BORCK CREEK – STRATEGIC STORMWATER PLANNING

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ABSTRACT

This paper is a case study of the future-proofing of the stormwater infrastructure for Richmond, the largest town township in the Tasman District. Borck Creek is one of the critical watercourses in the Richmond catchment serving a 1,400 hectare catchment area. It has gone through a significant journey of planning to secure a corridor not only for the use of stormwater relief, but also providing public amenity and ecological value.

This paper covers the following:

- A review of Richmond's flooding issues – key project driver.
- Programme planning process.
- Description of project implementation for the current work.
- Lessons learned.

Although these types of projects appear straightforward in their engineering and construction requirements, they can be the most complex to undertake owing to the range of differing needs from a large number of stakeholders.

KEY WORDS

Future-proofing, Stormwater, Flooding Policy Planning, Environment

PRESENTER PROFILE

James Tomkinson is a Civil Engineer with 22 years' experience, primarily in stormwater/wastewater and the roading sector. He has been with MWH NZ for17 years working mainly on projects for Tasman District Council's Professional Services Contract in roles of Project Technical Lead and Engineer to the Contract.

James was the Project Technical Lead for Borck Creek/Poutama Drain Widening and was involved in the overall project delivery including design, contract documentation preparation, tendering and site supervision.

Chris Blythe is a Project Manager for the Tasman District Council and is responsible for delivery of infrastructure projects. Chris's experience includes ten years of project and contract management in the education and community sectors in the UK and, more recently managing projects for the Tasman District Council's Long Term Plan.

1 INTRODUCTION

The Tasman District is one of the fastest growing regions in New Zealand and has historically experienced a shortage of available land for future residential and business growth. In 2006, the Council started planning for Richmond's future by re-zoning 300 ha of land for future development. As part of this process Borck Creek was identified as a critical stormwater drainage corridor by the Council, and there was strong support for public amenity and ecological improvements in the Corridor.

Subsequent stormwater modelling of the Richmond catchment demonstrated that Borck Creek was a critical drainage corridor for the easing of Richmond's flooding problems.

The upgrade of Borck Creek has taken some years to reach construction, and the recent re-structure of Tasman District Council's Engineering Services created an opportunity to give the programme a renewed impetus. Residential sub-division in the land around the lower reaches of Borck Creek also created a need to improve the stormwater capacity.

In 2015-16, approximately 2km of watercourse was upgraded for stormwater discharge, with initial ecological improvements and space for future amenities. This project has seen a high level of cross-team collaboration to agree priorities and compromises in the collective 'wish-list'.

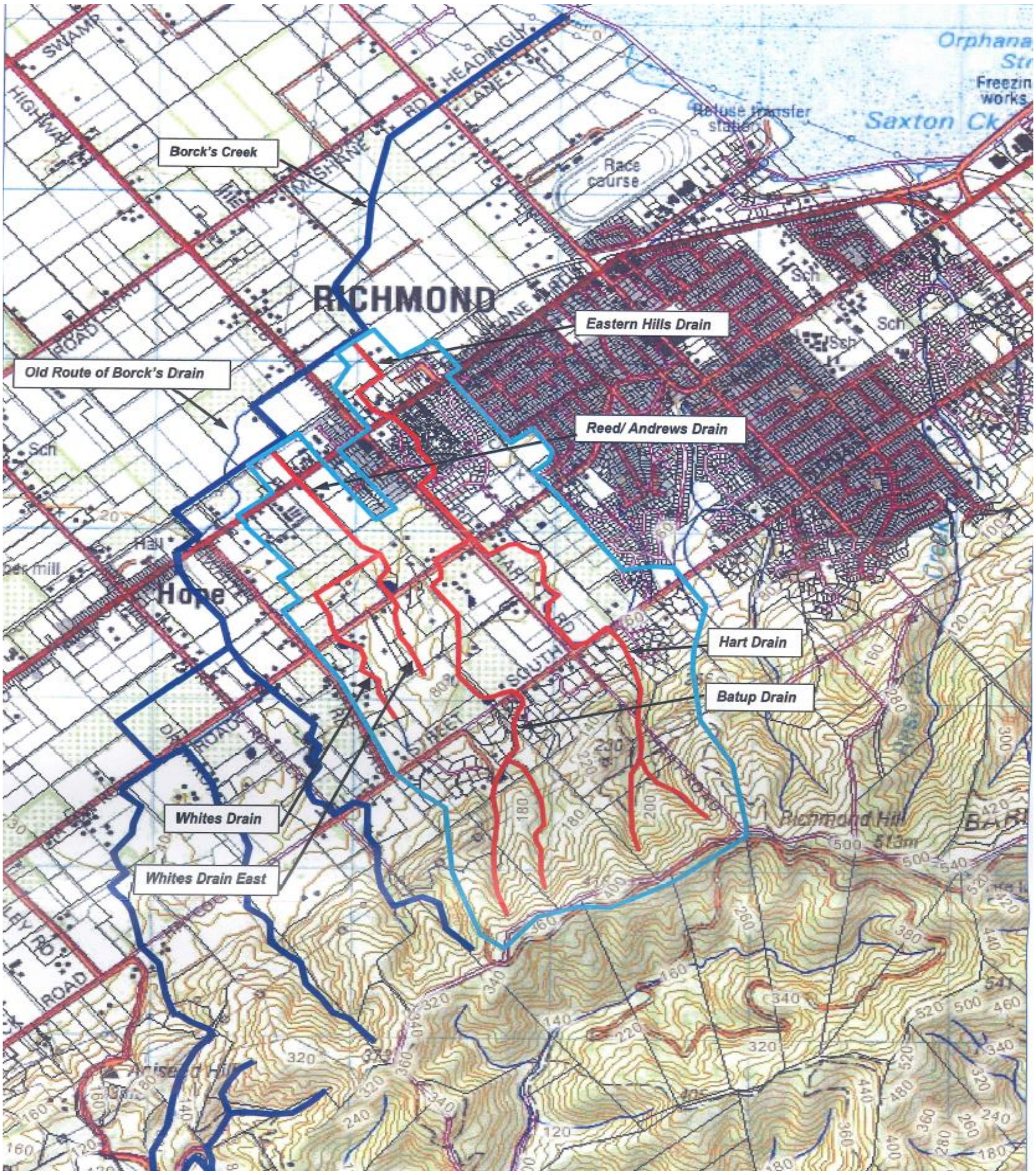
The construction works has enabled the project team to develop a methodology template for planning and implementing the stream widening works. This was achieved by good collaboration with the contractor, fish ecologist and consent compliance team to ensure all concerns were thought through and managed as the project evolved. This can now be used to inform future stormwater upgrades within the region.

2 CATCHMENT DESCRIPTION AND FLOODING ISSUES

Borck Creek is a major water course that conveys surface flood flows from the Richmond foothills and urban area into the Waimea Inlet. The Borck Creek system drains a total of 1430 ha located west of urban Richmond and comprises of 800 ha of hill country, 410 ha of intermediate terraces and 230 ha of floodplain. The catchment area includes the Poutama drain sub-catchment.

In pre-European times, the lower catchment of Borck Creek was swamp and mahinga kai for a kainga near Waimea River. The land was progressively drained from 1880 onwards for productive farm land. The Catchment Board and landowners, at various stages, widened and channelised the creek to improve drainage as the area developed. The creek is named after a Mr Borck who established a saw-mill in the area around 100 years ago (refer below to the location plan of Borck Creek).

Figure 1: Borck Creek Location Plan



Three rainfall events of significance have severely affected the Richmond area within the past 10 years:

- On 29 June 2003, 138mm of rainfall in 24 hours affected the greater catchment area resulting in widespread flooding of the Waimea Plains and, to a lesser extent, the Richmond township. Flooding was the result of the catchment's longer time of concentration, saturated ground conditions and a peak intensity lasting three hours at the end of the storm event.

Photographs 1 & 2: Flooding Around Hope on the Waimea Plains

- A storm event in December 2011 was unusual in that rainfall was highest near the coast. Commonly, the largest totals are seen at the highest elevations and are often twice as much as observed at lower elevations. In this event, the majority of the rain fell over a 48 hour period. Richmond received a total of 280mm over 48 hours; around one quarter of Richmond's normal annual rainfall. It was estimated to have an occurrence of every 250 years. The event resulted in a number of serious land slips and debris flows in parts of the Tasman and Nelson Districts.

- On 21 April 2013, one of the most intense rainfall events recorded in New Zealand occurred above the Richmond Township. It caused considerable flood damage through urban, recreation and industrial areas on the Richmond and Stoke foothills. The Stoke/Richmond storm peaked at 101mm over one hour, which is the third highest total recorded in New Zealand (behind 134mm Crop Valley Southern Alps and 109mm in Leigh North of Auckland).

Photographs 3 & 4: Flooding Richmond Town Centre

3 THE PROGRAMME PLANNING PROCESS

From 2003 there followed a series of investigations and reports that led to a re-zoning process to enable both development but also Designation of the stormwater corridor. This led to land agreements and purchases before any significant construction work could be started. It took ten years from the trigger event (2003) to undertaking any physical work. Table 1 provides a summary of the programme timeline.

Table 1: Programme Timeline

April 2003	MWH provides the Tasman District Council a report to summarise impacts of the significant rainfall event.
June 2004	Another rainfall event spurs the Council to investigate options to address flooding in Richmond.
2004	Changes to Development Impact Levy's considers levels of service and how to meet costs for improvements.
2006	MWH report identifies Borck Creek programme, land required, hydraulic capacities required for post 2030. Channel profiles, widths and amenity and ecology concepts are developed.
2007	OPUS provides climate change predictions report for the Tasman District Council. MWH provides hydraulic analysis of the stormwater network under future possible land-use conditions.
2008	MWH report 'Richmond Stormwater Modelling Option Analysis' has an area-wide assessment of system capacity and performance.
2007-09	Designation process by the Council to allocate land for stormwater, amenity and ecology outcomes.
2010	Land purchases start on lower sections of creek.
2010-13	The Council and a developer initiate work in sections of lower reaches of Borck Creek. Programme Planning by MWH - Long term planning timeframes needed to resolve the design aspects, determine a corridor, public consultation, resource consent land designation, land acquisition, estimates, hydrology studies, a programme of work scheduled over a number of years, land purchases and initial consents for the first phases of work.
2014	Re-structure of the Tasman District Council Engineering Services brings many services in-house, including establishing a new Programme Delivery Team to deliver key capital projects.
2014-15	Borck Creek-Poutama Drain widening project initiated for the first section of Lower Borck Creek and Poutama Drain. Engineering Services Activity Planning team initiate a Richmond catchment hydrology study to assist forward planning.
Oct 2014	Tender for Borck-Poutama work (current project).
March 2015	Widening works commence.
March 2016	Widening works complete – landscape planting on-going.
2015-16	Decision made to review the Borck Creek programme owing to the Richmond Central Stormwater Infrastructure Upgrade (a response to the 2013 flooding event).

4 IMPLEMENTING THE PLAN

There are challenges in developing a long-term programme of work. The on-going 'real-world' change has made it difficult to remain on one programme of work. Each rain event brings about different information, responses and priorities for the Council. Pressure by developers sets challenging timelines to have physical work hastily completed.

There is also pressure on the capital programme to meet annual funding allocations and avoid carry-forwards of funding (and work) into following years. Furthermore, the phasing of work over a number of years was required to make the programme affordable within the context of the Council debt and rates.

It is also easy to underestimate the time needed to undertake land purchase and gain agreement with land owners. The programme team decided to progress work despite land agreements not being completed, so the project could be put out for Tender and construction progressed.

The process of consent planning poses its problems to try to understand both the big picture and also individual projects within the programme. Negotiations were held with the Council staff and the Consenting Authority about consent condition requirements. Some conditions added costs and complexity beyond the stormwater outcomes and funding allocated in the Activity Management Plan and Long Term Plan.

There was significant stakeholder involvement including, the Council's Engineering and Consenting departments, rate payer consultation, landowners, iwi, Heritage New Zealand and contractors.

4.1 IMPLEMENTATION – FROM 2014 ONWARD

Since the three outcomes (stormwater, amenities and ecology) of the Designation would influence the design and Resource Consent conditions for the work, a cross-Council steering group was created to scope the project. This group is facilitated by the Project Manager and includes the Activity Planning Adviser, Water Quality Officer, and staff from Parks and Reserves, Community Development, a Resource Scientist and a Policy Planner from Environment and Planning. MWH provides technical inputs such as design and Resource Management Act compliance expertise.

External stakeholders include iwi through Tiakina te Taiao, local industry, residents affected by flooding, landowners and tenants, Network Tasman and Heritage New Zealand.

4.3 FOCUS ON THE OUTCOMES

The Project Manager was new to Tasman District Council and worked to establish good working relationships with team members and stakeholders. The aim was to orientate the project as being focused on the three designation outcomes – stormwater, amenities and ecology.

There were differences in opinion about key outcomes such as:

- How best to provide for future walkways and amenity access.
- Where to locate maintenance access.
- How to create a space that had the ecological values while enabling cost-effective maintenance, and avoiding creating barriers in the stream that could impinge flood flows.
- Whether to have a 'park-like' setting or more natural planting.

4.2 STEERING GROUP DISCUSSIONS

To meet the Council Long Term Plan programme, project planning was undertaken relatively quickly and there was a wide range of 'wishes' on the list. As the project is driven by the Engineering Services there were concerns among the steering group that stormwater outcomes would be prioritised over other outcomes. The Project Manager encouraged that the group view this as a Council project, rather than 'just a stormwater project'. There was general consensus about how to improve amenity and ecology values, and ensure that this project created a platform for future improvements, perhaps over many decades.

However, throughout the project there was tension between the funding available and the opportunities to improve the ecology and amenity. Many of the discussions focused on planning works that would need limited future physical changes and maintenance. Some challenges include:

- Uncertainty of future development - what capacity should the channel be design for currently.
- Three flow restrictions within the existing channel create flood risks.
- Lack of space in the Poutama designation for maintenance access.
- Not all the land had been acquired and negotiations were becoming protracted.
- A NZ Transport Agency (NZTA) designation along part of Poutama Drain created issues for landowners.
- Concern that future demand could exceed the stormwater capacity.
- Future widening could result in moving the low-flow channel again in the future.
- How best to give the eco-system a 'head-start' - stream-bed seeding, improved bed material, larger native plantings.

4.2 DEFINING THE METHODOLOGY

As part of the planning, there were several site walkovers with the whole team to define the project methodology. This process helped everyone understand the context of the work, and catch any issues that needed to be considered.

Examples include:

- Two heritage oak trees were scheduled to be removed as part of the project, but these have been retained by involving an arborist in the construction work.
- The same oak trees were protected by a belt of macrocarpas that had to be removed for the stream widening, and also were not appropriate for the stream environment. The arborist shaped the oak trees to protect them from wind damage.
- Discussing the merits of existing plants and the extent of additional planting requirements. A practical approach was taken to accept existing grasses and focus on removing gorse, macrocarpa and lucerne.
- Discussing locations of future walkways and connections.
- Methodology for fish passage and fish capture. The ecologist supported a consent application to allow works during inanga spawning season to give the contractor more flexibility.
- Methods to minimise sediment during works. This evolved throughout the project.
- Discussions with landowners about access, location of irrigation pipes, and working in with existing land-use such as a plant nursery.
- Splitting Poutama Drain flows during its widening to prevent sedimentation entering the recently widen Borck Creek.
- Having space available to adjoining land to enable the physical works to operate and stock pile material.

4.3 THE SCOPE OF WORK

The steering group agreed the widening work would be an interim width, not the final designated width, as there were three restrictions within the existing channels – one being a 9.5m width restriction on Poutama Drain and two flow restrictions of approximately $32m^3/s$ on Borck Creek. The final planned capacity is not required for decades, but the interim widening would provide medium term capacity improvements. The scope included:

- abandoning an existing straight channel and creating low-flow meanders, secondary channels, wetlands and islands;
- native planting and fish capture, Borck Creek would be developed such that minimal future works would be required;
- Poutama Drain widened was staged in 2 separable portions within the contract documentation to allow land to be purchase while Borck Creek was being widened.

Table 2 summarises the design requirements for the 2015-16 widening works.

Table 2: Project Scope Summary

Scope	**Borck Creek**	**Poutama Drain**
Designation	70m width	15-20m width
Old channel capacity	10 – 15m^3/s	3-5m^3/s
New channel capacity	35m^3/s	7-10m^3/s
Old width	7m	3-5m
New Width	40m	7-13m
Amenity	Space for future walkway, cycleway, recreation	Future connecting walkways
Ecology	Meander, ecological planting	Meander, ecological planting

5 TECHNICAL ASPECTS

Although Council had undertaken the designation process for Borck Creek it still needed to have funding available and the willingness of affected landowners to sell land to be able to undertake the physical works. Additionally, the previously widened sections of Borck Creek had been completed at lower levels of service based on older Engineering standards and with no allowance for global warming. These restrictions included the Lower Queen Street Bridge which was limited to between 30-35m^3/s and at a downstream connection point near the estuary.

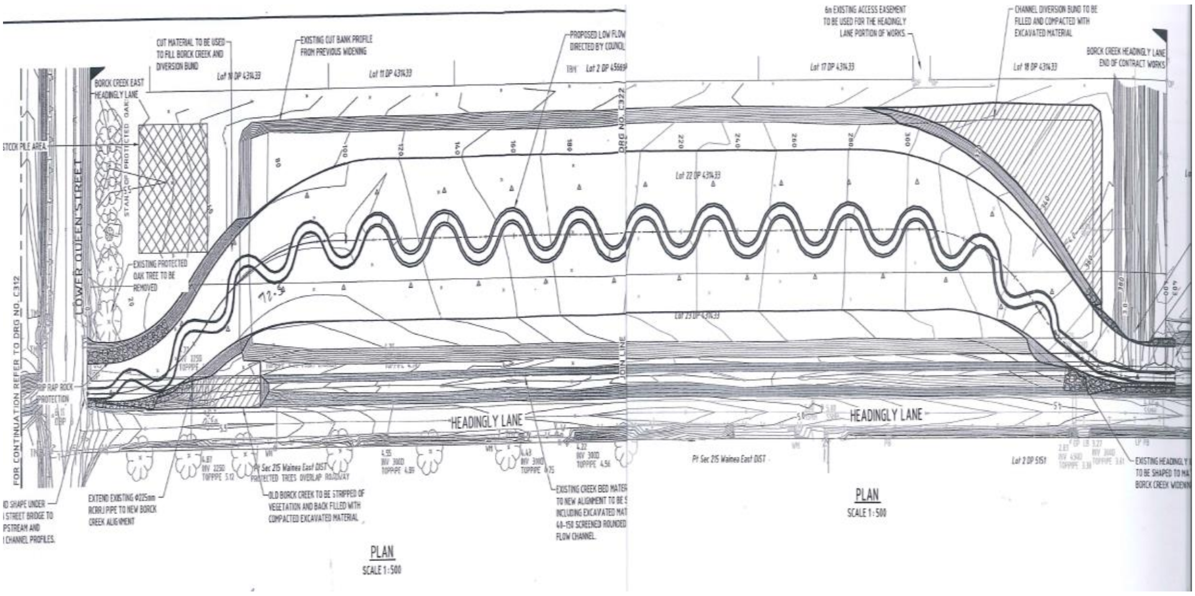
5.1 LEVEL OF SERVICE

As no stormwater modelling work had been undertaken for the wider catchment area and with the complex overland flow nature of the Waimea Plains, it was difficult to advise the Council on the level of service it should achieve in the short, medium and long terms for the current Borck Creek widening. It was finally agreed with the Council that Borck Creek would be widened to 25m at the base and to have a capacity of 35m^3/s. This was equivalent to a present day Q_{50} flood event. The decision to do this was to enable a step towards future widening while a more extensive catchment modelling project was underway (due to complete in 2017).

5.1 CHANNEL DEPTH

A further consideration in the design of Borck Creek was its depth as it was always intended to undertake widening below existing ground level to avoid bunding alongside future development. This proved difficult to match and transition with existing structures such as the Lower Queen Street Bridge and the downstream Hislop property as the future widening was based on central invert levels while the current design needed to transition out to existing figures located to one side necessitating flatter grades (refer to Figure 2).

Figure 2: Borck Creek low flow meander transition with the lower Queen St Bridge and Hislop property.



5.1 FREEBOARD

Meeting the Tasman District Council Engineering Standard of providing 250mm of freeboard also proved difficult to achieve along the full length of the widening due to batter height variability between cross-sections (due to ground variability along the old Waimea Flood Plain). A conservative approach was taken to generally provide the full capacity at the cross section with low points in the batters or install bunding to fill in old flood channels.

Photographs 5 & 6: Before and After Formation of Borck Creek

The early Brock Creek designs provided various flood levels based on different flood events and public use. This included three levels; a low flow channel to deal with the natural creek flows, an active channel intended to take the Q_5 year event which excluded public amenity, and finally the flood channel to accommodate a Q_{100} event.

5.1 WATER TABLE

The high water table in the area of the proposed widening provided difficulties from a constructability perspective and in particular managing the resource consent conditions. Having a well thought-out construction methodology prepared as part of the resource consent set the criteria for the Contractor in the tender document to either follow or alter, but needed to be robust to show they clearly understood the scope of works and the consent compliance requirements.

5.1 FUTURE MAINTENANCE

Future maintenance was also a key consideration in the design of the Borck Creek widening to allow mowing to be undertaken safely and efficiently within the final channel profile. This ultimately proved harder to achieve and manage as the low flow channel and wetland areas were in the control of the ecologist and we weren't able to achieve the practical maintenance outcome we had intended.

6 ECOLOGICAL IMPROVEMENTS

A number of habitat considerations were taken into account which included the following:

- Low flow meander alignment.
- Variety of water depth and width.
- Variety of clean stream substrate (including woody debris and providing interstitial space).
- Riparian tree cover.
- Variety of bank shape and connection of the stream to its flood plain (by creation of riparian wetlands).

In the process of diverting the creek from the old straight channel into the new 'ecological channel', fish were transferred to safe locations with preference being the same location. This amounted to almost 1000 fish per 100m; mostly eels, inanga and common bully. The water was then diverted into the new channel, a final sweep to recover any stranded fish was undertaken before the old Borck Creek was filled in. Clean gravels were added to the new channel to ensure habitat (space between the stones) within the bed for fish and invertebrates.

Consideration was also given to incorporate ecological and planting improvements such as logs in the stream bed and riparian planting which had be considered regarding the potential impact on flows and capacity.

The work was only carried out in 2015 and the riparian planting is planned for autumn-winter of 2016 so it will be some years before the full ecological potential of the creek is reached. Challenges in the future will be to protect the creek and this investment in the stream ecosystem by treating urban stormwater effectively prior to discharge to the waterway and to ensure that sufficient groundwater recharge is maintained in future subdivisions to ensure that groundwater levels are high enough to maintain the springs that feed the stream.

7 PROCUREMENT

Given the risks and need for the ecological elements a Price Quality Method tender was issued to the open market tender, with a 70/30 split of price/quality. The Tasman District Council and MWH collaborated on the tender documents to ensure a balance of the big picture and technical specifics were clearly stated and understood within the document. Three good quality tenders were received and Downer NZ Limited won the contract.

The Contract has three separable portions, two for the widening on land the Council did not own at time of tender. This bought some time to progress land purchase while the tender process occurred.

8 CONSTRUCTION MANAGEMENT

During the construction phase, there were regular team meetings to confirm methodologies, consent requirements in relation to specific locations on site, and it was decided this was best led by a core delivery team comprising the Project Manager, Stormwater Maintenance, MWH Consultant and a Horticultural Officer.

In terms of other contractors involved in the construction, Tiakina te Taiao undertook a Cultural Health Assessment of the watercourses before work was started and provided iwi monitors. Two main contractors were procured, one for earthworks the other for native riparian planting. We also appointed a fresh water ecologist to fish the streams and an arborist to advise about care for protected trees.

We were able to accommodate some of the landowner needs such as on-going liaison, access across the creek during works, working around apple sapling harvesting, and maintaining a summer water consent take for a berry farm. They also negotiated access to private land alongside the site for easier and safer works access.

Two sections of land on Poutama Drain had not been purchased at the time of the tender, but negotiations were well underway. As a result, three separable portions were created so that we had time to secure the land, or not continue the work as a contingency. One section was obtained in time to progress the works, and the other has been put on hold pending a review of the wider programme.

Sediment management was a significant part of the construction work, and we worked with the Contractor, freshwater ecologist and Consent Compliance to discuss and agree sediment control plans, and also to adjust the methodology as things changed, such as weather events and change of seasons. This partnership approach meant sediment control was responsive to changes during the works, but also allowed us to develop a good practice approach which we can apply to other projects.

For example, the lower section of Borck Creek was widened in 2011 by a developer and had good vegetation cover and creating a meander was relatively straightforward. However, upstream we cut the flood channel as well as creating a meander, leaving lots of exposed land. The model we found most successful was to cut the flood channel first, allow grass cover to become well-established and then cut the meander. This means thinking about the phasing of physical work over time to allow grass cover to establish, which reduced the risk of sediment entering the watercourse.

9 PROJECT OUTCOMES

9.1 SUCCESSES

Getting Tasman District Council stakeholders buy-in early on in the project and having a team approach went a long way to get consensus on the scope and methodologies. Having a representative from different Council departments meant there was someone familiar with the work and who was able to provide expertise promptly.

The Council took a risk in tendering the work while the consent application and land purchases were still underway. Normally Council's project gate process would not permit this, but the risks were mitigated by having separable portions in the contract and a project contingency budget as well as a construction contingency.

The first section of work was treated somewhat as an experiment to inform the construction of the next stages of work. This removed some stress and concern about 'doing it right first time' and allowed us to work out how to plan meanders, deal with sediment control and forming a working relationship with the Contractor, Downer. We reviewed the 'ecological' upgrade costs at the end of the first section and found them to be modest. We were able to hone the methodology to further reduce costs as we worked upstream. These costs can now be included in future AMPs where ecological upgrades are required.

By the end of the project, we had developed a good methodology for the channel earthworks. We found the best way to approach this work is to do the bulk earthworks and form the flood channel first, then seeded the bare earth. Once grass was established, we found this stabilised the channel and made forming meanders and wetlands easier. This learning will help inform future projects of the issues and problems encountered and help with the consent applications.

One requirement of the Resource Consent was to ensure a stream bed depth of 350mm containing a mixture of cobble sizes. A contract variation was issued to Downer to dig a test pit to see if material could be extracted and washed on site rather than import material. (This was based on work undertaken in the Heathcote River in Christchurch). However, there was insufficient material in the ground to extract, with a layer around 100mm at the depth of the new channel. As a result, imported material was used. Since 100mm existed only 250mm was brought in, and the exercise had minimal budget impact.

10 CHALLENGES

A lot of time was spent discussing the different needs of the three main teams (Engineering, Parks and Reserves, Environment and Planning) throughout the project. Overall despite a few setbacks and issues, the project has achieved more than if it was led only as a 'stormwater upgrade' project.

An NZTA designation on the last section of the Poutama Drain creates isolated parcels of land for landowners between the new drain and the NZTA designation. We are negotiating with NZTA and landowners to see if we can move the drain location to the land boundary. This has put this section of work on hold.

The ecological consent conditions created an uncertain cost to the Council owing to the timing of the consent application and tender process. This has turned out to be 5% additional cost for ecological stream improvements and approximately 10% for extensive native planting. This is useful for future planning where ecological upgrades are desirable.

Protracted land negotiations with land owners slowed down the project or added costs as land agreement conditions were agreed (eg. fencing and land reinstatement).

Tasman District Council was working with a developer wanting to progress residential subdivisions around the area of works. The developer's consent requirements included requiring the channel upgrades for stormwater run-off.

We were unable to draw on much experience from other regions and we found most case studies on stream improvements are from the large urban Councils. There were few examples if any, we could find that fitted within our more modest budgets. E.g. comparing Borck Creek to the Heathcote reinstatement had limited value.

The first phase of works will not be to the full designated width, as this capacity is not needed for decades, but also the funding is not available for that quantity of work. There was difficulty in judging what flows to design for as there was not any detailed modelling data to draw upon.

The single biggest challenge has been the change to the programme brought about by the Richmond Central Stormwater Infrastructure Upgrade (Refer to the 2015-16 entry in Table 1). This proposes to route a new 1600mm stormwater gravity-pressure pipeline into Poutama Drain, which was not part of the initial programme strategy.

11 CONCLUSIONS

The main learning from this programme experience is that these projects are complex and difficult to implement. As with any programme there have been challenges to progress, but the key success factors have been the importance of a team approach to the programme, having a good earthworks contract and support from a range of experts, and building good relationships with all stakeholders.

In particular, the following are recommended:

- Allow plenty of time for land negotiations – E.g. one took some seven years from start to finish.
- Having stormwater engineers involved at the policy planning stage meant that the viability of the corridor for stormwater improvements was understood and connected with Council policy and re-zoning processes.

- Decide when you have enough information to progress works – there will never be a perfect time to start as the world is constantly changing.
- Have a team of people who understand the project so they can provide input when needed, particularly in situations where problems arise on site.
- Consider Price/Quality procurement of contractors where there are multiple outcomes such as stormwater, amenity and ecological improvements.
- Ensure there are thorough and robustly documented design reviews and sign-off processes.
- Consider land-use around the works – such as access to land for horticulture and seasonal water takes.
- Run community briefing sessions – we ran one at the Library, a nearby residential care-home and set up a webpage and email newsletter database.
- Do not let risk aversion stop progress – we had significant risks entering the construction phase, but we had mitigations in place, and Engineering Services accepted these risks.
- Try to appoint a Project Manager who can remain impartial to the pushes and pulls of stakeholders, balance needs, broker relationships and consider the differing views around the table.
- Get the right experts involved – iwi, ecologist, stream ecologist, arborist, and archaeologist.
- Maintain a risk and issues log to document things as they happen.
- Do not be afraid to experiment – create opportunities to test methodologies while minimising risk to the contractor.
- Involve Consent Compliance in the Erosion Sediment Control planning early, and throughout works.

ACKNOWLEDGMENTS

Figures 1 and 3 images courtesy South Richmond Development Area Study – Stormwater Concept Design 2006

Figure 2 images courtesy of Borck Creek and Poutama Drain Widening Project.

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