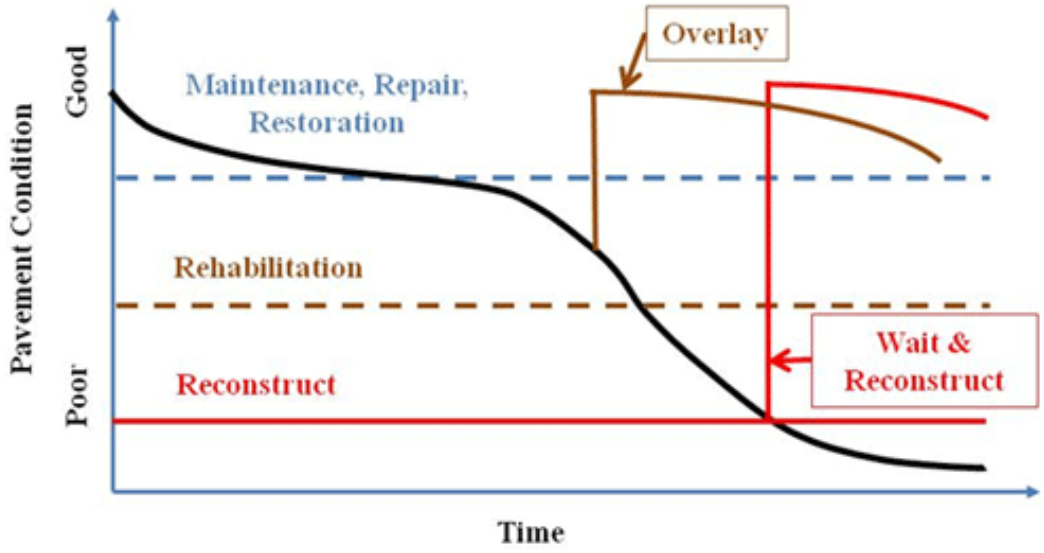


Figure 4. Federal Highway Administration Three Treatment Zones, Maintenance, Rehabilitation and Reconstruction

This paper focuses on well timed renewals/rehabilitation programmes as a cost effective way of extending asset life. In addition the highly developed and constrained environment brought about by the increasing development density within New Zealand in some circumstances makes renewal/rehabilitation of existing assets the only practical option.

The design life for pipe lining technology is typically 50 years and the design life for replacement pipelines can be up to 100 years. The design life for things such as manhole benching and sealing repairs is less easy to assess. However we know rehabilitation programmes represent a considerable extension of infrastructure service life but typically with a lower capital cost and work footprint than a full replacement of the asset.

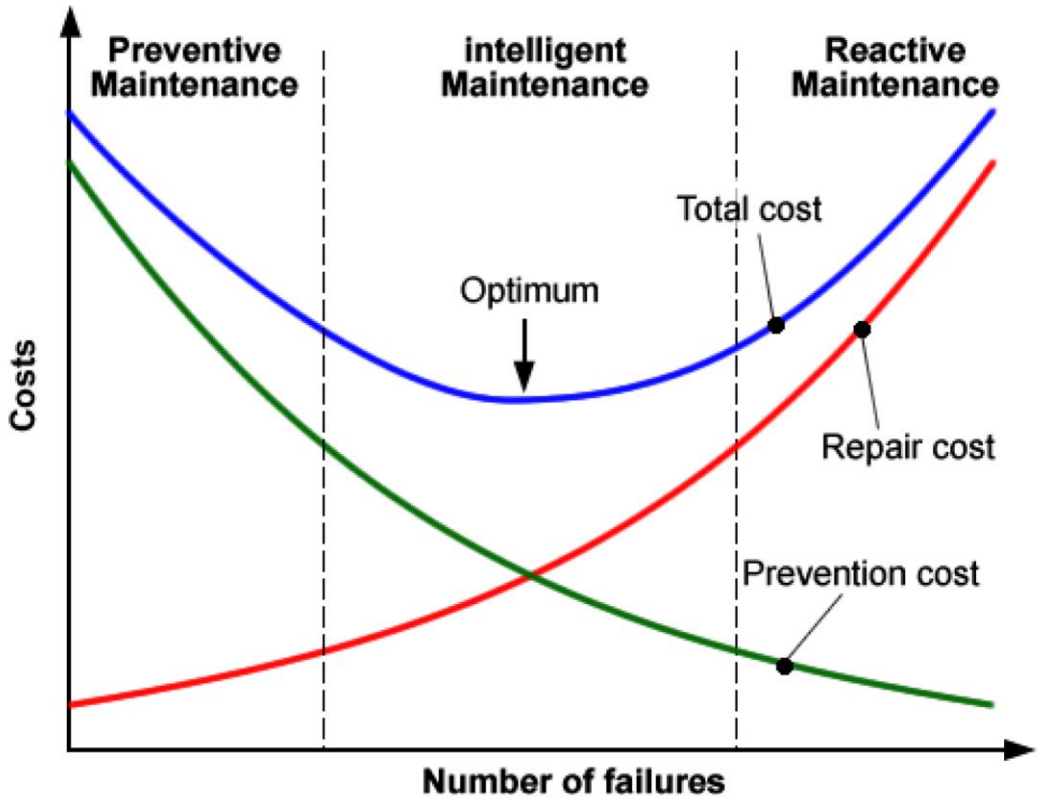


Figure 5. Minimising Total Asset Operating Costs

This paper examines and compares two approaches to completing a programme of renewal and rehabilitation. The first is a standard or typical approach, and the second is a new approach based on extensive contractor and Utility Operator collaboration.

In the typical approach, project scoping is often separated by a considerable time period from the works programme and conducted by the Utility Operator and their maintenance contractor. This can lead to a lack of understanding of the technical capabilities available to the contractors doing the work and potential for misidentification of the project scope.

We examine the issues associated with each approach, identify potential benefits of a new approach and look at a number of real world case studies completed together by Pipeline & Civil and Harrison Grierson.

2 STANDARD APPROACH

2.1 DESCRIPTION OF STANDARD APPROACH

Under a standard approach to a renewals programme the wastewater Utility Operator identifies issues within the network from their maintenance records and feedback from their customers, maintenance and operations teams. Once a number of sites are identified a package of works is formed.

Initial investigations may now be completed, typically by the maintenance contractor, including site inspections, cleaning and CCTV inspections. Invasive works to confirm scope is typically not undertaken at this stage. A basic scope is developed and documented for each site.

The scope generally identifies the methodology to be used, and covers a broad range of techniques including, manhole repairs, open cut works to remove dips or displaced joints, replacement of pipe bridges, pipe bridge structural repairs or piling, different lining methodologies and other trenchless techniques.

Once a package of works is identified the Utility Operator will engage a professional services team or assign their own internal design resources to confirm the scope of the works, prepare design plans, determine suitable methodologies and prepare documents for the tendering of the works. This will include project specifications, and a schedule of prices. At the same time any sites where consents are required will be identified and consents will be prepared and submitted based on the assessed methodology.

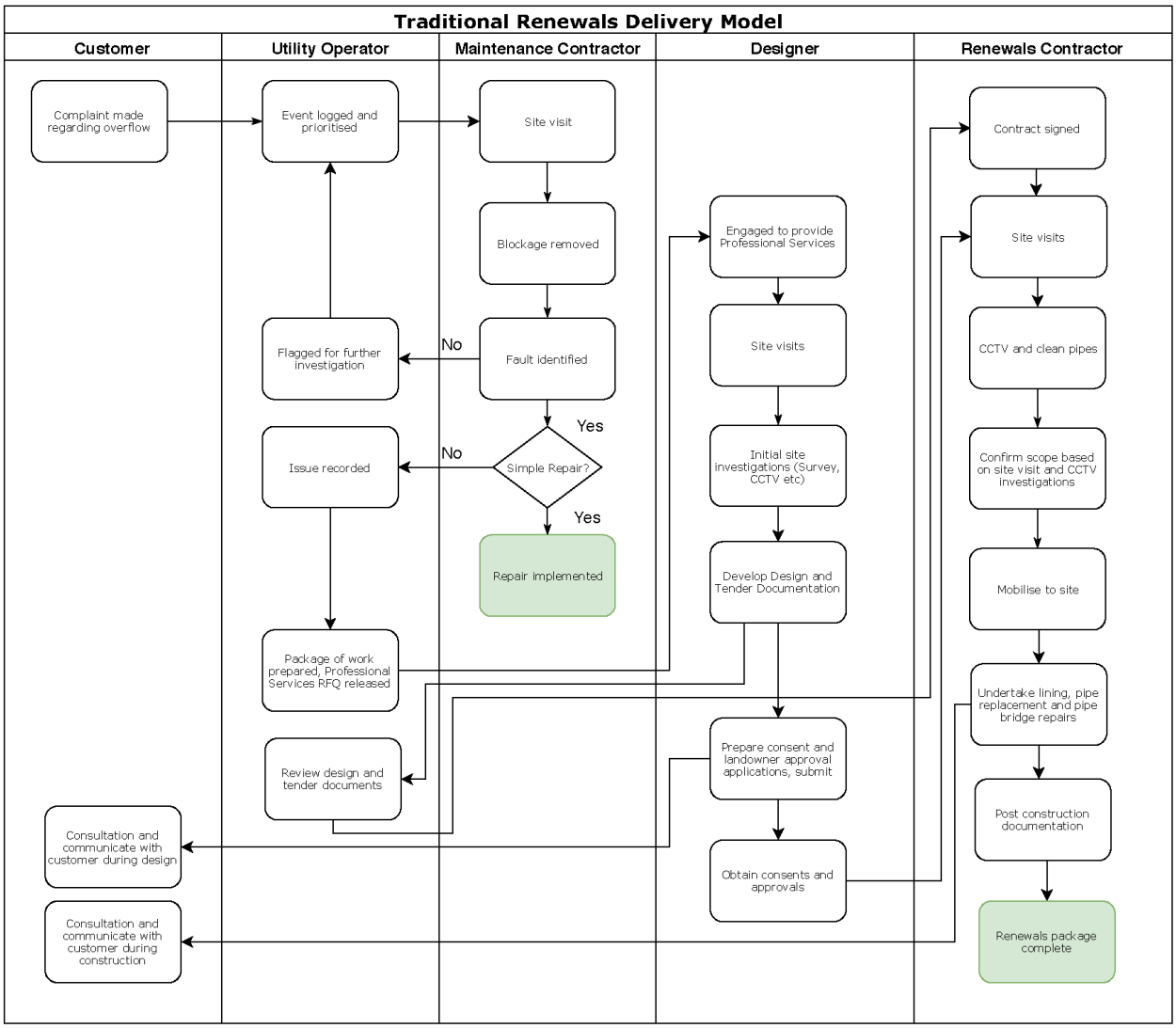
The physical works are then tendered competitively, and a contractor will be engaged to carry out the package of works. Most works of this type will be tendered under NZS 3910 (construct only) on the basis of measure and value.

The implementation phase of the works will then begin. Due to the inconsistent timeframes and outcomes associated with obtaining resource consents and the landowner consultation and approval process, consents for the project sites that require them are often received, after tenders close or even during the construction period. The Contractor is required to adjust the delivery programme to accommodate the consent delays while attempting to make best use of their resources (and those of their sub-contractors) committed to the project.

The standard approach can be augmented with smart elements such as predictive software and deterioration modelling. However there can be considerable barriers to entry to this in cost and scale.

2.1.1 A Standard Delivery Model for Wastewater Renewals

A typical delivery model for wastewater renewals is set out in the flowchart below. In this model the solutions are fully designed prior to tendering the work, but often consents and landowner approvals are only obtained after the contractor has mobilised.



2.2 ISSUES

There are a number of issues with the standard approach to preparing and implementing a renewals programme that can lead to cost fluctuation and delays.

2.2.1 INCORRECT SCOPE IDENTIFICATION

Incorrect scope identification effects the measure of the works, the proposed methodology and, often critically, the consenting requirements for the works. So it is no surprise that it is a key cause of project delay and cost fluctuation. Common reasons for incorrect scope identification include:

2.2.2 CCTV PRACTICE

It may take a significant period of time for a Utility Operator to put together a package of renewals work of a sufficient scale to justify the cost of the design, tender and construction processes. As a result Closed Circuit Television Inspection (CCTV) information gathered for some individual sites can be several years out of date by the time a tender is awarded and works commence.

CCTV gathered during the investigation phase is often gathered as part of maintenance work (such as jetting or root removal) and so focusses on this rather than project scope identification.

There may also be areas where a Utility Operator does not want to have to conduct invasive works to allow for a full CCTV to be completed prior to the project physical works. For example, where dips or displaced joints prevent a complete CCTV of the pipeline and must be repaired to allow a complete inspection.

Incorrect Asset Identification

This can be surprisingly common for a number of reasons. The quality of Geographical Information System (GIS) information can be quite variable, with some very accurate information and some less so, depending on the age and accuracy of the source data. It is fairly common to uncover additional buried manholes, bends, chambers or other features that are not identified on the GIS.

When identifying the assets for renewal, there is also often a bias towards the property where overflows occur or complaints are received. For example a site where overflows occur will often be identified as the section of pipe requiring renewal. However it may simply be the point with the lowest manhole lid level and the problem may be in a section of pipe further downstream. Similarly root removal in a section of pipeline may temporarily solve the maintenance issue with that particular section of line without identifying downstream dips or displaced joints that are also a contributing factor.

This can be mitigated with a comprehensive package of cleaning and CCTV and survey prior to tender, however there can be property owner access and practical issues with this type of investigation, and the continued deterioration or failure of the assets must be carefully considered when allocating contingency in the budget.

Incorrect Measurement

For a large package of renewals it may not be practical to physically measure the extent of works for each site.

Measurement from GIS can often overstate or understate the quantity of work to be completed as a result of inaccuracies in historic data. Historic as-builts may not reflect the history of maintenance or upgrade work that has taken place in the network. As a result it is not uncommon to begin works and determine that a section of pipe indicated as PVC actually transitions from PVC, to AC, to earthenware pipe, each with a slightly different ID. In other cases the pipe diameter has been incorrectly recorded in the GIS or incorrectly measured during CCTV. This can then have a significant impact on the type of renewal to be completed and the measure of the works. For example, at one particular site we encountered a 150mm public sewer which transitioned to a 100mm sewer, underneath a pool. As it was not feasible to demolish the pool to excavate the transition fitting, a customised liner had to be designed, trialed and installed.

This issue also extends to pipe bridge sites where identifying the location and type of transition from steel pipe on either side of the abutments often determines the extent of replacement required. However this is commonly underground and can require excavation to identify.

Outcomes

The effect of the incorrect scope identification above can have a significant impact on overall project outcomes for wastewater network operators. Notably:

- The need for changes to methodology and type of work.
- The need to re-negotiate with landowners and other stakeholders as the nature of the works has changed.
- The need to seek new or varied resource consents including tree consents
- The need to re-approve or extend the project budget. Or conversely, approved budget is not utilised.
- Poor public relations when works do not take place as planned or start and then must be halted to allow re-design.

2.2.3 LACK OF FLEXIBILITY FOR NEW TECHNOLOGIES

Under a standard approach to a programme of wastewater renewals, the works will typically be scheduled and priced based on the particular type of renewal methodology required (for example meters of CIPP lining, metres of open cut up to 1.5m depth). This can then cause an issue when the contractor indicates that their preferred methodology for the works departs from what is included in the schedule of rates. For example if the contractor suggests an alternative of pipe bursting or HDD then scheduled rates, specifications for the works, reinstatement etc may all not be addressed in the contract documents. However this can represent the best and most effective way of completing the renewal.

A consenting barrier also exists as the new proposed methodology may not comply with the existing consent for the works or conversely, can mean that an applied for consent is actually no longer required. Once again this can have a significant impact on overall project duration.

Outcomes

The most complex and challenging sites require the most bespoke solutions and typically require the contractor and his sub-contractors to develop an individual solution to a complex problem. As a result the net effect of this is to shift all the most complex and challenging projects to the end of the programme. This then can lead to a situation where all except one or two projects are completed within the project programme. But there is then a significant delay in finally closing out the project as one or two challenging sites are addressed. This can lead to increased costs for all parties and reduces the cost-effectiveness of the programmed approach.

2.2.4 RISK PROVISIONS AND TENDER TAGS

In a competitive tender process the designer and/or contractor may have only a short time to assess the scope of works for a large package of sites. Many Utility Operators have a significant aversion to taking on project risk and so attempt to pass scope risk onto the contractor in the drafting of civil works contracts. The issues of scope identification discussed above can also lead to a considerable difference between the works tendered and those that are ultimately completed. With this in mind, contractors decide what appropriate risk provision for the works will be included in their pricing. In practice significant uncertainty leads to higher tender pricing as contractors attempt to price in project risk.

In the New Zealand environment a considerable portion of civil works tenders are evaluated using the lowest cost conforming methodology or a weighted attributes method with a significant price weighting. This discourages contractors making appropriate risk provisions because it makes their tender price less competitive. One solution for contractors is to tag out of project scope changes and associated risk. However as Utility Operators may not be willing to accept the transfer of risk to them this can lead to protracted award negotiations and delays in award of the physical works programme. It also encourages gamesmanship and a cynical approach to the tender process.

2.2.5 CASE STUDIES

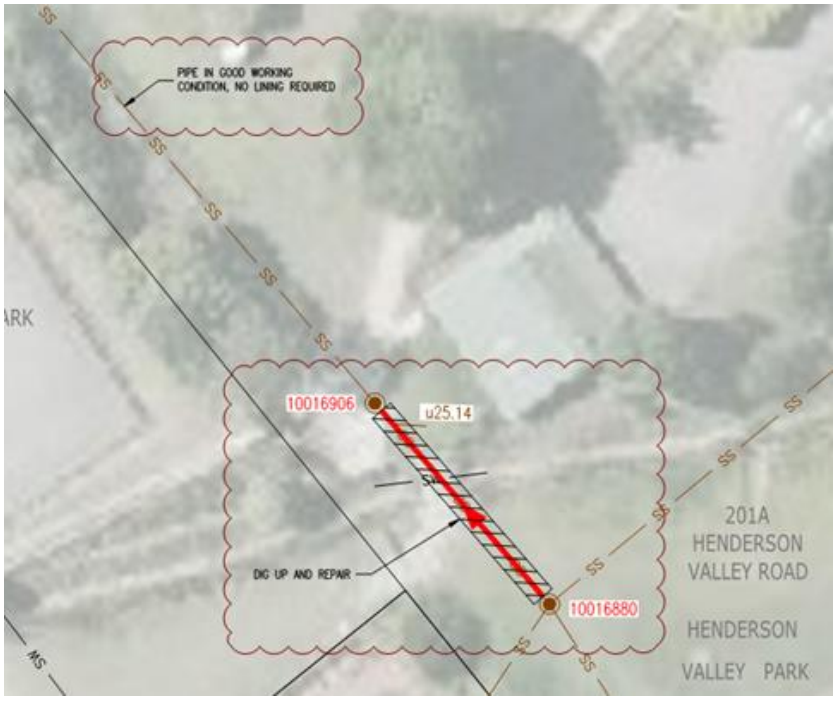
Three case studies are presented below. They provide examples from the implementation of a typical renewals programme and identify how project scope can change and the associated outcomes for a Utility Operator.

Name of project	**West Harbour Pipe Bridges**
Summary	The physical works are scoped based on brief initial assessments carried out by third parties. In this case, errors in the scope resulted in additional consenting, delays and a significant additional cost.
Cost Variance ($+/-)	+$83,000.00
Programme Variance	Uncertainty due to consenting, 3 months before works could be started.
Original Scope	**From the project definition sheet:** Pipe Bridge Details: Length 10m and 24m, Material CLS, Diameter DN300 Description: Replace pipe bridge Background: Coating has failed, large areas of exfoliation Justification: Pipe bridge visual inspection has condition grade 4 or grade 5 Additional information: NIL Issues to be aware of: NIL

	 
Final Scope of works	Pipe Bridge Details: Length 46m and 38m, Material CLS, Diameter DN300 

	
Effect on Project	The original project definition sheet significantly underestimated the length of pipe bridge to be replaced and this was reflected in scheduled quantities resulting in a $83,000.00 difference to contract price. Complex access arrangements were not identified in the initial definition sheets. Helicopter works are required for both of these replacements. This methodology had a follow on impact on the consenting for works in a Reserve and the programme order of works.
Areas identified for improvement Likely outcomes:	1. Initial investigations should be carried out by the contractor and agreed with the client. 2. The pipe bridge replacement items should be lump sums. Earlier contract investigation would have identified access constraints and works methodology (helicopter work). The consenting of this site could have then been prioritised to reduce effect on programme and delivery. These more complex and challenging sites would not be pushed towards the end of the contract reducing risk of late programme adjustments.

Name of project	**Valley Road**
Summary	The true scope of the project could not be assessed until after jetting and root cutting works had taken place. As a result incorrect works were scheduled. If consenting assessments and contamination of the site were addressed earlier cost and programme variance would be removed.
Cost Variance ($+/-)	-$28,000.00
Programme Variance	- 1 week no lining required. Delay to start of works due to potential contamination.
Original Scope	**From the project definition sheet:**  Rehabilitation Details: Lining Length 192m, dip repair Material EW, Diameter DN150 Description: Relay dipped section then line. Background: Major dip & displaced joint in first line & root infiltration issues in general. Justification: Identified by Operations as causing regular overflow and excessive maintenance cost >200 properties affected. (Ops Priority 1). Additional information: None identified.

	Issues to be aware of: None identified.
Final Scope of works	Open cut repair only: Length 32m, Material EW with existing patch repair, MH repairs (not originally identified). Consenting checks identified the site as potentially contaminated and additional sampling was undertaken. This came back positive for low level contamination but did not require consent. 
Effect on Project	A more thorough investigation identified that only an open cut dip repair was required with the rest of the line in good condition and not needing lining. The low level contamination identified during the consent evaluation did not require a consent but caused considerable delay while this was assessed and testing was conducted.
Areas identified for improvement Likely outcomes:	1. Initial investigations should be carried out by the contractor and agreed with the client. 2. Contamination testing should be carried out during these investigations The lining works would not be included in the contract as they are not required. The dip repair is required but would have been priced as a lump sum after initial investigations. The length of the dip and type of replacement would have been identified.. Cost variance would have been reduced significantly.

	The contamination risk would be identified early during consent scoping allowing a reduction in programme risk and earlier investigations to reduce effect on programming.

Name of project	**3 Stencil Place**
Summary	The works were assessed as a lining project. However the overflows were found to be the result of a dipped pipe bridge. A contractor could have proceeded with the lining works without solving the problem leading to an unsatisfactory result for Watercare and a future project to address the pipe bridge. The collaborative approach and agreed principal's requirements during initial scoping would have solved this problem.
Cost Variance ($+/-)	+$50,000
Programme Variance	Extension of Time due to increase in scope. Procurement lead time of 4 weeks for pipe bridge materials.
Original Scope	**From the project definition sheet:** Rehabilitation Details: Lining Length 30.7m, Material AC, Diameter DN150 Description: Structural rehabilitation of existing 2x 150mm pipe between the pipe bridge and manhole. Background: Root infiltration through joints. Justification: Identified by Operations as causing regular overflow and excessive maintenance cost.(Ops Priority 1) Additional information: None identified. Issues to be aware of: None identified.

	
Final Scope of works	Pipe Bridge Replacement: Length 13m, Material CLS. The change of scope was only discovered when a thorough pre-lining jetting and inspection was carried out. After jetting of the pipe it was decided that no lining of the pipeline was required. The regular overflows were identified as actually being a result of a significant dip in the pipe bridge and not as a result of root intrusion or other issues within the pipeline sections.
Effect on Project	As a result additional CLS pipe had to be procured welded and coated, a four week lead time. A consent is required for the pipe bridge replacement. Because this was not part of the original consenting programme it is not possible to slot it in to one of the existing consenting bundles which had already been submitted. A separate consent and submission was required.
Areas identified for improvement Likely outcomes:	1. Initial investigations should be carried out by the contractor and agreed with the client. 2. Consenting assessments should be undertaken based on the concept design and methodology. Items with a lead time such as fabricated pipe spools would be ordered and coated in advance of the physical works programme. The distribution of works will be improved resulting in less strain on both Contractor and client resources at the end of the programme. The works can undergo an accurate consenting assessment earlier and be programmed accordingly.

3 NEW APPROACH

3.1 DESCRIPTION OF NEW APPROACH

3.1.1 INVESTIGATION AND SCOPING

The primary improvement to the standard renewals design and construct contract is for the renewals contractor to undertake the investigation and scoping for a package of renewal works, where previously this had been undertaken by the maintenance contractor and/or the design consultant. This approach combines elements of Early Contractor Involvement (ECI) and design and construct.

By utilising the experience and skill of the renewals contractor's resources (design engineers, planners and construction engineers combined) the quality of the investigation and scoping is improved and this forms the basis for more accurate, effective and efficient design that better accounts for the constraints of consenting.

3.1.2 CONCEPT DESIGN AND PRICING

Following completion of the investigation and scoping the renewals contractor develops and documents the concept design and methodology. They undertake a consenting assessment and initial consultation with landowners. Finally they prepare a fixed lump sum price for the package of works.

The design is evaluated by the Utility Operator and the price breakdown checked and assessed against competitively established rates and/or historical price data. Third party independent estimators may be used to verify pricing or help resolve disagreements between the parties.

3.1.3 AN ENHANCED DESIGN AND CONSTRUCT CONTRACT

The new approach contract is based on standard NZS3916:2013 contract conditions with amendments to cater for

1. The investigation and scoping works,
2. Independent cost evaluation (when agreement on scope or price cannot be reached), and
3. Assignment of responsibility for certain risks that were not able to be assessed at concept design stage such as unstable slopes, unforeseen geotechnical conditions, unknown services, unreasonable landowners, specialist input into consents and the outcome of iwi consultation. This is made easier as the risks are better defined.

3.1.4 INTEGRATED WORKFLOWS

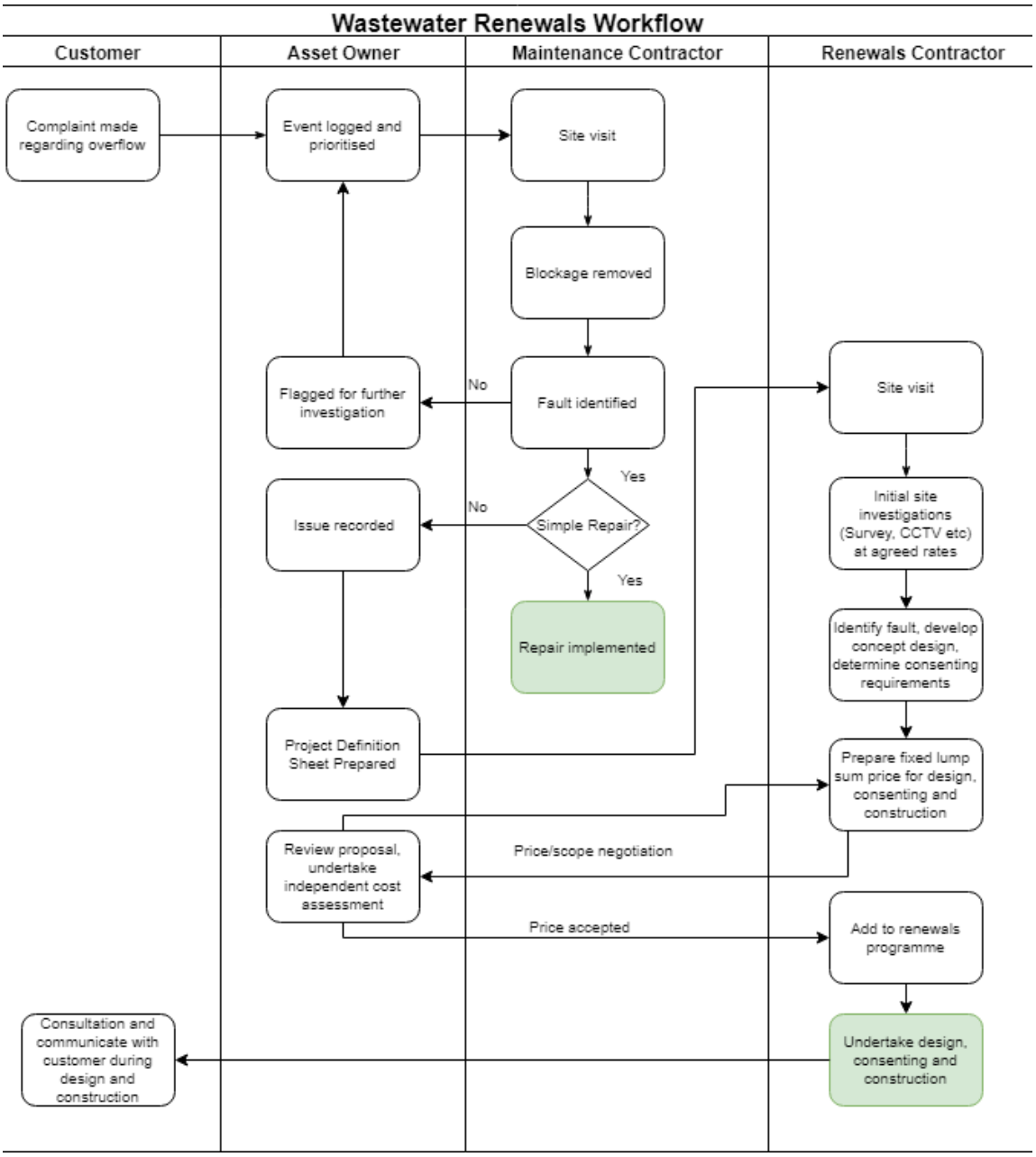
The maintenance contractor's existing workflow is used to identify recurring problems in the network that cannot be properly scoped, repaired simply or require consenting. Alerts are raised through the Utility Operator's asset management system (or business intelligence system) to identify recurring complaints and repair costs can be tracked and used to trigger escalation to the renewals contractor.

Once escalated these problems are thoroughly investigated by the renewals contractor so a solution can be developed.

For example, if a pipe is constantly blocking and requires regular jetting by the maintenance contractor, but no obvious defect can identified, or the solution requires major repair work, this would be flagged by the maintenance contractor to the asset

owner, who would prepare and issue a Project Definition Sheet (PDS) to the renewals contractor. This is the first step in the renewals workflow.

The integrated workflow is summarised in Figure 1 below:



For maximum efficiency it is best if the renewals are bundled into packages of at least 10 sites and these are regularly released to the renewals contractor to maintain a steady workload for the design, consenting and construction staff.

The work is delivered in two key stages:

1. Investigation, concept design and pricing
2. Detailed Design, Consenting and Construction

During the first stage, the renewals contractor investigates the sites, reviews available information and scopes the work. Site investigation may include:

1. Site visits
2. Basic survey (levelling) or review of GIS/Lidar data
3. Condition assessment of manholes and pipe bridges
4. CCTV and/or source detection
5. Arborist assessment
6. Desktop assessment of contamination (i.e. HAIL sites)
7. Field testing for contamination
8. Desktop study of geotechnical data
9. Desktop assessment of existing services

This investigation work is undertaken using agreed scheduled rates for CCTV, root removal, source detection, traffic management and third party specialists (generally environmental consultants).

The costs for the contractor's management and administration are recovered under the time related costs in the renewals contract, as generally the investigation tasks are undertaken by the site engineering and project management staff delivering the physical works within the larger programme of works. Alternatively a lump sum rate per site could be agreed for the management and administration of the investigation work.

Concept designs and consenting assessments are developed by the renewals contractor (in conjunction with their design and consenting team) and the package of work is priced as a lump sum offer for the design, consenting and construction.

They develop a lump sum design, consent and construct offer.

Client evaluates solution and price, negotiates and finalises contract.

Contractor deliver programme of works, works not requiring detailed design and consent may be accelerated.

4 BENEFITS

4.1.1 COMMERCIAL BENEFITS

Cost certainty is dramatically improved for the Utility Operator through:

- Reduced cost variance through accurate scoping
- Fixed lump sum pricing shifts the scope, design and consenting risk from the Principal to the renewals contractor

The renewal works are delivered cost effectively by:

- Just fixing the problem - accurate scoping reduces wasted design and construction efforts, and minimises delays during construction when the scope is found to be incorrect and requires re-design.
- Selecting the right tool for the job - the use of new technology and materials is instrumental in reducing cost.

- Leveraging off the scale of the packages - favourable rates can be obtained from design consultants and specialist subcontractors based on a predictable long term workload.
- Field engineering staff can be efficiently utilised to perform scoping and investigation tasks within their day-to-day construction workload - this avoids duplication of effort and improves knowledge transfer and continuity between design and construction phases.
- The consenting and planning resources are available to the contractor during concept development and design and can indicate where adjustments can be made to reduce consent and compliance requirements and shrink timeframes.
- The renewals contractor can achieve high utilisation of labour and plant resources, thereby providing competitive rates for preliminary and general activities and reduced margin on direct costs.
- The Principal's administration and construction monitoring activities are minimised.

4.1.2 OPPORTUNITIES FOR USING NEW TECHNOLOGIES

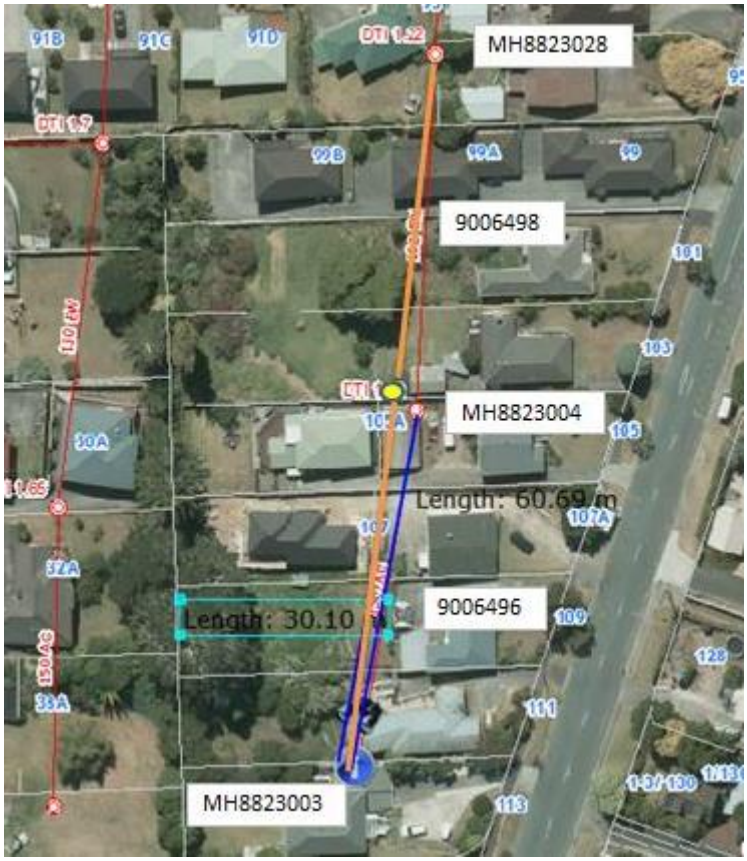
A key advantage of this new approach is that opportunities for innovation and new technologies and/or materials are easily able to be incorporated in the design and consents. In a traditional construct only contract, the designer is required to select a preferred methodology in order to complete the design and consenting process and prepare tender documents.

Following the investigation and scoping activities, the renewals contractor will assess the construction techniques available and select the optimal methodology for each site. To maximise the benefit to the Utility Operator, it is preferable that the renewals contractor has the capability to perform a range of techniques. In previous renewal packages delivered by the authors, the following methods have been utilised:

1. Cure in Place Pipe (CIPP),
2. Spiral PVC lining,
3. Removal of grout and protrusions using robotic cutters,
4. Horizontal directional drilling,
5. Pipe bursting,
6. Slip lining,
7. Open cut pipe replacement,
8. Replacement of pipe bridges using helicopters, and
9. Replacement of cast in-situ concrete pipe bridges up to 600mm diameter using flow-through bypasses

It is common for several different methodologies to be required in combination to address a single site.

4.1.3 CASE STUDIES

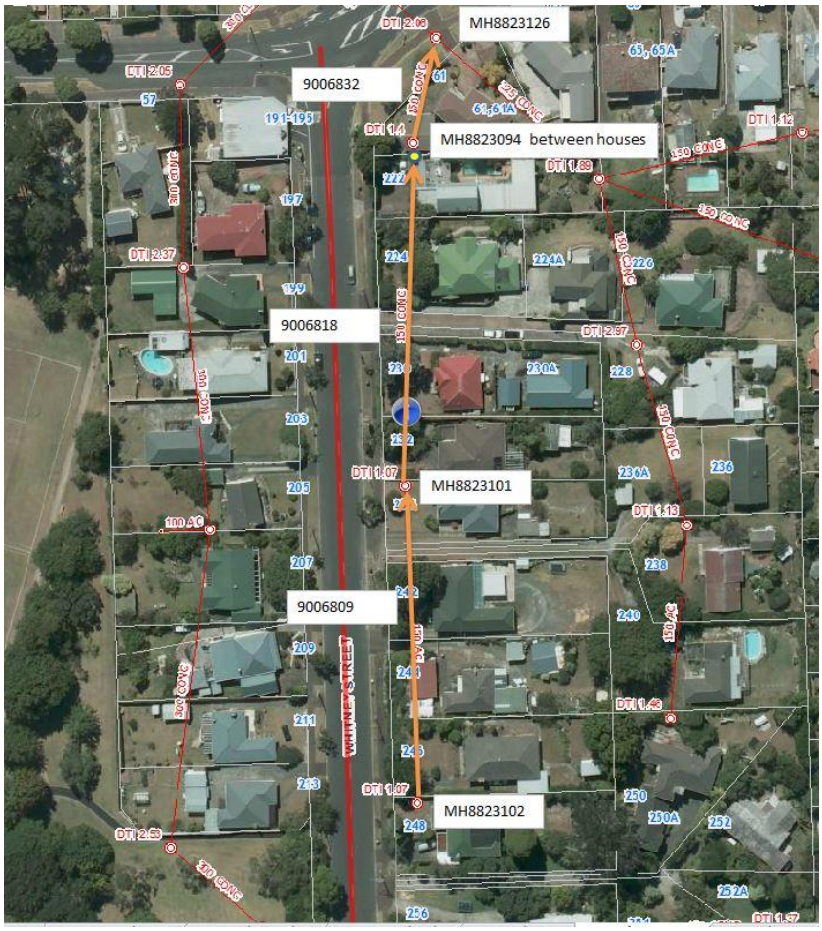
Name of project	**Wastewater Renewals 2017 - Blockhouse Road**
Summary	A 150NB pitch fibre sewer laid during the 1970s had completely failed resulting in blockages and overflows to the stormwater network. Incomplete CCTV information was available and laterals had not be located. The Principal assessed the works would require the replacement of a 91m section of the pipe, and had assessed that directional drilling would need to be used due to the position of the houses.
Original Scope	**From the project definition sheet:** Drill new 180 O.D PE line from boundary of 99 and 101 to head of line at 113 Blockhouse Rd. Install new house connections and connect to existing laterals. Install new manhole. 

Investigation	The investigation involved review of house plans, service locations, manhole inspections, CCTV, source detection, push cam and topographic surveying.
Scope	The investigation revealed several critical aspects: 1. The pipe had completely collapsed in one location and sewerage was seeping into a stormwater catchpit 2. The pitch-fibre pipe extended further downstream to manhole 9006498 (where it became PVC in good condition) 3. A new retaining wall was located very close to the available corridor that would need to be used if the pipe was replaced by HDD 4. Access to the work sites was difficult - many properties had no access to the rear of the sections The concept design was to replace the pipe with a new 150NB pipe downstream MH 8823003 and connect to the recently constructed PVC pipe under the house - a total of 97 metres, and reconnect 7 laterals.
Design solution	The detailed design solution was to replace the existing sewer with a 150NB PVC pipe using pipe bursting. This was selected for three reasons: 1. The existing manholes could be retained and just rebenched - a proposed manhole was not required 2. The risk to houses was minimised 3. Service relocation risk was minimised 4. Equipment could be easily mobilised to site


93
91D
93
95
99B
99A
99
Excavate and connect
to existing PVC pipe
35m
103
105A
Rebench manhole
107A
107
Replace with 150NB
PVC by pipe bursting
62m
109
128
111
Rebench manhole

Name of project	**Wastewater Renewals 2017 - Waiata Reserve**
Summary	A 225NB sewer cast insitu concrete sewer, constructed in 1921 had significant root intrusion, a history of overflows and had started to fail resulting in tomos. The sewer was located in heavily vegetated sections of the Waiata Reserve and access was restricted by the stream. Initial CCTV information provided by the maintenance contractor indicated that three sections had becoming partially blocked with grout. They had assessed that the works would require the replacement of a 130m section of the pipe, and had assessed that pipe bursting would be necessary due to the obstructions and vegetation which restricted clearing.
Original Scope	**From the project definition sheet:** Replace 4 pipelines, from MH8825800 to MH9248917 installing a 250mm diam PE wastewater pipeline, 0 Laterals. Need to rehabilitate or replace 1 manholes. 
Investigation	The investigation involved a site visit, manhole inspections and CCTV.

Scope	The investigation revealed several critical aspects: 1) One of the manholes had been buried 2) A tree consent would be required in order to clear trees for access to be able to excavate the pipe bursting pits 3) The pipeline appeared to be shallow in places The concept design was to rehabilitate the pipe using a structural liner and repair the manholes.
Design solution	The detailed design solution was to rehabilitate 130m of the existing sewer with a Expanda spiral wound PVC liner and repair the five manholes by hand, instead of using pipe bursting. This solution was selected for four reasons: 1. By eliminating the need for excavation, the effects on the vegetation and park users could be minimised, simplifying the consent and parks approval process 2. The grout obstructions were carefully assessed and we were confident they could be removed using a robotic cutter 3. The risk of ground heave in shallow sections was eliminated 4. PVC lining was significantly cheaper than bursting (delivered approximately $40,000 of savings to the client)

Name of project	**Wastewater Renewals 2017 - Whitbey Road,**
Summary	A 150NB pitch fibre sewer laid during the 1970s had significant deformation failed resulting in regular blockages. Due to the deformation it was not possible to CCTV large sections of the pipe. The Principal assessed the works would require the replacement of a 176m long sewer line by HDD or open cut.
Original Scope	**From the project definition sheet:** Relay 176m of existing pitch fibre pipeline by open cut or drilling, installing 3 new manholes. 
Investigation	The investigation involved review of house plans, service locations, manhole inspections, CCTV, source detection, arborist assessment, push cam and topographic surveying.

Scope	The investigation revealed several critical aspects: 1. The downstream section of the sewer (17m) had been replaced and was in good condition 2. Open cut would be difficult and expensive given the trees and reinstatement costs. 3. For a HDD alignment, the pipe depth would need to be increased, resulting in lateral connections over 3m deep The concept design was to replace the pipe with a new 150NB pipe between the head of the line and the existing manhole MH88230094 - a total of 159 metres, rehabilitate three manholes and reconnect 8 laterals.
Design solution	The design solution was to replace the existing sewer with a 150NB PVC pipe using pipe bursting. This was selected for three reasons: 1. The existing manholes could be retained 2. The risk to houses was minimised 3. Service relocation risk was minimised 4. The overall cost was lower than HDD due to the elimination of new manholes and grouting

5 ISSUES

5.1.1 COMMERCIAL ISSUES

The success of this new approach relies on the parties having a high level of trust based on a fair and transparent mechanism for pricing and risk allocation.

Establishing value for money is critical for Utility Operators. Having an efficient programme of works will inherently provide value, but establishing whether a rate or price is fair and reasonable can be subjective and led to disputes.

For a contract to be successful, both parties require certainty. If the contractor is not certain about the type and scale of work they will undertake, pricing will often be inflated to cover the risk of patchy workload or under recovery of fixed costs. Conversely if the Utility Operator is uncertain about how work will be valued and what the out-turn cost will be, they will find it difficult to obtain approval for contract award, set budgets and report on the performance

Ideally, whenever possible, margins and rates should be established by competitive tender. Where this is not practical or possible, independent third party estimators should be used to review pricing (ideally on an open book basis) and assess whether value is being offered.

Another mechanisms available to Utility Operators is to run two parallel renewals contracts with a well documented and managed performance management system. Both contractors could be regularly measured against Key Performance Indicators (KPIs), including price, and work apportioned accordingly.

6 CONCLUSIONS

The conclusion to be drawn from this paper is not that a new approach will suit all renewals projects or should be adopted by all Utility Operators. Rather, Utility Operators should consider the type of renewals works they are undertaking and the type of outcomes they are hoping to achieve as they are developing their renewals programme.

If the Utility Operator has a mature project team with a good understanding of renewals works and suitable main contractors available then it may suit taking a new more collaborative approach. This is particularly true for packages of more complex and challenging renewals projects, where a range of solutions may be required and the best solution may need significant development by the contractor.

There are still issues that need to be resolved such as providing transparency and tension around pricing. However this can be addressed by independent review and collaborating with a small number of main contractors to ensure performance can be monitored and compared.

The benefits of a more collaborative approach utilising NZS 3916 and bringing the contractor into the design development and scoping of the project are:

- Increased price and programme certainty as a result of accurate scoping.
- An even distribution of project expenditure and resourcing avoiding sharp peaks and troughs and allowing knowledge and skills to be maintained.
- Shorter timeframes for consents and consents that match the proposed works.
- Access to the most effective technical solutions to the more complex problems within a renewals programme.

REFERENCES

Figure 1. Extract from Treasuries 30 Year New Zealand Infrastructure Plan 2015

Figure 2. Extract from Asset Management Plan 2016 to 2036, Watercare Services Limited, 2016

Figure 3. Statistics Canada 2006. The Age of Public Infrastructure in Canada

Figure 4. Federal Highway Administration Three Treatment Zones, Maintenance, Rehabilitation and Reconstruction